JANUS® G3

Automated Workstation

IVD User Manual

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P/N CLS146039 Rev. L
Publication Date: April 27, 2022
For In Vitro Diagnostic Use

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Content

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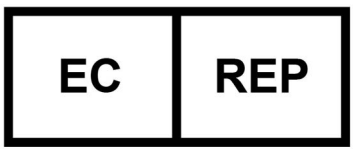
CE

This device complies with all CE rules and requirements.

EC REP



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Chapter 1

Introduction

This section provides an introduction to the JANUS® G3 Automated Workstation and contains the following information:

- Intended Purpose on page 14
- JANUS G3 System Features on page 15
- Purpose of this Manual on page 15
- Prerequisite Skills and Knowledge on page 16
- Installation on page 16
- Conventions in this Document on page 16
- Table of Symbols on page 17
- Revision History on page 18
- Warranty Terms and Conditions on page 18
- Regulatory Compliance on page 19
- FCC Compliance on page 19

! *NOTE* *For the purposes of this document the term Integration (and derivations thereof) are defined as establishing an interface between equipment that facilitates communication and interactions between the equipment without altering the structural and functional integrity of the equipment.*

Intended Purpose

The JANUS G3 Automated Workstation is an automated, programmable liquid handling instrument suitable for use in clinical settings by trained laboratory personnel to facilitate the pipetting and dilution of fluids in sample preparation work flows. Liquid transfers can be performed in a multi-tipped mode from any combination of laboratory containers including 384- and 1536-well formats for complete assay automation. The JANUS G3 system is controlled by WinPREP®, a flexible, powerful, and intuitive software application running on a Windows compatible computer.

JANUS G3 System Features

The following list describes the features of the JANUS system:

- Computer controlled Cartesian X-Y-Z robotic liquid handling system
- Varispan® arm, providing a choice of sampling probes, variable spacing between sampling probes and Independent Z drives
- Accusense®, patented independent liquid level sensing
- Modular Dispense Technology (MDT) pipetting arm, providing flexible pipetting throughput with Interchangeable Head technology
- Nanoliter (nL) pipette volumes with NanoHead® or Pin Tool options
- Positioning reproducibility
- Labware movement and manipulation with robotic Gripper arm
- Flexible and extensible deck layouts and deck configurations
- Integration with other laboratory equipment
- Various options and accessories

Purpose of this Manual

This manual provides a general overview of the JANUS G3 system and familiarizes you with its operation. Tutorials are included to introduce you to some of the more common setup and operation tasks.

Additional System Documentation

Refer to the following additional documentation as necessary:

- Online Help
  The online help includes the contents of this manual and additional reference material describing the WinPREP software windows. Access the online help from the **Help** menu in WinPREP.
- Options and Accessories Manuals
  Individual manuals are provided with many of the available options and accessories that you integrate with the JANUS G3 instrument. The Operation Manual for an option or accessory explains how to use the hardware and software. An Integration Manual may be included with some options to describe how to integrate the option into the system.

Prerequisite Skills and Knowledge

To use this documentation, you must be familiar with the basic concepts of computer use and common software packages, such as Microsoft Windows and Excel. You must have a basic knowledge of Microsoft Windows.

You must also be familiar with basic liquid handling practices, such as pipetting, replicate dispenses, dilutions, etc. If you are not familiar with these concepts, or need a review, see Appendix A: Liquid Handling on page 379.

Ensure that all personnel involved with the operation of the instrument have:

- Received instruction in general safety practices for laboratories.
- Received instruction in specific safety practices for the instrument.
- Read and understood all related MSDSs.

Installation

To be installed only by qualified PerkinElmer personnel.

❗ *WARNING* *Appliance inlet is disconnecting device. Place device or equipment in a manner so that disconnecting device is accessible at all times.*

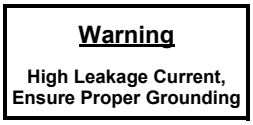
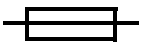
☞ *NOTE* *Do not unpack the JANUS G3 shipping container prior to the arrival of the PerkinElmer Field Service Engineer. The JANUS G3 instrument must be installed by qualified PerkinElmer service personnel.*

Conventions in this Document

The following conventions are used in this manual:

Convention Example	**Meaning**
Type **100** in the **Volume** text box.	This command means to type a specific string of characters as described in the instruction. The characters that you need to type are printed in **Bold**.
Select **CSV (Comma Delimited) (*.csv)** in the **Files of Type** drop-down list.	This command means to select an item from a list, as described in the instruction. The option that you need to select is printed in **Bold**.
Click the **Save** button.	An item on a window is printed in **Bold Initial Caps** (the first letter in the item is capitalized).
Select **File > Save As** on the main window.	A greater than symbol separates each item in a menu selection. In this example, select the **Save As** command on the **File** menu.

Table of Symbols

Symbol	Explanation of Symbols
	**WARNING**: Indicates situations that could result in personal injury to yourself or another person or damage to the instrument. Warning (ISO 7000-0434B)
	Risk of Electrical Shock (IEC 60417-6042)
	Alternating current (IEC 60417-5032)
	Protective Earth Ground (IEC 60417-5019)
	On (Supply) (IEC 60417-5007)
	Off (Supply) (IEC 60417-5008)
	Biological Risks (ISO 7000- 0659 (2004-01))
	Fuse Label / (IEC 60417-5016) Current Warning
	Warning High Leakage Current, Ensure Proper Grounding
	Warning Laser Product. Avoid Direct Exposure to Beam (ISO 3864)
	Pinch Hazard
	Hand Crush / Force From Above
	Hot Surface (ISO 3864)
	Fuse (IEC 60417-5016)
	CE Compliance Mark

Symbol	Explanation of Symbols
	EC authorized representative (ISO 15223-1:2016)
	Serial Number (ISO 7000-2498)
	Catalog Number (ISO 7000-2493)
	In vitro diagnostic device (ISO 15223-1:2016)
	Symbol for “Manufacturer” adjacent to the name and address of the manufacturer. (ISO 7000-3082)
	Waste Electrical & Electronic Equipment (EN50419:2005)
	Warning Class II laser Do not stare into beam

Revision History

Table 1-1. Revisions CLS146039

Revision	Description of Change
L	Update for IVDR compliance. • Added Revision History Table. • Renamed Intended Use section to Intended Purpose. • Revised Intended Purpose • Added Serious Incident Reporting to Safety Recommendations.

Warranty Terms and Conditions

Warranty terms and conditions for the JANUS G3 Automated Workstation are provided separately in a stand-alone document.

Regulatory Compliance

This equipment must be used only by trained personnel in a controlled laboratory environment.

Replace fuses only with the same type and rating.

Service should only be performed by a qualified PerkinElmer representative.

Refer to the *JANUS G3 Quick Start Guide* CD for translated Quick Start Guides.

This equipment must only be used with IEC listed accessories (computer, printer, monitor, etc.).

If the instrument is received in a damaged condition, request an immediate inspection by the carrier and local technical service representative. PerkinElmer is not responsible for damage occurring during transit. However, PerkinElmer will assist in ensuring a satisfactory settlement from the carrier.

Upon receipt of all damage/inspection reports, PerkinElmer will arrange for either instrument repair or replacement.

For proper ventilation of this equipment, a distance of 6 inches (15cm) must be maintained from this unit to any other surface.

FCC Compliance

This equipment complies with the limits of FCC Part 15 Class A.

Any changes or modifications not expressly approved by PerkinElmer could adversely affect compliance.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Chapter 2

Overview

This chapter provides an overview of the main components of the system and includes important safety recommendations:

- Hardware Overview on page 20
- JANUS G3 Instrument Description on page 27
- Options and Accessories on page 34
- WinPREP Software Overview on page 43
- JANUS Application Assistant Software Overview on page 47
- Labware Overview on page 48
- Security Overview on page 49
- System Specifications on page 50
- Safety Recommendations on page 54

Hardware Overview

The JANUS G3 Automated Workstation supports independent modules that you can configure and expand as necessary for laboratory growth.

The modular system can be designed in a variety of hardware configurations to meet the application needs of your laboratory. All JANUS G3 systems use the WinPREP software to create protocols and the JANUS Application Assistant software to control the instrument and run protocols.

This section includes the following information:

- Modular Design on page 21
- Available Configurations on page 21
- Deck Configurations on page 24
- Deck Plates on page 24
- Rail Configurations on page 26

Modular Design

The JANUS G3 system allows you to select the size of the JANUS G3 instrument and the desired system components including pipetting arms, robotic gripper arms, and deck layouts. This modular design provides a wide variety of configuration and expansion options.

Available Configurations

The sections below describe each of the platforms and the configurations supported on each platform. The required options are necessary for the instrument to function; however, you can choose from any of the listed optional components for a specific platform.

Mini Platform

The Mini Platform uses a small deck configuration and supports one pipetting arm: either a Varispan (4 or 8-tip) or MDT. The Mini Platform only includes a single pipetting arm. The Mini Platform has one deck plate.

Figure 2-1. Mini Platform with MDT Arm and Mini Platform with Varispan Arm

Standard Platform

The Standard Platform uses a medium deck configuration and must contain at least one pipetting arm: either a Varispan (4 or 8-tip) or MDT. The Standard Platform supports the Varispan (4 or 8-tip) arm, the MDT arm, and the Gripper arm. The Standard Platform has two deck plates.

The Standard Platform can include up to three arms if equipped with the optional secondary rail, or two arms without the optional secondary rail.

Figure 2-2. Standard Platform with Varispan Arm and MDT Arm

Integrator's Platform

The Integrator's Platform is the same as the Standard Platform, but can include the following options:

- Right Deck Extension to increase the deck capacity
- Extended Front, Primary, and Secondary Rail (for three-arm instruments) to allow the system to reach off-deck locations and integrate with other devices such as plate readers, incubators, etc.

Expanded Platform

The Expanded Platform uses a large deck configuration and must contain at least one pipetting arm. The Expanded Platform supports the Varispan (4 or 8-tip) arm, the MDT arm, and the Gripper arm. The Expanded Platform has three deck plates.

The Expanded Platform can include up to three arms if equipped with the optional secondary rail, or two arms without the optional secondary rail.

Figure 2-3. Expanded Platform with Varispan Arm and MDT Arm

Extended Platform

The Extended Platform is the same as the Expanded Platform with additional reach to off-deck positions on the right side of the instrument. Extended front and primary rails enable the system to access off-deck positions on devices located to the right of the instrument.

Configuration Guidelines

The following guidelines provide important information to consider when planning the system configuration:

- The system cannot contain multiple arms of the same type. A system can, at most, have one of each of the following arms:
  - Varispan Pipetting
  - MDT Pipetting
  - Gripper

  For instance, a system cannot contain two Varispan pipetting arms. Certain other system selections, such as deck length, influence the number of arms you can select for a system.
- Two integrated arms requires a Standard or Expanded primary rail configuration.
- The Mini Platform only supports a single arm.
- Dual pipetting arm configurations with the Gripper option require a secondary rail.

Deck Configurations

Deck configuration options provide several deck sizes. Deck plates are available for either MDT or Varispan arms. The arrangement of the deck plates on the instrument can be changed as desired to optimize the positioning of the labware.

The table below shows the microplate deck capacity for each platform.

Platform	Mini	Standard	Integrator	Expanded
Configuration				
Varispan	12	24	24 (32)*	32
MDT	9	15	15 (21)*	21
Varispan + MDT	Not Available	18	18 (24)*	29

* with optional Deck Expansion Module

Deck Plates

The JANUS G3 deck is made up of one or more deck plates, depending on the platform. These plates contain rows and columns of physical deck positions which form a grid; the intersection of a row and column identifies a position on the deck. The software uses these positions to locate labware you place on the deck.

There are two standard types of deck plates available for JANUS G3: Varispan and MDT. The decks are optimized for use with the associated pipetting arm, so the column spacing differs slightly between the two deck plate types. Figure 2-4 shows the differences between the spacing for each type of deck plate.

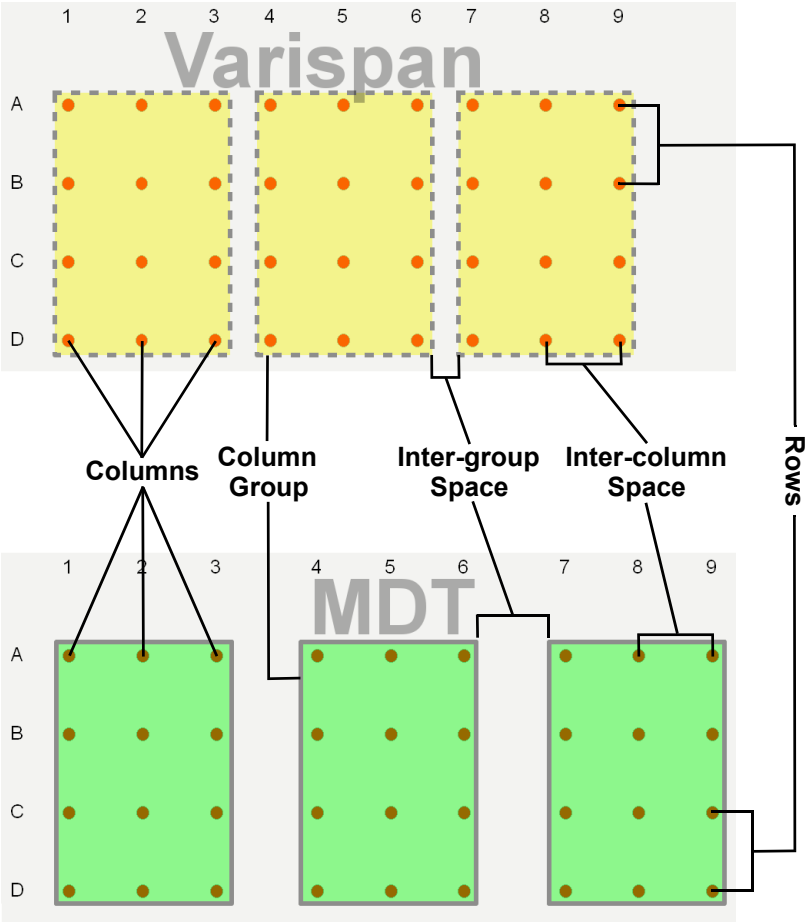


Figure 2-4. Deck Grid Layout Examples

Figure 2-4 shows the rows and columns on both types of deck plating. Rows are identified by letters and columns are identified by numbers. To identify a position on a deck plate, specify the row letter and then the column number. For example, **A1** identifies the upper-left position on a deck plate: Row A, Column 1. Column numbering restarts for each separate deck plate so it is important to identify the deck plate in addition to the row and column. Typically, you identify deck plates by their positions on the instrument's frame: Left, Middle, and Right. For example, to identify the upper-left position on the left deck plate you can refer to **Left[A1]**. The instrument tracks and identifies the labware you place on the deck using this information. When tracking the placement of labware, the software includes the plate type as well, and displays the location in the format **Var-Left[A1]** or **MDT-Right[D7]**.

Row placement and spacing is the same for both types of deck plates. However, the arrangement and grouping of columns differs according to the deck plate type. Column groups, identified in Figure 2-4 by the outlined, shaded areas, are made up of three adjacent columns. Column groups include three columns because standard labware requires this amount of space on the deck. Inter-group spaces separate column groups, as shown in Figure 2-4.

As Figure 2-4 illustrates, the inter-group space is the primary difference between deck plate types. The MDT deck plate has a larger inter-group space than a Varispan deck plate. This extra inter-group space is necessary to accommodate certain MDT-related labware such as docking stations, wash bowls, and tip load supports and helps prevent a piece of labware from obstructing more than the required three columns on the deck.

Note that pipetting arms and deck plates are completely compatible. You can use an MDT arm with a Varispan deck plate and a Varispan arm with an MDT deck plate. The differences in plate types is for deck space optimization only. Using an MDT arm with a Varispan deck plate decreases the amount of labware that will fit on the deck because the Varispan deck plate has a smaller inter-group space. Certain types of MDT labware will obstruct additional deck positions on the Varispan deck, resulting in a diminished labware capacity for the deck.

When placing labware on the deck, the MDT head requires the labware to be placed one row apart, not immediately next to each other, to prevent the head from coming into contact with other labware on the deck.

Rail Configurations

Each JANUS G3 instrument has two rails that provide travel support for the pipetting and gripper arms. The rail on the front of the instrument, just above the plastic safety shield, is the *front* rail. The rail in the back of the instrument is the *primary* or X-rail. Three arm systems - instruments with two pipetting arms and a Gripper arm - require a second rail on the rear of the system. This rail is located just above the primary rail and is the *secondary* rail. The rear rails provide support for the arms and the travel path for the robotic arms. The front rail primarily provides support for the arms.

The configuration of the primary and secondary rail provides *integration* options for the system. With a secondary rail configuration that is longer than the deck, liquid handling and gripper arms can access *off-deck* locations for integration with other laboratory equipment.

Secondary rails that are longer than the deck can be offset to either side of the instrument platform for greater flexibility. By moving one arm *off the deck*, the other arm can freely access the entire deck.

JANUS G3 Instrument Description

All JANUS G3 systems have certain components in common, such as the status lights, front door, deck, and System Pause button. Figure 2-5 identifies the common components of all JANUS G3 systems.

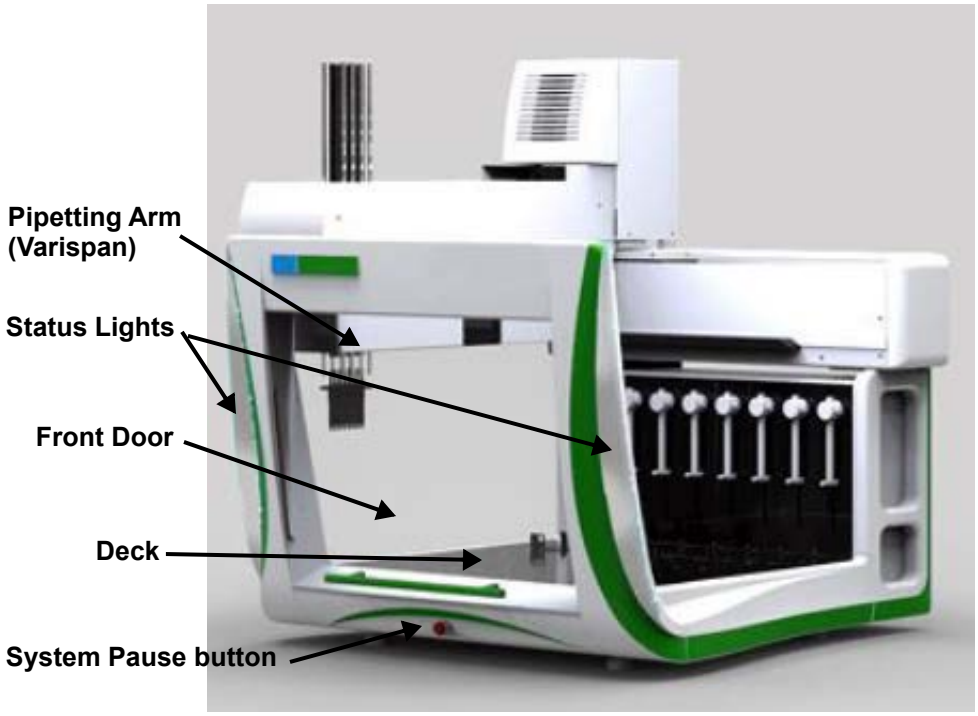


Figure 2-5. JANUS G3 Instrument Components

Pipetting Arm - The arm(s) on the system that perform liquid handling operations. Figure 2-5 shows a Varispan arm. The arms that are supported on a system depend on the system platform. See Available Configurations on page 21 for descriptions of each platform. For more information about each type of pipetting arm, see Varispan Pipetting Arm on page 30 or MDT (Modular Dispense Technology) Pipetting Arm on page 31.

Gripper Arm - (Not shown in Figure 2-5) The Gripper arm is used to transport labware to or from JANUS G3 deck locations or off-deck locations supported by the configuration of the system. For more information, see Gripper Arm on page 33.

Status Lights - The two status lights indicate the current status of the system. The status lights automatically dim after remaining in the same state for a specified time period. The colors displayed for each status and the time until the lights dim can be customized if desired. See Configuring the Status Lights on page 330 for instructions. The default colors of the status lights are:

- Green - The system is running a protocol. The lights remain green if the instrument is paused.
- Blinking Green - The system is waiting for user input.
- Blue - The system is idle or a protocol is complete.
- Red - The system has encountered an error.

Front Door - Grasp the middle of the handle and lift the handle up and slightly out away from the instrument to open the front door.
The doors are equipped with an interlock switch that prevents the system from moving while the doors are open. Opening a door while a protocol is running disables all arm X, Y, and Z motors immediately and displays a warning message in the software. If the door is opened during a Varispan aspirate or dispense operation, the system will finish the aspirate or dispense. If the door is opened during an MDT aspirate or dispense operation, the system will stop the aspirate or dispense immediately.

☞ *Note: If the door is opened while an arm is moving in the X direction, the arm may continue to glide, without power, in the direction it was moving.*

☞ *Note: If possible, press the Pause button in the software to pause the system before opening the door to make resuming the protocol easier.*

To continue running the protocol, close the door, if necessary use the Direct Control window to set up the instrument to continue the protocol, and then select the desired recovery option in the software.

Deck - Interchangeable deck plates used to accurately locate labware and support tiles. For information on the number of deck plates supported on each platform, see Available Configurations on page 21.

System Pause button - Pressing the System Pause button on the front of the instrument while a protocol is running disables all arm X, Y, and Z motors immediately and displays a warning message in the software. If the System Pause button is pressed during a Varispan aspirate or dispense operation, the system will finish the aspirate or dispense. If the System Pause button is pressed during an MDT aspirate or dispense operation, the system will stop the aspirate or dispense immediately. For information about restarting a protocol after pressing the System Pause button, see Using the System Pause Button on page 173.

Connection Panel - (Not shown in Figure 2-5) See JANUS G3 Connection Panel on page 29.

JANUS G3 Connection Panel

The JANUS G3 instrument includes a connections panel (see Figure 2-6) on the left end of the instrument. This panel includes the main power, USB cable, and connection ports for several optional accessories. For Mini systems with an 8-Tip Varispan arm, the connection panel is located on the Remote Electronics Box.

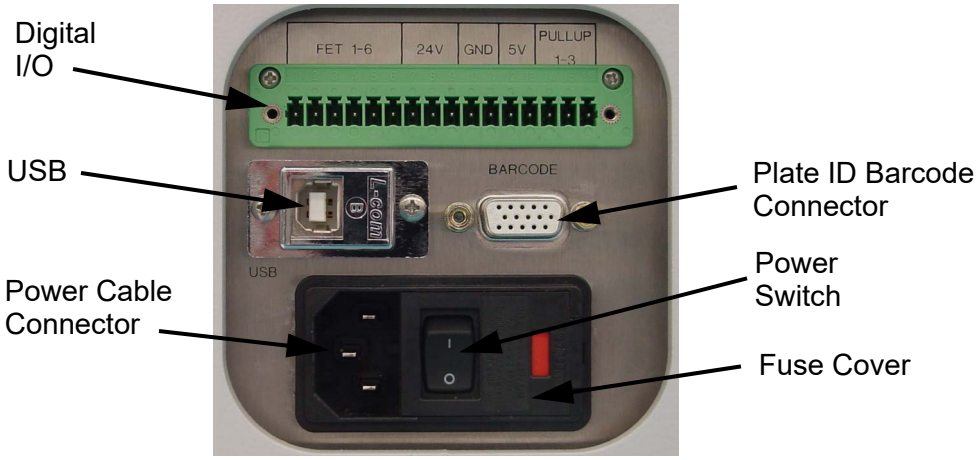


Figure 2-6. JANUS G3 Connectors

Digital I/O port - Provides communication for optional accessories such as the Tube Barcode Reader. For more information about optional accessories, contact your PerkinElmer sales representative.

USB Cable - Uses a permanently-connected USB cable to connect the JANUS G3 to a USB port on the Windows computer running WinPREP. This is the only communication between WinPREP and the JANUS G3.

Barcode Port - Connects the optional Plate ID Barcode Reader to the JANUS G3 system. This connection provides communication between the JANUS G3 and the Plate ID Barcode Reader accessory. This connection is not used if the system does not include the Plate ID Barcode Reader option.

Power Cable Connector - Connects the JANUS G3 instrument to an appropriate power outlet. This is the main power connector for the instrument.

WARNING *Appliance inlet is disconnecting device. Place device or equipment in a manner so that disconnecting device is accessible at all times.*

Power Switch - The main power switch for the instrument.

Fuse Cover - Contains the appropriate fuses.

Varispan Pipetting Arm

The Varispan pipetting arm provides sample access to individual sample positions on the deck, with each tip moving vertically and independently. The Varispan feature provides flexible spacing between the sampling tips. JANUS G3 supports either 4-tip or 8-tip Varispan pipetting arms. The Varispan arm supports both disposable and fixed tips. Fixed tips are the metal tips connected to the fluid path for the arm. Disposable tips are plastic tip adapters that fit over the system's fixed tips. You can use either type of tips or combine them in the same protocol. Disposable tips are discarded after use in a procedure or protocol.

Each tip is supported by an independent liquid path and syringe pump, allowing maximum flexibility. The volume and the locations are independent, allowing you to select specific wells for each pipetting operation.

The Varispan arm provides Liquid Level Sensing (Liquid Level Sense) for each of the pipetting tips. Liquid Level Sensing enables the instrument to determine the level or depth of liquid in the labware wells and dynamically adjust the speed at which the tips move into or out of the liquid. This helps ensure the tips remain properly submerged in the liquid during pipetting operations.

The Varispan arm is available on select JANUS G3 configurations. You can also add the Varispan arm as an additional option on some existing JANUS G3 platforms with an MDT arm. Contact PerkinElmer (see page 2) for more information.

Peristaltic Pump Box Connection Panel

The JANUS Peristaltic Pump (peri pump) Box, included with systems equipped with a Varispan arm, includes a connections panel on the back of the Peri Pump Box. This panel includes the main communication port, system liquid sensor port, and digital I/O port. Figure 2-7 shows the JANUS Peri Pump Box connections panel.

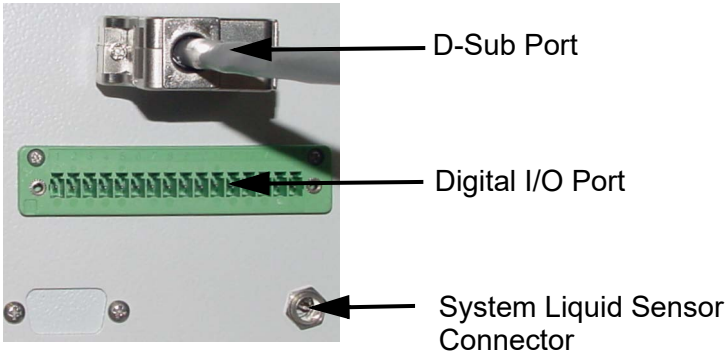


Figure 2-7. JANUS Peri Pump Connectors

D-SUB Port - Provides communication between the JANUS G3 and the peri pump. Connects to the Peri Pump Connector on the JANUS G3.

Digital I/O Port - Provides communication for optional accessories. For more information about optional accessories, contact your PerkinElmer sales representative.

System Liquid Sensor Connector - Connects the sensor in the system liquid container to the peri pump. This sensor uses a float mechanism to monitor the level of the system liquid fluid in the container.

MDT (Modular Dispense Technology) Pipetting Arm

The MDT (Modular Dispense Technology) pipetting arm is a flexible JANUS G3 option for automated liquid handling of low to high throughput microplate applications. The patented interchangeable head design provides a convenient and flexible way to support many different head sizes on the MDT pipetting arm.

The MDT arm does not contain independent liquid paths for each tip. All tips aspirate and dispense in unison. You can, however, load a partial box of disposable tips, thereby selectively using some tips to aspirate and dispense samples. Liquid Level Sensing (Liquid Level Sense) is not available for the MDT arm.

The MDT arm is available on select JANUS G3 configurations. The MDT arm can be used with the Varispan and/or Gripper arm in certain JANUS G3 configurations. See Available Configurations on page 21 for more information.

When placing labware on the deck, the MDT head requires the labware to be placed one row apart, not immediately next to each other, to prevent the head from coming into contact with other labware on the deck.

Dispense Heads

JANUS G3 supports several different MDT heads, including 96 and 384-tip dispense heads. These heads are capable of dispensing into 96, 384, and 1536-well plates, and are fully interchangeable. Nanoliter dispensing can be performed using the optional NanoHead (50 nL to 1 µL) or the MDT Pin Tool (20 to 500 nL). You can switch MDT heads dynamically during a single protocol, providing an unprecedented level of flexibility to your assays.

Head ID Tag

The Head ID tag is located on the top of each interchangeable head. This tag is used by the system to identify the head. When you place the head and docking station on the deck, this ID tag must always be oriented so that it is located to the right. The tag must line up with a sensor on the base of the tower. When the tower is lowered to retrieve the head from the docking station, the sensor reads the tag to identify the head that is being used. If the system cannot find the tag (this will happen if the head is reversed in the docking station), you will receive a message that the system cannot identify the head type.

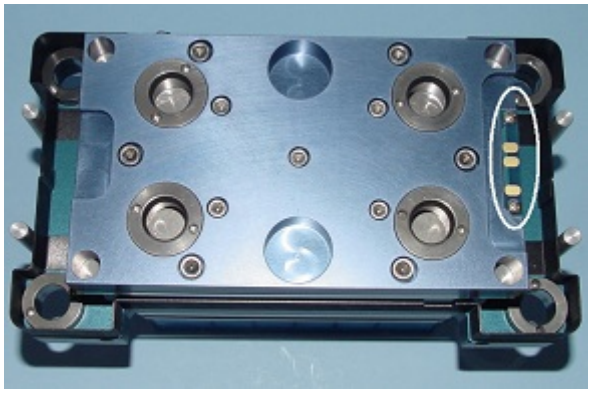


Figure 2-8. Head ID Tag

Docking Station

The docking station is required for loading and unloading the interchangeable heads on the MDT arm. The NanoHead Docking Station Adapters must be used with the MDT Docking Station when storing or loading the NanoHead. See Docking Station Restrictions on page 120 for information on locating the docking station on the deck.

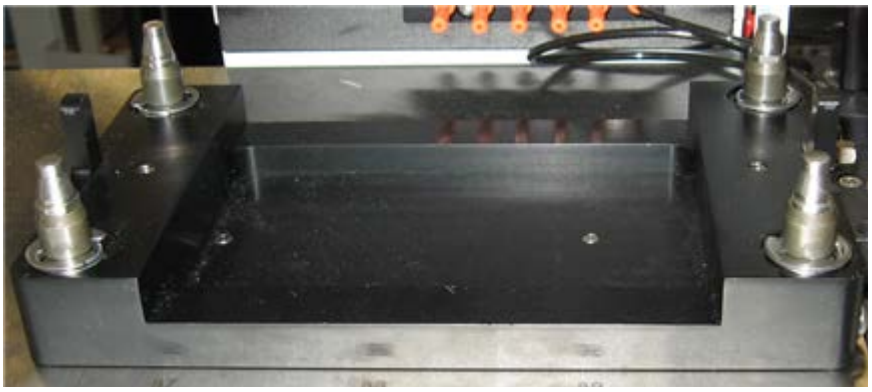


Figure 2-9. Docking Station

MDT Gripper

The MDT arm can include an optional gripper for additional gripper functionality. The MDT Gripper can be used to move plates and tip boxes. The MDT Gripper moves in the same X, Y, and Z axes as the MDT arm, and also includes gripping (close and open) movements to provide outside grip and inside grip capabilities. Covers must be removed from tip boxes. The Gripper will not transport tip boxes with covers.

The MDT gripper is an extension of the MDT pipetting arm and is not offered as a stand-alone option.

Gripper Arm

The Gripper arm is a fully-integrated option that can be used to move labware from one deck location to another, move labware to off-deck locations, or assemble/disassemble multi-part labware components such as manifolds.

The Gripper arm can be mounted on the same rail as the pipetting head for a two arm configuration. It can also be mounted on the secondary rail as a second or third arm on systems configured with one or two pipetting arms, respectively.

The Gripper arm moves in the same X, Y, and Z axes as the liquid handling arms, and also can rotate 355 degrees (theta axis), allowing access to labware in any orientation on the deck. The Gripper also includes gripping (close and open) movements to provide outside grip and inside grip capabilities. The Gripper can securely grasp and move labware or special components such as Solid Phase Extraction manifold parts from inside a manifold where necessary.

Options and Accessories

The following options and accessories are described in this manual:

- Enclosure Option on page 35
- UV Light Option on page 36
- MDT Pipetting Arm Accessories on page 36

The following options and accessories can be integrated with the JANUS G3 instrument:

- PerkinElmer Victor
- PerkinElmer EnVision
- Enhanced Security software
- Plate ID Bar Code Reader
- Tube Barcode Reader
- PlateStak® System
- Solid Phase Extraction/Vacuum Filtration
- Several shakers and heaters
- Deck expansion modules
- Thermal Cycler integration
- Inheco On Deck Thermal Cycler (ODTC)
- FlexDrop integration
- PlateWash System integration
- Proteomics integration
- A variety of labware accessories

Individual manuals are provided with the options and accessories listed above. Refer to the user documentation included with the option or accessory for detailed operating instructions.

Enclosure Option

An optional JANUS G3 Enclosure is offered to shield the instrument deck from dust and particulates. The enclosure is offered in two heights to accommodate the configuration of the JANUS G3 instrument. The shorter enclosures are compatible with systems that only include a Varispan arm. The taller enclosures are compatible with systems that include an MDT arm and/or a Gripper arm. Figure 2-10 shows the two different enclosures for the JANUS G3 Mini Platform.

The Enclosure also includes interior lights to illuminate the JANUS G3 deck. See Controlling the Interior Lights on page 103 for more information.

Figure 2-10. JANUS G3 Mini with Varispan Arm Enclosure and JANUS G3 Mini with MDT Arm Enclosure

The UV Light option requires an enclosure option to be installed before the UV light can be operated. The enclosure blocks UV light from exiting the enclosure. Door switches turn off the UV light if any enclosure door is opened during operation and prevent the light from turning on when any door is open.

UV Light Option

The optional JANUS G3 UV Light provides UVC light with a wavelength of 2,537 Angstroms (254 nm) over the deck of the JANUS G3. A minimum UVC dose of 5uW per square centimeter per second is provided. All items on the deck may need to be removed and the arms may need to be moved to expose the entire deck.

The UV Light option is offered in two sizes. The JANUS G3 UV Light, Mini is compatible with the JANUS G3 Mini platform. The JANUS G3 UV Light, Std/Exp is compatible with the JANUS G3 Standard or Expanded Platform.

WARNING *Unprotected eyes and skin can be seriously damaged by exposure to UVC radiation. Do not open any doors or covers while the UV Light is switched on.*

- *Close all enclosure doors and install covers on any tip chutes, tip box chutes, or open deck locations before operating the UV Light via Direct Control or in a protocol. The enclosure panels block the shortwave UV radiation.*
- *Do not defeat the door interlock switches.*
- *See UV Light Safety on page 58 for additional important safety information.*

The JANUS G3 UV Light option must be used with the optional enclosure (see page 35). The acrylic glass panels of the enclosure block the UV light. Interlock switches on the enclosure doors turn the UV light off if a door is opened while the light is on, and prevent the light from being turned on while a door is open.

The UV Light is controlled by the WinPREP and JANUS Application Assistant software. See the *JANUS G3 User Manual* and JANUS Help file for UV Light operating instructions.

MDT Pipetting Arm Accessories

The MDT arm can use several options and accessories. These include wash stations, docking stations, auto tip loaders, reagent containers, and various head configurations. Contact your PerkinElmer sales representative for a complete list of accessories available for the MDT arm.

The following MDT arm accessories are described in this manual:

- NanoHead (below)
- Serial Dilution Tools on page 38
- Pin Tools on page 42

NanoHead

The NanoHead is a low volume 384-tip dispense head available for JANUS G3 instruments equipped with an MDT arm. Using the NanoHead, you can pipette fluid volumes between 50 nanoliters (nL) and 1 microliter (µL). You can only use the NanoHead with 384-well and 1536-well plates because the head uses the 384-well format. The NanoHead can only access plates with wells in multiples of 384.

The NanoHead is especially useful for pipetting from stock compound plates directly into reaction plates. This requires fewer assay preparation steps and increases the overall accuracy of the assay. The NanoHead can be used for compound reformatting in high throughput screening, plate replication, and reagent addition, in applications such as PCR.

Serial Dilution Tools

The optional Serial Dilution Tools (SDT) are a group of MDT dispense heads you use with the MDT arm to perform direct and serial dilutions. The Serial Dilution Tools can load a single row or single column of disposable tips from a standard full box of tips and includes protocols to perform a serial dilution.

Although you can perform serial dilutions using the MDT arm without the Serial Dilution Tools, this option streamlines the process and eliminates the need to use partially loaded tip boxes. It also allows you to perform multiple serial dilution operations by loading rows or columns of disposable tips from a standard tip box.

The Serial Dilution Tools include:

- SDT Heads on page 38
- SDT Tip Box Support on page 41
- SDT Docking Station on page 41

For tips on using the SDT Head, Docking Station, and Tip Box Support, see Labware Positioning Considerations on page 119.

SDT Heads

The Serial Dilution Tool Heads available are listed in the table below. Each head is described in more detail later in this section.

Dispenser Head	Configuration	Compatible Tips
MDT I200RC Serial Dilution Tool	column or row	P200
MDT I50R Serial Dilution Tool	row only	P50 P20
MDT I50C Serial Dilution Tool	column only	P50 P20
MDT I30RC Serial Dilution Tool	column or row	P30 P10

The row and/or column orientation refers to the pattern of mandrels on the SDT head itself and not to the orientation of the tips as they reside in the disposable tip box. When the SDT head moves to the tip box and columns are being accessed, the head starts at the right-most column of the tip box and moves across the tip box (one column at a time). When rows are being accessed, the MDT head starts at the bottom-most row of the tip box and moves up to the top-most row of the tip box (one row at a time). After the tips have been picked up and used in a protocol, they must be dropped in a waste chute. Do not return the used tips to the tip box.

Serial Dilution Tools are available as an option on any current instrument equipped with an MDT arm. Existing instruments can be upgraded to include the option. Contact PerkinElmer (see page 2) for additional information.

MDT I200RC Serial Dilution Tool: Supports column or row pickup and is compatible with P200 tips. The mandrels on the MDT I200 RC Serial Dilution Tool are located around the entire perimeter of the head.

Figure 2-11. MDT I200RC Serial Dilution Head

MDT I50R Serial Dilution Tool: Supports row pickup and is compatible with P50 and P20 disposable tips. The mandrels on the MDT I50R Serial Dilution Tool are located on the front edge of the head (the “front” becomes the “back” when you turn the head over).

Figure 2-12. MDT I50R Serial Dilution Head

MDT I50C Serial Dilution Tool: Supports column pickup and is compatible with P50 and P20 disposable tips. The mandrels on the MDT I50C Serial Dilution Tool are located on the left edge of the head.

Figure 2-13. MDT I50C Serial Dilution Head

MDT I30RC Serial Dilution Tool: Supports column or row pick up and is compatible with P30 and P10 disposable tips. The tip holes on the MDT I30RC Serial Dilution Tool are located along the left edge and front edge of the head (the “front” becomes the “back” when you turn the head over).

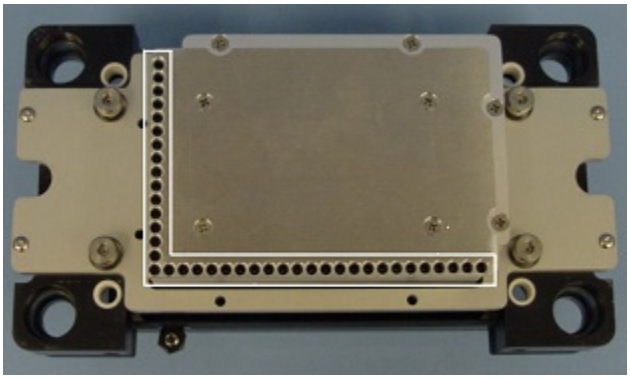


Figure 2-14. MDT I30RC Serial Dilution Head

SDT Tip Box Support

The SDT Tip Box Support is required for the JANUS Serial Dilution Tools. The SDT head can load disposable tips only from tip boxes in the SDT Tip Box Support Tile. See Tip Loading Restrictions (Serial Dilution Tools only) on page 122 for information on locating the SDT Tip Box Support Tile on the deck.

Figure 2-15. Serial Dilution Tools Tip Box Support Tile

SDT Docking Station

The Serial Dilution Tools require an SDT Docking Station (Figure 2-16) to load and unload the interchangeable heads on the MDT arm. Four different SDT heads are available to support a total of five different disposable tip sizes. Refer to MDT (Modular Dispense Technology) Pipetting Arm on page 31 for more information about available SDT head options and supported tip sizes.

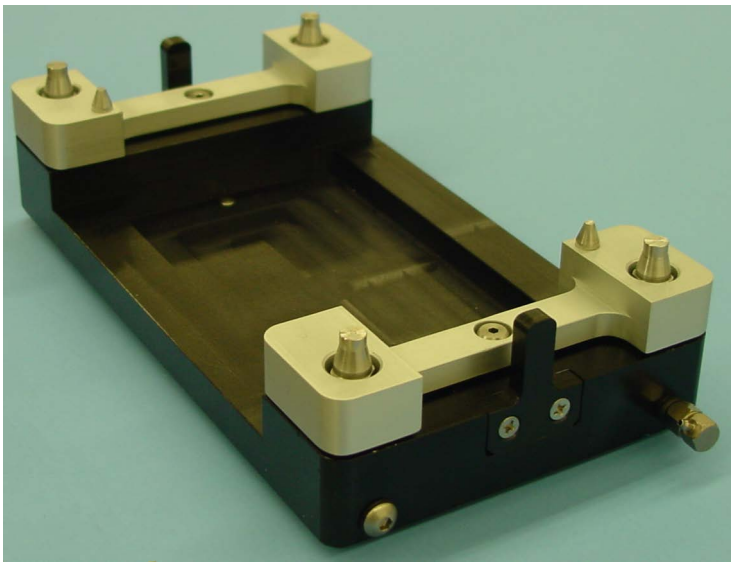


Figure 2-16. Serial Dilution Tools Docking Station

Pin Tools

The MDT Pin Tools are optional MDT heads that allow controlled pipetting of volumes as small as 20 nanoliters (nL).

In contrast to the NanoHead head, the pins on the pin tool do not contain a liquid column. The pins are solid and mount directly to the base plate. The plate attaches to the arm by slipping over the dispense head. The tips are inserted into the labware wells. The pins transfer liquid when the liquid adheres to the sides and tips of the pins. The physical properties of the pin and the liquid being transferred directly affect the transfer volume. For example, the diameter of the pin, the surface tension of the pin's coating, the surface tension of the liquid being transferred, the distance the pin is inserted into the liquid, and the speed at which the pins are withdrawn from the liquid all influence the transfer volume. When these variables are taken into consideration, the accuracy of the liquid transfer is very high, with a reliability of 95% or more.

PerkinElmer provides a wide variety of pin tool choices, based on the number of pins, desired pipetting volume, and construction material. Contact your PerkinElmer sales representative for a complete list of pin tools available for the MDT arm.

WinPREP Software Overview

The JANUS G3 system uses two software applications to control the system: WinPREP and JANUS Application Assistant.

- WinPREP is used to set up the system, calibrate the instrument, and to create, edit, and evaluate the protocols. See WinPREP Main Window for an overview of the WinPREP Main Window.
- JANUS Application Assistant is used to run protocols, run diagnostic tests, and run maintenance protocols. See JANUS Application Assistant Software Overview for an overview of the JANUS Application Assistant Main Window.

WinPREP Main Window

WinPREP makes protocol creation and development easier by providing an intuitive and easy-to-use graphical interface and many predefined procedures to create protocols. The Procedures already contain the required individual steps and can be combined and configured to construct more complex protocols. WinPREP also includes protocols that can be used as-is or as templates for developing similar protocols.

The main window of the WinPREP software, shown in Figure 2-17, is divided into two views that graphically represent the contents of the protocol.

The **Protocol Outline View**, on the left, defines the individual steps for the protocol. The **Deck View,** on the right, defines the labware on the deck and is used to specify the source and destination labware for the steps in the protocol. To adjust the relative size of the two views, drag the vertical divider between the views horizontally in the window.

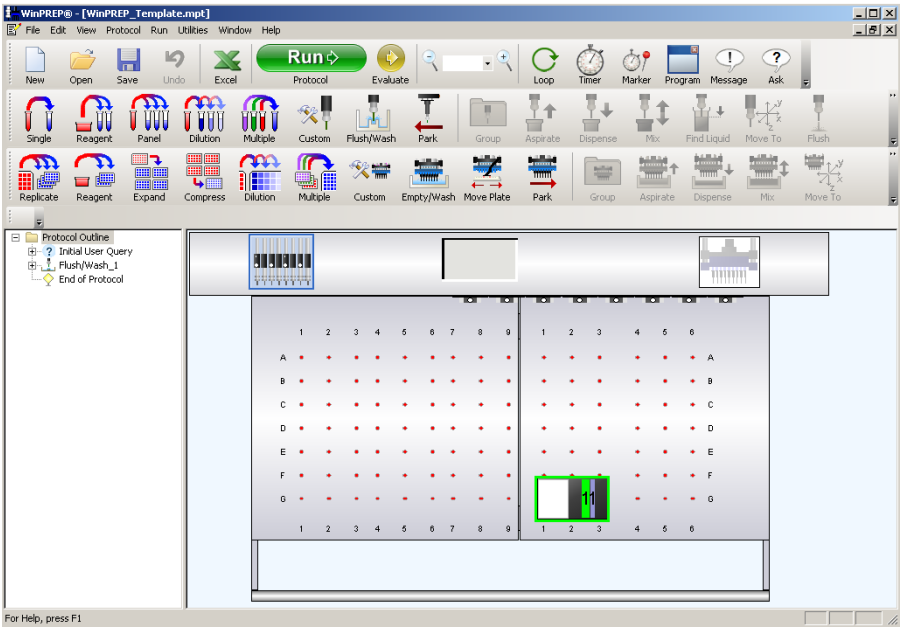


Figure 2-17. Protocol Outline View (Left) and Deck View (Right)

Multiple protocols can be open at the same time in the WinPREP main window. You can have several protocols open in WinPREP. The JANUS Application Assistant is used to run the protocol in the active window.

Protocol Outline View

The **Protocol Outline View** displays a visual representation of the protocol. The Protocol Outline uses a standard tree structure to show the order, hierarchy and organization of the operations in the protocol. The Protocol Outline View provides access to the parameter windows to define the parameters for each procedure and step in the protocol. Figure 2-18 shows an example of a protocol outline.

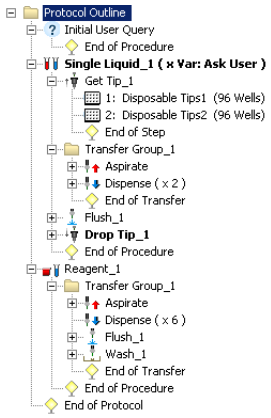


Figure 2-18. Protocol Outline View

For more information about the Protocol Outline view, see the JANUS Online Help. For detailed explanations of the available procedures and steps, see Procedures and Steps on page 184.

Mapping is the process of associating a node with the labware used by the node; mapping consists of linking a step in the protocol outline to a labware item on the deck. You cannot start a protocol until *each* liquid handling step or gripper step in the protocol outline is mapped to at least one labware item. The names of unmapped procedures or steps display in **bold** type in the protocol outline to signify their unmapped status. For more information about the mapping labware, see Mapping the Labware on page 139.

Deck View

The Deck View displays the physical deck layout for the protocol. The type of labware and the position of labware must be identified for the protocol. The deck view is a graphical representation of the labware position, type, and location on the deck. The deck view also indicates the labware mapped to a procedure or step selected in the protocol outline. The open space at the top of the deck can be used to temporarily hold labware. Labware can be stacked in the deck view.

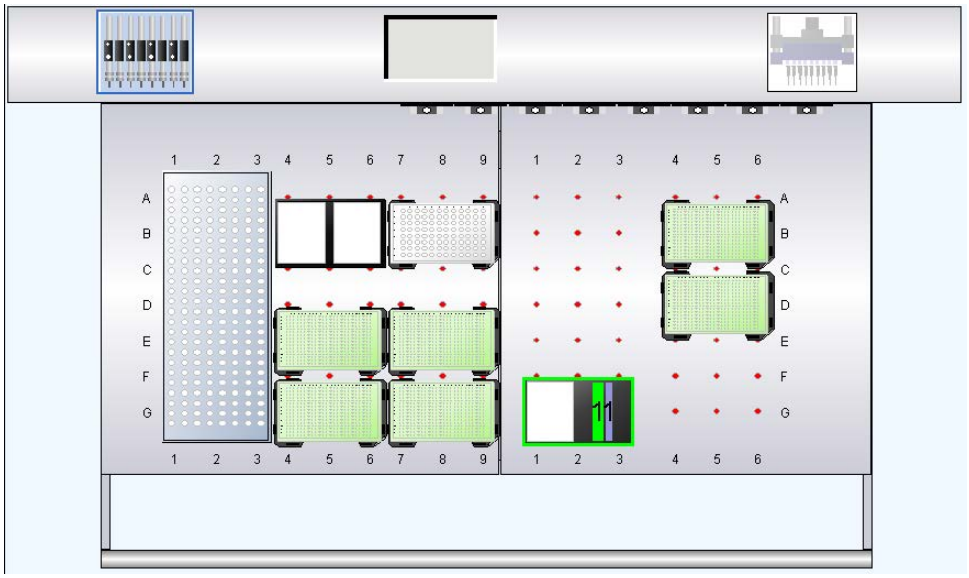


Figure 2-19. Deck View (8-Tip and MDT System)

The arm icons at the top of the deck view display the arms that are installed on the system. Click an arm icon to select the arm and to display the deck calibration status for each arm. For more information about deck calibration, see Calibrating the System on page 285.

Toolbars

The WinPREP software displays several toolbars at the top of the window. These toolbars provide quick, graphical shortcuts to commonly used menu functions and to procedures and steps used in protocols. Hovering the cursor over a button displays a tool tip that describes the function of the button.

Only the buttons that are appropriate for the current operation are enabled. Disabled buttons are indicated by the lack of color and a dim display. You can view or hide a toolbar by selecting the toolbar name on the **View** menu. You can customize the toolbar by adding, removing, or rearranging buttons. For more information, see Customizing the Toolbars on page 193.

Figure 2-20. Toolbars

For more information about the WinPREP procedures and steps available on the toolbars, see Procedures on page 184 and Steps on page 192.

For detailed descriptions of the toolbars, see the JANUS online Help.

JANUS Application Assistant Software Overview

The JANUS Application Assistant software is used to select and run protocols on the JANUS G3 system. The tabs along the top of the window allow you to easily select the protocol that you want to run, specify any parameters for the protocol, gather the labware, place the labware on the deck, run the protocol, and then clean up the instrument after the run. Maintenance and diagnostic protocols are also available in the JANUS Application Assistant.

For detailed instructions on running protocols, see Running Protocols on page 164.

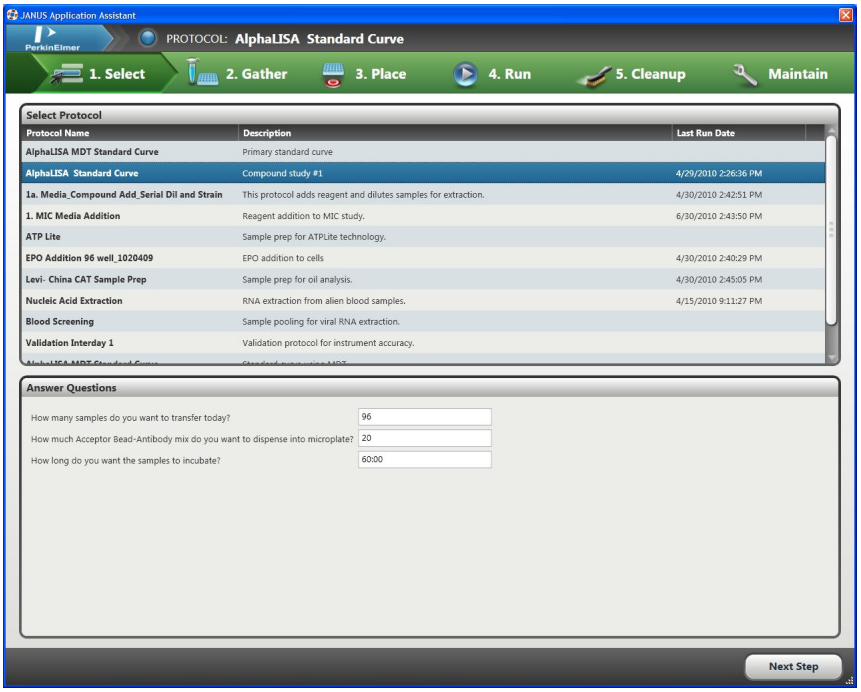


Figure 2-21. JANUS Application Assistant Software

The JANUS Application Assistant Editor software is a utility used to set up protocol categories and assign protocols to each category. If a protocol is not assigned to a protocol category, the protocol is not displayed in the JANUS Application Assistant software. For more information about protocol categories, see Add the Protocol to a Protocol Category on page 153.

See the JANUS online help for complete descriptions of each tab in the JANUS Application Assistant.

Labware Overview

WinPREP labware is an electronic representation of the physical laboratory equipment you use in a protocol. Labware consists of test tubes, test tube racks, microplates, support tiles, flush/wash stations, and many other types of common laboratory equipment. WinPREP groups similar types of labware into categories. You assign labware to categories in the labware library (see page 250). This organization makes it easier to find the labware.

The labware definition defines the number and organization of sample positions on the labware item. The labware definition also defines whether the labware contains positions for multiple reservoirs or troughs.

WinPREP provides an extensive library of predefined labware items. While the predefined labware will meet many of your needs, you might require a piece of labware not defined in the library. WinPREP includes the **Labware Definition Wizard** to easily define new or custom labware.

For more information about labware, see Creating the Deck Layout on page 118 and Labware Libraries on page 250.

Support Tiles

Each labware support tile has an indicator showing where to read the grid coordinates for the labware position. For microplates, a cutout in the bottom of the support tile shows the coordinate ID of the plate. Other labware supports have their own coordinate indicators.

Mapping Labware

Each step or procedure that accesses labware must be *mapped* to the labware for the step or procedure. Mapping labware is the process of associating the plates, tubes, flush/wash stations, etc. to the actual procedures and steps in the protocol outline.

Mapping labware requires an understanding of the **Deck View**. For more information about the deck view, and the process of mapping labware, see Mapping the Labware on page 139.

Security Overview

System security for the JANUS G3 Automated Workstation, the WinPREP software, and the JANUS Application Assistant software is handled through the standard Windows User Account security. Security and privilege access is controlled through password protected user log in. Three levels of security access for user accounts are created when WinPREP is installed:

- Packard User
- Packard Administrator
- Packard TSE

Each security level allows increased accessibility to the system over the previous level, with Packard TSE having the greatest control. You can create as many users as necessary to maintain security and usability of the system. System administrators can create or modify User Accounts with the User Manager program, one of the standard Administrative Tools provided with the Windows operating system. For more information on the security levels and instructions on assigning users to a security group, see JANUS Security on page 231.

In addition to the standard Windows User Account security, PerkinElmer offers the JANUS Enhanced Security Option. The JANUS Enhanced Security option provides 21 CFR Part 11 compatibility.

System Specifications

This section describes the physical specifications, the environmental requirements, and the electrical requirements of the JANUS G3 system. The actual size and weight of the system can vary, depending on the deck configuration, installed options, etc.

For In Vitro Diagnostic Use.

Pipetting Precision

Pipetting arm	Tip/Head	Volume	% CV	Condition
Varispan	20 uL disposable tip	5 uL	< 2%	Distilled water, 500 uL syringe
	Fixed tip	50 uL	< 1%	Distilled water, 500 uL syringe
MDT	P20 disposable tip on P50 96-tip Head	1 uL	< 2%	
	P30 or P10 disposable tips on P30 384-tip Head	1 uL	< 5%	
	P50 disposable tips on P50 96-tip Head	5 uL	< 1%	
	P235 disposable tips on P235 96-tip Head	50 uL	< 1%	

Pipetting precision above is typical when using distilled water under controlled conditions.

Physical Dimensions for Cladded Instruments

The sizes below are for the instrument only and do not include optional accessories.

Height x Width x Depth

Platform	Mini	Standard	Integrator	Expanded
Configuration				
Varispan	34” (864 mm) x 31” (788 mm) x 33” (838 mm)	34” (864 mm) x 47” (1194 mm) x 33” (838 mm)	34” (864 mm) x 62” (1575 mm) x 33” (838 mm)	34” (864 mm) x 62” (1575 mm) x 33” (838 mm)
MDT	44” (1118 mm) x 31” (788 mm) x 33” (838 mm)	44” (1118 mm) x 47” (1194 mm) x 33” (838 mm)	44” (1118 mm) x 62” (1575 mm) x 33” (838 mm)	44” (1118 mm) x 62” (1575 mm) x 33” (838 mm)
Varispan + Gripper Arm	Not Available	43” (1092 mm) x 47” (1194 mm) x 33” (838 mm)	43” (1092 mm) x 62” (1575 mm) x 33” (838 mm)	43” (1092 mm) x 62” (1575 mm) x 33” (838 mm)
Varispan + MDT	Not Available	44” (1118 mm) x 47” (1194 mm) x 33” (838 mm)	44” (1118 mm) x 62” (1575 mm) x 33” (838 mm)	44” (1118 mm) x 62” (1575 mm) x 33” (838 mm)

Instrument Weights for Cladded Instruments (Approximate)

The weights below are for the instrument only and do not include any optional accessories. Add the weight of any optional accessories for total system weight.

Net Weight/Shipping Weight

Platform	Mini	Standard	Integrator	Expanded
Configuration				
Varispan	210 lb (95 kg)/ 370 lb (168 kg)	265 lb (120 kg)/ 435 lb (198 kg)	290 lb (132 kg)/ 570 lb (259 kg)	310 lb (141 kg)/ 590 lb (268 kg)
MDT	215 lb (98 kg)/ 350 lb (159 kg)	255 lb (116 kg)/ 435 lb (198 kg)	275 lb (125 kg)/ 570 lb (259 kg)	295 lb (134 kg)/ 590 lb (268 kg)
Varispan + MDT	Not Available	325 lb (148 kg)/ 445 lb (202 kg)	355 lb (161 kg)/ 580 lb (263 kg)	375 lb (170 kg)/ 600 lb (272 kg)
Gripper Arm	Not Available	+ 50 lb (23 kg)	+ 50 lb (23 kg)	+ 50 lb (23 kg)

Physical Dimensions for Instruments with Enclosure

The sizes below include only the JANUS G3 instrument with the optional Enclosure.

Height x Width x Depth

Platform	Mini	Standard	Integrator	Expanded
Configuration				
Varispan 8-Tip Short	38" (965 mm) x 38" (965 mm) x 35" (890 mm)	38" (965 mm) x 55" (1400 mm) x 35" (890 mm)	38" (965 mm) x 70" (1780 mm) x 35" (890 mm)	38" (965 mm) x 70" (1780 mm) x 35" (890 mm)
MDT Tall	46" (1170 mm) x 38" (965 mm) x 35" (890 mm)	46" (1170 mm) x 55" (1400 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)
Varispan 8-tip + Gripper Arm Tall	Not Available	46" (1170 mm) x 55" (1400 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)
Varispan + MDT Tall	Not Available	46" (1170 mm) x 55" (1400 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)	46" (1170 mm) x 70" (1780 mm) x 35" (890 mm)

Instrument Weights for Instruments with Enclosure (Approximate)

The weights below do not include any optional accessories. Add the weight of any optional accessories for total system weight.

Net Weight/Shipping Weight

Platform	Mini	Standard	Integrator	Expanded
Configuration				
Varispan 8-Tip Short	275 lb (125 kg)/ 410 lb (186 kg)	310 lb (141 kg)/ 350 lb (159 kg)	Not Available	345 lb (157 kg)/ 640 lb (290 kg)
MDT Tall	335 lb (152 kg)/ 470 lb (213 kg)	375 lb (171 kg)/ 425 lb (193 kg)	Not Available	420 lb (191 kg)/ 715 lb (325 kg)
Varispan + MDT Tall	Not Available	445 lb (202 kg)/ 565 lb (256 kg)	Not Available	500 lb (227 kg)/ 725 lb (329 kg)
Gripper Arm	Not Available	+ 50 lb (23 kg)	Not Available	+ 50 lb (23 kg)
UV Light	+ 25 lb (12 kg)	+ 25 lb (12 kg)	Not Available	+ 25 lb (12 kg)

Compressed Air Requirements (for MDT Arm only)

The MDT arm requires a clean, dry source of compressed air that meets the following specifications: 110-145 psi (8-10 bar) at 2.0 cubic feet (56.6 L) per minute.

Environmental Requirements

Operating Environment

The environmental requirements for the JANUS G3 Automated Workstation are:

Temperature[a]	59-95ºF (15-35ºC)
Relative Humidity	15-85% at 85ºF (30ºC), non-condensing
Altitude[b]	< 6500 ft. (2000 m)
For Indoor Use Only	

a. Liquid DMSO freezes at 65ºF (18.5ºC) if used.
b. Contact PerkinElmer for higher altitude operation.

Storage Environment

The JANUS G3 Automated Workstation requires the following environmental conditions for storage:

Temperature	-4 to 122ºF (-20 to 50ºC)
Relative Humidity	10 to 85%, non-condensing
Pressure	50 to 106 kPa

Transport Environment

The JANUS G3 Automated Workstation requires the following environmental conditions during transport:

Temperature	-4 to 122ºF (-20 to 50ºC)
Relative Humidity	10 to 85%, non-condensing
Pressure	50 to 106 kPa
Via air-ride truck or plane	

Electrical Ratings

The electrical ratings for the JANUS G3 Automated Workstation are:

Rated Input Voltage, Frequency, and Power	**Models:** *CJL4M01, CJI4M01, CJM4M01, CJL8M01, CJI8M01, CJM8M01* *YJL4M01, YJI4M01, YJM4M01, YJL8M01, YJI8M01, YJM8M01* 100, 120 VAC, 50-60 Hz, 525 VA 200, 230 VAC, 50-60 Hz, 525 VA
	All other models: 100, 120 VAC, 50-60 Hz, 350 VA 200, 230 VAC, 50-60 Hz, 350 VA
Current	~3.0 Amps at 120 VAC ~1.5 Amps at 220 VAC
Fuse Rating	10 A T-250VAC at 100 to 130 VAC (5x20 mm fuse) 5 A T-250VAC at 200 to 260 VAC (5x20 mm fuse)
UV Light Input Voltage, Frequency (only if UV Light is installed)	100, 120 VAC, 50-60 Hz 200, 230 VAC, 50-60 Hz (Power is included in system power above)
Over voltage Category	II
Pollution Degree	2
Protection Class	I

Safety Recommendations

This section contains the following types of safety information:

- Warnings and Precautions on page 55
- Chemical and Biological Safety on page 56
- Flammable and Combustible Materials on page 57
- UV Light Safety on page 58
- Laser Safety on page 58

Warnings and Precautions

The following general safety recommendations apply to the use of this system.

WARNINGS

- *For systems operating at voltages other than 120 VAC or 220 VAC, a locally-approved 3-prong plug may be required to properly power the system. Prevent electrical shock through the use of proper plugs and good earth ground connections. Proper Wiring specifications:*
  Live (L) - Brown Lead
  Neutral (N) - Blue Lead
  Earth (E) - Green/Yellow Lead
- *The JANUS G3 system is very heavy. Do not attempt to move the system without sufficient assistance.*
- *Do not move the system fully assembled. Disconnect the computer, any accessories, and all external plumbing connections prior to moving the instrument.*
- *Use both hands when lifting or moving the system. Lift the system only from the bottom.*
- *Appliance inlet is disconnecting device. Place device or equipment in a manner so that disconnecting device is accessible at all times.*
- *Using the instrument in a manner other than that intended by the manufacturer can impair the instrument's safety systems, potentially resulting in injury or death.*
- *Do not defeat the door interlock switches.*
- *Instrument components may move during operation. Always keep body parts, hair, jewelry, and clothing away from the instrument during operation.*
- *Always Pause or Stop the instrument before loading and unloading samples, reagents, or consumables. (Pause the instrument by clicking the Pause button in the software or by opening the front door of the instrument. Stop the instrument by clicking the Abort button in the software.)*
- *Only use consumables that are within their expiration date.*
- *Any serious incident that has occurred in relation to the device shall be reported to the manufacturer (see page 2) and the competent authority of the Member State in which the user is established.*

Chemical and Biological Safety

WARNING Biological Risks

In some applications, chemicals or samples used with the JANUS G3 are potentially hazardous and can cause illness.

Read and understand the material safety data sheet (MSDS) provided by the chemical manufacturer before you store, handle, or work with any chemical or hazardous material.

Minimize contact with and inhalation of chemicals and chemical wastes.

Wear appropriate personal protective equipment when handling chemicals or samples (e.g. safety glasses, gloves, or clothing). For additional safety guidelines consult the MSDS.

Handle all samples using good laboratory practices to prevent bio-hazards.

Be sure to use all standard laboratory precautions when handling used or contaminated disposable tips.

Do not leave chemical containers open. Use only with adequate ventilation, including a fume hood, if necessary.

Check regularly for chemical leaks or spills. If a leak or spill occurs, follow the chemical manufacturer's cleanup procedures as recommended on the MSDS.

Dispose of chemical or infectious waste in accordance with good laboratory practices and local, state/provincial, or national environmental and health regulations.

After emptying waste containers, seal the waste containers appropriately.

Comply with all local, state/provincial, or national laws and regulations related to chemical and waste storage, handling, and disposal.

Flammable and Combustible Materials

There is a risk of fire if flammable materials are used in the fluid path. Caution is advised when doing so while operating this instrument.

Before turning the power on, physically inspect the instrument fluid paths and verify there are no leaks.

Verify there is no interference between the instrument's mechanical components and any liquid containers on the deck.

User Precautions

When handling flammable liquids, follow these precautions:

1. Keep all flammable liquids in covered containers when not in use.
2. When handling flammable or combustible liquids, promptly and safely dispose of leakage or spills.
3. Use a closed piping system, or a device drawing through the top, to transfer flammable or combustible liquids between vessels, containers, or portable tanks.
4. Transfer flammable or combustible liquids only in areas with adequate ventilation. Possible sources of ignition are not permitted in any areas where flammable vapors may travel.
5. Never transfer flammable or combustible liquids by means of air pressure on the container or portable tank. Doing so could exceed the maximum pressure rating for the container. Transferring flammable or combustible liquids by means of air pressure on the container could result in a flammable atmosphere in the container or tank. Such an atmosphere would be particularly sensitive to ignition due to the increased pressure.

To minimize the risk of ignition of flammable liquid or vapors, follow these precautions:

1. Review the Material Safety and Data Sheet (MSDS) for the material you are using to understand the specific hazards involved.
2. Store flammable materials in a cool, well-ventilated area away from corrosives, oxidizers, and ignition sources.
3. Label all containers and cabinets with appropriate "flammable materials" signs.
4. Never smoke in an area where flammable materials are used or stored.
5. Minimize the amount of flammable materials used.
6. Use only approved containers or tanks to store flammable materials.

7. Ground and bond flammable material containers to prevent static charge buildup.
8. Dispose of flammable materials according to accepted, approved practices. Never pour flammable materials down a drain or sink.
9. Dispose of empty flammable containers in an approved manner.
10. Wear appropriate personal protective equipment, such as splash aprons and goggles, when handling flammable liquids.

UV Light Safety

WARNING *If the optional UV Light is installed on the JANUS G3, read the safety precautions below for important information on protection from ultraviolet radiation before operating the UV Light.*

- *Read the UV Light documentation that is included with the UV Light.*
- *Close all enclosure doors and install covers on any tip chutes, tip box chutes, or open deck locations before operating the UV Light via Direct Control or in a protocol. The enclosure panels block the shortwave UV radiation.*
- *Do not open any panel or cover while the UV Light is switched on.*
- *Unprotected eyes and skin can be seriously damaged by exposure to UVC radiation.*
- *Do not defeat the door interlock switches while the UV light is in operation.*
- *Cover any openings for tip chutes or waste chutes.*

Laser Safety

If the optional barcode reader is installed, use caution when operating the barcode reader.

WARNING ***BRIGHT LIGHT HAZARD****. JANUS G3 systems may include a barcode reader. Read and follow the instructions and safety precautions in the barcode reader manual to prevent eye injury.*

Chapter 3

Protocol Tutorials

The tutorials in this chapter are intended to introduce you to the basic operation of the JANUS G3 system. If you are new to PerkinElmer automated liquid handling, this chapter will help you understand the basic steps required to create and run a protocol on the JANUS G3 system. You can follow the tutorials for each of the arms installed on the system.

This chapter includes the following procedures:

- Starting the WinPREP Software on page 59
- Preparing the Instrument for Use on page 60
- New Protocol Tutorial on page 60
- Varispan Single Liquid Transfer Tutorial on page 61
- Varispan Mother-Daughter Transfer Protocol Tutorial on page 71
- MDT Plate Expansion Protocol Tutorial on page 82
- Gripper Arm Tutorial on page 96
- MDT Serial Dilution Tutorial on page 98
- Controlling the Interior Lights on page 103
- Using the UV Light on page 104
- Running a Protocol on page 107

Follow the tutorials to understand the basic operation of the JANUS G3 system with the hardware options specific to the JANUS G3 system. For a more detailed description of creating and editing protocols, see Creating and Editing Protocols on page 111.

Starting the WinPREP Software

Use the WinPREP software to create and edit Protocols.

To start WinPREP:

1. Turn on the JANUS Workstation and all accessories.

2. Double-click the **WinPREP for JANUS** icon on the Windows desktop
   OR
   Select **Start > All Programs > JANUS > WinPREP for JANUS** on the Windows Start menu.
   Wait for the software to start and the instrument to initialize.

Preparing the Instrument for Use

Before running a protocol, initialize the system (select **Utilities > Setup > Instrument > Initialize**), verify the deck is calibrated, and prime the Varispan. Do not click or right-click in the WinPREP software while the instrument is initializing.

Calibrating the Deck

Calibrate the deck on a regular basis. PerkinElmer recommends you calibrate the instrument at least once a week. Closely monitor the system for calibration issues and recalibrate more often if necessary. For more information on calibrating the system, see Deck Calibration on page 285.

Caution: The procedures in this chapter assume you have properly calibrated the deck for each arm on the system. If you have not calibrated the deck for the arms on the system, please do so before proceeding.

Priming the Varispan Pipetting Arm

You should prime the Varispan pipetting arm before each use. This is especially important after the instrument is idle for any length of time. Priming the system flushes and washes the tips and fills the liquid path with system liquid. Priming also helps clear the liquid path of growth, precipitates, and crystals that can form when liquid is stagnant. Use the Flush and Wash Tips diagnostic test to prime the system. For instructions, see Flush the Varispan Pipetting Arm on page 399.

New Protocol Tutorial

Each of the protocol tutorials in this section starts with a new empty protocol. Use this procedure to create a new protocol before starting each of the protocol tutorials.

To create a new protocol for the protocol tutorials:

1. Select **File > New** on the main menu. The **Open a Protocol Template** window opens.
2. Click the **None** button to create a new empty protocol (not based on an existing protocol). A new empty protocol opens in the Protocol Outline View.
3. Select **File > Save As** to save the file. The **Save As** window opens.
4. If necessary, navigate to the desired location. The default location is C:\Packard\JANUS\bin.
5. Type a unique name in the **File Name** text box.
6. Click the **Save** button. The new protocol opens in the Protocol Outline view.

Follow the desired tutorial procedures in this section to create simple protocols that demonstrate the functions available for each arm on the system.

Varispan Single Liquid Transfer Tutorial

This section describes how to create a Single Liquid Transfer protocol using the Varispan arm. The Single Liquid procedure aspirates liquid from one source position per sample and dispenses liquid into one destination position on one or more plates, depending on the number of replicates defined. The Varispan protocol that is created in this section transfers 100 uL of liquid from 10 test tubes into 10 wells of a 96-well microplate.

This section contains the following procedures:

- Populate the Deck on page 61
- Add the Procedures to the Protocol on page 63
- Map the Labware on page 64

Populate the Deck

The Single Liquid Transfer protocol uses the labware listed below. If you are using different labware, make sure to select the correct labware in the Add Labware window.

- (1) Test Tube Rack (192 Position for 12mm tubes)
- (1) Solid Medium Support Tile
- (1) 96 Well Plate (PerkinElmer PICOPlate)
- (1) Flush/Wash Station (Washbowl and 2 troughs)

Note: This protocol uses deck locations for a Mini platform JANUS G3 with one deck plate. If the JANUS G3 system has multiple deck plates, you can choose another appropriate deck location if desired.

To populate the deck:

1. Select the **Varispan** icon in the upper-left corner of the instrument graphic on the Deck View.
2. Right-click on a clear area of the deck in the **Deck View** and select **Add Labware**. The **Add Labware** window opens.
3. Select *96 Well Plate* in the **Category** drop-down list. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields display default values based on the category.
4. Select *96 well PICOPlate (Packard)* in the **Labware** drop-down list and click the **Add Labware to Deck** button. The cursor changes to indicate that you can place the new labware on the deck.

☞ *Note: If you do not have any physical plates that match the labware selection, change the labware selection to match the physical plates you are using.*

5. Position the cursor near the middle of the left deck plate (C4 is recommended) and click to place the labware. The deck location should be Var-Left[C4].
6. Select *Flush/Wash* in the **Category** drop-down list on the **Add Labware** window. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields display default values based on the category.
7. Select *Washbowl + 2 Troughs* in the **Labware** drop-down list and click the **Add Labware to Deck** button.
8. Position the cursor near the front right corner of the left deck plate (G7 is recommended) and click to place the labware. The deck location should be Var-Left[G7].

☞ *Note: Place the Flush/Wash station near the front edge of the deck so that the drain tubing can reach the waste bottle.*

9. Select *Test Tube* in the **Category** drop-down list on the **Add Labware** window. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields display default values based on the category.
10. Select *Rack 12mm Tube-Vial- 192 pos* in the **Labware** drop-down list and click the **Add Labware to Deck** button.
11. Position the cursor over deck location B1 on the left deck and click to place the labware. The deck location should be Var-Left[B1]. Figure 3-1 shows the labware layout on the deck.

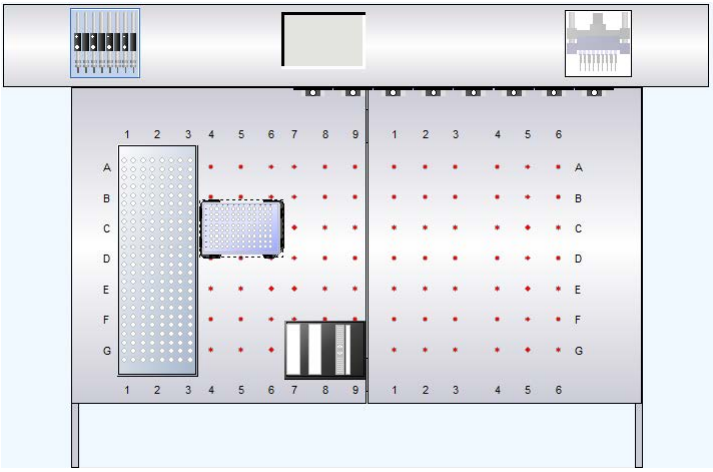


Figure 3-1. Labware Layout for Single Liquid Transfer

12. Close the Add Labware window.
13. See Add the Procedures to the Protocol on page 63.

Add the Procedures to the Protocol

The Single Liquid transfer protocol requires two procedures: a Single Liquid procedure and a Flush/Wash procedure. The Single Liquid procedure is added to the protocol first as described below. The Single Liquid procedure aspirates 100uL of liquid from each of the 10 the test tubes and dispenses 100uL of liquid into the first 10 wells of the microplate.

To add the Single Liquid procedure:

1. Select the **End of Protocol** node in the protocol outline.
2. Select **Protocol > Add Procedure > Single Liquid** from the menu bar or click the Single button on the Varispan toolbar. A **Procedure Under Construction** node is inserted in the protocol outline and the **Overview** tab on the **Single Liquid Parameters** window opens.
3. If desired, you can change the procedure name or procedure type in the Overview tab. This example uses the default values for all parameters unless specified.
4. Type *100* in the **Dispense Volume (µL)** field.
5. Select *WaterWasteFT_1 ml.prf* in the **Performance File** drop-down list (or the appropriate performance file for the Varispan syringe size).
6. Click **OK** to apply and save the parameters. The **Single Liquid Parameters** window closes and the **Procedure Under Construction** node is replaced with the **Single Liquid_1** node in the protocol outline.

☞ *Note: This example uses fixed tips on the Varispan arm. If you are using disposable tips, add the appropriate disposable tips to the deck view and then change the* **Tip** *and* **Performance File** *settings on the* ***Overview*** *tab in the* ***Single Liquid Parameters*** *window.*

Add the Flush/Wash procedure before the Single Liquid procedure in the protocol outline as described below. Flushing and washing the tips *before* the Single Liquid procedure is precautionary and helps ensure the tips are clean and free from contamination before aspirating the first sample from the source labware. Note that the Single Liquid procedure includes a Flush/Wash cycle. This cycle is performed after the Dispense step and helps to prevent cross-contamination of the samples in the destination labware.

To add the Flush/Wash procedure before the Single Liquid procedure:

1. Select the **Single Liquid_1** procedure node in the protocol outline.
2. Select **Protocol > Add Procedure > Flush/Wash** from the main menu or click the Flush/Wash button on the Varispan toolbar. A *Procedure Under Construction* node is inserted in the protocol outline and the **Overview** tab on the **Flush/Wash Parameters** window opens.

3. Click **OK** to apply and save the default parameter settings. The **Flush/Wash Parameters** window closes and the **Procedure Under Construction** node is replaced with the Flush/Wash procedure in the protocol outline. Figure 3-2 shows the current protocol.

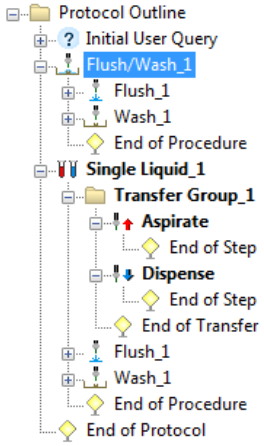


Figure 3-2. Protocol Outline for Single Liquid Transfer

4. See Map the Labware on page 64 to specify the labware for each liquid handling step.

Map the Labware

In the previous steps, you populated the deck and set up and configured the protocol outline. However, the protocol will not run yet because the steps in the protocol outline are not linked with any labware. The aspiration step cannot aspirate liquid unless you specify the location of the liquid. The dispense step cannot dispense liquid unless you specify the destination labware. You must specify the specific labware for each protocol or step. You also need to specify whether to use all wells or only some of the wells in a piece of labware. Mapping the labware to a node lets you specify the wells in the labware that the node uses.

The node name for any unmapped node displays in bold type in the protocol outline to identify the nodes that require labware mapping.

Because you populated the deck with the necessary labware prior to adding procedures to the protocol outline, WinPREP automatically mapped some labware to its associated protocol outline steps. Specifically, the software mapped both flush and wash steps to the only flush/wash station on the deck. You do not need to manually map these nodes. This is possible because the flush and wash stations of the flush/wash labware have a single purpose. WinPREP cannot automatically map the aspirate and dispense nodes because, unlike the flush/wash station, other types of labware can have multiple functions. To complete the protocol setup, you map the appropriate labware to the aspirate and dispense nodes in the protocol outline.

To assign labware to protocol outline steps, drag the labware image from the deck view and drop it onto the desired node in the protocol outline to create the association.

To map the "source" and "destination" plates:

1. Expand the **Single Liquid_1** node by clicking the plus (+) sign next to the node, if necessary. The node expands to display the individual aspirate and dispense steps in the procedure node.
2. Expand the aspirate and dispense nodes in the Transfer Group node under the **Single Liquid_1** node. The End of Step markers display for the aspirate and dispense nodes as shown in Figure 3-3.

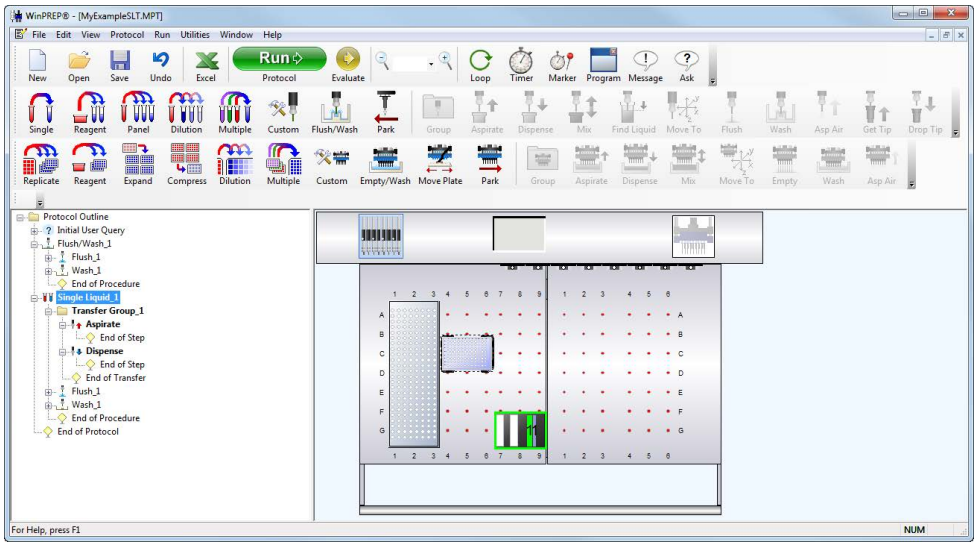


Figure 3-3. Single Liquid transfer before labware mapping

3. Click and drag the test tube rack to the Aspirate step of the Single Liquid procedure. WinPREP maps the test tube rack to the node and creates a Well Map Segment node under the Aspirate step node. The node title text changes from bold to regular weight. The test tube rack is outlined in red, indicating that it is mapped to an **Aspirate** step.
4. Click and drag the 96 well plate to the **Dispense** step of the Single Liquid procedure. WinPREP maps the 96 well plate to the node and creates a Well Map Segment node under the **Dispense** step node. The 96 well plate is outlined in blue, indicating that it is mapped to a Dispense step.

All the nodes in the protocol outline are mapped to labware on the deck. Note that none of the node names are in bold type, indicating that all nodes are mapped to labware. Figure 3-4 shows the current protocol and the mappings you assigned.

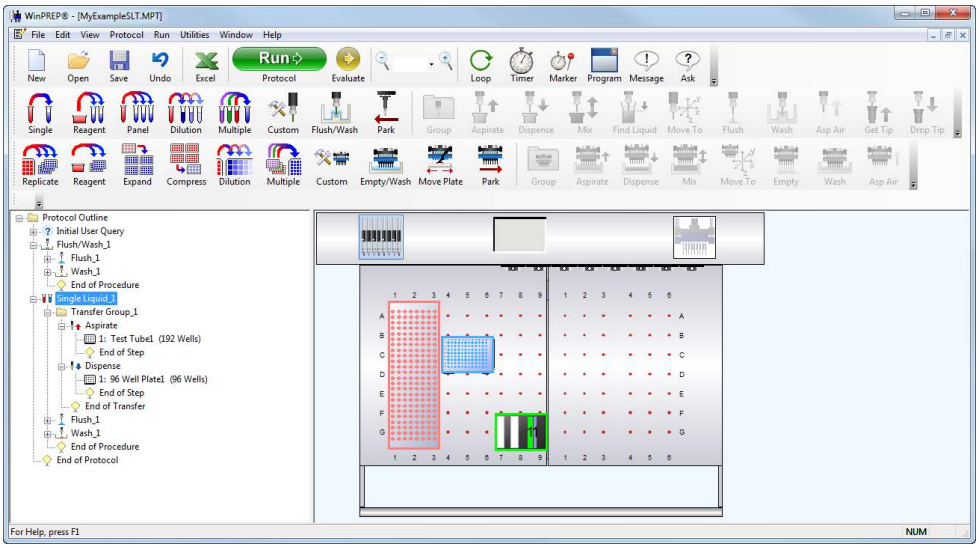


Figure 3-4. Single Liquid transfer after labware mapping

Each type of step node has a default color. For example, Aspirate steps are red, dispense steps are blue, and wash steps are green. This provides an easy method to locate the labware mapped to a particular node. See Default Color Associations on page 149 for a complete list of default colors. When you select a node in the protocol outline, the labware mapped to that node is outlined with the node's default color. The colored lines in Figure 3-4 further illustrate labware to node mappings.

The Single Liquid transfer protocol is nearly complete. The final step is to create well maps for the labware. Labware and nodes can have a many to many relationship, meaning each piece of labware can be mapped to multiple nodes or each node can use multiple pieces of labware. Well maps specify which wells in a plate or rack should be used by a node. This allows you to specify that certain wells in a plate or rack are used by one node while other wells in the plate or rack are used by a different node. Any piece of labware with wells requires you to identify the wells you want to use, either through a well map, worklist file, etc.

By default, WinPREP sets the well map to include all wells in the labware. However, you can use a subset of the total wells on the plate. For this reason, you should always set the appropriate well map for the labware used in the protocols.

To define the flush/wash well maps:

1. Expand the Pre-Single Liquid Flush/Wash node (**Flush/Wash_1**) by clicking the plus (+) sign next to the node, if necessary, to display the individual Flush and Wash steps.
2. Double-click the **Well Map Segment** node of the Flush node (see Figure 3-5) under the **Flush/Wash_1** node.

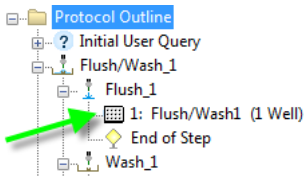


Figure 3-5. Flush Well Map Segment node

The **Well Map Segment Parameters** window opens as shown in Figure 3-6.

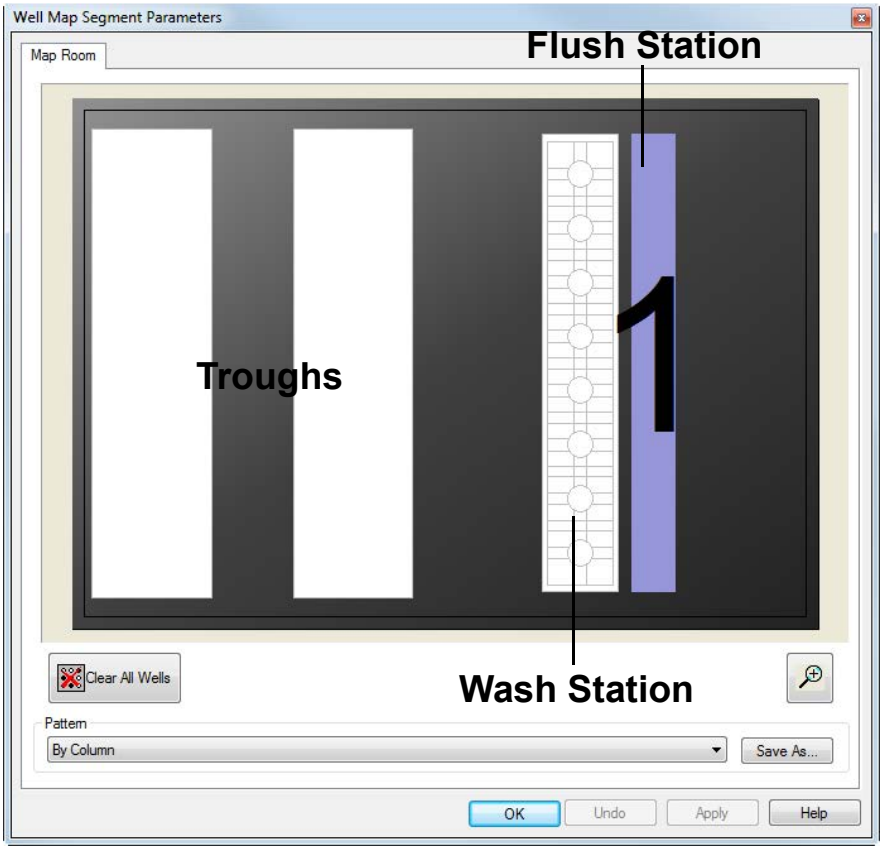


Figure 3-6. Well Map Segment Parameters window for Flush node

The Well Map Segment Parameters window contains the well layout for the selected labware, in this case a Flush/Wash Station + 2 Troughs. The labels identify the wells in the layout. In this example, the right-most well is identified by a number one and a shaded color because the Flush/Wash station is mapped to the Flush step. The right-most well is the flush station. The wells in the labware were identified during the creation of the labware definition. WinPREP identified the flush station well and automatically mapped it to the step. You can toggle the flush station well on and off by clicking in the boundary of the well. Make sure the well is enabled before proceeding.

3. The second Flush node and the two Wash nodes are automatically mapped to the Flush/Wash station if the Flush/Wash station is in the Deck Layout when the procedures are added to the protocol.
4. Expand the **Single Liquid_1** node by clicking the plus (+) sign next to the node, if necessary to display the Well Map Segments for the Aspirate node and the Dispense node.
5. Double-click the **Well Map Segment** node under the Aspirate node. The **Well Map Segment Parameters** window opens as shown in Figure 3-7.

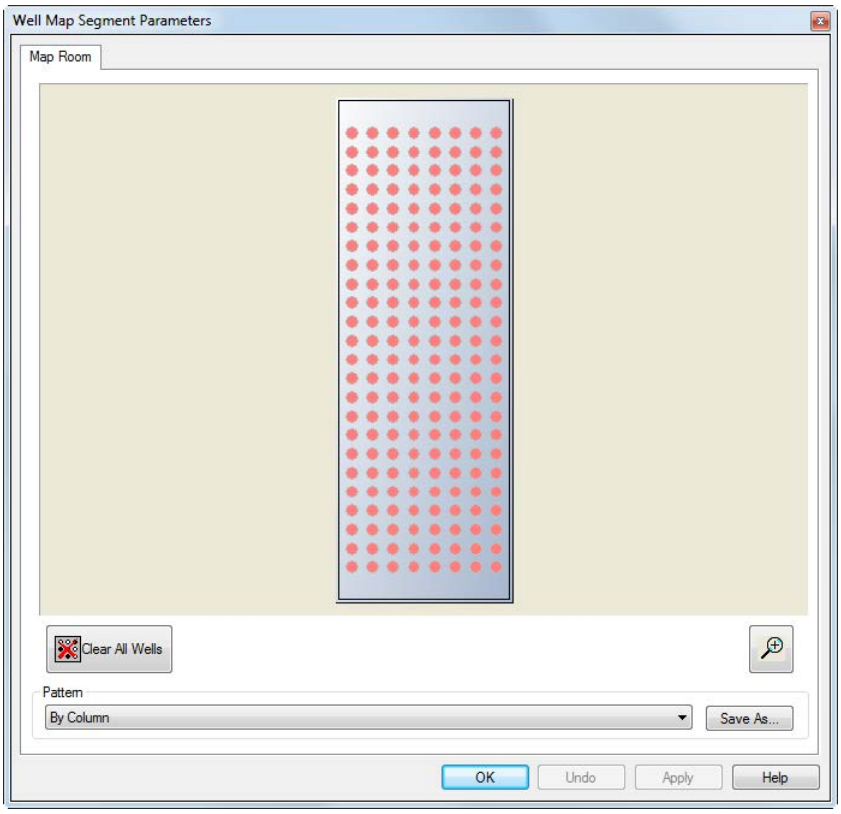


Figure 3-7. Well Map Segment Parameters Window for Aspirate Node

By default, WinPREP selects all of the wells on the labware as shown in Figure 3-7. Each well is shaded in color and numbered by column, starting with the upper left corner. The color indicates the node that the labware is linked to; the mapping applies to the linked node only. You can link a single piece of labware to multiple steps in the outline and define independent well mappings for each.

6. Click the **Clear All Wells** button to deselect all the wells in the labware.

7. Click in the upper corner of the well map, just above the top row and a little to the left of the first column, and drag a rectangle around the first ten wells in the well map. This selects the first ten wells in the left-most column, highlighting the wells in red and numbering the wells from top to bottom as shown in Figure 3-8.

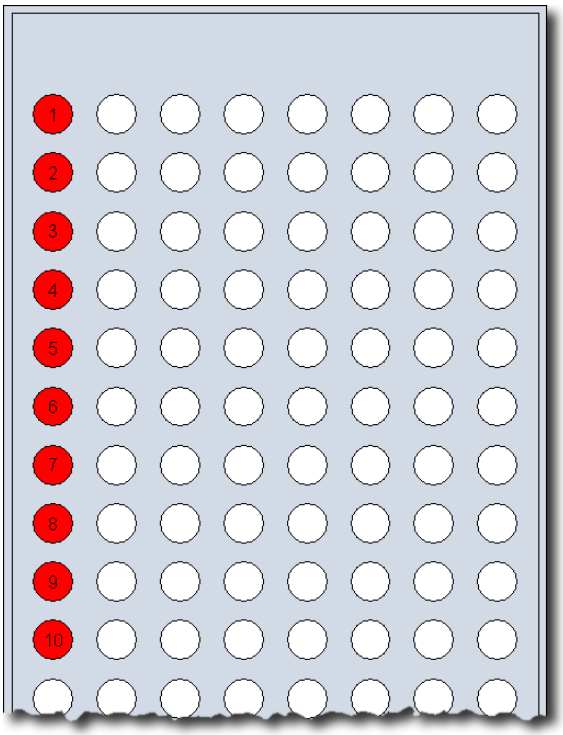


Figure 3-8. Aspirate Well Map with Columns selected

The starting point for the drag operation determines the numbering order. Dragging up from the bottom of the selection numbers the wells from bottom to top.

8. Click **OK** to save the mapping and close the window.
9. Double-click the **Well Map Segment** node under the Dispense node to open the **Well Map Segment Parameters** window for the node.

   As with the Aspirate step well map, WinPREP selects all wells in the well map, shades them in color, and numbers the wells. Because this well map applies to a Dispense step, the color is blue, the default color for Dispense steps.

10. Click the **Clear All Wells** button to deselect all the wells in the labware.
11. Drag a rectangle around the first column of eight wells in the well map, and then the top two wells in the second column to select ten wells, as shown in Figure 3-9.

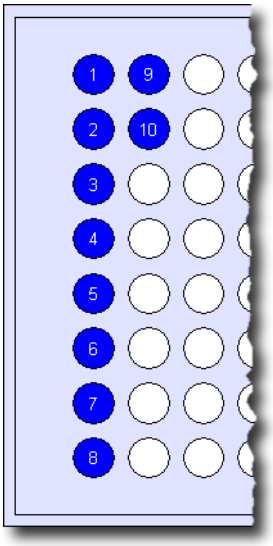


Figure 3-9. Dispense Well Map with Columns selected

12. Click **OK** to save the mapping and close the window.

13. Select **File > Save** to save the protocol.

The protocol setup is complete. The protocol transfers liquid from each of the first ten wells in the source test tube rack into the first ten wells in the destination 96 well plate. The protocol pipets 100µL of liquid from the first well of the test tube rack, dispenses this volume into the corresponding well on the destination plate, and then flushes and washes the tips. This process repeats for each of the samples, in this case, nine more times.

To run the protocol, see Running Protocols on page 164.

Varispan Mother-Daughter Transfer Protocol Tutorial

This section describes how to create a “Mother-Daughter” transfer using a Panel procedure for the Varispan arm.

The Panel procedure aspirates liquid from one source position and dispenses the liquid into two or more destination positions. The destination positions are usually in separate plates or racks, but in the same well position. Panel procedures are useful for pipetting from one source plate or set of source tubes into multiple destination plates or sets of destination tubes.

In the “Mother-Daughter” transfer example, you will create a protocol that uses the Varispan arm to transfer liquid from one plate (the mother) into three other plates (the daughters), creating three copies of the original plate.

