

333 and 334 Pumps User's Guide

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333 and 334 Pumps 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 333 and 334 Pump User's Guide.

The instruments described in this document are piston pumps, which should only be used in an indoor environment for pumping purposes by qualified personnel. If a 333 Pump, or a 334 Pump, is used in a manner not specified by Gilson, the protection provided by the pump may be impaired.

Voltages present inside the 333 and 334 Pumps are potentially dangerous. If there is a problem with any pump, the power cable should be removed until qualified service personnel have repaired it. This is to prevent anyone from inadvertently using the pump, thus causing possible harm to themselves, or damage to the pump itself.

The leakage current of a 333 Pump, and of a 334 Pump, is within the limits allowed by safety standards of laboratory equipment. An efficient ground connection is imperative for the physical protection of the user.

Power supply cord reference 500005 is for use in France and Germany. Power supply cord reference 500006 is for use in USA and Canada. For other countries contact your local Gilson distributor.

The maximum voltage for any electrical device connected to each input or output contact of a 333 Pump is 48 V.

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.




Safety

Cleaning, dismantling, maintenance, adjustment and repair should only be performed by personnel trained in such work, and who are aware of the possible dangers involved. Neither a 333 Pump, nor a 334 Pump, nor the pump heads, may be sterilized, using an autoclave, or any other device. When you need to clean a pump, 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) |

Declaration of Conformity

Application of Council Directives: **89/336/EEC and 73/23/EEC**

Standards to which Conformity is Declared:

Electromagnetic Compatibility:

EN 50081-1 (1992) and EN 50081-2 (1992) for emission
EN 50082-1 (1998) and EN 50082-2 (1995) for immunity

Safety:

EN61010-1, (1993, including AMD A2: 1995),
UL 3101-1 (1993) and CAN/CSA 1010-1 (1992, including MOD2:
1997)

Manufacturer:

Gilson S.A.
72, rue Gambetta
BP45
95400 Villiers-le-Bel
France

Type of Equipment:

Laboratory Equipment

Product:

333 and 334 Pumps

Beginning with Serial Number:

196534 for 333 and 196540 for 334

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



Hervé Le Dorze
Quality Assurance Manager
Place: Sarcelles
Issue Date: 03/01/2000

The Gilson S.A. quality assurance system is registered as complying with ISO 9001
International Quality Standard, Registration Certificates No. 6621 and No. 18623 BVQI.

Gilson 333 and 334 single-solvent pumps are for use in preparative chromatography (20 to 100 mm bore columns). Described in this User's Guide they are individually known as 333 Pumps and 334 Pumps. Also described is Gilson 333-334, as a gradient system.

Notational Conventions and Units

Software Related Conventions (333 Pump)

The software displays messages and read only values on the control panel's screen as normal typeface inside a frame. This convention is followed in this User's Guide.

For software options where a key must be pressed, the related function is represented in bold (e.g. **Edit**, **HELP**).

When time is expressed in minutes it is to two decimal places. For example, 7.75 min is actually 7 minutes and 45 seconds.

Units and Conversion Factors

Conversion Factors

| To Convert from: | atm | bar | MPa | psi |
|------------------|-------|-------|--------|------|
| atm | 1 | 1.013 | 0.101 | 14.7 |
| bar | 0.987 | 1 | 0.1 | 14.5 |
| MPa | 9.87 | 10 | 1 | 145 |
| psi | 0.068 | 0.069 | 0.0069 | 1 |

1 atm = 760 mm Hg = 10⁴ mm H₂O

1 hPa = 1 mbar = 10 mm H₂O

1 mm Hg = 1 Torr = 1.33 mbar = 133 Pa = 0.0193 psi

International System of Units (SI)

SI units are used in this document for specifications and reference data, although "Units in Use with the SI Unit" (e.g. bar and liter) are used in appropriate contexts.

The following information comes from the Handbook of Chemistry and Physics, 79th edition by D. R. Lide, CRC Press, 1998-1999, Section 1.19-23.

Name, Symbol, and Conversion factors

Pressure (Derived Unit)

Name of the SI Unit: pascal (symbol: Pa)

Unit in Use with the SI Unit: bar (symbol: bar)

Thermodynamic Temperature (Base Unit)

Name of the SI Unit: kelvin (symbol: K)

$T(K) = T(^{\circ}C) + 273$

$T(^{\circ}C) = [T(^{\circ}F) - 32] / 1.8$

$T(^{\circ}F) = [1.8 \times T(^{\circ}C)] + 32$

Length (Base Unit)

Name of the SI Unit: meter (symbol: m)

1 m = 3.28 feet = 39.4 inches

1 foot = 30.5 cm

1 inch = 25.4 mm

Volume (Derived Unit)

Name of the SI Unit: cubic meter (symbol: m³)

Unit in Use Together with the SI: liter (symbol: liter, l or L).

1 liter = 1 dm³ = 1000 cm³

1 gallon (UK, liquid) = 4.55 liter

1 gallon (USA, liquid) = 3.79 liter

Weight (Base Unit)

Name of the SI Unit: kilogram (symbol: kg)

1 kg = 2.20 pounds

1 pound = 0.454 kg

Prefixes

Prefix symbols should be printed in roman type (upright) with no space between the prefix and the unit symbol (e.g. km for kilometer).

Prefixes are not to be used with temperature units.

| Multiples | | | Submultiples | | |
|------------------|--------|--------|-------------------|--------|--------|
| Factor | Prefix | Symbol | Factor | Prefix | Symbol |
| 10 ¹ | deka | da | 10 ⁻¹ | deci | d |
| 10 ² | hecto | h | 10 ⁻² | centi | c |
| 10 ³ | kilo | k | 10 ⁻³ | milli | m |
| 10 ⁶ | mega | M | 10 ⁻⁶ | micro | μ |
| 10 ⁹ | giga | G | 10 ⁻⁹ | nano | n |
| 10 ¹² | tera | T | 10 ⁻¹² | pico | p |
| 10 ¹⁵ | peta | P | 10 ⁻¹⁵ | femto | f |
| 10 ¹⁸ | exa | E | 10 ⁻¹⁸ | atto | a |
| 10 ²¹ | zetta | Z | 10 ⁻²¹ | zepto | z |
| 10 ²⁴ | yotta | Y | 10 ⁻²⁴ | yocto | y |

Overview

User's Guide Description and Applicability

This user's guide is both for 333 Pumps and for 334 Pumps. Information that applies uniquely to one or other of these models is clearly identified at the appropriate point. Except for the absence of two components, no distinction is made at the hydraulic level between the 334 (extra solvent remote-controlled pump) and the 333 (primary solvent master-pump), so much of this type of information (e.g. Chapters 2 and 5) relates to both 333 and 334 Pumps.

There are differences at the physical and electrical level: 334 Pumps have no control panel or output connector, so the information relating to the pump's software (e.g. Chapter 4) is only directly relevant to a 333 Pump.

Chapter 1 contains brief descriptions of 333 and 334 Pumps, together with unpacking instructions, and warranty details.

Chapter 2 contains descriptions of 333 and 334 Pump's major components.

Chapter 3 contains instructions for installing, and setting-up 333 and 334 Pumps.

Chapter 4 contains details of the 333 Pump software used for configuration and control. Directly, this information only concerns 333 Pumps. However, there are implications for any 334 Pumps controlled from a 333 Pump.

If you use external software to control 33X Pumps (up to three), you should refer to the manual for the controlling software (e.g. UniPoint). Some supplementary information has been included relating to UniPoint and GLP functions.

Chapter 5 applies to 333 and 334 Pumps; it describes preventive maintenance, troubleshooting, and procedures for dismounting the heads.

Chapter 6 contains reference information, relevant to 333 and 334 Pumps: specifications, technical data, hydraulic parameter information (solvent miscibility and compressibility corrections), and separate parts lists (items and references) for each pump model.

Chapter 7 contains information relating to GSIOC control and a list of available commands.

Hardware Description

333 and 334 Pumps are reciprocating piston pumps for preparative chromatography using from 20 mm to 100 mm bore columns. Individually, they are for single solvent delivery under high pressure. Each 33X Pump is equipped with two pump heads.

333 Pumps are master pumps designed to pump up to three solvents (depending on the configuration). They also have an integrated pressure, purge and mixing module (PPMM), an outlet filter, and optionally a solvent valve block.

333 Pumps have a control panel (integral keypad and screen) for configuring, programming, and coordinating with other equipment (pumps, detectors, injectors, etc.).

334 Pumps are designed as slave pumps for delivery of a second solvent (B) and (with two additional 334 Pumps) a third solvent (C), to be mixed with the primary solvent (A) pumped by the 333.

334 Pumps have no PPMM, no outlet filter, and because they have no control panel they are physically shorter. They may be controlled by 333 Pump software using its control panel, or by PC based software such as Gilson's UniPoint and GSIOC (Gilson Serial Input-Output Channel) commands.

333 Pump Software Description

Although the pre-installed software is designed to be user-friendly, you are advised to read this guide carefully before using the pump. Programming consists of entering configuration details for your pump, and then a sequence of events (flow rate, composition, electrical contacts, etc.) as a Method Program.

By means of the pre-installed software (or PC based software), a 333 Pump may be used to control a Gilson detector and up to three other pumps, of the following types: a 334 Pump, Gilson 30X Series Pumps (with any head), or another 333 Pump. If solvent injection is required, the injection pump must be of the 30X Series.

Alternatively, you may use Gilson UniPoint™ system software to control 333 and 334 Pumps, and associated Gilson equipment (via Gilson 506C interface and GSIOC slave bus). Coordination with any other instrument is carried out by electrical contacts.

One of the following Gilson detectors (UV-vis absorbance detection) may also be controlled from a 333 Pump: single-wavelength Model 151 or 152, dual-wavelength Model 155 or 156. You should refer to the user's guide of the relevant detector for full information, including soft-key functions that are accessible from the control panel of a 333 Pump.

Operating Principle

You have to go through three main steps before running your 333 Pump based Method Program:

- 1) Define the system configuration (enter descriptions of your pumping system's hardware).
- 2) Select the type of events and key in the related parameters (flow rate, composition, and coordination). The Method Program (configuration, list of events and associated parameters) is saved automatically by the software.
- 3) Initialize the system by priming the solvent channels; then run the Method Program.

Unpacking

Hardware

You are advised to check your pump immediately, even if it is not to be used until later. Upon receipt of your instrument, unpack the unit carefully, inspect it for possible damage, and check the contents of each carton against the list of parts and accessories given in the Chapter 6. Your supplier should be notified immediately of any inconsistencies or any damage.

Your pump is delivered in a crate containing the main module and accessories. The original packing should be kept, especially for the period during which the instrument is under warranty, in case the equipment has to be returned to the factory.

Because of their weight (about 35 kg, 44 kg packed), you should take special care when handling the large cartons. Pump modules are heavy and should be lifted from the carton with care, by two persons. Instructions describing the unpacking procedures are to be found on and in the carton.



Software

The software is pre-installed and is accessible, using the control panel, immediately after switching on a 333 Pump.

Warranty

If the pump does not appear to function correctly, first verify the electrical connections are correct and that the instrument is switched on. Contact your Gilson distributor for technical advice or possibly a service visit. Any service required will be given within the warranty conditions assured by your Gilson distributor.

Customer Service

Gilson and its worldwide network of authorized distributors provide customers with four types of assistance: sales, technical, applications and service.

Customer Service personnel are able to serve you more efficiently if you provide the following information.

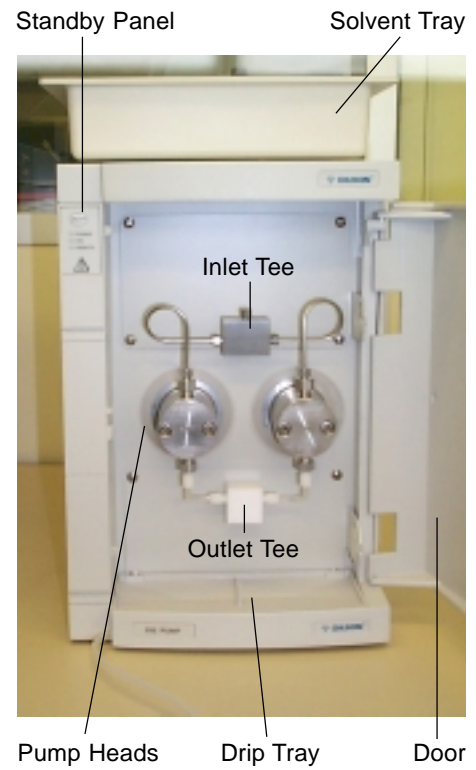
- 1) The serial number and model number of the equipment involved.
- 2) Type of computer (if used), available memory, microprocessor and software version(s) in operation.
- 3) The installation procedure you used.
- 4) A concise list of the symptoms.
- 5) A list of operating procedures and conditions you were using when the problem arose.
- 6) A list of other devices connected to the system and a system diagram showing the connections.
- 7) A list of other electrical connections in the room.

The front of a 333 Pump incorporates the control panel, and the pump's principal hydraulic components, which are pre-mounted. The hydraulics may be concealed by the removable door. Also shown is the standby panel, which shows the operating status of the pump, and may be used to switch on and off the pump.

The 334 Pump, which is shorter, has no control panel and operates in the slave mode. There is a drip tray at the bottom of both pumps. Solvent bottles can be placed in a removable tray at the top of a 333 or a 334 Pump, on the bench, or on the floor.

A single 333 Pump is for use in the isocratic mode. By adding one or two 334 Pumps two or three solvents may be mixed. By adding a 30X pump, solvent injection may be performed. However, in total no more than three additional pumps of any type may be controlled from a 333 Pump, whether the controlled pumps be used for mobile phase, or for injection.



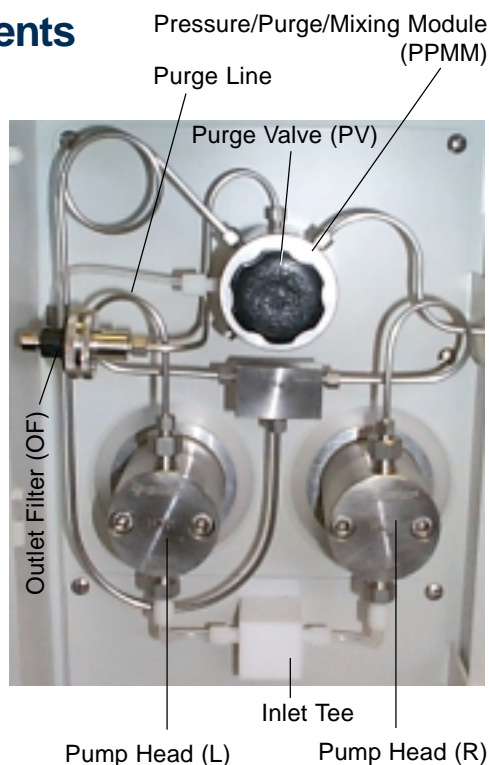


333 Pump's Hydraulic Components

The principal hydraulic components of a 333 Pump are: pump heads, PPMM, and the outlet filter. Construction characteristics are given in Chapter 6.

Two reciprocating pump motors are contained within the body of the pump. The tops of the pump motors protrude through the front panel.

For Pump 1 the filtered-solvent line connects to the inlet-tee; outlets from the tee connect to the pump heads (1L and 1R), thus the motors pump the same solvent (A) to the pressure module. For Pumps 2 and 3 the heads are respectively designated 2L and 2R for solvent B, plus 3L and 3R for solvent C.



333 Pump's Hydraulic Components

Pressure, Purge and Mixing Module (PPMM)

Three functions are combined in the PPMM:

- a pressure transducer (0-60 MPa),
- a static mixer to blend up to 3 solvents under high pressure (2.85 ml chamber volume),
- a purge valve to manually switch the mobile phase between outlet filter and drain.

To operate the purge valve, turn the black knob fully clockwise to direct the flow to the outlet filter, fully counterclockwise to direct the flow to the atmospheric purge-outlet.

Outlet Filter

The outlet filter (Upchurch A332) characteristics are: 10 μm threshold, 1.6 mm thickness, 19 mm diameter, and 160 μl total internal volume.

Solvent Outlet Line



Solvent Inlet (Check-Valve)

Pump Heads

H3 pump heads for preparative use (flow rates between 0.20 and 200 ml/minute, 21 MPa) are pre-mounted directly onto the tops of the driving mechanisms, which have the same axis as the piston motors, so pump heads may be serviced with relative ease. The pump heads must be dismantled for routine servicing purposes (e.g. changing a piston seal).

Each head has a solvent inlet port, a solvent outlet port, an inlet port to the rinsing chamber, an outlet port from the rinsing chamber, and a reciprocating piston. Shown here are the external components, the internal components are described in Chapter 5 (Maintenance).

The piston seal and the bellows are inside the pump head. The solvent inlet port and the solvent outlet port are fitted with connectors containing the check valves. All of these items can be serviced by the user.

Optional Components

Solvent Valve Block

Up to four solvent lines may be connected to the solvent block of each configured 333 or 334 Pump. These solvents may be switched under software control. Thus a two-solvent workstation, where each pump is equipped in this way, permits selection of solvents A1 to A4 from Pump A and B1 to B4 from Pump B. Adding a third pump enables you to select solvents C1 to C4.

Solvent Degasser

The Gilson 864 Degasser is an on-line solvent degasser with four channels, operating under a vacuum of 70 hPa. It maximizes the stability of the chromatographic results by removing dissolved gasses from solvents, down to less than 0.4 ppm, for oxygen dissolved in water, at a flow rate of 1 ml/minute. It is compatible with 33X Pumps up to 10 ml/min (50 ml/min with water) to maintain flow rate accuracy.

333 Pump Control Components

The components for controlling from a 333 Pump are at the front of the instrument. All electrical connections are made at the rear.

Control Panel



Display Unit and Screens

The 40-character, 8-line unit is used to display sets of information: parameters, commands, messages (time related events, flow rates, solvent composition, in-run information, etc.), and soft-key functions.

A 'screen' comprises of a set of information, depending on the software and the choices that you make. Each screen has a unique number, accessible by pressing the **HELP** key.

Keypad and Function Keys

Soft-keys

The bottom line of the display unit is reserved for labeling six variable-function soft-keys (identified by the six evenly spaced circles just below the display unit). The functions of the soft-keys, which are determined by the software, may change from screen to screen. For any given screen, the current function is displayed above each active soft-key. Inactive keys have no function displayed.

Pressing a soft-key selects the function displayed directly above it, for example: **Edit**, **Create**, and **Run**. Descriptions of these and all other soft-key labels are given in Chapter 4.

Fixed function keys

In addition to the variable-function soft-keys, there are fixed function keys as follows:

HELP: to display advice at any time, with no effect on the operation of the pump,

ESC: to change from a software level to a higher one or quit a HELP screen,

CLEAR: to cancel your last entry before it is stored in the memory,

ENTER: to confirm a selection or value and store it in the memory,

Arrow keys (4): to move from one variable field to another (screen dependent),

Numeric keys (0 to 9, and .): to enter values (for predefined parameters).

Stand-by Panel

The stand-by panel comprises an ON/OFF key and three Light Emitting Diodes (LEDs):

- 1) The 'POWER' LED (green) lights up when the main ON/OFF switch is set to ON.
- 2) The 'ON' LED (yellow) lights up when the main ON/OFF (I/O) switch is set to ON (I) and the ON/OFF key on the standby panel is set to ON (pressing the key toggles between ON and OFF).
- 3) The 'ERROR' LED (red) lights up under certain anomaly conditions (see Chapter 5).



The ON/OFF key on the panel is for use when you want to turn off the power for a short period of time or to stop the 333 or 334 Pump instantaneously.

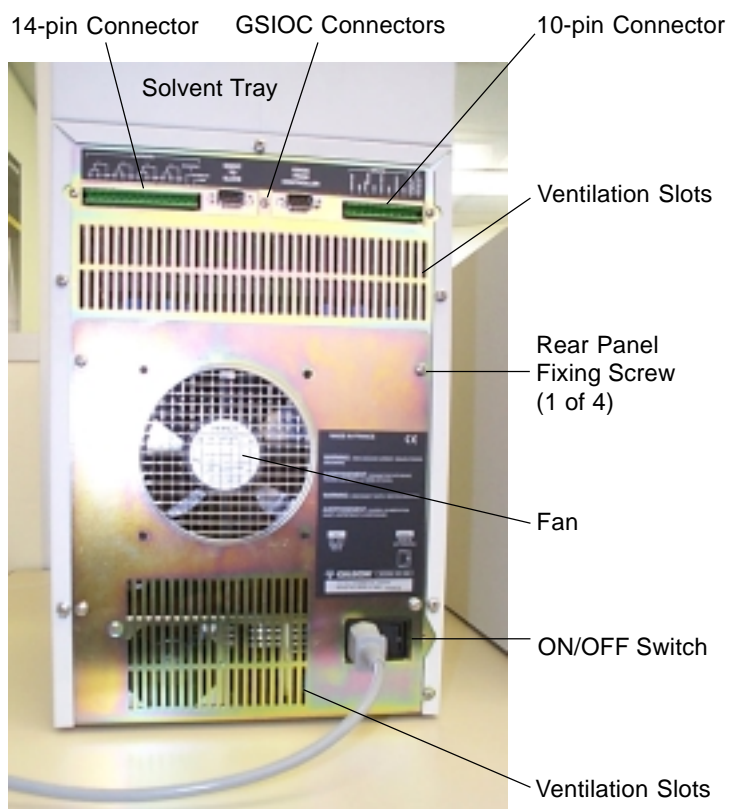
When you want to turn off the power for a longer period of time you should also switch off the power using the main ON/OFF switch on the back panel of the 333 or 334 Pump.

Rear Panel - Electrical Connectors

All electrical connections are made to the rear panel. Also visible are the fan's ventilation slots, which must never be obstructed in any way.

The function of each item is as follows:

- 1 Main power ON/OFF switch.
- 2 Power supply cable socket.
- 3 Fuses and voltage selector.
- 4 14-pin connector socket for output contact signals (relay type).
- 5 10-pin connector socket: 4 input signal channels and 2 output channels:
1 digital output converted to analog (pin-9, 0-1 V, configurable),
1 analog output (pin-10, 142-1000 mV, for pressure).
- 6 GSIOC from controller (333 Pump or computer).
- 7 GSIOC to slave pump (333, 334 Pump and/or 30X Pump) or Gilson 15X UV Detector.



For a 334 Pump, which has no other type of connector, a pair of rotary switches for setting GSIOC ID number setting and bit rate, replaces the left-most GSIOC socket.

Power Connector

The standard 3-pin connector accepts the power supply cord supplied with your 333 or 334 Pump. Power supply cord reference 500005 is for use in France and Germany. Power supply cord reference 500006 is for use in USA and Canada. For other countries, your local Gilson distributor can advise you concerning the type of power connector to use.

Input/Output Signal Connectors (333 Pump)

The two sockets use the 14-pin and 10-pin connectors supplied with your 333 Pump.

GSIOC Connectors

The 9-pin socket(s) accept standard GSIOC connectors. The 333 Pump has two connectors (To Slave and From Controller); the 334 Pump has one connector (From Controller) and two switches for setting GSIOC parameters.

Only use standard GSIOC (Gilson Serial Input Output Channel) connectors.



Accessories

The standard accessories, supplied with the pump, include plumbing items, tools, and electrical connectors. Additional accessories, to be ordered separately, include solvent valve block, solvent degasser, an injection valve holder, extra plumbing items, a column holder, electrical interfaces, and cable kits. A shelf is available on which the pump can be placed, allowing a 30X Pump to be placed underneath.

A diskette is supplied containing Gilson's Pump Data Transfer Software, which enables the user to download information from a 333 Pump to a Personal Computer (PC).

Chapter 6 contains comprehensive lists of items supplied as standard and additional accessories, plus a list of recommended spare parts.

Your 333 or 334 Pump is delivered with its principal hydraulic components already installed. You are advised to read this section, which contains important information relating to both 333 and 334 Pumps; instructions are given for installing accessories, where appropriate.

The software described in this Chapter is for users for whom a 333 Pump is the controlling device. If your controlling device is a PC using (for example) Gilson's UniPoint Software, you should refer to the documentation relating to UniPoint.

The key steps, the minimum necessary to configure the pump(s) from a Master 333 Pump, are given in this Chapter - for full details of 333 software, refer to Chapter 4.

Here is a summary of the key steps:

- 1) Electrically connect the 333 or 334 Pump and any associated components (a detector, other pumps, etc.), connect them to a suitable power supply, and switch-on all components.
- 2) If control is from a Master 333 Pump, check or enter the configuration details using the control panel on the 333 Pump. If control is from PC based software (e.g. UniPoint) refer to the user's guide for the controlling software.
- 3) Make the hydraulic connections to the 333 and 334 Pumps and their associated components, then prime the pump(s); refer to Chapter 4.

You are then ready to enter or activate a Method Program using the control panel of the 333 Pump or from the controlling software.

For software information relating Gilson 15X Detectors, you are advised to refer to the appropriate 15X Detector User's Guide.



Electrical Connections - Switching On

Power Supply

Plug the power supply cord that you received with the pump into the socket on the power receptacle and to a suitable source of power. The actual plug used depends on the country in which you will operate the pump, should the one supplied not be suitable, contact your Gilson representative.

Fuse Installation and Voltage Selection

There are no fuses to install, the pump is simply connected to an AC power supply of 110/120 V or 220/240 V. Automatic selection of the operating voltage takes place on the power supply board.



Switching-on

Gilson 333 and 334 Pumps have two ON/OFF switches: one on the power receptacle and the other at the front (above the LEDs).

To switch on a 333 or 334 Pump:

- 1) Press the switch on the power receptacle to the 'I' position; the 'Power' LED (green) on the front panel should light-up; if it does not, check the power connections.
- 2) Press the soft-touch key on the standby panel; the 'ON' LED (yellow) should light-up. With a 333 Pump, the start up screen should be visible on the control panel's display unit. The third indicator light on a 334 Pump is labelled 'Remote'; on a 333 Pump, it is labelled 'Error'.



333 Pump

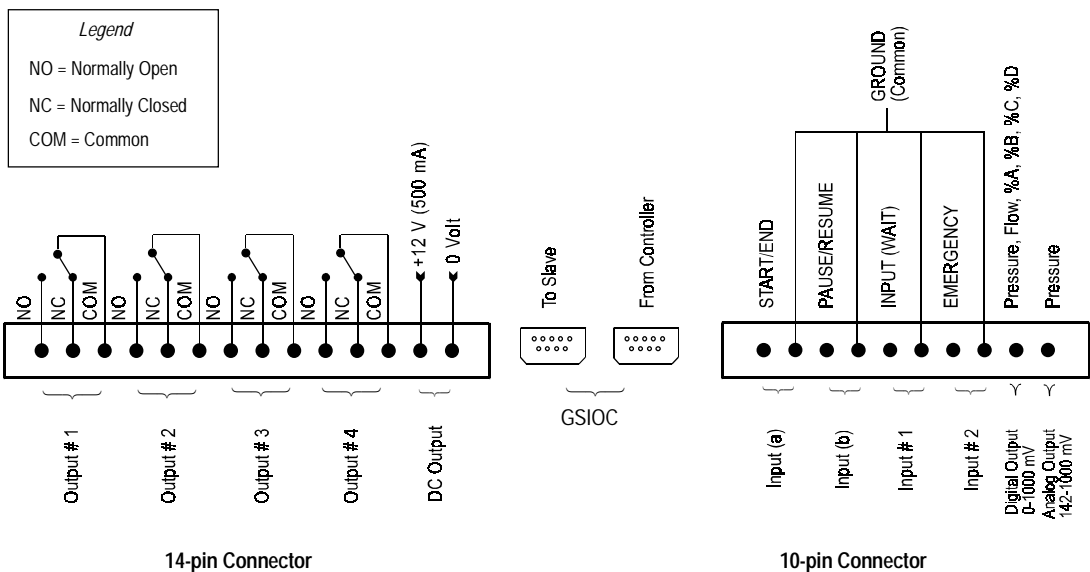
334 Pump

Electrical Connections - Communications

You need to connect GSIOC cables between the pumps, make connections to the detector, and make any single-wire contact connections (for input/output signals), which may be necessary for communicating with other equipment.

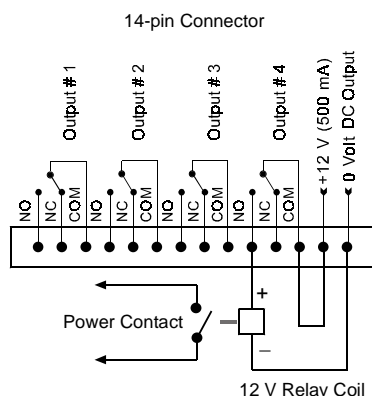
Contact Connections (Input & Output)

The input and output contact functions are shared between two terminal blocks (14-pin and 10-pin) situated on the pump's back panel. **The maximum input voltage for any electrical device connected to each input or output contact is 48 V.**



In order to connect signal wires to the terminal blocks, you must first fit the appropriate connector (as supplied in the standard accessories package). The 14-pin connector fits the left-hand socket and the 10-pin connector fits the right-hand socket. After gently pushing each connectors into its socket, you can connect wires to the appropriate terminal.

To connect a wire to the terminal you should strip back the wire's protective covering by 5 mm, undo the terminal's fixing screw, push the bared wire into the corresponding hole in the terminal block, and then tighten the fixing screw using a small screwdriver.



Powering an External Relay

A 12 V (500 mA) DC supply is available at the right-most pair of pins of the left-hand terminal. This supply can be switched manually from the control panel or automatically from a Method Program by connecting it to one of its neighboring outputs.

Output Signals

- a) Four two-way relay-type outputs are available via the left-hand socket. Each of these outputs is electrically isolated from the others and from ground. Switching from the 'normally closed' to the 'normally open' position takes place under software control (see Chapter 4) at pre-programmed times. You can program these contacts to 'Open', 'Close', or 'Pulse', for a specific duration.

You connect one wire from the receiving device to the common terminal of Output # 1 (2, 3, or 4) and a second wire to either the corresponding 'normally open' or 'normally closed' terminal, depending on the requirements of the receiving device.

- b) An output (pin # 9) is available on the right-hand socket for feeding a recorder or a PC (via a suitable interface). This output, which comes from the pump's microprocessor, can be configured to follow pressure, flow, or composition (%A, %B, or %C). It is labelled 'Digital' but outputs a series of discrete signals (0 - 1 V) via the digital-to-analog converter.
- c) An output (pin # 10) is available on the right-hand socket for feeding any suitable recorder or a PC (via a suitable interface). This analog output, which comes directly from the sensor, is for pressure only (0.142 - 1 V for 0 - 60 MPa).

Input Signals

Four pairs of terminals of the right hand socket are dedicated to specific software-related input functions:

START/END
PAUSE/RESUME
INPUT (WAIT) (Input # 1)
EMERGENCY (Input #2)

You connect a pair of wires from an output (e.g. relay-type) of the external device, to a pair of terminals, for each of the functions that you want controlled externally.

Except for WAIT, to activate one of these inputs, you must change the state (close or open) of an output on the external device.

START/END

An external relay contact, connected to this input, may be used to start (OPEN → CLOSE) and stop (CLOSE → OPEN) program.

PAUSE/RESUME

An external relay contact, connected to this input, may be used to pause (OPEN → CLOSE) and resume (OPEN → CLOSE) the Method Program currently running. The pause may be configured (Chapter 4) with or without flow.

With flow means that pumping continues at the rate and composition that existed at the time the pause was initiated; when 'resume' is signaled the Method Program continues from the same point.

INPUT (WAIT) (Input # 1)

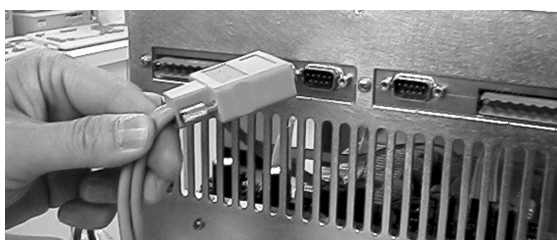
An external relay contact, connected to this input, may be used to signal to the Method Program currently running the 333 Pump that the external equipment (e.g. fraction collector, sampling injector) is ready.

EMERGENCY (Input #2)

Closing an external relay contact, connected to this input, may be used to signal to the pump software to start a Safety Program file (file 24).

GSIOC Connections

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 500933). 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.

A) A 334 (or a second 333 Pump) is being controlled from a 333 Pump.

Plug one end of a GSIOC cable into the socket marked 'GSIOC FROM CONTROLLER' on the first pump (or detector) being controlled and plug the other end into the socket marked 'GSIOC TO SLAVE' on the controlling pump.

B) A 334 or 333 Pump is being controlled from a computer.

Plug one end of a GSIOC cable into the socket marked 'GSIOC FROM CONTROLLER' on the first pump being controlled, plug the other end into the GSIOC socket of a Gilson 506C System Interface Module, and connect an RS232 cable from the 506C to the computer. Alternatively you can use a Gilson 605 RS232C-GSIOC Adapter.

Chapter 7 contains a description of the GSIOC cable, connector pin-out information, a detailed description of the GSIOC protocol, and a list of commands.

GSIOC ID

You must use the default values for a system where a 333 Pump (Master) is controlling other devices (slaves). By default the master pump is assigned ID # 1, the slave elution pumps are assigned ID # 2, and #3. The slave injection pump is assigned ID #4.

The GSIOC IDs may be changed where the pump(s) are being controlled from a computer. In which case, the configured IDs must correspond to those set using the controlling software.

For each level, the GSIOC identification number (ID) that you set must be unique for each item of Gilson equipment.

For a 333 Pump, the ID (0-63) is configured as follows:

- 1) Switch on the pump; wait until initialized.
- 2) Press in turn: **Edit, Config, Misc.**
- 3) Key in the desired ID for the 333 Pump, then press **ENTER.**

For a 334 Pump, the ID (0-9) is set mechanically using the left-hand of the two selectors on the rear panel (see Figure 3.5b).

For a 305 Pump, the ID (0-63) is configured using the 305 Pump's keypad (see 305 Pump User's Guide).

For a 306 Pump, the ID (0-63) is set mechanically using switches on the rear panel (see 306 Pump User's Guide).

Bit Rate

You must use the default values for a system where a 333 Pump (Master) is controlling other devices (slaves).

When a 334 Pump is used as a slave to a 333 Pump, the bit rate of the slave must be set to 'External'. Or, when the bit rates of the sending and receiving devices need to be matched, you can set a specific bit rate.

GSIOC ID (0-9)



Bit Rate



0 = External
1 = 9600 baud
2 = 19200 baud

For a 333 Pump, the bit rate is set as follows:

- 1) Switch on the pump; wait until initialized.
- 2) Press in turn: **Edit, Config, Misc.**
- 3) Press the down arrow key.
- 4) Press **Change** until you see the desired bit rate (1200 to 19200 or External).
- 5) Press **ENTER**.

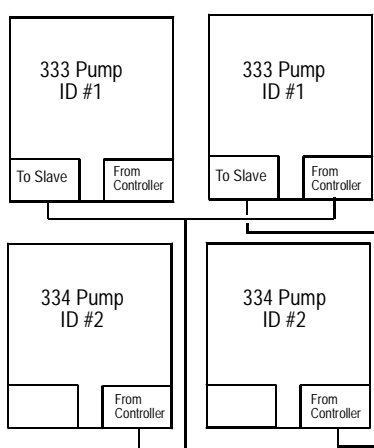
For a 334 Pump, the bit rate (9600, 19200, or External) is set mechanically using the right-hand of the two selectors on the rear panel.

