Contents

1 Declaration of conformity

WATSON MARLOW Pumps

CE

Watson-Marlow Limited
Falmouth
Cornwall
TR11 4RU
England

EC Declaration of Conformity

1. PF7 Peristaltic Filler

2. Manufacturer:
   Watson Marlow Ltd
   Bickland Water Road
   Falmouth
   TR11 4RU
   UK

3. This declaration of conformity is issued under the sole responsibility of the manufacturer

4. All models and versions of the PF7 series of peristaltic filler with all approved pump heads, tubing and accessories.

5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:
   Machinery Directive 2006/42/EC
   EMC Directive 2014/30/EC
   ROHS Directive 2011/65/EU

6. Harmonised standards used:
   BS EN61010-1:2010 third edition Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements
   EN61326-1:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements Part 1: General requirements
   BS EN 60529:1992+A2:2013 Degrees of protection provided by enclosures (IP code)

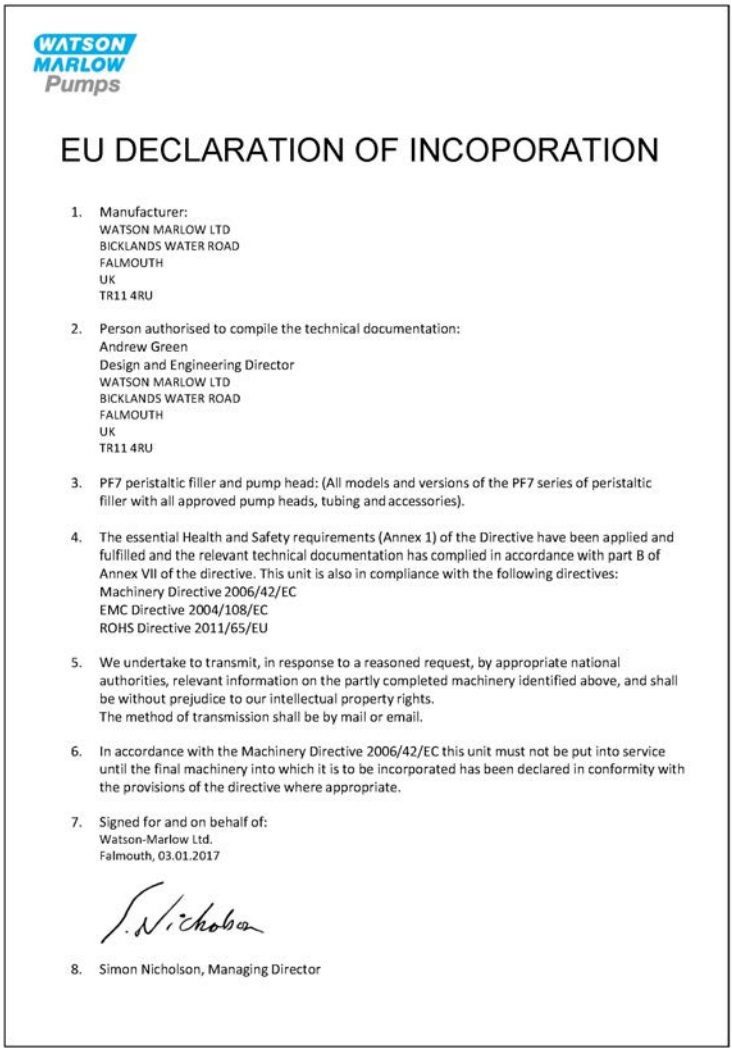
7. Intertek Testing and Certification Ltd, No: 3272281, performed compliance testing to BS EN 61010-1:2010, IEC 61010-1:2010, UL 61010-1:2010 and CAN/CSA C22.2 Bo 6101010-1:2010 and issued certification of compliance to these standards.

Signed for and behalf of:
Watson Marlow Ltd
Falmouth, 1st January 2017

S. Nicholson

Simon Nicholson, Managing Director, Watson-Marlow Limited

2 Declaration of incorporation



WATSON MARLOW Pumps

EU DECLARATION OF INCOPORATION

1. Manufacturer:
   WATSON MARLOW LTD
   BICKLANDS WATER ROAD
   FALMOUTH
   UK
   TR11 4RU

2. Person authorised to compile the technical documentation:
   Andrew Green
   Design and Engineering Director
   WATSON MARLOW LTD
   BICKLANDS WATER ROAD
   FALMOUTH
   UK
   TR11 4RU

3. PF7 peristaltic filler and pump head: (All models and versions of the PF7 series of peristaltic filler with all approved pump heads, tubing and accessories).

4. The essential Health and Safety requirements (Annex 1) of the Directive have been applied and fulfilled and the relevant technical documentation has complied in accordance with part B of Annex VII of the directive. This unit is also in compliance with the following directives:
   Machinery Directive 2006/42/EC
   EMC Directive 2004/108/EC
   ROHS Directive 2011/65/EU

5. We undertake to transmit, in response to a reasoned request, by appropriate national authorities, relevant information on the partly completed machinery identified above, and shall be without prejudice to our intellectual property rights.
   The method of transmission shall be by mail or email.

6. In accordance with the Machinery Directive 2006/42/EC this unit must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the directive where appropriate.

7. Signed for and on behalf of:
   Watson-Marlow Ltd.
   Falmouth, 03.01.2017

   S. Nicholson

8. Simon Nicholson, Managing Director

3 Safety notes

This safety information should be used in conjunction with the rest of this operating manual.

In the interests of safety, this pump and pumphead should only be used by competent, suitably trained personnel after they have read and understood the manual and considered any hazard involved. If the pump is used in a manner not specified by Watson-Marlow Ltd, the protection provided by the pump may be impaired. Any person who is involved in the installation or maintenance of this equipment should be fully competent to carry out the work. In the UK this person should also be familiar with the Health and Safety at Work Act 1974.

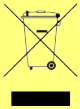
This symbol, used on the pump and in the manual, means: Caution, refer to accompanying documents.

This symbol, used on the pump and in the manual, means: Do not allow fingers to contact moving parts.

This symbol, used on the pump and in the manual, means: Caution, hot surface.

This symbol, used on the pump and in the manual, means: Caution, risk of electric shock.

This symbol, used on the pump and in the manual, means: Personal Protective Equipment (PPE) must be worn.



This symbol, used on the pump and in the manual, means: Recycle this product under the terms of the EU Waste Electrical and Electronic Equipment (WEEE) Directive.

Fundamental work with regard to lifting, transportation, installation, starting-up, maintenance and repair should be performed by qualified personnel only. The unit must be isolated from mains power while work is being carried out. The motor must be secured against accidental start-up.

There is a user-replaceable type fuse in the fuse holder above the power input connector at the back of the pump. In some countries, the mains power plug contains an additional replaceable fuse.

There are no user-serviceable fuses or parts inside this pump.

This pump must be used only for its intended purpose.

The pump must be accessible at all times to facilitate operation and maintenance. Access points must not be obstructed or blocked. Do not fit any devices to the drive unit other than those tested and approved by Watson-Marlow Ltd. Doing so could lead to injury to persons or damage to property for which no liability can be accepted.

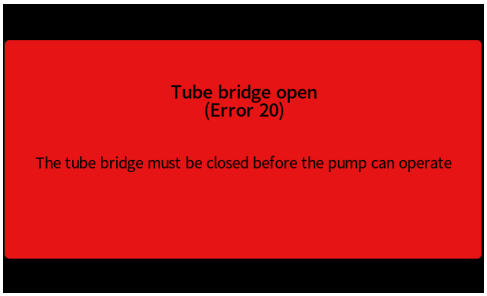
The pump's main plug is the disconnecting device (for isolating the motor drive from the mains supply in an emergency). Do not position the pump so that it is difficult to disconnect the mains plug.