This section contains the following procedures:

- Populate the Deck on page 61
- Add the Procedures to the Protocol on page 73
- Map the Labware on page 75

To create an MDT protocol, see MDT Plate Expansion Protocol Tutorial on page 82.

Populate the Deck

For the “Mother-Daughter” transfer, you populate the deck with the necessary labware. This example requires a total of four racks or plates and a Flush/Wash station. You can use any plates or racks that you choose, but the instructions that follow use **96 Well Plates**.

To populate the deck:

1. Select the Varispan arm icon in the deck view. The deck view displays the calibration status for the deck.
2. Right-click on the **Deck View** and select **Add Labware** from the menu. The **Add Labware** window opens.
3. Select *96 Well Plate* in the **Category** drop-down list. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields update with information from the selected category.

4. Select *96 well PICOPlate (Packard)* in the **Labware** drop-down list, select *Plate-Adapter Support Tile* in the **Support Tile** drop-down list, type *Mother* in the **Name** field, and click the **Add Labware to Deck** button. The cursor changes to indicate that you can place the new labware on the deck.

☞ *Note: If you do not have any physical plates that match the Labware selection, change the labware selection to match the physical plates that you are using.*

5. Position the cursor over the desired location of the labware and click to place the labware. Place the mother plate near the back middle of the deck as shown in Figure 3-10. The exact position will vary depending on the JANUS G3 model you are using.
6. Repeat steps 2 through 5 three more times, naming the plates *Daughter1*, *Daughter2*, and *Daughter3*, respectively. Position the plates in the middle of the deck as shown in Figure 3-10.

☞ *Note: The new protocol you created includes a Flush/Wash station (Washbowl + 1 Trough) by default, so it is not necessary to add this item to the deck.*

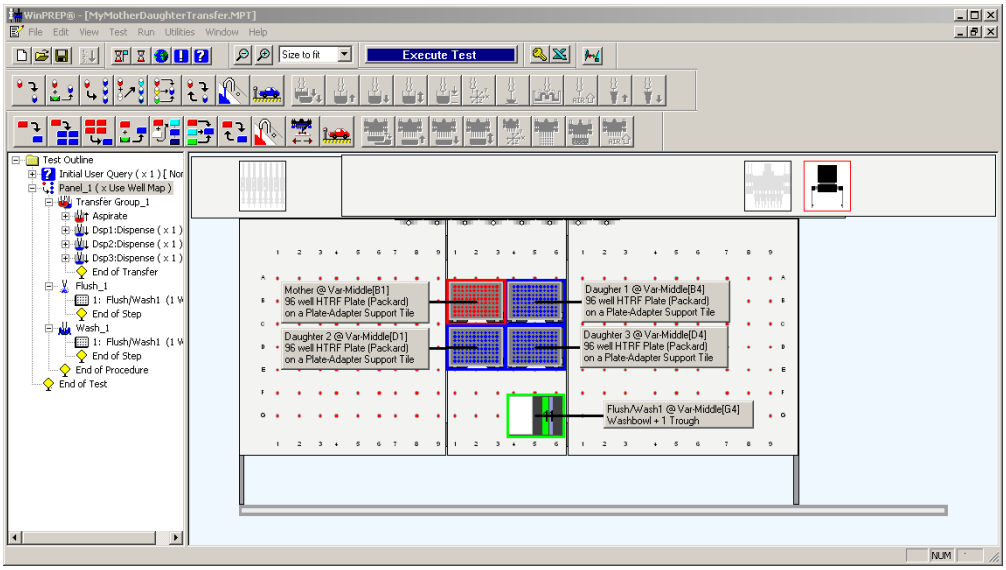


Figure 3-10. Mother - Daughter Transfer Plate Positioning

☞ *Note: The Flush/Wash station must be placed near the edge of the deck so that the drain tubing can reach the waste bottle.*

When the deck contains the proper labware, see Add the Procedures to the Protocol on page 73.

Add the Procedures to the Protocol

To set up the “Mother-Daughter” transfer, you add the necessary procedures to the protocol outline as described below. After you select and add the procedures to the protocol outline, you can modify the procedure parameters to perform the “Mother-Daughter” transfer. While you can manually create the protocol by including and defining individual steps, it is easier and more efficient to use the Panel procedure as the starting point. The Panel procedure provides the necessary functionality for the “Mother-Daughter” transfer.

To select and add the Panel procedure:

1. Select **Protocol > Add Procedure > Panel** from the menu bar. A **Procedure Under Construction** node is inserted into the protocol outline and the **Panel Parameters** window opens.
2. Select the **Overview** tab and type *Mother-Daughter Transfer* in the **Name** field.
3. Click the **Add** button in the **Panel List** frame twice to add two rows to the **Panel List** table. These three rows specify parameters for the three dispenses to the daughter plates. Figure 3-11 shows the Panel Parameters window.

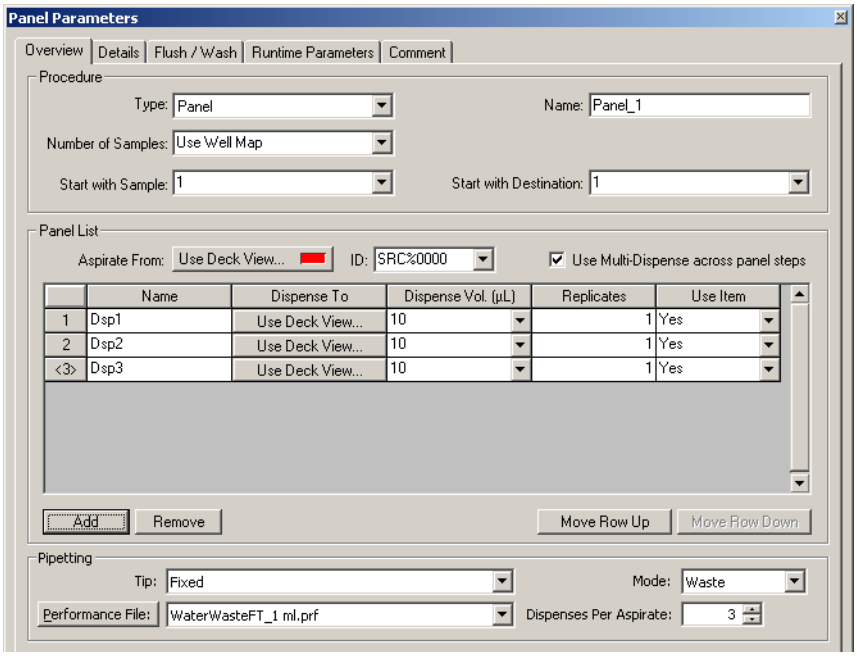


Figure 3-11. Panel Parameters window for Mother-Daughter Transfer

4. Change the **Dispense Vol. (µL)** field to *50* for each row in the **Panel List** table. This instructs WinPREP to transfer 50µL of sample from each mapped well in the mother plate to its corresponding mapped well in each of the daughter plates.

☞ *Note: This example uses fixed tips on the Varispan arm. If you are using disposable tips, change the settings under* **Pipetting** *on the* **Panel Parameters** *window.*

5. Click **OK** to apply and save the parameter settings. The **Panel Parameters** window closes and the **Procedure Under Construction** node is replaced with the Panel procedure in the protocol outline.

After adding the Panel procedure, it is a good idea to add a pre-Panel Flush/Wash procedure to the protocol outline. Adding this procedure before the Panel is precautionary and helps ensure the tips are clean and free from contamination before aspirating the first sample from the “mother” plate. Note that the Panel procedure includes a Flush/Wash cycle. This cycle is performed prior to each aspiration step and helps to prevent cross-contamination of the samples in the plates.

To add the pre-Panel Flush/Wash procedure:

1. Select the Panel procedure node. It is the node labeled **Mother-Daughter Transfer** in the protocol outline.
2. Select **Protocol > Add Procedure > Flush/Wash** from the main menu. A **Procedure Under Construction** node is inserted in the protocol outline and the Flush/Wash Parameters window opens.
3. Type *Pre-Panel Flush/Wash* in the **Name** field and click **OK**. The **Flush/Wash Parameters** window closes and the **Procedure Under Construction** node is replaced with the Flush/Wash procedure in the protocol outline.

The protocol outline is complete. The last step is to map the labware (see page 75).

Map the Labware

Mapping the labware associates the labware on the deck with the procedures in the protocol outline and specifies the wells that are used by each procedure. Mapping the labware specifies the source location of the liquid for the aspirate step, the destination location for the dispense step, and the wells to aspirate from or dispense to.

The node name for any unmapped node displays in bold type in the protocol outline to identify the nodes that require labware mapping.

In a “Mother-Daughter” transfer, you aspirate liquid from the mother plate and dispense it into each of the daughter plates. To accomplish this action as efficiently as possible, WinPREP aspirates enough liquid to dispense into each of the daughter plates before returning to aspirate the next well in the mother plate.

For example, the Panel procedure will dispense 50µL into each of the three daughter plates. The Varispan arm aspirates 150µL from the first well in the mother plate and dispenses 50µL into the first well in the first daughter plate. It then moves to the second daughter plate and dispenses 50µL into the first well, and then moves to the third daughter plate and dispense the final 50µL. After completing the dispenses, the Varispan arm moves to the Flush/Wash station and cleans the tips. The cycle then starts over with the next well in the mother plate and continues until all the mapped wells in the mother plate have been transferred.

To map the mother and daughter plates:

1. Expand the **Mother-Daughter Transfer** node by clicking the plus (+) sign next to the node, if necessary. The node expands to display the individual aspirate and dispense steps in the procedure node.
2. Expand each of the aspirate and dispense nodes in the Transfer Group node under the **Mother-Daughter Transfer** node to display the **End of Step** markers for each of the aspirate and dispense nodes as shown in Figure 3-12.

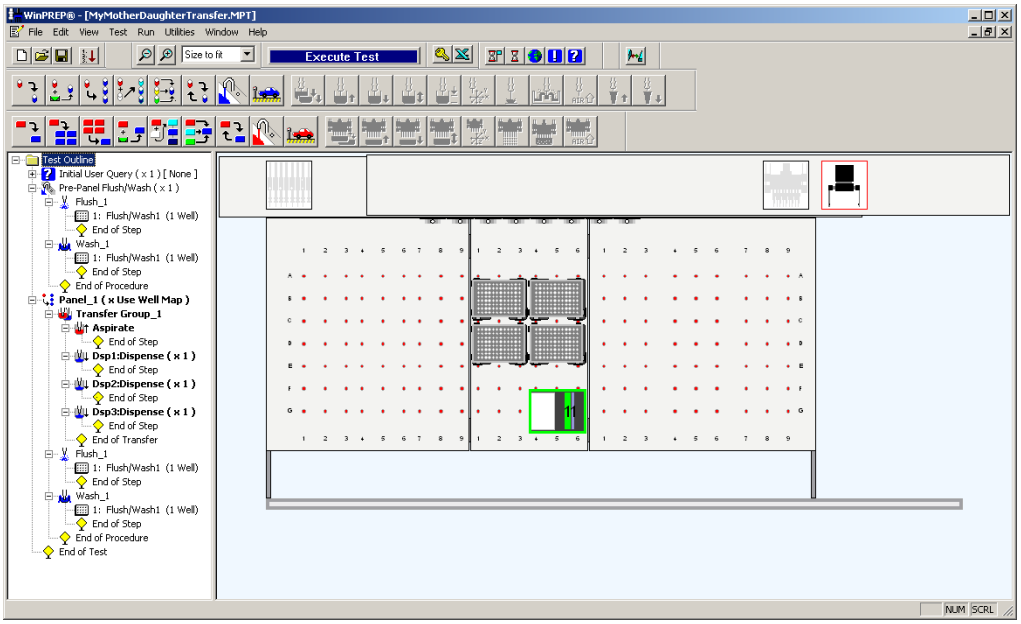


Figure 3-12. Mother-Daughter transfer before labware mapping

3. Click on the **Mother** plate on the deck and drag it to the **Aspirate** step of the **Mother-Daughter Transfer** procedure. WinPREP maps the **Mother** plate to the node and creates a Well Map Segment node under the Aspirate step node. The node title text changes from bold to regular weight. The **Mother** plate is outlined in red, indicating that it is mapped to an **Aspirate** step.

   (See Figure 3-10 for the plate positions or hover the cursor over the plate on the deck view to display the labware information, as shown in Figure 3-13.)

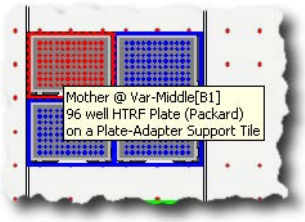


Figure 3-13. Tooltip Information for Labware

4. Click on the **Daughter1** plate on the deck and drag it to the first Dispense step (**Dsp1**) of the **Mother-Daughter Transfer** procedure. WinPREP maps the **Daughter1** plate to the node and creates a Well Map Segment node under the **Dsp1:Dispense** step node. The **Daughter1** plate is outlined in blue, indicating that it is mapped to a **Dispense** step.

5. Click on the **Daughter2** plate on the deck and drag it to the second Dispense step (**Dsp2**) of the **Mother-Daughter Transfer** procedure. WinPREP maps the **Daughter2** plate to the node and creates a Well Map Segment node under the **Dsp2:Dispense** step node. The **Daughter2** plate is outlined in blue, indicating that it is mapped to a **Dispense** step.
6. Click on the **Daughter3** plate on the deck and drag it to the third Dispense step (**Dsp3**) of the **Mother-Daughter Transfer** procedure. WinPREP maps the **Daughter3** plate to the node and creates a Well Map Segment node under the **Dsp3:Dispense** step node. The **Daughter3** plate is outlined in blue, indicating that it is mapped to a **Dispense** step.

All the nodes in the protocol outline are mapped to labware on the deck. Note that none of the node names are in bold type, indicating that all the nodes are mapped to labware. Figure 3-14 shows the current protocol and the mappings you assigned.

☞ *Note: You do not need to map the Flush and Wash steps. WinPREP automatically maps these steps to the Flush/Wash Station, based on the labware definition for the Flush/Wash station. This only occurs when you populate the deck **before** adding the procedures to the protocol outline. Creating the protocol outline before you add labware to the deck view prevents the software from automatically mapping any labware.*

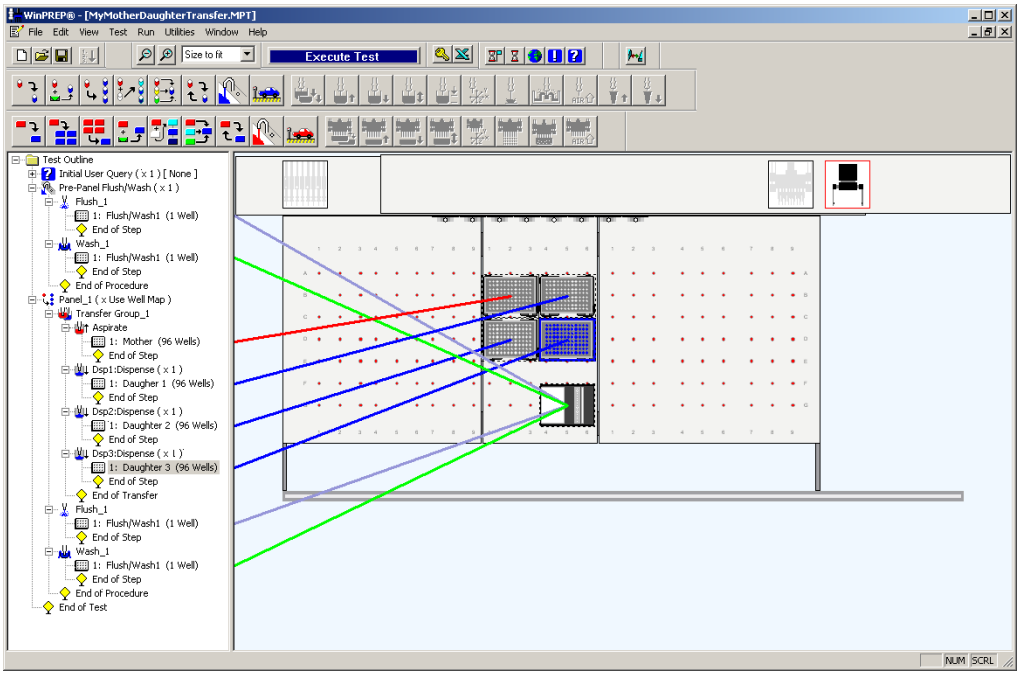


Figure 3-14. Mother-Daughter transfer after labware mapping

Each type of step node has a default color. For example, aspirate steps are red, dispense steps are blue, and wash steps are green. This provides a way to easily identify the labware mapped to a particular step. See Default Color Associations on page 149 for a complete list of default colors. When you select a node in the protocol outline, the labware mapped to that node is outlined with the node's default color. The colored lines in Figure 3-14 connect the selected node to the labware used by the node.

The "Mother-Daughter" Transfer protocol is nearly complete. The final step is to create well maps for the labware. Labware and nodes can have a many to many relationship, meaning each piece of labware can be mapped to multiple nodes or each node can use multiple pieces of labware. Well maps specify which wells in a plate or rack are used by a node. This allows you to specify that certain wells on a rack are used by one node while other wells on the rack are used by a different node. Any piece of labware with wells requires a well map.

By default, WinPREP sets the well map to include all wells in the labware. However, you will often only use a subset of the total wells on the plate. For this reason, you should always set the appropriate well map for the labware used in the protocols.

To define the well maps:

1. Expand the **Pre-Panel Flush/Wash** node by clicking the plus (+) sign next to the node, if necessary. The nodes expand to display the individual Flush and Wash steps in the procedure node.
2. Double-click the **Well Map Segment** node (see Figure 3-15) of the **Flush** node under the **Pre-Panel Flush/Wash** node.

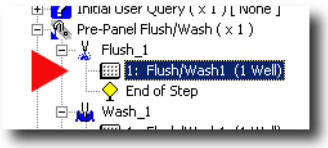


Figure 3-15. Flush Well Map Segment node

The **Well Map Segment Parameters** window opens as shown in Figure 3-16.

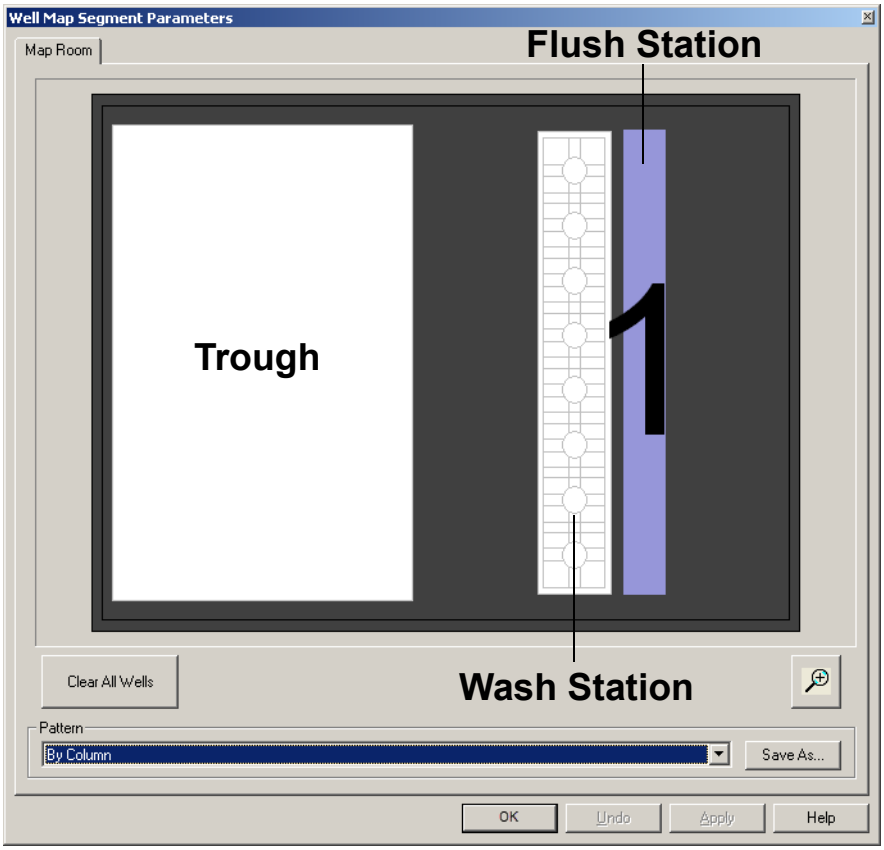


Figure 3-16. Well Map Segment Parameters window for Flush node

This window contains the well layout for the selected labware, in this case a Flush/Wash Station + 1 Trough. The labels identify the wells in the layout. In this example, the right-most well is identified by a numeral one and a shaded color. This is because the Flush/Wash station is mapped to the Flush step in the procedure. As shown in the labware diagram, the right-most well is the flush station. The wells in the labware were identified during the creation of the labware definition. WinPREP identified the flush station well and automatically mapped it to the step. You can toggle the flush station well on and off by clicking in the boundary of the well. Make sure the well is enabled before proceeding.

3. Repeat the previous step for the other Flush node and the two Wash nodes. WinPREP automatically selects the appropriate well mappings for these nodes based on the labware definitions.
4. Expand the **Mother-Daughter Transfer** node by clicking the plus (+) sign next to the node, if necessary. Expand this node, and its child nodes to display the Well Map Segments for the aspirate node and the dispense nodes.
5. Double-click the **Well Map Segment** node under the aspirate node. The **Well Map Segment Parameters** window opens as shown in Figure 3-17.

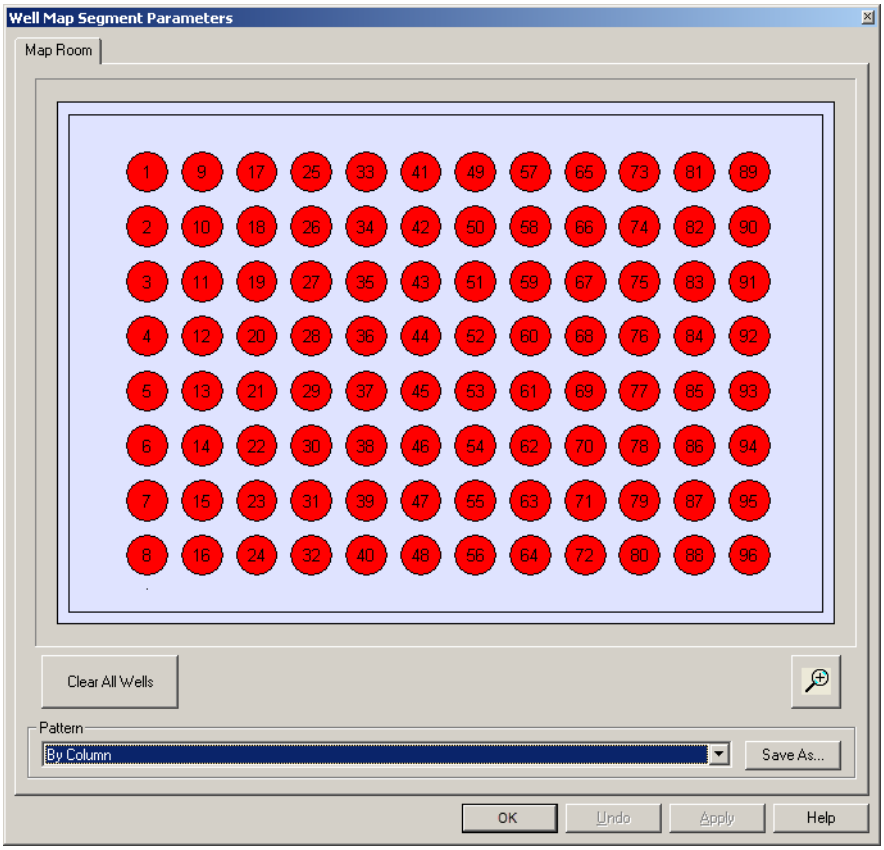


Figure 3-17. Well Map Segment Parameters window for Aspirate node

By default, WinPREP selects all wells on the labware, as shown in Figure 3-17. Each well is shaded in color and numbered, by column, starting with the upper left corner. The color indicates the node that the labware is linked to; the mapping applies to the linked node only. You can link a single piece of labware to multiple steps in the outline and define independent well mappings for each.

6. Click the **Clear All Wells** button to deselect (clear) all the wells in the labware.
7. Click in the upper corner of the well map, slightly above the top row and slightly to the left of the first column, and drag a rectangle around the first four columns in the well map. The first four columns are selected and highlighted in red, and the wells are numbered from top to bottom and then left to right as shown in Figure 3-18.

   The starting point for the drag operation determines the numbering order. Using the bottom right corner as the starting point would number the columns from bottom to top and right to left.

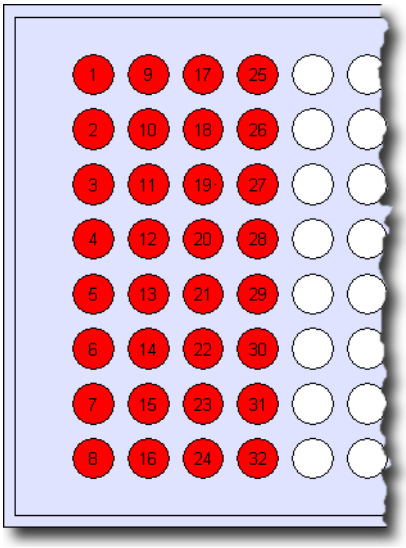


Figure 3-18. Aspirate Well Map with Columns Selected

8. Click **OK** to save the mapping and close the window.
9. Double-click the **Well Map Segment** node under the first dispense node (Daughter1). The **Well Map Segment Parameters** window for the node opens with all wells selected in blue (Dispense) and numbered by column.

   (Note that the steps below select the wells for dispensing into each plate. Only the wells required for the protocol will be used, so only the first 4 columns will contain liquid at the end of the protocol. If using the Stop Procedure action at End of Well Map or if not using the wells in the default order, the exact well map must be selected.)
10. Click the **Clear All Wells** button to deselect (clear) all the wells in the labware.
11. Drag a rectangle around the first four columns in the well map, just as you did for the aspirate step well map. The selected rows are highlighted and numbered.
12. Click **OK** to save the mapping and close the window.
13. Repeat steps 9 through 12 for the remaining two daughter plates.
14. Select **File > Save** to save the protocol.

The protocol setup is complete. The protocol duplicates the mother (source) plate into three daughter (destination) plates by individually pipetting 50µL of liquid from each well in the first four columns of the mother plate and dispensing this volume into the corresponding wells on the daughter plates.

To run the protocol in Evaluation mode (without moving the instrument) to check for errors, see Evaluating a Protocol on page 151.

To run the protocol, see Running Protocols on page 164.

MDT Plate Expansion Protocol Tutorial

This section describes how to create a Plate Expansion protocol using an Expand Plate procedure for the MDT arm.

The Expand Plate procedure is used to separate the samples in a plate of higher well density to several destination plates with lower well density. Well density refers to the number of wells on a plate. For example, a 384-well plate has a higher well density than a 96-well plate. When complete, the Expand Plate procedure generates multiple plates, each containing a specific subset of the wells on the source plate.

In the Expand Plate procedure example, you will create a protocol that separates the samples in a 384-well plate into four 96-well plates.

This section contains the following procedures:

- Populate the Deck on page 82
- Add the Procedures to the Protocol on page 87
- Map the Labware on page 88

To create a Varispan protocol, see Varispan Single Liquid Transfer Tutorial on page 61 or Varispan Mother-Daughter Transfer Protocol Tutorial on page 71.

Populate the Deck

For the Expand Plate procedure, you populate the deck with the necessary labware as described below. This example requires a total of five racks or plates, a docking station, dispenser head, tip load carrier with tips, and Flush/Wash station. You can use any plates, racks, heads, and tips that you choose, but the instructions that follow use the following:

- 384-well source plate
- Four 96-well destination plates
- I200 - 96 Tip Head
- P235 - 96 Tip Box
- 1 Well Tipwash Tile

If you do not have the described labware, substitute the labware items you are using when setting up the labware. Also, remember that the dispenser head you use influences the types of tips you can select.

To populate the deck:

1. Select the MDT arm icon in the deck view. The deck view displays the calibration status for the deck.

2. Right-click on the **Deck View** and select **Add Labware** from the menu. The **Add Labware** window opens.
3. Select *384 Well Plate* in the **Category** drop-down list. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields update with information from the selected category.
4. Select *384 round well (USA Scientific)* in the **Labware** drop-down list, select *Plate-Adapter Support Tile* in the **Support Tile** drop-down list, type *Source* in the **Name** field. Figure 3-19 shows the completed **Add Labware** window.

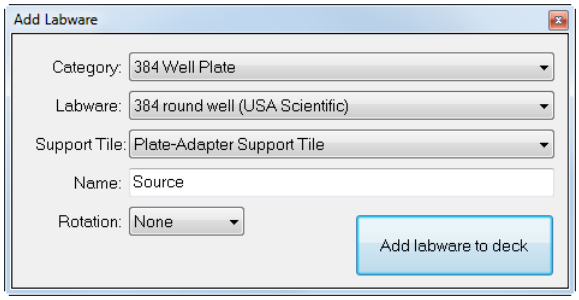


Figure 3-19. Add Labware window for 384-well Source Plate

☞ *Note: If you do not have any physical plates that match the labware selection, change the labware selection to match the physical plates that you are using.*

5. Click the **Add Labware to Deck** button. The cursor changes to indicate that you can place the new labware on the deck.
6. Position the cursor over the desired location of the labware and click to place the labware. Place the Source plate near the back middle of the deck as shown in Figure 3-25 on page 86. The exact position will vary depending on the JANUS G3 model you are using.
7. Select *96 Well Plate* in the **Category** drop-down list on the **Add Labware** window. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields update with information from the selected category.
8. Select *96 Well (default)* in the **Labware** drop-down list, select *Plate-Adapter Support Tile* in the **Support Tile** field, and type *Target1* in the **Name** text box. Figure 3-20 shows the completed **Add Labware** window.

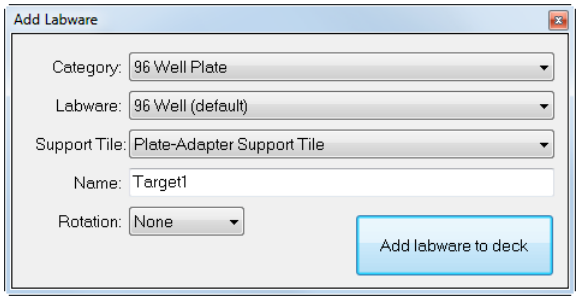


Figure 3-20. Add Labware window for 96-well Target Plate

9. Click the **Add Labware to Deck** button.
10. Position the cursor over the desired location of the labware and click to place the labware. Place the Target1 plate near the front middle of the deck as shown in Figure 3-25 on page 86.
11. Repeat steps 9 and 10 three more times, naming the plates *Target2*, *Target3*, and *Target4*, respectively. Place the four target plates together near the front middle of the deck.
12. Select *Flush/Wash* in the **Category** drop-down list on the **Add Labware** window. The **Labware**, **Support Tile**, **Name**, and **Rotation** fields update with information from the selected category.
13. Select *1 Well Tipwash Tile* in the **Labware** drop-down list and type *Flush/Wash1* in the **Name** text box. Figure 3-21 shows the completed **Add Labware** window.

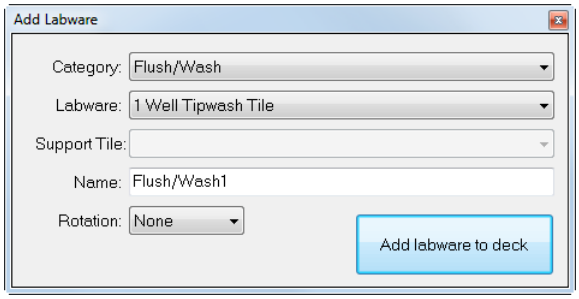


Figure 3-21. Add Labware window for 1-well Tip Wash

The **Support Tile** option is not available because the support tile is part of the labware itself.

14. Click the **Add Labware to Deck** button.
15. Position the cursor over the desired location of the labware and click to place the labware. Place the 1-well Tip Wash near the front of the deck as shown in Figure 3-25 on page 86.
16. Select *Head* in the **Category** drop-down list on the **Add Labware** window.

17. Select *I200 - 96 Tip Head* in the **Labware** drop-down list, select *Head-Adapter Right Side Support Tile* in the **Support Tile** drop-down list, and type *Head1* in the **Name** field. Figure 3-22 shows the completed **Add Labware** window.

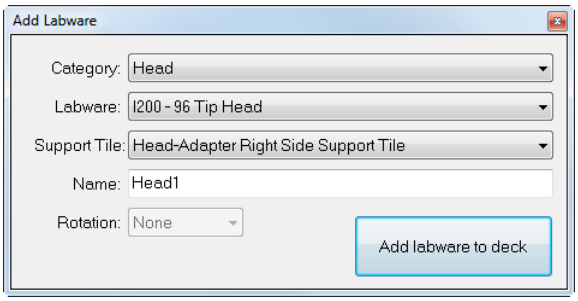


Figure 3-22. Add Labware window for I200 - 96 Tip Head

The *Head-Adapter Right Side Support Tile* is designed for use against the right edge of the deck. When used along the right edge of the deck, this support tile minimizes the amount of deck space used by the labware. While you can use the support tile in other locations on the deck, you will not receive the space optimization benefits.

18. Click the **Add Labware to Deck** button.
19. Position the cursor near the back of the deck, on the right edge, and click to place the labware.
20. Select *Tip Box* in the **Category** drop-down list on the **Add Labware** window.
21. Select *P235 - 96 Tip Box* in the **Labware** drop-down list, select *Plate-Adapter TipLoad Support Tile* in the **Support Tile** drop-down list, and type *Tip Box1* in the **Name** text box. Figure 3-23 shows the completed **Add Labware** window.

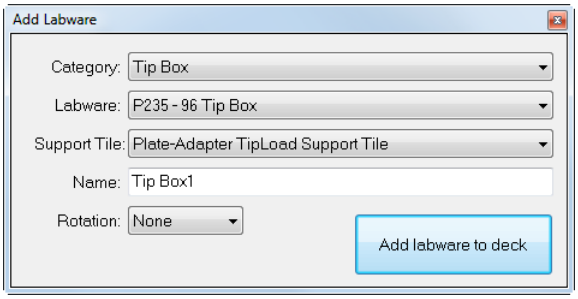


Figure 3-23. Add Labware window for P235 - 96 Tip Box

The *Plate-Adapter TipLoad Support Tile* is necessary so the MDT arm can automatically load tips during the procedure.

22. Click the **Add Labware to Deck** button.
23. Position the cursor over the desired location of the labware and click to place the labware. Place the tip box near the rear of the deck.
24. Select *TipChute* in the **Category** drop-down list on the **Add Labware** window.

25. Select *Waste Chute (coated)* in the **Labware** drop-down list and type *TipChute1* in the **Name** field. Figure 3-24 shows the completed **Add Labware** window.

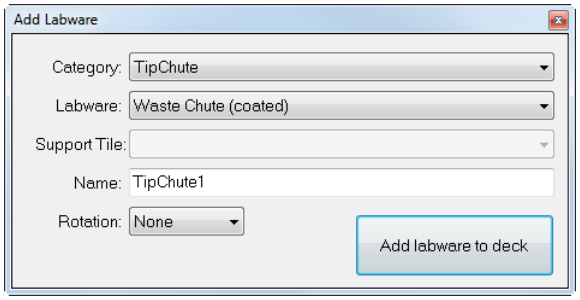


Figure 3-24. Add Labware window for Waste Chute

The **Support Tile** option is not available because the reference pins used to position the waste chute on the deck are part of the labware itself, so this item does not use a support tile.

26. Click the **Add Labware to Deck** button.
27. Position the cursor over the desired location of the waste chute and click to place the labware. Place the waste chute at the front of the deck.
28. Position the labware on the deck similar to the layout in Figure 3-25.

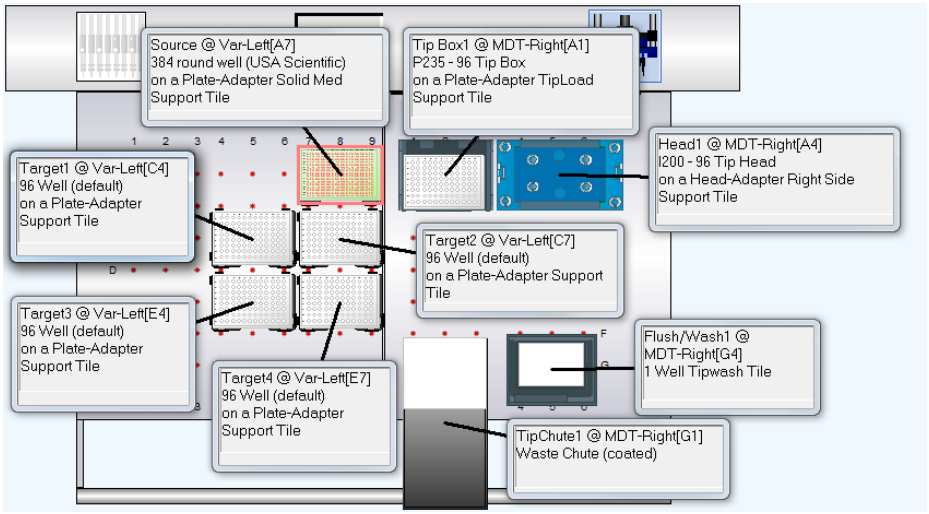


Figure 3-25. Plate Expansion Labware Positioning

☞ *Note: The Flush/Wash station must be placed near the edge of the deck so that the drain tubing can reach the waste bottle.*

When the deck contains the proper labware, see Add the Procedures to the Protocol on page 87.

Add the Procedures to the Protocol

To set up the Expand Plate protocol, you add the necessary procedures to the protocol outline as described below. While you can manually create the protocol by including and defining individual steps, it is easier and more efficient to use the Expand Plate procedure as the starting point. The Expand Plate MDT procedure includes several steps, specifically, **Load Head MDT**, **Get Tips MDT**, **Aspirate MDT**, **Dispense MDT**, **Empty MDT**, **Wash MDT**, and **Drop Tip MDT**.

To select and add the Expand Plate procedure:

1. Select **Protocol > Add Procedure > Expand Plate MDT** from the menu bar or click the Expand button on the MDT toolbar. A **Procedure Under Construction** node is inserted into the protocol outline and the **Expand Plate MDT Parameters** window opens.
2. Select the **Overview** tab and type *Plate Expansion* in the **Name** text box.
3. Select the **Load Head** check box. Selecting this option also selects the **Get Tips** and **Drop Tips** check boxes as shown in Figure 3-26.

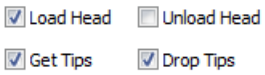


Figure 3-26. Expand Plate MDT Parameters

4. Change the **Dispense Vol. (µL)** field to *100*. This transfers 100µL of sample from each mapped well in the source plate to the corresponding mapped well in each of the target plates.
5. Click the **Tip Management** tab and select the **Enable** check box under **Empty** as shown in Figure 3-27. If selected, the tips are emptied before the Wash step.

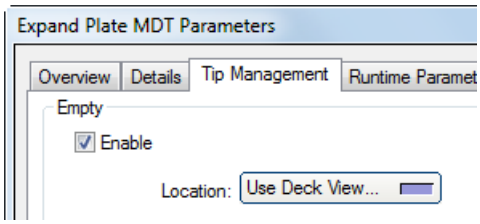


Figure 3-27. Expand Plate MDT Parameters Enable Empty

6. Select the **Enable** check box under **Wash**. If selected the tips are washed after each Dispense step.
7. Click **OK** to apply and save the parameter settings. The **Expand Plate MDT Parameters** window closes and the **Procedure Under Construction** node is replaced with the **Plate Expansion** procedure in the protocol outline.

To map the labware, see Map the Labware on page 88.

Map the Labware

Mapping the labware involves associating the labware on the deck with the procedures in the protocol outline and specifying the wells that are used by each procedure. Mapping the labware specifies the source location of the liquid for the Aspirate step, the destination location for the Dispense step, and the wells to aspirate from or dispense to.

The node name for any unmapped node displays in bold type in the protocol outline to identify the nodes that require labware mapping.

The Expand Plate procedure aspirates liquid from each quadrant of the 384-well source plate and dispenses it into one of the 96-well target plates. For example, the Plate Expansion procedure aspirates 100µL from the 96-wells in quadrant 1 of the source plate and dispenses the liquid into all 96 wells in the first target plate. The MDT arm moves to the Wash station and washes the tips. The MDT arm returns to the source plate, aspirates 100µL from the second quadrant of 96 wells, and dispenses the liquid into the second 96-well target plate. WinPREP then washes the tips, aspirates liquid from the third quadrant of 96 wells in the source plate, and dispenses into the third target plate. Finally, WinPREP washes the tips once more, aspirates the liquid from the remaining quadrant of 96 wells on the source plate, and dispenses the liquid into the fourth target plate. The 384 samples contained on the source plate have been dispensed by quadrant into four different 96-well plates.

The steps below describe how to associate the labware on the deck with the appropriate steps in the protocol outline.

To map the Plate Expansion labware to the protocol outline nodes:

1. Expand the **Plate Expansion** node by clicking the plus (+) sign next to the node, if necessary, to display the individual steps in the procedure.
2. Select **View > Expand All Outline Steps** from the main menu to expand all of the nodes in the protocol outline. The **End of Step** markers display for each of the nodes as shown in Figure 3-28.

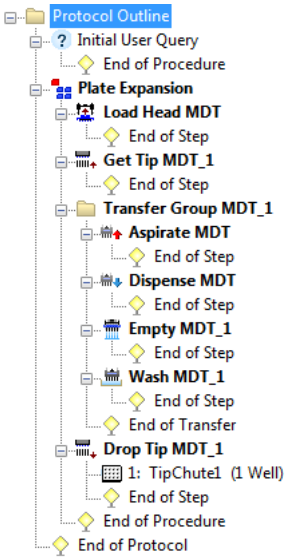


Figure 3-28. Expand Plate procedure before labware mapping

3. Double-click the **Plate Expansion** procedure node in the protocol outline. The **Expand Plate MDT Parameters** window opens.
4. Select *I200 - 96 Tip Head* in the **Dispense Head** drop-down list and select *P235 - 96 Tip Box* in the **Tip** drop-down list as shown in Figure 3-29.

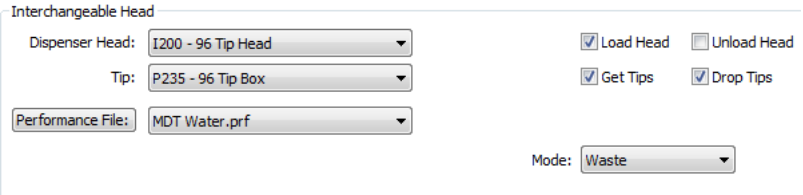


Figure 3-29. Dispenser Head and Tip settings for Expand Plate Procedure

5. Select *MDT Water.prf* in the **Performance File** drop-down list.
6. Click **OK** to save the parameter settings and close the **Expand Plate MDT Parameters** window.

   The Plate Expansion procedure parameters provide the information the software needs to automatically map the labware for many of the steps in the protocol outline. Notice that all the nodes have mapped labware except the **Aspirate** and **Dispense** steps. The software cannot map these steps automatically because it cannot determine which labware to associate with the aspirate and dispense steps.

☞ *Note: Automatic mapping only occurs when you populate the deck **before** constructing the protocol outline. Creating the protocol outline before you add labware to the deck view prevents the software from automatically mapping any labware.*

7. Click on the **Source** plate on the deck and drag the **Source** plate to the **Aspirate** step of the **Transfer Group MDT_1** procedure. WinPREP maps the **Source** plate to the node and creates a Well Map Segment node, shown in Figure 3-30, under the **Aspirate** step node. The node title text changes from bold to regular weight. The **Source** plate is outlined in red, indicating that it is mapped to an **Aspirate** step.

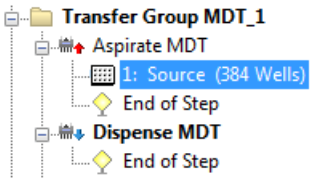


Figure 3-30. Well Map Segment Node for Aspirate step

(See Figure 3-25 for the plate positions or hover the cursor over a plate on the deck view to display the labware information as shown in Figure 3-31.)

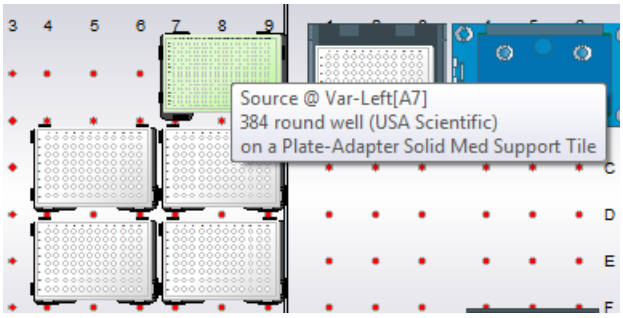


Figure 3-31. Tooltip information for labware

8. Click on the **Target1** plate on the deck and drag the **Target1** plate to the **Dispense** step of the **Transfer Group MDT_1** procedure. WinPREP maps the **Target1** plate to the node and creates a Well Map Segment node under the **Dispense MDT** step node. The **Target1** plate is outlined in blue, indicating that it is mapped to a **Dispense** step.

☞ *Note:* *Dragging and dropping the labware onto the* **End of Step** *node for the* **Dispense** *step adds the Well Map Segment for the labware to the end of the* **Dispense** *node. This ensures the nodes are in the proper order.*

9. Repeat step 8 for each of the other three target plates (**Target2**, **Target3**, and **Target4**). Be sure to drag these plates to the **Dispense** step in the proper order.

All the nodes in the protocol outline are mapped to labware on the deck. Note that none of the node names are in bold type, indicating that all of the nodes are mapped to labware. Figure 3-32 shows the current protocol and the mappings you assigned.

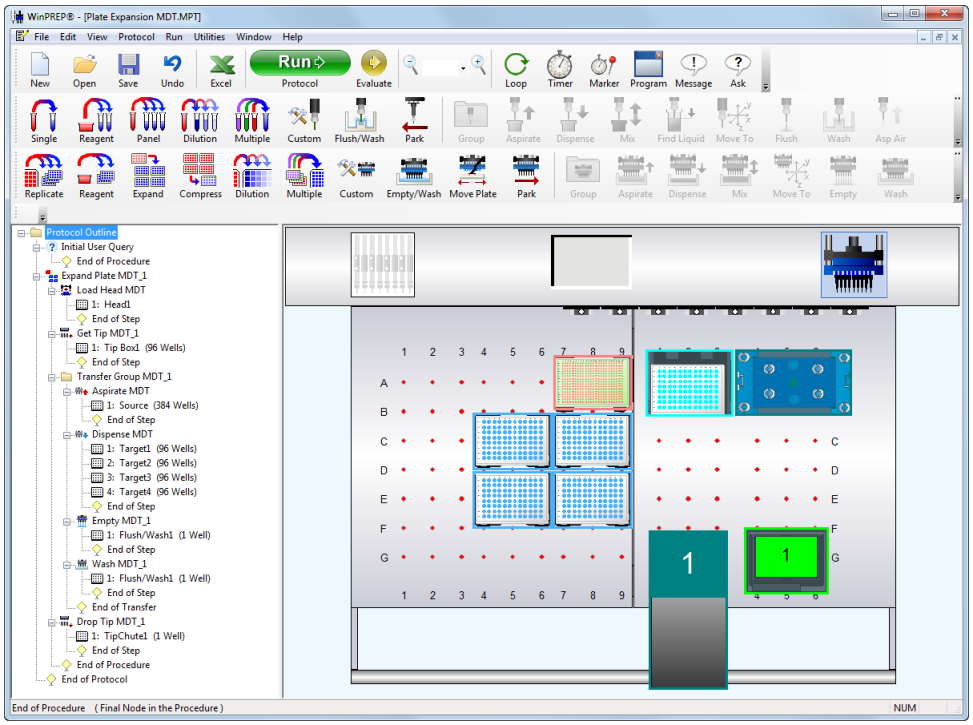


Figure 3-32. Expand Plate Procedure after Labware Mapping

Each type of step has a default color. For example, aspirate steps are red, dispense steps are blue, and wash steps are green. Select a node to display the color coding for the labware mapped to the node. See Default Color Associations on page 149 for a complete list of default colors. When you select a node in the protocol outline, the labware mapped to that node is outlined with the node's default color. Right-click a node and select **Labware Used By** to display colored lines to the labware used by the node.

The Expand Plate protocol is nearly complete. The final step is to create well maps for the labware. Labware and nodes can have a many to many relationship, meaning each piece of labware can be mapped to multiple nodes or each node can use multiple pieces of labware. Well maps specify which wells in a plate or rack are used by a node. Any piece of labware with wells requires a well map.

Unlike the Varispan arm, which allows you to select individual wells on a piece of labware, the MDT arm uses multiple wells on a piece of labware. The number of wells is determined by the pipetting head and tips The Varispan accesses individual wells, one by one or up to eight at a time. The MDT arm does not access wells individually. It simultaneously pipettes into or out of all the tips on the head at once. While this prevents access to individual wells and removes the ability to set the order the instrument accesses the wells, it provides high throughput pipetting and the ability to process entire plates or quadrants of plates in a single aspirate/dispense cycle.

By default, WinPREP sets the well map to include all wells in the labware. For the automatically mapped items in the Expand Plate procedure, this is the correct, and desired, setting. However, the aspirate and dispense steps in the Plate Expansion procedure node are not automatically mapped. You must set the appropriate well maps for the labware in these nodes.

To define the Expand Plate procedure well maps:

1. Expand the **Transfer Group MDT_1** node by clicking the plus (+) sign next to the node, if necessary, to display the Well Map Segments for the Aspirate node and the Dispense nodes.
2. Double-click the **Well Map Segment** node under the Aspirate node. The **Well Map Segment Parameters** window opens as shown in Figure 3-33.

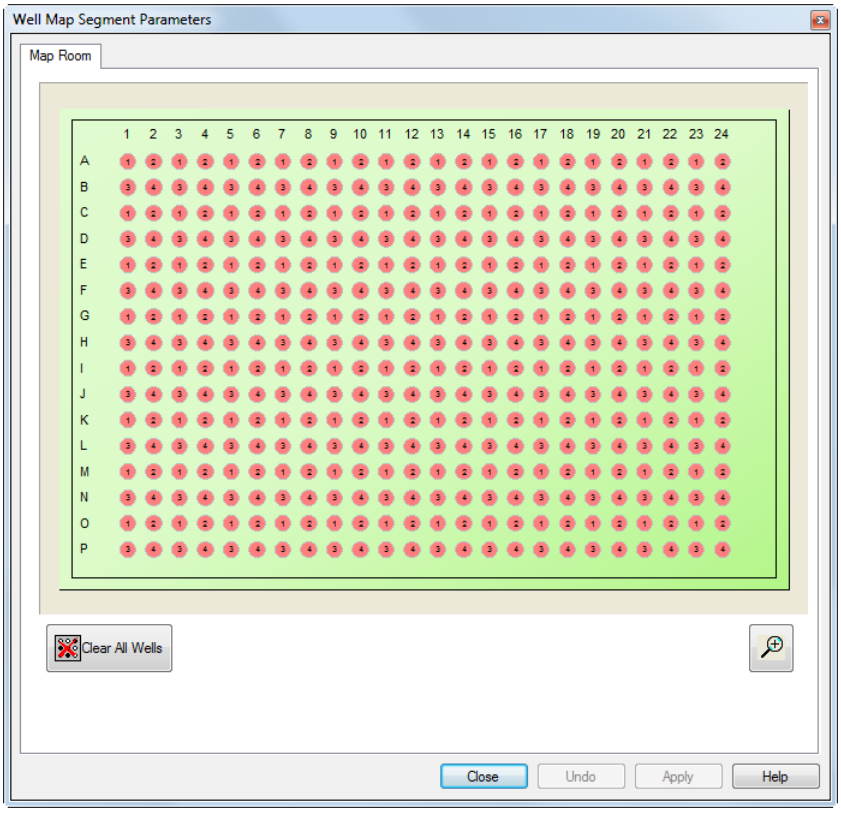


Figure 3-33. Well Map Segment Parameters window for Aspirate node

Because this labware is mapped to an MDT procedure, WinPREP selects all wells on the labware, as shown in Figure 3-33. Each well is shaded in color and numbered. The color indicates the node in the protocol outline the labware is linked to; the mapping only applies to the linked node.

The Plate Expansion procedure moves the liquid from a plate with a high well density (384-wells) to multiple plates with a lower well density (96-wells each). The procedure requires four 96-well plates and one 384-well plate (4 **x** 96 **=** 384). The head currently loaded on the MDT arm contains 96 tips. To perform the expansion, the MDT arm will complete four aspirate and dispense steps, one for each of the target plates.

To transfer the liquid, the arm will aspirate from 96 wells on the source plate and dispense that liquid into the wells on the first target plate. It will then repeat the aspirate and dispense steps three additional times, once for each of the remaining target plates. Each aspirate operation will access 25% of the wells on the source plate.

To systematically access each of the samples on the source plate, the software segments the wells into “quadrants” and numbers each well from one to four. Each quadrant on the 384-well plate contains a total of 96 wells. Wells that contain the same number are in the same quadrant.

Figure 3-34 shows the quadrant numbering scheme.

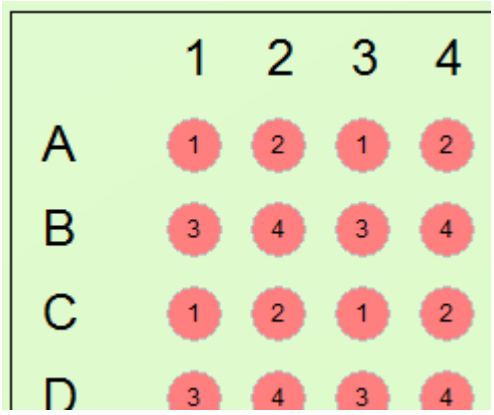


Figure 3-34. Quadrant Numbering for 384-well Source plate

All the wells in quadrant 1 are aspirated at the same time. The same is true for all the wells in quadrants 2, 3, and 4. Figure 3-35 and Figure 3-36 shows the wells included in each of the quadrants.

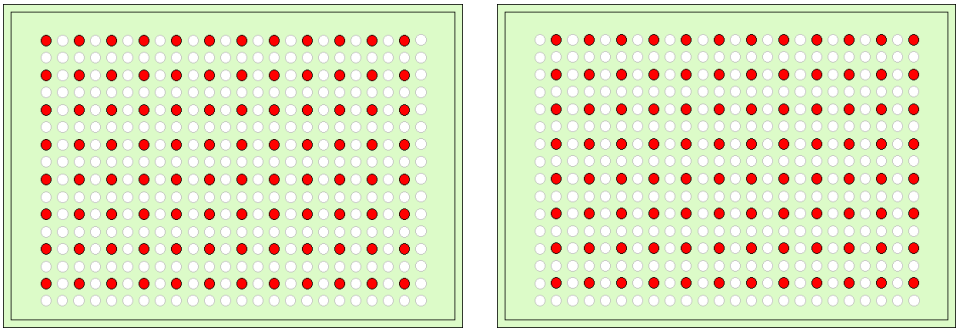


Figure 3-35. Source plate wells in Quadrant 1 (left) and Quadrant 2 (right)

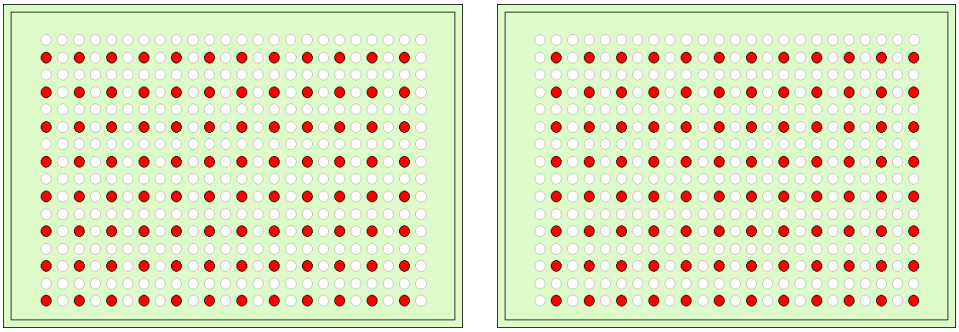


Figure 3-36. Source plate wells in Quadrant 3 (left) and Quadrant 4 (right)

The default well map is ideal for this procedure because the quadrant numbers correspond to the numbers of the target plates (quadrant 1 goes into Target1, quadrant 2 goes into Target2, etc.) You can experiment with selecting and clearing wells on the well map, but make sure all four quadrants are selected as shown in Figure 3-34 before proceeding.

3. Click the **Close** button to save the well map and close the **Map Room** window. (If you modified the well map, the **OK** button replaces the **Close** button.)
4. Double-click the first **Well Map Segment** node under the Dispense node. The **Well Map Segment Parameters** window opens as shown in Figure 3-37.

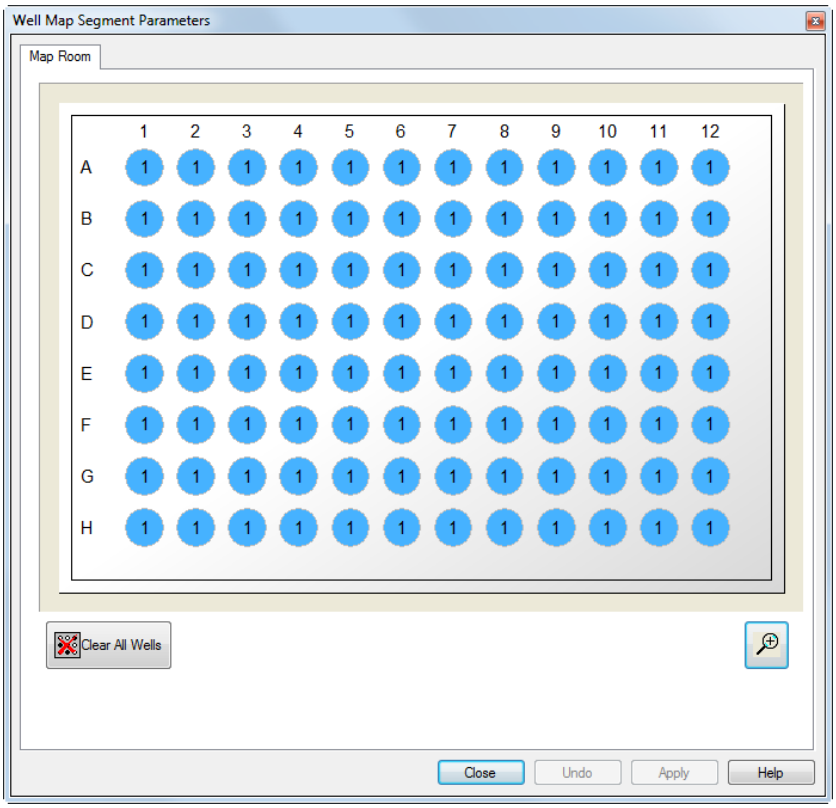


Figure 3-37. Well Map Segment Parameters window for Dispense node

This well map represents the wells for the Target1 plate. WinPREP selects all wells in the well map, shades them in color, and numbers them. Because this well map is for a Dispense step, the color is blue, which is the default color for dispense steps. All of the wells contain the same number because the tips on the dispenser head access all 96 wells at the same time.

5. Click **OK** to accept the default well map.
6. Verify all wells are selected for each of the three remaining Well Map Segment nodes. Each of the well maps are identical to the well map for Target1.

The protocol setup is complete. The protocol expands the source 384 well plate into four destination 96 well plates. The protocol individually pipets 100µL of liquid from the wells in one quadrant of the source plate and dispenses the entire volume into the wells on the destination plate with the same number as the quadrant (Quadrant 1 into Target1, Quadrant 2 into Target2, etc.).

To run the protocol in Evaluation mode (without moving the instrument) to check for errors, see Evaluating a Protocol on page 151.

To run the protocol, see Running Protocols on page 164.

Gripper Arm Tutorial

Gripper arm procedures are typically added to a protocol that also includes pipetting procedures. This section describes the procedures used to move the plates. See Varispan Single Liquid Transfer Tutorial on page 61, Varispan Mother-Daughter Transfer Protocol Tutorial on page 71, or MDT Plate Expansion Protocol Tutorial on page 82 for examples of pipetting protocols.

Follow the same three steps you use to set up a WinPREP pipetting protocol:

1. Populate the deck
2. Add the procedures to the protocol
3. Map the labware

Populate the Deck

WinPREP does not dynamically change the deck layout to represent labware movement in the protocol. You must lay out labware in all locations that will be accessed by the Gripper arm. For example, if a microplate will be located in position D10 at the start of the protocol but will be moved onto a shaker during the protocol, you must add a microplate at D10 AND on the shaker in the Deck View.

Add the Procedures to the Protocol

When adding a Move Plate Procedure to the protocol outline, you should modify the name of the procedure to include the plate type and location, for example: Move_Plate-96Plate D10 to shaker.

To add a Move Plate procedure to the protocol:

1. Select the step in the protocol above which you want to add the Move Plate procedure.
2. Select **Protocol > Add Procedure > Move Plate** on the main menu or click the **Move Plate** icon on the toolbar. The Move Plate Parameters window opens.
3. Type the desired name in the **Name** field. The name should indicate the plate that is being moved and the source and destination locations, for example **Move_Plate-96Plate D10 to shaker**.
4. To move a plate from one location to another, select both the **Get Plate** and **Move/Put Plate** check boxes on the Overview tab. Otherwise, select either check box to pick up a plate or to put down a gripped plate. (The Get and Put locations will be specified when you map the labware.)

5. Click the **OK** button to save the parameters and close the Move/Put Plate Parameters window. The Move/Put Plate procedure is added to the protocol.

The pipetting arm(s) are automatically parked at a safe location when a Move Plate procedure is executed in a WinPREP protocol and when you open the Teach Position window. You do not have to add Park Arm procedures to the protocol.

Map the Labware

When mapping labware to the liquid handling procedures, you need to remember where the labware is located at that point in the protocol, so that the appropriate labware location can be mapped to the correct step in the procedure.

You must also map the labware to the Get Plate and Move/Put Plate steps in the procedure to specify where to pick up the plate and where to put down the plate. You can drag-and-drop on-deck labware or select from taught on-deck or off-deck positions.

To map the Get Plate and Move/Put Plate steps:

1. In the protocol outline, expand the **Move Plate** procedure by clicking the plus (+) sign next to the procedure node, if necessary. The node expands to display the Get Plate and Put Plate steps.
2. Double-click on the **Get Plate** step on the protocol outline. The Get Plate Parameters window opens.
3. Select the desired labware mapping in the Labware Source drop-down list. For this example, select the **Use Deck View** option. (For information about other options, see the JANUS Help.)
4. Click the **OK** button in the Get Plate Parameters window to save the parameters and close the window.
5. Click on the plate that you want to pick up in the deck view and drag the plate onto the **Get Plate** step.
6. Double-click on the **Put Plate** step to open the Put Plate Parameters window.
7. Select the desired labware mapping in the Labware Source drop-down list. For this example, select the **Use Deck View** option. (For information about other options, see the JANUS Help.
8. Click the **OK** button in the Put Plate Parameters window to save the parameters and close the window.
9. Click on the plate in the location in the deck view where you want to put the plate and drag the plate onto the **Put Plate** step.

The Get Plate and Put Plate steps in the Move Plate procedure are now mapped to the labware on the deck.

MDT Serial Dilution Tutorial

This tutorial explains the differences between creating an MDT protocol and creating a Serial Dilution Protocol using the MDT Serial Dilution Tools (SDT). You should understand how to create an MDT Protocol before referring to these instructions. See MDT Plate Expansion Protocol Tutorial on page 82 for a tutorial on using the MDT arm.

The following sections are included:

- Calibrating the Deck on page 98
- Selecting the Correct Support Tiles on page 98
- Selecting an Interchangeable Head and the Appropriate Tip Loading Pattern on page 100
- Mapping Patterns on page 101

Calibrating the Deck

You must calibrate the deck before you use the Serial Dilution Tool interchangeable heads. You cannot use any of the Serial Dilution Tool interchangeable heads to calibrate the deck. You need to use a convention MDT head to calibrate the deck. The Serial Dilution Tool interchangeable heads are not equipped with a full head of tips, which are needed to calibrate the deck.

Selecting the Correct Support Tiles

You need to select the correct tip box support and the correct docking station that is compatible with the selected Serial Dilution MDT interchangeable head. These items are selected when you populate the deck view. The deck view is populated from the Add Labware dialog. When you click on the drop-down arrow at the dialog's Support Tile selection a comprehensive list of available support tiles are displayed.

The SDT supports either a Right-Oriented Docking station (the pneumatic air line is located on the right side of the docking station) or a Left-Oriented Docking station (the pneumatic air line is located on the left side of the docking station). This tutorial includes instructions for using either docking station. Use the procedure that matches the hardware on the deck.

To add the SDT tip box support:

1. Right-click on a blank area of the deck view and select **Add Labware** from the menu. The Add Labware Window opens.
2. Select **Head** in the **Category** drop-down list.

3. Select the SDT head you are using (**I30RC - 384 Tip Head** in this example) in the **Labware** drop-down list.
4. Select **Plate-Adapter SDT TipLoad Support Tile** in the **Support Tile** drop-down list.

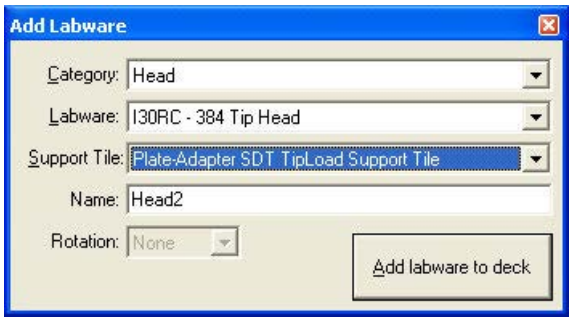


Figure 3-38. Add Labware for SDT Tip Box Support

5. Click the **Add labware to deck** button.

6. Use the cursor to position the Tip Load Support tile image on the deck view. Make sure that the deck view location corresponds to the support tile's physical location on the deck.
7. Click to place the Tip Load Support tile image on the deck layout.
8. Add the appropriate docking station, either left-oriented or right-oriented, to the deck layout as described below.

To add a right-oriented Docking station:

1. With the Add Labware window still open, select **Head-Adapter Right Side SDT Support Tile** in the **Support Tile** drop-down list.

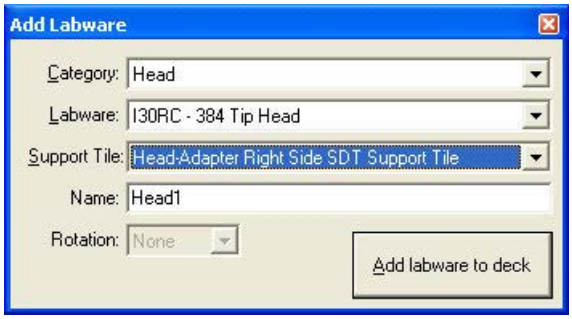


Figure 3-39. Add Labware for SDT Right Docking Station

2. Click the **Add labware to deck** button.

3. Use the cursor to position the SDT Support Tile image on the deck view. Make sure that the deck view location corresponds to the support tile's physical location on the deck.
4. Click to place the SDT Support Tile image on the deck layout.

To add a left-oriented Docking station:

1. With the Add Labware window still open, select **Head-Adapter Left Side SDT Support Tile** in the **Support Tile** drop-down list.

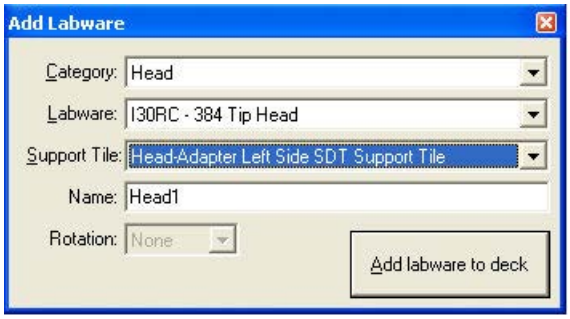


Figure 3-40. Add Labware for SDT Left Docking Station

2. Click the **Add labware to deck** button.

3. Use the cursor to position the SDT Support Tile image on the deck view. Make sure that the deck view location corresponds to the support tile's physical location on the deck.
4. Click to place the SDT Support Tile image on the deck layout.

Selecting an Interchangeable Head and the Appropriate Tip Loading Pattern

The type of interchangeable head that you choose determines the type of tip loading pattern available and the type of tips that are supported. (See Serial Dilution Tools on page 38 for detailed descriptions of each Serial Dilution Head.) Select the Dispenser Head, Disposable Tips, and Tip Loading Pattern in the **Overview** tab on the **Serial Dilution (MDT) Parameters window**.

Serial Dilution Tool, MDT P30, row and column: Supports left column or top row Tip Loading Pattern and is compatible with P30 and P10 disposable tips.

- Select **I30RC - 384 Tip Head** in the **Dispenser Head** drop-down list.
- Select either **Left Column** or **Top Row** in the **Tip Loading Pattern** drop-down list.

Serial Dilution Tool, MDT P235, row and column: Supports left column or top row Tip Loading Pattern and is compatible with P235 tips.

- Select **I200RC - 96 Tip Head** in the **Dispenser Head** drop-down list.
- Select either **Left Column** or **Top Row** in the **Tip Loading Pattern** drop-down list.

Serial Dilution Tool, MDT P50, row: Supports top row Tip Loading Pattern and is compatible with P50 and P20 disposable tips.

- Select **I50R - 96 Tip Head** in the **Dispenser Head** drop-down list.
- Select **Top Row** in the **Tip Loading Pattern** drop-down list.

Serial Dilution Tool, MDT P50, column: Supports left column Tip Loading Pattern and is compatible with P50 and P20 disposable tips.

- Select **I50C - 96 Tip Head** in the **Dispenser Head** drop-down list.
- Select **Left Column** in the **Tip Loading Pattern** drop-down list.

Mapping Patterns

1. Double-click on the destination plate in the protocol outline to open the Well Map Segment Parameters window.
2. Click the **Clear All Wells** button to clear the wells in the labware.
3. Select the desired pattern in the **Pattern** drop-down list (Left Column or Top Row as described below).
4. Select the wells in the labware that you want to apply the pattern to. The wells are selected according to the Pattern as described below.
5. Click **OK** to save the mapping and close the window.

Left Column Well Map - When you select **Left Column** in the Tip Loading Pattern, the default map room displays a right-to-left dispensing pattern: the order by which the liquid will be dispensed into the destination plate as the serial dilution protocol progresses.

Figure 3-41 shows a 96-well plate with a right-to-left dispensing pattern. The head begins at the column on the right (numbered 1), and progresses to the column on the left (numbered 12).

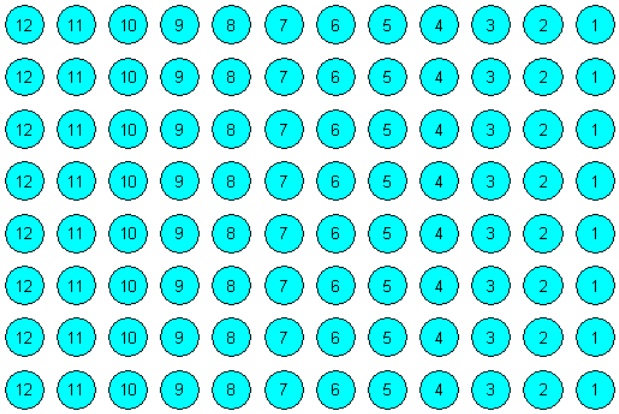


Figure 3-41. Right-to-Left Dispensing Pattern

Top Row Well Map - When you select an interchangeable head that is suitable for top row tip pickup, the default map room displays a bottom-to-top dispensing pattern: the order by which the liquid will be dispensed into the destination plate as the serial dilution protocol progresses.

Figure 3-42 shows a 96-well plate with a bottom-to-top dispensing pattern. The head begins at the row at the bottom (numbered 1), and progresses to the row on the top (numbered 8).

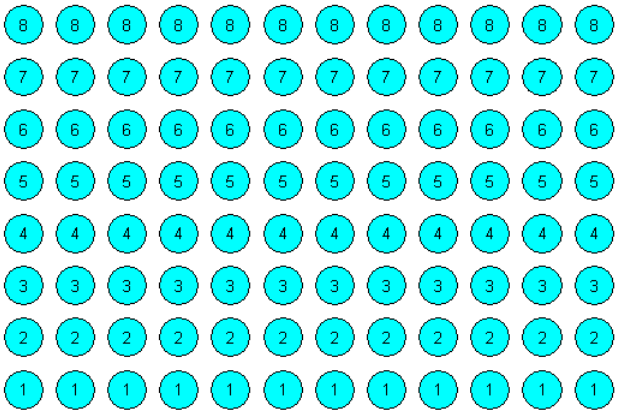


Figure 3-42. Bottom-to-Top Dispensing Pattern

Controlling the Interior Lights

The Interior Lights have a default state (On or Off) and a Brightness setting. These settings are used when a protocol is not running or if the protocol does not contain any commands to change the interior light setting.

To change the default Interior Light Settings:

1. On the main menu, select **Utilities > Setup > Instrument > Settings**.
2. Click the **Integration Manager Tab**.
3. Select the **Interior Light** row.
4. Click the **Configure** button. The Preview Interior Light window opens.
5. Select the desired settings. The interior lights display at the selected settings.
6. Click **OK** to save the settings.

To control the interior lights in a protocol:

1. In the protocol, click the Interior Lights button on the Integration Toolbar. The Integration Parameters window opens with the Interior Lights integration selected in the **Integration Name** drop-down list.
2. Select the desired command (Turn On or Turn Off) in the **Command** drop-down list.
3. If desired, select Runtime parameters or add a comment.
4. Click the **OK** button to add the command to the protocol.

When the protocol is executed, the interior lights will turn on or off when the command is executed. When the protocol is complete, the interior lights will return to the default setting selected in the Preview Interior Light window (described above).

Using the UV Light

The UV light requires that the Enclosure is installed on the system. The UV light does not turn on unless all of the enclosure doors are closed.

WARNING *Unprotected eyes and skin can be seriously damaged by exposure to UVC radiation. Do not open any doors or covers while the UV Light is on.*

- *Close all enclosure doors and install covers on any tip chutes, tip box chutes, or open deck locations before operating the UV Light via Direct Control or in a protocol. The enclosure panels block the shortwave UV radiation.*

To install the UV Light Option Software:

When the system is installed, the UV Light Option software is usually installed. If it is not already installed, refer to Installing and Registering Integration Devices on page 331 to install the software from the UV Light Option Software CD. After the UV Light software is installed, see Adding a Device to the Deck and Creating the Integration on page 333 to add the UV Light to the Integration Manager tab in the Instrument Settings window. Figure 3-43 shows the Integration Manager tab with the UV Light added. (The UV Light is not added to the Deck Layout tab.)

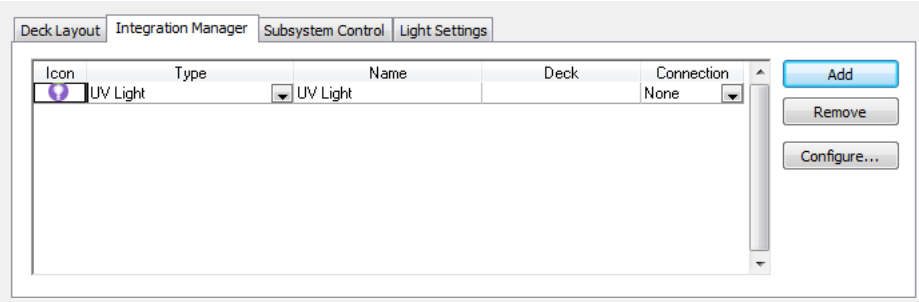


Figure 3-43. UV Light in Integration Manager Tab

To manually control the UV Light:

1. On the main menu, select **Utilities > Setup > Instrument > Settings**.
2. Click the **Integration Manager Tab**.
3. Select the **UV Light** row.
4. Click the **Configure** button. The UV Light Testing window opens as shown in Figure 3-44.

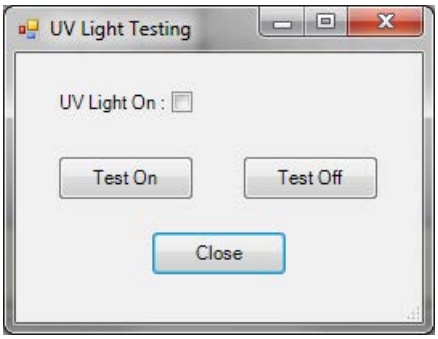


Figure 3-44. UV Light Testing Window

5. Click the **Turn On** button or the **Turn Off** button to manually control the UV Light.

WARNING *Unprotected eyes and skin can be seriously damaged by exposure to UVC radiation. Do not open any doors or covers while the UV Light is switched on.*

- *Close all enclosure doors and install covers on any tip chutes, tip box chutes, or open deck locations before operating the UV Light via Direct Control or in a protocol. The enclosure panels block the shortwave UV radiation.*

6. Turn the UV light **Off** before closing the windows.

To control the UV light in a protocol:

1. In the protocol, click the UV Light button on the Integration Toolbar.

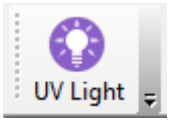


Figure 3-45. UV Light Button in Integration Toolbar

The Integration Parameters window opens with the UV Light integration selected in the **Integration Name** drop-down list.

2. Select the desired command (Turn On or Turn Off) in the **Command** drop-down list.

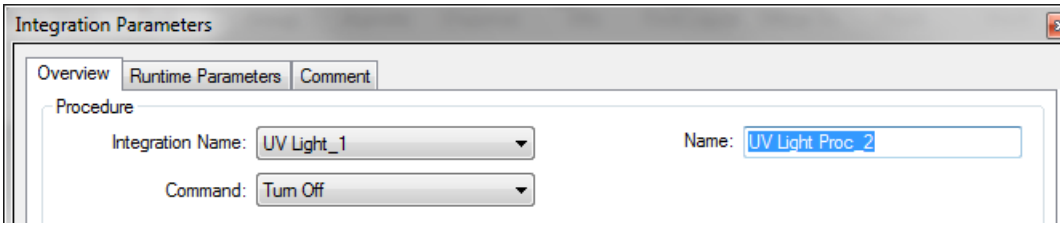


Figure 3-46. UV Light, Turn Off Command

3. If desired, select Runtime parameters or add a comment. (Runtime Parameters are not generally used with the UV Light.)
4. Click the **OK** button to add the command to the protocol.

Timer commands can be added to the protocol to wait a specific time period before turning the UV Light off, if desired. Commands can also be added to move the arms to ensure the entire deck is exposed to the UV Light.

When the protocol is executed, the UV light will turn on or off when the command is executed. Make sure to turn the UV light **Off** at the end of the protocol.

Running a Protocol

JANUS Application Assistant guides you through the process of selecting and running a protocol. Use the JANUS Application Assistant to:

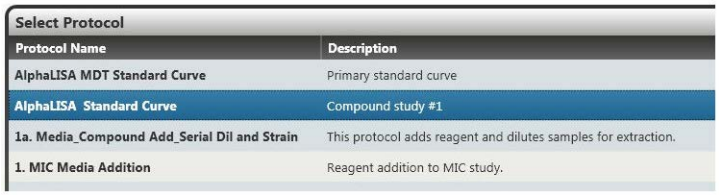
1. Select a protocol.
2. Gather supplies you need to run the protocol.
3. Place the labware and reagents on the deck of the instrument.
4. Run the protocol and monitor its progress as the protocol executes.
5. Cleanup the instrument after the successful execution of the protocol.

To open JANUS Application Assistant, double-click the **JANUS Application Assistant** icon on the Windows desktop.

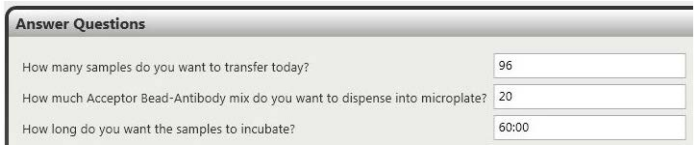
Step 1: Select a Protocol

1. Click the **Select** button

2. Select the protocol that you want to run in the **Select Protocol** section of the window:



3. Respond to the questions in the **Answer Questions** section of the window. You must respond to these questions before you move to the next step. The answers that you provide are used during the execution of the protocol:



4. Go to Step 2: Click the **Next Step** button or the **Gather** button:

Step 2: Gather Supplies

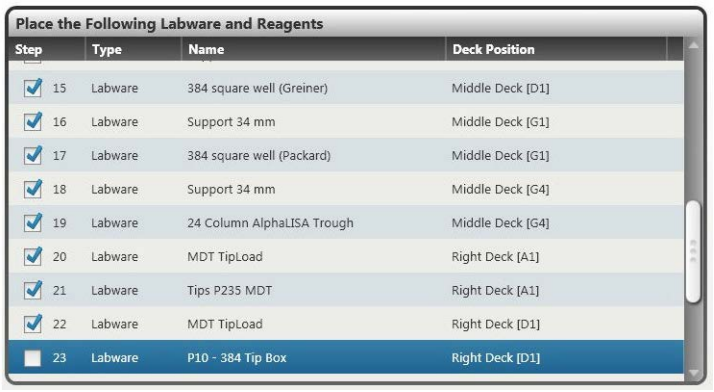
1. Inspect the checklist (under the section **Gather the Following Labware and Reagents**) and collect the labware that you need to run the protocol. Click each labware item that you collect. All labware that is listed is required. For convenience, the location of a lab item or reagent may be listed.

! ***WARNING*** *Only use consumables that are within their expiration date.*

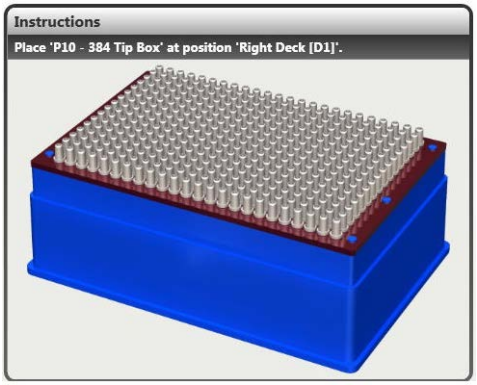
2. Go to Step 3. Click the **Next Step** button or the **Place** button:

Step 3: Place Labware on Deck

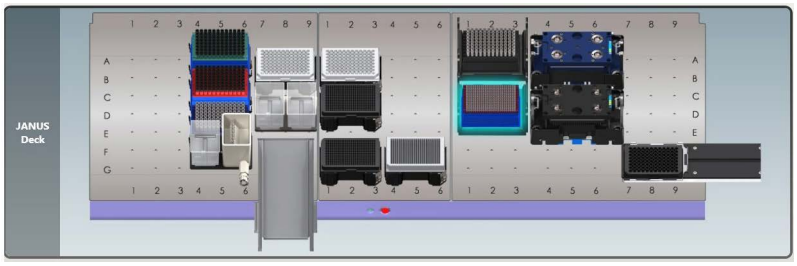
1. You need to populate the instrument deck with the labware items that you collected in Step 2. The collected labware and reagents are listed under the **Place the Following Labware and Reagents** section of the window. The Deck Position of each item is also listed. Click each labware item that you place on the deck:



2. When you select an item in the top left section of the window (**Place the Following Labware and Reagents**) the item's placement instructions are displayed under the **Instructions** section of the window.



3. The bottom portion of the window displays a view of the entire populated deck.



4. Go to Step 4. Click the **Next Step** button or the **Run** button:

Step 4: Run the Protocol

1. Click the **Start** button.

2. Monitor the progress of the protocol if desired.
3. Go to Step 5. Click the **Next Step** button or the **Cleanup** button. (Note that if JANUS Application Assistant was started directly from WinPREP, JANUS Application Assistant will display a message and close so that you can continue protocol development.)

Step 5: Cleanup

1. There are two sections to the Cleanup window (see Figure 3-47). The top half lists labware that must be removed from the deck. The bottom half of the window lists specific tasks that you need to perform. The first task is to clear the deck of labware that is listed in the top half of the screen. You may notice that some labware items require no action. Click the check box adjacent to each completed action item.

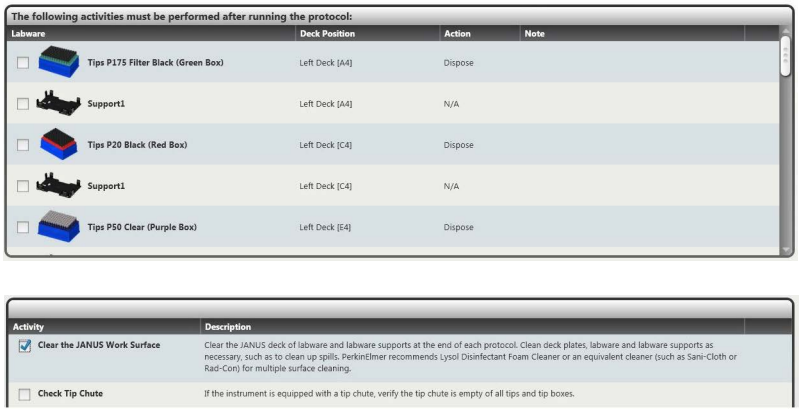


Figure 3-47. Cleanup Window

Protocol execution is now complete. Click the **X** button to exit JANUS Application Assistant.

Chapter 4

Creating and Editing Protocols

A protocol is a sequence of commands that specifies the actions used to process samples. You create protocols by adding procedures or steps to perform the actions you want in the protocol. Use the **Protocol Outline View** to add, remove, modify, move, and copy procedures or steps in the protocol outline. Perform the procedures below in any order as needed to create the protocol you require.

This chapter contains the following general information:

- About Protocols on page 113
- About Procedures on page 114
- About Steps on page 116

This chapter contains the following procedures:

- Creating a New Protocol on page 116
- Setting the Protocol Outline Parameters on page 117
- Creating the Deck Layout on page 118
  - Labware Positioning Considerations on page 119
  - Adding Labware to the Deck View on page 123
  - Selecting Labware on page 126
  - Changing the Labware Name on page 126
  - Editing Labware Parameters on page 127
  - Moving Labware on page 127
  - Duplicating Labware on page 128
  - Deleting Labware on page 129
  - Viewing Labware Labels on page 129
  - Sizing the Deck View on page 131
- Adding Procedures to the Protocol on page 132
  - Adding a Step to a Custom Procedure on page 133
  - Adding a Transfer Group to a Custom Procedure on page 134

- Editing Nodes in the Protocol on page 135
  - Editing Procedure or Step Parameters on page 135
  - Moving a Node on page 135
  - Renaming a Node on page 136
  - Copying a Node on page 136
  - Copying a Node from Another Protocol on page 137
  - Deleting a Node on page 138
  - Undo and Redo Changes on page 138
- Mapping the Labware on page 139
  - About Well Maps on page 139
  - Mapping Labware to a Step on page 146
  - Modifying Well Maps on page 146
  - View Labware Associations on page 147
  - Default Color Associations on page 149
  - Creating Well Map Patterns on page 150
- Evaluating a Protocol on page 151
- Add the Protocol to a Protocol Category on page 153
- Arranging the Protocols in the JANUS Application Assistant on page 154
- Using Variables on page 155
  - Ask User Variable on page 155
  - Calculate Variable on page 157
  - Select Variable on page 160

For step-by-step tutorials that explain how to create specific types of protocols for each of the major components of a system, see Protocol Tutorials on page 59.

Caution: The procedures in this chapter assume you have properly calibrated the deck for each arm on the system. If you have not calibrated the deck, see Calibrating the System on page 285 before proceeding.

About Protocols

Each protocol (*.mpt) begins with a **Protocol Outline** node and ends with an **End of Protocol** node. The nodes between the starting and ending nodes represent the procedures the protocol performs. Each procedure or step in the protocol displays a node in the protocol outline.

Nodes

The nodes in the protocol define the operations and functions to be performed by the protocol. Each node represents a procedure (group of steps) or an individual step in the protocol. Each *procedure* node contains a series of nodes, either embedded procedures or steps, that define the functions of the procedure. Each *step* node identifies an individual function and the labware used by that function.

Each node in the Protocol Outline displays an icon to identify the type of node and a name that you can customize if desired.

Procedure or Custom nodes that contain other nodes include a Branch Box to show or hide the child or component nodes. Each procedure node can be expanded to view or modify the steps in the procedure.

Double-click a procedure or step node to open the parameter window to define the specific settings for each procedure or step.

Branch Box

The Branch box collapses or expands a node to control the level of detail visible in the protocol outline. A branch box is located to the left of each node that contains additional nodes at the next level. Click the *plus* (+) or *minus* (-) to expand or collapse a node.

You can expand and collapse all of the nodes using the **Expand All Outline Steps** and **Collapse All Outline Steps** commands in the **View** menu.

Protocol Outline Node

When you create a new protocol, the new protocol automatically starts with a **Protocol Outline** node. The **Protocol Outline** node is always the highest possible (not indented) entry in any protocol outline. Figure 4-1 shows the starting protocol outline.

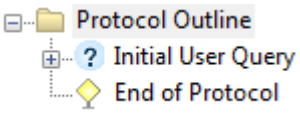


Figure 4-1. Protocol Outline of a New Protocol

The Parameters window for the **Protocol Outline** node specifies parameters that affect the entire protocol, as opposed to an individual procedure or step. These global parameters include report generation and how to handle specific events that occur during a protocol. The comment field specifies a description of the protocol for future reference.

An **End of Protocol Node** is automatically included at the end of each protocol in the Protocol Outline. No parameters or other selections are available for an End of Protocol node.

Compatibility with MultiPROBE II Tests

MultiPROBE II (*.mdt) protocol (test) files are supported in WinPREP, including labware definitions,

About Procedures

Each procedure provides a unique set of operations to define a pipetting procedure, non-pipetting procedure, or integration procedure. A pipetting procedure (see page 184) contains a sequence of steps that perform a liquid transfer. A non-pipetting procedure (see page 188) contains a sequence of steps that perform other actions that do not involve liquid transfer, such as prompting the operator for input. An integration procedure (see page 115) contains the configuration and operation options for an integrated device on the system. A Custom procedure (see page 116) is used to add steps directly into a procedure.

The procedures in the protocol outline are usually the first level of indentation in the outline, but procedures can be included in another procedure as an *embedded procedure* (see page 115).

You configure to parameters for each procedure using the Procedure **Parameters** window. The online help provides a detailed description of the Parameters window for each procedure. Click the Help button at the bottom of a Parameters window to display the Online Help.

When you add a procedure to a protocol, the system adds a temporary **Procedure Under Construction** entry, as shown in Figure 4-2, to the Protocol Outline above the currently selected node or at the nearest logical position and opens the procedure **Parameters** window. You can accept the default parameters or configure the procedure, as desired. When you apply the parameters to the procedure by clicking the **Apply** button on the **Parameters** window, WinPREP replaces the **Procedure Under Construction** entry with the defined procedure.

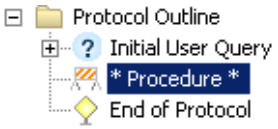


Figure 4-2. Procedure Under Construction

Adding one of the predefined procedures automatically includes the necessary steps in the procedure. You can modify the parameters for procedures and steps after adding the procedure to the protocol. You can also create Custom procedures and define the individual steps required for the protocol.

When you change the parameters of a predefined procedure, the system automatically propagates the changes through all the procedures and steps in the procedure. Common parameters that can affect the steps include the number of replicates, dispenses per aspirate, tip type, pre-aspirate mix cycles, and post-dispense mix cycles.

Integration Procedures

Integration procedures provide you with configuration and control over an integrated hardware device directly from the WinPREP protocol. The options available depend on the device you are integrating and the control interface provided by the device's manufacturer. For more information on integrations and the Integration Manager, see Integrating Devices on page 331.

Embedded Procedures

Embedded Procedures depend on another procedure and run as part of a parent procedure. In the protocol outline, an embedded procedure is indented under its parent procedure. Any procedure can be an embedded procedure. Embedded Procedures typically contain three additional fields on the **Overview** tab (Start After X Samples, Execution Mode, and Restart Every X Samples) and one additional field on the **Runtime Parameters** tab (Index Column Files By).

Embedded Procedure Example: You can use embedded procedures to set up a repeating pattern between two sample types, such as unknowns and controls. If you want to pipette controls after every 50 samples, you would define an "Unknowns" Single Liquid procedure and embed a "Controls" Single Liquid procedure within it that executes after every 50 samples of the parent. For details about this example, see Embedded Controls Procedure on page 358.

Custom Procedures

A Custom procedure allows you to add individual steps in any order to build a procedure that conforms to the needs of the particular application. You must add and define each transfer group and step in a Custom procedure. You must also keep track of all of the parameters that make up the procedure. The system does *not* automatically propagate parameter settings from the procedure tab to the dependent steps, nor does it check the validity of the procedure definition parameters. Finally, you must rigorously test the Custom procedures to ensure they perform correctly.

About Steps

Steps designate specific pipetting or arm movement operations that the instrument performs. In the protocol outline, a step is a node that exists in a procedure or transfer group. In predefined procedures, appropriate steps are automatically inserted in the procedure, according to the type of procedure and its definition. In Custom procedures, you are able to insert your own steps into the protocol outline. Types of steps include both pipetting and non-pipetting steps appropriate for the system configuration.

Every step is performed at a specific location on the deck, identified by a labware name and a well position in the labware. Each step is associated with a well map that specifies one or more well locations on a piece of labware. A labware node is indented under the step if the step is mapped to labware. The labware node name indicates the name of the mapped labware and the number of sample positions in the well map. Steps that use mapping information from a file or another step do not have a mapped labware node associated with them.

Creating a New Protocol

This procedure describes how to create a new blank protocol. After the protocol is created, you can use the Protocol Tutorials on page 59 to learn how to use the system components and accessories or use the procedures in this section to create your own protocol.

To create a new protocol:

1. Click **File > New** on the main menu. The **Open a Protocol Template** window opens.

2. Select the template to use to create the new protocol:
   - Click **None** to create a new, blank protocol. (Select this option if you are going to follow the tutorials to create a protocol.) The empty protocol opens.
     OR
   - Select the name of the protocol to use as a template and click **Open**. A new protocol containing the protocol outline and labware from the template opens.
3. Click **File > Save As** to save the new protocol. The **Save As** window opens.
4. Type a unique name in the **File Name** text box, specify the desired location, and click **Save**. Protocols must be saved in the C:\Packard\Janus\Bin folder or in a sub folder, and protocol path and name length is limited to 126 characters.
5. If you want to follow a tutorial to learn about creating protocols, see Protocol Tutorials on page 59. If you want to create a new protocol, see Setting the Protocol Outline Parameters on page 117.

Setting the Protocol Outline Parameters

The Protocol Outline Parameters specify report generation options for the protocol, the actions to take for specific events that can occur during the protocol, and a description of the protocol.

To set the Protocol Outline Parameters:

1. Double-click the **Protocol Outline** node to open the Protocol Outline Parameters window.
2. To add reports to the **Overview** tab, see Reports on page 240.
3. On the **Advanced** tab, specify actions to take if specific events occur during the protocol.
4. On the **Comments** tab, type any desired text to identify or describe the protocol.
5. Click the **OK** button to save the settings and close the window or click the **Apply** button to save the settings and leave the window open.

Creating the Deck Layout

Any labware that is on the deck when the protocol will run must be shown in the deck view, even if the labware is not used in the protocol. WinPREP uses the deck layout to define the locations for liquid handling operations. WinPREP also uses the deck view to determine the travel paths of the arms as the arms move across the deck. The travel path is optimized to speed up the protocol execution and minimize unnecessary arm movements. If labware is on the instrument deck but not shown in the deck view, WinPREP could calculate a travel path that causes the head or tips to contact the labware.

The procedures in this section explain how to create and edit the deck layout that displays in the Deck View.