When a 334 Pump is used as a slave to a 333 Pump, you must select 'External'.

For a 306 Pump, the bit rate is set mechanically using switches on the rear panel (see 306 Pump User's Guide). When the 306 Pump is used as a slave to a 333 Pump, you must select 'External'.

External clock control should also be selected for all pumps running under computer control. Internal is used when the connected device does not provide a clock source, in which case you have to select an appropriate bit rate.

Twin Pump Systems



Two pumps may be connected in parallel thereby doubling the programmed flow rate. In theory there is no limit to the number of pumps that can be connected in parallel, but the twin system with two liquid streams is the most practical. The hydraulic outlet tubings are connected together using a Tee-piece to increase the overall flow rate.

To set-up 333 or 334 Pumps to operate in parallel, you must give each of the paralleled pumps the same GSIOC ID: the Master 333 Pump has an ID = 1 as does its twin; the Slave 32X Pump and its twin both have an ID = 2, and so on. The twinned pumps are connected together using GSIOC cables.

When operating a twinned system, the commands from the controlling device go to each pair of twins, so that they act in unison. The twinned pumps must have the same configuration as their master pumps.

Hydraulic Connections

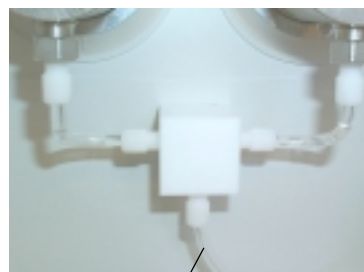
Solvent Inlet Lines

For each solvent pump, the standard accessory package contains an inlet line fitted with a 20 μm inlet filter.

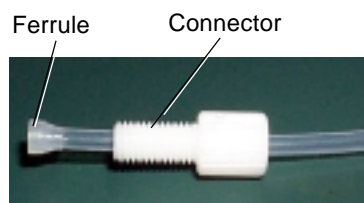
Air entering the hydraulic circuit would adversely affect the flow rate. Make sure that all connectors are correctly seated and properly tightened.

Proceed, with care, as follows:

- 1) Remove the plastic plug from the inlet of each head.
- 2) Check that the reverse ferrule is correctly seated at the end of the tubing.
- 3) Connect line A to inlet tee-piece of Pump A, line B to inlet tee-piece of Pump B, etc. When screwing or unscrewing the white connector, simultaneously push the tubing so that the end of the tubing touches the bottom of the female port and so that the ferrule is not gripped by the connector, which would otherwise cause the tubing to twist.
- 4) Check that the connectors are tight enough to prevent air from entering the hydraulic circuit.
- 5) In normal use, the pump operates with the door closed, the solvent line must therefore be threaded through the port to the exterior, before placing the inlet filter in the appropriate solvent bottle.
- 6) Clip the solvent lines to the tray. First, each tubing is attached to a clip by pushing it gently into the fissure, then the clip is pushed into the appropriate slot on the tray.
- 7) Prime the solvent lines (refer to Chapter 4).

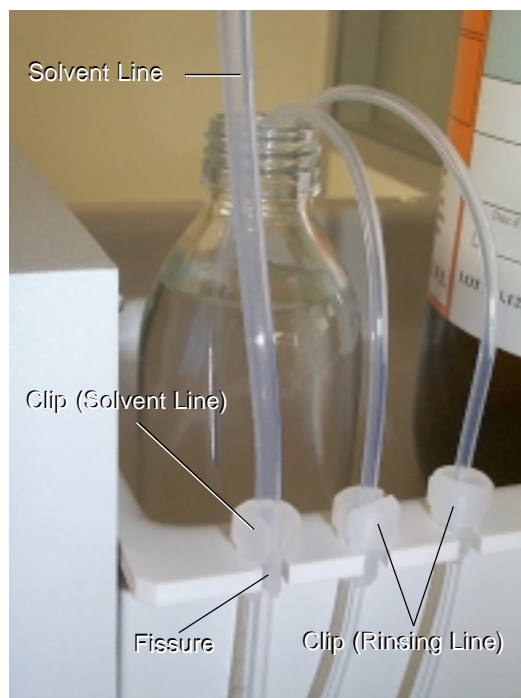


Solvent Inlet Line



Ferrule

Connector



Solvent Line

Clip (Solvent Line)

Fissure

Clip (Rinsing Line)



Piston Rinsing Chamber

If the solvent is an aqueous solution containing more than 0.1 M of solute, which is solid in ambient conditions, then the piston should be rinsed continuously with water. A plumbing kit (ref: E66379) should be installed for the piston rinsing chambers of both heads.

- 1) The plumbing kit consists of: two rinsing lines, which connect to the rinsing-chamber inlets at the **bottom** of each head (the longer line connects to the left head) and two shaped purge lines, which connect to the rinsing-chamber outlets at the **top** of each head.
- 2) Fill the glass bottle (reference E66386) with distilled water and push the open end of each rinsing line through the bottle's pierced cap, to between 1 to 2 cm of the bottom.
- 3) Clip the rinsing lines to the tray. Each line is first attached to a clip by pushing it gently into the fissure, and then the clip is pushed into a slot on the tray.
- 4) Ensure that each purge line is closed (turn each connector fully counterclockwise until finger tight), then press **Manual**, **Prime**, **Start**. After about 20 seconds, water should have sufficiently filled the rinsing line, even though some air is also present.
- 5) Press **Stop**; then undo both purge-line connectors. Water will run from each purge line into the drip tray; the rinsing lines and rinsing chambers will fill with water. When you see bubble-free water in the rinsing lines, and that air is no longer exiting from the head via the purge lines, close both purge lines. In use, water from the small bottle rinses the piston - although it is a closed circuit you may need to change the water from time to time, and of course repeat this procedure.

Injector Connection

Connect the appropriate tubing to the outlet filter of the 333 Pump.

Drip Tray

The removable drip-tray fitted to the pump is supplied as standard.

The drip tray slots into the well at the bottom of the pump. Installation consists of lifting up the tray, fitting one end with a length of tubing. The other end of the tubing goes to the drain (or a suitable receptacle) via the drain tubing exit port. Installation is completed by replacing the drip tray.

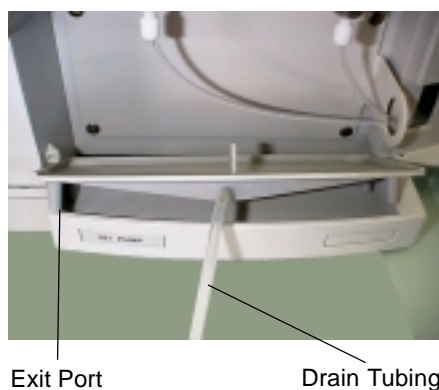
Solvent Valve Block Installation

A solvent valve block is available as an optional extra; it may be used to test the effectiveness of different solvents (or to perform rinsing, cleaning, and conditioning). The liquids are routed via suitable tubing to the valve block, which performs all of the required switching functions, at low pressure, under software control.

This item would be pre-installed by your Gilson representative. The solvent valve block replaces the plate that can be seen just above the drip tray.

Pump Head Installation

The pump heads are pre-installed. However, for routine servicing, you will need to remove the pump heads (refer to Chapter 5).



Accessories

Additional accessories may be obtained from Gilson, these are: a degasser, a column holder, a holder for a manual injection valve, and a shelf to enable you to stack 333, 334 Pumps, and 15X Detectors. This shelf is designed to support the weight of the pump and solvent bottles. Assembly consists of using the supplied screws to attach four legs to the metallic tray. Space is available between the legs for a detector or a 30X Pump.

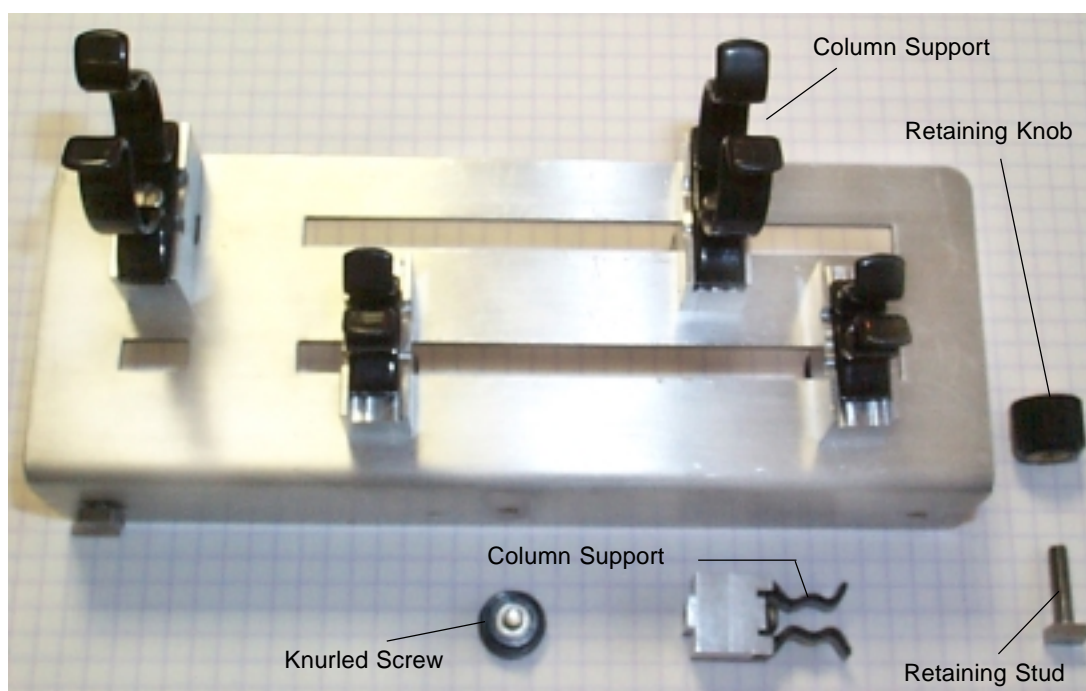
The solvent-bottle tray, which is supplied as a standard accessory, is easily fitted to both 333 and 334 Pumps.

Degasser

Please refer to the User's Guide of the Gilson 864 degasser.

Column Holder

The column holder attaches to the left side of the pump. Three pairs of column support, fitted with clips for different diameter columns, are provided in the kit.



Holder Installation

- 1) Loosely fit the retaining stud.
- 2) Slide the studs into the tops of the retaining slots at the side of the pump.
- 3) When the holder is correctly positioned, fully tighten the retaining knobs.

Support Installation

- 1) Push one of a pair of column supports into either of the slots.
- 2) Fix the column support in position using a knurled screw.
- 3) Repeat for the second column support but don't fully tighten the screw.
- 4) Slide the second column support along the long slot to match the length of the column.
- 5) Fully tighten the screws.

Injection Valve Holder

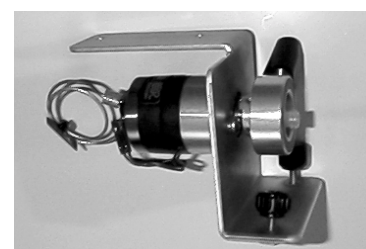
The injection valve holder has two pairs of holes, one pair is for mounting the valve in the vertical position and the other is for mounting the valve in the horizontal position.

Holder Installation

- 1) Loosely fit the retaining studs to either pair of holes.
- 2) Slide the feet into the top of the retaining slot at the side of the pump.
- 3) When the holder is securely positioned, fully tighten the retaining-feet knobs.

Valve Installation

- 1) Secure the valve body to the holder using two screws.
- 2) Fit the valve handle, as described in the documentation supplied by the valve manufacturer.





Solvent-bottle Tray

The figure shows the tray being fitted to a 333 Pump. For a 334 Pump, the tray simply sits on top of the pump, its feet resting in the special recesses.

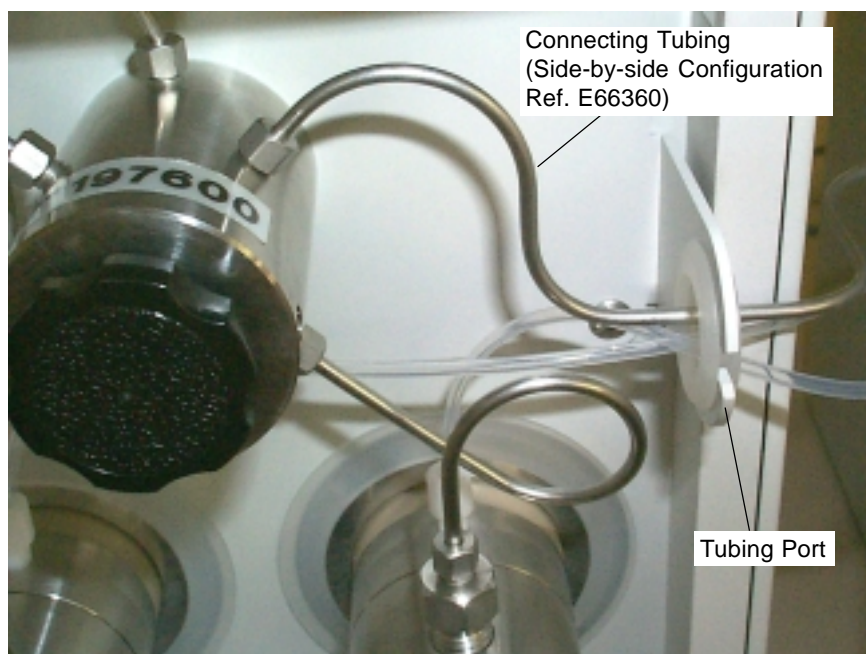
Positioning the Pumps

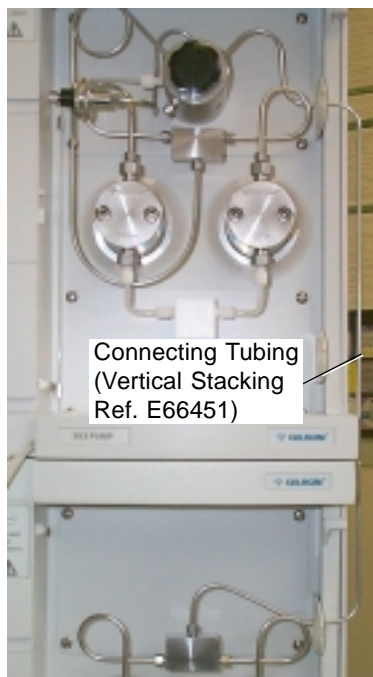
Horizontal Configuration

In normal use the pumps may be placed side-by-side (see “Configuration Example 1”). The 333 Pump (Solvent A), at the left, is fitted with PPMM and outlet filter. To connect to the 334 Pump at the right, you require a special shaped tubing (E66360), available as a standard accessory. Solvent B is routed via the outlet tee-piece of 334 Pump, to an inlet on the PPMM of the 333 Pump, where the two solvents are mixed at high pressure.

In order to maximize the performance of your 333-334 Pumping System, it is important that you use only the special shaped tubing to link the two pumps.

The tubing linking the two pumps goes through the tubing port, together with solvent and rinsing port tubings. In the figures, the tubing-port is in the position where the tubings are “locked” in place. To make it easy to install and to remove tubings, there is a fissure in the tubing port, which is accessed by rotating the tubing port until the fissure lines up with the opening in its housing.





In order to maximize the performance of your 333-334 Pumping System, it is important that you use only the special shaped tubing to link the two pumps.

Vertical Stacking

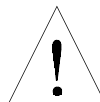
Where bench space is at a premium, the pumps may be stacked one on top of the other. The 333 Pump (Solvent A), at the top, is fitted with PPMM and outlet filter. To connect to the 334 Pump at the bottom, you require a special shaped tubing (E66451), available as an additional accessory. Solvent B is routed via the outlet tee-piece of 334 Pump, to an inlet on the PPMM of the 333 Pump, where the two solvents are mixed at high pressure.

The tubing linking the two pumps goes through the tubing port, together with solvent and rinsing port tubings. In the figures, the tubing-port is in the position where the tubings are "locked" in place. To make it easy to install and to remove tubings, there is a fissure in the tubing port, which is accessed by rotating the tubing port until the fissure lines up with the opening in its housing.

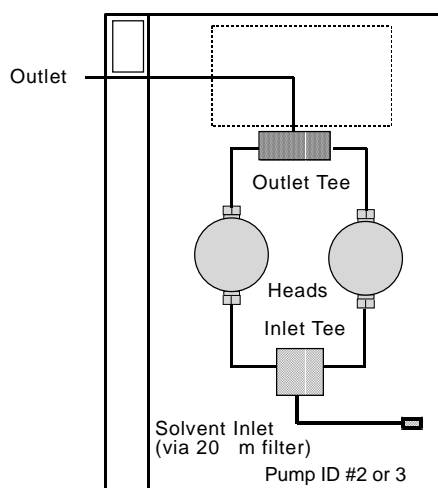
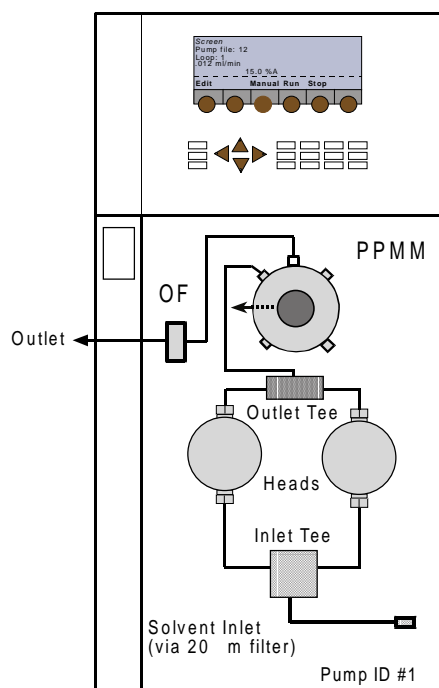
Setting-up

Basic Elements

Take care when you are reconfiguring a 333 Pump, and have previously created Method Program files, you will probably need to modify these files, if they are to work correctly with the new configuration (types of solvent, associated pumps, etc.).

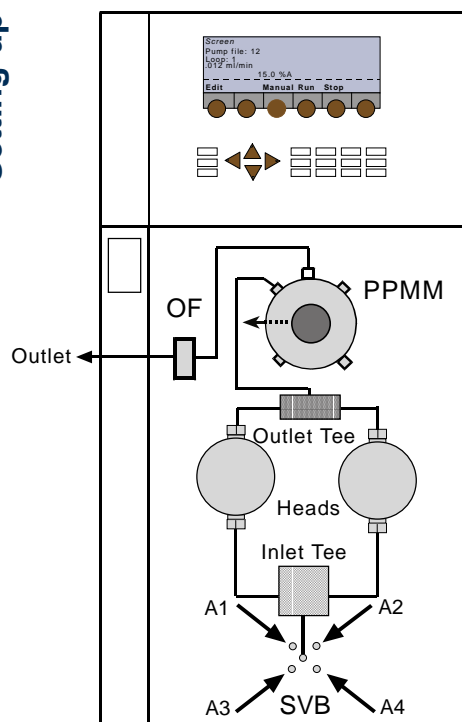


A 333 Pump may be used alone, or as the master pump controlling up to two other solvent pumps (333 or 334). It may also be used to command an injection pump (30X). 334 Pumps are for use as extra solvent pumps always connected hydraulically to the PPMM of a 333 Pump.



Key:
 PPMM = See text below
 OF = Outlet Filter
 T = Tee-piece

Setting-up



Extended capabilities for solvent selection are offered by the addition of a Solvent Valve Block (SVB) to any of the configured pumps (A1 to A4, B1 to B4, C1 to C4). Figure opposite shows how the addition of a Solvent Valve Block (SVB) could be used to test the effectiveness of different solvents, selected successively. The solvents are routed via suitable tubing to the SVB, which performs all of the required switching functions, at low pressure (no mixing takes place between solvents connected to a valve block).

Three typical configurations are described in the following Sections:

- 1) **Binary Gradient** (or an isocratic mixture of two solvents): 333-334 Pumping System. (or ternary gradient: 333-334-334 Pumping System).
- 2) **Injection Configuration**: 333-334 Pumping System and 30X injection pump.
- 3) **Binary Gradient** (controlled from a PC): 333-334 Pumping System.





Configuration Example 1: Binary Gradient or Isocratic

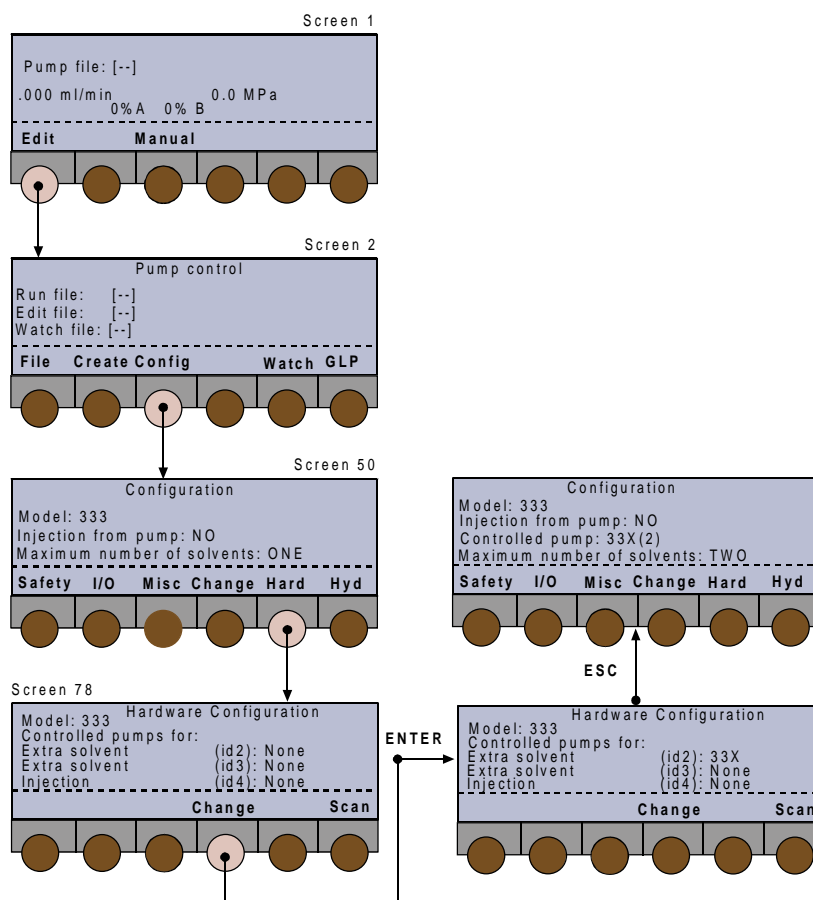
A 333 Pump may be set-up to control the flow and composition on a time variant (gradient) or a time invariant (isocratic) basis, when associated with a 334 Pump. Thus, you can pump gradients using two solvents, or you can pump in isocratic mode, after mixing (A from one pump, B from the other).

For a binary-gradient configuration, install a 333 Pump (Master) at the left and a 334 Pump (Slave) at the right, although the slave pump could be a second 333 Pump. Solvent B is routed via the outlet Tee-piece of the 334 Pump to an inlet on the PPMM of the Master 333 Pump, where the two solvents are combined at high pressure. When three solvents are to be combined, a second slave pump can be connected to the PPMM.

Setting-up - What You Must Do

- 1) Switch on the pump(s); check and set their GSIOC IDs, the start-up screen appears (briefly, Screen 0); then make the electrical connections between the instruments, including the GSIOC cable linking Master to Slave.

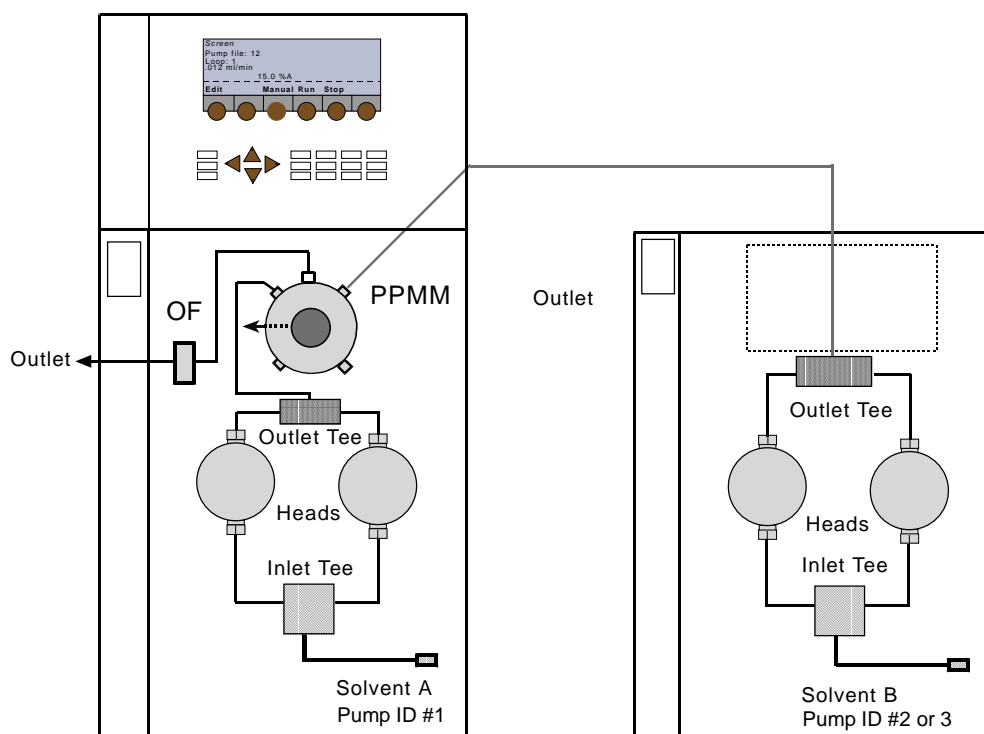
Setting-up



In the Figures given in this Chapter: The key to push is indicated by the lighter color soft-key; follow the path indicated by the arrows. When you should push other control panel keys (e.g. ENTER) these are indicated in bold at the appropriate point.

2) Check and if necessary change the software configuration:

- at the Run Screen (1), press **Edit**, or **Pump** if linked to a Gilson 15X Detector.
- at the Pump Control Screen (2) press **Config**.
- for a new pump, the Configuration Screen (50) shows 333 as the model, H3 as the head type, 'Injection from pump: NO', 'Maximum number of solvents: ONE'.
- to add solvent pump B, press **Hard**; Screen (78) appears, at 'Extra solvent (id 2)' press **Change**, until you see '334' (or '333'), press **ENTER**.
- the Configuration Screen (50) should now show 333 as the model, H3 as the head type, 'Injection from pump: NO', 'Maximum number of solvents: TWO'.
- then for each solvent pump (if head type does not match those fitted to either pump),
- select 'Head type', press **Change**, until you see the head type fitted (H3), press **ENTER**.



Alternatively, provided the first step (1) is completed correctly, you may press **Scan** to identify any connected pumps, which are then added to Screen 78 next to their currently configured IDs. You are now ready to create your Method Program file(s). Optionally, you can modify advanced configuration features (refer to Chapter 4).

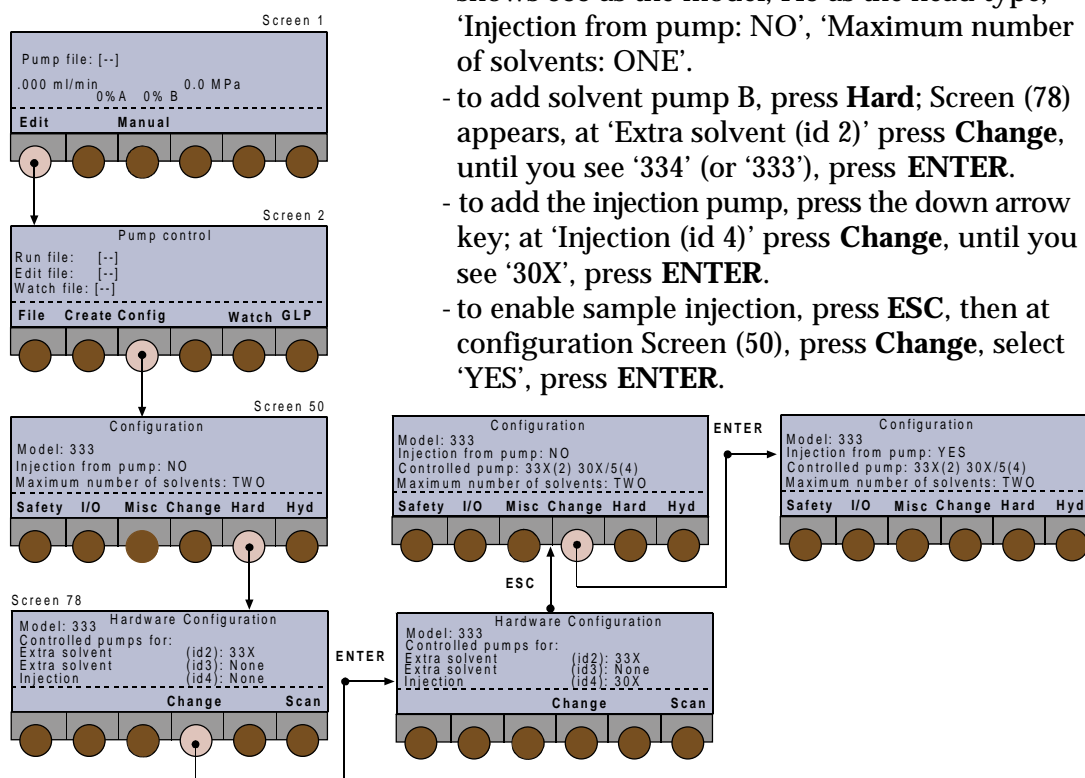
- 3) Make the following hydraulic connections:
 - from the Outlet Filter of the Master 333 Pump to the downstream injector.
 - solvent line A to the inlet Tee-piece on the Master 333 Pump,
 - solvent line B to the inlet Tee-piece on the Slave 334 Pump,
 - special tubing (ref: E66360) from the Tee-piece of the Slave Pump to the inlet on the 333's PPMM.
 - prime the system (refer to Chapter 4).

Configuration Example 2: Solvent Mixing and Injection

A 333 Pump may be set-up to control the flow and composition on a time variant (gradient) or a time invariant (isocratic) basis; to carry out sample injection, a 30X Pump must also be associated with the 333 Pump. In this case, the 333 Pump controls the injection pump, flow, and composition. Solvent B is routed via a Tee-piece to an inlet on the PPMM of the Master 333 Pump, where the two solvents are combined at high pressure.

Setting-up – What You Must Do

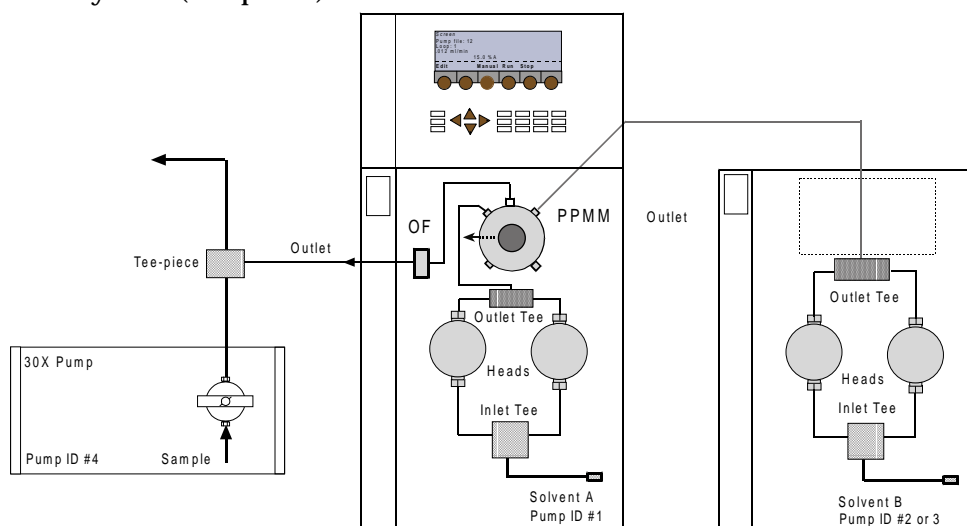
- 1) Switch on the pump(s); check and set their GSIOC IDs, the start-up screen appears (briefly, Screen 0); then make the electrical connections between the instruments.
- 2) Check and if necessary change the software configuration:
 - at the Run Screen (1), press **Edit**, or **Pump** if linked to a Gilson 15X Detector.
 - at the Pump Control Screen (2) press **Config**.
 - for a new pump, the Configuration Screen (50) shows 333 as the model, H3 as the head type, 'Injection from pump: NO', 'Maximum number of solvents: ONE'.
 - to add solvent pump B, press **Hard**; Screen (78) appears, at 'Extra solvent (id 2)' press **Change**, until you see '334' (or '333'), press **ENTER**.
 - to add the injection pump, press the down arrow key; at 'Injection (id 4)' press **Change**, until you see '30X', press **ENTER**.
 - to enable sample injection, press **ESC**, then at configuration Screen (50), press **Change**, select 'YES', press **ENTER**.



- the Configuration Screen (50) should now show 333 as the model, H3 or H2 as the head type, 'Injection from pump: YES', 'Maximum number of solvents: TWO'.
- then for each solvent pump (if head type does not match those fitted to either pump),
- press **Hyd**, then at the next screen (90 for Solvent A, 91 for Solvent B, etc.) :
- select the solvent pump to change by pressing the **Next** or the **Prev** key,
- select 'Head type', press **Change**, until you see the head type fitted (H3), press **ENTER**.
- head size and other parameters for the injection pump (Screen 94) can be accessed by pressing the **Inject** soft-key at Screen 90, 91, or 92.

Alternatively, provided the first step (1) is completed correctly, you may press **Scan** to identify any connected pumps, which are then added to Screen 78 next to their currently configured IDs. You are now ready to create your Method Program file(s). Optionally, you can modify advanced configuration features (refer to Chapter 4).

