GX-271 Liquid Handler

User's Guide

GILSON®

Gilson, Inc. | PO Box 620027 | Middleton, WI 53562-0027 | Tel: 608-836-1551 OR 800-445-7661 | Fax: 608-831-4451
Gilson S.A.S. | 19, avenue des Entrepreneurs | BP 145, F-95400 Villiers-le-bel, FRANCE
www.gilson.com | sales@gilson.com | service@gilson.com | training@gilson.com

LT350012-04

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Safety

Read this chapter before installing and operating the instrument.

Only trained technical personnel in a laboratory environment may use the instrument for non-medical, liquid handling purposes. For safe and correct use of the instrument, operating and service personnel must follow all instructions contained in this guide when installing, cleaning, and maintaining the instrument. All safety precautions must be observed during all phases of operation, service, and repair of the instrument.

Failure to comply with these precautions or with warnings described in the user's guide violates safety standards of design, manufacture, and intended use of the instrument. Gilson assumes no liability for customers failing to comply with these requirements.

The instrument has been certified to safety standards required in Canada, Europe, and the United States. Refer to the rear panel label on the instrument and the Declaration of Conformity document for the current standards to which the instrument has been found compliant.

Electronic and Hazard Symbols

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
	Keep hands clear of probe Garder les mains éloignees de l'aiguille Halten Sie Hände fein von der Nadel

Safety Notices

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

Lifting

The instrument exceeds the weight one person can lift safely. Two or more people are required to lift the instrument safely. Always lift the instrument from the base and follow any unpacking instructions provided with the instrument.

Voltage

Ensure that the rear panel is easily accessible. Detach all sources of voltage from the instrument before the service, repair, or exchange of parts. Use only the grounded AC cord provided. Ungrounded power cords can result in electrical shock and serious personal injury. Use only approved fuses with the specified current rating. The instrument must be operated within the voltage specified on the rear panel of the instrument.

Probes

Keep clear of the probe while the X/Y/Z arm is in motion to avoid personal injury. Probes may contain hazardous substances.

Solvents

Observe safe laboratory practices when handling solvents. Adequate safety precautions, such as proper ventilation, safety glasses, etc., must be used when handling dangerous liquids. Refer to the Material Safety Data Sheet (MSDS) for each solvent before use.

Replacement Parts

Only use the replacement parts mentioned in this user's guide.

Sécurité

Merci de lire attentivement cette section avant toute installation ou utilisation de l'instrument.

Cet instrument est exclusivement destiné à être utilisé dans un environnement de laboratoire, par un personnel qualifié, à des fins de manipulations de liquides non-médicales. Pour une utilisation correcte et en toute sécurité de l'instrument, il est nécessaire que le personnel qui utilise et réalise la maintenance de l'instrument, suive les instructions contenues dans ce guide lors de l'installation, du nettoyage et de la maintenance de l'instrument. Toutes les consignes de sécurité doivent être respectées durant toutes les phases de fonctionnement, d'entretien ou de réparation de l'instrument.

Le non-respect de ces précautions ou des avertissements spécifiques mentionnés dans ce guide compromet les normes de sécurité de conception, de fabrication et d'utilisation prévue de l'instrument. Gilson décline toute responsabilité en cas d'incapacité du client à se conformer à ces exigences.

L'instrument a été certifié conformément aux normes de sécurité en vigueur au Canada, en Europe et aux Etats-Unis. Merci de vous reporter aux indications mentionnées sur le panneau arrière de l'instrument ainsi qu'au document de Déclaration de Conformité aux normes pour lesquelles l'instrument a été déclaré conforme.

Symboles Électroniques et de Dangers

Les symboles électroniques et de dangers suivants peuvent apparaitre sur l'instrument:

Symbole	*Signification*
~	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
	Keep hands clear of probe Garder les mains éloignees de l'aiguille Halten Sie Hände fein von der Nadel

Notes de Sécurité

Les notes de sécurité suivantes peuvent apparaitre dans ce document:

⚠WARNING	WARNING (AVERTISSEMENT) indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures graves.
⚠CAUTION	CAUTION (ATTENTION) indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures mineures ou légères.
NOTICE	NOTICE (AVIS) indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des dommages matériels.

Déplacement

Le poids de l'instrument implique que deux personnes ou plus sont requises pour le déplacer en toute sécurité. Toujours soulever l'instrument par sa base et suivre les instructions de déballage fournies avec l'appareil.

Tension

S'assurer que l'accès au panneau arrière est libre. Déconnecter la source d'alimentation avant toute opération d'entretien, de réparation ou de remplacement de pièces. Utiliser exclusivement le bloc et le cordon d'alimentation avec raccordement à la terre fournis. Un cordon d'alimentation sans terre peut provoquer choc électrique et graves blessures. Utiliser exclusivement des fusibles de l'intensité et du type spécifié. Pour le fonctionnement, respecter la tension indiquée sur le panneau arrière de l'instrument.

Aiguilles

Afin d'éviter tout risque de blessure, rester à distance des aiguilles lorsque le bras X/Y/Z est en mouvement. Les aiguilles peuvent contenir des substances dangereuses.

Solvants

Respecter les Bonnes Pratiques de Laboratoire lors de la manipulation de solvants. Si des liquides dangereux sont utilisés, s'assurer que la ventilation est adéquate et porter en permanence un équipement de protection individuelle (EPI), tel que : lunettes, gants et vêtements de protection. Se reporter aux Fiches de Données de Sécurité relatives aux solvants avant toute utilisation.

Pièces Détachées

S'assurer d'utiliser seulement les pièces détachées mentionnées dans le guide utilisateur. S'il est nécessaire de changer des pièces non listées, merci de contacter votre représentant Gilson local.

Introduction

Chapter One

This chapter provides information on the following topics:

Description

The GX-271 Liquid Handler is an X/Y/Z instrument that automates liquid handling procedures. The liquid handler can be configured with a GX Solvent System or VERITY® Syringe Pump, rinse stations, and racks. Optional accessories include a GX Direct Injection Module, GX Rinse Pump, and fraction collection valve.

GX-271 Liquid Handler with GX Solvent System

GX Solvent System

A bi-directional pump that can switch from aspirate to dispense mode. The solvent system can handle flow rates up to 50 mL/min. The solvent selection valve can accommodate up to five different reservoir solvents.

For plumbing instructions, refer to page 79 of its appendix.

Fraction Collection Valve

A three-way valve mounted low on the Z-arm. This design allows for reduced dead volume and collection of larger volumes.

For plumbing instructions, refer to page 88 of its appendix.

GX Direct Injection Module

Mounted on the locator plate of the GX-271 Liquid Handler. The 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 injection module feature a vertical direct connection for the injection port. One injection module can be placed on the locator plate of the GX-271 Liquid Handler.

For plumbing instructions, refer to page 95 of its appendix.

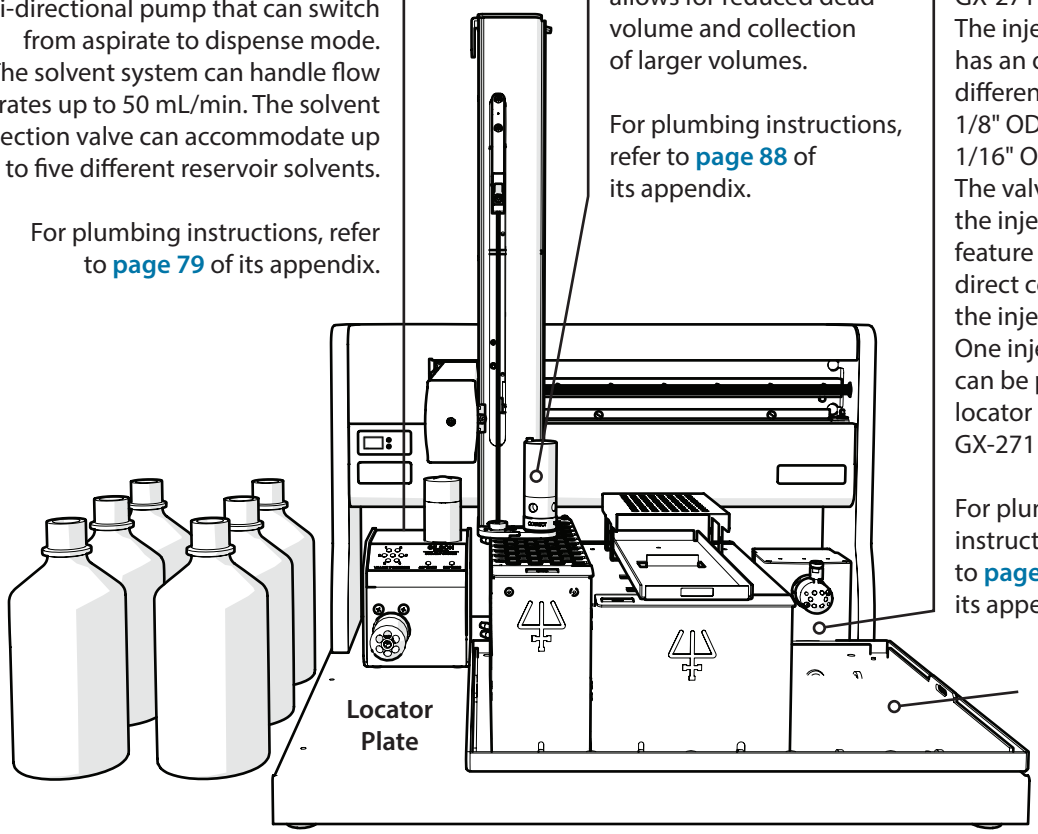
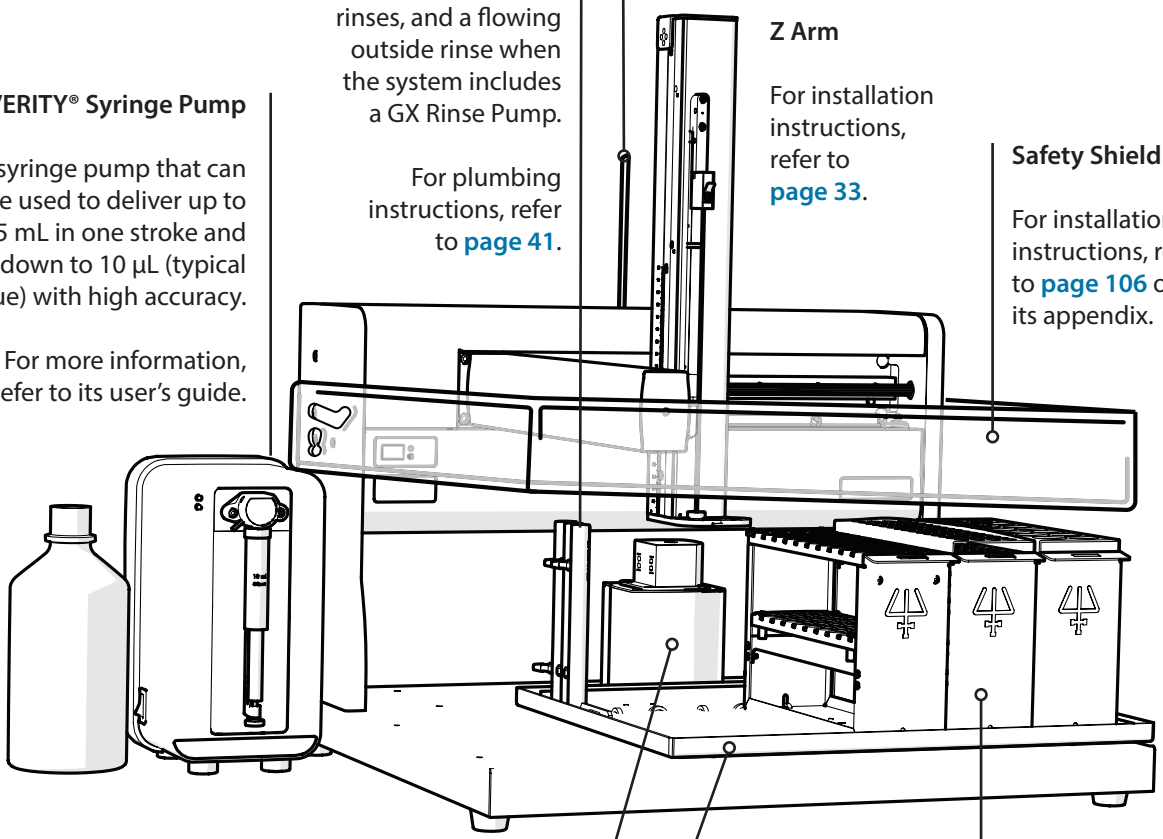


Figure 1: System Overview and Description of the GX-271 Liquid Handler with GX Solvent System

GX-271 Liquid Handler with VERITY® Syringe Pump



Rinse Stations

Probe rinsing occurs through up to three dedicated rinse stations capable of performing inside and outside rinses, and a flowing outside rinse when the system includes a GX Rinse Pump.

For plumbing instructions, refer to page 41.

Cable Support Rod

Z Arm

For installation instructions, refer to page 33.

VERITY® Syringe Pump

A syringe pump that can be used to deliver up to 25 mL in one stroke and down to 10 µL (typical value) with high accuracy.

For more information, refer to its user's guide.

Safety Shield

For installation instructions, refer to page 106 of its appendix.

GX Rinse Pump

Integration of a GX Rinse Pump provides the option for a flowing rinse using high or low flow settings.

For installation instructions, refer to page 101 of its appendix.

Locator Pan

For installation instructions, refer to page 28.

Racks

For installation instructions, refer to page 51.

Figure 2: System Overview and Description of the GX-271 Liquid Handler with VERITY® Syringe Pump

Unpacking

The instrument is delivered with most major components already assembled. Keep the original container and packing assembly in case the instrument must be returned to the factory.

To unpack the instrument:

1. Open the box and remove the foam inserts.
2. Remove the accessory box from the locator plate of the instrument and set aside.
3. Grip the instrument at the base and lift it out of the box. Place it on a lab bench or cart.

⚠CAUTION	It is recommended that two people lift the unit out of the box.

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

4. Remove the plastic wrap covering the liquid handler.

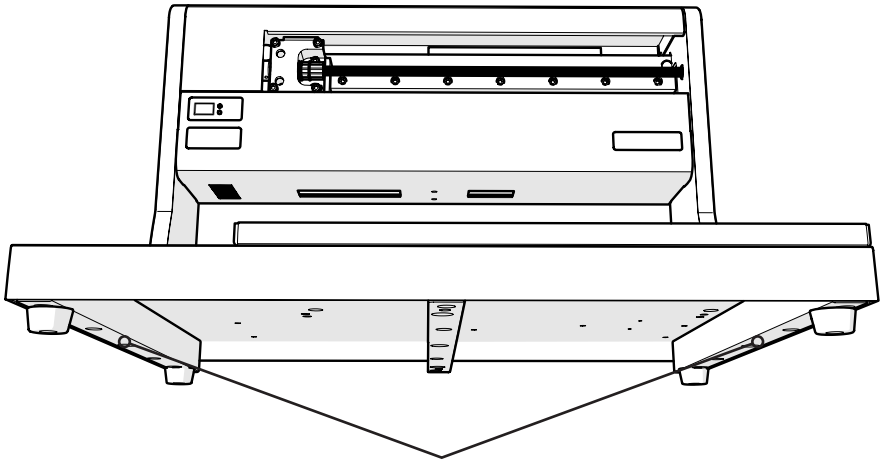


Figure 3: Unpacking the GX-271 Liquid Handler (Bottom View)

Standard Equipment

The following items are considered standard equipment and are provided with the GX-271 Liquid Handler:

- Locator Pan
- Z-Arm
  - Isolator Probe Holder
- Accessory Package
  - Allen Wrenches (2.5, 3, and 4 mm)
  - Ethernet Cable
  - Fuses and Fuse Drawer
  - Gilson Ethernet Utility
  - GSIOC Cable
  - GX-27X Offset Utility Kit
  - Liquid Level Detection (LLD) Cable Assembly
  - Phillips Screwdriver
  - Power Cords
  - RS-232 Cable
  - Spiral Wrap
  - Terminal Block Connectors (6- and 8-pin)
  - Tubing Retaining Clips
  - Z Height Adjustment Tools (125 and 175 mm)

Documentation

The following documents are included with the GX-271 Liquid Handler:

- Declaration of Conformity
- Hazardous Materials Declaration (China RoHS)
- Installation Qualification (IQ) Procedure
- GX-271/GX-274 Liquid Handlers Documentation CD, which includes this user's guide, the *GX-274 Liquid Handler User's Guide*, and IQ procedure documents.
- GX-27X Offset Utility Kit CD, which includes an instruction document
- Gilson Ethernet Utility CD, which includes an instruction document
- Quality Control (QC) Checklist
- Unpacking Instructions

Accessories

Required

Some accessories are required, but are ordered separately:

- Guide Foot Assembly
- GX Solvent System or VERITY® Syringe Pump
- Probes
- Racks
- Rinse Stations
- Tray Insert

Refer to the **Parts and Accessories** appendix for part numbers.

Optional

- GX Rinse Pump
- GX Direct Injection Module
- Fraction Collection Valve Package
- Safety Shield
- Solvent Bottle Racks
- Syringes

Refer to the **Parts and Accessories** appendix for part numbers.

Customer Service

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

If you need assistance, please contact your local Gilson representative. Detailed contact information can be found at **www.gilson.com**. To help us serve you quickly and efficiently, refer to **Before Calling Us** on page 72.

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All other trademarks within are trademarks or registered trademarks of Gilson, Inc.

Technical Specifications

Please be aware of the following before operating the instrument.

NOTE	Changes or modifications to the instrument not expressly approved by Gilson could void the factory-authorized 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 instrument to ensure compliance with the FCC Class A limits.

Technical specifications for the following components are available below and in their respective appendices:

- **GX-271 Liquid Handler** on page 24
- **GX Solvent System** on page 76
- **Fraction Collection Valve** on page 86
- **GX Direct Injection Module** on page 92
- **GX Rinse Pump** on page 100

GX-271 Liquid Handler

Technical Specification	*Definition*	
Arm Speed	• 350 mm/sec along X-axis • 350 mm/sec along Y-axis • 125 mm/sec along Z-axis	
Communication	• Ethernet • RS-232 • GSIOC	
Contact Control	• Two inputs, transistor-transistor logic (TTL) contact closures • Two relay outputs • Two switched +24V DC 1A outputs • One safety input	
	NOTICE	Switching to voltages higher than 30V or greater than 1A of current may damage the instrument.
Dimensions (W x D x H)	59.7 x 54.1 x 57.1 cm (23.5 x 21.3 x 22.5 in.)	
	NOTE	Dimensions do not include the VERITY® Syringe Pump.
	NOTE	The height dimension does not include the Z-arm, which will vary depending on where the Z-arm is clamped.
Environmental Conditions	• Indoor use • Altitude: up to 2000 m • Temperature range: 5°C–40°C • Humidity: Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.	
Front Panel	Two digit display and indicator lights for power and error.	
Fuse	Two 5 x 20 mm, "T" type, 3.15A fuses	
Horizontal Motion Strength	• X: 2.0 kg (4.5 lbs.) • Y: 2.0 kg (4.5 lbs.)	

Liquid Contact Materials*

*Refer to the **Materials** appendix for more details.

Description	*Material*
Probe Guide	PET
Probe	316L Stainless Steel
Rinse Station	PET
Transfer Port	PEEK PET PTFE 316L Stainless Steel
Tubing (Drain)	Tygon®

GX-271 Liquid Handler Technical Specifications (continued on page 26)

GX-271 Liquid Handler

Technical Specification	*Definition*	
Liquid Level Detection (LLD)	Capacitive liquid level detection is supported when using tubes in aluminum racks.	
Locator Plate Capacity	Code 33X/34X racks	Up to five of these racks can be placed on the tray insert.
	Solvent bottle rack	One solvent bottle rack can be placed at the back of the tray insert.
Power Requirements	Frequency: 50 to 60 Hz	
	Voltage: 100–240V (Universal Input)	
	Current rating	• 2.0A for 100–120V • 1.0A for 220–240V
	Power consumption: 250W maximum	
Probe Positioning Performance	• Accuracy: ± 0.75 mm in X/Y/Z dimensions • Repeatability: ± 0.20 mm in X/Y/Z dimensions	
Probe Rinse	Probe rinsing occurs through up to three dedicated rinse stations capable of performing inside and outside rinses, and a flowing outside rinse when the system includes a GX Rinse Pump.	
Safety and Compliance	The instrument has been certified to safety standards specified for Canada, Europe, and the United States. Refer to the instrument rear panel label and the Declaration of Conformity document for the current standards to which the instrument has been found compliant.	
Sampler Type	X/Y/Z instrument with stationary rack design.	
Software Control	PC control via Ethernet communication and TRILUTION® software	
Vertical Punch Strength	4.5 kg (10.0 lbs.)	
Weight* *with Z-arm	22 kg (48 lbs.)	

Installation

Chapter Two

The GX-271 Liquid Handler and its components should be set up and installed in the order shown below. Complete instructions for each step are included in this chapter:

- **Locator Pan Installation and Setup**
- **Z-Arm Setup**
- **Plumbing Connections**
- **Rear Panel Connections**
- **Rack Installation**
- **Final Z-Arm Adjustments**

Locator Pan Installation and Setup

This section takes you through the steps for installing the locator pan on the locator plate of the GX-271 Liquid Handler along with the tray insert and rinse stations.