- Labware Positioning Considerations on page 119
- Adding Labware to the Deck View on page 123
- Selecting Labware on page 126
- Changing the Labware Name on page 126
- Editing Labware Parameters on page 127
- Moving Labware on page 127
- Duplicating Labware on page 128
- Deleting Labware on page 129
- Viewing Labware Labels on page 129
- Sizing the Deck View on page 131

Labware Positioning Considerations

This section provides guidelines for labware placement. Due to physical accessibility limitations of the labware, the arms, and some accessories, there may be restrictions on placing labware in certain locations. This section includes important information about arranging labware on the deck and helps you avoid common mistakes. Review this section when deciding on the location of labware on the deck.

- Accessible Deck Areas on page 119
- Docking Station Restrictions on page 120
- Tip Box Support Tile Restrictions on page 121
- Tip Loading Restrictions (Serial Dilution Tools only) on page 122
- Support Tile Restrictions on page 123
- Tipwash Bowl Restrictions on page 123
- Waste Chute Restrictions on page 123
- Labware Movement Restrictions on page 123

Accessible Deck Areas

Because each arm physically occupies space over the deck when the arm is parked, the deck areas accessible to each arm differ if there are multiple arms on the system. Much of the accessible areas for each arm overlap, however, there are also inaccessible areas for each arm. Figure 4-3 illustrates this principle for a system with two pipetting arms.

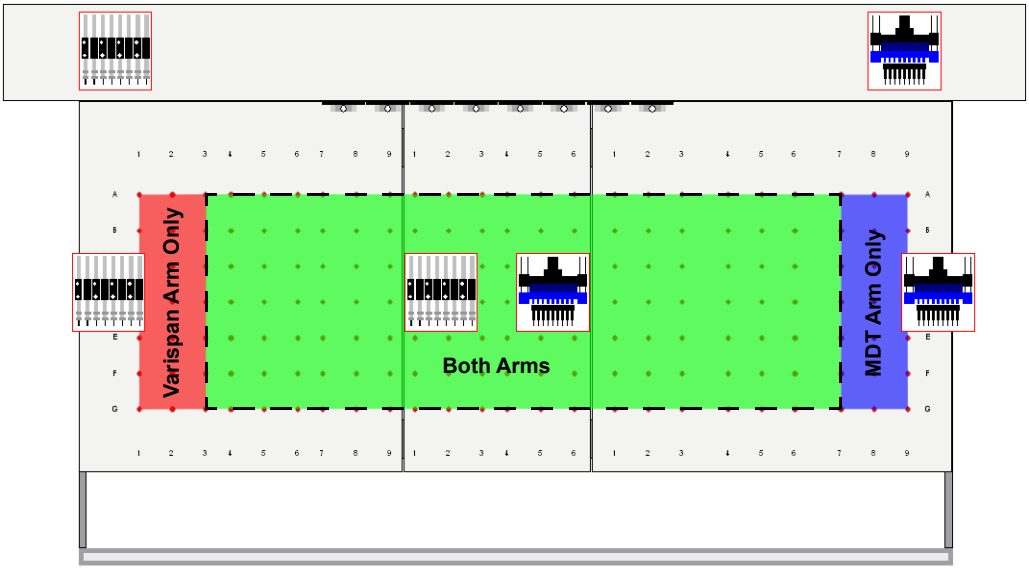


Figure 4-3. Deck Areas Accessible by each Arm

The green area enclosed by the dashed line in Figure 4-3 shows the deck locations accessible by *both* pipetting arms on the system. Labware positioned in this area provides greater efficiency because the system can optimize arm movements during the protocol.

☞ *Note: Each arm has its own accessible area. The green rectangle in Figure 4-3 shows the area where the accessible areas overlap. The image also shows the areas where one arm can reach, but the other cannot.*

The size of the accessible area depends on the arm configurations and deck size of the system. An arm cannot access the three columns on the opposite end of the deck if a second arm is installed. For example, in Figure 4-3, the MDT arm cannot reach the three columns immediately under the Varispan arm and the Varispan arm cannot reach the three columns immediately under the MDT arm. This situation becomes even more complex on a system with three arms.

Thorough planning and testing are the best ways to avoid issues associated with an unreachable deck area. Experiment with the protocol procedures and system configuration to familiarize yourself with the accessible and inaccessible areas of the deck.

Docking Station Restrictions

Always place the tip box support and tip box for the associated head immediately to the left of the head's docking station as shown in Figure 4-4. This prevents the arm from accessing the tip box when the head is seated in the docking station. The head must be loaded before loading tips and this positioning ensures the head is never docked when attempting to load the associated tips.

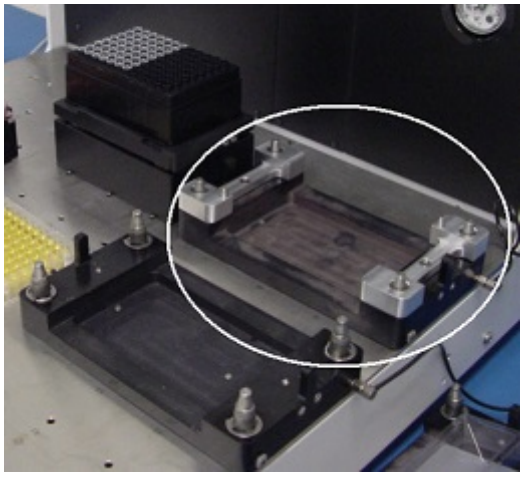


Figure 4-4. Docking Station and Tip Box Support Positioning

The recommended location for a Docking Station is the right-most column of the instrument in the back row of the deck to allow access to labware in the front deck positions. The right column imposes the fewest limitations on adjacent deck positions.

Do not place any labware (Tip Chute, Tipwash Bowl, microplates, etc.) to the left of a Docking Station that contains, or will contain, a docked head. The height of the docked head can restrict access to the labware or accessories.

When using the MDT gripper to move labware, ensure that all Docking Stations with seated heads do not obstruct the path of the MDT arm. Often, gripped labware will not vertically clear a docked head. Only standard height plates (14 mm) or smaller in the MDT gripper will clear a Docking Station containing a docked head. Taller labware, tip boxes, etc., hang too low in the MDT gripper's fingers to clear a docked head.

Tip Box Support Tile Restrictions

If the Docking Station is located on the right side of the deck as recommended, place the associated Tip Box Support to the immediate left of the Docking Station. A docked head can physically block access to other labware or accessories (tip chute, Tipwash bowl, microplates, etc.) located to the immediate left of a docking station.

If the Docking Station is located on the left side of the deck, the recommended position for the associated Tip Box Support depends on whether the Gripper option is installed. If the MDT gripper *is not* installed, position the Tip Box Support immediately to the right of the associated Docking Station. If the MDT gripper option *is* installed, the deck position immediately to the right of the docking station is restricted and you must position the Tip Box Support at another deck location.

Labware located beside a Tip Box Support must be less than 72 mm above the level of the deck. Labware located in front of a Tip Box Support must be less than 108 mm above the level of the deck. Labware or accessories taller than 108 mm will interfere with the attachment of tips. Examples of taller labware include another Tip Box Support, Tip Chutes, Tall Support Tiles, docked heads, tall labware, Tipwash Bowls, etc.

Do not place a Tip Box Support behind a Docking Station that contains, or *can* contain, a docked head. The height of the docked head will interfere with the attachment of tips.

Tip Loading Restrictions (Serial Dilution Tools only)

Due to the force required to load a single row or column of disposable tips, you must place the Tip Box Support Tile (shown in Figure 2-15) in the back row (A) of the JANUS G3 deck. This enables the MDT arm to exert the necessary downward force to load the tips properly. If you do not position the Tip Box Support Tile in row A, the tips may not load properly and could negatively affect the liquid transfer results.

When you load a column of tips, the Serial Dilution Tools head starts at the right-most column of the tip box and progresses column by column from right to left until the tip box is empty. If you position the docking station to the right of the tip box support, as recommended, the docking station will not obstruct the head as it loads tips.

☞ *Note: You should always use the WinPREP protocol to load tips for the Serial Dilution Tool head. Never attempt to load tips onto the SDT heads manually.*

When you load a row of tips, the Serial Dilution Tools head starts at the bottom row of the tip box and progresses row by row from bottom to top until the tip box is empty. You can specify the rows and columns containing the tips you want to load by setting the Tips Well Map. This is identical to the way you set the well map for a microplate. Because the MDT head accesses the box from the front in these cases, you should keep the area of the deck in front of the tip box free from any labware. The height of any labware positioned in front of the Tip Load Support Tile must be less than 108mm.

Figure 4-5 illustrates these concepts.

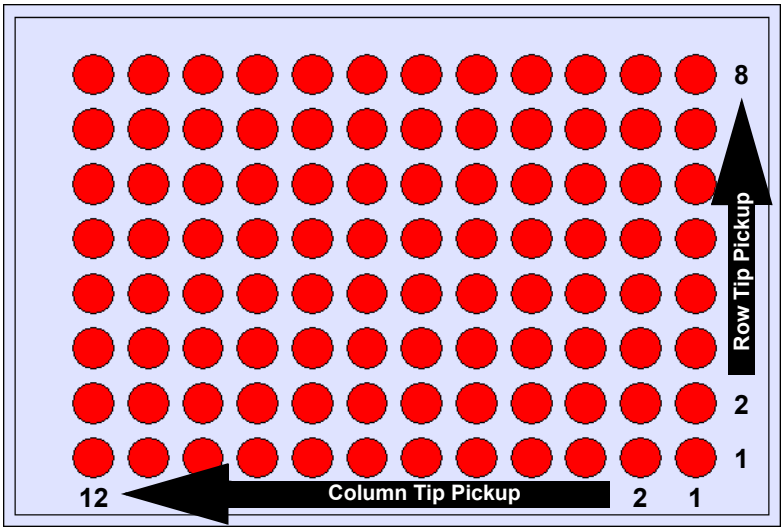


Figure 4-5. Serial Dilution Row and Column Tip Loading Example

Support Tile Restrictions

If you use an I30 Head with P10 or P30 Tips or an I50 Head with P20 Tips, put the target labware on a Tall Support Tile. The listed tip and head combinations cannot reach the bottoms of the wells when the target plate is on anything other than a Tall Support Tile. Tall labware in surrounding positions can also limit how deeply the tips reach into the wells on a plate.

You should only place Tip Boxes on supports that are shorter than the surrounding tiles if you intend to pipette into or out of the labware located in the adjacent positions.

Tipwash Bowl Restrictions

Place all Tipwash Bowls in either the front or back row to facilitate plumbing of wash and waste liquid lines.

Locating the Tipwash Bowl next to a Tip Load Carrier restricts how deeply the tips can reach into the wash bowl.

Waste Chute Restrictions

Place the Waste Chute in the front row so the chute is below the level of the deck by hanging over the edge of the instrument.

Labware Movement Restrictions

Due to the physical height of the docking station, gripped labware may not vertically clear a docked head. Only standard height plates in the Gripper will clear an MDT Head in a Docking Station on the deck. Tall labware, tip boxes, etc., hang too low in the MDT gripper to clear a docked head.

You cannot use the MDT gripper when the Pin Tool is attached to the MDT arm. The MDT gripper cannot grip Tip Boxes when disposable tips are attached to the dispense head.

The Gripper and the MDT gripper cannot transport tip boxes with covers. Remove the Cover before moving a tip box with the gripper.

Adding Labware to the Deck View

The Labware in the Deck View is used by the software to properly position the instrument when accessing labware. Labware is categorized into categories to assist in selecting the desired labware when populating the deck. If the labware you are using is not defined, you can define new labware as described in Creating New Labware on page 252.

To add labware to the deck view:

1. If desired, position the labware required for the protocol on the instrument deck. See Labware Positioning Considerations on page 119 for guidelines for certain types of labware.
2. Select the desired arm by clicking its icon in the deck view. This updates the deck view to show the calibration status for the selected arm.
3. Select **Protocol > Add Labware** from the WinPREP menu or right-click on a clear area of the deck in the deck view and select **Add Labware** from the shortcut menu. The **Add Labware** window opens as shown in Figure 4-6.

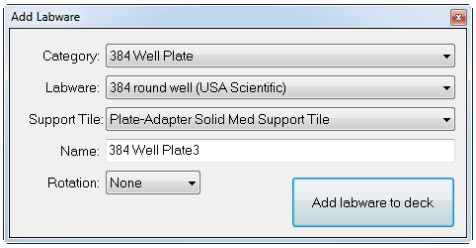


Figure 4-6. Add Labware window

☞ *Note: The list of labware available on the* **Add Labware** *window reflects the content of the Labware Library. For more information on the Labware Library, see Labware Libraries on page 250.*

4. Select the category that contains the labware you want to add in the **Category** drop-down list. The **Labware** field updates to include a list of all the labware for the selected category.
5. Select the desired labware from the **Labware** field. The **Support Tile**, **Name**, and **Rotation** fields update with default settings for the selected labware.
6. If the labware will be placed on a different support tile than the one listed, select the desired support tile in the **Support Tile** drop-down list. (If the correct support tile is not specified, the tips may be positioned too high to aspirate or dispense properly, or so low that the tips contact the bottom of the plate.)
7. If the labware will be placed in a rotated position on the deck, select the number of degrees (90, 180, or 270) to rotate the labware (clockwise) in the **Rotation** drop-down list. (Rotation must be specified when the labware is added to the deck. The labware cannot be rotated after it is placed in the deck view.)

8. Click the **Add Labware to Deck** button and position the cursor over the desired location on the deck. A dashed outline of the labware indicates the size and shape of the labware so you can see where it will fit. The status bar in the lower-left corner of the WinPREP window, below the Protocol Outline View, displays the current deck location. The location should match the physical position of the labware on the deck. Hold the ALT key while placing labware to overlay one piece of labware on top of another.

☞ *Note:* *WinPREP limits the placement of the labware to a valid, recognized position. Figure 4-7 shows an example of an invalid position. When the labware is positioned over a valid deck location, the cursor changes to an arrow, without the slashed circle, and you can click to place the labware.*

Figure 4-7. Incorrect Labware Position

❖ *Tip:* *When overlaying labware in the same deck locations, you can use the open location at the top of the deck view to temporarily hold stacked labware to map or access the labware underneath. You must place labware onto the deck before moving labware to the Temp location at the top of the deck view. If the overlaid labware items are the same visual size, you can redefine one of them to be slightly larger and choose a different color. Do not change the well-to-well positions when changing the labware properties. See Chapter 11: Labware Libraries on page 250 for more information. You can indicate in the JANUS Application Assistant Editor if the labware is not on the deck at the start of the protocol.*

9. Click to place the labware on the deck view.

☞ *Note:* *To overlay labware in the same deck location, press and hold the* **<Alt>** *key while placing the labware on top of an existing labware item. This positions both items at the same deck location.*

10. Repeat these steps until all the necessary labware is on the deck.

After you place a piece of labware on the deck, you can select, move, duplicate, and delete it. Refer to the remainder of this chapter for instructions.

Selecting Labware

You must select labware in the deck view to move, copy, map, delete, or edit it. To select labware in the deck view, click on the labware item. A dashed outline around the labware indicates it is the active selection. To deselect the labware, click any other labware, or any unpopulated area of the deck.

To select a group of labware, use one of the methods below:

To select multiple labware items by dragging:

1. Click on an unpopulated area of the deck and drag a rectangle around the labware you want to select.
2. When you release the mouse button, all the labware items in the rectangle are selected. Each selected labware item displays a dashed outline.

☞ *Note: You must completely enclose a piece of labware when selecting it with the click and drag option. Labware that is only partially enclosed in the rectangle is not included in the selection.*

To select multiple labware items by clicking:

1. Click the first labware item you want to select.
2. Hold the **<Shift>** key and click each additional labware item you want to select. Click an item a second time to deselect it.
3. Release the **<Shift>** key when you have selected the desired items. Each of the selected labware items displays a dashed outline in the deck view.

Use any combination of these methods to select multiple items. For example, drag around a group of items and then include or exclude labware by **<Shift>** clicking.

❖ *Tip: Perform the drag selections first, as this operation always deselects any currently selected items.*

Changing the Labware Name

To change the name of labware on the deck:

1. Double-click the labware you want to rename. The **Labware Parameters** window opens.
2. Type the new name in the **Name** text box.
3. Click **OK** to apply the new name and close the window.

When you hover the cursor over the labware, or enable labware labeling, WinPREP displays the new name for the labware item.

Editing Labware Parameters

To edit the labware parameters:

1. Select the desired labware in the deck view.
2. Do one of the following:
   - Double-click the desired labware in the deck view.
   - Right-click the desired labware and click **Properties** from the menu.
   - Highlight the desired labware in the deck view by clicking on the labware. Select **Edit > Parameters** on the main menu.
   - Highlight the desired labware in the deck view by clicking on the labware. Press **<Alt> + <Enter>** on the keyboard.
3. Edit the parameters in the labware **Parameters** window as desired.
4. Click the **Close** button (or the **OK** button if modifications have not been applied), or click the X (Close) button in the upper right corner of the parameters window. WinPREP prompts you to save the changes if modifications were made but not applied and then closes the **Parameters** window.

Moving Labware

After placing labware in the deck view, you can easily reposition it to match the actual deck configuration or to make room for other labware. You can move pieces of labware individually or in groups. As described in Adding Labware to the Deck View on page 123, you cannot place labware in an unrecognized deck location.

When you move a group of labware, the same relative configuration is maintained between the labware in their new locations. There must be room for *all* of the labware in the new location or you will not be able to reposition the group.

Moving labware *does not affect* existing mapping for that labware.

To move labware by dragging:

1. Select one or more pieces of labware on the deck. For more information about selecting labware, see Selecting Labware on page 126.
2. Click and drag the labware icon, or one of the labware icons in the group to the new deck location.

You can also move labware by changing its deck position parameters. The deck position parameters identify the location of the labware by its row (alphabetic) and column (numeric) values. These values identify the location of the reference pin, a metal post on the bottom of the labware or support tile, that inserts into the deck plating. The reference pin is the point of reference for labware sizes, orientation, and position. You can only use deck position parameters to move individual pieces of labware.

To move labware by modifying deck position parameters:

1. Double-click the desired labware. The **Labware Parameters** window opens as shown in Figure 4-8.

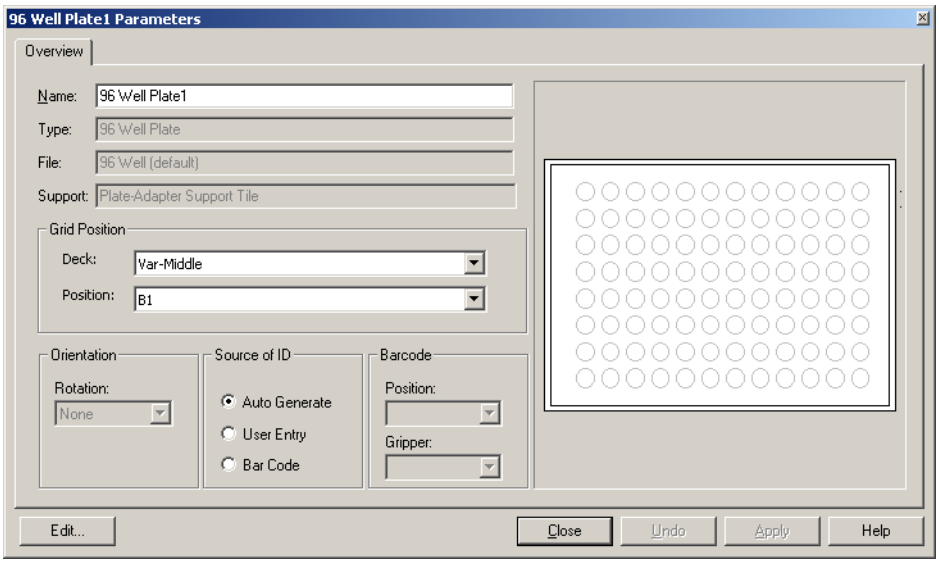


Figure 4-8. Labware Parameters window

2. Change the **Deck** and **Position** values in the **Grid Position** frame to the desired location for the labware.
3. Click **OK** to close the **Labware Parameters** window and reposition the labware.

The **Deck** and **Position** drop-down lists on the **Labware Parameters** window represent all possible deck locations for the deck configuration. By moving labware in this way, you can precisely position one piece of labware *on top of* a second piece of labware.

Duplicating Labware

You can duplicate labware in either of two ways. You can add multiple instances of the same labware using the **Add Labware** window. Each time you click the **Add Labware to Deck** button, you place a new instance of the selected labware on the deck. You can also duplicate an existing piece of labware as described below.

To duplicate labware:

1. Hold down the **<Ctrl>** key and click and hold the left mouse button on the labware you want to copy. The cursor changes to include a plus (+) sign.
2. Drag the labware to a new deck location. A copy of the selected labware is placed in the new location.

The new labware will have the same parameters as the original labware except it will have a different name, since each piece of labware in the deck view must have a unique name. WinPREP creates unique names for the labware by appending a sequential number to the end of the labware name. For example, if you duplicate a labware item named *96 Well Plate1* the software assigns the name *96 Well Plate2* to the duplicated item. If the next sequential number is already in use on the deck, WinPREP assigns the next highest unused number.

Deleting Labware

If the protocol changes or you accidentally add labware that you do not need, you might want to remove it from the deck view. Having unnecessary or unused labware on the deck clutters the view and makes it more difficult to position the labware required for the protocol. In these cases, you should delete the unneeded labware.

To delete labware:

1. Select the labware you want to delete. This can be individual labware or groups of labware.
2. Press the **Delete** key on the keyboard or right-click the selected labware and choose the **Remove Labware from deck** option on the menu.

The labware graphic is removed from the deck view and any existing mappings to the protocol outline are deleted. Nodes that were mapped to this labware become unmapped and display in bold type.

Caution: Use caution when deleting labware. The delete operation cannot be undone. If you mistakenly remove labware, you must re-add and re-configure the items.

Viewing Labware Labels

Labware labels are descriptive, graphical elements that provide information about a piece of labware. When enabled, labware labels display the labware name, deck location, labware type and support type for each piece of labware in the Deck View. Labware labels are positioned on top of the labware by default. Reposition the label by dragging them to the desired location. Figure 4-9 shows the deck with labware labels.

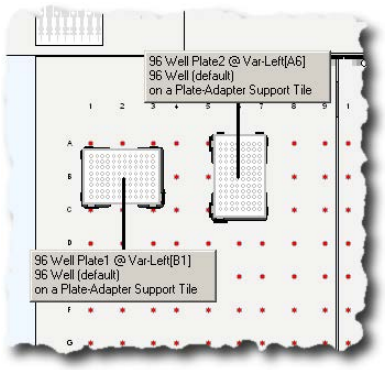


Figure 4-9. Labware label example

Labware labels help you identify labware on the deck. This is especially useful when documenting the protocols. You can activate labware labeling and capture the screen image for use in your own documentation.

To show or hide labware labels:

1. Right-click on any unpopulated area of the deck to open the shortcut menu.
2. Select **Labware labels** from the menu. When enabled, a check mark displays to the left of the menu item.

If you enabled Labware labels, any labware on the deck displays a label. If you disabled Labware labels, the labware on the deck no longer displays any labels.

☞ *Note: Custom label positioning is reset, and any custom label positioning is lost, when you disable labware labeling.*

To reposition a labware label:

1. Enable labware labeling as described in the previous section.
2. Click and drag the label to the desired location on the deck view.

The labware label is positioned in the new location. A line connects the label to the labware it describes.

To selectively disable labware labels:

1. Enable labware labels, if necessary, as described above.
2. Double-click the Labware label that you *do not* want to display. The label closes.

To restore the Labware labels you selectively disabled, disable Labware labeling and then enable it again. This restores all Labware labels for all the labware on the deck.

☞ *Note: Custom label positioning is reset, and any custom label positioning is lost, when you disable labware labeling.*

Sizing the Deck View

You can resize the deck view to display varying levels of detail, as required. If you want to see the details of the mapping order on a particular piece of labware, zoom in (increase the zoom percentage) until you can read the necessary information. If you need to see the overall layout of the deck, zoom out (decrease the zoom percentage) so that the whole deck is represented in the view. The **Size to Window** option automatically resizes the deck view as the WinPREP main window is resized.

To zoom on the deck view:

1. Right-click on a clear area of the deck in the deck view to open the shortcut menu.
2. Select **Zoom** on the shortcut menu to display the available options.
3. Select the desired zoom factor. The options are described below:

Option	Result
Percentage	Increases or decreases the deck view to the selected percentage of the actual size.
Size to Window	Resizes the deck view to fit in the current WinPREP window (the default zoom value).
Increase/Decrease	Increases or decreases the zoom of the deck view by a fixed value.

4. Repeat these steps until you reach the desired zoom level.

You can also zoom to an area of the deck by holding **<Ctrl>+<Shift>** and clicking the area on the deck view. To zoom out from the area, hold **<Ctrl>+<Shift>** and right-click the on the deck view.

When you close a protocol, the deck view zoom level returns to the default value. The **Size to Window** command also returns the deck view to its default zoom level.

Adding Procedures to the Protocol

To add a procedure to the protocol outline, specify the insertion point in the protocol outline and the type of procedure to insert as described below.

❖ *Tip:* *If the selected location is not appropriate for a procedure, the procedure is placed in the closest logical location. If you insert a procedure in a position that you do not want, you can move it later.*

To add a procedure to the protocol outline:

1. Select the node immediately **below** the location where you want to insert the new procedure. (You can select an **End of Protocol** node or **End of Procedure** node to place the procedure at the end of a protocol or procedure.)
2. Do one of the following:
   - Select **Protocol > Add Procedure** on the main menu and select the desired procedure.
   - Right-click on a clear area in the protocol outline, select **Add Procedure**, and select the desired procedure from the menu.
   - Click the toolbar button for the desired procedure.
   - Copy an existing procedure in the protocol outline and paste it in the desired location (see Copying a Node on page 136 for more information).
   - Copy an existing procedure from another protocol outline and paste it into the current procedure (see Copying a Node from Another Protocol on page 137 for more information).
3. If you are inserting a procedure into another procedure, WinPREP displays a dialog to alert you that you are creating a child procedure. If this is your intention, click **Yes**, otherwise, click **No**. For more information, see Embedded Procedures on page 115.
4. The Procedure **Parameters** window opens. Make the desired selections on each tab.
   - On the **Overview** tab, type the desired name for the procedure in the **Name** text box. The name displays in the protocol outline and should allow you to determine the purpose of the procedure in the protocol.
   - If using variables to prompt for values at runtime, select the desired parameters on the Runtime Parameters tab. To use variables to supply a value for a parameter at runtime, see Using Variables on page 155.
5. Click the **OK** button in the Parameters window to add the procedure to the protocol outline.
6. Repeat this procedure to add all of the required procedures to the protocol.
7. See Mapping the Labware on page 139.

Adding a Step to a Custom Procedure

To add a step to the protocol outline, you must include the step in a **Custom** procedure. This procedure describes how to add a Custom procedure and then how to add a step to the Custom procedure.

❖ *Tip:* *If the selected location is not appropriate for the step, it is placed in the closest logical location. If you insert a step in an incorrect position, you can move it later.*

To add a step to the protocol outline:

1. Select **Tools > Add Procedure > Custom** from the main menu. A **Procedure Under Construction** node is inserted in the protocol outline and the **Custom Parameters** window opens.
2. Click **OK** to accept the default parameters and close the window. A Custom Procedure node is inserted in the protocol outline.
3. Expand the **Custom_1** procedure by clicking the plus (+) sign next to the node, if necessary, to display the steps in the procedure.
4. Select the **End of Procedure** node in the **Custom_1** node.
5. Do one of the following:
   - Select **Protocol > Add Custom Step** on the main menu and select the desired step from the menu.
   - Right-click the Custom node in the protocol outline, select **Add Custom Step**, and select the desired step from the menu.
   - Click the toolbar button corresponding to the desired step type.
   - Copy an existing step in the protocol outline and paste it into the current location (see Copying a Node on page 136 for more information).
   - Copy an existing step from another protocol outline and paste it into the current location (see Copying a Node from Another Protocol on page 137 for more information).

☞ *Note:* *The* **Add Custom Step** *menu is enabled only if the position selected in the protocol outline is in a Custom procedure.*

6. Select the desired parameters in the **Parameters** window that opens when you insert the step.
7. To use variables to supply a value for a parameter at runtime, see Using Variables on page 155.
8. Click the **OK** button in the Parameters window to add the procedure to the protocol outline.
9. See Mapping the Labware on page 139.

Adding a Transfer Group to a Custom Procedure

In a Custom procedure, you can add and define each Transfer Group individually as described below. Specify where to insert the new transfer group in the protocol outline by selecting the entry immediately **below** the desired location in a Custom procedure.

❖ *Tip:* *If the location is not appropriate for a transfer group, it is placed in the closest logical location. If you insert a group in a position that you do not want, you can move it later.*

To add a transfer group to a Custom procedure:

1. In a Custom procedure or a Custom MDT procedure, select the step or End of Procedure node immediately **below** the location where you want to add the Transfer Group.
2. Do one of the following:
   - Select **Protocol | Add Custom Step | Transfer Group** on the main menu.
   - Click the **Transfer Group** button on the toolbar.
   - Copy an existing transfer group node already in the outline.
   - Copy an existing transfer group node from another protocol outline.
3. Define the transfer group using the parameters window that opens when you insert the transfer group. Select the desired type of Transfer Group in the **Type** drop-down list. Type the desired name for the transfer group in the **Name** text box. Select the desired steps to include in the transfer group. Specify the volumes for Aspirate and Dispense as required.
4. Double-click the **Custom** node to specify procedure options such as the number of samples, starting wells, number of times to repeat the procedure, pipetting options, and performance file.
5. To use variables to supply a value for a parameter at runtime, see Using Variables on page 155.
6. Click the **OK** button in the Parameters window to add the procedure to the protocol outline.
7. Double-click the steps inside the **Transfer Group** node and select the desired parameters for any steps as necessary.
8. See Mapping the Labware on page 139.

Editing Nodes in the Protocol

The nodes in the protocol can be moved, renamed, copied, and deleted after the protocol is created. Refer to the following procedures for instructions:

- Editing Procedure or Step Parameters on page 135
- Moving a Node on page 135
- Renaming a Node on page 136
- Copying a Node on page 136
- Copying a Node from Another Protocol on page 137
- Deleting a Node on page 138
- Undo and Redo Changes on page 138

Editing Procedure or Step Parameters

To edit the parameters for a procedure or step:

1. Select the desired node in the protocol outline.
2. Do one of the following:
   - Double-click the desired node in the protocol outline.
   - Right-click the desired node and click **Edit Node** from the menu.
   - Highlight the desired node by clicking on the node. Select **Edit > Parameters** on the main menu.
   - Highlight the desired node by clicking on the node. Press **<Alt> + <Enter>** on the keyboard.
3. Change the parameters as desired.
4. Click the **Apply** button. The changes are saved to the protocol.
5. Click the **Close** button to close the parameters window.

Moving a Node

If you need to reorder the steps or procedures in a protocol outline, you can move an entire procedure or step node to another position in the outline. All of the parameters and mapping information associated with the node are moved with the node.

To move a node:

1. Select the node you want to move.

2. Click and drag the selected node to the desired location in the protocol outline.

❖ *Tip:* *Move the cursor off the top or bottom of the Protocol Outline View to scroll the protocol in the desired direction.*

☞ *Note:* *While dragging the node, the cursor changes to a document page when it is over an acceptable location in the protocol outline. WinPREP only allows you to drop the node in an appropriate location.*

Renaming a Node

A procedure or step node can be renamed in the protocol outline to easily identify the purpose of the node or to differentiate one node from another node.

To rename a node:

1. Click on the node that you want to rename.
2. Pause and then click the node a second time. The node name becomes editable. (If you click too quickly and double-click the node name, the node parameters window opens. You can change the name in the Overview tab on the parameters window and click the **OK** button.)
3. Type the desired name for the node.
4. Press the **Enter** key or click on another node to complete the name change.

Copying a Node

If you need to duplicate a step or procedure in a protocol outline, you can copy an existing node to another position in the outline. All of the parameters and mapping information are duplicated with the node, except that WinPREP assigns a unique name to the new node. You can change the assigned name in the procedure or step Parameters window.

To copy a node:

1. Select the node you want to copy.
2. Press and hold the **<Ctrl>** key.
3. Click and drag the node to the new location in the protocol outline.

4. Release the **<Ctrl>** key after dropping the node in the desired location.

❖ *Tip: Move the cursor off the top or bottom of the Protocol Outline View to scroll the protocol in that direction while dragging the node.*

☞ *Note: While dragging the node, the cursor changes to a document page with a plus sign when it is over an acceptable destination location in the protocol outline. WinPREP only allows you to drop the node in an appropriate location.*

Copying a Node from Another Protocol

If you want to use a defined step or procedure in another protocol outline, you can copy an existing node from one protocol to another. All of the related parameters, including the currently mapped labware, are duplicated with the node. If a node with the name of the copied node already exists in the target protocol outline, a unique name is generated and applied to the copied node.

To copy a node from another protocol:

1. Open both the source and target protocols and adjust the windows so that you can view both protocol outlines simultaneously. Use **Window > Tile Vertically** to position the open protocol windows in the WinPREP window.
2. Select the node that you want to copy.
3. Click the node and drag it from the source protocol outline to the desired location in the destination protocol outline.

☞ *Note: While dragging the node, the cursor changes to a document page with a plus sign when it is over an acceptable destination location in the target protocol outline. WinPREP only allows you to drop the node in an appropriate location.*

❖ *Tip: If you drop the node in the same outline where it originated, you will **move** the node rather than **copy** it.*

❖ *Tip: Move the cursor off the top or bottom of the Protocol Outline View to scroll the protocol in that direction while dragging a node.*

4. When you drop the node, WinPREP copies the node in the source protocol to the location in the destination protocol. Any labware mapped to the node is also copied to the protocol if it can be positioned on the same deck location. If the deck location for mapped labware is already occupied, the labware is not copied to the destination protocol.

Deleting a Node

If a node in the protocol outline is not needed or if you mistakenly added a node, you can delete it from the protocol outline. Deleting a node from the protocol outline only removes the node itself; it does not remove the associated labware from the deck.

To delete a node:

1. Select the node you want to delete.
2. Press the **<Delete>** key, or right-click the node and select **Remove** from the menu. WinPREP deletes the node, and any child nodes contained in the node.

☞ *Note: If you add a procedure or transfer group to the protocol outline, you cannot individually delete the steps that make up the procedure or transfer group. You must delete the entire procedure or transfer group. Any steps added individually, and not part of a procedure or transfer group, can be deleted individually.*

Undo and Redo Changes

Selecting **Undo** reverses the last change that you made to the protocol. Changes can include adding, removing, or changing procedures, steps, or labware. **Redo** is an undo for undo. It restores the changes to the protocol. WinPREP supports multiple levels of undo so you can easily undo the last several changes by repeatedly using undo.

Mapping the Labware

Mapping is the process of associating a node with the labware used by the node; mapping consists of linking a step in the protocol outline to a labware item on the deck. You cannot start a protocol until *each* liquid handling step or gripper step in the protocol outline is mapped to at least one labware item. The names of unmapped procedures or steps display in **bold** in the protocol outline to signify their unmapped status.

This section contains the following information:

- About Well Maps on page 139
  - Varispan Arm and Well Map Order on page 139
  - MDT Arm and Well Map Order on page 141
  - Serial Dilution Tools Option and Well Map Order on page 143
- Mapping Labware to a Step on page 146
- Modifying Well Maps on page 146
- Creating Well Map Patterns on page 150

About Well Maps

The **Well Map** defines the processing order of the individual sample positions in the labware. The well map for labware can include single or multiple groups of sample positions. Mapping the labware includes selecting the sample groups, and specifying the order in which to use the groups and the samples within each group.

The options available in a well map depends on the arm that is accessing the labware. The following sections describe the well map for each arm:

- Varispan Arm and Well Map Order
- MDT Arm and Well Map Order
- Serial Dilution Tools Option and Well Map Order

Varispan Arm and Well Map Order

The Varispan arm accesses wells on the labware one tip at a time. Depending on the labware definition, multiple tips may be able to access the labware simultaneously to decrease the processing time. The labware definition includes a default order for the wells, but you can define any desired order for the labware. Note that extremely complex or random mappings increase processing time (because the arm moves less efficiently) and are difficult to track and maintain.

The labware definition determines the default **Well Map**. Figure 4-10 shows the default **Well Map** for a 96-well plate mapped to a Dispense step.

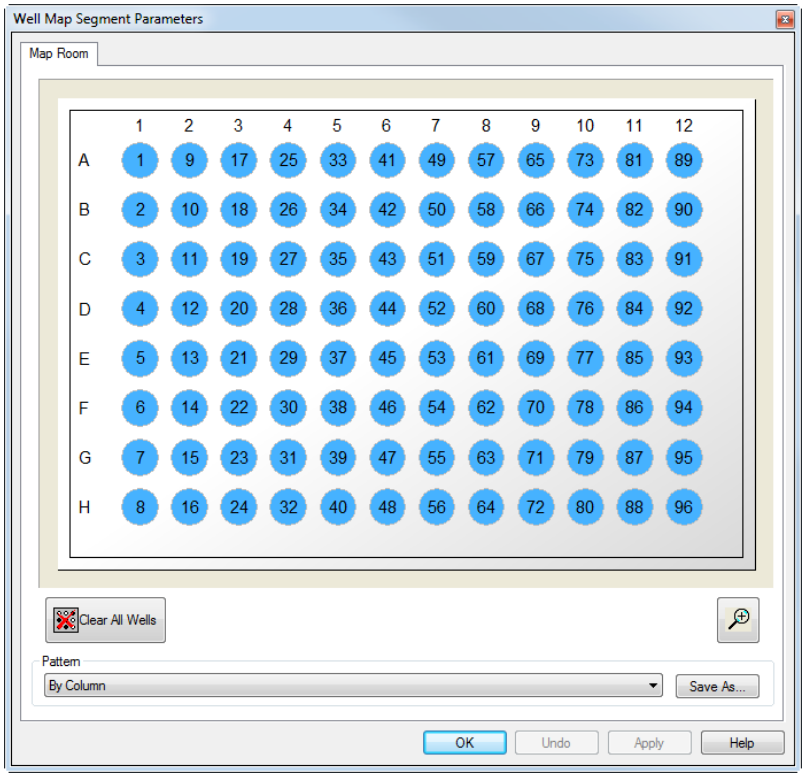


Figure 4-10. Well Map Segment Parameters Window

The **Well Map Segment Parameters window** provides a graphical interface to choose the wells to include in the **Well Map**. Active wells contain the color of the parent node and a number indicating the sequential order of the well in the well map segment.

Clicking individual wells toggles the well on or off. If the well is currently included in the map order (has a number assigned), clicking the well removes it from the segment and decreases all successive numbers to fill in the numbering gap. If the well is currently excluded from the map order, clicking the well toggles it on and assigns it a number one greater than the highest number in the map.

To toggle groups of contiguous wells, drag a rectangle around the desired group. The whole group is toggled on or off as appropriate. When groups are toggled *on*, the **Pattern** applies to the numbering order, starting in the corner you used to start the rectangle. Groups of wells are always ordered according to the currently selected **Pattern**, but different patterns can be applied to different groups if necessary. For more information about well map patterns, see Creating Well Map Patterns on page 150.)

The **Clear All Wells** button clears all wells in the map and provides a clean starting point for the selections.

Well Map Plate Row/Column Labeling

Row and column labels assist you in identifying the wells in the labware. Each row and column are displayed directly on the labware diagram. The title of the window displays the location of the well under the cursor. If the well is mapped, the pipetting sequence for that well also displays in the window title bar. This is especially useful when using high density plates such as 1536-well plates.

In Figure 4-11, well **I12** is the 89th well to be pipetted in the procedure:

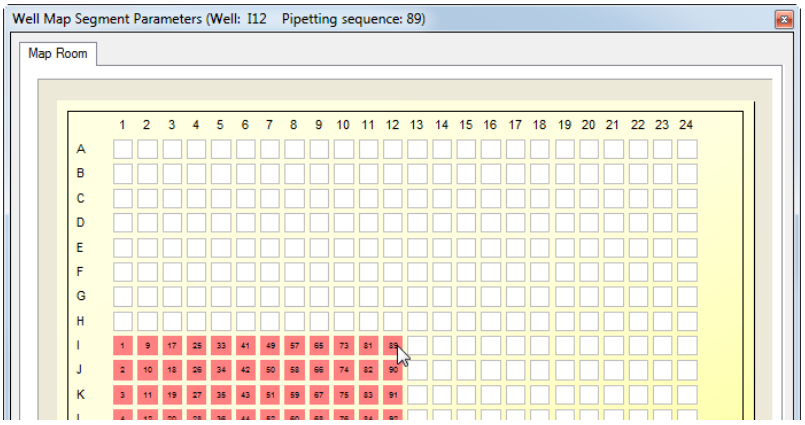


Figure 4-11. Well Map Plate Row/Column Labeling Example 1

MDT Arm and Well Map Order

The MDT arm simultaneously accesses as many wells on the labware as the currently loaded dispenser head supports. For example, if the dispenser head has 96 tips and the plate has 96 wells, the MDT arm accesses the entire plate at once. If the dispenser head has 96 tips and the plate has 384 wells, the MDT arm accesses 96, or 25%, of the wells on the plate. Dispenser heads are available with 96 or 384 tips. Plates are typically available with 96, 384, or 1536 wells. Note that these are all multiples of 96 (4 **x** 96 **=** 384; 16 **x** 96 **=** 1536 or 4 **x** 384 **=** 1536).

The labware definition for the plate includes a default order for the wells. The default order depends on the number of tips on the dispenser head. When the plate has a higher well density than the tips on the head, the MDT arm accesses the plate by quadrants. A quadrant defines a group, or subset, of wells on the plate. You cannot redefine which wells make up a quadrant, but you can customize the order in which the MDT arm accesses the quadrants.

By default, the labware definition determines the **Well Map Order** for the labware. Figure 4-12 and Figure 4-13 provide examples of the default **Well Map Order** for mapped labware.

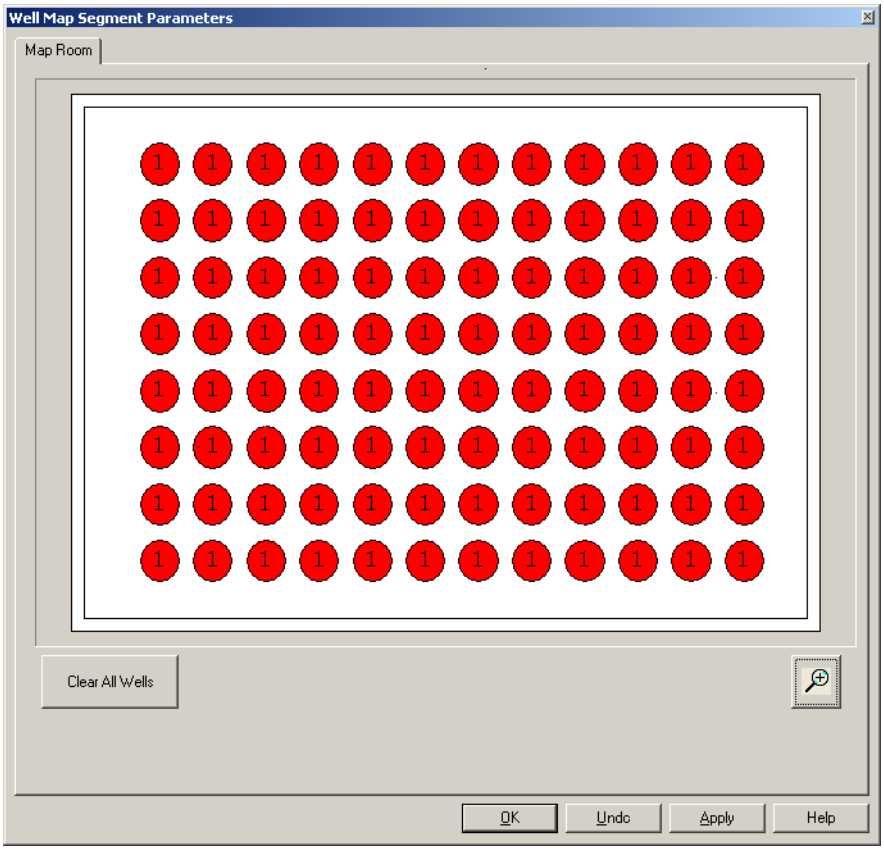


Figure 4-12. Well Map Segment Parameters window

The **Well Map Segment Parameters window** provides a graphical interface to choose the wells you want to include in the **Well Map Order**. Active wells contain the color of the parent node and a number indicating the sequential order of the well in the well map segment. Notice that the software numbers all wells that are accessed by the head at the same time with the same number. Figure 4-14 shows a 384-well plate that is accessed by a 96 tip MDT head using four quadrants

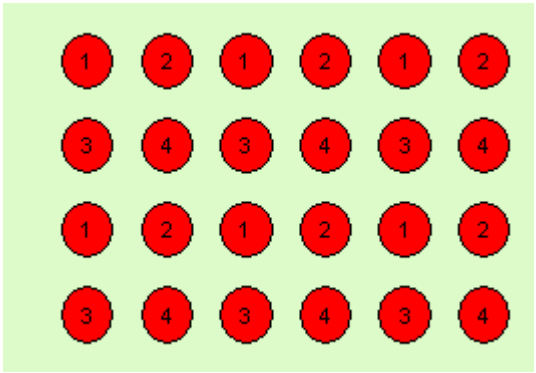


Figure 4-13. Well Map Segment Parameters with quadrants

In this case, the software numbers the wells from one to four. These numbers indicate the quadrant for each well. For example, all wells numbered one are part of quadrant one. When accessing labware by quadrants, the MDT arm pipettes into or out of quadrant one first, quadrant two second, etc. You cannot add or remove wells from a quadrant, but you can redefine the order in which the software access the quadrants. Figure 4-14 shows the same plate with the quadrants renumbered.

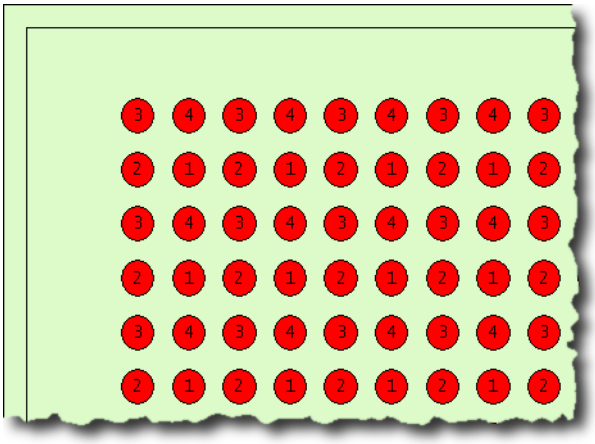


Figure 4-14. Well Map Segment Parameters with renumbered quadrants

Clicking an individual well toggles the entire map, or the quadrant the well belongs to, on or off.

In contrast to the Varispan arm, dragging a rectangle around a group of wells in the Map Room has no effect. Since standard heads loaded with a full box of disposable tips simultaneously access multiple wells on a plate with the MDT arm, you cannot select individual wells or groups of wells.

The **Clear All Wells** button deselects all wells in the map. Click any well to reselect all wells, or the quadrant the well belongs to, on the map.

Serial Dilution Tools Option and Well Map Order

The Serial Dilution Tools (SDT) are an option specifically for the MDT arm that you can use to access either a single row or a single column of wells on a plate. Row or column access depends on the dispenser head you use. Each head only supports specific disposable tips. For more information on the dispenser heads available for the Serial Dilution Tools, and the disposable tips supported, see MDT (Modular Dispense Technology) Pipetting Arm on page 31.

By default, the labware definition determines the **Well Map Order** for the labware. Figure 4-15 and Figure 4-16 provide examples of the default **Well Map Order** for mapped labware.

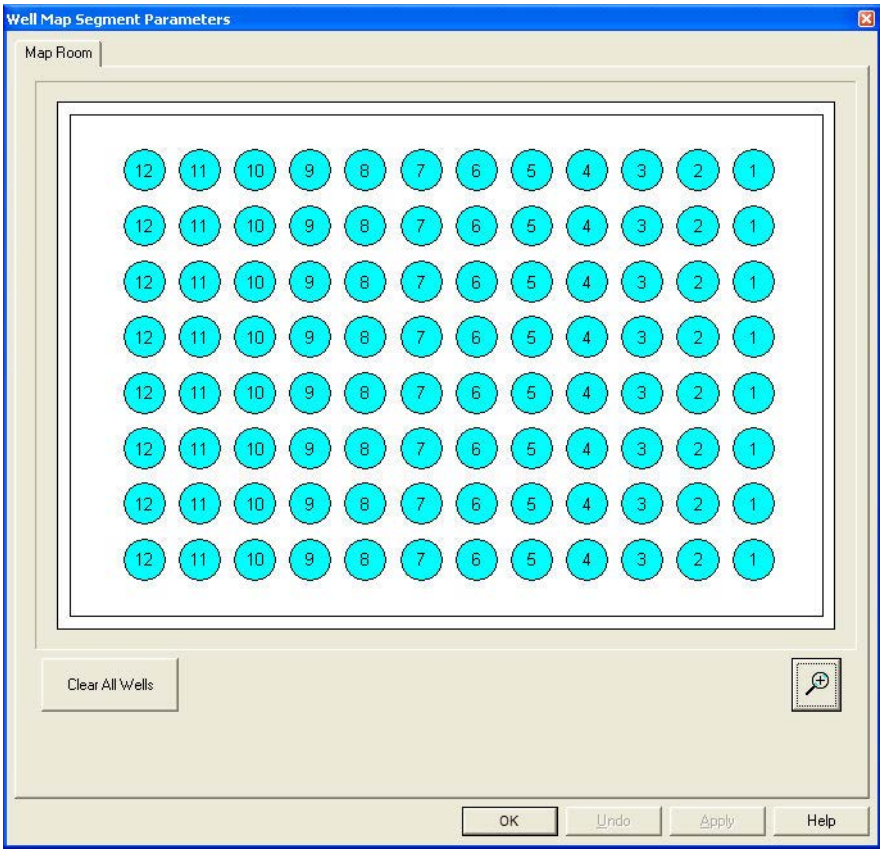


Figure 4-15. SDT Tip Well Map Segment Parameters window - Column

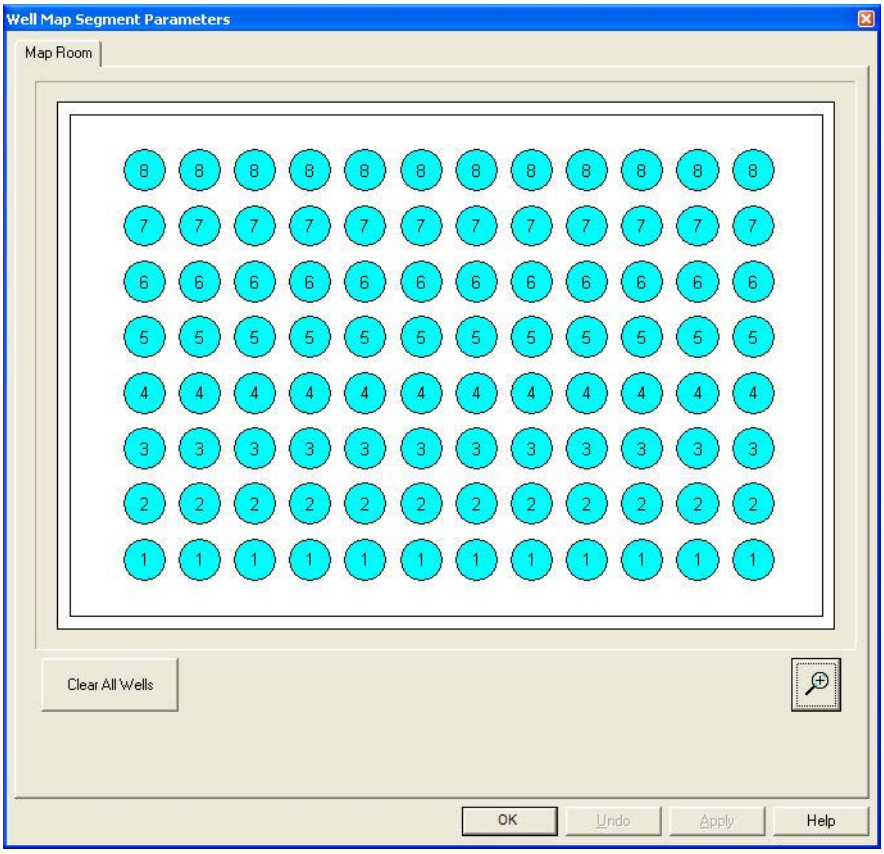


Figure 4-16. SDT Tip Well Map Segment Parameters window - Row

The **Map Room** provides a graphical interface to choose the rows or columns you want to include in the **Well Map Order**. Active wells contain the color of the parent node and a number indicating the sequential order of the rows or columns in the well map segment. Notice that the software numbers each well in the column or row the same because the Serial Dilution Tools head accesses all the wells in a row or column.

Clicking an individual well toggles the row or column the well belongs to on or off.

The **Clear All Wells** button deselects all wells in the map. Clicking any well reselects all the wells in the row or column.

Mapping Labware to a Step

To use the labware on the deck, you map the labware items to the individual steps in the protocol. WinPREP makes this an easy, drag and drop task in the deck view.

To map labware:

1. Expand the protocol outline as necessary to make the nodes you want to map visible. Labware maps to individual steps, not procedure nodes.
2. Select the labware that you want to map to the node. You can map individual pieces or groups of labware.
3. Click and drag the selected labware, or one of the pieces in the group onto the appropriate step in the outline.
4. When you drop the labware, WinPREP inserts a **Well Map Segment** node under the step. The Well Map Segment node identifies the mapped labware and its well map. By default, all wells in the labware are selected.
5. If you want to change the well map, see Modifying Well Maps on page 146.

The labware is mapped to the step. You can accept the default well map or you can modify it as needed. For more information about the well map for each type of pipetting arm, see About Well Maps on page 139.

Modifying Well Maps

Modifying the well map is optional if the default mapping and numbering meets your needs. Modifying the default well map is necessary if you do not want to process all of the wells in the labware or want to change the order in which the wells are used.

To change the Well Map:

1. Double-click the **Well Map Segment** node you want to modify. The **Well Map Segment Parameters** window opens (Figure 4-10). By default, all wells are selected and numbered.
2. Clear the wells you do not want to include in the well map segment. You can select each well position individually or select wells as a group.

☞ *Note: Since the MDT arm accesses all wells on the labware at once, all wells are either selected or deselected. Clicking a well toggles the well map for the entire plate on or off.*

3. Click **OK**. The **Well Map Segment Parameters** window closes.

View Labware Associations

When you select a node in the **Protocol Outline**, WinPREP updates the deck view and identifies any labware mapped to that node. The labware mapped to the selected node is outlined with the color associated with the node or the step type.

Selecting a step node highlights all the labware mapped to that node. If you select a transfer group or procedure node, the labware mapped to ALL of the steps in the group or procedure are indicated. (Notice the labware for both the Aspirate *and* Dispense steps of the transfer group are highlighted in Figure 4-17.)

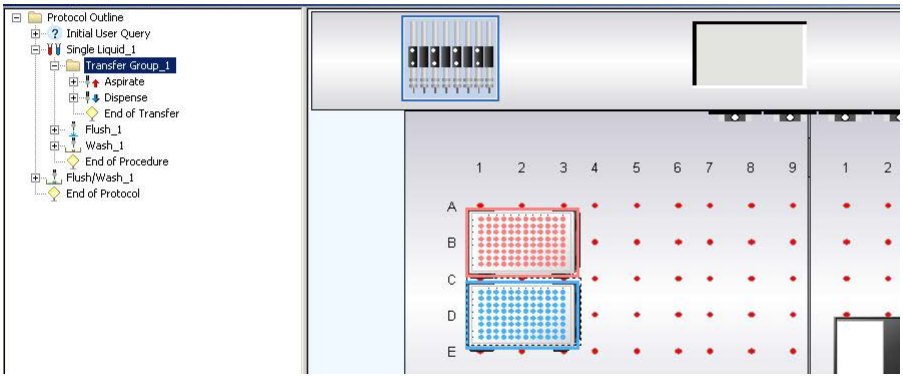


Figure 4-17. Labware to Outline Node Association

☞ *Note: The labware association colors display as a border around the labware and enable you to easily identify the purpose of the labware in the protocol. The labware color is completely customizable; you can modify color assignments on the* **Details** *tab of the* **Labware Definition** *window or in the properties window for the node.*

Default colors are assigned for each of the step types, but you can change the color for each step as desired. For a description of default colors, including the steps to change the default color, see Default Color Associations on page 149.

The Default Colors method easily handles cases where there are few labware objects on the deck or when each piece of labware is related with one and only one step in the procedure. In reality, labware mappings are often much more complex. Fortunately, WinPREP allows you to view node to labware mappings based on a selected node or on selected labware.

To view the labware associated with a node:

1. Right-click the desired node in the protocol outline.
2. Select **Labware Used by Node** from the menu.

WinPREP draws a line between the node and any labware mapped to that node. The line is color-coded to the color of the node. As described previously, selecting a step node identifies all the labware mapped to that step; selecting a transfer group or procedure node identifies the labware mapped to *all* the steps in the group or procedure.

To view the nodes associated with labware:

1. Right-click the desired labware in the protocol outline.
2. Select **Node(s) using Labware** from the menu.

WinPREP draws a line between the labware and any nodes that use the labware. The line is color-coded to the color of the node as shown in Figure 4-18.

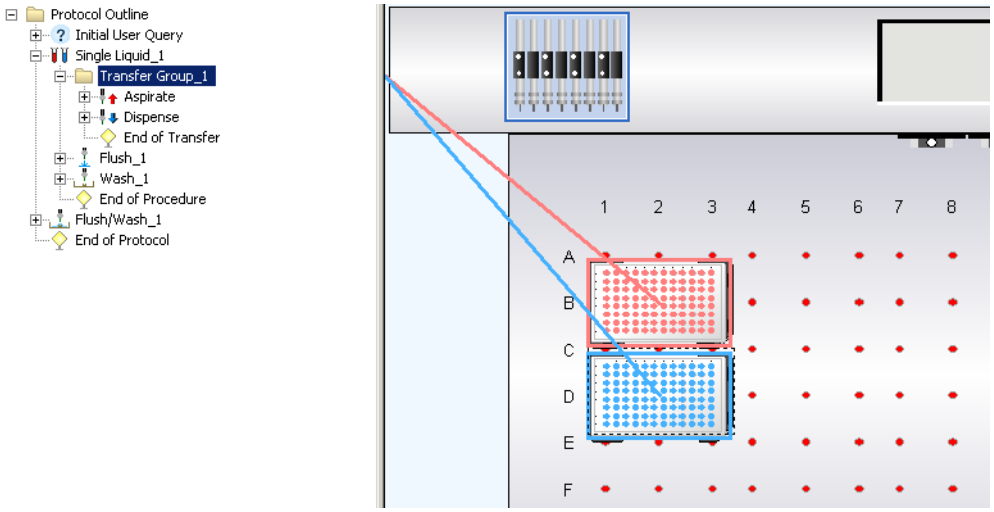


Figure 4-18. Labware Mapping to Outline Nodes

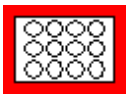
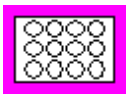
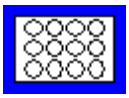
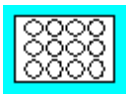
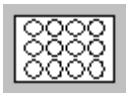
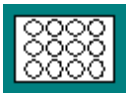
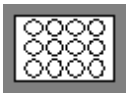
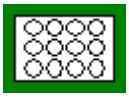
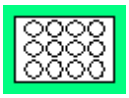
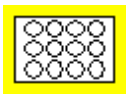
Each piece of labware can be mapped to several nodes. A labware object can contain multiple association lines, even if the matching node is off the screen or hidden in its collapsed parent node.

The color of the lines corresponds to the color defined for the mapped step. This color is the same as the color identifying mapped wells on the labware. In Figure 4-18 above, the default colors were used for the mapped aspiration and dispense steps. (Red and blue, respectively.) Note that a group of labware can be mapped to a single step in the outline and the labware will be used in order without having to stop and change the labware.

☞ *Note:* *Remember, you can segment each labware into subgroups of sample positions and map each subgroup to separate steps with different functions. Some labware, such as the Flush/Wash station have multiple functions by the nature of their definition. In both of these cases, multiple lines, of different colors, can be drawn to this labware.*

Default Color Associations

The default colors for each step type are shown in the table below.

	**Aspirate Step (red)**		**Mix Step (violet)**
	**Dispense Step (blue)**		**Get Tip Step (cyan)**
	**Diluent Step (gray)**		**Drop Tip Step (dark cyan)**
	**Flush Step (dark gray)**		**Find Liquid Step (dark green)**
	**Wash Step (green)**		**Move To Target Step (yellow)**

You can change the colors for individual steps in the **Well Map Settings** window. In most cases, the default colors are sufficient. However, you might need change the default color for a step. The procedure below describes how to change the default color for an individual step.

To change the default color for a step:

1. Double-click the desired node in the protocol outline view to open the **Parameters** window.

2. Click the **Location** button in the **Step** frame on the **Overview** tab to open the **Well Map Settings** window.
3. Click the Color button, located to the right of the **Map Type** field, to open the Color window. Figure 4-19 shows the Color button.

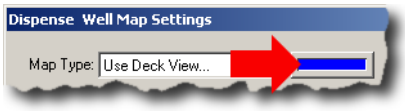


Figure 4-19. Color Selection button

4. Click the desired color in the palette and click **OK** to close the **Color** window.
5. Click **OK** to apply the color change and close the **Well Map Settings** window.
6. Click **OK** to close the **Step Parameters** window.

The selected node mapping displays the new color.

Creating Well Map Patterns

A Well Map Pattern specifies a specific pattern of wells to select. Well Map Patterns are applied to the well map any time a selection is made in the Well Map Segment Parameters window. Well Map Patterns are typically used to map wells for the serial dilution tool heads, or to specify a numbering pattern that is different from the default, for example, to access every other well across a column.

To save a Well Map pattern:

1. Open the **Well Map Segment Parameters** window for the labware.
2. Define the desired pattern by selecting and deselecting the appropriate wells.
3. Click the **Save As** button in the **Pattern** frame when you are satisfied with the selections. The **Save As** window opens.
4. Navigate to the **bin** folder in the WinPREP installation folder, type a unique name in the **File Name** text box, and click **Save**.

WinPREP saves the pattern file and you can apply this pattern to any labware item. Applying the pattern to labware that differs significantly from the object used to define the pattern might yield unexpected results, so it is a good idea to indicate the labware type in the file name when saving the pattern file. This helps you match custom pattern files to the appropriate labware.

To apply a Well Map pattern:

1. Open the **Well Map Segment Parameters** window for the labware you want to configure with the pattern file.

2. Click the **Clear All Wells** button or drag a selection around the entire well map to clear all the wells.

☞ *Note: Applying the pattern file to a well map with all the wells selected produces the inverse of the pattern file; the wells that are selected in the pattern file are deselected in the well map.*

3. Select the desired pattern from the **Pattern** drop-down list.
4. Click and drag to select the desired wells in the **Map Room** tab. WinPREP applies the pattern to the selected wells in the well map. If you do not select the entire well map, the WinPREP applies the portion of the pattern that applies to the selected region.
5. Click **OK** to save the well mapping and close the **Well Map Segment Parameters** window.

You can apply pattern files to the labware to quickly define common well mappings. This saves you the time and effort of selecting the wells individually.

Evaluating a Protocol

The Protocol Evaluation option is used to run the protocol without performing the liquid handling or moving the arms in the Z direction. You can choose whether to move the arms in the X and Y directions and whether to execute pre-step and post-step functions. WinPREP provides multiple levels of evaluation on the Protocol Options window.

WinPREP processes each of the steps in the protocol outline but does not actually perform the defined steps. The instrument does not move, or moves only in the X and Y directions, and no pipetting or labware move operations occur.

Protocol Evaluation provides a quick way to check the protocol for mistakes, such as nodes that map to the wrong labware, variable prompts and names, etc. The windows displayed when evaluating a protocol are identical to those displayed during protocol execution.

To change the current Evaluation Level:

1. Select **Protocol > Options** on the main menu. The Protocol Options window opens.

Figure 4-20. Protocol Options Window

2. Select the Display Summary After Evaluate Protocol check box if you want a summary of the protocol to display automatically after the protocol is evaluated.
3. Select the desired Evaluation Level in the drop-down list:
   - **1 - Non-Moving, Skip Pre/Post-Step Functions:** The instrument's arms will not move as the protocol is evaluated. Any pre-step or post-step functions that have been included in the steps will NOT be run.
   - **2 - Non-Moving, Run Pre/Post-Step Functions:** The instrument's arms will not move as the protocol is evaluated. Any pre-step or post-step functions that have been included in the steps will be run.
   - **3 - Moving, Run Pre/Post-Step Functions:** The instrument's arms will move in the X and Y directions as the protocol is evaluated but not in the Z direction. No liquid handling will be performed. Any pre-step or post-step functions that have been included in the steps will be run.
4. Click the **OK** button to save the changes and close the Protocol Options window.

To evaluate a protocol:

1. Open or select the desired protocol in WinPREP to make it the active protocol.
2. Select **Run > Evaluate Protocol** on the main menu.
3. Watch the protocol run, responding to any prompts as necessary. The protocol summary report will display at the end of the protocol if the option is selected in the Protocol Options window.
4. If you need to make changes to the protocol, edit the protocol (see page 135).
5. To run the protocol from WinPREP, click the **Run Protocol** button and see Running Protocols on page 164).
6. To allow the protocol to be run directly from the JANUS Application Assistant, see Add the Protocol to a Protocol Category on page 153. Only protocols that are included in a protocol category are displayed in the **Select** tab in the JANUS Application Assistant.

Add the Protocol to a Protocol Category

If the WinPREP protocol is going to be run in the JANUS Application Assistant, the protocol must be added to a protocol category. Only protocols that have been assigned to a protocol category are displayed in the Select tab in the JANUS Application Assistant.

To add a protocol to a protocol category:

1. On the WinPREP main window, select **Utilities > Application Assistant Editor**. The JANUS Application Assistant Editor window opens.
2. Click the **Protocol Categories** tab. All of the existing protocol categories display in the list. You can add the protocol to an existing protocol category or create a new protocol category.
3. To create a new protocol category, click the **Add** button. The Add Category window opens.
   If the desired category already exists, select the protocol category name, click the **Edit** button, and go to step 6.
4. Type the desired name for the protocol category in the **Name** text box.
5. Click the **OK** button. The Add Category window closes and the Protocol Categories tab displays the new protocol category.
6. Click the name of the category that you want to add the protocol to and click the **Edit** button. The Edit Category window opens and displays any protocols that are already included in the protocol category.
7. Click the **Add** button on the Edit Category window to open the Add Protocol window.
8. Click the **Browse** button and select the name of the protocol to add to the protocol category. (You can type the folder and name of the protocol in the text box if desired.)
9. If desired, type a description of the protocol in the **Description** text box. The description displays on the Select tab in the JANUS Application Assistant.
10. Click **OK** in the Add Protocol window.
11. Click **OK** in the Edit Category window.
12. Click **OK** in the JANUS Application Assistant Editor.

Arranging the Protocols in the JANUS Application Assistant

The order of the categories listed in the Protocol Categories tab on the JANUS Application Assistant Editor determines the order of the protocols listed in the Select Tab in the JANUS Application Assistant. You can change the order of the categories to determine which applications display first in the JANUS Application Assistant.

These instructions only apply if you open the JANUS Application Assistant from the Windows desktop. If you open the JANUS Application Assistant from WinPREP, the active protocol is selected automatically and you cannot choose a different protocol.

1. Select **Utilities > Application Assistant Editor** on the WinPREP menu bar. The JANUS Application Assistant Editor Window opens.
2. Click the **Protocol Categories** tab. All of the existing protocol categories display in the list.
3. Select the protocol category that you want to move, and click the **Move Up** or **Move Down** buttons to change the order of the protocol categories.
4. Click **OK** to save the ordered list and close the JANUS Application Assistant Editor.

Using Variables

Variables are a powerful and useful tool that provide a more flexible protocol platform. Variables enable the user to specify parameter values at run time, such as the number of samples to process or the volume of reagent to dispense. You can set many different parameters at runtime using variables. For a complete list of the parameters you can set with variables, see Tab Controls and Runtime Parameters on page 220.

There are three general types of variables available in WinPREP. Each of these variable types is described in detail in this section.

- Ask User Variable on page 155
- Calculate Variable on page 157
- Select Variable on page 160

The following procedures are included describing specific uses for variables:

- Prompting for a File Name at Runtime on page 160
- Prompting for Labware IDs at Runtime on page 163

Ask User Variable

The Ask User variable prompts the user to specify a value for a defined variable at runtime. It is commonly used to request the number of samples to process during a protocol run. Any runtime parameter that includes the **Var: Ask User** option can be set in this way. When you set a runtime parameter to **Var: Ask User**, the Initial User Query includes a page to prompt for the value of the variable at the beginning of the protocol.

You can also use the **Var: Ask User** option to selectively process nodes in the protocol outline. You can define a single, comprehensive protocol to include all aspects of an assay and then selectively apply portions of the protocol on a run-by-run basis. You set this option in the Runtime Parameters tab of a procedure node. In the Parameter column, locate the **Use This Node** entry and set the associated *Gets Data From* field to *Var: Ask User*; WinPREP creates and names a default variable to hold the value specified at runtime. When you set a procedure's **Use This Node** option to *Var: Ask User*, WinPREP includes a page in the Initial User Query to prompt you for a decision to use or ignore the steps. During the run, the selected steps are performed and the unchecked steps are skipped.

Using the Mother-Daughter Transfer protocol you created in Chapter 3: Protocol Tutorials on page 59 as an example, you can design the protocol to prompt you for the plates to include during the protocol run. You do this by setting the **Use This Node** options to *Var: Ask User* for each aspirate and dispense node on the **Runtime Parameters** tab. When you do this, the software creates and assigns a unique runtime variable to the **Use This Node** parameter for each of the plates. Once created, you can set certain options associated with the variables, such as the variable's name, type, and default value. Clicking the **Variables** button on the **Runtime Parameters** tab opens the **Runtime Variable Definitions** window.

Figure 4-21 shows the **Runtime Parameters** and **Runtime Variable Definitions** windows for this configuration.

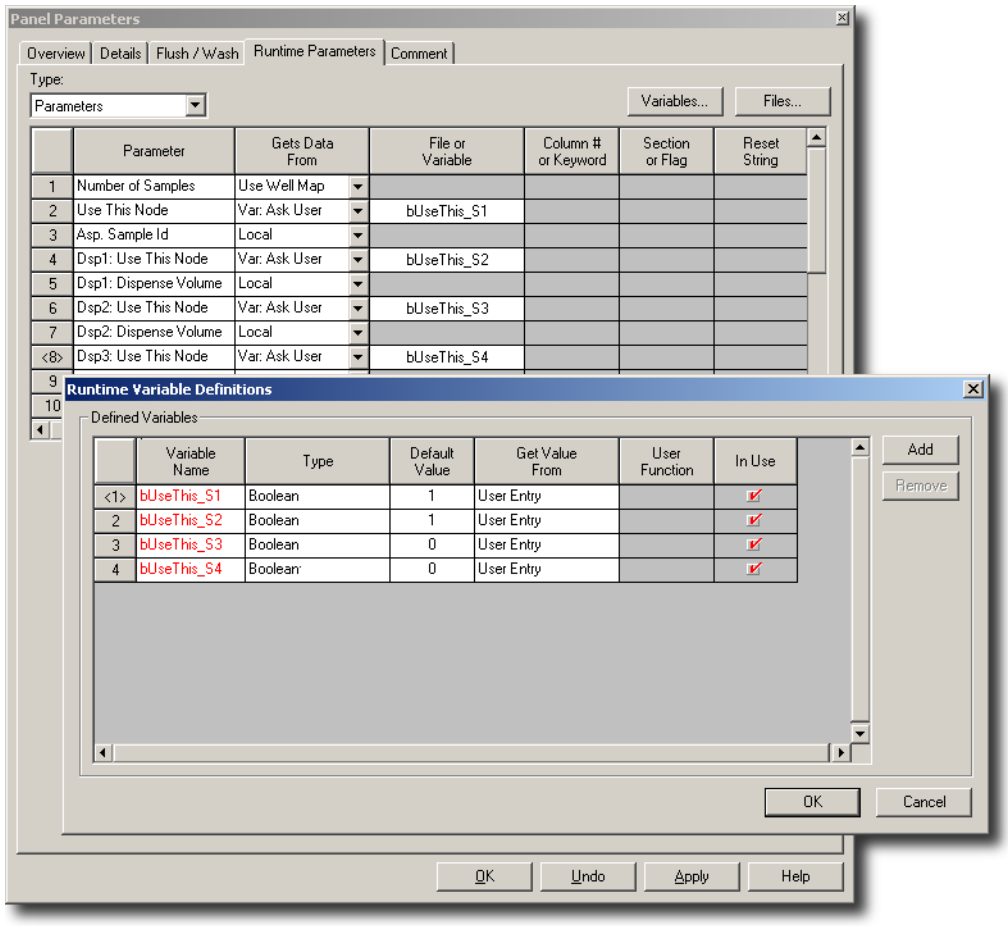


Figure 4-21. Runtime Variable Definitions

Each Aspirate and Dispense step now has a variable associated with its **Use This Node** parameter. The system sets the **Type** option for each variable to *Boolean*. Boolean variables contain data that can take one of two values: *on* or *off*. You can also think of this as *Yes* or *No*. In this example, the Boolean type specifies which plates to process and which to exclude. Each variable has its **Default Value** field set to *1* or *0* (zero). In WinPREP, *1* represents *on* and *0* represents *off*. The Default Value field indicates the default variable value in the Questions at the start of the protocol. By setting a runtime variable's value to *1* (Yes) in the questions at the start of the run, you instruct the software to include the plate associated with that variable by default.

If the variables are set up as shown in Figure 4-21, the default values in the questions at the start of the run include the "mother" and "daughter1" plates and exclude the "daughter2" and "daughter3" plates. If the default values are not changed, the protocol will aspirate from the "mother" plate, dispense into the "daughter1" plate, and then the protocol will end.

Calculate Variable

Use the Calculate variable to dynamically create a variable value based on other variable values. Typically, calculated values rely on values specified at the beginning of a run.

For example, consider a case where you must add reagent to wells prior to adding samples. However, the number of samples, and the number of replicates of each sample, vary between protocol runs. The number of wells depends on the number of samples, and its replicates, which are pipetted later in the protocol. In this case, the number of destinations must be calculated: the product of the number of samples and the number of replicates, as shown below.

number of samples **x** *number of replicates* **=** *number of destinations*

The steps below provide an example of calculated variables.

To configure a calculated variable:

1. Create a new protocol with a Reagent node and a Single Liquid Transfer node. The Reagent node should occur before the Single Liquid Transfer node in the protocol outline.
2. Set both the **Number of Samples** and the **Replicates** runtime parameters to *Var: Ask User* for the single liquid transfer. WinPREP creates two runtime variables, **nNbrOfSamples_S1** and **nReplicates_S1**, to hold the values specified at runtime.
3. Set the **Number of Destinations** runtime parameter to *Var: Calculate* for the reagent node. WinPREP creates a runtime variable, **nDestinations_S1**, and an associated user function.

4. Click the **Variables** button on the Reagent node's **Runtime Parameters** tab. The **Runtime Variable Definitions** window opens.
5. Locate the row in the table where the variable name is **nDestinations_S1**. This is the default variable name WinPREP created for the calculated variable (Number of Destinations).
6. Click the **Edit** button in the **User Function** column associated with the variable name. The **User Function Edit** window opens.
7. Position the cursor immediately below the two lines in the function body that begin with double slashes (//). These lines are comments. You can include your own comments by beginning a line with double slashes.
8. Type the following line of code in the function body:

   Rt_nDestinations_S1 = Rt_nNbrOfSamples_S1 * Rt_nReplicates_S1;

☞ *Note: You can only type in the white area (body) of the user function. Be sure to include a semicolon (;) at the end of the calculation code; the semicolon identifies the end of the statement.*

This statement multiplies the Number of Samples (**Rt_nNbrOfSamples_S1**) with the Replicates (**Rt_nReplicates_S1**) to produce the Number of Destinations (wells) for the procedure. These variable names represent the default names generated by WinPREP. The Number of Samples and Replicates variables hold the values specified at the start of the protocol.

☞ *Note: In our calculation for the variable,* **nDestinations_S1***, the* **Rt_** *before each variable name identifies the variable as a "run time" variable. You can name the variables however you like, but it is a good idea to identify them in this way.*

Figure 4-22 shows the completed **User Function Edit** window.

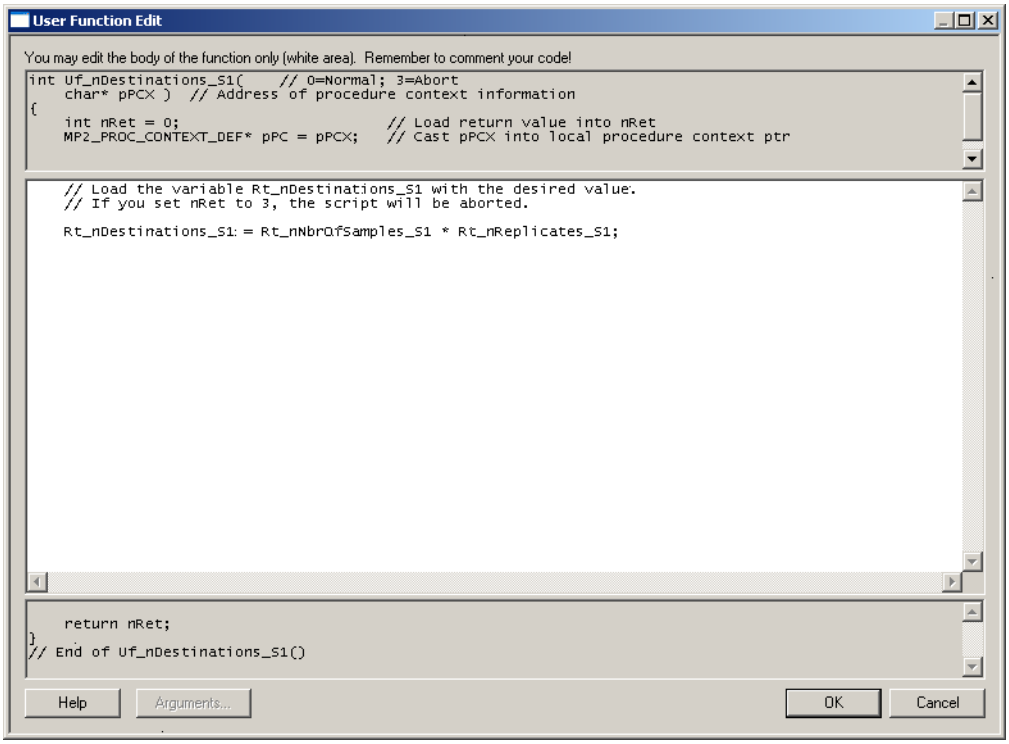


Figure 4-22. Completed User Function Edit window

It is critical that you use the correct syntax (variable names, underscores, trailing semi-colon) and letter case (upper case and lower case letters.) If the User Function is not typed correctly, WinPREP will not recognize the MSL (MultiPROBE Scripting Language) commands.

9. Click **OK** to save the changes to the user function and close the **User Function Edit** window.
10. Click **OK** to close the **Runtime Variable Definitions** window.
11. Click **OK** to save the parameter changes and close the Reagent Parameters window.

At runtime, the protocol prompts you for the Number of Samples and the Replicates for each sample. WinPREP then uses these values to calculate the Number of Destinations (**nDestinations_S1**) requiring reagent.

Select Variable

The Select variable allows you to reuse the value of a previously defined variable. It is useful in protocols that require the repeated use of a variable. For example, if a calculation for volume is defined, you can select the same calculation value in a different node later in the same protocol.

To use the Select variable:

1. Open the **Parameters** window for the desired step.
2. Set the parameter that should reuse a previous variable value to *Var: Select*.
3. Select the **Runtime Parameters** tab.
4. Select the variable name that contains the value you want to reuse in the **File or Variable** column for the parameter you selected above.
5. Click **OK** to save the changes and close the **Parameters** window.

Now, two nodes in the protocol use the value of a single calculated variable.

Prompting for a File Name at Runtime

To prompt for a file name at runtime:

Selecting a Procedure

1. Select the procedure that needs to use the file for deferred runtime parameter values.
2. Double click the procedure node to open the Procedure's parameters window.

Declaring a Variable

1. Click the **Runtime Parameters** tab.
2. Click the **Variables** button to open the Runtime Variable Definitions window.
3. Click the **Add** button to insert a new row into the table of variables.
4. Enter a name for a variable to specify the file name that you will be entering.
5. Make sure that the Variable Type is **Text**. Choose it from the drop-down list if necessary.
6. Enter a default value if you want to use one. This default will be used if you fail to enter a value at runtime.
7. Make sure that the Get Value From column indicates **User Entry**. Choose it from the drop-down list if necessary.
8. Click the **OK** button to save the variable declaration and return to the Runtime Parameters tab.

Defining a File

1. Click the **Files** button to open the File Definitions window.
2. Click the **Add** button to insert a new row in the table of file definitions.
3. Choose the variable name declared above from the drop-down list in the File or Variable column.
4. Make sure that the File Type matches the format of the file (column or keyword) that you intend to use. Change it using the drop-down list if necessary.
5. For column type files, make sure that the Start Record is correctly indicated for the file.
6. For column type files, make sure that the Column Delimiter is correctly indicated for the file.
7. Click the **OK** button to save the file definition and return to the Runtime Parameters window.

Preparing the Pipetting Parameter

1. Find the pipetting parameter that you need to defer to a file identified at runtime. This parameter may be found on any appropriate tab in the procedure or on the Runtime Parameters tab.
2. From the drop-down list for the parameter (Gets Data From column on the Runtime Parameters tab), select the File format that will match the format of the intended file.

Defining the Runtime Parameter Requirements

1. Find the appropriate parameter to be defined in the Runtime Parameters list.
2. Make sure that the Gets Data From column correctly identifies the type of file that is going to be used.
3. In the File or Variable column, choose the defined variable name from the drop-down list. This is the same name that you used when you declared the variable earlier in this discussion.
4. If necessary, define any additional fields that are appropriate for the type of file that you are using.
5. Click the Apply button to implement the changes that you have made for the procedure.

Creating the Initial User Query Prompt

1. Double click on the Initial user Query node in the protocol outline to open the Initial User Query Parameters window.
2. In the middle section of the Overview tab, click the **Add** button to insert a page in the query.
3. Name the page as desired.

4. In the lower section of the Overview tab, click the **Add** button to insert a prompt onto the new query page.
5. In the variable column, choose the defined variable name from the drop-down list. This is the same name that you used when you declared the variable earlier in this discussion from the drop-down list.
6. Enter the text that you want to appear when the prompt for this variable is displayed.
7. Enter the text that you want to appear in the help line of the query page when this variable is selected.

Creating the File Browser Window

1. Click on the button that appears in the Enter Via column of the table. This button will usually be labeled Edit Box (text) when you first enter it in the table.
2. Choose the File Browser tab in the window that appears.
3. Enter the desired Dialog Title for the custom File Browser window.
4. Determine the File Filters for the custom File Browser window.
5. Choose an Initial Directory for the custom File Browser window.
6. Ignore the Default Extension field for the particular application of the File Browser window.
7. Make sure that the Save As check box is NOT marked for the application of the File Browser window.
8. Click the **OK** button to complete the creation of the File Browser window.

Complete the Protocol Definition

1. Click the **Apply** button on the Initial User Query Parameters window to implement the changes that you have made.
2. Define any other necessary steps or procedures in the protocol outline. You can even choose this same file for other parameters if appropriate by indicating the same filename on the Runtime Parameters tab for the necessary parameters.

Running the Protocol

1. When you run the protocol, you will be prompted to enter or select a file that will contain the necessary information for the parameters that you have linked to it.
2. Select an appropriate file and the protocol should continue, receiving parameter values from the file where appropriate.

Prompting for Labware IDs at Runtime

To have the system prompt you for the name of the labware at runtime:

Layout Labware

1. Add the labware in the Deck View. Be sure that AT LEAST every piece of labware that needs to be prompted for an ID is on the deck. Typically, you should lay out the entire Deck View to be sure that it is done.
2. Identify the labware that will require a specific labware ID.

Define Labware Parameters

1. Double-click the labware in the Deck View to open the Labware Parameters window for the corresponding labware.
2. Select the **User Entry** option under **Source of ID** in the Labware Parameters window.
3. Click the **Apply** button to apply the change to the labware.
4. Click the **Close** button to close the Labware Parameters window.
5. Repeat this procedure for EACH piece of labware in the Deck View that you want to specify the ID at runtime. Separate parameters are maintained for each piece of labware in the Deck View. This parameter is not applied to the type of labware.

Runtime Requirements

1. At runtime, a **Labware Change Request** window will display so that you can enter the labware ID for the indicated labware. Accept the default or enter your own ID for the labware.
2. Repeat this ID entry for each **Labware Change Request** window that displays. There will be a window for every labware item that you identified above as requiring a specific labware ID.

Labware Change Requirements

1. During the protocol, if a labware item that you identified above as requiring a specific labware ID requires changing due to the number of samples that are processed, you need to enter a new labware name every time that you are prompted to change the labware.

Chapter 5

Running Protocols

The JANUS Application Assistant guides you through the entire process of selecting and running a protocol. Use the JANUS Application Assistant to:

1. Start the JANUS Application Assistant software (page 165)
2. Select a protocol (see page 166)
3. Gather supplies you need to run the protocol (see page 167)
4. Place the labware and reagents on the deck of the instrument (see page 167)
5. Run the protocol and monitor its progress as the protocol executes (see page 169)
   - — Monitoring the Protocol Execution on page 171
   - — Pausing a Protocol on page 172
   - — Stopping a Protocol on page 172
   - — Using the System Pause Button on page 173
6. Cleanup the instrument after the successful execution of the protocol (see page 174)

This section also includes the following information about messages during protocol execution and using the Direct Control window during error recovery:

- Execution Messages on page 175
  - — Status Messages on page 175
  - — Error Messages on page 177
  - — Direct Control on page 182

Caution: The procedures in this chapter assume you have properly calibrated the deck for each arm on the system. If you have not calibrated the deck, please do so before proceeding. See Calibrating the System on page 285 for more information.

Starting JANUS Application Assistant

To open JANUS Application Assistant:

1. Double-click the **JANUS Application Assistant** icon on the Windows desktop, or open the protocol in WinPREP and then click the **Run Protocol** button on the WinPREP main window.

Figure 5-1. JANUS Application Assistant Icon and Run Protocol Button

The JANUS Application Assistant opens and displays the **Select** tab as shown in Figure 5-2.

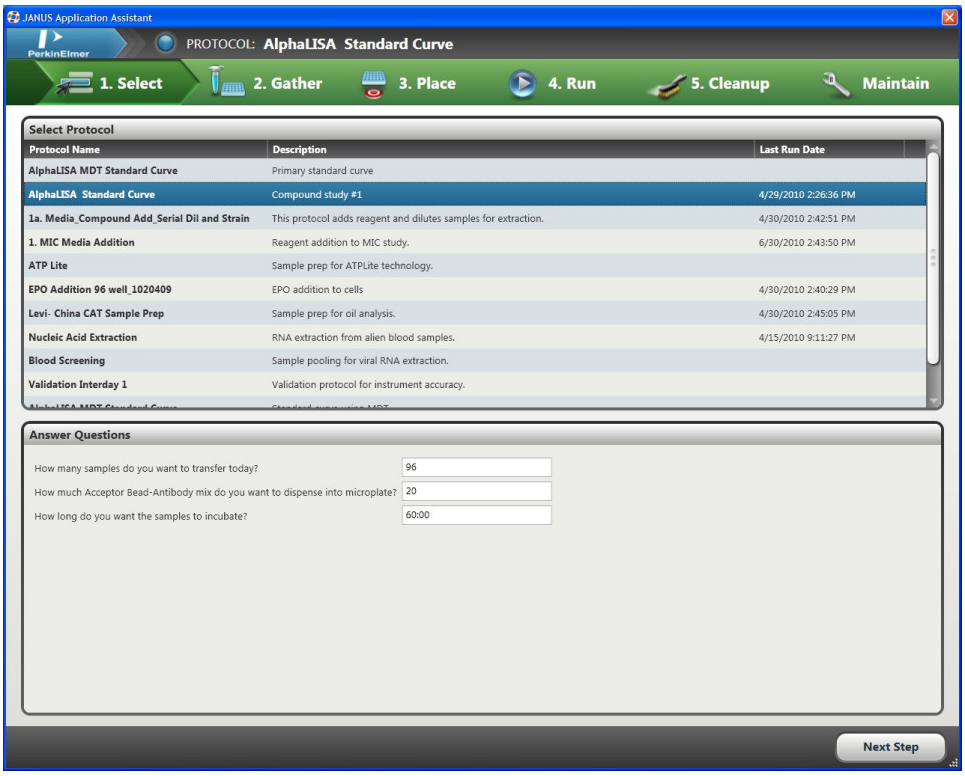


Figure 5-2. JANUS Application Assistant

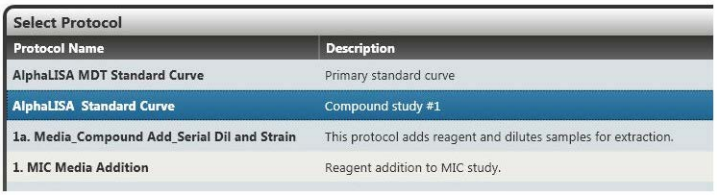
2. If you opened JANUS Application Assistant from the desktop, see Step 1: Select a Protocol.
   If you opened JANUS Application Assistant from WinPREP, click the **Gather** tab and see Step 2: Gather Supplies.

Step 1: Select a Protocol

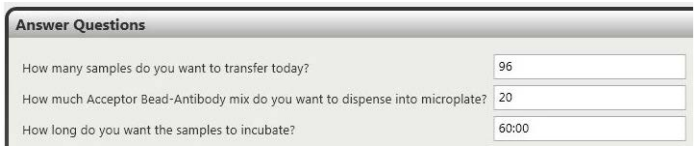
If the JANUS Application Assistant software was opened using the desktop icon, you can select the protocol to run as described below. Only protocols that are in a protocol category display in the Select tab. See Add the Protocol to a Protocol Category on page 153 if the desired protocol is not displayed in the Select tab. If JANUS Application Assistant was opened using the **Run Protocol** button in WinPREP, the active protocol in WinPREP opens automatically and the protocol cannot be changed. See page 167 to gather the supplies for the open protocol.

1. Click the **Select** button.

2. Select the protocol that you want to run under **Select Protocol**.



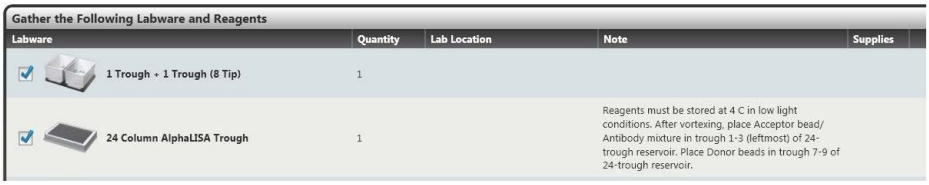
3. Respond to the protocol questions under **Answer Questions.** You must respond to these questions before you move on to the next step. The answers that you provide are used during execution of the protocol.



4. Click the **Next Step** button or the **Gather** button and see Step 2: Gather Supplies.

Step 2: Gather Supplies

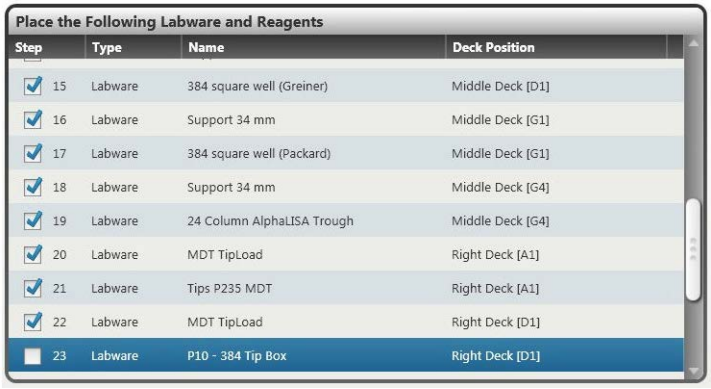
1. Use the checklist under **Gather the Following Labware and Reagents** to collect the labware for the protocol. If desired, select the check box for each labware item that you collect. All labware that is listed is required. For convenience, the location of a lab item or reagent may be listed.



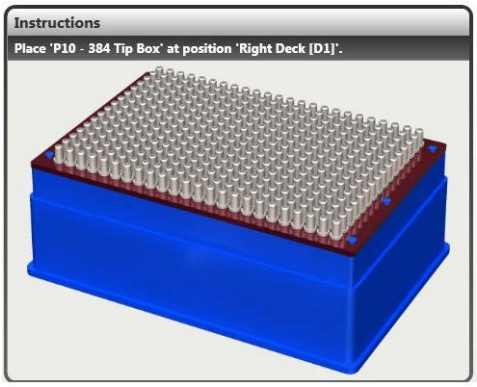
2. Click the **Next Step** button or the **Place** button and see Step 3: Place the Labware on the Deck.

Step 3: Place the Labware on the Deck

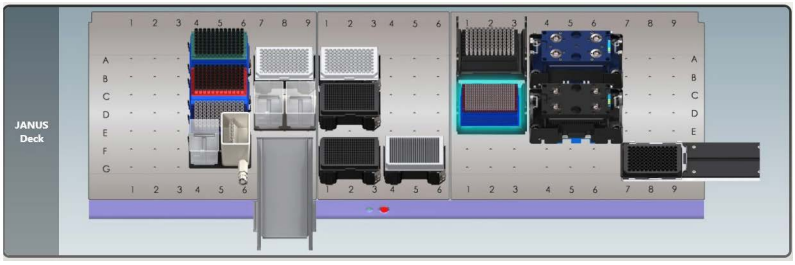
1. Place the labware listed under **Place the Following Labware and Reagents** on the instrument deck in the specified position. If desired, select the check box for each labware item that you place on the deck.



2. When you select an item under **Place the Following Labware and Reagents,** the item graphic and the item's placement instructions display under **Instructions**.



The deck view at the bottom of the window displays the entire populated deck and highlights the labware selected in the **Place the Following Labware and Reagents** list.



3. Click the **Next Step** button or the **Run** button and see Step 4: Run the Protocol.

Step 4: Run the Protocol

1. Verify that the front door is closed.
2. Click the **Start** button. The Status panel displays the Reset Tip Boxes tab and the Verify Labware Location tab.
3. If the protocol contains tip boxes, the tip boxes and the number of new and used tips in each tip box are listed in the **Reset Tip Boxes** tab as shown in Figure 5-3.

Figure 5-3. Reset Tip Boxes Tab

4. Verify the correct number of new and used tips are listed for each tip box. If the numbers are not correct, or if you want to swap a used tip box for a new tip box, select the tip box and use the **Fill** or **Empty** button to set up the tips.
5. If you want to verify that the labware is placed in the correct locations, click the Verify Labware Locations tab as shown in Figure 5-4.

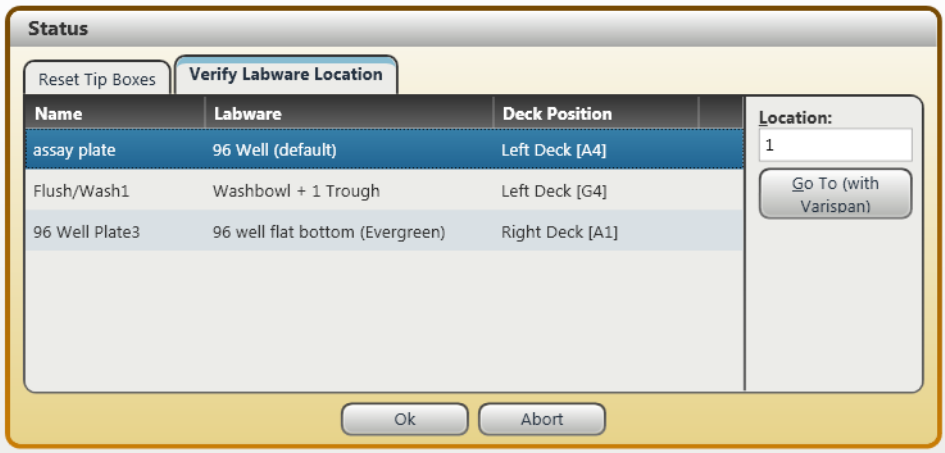


Figure 5-4. Verify Labware Location Tab

6. If desired, select a labware item in the **Verify Labware Locations** tab and use the **Go To** button to move the desired arm over specified position in the labware.
7. To start the run, click the **OK** button in the Status panel. The Progress Panel displays the procedures in the protocol and highlights the name of the procedure that is currently running.