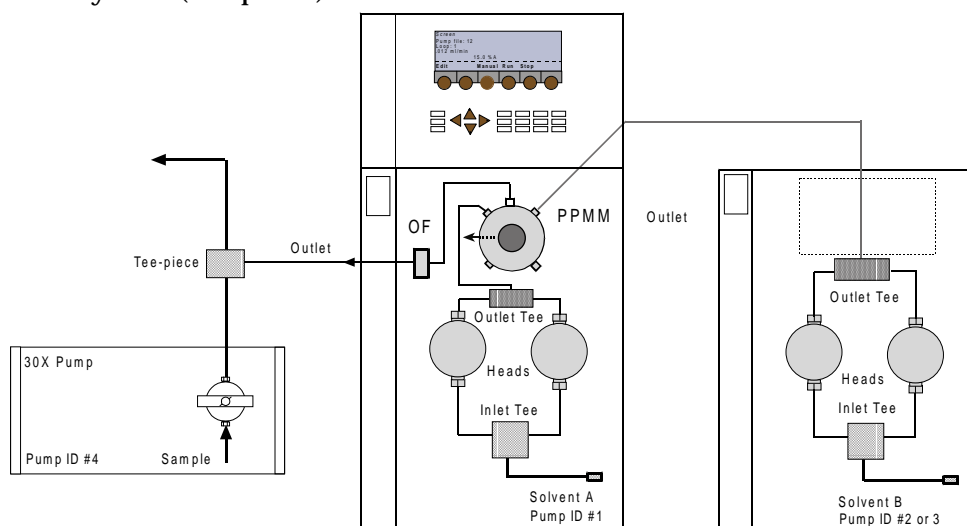
- 3) Make the following hydraulic connections:
- from the Outlet Filter of the Master 333 Pump to the downstream Tee-piece.
 - solvent line A to the inlet Tee-piece on the Master 333 Pump,
 - solvent line B to the inlet Tee-piece on the Slave 334 Pump,
 - special connector (ref: E66360) from the outlet Tee-piece of the Slave Pump to the inlet of the 333's PPMM.
 - prime the system (Chapter 4).



- the Configuration Screen (50) should now show 333 as the model, H3 or H2 as the head type, 'Injection from pump: YES', 'Maximum number of solvents: TWO'.
- then for each solvent pump (if head type does not match those fitted to either pump),
- press **Hyd**, then at the next screen (90 for Solvent A, 91 for Solvent B, etc.) :
- select the solvent pump to change by pressing the **Next** or the **Prev** key,
- select 'Head type', press **Change**, until you see the head type fitted (H3), press **ENTER**.
- head size and other parameters for the injection pump (Screen 94) can be accessed by pressing the **Inject** soft-key at Screen 90, 91, or 92.

Alternatively, provided the first step (1) is completed correctly, you may press **Scan** to identify any connected pumps, which are then added to Screen 78 next to their currently configured IDs. You are now ready to create your Method Program file(s). Optionally, you can modify advanced configuration features (refer to Chapter 4).

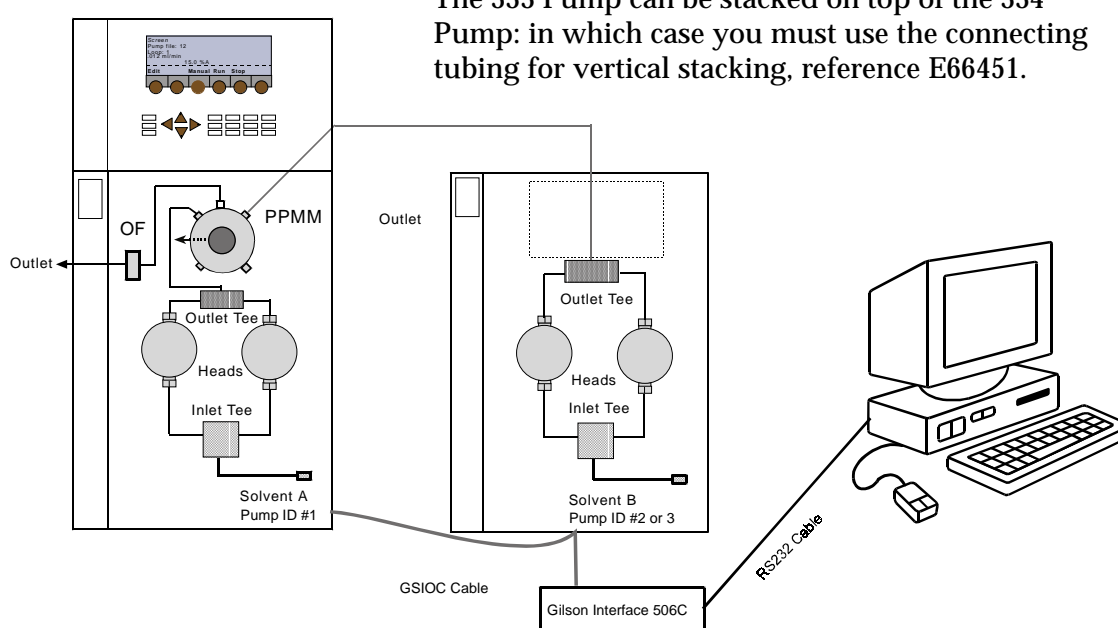
- 3) Make the following hydraulic connections:
- from the Outlet Filter of the Master 333 Pump to the downstream Tee-piece.
 - solvent line A to the inlet Tee-piece on the Master 333 Pump,
 - solvent line B to the inlet Tee-piece on the Slave 334 Pump,
 - special connector (ref: E66360) from the outlet Tee-piece of the Slave Pump to the inlet of the 333's PPMM.
 - prime the system (Chapter 4).



Configuration Example 3: 333-334 Pumping System with Control from a PC

The 333 Pump (Solvent A), at the left, is fitted with a PPMM. To connect to the 334 Pump at the right, you require a special shaped tubing (ref: E66360). Solvent B is routed via the outlet tee-piece of 334 Pump, to an inlet on the PPMM of the 333 Pump, where the two solvents are mixed at high pressure.

The 333 Pump can be stacked on top of the 334 Pump: in which case you must use the connecting tubing for vertical stacking, reference E66451.



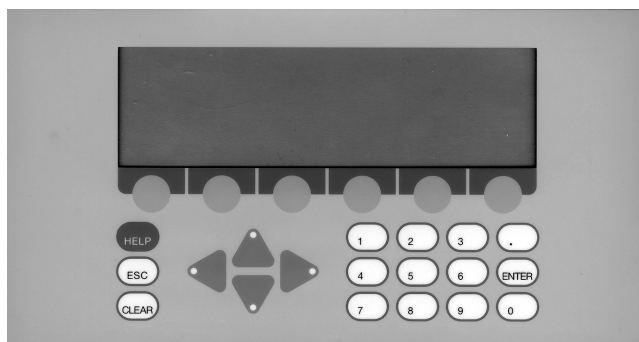
Setting-up – What You Must Do

- 1) The two pumps must have different GSI OC IDs (except if working in parallel); normally 1 and 2. Set their GSI OC IDs using the rotary switches on their rear panel.
- 2) Make the electrical connections between the PC, systems interface module. The two female connectors on the GSI OC cable are plugged into the “FROM CONTROLLER” sockets on the pumps and a second cable connects from the male socket to the next unit in the line (e.g. 15X Detector) or the systems interface module (Gilson 506C).
- 3) Switch on the pumps.
- 4) Use the controlling software (UniPoint) to configure and program the pumps.

- 5) Make the following hydraulic connections:
- from the Outlet Filter of the 333 Pump to the downstream injector.
 - solvent line A to the inlet tee-piece on 333 Pump,
 - solvent line B to the inlet tee-piece on 334 Pump,
 - special tubing (ref:E66360) from the outlet tee-piece of the 334 Pump to the inlet of the 333's PPMM.
 - prime the system.

Using the Control Panel

The control panel consists of a display unit and a keypad.



Display Unit

The 40-character, 8-line display unit is used to show time related events, flow rate, solvent composition, in-run information, and so on. The bottom line of the display unit is for labeling six variable-function soft-keys.

Keypad

The soft-keys are identified by the six evenly spaced circles just below the display unit.

Pressing a soft-key selects the function displayed directly above it, for example: **Edit**, **Manual**, and **Run**. Descriptions of these and all other soft-key labels are given later in this Chapter. Where a soft-key may take an alternative label, the alternative is shown in between parenthesis; for example, **Edit (Pump)**.

In addition to the variable-function soft-keys, there are fixed function keys as follows:

Four arrow keys:

to navigate around the screen,

Eleven numeric keys (0 to 9, and .):

to enter values (for predefined parameters),

ENTER to enter a value or option into memory,

HELP for detailed help messages (including the screen number).

CLEAR to cancel a value before it is entered into the memory,

ESC to change from a software level to a higher one.

For the screens that illustrate this Chapter, the soft-key to press is indicated by the lighter color soft-key; follow the path indicated by the arrows. When you should press other control panel keys (e.g. **ENTER**) these are indicated in bold at the appropriate point.

Switching On the Pump

- 1) The power supply switch, located on the rear panel, must be set to the ON position (I); the POWER LED comes on. Next, press the ON/OFF switch on the standby panel at the front of the pump; the ON LED illuminates.
- 2) After switching on a 333 Pump, the display shows *Screen 0* for one second whilst initialization takes place. During which time a message indicating the software version is displayed, then you see the ready-to-run screen (*Screen 1*). This dynamic screen varies according to the associated equipment, whether a Method Program exists, and according to in-run information.

Wait for 1 second ...

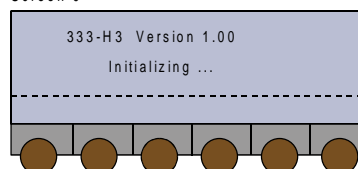
Screen 1 looks like this, the first time you switch on, when a Gilson Model 15X Detector is associated with the pump. In this case the top line is dedicated to showing the output signal and wavelength of that detector. Dual wavelength detectors (155 & 156) have both output signals displayed. The **Detect** key accesses the detector functions.

Screen 1 looks like this, the first time you switch on, when no Method Program file has yet been run and when there is no associated 15X Detector.

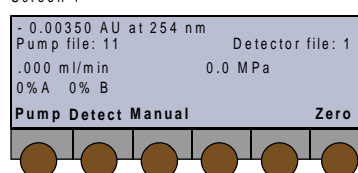
Screen 1 looks like this, when you switch on, and a Method Program file has been run previously.

Screen 1 may look like this where, at the end of the Method Program, the flow rate is > zero.

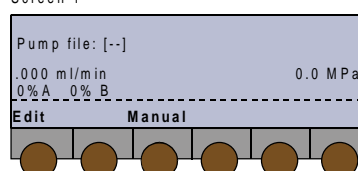
Screen 0



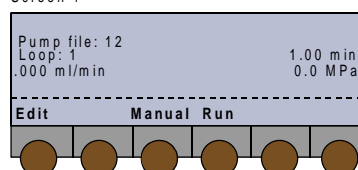
Screen 1



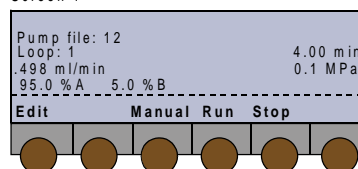
Screen 1



Screen 1



Screen 1



Convention for pump file numbers:

Pump file: [--] = no file selected.

Pump file: [xx] = file xx is selected but is empty.

Pump file: xx = file contains at least one event
(Method Program or Safety File)

Priming

The following steps must be completed before operating the pump, under the control of the pump's software, by a computer based program, or manually from the pump's control panel.

- 1) Make the electrical and hydraulic connections to the pump(s).
- 2) Connect the power and switch on the pump(s).
- 3) Prime the hydraulics, initialize and run-in the piston seals (if new).

Hydraulic Priming

This is an essential step, which must be carried out before operating a 333 Pump or 334 Pump.

- 1) If one or more pumps are controlled from a 333 Pump, the additional pump(s) must be declared in the configuration (see "Configuring").
- 2) Fill the solvent bottles with (degassed) HPLC-grade solvents and immerse the filters of the pumps' inlet tubings in these bottles.
- 3) Switch the valve to the purge position.
- 4) Press **Manual**, **Prime**, then **Start** for the pump head that is to be primed (see "Manual Operations"). If after two minutes, solvent does not flow from the purge valve's outlet, check that the valve is in the open position, then remove the tubing and attach a syringe to the purge valve's outlet, using a suitable adapter.
- 5) Draw solvent into the syringe while continuing to pump. When solvent appears in the syringe, press **Stop**, to cease pumping.
- 6) Reconnect the tubing and continue priming for as long as is necessary. No bubbles should be present in the solvent flowing through the tubing. Press **Stop**, to cease pumping.
- 7) Repeat the procedure for the other pumps in the system.

- A) Running a pump head dry, for more than a short time, will damage the piston seal.
- B) Ensure that the purge valve is fitted with a drain tube, before priming the pump.
- C) During priming the low pressure limit is inactive, the high pressure limit is automatically set to 3 MPa, to protect the column if you forget to open the purge valve, in which case the screen displays the following message, 'Open Purge Valve'.



After Priming

- 1) Use the GLP function **Seal** to initialize the piston seals.
- 2) After completing the installation and configuration processes, you can create and run Method Programs.

Configuring

Introduction

To configure, you enter descriptions of your pumping system's hardware. You verify, and where necessary, change the configuration (refer to "Hardware Configuration" and "Hydraulic Configuration" for detailed information).

As a minimum, you must correctly describe and identify (GSIOC) all pumps: the controlling pump (Master) and those it controls (Slaves).

Additionally, you may configure the input/output signal parameters, safety functions, and fine tune the hydraulic parameters (refill time, inlet pressure, compressibility, etc.).

Procedure

Switch on the 333 Pump, then (after initialization) you see the ready-to-run screen (*Screen 1*). You will see the following soft-keys at one time or another:

Pump (Edit) to access pump operations,

Detect to access an associated detector,

Manual to prime and operate manually,

Run to run the current Method Program file,

Pause to interrupt the Method Program,

Resume to restart a paused Method Program,

End to stop a Method Program,

Stop to stop pumping and Method Program (if running),

Zero to zero the detector signal (if associated).

- 1) Press: **Pump (Edit)**, you see the 'Pump Control' screen (*Screen 2*) you will see the following soft-keys at one time or another:

File to access the file management operations,

Edit (Create or View) to modify an existing Method Program file,

Create (Edit or View) to enter a new Method Program file,

View (Edit or Create) to read (only) an existing Method Program file,

Config to enter configuration parameters,

GLP to access audit, maintenance, run-in and test functions for a 333 pump,

Watch to obtain post-run information.

- 2) Press: **Config**, you see the 'Configuration' screen (*Screen 50*), which indicates the model and head type for the Master pump and any pumps under its control. Inside this mainly descriptive screen, you can activate an associated sample injection pump. The available soft-keys are:

Safety to access high and low pressure limits, restart and malfunction options,

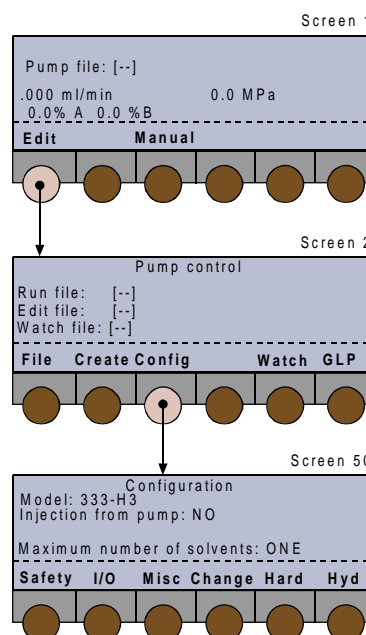
I/O to access specific Input/Output functions (pulse length, output signal type, etc.),

Misc for GSIOC id, bit rate, units, display contrast, screen saver, beeper ON/OFF.

Hard to change the pump model and identify any controlled pumps,

Hyd to access hydraulic parameters, such as Inlet Pressure and Compressibility.

When setting-up a new system you should proceed by reviewing, and changing where necessary, these items in the following order: Hard, Hyd, Safety, I/O, and Misc.



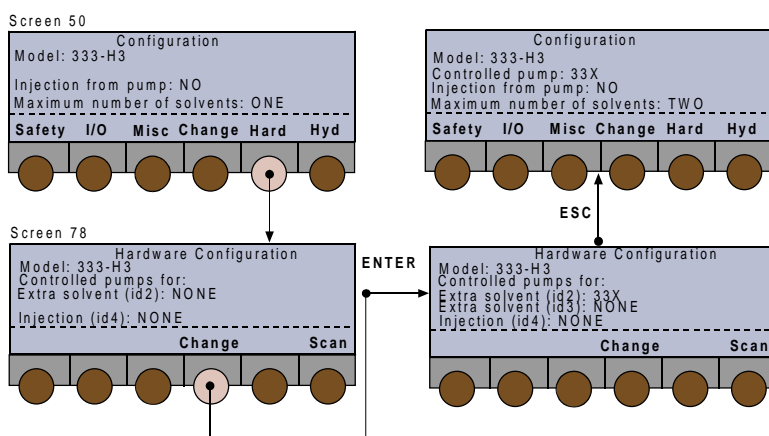
- (1) The top-line of the in-run screen is reserved for a Model 15X detector, if associated with a 333 Pump (not shown in most of the Figures given in this Chapter).
- (2) For the functions accessible from the 'Detect' soft-key, you should refer to the user's guide for the relevant detector.

Hardware Configuration

Starting at *Screen 50*, which shows the current configuration, press **Hard**, you see the 'Hardware Configuration' screen (*Screen 78*). The available soft-keys are:

Change to change the current selection,

Scan to check the GSIOC bus for suitably connected and viable pumps.



A Master 333 Pump can control one or two additional solvent pump (Slaves) and an injection pump. The controlled pumps must be assigned as follows:

'Extra solvent (id 2)' can be a 333 Pump or a 334 Pump,

'Extra solvent (id 3)' can be a 333 Pump or a 334 Pump.

'Injection (id 4)' must be a 30X Pump, if an injection (sample) pump is present.

Adding a Solvent Pump

- 1) Use the arrow keys to move the cursor to 'Extra solvent (id 2)', if you want to add an extra pump for solvent B, and then to 'Extra solvent (id 3)', for solvent C. If you only have two solvent pumps, the second pump must be configured as solvent B.
- 2) Press **Change** until you find the required option (333 or 334) then press **ENTER**, or press **Scan** to scan the GSIOC bus for devices connected to the pump.
- 3) Press **ESC** to return to *Screen 50*; check that all pumps are listed correctly, including the head type (for 30X pumps):
e.g. 33X (for 333 and 334), 30X-10 (for 305, 306, 307, and 308), or NONE.

'Scan' checks the ids of the controlled pumps, which must be connected via GSIOC, and switched on. Scan does not validate the pump's configuration - you must ensure that you describe the pump correctly to the software.

Adding an Injection Pump

- 1) Use the arrow keys to move the cursor to 'Injection (id 4)' to assign a 30X Pump for injecting samples.
- 2) Press **Change** to select 30X, then press **ENTER**, or press **Scan** to scan the GSIOC bus for devices connected to the 333 Pump.
- 3) Press **ESC** to return to *Screen 50*; check that the injection pump is listed correctly; the format for a 30X Pump is '30X-abc', where 'abc' is the configured pump-head size (see Hydraulic Configuration). You must confirm the assignment as follows: with the cursor at 'Injection from pump: NO' press **Change** until you see 'YES', then press **ENTER**.

Removing a Pump

- 1) Use the arrow keys to move the cursor to 'Extra solvent (id 2)', if you want to remove the extra pump for solvent B.
- 2) Press **Change** until you find the required option (NONE) then press **ENTER**.
- 3) With the cursor at the appropriate line, repeat for 'Extra solvent (id 3)' **or** repeat for 'Injection (id 4)'. Press **ESC** to return to *Screen 50*.

Hydraulic Configuration

Press **Hyd** to access the 'Hydraulic Configuration' screens for each of the solvent pumps defined earlier. The first (Screen 90) is for Pump 1 (Solvent A), the second (Screen 91) is for Pump 2 (Solvent B), and the third (Screen 92) is for Pump 3 (Solvent C). You move between screens using the **Next/Prev** keys. The sample pump is accessed using the **Inject** soft key.

Each screen enables you to select the head type, define a Solvent Valve Block (SVB), and name a solvent for each of its four channels, or to specify a value for compressibility for each.

The available soft-keys are:

Next to go to the next screen,

Prev to go to the previous screen,

Adjust to configure advanced hydraulic functions,

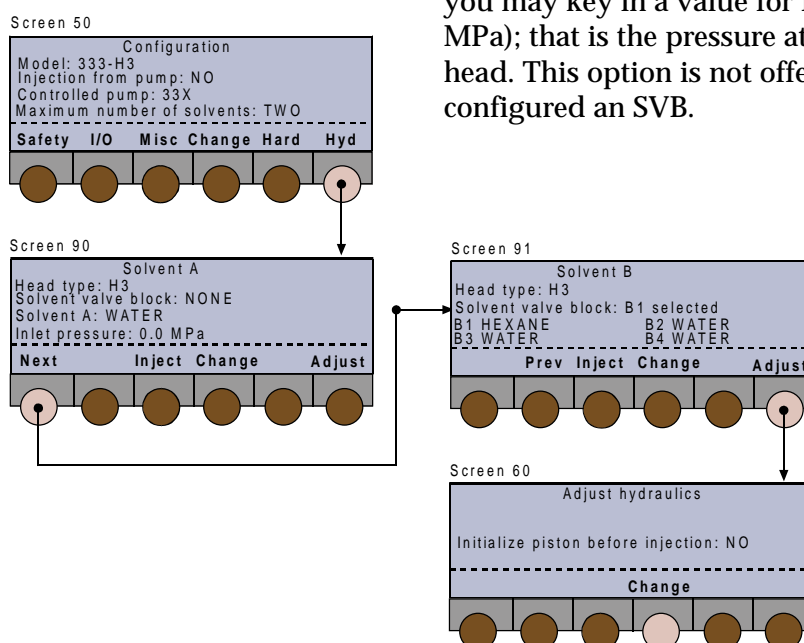
Change to change the current selection,

Inject to configure the sample injection pump.

Configuring a Solvent Pump

For each solvent pump:

- 1) Check that the head corresponds to the type fitted; press **Change** to modify the type configured, press **ENTER** to confirm. For 333 and 334 Pumps the head type must be H3.
- 2) For each pump fitted with a SVB: use the arrow keys to select 'Solvent valve block: NONE'; press **Change** to select a solvent channel (A1 to A4, B1 to B4, C1 to C4), press **ENTER** to confirm. If no SVB is fitted, you can skip this step, in which case you see only one solvent channel per pump (A, B, or C) for each of which you may select the solvent type and enter a value for Inlet Pressure.
- 3) For each solvent channel (A or A1 to A4, B or B1 to B4, C or C1 to C4), use the arrow keys to select a solvent name (or enter a value for compressibility), press **Change** to select another solvent, press **ENTER** to confirm. For more, see 'Named Solvents - Compressibility' (below) and for full details, refer to Chapter 6.
- 4) Optionally, for each single-solvent channel pump, you may key in a value for Inlet Pressure (0-50 MPa); that is the pressure at the inlet to the pump head. This option is not offered when you have configured an SVB.



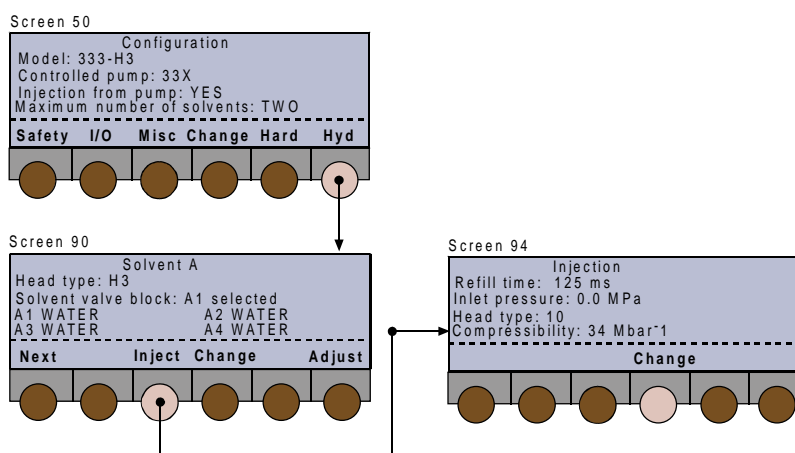
Adjusting the Hydraulics

Press **Adjust** to access 'Adjust Hydraulics' screen (Screen 60) in order to access the following: 'Initialize piston before injection' (only if 'Injection from pump' = YES).

Initializing the piston of the injection pump 30X can improve injection precision at low flow rates (set to YES).

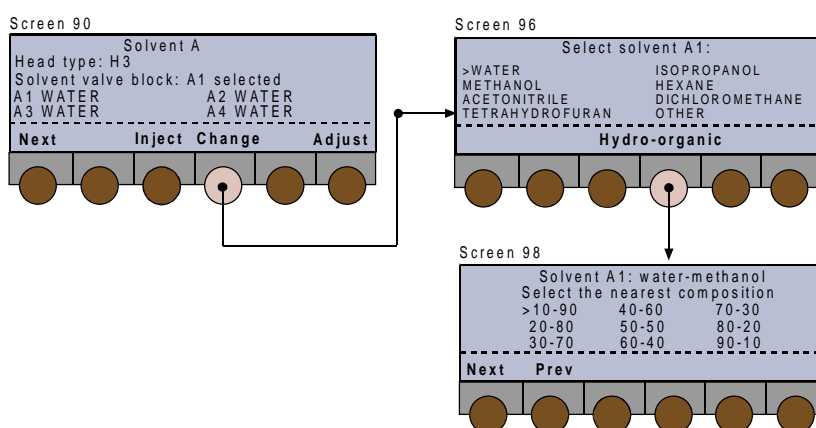
Configuring an Injection Pump

- 1) Starting at *Screen 50*, press **Hyd** to access the configuration screen for solvent A (*Screen 90*).
- 2) At *Screen 90* (or *Screen 91* - solvent B, or *Screen 92* - solvent C), press **Inject** to access the parameters for the injection pump (*Screen 94*): 'Refill Time, Inlet Pressure, Head Type, Compressibility'.
Refill Time (125-1000 ms) is the duration of the piston return stroke. If cavitation occurs use a higher value.
Compressibility (0-2000 Mbar⁻¹) is the compensation parameter for solvent compressibility.
- 3) Use the arrow keys to move the cursor to the parameter that you want to change.
- 4) Key in the desired value, then after keying in the value press **ENTER**. After pressing **ENTER** the cursor jumps automatically to the next parameter. In particular, you must key in an appropriate (see above) value for compressibility.



Named Solvents - Compressibility

For each solvent channel (A1 to A4, B1 to B4, or C1 to C4) or pump (A, B, or C), you can select a solvent from the list of names or press **HYDRO-ORGANIC** to select from the list of mixtures. The software will automatically enter a value for compressibility (as given in Chapter 6). Alternatively, you can manually key in a value for compressibility (see below).



- 1) Starting at *Screen 90* (or *Screen 91* - solvent B, or *Screen 92* - solvent C), use the arrow keys to move the cursor to the channel or solvent, then press **Change**.
- 2) To select another solvent (*Screen 96*), use the arrow keys to move the cursor to the required solvent, then press **ENTER**. You are returned to *Screen 90*, *91*, or *92*, where the new solvent name should appear for the selected channel or pump.
- 3) Starting at *Screen 96*, press **HYDRO-ORGANIC**, use the arrow keys to move the cursor to the required mixture, then press **ENTER**. *Screen 98* lists water-methanol mixtures and *Screen 100* lists water-acetonitrile mixtures; use **Next** and **Prev** to switch between these screens.
- 4) To enter a value for compressibility (manually); start at *Screen 96*, use the arrow keys to move the cursor to **OTHER**, then press **ENTER**. You are returned to *Screen 90*, where the solvent name is replaced by a compressibility value corresponding to the last configured solvent (default value).

The moving cursor should be underneath the default value. To enter a different value, key in the required compressibility and then press **ENTER**.

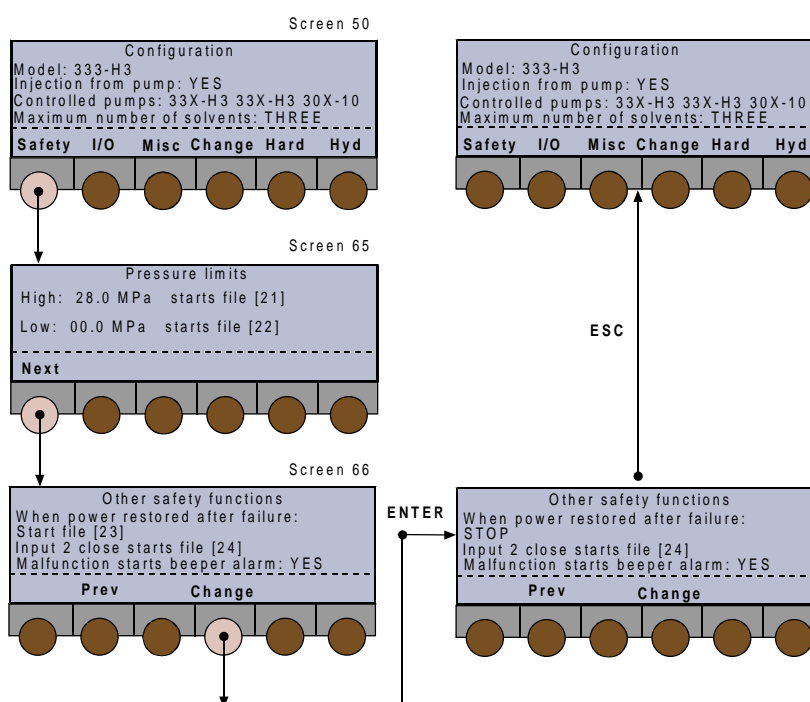
Safety Functions

Press **Safety**, you see the 'Pressure Limits' screen, which shows the high and low pressure limits and the associated safety files. The available soft-keys are:

Next to configure the 'Other safety functions' (Screen 65).

Prev to return to the 'Pressure Limits' screen (Screen 66).

Change to change the current selection.



Pressure Limits are model and configuration dependent and subject to automated validation. You need to ensure that the pressure limits defined here are suitable for the safe and correct operation of your system.

Other safety functions allow you to decide on the course of action after a power failure and to turn on or off the beeper.

Take care to ensure that safety files started as a result of choices made here perform the desired actions (e.g. stop pumping).

File numbers 21 to 24 are reserved for safety files, therefore they should not be assigned to Method Programs. You should create Safety Programs for files 21-24 in the same way that you create Method Programs. In each case, if you do not create the file, an error message will be displayed on the screen and the pump will stop. If file #21 is being executed, the pressure limit is automatically raised by 10%; then, if the new pressure limit is passed, the pump stops.

When the low pressure limit is crossed by decreasing values, the effect is delayed by 0.3 of a minute, whatever be the effect: stop pumping if file 22 is empty, or start file 22 if you have defined it. The delay is to allow the Method Program to continue, if a fugitive air bubble creates a brief and abrupt pressure decrease.

Changing the Pressure Limits

The maximum values for these limits are configuration dependent. **High limit > Low limit.**

- 1) Key in the new value for 'High:' (0 to 21 MPa) - starts file [21], press **ENTER**.
- 2) Key in the new value for 'Low:' (0 to 60 MPa) - starts file [22], press **ENTER**.
- 3) Press **Next** to configure the 'Other safety functions'.

Other Safety Functions

One function is predetermined - you cannot change 'Input 2 close starts file [24]'.

After a power failure you may choose to stop the pump, continue with the file (Method Program) that was running at the time of the failure, or start safety file [23]. To select the required option:

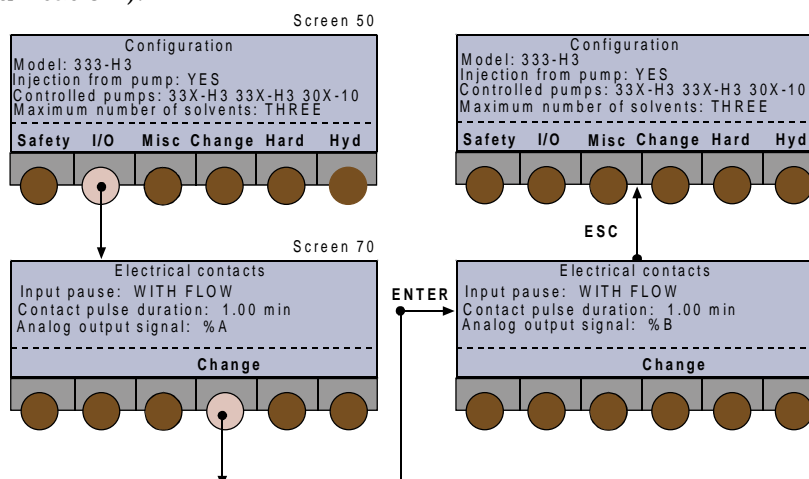
- 1) With the cursor at 'When power restored after failure:' - starts file [23], press **Change**.
- 2) At the required option (STOP, CONTINUE SAME FILE, START FILE [23]), press **ENTER**.
- 3) With the cursor at 'Malfunction sounds beeper alarm:', press **Change**.
- 4) At the required option (YES, NO), press **ENTER**.
- 5) Press **ESC** to return to *Screen 50*.



Caution: File numbers 21 to 24 are reserved for the safety features described here. However, these files do not exist until you create the Safety Programs. You must ensure that any Safety Programs that you create and save as files 21 to 24 function correctly and provide the desired level of protection.

Electrical Contacts

Press **I/O**, you see the 'Electrical Contacts' screen (*Screen 70*), which allows you to modify certain options related to electrical signals (see 'Electrical Connections-Communication').



- You may either continue with or stop the flow when an input pause signal is received.
- You may set the length of an output pulse to between 0.01 and 1 minute (0.6 to 60 seconds).
- You may set the output signal to follow pressure, flow rate, composition (%A, %B, or %C). If you choose one of the composition parameters, you should also enter a value for Delay Volume (0 to 90 ml) to get the best synchronization between the programmed profile and the detected profile.

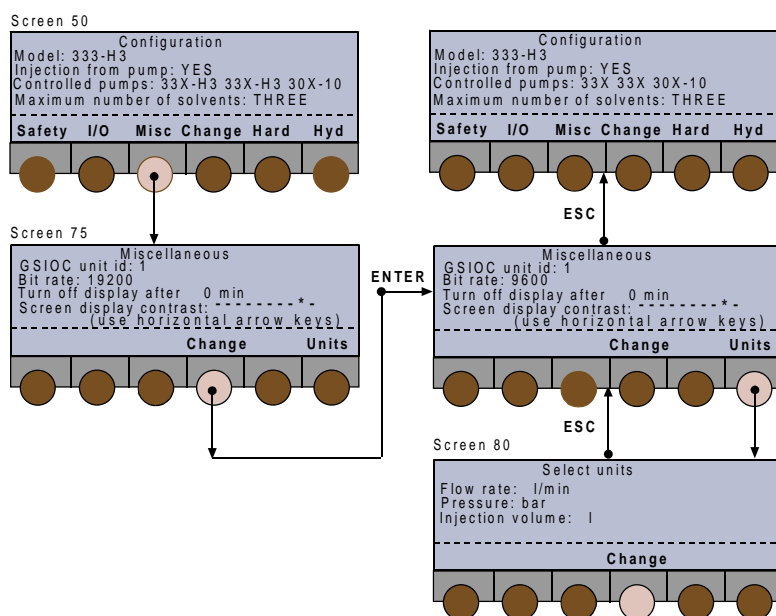
Changing a Function

- With the cursor at 'Input pause: ', press **Change**.
- At the required option (WITH FLOW, WITHOUT FLOW), press **ENTER**.
- With the cursor at 'Contact pulse duration:', key in a value (0.01 to 1), press **ENTER**.
- With the cursor at 'Analog output signal:', press **Change**.
- At the required option (FLOW, PRESSURE, %A, %B, or %C), press **ENTER**.
- If either %A, %B, or %C is selected 'Delay Volume:' appears (next line). With the cursor at 'Delay Volume:', key in a value (0 and 90), press **ENTER**.
- Press **ESC** to return to *Screen 50*.