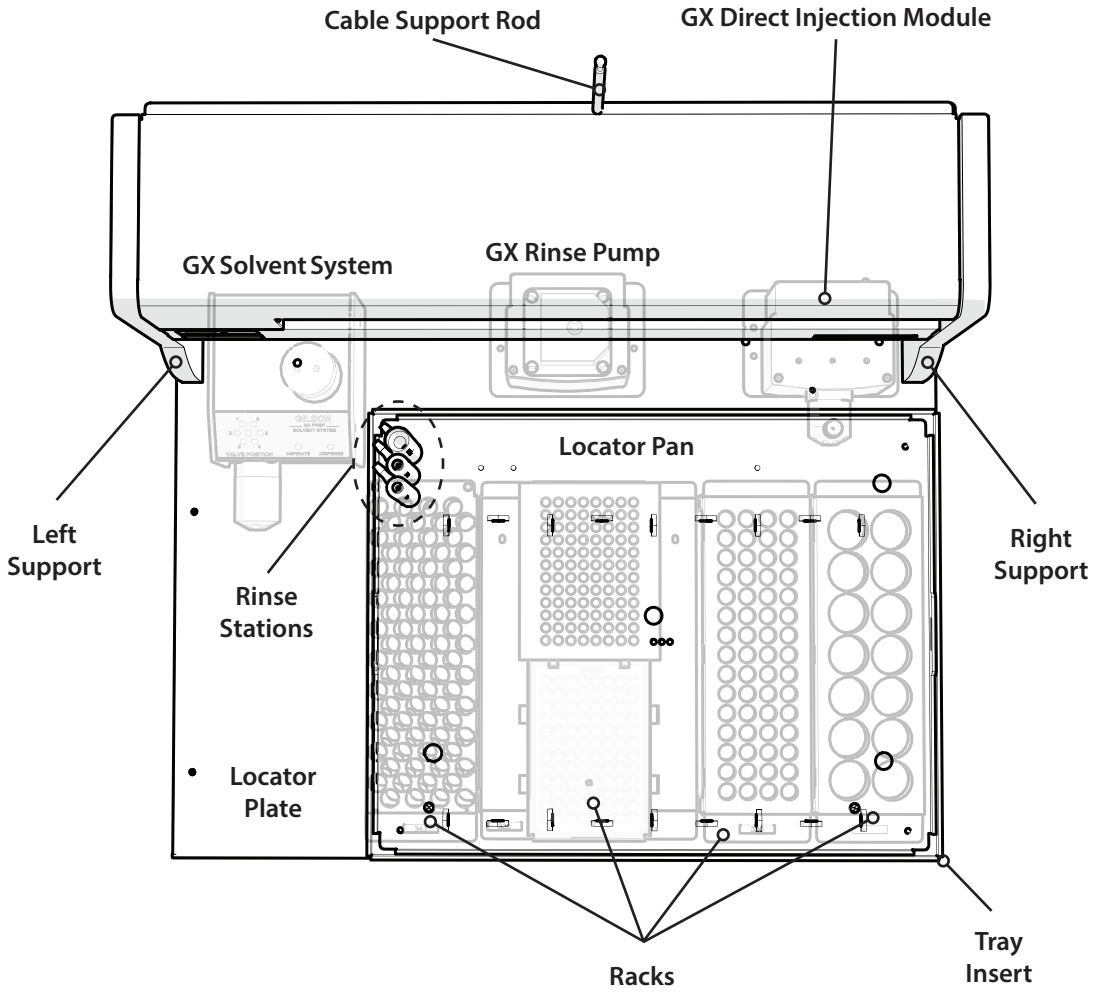


Figure 4: Overview of GX-271 Liquid Handler with Accessories

Locator Pan Installation

The locator pan is installed on the locator plate of the instrument. The locator pan holds the tray insert. To install the locator pan:

1. Orient the two posts on the bottom of the locator pan toward the back of the instrument.
2. Place the locator pan on the locator plate. The front and right side of the locator pan should be flush with the front and right side of the locator plate. The two posts should be inserted in the locator pan.
3. Locate the two screws included with the locator pan, and place them in the holes at the front of the instrument. Tighten the screws using a Phillips screwdriver.

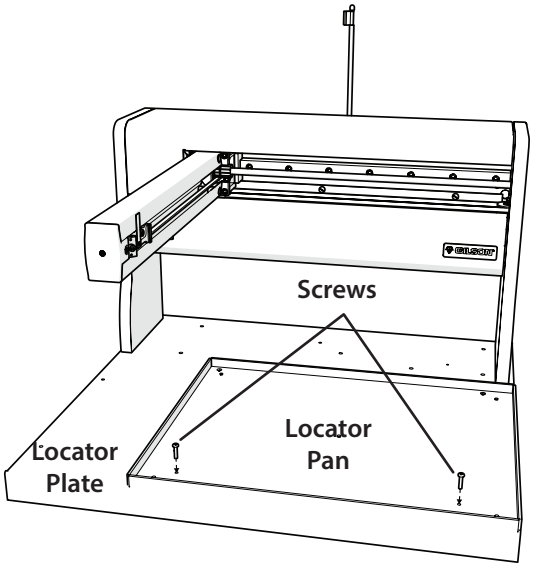


Figure 5: Installing the Locator Pan

Rinse Station Setup

Rinse stations must be installed on the tray insert before the tray insert is installed on the locator pan. Refer to **Rinse Station Locations** on page 30 before installing the tray insert.

Up to three rinse stations can be installed on the tray insert. There are two types of rinse stations available, one for the outside rinse of the probe and another for the inside rinse of the probe, which can also function as a drain. Rinse stations are available in 125 or 175 mm varieties. Refer to the table below for part numbers.

Part Number	*Description*
26034552	Outside Probe Rinse, 125 mm
26034551	Outside Probe Rinse, 175 mm
26034554	Inside Probe Rinse/Drain Station, 125 mm
26034555	Inside Probe Rinse/Drain Station, 175 mm

Outside Probe Rinse

Outside probe rinse stations can be configured for a static or flowing rinse.

- For a static rinse, install the plug in the bottom hole and the drain in the top hole.
- For a flowing rinse, install the plug in the top hole and the drain in the bottom hole.

Inside Probe Rinse

The inside probe rinse station can also function as a drain.

Rinse Station Locations

Outside Probe Rinse

Install the outside probe rinse stations in the front or center positions on the tray insert.

Inside Probe Rinse

Install the inside probe rinse station in the rear position on the tray insert.

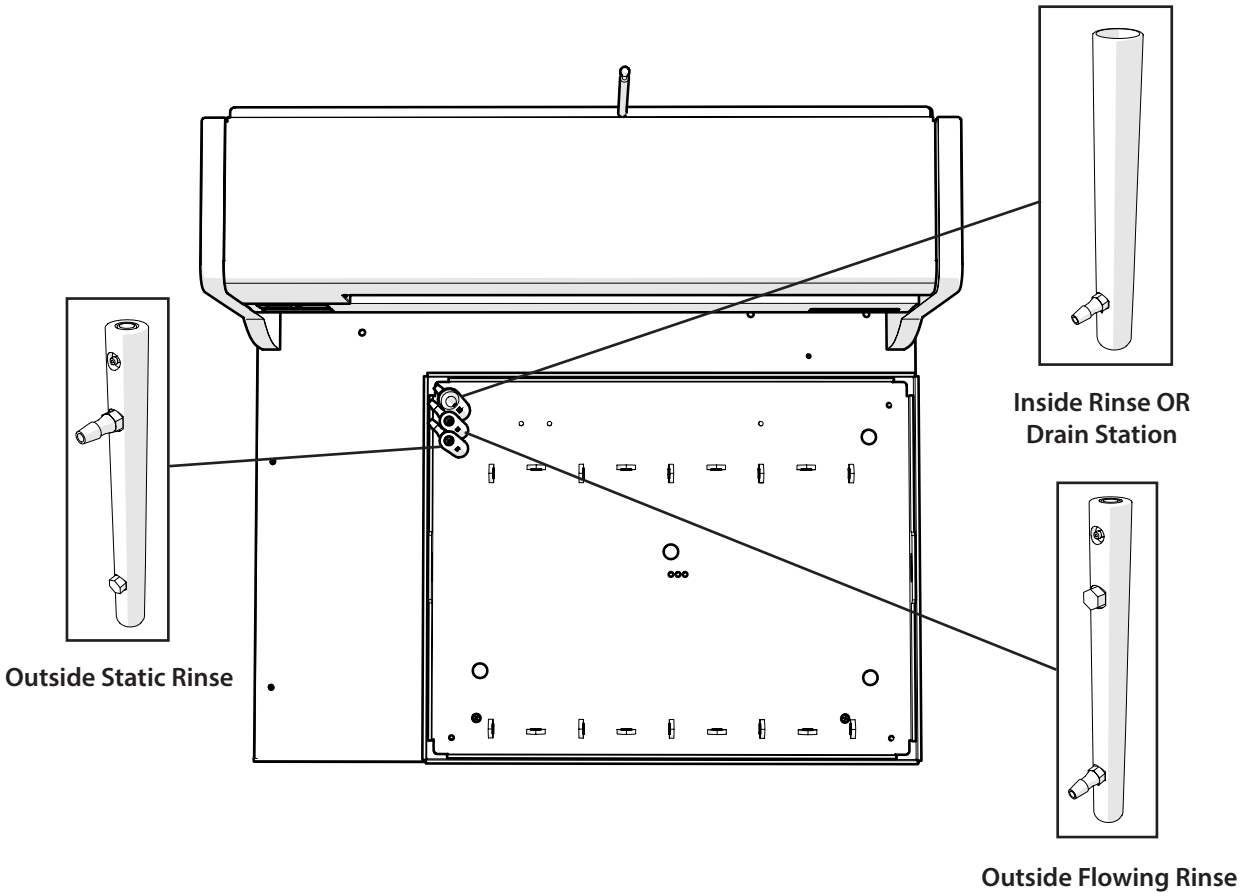


Figure 6: Installing the Rinse Stations on the Tray Insert

Rinse Station Installation on the Tray Insert

1. Locate the following items included with the rinse station:
   - Flat-Head Screw
   - Hex Nut
   - Rinse Station Support

NOTE	The rinse station also includes a socket head cap screw that will not be used for this installation.

2. Place the hex nut in the recessed end of the rinse station support. Push the hex nut all the way into the recessed opening on the rinse station support using a Phillips screwdriver.
3. Place the flat-head screw up through the bottom of the tray insert and place the rinse station support and hex nut assembly over the screw. Ensure that the rinse station support is perpendicular to the tray insert, and then tighten the screw to the rinse support and hex nut assembly using a Phillips screwdriver.
4. Repeat steps 1 through 3 for all other rinse stations.

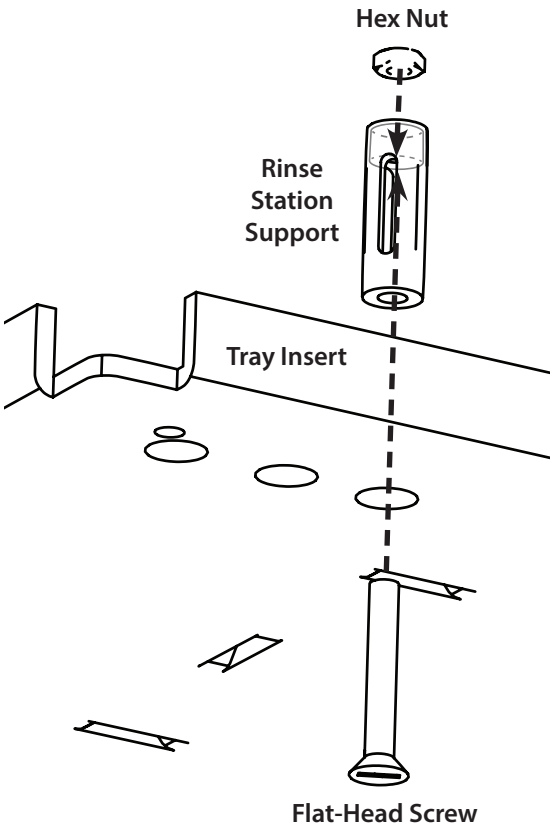


Figure 7: Installing the Rinse Station on the Tray Insert

Tray Insert Installation

The tray insert is used to position the racks and the rinse stations on the instrument. In the center of the tray insert there are three holes used to identify the insert.

To install the tray insert on the locator pan of the instrument:

1. Make sure that the rinse stations (or the holes for the rinse stations) are located at the left rear of the tray insert.

NOTE	The rinse stations should be installed before installing the tray insert on the locator pan. Refer to **Rinse Station Installation on the Tray Insert** on page 31 for more information on installing the rinse stations.

2. Place the tray insert in the locator pan of the instrument. The holes on the tray insert should line up with the posts on the locator pan.

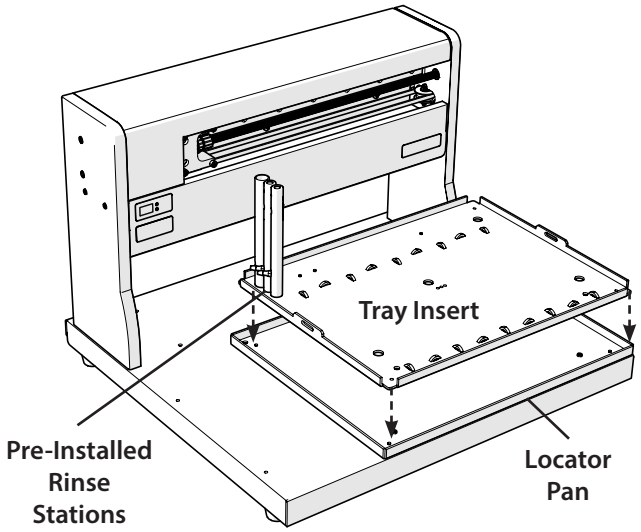


Figure 8: Installing the Tray Insert

Z-Arm Setup

NOTE	All of the components on 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. Isolator Probe Holder Installation
2. Guide Foot Installation
3. Z-Arm Installation
4. Probe Installation
5. Liquid Level Detection (LLD) Cable Installation
6. Z Travel Height Adjustment

Isolator Probe Holder Installation

Follow the instructions below to install the isolator probe holder (part number 2604615) on the isolator mounting block on the Z-arm.

NOTE	The isolator mounting block is factory-installed. Do not remove it from the Z-arm.

1. Remove the screw from the bottom of the isolator mounting block using the 3 mm Allen wrench.
2. Slide the isolator mounting block down as far as it will go to the bottom of the Z-arm.

NOTE	There may be some resistance when sliding the isolator mounting block.

3. Lay the Z-arm on its back on a flat surface.
4. Orient the isolator probe holder so that the D notch is at the top and the connector for the LLD cable is facing out. Place the D notch in the isolator probe holder over the lower part of the isolator mounting block.
5. Place the screw removed in Step 1 up through the bottom of the isolator probe holder and into the isolator mounting block. Tighten using the 3 mm Allen wrench.

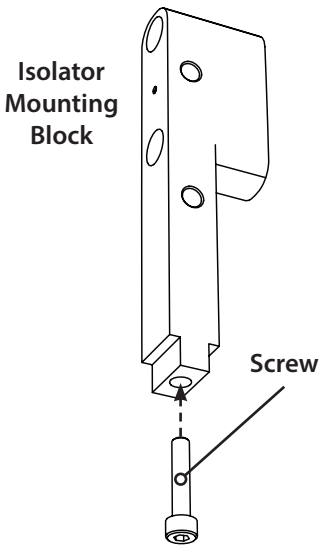


Figure 9: Close-Up of Isolator Mounting Block (Exploded View)

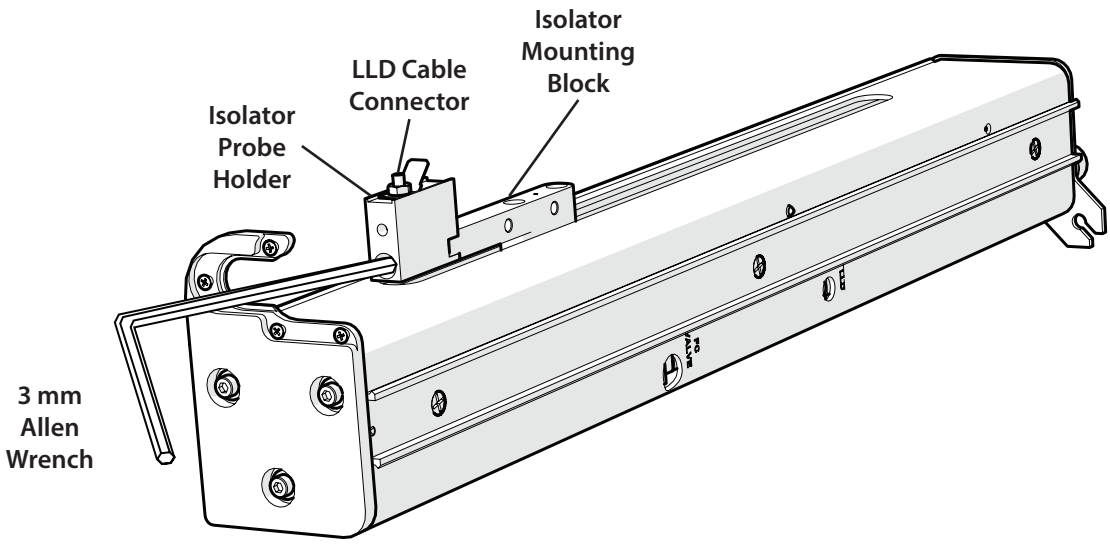


Figure 10: Z-Arm Components

Guide Foot Installation and Setup

The guide foot assembly (ordered separately) includes the probe guide insert and six screws. (Four of the screws are used to secure the guide foot on the Z-foot and the other two screws are extras.)

There are different guide foot assemblies available depending on the outer diameter of the probe being used. Refer to the table for part numbers.

Guide Foot Installation

The guide foot is installed on the Z-foot of the Z-arm.

To install the guide foot:

1. Lay the Z-arm on its back on a flat surface.
2. Locate the probe guide insert and place it on the top of the guide foot. The probe guide insert should be oriented so the wider part is at the bottom and the three holes are at the top.

   Each insert is marked with a number of indentations for identification. Refer to **Figure 12**.
3. Place the guide foot below the Z-foot and align the holes in the guide foot with the holes in the Z-foot.
4. Place four of the Phillips screws through the bottom of the guide foot into the Z-foot and tighten.

Part Number	*Probe Guide Insert*	*Indentations*
2604610	1.3 mm	0
2604611	1.5 mm	1
2604612	1.8 mm	2
2604613	2.3 mm	3
2604614	2.7 mm	4

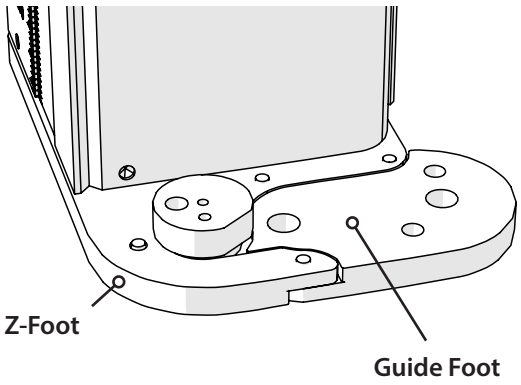


Figure 11: Guide Foot Installed on Z-Foot

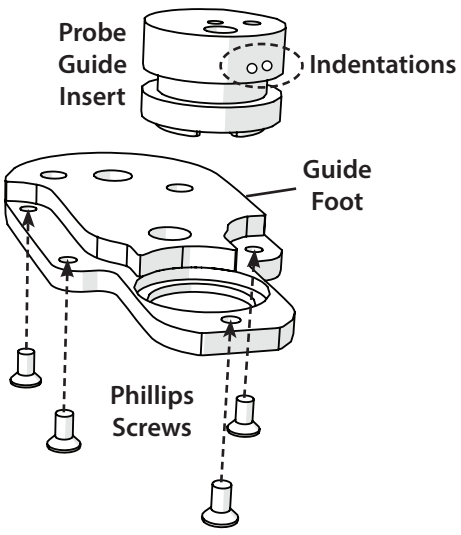


Figure 12: Guide Foot Assembly (Exploded View)

Z-Arm Installation

Follow these steps to install the Z-arm:

1. Loosen the mounting screw on the Z-arm mounting bracket located on the Y-arm using the 3 mm Allen wrench. Turn counterclockwise to loosen.
2. Partially pull out the bracket. Do not remove completely.
3. Place the Z-arm into the mounting bracket. You will need to 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. Refer to **Z-Arm Height Adjustment** on page 38.