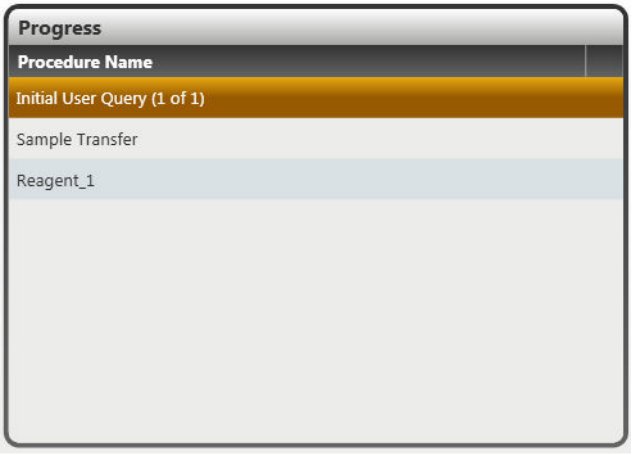


Figure 5-5. Progress Panel

8. Monitor the progress of the protocol if desired. (see page 171).
9. If you need to pause the protocol, see Pausing a Protocol on page 172.
10. If you need to stop the protocol before the run is complete, see Stopping a Protocol on page 172.
11. To use the System pause button on the front of the instrument, see Using the System Pause Button on page 173.
12. If an error message displays, see Error Messages on page 177.
13. If JANUS Application Assistant was opened from the Windows desktop or Start menu, click the **Next Step** button or the **Cleanup** button when the protocol run completes and see Step 5: Cleanup on page 174.

    If JANUS Application Assistant was opened directly from WinPREP, a Protocol Complete message displays when the run completes. Click OK to return to WinPREP to continue with protocol development. To view the Cleanup tab, re-open the protocol in JANUS Application Assistant and click the **Cleanup** button.

Monitoring the Protocol Execution

When you start a protocol, the **Progress** panel opens and remains throughout the duration of the protocol. As the protocol runs, other panels might also open to prompt you to perform an action or to request information required by the protocol.

Other panels can open during the execution of the protocol, as well. Additional panels or user actions can result from defined User Message, User Query, or Bar Code Scan procedures in the protocol outline or if the protocol requires any Labware Changes for the mapped labware during the protocol. Labware changes are required when the system detects the pipetting operations on a piece of labware exceed the capacity of the labware itself. For example, if the system has more pipetting operations to perform on a plate and it determines that it has used all of the wells on the plate, it creates a labware change condition.

Any other message panels you receive most likely indicate an error during the execution of the protocol. Be sure to read these messages carefully so that you can determine the exact nature of any problems or failures you encounter.

Progress Panel

While the protocol is running, the current status of the protocol displays in the **Progress** panel. The Pause button temporarily pauses the protocol, if necessary (see page 172). Once paused, you can either resume execution of the protocol or abort the protocol execution.

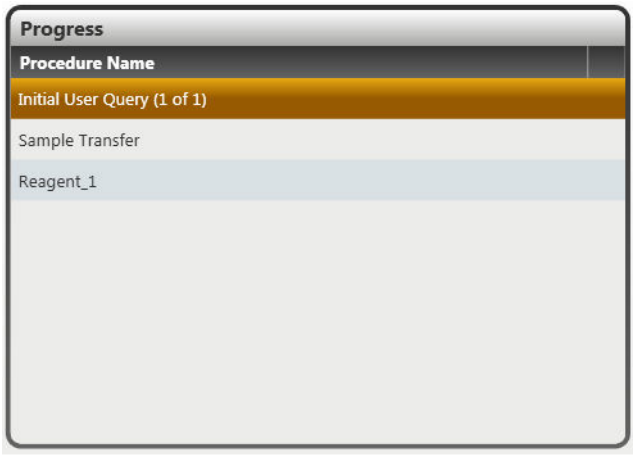


Figure 5-6. Progress Panel

Pausing a Protocol

If you click the **Pause** button in the JANUS Application Assistant, all the arm motors stop after the current step is completed. If the Varispan or MDT is aspirating or dispensing, the aspirate or dispense is completed.

You can safely perform actions such as adding liquids to the consumables by opening the front door while the system is paused. Close the door when you are ready to resume the protocol.

Click the **Resume** button to continue the protocol execution.

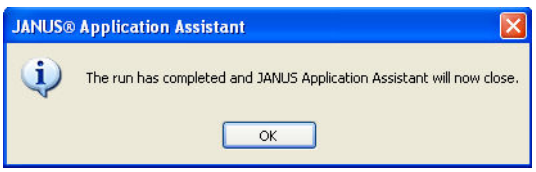
Stopping a Protocol

After the protocol begins to execute, you can stop the protocol by clicking the **Abort** button in the JANUS Application Assistant:

When you click the Abort button, a message displays to verify that you want to abort the protocol.

If you click **Yes**, the system disables all motors and a message displays to indicate that JANUS Application Assistant will close. Click the **OK** button.

☞ *Note: If there are disposable tips on the Varispan, you MUST manually remove the disposable tips after aborting a protocol.*



If you click **No**, the protocol will continue execution.

Using the System Pause Button

Figure 5-7. System Pause Button

If you need to stop the system any time during the execution of a protocol, you can press the red **System Pause** button on the front of the instrument. If possible, press the software Pause button to pause the system before opening the door if you plan to resume the protocol execution. The system actions depend on which action is taking place when the System Pause button is pressed.

Pressing the System Pause button during an arm movement immediately disables the X, Y, and Z arm motors and displays a warning message in the software.

☞ *Note: If the System Pause button is pressed while an arm is moving in the X direction, the arm may continue to glide, without power, in the direction it was moving.*

- **Pressing the System Pause button during a syringe pump motion** will finish the aspirate or dispense before stopping.

☞ *Note: Pressing the* System Pause *button during an aspirate when the Varispan is following the liquid level stops the liquid tracking motion but not the pump motion. You may receive a Tracking error in these cases, and the system may aspirate air.*

- **Pressing the System Pause button during an MDT Aspirate or Dispense step** will stop the aspirate or dispense immediately.

☞ *Note: The MDT aspirate or dispense stops immediately, even if the aspirate or dispense is not complete. Continuing the protocol may result in dispense errors or aspirating liquid into the head. Use Direct Control to empty the MDT in an appropriate location before restarting the protocol.*

When the system has completely stopped, the Status panel displays buttons to **Abort**, **Continue**, or to open the **Direct Control** window as shown in Figure 5-8.

❗ ***WARNING*** *Do not access the inside of the instrument until the Status panel displays the System Pause message as shown in Figure 5-8.*

If you continue the protocol, you may receive a second message indicating a Horizontal Motion error or Vertical Motion error if the arm was moving when the system was paused.

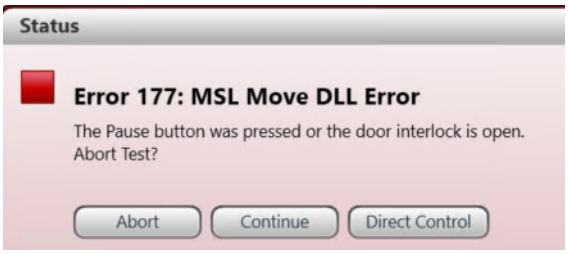
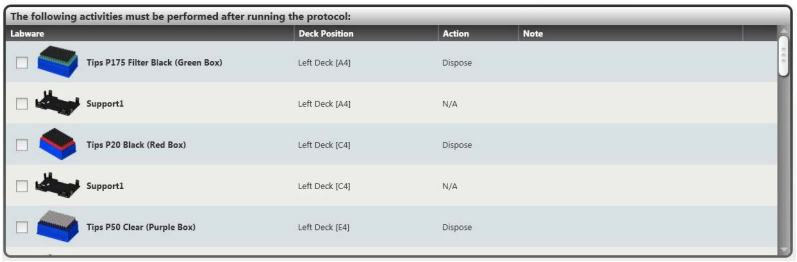


Figure 5-8. System Pause Button Pressed or Door Opened

Step 5: Cleanup

There are two sections to the Cleanup window (below). The top half lists labware that must be removed from the deck. The bottom half of the window lists specific tasks that you need to perform.

1. Remove the labware that is listed in the top half of the window from the instrument deck. (Some labware items require no action.) If desired, select the check box next to each labware item as it is removed.
2. Complete each cleanup activity listed at the bottom of the window. If desired, select the check box as each cleanup activity is completed:



This completes the protocol execution. Click the **X** button to close JANUS Application Assistant.

Execution Messages

This section describes messages that can display during operation. Messages are grouped into two general categories: Status Messages and Error Messages. The sections below describe each type in detail.

Status Messages

This section describes the status messages and user prompts that may display as you operate the instrument. Status messages provide information about the current run or request input necessary to complete the protocol.

- Labware Change Request Panel on page 175
- Reset Tip Boxes Tab on page 175
- Sample List Processing Results Panel on page 176
- Verify Labware Location Panel on page 176

Labware Change Request Panel

This panel displays when you need to change a piece of labware on the deck, such as when all of the mapped positions in the current piece of labware have been used, but the protocol has not yet completed. Configuring the protocol to stop and prompt you for a labware change displays this panel. Double-click the Protocol Outline node to open the **Protocol Outline Parameters** window, click the **Advanced** tab, and select **Stop and Display Message** under **On Assembly Change**.

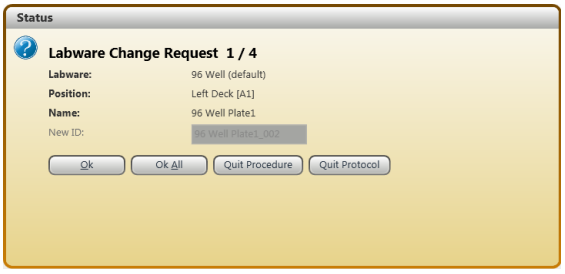


Figure 5-9. Labware Change Request Panel

Reset Tip Boxes Tab

When you click **Reset Tip Boxes** you can fill the disposable tip boxes on the deck and then reset the system counters for each box.

The system tracks the number of tips used from each tip box on the deck and monitors the tip quantity based on the location of the tip in the tip box. In this way, you do not always have to start with a full box of tips for a protocol; a protocol can use the tips remaining from a previous protocol run and can even prompt you for an assembly change when the tip boxes are empty.

The **Reset Tip Boxes** tab, shown in Figure 5-10, includes a list of the tip boxes on the deck. You can select a tip box from the list, replace the box with a full set of tips, and reset its counter to full. You can also set a box's counter to empty if you are using it to dispose of used tips. You can also use this panel to move the pipetting arm over the selected tip box to ensure you are resetting the correct box.

Figure 5-10. Reset Tip Boxes Tab

Sample List Processing Results Panel

This panel detects and tracks problems between sample list files and scanned bar codes. There are two problem situations: missing tubes and excess tubes. The missing tubes issue occurs when the provided sample list files contain more sample IDs than are read during the bar code scan. The Excess tubes issue occurs when bar code scans read sample IDs that do not exist in the sample list files. In either of these situations, WinPREP displays the **Sample List Processing Results** panel.

To correct either of these conditions, make changes to the tubes in the cassettes and rescan all of the mapped cassettes or abort the protocol and correct the sample list files.

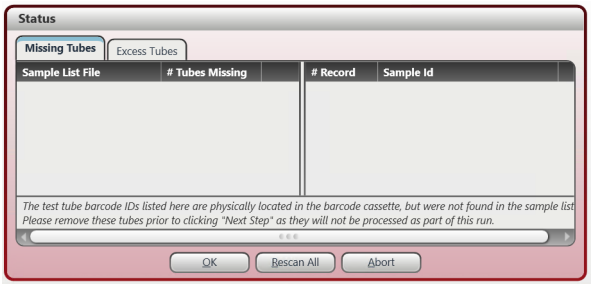


Figure 5-11. Missing Tubes or Excess Tubes

If you click the **OK** button, the protocol continues despite the discrepancies reported in the panel.

Verify Labware Location Panel

You can verify the list of labware the system needs to perform the protocol. Each referenced labware is shown in the list so that you can check the labware locations and types against the actual deck configuration.

You can also use the Varispan pipetting tips to physically check the locations of the labware. By selecting labware in the list, you can use the position slider, immediately above the **Go To** button, to specify any well position defined in that labware. after you choose a location, you can use the **GoTo** button to lower one of the Varispan arm pipet tips over that location. By checking the alignment of the tip with the actual position, you can verify that the labware is properly identified and positioned on the deck.

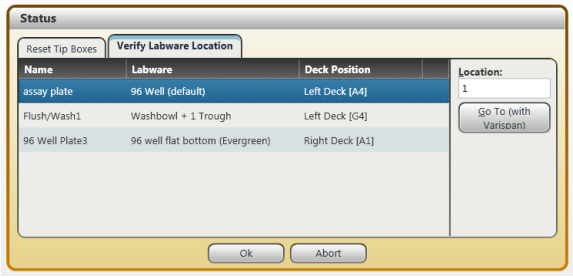


Figure 5-12. Verify Labware Locations panel

Error Messages

This section describes the following error messages that can display as you operate the instrument.

- Clot Detect Error on page 177
- Disposable Tip Warning on page 178
- Horizontal Motion Error on page 178
- Liquid Sense Error on page 178
- Tracking Error on page 179
- Vertical Motion Error on page 179
- Stack Space Error on page 180
- Barcode Reader Scan Errors Pane on page 181

Clot Detect Error

When you enable this feature, the system registers an error when a clot is detected at a sample position during the execution of the protocol. You enable clot detection on the **Liquid Sense** tab of the pipetting step's parameters window. The Clot Detect Error message opens so that you can choose how to proceed after the error.

You can choose to **Abort** the protocol, **Ignore** the error or **Skip** the Sample after receiving this error message.

Disposable Tip Warning

This warning message occurs when you start a protocol and the system senses that there are disposable tips already on the tip adapters. If the system senses tips on the adapters, it strips off the existing tips at any tip chute available on the deck. If no tip chute is available, the system prompts you with the Disposable Tip Warning message window.

You can remove the existing tips and continue the protocol or you can abort the protocol. Add a Drop Tip step to the protocol outline or manually eject the tips over the tip chute.

! ***WARNING*** *Be sure to use all standard laboratory precautions when handling used or contaminated disposable tips.*

Horizontal Motion Error

An error can occur if there is an obstruction or physical interference with the motion of the arm as it is moving around the deck. When the system detects interference, it displays the Horizontal Motion Error message so that you can abort the protocol or attempt to recover from the error.

In most cases you can recover from this type of error by clearing the obstruction that caused the error and clicking the **Retry** button. This can also occur if the **Pause** button was pressed during an arm motion due to the abruptness of the stop; typically, you can recover from these types of motion errors.

Liquid Sense Error

The liquid sense option, which is enabled by default, causes the system to report errors if the Varispan arm detects no liquid or insufficient liquid in the sample position during the execution of the protocol. You enable and disable liquid level sensing on the **Liquid Sense** tab of the pipetting step's parameters window. The Liquid Sense Error message opens so that you can choose how to proceed after the error.

Following this type of error, you can choose how to recover from the lack of liquid. You can **Abort** the protocol or add liquid and **Retry** the operation. You can also examine the sample position and choose to **Ignore** the liquid sense error or **Skip the Sample**, depending on whether or not there really is sufficient liquid present. The final option is to move the tip all the way to the **Bottom** of the current sample position and pipette from there. To do this, visually verify that the well contains liquid and click the **Go To Bottom** button. The system moves the tip to the bottom of the well, based on the labware definition for the labware, and begins the pipetting operation.

WARNING *If you pipette from the bottom of the well, and the volume of available liquid is less than the requested pipette volume, you might aspirate air. This can negatively affect the results of the protocol and the performance of the system.*

NOTE *If you use the Go To Bottom button, the tip might be submerged in the sample liquid farther up the tip than the wash submersion. This can contribute to carryover and sample contamination. Take care to avoid this issue by setting the wash submersion to a sufficient depth.*

Tracking Error

A tracking error occurs if there is physical interference with the vertical Z motion while the system is trying to follow the liquid level height. The Tracking Error message opens so you can choose how to proceed with the rest of the protocol.

Tracking errors can occur during either aspirate or dispense steps. If you **Continue**, the sample is skipped due to the potential severity of this type of error. For example, when tracking is interrupted during an aspiration, it is possible the system aspirated air instead of the designated liquid. When tracking is interrupted during a dispense, the tip could have submerged in the liquid, potentially contaminating the sample and tip.

Vertical Motion Error

A vertical motion error occurs if there is physical interference with or an obstruction to the vertical motion of one or more of the pipetting tips or the MDT Dispense head when they are in motion. The message opens so that you can abort the protocol or attempt to recover from the interruption.

Usually, you can recover from this type of error by clearing the obstruction that caused the error and clicking the **Yes** or **No** button. The **Yes** button retracts the tips in case they have pinned the obstruction on the deck or are otherwise jammed. If you can clear the obstruction without moving the tips, you can click the **No** button.

A Vertical Motion Error can also occur if you press the **Pause** button during a vertical motion. This is due to the abruptness of the stop, and you should be able to recover from the error in this case.

Stack Space Error

A Stack Space error occurs if the protocol is very large and runs out of stack space. Click the **OK** button in the error window and then Abort the protocol to increase the stack space.

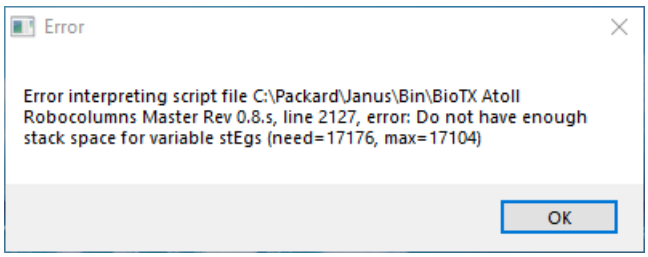


Figure 5-13. Stack Space Error

To prevent the Stack Space error, double-click **msl.exe** in **C:\Packard\Janus\Bin** to start MSL, click **Options** at the top of the MSL window to open the options Dialog, increase the **Maximum Stack Space (Bytes)** setting to a larger number, click **OK**, and then close MSL.

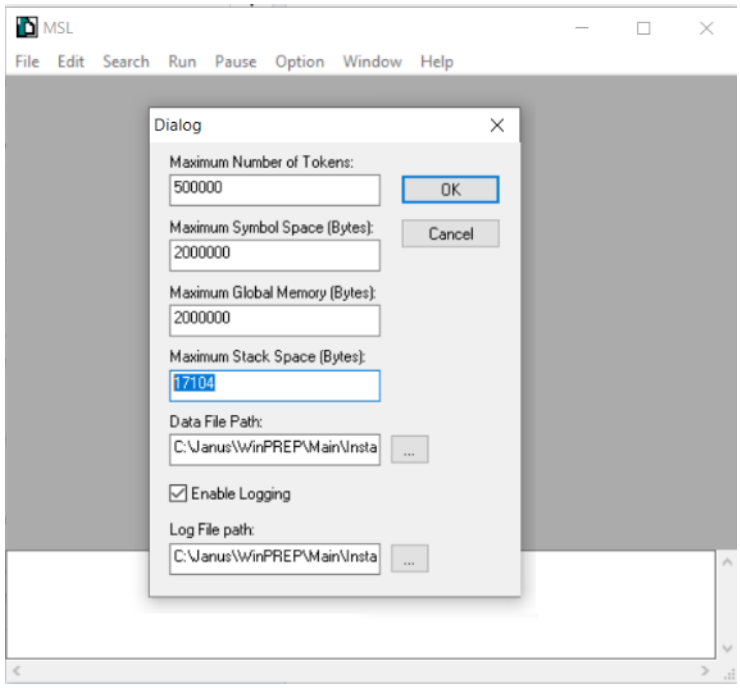


Figure 5-14. Stack Space Setting

Barcode Reader Scan Errors Pane

This panel displays any tubes that have missing barcodes or barcodes that cannot be read by the Tube Bar Code Reader-Laser or Tube Bar Code Reader-Vision. This panel enables you to manually type a barcode for a specific tube, to correct the barcode label on a tube and then rescan the tube cassette, or to skip the sample in a tube. See Tube Bar Code Reader Scan Errors on page 215 for detailed instructions.

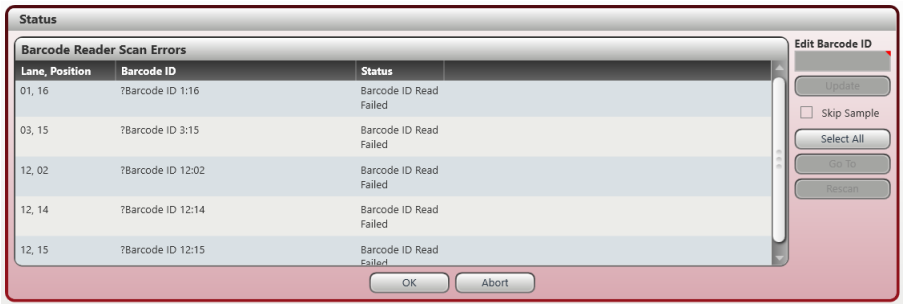


Figure 5-15. Barcode Reader Scan Errors

Direct Control

Some error messages include a **Direct Control** button to access the Direct Control window. Use the tabs on the Direct Control window to recover from errors or to move arms or arm components while the system is in an error state. Only the tabs for arms that are installed on the system display. Figure 5-16 shows the Varispan tab on the Direct Control window. See the WinPREP online Help file for detailed descriptions of the Varispan, MDT Head, and GIP Gripper Arm tabs.

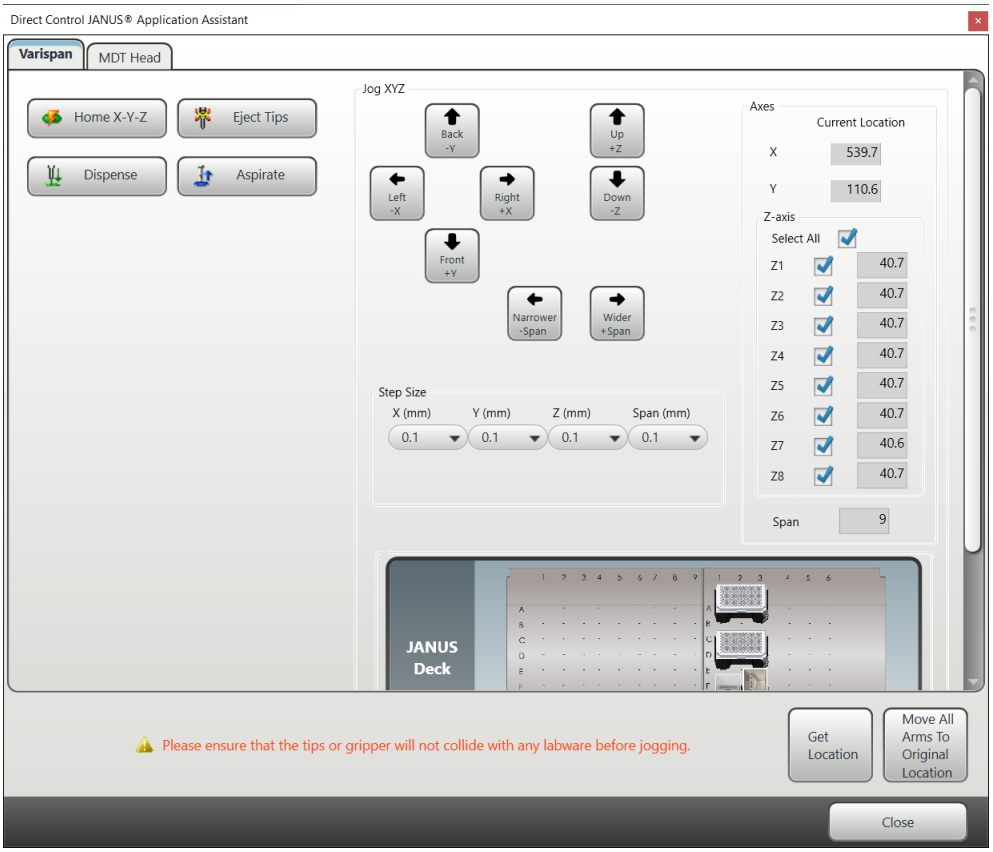


Figure 5-16. Direct Control Window - Varispan tab

Use the controls on the tabs to move the arms, eject tips, raise or lower tips on the Varispan (individually or all at once), dispense or aspirate with the Varispan, raise or lower the MDT head, or open or close gripper fingers to recover from an error.

If you want to retry the step that generated the error, the arms must be in their original positions. If any arm is not in the original position, you are prompted to allow the system to move the arms back to their original positions as shown in Figure 5-17. Click the **Yes** button to move the arms back or the **No** button to go back to the JANUS Application Assistant to abort the protocol.

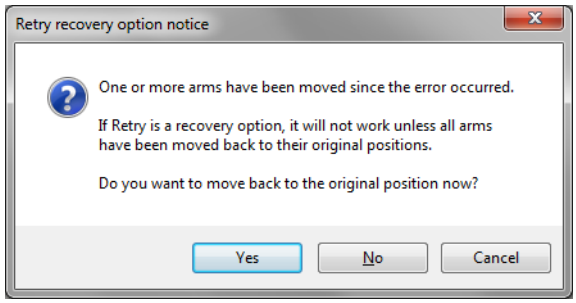


Figure 5-17. Retry Recovery Option Notice Window

Chapter 6

Procedures and Steps

The procedures and steps in a protocol determine the movements of the instrument during a run. This section lists the Procedures and Steps that are available for each component. Only the procedures and steps valid for installed components are displayed.

Procedures

Procedures are high-level nodes in the protocol outline that usually contain individual steps to perform a specific function. The Procedure Parameters window contains the options available for the procedure. The steps that are included in a procedure are often determined by the options selected in the Procedure Parameters window. Selections in the Procedure Parameters window are automatically updated in the Step Parameters windows.

- Varispan Procedures on page 184
- MDT Procedures on page 186
- Non-Pipetting Procedures on page 188
- Procedure Parameters Window on page 191

Varispan Procedures

Varispan procedures move liquid from one location to another using the tips on the Varispan arm or move the Varispan arm to a specific location. For information on MDT procedures, see MDT Procedures on page 186. For information on non-pipetting procedures, see Non-Pipetting Procedures on page 188.

Single Liquid (Varispan)

The Varispan Single Liquid procedure transfers a single liquid (one or more replicates) at a time from one source position to one or more destination positions (depending on the number of replicates defined). The default configuration of the procedure includes one Transfer Group (one aspirate and one dispense step per Transfer Group) for each replicate of each sample, a flush step, and a wash step. Mixing is allowed before the aspirate step and after the dispense step.

Reagent (Varispan)

The Varispan Reagent procedure aspirates liquid from one source position and dispenses liquid at two or more destination positions, such as adding reagent to all wells of a plate. The default configuration of the procedure includes one aspirate step and one dispense step. Replicates are not applicable, and multi-pipetting is allowed. Mixing is allowed before each aspirate step and after each dispense step unless multi-pipetting is defined.

Panel (Varispan)

The Varispan Panel procedure aspirates liquid from one source position and dispenses liquid to two or more destination positions, which generally are not contiguous wells in labware. Panel procedures are useful for pipetting liquid into multiple plates from the same set of source tubes or plates. You can also use Panel procedures for “mother-daughter” plate-to-plate transfers.

Dilution (Varispan)

The Varispan Dilution procedure has three varieties: direct, serial, and custom. The Direct dilution produces consistently accurate dilutions as each dilution is independent of any other dilution steps. The Serial dilution produces progressively increasing dilutions as the source for each subsequent dilution is the diluted sample of the current well. The Custom dilution is completely flexible, allowing you to define any sequence of dilution steps that you desire.

Multiple Liquid (Varispan)

The Varispan Multiple Liquid procedure aspirates liquid from two or more source positions and dispenses all of the liquid at one destination position. The default configuration of the procedure typically includes multiple aspirate steps for each dispense step. A Multiple Liquid procedure with only one aspirate step is the same as a Single Liquid procedure. The default configuration of the procedure includes one Transfer Group (multiple aspirates and one dispense step per transfer group) that executes once for each replicate of the procedure, a flush step, and a wash step. Mixing is allowed in the Transfer Group before the first aspirate step and after the dispense step.

Flush/Wash (Varispan)

In a Varispan Flush step, the system dispenses liquid through the pipetting tips to clean the inside of the tips and ensure a constant flow of system liquid through the system. Any sample or reagent material left in the tips is dispensed at the waste position when the tips are flushed. You must ensure that a waste container is mapped to each Flush step.

In a Varispan Wash Step, the system dispenses liquid through the pipetting tips to wash both the inner and outer walls of the tips. You must ensure that labware in the deck view is mapped to each wash step.

Park Arm (Varispan)

The Park Arm procedure positions the Varispan arm so that it is out of the way when you are performing deck or labware maintenance. This position should have a waste container to catch any liquids dispensed or leaked during the maintenance of the pumps, tips, or tubing.

The Park Arm procedure includes a single Move To Target step.

MDT Procedures

MDT procedures move liquid from one location to another using the MDT head, move the MDT arm to a specific location, or use the MDT gripper to move labware to defined locations. For information on Varispan procedures, see Varispan Procedures on page 184. For information on non-pipetting procedures, see Non-Pipetting Procedures on page 188.

Replicate Plate MDT

The MDT Replicate Plate procedure transfers liquid from a source plate to one or more destination plates. Dispense volumes can differ from plate to plate. Source and destination plates must have the same number of wells. The MDT head aspirates from the next location in the aspirate step list and dispenses to the next location in the dispense list of each dispense step.

Reagent MDT

The MDT Reagent procedure is a special version of the Single Liquid procedure. The Reagent procedure aspirates liquid from one source position and dispenses liquid at two or more destination positions. Use this procedure to quickly and efficiently add a reagent liquid to all wells in a plate.

The default configuration of the procedure includes one Transfer Group (one aspirate and one dispense step per transfer group). Replicates are not supported, but you can define multiple dispenses per aspirate to optimize the speed of the reagent transfer. Use the well map to specify the order in which the instrument fills the wells or you can allow the software to determine the most efficient dispense order.

By default, the system tries to aspirate enough reagent to perform as many dispenses as possible. If necessary (due to tip volume restrictions), the aspiration step repeats to fulfill the dispense step requests. If desired, you can limit the number of dispenses per aspirate. Mixing is always allowed before aspiration, but mixing after dispense requires you to set one dispense per aspirate.

Expand Plate MDT

The MDT Expand Plate procedure transfers the same volume of liquid from a source plate to one or more destination plates; each destination plate contains a unique subset of the wells in the source plate. The total number of wells on the destination plates must equal the number of wells on the source plate.

The labware mapping order in the protocol outline defines the order of pipetting operations. The MDT head aspirates from the next location in the aspirate step and dispenses to the next location in the dispense step. In the simplest case, this includes one aspirate followed by a sufficient number of dispenses to plates mapped in the dispense step. When complete, each well in the source plate is transferred to a well in one of the dispense plates. Using this method, a 384-well plate can be expanded to four 96-well plates.

The expansion procedure supports Replicates. However, replicates are dispensed into replicate plates, rather than adjacent wells in the same plate.

Compress Plate MDT

The MDT Compress Plate procedure transfers the same volume of liquid from one or more source plates (up to four) to one destination plate. The contents of each source plate are in a unique subset of the wells in the destination plate. The total number of wells on the source plates must equal the number of wells on the destination plate.

The labware mapping order in the protocol outline defines the order of pipetting operations. The MDT head aspirates from the next location in the aspirate step list and dispenses to the next location in the dispense step. In the simplest case, this is one aspirate followed by a dispense to a quadrant in a plate mapped in the dispense step. When complete, each well in the source plates is transferred to a well in a dispense plate. Using this method, four 96-well plates can be compressed into a single 384-well plate.

The compression procedure supports replicates. However, replicates are dispensed into adjacent quadrants in the same plate, rather than replicate plates.

Dilution MDT

There are two types of MDT Dilution procedures: Direct and Serial.

Direct dilutions use a single reagent source for all dilution steps. Each dilution in the set is aspirated from the original source location and diluted into a new well. This produces extremely accurate dilutions because each operation is independent.

Serial dilutions are step-wise operations that use the product of the previous dilution step as the aspirate source for the current dilution. This produces increasingly lower concentrations of the original sample. This procedure creates low concentration dilutions that would otherwise be difficult to prepare.

Multi-Liquid MDT

The MDT Multiple Liquids procedure aspirates two or more source liquids and dispenses them into one destination plate. This procedure is useful for preparing test kits that require multiple liquid components or where sample material from two or more sources is required.

Tip washing between aspirates is not available because the MPD head is emptied as part of the tip wash step. Replicates are supported but multiple dispenses per aspirate are not. Rather, the aspirate sequence is repeated and dispensed into the adjacent quadrant or next plate.

Custom Pipetting MDT

The MDT Custom Pipetting procedure builds a user-defined sequence of steps. The MDT custom procedure allows you to add individual steps in any order to build a procedure that conforms to the needs of the particular application. You must add and define each transfer group and step in a custom procedure.

The system does not propagate parameter settings from the procedure tab to the dependent steps automatically, nor does it validate the procedure definition parameters. You must ensure the custom procedures you create run correctly.

Empty/Wash MDT

The MDT Empty/Wash procedure empties the liquid remaining in the MDT head and washes the interior and exterior of the attached disposable tips. The system washes the tips by aspirating and dispensing liquid from a wash trough for a specified number of cycles.

Move Plate MDT

The Move Plate MDT procedure enables you to move plates using the MDT Gripper. You can use this procedure to move labware from one deck location to another.

A Move Plate MDT procedure must contain either a Get Plate step, a Move/Put Plate step, or both.

Park MDT

The Park MDT procedure moves the MDT arm to a safe location so that it is out of the way of other instrument arms.

The Park MDT procedure includes a single Move To Target step.

Non-Pipetting Procedures

Non-pipetting procedures do everything *except* perform liquid handling operations. For information on Varispan procedures, see Varispan Procedures on page 184. For information on MDT procedures, see MDT Procedures on page 186.

Loop

The Loop procedure allows you to repeat execution of one or more procedures in the protocol outline. Add the procedures to repeat as child procedures inside the loop.

Timer

The Timer procedure can perform any of the following time-related tasks:

- immediately pause the protocol for a defined length of time; for example, you can delay the start of a protocol or wait during an incubation period
- pause the protocol until a defined date and time; for example, you can delay the start of a protocol overnight
- pause the protocol for a defined length of time, calculated from a specific Time Marker; for example, to provide the same time spacing between sample transfers or reagent additions

Time Marker

The Time Marker procedure inserts a time reference point in the protocol outline. This marker is then available as a reference point to one or more Timer Procedures. Each time marker is unique and has a corresponding parameters window.

User Program

The User Program procedure runs an external program or function to perform specific actions. These actions might be to communicate with another device such as a robot or other instrumentation, to perform data transfer functions with another computer, or to execute unique functions for a specific application.

User Message

The User Message procedure defines and displays custom messages at runtime. You can use this procedure to display reminders or information in the protocol. The protocol pauses until you respond to the message. User messages may also ask Yes/No questions; a negative response stops the protocol and a positive response continues with the next node in the protocol outline. For example, you can embed a User Message procedure inside another procedure to periodically ask whether you want to continue running the protocol or are ready to quit.

User Query

The User Query procedure prompts the user for information at runtime. The protocol pauses until the user responds to the message. You can place User Query procedures anywhere in the protocol outline; this makes it easy to provide up to the minute values, as needed. The information entered by the user is stored in variables that were defined during protocol setup and populates the procedure parameters associated with the variables.

Variables can be defined for requesting information such as text, numerical data, or date and time data. Variable creation and query definitions determine the type of values expected, including checking entry limits and providing a list of possible responses, if necessary.

Initial User Query

The Initial User Query procedure creates multiple query pages that open at the *beginning* of the protocol. By default, the Initial User Query includes all parameters deferred to runtime entry from the entire protocol. It is a good idea to modify the Initial User Query procedure *after* completely setting up the procedures and steps in the protocol outline.

Initial User Query pages provide the interface to assign parameter values deferred to runtime. You can organize the individual queries onto separate pages as necessary, giving each page a unique name.

Use the User Query procedure to create query pages that come up during other stages of the protocol. The User Query procedure is described in detail on page 189.

Move Plate (Gripper)

Only displays if a Gripper arm is installed. The Move Plate procedure adds a Get Plate step and a Put Plate step to move a plate using the Gripper arm. You can define the source and destination deck locations of the labware that you want to move. You can also select from previously taught positions, or if necessary, you can teach new positions.

Bar Code Scan

Only displays if a Tube Bar Code Scanner is installed. The Barcode Scan procedure reads the sample ID barcode information from a set of sample tubes. If you supply a Sample List file, the scanned IDs are checked against the IDs in the sample list file and related information for the samples can be read from the corresponding record in the file.

This procedure is only available on systems configured with a Tube Bar Code Scanner.

Procedure Parameters Window

Each procedure **Parameters** window contains several tabs that organize the parameters into logical groups. Each window contains one or more of the tabs shown in Figure 6-1, which in turn contain parameters appropriate to the specific type of procedure. After making changes to any of the parameters, accept the changes by clicking the **Apply** button, or cancel the changes by clicking the **Undo** or **Cancel** button. The **Apply** button updates *all* parameters on *all* tabs of the procedure.

Figure 6-1. Procedure Parameters Tabs

Click the desired tab at the top of the window to display the parameters on the tab. Refer to the online help for a complete description of procedure parameters, controls, and settings.

☞ *Note: The title bar displays the procedure type, regardless of which tab is active.*

Open the Procedure Parameters Window

There are several ways to open a parameters window for a node in the protocol outline or for labware in the deck view. The results are identical, whichever action you choose to use.

To open a procedure parameters window:

1. Select the desired node in the protocol outline.
2. Do one of the following:
   - Double-click the desired node in the protocol outline.
   - Right-click the desired node and click **Edit Node** from the menu.
   - Highlight the desired node in the protocol outline by clicking on it. Select **Edit > Parameters** on the main menu.
   - Highlight the desired node in the protocol outline by clicking on it. Press **<Alt> + <Enter>** on the keyboard.

WinPREP opens the **Parameters** window for the selected node. You can modify and configure the parameters for the node as desired.

Close the Procedure Parameters Window

When you finish modifying the procedure parameters, you can apply the changes and close the window.

To close the procedure parameters window:

1. Click the **Close** button (or the **OK** button if modifications have not been applied), or click the X (Close) button in the upper right corner of the parameters window. WinPREP prompts you to save the changes if modifications were made but not applied and then closes the **Parameters** window.

Steps

Each step in the protocol outline has a step parameters window associated with it. Types of steps include both the pipetting and the non-pipetting steps listed below:

- Transfer Group
- Aspirate Air
- Aspirate
- Dispense
- Drop Tip
- Find Liquid
- Flush
- Get Tip
- Mix
- Move to Target
- Wash
- Find Liquid
- Pre-Aspirate Mix
- Transfer Group MDT
- Aspirate Air MDT
- Aspirate MDT
- Dispense MDT
- Empty MDT
- Mix MDT
- Move to Target MDT
- Wash MDT
- Move/Put Plate

Step Parameters Window

Each step **Parameters** window contains several *tabs* that organize the parameters into logical groups. Each window contains one or more of the tabs shown in Figure 6-2, which in turn contain parameter fields appropriate to the specific type of step. After making changes to any of the parameters, accept the changes by clicking the **Apply** button or cancel the changes by clicking the **Undo** button. Clicking **Apply** updates *all* parameters on *all* tabs of the step.

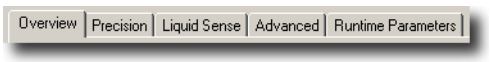


Figure 6-2. Step Tabs

Click the desired tab at the top of the window to display the parameters associated with that tab. Refer to the online help for a complete description of procedure parameters, controls, and settings.

☞ *Note: The step type always displays in the window title bar regardless of which tab is active (currently displayed).*

Open the Step Parameters Window

There are several ways that you can open a parameters window for the currently selected node. The results are identical, whatever action you choose to use.

To open the step parameters window:

1. Select the desired step node in the protocol outline.
2. Do one of the following:
   - Double-click the selected node in the protocol outline.
   - Right-click the selected node and click **Edit Node** from the menu.
   - Select **Edit > Parameters** from the main menu.
   - Press **<Alt> + <Enter>** on the keyboard.

WinPREP opens the **Parameters** window for the selected step node. You can modify and configure the parameters for the node or labware as desired.

Close the Step Parameters Window

When you finish modifying the step parameters, save or discard the changes and close the window.

To close the step parameters window:

- Click the **Cancel** button to close the window without saving any changes to the parameters.
- Click the **Close** button if changes have already been applied or if no changes have been made.
- Click the **OK** button to save the changes and close the window.

WinPREP closes the **Parameters** window.

Customizing the Toolbars

The toolbars in WinPREP can be customized to suit your needs. The customizations are saved for each user so that each user can have the look that best suits them.

The following procedures are included in this section:

- Hiding Toolbars (page 194)
- Removing or Moving Buttons (page 194)
- Adding Buttons to a Toolbar (page 194)
- Renaming Buttons (page 195)
- Adding a Custom Image to a Toolbar Button (page 196)
- Resetting the Toolbar to Factory Settings (page 197)

Hiding Toolbars

To hide a toolbar, right-click on a blank area of the toolbar. On the popup menu, uncheck the toolbars you want to hide. **Standard** shows or hides the Main toolbar.

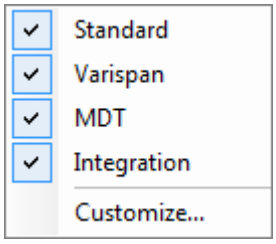


Figure 6-3. Toolbar Shortcut Menu

Toolbars can also be shown or hidden from the **View** menu. Select the toolbar name on the **View** menu to show or hide the toolbar. **View > Procedure Toolbar** toggles the view of any arm toolbars (MDT and Varispan).

Removing or Moving Buttons

To change the content of the toolbars, use the Customize window. Right click on a blank area of the toolbar and select **Customize**.

While the Customize window is open you can click and drag buttons on the toolbar.

- Drag a button to the left or right to change the order.
- Drag a button off the toolbar to remove it.
- Drag a button a little bit to the right or left to create a vertical separator.

Adding Buttons to a Toolbar

To add a menu command as a button on a toolbar:

1. Right click on a blank area of the toolbar and select **Customize**.
2. Click the **Commands** tab in the Customize window.

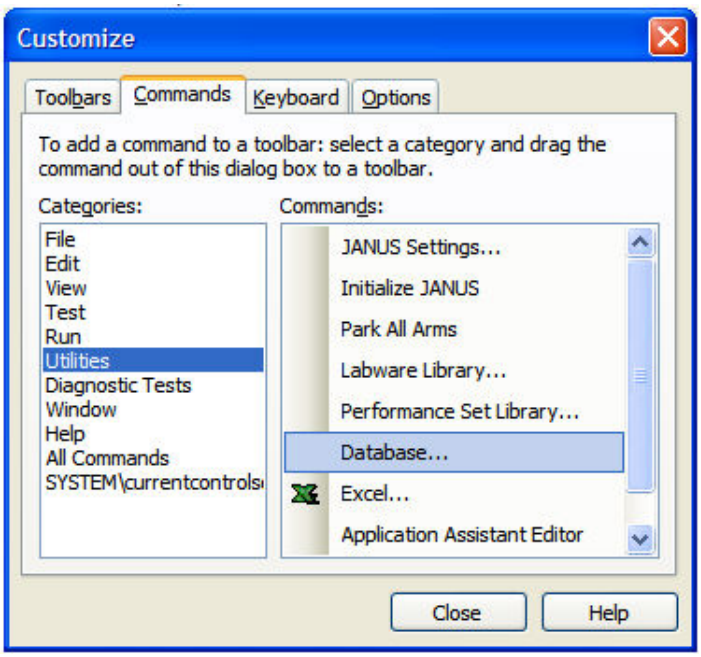


Figure 6-4. Commands Tab in the Customize Window

To add the Access database as a toolbar button:

1. Select **Utilities** as the category.
2. Drag **Database** from the command list to the toolbar. As you move the cursor over the buttons, an indicator shows where the button will be added.

3. Release the mouse button when the button is in the desired location. A text button is created.

Figure 6-5. Database Button

4. You can stop here or you can further customize the button by changing the name and image.

Renaming Buttons

Rename a button by right-clicking on the button and typing a new name in the **Name** field.

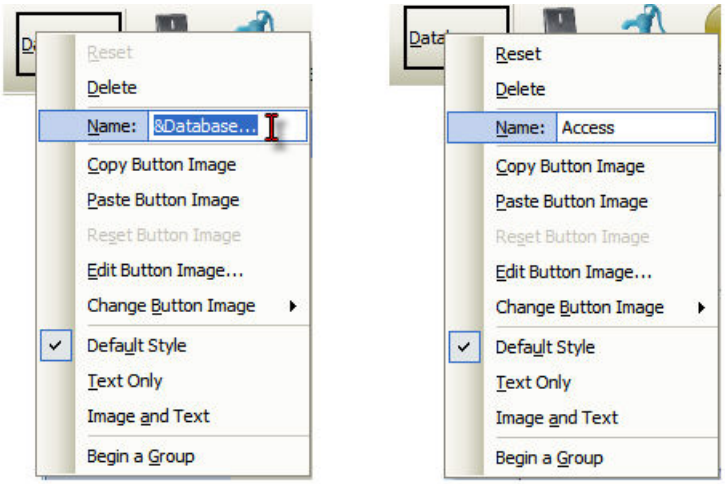


Figure 6-6. Changing a Button Name

Adding a Custom Image to a Toolbar Button

To add a custom image to a button:

1. Right-click on the button and select **Edit Button Image**. The Button Editor window opens.

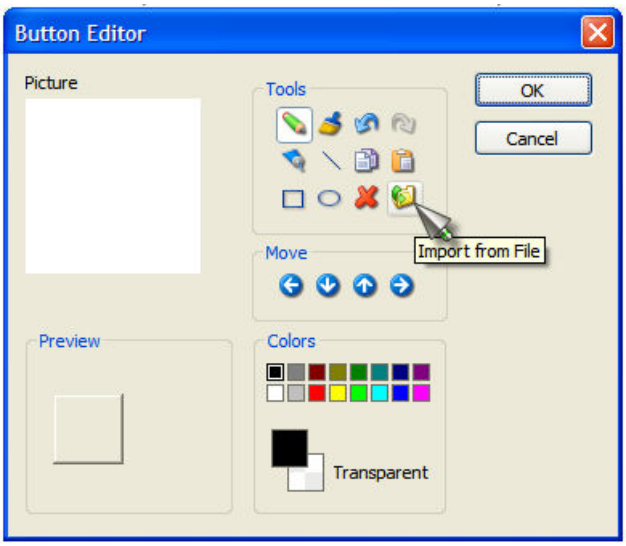


Figure 6-7. Button Editor Window

2. Click the **Import from File** button on the Tools palette.
3. Navigate up one level and look for the “Images” folder. This contains a selection of button images.
4. Select the image you want to use for the button and click **Open**.

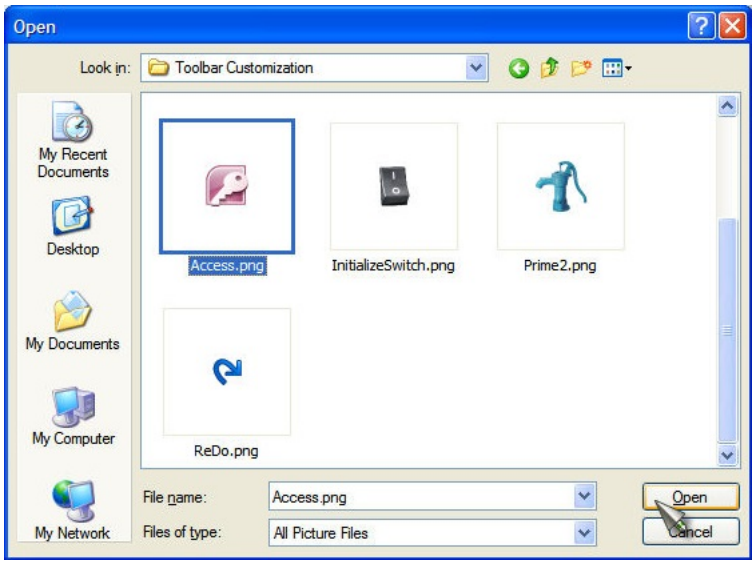


Figure 6-8. Select the Button Icon

5. Click **OK** in the Button Editor to add the icon to the button.

Resetting the Toolbar to Factory Settings

To reset the toolbars back to the factory settings:

1. Right click on a blank area of the toolbar and select **Customize**.
2. Click the **Toolbars** tab in the Customize window.
3. Click the **Reset** button.

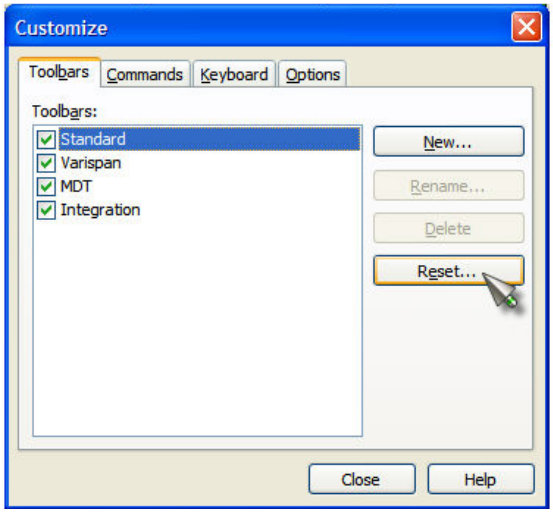


Figure 6-9. Reset the Toolbars

Chapter 7

Bar Code Readers

The JANUS workstation offers two types of Bar Code Readers: The Plate ID Bar Code Reader to read individual bar codes from labware, or the Tube Bar Code Reader to read bar codes from test tubes in tube cassettes on the deck.

This section describes the two options and explains the commands required to use the bar code readers in WinPREP protocols.

This chapter contains the following information and procedures:

- Bar Code Scan Files on page 199
- Sample List Files on page 201
- Use a Scan File as a Sample List on page 202
- Plate ID Bar Code Reader Protocols on page 203
- Tube Bar Code Reader Protocols on page 207

For step-by-step tutorials that explain how to create specific types of protocols for each of the major components of a system, see Protocol Tutorials on page 59.

Caution: The procedures in this chapter assume you have properly calibrated the deck for each arm on the system. If you have not calibrated the deck, see Calibrating the System on page 285 before proceeding.

Bar Code Scan Files

A Scan File contains all of the Sample IDs read during the Bar Code Scan Procedure or Tube Rack Scan Procedure. The name of the Scan file is specified in the Scan procedure. The Scan File makes scanned IDs and position information available to other programs or functions. By default, the file is named using the procedure name followed by a ".csv" file extension and is saved in the "\Janus\Bin" folder.

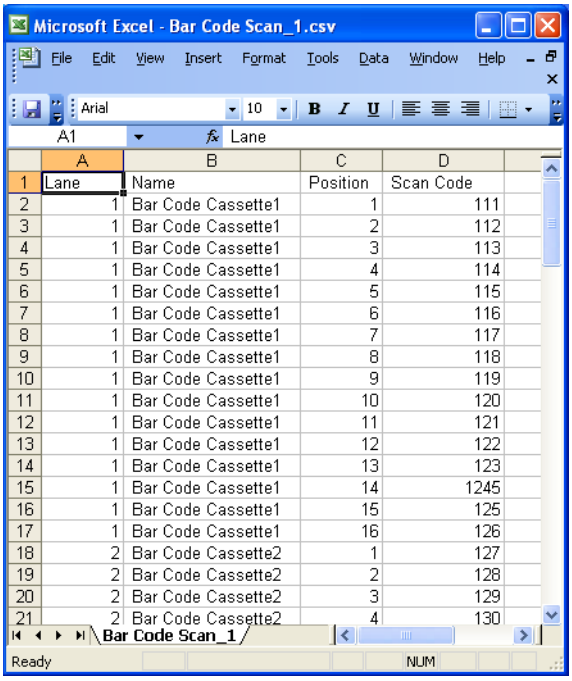
Note: Scan Files are NOT automatically deleted at the end of the protocol. You should manually remove them when they are no longer needed.

The Scan File for a **Tube Rack Scan** procedure contains the following fields for each tube, in the order below:

- **Column 1 - Lane**: The cassette position, numbered from left (lane 1) to right (lane 12 or lane 6).
- **Column 2 - Name**: The name of the cassette specified when the labware was added to the deck.
- **Column 3 - Position**: The sample position in the cassette, numbered from the back of the instrument (position 1) to the front of the instrument (position 16).
- **Column 4 - Scan Code**: The Sample ID scanned from the barcode label on the sample.

Figure 7-1 shows a scan file generated during a protocol. Record 1 in the Scan File is the heading row. The data starts at Record 2 if using the Scan File as a Sample List.

NOTE: If you want to keep a copy of the scan file, you should change the file name each time the Bar Code Scan procedure is used. WinPREP writes a new scan file.csv to the \bin folder and overwrites the existing file of the same name during each run.



	A	B	C	D
1	Lane	Name	Position	Scan Code
2	1	Bar Code Cassette1	1	111
3	1	Bar Code Cassette1	2	112
4	1	Bar Code Cassette1	3	113
5	1	Bar Code Cassette1	4	114
6	1	Bar Code Cassette1	5	115
7	1	Bar Code Cassette1	6	116
8	1	Bar Code Cassette1	7	117
9	1	Bar Code Cassette1	8	118
10	1	Bar Code Cassette1	9	119
11	1	Bar Code Cassette1	10	120
12	1	Bar Code Cassette1	11	121
13	1	Bar Code Cassette1	12	122
14	1	Bar Code Cassette1	13	123
15	1	Bar Code Cassette1	14	1245
16	1	Bar Code Cassette1	15	125
17	1	Bar Code Cassette1	16	126
18	2	Bar Code Cassette2	1	127
19	2	Bar Code Cassette2	2	128
20	2	Bar Code Cassette2	3	129
21	2	Bar Code Cassette2	4	130

Figure 7-1. Scan File in Excel

Use the Runtime File Definitions window to change the name or location of the scan file. Click the **Files** button on the **Runtime Parameters** tab to open the Runtime File Definitions window (see Figure 7-2). Click the file name to change the name.

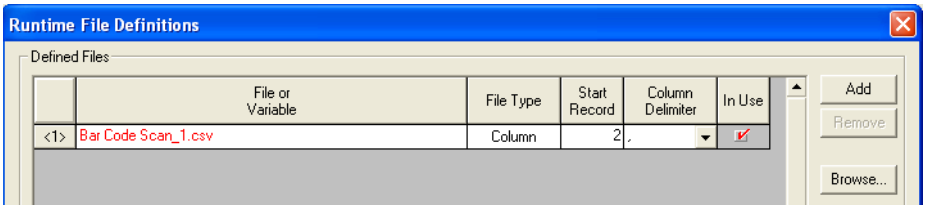


Figure 7-2. Scan File Name in Runtime File Definitions Window

Sample List Files

Sample List files are CSV files that contain a list of bar codes (Sample IDs). The Sample list files can be used to track samples during a run or to specify parameters for each sample based on the scanned bar code. The bar codes that are scanned during a run can be compared to the bar codes in the Sample List and actions can be taken depending on whether the scanned bar codes are found in the Sample List. The Sample List can also be used to verify that all of the bar codes in the Sample List have been scanned by the bar code reader.

The Sample List files for a Bar Code Scan procedure or a Tube Rack Scan procedure are specified on the Sample Lists tab as shown in Figure 7-3. To use the scan file as a sample list, see page 202.

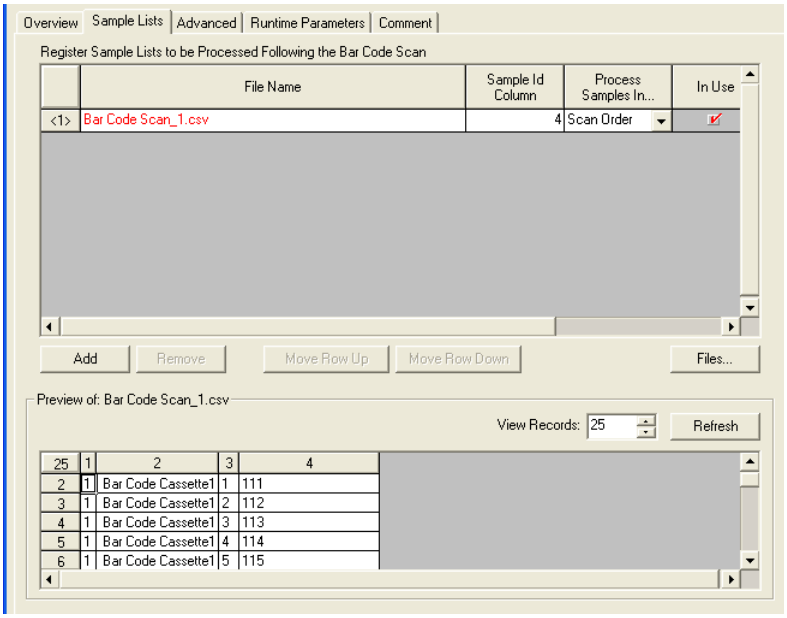


Figure 7-3. Sample Lists Tab

If more than one Sample List file is specified, each Sample List file is read starting with the file in Row 1 and continuing down.

Use a Scan File as a Sample List

A scan file can be used as a Sample List file by selecting the **Yes, and Use as a Sample File** option in the Bar Code Scan Procedure or Tube Rack Scan Procedure.

The Scan File is then used as the Sample List for the procedure and is automatically added to the table on the Sample List tab. The column number of the ID and the file name are automatically entered in the table, since the format of the file is already defined. Choosing to use the file in Scan Order or List Order has no effect, because for this file they are exactly the same.

Plate ID Bar Code Reader Protocols

The Plate ID Bar Code Reader is a JANUS G3 option that works with the Gripper arm or MDT Gripper to read bar code labels on labware during a protocol. The Gripper arm or MDT Gripper moves a labware item to a defined position in front of the Plate ID Bar Code Reader so the bar code reader can read the bar code on the labware. WinPREP saves the bar codes in a CSV file that you can use to specify how the sample is processed or to produce reports. The Plate ID Bar Code Reader is also called the Secondary Bar Code Reader, or SBCR.

Before operating the Plate ID Bar Code Reader, teach the Plate ID Bar Code Reader position to the Gripper arm or MDT Gripper using the instructions in Teaching Off-Deck (or Special On-Deck) Locations on page 319.

Creating a Protocol for the Plate ID Bar Code Reader

When you create a protocol for the Plate ID Bar Code Reader, the protocol outline displays procedures and steps that make up the protocol. The Deck View displays the deck positions used during the protocol. The Plate ID Bar Code Reader, during the “Get Plate” portion of each Gripper “Move” procedure, scans labware items occupying positions on the deck marked for bar code identification. During the plate bar code reader protocol, the system expects a bar code on any labware item that occupies that deck position. The barcode on labware is indicated by the deck position and not the labware item.

Several predefined sample protocols are supplied with the Plate ID Bar Code Reader. You can use one of these predefined protocols and modify it as necessary or you can create your own custom protocol. If you create a custom protocol, you must include a **Setup Bar Code Parameters** node in the protocol (see Selecting the Plate ID Bar Code Reader (SBCR) Parameters on page 206). You must also create user functions for the Plate ID Bar Code Reader (see Creating Plate ID Bar Code Reader User Functions on page 204).

To access the predefined sample protocols, select **File > Open** on the main menu, browse to the sample protocols in C:\Packard\JANUS\bin\Samples\, and choose the appropriate protocol. The names of Plate ID Bar Code Reader protocols start with “SBCR...”.

To use the Plate ID bar code reader:

1. Open one of the predefined bar code reader sample protocols supplied with the system or create a custom protocol.
2. Customize the sample protocol, if necessary.
3. Save the file with a new, unique name. Do not overwrite the original sample protocols.

4. Specify the deck positions that contain labware items you want to scan with the plate bar code reader. Use the **Labware Parameters** window for labware in the Labware Library. Use the **Teach Position** and **Teach Manifold Components** windows for custom labware positions. See Calibrating the Gripper Arm on page 312 for more information.
5. Verify that the plate ID bar code reader setup parameters are appropriate for the protocol. See Selecting the Plate ID Bar Code Reader (SBCR) Parameters on page 206 for more information.

☞ *Note: The protocol **must** contain a* **Setup Barcode Parameters** *procedure. Create your own or copy one from one of the sample protocols provided with the system.*

6. If creating a custom protocol, create **User Functions** for the plate bar code reader or copy the required functions from other protocols (see Creating Plate ID Bar Code Reader User Functions on page 204).
7. Execute the protocol.

The system moves and scans each of the plates specified in the protocol.

Creating Plate ID Bar Code Reader User Functions

If you are creating a custom Plate ID bar code reader protocol, you must create user functions to initialize the barcode reader and to abort the Plate ID bar code reader protocol as described below. If you use one of the predefined sample protocols, these user functions are already included in the protocol. Create the Plate ID bar code reader User Functions for a custom protocol as described below:

To create a Plate ID Reader Initialize function

1. Double-click on the **Protocol Outline** node of the protocol. The **Protocol Outline Parameters** window opens.
2. Click the **Advanced** tab.
3. Select **Run User Function** in the **Action To Take** field of the **On Protocol Startup** frame.
4. Click the **List** button in the **On Protocol Startup** frame. The **User Function List** window opens.
5. Click the **Add** button.
6. Type an appropriate name for the new user function, for example: Initialize Plate ID Reader, in the **Function Name** column.
7. Click the **Edit** button. The **User Function Edit** window opens.
8. Type: **SBCR_Initialize( );**

9. Click the **OK** button in the **User Function Edit** window.
10. Click the **OK** button in the **User Function List** window.
11. Select the **initialize** function in the **User Function** field of the **On Protocol Startup** frame.
12. Click the **OK** button in the **Protocol Outline Parameters** window.

Create a Plate ID Reader Abort Function

1. Double-click the **Protocol Outline** node of the protocol. The **Protocol Outline Parameters** window opens.
2. Click the **Advanced** tab.
3. Select **Run User Function** in the **Action To Take** field of the **On Protocol Abort** frame.
4. Click the **List** button in the **On Protocol Abort** frame. The **User Function List** window opens.
5. Click the **Add** button.
6. Type an appropriate name for the new user function, for example: Abort Plate ID, in the **Function Name** column.
7. Click the **Edit** button. The **User Function Edit** window opens.
8. Type: **SBCR_Abort( );**
9. Click the **OK** button in the **User Function Edit** window.
10. Click the **OK** button in the **User Function List** window.
11. Select the abort function in the **User Function field** of the **On Protocol Abort** frame.
12. Click the **OK** button in the **Protocol Outline Parameters** window.

Selecting the Plate ID Bar Code Reader (SBCR) Parameters

If you are creating a custom Plate ID Bar Code Reader protocol, you must include a **Setup Barcode Parameters** node after the Initial User Query node in the protocol. If you use one of the predefined sample protocols, this node, named SBCR Setup, is included by default.

To set up the Plate ID Barcode Reader Parameters in a protocol:

1. Right-click on the Protocol Outline node and select **Add Procedure > User Procedure > User Program**, or double-click on the Setup Barcode Parameters node if it is already created. The **User Program Parameters** window opens.

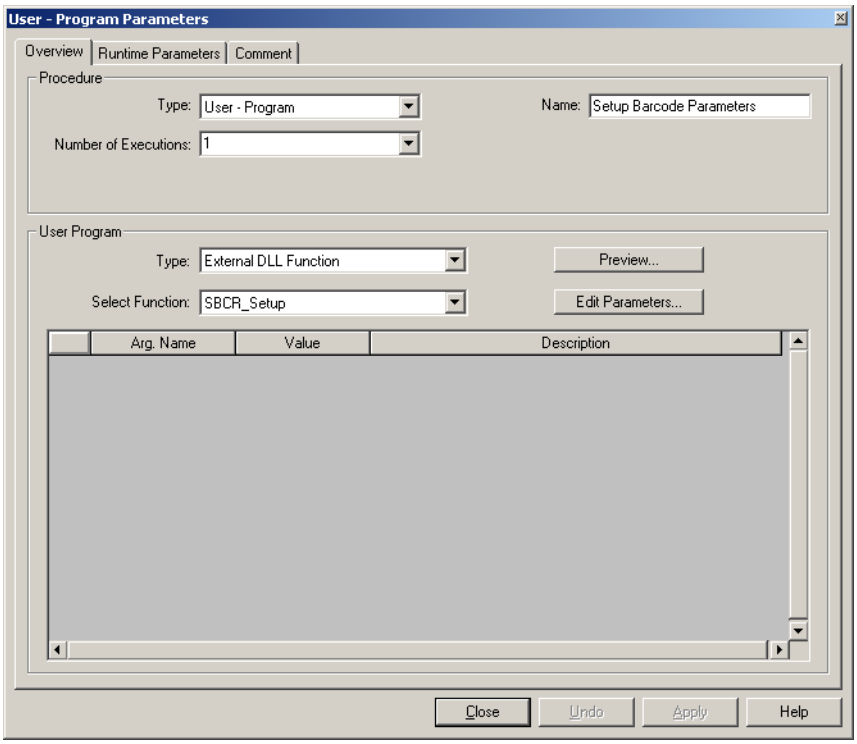


Figure 7-4. User-Program Parameters Window for Plate ID Barcode Reader

2. Select *External DLL Function* in the **User Program-Type** drop-down list.
3. Select *SBCR_Setup* in the **Select Function** drop-down list.
4. Click the **Edit Parameters** button. The **Plate Bar Code Reader Setup** window opens.

5. Verify that the Plate ID barcode reader setup parameters are appropriate for the protocol. The parameters are described in the Plate Barcode Reader Setup Window topic in the online Help. The settings on the Reader tab specify the name of the read position for the gripper, the location of the bar code, the orientation of the barcode reader, the actions on errors or duplicate bar codes, and whether to read the barcodes on the labware and generate a scan file. Specify any Worklist settings or report settings on the corresponding tabs.
6. Change the **Name** as desired, typically either Setup Barcode Parameters or SBCR Setup.
7. Click the **Close** button.

Tube Bar Code Reader Protocols

The Tube Barcode Reader option is used to read bar code labels on test tubes during a protocol. The JANUS supports two 12-Lane Tube Bar Code Readers, the Tube Bar Code Reader - Laser and the Tube Bar Code Reader - Vision. The Tube Bar Code Reader - Laser uses a laser bar code reader to read the tube bar codes. The Tube Bar Code Reader - Vision uses a camera bar code reader to read the tube bar codes. The appropriate option is selected when the WinPREP software is installed on the system controller.

Use The **Bar Code Scan** procedure to scan the tubes in the 12 Lane barcode rack with the installed bar code reader. During the Bar Code Scan procedure, the Tube Bar Code Reader arm moves a cassette of test tubes into position in front of the Tube Bar Code Reader. The Tube Bar Code Reader reads the bar code label on each tube and stores the decoded barcode information in a CSV file that you can use to specify protocol steps or produce reports.

See Calibrating the Tube Barcode Reader on page 323 for instructions on calibrating the Tube Bar Code Reader deck, teaching the Engage Position, and teaching the cassettes.

Create a Protocol for the Tube Barcode Reader

The **Bar Code Scan** procedure reads the sample ID bar code information from a cassette of test tubes. If you supply a sample list file, the scanned IDs are checked against the IDs in the sample list file so that related information can be read from the appropriate record in the file.

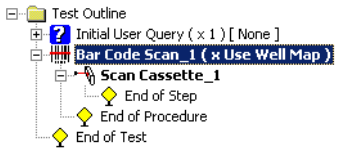


Figure 7-5. Example Bar Code Scan Node in Protocol Outline

In the Deck View, the Tube Barcode Reader option occupies the left side of the deck, as shown in Figure 7-6.

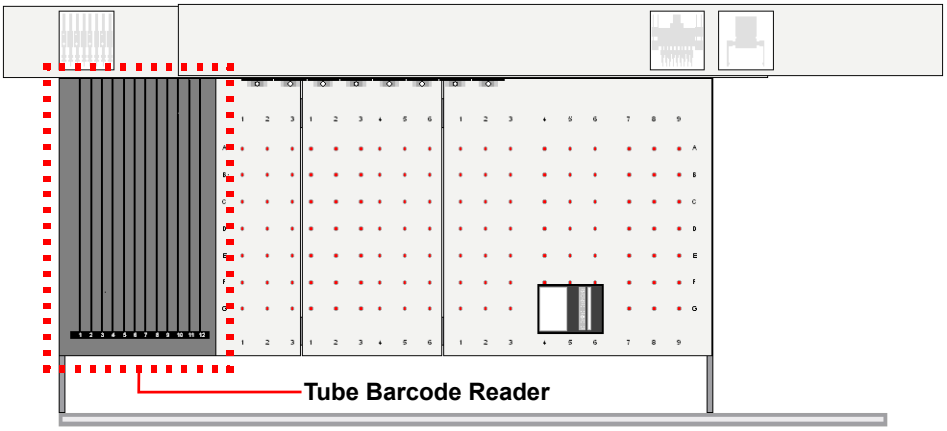


Figure 7-6. Example Tube Barcode Reader in Deck View

If you are creating a new Tube Bar Code Reader protocol, you must include a **Bar Code Scan** procedure in the protocol. If you use one of the predefined sample protocols, such as **Bar Code Scan Demo.MPT**, this procedure is already included.

☞ *Note: The sample protocols provided with WinPREP are located in the* ***\bin\Samples*** *folder in the WinPREP installation folder.*

To create a protocol using the tube barcode reader:

1. Select **File > New** to open the **New** window.
2. Select **Protocol** and click **New** to open the **Open a Protocol Template** window.
3. Click **None** to create a new protocol.

4. Click **File > Save As** to save the file. The **Save As** window opens.
5. Type a unique name in the **File Name** field and click **Save**. WinPREP creates a new protocol, saves it, and opens it in the **Protocol Outline View**.
6. Select the **End of Protocol** node in the protocol outline and click the **Bar Code Scan** button on the toolbar.

   WinPREP creates a temporary **Procedure Under Construction** node in the protocol outline and opens the **Bar Code Scan Parameters** window, as shown in Figure 7-7.

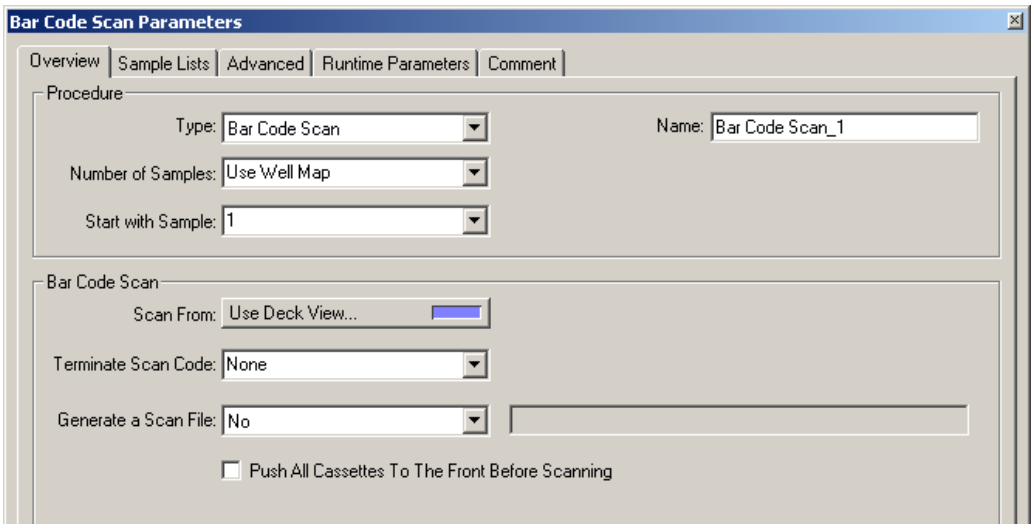


Figure 7-7. Bar Code Scan Parameters Window

7. Click **OK** on the **Bar Code Scan Parameters** window.

   The software closes the **Bar Code Scan Parameters** window and converts the Under Procedure node into a **Bar Code Scan** node.
8. Click **File > Save As** to open the **Save As** window.
9. Type a unique file name and click **Save** to save the protocol.
10. Set the Bar Code Scan parameters. See Setting the Bar Code Scan Parameters on page 210.

Setting the Bar Code Scan Parameters

The **Bar Code Scan Parameters** window specifies the functions for the tube barcode reader.

To set the Bar Code Scan parameters:

1. Double-click the **Bar Code Scan** procedure in the protocol.
2. On the **Overview** tab in the **Bar Code Scan Parameters** window, specify the following Bar Code Scan parameters:
   - **Scan From**: Specifies the source of the locations to scan.
   - **Terminate Scan Code**: Specifies a bar code to use to end tube bar code scanning. Type the value or specify a variable or file name. If thee specified bar code is read, the Bar Code Scan procedure terminates. The scan file /sample list stops at the termination bar code and no additional bar codes are processed.
   - **Generate a Scan File**: Specifies whether to generate a Scan File (see page 199) of the bar codes that are read during the Bar Code Scan procedure. The Scan File can be used as a Sample List File (see page 202) for the protocol if desired.
3. Click the **OK** button to save the settings and close the Bar Code Scan window.

☞ *Note: The Tube Barcode Reader can read many common bar code formats, as long as the labels meet defined minimum quality standards. For more information on the supported bar code formats, see Tube Barcode Reader Supported Formats on page 210.*

Tube Barcode Reader Supported Formats

The JANUS Tube Barcode Reader has been tested to reliably read bar code labels generated using the following formats:

- Interleaved 2 of 5 (uses a modulus 10 check digit)
- Code 39 High Density
- Codabar High Density
- 128 Auto High Density
- UPC-A Medium Density

Note: The UPC-A Medium Density format was tested during development but did not produce reliable or acceptable read results. PerkinElmer recommends you use one of the more reliable formats to generate the bar code labels.

Tube Bar Code Label Quality

By following minimum quality guidelines when producing bar code labels, you ensure accurate and reliable bar code read results. This section describes important guidelines to follow when producing bar code labels. Print Quality Labels must meet the print quality specifications outlined in the “ANSI X#.182-1990 Bar Code Print Quality-Guideline.”

Regardless of the bar code format used to encode label information, certain minimum quality specifications for the printing of the labels is required. The better the label generation, the more reliable the scanning can be. PerkinElmer recommends the following minimum specifications when printing bar code labels:

- **Minimum Print Contrast Signal (PCS)**: 80%
- **Minimum Reflectance Difference (MRD)**: 45%
- **Decodability**: 100%
- **Length:** 10 mm – 100 mm
- **Height**: 8 mm – 30 mm
- **Label Coatings**: Resin-coated paper labels, Retroreflective labels, Laminated Labels
- **Character Limit:** 64 alphanumeric characters (including the start character, stop character, and check digits).
- **Barwidth/Density:** 0.19 mm to 0.51 mm (including narrow bar width and wide-to-narrow ratios). The bar code density (narrow bar width) for each bar code format is defined as:

Bar Code Format	Density
Interleaved 2 of 5	0.007 inches (0.178 mm)
Code 39 High Density	0.007 inches (0.178 mm)
Codabar High Density	0.007 inches (0.178 mm)
128 Auto High Density	0.008 inches (0.203 mm)
UPC-A Medium Density	0.011 inches (0.279 mm)

Loading the Test Tubes in the Cassettes

The test tubes must be placed in the cassettes with the barcodes displayed on the right side of the cassette, toward the bar code reader on the arm. The Barcodes should be fully visible in the cutout in the cassette. Make sure the labels are not stained, peeling, or folded.

The Tube Bar Code Reader-Laser option uses tube cassettes without bar code labels below each tube location as shown in Figure 7-8.

Figure 7-8. Tube Bar Code Reader-Laser Cassette

The Tube Bar Code Reader-Vision uses tube cassettes with bar code labels below each tube location and inside the back of each tube location as shown in Figure 7-9. The bar code label at the back of each tube position is only visible if there is no tube in the location. This allows the Tube Bar Code Reader-Vision to determine when there is no tube present. The Tube Bar Code Reader-Laser does not sense when a tube location is empty. Make sure you are using the proper cassettes.

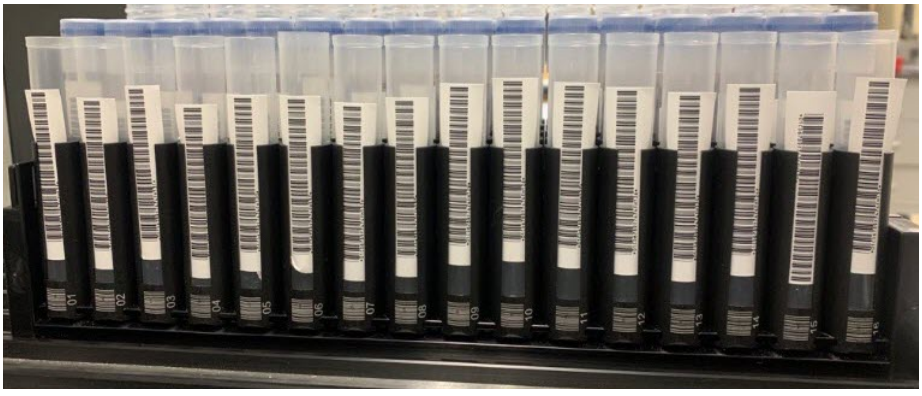


Figure 7-9. Tube Bar Code Reader-Vision Cassette

Tube Bar Code Reader Example Protocol

The example protocol shown in Figure 7-10 scans the barcode cassettes and creates a sample list. The sample list is then used to aspirate from the test tubes and dispense into the 96 well microplate. The samples from the test tubes can be tracked to the wells in the plate.

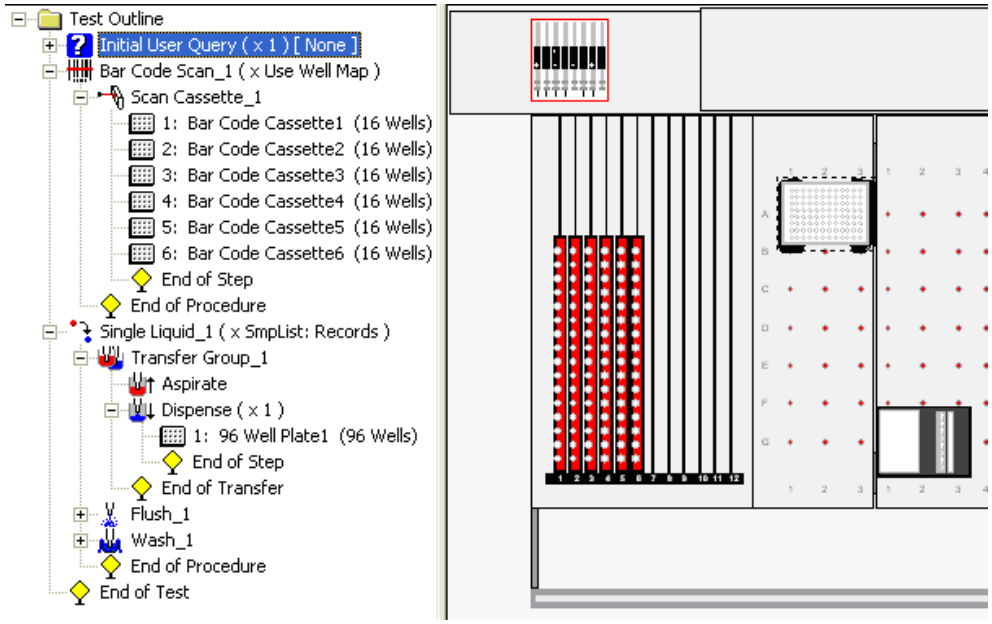


Figure 7-10. Tube Bar Code Reader Protocol

For the protocol above to use the newly created sample list, the Single Liquid parameters must be set to **Aspirate From:** *SmpList: ScanMap*. The **Number of Samples** needs to be set to *SmpList: Records* as shown in Figure 7-11.

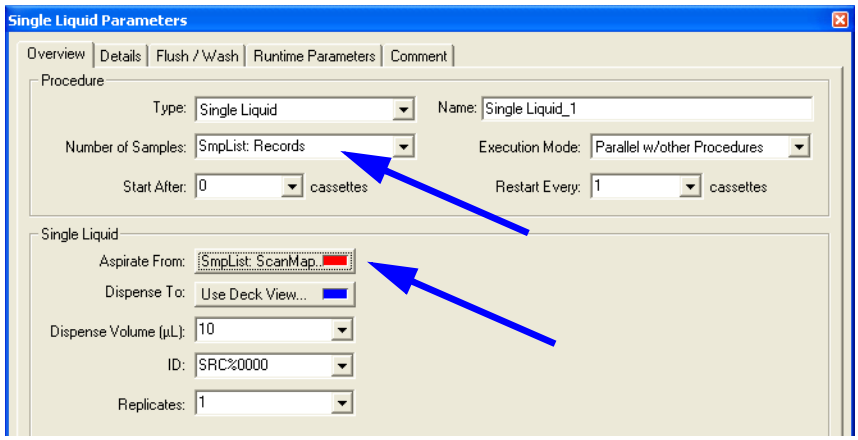


Figure 7-11. Single Liquid Parameters

The Aspirate location could also be set to **Map Type:** *SmpList: Column* as shown in Figure 7-12.

Figure 7-12. Aspirate Well Map Settings

If using *SmpList: Column* as the Aspirate Well Map, the Rack Name Column # and Position Name Column # must be specified in the **Runtime Parameters** tab, **Type:** *Well Maps*. The example in Figure 7-13 uses Column 2 for the Rack Name and Column 3 for the Position.

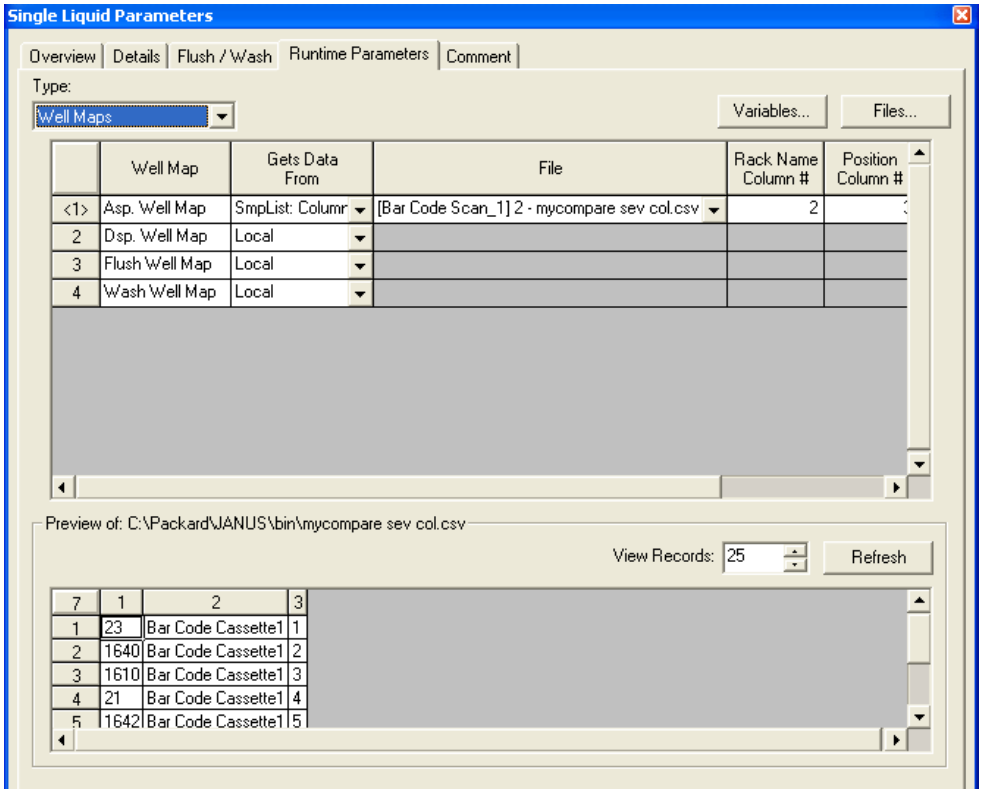


Figure 7-13. Single Liquid Parameters, Runtime Parameters Tab

Tube Bar Code Reader Scan Errors

When running a protocol that reads tube bar codes, if an error occurs while reading a bar code, the Barcode Reader Scan Errors pane displays as shown in Figure 7-14.

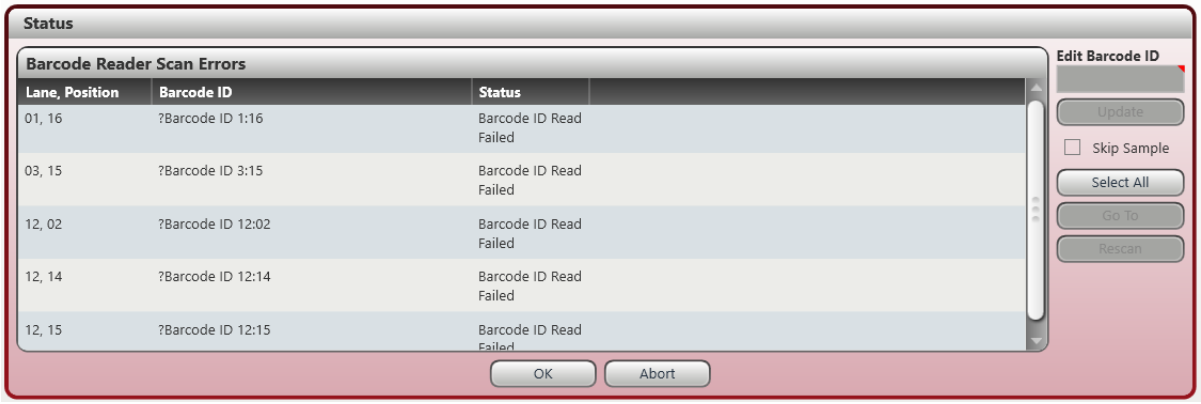


Figure 7-14. JANUS Application Assistant Barcode Reader Scan Errors

To correct an error, click the tube in the Barcode Reader Scan Errors pane to select the row. Each tube is identified in the table by the Lane number and Position number in the first column.

- To manually type the barcode, type the barcode in the **Edit Barcode ID** text box and click the **Update** button.
- To skip processing the tube for the rest of the run, click the **Skip Sample** check box.
- To move the tube cassette in front of the barcode reader, click the **Go To** button.
- To try scanning the tube again, click the **Rescan** button.

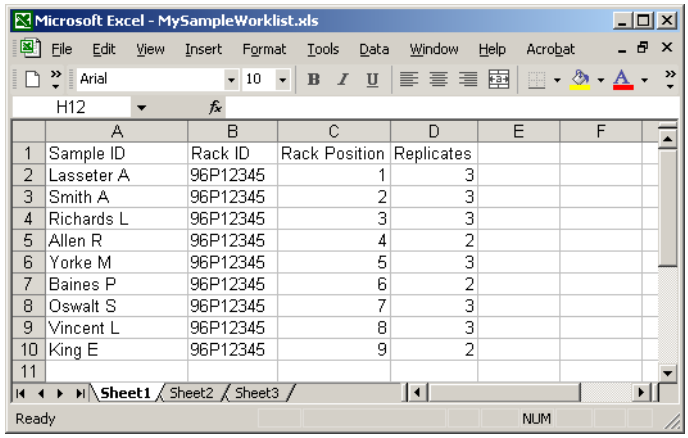
Chapter 8

Worklists

From the perspective of sample preparation, a worklist file contains specific information about each sample you want to process. The information in the file can vary, depending on the laboratory and protocol requirements. Typically, worklist files include a sample ID and the position of the sample at a minimum.

Worklist files can contain significantly more information about each of the samples, if desired. They can include dilution values, well mapping locations, sample volumes, replicate information, protocol selections, etc. WinPREP can read any runtime parameter from a worklist file. If necessary, you can include multiple worklist files in the protocol, assigning and using them as needed in the procedures.

You can use any program to create or edit worklists for JANUS G3, as long as it is capable of generating a delimited ASCII file. Most spreadsheet, word processor, and database programs can produce this kind of output. Delimited ASCII files are column-based and each row, or record, in the file contains information about a single sample. Each column represents a specific piece of information and a delimiter character separates columns in the record. The delimiter character can vary, but a comma is one of the most widely used. In fact, commas are so popular that comma-delimited text files have a specific name: Comma Separated Values or CSV. CSV file names typically include the "**.csv**" extension. While this is not a requirement, it helps identify the structure of the file. Figure 8-1 shows a typical worklist file.



	A	B	C	D	E	F
1	Sample ID	Rack ID	Rack Position	Replicates		
2	Lasseter A	96P12345	1	3		
3	Smith A	96P12345	2	3		
4	Richards L	96P12345	3	3		
5	Allen R	96P12345	4	2		
6	Yorke M	96P12345	5	3		
7	Baines P	96P12345	6	2		
8	Oswalt S	96P12345	7	3		
9	Vincent L	96P12345	8	3		
10	King E	96P12345	9	2		
11						

Figure 8-1. Worklist File Example

In this example, each row in the file is a single record and each record contains four pieces of information: sample ID, labware ID, position, and number of replicates. The first row in the file is the header, or title, record and identifies the data contained in each column.

Notice that the example worklist file is open in Microsoft Excel. WinPREP uses Microsoft Excel as its worklist and data file editor and includes a copy of Excel for this purpose. You can use any text-editing program to create and edit worklist files, but PerkinElmer recommends Microsoft Excel. The examples in this chapter all use Excel to manipulate worklist files.

Create and Edit a Worklist

When you create a worklist in Excel, or any other external program, you must specify and use one of the three WinPREP delimiter characters: a comma, a tab, or a space. Make sure the data does not contain any instances of the selected delimiter character. If the data contains the delimiter characters, or if the file uses a delimiter character other than a comma, tab, or space, WinPREP may not be able to process the data correctly.

For example, if you select a comma as the delimiter character for the worklist file, the worklist data should not include a comma but it can, and often will, contain spaces or tabs.

Using Excel to Edit a Worklist

Microsoft Excel provides all the functionality required to create, import, export, edit, and save worklist files. The sections below describe how to import and export CSV files using Microsoft Excel.

Exporting CSV files from Excel

To export CSV files from Excel, save the file using the CSV file type as described below.

To export a CSV file from Excel:

1. Use **File > Save** to save the Excel file.

Caution: Make sure the data in the Excel file does not contain any commas. If the data contains commas, Excel encloses the cell data in double quote (“) characters. This may cause problems, or undesirable output.

2. Select **File > Save As** from the menu bar. The **Save As** window opens.
3. Use the File Browser on the **Save As** window to select the desired export location for the CSV file.

4. Type a name for the file in the **File Name** field.
5. Select *CSV (Comma Delimited) (*.csv)* in the **Files of Type** list.
6. Click **Save**. Excel displays a message stating the selected file type does not support workbooks that contain multiple sheets.
7. Click **OK** to save the currently active sheet and close the warning window. Excel displays a second warning message stating the file may contain features that are not compatible with CSV files.
8. Click **Yes** to retain the file in CSV format and close the window.
9. Close the file and Microsoft Excel.

Importing CSV files into Excel

Importing a CSV file into Excel displays the values in each record in one row, with each data value in a single cell.

To import a CSV file into Excel:

1. Start Microsoft Excel.
2. Select **File > Open** from the menu bar.
3. Select *Text Files (*.prn; *.txt; *.csv)* in the **Files of Type** list.
4. Use the File Browser on the **Open** window to locate the desired CSV file.
5. Select the file and click **Open**. Excel opens and displays the contents of the file in a new window.

☞ *Note: If the data in the CSV file is not imported properly, it may be due to commas in the data. This is generally the case if some records import properly but other records do not.*

Using Worklists

Worklists are a powerful feature of the JANUS G3 system. You can configure a protocol generically, without having to specify sample information, and supply this information at runtime using a worklist. You do not need to specify the number of samples you want to process, since WinPREP reads this information from the worklist file. In fact, you can specify many different types of runtime parameters in a worklist file. Table 8-1 on page 220 provides a complete list of these parameters. Refer to the online help for a complete description of each control and parameter.

The ability to dynamically configure the protocols at runtime, from one or more worklist files, provides a flexible and efficient way to configure and reuse protocols.

Worklists also make it possible to store sample data in a location other than the protocol. You can enter, edit, maintain, and manipulate sample data in a custom database or Laboratory Information Management System (LIMS), and export the necessary data to a worklist for processing.

To use a worklist, you must associate it with one or more procedure nodes in a protocol. You can associate worklists with a procedure node in two different ways: statically, by linking the file to the node during protocol creation, or dynamically, by querying the operator for a worklist at runtime.

This section contains the following procedures:

- Statically Link a Worklist on page 221
- Dynamically Link a Worklist on page 224

Tab Controls		Runtime Parameters	
Tab	**Control Name**	**Type**	**Parameter Name**
Overview	Number of Samples	Parameters	Number of Samples
	Start with Sample	Parameters	Start with Sample
	Start with Destination	Parameters	Start with Destination
	Aspirate From	Well Maps	Asp. Well Map
	Dispense To	Well Maps	Dsp. Well Map
	Dispense Volume	Parameters	Dispense Volume
	Replicates	Parameters	Replicates
	ID	Parameters	Asp. Sample Id
Details	Waste Volume	Parameters	Waste Volume
	LLS	Parameter	LLS Verification
	Pre-Aspirate Mix Volume	Parameters	Pre-Aspirate Mix Volume
	Pre-Aspirate Mix Cycles	Parameters	Pre-Aspirate Mix Cycles
	Post-Dispense Mix Volume	Parameters	Post-Dispense Mix Volume
	Post-Dispense Mix Cycles	Parameters	Post-Dispense Mix Cycles
	Air Gap(s): System	Parameters	System Air Volume
	Air Gap(s): Transport	Parameters	Transport Air Volume
	Tip Adapters	Parameters	Tip Adapter List
Flush/Wash	Flush Location	Well Maps	Flush Well Map
	Flush System Liquid Volume	Parameters	Flush Volume
	Flush Cycles	Parameters	Flush Cycles
	Wash Fixed Tips Location	Well Maps	Wash Well Map
	Wash Fixed Tips System Liquid Volume	Parameters	Wash Volume
	Wash Fixed Tips Cycles	Parameters	Wash Cycles
Misc.	N/A	Parameters	Use This Node

Table 8-1. Tab Controls and Runtime Parameters

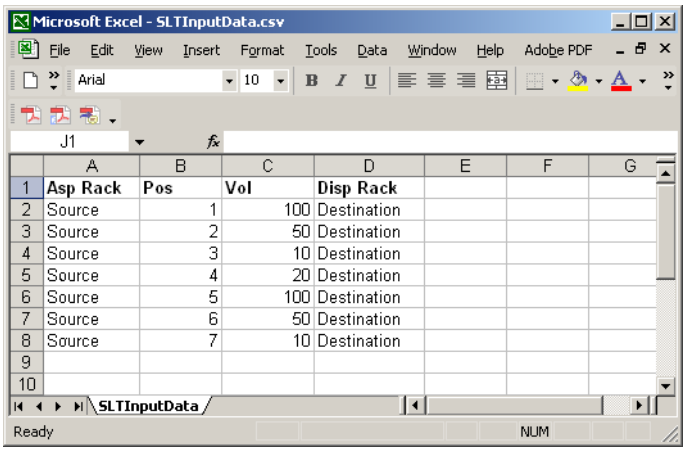
Statically Link a Worklist

When you statically link a worklist to a protocol, it is included in the protocol from that time forward. When you run the protocol, WinPREP looks for the file in the location you specified when you linked the file, and reads the file data. If it cannot find the specified file, the software displays a file not found error.