GSIOC ID and Miscellaneous

Press **Misc**, you see the 'Miscellaneous' screen (*Screen 75*), which allows you to modify the following items:

- GSIOC id (0-63). This must be done if one 333 Pump is to be used as a slave to another (each must have a unique id) or if the default id (#1) conflicts with other equipment.
- Bit rate of the 333 Pump (External, 1200, 2400, 4800, 9600, 19200).
- Turn off the display after 'x' minutes (press any key to reactivate the display).
- Screen contrast.
- Units of displayed values for flow rate, pressure, and injection volume.



The available soft-keys are:

Units to modify the units displayed (*Screen 80*).

Change to change the current selection.

Changing the GSIOC ID

Key in a number between 0 and 63, then press **ENTER**.

Changing the Bit Rate

- With the cursor at 'Bit rate:', press **Change**.
- At the required option (EXTERNAL, 1200, 2400, 4800, 9600, 19200), press **ENTER**. EXTERNAL is the recommended setting.
- Press **ESC** once to return to *Screen 50*.

Changing the Screen Saver

- 1) Place the cursor at 'Turn off display after: ... min:'.
- 2) Key in a number between 0 and 999 minutes, then press **ENTER**.

The display is turned off at the end of the specified period of time, counting from the moment when you last pressed a key.

Otherwise, 0 disables the screen saver.

Changing the Screen Contrast

Press either of the horizontal arrow keys (◀ ▶) until you arrive at a suitable level. This is shown as follows: 'Screen display contrast: -----* ' where the * marks the current setting.

Changing the Units

- 1) Starting at *Screen 75*, press **Units**, you see the 'Select Units' screen (*Screen 80*).
- 2) With the cursor at 'Flow rate: ml/min', press **Change** to select 'µl' or 'ml', then press **ENTER**.
- 3) With the cursor at 'Pressure: MPa', press **Change** to select 'MPa' or 'psi' or 'bar', then press **ENTER**.
- 4) With the cursor at 'Injection volume:', press **Change** to select 'µl' or 'ml' or 'l', then press **ENTER**.
You may also use the vertical arrow keys (▲ and ▼) to move the cursor from one parameter field to another, but you must first confirm the previous selection by pressing **ENTER**.
- 5) Press **ESC** once to return to *Screen 75*, twice to return to *Screen 50*.

Beeper Status

- 1) Starting at *Screen 75*, press **Other**, you see *Screen 76*.
- 2) Use **Change** to set the keypad beeper to either ON or OFF.
- 3) Confirm your selection by pressing **ENTER**.
- 4) Press **ESC** to return to *Screen 50*.

Manual Operations

Introduction

The following manual functions are available:

- a) Prime the channels (must be done for a new pump or pump head).
- b) Pump solvents at a specific flow rate and composition (to condition the column).
- c) Operate the four contact outputs.

Procedure

Switch on the Model 333 Pump, after initialization you see the ready-to-run screen (*Screen 1*). You will see the following soft-keys at one time or another:

Pump (Edit) to access pump operations,

Detect to access an associated detector,

Manual to prime and operate manually,

Run to run the current Method Program file,

Pause to interrupt the Method Program,

Resume to restart a paused Method Program,

End to stop a Method Program,

Stop to stop pumping,

Zero to zero the detector signal (if associated).

Press: **Manual**, at the 'Manual Control' screen (*Screen 8*) you will see following soft-keys:

Flow to pump solvents at a specific flow rate.

Prime to prime specific channels.

Output to operate the four contact outputs.

Hydraulic Priming

Hydraulic priming is an essential precursor to operating the pump. Refer to Page 4-4 for essential information. You can prime any actively associated pump (333, 334 , or 30X) from the 333 Master Pump.

Press **Prime**, you see the 'Prime' screen (*Screen 25*); for each channel the available soft-keys are:

Start to start pumping.

Stop to stop pumping.

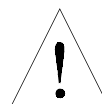
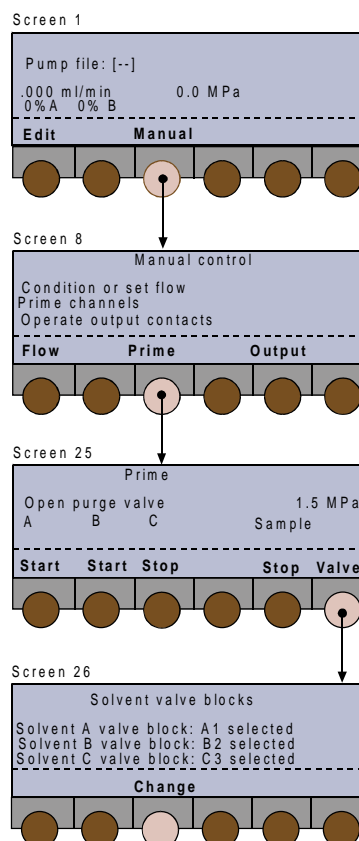
Valve to select solvent valve block channel (if fitted).

Priming Channels

Screen 25 shows all of the currently configured channels (up to 4) A, B, C, and Sample in this example.

- 1) Open the purge valve to the drain vessel.
- 2) Press the **Start** soft-key corresponding to the channel(s) you wish to prime. Self-priming is generally obtained after 2 minutes. If not, press **Stop**. Disconnect the drain tubing from the purge valve, and replace it with a suitable syringe equipped with its adapter. Press **Start**, then draw on the syringe piston, while the pump is active.
- 3) When the line is filled with liquid, press the **Stop** soft-key corresponding to the channel(s) you wish to stop priming.
- 4) Press **ESC** to return to *Screen 8*. You must stop all channels before pressing ESC, in order to leave this screen.

Running a pump-head dry, for more than a short time, will damage the piston seal. Therefore, be prepared to intervene manually in the priming process.



Manual Flow Control

Press **Flow**, you see the 'Manual Flow Control' screen (*Screen 20*); after entering the parameters the available soft-keys are:

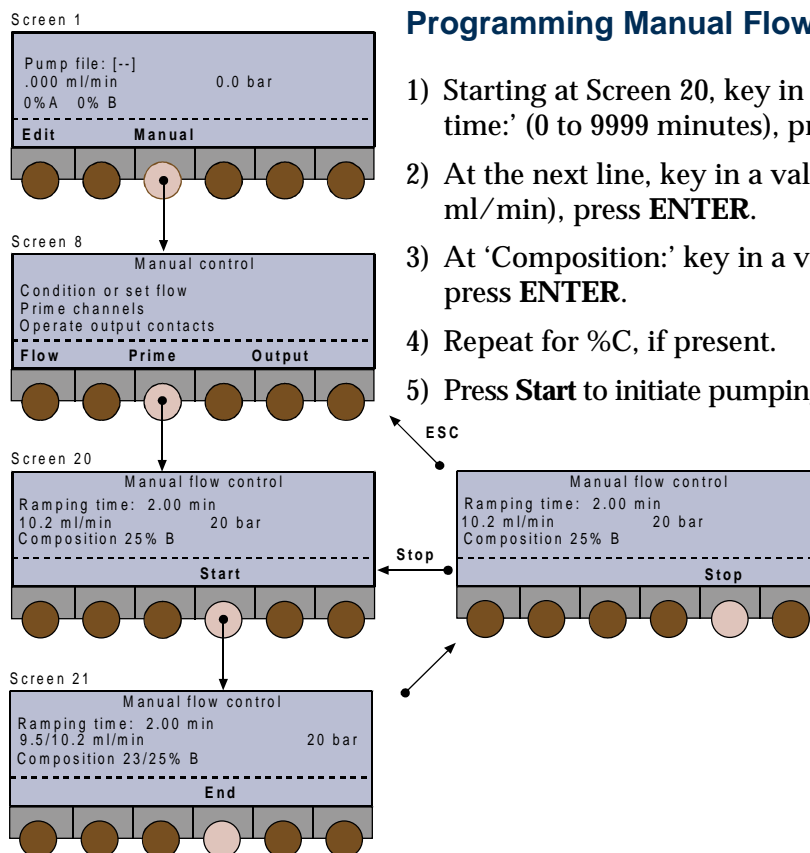
Start to start pumping after ramping on to the desired flow rate and composition. Present if the values demanded are different from the actual values.

Stop to stop pumping (immediately).
Present only if flow is not equal to zero.

End to interrupt the ramp-on (*Screen 21*), pumping continues.

Zero to zero the detector signal (if associated).

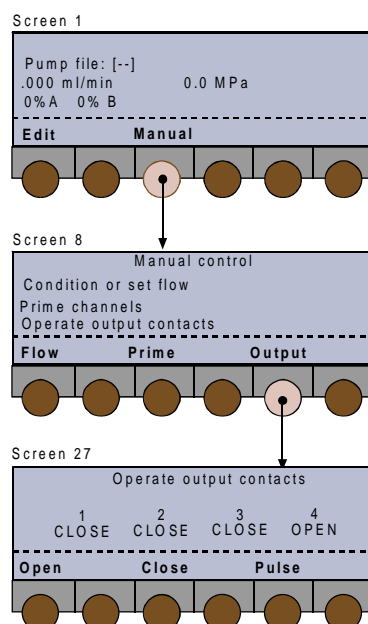
Screen 20 is the ready-to-run screen, which displays dynamic data for the pump and an associated detector (top line).



Back to **Screen 20**, at end of specified 'Ramping Time', or after pressing **End** (pump continues at flow rate and composition of **Screen 21**).

Programming Manual Flow

- 1) Starting at **Screen 20**, key in a value for 'Ramping time:' (0 to 9999 minutes), press **ENTER**.
- 2) At the next line, key in a value for flow (0 to 15 ml/min), press **ENTER**.
- 3) At 'Composition:' key in a value (0 to 100) for %B, press **ENTER**.
- 4) Repeat for %C, if present.
- 5) Press **Start** to initiate pumping or **ESC** to abort and return to **Screen 8**.



The pulse length (0.01 to 1 minute) is configurable (**Config, I/O, Contact Pulse Duration**).

Output

Refer to Chapter 3 for a physical description of the output connectors, which may be programmed to send a signal to other equipment during a run.

Press **Output**, you see the 'Operate Output Contacts' screen (**Screen 27**); for contact (1 to 4) the available soft-keys are:

Open to set the contact to normally open.

Close to set the contact to normally closed.

Pulse to change the state (open or closed) of the contact.

- 1) Press either of the horizontal arrow keys to select a contact.
- 2) Use the appropriate soft-key to change the selected contacts state.
- 3) Press **ESC** to return to **Screen 8**.

Entering Method Programs

Creating and editing Method Program files is detailed in the following Sections. You are advised to check and correct the configuration parameters before using the edit functions to create a list of events and the related parameters (flow rates, volumes, composition, and so on).

Creating a Method Program consists of two simple steps: assigning a file number and entering a list of events that you want to occur at the times that you specify. However, it is recommended that you list the events required by your Method Program, on paper, before attempting to create the file.

Method Program files (1 to 20) can be looped and linked to other files.

Safety Program files (21 to 24) are created in exactly the same way as Method Program files.

Getting Started

Switch on the Model 333 Pump, then (after initialization) you see the in-run screen (*Screen 1*).

You will see the following soft-keys at one time or another:

- Pump (Edit)** to access pump operations,
- Detect** to access an associated detector,
- Manual** to prime and operate manually,
- Run** to run the current Method Program file,
- Pause** to interrupt the Method Program,
- Resume** to restart a paused Method Program,
- End** to stop a Method Program,
- Stop** to stop pumping,
- Zero** to zero the detector signal (if associated).

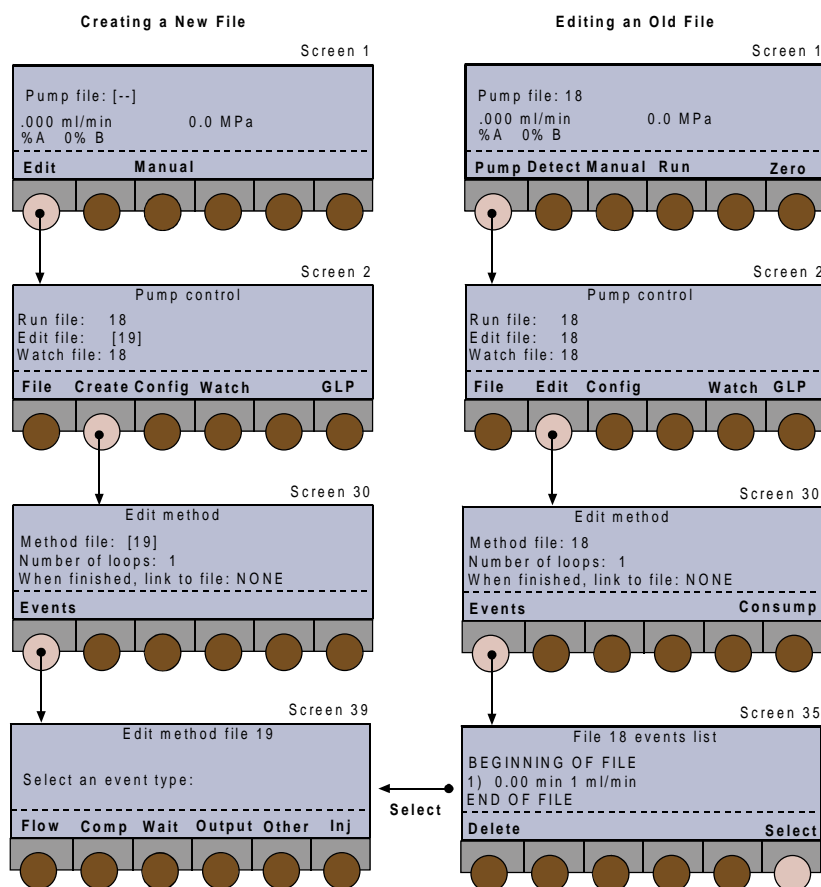
- 1) Press **Pump (Edit)**, you see the 'Pump Control' screen (*Screen 2*); you may be presented with the following soft-keys at one time or another:
File to access file operations,
Edit (Create) to review or modify a Method Program, or ...
View to review a file that can't be modified,
Create (Edit) to begin editing a Method Program,
Config to enter a configuration parameters for the currently selected Edit File,
GLP to access audit, maintenance, run-in and test functions for a 333 Pump,
Watch to obtain post-run information.
- 2) With the cursor on 'Edit file: #', key in the number of the file that you wish to edit (or create). For a new file the number is contained by square brackets [#].
- 3) Press **Create or Edit** (for an existing file), you see the 'Edit Method' screen (*Screen 30*); the possible soft-keys are:
Events to access or enter a list of events,
Link to link the file currently selected to another file,
No Link to undo a link with another file,
Consump to see the predicted fluid consumption for the file currently selected.

Creating and Editing Method Programs

Entering Events

With reference to the following figures, starting at *Screen 30*, press **Events** (or **Select**), you see the 'Edit Method File' screen (*Screen 39*); you will be presented with soft-keys for the following event types:

- FLOW** to schedule the flow rates,
- COMP** to schedule a change in the composition of the mobile phase,
- WAIT** to wait for a signal (e.g. injection) on input #2,
- OTHER** to schedule a switch Solvent Valve Block event, or a detector event,
- OUTPUT** to schedule output signals,
- INJ** to schedule an injection from the pump (if configured).

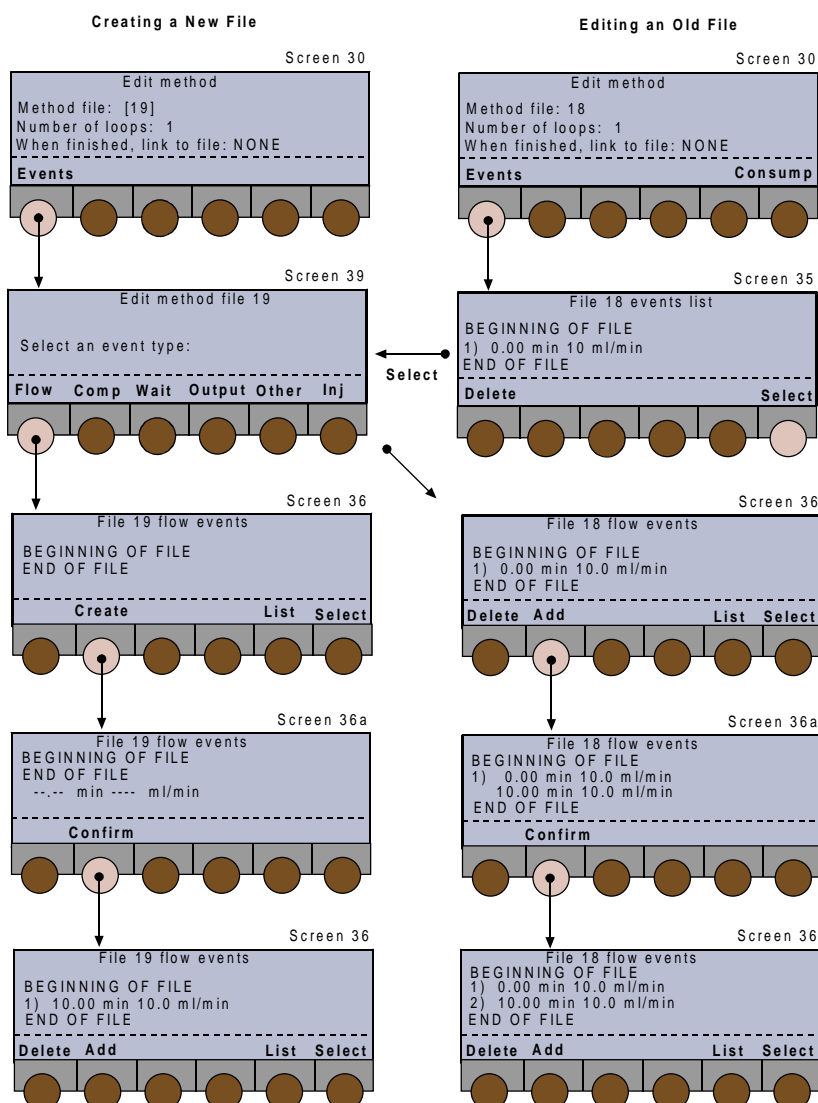


You can enter all or any of these event types according to the requirements of your Method Program (see Method Program work sheet, page 4-29). Whichever event types you enter, the procedure is the same.

- 1) Press an event type key (**FLOW**, **WAIT**, **COMP**, etc.); you see the first 'File # xxxx events' screen (Screen 36), the possible soft-keys are:
Delete to remove an event from a file, Present provided at least one event is present.
Create (Add) to create the first event in a new file ([#]), or the first event of this type in an existing file (#),
Time (Flow) to toggle between injection flow rate and duration,
Add (Create) to add an event to a file,
List to review the events currently present in a file,
Select to choose an event type to add to the file (Screen 39),
Confirm to affirm the value entered (at Screen 36a)
- 2) Press **Create** or **Add**, you see the second 'File # xxxx events' screen (Screen 36a); key in the time of the event, followed by parameters, which vary according to the event type (see below).

After keying in one of a series of parameter values, pressing **ENTER** automatically moves the cursor on to the next parameter. However, you may use the horizontal arrow keys (◀ ▶) to move the cursor to the parameter that you wish to modify.

- 3) Press **Confirm**, then **Add** to add an event of the same type (returns to *Screen 36*) or **Select** to choose a different event type (returns to *Screen 39*).
- 4) Continue to cycle between *Screens 36* and *36a* (**Add**) or *Screens 36*, *36a*, and *39* (**Select**) until you have completed the schedule of events. Normally, you would enter the complete profile for events of one type before using **Select** to access the next parameter type (e.g. **FLOW**, then **COMP**, followed by **INJ**, **WAIT**, and **OUTPUT**). If the events are not entered sequentially, the software automatically sorts them into the correct time-order.
- 5) When done, press **ESC** to return to *Screen 30*. Here, by pressing **Consump**, you may access solvent consumption (per loop) for the currently configured channels (*Screen 32*) ; press **ESC** to return to *Screen 30*.



FLOW

- 1) Key in a time (0.00 to 9999 minutes), then press **ENTER**,
- 2) Key in a flow rate (0 to 400 ml/min), then press **ENTER**,
- 3) For a new event (after **Add**), press **Confirm** to affirm the values entered,
- 4) Press **ESC** to go back to *Screen 30*.

COMP

- 1) Key in a time (0.00 to 9999 minutes), then press **ENTER**,
- 2) Key in a percentage (0 to 100), for solvent channel 'B', then press **ENTER**,
- 3) Key in a percentage (0 to 100), for solvent channel 'C' (if configured),
- 4) For a new event (after **Add**), press **Confirm** to affirm the values entered,
- 5) Press **ESC** to go back to *Screen 30*.

WAIT

- 1) Key in a time (0.00 to 9999 minutes), then press **ENTER**,
- 2) Press **Change** to select either CLOSE or OPEN,
- 3) Press **Confirm** to affirm the value entered, or **CLEAR** to abort the value.
- 4) Press **ESC** to go back to *Screen 30*.

OUTPUT

- 1) Key in a time (0.00 to 9999 minutes), then press **ENTER**,
- 2) Key in an output contact number (1 to 4), then press **ENTER**,
- 3) Press **Change** to select either CLOSE, OPEN, or PULSE (see Section 4.2.2 for pulse length),
- 4) For a new event (after **Add**), press **Confirm** to affirm the values entered,
- 5) Press **ESC** to go back to *Screen 30*.

INJ

You enter one injection event (per loop), specifying the time at which the injection starts and the volume to be injected. The third parameter can be either the required flow rate or the length of the injection (duration).

If you enter the required flow rate, the duration is calculated according to the volume of sample you specify, and vice versa. Flow rate and volume depend on the size of head fitted to the 30X Pump. There are two extra soft keys (*Screens 35 and 36*) for an injection event:

Time (Flow) to select time as the third parameter,

Flow (Time) to select flow rate as the third parameter.

- 1) Key in the time at which the injection starts (0.00 to 9999 minutes), then press **ENTER**,
- 2) Key in the volume of sample to be injected (0 to 500 ml), then press **ENTER**,
- 3) Key in an injection flow rate (0.001 to 5 ml/minute*), then press **ENTER**, or ...
- 4) Key in an injection duration (.001 to 9999 minutes*), then press **ENTER**,
- 5) Press **Confirm** to affirm the values entered,
- 6) Press **ESC** to go back to *Screen 30*.

* Depends on the injection volume entered previously.

OTHER

After pressing **OTHER**, you see *Screen 40*: for solvent selection, press **Solvent**; for a detector event, press **Detect**.

Solvent

- 1) Key in a time (0.00 to 9999 minutes), then press **ENTER**,
- 2) Press **Change** to select from the available channels (A1 to A4, B1 to B4, C1 to C4).
- 3) Press **ENTER**, then **Confirm**.
- 4) Press **ESC** to go back to *Screen 30*, or **Prev**.

Detect

- 1) Press **Lamp off** or **Zero**.
- 2) Key in a time (0.00 to 9999 minutes),
- 3) Press **ENTER**, then **Confirm**.
- 4) Press **ESC** to go back to *Screen 30*, or **Prev**.

Creating Loops

You create loops to repeat the Method Program 'n' times, which means the number of times the Method Program will be executed before it ends. With reference to *Screen 30*:

- if necessary, move the cursor using the vertical arrow keys to the 'Number of loops:' line, key in a number between 1 and 999, then press **ENTER**.

Linking Files

You link files so that they will be executed as a chain, that is they will be run one after the other, starting with the file currently selected. With reference to *Screen 30*:

- if necessary, move the cursor using the vertical arrow keys to the '... link to file:' line, press the **Link to**, key in the number of the file (1-24) to which the current file is to be linked, and then press **ENTER**. To undo a link you must press the **No Link** key.

Listing Events

At *Screens 36 or 36a*, press **List** to list all of the events entered in the currently selected file, the possible soft-keys are:

Delete to remove an event from a file,

Time (Flow) to toggle between injection flow rate and duration,

Change to change the state of an output,

Select to select an event type from *Screen 39*.

As well as reviewing a Method Program file, you may change the parameters. In either case, you use the vertical arrow keys (**▲** and **▼**) to scroll through the list of events and to move the cursor from one parameter field to another.

After keying in each new value, you must press **ENTER** to confirm the value and move the cursor on to the next parameter.

Deleting Events

- 1) At *Screens 35 or 36*, use the vertical arrow keys to scroll through the list of events.
- 2) With the cursor at the line corresponding to the event that you want to delete, press **Delete**.
- 3) At *Screen 37*, press **Yes** to confirm the deletion (returns to *Screen 35*) or **No** to return to *Screen 36*.
- 4) Repeat for other events, if required, and press **List** to review the revised Method Program file.
- 5) When done, press **ESC** to return to *Screen 30*.

Method Program Work Sheet

File Number:

Method Name

SETUP PARAMETERS

Pressure: High limit = Low limit =

Number of pumps = Loops = Link file =

| Pump Line | Model | Solvent | I.D | Refill | Comp | Head Size |
|-----------|-------|---------|-----|--------|------|-----------|
| A | | | | | | |
| B | | | | | | |
| C | | | | | | |
| D or Inj | | | | | | |

I/O OPERATIONS

| Time | Contact | State | Function |
|------|---------|-------|----------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

PROGRAM STEPS

| Step No | Time | Event | Operation |
|---------|------|-------|-----------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |

| Step No | Time | Event | Operation |
|---------|------|-------|-----------|
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| | | | |
| | | | |
| ... | | | |
| | | | |
| | | | |
| 30 | | | |

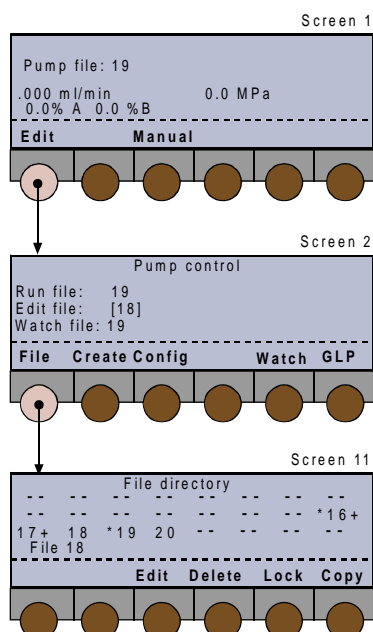
File Management

The file management facility enables you to see a list of currently assigned files, to copy, lock, delete, and edit files.

Procedure

Switch on the 333 Pump, then (after initialization) you see the ready-to-run screen (*Screen 1*). You will see the following soft-keys at one time or another:

- Pump (Edit)** to access pump operations,
- Detect** to access an associated detector,
- Manual** to prime and operate manually,
- Run** to run the current Method Program file,
- Pause** to interrupt the Method Program,
- Resume** to restart a paused Method Program,
- End** to stop a Method Program,
- Stop** to stop pumping,
- Zero** to zero the detector signal (if associated).



- 1) Press: **Pump (Edit)**, you see the 'Pump Control' screen (*Screen 2*) you may be presented with the following soft-keys at one time or another:
 - File** to access the file management operations,
 - Edit (Create or View)** to modify an existing Method Program file,
 - Create (Edit or View)** to enter a new Method Program file,
 - View (Edit or Create)** to review an existing Method Program file,
 - Config** to enter a configuration parameters for the currently selected file,
 - GLP** to access audit, maintenance, run-in and test functions for a 333 Pump,
 - Watch** to obtain post-run information.
- 2) Press: **File**, to access the file management screen, you see the 'File Directory' screen (*Screen 11*), which shows all currently assigned files. Use any of the arrow keys to move around the screen. Which of the possible soft-keys you see depends on the state of the file (#) you select:

[#] = file unedited (empty)

*# = file locked

#+ = file linked

Create (Edit or View) to enter a new Method Program file,

Edit (Create or View) to modify an existing Method Program file,

View (Edit or Create) to review an existing Method Program file,

Delete to delete the currently selected file,

Lock (Unlock) to lock (or unlock) the currently selected file,

Copy to copy the currently selected file.

Links shows which files are linked to the currently selected file.

Create or Edit

These keys allow you to create a Method Program in a previously empty file, or to edit an existing file.

View

View enables you to view a locked file, using the same screens as **Edit**, but without the possibility to use the **Delete** key to remove events from the file currently selected, or to delete the file itself. However, you may copy a locked file and then edit the copied file.

Delete

To delete a file press **Delete** (*Screen 18*), then press **Yes**. If in doubt, press **No**, because a deleted file cannot be recovered (unless a copy exists).

Pressing either key returns you to *Screen 11*.

Lock

To lock a file press **Lock** (*Screen 19*), then press **Yes**. If in doubt, press **No**, a locked file cannot be edited or deleted. However, you may copy a locked file, in which case the copy is automatically unlocked by the software. A locked file is indicated by an asterisk before the file number (*#).

Pressing either key returns you to *Screen 11*.

UnLock

To unlock a file press **Unlock** (*Screen 19*), then press **Yes**. A locked file is indicated by an asterisk before the file number (*#).

Pressing either key returns you to *Screen 11*.

Copy

To copy a file press **Copy** (*Screen 14*); key in the number to which the currently selected file will be copied. A message appears asking you to confirm your actions; normally press **Yes**. Or, if in the destination file already exists, press **No**, unless you want to overwrite the existing file. Care! overwritten files cannot be recovered.

Pressing either key returns you to *Screen 11*.

Links

To see how the existing files are linked, press **Links**, the following screen (*Screen 12*) shows the order in which the linked files will be run.

‘Chain circular’ means that you have cross linked files resulting in more than one occurrence of one or more file numbers, in the series.

Take care, when linking files. Bad links can lead to unforeseen consequences. Linking to a file that does not yet exist is not allowed.

You should consider carefully your linking strategy, create, and check the files before linking them (see “Linking Files”).

Good Laboratory Practice (GLP) Functions

All of the following functions are available where control is from a 333 Pump. UniPoint users should refer to the UniPoint User's Guide for Audit Trail and Maintenance related functions.

- a) Audit trail records the sequence of events that take place during a run when you execute one or more Method Program files. Audit trails are recoverable by the PC based Pump Data Transfer software supplied with each 333 Pump. From the Control Panel of a 333 Pump you can only activate or deactivate the audit trail function and adjust the date and time.
- b) You can access the pump's maintenance logs for the Master 333 Pump and its Slave 33X Pump (if connected via GSIOC) and activate the dismount function. When replacing any 333 or 334 Pump head, you are obliged to use the dismount function in order to be able to physically remove the head from the front of the pump.
- c) New piston-seals should be run-in after installation. The seal installation procedure prepares the piston seals in advance of a full run-in (10 to 12 ml/min using methanol or isopropanol).
- d) 'Leak' is used to check the 'watertightness' of the hydraulic circuit.
- e) A pre-programmed qualification test is available to test the mixing functions of the Master 333 Pump.

Procedure

Switch on the 333 Pump, then (after initialization) you see the ready-to-run screen (*Screen 1*).

- 1) **Edit (Pump)** to access pump operations, you see the 'Pump Control' screen (*Screen 2*).
- 2) Press **GLP**, you see the 'GLP' screen (*Screen 82*); the possible soft-keys are:

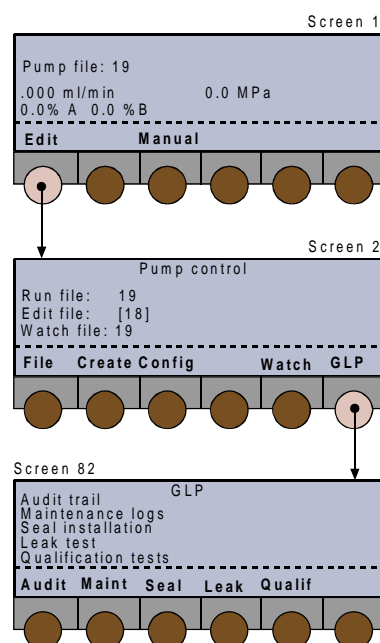
Audit to access the audit trail functions,

Maint to verify maintenance logs or dismount a pump head,

Seal to install the piston seals,

Leak to test the hydraulic circuit,

Qualif to perform the qualification test.



Audit Trail

Starting from the 'GLP' (*Screen 82*), press **Audit** (*Screen 83*), then use the arrow keys to move the cursor to the field you wish to change. To switch on or off the audit trail: select the 'Audit trail used:' field, press **Change** to select ON or OFF, then press **ENTER**.

Date and Time

- 1) Select the 'Date:' field, key in the date as a 6-digit number (ddmmyy, for example 140299), then press **ENTER**.
- 2) Select the 'Time:' field, key in the time as 4 digits separated by a point (hours.minutes, for example 22.35), then press **ENTER**.
The date and time are retained when you switch off the 333 Pump (or in the event of a power failure).
- 3) Press **ESC**, to return to *Screen 82*.

Dismounting Pump Heads and Accessing Maintenance Logs

This series of screens enables you to review, and if required (after changing a pump head), reset the maintenance logs for each of the currently configured 333 and 334 pump heads.

In addition, the dismount procedure is required, in order to be able to change a piston seal or a piston assembly.

Starting from the 'GLP' (*Screen 82*), press **Maint** to access 'Maintenance logs' (*Screen 84*); you will see these soft-keys at one time or another:

Change to select the pump-head, then press **ENTER** to confirm:

Solvent A Pump 1L, 1R; Solvent B Pump 2L, 2R;
Solvent C Pump 3L, 3R.

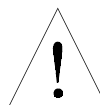
Dismount to move the pump head pistons to the dismount position,

End to finish the dismount procedure,

Logs to review and reset the pump-head logs.

Dismount Procedure

Caution: The dismount procedure should only be carried out by suitably qualified people.



The pistons must go to the dismount position before you can physically remove the head(s) from the pump.

- 1) After selecting a pump-head, press **Dismount**, then press **ENTER**.
- 2) You now see *Screen 250*; before pressing **Yes** check that it is safe to set the piston in motion!
- 3) Wait while the piston moves to the dismount position (*Screen 254*), until you see the message 'Change heads' (*Screen 252*).
- 4) Remove the pump head, carry out the required servicing (see Chapter 5, Maintenance), and refit the pump head.
- 5) When done, press **End**; wait while the pistons move into position (*Screen 254a*), until you see the message '... dismount heads' (*Screen 256*).
- 6) If you have finished press **No** to return to *Screen 84* and **ESC** to return to *Screen 82*.

Maintenance Logs

You use this function to view the log of wear parts for any configured 333 or 334 Pump. The log contains the usage of the part to date (hours), the user set upper limit (hours), or the number of operational piston cycles that the part has completed (megacycle = one million cycles). The parts logged are the piston, piston seal, inlet check valve ('In CV'), outlet check valve ('Out CV').

After the specified usage, you would normally service or replace the part in question (see Chapter 5). You specify limit values that are suitable for your applications and in line with GLP procedures applicable to your working environment.

- 1) After selecting a pump-head, press **Logs**.
- 2) To reset a logged value, use the vertical arrow keys to select the part, press **Reset**.
- 3) To change an upper limit, use the arrow keys to select the required field, key in the new value, then press **ENTER**. The flashing cursor indicates the currently selected field.
- 4) Press (two times) **ESC**, to return to *Screen 82*.

