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306 Pump
User's Guide

Solutions at Work for You



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306 Pump
User's Guide

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Safety

Read this section carefully before installing and operating the pump.

For safe and correct use of the pump, it is essential that both operating and service personnel follow generally accepted safety procedures as well as the safety instructions given in this document, the 306 Pump User's Guide.

The instrument described in this document is a slave piston pump for use in multi-pump applications. It can be controlled either by a computer with Gilson software or by a Gilson 305 Master pump acting as a system controller. It should only be used in the laboratory or similar indoor environment, by qualified personnel. If the instrument is used in a manner not specified by Gilson, the protection provided by the instrument may be impaired.

Ensure that the ventilation fan on the Piston Pump operates and is not obstructed when the instrument is installed.

Voltages present inside the instrument are potentially dangerous. If there is a problem with the instrument, the power cable should be removed until qualified service personnel have repaired it. This is to prevent anyone from inadvertently using the instrument, thus causing possible harm to themselves, or damage to the instrument itself.

The leakage current of this instrument is within the limits allowed by safety standards for laboratory equipment. An efficient ground connection is imperative for the physical protection of the user.

Power supply cord reference 7080316106 is for use in France and Germany. Power supply cord reference 7080316105 is for use in USA and Canada. For other countries contact your local Gilson distributor. You must only use the type of fuse described and specified in this document: 2.0 Amp type "T" slow blow for use where the power supply is between 100 V and 120 V, 1.0 Amp type "T" slow blow fuse for use where the power supply is between 220 V and 240 V.

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However, adequate protection including clothing and ventilation must be provided if dangerous liquids are used. In case of incidental spillage, carefully wipe with a dry cloth, taking into account the nature of the spilled liquid and the necessary safety precautions.

Cleaning, installation, dismantling, maintenance, adjustment and repair should only be performed by personnel trained in such work, and who are aware of the possible dangers involved. This instrument must not be sterilized, using an autoclave, or any other mechanical device. When you need to clean this instrument, use one of the three following methods:

1 - a clean dry cloth,
2 - a cloth dampened with water,
3 - a cloth dampened with soapy water.

If a cloth dampened with soapy water is used to clean the pump, only domestic soap may be used. No other form of detergent or chemical may be used.

These electronic and hazard symbols appear on the pump:

Symbol	Explanation
~	Alternating current
	PROTECTIVE CONDUCTOR TERMINAL
I	On (Supply switch)
O	Off (Supply switch)
	Caution, risk of electric shock
	Caution (refer to User's Guide)

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Introduction 1

The Model 306 is designed for multi-pump applications. The 306 is a slave pump in Gilson chromatography systems and is controlled either by a computer with Gilson software or by a Gilson 305 Master pump acting as a system controller.

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Using this Manual

The 306 piston pump is a precision instrument which is simple and easy to use. To gain the maximum from the instrument, you should:

- Read the description of the instrument in chapter 2.
- Install the instrument as shown in chapter 3.
- Follow the operating instructions given in chapter 4.

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Unpacking

The 306 piston pump is packed in a single carton. Upon receipt of your instrument, carefully unpack the unit and inspect it for possible damage. This should be done immediately. Check the contents of the carton against the parts list to verify that all parts are included and undamaged. The parts list is given in Appendix A. Do this now, even if the unit will not be used immediately. Report any damage to the responsible carrier immediately. Read the description in chapter 2 to become familiar with the instrument, its different parts and their names.

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Introduction 1

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Description 2

This chapter describes the physical layout of the 306 piston pump. It describes the main body of the 306 and the position of the electrical connectors on the rear panel.

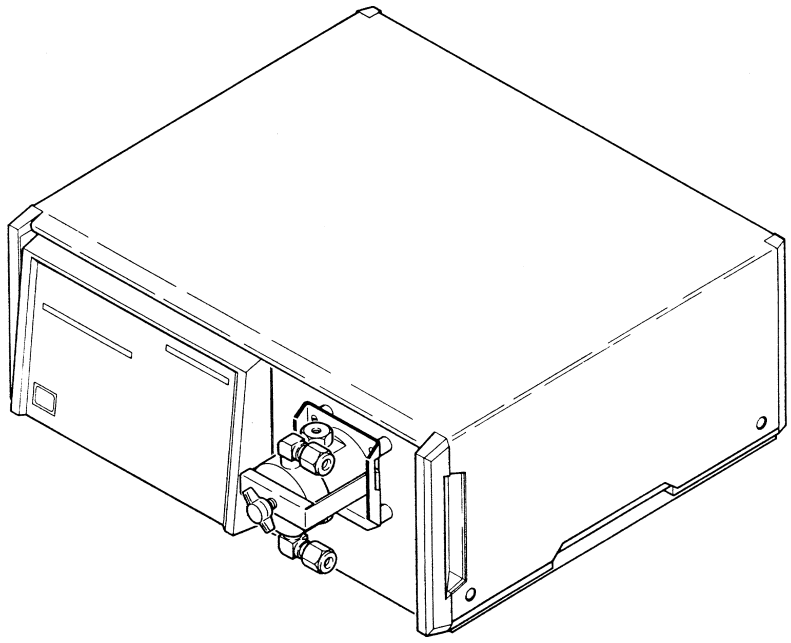
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Front View

Front view

The figure below shows a front view of the 306 with a pump head mounted. There are 3 indicators on the front panel. The function of each indicator is as follows:

- **Mains on/off**
  This indicator is on when the 306 pump is on.
- **Remote indicator**
  This indicator is on when the 306 is under the control of a system controller, either a computer or a Gilson 305 Master pump.
- **Prime**
  This indicator is on when the 306 piston pump is being primed.



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Rear View

The figure below shows a rear view of the 306 with the electrical connectors. The function of each connector is as follows:

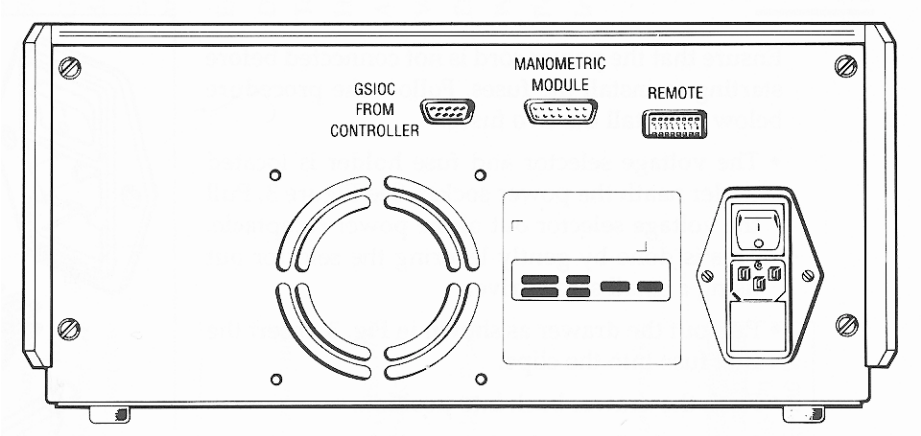
- **GSIOC FROM CONTROLLER**
  Connection to the controller, either a computer or a Gilson 305 Master pump.