See Dynamically Link a Worklist on page 224 for instructions on how to dynamically query for a worklist file at runtime.

To use a worklist in a protocol:

☞ *Note:* *The steps* below *assume you are setting up a Single Liquid Transfer procedure to use a worklist and that the worklist you want to use already exists. The data included in the worklist includes source labware name, source labware sample position, transfer volume, and destination labware name. Figure 8-2 shows the worklist (***SLTInputData.csv***) used in these examples.*



	A	B	C	D	E	F	G
1	**Asp Rack**	**Pos**	**Vol**	**Disp Rack**			
2	Source	1	100	Destination			
3	Source	2	50	Destination			
4	Source	3	10	Destination			
5	Source	4	20	Destination			
6	Source	5	100	Destination			
7	Source	6	50	Destination			
8	Source	7	10	Destination			
9							
10							

Figure 8-2. Worklist Example (SLTInputData.csv)

1. Open the desired protocol in WinPREP.
2. Make sure you have a source labware named *Source* and a destination labware named *Destination* on the deck. You also need a Flush/Wash station on the deck.
3. Double-click the **Single Liquid_1** procedure node. The **Single Liquid Parameters** window opens.
4. Click the **Runtime Parameters** tab and click the **Files** button to open the **Runtime File Definitions** window.
5. Click the **Add** button to insert a new row in the **Defined Files** frame. This is where you associate the worklist file with the procedure.

6. Click in the **File or Variable** field in the newly-created row and click the **Browse** button to open the **Select File** window.
7. Use the file browser to select the desired worklist file and click **Open**. (This example uses a worklist file named **SLTInputData.csv**.)

   The software loads the file name, including path, into the **File or Variable** column in the **Defined Files** table and updates the **Preview of** pane with a preview of the first few records in the file. You can adjust the number of preview records by increasing or decreasing the **View Records** value.

☞ *Note: The starting location in the **Select File** window defaults to the **bin** folder in the WinPREP installation folder.*

8. Set the **File Type**, **Start Record**, and **Column Delimiter** to *Column*, *1*, and "," (the comma character, without the double quotes), respectively and click **OK**. Figure 8-3 shows this window. The **In Use** option is not checked because the worklist file is not yet associated with any runtime parameters.

☞ *Note: If the worklist file includes a header record, set the **Start Record** value to 2. This instructs WinPREP to ignore the first record in the file, as it does not contain sample data.*

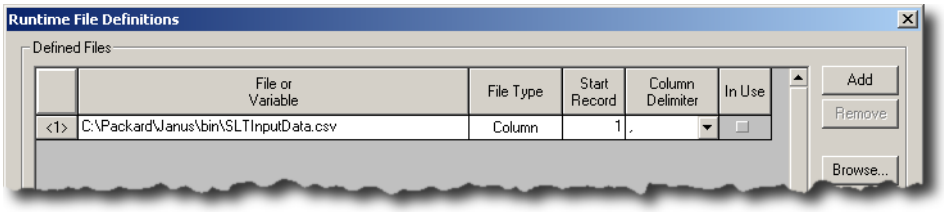


Figure 8-3. Runtime File Definitions window

9. Select *Well Map* from the **Type** drop-down list on the **Runtime Parameters** tab. The window displays the well map settings for the procedure.
10. Set the **Gets Data From** values to *File: Column* for both the **Asp. Well Map** and **Dsp. Well Map** parameters. The **File** values for both parameters update to the name of the worklist file. The **Rack Name Column #**, and **Position Column #** fields update to *1* and *2*, respectively. This is correct, except the **Rack Name Column #** for the **Dsp. Well Map** parameter should be the fourth column. Change this value to *4* and click **Apply**. Figure 8-4 shows this window in its completed state.

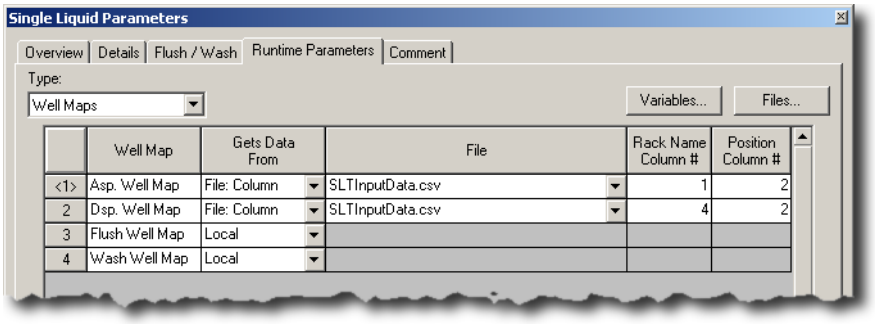


Figure 8-4. Runtime Parameters Well Map Settings window

This instructs WinPREP to transfer liquid from well one in the source plate to well one in the destination plate, well two in the source plate to well two in the destination plate, etc.

11. Select **Parameters** in the **Type** drop-down list. The window displays the runtime parameters for the procedure.
12. Set the **Gets Data From** value of the **Number of Samples** parameter to *File: Records*. This allows WinPREP to determine the number of samples to process from the number of records in the worklist file. The **File or Variable** column updates to include the name of the worklist file and the **Preview of** pane displays a preview of the records in the worklist.

☞ *Note: Because you associated the worklist file with a runtime parameter (**Number of Samples**), the **In Use** option on the **Runtime File Definitions** window is marked with a red check mark.*

13. Set the **Gets Data From** values for **Asp. Sample Id** and **Dispense Volume** parameters to *File: Column*. The **File or Variable** value updates to the name of the worklist file and the **Column # or Keyword** value updates to the numerical value one. Since the aspirate sample ID and dispense volume for the samples is in column two and three of the worklist, set the **Column # or Keyword** for **Asp. Sample Id** to 2 and **Dispense Volume** to *3*.
14. Click **Apply**. The worklist is statically linked to the protocol procedure.
15. Click **Close** to close the **Single Liquid Parameters** window.

When you run this protocol, WinPREP reads and processes the data in the file. As long as the file name and location stay the same, you can process new samples by updating the data in the file.

☞ *Note: When you set up the protocol, you specified the column numbers for input controls. For this reason, the order of the columns in the worklist file is important; you can change the data in the worklist but the arrangement of columns must be the same as the original worklist file.*

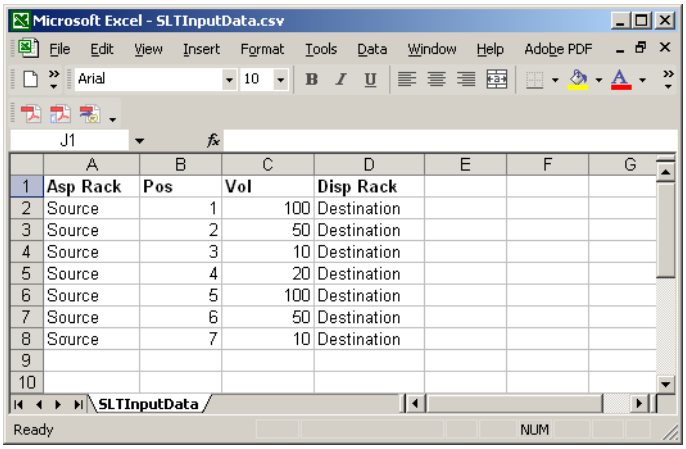
Dynamically Link a Worklist

In the previous example, you statically linked a worklist to the protocol outline. This method saves you the trouble of having to create a new protocol for the specified data and separates the protocol procedure from the data. You only need to update the worklist file when you want to process new data. This works fine for single protocols or protocols you run infrequently. However, instead of statically linking the worklist to the protocol, you can design the protocol so it queries for the worklist at runtime. This provides a whole new level of flexibility to your processing flow. You can set up and configure a protocol once and then dynamically select the sample data you want to process. Even though the data in the worklist changes, the protocol can process it, as long as the structure of the worklist remains the same.

To use the worklist, you must set up the protocol to prompt for a worklist file at runtime as described below.

To query for a worklist in a protocol:

☞ *Note:* *The steps* below *assume you are setting up a Single Liquid Transfer procedure to use a worklist and that the worklist you want to use already exists. The data included in the worklist includes source labware name, source labware sample position, transfer volume, and destination labware name. Figure 8-5 shows the worklist (***SLTInputData.csv***) used in these examples.*



	A	B	C	D	E	F	G
1	Asp Rack	Pos	Vol	Disp Rack			
2	Source	1	100	Destination			
3	Source	2	50	Destination			
4	Source	3	10	Destination			
5	Source	4	20	Destination			
6	Source	5	100	Destination			
7	Source	6	50	Destination			
8	Source	7	10	Destination			
9							
10							

Figure 8-5. Worklist Example (SLTInputData.csv)

1. Open the desired protocol in WinPREP.

2. Make sure you have two liquid containers such as test tube racks, microplates, etc., on the deck: one named *Source* and one named *Destination*. The Single Liquid procedure also requires a Flush/Wash station.

☞ *Note:* *To name labware, place the labware on the deck, double-click the item, type the name in the **Name** field on the labware **Parameters** window, and click **OK**. When you hover the cursor over the labware, the Tooltip displays the new name, along with other information about the labware.*

It is important to note the names of the source and destination labware on the deck must match the names in the worklist file *exactly*. If they do not match, WinPREP cannot perform the requested pipetting steps.

3. Double-click the **Single Liquid_1** procedure node you want to link with the worklist. The procedure parameters window opens.
4. On the **Overview** tab, set the **Gets Data From** fields for **Number of Samples** parameter to *File: Records*, the **Asp. Sample Id** parameter to *File: Column*, and the **Dispense Volume (µL)** parameter to *File: Column* and click **Apply**. Figure 8-6 shows a completed example of this window.

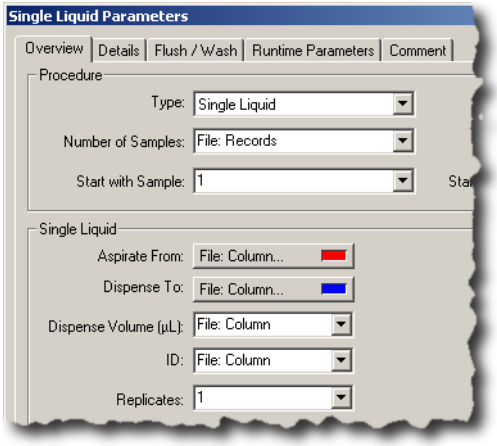


Figure 8-6. Single Liquid Parameters Settings

By setting the **Number of Samples** field to *File: Records*, WinPREP determines the number of samples to process by counting the number of records in the worklist file. This provides a way to dynamically determine the number of samples to process with each run of the protocol.

5. Select the **Runtime Parameters** tab and click the **Variables** button to open the **Runtime Variables Definitions** window.
6. Click the **Add** button to insert a new row in the **Defined Variables** table.

7. Type *Select_Worklist* in the **Variable Name** field and click **OK** to create the variable and return to the **Runtime Parameters** tab.

☞ *Note: Variable names cannot contain spaces. Use the underscore (_) to denote spaces in variable names.*

Figure 8-7 shows the complete **Runtime Variables Definitions** window.

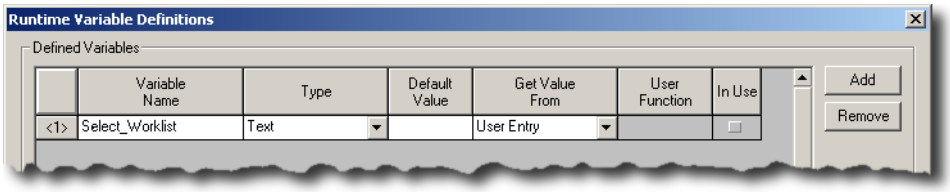


Figure 8-7. Runtime Variables Definitions

8. Click the **Files** button to open the **Runtime File Definitions** window.

   Because you set the parameters on the **Overview** tab to *File: Column*, the software created a "placeholder" entry in the **Defined Files** table.

9. Set the **File or Variable** field to *Var: Select_Worklist* for the row you inserted and click **OK** to return to the **Runtime Parameters** tab.

10. For the **Number of Samples** parameter, set the **File or Variable** column to *Select_Worklist*. The **Get Data From** field for this parameter is already set to *File: Records*, because you selected this option on the **Overview** tab.

11. For both the **Asp. Sample Id** and **Dispense Volume** parameters, set the **Gets Data From** column to *File: Column* and the **File or Variable** column to *Select_Worklist*.

12. For the **Asp. Sample Id** and **Dispense Volume** parameters, set the **Column # or Keyword** column to *2* and *3*, respectively. Figure 8-8 shows a completed example of this window.

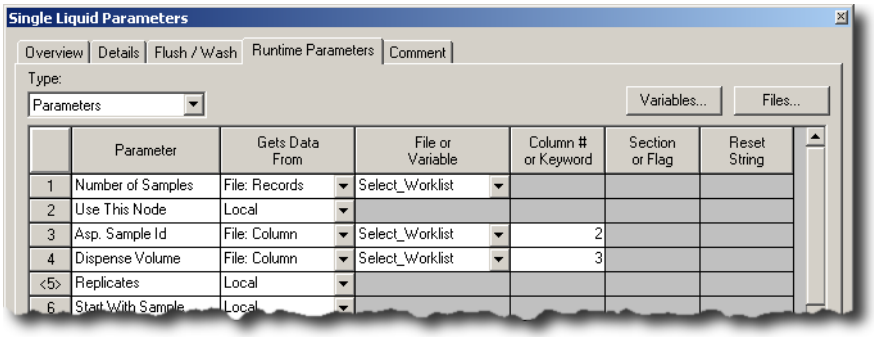


Figure 8-8. Runtime Parameters

13. Select *Well Maps* in the **Type** drop-down list.

14. For the **Asp. Well Map** and **Dsp. Well Map** parameters, set the **Gets Data From** columns to *File: Column*. The **File** column updates to contain the *Select_Worklist* runtime variable name, as shown in Figure 8-9.

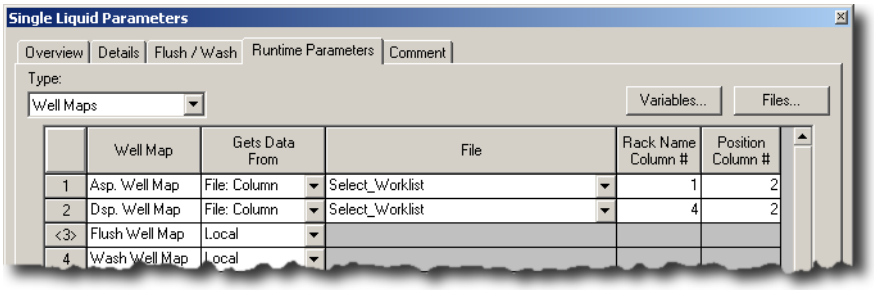


Figure 8-9. Runtime Well Map Parameters

15. For the **Asp. Well Map** parameter, set the **Rack Name Column #** and **Position Column #** columns to *1* and *2*, respectively. This tells the software where in the worklist to find the well map information for the aspirate step of the procedure.
16. For the **Dsp. Well Map** parameter, set the **Rack Name Column #** and **Position Column #** columns to *4* and *2*, respectively. This tells the software where in the worklist to find the well map information for the dispense step of the procedure.
17. Click **OK** to save the changes and close the properties window.
18. Double-click the **Initial User Query** node in the protocol outline. The **Initial User Query Parameters** window opens as shown in Figure 8-10.

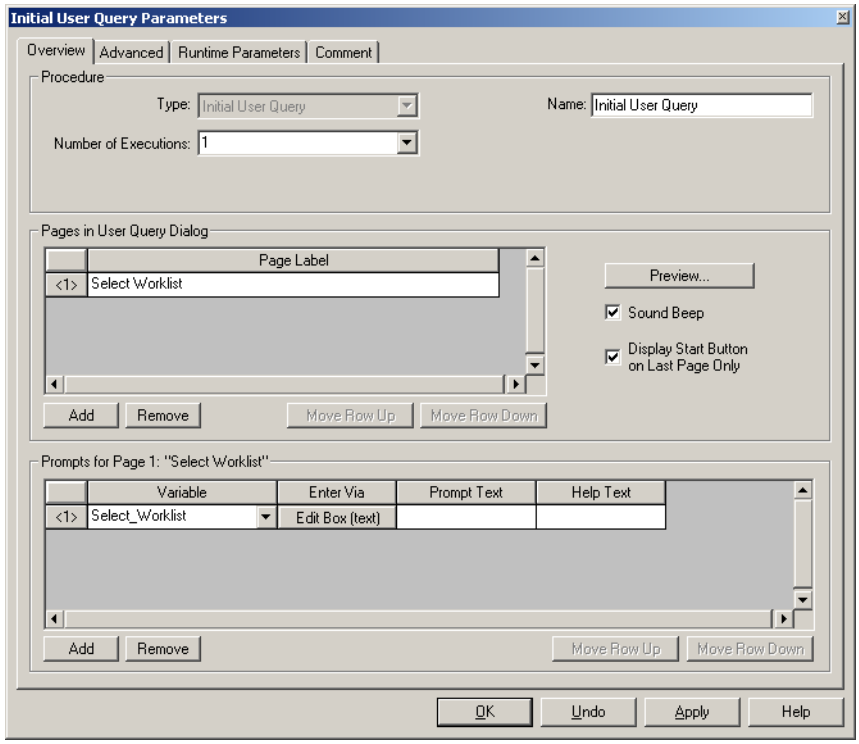


Figure 8-10. Initial User Query Parameters

19. Click the **Add** button under **Pages in User Query Dialog** to add a new query page. The query page is used to prompt for the worklist at runtime.
20. Type *Select Worklist* in the **Page Label** column and click the **Add** button in the **Prompts for Page 1: "Select Worklist"** frame.
21. Set the **Variable Name** field to *Select_Worklist* and click the button in the **Enter Via** column to open the **Enter Via** window shown in Figure 8-10.

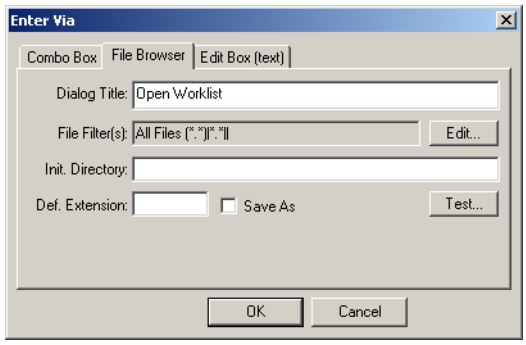


Figure 8-11. Enter Via window

22. Select the **File Browser** tab, type *Open Worklist* in the **Dialog Title** field, and click the **Edit** button to the right of the **File Filters** field. The **File Selection Filter(s)** window opens as shown in Figure 8-12.

    The file browser allows you to prompt with a standard Windows file browser to locate and select the worklist file. File filters limit the files that display in the file browser to one or more file extensions.

23. Click the **Add** button to insert a new filter row, type *Comma Separated Values (CSV) (*.csv)* in the **Description** field and **.csv* in the **Value** field, and click the **Move Row Up** button to move the row to the top of the list. Figure 8-12 shows the **File Selection Filter(s)** window in its completed state. Click **OK** to save the changes and return to the **Enter Via** window.

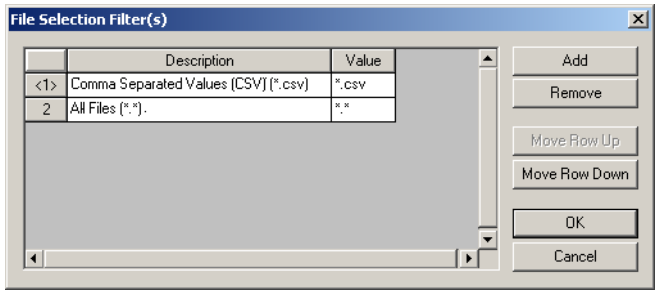


Figure 8-12. File Selection Filter(s) window

24. Type the path to the folder where you want the file browser to start in the **Init. Directory** field. This specifies the folder that opens in the file browser when it starts.

☞ *Note: If you do not enter a value in the **Init. Directory** field, the initial folder defaults to the **\Bin** folder in the WinPREP installation folder.*

Figure 8-13 shows the **Enter Via** window in its completed state.

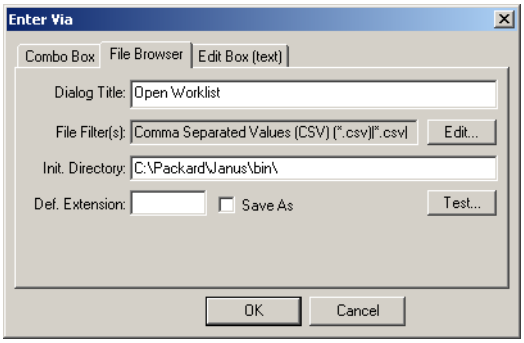


Figure 8-13. Enter Via window

25. Click the **Test** button to preview how the file browser looks and works. When you are done previewing the file browser, click **Cancel** to return to the **Enter Via** window.

26. Click **OK** to save the changes and return to the **Initial User Query Parameters** window.
27. Click **OK** to save the changes and close the **Initial User Query Parameters** window.
28. Select **Run > Evaluate Protocol** to view the window in the protocol. This operation executes the steps in the protocol without actually moving the equipment or pipetting liquids. Figure 8-14 shows a worklist query window at runtime.

☞ *Note:* *If you prompt for a worklist in the protocol, each of the potential worklist files must follow a consistent format. For instance, in this example, sample ID and volume of liquid to transfer occupy columns one and two in the file, respectively. Any future files must follow the same convention; they must contain the sample ID in column one and the volume of liquid to transfer in column two.*

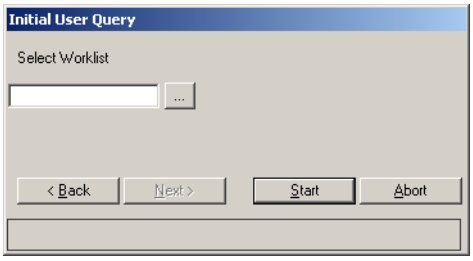


Figure 8-14. Query for Worklist windows

Each time the protocol runs, the user is prompted for the input worklist.

Chapter 9

JANUS Security

System security for the JANUS G3 Automated Workstation, the WinPREP software, and the JANUS Application Assistant software is handled through the standard Windows User Account security. Security and privilege access is controlled through password protected user log in. Three levels of security access for user accounts are created when WinPREP is installed:

- Packard User
- Packard Administrator
- Packard TSE

Each security level allows increased accessibility to the system over the previous level, with Packard TSE having the greatest control. You can create as many users as necessary to maintain security and usability of the system. System administrators can create or modify User Accounts with the User Manager program, one of the standard Administrative Tools provided with the Windows operating system.

In addition to the standard Windows User Account security, PerkinElmer offers the JANUS Enhanced Security Option, which provides 21 CFR Part 11 compatibility. For more information, see the documentation that is included with the JANUS Enhanced Security Option integration kit.

This section contains the following information:

- Security Levels on page 232
- Assigning Local Users to JANUS Security Groups on page 234
- Assigning Domain Users to JANUS Security Groups on page 238

Security Levels

The sections below describe each of the three levels of security access in detail. The JANUS Security levels only affect access to WinPREP and JANUS Application Assistant. Other programs are not affected by the JANUS security.

Packard User
Packard User level has the most restricted accessibility to the system. These users can open and run protocols that are already defined. They cannot modify the protocols or change any parameters except for those that require a runtime response. This group can also access system setup and diagnostic tests.

Packard Administrator
Packard Administrator level has permission to create, open and run protocols as necessary for the administration of the system. This group also has access to calibration, setup and performance file utilities that are required to ensure proper operation of the system.

☞ *Note: Packard Administrator level does **not** include system administrator permissions. If this is desired, make the user account a member of both the Packard Administrator **and** the Administrators groups.*

Packard TSE
Packard TSE level is intended only for use by the PerkinElmer Technical Service Engineer. An account for this purpose is automatically created on installation to allow password access by appropriate personnel for setup and maintenance purposes. This user has all of the Packard Administrator privileges plus access to additional service utilities for system calibration, configuration, and troubleshooting.

When the Technical Service Engineer logs into Windows with Packard TSE level, they have unrestricted access to all functions of the WinPREP software and the service utilities.

☞ *Note: Packard TSE group does **not** include system administrator permissions. If this is desired, make the user account a member of both the Packard TSE **and** the Administrators groups.*

The table below summarizes the functionality available for each security level:

Task	Packard User	Packard Admin	Packard TSE
Open existing protocols in WinPREP or JANUS Application Assistant	Yes	Yes	Yes
Respond to User Query prompts for runtime parameters	Yes	Yes	Yes
Execute protocols	Yes	Yes	Yes
Save protocols in WinPREP	No	Yes	Yes
Modify existing protocol outlines	No	Yes	Yes
Add labware to the deck view	No	Yes	Yes
Modify existing deck layouts	No	Yes	Yes
Evaluate protocols	Yes	Yes	Yes
Edit the Labware Library	No	Yes	Yes
Edit the Performance Set Library	No	Yes	Yes
Perform Utilities-Setup functions	Yes	Yes	Yes
Perform Utilities-Diagnostic Tests functions	Yes	Yes	Yes
Perform Utilities-Database maintenance functions	Yes	Yes	Yes
Run service utilities for configuration, calibration and troubleshooting	No	No	Yes

Creating or Modifying User Accounts

To add a new user for the JANUS G3 Automated Workstation, you must have Windows System Administrator privileges on the computer. Only System Administrators can create or modify User Accounts.

When the WinPREP software is originally installed, three new Local Groups are created. By making a user account a member of one of these three groups, the user's access to features in the WinPREP software and the JANUS Application Assistant software is defined. Each level of security builds on the previous level, so you do not need to add more than one of the defined security groups to a User Account.

Users can be local users that are only defined by a Local user account on the computer, or domain users that have a user account on the domain that is used to log into the local computer. See the appropriate section below for details on assigning a user account to a JANUS security group:

- Assigning Local Users to JANUS Security Groups on page 234
- Assigning Domain Users to JANUS Security Groups on page 238

Assigning Local Users to JANUS Security Groups

This section explains how to change the Security Group for a Local User. This procedure can only be performed by a user with **Packard Admin** or **Packard TSE** permissions.

1. Click the **Windows Start** button.
2. Right-click on **Computer** and then click **Manage** in the shortcut menu. The Computer Management window opens.

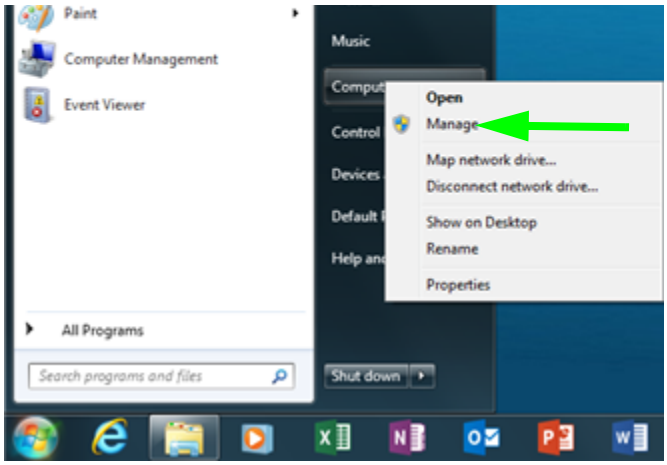


Figure 9-1. Computer > Manage

3. Navigate to **Local Users and Groups > Users**.

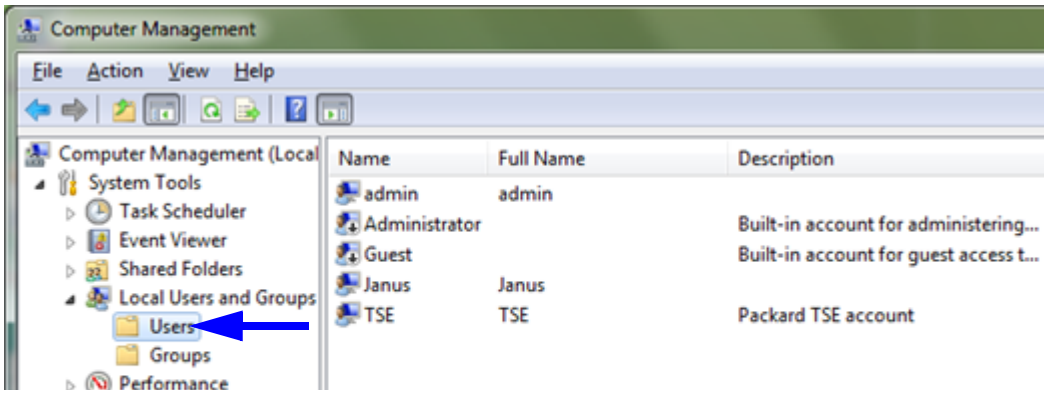


Figure 9-2. Users Folder

4. Double-click the Name of the User to change the security group. The Properties window for the selected user opens as shown in Figure 9-3.

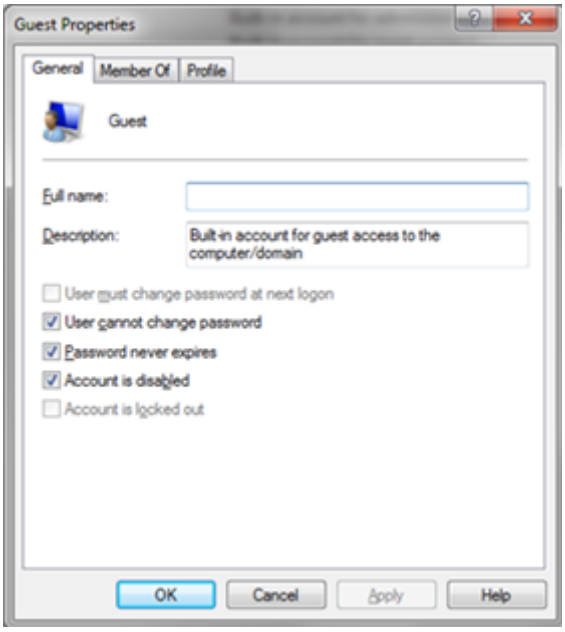


Figure 9-3. User Properties Window

5. Click the **Member Of** tab.

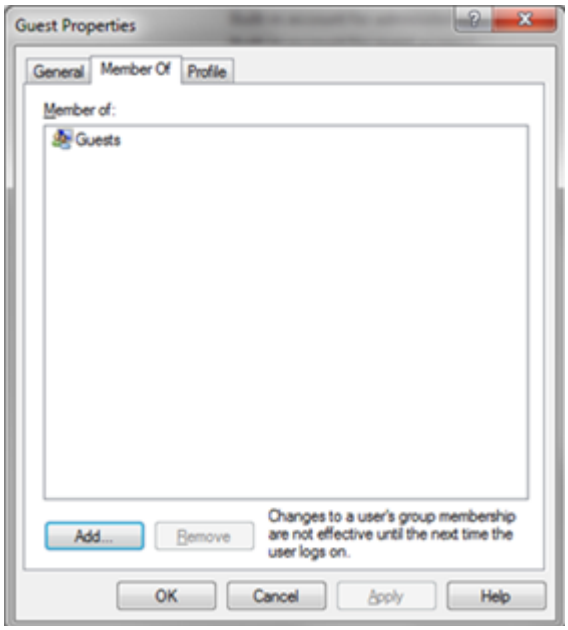


Figure 9-4. Member Of Tab

6. Click the **Add** button. The Select Groups window opens.
7. Click the **Advanced** button (see Figure 9-5) to search for the desired group.

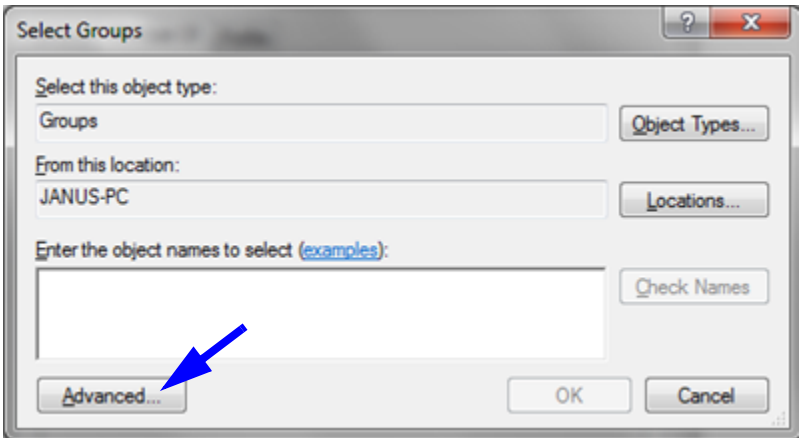


Figure 9-5. Select Groups Window - Advanced Button

8. Click the **Find Now** button. All Groups defined on the computer display at the bottom of the window as shown in Figure 9-6.

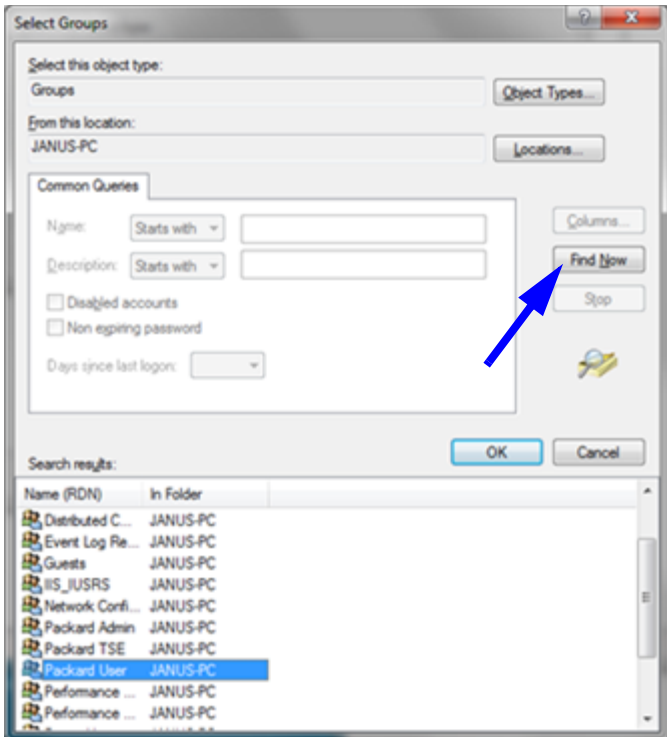


Figure 9-6. Find Now-Search Results

9. Double-click the Security group to add the group to the selected user, or highlight multiple groups and click the **OK** button. (See Security Levels on page 232 for details about the permissions for each security group.) The Select Groups window displays the selected security groups.
10. Click the **OK** button to display all groups assigned to the user in the **Member Of** list as shown in Figure 9-7.

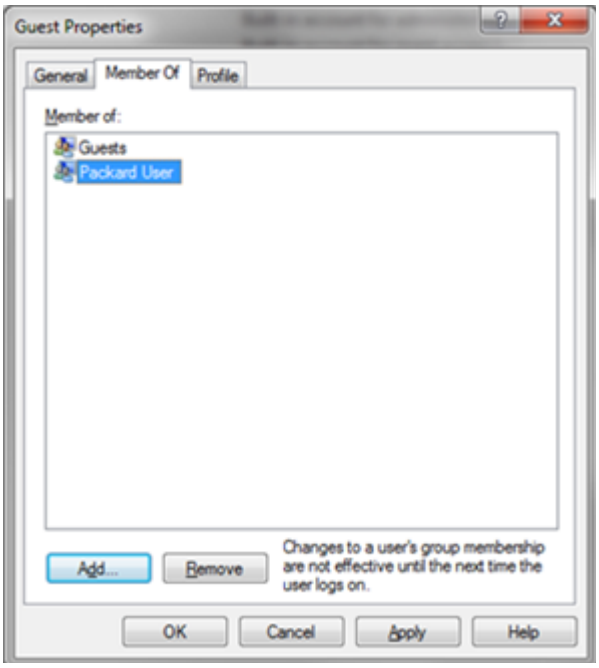


Figure 9-7. New security Groups Added

11. Click the **OK** button to save the changes.

☞ ***Note:*** *To remove a security group from the user, highlight the group in the **Member Of** list and click the **Remove** button.*

☞ ***Note:*** *The security group changes will take affect the next time the user logs in.*

Assigning Domain Users to JANUS Security Groups

This section explains how to assign a Domain User to a JANUS Security Group. This procedure can only be performed by a user with **Packard Admin** or **Packard TSE** permissions.

1. Click the **Windows Start** button.
2. Right-click on **Computer** and then click **Manage** in the shortcut menu. The Computer Management window opens.
3. Navigate to **Local Users and Groups > Groups**.
4. Double-click the Name of the Local Group that you want to assign the user to (Packard Admin, Packard User, or Packard TSE). The Properties window for the selected group opens.
5. Click the **Add** button. The Select Users, Computers, Service Accounts, or Groups window opens.

6. Click the **Advanced** button.
7. Verify the domain for the user account is listed in the **From this location** text box. If necessary, click the **Locations** button and select the correct location.
8. Click the **Find Now** button. All users defined on the specified domain display at the bottom of the window. If desired, use the Name and Description filters to locate the desired user.
9. Double-click the user name to add the user to the selected group, or highlight multiple users and click the **OK** button. (See Security Levels on page 232 for details about the permissions for each security group.) The Select Users, Computers, Service Accounts, or Groups window displays the users selected to add to the group.
10. Click the **OK** button to display all of the users in the group in the Properties window for the group.
11. Click the **OK** button to save the changes.

☞ ***Note:*** *To remove a user from the security group, highlight the user in the **Members** list and click the **Remove** button.*

☞ ***Note:*** *The security group changes will take affect the next time the user logs in.*

Chapter 10

Reports

WinPREP tracks and maintains data about the protocols you run on the instrument. The software installation included a full version of Microsoft Access, which WinPREP uses as its database and reporting engine. Several reports, useful for auditing and tracking, are included with WinPREP. The tools built into Microsoft Access can be used to create custom reports.

This section contains:

- Protocol Activity Reports on page 240
- Adding Reports on page 242
- Viewing Reports on page 243
- Purge Protocol Reporting Data on page 245
- Custom Reports on page 246
- Writing Custom Queries on page 249

Protocol Activity Reports

When you run a protocol, WinPREP logs information about the equipment and protocol in its database. This data is the basis for a variety of protocol activity reports. These reports, which summarize information about the protocol runs, provide a historical record of the instrument's operation and usage.

The reports provided with the instrument are grouped into the following general categories:

- Protocol Summary Report
  There are multiple versions of this report; each contains the same information but uses different sort criteria to display the data. The report can be sorted by Source Rack ID, Destination Rack ID, or Comma Delimited. You can output these reports to screen, printer, or file.
- Labware Movements Report
  There are two versions of this report; each contains the same information but uses different sort criteria to display the data. The report can be sorted by Labware ID or Chronologically. You can output these reports to screen, printer, or file.

- Labware Movements and Pipetting Chronological Report
  This report comes in a single version, sorted chronologically by Labware Movements and Pipetting. You can output this report to screen, printer, or file.
- Error Report
  There are multiple versions of this report; each contains the same information but uses different sort criteria to display the data. The report can be sorted by Well Position, Sample ID, Component, Showing Preceding Operation, or All Operation Errors. You can output these reports to screen, printer, or file.
- Dispense Volume Report
  There are multiple versions of this report; each contains the same information but uses different sort criteria to display the data. The report can be sorted by Sample Rack Well, Rack Well Sample, or Chronological by Tip. You can output these reports to screen, printer, or file.
- Aspirate Dispense Volume Report
  There are two versions of this report; each contains the same information but uses different sort criteria to display the data. The report can be sorted by Sample Rack Well or Chronological by Tip. You can output these reports to screen, printer, or file.

In addition to the reports, two queries are provided with the software:

- _DispenseVolumeQueryForTestId
  This query extracts the dispense volume data for a specific protocol ID. You can output the results of this query to screen, file, or Excel. If you choose to output the files in Excel, the query opens Excel and displays its results in a new spreadsheet window.
- _AspirateDispenseVolumeQueryForTestId
  This query extracts the aspirate and dispense volume data for a specific protocol ID. You can output the results of this query to screen, file, or Excel. If you choose to output the files in Excel, the query opens Excel and displays its results in a new spreadsheet window.

The sections below describe how to add reports to the protocol outline, view reports, purge protocol reporting data, and create custom reports.

Adding Reports

You can configure the protocols to create one or more reports automatically. This configuration allows you to send the automatically generated reports to the screen, to a file, or to the default printer. You assign automated report generation on a protocol-by-protocol basis, so you can automatically generate reports for some protocols and not others. To automate report generation, you must associate one or more reports with the protocol outline by adding them to the Protocol Outline node as described below.

To add a report to a protocol:

1. Double-click the **Protocol Outline** node in the protocol outline to open the **Protocol Outline Parameters** window shown in Figure 10-1.

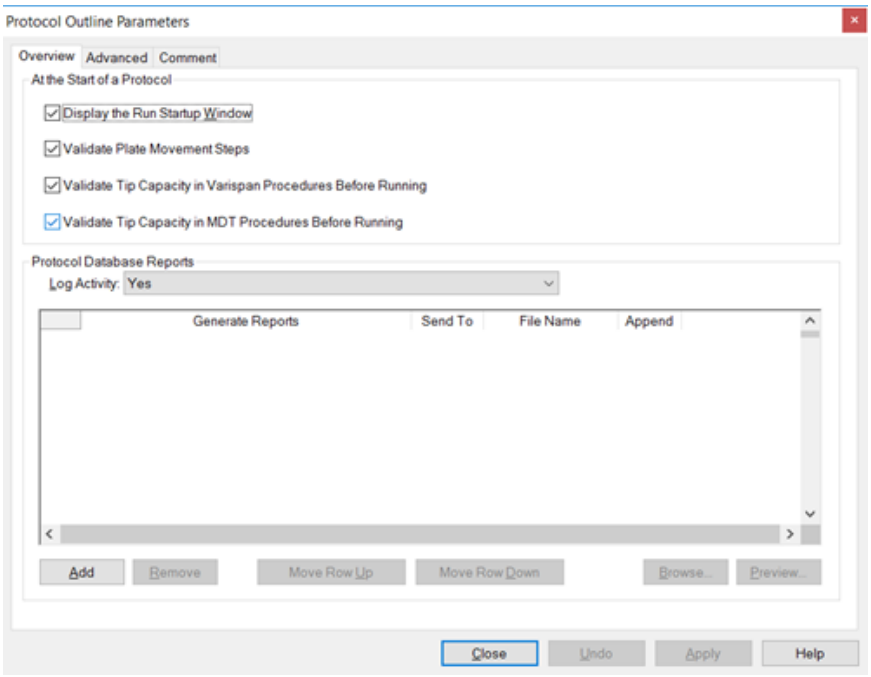


Figure 10-1. Protocol Outline Parameters Window

2. Select either *Yes* or *Yes, but purge the protocol after reports are generated* in the **Log Activity** drop-down list. Selecting *Yes* records the protocol data in the database for later reporting. You can generate reports from this data until you purge it from the database. Selecting *Yes, but purge the protocol after reports are generated* records the protocol data, immediately generates the selected reports, and deletes the data from the database. With this option, the generated reports are the only record of the protocol. If you choose *No* for the **Log Activity** option, WinPREP will not record the protocol data.
3. Click **Add** in the **Protocol Database Reports** frame to add a report option to the table.

4. Set the **Generate Reports** option to the name of the desired report. If you are not sure which report you want to include, click **Preview** to open the database and to generate an example of one or more reports using data from previous protocols.
5. Select the desired output format in the **Send To** drop-down list. You can choose to send the report to the screen, save it to a file, or print it to the default printer. selecting *File* as the **Send To** value enables the **File Name** and **Append Id** columns in the table. Type a file name, including path, in the **File Name** field, or use the **Browse** button to select the desired output file. When selected, the **Append Id** option adds the protocol identification number from the database to the file name you supply.
6. Repeat step 3 through step 5 until the table includes all the desired reports.
7. Click **OK** to save the settings and close the window or click **Apply** to save the settings without closing the window.

Viewing Reports

By default, WinPREP logs information about each protocol in a database; viewing reports is a manual process. You must open the database, select the desired protocol, and generate one or more reports. However, you can configure WinPREP so it generates and saves reports to a file or displays them on the screen as the protocol runs. Since you configure and apply these settings in the protocol outline, you can customize the reporting setup for each protocol. This provides a great deal of flexibility.

Manually Viewing Reports

You can manually generate, view, print, and save reports based on the recorded information. These reports are installed with the software and display data recorded by WinPREP during a protocol run.

To manually view reports:

1. Click the Microsoft Access icon on the WinPREP toolbar to open the reporting database.
2. Select the name of the protocol you want to view in the **Protocol Selection** frame.
3. Select the desired report or query from the **Report/Query/Action Selection** drop-down list.

4. Select the format for the report in the **Output Selection** drop-down list.

☞ *Note:* *If you selected File in the **Output Selection** list, WinPREP opens a **Save As** window. Browse to the desired location, type a file name, and click **Save** to close the window. The **Output File** field on the database window updates to display the path and filename for the file you entered.*

5. Click **Apply** to generate the report. Note that:
   - If you selected *Screen* as the **Output Selection** type, Microsoft Access displays the formatted report in a new window where you can print or view the report.
   - If you selected *File* as the **Output Selection** type, Microsoft Access saves a plain text file to the specified location.
   - If you selected *Print* as the **Output Selection** type, Microsoft Access sends a copy of the formatted report to the default printer.
   - If you selected *Excel* as the **Output Selection** type, Microsoft Access opens Microsoft Excel and displays a tabular list of the report data. Excel is only available when you select one of the query types in the **Report/Query/Action Selection** list.
6. Repeat steps 2 through 5 to generate each of the reports you want.
7. Click **Exit** to close Microsoft Access when you are finished generating and viewing reports.

Viewing Reports after each Run

As described in the previous section, you can manually generate and save reports for any protocol, as long as the protocol data is in the database. However, you might want a report of the protocol execution without storing the data in the database. In this case, you can configure WinPREP to generate a set of reports, and purge the data recorded during the protocol run, when the protocol completes.

To automatically create reports at protocol completion:

1. Double-click the **Protocol Outline** node in the protocol outline to open the **Protocol Outline Parameters** window.
2. Make sure the **Log Activity** option is set to the *Yes, but purge the protocol after reports are generated* or the *Yes* option.
3. Use the **Add** and **Remove** buttons to select the desired reports in the **Protocol Database Reports** frame. See Adding Reports on page 242 for more information.

4. Set the **Send To**, **File Name**, and **Append Id** options, as required.

*Note: If the file specified in the **File Name** field already exists, the new file will overwrite the contents of the existing file.*

5. Click **OK** to save the settings and close the window or click **Apply** to save the settings without closing the window.
6. Save and run the protocol. The software executes the protocol and generates, saves, and displays the reports and queries you configured for the protocol.

Purge Protocol Reporting Data

Because WinPREP tracks and logs information about each protocol you run, the database can become very large over time or after many protocol operations. This size increase can negatively affect database performance. It is a good idea to periodically clear the database of unnecessary protocol data. You should also regularly compress the database to keep its overall size manageable, or you can configure WinPREP to purge protocol data from the database automatically. For more information, see Viewing Reports after each Run on page 244.

To manually purge protocol data from the database:

1. Click the Microsoft Access icon on the WinPREP toolbar or select **Utilities > Database** from the main menu to open the reporting database.
2. Select the name of the protocol you want to purge in the **Protocol Selection** frame.
3. Click the **Purge** button. WinPREP deletes the information for the selected protocol from the database.

Caution: Take care when using the purge operation. There is no way to recover protocol reporting data after you purge it from the database.

4. Repeat step 2 and step 3 to delete the remaining unnecessary report data. You can select multiple items by holding down the **<Shift>** key while clicking.
5. Click **Exit** to close the database.

To compress the database:

1. In WinPREP, hold down the **<Shift>** key and click the Microsoft Access icon or use Windows Explorer to navigate to the location where the database is located (in the **database/** folder of the WinPREP installation folder). Hold down the **<Shift>** key and double-click the Microsoft Access icon.

   This bypasses the reporting interface and opens the Microsoft Access object browser window.

2. Select **Tools > Database Utilities > Compact and Repair Database** from the menu bar. Access may display a **Security Warning** window, advising you that the file may not be safe. Click **Open** to close this window.

Microsoft Access reads through the file and attempts to compact the data and structures in the database. It is possible to get a significant amount of compression of the data using this method.

Caution: The time required to compress the database can vary considerably based on factors such as the size of the database at the time you perform the compression.

Custom Reports

Because WinPREP uses Microsoft Access as its data store and reporting engine, there are a wide range of reporting options available. The software comes with several pre-built report templates and you can create custom or specialized reports to suit your needs.

Microsoft Access provides two ways to create custom reports: the report wizard and the report designer. The report wizard automates the process of designing a report by presenting a series of options, such as the tables or queries containing the data and the fields you want to include on the report. The selections to these options provide the information the wizard needs to build the report. Once created, you can further customize the report using the report designer. The wizard is the quickest and easiest way to create a customized report; however, it does not provide the same level of fine control as using the designer.

The report designer provides the tools you need to build the report manually. Using a point-and-click interface, you can configure nearly every aspect of the report including page layout, header and footer content, data content, and text formatting. While it requires more work than the wizard, it grants you complete control over the look and content of the report.

Often, some combination of the report wizard and the report designer is the easiest way to create a customized report. You can use the report wizard to quickly generate the report and then use the report designer to organize and rearrange the page layout or data content to meet your needs.

Detailed explanations of the report wizard and the report designer are beyond the scope of this document. If you have questions about the report designer or report wizard when completing the procedures below, refer to the online help provided with Microsoft Access.

To create a custom report using the report wizard:

1. **<Shift> + click** the Microsoft Access icon on the WinPREP toolbar to open the reporting database. This bypasses the reporting interface and opens the Microsoft Access object browser window shown in Figure 10-2.

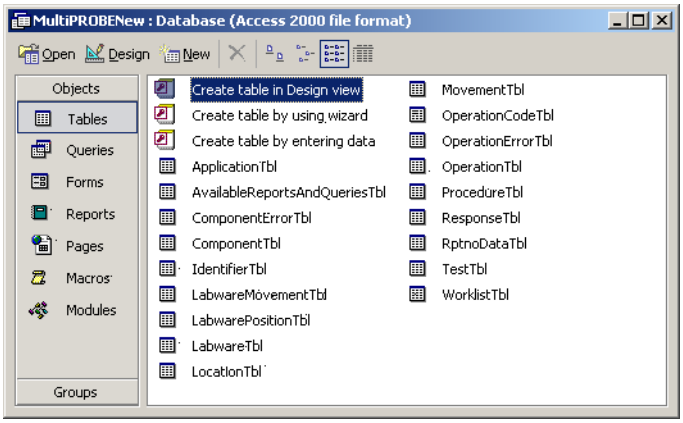


Figure 10-2. Microsoft Access Object Browser window

2. Select **Reports** from the **Object** column on the left side of the window. The browser portion of the window updates and displays a list of all the available report layouts.
3. Double-click **Create report by using wizard** in the object browser list box.
4. Select the source of the data (table or query) from the **Tables/Queries** drop down list, move the fields you want to include on the report from the **Available Fields** list box to the **Selected Fields** list box, and click **Next**.
5. Select the grouping levels for the report, as desired, and click **Next**.
6. Select the sort order for the detail lines on the report, as desired, and click **Next**.
7. Select the **Layout** and **Orientation** options for the report and click **Next**. As you select layout options, the preview pane updates and displays a simplified view of the selected report.
8. Select a style for the report and click **Next**. The style controls the colors, images, and backgrounds used on the report. As you select style options, the preview pane updates and displays a simplified view of the selected style.
9. Type a title for the report, click the **Preview the Report** option, and click **Finish**. WinPREP saves the custom report and opens it for preview in a new window.

Caution: Be sure to select a unique name for the custom report. If you do not, the custom report will overwrite any existing report with the same name.

10. The report is available in the **Generate Reports** list on the Protocol Outline Parameters window.

To create a custom report using the report designer:

1. **<Shift>**-click the Microsoft Access icon on the WinPREP toolbar to open the reporting database. This operation bypasses the reporting interface and opens the Microsoft Access object browser window. (See Figure 10-2 for an example.)
2. Select **Reports** from the **Object** column on the left side of the window. The browser portion of the window updates and displays a list of all the available report layouts.
3. Double-click **Create report in design view** in the object browser list box. Access opens a new, blank report design window.
4. Design the report as desired using the tools in the report designer tool box. For information about using the report designer, including tools, consult the Microsoft Access online help.
5. Select **File > Save As** to save the file.
6. Type a name for the custom report and click **OK**.

Caution: Be sure to select a unique name for the custom report. If you do not, the custom report will overwrite any existing report with the same name.

7. Continue designing the report until you are satisfied with the way it looks, save the changes, and close the report designer window.
8. Double-click the report in the object browser list box to open and populate the report with the data you specified.
9. The report is available in the **Generate Reports** list on the Protocol Outline Parameters window.

Writing Custom Queries

Queries are typically used to output columnar data without any special formatting. This data can then be viewed on screen, exported to a file or exported directly to Excel for further analysis. The following steps describe how to write your own query in Access:

1. Name the query. The name must begin with an underscore (_) character. Only queries beginning with the underscore character will display in the Report/ Query/Action Selection frame of the Database Operations window.
2. Filter the query. To filter the query to include only the selected protocolId, you must:
   - Include “protocolId” as one of the columns returned by the query.
   - Create a form with a name that is the same as the query, with the name preceded by the word “Form”. For example, if the query name is “_UserQuery”, the form name must be “Form_UserQuery”.
   - Include “protocolTbl.protocolId” as one of the columns returned by the query, if the query output is directed to a file.
3. Open the Microsoft Access form named “registers”. This action “registers” the query so that it is available in the WinPREP Protocol Outline Parameters window Generate Reports list.

Chapter 11

Labware Libraries

The Labware Library is used to create and edit labware used in the WinPREP software This section describes how to use the labware library.

WinPREP labware is an electronic representation of the physical laboratory equipment used on the instrument deck during a protocol. Labware includes test tubes, test tube racks, microplates, support tiles, flush/wash stations, and many other types of common laboratory equipment. WinPREP groups similar types of labware into categories. Labware is assigned to a category when the labware is created. The labware categories make it easier to locate the desired labware.

WinPREP provides an extensive library of predefined labware items. Although the predefined labware will meet many of your needs, you may require labware that is not defined in the library. Before you can use new labware with the JANUS G3, you must define the physical dimensions of the labware so that the JANUS G3 can accurately access the labware.

This section contains the following procedures:

- Viewing the Labware in the Labware Library on page 251
- Creating New Labware on page 252
  - Copy an Existing Labware Definition on page 252
  - Create a New Labware Definition on page 253
  - Open the Labware Properties Window on page 259
  - Set the Labware Properties in the Details Tab on page 261
  - Evaluate the Labware on page 262
- Editing Labware on page 264
- Creating Custom Labware Images on page 264
- Importing Labware Definitions on page 267

Viewing the Labware in the Labware Library

The Labware Library window enables you to view the labware assigned to each labware category, to add new labware, or to edit existing labware.

To view labware in the Labware Library window:

1. Select **Utilities > Labware Library** on the main menu. The Labware Library window opens as shown in Figure 11-1. The **Labware Library** window lists all of the defined labware categories on the left side of the window.

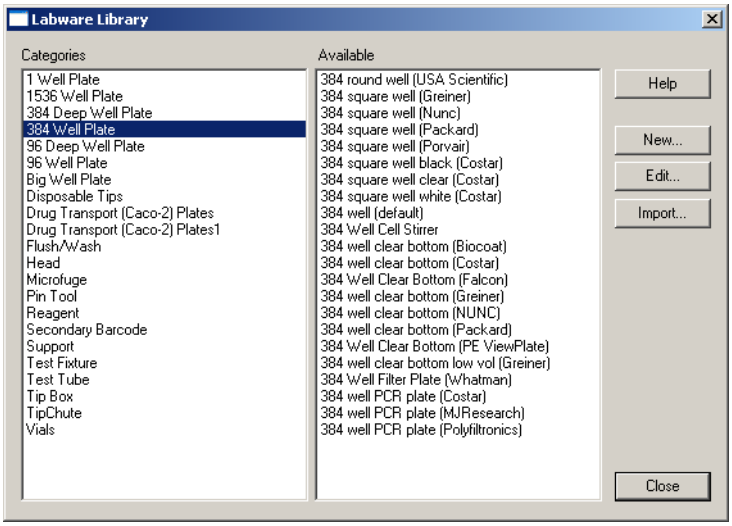


Figure 11-1. Labware Library window

2. Select a category in the **Category** list. The **Available** list displays all of the labware in the selected category. (Labware can only be included in one category.)
3. If you want to edit a labware item or view the labware parameters, select the labware name and click the **Edit** button. See Editing Labware on page 264.
4. If you want to create a new labware item, click the **New** button. You do not have to select a category or labware name. The New Labware Wizard opens. See Creating New Labware on page 252.
5. If you want to import labware definitions from another JANUS G3 system or a MultiPROBE II system, click the **Import** button. See Importing Labware Definitions on page 267.

Creating New Labware

The **New Labware Wizard** provides a step-by-step process to define new labware for the system. You can create a new labware definition either by basing the new labware on an existing labware item or by manually selecting the options for the new labware.

The New Labware Wizard asks you a series of questions about the general layout of the labware. As you respond to these questions and click the **Next** button, you proceed through a series of pages with questions appropriate to the selections you made on previous pages. The next page in the wizard depends on the responses to previous pages. To change the selection on a previous page, click the **Back** button one or more times to return to previous pages. On the final window, click the **Finish** button to save the labware with the selections.

After completing the **New Labware Wizard**, use the **Labware Properties** window to define the critical dimensions of the labware. You can use the **Evaluate** tab to actually move a tip or arm to the desired position or you can use the **Details** tab to enter physical measurements. In either case, you need to provide data for *all* the critical parameters listed on the left side of the Details tab.

Overview of creating new labware:

1. Follow the instructions in Viewing the Labware in the Labware Library on page 251 to open the New Labware Wizard.
2. Choose whether to base the new labware on existing labware:
   - See Copy an Existing Labware Definition on page 252 to base the new labware on an existing labware definition.
   - See Create a New Labware Definition on page 253 to create a new labware item.
3. When the New Labware Wizard is complete, see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262 to set additional labware parameters.
4. If a Gripper arm is installed, see Editing Labware on page 264 to verify and adjust the labware parameters for the gripper.

Copy an Existing Labware Definition

You can copy an existing labware definition and use it as a starting point for a new labware definition. The overall layout of the new labware will be the same as the one that you copy. The specific details of the labware, wells, and well spacing can be modified as necessary to describe the new labware.

To create new labware by copying an existing definition:

1. Select **Utilities > Labware Library** from the main menu to open the **Labware Library** window.
2. Click the **New** button to start the **New Labware Wizard**.
3. Select the *Yes* option to indicate that you want to copy the new definition from an existing definition and click **Next**.
4. In the **Copy Definition From** text box, type the name of the definition file (**.lab**) you want to copy or use the browse button to choose the file name of existing labware.
5. In the **Save Labware with Name** text box, type the name for the new file, or use the browse button to select the location and filename for the new file, and click **Next**. All labware definition files should be located in **C:\Packard\JANUS\Labware Files**.

*Caution: Be sure to provide a unique file name for the new file. If you use the name of an existing labware definition file, the new file will overwrite the existing file. The specified name is the filename for the saved definition file and also identifies the labware in the selection drop-down lists on the **Add Labware** and **Labware Library** windows. Use a name that is descriptive enough for future reference and identification.*

6. Click **Finish** to complete the wizard. The new labware is an exact copy of the existing labware and is added to the same category as the definition you copied. To change or verify the labware parameters, see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

Create a New Labware Definition

If you want to define new labware that is not based on existing labware, you must specify all aspects of the labware layout before you can define the specific details of the labware, wells, and well spacing.

To create new labware:

1. Select **Utilities > Labware Library** to open the **Labware Library** window.
2. Click the **New** button to start the **New Labware Wizard**.
3. Select the *No* option to indicate that you do not want to copy the new definition from an existing definition and click **Next**.

4. Select the desired **Labware Type**:
   - **Plate/Rack** - Use for labware that contains multiple, definable sample positions. This can be a regular repeating pattern of sample positions or a random positioning with various sized wells. This labware type includes microplates of various configurations, test tube racks, vial racks, and similar devices.
   - **Support** - Use for deck supports that position the actual labware on the deck. Supports have locating pins to ensure accurate positioning on the deck and labware guides to ensure that the labware is always positioned consistently in the support.
   - **Multi-Function** - Use for labware with a standard frame to simultaneously hold multiple kinds of labware with different functions. The functions available for placement in these frames are Wash Bowls, Reagent Troughs, and Tip Chutes. You must define the combination of functions for the new labware. Most functions are predefined for each layout, but you can make any required changes while defining the labware.
   - **Bar Code Cassette** - Use for the specific rack that moves labeled tubes in front of the bar code scanner. These predefined racks can only be used in the bar code lanes on the deck.
5. Select the category for the new labware in the **Category** drop-down list or type a new category name to create a new category.
6. Type the desired name for the new labware in the **Name** text box. The name cannot include special characters such as commas, colons, slashes, etc. To change the location of the new labware file, click the Browse button and specify the location and file name. The default location for labware files is **C:\Packard\JANUS\Bin**.

*Caution: Be sure to provide a unique file name for the new file. If you use the name of an existing labware definition file, the new file will overwrite the existing file. The specified name is the filename for the saved definition file and also identifies the labware in the selection drop-down lists on the **Add Labware** and **Labware Library** windows. Use a name that is descriptive enough for future reference and identification.*

7. Click **Next**. If you are defining *Support* or *Bar Code Cassette* labware, the definition is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

   If you are defining *Plate/Rack* or *Multi-Function* labware, see Defining New Plate/Rack Labware on page 255 or Defining New Multi-Function Labware on page 257.

Defining New Plate/Rack Labware

This section assumes you selected **Plate/Rack** as the **Labware Type** on the previous wizard screen. If not, go back to Create a New Labware Definition and locate the section for the selected labware type.

To define new Plate/Rack labware, the wizard guides you through the process of configuring the support requirements, well configurations, and well details.

Continuing from the steps in Create a New Labware Definition:

1. Select the **Support Requirements** for the new labware:
   - **Does Not Require Support** - Choose this setting if the labware is self positioning and does not require the use of any support labware. A typical example of labware that does not require a support is a test tube rack or the standard wash bowl.
   - **Labware Requires Support** - Choose this setting if the labware requires a support to be placed on the deck. The support labware generally ensures the deck position of the labware, and can hold the labware at specific heights for the protocols. Typical examples of labware that require a support are microplates or disposable tip boxes.
2. Click **Next**.
3. Select the **Well Configuration** of the new labware:
   - **Row/Column** - Choose this setting if the labware uses a regular repeating pattern of sample positions in rows and columns. All sample positions must be the same size and shape with consistent spacing throughout the rack. Staggered columns are allowed if the offset is uniform.
   - **Circular** - Choose this setting if the sample positions are oriented in a circular pattern. All sample positions must be the same size and shape with consistent spacing in the circle. This layout only supports single circles; concentric circles are not supported.
   - **Custom** - Choose this setting if the layout of the labware is not regular or if the well sizes are not uniform. You must define the size, shape, and location of each well individually.
4. Click **Next**.

   As described in Create a New Labware Definition, the selections on each window determine the path the wizard takes. When you click **Next** after selecting the **Well Configuration**, you must complete additional setup steps. These additional steps are similar for each configuration, and any differences in the wizard path are noted.

5. For **Row/Column well configurations**, specify the well options:
   - **Number of Columns** - Specifies the number of columns on the new labware. Set the value to the number of columns on the new labware.
   - **Number of Rows** - Specifies the number of rows on the new labware. Set the value to the number of rows on the new labware.
   - **Staggered Wells** - Specifies that the columns in the new labware are staggered. Enable this option if the columns on the new labware are staggered.
   - **Label Wells** - Specifies how to identify the sample positions in the new labware. You can choose sequential numbering throughout the labware (for labware such as test tube racks) or use the row/column labeling scheme (commonly used for microplates). Select the option that best matches the layout of the labware.
6. For **Circular well configurations**, specify the well options:
   - **Number of Wells in the Circle** - Specifies the number of wells that make up the perimeter of the circle on the new labware. Set the value to the number of wells on the labware.
7. For **Custom well configurations**, use the **Add** button to insert a row into the Custom Well Details table for each well in the labware. Set the following options for each well:
   - **Circular** - Specifies the shape of the sample position (well) in the labware. Select this check box if the well is round. Clear this check box if the well is rectangular.
   - **Width** - Specifies the width of the well in millimeters (mm). If Circular is selected for this well, specifies the diameter of the well in millimeters (mm).
   - **Length** - Specifies the length of the well in millimeters (mm). If Circular is selected for this well, specifies the diameter of the well in millimeters (mm).
   - **Tips Per Well** - Specifies the number of tips that can access one well at the same time. For labware that typically contains sample material, this is often a single tip. In this case, enter a numerical value of one. For labware intended to hold reagents, the well may be large enough to accommodate multiple tips simultaneously. In this case, enter the maximum number of tips that can fit into the well at the same time.
8. Click **Next**. If you are defining *Custom* well configuration labware, the definition is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

   For *Circular* and *Row/Column* types, continue with the next step.

9. Select the well parameters for the labware:
   - **Circular Wells** - Specifies the shape of the sample positions (wells) in the labware. Select this check box if the well is round. Clear this check box if the well is rectangular. This selection changes the well dimension options on the page. You must define the diameter of circular wells or the length and width of rectangular wells. All well dimensions are in millimeters (mm).
   - **Tips per Well** - Specifies the number of tips that can access a single well at the same time. For labware that typically contains sample material, this is often a single tip. In this case, enter a numerical value of one. For labware intended to hold reagents, the wells may be large enough to accommodate multiple tips simultaneously. In this case, enter the maximum number of tips that can fit into a well at the same time.
   - **Well Diameter** - Specifies the diameter of wells on the labware in millimeters (mm). Each well must be the same size. This setting is only available for circular wells.
   - **Well Length** - Specifies the length of the wells on the labware in millimeters (mm). Each well must be the same size. This setting is only available for rectangular wells.
   - **Well Width** - Specifies the width of the wells on the labware in millimeters (mm). Each well must be the same size. This setting is only available for rectangular wells.
10. Click **Next**. If you are defining *Circular* or *Row/Column* well configuration labware, the definition is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

Defining New Multi-Function Labware

This section assumes you selected **Multi-Function** as the **Labware Type** on the previous wizard screen. If not, go back to Create a New Labware Definition and locate the section for the selected labware type.

To define new Multi-Function labware, the wizard guides you through the process of configuring labware combinations, trough details, and support requirements.

Continuing from the steps in Create a New Labware Definition:

1. Select the frame/wash bowl/trough configuration that matches the labware you are configuring:
   - **Trough Frame + Wash Bowl** - Select this option if one side of the frame contains a Wash Bowl and the other side accepts some configuration of Reagent Troughs.
   - **Wash Bowl + Tip Chute** - Select this option if one side of the frame contains a Wash Bowl and the other side contains a Tip Chute for ejecting used disposable tips as waste.
   - **Trough Frame + Trough Frame** - Select this option if both sides of the frame accept some configuration of Reagent Troughs.
   - **Trough Frame + Tip Chute** - Select this option if one side of the frame accepts some configuration of Reagent Troughs and the other side contains a Tip Chute for ejecting used disposable tips as waste.
2. Click **Next**. If you are defining *Wash Bowl + Tip Chute* labware, the definition is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

   If you are defining *Trough Frame + Wash Bowl*, *Trough Frame + Tip Chute*, or *Trough Frame + Trough Frame* labware, continue with the next step. The following steps are similar for all types, and any differences in the wizard path are noted.
3. Select the number of troughs the trough frame holds and click **Next**.

☞ *Note:* *If you selected Trough Frame + Trough Frame in the **Multi-Function** frame, you must specify the number of troughs in both the left and right openings of the trough frame.*

   If you are defining *Trough Frame + Wash Bowl* or *Trough Frame + Tip Chute* labware, the definition is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

   If you are defining *Trough Frame + Trough Frame* labware, continue with the next step.

4. Select whether or not the labware uses a support under **Support Requirements**:
   - **Does Not Require Support** - Select if the labware is self positioning and does not require the use of any support labware.
   - **Labware Requires Support** - Select if the labware requires a support to be placed on the deck.
5. Click **Next**. The definition for *Trough Frame + Trough Frame* labware is complete. The Last Page of the New Labware Wizard opens and displays a reminder that the labware dimensions and well locations need to be evaluated. Click the **Finish** button and see Set the Labware Properties in the Details Tab on page 261 and Evaluate the Labware on page 262.

Open the Labware Properties Window

The Labware Properties window specifies the name, dimensions, and graphics for the selected labware. Use the tabs on the Labware Properties window to verify the current settings, edit the labware properties, or evaluate the labware (use the instrument to measure the labware dimensions).

To open the Labware Properties window:

1. If you will be evaluating labware, select a location on the instrument deck and place the labware (and the support if applicable) at the desired location. Choose a calibrated position on the deck with good visibility of the labware.
2. If you will be evaluating the labware, **select the arm icon** that will be used to evaluate the labware at the top of the Deck View on the WinPREP main window. If you are changing the settings on the Details tab, only the parameters for the selected arm are displayed on the Details tab.

Note: Evaluating the labware requires that the instrument is calibrated and that the tips are properly aligned. If necessary, run the Calibration and Tip Alignment diagnostics before continuing (see Diagnostic Tests on page 408 for more information).

3. Select **Utilities > Labware Library** on the main menu, select the category that contains the labware, select the labware name, and click the **Edit** button.

   OR

   If the labware is already on the Deck View in the correct location, double-click a labware item of the same type that you want to edit. The Labware Parameters window opens. Click the **Edit** button.

   The Prepare for Labware Evaluation window opens as shown in Figure 11-2

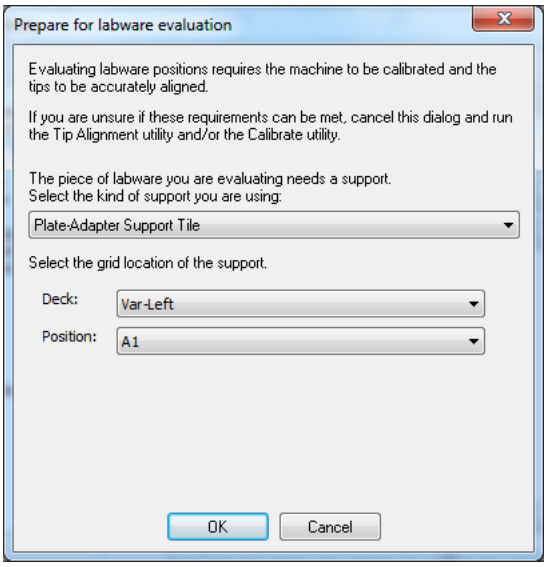


Figure 11-2. Prepare for Labware Evaluation window

4. Select the **Plate Adapter Support Tile** that will be used on the deck during the labware evaluation. (If you are not going to evaluate the labware, leave the default settings and skip to step 7.)
5. Select the **Deck** that the labware is placed on for evaluation.
6. Select the **Position** of the labware you want to evaluate. (Rotation is not supported during labware evaluation.)
7. Click **OK**.
8. If tips are attached to the Varispan arm, you are prompted to remove the tips. Manually remove the tips and click **OK**.
9. The **Labware Properties** window opens and displays the properties for the selected labware.
10. See Set the Labware Properties in the Details Tab on page 261 or Evaluate the Labware on page 262.

Set the Labware Properties in the Details Tab

After new labware is created or if changes to existing labware are necessary, labware properties such as the name, color, and image of the labware can be changed on the **Details** tab of the **Labware Properties** window. Labware dimensions and gripper offsets can also be changed on the Details tab, although it is usually easier to use the instrument to define the dimensions rather than manually measuring and entering the values. See Evaluate the Labware on page 262 for instructions on using the instrument arms to define the labware dimensions.

To change Labware Properties on the Details tab:

1. Open the Labware Properties Window (see page 259 for details).
2. Click the **Details** tab.
3. To change the color of the labware in the Deck Layout View, click the **Color** field, select the desired color from the Color window, and click the **OK** button.
4. To specify the location where the labware is located in the lab, type the desired text in the **Lab Location** field. (This text displays on the **Gather tab** in the **JANUS Application Assistant**.)
5. To specify the images to use to display the labware in the software, type the image names in the **Image File** and **Deck Image File** fields. (See Creating Custom Labware Images on page 264 for information on creating and naming the graphic files.)
6. Click **OK** to save the settings.

Evaluate the Labware

The WinPREP software uses the dimensions of the labware to calculate the correct position of the arm when accessing labware. When new labware is defined, you can use the **Evaluate** tab for a selected arm on the **Labware Properties** window to measure the dimensions of the labware. Evaluating labware uses the motors and the actual arms to accurately define the dimensions of the labware. You must identify the locations of the front right corner of the labware, the center of sample positions, and specific critical heights for the labware.

When you evaluate a labware item, the system uses the selected arm to perform the measurements. Make sure the desired arm is selected *before* beginning the evaluation. You can choose whichever pipetting arm you prefer but the windows for each arm are slightly different. If a Gripper arm or MDT Gripper is installed and the labware will be moved with the gripper, you should also evaluate the labware with the gripper to define gripper-specific parameters.

You can use the Evaluate Labware feature to use the Varispan or MDT pipetting arm to measure and record the dimensions for the labware. This is the easiest and most efficient way to optimize labware and creates the most accurate labware definitions because the hardware used to define the labware is the same hardware that will access the labware.

Note: To use an instrument arm to evaluate labware dimensions, the labware must be on a calibrated deck position. If the labware location on the deck does not display in green, you will not be able to evaluate the labware at that deck position.

To evaluate the labware:

1. At the top of the deck view in the WinPREP main window, select the icon for the arm you want to use to evaluate the labware.
2. Open the Labware Properties Window (see page 259 for details). (The labware and support, if required, should be placed on the deck and the proper location specified in the Prepare for Labware Evaluation window.)
3. Click the **MDT Evaluate** tab or the **Var Evaluate** tab, depending on which arm you want to use to evaluate the labware or which arm is installed on the instrument.
4. If using the Varispan arm, select the tip to use for alignment in the **Tip** drop-down list. It is usually easiest to use the tip closest to you, either tip number 4 on a 4-Tip system, or tip number 8 on an 8-Tip system.
5. Click on a dimension parameter in the table to select the row.

6. Click the **Go To** button. The instrument moves to the X and Y position shown in the table.
7. Check the alignment of the specified tip with the location indicated on the labware diagram. If the tip is not aligned with the location indicated, you must move the tip until it is properly aligned. You can align the tip manually or you can use the software.
   - **To manually align the tip**, click the **Off** option under **Motor Power**, manually move the tip and arm as required to align the tip with the indicated location, and then click the **On** option under **Motor Power**.
   - **To use the software**, use the Z Motor buttons to move the tip down close to the desired position, and then use the X/Y Motor buttons to move the arm as required to align the tip with the indicated location. Adjust the **Step Size** as needed to increase or decrease the distance moved for each step.
8. Adjust the height parameters by positioning the tip or head at the desired height. See the text at the bottom of the Details tab or in the JANUS Help file for a description of each parameter.

   Tip: If all of the wells in the labware are the same height and depth, you can select the **Update Z for All Wells** check box when measuring a height to define the current vertical position for ALL of the troughs or wells at once.
9. When the tip is aligned with the location shown on the labware diagram, click the **Update** button to display the current location in the table.
10. Repeat steps 5 through 9 until dimensions for ALL of the parameters have been defined.
11. If necessary, click the **Details tab** to access parameters for customized trough shape, size, and position. Default trough definitions describe standard reagent troughs.
12. If desired, see Creating Custom Labware Images on page 264 to use a custom graphic file to display the labware in the WinPREP and JANUS Application Assistant software.
13. If an MDT Gripper or Gripper Arm is installed on the system and the labware will be moved by the gripper, see Editing Labware on page 264.
14. Click the **OK** button to save the labware definition.

Editing Labware

Labware Parameters specify settings for a specific labware item on the deck in a specific protocol. Labware Properties specify settings common to all labware of the specified type used in any protocols.

To edit parameters for existing labware:

1. If the labware is already on the deck view, right-click the labware graphic and select **Properties**. The Labware Parameters window opens.
2. Change the labware Name, Deck, Position, Source of ID, Barcode Position, and Barcode Gripper as desired.
3. Click the **OK** button. The Labware parameters for the labware item on the deck are updated.

To edit properties for a specific labware type:

1. Open the Labware Properties Window (see page 259 for details). (If you are going to evaluate labware, the labware and support, if required, should be placed on the deck and the location specified in the Prepare for Labware Evaluation window.)
2. To change the labware dimensions by evaluating the labware, see Evaluate the Labware on page 262 to measure the dimensions, and then click the **OK** button on the Labware Properties window to save the changes to the labware file.
3. To change the Labware Properties in the Details tab, see Set the Labware Properties in the Details Tab on page 261 to type the dimensions directly in the window and then click the **OK** button on the Labware Properties window to save the changes to the labware file.

Creating Custom Labware Images

JANUS Application Assistant uses two images for each piece of labware:

- The “Hero” image provides a close up picture of the labware so you can easily identify the item. The Hero image displays in the Instructions panel on the Place tab in the JANUS Application Assistant.
- The “Deck” image is used to show how the labware is positioned on the deck next to other labware. The Deck image displays on the deck view in the Place tab and Run tab in the JANUS Application Assistant.

WinPREP uses the “Deck” image to display the labware on the Deck View.

WinPREP and JANUS Application Assistant come with both “Hero” images and “Deck” images for common labware installed with the system. In some cases, you may want to create custom labware. It is highly recommended that you also create images for each new piece of custom labware. If you don't create a custom image, a default generic image is displayed. This may cause confusion if you create several new pieces of custom labware that all use the same images. Using custom images will eliminate confusion when viewing the images in WinPREP or JANUS Application Assistant.

The images that you create must adhere to several rules so that they display correctly in the software. If these rules are not followed, the images may not display, may appear in the wrong place, or may be the wrong size.

Hero Image Rules

- The file must be an image file of type PNG. Transparency should be used where the physical labware has no material.
- The image dimensions should be large enough to clearly identify the labware. Typical hero images are approximately 1500X1000 pixels. The image is scaled to the appropriate size when displayed in the software.
- Hero images are recommended to be viewed from the right and above. This gives perspective on the height, width, and depth of the item. You can refer to existing hero images for examples.
- The filename for the hero image should adhere to the following naming convention. The base part of the filename should match the labware name. The label “_Hero” should then be appended. For example, if the custom labware has the labware name of “MyCustomLabware.LAB” then the hero image name should be “MyCustomLabware_Hero.PNG”.
- Edit the custom labware in the **Labware Properties** window and add the hero image filename to the “Image File” field. In the example above, enter “MyCustomLabware_Hero.PNG”.

Deck Image Rules

- The file must be an image file of type PNG. Transparency should be used where the physical labware has no material.
- The deck images are displayed at a Y angle of 50 degrees where 0 degrees is an overhead view.
- The width (x) of the image must be Labware Width (mm) * 3.285. The depth (y) of the image must be Labware Depth (mm) * 2.5165.
- If the labware can be rotated (to 90, 180 or 270 degrees) then rotated deck images must be created for the labware to display properly on the deck.
- The filename for the deck images must use the following naming convention. The base part of the filename should match the labware name. The label "_Deck" is then appended. Finally the rotation angle should be appended as "_0" for 0 degrees, "_90" for 90 degrees, etc. For example, if the custom labware is named "MyCustomLabware.LAB" and can have rotations of 0 and 180 degrees, then the deck image filenames should be "MyCustomLabware_Deck_0.PNG" for 0 degrees of rotation and "MyCustomLabware_Deck_180.PNG" for 180 degrees of rotation.
- Edit the new labware in the **Labware Properties** window and add the deck image filename to the "Deck Image File" field. In the example above, enter "MyCustomLabware.PNG". The software automatically inserts "_Deck" and the appropriate angle when displaying the images in WinPREP or JANUS Application Assistant.

Both hero and deck image files must be placed in the **\Labware Files** folder.

Importing Labware Definitions

WinPREP provides an easy way to convert MultiPROBE II labware rack files (**.rak**) to the labware definitions (**.lab**) used by WinPREP. To convert the files, use the Import function in the Labware Library.

To import an older (.rak) labware definition:

1. Select **Utilities > Labware Library** from the main menu. The **Labware Library** window opens.
2. Click the **Import** button. The **Import Labware Window** opens as shown in Figure 11-3.

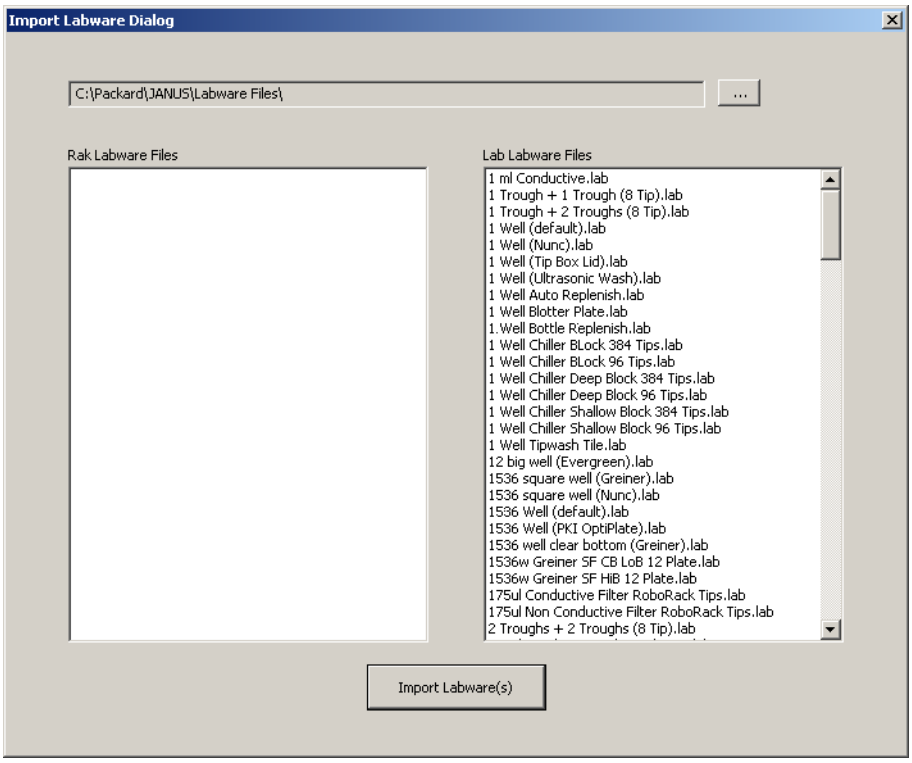


Figure 11-3. Import Labware Window

3. Click the **Browse** button, at the top of the window. Use the **Browse for Folder** window to locate and select the location where the desired rack (**.rak**) files are stored. The **Import Labware Window** updates to display a list of rack files in the left column.
4. Select one or more rack files you want to convert. To select multiple files, hold down the **<Ctrl>** key and click the file names in the **Rak File Names** list.

5. Click the **Import Labware(s)** button at the bottom of the **Import Labware Window**. WinPREP converts the files and saves them with a WinPREP labware (**.lab**) extension, as shown in Figure 11-4. WinPREP saves the converted file in the same location as the rack file.

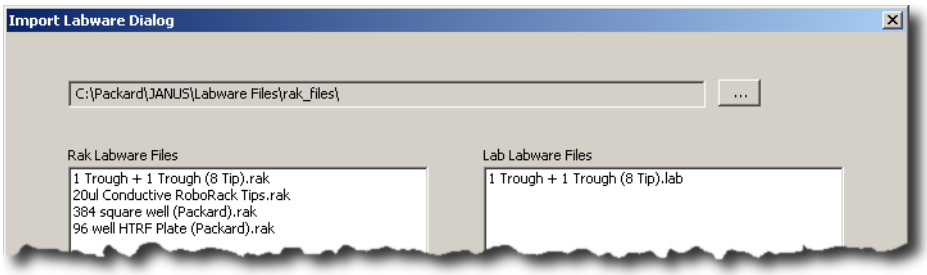


Figure 11-4. Import Labware Window with Converted Rack file

6. Move the converted labware file into the **Labware Files** folder in the WinPREP installation folder. If you do not move the files, they may not be available for use in protocols.

☞ *Note: WinPREP saves the converted file in the same location as the rack file.*

The conversion is complete. You can use the converted file in any WinPREP protocols. You can also convert older, MultiPROBE II protocols for use with the JANUS G3 system. If you do this, be sure to convert any rack files used by the older protocol to the newer labware format.

Chapter 12

Performance Files

Liquid delivery calibration of JANUS G3 is based on the use of performance files. Performance files ensure accurate pipetting by adjusting system parameters to optimize for several factors including tip type, mode of operation, aspirate and dispense volume, and fluid properties.

PerkinElmer includes several performance files with WinPREP. Varispan performance files are categorized according to tip type (fixed or disposable) and pipetting mode (blowout or waste). MDT performance files are categorized according to the dispenser head type: Standard, NanoHead, and Pin Tool. Performance files can help you address most common performance recommendations. The performance files are located in the **Performance Files** folder in the WinPREP installation folder.

The Performance Set Library is a catalog of the performance files on the system. Use the Performance Set Library to select, edit, and create new performance files. The performance files for the system depend on the types of tip adapters and disposable tip types available for the instrument.

This chapter contains information on performance files, including:

- Using Performance Files (page 269)
  - Performance File Parameters (page 272)
  - Choosing a Performance File (page 276)
- Creating Performance Files (page 277)
- Editing Performance Files (page 280)
  - Missing Performance Files (page 281)
  - Volume Compensation (page 282)
  - General Performance Guidelines (page 284)

Using Performance Files

The desired performance file is specified on the **Overview** tab of each procedure. The type of tip you select for a procedure and the mode of operation control which performance files you can select in the procedure.

Performance files contain two general types of parameters: performance set and selection criteria. Varispan performance files also contain a third type of information known as Global Parameters. You can configure each type of information through an individual tab on the Performance File properties window.

Selection Criteria parameters define the compatibility of the performance file with respect to tip types, pipetting mode, and syringe sizes. By enabling one or more tip types for the **Adapter Tips** parameter (Varispan) or the **MDT Tip Type** parameter, you specify the tips that can use the performance file. Figure 12-1 and Figure 12-2 provide examples of the **Selection Criteria** tabs for the Varispan and MDT arms.

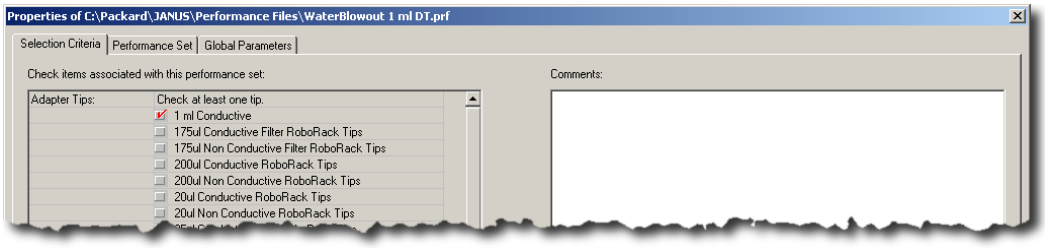


Figure 12-1. Performance File Properties - Varispan Selection Criteria

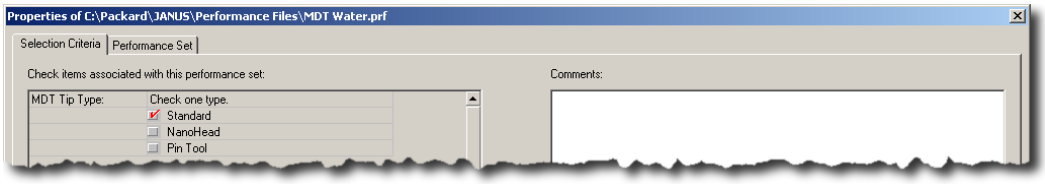


Figure 12-2. Performance File Properties - MDT Selection Criteria

The selection criteria options for the MDT arm are minimal and only contain settings for the tip type. Varispan selection criteria also includes **Pipetting Mode** and **Syringe Sizes**. When you set the **Pipetting Mode** parameter, you specify the operation mode (blowout or waste) for the performance file. Finally, setting the **Syringe Sizes** option identifies the syringes that can use the performance file. You can set adapter tips, pipetting modes, and syringe sizes by modifying these values on the **Selection Criteria** tab of the performance file properties window.

Performance Set parameters address the performance characteristics of liquids. The volume of the liquid you are pipetting influences these characteristics. You can review, modify, and delete records in the performance file on the **Performance Set** tab of the performance file properties window. You can also use this window to modify the parameters for existing records in the performance file. The **MDT Tip Type** parameter specifies the tips that can use the performance file. Figure 12-3 and Figure 12-4 provide examples of the **Performance Set** tabs for the Varispan and MDT arms.

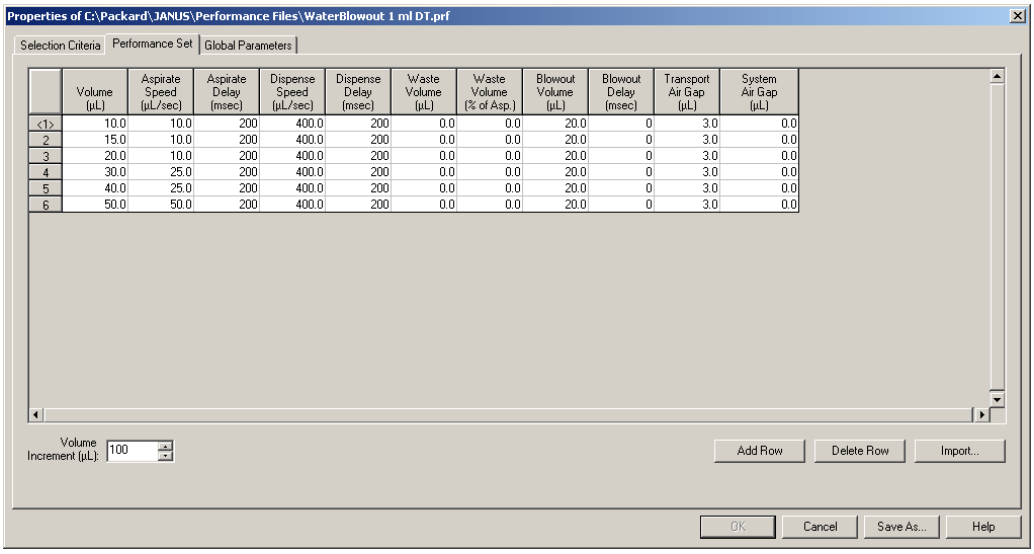


Figure 12-3. Performance File Properties - Varispan Performance Set

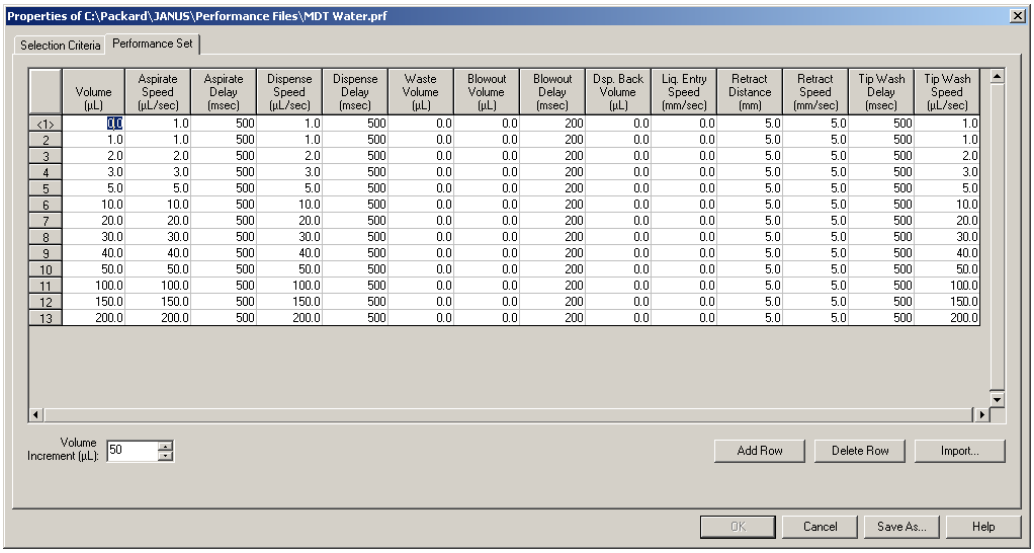


Figure 12-4. Performance File Properties - MDT Performance Set

To optimize the performance of the system for a specific liquid volume, the performance set parameters include pump speeds, pump delays, mode (waste and blowout) volumes, and air gap volumes for a range of liquid volumes. Several of the parameters are common between pipetting arms. However, each arm requires certain unique settings and this causes the performance set data to differ between Varispan and MDT arms.

Global Parameters are Varispan performance factors that are not dependent on the volume or type of liquid you are handling. These settings control various factors such as moving into and out of a sample liquid, liquid level sense parameters, syringe pump accelerations, and volume compensation. You can modify these parameters on the **Global Parameters** tab of the performance file properties window. Figure 12-5 shows the Varispan Global Parameters tab.

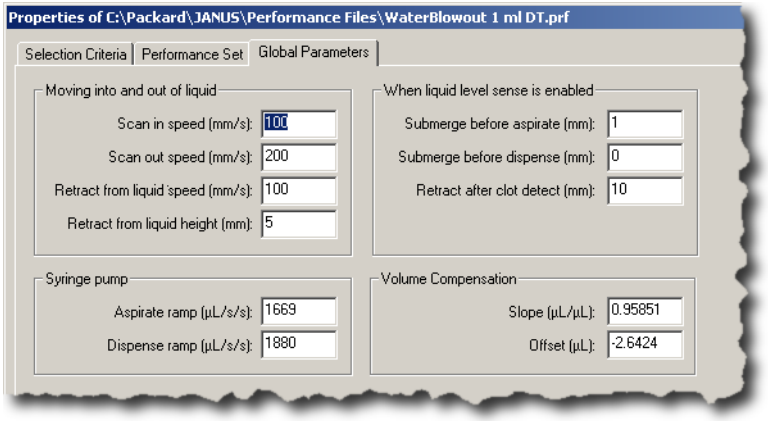


Figure 12-5. Performance File Properties - Varispan Global Parameters

The sections below describe performance files in more detail.

Performance File Parameters

The previous section gave you a brief introduction to performance file parameters. This section provides details about each type of performance file parameter individually.

Selection Criteria

Specifies the conditions under which a specific performance file can be selected, including which arms, tips, dispenser heads, modes, etc. are valid.

Performance Set

Performance Set parameters differ slightly between pipetting arms. The table below describes each of the Performance Set options and identifies the arms affected by each.

