# Table of Contents

## Declaration of Conformity

## 1 Introduction

- Safety Precautions ............................................................... 1-1
- Description ............................................................................ 1-2
- Unpacking ............................................................................. 1-3
  - Standard Equipment .................................................... 1-4
  - Accessories ..................................................................... 1-5
- Customer Service ................................................................. 1-6
- Technical Specifications ..................................................... 1-7

## 2 Installation

- Locator Plate Installation ................................................... 2-2
- Armlock Removal ................................................................ 2-3
- Z-Arm Installation ............................................................... 2-4
  - Installing the Z-Arm Cable Support Rod ................. 2-5
- Probe Installation ................................................................. 2-6
  - Installing the Probe Guide ............................................. 2-6
  - Installing the Probe Holder ........................................... 2-7
  - Installing the Probe ...................................................... 2-7
  - Installing the Level Sensing Cable ............................. 2-7
- Syringe Installation .............................................................. 2-8
- Plumbing Connections ........................................................ 2-9
  - Inlet and Vent Tubing Installation ......................... 2-9
  - Transfer Tubing Installation ....................................... 2-10
  - Rinse Station and Drain Waste Tubing
    Installation ..................................................................... 2-13
- Rack Setup ............................................................................ 2-17
  - Code 200-Series and Code 500-Series Racks ......... 2-17
  - Code 200-Series and 20- or 30-Series Racks ............ 2-18
  - Only 20- or 30-Series Racks ........................................ 2-19
- Final Z-Arm Adjustment ................................................... 2-20
Electrical Connections ........................................................ 2-21
Rear Panel ....................................................................... 2-21
Input/Output Ports ...................................................... 2-22
RS-232 Port ..................................................................... 2-24
Keypad Port ................................................................... 2-25
GSIOC Port ..................................................................... 2-26
Unit ID and Baud Rate/Mode Selection .................. 2-27
Fuses ................................................................................ 2-29
Power Cord Connection .............................................. 2-29

3 Operation

Front Panel ............................................................................ 3-2
Start Button .................................................................... 3-2
Stop Button ..................................................................... 3-2
LED Display ................................................................... 3-2
Power Indicator Light .................................................. 3-2
Start Up ................................................................................. 3-3
Running Programs .............................................................. 3-4
Running Programs from Keypad .................................. 3-6
Configuring the Liquid Handler ....................................... 3-8
Pump Type ..................................................................... 3-9
Syringe Options ............................................................. 3-9
Rinse Site ......................................................................... 3-10
Liquid Detector .............................................................. 3-11
Adjust X&Y .................................................................... 3-11
Z Height .......................................................................... 3-12
Home Phase.................................................................... 3-13
Safety Contact ............................................................... 3-13
Bearing Life .................................................................... 3-14
Sound and Display ....................................................... 3-14
Emergency Contact ...................................................... 3-14
Priming the Liquid Handler ............................................ 3-15
Pausing the Priming Cycle ............................................ 3-15
Stopping the Priming Cycle .......................................... 3-15
Testing the Liquid Handler's Contacts ......................... 3-16
4 Maintenance

Helpful Hints .............................................................. 4-2
Cleaning .......................................................................... 4-3
  Cleaning the Liquid Handler .................................. 4-3
  Cleaning the Syringe ............................................. 4-3
  Cleaning the Fluid Path ........................................ 4-7
  Cleaning the Valve ................................................ 4-11
Replacing Parts .......................................................... 4-13
  Replacing Tubing .................................................. 4-13
  Replacing the Piston Seal .................................. 4-14
  Replacing the Syringe .......................................... 4-21
  Replacing the Valve ............................................. 4-23
  Replacing the Probe .......................................... 4-24
  Replacing a Fuse .................................................. 4-26
Checking Position Alignment .................................... 4-27
Transporting the Liquid Handler ............................. 4-28

5 Troubleshooting

Error Messages ............................................................ 5-2
Mechanical .................................................................. 5-6
Electrical ..................................................................... 5-7
Tubing and Syringe Pump ........................................ 5-9
Liquid Level Detector ................................................ 5-12
Repair and Return Policies ......................................... 5-13

Appendix A Replacement Parts and Accessories

Control Software ......................................................... A-1
Probes for 125 mm Z-Arm ....................................... A-2
Probes for 175 mm Z-Arm ....................................... A-5
Probe Holder/ Guide Kits .......................................... A-6
Syringes, Transfer Tubing, and Waste Bottle ............ A-7
Rinse Station ............................................................. A-8
Cables and I/O Accessories ..................................... A-10
Miscellaneous ......................................................... A-10

Appendix B Racks

Peltier Racks ............................................................. B-14
<table>
<thead>
<tr>
<th>Appendix C</th>
<th>Specifications Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volumetric Precision and Accuracy Methods ..........C-2</td>
</tr>
<tr>
<td></td>
<td>50 µl: Open to Open Tube ...........................................C-3</td>
</tr>
<tr>
<td></td>
<td>50 µl: Closed to Open Tube .........................................C-4</td>
</tr>
<tr>
<td></td>
<td>500 µl: Open to Open Tube .........................................C-5</td>
</tr>
<tr>
<td></td>
<td>500 µl: Closed to Open Tube........................................C-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendix D</th>
<th>GSIOC Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GSIOC Commands..................................................D-2</td>
</tr>
<tr>
<td></td>
<td>GSIOC Command List .............................................D-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendix E</th>
<th>Pipetting Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimizing Cross-Contamination .........................E-2</td>
</tr>
<tr>
<td></td>
<td>Minimizing Dilution Effect ....................................E-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendix F</th>
<th>Low Pressure Valve Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>215 Low Pressure Valve and</td>
</tr>
<tr>
<td></td>
<td>215 Prep FC Valve (High Mount) ........................................F-2</td>
</tr>
<tr>
<td></td>
<td>215 Prep FC Valve (Low Mount) ........................................F-3</td>
</tr>
<tr>
<td></td>
<td>Plumbing Connections.........................F-8</td>
</tr>
<tr>
<td></td>
<td>Making Tubing Connections.............F-8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendix G</th>
<th>Using an Additional 819 Module for Fraction Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Example UniPoint Method ......................................G-3</td>
</tr>
</tbody>
</table>
Declaration of Conformity

Application of Council Directives:

89/336/EEC, 73/23/EEC

Standards to which Conformity is Declared:

EN 61326, EN 61000-3-3, EN 61000-3-2, EN 61010-1

Manufacturer’s Name ........................................... Gilson, Inc.

Manufacturer’s Address ....................................... 3000 W. Beltline Highway
                                                    Middleton, WI  53562

EC Office Address .................................................. Gilson S.A.S.
                                                    19 Avenue des Entrepreneurs, B.P. 145
                                                    F-95400 Villiers-le-Bel, France

Type of Equipment ................................................. Laboratory Equipment

Model. ....................................................................... 215 Liquid Handler

Beginning with Serial Number: 259K3001

Month and Year of Manufacture: October 1993

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Place: Middleton, WI (USA)                                 Michael Jacquart
Issue Date: October 1994                           Senior Vice President
                                                    Corporate Technology Development
Introduction

Safety Precautions

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

Because the probe installed on the Z-arm may contain a dangerous substance, do not interfere in the work area of the instrument until the liquid handler has completed its procedures. If dangerous liquids are used, adequate protection such as proper ventilation, safety glasses, etc., should be used.

Always switch the power to off when making adjustments to the liquid handler. The potential exists for bodily harm if you interfere with the work area of the instrument while it is running.
Description

The Gilson 215 Liquid Handler is an XYZ robot that can automate any number of manual liquid handling procedures. The liquid handler’s ability to pierce thick septa allows access to samples in clinical sample tubes without exposing the user to biological hazards. The optional built-in syringe pump provides for the accurate and precise handling of liquids.
Unpacking

The 215 Liquid Handler is delivered with all major components already assembled except for auxiliary parts such as the Z-arm, probe, racks, tubing, etc. Keep the original container and packing assembly in case the liquid handler must be returned to the factory.

The 215 Liquid Handler and its components are shipped in two containers:

- One container holds the auxiliary items, such as locator plate, tubing, probes, syringes, rinse inserts, Z-arm, and any other accessories you may have ordered with your system.

- The other container holds the 215 Liquid Handler.

To remove the liquid handler from its container:

1. Cut the metal strapping.
2. Lift the outer box off and away from the liquid handler.
3. Lift the inner box off and away from the liquid handler.
4. Lift the unit off its base platform and place it on a lab bench or cart. Gilson recommends that two people lift the liquid handler off the base of the packing container. To lift the liquid handler:
   a) Using the two cutouts for hand holds, place a hand at the base of the packing container.
   b) Grip the liquid handler under the base plate.
   c) Lift the unit up and out of the foam packing material. The side containing the electronics cabinet is the heavier side.

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

Once the liquid handler and the accessories containers have been unpacked, you should have the following:

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2510121</td>
<td>215 Liquid Handler with syringe pump</td>
</tr>
<tr>
<td></td>
<td>Locator plate with one drain base (includes four mounting screws)</td>
</tr>
<tr>
<td></td>
<td>Rinse drain package which includes:</td>
</tr>
<tr>
<td></td>
<td>• 2-liter waste bottle</td>
</tr>
<tr>
<td></td>
<td>• Cap with quick connect fitting</td>
</tr>
<tr>
<td></td>
<td>• Rinse station with fittings</td>
</tr>
<tr>
<td></td>
<td>• 5 feet of Tygon waste tubing with quick connect fitting</td>
</tr>
<tr>
<td></td>
<td>Z-arm and control cable with retaining clip</td>
</tr>
<tr>
<td></td>
<td>Accessory package which includes:</td>
</tr>
<tr>
<td></td>
<td>• Fuse drawers, fuses, and power cords</td>
</tr>
<tr>
<td></td>
<td>• 10-pin terminal block connector</td>
</tr>
<tr>
<td></td>
<td>• 8-pin terminal block connector</td>
</tr>
<tr>
<td></td>
<td>• 9/64&quot; ball driver for removal of armlock</td>
</tr>
<tr>
<td></td>
<td>• Eight tubing retaining clips</td>
</tr>
<tr>
<td></td>
<td>• Cable support rod with bracket and two Phillips-head attachment screws</td>
</tr>
<tr>
<td></td>
<td>• Level sensing cable</td>
</tr>
<tr>
<td></td>
<td>• Tubing support rod</td>
</tr>
<tr>
<td></td>
<td>• Syringe pump valve and vent tubing</td>
</tr>
<tr>
<td></td>
<td>Inlet tubing package which includes:</td>
</tr>
<tr>
<td></td>
<td>• 1/4&quot;-28 coupler</td>
</tr>
<tr>
<td></td>
<td>• PTFE inlet tubing (650 x 3 x 2 mm)</td>
</tr>
<tr>
<td></td>
<td>• PTFE inlet tubing (650 x 3 x 2 mm) with 20 µm stainless steel filter</td>
</tr>
</tbody>
</table>

215 Utility Programs CD-ROM

215 Liquid Handler User’s Guide
2510191  215 Liquid Handler without syringe pump

Locator plate with one drain base
(includes mounting screws)

Rinse drain package which includes:
• 2-liter waste bottle
• Cap with quick connect fitting
• Rinse station with fittings
• 5 feet of Tygon waste tubing with quick connect fitting

Z-arm and control cable with retaining clip

Accessory package which includes:
• Fuse drawers, fuses, and power cords
• 10-pin terminal block connector
• 8-pin terminal block connector
• 9/64" ball driver for removal of armlock
• Eight tubing retaining clips
• Cable support rod with bracket and two Phillips-head attachment screws
• Level sensing cable
• Tubing support rod

215 Utility Programs CD-ROM

215 Liquid Handler User’s Guide

**Accessories**

Based upon your configuration, you’ll also receive additional accessories, such as the probe, syringe, transfer tubing, racks, etc. If necessary, refer to **Appendix A** for part numbers.
Customer Service

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

If you need assistance, please contact your Gilson representative or if you are in the United States call the Gilson Customer Service Department at 800-445-7661 or 608-836-1551. You can also contact the Customer Service Department via its electronic mail (email) address: service@gilson.com. Specific contact information can be found on the Gilson website at www.gilson.com. To help us serve you quickly and efficiently, please refer to the Before calling us section on page 5-13.
Technical Specifications

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

**Warning**: Changes or modifications to the liquid handler not expressly approved by Gilson could void the factory-authorized warranty.

The liquid handler has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC commercial environment. The liquid handler generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of the liquid handler in a residential area is likely to cause harmful interference; in which case, the user will be required to correct the interference at the user’s own expense.

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

<table>
<thead>
<tr>
<th>Technical Specification</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Arm speed               | >45.7 cm/sec (>18 in/sec) in X dimension  
                          | >40.6 cm/sec (>16 in/sec) in Y dimension |  
| Carryover               | <1 ppb using a septum-piercing probe with capacitive level-sensing. |  
| Contact control         | Four inputs (contact closure, TTL, or open-collector), four relay outputs, and one switched +24V DC 1A output |  
| Environmental conditions| Indoor use  
                          | Altitude: up to 2000 m  
                          | Temperature range: 5–40°C  
                          | Air pressure: 75–105kPa  
                          | Pollution degree: 1 or 2, in accordance with IEC 66  
                          | Humidity: Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C |  
| Front panel             | 8-character display, START soft key and emergency STOP soft key |  
| Horizontal motion strength | X: 5 kg (11.1 lb)  
                          | Y: 7 kg (15.6 lb) |  
| Liquid level sensing    | Capacitive or conductive |  
| Locator plate capacity  | Up to five Code 200-series racks, up to seven Code 20- or 30-series racks (or a combination of up to five racks of both types), or one Code 500-series rack and one Code 200-series rack |  
| Manufacturing standards | Safety certification:  
                          | • UL 3101-1  
                          | • CSA C22.2—No. 1010.1-92  
                          | • EN 61010-1  
                          | EMC certification:  
                          | • EN 61326  
                          | • EN 61000-3-2 1995  
                          | • EN 61000-3-3 1995  
                          | • FCC Part 15 |
# Technical Specifications

## Maximum syringe flow rates for water

<table>
<thead>
<tr>
<th>Syringe Size</th>
<th>Maximum Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 µl</td>
<td>3.37 ml/min</td>
</tr>
<tr>
<td>250 µl</td>
<td>8.43 ml/min</td>
</tr>
<tr>
<td>500 µl</td>
<td>16.87 ml/min</td>
</tr>
<tr>
<td>1000 µl</td>
<td>33.75 ml/min</td>
</tr>
<tr>
<td>5000 µl</td>
<td>100.00 ml/min</td>
</tr>
<tr>
<td>10000 µl</td>
<td>100.00 ml/min</td>
</tr>
<tr>
<td>25000 µl</td>
<td>100.00 ml/min</td>
</tr>
</tbody>
</table>

## Physical space requirement

91.4 x 61 x 55.8 cm (36 x 24 x 22 in)*

*Maximum height. Z-arm height is adjustable to accommodate vessel heights between 1 and 150 mm (dependent on installed Z-arm).

## Power requirements

- Frequency: 50 to 60 Hz
- Voltage: 100-120V or 220-240V, mains voltage fluctuations not to exceed ±10% of the nominal voltage
- Current rating: 2.0A for 100-120 or 1.0A for 220-240V

## Probe positioning performance

- Accuracy:
  - +/- 0.5 mm in X/Y dimensions
  - +/- 1 mm in Z dimension
- Repeatability:
  - +/- 0.25 mm in X/Y/Z dimension

## Probe rinse

Probe rinsing occurs through a dedicated rinse station for rinsing the inside and outside of the probe; selectable rinse volume and flow rate. Optional inserts for level-sensing, non-level-sensing, and flowing rinse.

## Sampler type

XYZ with stationary rack design
### Technical Specifications

| **Software control** | Computer control via RS-232 or GPIB and Gilson control software  
|                      | Local control via Gilson XL Keypad |
| **Syringe capacity** | 100, 250, 500, 1000, 5000, 10000, or 25000 µl |
| **Syringe pump**     | Internal integral high-precision single piston syringe pump |
| **Vertical punch strength** | 4.9 kg (11.0 lb) |
| **Volumetric accuracy and precision** | See Appendix C for details about the configuration and test procedure that Gilson used to determine the limits below. The volumetric accuracy and precision listed are maximums. |
|                      | Open bottle to open tube transfer:  
|                      | 50 µl A=0.25%, CV=0.38%  
|                      | 500 µl A=0.19%, CV=0.13% |
|                      | Sealed tube to open tube transfer:  
|                      | 50 µl A=2.0%, CV=0.63%  
|                      | 500 µl A=1.38%, CV=0.25% |
| **Weight**           | 39.9 kg (89 lb) |
This section takes you through the steps for setting up your 215 Liquid Handler.
Locator Plate Installation

The locator plate serves two functions:

- Positions the racks and accessories that fit onto the bed of the liquid handler.
- Contains liquid spills, such as those caused by overflowing vessels.

The locator plate and its four mounting screws are shipped in a separate box with the liquid handler’s accessories. To install the locator plate onto the instrument bed:

1. Make sure the locator plate’s rinsing station base is at the rear of the instrument. The locator plate will only install in this orientation.

2. Align the four corner holes of the locator plate with the four holes on the instrument bed and lower the plate onto the bed.

3. Using a Phillips screwdriver, secure the locator plate using the four mounting screws.
Armlock Removal

The armlock on the liquid handler secures the Y-arm during shipment. You must remove the armlock prior to installing the Z-arm and operating the instrument. If the armlock is not removed, the liquid handler cannot move in the X direction. This results in an error state during operation.

If you need to move the liquid handler, always reinstall the armlock. This safeguards against mechanical damage.