- **MANOMETRIC MODULE**
  Connection to the manometric module.

- **REMOTE**
  Use these switches to set the GSIOC identity number.

- **Power switch**
  On / off power switch.

- **Power receptacle**
  Voltage selector and fuse holder.



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Installation 3

This chapter describes how to install the 306. It is recommended that you follow the installation instructions in the order that they are presented in the manual.

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Electrical Installation - Power

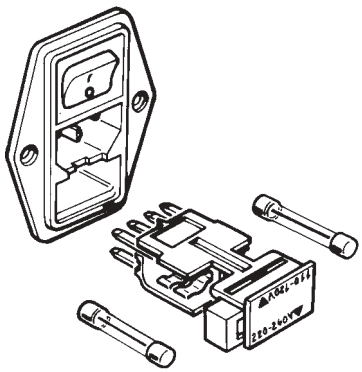
For safety reasons, the 306 is shipped without the fuses installed and with the voltage selector in the 220/240 Volt position. You must:

- Insert the correct fuses.
- Set the voltage selector to your local voltage.

Inserting the Fuses

Ensure that the power cord is not connected before starting to install the fuses. Follow the procedure below to install the **two** fuses.

- The voltage selector and fuse holder is located under neath the power socket. See opposite figure. Pull the voltage selector out of the power receptacle. This is done by gently levering the selector out using a small screwdriver.
- Pull out the drawer as shown in the figure opposite. Insert the first fuse into the clips.
- Push the drawer back into position.
- Pull out the drawer for the second fuse which is on the other side of the voltage selector. Insert the second fuse into the clips.



The instrument requires two fuses to be installed. The type of fuses required are: 2.0 Amp type “T” slow blow for 100 -120 V, 1.0 Amp type “T” slow blow for 220-240 V.

For safety reasons, piston pumps are delivered without fuses installed. Fuses must be installed by the user upon delivery.

Selecting the Voltage

The 306 can be set to operate at 100/120 volts or 220/240 volts. The different voltages are selected depending on the orientation of the fuse holder.

To set the voltage to 100/120 volts:

Insert the fuse holder with the numbers 110/120 on the bottom, facing the small white arrow.

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To set the voltage to 220/240 volts:

Insert the fuse holder with the numbers 220/240 on the bottom, facing the small white arrow.

For safety reasons, do not connect the power cord until you have finished assembling the instrument.



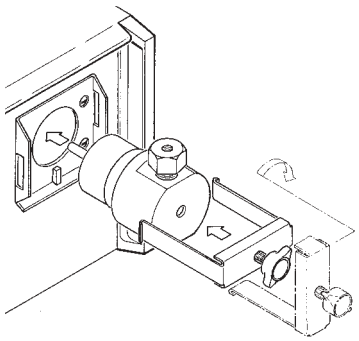
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Mechanical Installation

This section explains how to install the pump head, the mast clamp and mast. The pump head and mast clamp for each pump should be installed before positioning the modules.

Pump Head Installation

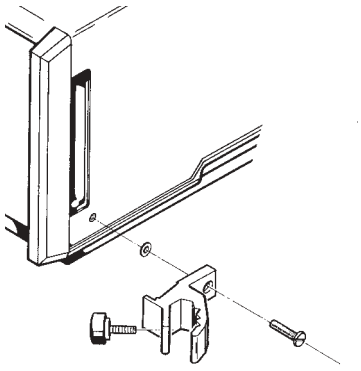
The pump head is shipped in a hard case to protect it during transit. Unpack the pump head from its case and check that all of the parts are included. Follow the procedure below to install the pump head.



- Insert the pump head into the front aperture of the pump. See the opposite figure. The notch at the bottom of the pump head body must be fitted onto the matching pin on the pump, just below the aperture. This notch ensures that the inlet port is on the bottom and the outlet port is on the top.
- Holding the pump head in place with one hand, set the clamp diagonally over the head.
- Turn the clamp clockwise into position in the slots on both sides of the pump head.
- Tighten the thumb screw until the clamp holds the pump head securely. Make sure that the clamp ends are secured in their slots on both sides.

See the pump head User's Guide for more information on the pump head.

Mast Installation



The mast is used to stabilise a system when several modules are stacked on top of each other. It can also used to hold the prime/purge valve and a manual injection valve. The mast clamp should be installed before positioning the 306 in a system. The mast is added after all of the modules have been put in place. Follow the procedure below to install the mast clamp.

- Remove the side screw holding the module cover. See the opposite figure.
- Screw on the mast clamp.

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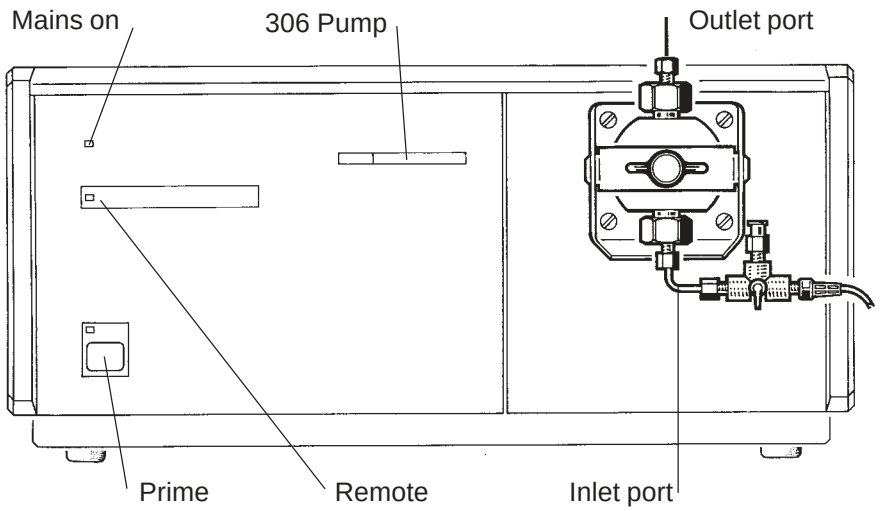
Fix one clamp onto each pump in the system. After all the modules have been positioned, the stainless steel mast can be secured within the clamps. The lower end of the mast should be level with the bottom of the lowest pump.

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Hydraulic Connections

Connect the 306 pump head input with the inlet tubing assembly provided with the pump head. The connections to the 306 pump head output should be made using stainless steel or titanium tubing.

The following figures show the hydraulic connections for different HPLC system configurations.