Arm	Parameter	Description
Varispan and MDT	**Volume**	Specifies the liquid volume in microliters (µL) for which the parameter values of the row will apply. These parameters in this row are applicable for liquid volumes from this value up to the volume indicated for the next row.
	Aspirate Speed	Specifies the speed of the syringe pumps or dispenser head when aspirating liquid. Specifies the pump speed in microliters per second (µL/s) to use when aspirating with the syringe pumps. The viscosity and volume of liquid being moved determine the optimum pump speeds.
	Aspirate Delay	Specifies the time in milliseconds (mSec) to pause after an aspiration using the syringe pump and before any other operation or function. Due to the elasticity of the liquid column, particularly the air gaps, there is a delay between the time that the syringe stops and the time that liquid movement is complete.
	Dispense Speed	Specifies the pump speed in microliters per second (µL/s) to use when dispensing with the syringe pumps. The viscosity and volume of liquid being moved determine the optimum pump speeds.
	Dispense Delay	Specifies the time in milliseconds (mSec) to pause after a dispense using the syringe pump and before any other operation or function. Due to the elasticity of the liquid column, particularly the air gaps, there is a delay between the time that the syringe stops and the time that liquid movement is complete.
	Waste Vol. (µL)	Specifies the waste volume in microliters (µL) to be used when µL is selected as the measurement units for waste volume. The value in this column determines the waste volume directly.
	Blowout Mode	Specifies the volume of air in microliters (µL) to be used to blowout the tip when the blowout mode is selected for a procedure. The value in this column determines the blowout volume directly.
	Blowout Delay	Specifies the time in milliseconds (mSec) to delay after sample liquids are dispensed and before the blowout is performed. By defining an appropriate delay time, any liquids remaining in the tip due to viscosity or surface tension have an opportunity to drain down to the bottom of the tip and get blown out when the air is dispensed.
Varispan only	**Waste Vol. (% of Asp.)**	When % of Aspirate is selected as the measurement units for waste volume, specifies the waste volume to use, as a percentage of the aspiration volume for the step. Enter values for this column in percentages (for example, enter 15 for 15%).
	Transport Air Gap	Specifies the volume in microliters (µL) for the air gap aspirated between liquid aspirates to prevent dilution or contamination.
	System Air Gap	Specifies the volume in microliters (µL) for the air gap aspirated before any liquid aspirates to prevent liquid contact with the system liquid.

Arm	Parameter	Description
MDT only	**Dsp. Back Volume**	Specifies the volume in microliters (µL) of aspirated liquid to dispense back into the well after an aspirate operation. This setting is useful for reducing the First Shot Effect and depends on the viscosity of the liquid you are pipetting.
	Liq. Entry Speed	Specifies how fast in millimeters per second (mm/s) the MDT tips move down when entering liquid in the well.
	Retract Distance	Specifies the distance in millimeters (mm) that the MDT tips retract from the liquid using the Retract Speed.
	Retract Speed	Specifies the speed in millimeters per second (mm/s) that the MDT tips are moving when leaving the liquid. This speed depends on the viscosity and surface tension characteristics of the liquid for which the performance file is defined. Typically, this speed is slower than other travel speeds to ensure any liquid on the outside of the tips has a chance to wick off into the well.
	Tip Wash Delay	Specifies the time in milliseconds (ms) that the MDT tips pause between aspirate and dispense operations when washing tips.
	Tip Wash Speed	Specifies the speed in microliters per second (µL/s) that the MDT tips aspirate and dispense liquid in the wash bowl.

Global Parameters

Global Parameters are various options to control the way the Varispan arm aspirates and dispenses liquids. The following table describes each of these options in detail.

Group	Parameter	Description
Moving into and out of liquid	**Scan in speed (mm/s)**	Specifies the speed in millimeters per second (mm/s) that the Varispan tips move down when searching for liquid with the liquid level sense option. This speed depends on the electrical characteristics of the liquid for which the performance file is defined.
	Scan out speed (mm/s)	Specifies the speed in millimeters per second (mm/s) that the Varispan tips move up when searching for the top of the liquid with the liquid level sense option. This speed depends on the electrical characteristics of the liquid for which the performance file is defined.
	Retract from liquid speed (mm/s)	Specifies the speed in millimeters per second (mm/s) that the Varispan tips are moving when leaving the liquid. This speed depends on the viscosity and surface tension characteristics of the liquid for which the performance file is defined. Typically, this speed is slower than other travel speeds to ensure any liquid on the outside of the tips has a chance to wick off into the well.
	Retract from liquid height (mm)	Specifies the distance in millimeters (mm) that the Varispan tips retract from the liquid using the Retract from Liquid Speed. Note, this height is also used in the clot detection routine, when enabled.

Group	Parameter	Description
When liquid level sense is enabled	**Submerge before aspirate (mm)**	Specifies how far in millimeters (mm) into the sample liquid the Varispan tips submerge before beginning to aspirate liquid when using Liquid Level Sensing. Both positive and negative values are allowed for this parameter, with positive numbers submerging the tip into the liquid and negative values retracting the tip above the sensed level of the liquid. This distance positions the tip into or above the liquid when aspirating.
	Submerge before dispense (mm)	Specifies how far in millimeters (mm) into the liquid the Varispan tips submerge before beginning to dispense liquid. Both positive and negative values are allowed for this parameter, with positive numbers submerging the tip into the liquid and negative values retracting the tip above the sensed level of the liquid. This distance positions the tip into or above the liquid when dispensing.
	Retract after clot detect (mm)	Specifies distance in millimeters (mm) to retract for the second retraction step if a clot is detect ed. This routine uses the liquid level sense option to detect when clots form at the ends of the tips.
Syringe Pump	**Aspirate ramp (µL/s/s)**	Specifies how quickly the Varispan syringe pump motors reach the Aspiration Speeds specified on the Performance Set tab. In the performance files provided with the instrument, this value is optimized for the fluid dynamics of the associated system liquid. If you create your own performance files, be sure to determine the appropriate values for this parameter. Enter values for this parameter in microliters per second per second ($\mu L/s^2$).
	Dispense ramp (µL/s/s)	Specifies how quickly the Varispan syringe pump motors start and stop a dispense stroke. In the performance files provided with the instrument, this value is optimized for the fluid dynamics of the associated system liquid. If you create your own performance files, be sure to determine the appropriate values for this parameter. Enter values for this parameter in microliters per second per second ($\mu L/s^2$).
Volume Compensation	**Slope (µL/µL)**	Specifies the slope of the linear response curve determined for the associated system liquid. The relationship between the Varispan syringe stroke movements and actual liquid delivered, while reasonably linear, is not necessarily one-to-one. To compensate for this physical inequality, the system calculates the actual syringe stroke required to deliver the requested volume. The compensation is based on the Slope and Offset parameters. See Volume Compensation on page 282 for more information about how to calculate this parameter.
	Offset (µL)	Specifies the actual Y-offset (or Y-intercept) of the linear response curve determined for the associated system liquid. The relationship between the Varispan syringe stroke movements and actual liquid delivered, while reasonably linear, is not necessarily one-to-one. To compensate for this physical inequality, the system calculates the actual syringe stroke required to deliver the requested volume. The compensation is based on the Slope and Offset parameters. See Volume Compensation on page 282 for more information about how to calculate this parameter.

Choosing a Performance File

The performance files available in a protocol depend on the tip type and mode selected. You can only select performance files that apply to the tips and mode identified in the procedure. For example, you cannot select a performance file for blowout mode if the procedure uses waste mode, and you cannot use a performance file for disposable tips if the procedure uses fixed tips.

To select a performance file:

1. Double-click the desired procedure node in the protocol outline.
2. Select the desired **Tip** and **Mode** values in the **Pipetting** frame of the **Overview** tab. WinPREP scans the Performance Set Library and displays a list of compatible performance files in the **Performance File** drop-down list. Figure 12-6 shows these controls.

☞ *Note: Fixed tips are the only available tip type until you add some form of disposable tip labware to the deck.*

Figure 12-6. Overview Tab: Pipetting Frame

3. Select the desired performance file from the **Performance File** drop-down list, as shown in Figure 12-7.

☞ *Note: Click the **Performance File** button to open the performance file properties window for the selected performance file. Be careful when viewing performance files in this way because any changes you make will overwrite the original file. See Editing Performance Files on page 280 for more information.*

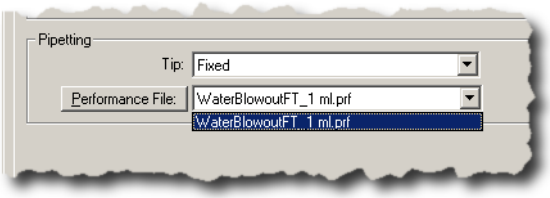


Figure 12-7. Performance File drop-down list

4. Click **Apply** on the procedures parameters window to save the changes.
5. Click **OK** to close the procedure parameters window.

Creating Performance Files

The Performance Set Library window displays a catalog of all the performance files currently defined for the system. You can edit existing files or add new files to the library as necessary. The performance file drop-down list on a procedure's **Overview** tab displays the compatible performance files from the Performance Set Library.

Figure 12-8 shows the **Performance Set Library** window.

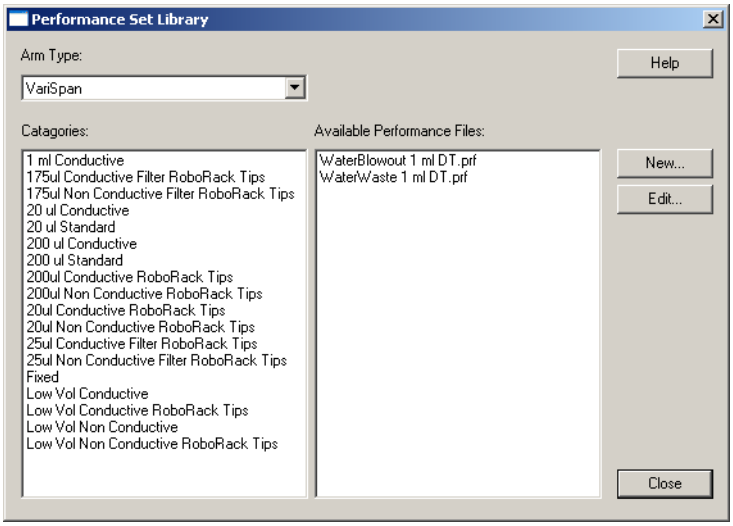


Figure 12-8. Performance Set Library window

In most cases, the performance files supplied with the JANUS G3 system are all you need. However, in certain instances you might want to create a new, or modify an existing, performance file. If an existing performance file contains most of the information you need, you can use it as a template for the new file to save time. For more information, see Editing Performance Files on page 280.

To create a new performance file:

1. Select **Utilities > Performance Set Library** from the WinPREP menu bar to open the **Performance Set Library** window.
2. Set the **Arm Type** value to the desired arm.
3. Select the tip type in the **Categories** list. When you select a tip type, the **Available Performance Files** list displays all the performance files available for the selected tip type.
4. Click the **New** button on the **Performance Set Library** window to open the new performance file properties window, shown in Figure 12-9.

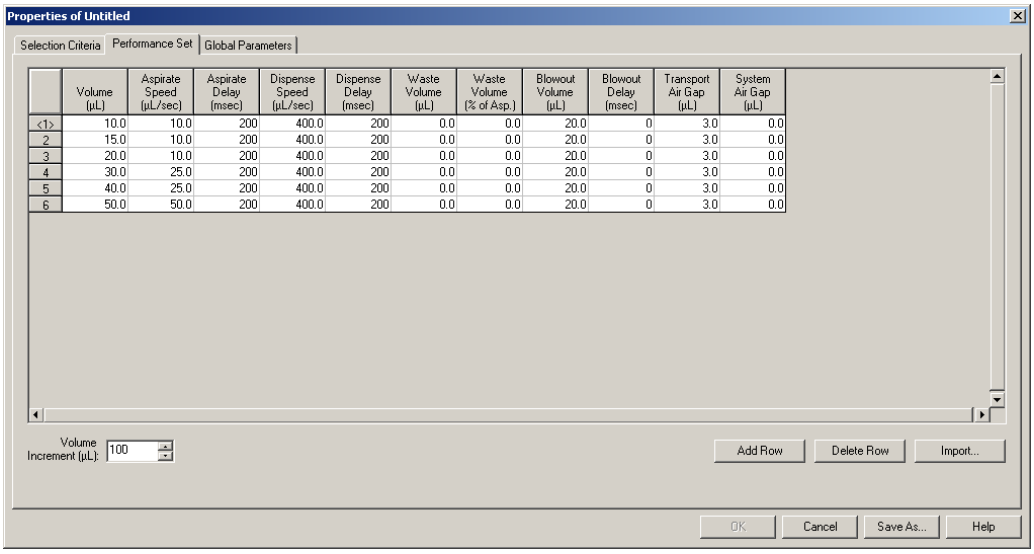


Figure 12-9. New Performance File Properties window - Performance Set tab

5. Click **Save As**.
6. Provide a unique **File name** for the new performance file and click **Save**. The ".prf" extension is automatically added to the file name.

☞ *Note: Save all performance files in the* **Performance Files** *folder in the WinPREP installation folder. If you do not save the custom performance files in the correct location, you may not be able to access them from WinPREP.*

7. Modify the values on the **Performance Set** tab as necessary for the application. The **Performance Set** tab contains the majority of the data for the performance file. It allows you to set the volume, aspirate speed, aspirate delay, dispense speed, dispense delay, waste volume, blowout volume, etc.
8. Once you modify the first value, WinPREP displays a warning window, shown in Figure 12-10. Since this is a new performance file and is not associated with any protocols, click **OK** to close the warning window and continue modifying the file as needed.

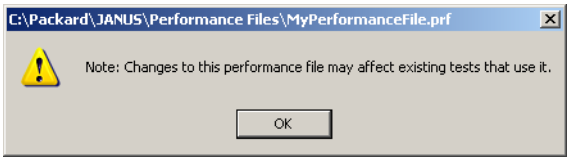


Figure 12-10. Edit Performance File Warning window

9. Click the **Selection Criteria** tab and modify the values as needed. An example of the **Selection Criteria** tab is shown in Figure 12-11.

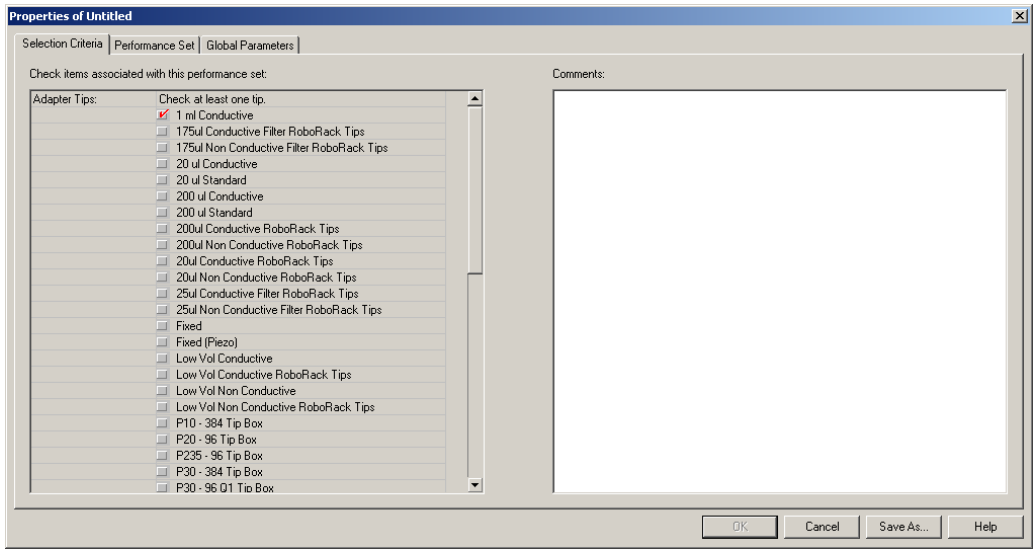


Figure 12-11. New Performance File Properties window - Selection Criteria tab

The **Selection Criteria** tab identifies the associated tip type, pipetting mode, and tip size for the performance file.

10. For Varispan performance files, click the **Global Parameters** tab and modify the values as necessary for the application. Figure 12-11 shows the **Global Parameters** tab.

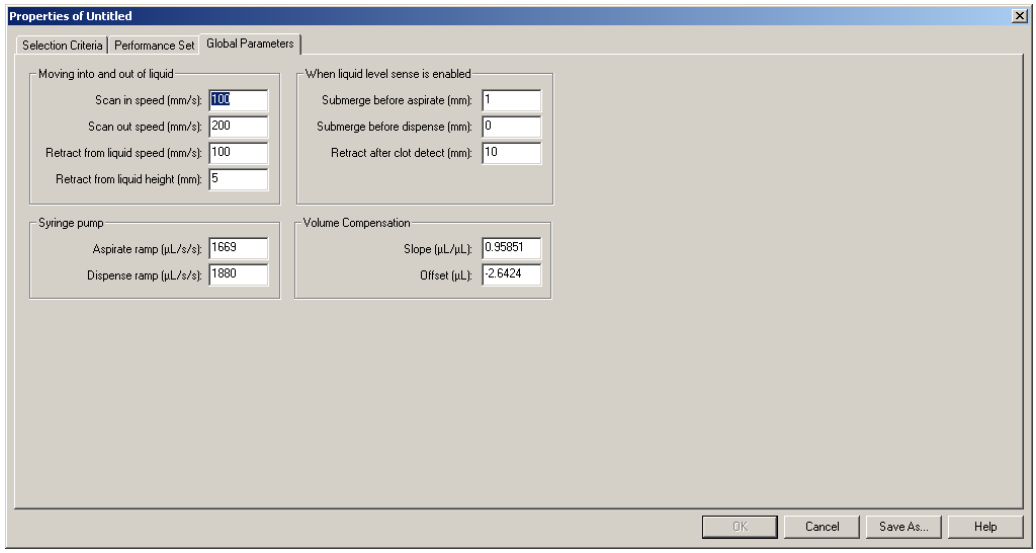


Figure 12-12. New Performance File Properties window - Global Parameters tab

The **Global Parameters** tab contains options that specify tip movement into and out of liquid, syringe pump acceleration, Liquid Level Sensing (LLS), and volume compensation.

11. Click **OK** when you are finished modifying the file.

Editing Performance Files

In certain situations, the performance files provided with the equipment may not meet your needs. You might need to modify certain parameters or optimize the performance file for the protocol. While you can create a new performance file and type in the values, editing an existing performance file is often the easiest and fastest way to create a customized performance file.

To edit an existing performance file:

1. Select **Utilities > Performance Set Library** from the WinPREP menu bar to open the **Performance Set Library** window.
2. Select the tip type from the **Adapter Tip Categories** list. When you select an adapter tip category, the **Available** list updates to display all the performance files available for the tip selection.
3. Select the Performance file (*.prf) that most closely meets the needs of the application from the performance files listed.
4. Click **Edit**. The Performance File Properties window opens as shown in Figure 12-13.

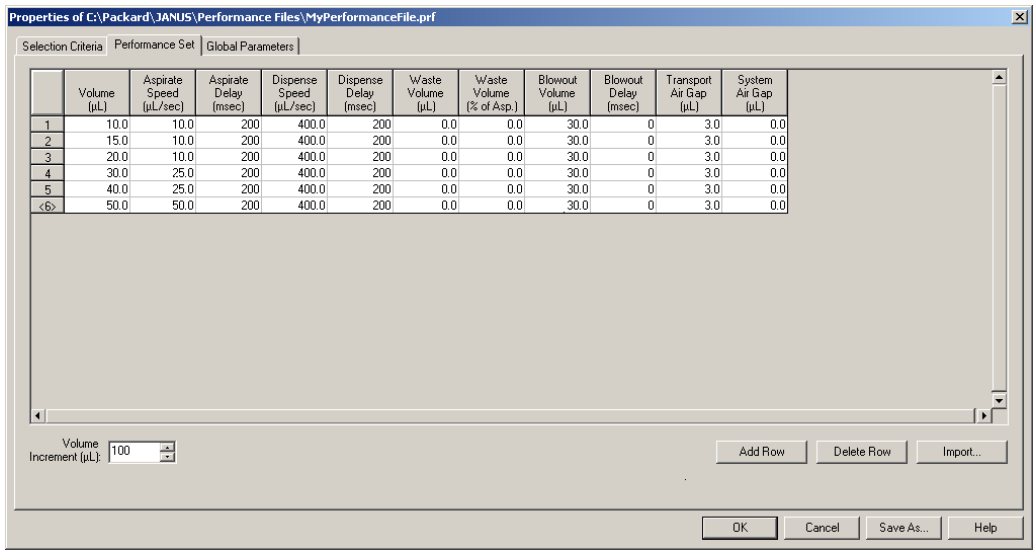


Figure 12-13. Performance File Properties window

The **Performance File Properties** window displays the parameters associated with the performance file. The title bar of the window contains the path and name of the performance file you are editing. You can edit any of the **Performance Set**, **Global Parameters**, or **Selection Criteria** values for the file.

5. Click **Save As**.

6. Provide a unique **File name** for the custom performance file and click **Save**. The ".prf" extension is automatically added to the file name.

Caution: Do not save the file using a name that matches one of the supplied performance files as these files can be overwritten during a system software update. Saving the custom performance files with unique names helps protect from this type of data loss.

Note: Save all performance files in the **Performance Files** *folder in the WinPREP installation folder. If you do not save the custom performance files in the correct location, you may not be able to access them from WinPREP.*

7. Modify the values on the **Performance Set**, **Global Parameters**, and **Selection Criteria** tabs, as necessary for the application. When you modify the first value, WinPREP displays a warning window as shown in Figure 12-10 on page 278. Since you saved this file with a new name, and it is not associated with any protocols, click **OK** to close the warning window.
8. Continue modifying the file as needed.
9. Click **OK** when you are finished modifying the file.

Note: Changes can be made to the new performance file without compromising the original Performance File.

The new performance file is available in the **Performance File** list on the **Overview** tab of the protocol procedures.

Missing Performance Files

If the performance file drop-down list is blank after you select a tip for the **Tip** parameter, there is no performance file that exactly matches the dispensing conditions. Either the **Mode** parameter is incorrect or the system's syringe size is invalid for the tip or dispenser head type.

The syringe size and mode for an existing performance file can be modified to create the required performance file.

To modify a performance file:

1. Select **Utilities > Performance Set Library** from the main menu to open the **Performance Set Library** window.
2. Select the Arm Type associated with the performance file you want to modify.
3. Select the tip type and the performance file and click **Edit**.
4. Select the **Selection Criteria** tab. This tab lists all the conditions that apply to the performance file.

5. Change the desired parameters by enabling or disabling the check boxes associated with the parameters. More than one box can be selected for a parameter.

☞ *Note: Changing the Selection Criteria for a performance file may change the precision and accuracy of the instrument.*

6. Click **Save As** to open the **Save As** window.
7. Provide a unique name for the new performance file and click **Save** to save the file and close the window.

✋ *Caution: Do not save the file using a name that matches one of the supplied performance files as these files can be overwritten during a system software update. Saving the custom performance files with unique names helps protect from this type of data loss.*

8. Click **OK** to close the performance file Properties window and return to the Performance File Library.

The custom performance file is available from any step that matches the defined criteria.

Volume Compensation

WinPREP uses slope and offset values to compensate for differences between requested and actual volumes in a pipetting operation. You can view and edit these values on the **Global Parameters** tab of the performance file properties window.

To calculate the slope and offset (y-intercept) values, consider the slope-intercept equation, shown in Eq. 12.1.

$$y = mx + b \qquad \textbf{(Eq. 12.1)}$$

The component parts of the slope-intercept equation apply to WinPREP in the following way:

- y is the actual volume delivered by JANUS G3
- m is the slope value WinPREP reads from the performance file
- x is the requested volume entered by the user
- b is the offset value WinPREP reads from the performance file

When applied to the slope-intercept equation, the slope and offset values help WinPREP compensate for differences between the requested volume and the actual volume. Using the slope, offset, and slope-intercept equation, WinPREP can adjust the actual volume so that it represents the requested volume.

The slope and offset values are determined by gravimetrically measuring expected versus actual dispense volumes over a range of volumes and then determining the linear regression line that fits those points. The slope and offset (y-intercept) values for the linear regression line are the values you enter in the fields on the **Global Parameters** tab in the performance file properties window. Prior to gravimetrically measuring and calculating the slope and offset, the values should be set to **1** and **0**, respectively.

Caution: You should clean the liquid path (tips, tubing, syringes, etc.) before attempting to determine the slope and offset values. See *Appendix B: Caring for the System on page 398* *for more information on cleaning the system.*

Caution: Wear gloves when performing the gravimetric analysis as oils and contaminants from your fingers can add weight to the test tubes.

To determine the slope and offset values:

1. Select and open a performance file displayed in the **Performance Set Library** window.
2. Click **Save As**. Provide a unique **File name** for the custom performance file and click **Save**. This file is strictly for testing purposes, so name it accordingly.
3. Select the **Global Parameters** tab and type "*1*" and "*0*", without the quotes, in the slope and offset fields, respectively. Click **OK** to save the file.
4. Set up a protocol using the newly-created performance file and run ten replicate/tip protocols for each tip using four different volumes (for example, for 20 µL tips, test 2 µL, 5 µL, 10 µL, and 14 µL).
5. Plot the mean value for the results of each tip at each of the tested volumes. The x-axis represents the requested volume (the volume desired by the user) while the y-axis represents the dispensed volume (the actual volume dispensed, calculated from the data set). Fit the linear regression line through the points. Note the linear regression should yield a correlation coefficient of 0.999 or better to be statistically valid. Obtain the slope and y-intercept of the regression line, as well. The ideal results for this regression line would be a slope of one and y-intercept of zero as this would mean the protocol data correlated perfectly with the requested volumes.
6. Return to the **Global Parameters** tab for the protocol performance file, enter the linear regression derived values for the slope and intercept, and save the file.

7. Rerun the replicate/tip protocols you used to verify the slope and intercept. Use the same method to determine the actual versus requested volume delivery for the instrument.

☞ *Note: If one tip dispenses differently than the other tips, it may be due to a leak, loose fitting, or some type of debris in the liquid path for that tip. Clean the liquid path and thoroughly check it for leaks, loose fittings, or other problems.*

General Performance Guidelines

The sections below describe performance recommendations that you set in WinPREP, rather than in a performance file.

Liquid Level Sense Verification

Liquid Level Sense (LLS) verification may be enabled for samples that have a propensity to foam. This feature enables WINPREP to verify the liquid level multiple times per transfer. Parameters refining the LLS verification feature are defined in the **Arm Settings** window (select **Utilities > Setup > *n* Tip Arm > Arm Settings** (where n is the number of tips on the pipetting arm) from the menu bar to open this window). You can enable LLS Verify on a per procedure basis on the **Procedure Details** tab in WinPREP.

Tracking

As liquid is aspirated out of a well, the JANUS Script Language (MSL) calculates the rate at which the liquid level drops. This allows the JANUS G3 instrument to “follow” the liquid level down. The opposite tracking occurs for dispensing. You may need to adjust the tracking speed if the well is not defined correctly or has a non-definable characteristic such as a conical bottom. The default value is 100%, which moves the tip at the same speed as the speed calculated by MSL based on the geometry of the well and the viscosity of water. You can adjust the Tracking value to make the system track faster or slower. The Tracking speed is specified on the **Overview** tab of an aspirate or dispense step. Adjusting the Aspirate Tracking to 130% helps ensure the tip is in pure liquid and does not aspirate air.

Large Syringe Volumes

Syringe volumes greater than 1 ml (2.5 and 5 mL) may not require any volume compensation. If you experience precision and accuracy problems with large volume syringes, set the Slope and Offset values in the performance file to 1 and 0, respectively. These values are specified on the **Global Parameters** tab of the performance file.

Chapter 13

Calibrating the System

This chapter describes how to calibrate the instrument to ensure accurate positioning of the arms and tips. This chapter contains the following calibration procedures:

- Deck Calibration on page 285
- Calibration Types on page 287
  - Uncalibrated Points on page 287
  - Initial/Reset on page 288
  - 3 Point Calibration on page 289
  - Individual Point on page 291
- Deck Calibration Coordinate System
- Calibration Procedures
  - Selecting an Arm on page 293
  - Calibrating the Varispan Pipetting Arm on page 294
  - Calibrating the MDT Pipetting Arm on page 297
  - Calibrating the MDT Arm for 1536-Well Microplates on page 307
  - Calibrating the NanoHead on page 311
  - Calibrating the MDT Gripper on page 311
  - Calibrating the Gripper Arm on page 312
  - Calibrating the Tube Barcode Reader on page 323

Deck Calibration

Deck calibration is an important consideration and directly influences the accuracy and precision of the instrument. By calibrating the deck, you manually identify the physical location of deck locations for the system. This calibration, along with reliable labware definitions, allows the system to accurately locate and pipette from precise locations on the deck.

By design, the instrument must conform to very rigorous engineering tolerances. However, small material and mechanical variances can and do occur. Calibrating the deck allows you to correct for these variances and greatly improves the ability of the instrument to access precise labware locations, such as the wells in a 1536 well plate.

WinPREP uses colors to identify calibrated versus uncalibrated points on the deck. The color-coding identifies the points that are calibrated for the selected arm. The color-coding also identifies the calibration method used to calibrate each point on the deck.

You should recalibrate the deck (and realign the tips) if any system component crashes into another component or deck item and the positioning of the system component is affected. Prepare the instrument by running the **Random Move Test** prior to calibrating the arms.

To calibrate an arm, you use the **Calibration** window to physically locate specific points on the deck. This process defines the exact location of specific points so the system can accurately locate any position on the deck, compensating for skewed or sloping decks.

For the initial calibration, you must complete the **Initial/Reset Calibration** to determine a coarse positioning for the deck. After you perform the Initial/Reset calibration, you can choose any of the Calibration Types to more precisely calibrate the deck. WinPREP provides three calibration types. See Calibration Types on page 287 for more information.

- **Initial/Reset Calibration** - Calibrates the entire deck based on a single measured point.
- **3 Point Calculated Calibration** - Calibrates the area enclosed by three measured points. If the measured points make up a right triangle, the software calibrates the points enclosed by the rectangle bounded by the three points.
- **Individual Point Calibration** - Calibrates the deck by teaching one location at a time.

☞ *Note: Performing an Initial/Reset Calibration on the system clears all previous calibration information for all decks.*

All calibration methods involve moving to and saving the locations of one or more points on the deck. The number of points you save and the location of the calculated positions vary depending on the selected calibration type.

You calibrate the instrument using a combination of the three calibration types. This provides you with a great deal of flexibility and makes it easy to tailor the calibration of the instrument to your specific needs. It also allows you to set up areas of the deck that are calibrated with a high degree of precision.

See Calibration Types on page 287 for descriptions of each of the calibration types and how to determine the calibration status for a specific arm.

Calibration Types

The following types of calibration are specified in WinPREP:

- Uncalibrated Points on page 287
- Initial/Reset on page 288
- 3 Point Calibration on page 289
- Individual Point on page 291

Uncalibrated Points

Points on the deck that are uncalibrated display as red points. You perform deck calibration independently for each arm. For example, on a two arm system, the Varispan arm can be calibrated while the MDT arm is uncalibrated. An arm can be completely or partially calibrated to the deck. Figure 13-1 shows an uncalibrated deck with a Varispan arm (selected) and an MDT arm.

Figure 13-1. Example of Uncalibrated Deck View

Figure 13-1 shows that the Varispan arm is not calibrated to the deck because all points on the decks are red when the Varispan arm is selected. This calibration status is only for the Varispan arm. To view the calibration status of another arm, click the arm icon (the MDT icon is in the upper right corner in Figure 13-1).

Initial/Reset

WinPREP uses Initial/Reset calibration type to calibrate the entire JANUS deck based on a single measured point. When you use this method to calibrate an arm to the deck, you locate and save a single deck position. WinPREP uses the measured point to calculate the approximate locations of all other deck positions.

The Initial/Reset calibration provides a quick and easy way to calibrate the deck in a single step, but it is the least accurate method of calibration. The calculated locations may be adequate for operating the system when using labware with relatively large sample positions, such as Big Well or some 96-well plates. However, it does not provide the precision necessary to access small wells, such as wells in 1536-well plates. The Initial/Reset calibration does not compensate for any skewing, sloping, warping or other physical abnormalities that may affect deck positions. Deck abnormalities may present problems when attempting to use high density labware.

The single point measured during Initial/Reset calibration displays as a green Measured position. The rest of the positions on the deck are calculated from the single measured point and display as white 1-point calculated points, as shown in Figure 13-2.

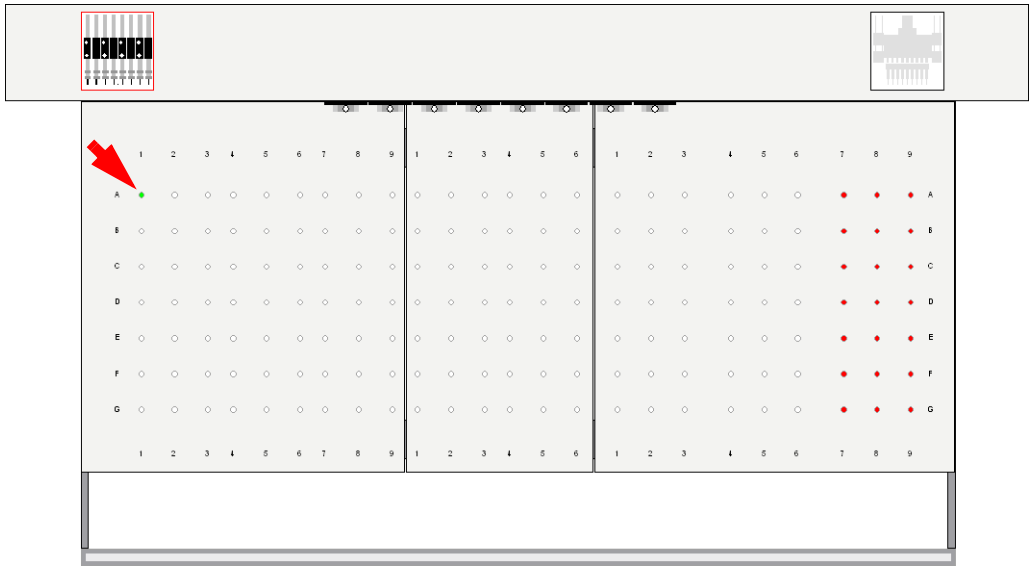


Figure 13-2. Example of Initial/Reset Calibration

In Figure 13-2, all deck positions except the upper left corner and the right three columns of the right-most deck plate display as white points, indicating the points were calculated from the Initial/Reset calibration. The upper left position (A1 as denoted by the arrow) displays as a green point, indicating the position was physically measured with the Varispan arm. WinPREP uses the measured position to calculate the rest of the positions on the deck. The right three columns (7, 8, and 9) on the right deck plate display as red points because the Varispan arm is unable to physically access these positions. The MDT arm is above this deck area and prevents the Varispan arm from reaching these positions. WinPREP does not calibrate these positions because they are inaccessible to the arm.

3 Point Calibration

The 3 Point calibration provides a quick and easy way to calibrate the deck. It is more accurate than the Initial/Reset calibration but less accurate than measuring each point with an Individual Point calibration. This method is usually adequate for larger labware targets, such as Big Well, 96-well plates, or 384-well plates. However, it may not provide the precision necessary to access very small targets, such as wells in 1536-well plates.

WinPREP uses a 3 Point calibration to calibrate portions of the deck based on three measured points. When you use this method to calibrate an arm to the deck, you measure and verify the locations of three positions on the same deck. The software then calculates all other positions included in the triangle or rectangle bounded by the three measured points. The positions that are calculated by WinPREP (3 Point Calculated) depend on the orientation of the three measured points.

The measured points (positions A1, G1, and G9, as denoted by the arrows in Figure 13-3) display in green. The 3 Point Calculated points display in yellow.

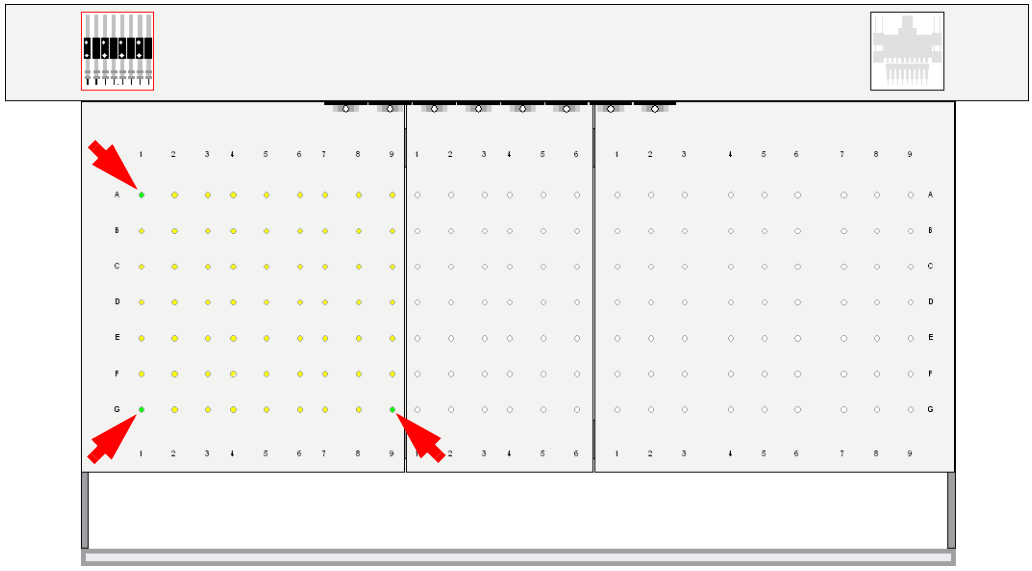


Figure 13-3. Example of 3 Point Calculated Calibration

Unlike the Initial/Reset calibration, which calculates all positions on the current deck, the positions calculated by the 3 Point calibration are limited to the triangle or rectangle bounded by the three measured points. All other deck positions remain unchanged and display in white. The orientation of the measured points determines the points that are calculated, as shown in Figure 13-4.

❖ *Tip:* *When calibrating the deck with the 3 Point calibration, all three points must be on the same deck.*

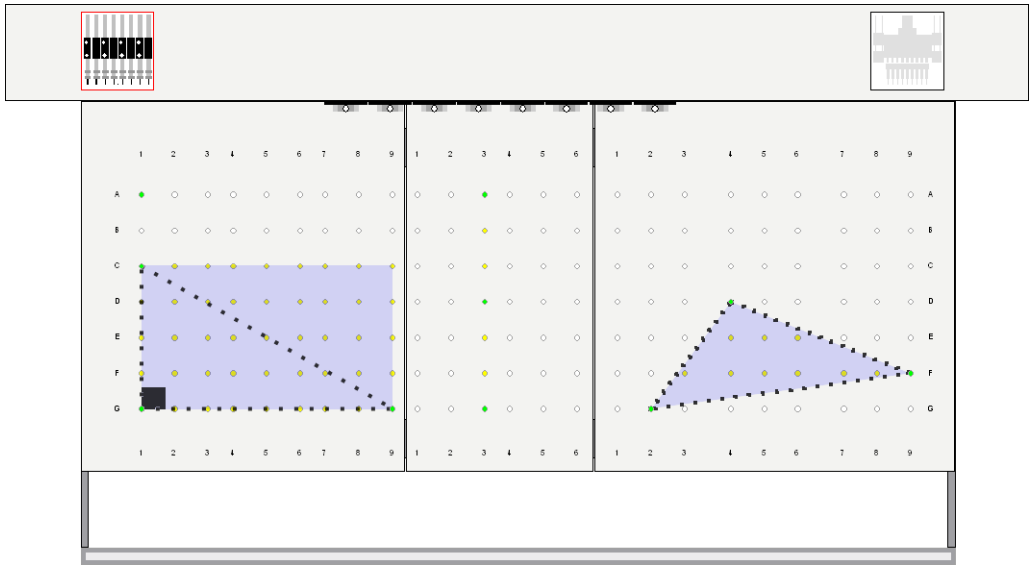


Figure 13-4. Calibration Areas for 3 Point Calculated Calibration

The 3 Point Calculated area on the left uses C1, G1, and G9 as the measured points. The 3 Point Calculated area on the center deck uses A3, D3, and G3 as the measured points. The 3 Point Calculated area on the right deck uses D4, F9, and G2 as the measured points. The dashed lines illustrate the triangles formed by the three measured points for each calibration. The shaded regions demonstrate the areas included when calculating the positions. The triangle on the left has a solid, black box in the lower vertex of the triangle, indicating a right angle (90º).

When the measured points for a 3 Point Calculated includes a right angle, such as the example on the left deck in Figure 13-4, the software determines the rectangle that bounds the points in the triangle and calculates the positions for all points inside the rectangle. It does this by rotating the triangle 180º around the center of the longest edge, (the hypotenuse). The hypotenuse is the side opposite the right angle of the triangle.

When the measured points for the calibration do not include a right angle, such as the example on the right deck in Figure 13-4, the software calibrates all the points enclosed in the triangle. Only the points completely enclosed in the triangle are calibrated; if a portion of the point extends beyond or lies on the bounding triangle, the software excludes that point from the calibration.

The example on the center deck in Figure 13-4 is a special case of three point calibration. It demonstrates the calibration behavior when all three measured points are in a line. In this example, the measured points are A3, D3, and G3, thereby including the whole column. While this provides an easy way to calibrate a single column or row on the deck, it does not have to include the entire column or row. You can include only the portions that you require.

Individual Point

The Individual Point calibration type allows you to access any individual deck location on the deck. By calibrating individual points, you measure the locations of single points for precise positioning. Only the points you choose to calibrate in this calibration type are modified. The calculated points from any previous calibrations are not affected.

While it is the most time consuming, the Individual Point calibration method provides the highest level of precision and may be required for labware with very small wells, such as 1536-well plates. This method can also be used to more accurately calibrate the arms for any other labware or positions as necessary.

Deck Calibration Coordinate System

The coordinate system used for calibrating the deck is measured from the deck origin, which is determined by the physical edges of the left-most deck plate. The deck origin is located in the back-left corner of the instrument deck.

All measurement values are in millimeters (mm) and specify the distance from the deck origin. The X coordinate values increase (become larger) as the arm moves to the right of the deck and decrease (become smaller) as the arm moves toward the left. The Y coordinate values increase as the arm moves toward the front of the deck and decrease as the arm moves closer to the back. The Z coordinate values decrease as the tip or head moves closer to the deck and increase as the tip or head moves away from the deck.

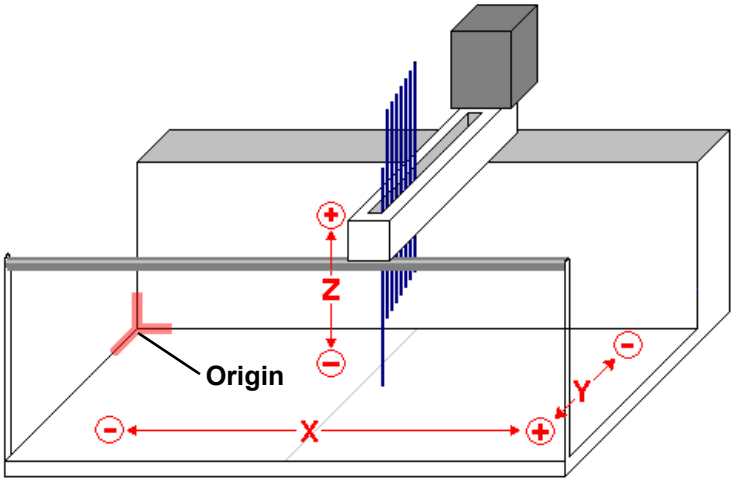


Figure 13-5. Deck Calibration Coordinate System

Calibration Procedures

This section describes calibration of the Varispan pipetting arm, MDT pipetting arm, Gripper arm, and Tube Bar Code Reader. In most respects, the calibration of the Varispan and MDT pipetting arms is very similar. Separate calibration procedures are provided for each arm because there are important differences.

This section includes:

- Selecting an Arm on page 293
- Calibrating the Varispan Pipetting Arm on page 294
- Calibrating the MDT Pipetting Arm on page 297
- Calibrating the MDT Arm for 1536-Well Microplates on page 307
- Calibrating the NanoHead on page 311
- Calibrating the MDT Gripper on page 311
- Calibrating the Gripper Arm on page 312
- Calibrating the Tube Barcode Reader on page 323

Selecting an Arm

Selecting an arm displays the calibration status for the arm in the Deck View. To select an arm, click the arm icon at the top of the Deck View. The icon for the selected arm becomes active and the deck view updates to display the calibration status for the selected arm. The icon for the active arm displays in color with a blue outline; the icon for an inactive arm displays in gray. Figure 13-6 shows the Varispan arm selected as the active arm.

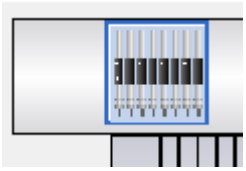


Figure 13-6. Example of Varispan Arm Selected

Calibrating the Varispan Pipetting Arm

To calibrate the Varispan arm using the WinPREP software, you measure individual or multiple points on the deck. WinPREP can then calculate other positions on the deck based on the measured points.

To setup the Calibration:

1. Prepare for calibration by removing any disposable tips from the Varispan.
2. Select **Utilities > Setup > Varispan-<x>tip > Calibrate** on the main menu, where *<x>tip* identifies the number of tips on the Varispan arm. The **Deck Calibration: Varispan** window opens as shown in Figure 13-7.

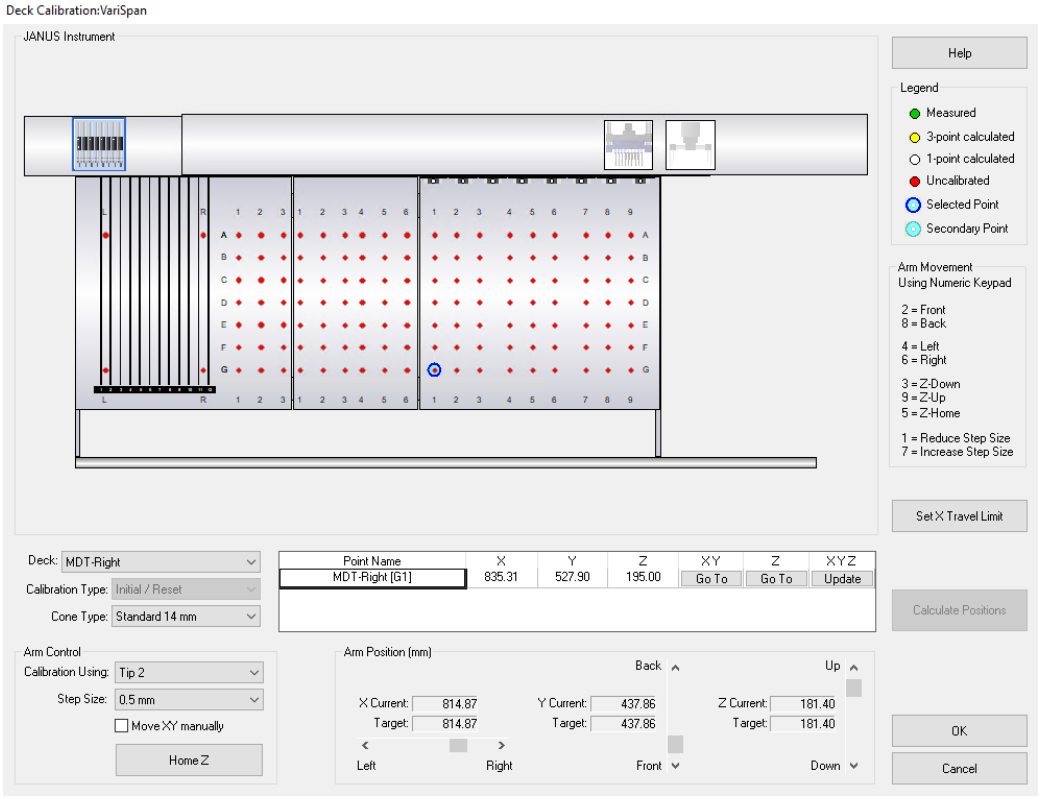


Figure 13-7. Varispan Deck Calibration Window

3. Select the deck to calibrate in the **Deck** drop-down list below the deck view.
4. Choose a **Calibration Type** in the drop down list. The default calibration point(s) is/are selected on the specified deck.

   If you are calibrating the deck for the first time, the **Calibration Type** must be **Initial/Reset**. If you choose Initial/Reset calibration, all previous calibration points on the entire deck are cleared. After the Initial/Reset calibration, you can choose 3 Point or Individual Point.

5. Select the tip to use to calibrate the deck in the **Calibration Using** drop-down list. (Use Tip 2 unless Tip 2 does not reach the position you are teaching.)
6. Place the calibration cone, shown in Figure 13-8, in the selected deck position. The calibration cone is provided with the instrument.

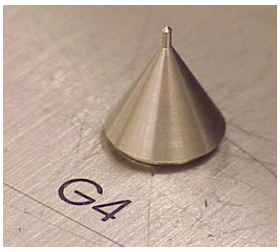


Figure 13-8. Varispan Calibration Cone

7. Measure and record the calibration points as described below.

To define the calibration points:

1. Select the first row in the **Point Name** table. The first calibration point is selected in the deck view and outlined in dark blue as shown in Figure 13-9. For Initial/Reset calibration, only one point is listed. For 3 Point calibration, the two remaining points are outlined in light blue.

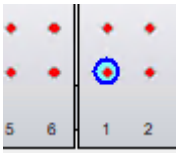


Figure 13-9. Example of Selected Calibration Point (Initial/Reset)

The **Point Name** column displays the name and location of the calibration points. Each row in the table represents a calibration point on the deck, as shown in Figure 13-10. For 3 Point calibration, there are three points listed.

2. If you want to change the points that will be measured, click the row in the table, and then click a point on the deck view. The row updates to the selected point.

Point Name	X	Y	Z	XY	Z	XYZ
Var-Middle [A1]	511.43	133.10	13.60	Go To	Go To	Update
Var-Middle [G1]	511.43	437.90	13.60			
Var-Middle [G6]	752.73	437.90	13.60			

Figure 13-10. Point Name Table (Varispan Arm, Middle Deck)

3. Select the type of calibration cone in the **Cone Type drop**-down list.

4. Click the **Go To** button for the associated calibration point. The arm moves to the specified location and lowers the reference tip so you can align it with the calibration cone.

   If the tip is very far from the selected point, you can select the **Move XY Manually** option and manually move the arm close to the point.

❖ *Tip:* *Use the **Up** and **Down** controls to make sure the tip is above the calibration cone. You do not want the tip to touch the calibration cone during horizontal adjustment, but the closer the tip is to the calibration cone, the easier to it is to check the alignment.*

5. Use the **Forward**, **Back**, **Right**, and **Left** controls under **Arm Position** to make fine adjustments until the tip is aligned with the point of the calibration cone. Aligning the tip with the calibration plate or calibration cone is a visual determination. (The **Move XY Manually** option is automatically cleared when you click one of the motor control buttons.)

   Select the desired **Step Size** to specify the distance the arm moves each time you click the **Arm Position** controls.

6. Use the **Up** and **Down** controls to make fine vertical adjustments until the end of the tip touches the tip of the calibration cone. The tip should be close enough to the calibration cone to prevent the cone from being lifted up, but you should be able to easily rotate the calibration cone around the vertical axis.

❗ ***WARNING*** *When performing this step, be very careful that you do not bend or break the tip or crash the tip into the deck or calibration cone. Doing so could severely damage the Varispan tips and arm.*

7. Click **Update** next to the point in the **Point Name** table when the tip is aligned. WinPREP saves the current location for the point and updates the row in the **Point Name** table. The measured point displays in green in the deck view, indicating its calibration status is *Measured*.
8. Click the **Home Z** button to raise the tip to a safe travel height above the deck.
9. For 3 Point or Individual Point calibration, click another row in the table and repeat the procedure until all of the calibration points are measured.
10. Click the **Calculate Positions** button to process the measured points and calculate the locations of all other deck positions in the affected region as determined by the selected calibration mode.

☞ *Note:* *The Calculate Positions button is not available in Individual Point calibration. Individual Point calibration only measures one point, so there is no calculation or interpolation of other points on the deck.*

11. If performing an Initial/Reset calibration, a message box opens to remind you that all calibration points on the deck will be reset. Click Yes to reset the calibration points or No to revert to the last saved calibration.

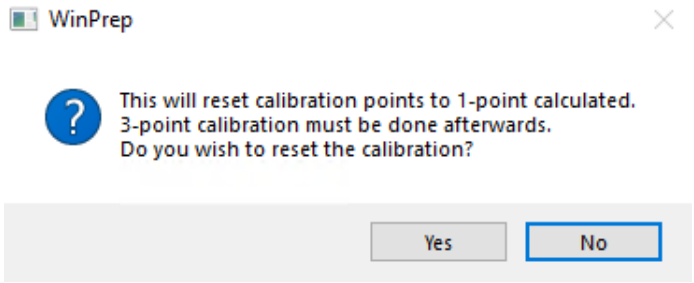


Figure 13-11. Reset Calibration Window

12. After the points are calibrated, the deck view updates the color of the deck positions depending on the calibration method used (white for Initial/Reset or yellow for 3 Point).
13. Click **OK** to save the results and close the calibration window.
14. After performing an Initial/Reset Calibration, perform a 3 Point calibration for each deck to ensure accurate positioning of the tips.

Varispan deck calibration is complete. Individual areas of a deck, such as the Tube barcode reader lanes (see Calibrating the Tube Barcode Reader on page 323) or a recessed deck, are calibrated separately from the rest of the deck.

Calibrating the MDT Pipetting Arm

To calibrate the MDT pipetting arm, you measure individual or multiple points on the deck. WinPREP calculates other positions on the deck based on the measured points.

Unlike the Varispan pipetting arm, the MDT arm requires additional preparation steps before beginning the calibration. You must load a dispense head and disposable tips before you can calibrate the system. If the system has not been calibrated, you must load and unload the head and tips manually. This step is very important as it sets the necessary Z height parameters in the software. Failure to complete this mandatory step could severely impair the precision and accuracy of the instrument. After calibration, the head and tips can be loaded either manually or automatically.

This section describes how to load and unload the tips and head manually and automatically. You can use whichever approach you prefer after the system is calibrated.

Loading Dispense Heads and Tips

This section explains the two methods for loading a dispense head and tips: manually (see page 298) and automatically (see page 299). Automatically loading a head and tips requires less manual work but also requires that the system is calibrated. Manually loading a head and tips requires more manual interaction, but can be used if the system is not yet calibrated.

To manually attach an MDT head and tips:

1. Place a Dispense Head in the Docking Station on the deck. Orient the head so that the Head ID Pickup on the head is on the right, as shown in Figure 13-12.

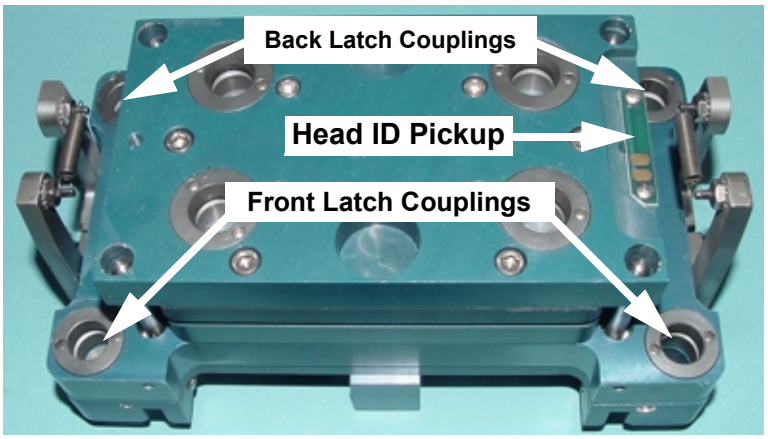


Figure 13-12. Dispense Head Orientation for Manual Load

2. Choose **Utilities > Setup > MDT > Calibrate** from the main menu. The **Deck Calibration: MDT** window opens.
3. Use the **Forward**, **Back**, **Right**, and **Left** buttons to align the head over the docking station.
4. Use the **Up** and **Down** buttons to make fine vertical adjustments until the arm is near the docked head.

WARNING *When performing this step, be very careful that you do not crash the MDT arm into the deck, docking station, or docked head.*

5. Use the **Forward**, **Back**, **Right**, and **Left** buttons once more to visually align the quick release latches with the couplings in the four corners of the docked head.
6. When the quick release latches are aligned with the couplings in the four corners of the head, click the **Manual Head Load** button.
7. The MDT arm moves down and engages the latching mechanisms for the head. Once latched, the arm moves up and lifts the head out of the docking station.

8. A prompt opens asking you to accept the Z Height recorded with the head pickup. If the head loaded properly (all latches engaged completely), accept the new Z Height setting. Reject the Z Height and retry the manual head load if errors occur.
9. Click the **Manual Tip Load** button. A dialog box asks if you are ready to proceed.
10. Click the **OK** button. You are prompted to load the Tip Box Carrier onto the MDT head.
11. Place a full Tip Box in the Tip Load Carrier.
12. Manually hook the Tip Load Carrier onto the bottom of the head. The hook *openings* must be toward the front of the instrument. Once fully connected, the Tip Load Carrier will hang suspended from the MDT head.

Caution: Make sure all four hooks on top of the Tip Load Carrier are secured before proceeding.

13. Click the **OK** button. The system moves the Tip Load Carrier up to press the tips onto the head's tip adapters and then lowers the Tip Load Carrier. You are prompted to remove the Tip Load Carrier from the MDT Head.
14. Remove the Tip Load Carrier and then click the **OK** button.
15. Set up the MDT calibration (see page 300).

To automatically attach an MDT head and tips:

NOTE *If you are calibrating the instrument for the first time, you cannot automatically load the dispense head and tips. You must manually load the head and tips. See page 298 for complete details.*

1. Place a Dispense Head in the Docking Station on the deck. Orient the head so that the Head ID Pickup on the head is on the right, as shown in Figure 13-12.
2. Choose **Utilities > Setup > MDT > Calibrate** from the main menu. The **Deck Calibration: MDT** window opens.
3. Click **Head Change**. The **Head Change** window opens.

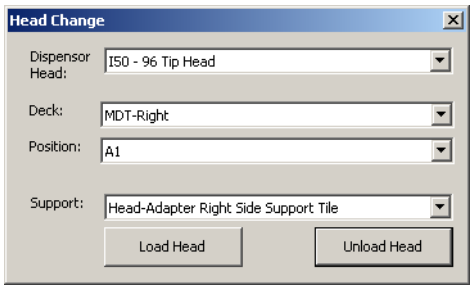


Figure 13-13. Head Change Window

4. Select the appropriate Dispenser Head, Deck, Position, and Support values in the drop-down lists.
5. Click **Load Head**. The **Head Change** window closes. The MDT arm moves to the specified deck location and loads the head in the docking station.
6. Place a full Tip Box in the Tip Load Carrier on the deck. The hook *openings* should face the front of the instrument.
7. Click **Tip Change**. The Tip Change window opens.

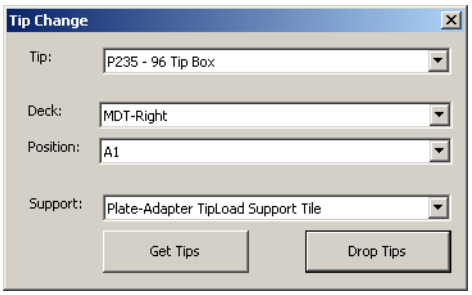


Figure 13-14. Tip Change Window

8. Choose the appropriate **Tip** type, **Deck**, **Position** and **Support** values in the drop-down lists.
9. Click **Get Tips**. The Tip Change window closes. The MDT arm moves to the specified deck location and loads the tips in the tip carrier. The automatic head and tip load is complete.
10. Set up the MDT calibration (see page 300).

To set up the MDT calibration:

1. If not already done, attach the desired head and load the tips.

☞ *Note:* *If this is the first time you are calibrating the instrument, you must manually load the head and tips. Otherwise, you can automatically load the head and tips. For instructions on loading tips manually and automatically, see Loading Dispense Heads and Tips on page 298.*

2. Select **Utilities > Setup > MDT > Calibrate** on the main menu. The **Deck Calibration MDT** window opens as shown in Figure 13-15.

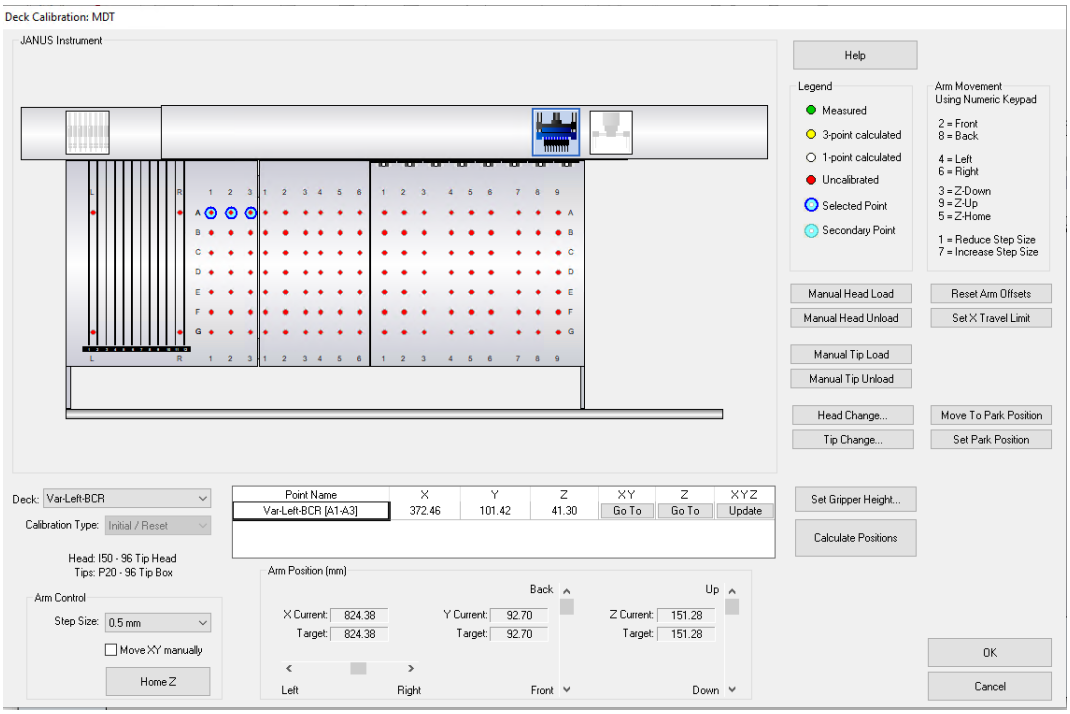


Figure 13-15. MDT Calibration Window

3. Select the deck to calibrate in the **Deck** drop-down list below the deck view.
4. Choose a **Calibration Type** in the drop down list. The default calibration point(s) is/are selected on the specified deck.

   If you are calibrating the deck for the first time, the **Calibration Type** must be **Initial/Reset**. If you choose Initial/Reset calibration, all previous calibration points on the entire deck are cleared. After the Initial/Reset calibration, you can choose 3 Point or Individual Point.
5. Place the calibration plate, shown in Figure 13-16, in the first calibration position. The calibration plate is provided with the instrument.

☞ *Note: Place the calibration plate in a medium, solid support tile before placing it on the deck. The support tile provides the reference pins necessary to position the calibration plate to the deck.*

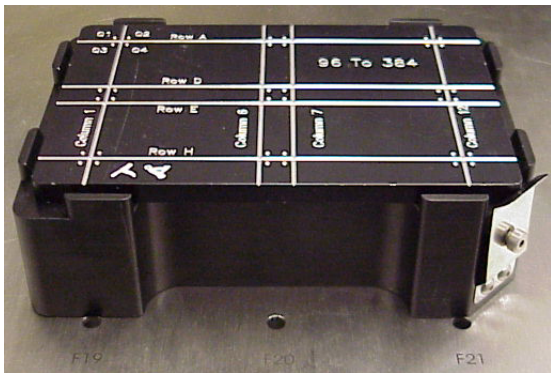


Figure 13-16. MDT Calibration Plate (on Medium Support Tile)

6. Define and record the calibration points (see page 302).

To define the calibration points:

1. Select the first row in the **Point Name** table. The selected points are outlined in dark blue as shown in Figure 13-17. For Initial/Reset calibration, only one set of points is listed. For 3 Point calibration, the two remaining sets of points are outlined in light blue.

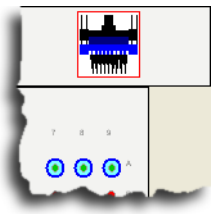


Figure 13-17. Example of Selected Calibration Point (MDT)

The MDT arm accesses all wells of a labware plate simultaneously due to the physical structure of the head and arm. The MDT calibration requires you to calibrate the three deck points that correspond to the width of the head and selects the points accordingly, as shown in Figure 13-17.

WinPREP measures three points at the same time for the MDT arm. WinPREP always selects three points in a row when calibrating the MDT arm. Clicking either A7, A8, or A9 selects three points (A7, A8, and A9) for the calibration points as shown in Figure 13-17.

The **Point Name** column displays the calibration point names as "**DeckName [Range of Three Points]**". Each row in this table represents three measured points on the deck, as shown in Figure 13-18. The X, Y, and Z values are the point on the left side of the range.

Point Name	X	Y	Z	XY	Z	XYZ
MDT-Right [A7-A9]	1158.54	101.52	41.30	Go To	Go To	Update

Figure 13-18. Calibration Points Table - MDT

2. Click the **XY Go To** button for the associated calibration point. The arm moves over the specified location.
3. Click the **Z Go To** button to lower the head so that you can align the disposable tips with the calibration plate.

☞ ***NOTE*** *Use the **Up** and **Down** controls to make sure the disposable tips are above the calibration plate. You do not want the disposable tips to touch the calibration plate during horizontal adjustments, but the closer the disposable tips are to the calibration plate, the easier it is to check the alignment.*

4. Use the **Forward**, **Back**, **Right**, and **Left** buttons to align the disposable tips with the row and column grooves in the calibration plate. Aligning the tips with the calibration plate is a visual determination.

   Select the desired **Step Size** to specify the distance the arm moves each time you click the **Arm Position** controls.
5. Use the **Up** and **Down** buttons to move the arm until the disposable tips almost touch the bottom of the grooves in the calibration plate.

❗ ***WARNING*** *When performing this step, be very careful that you do not bend or break the tips or crash the tips or head into the deck or calibration plate.*

6. Click **Update** in the **Point Name** table when the disposable tip is aligned with the calibration plate. WinPREP saves the current location for the three points and updates the row in the **Point Name** table. The three points display in green in the deck view, indicating the calibration status is *Measured*.
7. Click the **Home Z** button to raise the head and tips to a safe travel height above the deck.
8. For 3 Point or Individual Point calibration, choose another alignment point and repeat the procedure until all of the calibration points are measured. For 3 Point Calibration, three default alignment points are selected. Click a row in the table and click a different deck location to change the calibration points.
9. Click the **Calculate Positions** button to process the measured points and calculate the locations of all other positions in the affected region as determined by the selected calibration mode.

☞ ***NOTE*** *The Calculate Positions button is not available in Individual Point calibration. Individual Point Calibration only measures one point, so there is no calculation or interpolation of other points on the deck.*

10. If performing an Initial/Reset calibration, a message box opens to remind you that all calibration points on the deck will be reset. Click Yes to reset the calibration points or No to revert to the last saved calibration.

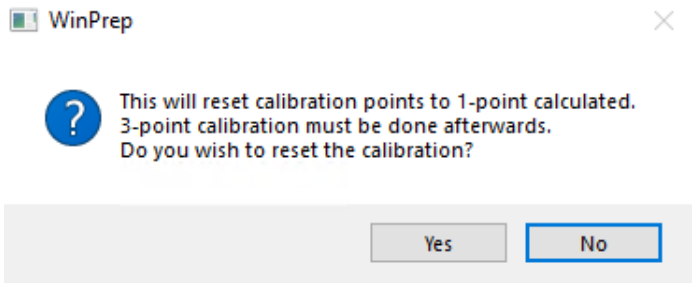


Figure 13-19. Reset Calibration Window

11. After the points are calibrated, the deck view updates the color of the deck positions depending on the calibration method used (white for Initial/Reset, yellow for 3 Point, green for Measured).
12. Click **OK** to save the results and close the calibration window.
13. After performing Initial/Reset calibration, perform a 3 Point calibration for each deck to ensure accurate positioning of the head.

☞ ***NOTE*** *If this is the first time you are calibrating the instrument, you must manually unload the head and tips. Otherwise, you can automatically unload the head and tips. For instructions on unloading heads and tips manually and automatically, see Unloading Dispense Heads and Tips.*

Unloading Dispense Heads and Tips

Similar to loading tips, the MDT dispense head and tips can be unloaded manually (see page 304) or automatically (see page 305). Automatically unloading the head and tips requires less manual work but also requires that the system is calibrated. Manually unloading the head and tips requires more manual interaction but can be used if the system is not yet calibrated.

To manually unload an MDT head and tips:

1. Place an empty Tip Box in the Tip Load Carrier.
2. Manually hook the Tip Load Carrier onto the bottom of the head. The hook *openings* must be toward the front of the instrument. Once fully connected, the Tip Load Carrier will hang suspended from the MDT head.

☞ ***NOTE*** *Make sure all four hooks on top of the Tip Load Carrier are secured before proceeding.*

If not using a Tip Load Carrier, place a container under the head to catch the dropped tips or use the **X**, **Y**, and **Z** directional controls to move the arm over a tip chute.

3. Select **Utilities > Setup > MDT > Calibrate** on the main menu. The **Deck Calibration: MDT** window opens.

4. Click the **Manual Tip Unload** button. The system ejects the disposable tips from the tip adapters into the empty tip box, container, or tip chute.
5. Remove the Tip Load Carrier from the bottom of the head, if necessary.
6. Use the **Forward**, **Back**, **Right**, and **Left** buttons to align the head over the docking station.

WARNING *Make sure the docking station you plan to unload the head into does not already contain a dispense head.*

7. Use the **Up** and **Down** buttons to move the head down near the docking station.

NOTE *When performing this step, be very careful that you do not crash the head into the docking station or deck.*

8. As the head gets close to the docking station, use the **Forward**, **Back**, **Right**, and **Left** buttons to visually align the two head with the docking station.
9. When the head is aligned with the docking station, click the **Manual Head Unload** button.

   The MDT arm moves down and releases the latching mechanisms for the head. After releasing the head, the arm moves up, leaving the head in the docking station.

The manual head and tip unload is complete and the MDT calibration is complete. You can reload the head and tips to perform additional calibrations or start using the instrument to run protocols.

To automatically unload the MDT head and tips:

NOTE *If you are calibrating the instrument for the first time, you must manually unload the head and tips (see page 304).*

1. Select **Utilities > Setup > MDT > Calibrate** on the main menu. The **Deck Calibration: MDT** window opens.
2. Place an empty Tip Box in the Tip Load Carrier on the deck. The hook *openings* must be toward the front of the instrument. If not ejecting the tips into an empty tip box, the tips can be ejected into a tip chute on the deck.
3. Click **Tip Change**. The **Tip Change** window opens (see Figure 13-14 on page page 300).
4. Choose the appropriate **Tip** type, **Deck**, **Position**, and **Support** values in the drop-down lists. The deck and position fields specify the location where the system will unload the tips.
5. Click **Drop Tips**. The **Tip Change** window closes and the MDT arm moves to the specified deck location and unloads the tips from the tip adapters.

6. Click **Head Change**. The **Head Change** window opens (see Figure 13-13 on page page 299).
7. Choose the appropriate **Dispenser Head**, **Deck**, **Position**, and **Support** using the drop-down lists and click **Unload Head**.

   The **Head Change** window closes. The MDT arm moves to the specified deck location and unloads the head into the docking station.

The automatic head and tip unload is complete. The MDT calibration is also complete. You can reload the head and tips to perform additional calibrations or start using the instrument to run protocols.

Calibrating the MDT Arm for 1536-Well Microplates

Accessing the wells on a 1536-well microplate requires precise and accurate positioning. You must perform additional calibration tasks to ensure the high level of precision and accuracy.

The following items outline the conditions necessary to reliably aspirate from and dispense into 1536-well microplates using the MDT pipetting arm.

- Perform the deck calibration with the dispense head and disposable tips (if applicable) you will use to access the 1536-well microplate.
- Perform an Individual Point calibration at each deck location that will support a 1536-well plate. See 1536-Well Calibration Method on page 308 for instructions.
- The I30 dispenser head and P30 or P10 disposable tips are the optimal choices for accessing 1536-well microplates. The I50 dispenser head, with P20 disposable tips, is also acceptable for accessing 1536-well microplates.
- If using both I30 and I50 heads on the same system, you must use the Individual Point calibration method to re-calibrate any common deck positions before switching from one head to the other. If the heads access1536-well plates on different deck positions, recalibration is not necessary.
- If both NanoHead and MDT dispense heads access the same 1536-well Plate, perform the Individual Point calibration with the disposable tip dispense head first and verify the calibration with the NanoHead Calibration Tool.
- Use the Individual Point calibration method to recalibrate all 1536-well plate positions on the deck if the MDT pipetting arm encounters any obstruction during motion.

Calibrating the JANUS G3 Deck for 1536-Well Microplates

This section describes how to calibrate deck locations for improved positional accuracy when using 1536-well microplates.

Using this method, you can verify the calibration by observing how all the tips align with the wells in a 1536-well plate. You can ensure the tips do not touch the tops or sides of the wells. You can also check the alignment of all tips and see how the tip locations vary from well to well. This allows you to estimate any necessary adjustments based on all the tips rather than a few distributed tips.

Although this method uses the **Labware Evaluation** screen, it does not change any labware definitions. This method changes the calibrated deck positions to improve access to 1536-well microplates.

1536-Well Calibration Method

Perform the following calibration method for all deck locations where you want to use the MDT pipetting arm to access 1536-well microplates.

Prior to beginning any calibrations, fully level the instrument and adjust for head-to-deck level and squareness to ensure optimal positional accuracy.

To perform a 1536-well calibration:

1. Calibrate each deck plate using a 3 Point calibration. Perform the calibration procedure using the disposable tips you will use when accessing the 1536-well microplate. See Calibrating the MDT Pipetting Arm on page 297 for more information on performing a 3 Point calibration.
2. Perform an Individual Point calibration for the 1536-well microplate deck position using the procedure described in Calibrating the MDT Pipetting Arm on page 297.

   When using disposable tips to access the 1536-well microplate, use the actual dispense head that will access the plate wells. Load the head with a new box of disposable tips. When using the NanoHead to access the 1536-well microplate, use the NanoHead calibration tool.

☞ *Note: If the disposable tip head and the NanoHead will access the same 1536-well microplate, calibrate the deck with the disposable tip head first followed by verification with the NanoHead calibration tool.*

3. Remove the MDT calibration plate from the deck support tile and replace it with a 1536-well microplate. The microplate must be identical to the plate type used in the actual protocol.

☞ *Note: The labware file for the microplate used in the calibration must be accurate according to the microplate manufacturer's specifications. Unless an accurate labware file is available, this method of adjusting the calibration should not be used.*

☞ *Note: Position the microplate in the medium solid support tiles so the plate is pushed to the left/back corner of the support.*

4. Open a new WinPREP protocol and populate the deck view with a 1536-well microplate and support. Be sure to place these items in the same deck location you calibrated in Step 2 above.
5. Double-click the microplate in the deck view to open the **Labware Parameters** window, shown in Figure 13-20.

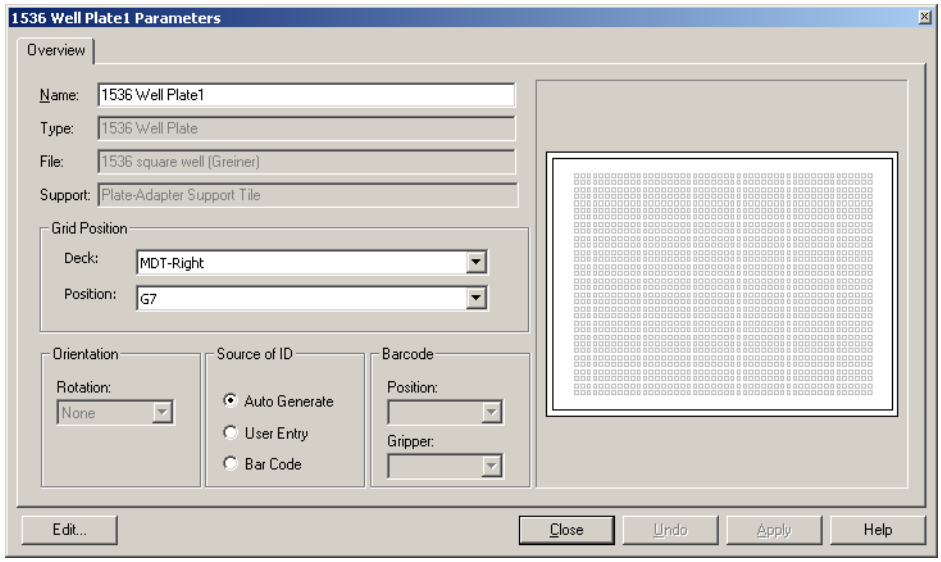


Figure 13-20. Labware Parameters Window

6. Click **Edit** in the lower-left corner of the **Labware Parameters** window and click **OK** on the **Prepare for Labware Evaluation** window. The **Properties** window opens as shown in Figure 13-21.

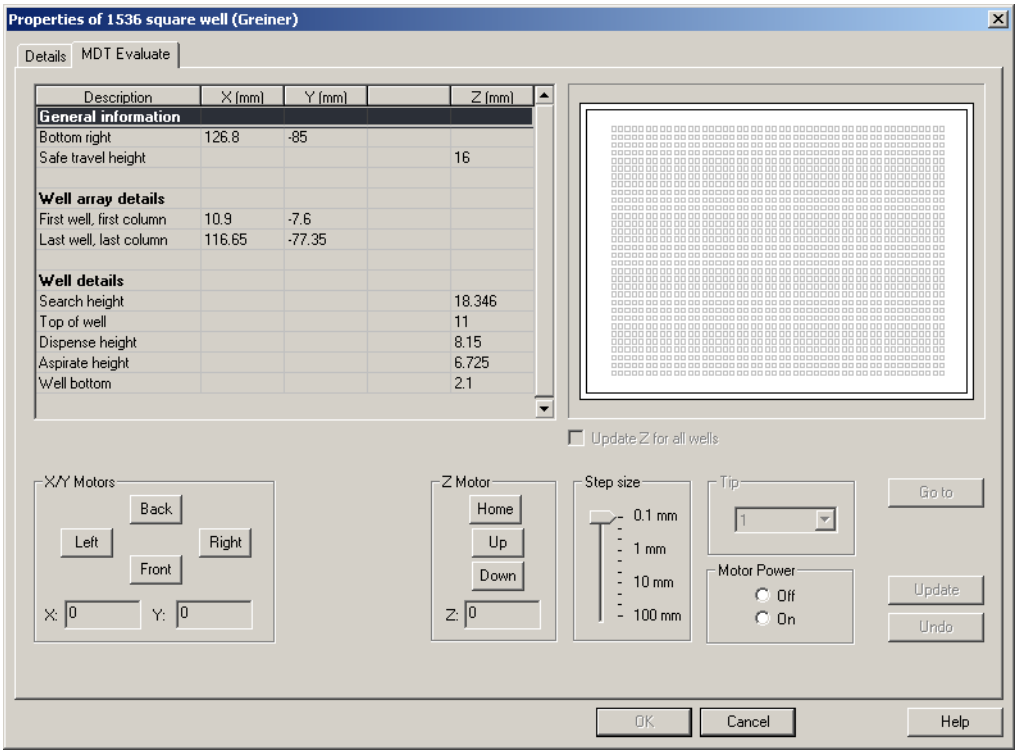


Figure 13-21. Labware Properties Window

7. Select the **first well, first column** field in the table on the left side of the window, as shown in Figure 13-22.

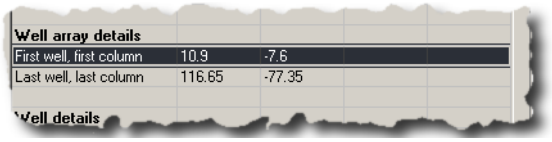


Figure 13-22. Labware Properties Window

8. Click the **Go to** button to move the A1 tip of the MDT head to the center of well A1.
9. Before making any adjustments to the position of the MDT arm or tips, record the X and Y coordinates shown in the **X/Y Motors** frame. These are the *starting* X and Y values.
10. Set the **Step size** option to *1 mm* and use the **Z Motor Up** and **Down** buttons to move the tips into and out of the wells.
11. While moving the tips in and out of the wells, listen for any tip contact with the well walls and look to make sure the tips are centered in the wells. Inspect as many tips as possible and visually average the tip positions in the wells.
12. If you need to adjust the calibrated position, make fine X- and Y-axis adjustments using the controls in the **X/Y Motors** frame until, on average, all of the tips are centered in the wells.
13. Write down the current X and Y positions. These are the *ending* X and Y values.
14. Subtract the *starting* X and Y values from the *ending* X and Y values. The change in positioning is referred to as delta-X (ΔX) and delta-Y (ΔY).
    NOTE: Do **not** update the labware properties for the 1536 well microplate.
15. Record the delta-X and delta-Y (ΔX and ΔY) values and close the **Labware Definition** window without updating.
16. Remove the 1536 well microplate from the deck.
17. Select **Utilities > Setup > MDT > Calibrate** on the main menu to open the **Deck Calibration: MDT** window. Click **Go To** to move the MDT arm to the calibrated deck position.
18. Using the **Arm Position** control, adjust the X and Y position by the ΔX and ΔY values recorded in Step 15 above.
19. Click **Update** to record the changes to the calibrated position and click **OK** to close the **Deck Calibration MDT** window.
20. Verify the first well position for the same 1536-well microplate at this deck location by repeating Steps 5 through 8 above.

The calibration is complete. Note: you must repeat these calibration steps each time you load a different MDT head.

Calibrating the NanoHead

To calibrate the NanoHead, follow the instructions for Calibrating the MDT Pipetting Arm on page 297, but use the NanoHead Calibration Tool to align the head with the calibration plate.

Calibrating the MDT Gripper

If the MDT arm includes an MDT gripper, the X and Y position of the head is set when calibrating the MDT arm, but you must also calibrate the MDT gripper by setting the gripper height.

To calibrate the MDT gripper:

1. Load the MDT head with disposable tips.
2. Select **Utilities > Setup > MDT > Calibrate** on the main menu to open the **Deck Calibration: MDT** window (see Figure 13-15 on page 301).
3. Click the **Set Gripper Height** button. The Set Gripper Height window opens as shown in Figure 13-23.

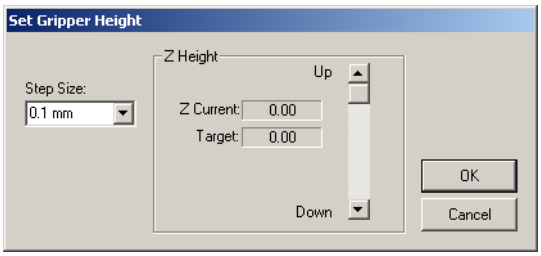


Figure 13-23. Set Gripper Height Window

4. Use the **Z Height** controls to lower the MDT gripper fingers until the bottom of the fingers are flush with the bottom of the disposable tips on the head.

❖ *Tip: Hold an item with a flat surface, such as the MDT Calibration Plate or a rigid piece of cardboard, against the bottom of the tips and move the gripper down to contact the same surface.*

5. When the gripper is positioned properly, click **OK** to save the vertical height and close the **Set Gripper Height** window.
6. Click **OK** to close the **Deck Calibration: MDT** window.

The MDT gripper calibration is complete. You can proceed with additional calibration tasks or begin using the instrument.

Calibrating the Gripper Arm

In order for the system to reliably manipulate labware using the Gripper, it must be able to accurately locate the labware with the Gripper fingers. When you calibrate the Gripper arm, you identify and measure points on the instrument's deck. Each Gripper calibration point consists of three deck positions. Once calibrated, you can associate grippable labware on the deck with Get Plate and Move/Put Plate steps in the protocol outline. You can specify that an item is grippable by providing the necessary information in its labware definition.

- For standard On-Deck positions, see Calibrate the Deck for the Gripper Arm below.
- For labware positions that are located off the deck but within range of the Gripper arm, or special locations on the deck such as in front of a barcode reader, see Teaching Off-Deck (or Special On-Deck) Locations on page 319. Use this procedure to teach positions on incubators, shakers, readers, or plate sealers, or to position labware in front of barcode readers for plate identification, etc.
- For manifold components that are located at a single location, see Teaching Manifold Component Locations on page 321. Manifold components that can be assembled or disassembled during a protocol are typically located at a single location, but with different heights and/or finger positions to grip each manifold component.

Calibrate the Deck for the Gripper Arm

To setup the Gripper calibration:

1. Select **Utilities > Setup > GripperArm (**or **ExtendedGripper) > Calibrate** on the WinPREP menu. The **Deck Calibration: Gripper window** opens as shown in Figure 13-24. Default calibration points are selected based on the selected deck and calibration type.

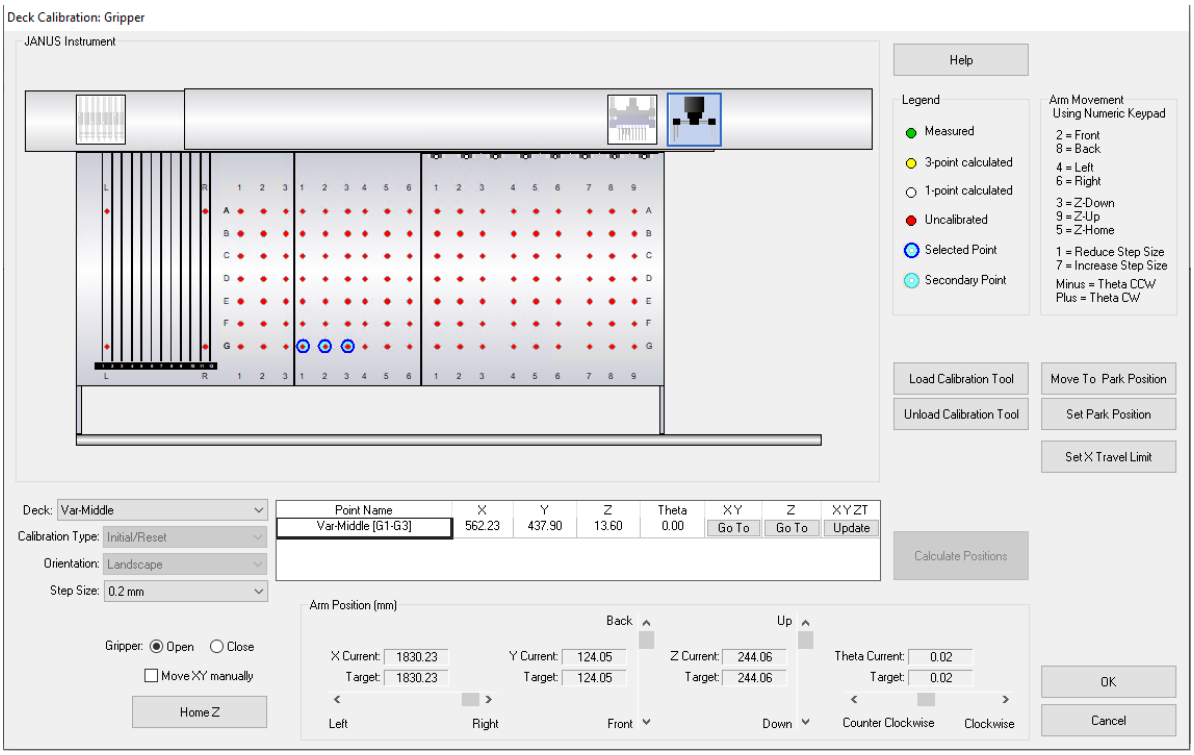


Figure 13-24. Gripper Calibration Window

2. Click the deck position where you want the gripper arm to move to load the Gripper Calibration Tool. The point should enable you to reach the keyboard and calibration tool at the same time. The position is highlighted in the deck layout but the gripper does not move. Note that the calibration position in the Calibration Point Table updates to the selected position.
3. Click the **Load Calibration Tool** button on the Deck Calibration: Gripper window. The gripper moves to the point selected on the deck layout. The Gripper **Get Calibration Tool** window opens as shown in Figure 13-25.

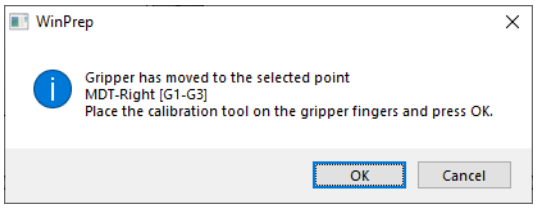


Figure 13-25. Get Calibration Tool Window

4. Place the calibration tool, shown in Figure 13-26, onto the Gripper fingers and hold it up on the Gripper fingers.

   The Gripper fingers fit through the four oval holes in the Gripper calibration tool, as shown in Figure 13-27. Make sure that the metal pins in the Gripper calibration tool point downward.

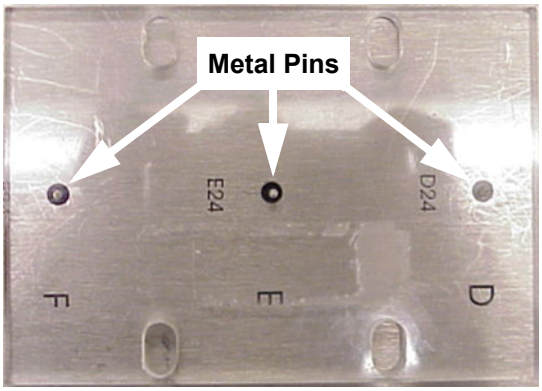


Figure 13-26. Gripper Calibration Tool

5. Click **OK**. The Gripper fingers open to grip the calibration tool and the Get Calibration Tool window closes. Carefully move the gripper tool down on the fingers until the bottom of the plate rests on the horizontal finger pins, as shown in Figure 13-27.

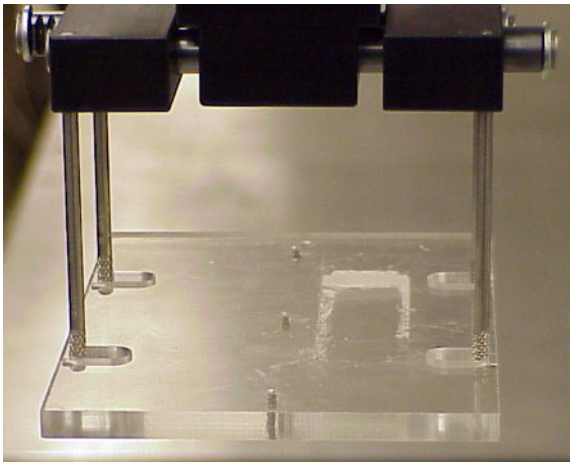


Figure 13-27. Gripper Calibration Tool on Gripper Fingers

6. In the Deck Calibration: Gripper window (see Figure 13-24), select the deck to calibrate in the **Deck** drop-down list below the deck view.
7. Choose a **Calibration Type** in the drop down list. The default calibration point(s) is/are selected on the specified deck.
8. If you are calibrating the deck for the first time, the **Calibration Type** must be **Initial/Reset**. If you choose Initial/Reset calibration, all previous calibration points on the entire deck are cleared. After the Initial/Reset calibration, you can choose 3 Point or Individual Point.
9. Set the **Orientation** option to the orientation of the gripper for calibration, normally **Landscape**. Figure 13-28 shows a 96-well plate in landscape and portrait orientations.

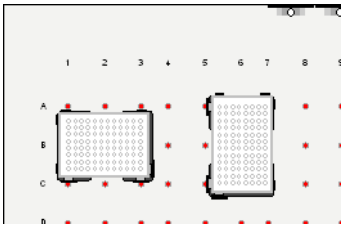


Figure 13-28. Labware Orientation Example (Landscape and Portrait)

10. Select and record the calibration points as described below.

To select the calibration points:

1. Select the deck to calibrate in the **Deck** drop-down list below the deck view. The default calibration point(s) for the deck are selected.
2. Click the first row in the **Point Name** table. The selected point is outlined in dark blue as shown in Figure 13-29. Any other default points are outlined in light blue.

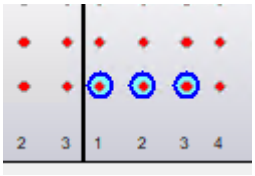


Figure 13-29. Example of Selected Gripper Calibration Point

The software selects deck positions in groups of three because there are three pins on the Gripper calibration tool. The software automatically selects three deck locations when you click one Gripper calibration point. For example, when you click position G1, the software selects positions G1, G2, and G3.

The **Point Name** column shows the selected calibration points (one for Initial/ Reset or Individual Point calibration, three for 3 Point calibration). Each row represents a Gripper calibration point on the deck, as shown in Figure 13-30.

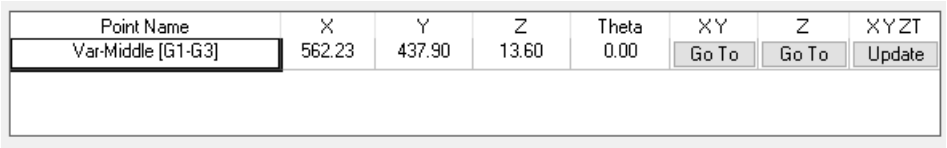


Figure 13-30. Point Name Table

3. Place three calibration cones, shown in Figure 13-31, in the three deck positions associated with the calibration point you want to measure. The three deck positions are indicated on the deck view and in the Point Name table. The calibration cones are provided with the instrument.

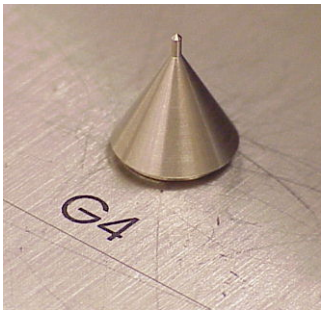


Figure 13-31. Gripper Calibration Cone

You use three deck positions because the Gripper calibration tool contains three alignment pins. During calibration, align the three metal pins in the Gripper calibration tool with the three deck positions. The Point Name Table displays the coordinates of the middle of the three deck positions. For example, in landscape orientation, to measure position G2, select positions G1, G2, and G3. In portrait orientation, to measure position B2, select positions A2, B2, and C2.

4. Click the **XY Go To** button for the associated calibration point. The arm moves above the specified location.

   Alternately, if the Gripper arm is far from the selected point, select the **Move XY Manually** check box and physically move the arm until the pins are close to the calibration cones. Deselect the **Move XY Manually** check box before proceeding.

5. Click the Z **Go To** button for the associated calibration point. The Gripper arm moves down to the specified height.

❖ *Tip:* *Use the **Up** and **Down** controls to make sure the pins on the calibration plate are above the calibration cones. You do not want the pins to touch the calibration cones during horizontal adjustments, but the closer the pins are to the calibration cones, the easier it is to check the alignment.*

6. Use the **Front**, **Back**, **Right**, and **Left** position slider controls in the **Arm Position** frame of the window to make fine adjustments until the pins on the calibration plate are aligned with the points of the calibration cones. Aligning the pins with the calibration cones is a visual determination.

   Select the desired **Step Size** to specify the distance the arm moves each time you click the **Arm Position** controls.

7. Use the **Up**, **Down**, **Clockwise**, and **Counterclockwise** position slider controls to make fine vertical and rotational adjustments until the pins on the bottom of the calibration plate touch the tips of the calibration cones. Align the pins with the tips of the calibration cones; the pins on the calibration plate should not touch or exert any pressure on the tips of the calibration cones. See Figure 13-32 for an example of calibration pin to cone alignment.

***WARNING**: When performing this step, be very careful that you do not bend or break the calibration pins or calibration cones or crash the calibration pins into the deck or calibration cones. Doing so could damage the Gripper arm or calibration plate.*

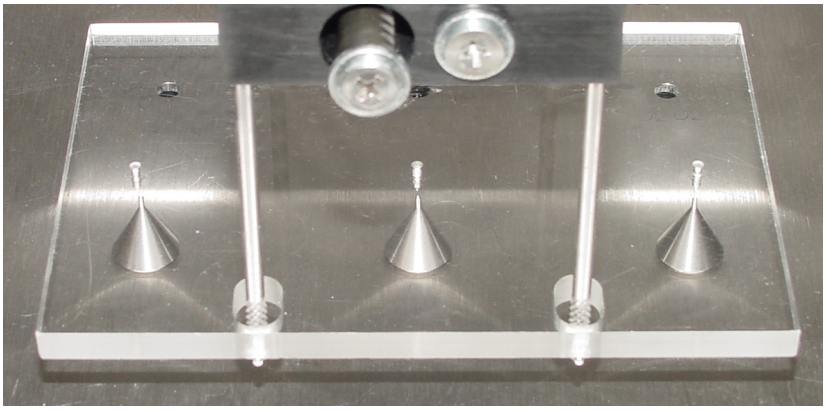


Figure 13-32. Gripper Calibration Tool Alignment with Calibration Cones

8. Click **Update** in the **Point Name** table when the Gripper Calibration Tool is aligned. WinPREP records the measured location for the point and updates the selected row in the **Point Name** table. The measured point displays in green, indicating its calibration status is *Measured*.
9. Click the **Home Z** button to raise the Gripper to a safe travel height above the deck.
10. For 3 Point or Individual Point calibration, click another row in the table and repeat the procedure until all of the calibration points are measured.
11. If you want to unload the gripper calibration tool, click the deck location where you want to unload the calibration tool and then click the **Unload Calibration Tool** button. The Gripper moves to the selected location and then moves down to approximately 10mm above the deck. The Unload Gripper Calibration Tool window opens as shown in Figure 13-33.

