Bruker BioSpin

BEST NMR

215 Liquid Handler
Installation & User Manual

Version 002

think forward

NMR Spectroscopy

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Introduction 1

General Safety Instructions 1.1

For security reasons you should read this manual before set-up and first usage of the BEST - NMR 215 Liquid Handler. Keep this manual near the Liquid Handler for later reference. It must be ensured that all persons who have to perform activities on the machine, have access to the operating manual at all times.

- The machine may only be operated by persons who have been specially trained, briefed and authorized. They must be familiar with the operating manual and act in accordance with it.
- Never touch moving parts on the device. Always wait until all parts come to a complete stop.
- After the final sample preparation the device must come to a complete stop, and the needle must have reached its safe park-position, before any further work can be started at the liquid handler or before it is left unattended.
- 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.
- The supply voltage must be identical to the specifications on the rating plate.
- All labels on the machine which display safety and operating instructions must always be kept legible. Worn or damaged labels must be replaced immediately.
- If erroneous behavior of the BEST - NMR 215 Liquid Handler or accessories occurs during operation, shut the machine down, remove the power supply and contact customer service.
- If there is visible damage to any of the devices or the power cables, these must not be operated. Consult a technician before reactivating the device again.
- Improper repairs may result in major hazards for the user. Never disassemble the device on your own nor try to repair it yourself.
- Use only original equipment manufacturer (O.E.M.) accessories.

Correct Usage *1.2*

The machine BEST NMR 215 Liquid Handler is intended exclusively for:

- Preparing and transferring a liquid sample out of a suited vessel into a NMR flow probe.
- Preparing means to dilute and mix a sample using the Gilson dilutor and the probe mounted to the Z-arm.
- Transferring means to take a prepared sample with Gilson probe, connecting the probe to an injection port and pushing it via a transfer capillary to the measurement cell of the NMR flow probe.
- Correct usage also includes reading this operating manual and complying with all the instructions it contains - in particular the safety instructions. Furthermore, all inspection and maintenance work must be carried out at the stipulated intervals.

The machine is not designed for applications other than those listed here - this is considered improper use! In particular we advise that the following is prohibited:

- When the liquid handler is used inside the BEST Cover the service doors in the rear must be closed during operation. These doors are to be used for service and set-up only and must be kept closed during normal operation. The extra safety functionality of the cover only apply if these doors remain closed. In addition, the inert gas atmosphere will escape and provide a danger for personnel.

If the machine BEST - NMR 215 Liquid Handler is not used in accordance with these conditions, safe operation of the machine cannot be guaranteed.

The BEST NMR 215 Liquid Handler manufacturer is not responsible for any injury or damage to persons or property resulting from improper use of the device.

Danger of Injury from the Liquid Handler *1.2.1*

The robotic movement of the liquid handler is very fast and may surprise anyone not familiar with its operation. While the arm of the liquid handler will stop if there is something in it's way, it might still cause bruises or may, for example, push your arm into glass tubes and cause cuts.

The needle is meant to pierce thick septa and has the power to cause deep painful cuts. If it should hit a nerve or joint, it might also cause a permanent defect of the hand. Therefore do not reach within the work area of the robot while it is operational and ensure that others are protected from injuries as well.

Our BEST Cover will add to the safety of the operating personnel and help prevent accidents.

Danger from Samples and Other Substances *1.2.2*

For the operation of the BEST - NMR 215 Liquid Handler no dangerous liquids, solvents or gases are required. However you may wish to use potentially dangerous substances or samples (poisonous, corrosive, infectious, radioactive, etc) for your experiments. The usage of these substances requires special attention and different safety regulations may apply. The operator is responsible to meet these special requirements (ventilation, first aid installations, personal protection, etc). Also observe any instructions on the liquids, solvents or gases containers.

When operating with dangerous substances, you must be particularly aware of the potential threat of the needle or breaking glass. While injuries from the needle would be painful, the threat of substances reaching the bloodstream through open wounds is potentially lethal.

.Therefore never reach within the work area of the robot while it is operational and make sure others are protected from this danger

If the liquid handler is used in an inert gas atmosphere, it may be necessary to monitor the oxygen levels or ensure adequate ventilation.

Before Starting *1.2.3*

Familiarize yourself sufficiently with:

- The machine's operating and control elements.
- The machine's fittings.
- How the machine works.
- The immediate environment of the machine.
- The safety devices.
- Measures to be taken in case of an emergency.

Explanation of the Safety Symbols *1.3*

	This symbol indicates primarily danger to personal health, but damage to the machine, property or the environment is also possible. Failure to observe these warnings could result in serious, even fatal, injuries.
Caution	This symbol is found on the rear of the BEST Cover above and on the service doors. When these doors are open one can reach within the work area of the needle, without disabling the robot. These doors are intended for easier handling and set up, but must be closed during normal operation. Make sure these doors are in their proper position before starting the machine. When you intend to make adjustments through these openings make sure that the robot is shut down and that you do not reach in the work area of the robot.

	This symbol indicates danger of injuries to hands or arms. Failure to observe these warnings could result in serious cuts and bruises and may even result in permanent damages.
Warning	This symbol is found near the needle of the robot. The strong Z-drive of this robot is meant to pierce thick septa. Keep your hands clear of the entire work area and especially from the needle.

	This symbol indicates danger of automatic moving parts. Failure to observe these warnings could result in cuts and bruises.
Warning	This symbol is found on the arm of the robot. The robot moves at high speeds and might push your arm or hand against a wall or into glass tubes. Always be aware of sudden movements. Never reach into the work area of the robot while the robot is operational.

During Service *1.4*

The servicing tasks defined in the operating manual - tuning, cleaning, lubrication, maintenance - must be performed when due.

Before performing the serve work, you must observe the following:

- Personally ensure that all potentially dangerous substances have been removed. Be aware that capillaries, the syringe, the needle or other devices may still contain unknown substances.

- Switch off the central power supply using the master switch, whenever an operation does not specifically require the robot to be switched on.
- Strictly follow the procedures described in the manual. Repairs, inspections or servicing procedures not described in the operating manual must be performed by BRUKER technicians.
- Replace all defective machine parts immediately
- Use only OEM replacement parts

After completing the service work and before starting the machine, you must observe the following points:

- Check that all previously removed protective devices, covers, container lids and filters have been replaced correctly. The service doors on the rear of the BEST Cover, if used, must be in place.
- Make sure that all previously used tools, materials and other equipment are removed from the operating area.
- Make sure that all the machine's safety devices are functioning properly.

Changes to the Machine *1.4.1*

For safety reasons, no unauthorised changes may be made to the machine.

The safety features must not be changed, removed or otherwise altered.

All planned changes must be authorized in writing by the responsible BRUKER company.

Use only OEM replacement parts. These parts are especially designed for the machine. With non-OEM parts there is no guarantee that they have been designed and built to comply with the stress and safety requirements of the machine.

Parts and special fittings which were not supplied by BRUKER are also not approved for use in/on the machine.

Safety Evaluation *1.5*

It is recommended, and in some countries is required, that the operator evaluates the safety of the set-up and environment of the machine. On the bases of this report he should prepare special work instructions and procedures for the employees to ensure maximum safety.

Description 1.6

The BEST 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 built-in dilutor provides for the accurate and precise handling of liquids.

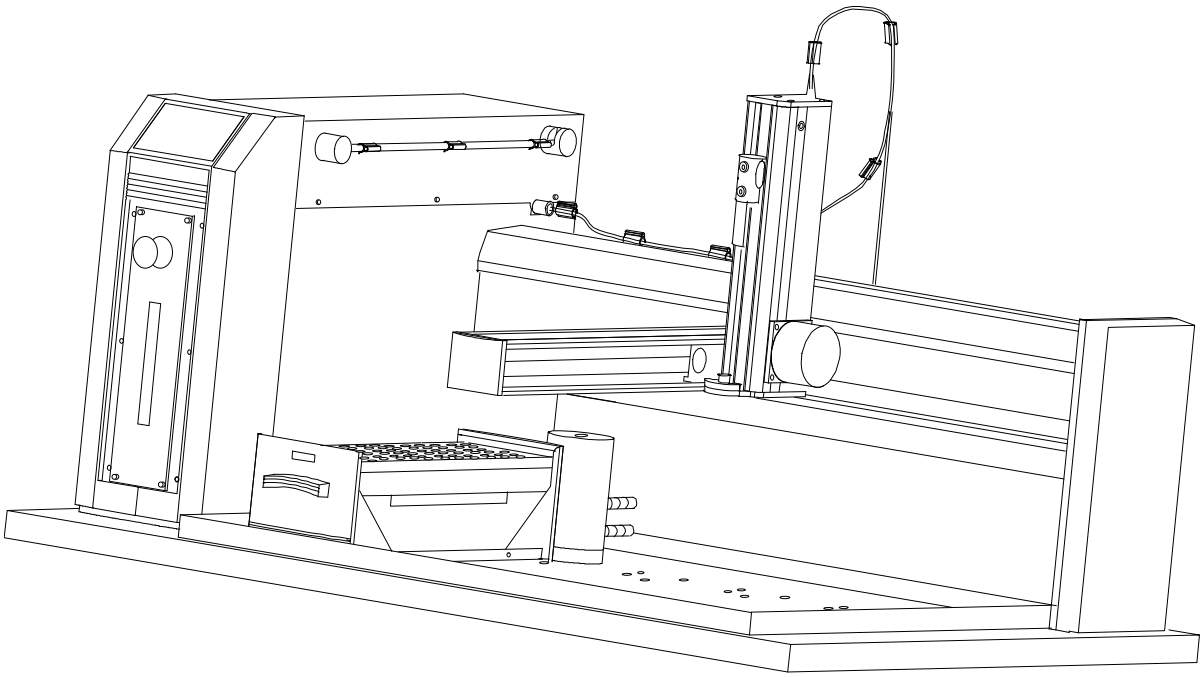


Figure 1.1. The BEST 215 Liquid Handler

Unpacking 1.7

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

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

- One box contains the 819 valve actuator.
- One box contains a set of vials and the capillary set, as well as the 10 m serial cable.
- The biggest container holds the 215 Liquid Handler.
- The container inside the 215 Liquid Handler box holds the auxiliary items, such as locator plate, tubing, probes, syringes, rinse inserts, Z-drive, and any other accessories like the rack code 211 you may have ordered with your system.

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. Bruker recommends that two people lift the liquid handler off the base of the packing container.

!! Do not lift or handle the 215 by the XY arm to lift the liquid handler:!!

1. Using the two cutouts for hand holds, place a hand at the base of the packing container.
2. Grip the liquid handler under the base plate.
3. 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 XY-arm (the horizontal arm). Always lift the instrument from its base.

Standard Equipment *1.7.1*

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

H9376 - 215 unit with dilutor 402

Locator plate with one drain base (includes 4 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

125 mm Z-drive and control cable with retaining clip

Accessory package which includes:

- Fuse drawers, fuses, and power cords
- 10-pin terminal block
- 8-pin terminal block
- 9/64" ball driver for removal of armlock
- 8 tubing retaining clips
- Cable support rod with bracket and 2 Phillips–head attachment screws
- Level sensing cable
- Tubing support rod
- Dilutor valve and vent tubing
- 819 Valve Actuator with 7000L valve mounted
- Rack 211H

Inlet tubing package which includes:

- 1/4"-28 coupler
- TFE inlet tubing (650 x 3 x 2 mm) with 20 µm stainless steel filter

H9303 - BEST-NMR 215 Liquid Handler Manual

H9437 - Accessories

Based upon your configuration, you'll also receive additional accessories, such as the probe, dilutor syringe, transfer tubing, fittings, 211H bottles with caps and septa, racks, etc.

In ***"Replacement Parts and Accessories" A on page 57*** you will find a detailed list of spare parts and accessories.

Customer Service *1.8*

If you need assistance, please contact your Bruker representative. You can also contact the BEST-NMR group via its e-mail address: <bestnmr@bruker.de>. To help us serve you quickly and efficiently, please refer to ***"Repair and Return Policies" 5.3 on page 53***.

Technical Data 1.9

The following specifications and information are subject to change without notice.

Warning: Changes or modifications to the liquid handler not expressly approved by Bruker could void the user's authority to operate the liquid handler.

Note: 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.

Manufacturing Standards 1.9.1

Safety Certification

CE UL 1262

CSA C22.2 - No. 151

EC 1010-1

EMC Certification

EN 50082-1

FCC Class A

EMI Certification

EN 50081-1

Sampler Type	XYZ robot with stationary rack design
Pumping System	Integral high-precision single piston dilutor pump
Dilutor Syringe Capacity	5000 µl, 8Bruker Srandard (100, 250, 500, 1000, 10000 or 25000µl available from the local Gilson distributor)
Front Panel	8-character display, Start and emergency Stop soft keys
Volumetric Accuracy and Precision	(values according to Gilson Inc. USA) The volumetric accuracy and precision listed are maximums. Under most circumstances, you can expect performance that surpasses these specified limits.