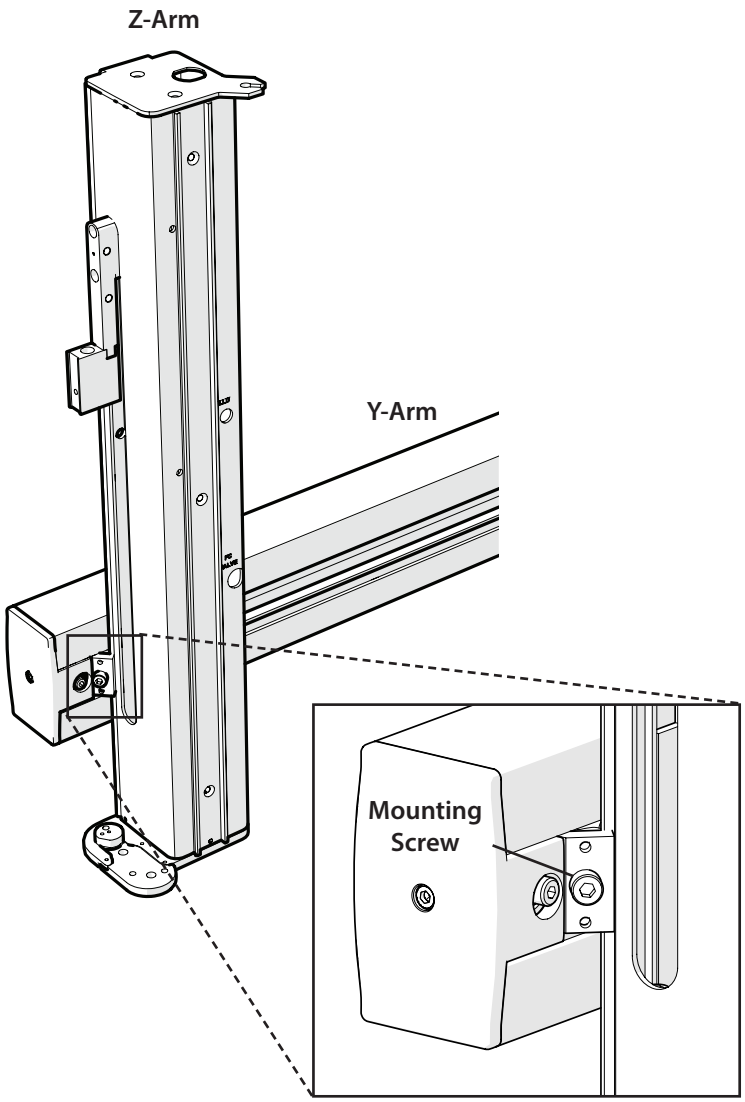


Figure 13: Z-Arm Mounted on GX-271 Liquid Handler

Adjusting the Z Travel Height

The Z travel height is set by default to the S2 position (125 mm).

Follow these steps to adjust the Z travel height:

1. Remove the stop pin (part number 260463) from the Z-arm using the 3 mm Allen wrench. The stop pin is installed on the left side of the Z-arm in the hole labeled S2.

NOTE	If you will be setting the Z travel height to 175 mm, you will not use the stop pin. If the stop pin is not being used, it should be stored for future use.

2. Insert the stop pin in the proper hole on the Z-arm.
   - S1 for 56 mm probes
   - S2 for 125 mm probes
   - No pin installed for 175 mm probes
3. Tighten the head of the stop pin until it reaches a hard stop using the 3 mm Allen wrench.

NOTE	The stop pin is inserted in a hole on the left side of the Z-arm and as it is tightened should enter the adjacent hole on the right side of the Z-arm. The tip of the stop pin is visible on the right side of the Z-arm.

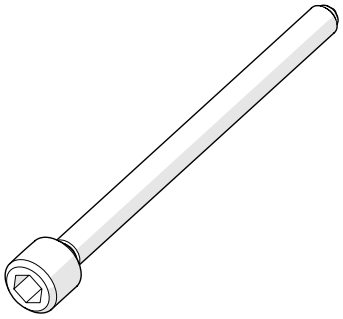


Figure 15: Stop Pin

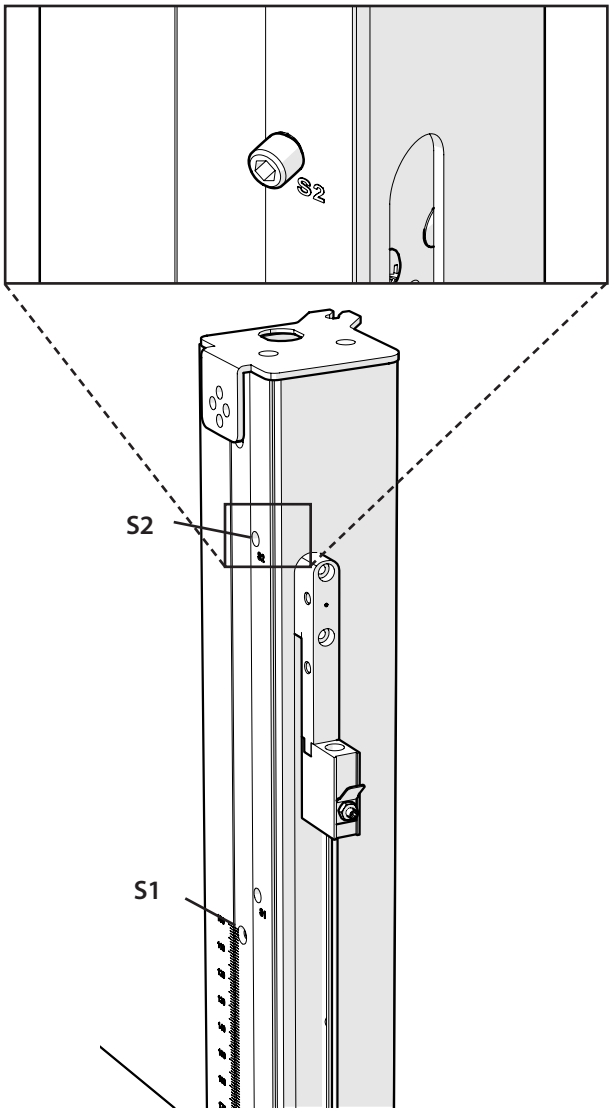


Figure 14: S1 and S2 Positions

Z-Arm Height Adjustment

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

1. Locate the Z-height adjustment tool (125 mm, part number 25051094) or (175 mm, part number 25051095) that was shipped in the accessory package.
2. Loosen the mounting screw on the Z-arm mounting bracket using a 3 mm Allen wrench and slightly raise the Z-arm.
3. Place the Z-height adjustment tool under the Z-arm.
4. While holding the adjustment tool in place, use the other hand to lower the Z-arm until it lightly rests on the adjustment tool.
5. Tighten the mounting screw on the Z-arm mounting bracket to secure the Z-arm.
6. Remove the adjustment tool.

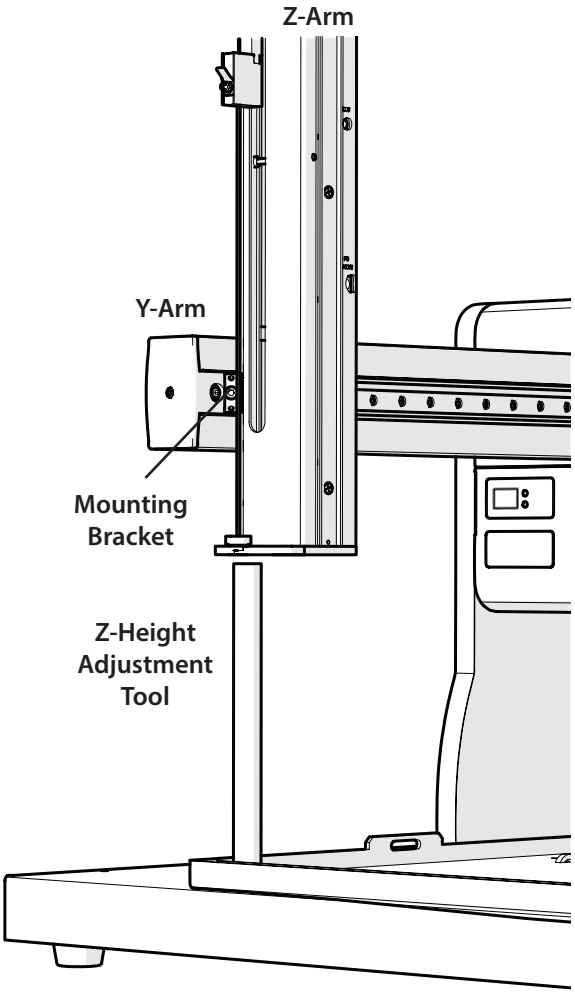


Figure 16: Z-Arm Height Adjustment

Probe Installation

There are different probes available for use on the instrument. Follow the instructions below to install a probe:

1. Insert a probe into the top of the isolator probe holder.
2. Pull the probe through the isolator probe holder.
3. Insert the tip of the probe into the center hole of the probe guide insert.

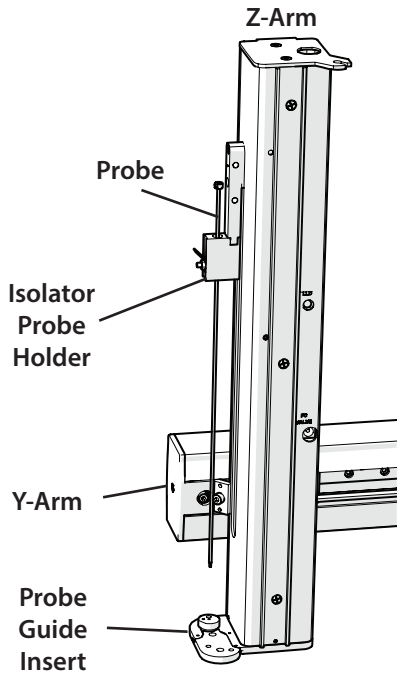


Figure 33: Installing the Probe

Liquid Level Detection (LLD) Cable Installation

To install the LLD cable assembly (part number 260461126):

1. Tighten the hex nut on the front of the isolator probe holder.
2. Place the metal slot end of the cable over the metal tab on the isolator probe holder.
3. Place the LLD cable into strain relief bracket at the top of the Z-arm.
4. Plug the other end of the cable into the LLD port on the right side of the Z-arm.

NOTE	Polypropylene racks, Teflon®-coated probes, and microplates are not compatible with liquid level detection.

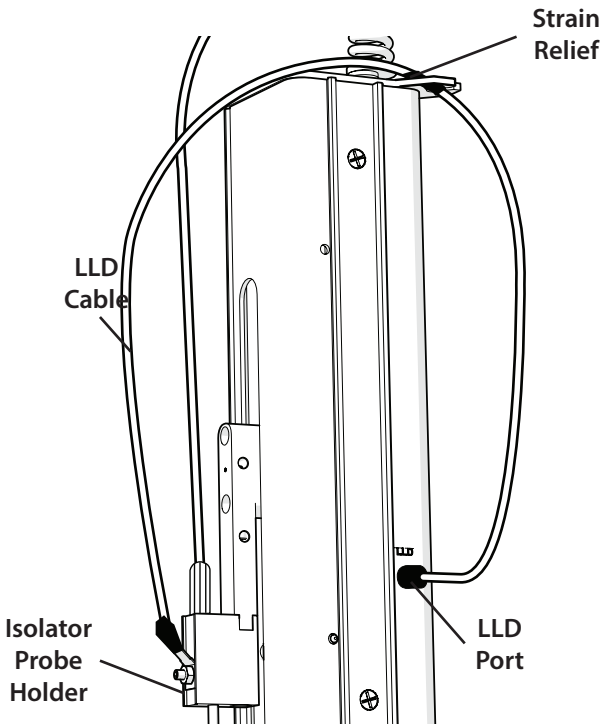


Figure 17: Installing the Liquid Level Detection Cable on the Z-Arm

Plumbing Connections

Refer to the following sections for detailed information on making plumbing connections.

- **Transfer Tubing Installation** on page 40
- **Rinse Station Plumbing** on page 41

NOTE	Information about plumbing connections for optional accessories can be found in its appendix.

Transfer Tubing Installation

Transfer tubing is ordered separately. Refer to the table below for part numbers.

Part Number	Volume
499424013	1.1 mL
499471112	5.5 mL
499474103	10.5 mL
499483602	30 mL

To install the transfer tubing:

1. Connect one end of the transfer tubing with fittings to the appropriate port on the VERITY® Syringe Pump or GX Solvent System and then finger tighten.
2. Connect the other end of the transfer tubing with fittings to the top of the isolator probe holder. Firmly tighten this fitting, since it holds the probe in place.

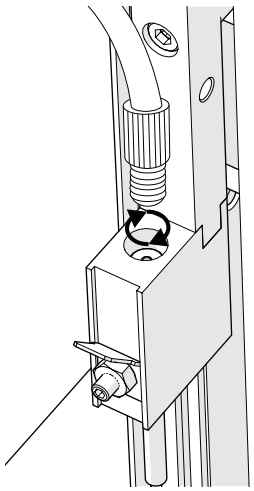


Figure 18: Connecting Transfer Tubing to the Probe and Isolator Probe Holder

Rinse Station Plumbing

To attach tubing to the rinse station:

1. Locate the 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 for a flowing rinse, refer to **Plumbing Connections** on page 102.

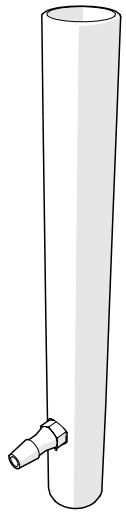
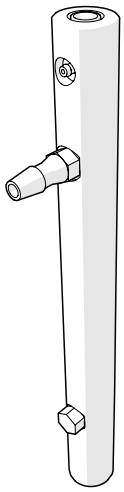
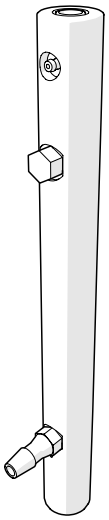
Inside Probe Rinse	*Outside Probe Rinse*	
	Static Rinse	*Flowing Rinse*
		

Figure 19: Rinse Station Configurations

Rear Panel Connections

The following section provides detailed information on making rear panel connections. For information about making rear panel connections for optional accessories, refer to its appendix.

Rear Panel Diagram

Refer to the diagrams below when making the connections to the GX-271 Liquid Handler.

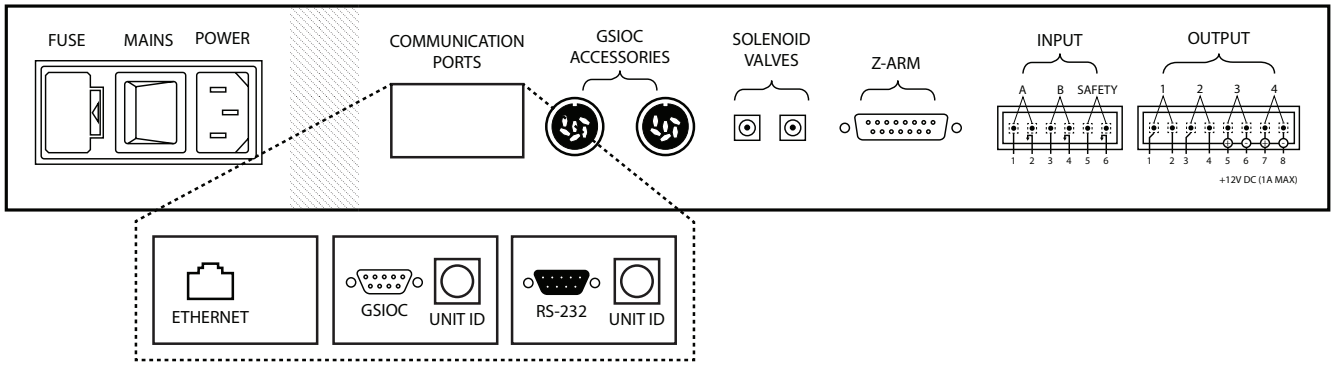


Figure 20: Rear Panel Diagram for Making Electrical Connections

Fuses

To install the fuses:

1. Locate the fuse drawer and two of the supplied fuses. Refer to the **Rear Panel Diagram** above for the location of this port.
2. Place a small screwdriver or a fingernail under the tab on the fuse drawer to detach it.
3. Remove the fuse drawer from its receptacle on the rear panel.
4. Insert the fuses in the fuse drawer.
5. Insert the fuse drawer into its receptacle on the rear panel.

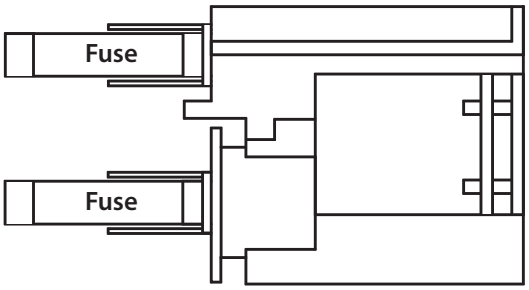


Figure 21: Fuse Diagram

Ethernet

The liquid handler is shipped with Ethernet, RS-232, or GSIOC communication. The following instructions apply to Ethernet communication. For information on RS-232 communication, refer to page 44. For information on GSIOC communication, refer to page 45.

NOTE	Ethernet is the only Gilson software supported configuration.

To make the Ethernet connection to the instrument, a router (ordered separately) and Ethernet cables are required. Follow the steps below to make the Ethernet connection:

1. Locate the Ethernet cable provided with the router.
2. Plug one end of the Ethernet cable into an available Ethernet port on the router and the other to the PC.
3. Turn on the PC.
4. Connect the AC power cord to the router, then plug the power cord into a grounded outlet. If necessary, switch the router ON.
5. Ensure that the liquid handler is powered OFF.
6. Locate the Ethernet cable provided with the accessory kit.
7. Plug one end of the Ethernet cable into the ETHERNET port on the liquid handler and the other to an available Ethernet port on the router.

NOTE	Do not turn on the liquid handler until directed to in the **Operation** chapter.

RS-232

The liquid handler is shipped with Ethernet, RS-232, or GSIOC communication. The following instructions apply to RS-232 communication. For information on Ethernet communication, refer to page 43. For information on GSIOC communication, refer to page 45.

NOTE	Ethernet is the only Gilson software supported configuration.

Connection Setup

The RS-232 port is used to transfer information between the liquid handler and a computer. To connect the liquid handler to the computer, you will need the RS-232 cable (part number 36083129, included in the accessory package).

Connecting an RS-232 Cable to the GX-271 Liquid Handler

1. Attach 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. Attach the female end of the RS-232 cable to the RS-232 serial communications port on the computer. Tighten the retaining screws.

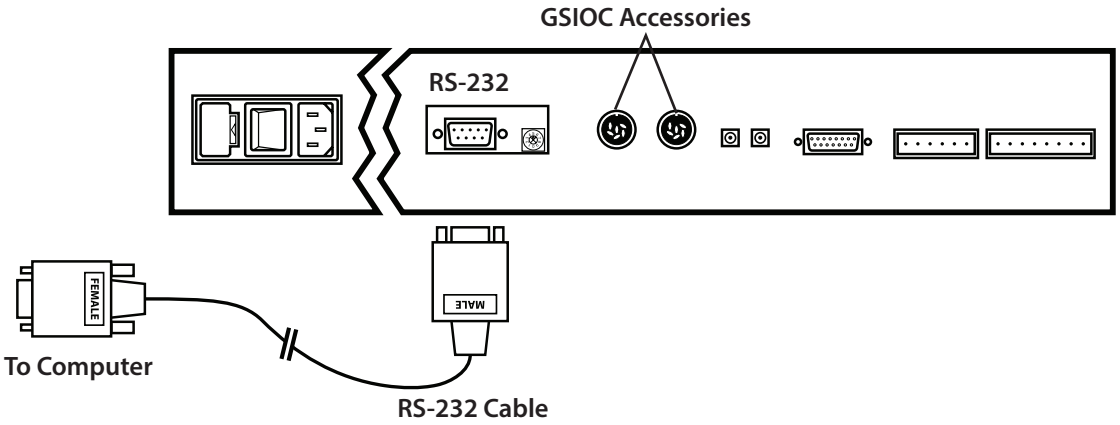


Figure 22: RS-232 Cable to Computer

Unit ID

Refer to the **Rear Panel Diagram** on page 42 for the location of the unit ID selector. The unit ID identifies the liquid handler to software packages that can issue commands to the liquid handler. At the factory, the unit ID on the liquid handler is set to 20.

To change the unit ID:

1. Gently insert a small flat-blade screwdriver into the unit ID selector on the rear panel and turn it. Refer to **Rear Panel Diagram** on page 42 for the location of the unit ID selector
2. Align the white dot with one of the indicated numbers. The unit ID is 20 plus the selected number.

NOTE	For information about setting the unit ID for liquid handler accessories that utilize RS-232 communications, refer to its respective appendix.

GSIOC

The liquid handler is shipped with Ethernet, RS-232, or GSIOC communication. The following instructions apply to GSIOC communication. For information on Ethernet communication, refer to page 43. For information on RS-232 communication, refer to page 44.

NOTE	Ethernet is the only Gilson software supported communication configuration.

Connection Setup

A 508 or 506C System Interface Module is required for communication between the liquid handler and the computer. Use the GSIOC cable (part number 36078143, included in the accessory package) to connect the liquid handler to the interface module.

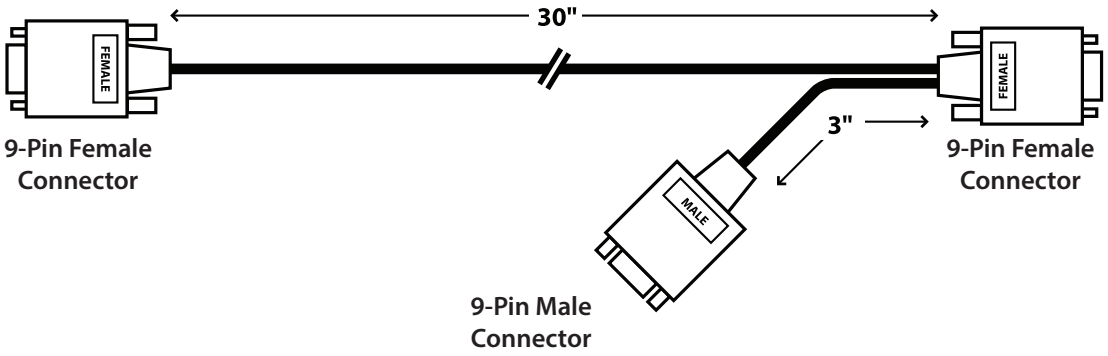


Figure 23: GSIOC Cable

Connecting the GX-271 Liquid Handler to the Interface Module

1. Attach the female connector of the GSIOC cable (located individually at one end of the cable) to the GSIOC port on the interface module. Tighten the retaining screws.
2. Attach the female connector of the GSIOC cable (located on the same end as the male connector) to the GSIOC port located on the rear panel of the liquid handler. Tighten the retaining screws.

