

GX-281 Liquid Handler User's Guide

GX-281 Liquid Handler User's Guide

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Safety

Read this section before installing and operating the GX-281 Liquid Handler.

The GX-281 Liquid Handler is intended to be used in a laboratory environment by trained technical personnel.

For safe and correct use of this instrument, it is recommended that both operating and service personnel follow the instructions contained in this guide when installing, cleaning, and maintaining the instrument.

The following safety precautions must be observed during all phases of operation, service, and repair of the instrument. Failure to comply with these precautions or with specific warnings elsewhere in this user's guide violates safety standards of design, manufacture, and intended use of the instrument. Gilson assumes no liability for the customer's failure to comply with these requirements.

The liquid handler has been certified to UL, CSA, and CE Safety standards.

Safety

The following electronic and hazard symbols may appear on the instrument:

Symbol	Explanation
~	Alternating current Courant alternatif Wechselstrom
	Direct current Courant continu Gleichstrom
	Protective conductor terminal Borne de terre de protection Schutzleiteranschluss
	Electrical power ON Sous tension Netzschalter ein
o	Electrical power OFF Hors tension Netzschalter aus
	Caution Attention Vorsicht
	Caution, risk of electric shock Attention, risque de choc électrique Vorsicht, Elektroschockgefahr
	Caution, hot surface Attention, surface chaude Vorsicht, heiße Oberfläche
	Fuse Fusible Sicherung

Safety

The following safety notices may appear in this document:

 WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, may result in serious injury
 CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury
NOTICE	NOTICE indicates a potentially hazardous situation which, if not avoided, may result in equipment damage

Voltage

Access to the rear panel is necessary. The instrument must be detached from all voltage sources before service, repair, or exchange of parts.

For normal operation, the instrument is to be grounded through the AC line cord provided. Failure to do so can result in a potential shock hazard that could result in serious personal injury.

Use only fuses with the rated current and of the specified type (fast acting, normal blow, time delay) as listed on the rear panel of the instrument.

The instrument must only be operated with the voltage specified on the rear panel label of the instrument using a grounded AC line cord.

Probes

While operating the liquid handler, keep hands clear of probe to avoid risk of personal injury by piercing.

Because the probe installed on the Z-arm may contain a dangerous substance, do not interfere in the work area of the instrument until the liquid handler has completed its procedures.

Solvents

Observe safe laboratory practices when handling solvents. If dangerous liquids are used, adequate protection such as proper ventilation, safety glasses, etc., should be used.

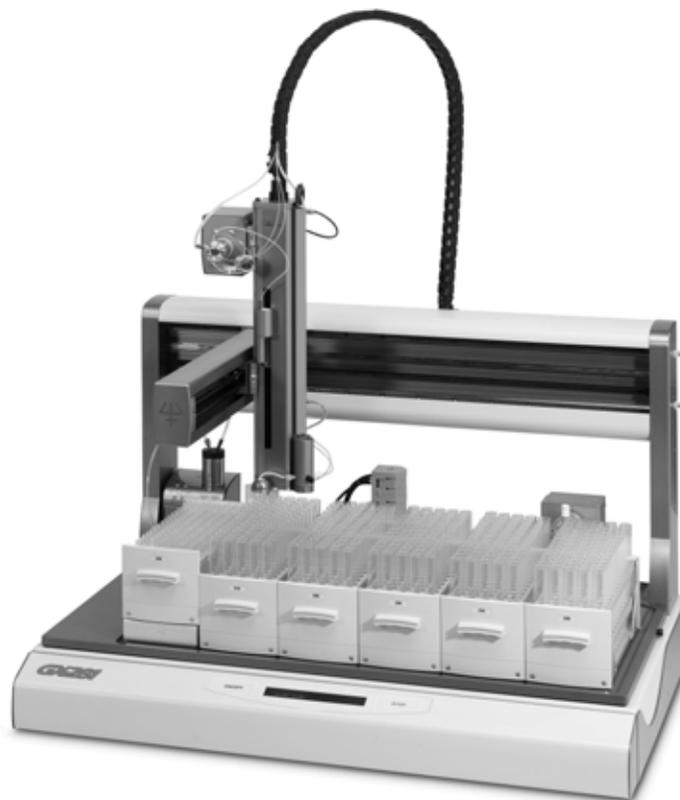
Refer to the Material Safety Data Sheets for the solvents before use.

Replacement Parts

Be sure to use only replacement parts mentioned in **Chapter 4, Maintenance** and **Appendix A, Replacement Parts and Accessories**. Do not repair or change parts which are not listed in this user's guide. If it is necessary to change parts not listed, please contact your Gilson-authorized representative.

This chapter provides information on the following topics:

- **Description**
- **Unpacking**
- **Customer Service**
- **Technical Specifications**



GX-281 Liquid Handler

Description

The **GX-281 Liquid Handler** is an X/Y/Z instrument that can automate liquid handling procedures. The locator plate can be configured with several different accessories and racks. The GX-281 Liquid Handler can be configured with a solvent system, two different types of injection modules, a fraction collection valve, and a rinse pump.

The **GX Solvent System**, included with the GX-281 Liquid Handler, is a bi-directional pump that can switch from aspirate to dispense mode. The GX Analytical Solvent System can handle flow rates up to 5 mL/min. The GX Prep Solvent System can handle flow rates up to 50 mL/min. The solvent selection valve on the GX Solvent System can accommodate up to five different reservoir solvents.

Optional Accessories

The **GX Z Injection Module** is mounted on the Z-arm of the liquid handler. The probe is plumbed directly to the GX Z Injection Module, eliminating the need for an injection port.

The **GX Direct Injection Module** is mounted on the locator plate of the GX-281 Liquid Handler. The GX Direct Injection Module has an option of four different valves (for 1/8" OD sample loops or 1/16" OD sample loops). The valves available for the GX Direct Injection Module feature a vertical direct connection for the injection port. Up to two GX Direct Injection Modules can be placed on the locator plate of the GX-281 Liquid Handler.

The **Fraction Collection Valve** is a three-way valve mounted low on the Z-arm. This design allows for reduced dead volume and collection of larger volumes.

Unpacking

The GX-281 Liquid Handler is delivered with all major components already assembled except for auxiliary parts such as the Z-arm, probe, racks, tubing, etc. Keep the original container and packing assembly in case the liquid handler must be returned to the factory.

To unpack the GX-281 Liquid Handler:

- 1 Cut the metal strapping holding the cardboard boxes together.
- 2 Lift the top box off and away from the liquid handler.
- 3 Remove the accessory boxes from the locator plate of the liquid handler.
- 4 Lift the unit off its base platform and place it on a lab bench or cart.

CAUTION It is recommended that at least two people lift the liquid handler off the base of the packing container as it weighs over 68 kg (150 lbs).

NOTICE **Do not** attempt to lift the instrument from the Y-arm (the horizontal arm). Always lift the instrument from its base.

To lift the liquid handler:

- a) Grip the liquid handler under the base plate.
- b) Lift the unit up and out of the foam packing material.

Standard Equipment

After the liquid handler and accessories have been unpacked, you should have these items:

- One of the following liquid handlers:

Part Number	Description
261030	GX-281 Liquid Handler with GX Prep Solvent System
261031	GX-281 Liquid Handler with GX Prep Solvent System and bar code reader
261032	GX-281 Liquid Handler with GX Analytical Solvent System
261033	GX-281 Liquid Handler with GX Analytical Solvent System and bar code reader

- Z-arm
- Z-arm cable assembly
- GX Analytical Solvent System or GX Prep Solvent System which include valve to pump tubing, solvent inlet tubing, waste tubing and fittings, dowel pins, and power cable
- GX-281 shield kit
- Accessory package which includes Z height adjustment tools (125, 175, and 210 mm), lower probe holder cover, GSIOC cable, RS-232 cable, two 3/16" shoulder bolts, 5/32" tee handled Allen wrench, 3/32" Allen wrench, socket drive, waste tubing and fittings, cable clips and attachment screws, spline wrench for headless nuts, fuses, and fuse drawers
- power cords
- GX-281 Offset Utility Kit

Documentation

The following documents are included with the GX-281 Liquid Handler:

- GX-281 Liquid Handler Documentation CD
- Installation Qualification/Operational Qualification Procedures
- Unpacking the GX-281 Liquid Handler
- Declaration of Conformity

Accessories

Based upon your configuration, you also ordered and received additional accessories, such as the probe, transfer tubing, sample loops, racks, etc. If necessary, refer to [Appendix A, Replacement Parts and Accessories](#) for part numbers.

Guide Foot Assembly

<i>Part number</i>	<i>Description</i>
26036197	Guide foot assembly for 1.3 mm probes
26036198	Guide foot assembly for 1.5 mm probes
26036199	Guide foot assembly for 1.8 mm probes
26036200	Guide foot assembly for 2.3 mm probes
26036201	Guide foot assembly for 2.7 mm probes

Optional Accessories

GX Direct Injection Module

<i>Part number</i>	<i>Description</i>
261354	GX Direct Injection Module, 1/16" Prep
261355	GX Direct Injection Module, 1/8" Prep
261356	GX Direct Injection Module, 1/16" Analytical, Stainless Steel
261357	GX Direct Injection Module, 1/16" Analytical, PEEK
26035470	Plumbing Package, Direct Inject 1/16" and 1/8"

GX Z Injection Module

<i>Part number</i>	<i>Description</i>
261353	GX Z Injection Module
26035370	Plumbing Package, Z Inject

GX Rinse Pump

<i>Part number</i>	<i>Description</i>
261352	GX Rinse Pump

Fraction Collection Valve

<i>Part number</i>	<i>Description</i>
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2604705	GX-Series Low Mount Fraction Collection Package
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Customer Service

Gilson, Inc. and its worldwide network of authorized representatives provide customers with the following types of assistance: sales, technical support, applications, and instrument repair.

If you need assistance, please contact your Gilson-authorized representative. Specific contact information can be found at www.gilson.com. To help us serve you quickly and efficiently, please refer to **Before Calling Us** on page 5-9.

Technical Specifications

Please be aware of the following before operating the liquid handler.

NOTICE

Changes or modifications to the liquid handler not expressly approved by Gilson could void the warranty.

This instrument complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this instrument may not cause harmful interference, and (2) this instrument must accept any interference received, including interference that may cause undesired operation.

Shielded cables must be used with the liquid handler to ensure compliance with the FCC Class A limits.

GX-281 Liquid Handler	
<i>Technical Specification</i>	<i>Definition</i>
Arm Speed	0.01 to 600.00 mm/sec in X dimension 0.01 to 600.00 mm/sec in Y dimension 0.01 to 125.00 mm/sec in Z dimension
Contact Control	Four inputs (contact closure, TTL), four relay outputs, four switched +24V DC 1A outputs, one safety input, and one analog input Note: For your safety, do not switch voltages higher than 30V even though the output contacts are rated for high voltage.
Data Acquisition	An input channel for analog-to-digital conversion Input impedance: More than 100K ohms Input voltage range: -1.0V to +1.0V Input resolution: 10µV
Dimensions (W x D x H)	88.9 x 76.2 x 96.5 cm (35 x 30 x 38 in)
Display	Two lines of 40 alphanumeric characters; vacuum fluorescent display
Environmental Conditions	Indoor use Altitude: up to 2000 m Temperature range: 5°–40°C Air pressure: 75–105 kPa Humidity: Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C
Front Panel	ON/OFF and STOP soft keys and LED indicator light for power
Fuse	5 x 20 mm "T" type 5.0A One for 100–120V; two for 220–240V

continued (1 of 2)

GX-281 Liquid Handler (Continued)		
<i>Technical Specification</i>	<i>Definition</i>	
Horizontal Motion Strength	X: 1.4 kg (3 lbs) Y: 0.7 kg (1.5 lbs) Z: 5.4 kg (12 lbs)	
Locator Plate Capacity	Up to six Code 200-series racks	
	Qty	Capacity
	576	13 x 100 mm tubes
	450	16 x 100 mm tubes
	420	18 x 150 mm tubes
	162	20 mL scintillation vials
		40 mL scintillation vials
	For a full list of available racks go to www.gilson.com .	
Power Requirements	Frequency: 50 to 60 Hz Voltage: 100–240V (Universal Input) Current rating: 5.0A for 100–120V or 2.5A for 220–240V Power consumption: 500W maximum	
Probe Positioning Performance	Accuracy: +/- 0.05 mm in X/Y/Z dimensions Repeatability: +/- 0.025 mm in X/Y/Z dimensions	
Probe Rinse	Probe rinsing occurs through a dedicated rinse station	
Safety Approvals/ EMC Compliance	Certified to UL, CSA, CE, and C-Tick Safety and EMC standards.	
Sampler Type	X/Y/Z with stationary rack design	
Software Control	Computer control via RS-232 or GSIOC and TRILUTION® software	
Vertical Punch Strength	4.5 kg (10.0 lbs)	
Weight	68.0 kg (150 lbs)	

continued (2 of 2)

GX Solvent System	
<i>Technical Specification</i>	<i>Definition</i>
Back Pressure	50 psi
Dimensions (W x D x H)	10.8 x 14.8 x 18.2 cm (4.25 x 5.83 x 7.15 in)
Flow Rate	<p>Analytical 500 nL/min up to 5 mL/min</p> <p>Preparative 1 μL/min up to 50 mL/min</p>
Liquid Contact Materials	Valcon H, Nitronic 60 (N60), PTFE
Power Requirements	Voltage: 24V DC Current rating: 1.5A
Pump Internal Volume	<p>Analytical 100 μL \pm 2 μL</p> <p>Preparative 625 μL \pm 12 μL</p>
Selection Valve Switching Speed	180 msec
Volumetric Accuracy	See Appendix B, Specifications Methods for details about the configuration and test procedure that Gilson used to determine the limits below. Accuracy: \pm 2% for (100 μ L–25 mL) water
Weight	2.2 kg (4.9 lbs)

GX Direct Injection Module	
<i>Technical Specification</i>	<i>Definition</i>
Available Valves	<p>Analytical</p> <p>Stainless steel direct injection valve (2-position, 6-port) 0.016" ID ports, 1/16" OD</p> <p>PEEK direct injection valve (2-position, 6-port) 0.016" ID ports, 1/16" OD</p> <p>Preparative</p> <p>Stainless steel direct injection valve (2-position, 6-port) 0.060" ID ports, 1/8" OD</p> <p>Stainless steel direct injection valve (2-position, 6-port) 0.030" ID ports, 1/16" OD</p>
Available Sample Loops	<p>Analytical</p> <p>For GX Direct Injection Module (1/16"): 2 µL, 5 µL, 10 µL, 20 µL, 50 µL, 100 µL, 250 µL, 500 µL, 1 mL, and 2 mL</p> <p>Preparative</p> <p>For GX Direct Injection Module (1/8"): 5 mL, 10 mL, 20 mL, and 25 mL</p> <p>For GX Direct Injection Module (1/16"): 250 µL, 500 µL, 1 mL, 2 mL, and 5 mL</p>
Dimensions (W x D x H)	12.1 x 8.9 x 10.1 cm (4.75 x 3.50 x 3.98 in)
Front Panel	LED indicator for LOAD and INJECT positions
Injection Carryover	<0.005%
Injection Reproducibility	<p>See Appendix B, Specifications Methods for details about the configuration and test procedure that Gilson used to determine the limits below.</p> <p><1.0% CV (total loop)</p> <p><3.5% CV (partial loop)</p>
Liquid Contact Materials	Valcon H, Nitronic 60 (N60), PTFE

continued (1 of 2)

GX Direct Injection Module (Continued)	
<i>Technical Specification</i>	<i>Definition</i>
Power Requirements	Voltage: 24V DC Current rating: 1.0A
Valve Switching Speed	Analytical 200 msec for GX Direct Injection Module (1/16") Preparative 200 msec for GX Direct Injection Module (1/16") 300 msec for GX Direct Injection Module (1/8")
Weight	1.2 kg (2.63 lbs)

continued (2 of 2)

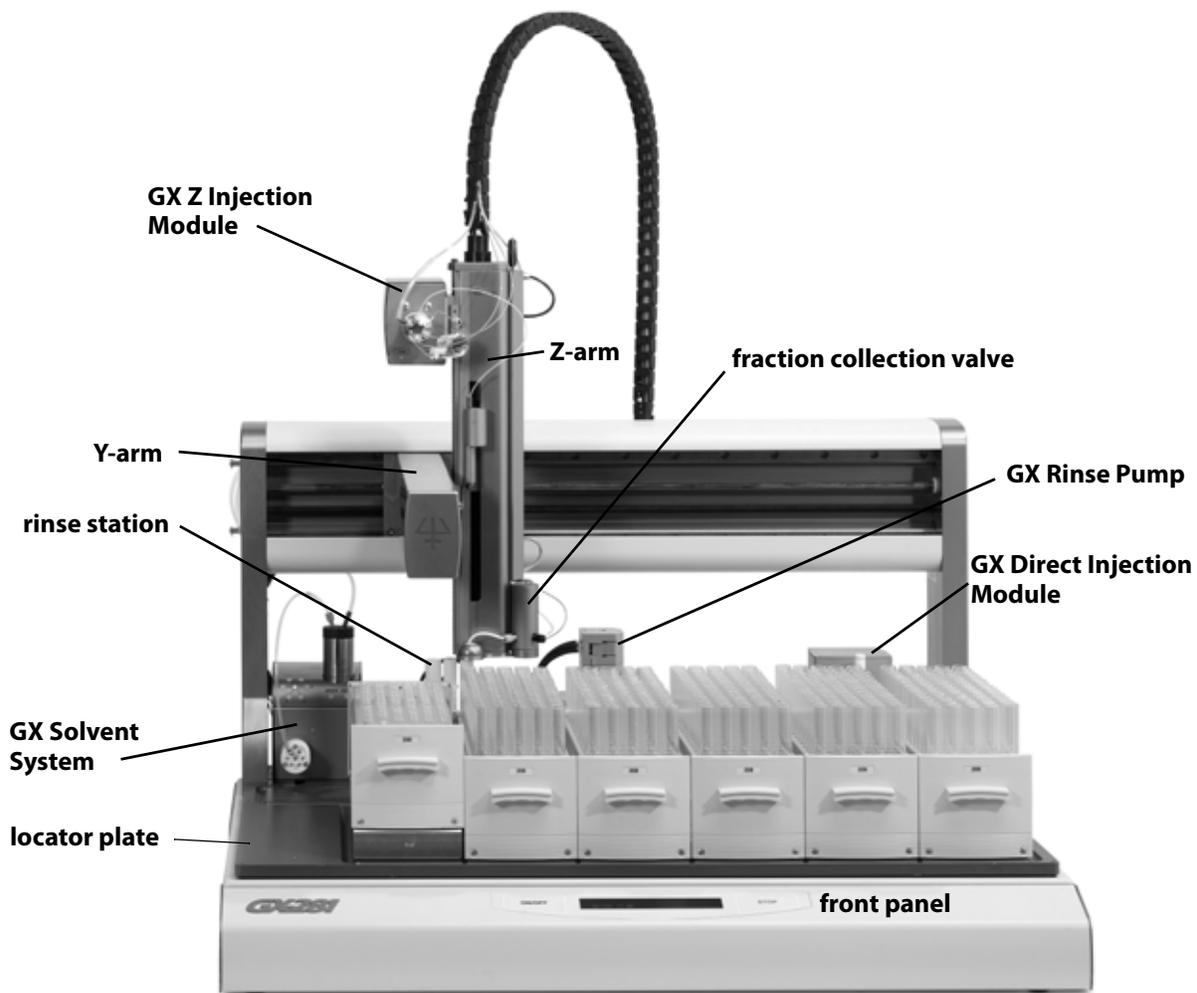
GX Z Injection Module	
<i>Technical Specification</i>	<i>Definition</i>
Available Valves	Continuous flow Valco valve for 1/16" OD sample loops
Available Sample Loops	250 μ L, 500 μ L, 1 mL, 2 mL, and 5 mL
Dimensions (W x D x H)	7.2 x 14.7 x 9.2 cm (2.82 x 5.80 x 3.63 in)
Injection Reproducibility	See Appendix B, Specifications Methods for details about the configuration and test procedure that Gilson used to determine the limits below. <2.0% CV (partial loop)
Liquid Contact Materials	Valcon H, Nitronic 60 (N60), PTFE
Power Requirements	Voltage: 24V DC Current rating: 1.0A
Valve Switching Speed	180 msec
Weight	1.1 kg (2.53 lbs)

GX Rinse Pump	
<i>Technical Specification</i>	<i>Definition</i>
Contact Control	One input (contact closure) and one switched +24V DC 1A output
Dimensions (W x D x H)	12.1 x 8.9 x 18.3 cm (4.76 x 3.5 x 7.2 in)
Power Requirements	Voltage: 24V DC Current rating: 1.0A
Rinse Speed	High speed: 200 rpm Low speed: 120 rpm
Weight	1.0 kg (2.28 lbs)

Fraction Collection Valve	
<i>Technical Specification</i>	<i>Definition</i>
3-Way Valve	Three-port, PTFE, 114 μ L internal volume, 10 μ L dead volume, up to 200 mL/min

The liquid handler and its components should be set up and installed in the following order. Complete instructions for each step are included in this chapter.