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%

Carryover	<1 ppb using septum-piercing probe (capacitive, level-sensing). Referring to Gilson information on the method used to determine carryover.	
Liquid Level Sensing	Capacitive or conductive (currently 12.2001 not supported in BEST-NMR, but under development)	
Needle Rinse	Through a dedicated rinse station for rinsing the inside and outside of the needle; selectable rinse volume and flow rate. Optional inserts for level sensing, non-level sensing and flowing rinse.	
Probe Positioning Performance	Accuracy:	+/- 0.5 mm in X/Y dimensions
		+/- 1 mm in Z dimension
	Repeatability:	+/- 0.25 mm in X/Y/Z dimensions
Arm Speed	> 45.7 cm/sec (> 18 in/sec) in X dimension	
	> 40.6 cm/sec (> 16 in/sec) in Y dimension	

Vertical Punch Strength	4.9 kg (11.0 lb).
Horizontal Motion Strength	X: 5 kg (11.1 lb). Y: 7 kg (15.6 lb).
Rack 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.
Control	Computer control via RS-232 with Bruker-BEST-NMR Software.
Electrical Control	4 inputs (contact closure, TTL or open-collector), 4 relay outputs, and one switched +24 V DC, 1 A output.
Power Requirements	Frequency: 50/60 Hz Voltage: 100-120 V or 220-240 V; mains voltage fluctuations not to exceed ±10% of the nominal voltage. Current rating: 2.0 A for 100-120 or 1.0 A for 220-240 V.
Environmental Conditions:	Indoor use.
Altitude:	Up to 2000 m.
Temperature range:	5 - 40° C.
Air pressure:	75 - 105 kPa.
Pollution degree:	1 or 2 in accordance to IEC 66.
Humidity:	Maximum relative humidity 80% for temperatures up to 31° C, decreasing linearly to 50% relative humidity at 40° C.
Dimensions (W x D x H):	91.4 x 61 x 55.8 cm (36 x 24 x 22 in)*.
Maximum Height.	Z-drive (vertical arm) height is adjustable to accommodate vessel heights between 1 and 150 mm (dependent on installed Z-drive).
Weight	39.9 kg (89 lb).

Installation 2

Liquid Handler Setup 2.1

This section takes you through the steps for setting up your 215 Liquid Handler.

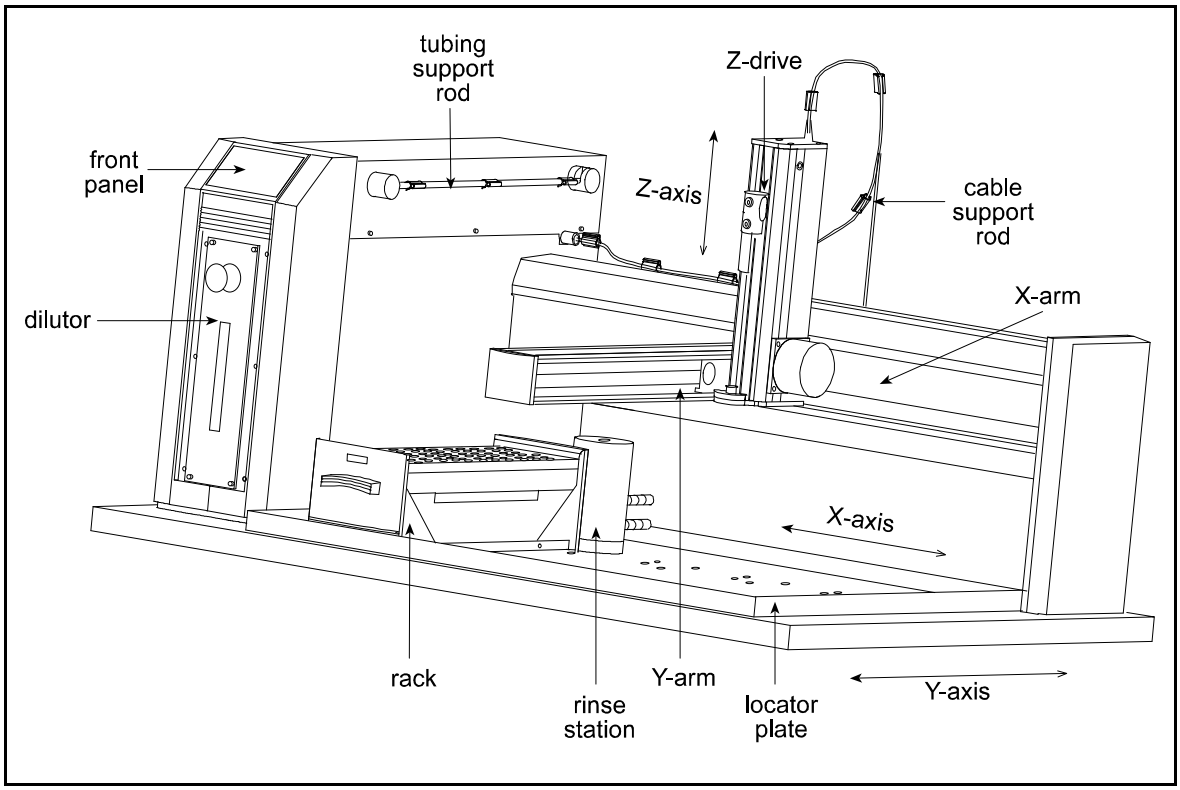


Figure 2.1. Key Components of the 215 Liquid Handler

Locator Plate Installation 2.2

The locator plate serves two functions:

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

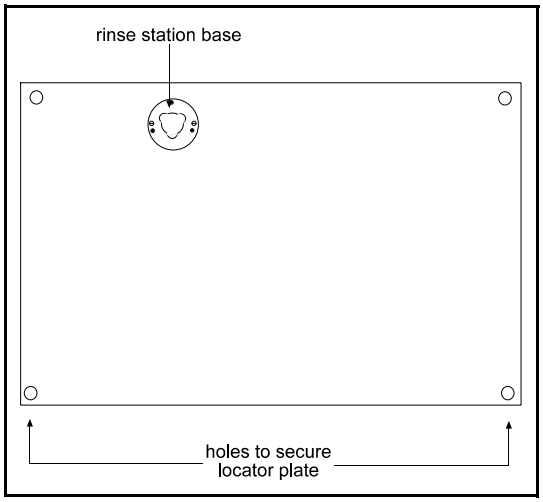


Figure 2.2. The Locator Plate

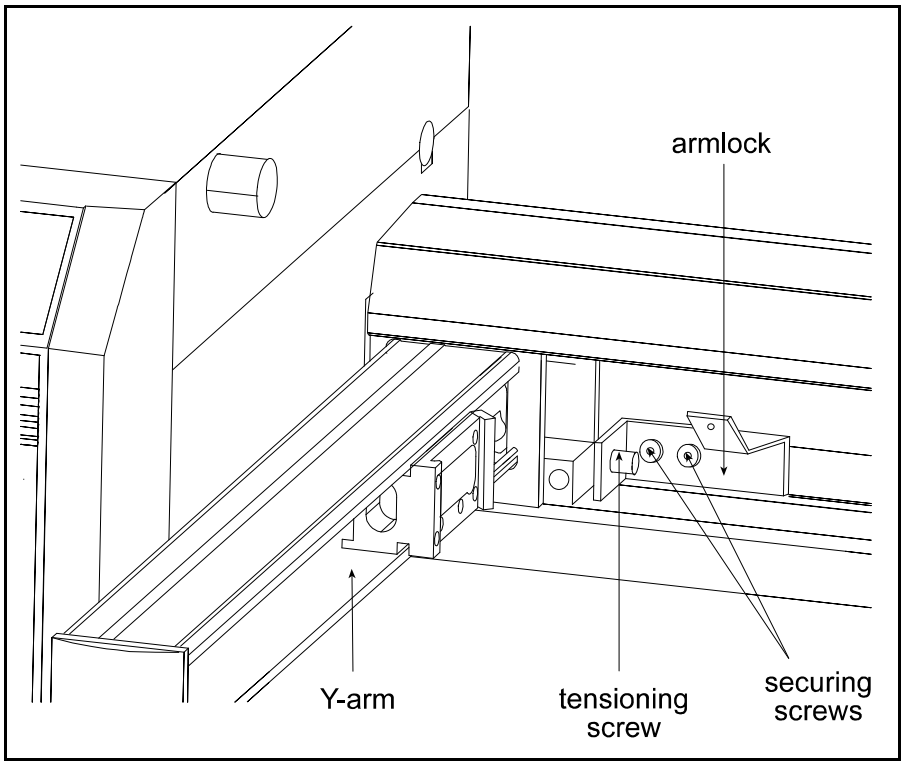
The locator plate and its four mounting screws are shipped in a separate box with the liquid handler's accessories. To install the locator plate onto the instrument bed:

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-head screwdriver, secure the locator plate using the four mounting screws.

Note: If you purchased the optional 6-position locator plate (Gilson Reference Number 25045513), the rinse station base is in the center rear of the locator plate.

Armlock Removal *2.3*

- The armlock on the liquid handler secures the Y-arm during shipment. You must remove the armlock prior to installing the Z-drive 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 re-install 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-Drive Installation *2.4*

Follow these steps to install the Z-drive:

1. Using a Phillips screwdriver, loosen the mounting screw on the Z-drive 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-drive into the mounting bracket. You will need to insert one side of the Z-drive into place at a time.
4. Tighten the screw on the mounting bracket until the Z-drive is secure.

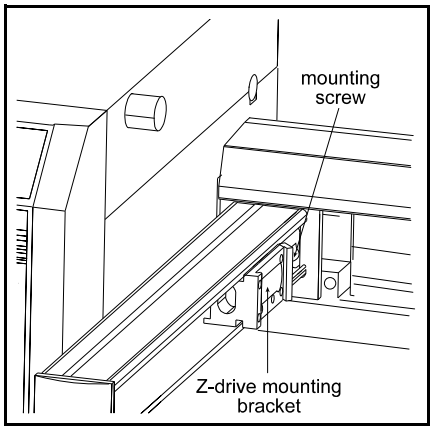
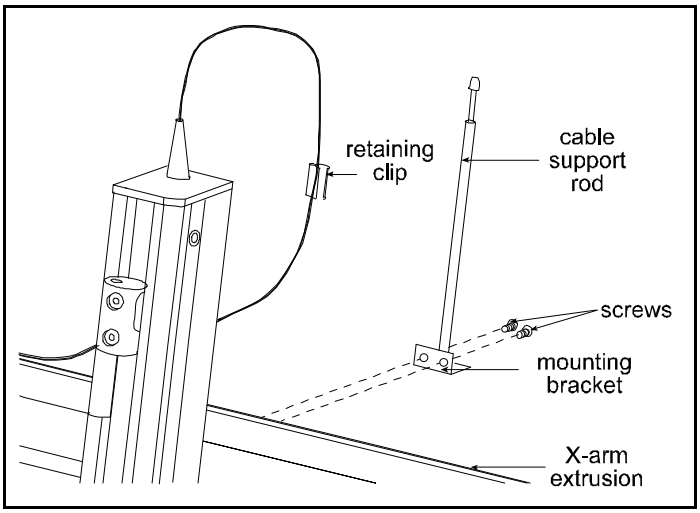


Figure 2.3. Z-Drive Installation

You'll adjust the Z-drive to its proper height after rack and rinse station installation. This adjustment is described in ***"Final Z-Drive Adjustment" on page 32***.



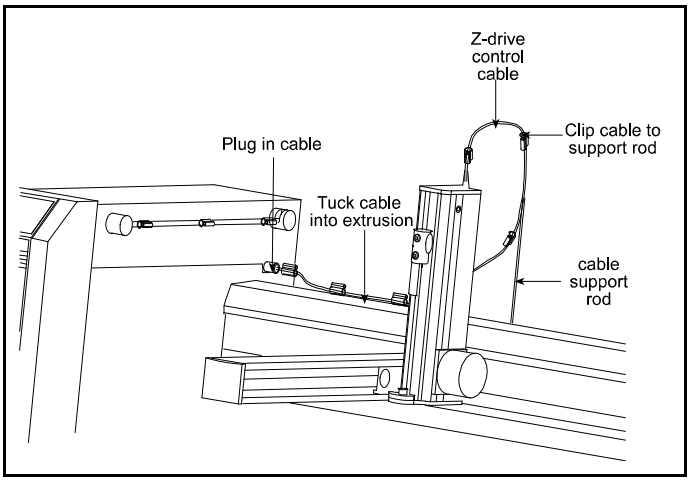
Installing the Z-drive

Using the two Phillips-head screws, attach the cable support.

Cable Support Rod

Rod bracket in the holes located in the rear of the X-arm extrusion.

Plug the Z-drive 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 the following figure.



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 *2.5*

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. BEST NMR is already equipped with best suited probe for high throughput and septum piercing. 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.