NOTE	The male connector of the GSIOC cable is used to connect modules to the liquid handler. Refer to **Connecting to GSIOC Modules** on page 47.

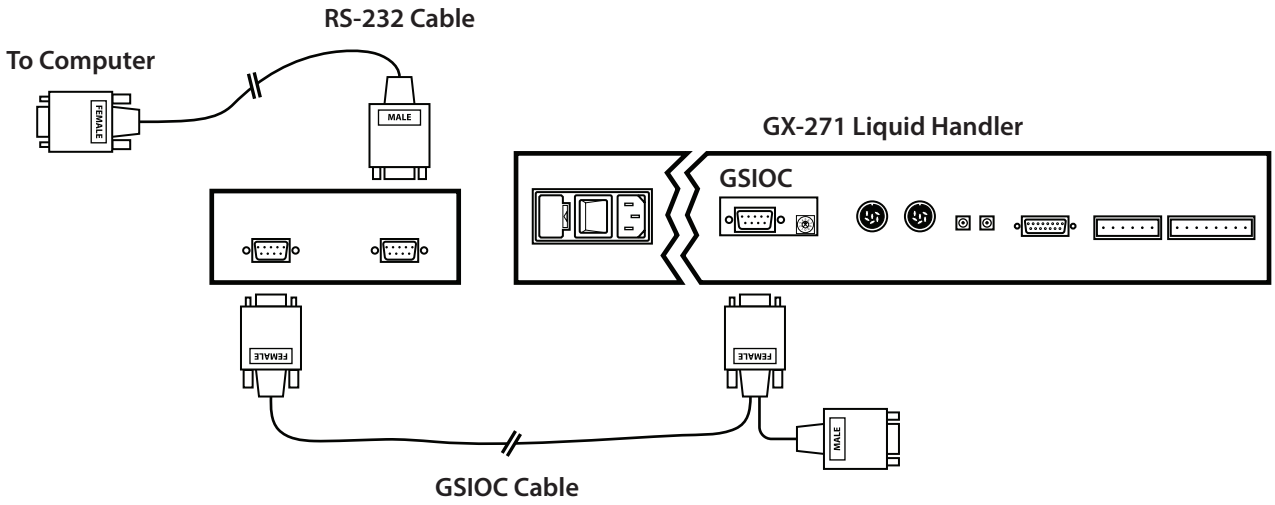


Figure 24: GSIOC Cable Connection from the GX-271 Liquid Handler to the 508 Interface Module

Connecting the Interface Module to the Computer

1. Locate the RS-232 cable provided with the interface module. Attach the male end of the RS-232 cable to the RS-232 port located on the rear panel of the interface module. Tighten the retaining screws.
2. Attach the female end of the RS-232 cable to the computer's RS-232 serial communications port. Tighten the retaining screws.

Connecting to GSIOC Modules

The GSIOC accessories ports are used to transfer information between the liquid handler and a GSIOC module. To connect the liquid handler to a GSIOC module, you will need a 6-pin to 9-pin GSIOC cable (ordered separately, part number 260354551).

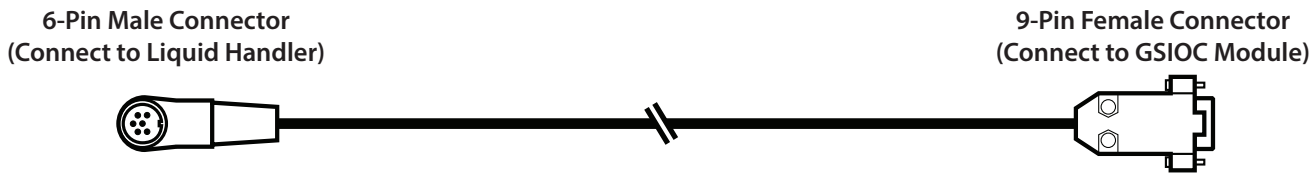


Figure 25: 6-Pin to 9-Pin GSIOC Cable

Connecting a 6-pin to 9-pin GSIOC Cable to the GX-271 Liquid Handler

1. Attach the male connector of the 6-pin to 9-pin GSIOC cable to one of the GSIOC ACCESSORIES ports located on the rear panel of the liquid handler.
2. Attach the female connector of the 6-pin to 9-pin GSIOC cable to the GSIOC module. Tighten the retaining screws using a flat-blade screwdriver.

NOTE	When you are using more than one GSIOC module, you will need both a 6-pin to 9-pin GSIOC cable and a standard GSIOC cable (ordered separately, part number 36078143).

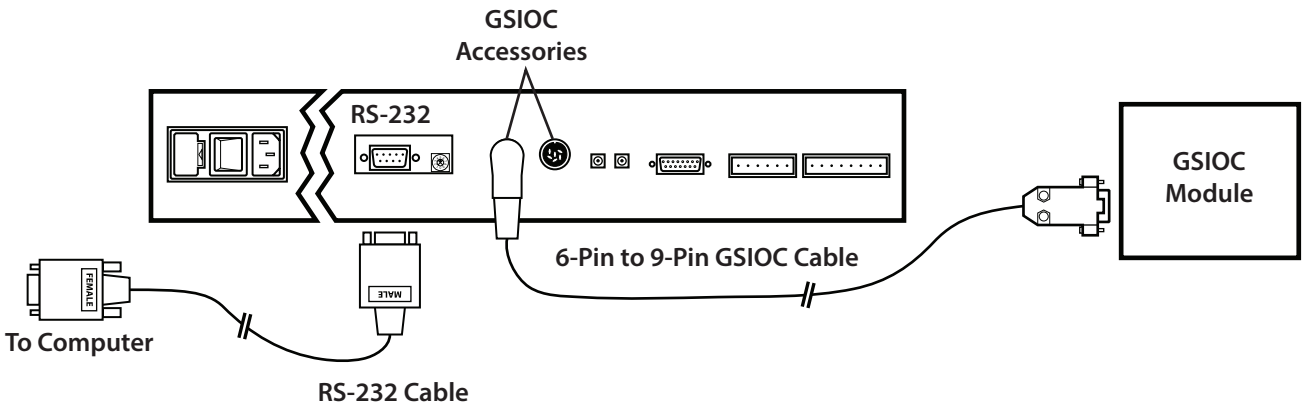


Figure 26: 6-Pin to 9-Pin GSIOC Cable Connection

Connecting to Multiple GSIOC Modules

NOTE	When connecting more than one GSIOC module, you will need an additional GSIOC cable (part number 36078143) for each additional module.

1. Attach the female connector of the GSIOC cable (located individually at one end of the cable) to the male connector of the GSIOC cable that is attached to the liquid handler. Tighten the retaining screws.
2. Attach the female connector (located on the same end as the male connector) to the GSIOC module. Tighten the retaining screws.

NOTE	The remaining male connector of the GSIOC cable (currently attached to the GSIOC module) is used to connect additional GSIOC modules.

3. Attach the female connector of the GSIOC cable (located on the same end as the male connector) to the male connector of the GSIOC cable currently attached to the GSIOC module. Tighten the retaining screws. Repeat step 3 for each additional module.

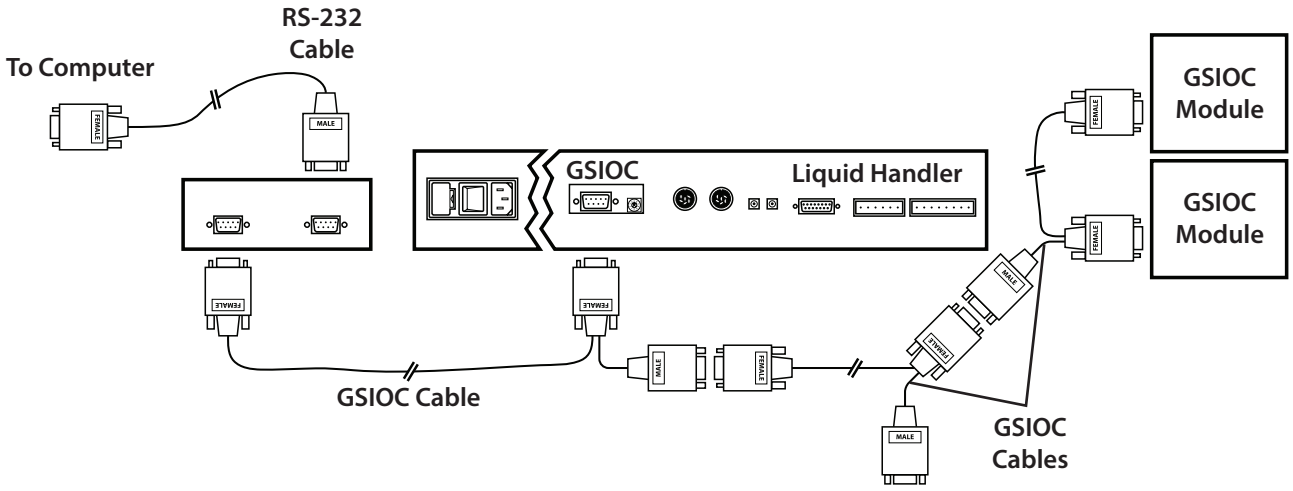


Figure 27: Connecting to Multiple GSIOC Modules

Unit ID

The unit ID identifies the liquid handler to software packages that can issue GSIOC commands to the liquid handler.

At the factory, the unit ID on the liquid handler is set to 20. There is no need to change this number, unless it has been assigned to another Gilson instrument that is also connected along the GSIOC.

To change the unit ID:

1. Gently insert a small flat-blade screwdriver into the unit ID selector on the rear panel and turn it. Refer to **Rear Panel Diagram** on page 42 for the location of the unit ID selector
2. Align the white dot with one of the indicated numbers. The unit ID is 20 plus the selected number.

NOTE	For information about setting the unit ID for liquid handler accessories that utilize GSIOC communications, refer to its respective appendix.

Z-Arm Connection

Connect the cable from the Z-arm to the Z-ARM port on the rear panel of the liquid handler. Refer to **Rear Panel Diagram** on page 42 for the location of this port.

Input and Output Ports

You can use the transistor-transistor logic (TTL) input and output contacts found on the rear panel of the instrument to control peripheral devices. Refer to the **Rear Panel Diagram** on page 42 for the location of the input and output ports.

Contact Inputs

The input terminal block of the instrument has six contacts. All of the inputs are paired, and each pair includes a GROUND reference ( ).

The contact input pairs are labeled A and B. 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.

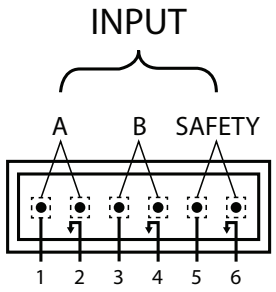


Figure 28: Input Contacts Digram

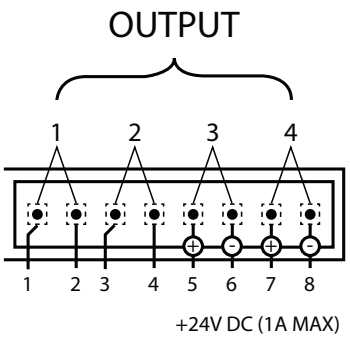
NOTICE	Never connect voltages higher than 5V DC to an input. When using TTL signals, be sure to match GROUND connections.

Contact Outputs and DC Power Outputs

The output terminal block has eight contacts.

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

Pins 5 through 8 are DC power outputs and can be turned on (supplying +24V DC) or off (+24V DC output will float) via software control.



Making Connections

To make connections, use the following items:

- 2-conductor cable (22–30 gauge for each wire)
- Wire insulation stripper
- Small-blade screwdriver

A 6-foot piece of suitable cable (part number 709910206) is available for purchase from Gilson.

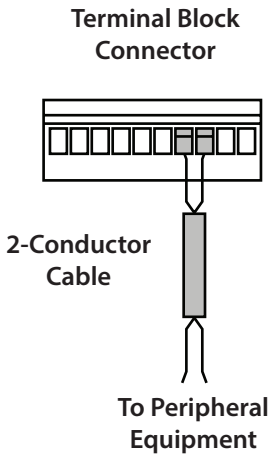


Figure 29: Terminal Block Connections

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 instrument. 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.

4. Push the wire all the way in, then tighten its corresponding pin screw.
5. Reconnect the terminal block connector to the instrument. Push the connector in as far as it will go. It is designed to fit snugly into its receptacle.
6. Connect the opposite ends of the wires to the other device(s). Be sure to match ground connections.
7. Label each cable to identify the purpose of the connection.

Power

Locate the appropriate power cord for your line voltage, and then connect the power cord to the power receptacle on the GX-271 Liquid Handler and then to a grounded power outlet.

Rack Installation

The GX-271 Liquid Handler is equipped to locate up to five Code 33X/34X-series. Refer to the **Parts and Accessories** appendix for a list of racks available for the instrument.

Code 33X/34X-Series Rack Installation

1. Orient the rack so that the code number is facing forward.
2. Locate the middle slot on the back of the rack. Slide this over the raised tab on the tray insert.
3. Fit the middle slot on the front of the rack over the raised tab in the front of the tray insert.

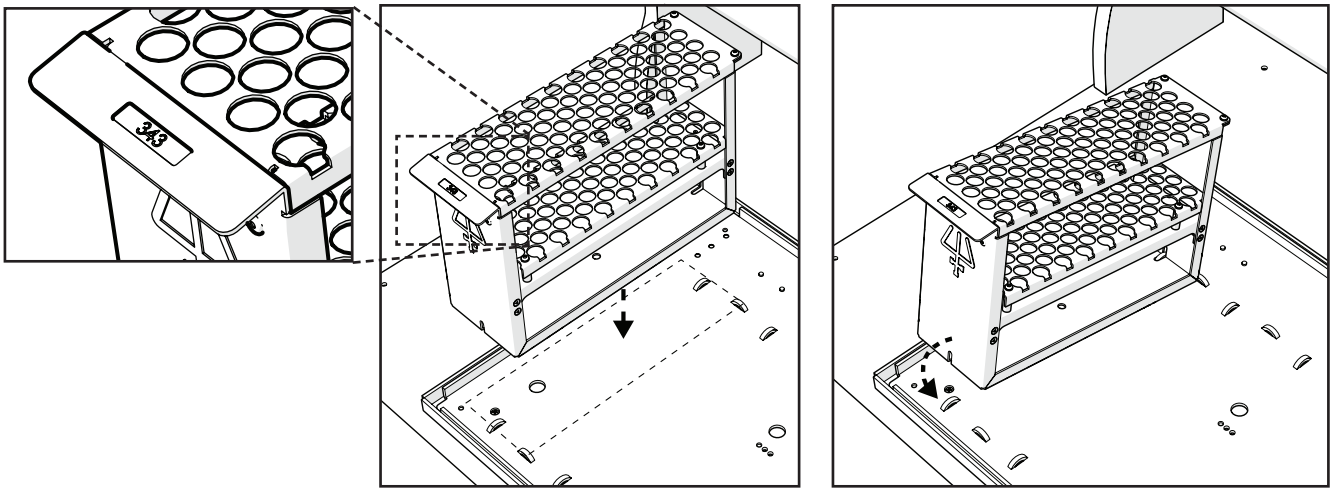


Figure 30: Orienting and Seating Racks on the Tray Insert

Solvent Bottle Rack Installation

Solvent bottle racks, ordered separately, can be installed on the tray insert.

To install a solvent bottle rack on the tray insert:

1. Align the holes on the bottom of the solvent bottle rack with the holes on the tray insert.

NOTE	The solvent bottle rack must be placed adjacent to the rinse station locations, even if the rinse stations are not installed.

2. Place the solvent bottles in the rack.

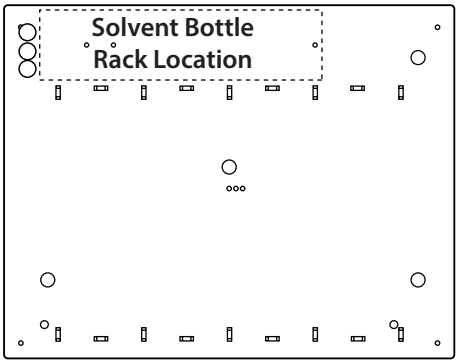


Figure 31: Solvent Bottle Rack Location

Final Z-Arm Adjustments

Z-Arm Cable Support Rod Installation

1. Using the Phillips screw included with the Z-arm cable support rod, attach the cable support rod to the rear panel of the instrument. Refer to the Rear Panel Diagram on page 42 for the location of the Z-ARM port. The hole for the screw is located on the rear panel near the top center of the instrument.
2. Snap the Z-arm control cable into the retaining clip on the Z-arm cable support rod.
3. Route the Z-arm cable through the retaining clip and collect tubing together before installing the spiral wrap. Ensure that there is enough slack in the Z-arm cable and tubing.

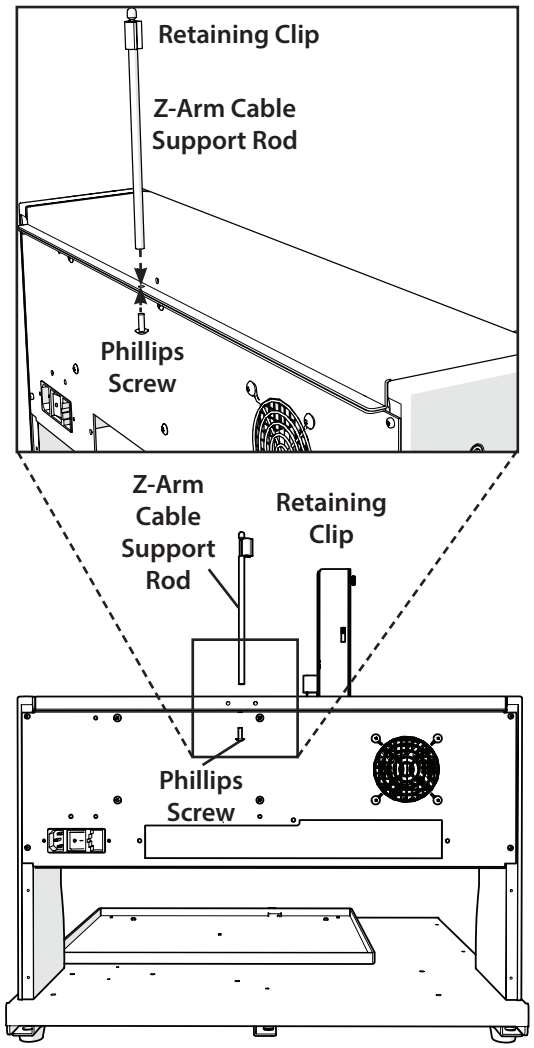


Figure 32: Installing the Z-Arm Cable Support Rod

Spiral Wrap Installation

Use the spiral wrap included in the accessory package to contain the tubing.

NOTE	If installing an optional fraction collection valve, complete all plumbing and installation instructions in the Fraction Collection Valve appendix prior to installing the spiral wrap.

Z-Arm Movement Verification

With all tubing, plumbing, and electrical connections made, manually move the Y-arm with the Z-arm attached to ensure that it can travel freely around the bed. If not, adjust the cable in the clip until it can move freely.

⚠CAUTION	Ensure that the GX-271 Liquid Handler is unplugged before manually moving the Z-arm.

Operation

Chapter Three

Install TRILUTION® LC v3.0 or TRILUTION® LH v3.0 (or higher) software according to the installation guide included with the software. These software packages provide control of the GX-271 Liquid Handler. For more information about TRILUTION LC or TRILUTION LH software, refer to the respective user's guide and documentation supplied with the software.

This chapter provides information on the following topics::

Front Panel

The front panel of the instrument contains an LED display, a power indicator light, and an error indicator light.

Power Indicator Light

The indicator becomes lit when you turn on power to the instrument using the power switch located on the rear panel. Refer to **Rear Panel Diagram** on page 42.

Error Indicator Light

The indicator becomes lit when an error has been encountered. Refer to **Error Messages** on page 68 for a list of error messages related to the liquid handler. For error messages related to liquid handler accessories, refer to its appendix.

Figure 34: Front Panel Location and Close-Up

Start Up

To start the instrument:

NOTICE	Ensure that all rear panel connections, plumbing, and installation instructions for the liquid handler and any required or optional accessories are made prior to starting the liquid handler.

1. Make sure the instrument is connected to a grounded power source.
2. Power on the PC first, the router next, and then the GX-271 Liquid Handler.
3. Power on the syringe pump (if applicable).
4. Start TRILUTION® LC or TRILUTION® LH software.

GX-27X Series Offset Utility

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

The GX-27X Series Offset Utility software (part number 21067529) is supplied on a CD located in the offset utility kit (part number 2604711).

The following are included:

- GX-27X Series Offset Utility CD for use with Windows® XP and Windows® 7
- 125 mm Offset Tool
- 175/185 mm Offset Tool
- GX-27X Series Offset Utility Kit Instructions

Install the GX-27X Series Offset Utility

Pre-Installation Checklist

Before beginning the installation:

❒ Log on as a Windows® Administrator

❒ Close all running applications

❒ Temporarily disable antivirus software

❒ Temporarily disable firewall

Installation

The installation of the GX-27X Series Offset Utility proceeds as follows:

1. Uninstall the previous version of the GX-27X Series Offset Utility (if necessary).
2. Insert the CD into the drive. If the setup program does not start automatically, browse for SETUP.EXE.
3. Install the Gilson Server (if not previously installed).
4. Install Microsoft® .NET Framework (if necessary).
5. Install the GX-27X Series Offset Utility. Follow the on-screen instructions.
    - If a User Account Control window appears, click Yes.
        - The installation path on a Windows® XP and Windows® 7 (32-bit) system is **C:\Program Files\Gilson\Utilities\GX-27X Series\Offset Utility**.
        - The installation path on a Windows® 7 (64-bit) system is **C:\Program Files (x86)\Gilson\Utilities\GX-27X Series\Offset Utility**.

Prepare to Run the GX-27X Series Offset Utility

1. Ensure that plumbing and electrical connections have been made as described in **Plumbing Connections** on page 40 and **Rear Panel Connections** on page 42.
2. Turn on the instruments.
3. Remove all racks from the tray insert.

Start the GX-27X Series Offset Utility

To start the GX-27X Series Offset Utility, click
Start > All Programs > Gilson Applications > GX-27X Series > GX-27X Series Offset Utility.

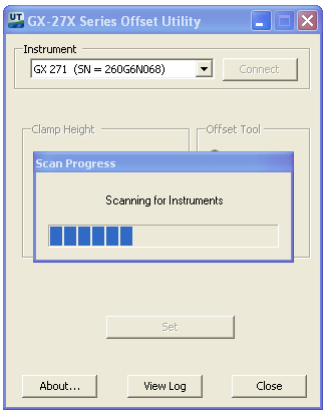
If any Windows® Security Alerts appear with Gilson, Inc. as the Publisher, click **Unblock (Windows® XP)** or **Allow Access (Windows® 7)**.

The GX-27X Series Offset Utility window will appear.

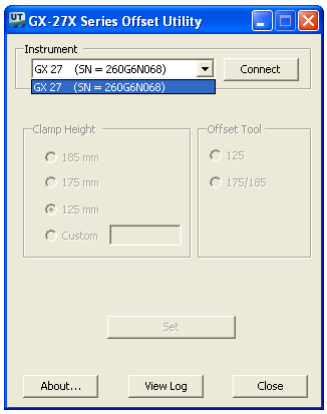
Use the GX-27X Series Offset Utility

Specify and Set Configuration

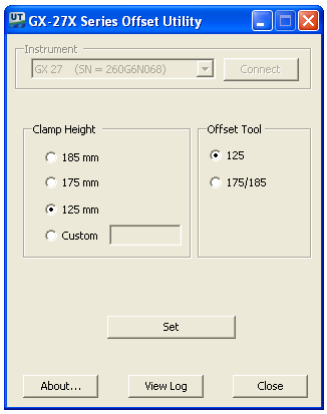
1. Allow instruments to scan into list.
   - Ethernet-controlled instruments will display the serial number (SN=).
   - GSIOC and RS-232-controlled instruments will display the Unit ID (ID=)
2. Select the instrument and then click **Connect**.
3. Select the Clamp Height and the Offset Tool and then click **Set**.



Step 1: Scan



Step 2: Connect



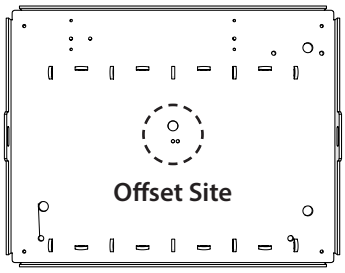
Step 3: Set

Determine and Set XY Offset

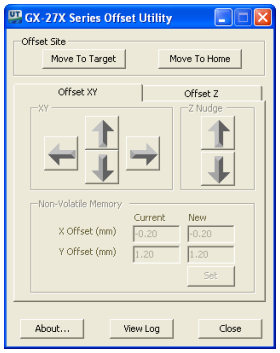
1. Place the selected offset tool on the center hole in the tray insert.
2. To move to the XY offset site, click **Move To Target**.
3. The arm will move to the offset site and then will move the probe 5 mm above the offset tool.
4. Use the **Z Nudge** arrows to move the probe down.
5. Offset the probe to the center of the offset tool using the **XY Arrow Keys**.

NOTE	If a message appears indicating that the minimum or maximum offset value has been reached, contact your local Gilson representative for assistance.

6. When the probe is centered, click **Set** to save the X and Y Offsets.



Step 1: Place the Offset Tool



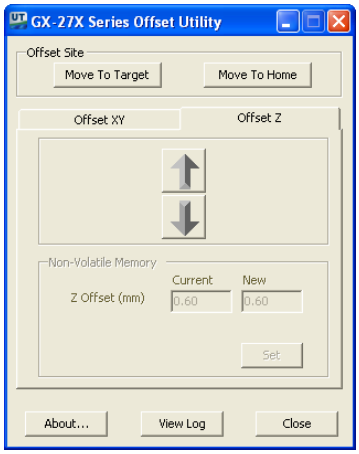
Steps 2 through 6: Moving and Setting the Offset

Determine and Set Z Offset

1. Select the Offset Z tab.
2. To move to the Z offset site, click **Move To Target**.
3. Use the arrows to align the tip of the probe with the top of the offset tool.
4. Slide a small piece of paper between the tip of the probe and the offset tool. If the top of the paper touches the tip of the probe, the Z offset is correct.

NOTE	If a message appears indicating that the minimum or maximum offset value has been reached, contact your local Gilson representative for assistance.

5. When the probe is aligned, click **Set** to save the Z offset.



Step 2: Move to Target

View Log

Click **View Log** to view the offset history for the connected instruments.

Move to Home

Click **Move To Home** to home the instrument.

Close Utility and Remove Tool

Close the software and then remove and store the offset tool.

Maintenance

Chapter Four

When performing the maintenance described in this chapter, use good laboratory practice, including, but not limited to, wearing protective clothing and preparing the maintenance space for service. After completing the maintenance operation, verify the safe and good working order of the part and instrument.

This chapter contains some general guidelines for maintaining the liquid handler.

Helpful Hints

To keep the system at peak performance, Gilson recommends doing the following:

- Change or clean the tubing regularly to maintain maximum performance.
- Flush the probe and rinse stations daily with appropriate solvents.
- Check periodically to ensure that all fittings are tight.
- Wipe up all spills immediately.
- Allow fluids to equilibrate to room temperature before running them through the system; cold fluids may cause leakage.

Cleaning

Liquid Handler

The instruments 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 an instrument, wipe it using a dry, clean cloth.

Fluid Path

Depending on the system use, it may be necessary to flush the entire fluid path. When flushing the fluid path, it is recommended to use a volume that is equal to ten times the syringe volume plus the transfer tubing volume.

Flush Volume = (10 * Syringe Volume) + Transfer Tubing Volume

It's important to clean the fluid path if you won't be using the system 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 instructions below.

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

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

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

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.

Part Replacement

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, loss of air gap or syringe stalling.

Probe

Remove the Z-Arm from the GX-271 Liquid Handler.

1. Using a 3 mm Allen wrench, loosen the mounting screw on the Z-arm mounting bracket.
2. Partially pull out the bracket. Do not remove completely.
3. Remove the Z-arm from the mounting bracket.

Refer to the appropriate instructions below depending on whether you're replacing the probe with one with the same outer diameter or a different outer diameter.

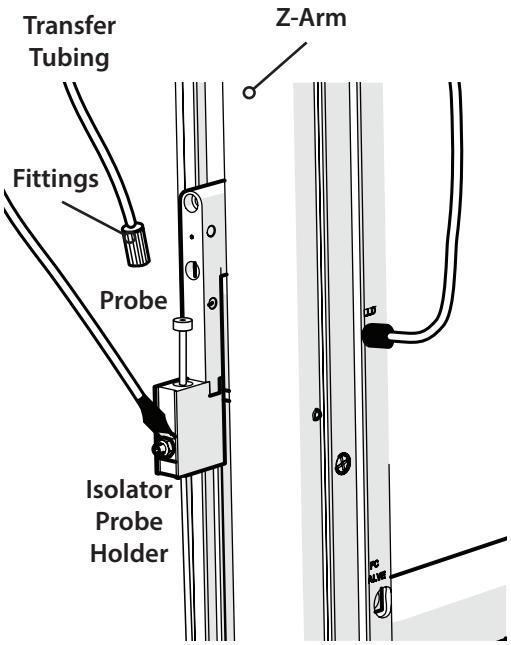


Figure 35: Replacing the Probe on the GX-271 Liquid Handler

Replacing a Probe with the Same Outer Diameter

To install a replacement probe with the same outer diameter as the probe that is currently installed:

1. Remove the transfer tubing fitting connected to the top of the isolator probe holder.
2. Grasp the current probe and push it up through the top of the isolator probe holder.
3. Install the new probe by pushing it through the top of the isolator probe holder. Make sure the tip of the probe sits inside the center hole of the probe guide insert.
4. Replace and tighten the fitting.

Replacing a Probe with a Different Outer Diameter

To install a replacement probe with a different outer diameter than is currently installed, you'll need a probe guide insert appropriate for the new probe.

1. Remove the transfer tubing fitting connected to the top of the isolator probe holder.
2. Grasp the current probe and push it up through the top of the isolator probe holder.
3. Using a Phillips screwdriver, remove the four screws from the bottom of the guide foot, and then remove the guide foot.
4. Remove the current probe guide insert and replace it with the new probe guide insert.

Part Number	Prob Guide Insert	Indentations
26046214	1.3 mm	0
26046215	1.5 mm	1
26046216	1.8 mm	2
26046217	2.3 mm	3
26046218	2.7 mm	4

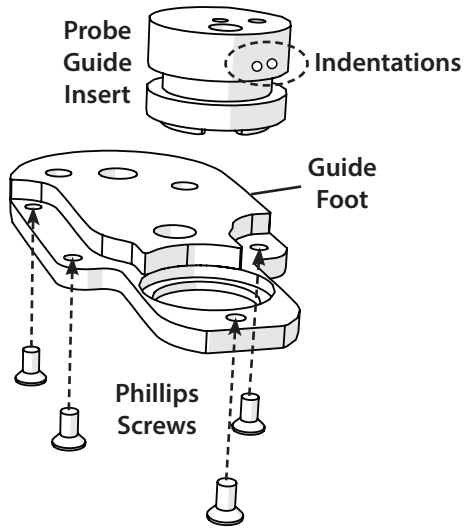


Figure 37: Guide Foot Assembly (Exploded View)

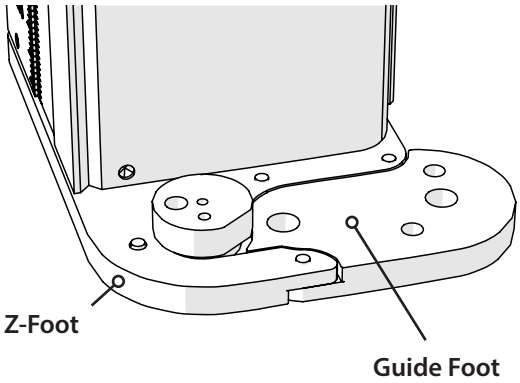


Figure 36: Guide Foot Installed on Z-Foot

5. Place the guide foot below the Z-foot and secure it using the screws.
6. Install the new probe by pushing it through the top of the isolator probe holder. Make sure the tip of the probe sits inside the center hole of the probe guide insert.
7. Replace and tighten the fitting.

Re-Install the Z-Arm on the Liquid Handler

1. Place the Z-arm in the mounting bracket. Insert on side of the Z-arm into place at a time (back to front).
2. Tighten the screw on the mounting bracket until the Z-arm is secure.

Run the GX-27X Offset Utility

It is recommended to run the GX-27X Offset Utility any time a change is made to the Z-arm, such as installing a different probe, changing the clamp height, or installing a different size probe guide insert. Refer to **GX-27X Series Offset Utility** on page 55 for more information.

Fuse

1. Power off the instrument and disconnect the power cord.
2. Locate or order replacement fuses. (Extras were provided with the instrument.)
3. Place a small screwdriver or a fingernail under the tab on the fuse drawer to detach it.
4. Remove the fuse drawer from its receptacle on the rear panel.
5. Replace both fuses. Use only fuses with the rated current and specified type as listed on the rear panel of the instrument.
6. Insert the fuse drawer into its receptacle on the rear panel.

Refer to the **Parts and Accessories** appendix for part numbers.

Transporting the Instrument

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

Troubleshooting

Chapter Five

This section provides information on the following topics:

Error Messages

When an instrument error occurs, a red indicator light flashes on the front panel of the instrument and the error number appears on the 2-digit, front panel display. For assistance with resolving an error, contact your local Gilson representative.

When an instrument error occurs on the GX-271 Liquid Handler, the error number appears on the 2-digit, front panel display. Refer to the table below for the error text.

Error	*Error Text*	*Solution*
0	No error	N/A
10	Unknown command	An unknown command was sent. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
11	Invalid NV-RAM address	Attempt to write to an NV-RAM address that doesn't exist. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
12	Safety contact closed	The safety contact was closed. Release contact. Send a Home command using the Gilson Ethernet Utility to clear the error. Restart controlling program.
13	Invalid command parameter	A numerical parameter was out of range. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
14	S buffer overflow	The S command buffer is full (up to 21 commands can be in the buffer). Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
15	S command while unhomed	A buffered S command was sent when the instrument was not homed. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
19	X encoder error	Motion was not detected while homing the X axis. Check cabling. Replace motor/encoder and/or replace Main PCB board.
20	Y encoder error	Motion was not detected while homing the Y-axis. Check cabling. Replace motor/encoder and/or replace main PCB board.
21	X homing error	Home failed on the X-axis. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.
22	Y homing error	Home failed on the Y-axis. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.

Error	Error Text	Solution
23	XY target out of range	A command was sent to set the XY position outside of the valid range. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
24	XY speed invalid	The specified XY speed is outside of the valid range. Send a Home command using the Gilson Ethernet Utility. Correct the error in the program controlling the instrument.
25	X stall or jam	X motion measured by encoders does not match requested motion. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.
26	Y stall or jam	Y motion measured by encoders does not match requested motion. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.
27	XY move while unhomed	Attempt to move to an XY location before completing the homing sequence. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
28	XY move while busy	Attempt to move to an XY location while XY is still in motion. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
29	Park location invalid	Attempt to move to a configured park location that is out of the allowed XY ranges. Check NV RAM locations 3 and 4.
31	Z homing error	Home failed on the Z-axis. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.
32	Z target out of range	A command was sent to set the Z position outside of the valid range. Send a Home command using the Gilson Ethernet Utility to clear the error. Check the clamp height setting with the GX-27X Series Offset Utility and/or correct the error in the program controlling the instrument.
33	Z speed invalid	The specified Z speed is outside of the valid range. Send a Home command using the Gilson Ethernet Utility. Correct the error in the program controlling the instrument.
34	Z stall or jam	Z motion measured by encoders does not match requested motion. Check for obstructions. Send a Home command using the Gilson Ethernet Utility to clear the error.

Error	Error Text	Solution
35	Z move while unhomed	Attempt to move to a Z location before completing the homing sequence. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.
36	Z move while busy	Attempt to move to a Z location while Z is still in motion. Send a Home command using the Gilson Ethernet Utility to clear the error. Correct the error in the program controlling the instrument.

Mechanical Troubleshooting

Probe No Longer Finding Tube Center

- Probe may be bent. Straighten or replace the probe.
- The instrument may need X/Y/Z adjustment. Run the GX-27X Series Offset Utility.

Electrical Troubleshooting

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 the instrument 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 the instrument should be compatible with device to which it is interfaced. Outputs are contact closures.

Unit Not Operational

- Make sure power is turned on and that the unit is plugged in.
- Check AC power cord connections.
- Try different AC outlet.
- Check fuses, and replace if necessary.

Unit Blows Fuses

- Contact your local Gilson representative.

Communication Troubleshooting

If a communication problem between the instrument and the software is suspected:

1. Close TRILUTION® software.
2. Power off the GX-271 Liquid Handler.
3. Cycle power to router by turning the router off, waiting 15 seconds, then powering the router back on.
4. Power on the GX-271 Liquid Handler.
5. Start TRILUTION® software.

Repair and Return Policies

Refer to the following information and then contact your local Gilson representative. Specific contact information can be found at **www.gilson.com**.

Before Calling Us

Your local Gilson representative will be able to serve you more efficiently if you have the following information:

- Serial number and model number of the instruments involved.
  - The serial number is located under the Y-arm near the rear of the GX-271 Liquid Handler.
  - The serial number is located on the back side, at the top of the Z-arm.
  - The serial number is located on the right side of the GX Solvent System.
  - The serial number is located on the right side of the GX Direct Injection Module.
  - The serial number is located on the right side of the GX Rinse Pump.
- Installation procedure you used.
- List of concise symptoms.
- List of operating procedures and conditions you were using when the problem arose.
- List of all instruments in the configuration and the connections to those instruments.
- 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, contact your local Gilson representative.

Non-Warranty Repair

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

Return Procedure

Contact your local Gilson representative 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 local Gilson representative regarding proper method of shipment. No responsibility is assumed by Gilson or your local Gilson representative 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 on the end-of-life policy. This is in accordance with the European Union Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

GX Solvent System

Appendix A

This chapter provides information on the following topics:

Technical Specifications

Please be aware of the following before operating the instrument.

NOTICE	Changes or modifications to the instrument not expressly approved by Gilson could void the factory-authorized 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 instrument to ensure compliance with the FCC Class A limits.

GX Solvent System

Technical Specification	*Definition*
Back Pressure	50 psi
Dimensions (W x D x H)	12.1 x 8.9 x 18.3 cm (4.76 x 3.5 x 7.2 in.)
Flow Rate	1 µL/min up to 50 mL/min
Liquid Contact Materials *Refer to the Materials appendix for more details.	*Material*
	PTFE
	Nitronic 60 (N60)
	Valcon H
Power Requirements	• Voltage: 24V DC • Current rating: 1.0A
Pump Type	Peristaltic
Pump Internal Volume	625 µL ± 12 µL
Volumetric Accuracy	• Volume Range: 100 µL–25 mL (water) • Accuracy at 500 µL: ± 10 nL • Accuracy at 10 mL: ± 200 µL
Weight	2.2 kg (4.9 lbs.)

GX Rinse Pump Technical Specifications

Installation

The GX Solvent System is installed next to the left support on the GX-271 Liquid Handler.

NOTE	Two locator pins are included with the solvent system, but are not used with the liquid handler.

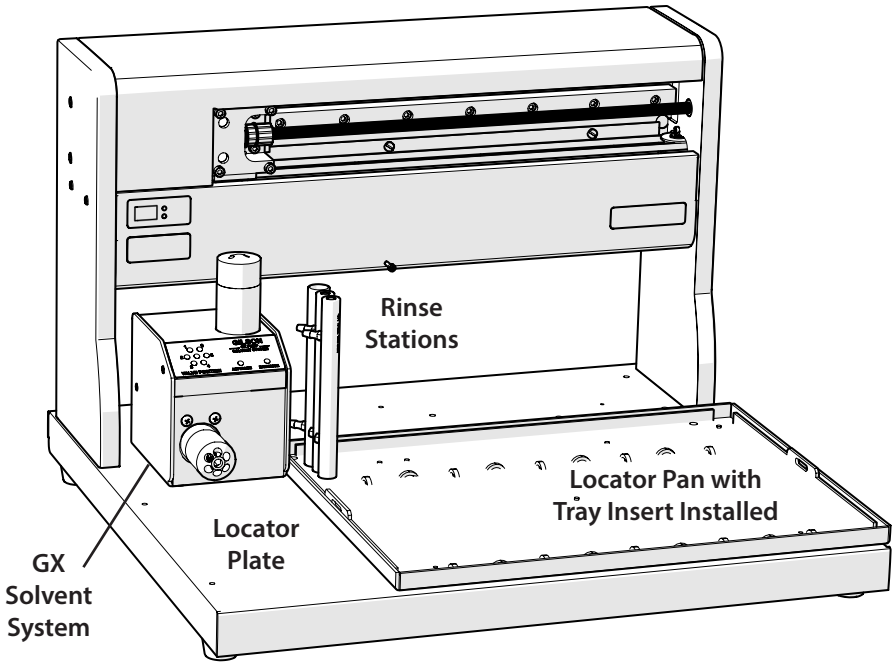


Figure 38: GX Solvent System Installed on the Locator Plate of the GX-271 Liquid Handler

Operation

Start Up

To start the solvent system module:

1. Ensure that the injection module is connected to the liquid handler. If not, ensure that the power is turned off to the liquid handler before making the connection.

NOTICE	Ensure that the power is turned off to the liquid handler before connecting or disconnecting the solvent system module.

2. Turn on power to the liquid handler. Power is supplied to the injection module by the liquid handler. The indicator lights on the solvent system illuminate briefly.

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.