To remove the armlock:

1. Remove the cardboard label in front of the armlock.

2. Using the 9/64" ball driver, loosen the tensioning screw that immobilizes the Y-arm.

3. Using the 9/64" ball driver, remove the two remaining screws that hold the armlock in place.

4. Remove the armlock and store it and the ball driver for future use.
Z-Arm Installation

Follow these steps to install the Z-arm:

1. Using a Phillips screwdriver, loosen the mounting screw on the Z-arm mounting bracket located on the Y-arm. Turn counterclockwise to loosen.

2. Partially pull out the bracket. Do not remove completely.

3. Place the Z-arm into the mounting bracket. You will need to insert one side of the Z-arm into place at a time.

4. Tighten the screw on the mounting bracket until the Z-arm is secure.

You’ll adjust the Z-arm to its proper height after rack and rinse station installation. This adjustment is described on page 2-20.
Installing the Z-Arm Cable Support Rod

1. Using the two Phillips screws, attach the cable support rod bracket in the holes located in the rear of the X-arm extrusion.

2. Plug the Z-arm control cable into the back topside of the control cabinet. The control cable should be tucked into the groove located in the top of the X-arm extrusion. The retaining clip that is already on the control cable should be snapped onto the top of the cable support rod. Refer to diagram below.

The control cable is correctly installed when the arm is extended to the extreme X and Y direction and the cable has enough slack.
Probe Installation

There are different probes available for use on the 215 Liquid Handler. Depending upon your application, you have purchased the appropriate probe and probe holder/guide kit. When installing the probe, probe holder and probe guide, refer to the following procedures and diagram that shows where they are installed on the liquid handler.

Installing the Probe Guide

The probe guide is installed on the top of the Z-foot.

1. Place the probe guide into the opening in the top of the foot.

2. Use the two Phillips screws to secure the probe guide to the foot.
Installing the Probe Holder

To install the probe holder, screw it into the bottom of the isolation probe holder.

Installing the Probe

Insert the probe into the top of the isolation probe holder and pull it through the holder until the tip of the probe is in the probe guide.

Installing the Level Sensing Cable

To install the level sensing cable:

1. Plug the quick connector into the socket located on the Z-arm.

2. Remove the screw from the right side of the isolation probe holder, install the ring-tongue connector onto the screw, and reattach the screw to the isolation probe holder.
Syringe Installation

If your liquid handler has a built-in syringe pump, the piston operating rod will be shipped in the down position. If the rod is not in the down position, please refer to the instructions on changing a syringe in Section 4. Those instructions detail how to lower the rod.

The following procedure is important for correct syringe piston alignment. Improper alignment may cause premature piston seal failure.

1. Remove the valve and syringe from their packages.

2. Lubricate the piston with diluent in order to reduce piston seal friction during syringe installation.

3. Loosely screw the syringe into the valve. Do not fully tighten.

4. Loosely attach the valve to the syringe pump with the supplied screws.

5. Pull down the piston so it comes into contact with the piston operating rod and firmly tighten the piston holding screw.

6. Fully tighten the valve screws to secure the valve.

7. Fully tighten the syringe to the valve.

Note: Remember the size of the syringe you are installing for later software configuration. (You can write the size in the margin here for reference.) See Configuring the Liquid Handler in Section 3.
Plumbing Connections

Inlet and Vent Tubing Installation

If your liquid handler contains a syringe pump, you received inlet tubing and vent tubing.

1. Install the 1/4"-28 fitting of the 2 mm ID tubing (part number 3645357) to the inlet side of the syringe pump. Refer to diagram on previous page if necessary.

2. Place the filtered end of the assembly into the bottle containing your diluent or probe rinse solution.

   **Note:** If you need to lengthen your inlet tubing, use the supplied tubing (part number 49948392) and coupling (part number F1410153).

3. Slip the vent tubing onto its port on the valve. Refer to diagram on page 2-8.
Transfer Tubing Installation

You can install straight or coiled transfer tubing. Refer to the appropriate instructions below.

**Straight tubing installation**

Follow these installation instructions if you are using the straight transfer tubing (part number 499421202):

1. Snap three tubing retaining clips onto the tubing support rod. Equally space the clips.

2. Install the tubing support rod in its brackets on the control cabinet. Insert the front end of the rod into the hole before placing the back end of the rod in its cradle.

3. Snap three tubing retaining clips onto the Z-arm control cable. Equally space the clips.

4. Snap the tubing into the small grooves on the clips installed on the tubing support rod and Z-arm control cable.

**Note:** You may need to pry the grooves apart using a flatblade screwdriver before snapping the tubing into place.
5 Gather any excess tubing into a coil to minimize the length of tubing and secure the coil using a twist tie. Position the excess tubing in a convenient location near the rear of the liquid handler.

6 Connect one end of the transfer tubing to the transfer tubing side of the syringe pump. Finger-tighten.

7 Connect the other end to the top of the isolation probe holder. Firmly tighten this fitting since it holds the probe in place.
Coiled tubing installation

Follow these installation instructions if you are using coiled transfer tubing (part number 499474102 or 4994474252):

1. Slide the coiled section of the tubing over the tubing support rod. Position the tubing so that the shorter piece of straight tubing is toward the syringe pump.

2. Install the tubing support rod in its brackets on the control cabinet. Insert the front end of the rod into the hole before placing the back end of the rod in its cradle.

3. Snap three tubing retaining clips onto the Z-arm control cable. Equally space the clips.

4. Snap the long, straight section of the coiled tubing into the small groove on the clips that are installed on the Z-arm control cable.

   **Note:** You may need to pry the grooves apart using a flatblade screwdriver before snapping the tubing into place.

5. Connect one end of the transfer tubing to the transfer tubing side of the syringe pump. Finger-tighten.

6. Connect the other end to the top of the isolation probe holder. Firmly tighten this fitting since it holds the probe in place. (Refer to diagram on page 2-11 if necessary.)
Rinse Station and Drain Waste Tubing Installation

You'll clean the probe using the rinse station. To eliminate carryover of liquids, the rinsing procedure pumps an excess volume of diluent or probe washing solution through the probe and out into the rinse station. The small diameter of the rinse station inserts allow the outside of the probe to be washed along with the inside.

There are three types of rinse station inserts available for the liquid handler:

- **Shallow-pocket insert** - This is a closed bottom rinse insert that is used for applications where the probe is only immersed in a few millimeters of the sample.

- **Deep-pocket insert** - This is a closed bottom rinse insert. This type of insert allows for a deeper insertion of the probe into the rinse well resulting in a greater area of the outside of the probe to be rinsed.

- **Flow-through insert** - This insert is used in applications where a rigorous wash of the probe's exterior is required. A second source of liquid is pumped to the rinse station when this insert is used.

It may be necessary to vary the types and volumes of probe wash solutions to most efficiently eliminate carryover of particular compounds. Generally, the smaller the volume of probe wash solution used, the faster your automated liquid handling protocol.
Installing the rinse station

The base of one rinse station is shipped already secured to the locator plate and is located at the rear of the locator plate. The locator plate can hold an optional second rinse station or you can move the rinse station base to the alternate location.

*Note:* If you purchased the optional 6-position locator plate, the rinse station base is located in the center rear of the locator plate and there are two additional (alternate) rinse station locations.

Before installing the rinse station, make sure the locator plate has been properly installed with the previously-installed rinse station base located at the rear of the instrument bed.

Gilson recommends that the rinse station be installed so that its tube fittings are pointing toward the rear of the liquid handler. That orientation is the one shipped from the factory.

To install the rinse station housing onto the base, follow these steps:

1. Align the triangle of the housing to the base.
2. Insert the housing into the base.
3. Press down and turn 60 degrees. The rinse station is secure when you feel the housing snap into place.
4 If you are satisfied with the standard orientation, follow steps 5, 6, and 7. See changing the orientation if the current location of the waste tubing fittings will obstruct the installation of non-standard racks or other accessories.

5 Install the rinse station insert by pressing the insert down into the housing until it snaps into place. You may want to lubricate the o-ring on the rinse station insert with water before pressing it into the housing.

6 Connect the Tygon waste tubing to the rinse station housing by twisting the tubing onto the barbed connectors on the rinse housing until secure.

7 Connect the other end of the Tygon waste tubing to the two-liter waste bottle. The waste bottle lid has a matching quick connect fitting that mates with the tubing's quick connect fitting.

**Note:** Make sure the waste bottle is placed in a location that is lower than the instrument bed of the liquid handler.
Changing the orientation

If you want to reorient the direction of the rinse tube fittings:

1. Press down on the rinse station housing.

2. Rotate the housing 120 degrees clockwise or counterclockwise. The housing is secure when you feel it snap into place.

3. Install the rinse station insert by pressing the insert down into the housing until it snaps into place.

4. Connect the Tygon waste tubing to the rinse station housing by twisting the tubing onto the barbed connectors on the rinse housing until secure.

5. Connect the other end of the Tygon waste tubing to the two-liter waste bottle. The waste bottle lid has a matching quick connect fitting that mates with the tubing's quick connect fitting.

Note: Make sure the waste bottle is placed in a location that is lower than the instrument bed of the liquid handler.
Rack Setup

The 215 Liquid Handler is equipped to locate code 20-, 30-, 200-, and 500-series racks. See Appendix B for a list of racks available for the liquid handler.

Depending on the racks you're using, refer to the appropriate procedures below.

**Note:** If the optional 6-position locator plate is installed and you place racks in the far right and left positions of the plate, the liquid handler cannot access all of the tubes in the racks. The far right and left positions are for installing two Gilson 818 AutoMix modules onto the liquid handler. Refer to the 818 AutoMix User's Guide for AutoMix and rack placement.

**Code 200-Series and Code 500-Series Racks**

If all your racks are Code 200-series or Code 500-series racks, place them directly onto the locator plate:

1. Orient the rack so that the code number (for example, 200) is facing forward.

2. Fit the rack on the locator plate so that the slots and holes on the underside of the rack align with the pins on the locator plate.
Code 200-Series and 20- or 30-Series Racks

To use a combination of Code 200-series and 20- or 30-series racks on the locator plate:

1. Install each Code 200-series rack as described above.

2. For each Code 20- or 30-series rack, place an adapter plate onto the locator plate. Fit the plate so that the slots on the adapter plate align with the pins on the locator plate.

3. Place the 20- or 30-series rack onto the adapter plate.
Only 20- or 30-Series Racks

If all your racks are Code 20- or 30-series racks, follow the steps below.

**Note**: This configuration is not available for a 6-position locator plate.

1. Install a locator tray onto the locator plate of the liquid handler.
   - For Code 20-series racks, the handles face the front.
   - For Code 30-series racks, the hose fittings should face the back.

2. Position each rack onto the locator tray. You can install up to seven racks using this tray.
Final Z-Arm Adjustment

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

1. Loosen the mounting screw on the Z-arm mounting bracket until the Z-arm can slide up and down. Refer to diagram on page 2-4 for location of mounting bracket, if necessary.

2. Slide Z-arm and adjust to proper height. Gilson recommends that the foot of the Z-arm rests approximately 5 mm from the top of the tallest vessel in a rack or from the top of the rinse station. For example, if you have a Code 200 rack with 13 x 100 mm Vacutainer tubes, the Z-arm should be set at a height of 125 mm.

3. Tighten the screw on the mounting bracket until the Z-arm is secure.

4. Note the installed height of the Z-arm using the graduated scale located on one side of the arm and note it on this page. This height is required when setting up parameters in the 215 Setup Utility program described in Section 3.
Electrical Connections

Rear Panel

1. Input/Output (I/O) ports
2. Gilson Serial Input/Output Channel (GSIOC) port
3. Keypad port
4. RS-232 port
5. Fuse drawer
6. Power switch
7. Power receptacle
8. Unit ID selector
9. Baud rate/mode selector
Input/Output Ports

You can use the input and output contacts found on the rear panel of the liquid handler to control peripheral devices. Refer to the diagram on page 2-21 for the location of the input/output ports.

Contact inputs

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

The contact input pairs are labeled A, B, C, and D.

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

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

Contact outputs

The output terminal block has 10 contacts.

Pins 1 and 2 supply a +24V DC output. Do not use this output unless the receiving device can accept 24V power.

Pins 3 through 10 are paired, isolated-relay contact closures and are labeled 1, 2, 3, and 4.

Items you'll need

To make connections, you'll need the following:

- terminal block connectors
- 2-conductor cable (22 - 30 gauge for each wire)
- wire insulation stripper
- small-blade screwdriver

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

Electrical Connections
Making connections

To prepare and make connections with the 2-conductor cable:

1. Cut the cable into pieces of appropriate length.
2. Strip about 0.25 cm of insulation from each end of the cable.
3. Remove the terminal block connector from the liquid handler. Insert each wire into the appropriate slot on the terminal block connector.

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

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

4. Reconnect the terminal block connector to the liquid handler. The wires will be facing left and the pin screws will be facing you as you look at the rear of the instrument. Push the connector in as far as it will go. It is designed to fit snugly into its receptacle.

5. Connect the opposite ends of the wires to the other device(s). Be sure to match ground connections.

6. Label each cable to identify the purpose of the connection.
RS-232 Port

The RS-232 port is used to transfer information between the liquid handler and a computer. For the location of the RS-232 port, refer to the diagram on page 2-21.

Be sure your computer is turned off before making any connections.

To connect your computer to the liquid handler, you'll need an RS-232 cable. Obtain a cable with D-connectors that are appropriate for the liquid handler and your computer. The liquid handler requires a 25-pin male D-connector. Refer to the back panel of your computer or its documentation to determine which type of D-connector it requires. RS-232 cables are available from Gilson and your local computer store.

Connecting an RS-232 cable

Attach the male end of the RS-232 cable to the RS-232 port located on back panel of the 215 Liquid Handler. Tighten the retaining screws.

Attach the female end of the RS-232 cable to the computer's RS-232 serial communications port. (Do not mistake it for the female 25-pin parallel printer port!) Again, tighten the retaining screws.
Keypad Port

The keypad port is used to connect the Gilson Keypad Controller to the liquid handler. For the location of the Keypad port, refer to the diagram on page 2-21.

Using the keypad, you can run programs that control the liquid handler. See Section 3 for more information on running programs using the keypad.
GSIOC Port

Gilson systems feature a two-way communication interface between the computer and most Gilson modules. Communication occurs along the Gilson Serial Input/Output Channel (GSIOC).

The liquid handler can convert the RS-232 signal levels used by computers to the RS-422/485 signal levels required by the GSIOC and vice versa. (See page 2-24 for information on making the RS-232 connection between the liquid handler and computer.)

GSIOC cable

Use the GSIOC cable to link an additional Gilson GSIOC module to the liquid handler and control both devices via a program executed on the computer or Gilson Keypad Controller.

Connect the female connector, located individually at one end of the cable, into the GSIOC port of the liquid handler. Tighten the retaining screws. (Refer to diagram below.)

Connect the other female connector, located on the same end as the male connector, to the Gilson module. Tighten the retaining screws.

If you're connecting another Gilson module, use the male connector to join another GSIOC cable and make the necessary connection to the next Gilson module.
Unit ID and Baud Rate/Mode Selection

Use the SW1 selector to choose a different unit ID and the SW2 to choose a different baud rate/ mode. If necessary, refer to the diagram on page 2-21 for the location of these selectors.

Unit ID

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

At the factory, Gilson set the unit ID to 22. There is no need to change this number unless it is the same as that assigned to another Gilson instrument that's also connected along the GSIOC.

To change the unit ID:

1 Gently insert a small flat blade screwdriver into the SW1 selector on the rear panel and turn it.

2 Align the white dot with one of the indicated numbers. The unit ID is 20 plus the selected number.
Baud rate/mode

As a default, the baud rate/mode is set to 6, indicating that the liquid handler is set for a baud rate of 19200 and is a master device.

You’ll need to change the selection to 0 (zero) if the liquid handler is connected via the GSIOC to a Gilson system and is being controlled by Gilson controller software. A setting of 0 indicates the liquid handler is a slave device and the baud rate is being clocked externally.

Note that other selections are available if the liquid handler is being controlled by non-Gilson applications. Refer to the table shown on the liquid handler’s rear panel; see page 2-21.

To change the baud rate/mode:

1. Gently insert a small flat blade screwdriver into the SW2 selector on the rear panel and turn it.

2. Align the white dot with one of the indicated numbers.
Installation

Fuses

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

1. Locate the accessory package containing the fuse drawer appropriate for your line voltage. Discard the other fuse drawer.

2. Locate the accessory package containing the 2.5A "T" Slo-Blo fuse (5 x 20 mm size) fuses.

3. Install the fuse(s) into the fuse drawer. The fuse drawer for 100/120V accepts one fuse. The fuse drawer for 220/240V accepts two fuses.

4. Insert the fuse drawer into its receptacle in the liquid handler. See rear panel diagram on page 2-21.

Power Cord Connection

Locate the appropriate power cord for your line voltage. Discard the other power cord.

Use the power cord to connect the liquid handler to an AC power source.
The 215 Liquid Handler is controlled as follows:

- Via a method running on a personal computer. You create the method using UniPoint™ System Software, 735 Sampler Software, Gilson Sampler Software*, or 709 Sampler Manager Software*. All are ordered separately. See Appendix A, Replacement Parts and Accessories for part numbers.

  *Gilson Sampler Software and 709 Sampler Manager Software have been discontinued and are no longer available for purchase.

- Via an executable file running on a Gilson Keypad Controller.

If you have not already done so, install the UniPoint™ System Software, 735 Sampler Software, Gilson Sampler Software, or 709 Sampler Manager Software. Refer to the User's Guide included with the software.
Front Panel

The front panel of the liquid handler contains a Start button, Stop button, LED display, and power indicator light.

Start Button

The Start button can be used to home the XYZ-arm when the liquid handler is first powered up or when the motors for the XYZ-arm have been relaxed. When pressed, the yellow LED lights.