Seal Installation

This procedure is designed for installing new piston-seals, using isopropanol. For a different solvent, you should adapt the flow rate in proportion to the viscosity of the solvent used.

The procedure is in two parts:

- first priming for two minutes at a fixed flow rate to the drain (see table, below),
- second pumping at a pre-programmed gradient (ascending then descending flow rate) against the back pressure provided by the supplied capillary tubing, for 14 minutes. If the pressure indicated in the table is reached before 2 minutes, then the software interrupts the positive flow rate gradient, and maintains, during 10 minutes, the flow rate at the value that generated this pressure, otherwise it goes to the flow rate indicated in the table and maintains it during 10 minutes. At the end of this time, the flow rate linearly decreases to zero in 2 minutes.

Implementation

The flow rate and pressure values (see table, below) used by the pre-stored procedures are implemented through two soft-keys: **GLP/Seal** and **GLP/Leak**.

Flow Rates and Pressure Values (F and P) Implemented by Pre-stored Procedures GLP/Seal and GLP/Leak (Refer to 'Implementation', above).

| Pump-Head | Prime | GLP/Seal | | | GLP/Leak | |
|-----------|----------------------|----------------------------|----------------------------------|-------------------------------|-------------------------------|----------------------------------|
| | F Fixed ml/min | Purge F Fixed ml/min | Procedure F Default ml/min | Procedure P Default MPa | Procedure P Default MPa | Procedure F Default ml/min |
| 33X-H3 | 50 | 50 | 15 | 15 | 15 | 0.5 |
| 33X-H2 | 35 | 35 | 25 | 45 | 45 | 0.5 |
| 30X-5 | 5 | 3.75 | 5 | 45 | 45 | - |
| 30X-10 | 10 | 7.5 | 10 | 45 | 45 | - |
| 30X-25 | 25 | 18.75 | 12 | 21 | 28 | - |
| 30X-50 | 50 | 22.5 | 12 | 10.5 | 14 | - |
| 30X-100 | 100 | 22.5 | 12 | 5.2 | 7 | - |
| 30X-200 | 200 | 22.5 | 12 | 2.6 | 3.5 | - |

GLP/Seal uses the supplied capillary, 0.13 x 1.6 x 185 mm (ref: E66394), which is to be connected at the outlet filter, and water as the recommended solvent. In these conditions, the pressure is generally reached before the default flow rate.

GLP/Leak uses the supplied plug (ref: 410478), which must be connected at the outlet filter.

You can select any configured pump. The parameters are adjusted automatically by the software.

Starting from the 'GLP' (*Screen 82*), press **Seal** (*Screen 265*); you will see these soft-keys at one time or another:

Change to select the pump-head to run-in,

Start to start the pumping,

Continue to start pumping at the programmed rate,

End to stop the pump.

- 1) Connect the supplied capillary tubing (ref: E66394) to the outlet of the outlet filter; then switch the purge valve to the drain position.
- 2) Press **Change** followed by **ENTER**, to select the pump to run-in.
- 3) Optionally, if you are not using isopropanol as the solvent, you may change the flow rate.
Normally, you should keep the default value given in the table.
- 4) Press **Start** to start the pump (*Screen 266*) or **End** to stop the pump (in an emergency).
- 5) After two minutes the pump stops (*Screen 267*); switch the purge valve to the use position, then press **Continue**.
- 6) The pump then runs the pre-programmed sequence (*Screen 268*).
- 7) After the program has finished (*Screen 265*), press **ESC** (*Screen 82*), then run the leak test or press **Seal** to repeat the procedure for another pump.

Leak Test

This test consists of pressurizing the pump at a user selectable pressure, in a closed hydraulic circuit. When this pressure is reached the pump stops. If during the next 5 minutes the pressure decay is less than 10 % the test is successful. For a successful test 'OK' is displayed on the screen, otherwise, 'FAILED' is displayed. Check for leaks before repeating the test. Starting from the 'GLP' (*Screen 82*), press **Leak** (*Screen 260*); you will see these soft-keys at one time or another:

Start to start the test (pump starts),

End to end the test (pump stops).

- 1) The outlet from the pump (filter) should be sealed with plug supplied, before running the test.
- 2) Maintain or modify the proposed values for flow rate (0.5 ml/min) and pressure (15 MPa).
- 3) Press **Start** to start the pump or **End** to stop the pump (in an emergency).
- 4) Press **ESC**, to return to *Screen 82*.

The selected test pressure must be within the configured pressure limits.

Mixing Test

This test is based on an ASTM method for determining the linearity, accuracy, and repeatability of a binary composition gradient. The test automatically implements a program consisting of three loops.

Starting from the 'GLP' (*Screen 82*), press **Mix** (*Screen 270*) to perform the binary mixing test. For details, refer to the document entitled 'Operational Qualification Procedure', reference 804041.

Running a Method Program

Preparing for a Run

In addition to creating your Method Program file, the following steps must be completed before running a Method Program.

- 1) Make the electrical and hydraulic connections between the pump(s) and other equipment in the system, as described in Chapter 3.
- 2) Connect the power and switch on all of equipment.
- 3) Configure the Master 333 Pump.
- 4) Prime the hydraulics, initialize and run-in the piston seals (if new).

Starting and Stopping a Run

Switch on the Model 333 Pump, then (after initialization) you see the ready-to-run screen (*Screen 1*). Before starting the run, you may see the following soft-keys:

Pump (Edit) to access pump operations,

Detect to access an associated detector,

Manual to prime and operate manually,

Run to run the current Method Program file,

Zero to zero the detector signal (if associated).

- 1) The cursor indicates the currently selected file number; to select a different file key in its number, then press **ENTER**.
- 2) Press: **Run**, you will see the following soft-keys at one time or another:
 - Edit** to view or modify any file during a run (it may be another file),
 - Pause** interrupt the Method Program (pumping continues),
 - Resume** to continue a paused Method Program,
 - End** to stop the Method Program file (pumping continues),
 - Stop** to stop pumping (the Method Program may continue).

After pressing **Run**, the ready-to-run screen dynamically displays the flow rate and composition of the mobile phase, and displays the pressure detected by the pressure sensor. The top line of the screen is reserved for information from a 15X detector (if connected).

If you press **Pause**, the Method Program is interrupted, but pumping continues at the rate and composition that existed when that soft-key was pressed. A pause time counter replaces the run time counter until you press **End** or **Resume**. Pressing **Resume**, restarts the Method Program, from the point at which it interrupted. Pressing **Stop** during a pause stops pumping until you press **Resume**.

Whenever you press **End**, the Method Program is terminated, but pumping continues at the rate and composition that existed when that soft-key was pressed. After pressing **Stop**, you may need to press **End** to terminate the Method Program.

When a Method Program comes to an end, the pump continues to pump at the flow rate and composition that were applicable at the last programmed event (or at the end of 'n' loops); unless you program a flow rate of zero at the end of the program, or link the run file to a stop program, otherwise you must press **Stop** to stop pumping.

You can press the **Edit** key, to access and change the Method Program parameters, even when the Method Program to be edited is running. When you see the word 'running' after the file number (on selected screens), it means that the **Method Program** is either running or paused; it does not refer to the pistons, which may be pumping or stopped. Likewise, the absence of the word 'running' does not imply that the pistons are not in motion.

Post Run Information

At the 'Pump control' screen (*Screen 2*), press **Watch** to obtain the following post-run information:

- the minimum and the maximum pressures attained during the latest run of the file selected by the watch file number.
- the time taken per cycle for each piston (provided the flow and composition remained constant during the run). This may be useful information when analyzing baseline pulsations (for example).

In the case of linked files, the first one is selected automatically, but you can select another one.

For a complete log of events you should use the Audit trail function. Audit trail records the unprogrammed events that take place during a run when you execute one or more Method Program files. Audit trails are recoverable by PC based software .

Before a run of after pressing **Stop** (no flow).

| | |
|-----------------------|-----------------------|
| Pump file: 19 | |
| Loop: 1 | 7.50 min |
| 0 ml/min | 16.0 bar |
| 0 % A 0 % B | |
| ----- | |
| Edit | Manual Run |
| <input type="radio"/> | <input type="radio"/> |

During a run (flow and composition changing).

| | |
|-----------------------|-----------------------|
| Pump file: 19 | |
| Loop: 1 / 3 | 1.58/7.5 min |
| 4.2 ml/min | 16.0 bar |
| 25 % A 75 % B | |
| ----- | |
| Edit | Pause End |
| <input type="radio"/> | <input type="radio"/> |

During a run, after pressing **Pause** (flow and composition constant at rates when program was paused).

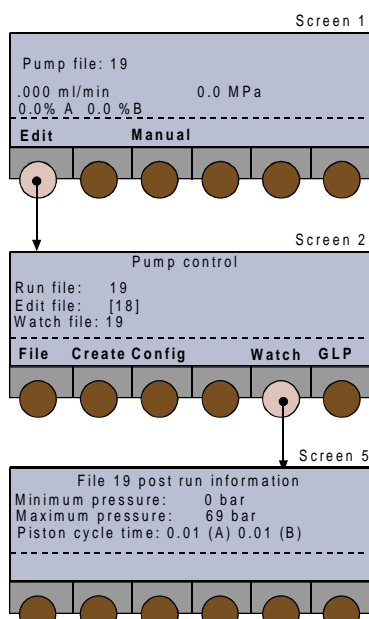
| | |
|-----------------------|-----------------------|
| Pump file: 19 | |
| Loop: 2 / 3 | Pause 0.50 min |
| 4.2 ml/min | 16.0 bar |
| 25 % A 75 % B | |
| ----- | |
| Edit | Resume End Stop |
| <input type="radio"/> | <input type="radio"/> |

During a run, after pressing **End** (flow and composition constant at rates when program was ended).

| | |
|-----------------------|-----------------------|
| Pump file: 19 | |
| Loop: 2 | 1.50 min |
| 7.0 ml/min | 16.0 bar |
| 16 % A 84 % B | |
| ----- | |
| Edit | Manual Run Stop |
| <input type="radio"/> | <input type="radio"/> |

After a run, before pressing **Stop** (flow and composition constant at rates when program ended).

| | |
|-----------------------|-----------------------|
| Pump file: 19 | |
| Loop: 3 | 7.50 min |
| 10.0 ml/min | 16.0 bar |
| 50 % A 50 % B | |
| ----- | |
| Edit | Manual Run Stop |
| <input type="radio"/> | <input type="radio"/> |



Information Transfer

Gilson software is supplied with each 333 Pump to transfer information between a 333 Pump and a computer. This diskette-based Pump Data Transfer (PDT) software is for use on a Personal Computer (PC) or similar, running under Windows 95 or higher.

Data transferred from the pump may be printed out from the PC or saved as files. In addition previously saved Configuration and Method Files may be transferred from a PC to a pump.

Connections

1) Using a Gilson 605 Adapter

For simpler systems, or where control is normally from the 333 Pump's keyboard, a 605 Adapter is normally sufficient. Your computer must have at least one serial communications socket.

When connecting a Model 605 to an IBM PC (or equivalent) having a 9-pin RS-232 output, a 9-pin D (female) to 25 pin D (male) converter is required.

- i) Connect the 9-pin (female) end of the converter to the 9-pin (male) RS 232 socket on the PC.
- ii) Connect the 25-pin (female) end of the Model 605 to the 25-pin (male) connector on the converter.
- iii) Connect the 9-pin (female) connector of the Model 605 to the 9-pin (male) GSIOC socket on the right-hand 9-pin (male) GSIOC socket (From Controller) on the Master 333 Pump.
- iv) When connecting to a two-pump system, a GSIOC Cable is also required from the 'To Slave' socket on the Master 333 Pump to the 'From Controller' socket on the slave pump.

2) Using a Gilson 506C Interface

For more complex systems, you need:

- a Model 506C Interface,
 - a 9-pin D (female) to 25-pin D (male) converter,
 - a 25-pin male-female connection cable.
- i) Connect the 9-pin (female) end of the converter to a 9-pin (male) RS 232 socket on the IBM PC.
 - ii) Connect the female connector of the 25-pin cable to the 25-pin (male) connector on the converter.
 - iii) Connect the male connector of the 25-pin cable to the RS-232 socket of the 506C Interface.

- iv) Connect a GSIOC cable from the GSIOC socket of the 506C Interface to the 333 or 334 Pump.

Installation

- 1) The PDT Software runs under Windows 95 or Windows NT 4.0.
- 2) Place the diskette supplied by Gilson, in drive A.
- 3) Run the Setup.exe file.
- 4) Follow the instructions given on the screen.

Functionality

Four data types can be transferred from the pump: Audit Trail, Method, Configuration, and Counters. After transfer, data can be printed or stored as files on the computer. All files stored on the computer can be recovered and printed. Two types can be transferred back to the pump: Method and Configuration. The table shows the functions that are possible for each data type.

You can add comments or supplementary information to each file saved.

Transferable Data Types

| | Import | Export | Open | Close | Save | Print |
|----------|--------|--------|------|-------|------|-------|
| Audit | x | | x | x | x | x |
| Method | x | x | x | x | x | x |
| Config | x | x | x | x | x | x |
| Counters | x | | x | x | x | x |

Drop down menus allow you to access the following data types:

Audit Trail

Displays the Audit Trail File including the following tabulated headings: Config, Method and Log. Config contains the information detailed below (Main, etc.).

Method

Displays graphical and numeric data of the transferred or opened method.

Config

Displays parameters and data for the transferred or opened configuration. The information is grouped under the following tabulated headings: Main, Safety, Others, I/O, Solvent A, Solvent B, etc.

Counters

Displays the counters for the transferred or opened data set.

Control of a Model 15X Detector

The following is a summary of information relating to Gilson Model 15X Detectors. For complete information, refer to the relevant detector user's guide.

Introduction

Any one of the following Models can be controlled from a 333 Pump:

- Model 151 Single Wavelength Detector (with Control Panel),
- Model 152 Single Wavelength Detector (no Control Panel),
- Model 155 Dual Wavelength Detector (with Control Panel),
- Model 156 Dual Wavelength Detector (no Control Panel).

Control includes programming two events in the 333 Method Program (detector signal autozero and detector lamp off).

Procedure

- 1) Make sure the Detector ID is set to 16 (top switch) and that the Baud rate is set to External (bottom switch, at position = 0).
- 2) Connect a GSIOC cable from the 'To Slave' socket on your 333 Pump to the appropriate socket on the detector.
- 3) Switch on both the pump and the detector, at their rear panels.
- 4) Switch on the pump and the detector lamp, at their front panels (Power and Lamp On).
- 5) Wait (~ 1 minute) while the detector completes its validation process; the top line of the pump's screen shows the status, and after validation of the output from the active channel(s).
- 6) Press the **Detect** soft-key on the pump.

Software Functions

After pressing the **Detect** soft-key on the pump a series of screens showing the pump parameters are available. In addition you have access to the same soft-key functions that are normally accessible from the control panels of the Model 151 and Model 155 detectors.

The soft-keys are:

Next to access the following screen,

Previous to access the previous screen,

Mode to access mode and other soft-keys,

Event to output an event marker,

Zero to zero the baseline.

The following parameters can be viewed:

- sensitivity for each channel,
- peak width,
- ratio multiplier (dual wavelength mode)
- ratio threshold (dual wavelength mode)

After pressing **Mode** the following soft-keys become available:

Single to select single-wavelength mode,

Dual to select dual-wavelength mode,

Scan to store a reference scan, (or to compare with previous reference),

File to access the file functions,

Setup to configure the detector,

Status to view (and reset) lamp usage, etc.

For more information, refer to the 151 or 155 Detector User's guide.

For all 15X detectors, the remote indicator lights-up after pressing the 'Detect' key on the pump's control panel plus pressing a detector command (e.g. Zero); after which, for the 151 and 155 Detectors, selections made from the pump's control panel are shown on its screen and are mimicked on the detector's screen. Under remote control, the 151 and 155 keyboards no longer function.

PC Software for 333 and 334 Pump Control

Users of Gilson's UniPoint software who want to control or communicate with 333 or 334 Pumps should refer to the corresponding user's guide for further information.

GSIOC commands may also be used to dismount and remount pump heads, and to read, modify, or reset the maintenance counters.

1. Use the *GSIOC Utility* Software (installed with UniPoint) including the following dialog boxes: Identification Number, Command (Immediate or Buffered), and Response.
2. Enter GSIOC commands and parameters corresponding to the desired information, in the appropriate dialog boxes.

Maintenance and Troubleshooting 5

For 333 and 334 Pumps, user maintenance is generally limited to the following:

- 1) cleaning check valves and filters,
- 2) replacing parts subject to wear and tear in each pump head: piston seal, check valves, and piston assembly.

General guidelines for the periodic replacement of the ‘wear parts’ are indicated below, according to the amount of use: intensive, regular, or occasional. This schedule should be regarded as a guide; changes in performance, or visible leaks, give an indication that a part should be changed.

Typical Replacement Schedule for Wear Parts

| Component | Intensive (168 h/week) | Regular (40 h/week) | Occasional (10 h/week) |
|-----------------|------------------------|----------------------|------------------------|
| Piston seals | 4.5 months (3000 h) | 1-1.5 years (2500 h) | 2 years (1000 h) |
| Check valves | 7 months (4500 h) | 1.5 years (3000 h) | 3 years (1500 h) |
| Piston assembly | 9 months (6000 h) | 2-3 years (5000 h) | 4 years (2000 h) |

The figures are based on the assumption that the pump is working at half its maximum flow rate and pressure.

The nature of the liquid pumped is a major factor affecting longevity of the piston seal:

- standard UHMWPE seals are best suited for water, aqueous solutions, alcohols, acetonitrile, and (in general) polar solvents,
- black PTFE piston seals, offered as additional accessories, are best suited for tetrahydrofuran, hexane, methylene chloride, carbon dioxide, and (in general) low-polarity solvents.

You can check and reset your pump’s Maintenance Logs (press **Edit, GLP, Maint ...**). If your type of use is intensive with relatively constant solvents and operating conditions, then set the limiting values (numbers of hours) to reflect your experience as well as GLP requirements.

Pump Head Maintenance

Before a head can be physically removed from a 333 or a 334 Pump, you must disengage the pump-head from the pump-motor, by using the software dismount procedure. This procedure is accessed from the control panel of the Master 333 Pump or by GSIOC commands from the PC based controlling software (see page 4-35). There is an alternative manual procedure in case of the loss or unavailability of power (see below).

Normal Dismounting Procedure



- 1) Open the purge valve, by turning the black knob on the Pressure Module counterclockwise.
- 2) After powering up the pump, use the software dismount procedure (refer to Chapter 4) to 'release' the pump head.
- 3) Disconnect all solvent lines from the pump head(s) in question.
- 4) Progressively remove each of the two screws securing the pump head to the pump motor, using the supplied 5-mm Allen wrench. Support the pump head with your other hand, after loosening the two screws (moderate force is required).

Alternative Dismounting Procedure

- 1) Open the purge valve, by turning the black knob on the Pressure Module counterclockwise.
- 2) Switch off the 333 or 334 Pump(s) and disconnect it from the power supply.
- 3) Remove the back panel (to which the fan is attached) by undoing the retaining screws. The mounting screws for both heads are now visible.
- 4) Insert a 3-mm Allen wrench into the mounting screw, turning it in the clockwise direction, until you reach a stop (you will hear a 'thump' as you hit the stop). At this point, the piston engaging mechanism will be withdrawn to a maximum distance into the interior of the pump motor. Then turn the wrench two turns counterclockwise.

- 5) Disconnect all solvent lines from the pump head(s) in question.
- 6) Progressively remove each of the two screws securing the pump head to the pump motor, using the supplied 5-mm Allen wrench. Support the pump head with your other hand, after loosening the two screws (moderate force is required).

When remounting the pump head you can leave the mechanism at the fully withdrawn position - in fact, if you turn the retaining screw fully counterclockwise, you reach another stop, and risk unscrewing the mechanism (at the fully out position), if excessive force is used.

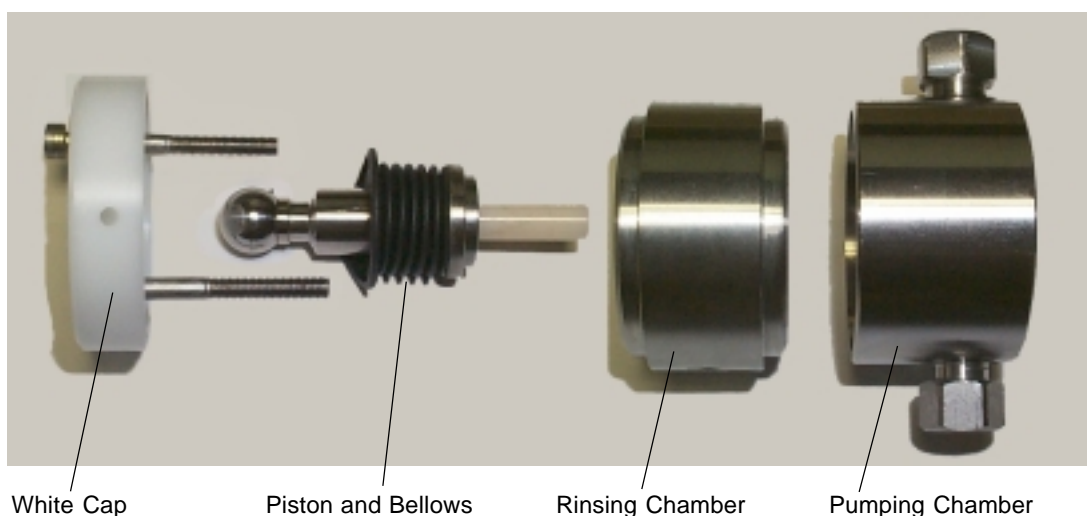
Disassembling a Pump Head



The following steps should be carried out on a clean, dry surface. No special tools are required.

- 1) Undo the two retaining screws using a 3 mm Allen wrench, as supplied.
- 2) Remove the white cap and retaining screws.
- 3) Pull the piston and bellows out of the body of the pump head.
- 4) Pull apart the two halves of the pump head (with a slight twisting motion).
- 5) Inspect the bellows for damage; if this component needs to be replaced, use your thumbs to push it firmly away from the retaining collar.





Replacing a Piston Seal

The following steps should be carried out on a clean, dry surface. No special tools are required.



- 1) Pull apart the two halves of the pump head (with a slight twisting motion).
- 2) Remove the piston seal either by:
 - a) carefully levering out the seal using the end of the Allen wrench, in which case the seal must be discarded, or ...
 - b) blocking the outlet and using an air line, inserted into the center of the seal, to blow the seal out of the recess in the pump head.
- 3) Clean out any debris from the old seal remaining in the recess using a soft cloth or an air line.
- 4) Push a new seal carefully into the recess. Only use the type of seal specified in Chapter 6.
- 5) Initialize and run in the new seal(s).

Piston Rinsing Chamber



When a pump is delivered, the inlet and outlet ports to the rinsing chamber are fitted with plugs, which prevent airborne particles from entering the ports. If you do not need to use piston rinsing, you should leave these plugs in place.

If you pump a liquid containing more than 0.1 M of solute, being solid in normal ambient conditions, you must rinse the piston(s) when pumping, using the same liquid, but without the solute.

To facilitate the required connections (refer to Chapter 3) for the rinsing liquid a plumbing kit is available as a standard accessory (ref: E66379).

You should change the rinsing liquid at least once a week.

Piston and Bellows

Although the size and material of the piston-shaft vary between different head sizes, the procedure is the same; to inspect and if necessary replace the bellows, follow the steps shown in the figure (a, b, c).

Use your thumbs to remove the bellows; moderate force is required. When removing the bellows, support the piston by the head, not by the shaft. This advice applies mainly to the smaller and more fragile shafts such as those used to demonstrate this procedure in the figure (H1 head); the ceramic shafts of H3 heads are thicker and less susceptible to damage.

a) H3 Piston Assembly



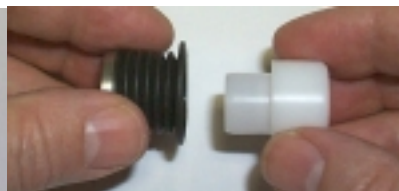
b) Removing the Bellows



c) Individual Components (Piston & Bellows)



d) Inserting the Tool



Mounting The Bellows

- 1) Insert the tool (ref: E66231), which ensures that the orifice at the end of the bellows remains open, into the open end of the bellows (d).
- 2) Place the tool on a firm, flat, surface.
- 3) Push down on the metallic ring using four digits (e), until the orifice grips the end of the tool on its own.

e) Opening the Orifice



Refitting The Bellows

- 1) The tool, which keeps the end of the bellows open, enables the bellows to be slid back into position (f).

f) Refitting - Step 1

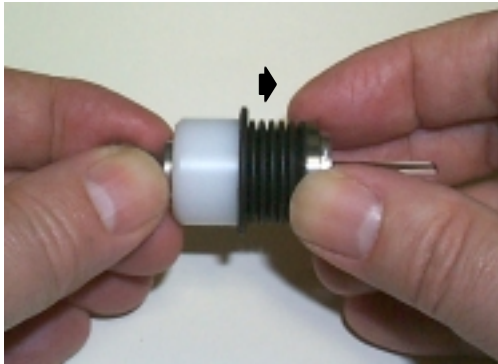


Pump Head Maintenance

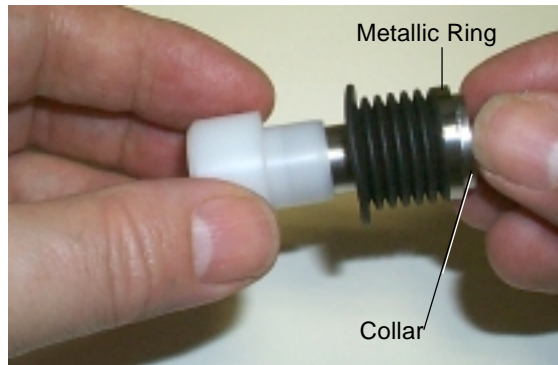
Pull on the metallic ring to refit the bellows; moderate force is required. When refitting the bellows, support the piston by the head, not by the shaft.

- 2) Pull on the metallic ring at the end of the bellows until it can go no further (g).
- 3) Remove the tool and check that end of the bellows (with the metallic ring) is correctly seated against the piston collar (h).

g) Refitting - Step 2



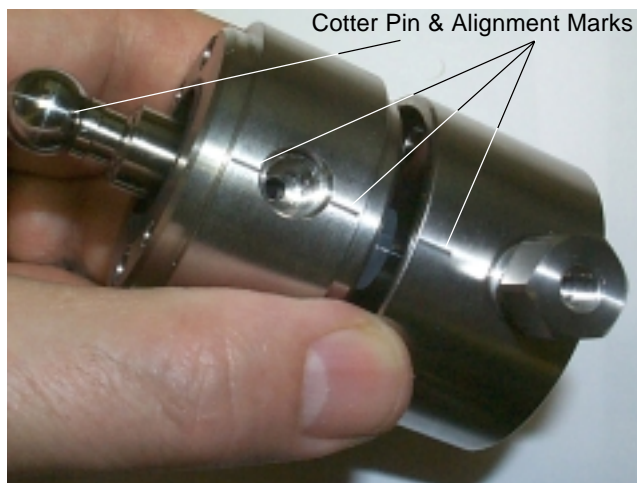
g) Refitting - Step 3



Reassembling a Pump Head

- 1) Push together the two halves (rinsing and pumping chambers) of the pump head (with a slight twisting motion).
- 2) Turn the rinsing chamber relative to the pumping chamber, until holes for the pump head retaining screws are aligned (because of the asymmetry of the holes there is only one correct position).
- 3) Check that the marks on the rinsing and pumping chambers are aligned (a).
- 4) Refit the bellows (new if necessary) to a clean piston and insert the assembly fully into the rinsing chamber (b).

a) Correct Alignment of Chambers and Pistons



b) Correctly Piston Assembly



- 5) Turn the piston until the small cotter-pin at the rounded end of the piston is in line (approximately) with the alignment marks on the pump head.
- 6) Refit the white cap (c), reinsert the screws, and progressively tighten them (d), making sure that the alignment marks are still correctly aligned (do not overtighten the screws).

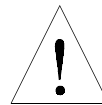
c) Refitting the White Cap



d) Tightening the Screws



Do not turn the piston after the head is reassembled, because it is possible to damage the bellows.



Check Valves

The two check valves, inlet and outlet, should be cleaned periodically, to ensure reliable flow rates. If they become partially blocked the flow rate will drop, in which case they must be cleaned or replaced.

The inlet and outlet check valve cartridges are identical for H3 heads (but the connectors are not, take care).

For 333 and 334 Pumps, Gilson check valves are supplied in the form of cartridges: one for the inlet connector and one for the outlet connector.

Cleaning a Check Valve

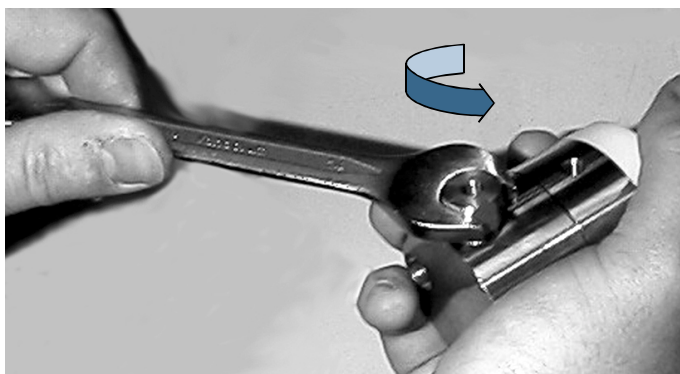
This procedure is carried out with the check valves in situ:

- 1) Open the purge valve to the drain position.
- 2) Pump isopropanol (provided the current solvent and isopropanol are miscible).
- 3) When the pump head is full of isopropanol, stop the flow for at least 15 minutes, to dissolve any sticky deposits.
- 4) Reconnect the current solvent and pump to the drain to clear the isopropanol.
- 5) Check that the flow rate has returned to normal, if not remove the check valve.
- 6) Clean the check valve by blowing compressed air through it, or replace it with a new one.

Replacing a Check Valve

You can, if necessary, replace a check valve without dismounting the head. However, in this case you must first turn off the pump and disconnect the hydraulic tubing(s) from the connector(s).

- 1) Loosen the connector using the supplied 14 mm wrench.
- 2) Fully unscrew the connector from the pump head, by hand.
- 3) Remove the check valve from the connector.
- 4) Make sure that the connector and pump-head housing are clean.
- 5) Slide a new check valve, with the orientation shown in the figure, into the connector.
- 6) Screw the connector into the pump-head housing.
- 7) Carefully tighten the connector using a torque wrench set to 7 Nm. Or, turn the connector using the 14-mm wrench until there is contact, then tighten the connector by turning it a further 30° in the clockwise direction. If leakage is observed, tighten the connector progressively until the leakage stops.
- 8) Run the pump and perform the leak test (Chapter 4).



Check Valve (H3)



Arrow on the H3 inlet an outlet cartridges must point in direction of solvent flow.

Filters

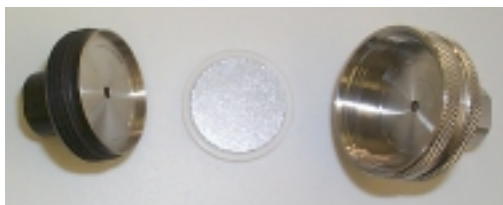
Inlet Filters



To protect the check valves, an inlet filter must be used with all solvents. Inlet filters must be in good condition for the pump to operate efficiently.

Change the inlet filter if you suspect that it has become plugged.

Outlet Filter



The outlet filter protects the injection valve and the column. A plugged outlet filter may cause pressure build-up and leaks.

You should routinely check and clean the interior of the outlet filter, and when necessary replace the filter cartridge.

- 1) Remove the filter from the pump.
- 2) Separate the two halves of the filter casing using two 11 mm wrenches and remove the filter cartridge.
- 3) Rinse the interior of both halves of the casing using a suitable solvent, using an air line to complete the cleaning process.
- 4) Clean the filter cartridge, using a jet of solvent, or fit a new filter cartridge.
- 5) When you reinstall the filter cartridge, place it in the black (downstream) half of the casing; this ensures that the cartridge is properly seated before reassembling the filter casing.
- 6) Reassemble the filter casing, using moderate force, then refit the filter to the pump and re-prime the system, checking for leaks.

Troubleshooting

When troubleshooting, try to check each part of the system independently; try one solution at a time and proceed in a systematic way.

If for example, the delivered flow rate is not correct, check each pump head independently. Check the solvent bottles, the connections between the bottles and pump heads, inlet filters, outlet filters, and so on. Systematically check each component in the circuit, even if it's new.

Refer to the following tables for diagnostic information relating respectively to electrical and to hydraulic problems.

Error situations are signalled by a 333 Pump by means of an error message appearing on the screen and the error LED on the front panel lighting up. On the 334 Pump the error LED is replaced by 'remote'; this LED simply indicates when the slave is being controlled from the master.

Error LED (333 Pump)

The error LED could light-up (steady red) for any of the following reasons:

- 1) A pump motor has ceased to function or has been asked to function in a way that is not possible.
- 2) Communication has failed with a slave pump.
- 3) Pressure limits have been exceeded (high - file #21 or low - file #22). Any attempt to run a file that does not exist will activate the error LED.
- 4) Restart after a power failure has attempted to start file #23. However, the file does not exist; the software stopped the pump and activated the error LED.
- 5) Input #2 was closed, attempting to start file #23. However, the file does not exist; the software stopped the pump and activated the error LED.
- 6) A maintenance counter limit has been reached (see Chapter 4).
- 7) The audit trail is saturated.
- 8) Invalid setting.