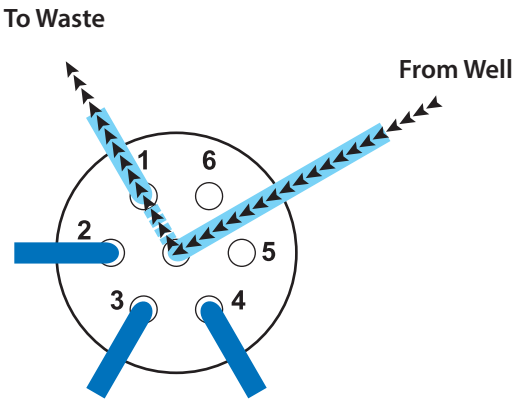


Figure 39: Aspirate Sequence

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.

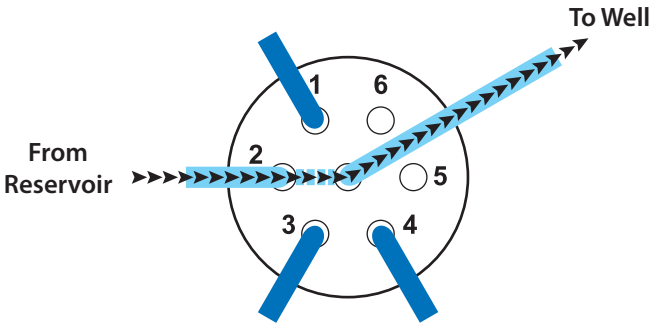


Figure 40: Dispense Sequence

Plumbing Connections

This section will take you through the steps for plumbing the GX Solvent System.

Before making the plumbing connections, locate the items listed below.

Part Number	*Description*
Included with the GX Solvent System:	
499484021	Solvent inlet tubing
49948122	Solvent valve to pump tubing
490032	Waste tubing, 0.063 (ID) x 0.125 (OD), PTFE (15 ft)
490410332	P-331 nut, 1/8", 1/4-28 PEEK
49041027	P-359 ferrule, 1/8"
and one of the following, ordered separately:	
499424013	Transfer tubing 1.1 mL
499471112	Transfer tubing 5.5 mL
499474103	Transfer tubing 10.5 mL
499483602	Transfer tubing 30 mL

Connection Diagrams

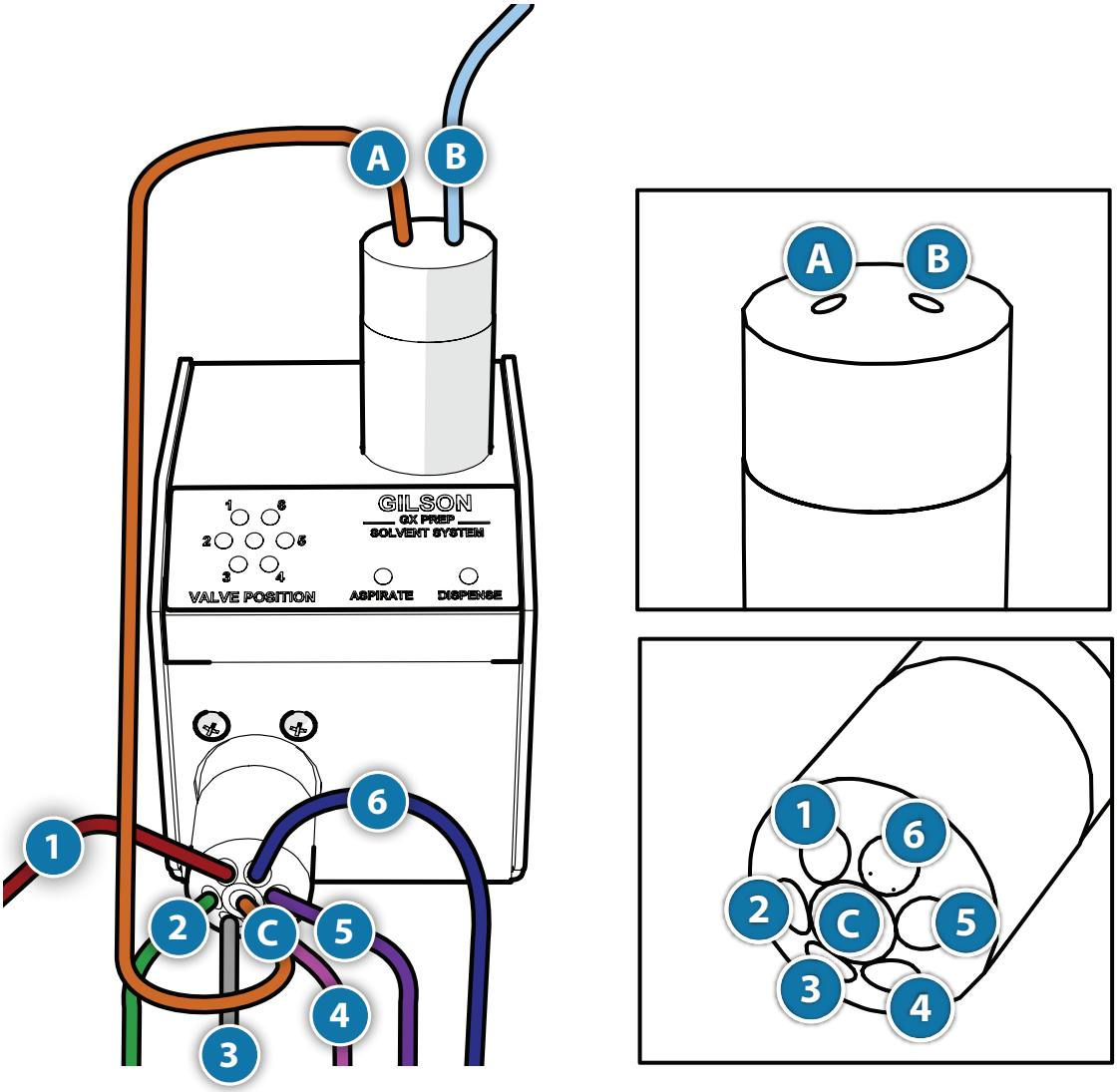


Figure 41: GX Solvent System Plumbing Connection Diagram with Close Up of Valves

Port Connections and Plumbing

GX Solvent System	Tubing	Connections
Port 1 to Waste	15 feet of Teflon tubing (0.063" ID x 0.125" OD)	Upchurch P-331 PEEK nut and P-359 ferrule.
Ports 2–6 to Reservoir	Solvent inlet tubing (part number 499484021)	Connect the end of the tubing with the fitting attached to ports 2–6 on the selection valve.
	40 inches of Teflon tubing (0.085" ID x 1/8" OD)	
Center Port (C) to Port A	Solvent valve to pump tubing (part number 49948122)	Connect one end to the center port on the valve and the other end to port A on the pump.
	14 inches of Teflon tubing (0.085" ID x 1/8" OD)	
Port B to Probe	1.1 mL transfer tubing (part number 499424013)	Connect one end to the probe and the other end to port B on the pump.
	87 inches of Teflon tubing (0.030" ID x 1/16" OD)	
	5.5 mL transfer tubing (part number 499471112)	Connect the end with the headless nut to the probe and the other end to port B on the pump.
	102 inches of Teflon tubing (0.062" ID x 1/8" OD)	
	10.5 mL transfer tubing (part number 499474103)	Connect one end to the probe and the other end to port B on the pump.
	204 inches of Teflon tubing (0.062" ID x 1/8" OD)	
	30 mL transfer tubing (part number 499483602)	Connect one end to the probe and the other end to port B on the pump.
	360 inches of Teflon tubing (0.085" ID x 1/8" OD)	

Rear Panel Connections

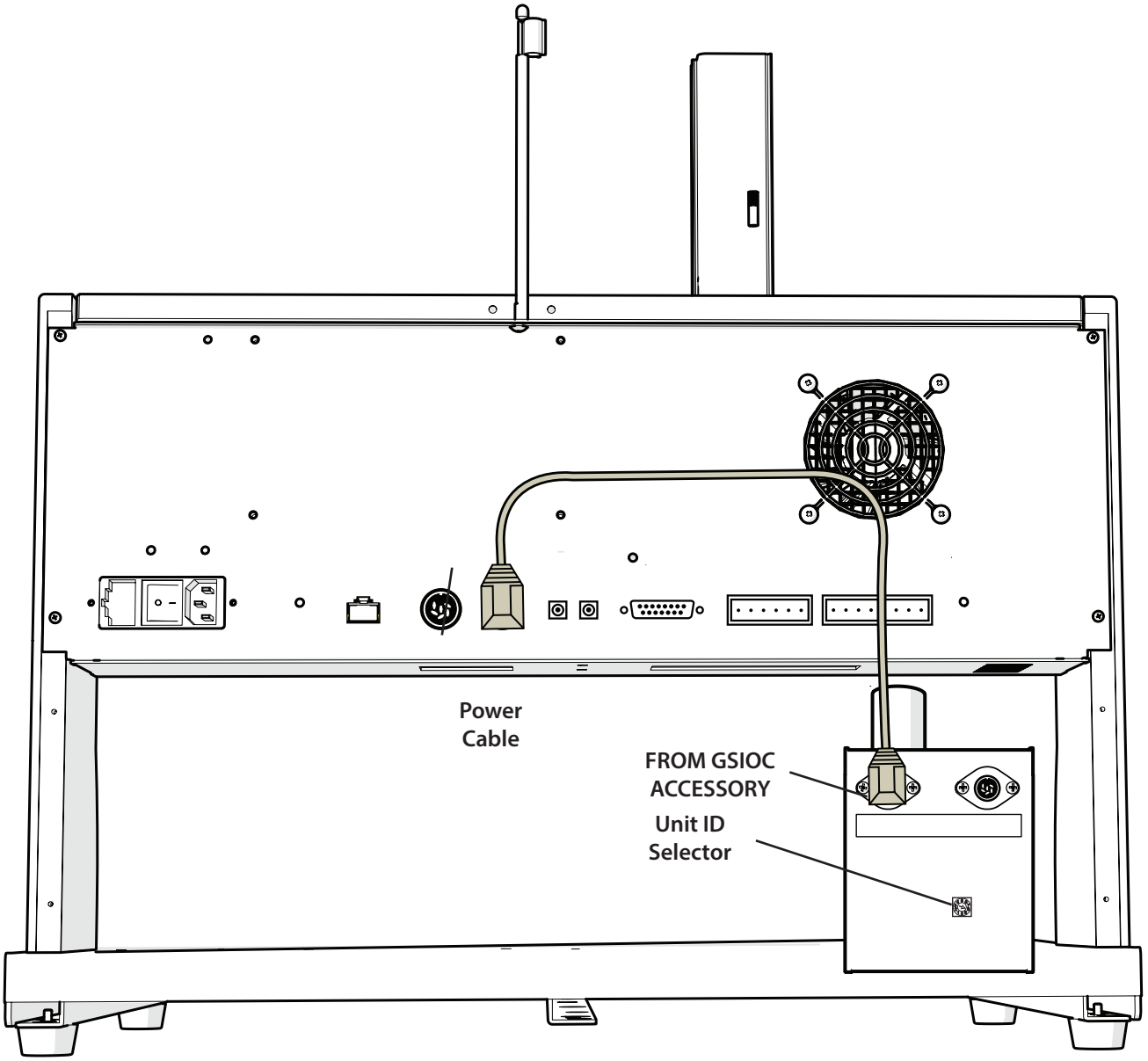
To make connections between the solvent system and the liquid handler refer to the diagram and instructions below.

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

NOTICE	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 power cable (part number 26035455) to the FROM GSIOC ACCY port on the solvent system. The

3. Connect the other end of the power cable to one of the GSIOC ACCESSORIES ports on the rear panel of the GX-271 Liquid Handler.



Unit ID

At the factory, the unit ID on the GX Solvent System is set to 0.

Refer to the table below for the correct setting, which is dependent on the type of communication to be used.

Unit ID	*Communication*	*Diagram*
8	Ethernet	
0	RS-232	
0	GSIOC	

Fraction Collection Valve

Appendix B

This appendix provides information on the following topics:

Technical Specifications

Please be aware of the following before operating the instrument.

NOTICE	Changes or modifications to the instrument not expressly approved by Gilson could void the factory-authorized 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 instrument to ensure compliance with the FCC Class A limits.

Fraction Collection Valve

Technical Specification	*Definition*	
Available Valves	Three-port (PTFE)	
Internal Volume	120 µL	
Dead Volume	10µL	
Flow Rate	Up to 200 mL/min	
Liquid Contact Material	*Description*	*Material*
	Fitting	PTFE
	Valve	PEEK

Installation

Valve and Power Cable

The fraction collection valve is installed on the guide foot.

To install the fraction collection valve:

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.
2. Connect the black cable from the top of the valve to the FC VALVE port on the side of the Z-arm.

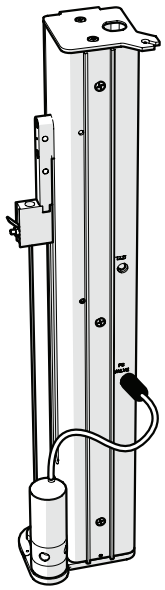


Figure 45: Fraction Collection Valve Installed on the Z-Arm

Tube and Wire Routing Strip

The tube and wire routing strip (part number 26036123) is included with the fraction collection valve.

To install the tube and wire routing strip:

1. Using the 3 mm Allen wrench included in the accessory package, loosen the stop pin so that it is flush with the right side of the Z-arm.

NOTE	The stop pin is factory installed on the left side of the Z-arm in the hole labeled S2.

2. Orient the tube and wire routing strip so that the side with two smaller notches is on the left.
3. Slide the tube and wire routing strip over the two raised rails on the right side of the Z-arm. The notch should line up with the hole in the Z-arm for the stop pin.
4. Fully tighten the stop pin. The tip of the stop pin should be visible on the right side of the Z-arm.

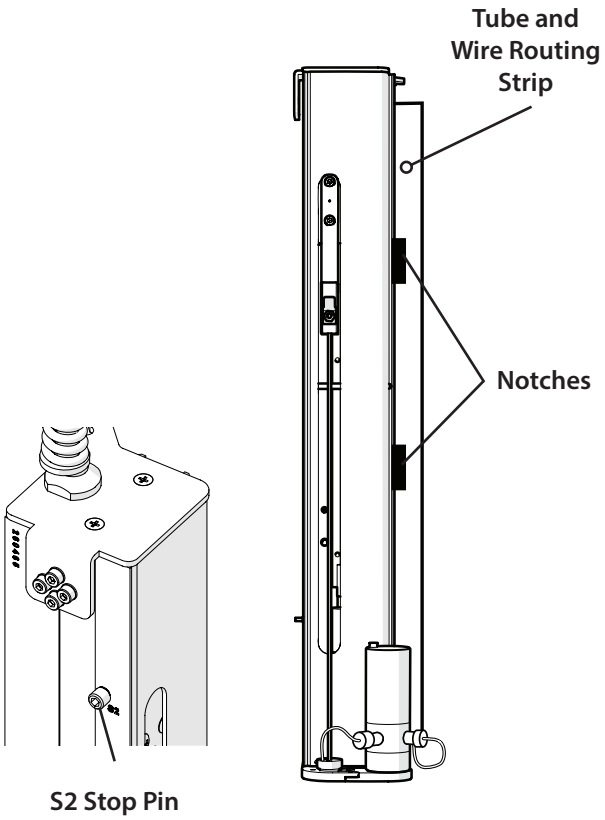


Figure 42: Installing the Tubing Routing Strip

Plumbing Connections

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

Before making the plumbing connections, locate the plumbing package for the fraction collection valve (part number 26037270) that 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) (x5)
49041011	Ferrule, 1/16", red, (P-200R) (x5)
F1410050	Couplings, 200–16 (x5)
49041015	Ferrule, flangeless, 1/8", TEFZEL (P-300)
49041016	Nut, 1/4–28 x 1/8" Delrin (P-304)
490032	Tubing, 1.5 mm ID x 3.0 mm OD, TFE clear, (15 ft)
26036123	Tube & wire routing strip, Z drive

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. Refer to **Valve Connections and Description** on page 90 for port locations.
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.

   The 1/8" tubing uses the larger guide hole and the 1/16" tubing uses the smaller guide hole.

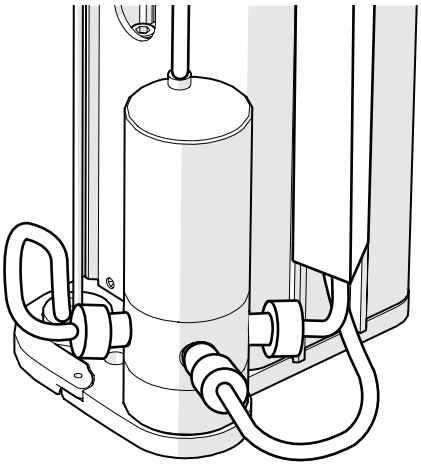


Figure 43: Close Up of Fraction Collection Valve Tubing Routed Through the Tube and Wire Routing Notches

Valve Connections and Description

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

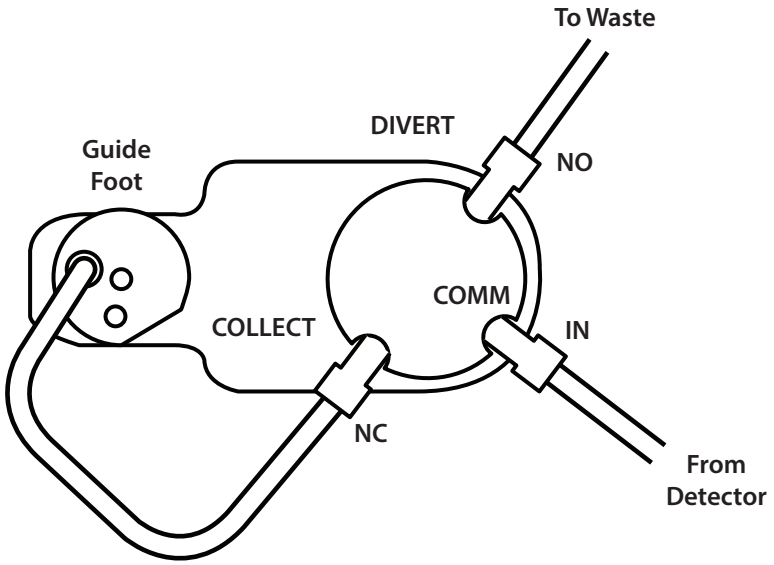


Figure 44: Fraction Collection Valve Connections (Top View)

3-Way Valve	*Tubing*	*Connections and Descriptions*
NC (Normally Closed) Port ***COLLECT Position***	1/16" TFE probe (part number 25077423) OR 1/8" TFE probe (part number 25077422)	NC Port to Probe
		Information on making these connections can be found in Installing the **Installing the Collection Probes** on page 89.
COMM (Common) Port ***INLET Position***	PEEK tubing 0.030"x 1/16" x 5 feet (part number 49953059)	Common Port to Coupler
		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).
NO (Normally Open) ***DIVERT Position***	Teflon tubing 1.5 mm (ID) x 3.0 mm OD x 15 feet (part number 490032)	NO Port to Waste
		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.

GX Direct Injection Module

Appendix C

This appendix provides information on the following topics:

Technical Specifications

Please be aware of the following before operating the instrument.

NOTICE	Changes or modifications to the instrument not expressly approved by Gilson could void the factory-authorized 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 instrument to ensure compliance with the FCC Class A limits.

GX Direct Injection Module

Technical Specification	*Definition*	
Available Valves	***Analytical***	Stainless steel direct injection valve • (2-position, 6-port) 0.016" (ID) ports, 1/16" (OD)
		PEEK direct injection valve • (2-position, 6-port) 0.016" (ID) ports, 1/16" (OD)
	Preparative	Stainless steel direct injection valve • (2-position, 6-port) 0.060" ID ports, 1/8" OD
		Stainless steel direct injection valve • (2-position, 6-port) 0.030" ID ports, 1/16" OD
Available Sample Loops	***Analytical***	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
	Preparative	For GX Direct Injection Module (1/8"): • 5 mL, 10 mL, 20 mL, and 25 mL
		For GX Direct Injection Module (1/16"): • 250 µL, 500 µL, 1 mL, 2 mL, and 5 mL
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* *Contact Gilson, Inc. (techsupport@gilson.com) to learn what methods and conditions were used to obtain the values.	***Analytical (1/16")***	< 0.005%
		• Stainless steel valve and port • 20 µL loop • Total loop overfill

GX Direct Injection Module Technical Specifications (continued on page 93)

GX Direct Injection Module

Technical Specification	*Definition*	
Injection Reproducibility* *Contact Gilson, Inc. to learn what methods and conditions were used to obtain the values.	***Analytical (1/16")***	CV < 0.7%
		• Stainless steel and PEEK valves and ports • 20 µL loop • Total loop overfill
	Preparative (1/16")	CV <0.9%
		• Stainless steel valve and port • 1 mL loop • Partial loop
Liquid Contact Materials* *Refer to the **Materials** appendix for more details.	***Description***	***Material***
	Injection Valve	Valcon H Nitronic 60 (N60) PTFE PAEK
	Injection Port	PPS SS
Power Requirements	• Voltage: 24V DC • Current rating: 1.0A	
Valve Switching Speed	• 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.)	

Installation

Install the GX Direct Injection Module on the right side of the locator plate, next to the liquid handler's right support.