If hazardous fluids are to be pumped, safety procedures specific to the particular fluid and application must be put in place to protect against injury to persons.

This product does not comply with the ATEX directive and must not be used in explosive atmospheres.

The PF7 contains a non-replaceable Manganese Dioxide Lithium Battery (Li/MnO_2), IEC CR2032, with a typical capacity of 225mAh, containing 0.07g of Lithium.

Primary operator protection from rotating parts of this pump is provided by isolating the pump from mains power before opening the pump head tube bridge. The pump also provides a tube bridge open indicator. If the tube bridge is opened, the tube bridge open screen is displayed.



The tube bridge must be closed for the warning screen to clear and the pump to start.

4 Peristaltic pumps - an overview

Peristaltic pumps are the simplest possible pump, with no valves, seals or glands to clog or corrode. The fluid contacts only the bore of a tube, eliminating the risk of the pump contaminating the fluid, or the fluid contaminating the pump.

How they work

A compressible tube is squeezed between a roller and a track on an arc of a circle, creating a seal at the point of contact. As the roller advances along the tube, the seal also advances. After the roller has passed, the tube returns to its original shape, creating a partial vacuum which is filled by fluid drawn from the inlet port.

Before the roller reaches the end of the track, a second roller compresses the tube at the start of the track, isolating a packet of fluid between the compression points. As the first roller leaves the track, the second continues to advance, expelling the packet of fluid through the pump's discharge port. At the same time, a new partial vacuum is created behind the second roller into which more fluid is drawn from the inlet port.

Backflow and siphoning do not occur, and the pump effectively seals the tube when it is inactive. No valves are needed.

The principle may be demonstrated by squeezing a soft tube between thumb and finger and sliding it along: fluid is expelled from one end of the tube while more is drawn in at the other.

Animal digestive tracts function in a similar way.

Suitable applications

Peristaltic pumping is ideal for most fluids, including viscous, shear-sensitive, corrosive and abrasive fluids, and those containing suspended solids. They are especially useful for pumping operations where hygiene is important.

Peristaltic pumps operate on the positive displacement principle. They are particularly suitable for metering, dosing and dispensing applications. Pumps are easy to install, simple to operate and inexpensive to maintain.

5 When you unpack your pump

5.1 Unpacking your pump

Unpack all parts carefully, retaining the packaging until you are sure all components are present and in good order. Check against the components supplied list, below.

5.2 Packaging disposal

Dispose of packaging materials safely, and in accordance with regulations in your area. The outer carton is made of corrugated cardboard and can be recycled.

5.3 Inspection

Check that all components are present. Inspect components for damage in transit. If anything is missing or damaged, contact your distributor immediately.

5.4 Components supplied

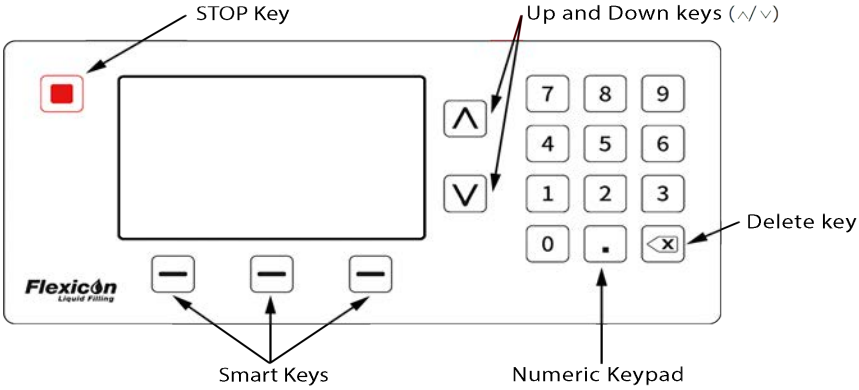
- PF7 pump drive unit, fitted with QC12 pumphead
- A QC12 pumphead tube clamp set
- The designated power cable
- Product manual

5.5 Storage

This product has an extended shelf life. However, care should be taken after storage to ensure that all parts function correctly. Please observe the storage recommendations and use-by dates which apply to tubing you may wish to bring into service after storage.

6 Pump operation

6.1 Keypad



The **STOP key** will immediately stop the pump, regardless of what screen is currently displayed. If the pump is stopped part way through a fill, a message stating this will be displayed.

6.2 Glossary of icons

The PF7 uses a range of graphical icons to help navigation, in both the smart key function indicator area and the screen info bar area.

Smart key icons	
	BACK TO PREVIOUS SCREEN
	NO / CANCEL
	EDIT
	MODE
	NEXT
	PAUSE
	RUN
	STOP
	YES/CONTINUE

Screen info icons			
	BALANCE CONNECTED (White Icon)		REPORTING ON (White Icon)
	BALANCE CONNECTED BUT NOT USABLE (Red Icon)		REPORTING IN PROGRESS (Blue Icon)
	PRINTER CONNECTED		REPORTING ERROR (Red Icon)
	RECIPE		REPORTING OFF
	USER		FILL ACTIVATION BY TIME DELAY
	ADMINISTRATOR		FILL ACTIVATION BY EXTERNAL INPUT
	RECALIBRATION REMINDER		FILL ACTIVATION BY KEYPAD
	RECALIBRATION REQUIRED (Red Icon)		

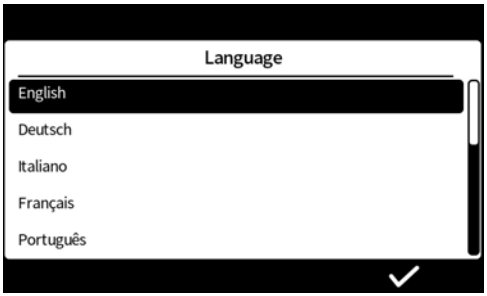
6.3 Switching the pump on for the first time

Powering up

Power up the pump. The pump displays the start-up screen with the Flexicon logo.

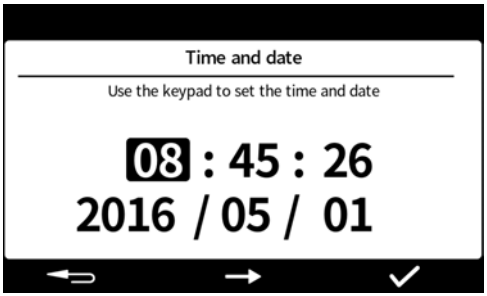
Language selection

Select the display language using the up and down keys (∧/∨) and then the  .



Setting the time and date

Enter the time and date using the numeric keypad. The time format is hh/mm/ss and the date format is yyyy/mm/dd. The time is 24hr format.



Pressing  will move the selection forward. Once the time and date is correct, press  . Pressing  at any point returns to the previous screen.

Setting the filling method

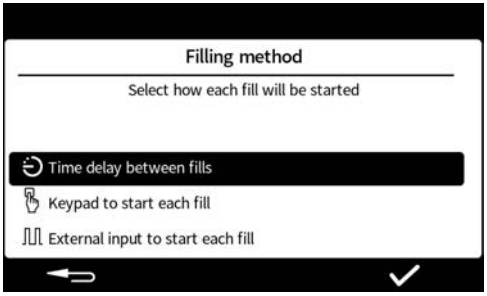
The filling method defines how each fill will be started.