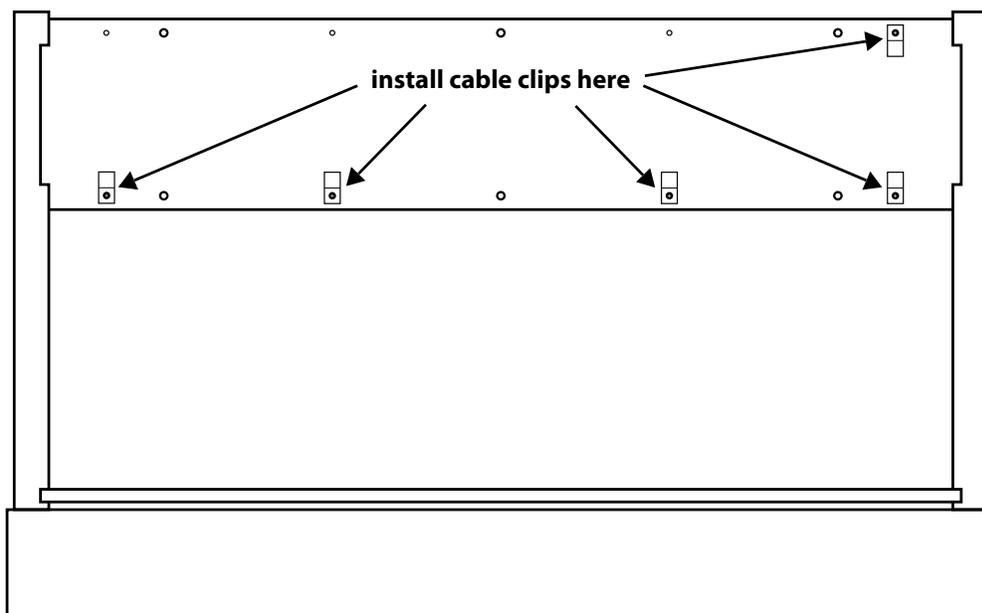
- 1 **Cable Clip Installation**
- 2 **Z-Arm Setup**
- 3 **Z-Arm Cable Assembly Setup and Installation**
- 4 **Z-Arm Installation**
- 5 **GX Z Injection Module Installation (Optional)**
- 6 **Locator Plate Setup**
- 7 **Rack Installation**
- 8 **RS-232, GSIOC, and Input/Output Connections**
- 9 **Plumbing Connections**
- 10 **Final Rear Panel Connections**
- 11 **Shield Installation**
- 12 **Final Z-Arm Height Adjustment**
- 13 **Unit ID Selection—GX-281 Liquid Handler**
- 14 **GX-281 Offset Utility**



Cable Clip Installation

The cable clips will be used to route the transfer tubing and the Z-arm cable.

- 1 Locate the five cable clips and Phillips screws that were included in the accessory package.
- 2 Attach the clips to the back of the liquid handler using a Phillips screwdriver. Refer to the diagram for location and orientation.



back of GX-281 Liquid Handler

Z-Arm Setup

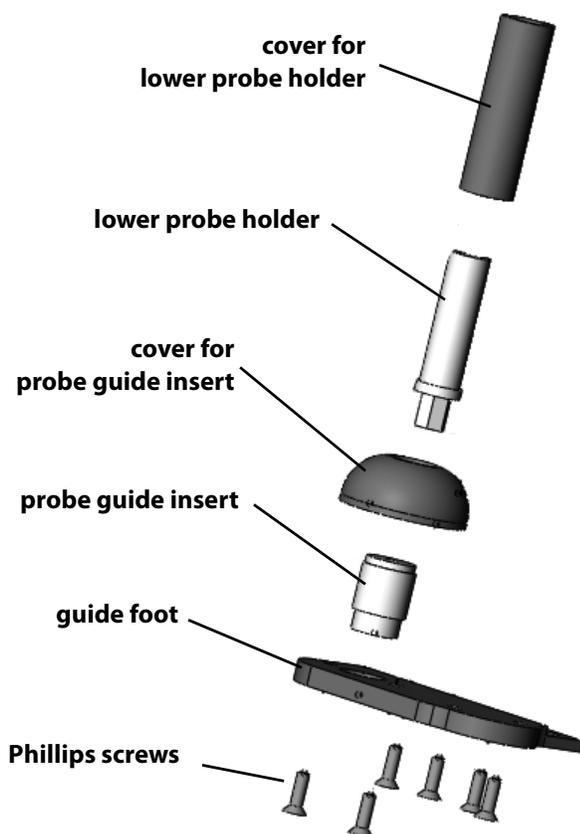
All of the components of the Z-arm must be installed before the Z-arm is attached to the instrument. Do not install the Z-arm until instructed to do so.

The Z-arm and its components should be assembled and installed in the following order:

- 1 **Guide Foot Assembly**
- 2 **Lower Probe Holder Installation**
- 3 **Guide Foot Installation**
- 4 **Fraction Collection Valve Installation (Optional)**
- 5 **Z-Arm Cable Assembly Setup and Installation**
- 6 **Z-Arm Installation**
- 7 **Z-Arm Cable Connection**
- 8 **Z Travel Height Adjustment**
- 9 **Probe Installation**
- 10 **LLD (Liquid Level Detection) Cable Installation**
- 11 **GX Z Injection Module Installation (Optional)**
- 12 **Final Z-Arm Height Adjustment**

Guide Foot Assembly

The guide foot assembly (ordered separately) includes the following parts: the guide foot, the probe guide insert and cover, the lower probe holder and cover, and six screws.



There are different sizes of guide foot assemblies available depending on the outer diameter of the probe being used. Each probe guide is marked with a number of spots. Refer to the table for part numbers.

Probe OD	Guide Foot Assembly Part Number	Probe Guide Insert Part Number	Lower Probe Holder Part Number
1.3 mm	26036197	2603614215	2603614111
1.5 mm	26036198	2603614216	2603614112
1.8 mm	26036199	2603614217	2603614113
2.3 mm	26036200	2603614218	2603614114
2.7 mm	26036201	2603614219	

Lower Probe Holder Installation

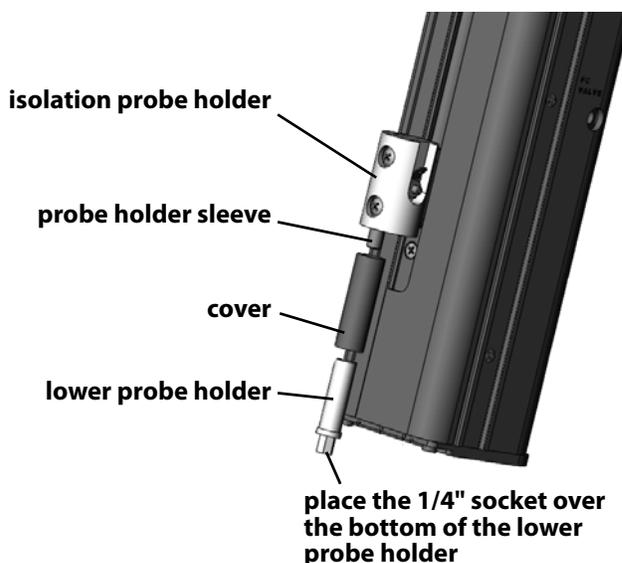
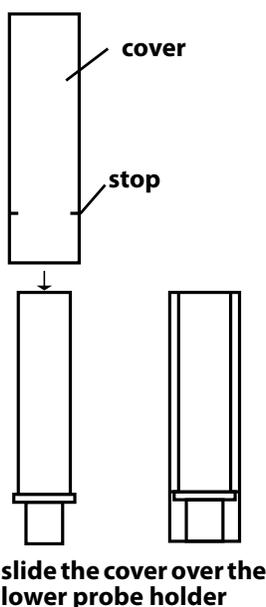
The lower probe holder is installed on the front of the Z-arm, below the isolation probe holder.

Before beginning this procedure locate the following:

- 1/4" socket (part number 4351025) included in the GX-281 accessory package
- lower probe holder cover (part number 2603614102) included in the guide foot assembly
- lower probe holder, included in the guide foot assembly

To install the lower probe holder:

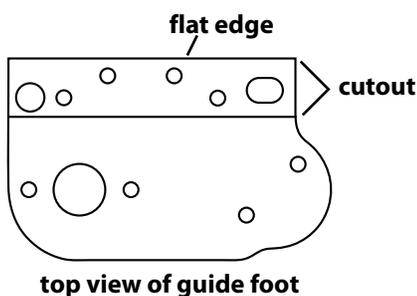
- 1 Lay the Z-arm on its back on a flat surface.
 - 2 Orient the cover so that the stop on the inside is closer to the bottom and then slide the cover over the lower probe holder.
- Note:** The lower probe holder should be flush with the cover; if it extends past the end of the cover, the cover is not oriented correctly. Refer to the diagram for the correct orientation.
- 3 Place the smaller end of the 1/4" socket over the bottom of the lower probe holder. Then place this assembly at the bottom of the probe holder sleeve.
 - 4 Rotate the 1/4" socket clockwise to tighten. Then remove the 1/4" socket.



Guide Foot Installation

To install the guide foot on the Z-arm:

- 1 Lay the Z-arm on its back on a flat surface.
- 2 Place the guide foot below the Z-arm and align the four holes on the guide foot with the holes on the bottom of the Z-arm.

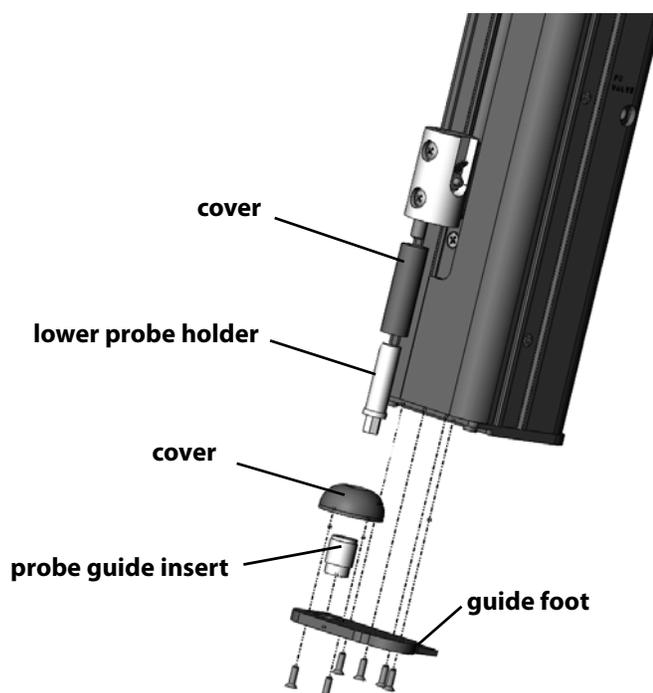


Note: Orient the guide foot with the flat edge at the back and the cutout on the top. The cutout will fit in the indent on the Z-arm.

- 3 Place four of the Phillips screws through the bottom of the guide foot into the Z-arm and tighten.

To install the probe guide insert on the guide foot:

- 1 Place the probe guide insert on top of the guide foot.
- 2 Place the cover over the probe guide insert and align the holes on the cover with the holes on the guide foot.
- 3 Place the remaining two Phillips screws through the bottom of the guide foot into the cover and tighten.

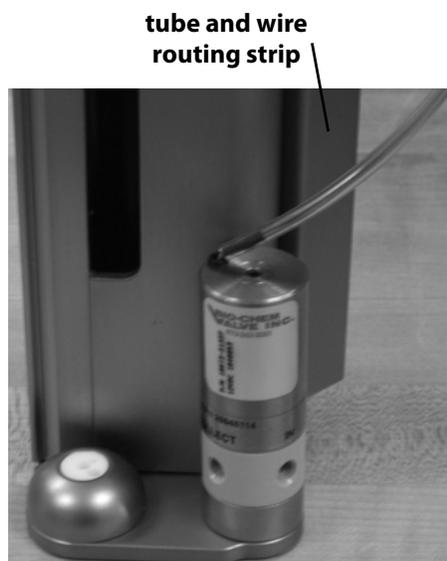


Fraction Collection Valve Installation (Optional)

The fraction collection valve is included in the GX-Series Low Mount Fraction Collection Package (ordered separately, part number 2604705).

To install the fraction collection valve on the guide foot:

- 1 Place the valve on top of the guide foot as shown in the photo. Align the two holes on the bottom of the valve with the holes on the guide foot. Attach the valve to the guide foot using the two Phillips screws included with the valve.
- 2 Connect the green cable from the valve to the FC VALVE port on the side of the Z-arm.



fraction collection valve installed on the guide foot

Tube and Wire Routing Strip Installation

The tube and wire routing strip (part number 26036143) is included with the fraction collection valve.

To install the tube and wire routing strip:

- 1 Locate the two raised rails on the right side of the Z-arm.
- 2 Attach the right side of the tube and wire routing strip to the right side of the rail on the Z-arm.
- 3 Snap the left side of the tube and wire routing strip over the left side of the rail on the Z-arm.

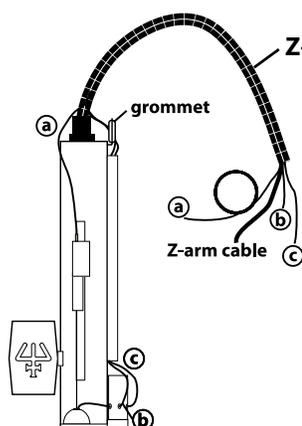
Z-Arm Cable Assembly Setup and Installation

The Z-arm cable assembly is included with the GX-281 Liquid Handler.

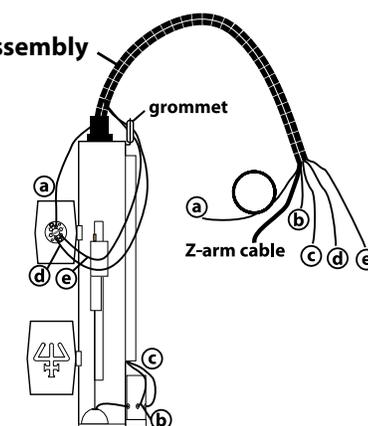
Z-Arm Cable Assembly Setup

Some of the tubing will be placed in the Z-arm cable assembly before being connected to the instrument. To prepare for this:

- 1 Lay the Z-arm cable assembly on a flat surface with the “zipper” facing up.
- 2 Remove the “zipper” by pulling up and out on the bottom end. Leave the Z-arm cable in the assembly. Then set the “zipper” off to the side.
- 3 Place the following tubing in the Z-arm cable assembly. For more detailed information, including part numbers, refer to **Plumbing Connections** on page 2-29. (Do not connect any of the tubing until instructed to do so.)
 - a) transfer tubing assembly
 - The end of the transfer tubing with the headless nut attached and the shorter length of Z-arm cable should exit the same end of the assembly.
 - The coiled end of the transfer tubing and the longer length of Z-arm cable should exit the same end of the assembly.
 - b) PEEK tubing (for FC valve only)
 - c) Teflon waste tubing (for FC valve only)
 - d) PEEK tubing (for GX Z Injection Module only)
 - e) PEEK tubing (for GX Z Injection Module only)



GX Solvent System and FC valve plumbing



GX Solvent System, FC valve, and GX Z Injection Module plumbing

- 4 After all of the tubing is in place in the Z-arm cable assembly replace the “zipper”.

Z-Arm Cable Assembly Installation

To install the Z-arm cable assembly on the Z-arm:

- 1 Orient the Z-arm cable assembly and tubing so that the short end of the Z-arm cable is closest to the Z-arm.
- 2 Route all of the tubing at that end of the assembly (except the transfer tubing) through the grommet on the right side of the Z-arm.
- 3 Route the tubing for the fraction collector down through the tube and wire routing strip on the side of the Z-arm.
- 4 Connect the Z-arm cable to the port on the top of the Z-arm.

Z-Arm Installation

Follow these steps to install the Z-arm:

- 1 Using the supplied 5/32" T-handled Allen wrench, loosen the mounting screw on the Z-arm mounting bracket located on the Y-arm. Turn counterclockwise to loosen.
- 2 Partially pull out the bracket. Do not remove completely.
- 3 Place the Z-arm into the mounting bracket. Insert one side of the Z-arm into place at a time (back to front).
- 4 Tighten the screw on the mounting bracket until the Z-arm is secure.

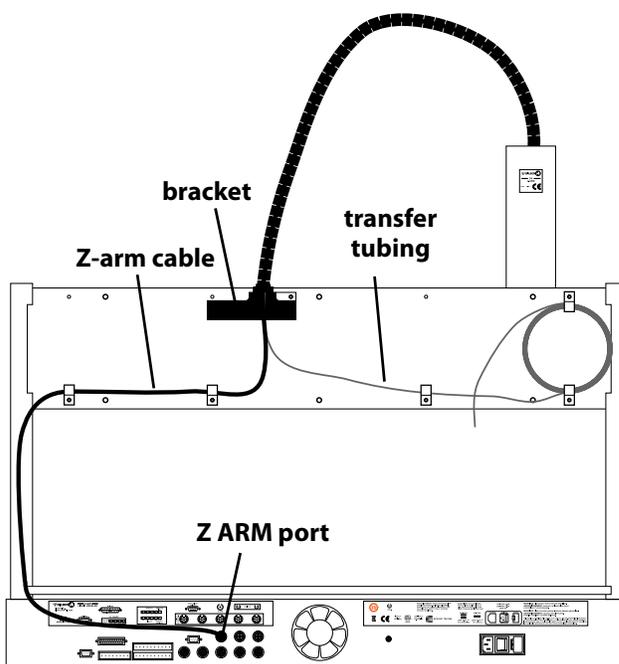


The Z-arm will be set to its proper height as the final step of the installation. This adjustment is described in [Final Z-Arm Height Adjustment](#) on page 2-43.

Z-Arm Cable Connection

To connect the Z-arm cable to the liquid handler:

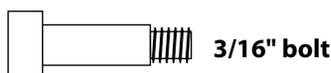
- 1 Place the end of the Z-arm cable through the bracket on the back of the liquid handler.
- 2 Route the Z-arm cable and the transfer tubing through the clips on the back of the liquid handler. Refer to the diagram for the location of these clips.
- 3 Connect the Z-arm cable to the Z ARM port on the rear panel of the liquid handler.



Z Travel Height Adjustment

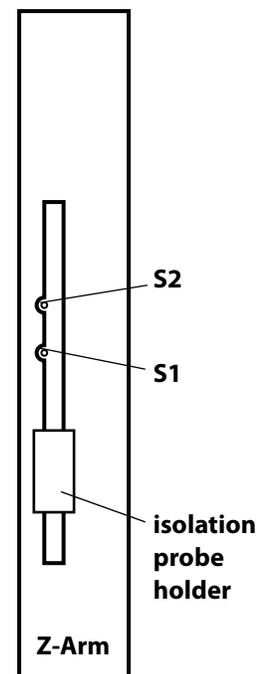
Follow these steps to adjust the Z travel height:

- 1 Push the isolation probe holder down as far as it will go.
- 2 Locate the 3/16" bolt (part number 4014194160) that was included with the Z-arm. (There are extra bolts included in the accessory package that came with the liquid handler.)



- 3 Place the bolt on the supplied 3/32" Allen wrench and insert into the proper hole on the Z-arm. Turn clockwise to tighten.
 - S1 for 125 mm probes
 - S2 for 175 mm probes
 - No bolt installed for 210 mm probes

Note: Store the bolt in the right side bracket hole on the back of the liquid handler for future use.



Probe Installation

There are different probes available for use on the GX-281 Liquid Handler. Depending upon the application, purchase the appropriate probe and guide foot assembly.

To install the probe on the Z-arm, insert the probe into the top of the isolation probe holder and pull it through the holder until the tip of the probe is in the probe guide insert.

LLD (Liquid Level Detection) Cable Installation

The LLD cable assembly (part number 25064040) is included with the Z-arm.

To install the LLD cable assembly:

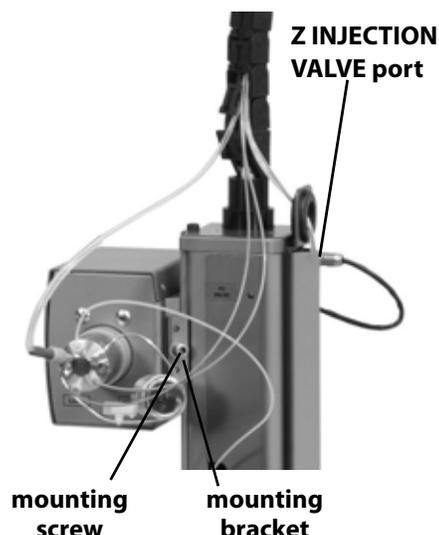
- 1 Tighten the hex nut on the right side of the isolation probe holder.
- 2 Place the metal slot end of the cable over the metal tab on the isolation probe holder.
- 3 Plug the other end of the cable into the LLD port on the right side of the Z-arm. Align the red line on the cable with the slot on the port.



GX Z Injection Module Installation (Optional)

To install the GX Z Injection Module on the Z-arm:

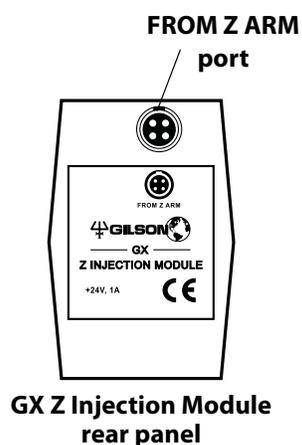
- 1 Using the supplied 5/32" T-handled Allen wrench, loosen the mounting screw on the mounting bracket located on the GX Z Injection Module. Turn counterclockwise to loosen.
- 2 Partially pull out the bracket. Do not remove completely.
- 3 Mount the GX Z Injection Module on the top left side of the Z-arm. Mount one side of the injection module at a time (back to front). The valve should face the front and the mounting bracket should face the right.
- 4 Tighten the screw on the mounting bracket until the GX Z Injection Module is secure on the Z-arm.