Error Messages (333 Pump)

Many types of messages are displayed on the screen, for example 'errors' during the entry of Method Program or configuration parameters. For this type of error the software displays messages that explain the required corrective action. However, there are some critical error situations that can occur during or after a run.

| Message | Corrective Action |
|--|--|
| "Pressure lower than 'X' " | Check for leaks, check configuration parameters, check and possibly rerun Method Program file. |
| "Pressure higher than 'Y' " | Check hydraulics, check configuration parameters, check and possibly rerun Method Program file. |
| "Input 2 was activated" | Check hydraulics, check configuration parameters, check and possibly rerun Method Program file. |
| "Power restored after failure" | The latest run could be invalid. Check the system before a possible rerun of this file. |
| "Channel 'Z' failing" | Failure may be caused by a blockage (tubing, check valve, etc.). Check the hydraulics, especially Channel 'Z', check configuration parameters, check and possibly rerun Method Program file. |
| "Communication fails with 'N' " | Check that pump 'N' is switched on. Check GSIOC ID and connections. |
| "File does not exist" | Check that you are trying to run a valid file. Check that any linked files are valid. |
| "Maintenance limit is passed for 'M' " | Service item 'M' and reset the counter (see Chapter 4, Config, GLP). |
| "Audit trail is saturated" | Archive the audit trail (PC), then reset the audit trail. |
| "Validation process has restored default parameter(s)" | Check all Method Program and configuration parameters. |
| "RAM error contact your Gilson representative" | Contact your distributor. |

Electrical & Program Problems

| Problem | Possible Causes | Solutions |
|--|--|--|
| Pump does not operate - no POWER indicator LED. | No power or fuse blown. | Check fuses, plug-in power cord, switch on at rear. |
| Pump does not operate - no ON indicator LED. | Pump is not operational. | Press the ON/OFF key on the standby panel. |
| Pump does not stop at the end of a run. | Not programmed. | Program a flow rate of zero and a composition of zero at the desired end time for all solvents. |
| Error LED lights up. | Various. | See text. |
| Slave pump does not operate. | No GSIOC communication. | Check GSIOC cable(s) are connected correctly between pumps and that GSIOC ID #s are correctly set. |
| Pump 'X' is missing message appears on the screen. | No GSIOC communication or the Slave Pump ('X') is not switched on. | Switch on the Slave Pump, check GSIOC connectors, the baud rate and ID of the slave. |

Hydraulic Problems

| Problem | Possible Causes | Solutions |
|--|---|--|
| Air bubbles in both the inlet and the outlet tubings. | Inlet tubing is loose. Nut and/or ferrule damaged. | Tighten the connectors. Replace the nut and/or ferrule |
| | Inlet filter is plugged. | Clean or replace the inlet filter(s). |
| | Refill time is too short. | Increase the refill time (see Chapter 4, Config, Hyd). |
| Air bubbles in the outlet tubing, only. | Loose connection of outlet. | Tighten connectors. |
| Leaks from a pump head. | Defective piston seal. | Replace the defective seal. |
| Abnormally low flow rate. | Leaks. | Check the hydraulic circuit for leaks. |
| | Air entering upstream from the head. | Check the upstream connections. |
| | Plugged inlet filter. | Replace inlet filter. |
| | Defective check valve. | Replace check valve. |
| | Incorrectly mounted pump head. | Remount the pump head. |
| Abnormally high pressure. | Plugged outlet filter. | Clean or replace outlet filter. |
| | Column particle size too small or plugged column. | Replace check valve. Change or flush column. |
| | Mobile-phase viscosity too high. | Use lower viscosity solvents or increase temperature. |
| Baseline noise , periodic pulses (see Chapter 4, piston cycle time). | Mixer volume too small. | Increase mixer volume. |
| | Air in the hydraulics. | Prime the pump, degas the solvent. |
| | Faulty pressure module | Contact your Gilson representative. |

This Chapter contains Technical Data, Lists of Parts and after Reference Information.

Technical Data

The following information presents construction and operational characteristics for Gilson 333 and 334 Pumps. The operational characteristics include:

- Performance data, quantifying separately the accuracy (bias [1]) and the associated repeatability (Standard Deviation, SD) for pressure, flow rate, two-solvent composition [2], and repeated sample injection from an extra pump. These performance data were estimated for common solvents (water, methanol, acetonitrile, tetrahydrofuran, isopropanol, hexane, and dichloromethane), 20-23 °C (988-1038 hPa, 45-75 % humidity), over the whole nominal ranges for flow rate, and pressure, using the recommended values for adjustment parameters (inlet pressure, solvent name or compressibility correction), and excluding the uncertainty in measurement attributable to the measuring procedure.
 - Limits of acceptance for the results specified in the individual Quality Control Report supplied with each pump and in the Operational Qualification Procedure (to be implemented by qualified personnel).
- [1] The bias of a measuring instrument is the systematic error of the indication of a measuring instrument. The bias is normally estimated by averaging the error of indication over an appropriate number of repeated measurements (source: Characteristics of Measuring Instruments, in *International Vocabulary of Basic and General Terms in Metrology*, 2nd Edition, ISO, 1993, Section 5).
- [2] Gilson Operational Qualification procedure for 333 and 334 Pumps, based on P. A. Hartman, *Proposed Standard Practice for the Evaluation of Gradient HPLC Pumps*, ASTM E-19.09.07, May 1990.

Gilson 333 and 334 (33X) Pumps

Type of Pump

Gilson 333 Pump is a primary-solvent master pump, equipped with a control panel, and a pressure, purge and mixing module (PPMM). Gilson 334 Pump is a secondary-solvent remote-controlled pump, without a control panel, and without a PPMM.

Both are single-solvent, dual-piston, reciprocating pumps; 200 ml/min and 21 MPa. Each pump is factory-fitted with two H3 pump heads. Up to three 33X Pumps, including one 333 Pump (because it is fitted with a PPMM) can be associated to deliver three solvents, mixed at high pressure, flowing up to 599 ml/min at 33.3% of each.

Use of Pumps

For preparative-scale HPLC, 33X Pumps may be used with 20 to 100 mm bore columns.

For each configured pump, a Solvent Valve Block (SVB) is available as an additional accessory; a SVB enables four solvents to be switched under software control (twelve solvents for three associated pumps).

For isocratic mobile phases, one pump is used, giving single-solvent delivery under high pressure, with flow rate, and event programming (including solvent switching, if a SVB is fitted).

For composition-gradient mobile phases (with high-pressure mixing), binary systems require two pumps (333 - 334); ternary systems require three pumps (333 - 334 - 334). Composition, flow rate, and events (including solvent switching, if SVB is fitted) are all programmable from the 333 Pump, or from a PC using Gilson software (UniPoint).

Working Range and Performance Data

Solvents

Nature: common solvents, buffers and any liquids chemically compatible with the flow-path materials (see below).

Viscosity: 0.3-20 mPa.s (cP).

Temperature: 2-40 °C.

Compressibility: up to 2000 Mbar⁻¹.

Solute concentration: typically up to 1 M of solutes being solid in ambient conditions (piston rinsing chamber is a standard feature).

pH: 1-13 (if less than 0.1 M chloride ions).

Flow-path Materials

Metals: stainless steel (AISI 316L), and titanium (ASTM grade 2).

Thermoplastics: FEP, PTFE, PCTFE, ETFE, and UHMWPE.

Refractories (pump head): ruby and ceramics.

Pressure

Nominal range: from 0.5 MPa (5 bar, 70 psi) up to 21 MPa (210 bar, 3040 psi).

Selectable units: MPa, bar and psi (default: MPa), three significant digits.

Readout increment: 0.1 MPa (1 bar, 10 psi).

Digital output acquisition period: 500-1000 ms (pin 9).

Analog output: 142-1000 mV for 0-60 MPa (pin 10).

Safety limits: low and high, both adjustable from 0 to 21 MPa (default: 0 and 21 MPa).

Accuracy (bias): $< \pm 2\%$ or 0.1 MPa whichever is greater.

Repeatability (SD): $< 1\%$ or 0.1 MPa whichever is greater.

Residual pulsation amplitude (according to the volume of liquid pressurized downstream from the pump); recorded from pin 10: < 0.1 MPa for 200 ml (40 x 250 mm column); $< 1\%$ or 0.3 MPa whichever is greater for 10 ml (20 x 50 mm column); $< 9\%$ or 1.3 MPa for 50 μ l (0.25 x 1000 mm tubing).

Flow Rate

Selectable units: liter/h and ml/min (default: ml/min), three significant digits.

Adjustment increment: 0.01 ml/min.

Adjustable range: from 0.02 ml/min for one solvent, up to 599 ml/min for three solvents at 33.3 % each.

Single Solvent (333)

Nominal range: 0.2-200 ml/min

Accuracy (bias): $< \pm 1\%$ or 5.3 μ l/min whichever is greater.

Repeatability (SD): $< 0.5\%$ or 2.7 μ l/min whichever is greater.

($< 0.2\%$ specified for 5-50 ml/min after a run of > 30 minutes with a new piston seal).

Two Solvents Mixed Under Pressure (333-334)

Nominal range: 2-200 ml/min, up to 400 ml/min for 50 %B.

Accuracy (bias): $< \pm 2\%$ or 53 μ l/min whichever is greater (mass flow-rate at constant temperature).

Repeatability (SD): $< 0.7\%$ or 27 μ l/min whichever is greater.

Composition and Mixing

Number of solvents: three (A, B and C), each one selectable out of four using the solvent selection valve block supplied as an additional accessory for each pump.

Composition increment: 0.1 %.

Dwell volume (total system volume from mixing point to filter outlet [2]): from 2.2 ± 0.1 ml at 2 ml/min to 3.7 ± 0.1 ml at 200 ml/min, pressure-independent.

Effective mixing vol. (indicative of mixing volume [2]): from 1.2 ± 0.1 ml at 2 ml/min to 2.7 ± 0.1 ml at 200 ml/min.

Composition time-constant (to reach the injection valve with 63 % of the nominal composition value): from 40 s at 2 ml/min to 1 s at 200 ml/min.

Gradient linearity range [2]: 1-98 %B for 10 ml/min and higher.

Accuracy (bias): $< \pm 0.7$ %B from 10 % composition steps, for 10 ml/min and higher.

Repeatability (SD): < 0.5 % from 2 % composition steps, for 10 ml/min and higher.

Residual UV-absorbance pulsation amplitude for binary mixtures: < 2 % of the UV-absorbance contrast between the two solvents, or 10 mAU/cm, whichever is the greater.

Sample Injection from Extra Pump

Requirement: extra Gilson 30X pump (305/306/307/308 with any head), tee fitting and extra tubing at column inlet.

Volume range: from 2×10^{-3} to 10^2 x head size in ml (10 μ l to 20 liters).

Flow rate: from 2×10^{-3} to 1 x size in ml/min (10 μ l/min to 200 ml/min).

Minimum adjustments: 10^{-4} x head size for volume (ml) and flow rate (ml/min).

Time: from 0.01 to 9999 min.

Injection volume accuracy (bias):
 $< \pm 1$ % or 5×10^{-5} x head size in ml, whichever is greater, for the whole volume range.

Injection volume repeatability (SD):
 < 0.5 % or 2×10^{-5} x head size in ml, whichever is greater, for the whole volume range.

Control Characteristics

Control from a 333 Pump

Control Panel

Keypad: 25 functional keys including six soft-keys.

Display: eight lines of 40 characters each, adjustable contrast (10-position), turning off after 0-999 min (default: 10 min).

Keystroke beeper: on or off (default: on).

Alarm beeper: on or off (default: on).

Controlled Gilson Instruments

Gilson 333 (GSIOC master) can control a Gilson detector and 3 other Gilson pumps:

- For UV-vis absorbance detection:
a single-wavelength model 151/152, or a dual-wavelength model 155/156.
- For repeated sample injection into preparative systems:
a 30X Pump (305/306/307/308 with any head).
- For up to three solvents:
two additional 33X Pumps.
- For up to three solvents and repeated sample injection:
two additional 33X Pumps plus one 30X.

Coordination with any other instrument: carried out by electrical contacts.

Electrical Contacts

Maximum accepted voltage: 48 V for each input and output contact.

Inputs (TTL type): wait for injection (configurable and programmable), emergency signal, run/end, and pause/resume.

Outputs: four configurable and programmable outputs (relay type, 30 V, 2 A); one DC power supply (12 V, 0.5 A, to be associated with a programmable output); one digital output converted into analog signal (1 V, pin 9) and configurable for pressure, flow rate or composition; one analog output (142-1000 mV, pin 10) for pressure (0 - 60 MPa).

Manual Control

Operations: prime, flow rate, and electrical output contacts.

Prime: carried out at 50 ml/min, successive or simultaneous for each channel.

Operating Programs

Application methods: mobile-phase flow-rate and composition (constant or multi-segment linear gradient), sample injection from extra pump, digital coordination with detector (signal autozero and lamp switching), coordination by electrical contacts with other instruments, programmable solvent selection (with additional valve block), safety, maintenance, and mixing test (see below); 20 files of 30 steps, with indication of solvent consumption.

Mixing test: pre-stored binary gradient profile, according to the ASTM E-19.09.07 [2], for the evaluation of the range of composition linearity, and of the composition accuracy and repeatability, using 20 % steps and selectable flow rate.

Safety methods: four files of 30 steps (pressure limits, emergency and power failure); anomaly processing procedures with related outcomes including red light indicator, beeper alarm, pumping stop, end of program, display of specific message defining the anomaly, and edition of this message in an audit trail which can be printed out from a PC (Pump Data Transfer software - supplied, 605 interface required).

Watch function: post-run information displaying minimum and maximum pressures, plus piston cycle times for isocratic work.

GLP functions: audit trail of unexpected events, anomalies, conditional operations, loops and links; maintenance logs for all wear parts (use and limits, hours and number of cycles); automatic procedures for piston seal installation, leak test, and mixing test.

Data transfer: PC software supplied on diskette permits to view and print with headlines all method files (application, safety and mixing test), plus configuration and audit trail (605 interface required, Windows 95, 98 or NT).

Time range: from 0.01 to 9999 min (0.6 s to 166 h) by steps of 0.01 to 1 min according to the range used.

Loops: 1-999 (default: 1).

Link: one for each file (default: none).

Adjustment Parameters

Ramping time for manual flow control: 0-9999 min (default: 0 min).

Head size: H3.

Compressibility correction (K_0): 0-2000 Mbar⁻¹ (default: 34 Mbar⁻¹ for water).

Inlet pressure (P_0): 0-20 MPa (default: 0 MPa).

Initialize piston before injection from pump: yes or no (default: no).

After power failure: continue, stop, or start a specific file (default: continue).

Pause input contact: with or without flow (default: without flow).

Wait for injection input contact: close or open (no default, compulsory answer depending on associated injector).

Output contact state: close, open or pulse (no default, compulsory answer depending on associated instrument).

Pulse output contact: 0.01-1 min (default: 0.03 min).

Analog output profile (pin 9): pressure, %B, %C, or flow rate (default: pressure).

Delay volume (associated with composition-profile analog output): 0-90 ml (default: 0).

GSIOC unit identification: 0-63 for 333 (default: 1), 0-9 for 334 (default: 2).

GSIOC bit rate: external, 19200, 9600, 4800, 2400 or 1200 baud for 333 (default: external); external, 19200 or 9600 baud for 334 (default: external).

Parameters for Associated 30X Injection Pump

Head size: 5, 10, 25, 50, 100 or 200 (default: 5).

Refill time: 25-1000 ms (default 125).

Compressibility correction and inlet pressure: as above.

Maintenance Counters

Time: up to 9999 h for wear parts (piston seal, check valves, and piston assembly).

Cycles: up to 10⁸ for wear parts.

Computer Control of 333 and 334 Pumps

From a future version of Gilson UniPoint system software via Gilson 506C interface and GSIOC slave bus.

From other system software: using Gilson 506C or 605 interface, GSIOC slave bus and commands (*refer to Chapter 7*).

Hydraulic Components

Standard Components

Low-pressure Plumbing

Filter: 316 steel, 20 μm , for 4.8 mm (3/16") tubing.

Tubing: FEP, 3.2 x 4.8 mm (3/16").

Nut: POM, white, 5/16"-24 TPI, for 4.8 mm (3/16") tubing.

Ferrule: ETFE, natural, for 4.8 mm (3/16") tubing.

H3 Piston Pump Heads

Identification: Gilson 866028 plus serial number.

Flow-path materials: 316 steel (body), ceramic (piston), UHMWPE (standard piston seal), ruby (check-valve ball), sapphire (check-valve seat), and titanium (body).

Maximum pressure: 21 MPa.

Stroke volume: 1595 μl .

Minimum piston cycle time at 200 ml/min: 956 ms for atmospheric pressure, 881 ms for 21 MPa (1500 Mbar-1), each piston delivering during half of the cycle.

Maximum instantaneous inlet flow rate: 399 ml/min during 227 ms.

Dead volume: 848 μl .

Piston rinsing chamber volumes: 4.0 ml total and 1.2 ml stroke (75 ml/min for 200 ml/min solvent delivery).

Pressure, Purge, and Mixing Module (PPMM)

Identification: Gilson 866344 plus serial number.

Flow-path materials: 316 steel (body, pressure transducer, grid, and packing balls), PEEK (mobile seal), and PTFE (fixed seal).

Internal volume: 2.85 ml (± 0.1 ml), 15.2 mm ID cylinder packed with forty-one 5-mm balls.

Maximum pressure: 30 MPa.

Number of ports: six (2.1 mm diameter external through-holes).

Outlet Filter Assembly

Identification: Gilson 410707 (Upchurch S-1579).

Flow-path materials: 316 steel (body and frit filter), ETFE (frit ring).

Internal volume: 160 μl (2.1 mm diameter through-holes).

Filter: 10 μm , 1.6 mm thickness, 19 mm diameter (Gilson 410730, Upchurch A331).

High-pressure Plumbing

Filter: 316 steel, 10 μm , 19 mm diameter, 1.6 mm thickness, 81 μl , for 3.2 mm (1/8") tubing.

Tubing upstream from the filter: 316 steel, 2.1 x 3.2 mm (1/8").

Tubing downstream from the filter: 2.1 x 3.2 mm (1/8").

Nut: 316 steel, 1/4-28 TPI, for 3.2 mm (1/8") tubing.

Ferrule: 316 steel, for 3.2 mm (1/8") tubing.

Total Pressurized Volume

10.4 ml inside 333 Pump, 17 ml inside 333-334 Pumping System.

Additional Components***Solvent Selection Valve Block***

Identification: Gilson E66465 plus serial number. Reference includes holder, four inlet tubings and filters, tubing and Tee-piece for connecting to pump heads.

Flow-path materials: PTFE.

Number of ports: one outlet and four inlets to select one solvent out of four.

Internal volume: 240 μl total per channel, including 80 μl in common path (3.2 mm diameter through-holes).

On-line Vacuum Solvent Degasser

Identification: Gilson 864 Degasser (Gilson E66250) plus serial number.

Flow-path materials: PTFE and PPS.

Number of channels: four.

Internal volume: 9.2 ml per channel.

Pressure drop: < 25 hPa for water at 10 ml/min

Vacuum: 69-72 hPa.

Maximum flow rate per channel: 50 ml/min for water and 10 ml/min for organic solvents to maintain the flow-rate accuracy of 333 and 334 pumps.

Residual concentration of dissolved oxygen (oxygen-saturated water, 1 ml/min, 25°C):

< 0.4 ppm for a single channel,

< 0.2 ppm for two channels in series.

Power consumption: 32 W.

Size: 80 (width) x 150 (height) x 260 (depth) mm.

Weight: 3 kg.

Wear Parts

Outlet filter, piston seals, inlet check-valves, outlet check-valves, piston assemblies.

Quality References

Individual Quality Control Report

Flow Rate Accuracy and Repeatability

Conditions

Automated gravimetry, water 20-23 °C (988-1038 hPa, 45-75 % humidity), 0.9968 g/ml, 5 ml/min, 10 ± 2 MPa, default values for all adjustment parameters. Six measurements of 1 minute each, after a less than 30-minute run with a new piston seal.

Limits of Acceptance

Accuracy (bias): $< \pm 1$ %

Repeatability (SD): < 0.3 % (< 0.2 % after a more than 30-minute run with a new piston seal).

Operational Qualification Procedure

Leak Test

Duration: Approximately 10 min.

Conditions

Pressure: 15 MPa.

Limit of Acceptance

Pressure decay: < 10 % in 5 min.

Complete Procedure for Composition and Flow-rate

Duration: Less than 2 hours, in total.

Conditions

Solvent A is methanol, solvent B is methanol plus 0.3 % acetone, 10 ml/min, 1-2 MPa, mixing test program pre-stored under GLP / Mix (to be recorded as file 20). Three cycles of 27.5 min each including composition ramp and steps.

UV-absorbance measurement, 265 nm, 500 mAUFS.

One measurement per step.

Digital flowmeter, typically 1 μ l/min resolution, 0.2-0.3 ml priming volume,

$\pm A$ % accuracy bias, R % repeatability RSD. Six measurements.

Limits of Acceptance

Flow rate accuracy (bias): $< \pm (A + 2) \%$.

Flow rate repeatability (RSD): $< (R^2 + 0.7^2)^{0.5} \%$.

Composition linearity range: 2-97 %B.

Composition accuracy (bias): $< \pm 1 \%$ B for each composition step.

Composition repeatability (RSD): $< 1 \%$.

Environmental Conditions**Operation**

Voltage: 90-260 V, 50 or 60 Hz.

Power: 600 W.

Electrical installation: category II.

Temperature: 10-40 °C for 333 Pump, 4-40 °C for 334 Pump.

Humidity: 15-80 %.

Pollution: degree 2.

Storage

Temperature: -15 °C to 40 °C.

Humidity: as for operation.

Size and Weight

333 Pump: Width 260 mm, height 507 mm, depth 410 mm. Weight: > 35 kg (44 kg packed).

334 Pump: Width 260 mm, height 387 mm, depth 410 mm. Weight: > 35 kg (44 kg packed).

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:

- (1) Dichloromethane.
- (2) Tetrahydrofuran.
- (3) Ethanol.

Flow Rate Accuracy

Principle

- 1) To generate the selected flow rate with the specified accuracy, maintained under high pressure and for a variety of liquids, the soft-ware adds two complementary corrections to the basic 'piston flow rate'. Defined from the piston stroke volume only, the piston flow rate is theoretically accurate only at atmospheric pressure.

The objective flow rate (F) is considered as the sum of three components, $F = F_0 + F_1 + F_2$

F_0 , the piston flow rate decreases when pressure increases,

F_1 , the compensation flow rate for the liquid compressibility, increases with pressure,

F_2 , the compensation flow rate for all other factors, also increases with pressure.

The piston flow rate (F_0) is defined by $F_0 = N_0 V_s$, where:

N_0 = number of piston cycles per unit time and V_s = piston stroke volume.

- 2) The compensation flow rate (F_1) is calculated as a function of five variables:

$F_1 = f_1 (F_0, V_s, V_D, P, X)$, where:

V_D is the volume of the dead space inside the compression chamber,

P is the operating pressure,

X is the compressibility of the liquid under the pressure P.

In the software, X is calculated using the simplified Tait equation: $X = c/(P + d)$

Coefficient 'c' varies only slightly with the nature of the liquid. It is a constant included in the software. Coefficient 'd' is calculated (first estimate), from liquid compressibility at atmospheric pressure, X_0 (for $P=0$). Values of X_0 for some common solvents are given in the following tables.

The operating pressure 'P' is continuously transmitted by the Pressure Transducer to the firmware in the pump.

- 3) The complementary compensation flow rate (F_2) is defined as the difference:

$$F_2 = F - (F_0 + F_1)$$

When F_2 was measured, experimental results yielded a simple function: $F_2 = f_2(a, b, P)$.

Coefficients 'a' and 'b' were determined for each pump head; they are manufacturing constants related to the pump head size.

Adjustments

Experimental results showed that it was possible to define an optimum empirical value K_0 for X_0 . This value K_0 , called **empirical compressibility correction for use with Gilson 32X and 33X Pumps** is given below. Your attention is drawn to the fact that K_0 is not a physical constant.

The empirical values (generated at 20-23 °C) were obtained from experiments to maximize the flow rate accuracy, i.e. minimize the bias, minimize its pressure dependence, center it on zero, and obtain closely related values for common solvents having very different physical properties. Extensive measurements of the bias versus X_0 were carried out over the whole pressure range.

For Gilson 333 and 334 Pumps, the empirical compressibility correction K_0 maximizes the accuracy of flow rate and two-solvent composition over the whole of their nominal ranges for flow rate and pressure.

| Solvent | K_0 (Mbar ⁻¹) |
|-----------------|-----------------------------|
| Water | 34 |
| Methanol | 162 |
| Acetonitrile | 180 |
| Isopropanol | 162 |
| Ethanol | 148 |
| Tetrahydrofuran | 150 |
| Hexane | 290 |
| Heptane | 270 |
| Dichloromethane | 200 |
| Chloroform | 204 |

Empirical Compressibility Correction (K_0)

| Mixture | K_0 (Mbar ⁻¹) |
|-----------------------|-----------------------------|
| Water-methanol, 10-90 | 130 |
| Water-methanol, 20-80 | 110 |
| Water-methanol, 30-70 | 92 |
| Water-methanol, 40-60 | 73 |
| Water-methanol, 50-50 | 55 |
| Water-methanol, 60-40 | 46 |
| Water-methanol, 70-30 | 43 |
| Water-methanol, 80-20 | 40 |
| Water-methanol, 90-10 | 37 |

| Mixture | K_0 (Mbar ⁻¹) |
|---------------------------|-----------------------------|
| Water-acetonitrile, 10-90 | 146 |
| Water-acetonitrile, 20-80 | 123 |
| Water-acetonitrile, 30-70 | 103 |
| Water-acetonitrile, 40-60 | 82 |
| Water-acetonitrile, 50-50 | 62 |
| Water-acetonitrile, 60-40 | 52 |
| Water-acetonitrile, 70-30 | 48 |
| Water-acetonitrile, 80-20 | 42 |
| Water-acetonitrile, 90-10 | 36 |

Properties of Common Solvents

With reference to the table, lines 1 to 8 are physical properties compiled from the *Handbook of Chemistry and Physics*, 79th edition, D. R. Lide, CRC Press, 1998-1999.

F_c and $\Delta P/L$ are examples of basic hydrodynamic calculations.

P' is the polarity calculated by L.R. Snyder (*Journal of Chromatographic Sciences*, 16, 223, 1978) from experimental measurements by L. Rohrschneider (*Analytical Chemistry*, 45, 1241, 1973).

| | Water | Methanol | Acetonitrile | Tetrahydrofuran | Isopropanol | Hexane | Dichloromethane |
|--------------------------------------|-------|----------|--------------|-----------------|-------------|--------|-----------------|
| UVC (nm) | 180 | 205 | 190 | 212 | 205 | 195 | 233 |
| RI | 1.333 | 1.329 | 1.344 | 1.406 | 1.378 | 1.376 | 1.424 |
| BP (°C) | 100 | 65 | 82 | 66 | 82 | 69 | 40 |
| VP (hPa) | 32 | 169 | 118 | 216 | 60 | 202 | 582 |
| η (cP = mPa.s) | 1.00 | 0.60 | 0.37 | 0.55 | 2.3 | 0.33 | 0.44 |
| ρ (g/ml) | 0.997 | 0.79 | 0.78 | 0.88 | 0.78 | 0.66 | 1.32 |
| η/ρ (cP/g.ml ⁻¹) | 1.00 | 0.76 | 0.47 | 0.62 | 2.9 | 0.50 | 0.33 |
| X_0 (Mbar ⁻¹) | 46 | 123 | 99 | 93 | 100 | 160 | 97 |
| F_c (ml/min) | 28 | 21 | 13 | 18 | 83 | 14 | 9.4 |
| $\Delta P/L$ (MPa/m) | 0.17 | 0.10 | 0.06 | 0.10 | 0.40 | 0.06 | 0.08 |
| P' | 10.2 | 5.1 | 5.8 | 4.0 | 3.9 | 0.1 | 3.1 |

UVC: UV cutoff

RI: refractive index at 20 °C

BP: boiling point at 1013 hPa

VP: vapor pressure at 25 °C

η : kinematic viscosity at 20 °C

ρ : density at 20-23 °C

F_c : critical flow rate for a 0.25 mm ID tubing

F_c (ml/min) = $113 \times 0.25 \text{ mm} \times \eta$ (cP)/ ρ (g/ml)

$\Delta P/L$: linear pressure drop for 1 ml/min and 0.25 mm ID tubing

$\Delta P/L$ (MPa/m) = $6.8 \times 10^{-6} \times 1 \text{ ml/min} \times 100 \text{ cm} \times \eta$ (cP)/(0.25 mm)⁴

X_0 : compressibility at 20 °C

Safety Data for Flammable Solvents

For flammable solvents, the following table gives safety data according to the following definitions and references:

Definitions

1. The **flash point** (FP) is the lowest temperature at which a substance or mixture in an open vessel gives off enough combustible vapors to produce a momentary flash of fire when a small flame is passed near its surface [1].
2. A substance is classified as **flammable** if its FP is lower than 38 °C [2].
3. The **auto-ignition temperature** (AIT) is the lowest temperature at which a substance can self-ignite at atmospheric pressure, without an external ignition source. The determination of AIT is rather imprecise and apparatus-dependent. Nevertheless, the AIT indicates the maximum allowable surface temperature of equipment and apparatus when exposed to air-vapor mixtures of these substances [2].
4. An **explosive atmosphere** consists of a mixture of the vapor of a flammable substance being at a temperature higher than its FP with air at a concentration within **the limits of flammability** (LOF) [3].

Volatile does not imply flammable; for example dichloromethane is volatile, but is non-flammable.

| | Ethanol | Methanol | Acetonitrile | Tetrahydrofuran | Isopropanol | Hexane | Heptane | Ethyl acetate | Diethyl ether |
|----------|---------|----------|--------------|-----------------|-------------|--------|---------|---------------|---------------|
| BP (°C) | 78 | 65 | 82 | 66 | 82 | 69 | 98 | 77 | 35 |
| VP (hPa) | 93 | 169 | 118 | 216 | 60 | 202 | 55 | 121 | 735 |
| FP (°C) | 12 | 11 | 6 | -14 | 12 | -22 | -4 | -4 | -45 |
| AIT (°C) | 490 | 510 | 520 | 320 | 540 | 260 | 230 | 490 | 190 |
| LOF (%) | 3-19 | 7-36 | 3-16 | 2-12 | 2-12 | 1-8 | 1-7 | 2-11 | 2-36 |

References

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Abbreviations for Thermoplastic Materials

| | |
|--------|---|
| EP | Ethylenepropylene |
| ETFE | Ethylenetetrafluoroethylene (e.g. Tefzel™ from Du Pont de Nemours) |
| FEP | Fluoride ethylenepropylene |
| PCTFE | Polychlorotrifluoroethylene (e.g. Kel-F™ from 3M) |
| PE | Polyethylene |
| PEEK | Polyetheretherketone |
| POM | Polyoxymethylene (e.g. Delrin™ from Du Pont de Nemours) |
| PP | Polypropylene |
| PPS | Polyphenylene sulfide (e.g. Ryton™ from Phillips Petroleum) |
| PTFE | Polytetrafluoroethylene (e.g. Teflon™ from Du Pont de Nemours) |
| UHMWPE | Ultra-high molecular-weight polyethylene |

Part Numbers

Pump, Standard Accessories, and Documents are supplied as standard. Additional Accessories, Wear Parts, and Replacement Parts, are available from your Gilson distributor.

Gilson 333 Pump

| Reference | Description |
|-----------|--|
| E66013 | 333 Pump (110 and 220 V), single solvent, 200 ml/min, 21 MPa |

Gilson 333 Pumps can accept any electrical voltage from 90 to 260 V (50 or 60 Hz). Each is supplied with two power cords, part number 500006 for 110 V and 500005 for 220 V.

Standard accessories

| Reference | Description | Quantity |
|------------------|--|----------|
| Hydraulic | | |
| 866149 | Bottle tray for 333 and 334 Pumps | 1 |
| E66381 | Inlet tubing, FEP, 3.2 x 4.8 x 1250 mm, 3/16", with filter, for connecting to pump (tee-piece) | 1 |
| E66391 | Tubing, 316 steel, 2.1 x 3.2 x 500 mm, 1/8", 1.73 ml (to injector) | 1 |
| 430057 | Tubing, 316 steel, 1 x 1.6 x 600 mm, 1/16", 471 µl (to injector) | 1 |
| E66394 | Tubing, 316 steel, 0.13 x 1.6 x 185 mm, 1/16", 2 µl pre-shaped (GLP/Seal) | 1 |
| E66384 | Adapter, 316 steel, 1/4" - 28 TPI male & 10-32 TPI female, 1 mm through, 11 µl | 1 |
| E66379 | Plumbing kit for piston rinsing chambers (connect to pump heads) | 1 |
| E66386 | Bottle, glass, 180 ml, pierced PE cap, screwed cap, for piston rinsing solvent | 1 |
| 410470 | Nut, 316 steel, 28 TPI, for 3.2 mm, 1/8" tubing (Upchurch C235) | 2 |
| 410471 | Ferrule, 316 steel, for 3.2 mm, 1/8" tubing (Upchurch C236) | 2 |
| 410426 | Nut, 316 steel, 10-32 TPI, for 1.6 mm, 1/16" tubing (Upchurch U400) | 2 |
| 410425 | Ferrule, 316 steel, 10-32 TPI, for 1.6 mm, 1/16" tubing (Upchurch U401) | 2 |
| E66463 | OQ plumbing kit | 1 |

| Reference | Description | Quantity |
|-------------------|--|----------|
| Mechanical | | |
| 610101 | Spanner for tubing nuts, 6.3 - 7.9 mm (¼" - 5/16") | 1 |
| 610112 | Spanner for check valve holder, 14 mm | 1 |
| 610117 | Spanner for outlet filter, double-ended 11 and 13 mm | 2 |
| 610043 | Allen wrench, 3 mm (rear-end, to release pump head) | 1 |
| 610045 | Allen wrench, 5 mm (front-end, to remove pump head) | 1 |
| E66157 | Tubing clip, PP, for 3.2 mm, 1/8" for 333 and 334 Pump bottle-tray | 2 |
| E66158 | Tubing clip, PP, for 4.8 mm, 3/16" for 333 and 334 Pump bottle-tray | 1 |
| E66231 | Bellows mounting tool, POM, white, piston assembly, for pump heads | 1 |
| Electrical | | |
| 506341 | Barrier strip connector, 14-pin (for output contacts) | 1 |
| 506367 | Barrier strip connector, 10-pin (for input contacts and two outputs) | 1 |
| 500006 | Power cord, 110 V | 1 |
| 500005 | Power cord, 220 V | 1 |

Documents and Data Transfer Software

| Reference | Description | Quantity |
|-----------|---|----------|
| 804035 | Quality control certificate, 333 and 334 Pumps | 1 |
| None | Quality control report, 333 and 334 Pumps | 1 |
| 801422 | User's guide, 333 and 334 Pumps | 1 |
| 804040 | Installation Qualification procedure, 333 and 334 Pumps | 1 |
| 804041 | Operational Qualification procedure, 333 and 334 Pumps | 1 |
| 801397 | Unpacking notice | 1 |
| E66382 | PC software for 333 Pump data-transfer | 1 |

Gilson 334 Pump

| Reference | Description |
|-----------|--|
| E66014 | 334 Pump (110 and 220 V), single solvent, 200 ml/min, 21 MPa |

Gilson 334 Pumps can accept any electrical voltage from 90 to 260 V (50 or 60 Hz). Each is supplied with two power cords, part number 500006 for 110 V and 500005 for 220 V.