Stop Button

The Stop button is a large touch-sensitive pad that can be used to terminate a program and stop the liquid handler from responding to any more commands coming from the running program. This button also relaxes the motors for the XYZ-arm so that you can easily lift the probe and move the arm. When pressed, the yellow LED light is turned off.

In a situation where an emergency stop is required, pressing the Stop button immediately stops the liquid handler. The stop button is designed to be sensitive enough that if you just brush it with your hand it activates.

LED Display

The 8-character LED display shows the current status of the liquid handler and any error codes as they are encountered. Your program can also contain instructions for showing 8-character messages on the display when the program is run.

Refer to Section 5, Troubleshooting for a list of current error codes and required actions.

Power Indicator Light

This indicator becomes lit when you turn on power to the liquid handler using the power switch located on the rear panel. Refer to the rear panel diagram on page 2-21 if necessary.
Start Up

To start the liquid handler:

1. Make sure the liquid handler is connected to a power source and that the armlock has been removed.

2. Turn on the liquid handler using the power switch located on the rear panel. Refer to rear panel diagram on page 2-21 if necessary. The power indicator light on the front panel illuminates.

   When power is turned on, the liquid handler beeps and displays the current version of its installed firmware. This message appears for about one second before the LED display returns to a blank state.

   In order to determine what PROM version is installed in your liquid handler, you may need to turn the unit off then on again and watch the display for the version number to appear.

3. After the liquid handler powers up, press the Start button. This initiates the homing sequence that allows the liquid handler to determine its mechanical reference positions. The sequence takes approximately one minute to complete.

   While the homing sequence progresses, the LED display shows Homing. When the sequence completes, it blanks.

   **Note:** If the program being executed by the liquid handler doesn't include commands for homing the instrument, perform step 3 before starting the program.

   The utility programs supplied with the liquid handler home the instrument if necessary.
Running Programs

The liquid handler is controlled by programs executed from a personal computer or Gilson Keypad Controller.

Programs for Windows 98/NT users

Executable (.EXE) programs can be run from a computer. The computer is connected to the liquid handler via an RS-232 cable. Refer to Section 2 for correct installation of the RS-232 cable between the liquid handler and the computer.

The following utility programs are supplied on the 215 Utility Programs CD-ROM supplied with your liquid handler.

215 Setup Utility - Specifies configuration parameters for the liquid handler.

215 Priming Utility - Primes the transfer tubing.

215 Contact Test Utility - Enables you to test contact connections.

215 Injection Z-Height Utility - Enables you to adjust the height of the Z-arm when used with an 819 Injection Module.

Pascal versions for the above programs are available upon request.
Programs for Gilson keypad users

The following programs are copied to your computer's disk as part of the 709 Sampler Manager Software installation and can be used if you are controlling the liquid handler via the Gilson keypad.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET_215.EXE</td>
<td>Specifies configuration parameters for the liquid handler. See page 3-8.</td>
</tr>
<tr>
<td>PRIMER.EXE</td>
<td>Primes the tubing. See page 3-15.</td>
</tr>
<tr>
<td>CONTACT.EXE</td>
<td>Enables you to test contact connections. See page 3-16.</td>
</tr>
<tr>
<td>INJPORT.EXE</td>
<td>Cleans the liquid handler's probe, primes the syringe pump, or rinses the injection port of an 819 Injection Module. For more information, refer to the 819 Injection Module User's Guide.</td>
</tr>
<tr>
<td>INJECT_Z.EXE</td>
<td>Enables you to adjust the height of the Z-arm when used with an 819 Injection Module. For more information, refer to the 819 Injection Module User's Guide.</td>
</tr>
<tr>
<td>INJ_215.EXE</td>
<td>Injects a series of samples onto an HPLC system. For more information, refer to the 819 Injection Module User's Guide.</td>
</tr>
</tbody>
</table>

The Pascal versions of the above programs are also copied to the computer as part of the software's installation. You can modify them as required using the software.
Running Programs from Keypad

A Gilson Keypad Controller can be used as an alternate interface between the user and liquid handler. The keypad is connected to the liquid handler via a coiled cable. Refer to Section 2 for correct connection of the cable to the Keypad port, located on the liquid handler's rear panel.

The keypad consists of:

- an 8-line, 40-character display (white characters on a blue background)
- numeric keypad with an enter key
- four cursor direction keys
- three function keys, help, esc, clear
- 3 1/2" disk drive with protective cover

Supplied with the 709 Sampler Manager Software installation disks is the 215 Keypad disk that contains the programs listed on page 3-4 and the files listed below. In order to run an executable file from the keypad, the disk on which your program is stored must contain the following files.

- MGIIOC.SYS
- AUTOEXEC.BAT
- CONFIG.SYS
- MENU.EXE

An optional program to set the time and date is also provided on the disk but is not required to run programs controlling the liquid handler. Files for this optional program are DAYTIME.EXE and DAYTIME.TXT.

To copy your liquid handler program(s) onto the disk, use the COPY command in DOS or use the Windows Explorer in Microsoft Windows.

The MENU.EXE program allows you to view and select one of up to 14 executable files stored on the disk. If you have more than 14 files and you want to maintain your keypad disk, move the utility programs and example programs to another disk or to a computer for storage.
To run an executable file, enter the number of the program corresponding to the menu selection and press enter. To stop a program, press the Stop button on the liquid handler's front panel or follow the program-specific instructions for stopping the program.

If a program prompts you for a yes or no (Y/N) response, press 1 on the keypad to indicate yes or 0 to indicate no.
Configuring the Liquid Handler

The liquid handler comes from the factory with its configuration set by Gilson. Configuration information is stored in the non-volatile memory of the liquid handler. Prior to using the liquid handler for the first time, it is important to review and adjust the default configuration to make sure it is correct for your application.

The following pages describe how to use SET_215.EXE to configure the liquid handler. If you’re using the 215 Setup Utility, refer to its online help if you need assistance.

The SET_215.EXE file is a utility program that allows you to review and if necessary change the configuration options set for the liquid handler. This file is supplied on a separate disk for use in a Gilson Keypad Controller.

When you execute SET_215.EXE from the computer or keypad, a menu appears.

1  pump type
2  syringe options
3  rinse site
4  liquid detector
5  adjust X & Y
6  Z height
7  home phase
8  safety contact
9  bearing life
10 sound & display
11 emergency contact

To select a menu item, type its number and press enter. From within each menu item, typing 0 and pressing enter will return you to the menu.

Following is a description of each of the menu items.
Pump Type

Use this menu item to set the type of syringe pump. This setting tells the liquid handler what type of pump is installed or indicates that no pump (blank front) is installed. If the syringe pump type actually installed does not match the setting indicated in the configuration file, an error will occur during operation.

Factory default indicates that a Gilson 402 Syringe Pump is installed.

Syringe Options

Change the syringe size - In order to properly aspirate and dispense requested volumes, the liquid handler must know the size of the currently installed syringe. Incorrect settings can cause improper volumes to be aspirated or dispensed during operation or can cause an error to occur.

Factory default is 0 for the syringe size.

Input the correct syringe size in microliters. If you don't know the size of syringe installed, check the container in which the syringe was shipped for size information.

Lower piston to change the syringe - Selecting option 2 facilitates replacement of a new syringe by causing the syringe piston to move to the bottom of its stroke. At this time, you are prompted to install a new syringe. Once installed, press any key to home the syringe pump.
Rinse Site

The liquid handler stores the location of the default rinse site, for a 5-position locator plate, in memory. This allows the liquid handler to move to this location before homing the syringe and prevents the spilling of waste liquid or rinse diluent.

Coordinates for the rinse station location are provided for the X-, Y-, and Z-axis in millimeters. The factory default rinse location is 114.4 mm in X, 3.8 mm in Y, and 100 mm in Z for a shallow-pocket rinse insert. Change the Z coordinate to a value from 55 to 65 mm if a deep-pocket insert is installed or from 20 to 55 mm if a flow-through rinse insert is installed.

If the rinse station has been moved to the right side of the 5-position locator plate, change the X coordinate to 473.1 mm. Leave the Y coordinate at 3.8 mm. Change the Z coordinate to a value from 55 to 65 mm if a deep-pocket insert is installed or from 20 to 55 mm if a flow-through rinse insert is installed.

If a 6-position locator plate is installed, change the X coordinate to the appropriate value, listed below. Leave the Y coordinate at 3.8 mm. Change the Z coordinate to a value from 55 to 65 mm if a deep-pocket insert is installed or from 20 to 55 mm if a flow-through rinse insert is installed.

<table>
<thead>
<tr>
<th>Rinse station location</th>
<th>X coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>169.3 mm</td>
</tr>
<tr>
<td>Center (factory default)</td>
<td>288.9 mm</td>
</tr>
<tr>
<td>Right</td>
<td>408.0 mm</td>
</tr>
</tbody>
</table>
Liquid Detector

Use this option to adjust the sensitivity of liquid detection as desired.

Raising the percentage suppresses false liquid detection while lowering the percentage increases sensitivity for situations where liquid is harder to detect. By lowering the probe so it touches the liquid for one of your samples, you can manually test the current sensitivity of the liquid detection. In this manner, you can observe the amount of change you might expect with each sample.

The factory default setting is 6%.

Adjust X&Y

This option allows you to test whether the liquid handler is properly adjusted and to make minor adjustments to the X- and Y-axis offsets if needed. Items available in this option are described below.

Items 3 or 4 within this menu should be run first to check the initial X and Y coordinates. Then you can modify the X and Y offsets using items 1 and 2, respectively.

1 Alters the X offset in millimeters.

2 Alters the Y offset in millimeters.

   If you changed the X or Y offset, the liquid handler will store the new coordinates.

3 Homes the liquid handler if it is not already homed and moves the XYZ-arm to the installed rinse site. The Z-arm becomes relaxed so that you can manually move the probe to visually check the alignment with the rinse station. Pressing any key re-homes the liquid handler.

4 Prompts you for a target location in the X-axis and then a target location in the Y-axis. The XYZ-arm moves to this target location and the Z-arm is relaxed so that you can manually move the probe for visual alignment confirmation on a target site. Pressing any key re-homes the liquid handler.
Z Height

The Z-arm can be clamped at an adjustable height over the locator plate. You can set this height so that the liquid handler is able to properly find heights that you specify. Additionally, you can set the size of the Z-arm that is currently installed to control the amount of travel in the Z-axis. If Z height is set here to match the actual Z mounting bracket clamp, a height of 0 mm means the Z-arm foot is flat on the locator plate.

The current distance from the bottom of the Z-arm to the bottom of the locator plate pins is displayed along with the maximum height the Z-arm can travel. Items available in this option are:

1. Sets the height of the Z tower. Use the scale on the Z-arm to determine the height, in millimeters, that the tower is clamped. Refer to the following diagram for setting the proper height of the Z-arm.

2. Alters the amount of Z-axis travel, in millimeters, dependent on the type of Z-arm installed in your liquid handler. Two types of Z-arms are available:
   - 125 mm (default setting)
   - 175 mm
Home Phase

Use this option to display the current X and Y phase of the liquid handler. To re-phase this instrument, the liquid handler must home itself 10 times. Press N (or 0 if using a keypad) to exit this option or press Y (or 1 on the keypad) to start the homing process. Once the process is completed, you can save the new phases to nonvolatile RAM or exit without saving the new phases.

The liquid handler finds out where home is located by "feeling" for the back and left walls of the unit. It expects to find these walls in the same place each time. If it does not, you will get an error. If this error was caused by an obstruction, just clear the obstruction and try again. If the problem does not clear or if a change is made to the mechanics, you will probably need to repeat this option to find the true home location.

Safety Contact

The liquid handler has provisions for connecting safety devices that your application may require, as long as they present a contact closure or TTL type interface. This option allows you to specify which input contact is connected to the safety device and what is the active state of that device. The function of the safety contact is equivalent to pressing the Stop button on the liquid handler’s front panel.

To use this option, choose one of the contacts. Once a contact is chosen, select:

1. Activate when the contact is open
2. Activate when the contact is closed
0. Do not activate (default setting)
Bearing Life

This option is a visual record of XYZ travel in kilometers and the number of full strokes the dilutor has performed. This is a read only option.

Sound and Display

Use this option to adjust the brightness of the display, sound level and tone. Select:

1. Alters the sound level. You can choose from three levels of sound: 0 = quiet, 1 = middle and 2 = loud (default setting).

2. Alters the tone. You can choose from two types of tone: 0 = sine wave tone (default setting) and 1 = triangle wave tone.

3. Alters the brightness of the LED display on the front panel. You can select a range of 0 through 7 where 0 is the dimmest and 7 is the brightest. Default setting is 5.

Emergency Contact

The emergency stop option provides for sending a signal to a peripheral device (such as a Gilson 818 AutoMix) whenever the liquid handler's Stop button is pressed or safety input is activated.

To use this option, choose one of the contacts (1 - 3). Once a contact is chosen, select:

1. Activate when the contact is open
2. Activate when the contact is closed
0. Do not activate (N.A.)

Note: Once the emergency output has been activated, reset the contact to its non-emergency state using CONTACT.EXE, described on page 3-16.
Priming the Liquid Handler

Following is a description of how to use the PRIMER.EXE utility program to prime the syringes and transfer tubing lines with liquid. If you're using the 215 Priming Utility (for Windows 98/NT users), refer to its online help if you need assistance.

PRIMER.EXE is supplied on a separate disk for use in a Gilson Keypad Controller.

Gilson recommends using PRIMER.EXE before using the liquid handler for the first time or if the instrument has not been used for some time. This program will eliminate any air that remains in your liquid lines.

When executed, PRIMER.EXE causes the liquid handler to home itself. Homing will appear on the LED display. Next, you are prompted to enter a priming speed (in milliliters per minute). Once a speed is entered, priming begins immediately and a message is sent to the screen confirming the size of the current syringe. At the same time, Priming will appear on the LED display on the front panel.

Pausing the Priming Cycle

You can pause the priming cycle at any time by pressing any key. If a pause is activated while the syringe pump is in a downward motion, the syringe is stopped at the bottom of its stroke. If a pause is activated while the syringe pump is in an upward motion, the syringe is stopped at the top of its stroke.

Pausing the priming cycle also causes Pause to display on the LED display on the front panel.

To resume the priming cycle, press 1.

Stopping the Priming Cycle

To terminate priming, press any key then press 0. This causes the syringe pump to home and Done to appear on the LED display.
Testing the Liquid Handler’s Contacts

Following is a description of how to use CONTACT.EXE to activate output contacts to determine if the correct contact connections have been made to peripheral devices to be controlled by the liquid handler. It also identifies the state of input contacts. If you’re using the 215 Contact Test Utility (for Windows 98/NT users), refer to its online help if you need assistance.

CONTACT.EXE is supplied on a separate disk for use in a Gilson Keypad Controller.

Before running this program, you need to connect the peripheral device’s inputs to the appropriate output pair on the liquid handler. If necessary, refer to Section 2 for information on making contact connections.

Once CONTACT.EXE is running, the program continuously displays the state of outputs and inputs. You can toggle the state of any of the five available output contacts. For example, if you want to test that output contact 1 is triggered, type 1. If you want to toggle the +24V output, type 5.

**Caution:** If you are running the CONTACT.EXE program from the keypad and toggle the +24V output, you’ll lose power to the keypad. To prevent this, make a jumper connection between pins 1 and 2 (output 5) and the pin pair for one of the other four outputs. Instead of toggling output 5, toggle the appropriate output for the pin pair connected to output 5.
To obtain optimum performance and maximum life from the 215 Liquid Handler, it is important to keep the instrument well-maintained.

This section contains some general guidelines that will help you to maintain your liquid handler.
Helpful Hints

In order to keep your liquid handler at peak performance, Gilson recommends that you do the following:

- Change or clean the piston seals and tubing regularly to maintain maximum syringe pump performance.

- Do not cycle the syringe pump without fluid. Doing this causes excessive piston seal wear.

- Flush the syringe pump, probe housing, and rinse stations daily with distilled or deionized water. On a weekly basis, flush these instruments with a 10% solution of bleach or weak detergent.

- If bubbles remain in the syringe after priming, clean the syringe with alcohol.

- Check periodically to ensure that all fittings are tight.

- Check that the syringe is tight in the syringe pump valve fitting.

- Wipe up all spills immediately.

- Cold fluids may cause leakage; warm fluids to room temperature before running them through the system.
Cleaning

Cleaning the Liquid Handler

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

Cleaning the Syringe

If your liquid handler is equipped with a syringe pump, it may be necessary to clean the syringe. Cleaning the syringe is needed when some or all of the following occurs:

- Corrosive or hazardous liquids have been pumped
- Possible back flow of liquids into the waste tubing
- Leakage
- Aspiration of samples or reagents into the syringe

To clean the syringe, follow the procedures on the next page and use the diagram below as a reference.

![Diagram of syringe components]

- to inlet tubing
- to transfer tubing
- valve screw
- valve
- to vent tubing
- syringe
- piston
- piston holding screw
- piston operating rod
Removing the syringe

The following procedures use the SET_215.EXE program; however, you can use the 215 Setup Utility program instead.

To remove the syringe:

1. Start the SET_215.EXE program, described in Section 3.

2. Select item 2, Syringe Options, from the SET_215 menu. The installed syringe size is displayed along with an options menu.

3. Select the Lower piston to change the syringe option. This causes the piston operating rod to descend as the syringe pump aspirates from the reservoir. The syringe pump will stop at the bottom of its stroke, switching the valve to the outlet position.

4. Disconnect the syringe piston from the piston operating rod by unscrewing the piston holding screw on the underside of the rod when the Install new syringe now prompt appears.

5. Remove the two screws securing the valve to the syringe pump and then remove the valve and syringe assembly.

6. Unscrew and remove the syringe from the valve.
Cleaning the syringe

Once the syringe has been removed, it can be cleaned:

1. Place the syringe in a beaker containing methanol. Then aspirate and dispense several volumes of methanol through the syringe.