GX Z Injection Module Rear Panel

To make connections between the GX Z Injection Module and the liquid handler:

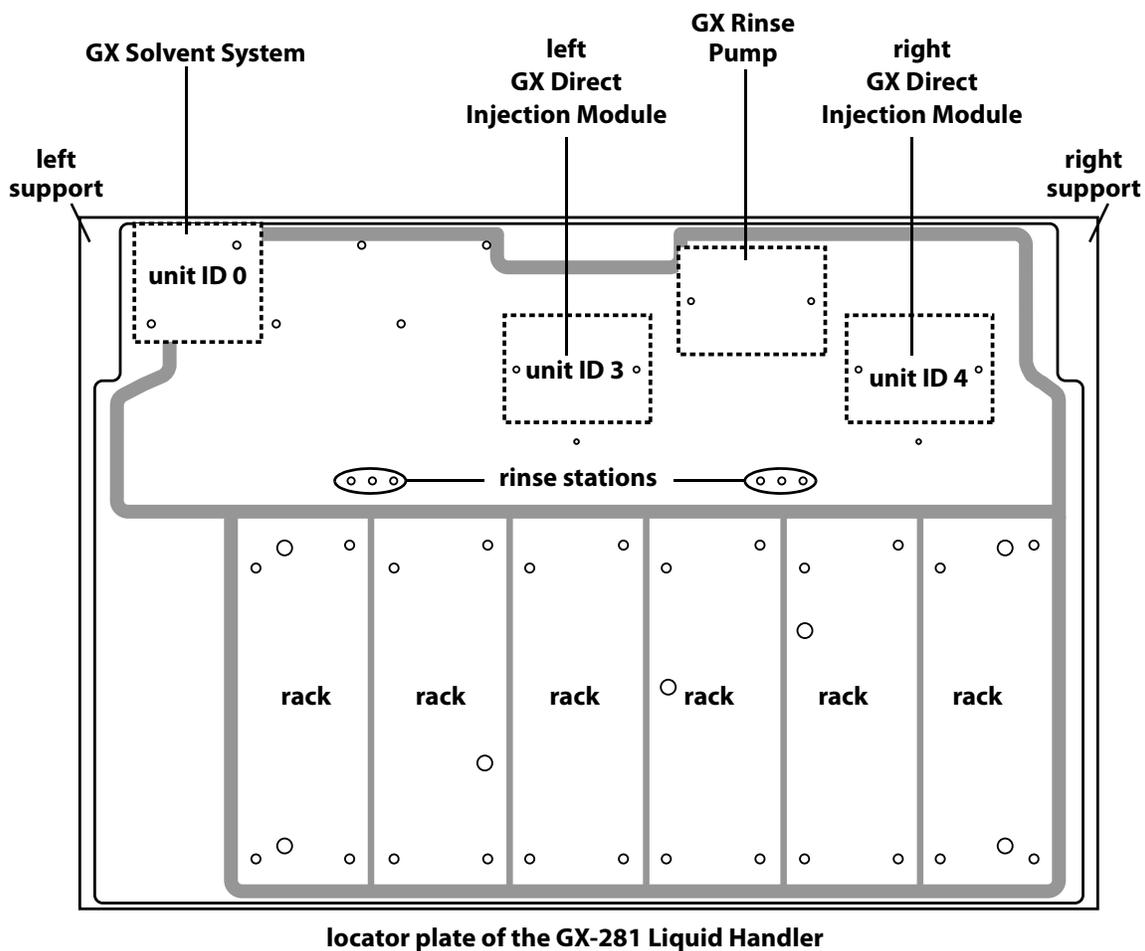
- 1 Ensure that the power is turned off to the liquid handler.
- 2 Plug one end of the cable supplied with the GX Z Injection Module to the FROM Z ARM port on the rear panel of the injection module. Align the red dot on the cable with the red dot on the port.
- 3 Connect the other end of the cable to the port labeled Z INJECTION VALVE on the top right side of the Z-arm, aligning the red dots on the cable and the port.



Locator Plate Setup

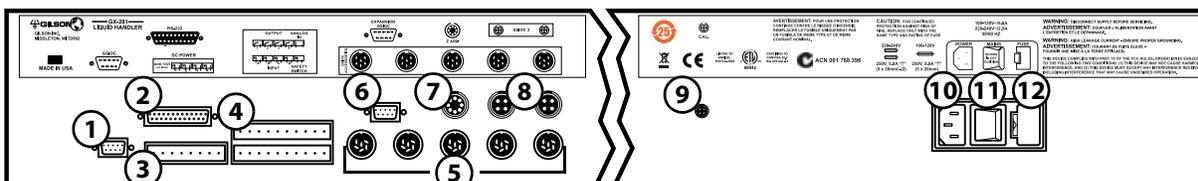
This section takes you through the installation and rear panel connections for each accessory on the locator plate of the liquid handler.

To install accessories on the locator plate of the liquid handler refer to the following diagram and instructions.



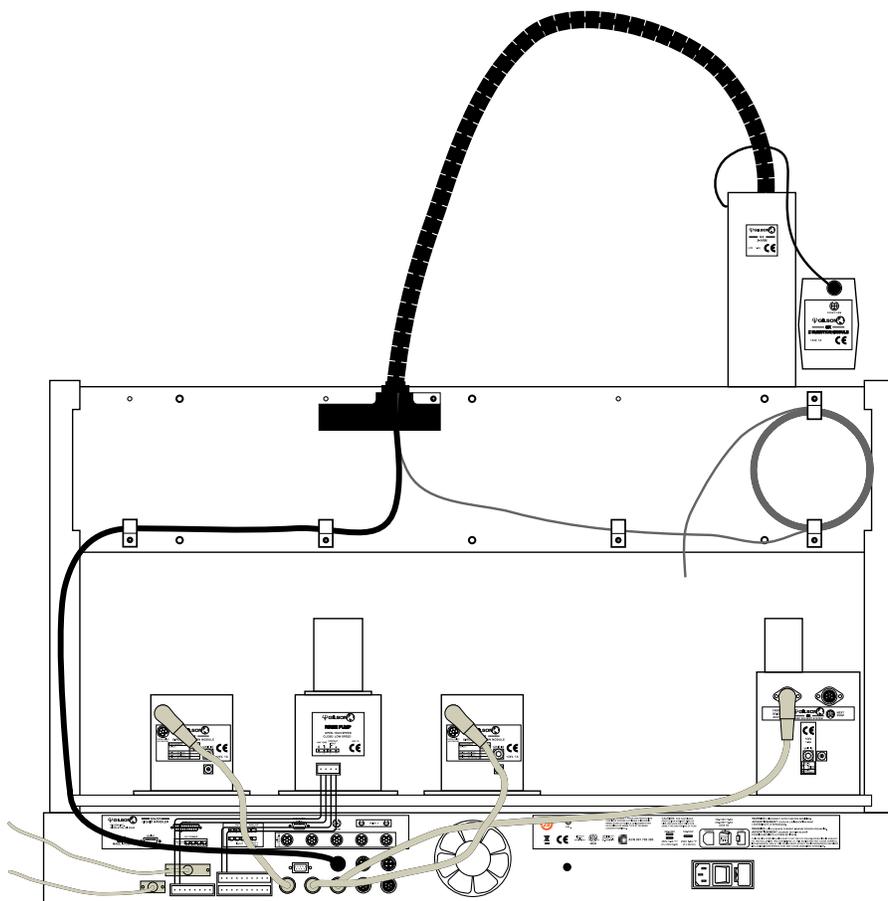
Rear Panel Connections

Refer to the following diagrams when making rear panel connections.



GX-281 Liquid Handler rear panel—partial

- 1 Gilson Serial Input/Output Channel (GSIOC) port
- 2 RS-232 port
- 3 Switched 24V DC power
- 4 Input/Output (I/O) ports/safety/analog
- 5 GSIOC accessories
- 6 Expansion GSIOC (not used)
- 7 Z-arm
- 8 GSIOC 2 (not used)
- 9 Alignment kit laser port
- 10 Power receptacle
- 11 Power switch
- 12 Fuse drawer





GX Solvent System Installation

The GX Solvent System is installed next to the left support on the liquid handler (as shown in the photo).

To install the solvent system on the locator plate:

- 1 Locate the two pins (part number 4533250050) shipped with the solvent system and place them in the two holes on the back left side of the locator plate. Refer to the diagram on [page 2-16](#) for the location of these holes.
- 2 Align the pins with the holes on the solvent system. Then push the solvent system into place.

GX Solvent System Rear Panel

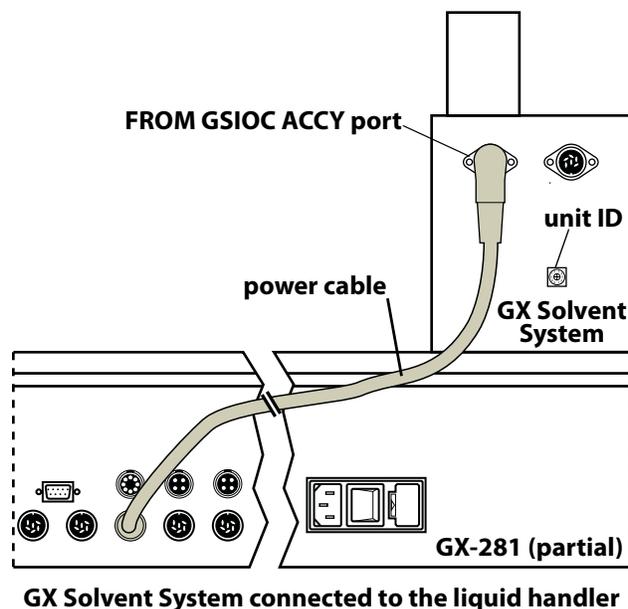
To make connections between the solvent system and the liquid handler:

- 1 Ensure that the power is turned off to the liquid handler.

Note: Any time the solvent system will be disconnected from the liquid handler ensure that the power is turned off to the liquid handler.
- 2 Connect the right-angled end of the power cable (part number 26035455) to the FROM GSIOC ACCY port on the solvent system.
- 3 Connect the other end of the power cable to one of the GSIOC ACCESSORIES ports on the rear panel of the GX-281 Liquid Handler.

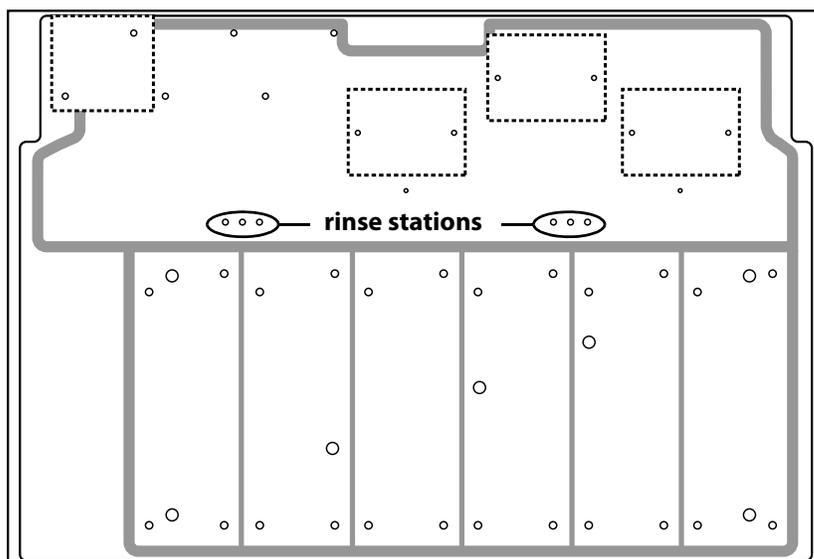
Unit ID

The unit ID on the solvent system is set to 0.



Rinse Station Installation

The rinse stations are installed on the locator plate. Refer to the diagram for the location of the rinse stations.



Up to six rinse stations can be installed on the locator plate of the liquid handler. There are two types of rinse stations available. Each of these is available in three different heights.

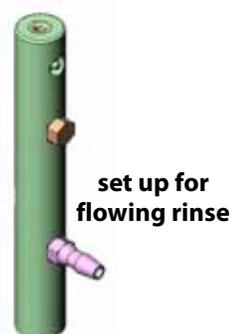
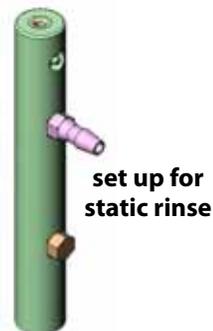
Available rinse stations:

Part number	Description
26034552	Rinse station, GX 125 mm (Rinse station for outside rinse of probe)
26034551	Rinse station, GX 175 mm (Rinse station for outside rinse of probe)
26034553	Rinse station, GX 210 mm (Rinse station for outside rinse of probe)
26034554	Rinse station, GX 125 mm FC (Drain/rinse station for inside rinse of probe)
26034555	Rinse station, GX 175 mm FC (Drain/rinse station for inside rinse of probe)
26034556	Rinse station, GX 210 mm FC (Drain/rinse station for inside rinse of probe)

Before installing the rinse station determine what type of rinse you will be performing.

With the Rinse Station for Outside Rinse of Probe you can perform a static rinse or a flowing rinse using the GX Rinse Pump.

- For a static rinse place the plug in the bottom hole and the drain in the top hole.
- For a flowing rinse place the plug in the top hole and the drain at the bottom



rinse station for outside rinse of probe



drain/rinse station for inside rinse of probe

Use the Drain/Rinse Station to perform an inside rinse.

It is suggested to install the rinse station in the location closest to the injection port on the GX Direct Injection Module (if installed).

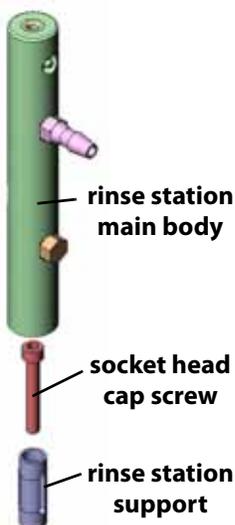
To install the rinse station on the locator plate:

- 1 Locate the following items included with the rinse station:

- rinse station support
- socket head cap screw

Note: The rinse station also includes a flat-head screw and hex nut that will not be used for this installation.

- 2 Use the socket head cap screw provided to fasten the rinse station support to the base. Do not over tighten.
- 3 Place the main body of the rinse station on the support so that after it is in place you can give it a 1/4 clockwise turn to secure the rinse station tightly. For example, if you want the fittings on the rinse station to face the back, initially place it so that the fittings are facing the left support of the liquid handler.



GX Rinse Pump Installation (Optional)

The GX Rinse Pump is installed on the right side of the liquid handler between the GX Direct Injection Modules (if installed).



GX Rinse Pump on the locator plate of the liquid handler

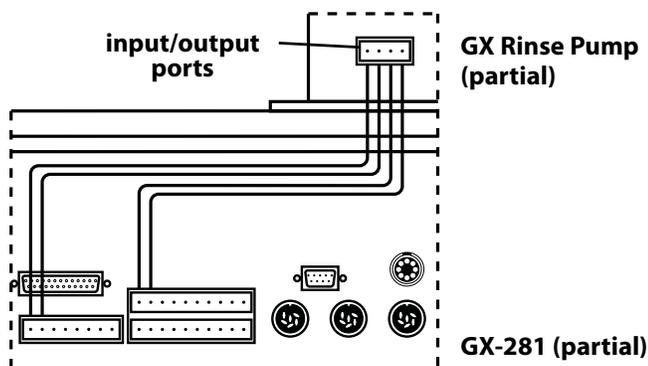
To install the GX Rinse Pump on the locator plate:

- 1 Align the holes on the base of the GX Rinse Pump with the holes on the locator plate of the liquid handler. Refer to the diagram on [page 2-16](#) for the location of these holes.
- 2 Put the thumbscrews in place and tighten.

GX Rinse Pump Rear Panel

To make connections between the GX Rinse Pump and the liquid handler:

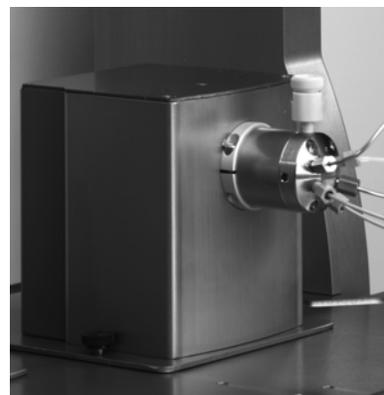
- 1 Locate the GX Rinse Pump cable connector (part number 26035255). This assembly contains three pre-wired terminal block connectors.
- 2 Connect the four pin terminal block connector to the rear panel of the GX Rinse Pump.
- 3 Connect the eight pin terminal block connector to the +24V DC power outputs on the rear panel of the GX-281 Liquid Handler. The wires should be on the left side of the block when connected.
- 4 Connect the ten pin terminal block connector to the output ports on the rear panel of the GX-281 Liquid Handler. The wires should be on the left side of the output block when connected.



GX Rinse Pump connected to the liquid handler

GX Direct Injection Module Installation (Optional)

Up to two injection modules can be installed on the locator plate of the liquid handler. One is installed next to the right support of the liquid handler and the other is installed on the left side of the GX Rinse Pump (if installed).

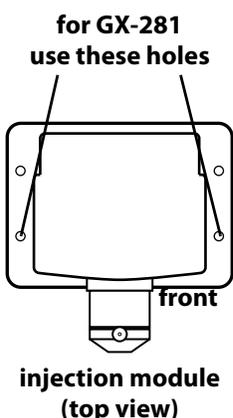


GX Direct Injection Module on the locator plate of the liquid handler

Injection Module

To install the GX Direct Injection Modules on the locator plate of the liquid handler:

- 1 Locate the pins (part number 4533125037) shipped with the injection module and place them in the holes on the locator plate of the liquid handler. Refer to the diagram on [page 2-16](#) for the location of these holes.
- 2 Align the pins with the holes on the bottom of the injection module. Then push the injection module into place.
- 3 Place one of the provided screws through the front set of holes on each side of the injection module and tighten using the supplied ball driver wrench.

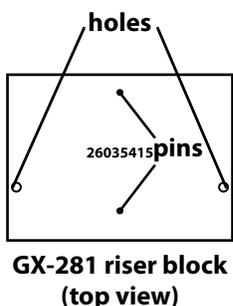


Injection Module with Riser Block

Use the GX-281 Direct Inject Riser Block (part number 26035457, ordered separately) when collecting fractions to tubes 150 mm and taller.

To install the riser block and the GX Direct Injection Module on the locator plate:

- 1 Locate the pins (part number 4533125037) shipped with the injection module and place them in the holes on the locator plate of the liquid handler. Refer to the diagram on [page 2-16](#) for the location of these holes.
- 2 Align the pins on the locator plate with the holes on the bottom of the riser block. Then push the riser block into place.
- 3 Align the pins on the top of the riser block with the holes on the bottom of the injection module and then push the injection module into place.
- 4 Place the two screws (included with the riser) through the front set of holes on the injection module and tighten using the supplied ball driver wrench.



GX Direct Injection Module Rear Panel

To make connections between the GX Direct Injection Module and the liquid handler:

- 1 Ensure that the power is turned off to the liquid handler.
Note: Any time the injection module will be disconnected from the liquid handler ensure that the power is turned off to the liquid handler.
- 2 Connect the right-angled end of the power cable (part number 26035455) to the FROM GSIOC ACCESSORY port on the injection module.
- 3 Connect the other end of the power cable to one of the GSIOC ACCESSORIES ports on the rear panel of the liquid handler.

Unit ID

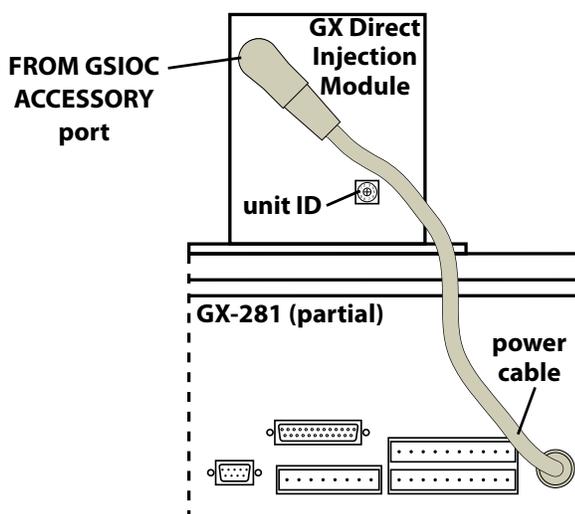
The unit ID on the GX Direct Injection Module is set to 3. The unit IDs are:

- Left GX Direct Injection Module - unit ID=3
- Right GX Direct Injection Module - unit ID=4

Note: If only one GX Direct Injection Module is being used it can be placed on either the left or the right but the unit ID **must** correspond to its location on the locator plate.

To change the unit ID:

- 1 Gently insert a small flat-blade screwdriver into the selector on the rear panel and turn it.
- 2 Align the white dot with one of the indicated numbers.



Rack Installation

The GX-281 Liquid Handler is equipped to locate up to six Code 200-series racks. Racks information can be found at www.gilson.com.

To install a rack:

- 1 Orient the rack so that the code number (for example, 200) is facing forward.
- 2 Fit the rack on the locator plate so that the slots and holes on the underside of the rack align with the pins on the locator plate.