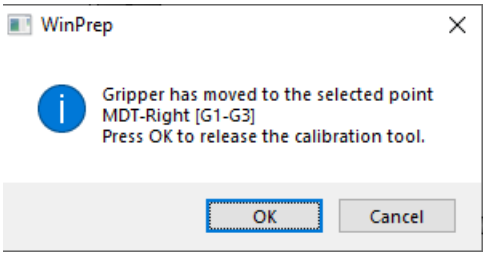


Figure 13-33. Unload Gripper Calibration Tool Window

12. Hold your hand under the calibration tool to prevent the tool from dropping onto the deck and click the **OK** button to release the Gripper calibration tool.
13. Click the **Calculate Positions** button to process the measured reference points and calculate the locations of all other deck positions in the affected region as determined by the selected calibration mode.

☞ *Note: The Calculate Positions button is not available in Individual Point Calibration mode. This mode calibrates individual points, so there is no calculation or interpolation of other points on the deck.*

14. If performing an Initial/Reset calibration, a message box opens to remind you that all calibration points on the deck will be reset. Click **Yes** to reset the calibration points or No to revert to the last saved calibration.

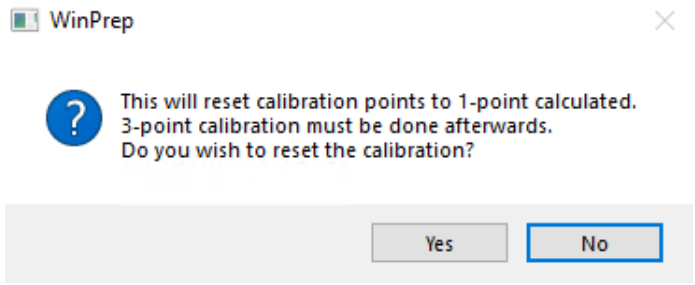


Figure 13-34. Reset Calibration Window

15. After the points are calibrated, the deck view updates the color of the deck positions depending on the calibration method used (white for Initial/Reset or yellow for 3 Point).
16. Click **OK** to save the results and close the calibration window.
17. After performing Initial/Reset calibration, perform a 3 Point calibration for each deck to ensure accurate positioning of the gripper.

Teaching Off-Deck (or Special On-Deck) Locations

The **Teach Position** window allows you to teach custom positions for the Gripper arm.

To teach Gripper positions for Off-Deck or special On-Deck locations:

1. Select **Utilities > Setup > Gripper > Teach Positions** on the main menu. The Select Taught Position window opens as shown in Figure 13-35.

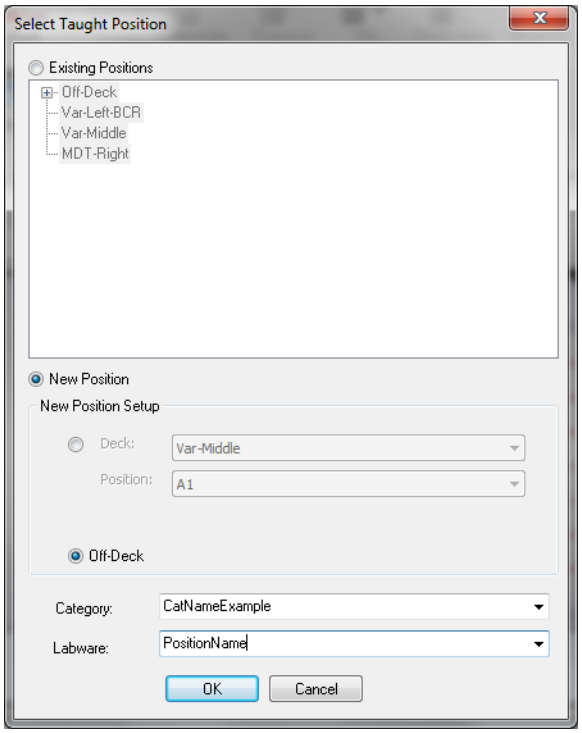


Figure 13-35. Select Taught Position Window

2. If the position already exists, select the Existing Positions option, select the name of the position to teach, and go to step 8.
3. To create a new position, select the **New Position** option.
4. Select whether to create an **On-Deck** or **Off-Deck** position. On-Deck positions are relative to a location on the deck. Off-Deck locations are relative to the Deck Origin (see Deck Calibration Coordinate System on page 292).
5. If creating an On-Deck position, select the **Deck** and the **Position** that the taught position will be relative to.
6. Type a Category name for the position in the **Category** text box. The Category name groups the taught positions so they are easier to identify.
7. Type a name for the position in the **Labware** text box.
8. Click the **OK** button. The Teach Position window opens as shown in Figure 13-36.

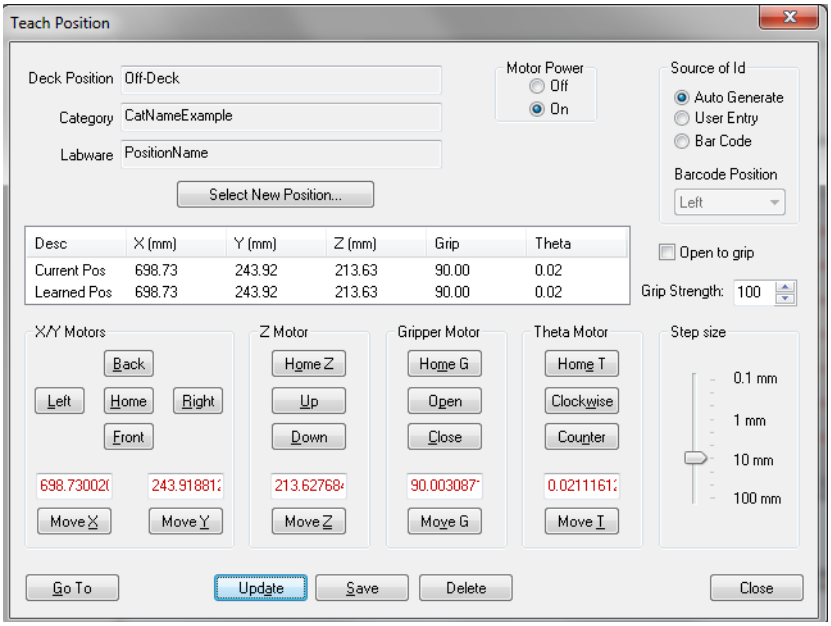


Figure 13-36. Teach Position Window for Gripper Arm

9. Position the labware in the position it will be located in when the gripper will be moving the labware.
10. If the labware item must be gripped by the fingers from the inside of the lip of the labware, select the **Open to grip** check box.
11. Change the step size, as necessary to facilitate precise positioning.
12. Move the fingers to the precise location of the labware (rotate the fingers if necessary) and position the four fingers equidistant from the labware.
13. Click the **Update** button to display the current position of the gripper and fingers in the Learned Position row of the table.
14. Click the **Save** button to save the position.
15. If desired, click the **Select** button to open the **Select Taught Position** window and repeat steps 2-14 until all the necessary positions are taught.
16. Click the **Close** button to close the Teach Position Window.
17. Click the **OK** button to close the **Select Taught Position** window.

Teaching Manifold Component Locations

The **Teach Manifold Components** window allows you to teach the gripper positions for manifold components. This allows the gripper to adjust for the variable height and size of different manifold components as components are added or removed from the manifold during the protocol. Manifold Component Locations are relative to the deck position of the labware.

1. Select **Utilities > Setup > Gripper > Teach Manifold Components** on the main menu. The **Select Manifold Components** window opens as shown in Figure 13-37.

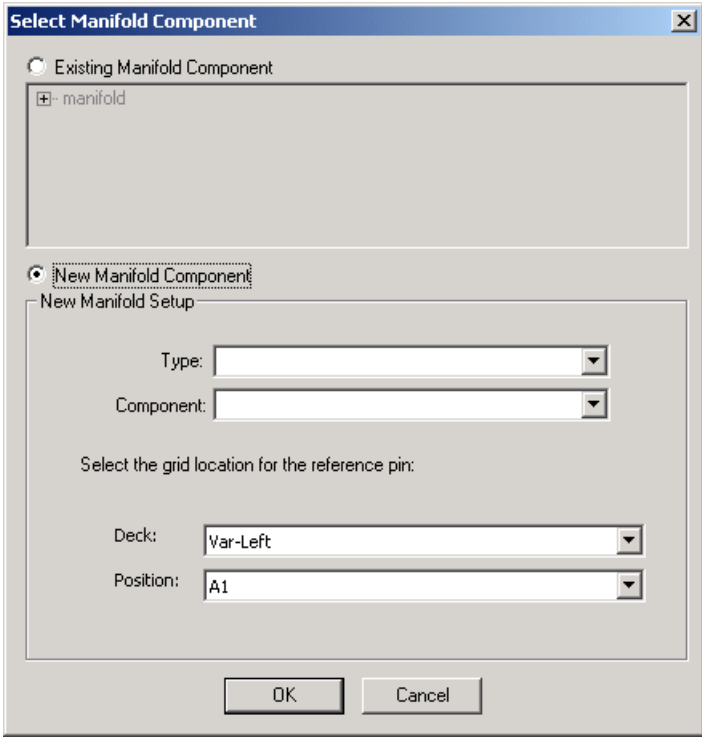


Figure 13-37. Select Manifold Component Window

2. If the component already exists, select the **Existing Manifold Component** option, select the name of the manifold component to teach, and go to step 7.
3. To create a new manifold component, select the **New Manifold Component** option.
4. Type the desired name for the type of manifold in the **Type** drop-down list, or select an existing type if the manifold has already been created.
5. Type the desired name for the component to teach in the **Component** drop-down list.
6. Select the **Deck** and **Position** where the labware is located on the deck.

7. Click the **OK** button. The Teach Manifold Components window opens as shown in Figure 13-38.

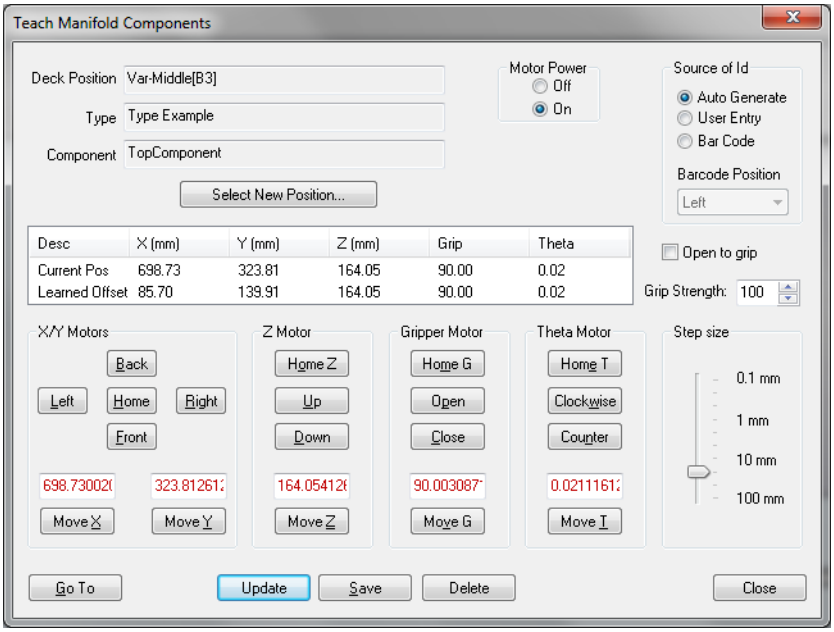


Figure 13-38. Teach Manifold Components Window

8. If the labware will be gripped from the inside of the labware, select the **Open to Grip** check box.
9. Change the **Step Size** as necessary to precisely position the gripper.
10. Use the Motor buttons to position the gripper in the proper location to grip the labware.
11. Verify the gripper fingers are equidistant from the labware by opening or closing the fingers until they almost touch the labware and verifying that the gripper is centered.
12. Open or close the gripper fingers all the way, so the fingers are as far as possible from the labware.
13. Click the **Update** button to display the current position of the Gripper arm in the table.
14. Click the **Save** button to save the position.
15. If desired, click the **Select New Position** button to open the **Select Manifold Components** window and repeat steps 2-14 until all the necessary components are taught.
16. Click the **Close** button to close the Teach Manifold Components window.
17. Click the **OK** button to close the **Select Manifold Components** window.

Calibrating the Tube Barcode Reader

This procedure calibrates the Varispan arm to the Varispan Tube Barcode Reader deck (Var-Left-BCR). The Tube Barcode Reader has 12 lanes of tube cassettes numbered 1 to 12 from left to right. Each cassette holds 16 tubes numbered from 1 to 16 (from back to front). The barcode scanner (laser or optical) reads the barcodes on the tubes in the tube cassettes as the cassette is moved in front of the barcode scanner.

This section contains the following procedures for calibrating the Tube Barcode Reader:

- Calibrating the Tube Barcode Reader Deck on page 323
- Teaching the Tube Barcode Reader Engage Position on page 326
- Teaching Labware for the Tube Barcode Reader Cassettes on page 327

Calibrating the Tube Barcode Reader Deck

Teach the Varispan Tube Barcode Reader deck using a 3 Point calibration as described below.

To calibrate the Varispan Tube Barcode Reader Deck:

1. Select **Utilities > Setup > Varispan 8-Tip or 4-Tip > Calibrate**. The **Deck Calibration:Varispan** window opens as shown in Figure 13-39.

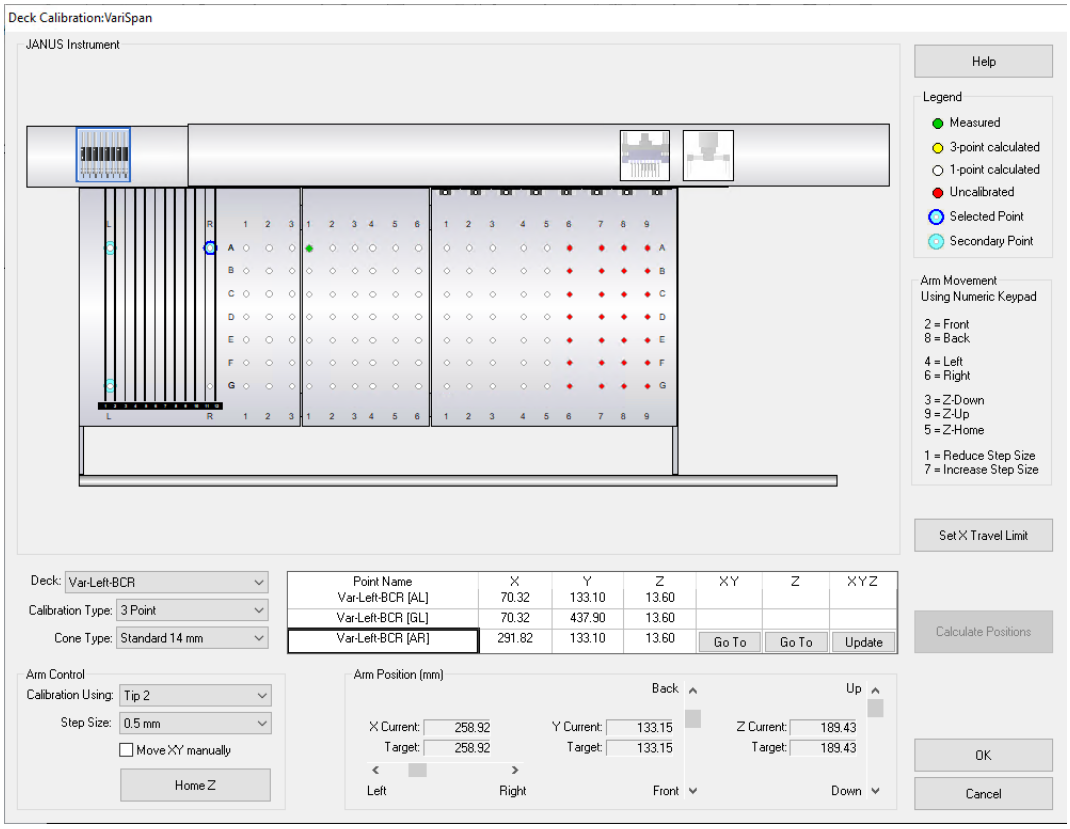


Figure 13-39. Calibrate Tube Barcode Reader, Initial/Reset Calibration

2. Select **Var-Left-BCR** in the Deck drop-down list.
3. Select **3 point** in the **Calibration Type** drop-down list.
4. Click position AL on the tube rack on the deck layout. Three default points (GL-Left Front, AL-Left Rear, and AR-Right Rear) are circled on the Var-Left-BCR Deck.

☞ *NOTE: The Var-Left-BCR Deck positions must be taught in the following order: GL, AL, and then AR. Teaching in any other order will not calculate the positions properly. The positions must form a right angle when teaching.*

5. In the **Cone Type** drop-down list, select **Standard 14mm**.
6. Remove the black plastic 12-lane rack from the deck.
7. Place the **calibration cone** (P/N 5077293) in position **GL**.
8. Click the **Go To** button in the **XY** column for position AR. The Varispan arm moves to the taught position in the X and Y directions, but the tip does not move down.

9. Click the **Go To** button in the **Z** column for position AR. The selected Varispan tip moves down and should lightly contact the top of the cone. When the arm and tip are positioned correctly, you should be able to rotate the cone, but not remove the cone from under the tip.
10. If the position needs to be adjusted, use the **Step Size** setting and the **Position** buttons to move the arm left/right or forward /back and to move the tip up/down. Click the **Update** button when the arm and tip are in the correct positions.
11. Click the **Update** button to teach each position.
12. Repeat to teach positions AL and then AR.
13. Click the **Calculate Positions** button. The Tube Imaging Module positions on the Var-Left-BCR deck are calculated based on the new taught positions. (The calculated positions on the Var-Left-BCR Deck display in yellow to indicate the 3 Point calibration is complete.)
14. Replace the black plastic 12-lane rack on the deck.
15. Calibrate the right side of the Var-Left-BCR deck by performing a 3 point calibration using three points that form a right angle to enclose the deck. The default is A1, G1, and then G3.

Teaching the Tube Barcode Reader Engage Position

When reading barcodes, the engagement finger on the arm interlocks with a notch on the end of the cassette and pulls the tube cassette past the tube barcode reader. To ensure the finger properly engages with the cassette, you must calibrate the tube barcode reader. This calibration defines the exact location of the initial finger engagement for the first cassette (Lane 1). The system determines the engagement positions of the remaining cassettes based on the first cassette.

To calibrate the tube barcode reader:

1. Position a cassette in Lane 1 with the metal tab toward the back of the deck and move the cassette to the front of the instrument.
2. Select **Utilities > Setup > Bar Code Scanner > Setup**. The **Setup Lane 1 Engage Position** window opens as shown in Figure 13-40 to define the engagement position for the first cassette on the deck.

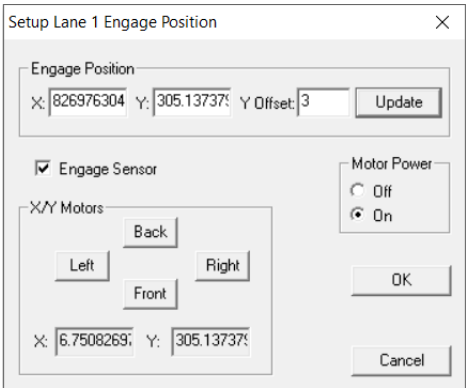


Figure 13-40. Setup Lane Engage Position window

3. Use the **Left**, **Right**, **Back**, and **Front** directional control buttons to position the engagement finger in the center of the notch on the end of the cassette in Lane 1. Verify the **Engage Sensor** check box displays a check mark, indicating that the sensor detects the cassette.

   Alternately, set the **Motor Power** option to **Off** and manually move the barcode finger into proper alignment. (Motor power is automatically restored when you use any of the directional buttons. You do not have to explicitly turn the motor power back on.)
4. Verify that the finger engages with the cassette and click **Update** to save the new position.
5. Click **OK** to close the window.
6. Adjust the **Y Offset** if necessary. If the cassette is not positioned all the way at the front of the rail when moving the rack to the Home position, increase the Y Offset. If the cassette bumps against the front of the rail and the back of the cassette lifts, decrease the Y Offset.

Teaching Labware for the Tube Barcode Reader Cassettes

Teaching the tube cassettes enables the Varispan tips to accurately access the tubes in the cassettes. Two positions, Tube 1 and Tube 16, are taught. The remaining positions in the cassette are calculated relative to the two taught positions.

To teach the tube cassettes:

1. Open any protocol that includes the Tube Barcode Reader.
2. Add the Tube Bar Code Cassette labware to Lane 1 of the tube rack, specifying the tubes you are using.
3. Place a tube in Position 1 of the tube cassette, place the tube cassette in Lane 1, and move the tube cassette all the way to the front of the rail.
4. Right-click on the cassette in lane 1 and click **Properties**. The Tube Bar Code Cassette1 Parameters window opens.
5. Click the **Edit** button. The Prepare For Labware Evaluation window opens.
6. Click the **OK** button. The Properties window for the specific tube opens (Figure 13-41).

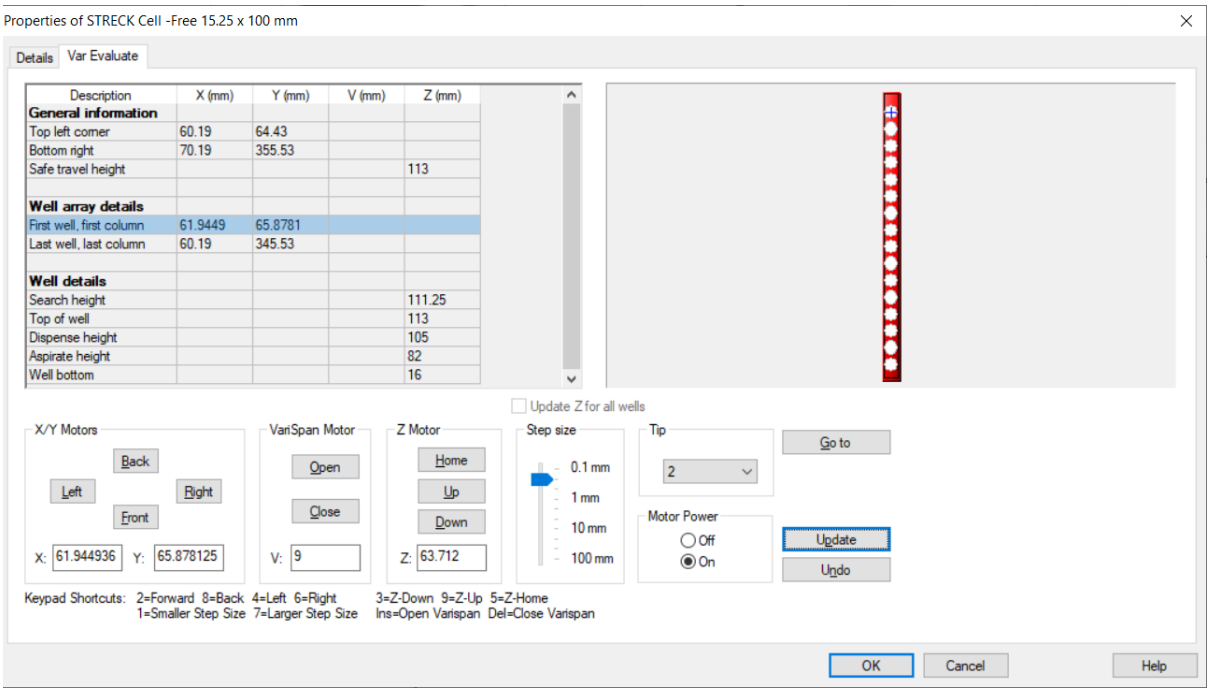


Figure 13-41. Streck Properties Window

7. Click the **Var Evaluate** tab.
8. Click the **First Well, First Column** entry in the table.
9. Click the **GoTo** button to move the tip to the XY location in the table.

10. Use the **Left/Right** and **Back/Front** buttons to align Tip 2 with the center of the tube in Lane 1, Position 1 (the back position on the far left cassette).
11. Use the **Up/Down** buttons to align the end of the tip with the top of the tube as shown in Figure 13-42.

Figure 13-42. Tube Cassette in Lane 1

12. Click the **Update** button.
13. Click the **Last Well, Last Column** entry in the table.
14. Click the **GoTo** button to move the tip to the XY location in the table.
15. Use the **Left/Right** and **Back/Front** buttons to align Tip 2 with the center of the tube in Lane 1, Position 16 (the front position on the far left cassette).
16. Use the **Up/Down** buttons to align the end of the tip with the top of the tube as shown in Figure 13-42.
17. Click the **Update** button.
18. Click the **OK** button. The tip moves up to the Z Home position.
19. If you are using multiple tube types, repeat to teach the other tubes in the cassette.
20. Close the protocol.

Chapter 14

System Configuration

This chapter describes how to configure the instrument and its various subsystems so that it functions correctly. Specifically, this chapter describes how to configure the following:

- JANUS G3 Instrument on page 329
- Varispan Pipetting Arm on page 340
- MDT Pipetting Arm on page 340
- Gripper Arm on page 340

It also describes how to calibrate the deck. You should recalibrate (and realign the tips) if the sampling tips or arms crash into anything. You should also recalibrate the deck regularly. While weekly calibration is not critical (the instrument should stay in calibration if operating smoothly for longer than a week) it is import to have scheduled times for calibration and quarterly is too infrequent.

JANUS G3 Instrument

This section describes how to change the JANUS G3 deck configuration, add and enable integrated instruments, initialize the system, and park the arms.

- Changing the Deck Configuration on page 330
- Configuring the Status Lights on page 330
- Integrating Devices on page 331
- Initializing the System on page 339
- Parking the Arms on page 339

Changing the Deck Configuration

If you change the deck plates on the instrument, you must change the deck configuration in the Instrument Setup window to match the actual system hardware.

To change the instrument deck configuration:

1. Select **Utilities > Setup > Instrument > Settings** on the WinPREP main menu. The Instrument Setup window opens.
2. Select the installed deck plates from the Deck Configuration Controls (see Figure 14-1) below the instrument Layout.

Figure 14-1. Deck Configuration Controls

3. Click the **OK** button to save the settings and close the Instrument Setup window.
4. After changing deck plates, you must calibrate the arms and reteach any gripper positions.

Configuring the Status Lights

You can customize the status lights on the front of the instrument. The colors, brightness, and the time elapsed until the status lights dim can be changed as desired.

To configure the status lights:

1. Select **Utilities > Setup > Instrument > Settings** on the WinPREP main menu. The Instrument Setup window opens.
2. Click the **Light Settings** tab.
3. Select the desired options for the status lights. (See the description of the Instrument Setup Window - Light Settings tab in the online help for details.)
4. Click the **OK** button to save the settings.

Integrating Devices

You must enable the deck and subsystem options so that the software can use the hardware that is installed. You enable these options in the **Instrument Options** window. To open the Instrument Options window, select:
Utilities > Setup > Instrument > Settings.

Using the Integration Manager requires two general steps:

- Installing and Registering Integration Devices
- Adding a Device to the Deck and Creating the Integration

The following sections describe each of these steps in greater detail.

Installing and Registering Integration Devices

The first step to creating an integration on the JANUS G3 system is to install and register the DLL or OCX files for the integration devices.

In many cases, the hardware device's manufacturer provides an installation disk with the hardware. The installation disk usually includes an automated process for installing and registering the integration device. If this is the case for the hardware, you can skip to Adding a Device to the Deck and Creating the Integration on page 333. If the hardware does not include an automated installation, you must install and register the integration device manually. This section describe how to perform the manual installation and registration.

To install and register an integration device:

1. Make sure WinPREP is not active. Close WinPREP if necessary.
2. Obtain the DLL/OCX file for the hardware device. This file should be among the support files provided by the hardware manufacturer.
3. Place the DLL/OCX file in the **Integrations** folder in the WinPREP installation folder. The WinPREP installation folder defaults to **C:\Packard\JANUS** and this is the most common location. If this is not the location for the particular installation, locate the actual installation folder or contact your system administrator.
4. Open a Command Prompt window:
   Click the Windows **Start** button, type **cmd** in the Search text box, and then click the **cmd.exe** program.
5. Type the following command at the command prompt and press **Enter**:

   X:

   Where "X" is the drive letter identifying the location of the WinPREP installation. The default installation drive for WinPREP is "C".

6. Type the following command at the command prompt and press **Enter**:

   cd \Packard\JANUS\Integrations

   This uses the **cd** (change directory) DOS command to change to the **Integrations** folder.

☞ *Note: If the WinPREP installation is in a location other than the default (**C:\Packard\JANUS**), substitute the actual location for the default location shown in the previous command.*

7. Type the following command at the command prompt and press **Enter**:

   regsvr32 IntegrationDevice.DLL

   where **IntegrationDevice.DLL** is the name of the DLL or OCX file you want to register. Figure 14-2 shows an example.

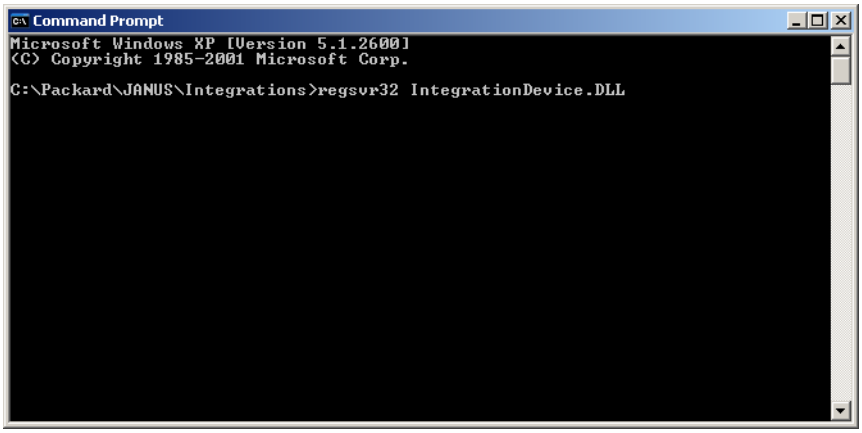


Figure 14-2. Registering a DLL or OCX file

8. When the command completes, the command prompt returns and Windows displays a confirmation message, as shown in Figure 14-3.

Figure 14-3. DLL/OCX registration confirmation window

☞ *Note: If you receive an error message, make sure you typed the command and file name correctly. Also make sure you copied the DLL/OCX file into the **Integrations** folder and executed the **cd** command successfully.*

9. Click **OK** to close the registration confirmation window.

10. Type the following command at the command prompt and press **Enter**:

    exit

    The **Command Prompt** window closes.

When you complete the previous steps, the integration DLL/OCX is ready to use in WinPREP. See Adding a Device to the Deck and Creating the Integration to add an instance of the integration device to the deck and create the integration.

Adding a Device to the Deck and Creating the Integration

After adding the integration interface for the internal device, you must integrate the device into the liquid handling work flow using the Integration manager.

To add the device and create the integration:

1. Select **Utilities > Setup > Instrument > Settings** from the main menu. The **Instrument Setup** window opens as shown in Figure 14-4.

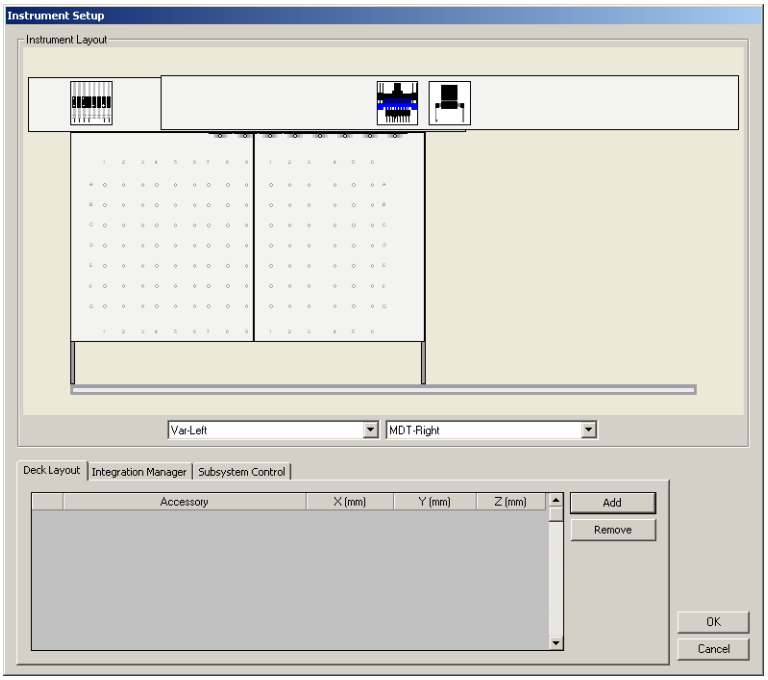


Figure 14-4. Instrument Setup window

☞ *Note: If the device you want to integrate already exists in the table on the Deck Layout tab, you can skip Steps 2 through 4 and start with Step 5.*

2. Select the **Deck Layout** tab on the **Instrument Setup** window, if it is not already the active tab.
3. Click **Add** to insert a new row in the **Deck Layout** table, as shown in Figure 14-5.

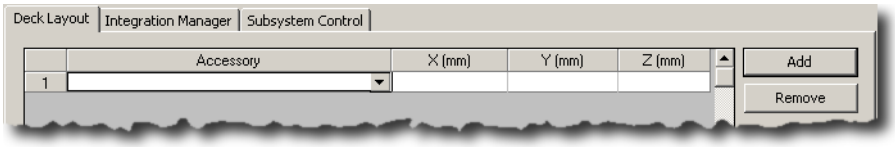


Figure 14-5. New Deck Layout Table Entry

4. Use the **Accessory** drop-down list to select the hardware you want to integrate. For the purposes of this example, the selection is *PlateStak-URight*. The table updates with the position data (X, Y, and Z distances) for the selected device, as shown in Figure 14-6.

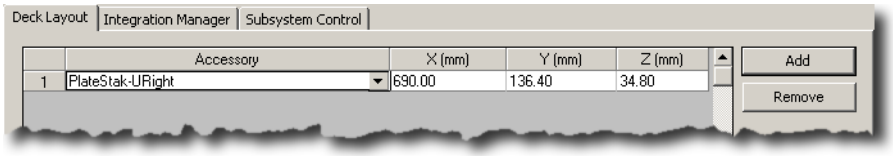


Figure 14-6. Accessory Selection in Deck Layout Table

By setting this option, you are selecting the device and its placement with respect to the JANUS G3 deck. The optional hardware devices installed on the system and the configuration of the JANUS G3 instrument determine the options available in the **Accessory** list. In this example, and as the Accessory setting implies, the PlateStak is located in the upper right corner of the deck.

☞ *Note: Make sure the position on the physical deck matches the virtual deck layout before running the protocols. Exact positioning is not required because you determine this information during deck calibration.*

5. Select the **Integration Manager** tab.
6. Click **Add** to insert a new row in the **Integration Manager** table, as shown in Figure 14-7.

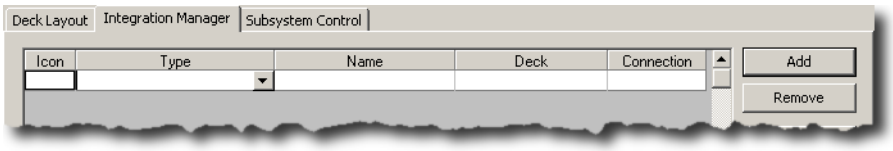


Figure 14-7. New Integration Manager Table Entry

7. Set the **Type** option to the device you want to integrate. This example uses the *PlateStak* option. When you set the **Type** option, the **Icon**, **Name**, and **Connection** fields populate with default values, as shown in Figure 14-8.

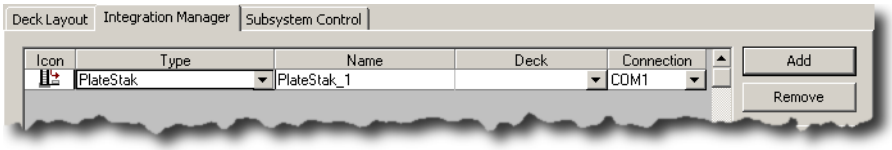


Figure 14-8. PlateStak Integration type

☞ *Note: If the device you are integrating is not connected to the assigned **Connection** port, set it to the appropriate value.*

8. Set the **Deck** option to the device you want to integrate. This example uses the PlateStak device you placed on the deck in *Step 4* above. The **Deck** drop-down contains a list of all the integration devices available.

☞ *Note: The **Configure** button opens a window containing configuration options for the device selected in the **Type** option. These options vary depending on the selected device and the control options supplied in hardware's DLL/ OCX.*

9. Click **OK** to save the changes and close the **Instrument Settings** window. WinPREP now displays a toolbar with a button for the integrated hardware, in this example, the PlateStak. Figure 14-9 shows the toolbar icon.

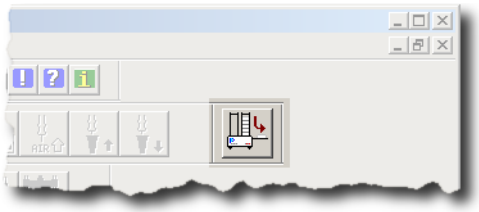


Figure 14-9. PlateStak Integration Toolbar Button

The integration is complete. You can include the PlateStak device in a protocol outline by clicking the icon on the integration toolbar, selecting **Protocol > Add Procedure > Integrations > PlateStak_1** from the main menu, or right-clicking in the protocol outline and selecting **Add Procedure > Integrations > PlateStak_1** from the menu. WinPREP inserts a procedure node into the protocol outline and opens an **Integration Parameters** window where you can configure the device's parameters.

Parameters differ for each integration device. Consult the device's specific documentation for more information on parameter settings.

Using the Integration Toolbar Buttons

The buttons on the Integration toolbar provide access to individual instances of integrations configured on the instrument. The Integration toolbar only displays if at least one integration has been added to the system using the Integration Manager. The icons on the toolbar vary depending on the number and types of integrations that are configured. Figure 14-9 shows the Integration toolbar after adding a PlateStak integration.

When you add multiple integration instances of the same device type, the Integration toolbar displays a button for each integration. For example, if you added two PlateStak integrations, the Integration toolbar would contain two PlateStak buttons, as shown in Figure 14-10.

Figure 14-10. Integration Toolbar (with multiple PlateStak integrations)

Although the icons are the same, the buttons represent individual integration instances. Hover the cursor over a button on the Integration toolbar to display the name of the integration instance. This helps you determine which icon on the toolbar relates to an associated integration instance. Figure 14-11 shows this functionality.

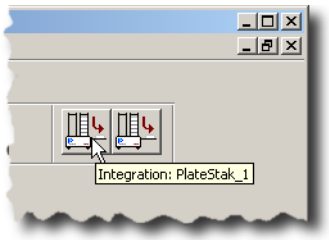


Figure 14-11. Tooltip display for Integration Toolbar

Clicking a button on the Integration toolbar inserts an Integration node for the specific integration into the protocol outline. For example, Figure 14-12 shows an Integration toolbar containing both a PlateStak and an IKA Shaker integration. It also shows the corresponding Integration nodes for these instances in the protocol outline.

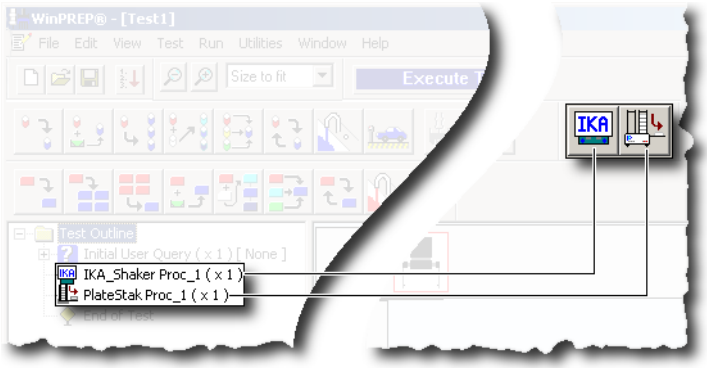


Figure 14-12. Integration toolbar and corresponding integration nodes

You use the Integration node to configure and control the integration device directly from the WinPREP protocols. Figure 14-13 shows an example of the Integration Parameters window.

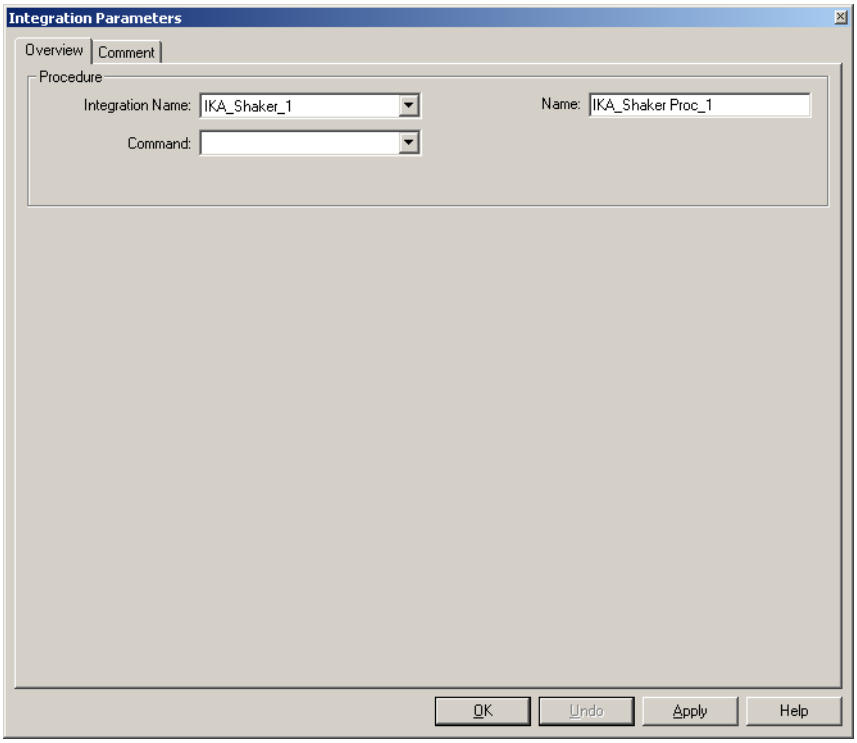


Figure 14-13. Integration Parameters window

This example shows the **Integration Parameters** window for an IKA Shaker integration. The procedure frame of the window contains common integration settings such as **Integration Name**, **Name**, and a **Command** drop-down list. The bottom portion of the window updates with control parameters based on the selected integration instance and the selected **Command** parameter.

The **Integration Name** defines the integration instance associated with the integration node. In this example, it is the IKA shaker. However, if you change the **Integration Name**, WinPREP dynamically updates the node to reflect the selected integration instance. The **Name** field is a unique identifier for the integration node in the protocol outline. You can change the name by typing the desired text in the field or you can accept the default value. The commands available in the **Command** drop-down list is determined by the integration instance. For example, commands for the IKA Shaker include *Turn Shaker On* and *Turn Shaker Off*, while commands for the PlateStak are more extensive and include *DownStack*, *MoveCarrier*, *ReStack*, *SetUpMagazines*, *UpStack*, and *WaitForCompletion*. Selecting a command in the **Command** list displays the configuration and options associated with the command on the lower part of the window. Figure 14-14 shows an example of the **Integration Parameters** window for the IKA Shaker integration with *Turn Shaker On* selected in the **Command** drop-down list.

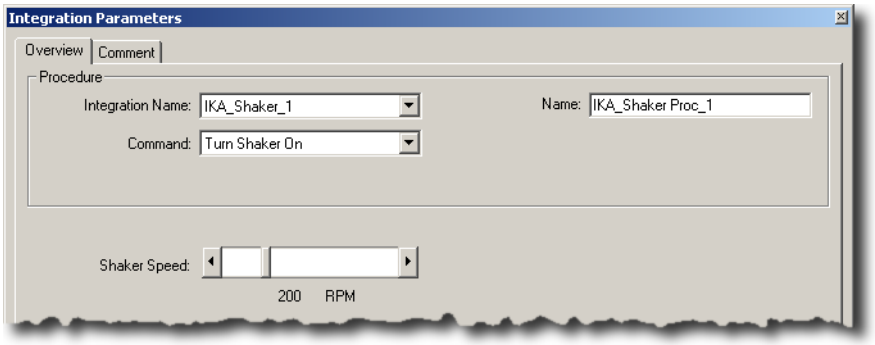


Figure 14-14. IKA Shaker Integration Parameters window

As shown above, the *Turn Shaker On* **Command** has one parameter to control the speed of the shaker.

You can also add a generic integration node to the protocol. A generic integration node is an integration node in the protocol outline not associated with a specific integration instance. You can insert a generic integration node by clicking the Integration icon on the **Time and Dialog Functions** toolbar. The icon used to represent a generic integration node and the generic integration node's toolbar button are shown in Figure 14-15.

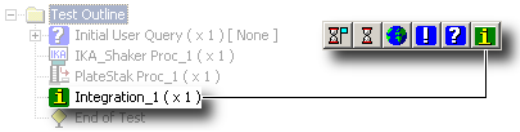


Figure 14-15. Generic Integration Node

Figure 14-16 shows the **Integration Parameters** window for a generic integration procedure.

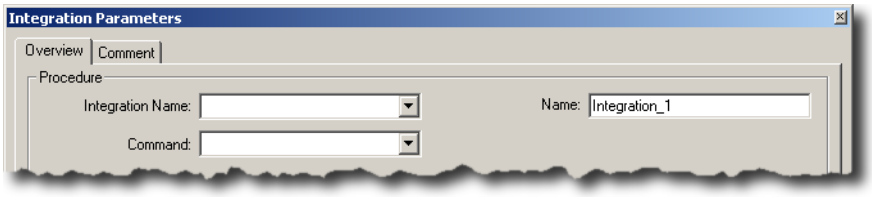


Figure 14-16. Generic Integration Parameters window

Because no specific integration instance is associated with the generic integration, the **Integration Name** field is blank and the **Name** field identifies the node as an integration. If you change the **Integration Name** option to one of the recognized integration instances, WinPREP converts the generic integration node into an integration node for the selected integration.

Initializing the System

To initialize the system, select **Utilities > Setup > Instrument > Initialize** from the main menu.

When you execute the Initialize command, the system goes through a series of motions as it finds Home positions for each of the motions. A status box opens to display the progress and the current axis being initialized. The arms, tips, and syringe pumps all move at various times during the initialization as the home positions are verified and reestablished.

☞ *NOTE: Do not click or right-click in the WinPREP software until initialization is complete. Interfering with the Initialization could cause WinPREP to crash.*

This initialization is similar to the initial startup routine that occurs when you apply power to the instrument.

Parking the Arms

To park all the arms on the system, select **Utilities > Setup > Instrument > Park All Arms** from the main menu.

When you execute the Park All Arms command, the system goes through a series of motions as it attempts to find the home positions for each of the installed arms. The system components (arms, tips, heads, etc.) all move at various times during the initialization as the home positions are verified and reestablished.

Varispan Pipetting Arm

The Varispan arm accesses labware on a well-by-well basis. Each well is treated as a separate entity and the operations for each well, including aspiration and dispense volumes, can be tailored accordingly. This provides an unprecedented level of flexibility with your assays, allowing you to tailor protocols to suit your needs. You can use a single well, multiple wells, or all the wells on a particular piece of labware.

Varispan Arm Configuration

The **Arm Settings** window provides access to important parameters stored in the instrument's configuration file. These parameters provide values that are system dependent. Some of these values represent system options such as syringe size, tip adapters and liquid level sense verification, while others represent global values for syringe pump speeds during the aspirate, dispense, flush and wash steps.

The Varispan arm must be calibrated before use. See Calibrating the Varispan Pipetting Arm on page 294 for instructions.

MDT Pipetting Arm

The MDT arm accesses labware on a plate-by-plate basis. Each well on the labware is treated the same and the operations for each well are identical. This provides an easy way to duplicate entire plates, compress and expand plates, add reagent to an entire plate, and perform multi-liquid procedures.

MDT Arm Configuration

Unlike the Varispan arm, the MDT arm does not provide any options for you to configure directly. The head type controls the number of pipetting tips and volumes available in the protocols.

The MDT arm must be calibrated before use. See Calibrating the MDT Pipetting Arm on page 297 for instructions.

Gripper Arm

The Gripper arm operates in the same X, Y, and Z-directions as the primary liquid handling arm, but is also capable of gripping and rotational (theta) motions.

The Gripper arm moves in the following directions:

- X Horizontal movement is along the front of the instrument and parallel to the X-axis of the primary arm.
- Y Horizontal movement is perpendicular to the front of the instrument and parallel to the Y-axis of the primary arm.
- Z Vertical movement is parallel to the Z-axis of the primary arm.
- Rotational movement is the rotation in the horizontal plane about the Z-axis.
- Gripping movement is the opening and closing of the Gripper fingers in the horizontal plane.

The Gripper arm must be calibrated before use (see Calibrating the Gripper Arm on page 312).

Caution: After upgrading or reinstalling the WinPREP software, you must completely recalibrate the deck and then verify all taught positions and reteach any incorrect or inaccurate locations.

The Gripper arm does not require configuration before use, but speed profiles are provided to specify the speeds at which the Gripper arm travels.

Speed Profiles

You can create unique “speed profiles” for the Gripper Arm. Each profile includes rates of acceleration and velocity for the Gripper Arm’s X motor, Y motor, Z motor, and theta motor. You can create a speed profile in the Gripper Arm Motion Preference Editor. After a profile is created, it can be saved and later used in other protocols with similar gripper speed requirements.

Chapter 15

Example Protocols

WinPREP includes several example protocols to demonstrate the features and techniques you can use when creating protocols. These protocols provide examples of many common liquid handling procedures. The example protocols are located in the **\bin\samples** folder in the WinPREP installation folder. Each example protocol includes a short description on the **Comment** tab of the **Protocol Outline** node. To view the description, open the example protocol, double-click the **Protocol Outline** node, and select the **Comment** tab.

This chapter includes a detailed description of several of the example protocols, and explains the protocol definition and setup in detail. This information is also available in the online help. To access the online help, select **Help > Help Topics** from the menu bar. The Help window opens and remains *on top* of all other windows. You can resize the WinPREP window to fit *beside* the help window so you can use the WinPREP window and the Help window at the same time as shown in Figure 15-1.

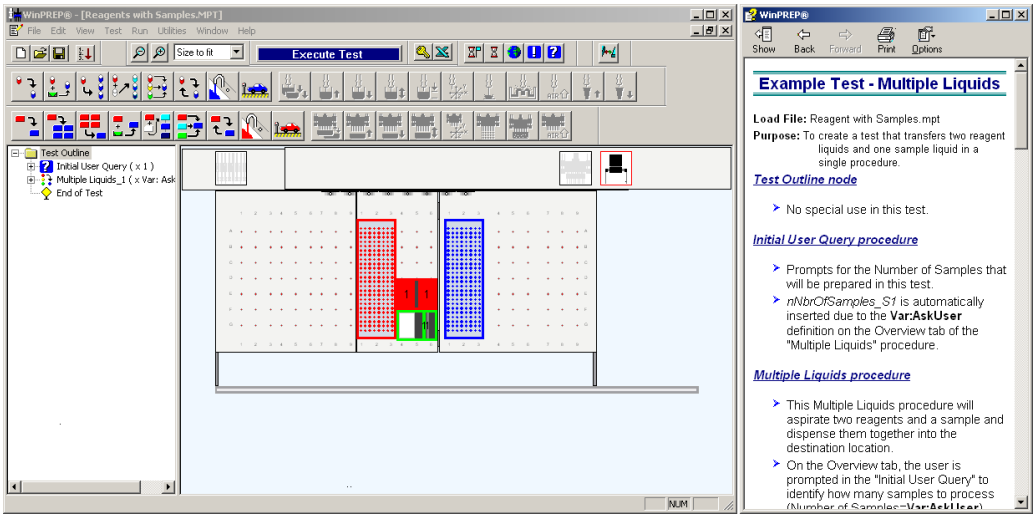


Figure 15-1. Example Protocol Description Tiled with WinPREP

Each protocol description includes the name of the protocol and a general description of its purpose. Before reading the protocol description, you can open the indicated protocol so you can examine the nodes, parameters, and deck setup. Open the node and labware parameter windows as you read about them. This is an excellent way to familiarize yourself with the details of protocol setup.

If one or more of the example protocols are similar to the protocol you need to create, you can save a copy of the protocol and use it as a starting point for the new protocol. Pay particular attention to the reasons and special considerations in the description, as you may need to modify values or mappings to make the protocol work with your modifications. Do not make changes to the original example protocols because this will make the protocol descriptions difficult to use as a reference in the future.

See Basic Varispan Example Protocols on page 343, Basic MDT Example Protocols on page 361, and Advanced Varispan Example Protocols on page 366.

Basic Varispan Example Protocols

These protocols provide examples for using the Varispan to perform basic protocol operations such as multiple liquid handling, using disposable tips, and dilutions. For examples using advanced Varispan functionality, see Advanced Varispan Example Protocols on page 366.

This section includes:

- Multiple Liquid on page 343
- Disposable Tips on page 346
- Serial Dilution on page 349
- Reagent Before Samples Protocol on page 354
- Reagent After Samples Protocol on page 356
- Embedded Controls Procedure on page 358

Multiple Liquid

Load File: Reagent with Samples.MPT

Purpose: Transfers two reagent liquids and one sample liquid in a single procedure.

Protocol Outline node

- ❑ No special use in this protocol.

Initial User Query procedure

- ❑ Prompts for the **Number of Samples** to prepare in this protocol.
- ❑ *nNbrOfSamples_S1* is automatically inserted due to the **Var:AskUser** definition on the **Overview** tab of the “Multiple Liquids” procedure.

Multiple Liquids procedure

- ❑ This Multiple Liquids procedure aspirates two reagents and a sample and dispenses them together into the destination location.

- On the **Overview** tab, the “Initial User Query” prompts you to identify how many samples to process (Number of Samples= **Var:AskUser**). The number entered is stored in the variable *nNbrOfSamples_S1*.
- On the **Overview** tab, the **Multi-Liquid List** table contains three rows. Each row contains information about aspirating a single liquid in the procedure.
  - The first row identifies the first aspiration (Reagent 1) and aspirates 300 µL of the specified liquid (Aspirate Volume=**300**). This row also indicates the protocol uses the row (Use=**Yes**) and the aspirated liquid does not have an associated sample ID (ID=**None**). Mapping for this aspiration is specified in the appropriate aspiration step below (Aspirate From=**Use Deck View**).
  - The second row identifies the second aspiration (Reagent 2) and aspirates 100 µL of the specified liquid (Aspirate Volume=**100**). This row also indicates the protocol uses the row (Use=**Yes**) and the aspirated liquid does not have an associated sample ID (ID=**None**). Mapping for this aspiration is specified in the appropriate aspiration step below (Aspirate From=**Use Deck View**).
  - The third row names the last aspiration “Sample” and aspirates 100 µL of sample liquid (Aspirate Volume=**100**). This row also indicates the protocol uses the row (Use=**Yes**) and the sample ID takes the form SRCxxxx (ID=**SRC%0000**). Mapping for this aspiration is specified in the appropriate aspiration step below (Aspirate From=**Use Deck View**).

Transfer Group node

- All parameters in the Transfer Group are determined through the procedure definition.

Reagent 1:Aspirate step

- The **Sample ID** field inherits its value from the first row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.
- The **Sample Volume** field inherits its value from the first row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.
- The “Reagent 1:Aspirate” step for the procedure is mapped to one of the troughs in the Reagent Trough rack.
- In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is segmented so that only the first trough position is used for this reagent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Reagent Trough is defined to *Wrap Around* to keep using the same reagent liquid for all the samples.

Reagent 2:Aspirate step

- The **Sample ID** field inherits its value from the second row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.

- The **Sample Volume** field inherits its value from the second row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.
- The “Reagent 2:Aspirate” step for the procedure is mapped to one of the troughs in the Reagent Trough rack.
- In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is segmented so that only the second trough position is used for this reagent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Reagent Trough is defined to *Wrap Around* to keep using the same reagent liquid for all the samples.

Sample:Aspirate step

- The **Sample ID** field inherits its value from the third row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.
- The **Sample Volume** field inherits its value from the third row of the **Multi-Liquid List** table on the **Overview** tab of the procedure.
- The “Sample:Aspirate” step for the procedure is mapped to labware on the deck.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the labware is set to *Assembly Change* to prompt for more samples if necessary.

Dispense step

- The “Dispense” step for the procedure is mapped to a second set of labware on the deck.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the labware is set to *Assembly Change* to prompt for more labware if necessary.

Looping

- The “Multiple Liquid” procedure is repeated until *nNbrOfSamples_S1* samples have been processed.

Multiple Liquid Flush step

- This step is mapped to the Flush/Wash station on the deck.

Multiple Liquid Wash step

- This step is mapped to the Flush/Wash station on the deck.

Disposable Tips

Load File: 200 ul Transfer with 200 ul DT (via Panel).MPT

Purpose: Transfers 200 µL of sample using disposable tips with a maximum capacity of 150 µL. Transfer the liquid in two steps using a Panel procedure.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- Prompts for the Number of Samples to prepare in this protocol.
- *nNbrOfSamples_S1* is automatically inserted due to the **Var:AskUser** definition on the **Overview** tab of the “200µL Dispense w/DT” procedure.

Flush/Wash procedure

- This initial Flush/Wash procedure ensures the tips are clean and free of any contamination before starting the protocol.
- Both the Flush and Wash steps map to the Flush/Wash station on the deck.

200µL Dispense w/DT procedure

- This Panel procedure aspirates liquid from one location and dispenses it in another in two separate locations.
- On the **Overview** tab, the user is prompted in the “Initial User Query” to identify how many samples to process (Number of Samples= **Var:AskUser**). The number entered is stored in the variable *nNbrOfSamples_S1*.
- Mapping for the sample location is specified in the Aspiration step below (Aspirate From=**Use Deck View**).
- Notice that the **Use Multi-panel across dispense steps** check box is not selected, so two transfer groups are created to transfer sample liquid in two steps. Each Transfer Group has independent Aspirate and Dispense steps.

- On the **Overview** tab, two rows are added to the **Panel List** table. Each row contains the information for one of the Dispense steps to be performed.
  - The first row names the first dispense operation Disp1 and defines the volume to be dispensed as 100 µL (Dispense Volume=**100;** total volume of 200 µL ÷ 2). The information also indicates that there will not be any replicates (Replicates=**1**) and that the row should be used (Use=**Yes**). Mapping for this dispense is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).
  - The second row names the second dispense operation Disp2 and defines the volume to be dispensed as 100 µL (Dispense Volume=**100;** total volume of 200 µL ÷ 2). The information also indicates that there will not be any replicates (Replicates=**1**) and that the row should be used (Use=**Yes**). Mapping for this dispense is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).
- The “200µL Dispense w/DT” procedure is defined on the **Overview** tab to use disposable tips (Tip=**200µL Conductive RoboRack Tips**).

Get Tip step

- The Get Tip step is mapped to a set of two disposable tip boxes on the deck.

Transfer Group_1 node

- All parameters in the Transfer Group are determined through the procedure definition.

Aspirate step

- The Aspirate step for the procedure is mapped to source labware on the deck.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the source labware is set to *Assembly Change* to prompt for more samples if necessary.

Disp1:Dispense step

- On the **Overview** tab, the **Sample Volume** field for the step inherits its value from the first row in the **Panel List** table on the **Overview** tab of the procedure.
- The “Disp1” Dispense step for the procedure is mapped to another set of labware on the deck.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the destination labware is set to *Assembly Change* to prompt for more labware if necessary.

Transfer Group_2 node

- All parameters in the Transfer Group are determined through the procedure definition.

Aspirate step

- The Aspirate step for the procedure is a duplication of the first Aspirate step. This step cannot be edited or mapped individually.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the labware is set to *Assembly Change* to prompt for more labware if necessary.

Disp2:Dispense step

- On the **Overview** tab, the **Sample Volume** field for the step inherits its value from the second row in the **Panel List** table on the **Overview** tab of the procedure.
- The “Disp2” Dispense step for the procedure is mapped to the destination labware on the deck. This is the same location as the first Dispense step. Each Dispense step maintains its own mapping into this labware, so the second Dispense uses exactly the same location as the first Dispense step for each sample.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the labware is set to *Assembly Change* to prompt for more labware if necessary.

Flush step

- This Flush step is mapped to the Flush Wash station on the deck.
- This Flush step disposes of the Waste Volume aspirated for the sample.

Drop Tip step

- This step is mapped to the Tip Chute on the deck for disposal of the used disposable tips.
- Excess sample aspirated in the last step is dispensed as waste with the tip during this step.

Looping

- The “200µL Dispense w/ DT” procedure repeats for the number of samples identified during the Initial User Query.

Flush/Wash procedure

- This procedure is included to provide final cleanup of the tip adapters before finishing the protocol.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Serial Dilution

Load File: Serial Dilution.MPT

Purpose: Creates serial dilutions from original samples.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- Prompts for the Number of Samples to prepare in this protocol.
- *nNbrOfSamples_S1* is automatically inserted due to the **Var:AskUser** definition on the **Overview** tab of the “Dilution - Serial” procedure.

Dilution - Serial procedure

- This Serial Dilution procedure aspirates a sample and a diluent and then dispenses them together into the destination location.
- The location of the diluent material is specified in the first diluent aspiration step below (Diluent From=**Use Deck View**). All subsequent Aspirate Diluent steps are mapped to this same location.
- The *first* sample aspiration step below identifies the location of the original samples (Aspirate From=**Use Deck View**). Subsequent dilution aspirations in a Serial Dilution procedure *always* map to the destination of the previous step.
- The Auto Fade check box is selected so that the series of dilutions in the microplates will be evident in the Deck View. By selecting the procedure in the outline, all four of the defined dilutions appear mapped into the chosen columns of the destination plates, as shown by the different intensities of blue color in the columns. You may find it necessary to zoom in on the deck view to see this distinction in microplates.

- On the **Overview** tab, four rows are added to the **Dilution List** table. Each row contains the information for one step of the serial dilution.
  - The first row names the first dilution step “Dil1” and aspirates 50 µL of sample (Aspirate Volume=**50**) and 250 µL of diluent (Diluent Volume=**250**). Mapping for the dispensing of this dilution step is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).
  - The second row names the second dilution step “Dil2” and aspirates 100 µL of sample (Aspirate Volume=**100**) and 200 µL of diluent (Diluent Volume=**200**). Mapping for the dispensing of this dilution step is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).
  - The third row names the next dilution step “Dil3” and aspirates 50 µL of sample (Aspirate Volume=**50**) and 250 µL of diluent (Diluent Volume=**250**). Mapping for the dispensing of this dilution step is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).
  - The last row names the fourth dilution step “Dil4” and aspirates 100 µL of sample (Aspirate Volume=**100**) and 200 µL of diluent (Diluent Volume=**200**). Mapping for the dispensing of this dilution step is specified in the appropriate dispense step below (Dispense To=**Use Deck View**).

Transfer Group_1 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil1:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the first row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil1:Aspirate Diluent” step for the procedure is mapped to one of the troughs in the Reagent Trough rack.
- In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Reagent Trough is defined to *Wrap Around* to keep using the same diluent location for all the samples.

Dil1:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the first row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil1:Aspirate” step for the procedure is mapped to the 96 well Deep Well Plate on the deck.

- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Deep Well Plate is set to *Assembly Change* to prompt for more plates if necessary.

Dil1:Dispense step

- The “Dil1:Dispense” step for the procedure is mapped to a set of three 96 well microplates on the deck.
- When mapping the Dispense steps for any Dilution procedure, WinPREP asks if you would like to redistribute the wells by column among all the dilution steps. If you answer **Yes**, one or more columns of wells in the labware (based on the number of dilution steps) will be mapped to each dispense step in the dilution.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Assembly Change* to prompt for more microplates if necessary.

Transfer Group_2 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil2:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the second row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil2:Aspirate Diluent” step for the procedure maps to the same trough as the first step in the series, by default.
- In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is segmented so that only the first trough position is used for diluent.
- This node does not have an associated **Map Room** node because it inherits the Reagent Trough rack assigned to the first aspirate diluent step in the series.
- In the **Well Map Settings** window, the **Map Type** value for the Reagent Trough defaults to *Org. Sample* to keep using the same diluent location for all the samples.

Dil2:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the second row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil2:Aspirate” step for the procedure is mapped to the Dispense location of the previous dilution (Location=**Prev. Dilution**). In this case, the previous dispense location is “Dil1:Dispense”.

Dil2:Dispense step

- This Dispense step inherits its destination well mapping from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates are set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_3 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil3:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the third row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil3:Asp. Diluent” step for the procedure maps to the same trough as the first step in the series, by default.
- This node does not have an associated **Map Room** node because it inherits the Reagent Trough rack assigned to the first aspirate diluent step in the series.
- In the **Well Map Settings** window, the **Map Type** value for the Reagent Trough defaults to *Org. Sample* to keep using the same diluent location for all the samples.

Dil3:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the third row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil3:Aspirate” step for the procedure is mapped to the Dispense location of the previous dilution (“Dil2:Dispense”).

Dil3:Dispense step

- This Dispense step inherits its destination well mapping from the distribution of the Dil2:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_4 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil4:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fourth row in the **Dilution List** table of the “Dilution - Serial” procedure.

- The “Dil4:Aspirate Diluent” step for the procedure maps to the same trough as the first step in the series, by default.
- This node does not have an associated **Map Room** node because it inherits the Reagent Trough rack assigned to the first aspirate diluent step in the series.
- In the **Well Map Settings** window, the **Map Type** value for the Reagent Trough defaults to *Org. Sample* to keep using the same diluent location for all the samples.

Dil4:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fourth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil4:Aspirate” step for the procedure is mapped to the Dispense location of the previous dilution (“Dil3:Dispense”).

Dil4:Dispense step

- This Dispense step inherits its destination well mapping from the distribution of the Dil3:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Aspirate Excess Sample step

- This step evens out the volume in the last well of the series. By design, the system aspirates sample from the previous dilution step to create the next dilution. Therefore, the *last* dilution has a greater volume than the rest in the series, because it is not the basis for the next dilution. This step aspirates the volume specified for the last dilution and disposes of it as waste.
- The **Sample Volume** field inherits its value from the volume specified for the last dilution in the series, in this case the fourth row of the **Dilution List** table (Aspirate Volume=**100**).

Serial Dilution Flush step

- This step is mapped to the Flush/Wash station on the deck.
- This step disposes of the excess sample aspirated in the “Aspirate Excess Sample” step.

Serial Dilution Wash step

- This step is mapped to the Flush/Wash station on the deck.

Looping

- The “Dilution - Serial” procedure repeats until *nNbrOfSamples_S1* samples are processed.

Reagent Before Samples Protocol

Load File: Reagent Addition before Sample Addition.MPT

Purpose: Transfers reagent material to the destination wells before transferring the sample material to the wells.

Protocol Outline node

- ❑ No special use in this protocol.

Initial User Query procedure

- ❑ Prompts for the value of *nNbrOfSamples_S1*, which is automatically included as a prompt due to the **Var:AskUser** definition for **Number of Samples** field on the **Overview** tab of the “Single Liquid” procedure.
- ❑ Prompts for the value of *nReplicates_S1*, which is automatically included as a prompt due to the Var:AskUser definition for **Replicates** on the **Overview** tab of the “Single Liquid” procedure.

Reagent procedure

- ❑ This Reagent procedure transfers the reagent liquid to the destination wells.
- ❑ The number of wells to fill with reagent is a calculated value (Number of Destinations=**Var:Calculate**). The calculation is based on the two variable values entered at runtime and is defined on the **Runtime Parameters** tab described next.
- ❑ From the **Runtime Parameters** tab, click the **Variables** button and **Edit** the calculation for the variable *nDestinations_S1*. The Number of Destinations is calculated by multiplying the **Number of Samples** value and the **Number of Replicates** value from the “Single Liquid” procedure below.
- ❑ The **Volume** of reagent to transfer to each well is 100 µL (Dispense Volume=**100**).
- ❑ Enough reagent is taken in a single aspirate to dispense for six samples (Dispenses Per Aspirate=**6**) as determined by the maximum volume of the syringe pumps.

(Reagent) Transfer Group node

- ❑ The “Reagent” procedure definition determines all the parameters in the Transfer Group.

Reagent Aspirate step

- ❑ The “Aspirate” step for the “Reagent” procedure is mapped to one of the troughs in the Reagent Trough rack.
- ❑ In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is mapped so that only the first trough position is used for reagent.

- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Reagent Trough is defined to *Wrap Around* to keep using the same reagent liquid for all the samples.

Reagent Dispense step

- The “Dispense” step for the “Reagent” procedure is mapped to a set of three 96 well microplates on the deck.
- The **Dispense Volume** field on the **Overview** tab inherits its value from the “Reagent” procedure definition.

Reagent Flush step

- This step is mapped to the Flush/Wash station on the deck.

Reagent Wash step

- This step is mapped to the Flush/Wash station on the deck.

Looping the Reagent procedure

- The “Reagent” procedure repeats until *nNbrOfSamples_S1 * nReplicates_S1* sample positions are filled with reagent material.

Single Liquid procedure

- This Single Liquid procedure contains the “sample transfer” part of the protocol.
- On the **Overview** tab, the “Initial User Query” prompts to identify the number of samples to process (Number of Samples= **Var:AskUser**). The number entered is stored in the variable *nNbrOfSamples_S1*.
- On the **Overview** tab, the “Initial User Query” prompts to identify the replicates per sample for the procedure (Replicates= **Var:AskUser**). The number entered is stored in the variable *nReplicates_S1*.
- The volume of each sample dispensed is set to 50 µL (Dispense Volume=**50**).
- For efficient pipetting in situations where multiple replicates are requested, the number of dispenses specified for a single aspirate is set arbitrarily high (Dispenses per Aspirate=**8**) on the **Overview** tab. Replicate requests (up to eight) are dispensed from a single aspiration.

(Single Liquid) Transfer Group node

- The “Single Liquid” procedure definition determines all parameters in the Transfer Group.

Single Liquid Aspirate step

- The Aspirate step for the Single Liquid procedure is mapped to a set of three 96 well microplates on the deck.

Single Liquid Dispense step

- Mapping for this step is set to *Match to Step(s)*…. In this case, the mapping points to the “Reagent Dispense” step so that the sample material is added to those wells that already contain the reagent material from the previous procedure.
- The **Dispense Volume** field inherits its value from the **Overview** tab of the “Single Liquid” procedure.

Single Liquid Flush step

- This step is mapped to the Flush/Wash station on the deck.

Single Liquid Wash step

- This step is mapped to the Flush/Wash station on the deck.

Looping the Single Liquid procedure

- The Single Liquid procedure repeats until *nNbrOfSamples_S1* samples (with *nReplicates_S1* replicates) are processed.

Reagent After Samples Protocol

Load File: Reagent Addition after Sample Addition.MPT

Purpose: Transfers reagent to the destination wells *after* all the sample material is transferred.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- Prompts for the value of *nNbrOfSamples_S1*, which is automatically included as a prompt due to the **Var:AskUser** definition for **Number of Samples** field on the **Overview** tab of the “Single Liquid” procedure.
- Prompts for the value of *nReplicates_S1*, which is automatically included as a prompt due to the **Var:AskUser** definition for **Replicates** on the **Overview** tab of the “Single Liquid” procedure.

Single Liquid procedure

- This Single Liquid procedure contains the “sample transfer” part of the protocol.
- On the **Overview** tab, the user is prompted in the “Initial User Query” to identify how many samples to process (Number of Samples= **Var:AskUser**). The value entered is stored in the variable *nNbrOfSamples_S1*.
- On the **Overview** tab, the user is prompted in the “Initial User Query” to identify the replicates per sample for the procedure (Replicates= **Var:AskUser**). The value entered is stored in the variable *nReplicates_S1*.
- The dispense volume of each sample is set to 50 µL on the **Overview** tab (Dispense Volume=**50**).

- On the **Overview** tab, the number of dispenses per single aspirate (Dispenses per Aspirate=**2**) is defined to limit the aspiration volume by the capacity of the disposable tips (150 µL). This value is derived from (50 µL dispense volume * 2 dispenses per aspirate) + 5 µL waste volume <= 150 µL.
- The “Single Liquid” procedure is defined on the **Overview** tab to use disposable tips (Tip=**200µL Conductive RoboRack Tips**).

Get Tip step

- The Get Tip step is mapped to a set of two disposable tip boxes on the deck.

(Single Liquid) Transfer Group node

- All parameters in the Transfer Group are determined through the “Single Liquid” procedure definition.

Single Liquid Aspirate step

- This Aspirate step for the “Single Liquid” procedure is mapped to the source labware on the deck.

Single Liquid Dispense step

- This Dispense step for the “Single Liquid” procedure is mapped to a set of four 96 well microplates on the deck.
- The **Dispense Volume** inherits its value from the **Overview** tab of the Single Liquid procedure.

Drop Tip step

- This step is mapped to the Tip Chute on the deck for disposing of the used disposable tips.

Looping the Single Liquid procedure

- The Single Liquid procedure repeats until *nNbrOfSamples_S1* samples (with *nReplicates_S1* replicates) have been processed.

Reagent procedure

- This Reagent procedure transfers the reagent material to the destination wells that contain sample material.
- The Volume of reagent to transfer to each well is 100 µL (Dispense Volume=**100**).
- Enough reagent is aspirated in a single aspirate to dispense six samples (Dispenses per Aspirate=**6**) for efficient processing.
- The “Reagent” procedure is defined on the **Overview** tab to use the tip adapters as fixed tips (Tip=**Fixed**).

(Reagent) Transfer Group node

- All parameters in the Transfer Group are determined through the “Reagent” procedure definition.

Reagent Aspirate step

- The “Aspirate” step for the “Reagent” procedure is mapped to one of the troughs in the Reagent Trough rack on the deck.
- In the **Map Room** window for the labware mapped to this node, the Reagent Trough rack is segmented so that only the first trough position is used for reagent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Reagent Trough is set to *Wrap Around* to keep using the same reagent liquid for all the samples.

Reagent Dispense step

- The “Dispense” step for the “Reagent” procedure is mapped to a set of four 96 well microplates on the deck. This is because the **Location** field on the **Overview** tab is set to **Match To Steps**. This binds the reagent dispense to the same locations at the dispenses from the transfer group.
- The **Dispense Volume** field on the **Overview** tab inherits its value from the “Reagent” procedure definition.

Reagent Flush step

- This step is mapped to the Flush/Wash station on the deck.

Reagent Wash step

- This step is mapped to the Flush/Wash station on the deck.

Looping the Reagent procedure

- The “Reagent” procedure repeats until reagent material is added to all sample positions processed in the “Single Liquid” procedure.

Embedded Controls Procedure

Load File: Unknowns and Controls.MPT

Purpose: Inserts a set of three Controls, in duplicate, at the beginning of every 96 well plate where the unknowns are also prepared in duplicate.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- Prompts for the value of *nNbrOfSamples_S1*, which is automatically included as a prompt due to the **Var:AskUser** definition for **Number of Samples** field on the **Overview** tab of the “Unknowns” procedure.

Initial Flush/Wash procedure

- This initial Flush/Wash procedure ensures that the tips are clean and free of any contamination before starting the protocol.
- Both the Flush and Wash steps map to the Flush/Wash station on the deck.

Unknowns procedure

- This Single Liquid procedure includes an embedded “Controls” procedure to process the control samples and the processing instructions for the Unknowns.
- On the **Overview** tab, the user is prompted in the “Initial User Query” to identify how many samples to process (Number of Samples= **Var:AskUser**). The number entered is stored in the variable *nNbrOfSamples_S1* and specifies the number of Unknown samples processed by this procedure.
- On the **Overview** tab, the **Sample ID** for the Unknowns is an auto-incrementing value of the form UNK_#### (ID=**UNK_%0000**).
- On the **Overview** tab, the Unknown samples are prepared in duplicate (Replicates=**2**).
- On the **Overview** tab, the Unknown samples are prepared with volumes of 50 microliters (Dispense Volume=**50**) per sample.
- On the **Overview** tab, enough sample is taken in one aspiration to dispense duplicate samples (Dispenses per Aspirate=**2**).
- On the **Overview** tab, the **Aspirate From** location reflects the mapping selection made for the “Aspirate Unknowns” step below.
- On the **Overview** tab, the **Dispense To** location reflects the mapping selection that is made for the “Dispense Unknowns” step below.

Controls procedure

- This embedded Single Liquid procedure prepares three Control samples, in duplicate.
- On the **Overview** tab, three Control samples are prepared (Number of Samples=**3**), in duplicate (Replicates=**2**).
- On the **Overview** tab, the Controls are prepared and dispensed as the very first samples of the protocol, before any Unknown samples (Start After=**0**).
- On the **Overview** tab, controls are prepared at the beginning of every microplate (Restart Every=**45**). This value is derived from (96 wells - (3 controls * 2 control replicates) ÷ 2 unknown replicates = 45).
- On the **Overview** tab, the embedded procedure is set to optimize the tip usage between the two procedures by simultaneously pipetting both procedures if possible (Execution mode=**Parallel with other Procedures**).
- On the **Overview** tab, the **Sample ID** for the Controls is an auto-incrementing value of the form CTRL_#### (ID=**CTRL_%0000**).
- On the **Overview** tab, the Control samples are prepared with volumes of fifty microliters (Dispense Volume=**50**) per sample.
- On the **Overview** tab, enough sample is aspirated to dispense the duplicates for a single Control sample (Dispenses per Aspirate=**2**).

- On the **Overview** tab, the **Aspirate From** location reflects the mapping selection made for the “Aspirate Controls” step below.
- On the **Overview** tab, the **Dispense To** location reflects the mapping selection made for the “Dispense Controls” step below.

(Controls) Transfer Group node

- All parameters in the Transfer Group are determined through the “Controls” procedure definition.

Aspirate Controls step

- The Big Well Plate on the deck is mapped to this “Aspirate Controls” step.
- In the **Map Room** window for the labware mapped to this node, the Big Well Plate is segmented so that only the first three well positions are used for Controls.
- In the **Well Map Settings** window, the color for the “Aspirate Controls” step changes to distinguish it from the “Aspirate Unknowns” step in the protocol.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the Big Well Plate is set to *Wrap Around* to keep using the same three wells for the Controls.
- On the **Overview** tab, the ID inherits its value from the “Controls” procedure definition.

Dispense Controls step

- In the **Well Map Settings** window, this step is defined to *Continue From* the “Dispense Unknowns” step mapping. When the Controls are processed, they should be dispensed to the next available positions in the labware mapped to the “Unknowns” procedure. According to the calculations for the **Restart After Every** parameter in the “Controls” procedure, this will be the first six wells in every microplate.
- The **Dispense Volume** field on the **Overview** tab inherits its value from the “Controls” procedure definition.

Controls Flush step

- This step is mapped to the Flush/Wash station on the deck.

Controls Wash step

- This step is mapped to the Flush/Wash station on the deck.

(Unknowns) Transfer Group node

- All parameters in the Transfer Group are defined through the “Unknowns” procedure definition.

Aspirate Unknowns step

- The Test Tube Rack is mapped to this “Aspirate Unknowns” step.
- The ID on the **Overview** tab inherits its value from the “Unknowns” procedure definition.

Dispense Unknowns step

- ❑ This step is mapped to the set of 96 Well Plates on the deck. The plates are used in the order mapped.
- ❑ The **Dispense Volume** field on the **Overview** tab inherits its value from the “Unknowns” procedure definition.

Unknowns Flush step

- ❑ This step is mapped to the Flush/Wash station on the deck.

Unknowns Wash step

- ❑ This step is mapped to the Flush/Wash station on the deck.

Looping

- ❑ The Unknowns procedure repeats until *nNbrOfSamples_S1* Unknown samples are processed. If more sample positions are required than are available, WinPREP prompts for an Assembly Change.

Basic MDT Example Protocols

This section includes an examples for using the MDT with the Serial Dilution Head to perform a serial dilution by rows.

This section includes:

• Serial Dilution Tools Serial Dilution - Row on page 361

Serial Dilution Tools Serial Dilution - Row

Load File: Example Script SDT_Row.MPT

Purpose: Creates a row-based serial dilution using the MDT Serial Dilution Tools.

Requires: Modular Dispense Technology Serial Dilution Tools option and labware.

The protocol uses PerkinElmer half-area plates for the assay. If you use different labware, be sure to adjust the plate heights/volumes as necessary in the WinPREP protocol.

When preparing this protocol, you must add the desired reagent into the first row of the microplate prior to running the protocol. This reagent is the basis for the dilution and the protocol is designed to pick up the initial dilution volume from the first row of the plate.

A second Serial Dilution Tools example protocol (**Example Script SDT_Column.MPT**) is included. It is almost identical to the protocol described here except it uses a column-wise, rather than a row-wise, approach.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- No special use in this protocol.

Example Row Serial Dilution Procedure

- This step loads the MDT Serial Dilution Tools head and transfers buffer into each of the mapped wells in the microplate.

Load Head MDT

- Loads the Serial Dilution Tools head onto the MDT arm. In this case, the protocol uses the **I50R - 96 Tip head**.

Transfer Group MDT_1

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (first row of plate), dispenses the liquids into the second row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_1

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. For this step, the tip box is completely full and the procedure picks up the bottom row of tips out of the box.

Dil1:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil1:Aspirate MDT

- Aspirates 25µL of reagent liquid from the first row of wells on the plate.

Dil1:Dispense MDT

- Dispenses the contents of the tips into the second row of the microplate. The first row contains undiluted reagent liquid and acts as the initial dilution source and a control for the assay.

Post-dispense Mix

- Mixes the reagent and diluent in the wells. This step performs four total mix cycles.

Drop Tip MDT_1

- Moves the arm to the tip chute and disposes of the used tips.

Transfer Group MDT_2

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (second row of plate), dispenses the liquids into the third row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_2

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous step used the bottom row of tips so this step picks up the next available row of tips.

Dil2:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil2:Aspirate MDT

- Aspirates 25µL of reagent liquid from the second row of wells on the plate.

Dil2:Dispense MDT

- Dispenses the contents of the tips into the third row of the microplate. The second row contains the first step of the dilution sequence and acts as the dilution source for the current step.

Post-dispense Mix

- Mixes the reagent and diluent in the wells of the third row. This step performs four total mix cycles.

Drop Tip MDT_2

Moves the arm to the tip chute and disposes of the used tips.

Transfer Group MDT_3

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (third row of the plate), dispenses the liquids into the fourth row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_3

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous steps used the two bottom rows of tips so this step picks up the next available row.

Dil3:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil3:Aspirate MDT

- Aspirates 25µL of reagent liquid from the third row of wells on the plate.

Dil3:Dispense MDT

- Dispenses the contents of the tips into the fourth row of the microplate. The third row contains the second step of the dilution sequence and acts as the dilution source for the current step.

Post-dispense Mix

- Mixes the reagent and diluent in the wells of the fourth row. This step performs four total mix cycles.

Drop Tip MDT_3

Moves the arm to the tip chute and disposes of the used tips.

Transfer Group MDT_4

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (fourth row of the plate), dispenses the liquids into the fifth row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_4

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous steps used the three bottom rows of tips so this step picks up the next available row.

Dil4:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil4:Aspirate MDT

- Aspirates 25µL of reagent liquid from the fourth row of wells on the plate.

Dil4:Dispense MDT

- Dispenses the contents of the tips into the fifth row of the microplate. The fourth row contains the third step of the dilution sequence and acts as the dilution source for the current step.

Post-dispense Mix

- Mixes the reagent and diluent in the wells of the fifth row. This step performs four total mix cycles.

Drop Tip MDT_4

Moves the arm to the tip chute and disposes of the used tips.

Transfer Group MDT_5

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (fifth row of the plate), dispenses the liquids into the sixth row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_5

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous steps used the four bottom rows of tips so this step picks up the next available row.

Dil5:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil5:Aspirate MDT

- Aspirates 25µL of reagent liquid from the fifth row of wells on the plate.

Dil5:Dispense MDT

- Dispenses the contents of the tips into the sixth row of the microplate. The fifth row contains the fourth step of the dilution sequence and acts as the dilution source for the current step.

Post-dispense Mix

- Mixes the reagent and diluent in the wells of the sixth row. This step performs four total mix cycles.

Drop Tip MDT_5

Moves the arm to the tip chute and disposes of the used tips.

Transfer Group MDT_6

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (sixth row of the plate), dispenses the liquids into the seventh row of the plate, mixes the dilution, and disposes of the used tips.

Get Tip MDT_6

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous steps used the five bottom rows of tips so this step picks up the next available row.

Dil6:Asp. Diluent MDT

- Aspirates 25µl of diluent liquid from the diluent trough.

Dil6:Aspirate MDT

- Aspirates 25µL of reagent liquid from the sixth row of wells on the plate.

Dil6:Dispense MDT

- Dispenses the contents of the tips into the seventh row of the microplate. The sixth row contains the fifth step of the dilution sequence and acts as the dilution source for the current step.

Post-dispense Mix

- Mixes the reagent and diluent in the wells of the seventh row. This step performs four total mix cycles.

Drop Tip MDT_6

- Moves the arm to the tip chute and disposes of the used tips.

Reagent MDT_1

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough), dispenses the reagent into the eighth row of the plate, and disposes of the used tips.

Get Tip MDT_1

- Moves the MDT arm to the disposable tip box and picks up a row of tips from the tip box. Note that the previous steps used the six bottom rows of tips so this step picks up the next available row.

Transfer Group MDT_1

- This group loads a row of tips from the disposable tip box, aspirates reagent (reagent trough) and diluent liquid (sixth row of the plate), dispenses the liquids into the seventh row of the plate, mixes the dilution, and disposes of the used tips.

Aspirate MDT

- ❑ Aspirates 25µl of diluent liquid from the diluent trough.

Dispense MDT

- ❑ Dispenses the contents of the tips into the eighth row of the microplate. The eighth row is not a part of the actual dilution sequence and contains only diluent liquid. In this way, it acts as a secondary control along with the reagent control in the first row.

Drop Tip MDT_1

- ❑ Moves the arm to the tip chute and disposes of the used tips.

Unload Head

- ❑ Moves the MDT arm to the docking station and releases the Serial Dilution Tools head.

Advanced Varispan Example Protocols

The advanced example protocols address more advanced WinPREP functionality, such as using input files to select samples and create dilutions. The following sections describe each advanced example protocol in detail.

- Select Samples Using File on page 366
- Dilutions Using a File on page 369
- Top Off Wells on page 376

For more information on Basic Example Protocols see Basic Varispan Example Protocols on page 343 or Basic MDT Example Protocols on page 361.

Select Samples Using File

Load File: Hits Reformatting.MPT

Purpose: Processes selected samples from a set of labware based on a “hits” list from a file.

Protocol Outline node

- ❑ No special use in this protocol.

Initial User Query procedure

- ❑ No special use in this protocol.

Flush/Wash procedure

- ❑ This procedure ensures the tip adapters are clean and free from contamination before starting the protocol.

Single Liquid procedure

- ❑ This Single Liquid procedure aspirates selected samples from a set of labware and dispense them into a set of destination labware.

- On the **Overview** tab, the number of samples to process is based on the number of records in a supplied data file (Number of Samples=**File:Records**). The number of samples is determined by counting the number of records (lines) in an ASCII data file. Specify the name of the data file on the **Runtime Parameters** tab as described below.
- The selected samples (“hits”) to transfer, and their locations in the labware, must be identified in an ASCII data file. This file, therefore, contains the sample map for the samples (Aspirate From=**File:Column**). Specify the name of the data file on the **Runtime Parameters** tab as described below.
- The supplied data file also specifies the **Sample ID** field value (ID=**File:Column**). The **Runtime Parameters** tab specifies the name of the data file, as described below.
- The **Sample Volume** field is defined to be 10 µL for this protocol (Dispense Volume=**10**).
- The Single Liquid procedure is defined on the **Overview** tab to use disposable tips (Tip=**200ul Conductive RoboRack Tips**).
- On the **Runtime Parameters** tab, the **Number of Samples** parameter reflects the **File:Records** entry from the **Overview** tab. The desired file is specified in the next column (File or Variable=**Hits Reformatting.csv**). When this row is selected in the table, a portion of the file displays in the preview frame at the bottom of the tab.
- On the **Runtime Parameters** tab, the **Aspirate Sample ID** parameter reflects the **File:Column** entry from the **Overview** tab. The desired file is specified in the next column (File or Variable=**Hits Reformatting.csv**). The next column in the row indicates that the **Sample ID** value is in the first column of the file (Column # or Keyword=**1**).
- On the **Runtime Parameters** tab, change the Type to *Well Maps* using the drop-down list. The **Parameters List** displays the different Well Maps required during the protocol.
- On the **Runtime Parameters** tab, the **Aspirate Well Map** parameter reflects the **File Based Map** entry from the **Overview** tab (Gets Data From=**File:Column**). The third column identifies the desired data file (File=**Hits Reformatting.csv**). The next column in the row indicates that the name of the labware is located in the second column of the file (Rack Name Column #=**2**) and the sample position in the labware is located in the third column of the file (Position Column #=**3**). File based well maps require these two parameters to uniquely identify each sample location on the deck.

- On the **Runtime Parameters** tab, click the **Files** button to display the Runtime File Definitions window. Notice the data file (**Hits Reformatting.csv**) is defined in the table as a **comma** delimited, **column** based file with data starting in record **2**. In the file itself, the first line (record) in the file contains column headers, identifying the data in the columns of the file. The **In Use** flag indicates this file is already identified for use in at least one part of the protocol (**Number of Samples**, **Sample ID**, and **Aspirate Well Map**).
- The Deck View contains three 96 well microplates that may or may not contain the samples indicated in the data file. In fact, if you examine the example Well Mappings in the data file, you can see that 24 of the “hits” are on the first plate (column 2=**96 Well Plate1**), 14 “hits” are on the second plate (column 2=**96 Well Plate2**) and 63 “hits” are on the third plate (column 2=**96 Well Plate3**) for a total of 101 “hits” out of a possible 288 samples.
- Three functions in the protocol use the indicated data file (**Hits Reformatting.csv**). The number of records in the file (minus the header record) specifies the number of samples to process. The first column contains a Sample ID that uniquely identifies each sample record. The second and third columns identify the location of the sample by Rack Name and Sample Position in the labware, respectively.

Get Tip step

- The Get Tip step is mapped to a set of two disposable tip boxes on the deck.

Transfer Group node

- All parameters in the Transfer Group are determined through the procedure definition.

Aspirate step

- The **Location** field on the **Overview** tab inherits its value from the procedure definition (Location=**File Based Map**).
- The **Sample ID** field on the **Overview** tab inherits its value from the procedure definition.
- On the **Runtime Parameters** tab, the **Asp. Sample Id** parameter in the table inherits its value from the **Runtime Parameters** tab for the “Single Liquid” procedure.
- On the **Runtime Parameters** tab, the Aspirate Well Map definition in the table (Parameter Type=**Well Map**) inherits its value from the **Runtime Parameters** tab for the procedure.

Dispense step

- The **Dispense Volume** field value on the **Overview** tab inherits its value from the procedure definition (Dispense Volume=**10**).
- The Dispense step maps to a set of three 96 well microplates on the deck.

- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates are set to *Assembly Change* to prompt for more labware if necessary.

Flush step

- This step disposes of any waste volume and flushes the tips with system liquid.
- The Flush step maps to the Flush/Wash station on the deck.

Drop Tip step

- This step is mapped to the Tip Chute on the deck for disposal of the used disposable tips.

Looping

- The “Single Liquid” procedure repeats for every record in the data file.

Flush/Wash procedure

- This procedure is included to provide final cleanup of the tip adapters before completing the protocol.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Dilutions Using a File

Load File: Serial Dilution (Importing Dilutions).MPT

Purpose: Processes samples in a serial dilution, picking up dilution factors from a file that vary from sample to sample.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- No special use in this protocol.

Flush/Wash procedure

- This initial Flush/Wash procedure ensures the tips are clean and free of any contamination before preparing the dilutions.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Dilution - Serial procedure

- This Serial Dilution procedure aspirates a sample and a diluent and dispenses them together into the destination location.

- On the **Overview** tab, the number of records in the supplied file identifies the number of samples to process (Number of Samples=**File:Records**). The number of samples is determined by counting the number of records (lines) in an ASCII data file. Specify the name of the data file on the **Runtime Parameters** tab as described below.
- The *first* sample aspiration step below identifies the location of the original samples (Aspirate From=**Use Deck View**). Subsequent dilution aspirations in Serial Dilution procedures *always* map to the destination of the previous step.
- The *first* diluent aspiration step below identifies the location of the diluent material (Diluent From=**Use Deck View**). All subsequent diluent aspiration steps map to this same location.
- The **Auto Fade** check box makes it easy to identify the series of dilutions in the microplates. By selecting the “Dilution - Serial” procedure in the protocol outline, all six of the defined dilutions map into the chosen columns of the destination plates, as shown by the different intensities of blue color in the well columns. You may find it necessary to zoom in on the deck view to see this distinction in microplates.
- On the **Overview** tab, six rows make up the **Dilution List** table. Each row contains the information for one step of the serial dilution.
- Each row names the dilution step “Dil#”, where “#” is a number. The volumes of sample and diluent are read from the columns in a comma delimited ASCII data file (Aspirate Vol.=**File:Column** and Diluent Vol.=**File:Column**). Specify the file name and column positions for these parameters on the **Runtime Parameters** tab. Mapping for the dispensing of each dilution step is done in the appropriate dispense step below (Dispense To=**Use Deck View**).
- The “Dilution - Serial” procedure is defined on the **Overview** tab to use disposable tips (Tip=**200ul Conductive RoboRack Tips**).
- On the **Runtime Parameters** tab, the **Number of Samples** parameter reflects the **File:Records** entry from the **Overview** tab. The **File or Variable** column specifies the input file (File or Variable=**Serial Dilution.csv**). When this row is selected in the table, a preview of the file displays in the **Preview** frame at the bottom of the tab.
- On the **Runtime Parameters** tab, each of the **Dil#:Sample Vol.** parameters reflects the **File:Column** entry from the **Overview** tab. The next column specifies the input data file (File or Variable=**Serial Dilution.csv**). The next column in the row indicates that the **Sample Volume** value is located in the first column of the file (Column # or Keyword=**1**).
- On the **Runtime Parameters** tab, each of the **Dil#:Diluent Vol.** parameters should reflect the **File:Column** entry from the **Overview** tab. The desired file is specified in the next column (File or Variable=**Serial Dilution.csv**). The next column in the row indicates that the **Diluent Volume** value is located in the second column of the file (Column # or Keyword=**2**).

- From the **Runtime Parameters** tab, click the **Files** button to access the **Runtime File Definitions** window. Notice that the data file (**Serial Dilution.csv**) is defined as a **comma** delimited, **column** based file with data starting in record **2**. In the file itself, the first line (record) in the file contains column headers for the data in the columns. The **In Use** flag indicates that this file is already identified for use in at least one part of the protocol (**Number of Samples**, all six **Dil#:Sample Volume** parameters and all six **Dil#:Diluent** volume parameters).
- The indicated data file (**Serial Dilution.csv**) is used for three functions in this protocol. The number of records in the file (minus the header record) indicates the number of samples to process. The first column contains the Sample Volume and the second column contains the Diluent Volume for each sample record. The protocol uses the same Sample and Diluent Volumes for each of the dilution steps in the series.

Get Tip step

- The Get Tip step is mapped to a set of two disposable tip boxes on the deck.