Standard accessories

| Reference | Description | Quantity |
|-------------------|--|----------|
| Hydraulic | | |
| 866149 | Bottle tray for 333 and 334 Pumps | 1 |
| E66381 | Inlet tubing, FEP, 3.2 x 4.8 x 1250 mm, 3/16", with filter, for connecting to pump (tee-piece) | 1 |
| E66379 | Plumbing kit for piston rinsing chambers (connect to pump heads) | 1 |
| E66386 | Bottle, glass, 180 ml, pierced PE cap, screwed cap, for piston rinsing solvent | 1 |
| E66360 | Tubing, 316 steel, 2.1 x 3.2 x 600 mm, 1/8", 2.08 ml pre-shaped (334 tee to 333 PPMM) | 1 |
| Mechanical | | |
| 610101 | Spanner for tubing nuts, 6.3 - 7.9 mm (¼" - 5/16") | 1 |
| 610112 | Spanner for check valve holder, 14 mm | 1 |
| 610117 | Spanner for outlet filter, double-ended 11 and 13 mm | 2 |
| 610043 | Allen wrench, 3 mm (rear-end, to release pump head) | 1 |
| 610045 | Allen wrench, 5 mm (front-end, to remove pump head) | 1 |
| E66157 | Tubing clip, PP, for 3.2 mm, 1/8" for 333 and 334 Pump bottle-tray | 2 |
| E66158 | Tubing clip, PP, for 4.8 mm, 3/16" for 333 and 334 Pump bottle-tray | 1 |
| E66231 | Bellows mounting tool, POM, white, piston assembly, for pump heads | 1 |
| Electrical | | |
| 500933 | GSIOC cable | 1 |
| 500006 | Power cord, 110 V | 1 |
| 500005 | Power cord, 220 V | 1 |

Documents

| Reference | Description | Quantity |
|-----------|--|----------|
| 804035 | Quality control certificate, 333 and 334 Pumps | 1 |
| None | Quality control report, 333 and 334 Pumps | 1 |
| 801397 | Unpacking notice | 1 |

Additional Accessories for 333 and 334 Pumps

| Reference | Description |
|----------------------------------|--|
| Hydraulic | |
| E66250 | Gilson 864 degasser, 4-channel, PTFE and PPS, 9.2 ml, 70 hPa |
| 400141 | Piston seal, PTFE, black, flange-type, Hastelloy C276 spring, for H3 pump head |
| E66387 | Four-solvent selection valve block, PTFE, fully equipped, for 333 and 334 Pumps; includes: <ul style="list-style-type: none"> - 1 x 866383: Valve block, 4-solvent, without holder and tubing, for 333 and 334 Pumps - 1 x E66369: Holder, valve block for 333 and 334 Pumps - 3 x E66381: Tubing, FEP, 3.2 x 4.8 x 1250 mm, for 333 and 334 Pumps - 1 x E66370: Tubing, FEP, 3.2 x 4.8 x 150 mm, with fittings (from valve to tee-piece) - 1 x E66375: Tee piece, PTFE, 5/16"- 24 TPI, for 3/16" tubing - 3 x E66158: Tubing clip for bottle tray, 4.8 mm (3/16"); 333 and 334 Pumps (clips tubing to tray) |
| E66464 | Fraction-collection valve block, PTFE, fully equipped, 33X Pumps; includes: <ul style="list-style-type: none"> - 1 x 866053: Valve block, 4-solvent, without holder and tubing, 32X Pumps - 1 x E66124: Holder, valve block, 32X and 33X Pumps - 1 x 420564: Tubing, FEP, 1.6 x 3.1 x 4000 mm (from detector and to collection vessels) - 6 x 410428: Nut, POM, white, 1/4"- 28 TPI, for 3.2 mm tubing (Upchurch P303) - 6 x 410429: Inverted ferrule, ETFE, natural, for 3.2 mm tubing (Upchurch P300N) - 1 x 410153: Coupling, PVDF, 1/4"- 28 TPI |
| E66451 | Tubing, 316 steel, 2.1 x 3.2 x 663 mm, 2.30 ml, pre-shaped, 334 tee fitting to PPMM (vertical stacking) |
| 430067 | Tubing, 316 steel, 1 x 1.6 x 900 mm, 1/16", 707 µl, system connections |
| 430046 | Tubing, 316 steel, 2.1 x 3.2 x 2000 mm, 1/8", 6.9 ml, system connections |
| Mechanical and Electrical | |
| E66195 | Valve holder without valve |
| E66197 | Column holder, equipped for 2 to 20 mm i.d. column, for 333 and 334 Pumps |
| E66201 | Shelf, 180 x 240 x 425 mm (external), for stacking pump or injector over detector |
| 500944 | Cable kit, 4-wire, 1.7 m, for electrical input/output contacts |

Wear Parts

All wear parts are hydraulic parts.

| Reference | Description |
|-----------|--|
| 410730 | Filter, 316 steel, 10 µm, 1.6 x 19 mm, for 333 and 334 Pumps (Upchurch A331) |
| 400140 | Piston seal, UHMWPE, yellow, flange-type, Ti spring, for H3 pump head |
| 400141 | Piston seal, PTFE, black, flange-type, Hastelloy C276 spring, for H3 pump head |
| E66330 | Check-valve cartridge, inlet and outlet, for H3 pump head |
| E66333 | Piston assembly, for H3 pump head |

Replacement Parts

| Reference | Description |
|------------------|---|
| Hydraulic | |
| 866383 | Valve block, 4-solvent, without holder and tubing, for 333 and 334 Pumps |
| 866149 | Bottle tray, 33X Pumps |
| 410706 | Inlet filter, 316 steel, 20 µm, 5/16" - 24 TPI, 4.8 mm tubing, no fitting |
| 420606 | Tubing, FEP, 3.2 x 4.8 mm, 3/16", per meter (H3 inlet) |
| 410450 | Nut, POM, white, 5/16" - 24 TPI, 4.8 mm, 3/16" tubing (Upchurch P138) |
| 410451 | Ferrule, ETFE, natural, 4.8 mm, 3/16", tubing (Upchurch P133N) |
| 410108 | Plug, PVDF, natural, 1/4" - 28 TPI |
| 410472 | Plug, POM, white, 5/16" - 24 TPI (Upchurch P557) |
| 410449 | Plug, POM, white, 5/16" - 24 TPI, with 1 mm through-hole |
| E66381 | Inlet tubing, FEP, 3.2 x 4.8 x 1250 mm, H3 pump head; includes: - 1 x 410706: Inlet filter, 316 steel, 20 µm - 1 x 420606: Tubing, FEP, 3.2 x 4.8 x 1200 mm, 3/16" (H3 inlet) - 2 x 410450: Nut, POM, white, 5/16"-24 TPI, 4.8 mm, 3/16" tubing (Upchurch P138) - 2 x 410451: Ferrule, ETFE, natural, 4.8 mm, 3/16" tubing (Upchurch P133N) |
| E66379 | Plumbing kit, piston rinsing chambers, 333 and 334 Pumps; includes: - 1 x E66316: Tubing, FEP, 2 x 3 x 830 mm, 1/8", right - 1 x E66317: Tubing, FEP, 2 x 3 x 930 mm, 1/8", left - 2 x E66389: Tubing, FEP, 3.2 x 4.8 x 234 mm, 3/16", preshaped - 2 x 410429: Ferrule, ETFE, natural, 3.2 mm, 1/8" tubing (Upchurch P300N) - 2 x 866183: Drain nut, PCTFE, natural, 5/16" - 24 TPI, 4.8 mm, 3/16" tubing, with seal |
| E66183 | Drain nut, PCTFE, natural, 5/16" - 24 TPI, 4.8 mm, 3/16" tubing, with seal |
| 866067 | Bellows, fluoroelastomer, piston rinsing chamber, H1/H2/H3 pump heads |
| 866160 | Drip pan, PP, with drain tubing (silicone, 4 x 6 x 1000 mm), 33X Pumps |
| 420028 | Tubing, silicone, 4 x 6 mm, per meter (drip pan drain) |
| E66463 | OQ plumbing line, fully equipped, 333 and 334 Pumps; includes: - 1 x 430060: Tubing, 316 steel, 0.25 x 1.6 x 550 mm - 1 x 410426: Nut, 316 steel, 10-32 TPI, 1.6 mm (1/16") tubing - 1 x 410425: Ferrule, 316 steel, 10-32 TPI, 1.6 mm (1/16") tubing - 1 x 410456: Union fitting, 316 steel, 10-32 TPI, 0.025 µl (Upchurch U435) |
| 430060 | Tubing, 316 steel, 0.25 x 1.6 x 550 mm |
| 410426 | Nut, 316 steel, 10-32 TPI, 1.6 mm, 1/16" tubing |
| 410425 | Ferrule, 316 steel, 10-32 TPI, 1.6 mm, 1/16" tubing |
| 410456 | Union fitting, 316 steel, 10-32 TPI, 0.25 mm through, 0.025 µl (Upchurch U435) |
| E66357 | Tubing, 316 steel, 2.1 x 3.2 x 210 mm, 727 µl, preshaped, 2 fittings, PPMM to outlet filter |
| E66450 | Tubing, 316 steel, 2.1 x 3.2 x 600 mm, 2.08 ml, preshaped, 2 fittings, 333 tee fitting to PPMM |
| E66355 | Tubing, 316 steel, 2.1 x 3.2 x 197 mm, 682 µl, preshaped, 2 fittings, right H3/33X to tee fitting |
| E66356 | Tubing, 316 steel, 2.1 x 3.2 x 197 mm, 682 µl, preshaped, 2 fittings, left H3/33X to tee fitting |
| E66360 | Tubing, 316 steel, 2.1 x 3.2 x 600 mm, 2.08 ml, preshaped, 2 fittings, 334 tee fitting to PPMM |
| E66314 | Tee fitting, 316 steel, 1/4" - 28 TPI, 2.1 mm through, 38 µl |
| 866028 | H3 Pump Head for 333 and 334 Pumps |

| Reference | Description |
|---|--|
| 866344 | PPMM, 316 steel and PTFE, 30 MPa, 2.85 ml, 333 Pump |
| 410707 | Filter assembly, 316 steel, 2.1 mm thru, 10 µm, 1.6 x 19 mm, 21 MPa, 333 Pump (Upchurch S1579) |
| 410730 | Filter, 316 steel, 10 µm, 1.6 x 19 mm, 333 pump (Upchurch A331) |
| E66391 | Tubing, 316 steel, 2.1 x 3.2 x 500 mm, 1.73 ml, straight (to injector) |
| 430057 | Tubing, 316 steel, 1 x 1.6 x 600 mm, 471 µl, straight (to injector) |
| E66394 | Tubing, 316 steel, 0.13 x 1.6 x 185 mm, 2 µl, preshaped, one fitting (GLP/Seal) |
| E66384 | Adapter, 316 steel, 1/4" - 28 TPI male and 10-32 TPI female, 1 mm through, 11 µl |
| 410470 | Nut, 316 steel, 1/4" - 28TPI, for 3.2 mm, 1/8" tubing (Upchurch C235) |
| 410471 | Ferrule, 316 steel, for 3.2 mm, 1/8" tubing (Upchurch C236) |
| 410478 | Plug, 316 steel, 1/4" - 28 TPI, 333 and 334 Pumps |
| Mechanical and Electrical | |
| E66211 | Column holder clips, 1/4", two units |
| E66212 | Column holder clips, 1/2", two units |
| E66215 | Column holder clips, 1", two units |
| E66157 | Tubing clip, PP, for 3.2 mm, 1/8" tubing and 33X bottle tray, two units |
| E66158 | Tubing clip, PP, for 4.8 mm, 3/16" tubing and 33X bottle tray |
| 500933 | GSIOC Cable |
| 506341 | Barrier strip connector, 14-pin (output contacts) |
| 506367 | Barrier strip connector, 10-pin (input contacts and two outputs) |
| Documents and Data Transfer Software | |
| 801422 | User's guide, 333 and 334 Pumps |
| 804040 | Installation Qualification procedure, 333 and 334 Pumps |
| 804041 | Operational Qualification procedure, 333 and 334 Pumps |
| E66382 | PC software for 333 Pump data-transfer |

GSIOC stands for Gilson Serial Input Output Channel. GSIOC is a bidirectional communications channel that can link a controlling device with up to 63 other devices. The system controller (or master module) controls all of the connected devices (or slaves) in the system by sending GSIOC commands. The master communicates with one slave at a time. When the master identifies a slave, it connects to the channel as the previous slave disconnects.

Each device connected to the GSIOC channel is distinguished by a unique GSIOC identity number (ID). For the 333 Pump the ID may be set to any number between 0 and 63; for the 334 Pump the ID may be set from 0 to 9.

333 and 334 Pumps can receive GSIOC commands (as can most other Gilson modules). 333 Pumps are also capable of sending commands as the controlling device. Alternatively, the controlling device may be a computer (via a suitable interface) on which a GSIOC driver and the controlling software is installed. The controlling software must be able to receive and transmit GSIOC commands, character-by-character, according to the protocol specified in this document.

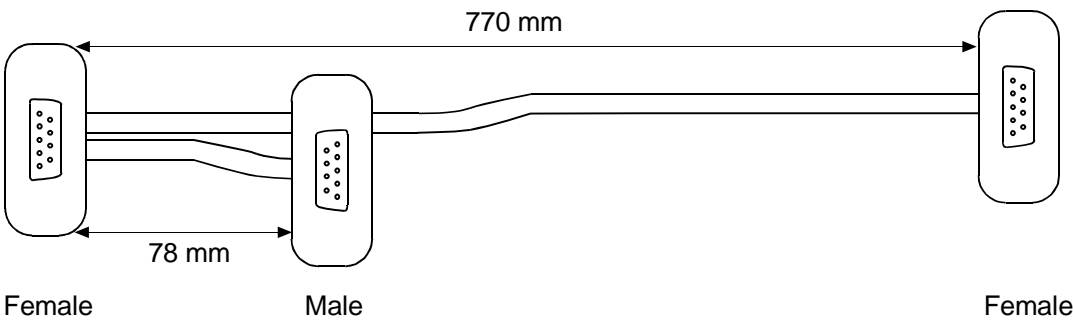
There are two command types that the controlling device sends to a slave device: buffered and immediate. The slave executes buffered commands as background processes. Immediate commands have a higher priority; the slave device interrupts the execution of a buffered command to execute an immediate command. Immediate commands, unlike buffered commands, allow the slaves to send data to the master. Therefore, status requests from the master must be immediate commands.

Connections between devices are made with specific Gilson GSIOC cables (9-pin D connectors). The multi-drop protocol allows the addition of more slaves into the system by permitting the cabling to be connected as a daisy-chain.

Physical Level

GSIOC Control Cable

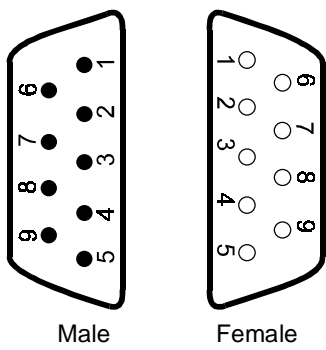
The control cable contains one male and one female connector at the master end, and one female connector at the slave end.



GSIOC Connector Pin Functions

The GSIOC cable has nine wires connecting corresponding pins. GSIOC consists of three differential signal pairs: the master data pair, the slave data pair, and the clock pair. To improve immunity to electrical noise, differential signals are used to eliminate ground loops in the system.

The pin-out and pin functions are as follows.



| Pin | Function | Source |
|-----|---------------|--------|
| 1 | Reserved | |
| 6 | Reserved | |
| 2 | - slave data | slave |
| 7 | + slave data | slave |
| 3 | - master data | master |
| 8 | + master data | master |
| 4 | - clock | master |
| 9 | + clock | master |
| 5 | ground | |

Electrical Level

The signals on the GSIOC are differential and are compatible with RS-422 and RS-485 specifications. The master device drives both the master data pair and the clock pair.

Each slave drives the slave pair only when it is selected. All slaves must be capable of deselecting from the channel on command. Both the controller and slaves should look for parity, framing, and overrun errors.

Although GSIOC is differential, the common mode voltage between slaves and masters should be less than $\pm 7V$ to ground. The ground connection is not implemented in every GSIOC device, so they must be grounded locally by connecting the machine to a good earth circuit. This ensures compliance with the common mode specification.

The GSIOC clock is either transmitted by the channel link (external clock) or its local (internal) clock; in which case Master and Slave must have the same bit rate. The clock runs at sixteen times the desired bit rate, normally set at 19200. For a 333 Pump the bit rate may be set (using the control panel) to 1200, 2400, 4800, 9600, 19200, or External; for a 334 Pump three switch settings are available: 9600, 19200, or External.

Bit Rates

When a 333 Pump is used as a slave to another 333 Pump, or is controlled from a computer, the bit rate of the slave must be set to 'External'. Or, when the bit rates of the sending and receiving devices need to be matched, you can set a specific bit rate for both.

For a 333 Pump, the bit rate is set as follows:

- 1) Switch on the pump; wait until initialized.
- 2) Press in turn: **Edit**, **Config**, **Misc**.
- 3) Press the H key.
- 4) Press **Change** until you see the desired bit rate (1200 to 19200 or External).
- 5) Press **ENTER**.

For a 334 Pump the bit rate (9600, 19200, or External) is set mechanically using the right-hand of the two selectors on the rear panel.

GSIOC IDs

The GSIOC IDs may be changed where the pump(s) are being controlled from a computer. In which case, the configured IDs must correspond to those set using the controlling software. For each level (i.e. from one Master), the GSIOC identification number (ID) that you set must be unique for each item of Gilson equipment.

For a 333 Pump, the ID (0-63) is configured as follows:

- 1) Switch on the pump; wait until initialized.
- 2) Press in turn: **Edit, Config, Misc.**
- 3) Key in the desired ID for the 333 Pump, then press **ENTER**.

For a 334 Pump the ID (0-9) is set mechanically using the left-hand of the two selectors on the rear panel.

Character Level and Format

Because the GSIOC is a multi-drop channel, with the ability to have several slave units connected at the same time, GSIOC reserves some of the possible characters for channel control.

The data format is asynchronous serial, with one start bit, eight data bits, one even parity bit, and one stop bit. Any parity error can be corrected by reconnecting and restarting the message.

| Bit | Function |
|-----|-----------------------|
| s | start bit |
| 0 | value 1 |
| 1 | value 2 |
| 2 | value 4 |
| 3 | value 8 |
| 4 | value 16 |
| 5 | value 32 |
| 6 | value 64 |
| 7 | address flag if high* |
| p | parity (even) |
| s | stop (optional) |

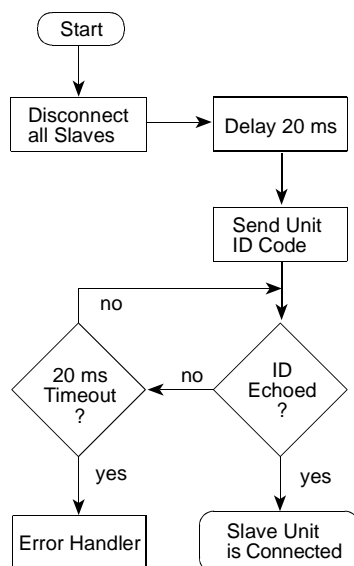
* Or the last character for an immediate command response.

Disconnect and Connect Sequences

The following sequence is used to select a slave device:

- 1) The master sends a 255 ASCII character (FF hexadecimal) to disconnect all slaves from the GSIOC.
- 2) The master device uses one of the following terminations to ensure that no slaves are active:
 - passive (no break) termination; the master waits for 20 milliseconds to allow all slaves to disconnect,
 - break active; the master receives a 'break' character as soon as a selected slave disconnects.
- 3) The master announces the binary name of the desired slave device. The value of the binary name is equal to the unit ID plus 128 (10000000 binary). For example, if a unit's ID is 16 (10000 binary) its binary name is 10010000.

Binary names are used to identify devices because GSIOC interprets unit IDs (ASCII 0 to 63) as commands.



- 4) The slave device that recognizes the binary name as its own connects its transmitter to the slave data channel and echoes its binary name to the master. The selected slave device must respond within 20 milliseconds, otherwise the master assumes that the desired slave is not available. Any slave device that does not recognize its own name remains disconnected.
- 5) After the slave device is connected, the master device may send a command (immediate or buffered) as described in the following Sections.

The selected device remains active until it receives the disconnect code (FF hexadecimal) or the binary name of a different slave device.

Immediate Command Protocol

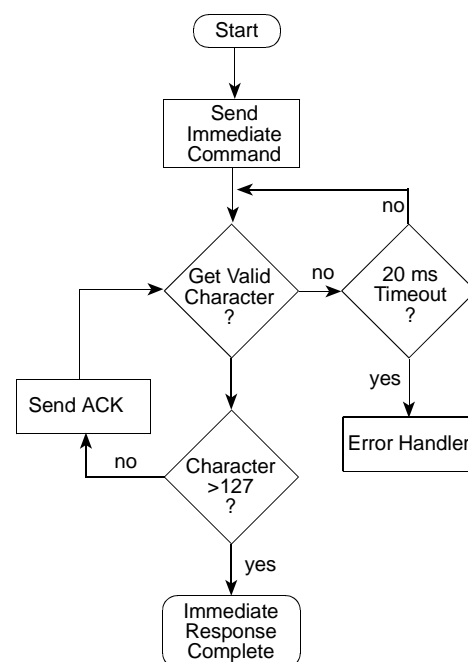
Immediate commands, which are always in the form of a single character, request status reports from a slave device, for example:

- what kind of device are you?
- what is your current operating mode?
- what are you doing now?

When a master device issues an immediate command to a designated slave, the slave interrupts its current job to respond to the immediate (high priority) command.

After a slave device receives an immediate command, it answers the request with the first character of its response. The master checks the value of the ASCII character. If the character's value is less than 128, it responds to the slave with an ACK character (06 hexadecimal). This exchange continues until the slave sends the last character of the response. To indicate that the last character is being sent, the slave adds 128 (10000000 binary) to the character's value.

In response to an unrecognized immediate command, a slave responds with the pound sign (#).



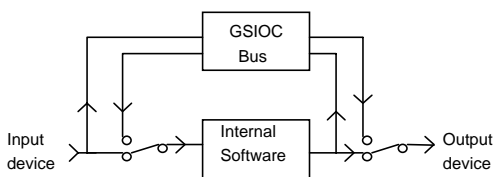
This document includes commands for pumps that may not be commercially available.

Introduction to GSIOC Commands

GSIOC commands for 333 and 334 Pumps are detailed in the following tables, with their type (buffered or immediate) and function. The response format is described for immediate commands (type 'I'). For buffered commands (type 'B') the parameters are documented.

There are two device types: input devices and output devices. For a 333 Pump input devices are: the keypad, the contact inputs, and the pressure transducer. The 333 Pump output devices are: the PPM, the contact outputs, the display unit (screen), and the 4-way valve block (optional).

The pump peripheral devices can be either driven by the internal software or by the GSIOC bus. A type of software switch (actually a dedicated GSIOC command) is used to disconnect and reconnect each device from the internal software, as illustrated below.



- 1) When using any command, take care to use the correct, command specific, syntax. A syntax error could have unforeseen consequences.
- 2) The commands and parameters described in this document are case specific. You must take care to use the specified case (upper or lower).

Commands for 333 and 334 Pumps

Operational Functions

| Command | Type | Description |
|---------|------|--|
| % | I | Request module identification |
| % | B | Define Module identification |
| \$ | I | Master reset |
| ? | I | Pump status |
| ? | B | Application control |
| C | B | Reset maintenance counters |
| C | I | Read maintenance counters |
| D | B | Dims or brightens front panel display (333 Pump only) |
| D | I | Read file directory |
| E | B | Assigns a value to a parameter |
| E | I | Read the value of a parameter |
| F | B | Set pumping parameters |
| F | I | Returns pumping parameters |
| G | B | Write application event into Edit file |
| G | I | Read application event from Edit file |
| H | I | Reset Application event index |
| H | B | Delete application event from Edit file |
| I | B | Write contact inputs (333 Pump only) |
| I | I | Read contact inputs (333 Pump only) |
| i | I | Read contact input buffer (333 Pump only) |
| J | B | Write contact outputs (333 Pump only) |
| J | I | Read contact outputs (333 Pump only) |
| j | I | Read contact output buffers (333 Pump only) |
| K | B | Input remote keystrokes |
| K | I | Read key entry |
| n | I | Reset Audit trail configuration parameters index (333 Pump only) |
| N | I | Read Audit trail configuration parameters (333 Pump only) |
| O | B | Set Audit trail files index (333 Pump only) |
| O | I | Read audit trail files (333 Pump only) |
| o | I | Read audit trail files events (333 Pump only) |
| Q | B | Enter pressure value |
| Q | I | Read pressure value |
| S | I | Buffer status |
| T | I | Read Audit trail line (333 Pump only) |
| t | I | Reset audit trail file line index (333 Pump only) |
| U | B | Delete Audit trail file (333 Pump only) |
| W | B | Write display (333 Pump only) |
| W | I | Read display (333 Pump only) |
| w | I | Read display buffer (333 Pump only) |
| z | I | Read compression stroke |

Maintenance Functions

| Command | Type | Description |
|---------|------|--|
| a | B | Dismount/Mount head |
| b | B | Start maintenance sequence |
| c | B | Calibrate pressure transducer |
| c | I | Pressure transducer calibration status |
| d | I | Leakage maintenance sequence status |
| e | I | Run in maintenance sequence status |
| g | B | This command is for Gilson use only |
| i | B | This command is for Gilson use only |
| h | B | This command is for Gilson use only |
| h | I | Motor status |

Description of Commands

| Command | Type | Description |
|---------|------|--|
| % | I | Request module identification Response format: xxx Va.bc where Va.bc is the software version and xxx is the pump identification string. xxx = '333' for 333 Master Pump xxx = '334' for 334 Slave Pump |
| % | B | Define module identification syntax is %string where: string = '333' for 333 Master Pump string = '334' for 334 Slave Pump Comment: This command sets all parameters to the default value, erases all applications, erases all counter values. |
| \$ | I | Master reset returns \$ and reset the machine in its power-up state. |

| Command | Type | Description |
|----------|----------|---|
| ? | I | <p>Pump status returns abcde where: a is the application status: 'S' for Stop. 'R' for Running. 'P' for Pause. 'C' for Conditioning. ***** only for maintenance ***** 'O' for <To run in new piston seal> sequence running. '1' for < Leakage checking> sequence running. b is the pump status '-' for normal operation. 'L' for low pressure limit (the reading resets the low pressure limit state). 'H' for high pressure limit. c is the invalid condition flag '-' for normal operation. 'I' for invalid settings. The invalid conditions flag is reset by: Start a file or send a flow=0 using the buffered 'F' command. d is the status of the right head actuator in single piston mode or the status of both head actuators in Dual piston mode. '-' for no errors. 'E' if there is an error. e is the status of the left head actuator in single piston mode. '-' for no errors or if the pump works in dual piston mode. 'E' if there is an error.</p> |
| ? | B | <p>Application control syntax is ?ab where a is: 'S' for Stop. 'R' for running application; b is the running file number. 'P' for Pause. 'Q' for Resume application. This command will be ignored if it is inconsistent (e.g. run an application which does not exist).</p> |
| C | B | <p>Write maintenance counters Syntax is Cn,m=x where: n is the Head identification. n=1R means right head of master pump (if 333). n=1L means left head of master pump (if 333). n=2R means right head of slave pump 1. n=2L means left head of slave pump 1. n=3R means right head of slave pump 2. n=3L means left head of slave pump 2. m is the counter identification. m=0 means piston seal counter (for head counter). m=1 means piston counter (for head counter). m=2 means outlet check valve counter (for head counter). m=3 means inlet check valve counter (for head counter). x = R means RESET counter; x = 0 to 65534 means set counter limit. The limit value is in hours, except for solvent selector valve where the limit is in 10000 cycles unit. Command 'Cn,m' only sets the counter index used by the C immediate command.</p> |

Commands for 333 and 334 Pumps

| Command | Type | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|------|---|-------------|---|-----------|-------|-------|---|-----|--|---------|---|---|-----|---|---------|---|---|--|---------|---|---|-------------------|--|---|---|----------------------|-----------|-------------|---|---|---------------------------------------|-------------|--|
| C | I | Read maintenance counters Response format is n,m=xxx,yyy,zzz n is the Head identification. See buffered C command. m is the counter identification. See buffered C command. xxx is the lifetime counter value in hours. (Does not exist for solvent selector valve counter.) yyy is the cycles counter value in unit = 10000 cycles. zzz is the counter limit value. (In hours for all counters except for solvent selector valve counter; for the solvent selector valve, the limit is in 10000 cycles unit.) The pump returns the counter with the index sets by the last buffered C command. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | B | Dims or brightens front panel display Syntax: Dn where: n= 0 dims display n= 1 brightens display. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | I | Read file directory Response format: returns all existing file number separated by a comma. If there is no existing file, return 'N' (example: 1,5,21,24) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | B | Assigns a value to a parameter Syntax: Ennn=mmmmmmm where nnn is the parameter code (see below) mmmmmm is the value assigned to the parameter. The following list identifies the code assigned to each parameter; it also gives the range of values that can be entered. For 'type' R/W = Read/Write, R = Read only, L= available for N command. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table><tr><th>Code</th><th>Type</th><th>Parameter</th><th>Units</th><th>Range</th></tr><tr><td>0</td><td>R/W</td><td>Application number selected to run (RFile)</td><td>1 to 24</td><td rowspan="4">returns: 0 if STOP, 1 if RUNNING, 2 if PAUSE, 3 if WAITING CONTACT, 4 if WAITING CONTACT and PAUSE, 5 if INJECTING, 6 if INJECTING and PAUSE.</td></tr><tr><td>1</td><td>R/W</td><td>Application number selected for edition (EFile)</td><td>1 to 24</td></tr><tr><td>2</td><td>R</td><td>Currently running application number (CFile)</td><td>1 to 24</td></tr><tr><td>3</td><td>R</td><td>Application state</td><td></td></tr><tr><td>4</td><td>R</td><td>Running Elapsed time</td><td>1/100 min</td><td>1 to 999999</td></tr><tr><td>5</td><td>R</td><td>Total flow rate of the pumping system</td><td>1/10 µl/min</td><td>Per pump 0 to 50000 for H2 Per Pump 0 to 2x10⁶ for H3</td></tr></table> | Code | Type | Parameter | Units | Range | 0 | R/W | Application number selected to run (RFile) | 1 to 24 | returns: 0 if STOP, 1 if RUNNING, 2 if PAUSE, 3 if WAITING CONTACT, 4 if WAITING CONTACT and PAUSE, 5 if INJECTING, 6 if INJECTING and PAUSE. | 1 | R/W | Application number selected for edition (EFile) | 1 to 24 | 2 | R | Currently running application number (CFile) | 1 to 24 | 3 | R | Application state | | 4 | R | Running Elapsed time | 1/100 min | 1 to 999999 | 5 | R | Total flow rate of the pumping system | 1/10 µl/min | Per pump 0 to 50000 for H2 Per Pump 0 to 2x10 ⁶ for H3 |
| Code | Type | Parameter | Units | Range | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | R/W | Application number selected to run (RFile) | 1 to 24 | returns: 0 if STOP, 1 if RUNNING, 2 if PAUSE, 3 if WAITING CONTACT, 4 if WAITING CONTACT and PAUSE, 5 if INJECTING, 6 if INJECTING and PAUSE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | R/W | Application number selected for edition (EFile) | 1 to 24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | R | Currently running application number (CFile) | 1 to 24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | R | Application state | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | R | Running Elapsed time | 1/100 min | 1 to 999999 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | R | Total flow rate of the pumping system | 1/10 µl/min | Per pump 0 to 50000 for H2 Per Pump 0 to 2x10 ⁶ for H3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Command | Type | Description | | | | |
|---------|------|-------------|-------|---|--------------------|--|
| | | Code | Type | Parameter | Units | Range |
| | | 6 | R | Percentage of Solvent A | 1/10 % | 0 to 1000 |
| | | 7 | R | Percentage of Solvent B | 1/10 % | 0 to 1000 |
| | | 8 | R | Percentage of Solvent C | 1/10 % | 0 to 1000 |
| | | 10 | R | Reserved for the SF pump | | |
| | | 11 | R/W | Pressure unit | | 0 for MPa, 1 for bar, 2 for psi |
| | | 12 | R/W | Alarm | | 0 if beeper on alarm is OFF, 1 if beeper on alarm is ON |
| | | 13 | R/W L | Pump A head size code (can't be changed if pumping) | | 50 for H2, 200 for H3 |
| | | 14 | R/W L | Pump B head size code (can't be changed if pumping) | | 50 for H2, 200 for H3 |
| | | 15 | R/W L | Piston mode (can't be changed if pumping) | | 2 for DUAL piston mode |
| | | 16 | R/W L | Pump A Inlet pressure | 1/10 MPa | 0 to 500 |
| | | 17 | R/W L | Pump B Inlet pressure | 1/10 MPa | 0 to 500 |
| | | 18 | R/W L | Reserved for 32X Pumps | ms | 125 to 1000 |
| | | 19 | R/W L | Reserved for 32X Pumps | ms | 125 to 1000 |
| | | 20 | R/W L | Reserved for 32X Pumps | Mbar ⁻¹ | 0 to 2000 |
| | | 21 | R/W L | Reserved for 32X Pumps | Mbar ⁻¹ | 0 to 2000 |
| | | 22 | RL | Nb of solvents (can't be changed if pumping) | 1 to 3 | |
| | | 23 | R/W L | Mixing mode (can't be changed if pumping) | | 0 for HPM |
| | | 24 | R/W L | Injection mode (can't be changed if pumping) | | 0 for no injection, 1 for injection |
| | | 25 | R/W L | Signal output profile | | 0 for PRESSURE, 1 for FLOW, 2 for % of pump A, 3 for % of pump B, 4 for % of pump C, 0 to 900000 |
| | | 26 | R/W L | Delay volume for signal output % profile. | 1/10 µl | |
| | | 27 | R/W L | Contact output pulse duration | 1/100 min | 1 to 100 |
| | | 28 | R/W L | Audit trail option | | 0 if ON, 1 if OFF |
| | | 29 | R/W L | Contact input PAUSE with/without flow | | 0 if Pause without FLOW, 1 if Pause with FLOW |
| | | 30 | R/W L | Elution pump synchronization before injection. | | 0 if synchronization OFF, |
| | | 31 | R/W L | Reserved parameter (Gilson only) | | |
| | | 32 | R | Pause time | 1/100 min | 0 to 999999 |
| | | 33 | R | Wait contact time | 1/100 min | 0 to 999999 |
| | | 34 | R/W | Date (time) | min | 0 to 23 x 60+59 |
| | | 35 | R/W | Date (day) | | 1 to 31 |
| | | 36 | R/W | Date (month) | | 1 to 12 |
| | | 37 | R/W | Date (Year) | | 0 to 99 |
| | | 38 | R L | Pump model | | 3 for 33X |
| | | 39 | R L | Remote pump | | 0 for Master Pump, 1 for Slave Pump |
| | | 40 | R/W | Link application | | 1 to 24 |
| | | 41 | R/W | Number of loops | | 1 to 999 |