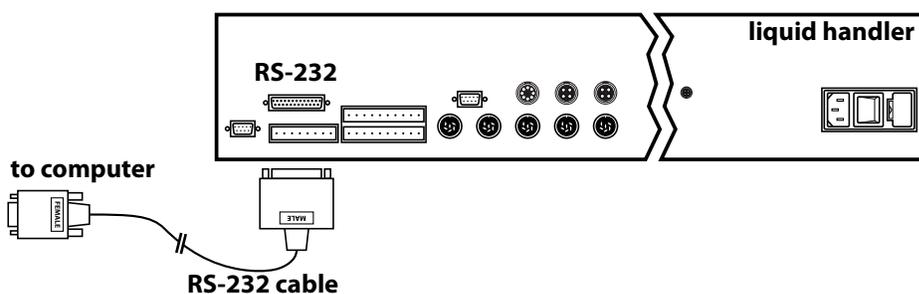
RS-232, GSIOC, and Input/Output Connections

RS-232 Port

The RS-232 port is used to transfer information between the liquid handler and a computer. To connect your computer to the liquid handler, you will need the RS-232 cable (part number 36083122, included in the accessory package).

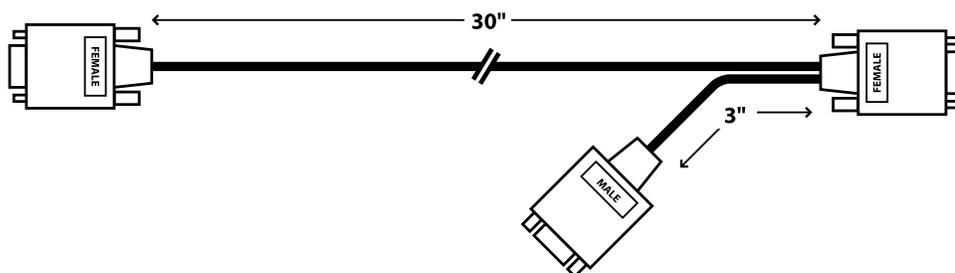
To connect the RS-232 cable

- 1 Connect the male end of the RS-232 cable to the RS-232 port located on the rear panel of the liquid handler. Tighten the retaining screws.
- 2 Connect the female end of the RS-232 cable to the computer's RS-232 serial communications port. Tighten the retaining screws.



GSIOC Port

Use the GSIOC cable (part number 36078143, included in the accessory package) to link other instruments to the liquid handler and control all from one computer.

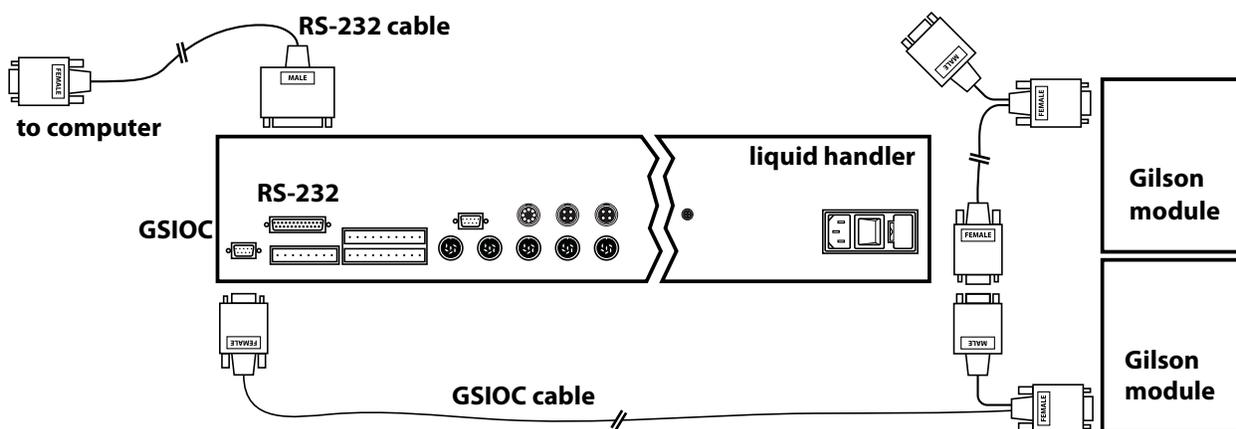


To connect the GSIOC cable:

- 1 Connect the female connector, located individually at one end of the cable, to the GSIOC port of the liquid handler. Tighten the retaining screws.
- 2 Connect the other female connector, located on the same end as the male connector, to the Gilson module. Tighten the retaining screws.

If you are connecting more than one Gilson module, use the male connector to attach an additional GSIOC cable. Use the female connectors to connect to each Gilson module.

Cables should be arranged in a linear fashion. Any “Y-branching from the main GSIOC cable may create noise.



GSIOC Expansion Port

The GSIOC expansion port is not used.

Input/Output Ports

You can use the input and output contacts on the rear panel of the liquid handler to control peripheral devices. Refer to [Rear Panel Connections](#) on page 2-17 for the location of the input/output ports.

Inputs

The input terminal block of the liquid handler has ten contacts. All of the inputs are paired, and each pair include a GROUND reference (⏏).

The contact input pairs are labeled A, B, C, and D; there is also a safety contact input.

A contact is connected if it has a short across the input or is held low by a TTL output or other device.

Never connect voltages higher than 5V DC to an input. When using TTL signals, be sure to match GROUND connections.

Outputs

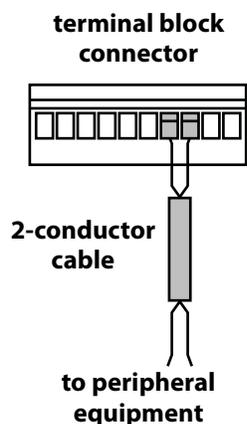
The output terminal block has ten contacts.

Pins 1 through 8 are paired, isolated-relay contact closures and are labeled 1, 2, 3, and 4.

Pins 9 and 10 are ANALOG IN and require an analog signal (+/- 1V).

DC Power Outputs

The four DC power outputs can be turned on (supplying +24V DC) or off (+24V DC output will float) via software control.



Make Connections

To make connections, you'll need the following:

- 2-conductor cable (22–30 gauge for each wire)

You can purchase a 6-foot piece of suitable cable (part number 709910206) or a package of 5 cables with identification markers (part number 36078155) from Gilson.

- wire insulation stripper
- small-blade screwdriver

To make connections with the 2-conductor cable:

- 1 Cut the cable into pieces of appropriate length.
- 2 Strip about 3 mm of insulation from each end of the cable.
- 3 Remove the terminal block connector from the liquid handler. Insert each wire into the appropriate terminal on the terminal block connector.

Note: When making connections, be sure to maintain the correct orientation of the connector relative to the port.

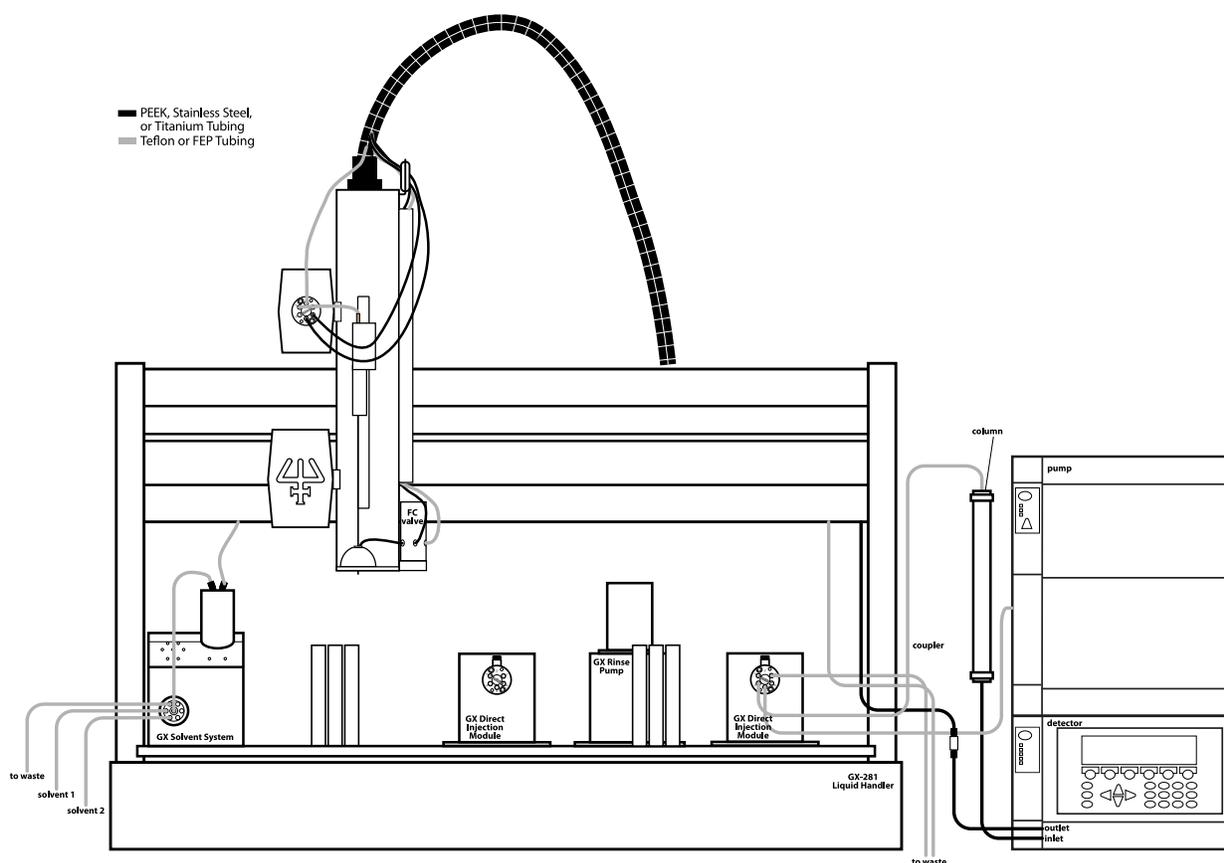
Push the wire all the way in; then tighten its corresponding pin screw.

- 4 Reconnect the terminal block connector to the liquid handler. Push the connector in as far as it will go. It is designed to fit snugly into its receptacle.
- 5 Connect the opposite ends of the wires to the other device(s). Be sure to match ground connections.
- 6 Label each cable to identify the purpose of the connection.

Plumbing Connections

The tables and diagrams in the following sections provide detailed information about making these plumbing connections:

- For **Drain Tubing** see page 2-30
- For **GX Solvent System Plumbing** see page 2-31
- For **Fraction Collection Valve Plumbing (Optional)** see page 2-34
- For **GX Z Injection Module Plumbing (Optional)** see page 2-36
- For **Rinse Station Plumbing** see page 2-38
- For **GX Rinse Pump Plumbing (Optional)** see page 2-39
- For **GX Direct Injection Module Plumbing (Optional)** see page 2-40



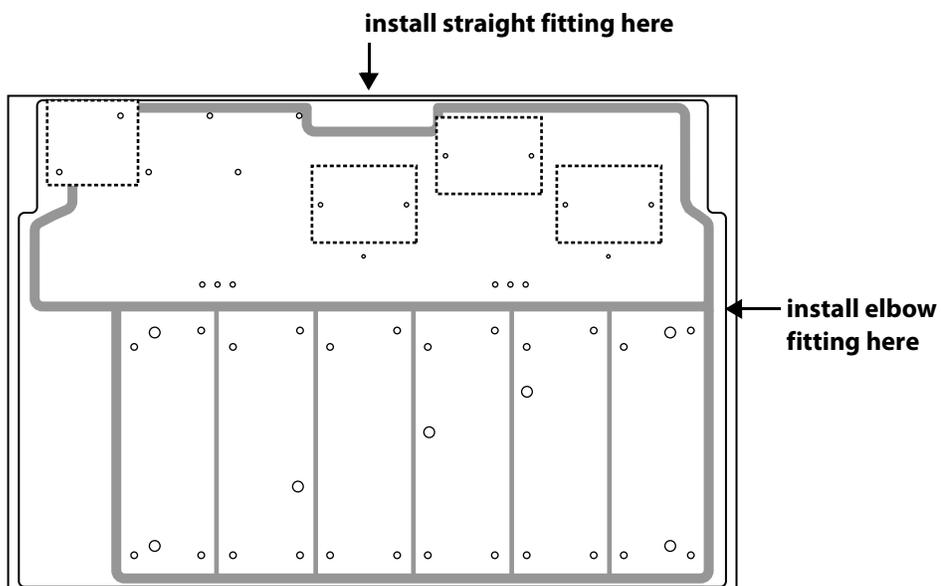
Drain Tubing

Locate the following items included in the GX-281 Accessory Package:

Part number	Description
49081701	Barbed adapter, elbow, 1/8" NPT TO 3/8" tubing
49081702	Barbed adapter, straight, 1/8" NPT to 3/8" tubing
470343706	Tubing, 5/16" x 7/16", Tygon, two lengths of 10 feet each

Install the elbow fitting in the hole located on the right side of the locator plate and install the straight fitting on the hole located at the back of the locator plate.

Attach one length of tubing to each fitting. Place the free ends of the tubing in the waste container.



GX Solvent System Plumbing

This section will take you through the steps for plumbing the GX Solvent System. Before making the connections, locate the items listed below.

Included with the solvent system:

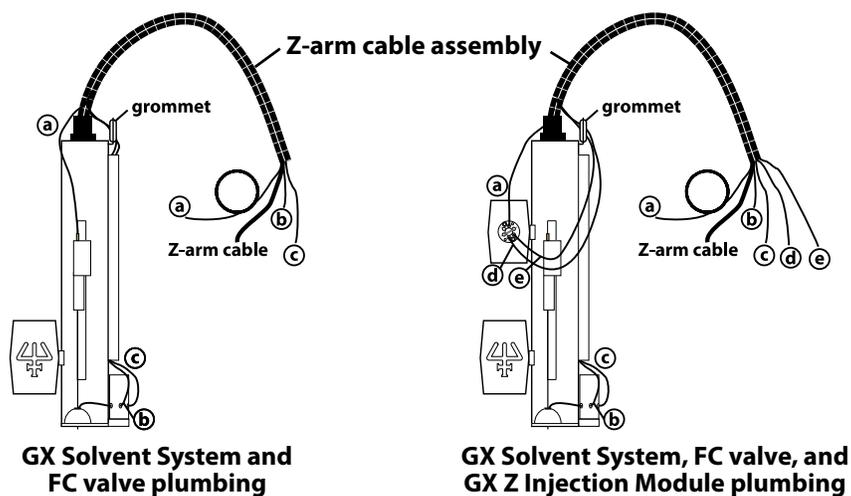
Part number	Description
49962142	Solvent valve to pump tubing, analytical (Analytical)
49948122	Solvent valve to pump tubing, prep (Prep)
499484021	Solvent inlet tubing
490032	Waste tubing, 0.063" ID x 0.125" OD, PTFE, clear (15 ft)
490410332	P-331 nut, 1/4–28 PEEK
49041027	P-359, 1/8" ferrule

Transfer Tubing

The transfer tubing is ordered separately, refer to the table below for part numbers. If a GX Z Injection Module is being used, there is transfer tubing included in the GX Z Injection Module Plumbing Package (part number 26035370).

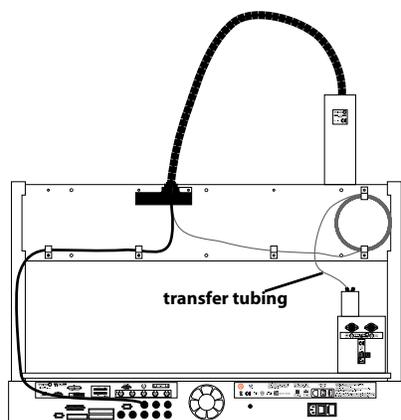
Part number	Description
49963972	Transfer tubing 500 μ L (Analytical)
49962872	Transfer tubing 1.1 mL (Analytical)
499671112	Transfer tubing 5.5 mL (Analytical)
499424013	Transfer tubing 1.1 mL (Prep)
499471112	Transfer tubing 5.5 mL (Prep)
499474103	Transfer tubing 10.5 mL (Prep)
499483602	Transfer tubing 30 mL (Prep)
499486002	Transfer tubing 50 mL (Prep)

Note: The transfer tubing should already be routed through the Z-arm cable assembly (see [Z-Arm Cable Assembly Setup and Installation](#) on page 2-9 for details).



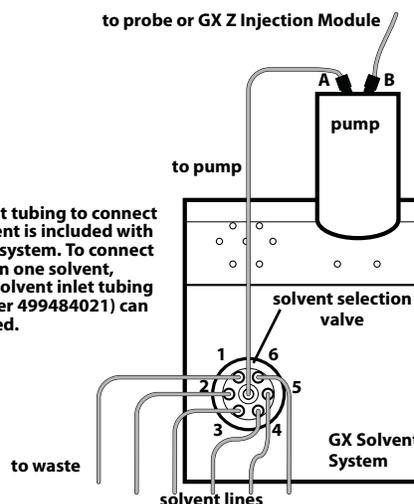
- a) transfer tubing assembly
 - The end of the transfer tubing with the headless nut attached and the shorter length of Z-arm cable should exit the same end of the assembly.
 - The coiled end of the transfer tubing and the longer length of Z-arm cable should exit the same end of the assembly.
- b) PEEK tubing (for FC valve only)
- c) Teflon waste tubing (for FC valve only)
- d) PEEK tubing (for GX Z Injection Module only)
- e) PEEK tubing (for GX Z Injection Module only)

The table and diagrams provide detailed information about making the plumbing connections for the solvent system.



Route the transfer tubing through the clips on the back of the liquid handler before connecting to port B on the solvent system's pump.

Solvent inlet tubing to connect to one solvent is included with the solvent system. To connect to more than one solvent, additional solvent inlet tubing (part number 499484021) can be purchased.



Solvent System	Tubing	Connections
Port 1 to waste	Teflon tubing 0.063" ID x 0.125" OD x 15 feet (part number 490032)	Upchurch P-331 PEEK nut and P-359 ferrule.
Ports 2–6 to reservoir	Solvent inlet tubing (part number 499484021)	
	40 inches of Teflon tubing (0.085" ID x 1/8" OD)	Connect the end of the tubing with the fitting attached to ports 2–6 on the solvent selection valve. Place the other end in the appropriate solvent.
Center port to port A (Analytical)	Solvent valve to pump tubing (part number 49962142)	
	14 inches of Teflon tubing (0.030" ID x 1/16" OD)	Connect the end with the headless nut to the center port on the valve and the end with the fingertight fitting to port A on the pump.
Center port to port A (Prep)	Solvent valve to pump tubing (part number 49948122)	
	14 inches of Teflon tubing (0.085" ID x 1/8" OD)	Connect one end to the center port on the valve and the other end to port A on the pump.
Port B to probe (Analytical)	500 µL transfer tubing (part number 49963972)	
	96 inches of Teflon FEP tubing (0.020" ID x 1/16" OD)	Connect the end with the headless nut to the probe and the end with the fingertight fitting to port B on the pump.
	1.1 mL transfer tubing (part number 49962872)	
	95 inches of Teflon FEP tubing (0.030" ID x 1/16" OD)	Connect the end with the headless nut to the probe and the end with the fingertight fitting to port B on the pump.
Port B to probe (Prep)	5.5 mL transfer tubing (part number 499671112)	
	111 inches of Teflon FEP tubing (0.062" ID x 1/8" OD)	Connect the end with the headless nut to the probe and the other end to port B on the pump.
	1.1 mL transfer tubing (part number 499424013)	
	87 inches of Teflon tubing (0.030" ID x 1/16" OD)	Connect one end to the probe and the other end to port B on the pump.
Port B to probe (Prep)	5.5 mL transfer tubing (part number 499471112)	
	102 inches of Teflon tubing (0.062" ID x 1/8" OD)	Connect the end with the headless nut to the probe and the other end to port B on the pump.
	10.5 mL transfer tubing (part number 499474103)	
	204 inches of Teflon tubing (0.062" ID x 1/8" OD)	Connect one end to the probe and the other end to port B on the pump.
	30 mL transfer tubing (part number 499483602)	
	360 inches of Teflon tubing (0.085" ID x 1/8" OD)	Connect one end to the probe and the other end to port B on the pump.
	50 mL transfer tubing (part number 499486002)	
600 inches of Teflon tubing (0.085" ID x 1/8" OD)	Connect one end to the probe and the other end to port B on the pump.	
Port B to port 1 on GX Z Injection Module	Transfer tubing (part number 499474103)	
	204 inches of Teflon tubing (0.062" ID x 1/8" OD)	Connect one end to port B on the pump. Attach the P-654 adapter (part number 490410654 included in the GX Z Injection Module plumbing package) to port 1 on the GX Z Injection Module. Then connect the other end of the transfer tubing to the adapter.

Fraction Collection Valve Plumbing (Optional)

This section will take you through the steps for plumbing the fraction collection valve.

Before making the connections, locate the Plumbing Package for the Low Mount FC Valve (part number 26037270) which contains the following:

Part number	Description
49953029	Tubing, 0.030" x 20 ft, PEEK
25077422	Collection tube, 1/8" TFE
25077423	Collection tube, 1/16" TFE
49041012	Nut, 1/16", black, (P-201) (5)
49041011	Ferrule, 1/16", red, (P-200R) (5)
F1410050	PVDF coupling for 1/4"-28 fitting, package of 5
49041015	Ferrule, flangeless, 1/8", TEFZEL (P-300) (1)
49041016	Nut, 1/4-28 x 1/8 Delrin (P-304) (1)
490032	Waste tubing, 0.063" ID x 0.125" OD, PTFE, clear (15 ft)
26036143	Tube and wire routing strip, GX-28X Z-arm
26036123	Tube and wire routing strip (blue/grey, not used with GX-281)

Note: The PEEK tubing and waste tubing should already be routed through the Z-arm cable assembly and the tube and wire routing strip (see [Z-Arm Cable Assembly Setup and Installation](#) on page 2-9 for details).

Assembling the Collection Probes

Refer to the following procedures to assemble the collection probes. The probe packages come with all of the necessary materials.