2. Place the syringe in a beaker containing distilled or deionized water. Then aspirate and dispense several volumes of water through the syringe.

3. Hold the syringe housing in one hand. Clean the syringe using a non-abrasive cloth dampened with alcohol. Remove the piston and clean the piston with a non-abrasive cloth dampened with alcohol.

4. Dry the syringe and piston using a clean, lint-free cloth.
Reinstalling the syringe

When the syringe is clean, reinstall it:

1. Lubricate the piston with reservoir solvent to reduce friction on the piston seals during reinstallation.

2. Loosely screw the syringe into the valve. Do not fully tighten.

3. Loosely attach the valve with its screws to the syringe pump.

4. Pull down the piston so it comes into contact with the piston operating rod and firmly tighten the piston holding screw.

5. Fully tighten the valve screws to secure the valve.

6. Fully tighten the syringe into the valve.

7. Press any key to home the syringe pump and return to the menu listing for the SET_215.EXE program.
Cleaning the Fluid Path

Depending upon your use of the workstation, 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.

\[
\text{flush volume} = (10 \times \text{syringe volume}) + \text{transfer tubing volume}
\]

It's important to clean the fluid path if you won't be using the workstation 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** - Follow this procedure if the fluid path is in contact with 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 - Follow this procedure if the fluid path is in contact with 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** - Follow this procedure if the fluid path is in contact with biological fluids such as blood products:

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.
Cleaning the Valve

Clean the syringe pump's valve with a nonabrasive cloth after any of the following situations have occurred:

- Corrosive or hazardous liquids have been pumped
- Possible back flow of liquids into the waste tubing
- Leakage

Removing the valve

To clean the valve, first remove it from the syringe pump:

1. Disconnect the inlet, transfer and vent tubing from the valve.
2. Disconnect the syringe from the valve and remove the valve from the syringe pump as described on page 4-4.

Disassembling the valve

1. Hold the valve body firmly in one hand. Using a 17 mm open-ended wrench, turn the valve axle guide counterclockwise and separate the two halves.
2. Pull the valve axle away from the valve main body.
3. Separate the ceramic stator from the ceramic rotor.
4. Tap the valve axle guide against a solid level surface to remove the spring and PTFE end piece.

Note: Do not remove the ceramic stator from the valve main body.
Cleaning and reinstalling the valve

The disassembled parts of the valve can be cleaned using a non-abrasive cloth dampened with alcohol or by autoclaving.

1. Dry the components using a clean, lint-free cloth.

2. Reassemble the valve parts by reversing the above procedure.

3. Reinstall the syringe and valve by following the instructions on page 4-6.
Replacing Parts

Replacing Tubing

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

Replace both the transfer tubing and inlet tubing as needed. See Appendix A for part numbers for replacement tubing. For tubing installation procedures, see Section 2.
Replacing the Piston Seal

To change the syringe pump's piston seal, refer to the instructions on the following pages. For part numbers for replacement seals, contact Gilson Customer Service at 800-445-7661 or 608-836-1551. You can also contact the Customer Service Department via its electronic mail (email) address: service@gilson.com.

Outside the United States, contact your Gilson representative.

100 and 250 µl syringes

1. Remove the syringe from the pump as described on page 4-4.

2. Slide the piston out of the syringe barrel.

3. Remove the piston seal from the piston rod by carefully pinching the piston seal with a pair of pliers and gently pulling the piston seal off the piston rod. Take care not to damage the end of the piston rod when removing the seal. (It is possible to remove the seal by pinching it between the thumb and forefinger nails and pulling.)

4. Remove any remaining debris of the original piston seal from the end of the rod.

5. The 100 µl and 250 µl pistons have a narrow rod that may be damaged if handled incorrectly. In order to fit a new piston seal without unduly bending the piston rod, undo the Allen screw that secures the piston button to the piston rod. Slide the button down the piston rod to within 10 mm of the end of the rod where the new piston seal is to be mounted and re-tighten it in position.

6. Put the new piston seal in its recess in the piston seal mounting tool. The 100 µl and 250 µl piston seals use the same tool. One face of the tool has a recess for the 100 µl piston seal, the other face has a recess for the 250 µl piston seal.
7 Hold the piston button and gently push the end of the piston rod into the new piston seal.

8 Remove the piston assembly from the piston seal holder. Slacken the piston button and slide it away from the piston rod.

9 Dip the piston seal in distilled water and slide the piston assembly into the syringe.

10 Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops (the seal is level with the end of the syringe).

11 For the 100 µl piston only, insert the support collar as shown on the right. The support collar should be replaced after 60,000 strokes.

12 Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.

13 Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.

14 Remount the syringe on the pump as described on page 4-6.
500 µl syringes

1. Remove the syringe from the pump as described on page 4-4.

2. Slide the piston out of the syringe barrel.

3. Remove the piston seal from the piston rod by carefully pinching the piston seal with a pair of pliers and gently pulling the piston seal off the piston rod. Take care not to damage the end of the piston rod when removing the piston seal.

4. Remove any remaining debris of the original seal from the end of the piston rod.

5. Put the new piston seal in its recess in the piston seal holding tool.

6. Turn the tool upside down and place the piston assembly as shown in the figure on the left.

7. Slacken the piston button and remove it from the piston rod. Slide the clamping tool down the piston rod and press the two tools firmly against each other. A slight rotation of the clamping tool ensures a correct fitting.

8. Remove the tools away from the piston assembly.

9. Dip the piston seal in distilled water and slide the piston into the syringe.

10. Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops (the seal is level with the end of the syringe).

11. Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.
12 Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.

13 Make sure of the presence of the plastic cover when re-mounting the syringe on the pump.

14 Remount the syringe on the pump as described on page 4-6.
1 ml syringes

1 Remove the syringe from the pump as described on page 4-4.

2 Slide the piston out of the syringe barrel.

3 Remove the piston seal from the piston rod by carefully pinching the piston seal with a pair of pliers and gently pulling the piston seal off the piston rod. Take care not to damage the end of the piston rod when removing the piston seal.

4 Remove any remaining debris of the original seal from the end of the piston rod.

5 Put the new piston seal in its recess in the piston seal holding tool.

6 Holding the piston rod firmly, gently push the end of the piston rod into the new piston seal until the rod is clamped in the piston seal.

7 Remove the piston assembly from the holding tool.

8 Dip the piston seal in distilled water and slide the piston into the syringe.

9 Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops (the seal is level with the end of the syringe).

10 Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.

11 Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.

12 Remount the syringe on the pump as described on page 4-6.
5 ml and 10 ml syringes

1. Remove the syringe from the pump as described on page 4-4.

2. Slide the piston out of the syringe barrel.

3. Remove the piston seal from the shaft by carefully pinching the piston seal with a pair of pliers and gently pulling the piston seal off the shaft. Take care not to damage the end of the shaft when removing the piston seal.

4. Remove any remaining debris of the original piston seal from the end of the shaft.

5. Insert the new piston seal in the recess of the piston seal holder. Make sure that the aperture is facing outward and the O-ring is inside the seal.

6. Place the piston shaft in the piston shaft holder, see figure below.

7. Screw the two parts of the tool together until tight.

8. Unscrew the tool, the piston seal should be correctly seated on the shaft.

9. Dip the piston seal in distilled water and slide the piston into the syringe.

10. Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.

11. Remount the syringe on the pump as described on page 4-6.
25 ml syringes

1. Remove the syringe from the pump as described on page 4-4.

2. Slide the piston out of the syringe barrel.

3. Hold the piston seal firmly in one hand and unscrew the seal from the piston shaft.

4. Screw a new piston seal on the shaft.

5. Slide the piston into the syringe barrel and complete the piston seal fitting by screwing the shaft until the piston seal turns with the piston shaft.

6. Dip the piston seal in distilled water and slide the piston up and down in the syringe barrel five or six times to ensure a smooth movement between the piston and syringe.

7. Remount the syringe on the pump as described on page 4-6.
Replacing the Syringe

If necessary, refer to the diagram on page 4-3 while performing the procedures below. The following procedures use the SET_215.EXE program; however, you can use the 215 Setup Utility program instead.

Removing the syringe

1. Run the SET_215.EXE program. Refer to Section 3 for more information on running programs.

2. Select item 2, Syringe options, from the program's menu. The installed syringe size is displayed along with an options menu.

3. Select the Lower piston to change the syringe option. This causes the XYZ-arm to move to the rinse station and the syringe pump's piston operating rod to descend as the syringe pump aspirates from the reservoir. The syringe pump will stop at the bottom of its down stroke and the valve will switch to the outlet position.

   **Note:** If the liquid handler is not homed when this option is selected, the unit will home before it moves to the rinse site.

4. When the program prompt Install new syringe now appears, disconnect the syringe piston from the piston operating rod by removing the piston holding screw on the underside of the rod.

5. Remove the screws attaching the valve to the syringe pump and remove the valve and syringe.

6. Unscrew and remove the syringe from the valve.
Mounting new syringe

1. Loosely screw the replacement syringe into the valve. Do not fully tighten.
2. Loosely attach the valve to the syringe pump with its screws.
3. Pull down the piston so it comes into contact with the piston operating rod and firmly tighten the piston holding screw.
4. Fully tighten the valve screws to secure the valve.
5. Fully tighten the syringe into the valve.
6. Press any key when finished. The liquid handler will move to the rinse site and the syringe pump will re-initialize with the new syringe.

**Note:** If you installed a new syringe of a different size than the one you replaced, you need to run SET_215.EXE or the 215 Setup Utility to change the syringe size.
Replacing the Valve

To replace the syringe pump's valve, follow the instructions below. If necessary, refer to the syringe pump diagram on page 4-3.

1. Disconnect the inlet, transfer and vent tubing from the valve.

2. Disconnect the syringe and the valve from the syringe pump. Refer to the procedure for replacing the syringe on page 4-21.

3. Re-install the syringe and the replacement valve. Refer to the procedure for mounting new syringe on page 4-22.

4. Reconnect the inlet, transfer and vent tubing to the newly installed valve.
Replacing the Probe

Refer to the appropriate instructions below depending on whether you’re replacing the probe with one of the same type or one of a different type.

Installing same type of probe

To install a replacement probe of the same type that’s currently installed:

1. Remove the transfer tubing’s 1/4\"-28 fitting connected to the top of the isolation probe holder.

2. Grasp the current probe and push it up through the top of the isolation probe holder.

3. Install the new probe by pushing it through the top of the isolation probe holder. Make sure the tip of the probe sits inside the probe guide.

4. Replace and tighten the 1/4\"-28 fitting.
Installing different type of probe

To install a replacement probe of a different type than is currently installed, you'll need to obtain a probe kit. Each kit includes a probe guide, probe holder, and probe.

1. Remove the transfer tubing's 1/4"-28 fitting connected to the top of the isolation probe holder.

2. Grasp the current probe and push it up through the top of the isolation probe holder.

3. Remove the current probe guide from the opening in the top of the foot by unscrewing the two Phillips screws. Then place the new probe guide into the top of the foot and secure it using the screws.

4. Remove the current probe holder by unscrewing it from the bottom of the isolation probe holder. Then install the new probe holder by screwing it into the isolation probe holder.

5. Install the new probe by pushing it through the top of the isolation probe holder. Make sure the tip of the probe sits inside the probe guide.

6. Replace and tighten the 1/4"-28 fitting.
Replacing a Fuse

A blown fuse may indicate the existence of another problem in the instrument. If the replacement fuses blow, don't try others. Contact your local representative or Gilson. See **Before calling us** in **Section 5**.

To change a fuse, follow these steps.

1. Disconnect the power cord from the power outlet and from the rear panel receptacle.
2. Locate the fuse drawer on the rear panel. See page 2-21 if necessary.
3. Insert a small screwdriver into the notch under the fuse drawer.
4. Twist the screwdriver to open and remove the fuse drawer. The fuse drawer contains one 2.5A "T" Slo-Blo fuse (5 x 20 mm size) for a 100/120 voltage selection. It contains two 2.5A fuses for a 220/240 voltage selection.
5. Remove the old fuse(s) and insert the new fuse(s).
6. Insert the fuse drawer into its receptacle in the liquid handler.
Checking Position Alignment

The SET_215.EXE program, described in Section 3, allows you to test whether the liquid handler is properly aligned and to make minor adjustments to the X-axis and Y-axis offsets if needed. To check the current alignment and make adjustments as needed, select the Adjust X&Y option from the menu. The four items available in this option are described below.

**Note:** You can also use the 215 Setup Utility Program to adjust the X-axis and Y-axis offsets if needed. Refer to its online help.

Items 3 or 4 within this menu should be run first to check the initial X and Y coordinates. Then you can modify the X and Y offsets using items 1 and 2, respectively.

1. Alters the X offset in millimeters.

2. Alters the Y offset in millimeters.

   If you changed the X or Y offset, the liquid handler will store the new coordinates.

3. Homes the liquid handler if it is not already homed and moves the XYZ-arm to the installed rinse site. The Z-arm becomes relaxed so that you can manually move the probe to visually check the alignment with the rinse station. Pressing any key homes the liquid handler.

4. Prompts you for a target location in the X-axis and then a target location in the Y-axis. The XYZ-arm moves to this target location and the Z-arm is relaxed so that you can manually move the probe for visual alignment confirmation on a target site. Pressing any key re-homes the liquid handler.
Transporting the Liquid Handler

When moving the liquid handler to another location or when sending it back to the factory, do not use the Y-arm as a handle. Reinstall the armlock (see Section 2) and always lift the liquid handler from the base.
Troubleshooting
## Error Messages

<table>
<thead>
<tr>
<th>Error</th>
<th>Description</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Invalid Pump Type</td>
<td>Run SET_215.EXE or the 215 Setup Utility program to correct the problem.</td>
</tr>
<tr>
<td>11</td>
<td>Undefined syringe size</td>
<td>Run SET_215.EXE or the 215 Setup Utility program to correct the problem.</td>
</tr>
<tr>
<td>12</td>
<td>Pump not found</td>
<td>Contact the Gilson Customer Service Department.</td>
</tr>
<tr>
<td>13</td>
<td>Syringe speed out of range</td>
<td>This can be caused by an incorrect syringe size setting. Run SET_215.EXE or the 215 Setup Utility program to check that the correct syringe size was entered. If you do not know the size of the syringe installed, check the container the syringe was shipped in for size information. Or, the requested aspirate or dispense speed is too fast for the installed syringe. Refer to the table listing the maximum flow rates on page 1-9 and then change the speed accordingly in program controlling the liquid handler.</td>
</tr>
<tr>
<td>14</td>
<td>Invalid syringe volume</td>
<td>Requested aspirate or dispense volume is too large for syringe installed. Modify the syringe aspirate and dispense volumes in the program controlling the liquid handler. An incorrect syringe size setting can also cause improper volumes to be aspirated or dispensed during operation or can cause an error to occur. Run SET_215.EXE or the 215 Setup Utility program to check that the correct syringe size was entered.</td>
</tr>
</tbody>
</table>
| 15    | NV-RAM checksum is invalid               | - Send the buffered ~9 GSIOC command to reset the NV-RAM and initialize to the default value. Run SET_215.EXE or the 215 Setup Utility program  
- Replace the main board |
<p>| 16    | X scale factor is invalid                | Contact the Gilson Customer Service Department.                                                                                       |
| 17    | Y scale factor is invalid                | Contact the Gilson Customer Service Department.                                                                                       |
| 18    | Z scale factor is invalid                | Contact the Gilson Customer Service Department.                                                                                       |</p>
<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>X motor position error</td>
<td>Turn power on/off to the liquid handler.</td>
</tr>
<tr>
<td>21</td>
<td>Y motor position error</td>
<td>Turn power on/off to the liquid handler.</td>
</tr>
<tr>
<td>22</td>
<td>Z motor position error</td>
<td>Turn power on/off to the liquid handler.</td>
</tr>
<tr>
<td>24</td>
<td>X target less than minimum X</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>25</td>
<td>X target more than maximum X</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>26</td>
<td>Y target less than minimum Y</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>27</td>
<td>Y target more than maximum Y</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>28</td>
<td>Z target less than minimum Z</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>29</td>
<td>Z target more than maximum Z</td>
<td>Send the immediate Q command using the GSIOC Utility Program to read the travel range. Correct the error in the program controlling the liquid handler.</td>
</tr>
<tr>
<td>30</td>
<td>X encoder inactive</td>
<td>Contact the Gilson Customer Service Department</td>
</tr>
<tr>
<td>31</td>
<td>Y encoder inactive</td>
<td>Contact the Gilson Customer Service Department</td>
</tr>
<tr>
<td>32</td>
<td>Z position sensor inactive</td>
<td>Contact the Gilson Customer Service Department</td>
</tr>
<tr>
<td>33</td>
<td>Safety contact activated</td>
<td>Release contact; restart.</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
<td>Solution</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>34</td>
<td>X home phase is invalid</td>
<td>Run SET_215.EXE or the 215 Setup Utility program to correct the problem.</td>
</tr>
<tr>
<td>35</td>
<td>Y home phase is invalid</td>
<td>Run SET_215.EXE or the 215 Setup Utility program to correct the problem.</td>
</tr>
<tr>
<td>36</td>
<td>X and Y home phases are invalid</td>
<td>Run SET_215.EXE or the 215 Setup Utility program to correct the problem.</td>
</tr>
<tr>
<td>40</td>
<td>Gilson m402 invalid valve position</td>
<td>This is caused by the valve stem not turning properly or the encoder not registering properly. Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>41</td>
<td>Gilson m402 valve missing</td>
<td>Contact the Gilson Customer Service Department.</td>
</tr>
<tr>
<td>42</td>
<td>Gilson m402 undefined valve command</td>
<td>Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>43</td>
<td>Gilson m402 valve communication error</td>
<td>Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>44</td>
<td>Gilson m402 valve unit busy</td>
<td>Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>45</td>
<td>Gilson m402 syringe overload</td>
<td>- Slow down flow rate indicated for aspirate and dispense commands in the program controlling the autoinjector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Use less viscous liquid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Use larger ID transfer tubing</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
<td>Solution</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>46</td>
<td>Gilson m402 syringe missing</td>
<td>Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>47</td>
<td>Gilson m402 undefined syringe command</td>
<td>Try operating without a valve. If that fails, you will probably need a new module. If that works check the valve assembly for smooth operation. If necessary, replace valve.</td>
</tr>
<tr>
<td>48</td>
<td>Gilson m402 syringe communication error</td>
<td>Replace the syringe pump.</td>
</tr>
<tr>
<td>49</td>
<td>Gilson m402 syringe unit busy</td>
<td>Replace the syringe pump.</td>
</tr>
</tbody>
</table>
Mechanical

Probe no longer finding tube center

• Probe may be bent. Straighten or replace the probe.