Transfer Group_1 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil1:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the first row in the **Dilution List** table of the “Dilution - Serial_1” procedure.
- The “Dil1:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough is set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil1:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the first row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil1:Aspirate” step for the procedure is mapped to the labware on the deck.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the labware is set to *Assembly Change* to prompt for more samples if necessary.

Dil1:Dispense step

- The “Dil1:Dispense” step for the procedure maps to a set of four 96 well microplates on the deck.
- When mapping the Dispense steps for any Dilution procedure, WinPREP asks if you would like to redistribute the wells by column among all the dilution steps. If you answer *Yes*, one or more columns of wells in the labware (based on the number of dilution steps) are mapped to each dispense step in the dilution.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Assembly Change* to prompt for more microplates if necessary.

Transfer Group_2 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil2:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the second row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil2:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough his set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil2:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the second row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil2:Aspirate” step for the procedure maps to the Dispense location of the previous dilution (“Dil1:Dispense”).

Dil2:Dispense step

- This Dispense step inherits the well mapping of the destination labware from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_3 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil3:Asp. Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the third row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil3:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough is set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil3:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the third row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil3:Aspirate” step for the procedure maps to the Dispense location of the previous dilution (“Dil2:Dispense”).

Dil3:Dispense step

- This Dispense step inherits the well mapping of the destination labware from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_4 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil4:Aspirate Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fourth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil4:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.

- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough is set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil4:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fourth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil4:Aspirate” step for the procedure maps to the Dispense location of the previous dilution (“Dil3:Dispense”).

Dil4:Dispense step

- This Dispense step inherits the well mapping of the destination labware from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of WMap** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_5 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil5:Aspirate Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fifth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil5:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough is set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil5:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the fifth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil5:Aspirate” step for the procedure maps to the Dispense location of the previous dilution (“Dil4:Dispense”).

Dil5:Dispense step

- This Dispense step inherits the well mapping of the destination labware from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Transfer Group_6 node

- All parameters in the Transfer Group are determined through the procedure definition.

Dil6:Aspirate Diluent step

- The **Sample Volume** field on the **Overview** tab inherits its value from the sixth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- The “Dil6:Aspirate Diluent” step for the procedure maps to one of the troughs in the Flush/Wash station.
- In the **Map Room** window for the labware mapped to this node, the Flush/Wash station is segmented so that only the first trough position is used for diluent.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the reagent trough is set to *Wrap Around* to keep using the same diluent location for all the samples.

Dil6:Aspirate step

- The **Sample Volume** field on the **Overview** tab inherits its value from the sixth row in the **Dilution List** table of the “Dilution - Serial” procedure.
- On the **Overview** tab, the **Sample ID** field inherits its value from the procedure definition.
- The “Dil6:Aspirate” step for the procedure maps to the Dispense location of the previous dilution (“Dil5:Dispense”).

Dil6:Dispense step

- This Dispense step inherits the well mapping of the destination labware from the distribution of the Dil1:Dispense step mapping above.
- In the **Well Map Settings** window, the **Action at End of Well Map** value for the microplates is set to *Wrap Around* so that only one prompt for Assembly Change (“Dil1:Dispense”) occurs.

Aspirate Excess Sample step

- This step evens out the volume in the last well of the series. By design, the system aspirates sample from the previous dilution step to create the next dilution. Therefore, the *last* dilution has a greater volume than the rest in the series, because it is not the basis for the next dilution. This step aspirates the volume specified for the last dilution and disposes of it as waste.

- The **Sample Volume** field inherits its value from the volume specified for the last dilution in the series, in this case the sixth row of the **Dilution List** table (Aspirate Volume=**File:Column**).

Drop Tip step

- This step maps to the Tip Chute on the deck for disposal of used disposable tips.
- The tip, along with any Excess Sample aspirated in the last step, is disposed of as waste during this step.

Looping

- The “Dilution - Serial” procedure repeats until a sample is processed for every record in the data file.

Flush/Wash procedure

- This procedure provides final cleanup of the tip adapters before finishing the protocol.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Top Off Wells

Load File: TopOffWells - Simple.mpt

Purpose: To top-off wells with a reagent so that each sample position will have the same amount of liquid in it.

Protocol Outline node

- No special use in this protocol.

Initial User Query procedure

- Prompts for the value of two parameters. Variables for these parameters are defined and used elsewhere in the protocol.
- *nNbrOfSamples_S1* is automatically inserted due to the **Var:AskUser** definition on the **Overview** tab of the “Top-Off Wells” procedure.
- dAspVolume_S1 is automatically added to the query page due to the **Var:AskUser** definition on the **Overview** tab of the “Aspirate (if not enough liq. In well)” step.

Flush/Wash procedure

- This initial Flush/Wash procedure is included to ensure that the tips are clean and free of any contamination before touching the liquid of your samples.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Top-Off Wells procedure

- This “Custom” procedure contains the actual steps that perform the top-off process. The procedure controls the number of samples to process which is identified as **Var:AskUser** to prompt for a value in the “Initial User Query”. The number of samples entered by the user is stored in the variable *nNbrOfSamples_S1* for use in this procedure.
- Waste mode is selected as the pipetting mode on the **Overview** tab of the procedure.

Find Liquid Level step

- This Find Liquid step lowers the tip until it touches the liquid in the well as determined by the liquid level sense. The height at which liquid is found determines the volume of liquid in the well.
- On the **Overview** tab, the **Increment Location Every Replicate** ensures that the well maps for steps that follow can be matched to this step.
- Mapping for this step is set on the **Overview** tab to **Use Deck View**.
- A 96 well plate in the deck view is dragged onto the step. The protocol will prompt you for an assembly change as necessary when the number of samples is greater than 96.

Aspirate (if not enough liq. In well) step

- This Aspirate step is used to determine the volume of liquid, if any, that is required to top off the well. That volume will be aspirated in preparation for dispensing in the next step.
- On the **Overview** tab, the **Sample Volume** is identified as **Var:AskUser** to prompt for a value in the “Initial User Query”. It is convenient to use the **Sample Volume** parameter to prompt for the target volume, as the actual aspirate volume will be calculated in the user function as defined next.
- A Pre-Step function is defined on the **Advanced** tab to get information from the “Find Liquid Level” step (previous node in the protocol outline) and determine the values needed for this step to aspirate the appropriate volume of liquid.
- Information stored for a step can be accessed by functions in subsequent steps of the same procedure. This can include the volume of liquid found in a well based on the height of the liquid. In this function, the volume will be subtracted from the target volume (*dAspVolume_1*) entered in the “Initial User Query”.
- If the current volume in the well is within 5 uL of the target volume, the entire sample is skipped and the protocol continues with the next sample. Notice that this will cause the following “Dispense” and “Flush” steps to be skipped for this sample as well.

- If there is not enough liquid in the well, the volume difference is calculated (target - actual). This volume, along with the associated pump speed (as determined from the performance file) are set at this time in the function. This calculated value replaces the original Sample volume value (*dAspVolume_1*) that was actually used for another purpose (target volume).
- Mapping for this step is set on the **Overview** tab to **Use Deck View**.
- The reagent trough that is part of the Flush/Wash station in the deck view is dragged onto the step. The trough is defined to **Wrap Around** as the **Action At End of Well Map** so that the same trough position is used for the entire protocol.

Dispense step

- This Dispense step uses a Pre-Step function defined on the **Advanced** tab to determine how much system liquid was aspirated in the previous Aspirate step.
- If no liquid was aspirated (no additional volume was required), this step is not executed for the sample.
- If there was liquid aspirated (sample did not meet minimum volume) the step is set to dispense that volume. Both the volume and pump speed (as determined from the performance file) are set at this time in the function. The volume determined in the function replaces the default **Volume** defined on the **Overview** tab for this Dispense step.
- Mapping for this step is set on the **Overview** tab to **Match the** "**Find Liquid Level"** step so that additional liquid is dispensed into the same well that was tested.

Flush step

- This Flush step ensures that any liquid remaining in the tip is ejected before checking the next sample. This is necessary because the procedure is defined to use the Waste Mode.
- The Flush step is mapped to the Flush/Wash station on the deck.

Looping

- The Top-Off Wells procedure is repeated until *nNbrOfSamples_S1* samples have been topped off or skipped.

Flush/Wash procedure

- This final Flush/Wash procedure is included to ensure that the tips are clean and free of any contamination before finishing the protocol.
- Both the Flush and Wash steps are mapped to the Flush/Wash station on the deck.

Appendix A

Liquid Handling

The JANUS G3 Automated Workstation uses an “aspirate and dispense” method of sampling. System liquid (usually distilled water) is used as hydraulic fluid in the instrument. Before the sampling tips can aspirate liquid, the system must be primed with the system liquid. For some applications the system can be primed with reagent or diluent (see Prime the System with Reagent on page 380 for more information).

The system liquid, once primed through the tubing and sampling tips, acts like non-compressible hydraulic fluid in a braking system. The syringe pump moves the syringe plunger up and down in the syringe barrel like a piston. The movement of the syringe plunger moves the system liquid. The motion of the system liquid pulls and pushes sample liquids and other fluids into and out of the sampling tip.

Caution: Never run the instrument without fluid. Running a system dry (without fluid) can accelerate seal, syringe, and valve wear.

This chapter contains information on the concepts of Liquid Handling:

- Movement of the Sampling Tip on page 380
- Accuracy and Precision on page 386
- Determining Aspirate and Dispense Rates on page 392

Movement of the Sampling Tip

After the lines have been primed, the sampling tip moves to the source tubes or vials to aspirate liquid. The downward motion of the syringe plunger causes the system liquid to draw, or aspirate, fluid into the sampling tip at the source position. This fluid can include samples, controls, standards, reagent, or diluent.

After aspirating fluid, the sampling tip moves to the destination position. The upward motion of the syringe plunger causes the system liquid to push, or dispense, fluid out of the sampling tip into the destination position.

Thus, one cycle of the syringe equals one downward motion and one upward motion of the plunger. The motion of the syringe plunger coupled with the system liquid causes fluid to move throughout the tubing and the sampling tip.

Prime the System with Reagent

Certain assays require time-dependent dispensing of reagent. In these situations, using the conventional aspirate and dispense method is undesirable because too much time transpires between the first and last dispense operations. If the elapsed time is too great, protocol results may be negatively affected.

Priming the system with reagent can be used to dispense reagent into multiple destinations without the sampling tips returning to the reagent trough multiple times. This method reduces the amount of time it takes to dispense reagent.

To prime the system with reagent, replace the system liquid with a sufficient amount of reagent liquid and run the Flush and Wash Tips utility. This displaces the system liquid in the system tubing with reagent. You should only use this option for protocols where the timely dispensing of reagent is critical. For more information about the Flush and Wash Tips utility, see Flush and Wash Tips on page 415.

☞ *Note: When using the Flush and Wash Tips utility to prime the system with reagent, be sure to specify an adequate volume and enough Flush/Wash cycles to replace all the system liquid in the liquid path with reagent.*

To return the system to its normal operating state, replace the reagent liquid with system liquid and run the Flush and Wash Tips utility at least three more times. This restores the instrument to its “normal” condition; it backprimes the reagent in the lines and replaces it with system liquid.

☞ *Note: When using the Flush and Wash Tips utility to prime the system with system liquid, be sure to specify an adequate volume and enough flush/wash cycles to replace all the reagent in the liquid path with system liquid.*

The Syringe Valve

A syringe pump connects to each sampling tip on the pipetting arm of the JANUS G3 device. The syringe pump controls the aspiration and dispensation of liquid through the sampling tip. Each syringe pump is composed of three major components: a pump, a syringe, and a valve. The pump moves the syringe plunger up and down in the barrel of the syringe. The syringe measures and stores the liquid aspirated or dispensed. The syringe valve directs the flow of liquids in the system.

The syringe valve is mounted on top of each syringe (Figure A-1). The internal mechanism of the valve contains a connection pathway that rotates clockwise and counter-clockwise to properly direct the flow of fluid in the instrument, including:

- The flow of system liquid from the system liquid container to the syringe. This process is the first step in priming the system.
- The flow of system liquid into the syringe pump outlet tubing and the sampling tip. This process represents the final step in priming the system.
- The aspiration and dispensing of fluid. This process is the aspirate/dispense cycle, where the sampling tip picks up one or more liquids from source locations and dispenses them into one or more destination locations.
- The flow of system liquid from the peristaltic pump through the syringe pump outlet tubing and the sampling tip. This process represents the flush of the system after completion of sample processing.

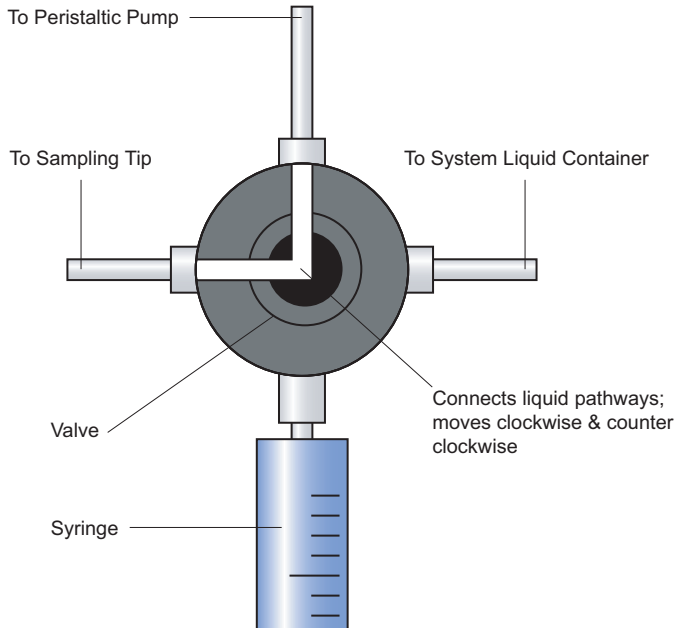


Figure A-1. Syringe Valve

The syringe valve has three positions. Each position corresponds to a specific flow requirement of the system:

- Position A directs system liquid from the system liquid container into the syringe, as shown in Figure A-2.
- Position B directs liquid from the syringe to the sampling tip, shown in Figure A-3. This position is used to aspirate and dispense liquids after the syringe pump outlet tubing and the sampling tip have been primed with system liquid.
- Position C directs system liquid from the peristaltic pump to the sampling tip as shown in Figure A-4. This position is used to clean (flush) the syringe pump outlet tubing and the sampling tip.

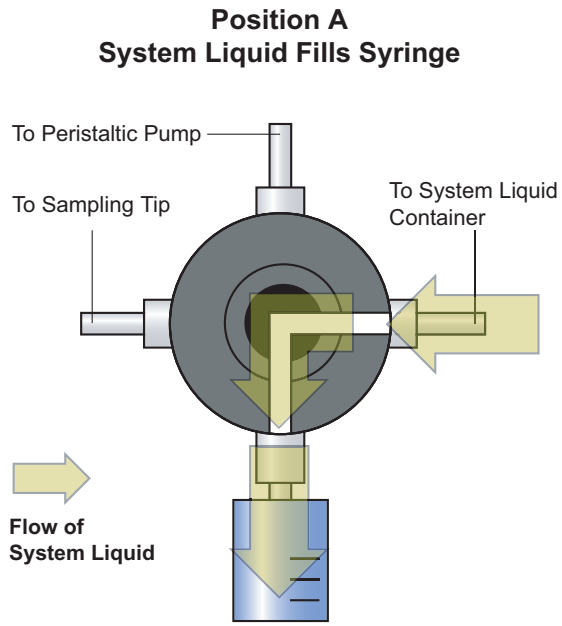


Figure A-2. Syringe Valve Positions: Position A

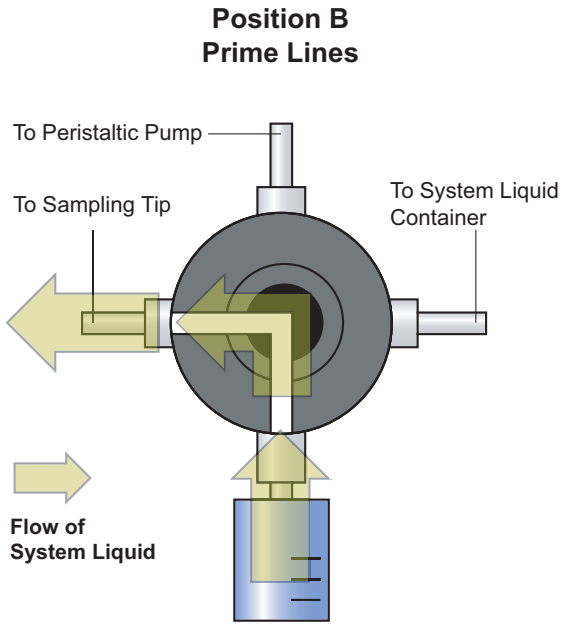


Figure A-3. Syringe Valve Positions: Position B

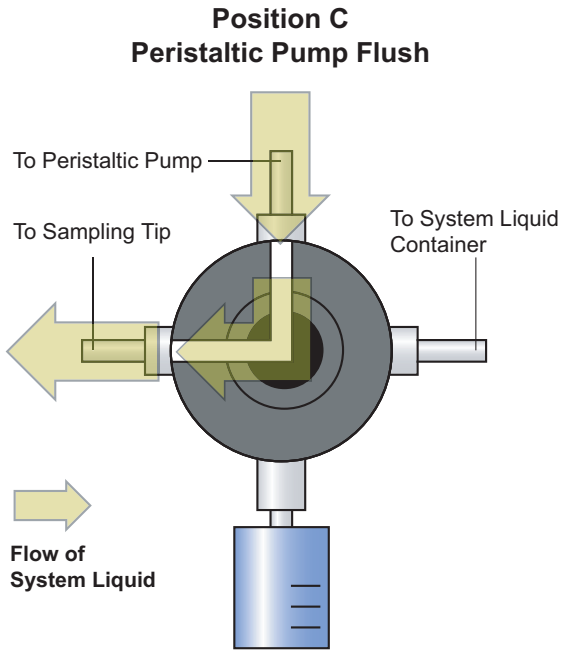


Figure A-4. Syringe Valve Positions: Position C

Aspirate and Dispense Example

The example below demonstrates syringe valve tube movement, sampling tip movement, the use of air gaps, and the two-step wash process at the wash station. In the example, the protocol aspirates 50 µL of sample and dispenses the sample to duplicate destination tubes in a multi-pipetting mode. Ten microliters of sample waste are dispensed into the waste position of the wash station.

☞ *Note: The liquid volumes here are just examples; they can vary with the requirements of real protocols.*

Refer to Figures A-2 through A-5 as you read through these steps.

1. The syringe valve tube rotates to position A (Figure A-2) and the syringe pump moves the syringe plunger down. This action pulls system liquid into the syringe. When the system liquid fills the syringe, the syringe valve rotates to position B (Figure A-3). It remains in this position through step 7. The syringe pump moves the syringe plunger up and forces system liquid through the syringe pump outlet tubing and sampling tip. The system is now primed. This step also represents the initial system flush.
2. The syringe pump moves the syringe plunger down and aspirates 10 µL of air into the bottom of the sampling tip. This volume of air separates the system liquid from the sample and is known as the “System Air Gap” (see Air Gaps on page 389 for more information.)
3. The syringe pump moves the syringe plunger down and aspirates 110 µL of sample into the sampling tip. This volume represents two individual dispensations of 50 µL each and 10 µL of sample waste. The waste volume represents the sample at the top of the liquid column in the sampling tip, just beneath the system air gap. This fluid can become diluted by the system liquid and is dispensed at the wash station at the end of the cycle.
4. The syringe pump moves the syringe plunger down and aspirates three microliters of air into the sampling tip. This volume of air, known as the “Transport Air Gap,” provides a barrier between the sample liquid and the end of the sampling tip. The transport air gap helps prevent the sample from dripping off the tip during high speed movements (see Air Gaps on page 389 for more information.)
5. The sampling tip moves to the first dispense location and dispenses the transport air gap and 50 µL of sample.
6. The sampling tip aspirates a transport air gap (three microliters of air) and moves to the second dispense location where it dispenses the transport air gap and 50 µL of sample.

7. The sampling tip moves to the wash station and dispenses 10 µL of sample waste and 10 µL of air (the system air gap) into the waste position of the wash station. The syringe valve rotates to position C (Figure A-4). The peristaltic pump flushes the syringe pump outlet tubing and sampling tip by pushing system liquid through the tubing.
8. The sampling tip moves from the waste position to the wash position (chimneys) of the wash station where the peristaltic pump flushes the tubing and sampling tip a second time.

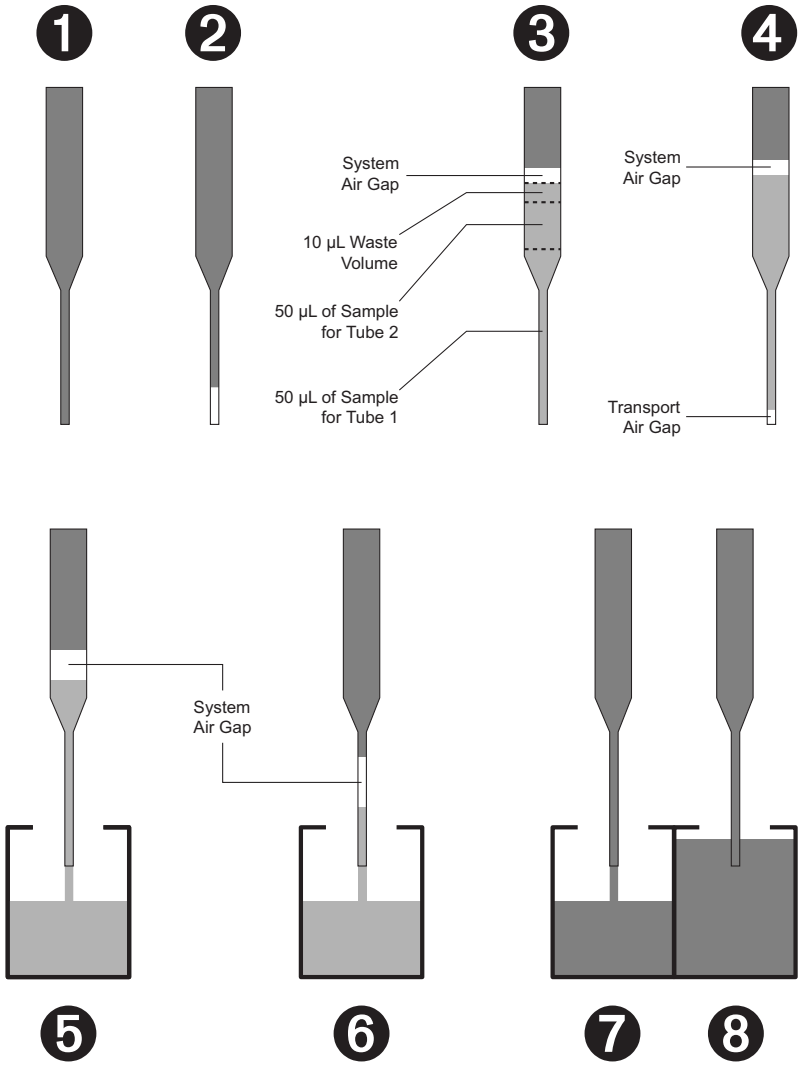


Figure A-5. Basic Liquid Handling

Basic Liquid Handling Process (in brief)

- Start with system liquid in sampling tip and tubing.
- Aspirate 10 µL of air.
- Aspirate 110 µL of sample.
- Aspirate 3 µL of air.
- Dispense 3 µL of air and 50 µL of sample in tube 1.
- Dispense 50 µL of sample in tube 2.
- Dispense 10 µL of sample waste volume and 10 µL air gap.
- Wash sampling tip.

Accuracy and Precision

Accuracy is the ability of a measurement to match the actual value of the quantity being measured. In liquid handling, this involves accurately dispensing a predetermined amount of fluid. In other words, when a protocol procedure requires 10 µL of fluid, the system dispenses 10 µL of fluid.

Precision is the reproducibility of a measurement. In liquid handling, this is the reproducibility of a dispensed volume. The system should precisely dispense a specific volume each and every time that volume is requested.

You can determine the Accuracy and Precision of the JANUS G3 using the Syringe Test utility in the WinPREP software. To run the Syringe Test, select **Utilities > Syringe Test** from the WinPREP drop-down menu (see Caring for the System on page 398 for more information.)

Many factors can influence the accuracy and precision of the automated liquid handling protocol results. The sections below provide insight into these factors and suggest ways to reduce, minimize, or overcome the impact these issues have on your results.

Delays

A delay is a short pause of the pipetting arm, programmed to occur just before or after aspirating or dispensing fluid. The delay allows the fluids in the liquid column to equilibrate before performing the next step. Delays tend to enhance accuracy and precision. The standard delay time (aspiration and dispense) is 200 ms.

Blowout Mode

Blowout mode refers to the process of using the system air gap, and sometimes additional air, to force any remaining sample from the sampling tip into the sample container. Blowout mode can be used with serial dilutions, predilutions, when dispensing reagent with sample, and any other application that requires pipetting very small fluid volumes.

Typically, blowout mode is used when dispensing sample volumes smaller than 10 µL. You cannot use blowout mode when you aspirate a waste volume or for multiple dispense/aspirates (see Sample Waste Volume on page 390 for more information about waste volume.)

☞ *Note: Blowout Mode is not recommended for viscous solvents or samples.*

Multiple Dispenses

Multi-dispensing is when enough liquid is drawn up into the sampling tip to dispense into more than one destination position without having to aspirate more sample. Multi-dispensing is useful when making replicate dispenses.

Before the liquid is dispensed at each destination position, a portion of the liquid is dispensed as waste; this portion is referred to as the dispense back/prime volume. A dispense back/prime volume must be used to minimize the first shot effect (see First Shot Effect on page 387 for more information.)

The maximum number of multiple dispenses is eight, however, accuracy and precision decrease after four to five replicate dispenses. In addition, multiple dispenses are especially prone to the dilution effect (see The Dilution Effect on page 388 for more information.)

First Shot Effect

The first shot effect occurs when a small amount of the sample volume adheres to the inside of the sampling tip. As a result, the first amount dispensed is less than subsequent dispenses. Typically, the first shot effect occurs when using multiple dispenses.

The best way to reduce the first shot effect is to make use of a dispense back/prime volume when performing multiple dispenses (see Multiple Dispenses on page 387 for more information.)

The Dilution Effect

The dilution effect describes situations where other liquids in the system dilute aspirated samples. The dilution effect occurs in at least two ways. During aspiration, the system liquid leaves tiny droplets behind inside the tip and Teflon® tubing. The leading portion of the aspirated sample picks up these droplets, thereby becoming diluted.

Dilution also occurs at the interface between the system liquid and the sample. When the system aspirates a sample, the sample liquid and the system liquid come into direct contact. When this happens, the system liquid dilutes the upper portion of the sample. Any reagents or samples aspirated into the tubing can become diluted due to contact with the system liquid.

Figure A-6 shows how fluids mix to create the dilution effect.

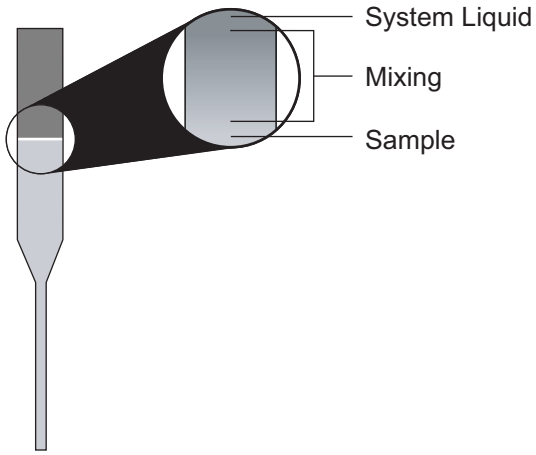


Figure A-6. Dilution Effect

There are several measures you can take to reduce the frequency and level of dilution effect you experience when running your assays. These measures are described in detail in the sections below.

Air Gaps

Air gaps are specific volumes of air aspirated into the tips and tubing to separate the fluids in the liquid column. There are three types of air gaps:

- System
  The system air gap separates the sample volume from the system liquid. The default is 10 µL. This helps to prevent your sample from becoming diluted by mixing with the system liquid.
- Separation
  The separation air gap is similar to the system air gap except it separates multiple samples rather than a single sample and the system liquid. Using separation air gaps between the various aspirated liquids helps maintain precision and minimizes any cross reaction between the liquids during transfer. An example would be to aspirate buffer, patient serum, and tracer at then dispense all three at one time. In this scenario, there are two separation air gaps: one between the buffer and patient serum and one between the patient serum and tracer.
- Transport
  The transport air gap prevents the aspirated sample from dripping out of the sampling tip. Dripping is unlikely with most non-volatile liquids. However, non-volatile liquids may drip from the sampling tip when there is a leak in the system or air is trapped in the tubing between the syringe and the tip. In this situation, a transport air gap is a temporary fix for the underlying problem. Volatile solvents, such as methanol (MeOH), routinely require transport air gaps to prevent dripping.

  Each movement of a liquid column introduces error. The movement associated with a transport air gap has the potential to introduce error and should be avoided when possible.

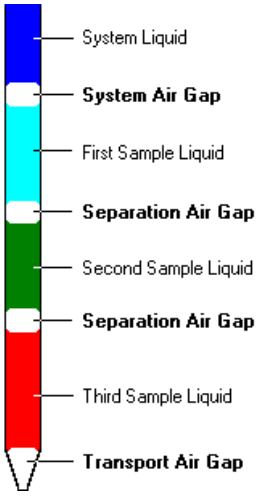


Figure A-7. Air Gaps

The volume of the sample helps determine the size of the air gap. Specifically, the larger the aspirated volume, the larger the air gap. Table A-1 lists the recommended air gaps for a range of sample volumes.

Volume of Liquid	Recommended air gap
< 100 µL	5 µL
100–200 µL	8 µL
> 200 µL	10 µL

Table A-1. Recommended air gaps

Very small air gaps, 5 µL or less, can dislodge from the Teflon tubing and move into the liquid. A more reasonable system air gap value for most standard dispensing is 10 µL. There is also danger in having a system air gap that is too large. Unlike various liquids in the system, the system air gap is compressible and expandable, giving it properties much like a spring. If the system air gap is too large, its “spring action” can influence liquid column motion and dispense precision (see The Elasticity Effect on page 391 for more information.)

While air gaps minimize the dilution effect, they do not entirely eliminate it. A minute amount of dilution can occur around the edges of the air gap resulting from the surface tension of the liquids as they move up and down in the small diameter tubing. Minute quantities of system liquid can also cling to the sides of the tubing and dilute the sample. Including a sample waste volume helps to reduce this problem even further (see Sample Waste Volume on page 390 for more information.)

In general, minimize the size and number of air gaps used, since too much air can compromise the hydraulic effect of the liquid system. Air gaps can also contribute to an “Elasticity Effect” (see The Elasticity Effect on page 391 for more information.)

Sample Waste Volume

Incorporating a sample waste volume can help overcome the dilution effect. The waste volume represents extra sample fluid at the top of the liquid column in the sampling tip, just beneath the air gap. This fluid can become diluted by system liquid or sample. By aspirating more sample than needed, the waste volume collects any remaining liquid droplets in the tip and tubing. The waste volume is not used in the dispense and is dispensed as waste in the wash station at the conclusion of the cycle.

The waste volume used should increase as the aspirated volume increases, with waste volumes of 30–35% or more often being necessary to effectively stop dilution. In some extreme cases, a waste volume of 50–100% may be necessary.

For example, when aspirating and dispensing sample fluid you can define the following sample volume and waste volume:

- Sample Volume 100 µL
- Waste Volume 10 µL

Aspirate 110 µL of sample fluid at the source tube or vial. Next, dispense 100 µL of sample fluid into the destination tube or vial. Dispense the remaining 10 µL of sample into the waste position of the wash station. The sample waste volume occupies the area immediately beneath the air gap in the sampling tip; it is the portion of sample that is most likely to be diluted by system liquid.

Multiple dispenses are especially prone to the dilution effect and may show a concentration gradient from the first dispense to the last if the waste volume is too small. The order in which you aspirate fluids may also contribute to, or protect against, the dilution effect. For example, when adding buffer and sample to a well, aspirate the buffer first, then the sample, and dispense the two together. When aspirated in this way, any dilution to the sample is by the buffer rather than the system liquid.

The Elasticity Effect

The elasticity effect describes the tendency of gases, in this case air gaps, to compress or expand in the fluid column.

Large air gaps are easily compressed when fluids are dispensed during high speed pump motions. When the pump motion ceases, the air gap “bounces” and causes the fluids in the tubing to move. The movement of fluids in the tubing can have a negative effect on accuracy and precision.

Large air gaps can also be stretched and break down when fluids are aspirated during high speed pump motions. When the air gap disintegrates, the sample liquid is diluted by the system liquid, having a negative affect on accuracy and precision (see Aspirate Rates on page 393 for more information.)

The volume of each air gap should be kept as small as possible to minimize the elasticity effect. Air gap volumes depend on the volume of the aspirated fluid samples but should follow the recommendations in Table A-1. Anything larger than 10 µL can increase the potential for the elasticity effect.

Overloading the Varispan Syringe Volume

Varispan syringe volume overloading occurs when the aspirated sample volume is larger than the internal volume of the syringe. The valve on the pump rotates when the syringe is at its lowest position. The piston inside the syringe is then raised up to its highest position. The valve is then rotated back to aspirate additional sample as the plunger inside the syringe is drawn down. This series of valve rotation and plunger movement continues until the volume of sample aspirated equals the desired volume.

Note that because the volume aspirated in this case exceeds the maximum volume of the tip, the aspirated liquids are held in the system tubing. This allows the JANUS G3 to aspirate a volume of liquid that is higher than the volume of the tips or the volume of the syringes.

Performance Files

Performance files provide a basic foundation for correcting for proper liquid volume delivery. Performance files optimize pipetting accuracy by adjusting parameters based on tip type, mode, fluid volume, and fluid properties. Select the performance file designed for the specific system liquid or create a custom performance file that meets your needs (see Performance Files on page 269 for more information.)

Determining Aspirate and Dispense Rates

Fluid aspiration and dispensation rates can greatly affect accuracy and precision. The volume of fluid in the aspiration or dispense step influences the rate at which the fluid is moved. For aspirations, smaller sample volumes require lower rates while larger sample volumes require higher rates. For dispenses, the opposite is true: smaller sample volumes require higher rates while larger volumes require lower rates.

You can specify these rates when you set up a protocol or specify the values in micro-liters per second (µL/s).

Table A-2 lists the recommended aspirate and dispense rates for a range of sample volumes.

Volume of Liquid	Recommended Aspiration Rate	Recommended Dispense Rate
< 5 µL	10 µL per second	400 µL per second
5–29 µL	25 µL per second	400 µL per second
30–49 µL	50 µL per second	400 µL per second
50–99 µL	75 µL per second	400 µL per second
100–max µL	125 µL per second	400 µL per second

Table A-2. Recommended Aspiration and Dispense Rates

The recommended rates in Table A-2 assume a fluid viscosity similar to that of water. Fluids having a higher viscosity require slower aspiration and dispense rates.

☞ *Note: By default, the WinPREP software sets the sample aspiration and dispense rates to the recommended values. You can accept the default values when you set up a protocol or you can enter the rates as desired.*

Aspirate Rates

Aspiration rates that exceed those suggested for a specified volume can increase throughput of sample processing. However, the vigorous movement of fluid in the sampling tip tends to destroy air gaps and makes fluids subject to dilution and elasticity.

For example, 50 µL of sample that is aspirated at 100 µL/s instead of the recommended rate of 50 µL/s, can break down the air gap that separates the sample from the system liquid (Figure A-8). The breakdown of the air gap can cause sample dilution, and thus the quality of the dispensed liquid.

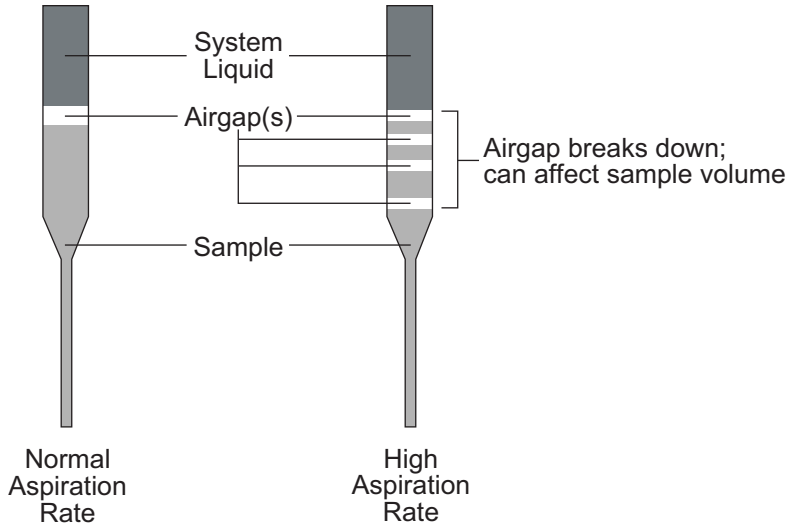


Figure A-8. Breakdown of air gap

Lower aspirate rates produce less force on the air gap in the sampling tip. Reduced force greatly lessens the risk that the air gap will break down and compromise the accuracy and precision of the pipetted volumes.

The effects of increased and decreased aspirate rates on accuracy and precision are shown in Figure A-9.

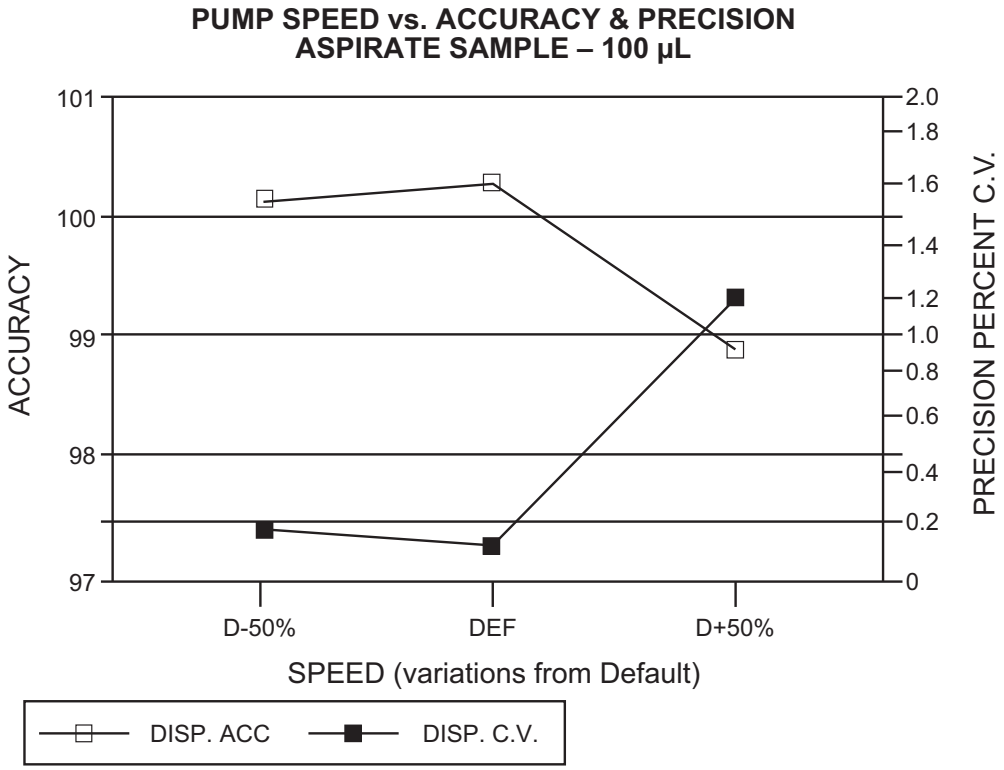


Figure A-9. Effects of Aspirate Rate

☞ *Note: Data shown in Figure A-9 was obtained gravimetrically under optimum laboratory conditions. Trends may differ for other volumes or conditions.*

Dispense Rates

Dispense rates that exceed those recommended for a specified volume can also increase throughput of sample processing. However, high dispense rates tend to increase the mixing of fluids in the reaction tube.

For example, dispensing 100 µL of sample and 100 µL of reagent at a rate of 600 µL per second, instead of the recommended rate of 400 µL per second, will effectively mix the reagent and sample in the reaction tube. Be careful of splashing when dispensing fluid into shallow vessels such as microplates. Very high dispense rates increase the potential for splashing.

Conversely, slower dispense rates result in less vigorous movement of fluid in the reaction tube. This means much less mixing of fluids.

When dispensed too slowly, small quantities of fluid adhere to the sampling tip instead of being dispensed into the destination container. These drops reduce the precision of the dispensed volume and can contaminate or dilute other samples.

The effects of increased and decreased dispense rates on accuracy and precision are shown in Figure A-10.

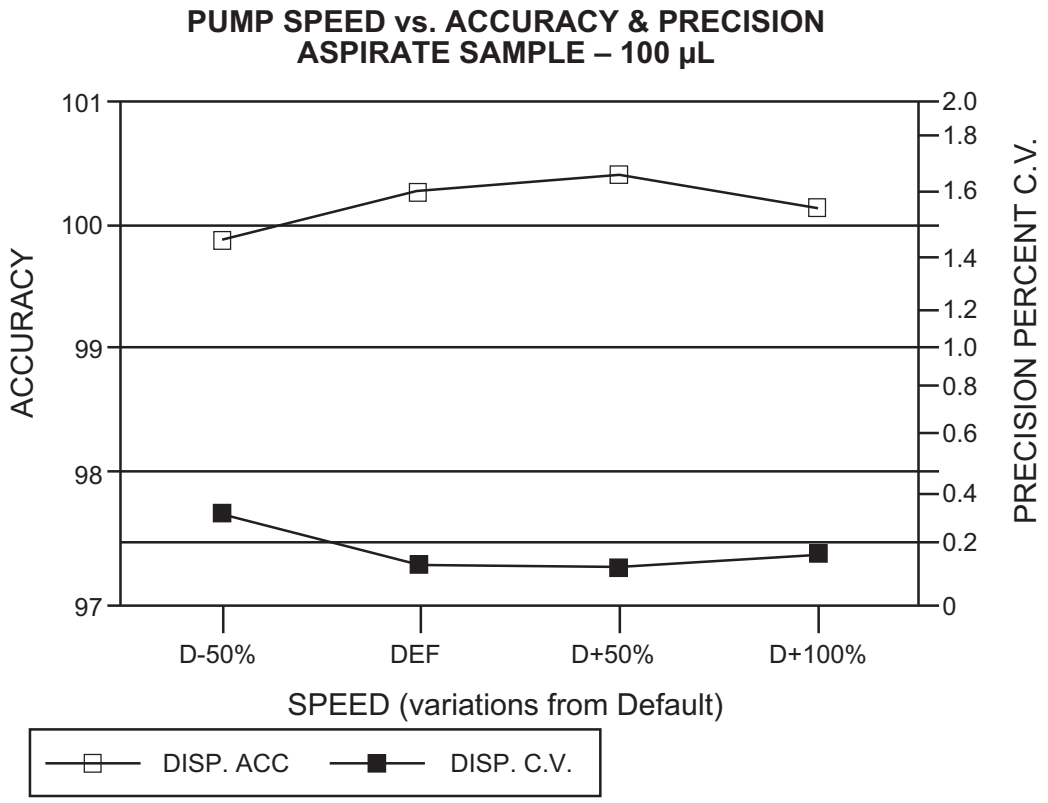


Figure A-10. Effects of Dispense Rates

☞ *Note: Data shown in Figure A-10 was obtained gravimetrically under optimum laboratory conditions. Trends may differ for other volumes or conditions.*

Liquid Viscosity

Finding the optimum aspirate and dispense rates requires some experimentation. The recommended rates in Table A-2 assume a liquid viscosity similar to water. You must consider this factor as you set the optimum aspirate and dispense rates.

When using viscous fluids, it is recommended that you decrease aspirate and dispense rates. Thicker fluids create different hydrodynamics and can increase the elasticity effect on air gaps.

For example, to aspirate 45 µL of polyethyleneglycol (PEG), you might want to set the aspirate rate at 30 µL/s and set the dispense rate at 400 µL/s (see Table A-2). In both instances, the rates are slower than if the solution were of a normal viscosity.

For very viscous fluids, it can be helpful to increase the delay (see Delays on page 386 for more information.) The standard delay time (aspiration and dispense) is 200 ms. Increase the delay to over 200 ms for viscous fluids; the thicker the fluid, the longer the delay.

Meeting Your Requirements

Aspirate and dispense rates should be set to effectively transport samples in the tubing. Consult your PerkinElmer liquid handling specialist for the rates best suited to handle your pipetting requirements.

Appendix B

Caring for the System

This chapter describes the diagnostic testing and regular preventive maintenance you should perform to maintain the JANUS G3 system.

This section contains:

- Preventative Maintenance Procedures on page 398
- Preventative Maintenance Checklist on page 402
- As-Needed Maintenance on page 403
- Diagnostic Tests on page 408
- Removal of Equipment from Use for Repair or Disposal on page 426

! ***WARNING*** *Do not perform any maintenance procedures other than those included in this manual.*

Preventative Maintenance Procedures

Preventive maintenance consists of Daily, Weekly, Quarterly, and As Needed procedures that help to ensure proper operation of the system. Refer to each section for the appropriate maintenance procedures.

- Daily Preventative Maintenance on page 398
- Weekly Preventative Maintenance on page 400
- Monthly Preventative Maintenance on page 401
- Quarterly Preventative Maintenance on page 401

Daily Preventative Maintenance

Daily maintenance includes tasks that should be performed on a daily basis to help ensure the accuracy of the protocols and smooth functioning of the instrument. The daily maintenance tasks are minimal and require very little time to complete.

While PerkinElmer recommends that you perform these operations at least once per day, perform them as frequently as needed to keep the instrument in good working order.

Flush the Varispan Pipetting Arm

Flushing the Varispan pipetting arm helps to keep the system free of air bubbles, crystals, precipitates, and biological growth that can accumulate in the tubing, valves, and syringes. If allowed to accumulate in the liquid path, these items can decrease the accuracy and precision of the instrument. To prevent this problem, flush the system at the start of each day.

To flush the system:

1. Fill the system liquid container with system liquid appropriate for the application.
2. Select **Utilities > Diagnostic Tests > Flush and Wash Tips** to start the flush process (page 415).
3. Set both the Flush and Wash volumes to 10,000 µl, when prompted.
4. Flush with enough liquid to remove all air bubbles in the tubing from the system liquid container to the tips.
5. After completing the desired number of flush cycles, inspect the tubing for air bubbles. If there is any air in the tubing, repeat the flush as many times as necessary to purge the air from the system. Gently tapping the tubing or syringe plunger can help to dislodge bubbles in the tubing or syringes.

Clean the Deck, Support Tiles, and Racks

Clean the work surface of the instrument at the end of each working day. Remove all support tiles and racks from the deck and carefully clean the deck using a soft cloth and multi-surface cleaner. Clean all support tiles, racks, and labware locating pins before returning the support tiles and racks to the deck.

PerkinElmer recommends 70% ethanol, Lysol® Brand Disinfectant Foam Cleaner or a similar cleaner (such as Sani-Cloth® or Rad-Con™) for multiple surface cleaning.

Caution: If you clean the system with a 1% bleach solution, rinse thoroughly with distilled water or clean with surface cleaner immediately after using bleach.

Check the Syringe Pump Outlet Tubing

Visually inspect the syringe pump outlet tubing for air bubbles and leaks. If you discover leaks, finger tighten the tubing connections to the syringe pump valves.

WARNING *Be careful not to over-tighten the tubing connections.*

Empty the Waste Container

Empty the waste container as needed during daily operation and always empty the waste container at the end of the working day. Dispose of all liquid waste according to accepted laboratory practices.

Clean the Sampling Tips

Clean the sampling tips with alcohol at the beginning of each day. Gently wipe each tip using an alcohol wipe or a soft, lint free cloth and 70% ethanol. Visually inspect each sampling tip and replace scratched or damaged tips.

Weekly Preventative Maintenance

Perform the tasks below on a weekly basis. These tasks, along with the Daily Maintenance, are designed to keep the instrument in good working order. Perform these operations at least once per week or more frequently, if needed.

Flush System if Unused For An Extended Period

Thoroughly flush the system at least once per week if the instrument has not been used during the week. Use the **Flush and Wash Tips** utility (page 415) to remove any residue, deposits, and air bubbles.

Visually Check Tubing

Visually inspect the tubing once a week to ensure it is in good condition and properly connected to all components. Tighten tubing connections if you find poor or loose connections or notice any signs of leakage. Make sure the interior of the tubing is clean and free of deposits, residue, air bubbles, and clogs. Thoroughly flush the system if you notice the presence of any of these conditions. Refer to the **Flush and Wash Tips** utility (page 415) for more information.

WARNING *Be careful not to over-tighten the tubing connections.*

If tightening the tubing connections and flushing the system does not correct the leak, you may need to clean the system (page 401) or replace the tubing (page 405.)

Visually Check Syringes

Visually inspect the syringes once a week to ensure they are in good working order. Syringes should be clean and free of leaks. Replace any damaged, leaking, or worn syringes (page 404).

Monthly Preventative Maintenance

Clean and Fill the System Liquid Container

Inspect the level of the system liquid at the beginning of each working day. Completely empty the system liquid container and refill with new system liquid at least once a month. PerkinElmer recommends degassed, distilled water, type I, type II or type III deionized water, or other liquid appropriate for the application for use as the system liquid.

Quarterly Preventative Maintenance

Perform the maintenance procedures below at the end of each quarter or after 200 hours of operation, whichever comes first. The frequency is only a recommendation and you should perform these procedures as frequently as needed.

Disinfect the Fluid Path

Clean the fluid path with 70% ethanol, a 0.5% Lysol IC solution, 1% bleach solution, or an equivalent fines-free certified cleaner. Rinse well after cleaning, especially when using bleach solution, to prevent damage to the instrument. Flushing the system helps prevent the growth of bacteria and fungi and the formation of crystals and precipitates in the tubing, valves, and syringes. These residues can affect the accuracy and precision of the instrument and shorten the lifetime of flow path components (see Daily Cleaning on page 414 for more information). Also wipe clean the outside of the syringe and peri-pump tubing in the system liquid container.

Clean the Waste Tubing

Clean the waste tubing by carefully pouring a solution of laboratory detergent (10% bleach) down the wash station drain. The solution cleans the waste tubing by running down the drain in the wash station and passing through the waste tubing. Flush the waste tubing of any remaining cleaner by pouring clean, distilled water down the wash station drain.

Preventative Maintenance Checklist

Use this checklist to log the Preventative Maintenance activities for the JANUS G3 system. You can print the checklist, or create a new checklist based on your laboratory's specific maintenance schedule and requirements.

Start-Of-Month

__ Clean and Refill System Liquid Container (see page 401)

Start-Of-Week

__ Visually Check Tubing (see page 400)
__ Visually Check Syringes (see page 400)

Start-Of-Day

__ Flush Varispan with System Liquid (see page 399)
__ Check Syringe Pump Outlet Tubing (see page 399)

End-Of-Day

__ Clean Sampling Tips (see page 400)
__ Empty Waste Container (see page 400)
__ Clean Deck, Support Tiles, and Racks (see page 399)
__ Daily Cleaning, if desired (see page 414)

End-Of-Week

__ Flush & Wash Tips if unused for an extended period (see page 400)

Quarterly

__ Disinfect the Fluid Path (see page 401)
__ Clean Waste Tubing (see page 401)

Name (print): _____

Signature: _____ Date: _____

As-Needed Maintenance

This section describes maintenance routines that do not correspond to a set schedule. Perform these procedures as often as necessary to keep the system in good working order.

In addition to the procedures listed here, the Diagnostic Tests section (page 408) provides additional routines to diagnose and calibrate the system.

- Check Deck Calibration on page 403
- Test the Syringes on page 403
- Test Tip Pickup on page 404
- Test Liquid Level Sense on page 404
- Syringe Replacement on page 404
- Tubing Replacement on page 405
- Sanitize Drip Pans on page 406
- Change the UV Lamp on page 406

Check Deck Calibration

If the sampling tips, dispense head, arms, or gripper hit another arm or anything on the deck, verify the deck calibration. The deck does not need to be recalibrated unless the instrument is not performing as expected. Verify the deck layout and labware definitions are correct before calibrating the deck. Before calibrating the deck (see Calibration Procedures on page 292), run the Random Move Test (see page 419) to prepare the instrument. Contact PerkinElmer Technical Support (see page 2), if assistance is required.

Test the Syringes

The Syringe Test uses gravimetric analysis to determine the accuracy and precision of the syringes (see Syringe Test on page 420 for more information.) Use the Syringe Test to verify the accuracy and precision of dispense or aspirate volumes in one or more tips.

After completing the test, the values for the mean, standard deviation, and percent coefficient of variation (%CV) for the tested tip are calculated. To record these statistical values, make sure the result window is active and press Alt + Print Screen on the keyboard. This saves an image of the screen to the Windows clipboard that you can paste into a word processing or graphic editing program.

If you create a new performance file to improve the accuracy and precision, verify that all affected protocols use the new performance file.

Test Tip Pickup

When using disposable tips, the instrument's ability to pick up, sense, and drop (strip) tips reliably is important for the overall performance of the system. The Pickup Tips Test (page 417) runs through several cycles of picking up, sensing, and dropping tips. When the protocol is complete, WinPREP generates a summary detailing the tip type, adapter number, number of pickup attempts, and number of errors recorded during the test. You can print, save, or delete this report as needed. If the system is operating properly, the summary will show zero errors.

Test Liquid Level Sense

The Liquid Sense Test utility (page 416) checks the ability of the system to accurately detect liquid, which helps ensure the accuracy and precision of pipetting operations. This test detects when the tips contact liquid in the well or reservoir and reports the height of the liquid.

☞ ***Note*** *The Liquid Level Sense test will report a height of zero in the report if there is no liquid in the well or reservoir. To avoid this issue during the liquid level sense test, make sure you provide enough liquid in the testing containers.*

Syringe Replacement

Replace each syringe as needed. Inspect the syringes for leaks and excessive wear at least once a week, as outlined in Visually Check Syringes (page 400.) Replace syringes if the glass barrel is scratched or scored or if the syringe leaks around the Luer lock fitting at the top of the syringe.

To replace a syringe:

1. Lower the syringe plungers using the **Change Syringe** test (see page 413). While the syringes are lowering, the Reset Pump window opens.
2. Remove the syringe bolt at the base of the syringe. Turn the screw counterclockwise.
3. Turn the syringe barrel and Luer lock counter-clockwise. Unscrew using the top corrugated section. Do not handle the syringe by the glass to prevent breaking the syringe.
4. Gently pull the syringe barrel down.
5. Dispose of the old syringe according to accepted laboratory procedures.
6. To install the new syringe, fasten the Luer lock on the top of the syringe to the base of the valve. Turn the Luer lock and syringe barrel clockwise. Assist the syringe in an upward motion while turning to prevent stripping the threads on the valve. Do not over-tighten.

7. Secure the syringe bolt onto the syringe pump module connection. Turn the syringe bolt clockwise.
8. Click **OK** in the Reset Pump window AFTER the syringe(s) have been replaced.
9. Complete the Change Syringe test.

Tubing Replacement

Regularly inspect the Marprene® tubing from the System Liquid Container to the manifold block. Replace the tubing once every six months or as needed. Immediately replace the tubing if it is excessively worn, stiff, or leaks.

To replace the peristaltic pump Marprene tubing:

1. Disconnect the system liquid tubing from the system liquid container.
2. Remove all fluid from the tubing using the **Flush and Wash Tips** utility (page 415).
3. Remove the faceplate on the plastic tubing guide. Starting on the right end, simultaneously apply pressure to the top and bottom of the guide to detach the clips on the guide from the groove in the faceplate.
4. Disconnect the Marprene tubing by loosening the connector on the manifold block.
5. Remove the tubing from the tubing guide.
6. Feed the new tubing into the tubing guide and out through the bottom of the guide to the manifold block.
7. Attach new tubing to the manifold block.
8. Reattach the tubing guide faceplate by inserting the clips on the tubing guide into the grooves on the faceplate.
9. Reconnect the system liquid tubing to the system liquid container.
10. Run the **Flush and Wash Tips** utility as needed to flush the air out of the system and fill the lines with system liquid.
11. Check for leaks in the system.

Sanitize Drip Pans

Drips pans are plastic troughs that occupy the space immediately below the deck. These pans help contain spills by catching any liquids that drip or spill onto the deck surface. (Note that workstations with recessed decks use non-removable metal drip pans.)

To sanitize the drip pans:

1. Remove each of the four screws connecting the deck plate to the frame.
2. Lift the deck plate up and away from the frame.
3. Lift the drip pans up and out of the frame base.
4. Wash and rinse the pans with mild laboratory detergent and water.
5. Drain, dry, and replace the drip pan in the frame base.
6. Place the deck plate on top of the frame. Make sure the deck plate is oriented properly.
7. Reattach the deck plate to the frame using the four deck plate screws.

Change the UV Lamp

In the instructions below, “Lamp” refers to the UV Bulb only. The UV Lamp should be replaced after 3 years to maintain optimal efficiency.

Supplies required:

To change the UV Lamp, have the following supplies available:

- Replacement UV Lamp
- Gloves (latex, nitrile, or cotton)

To change the UV Lamp:

1. Turn off the JANUS G3 power and unplug the JANUS G3 power cord and the UV Light power cord.

WARNING UV LIGHT*. Verify the UV Light is off and the power is disconnected before proceeding. Unprotected eyes and skin can be seriously damaged by exposure to UVC radiation.*

2. Follow the handling and safety instructions included with the new UV lamp (light bulb) at all times. Do not touch the lamp without gloves.
3. Carefully remove the UV Lamp from the clips (see Figure B-1 on page 407) by pulling the bulb down out of the clips.

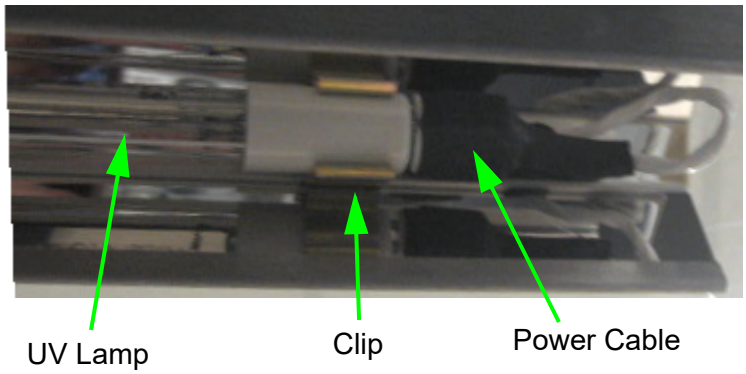


Figure B-1. UV Light Parts

4. Unplug the Lamp Power Cable from the Lamp.
5. Plug the Lamp Power Cable into the new lamp.
6. Press the UV Lamp into the clips. Make sure the clips only contact the white end caps on the bulbs. Do not position the lamp with the clips on the glass tube.
7. Close the enclosure doors.
8. Plug in the JANUS G3 power cord and the UV Light power cord.
9. Turn the JANUS G3 power switch on (I).

☞ *NOTE* *UV Lamp contains Mercury. Dispose of in accordance with local Disposal Laws.*

Diagnostic Tests

The WinPREP software includes diagnostic tests to help keep the Varispan, MDT, Gripper, Plate ID Barcode Reader, and Tube Barcode Reader equipment operating properly. Each test performs a specific function such as properly positioning the system components for a maintenance task or checking the system for mechanical problems. PerkinElmer provides these tests as a standardized way for you to calibrate the equipment and identify and correct a range of problems. These tests can help ensure the instrument is operating with a high degree of accuracy and precision, and is free of several mechanical or electrical problems.

To use any of the diagnostic tests, select **Utilities > Diagnostic Tests** and choose the desired test from the list. Figure B-2 shows the **Diagnostic Tests** menu. Only the diagnostic tests for the installed system components display.

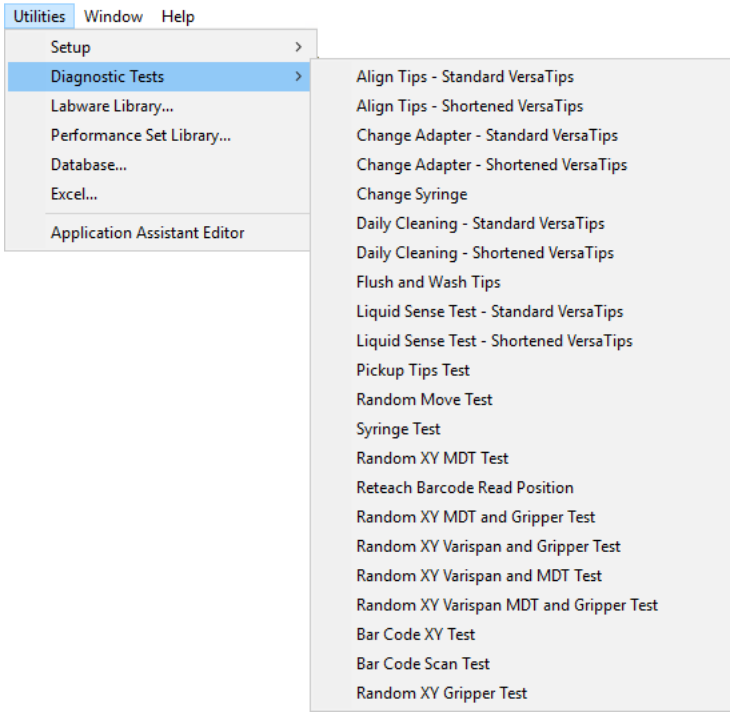


Figure B-2. Diagnostic Tests Menu

When you execute any of the diagnostic tests from the **Utilities > Diagnostic Tests** menu, WinPREP displays the window shown in Figure B-3. The test will not continue until you click one of the buttons on the window. This pause gives you an opportunity to verify that the physical deck configuration matches the deck configuration in the test *before* performing the test.

While each test has a default deck layout, you can position the labware anywhere on the deck. Just make sure the physical deck configuration matches the test deck configuration. Either move the physical labware to match the deck layout in the test or move the test deck labware to match the locations of the physical labware on the deck. Be sure to save the test if you want to change the default positioning permanently or save the modified test with a unique name.

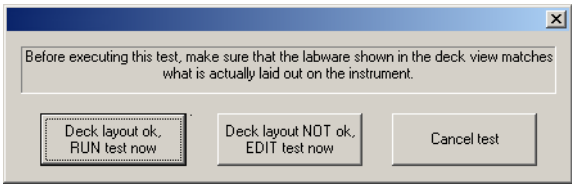


Figure B-3. Diagnostic Test Introductory Message

Depending on the size of the screen and the position of the WinPREP main window, you may need to move this window to view the entire deck layout. Make sure the window is not blocking the view of labware on the deck view.

The sections below provide details about running each of the diagnostic tests provided with the instrument.

- Align Tips on page 409
- Change Adapter on page 411
- Change Syringe on page 413
- Daily Cleaning on page 414
- Flush and Wash Tips on page 415
- Liquid Sense Test on page 416
- Pickup Tips Test on page 417
- Random Move Test on page 419
- Syringe Test on page 420
- Random XY Tests on page 421
- Reteach Barcode Read Position on page 421
- Barcode XY Test on page 423
- Barcode Scan Test on page 423
- Random XY Gripper Test on page 424

Align Tips

The Align Tips diagnostic test helps you check and adjust the alignment of the Varispan tip adapters. The test moves the Varispan pipetting arm to the tip alignment test fixture so you can visually verify the tip alignment.

To run the Align Tips diagnostic test:

1. Insert the calibration cones into the tip alignment test fixture based on the number of tips on the Varispan arm (see Figure B-4).

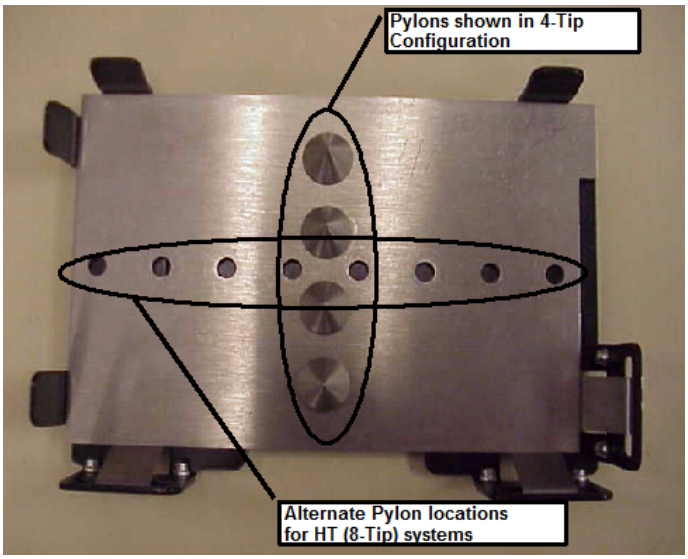


Figure B-4. Tip Alignment Calibration Fixture

2. Select **Utilities > Diagnostic Tests > Align Tips** (choose either Standard or Shortened VersaTips). The **AlignTips.MPT** introductory window opens.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

3. If the default test setup is acceptable, position the test fixture and wash bowl at the indicated locations on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the protocol outline or labware positions, click the **Deck Layout Not OK** button, make the necessary modifications, position the test fixture and wash bowl in the indicated locations on the deck, and click the **Run Protocol** button on the toolbar.

4. When the system positions the tips over the test fixture, make sure that each tip aligns with the associated calibration cone in the fixture. Gently rotate the tips around the vertical (Z) axis of the tip to correct any improperly aligned tips.

❗ ***WARNING*** *N**ever** bend the VersaTip® adapters. If a VersaTip adapter is out of alignment with the calibration cone, try rotating the tip to correct the misalignment.*

5. Click **OK** in the message window to complete the alignment. The arm moves to the wash bowl position to end the test.

Change Adapter

Use the **Change Adapter** diagnostic test to change the Varispan tip adapters, for example, to switch from fixed tips to VersaTips. The procedure lowers each tip, one at a time, so that you can access the mounting hardware and change the adapter.

To run the Change Adapter diagnostic test:

1. Insert the calibration cones into the tip alignment test fixture based on the number of tips on the Varispan arm (see Figure B-4).
2. Select **Utilities > Diagnostic Tests > Change Adapter** (choose either Standard or Shortened VersaTips) to open the **ChangeAdapter.MPT** introductory window.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

3. If a tip stripper sleeve is installed in a 4-tip system, remove the tip stripper sleeve by pulling it straight down until the guide pin detaches from the tip holder. (Refer to Figure B-5 for parts identification.)
   If a tip stripper sleeve is installed in an 8-tip system (not shown), loosen the sleeve screw and then remove the tip stripper sleeve. (Failure to loosen the sleeve screw can damage the system).

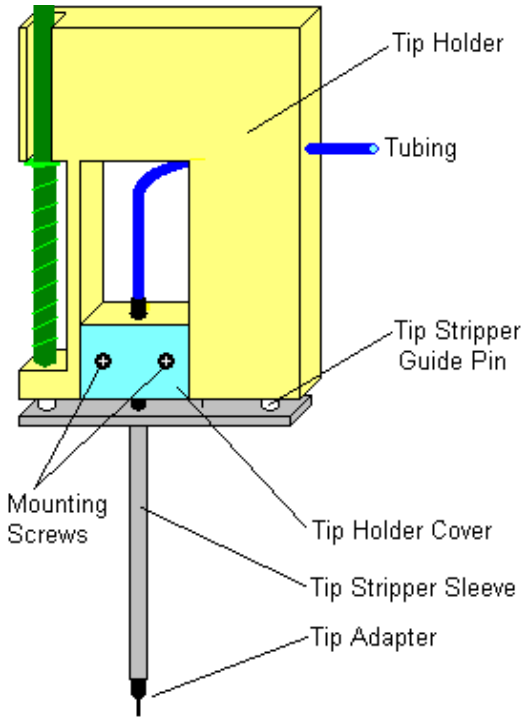


Figure B-5. Tip Adapter Mounting Assembly.

4. If the default test setup is acceptable, position the test fixture and the wash bowl at the indicated locations on the deck, and click the **Deck Layout OK** button.

   OR

   If you need to modify the protocol outline or labware positions, click the **Deck Layout Not OK** button, make the necessary modifications, position the test fixture and the wash bowl at the indicated locations on the deck, and click the **Run Protocol** button on the toolbar.

   The system positions the tips over the test fixture and the **Next Adapter** window opens.

5. Type the number of the tip adapter that you want to change in the **Adapter Number** text box and click **Continue**.
6. Loosen the screws that secure the cover to the tip holder and remove the tip holder cover.
7. Disconnect the tubing from the top of the tip adapter by gently pulling the tube and adapter apart.

☞ *Note: The number of screws securing the cover to the tip holder differs between four and eight tip arms. For the 8-Tip arm, loosen the bottom screw shown in Figure B-6. For the 4-Tip arm, loosen the two screws shown in Figure B-6.*

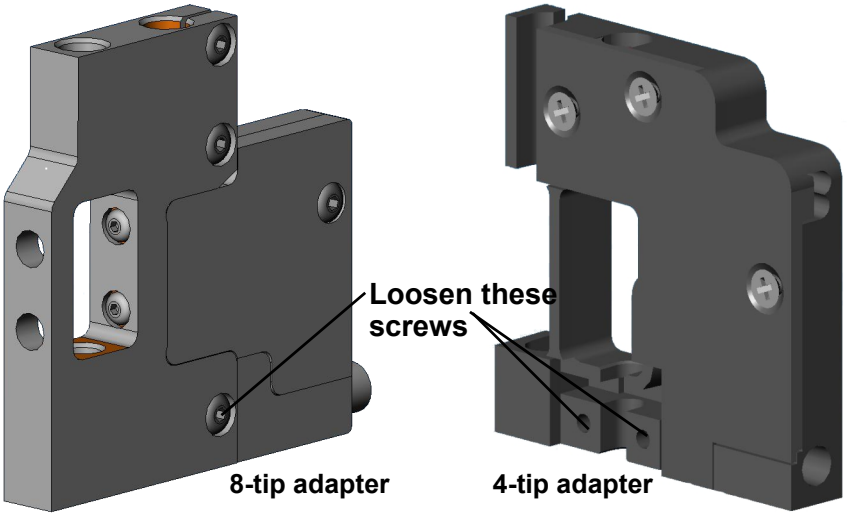


Figure B-6. Tip Holder Cover Screws

8. Connect the tubing to the new tip adapter.
9. Securely seat the notch in the tip adapter into the holder.
10. Replace the tip holder cover. Make sure the cover is oriented properly and then tighten the screws.

11. Reinstall the tip stripper sleeve. Tighten the screw for 8-Tip arms.
12. After the adapter is securely mounted, align it with the corresponding calibration cone in the fixture. Gently rotate the tip adapter to align the tip.
13. Click **OK** on the **Change Adapter in Progress** window to continue.
14. Repeat Steps 5 through 13 for each of the tip adapters on the system. If you do not want to change a tip adapter for a tip, click **Continue** on the **Next Adapter** window and **OK** on the **Change Adapter in Progress** window.
15. When all tips have been changed or skipped, the arm moves to the wash bowl position to flush and wash the adapters and the software displays the **Change Machine Setup** window.
16. Take note of the message to update the adapter type for the machine and click **OK** on the **Change Machine Setup** window to complete the procedure.

Change Syringe

Use the **Change Syringe** diagnostic test to change Varispan syringes. The procedure moves each syringe plunger to its lowest position so that you can remove and install syringes as needed.

To run the Change Syringes diagnostic test:

1. Select **Utilities > Diagnostic Tests > Change Syringe** to open the **ChangeSyringe.MPT** introductory window.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

2. If the default test setup is acceptable, position the wash bowl at the indicated location on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the labware position, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button on the toolbar.

   The utility moves the syringe plungers to their lowest positions and opens the **Reset Pump** window.
3. Remove the thumbscrew securing the base of the plunger and gently rotate the syringe barrel counter-clockwise while exerting a slight downward pressure until the tip of the syringe is free from the Luer lock connector.
4. Insert the tip of the new syringe into the Luer lock connector. Turn the syringe barrel clockwise while exerting a slight upward pressure, taking care not to exert any sideways force. This helps prevent stripping the threads on the valve and reduces wear on the syringe seal. Do not over-tighten this connection or you could damage the valve, Luer lock connector, or syringe.

5. Replace the thumbscrew securing the plunger.
6. Repeat Steps 3 and 4 for the remainder of the syringes you want to replace.
7. Click the **OK** button on the **Reset Pump** window to complete the procedure. The system moves the syringe pumps to the home positions.
8. Take note of the final message to update the syringe volume for the machine and click the **OK** button on the **Change Machine Setup** window to complete the procedure.

Daily Cleaning

Use the **Daily Cleaning** diagnostic test to clean the Varispan fluid path. This test cleans the liquid path between the syringe and the tip adapter by aspirating and soaking in a 0.5% Lysol IC solution, 70% ethanol, 1% bleach solution, or similar disinfectant.

Caution: If you clean the system with bleach, perform a subsequent rinse with distilled water as described in *Flush the Varispan Pipetting Arm on page 399**.*

Since the procedure takes eight hours to complete, PerkinElmer recommends that you run the Daily Cleaning test as an end-of-day procedure. The test can be shortened to 30 minutes if desired. This ensures the system is sanitized and primed with system liquid at the start of the next operating day.

To run the Daily Cleaning diagnostic test:

1. Prepare the required amount (≥ 20 mL for a 4-tip system or ≥ 40 mL for a 8-tip system) of cleaning solution. PerkinElmer recommends a 1:200 dilution of Lysol IC, 70% ethanol, 1% bleach solution, or similar disinfectant, as the cleaning solution.
2. Place a washbowl with one trough on the deck. Fill the trough with the cleaning solution.
3. Select **Utilities > Diagnostic Tests > Daily Cleaning** (choose either Standard or Shortened VersaTips) to open the **DailyCleaning.MPT** introductory window.

Note: Make sure the physical labware matches the defined test labware, including deck locations.

4. If the default test setup is acceptable, click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.

The test includes the following sequential steps:

- Preliminary flush/wash
  The system performs a standard flush/wash to rinse the tips and tubing with system liquid.
- Pre-cleaning aspirate
  The system moves to the trough of the wash station and aspirates 2000 µL of cleaning solution into each tip and tube.
- Pre-cleaning dispense
  The system moves to the drain of the wash station and dispenses the 2000 µL of cleaning solution from each tip as waste.
- Pre-cleaning flush/wash
  The system performs another flush/wash with system liquid to rinse the tubing and tips.
- Cleaning aspiration
  The system moves to the trough of the wash station and aspirates 2000 µL of cleaning solution into each tip and tube. Once aspirated, the system holds the cleaning liquid in the tips and tubing for eight hours to soak the liquid path. This time can be shortened to 30 minutes if desired.
- Cleaning dispense
  The system moves to the drain of the wash station and dispenses the 2000 µL of cleaning solution from each tip as waste.
- Post-cleaning flush/wash
  The system performs a final flush/wash with system liquid to rinse the cleaning solution out of the tips and tubing.

Flush and Wash Tips

The **Flush and Wash Tips** diagnostic test flushes and washes the Varispan tip adapters with system fluid. The system moves the tips to the wash station, flushes the tips and tubing with the syringe pumps, and washes the tips and tubing with the peristaltic pump.

Use this procedure to clear various liquids out of the Varispan tips and tubing or purge air from the liquid column.

To run the Flush and Wash Tips diagnostic test:

1. Select **Utilities > Diagnostic Tests > Flush and Wash Tips** to open the **FlushSysLiq.MPT** introductory window.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

2. If the default test setup is acceptable, position the wash bowl at the indicated location on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the protocol outline or labware position, click the **Deck Layout Not OK** button, make the necessary modifications, position the wash bowl at the indicated location on the deck, and click the **Run Protocol** button.

3. When prompted, type the volumes of system liquid to use for the flush and wash cycles and click **Start**. The maximum volume for either field is 10,000 µL.

Liquid Sense Test

Use the **Liquid Sense** diagnostic test to check the operation of the Varispan liquid sensing circuitry. Problems with the liquid level sensing functionality can greatly reduce the accuracy and precision of the instrument.

To run the Liquid Sense diagnostic test:

1. Select **Utilities > Diagnostic Tests > Liquid Sense Test** (choose either Standard or Shortened VersaTips) to open the **LiqSenseTest.MPT** introductory window.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

2. If the default test setup is acceptable, position the test tube cassette and wash bowl at the indicated locations on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the protocol outline or labware positions, click the **Deck Layout Not OK** button, make the necessary modifications, position the test tube cassette and wash bowl at the indicated locations on the deck, and click the **Run Protocol** button.

3. Click **Next** on the **Liq Sense Test Entries** window.

4. When prompted, type the numbers of the sample positions to test (maximum of 16) and the number of times to test each position and click **Start**. Be sure to fill the test tube cassette with tubes containing liquid for the number of sample positions that you enter. The sample positions follow the standard well map for the labware.

   The system positions the tips over the tubes in the cassette and moves each tip down into the tube until it detects liquid. This process repeats the number of times specified in the **Liq Sense Test Entries** window. When the test completes, WinPREP generates and displays a report of the test results (shown in Figure B-7) You can examine the results in the report window and print the report, if desired.

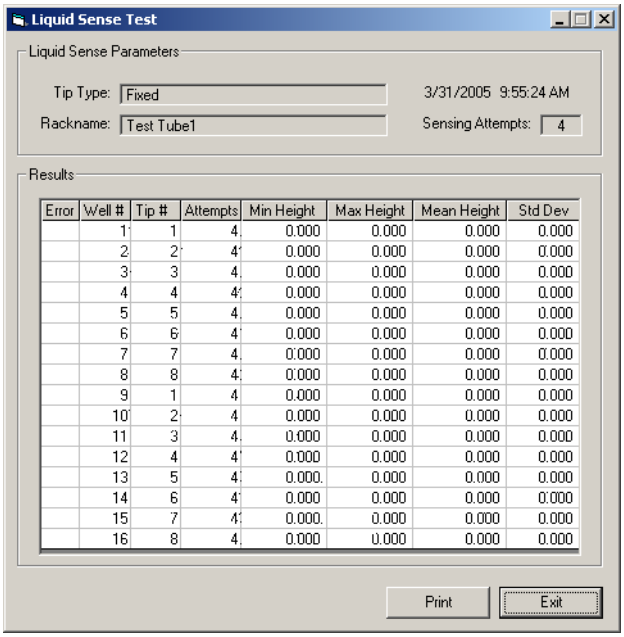


Figure B-7. Liquid Sense Test Report window

5. Click **Exit** to close the window and complete the procedure. The arm moves to the wash bowl and flushes and washes the tips to remove any test liquid picked up during the test.

Pickup Tips Test

Use the **Pickup Tips** diagnostic test to check the operation of the Varispan arm's disposable tip handling functions. The test determines the instrument's ability to pickup and release disposable tips by repeating a series of pickup/release operations.

To run the Pickup Tips diagnostic test:

1. Select **Utilities > Diagnostic Tests > Pickup Tips Test** to open the **PickupTipTest.MPT** introductory window.

☞ *Note:* *Make sure the physical labware matches the defined test labware, including deck locations. If you are using disposable tips that are different from the disposable tips identified in the test, modify the test setup to match the tip type.*

2. If the default test setup is acceptable, position the disposable tip rack and wash bowl at the indicated locations on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the protocol outline or labware positions, click the **Deck Layout Not OK** button, make the necessary modifications, position the disposable tip rack and wash bowl at the indicated locations on the deck, and click the **Run Protocol** button.

3. Click **Next** on the **Tip Test Entries** window.

4. When prompted, type the number of tips to pick up during the test and click **Start**. Be sure to refill the tip box completely before proceeding.

   The system positions the tip adapters over the tip rack, moves the tip adapters down, picks up disposable tips, and retracts the tip adapters. The system then moves the tip adapters down and ejects the disposable tips to their original locations. When the test completes, WinPREP generates and displays a report of the test results (shown in Figure B-8) You can examine the results in the report window and print the report, if desired.

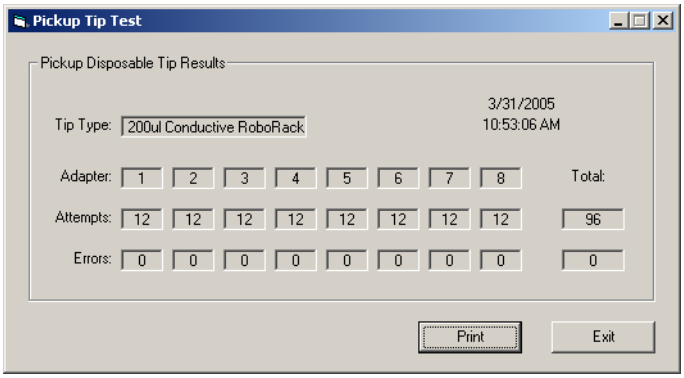


Figure B-8. Pickup Tips Test Results window

5. Click **Exit** to close the window and complete the procedure. The arm moves to the wash bowl to complete the test.

Random Move Test

Use the **Random Move** diagnostic test to check the movement of the Varispan pipetting arm over the deck. The procedure tests movements in the X, Y, and Z directions and reports any errors identified during the movement of the arm.

To run the Random Move diagnostic test:

1. Remove all labware (racks, tubes, plates, etc.) from the deck and the deck extension. If present, remove the right angle bracket, the DPC shaker, and the IKA shaker.
2. Select **Utilities > Diagnostic Tests > Random Move Test** to open the **Random XY Test.MPT** introductory window.
3. If the default test setup is acceptable, click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.

Caution: Do not add labware to the deck layout in the test. Items left on the deck during the random move test can damage the pipetting arm.

4. When prompted, type the number of movements that you want the arm to make during the test and click **Start**. This is the number of horizontal positions randomly accessed during the test. At each position, the tips move down to the deck and then return to the higher travel position. The default value of 100 is usually sufficient.
5. Remove any remaining labware from the deck and click **OK** to start the test. The arm moves around the deck randomly and a status window opens to show the progress of the test. The status window shows the number of random movements completed and the errors encountered for each motor.
6. Click **OK** at the end of the test to close the status window.

Note: If you receive any errors during the execution of this test, contact PerkinElmer Customer Care (see page 2) for maintenance.

Syringe Test

Use the **Syringe** diagnostic test to check the operation, accuracy, and precision of the Varispan syringe pumps. The procedure tests the syringe pumps by dispensing a specific volume of liquid into several test tubes and calculating the actual volume dispensed, by weight. While you can calculate the dispense accuracy and precision based on a single test tube, PerkinElmer recommends a series of ten tubes in order produce a statistically significant value.

☞ *Note: Wear gloves throughout this procedure as oils and other contaminants from your fingers adds weight to the tubes.*

To run the Syringe diagnostic test:

1. Select **Utilities > Diagnostic Tests > Syringe Test** to open the **SyringeTest.MPT** introductory window.

☞ *Note: Make sure the physical labware matches the defined test labware, including deck locations.*

2. If the default test setup is acceptable, position the test tube cassette and wash bowl at the indicated locations on the deck and click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.

3. Type the volume of liquid to dispense during the test, the number of the syringe pump to test (tip adapter number), and the number of tubes in which to dispense.
4. Click **Start** to continue. WinPREP displays the **Syringe Test** window.
5. Record the weights for ten empty test tubes. Place these tubes into the first ten positions of the cassette in the order in which you weighed them.
6. Type the weights (in milligrams) of the *empty* tubes into the **Empty (mg)** fields of the **Syringe Test** window. After entering the ten weights, click the **Start Pipetting** button to close the **Syringe Test** window and begin dispensing liquid.

   The system performs preliminary flush/wash and aspirate/dispense cycles before dispensing the defined volume into the ten empty tubes. After dispensing into the final tube, the pipetting arm moves to the wash bowl and the **Syringe Test** window opens.
7. Reweigh the ten test tubes, in order, including the dispensed liquid, and record the values. Type the values into the **Full (mg)** fields of the **Syringe Test** window.

8. Click the **Calculate** button to display the net weights and actual volumes dispensed and a statistical analysis of the values as shown in Figure B-9. You can examine the data and print the results, if desired.

☞ *Note: The volume calculation assumes a liquid with a specific gravity of 1.00, such as degassed, distilled water. You can use other liquids in the syringe test, but you must manually correct for differences in specific gravity.*

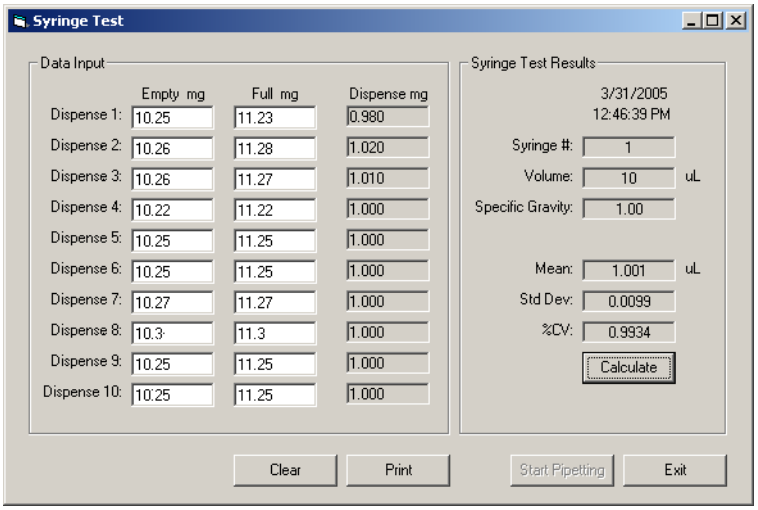


Figure B-9. Syringe Test window with results

9. Repeat the previous steps for each of the syringes you want to test.
10. Click **Exit** to close the window and complete the test.

Random XY Tests

Random XY Tests are available for the arms installed on the system. Choose the tests for the desired arms. Remove all labware from the decks before running random moves tests.

Reteach Barcode Read Position

Use the Reteach Barcode Read Position diagnostic test to check the position of the Gripper arm in front of the Plate ID barcode reader. The procedure tests the position by gripping a microplate on the deck, moving the Gripper arm to the taught location, and attempting to read the barcode on the plate.

To run the Reteach Barcode Read Position diagnostic test:

1. Remove all labware (cassettes, tubes, plates, etc.) from the deck.

2. Select **Utilities > Diagnostic Tests > Reteach Barcode Read Position** to open the **SecondaryBarcodeReteachBarcodeReaderPosition.MPT** introductory window.
3. If the deck layout shows one plate on the deck and it is positioned correctly, click the **Deck Layout OK** button.

   OR

   If you need to modify the deck layout, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button. If the plate is not shown on the deck, move the plate from the Temporary Labware Storage location at the top of the deck layout to the desired deck position.

Caution: Do not add any other labware to the deck layout. Items on the deck other than those specifically requested during the protocol can damage the Gripper arm.

4. Place the specified labware at the location indicated in the Deck View on the **Place** tab.
5. On the **Run** tab, click the **Start** button.
6. Verify the labware locations on the deck and then click the **OK** button at the bottom of the Status panel.
7. The Verify Labware Setup Message displays. Verify the location of the barcode label and click the **OK** button. The Gripper arm picks up the plate from the deck location and moves to the position in front of the Plate ID reader.
8. At the next prompt, open the Teach Position window (**Utilities > Setup > Gripper > Teach > Labware Position**) and select the Off-Deck position named Barcode-Reader1.

   When the Teach Position window opens, a smaller Test Barcode Reader window opens to monitor the reading parameters.
9. Use the arrow buttons in the Teach Position window to move the plate forward and back to maximize the **Decode Rate**. The Decode Rate value should be at least 500 reads per second.
10. Verify that the **Barcode Data** value correctly represents the data on the barcode label.
11. Update and save the final position, as prompted.
12. Manually close the Teach Positions window and the Test Barcode Reader window.
13. Run the rest of the protocol to return the plate to the deck.

Barcode XY Test

Use the Barcode XY diagnostic test to check the movement of the barcode arm over the barcode cassette area of the deck. The procedure tests the movement of the barcode arm in the X and Y directions and reports any errors identified during the movement of the arm.

To run the Barcode XY diagnostic test:

1. Remove all barcode cassettes and labware (racks, tubes, plates, etc.) from the deck.
2. Select **Utilities > Diagnostic Tests > Barcode XY Test** to open the **BarcodeXYTest.MPT** introductory window.
3. If the default test setup is acceptable, click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.

Caution: Do not add any other labware to the deck layout. Items on the deck during the Barcode XY test can interfere with the movement of the barcode arm

4. Specify the number of movements that you want to make during the test. This is the number of randomly determined positions that will be accessed during the test.
5. You are reminded to remove ALL of the barcode cassettes from the deck. If you have not already done this, DO IT NOW. The barcode arm will move randomly around the deck, and any cassettes on the deck will interfere with the arm movement.
6. Click the OK button. The barcode arm moves randomly around the barcode cassette area of the deck to access the number of positions specified at the beginning of the test.
7. At the end of the test, the window displays the number of motions for each motor and the number of errors encountered.
8. If any errors occur during the test, reteach the barcode arm or contact PerkinElmer Customer Care (see page 2).

Barcode Scan Test

Use the Barcode Scan diagnostic test to verify the scanning of barcode labeled test tubes on the deck. The procedure tests the barcode label scanning by scanning the barcode labels multiple times and then displaying the resulting barcode values in Microsoft Excel.

To run the Barcode Scan diagnostic test:

1. Load the barcode cassettes to be tested with barcode labeled test tubes. Load the cassettes from left to right.
2. Select **Utilities > Diagnostic Tests > Barcode Scan Test** to open the **BarcodeScanTest.MPT** introductory window.
3. If the default test setup is acceptable, click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.
4. Specify the number of cassettes to scan and the number of times to scan the cassettes for comparison.
5. Click the **OK** button. The cassettes are scanned starting with Lane 1 and continuing for the number of lanes specified at the beginning of the test. The scanned barcode from each tube is written to a file.
6. The cassettes are rescanned as many times as specified at the start of the protocol for the number of repeats. Each time a tube is scanned, the new barcode is added to the file for later comparison.
7. When all scanning is complete, Microsoft Excel opens and displays the saved file. The barcodes from each repeat scan display in a new column. Sort the rows as necessary to verify that the barcodes for a single barcode labeled tube is always the same.
8. If you receive any errors during the execution of this test, reteach the barcode arm or contact PerkinElmer Customer Care (see page 2).

Random XY Gripper Test

Use the Random XY Gripper diagnostic test to check the movement of the Gripper arm over the deck. The procedure tests the movement of the gripper arm in the X and Y directions, and reports any errors identified during the movement of the gripper arm.

To run the Random XY Gripper diagnostic test:

1. Remove all labware (racks, tubes, plates, etc.) from the deck.
2. Select **Utilities > Diagnostic Tests > Random XY Gripper Test** to open the **RandomXYGripperTest.MPT** introductory window.

3. If the default test setup is acceptable, click the **Deck Layout OK** button.

   OR

   If you need to modify the test, click the **Deck Layout Not OK** button, make the necessary modifications, and click the **Run Protocol** button.

Caution: Do not add labware to the deck layout in the test. Items on the deck during the gripper arm random move test can damage the Gripper arm.

4. Type the number of movements that you want the arm to make during the test and click **Next**. The **Initial User Query: Gripper Motor Velocities and Accelerations** window opens as shown in Figure B-10.

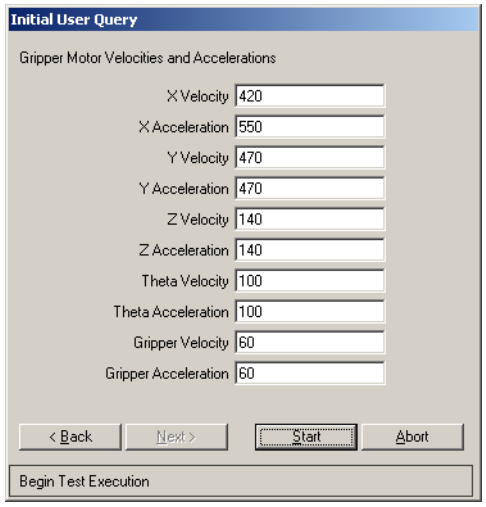


Figure B-10. Gripper Arm Motor Velocities and Accelerations setup

5. Change the values for the velocities and accelerations, if desired. In most cases, the default values are sufficient. All velocities are measured in millimeters per second (mm/s) while accelerations are measured in millimeters per second per second (mm/s²), except those describing Theta movements. Theta velocity and acceleration are measured in degrees per second (deg/s) and degrees per second per second (deg/s²), respectively.
6. Remove any remaining labware from the deck and click **Start**. The gripper arm moves around the deck randomly and a status window opens to show the progress of the test. The status window shows the number of random movements completed and the errors encountered for each motor.
7. Click **OK**, at the end of the test, to close the status window and complete the procedure.

Note: If you receive any errors during the execution of this test, contact PerkinElmer Customer Care (see page 2).

Removal of Equipment from Use for Repair or Disposal

1. Prepare the instrument for removal from use, transportation, or disposal by cleaning the Work Surface, Tiles, and Racks as described on page 399.
2. Empty any waste bottles, the system liquid container, and the system liquid tubing.
3. Conform to all local, state/provincial, or national environmental and health regulations when disposing of waste.

WEEE Do not dispose of the JANUS G3 as unsorted municipal waste. See the PerkinElmer website (www.perkinelmer.com) for more information.

Appendix C

Troubleshooting

This chapter describes some general troubleshooting techniques that you can perform if you are having trouble with the JANUS G3 system.

- Liquid Handling Problems
- Troubleshooting Drops on the Sampling Tip
- Troubleshooting Liquid Level Sense Problems

Liquid Handling Problems

If you experience problems with air in the tubing or leaking syringes, check for the following problems:

- Check the fitting connections at valves and syringes. These connections only need to be finger tight. Over-tightening the fittings can result in decreased valve life.
- Check the syringe for scored glass. Replace if glass barrel is scratched or scored.
- Check the plunger cap and replace if it is no longer providing a good seal.
- Check the valves for moisture. Valves need to be replaced if there is any evidence of leaking.

Troubleshooting Drops on the Sampling Tip

If you experience problems with droplets forming on the ends of the tips, check for the following problems:

- Prime the system to ensure that there is no air in the lines.
- Check the fitting connections at valves and syringes. These connections only need to be finger tight. Over-tightening the fittings can result in decreased valve life.
- As a last resort, you can have the valves replaced.

Troubleshooting Liquid Level Sense Problems

If you experience Liquid level Sense problems, try using these troubleshooting procedures to isolate the problem.

- Reset and Initialize the instrument.
- Make sure that the Liquid Level Sense cables are not crossing each other's paths while the tips are in motion.
- If Liquid Level Sense errors follow tip and/or tip holder, swap the tip or tip holder to see if the problem follows the tip or the holder. If the problem follows the tip, replace the tip. If the problem follows the holder, replace the tip holder.
- Check that Liquid Level Sense cables are securely connected to the tip holders.
- Disconnect the Liquid Level Sense cables from the tip holders and check the cables for damage. If the connector body rotates with respect to the cable jacket, the cables are defective. The cable assembly will need to be replaced.
- If Liquid Level Sense error is occurring in a particular labware, check the labware definition. Z-start should be as low as possible without being in liquid.
- Check for drops at the end of the tips. Drops will cause liquid level sense problems. Drops may be caused by leaks in the liquid path, including a faulty syringe or a faulty valve.
- If the Liquid Level Sense problems are associated with sampling from labware that is physically located on an external device, make sure there is a good electrical path from the labware holder to the JANUS G3 deck (e.g. a continuous ground). If the sample volumes are small and the sample labware does not have a good ground mass directly beneath it, Liquid Level Sense may not sense the liquid.
- External devices may be interfering with the Liquid Level Sense signal. Mechanical vibrations can cause the tubing to strike against one another or the tip holders to contact one another. Harmonics can cause large physical displacements with very little energy being put into the system.
- If the external devices are connected to the same power source as the JANUS G3, electrical noise may be causing Liquid Level Sense errors. Try connecting external devices to a separate power source.
- If the problem persists, contact PerkinElmer Customer Care (see page 2).

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% CV 50

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