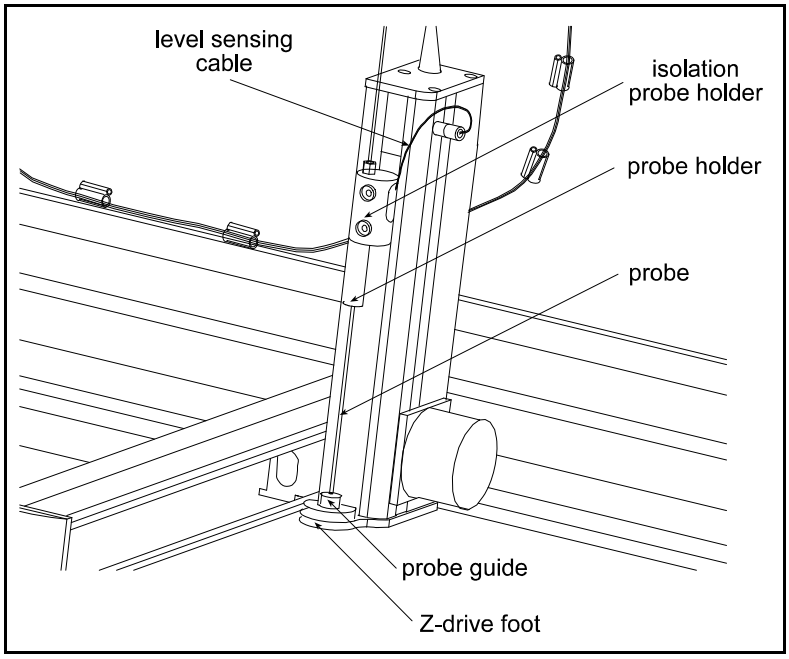


Figure 2.4. Location of Components for Probe Installation

Installing the Probe Guide

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

1. Place the probe guide into the opening in the top of the foot.
2. Use the two Phillips-head 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.

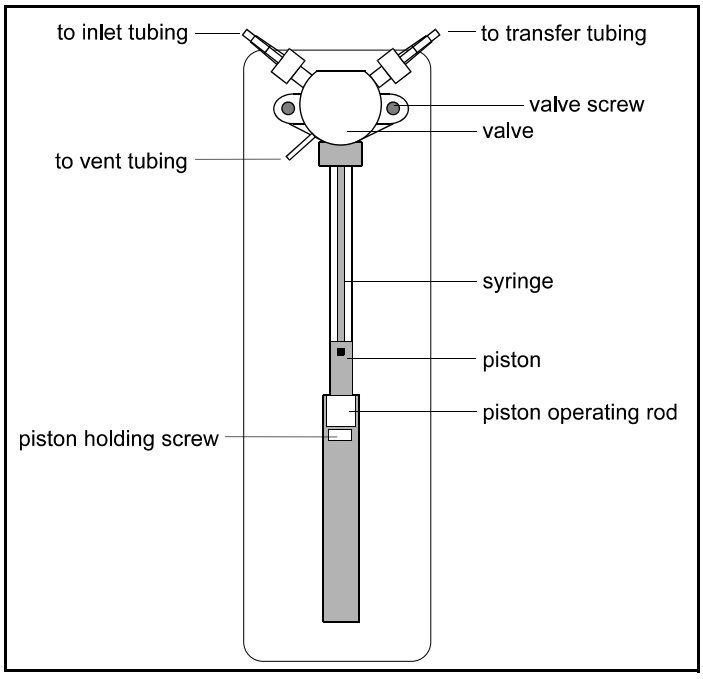
Installing the Level Sensing Cable

(currently 03.2004 not supported under BEST)

1. Plug the quick connector into the socket located on the Z-drive.
2. Remove the screw from the right side of the isolation probe holder, install the ring-tongue connector onto the screw, and re-attach the screw to the isolation probe holder.

Syringe Installation *2.6*

Your liquid handler has a built-in dilutor, and 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 ***"Re-installing the Syringe" on page 43***. 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 dilutor 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. (the standard size for BEST-NMR is 5000 µl)

819 Valve Installation *2.7*

The valve actuator 819 with the mounted 7000L Rheodine 6 port valve will be mounted together with the injection port support plate and the Bruker gas Valve Switch to the right side to your 215 liquid handler. Don't forget to loosen the two transport security screws before tightening the the long side screws. With this you ensure that the injection port will be straight and that the seal is not wearing out due to a mis-alignment.

Plumbing Connections *2.8*

Inlet and Sample Loop Installation *2.8.1*

For the dilutor, you received inlet tubing and a sample loop. (For the detailed size and length of tubing refer to ***"Connection of Capilaries" on page 69***)

1. Install the 1/4"-28 fitting of the 2 mm ID tubing (Gilson Reference Number 3645357) to the inlet side of the dilutor.
2. Place the filtered end of the assembly into the bottle containing your diluent or probe rinse solution.

   Note: If you need to shorten your inlet tubing, remount the filter, cut the tube with a proper cutter, fit it through the bottle cap and replace the filter

1. Mount the Bruker Wash Module to the support rod, like shown in the picture above.
2. Snap two tubing retaining clips onto the tubing support rod. Equally space the clips.
3. 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.

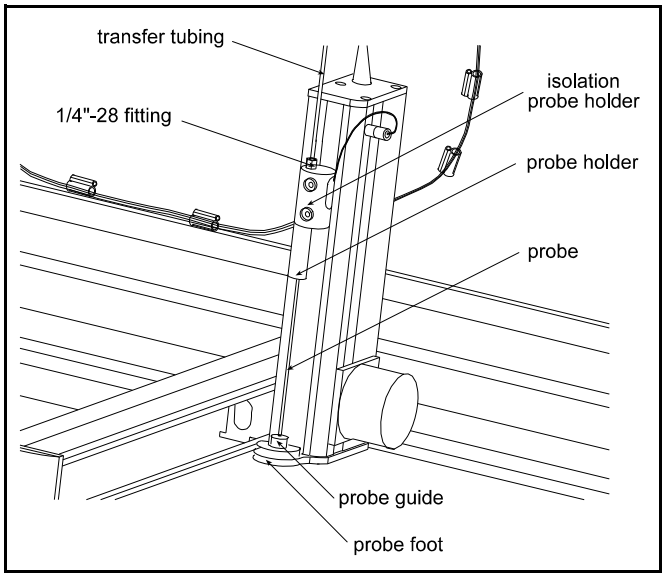
4. Connect the dilutor outlet (top right) with the inlet at the front of the Wash Module, called “Dilutor”.
5. Mount the “Inline Check Valve” CV3302 (Bruker #86714) to the upper “Wash” position
6. Connect the two rear Wash module outlets with the proper destinations. “Wash” is going to port 4 of the 819 dilutor valve and “Needle” will lead a 3m capillary to the liquid handler probe (s. next chapter)
7. 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.

Needle Tubing Installation *2.8.2*

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

1. Snap the tubing into the small grooves on the clips installed on the Z-drive control cable.

   Note: You can thread the capillary through before mounting the fittings.



2. Connect the sample loop (3000 x 1.0 mm ID 1/16”FEP tubing) between the port on the dilutor valve (see above) and the 215 probe (needle) (Refer to diagram shown in ***"Connection of Capilaries" on page 69***)
3. Connect the other end to the top of the isolation probe holder. Firmly tighten this fitting since it holds the probe in place.

Valve Tubing Installation *2.8.3*

Use the precut capillaries and follow the scheme shown in ***"Connection of Capilaries" on page 69***.

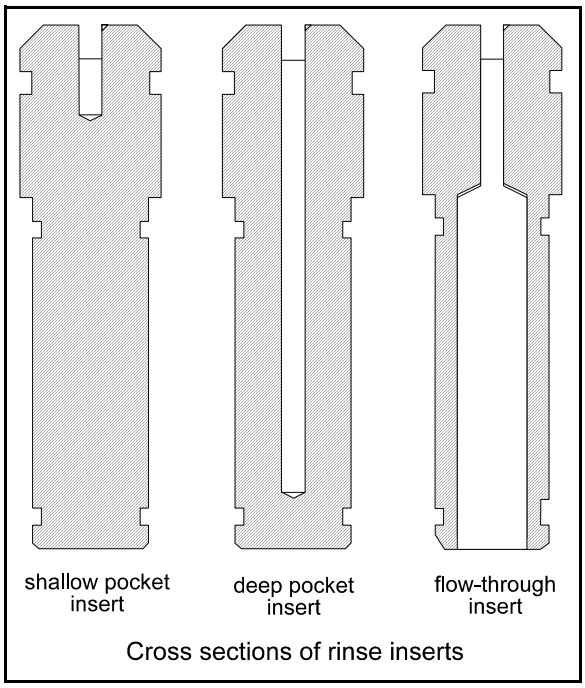
Use the tiny UNF10/32 fittings at the valve body to safe space for the injection port connection.

- Port 1 is connected directly to the injection port.
- Port 2 is connected to the NMR probe.
- Port 3 is leading to the Y of the Waste tubing (point 8 in the next chapter) A check valve “CV.3302” is mounted to this capillary to improve the conditions for the NMR measurements.
- Port 4 is connected to the outlet named “Wash” at the “Wash Module”.
- Port 5 is connected to the outlet of the “Gas Valve Switch”, which should be mounted to the right hand side of the 819 valve in using the same mounting screws.
- Port 6 is leading to the Y of the Waste tubing (point 8 in the next chapter).

Rinse Station and Drain Waste Tubing Installation ***2.8.4***

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

There are three different types of rinse station inserts available from Gilson.



Cross sections of rinse inserts

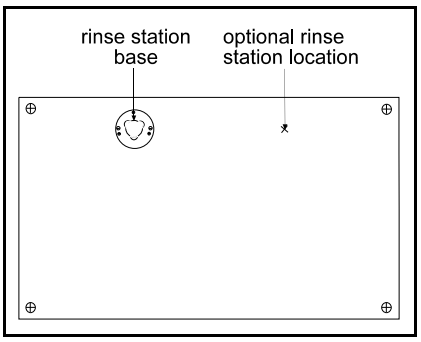
The rinse station insert for BEST-NMR is a deep pocket insert - This is a closed bottom rinse insert mainly used for non-level sensing applications. This type of insert allows for a deeper insertion of the probe into the rinse well resulting in a greater area of the outside of the probe to be rinsed.

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.

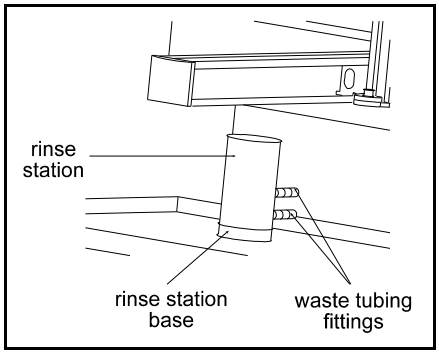
Installing the Rinse Station *2.8.5*

The base of one rinse station is shipped already secured to the rear of the locator plate.

Before installing the rinse station, make sure the locator plate has been properly installed with the rinse station base to the rear.

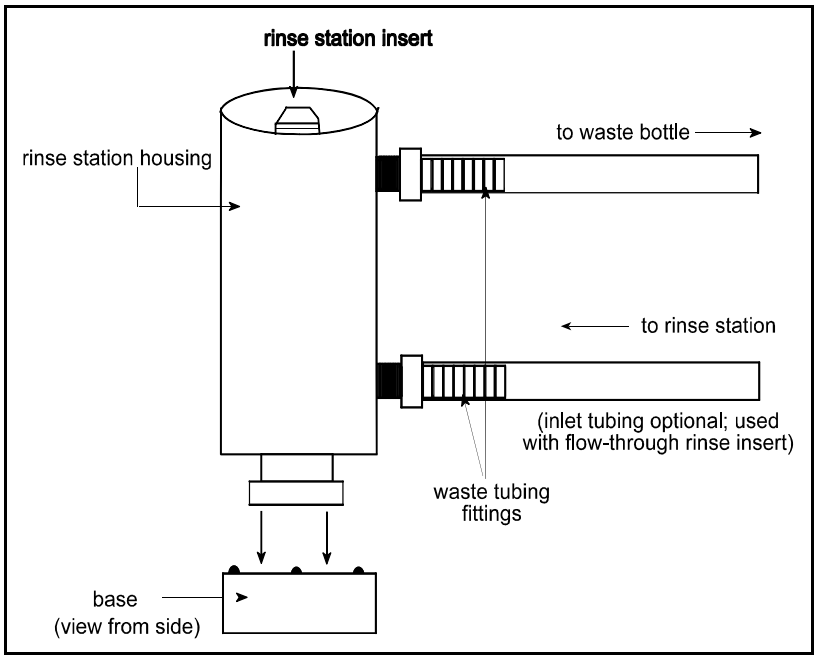


Install the rinse station so that its tube fittings are pointing toward the rear of the liquid handler. That orientation is the one shipped from the factory.



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 6, 7, and 8.
5. You may need to change the orientation if the current location of the waste tubing fittings will obstruct the installation of non-standard racks or other accessories.



6. Install the rinse station insert by pressing the insert down into the housing until it snaps into place. The top of the insert should be level with the rim of the housing.

   Note! It will be easier to push the insert into the rinse station by greasing the O-rings slightly with e.g. laboratory Silicon grease or a film of machine oil!

7. Connect the Tygon waste tubing to the rinse station housing by twisting the tubing onto the fittings on the rinse housing until secure. To be on the safe side you can also use the clamps in addition to secure the hose.
8. The Y-piece out of the capillary kit can be used to fit in directly behind the drain. The upper open end can then be used as an inlet for the waste capillaries coming from the 819 Valve Actuator.
9. 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. Is the customer going to use either DMSO or Chloroform, it is recommended to use special connectors, which will have inert Kalrez O-rings.