• Incorrect tray file defined. Review and if necessary change the tray file using the Tray Editor. Refer to the tray editor section in your Gilson control software user’s guide.

• Liquid handler may be misaligned. Perform the position alignment procedures, described on page 4-27.
## Electrical

### Input functions not operating

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

### Output functions not operating

- Make sure connections into terminal block connector are secure.
- Make sure terminal block connector is secure in the input/output port.
- Check connections for proper pin assignments.
- Output from liquid handler should be compatible with device to which it is interfaced. Outputs are contact closures.
Unit not operational

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

Unit blows fuses

- Contact Gilson Customer Service Department.
Troubleshooting

Tubing and Syringe Pump

Instrument will not draw in reagent
• Make certain all fittings are tight.
• Check valve fitting threads on the syringe pump. Replace if damaged.

No fluid being dispensed
• Make sure the syringe is tight within the valve fitting.
• If tubing is kinked or blocked, replace defective tubing.
• Replace the syringe pump valve if damaged. Turn the power to the liquid handler off and then on to re-initialize.

Reagent being pulled back into reservoir
• Replace the syringe pump valve if damaged. Turn the power to the liquid handler off and then on to re-initialize.

Air gap breaks up
• When aspirating a liquid, if the air gap breaks up, check to see if the tubing is the correct size.
• Reduce speed of aspiration.
• Increase size of air gap.
• Clean or replace any dirty tubing.
Syringe bubbles

- Make sure that all tube fittings are tight and air-free.
- Make sure the syringe pump syringe is tightened onto the valve.
- Clean the syringe if dirty. Refer to page 4-3.
- If any of the syringe pump valve fittings are damaged, replace the valve.

Fluid leak

- Replace any worn piston seals on the syringe piston. Instructions are supplied with replacement seals.
- Clean syringe pump valve. Refer to page 4-11.
- Allow reagents to warm to room temperature before using.

Incorrect aspirating and dispensing

- Check for leaks on all fittings and tubes leading to the probe.
- Tighten or replace fittings on inlet and transfer tubing as needed.
- Replace the syringe pump valve if damaged. Turn the power to the liquid handler off and then on to re-initialize.
Troubleshooting

Syringe stalls

• If the syringe on the syringe pump stalls, there may be a blockage in the tubing or valve. Inspect all tubing and the valve.

• If the syringe stalls due to an accelerated aspirate or dispense rate, reduce the rate in the program being run by the liquid handler.

Poor accuracy

• Worn piston seals and tubing can cause the liquid handler to perform with poor volumetric accuracy and precision. If the aspirate and dispense speeds are too fast, slow down the speeds to adapt to the tubing and probe type.
Liquid Level Detector

Liquid level detector not detecting liquid level

- Ensure that the level sensing cable is plugged in.
- Check sensitivity setting in SET_215.EXE or the 215 Setup Utility.
- Check if liquid is detectable. Liquid level detection works only if there is electrical conductivity in your liquid. Liquid level detecting will not work with most non-polar liquids. For intermediate polarity liquids and polar liquids, check the sensitivity setting in SET_215.EXE or the 215 Setup Utility.
- Check the Move Probe command in the Gilson 709 Sampler Manager Software. The height statement may be overriding liquid level detecting. See software User’s Guide.
- Call Gilson if this is caused by faulty circuitry.
Repair and Return Policies

Before calling us

Gilson Customer Service personnel will be able to serve you more efficiently if you have the following information:

- the serial number and model number of the equipment involved. The serial number is visible on the back of the control panel of the liquid handler.
- the installation procedure you used
- list of concise symptoms
- list of operating procedures and conditions you were using when the problem arose
- list of other devices connected to the liquid handler and a description of those connections
- list of other electrical connections in the room

Warranty repair

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

Non-warranty repair

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

For some units, rebuilt exchange components are available. Contact Gilson for details.

**Return procedure**

In the United States, contact the Gilson Customer Service Department to obtain authorization before returning any Gilson equipment. To return a piece of equipment:

- Carefully pack the unit to prevent damage in transit. Check with Gilson regarding proper method of shipment. No responsibility is assumed by Gilson 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. Ship to:

  Gilson, Inc.
  Attention: Customer Service
  (indicate the authorization here)
  3000 W. Beltline Highway
  Middleton, WI 53562

Outside the United States, contact your Gilson representative for return procedures.
For part numbers for syringe piston seals, contact the Gilson Customer Service Department at 800-445-7661 or 836-1551. Outside the United States, contact your local Gilson representative.

### Control Software

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2106773531</td>
<td>735 Sampler Software running directly from PC; requires PC with Microsoft Windows NT and serial cable.</td>
</tr>
<tr>
<td>210646</td>
<td>UniPoint System Software. Multiple HPLC system control with data analysis for PC-based systems (IBM or compatible). Requires Microsoft Windows NT® and 506C Interface Module (362831)</td>
</tr>
<tr>
<td>21064621</td>
<td>UniPoint System Software. Multiple HPLC system control with data analysis for PC-based systems (IBM or compatible). Requires Microsoft Windows® 98 and 506C Interface Module (362831)</td>
</tr>
</tbody>
</table>
## Appendix A

### Replacement Parts and Accessories

#### Probes for 125 mm Z-Arm

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2507234</td>
<td>Septum-piercing probe; side-entry, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, entry hole center is 3.5 mm from tip). Compatible with 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253640).</td>
</tr>
<tr>
<td>2507235</td>
<td>Septum-piercing probe; side-entry, vented, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, entry hole center is 3.5 mm from tip). Compatible with the 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253640).</td>
</tr>
<tr>
<td>2507236</td>
<td>Septum-piercing, short pencil-point probe; vented at 14 mm, side-entry, vented at 72 mm, capacitive level sensing, stainless steel. Dimensions: 272 x 1.8 x 0.8 mm ID. Compatible with the 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253640).</td>
</tr>
<tr>
<td>2507237</td>
<td>Septum-piercing, pencil-point probe; vented at 72 mm, side-entry, capacitive level sensing, stainless steel. Dimensions: 273 x 1.8 x 0.8 mm ID. Compatible with 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253640).</td>
</tr>
<tr>
<td>2507244</td>
<td>Septum-piercing probe; deflected tip, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole). Requires probe holder/guide kit (part number 253640).</td>
</tr>
<tr>
<td>2507245</td>
<td>Septum-piercing probe; deflected tip, vented, capacitive level-sensing, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole). Requires probe holder/guide kit (part number 253640).</td>
</tr>
</tbody>
</table>
Appendix A

Replacement Parts and Accessories

2507242 Septum-piercing probe; deflected tip, capacitive level-sensing, stainless steel with Teflon-coated liquid path, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions: 12 x 1.3 mm OD, bevel cut entry hole). Requires probe holder/guide kit (part number 253640).

2507243 Septum-piercing probe; deflected tip, vented, capacitive level-sensing, stainless steel with Teflon-coated liquid path, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID (tip dimensions 12 x 1.3 mm OD, bevel cut entry hole). Requires probe holder/guide kit (part number 253640).

27067361 Non septum-piercing probe; bevel tip, capacitive level-sensing, stainless steel. Dimensions: 220.5 x 1.5 x 1.1 mm ID. Requires probe holder/guide kit (part number 253641).

2507414 Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 220 x 1.3 x 0.8 mm ID (tip dimensions: 1.5 x 0.9 x 0.45 mm ID). Compatible with 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253642).

27067373 Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID (tip dimensions: 2 x 1.1 x 0.4 mm ID). Compatible with 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253641).

27067374 Non septum-piercing probe; constricted bevel tip, capacitive level-sensing, stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID (tip dimensions: 2 x 1.1 x 0.4 mm ID). Compatible with 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253641).
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2507252</td>
<td>Micro septum-piercing probe; constricted 45° bevel tip, capacitive level-sensing, stainless steel. Dimensions: 220 x 1.5 x 1.1 mm ID (tip dimensions: 10 x 0.7 x 0.4 mm ID). Compatible with 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253641).</td>
<td></td>
</tr>
<tr>
<td>2507256</td>
<td>Beveled-tip probe, stainless steel, grooved septum-piercing; 221 x 1.5 x 0.4 mm ID. Compatible with 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253641).</td>
<td></td>
</tr>
<tr>
<td>27067377</td>
<td>Grooved septum-piercing probe; beveled-tip, stainless steel. Dimensions: 221 x 1.5 x 0.4 mm ID. Compatible with 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253641).</td>
<td></td>
</tr>
<tr>
<td>27067375</td>
<td>Non-septum-piercing probe: beveled-tip, Teflon-coated stainless steel. Dimensions: 221 x 1.5 x 1.1 mm ID. Requires probe holder/guide kit (part number 253641).</td>
<td></td>
</tr>
<tr>
<td>27067376</td>
<td>Beveled-tip probe, stainless steel, grooved septum-piercing. Dimensions: 221 x 2.0 x 0.8 mm ID. Compatible with the 819 Injection Module; requires injection port (part number 2954640). Requires probe holder/guide kit (part number 253643).</td>
<td></td>
</tr>
<tr>
<td>251646</td>
<td>Inert gas probe assembly (for maintaining an inert atmosphere inside sealed vessel), beveled tip, stainless steel, strain-relief design. Dimensions: 274 x 1.8 x 0.8 mm ID. Includes probe holder/guide kit.</td>
<td></td>
</tr>
</tbody>
</table>
## Probes for 175 mm Z-Arm

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Dimensions</th>
<th>Compatibility</th>
<th>Required Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>2507214</td>
<td>Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel</td>
<td>269 x 1.8 x 1.4 mm ID (tip dimensions: 1.5 x 1.2 x 0.8 mm ID)</td>
<td>Requires injection port (part number 25051015)</td>
<td>Requires probe holder/ guide kit (part number 253640)</td>
</tr>
<tr>
<td>2507215</td>
<td>Non septum-piercing probe; constricted tip, capacitive level-sensing, stainless steel</td>
<td>269 x 1.3 x 0.8 mm ID (tip dimensions: 1.5 x 0.9 x 0.45 mm ID)</td>
<td>Requires injection port (part number 25051015)</td>
<td>Requires probe holder/ guide kit (part number 253642)</td>
</tr>
<tr>
<td>2507216</td>
<td>Non septum-piercing probe, bevel tip, capacitive level sensing, stainless steel</td>
<td>269 x 1.5 x 0.8 mm ID (tip dimensions: 1.5 x 0.9 x 0.45)</td>
<td>Requires injection port (part number 2954674)</td>
<td>Requires probe holder/ guide kit (part number 253641)</td>
</tr>
<tr>
<td>2507253</td>
<td>Micro septum-piercing probe; constricted 45° bevel tip, capacitive level sensing, stainless steel</td>
<td>269 x 1.5 x 1.1 mm ID (tip dimensions: 10 x 0.7 x 0.4 mm ID)</td>
<td>Requires injection port (part number 270728)</td>
<td>Requires probe holder/ guide kit (part number 253641)</td>
</tr>
<tr>
<td>2507254</td>
<td>Non septum-piercing probe; flat tip, capacitive level-sensing, stainless steel</td>
<td>269 x 1.8 x 1.4 mm ID</td>
<td>Requires injection port (part number 2954640)</td>
<td>Requires probe holder/ guide kit (part number 253640)</td>
</tr>
<tr>
<td>2507255</td>
<td>Non septum-piercing probe, bevel tip, capacitive level sensing, stainless steel</td>
<td>269 x 1.5 x 0.4 mm ID</td>
<td>Requires injection port (part number 2954640)</td>
<td>Requires probe holder/ guide kit (part number 253641)</td>
</tr>
<tr>
<td>2507555</td>
<td>Inert non septum-piercing probe; Teflon-covered stainless steel</td>
<td>269 x 2.7 x 0.8 mm ID (tip dimensions: 5 x 1.5 mm OD)</td>
<td>Requires injection port (part number 253645)</td>
<td>Requires probe holder/ guide kit (part number 253645)</td>
</tr>
</tbody>
</table>
Appendix A

Replacement Parts and Accessories

25075551  Non septum-piercing probe; straight tip. Dimensions: 256.6 x 2.7 x 0.8 mm ID. Requires probe holder/guide kit (part number 253645).

25073645  Non septum-piercing probe; beveled tip, capacitive level-sensing, stainless steel. Dimensions: 269 x 1.3 x 0.8 mm ID. Compatible with 819 Injection Module; requires injection port (part number 25051015). Requires probe holder/guide kit (part number 253642).

Probe Holder/Guide Kits

253640  Probe holder/guide kit; includes probe holder and guide for 1.8 mm outer diameter probes.

253641  Probe holder/guide kit; includes probe holder and guide for 1.5 mm outer diameter probes.

253642  Probe holder/guide kit; includes probe holder and guide for 1.3 mm outer diameter probes.

253643  Probe holder/guide kit; includes probe holder and guide for 2.0 mm outer diameter probes.

253645  Probe holder/guide kit; includes probe holder and guide for 2.7 mm outer diameter probes.
## Syringes, Transfer Tubing, and Waste Bottle

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25025341</td>
<td>100 µl syringe</td>
</tr>
<tr>
<td>25025342</td>
<td>250 µl syringe</td>
</tr>
<tr>
<td>25025347</td>
<td>500 µl syringe</td>
</tr>
<tr>
<td>25025343</td>
<td>1 ml syringe</td>
</tr>
<tr>
<td>25025344</td>
<td>5 ml syringe</td>
</tr>
<tr>
<td>25025345</td>
<td>10 ml syringe</td>
</tr>
<tr>
<td>25025346</td>
<td>25 ml syringe</td>
</tr>
<tr>
<td>499421202</td>
<td>1.5 ml FEP tubing; 0.8 mm ID x 10 feet</td>
</tr>
<tr>
<td>499474102</td>
<td>10.5 ml coiled FEP tubing; 1.5 mm ID x 24 feet</td>
</tr>
<tr>
<td>499474252</td>
<td>25.5 ml coiled FEP tubing; 1.5 mm ID x 50 feet</td>
</tr>
<tr>
<td>2954583</td>
<td>1.1 ml coiled FEP tubing; 2200 x 1.6 x 0.8 mm ID. Requires 2800 µl transfer tubing (part number 49948392) and coupling (part number F1410153).</td>
</tr>
<tr>
<td>2954671</td>
<td>3 ml coiled FEP tubing; 1.5 mm ID. Requires 2800 µl transfer tubing (part number 49948392) and coupling (part number F1410153).</td>
</tr>
<tr>
<td>29425066</td>
<td>5 ml coiled FEP Tubing; 1.5 mm ID. Requires 2800 µl transfer tubing (part number 49948392) and coupling (part number F1410153).</td>
</tr>
<tr>
<td>49948392</td>
<td>2800 µl FEP transfer tubing, 1000 x 3 x 2 mm</td>
</tr>
<tr>
<td>F1410153</td>
<td>PVDF coupling for 1/4&quot;-28 fitting</td>
</tr>
<tr>
<td>F1410050</td>
<td>PVDF couplings for 1/4&quot;-28 fitting, package of 5</td>
</tr>
<tr>
<td>23077310</td>
<td>Waste bottle (2 liter) with lid and quick-connect fitting</td>
</tr>
<tr>
<td>470343706</td>
<td>Tygon tubing (5/16&quot; ID x 7/16&quot; OD) for connection between rinse station and waste bottle; per foot</td>
</tr>
<tr>
<td>23077332</td>
<td>Quick-connect fitting to connect Tygon tubing to waste bottle</td>
</tr>
</tbody>
</table>
## Rinse Station

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>250782</td>
<td>Complete rinse station; includes rinse station base and body, Tygon tubing, and waste bottle with lid and quick-connect fitting. Order rinse station insert separately.</td>
</tr>
<tr>
<td>25045520</td>
<td>Rinse station body; connects to rinse station base and accepts one rinse station insert.</td>
</tr>
<tr>
<td>25245512</td>
<td>Rinse station base; attaches directly to 215 locator plate</td>
</tr>
<tr>
<td>25245532</td>
<td>Shallow-pocket rinse station insert, closed-bottom, for applications where the probe is only immersed in a few millimeters of the sample; for use with 125 mm Z-arm.</td>
</tr>
<tr>
<td>25245533</td>
<td>Deep-pocket rinse station insert, closed-bottom, allows for deeper insertion of the probe into the rinse well, resulting in a greater area of the outside of the probe to be rinsed; for use with 125 mm Z-arm.</td>
</tr>
<tr>
<td>25245531</td>
<td>Flow-through rinse station insert, open-bottom, for flowing rinse applications; for use with 125 mm Z-arm.</td>
</tr>
<tr>
<td>25245542</td>
<td>Shallow-pocket rinse station insert, closed-bottom, for applications where the probe is only immersed in a few millimeters of the sample; for use with 175 mm Z-arm.</td>
</tr>
<tr>
<td>25245543</td>
<td>Deep-pocket rinse station insert, closed-bottom, allows for deeper insertion of the probe into the rinse well, resulting in a greater area of the outside of the probe to be rinsed; for use with 175 mm Z-arm.</td>
</tr>
<tr>
<td>25245541</td>
<td>Flow-through rinse station insert, open-bottom, for flowing rinse applications; for use with 175 mm Z-arm.</td>
</tr>
<tr>
<td>23077333</td>
<td>Y-connector to connect two rinse stations to one waste bottle</td>
</tr>
</tbody>
</table>
Rack Accessories

For part numbers for available racks, refer to Appendix B. To create your own code 200-style rack, order the blank rack kit (part number 254461) and rivet gun (part number 4391002).