Time delay between fills, the next fill starts automatically at a set time delay after the previous fill ends.

Keypad to start each fill, requires  to be pressed to start every fill.

External input to start each fill, starts a fill whenever a signal is received through the start input pin.

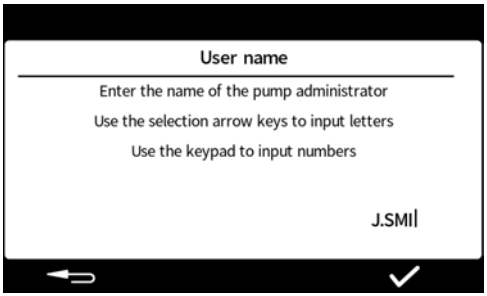
The Filling method icon will be displayed in the screen info bar area.



Select the display language using the up and down keys (∧/∨) and then press  . The filling method can be reset in settings mode

Setting the pump administrator

Enter a username for the pump administrator. The default username is USER1.



Press  to delete characters.

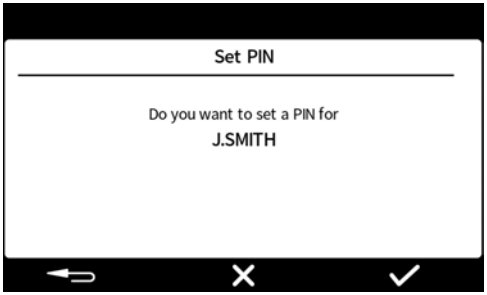
Use the up and down keys (∧/∨) to scroll through the available characters. After 1 second of inactivity the next character can be entered. Use the numeric keypad to enter numbers. Once the username is correct, press  .

Additional users can be set up in settings mode.

Setting a PIN

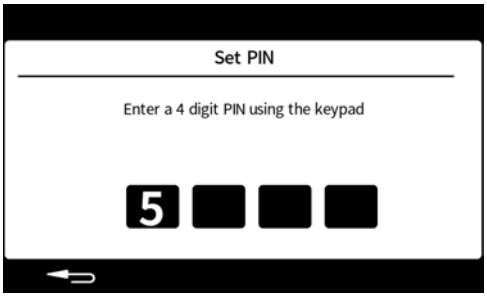
By setting a PIN number, a 4 digit number will be required to log in as the pump administrator. A log in is required whenever the pump is powered on or a user has logged out.

Ensure you keep a record of PIN numbers. If you lose them contact your local Watson-Marlow Ltd or Flexicon representative.



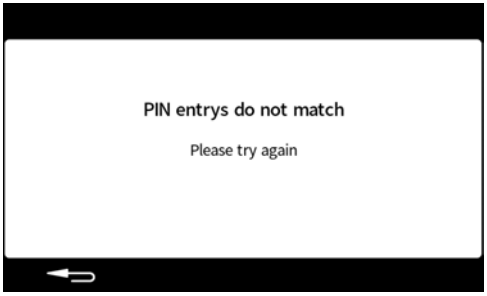
Press ✕ if a pin is not required or press ✓ if a PIN is required

If a pin is required, enter a 4 digit number using the numeric keypad



Re-enter the PIN when requested.

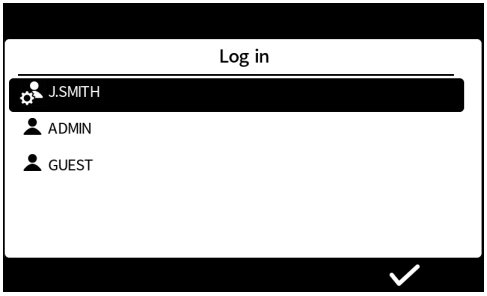
If the entry's don't match, the following screen will be displayed.



Press ⮌ to return to the first PIN entry screen.

6.4 Switching the pump on in subsequent power cycles

Subsequent power-up sequences will show the initialisation screen and then the Log-in screen.

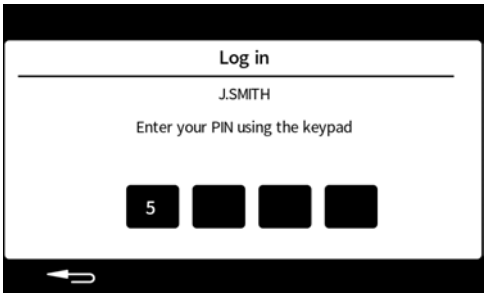


Select the desired username using the up and down keys (∧/∨) and then press  .

The icon by the username indicates the type of user; either a pump administrator or a user.

Entering your PIN number

If a PIN has been set for the selected user the following screen will be displayed.

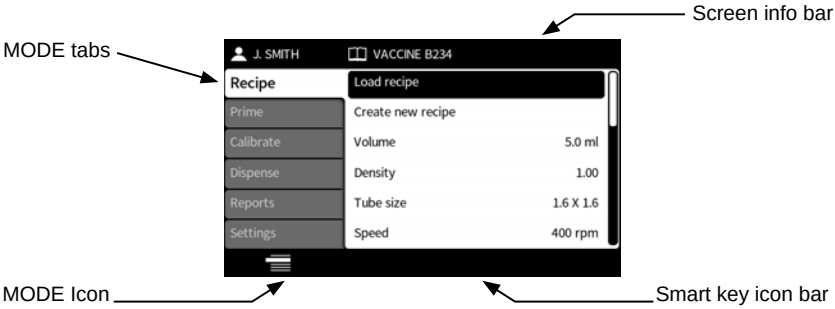


Enter a 4 digit number using the numeric keypad and then press  .

If an incorrect PIN is entered "Incorrect PIN, please try again" will be displayed.

6.5 Menu navigation

Pressing  scrolls through the PF7's different modes. The active mode is shown by the highlighted tab. The mode can be changed whenever the  icon is displayed. The PF7 has three smart keys, these change functionality depending on the screen being displayed.



6.6 Recipe Mode

Up to 200 recipes and 50 users can be stored in memory.

Editing a recipe

Select the Recipe tab to enter the recipe details.

Navigate through the recipe items using the up and down arrows (∧/∨) and press  to edit the value.

Each recipe item has clear entry instructions on the screen on how to edit or enter details.

Recipe Item	Description
Load recipe	Load a recipe from a list of stored recipes
Create a new recipe	Create a new recipe using the recipe items set
Volume	Fill volume
Density	Fluid density
Tube size	Tube size selection
Speed	Pumphead rotor speed
Acceleration	Rate at which the motor accelerates
Deceleration	Rate at which the motor decelerates
Anti-drip	Relative amount at which the motor reverses at the end of each dispense

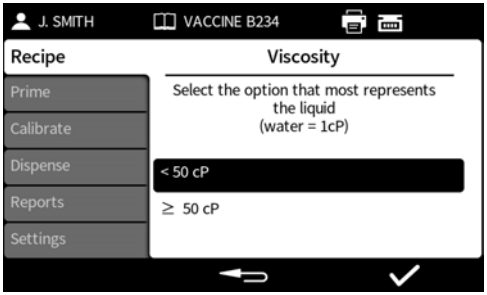
Recipe Item	Description
Start delay	Length of time from the pump receiving a start signal and the fill starting, (keypad or external input)
End delay	Length of time from the motor stopping and the pump being ready to start the next fill
First Fill delay	The time between a start signal and the first fill starting
Between fill delay	The time between one fill ending and the next fill starting
Recalibration reminder	Period between recalibrations after which a reminder will be displayed
Recalibration pause	Period between recalibrations after which the batch will be paused until a recalibration is performed
Protected recipe	If a recipe is set to be protected then it cannot be edited in any way
Save recipe	Saves the current filling parameters under a recipe name
Print recipe	Prints the current filling parameters
Delete recipe	Deletes a saved recipe

Creating a new recipe

When the **Create new recipe** option is used, some of the recipe parameters are automatically generated to give the recommended values for that fill. However, all recipe parameters can be edited after the new recipe has been created.