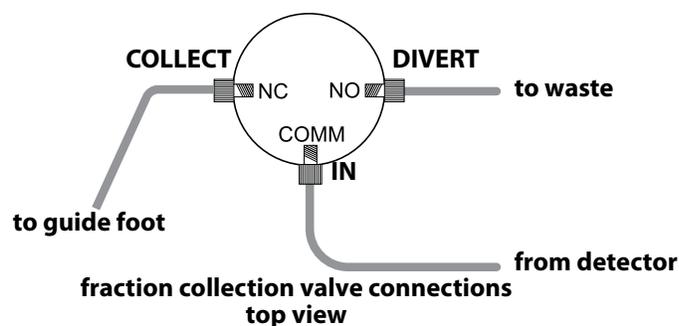
- For the 1/8" OD Teflon probe (part number 25077422):
 - 1 Cut a piece of the supplied 1/8" OD tubing to approximately 75 mm.
 - 2 Insert the supplied nut and ferrule onto the tubing.
- For the 1/16" OD Teflon probe (part number 25077423):
 - 1 Cut a piece of the supplied 1/16" OD tubing to approximately 70 mm.
 - 2 Insert the supplied nut and ferrule onto the tubing.

Installing the Collection Probes

- 1 Insert the end of the collection probe with the fitting attached into the COLLECT port of the valve.
- 2 For the 1/8" tubing, press the tubing against the back of the port and finger-tighten the screw.

Note: For the 1/16" tubing make sure that the tubing does not extend past the ferrule.
- 3 While holding the valve and collection probe, insert the collection probe into the guide hole until 3 mm of tubing is exposed below the guide foot.
- 4 The 1/8" tubing uses the larger guide hole and the 1/16" tubing uses the smaller guide hole.

The following table and diagram provide detailed information about making plumbing connections for the fraction collection valve.



3-way valve	Tubing	Connections
INLET COMM (common) port to coupler	PEEK tubing 0.030" x 1/16" x 20 feet (part number 49953029)	On both ends of the tubing, use an Upchurch P-201 nut (1/16", 1/4-28) and P-200 ferrule (1/16"). Route one end of the tubing down through the tube and wire routing strip and connect it to the IN port of the valve. Connect the other end to a coupler (part number F1410050).
DIVERT position NO (normally open) port to waste	Teflon tubing 0.063" ID x 0.125" OD x 15 feet (part number 490032)	Use an Upchurch P-304 nut (1/8", 1/4-28) and P-300 ferrule (1/8") on one end of the tubing. Route that end of the tubing down through the tube and wire routing strip and then connect it to the DIVERT port of the valve. Place the other end of the tubing in the waste container.
COLLECT position NC (normally closed) port to probe	1/16" TFE probe (part number 25077423) or 1/8" TFE probe (part number 25077422)	Note: Information about making these connections can be found in Installing the Collection Probes on page 2-35.

GX Z Injection Module Plumbing (Optional)

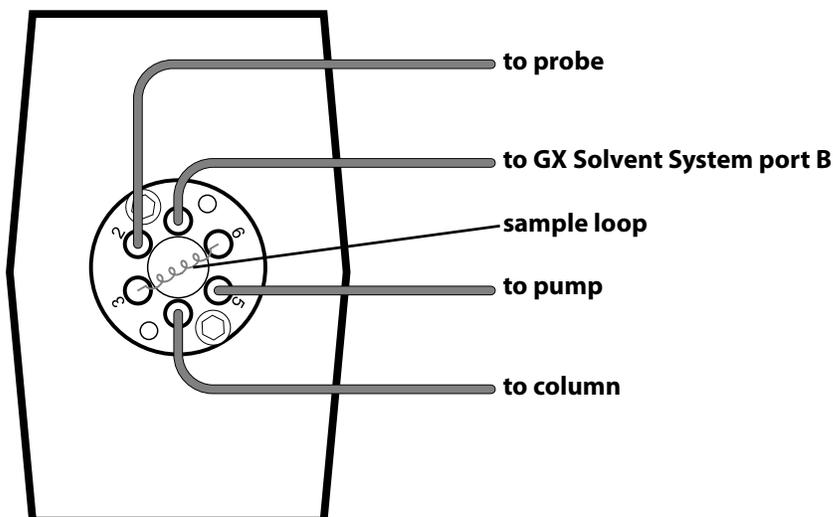
This section will take you through the steps for plumbing the GX Z Injection Module.

Before making the connections, locate the GX Z Injection Module Plumbing Package (ordered separately, part number 26035370) which contains the following:

Part number	Description
499474103	Transfer tubing assembly, 10.5 mL
49942142	Injection valve to probe tubing assembly
4903180411	MZN1PK 1/16" Valco nut (5)
4903180511	ZF1PK 1/16" Valco ferrule (5)
49953029	Tubing, 0.030" x 20 ft, PEEK (2)
49041031	P-706 PEEK ZDV Union, 0.050 Thru Hole (2)
36610101	Wrench, 5/16-1/4
490410654	Adptr, extra long 1/4-28 10-32, PEEK (P-654)

Note: The transfer tubing and the two lengths of PEEK tubing should already be routed through the Z-arm cable assembly (see [Z-Arm Cable Assembly Setup and Installation](#) on page 2-9 for details).

The table and diagram provide detailed information about making the plumbing connections for the GX Z Injection Module.



GX Z Injection Module	Tubing	Connections
Port 1 to GX Solvent System (port B)	Transfer tubing (part number 499474103) 204 inches of Teflon tubing (0.062" ID x 1/8" OD)	Attach the P-654 adapter (part number 490410654) to port 1. Connect one end of the transfer tubing to the adapter in port 1. Connect the other end to port B on the solvent system pump.
Port 2 to probe	Tubing, injection valve to probe (part number 49942142) 14 inches of tubing (0.030" ID x 1/16" OD)	One end of the tubing has an Upchurch P-287 nut and P-250 ferrule. Connect this end to the probe. The other end of the tubing has an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511). Connect this end to port 2 on the valve.
Port 3 to port 6	sample loop (ordered separately)	
Port 4 to column	PEEK tubing 0.030" x 1/16" (part number 49953029)	On one end of the tubing use an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511). Connect this end to port 4 on the valve. Connect the other end to a P-706 PEEK ZDV union (part number 49041031). Then connect another length of the PEEK tubing to the union.
Port 5 to pump	PEEK tubing 0.030" x 1/16" (part number 49953029)	On one end of the tubing use an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511). Connect this end to port 5 on the valve. Connect the other end to a P-706 PEEK ZDV union (part number 49041031). Then connect another length of the PEEK tubing to the union.

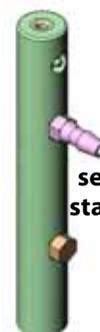
Rinse Station Plumbing

To attach tubing to the drain:

- 1 Locate the Tygon drain tubing (part number 470331206) included with the rinse station.
- 2 Connect the drain tubing to the barbed union on the rinse station.
- 3 If you are using a GX Rinse Pump, refer to the instructions on [page 2-39](#).



**drain/rinse station for
inside rinse of probe**



**set up for
static rinse**



**set up for
flowing rinse**

**rinse station for
outside rinse of probe**

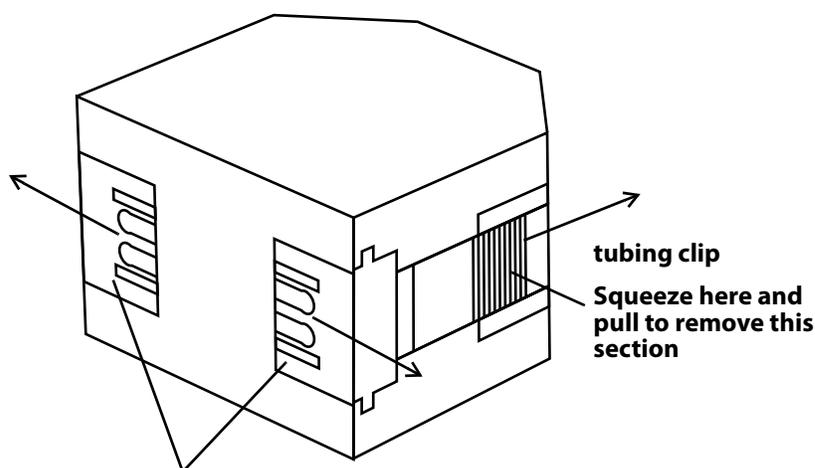
GX Rinse Pump Plumbing (Optional)

Locate the following tubing included with the rinse pump:

- 2.0 mm ID pharmed tubing assembly (part number 26035221)
- 1/16" ID x 3/16" OD neoprene tubing (part number 4715187060)

To install the tubing:

- 1 Remove the tubing clip from the top of the rinse pump by squeezing the sides and then pulling it out.



Slide these pieces out to install the pharmed tubing

- 2 Remove the two pieces from the side of the pump head. Store the pieces for future use. Place one end of the pharmed tubing assembly in the left side of the pump head and snap into place.
- 3 Place the other end of the pharmed tubing assembly in the right side of the pump head and snap into place.
- 4 Replace the tubing clip.
- 5 Connect a length of neoprene tubing to the top barbed fitting on the right side and place the other end in a reservoir.
- 6 Connect a length of neoprene tubing to the top barbed fitting on the left side to the rinse station.
- 7 Repeat steps 5 and 6 for the bottom set of fittings.

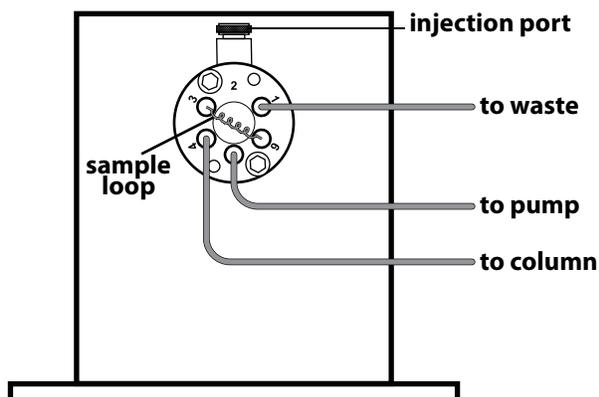
GX Direct Injection Module Plumbing (Optional)

This section will take you through the steps for plumbing the GX Direct Injection Module.

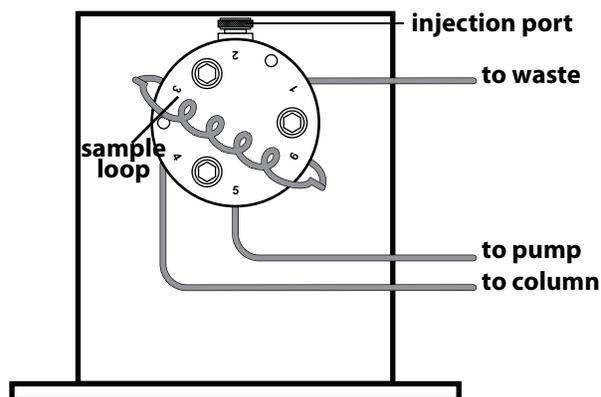
Before making the tubing connections, locate the Plumbing Package for the GX Direct Injection Module (part number 26035470) which contains the following:

Part number	Description
4903180411	MZN1PK nut (5)
4903180511	ZF1PK ferrule (5)
495033	Teflon tubing, 0.020" ID x 1/16" OD, 10 ft/pk

The following table and diagram provide detailed information about making plumbing connections for the GX Direct Injection Module.



GX Direct Injection Module for 1/16" OD Sample Loop



GX Direct Injection Module for 1/8" OD Sample Loop

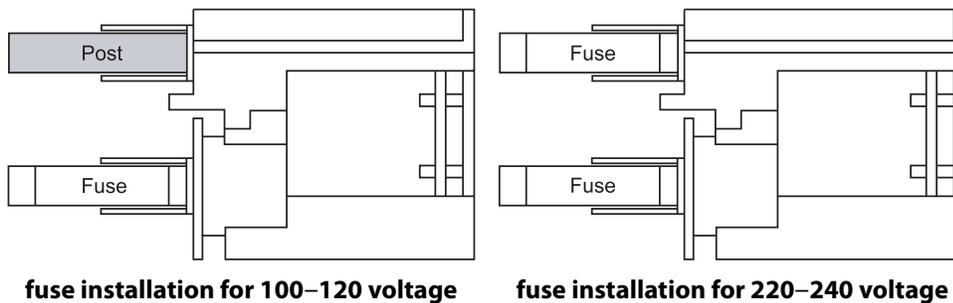
GX Direct Injection Module	Tubing	Connections
Port 1 to waste	Teflon tubing, 0.020" ID x 1/16" OD (part number 495033)	Use an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511) to connect the tubing to port 1 on the valve.
Port 2= injection port	N/A	One of the following: Injection port for 1.3 mm OD probe (part number 26035410) Injection port for 1.3 mm OD probe, SS (part number 26035412) Injection port for 1.5 mm OD probe (part number 26035411) Injection port for 1.5 mm OD probe, SS (part number 26035413)
Port 3 to port 6	sample loop (ordered separately)	
Port 4 to column		Use an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511) to connect the tubing to port 4 on the valve.
Port 5 to pump		Use an MZN1PK 1/16" nut (part number 4903180411) and a ZF1PK 1/16" ferrule (part number 4903180511) to connect the tubing to port 5 on the valve.

Final Rear Panel Connections

Fuses

You received the liquid handler without any fuses installed. To install the fuses:

- 1 Locate the accessory package containing the fuse drawer appropriate for your line voltage.
- 2 Locate the accessory package containing the 5.0A "T" Slo-Blo fuse (5 x 20 mm size) fuses.
- 3 Install the fuse(s) into the fuse drawer. The fuse drawer for 100–120V accepts one fuse. The fuse drawer for 220–240V accepts two fuses.
- 4 Insert the fuse drawer into its receptacle in the liquid handler. Refer to [Rear Panel Connections](#) on page 2-17 for the location of the fuse drawer.



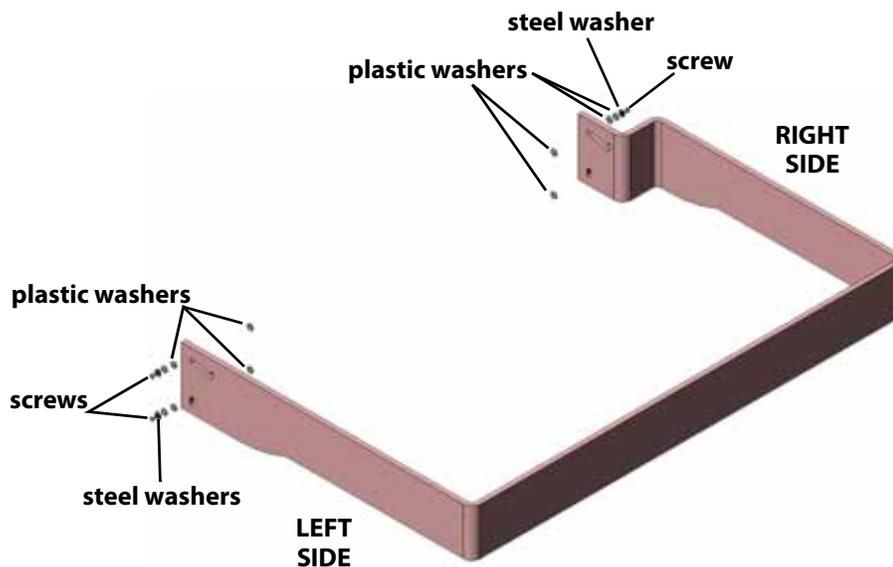
Power Cord Connection

Locate the appropriate power cord for your line voltage.

Use the power cord to connect the liquid handler to a power source.

Shield Installation

To install the shield:



- 1 Locate the GX-281 Shield Kit (part number 26037751).
- 2 Mount the right side of the shield to the right support of the liquid handler using the Phillips screws, steel washers, and plastic washers as shown in the diagram.
- 3 Mount the left side of the shield to the left support of the liquid handler using the Phillips screws, steel washers, and plastic washers as shown in the diagram.

Final Z-Arm Height Adjustment

Follow these steps to adjust the Z-arm to the proper height.

- 1 While holding on to the Z-arm, use the supplied 5/32" T-handled Allen wrench to loosen the mounting screw on the Z-arm mounting bracket until the Z-arm can slide up and down.
- 2 Slide Z-arm and adjust to proper height. Refer to the scale on the side of the Z-arm and set the clamp height to 125, 175, or 210.



The clamp height will be used in the GX-281 Offset Utility described on [page 3-5](#) and in the controlling software.

- 3 Tighten the mounting screw on the Z-arm mounting bracket so the Z-arm is secure.
- 4 Refer to [Z-Arm Fine Adjust](#) for a more precise adjustment.

Z-Arm Fine Adjust

- 1 Locate one of the Z-height adjustment tools that was shipped with the liquid handler. Refer to the table for part numbers.
- 2 Using the T-handled Allen wrench slightly loosen the mounting screw.

<i>Part Number</i>	<i>Height</i>
25051094	125
25051095	175
95260007	210



If the Z-arm mounting screw is loosened too far, the Z-arm could fall while performing the fine adjustment.

- 3 Place the Z-height adjustment tool under the Z-arm. Then place the Allen wrench in the screw on the top left side of the Z-arm. Turn clockwise to lower or counterclockwise to raise the Z-arm.
- 4 While holding the adjustment tool in place, slide the Z-arm off the Z-height adjustment tool. Ensure that the bottom of the Z-arm lightly rubs against the adjustment tool as it moves. Continue the fine adjustment until this is true.
- 5 Tighten the Z-arm mounting bracket so the Z-arm is secure.



Unit ID Selection—GX-281 Liquid Handler

The unit ID identifies each instrument to Gilson software packages that can issue GSIOC commands to the instrument. There is no need to change this number unless it is the same as that assigned to another Gilson instrument that's also connected along the GSIOC.

The unit ID on the GX-281 Liquid Handler is set using the front panel of the instrument. At the factory, Gilson set the unit ID to 25.

To change the unit ID:

- 1 Make sure the liquid handler is connected to a power source.
- 2 Turn on the liquid handler using the power switch located on the rear panel.
Do **NOT** press the ON/OFF button on the front panel.
- 3 Press and hold the STOP button.
- 4 While still holding the STOP button, press and hold the ON/OFF button until the indicator light turns green.
- 5 Release the ON/OFF button. DO NOT release the STOP button.
- 6 The unit ID appears on the display. The unit ID will change while you are holding down the STOP button.
- 7 When the unit ID reaches the desired number release the STOP button.

Note: If you only want to confirm the unit ID, release the STOP button as soon as the unit ID appears on the display.

GX-281 Offset Utility

Run the GX-281 Offset Utility before operating the GX-281 under routine software control.

Refer to [GX-281 Offset Utility](#) on page 3-5 for more information.

Both TRILUTION® LC Software and TRILUTION® LH Software provide programmed control of the GX-281 Liquid Handler.

This chapter provides the following information:

- A description of the **Front Panel** of the liquid handler
- How to **Start Up** the liquid handler
- An overview of the **GX-281 Utility Programs**
- How to use the **GX-281 Offset Utility**
- **Aspirate and Dispense Sequences**

Front Panel

The front panel of the liquid handler contains an ON/OFF button, a STOP button, a two-line display, and a power indicator light.



ON/OFF Button

The ON/OFF button is active when the rear panel power switch is ON.

STOP Button

The STOP button can be used to stop the liquid handler from responding to any more commands coming from the running program. This button also relaxes the motors for the XYZ-arm so that you can easily lift the probe and move the arm.

In a situation where an emergency stop is required, pressing the STOP button immediately stops the liquid handler.

Display

The two-line display shows the current status of the liquid handler and any error codes as they are encountered. Your program can also contain instructions for showing messages of up to two lines of 40 characters each on the display when the program is run. Refer to [Chapter 5, Troubleshooting](#) for a list of current error codes and required actions.

Power Indicator Light

The indicator becomes lit when you turn on power to the liquid handler using the power switch located on the rear panel. When the ON/OFF button is pressed, the indicator light turns green.

Start Up

To start the liquid handler:

- 1 Make sure the liquid handler is connected to a power source.
- 2 Turn on the liquid handler using the power switch located on the rear panel. Refer to **Rear Panel Connections** on page 2-17 for the location of this switch. The power indicator light on the front panel illuminates.

After the power is turned on, press the ON/OFF button. The liquid handler beeps and displays the current version of its installed firmware.

GX-281 Utility Programs

The GX-281 Utility Programs CD (part number 21067527) contains the following utility programs:

- **GX-281 Offset Utility**—refer to [GX-281 Offset Utility](#) on page 3-5
- **GSIOC Configuration Editor**—refer to [Appendix D, GSIOC Configuration Editor](#)
- **GSIOC Utility**—refer to [Appendix E, GSIOC Utility](#)

Install GX-281 Utility Programs

- 1 Insert the CD into the CD-ROM drive.
- 2 If the file does not start automatically, browse for SETUP.EXE on the CD.
- 3 Follow the on-screen instructions to install the utility programs.

GX-281 Offset Utility

It is recommended to run this utility at the time of installation and any time a change is made to the Z-arm, such as installing a different probe, installing a different guide foot assembly, or changing the clamp height.

The GX-281 Offset Utility is supplied on the GX-281 Utility Programs CD located in the GX-281 Offset Utility Kit (part number 264976).

The following components are included in the kit:

- GX-281 Utility Programs CD
- GX-281 offset tool
- 8-32 x 5/8 steel socket head set screw
- GX-281 Offset Utility Kit Instructions

Before You Begin

- 1 Ensure that plumbing and electrical connections have been made as described in [Chapter 2, Installation](#).
- 2 Ensure that the GX-281 Utility Programs have been installed. Refer to [Install GX-281 Utility Programs](#) on page 3-4 for instructions.
- 3 Remove all racks from the locator plate.
- 4 Place the offset tool on an empty rinse station location or remove a rinse station and put the offset tool in its place.

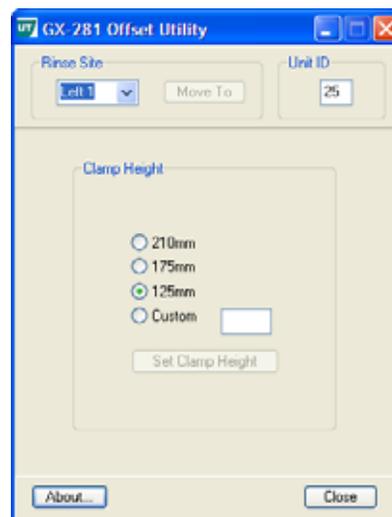
Start the GX-281 Offset Utility

Click **Start > All Programs > Gilson Applications > GX-281 Liquid Handler > GX-281 Offset Utility**.

The GX-281 Offset Utility window will appear.

Set the Clamp Height

Select the Clamp Height and then click **Set Clamp Height**.



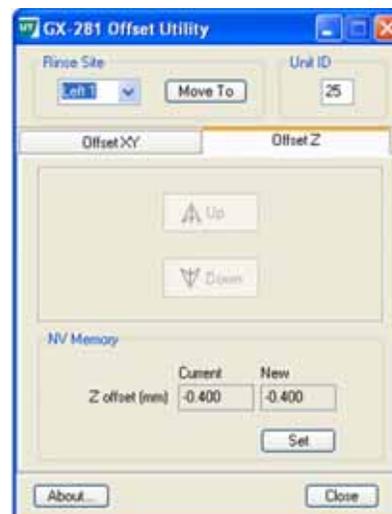
Set XY Offset

- 1 Select the Rinse Site where the offset tool is located and then click **Move To**.
- 2 The arm will move to that location with the Z at the top and relaxed.
- 3 Manually move the Z-arm down and align the probe to the center of the offset tool using the arrow keys.
- 4 When the probe is centered, click **Set** to save the XY offset.



Set Z Offset

- 1 Select the Offset Z tab.
- 2 Click **Move To**.
- 3 Use the arrows to align the tip of the probe with the top of the offset tool.
- 4 When the probe is aligned, click **Set** to save the Z offset.



Close Utility and Remove Tool

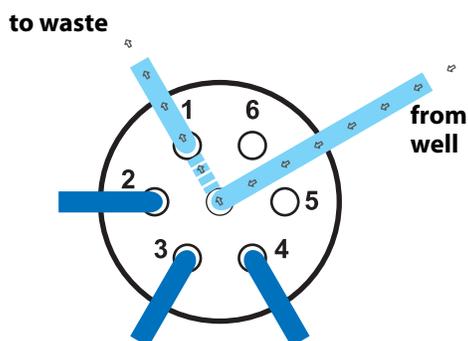
Close the software and then remove and store the offset tool. Replace the rinse station if necessary.

Aspirate and Dispense Sequences

Aspirating Fluid from a Well

Aspirate sequence:

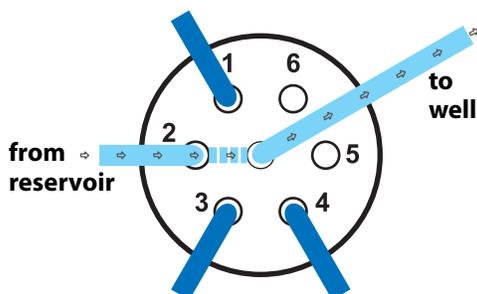
- 1 The selection valve on the solvent system switches to waste (position 1)
- 2 The solvent system starts moving, aspirating fluid from the well. The fluid in the transfer tubing is dispensed to waste.



Dispensing Fluid to a Well

Dispense sequence:

- 1 The selection valve switches to reservoir (positions 2–6).
- 2 The solvent system starts moving, dispensing fluid to the well. The fluid is aspirated from reservoir.



To obtain optimum performance and maximum life from the GX-281 Liquid Handler, it is important to keep the instrument well-maintained.

The GX-281 Liquid Handler is intended to be used in a laboratory environment by trained technical personnel.

This chapter contains the following information to help you maintain your liquid handler.

- **Helpful Hints**
- **Cleaning**
- **Replacing Parts**
- **Transporting the Liquid Handler**

Helpful Hints

To keep your liquid handler at peak performance, it is recommended that you do the following:

- Change or clean the tubing regularly to maintain maximum performance.
- Flush the probe and rinse stations daily with distilled or deionized water. On a weekly basis, flush these instruments with a 10% solution of bleach or weak detergent.
- Check periodically to ensure that all fittings are tight.
- Wipe up all spills immediately.
- Warm fluids to room temperature before running them through the system; cold fluids may cause leakage.

Cleaning

Cleaning the Liquid Handler

The liquid handler should be cleaned occasionally using a dry, clean cloth. Or, if necessary, use a cloth dipped in soapy water. If liquid is accidentally spilled on the liquid handler, wipe the instrument using a dry, clean cloth.

Cleaning the Fluid Path

Depending upon your use of the liquid handler, it may be necessary to flush the entire fluid path.

It's important to clean the fluid path if you won't be using the liquid handler for a while or if you're using a solution with a high salt concentration for a probe wash or as a diluent. Refer to the following instructions.

⚠ CAUTION To prevent injury, observe good laboratory practices when handling solvents. Know the physical and chemical properties. Refer to the Material Safety Data Sheets for the solvents used.

- 1 Prime the fluid path with distilled or deionized water.
- 2 Flush the fluid path with 30% ethanol. The fluid path has now been cleaned appropriately for weekend storage (or longer).
- 3 Prime and flush the fluid path with distilled or deionized water before running applications.

Cleaning Methods

Depending on the samples or reagents that come into contact with the fluid path, you may need to vary your cleaning methods accordingly. Use the following cleaning protocols as references and make any changes to them as required for the samples and reagents being pumped for your application.

Proteins and peptides

Follow this procedure if the fluid path is in contact with proteins and peptides.

CAUTION To prevent injury, observe good laboratory practices when handling solvents. Know the physical and chemical properties. Refer to the Material Safety Data Sheets for the solvents used.

- 1 Prime the fluid path with distilled or deionized water.
- 2 Flush the fluid path using a weak detergent solution.
- 3 Pause the priming sequence.
- 4 After 30 minutes, resume flushing and priming the fluid path using distilled or deionized water to pump the remaining detergent from the tubing into a waste container.
- 5 When you're satisfied that the entire fluid path has been flushed with water, end the priming sequence.

Acidic compounds, basic compounds, or salt solutions

Follow this procedure if the fluid path is in contact with acidic compounds, basic compounds, or salt solutions.

CAUTION To prevent injury, observe good laboratory practices when handling solvents. Know the physical and chemical properties. Refer to the Material Safety Data Sheets for the solvents used.

- 1 Prime the fluid path with distilled or deionized water.
- 2 Flush the fluid path using a 0.1N NaOH solution.
- 3 Pause the priming sequence.
- 4 After 10 minutes, resume priming the fluid path using distilled or deionized water. Prime until the fluid path has been flushed with water.
- 5 Pause the priming sequence.
- 6 Prime the fluid path using a 0.1N HCl solution.
- 7 Pause the priming sequence.
- 8 After 10 minutes, resume priming the fluid path using distilled or deionized water.

Biological fluids

Follow this procedure if the fluid path is in contact with biological fluids such as blood products.

CAUTION To prevent injury, observe good laboratory practices when handling solvents. Know the physical and chemical properties. Refer to the Material Safety Data Sheets for the solvents used.

- 1 Prime the fluid path with distilled or deionized water.
- 2 Make a solution of 10% bleach by adding one part of commercial bleach to nine parts of water.
- 3 Flush the fluid path using the bleach solution.
- 4 Pause the priming sequence.
- 5 After 30 minutes, resume priming the fluid path using distilled or deionized water to pump the remaining bleach solution from the tubing into a waste container.

Replacing Parts

Replacing Tubing

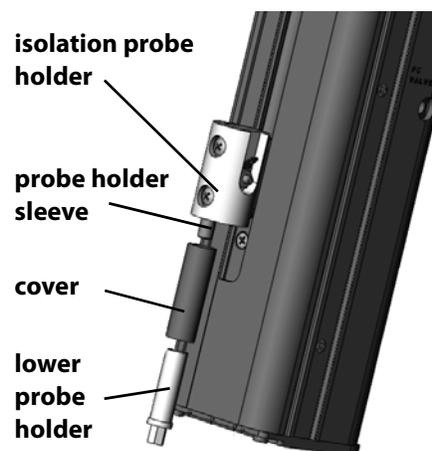
It is important to keep all tubing clean and free of crimps. Tubing that has become dirty, blocked, or crimped can result in poor accuracy and precision, or loss of air gap.

Replace both the transfer tubing and inlet tubing as needed. See [Appendix A, Replacement Parts and Accessories](#) for part numbers for replacement tubing. For tubing installation procedures, see [Chapter 2, Installation](#).

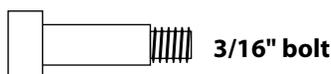
Replacing the Probe

To install a replacement probe:

- 1 Remove the transfer tubing's fitting connected to the top of the isolation probe holder.
- 2 Grasp the current probe and push it up through the top of the isolation probe holder.
- 3 Replace the lower probe holder. (Skip this step if the outer diameter of the replacement probe is the **same** as the probe that was originally installed.)
 - a) Remove the lower probe holder by placing the smaller end of the 1/4" socket over the bottom of the lower probe holder. Rotate the 1/4" socket counterclockwise to loosen. Then remove the 1/4" socket.
 - b) Separate the current lower probe holder from the lower probe holder cover. Place the lower probe holder cover over the new lower probe holder.
 - c) Place the smaller end of the 1/4" socket over the bottom of the lower probe guide. Then place this assembly at the bottom of the probe holder sleeve.
 - d) Rotate the 1/4" socket clockwise to tighten. Then remove the 1/4" socket.



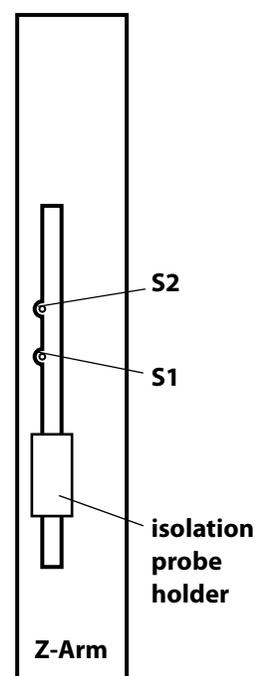
- 4 Replace the probe guide insert. (Skip this step if the outer diameter of the replacement probe is the **same** as the probe that was originally installed.)
 - a) Remove the probe guide cover by loosening the two Phillips screws on the bottom of the guide foot.
 - b) Remove the current probe guide insert and replace with the new probe guide insert. Then re-install the probe guide cover.
- 5 Install the new probe by pushing it through the top of the isolation probe holder. Make sure the tip of the probe sits inside the probe guide.
- 6 Replace and tighten the fitting.
- 7 Set the Z travel height. (Skip this step if the length of the replacement probe is the **same** as the probe that was originally installed.)
 - a) Push the isolation probe holder down as far as it will go.
 - b) Locate the 3/16" bolt that was included with the Z-arm. (If the Z travel height was set for 125 mm or 175 mm probes, the bolt is installed in either the S1 or S2 holes.



- c) Place the bolt on the supplied 3/32" Allen wrench and insert into the proper hole on the Z-arm. Turn clockwise to tighten.
 - S1 for 125 mm probes
 - S2 for 175 mm probes
 - No bolt installed for 210 mm probes

Note: Store the bolt in the right side bracket hole on the back of the liquid handler for future use.

- 8 Run the GX-281 Offset Utility. Refer to [GX-281 Offset Utility](#) on page 3-5 for instructions.



Replacing a Fuse

A blown fuse may indicate the existence of another problem in the instrument. If the replacement fuses blow, do not try additional fuses. Contact your Gilson-authorized representative. See [Before Calling Us](#) on page 5-9.

To replace a fuse:

- 1 Disconnect the power cord from the power outlet and from the rear panel receptacle.
- 2 Locate the fuse drawer on the rear panel. See [Rear Panel Connections](#) on page 2-17 if necessary.
- 3 Insert a small screwdriver into the notch under the fuse drawer.
- 4 Using the screwdriver, lift up to remove the fuse drawer. The fuse drawer contains one 5.0A "T" Slo-Blo fuse (5 x 20 mm size) for a 100–120 voltage selection. It contains two 5.0A fuses for a 220–240 voltage selection.
- 5 Remove the old fuse(s) and insert the new fuse(s).
- 6 Insert the fuse drawer into its receptacle in the liquid handler.
- 7 Connect the power cord.

Transporting the Liquid Handler

When moving the liquid handler to another location or when sending it back to the factory, **do not** use the Y-arm as a handle. Always lift the liquid handler from the base.

This chapter provides information about the following topics:

- **Error Messages**
- **Mechanical** and **Electrical** Troubleshooting
- **Repair and Return Policies**

Error Messages

Error	Error Text	Solution
10	unknown buffered command	An unknown command was sent. Clear the error by sending the buffered e command using the GSIOC Utility. Send a known legal command. (Correct the error in the program controlling the instrument.)
11	S buffer overflow	The S command buffer is full (up to 21 commands can be in the buffer). Clear the error by sending the buffered e command using the GSIOC Utility. Wait for some of the commands to execute before sending another. (Correct the error in the program controlling the instrument.)
12	safety contact closed	The safety contact was closed. Release contact; restart.
14	no pump configured	Attempt to use solvent system when not configured. Check NVM location 5.
15	stop key pressed	The front panel "STOP" key was pressed. Clear the error by sending the buffered e command using the GSIOC Utility.
16	invalid command parameter	A numerical parameter was out of range. Clear the error by sending the buffered e command using the GSIOC Utility. Then, enter a numerical parameter within the range. (Correct the error in the program controlling the instrument.)
17	invalid bar code angle	An invalid scan angle was specified. Enter a valid angle. The angle can be from 5 to 36. (Correct the error in the program controlling the instrument.)
18	S command while unhomed	A buffered S command was sent when the instrument was not homed. Clear the error by sending the buffered e command using the GSIOC Utility. Send a buffered H command to home the instrument. Resend the buffered S command. (Correct the error in the program controlling the instrument.)
19	Direct Inject missing	Attempt to use a GX Direct Injection Module that is not available. Check the unit ID of the GX Direct Injection Module and make sure it is powered ON.

Error	Error Text	Solution
20	pump missing	Attempt to use a solvent system that is not available. Check the unit ID of the solvent system and make sure it is powered ON.
21	no Direct Inj configured	Attempt to use a GX Direct Injection Module with no speed setting configured. Check NVM locations 11 and 12.
22	Z Inject missing	Attempt to use a GX Z Injection Module that is not available. Check the connections to the GX Z Injection Module.
101	XY invalid command	An invalid XY command was received. Send a known legal command. (Correct the error in the program controlling the instrument.)
102	XY invalid NVM address	Attempt to write to an NVM address that doesn't exist. (Correct the error in the program controlling the instrument.)
103	X homing error	Home failed on the X-axis. Clear the error by sending the buffered e command using the GSIOC Utility. Check for obstructions. Check encoders.
104	Y homing error	Home failed on the Y-axis. Clear the error by sending the buffered e command using the GSIOC Utility. Check for obstructions. Check encoders.
105	XY target out of range	A command was sent to set the XY position outside of the valid range. Resend the command with coordinates inside the range. (Correct the error in the program controlling the instrument.)
106	X stall or jam	XY motion measured by encoders does not match requested motion. Check for a jammed arm, bad encoder. Check cabling.
107	Y stall or jam	Motion measured by encoders does not match requested motion. Check encoder cabling.
108	XY moved while unhomed	Attempt to move to an XY location before completing the homing sequence. Send the buffered H command. (Correct the error in the program controlling the instrument.)

Error	Error Text	Solution
109	XY move while busy	Attempt to move to an XY location while XY is still in motion. Wait for the current commands to execute before sending another. (Correct the error in the program controlling the instrument.)
110	Park location invalid	Attempt to move to a configured park location that is out of the allowed XY ranges. Check NVM locations 6 and 7.
201	Z invalid command	An invalid Z command was received. Send a known legal command. (Correct the error in the program controlling the instrument.)
202	Z invalid NVM address	Attempt to write to an NVM address that doesn't exist. (Correct the error in the program controlling the instrument.)
203	Z homing error	Home failed on the Z-axis. Clear the error by sending the buffered e command using the GSIOC Utility. Check for obstructions. Check encoders.
204	Z move while unhomed	Attempt to move to a Z location before completing the homing sequence. Send the buffered H command. (Correct the error in the program controlling the instrument.)
205	Z move while busy	Attempt to move to a Z location while Z is still in motion. Wait for the current commands to execute before sending another. (Correct the error in the program controlling the instrument.)
206	Z stall or jam	Z motion measured by encoders does not match requested motion. Check for free operation of axis, check encoder.
207	Z target out of range	A command was sent to set the Z position outside of the valid range. Resend the command with coordinates inside the range. (Correct the error in the program controlling the instrument.)
208	Z speed invalid	The specified Z speed is outside of the valid range. (Correct the error in the program controlling the instrument.)
209	invalid LED blink rate	The specified blink rate is outside the range. The valid range is from 0 to 10. (Correct the error in the program controlling the instrument.)

Error	Error Text	Solution
210	unknown bar code reader	A command was sent to a bar code reader that does not exist. (Correct the error in the program controlling the instrument.)
211	primary bar code failed	Internal bar code reader not communicating when used. Check Z-arm internal cabling.
212	invalid scan angle	The bar code reader received a command specifying an angle that was outside the range. The valid range is from 5 to 36, or 0 for the default angle setting. (Correct the error in the program controlling the instrument.)
301	pump invalid command	An invalid solvent system command was received. Send a known legal command. (Correct the error in the program controlling the instrument.)
302	pump invalid NVM address	Attempt to write to an NVM address that doesn't exist. (Correct the error in the program controlling the instrument.)
303	solvent valve homing error	Home failed on the solvent selector valve. Replace the valve.
304	pump move while unhomed	Attempt to move the solvent selection valve before it is homed. Send the buffered P command to home the solvent system. (Correct the error in the program controlling the instrument.)
305	pump move while busy	Attempt to pump or switch valve while pump or valve is still moving. Wait for the current commands to execute before sending another. (Correct the error in the program controlling the instrument.)
306	solvent valve jam	Valve motion measured by encoders does not match requested motion. Check encoder.
307	invalid aspirate volume	Aspirate volume is greater than tubing volume. Specify a volume to aspirate that is less than the tubing volume. (Correct the error in the program controlling the instrument.)
308	dispense from waste	The solvent system received a command to dispense from the assigned waste port. (Correct the error in the program controlling the instrument.)

Error	Error Text	Solution
309	aspirate not to waste	The solvent system received a command to aspirate to a port other than the assigned waste port. (Correct the error in the program controlling the instrument.)
310	invalid flow rate	The specified flow rate is outside the range. The valid range is from 0.001 to 25 mL/min. (Correct the error in the program controlling the instrument.)
311	invalid solvent valve port	The solvent system received a command to turn the valve to an invalid position. (Correct the error in the program controlling the instrument.)
401	Dir Inj invalid command	The GX Direct Injection Module received an invalid command. Send a known legal command. (Correct the error in the program controlling the instrument.)
402	Dir Inj invalid NVM addr	(Correct the error in the program controlling the instrument.)
403	Dir Inj switch while busy	The GX Direct Injection Module received a command that instructed it to move while it was in motion. (Correct the error in the program controlling the instrument.)
404	Dir Inj illegal position	The GX Direct Injection Module received a command that instructed it to go to an illegal position. (Correct the error in the program controlling the instrument.)

Mechanical

Probe No Longer Finding Tube Center

- Probe may be bent. Straighten or replace the probe.
- Liquid handler may be misaligned. Follow the procedure in [GX-281 Offset Utility](#) on page 3-5.

Electrical

Input Functions Not Operating

- Make sure connections into terminal block connector are secure.
- Make sure terminal block connector is secure in input/output port.
- Check connections for proper pin assignments.
- Be sure pins from external devices are assigned correctly.
- Check polarity of input. Inputs should be a contact closure. If not, it must be TTL level (logic 0 activates).
- Confirm that source supplying input to liquid handler is working.

Output Functions Not Operating

- Make sure connections into terminal block connector are secure.
- Make sure terminal block connector is secure in the input/output port.
- Check connections for proper pin assignments.
- Output from liquid handler should be compatible with device to which it is interfaced. Outputs are contact closures.

Unit Not Operational

- Make sure power is turned on.
- Check power cord connections.
- Try different outlet.
- Check fuses; replace if necessary.
- Check all liquid handler connections and make sure that the unit is plugged in.

Unit Blows Fuses

- Contact your Gilson-authorized representative.

Repair and Return Policies

Before Calling Us

Gilson-authorized representatives will be able to serve you more efficiently if you have the following information:

- the serial number and model number of the instruments involved. Refer to the table for the location of the serial number.

<i>Item</i>	<i>Serial Number Location</i>
GX-281 Liquid Handler	Inside the right support, near the top
Z-arm	Back side, at the top
GX Solvent System	Right side
GX Direct Injection Module	Right side
GX Z Injection Module	Bottom
GX Rinse Pump	Right side

- the installation procedure you used
- list of concise symptoms
- list of operating procedures and conditions you were using when the problem arose
- list of other devices connected to the liquid handler and a description of those connections
- list of other electrical connections in the room

Warranty Repair

Units covered under warranty will be repaired and returned to you at no charge. If you have any questions about applicability, please contact your local distributor.

Non-Warranty Repair

For out-of-warranty repairs, contact your local distributor. A Customer Service representative will discuss service options with you and can assist in making arrangements to return the equipment, if necessary.

Rebuilt Exchange

For some units, rebuilt exchange components are available. Contact your local distributor for details.

Return Procedure

Contact your local distributor's Customer Service Department to obtain authorization before returning any Gilson equipment. To return a piece of equipment:

- Carefully pack the unit to prevent damage in transit. Check with your distributor regarding proper method of shipment. No responsibility is assumed by Gilson or your distributor for damage caused by improperly packaged instruments. Indicate the authorization on the carton and on the packing slip.
- Always insure for the replacement value of the unit.
- Include a description of symptoms, your name, address, phone number, and purchase order to cover repair costs, return and shipping charges, if your institution requires it.

Unit End-of-Life



When a unit reaches the end of its useful life, refer to www.gilson.com for directions and information about the end-of-life policy. This is in accordance with the European Union Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Replacement Parts and Accessories

A

Part Number Description

261030	GX-281 Liquid Handler with GX Prep Solvent System
261031	GX-281 Liquid Handler with GX Prep Solvent System and bar code reader
261032	GX-281 Liquid Handler with GX Analytical Solvent System
261033	GX-281 Liquid Handler with GX Analytical Solvent System and bar code reader

Probes (125 mm)

Part Number Description

2507234	Septum-piercing probe; side-entry, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, entry hole center is 3.5 mm from tip).
2507235	Septum-piercing probe; side-entry, vented, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, entry hole center is 3.5 mm from tip).
2507236	Septum-piercing, short pencil-point probe; vented at 14 mm, side-entry, vented at 72 mm, capacitive level sensing, stainless steel. Dimensions: 272 x 1.8 x 0.8 mm ID. Note: This probe is not compatible with the GX-Direct Injection Module.
2507237	Septum-piercing, pencil-point probe; vented at 72 mm, side-entry, capacitive level sensing, stainless steel. Dimensions: 273 x 1.8 x 0.8 mm ID.

Probes (125 mm) (Continued)

Part Number	Description
2507244	Septum-piercing probe; deflected tip, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole).
2507245	Septum-piercing probe; deflected tip, vented, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole).
2507242	Septum-piercing probe; deflected tip, capacitive level-sensing, stainless steel with Teflon-coated liquid path, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole).
2507243	Septum-piercing probe; deflected tip, vented, capacitive level-sensing, stainless steel with Teflon-coated liquid path, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions 12 x 1.3 mm OD, bevel cut entry hole).
27067361	Non septum-piercing probe; bevel tip, capacitive level-sensing, stainless steel. Dimensions: 220.5 x 1.5 x 1.1 mm ID.
2507414	Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 220 x 1.3 x 0.8 mm ID (tip dimensions: 1.5 x 0.9 x 0.46 mm ID).
27067373	Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID (tip dimensions: 2 x 1.1 x 0.4 mm ID).
27067374	Non septum-piercing probe; constricted bevel tip, capacitive level-sensing, stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID (tip dimensions: 2 x 1.1 x 0.4 mm ID).
2507252	Micro septum-piercing probe; constricted 45° bevel tip, capacitive level-sensing, stainless steel. Dimensions: 220 x 1.5 x 1.1 mm ID (tip dimensions: 10 x 0.7 x 0.4 mm ID).
2507256	Beveled-tip probe, stainless steel, grooved septum-piercing; 221 x 1.5 x 0.4 mm ID.
27067375	Non-septum-piercing probe: beveled-tip, Teflon-coated stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID.
251646	Inert gas probe assembly (for maintaining an inert atmosphere inside sealed vessel), beveled tip, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID.

Probes (125 mm) (Continued)

Part Number	Description
27067382	Bevel tip probe, stainless steel, grooved septum piercing; 221 x 2.0 x 0.8 mm ID (tip dimensions: 2.1 x 1.5 x 0.8 mm ID, 100 µL volume).
270673821	Bevel tip probe, coated stainless steel, grooved septum piercing; 221 x 2.0 x 0.8 mm ID (tip dimensions: 2.1 x 1.5 x 0.8 mm ID, 100 µL volume).
27067383	Probe, septum-piercing, 221 x 1.5 x 0.4 mm, bevel tip, grooved, 28.73 µL volume
270673831	Probe, septum-piercing, coated, 221 x 1.5 x 0.4 mm, bevel tip, grooved, 28.73 µL volume

Probes (175 mm)

Part Number	Description
2507214	Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 269 x 1.8 x 1.4 mm ID (tip dimensions: 1.5 x 1.2 x 0.79 mm ID).
2507215	Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 269 x 1.3 x 0.8 mm ID (tip dimensions: 1.5 x 0.9 x 0.46 mm ID).
2507216	Non septum-piercing probe, bevel tip, capacitive level sensing, stainless steel. Dimensions: 269 x 1.5 x 1.1 mm ID (tip dimensions: 1.6 x 1.2 x 0.79 mm ID).
2507253	Micro septum-piercing probe; constricted 45° bevel tip, capacitive level sensing, stainless steel. Dimensions: 269 x 1.5 x 1.1 mm ID (tip dimensions: 10 x 0.7 x 0.4 mm ID).
2507254	Non septum-piercing probe; flat tip, capacitive level-sensing, stainless steel. Dimensions: 269 x 1.8 x 1.4 mm ID.
2507255	Non septum-piercing probe, bevel tip, capacitive level sensing, stainless steel. Dimensions: 269 x 1.5 x 0.4 mm ID.
2507555	Inert non septum-piercing probe; Teflon-covered stainless steel. Dimensions: 269 x 2.7 x 0.8 mm ID (tip dimensions: 5 x 1.5 mm OD).
25075551	Non septum-piercing probe; straight tip. Dimensions: 256.6 x 2.7 x 0.8 mm ID.
25073645	Non septum-piercing probe; beveled tip, capacitive level-sensing, stainless steel. Dimensions: 269 x 1.3 x 0.8 mm ID.

Probes (210 mm)

Part Number	Description
26037001	Septum-piercing probe; bevel tip, grooved, stainless steel. Dimensions 301.3 x 2.0 x 0.8 mm ID (tip dimensions: 2.1 x 1.5 x 0.8 mm ID)
260370011	Septum-piercing probe; bevel tip, grooved, stainless steel inert probe with non-metallic coating. Dimensions 301.3 x 2.0 x 0.8 mm (tip dimensions: 2.1 x 1.5 x 0.8 mm ID).
26037002	Septum-piercing probe; bevel tip, grooved. Dimensions 304 x 1.5 x 0.4 mm.
260370021	Septum-piercing probe; coated. Dimensions 301.3 x 1.5 x 0.4 mm.
26037003	Micro septum-piercing probe. Dimensions 304 x 1.5 x 0.4 mm.
26037004	Angled tip probe. Dimensions 304 x 1.5 x 0.4 mm.
26037005	Non septum-piercing, beveled-tip probe. Dimensions 304 x 1.5 x 1.1 mm.
26037006	Straight tip probe. Dimensions 304 x 2.4 x 1.8 mm.
26037007	Straight tip probe. Dimensions 304 x 1.8 x 1.4 mm.

Guide Foot Assemblies, Probe Guide Inserts, and Lower Probe Holders

Part Number	Description
26036197	Guide foot assembly for 1.3 mm OD probes
26036198	Guide foot assembly for 1.5 mm OD probes
26036199	Guide foot assembly for 1.8 mm OD probes
26036200	Guide foot assembly for 2.3 mm OD probes
26036201	Guide foot assembly for 2.7 mm OD probes
2603614215	Probe guide insert, 3-way, for 1.3 mm outer diameter probes
2603614216	Probe guide insert, 3-way, for 1.5 mm outer diameter probes
2603614217	Probe guide insert, 3-way, for 1.8 mm outer diameter probes
2603614218	Probe guide insert, 3-way, for 2.3 mm outer diameter probes
2603614219	Probe guide insert, 3-way, for 2.7 mm outer diameter probes
2603614111	Lower probe holder for 1.3 mm outer diameter probes

Guide Foot Assemblies, Probe Guide Inserts, and Lower Probe Holders (Continued)**Part Number Description**

2603614112	Lower probe holder for 1.5 mm outer diameter probes
2603614113	Lower probe holder for 1.8 mm outer diameter probes
2603614114	Lower probe holder for 2.7 mm outer diameter probes

Transfer Tubing for GX Analytical Solvent System**Part Number Description**

49963972	Transfer tubing 500 μ L volume
49962872	Transfer tubing 1.1 mL volume
499671112	Transfer tubing 5.5 mL volume

Transfer Tubing for GX Prep Solvent System**Part Number Description**

499424013	Transfer tubing 1.1 mL volume
499471112	Transfer tubing 5.5 mL volume
499474103	Transfer tubing 10.5 mL volume
499483602	Transfer tubing 30 mL volume
499486002	Transfer tubing 50 mL volume

GX Solvent System and Accessories**Part Number Description**

261349	GX Analytical Solvent System
261350	GX Prep Solvent System
49962142	Solvent valve to pump tubing, analytical (Analytical)
49948122	Solvent valve to pump tubing, prep (Prep)
499484021	Solvent inlet tubing

GX Solvent System and Accessories (Continued)**Part Number Description**

490032	Waste tubing, 0.063" ID x 0.125" OD, PTFE, per ft (1/16" x 1/8")
490410332	P-331 nut, 1/4–28 PEEK
49041027	P-359, 1/8" ferrule

Rinse Pump, Rinse Stations, and Accessories**Part Number Description**

261352	GX Rinse Pump
26034552	Rinse station, GX 125 mm (Rinse station for outside rinse of probe)
26034551	Rinse station, GX 175 mm (Rinse station for outside rinse of probe)
26034553	Rinse station, GX 210 mm (Rinse station for outside rinse of probe)
26034554	Rinse station, GX 125 mm FC (Drain/rinse station for inside rinse of probe)
26034555	Rinse station, GX 175 mm FC (Drain/rinse station for inside rinse of probe)
26034556	Rinse station, GX 210 mm FC (Drain/rinse station for inside rinse of probe)
470331206	Tygon drain tubing, 3/16" ID x 5/16" OD, per foot
26035221	2.0 mm ID pharmed tubing assembly
47151870604	1/16" ID X 3/16" OD neoprene tubing, 4 ft/pkg

Low Mount Fraction Collection Package and Accessories**Part Number Description**

2604705	GX-Series Low Mount Fraction Collection package
26046114	Valve, 3-way, 200 mL PEEK 2xM3 TW
26037270	Plumbing package for the FC Valve (GX-271/GX-281)
49953029	Tubing, 0.030" x 20 ft, PEEK
25077422	Collection Tube, 1/8" TFE
25077423	Collection Tube, 1/16" TFE
49041012	Upchurch P-201 nut, flangeless, 1/16", 1/4-28, DELRIN® (ACETAL), black
49041011	Upchurch P-200R ferrule, flangeless, 1/16", TEFZEL® (ETFE), red

Low Mount Fraction Collection Package and Accessories (Continued)**Part Number Description**

F1410050	PVDF coupling for 1/4"-28 fitting, package of 5
49041015	Upchurch P-300 ferrule, flangeless, 1/8", TEFZEL® (ETFE), yellow
49041016	Upchurch P-304 nut, flangeless, 1/8", 1/4-28, DELRIN® (ACETAL), cream
490032	Waste tubing, 0.063" ID x 0.125" OD, PTFE, per ft (1/16" x 1/8")
26036143	Tube & wire routing strip, Z drive

Sample Loops for GX Direct Injection Module—Prep (1/16") and GX Z Injection Module**Part Number Description**

494400002	250 µL stainless steel sample loop (1/16" OD) for Valco valves
494400005	500 µL stainless steel sample loop (1/16" OD) for Valco valves
49440001	1 mL stainless steel sample loop (1/16" OD) for Valco valves
49440002	2 mL stainless steel sample loop (1/16" OD) for Valco valves
49440005	5 mL stainless steel sample loop (1/16" OD) for Valco valves

Sample Loops for GX Direct Injection Module—Analytical (1/16") Stainless Steel**Part Number Description**

49440003	2 µL stainless steel sample loop (1/16" OD) for Valco valves
49440004	5 µL stainless steel sample loop (1/16" OD) for Valco valves
49440006	10 µL stainless steel sample loop (1/16" OD) for Valco valves
49440007	20 µL stainless steel sample loop (1/16" OD) for Valco valves
49440008	50 µL stainless steel sample loop (1/16" OD) for Valco valves
49440009	100 µL stainless steel sample loop (1/16" OD) for Valco valves
494400002	250 µL stainless steel sample loop (1/16" OD) for Valco valves
494400005	500 µL stainless steel sample loop (1/16" OD) for Valco valves
49440001	1 mL stainless steel sample loop (1/16" OD) for Valco valves
49440002	2 mL stainless steel sample loop (1/16" OD) for Valco valves
49440005	5 mL stainless steel sample loop (1/16" OD) for Valco valves

Sample Loops for GX Direct Injection Module—Analytical (1/16") PEEK**Part Number Description**

49440011	2 µL PEEK sample loop (1/16" OD) for Valco valves
49440012	5 µL PEEK sample loop (1/16" OD) for Valco valves
49440013	10 µL PEEK sample loop (1/16" OD) for Valco valves
49440014	20 µL PEEK sample loop (1/16" OD) for Valco valves
49440015	50 µL PEEK sample loop (1/16" OD) for Valco valves
49440016	100 µL PEEK sample loop (1/16" OD) for Valco valves
49440017	250 µL PEEK sample loop (1/16" OD) for Valco valves
49440018	500 µL PEEK sample loop (1/16" OD) for Valco valves

Sample Loops for GX Direct Injection Module—Prep (1/8")**Part Number Description**

494400051	5 mL stainless steel sample loop (1/8" OD) for Valco valves
49440010	10 mL stainless steel sample loop (1/8" OD) for Valco valves
49440020	20 mL stainless steel sample loop (1/8" OD) for Valco valves
49440025	25 mL stainless steel sample loop (1/8" OD) for Valco valves

GX Direct Injection Module Accessories**Part Number Description**

261354	GX Direct Injection Module, 1/16" Prep
261355	GX Direct Injection Module, 1/8" Prep
261356	GX Direct Injection Module, 1/16" Analytical, Stainless Steel
261357	GX Direct Injection Module, 1/16" Analytical, PEEK
26035470	Plumbing package for the GX Direct Injection Module
490318041	Valco MZN1PK PEEK nut (0.062" long) for 1/16" OD tubing, package of 10
4903180411	Valco MZN1PK PEEK nut (0.062" long) for 1/16" OD tubing, 1 each
490318051	Valco ZF1PK PEEK ferrule (1/16"), package of 10
4903180511	Valco ZF1PK PEEK ferrule (1/16"), 1 each

GX Direct Injection Module Accessories (Continued)

Part Number	Description
495033	Teflon tubing, 0.023" ID x 0.062" (1/16") OD, package of 10 ft
26035410	Injection port assembly, GX Direct Injection Module, for 1.3 mm OD probes
26035411	Injection port assembly, GX Direct Injection Module, for 1.5 mm OD probes
26035412	Injection port assembly, GX Direct Injection Module, for 1.3 mm OD probes, stainless steel
26035413	Injection port assembly, GX Direct Injection Module, for 1.5 mm OD probes, stainless steel
250510153	Injection port seal for 1.3 mm OD probes
2954674	Injection port seal for 1.5 mm OD probes
26035457	GX-281 Direct Injection Module riser block assembly

GX Z Injection Module and Accessories

Part Number	Description
261353	GX Z Injection Module
26035370	Plumbing package for the GX Z Injection Module
36610101	Wrench, 5/16-1/4
490318041	Valco MZN1PK PEEK nut (0.062" long) for 1/16" OD tubing, package of 10
4903180411	Valco MZN1PK PEEK nut (0.062" long) for 1/16" OD tubing, 1 each
490318051	Valco ZF1PK PEEK ferrule (1/16"), package of 10
4903180511	Valco ZF1PK PEEK ferrule (1/16"), 1 each
49942142	Injection valve to probe tubing assembly
49953029	Tubing, 0.030" x 20 ft, PEEK
49041031	P-706 PEEK ZDV Union, 0.050 Thru Hole
490410654	Adptr, extra long 1/4-28 10-32, PEEK (P-654)
499474103	Transfer tubing assembly, 10.5 mL

Cables, Connectors, and Fuses**Part Number Description**

36083121	Serial cable, IBM PS/2-type, 25 to 25 pin
36083122	Serial cable, IBM AT-type, 9-pin female to 25-pin male
36083123	Serial cable adapter, 9-pin female to 25-pin male
638308512	Terminal block connector, 8-pin
638310512	Terminal block connector, 10-pin
6730504007	Fuse, 5.0 A T-5.0 slo-blo
709910206	2-conductor interconnect wire, 6', for making contact connections
36078143	Shielded GSIOC cable, 30"
25064040	Liquid Level Detection (LLD) cable

Z-Height Adjustment Tools**Part Number Description**

25051094	125 mm Z-height adjustment tool
25051095	175 mm Z-height adjustment tool
95260007	210 mm Z-height adjustment tool

Specifications Methods

B

This appendix contains information about the methods used to obtain the specifications listed in the **Technical Specifications** section in *Chapter 1, Introduction*.

System

GX-281 Liquid Handler

- 125 mm Z travel clamped at 125 mm
- Beveled-tip probe (part number 27067382), stainless steel, septum piercing; 221 x 2.0 x 0.8 mm ID, tip dimension 2.1 x 1.5 x 0.8 mm ID.
- Drain/Rinse Station for Inside Rinse of Probe (part number 26034554)
- Rinse Station for Outside Rinse of Probe (part number 26034552)

GX Prep Solvent System

- Volumetric Accuracy Transfer Tubing:
 - Transfer Tubing (part number 499483602) 30 mL, 0.085" x 1/8" x 360"
 - Transfer Tubing (part number 499474103) 10.5 mL, 0.062" x 1/8" x 204"
 - Transfer Tubing (part number 499424013) 1.1 mL, 0.030" x 1/16" x 87"
- Reproducibility Transfer Tubing
 - Transfer Tubing (part number 49942222) 3 mL, 0.030" x 1/16" x 261"

GX Z Injection Module

- Continuous flow Valco valve for 1/16" OD sample loops
- 2 mL stainless steel sample loop (part number 49440002)
- GX Z Injection Module plumbing package (part number 26035370)

GX Direct Injection Module for 1/8" OD Sample Loops

- Continuous flow Valco valve with a vertical direct connection for the injection port for 1/8" OD sample loops
- 10 mL stainless steel sample loop (part number 49440010)
- GX Direct Injection Module plumbing package (part number 26035470)

Volumetric Accuracy Method

Aspirate Rate

1 mL/min to 25 mL/min

Dispense Rate

1 mL/min to 25 mL/min

Rinse Volume

Inside 250 μ L; Outside 500 μ L

Liquid Transfer Method

DI Water and 50% Methanol:50% Water

- 1 Move Arm to Top
- 2 Aspirate 10 μ L or 50 μ L air gap at 1 mL/min from probe
- 3 Move Arm to Sample Location
- 4 Aspirate sample volume (100 μ L to 25 mL) at (1.0 mL/min to 25 mL/min)
- 5 Move Arm to Top
- 6 Move Arm to Target Location
- 7 Dispense sample volume (100 μ L to 25 mL) + $\frac{1}{2}$ of the air gap volume at (1.0 mL/min to 25 mL/min)
- 8 Move Arm to Top
- 9 Move Arm to Drain/Rinse Station GX-281
- 10 Dispense the remaining air gap
- 11 Rinse probe: dispense 250 μ L from reservoir at 10 mL/min
- 12 Move Arm to Rinse Station GX-281
- 13 Rinse probe: dispense 500 μ L from reservoir at 10 mL/min

Volumetric Accuracy Calculation

Percent accuracy = (dispensed weight/target weight) * 100

Volumetric accuracy data was obtained gravimetrically. A volume of deionized water was dispensed in a source tube and then transferred to a target tube.

All gravimetric data was obtained using a Sartorius AC 210P four-place balance.

Injection Reproducibility Method—GX Z Injection Module

HPLC Pump

322 Pump

- H2 Pump Head

Detector

UV/Vis Detector

- Wavelength: 254 nm
- Sensitivity: 0.01AU
- Peak Width: 0 sec

Column

- Phenomenex Luna 5u C18(2) 100A, 100 X 21.2mm, 5 micron

Mobile Phase/Rinse Solvent

- Isocratic 65% Methanol:35% Water
- Rinse Solvent 75% Methanol:25% Water

Flow Rate

- 15 mL/min

Rinse Volume

- The inside of the probe was rinsed with 1000 μ L from reservoir at 10 mL/min
- The outside of the probe was rinsed with 2000 μ L from reservoir at 10 mL/min

Injections

- Partial Loop injection. 750 μ L was injected into a 2 mL sample loop.
- Ten injections of 500 μ g/mL Methyl Paraben, Ethyl Paraben, Propyl Paraben in 70% Methanol:30% Water from two sample tubes.