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2504621</td>
<td>Adapter plate for installing Code 20- or 30-series rack on locator plate</td>
</tr>
<tr>
<td>2504632</td>
<td>Adapter rack for Code 0, 8, or 9 rack</td>
</tr>
<tr>
<td>2504627</td>
<td>Locator tray for installing up to seven Code 20- or 30-series racks on the locator plate.</td>
</tr>
<tr>
<td>2704429</td>
<td>Thermostating cuvette. Holds one Code 30, 31, 32, 33, or 34 rack. Requires circulating water bath for temperature control.</td>
</tr>
<tr>
<td>2759502</td>
<td>832 Temperature Regulator for electrically controlled sample heating or cooling; 100/120V, 50/60 Hz. Controls up to two 832 Thermostating Cuvettes. Order 832 Thermostating Cuvettes and thermostated racks separately.</td>
</tr>
<tr>
<td>2759550</td>
<td>832 Thermostating Cuvette. Holds one Code 30, 31, 32, 33, or 34 rack. Requires 832 Temperature Regulator.</td>
</tr>
<tr>
<td>27044307</td>
<td>Rack cover for Code 30 rack; stainless steel. Holds vial in rack wells when cooling samples.</td>
</tr>
<tr>
<td>27044317</td>
<td>Rack cover for Code 31 rack; stainless steel. Holds vials in rack wells when cooling samples.</td>
</tr>
<tr>
<td>27044337</td>
<td>Rack cover for Code 33 rack; stainless steel. Holds vials in rack wells when cooling samples.</td>
</tr>
<tr>
<td>27044347</td>
<td>Rack cover for Code 34 rack; stainless steel. Holds vials in rack wells when cooling samples.</td>
</tr>
</tbody>
</table>
## Cables and I/O Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25064040</td>
<td>Level-sensing cable</td>
</tr>
<tr>
<td>36083121</td>
<td>Serial cable, IBM PS/ 2-type, 25 to 25 pin</td>
</tr>
<tr>
<td>36083122</td>
<td>Serial cable, IBM AT-type, 9-pin female to 25-pin male</td>
</tr>
<tr>
<td>36083123</td>
<td>Serial cable adapter, 9-pin female to 25-pin male</td>
</tr>
<tr>
<td>638308512</td>
<td>Terminal block connector, 8-pin</td>
</tr>
<tr>
<td>638310512</td>
<td>Terminal block connector, 10-pin</td>
</tr>
<tr>
<td>709910206</td>
<td>2-conductor interconnect wire, 6’, for making contact connections</td>
</tr>
<tr>
<td>36078143</td>
<td>Shielded GSIOC cable, 30”</td>
</tr>
<tr>
<td>6730254007</td>
<td>2.5A, T-2.5 Slo-Blo fuse</td>
</tr>
</tbody>
</table>

## Miscellaneous

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2509211</td>
<td>Armlock with hex screw</td>
</tr>
<tr>
<td>4311403</td>
<td>9/ 64” ball driver (hex wrench for armlock)</td>
</tr>
</tbody>
</table>
The 215 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 liquid handler. Refer to Section 2 for rack installation procedures.
Appendix B

Racks

**Code 0 rack**

For 80 vessels  
Material: polypropylene  
Vessels and maximum capacity: 12 x 32 mm tubes (2 ml)  
Part number: 270430  
Required accessories: adapter plate (part number 2504621) and adapter rack (part number 2504632)

**Code 8 rack**

For 120 vessels  
Material: polypropylene  
Vessels and maximum capacity: 6 x 32 mm tubes (0.3 ml)  
Part number: 270438  
Required accessories: adapter plate (part number 2504621) and adapter rack (part number 2504632)

**Code 9 rack**

For 120 vessels  
Material: polypropylene  
Vessels and maximum capacity: 7 x 40 mm tubes (0.7 ml)  
Part number: 270439  
Required accessories: adapter plate (part number 2504621) and adapter rack (part number 2504632)

**Code 20 rack**

For 108 vessels  
Material: polypropylene  
Vessels and maximum capacity: 10 x 100 mm tubes (4.5 ml)  
Part number: 150425  
Required accessories: adapter plate (part number 2504621)
Appendix B

Code 21 rack

For 60 vessels
Material: polypropylene
Vessels and maximum capacity: 13 x 100 mm tubes (9 ml)
Part number: 150422
Required accessories: adapter plate (part number 2504621)

Code 22U rack

For 44 vessels
Material: polypropylene
Vessels and maximum capacity: from 10 x 75 mm tubes (3.5 ml) to 18 x 180 mm tubes (32 ml)
Part number: 150498
Required accessories: adapter plate (part number 2504621)
Note: Each of the reception cavities contains four positioning and retaining clips.

Code 23 rack

For 44 vessels
Material: polypropylene
Vessels and maximum capacity: 17 x 55 mm vials (6.8 ml)
17 x 65 mm vials (8 ml)
Part number: 150426
Required accessories: adapter plate (part number 2504621)

Code 23W rack

For 44 Waters WISP vials
Material: polypropylene and stainless steel
Vessels and maximum capacity: 15 x 45 mm (4 ml)
Part number: 270433
Required accessories: adapter plate (part number 2504621)
Appendix B

Racks

**Code 24 rack**

For 14 scintillation vials  
Material: polypropylene  
Vessels and maximum capacity: 28 x 60 mm (20 ml)  
Part number: 150427  
Required accessories: adapter plate (part number 2504621)

**Code 28 rack**

For 108 vessels  
Material: polypropylene  
Vessels and maximum capacity: 10 x 65 mm tubes (3 ml)  
10 x 75 mm tubes (3.5 ml)  
Part number: 150420  
Required accessories: adapter plate (part number 2504621)

**Code 29 rack**

For 60 vessels  
Material: polypropylene  
Vessels and maximum capacity: 12 x 75 mm tubes (5 ml)  
13 x 75 mm tubes (6 ml)  
Part number: 150429  
Required accessories: adapter plate (part number 2504621)

**Code 30 rack**

For 60 vessels  
Material: aluminum  
Vessels and maximum capacity: 12 x 32 mm vials (2 ml)  
Part number: 2704430  
Required accessories: adapter plate (part number 2504621) and thermostating cuvette (part number 2704429) or thermostating cuvette (part number 2759550) and 832 Temperature Regulator (part number 2759502)
Appendix

Code 31 rack

Thermostated rack for 108 vessels
Material: aluminum
Vessels and maximum capacity: 7 x 40 mm vials (0.7 ml)
Part number: 2704431
Required accessories: adapter plate (part number 2504621) and thermostating cuvette (part number 2704429) or thermostating cuvette (part number 2759550) and 832 Temperature Regulator (part number 2759502)

Code 32 rack

Thermostated rack for 60 vessels
Material: aluminum
Vessels and maximum capacity: 13 x 65 mm tubes (6 ml) 13 x 100 mm tubes (9 ml)
Part number: 2704432
Required accessories: adapter plate (part number 2504621) and thermostating cuvette (part number 2704429) or thermostating cuvette (part number 2759550) and 832 Temperature Regulator (part number 2759502)

Code 33 rack

Thermostated rack for 14 scintillation vials
Material: aluminum
Vessels and maximum capacity: 28 x 60 mm (20 ml)
Part number: 2704433
Required accessories: adapter plate (part number 2504621) and thermostating cuvette (part number 2704429) or thermostating cuvette (part number 2759550) and 832 Temperature Regulator (part number 2759502)
Appendix

Racks

**Code 200 rack**
For 96 VacuTainer tubes  
Material: aluminum  
Vessels and maximum capacity: 13 x 100 mm (9 ml)  
Part number: 2504600

**Code 201 rack**
For two microplates, two Eppendorf vials, and two 13 x 100 mm tubes  
Material: aluminum  
Vessels and maximum capacity: 96 well microplates  
Eppendorf vials (1.5 ml)  
13 x 100 mm tubes (9 ml)  
Part number: 2504601

**Code 201H rack**
For two microplates with hold-down covers  
Material: aluminum  
Vessels and maximum capacity: 96-well microplates  
Part number: 2504601H

**Code 202 rack**
For 96 VacuTainer tubes  
Material: aluminum  
Vessels and maximum capacity: 10.25 x 47 mm (2.5 ml)  
Part number: 2504602
Appendix B

Code 203 rack
For 96 VacuTainer tubes
Material: aluminum
Vessels and maximum capacity: 10.25 x 64 mm (4 ml)
Part number: 2504603

Code 204 rack
For 27 scintillation tubes
Material: aluminum
Vessels and maximum capacity: 28 x 57 mm (20 ml)
Part number: 2504604

Code 204F rack
Rack with funnel drain assembly
For 24 scintillation tubes
Material: aluminum
Vessels and maximum capacity: 28 x 57 mm (20 ml)
Part number: 2504604F
Requires 215 Prep FC Valve, Low Mount (part number 251774) and UniPoint v 3.2 and higher

Code 205 rack
For two deep well microplates, two Eppendorf vials, and two 13 x 100 mm tubes
Material: aluminum
Vessels and maximum capacity: 96 deep well microplates
Eppendorf vials (1.5 ml)
13 x 100 mm tubes (9 ml)
Part number: 2504605
Appendix B

Racks

**Code 205H rack**
For two deep-well microplates with hold-down covers  
Material: aluminum  
Vessels and maximum capacity: 96 deep-well microplates  
Part number: 2504605H

**Code 206 rack**
For 96 VacuTainer tubes  
Material: aluminum  
Vessels and maximum capacity: 13 x 75 mm (7 ml)  
Part number: 2504606

**Code 207 rack**
For 75 VacuTainer tubes  
Material: aluminum  
Vessels and maximum capacity: 16 x 100 mm (12 ml)  
Part number: 2504607

**Code 208 rack**
For 70 vessels  
Material: aluminum  
Vessels and maximum capacity: 18 x 150 mm (25 ml)  
Part number: 2504608
Appendix B

**Racks**

**Code 209 rack**
For 96 vessels  
Material: aluminum  
Vessels and maximum capacity: 12 x 32 mm  
Part number: 2504609

**Code 210 rack**
For 75 Vacutainer tubes  
Material: aluminum  
Vessels and maximum capacity: 16 x 75 mm (25 ml)  
Part number: 2504610

**Code 211 rack**
For 9 Boston round screw-cap bottles  
Material: aluminum  
Vessels and maximum capacity: 48 x 113 mm (125 ml)  
Part number: 2504611

**Code 211F rack**
Rack with funnel drain assembly  
For 8 Boston round screw-cap bottles  
Material: aluminum  
Vessels and maximum capacity: 48 x 113 mm (125 ml)  
Part number: 2504611F  
Requires 215 Prep FC Valve, Low Mount (part number 251774) and UniPoint v 3.2 and higher
**Code 211H rack**
For 9 Boston round screw-cap bottles with hold-down cover
Material: aluminum
Vessels and maximum capacity: 48 x 113 mm (125 ml)
Part number: 2504611H

**Code 212 rack**
For 96 VacuTainer tubes
Material: aluminum
Vessels and maximum capacity: 48 13 x 100 mm (9 ml)
   48 13 x 75 mm (7 ml)
Part number: 2504612
*Note:* Place the shorter tubes into the notched tube locations.

**Code 213 rack**
For 74 VacuTainer tubes
Material: aluminum
Vessels and maximum capacity: 37 16 x 100 mm (32 ml)
   37 16 x 75 mm (25 ml)
Part number: 2504613
*Note:* Place the shorter tubes into the notched tube locations.

**Code 214 rack**
For 96 VacuTainer tubes
Material: aluminum
Vessels and maximum capacity: 48 10.25 x 47 mm (2.5 ml)
   48 10.25 x 64 mm (44 ml)
Part number: 2504614
*Note:* Place the shorter tubes into the notched tube locations.
Appendix

Code 216 rack

For 60 Waters WISP vials
Material: aluminum
Vessels and maximum capacity: 15 x 45 mm (4 ml)
Part number: 2504616

Code 220 rack

For 70 vials
Material: aluminum
Vessels and maximum capacity: 17 x 62 mm
Part number: 2504620

Code 222 rack

For 27 conical bottom tubes
Material: aluminum
Vessels and maximum capacity: 27 (50 ml)
Part number: 2504622

Code 222F rack

Rack with funnel drain assembly
For 24 conical bottom tubes
Material: aluminum
Vessels and maximum capacity: 24 (50 ml)
Part number: 2504622F
Requires 215 Prep FC Valve, Low Mount (part number 251774) and UniPoint v 3.2 and higher
Appendix B

Racks

**Code 223 rack**
- For 96 tubes with screw caps
- Material: aluminum
- Vessels and maximum capacity: 16 x 100 mm
- Part number: 2504623

**Code 224 rack**
- For 192 vials
- Material: aluminum
- Vessels and maximum capacity: 8.5 x 41 mm
- Part number: 2504624

**Code 225 rack**
- For 30 vials
- Material: aluminum
- Vessels and maximum capacity: 25 x 150 mm
- Part number: 2504625

**Code 226 rack**
- For 96 Waters WISP vials
- Material: aluminum
- Vessels and maximum capacity: 15 x 45 mm (4 ml)
- Part number: 2504626
Appendix

Code 228 rack

For four reagent bottles
Material: aluminum
Vessels and maximum capacity: 4 (500 or 700 ml)
Part number: 2504628

Code 505 rack

For 10 standard or deep-well microplates
Material: aluminum
Part number: 2504651

Code 505H rack

For 10 standard or deep-well microplates with hold-down covers
Material: aluminum
Part number: 2504651H

Code 517 rack

For 17 microplates with hold-down cover
Material: aluminum
Part number: 2504653
Peltier Racks

**Code 242 Peltier rack**

For 2 shallow, flat-bottom, 96-well microplates  
Material: aluminum  
Part number: 25146331  
**Note**: Order Peltier Controller (part number 2515331) and junction box (part number 2505332) separately.

**Code 542 Peltier rack**

For 10 shallow, flat-bottom, 96-well microplates  
Material: aluminum  
Part number: 25146331  
**Note**: Order Peltier Controller (part number 2515331) separately.
**Appendix B**

**Code 852 Peltier rack**

For two Becton Dickinson Falcon 96-well, shallow-well assay plates. U-bottom style
Material: aluminum
Part number: 2514852
**Note:** Order Programmable Peltier Controller (part number 2515850) separately.

**Code 853 Peltier rack**

For 96 12x32 mm 2 ml, flat-bottom vials
Material: aluminum
Part number: 2514853
**Note:** Order Programmable Peltier Controller (part number 2515850) separately.

**Code 854 Peltier rack**

For two Ritter or Beckman 96-well, deep-well microplates
Material: aluminum
Part number: 2514854
**Note:** Order Programmable Peltier Controller (part number 2515850) separately.
This appendix contains information on the methods used to obtain the volumetric precision and accuracy specifications on page 1-9.
Volumetric Precision and Accuracy Methods

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

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

Details of each of the methods used follows.
50 µl: Open to Open Tube

**Probe:** Capacitive septum piercing probe  
**Transfer tubing:** 10 ft. 0.031 in. tubing with omni-fit  
**Sample:** degassed tap water  
**Type of transfer:** bottle to open tube  
**Tube size:** 13 mm x 100 mm  
**Amount initially in source:** 0 µl  
**Amount initially in target:** 1500 µl  
**Syringe size:** 500 µl  
**Pump aspirate speed:** 2 ml/ min  
**Pump dispense speed:** 10 ml/ min  
**Prime speed:** 20 ml/ min  
**Number of tubes:** 21  
**Aspirate height:** 0 mm  
**Dispense height:** 15 mm + follow  
**Air gap:** 15 µl  
**Sample volume delivered:** 50 µl  
**Rinse volume:** 500 µl  
**Actual tube ID:** 10.6 mm  
**Sensitivity setting:** 6% of initial reading  
**Total transfer time:** 3.32 min per 21 tube

**Additional notes**

A tube with 1000 µl degassed water was weighed before and after a test run to monitor evaporation. It was weighed using a Sartorius AC 210P four-place balance (#20201203).

Delivery was 10% of syringe size.

First tube out of each group of 21 was used as a visual monitor or reference only. It was used to confirm the system was working properly. The next 20 tubes were used for data collection.
50 µl: Closed to Open Tube

**Probe:** Capacitive septum piercing probe  
**Transfer tubing:** 10 ft. 0.031 in. with omni-fit  
**Sample:** degassed tap water  
**Type of transfer:** closed tube to open tube  
**Tube size:** 13 mm x 100 mm  
**Amount in source tube:** 4000 µl  
**Amount in target tube:** 1000 µl  
**Syringe size:** 500 µl  
**Pump aspirate speed:** 2 ml/ min  
**Pump dispense speed:** 10 ml/ min  
**Prime speed:** 20 ml/ min  
**Number of tubes:** 21  
**Aspirate height:** 15 mm + follow  
**Dispense height:** 15 mm + follow  
**Air gap:** 15 µl  
**Sample volume delivered:** 50 µl  
**Rinse volume:** 500 µl  
**Actual tube ID:** 10.6 mm  
**Sensitivity setting:** 6% of initial reading  
**Total transfer time:** 10.11 min per 21 tubes

**Additional notes**

A tube with 1000 µl degassed water was weighed before and after a test run to monitor evaporation. It was weighed using a Sartorius AC 210P four-place balance (#20201203).