Remember that filling accuracy can also be influenced by the length of the tubing and the position of the product tank.

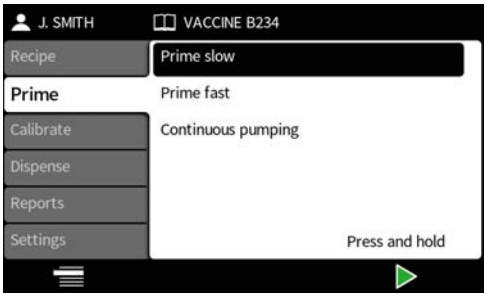
Whilst creating a new recipe, you will be asked if the viscosity of your liquid is most closely represented by the range (less than) <50cP or by the range (greater than) >50cP.



6.7 Priming and continuous pumping mode

The Prime mode allows you to prime the pump or run the pump continuously.

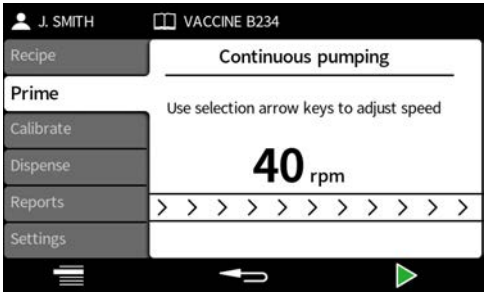
Navigate through the prime items using the up and down keys (∧/∨).



Prime item	Description
Prime slow	The pump will run forwards (slowly) as long as the key is held down
Prime fast	The pump will run forwards (fast) as long as the key is held down
Continuous pumping	The pump will run forwards at the set speed until the stop key is pressed

Press and hold the  key to prime the pump when using prime slow or prime fast. The speed of the prime slow and prime fast can be adjusted in the settings menu.

If continuous pumping is highlighted and the  is selected the continuous pumping screen is displayed. This allows you to select the speed the pump runs at when continuously pumping.

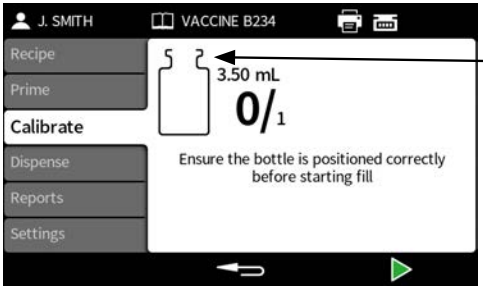


Adjust the pump speed using the up and down keys (∧/∨).

Press  to Start pumping. Press  or the Stop key to stop pumping.

6.8 Calibrate mode

Calibrating the pump before starting a batch and following any change to the recipe or fluid path is recommended to achieve the optimum filling accuracy.



Calibration icon: The number within the vial shows how many calibration fills have been carried out since the last batch or recipe parameters change

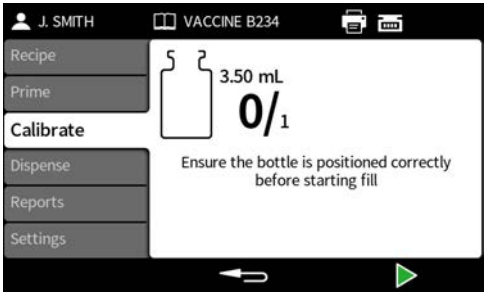
The pump uses the current recipe parameters during the calibration process, i.e. volume, density, tube size, speed, acceleration, deceleration, and anti-drip. The units used in calibration can be volume or mass and are set through the settings tab.

Calibrate item	Description
Single fill calibration	A calibration is done using a single fill
Multi-fill calibration	A calibration is done using an average value calculated from all the fills taken (2 and 99 fills)

If Multi-fill calibration is selected, a screen will be displayed to enter the number of fills that will be used to create an average fill calibration value.

If a balance is being used, it should be tared (set to zero) using the bottle(s) that will be used for the calibration fill(s)

Calibration fill(s)



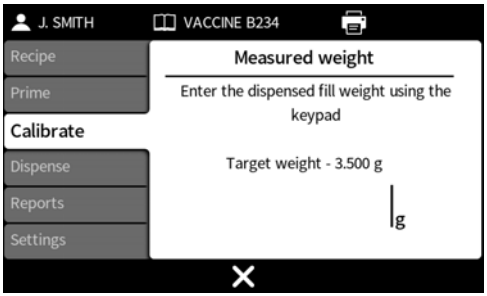
How the fill(s) are started depends on the selected filling method.

Time delay between fills - Press  or use the external input to start the first calibration fill. If doing a Multi-fill calibration, any further fills will start automatically after the Between fill delay has elapsed.

Keypad to start each fill - Press  to start the first calibration fill. If doing a Multi-fill calibration, press  to start any further fills.

External input start each fill - Press  or use the external input to start the first calibration fill. If doing a Multi-fill calibration, press  or use the external input to start any further fills.

Calibration value entry



If not using a balance connected to the pump, enter the dispensed value using the numeric keypad and press  .

If a balance is connected to the pump, the balance value will be automatically displayed. Place the filled bottle(s) on the balance and press  .

If a multi-fill calibration has been performed, the entered value should be the total value of all fills.

Calibration outside an acceptable level

If the calibration value entered is outside of the acceptable calibration range a warning screen will be displayed.

Calibration summary

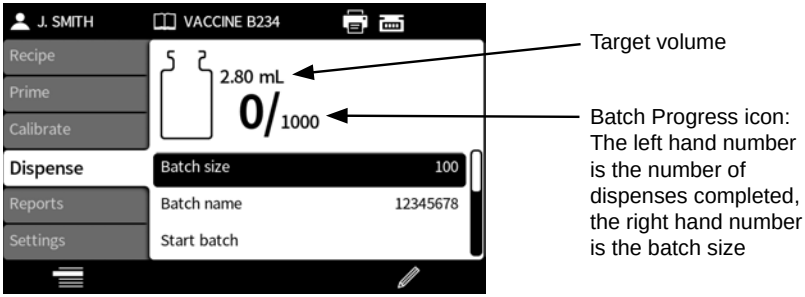
A calibration summary will be displayed. If the values are correct, press  to complete the calibration process.

6.9 Dispense Mode

Within the Dispense menu it is possible to start a batch, define the size of the batch required, give the batch a unique name and carry out a test fill.

Dispense item	Description
Batch size	Enter the number of fills to be done in the batch
Batch name	Name given to the batch
Start batch	Starts the batch
Test fill	Dispense a single fill without creating a batch report

Before a batch is dispensed, ensure that your recipe items are correct, your pump has been primed, calibrated and any additional settings are correct for your process.