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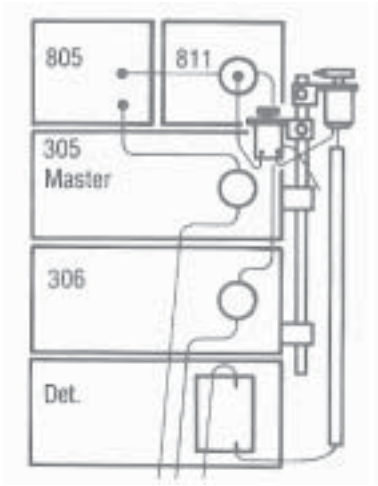
Positioning the Modules

Before putting each module in position, make sure that each module is ready, i.e. that the fuses have been installed and that any mechanical installation is finished.

The physical positioning of each of the modules in your system will depend on your type of system and the system controller. Some suggested layouts are given below. These layouts have been desigend to make the hydraulic and electrical connections as simple as possible.

Manual Injection System

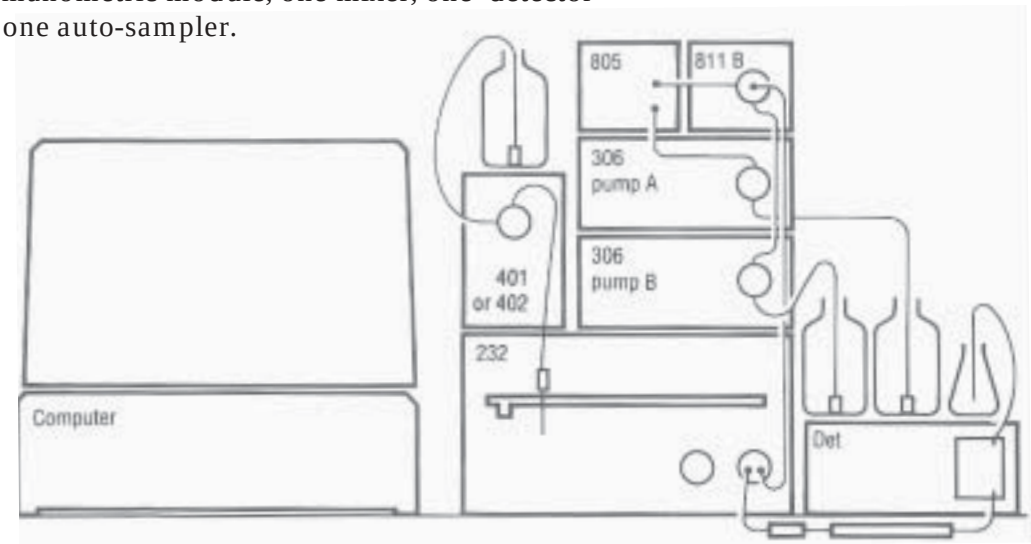
This is a binary gradient system with two pumps, one manometric module, one mixer and one detector. The system controller is a Gilson 305 Master pump. The different modules should be located as shown in the figure opposite.



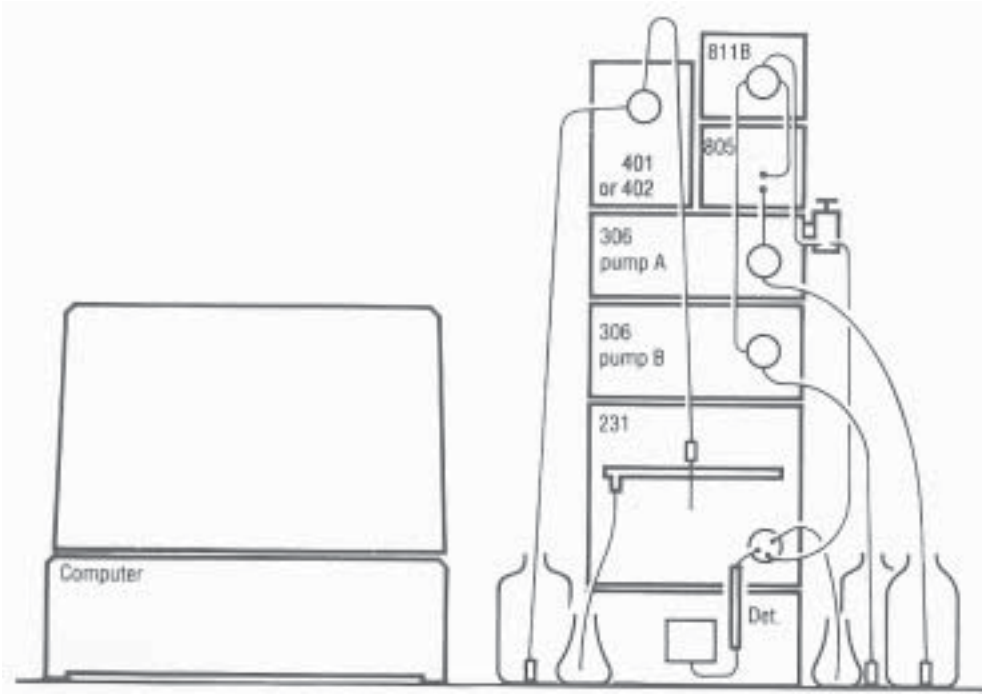
The detector is located at the bottom of the stack and the pumps and other modules are positioned over it. The 305 Master pump should be the top pump. This makes it easy to read the display and to use the keypad.

Auto-Analytical System

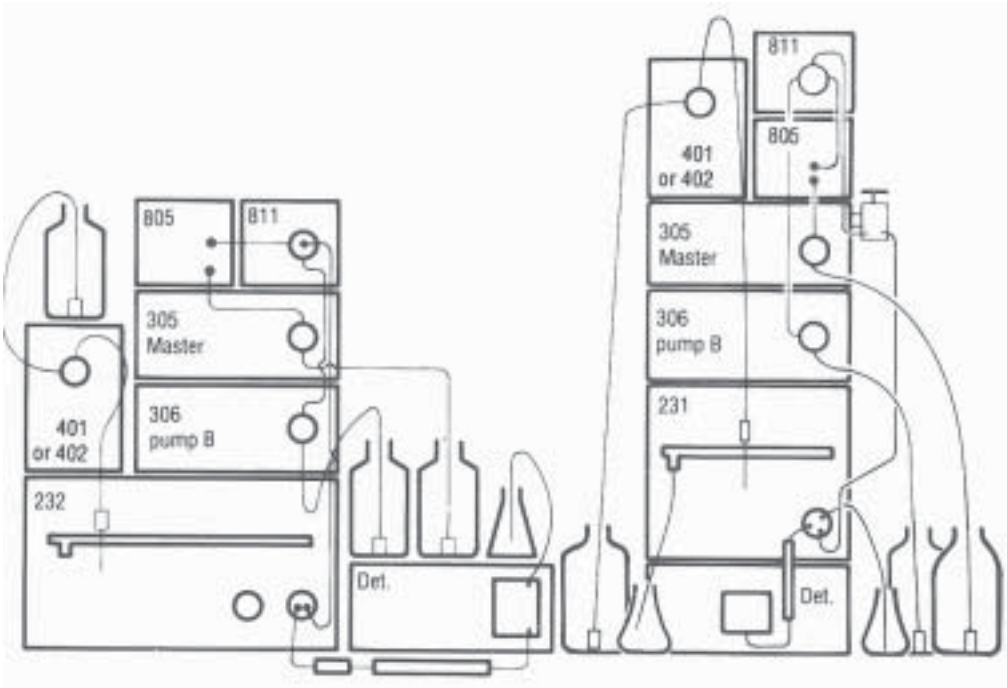
This is a binary gradient system with two pumps, one manometric module, one mixer, one detector and one auto-sampler.



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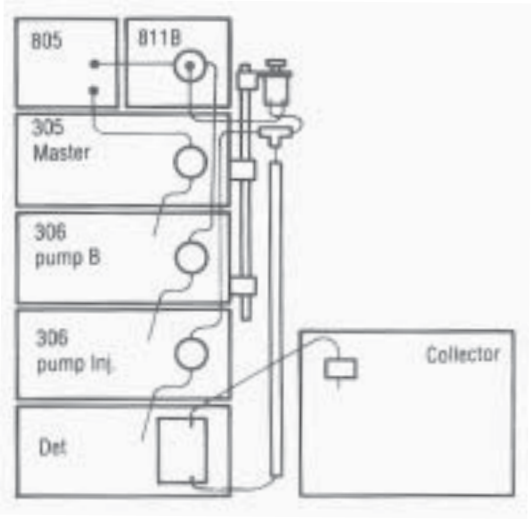
Depending on the type of automatic sample injector used, the modules are positioned in one of two ways. The system can be either two 306 slave pumps and a computer (see above) or one 306 slave pump and one Gilson 305 Master pump (see below).

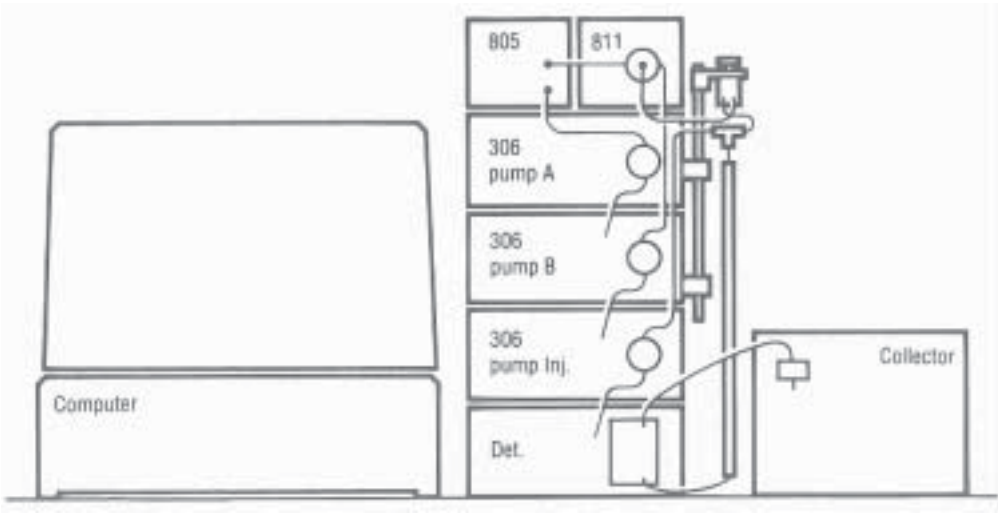


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Auto-Preparative System

This is a binary gradient system with two elution pumps, one injection pump, one manometric module, one mixer, one detector and one fraction collector. In this configuration, automatic injection is performed by the injection pump, located below the elution pumps. The system can be either two 306 slave pumps and one 305 Master pump (see opposite), or three 306 slave pumps controlled by a computer (see below).





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Electrical Connections - GSIOC

After positioning all of the modules in the system, it is necessary to connect each slave pump to the system controller. Two types of electrical connection must be made.

- The manometric module must be connected to one of the pumps in the system.
- All of the slave pumps must be connected to a system controller using the GSIOC cables provided.

Connecting the Manometric Module

The manometric module has two functions, to dampen the pulsations of the pump and to supply the current pressure value to the system controller. The system controller needs this information to implement the flow rate accuracy corrections and to ensure that the system pressure is not above or below the control limits entered in the program. There are two possible ways of connecting the manometric module depending on the type of controller.

A Gilson 305 Master piston pump is the system controller

In this case, the output from the manometric module must be connected to the MANOMETRIC MODULE socket on the nearest pump whatever model it is (305 or 306).

A computer with a Gilson software package is the system controller

In this case, the output from the manometric module can be connected to the socket marked MANOMETRIC MODULE on any pump in the system.

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Connecting the 306 to other Gilson modules

The system controller and the slave pumps in the system are connected together using the Gilson Serial Input Output Channel (GSIOC). Each module in the system has at least one GSIOC connector on its rear panel.

When connecting more than two pieces of equipment by GSIOC cable, the devices should be connected linearly (i.e. in series) using shielded Y-type Gilson cables (reference 36078143). This type of cable has a pair of female and male 9-pin D-connectors at one end and a second female connector at the other.

You will need one less cable than the number of devices being connected. The first pair of devices in the chain are connected using the female sockets at either end of the cable. Then for the third and subsequent devices, you connect another cable between the male socket on the GSIOC cable and the appropriate socket on the next device. Thus, you can 'daisy-chain' the pumps and other Gilson equipment such as a 15X detector.

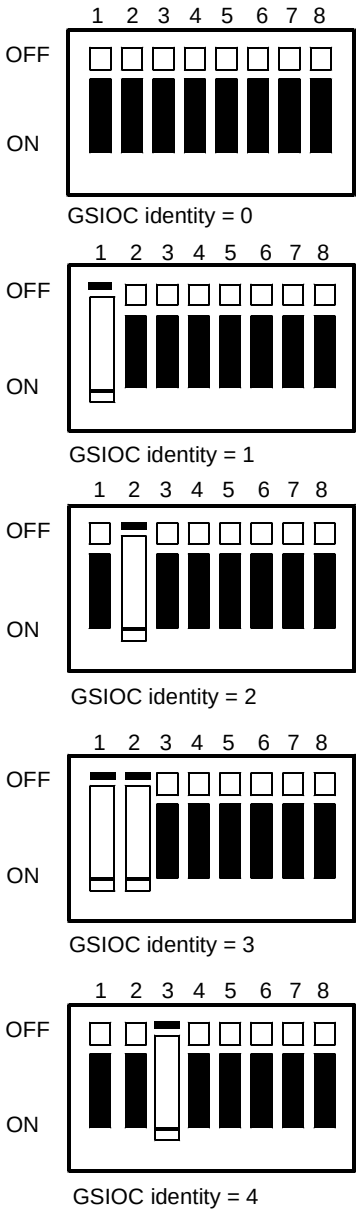
To connect a 306 pump to the system controller, you must connect the socket marked 'GSIOC FROM CONTROLLER' on the rear panel of the 306 to the system controller using the GSIOC cable provided. The system controller may be a 305, 321, 331 or 333 Pump, or a computer with Gilson HPLC system controller software (via a Gilson GSIOC Interface).

Setting the GSIOC identity number of the 306

Every module connected to the GSIOC channel is identified by a GSIOC identity number. Each module must have a different identity number. If the system controller is a computer using a Gilson HPLC software package, the identity number for each 306 slave pump can be set between 0 and 63. If the system controller is a Gilson 305 Master pump, the GSIOC identity numbers for each slave pump must be as given in the table. If it is a 321 or 33X Pump, refer to the relevant pump user's guide.

Slave pump	I.D. Number
B	2
C	3
Inj	4

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The 306 GSIOC identity number is set using the switches on the rear panel. The identity number is set according to the position of the switches.

Switches 1 to 6 represent a binary number with position 1 being the least significant bit. The 306 is shipped with the GSIOC identity number preset to 1. The figures opposite show the switch settings for GSIOC identity numbers 0, 1, 2, 3 and 4.

Switches 7 and 8 represent the GSIOC baud rate. Switches 7 and 8 are shipped in the off position and should not normally be altered. The baud rate can be changed to 9600 or 19200. 9600 is represented by switch 7 off and switch 8 on. 19200 is represented by switch 7 on and switch 8 off.

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Operation 4

Connect the power cord to the 306. The power cord must be connected to a power socket that is grounded. A grounded connection is necessary for safety and for the correct operation of the 306 pump. To ensure correct operation, all modules connected to the 306 should be connected to the same power line. Switch on the 306 using the On / Off switch on the rear panel. The power indicator on the front panel should light. If it does not light, check that all of the electrical installation instructions have been correctly followed.

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Priming the Pump Head

Do not run the pump when the pump head is dry. This can result in severe pump head damage.

Check that the solvent bottle is filled with HPLC grade, degassed solvent or buffer. Immerse the inlet tubing filter into the solvent reservoir.

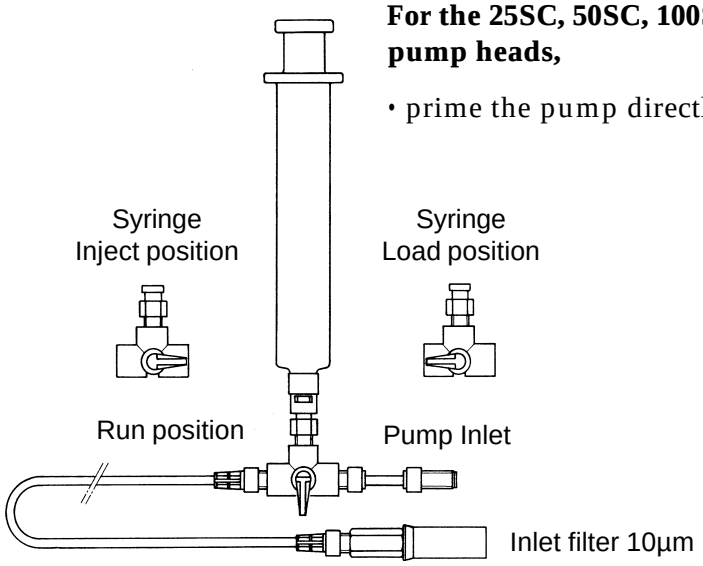
For 5SC, 10SC, 10WSC and 10WTi pump heads, use the syringe supplied with the pump head to prime the pump as follows:

- Attach the syringe to the luer fitting of the low pressure prime valve (refer to the figure below).
- Draw liquid into the syringe with the low pressure prime valve in the SYRINGE LOAD position.
- Turn the valve to the SYRINGE-INJECT position. Press the PRIME key on the front panel of the 306. The pump will start running at its maximum speed and the prime indicator on the front panel will light. Depress the syringe until the pump inlet is clear of bubbles and some liquid has passed through the pump outlet.
- Turn the valve to the RUN position. Remove the syringe from the prime valve. When no bubbles can be seen at the outlet tubing, press the PRIME key to end the priming procedure.

Check that there are no leaks in the system.

For the 25SC, 50SC, 100SC, 25WTi and 200WTi pump heads,

- prime the pump directly without syringe or valve.



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Checking that the 306 is properly connected (GSIOC to Controller)

The 306 piston pump is a slave pump. It must be connected to a system controller using the GSIOC cable provided. Make sure that the 306 is connected to the system controller and that the system controller is powered, in which case the remote indicator on the 306 should light-up.

The Gilson 306 pump is now ready to run. Return to your manual for the system controller, either a computer with Gilson HPLC system controller software or a Gilson 305 Master pump acting as a system controller. Proceed with the setting up of your complete HPLC system.

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Maintenance and Troubleshooting 5

The 306 pump has been designed to require a minimum level of care and maintenance. In practice, maintenance is limited to cleaning and replacing parts of the pump head.

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Pump Head Maintenance

The check valves and filters can be cleaned. Piston seals, check valves, piston assemblies, anti-extrusion gaskets and return springs should be replaced on a regular basis. A maintenance kit is available for each model of pump head. For details about maintenance kits and procedures, see the User's Guide for your pump head.

The use of equipment for continuous, unattended operation is becoming more and more important. For this reason, the following table gives an indication of replacement periods of maintenance parts according to the type of use, intensive, regular or occasional. The data in the table below assumes that the pump is working at half of its maximum flow rate and pressure. The nature of the liquid and the pump head model have only a small influence on these figures.

Time table for checking replacement parts according to the type of use.

Parts/Use	Intensive (168 h/week)	Regular (40 h/week)	Occasional (10h/week)
Piston seal	2 - 3 months	6 - 9 months	1 year
Set of check valves	3 - 6 months	1 year	2 years
Piston assembly	6 - 12 months	2 - 3 years	5 years
Anti-extrusion gasket	6 - 12 months	2 - 3 years	5 years
Return spring	1 year	2 - 3 years	5 years

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Troubleshooting

Electrical problems

Problem	Possible cause	Solution
Pump does not operate and power indicator does not light.	Power cord unplugged. Fuse blown. Incorrect voltage setting.	Check for power. See 'Electrical installation' in chapter 3.
Slave pump does not operate.	GSIOC cable not connected or incorrectly connected. Incorrect GSIOC identity number.	Check GSIOC cable is connected correctly to the socket on the 306. Check GSIOC identity number is set correctly.
Message 'Pump X missing' on the system controller	Incorrect GSIOC identity number set in pump X.	Set the GSIOC identity correctly. Refer to chapter 3.
Remote indicator does not light-up.	GSIOC cable not connected. Incorrect GSIOC identity number.	Connect the 306 pump to the system controller using the GSIOC cable provided and switch-on controller. Check GSIOC identity number is set correctly.

Hydraulic problems

Problem	Possible cause	Solution
Leaks from the hole at the bottom of the pump head.	Defective piston seal.	Replace piston seal. Refer to User's Guide for the pump head.
Low flow rate.	Leaks. Plugged inlet filter. Defective check valve. Pump head not mounted properly.	Check for leaks. Clean or replace the inlet filter. Refer to User's Guide for the pump head. Clean or replace the check valve. Refer to User's Guide for the pump head. Check that the pump head is properly mounted.
Air bubbles appear in both inlet and outlet tubing.	Loose connection of inlet tubing. Worn flange of inlet tubing. Inlet filter partly clogged. Refill time is too long for the solvent.	Tighten the connection (but do not overtighten). Replace the inlet tubing. Clean or replace the inlet filter. Decrease the refill time.
Air bubbles appear only in outlet tubing.	Loose connection of outlet tubing.	Tighten the connection (but do not overtighten).

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Accessory Parts List Appendix A

Parts lists for the 306 Pump, consisting of Standard Accessories and Additional Accessories.

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Standard Accessory Parts List

Reference	Qty	Description
3645388	1	SC type pump head clamp
36610101	1	Double-ended wrench, 1/4"- 5/16"
6730204007	4	Fuses 2.0 Amp type “T” slow blow (5 x 20 mm) for 100-120 V
7080316105	1	Power cord for 100-120 V
6730104006	4	Fuses 1.0 Amp type “T” slow blow (5 x 20 mm) for 220-240 V
7080316106	1	Power cord for 220-240 V
LT801175	1	Model 306 User’s Guide

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Additional Accessory Parts List

Reference	Description
36078143	GSIOC cable
03434939	Mast clamp
2105703	Hex Mast, 3/4” x 16 mm

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Appendix A

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GSIOC Control Appendix B

This chapter explains how to control the 306 from a computer using Gilson HPLC system controller software.

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GSIOC Features

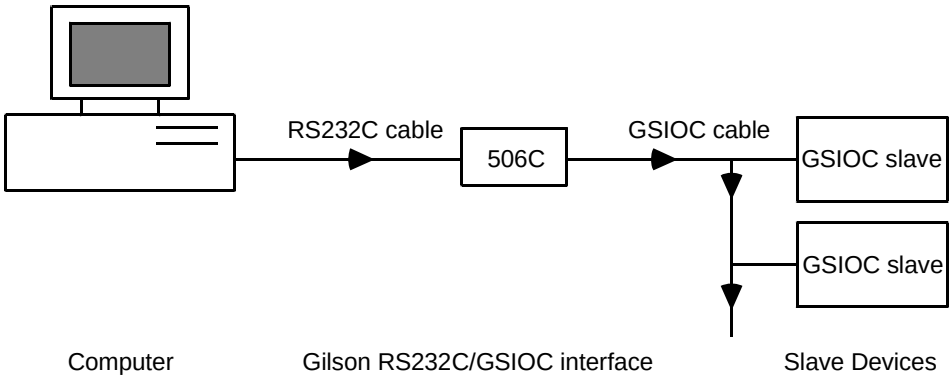
GSIOC stands for Gilson Serial Input Output Channel. This communications channel links all of the Gilson modules in a system together. The system controller controls all of the modules in a system by sending GSIOC commands to the slave modules, for example pumps or detectors. Each device connected to the GSIOC channel is distinguished by a GSIOC identity number between 0 and 63. The GSIOC identity number is set by switches inside each module or by the module's software. The controller communicates with one slave device at a time. The hardware and software requirements to control a module from a computer using the GSIOC are as follows:

- A PC running under Windows® 95, 98 or NT.
- A Gilson interface module, 506C.
- A Gilson HPLC system controller software package.

For more details consult the documentation that accompanies the Gilson software.

To get started you must:

- Install the Gilson HPLC system controller software on the computer.
- Connect the computer to the Gilson interface using the cable provided with the interface.
- Connect the output from the interface to the Gilson module using a GSIOC cable.
- Start the Gilson HPLC system controller software.



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GSIOC commands

Non-specific commands

The 306 software includes a set of commands that offers direct compatibility with first generation Gilson pumps.

Command	Type	Function
?	I	Request Status
B	B	Begin Dispense Cycle (s)
D	B	Set Dispense Mode
F	B	Set Flow Mode
L	B	Lock Pump
S	B	Stop Flow
U	B	Unlock Pump
Z or $	I	Master Reset

All commands are detailed below with their type, mode and function. Immediate commands have their response format described. Buffered command parameters are documented. Comments are added where necessary.

Immediate ?	Request Status Response format: abcdefgh where ‘a’ is the error status ‘L’ for low pressure limit ‘H’ for high pressure limit ‘I’ for Invalid settings ‘ ’ (blank) for no error. ‘b’ is the control status ‘L’ for ‘locked’ and ‘U’ for ‘unlocked’. ‘cdefg’ being the current parameters and ‘h’ the mode status ‘F’ for Flow mode ‘M’ for Microflow mode ‘D’ for Dispense mode ‘S’ for Stop (not in dispense mode)
Buffered B	Begin Dispense Cycle (s) Syntax: Bn Parameter: n is the number of dispense cycles. If n is omitted, it is considered as 1 by default.
Buffered D	Set Dispense Mode Syntax: D Comment: this command sets the pump in Dispense mode ; it does not initiate liquid flow.

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Buffered F	Set Flow Mode Syntax: F Comment: this command sets the pump in Flow mode ; it initiates liquid flow according to valid parameters.
Buffered L	Lock Pump Syntax: L Comment: this command sets the pump in the remote control mode. When the pump is 'locked', the PRIME switch is disabled, and the REMOTE led is turned on.
Buffered S	Stop Flow Syntax: S Comment: this command stops the liquid flow if the pump is in Flow mode. It has no effect when the pump is in the Dispense mode.
Buffered U	Unlock Pump Syntax: U Comment: this command restores the local control mode. The PRIME switch is enabled again, and the REMOTE led is turned off.
Immediate Z or $	Master Reset Response format: 'Z' or '$' is echoed.

Emulation commands

This set of commands is available only when the 306 pump has been set in emulation mode by the L buffered command. It allows the programmer to control the 306 pump with a larger range of parameters.