Delivery was 10% of syringe size.

First tube out of each group of 21 was used as a visual monitor or reference only. It was used to confirm the system was working properly. The next 20 tubes were used for data collection.
500 µl: Open to Open Tube

**Probe:** Capacitive septum piercing probe  
**Transfer tubing:** 10 ft. 0.031 in. tubing with omni-fit  
**Sample:** degassed tap water  
**Type of transfer:** bottle to open tube  
**Tube size:** 13 mm x 100 mm  
**Amount initially in source:** 500 µl  
**Amount initially in target:** 0 µl  
**Syringe size:** 500 µl  
**Pump aspirate speed:** 2 ml/min  
**Pump dispense speed:** 10 ml/min  
**Prime speed:** 20 ml/min  
**Number of tubes:** 21  
**Aspirate height:** 0 mm  
**Dispense height:** 15 mm + follow  
**Air gap:** 15 µl  
**Sample volume delivered:** 500 µl  
**Rinse volume:** 500 µl  
**Actual tube ID:** 10.6 mm  
**Sensitivity setting:** 6% of initial reading  
**Total transfer time:** 9.12 min per 21 tubes

**Additional notes**

Sample was dispensed into empty tubes. Therefore, no evaporation factor tube was used because empty tubes were targeted.

100% of syringe size was delivered.

Sartorius A.C 210P four-place balance (#20201203) was used to determine delivery and removal gravimetrically.

First tube out of each group of 21 was used as a visual monitor or reference only. It was used to confirm the system was working properly. The next 20 tubes were used for data collection.
500 µl: Closed to Open Tube

Probe: Capacitive septum piercing probe  
Transfer tubing: 10 ft. 0.031 in. tubing with omni-fit  
Sample: degassed tap water  
Type of transfer: closed tube to open tube  
Tube size: 13 mm x 100 mm  
Amount initially in source: 5000 µl  
Amount initially in target: 0 µl  
Syringe size: 500 µl  
Pump aspirate speed: 2 ml/ min  
Pump dispense speed: 10 ml/ min  
Prime speed: 20 ml/ min  
Number of tubes: 21  
Aspirate height: 15 mm + follow  
Dispense height: 15 mm + follow  
Air gap: 15 µl  
Sample volume delivered: 485 µl  
Rinse volume: 500 µl  
Actual tube ID: 10.6 mm  
Sensitivity setting: 6% of initial reading  
Total transfer time: 15.58 min per 21 tubes

Additional notes

A tube with 5000 µl weighed before and after test run used to monitor evaporation. It was weighed using a Sartorius AC 210P four-place balance (#20201203).  

Delivery was 97% of syringe size. (100% delivery was not possible due to 15 µl air gap).  

First tube out of each group of 21 was used as a visual monitor or reference only. It was used to confirm the system was working properly. The next 20 tubes were used for data collection.
The Gilson Serial Input Output Channel (GSIOC) is an asynchronous serial communications interface that enhances the power of your Gilson equipment.

The GSIOC incorporates an EIA RS-485 interface and allows up to 32 slave devices to be controlled from a single master in a multi-drop configuration.

Each slave device is identified by a unique number which must be known to the device and to the controller. The default ID code of the 215 is 22.

To control the 215 Liquid Handler via the GSIOC interface, you will need the following:

• a Personal Computer with Microsoft Windows 98 or NT and any Gilson control software or 706 Device Driver Software installed
• an unused RS-232 communication port

From the controller, you:

• specify the 215 as the device you want to control
• issue commands that set operating parameters, control operation, or request information from that device.
GSIOC Commands

There are two kinds of commands that you can send over the GSIOC:

• **Buffered commands** send instructions to the liquid handler. These commands are executed one at a time.

• **Immediate commands** request status information from the 215. These commands are executed immediately, temporarily interrupting other commands in progress.

GSIOC Command List

In the command list below, the GSIOC command must be entered in the proper upper or lower case format. If a buffered command requires additional information, you'll see italicized text next to the command. The description of the command identifies what you need to enter in place of the italicized parameter. Also note that if a parameter is optional, it appears within brackets, [ ].

I - Immediate  
B - Buffered

**Note:** Before sending any GSIOC commands to the syringe pump, it must be in its home position. Send a buffered d command to home the syringe pump (see page D-5). Also, before sending any GSIOC commands to the liquid handler it must be in its home position. Send a buffered H command to home the liquid handler (see page D-6).
<table>
<thead>
<tr>
<th>Command</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>I</td>
<td>Identifies the selected slave device. Returns character string: “215Vx.yz”, where x, y, and z represent software version.</td>
</tr>
<tr>
<td>$</td>
<td>I</td>
<td>Resets the 215.</td>
</tr>
<tr>
<td>@</td>
<td>I</td>
<td>Reads non-volatile memory (NV-RAM) at current address. Returns “aa=xxxx” where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>aa - Value between 0 and 19 for word type data or 100 to 119 for floating type data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxxx - Data at the address.</td>
</tr>
<tr>
<td>@aa[=xxxx]</td>
<td>B</td>
<td>Sets the value at NV-RAM address where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>aa - Value between 0 and 19 for word type data or 100 to 119 for floating type data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxxx - (Optional) Data at the address.</td>
</tr>
<tr>
<td>~n</td>
<td>B</td>
<td>Sets test mode depending on value assigned to n:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - XYZ test.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 - Syringe pump test.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Display liquid level sensor frequency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 - Disable XY phase checking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 - Reset NV-RAM and initialize to defaults.</td>
</tr>
</tbody>
</table>


9 I Reads contact input event FIFO. Returns “Xtttttt” where:

- State of the four contact inputs: 1 for closed, 0 for open. See table below.
- Time since the last buffered 9 command

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>@</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>H</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>L</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>M</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Whenever the status of a contact input changes, the state of all contacts and the time since the last buffered 9 command in the event FIFO is encountered.

9 B Clears the contact event FIFO and resets the contact input event timer.

A I Reads home phases for X and Y motors. Returns “Xphase/Yphase” where:

- XXX - X motor phase.
- YYY - Y motor phase.

Bf,d B Causes 215 to beep:

- F - Frequency in Hz; default is 2400.
- D - Duration of beep in tenths of seconds; default is 1.
Appendix

GSIOC Commands

cv=ss..ss B

Sets user-definable character:

v - Address (0 to 7) of user-defined character.
ss..ss - Characters, in hexadecimal ASCII code, for rows 1 through 7. See example below.

For example, the following command sets the pattern shown below to user-defined character address 0:
c0=1F111B151B111

<table>
<thead>
<tr>
<th>[Row]</th>
<th>[Pattern]</th>
<th>[Hex Code]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>*****</td>
<td>1F</td>
</tr>
<tr>
<td>2</td>
<td>*       *</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>***     *</td>
<td>1B</td>
</tr>
<tr>
<td>4</td>
<td>*       *</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>***     *</td>
<td>1B</td>
</tr>
<tr>
<td>6</td>
<td>*       *</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>*****</td>
<td>1F</td>
</tr>
</tbody>
</table>

D I

Reads dilutor status. Returns “vxxx” where:

v - Valve position: N if in needle position, R if in reservoir position.
xxx - Current volume in µl in syringe.

d B

Homes dilutor. Sends the piston to the upper position with the valve in the needle position.

Ddvvv[,ss][,Zzz] B

Sets syringe pump parameters:

d - Valve position: N if in needle position, R if in reservoir position.
vvv - Volume (in microliters) to be aspirated (+) or dispensed (-)
ss - (Optional) Syringe speed in ml/ min.
zz - (Optional) Z-arm speed in mm/ sec. Note that valve must be in needle position to use this parameter.

e I

Reads the current error number. Returns “nnn” which identifies the error number; see page 5-2 for listing of errors. If no error has occurred, returns 0.

e B

Clears error number.
Appendix D

GSIOC Commands

Exyz  B  Sets X, Y, and Z motor status:

- x  -  0 for disable or 1 for enable X motor.
- y  -  0 for disable or 1 for enable Y motor.
- z  -  0 for disable or 1 for enable Z motor.

For example, the following command disables the motors: E000.

F  I  Returns maximum flow rate in ml/ min for dilutor syringe.

H[Z]  B  Moves probe to home position.

- Z  -  (Optional) Homes Z only

I  I  Reads status of input contacts and front panel Start and Stop buttons. Returns “cccckk” where:

- ccccc  -  Status of input contacts A, B, C, and D: 1 if closed (shorted), 0 if open.
- kk  -  Status of front panel Start and Stop buttons: 1 if button has been pressed, 0 if it hasn’t been pressed. Value of kk is cleared after reading.

J  I  Reads status of output contacts. Returns “ccccp” where:

- ccccc  -  Status of output contacts 1, 2, 3, and 4: 1 if connected, 0 if disconnected.
- p  -  Status of keypad and auxiliary power: 1 if connected, 0 if disconnected.

Jcccc[p]  B  Sets output contacts and +24V external power.

- ccccc  -  Output contacts 1, 2, 3, and 4: 1 to connect, 0 to disconnect, X for no change.
- p  -  (Optional) Keypad and auxiliary power: 1 to connect, 0 to disconnect, X for no change.

jcttt  B  Pulses an output contact:

- c  -  Number of the output contact, 1 - 4.
- ttt  -  Duration of the pulse in tenths of seconds; default is 1.
<table>
<thead>
<tr>
<th>Command</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Reads X, Y, Z motor status and dilutor (pump) status. Returns “xyzp”. For each status, you’ll see U for unpowered, P for powered, R for running, or E for error.</td>
</tr>
</tbody>
</table>
| N       | Reads the liquid detector output. Returns “Innnn” where:  
|         | I - A for air or L for liquid.  
|         | nnnn - Current sensitivity threshold frequency in Hz. |
| Nffff   | Sets the liquid level sensing threshold frequency (ffff) is the frequency in Hz. |
| n       | Reads the actual frequency of liquid detection oscillator. Returns “ffff” which is frequency in Hz. |
| Q       | Reads the XYZ travel range. Returns “axis=min/ max” where:  
|         | axis - X, Y or Z.  
|         | min - Lowest position in tenths of millimeters.  
|         | max - Highest position in tenths of millimeters. |
| R       | Reads front panel LED display. Returns “cccccccc” which is the 8 characters currently shown on the display. If a character is non-printable, the hexadecimal ASCII code for the character is returned. |
| S       | Reads the command in the synchronization buffer. Returns “| ” if buffer is empty. |
| Smm     | Sends a synchronized buffered command (mm) that will be executed when the instrument is quiescent. Sending a command can overwrite unexecuted, existing commands. If you send this command without indicating a parameter (mm), the buffer is cleared. |
### GSIOC Commands

**Wcc..cc B**

Wcc..cc B writes character string (cc..cc) to the LED display. Characters outside the printing range are shown in hexadecimal ASCII code on the display. User definable characters are available with codes of 80 to 8F.

**X I**

Indicates the location of the probe in the X-axis and Y-axis. Returns “xxxx/ yyyy” which is X and Y position in tenths of millimeters.

**x I**

Indicates X motor status. Returns one of the following: U for unpowered, P for powered, R for running, or E for error.

**Xxxxx[/ yyyy] B**

Sets new X and Y positions where:

- xxxx - X position in tenths of millimeters.
- yyyy - Y position in tenths of millimeters.

**Xxxxx[,s] B**

Sets new X position where:

- xxxx - X position in tenths of millimeters.
- s - (Optional) Speed index of 0 or 1; default is 0

  - s Speed
    - 0 Normal speed 39.29 cm/sec
    - 1 Slow speed 7.06 cm/sec

**Y I**

Indicates the location of the probe in the Y-axis. Returns “yyyy” in tenths of millimeters.

**y I**

Indicates Y motor status. Returns one of the following: U for unpowered, P for powered, R for running, or E for error.

**Yyyyy[,s] B**

Sets new Y position where:

- yyyy - Y position in tenths of millimeters.
- s - (Optional) Speed index of 0 or 1; default is 0.

  - s Speed
    - 0 Normal speed 39.19 cm/sec
    - 1 Slow speed 6.71 cm/sec
Appendix

Z I Indicates the location of the probe in the Z-axis.
Returns “zzzz” in tenths of millimeters.

Zzzzz[,s] B Sets new Z position where:

- zzzz - Z position in tenths of millimeters.
- s - Speed index of 1 to 5; default is 4. See table.

<table>
<thead>
<tr>
<th>s</th>
<th>Speed (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.061</td>
</tr>
<tr>
<td>2</td>
<td>2.963</td>
</tr>
<tr>
<td>3</td>
<td>8.622</td>
</tr>
<tr>
<td>4</td>
<td>16.854</td>
</tr>
<tr>
<td>5</td>
<td>29.799</td>
</tr>
</tbody>
</table>

z I Indicates Z motor status. Returns one of the following:
U for unpowered, P for powered, R for running, or E for error.

zppp[,s] B Indicates the movement in the Z-arm. Stops when the liquid level has changed where:

- pppp - Z position in tenths of millimeters.
- s - Speed index of 1 to 5; default is 2. See table above.
Pipetting Techniques

By following these techniques, you'll be able to maximize accuracy and precision, and minimize carryover, with your 215 Liquid Handler.

Accuracy and precision of pipetting are dependent on the specifications of the pump you're using and the geometry of the probe tip. Following are the probes, and a description of each one's tip, available for the liquid handler.

<table>
<thead>
<tr>
<th>Probe</th>
<th>Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septum piercing</td>
<td>Bullet point, side entry</td>
</tr>
<tr>
<td>Non-septum piercing</td>
<td>Tapered, constricting tip, bottom entry</td>
</tr>
</tbody>
</table>
Minimizing Cross-Contamination

Cross-contamination of samples is caused by sample carryover on the probe tip or on its inner walls. Several methods are available to minimize cross-contamination.

- Use of the liquid level sensing capability of the 215 will reduce carryover by limiting immersion below the liquid surface.

- Cleansing the probe tip with a flowing rinse removes contaminants from the external surfaces of the probe.

- Dispensing liquid through the probe into the rinsing station will eliminate internal contamination.

An alternate internal/external cleansing using a non-flowing rinse is also possible. (Internal rinsing may not be required at all if large diluent volumes are dispensed immediately after dispensing of the sample - a common practice in dilution procedures.)
Minimizing Dilution Effect

An undesirable dilution sometimes occurs when an aspirated sample replaces rinse or diluent material. Some of the diluent fluid invariably clings to the tubing walls, causing the unwanted dilution of the sample. The part of the sample that enters the tubing first is affected most because it is the closest to the diluting liquid.

The corrective action you take depends on the stringency of your requirements for sample purity and precision.

- You can aspirate an air gap into the probe tip to separate different fluids passing through the tubing to reduce mixing.
- You can aspirate an amount in excess of the required sample volume, dispensing the excess sample, which is most subject to being diluted, to waste.

In extreme cases, you can combine the methods listed above and perform the following routine to eliminate mixing of different liquids.

1. Move probe to sample tube.
2. Aspirate air gap.
3. Lower probe to sample level.
4. Aspirate small amount of sample - this is the excess sample volume.
5. Lift probe.
6. Aspirate air gap.
7. Lower probe to sample level.
8. Aspirate sample amount.
The following example describes an instance when the above 8-step procedure is required. An operator needs to dispense 50 µl of reagent into each of 20 test tubes. The tube-to-tube consistency of reagent volume is critical. However, in order to save time, the operator wishes to make a single 1 ml aspiration from the reagent reservoir and then make multiple dispenses. If the 8-step procedure were not used, the last aliquot of the 20 dispenses would be more diluted than the others. If the procedure was used, the requirements of the routine and the operator’s desire to save time could both be met. (Recommended volumes in this example are 15 µl air gaps and 100 µl excess volume in Step 4.)
Low Pressure Valve Installation

To install and connect tubing to the 215 Low Pressure Valve, 215 Prep FC Valve (High Mount) or the 215 Prep FC Valve (Low Mount), refer to the information on the following pages.
215 Low Pressure Valve and 215 Prep FC Valve (High Mount)

Refer to the following procedures and diagram below when installing the valve mounting assembly. The diagram shows the valve removed from the valve mounting assembly. However, you do not have to remove the valve to install the valve mounting assembly onto the 215 Liquid Handler. Information on making tubing connections to the valve is on pages F-14 through F-16.

1. Locate the low pressure valve/valve mounting assembly in the 215 Low Pressure Valve Package or the 215 Prep FC Package (High Mount).

2. Remove the three stainless steel flat-head screws from the top of the Z-arm. Discard or store the screws.

3. Disconnect the Z-arm control cable from the right side of the control cabinet. To disconnect the cable, press the small rectangular tab on the bottom of the cable's connector and pull on the connector.

4. Thread the Z-arm control cable through the large hole in the top of the valve mounting assembly.

5. Secure the valve mounting assembly to the top of the Z-arm. Use the three stainless steel Phillips screws supplied with the assembly.

6. Connect the terminal block connector to the +24V output on the liquid handler’s rear panel.

7. Reconnect the Z-arm control cable to the right side of the control cabinet.
215 Prep FC Valve (Low Mount)

Valve mounting assembly

Refer to the following procedures and diagram below when installing the valve mounting assembly. Information on making the tubing connections to the 215 Prep FC Valve (Low Mount) is on page F-17.

1. Locate the low pressure valve/valve mounting assembly in the 215 Prep FC Package (Low Mount).

2. Remove the three stainless steel flat-head screws from the top of the Z-arm. Discard or store the screws.

3. Disconnect the Z-arm control cable from the right side of the control cabinet. To disconnect the cable, press the small rectangular tab on the bottom of the cable’s connector and pull on the connector.

4. Thread the Z-arm control cable through the large hole in the top of the valve mounting assembly.

5. Secure the valve mounting assembly to the top of the Z-arm. Use the three stainless steel Phillips screws supplied with the assembly.