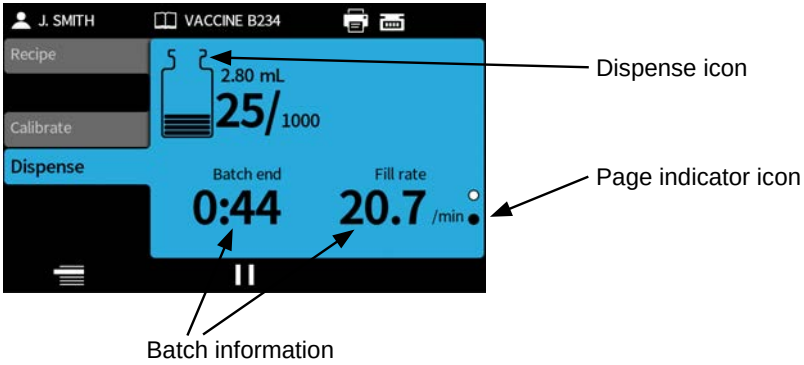


If Start batch is highlighted press  to start the batch. If reporting is **On**, a batch report will be created.

How the fills are started depends on the selected filling method.

When the pump is dispensing or ready to dispense, the screen background colour is blue.

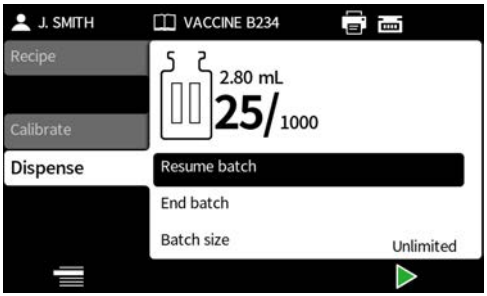
If the stop key is pressed at any point, the pump will stop immediately and a fill interrupt screen will be displayed.



Use the up and down keys (∧/∨) to change the information that is displayed whilst a batch is running.

Pausing a batch

To pause a batch press ⏸. Once the current fill has been completed, the batch will pause.

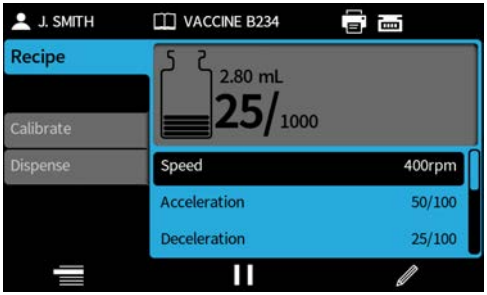


To resume filling press ▶.

Recipe changes whilst dispensing

It is possible to change a selection of recipe items (if active in the recipe tab) during a batch. Press ☰ to access recipe mode, this can be done regardless of whether the batch is filling or paused.

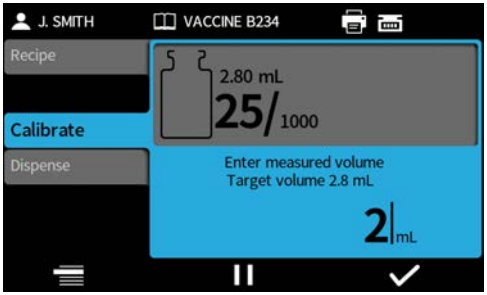
Navigate through the recipe items using the up and down arrows (∧/∨) and press  to edit the value.



If a recipe item is changed, the new value will be used for the next fill. If reporting is On, any changes will be included in the batch report.

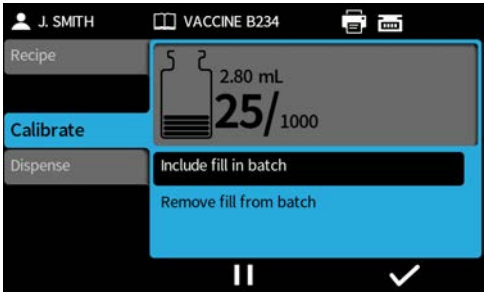
Calibration whilst dispensing

To calibrate the pump whilst filling, press  to access calibrate mode. If using a balance, ensure it was tared (set to zero) using the bottle to be filled before filling.



If not using a balance connected to the pump, enter the calibration value using the numeric keypad and press  .

If a balance is connected to the pump, the balance value will be automatically displayed. Place the filled bottle on the balance and press ✓.



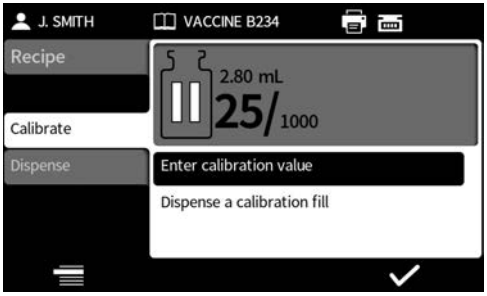
If the bottle used for calibration should be included in the batch, highlight **Include in batch** and press ✓.

If the bottle used for calibration should not be included in the batch, highlight **Remove from batch** and press ✓. A fill will then be removed from the total completed.

If reporting is **On**, the new calibration value will be included in the batch report.

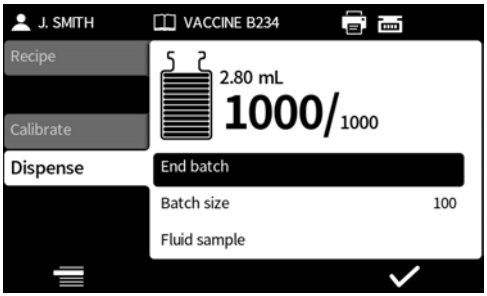
Calibration whilst paused

If the batch is paused and calibrate mode is accessed, either the calibration value can be entered without filling, or a calibration fill can be dispensed before the calibration value is entered.



Ending a batch

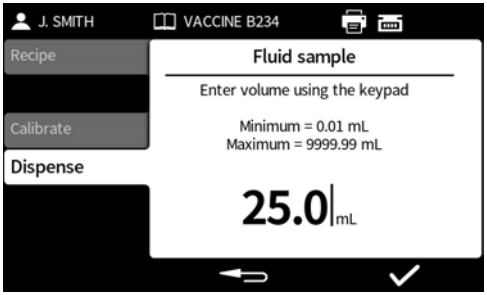
If a **Batch size** has been entered, the batch will pause automatically when the number of fills completed equals the batch size.



If **End batch** is highlighted press ✓ to end the batch. If reporting is **On**, the batch report will be completed.

Fluid sample

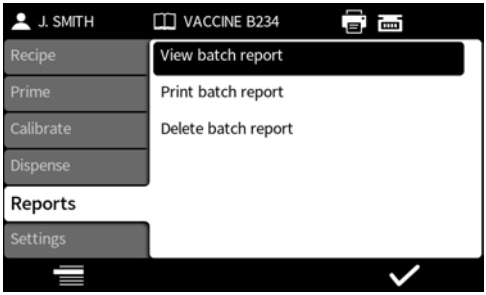
To take a fluid sample. Pause the batch, highlight **Fluid sample** and Press ✓.



Enter the desired value and press ✓. The fluid sample can then be dispensed.

6.10 Reports mode

Batch reports can be viewed, printed or deleted from the reports tab.