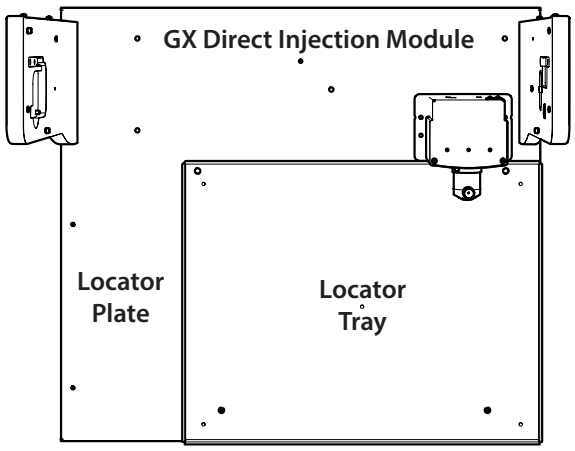


Figure 46: GX Direct Injection Module Bed Location

Injection Module

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

1. Align the rear set of holes on the GX Direct Injection Module base with the holes in the locator plate.
2. Place one of the provided screws on each side of the GX Direct Injection Module and tighten using the supplied ball driver wrench.

NOTE	There are two locator pins included with the GX Direct Injection Module; these pins will not be used with the GX-271 Liquid Handler.

Injection Module with Riser Block

Use the GX-271 Direct Inject Riser Block (part number 26035458, ordered separately) when collecting fractions to tubes 150 mm and taller, or when using the Code 33X/34X-series racks.

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

1. Align the pins on the top of the riser block with the holes on the bottom of the GX Direct Injection Module and then push the injection module into place.
2. Place the two screws (included with the riser) through the rear set of holes on the GX Direct Injection Module.
3. With the valve facing toward the front of the instrument, slide the injection module/riser assembly from the back of the instrument toward the front until it is lined up with the holes on the locator plate.
4. Using the supplied ball driver wrench, tighten the screws connecting the injection module/riser assembly to the locator plate.

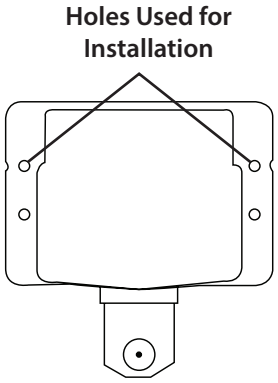


Figure 47: GX Direct Injection Module (Top View)

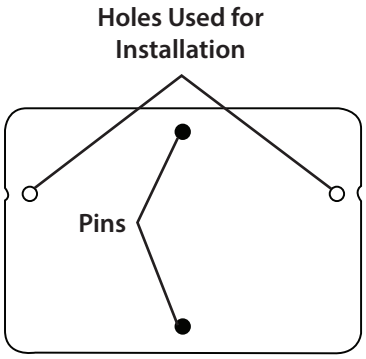


Figure 48: GX Direct Injection Module Riser Block (Top View)

Plumbing Connections

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

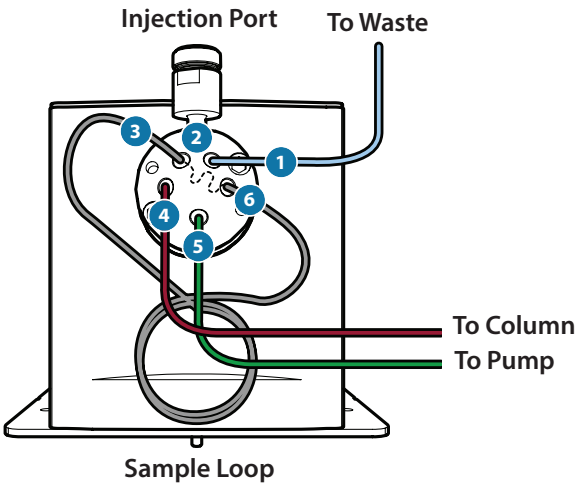


Figure 49: GX Direct Injection Module for 1/16" (OD) Sample Loop Plumbing Connections

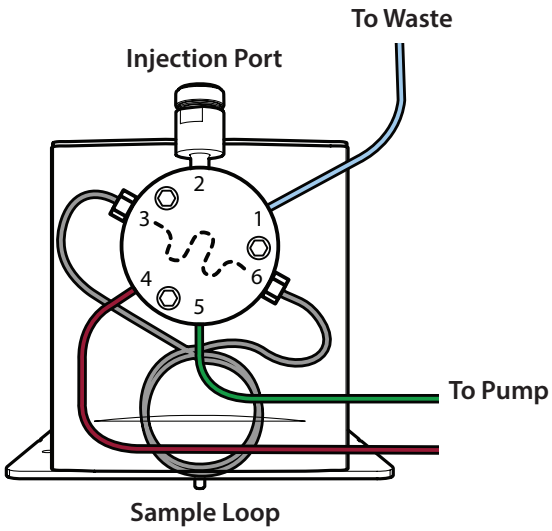


Figure 50: GX Direct Injection Module for 1/8" (OD) Sample Loop Plumbing Connections

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*	*Quantity*
4903180411	1/16" Nut, PEEK, (MZN1PK)	5
4903180511	1/16" Ferrule, PEEK, (ZF1PK)	5
495033	Teflon tubing, 0.020" ID x 1/16" OD, 10 ft/pk	1

Port Connections and Tubing

GX Direct Injection Module	*Tubing*	*Connections*
Port 1 to Waste	Teflon® tubing, 0.020" (ID) x 1/16" (OD), 10 ft. (part number 495033)	Use a 1/16" Nut, PEEK, (MZN1PK) (part number 4903180411) and a 1/16" Ferrule, PEEK, (ZF1PK) (part number 4903180511) to connect the tubing to Port 1 on the valve.
Port 2 (Injection Port)	N/A	Refer to **Injection Ports** on page 115 for injection port assemblies and injection port seal part numbers.
Port 3 to Port 6	Sample loop (ordered separately). Refer to the **Sample Loops** on page 113 appendix for part numbers.	
Port 4 to Column	Not supplied. Application specific.	Use a 1/16" Nut, PEEK, (MZN1PK) (part number 4903180411) and a 1/16" Ferrule, PEEK, (ZF1PK) (part number 4903180511) to connect the tubing to Port 4 on the valve.
Port 5 to Pump	Not supplied. Application specific.	Use a 1/16" Nut, PEEK, (MZN1PK) (part number 4903180411) and a ZF1PK 1/16" Ferrule (part number 4903180511) to connect the tubing to Port 5 on the valve.

Rear Panel Connections

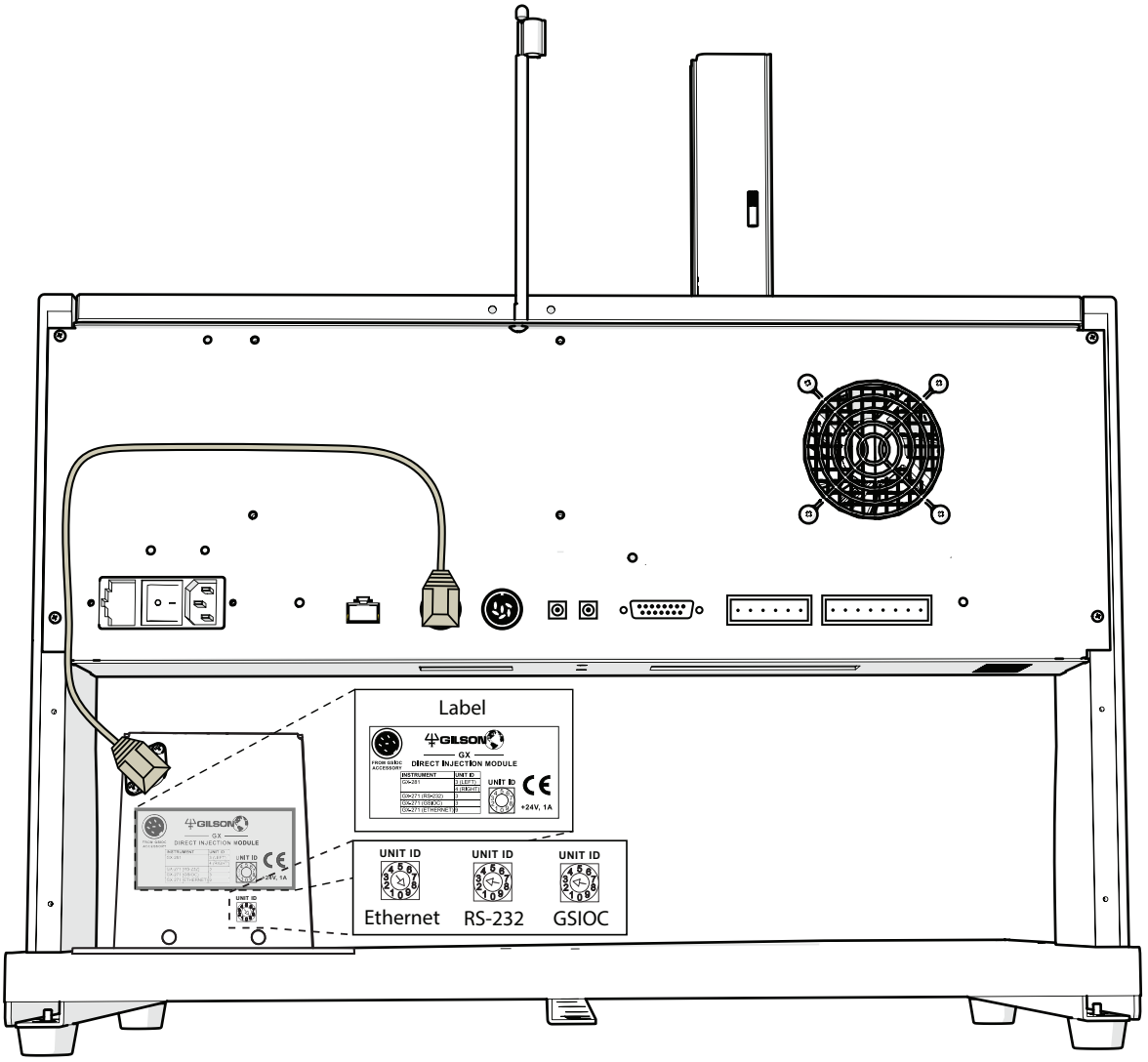
To make connections between the GX Direct Injection Module and the liquid handler refer to the diagram and instructions below.

1. Ensure that the power is turned off to the GX-271 Liquid Handler.

NOTICE	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 GX Direct 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

At the factory, the unit ID on the GX Direct Injection Module is set to 3.

Refer to the table below for the correct setting, which is dependent on the type of communication to be used.

Unit ID	*Communication*	*Diagram*
9	Ethernet	
3	RS-232	
3	GSIOC	

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.

GX Rinse Pump

Appendix D

This chapter provides information on the following topics:

Technical Specifications

Please be aware of the following before operating the instrument.

NOTICE	Changes or modifications to the instrument not expressly approved by Gilson could void the factory-authorized 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 instrument to ensure compliance with the FCC Class A limits.

GX Rinse Pump

Technical Specification	*Definition*
Contact Control	One input (contact closure) and one switched +24V DC 1A input
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
Pump Type	Peristaltic
Rinse Speed	High and low
Weight	1.0 kg (2.28 lbs.)

GX Rinse Pump Technical Specifications

Installation

Position the GX Rinse Pump near the rinse stations on the locator plate of the GX-271 Liquid Handler.

NOTE	Two thumbscrews are included with the rinse pump, but are not used with the liquid handler.

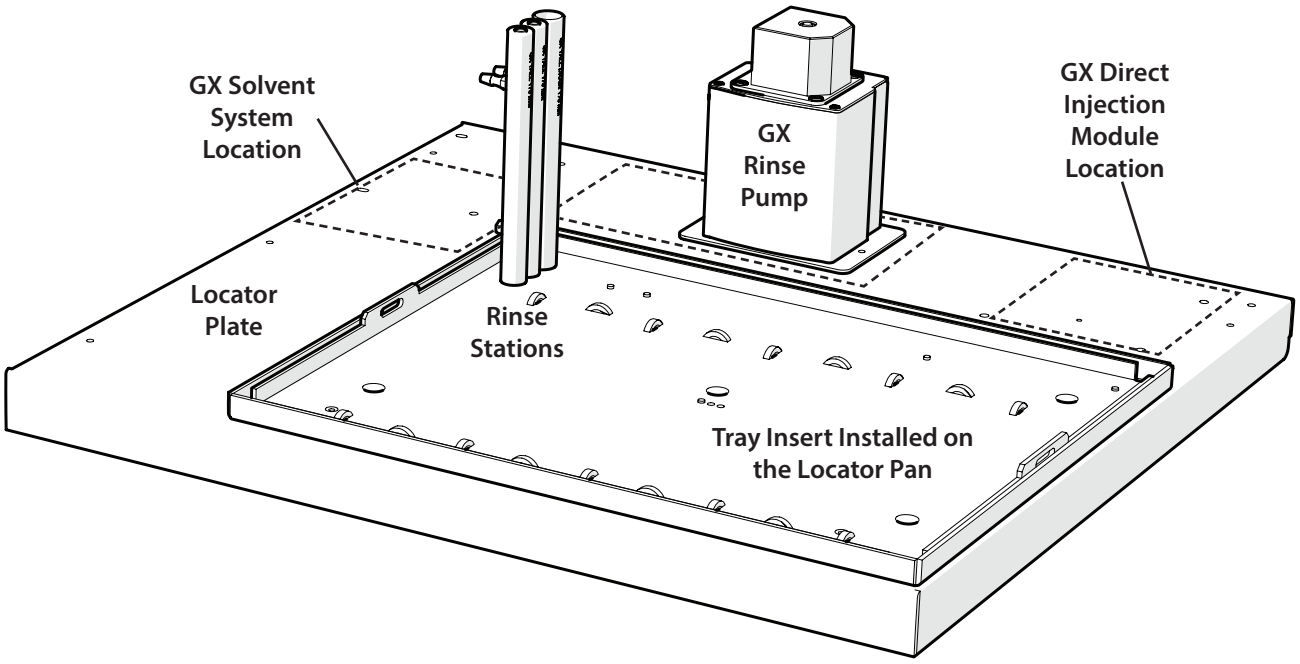


Figure 51: Installing the GX Rinse Pump on the Locator Plate of the GX-271 Liquid Handler

Plumbing Connections

Locate the following tubing included with the GX 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.
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.

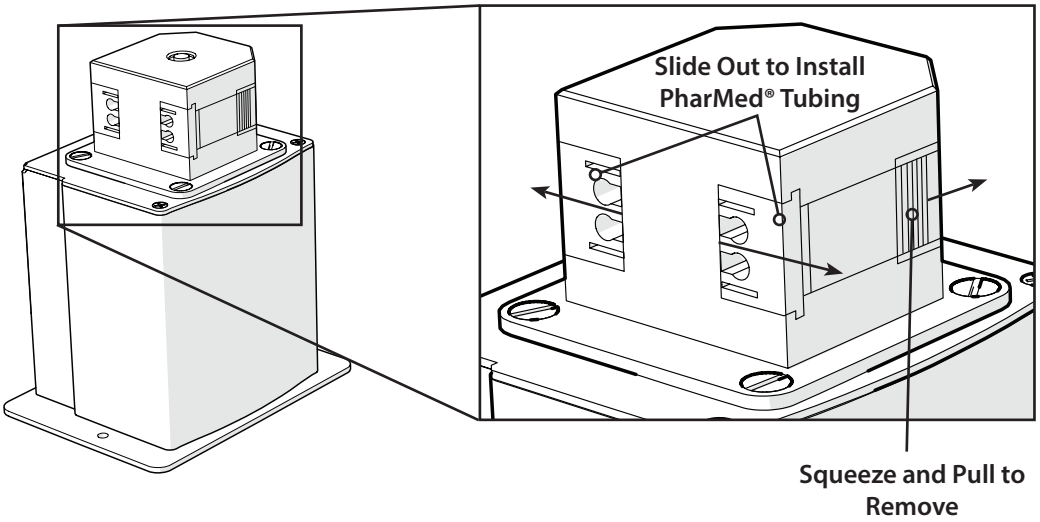


Figure 52: Disassembling the Rinse Pump Head of the GX Rinse Pump

3. Place the other end of the PharMed® tubing assembly in the right side of the GX Rinse Pump head and snap it into place.
4. Replace the tubing clip.
5. Connect a length of neoprene tubing to the top barbed fitting on the right side of the GX Rinse Pump 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.

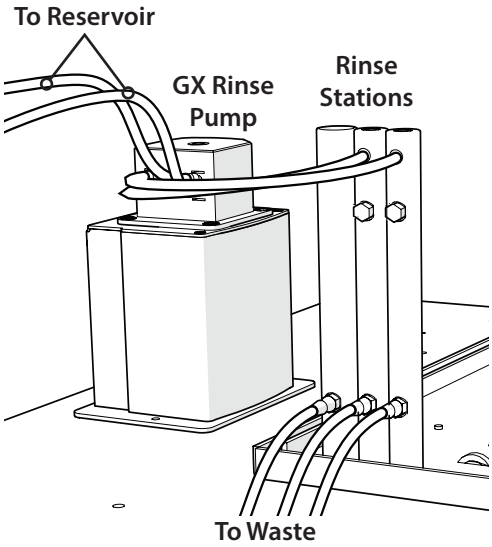


Figure 53: Making the Plumbing Connections to the GX Rinse Pump

Rear Panel Connections

To make connections between the GX Rinse Pump and the GX-271 Liquid Handler refer to the diagram and instructions below.

1. Ensure that the power is turned off to the GX-271 Liquid Handler.
2. Locate the GX Rinse Pump cable connector (part number 26035256). This assembly contains two prewired terminal block connectors. Another cable connector (part number 26035257) is included, but will not be used.
3. Connect the 4-pin terminal block connector to the rear panel of the GX Rinse Pump.
4. Connect the 8-pin terminal block connector to the output ports on the rear panel of the GX-271 Liquid Handler.

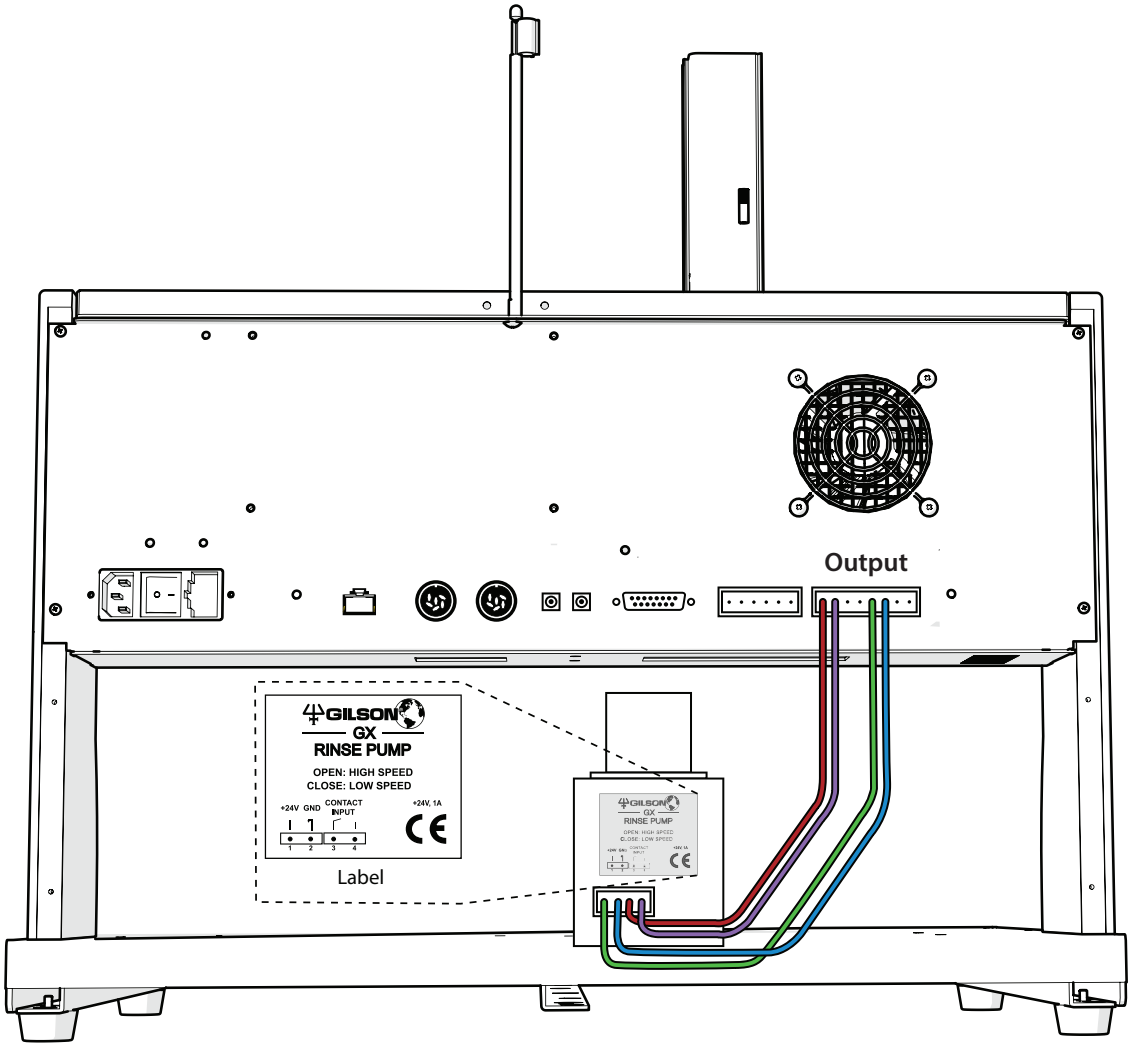


Figure 54: Connecting the GX Rinse Pump to the GX-271 Liquid Handler

Safety Shield

Appendix E

This chapter provides information on the following topics:

Installation

Refer to the instructions and diagram that follow to install the shield.