Note! Make sure the waste bottle is placed in a location that is lower than the instrument bed of the liquid handler and the that the waste hose will not build a knee, but will always descend.

Rack Setup *2.9*

The 215 Liquid Handler is equipped to locate code 200 racks. See ***"Replacement Parts and Accessories" on page 57*** for a list of racks available for the liquid handler.

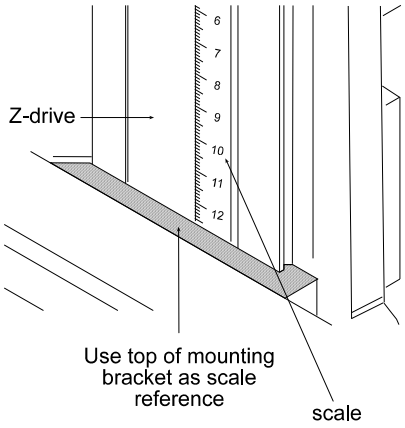
Depending on the racks you're using, refer to the appropriate procedures below.

Code 200-series Racks

1. If all your racks are code 200-series, place them directly onto the locator plate:
2. Orient the rack so that the code number or bar code support plate (e.g. 216) is facing forward.
3. 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.

Note! The Washing Rack (211, 304B or 306B) is always in the very left position on the 215 working bed. Its function is for cleaning and washing procedures and the software is expecting it in the first holder position. Using the closed injection port solution will give this position free for placing a sample rack.

Final Z-Drive Adjustment *2.10*



Follow these steps to adjust the Z-drive to the proper height:

1. Move the arm to the center of its working field.
2. Loosen the mounting screw on the Z-drive mounting bracket until the Z-drive can slide up and down. Refer to ***"Z-Drive Installation" on page 21*** for location of the mounting bracket, if necessary.
3. Slide Z-drive and adjust to proper height. The Z-drive should be set at a height of 125. Use the supplied cylindrical distance tube to adjust the proper height. Slide the mounting bracket to the front and place the distance tube directly underneath it. Turn the Z-drive into the mounting bracket and let it stand on the tube.
4. Tighten the screw on the mounting bracket until the Z-drive is secure.

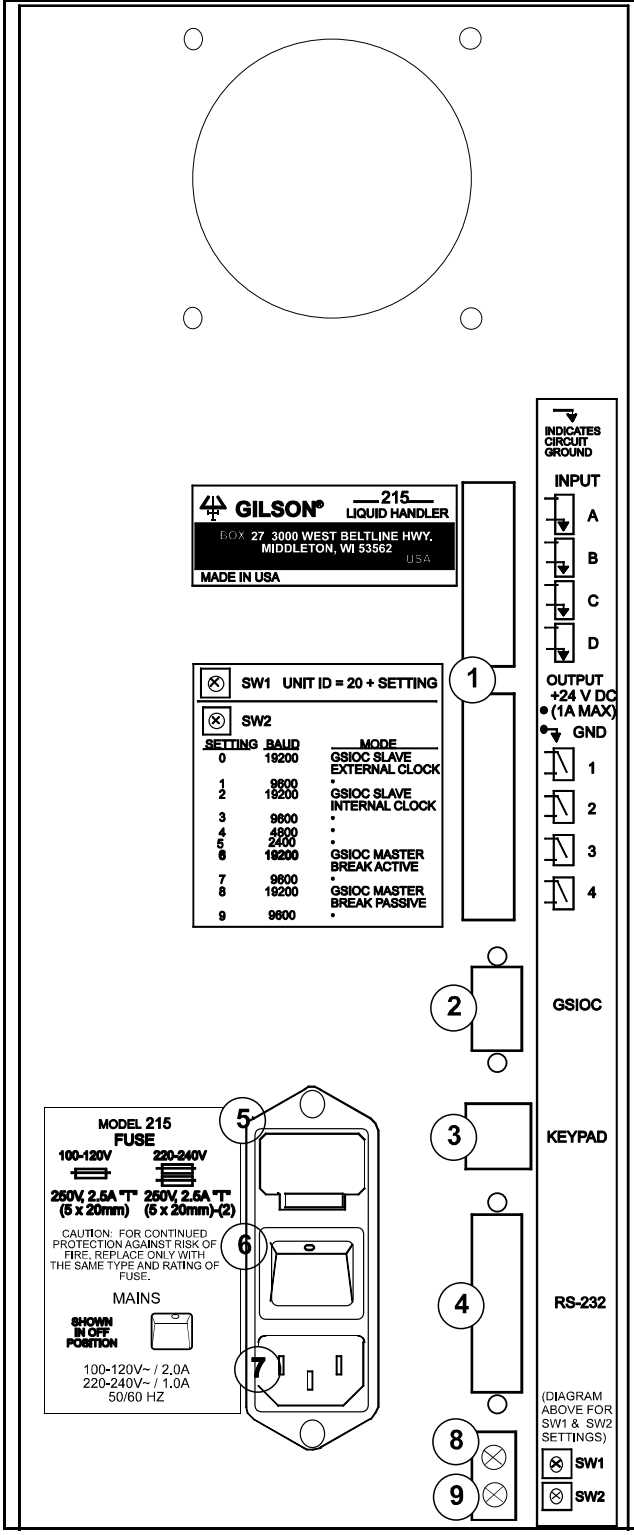
Note! Be aware that with the bar code reader the delivered distance tube for 127 should be used to ensure the proper use of the 205B code racks.

Note! Changing the height will impact the entire system and has to be set in the hardware configuration in the BEST-NMR software to the proper value.

Note! Be aware that for the use of cooling racks the delivered distance tube for 175 should be used to ensure the proper use of the 205B code racks.

Electrical Connections *2.11*

Rear Panel Connections *2.11.1*



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 input socket
8. Unit ID selector (pos. 2)
9. Baud rate/mode selector (pos. 6)

Input/Output ports:

You can use the input and output contacts found on the rear panel of the liquid handler to control peripheral devices.

Contact inputs:

The input barrier strip of the liquid handler has 8 connections. 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 5 V DC to an input. When using TTL signals, be sure to match GROUND connections.

Contact Inputs/Outputs

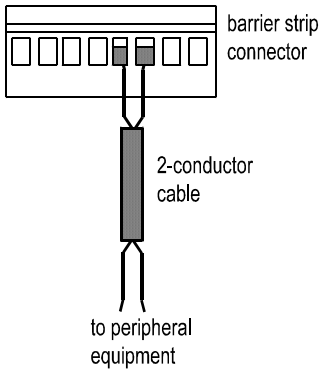
- The output barrier strip has 10 contacts.
- Pins 1 and 2 supply a +24 V DC output.
- Do not use this output unless the receiving device can accept 24 V power.
- Pins 3 through 10 are paired, isolated-relay contact closures and are labeled 1, 2, 3, and 4.

Items you'll need:

To make connections, you'll need the following:

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

Making Connections



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

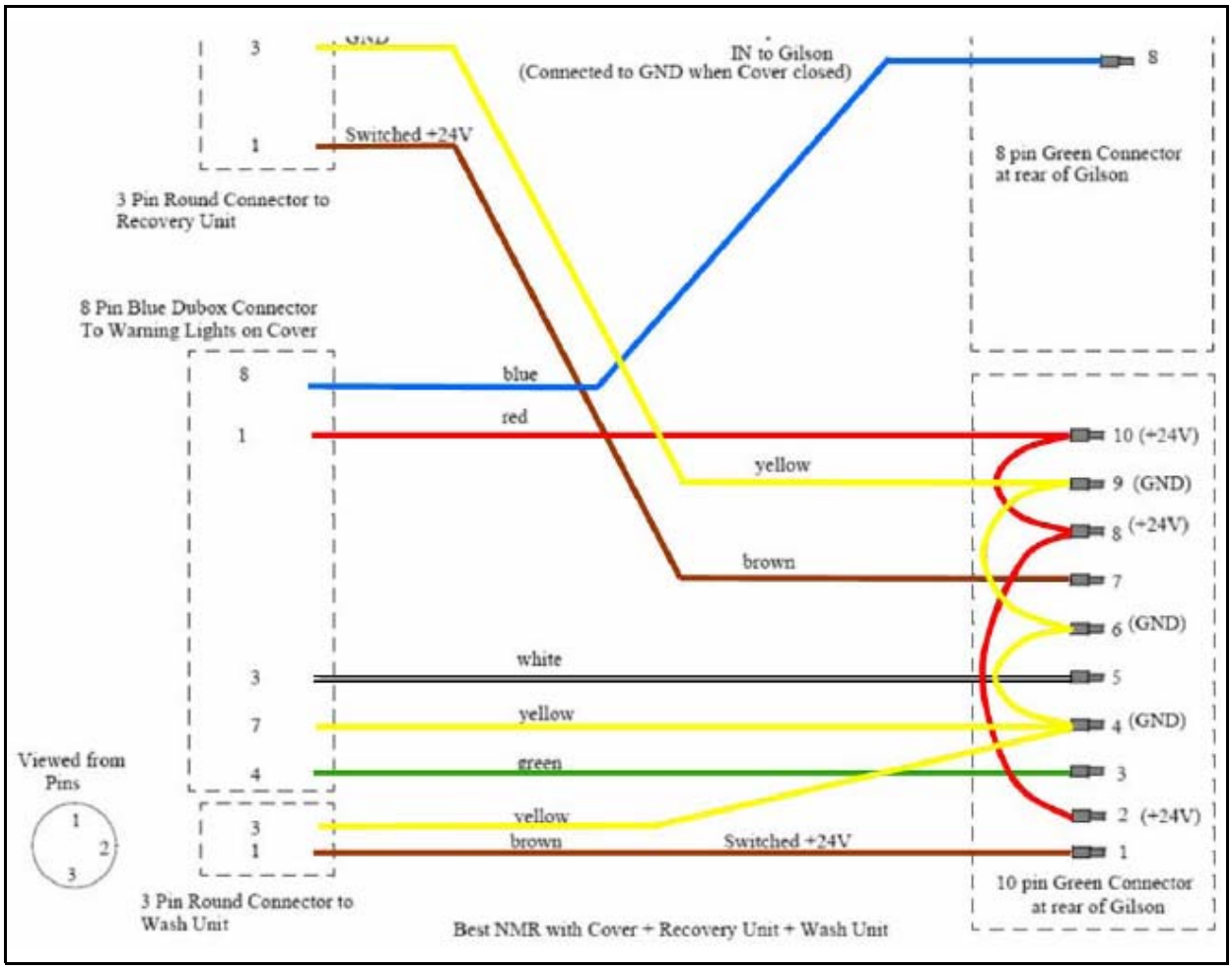
1. Cut the cable into pieces of appropriate length.
2. Strip about 0.25 cm of insulation from each end of the cable.
3. Remove the barrier strip from the liquid handler.
4. Insert each wire into the appropriate slot on the barrier strip.

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

   Push the wire all the way in; then tighten its corresponding pin screw.
5. Re-connect the barrier strip 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 barrier strip in as far as it will go. It is designed to fit snugly into its receptacle.
6. Connect the opposite ends of the wires to the other device(s). Be sure to match ground connections.
7. Label each cable to identify the purpose of the connection.

Usage of TTL Connectors (hood, gas switch)



RS-232 Port *2.12*

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 ***"Rear Panel Connections" on page 33***.

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. Use the Bruker cable #HZ100144. Is this cable to long, you can also use the RS-232 a cable available from Gilson and your local computer store.

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

Attach the other end of the 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.

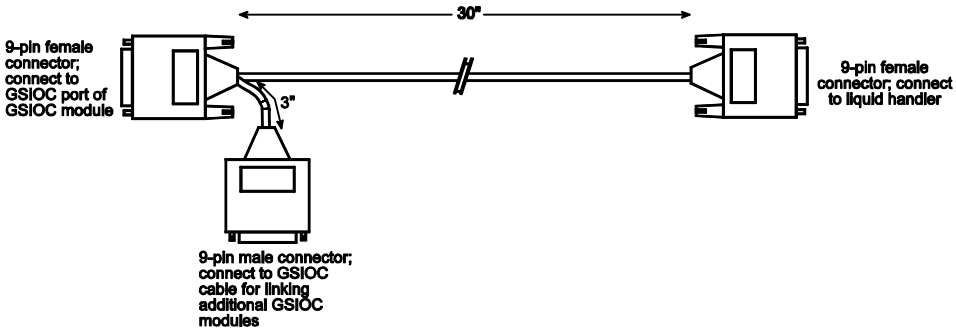
GSIOC Port 2.13

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).

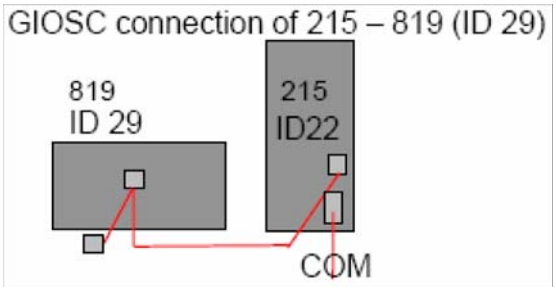
The liquid handler can convert the RS-232 signal levels used by computers to the RS-422/485 signal levels required by the GSIOC and vice versa.

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.

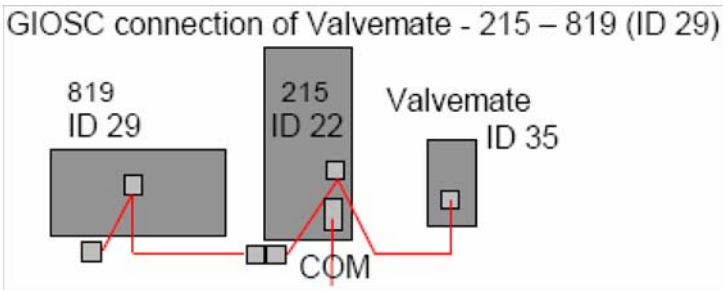


Insert the female connector, (refer to the above diagram), into the GSIOC port of the liquid handler. Tighten the retaining screws (Gilson Part # 36078143).



GIOSC Connection for BEST – NMR 2.13.1

GIOSC connection for BEST – NMR with solvent changing valve (Valvemate).



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. The figure above shows you the connection of the BEST – NMR setup

Unit ID and Baud Rate/Mode Selection 2.13.2

Use the SW1 selector to choose a different unit ID and the SW2 to choose a different baud rate/mode. The standard setting for SW2 is 6. If necessary, refer to the diagram on page 21 for the location of these selectors.

Note! Switch off the system before changing any settings.

Unit ID

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

At the factory, the 215 unit ID is set to ID 22. There is no need to change this number unless it is the same as that assigned to another Gilson device that's also connected along the GSIOC. The 819 with the injection port has to be set to ID 29.

To change the unit ID

1. Switch off the system.
2. Gently insert a small flat blade screwdriver into the SW1 selector on the rear panel and turn it.
3. Align the white dot with one of the indicated numbers. The unit ID is 20 plus the selected number. This is valid for the 215 liquid handler and the 819-valve actuator. The ID for the Valvemate actuator is set via software.

Baud Rate/Mode *2.13.3*

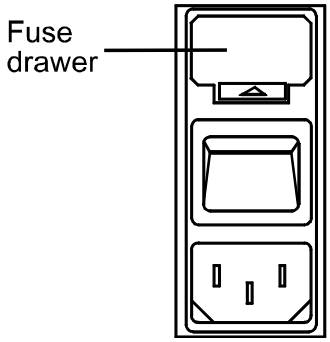
As a default, the baud rate/mode is set to 6, indicating that the liquid handler is set for a baud rate of 19200 and is a master device.

Ordinarily, this selection will not need to be altered.

To change the baud rate/mode, proceed as above:

Fuses *2.13.4*

You may have received the liquid handler without any fuses installed. Depending on your local voltage mount the 110V or 230V fuse drawer.



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 2.5 A “T” Slo-Blo fuse (5 x 20-mm size) fuses.
3. Install the fuse(s) into the fuse drawer. The fuse drawer for 100/120 V accepts one fuse. The fuse drawer for 220/240 V accepts two fuses.
4. Insert the fuse drawer into its receptacle in the liquid handler. See ***"Rear Panel Connections" on page 33***.

Power Cord Connection *2.13.5*

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.

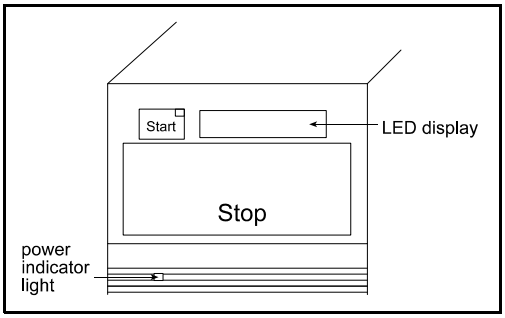
The system is delivered with a set middle European and USA standard power cable.

System Start-up 3

The BEST-NMR 215 Liquid Handler is controlled via the supplied serial cable (Bruker # HZ10144/A).

Front Panel 3.1

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. Pressing the Start button will not resume the currently running program unless instructions were included in the program to do so.

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 so sensitive 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 ***"215 Liquid Handler Error Messages" on page 49***, for a list of current error codes and required actions.

Power Indicator Light

This indicator lights when you turn on power to the liquid handler using the power switch on the rear panel. Refer to the rear panel diagram on page 25 if necessary.

Start-up *3.2*

To start the liquid handler:

1. Make sure the liquid handler is connected to a power source.
2. Turn on the liquid handler and all other devices which are connected using the power switches located on the rear (refer to ***"Rear Panel Connections" on page 33*** if necessary.) The power indicator light on the front panel becomes lit.
3. When power is turned on, the liquid handler beeps and displays the current version of its installed firmware. This message appears for about 1 second before the LED display returns to a blank state. (If starting the flow injection program refer to BEST software manual)
4. 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. (to guarantee correct functioning, the firmware should be at least 2.1 or higher
5. 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 1 minute to complete.
6. 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. Switch the power off and on again.
7. If necessary, use the utility and example programs supplied with the liquid handler, in order to home the instrument.

Configuring the Liquid Handler *3.3*

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 final configuration will be set with the BEST-NMR program. Please use the following instructions of the BEST software manual.

Maintenance 4

To obtain optimum performance and maximum life from the 215 Liquid Handler, it is important to keep the instrument well maintained.

This chapter contains some general guidelines that will help you to maintain your liquid handler.

Helpful Hints 4.1

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

- Change or clean the piston seals and tubing regularly in a monthly turn, to maintain maximum dilutor performance.
- Do not run the dilutor without fluid. Doing this causes excessive piston seal wear.
- 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 dilutor valve fitting.
- Wipe up all spills immediately. DMSO will destroy the lacquer coating the metal parts of the 215.
- Cold fluids may cause leakage; warm fluids to room temperature before running them through the system especially DMSO.

Cleaning 4.2

Cleaning the Liquid Handler

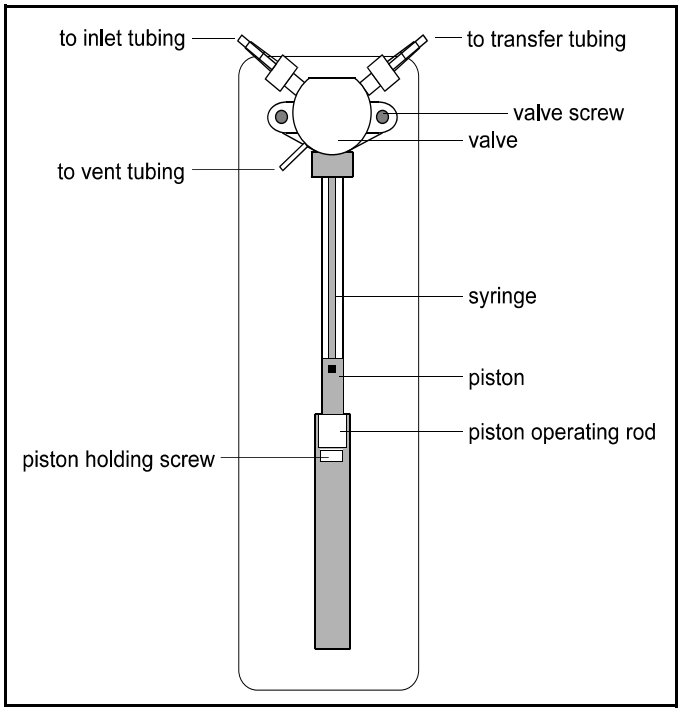
The liquid handler should be cleaned occasionally using a dry, clean cloth. Or, if necessary, use a cloth dipped in soapy water. If liquid is accidentally spilled on the liquid handler, wipe the instrument using a dry, clean cloth.

Cleaning the Syringe

If your liquid handler is equipped with a dilutor, 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.



Removing the Syringe

1. Unscrew the syringe piston holding screw.
2. Start the BESTADM Test Tool and press Lower Piston.
3. Disconnect the syringe piston from the piston-operating rod by unscrewing the piston holding screw on the underside of the rod when the prompt Install new syringe now appears.
4. Remove the two screws securing the valve to the dilutor and then remove the valve and syringe assembly.
5. 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.

Re-installing the Syringe

When the syringe is clean, re-install it:

1. Lubricate the piston with diluent in order to reduce friction on the piston seals during re-installation.
2. Loosely screw the syringe into the valve. Do not fully tighten.
3. Loosely attach the valve with its screws to the dilutor.
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 “Home Dilutor” to drive the piston rod to its upper position and tighten the screw.

Cleaning the Fluid Path

Depending upon your use of the liquid handler, it may be necessary to flush the entire fluid path. The following procedures use the PRIME command out of the BEST-NMR program. Start “bestadm” program in XWINNMR and open the test page. (Please refer to the BEST Software Manual how to set up BEST-NMR)

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

1. If necessary, place the dilutor’s inlet tubing into a beaker containing distilled or deionized water. Check the beaker during the priming sequence to ensure it always has liquid in it.
2. Press the PRIME button.
3. Inspect the dilutor for leaks.
4. Wipe up all spills on and around the dilutor immediately.

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. Place the dilutor’s inlet tubing into a beaker containing a weak detergent solution.
2. Start PRIME and pump until the entire fluid path has come into contact with detergent.
3. After 30 minutes, remove the inlet tubing from the detergent solution and immerse it in a bottle containing distilled or deionized water.
4. Continue the priming sequence and pump the remaining detergent from the syringe and tubing into a waste container.
5. You might repeat the priming step several times to succeed.

Acidic and Basic Compounds

Follow this procedure if the fluid path is in contact with acidic and basic compounds:

1. Place the dilutor's inlet tubing into a beaker containing 0.1 N NaOH.
2. Start PRIME and pump until the entire fluid path has come into contact with 0.1 N NaOH.
3. After 10 minutes, remove the inlet tubing from the 0.1 N NaOH and immerse it in a beaker containing distilled or deionized water.
4. Continue the priming sequence in PRIME Continue to prime until the fluid path has been flushed with water.
5. Place the dilutor's inlet tubing into a beaker containing 0.1 N HCl.
6. Press PRIME to continue the priming sequence. Continue to prime until the fluid path has been flushed with 0.1 N HCl.
7. After 10 minutes, remove the inlet tubing from the 0.1 N HCl and immerse it in a beaker containing distilled or deionized water.
8. Press PRIME to continue the priming sequence. Continue to prime until the fluid path has been flushed with water.
9. You might repeat the priming step several times to succeed.

Biological Fluids

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

1. Make a solution of 10% bleach by adding one part of commercial bleach to nine parts of water.
2. Place the dilutor's inlet tubing into a beaker containing the bleach solution.
3. Start PRIME and pump until the entire fluid path has come into contact with bleach.
4. After 30 minutes, remove the inlet tubing from the bleach solution and immerse it in a beaker containing distilled or deionized water.
5. Press PRIME to continue the priming sequences and pump the remaining bleach solution from the syringe and tubing into a waste container.
6. Prime the fluid path a minimum of 10 cycles with distilled or deionized water.
7. You might repeat the priming step several times to succeed.

Cleaning the Valve

Clean the dilutor's valve with a non-abrasive 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.

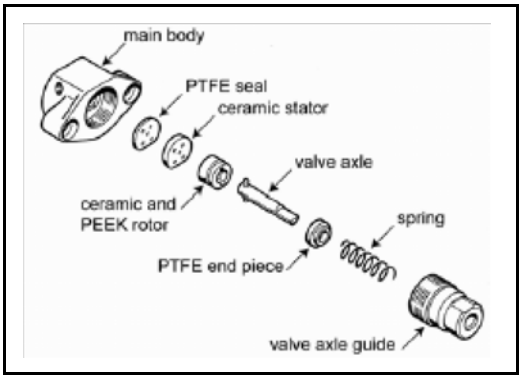
Removing the Valve

To clean the valve, first remove it from the dilutor:

1. Disconnect the inlet, transfer and vent tubing from the valve.
2. Disconnect the syringe from the valve and remove the valve from the dilutor as described on page 31.

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 Re-installing

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. Re-assemble the valve parts by reversing the above procedure.
3. Re-install the syringe and valve by following the instructions in the next section.

Replacing Parts *4.3*

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.

Removing the Syringe

1. Use the bestadm menu to lower the syringe.

2. Select the MOUNT to lower the syringe piston. This causes the XYZ-arm to move to the rinse station and the dilutor's piston operating rod to descend as the dilutor aspirates from the reservoir. The dilutor will stop in the middle 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.

3. Remove the screws attaching the valve to the dilutor and remove the valve and syringe.
4. 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 dilutor 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 dilutor will re-initialize with the new syringe.

Note: If you installed a new syringe of a different size to the one you replaced, you need to run "bestadm" – "hardware" setup and change the syringe size.

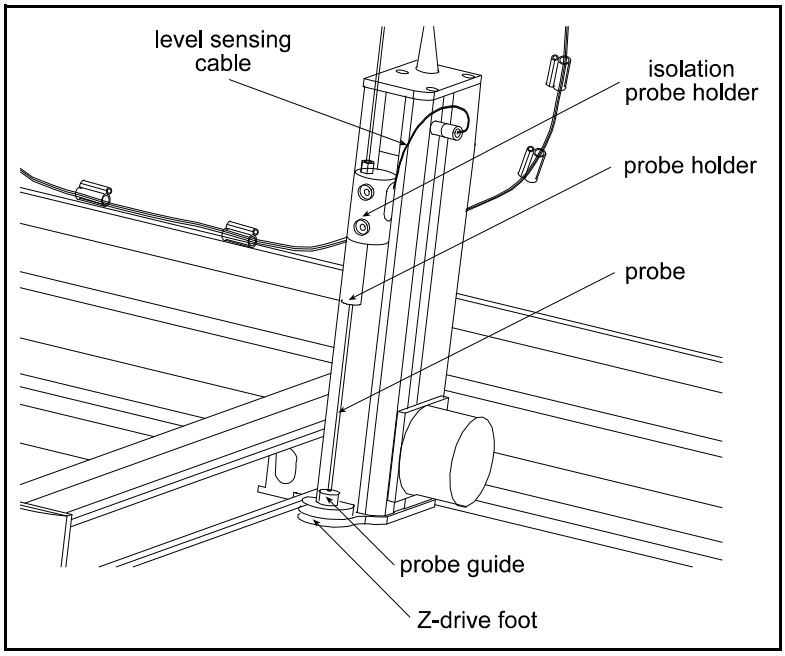
Replacing the Valve

To replace the dilutor's valve, follow the instructions below. If necessary, refer to the dilutor diagram in the section ***"Cleaning the Syringe" on page 42***.

1. Disconnect the inlet, transfer and vent tubing from the valve.
2. Disconnect the syringe and the valve from the dilutor. Refer to the procedure for replacing the syringe
3. Re-install the syringe and the replacement valve. Refer to the procedure for mounting new syringe, above.
4. Re-connect the inlet, transfer and vent tubing to the newly installed valve.
5. Press the "Start" button at the 215 to home the hardware

Replacing the Liquid Handler Probe

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



Installing Same Type

To install a replacement probe of the same type that's currently

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.

Note: Be aware that different types of probes will need also the corresponding Gilson Probe Holder/Guide Kits. Details are listed in the Gilson catalog.

Installing Different Type

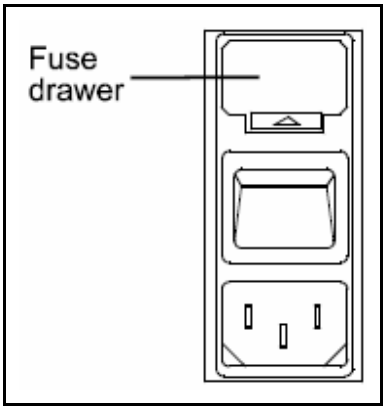
To install a replacement probe of a different type to that currently installed, you'll need to obtain a probe kit. Each kit includes a probe guide, probe holder, and probe.

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-head 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.

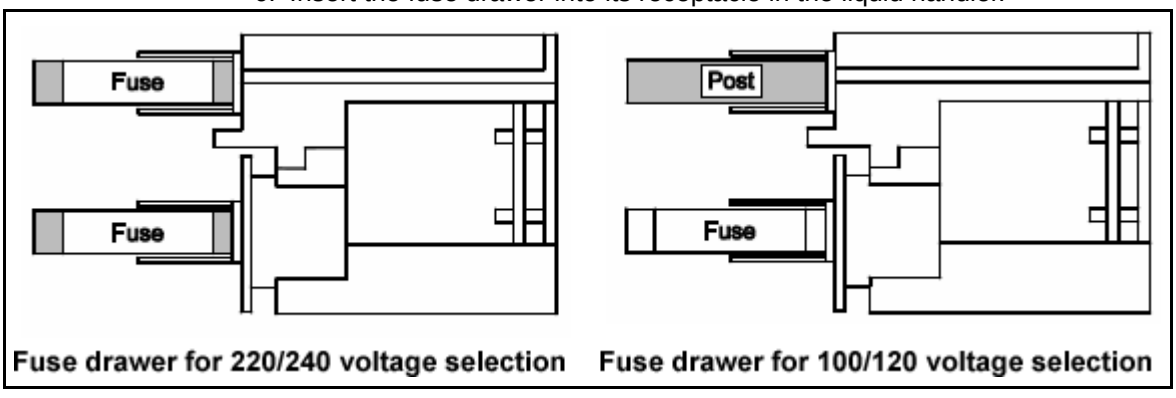
Replacing a Fuse

A blown fuse may indicate another problem in the instrument. If the replacement fuses blow, don't try others. Contact your local representative. **Note**: Before calling us please read the section ***"Repair and Return Policies" on page 53***.



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 ***"Rear Panel Connections" on page 33*** if necessary.
3. Insert a small screwdriver into the notch next to the fuse drawer.
4. Twist the screwdriver to open and remove the fuse drawer. The fuse drawer contains one 2.5 A "T" Slo-Blo fuse (5 x 20-mm size) for a 100/120-voltage selection. It contains two 2.5 A 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.



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. Re-install the armlock (see ***"Armlock Removal" on page 20***) and always lift the liquid handler from the base.

Troubleshooting 5

Electrical 5.1

Unit Completely Dead

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

Unit Blows Fuses

Contact the Bruker service department.

LED's Flashing on Front Panel

Check that a valve is installed.

Input and Output Functions Not Operating

- 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 Ø activates).
- Output from valve actuator should be compatible with device to which it is interfaced. Outputs are contact closures.
- Confirm that source supplying input to valve actuator is working.

Error Messages at the 215 Display 5.2

215 Liquid Handler Error Messages 5.2.1

A number of error messages may appear on the 215 front panel display either during system initialization or during a run. Refer to the following error message list to determine what action to take when an error message appears.

No.	Error Description	Possible solutions
10	Invalid Pump Type.	Run SET_215.EXE to correct problem.
		If this fails (and the SET_215 program appears to run correctly,) it most likely indicates a NV-RAM problem. The NV-RAM is socketed, and can be replaced. After NV-RAM replacement, the NV-RAM must be re-initialized and the alignment program, CORRECT.EXE must be run to assure best accuracy. It would be best to upgrade the PROM to the current rev level while replacing the NV-RAM. If this fails, there is likely a problem with the main electronics board. See ‘Main board replacement’ section.
11	Undefined syringe size.	Run SET_215.EXE to correct problem. If this fails, it most likely indicates a NV-RAM problem. See possible solution for Error 10 to handle suspected NV-RAM failures.
12	Pump not found.	This can be caused by an incorrect pump type. Check the pump type by running SET_215.EXE. This can also be caused by a loose cable. Turn off power to the unit, open the side panel, and check that the cables are properly and tightly connected. Removing and reseating the connectors on both ends (with power off) is recommended. If the cable connections are good, and the pump type is correct, the dilutor module itself may be malfunctioning. There are no field serviceable sub-assemblies in the dilutor module; the entire module should be replaced.
13	Syringe speed out of range.	Correct user program error.
14	Invalid syringe volume.	Correct user program error.
15	NV-RAM checksum is invalid.	The contents of the NV-RAM may be scrambled. This could be caused by a static discharge on the serial cable, power spike, or some other accident. First try to wipe the NV-RAM and reprogram by using CORRECT.EXE and SET_215.EXE. If this fails to restore proper operation, see the method for handling suspected NV-RAM failures under error 10.
16	X scale factor is invalid.	Rerun CORRECT.EXE. If this fails, try to wipe NV-RAM and rerun CORRECT.EXE. If this fails, then proceed with method for handling suspected NV-RAM failures in error 10.
17	Y scale factor is invalid.	See method for handling error 16.
18	Z scale factor is invalid.	See method for handling error 16.

20	X motor position error.	Cycle power to unit. If this does not clear the problem, or if the problem returns, it most likely indicates one of three problems: • Binding in the X axis mechanics can be found by moving the Y-arm over its full range of travel, with the power off. (Note: Do not move the arm too quickly, or potentially damaging back-EMF may be generated in the stepper motors, blowing out the driver chips.) If a sticky or rough spot is found in the travel, see if there is a mechanical problem at that location that can be cleared (e.g. paint that can be scraped off of the bearing area). If the motion problem can't be resolved, contact Customer Service. The X-axis is hard to service in the field. • Belt tension could be a problem, although is it very rare with the belts used in the 215 (Kevlar fiber). Check that there is correct tension in the belts: use GSUTIL to move the arm to the mid-point of the X travel (buffered X command). Then, with the motor still powered, move the arm toward the pump end, and check that the sprocket moves, rather than having the belt jump the sprocket. • A fault with the X axis position encoder could be the problem. If the encoder is the problem, check first that the cables are seated properly. With the power off, remove and re-connect the X axis encoder connector. If this fails to fix the encoder problem, replace the motor/encoder assembly.
21	Y motor position error.	Cycle power to unit. See the method for handling error 20.
22	Z motor position error.	Cycle power to unit. See the method for handling error 20, except note that the Z-drive has no encoder, only a limit sensor. Also check that the Z-drive cable is secure, unplug and reconnect with the power off, making sure the connector snaps back into the socket with a click.
24	X target less than minimum X.	Correct user program error.
25	X target more than maximum X.	Correct user program error.
26	Y target less than minimum Y.	Correct user program error.
27	Y target more than maximum Y.	Correct user program error.
28	Z target less than minimum Z.	Correct user program error.
29	Z target more than maximum Z.	Correct user program error.
30	X encoder inactive.	Check that the cable is seated properly. With the power off, remove and re-connect the X axis encoder connector. If this fails to fix the encoder problem, replace the motor/encoder assembly.
31	Y encoder inactive.	See method for handling error 30.
32	Z position sensor inactive.	Check that the Z-drive cable is secure, unplug and reconnect with the power off, making sure the connector snaps back into the socket with a click. If failure continues, replace the Z-drive board assembly located in the Z-drive.

33	Safety contact activated.	Release contact, restart. If contact is not shorted, check the status of the safety contact configuration with the SET_215.EXE program.
34	X home phase is invalid.	Run SET_215.EXE to correct problem. If the home phase wanders too much during the home phase definition part of the program, (more than +/- 5 counts,) something is not right with the mechanics. Some possible problems are: slipping of the sprocket collar, or junk on the face of the X-car where it touches the left hand support (inside the enclosure.) Clean the face of the car and the side plate, or try to jiggle the Y arm side to side while the motors are locked to determine the source of the problem.
35	Y home phase is invalid.	Run SET_215.EXE to correct problem. See method for handling error 34 if this fails.
36	X and Y home phases are invalid.	Run SET_215.EXE to correct problem. See method for error 34 if this fails.
39	Gilson m402 not initialized prior to use.	Correct user program error.
40	Gilson m402 invalid valve position.	This is caused by either the valve stem not turning properly, or the valve encoder not registering properly. Try operating without a valve. If that fails, you will probably need a new pump module. If it works check the valve assembly for smooth operation (follow procedure to clean the valve in Section 4 of the 215 User's Guide). If bad, replace valve.
41	Gilson m402 valve missing.	Contact the responsible Bruker Customer Service
42	Gilson m402 undefined valve command.	Contact the responsible Bruker Customer Service.
43	Gilson m402 valve communication error.	Contact the responsible Bruker Customer Service
44	Gilson m402 valve unit busy.	Contact the responsible Bruker Customer Service.
45	Gilson m402 plunger overload.	The piston may be operating at an excessively high speed, generating too much back-pressure. Try reducing the speed (flow rate) to see if this clears the problem. If this doesn't work, remove the fluid lines from the valve, and see if proper operation occurs. If it does, suspect blockage in the plumbing. If this does not work, try removing the piston and syringe, and see if it works. If it does, check for binding in the piston. If not, the 402 module must be replaced.
46	Gilson m402 syringe missing.	Replace 402 pump module.
47	Gilson m402 undefined syringe command.	Contact the responsible Bruker Customer Service
48	Gilson m402 syringe communication error.	Replace 402 pump module.
49	Gilson m402 valve unit busy.	Check for binding in the valve.

Repair and Return Policies 5.3

Before Calling Us

Bruker Service personnel will be able to serve you more efficiently if you have the following information available when you call:

- The serial number (located on the rear panel) of your valve actuator.
- 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 valve actuator and a description of those connections.
- List of other electrical connections in the room.

Warranty Repair

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

Non-warranty Repair

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

Rebuilt Exchange

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

Application Related Troubleshooting 5.4

Problem:

Air bubbles in the syringe during the aspiration of solvent out of the main bottle (or Valvemate).

Possible Reason:

- Empty bottle.
- Leakage in the connection.
- Clogged filter (clean or replace).
- DMSO at low Temperature.
- Defective dilutor valve.
- Wrong position of Valvemate.

Problem:

Two mixing phases in the syringe during the aspiration of solvent out of the Valvemate during the test procedure

Possible Reason:

- Wrong Valvemate position.
- Incomplete solvent change procedure.

Problem:

Air bubbles in the needle capillary during the aspiration of wash solvent or sample

Possible Reason:

- Aspiration speed too high.
- Clogged needle.
- Wrong capillary ID.

Problem:

Jerking movement in the needle capillary, during an aspiration step

Possible Reason:

- Older firmware (<2.30).

Problem:

Jerking movement in the needle capillary, when the needle is moving up after an aspiration step

Possible Reason:

- Clogged needle.
- Too short equilibrating time.

Problem:

Liquid drops in the outlet capillary at the dilutor valve.

Possible Reason:

- Overpressure due to high aspiration speed.
- Overpressure due to wrong valve position.
- Overpressure due to a clogged system.