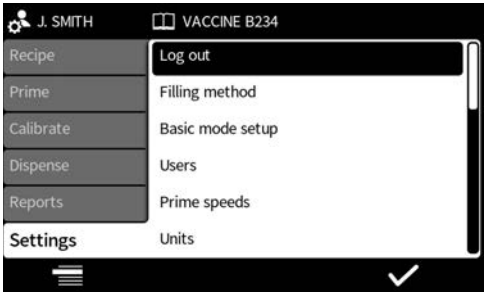


The report data stored and output by the PF7 are the values for the following:

- Software Version
- Batch number - unique ID
- Start time and date
- User name
- Batch name
- Recipe name
- Volume
- Density
- Calibration values when reporting is turned on
- Recipe setting changes while dispensing, when reporting is turned on
- Tube size
- Acceleration
- Deceleration
- Anti-drip
- Start delay
- End delay
- Between fill delay
- Batch size
- Speed

6.11 Settings mode

The Settings menu gives the user access to a number of general settings, navigate through the items using the up and down keys (∧/∨).



The full settings list is as follows:

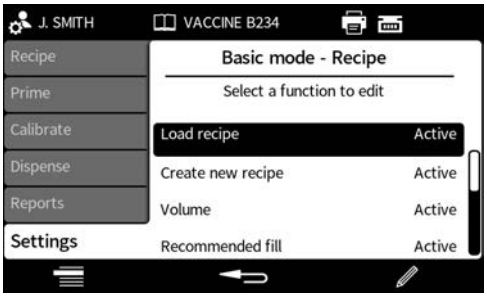
Settings item	Description
Log out	Selecting log out will return the pump to the Log in screen seen after a power cycle. The user PIN will need to be entered if set to Log in.
Filling method	How each fill is started. Either; Time delay between fills, Key press to start each fill or External input to start each fill.
Basic mode setup	Set which functions are available to users.
Users	Setting up new pump users, editing existing pump users and deleting users. Users can be set as either Users or Administrators.
Prime speeds	Setting the prime slow, prime fast and fluid recovery speed levels.
Units	Selecting the desired units for recipe and calibration modes.
First calibration value	Select how much of the recipe volume should be dispensed during the first calibration fill.
Reporting	Allowing the setting on or off, for the following; reporting, auto-printing and auto-deleting.
Default recipe	Setting up the default recipe values.
Printer and balance	List of printers and balances supported by the PF7.
Language	Language selection.
Time and date	Setting the time and date.
Pump info	Software version, pump run hours, website and model number.
Sound level	Setting sound volumes.
Backup and reset	Allowing the deleting of all recipes, the deleting of all reports or carry out a factory reset.

Log out

A user can log in and out of the pump to give security when the pump is unattended. If Log out is selected the pump will display the log in screen.

Basic mode setup

Basic mode setup allows an administrator to customise each menu tab for users.



Each menu tab can be active or hidden. Some items can also be customised as view only. When an item is selected as active, the item is both viewable and editable.

The options for each tab item are shown in the tables below:

Recipe tab item	Description
Load recipe	Active/hidden
Create new recipe	Active/hidden
Volume	Active/view only/hidden
Density	Active/view only/hidden
Tube size	Active/view only/hidden
Velocity	Active/view only/hidden
Acceleration	Active/view only/hidden
Deceleration	Active/view only/hidden
Anti-drip	Active/view only/hidden
Start delay / First fill delay	Active/view only/hidden
End delay / Between fill delay	Active/view only/hidden
Recalibration reminder	Active/view only/hidden
Recalibration pause	Active/view only/hidden
Recipe editable	Active/view only/hidden
Save recipe	Active/hidden
Print recipe	Active/hidden
Delete recipe	Active/hidden

Prime tab item	Description
Prime slow	Active/hidden
Prime fast	Active/hidden
Continuous pump	Active/hidden

Calibrate tab item	Description
Single-fill calibration	Active/hidden
Multi-fill calibration	Active/hidden

Dispense tab item	Description
Test fill	Active/hidden
Index filling machine	Active/hidden

Reports tab item	Description
Print	Active/hidden
View	Active/hidden
Delete	Active/hidden

Settings tab item	Description
Filling method	Active/hidden
Units	Active/hidden
Language	Active/hidden

Backup and reset

The backup and reset functions allow the user to delete all recipes, delete all reports or carry out a factory reset.

If a factory reset is performed the pump will erase all customised settings, recipes and reports and reset the pump to factory settings.

7 Setting up the fluid path

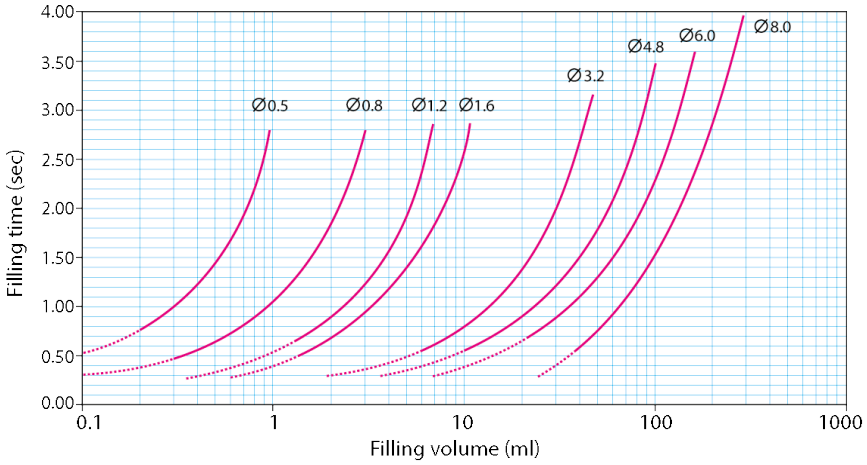
7.1 Tube selection

Tubes must be selected according to the application and volume to be filled. Use the table shown below for choice of tubes according to minimum volume to be filled.

In order to obtain stable and good results, the choice of tubing can be made according to the following guideline:

Volume (ml)	Filling Nozzle (mm i.d.)	Tubing (mm i.d.)	Y-Connector (mm i.d.)
<0.50	0.6	0.5	1.2
0.50 - 1.00	1.0	0.8	1.2
1.00 - 1.70	1.0	1.2	1.8
1.70 - 7.00	1.6	1.6	1.8
7.00 - 12.0	3.2	3.2	3.6
12.0 - 22.0	4.5	4.8	4.8
22.0 - 35.0	6.0	6.0	4.8
> 35.0	8.0*	8.0	7.5

* use non-return valve

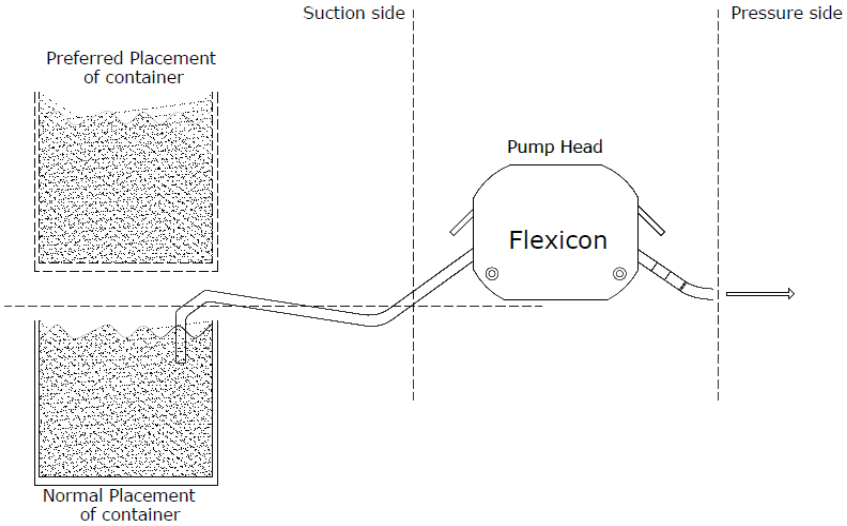


7.2 Placing the product container

In order to get an optimal filling; i.e. best accuracy, long periods between each calibration and the best capacity, the product container should be placed at the same level as pump head or preferably above the pump head level. The length between container, pump head and filling nozzle must be as short as possible.