Commands for 333 and 334 Pumps

| Command | Type | Description | | | | |
|---------|------|-------------|-------|--|--------------------|--|
| | | Code | Type | Parameter | Units | Range |
| | | 42 | R/W L | Restart after power failed option | | 0 means Stop, 1 means Continue current application, 2 means Start power failed application |
| | | 43 | R/W | Application locked | | 0 if application unlocked, not equal 0 if application locked |
| | | 44 | R/W L | Pump C head size code (can't be changed if pumping) | | 33X: 200 for 333/334 |
| | | 45 | R/W L | Reserved for 32X | | |
| | | 46 | R/W L | Pump C inlet pressure | 1/10 MPa | 0 to 500 |
| | | 47 | R/W L | Reserved for 32X | 1/10 MPa | 0 to 500 |
| | | 48 | R/W L | Reserved for 32X | ms | 125 to 1000 |
| | | 49 | R/W L | Reserved for 32X | ms | 125 to 1000 |
| | | 50 | R/W L | Pump C Liquid compressibility | Mbar ⁻¹ | 0 to 2000 (used in HPM mode only) |
| | | 51 | R/W L | Reserved for 32X | Mbar ⁻¹ | 0 to 2000 |
| | | 52 | R/W L | Inj pump head size code (can't be changed if pumping) | | 30X: 5, 10, 25, 50, 100, or 200 |
| | | 53 | R/W L | Inj pump Inlet pressure | 1/10 MPa | 0 to 500 |
| | | 54 | R/W L | Inj pump Refill time | ms | 125 to 1000 |
| | | 55 | R/W L | Inj pump Liquid compressibility | Mbar ⁻¹ | 0 to 2000 |
| | | 56 | R/W L | High pressure limit - must be higher than low pressure limit! | 1/10 MPa | 0 to 600 for 333, 334 0 to 300 for 331, 332 |
| | | 57 | R/W L | Low pressure limit - must be lower than high pressure limit! | 1/10 MPa | 0 to 600 for 333, 334 0 to 300 for 331, 332 |
| | | 58 | R/W L | Reserved for 32X | | 1 for solvent A, 2 for solvent B, 3 for solvent C, 0 for automatic activation, |
| | | 59 | R/W L | Reserved for 32X | | 1 for STOP |
| | | 60 | R L | Type of pump A | | 2=DUAL |
| | | 61 | R L | Type of pump B | | 0=NO PUMP, 2=DUAL |
| | | 62 | R L | Type of pump C | | 0=NO PUMP, 2=DUAL |
| | | 63 | R L | Reserved for 32X | | 0=NO PUMP, 1=SINGLE, 2=DUAL, 3=P30X |
| | | 64 | R L | Type of injection pump | | 0=NO PUMP, 3=P30X |
| | | 65 | R/W L | Reserved for 32X | 1/100 ml | 0 to 9999 |
| | | 66 | R/W | Keypad beeper | | 0 = OFF, 1 = ON |
| | | 67 | R | Control of pump channels (see F Command) | | 0 if controlled by the pump; 1 if controlled via GSIOC |
| | | 68 | R | Total flow of the pump (see F Command) | 1/10 µl | Same whether control is from pump or not. |
| | | 69 | R | Reserved for 32X | 1/10 µl | |
| | | 71 | RW/L | Flow unit | | 2 = ml/min, 3 = L/h |
| | | 72 | RW/L | Volume unit | | 0 = µl, 1 = ml, 2 = L |
| | | 73 | RW/L | Pressure unit | | 0 = MPa, 1 = bar, 2 = psi |

| Command | Type | Description | | | | |
|---------|------|--|-------|---|--------------------|--|
| | | Code | Type | Parameter | Units | Range |
| | | 75 | RW/L | Pump A solvent selector | | 0 = none, 1 = A1, 2 = A2, 3 = A3, 4 = A4 |
| | | 76 | RW/L | Pump B solvent selector | | 0 = none, 1 = B1, 2 = B2, 3 = B3, 4 = B4 |
| | | 77 | RW/L | Pump C solvent selector | | 0 = none, 1 = C1, 2 = C2, 3 = C3, 4 = C4 |
| | | Parameter codes 40, 41, and 43 refer to "Edit" application. This application is defined by Edit Application number (code 1). Comment: if the value mmmmm and the '=' sign are omitted, the value is unchanged, but the command sets the parameter index to the specified parameter (see above). To define an application, first send the editing application number, add events (see G and H commands) and then send all parameters defining this application; the parameters have to be consistent. | | | | |
| | | Code | Type | Parameter | Units | Range |
| | | 78 to 79 | | Reserved | | |
| | | 80 | R/W L | Pump A: selector A1 Solvent Compressibility K_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 81 | R/W L | Pump A: selector A2 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump A | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 82 | R/W L | Pump A: selector A3 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump A | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 83 | R/W L | Pump A: selector A4 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump A | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 84 | R/W L | Pump B: selector B1 Solvent Compressibility K_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 85 | R/W L | Pump B: selector B2 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump B | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 86 | R/WL | Pump B: selector B3 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump B | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 87 | R/W L | Pump B: selector B4 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump B | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 88 | R/W L | Pump C: selector C1 Solvent Compressibility K_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 89 | R/W L | Pump C: selector C2 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump C | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 90 | R/W L | Pump C: selector C3 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump C | Mbar ⁻¹ | 0 to 2000 (see notes) |

Commands for 333 and 334 Pumps

| Command | Type | Description | | | | |
|---------|------|-------------|-------|--|--------------------|----------------------------------|
| | | Code | Type | Parameter | Units | Range |
| | | 91 | R/W L | Pump C: selector C4 Solvent Compressibility K_0 used only if solvent selector is fitted to Pump C | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 96 | R/W L | Injection pump liquid compressibility K_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 100 | R/W L | Pump A: selector A1 Solvent Name | | See Table & notes |
| | | 101 | R/W L | Pump A: selector A2 Solvent Name | | See Table & notes |
| | | 102 | R/W L | Pump A: selector A3 Solvent Name | | See Table & notes |
| | | 103 | R/W L | Pump A: selector A4 Solvent Name | | See Table & notes |
| | | 104 | R/W L | Pump B: selector B1 Solvent Name | | See Table & notes |
| | | 105 | R/W L | Pump B: selector B2 Solvent Name | | See Table & notes |
| | | 106 | R/W L | Pump B: selector B3 Solvent Name | | See Table & notes |
| | | 107 | R/W L | Pump B: selector B4 Solvent Name | | See Table & notes |
| | | 108 | R/W L | Pump C: selector C1 Solvent Name | | See Table & notes |
| | | 109 | R/W L | Pump C: selector C2 Solvent Name | | See Table & notes |
| | | 110 | R/W L | Pump C: selector C3 Solvent Name | | See Table & notes |
| | | 111 | R/W L | Pump C: selector C4 Solvent Name | | See Table & notes |
| | | 116 | R/W L | Injection pump liquid | | See Table & notes |
| | | 120 | R L | Post run information: file number | | 1 to 24 or 0 if none selected |
| | | 121 | R L | Post run information: recorded | | 1= recorded 0 = not rec'd. |
| | | 122 | R L | Post run information: maximum pressure | 1/10 MPa | see pressure limits |
| | | 123 | R L | Post run information: minimum pressure | 1/10 MPa | see pressure limits |
| | | 124 | R L | Post run information: cycle time - solvent A | 1/100 min | 1 to 99999, 0 = n/a |
| | | 125 | R L | Post run information: cycle time - solvent B | 1/100 min | 1 to 99999, 0 = n/a |
| | | 126 | R L | Post run information: cycle time - solvent C | 1/100 min | 1 to 99999, 0 = n/a |
| | | 127 to 129 | | Reserved | | |
| | | 130 | R/W L | Pump A: selector A1 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 131 | R/W L | Pump A: selector A2 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 132 | R/W L | Pump A: selector A3 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 133 | R/W L | Pump A: selector A4 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 134 | R/W L | Pump B: selector B1 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 135 | R/W L | Pump B: selector B2 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 136 | R/W L | Pump B: selector B3 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 137 | R/W L | Pump B: selector B4 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 138 | R/W L | Pump C: selector C1 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 139 | R/W L | Pump C: selector C2 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |
| | | 140 | R/W L | Pump C: selector C3 Liquid Compressibility X_0 | Mbar ⁻¹ | 0 to 2000 (see notes) |

| Command | Type | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------|------|--|--------|---|--------------------|-----------------------|---------|------|-------|---|-------|---|----------|---|--------------|---|-----------------|---|-------------|---|--------|---|-----------------|---|---------|------|---------|------|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|-----------------------|----|---------------------------|----|
| | | Code | Type | Parameter | Units | Range | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 141 | R/W L | Pump C: selector C4 | Mbar ⁻¹ | 0 to 2000 (see notes) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 142 | to 149 | Liquid Compressibility X ₀ Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Notes: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1) Concerning flow correction and pressure pulsation reduction; if the solvent is one of the Named Solvents (for parameter codes 100 to 111, 116), the corresponding solvent code is sent (see below). When the pump receives the solvent code, it sets coefficients K ₀ and X ₀ to their predefined values. In case of an undefined solvent, both the flow correction coefficient K ₀ (Solvent Compressibility) and the pressure pulsation correction coefficient X ₀ (Liquid Compressibility) must be sent to the pump. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2) Writing a K ₀ value (for any parameter code from 80 to 91) overwrites the current value and sets the corresponding Solvent Name to 'Other'. When writing K ₀ , you must also send a value for X ₀ (see parameter codes 130 to 141). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 3) Writing an X ₀ value (for any parameter code from 130 to 141) overwrites the current value and sets the corresponding Solvent Name to 'Other'. When writing X ₀ , you must also send a value for K ₀ (see parameter codes 80 to 91, 96). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4) Except for 'Other', writing a Solvent Name (for any parameter code from 100 to 111) overwrites the corresponding values for both K ₀ and X ₀ . | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Solvent and Mixture Codes for Parameter Codes 100 to 111, 116 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table><tr><th>Solvent</th><th>Code</th></tr><tr><td>Other</td><td>0</td></tr><tr><td>Water</td><td>1</td></tr><tr><td>Methanol</td><td>2</td></tr><tr><td>Acetonitrile</td><td>3</td></tr><tr><td>Tetrahydrofuran</td><td>4</td></tr><tr><td>Isopropanol</td><td>5</td></tr><tr><td>Hexane</td><td>6</td></tr><tr><td>Dichloromethane</td><td>7</td></tr></table> <table><tr><th>Mixture</th><th>Code</th><th>Mixture</th><th>Code</th></tr><tr><td>Water-acetonitrile, 10-90</td><td>20</td><td>Water-methanol, 10-90</td><td>30</td></tr><tr><td>Water-acetonitrile, 20-80</td><td>21</td><td>Water-methanol, 20-80</td><td>31</td></tr><tr><td>Water-acetonitrile, 30-70</td><td>22</td><td>Water-methanol, 30-70</td><td>32</td></tr><tr><td>Water-acetonitrile, 40-60</td><td>23</td><td>Water-methanol, 40-60</td><td>33</td></tr><tr><td>Water-acetonitrile, 50-50</td><td>24</td><td>Water-methanol, 50-50</td><td>34</td></tr><tr><td>Water-acetonitrile, 60-40</td><td>25</td><td>Water-methanol, 60-40</td><td>35</td></tr><tr><td>Water-acetonitrile, 70-30</td><td>26</td><td>Water-methanol, 70-30</td><td>36</td></tr><tr><td>Water-acetonitrile, 80-20</td><td>27</td><td>Water-methanol, 80-20</td><td>37</td></tr><tr><td>Water-acetonitrile, 90-10</td><td>28</td><td>Water-methanol, 90-10</td><td>38</td></tr></table> | | | | | Solvent | Code | Other | 0 | Water | 1 | Methanol | 2 | Acetonitrile | 3 | Tetrahydrofuran | 4 | Isopropanol | 5 | Hexane | 6 | Dichloromethane | 7 | Mixture | Code | Mixture | Code | Water-acetonitrile, 10-90 | 20 | Water-methanol, 10-90 | 30 | Water-acetonitrile, 20-80 | 21 | Water-methanol, 20-80 | 31 | Water-acetonitrile, 30-70 | 22 | Water-methanol, 30-70 | 32 | Water-acetonitrile, 40-60 | 23 | Water-methanol, 40-60 | 33 | Water-acetonitrile, 50-50 | 24 | Water-methanol, 50-50 | 34 | Water-acetonitrile, 60-40 | 25 | Water-methanol, 60-40 | 35 | Water-acetonitrile, 70-30 | 26 | Water-methanol, 70-30 | 36 | Water-acetonitrile, 80-20 | 27 | Water-methanol, 80-20 | 37 | Water-acetonitrile, 90-10 | 28 |
| Solvent | Code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Methanol | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Acetonitrile | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tetrahydrofuran | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Isopropanol | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hexane | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dichloromethane | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mixture | Code | Mixture | Code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 10-90 | 20 | Water-methanol, 10-90 | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 20-80 | 21 | Water-methanol, 20-80 | 31 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 30-70 | 22 | Water-methanol, 30-70 | 32 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 40-60 | 23 | Water-methanol, 40-60 | 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 50-50 | 24 | Water-methanol, 50-50 | 34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 60-40 | 25 | Water-methanol, 60-40 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 70-30 | 26 | Water-methanol, 70-30 | 36 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 80-20 | 27 | Water-methanol, 80-20 | 37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water-acetonitrile, 90-10 | 28 | Water-methanol, 90-10 | 38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | I | Read value of parameter Response format: nnn=mmmm, where nnn identifies the parameter (see above) mmmm is the value. If the pump data base is busy, the response is '!'. In this case, send the command again later. Comment: Use the buffered 'Ennn' command first to specify the parameter to be reviewed. To read an application, first send the editing file number and then read all parameters (see also read application events command). In case of error (ex: EFile not defined): The response is '????'. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Command | Type | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|-----------|---------|---------|-----------------------------------|--|--|---------------------------------------|-------------------------|---------------|--------------------------------------|--|--|---------------------------------|---|---|---------------------------------|---|---|---------------------------------|---|---|-------------------------------------|--|--|------------------|---|---|-----------------|--------------------------------|--|--|--|--|--|---|--|---|---|--|-----------------------------------|--|--|----------------|----------------------|-----------------------|
| F | B | <p>Set pumping parameters</p> <p>Syntax: Fabcccc,ppp, dddd, eeee, ffff</p> <p>Where:</p> <p>a is the pump head identification: B for the 2 pump heads working in dual piston mode.</p> <p>b is the mode: F for flow mode.</p> <p>cccc is the flow value in tenth of $\mu\text{l}/\text{min}$.</p> <p>Range: 333, 334; 0 to 2000000 331, 332; 0 to 500000 (for each pump)</p> <p>If ccccc=0, the pump head(s) stop(s) and goes to its rest position.</p> <p>ppp is the working pressure in tenth of MPa</p> <p>In HPM mode, with a solvent valve block installed, the software opens the valve-port where the percentage is not equal to 0 and closes the other 3 ports.</p> <p>If dddd = eeee = ffff = 0, valve port 1 is opened.</p> <p>If dddd = is not equal to zero valve-port 2 is opened.</p> <p>If eeee = is not equal to zero valve-port 3 is opened.</p> <p>If ffff = is not equal to zero valve-port 4 is opened.</p> <p>Other pumping parameters such as head size, liquid compressibility, and inlet pressure for the dual piston mode must be defined, using the buffered 'E' command, before to use the 'F' command.</p> <p>Note: the time interval between two buffered 'F' commands must be at least 0.01 min.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F | I | <p>Returns pumping parameters</p> <p>Response format: 'abc' where:</p> <p>a is the piston mode: D for Dual piston mode</p> <p>b is the right head status</p> <p>F if the 2 heads (dual piston mode) are running in flow mode.</p> <p>S if the 2 heads (dual piston mode) are stopped.</p> <p>E if one of the two head motors is jammed (dual piston mode).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G | B | <p>Add application event in Edit file</p> <p>Syntax: G type, time, p1, p2, p3 where 'type' is the event code 'time' is the event time in hundredth of min. ranging from 0 to 999999.</p> <p>p1 to p3 are additional parameters depending on event type. The meaning and number of parameters depends one event type (see below). When an event is added, it is sorted by increasing time order and event type. If the application is full, the new event is ignored.</p> <table border="1"> <thead> <tr> <th>Parameter</th><th>Minimum</th><th>Maximum</th></tr> </thead> <tbody> <tr> <td>Event type = 0: FLOW EVENT</td><td></td><td></td></tr> <tr> <td>p1 Flow 1/10 $\mu\text{l}/\text{min}$</td><td>5 for 32X 40 for 333</td><td>See F command</td></tr> <tr> <td>Event type = 1: MIXTURE EVENT</td><td></td><td></td></tr> <tr> <td>p1 Percentage of pump B in $\%$</td><td>0</td><td>1000 and p1+p2+p3 inferior or equal to 1000</td></tr> <tr> <td>p2 Percentage of pump C in $\%$</td><td>0</td><td>1000 and p1+p2+p3 inferior or equal to 1000</td></tr> <tr> <td>p3 Percentage of pump D in $\%$</td><td>0</td><td>1000 and p1+p2+p3 inferior or equal to 1000</td></tr> <tr> <td>Event type = 2: OUTPUT EVENT</td><td></td><td></td></tr> <tr> <td>p1 Output number</td><td>1</td><td>4</td></tr> <tr> <td>p2 Output state</td><td colspan="2">0 = CLOSE, 1 = OPEN, 2 = PULSE</td></tr> <tr> <td>Event type = 3: INJECTION EVENT</td><td></td><td></td></tr> <tr> <td>p1 Injection flow, 1/10 $\mu\text{l}/\text{min}$</td><td colspan="2">See min and max flow for the injection pump</td></tr> <tr> <td>p2 Injection volume, 1/10 μl</td><td colspan="2">See min and max volume for the injection pump</td></tr> <tr> <td>Event type = 5: WAIT EVENT</td><td></td><td></td></tr> <tr> <td>p1 Input state</td><td>0 (wait input close)</td><td>1 (wait input opened)</td></tr> </tbody> </table> | Parameter | Minimum | Maximum | Event type = 0: FLOW EVENT | | | p1 Flow 1/10 $\mu\text{l}/\text{min}$ | 5 for 32X 40 for 333 | See F command | Event type = 1: MIXTURE EVENT | | | p1 Percentage of pump B in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | p2 Percentage of pump C in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | p3 Percentage of pump D in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | Event type = 2: OUTPUT EVENT | | | p1 Output number | 1 | 4 | p2 Output state | 0 = CLOSE, 1 = OPEN, 2 = PULSE | | Event type = 3: INJECTION EVENT | | | p1 Injection flow, 1/10 $\mu\text{l}/\text{min}$ | See min and max flow for the injection pump | | p2 Injection volume, 1/10 μl | See min and max volume for the injection pump | | Event type = 5: WAIT EVENT | | | p1 Input state | 0 (wait input close) | 1 (wait input opened) |
| Parameter | Minimum | Maximum | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Event type = 0: FLOW EVENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p1 Flow 1/10 $\mu\text{l}/\text{min}$ | 5 for 32X 40 for 333 | See F command | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Event type = 1: MIXTURE EVENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p1 Percentage of pump B in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p2 Percentage of pump C in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p3 Percentage of pump D in $\%$ | 0 | 1000 and p1+p2+p3 inferior or equal to 1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Event type = 2: OUTPUT EVENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p1 Output number | 1 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p2 Output state | 0 = CLOSE, 1 = OPEN, 2 = PULSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Event type = 3: INJECTION EVENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p1 Injection flow, 1/10 $\mu\text{l}/\text{min}$ | See min and max flow for the injection pump | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p2 Injection volume, 1/10 μl | See min and max volume for the injection pump | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Event type = 5: WAIT EVENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| p1 Input state | 0 (wait input close) | 1 (wait input opened) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Command | Type | Description |
|----------|----------|---|
| G | I | Read application event from Edit file Returns event, selected by application event index, as previously set by a buffered G command. Response format: EventNb, Type, Time, p1, p2, p3 where EventNb range from 0 to 29. Other parameters, separated by a comma, are defined in buffered G command. Note: Type = 255 means empty event (End of file). This command increments automatically the application event index. p1 to p3 are additional parameters depending of the event type. The meaning and number of parameters depends on the event type. Pump will return only parameters corresponding to event type. |
| H | B | Delete application event from Edit file Syntax: Hn where n is the event index. range from 0 to 29. |
| H | I | Reset Application event index Response format: 'H' if there is at least one event. 'N' if there is no event or if application does not exists. Application contains up to 30 events. The application can be read back event by event. This command sets the index to the first event if any. |
| I | B | Write contact inputs Syntax: labcd where: 'a' is the input #1 (Start/End). 'b' is the input #2 (Pause/Resume). 'c' is the input #3 (Wait). 'd' is the input #4 (Emergency). Parameters: 'C' for closed. 'D' for open. 'X' for state unchanged. '-' for reconnect to internal software. Comment: This command disconnects the input from the internal software if the corresponding parameter is 'C' or 'D'. The value is stored in the contact input buffer(s). |
| I | I | Read contact inputs Response format: 'abcd' as above; for each input: 'C' if closed and connect to internal software. 'c' if closed and disconnect from internal software. 'D' if open and connect to internal software. 'd' if open and disconnect from internal software. This command reads the state of the physical input. |
| i | I | Read contact input buffer Response format: same as I immediate command. Comment: this command reads the input buffer of the internal software instead of the physical input. |

| Command | Type | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|------------|--|-------------|----------|------|----------|-----|------------|-----|------|-----|------------|-----|-----|-----|------------|-----|-----|-----|------------|-----|-------|-----|------------|-----|------|-----|------------|-----|------|-----|-------|-----|-----|-----|-------|-----|-------|-----|------------|-----|-------|-----|--------|-----|------|-----|------|--|--|-----|----------|-----|------------|-----|------------|-----|-------------|
| J | B | <p>Write contact outputs</p> <p>Syntax: Jabcd where: 'a' is the Out1 relay. 'b' is the Out2 relay. 'c' is the Out3 relay. 'd' is the Out4 relay.</p> <p>Parameters: 'C' for Close. 'D' for Open. 'P' for Pulse. 'X' for state unchanged. '-' for reconnect to internal software.</p> <p>Comment: This command disconnects the output from the internal software if the corresponding parameter is 'C', 'D' or 'P'. The default pulse duration is 0.03 min unless set otherwise by the buffered command E.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| J | I | <p>Read contact outputs</p> <p>Response format: 'abcd' as buffered J command for each output: 'C' if closed and connects to internal software. 'c' if closed and disconnects from internal software. 'D' if open and connects to internal software. 'd' if open and disconnects from internal software.</p> <p>The returned state(s) refers to the physical output(s).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| j | I | <p>Read contact output buffers</p> <p>Response format and parameters: same as immediate J command.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| K | B | <p>Input remote keystrokes</p> <p>Syntax: 'K' + '=' + key codes+', up to 32 key codes per command.</p> <p>Parameters are ASCII codes, as follows:</p> <table><tr><th>Code</th><th>Key name</th><th>Code</th><th>Key name</th></tr><tr><td>'a'</td><td>Softkey F1</td><td>'0'</td><td>Zero</td></tr><tr><td>'b'</td><td>Softkey F2</td><td>'1'</td><td>One</td></tr><tr><td>'c'</td><td>Softkey F3</td><td>'2'</td><td>Two</td></tr><tr><td>'d'</td><td>Softkey F4</td><td>'3'</td><td>Three</td></tr><tr><td>'e'</td><td>Softkey F5</td><td>'4'</td><td>Four</td></tr><tr><td>'f'</td><td>Softkey F6</td><td>'5'</td><td>Five</td></tr><tr><td>'C'</td><td>Clear</td><td>'6'</td><td>Six</td></tr><tr><td>'E'</td><td>Enter</td><td>'7'</td><td>Seven</td></tr><tr><td>'.'</td><td>Dec. point</td><td>'8'</td><td>Eight</td></tr><tr><td>'X'</td><td>Escape</td><td>'9'</td><td>Nine</td></tr><tr><td>'H'</td><td>Help</td><td></td><td></td></tr><tr><td>'U'</td><td>Up arrow</td><td>'L'</td><td>Left arrow</td></tr><tr><td>'D'</td><td>Down arrow</td><td>'R'</td><td>Right arrow</td></tr></table> <p>Comment: when this command has been sent, the keyboard is locked but it can memorized up to 8 key strokes (beep can be heard).</p> <p>The key codes are stored in a buffer. At the time the keyboard is reconnect to the software, the buffer is cleared.</p> <p>Command 'K' without any codes reconnects the keypad to the internal software.</p> <p>Command 'K=' merely locks the keypad.</p> <p>Comment: The message 'Keypad locked' is shown on the lower line of the display instead label of soft-key.</p> <p>For the remote pumps, the remote led is turned on when the keypad lock command ('K=' ') is received. It is turned off with the unlock command ('K').</p> | Code | Key name | Code | Key name | 'a' | Softkey F1 | '0' | Zero | 'b' | Softkey F2 | '1' | One | 'c' | Softkey F3 | '2' | Two | 'd' | Softkey F4 | '3' | Three | 'e' | Softkey F5 | '4' | Four | 'f' | Softkey F6 | '5' | Five | 'C' | Clear | '6' | Six | 'E' | Enter | '7' | Seven | '.' | Dec. point | '8' | Eight | 'X' | Escape | '9' | Nine | 'H' | Help | | | 'U' | Up arrow | 'L' | Left arrow | 'D' | Down arrow | 'R' | Right arrow |
| Code | Key name | Code | Key name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'a' | Softkey F1 | '0' | Zero | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'b' | Softkey F2 | '1' | One | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'c' | Softkey F3 | '2' | Two | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'd' | Softkey F4 | '3' | Three | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'e' | Softkey F5 | '4' | Four | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'f' | Softkey F6 | '5' | Five | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'C' | Clear | '6' | Six | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'E' | Enter | '7' | Seven | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| '.' | Dec. point | '8' | Eight | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'X' | Escape | '9' | Nine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'H' | Help | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'U' | Up arrow | 'L' | Left arrow | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 'D' | Down arrow | 'R' | Right arrow | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Command | Type | Description |
|----------|----------|---|
| K | I | Read key entry Response format: 'x..xx', where 'x..xx' is an ASCII string, up to 8 characters long, encoding the last keys pressed. This command clears the buffer. Comment: If no key pressed, the ' ' ASCII characters is returned. If the keyboard has not been disconnected by a buffered command 'K', the '@' ASCII characters is returned. |
| n | I | Reset Audit Trail configuration parameters index Response format: 'n' if log file exist. 'N' if log file does not exists. |
| N | I | Read Audit Trail configuration parameters Response format: nnn=mmmm where nnn identifies the parameter (see E command), mmmm is the value. This command is similar to the immediate 'E' command, but returns information from the configuration recorded in the log file at the starting time. Only the designated parameters (L type) are available. If the pump data base is busy, the response is '!'. In this case, send the command again, later. Comment: Use the immediate 'n' command first to set the index to the first parameter in the table. The index is set to the next available parameters after each reading. In case of error the response is '????'. |
| O | B | Set Audit Trail files index Syntax: 'On' where n sets the stored file index ranging from 0 to 9. At the starting file time, the running file and its linked files (10 files maximum) are stored with the log file. This command sets the file index used by the 'O' immediate command and resets the Audit Trail file event index used in the 'o' immediate command. |
| O | I | Read Audit Trail files Response: n, m, p, q where: n = File number ranging from 1 to 24, any other value means the file does not exist. m = 0 if file is not locked, m=1 if it is locked. p = Nb of loop. q = Linked file. (255 if there is no linked file) Command reads the audit trail file selected by the index sets with the buffered O command, which must be used before. |
| o | I | Read Audit Trail files' events See G Command for response format. Returns event, selected by Audit Trail file event index. This command increments automatically the Audit Trail file event index. This index is reset by the O buffered command which must be used before. |

Commands for 333 and 334 Pumps

| Command | Type | Description |
|----------|----------|--|
| Q | B | <p>Enter pressure value</p> <p>Syntax: 'Qbxxx' in bar, Qpxx.xin MPa or Qkx.xx in kpsi</p> <p>If the parameter xxx is omitted, only the GSIOC pressure unit (used in immediate 'Q' command) is changed.</p> <p>This command does not affect the pressure unit for the user interface.</p> <p>Comment: This command disconnects the pressure value from the internal pressure transducer.</p> <p>'Q-' reconnects pressure to the internal pressure transducer.</p> |
| Q | I | <p>Read pressure value</p> <p>Response format: as above, in the pressure unit used by the last buffered 'Q' command.</p> <p>The default unit is the bar.</p> |
| S | I | <p>Buffer status</p> <p>Response format: ab where:</p> <ul style="list-style-type: none"> a = 0 if the GSIOC buffered command buffer is empty. a = 1 otherwise. b = 0 if all buffered commands have been accepted since the last immediate 'S' command. b = 1 if one or more buffered command has been rejected since the last immediate 'S' command. b is reset to 0 after it has been transmitted. <p>If the pump received several commands at the same time, or in the mean time, it is not possible to know where the error is.</p> |
| T | I | <p>Read Audit Trail file line</p> <p>Returns event pointed by Audit Trail line pointer.</p> <p>Response format: Event code,YY,MM,DD,HH,mm,par1,par2. where:</p> <ul style="list-style-type: none"> Event code is the event code (see below). YY is the year (0 to 99). MM is the month (1 to 12). DD is the day (1 to 31). HH is the hour (0 to 23). mm is the minute (0 to 59). Par1 is the first additional value (0 to 255). Par2 is the second additional value (0 to 65535). <p>Some parameters are not required for all events. In this case, the parameter exists in the response but has no meaning.</p> <p>When the pump data base is busy, the response is '!', so try again. If there are no available events or if the audit trail line pointer reaches the last line, the response is '!'.</p> <p>This command increments automatically the Audit Trail line pointer. Use immediate T command to set pointer at the beginning of the file.</p> |


| Command | Type | Description | | |
|----------|----------|---|--|---|
| | | (continued) | | |
| | | Event Code | Event Designation | Par1 |
| | | 'a' | Start of application | |
| | | 'b' | End of application | |
| | | 'c' | Stop application | |
| | | 'd' | Pause application | |
| | | 'e' | Resume application | |
| | | 'f' | Application modification | Application number. |
| | | 'g' | Configuration modification | |
| | | 'h' | Pressure limit reached | 0 for high pressure limit |
| | | | | Pressure limit in tenths of MPa |
| | | 'i' | Counter change | Head identification: 0 for head A 1 for head B 2 for head C 4 for inj head |
| | | | | Counter code: 0 for piston seal 1 for piston 2 for out check valve 3 for in check valve |
| | | 'j' | Counter limit | as for event code 'i' |
| | | 'k' | Power failure | 0 for STOP option 1 for Continue option 2 for start safety file |
| | | 'l' | Audit Trail is full | |
| | | 'm' | Injection event | |
| | | 'n' | Loop file begin | |
| | | 'o' | Link to next file | Link file |
| | | 'A' | Pressure limit reached (safety file absent) | 0 for high pressure limit 1 for low pressure limit |
| | | | | Pressure limit in tenths of MPa Pressure limit in tenths of MPa |
| | | 'B' | Power failure (safety file absent) | |
| | | 'C' | Emergency input activated (emergency file absent) | |
| | | 'D' | Invalid conditions | Flag reset by start a file or flow using the buffered 'F' command |
| | | 'E' | Hydraulic failed | Pump Number 0 for pump A 1 for pump B 2 for pump C 4 for inj pump |
| | | 'F' | Slave module absent | Unit ID |
| | | 'G' | Running file does not exist | |
| | | 'H' | Validation process has restored parameters to the default values | |
| | | 'K' | Pressure limit reached (safety file already running) | 0 for high pressure limit 1 for low pressure limit |
| | | | | Pressure limit in tenths of MPa Pressure limit in tenths of MPa |
| t | I | Reset Audit Trail line index Response format: 'T' if file exists. 'N' if file does not exists. The Audit trail file is an event file. Each line store one event. This file is read via GSIOC, event by event. See immediate 'S' command. This command sets the index to the first line. | | |

| Command | Type | Description |
|----------|----------|--|
| U | B | Delete Audit Trail file Syntax 'U'. |
| W | B | Write display Syntax: Wm=xx..xx . Where: m = line number = 0 to n-1, n being the number of the line. xx..xx is an alphanumeric string up to 40 characters long. Note that characters shown on the display unit may differ from characters sent by a computer. The string is made of: letters A-Z, a-z, numbers 0-9, special characters ! »#\$%&'()*+,-./{ }~ and space. If the string is less than 43 characters (3+40), the remaining right-most characters of the display are blanked. If it is longer, extra characters are ignored. The vertical bar () is not required if this command is the last one in the buffer. This command disconnects the corresponding line from the internal software. The syntax has several variants: W0=xx..x disconnects and writes xx..x on line 1. Wn= xx..x disconnects and writes xx..x on line n+1. W= disconnects the whole display (but lines are not blanked). W0= disconnects line 1(but lines are not blanked). Wn= disconnects line n+1(but lines are not blanked). W reconnects all lines. W0 reconnects line 1. Wn reconnects line n+1. |
| W | I | Read display Response format: Wn=xx..xx. Where: n is the line number (0 to 7). xx..xx is a 40-character alphanumeric string. This command returns the contents of the selected display line. The selection of the line is done using the buffered W command. The characters returned are the real contents of the physical display, not the message produced by the internal software. Comment: The first line to be returned is the last entered by the buffer 'W' write command. If the write command has not been used, the upper line is read at the first occurrence of the read command, the second line is read at the second, and so on. |
| w | I | Read display buffer Response format: as for immediate W command. Comment: reading mechanism same as immediate W command. The response is the image of the display line if it were connected to the internal software. This is also the message which will be restored to the display after a reconnect command. |

| Command | Type | Description |
|----------|----------|---|
| z | I | Read compression stroke Response format: aaaa, bbbb. Where: aaaa is the Head A compressibility stroke (if flow>zero) in one thousandth of the actual* piston stroke (0 to 1000). bbbb is equal to 0 and has no meaning in this context. * Actual Stroke = Complete Stroke multiplied by % of stroke. |
| a | B | Dismount/Mount heads Syntax: an. Where: n = D means send the two pump heads to the dismount position (both heads simultaneously). n = N means to initiate the head mounting sequence (both heads simultaneously). |
| b | B | Start maintenance sequence Syntax: bnm,p,q. Where: n = '0' -> Start <To run in new piston seal> sequence. m = 'S' to start sequence. p = the run in head: 0 for heads of pump A 1 for heads of pump B 2 for heads of pump C 3 not used in this context. 4 for the head of the inj pump q = the flow rate used to reach the run in pressure in tenth of μl . m = 'C' to continue sequence after priming. (see immediate 'e' command). n = '1' -> Start < Leakage test> sequence. m = test pressure value in tenth of Mpa ranging from up to system maximum pressure. p = the flow rate used to reach the test pressure in tenth of μl . n = 'S' -> Stop running maintenance sequence. If m,p,q are not useful, they do not exist. |
| c | B | calibrate pressure transducer Syntax: cammm. Where: a = 'L' for low point calibration a = 'H' for high point calibration mmm is the calibration pressure in tenths of MPa (0 to 600) for the high point calibration. It does not exist for low point calibration. |
| c | I | Pressure transducer calibration status Response format: a. Where: a = 'I' if there is no calibration before. a = 'Y' if the previous calibration command was successful. a = 'N' if the previous calibration command was unsuccessful. |
| d | I | Leakage maintenance sequence status Response format: a. Where a = 'R' for sequence running. a = 'K' if last sequence was successful. a = 'F' if last sequence failed. a = 'I' if no leakage sequence. |

Commands for 333 and 334 Pumps

| Command | Type | Description |
|----------|----------|---|
| e | I | Run in maintenance sequence status Response format: a. Where a = 'P' during priming phase of the sequence. a = 'E' when the pump is waiting before to begin the pressurization phase (see buffered 'b' command). a = 'R' during pressurization phase. a = 'I' if no Run In sequence. |
| g | B | Direct setting of motor frame control This command is for Gilson use only. |
| i | B | Update current frame This command is for Gilson use only. |
| h | B | Control the motor rotation This command is for Gilson use only. |
| h | I | Motor status Response format: abcd. Where: a = R if right motor is running, else = S. b = E if right motor error, else = N. c = R if left motor is running, else = S. d= E if left motor error, else = N. |



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