Command	Type	Function
R	B	Set Refill Time
R	I	Request Refill Time
d	B	Set Dispense Speed
d	I	Request Dispense Speed
s	B	Set Flow Speed
s	I	Request Flow Speed
v	B	Set Dispense Volume
v	I	Request Dispense Volume
z	B	Set Compressibility Stroke

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Buffered R	Set Refill Time Syntax: Rn Parameter: n is in the range 125 to 1000. The unit is the millisecond. Any intermediary value is valid.
Immediate R	Request Refill Time Response format: a 4-digit decimal number in the range 0125 to 1000. Returns the current refill time, in milliseconds.
Buffered d	Set Dispense Speed Syntax: dn Parameter: n is in the range 0 to 12272. The unit is the ten thousandth of the maximum flowrate of the pump head. Command example: ‘d1000’. With a 5 ml/min pump head, the selected dispense flowrate is thus 5*1000/10000 = 0.5 ml/min. Comment: this command does not initiate liquid flow (cf B command).
Immediate d	Request Dispense Speed Response format: a 5-digit decimal number in the range 00000 to 12172. Returns the current dispense speed, as define above.
Buffered s	Set Flow Speed Syntax: sn Parameter: n is in the range 0 to 12272. The unit is the hundredth of percent of the maximum flowrate of the pump head. Command example: ‘s2000’. With a 25 ml/min pump head, the selected flowrate is thus 25*2000/10000 = 5 ml/min. Comment: this command initiates liquid flow.
Immediate s	Request Flow Speed Response format: a 5-digit decimal number in the range 00000 to 12172. Returns the current flow speed, as defined above.
Buffered v	Set Dispense Volume Syntax: vn Parameter: n is in the range 0 to 1000000. The unit is the ten thousandth of the pump head nominal number ; for a 10 ml/min head, the dispense volume range is thus from 0.001 to 1000 ml.
Immediate v	Request Dispense Volume Response format: a7-digit decimal number in the range 0000000 to 1000000. Returns the current dispense volume, as defined above.
Buffered z	Set Compressibility Stroke Syntax: zn Parameter: n is in the range 0 to 10000. The unit is in ten thousandth of the stroke volume.

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Specific commands

This set of GSIOC commands is specific to the Model 306 pump. It is used by the controlling device in a multi-pump solvent delivery system. Below is the list of available commands in alphabetical order.

All commands are detailed below with their type, mode and function. Immediate commands have their response format described. Buffered command parameters are documented. Comments are added where necessary.

Command	Type	Function
%	I	Request Pump Identification
L	I	Request Manometric Module Identification
Q	B	Enter Pressure Unit
Q	I	Read Pressure Value
q	I	Autozero Pressure Reading

Immediate %	Request Module Identification Response format: '306Va.bc', where Va.bc is the software version.
Immediate L	Request Manometric Module Identification Response format: 4-character alphanumeric string Response example: 'M806' Comment: if no manometric module is present, 'None' is returned. If the manometric module is not recognized, 'Unkw' is returned.
Buffered Q	Enter Pressure Unit Syntax: Qu Parameter: u is 'B' for bars, 'P' for MPa, or 'K' for kpsi. Command example: 'QK' to select the kpsi unit.
Immediate Q	Read Pressure Value Response format: 'Bxxx' in bars, 'Px.xx' in MPa or 'Kxx.x' in kpsi. The unit in which the pressure is expressed is the one used by the last buffered Q command. At the power up, the default unit is the bar. Response example: 'K32.1' for 32.1 kpsi. Comment: if no manometric module present, 'N' is returned.
Immediate q	Pressure Reading Autozero Response format: 'q' is echoed. If autozeroing is not possible (converter out of range), 'n' is returned.

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GSIOC command example

In this example, we will command the 306 pump to inject 2 ml with a flow rate of 5 ml/min. A 5SC pump head is used on the injection pump. There are 5 steps to follow:

1. Lock the pump.	Buffered L
2. Set the pump in dispense mode.	Buffered D
3. Send the volume to be dispensed.	Buffered v
4. Send the flow rate for the dispense.	Buffered d
5. Start the dispense operation.	Buffered B

Two calculations have to be done, the number for the dispense volume and the number for the dispense flow rate.

For the dispense volume, you send the command: vxxxxxxx.

Calculate

$$xxxxxxx = \frac{\text{dispense volume x 10000}}{\text{pump head size}}$$

In our example

$$xxxxxxx = \frac{2ml \times 10000}{5} = 4000$$

The GSIOC command is **v4000**

For the dispense flow rate, you send the command: dxxxxx

Calculate

$$xxxxx = \frac{\text{Flow rate x 10000}}{\text{pump head size}}$$

In our example

$$xxxxx = \frac{5ml/min \times 10000}{5} = 100000$$

The GSIOC command is **d10000**

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The complete sequence is:

1. Buffered L
2. Buffered D
3. Buffered v4000
4. Buffered d10000
5. Buffered B1

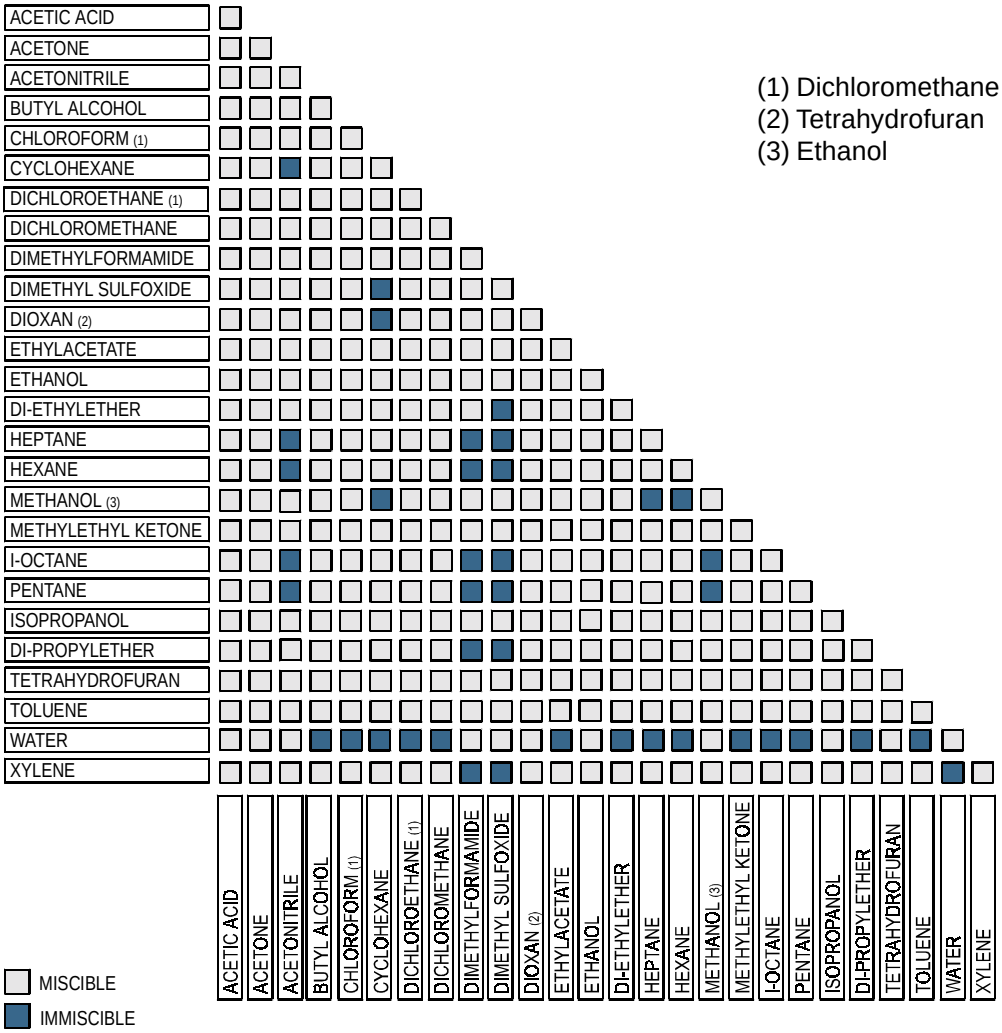
These steps can be sent as individual GSIOC commands to the 306 pump or they can be sent as one instruction. To send all of these commands as one instruction, send: LDv4000d10000