Injection Method

Partial Loop Z Injection

- 1 Move Z to Top
- 2 Move to Drain/Rinse Station GX-281
- 3 Move Z to Z Option and Z Offset
- 4 Dispense the volume held by the transfer tubing at 10 mL/min.
- 5 Move Z to Top
- 6 Set the Z injection valve to Load
- 7 Wait 1.2 seconds for the valve to switch
- 8 Aspirate air gap 10 μ L at 1 mL/min
- 9 Move to Sample Well
- 10 Move Z to Z Option and Z Offset
- 11 Aspirate injection volume at 4 mL/min
- 12 Move Z to Top
- 13 Aspirate pull volume at 4 mL/min
- 14 Wait Injection Equilibration Time
- 15 Synchronize
- 16 Set the Z injection valve to Inject
- 17 Move Arm to Drain/Rinse Station GX-281
- 18 Dispense the volume held by the transfer tubing at 10 mL/min.
- 19 Rinse probe: dispense 1000 μ L from reservoir at 10 mL/min
- 20 Move Arm to Rinse Station GX-281
- 21 Rinse probe: dispense 2000 μ L from reservoir at 10 mL/min

Injection Reproducibility Calculation

CV = (Standard deviation for injection set/ Average area for injection set) * 100

Injection Reproducibility Method—GX Direct Injection Module for 1/8" OD Sample Loops

HPLC Pump

333 Pump

334 Pump

- H3 Pump Head

Detector

UV/Vis Detector

- Wavelength: 230 nm
- Sensitivity: 0.01AU
- Peak Width: 0 sec

Column

- Phenomenex Luna 10u C18(2) 100A, 50 X 50.0 mm, 10 micron

Mobile Phase/Rinse Solvent

- Gradient Methanol:Water
- Rinse Solvent 50% Methanol:50% Water

Flow Rate

- 75 mL/min

Rinse Volume

- The inside of the probe was rinsed with 300 μ L from reservoir at 4 mL/min
- The outside of the probe was rinsed with 450 μ L from reservoir at 10 mL/min

Injections

- Partial Loop injection. 5000 μL was injected into a 10 mL sample loop.
- Ten injections of 20 mg/mL Methyl Paraben, Ethyl Paraben, Propyl Paraben in 50% Methanol:50% Water from two sample tubes.

Injection Method

Partial Loop Direct Injection

- 1 Move Z to Top
- 2 Set the injection valve to Inject
- 3 Move to Drain/Rinse Station GX-281
- 4 Move Z to Z Option and Z Offset
- 5 Dispense the volume held by the transfer tubing at 10 mL/min.
- 6 Move Z to Top
- 7 Aspirate air gap 20 μL at 0.5 mL/min
- 8 Move to Sample Well
- 9 Move Z to Z Option and Z Offset
- 10 Aspirate injection volume + Extra Volume at 20 mL/min
- 11 Move Z to Top
- 12 Move to Injection Well
- 13 Move Z to Z Option and Z Offset
- 14 Dispense Extra volume at 15 mL/min
- 15 Set the injection valve to Load
- 16 Wait 1.2 seconds for the valve to switch
- 17 Dispense Injection volume at 15 mL/min
- 18 Wait Injection Equilibration Time
- 19 Synchronize
- 20 Set the injection valve to Inject
- 21 Rinse probe: dispense 300 μL from reservoir at 4 ml/min
- 22 Move Arm to Rinse Station GX-281

23 Move Z to Z Option and Z Offset

24 Rinse probe: dispense 450 μ L from reservoir at 10 mL/min

Injection Reproducibility Calculation

CV = (Standard deviation for injection set/ Average area for injection set) * 100

Materials*

Nitronic 60

Chemical resistance is similar to Type 316 stainless, but its resistance to galling and oxidation make it superior to Type 316 or 303 in the majority of applications.

Stainless steel, Type 316

This is the standard tubing material for chromatography, suitable for a wide variety of applications. It is cold drawn seamless, not welded, with close tolerances held on both ID and OD. Type 316 is most commonly used for HPLC because of its superior chloride ion resistance.

PAEK

Polyaryletherketone is the generic name for the family of polyketone compounds. PAEK includes PEK, PEEK, PEKK, and PEKEKK, which differ in physical properties and, to a lesser degree, in inertness.

A range of PAEK-based composites are used for valves and fittings. These composites resist all common HPLC solvents and dilute acids and bases. However, concentrated or prolonged use of halogenated solvents may cause the polymer to swell. Avoid concentrated sulfuric or nitric acids (over 10%).

PEEK

Considered relatively inert and biocompatible, polyetheretherketone tubing can withstand temperatures up to 100°C. Under the right circumstances, 0.005"–.020" ID tubing can be used up to 5000 psi for a limited time, and 0.030" to 3000 psi. Larger IDs are typically good to 500 psi. These limits will be substantially reduced at elevated temperatures and in contact with some solvents or acids.

Its mechanical properties allow PEEK to be used instead of stainless in many situations and in some environments where stainless would be too reactive. However, PEEK can be somewhat absorptive of solvents and analytes, notably methylene chloride, DMSO, THF, and high concentrations of sulfuric and nitric acid. This tubing is highly prone to "kinking," or sealing off, if held in a sharp bend over time.

Valcon H

This composite, a carbon fiber reinforced, PTFE lubricated inert engineering polymer, has long been the standard for typical HPLC applications in which pressures are around 5000 psi and temperatures are not more than 75°C.

* Information provided by Valco Instruments Company Inc.

GSIOC Configuration Editor

D

The GSIOC Configuration Editor enables you to modify COM (serial communications) port and baud rate information. Or, you can use this editor if incorrect information appears in the GSIOC Utility window.

- 1 Locate the GSIOC Configuration Editor (GSCONFIG.EXE) using Windows Explorer or the shortcut at **Start > Programs > Gilson Applications > Utilities > GSIOC Configuration Editor**. During installation, this editor was stored to C:\GILSON\UTIL unless the installation path was changed.
- 2 Start the editor. The GSIOC Configuration Editor window appears.

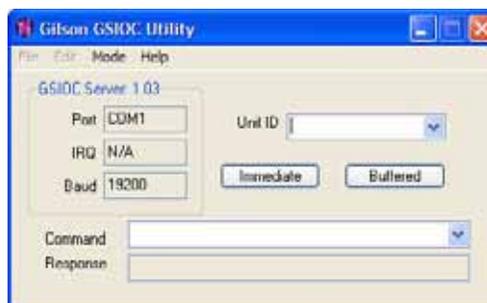


- 3 In the Port box, indicate the computer's serial communications port (COM) port to which the Gilson interface instrument (such as the liquid handler or 506C System Interface) is connected.
- 4 Click **19200** or **9600** to select the baud. The baud is the rate of data transmission between the computer and the Gilson instrument.
- 5 Click **OK** to save the changes. A message box appears indicating that the computer must be restarted before any changes become effective.

The GSIOC Utility allows you to issue commands to Gilson GSIOC instruments. Your Gilson-authorized representative may ask you to use this utility to verify that an instrument is connected correctly to the computer. For communication to occur, the Gilson instrument must be connected via an RS-232 connection to the computer or connected via a GSIOC connection to a Gilson interface instrument that is connected to the computer.

Start the GSIOC Utility

- 1 Locate the GSIOC Utility (GSUTIL32.EXE) using Windows Explorer or the shortcut at **Start > (All) Programs > Gilson Applications > Utilities > GSIOC Utility**. During installation, this utility was stored to C:\GILSON\UTIL unless the installation path was changed.
- 2 Start the utility. The GSIOC Utility window appears.



Review the Port and Baud Information

In the GSIOC Utility window, review the COM port and baud information. If any information is incorrect or missing, close the GSIOC Utility and use the GSIOC Configuration Editor to update the information. Refer to [Appendix D, GSIOC Configuration Editor](#).

Listing GSIOC Instruments

Using the GSIOC Utility, you can determine the instruments currently connected to the computer.

In the Mode menu, select **Scan!**

The Unit ID list box displays the unit IDs and the version of the connected instruments. If any connected instruments are missing from the list, ensure that the proper RS-232 or GSIOC connection exists between the computer and the instruments, and that the instruments do not have duplicate unit ID numbers.

Basic Mode

In the Basic mode, immediate and buffered GSIOC commands can be sent to specific Gilson instruments.

Review the Port, IRQ, and Baud information in this window. If any information is incorrect or missing, close the GSIOC Utility and use the GSIOC Configuration Editor to update the information.

There are two drop-down menus in the Basic mode of the Gilson GSIOC Utility: “Mode Menu” and “Help Menu”.

Basic Mode Buttons and Features

Immediate Button

Sends an immediate command to the Unit ID selected.

Immediate commands request status information from an instrument. These commands are executed immediately, temporarily interrupting any command in progress.

You can find a list of valid immediate commands for each instrument in its commands list or user’s guide.

Buffered Button

Sends a buffered command to the Unit ID selected.

Buffered commands send instructions to an instrument. These commands are executed one at a time.

You can find a list of valid buffered commands for each instrument in its commands list or user’s guide.

Command Field

Where the command to be sent is specified. For more information on sending commands, see [Send an Immediate Command](#) on page E-16 or [Send a Buffered Command](#) on page E-17.

Response Field

Returns a response to an immediate or buffered command.

The response to a successfully completed buffered command is “ok”.

Refer to the user’s guide for the Gilson instrument for a description of the valid response to immediate commands.

The response to an unsuccessfully completed immediate or buffered command is “#error”.

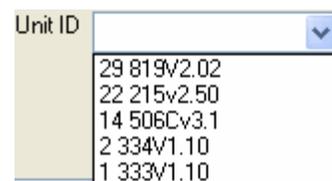
Basic Mode Menus

Mode Menu

There are three options in the Mode menu: “Scan!”, “Advanced”, and “Ghost”.

Scan!

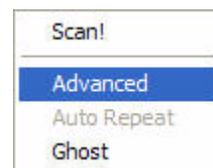
The Scan! option on the Mode menu allows you to scan for GSIOC instruments. After a scan, the Unit ID list box displays the unit IDs and the version of the connected instruments. If any connected



instruments are missing from the list, ensure that the proper RS-232 or GSIOC connection exists between the computer and the instruments, and that the instruments do not have duplicate Unit ID numbers.

Advanced

The advanced option in the Mode menu allows you to switch between the Basic and Advanced modes. A check mark means that the GSIOC Utility is in Advanced mode.



Ghost

The Ghost option in the Mode menu makes the GSIOC Utility window transparent (and always on top). This allows you to view another window behind the Utility. The Utility will remain fully functional in the Ghost mode.

Help Menu

Help Topics

When selected, the Help window for the Gilson GSIOC Utility appears.

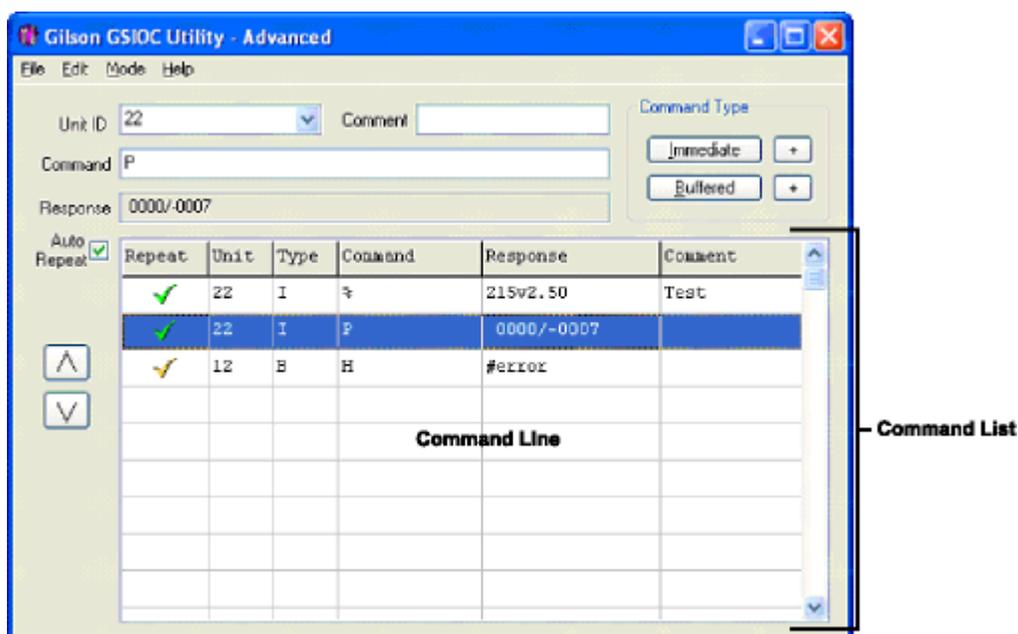
About

When selected, the About window appears.

This window displays the version of the Gilson GSIOC Utility, the GSIOC32.DLL, and the GSIOC Server or Driver; and the Port, IRQ, and Baud set by the GSIOC Configuration Editor.

Advanced Mode

In the Advanced mode, immediate and buffered GSIOC commands can be sent to specific Gilson instruments. In this mode, immediate and buffered commands with comments can be saved to a command list to be used as needed. The command lines can be repeated automatically to monitor the status of the instrument.



Review the Port, IRQ, and Baud information by selecting About... from the Help menu. If any information is incorrect or missing, close the GSIOC Utility and use the GSIOC Configuration Editor to update the information.

There are four drop-down menus in the Advanced mode of the Gilson GSIOC Utility: "File Menu", "Edit Menu", "Mode Menu", and "Help Menu".

Advanced Mode Buttons and Features

+ Button

The  next to  is used to insert an immediate command in the command list. For more information, see [Insert an Immediate Command](#) on page E-14.

The  next to  is used to insert a buffered command in the command list. For more information, see [Insert a Buffered Command](#) on page E-15.

Arrow Up or Arrow Down Button

These buttons ( or ) are used to change the position of a command in the command list.

To move a command

Highlight the command in the command list and use  to move the command up in the list or  to move the command down in the list.

Immediate Button

Sends an immediate command to the Unit ID selected. The Comment field is not used.

Selecting the Immediate button will not add the command to the command list.

For more information, see [Send an Immediate Command](#) on page E-16.

Buffered Button

Sends a buffered command to the Unit ID selected. The Comment field is not used.

Selecting the Buffered button will not add the command to the command list.

For more information, see [Send a Buffered Command](#) on page E-17.

Response Field

Returns a response to an immediate or buffered command.

The response will become gray after 15 seconds if no response is registered.

The response to a successfully completed buffered command is "ok".

Refer to the user's guide for the Gilson instrument for a description of the valid response to the immediate commands.

The response to an unsuccessfully completed immediate or buffered command is "#error".

To send a command line

Double-click on the Unit, Type, Command, Response, or Comment field to send the immediate or buffered command for that specific command line.

Command Line Column Headings

Repeat

A green check mark (✓) in the Repeat column means that an immediate command will automatically repeat when the Auto Repeat option is checked. Double-click on the Repeat field to select or deselect the Auto Repeat for that command line.

A yellow check mark (👉) in the Repeat column means that a buffered command will automatically repeat when the Auto Repeat option is checked. Double-click on the Repeat field to select or deselect the Auto Repeat option for that command line.

Unit

This is the Unit ID for the instrument in the command line.

Type

I - "Immediate Command", B - "Buffered Command"

Command

This is the GSIOC command for the command line.

Response

This is the GSIOC response when the command line is initiated with a double-click on the Unit, Type, Command, Response, or Comment field. The response will become gray after 15 seconds if no response is registered.

Comment

This is an optional comment that can be added to the command line.

Advanced Mode Menus

File Menu

There are four options in the File menu: "Open", "Save", "Save As...", and "Exit".

Open

The Open option in the File menu allows you to open previously created command lists (GSUTIL32 files). The extension for a GSUTIL32 file is .GSU.

Save

The save option in the File menu allows you to save the Advanced commands to GSUTIL32.GSU. The GSUTIL32.GSU file is automatically created in the location where GSUTIL32.EXE is stored.

The Advanced commands will automatically be saved to GSUTIL32.GSU if the Gilson GSIOC Utility is exited without saving.

The GSUTIL32.GSU is automatically opened when the Advanced mode is selected from the Mode menu.

Save As...

The Save As... option on the File menu allows you to save the Gilson GSIOC Utility commands that are currently defined. The file's name and path must be specified.

Exit

Closes the Gilson GSIOC Utility software.

Edit Menu

There are four options in the Edit Menu: "Insert Immediate", "Insert Buffered", "Selection", and "Font...".

Insert Immediate

The Insert Immediate option in the Edit menu allows you to insert an immediate command in the command list. The new command will be added to the last line in the command list.

The GSIOC Command will not be inserted if there is already a command line in the list with the same Unit ID and Command.

For more information, see [Insert an Immediate Command](#) on page E-14.

Insert Buffered

The Insert Buffered option in the Edit menu allows you to insert a buffered command in the command list. The new command will be added to the last line in the command list.

The GSIOC Command will not be inserted if there is already a command line in the list with the same Unit ID and Command.

For more information, see [Insert a Buffered Command](#) on page E-15.

Selection

Delete (Ctrl + D)

Deletes the highlighted command from the command list.

Up (Ctrl + U)

Moves the highlighted command up in the command list.

Down (Ctrl + D)

Moves the highlighted command down in the command list.

Execute (Ctrl + E)

Executes the highlighted command.

Repeat (Ctrl + R)

Adds or removes the repeat option for the highlighted command.

Font...

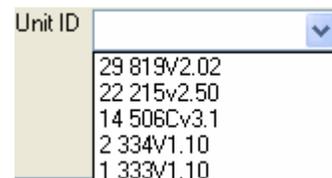
The Font... option on the Edit menu allows you to change the font options for the command list fields and headers, as well as the Unit ID, Comment, and Command text boxes.

Mode Menu

There are four options in the Mode menu: "Scan!", "Advanced", "Auto Repeat", and "Ghost".

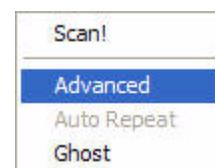
Scan!

The Scan! option on the Mode menu allows you to scan for GSIOC instruments. After a scan, the Unit ID list box displays the unit IDs and the version of the connected instruments. If any connected instruments are missing from the list, ensure that the proper RS-232 or GSIOC connection exists between the computer and the instruments, and that the instruments do not have duplicate Unit ID numbers.



Advanced

The advanced option in the Mode menu allows you to switch between the Basic and Advanced modes. A check mark means that the GSIOC Utility is in Advanced mode.



Auto Repeat

The Auto Repeat option on the Mode menu allows you to repeat command lines that appear in the command list.

A command line will only repeat if a check mark appears in the Repeat field. A check mark can be added by double-clicking on the Repeat field and selecting the Auto Repeat check box.

Starting from the top command line, this mode will refresh one repeating command line every 1/10th of a second. For example, if there are ten command lines with Repeat selected, each of these command lines will be initiated every second.

Auto Repeat mode is useful for monitoring the instrument using immediate commands and is designated in the Repeat field with a green check mark.

Auto Repeat mode is not intended to be used as a programming tool with buffered commands. Repeating buffered commands will be executed at a fixed time interval regardless if a command has finished. For this reason, the check mark in the buffered command line is yellow.

Auto Repeat mode can be selected from the Mode menu or by selecting the check box next to Auto Repeat.

Auto Repeat is deselected by default with the Advanced mode is first opened. When Gilson GSIOC Utility - Advanced is saved or closed, the status of Auto Repeat is saved.

Ghost

The Ghost option in the Mode menu makes the GSIOC Utility window transparent (and always on top). This allows you to view another window behind the Utility. The Utility will remain fully functional in the Ghost mode.

Help Menu

Help Topics

When selected, the Help window for the Gilson GSIOC Utility appears.

About

When selected, the About window appears.

This window displays the version of the Gilson GSIOC Utility, the GSIOC32.DLL, and the GSIOC Server or Driver; and the Port, IRQ, and Baud set by the GSIOC Configuration Editor.

Commands

Immediate Command

Immediate commands request status information from an instrument. These commands are executed immediately, temporarily interrupting any command in progress.

You can find a list of valid immediate commands for each instrument in its commands list or user's guide.

Buffered Command

Buffered commands send instructions to an instrument. These commands are executed one at a time.

You can find a list of valid buffered commands for each instrument in its commands list or user's guide.

Insert an Immediate Command

There are two ways to insert an immediate command in Advanced mode.

Using the Edit Menu

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Select Insert Immediate from the Edit menu. The new command will be inserted at the bottom of the command list.

Note: The command will not be inserted if there is already a command line in the list with the same Unit ID and command.

Using the + Button

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Click the  button next to the Immediate button. The new command will be inserted at the bottom of the command list.



Note: The command will not be inserted if there is already a command line in the list with the same Unit ID and command.

Insert a Buffered Command

There are two ways to insert a buffered command in Advanced mode.

Using the Edit Menu

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Select Insert Immediate from the Edit menu. The new command will be inserted at the bottom of the command list.

Note: The command will not be inserted if there is already a command line in the list with the same Unit ID and command.

Using the + Button

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Click the  button next to the Buffered button. The new command will be inserted at the bottom of the command list.



Note: The command will not be inserted if there is already a command line in the list with the same Unit ID and command.

Send an Immediate Command

Basic Mode

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type (or select) a Command.
- 3 Click .

Advanced Mode

Using the button

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Click .

Using Execute from the Edit menu

- 1 Highlight the command to be sent in the command list.
- 2 Choose Selection from the Edit menu and select Execute. (Or, type Ctrl + E.)

Using the command list

Double-click on the command line of the command you want to send.

Send a Buffered Command

Basic Mode

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type (or select) a Command.
- 3 Click .

Advanced Mode

Using the button

- 1 From the Unit ID drop-down box, select the unit ID of the instrument to send the command to.
- 2 Type a Command and Comment. (The comment is optional.)
- 3 Click .

Using Execute from the Edit menu

- 1 Highlight the command to be sent in the command list.
- 2 Choose Selection from the Edit menu and select Execute. (Or, type Ctrl + E.)

Using the command list

Double-click on the command line of the command you want to send.