Problem:

Air bubbles and ruptured liquid segments during the transfer step.

Possible Reason:

- Bad connections.
- First injection with a new solvent.

- Dispensing speed too high.

Problem:

No gas gaps visible in the transfer action when sample is entering the NMR probe.

Possible Reason:

- Aspiration speed too high.
- Gas gaps too small.
- LC- probe with a FI-Method.
- Clogged outlet.

Problem:

Solvent occurring on the top of the injection port during the transfer action

Possible Reason:

- Seal has to be exchanged.
- Wrong needle.
- Wrong seal.
- Aspiration speed too high.

Problem:

Sample position is always different.

Possible Reason:

- Leakage in system.
- Not enough sample.

Gas Gaps Too Small *5.4.1*

Problem:

Sample movement is not smooth but jerking during the transfer.

Possible Reason:

- Restriction in the pathway.
- Over pressure due to a clogged needle.
- Temperature too low (DMSO).

Problem:

Sample need several seconds to stop its movement after transfer action is finished.

Possible Reason:

- Overpressure in the outlet path.
- Speed to high.
- Gas gaps large.
- Viscosity too high (DMSO).

Problem:

- Sample keeps moving after transfer action is finished

Possible Reason:

- Leakage inside the 819 valve.

Recover Module Valve Defective *5.4.2*

Problem:

Recovery is not working sufficiently anymore

Possible reason:

- No gas flow at the Recover Module.
- Recover Module valve defective*.*
- No current to switch the Recover Module.

Problem:

Needle is hitting between the vials.

Possible Reason:

- Wrong rack code chosen.

Problem:

Needle is hitting vial bottom.

Possible reason:

- Wrong rack code chosen.
- Wrong Z-arm height (barcode).

Problem:

Needle makes a cracking noise in entering the injection port.

Possible Reason:

- Wrong needle Guide/Holder
- Wrong position of closed injection port
- Wrong Z-arm height (Bar Code)

Replacement Parts and Accessories

A

Table A.1. Replacement Parts and Accessories

Type/Included Parts	Bruker #	Gilson #	Comment
Gilson Liquid Handler 215	69401	2510121G	Generic
819 Valve Actuator	69407	251511G	Generic
7000L Rheodyne Valve	84414	3303430	Mounted
Injection Port	84421	2954640	
Septum Piercing Needle 1.5 mm	84536	27067376	2x
Probe Holder/Guide Kit f. Top Entry Needle	I20446	253643	
Spare Seal 1.5 mm	84540	2954674	2x
Deep Pocket Rinse insert	84419	25245533	
Dilutor Syringe 5ml	69403	25025344	
Rack Code 211	HZ13020	---	
Control Cable	HZ10144	---	
Capillary Set (Version November 2001)	H9336	---	
BEST Closed Injection Port	HZ06807	---	
**Rack Code 216 + 4ml Bottles	H9467	2504616	
**Rack Code 209 + 2ml Bottles	H9466	2504609	
**Rack Code 205 + 96 Well Plates	H9465	--	
BEST Installation Guide / Software Manual	H9330	---	
BEST-NMR Calibration Kit	H9643		
Wash Switch Valve	HZ10067	---	
Gas Switch Valve	HZ10068	---	
Inline Check Valve 1bar	86714	---	
Upgrade Set for BEST under XWINNMR 3.1	H9770	---	

** Depending on the option

Table A.2. Additional Parts

Part Description	Bruker #	Gilson #
BEST Safety Hood	HZ08142	---
BEST Temperature Controlled Transfer with 2.5 m Capillary (complete)	W1209598 Var.0	---
BEST Temperature Controlled Transfer with 1.5 m Capillary (complete)	W1209598 Var.1	---
BEST BVT3000 Controller (with two controlling circuits)	W1101266	---
BEST Transfer Capillary 2.5 m	W1209791 Var.0	---
BEST Transfer Capillary 1.5 m	W1209791 Var.1	---
BEST Valvemate Solvent Changing System (equipped with 4 bottles)	H9619	331051G + 33035424
BEST Valvemate Capillary Set + 4 x Bottles 1l	H9618	---
BEST Gilson Barcode reader (compl.) (SampleTrack requested)	H9545	---
BEST-NMR Calibration Kit (dyes for H_2O,CH_3OH, CHCN and $CHCL_3$)	H9643	---
BEST Fitting Set Gilson 215 (precut capillaries and fittings for Gilson 215)	H9436	---
LC-NMR / BEST NMR Capillary Service Set	H9495	---
Serial Cable 10m Gilson – NMR (direct control)	HZ10144	---
Septum Piercing Needle 0.8mm ID 1.5mm – Top Entry - Vented	84536	27067376
Septum Piercing Needle 0.8mm ID 1.3mm – Top and Side Entry – Vented	84535	2507235
Probe Holder / Guide Kit 1.5mm	84537	253643
Probe Holder / Guide Kit 1.3mm	69404	253640
Injection Port Seal for 1.5mm Probe	84540	2954674
Injection Port Seal for 1.3mm Probe	84539	250510153
Cooling Rack controller 85x for up to five Cooling Racks	85309	2505850
Cooling Rack 843 for 2ml vials (13x35)	85306	2504853
Cooling Rack 842 for 96 Deep Well (Ritter / Riplate)	85307	2504854
Cooling Rack 526 for 1.8ml Cryo Vials - Gilson Rack Code	85557	MRACK526
Rack Heightener for Rack 200 series	85312	
Waste Bottle 2l + Cap with Connector	85183 85182 85289	23077310 23077314 23077332

Table A.2. Additional Parts

Level Sensor Receiver (for up to 10 Sensors)	85310	Under development
Level Sensor positive (Waste Bottle)	(85311)	Under development
Level Sensor negative (Solvent Bottle)	(85311)	Under development
Rack 304B complete with bottles	H9697	---
Rack 306B complete with bottles	H9698	---
Bottle 150ml for Rack 30x	84756	---
Bottle 500ml without Connector for Rack 30x	85757	---
Bottle 500ml with connector for Rack 30x	84754	---
Bottle Cap for Rack 30x	84758	
Bottle Septum for Rack 30x	84757	---
Capillary Set for Rack 30x	H9696	---
Vials 2ml 13x 35 for Rack 209 (100/pck) + Caps + Septum	36680 36724 36766	---
Cryo Vials 1.8ml for Rack 526 (100/Pck) + Caps + Septum	85372	---
96 Well Plate 1ml (Ritter - Riplate)	68964	
Mat for 96 Well Plates 1ml	n.a.	---
96 Well Plate 2ml	68966	---
Mat for 96 Well Plates 2ml	68965	---
Vial 4ml 17x45 for Rack 216 (100/Pck) + Caps + Septum	68333 68337 68340	---
Bottles Type Boston 125 ml for Rack 211 + Caps + Septum	84599 84600 84601	---

Injection Port and Switch Valves

B

Closed Injection Port B.1

(Bruker Ord. # HZ06807)

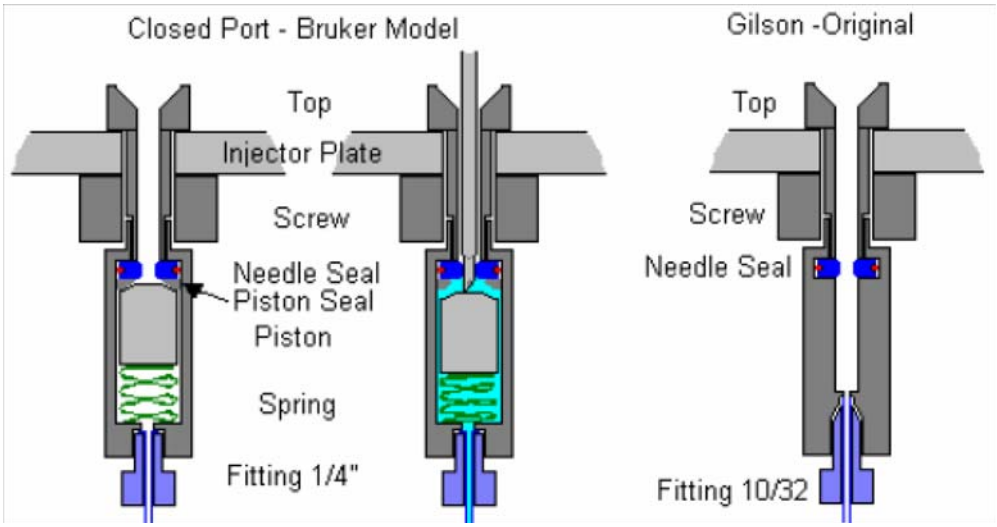


Figure B.1. Injection Port

With every BEST System, in addition to the Gilson Injection port, a Bruker designed “Closed Injector Port” is included. The advantage of this device is minimal leakage of solvent and that the flow path to the NMR probe is always closed.

A further advantage of such a design will be that to provide inert gas for the gas gaps and solvent for heading and cleaning liquid gaps. In this case we are not limited to the bottle sizes fitting in a Gilson Rack. Now you can connect also 2 l or 5 l bottles. The software version 3.1 and higher will support this feature.

Customer experience shows that after approximately one year of use, the piston seal is worn and must be replaced.

The installation should be done always in the following steps:

1. Mount top through injector plate (always the far left hole)
2. Fix it with the screw (hand tight or use the wrench and large screw driver)
3. Check there is no play
4. Mount the lower part and tighten it with the wrench
5. Connect the capillary (be aware it is a different fitting (1/4” flangeless))

If you have to change the needle and/or the piston seal and you don't want to damage the needle seal, you might use a thin needle (< 0.8 mm OD) to push everything out through the top in leading the needle through the lower fitting hole.

Be aware that the tiny spring might be lost easily during this action.

In many cases you can continue your work by turning the seals upside down. However, it is better and safer to exchange them with new ones.

BEST Gas Switch Valve *B.2*

(Bruker Ord. # H10067)

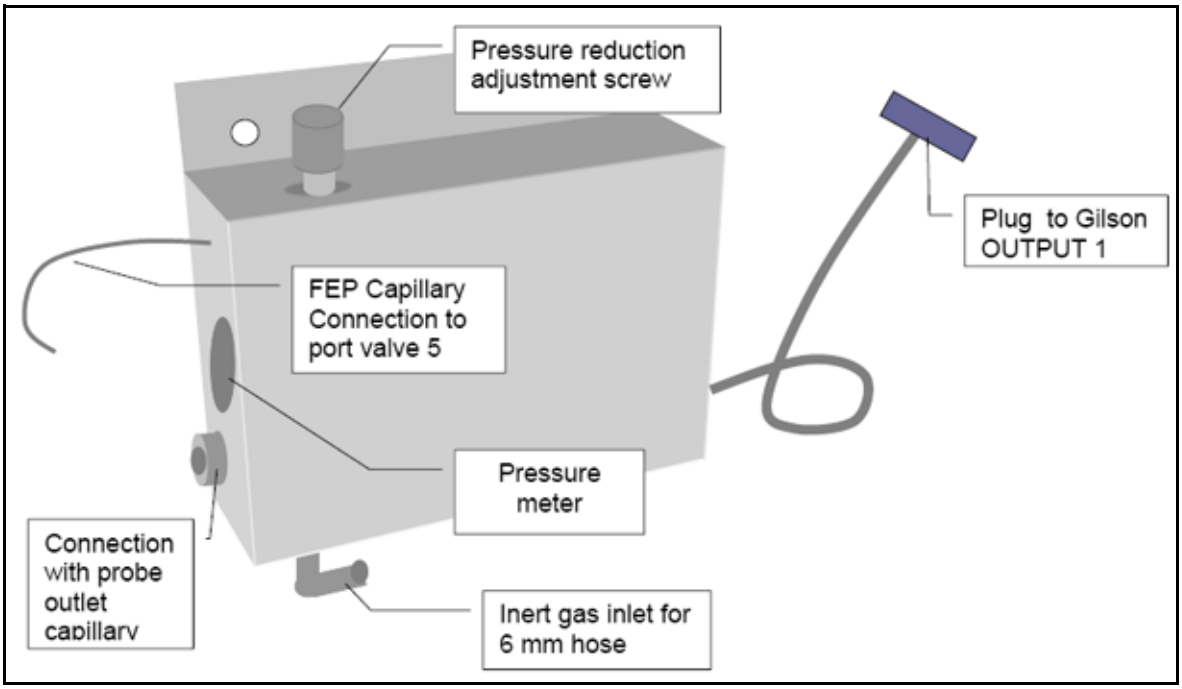
Description

For obtaining reproducible results in sample recovery using Syringe Mode this module is highly recommended .The gas switch valve can be mounted on the right hand side of the 215. You can use the same screws used for fixing the injection port plate.

It is recommended to adjust the gas pressure to < 5bar (< 35 psi).

The control of the module is possible with BRUK_XL version 990218 and higher.

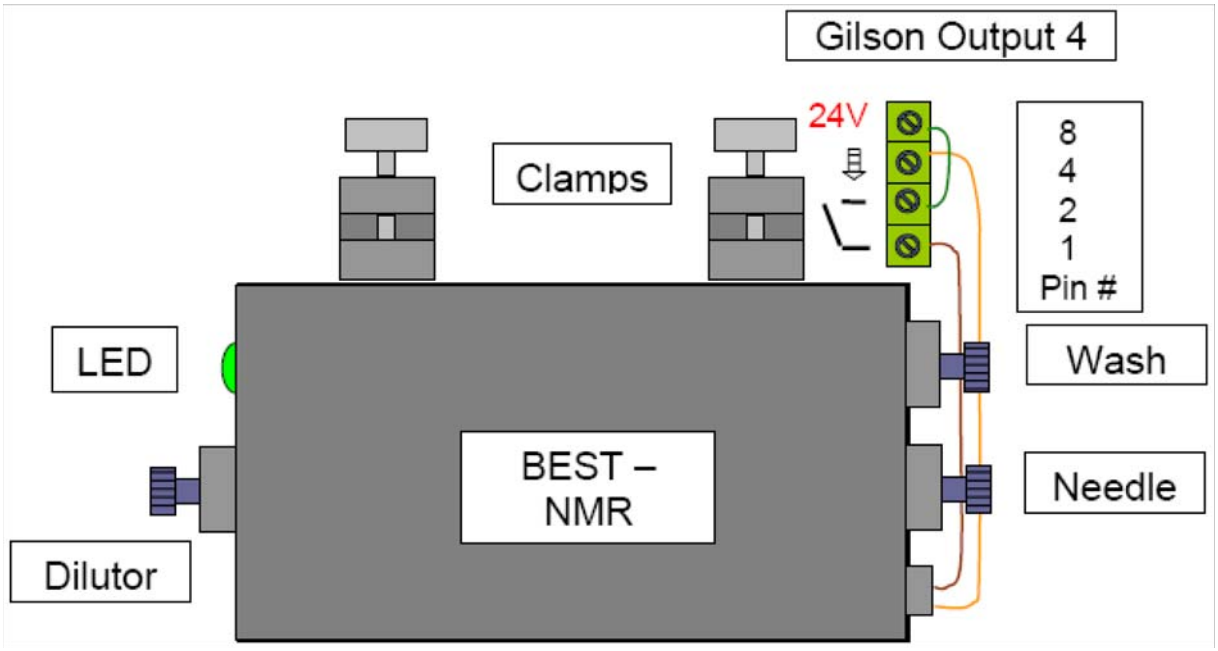
For installation with the Temperature Controlled Transfer Capillary, the back plate has to turned so that the mounting holes are placed under the module. In this position both parts, the recover module and the TCTC hose holder, can be secured with the two screws holding the injection port in place.



(Bruker Ord. # H10068)

Description

To speed up the washing action and to improve the washing efficency a new device called the “Washing Switch Valve” was introduced. It should be mounted directly behind the dilutor pump 402.



The Wash Module will be mounted with its clamps to the metal rod on the upper right side of the 215.

With tightening of the clamps it will be fixed to its position.

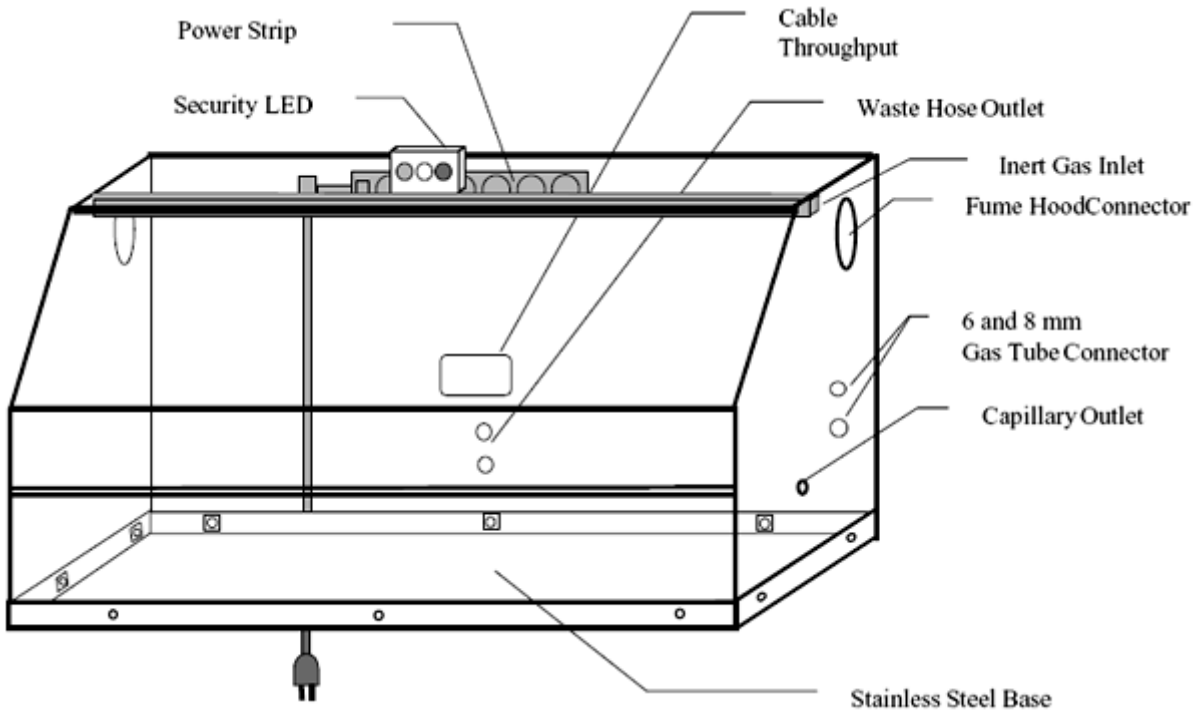
The “Dilutor” capillary will be mounted to the right outlet to the 402 dilutor valve.

The “Needle” outlet will be connected to the 215 probe.

The “Wash” outlet should go to the 819 port 4.

The electrical connection will be I/O output 4 on the backside of the liquid handler.

(Bruker Ord. No. HZ06623)



Safety Precautions **B.4.1**

- For safe and correct use of this hood, it is recommended that both operating and service personnel follow the instructions contained in this guide when performing installation, cleaning and maintenance.
- If dangerous liquids are used, adequate protection such as proper ventilation, safety glasses, etc., should be used.
- Always switch power 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.
- The hood is equipped with a safety power off door switch with green/yellow/red LED indicators to increase security The control of the LED is done via the Input/Output option from the 215.
- Use the distance piece in the right front corner of the hood for correct placement of the 215. This will prevent the potential for interference of the Gilson Z-arm with the door.
- Avoid direct contact of organic solvents with the hood surface.

Unpacking

The fume hood is delivered with all major components already assembled except for auxiliary parts such as legs, security lights, fume hood adapter, etc.

To Install the Fume Hood

- Open the box at the top and the front.
- Lift the unit off the box and place it on a lab bench or cart. Due to its weight it is recommended that a minimum of two people lift the hood off the base of the packing container.
- Leave enough space to dismount the hood from its wooden platform. It is possible to place the 215 through the open door and to do the installation inside. It is advisable and much easier to do the 215 installation and its respective connections without the cover in place.
- You should place the hood on a table which is stable enough to hold ~120 kg (~250lbs).
- If the legs are installed, the 4 leg mounts have to be installed first. Mount the legs and level the platform using the adjustable leg screws.
- Finish the 215 installation before replacing the hood cover.
- To get the stability and gas tightness of the hood, fix the hood to the wooden platform.
- The serial cables can be fed through the outside via the center hole in the rear.
- Plug all power cables inside before connecting the main power.

Technical Data *B.4.2*

The following information is subject to change without notice.:

Material: Macralon.

Measures: (L x D x H) 130 x 81 x 71 cm open 191 cm.

Weight: 89 kg (including platform and legs).

Warning: Modifications will void the safety feature of the hood.

The Temperature Controlled Transfer Capillary *B.5*

(Bruker Ord. No. W1209598 Var. x)

Two variations are available.

- The basic version is equipped with a 2.5m hose and is recommended for the use with standard magnets >300MHz.
- Variation 1 has a 1.5m hose and can be used also with Ultra Shielded magnets up to 600 MHz.

The system is delivered with a BVT3000 BEST which has two control circuits. One is for the probe temperature, the other one for the TCTC. In addition there are 4 AUX temperature connections possible, e.g. to record the room temperature.

To secure the hose in place a holder plate mount to the Gilson is included. To prevent the hose from hanging and placing stress at connections, a clamp and stand at the magnet are included.

Customer Information Sheet

C

See the next page.

Customer Information Sheet

Company / Institute .....
Customer Name (User) .....
Department .....
City code + City .....
Street .....
Country .....
Telephone .....
Fax .....
e-mail .....

Bruker Customer Number .....

System Information

Order number .....
Order Date .....
Installation Date .....

Hardware

- Autoinjector — Serial Number
  [] Gilson 215 .....
  [] Gilson 819 1).....
  [] Valvemate ..... No. of Ports.....

- Software — Version
  [] ICONNMR .....
  [] NMR .....
- Firmware .....
  [] Gilson 215 .....
- NMR
  Type / Field .....
  Probe .....

Remarks.....

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Date of Record .....

Connection of Capilaries

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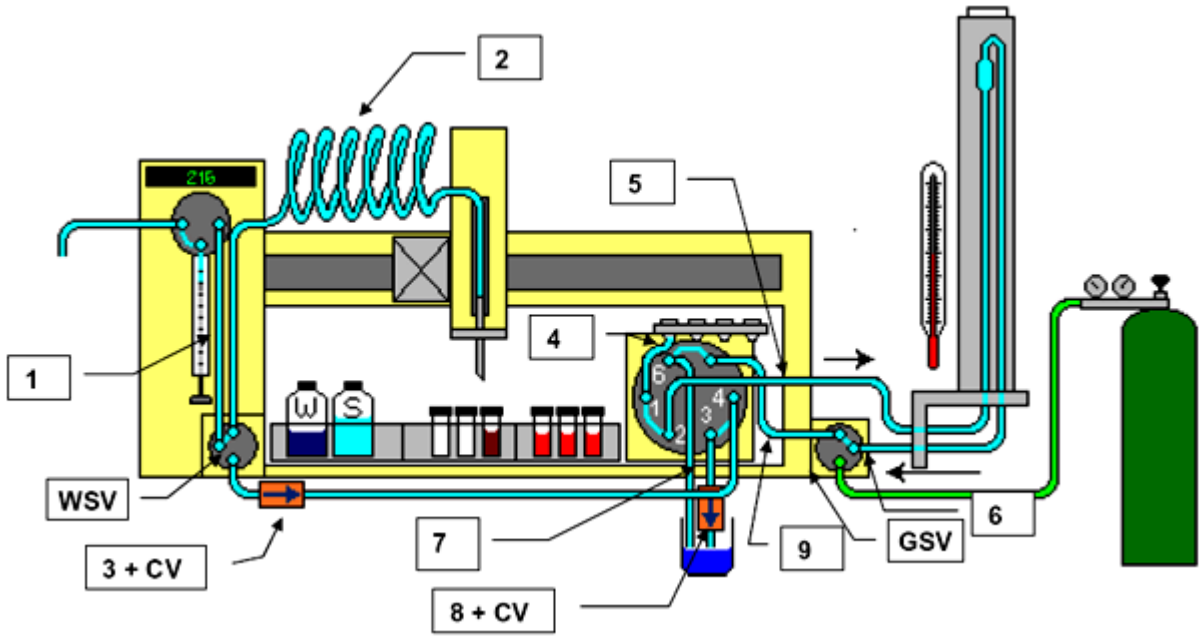

Nr.	Length	Dimension	Position	Fittings
1	500 mm	Capillary FEP 1/16” x 1.0	Dilutor – Wash Switch	¼” + ¼”
2	4000 mm	Capillary FEP 1/16” x 1.0	Wash Switch – Needle	¼” + ¼”
3	1500 mm	Capillary FEP 1/16” x 1.0	Wash Switch – CV – 819 Valve Port 4	¼” + UNF L
4	90 mm	Capillary FEP 1/16” x 0.5	Inj. Port – 819 Valve Port 1	¼ + UNF L
5	3000 mm	Capillary FEP 1/16” x 0.5	819 Valve Port 2 – Probe	UNF S +UNF L
6	3000 mm	Capillary FEP 1/16” x 0.5	Probe – Gas Switch	UNF L + UNF S
7	1000 mm	Capillary FEP 1/16” x 1.0	819 Valve Port 6 – Waste	UNF S + none
8	1000 mm	Capillary FEP 1/16” x 1.0	819 Valve Port 3 – CV – Waste	UNF L + none
9	300 mm	Capillary FEP 1/16” x 0.5	Gas Switch – 819 Valve Port 5	None + UNFS

FEP	➔ Fluoro Polymer
¼”	➔ Fitting ¼” 28 Thread for 1/6” Capillary Flangeless (Nut and Ferrule)
UNF S	➔ Fitting UNF 10/32 Nut short head for 1/6” Capillary
UNF L	➔ Fitting UNF 10/32 Nut long for 1/6” Capillary
WSV	➔ Wash Valve Module(Bruker #H10067)
GSV	➔ Gas Valve Switch(Bruker #H10068)
CV	➔ Inline Check Valve 1bar(Bruker #86714)

Figures

Figures

Tables

Tables

Notes:

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