1. Locate the GX-27X Shield Kit (ordered separately, part number 2604706).
2. Remove the top screw on the left support of the instrument using a 4 mm Allen wrench and replace it with one of the pivot pins included with the shield.
3. Remove the screw below the one that was just removed and replace it with a pivot pin.
4. Remove the top screw on the right support of the instrument and replace with one of the pivot pins included with the shield.
5. Remove the screw below the one that was just removed and replace it with a pivot pin.

NOTICE	Remove only one screw at a time from the support of the instrument. Replace each screw with a pivot pin before removing the next screw.

6. Place the shield over the pivot pins on both sides of the instrument.
7. Place a washer and then a screw over each of the pivot pins and then tighten each screw using a Phillips screwdriver.

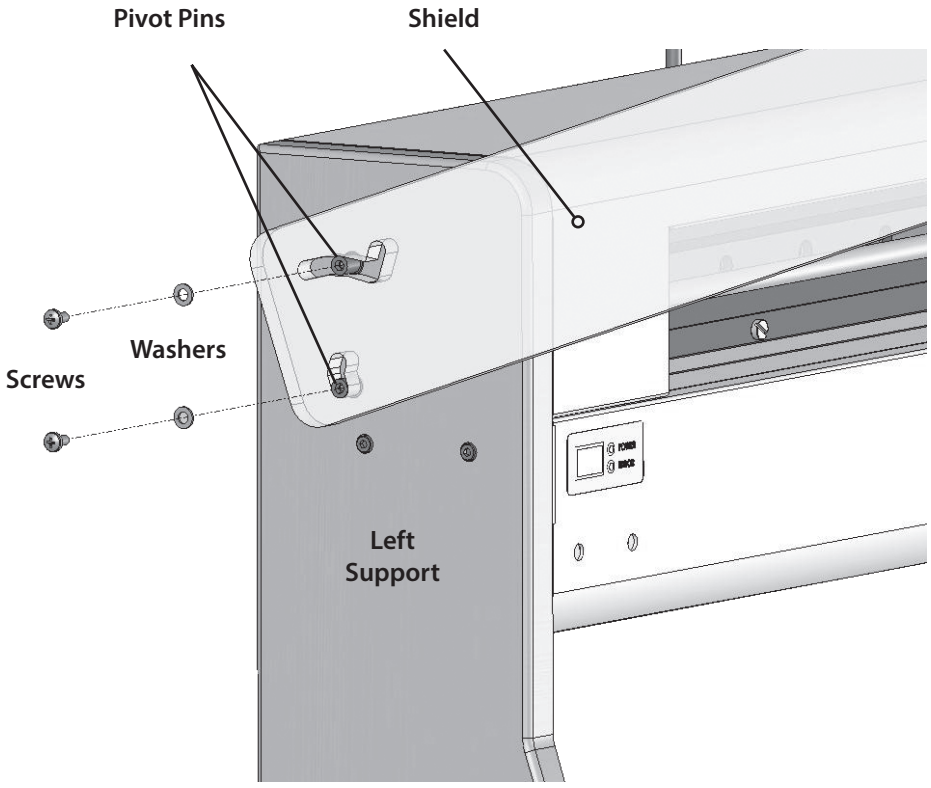


Figure 55: Shield Installation Diagram

Parts and Accessories

Appendix F

GX-271 Liquid Handler

Systems

Part Number	Description
2614101	GX-271 Liquid Handler (VERITY® Syringe Pump, ordered separately)
2614107	GX-271 Preparative Liquid Handler (includes GX Solvent System)

Probes

The following are commonly used probes. Contact your local Gilson representative for information about probe choices for other applications.

125 mm

Part Number	Description		
	Tip Type	Material	Dimensions (L x OD x ID mm)
2507234	Septum Piercing, Pencil Side	Stainless Steel	274 x 1.8 x 0.8 (1.3 Tip)
2507235	Septum Piercing, Side Entry	Stainless Steel	274 x 1.8 x 0.8
2507236	Septum Piercing, Side Entry	Stainless Steel	272.5 x 1.5 x 0.8
2507237	Septum Piercing, Pencil Point, Vented at 72 mm	Stainless Steel	273 x 1.8 x 0.8
2507242	Septum Piercing, Deflected, Vented	Stainless Steel	274 x 1.8 x 0.8 (12 x 1.3, Bevel-Cut Entry Hole)
2507243	Septum Piercing, Deflected	Teflon® Coated Stainless Steel	274 x 1.8 x 0.8 (12 x 1.3, Bevel-Cut Entry Hole)

125 mm

Part Number	Description		
	Tip Type	Material	Dimensions (L x OD x ID mm)
2507244	Septum Piercing, Deflected	Stainless Steel	274 x 1.8 x 0.8 (12 x 1.3, Bevel-Cut Entry Hole)
2507245	Septum Piercing, Deflected	Stainless Steel	274 x 1.8 x 0.8 (12 x 1.3, Bevel-Cut Entry Hole)
2507252	Micro Septum Piercing, Constricted, Beveled	Stainless Steel	220 x 1.5 x 0.4 (10 x 0.7 x 0.4 Tip)
2507253	Micro Septum Piercing, Constricted, Beveled	Stainless Steel	269 x 1.5 x 1.1 (0.6 Tip)
2507256	Septum Piercing, Beveled	Stainless Steel	221 x 1.5 x 0.4
2507414	Non-Septum Piercing, Constricted, Flat	Stainless Steel	220 x 1.3 x 0.8 (0.46 Tip)
27067361	Non-Septum Piercing, Beveled	Stainless Steel	220.5 x 1.5 x 1.1
27067373	Non-Septum Piercing, Constricted, Flat	Stainless Steel	221 x 1.5 x 1.1
27067374	Non-Septum Piercing, Constricted, Beveled	Stainless Steel	221 x 1.5 x 1.1 (2 x 1.1 x 0.4 Tip)
27067375	Non-Septum Piercing, Beveled	Teflon® Coated Stainless Steel	221 x 1.5 x 0.4
27067382	Septum Piercing, Beveled	Stainless Steel	221 x 2.0 x 0.8 (2.1 x 1.5 x 0.8 Tip)
270673821	Grooved Septum Piercing, Beveled	Coated Stainless Steel	221 x 1.5 x 0.8 (2.1 x 1.5 x 0.8 Tip)
27067383	Septum Piercing, Beveled	Stainless Steel	221 x 1.5 x 0.4
270673831	Grooved, Septum Piercing, Beveled	Teflon® Coated Stainless Steel	221 x 1.5 x 0.4

175 mm

Part Number	Description		
	Tip Type	Material	Dimensions (L x OD x ID mm)
2507214	Non-Septum Piercing, Constricted, Flat	Stainless Steel	269 x 1.8 x 1.4
2507215	Non-Septum Piercing, Constricted, Flat	Stainless Steel	269 x 1.3 x 0.8
2507216	Non-Septum Piercing, Beveled	Stainless Steel	269 x 1.5 x 1.1 (1.6 x 1.2 x 0.8 Tip)
2507237	Septum Piercing, Side Entry	Stainless Steel	273 x 1.8 x 0.8
2507252	Micro Septum Piercing, Constricted, Beveled	Stainless Steel	220 x 1.5 x 1.1 (10 x 0.7 x 0.4)
2507253	Micro Septum Piercing, Constricted, Beveled	Stainless Steel	269 x 1.5 x 1.1 (0.6 Tip)
2507254	Non-Septum Piercing, Flat	Stainless Steel	269 x 1.8 x 1.4
2507255	Non-Septum Piercing, Beveled	Stainless Steel	269 x 1.5 x 0.4
2507256	Septum Piercing, Beveled	Stainless Steel	221 x 1.5 x 0.4
25073645	Non-Septum Piercing, Beveled	Stainless Steel	269 x 1.3 x 0.8
2507555	Non-Septum Piercing, Inert	Teflon® Coated Stainless Steel	269 x 2.7 x 0.8 (5 x 1.5)
25075551	Non-Septum Piercing, Straight	Stainless Steel	256.6 x 2.7 x 0.8
251646	Beveled, Inert* *Designed to maintain an inert atmosphere inside a sealed vessel. Includes a probe holder and guide kit.	Stainless Steel	269 x 1.3 x 0.8
26017050	Septum Piercing, Beveled	Stainless Steel	269 x 2 x 0.8 (1.5 OD x 0.8 Tip)

Probe Guide Assemblies

Part Number	Description
2604610	1.3 mm guide foot assembly (Includes the guide foot, probe guide insert, and six screws)
2604611	1.5 mm guide foot assembly (Includes the guide foot, probe guide insert, and six screws)
2604612	1.8 mm guide foot assembly (Includes the guide foot, probe guide insert, and six screws)
2604613	2.3 mm guide foot assembly (Includes the guide foot, probe guide insert, and six screws)
2604614	2.7 mm guide foot assembly (Includes the guide foot, probe guide insert, and six screws)

Isolator Probe Holder

Part Number	Description
2604615	Isolator probe holder, single probe (GX-271 Liquid Handler)

Probe Guide Inserts

Part Number	Description
26046214	1.3 mm probe guide insert
26046215	1.5 mm probe guide insert
26046216	1.8 mm probe guide insert
26046217	2.3 mm probe guide insert
26046218	2.7 mm probe guide insert

Z-Arm and Components

Part Number	Description
260465	Z-arm, GX-271 Liquid Handler

Z-Arm Components

Part Number	Description
2604615	Isolator probe holder, single probe (GX-271 Liquid Handler)
260463	Stop pin

Rinse Stations

Part Number	Description
26034552	Rinse station for outside rinse of probe, 125 mm
26034551	Rinse station for outside rinse of probe, 175 mm
26034554	Drain/rinse station for inside rinse of probe, 125 mm
26034555	Drain/rinse station for inside rinse of probe, 175 mm

Cables and I/O Accessories

Part Number	Description
709910206	2-conductor interconnect wire, 6 ft., for making contact connections
36078142	Ethernet cable
6730314007	Fuse, 3.15 A, T-3.15, SLO-BLO
6770100411	Fuse drawer
260354551	GSIOC accessory cable, 6-pin DIN to 9-Pin DSUB
36078143	GSIOC cable
260461126	Liquid level detection (LLD) cable assembly
7080318114	Power cord, right angle, 110V
7080318115	Power cord, right angle, 220V
36083129	Serial cable, D9-pin male to D9-pin female (RS-232)
638306512	Terminal block connector, 6-pin
638308512	Terminal block connector, 8-pin

Miscellaneous

Part Number	Description
25051095	175/185 mm Z-height adjustment tool
25051094	125 mm Z-height adjustment tool
470331206	Rinse station drain tubing
2604706	Shield kit, GX-271 Liquid Handler

GX Solvent System

Part Number	Description
261350	GX Solvent System

Transfer Tubing Packages

Part Number	Description
250531744	5 mL volume
250531754	10.5 mL volume

Transfer Tubing

Part Number	Description
499424013	1.1 mL volume
499471112	5.5 mL volume
499474103	10.5 mL volume
499483602	30 mL volume

Inlet Tubing Assembly

Part Number	Description
3645357	Tubing assembly, 48" Inlet 25SC/215

Accessories

Part Number	Description
499484021	Solvent inlet tubing
49948122	Solvent valve to pump tubing
490032	Waste tubing, 0.063 (ID) x 0.125 (OD), PTFE (15 ft)
490410332	P-331 nut, 1/8", 1/4-28 PEEK
49041027	P-359 ferrule, 1/8"
26035455	Power cable

GX Rinse Pump

Part Number	Description
261452	GX Rinse Pump

Components

Part Number	Description
26035256	Power cable for GX Rinse Pump
26035221	PharMed Tubing Assembly 2.0 mm (ID)
4715187060	Tubing, 1/16" x 3/16" (OD), neoprene

GX Direct Injection Modules

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

Sample Loops

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

Prep (1/16")

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

Analytical, Stainless Steel (1/16")

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

Analytical, PEEK (1/16")

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

Injection Ports

Part Number	Description
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

Accessories

Part Number	Description
26035458	GX Direct Injection Module riser block assembly (GX-271 Liquid Handler)
26035470	Plumbing package for the GX Direct Injection Module
495033	Teflon tubing, 0.023" ID x 0.062" (1/16") OD (package of 10 ft)
490318041	Valco MZN1PK PEEK nut (0.062" long) for 1/16" OD tubing (package of 10 ft)
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

Fraction Collection Valve

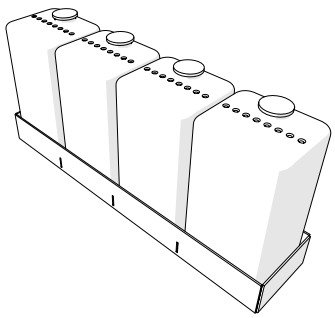
Part Number	Description
2604705	Fraction collection valve package

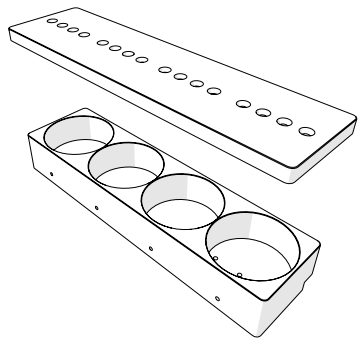
Components

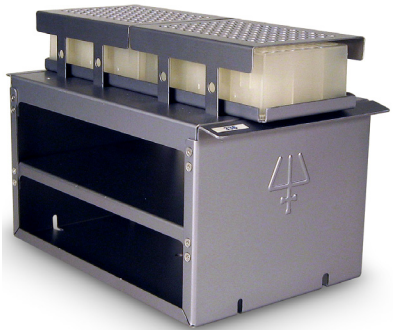
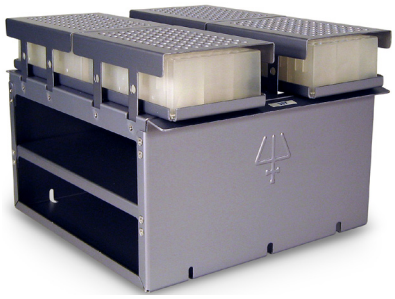
Part Number	Description
25077422	Collection tube, 1/8" TFE
25077423	Collection tube, 1/16" TFE
26037270	Plumbing package for the fraction collection valve (GX-271 Liquid Handler)
26036123	Tube & wire routing strip, Z drive
49041011	Upchurch P-200R ferrule, flangeless, 1/16", TEFZEL® (ETFE), red
49041012	Upchurch P-201 nut, flangeless, 1/16", 1/4-28, DELRIN® (ACETAL), black
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	Tubing, 0.063" ID x 0.125" OD, TFE, per ft (1/16" x 1/8")
49953029	Tubing, 0.030" x 20 ft, PEEK
F1410050	PVDF coupling for 1/4"-28 fitting (package of 5)

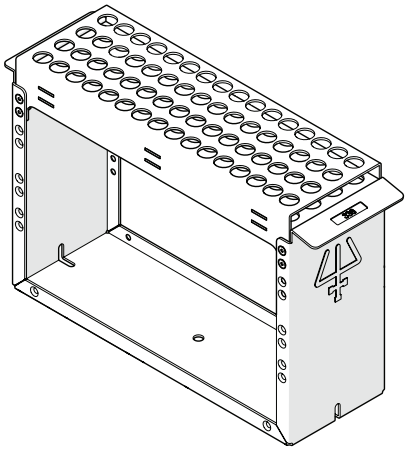
Racks

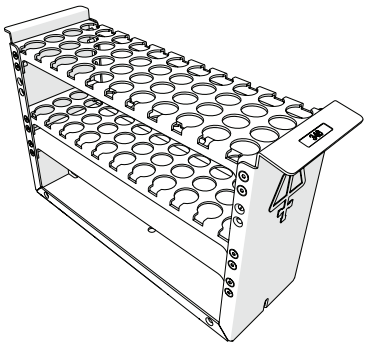
The GX-271 Liquid Handler can be configured with a variety of rack types and sizes. The following pages describe the racks that can be purchased for use on the GX-271 Liquid Handler. Refer to **Rack Installation** on page 51 for rack installation procedures.

Part Number	*Code*	*Rack Code*	*Material*	*Vessels*
260440086		121	Aluminum	60 Tubes 13 x 100 mm (9 mL)
260440087		122	Aluminum	39 Tubes 16 x 100 mm (12 mL)
260440005		N/A	Aluminum	4 500 or 700 mL Solvent Bottles

Part Number	Code	Rack Code	Material	Vessels
26044036		123	Teflon® (Top) High Density Polyethylene (HDPE) for Bottom	4 650 mL Solvent Bottles
260440031		330	Aluminum	60 Vials 12 x 32 mm (2 mL)
260440079		332	Aluminum	44 Tubes 18 x 150 mm (25 mL)
260440036		333	Aluminum	14 Scintillation Vials 25 x 50 mm (20 mL)

Part Number	Code	Rack Code	Material	Vessels
260440081		334	Aluminum	14 Scintillation Vials 40 mL
260440083		335	Aluminum	48 WISP Vials 15 x 45 mm (4 mL)
260440094		336	Aluminum	Two Microplates 96-well microplates (shallow or deep)
260440095		337	Aluminum	Four Microplates 96-well microplates (shallow or deep)

Part Number	Code	Rack Code	Material	Vessels
260440106		338	Aluminum	64 Vials 12 x 32 mm (2 mL)
260440039		341	Aluminum	108 Tubes 10 x 75 mm
260440025		343	Aluminum	80 Tubes 13 x 100 mm

Part Number	Code	Rack Code	Material	Vessels
260440041		345	Aluminum	44 Tubes 16 x 150 mm
260440049		346	Aluminum	44 Tubes 16 x 100 mm (15 mL)

Rack Heighteners

Part Number	Description
25045514	RH1 rack heightener assembly
27595513	RH2 rack heightener assembly

Tray Insert

Part Number	Description
26041033	Tray insert for up to 5 Code-20 series racks

Materials

Appendix G

Liquid Contact Materials

The information provided in the following table is accurate to the best of our knowledge and belief, but is intended for general information only.

Material	*Description*
316 Stainless Steel	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.
Ekonol	Ekonol has excellent solvent resistance with the exception of concentrated sulfuric acid and strong alkalis. The water absorption rate is low at 0.4% after 500 hours at 212° F. Ekonol Polyester is self-lubricating and provides excellent friction and wears properties. Ekonol Polyester is a very thermally stable polymer, making it easy to blend/fabricate with other high temperature materials. When combined with polytetrafluoroethylene (i.e., PTFE); it produces a composite material that has excellent temperature and wear resistance properties. The Ekonol Polyester/PTFE blend will not wear metal surfaces and resists self-wear better than any other PTFE composition. Applications for Ekonol Polyester/PTFE blends are varied and include packing sets, compressor ring sets, "0" ring seals, spring-loaded seals, lip seals, self-lubricating bearings and rotors or vanes of process pumps. Ekonol Polyester/PTFE works best under environmentally tough conditions where wear resistance, dimensional stability and corrosion resistance are critical.
FEP	Fluorinated ethylene propylene is another member of the fluorocarbon family with similar chemical properties. It is generally more rigid than PTFE, with somewhat increased tensile strength. It is typically more transparent than PTFE, slightly less porous, and less permeable to oxygen. FEP is not as subject to compressive creep at room temperature as PTFE, and because of its slightly higher coefficient of friction is easier to retain in a compression fitting.
HDPE	A linear polymer, High Density Polyethylene (HDPE) is prepared from ethylene by a catalytic process. The absence of branching results in a more closely packed structure with a higher density and somewhat higher chemical resistance than LDPE. High Density Polyethylene is also somewhat harder and more opaque and it can withstand rather higher temperatures (120° C for short periods, 110° C continuously).

Liquid Contact Materials (Continued on page 124)

Material	Description
Neoprene	Neoprene polychloroprene is a versatile synthetic rubber still used for many chemical and weather-resistant applications. Today, solid grades are used in synthetic rubber goods, and as base resins for adhesives. Water-based dispersions are ideal for adhesives, dipped goods and foam. Resistant to oil, wax and grease, Neoprene can withstand temperatures from -50°C to 120°C. It's also inherently resistant to ozone, weathering, and water or soil immersion.
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.
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.
PTFE	Polytetrafluoroethylene is the generic name for the class of materials such as Teflon®. It offers superior chemical resistance but is limited in pressure and temperature capabilities. Because it's so easy to handle, it is often used in low pressure situations where stainless steel might cause adsorption. PTFE tubing is relatively porous, and compounds of low molecular weight can diffuse through the tubing wall.
PVDF	PVDF, polyvinylidene fluoride, has excellent resistance to most mineral and organic acids, aliphatic and aromatic hydrocarbons, and halogenated solvents. Poor resistance to acetone, MEK, THF, and potassium and sodium hydroxide. Often supplied as Kynar®.
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.

Neoprene description provided by DuPont™ Inc. (**www.dupont.com**)

HDPE description provided by Dynalab Corporation (**www.dynalon.com**)

316 Stainless Steel, FEP, Nitronic 60, PAEK, PEEK, PTFE, PVDF, and Valcon H descriptions provided by Valco Instruments Company Inc (**www.vici.com**).

Ekonol description provided by Saint-Gobain Coating Solutions (**www.coatingsolutions.saint-gobain.com**)