The command to start the injection pump is B1. This command is sent when you want to start the pump.

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Solvent Miscibility Appendix C

Miscibility means that solvents should mix with each other in all proportions. That solvents should be miscible is important both during elution and when switching from one solvent to another. You are advised to refer to the table, below, when selecting solvents. For some solvents, lower toxicity alternatives are indicated [(1), (2), (3)], as follows:



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Appendix C

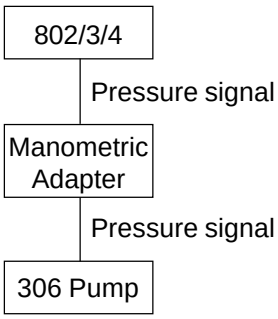
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1st Generation Pumping Systems

Appendix D

The following describes using a 306 with Gilson's first generation pumping systems.

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Using a 306 with an 802 Manometric Module

To have the specified flow rate accuracy associated with the 306 pump, the system controller for the 306 pump must receive a pressure signal.

When using an 805/806 or 807 type manometric module, the output from the manometric module can be connected directly to the 306 pump.

When using an 802/803 or 804 manometric module, the output can NOT be connected directly to the 306 pump. It is necessary to use a Gilson manometric adapter, which converts the pressure signal from the 802/803/804 module into a signal that can be used by the system controller for the 306 pump.

The system will have the specified flow rate accuracy of the 306 as the system controller receives a pressure signal. The pressure is displayed on both the system controller and the manometric module. The pressure limit s are set in the system controller software. The pressure controls on the manometric module have no effect.

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Using a 306 with a 302/303

When using a combination of 302 / 303 and 306 pumps, the message "Invalid settings" may appear when using the pump near its maximum flow rate. This is due to the controller asking a 302 / 303 motor to deliver more than it is capable of giving, because the 302 / 303 pump has a lower maximum motor speed (126 rpm) than the 306 pump (150 rpm).

Head size	Pressure (bar)	Maximum Flow rate (ml/min)
5	600	4.1
10	600	8.2
25	280	23.0
50	140	48.0
100	70	98.0
200	35	196.0

A 306 pump can accurately produce the maximum flow rate for a given headsize up to the maximum pressure. For example, with a 5SC head, the 306 can produce 5 ml / min up to 600 bar. The 302 / 303 pumps can NOT accurately produce the maximum flow rate up to the maximum pressure. An example using n-Hexane and a 303 pump is given in the above table. This liquid is one of the more compressible liquids and therefore one of the extreme cases.

If you program a flow rate for a 302 or 303, which it is not able to deliver, the slave sends a warning to the controller and the message " **Invalid settings**" is displayed. The motor runs at its maximum speed but the flow rate will not be accurate. The maximum flow rate that you can program depends on the pressure in the system and the compressibility of the liquid that you are using.

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Technical Data Appendix E

The following information presents construction and operational characteristics for Gilson 306 Pumps.

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Type of Pump

Externally controlled reciprocating pump, with single piston interchangeable head, constant stroke and fast refill motion. Installation category II and pollution degree 2.

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Working Range & Performance Data

Working Range, Pump Heads and associated Manometric Modules

A complete Gilson liquid delivery system includes up to four pumps, a manometric module and a mixer.

Pump head (model)	Flow rate range (ml/min)	Pressure range (MPa)	Manometric module (model)*
5SC	0.010 - 5	0.1 - 60	805
10SC	0.050 - 10	0.1 - 60	805
10WSC	0.050 - 10	0.1 - 60	805
10WTi	0.050 - 10	0.1 - 60	805
25WTi	0.125 - 25	0.1 - 28	806
25SC	0.125 - 25	0.1 - 28	806
50SC	0.250 - 50	0.5 - 14	806
100SC	0.500 - 100	0.5 - 7	807
200WTi	1.000 - 200	0.5 - 3.5	807

SC: Standard self-centering piston.

Ti: Titanium liquid contact-parts.

W: Washing compartment for salt-concentrated solutions (> 0.1M).

*: Pressure measurement and pulse dampening (< 1%).

Liquid contact materials

316L stainless steel, titanium, sapphire / ceramic, ruby, PCTFE, PTFE / HDPE.

Flow rate precision and accuracy at 20°C over full working range

Coefficient of variation

0.1-0.6% with aqueous solutions or hydro-organic polar solvent mixtures and 0.3-1% with hydrocarbons or chlorinated volatile solvents.

Maximum accuracy error

±1% with water over the full flow rate and pressure ranges.

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Control and Interfaces

External control

A Gilson 305, 321, 331, or 333 Master pump or a PC with Gilson HPLC system controller software.

Externally controlled operating modes

Constant flow rate (Flow), constant volume (Dispense), and time-based sequence (Program), with parameters identical to those of the 305 Master pump.

User interface

Prime button. Three lights indicating power on, remote control and prime. Rear panel microswitches for GSIOC identity number and baud rate selection.

Digital interface

Gilson Serial Input Output Channel (GSIOC) slave connector on rear panel.

Electrical interface

Manometric module connector on rear panel.

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Environmental Conditions

Operating Conditions

Indoor, in altitudes up to 2000 m, 4 to 40°C and in humidity up to 80%.

Size/Weight

W x H x D = 33 x 15 x 33 cm (13 x 6 x 13 inches) / 10 kg (22 pounds) with pump head.

Voltage/Power/Frequency

100-120 V or 220-240 V / 120 VA / 50-60 Hz.

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