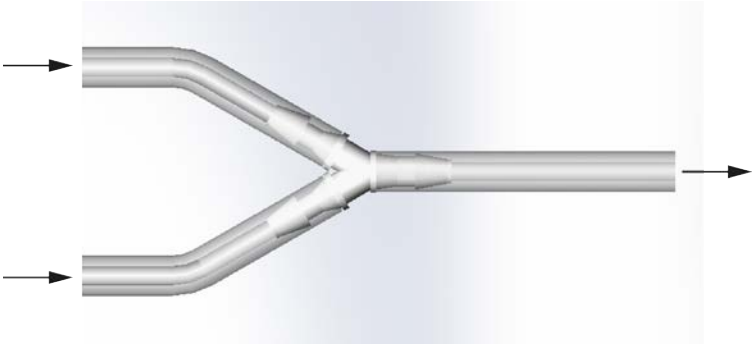
Placing the container higher than pump head level provides positive product support and may reduce the calibration interval. It is also recommended to place the container as close as possible to the pump on suction side.

Ensure there are no tight bends or obstructions which could reduce the fluid flow in the tube line.



7.3 Y-connector selection

Before mounting the tubes in the dispenser head the tubes must be assembled with a Y-connector.

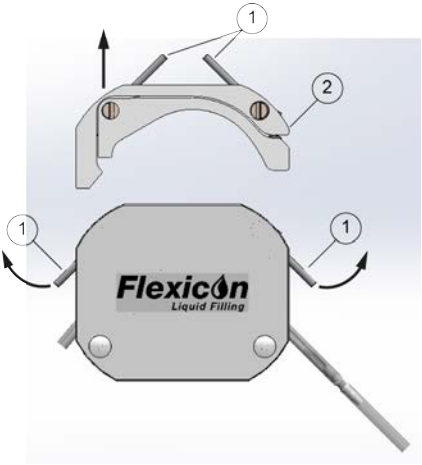


When the Y-connector has been assembled, mount the tubes in the dispenser head as shown below.

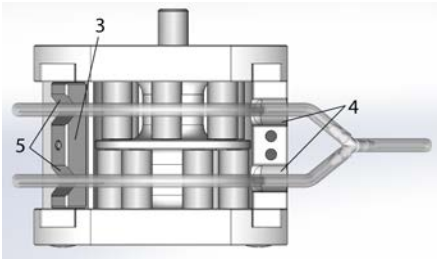
7.4 Loading the tube

Primary operator protection from rotating parts of this pump is provided by isolating the pump from mains power before opening the pump head tube bridge. The pump also provides a tube bridge open indicator. If the tube bridge is opened, the tube bridge open screen is displayed.

1. Open the dispenser head by lifting each of the two locking levers up (1) and lift the tube bridge (2).



2. Mount the correct tube lock (3) on its dowel pin and place the correct tubes in the dispenser head.



3. Looking towards the pump head from the front. The Y-connector must be situated to the right of the dispenser head.

   It is important that the tubes are situated in the two notches (4+5).

4. Place the tube bridge (2) in its tracks and press down the two locking levers (1).

   Never leave the dispenser mounted with tubes overnight.

   At least lift the locking levers (1) up in order to relieve the pressure in the tube.

8 Good pump installation practice

8.1 General recommendations

It is recommended that the pump is sited on a flat, horizontal, rigid surface, free from excessive vibration, to ensure the correct pumphead operation. Allow a free flow of air around the pump to ensure that heat can be dissipated. Ensure that the ambient temperature around the pump does not exceed the recommended maximum operating temperature.

Peristaltic pumps are self-priming and self-sealing against backflow. No valves are required in inlet or discharge line, except those specified as below.

8.2 Dos and don'ts

- Do not build a pump into a tight location without adequate airflow around the pump.
- Do keep delivery and suction tubes as short and direct as possible - though ideally not shorter than one metre - and follow the straightest route. Use bends of large radius: at least four times the tubing diameter. Ensure that connecting pipework and fittings are suitably rated to handle the predicted pipeline pressure. Avoid pipe reducers and lengths of smaller bore tubing than the pumphead section, particularly in pipelines on the suction side. Any valves in the pipeline must not restrict the flow. Any valves in the flow line must be open when the pump is running.
- Do ensure that on longer tube runs at least one metre of smooth bore, flexible tubing is connected to the inlet and discharge port of the pumphead to help to minimise impulse losses and pulsation in the pipeline. This is especially important with viscous fluids and when connecting to rigid pipework.
- Do use suction and delivery pipes equal to or larger than the tubing diameter bore. When pumping viscous fluids use pipe runs with a bore several times larger than the pump tube.
- Do site the pump at or just below the level of the fluid to be pumped if possible. This will ensure flooded suction and maximum pumping efficiency.
- Do run at slow speed when pumping viscous fluids. Flooded suction will enhance pumping performance, particularly for materials of a viscous nature.
- Do recalibrate after changing tubing, fluid or any connecting pipework. It is also recommended that the pump is recalibrated periodically to maintain accuracy.
- Do not pump any chemical not compatible with the tubing or pumphead.
- Do not run the pump with no tube or element fitted to the pumphead.
- Do not strap the control and mains cable together.

9 Connecting to a power supply

A well regulated electrical mains supply is required along with cable connections conforming to the best practice of noise immunity. It is not recommended to site these drives alongside 'dirty' electrical mains devices, such as 3-phase contactors and inductive heaters without special attention being paid to unacceptable mains-borne noise. Make suitable connection to an earthed single-phase mains electricity supply.

The PF7 uses a standard IEC socket and a country specific cord set. Ensure that all power supply cables are adequately rated for the equipment.

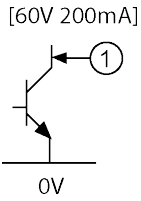
Set the voltage selector to 115V for 100-120V 50/60Hz supplies or 230V for 200-240V 50/60Hz supplies. Always check the voltage selector switch before connecting to the mains supply or the pump will be damaged.

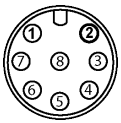
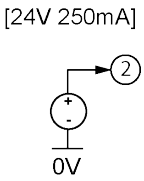
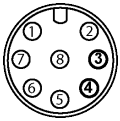
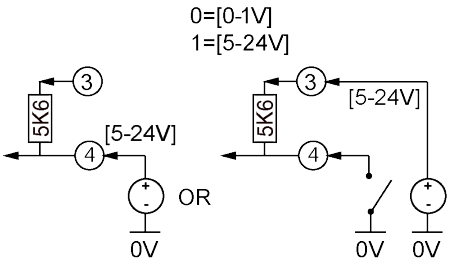
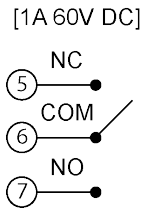
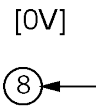
10 Control wiring

There are two off, M12 8-pin connectors on the rear of the PF7 unit; these contain pins that allow both inputs and outputs. Both connectors have the same pin configuration. The use of each pin is shown in the tables below, along with the pin function and the signal response.

Never apply mains power to the M12 connectors. Apply the correct signals to the pins shown. Limit signals to the maximum values shown. Do not apply voltage across other pins. Permanent damage, not covered by warranty, may result.

Pin Type	Pin(s)	CONNECTOR 1 Functionality	CONNECTOR 2 Functionality
Input	4	Start (5-24V)	Prime (5-24V)
Input pull-up	3		
Voltage output (24V)	2	Active	Active
Discrete output (Open Drain)	1	Active when filling (Start delay + filling + end delay)	Inactive when filling
Relay output	5, 6 & 7	General error	Paused
Ground	8		

Function	Pin number	Input/ Output	Signal response
Discrete Output (Open Drain)			

Function	Pin number	Input/ Output	Signal response
Voltage Output (24V)			
Input			
Relay (Normally Closed) Relay (Common) Relay (Normally Open)			
Signal and Power Return			

11 Pump specifications

11.1 Specification ratings

Operating temperature	5C to 40C (41F to 104F)
Storage temperature	-40C to 70C (-40F to 158F)
Humidity (non-condensing)	80% up to 31C (88F) decreasing linearly to 50% at 40C (104F)
Maximum altitude	2000m (6560ft)
Power consumption	140VA
Supply voltage	Filtered 100-120V/200-240V 50/60Hz 1pH
Maximum voltage fluctuation	+/-10% of nominal voltage.
Full load current	<0.6A@ 230V; <1.25A @ 115V
Fuse rating	Ceramic, 5x20mm, 2.5A, 250V AC, Time Delay
Installation category (overvoltage category)	II
Pollution degree	2
IP	IP32 to BS EN 60529
dB rating	<70dB (A) @ 1m
Control ratio	30-400rpm (3700:1)
Maximum speed	400rpm
Weight	12.5kg

12 Troubleshooting

If the pump display remains blank when the pump is switched on, make the following checks:

- Check that the mains power is available to the pump.
- Check the fuse in the wall plug if one is present.
- Check the position of the voltage selector switch.
- Check the mains power switch at the rear of the pump.
- Check the fuse holder in the centre of the switch plate at the rear of the pump.

If the pump runs but there is little or no flow, make the following checks:

- Check that fluid is supplied to the pump.
- Check for any kinks or blockages in the lines.
- Check that any valves in the line are open.
- Check that the tube and rotor are in the pumphead.
- Check that a tube is not split or burst.
- Check that the correct wall-thickness tube is being used.
- Check the direction of rotation.
- Check that the rotor is not slipping on the drive shaft.

13 Pump maintenance (including cleaning)

13.1 Service

There are no user serviceable parts inside the pump. The unit should be returned to a Watson Marlow Ltd or Flexicon approved service centre for service. For any additional service requirements, including help with scheduled maintenance of pump heads when included with any system please contact your nearest Watson Marlow Ltd or Flexicon representative.

13.2 Cleaning

Always isolate the pump from the mains power supply before opening any guard or track, or performing any positioning, removal or maintenance operation.

Remove the tube bridge and the tubes before cleaning the pump.

Acceptable cleaning agents regime	Cleaning precautions
Hydrogen peroxide vapour	Please follow all the Safety Data Sheet (MSDS) precautions.
Ethyl Alcohol 70%	Please follow all the Safety Data Sheet (MSDS) precautions.
Surface disinfectant containing Formaldehyde	Please follow all the Safety Data Sheet (MSDS) precautions.
6% concentration of hydrogen peroxide in water for injection (WFI)	Please follow all the Safety Data Sheet (MSDS) precautions.

13.3 Pumphead Removal

To remove the pumphead from the PF7, remove the tube bridge. Using a 5mm Hex key, remove the two pumphead mounting screws as shown below.

14 Warranty

Watson-Marlow Limited ("Watson-Marlow") warrants this product on behalf of Flexicon to be free from defects in materials and workmanship for five years from the date of shipment, under normal use and service.

Watson-Marlow's sole responsibility and the customer's exclusive remedy for any claim arising out of the purchase of any product from Watson-Marlow is, at Watson-Marlow's option: repair, replacement or credit, where applicable.

Unless otherwise agreed in writing, the foregoing warranty is limited to the country in which the product is sold.

No employee, agent or representative of Watson-Marlow has the authority to bind Watson-Marlow to any warranty other than the foregoing unless in writing and signed by a director of Watson-Marlow. Watson-Marlow makes no warranty of the fitness of its products for a particular purpose.

In no event:

i. shall the cost of the customer's exclusive remedy exceed the purchase price of the product;

ii. shall Watson-Marlow be liable for any special, indirect, incidental, consequential, or exemplary damages, however arising, even if Watson-Marlow has been advised of the possibility of such damages.

Watson-Marlow shall not be liable for any loss, damage, or expense directly or indirectly related to or arising out of the use of its products, including damage or injury caused to other products, machinery, buildings, or property. Watson-Marlow shall not be liable for consequential damages, including without limitation, lost profits, loss of time, inconvenience, loss of product pumped, and loss of production.

This warranty does not obligate Watson-Marlow to bear any costs of removal, installation, transportation, or other charges which may arise in connection with a warranty claim.

Watson-Marlow shall not be responsible for shipping damage of returned items.

Conditions

- Products must be returned by pre-arrangement to Watson-Marlow, or a Watson-Marlow or Flexicon approved service centre.
- All repairs or modifications must have been made by Watson-Marlow, or a Watson-Marlow or Flexicon approved service centre or with the express permission in writing of Watson-Marlow, signed by a manager or director of Watson-Marlow.
- Any remote control or system connections must be made in accordance to Watson-Marlow recommendations.

Exceptions

- Consumable items including tubing and pumping elements are excluded.
- Pumphead rollers are excluded.
- Repairs or service necessitated by normal wear and tear or by lack of reasonable and proper maintenance are excluded.

- Products which, in the judgement of Watson- Marlow, have been abused, misused, or subject to malicious or accidental damage or neglect are excluded.
- Failure caused by electrical surge is excluded.
- Failure caused by incorrect or sub-standard system wiring is excluded.
- Damage by chemical attack is excluded.
- Ancillaries such as leak detectors are excluded.
- Failure caused by UV light or direct sunlight.
- Any attempt to disassemble a Watson-Marlow product will invalidate the product warranty.

Watson-Marlow reserves the right to amend these terms and conditions at any time.

15 Information for returning pumps

In compliance with the UK Health and Safety at Work Act and the Control of Substances Hazardous to Health Regulations, you are required to declare the substances which have been in contact with product(s) you return to Watson-Marlow Ltd or it subsidiaries or distributors. Failure to do so will cause delays. Please ensure that you email us this information and receive a RGA (Returned Goods Authorisation) before you despatch the product(s). A copy of the RGA form must be attached to the outside of the packaging containing the product(s).

Please complete a separate decontamination certificate for each product and attach it to the outside of the packaging containing the product(s). A copy of the appropriate decontamination certificate can be downloaded from the Watson-Marlow Ltd website at www.wmftg.com

You are responsible for cleaning and decontaminating the product(s) before return.

16 Name and address of manufacturer

Watson Marlow Ltd
Falmouth, Cornwall
TR11 4RU
UK
Telephone: +44 (0) 1326 370370
Fax: +44 (0) 1326 376009
Email: aftersales.uk@wmftg.com
www.wmftg.com

17 Disclaimers

The information contained in this document is believed to be correct but Watson-Marlow Ltd Fluid Technology Group accepts no liability for any errors it contains and reserves the right to alter specifications without notice.

WARNING: This product is not designed for use in and should not be used for, patient-connected applications.