6. Connect the terminal block connector to the +24V output on the liquid handler’s rear panel.

7. Reconnect the Z-arm control cable to the right side of the control cabinet.
Appendix F

Low Pressure Valve Installation

Probe guide and valve mounting bracket

Refer to the following procedures and diagram below when installing the probe guide and valve mounting bracket.

1. Using a Phillips screwdriver, remove the two truss-head screws securing the probe guide to the foot.

2. Position the off-bed collection probe guide onto the Z-foot. Use the two supplied truss-head screws to secure.

3. Using a 9/64” Allen wrench, remove the two Allen screws attached to the front of the Z-arm motor.

4. Position the valve mounting bracket so the holes on each end align with the holes on the Z-arm motor.

5. Re-install the two Allen screws through the valve mounting bracket into the Z-arm motor holes. Firmly tighten the screws.

6. Snap the valve into the mounting clip.

Note: Do not attach the valve to the valve mounting clip until the bracket has been secured.
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 in length.
  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 in length.
  2. Insert the supplied nut and ferrule onto the tubing.

- For the 1/16" OD stainless steel probe (part number 25077421):
  1. The probe is pre-cut and bent to the correct position.
  2. Insert the supplied nut and ferrule onto the tubing.
Installing the collection probes

Refer to the following procedures and diagram below for on-bed collection using the 1/8” and 1/16” Teflon collection probes.

1 Remove the valve from the mounting clip.

2 Insert the end of the collection probe with the fitting attached into the NC port of the valve.

3 Press the tubing against the back of the port and finger-tighten the screw.

4 While holding the valve and collection probe, insert the collection probe a few millimeters into the appropriate on-bed guide hole.

5 Snap the valve into the valve mounting clip with the NC port facing the on-bed guide hole.

6 Push the collection tubing further into the guide hole until 3 mm of tubing is exposed below the guide foot.

**Note:** There should be no more than 1 mm of tubing exposed from the ferrule. Longer tubing may prevent the valve from switching.

**Note:** The valve may need to be shifted up or down in the valve mounting clip.
Refer to the following procedures and diagram below for off-bed collection using the 1/8” Teflon collection probe.

1. Remove the valve from the mounting clip.

2. Insert the end of the collection probe with fitting attached into the NC port of the valve.

3. Press the tubing against the back of the port and finger-tighten the screw.

4. While holding the valve and collection probe insert the collection probe a few millimeters into the off-bed guide hole.

5. Snap the valve into the valve mounting clip with the NC port facing the off-bed collection guide hole.

6. Push the collection tubing further into the guide hole until 3 mm of tubing is exposed below the probe guide.

Refer to the following procedures and the diagram above for off-bed collection using the 1/16” stainless steel collection probe.

1. Make sure there is no more than 1 mm of tubing exposed from the end of the ferrule (see Warning!). Insert the tubing and fitting into the NC port of the valve.

   Warning! Extra exposed tubing from the end of the ferrule can enter the valve port holes and prevent the valve from switching.

2. Raise the valve in the mounting clip so the probe tip is well above the probe guide.

3. Rotate the valve in the mounting clip until the probe is in alignment with the off-bed guide hole.

4. Lower the probe into the off-bed guide hole by lowering the valve’s position in the mounting dip. Lower the valve until 1 to 2 mm of the probe tip is below the guide foot.
Plumbing Connections

Following is a list of plumbing and plumbing-related connections to make in your HPLC system.

- Install the valve mounting assembly and valve, as described on page F-2 through F-4 in this booklet, if necessary.

- Make tubing connections

Making Tubing Connections

Before making the tubing connections, locate the items listed below:

- The plumbing package (part number 2507721) included with the 215 Low Pressure Valve Package. This package includes the following items. Surplus tubing and fittings are in the package.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4011141083</td>
<td>Three 6-32 x 1/2 Truss-head stainless steel screws</td>
</tr>
<tr>
<td>49041001</td>
<td>Two Upchurch Fingertight fittings (F-100N), Kel-F, 10-32</td>
</tr>
<tr>
<td>49041011</td>
<td>Six Upchurch flangeless ferrules (P-200R), Tefzel, 1/16”</td>
</tr>
<tr>
<td>49041012</td>
<td>Six Upchurch bushings (P-201), Delrin, 1/4-28 x 1/16”</td>
</tr>
<tr>
<td>49041042</td>
<td>Two Upchurch ferrules (F-142) for Fingertight fittings, PEEK, 10-32</td>
</tr>
<tr>
<td>490410630</td>
<td>Two Upchurch Fingertight III fittings (F-300), PEEK, 10-32</td>
</tr>
<tr>
<td>495031</td>
<td>Teflon tubing, 0.8 mm (0.030”) ID x 1/16”, 10 foot length</td>
</tr>
<tr>
<td>495033</td>
<td>Teflon tubing, 0.5 mm (0.020”) ID x 1/16”, 10 foot length</td>
</tr>
<tr>
<td>495034</td>
<td>Teflon tubing, 0.3 mm (0.010”) ID x 1/16”, 10 foot length</td>
</tr>
<tr>
<td>4957712</td>
<td>Upchurch PEEK tee with fittings (P-712), 0.020” ID, 1/4-28</td>
</tr>
<tr>
<td>49931108</td>
<td>Stainless steel tubing, 0.010” ID x 5 cm, no fittings</td>
</tr>
<tr>
<td>499311519</td>
<td>Stainless steel tubing, 0.010” ID x 5 feet</td>
</tr>
<tr>
<td>49931209</td>
<td>Stainless steel tubing, 0.010” ID x 20 cm, no fittings</td>
</tr>
<tr>
<td>49932059</td>
<td>Stainless steel tubing, 0.020” ID x 5 cm, no fittings</td>
</tr>
<tr>
<td>499321519</td>
<td>Stainless steel tubing, 0.020” ID x 5 feet</td>
</tr>
<tr>
<td>49932209</td>
<td>Stainless steel tubing, 0.020” ID x 20 cm, no fittings</td>
</tr>
<tr>
<td>54118025</td>
<td>Spiral wrap, 1/4” diameter, two 1-foot lengths</td>
</tr>
</tbody>
</table>
Or, the plumbing package (part number 2507731) included with the 215 Prep FC Package (High Mount). This package includes the following items. Surplus tubing and fittings are in the package.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>49041011</td>
<td>Five Upchurch flangeless ferrules (P-200R), Tefzel, 1/16”</td>
</tr>
<tr>
<td>49041012</td>
<td>Five Upchurch bushings (P-201), Delrin, 1/4-28 x 1/16”</td>
</tr>
<tr>
<td>49041015</td>
<td>Upchurch flangeless ferrule, 3 mm (1/8”); P300</td>
</tr>
<tr>
<td>49041016</td>
<td>Upchurch flangeless nut, 3 mm (1/8”); P304</td>
</tr>
<tr>
<td>495023</td>
<td>Tee, 1.5 mm bore</td>
</tr>
<tr>
<td>495032</td>
<td>TFE tubing, 1.5 mm ID x 3.0 mm OD (1/8”); pkg of 10 ft</td>
</tr>
<tr>
<td>49934059</td>
<td>0.040” stainless steel tubing, 5 cm, no fittings</td>
</tr>
<tr>
<td>49954059</td>
<td>0.040” (1/16”) PEEK tubing, 5 ft</td>
</tr>
<tr>
<td>49954239</td>
<td>0.040” PEEK tubing, 23 cm, no fittings</td>
</tr>
<tr>
<td>541180372</td>
<td>Spiral wrap, 3/8” diameter, black</td>
</tr>
<tr>
<td>F1410153</td>
<td>PVDF coupling, 1/4”-28</td>
</tr>
</tbody>
</table>

Or, the plumbing package (part number 2507742) included with the 215 Prep FC Package (Low Mount). This package includes the following items. Surplus tubing and fittings are in the package.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25077421</td>
<td>Collection tube 1/16” stainless</td>
</tr>
<tr>
<td>25077422</td>
<td>Collection tube 1/8” TFE</td>
</tr>
<tr>
<td>25077423</td>
<td>Collection tube 1/16” TFE</td>
</tr>
<tr>
<td>4011141063</td>
<td>Two 6-32 x 3/8 Truss-head stainless steel screws</td>
</tr>
<tr>
<td>49041011</td>
<td>Four Upchurch flangeless ferrules (P-200R), Tefzel, 1/16”</td>
</tr>
<tr>
<td>49041012</td>
<td>Four Upchurch bushings (P-201), Delrin, 1/4-28 x 1/16”</td>
</tr>
<tr>
<td>49041015</td>
<td>Upchurch flangeless ferrule, 3 mm (1/8”); P300</td>
</tr>
<tr>
<td>49041016</td>
<td>Upchurch flangeless nut, 3 mm (1/8”); P304</td>
</tr>
<tr>
<td>495032</td>
<td>TFE tubing, 1.5 mm ID x 3.0 mm OD (1/8”); pkg of 10 ft</td>
</tr>
<tr>
<td>49954059</td>
<td>0.040” (1/16”) PEEK tubing, two 5-foot lengths</td>
</tr>
<tr>
<td>54081253</td>
<td>0.125 diameter black cable clamp</td>
</tr>
<tr>
<td>541180372</td>
<td>Spiral wrap, 3/8” diameter, black</td>
</tr>
<tr>
<td>F1410050</td>
<td>200-16 coupling</td>
</tr>
</tbody>
</table>
• The FEP transfer tubing (part number 2954583, 2954671, 29425066, 499421202, 499474102 or 499474252) that came in the accessory package with the 215 Liquid Handler. If you ordered 1.1, 3, or 5 ml tubing, you must also locate the 2800 µl FEP tubing (part number 49948392) and coupling (part number F1410153).

• The back pressure regulator, supplied with the Gilson detector or ordered separately (part number 36070905 for a PEEK back pressure regulator or part number 36070906 for a stainless steel back pressure regulator). The back pressure regulator is not needed when using the 215 Prep FC Valves.
When plumbing the rest of the HPLC system, refer to the diagrams on the next page and the tables on pages F-14 through F-17.

Making tubing connections (high mount)

Making tubing connections (low mount)
The following diagram shows a magnified view of the 819 injection valve connections and the port connections that occur when the valve is in the LOAD or the INJECT position.

Connections to injection valve ports

The following diagram shows the Low Pressure or the 215 Prep FC (High Mount) valve installed in the spring clamp and the connections to your valve. Refer to the label associated with each port to ensure proper connections. To see the labels on the low pressure valve, remove the valve from the spring clamp.

Low pressure valve and tee connections
(viewed from the left side of the Z-arm)
The following diagrams show the 215 Prep FC Valve (Low Mount) installed in the spring clamp and the connections to the valve. When making connections to your valve, refer to the label associated with each port to ensure proper connections. To see the labels on the valve, remove the valve from the mounting clip.

215 Prep FC Valve (Low Mount) connections
top view
The tables on the following pages provide detailed information on making plumbing connections when the 215 Low Pressure Valve is installed.

<table>
<thead>
<tr>
<th>Low Pressure Valve/Tee Connection</th>
<th>Tubing</th>
<th>Fitting(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM (Common) port to back pressure regulator</td>
<td>Teflon tubing (part number 495034 or 495033 depending on flow rate—see Note); cut to appropriate length</td>
<td>On both ends of the tubing, use an Upchurch bushing and flangeless ferrule.</td>
</tr>
<tr>
<td>NO (Normally Open) port to waste</td>
<td>Teflon tubing (part number 495031)</td>
<td>Use an Upchurch bushing and flangeless ferrule to connect the tubing to the NO port.</td>
</tr>
<tr>
<td>NC (Normally Closed) port to tee</td>
<td>Stainless steel tubing (part number 49931108 or 49932059 depending on flow rate—see Note)</td>
<td>Use an Upchurch bushing and flangeless ferrule to connect the tubing to the NC port. On the tee end, use the fitting supplied with the tee. When you install the fittings on the tubing, the fittings touch each other, and it appears that the piece of tubing is too short. However, once each fitting is tightened into the tee or valve, the fittings no longer touch.</td>
</tr>
<tr>
<td>One side of tee to probe</td>
<td>23 cm of Teflon tubing (part number 495034 or 495033 depending on flow rate—see Note)</td>
<td>On the probe end of the tubing, use an Upchurch bushing and flangeless ferrule. On the tee end, use the fitting supplied with the tee.</td>
</tr>
<tr>
<td>One side of tee to syringe pump</td>
<td>FEP transfer tubing (part number 2954583, 2954671, 29425066, 499421202, 499474102, or 499474252)</td>
<td>If you are using 1.5, 10.5, or 25.5 ml transfer tubing, use the factory-installed fitting to connect the tubing’s other end to the syringe valve. If you are using 1.1, 3 or 5 ml transfer tubing, connect the coupling (part number F1410153) and 2800 µl tubing (part number 49948392) to the transfer tubing. Then connect the 2800 µl tubing to the tee.</td>
</tr>
</tbody>
</table>

**Note:** Use 0.010" ID tubing when plumbing an analytical system. When plumbing a semi-preparative system, Gilson recommends using 0.020" ID tubing. As a guide, use 0.020" ID tubing for the following connections in a semi-preparative system:
- injection valve port 2 to column (flow rates above 7 ml/min)
- low pressure valve NC port to tee (flow rates above 7 ml/min)
- tee to probe (flow rates above 10 ml/min)
The table below provides detailed information on making plumbing connections when the 215 Prep FC Valve (High Mount) is installed.

<table>
<thead>
<tr>
<th>215 Prep FC Valve (high mount)/Tee Connection</th>
<th>Tubing</th>
<th>Fitting(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM (Common) port to coupler</td>
<td>0.040&quot; (1/16&quot;) PEEK tubing (part number 49954059) cut to appropriate length</td>
<td>On both ends of the tubing, use an Upchurch bushing and flangeless ferrule.</td>
</tr>
<tr>
<td>NO (Normally Open) port to waste</td>
<td>Teflon tubing (part number 495032)</td>
<td>Use an Upchurch bushing and flangeless ferrule to connect the tubing to the NO port.</td>
</tr>
<tr>
<td>NC (Normally Closed) port to tee</td>
<td>0.040&quot; stainless steel tubing (part number 49934059), 5 cm</td>
<td>Use an Upchurch bushing and flangeless ferrule to connect the tubing to the NC port. On the tee end, use the fitting supplied with the tee. When you install the fittings on the tubing, the fittings touch each other, and it appears that the piece of tubing is too short. However, once each fitting is tightened into the tee or valve, the fittings no longer touch.</td>
</tr>
<tr>
<td>One side of tee to probe</td>
<td>23 cm of 0.040&quot; (1/16&quot;) PEEK tubing (part number 49954059)</td>
<td>On the probe end of the tubing, use an Upchurch bushing and flangeless ferrule. On the tee end, use the fitting supplied with the tee.</td>
</tr>
<tr>
<td>One side of tee to syringe pump</td>
<td>FEP transfer tubing (part number 2954583, 2954671, 29425066, 499421202, 499474102, or 499474252)</td>
<td>If you are using 1.5, 10.5, or 25.5 ml transfer tubing, use the factory-installed fitting to connect the tubing’s other end to the syringe valve. If you are using 1.1, 3 or 5 ml transfer tubing, connect the coupling (part number F1410153) and 2800 μl tubing (part number 49948392) to the transfer tubing. Then connect the 2800 μl tubing to the tee.</td>
</tr>
</tbody>
</table>
The table below provides detailed information on making plumbing connections when the 215 Prep FC Valve (Low Mount) is installed.

<table>
<thead>
<tr>
<th>215 Prep FC Valve connection (low mount)</th>
<th>Tubing</th>
<th>Fitting(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM (Common) port to coupler</td>
<td>0.040&quot; OD PEEK tubing (part number 49954059) 5 feet long</td>
<td>On both ends of the tubing, use a 1/16&quot; Upchurch bushing (part number 49041012) and flangeless ferrule (part number 49041011). Connect one end to the COMM port of the valve. Connect the other end to a coupler (part number F1410050).</td>
</tr>
<tr>
<td>NO (Normally Open) port to waste</td>
<td>Teflon tubing 1.5 mm ID (part number 495032)</td>
<td>Use a 1/8&quot; Upchurch bushing (part number 49041016) and flangeless ferrule to connect the tubing to the NO port.</td>
</tr>
<tr>
<td>NC (Normally Closed) port to probe</td>
<td>1/16&quot; stainless steel probe (part number 25077421) or 1/16&quot; TFE probe (part number 25077423) or 1/8&quot; TFE probe (part number 25077422)</td>
<td><strong>Note:</strong> Information on making these connections can be found on pages F-5 through F-7 in the <strong>Installing the collection probes</strong> section.</td>
</tr>
</tbody>
</table>
Using an Additional 819 Module for Fraction Collection

The 819 module contains a high-pressure Rheodyne two-position, switching valve that can be used to control the flow from the detector, to either waste or collect. It is an effective way to control flow when the rate is faster than 25 ml/min. The Rheodyne valve can sustain the higher pressures which are related to the faster flow rates unlike the valve used in the low pressure valve assembly (part number 251772).
The following diagrams show the port connection for the switching and injection valves when they are in the INJECT or LOAD position.

The switch valve requires a contact connection to the output barrier strip of the liquid handler. To make this connection, connect the input contact (pins 1, 2) on the back of the 819 Injection Module to output position 1 on the back of the liquid handler (pins 3, 4.) For more information on making contact connections, refer to Section 2, Installation of the 819 Injection Module User’s Guide or 215 Liquid Handler User’s Guide.
Example UniPoint Method

This is an example of a Control Method (startup.gct) that should be used to switch the valve on the second 819 module for fraction collection to the (LOAD) position before injecting the samples through the 819 injection valve. This method should be listed first in an Operations list, then followed by the series of samples with an associated Control Method.

The following is an example of an Operations List: