Reference Manual

qdos H-FLO

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1 Preface

1.1 Disclaimer

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

If the product is used in a way that is not intended or described in these instructions, the protection, performance, and/or lifespan may be negatively affected.

1.2 Translation of the original instructions

This instruction handbook has originally been written in English. Other language versions of this instruction handbook are a translation of the original instructions.

Table of contents

2 Introduction to the document

2.1 User groups

These instructions are the installation and maintenance instructions, for a Watson-Marlow qdos H-FLO pump, for reference during the products lifecycle by a:

User group	Definition
Responsible Person	A person, competent in their aera of expertise, in or acting on behalf of the users organisation responsible for: Installation, safe use of the product by operators, cleaning, maintenance, troubleshooting or decommissioning.
Operator	Competent person operating the product for its intended use.

2.1.1 Responsibility

A responsible person must use these instructions to:

- Ensure the product will be used within the scope of :
    - Intended Use (see "4.3 Intended use" on page 24)
    - Pumping of flammable liquids ("3.4 Pumping of flammable liquids" on page 22)
- Prior to a task, such as installation, operation or maintenance
    - Do a risk assessment.
    - Determine suitable personal protective equipment (PPE) that must be worn. Consider the following minimum PPE
        - Safety glasses
        - Safety boots
        - Gloves
- Train an operator to carry out task as required by the users organisation, such as operating the product, cleaning or maintenance.
- Approve water as a cleaning agent for use if required (see "25 Cleaning" on page 229)

The product must only be used by persons who have read and understood these instructions prior to a relevant task.

2.2 Information types

Specific non-safety information is presented throughout these instructions in the following format:

Information type	Explanation
Model variations	These instructions cover multiple models. Where instructions only apply to specific models, brackets ( ) and the word only are used in headings.
Abbreviations	Frequent abbreviations are identified when first used, using brackets, after the full name of the item: Example: Personal Protective Equipment (PPE)
Note	A note is a piece of additional information to consider. A note is indicated by a **superscript**. Example: **NOTE 1** **Body text of note**

2.3 Trademarks

- Watson-Marlow®, qdos® and ReNu® are registered trademarks of Watson-Marlow Limited.
- PROFIBUS® and PROFINET® are registered trademarks of PROFIBUS and PROFINET International (PI).
- EtherNet/IP is a registered trademark of ODVA, Inc.
- Viton® is a registered trademark of Dupont Dow Elastomers L.L.C.

3 Safety

3.1 Product damage—Remove from service

In the event of product damage. The pump must be removed from service by a responsible person. Do not continue to operate the pump.

3.2 Safety symbols

The following safety symbols may be used on the product, packaging and in these instructions:

Symbol	Name	Description
	**Hot surface**	This symbol indicates that the marked item can be hot and should not be touched without taking precautions
	**PPE required**	This symbol indicates Personal Protective Equipment must be worn prior to a task
	**Hazardous voltage**	This symbol indicates that hazardous voltages are present where a risk of electrical shock exists.
	**Rotating parts**	This symbol indicates rotating parts which should not be touched without following a safety instruction
	**Explosion**	This symbol indicates that there is a risk of explosion if the pump is misused in a specific manner.
	**Potential hazard**	This symbol identifies that an appropriate safety instruction should be followed or a potential hazard exists

3.2.1 Instructions for renewing safety symbols

If the safety labels on the product become accidently damaged, contact your local Watson-Marlow representative for information on obtaining replacements.

3.3 Safety signals

Signals indicate a possible hazard. Signals are used in these instructions when immediately relevant to the information, task or procedure.

3.3.1 Signals: With risk of personal injury

Signals indicating risk of a personal injury are presented when relevant to a task in this format:

WARNING

The WARNING signal word indicates a hazard. Risk of serious injury or death exists if the hazard is not avoided. Equipment or property damage may also occur.

 A safety symbol indicates a hazard with personal injury risk.	Hazard information—Information to explain: • Hazard type or nature of hazard • What could happen • How to avoid hazard

CAUTION

The CAUTION signal word indicates a hazard. Risk of minor or moderate injury exists if the hazard is not avoided. Equipment or property damage may also occur.

 A safety symbol indicates a hazard with personal injury risk.	Hazard information—Information to explain: • Hazard type or nature of hazard • What could happen • How to avoid hazard

3.3.2 Signals: With risk of equipment or property damage only

Signals indicating risk of equipment or property damage only are presented when relevant to a task in this format:

NOTICE

The NOTICE signal word indicates a hazard. Risk of equipment or property damage only.

Hazard information—Information to explain:

- Hazard type or nature of hazard
- What could happen
- How to avoid hazard

3.4 Pumping of flammable liquids

The pump is prohibited from installation or operation in explosive atmospheres. If the pump is to be used for the pumping of flammable liquids, a responsible person must carry out a risk assessment to ensure an explosive atmosphere could not occur by any activity involving: installation, operation, maintenance or decommissioning of the product.

The risk assessment should consider all risks, including:

- Leaks or spillage of the flammable liquid during:
    - First time pumphead installation procedure
    - Installation of all components of the fluid path
    - Maintenance replacement of the pumphead
    - Removal of the fluid path, or other decommissioning activity.
- Operating the pump to the point of pumphead tubing failure, resulting in:
    - Chemical incompatibility with pump materials of construction becoming exposed to the flammable liquid
    - Flow of flammable liquid through the pumphead safety overflow, into the process safety overflow system
- Ignition and spread of fire due to a leak, spillage or other escape of the flammable liquid into the process area.

The above list is not exhaustive. Its purpose is to provide additional guidance which a person unfamiliar with the product, may not otherwise consider.

4 Product overview

This section provides a product and specification overview.

4.1 Product introduction

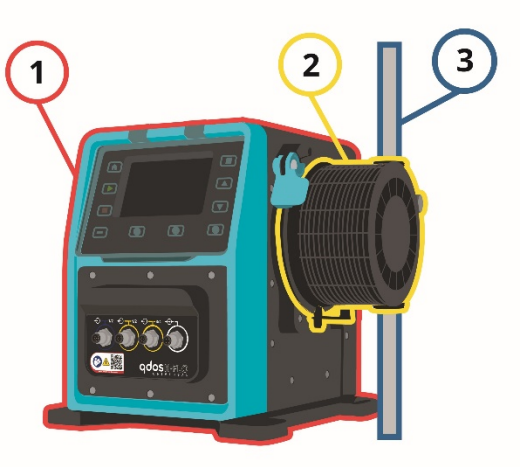
The Qdos® range of peristaltic chemical metering and dosing pumps cut costs through higher precision metering, with an accuracy of ±1 % and repeatability of ±0.5 % in dosing.

Qdos H-FLO pump delivers the same outstanding accuracy and reliability as other Qdos pumps but for higher flow rates, with a high chemical compatibility through a range of pumpheads.

The unique ReNu® pumphead achieves cost savings through minimal maintenance downtime. ReNu technology is a tool-free pumphead that fully contains fluid, which keeps your production area clean and free from contamination risk. The patented design enables accurate and repeatable flow for fluids of a wide range of viscosities.

4.2 General description

A Watson-Marlow qdos pump provides a flowrate of fluid through a fluid path, by the principle of positive displacement from the pumphead. A general illustration is provided below:



Number	Description
1	Pump drive
2	Pumphead
3	Process fluid path

4.3 Intended use

All model variants of the qdos range of pumps are designed for controlled fluid movement, in ordinary safe locations, except those fluids or applications listed below:

Prohibited use:

- Environments that require explosion proof certification.
- With fluids not chemically compatible [1]
- Installations, environmental or operating conditions which are beyond the specifications provided in these instructions.
- Applications with are directly life sustaining
- Applications within a Nuclear Island

NOTE 1 A procedure for checking chemical compatibility is provided in "28 Chemical compatibility" on page 250.

4.4 Pump models

A qdos pump is a combination of

- A qdos H-FLO drive
- A ReNu pumphead

The model variation, general arrangement, and features of each of these components is explained in the following sub-sections.

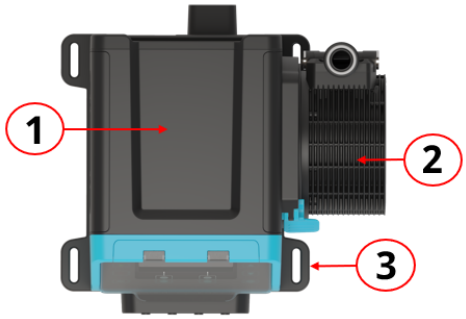
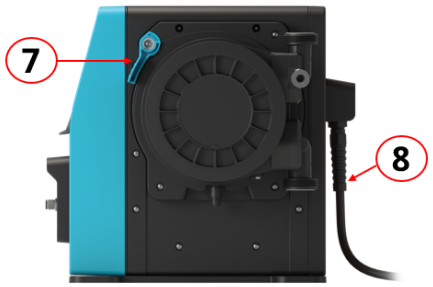
4.4.1 Drive: Model variations

qdos H-FLO drive is available in the following model variations:

<table>
<tr><th>Item</th><th>Variation</th></tr>
<tr><td>Pumphead mounting variations</td><td>2 pumphead mounting models (left or right)</td></tr>
<tr><td>Control models</td><td>6 control models:
Manual only control
Manual model (digital start/stop only)
Manual, or Analogue or Digital control
Universal
Universal+
Manual, or Network control
PROFIBUS
EtherNet/IP
PROFINET</td></tr>
<tr><td>Control connections</td><td>2 types of input and output control connections:
M Type: with M12 control connections
T Type: with user wired cable gland connections
<table>
<tr><th>Name</th><th>Description</th><th>Location</th><th>Models</th><th>Product code</th></tr>
<tr><td>M type</td><td>with M12 control connections</td><td>  </td><td>Manual
Universal
Universal+
PROFIBUS
EtherNet/IP
PROFINET</td><td>Product codes containing the letter M</td></tr>
<tr><td>T type</td><td>with user wired cable gland connections</td><td>  </td><td>Option only for
Universal
Universal+</td><td>Product codes containing the letter T</td></tr>
</table></td></tr>
</table>

4.4.2 Drive: General arrangement

The general arrangement of a DriveSure drive is illustrated below:

Number	Description	Picture
1	Drive	
2	Pumphead	
3	Baseplate	
4	HMI cover (shown open, resting on top of drive)	
5	HMI screen	
6	Control connections	
7	Pumphead locking lever	
8	Power cable	

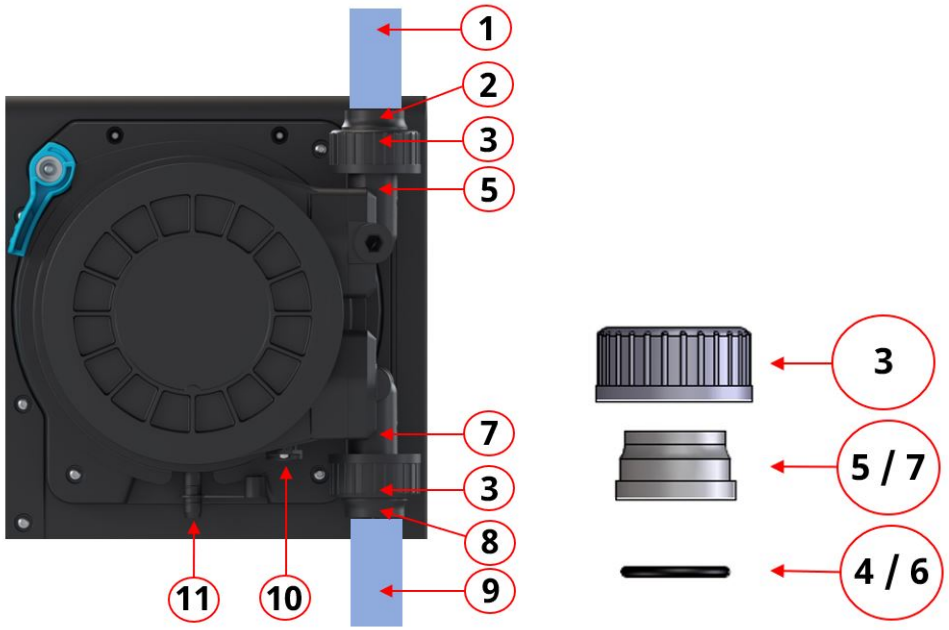
4.4.3 Pumphead: Model variations

There are 2 different pumphead types.

Pumphead	Application
ReNu SEBS	Optimised for sodium hypochlorite, and sulphuric acid applications
ReNu Santoprene	General purpose with great chemical compatibility across a range of applications

4.4.4 Pumphead: General arrangement

The general arrangement of a pumphead, with exploded view of the pumphead to fluid path connector is provided in the images below



Number	Name	Normally wetted by pumped fluid
1	Discharge fluid path	■
2	Discharge fluid connector, PVC-U	■
3	Connection collar, PVC-U	
4	Pumphead discharge fluid connection port o-ring	■
5	Pumphead discharge fluid connection port	■
6	Pumphead inlet fluid connection port o-ring	■
7	Pumphead inlet fluid connection port	■
8	Inlet fluid connector, PVC-U	■
9	Inlet fluid path	■
10	Pumphead drain	
11	Safety overflow	

4.5 Accessories

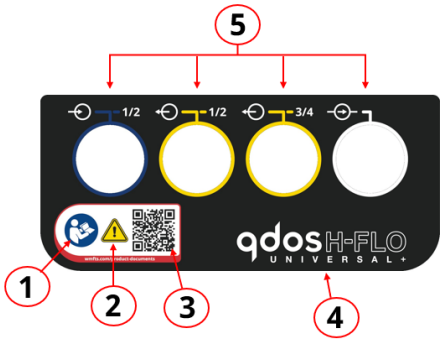
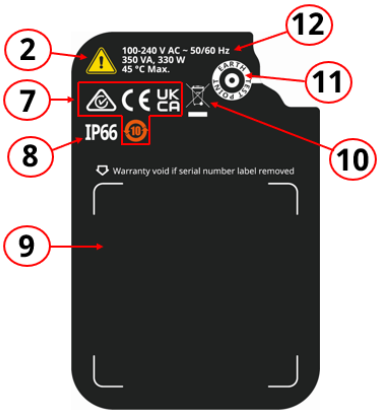
The qdos range is available with the following Watson Marlow accessories.

Item	Product code
Qdos H-FLO Fluid connector (Hydraulic Connection), PVC-U 3/4'' NPT (F)	0M9.601H.U03 [1]
Qdos H-FLO Fluid connector (Hydraulic Connection), PVC-U Rp 3/4''	0M9.601R.U03 [1]
Qdos H-FLO Connection Collar, PVC-U 25mm	0M9.601R.U0E [1]
Qdos H-FLO Control cable - General I/O M12A 8W Cable Straight F Connection, 3m (10ft) Length, Unshielded 24AWG	0M9.603Z.0CF [2]
Qdos control cable for manual model, M12A 5 Pin Yellow Insert , 3m (10ft) Length	0M9.203Y.000 [3]
Profibus Terminating Plug M12B 4W Male	0M9.603W.0EN
Qdos H-FLO Pressure Sensing Kit	0M9.605K.FTA [4]
Qdos H-FLO Pressure Sensing Kit - Gland Version U and U+	0M9.605K.FTT [4]

NOTE 1	The fluid connector and connection collars are supplied as a pair (2 off)
NOTE 2	The M12 8W (8 wire) control cable is for the Universal/Universal+ models only
NOTE 3	The control cable for use with the manual model features a 5 pin female m12 connector, This 5 pin connector will connect to male 4 pin, M12 connector of the manual model. The 5th pin (centre) is not used.
NOTE 4	The pressure sensing kit will be available for purchase Q2, 2024. The kit includes the relevant control cable .

Do not fit any devices or accessories other than those approved by Watson-Marlow or as specified in these instructions

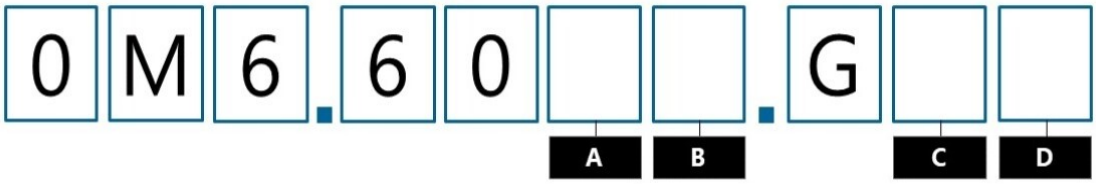
4.6 Product labels

Number	Name	Picture
1	Symbol: refer to these instructions	
2	Safety symbol	
3	QR code for instructions	
4	Product Range/Model	
5	Control connection labels	
6	Product manufacturer	
7	Compliance symbols	
8	Ingress protection rating	
9	Product serial number label location	
10	Disposal Symbol (not household waste)	
11	Earth bond test point	
12	A/C Power supply requirements	

4.7 Product code guide

The product model may be identified from its product code . The drive and pumphead each have a separate product code. These product codes are explained in the subsections below.

4.7.1 Drive product code



A	B	C	D
Model	**Input/Output connectors**	**Pumphead orientation**	**Power plug**
3: Manual 4: Universal 5: Universal+ 7: PROFIBUS 8: EtherNet/IP 9: PROFINET	M: M12 connectors T: User-wired cable gland connectors	L: Left R: Right	A: US B: Brazil C: Swiss D: India, South Africa E: European K: Australia R: Argentina U: UK Z: China

4.7.2 Pumphead product code

Description	Product code
ReNu 150 pumphead Santoprene	0M3.6200.PFP
ReNu 300 pumphead Santoprene	0M3.7200.PFP
ReNu 300 pumphead SEBS	0M3.7800.PFP
ReNu 600 pumphead Santoprene	0M3.8200.PFP

4.8 Specification

4.8.1 Performance

4.8.1.1 Flowrate and discharge pressure

Flow rates in the table below are based on pumping water at 20 °C in a 0 bar inlet and discharge pressure application

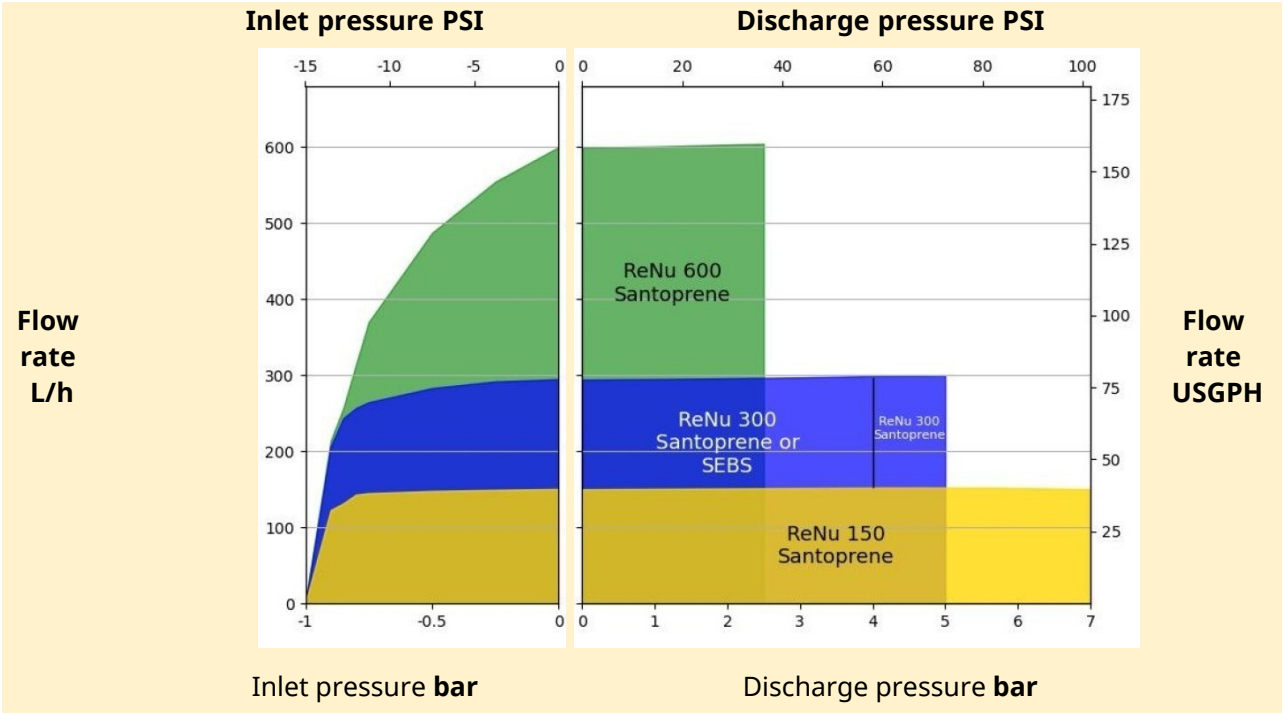
Pumphead	Flow rate				Discharge pressure	
	Min.		Max.		Max.	
	L/h	USGPH	L/h	USGPH	Bar	PSI
ReNu 150 Santoprene	0.12	0.032	150	39.62	7	102
ReNu 300 Santoprene	0.12	0.032	300	79.36	5	73
ReNu 300 SEBS	0.12	0.032	300	79.36	4	58
ReNu 600 Santoprene	0.12	0.032	600	158.5	2.5	36

Refer to the performance chart in the next section, for a graphical representation of the flow rate versus application pressure under certain conditions.

4.8.1.2 Performance curve

The performance curve demonstrates the impact of inlet and discharge pressure, on the flowrate from the pump, under the following conditions :

- Pumping water at 20 °C
- Maximum pumphead speed (rpm)



4.8.2 Physical specification

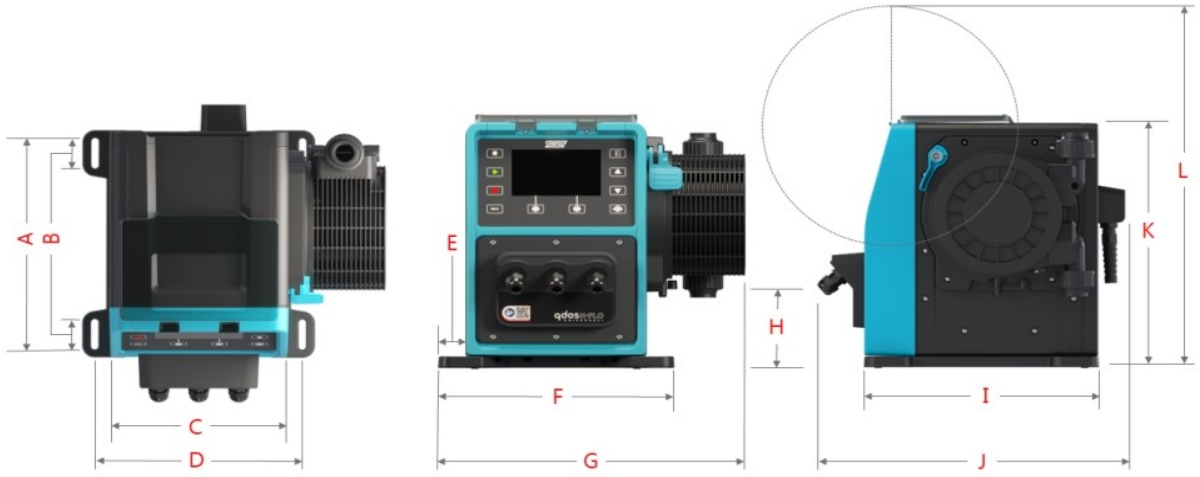
4.8.2.1 Environmental and operating conditions

Item	Specification
Ambient temperature range	5 °C to 45 °C (41 °F to 113 °F)
Humidity (non-condensing)	80 % up to 31 °C (88 °F), decreasing linearly to 50 % at 40 °C (104 °F)
Maximum altitude	2,000 m, (6,560 ft)
Pollution degree of the intended environment	2
Noise	<70 dB(A) at 1 m
Maximum fluid temperature [1]	SEBS pumpheads: 40°C (104 °F) [1] Santoprene pumpheads: 45°C (113 °F) [1]
Environment	Indoor and limited outdoor [2]
Ingress protection	IP66, NEMA4X

NOTE 1 Chemical compatibility is dependent on temperature. A procedure for checking chemical compatibility is provided in "28 Chemical compatibility" on page 250.

NOTE 2 Under certain conditions the pump is suitable for limited outdoor use. Contact your Watson-Marlow representative for advice.

4.8.2.2 Dimensions



A		B		C		D		E		F	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
276.0	10.866	35.0	1.378	224.0	8.819	260.0	10.236	33.7	1.327	291.5	11.476
G		**H**		**I**		**J**		**K**		**L**	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
380.0	14.961	118.7	4.673	334.3	13.161	394.2	15.520	332.3	13.083	482.0	18.976

4.8.2.3 Weight

4.8.2.3.1 Drive: M type

Model	Weight	
	kg	lbs
Manual	11.6	25.57
Universal	11.7	25.79
Universal+	11.7	25.79
PROFIBUS	11.7	25.79
EtherNet/IP	11.7	25.79
PROFINET	11.7	25.79

4.8.2.3.2 Drive: T type

Model	Weight	
	kg	Ibs
Universal	11.8	26.01
Universal+	11.8	26.01

4.8.2.3.3 Pumphead

Model	Weight	
	kg	Ibs
ReNu 150 pumphead Santoprene	2.6	5.73
ReNu 300 pumphead Santoprene	2.6	5.73
ReNu 300 pumphead SEBS	2.6	5.73
ReNu 600 pumphead Santoprene	2.6	5.73

4.8.3 Electrical power specification

Item	Specification
Power supply voltage/Frequency	Alternating Current (~100 V to 240 V AC 50/60 Hz)
Maximum voltage fluctuation	±10 % of nominal voltage
Overvoltage category	II
Rated power	350 VA, 330 W

4.8.4 Control specification

4.8.4.1 Speed increment

Item	Specification
Speed adjustment range	1900:1
Minimum drive shaft adjustment speed increment	0.1
4-20 mA resolution [1]	2184:1

NOTE1 4-20 mA resolution is only applicable to the Universal and Universal+ models

4.8.4.2 Control feature summary table

The control features of a qdos pump are summarised in the table below.

- M = M type control connections (M12)
- T = User wired cable gland connections (option for Universal and Universal+ model pumps only)

Operational modes	Manual	Universal	Universal+	EtherNet/IP	PROFIBUS	PROFINET
Manual	●	●	●	●	●	●
Bus Network Communication				●	●	●
Contact mode		●	●			
4-20 mA		●	●			
Fault reporting	●	●	●	●	●	●
Security	**Manual**	**Universal**	**Universal+**	**EtherNet/IP**	**PROFIBUS**	**PROFINET**
Keypad lock	●	●	●	●	●	●
PIN lock to protect set up	●	●	●	●	●	●
Features	**Manual**	**Universal**	**Universal+**	**EtherNet/IP**	**PROFIBUS**	**PROFINET**
RFID pumphead detection	●	●	●	●	●	●
Revolution counter	●	●	●	●	●	●
Flow calibration	●	●	●	●	●	●
Run hours	●	●	●	●	●	●

Operational modes	Manual	Universal	Universal+	EtherNet/IP	PROFIBUS	PROFINET
Advanced diagnostics				●	●	●
Numerical flow display	●	●	●	●	●	●
Numerical speed display	●	●	●	●	●	●
Fluid level monitor	●	●	●	●	●	●
Max (prime)	●	●	●	●	●	●
Control methods	**Manual**	**Universal**	**Universal+**	**EtherNet/IP**	**PROFIBUS**	**PROFINET**
Auto restart (after power restored)	●	●	●	●	●	●
Fluid recovery	●	●	●	●	●	●
Leak detection	●	●	●	●	●	●
5” (127 mm) colour TFT display	●	●	●	●	●	●
Input/Output options	M	M or T	M or T	M	M	M
Manual control capability	●	●	●	●	●	●
4-20 mA input & calibration		●	●			
4-20 mA output			●			
Contact input (pulse/batch)		●	●			
Pressure sensor input (pressure sensor purchased separately)		●	●	●	●	●
Manual speed adjustment range*	1900:1	1900:1	1900:1	1900:1	1900:1	1900:1
Minimum drive shaft adjustment speed increment	0.1	0.1	0.1	0.1	0.1	0.1
4-20 mA resolution		2184:1	2184:1			
Run stop input	●	●	●			
Run status output		●	●			
Alarm output		●	●			
Four configurable relay outputs		●	●			

Operational modes	Manual	Universal	Universal+	EtherNet/IP	PROFIBUS	PROFINET
Remote fluid recovery input		•	•	•	•	•
*Speed adjustment range depends upon pumphead chosen, maximum shown						

4.8.4.3 Start up defaults

Option	Default
Auto Restart	OFF
Auto Keypad Lock	OFF
Pin Protection	OFF
Asset Number	123465789A
Label for Pump	WATSON-MARLOW
Mode: Manual	Manual
Run Hours	0
Volume Counter (L)	0
Analog Scaling Factor	1.00
Flow calibration value	32.29

4.9 HMI Overview

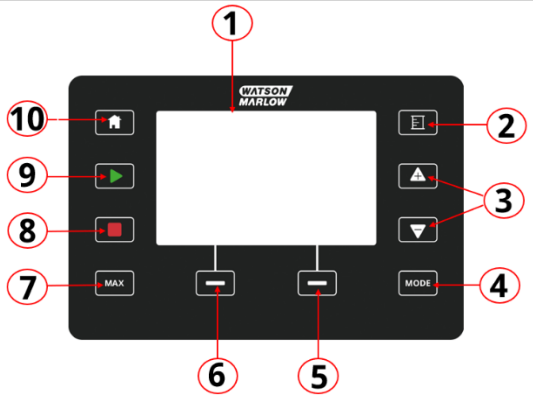
The HMI is a TFT display with keys. The keys are used to access the menus to configure or operate the pump.

Information relating to the HMI key and menus is explained in the table below:

Item	Method
Select button	Words highlighted in BLACK indicate the on screen options selected by pressing soft key
Button on pump	Words in **BLACK AND BOLD UPPER CASE** indicate the name of a key on the pump. For example, **START**
On screen text	Words in **Bold And Blue** are prompts that are displayed on the pump screen. For example, **General Settings** .
On screen header	Words in **BLUE AND BOLD UPPER CASE** are the header as displayed at the top of the pump screen. For example, **MAIN MENU**.

4.9.1 HMI layout

A summary of the key function is provided below:



Number	Name	Summary
1	Colour TFT display	HMI display with backlight.
2	Flow calibration	Key activates flow calibration mode
3	+/- Keys	Keys are used to change programmable values or move the selection bar up or down in the menus.
4	**MODE** [1]	When the MODE key is pressed the MODE menu is shown
5	Soft key 2	Perform the function displayed directly above the key.
6	Soft key 1	Perform the function displayed directly above the key
7	**MAX**	Key will run pump at maximum speed when in manual mode. This is useful for priming the pump.
8	**STOP**	Key will stop the pump in any control mode, when pressed at any time.
9	**START**	Key will: • Start the pump at the set speed when in manual mode or during flow calibration. • Deliver a contact dose when in CONTACT mode. In all other control modes this key will not start the pump.
10	**HOME** [1]	When the **HOME** key is pressed it will return user to HOME screen which displays the last known operating mode.

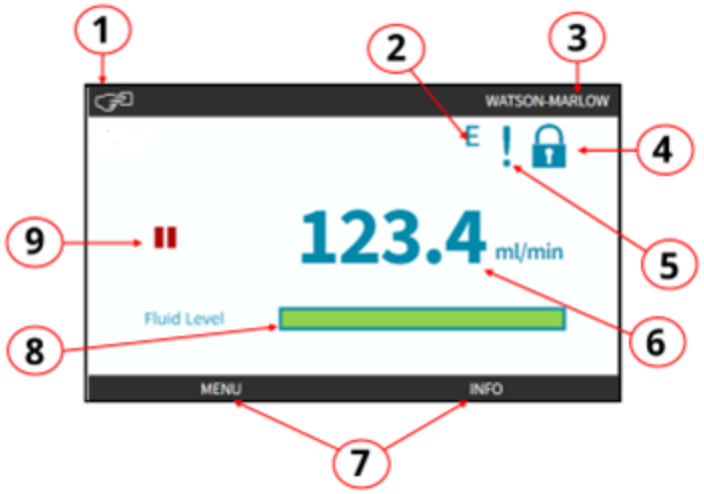
NOTE 1 If the **MODE** or **HOME** key is pressed while changes to settings are in progress, these changes will not be saved

4.9.2 HOME screen

The HOME screen is the main screen showing the last selected operating mode in Manual Mode. This screen is accessed using the HOME key.

An example of a HOME screen in Manual Mode is shown below.

Home Screen: (Manual mode)



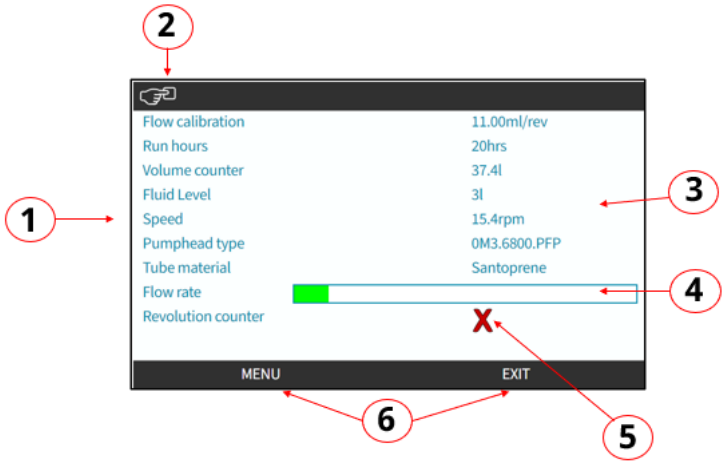
Item	Description
1	Indicates menu selection.
2	Indicates network is connected, (EtherNet/IP shown)
3	Displays pump label
4	Indicates keypad lock is enabled
5	Indicates pump is in Auto Restart mode (when Auto restart is enabled)
6	Displays pump speed and units
7	Indicates MENU and INFO options accessible by using soft keys
8	Progress bar only displayed if the Fluid level monitor or Revolution counter features are enabled
9	Indicates pump running status ■ The pump displays a RED stop icon when it is in a manually stopped condition. In this state the pump will not start unless the START key is pressed ■■ The pump displays a RED PAUSE icon when it is receiving a remote stop input whilst in a standby condition. The pump is placed in a standby condition by pressing the START key in manual mode, or by selecting Analog mode. In this state the pump will respond to a change in state of the start/stop input and may start automatically when it receives a control signal. When the pump is running it displays a turning icon to indicate a pumping state

4.9.3 INFO screen

The INFO screen should inform the user of the configuration of the drive. It is accessible even when pin protection is active. The info screen is accessible from the home screen of the drive in any mode using the INFO key.

An example of the INFO screen is shown below.

INFO Screen: (Manual mode)



Item	Description
1	User selected features.
2	Menu selection.
3	User set values and items
4	Visual flow rate bar
5	Visual indication if revolution counter is enabled or disabled
6	Indicate MENU and EXIT options accessible by using soft key

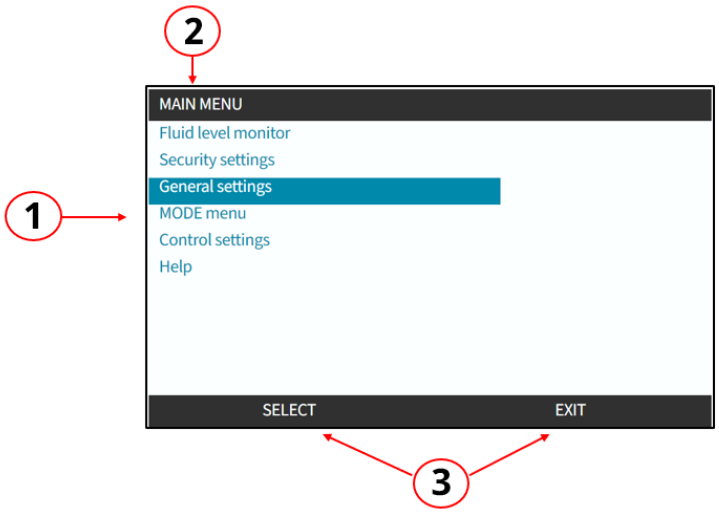
The features available on screen will be dependent on the drive model.

4.9.4 MAIN MENU overview

The MAIN MENU is the highest level menu. All features, functionality and settings are accessible through this menu and subsequent sub-menus.

The main menu screen is shown below.

MAIN MENU Screen:



Item	Description
1	User selected sub menus.
2	Menu selection.
3	SELECT and EXIT options accessible by using soft keys.

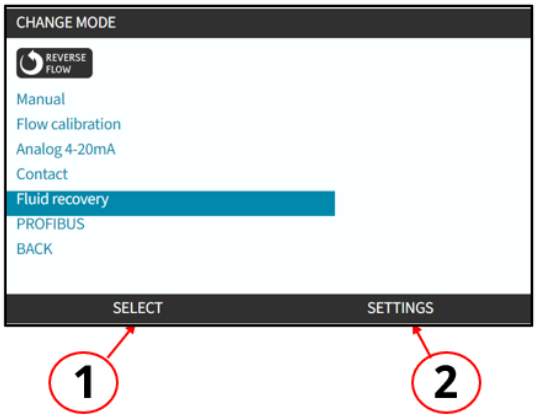
The main menu contains the following sub menus:

Sub menu	Summary
Fluid level monitor	Menu used to set up and view the inlet vessel fluid level.
Security settings	Menu used to control the access to the pump, such as PIN protection
General settings	Menu used to make general settings such as language, flow units, asset number, restore defaults etc
MODE menu	Menu used to change the mode of the pump, such as manual, analog or network mode
Control settings	Menu used to set control settings such as pumphead speed limit, reset run hours, configure inputs and outputs.
Help	Menu used to display help, such as a link to these instructions, the asset number, or software version.

4.9.5 MODE MENU overview

The MODE menu lists the available modes. Access to the MODE menu is through soft key 1 when the option is highlighted. If required, the settings will be available through soft key 2 when the option is highlighted.

MODE MENU Screen:



Item	Description
1	SELECT enables access to selected mode
2	SETTINGS allows configuration of selected mode.

The MODE menu contains the following sub menus.

Mode	Summary	Model exception
Manual (default)	Allows pump to be operated manually (Start/Stop/Speed)	Pump can also be operated via Start/Stop input
Flow calibration	Flowrate is calibrated to the pump	ALL MODELS
Analog 4-20 mA	Pump speed is controlled by an Analog signal	Universal and Universal+ only
Contact mode	Pump will meter a specific dose of fluid when an external signal is received, or operator presses the green **START** button.	Universal and Universal+ model only
PROFIBUS	Allows data exchange	PROFIBUS only
Ethernet/IP	Allows data exchange	EtherNet/IP only
PROFINET	Allows data exchange	PROFINET only
Fluid Recovery	Allows pump to operate in reverse to recover fluid from discharge line.	All models

5 Storage

5.1 Storage conditions

- Storage temperature range: -20 °C to 70 °C (-4 °F to 158 °F)
- Indoors
- Not in direct sunlight
- Humidity (non-condensing): 80 % up to 31 °C (88 °F), decreasing linearly to 50 % at 40 °C (104 °F)

5.2 Shelf life

The pumphead shelf life[1] is 2 years when stored in the original packaging within the storage conditions provided in the section above.

NOTE 1 The pumphead shelf life is written on the label on the side of the box

6 Lifting and carrying

6.1 Product in packaging

The drive and pumphead are not supplied in the same packaging. The weight is as follows:

6.1.1 Packed Weight

6.1.1.1 Drive: M type

Model	Packed weight	
	kg	lbs
Manual	14.8	32.63
Universal	14.9	32.85
Universal+	14.9	32.85
PROFIBUS	14.9	32.85
EtherNet/IP	14.9	32.85
PROFINET	14.9	32.85

6.1.1.2 Drive: T type

Model	Packed weight	
	kg	lbs
Universal	15.0	33.07
Universal+	15.0	33.07

6.1.2 Procedure: Lifting and carrying product in packaging

CAUTION

The packaged pump weighs up to 15.0 Kg (33.07 lb) depending upon model. The weight of the pump could cause a foot injury if dropped. Wear designated personal protective equipment when lifting and moving the pump.

Lift and carry the product using the procedure below:

1. Observe, the upright symbol on the packaging. 
2. Use two hands to lift the package at a time, in accordance with local health and safety procedures, keeping the product upright at all times.

6.2 Product removed from packaging

If the product has been removed from the packaging:

- Do not lift the pump by the top of the HMI.
- Obey the following safety signals

CAUTION

Lifting or moving the pump with the pumphead installed may result in the pumphead disengaging from the drive and falling.

CAUTION

Do not place or move the drive, by holding the driveshaft. The driveshaft has edges which may cause an abrasion.

7 Unpacking

7.1 Components supplied

A H-FLO drive and pumphead are sold separately. The components supplied with each part are detailed below

7.1.1 Drive

The drive will come with the following items included within the packaging

- Chosen model of drive unit
- 2 x Fluid connectors (3/4" Female Parallel thread in a PVC-U) in either Rp or NPT [1]
- 2 x Connection collars (PVC-U)
- Power cable (non- detachable) with regional power plug
- 3 x cable glands for T type only control connection models [2]
- Safety information leaflet with QR code to these instructions
- Declaration of Conformity

NOTE 1	Drives with an “A” at the end of the product code are supplied with NPT fluid connectors. All other drive product codes are supplied with the Rp fluid connectors.
NOTE 2	The 3 control connection cable glands are only supplied with the type T models.

7.1.2 Pumphead

The pumphead will come with the following items included within the packaging:

- Chosen model of pumphead
- 2 x Pumphead fluid connection seals pre-installed in the pumphead
- Safety information leaflet with QR code to these instructions
- Declaration of Incorporation

7.2 Unpacking, inspection and packaging disposal

1. Carefully remove all parts from the packaging.
2. Check that all components in "7.1 Components supplied" on the previous page are present
3. Inspect components for damage in transit.
4. If anything is missing or damaged, contact your Watson-Marlow representative immediately.
5. Dispose of the packaging according to local procedures.
    - Inner and outer carton: Cardboard (recyclable)
    - Pumphead protection: Plastic bag (recyclable)
    - Documents and accessory protection: Plastic bag (recyclable)

8 Installation—Overview

8.1 Responsibility

Installation must only be undertaken by a responsible person competent in their area of expertise to the installation chapter.

8.2 Using the HMI for installation

The use of the HMI will be required to set up the pump during installation. Review the HMI overview of screens, key operation and menus, in "4.9 HMI Overview" on page 39 prior to carrying out an installation task.

8.3 Installation chapter sequence

Installation is provided in the following sequence:

1. "9 Installation—Chapter 1: Physical" on page 52
2. "10 Installation—Chapter 2: Electrical power" on page 58
3. "11 Installation—Chapter 3: Fluid path" on page 62
4. "12 Installation—Chapter 4 Overview: Control" on page 77

   This chapter is divided into sub chapters depending on model:

   - "13 Installation—Sub-Chapter 4A: Control (Model: Manual)" on page 78
   - "14 Installation—Sub-Chapter 4B: Control (Models: Universal and Universal+)" on page 85
   - "15 Installation—Sub-Chapter 4C: Control (Model: PROFIBUS)" on page 134
   - "16 Installation—Sub-Chapter 4D: Control (Model: EtherNet/IP)" on page 152
   - "17 Installation—Sub-Chapter 4E: Control (Model: PROFINET)" on page 165

Follow the installation in the specific sequence above—The instructions have been written in a specific order to ensure pump has:

- Electrical power ("10 Installation—Chapter 2: Electrical power" on page 58) prior to the first time pumphead installation procedure in "11 Installation—Chapter 3: Fluid path" on page 62
- A pumphead installed ("11 Installation—Chapter 3: Fluid path" on page 62) prior to set up using the HMI.
- Control connections installed ("12 Installation—Chapter 4 Overview: Control" on page 77) prior to set up using the HMI

8.4 Installation chapter structure

Each of the installation chapters are divided into three main parts:

1. Part 1: Installation requirements, specification, and information for the chapter
2. Part 2: Installation procedures for the chapter
3. Part 3: Chapter specific HMI set up instructions

9 Installation—Chapter 1: Physical

A pumphead is pictured in all illustrations in this chapter for conceptualisation of the final installation. A pumphead should only be installed after "9 Installation—Chapter 1: Physical" above and "10 Installation—Chapter 2: Electrical power" on page 58 have been completed.

9.1 Part 1: Chapter installation requirements, specification and installation

9.1.1 Responsibility

Installation must only be undertaken by a responsible person competent in the physical installation of pumped systems.

A risk assessment must be undertaken by the responsible person to determine any hazards that may occur prior to chapter relevant system design, an installation task, or procedure.

9.1.2 Location

The product must be installed such that no part of the pump may exceed the environment limits provided below:

9.1.2.1 Environmental and operating conditions

Item	Specification
Ambient temperature range	5 °C to 45 °C (41 °F to 113 °F)
Humidity (non-condensing)	80 % up to 31 °C (88 °F), decreasing linearly to 50 % at 40 °C (104 °F)
Maximum altitude	2,000 m, (6,560 ft)
Pollution degree of the intended environment	2
Noise	<70 dB(A) at 1 m
Maximum fluid temperature [1]	SEBS pumpheads: 40°C (104 °F) [1] Santoprene pumpheads: 45°C (113 °F) [1]
Environment	Indoor and limited outdoor [2]
Ingress protection	IP66, NEMA4X

NOTE 1

Chemical compatibility is dependent on temperature. A procedure for checking chemical compatibility is provided in "28 Chemical compatibility" on page 250.

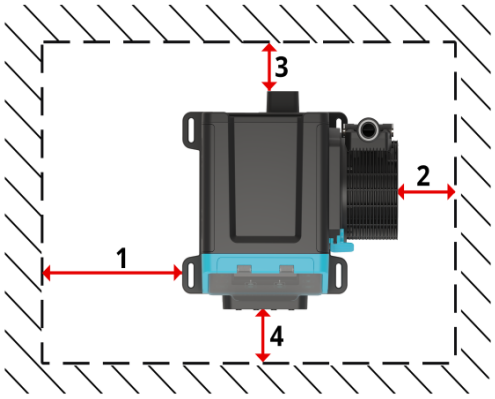
NOTE 2

Under certain conditions the pump is suitable for limited outdoor use. Contact your Watson-Marlow representative for advice.

9.1.2.2 Area around the product—not enclosed

The pump must be installed to facilitate additional installation, operation, maintenance, and cleaning. Access points must not be obstructed or blocked.

Installation clearances are provided in the illustrations and explanation table below:

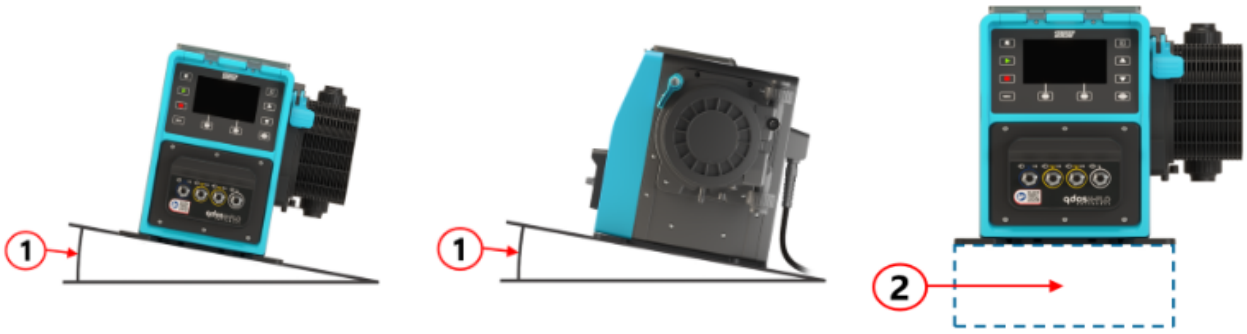


Number	Minimum clearance	Comment
1	0 mm	User to define based on mounting
2	200 mm, 7.87 in	Install and remove the pumphead (right hand pumphead mounting shown)
3	150 mm, 5.91 in	The minimum clearance is based on the • Bend radius of power cable Additional clearance will be needed to access the back of the pump for: • Information (serial number, product name) • Carry out an Earth bond test
4	100 mm, 3.94 in PROFIBUS, EtherNet/IP, PROFINET models = 115 mm (4.53 in)	The clearance is based upon a pump with a door at point 4 that can be opened or closed to the front of the pump. Additional clearance will be required for the: • Installation of control cables • Open and close the HMI cover • Operate and view the screen and keypad.

If the pump is to be installed inside an enclosure, contact your Watson-Marlow representative for advice.

9.1.2.3 Surface and orientation

The pump must be installed as follows in accordance with the illustrations and explanations table below:

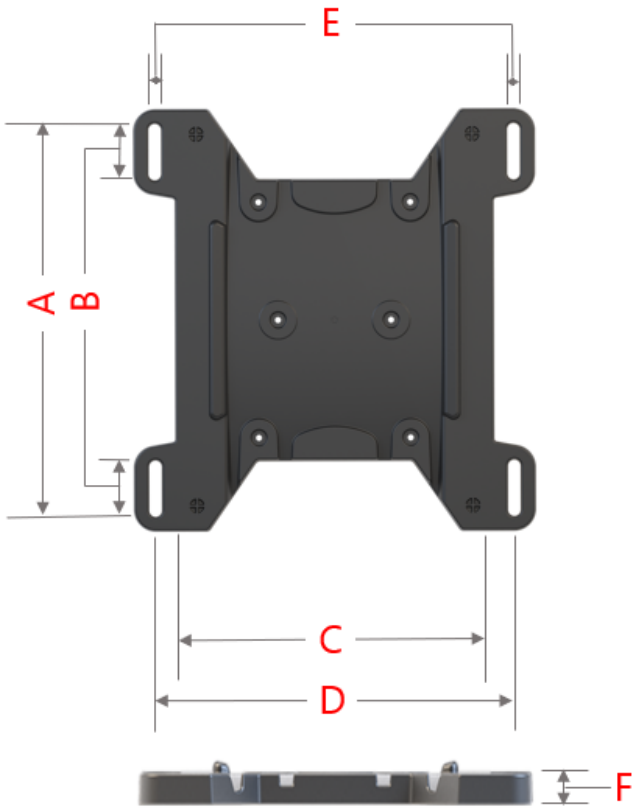


On a surface:

Number	Information
1	Install the pump on a level surface. **NOTICE** A mounting slope can cause poor lubrication, resulting in damage to the pump though accelerated wear. Install the pump on a level surface
2	With a surface mounting (such a plinth): • Suitable to ensure that the fluid path inlet connections has adequate space to be installed and removed. • Suitable to ensure that the pump is at a comfortable height for operation • Rated to support full weight of complete assembly and pumped product • Chemically compatible with the fluids being pumped • Free of vibration **NOTICE** Excessive vibration can cause poor lubrication, resulting in damage to the pump though accelerated wear. Install the pump on a surface free from excessive vibration.

9.1.3 Pump mounting dimensions

The dimensions for mounting the pump are provided by the illustration and table below



Letter	Dimension	
	mm	in
A	276	10.87
B	35	1.38
C	224	8.82
D	260	10.24
E [1]	11	0.43
F	14	0.55

NOTE 1 The mounting slots are designed to accommodate an anchorage fixing not larger than a M8 bolt with a minimum 15 mm OD M8 flat washer.

9.2 Part 2: Chapter installation procedures

9.2.1 Chapter pre-installation checklist

Carry out the following pre-installation checklist prior to following the installation procedure below:

1. Ensure all requirements of part 1 of this chapter have been met.
2. Ensure the pump has not yet been connected to electrical power, the fluid path, or the control system. The installation of these items is provided in subsequent chapters.

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

9.2.2 Procedure: Placing and mounting the pump

1. Ensure the chapter pre-installation checklist is complete.
2. Ensure the surface on which the pump is to be mounted is ready.
3. Place the drive on the surface to be mounted.

CAUTION

Do not place or move the drive, by holding the driveshaft. The driveshaft has edges which may cause an abrasion.

If the pump will be mounted to the surface follow these additional steps

4. Tighten anchorage fixings evenly until the drive is securely fixed. Do not overtighten.
5. Check the drive is mounted securely and cannot be moved easily.

10 Installation—Chapter 2: Electrical power

10.1 Part 1: Chapter installation requirements, specification, and information

10.1.1 Power specification requirements

Only connect to an earthed single phase power supply which meets the specification in the table below:

Item	Specification
Power supply voltage/Frequency	Alternating Current (~100 V to 240 V AC 50/60 Hz)
Maximum voltage fluctuation	±10 % of nominal voltage
Overvoltage category	II
Power consumption	350 VA, 330 W

If the quality of the AC power supply cannot be guaranteed, we recommend the use of appropriate commercial electrical supply stabilising equipment.

10.1.2 External devices

10.1.2.1 Overcurrent protection

Use an appropriate protected circuit in accordance with local regulations. The recommended overcurrent protection varies with power supply voltage.

Voltage	Amperage
230 V AC	2 A
115 V AC	4 A

10.1.2.2 Electrical power supply disconnection (isolation)

The power cable is fitted with a power plug. The power cable and power plug are specific to the product code, based upon the geographical use of the pump. The power plug is the electrical power supply disconnection device. The power plug is non locking, for connection to a corresponding geographical socket-outlet.

During electrical power installation, the pump must be positioned so that the disconnecting device is easy to reach and operate when required for electrical power isolation.

WARNING

The power plug is not IP66 or NEMA 4X rated. Install the power plug in a socket outlet with an enclosure rating matching the application ingress protection rating requirement.

10.2 Part 2: Chapter installation procedures

10.2.1 Chapter pre-installation checklist

At this stage of the installation sequence, the pump should be physically installed, with no power, and the fluid path or control system not yet connected.

Prior to electrical power installation, carry out the following pre-installation check to ensure:

- Pump has been installed in accordance with installation "9 Installation—Chapter 1: Physical" on page 52.
- All requirements of part 1 of this chapter have been met
- Power cable is not damaged
- Supplied AC power plug and corresponding socket outlet is correct for your Country/Region/Facility.

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

10.2.2 Earth continuity testing using the earth bond test point

Earth continuity from the power plug to the pump must be tested at the earth bond test point located on the back of the pump identified by this symbol:

NOTICE

Do not perform an earth continuity test using the motor shaft instead of the earth bond test point, as high current will damage the motor. Always use the earth bond test point to perform earth continuity testing

10.2.3 Procedure: Connecting to the power supply

1. Complete the pre-installation checklist provided in "10.2.1 Chapter pre-installation checklist" on the previous page
2. Ensure the power cable plug socket outlet is isolated from the power supply.
3. Ensure the electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required.
4. Connect the power cable plug to the power plug socket outlet.
5. Turn on the power supply to the power plug socket outlet. The pump will immediately receive power and the HMI screen will illuminate

10.2.4 Testing of electrical power and first time pump start up

When the pump is turned on for the very first time a leak detection message will appear. This is because the pumphead has not yet been installed.

For the purposes of testing the electrical power to the pump, this message indicates the pump is receiving power.

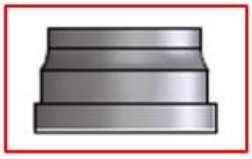
The procedure for installing the pumphead for the first time is provided in "11.2.2 Procedure: Pumphead installation" on page 67

11 Installation—Chapter 3: Fluid path

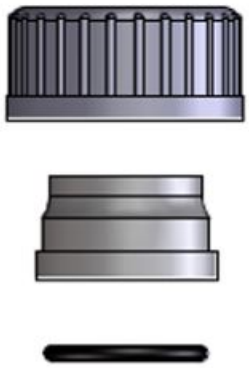
11.1 Part 1: Chapter installation requirements, specification, and information

11.1.1 Fluid path connectors

The drive is supplied with 2 x Fluid connectors (3/4" Female Parallel thread in a PVC-U) in either Rp or NPT [1].



Primary connection to the fluid path is using this connector in conjunction with the connection collars and pumphead port o-rings as illustrated below:



NOTE 1	Drives with an “A” at the end of the product code are supplied with NPT fluid connectors. All other drive product codes are supplied with the Rp fluid connectors.

11.1.2 Ancillary devices

A Watson-Marlow pump should be installed into a fluid path system with specific ancillary devices to ensure safe operation. These requirements are detailed in the sections below.

All devices, connections or pipework must be:

- Chemically compatible with the pumped fluid
- Have a specification rating higher than that of the application.

11.1.2.1 Non-return valve

Install a non-return valve in the discharge fluid path as close as possible to the pumphead in applications where pressurised backflow could create a hazard in the event of a pumphead tube or element failure.

If the pump is to be operated in reverse, the non-return valve will need to be bypassed during this operation, to avoid becoming a blockage.

11.1.2.2 Overpressure safety device

A Watson-Marlow pump operates by positive displacement. Should a blockage or restriction occur, the pump will continue to operate until either of the following occur:

- The pumphead tubing or element, or ancillary device may rupture, leak or otherwise fail
- The fluid path pipework or ancillary device, may rupture, leak or otherwise fail
- The drive fails

Install an overpressure safety device which can automatically activate in an overpressure event. This device should:

- Be as close as possible to the discharge pumphead port
- Be able to be set to a pressure which is lower than the pressure rating of the system
- Be able to stop the pump or divert the fluid to a safe location upon being triggered
- Have a fail-safe feature

11.1.2.3 Isolation and drain valves

Isolation and drain valves must be installed in the fluid path in the following scenarios:

- Where it is not practical to drain the entire fluid path during:
    - Pumphead tubing or element replacement
    - Where procedures require the pump to be removed from service, such as due to a fault
- The pump will act like a valve when stopped, preventing fluid from flowing through the pumphead.
    - As the tubing, element, or pumphead wears, there can be flow through the pumphead (which would be a normally closed fluid path). In applications where unintentional flow through the pumphead, cannot be tolerated or would create a hazard, then isolation valves must be installed.

Valves must be opened before the pump operates and closed after the pump has stopped.

11.1.3 Inlet and discharge pipework

11.1.3.1 General

Inlet and discharge pipes should be should:

- Be as short as possible
- Be as direct as possible
- Follow the straightest route
- Use bends of large radius
- With the largest diameter bore tube that will fit with your process.

11.1.3.2 Flow calibration

In order to carry out a flow calibration, the discharge pipework system will need to be designed to allow pumping into a graduated container near the pump.

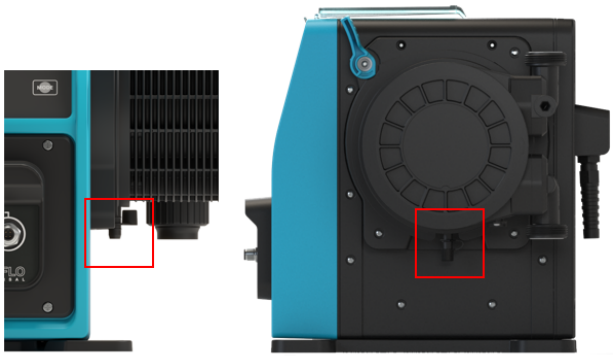
11.1.3.3 Piping vibration

Peristaltic pumps produce a pulsation which results in vibration of the peristaltic tubing and fluid path.

A Piping vibration and integrity assessment should be undertaken to determine the level of vibration suitable for the installation.

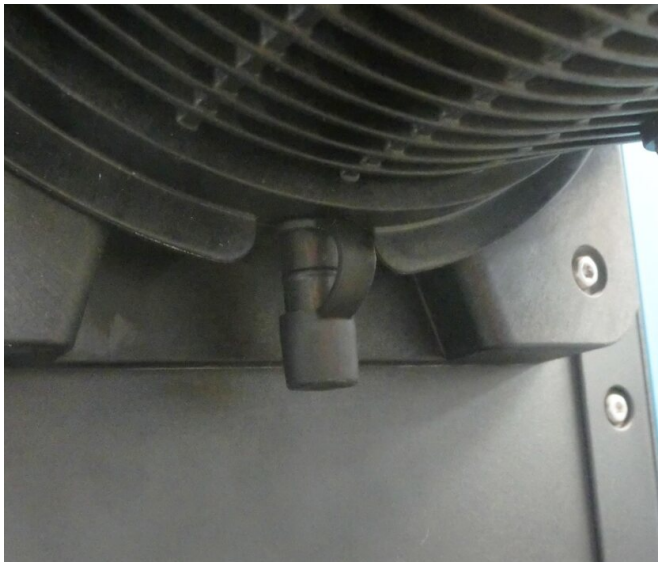
11.1.3.4 Safety overflow

All pumphead models have a hose barb safety overflow, as illustrated below



In the unlikely event of a leak detection sensor failure, the safety overflow provides a safe leak path for mixture of fluid and lubricant.

The pumphead has a factory fitted rubber cap on the safety overflow, which is unplugged, but not removed during installation of the safety overflow.



During installation remove the rubber cap from the opening to allow the safety overflow pipework connected, without removing the rubber cap item completely.

The safety overflow must flow away from the pump into a system designed to:

- Be vented
- Allow no back flow, due to pressure or blockage
- Have sufficient capacity
- Be obvious to user that fluid can be seen flowing in the event of a safety overflow event

11.2 Part 2: Chapter installation procedures

11.2.1 Chapter pre-installation checklist

Prior to installing the fluid path carry out the following pre-installation check to ensure:

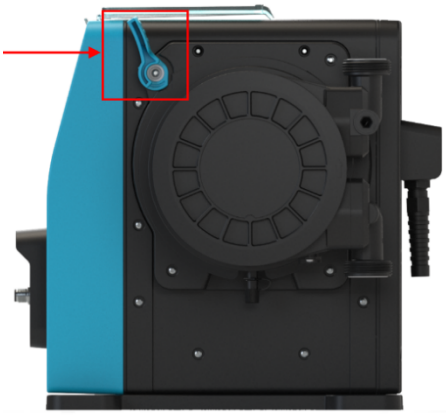
- Pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52 and "10 Installation—Chapter 2: Electrical power" on page 58
- All requirements of part 1 of this chapter have been met
- Power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required
- All items and tools for connection of the pump to the fluid path are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

11.2.2 Procedure: Pumphead installation

The installation procedure shown below is for a right hand pump is shown. A left-hand pump has an identical procedure.

1. Ensure the chapter pre-installation checklist is complete.
2. Isolate the power supply to the drive.
3. Ensure pumphead locking lever illustrated in the image below is set to enable the pumphead to be fitted.

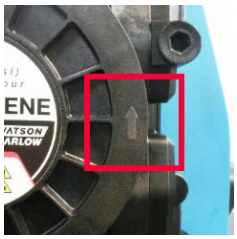


NOTICE

The pumphead locking lever is not designed to be loosened or tightened with a tool. Always operate the lever by hand.

4. Align pumphead with pump drive shaft and slide into position on pump housing.
5. Rotate pumphead in clockwise direction approximately 15°.
6. Ensure retaining lugs engage.

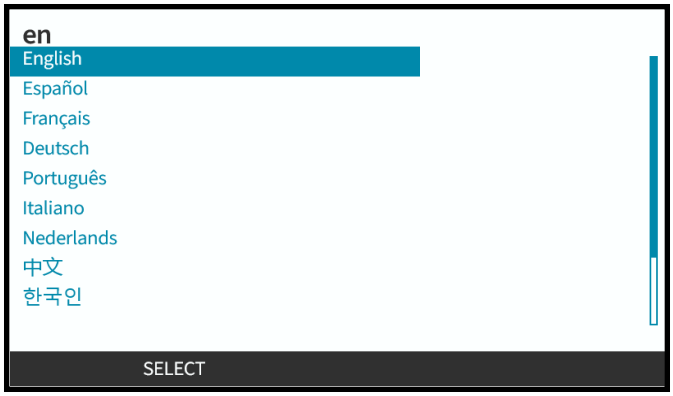
7. Check that the embossed arrow on pumphead is pointing upwards.



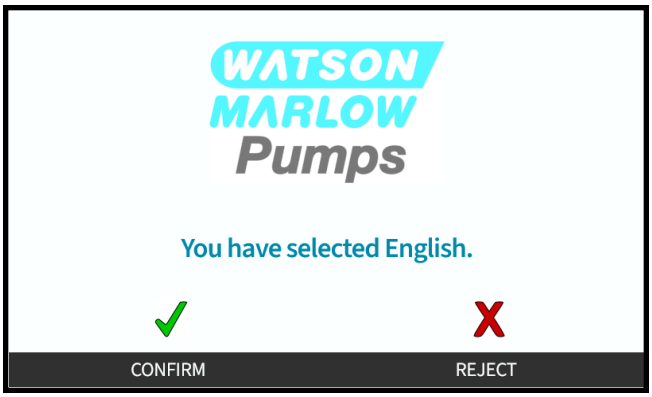
8. Lock pumphead into position by hand using pumphead locking lever. Do not use a tool.
9. Apply electrical power to pump. Pump will enter into its first time start up sequence and the Watson-Marlow logo will display for three seconds.

10. The screen below will be displayed to allow selection of the on screen text language.

Use **+/-** keys to highlight required language.



11. Press SELECT [−] to choose language.
12. Press CONFIRM [−] to continue.



13. To change your selection, press REJECT.
14. Press start and run pumphead for a few revolutions.
15. Stop pump.
16. Isolate the pump from the electrical power supply.
17. Check the locking lever is still correctly locked in position.

If not:

- Isolate pump from electrical supply
- Lock lever into position
- Repeat steps 13 to 16

11.2.3 Procedure: Installing the fluid path for the first time

1. Ensure the chapter pre-installation checklist is complete.
2. Isolate the power supply to the device.
3. Ensure the pumphead is installed. If not follow procedure "11.2.2 Procedure: Pumphead installation" on page 67 first.
4. Attach process fluid path connector to pumphead fluid connector, using a suitable tool to hold each connector.
5. Tighten by hand.
6. Reconnect the power supply.
7. Operate the pump, checking for leaks at the fluid path connections. If leaks are present. Stop the pump, and repeat steps 5 and 6.
8. Install the pumphead safety overflow as detailed below.

11.2.4 Connect the safety overflow

During installation remove the rubber cap from the opening to allow the safety overflow pipework connected, without removing the rubber cap item completely.

Do not block safety overflow of pumphead. Do not fit a valve to the pumphead. Do not discard the rubber safety cap

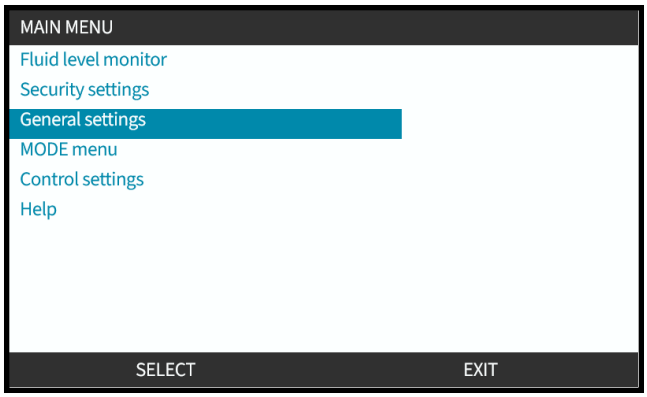
11.3 Part 3: Chapter specific HMI set up

11.3.1 HMI—Setting the flow units: general settings>flow units

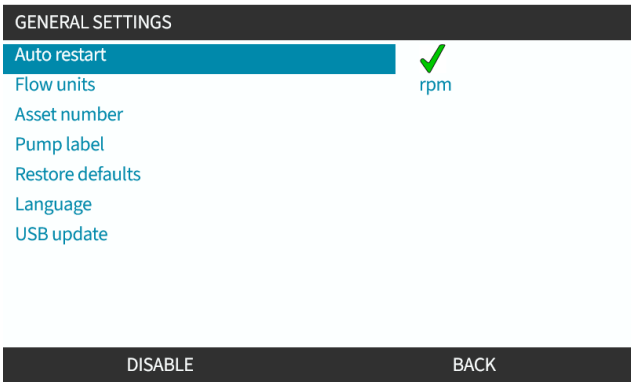
After the fluid path is installed the flowrate from the pump should be calibrated. Prior to fluid calibration the preferred flow units should be selected in general settings using the HMI.

From the **MAIN MENU**:

1. Use **+/-** keys to highlight **General settings**.
2. Press SELECT.



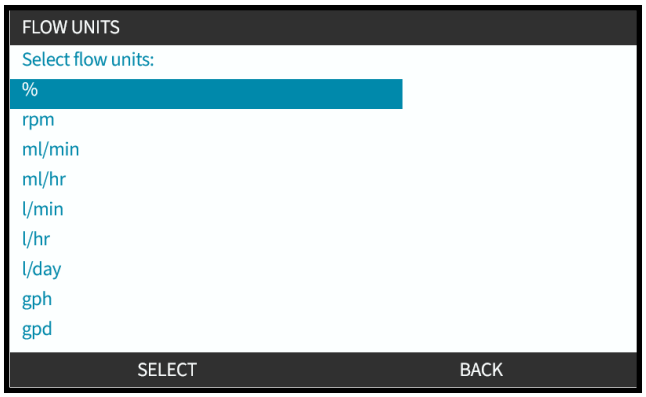
3. Use the **+/-** keys to highlight **Flow units** option.
4. Press SELECT.



5. To set displayed flow units for all pump displays.

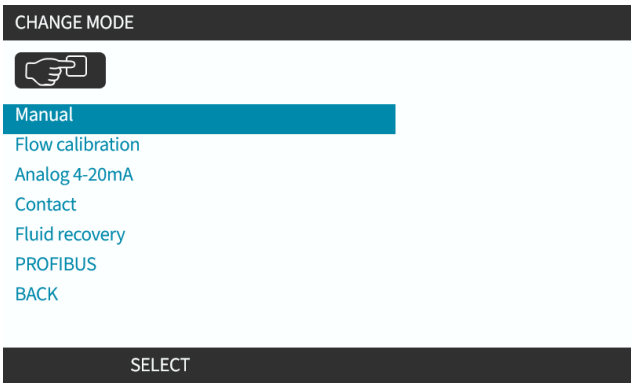
   Use the **+/-** keys to highlight preferred flow unit.

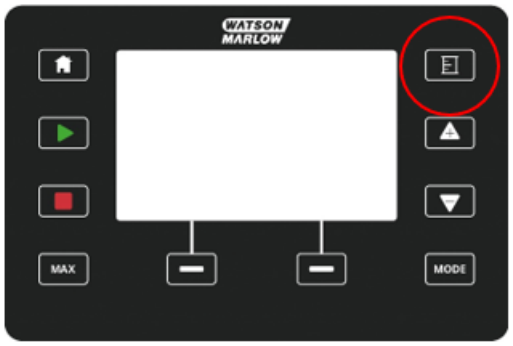
6. Press SELECT to store preference.



11.3.2 HMI—Calibrating the pump flowrate: MODE menu > Flow calibration

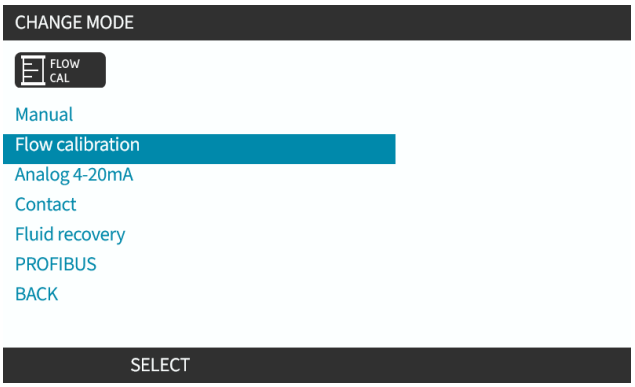
Flow calibration can be accessed from either the **MODE** Menu using the **+/-** keys, or using the **Flow calibration** key.



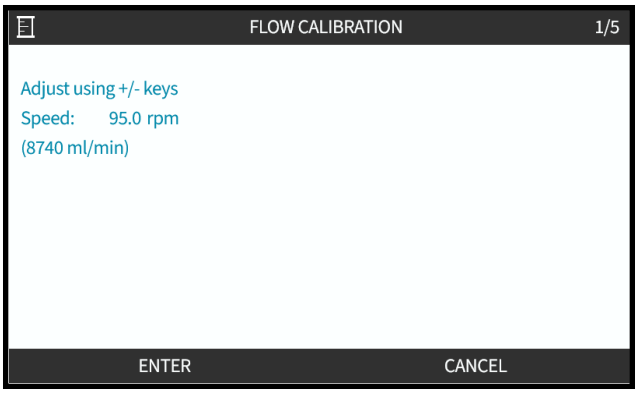


11.3.2.1 To calibrate pump flowrate:

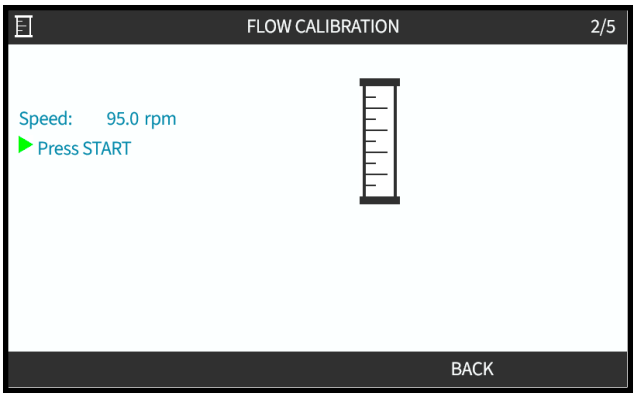
1. Enter the **Flow Calibration** menu from the **MODE** Menu by pressing SELECT.
2. Using the **Flow calibration** key.



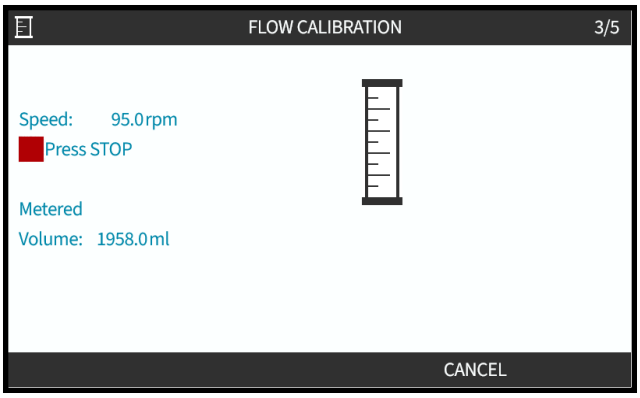
3. Use **+/-** keys to enter maximum flow rate limit.
4. ENTER.



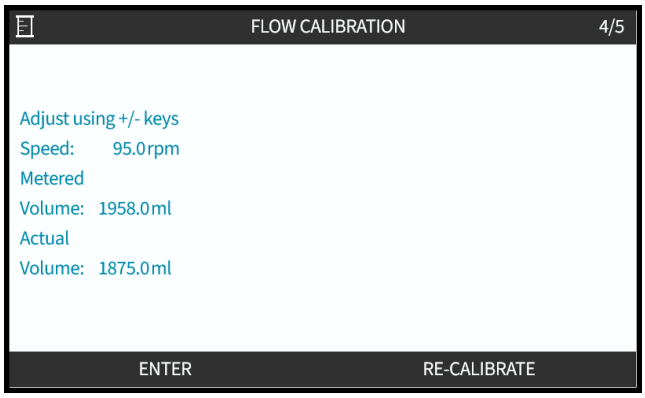
5. Press **START** to begin pumping a volume of fluid for calibration.



6. Press **STOP** to stop pumping fluid for the calibration.

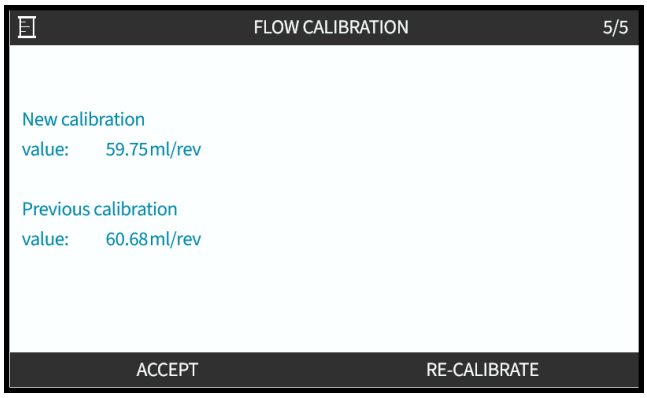


7. Using the **+/-** keys enter the actual volume of fluid pumped.



8. Pump now calibrated.

9. ACCEPT or, RE-CALIBRATE to repeat procedure.



11.3.2.2 Abort flow calibration

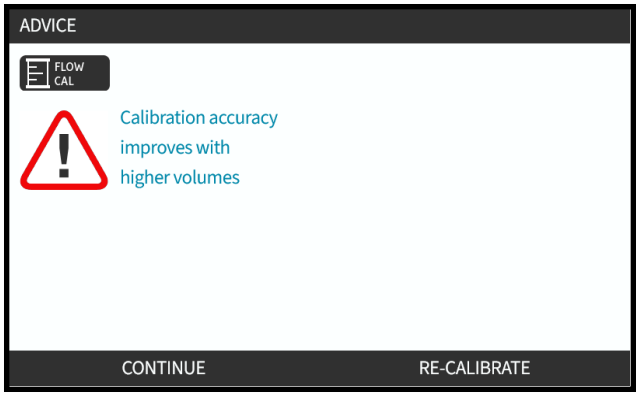
1. Press **HOME** or **MODE** to abort calibration.
2. This advice screen will be displayed.

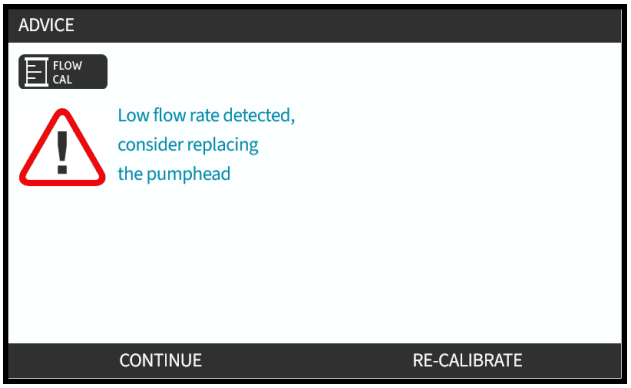
   Press BACK or, CONFIRM to continue.

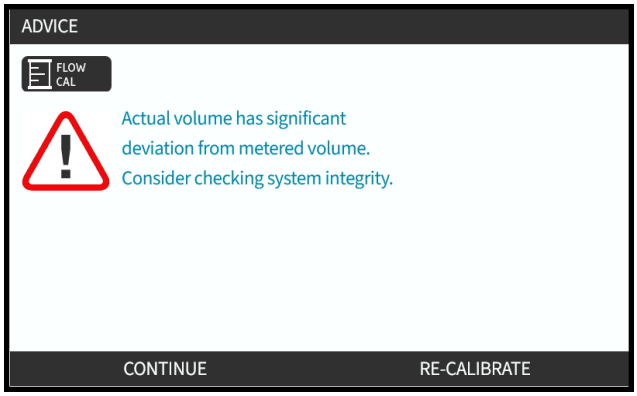
11.3.2.3 Troubleshooting flow calibration

The following advice screens may appear during calibration.

To clear, use either CONTINUE or, RE-CALIBRATE.







12 Installation—Chapter 4 Overview: Control

The control chapter is split into the following sub-chapters based upon model

Follow the sub-chapter based upon your model.

12.1 Sub-Chapter wiring diagram key

The following key is used in all Chapter 4 sub chapters

Symbol	Action	Symbol	Action
	Start		Output
	Stop		Input
	Start dose on rising edge		Analogue (4 – 20mA/0-10V) control

13 Installation—Sub-Chapter 4A: Control (Model: Manual)

This section provides information on connection, input/output specification and relevant set up using the HMI of the Manual model only.

13.1 Part 1: Sub-Chapter installation requirements, specification, and information

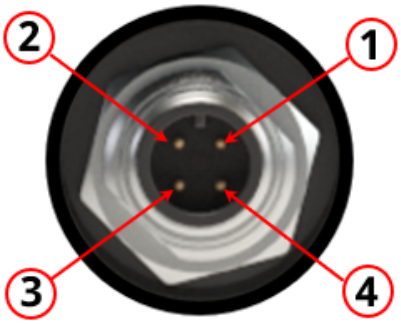
13.1.1 Control connections

13.1.1.1 Input/Output signal limits

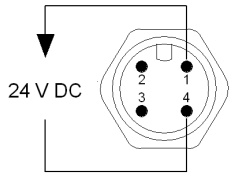
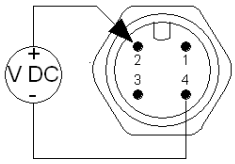
Parameter		Limits			Units	Comment
	Sym	Min	Nom	Max		
Digital Input voltage High	VD_{IH}	10.4		30	V	24V IEC 61131-2 Type 3
Digital Input Voltage Low	VD_{IL}	0		9.2		
Digital Input Abs Max voltage	VD_{in}	-60		60	V	
Digital Input current Limit	ID_{in}		2.25		mA	IEC 61131-2 Type 3

13.1.1.2 Overview—Control input: Start/Stop

A Start/Stop input connection is provided as an input connection for the manual model. All other models use a pressure sensor input connection in same location. It is not possible to use a pressure sensor with the manual model.

<table>
<tr><td>Location</td><td>The location of this connection is illustrated by the graphic below:
 
</td></tr>
<tr><td>Connector Specification</td><td>M12, Male, 4 Pin, A-code plug, IP66, NEMA4X</td></tr>
<tr><td>Control cable specification</td><td>Control cables for connecting to the manual model M12 input connector is available as a Watson-Marlow Accessory:
<table><tr><th>Item</th><th>Product code</th></tr><tr><td>Qdos control cable for manual model, M12A 5 Pin Yellow Insert , 3m (10ft) Length</td><td>0M9.203Y.000 [1]</td></tr></table>
NOTE 1 The control cable for use with the manual model features a 5 pin female m12 connector, This 5 pin connector will connect to male 4 pin, M12 connector of the manual model. The 5th pin (centre) is not used.</td></tr>
<tr><td>Pin out illustration</td><td> 
</td></tr>
</table>

13.1.1.3 Wiring information—Control input: Start/Stop

Function	Pin	Signal	Configurable	Wiring Diagram
START/STOP	Pin 1	24 V DC	No	
	Pin 2 (+)	START/STOP 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	
	Pin 3	No user connection	No	
	Pin 4 (-)	0 V Common	No	

13.2 Part 2: Sub-Chapter installation procedures

13.2.1 Sub-Chapter pre-installation checklist

Prior to installing the control connections and wiring carry out the following pre-installation check:

- Ensure the pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52, "10 Installation—Chapter 2: Electrical power" on page 58 and "11 Installation—Chapter 3: Fluid path" on page 62
- Ensure all requirements of part 1 of this chapter have been met
- Ensure the power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required
- Ensure the control cable(s) are not damaged
- Ensure items and tools for connection of the pump to the control system are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

13.2.2 Control connection precautions

When following the procedures below or wiring the control cables to the pinouts on the M12 connectors

- Keep 4 20 mA and low voltage signals separate from power supply
- Only connect to external circuits, that are separated from mains voltages by reinforced insulation. All of the product input and output terminals are separated from mains circuits by reinforced insulation.
- Do not apply mains power voltages to any of the M12 control connection pins.

13.2.3 Installation of M12 control cables (M type)

13.2.3.1 Protective caps

The M12 control connections are covered with protective caps during manufacture.

If any of the connections will not be used for control, leave the protective caps in place of a control cable for added protection of the product. A picture of the cap is illustrated in the picture:

13.2.3.2 M12 control cable installation procedure

Follow the procedure below to connect the M12 control cables.

1. Isolate the pump from its power supply
2. Carry out any control system wiring using the information in part 1 of this chapter
3. Connect the M12 connector to the appropriate location on the pump
4. Turn the screw thread by hand until it is tight
5. Check the cable is secure
6. Reconnect the power supply to the pump

13.3 Part 3: Sub-Chapter specific HMI set up

The sub-sections below provide information on manual model only related set up of the pump using the HMI.

13.3.1 HMI—Setting the start/stop: control settings>input

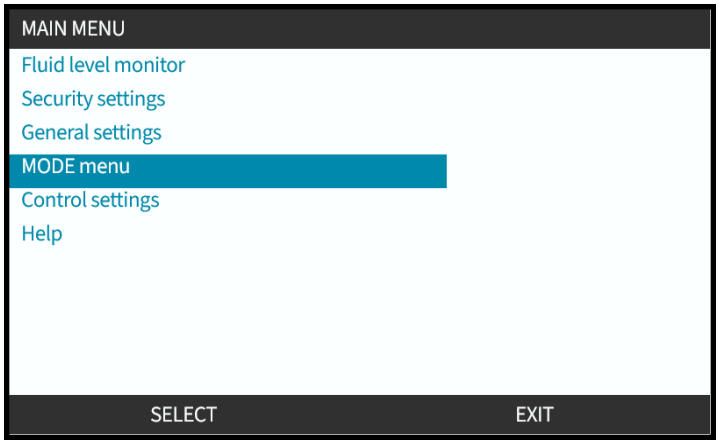
A start/stop signal can be used to stop the pump using the remote stop feature. This will not effect the following operation:

- Flow calibrations
- Max speed key operation
- Manual Fluid recovery

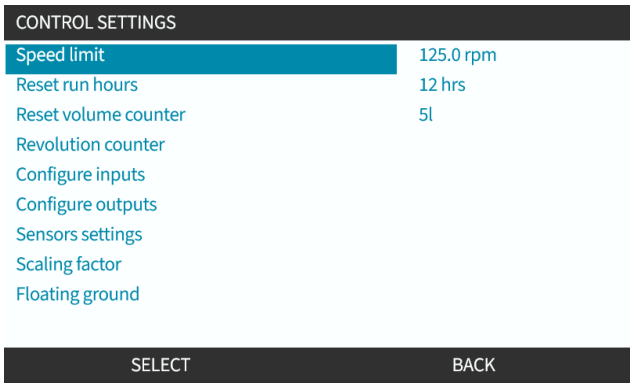
13.3.1.1 To configure start/stop: Polarity

The polarity of the voltage to start/stop can be set. A low polarity signal is recommended as the pump will stop if an input signal is lost.

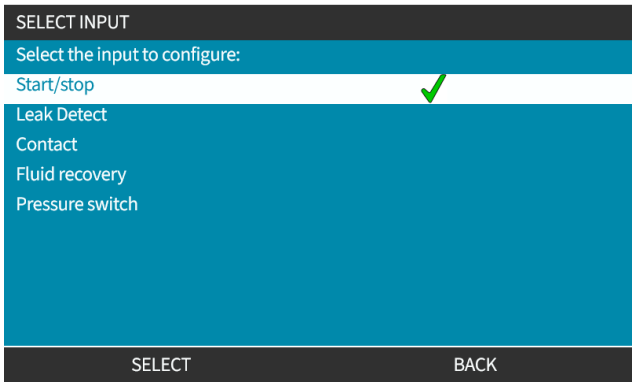
1. From the **MAIN MENU**.
2. Use **+/-** keys to highlight **CONTROL SETTINGS**.
3. Press SELECT.



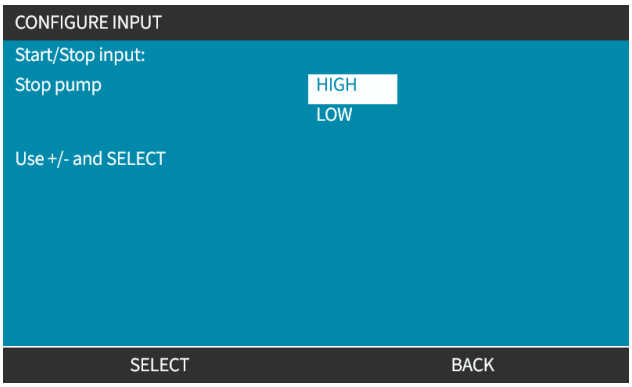
4. Highlight **Configure Input** option.
5. Press SELECT.



6. Use **+/-** keys to highlight **Start/Stop**.
7. Press SELECT.



8. Use **+/-** keys to highlight options
9. Press SELECT to enable HIGH or LOW polarity



13.3.1.2 To configure start/stop: Assign input

The start/stop cannot be assigned to any other input than #4.

14 Installation—Sub-Chapter 4B: Control (Models: Universal and Universal+)

14.1 Sub-Chapter overview

This section provides information on connection, input/output specification and relevant set up using the HMI of the Universal and Universal+ models only.

14.2 Part 1: Sub-Chapter installation requirements, specification, and information

14.2.1 Chemical metering: Analog: 4-20 mA, or Pulse?

Both a Universal and Universal+ pump can be used for chemical metering, using 2 primary automatic modes:

Mode	Explanation
Analog 4-20 mA	Continuously running in proportion to the flow, and at very low speeds is a much better solution than dosing at intervals (pulse) using contact mode. We recommend examining your process to identify whether a 4-20 mA signal can be used rather than a pulse. Where technology does not allow a 4-20 mA signal we recommend using a signal converter accessory. This can be used to change your pulse signal to a 4-20 mA signal, ideal for metering.
Pulse (contact mode)	Pulse dosing as an operation mode has its limitations due to the intermittent nature of this method. For example this would require enough pipework to ensure the solution is adequately mixed, or a mixing tank.

14.2.2 Connection type overview

There are two types of input and output control connections for the Universal and Universal+ models:

Name	Description	Location	Product code
M type	with M12 control connections		Product codes containing M
T type	with user wired cable gland connections		Product codes containing T

14.2.3 Control signal limits

The control signal limits are provided in the table below, this information applies to all Universal and Universal+ models (M and T types).

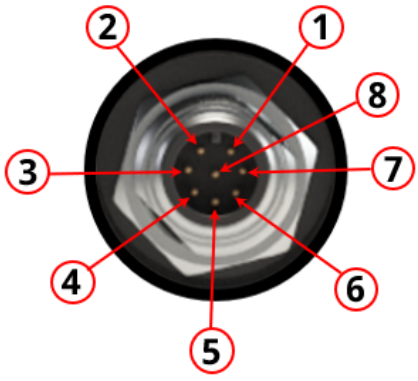
Parameter		Limits			Units	Comment
	Sym	Min	Nom	Max		
Digital Input voltage High	VD_{IH}	10.4		30	V	24V IEC 61131-2 Type 3
Digital Input Voltage Low	VD_{IL}	0		9.2		
Digital Input Abs Max voltage	VD_{in}	-60		60	V	
Digital Input current Limit	ID_{in}		2.25		mA	IEC 61131-2 Type 3
Analogue input measurement range	Iin	0		30	mA	
Analogue input Abs Max Current	IA_{in}	-0.01		33	mA	Internally limited to max voltage
M12 Output Relay Current	IL			1	A	Resistive load
M12 Output Relay switching Voltage	V_{OL}		24	60	VDC	
Terminal Output Relay Current	IL			5	A	Resistive load
Terminal Output Relay Switch Volts	V_{OL}			250	VAC	
Speed Output: 4-20 mA Hardware	Io	0		25	mA	±5%, 250R load To 0V common
Applied External Voltage: 4-2 0mA		-30		+30	V	Fault condition
Sensor 24V Supply			24		V	Up to 100 mA total

14.2.4 M type control connections

The M12 control connections vary by location, function, thread style, pin count and plug code.

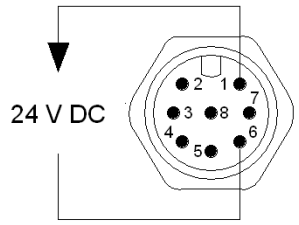
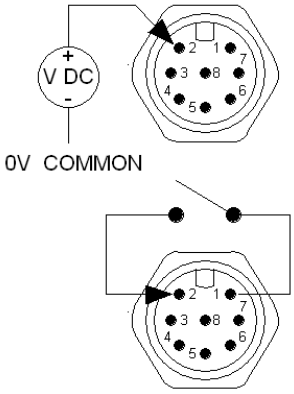
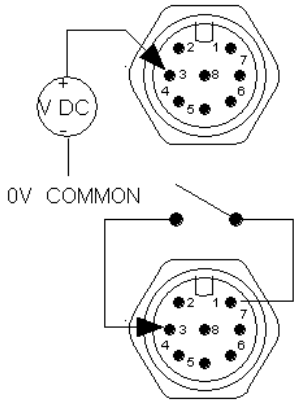
14.2.4.1 Overview: Control input (Universal and Universal+)

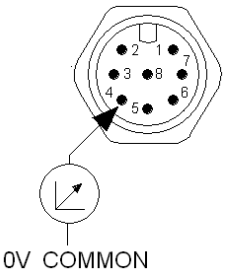
The control input connection is featured on the Universal and Universal+ models only

<table>
<tr><td>Location</td><td>This connection is located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td>M12, Male, 8 Pin, A-code plug, IP66, NEMA4X</td></tr>
<tr><td>Control cable specification</td><td>Control cables for connecting to the Universal/Universal+ model M12 input connector are available as a Watson-Marlow Accessory:
<table>
<tr><th>Item</th><th>Product code</th></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Straight F Connection, 3m (10ft) Length, Unshielded 24AWG</td><td>0M9.603Z.0CF</td></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Right-Angled F Connection, 3m (10ft) Length, Unshielded 24AWG</td><td>0M9.603Z.0DF</td></tr>
</table></td></tr>
<tr><td>Pin out illustration</td><td> 
</td></tr>
</table>

14.2.4.2 Wiring Information—Control input (Universal only)

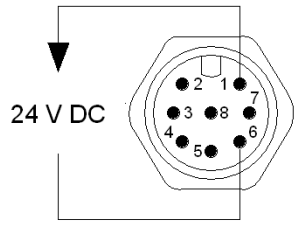
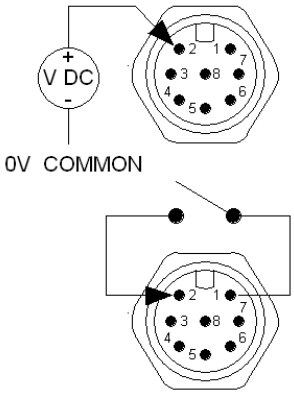
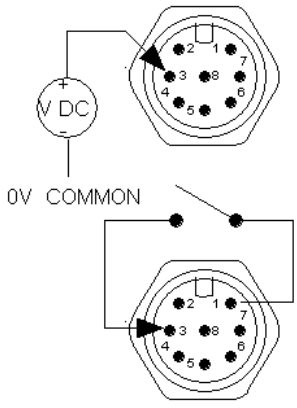
The following information applies to the Universal model only for the control input #1 connection

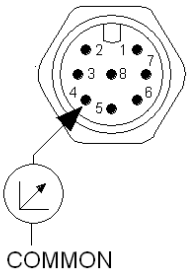
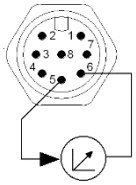
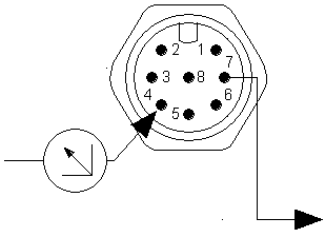
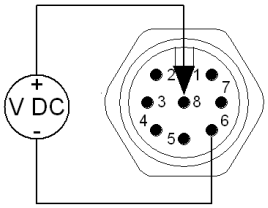
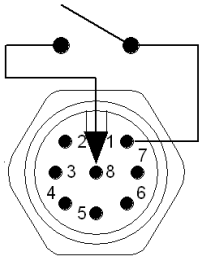
Function	Pin	Signal	Configurable	Wiring Diagram
	Pin 1	24 V DC	No	
INPUT 1	Pin 2 (+)	INPUT 1 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	
INPUT 2	Pin 3 (+)	INPUT 2 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	

Function	Pin	Signal	Configurable	Wiring Diagram
ANALOG 1P	Pin 4 (+)	4-20mA#1P 4 to 20 mA Positive Input	Yes [SPEED]	

14.2.4.3 Wiring Information—Control input (Universal+ only)

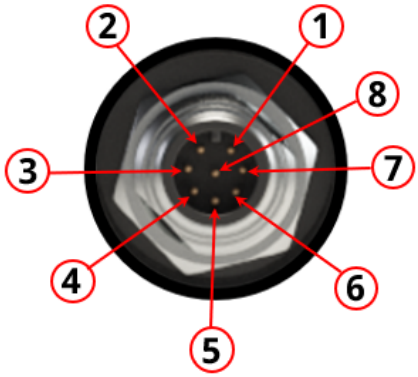
The following information applies to the Universal+ model only for the control input #1 connection

Function	Pin	Signal	Configurable	Wiring Diagram
	Pin 1	24 V DC	No	
INPUT 1	Pin 2 (+)	INPUT 1 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	
INPUT 2	Pin 3 (+)	INPUT 2 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	

Function	Pin	Signal	Configurable	Wiring Diagram
ANALOG 1P	Pin 4 (+)	4-20mA#1P 4 to 20 mA Positive Input.	Yes	
OUTPUT SPEED	Pin 5 (+)	4-20mA OUT Common shared connection with OUTPUT#1 Pin5	Yes	
	Pin 6 (-)	0 V Common	No	
ANALOG 1M	Pin 7 (+)	4-20mA#1M Analogue 1 -Reference/Pass through (Floating ground)	Yes	
START/STOP	Pin 8	START/STOP Stop = High 0 = [0 V to 9.2 V DC] ► 1 = [10.4 V to 30 V DC] ■ Stop = Low 0 = [0 V to 9.2 V DC] ■ 1 = [10.4 V to 30 V DC] ►	Yes	 

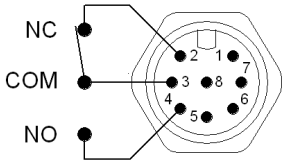
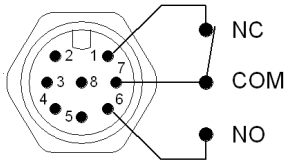
14.2.4.4 Overview—Control output #1 connection (Universal and Universal+)

The control output #1 connection is featured on the Universal and Universal+ models only.

<table>
<tr><td>Location</td><td>This connection is located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td>M12, Male, 8 Pin, A-code plug, IP66, NEMA4X</td></tr>
<tr><td>Control cable specification</td><td>Control cables for connecting to the Universal/Universal+ model M12 input connector are available as a Watson-Marlow Accessory:
<table>
<tr><th>Item</th><th>Product code</th></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Straight F Connection, 3m (10ft) Length, Unshielded 24AWG</td><td>0M9.603Z.0CF</td></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Right-Angled F Connection, 3m (10ft) Length, Unshielded 24AWG</td><td>0M9.603Z.0DF</td></tr>
</table></td></tr>
<tr><td>Pin out illustration</td><td> 
</td></tr>
</table>

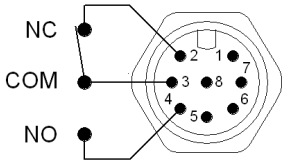
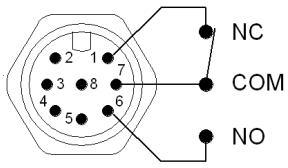
14.2.4.5 Wiring Information—Control output #1 connection (Universal only)

The following information applies to the Universal model only for the control output #1 connection.

Function	Pin	Signal	Configurable	Wiring Diagram
RELAY 1	Pin 2	RELAY1-NC 24 V 1 A DC Resistive	Yes	
	Pin 3	RELAY1-COM 24 V 1 A DC Resistive		
	Pin 4	RELAY1-NO 24 V 1 A DC Resistive		
RELAY 2	Pin 1	RELAY2-NC 24 V 1 A DC Resistive	Yes	
	Pin 7	RELAY2-COM 24 V 1 A DC Resistive		
	Pin 6	RELAY2-NO 24 V 1 A DC Resistive		
	Pin 5 (+)	No user connection		
	Pin 8 (-)	0 V Common	No	

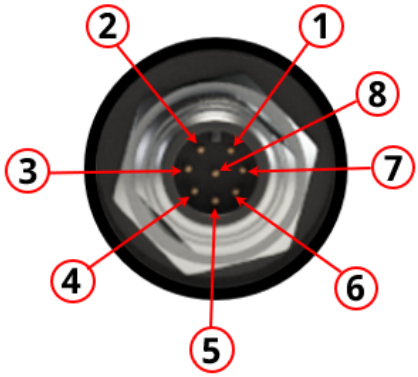
14.2.4.6 Wiring Information—Control output #1 connection (Universal+ only)

The following information applies to the Universal+ model only for the control output #1 connection.

Function	Pin	Signal	Configurable	Wiring Diagram
RELAY 1	Pin 2	RELAY1-NC 24 V 1 A DC Resistive	Yes	
	Pin 3	RELAY1-COM 24 V 1 A DC Resistive		
	Pin 4	RELAY1-NO 24 V 1 A DC Resistive		
RELAY 2	Pin 1	RELAY2-NC 24 V 1 A DC Resistive	Yes	
	Pin 7	RELAY2-COM 24 V 1 A DC Resistive		
	Pin 6	RELAY2-NO 24 V 1 A DC Resistive		
OUTPUT SPEED	Pin 5 (+)	4-20mA OUT Common shared connection with INPUT Pin5		
	Pin 8 (-)	0 V Common	No	

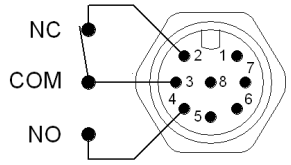
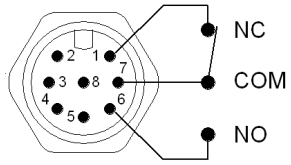
14.2.4.7 Overview—Control output #2 connection (Universal and Universal+)

The control output #2 connection is featured on the Universal and Universal+ models only.

<table>
<tr><td>Location</td><td>This connection is located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td>M12, Male, 8 Pin, A-code plug, IP66, NEMA4X.</td></tr>
<tr><td>Control cable specification</td><td>Control cables for connecting to the Universal/Universal+ model M12 input connector are available as a Watson-Marlow Accessory:
<table>
<tr><th>Item</th><th>Product code</th></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Straight F Connection, 3m (10ft) Length, Unshielded 24AWG.</td><td>0M9.603Z.0CF</td></tr>
<tr><td>Qdos H-FLO Control cable - General I/O M12A 8W Cable Right-Angled F Connection, 3m (10ft) Length, Unshielded 24AWG.</td><td>0M9.603Z.0DF</td></tr>
</table></td></tr>
<tr><td>Pin out illustration</td><td> 
</td></tr>
</table>

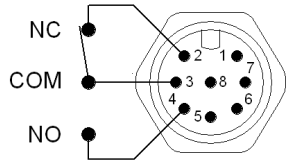
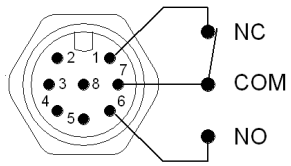
14.2.4.8 Wiring Information—Control output #2 connection (Universal only)

The following information applies to the Universal model only for the control output #2 connection.

Function	Pin	Signal	Configurable	Wiring Diagram
RELAY 3	Pin 2	RELAY3-NC 24 V 1 A DC Resistive	Yes	
	Pin 3	RELAY3-COM 24 V 1 A DC Resistive		
	Pin 4	RELAY3-NO 24 V 1 A DC Resistive		
RELAY 4	Pin 1	RELAY4-NC 24 V 1 A DC Resistive	Yes	
	Pin 7	RELAY4-COM 24 V 1 A DC Resistive		
	Pin 6	RELAY4-NO 24 V 1 A DC Resistive		
	Pin 5	No user connection	No	
ANALOG 2M	Pin 8	4-20mA#2M Analogue 2 - Reference/Pass through (Floating ground)	Yes	

14.2.4.9 Wiring Information—Control output #2 connection (Universal+ only)

The following information applies to the Universal+ model only for the control output #2 connection.

Function	Pin	Signal	Configurable	Wiring Diagram
RELAY 3	Pin 2	RELAY3-NC 24 V 1 A DC Resistive	Yes	
	Pin 3	RELAY3-COM 24 V 1 A DC Resistive		
	Pin 4	RELAY3-NO 24 V 1 A DC Resistive		
RELAY 4	Pin 1	RELAY4-NC 24 V 1 A DC Resistive	Yes	
	Pin 7	RELAY4-COM 24 V 1 A DC Resistive		
	Pin 6	RELAY4-NO 24 V 1 A DC Resistive		
	Pin 5	No user connection	No	

Function	Pin	Signal	Configurable	Wiring Diagram
ANALOG 2M 	Pin 8	4-20mA#2M Analogue 2 - Reference/Pass through (Floating ground)	Yes	

14.2.4.10 Overview—Control input: Pressure sensor (Universal and Universal+)

A pressure sensor input connection is provided, for use with the Watson-Marlow Pressure Sensor Kit on both the Universal and Universal+ models. It is not possible to use a third party pressure sensor.

Location	The pressure sensor input connection is located as illustrated by the graphic. 
Connector Specification	M12, Male, 4 Pin, A-code plug, IP66, NEMA4X.
Control cable specification	The pressure sensor kit comes with a pre-installed control cable. No other control cable should be used with this connection.
Pin out information	No pin out information is provided. This pressure sensor connection must only be used with the Watson-Marlow pressure sensor kit. Do not connect any other wires, or cables or attempt to wire to this connection.

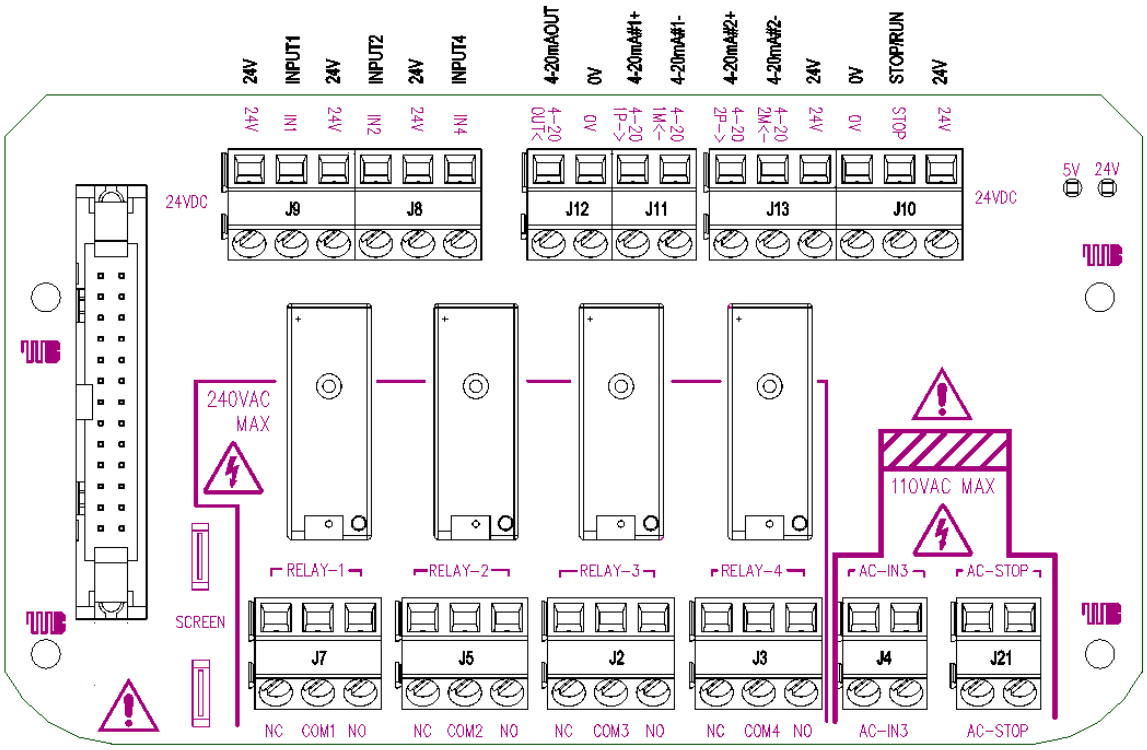
14.2.5 T Type (user wired cable gland connections)

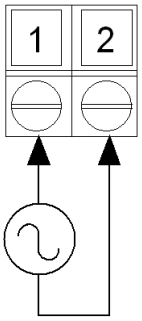
14.2.5.1 Overview—T-type connections

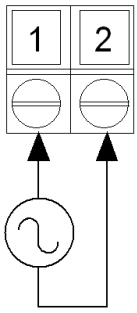
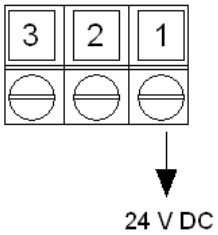
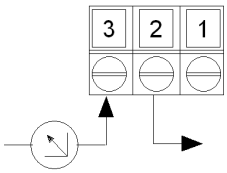
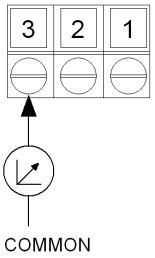
<table>
<tr><td>Location</td><td colspan="4">The terminal board is located behind the input/ouput panel on T type models
   </td></tr>
<tr><td>Connection Specification</td><td colspan="4">IP66, NEMA 4X</td></tr>
<tr><td rowspan="10">Control cable specification</td><td>Parameter</td><td>Data</td><td>NOTE 1</td><td>NOTE 2</td></tr>
<tr><td>Terminal Wire Size</td><td>24 AWG to 12 AWG</td><td>M2.5 Screw</td><td></td></tr>
<tr><td>Relay</td><td>SPCO</td><td>240 V 5 A AC resistive</td><td></td></tr>
<tr><td>Screen</td><td>0.25 Blade terminal connection</td><td>Optional cable EMC screen connection to pump Earth.
Not a protective earth or earth bond test point.</td><td>Max 10 mA
Max 50 V, with respect to 0 V</td></tr>
<tr><td>Cable section profile</td><td>Round</td><td></td><td></td></tr>
<tr><td>Cable outside diameter to ensure ingress rating</td><td>9.5 mm to 12 mm (0.374 in to 0.472 in)</td><td></td><td></td></tr>
<tr><td>Cable conductors</td><td>0.05 to 1.31 mm^2
(30 to 16 AWG) stranded or solid</td><td></td><td></td></tr>
<tr><td>Maximum temperature rating</td><td>85 °C (185 °F)</td><td></td><td></td></tr>
<tr><td>Maximum cables per gland</td><td>1</td><td></td><td></td></tr>
</table>

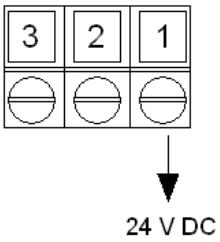
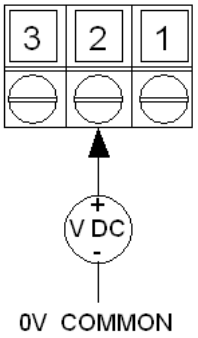
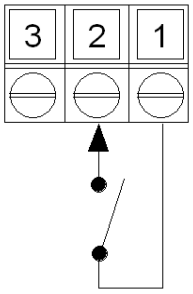
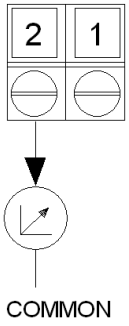
14.2.5.2 Wiring information—T type connections

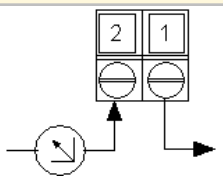
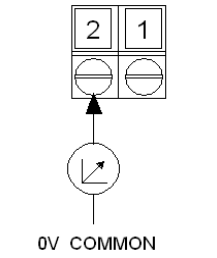
The layout of the terminal board is provided in the illustration below:

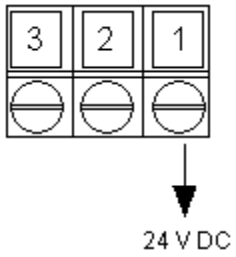
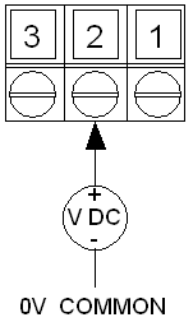
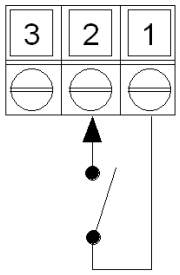
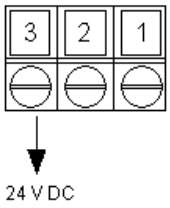


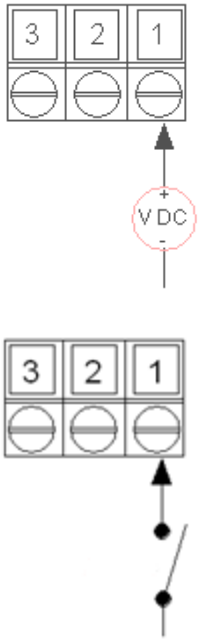
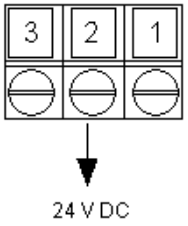
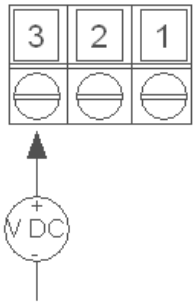
Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
STOP AC-INPUT	J21	Pin 1 (AC)	Stop = High 0 = [110 AC] ► 1 = [0 V AC] ■	Yes	
		Pin 2 (AC)	Stop = Low 0 = [0 V AC] ■ 1 = [110 V AC] ►		

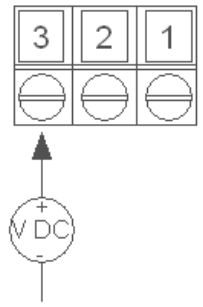
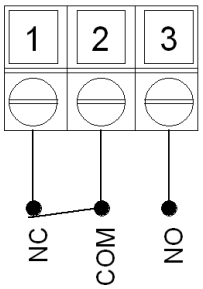
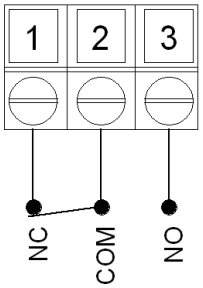
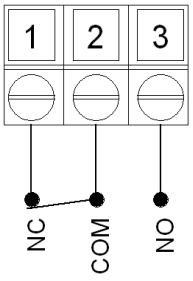
Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
INPUT-3 AC-INPUT	J4	Pin 1 (AC)	Stop = High 0 = [110 AC] ► 1 = [0 V AC] ■	Yes	
		Pin 2 (AC)	Stop = Low 0 = [0 V AC] ■ 1 = [110 V AC] ►		
J10 re-label	J10	Pin 1	24 V DC	No	
ANALOGUE 2	J13	Pin 2 (-)	4-20mA#2M Analogue 2 -Reference/Pass through (Floating ground)	Yes	
ANALOGUE 2		Pin 3 (+)	4-20mA#2P Analogue 2, positive input, 4 to 20 mA. [150R] =	Yes	

Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
START/STOP	J10	Pin 1	24 V DC	No	
		Pin 2	START/STOP Stop = High 0 = [0 V to 9.2 V DC] ▶ 1 = [10.4 V to 30 V DC] ■ Stop = Low 0 = [0 V to 9.2 V DC] ■ 1 = [10.4 V to 30 V DC] ▶	Yes	 
		Pin 3 (-)	0 V Common	No	
OUTPUT SPEED	J12	Pin 1 (-)	0 V Common	No	
		Pin 2 (+)	4-20mA OUT	Yes	

Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
ANALOGUE 1M	J11	Pin 1 (-)	4-20mA#1M Analogue 1 -Reference/Pass through (Floating ground)	Yes	
ANALOGUE 1P		Pin 2 (+)	4-20mA#1P Analogue 1+ input 4 to 20 mA Positive Input. [150R] = 	Yes	

Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
INPUT 1	J9	Pin 1	24 V DC	No	
		Pin 2 (+)	INPUT 1 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	 
		Pin 3	24 V 100 mA DC	No	

Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
INPUT 4	J8	Pin 1 (+)	INPUT 4 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	
		Pin 2	24 V 100 mA DC	No	
INPUT 2		Pin 3 (+)	INPUT 2 0 = [0 V to 9.2 V DC] 1 = [10.4 V to 30 V DC]	Yes	

Function	TERMINAL Connector	Pin	Signal	Configurable	Wiring Diagram
RELAY 1	J7	Pin 1	RELAY1-NO 240 V 5 A AC Resistive	Yes	
		Pin 2	RELAY1-COM 240 V 5 A AC Resistive		
		Pin 3	RELAY1-NC 240 V 5 A AC Resistive		
RELAY 2	J5	Pin 1	RELAY2-NO 240 V 5 A AC Resistive	Yes	
		Pin 2	RELAY2-COM 240 V 5 A AC Resistive		
		Pin 3	RELAY2-NC 240 V 5 A AC Resistive		
RELAY 3	J2	Pin 1	RELAY3-NO 240 V 5 A AC Resistive	Yes	
		Pin 2	RELAY3-COM 240 V 5 A AC Resistive		
		Pin 3	RELAY3-NC 240 V 5 A AC Resistive		
RELAY 4	J3	Pin 1	RELAY4-NO 240 V 5 A AC Resistive	Yes	
		Pin 2	RELAY4-COM 240 V 5 A AC Resistive		
		Pin 3	RELAY4-NC 240 V 5 A AC Resistive		

14.3 Part 2: Sub-Chapter installation procedures

14.3.1 Sub-Chapter pre-installation checklist

Prior to installing the control connections and wiring carry out the following pre-installation check:

- Ensure the pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52, "10 Installation—Chapter 2: Electrical power" on page 58 and "11 Installation—Chapter 3: Fluid path" on page 62
- Ensure all requirements of part 1 of this chapter have been met
- Ensure the power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required.
- Ensure the control cable(s) are not damaged
- Ensure items and tools for connection of the pump to the control system are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

14.3.2 Control connection precautions

When following the procedures below or wiring the control cables to the pinouts on the M12 connectors

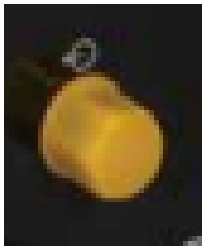
- Keep 4 20 mA and low voltage signals separate from power supply
- Only connect to external circuits, that are separated from mains voltages by reinforced insulation. All of the product input and output terminals are separated from mains circuits by reinforced insulation.
- M type: Do not apply mains power voltages to any of the M12 control connection pins.
- T Type: Do not apply mains power voltages to any of the terminals in terminal blocks (J8, J9, J10, J11, J12, or J13).

14.3.3 Installation of M12 control cables (M type)

14.3.3.1 Protective caps

The M12 control connections are covered with protective caps during manufacture

If any of the connections will not be used for control, leave the protective caps in place of a control cable for added protection of the product. A picture of the cap is illustrated in the picture:



14.3.3.2 M12 control cable installation procedure

Follow the procedure below to connect the M12 control cables.

1. Isolate the pump from its power supply
2. Carry out any control system wiring using the information in part 1 of this chapter
3. Connect the M12 connector to the appropriate location on the pump
4. Turn the screw thread by hand until it is tight
5. Check the cable is secure
6. Reconnect the power supply to the pump

14.3.4 Installation of user wired control cables (T type)

14.3.4.1 Removal and refitting of front input and output panel

In order to connect the cables to the terminals of the input output circuit board, the pump module cover must be removed and re-installed after wiring. Follow the procedure below.

1. Isolate the pump from its power supply.
2. Remove the six M3 x 10 Pozidrive screws from the module cover.

3. Remove the module cover from drive. Do not prise off with tools. Make sure gasket is retained within recessed channel of module cover.


4. Make sure that pre-fitted cable glands are properly seated, secure and have protective dust caps fitted.


5. Check that the gland nut is free to move. Use a 24 mm spanner if required and remove the protective dust caps.


6. Loosen, but do not remove the gland cap. Then insert control cable into loosened gland.
7. Pull through sufficient cable to reach the connectors required, leaving a little slack.
8. Strip the outer sheath as necessary.
9. Remove 5 mm of insulation from conductors. No tinning/ferrule required.
10. Insert bare cable end into the correct terminal.

11. Tighten down screw to clamp wire.
12. Prepare the cable screen(s) by twisting a suitable length. The twisted length(s) shall ideally be sleeved to prevent shorting.
13. Secure the end of the cable screen to the connector provided.
14. When all conductors are in position, tighten gland caps.
15. Check gasket and replace if damaged. Gasket ensures IP66 (NEMA 4X) protection.
16. Hold relay module cover in place and tighten six M3 x 10 Pozidrive screws.

14.4 Part 3: Sub-Chapter specific HMI set up

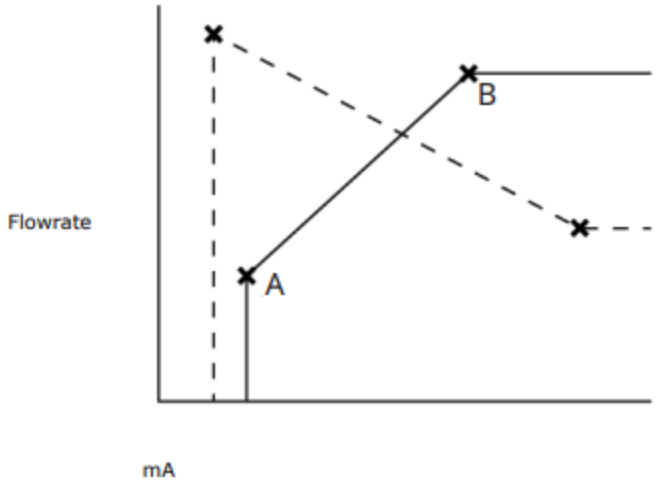
The sub-sections below provide information on control related set up of the pump using the HMI. Not all control settings or MODE menu items are explained here. For full information on:

- Mode Menus: See "22 HMI: Using the MODE menu" on page 202
- Control settings: See "23 HMI: Control settings menu" on page 211

Section	Summary
Change mode>Analog 4-20 mA	Analog 4-20 mA mode provides a flowrate from the pump proportional to an external mA signal input received.
Change mode>Contact mode	Contact mode provides the ability to deliver a user defined dose volume between 0.1 mL and 999 L. The dose can be delivered manually or by analogue control.
Control settings>Configure inputs	Assign inputs, configure.
Control settings>Configure outputs	Assign outputs, configure.
Control settings>Scaling factor	Scaling Factor adjusts 4-20 mA profile using a multiplication factor.
Control settings>Floating ground	A single 4-20 mA signal could be connected to two or more pumps in series. This would allow both pumps to be controlled through one input signal whereby, if either of the pumps fail or is powered off, then the second pump would receive the control signal.

14.4.1 CHANGE MODE>Analog 4-20 mA

In this operating mode the pump speed (flowrate) is proportional to external mA signal input received.

<table>
<tr><th>Model</th><th>Speed versus mA signal behaviour</th></tr>
<tr><td>Universal model</td><td>
<table>
<tr><th>Signal</th><th>Pump speed</th></tr>
<tr><td>4.1 mA</td><td>Minimum speed (0 rpm)</td></tr>
<tr><td>19.8 mA</td><td>Maximum speed (depends on pump head)</td></tr>
</table>
</td></tr>
<tr><td>Universal+ model</td><td>Relationship between external mA signal and flow rate determined by configuring two points A and B as shown in graph below.
 

Rate of flow can be proportional or inversely proportional to analog mA input</td></tr>
</table>

When mA signal greater than level point A and there is no STOP input, run status output will be energized as pump is running.

14.4.1.1 Effect of scaling factor

The 4-20 mA profile is a linear relationship where Y=mX+c. The scaling factor is a control setting that can be used to multiply the gradient (m) by a factor.

The scaling factor will not alter stored A and B points, set in Analog 4-20 mA mode.

For more information on the scaling factor setting see "23.1.7 Control settings>Scaling settings" on page 220

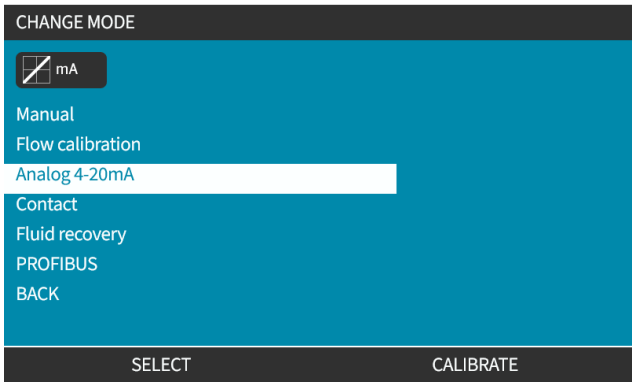
14.4.1.2 Effect of speed limit

The speed limit function in control settings will also scale the analog signal. The speed limit function takes precedence over the scaling factor. Speed limit cannot exceed high flow rate set point (B).

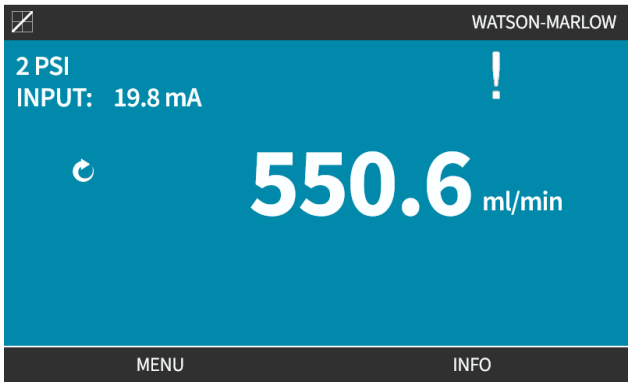
For more information on the speed limit setting see "23.1.1 Control settings>Speed limit" on page 212

14.4.1.3 Select Analog 4-20 mA mode

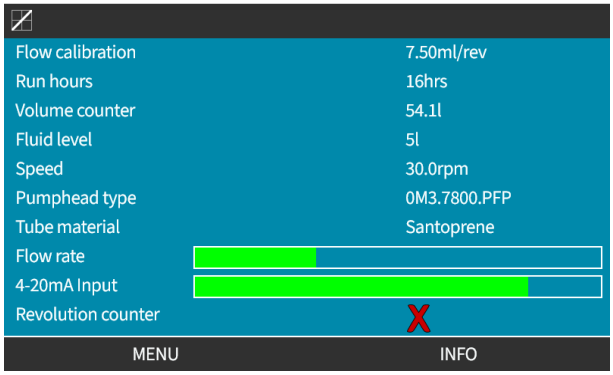
1. Press **MODE** button.
2. Use **+/-** keys to highlight **Analog 4–20 mA**.
3. SELECT



4. Once enabled, the current signal received by pump displayed on **HOME** screen.



5. Press INFO for more information including 4-20 mA calibration figures.



14.4.1.4 Calibrate the pump for 4-20 mA control (Universal+ only)

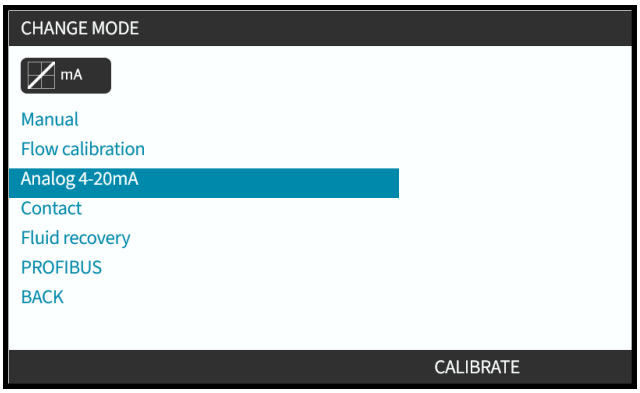
The universal+ model can be calibrated for minimum and maximum speed versus minimum and maximum mA signal.

There are two methods in the procedure below:

Method	Summary
Manual	Manually enter a signal figure using the **+/-** keys.
Input	Apply a signal, then select to confirm the figure. High and low signals must be within range.

To calibrate:

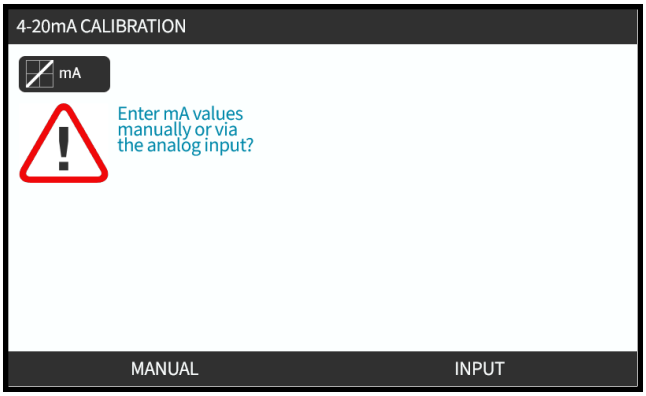
1. Stop the pump
2. Press **MODE** button
3. Use **+/-** keys to scroll to **Analog 4-20 mA**
4. CALIBRATE



4. Choose calibration method:

   MANUAL Enter value using **+/-** keys.

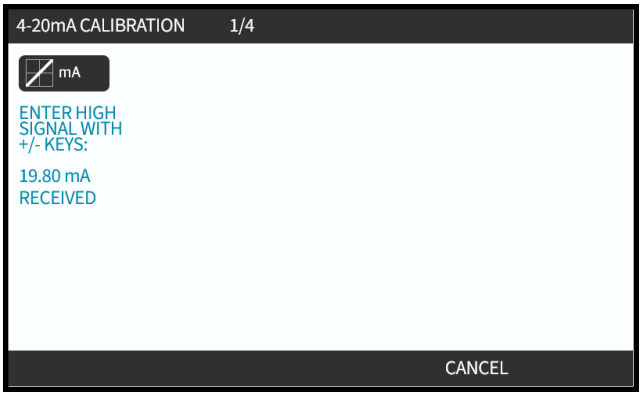
INPUT Apply current signals electrically to analog input.



14.4.1.4.1 Setting a high signal:

1. **MANUAL**—Enter value using **+/-** keys.

   INPUT—Send high signal input to pump.



2. ACCEPT option displays when high 4-20 mA signal is within tolerance:

   Press ACCEPT to set input or, CANCEL to return to previous screen

14.4.1.4.2 Setting high flow calibration:

1. Use **+/-** keys to scroll to choose flow rate:

   Select SET FLOW or, BACK to return to previous screen.

14.4.1.4.3 Setting a low signal

1. **MANUAL**—Enter value using **+/-** keys

   INPUT—Send low signal input to pump.

   If range between low and high signal is less than 1.5 mA, error message displayed.

2. ACCEPT option displays when low 4-20 mA signal is within tolerance:

   ACCEPT to set signal display or, BACK to return to previous screen.

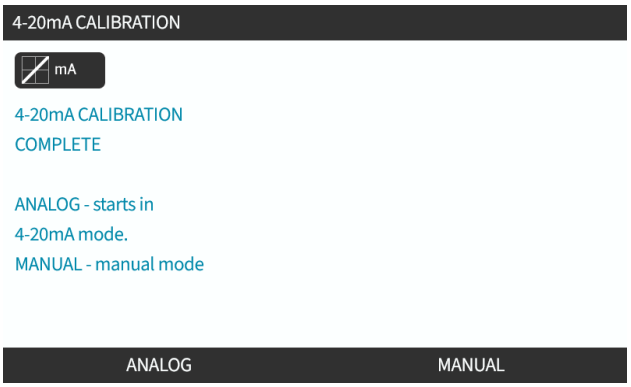
14.4.1.4.4 Setting low flow calibration

1. Use **+/-** keys to choose flow rate:

   SET FLOW or, BACK to return to previous screen

When all settings are entered, the calibration confirmation screen is displayed.

Select either ANALOG to use proportional mode or, MANUAL to use manual mode.

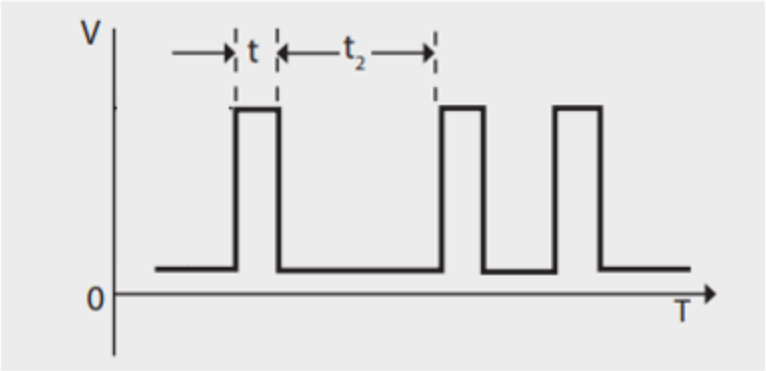


14.4.2 CHANGE MODE>Contact mode

Contact mode provides the ability to deliver a user defined dose volume between 0.1 mL and 999 L. This dose can be delivered by one of two methods:

Method	Summary
Manual dose	When the START key is pressed. This manual dose can only be delivered if an analogue does is not being delivered at the same time.
Analogue dose	Allows intermittent on/off dosing with variable duration controlled via external positive voltage pulse received by pump.

Pulse specification



Time (T)	
t:	40 ms (min) to 1000 ms (max)
T_2	> 1s

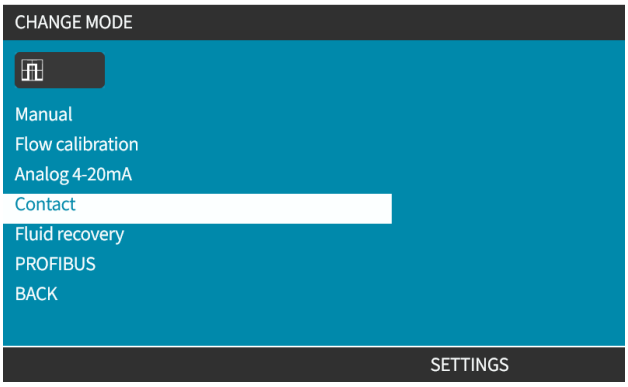
The following contact mode settings are available:

Item	Setting	
Contact dose volume	Set the volume of liquid to be dosed between 0.1 mL and 999 L	
Flow rate	Set the flowrate the dose will be produced (volume/flowrate = time). Doses which operate for less than 3 seconds are not recommended.	
Contact memory	Set whether to ignore or add pulses.	
	Ignore pulses	If set to “ignore”, pulses will be forgotten by the pump
	Add pulses	If set to “add” Pulses received during dosing will be queued in memory. Queued pulses will activate dispensing when the current dose has finished. If pulses are buffered in memory the pump will not stop between doses.

14.4.2.1 Procedure: Enable and configure contact mode

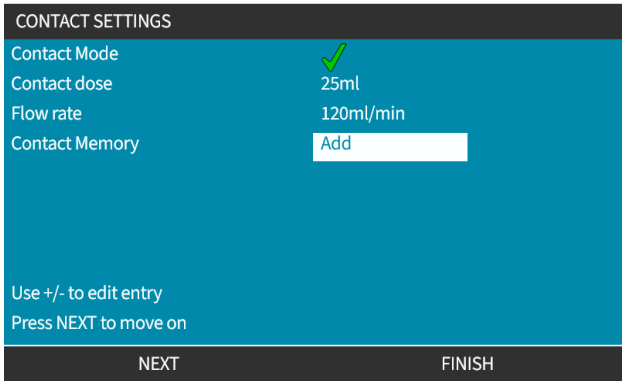
14.4.2.1.1 Enable contact mode

1. Highlight **Contact** from menu
2. Press SETTINGS to enable **Contact Mode** and allow editing of values

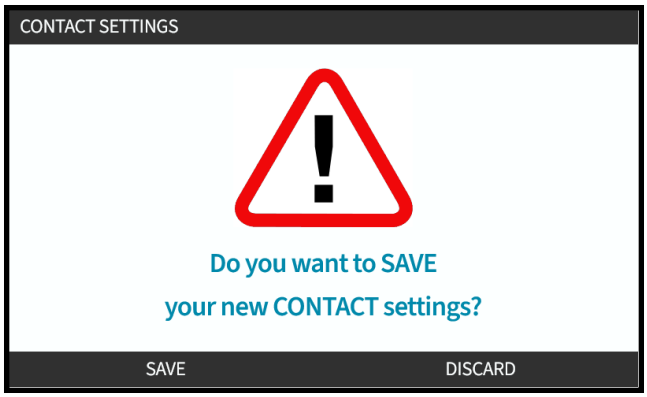


14.4.2.1.2 To configure contact mode settings

1. Referring to the Contact Mode Settings table, use **+/-** keys to enter a value for each setting.
2. Choose NEXT to cycle through settings.



3. When complete, press FINISH save screen will display.



4. Press SAVE to store data

   or

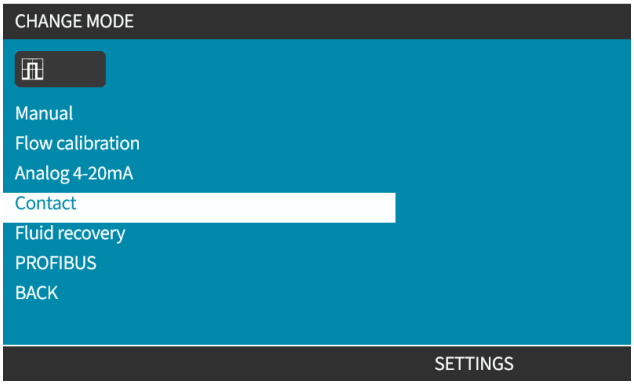
   Press DISCARD to return to previous page.

14.4.2.2 Procedure: View Contact home screen.

Once Contact mode is enabled and configured, easily view Contact mode home screen and settings via MODE button.

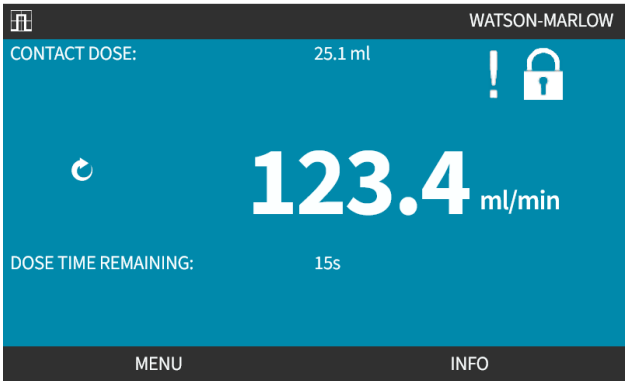
To view Contact mode home screen:

1. Press **MODE** key
2. Use **+/-** keys to highlight **Contact option**
3. Press SETTINGS.



The contact mode home screen will display.

- Contact dose
- Flow rate
- Dose time remaining for dose in progress.
  (Dose time only displayed on screen when dose time is between 3–999 seconds).



14.4.2.3 Contact mode>start/stop

The contact dose signal will trigger the drive to produce a dose based on the programmed flowrate and dose volume. This polarity of the voltage (high/low) which is used to trigger the dose, can be set. This is explained in the next section ("14.4.3.4 To configure Contact dose start trigger: Polarity" on page 121).

14.4.3 Control settings>Configure inputs

The following inputs [1] can be configured in control settings:

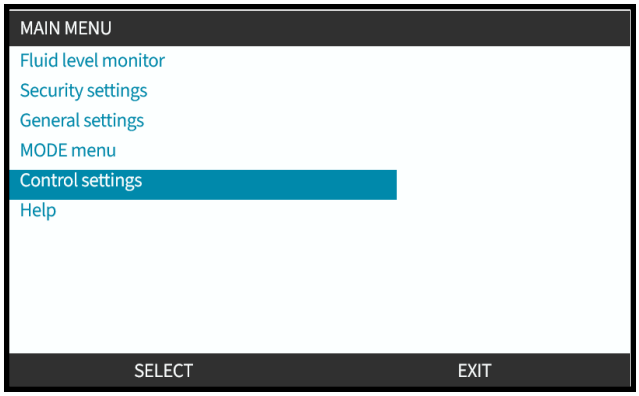
Item	Summary
Start/Stop	Configure polarity
Contact	Configure polarity, assign input
Fluid recovery	Configure polarity, assign input

NOTE 1 Input 1 and 2 may also be configured in relation to floating ground, as a sub-menu. This is explained in "23.1.8 Control settings>Floating ground" on page 220

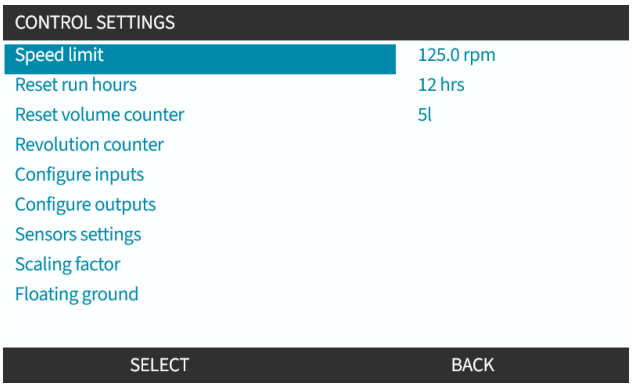
14.4.3.1 To configure inputs:

From the **MAIN MENU**

1. Use **+/-** keys to highlight **CONTROL SETTINGS**
2. Press SELECT.



3. Highlight **Configure Input** option.
4. Press SELECT.



14.4.3.2 To configure start/stop: Polarity

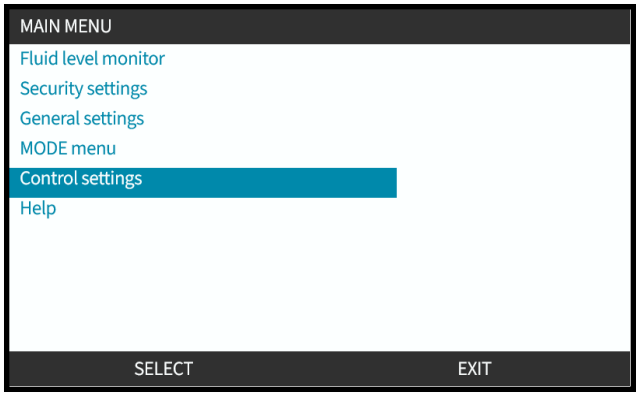
A start/stop signal can be used to stop the pump using the remote stop feature. This will not effect the following operation:

- Flow calibrations
- Max speed key operation
- Manual Fluid recovery

The polarity of the voltage to start/stop can be set. A low polarity signal is recommended as the pump will stop if an input signal is lost.

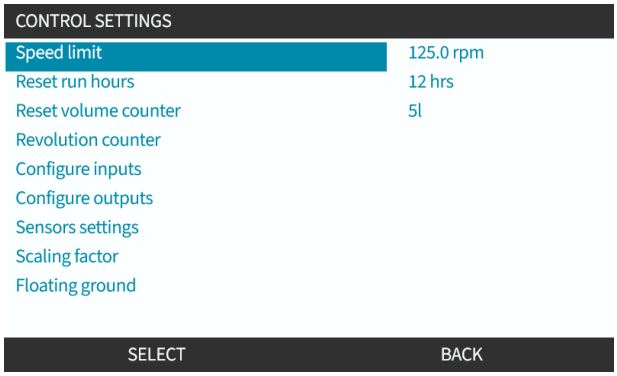
From the **MAIN MENU**

1. Use **+/-** keys to highlight **CONTROL SETTINGS**
2. Press SELECT.

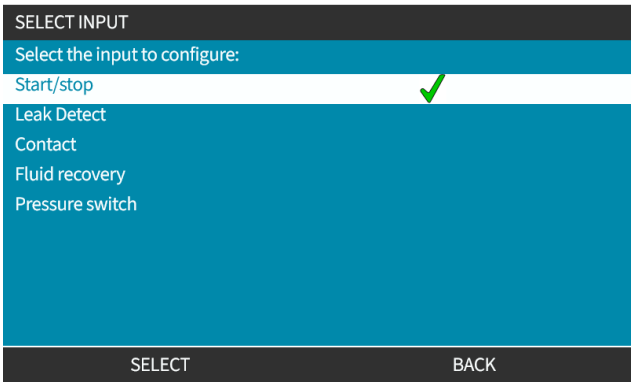


3. Highlight **Configure Input** option.

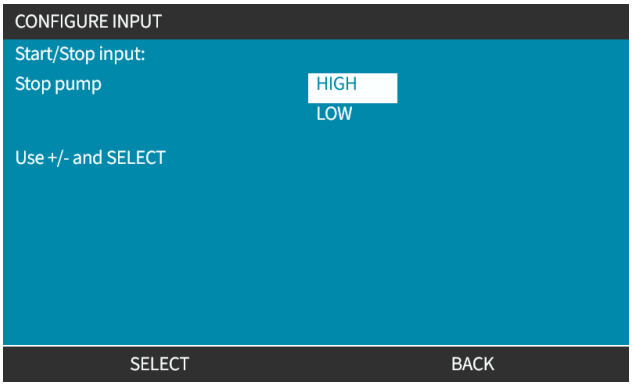
4. Press SELECT.



5. Use **+/-** keys to highlight **Start/Stop**
6. Press SELECT.



7. Use **+/-** keys to highlight options
8. Press SELECT to enable HIGH or LOW polarity



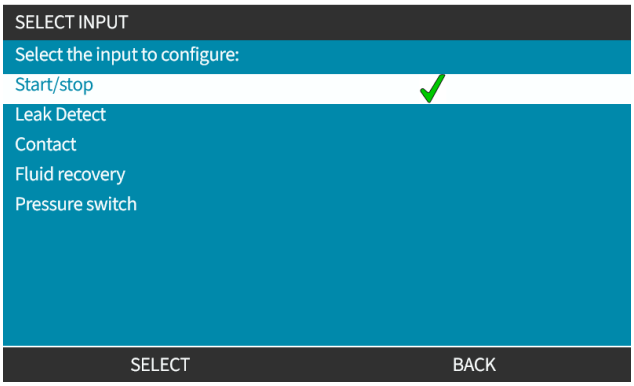
14.4.3.3 To configure start/stop: Assign input

The start/stop cannot be assigned to any other input than #4.

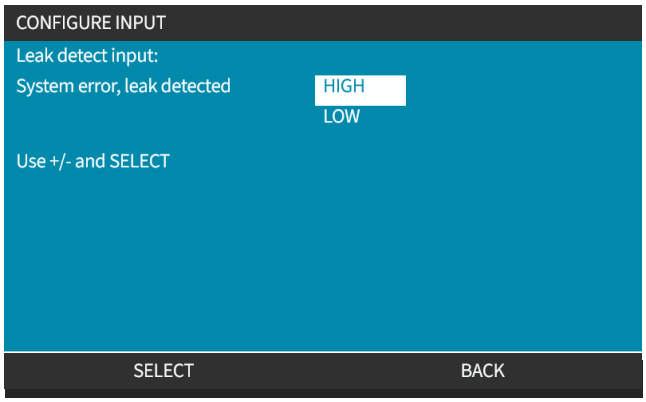
14.4.3.4 To configure Contact dose start trigger: Polarity

The polarity of the voltage to trigger the start of a contact dose can be set. A dose will only be delivered if the pump is in contact mode.

1. Highlight **Configure** option.
2. SELECT.



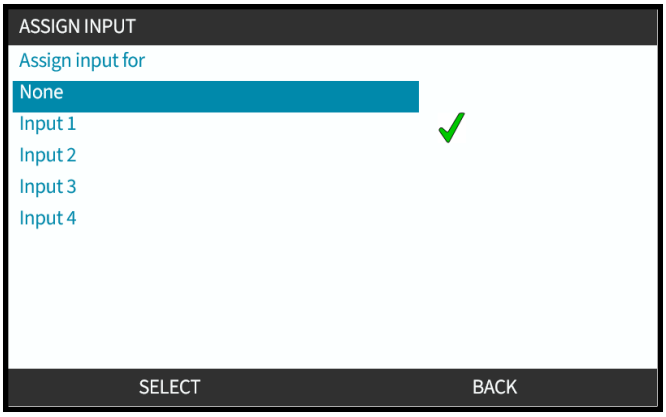
3. Use **+/-** keys to highlight options.
4. SELECT High or low polarity.



14.4.3.5 To configure Contact dose: Assign input

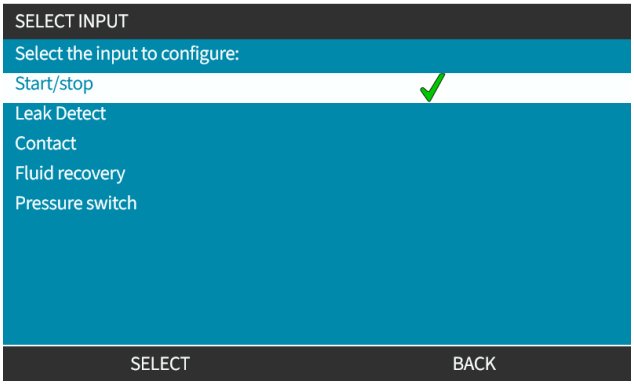
The contact dose trigger can be assigned to be on any of the 4 inputs.

1. Highlight the desired input number.
2. SELECT −.

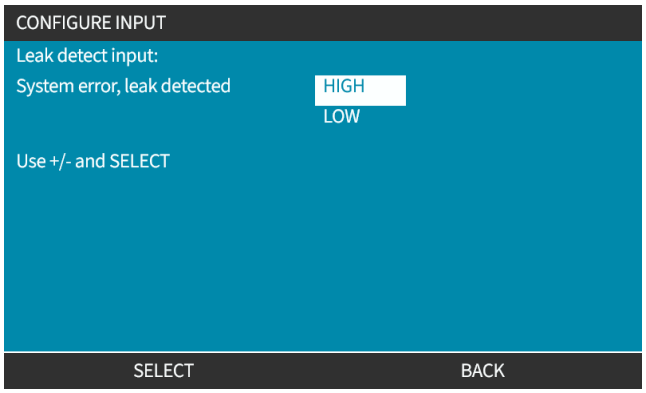


14.4.3.6 To configure fluid recovery polarity

1. Highlight **Configure** option.
2. SELECT −.



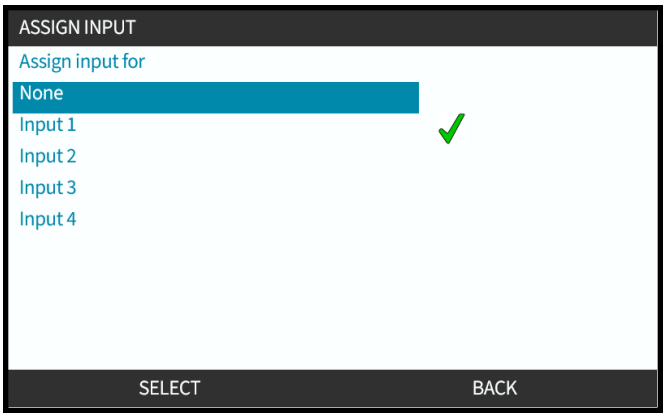
3. Use **+/-** keys to highlight options
4. SELECT − High or low polarity.



14.4.3.7 To configure Fluid recovery: Assign input

Fluid recovery can be assigned to be on any of the 4 inputs.

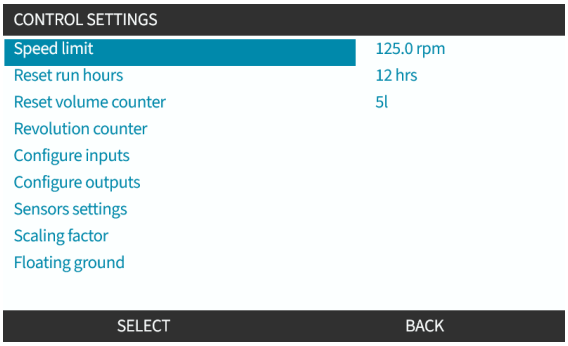
1. Highlight the desired input number.
2. SELECT −.



14.4.4 Control settings>Configurable outputs

14.4.4.1 To configure outputs:

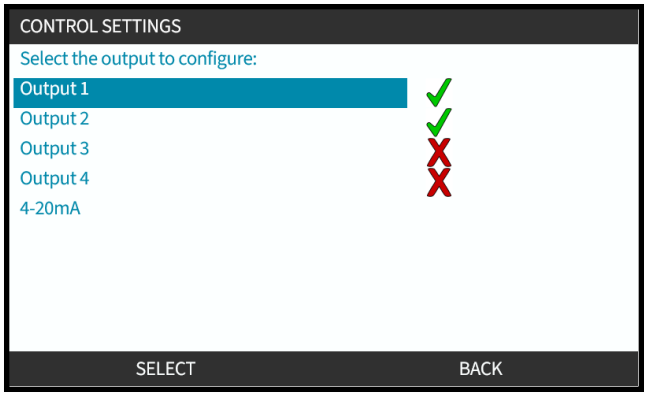
1. Highlight the **Configure outputs** option.
2. SELECT −.



14.4.4.1.1 To configure outputs 1 to 4:

1. Use **+/-** keys to highlight output to configure
2. Press SELECT.

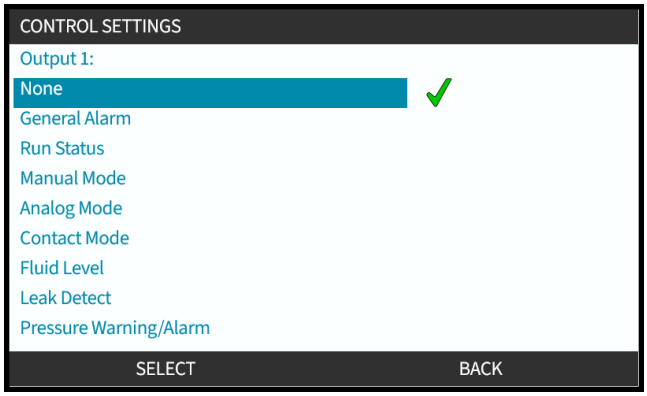
   Tick symbol ✓ indicates current selection



3. Use **+/-** keys to highlight required output option.

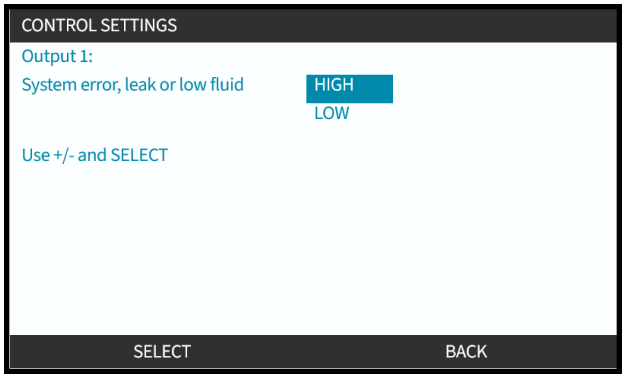
   Tick symbol ✓ indicates current selection

4. Press SELECT.



5. Use **+/-** keys to highlight required logic status option (HIGH or LOW)

6. Press SELECT.



7. Press SELECT to program output

   or

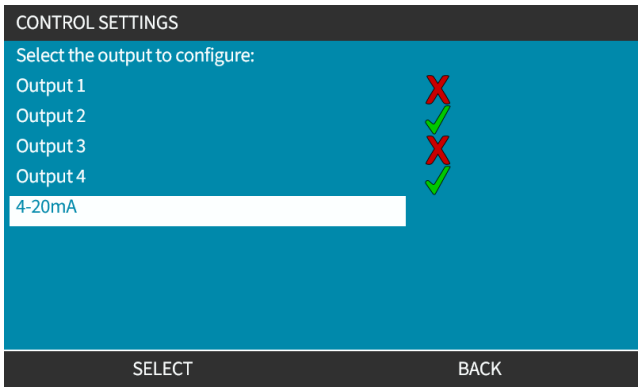
   Press BACK to cancel

14.4.4.2 Control settings 4 – 20 mA output (Universal+ model only)

The universal+ model only has a 4-20 mA output which can be configured. There are two options:

Scale	Explanation
Full scale	4-20 mA output is based on pumps full speed range. **0 rpm** | **Maximum rpm** 4 mA | 20 mA
Match input scale	4-20 mA output will scale to same range as 4-20 mA input. Example: If the 4-20 mA input has been scaled to provide 4 mA=0 rpm and 20 mA=20 rpm then an input of 12 mA will result in a set speed of 10 rpm and an output of 12 mA. This function will match both the mA and the rpm scales.

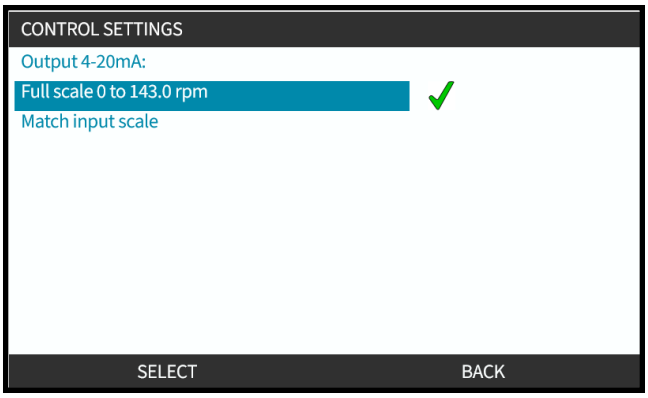
1. Use +/- keys to highlight **4-20 mA** option
2. SELECT −.



3. Use **+/-** keys to highlight required option.

   Tick symbol ✓ indicates current setting.

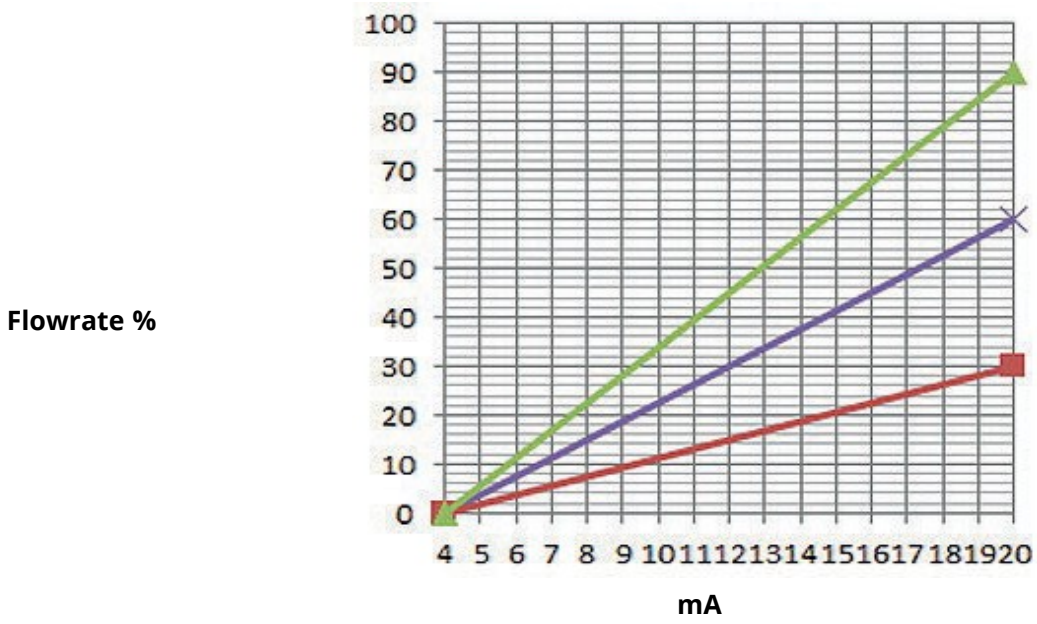
4. SELECT −.



14.4.5 Control settings>Scaling factor

The 4-20 mA profile is a linear relationship where Y=mX+c. The scaling factor is a control setting that can be used to multiply the gradient (m) by a factor.

Example shown in graph and table below:



Scaling factor		Effect on 4-20 mA profile
Scaling factor graph line colour	Scaling factor figure	
	1.50	Will increase flowrate (pump speed) by a factor of 1.50.
	1.00	No effect (Original 4-20 mA profile)
	0.50	Will decrease flowrate (pump speed) by a factor of 0.50.

14.4.5.1 Scaling factor versus speed limit

The speed limit function in control settings will also scale the analog signal. The speed limit function takes precedence over the scaling factor. The scaling factor will never cause pump to exceed speed limit.

The difference between scaling factor and speed limit is that the speed limit is a global variable applied in all modes.

For example

> if the 4-20 mA profile is 0 % flow at 4 mA to 100 % flow at 20 mA and a speed limit of 33 rpm is applied, followed by a scaling factor of 0.5, then the output will be 30 %. If a scaling factor of 2 is applied in the same scenario then the output will be 33 rpm or 60 %, as the speed limit takes precedence over the scaling factor.

If you are using manual scaling it is recommended to not use speed limit to avoid confusion.

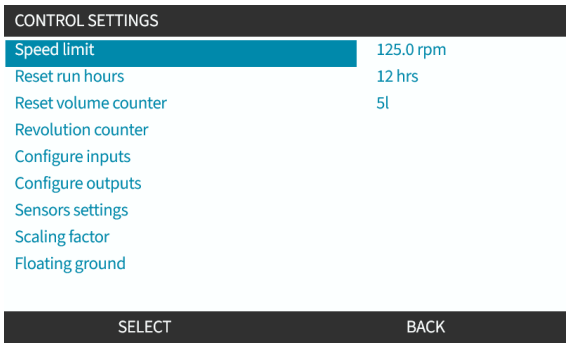
14.4.5.2 Effect on Analog 4-20 mA mode: A and B points

The scaling factor

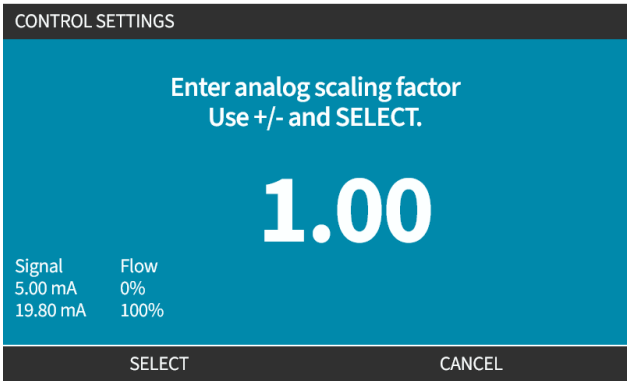
- Will not alter stored A and B points, set in Analog 4-20 mA mode
- Speed limit cannot exceed high flow rate set point (B).

14.4.5.3 To configure scaling factor:

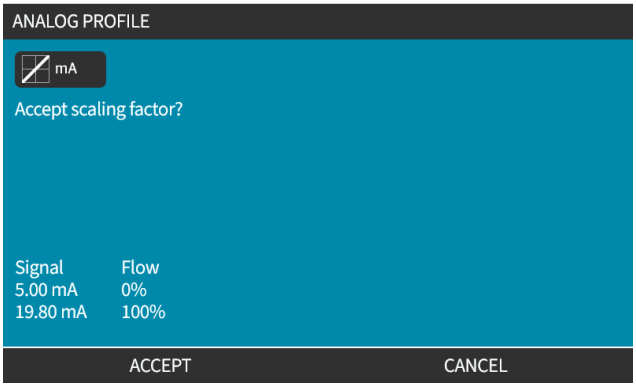
1. From the **Main Menu** use +/- to select **Control Settings**.
2. Use **+/-** keys to access **Scaling Factor**.



3. Use **+/-** keys to enter multiplication factor.
4. SELECT −.



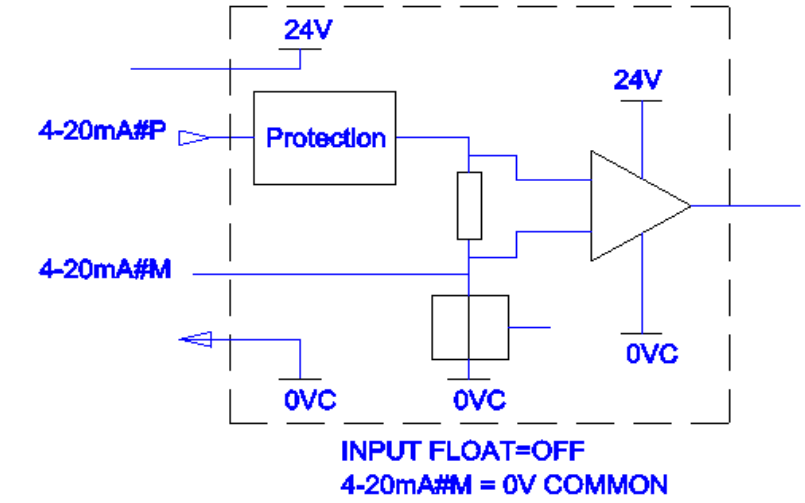
5. ACCEPT − to confirm new **4-20 mA Profile Figures**

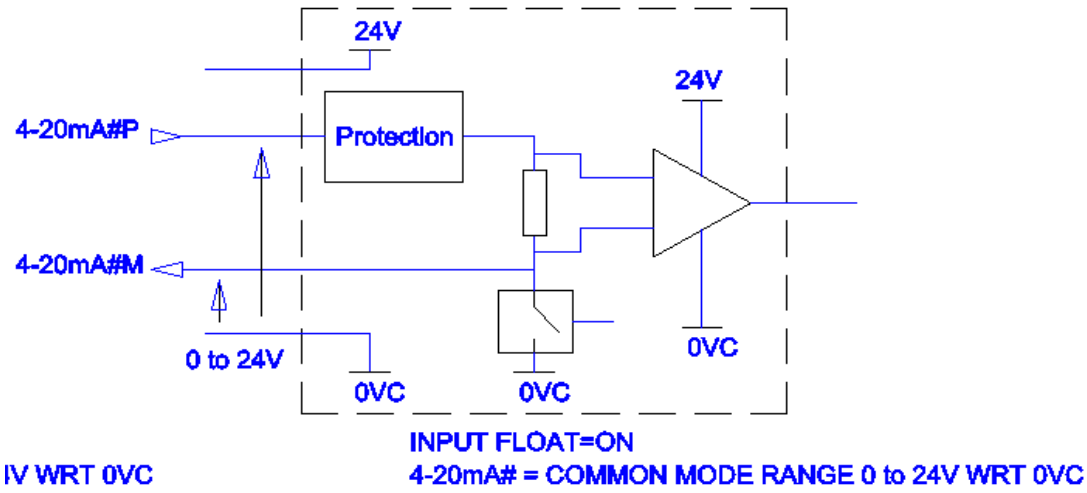


14.4.6 Control Settings>Floating ground

A single 4-20 mA signal could be connected to two or more pumps in series. This would allow both pumps to be controlled through one input signal whereby, if either of the pumps fails or is powered off, then another pump would receive the control signal.

Toggle	Action
Enabled	Floating ground
Disabled	Grounded at pump



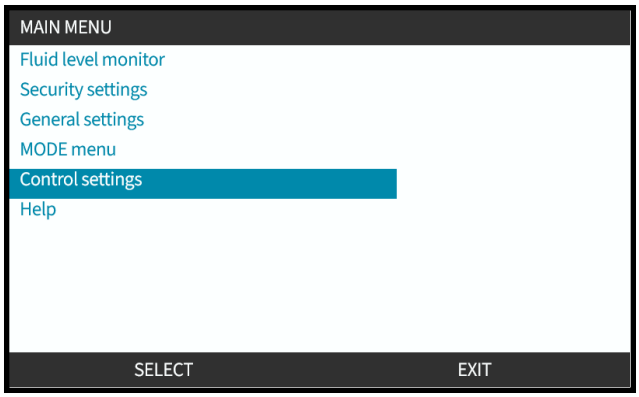


Contact your local Watson-Marlow representative if more information is required.

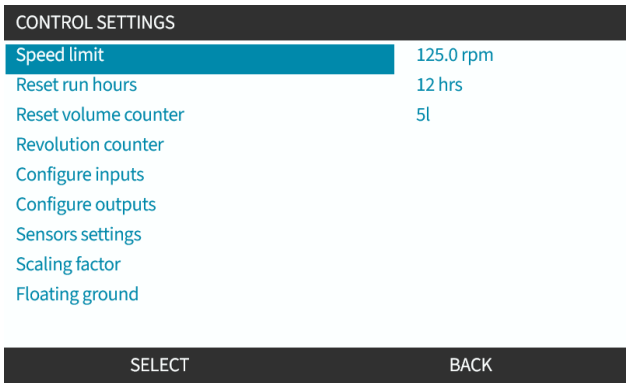
14.4.6.1 Set floating ground

From the **MAIN MENU**

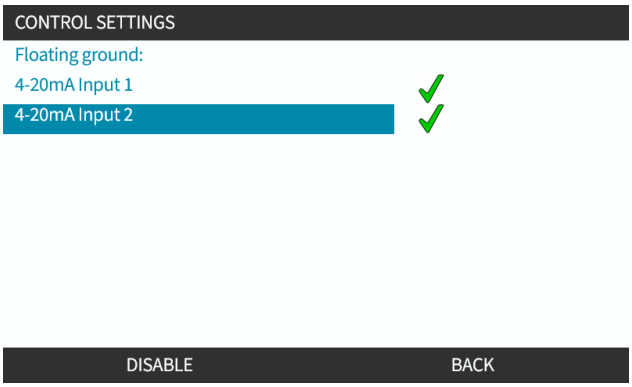
1. Use **+/-** keys to highlight **CONTROL SETTINGS**



2. Press SELECT
3. Highlight **Floating ground** option.
4. Press SELECT



5. Use **+/-** keys to highlight required input
6. Press Soft Key 1 to ENABLE or DISABLE floating ground



7. Press BACK to display **CONTROL SETTINGS**

15 Installation—Sub-Chapter 4C: Control (Model: PROFIBUS)

15.1 Sub-Chapter overview

This section provides information on connection, input/output specification and relevant set up using the HMI of the PROFIBUS model only.

15.2 Part 1: Sub-Chapter installation requirements, specification, and information

15.2.1 PROFIBUS GSD file

Qdos PROFIBUS pump can be integrated into PROFIBUS DP V0 network using a General Station Data (GSD) file. File identifies pump and contains key data including:

- Communication settings.
- Commands it can receive.
- Diagnostic information it can pass to PROFIBUS master on interrogation.

The GSD file may be downloaded from the Watson-Marlow website from the link below:

Web address: *https://www.wmfts.com/en/literature/other-resources/software-and-devices/*

Dataflow to/from pump may need to be byte-reversed, due to handling data between suppliers of master devices.

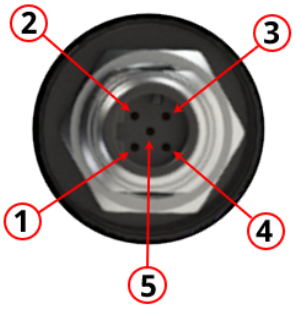
15.2.2 Control cable specification

A PROFIBUS specified cable, IP66 rated, with a M12 connector is required to connect and control a H-FLO PROFIBUS drive.

15.2.3 Control connections

The M12 control connections function by location, thread style, pin count and plug code vary.

15.2.3.1 Network connection

<table>
<tr><td>Overview</td><td>Two network connections are provided for the PROFIBUS models. Both connections have an identical function.
Both PROFIBUS connectors are joined internally to allow flexible network configurations. If the pump is to be used at the end of a network, we recommend the use of a PROFIBUS termination plug for maximum network speed and robustness. To maintain ingress protection the termination plug must be IP66, NEMA 4X rated.</td></tr>
<tr><td>Location</td><td>The connections are located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td>M12, Female, 5 Pin, B-code socket, IP66, NEMA 4X</td></tr>
<tr><td>Pin out illustration</td><td> 
</td></tr>
<tr><td>Pin out information</td><td><table>
<tr><th>Pin .</th><th>Signal</th></tr>
<tr><td>1</td><td>PB-5V</td></tr>
<tr><td>2</td><td>PROFIBUS Signal A</td></tr>
<tr><td>3</td><td>PROFIBUS Signal B</td></tr>
<tr><td>4</td><td>PB-0V</td></tr>
<tr><td>5</td><td>Cable Screen</td></tr>
</table></td></tr>
</table>

15.2.3.2 Control input: Pressure sensor

Overview	A pressure sensor input connection is provided, for use with the Watson-Marlow Pressure Sensor Kit. • It is not possible to use a third party pressure sensor
Location	The pressure sensor input connection is located as illustrated by the graphic. 
Specification	M12, Male, 4 Pin, A-code plug, IP66, NEMA 4X
Pin out information	No pin out information is provided. This pressure sensor connection must only be used with the Watson-Marlow pressure sensor kit. Do not connect any other wires, or cables or attempt to wire to this connection.

15.2.4 Units used in the PROFIBUS parameters

The following units are used in the PROFIBUS parameters

Name	Explanation	Example
DeciRPM	$1/10^{th}$ of an RPM	1205 deciRPM = 120.5 rpm
uL (microlitre)	$1/1000^{th}$ of a mL	1,000,000 uL/min = 1000 mL/min = 1 L/min

15.2.5 User parameter data

User Parameter Data									
Ext_User_Prm_Data_ Const[0]=	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Byte 0	Pump model	
Byte 1	Head type	
Byte 2	Field bus minimum speed	High Byte
Byte 3	Field bus minimum speed	Low Byte
Byte 4	Field bus maximum speed	High Byte
Byte 5	Field bus maximum speed	Low Byte
Byte 6	Fail safe	
Byte 7	Fail safe speed	High Byte
Byte 8	Fail safe speed	Low Byte

15.2.5.1 Pump model

Hex	Description
0x00	QFH

15.2.5.2 Head type

Hex	Description	Product Code
0x00	ReNu 150 pumphead Santoprene / PFPE 7 bar (102 psi)	0M3.6200.PFP
0x03	ReNu 300 pumphead Santoprene / PFPE 5 bar (73 psi)	0M3.7200.PFP
0x04	ReNu 300 pumphead SEBS / PFPE 4 bar (58 psi)	0M3.7800.PFP
0x05	ReNu 600 pumphead Santoprene / PFPE 2.5 bar (36 psi)	0M3.8200.PFP

15.2.5.3 Set Minimum/Maximum speeds

Min/Max Speed parameters are used to set Min/Max speed from PROFIBUS interface:

- Values must only be used if matching bit in Control Word is enabled and not zero.
- Values are 16 bit unsigned in deci RPM (1/10th of pumphead RPM).
- If pump is required to operate at lower speed than user defined minimum speed parameter data, (bytes 3, 4) pump will operate at defined minimum speed.
- If maximum speed configured in user parameter data, pump is limited to this maximum speed even when master requests a higher rpm.

15.2.5.4 Fail safe

The fail-safe user parameter is used to set the correct course of action to take in the event of a PROFIBUS communications failure. The fail-safe byte is configured as shown in the following table**1**.

NOTE 1 If no bits set or invalid pattern is set, default fail safe behaviour stops pump

Hex	Description
0x00	No fail safe action
0x01	Continue running using the last speed set point
0x02	Continue running using the fail-safe speed

15.2.5.5 Fail safe speed

Fail-safe speed parameter used to set speed at which pump should be driven if a PROFIBUS communications error occurs and fail- safe user parameter is set to 0x02.

15.2.6 PROFIBUS data exchange

PROFIBUS data exchange	
Default address	126
PROFIBUS Ident	0x0E7D
GSD File	WAMA0E7D.GSD
Config	0x62, 0x5D (3 words out, 14 words in)
User parameter bytes	6

15.2.6.1 Cyclic Data Write (from Master to pump)

Data type	Byte order	Description
16 bit	Byte 1 (high), 2 (low)	Control Word
16 bit	Byte 3 (high), 4 (low)	Pumphead Speed Setpoint (unsigned)
16 bit	Byte 5 (high), 6 (low)	Set Flow Calibration in µL per revolution

15.2.6.2 Control word

Control Word	
Bit	**Description**
0	Run
1	Direction (0 = CW, 1 = CCW)
2	Tacho count reset (1 = Reset count)
3	Reserved
4	Enable Fieldbus Min/Max Speeds (1 = Enabled)
5	Enable Fieldbus Flow Calibration (1= Enabled)
6	not used
7	Reset fluid level
9-15	Reserved

15.2.6.3 Pumphead Speed Setpoint

Speed setpoint is 16-bit unsigned integer value representing speed of pumphead in deciRPM

15.2.6.4 Set Flow Calibration

This parameter is used to set the flow calibration value from the fieldbus interface. The value is a 16 bit unsigned integer representing µL per revolution of the pumphead**1**.

NOTE 1 This value is only used if bit 5 of the Control Word is enabled

15.2.6.5 Cyclic Data Read (from pump to master)

Data type	Byte order	Description
16 bit	Byte 1 (high), 2 (low)	Status word
16 bit	Byte 3 (high), 4 (low)	Pumphead measured speed
16 bit	Byte 5 (high), 6 (low)	Hours run
32 bit	Byte 7 (high), 8 (low) Byte 9 (high),10 (low)	Revolution count
16 bit	Byte 11(high),12 (low)	Flow calibration
32 bit	Byte 13 (high), 14 (low) Byte 15 (high) ,16 (low)	Fluid level
32 bit	Byte 17 (high), 18 (low) Byte 19 (high), 20 (low)	Unassigned
32 bit	Byte 21 (high), 22 (low) Byte 23 (high), 24 (low)	Unassigned
32 bit	Byte 25 (high), 26 (low) Byte 27 (high), 28 (low)	Unassigned

15.2.6.6 Status word

Status word information is provided in the table below:

Bit	Description
0	Motor running (1 = Running)
1	Global Error Flag (1 = Error)
2	Fieldbus Control (1 = Enabled)
3	Reserved
4	Over current error
5	Under voltage error
6	Over voltage error

Bit	Description
7	Over temperature error
8	Motor stalled
9	Tacho fault
10	Leak detected or pumphead alert
11	Low Setpoint - out of range
12	Hight Setpoint – out of range
13	Reserved
14	Reserved
15	Reserved

15.2.6.7 Pumphead Speed

The pumphead speed is a 16-bit unsigned integer value representing speed of pump head in deciRPM.

15.2.6.8 Hours run

Hours run parameter is 16-bit unsigned integer representing whole hours of runtime.

15.2.7 Device-related diagnostic data

Device related diagnostic information is provided in the table below:

Bit type	Byte order	Description
--	Byte 1, 2, 3, 4, 5, 6	Mandatory Slave Byte
8 bit	Byte 7	Header byte
8 bit	Byte 8	Pump model
8 bit	Byte 9	Pump Head
16 bit	Byte 10 (high),11 (low)	Tube size
16 bit	Byte 12 (high),13 (low)	Minimum speed
16 bit	Byte 14 (high), 15 (low)	Maximum speed
32 bit	Byte 16 (high), 17 (low) Byte 18 (high), 19 (low)	Software version Main CPU
32 bit	Byte 20 (high), 21 (low) Byte 22 (high), 23 (low)	Software Version HMI CPU
32 bit	Byte 24 (high), 25 (low) Byte 26 (high), 27 (low)	Software Version HMI CPU
32 bit	Byte 28 (high), 29 (low) Byte 30 (high), 31 (low)	Software Version PROFIBUS CPU

15.2.8 Channel-related diagnostic data

Channel-related diagnostic blocks are always three bytes long in following format

Channel-related diagnostic block format	
Byte	**Description**
Byte 1	Header
Byte 2	Channel type
Byte 3	Channel-related error code

Channel-related error code	
Error description	**Error code**
Global error	0xA9
Over current	0xA1
Under Voltage	0xA2
Over Voltage	0xA3
Over Temperature	0xA5
Motor Stall	0xA4
Tacho Stall	0xB1
Leak detected	0xB2
Setpoint out of range - low	0xA8
Setpoint out of range - high	0xA7
Fluid level alert	0xB3

15.3 Part 2: Sub-Chapter installation procedures

15.3.1 Sub-Chapter pre-installation checklist

Prior to installing the control connections and wiring carry out the following pre-installation check:

- Ensure the pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52, "10 Installation—Chapter 2: Electrical power" on page 58 and "11 Installation—Chapter 3: Fluid path" on page 62
- Ensure all requirements of part 1 of this chapter have been met
- Ensure the power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required
- Ensure the control cable(s) are not damaged
- Ensure items and tools for connection of the pump to the control system are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

15.3.2 Control connection precautions

When following the procedures below or wiring the control cables to the pinouts on the M12 connectors

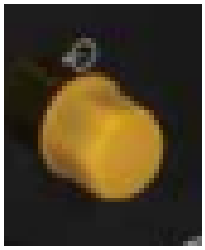
- Keep 4-20mA and low voltage signals separate from power supply
- Only connect to external circuits, that are separated from mains voltages by reinforced insulation. All of the product input and output terminals are separated from mains circuits by reinforced insulation.
- Do not apply mains power voltages to any of the M12 control connection pins.

15.3.3 Installation of M12 control cables (M type)

15.3.3.1 Protective caps

The M12 control connections are covered with protective caps during manufacture

If any of the connections will not be used for control, leave the protective caps in place of a control cable for added protection of the product. A picture of the cap is illustrated in the picture:



15.3.3.2 M12 control cable installation procedure

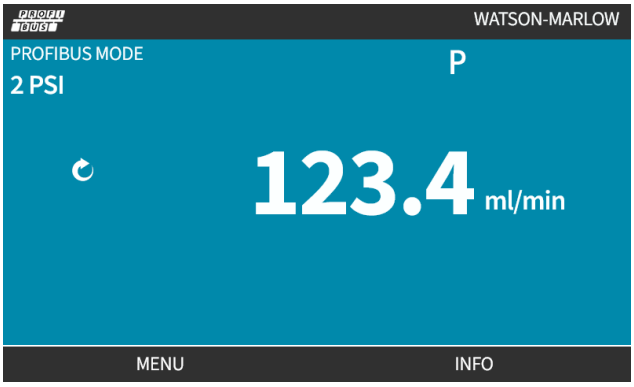
Follow the procedure below to connect the M12 control cables.

1. Isolate the pump from its power supply
2. Carry out any control system wiring using the information in part 1 of this chapter
3. Connect the M12 connector to the appropriate location on the pump
4. Turn the screw thread by hand until it is tight
5. Check the cable is secure
6. Reconnect the power supply to the pump

15.3.4 Master slave communications sequence

15.3.4.1 Data exchange

In PROFIBUS mode, the screen below is displayed, the **P** indicates data exchange is happening.

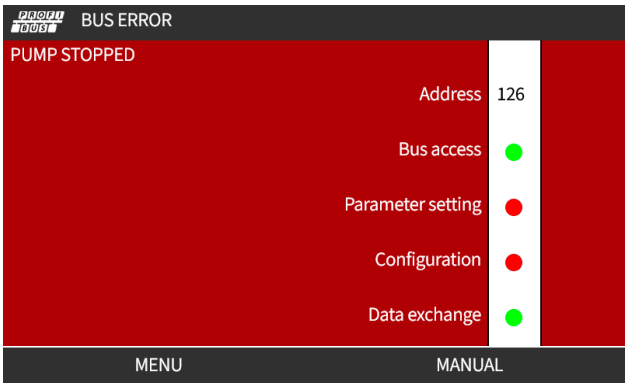


This screen will only be displayed after successful implementation of Master Slave communications, which always follow the sequence described below.

Master Slave communications sequence	
Power On Reset	Power ON/reset of Master or Slave
	
Parameterisation	Download parameters into the field device (selected during configuration by the user)
	
I/O configuration	Download of I/O configuration into the field device (selected during configuration by the user)
	
Data exchange	Cyclic data exchange (I/O data) and field device reports diagnostic

15.3.4.2 Loss of data exchange

If data exchange is lost at any time, the following screen will be displayed. The first red dot corresponds to the stage at which the error occurred, and subsequent stages will indicate a red dot because the communication sequence halted before this point.



The screen will state running or stopped, depending on how the user has set up the fail-safe function within the PROFIBUS GSD file. The **MODE** button gives access to the PROFIBUS settings and the station address. When menus are accessed, the pump continues to run in PROFIBUS mode.

If the **MODE** or **MENU** button has been pressed, after five minutes of inactivity the pump will revert to the home screen and discard any unsaved changes, if there are still no communications then the BUS ERROR screen will be displayed.

15.4 Part 3: Sub-Chapter specific HMI set up

The sub-sections below provide information on PROFIBUS only related set up of the pump using the HMI.

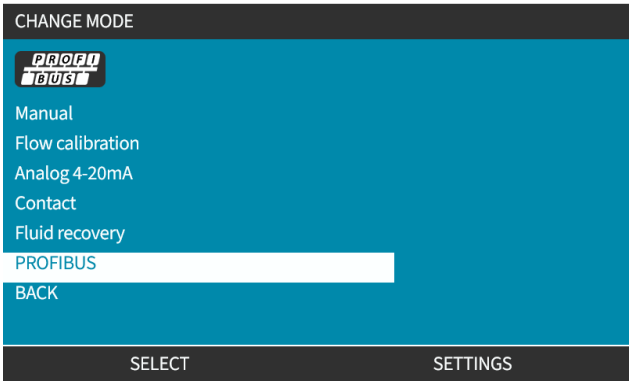
For full information on:

- Mode Menus: See "22 HMI: Using the MODE menu" on page 202
- Control settings: See "23 HMI: Control settings menu" on page 211

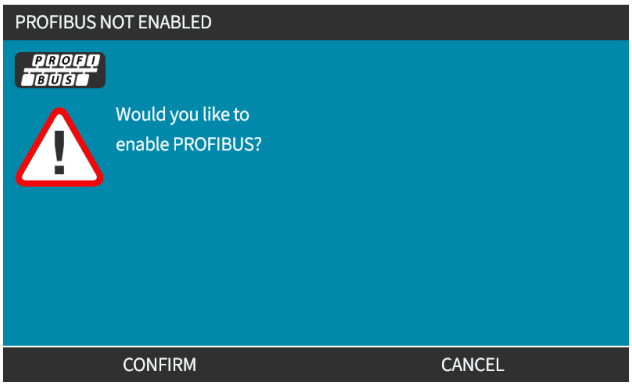
15.4.1 Procedure: Select and enable PROFIBUS

To select and enable PROFIBUS mode:

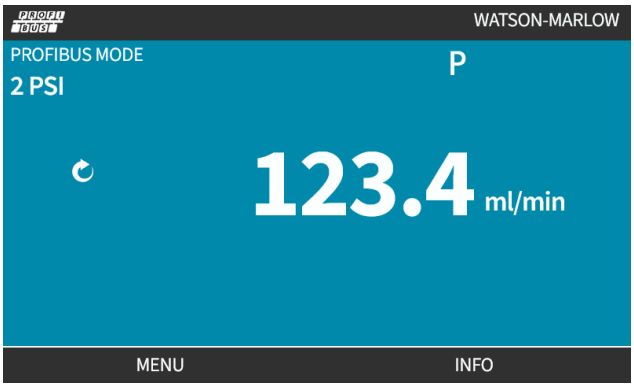
1. Press **MODE** key
2. Use **+/-** keys to highlight **PROFIBUS**
3. SELECT.



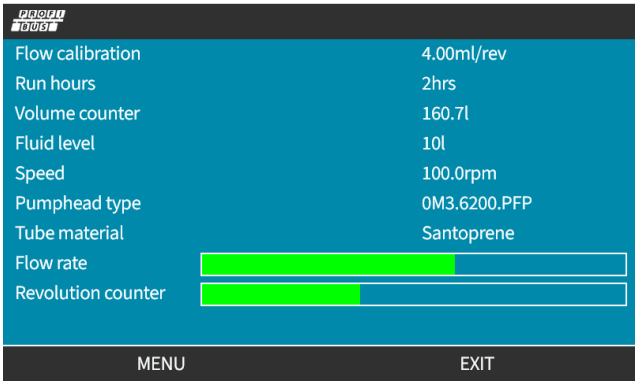
4. Press CONFIRM to enable PROFIBUS



5. PROFIBUS home screen shows white icon to indicate data exchange.



6. Pressing INFO [−] displays pump information screen

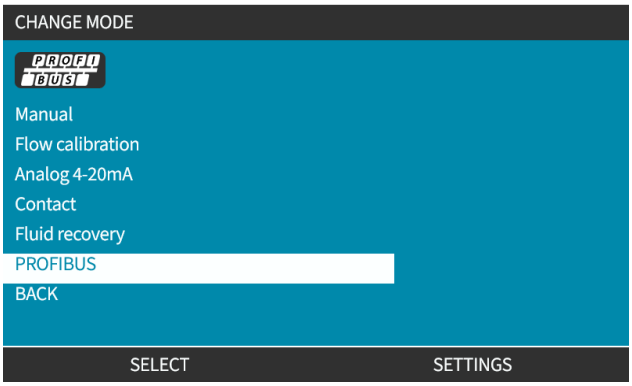


15.4.2 Procedure: Assigning the PROFIBUS station address at the pump

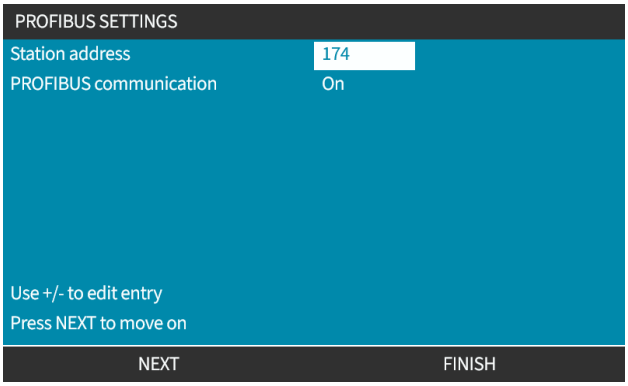
The station address cannot be automatically assigned by master.

15.4.2.1 To assign PROFIBUS station address

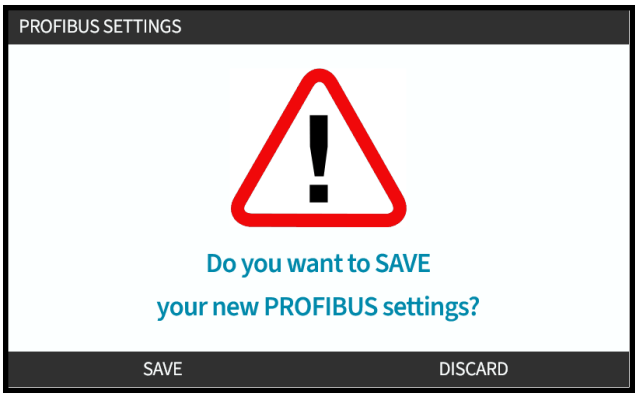
1. Press **MODE** key
2. Use **+/-** keys to highlight **PROFIBUS**
3. SELECT.



4. Use **+/-** keys to edit station address.



5. Choose FINISH to set station address
   or
   NEXT to select **PROFIBUS Communication**
   When FINISH is selected the save settings screen will be displayed:
6. Select SAVE to store settings


PROFIBUS SETTINGS
Do you want to SAVE
your new PROFIBUS settings?
SAVE
DISCARD

16 Installation—Sub-Chapter 4D: Control (Model: EtherNet/IP)

This section provides information on connection, input/output specification and relevant set up using the HMI of the EtherNet/IP model only.

16.1 Part 1: Sub-Chapter installation requirements, specification, and information

16.1.1 EDS File

The EDS file may be downloaded from the Watson-Marlow website from the link below:

Web address: *https://www.wmfts.com/en/literature/other-resources/software-and-devices/*

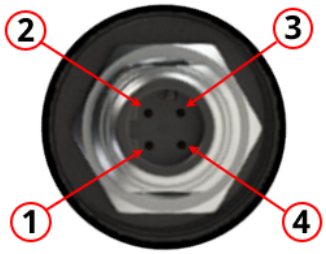
16.1.2 Control cable specification

A category 5e. shielded ethernet cable, IP66 rated, with a M12 connector is required to connect and control a H-FLO EtherNet/IP drive.

16.1.3 Connections

The M12 control connections function by location, thread style, pin count and plug code vary.

16.1.3.1 Network connection

<table>
<tr><td>Overview</td><td colspan="2">Two network connections are provided for the EtherNet/IP model. Both connections have an identical function.</td></tr>
<tr><td>Location</td><td colspan="2">The connections are located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td colspan="2">M12, Female, 4 Pin, D-code socket, IP66, NEMA 4X</td></tr>
<tr><td>Pin out illustration</td><td colspan="2"> 
</td></tr>
<tr><td rowspan="5">Pin out information</td><td>Pin .</td><td>Signal</td></tr>
<tr><td>1</td><td>TDA+</td></tr>
<tr><td>2</td><td>RDA+</td></tr>
<tr><td>3</td><td>TDA-</td></tr>
<tr><td>4</td><td>RDA-</td></tr>
</table>

16.1.3.2 Control input: Pressure sensor

Overview	A pressure sensor input connection is provided, for use with the Watson-Marlow Pressure Sensor Kit. • It is not possible to use a third party pressure sensor
Location	The pressure sensor input connection is located as illustrated by the graphic. 
Specification	M12, Male, 4 Pin, A-code plug, IP66, NEMA 4X
Pin out information	No pin out information is provided. This pressure sensor connection must only be used with the Watson-Marlow pressure sensor kit. Do not connect any other wires, or cables or attempt to wire to this connection.

16.1.4 EtherNet/IP parameters

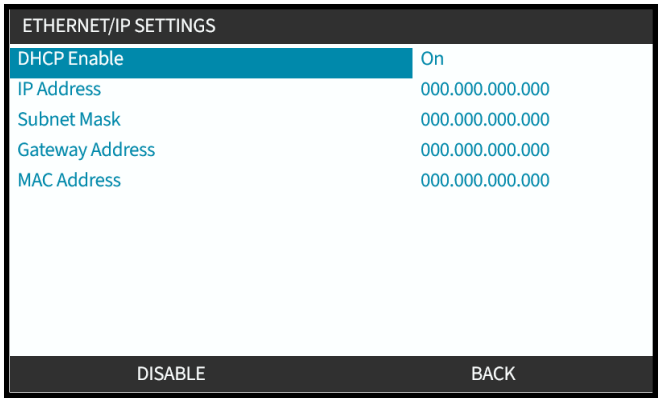
16.1.4.1 Units used in the EtherNet/IP parameters

The following units are used in the EtherNet/IP parameters

Name	Explanation	Example
DeciRPM	1/10th of an RPM	1205 deciRPM = 120.5 rpm
uL (microlitre)	1/1000th of a mL	1,000,000 uL/min = 1000 mL/min = 1 L/min

16.1.4.2 Network parameters

The network parameters for communication of the pump with the network, are pre-programmed during production:



The DHCP can be disabled, and the network parameters manually configured using the HMI. This is explained in "16.3.2 Procedure: Set IP address using the HMI " on page 162.

16.1.4.3 Cyclic parameters

The table below lists the Ethernet IP cyclic parameters and the functionality available through the interface

ADI	Name	Access	Type	Description
2	SetSpeed	Write	UInt16	Speed set in Deci RPM. Max speed depends on head type. See "16.1.4.5 Pumphead enumeration table" on page 158
3	SetSpeedLimit	Write	UInt16	Speed set in Deci RPM. Max speed depends on head type. See "16.1.4.5 Pumphead enumeration table" on page 158
4	SetFailsafeSpeed	Write	UInt16	If the failsafe is enabled, pump will run continuously at selected speed in the event of a communications loss.
13	Flow calibration (µL/rev)	Read	UInt32	Reports Flow calibration value.
14	RunHours	Read	UInt32	Report number of hours pump has run
15	Reserved			
16	Reserved			
17	Reserved			
18	Reserved			
19	Reserved			
20	Reserved			
21	Reserved			
22	Reserved			
23	Reserved			
24	Reserved			
25	Total volume pumped (µL)	Read	UInt32	Displays totalised flow value
26	RevolutionCount	Read	UInt32	Displays revolution count in full rotations
27	PumpSpeed	Read	UInt16	Displays current pump speed set point
28	SpeedLimit	Read	UInt16	Displays current speed limit set point
38	PumpHead	Read	UInt8 (Enum)	Displays currently selected pump head. See "16.1.4.5 Pumphead enumeration table" on page 158
64	ErrorAcknowledge	Write	Unit8	Bit 0 = Acknowledge error, If set to 1 will acknowledge pump errors

ADI	Name	Access	Type	Description
101	Control bitfield	Write	Unit16	Bit 0 = Set fail safe enable, Enabled the failsafe speed. If disabled, pump will stop in the event of a communications loss. If enabled, pump will run at the speed set in the “SetFailsafeSpeed” parameter Bit 1 = Set pump direction to anti-clockwise, if set, pump will run anti-clockwise. Pump defaults to clockwise rotation Bit 2 = Start pump, set to 1 (true) to allow pump to run. 0 will stop pump. Note that pump enable needs to be set Bit 3 = Enable pump, Set to 1 to allow pump to run. Setting to 0 will stop pump and not allow pump to run. Bit 4 = Reset pump run hours to zero, Resets run hours accumulator Bit 5 = Unused Bit 6 =Reset flow totaliser to zero, set to 1 to reset Total volume pumped to 0. Set to 0 to allow Total volume pumped to accumulate Bit 7 = Reset revolution count to zero, set to 1 to reset Pump head revolution count to 0. Set to 0 to allow Pump head revolution count to increment.
102	Error Bitfield byte 1	Read	Unit32	Bit 0 = Leak detected, Leak detect signal high requires clearing and acknowledging before pump can resume. Bit 1 = Motor Stall error active, If set, pump has a Motor Stall Error. Follow onscreen instructions Bit 2 = Motor Speed error. If set pump has a speed error. Follow onscreen instructions Bit 3 = Over Current error active. If set, pump has an over current error. Follow onscreen instructions Bit 4 = Over voltage error active. If set, pump has an over voltage error. Follow onscreen instructions Bit 5 = Unused Bit 6 = Reserved Bit 7 = Reserved

ADI	Name	Access	Type	Description
	Error Bitfield byte 2		Unit32	Bit 0 = Reserved Bit 1 = Reserved Bit 2 = Reserved Bit 3 = Reserved Bit 4 = Reserved Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved
	Error Bitfield byte 3	Read	Unit32	Bit 0 = Reserved Voltage Error Bit 2 = Over Temperature Error Bit 3 = Software Fault. If set, there is a software fault Bit 4 = Hardware Fault. If high, there is an Inverter Gate Drive Fault Bit 5 = Power supply over power error
103	Status bit field	Read	Byte	Bit 0 = Pump running anti clockwise. If set, pump is running anti clockwise (Fluid recovery active) Bit 1 = Pump is currently running. If set pump is currently running
109	SoftwareFault	Read	Bool	If set high, there is a software fault
110	HardwareFault	Read	Bool	If high ,there is an Inverter Gate Drive Fault

16.1.4.4 Drive model enumeration table

Drive model	Abbreviation	Enum
QDOS H-FLO	QHF	1

16.1.4.5 Pumphead enumeration table

Description	Enum	Maximum speed (DeciRPM)
ReNu 150 pumphead Santoprene / PFPE 7 bar (102 psi)	01	1300
ReNu 300 pumphead Santoprene / PFPE 5 bar (73 psi)	04	1600
ReNu 300 pumphead SEBS / PFPE 4 bar (58 psi)	05	1350
ReNu 600 pumphead Santoprene / PFPE 2.5 bar (36 psi)	06	1700

16.1.4.6 Acyclic data records

The table below lists the Ethernet IP acyclic parameters and the functionality available through the interface

ADI	Name	Access	Type	Description
37	PumpModel	Read	UInt8 (Enum)	Displays currently drive model See "16.1.4.4 Drive model enumeration table" on the previous page
63	Asset Number	Read	Unsigned8 array length 21 including NULL terminator (OctetString)	Read pump Asset number
108	Serial Number	Read	Char21	Reports pump serial number

16.2 Part 2: Sub-Chapter installation procedures

16.2.1 Sub-Chapter pre-installation checklist

Prior to installing the control connections and wiring carry out the following pre-installation check:

- Ensure the pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52, "10 Installation—Chapter 2: Electrical power" on page 58 and "11 Installation—Chapter 3: Fluid path" on page 62
- Ensure all requirements of part 1 of this chapter have been met
- Ensure the power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required.
- Ensure the control cable(s) are not damaged
- Ensure items and tools for connection of the pump to the control system are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

16.2.2 Control connection precautions

When following the procedures below or wiring the control cables to the pinouts on the M12 connectors

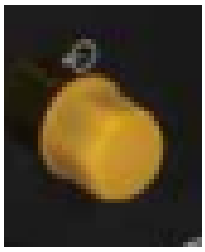
- Keep 4 20 mA and low voltage signals separate from power supply
- Only connect to external circuits, that are separated from mains voltages by reinforced insulation. All of the product input and output terminals are separated from mains circuits by reinforced insulation.
- Do not apply mains power voltages to any of the M12 control connection pins.

16.2.3 Installation of M12 control cables (M type)

16.2.3.1 Protective caps

The M12 control connections are covered with protective caps during manufacture

If any of the connections will not be used for control, leave the protective caps in place of a control cable for added protection of the product. A picture of the cap is illustrated in the picture:



16.2.3.2 M12 control cable installation procedure

Follow the procedure below to connect the M12 control cables.

1. Isolate the pump from its power supply
2. Carry out any control system wiring using the information in part 1 of this chapter
3. Connect the M12 connector to the appropriate location on the pump
4. Turn the screw thread by hand until it is tight
5. Check the cable is secure
6. Reconnect the power supply to the pump

16.3 Part 3: Sub-Chapter specific HMI set up

The sub-sections below provide information on EtherNet/IP only related set up of the pump using the HMI.

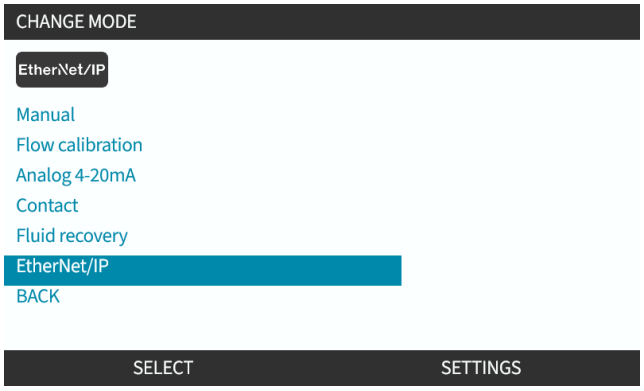
For full information on:

- Mode Menus: See "22 HMI: Using the MODE menu" on page 202
- Control settings: See "23 HMI: Control settings menu" on page 211

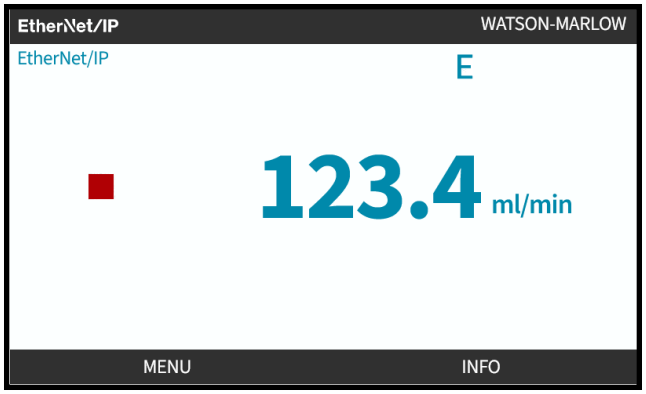
16.3.1 Procedure: Select EtherNet/IP mode using the HMI

To select EtherNet/IP mode:

1. Press **MODE** key
2. Use **+/-** keys to scroll to **EtherNet/IP**
3. SELECT



4. Pump will display the EtherNet/IP home screen



16.3.2 Procedure: Set IP address using the HMI

Configuring the IP address can be undertaken by two methods:

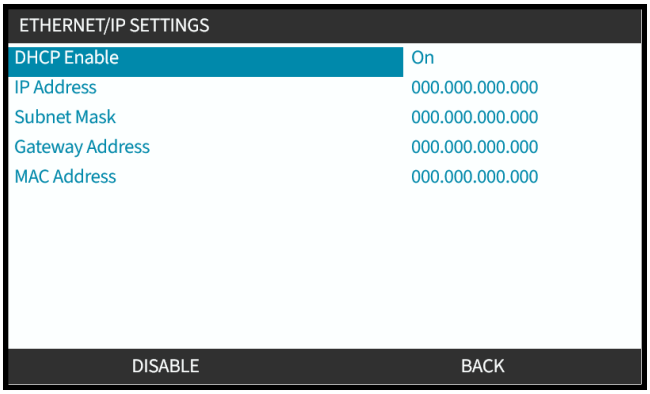
- Method 1: Set static IP Address (manual, DHCP disabled)
- Method 2: Set dynamic IP Address (automatic, DHCP enabled)

16.3.2.1 Procedure: Method 1: Static IP address.

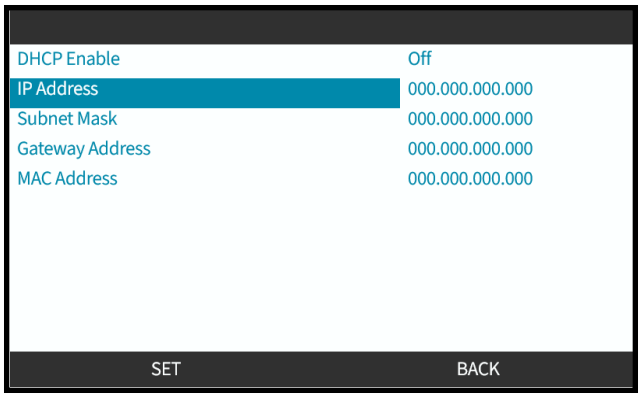
By default, DHCP is enabled. The means the drive will automatically receive an IP address when the drive is connected to a network.

If a static IP address is to be used, the DCHP must first be disabled. Follow the procedure to disable the DHCP and set a static IP address

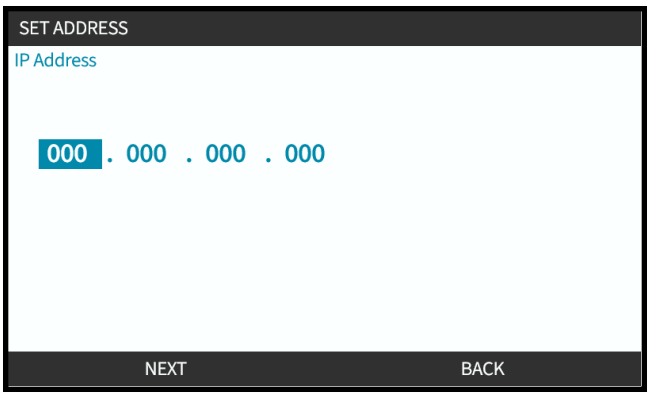
1. Highlight the DHCP setting
2. Choose DISABLE −.



3. Select the IP address
4. Press SET −



5. Use **+/-** keys to enter the highlighted values.
6. Use NEXT [−] to move to next value



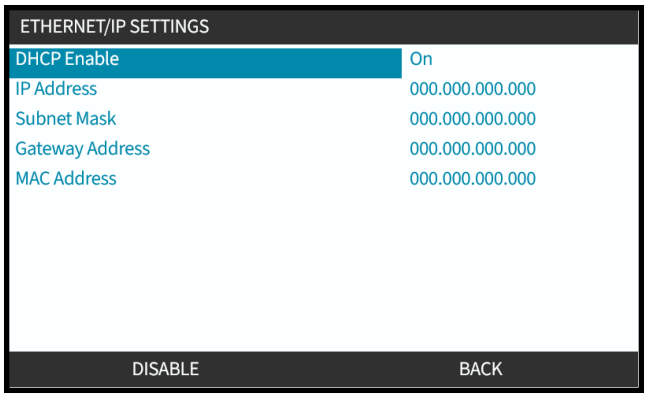
7. When final value is entered, choose ENTER [−] to commit setting.

To set the **Subnet mask** and **Gateway address** repeat steps 3 to 7.

16.3.2.2 Procedure: Method 2: Set dynamic IP Address (automatic, DHCP enabled)

DHCP is enabled by default, it is only necessary to re-enable DHCP if it was previously disabled when an IP address was manually set.

1. Highlight the DHCP setting
2. Ensure that DCHP is Enabled

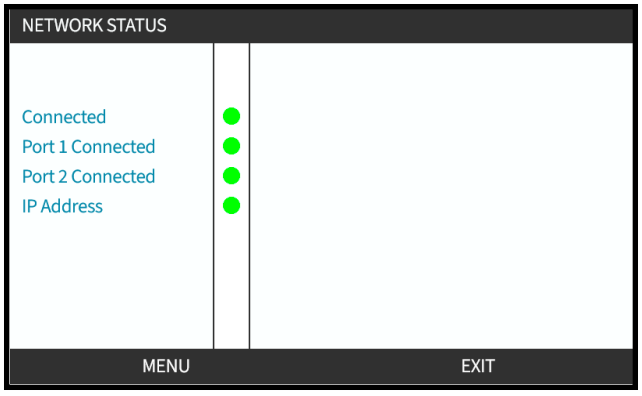


A DHCP server within the network will allocate the drive an IP address based on the MAC address.

16.3.3 Network status screens

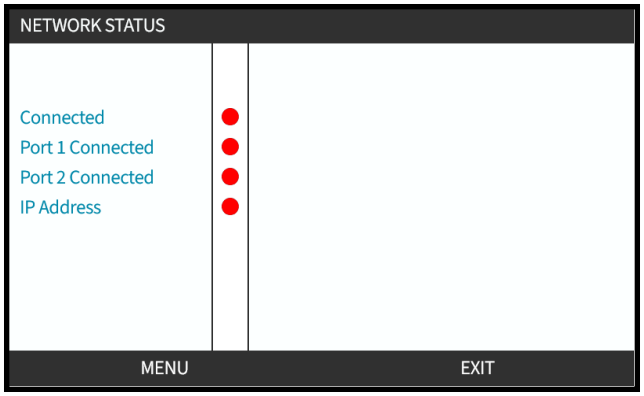
If the pump is not running and connections are made to ports, the IP address is assigned, and the drive is connected to master.

The status screen of this will be shown below:



If the pump is not running with no connections made to ports, the IP address is not assigned, and the drive is not connected to master.

The status screen of this will be shown below:



17 Installation—Sub-Chapter 4E: Control (Model: PROFINET)

This section provides information on connection, input/output specification and relevant set up using the HMI of the PROFINET model only.

17.1 Part 1: Sub-Chapter installation requirements, specification, and information

17.1.1 GSDML File

The GSDML file may be downloaded from the Watson-Marlow website from the link below:

Web address: *https://www.wmfts.com/en/literature/other-resources/software-and-devices/*

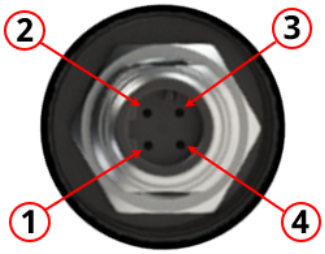
17.1.2 Control cable specification

A category 5e. shielded PROFINET cable, IP66 rated, with a M12 connector is required to connect and control a H-FLO PROFINET drive.

17.1.3 Connections

The M12 control connections function by location, thread style, pin count and plug code vary.

17.1.3.1 Network connection

<table>
<tr><td>Overview</td><td colspan="2">Two network connections are provided for the PROFINET model. Both connections have an identical function.</td></tr>
<tr><td>Location</td><td colspan="2">The connections are located as illustrated by the graphic.
 
</td></tr>
<tr><td>Specification</td><td colspan="2">M12, Female, 4 Pin, D-code socket, IP66, NEMA 4X</td></tr>
<tr><td>Pin out illustration</td><td colspan="2"> 
</td></tr>
<tr><td rowspan="5">Pin out information</td><td>Pin .</td><td>Signal</td></tr>
<tr><td>1</td><td>TDA+</td></tr>
<tr><td>2</td><td>RDA+</td></tr>
<tr><td>3</td><td>TDA-</td></tr>
<tr><td>4</td><td>RDA-</td></tr>
</table>

17.1.3.2 Control input: Pressure sensor

Overview	A pressure sensor input connection is provided, for use with the Watson-Marlow Pressure Sensor Kit. • It is not possible to use a third party pressure sensor
Location	The pressure sensor input connection is located as illustrated by the graphic. 
Specification	M12, Male, 4 Pin, A-code plug, IP66, NEMA 4X
Pin out information	No pin out information is provided. This pressure sensor connection must only be used with the Watson-Marlow pressure sensor kit. Do not connect any other wires, or cables or attempt to wire to this connection.

17.1.4 PROFINET Parameters

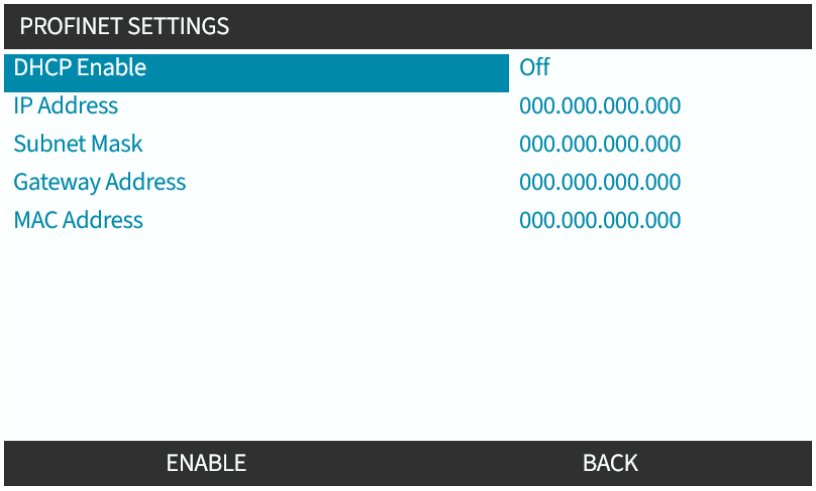
17.1.4.1 Units used in the PROFINET parameters

The following units are used in the EtherNet/IP parameters

Name	Explanation	Example
DeciRPM	1/10th of an RPM	1205 deciRPM = 120.5 rpm
uL (microlitre)	1/1000th of a mL	1,000,000 uL/min = 1000 mL/min = 1 L/min

17.1.4.2 Network parameters

The network parameters for communication of the pump with the network, are pre-programmed during production:



The DHCP can be disabled, and the network parameters manually configured using the HMI. This is explained in "17.3.2 Procedure: Set IP address using the HMI " on page 176.

17.1.4.3 PROFINET cycle time

Minimum device interval 32 ms

17.1.4.4 Cyclic parameters

The table below lists the PROFINET cyclic parameters and the functionality available through the interface

ADI	Name	Access	Type	Description	Module
2	Set pump speed (deciRPM)	Write	UInt16	Speed set in Deci RPM. Max speed depends on head type. See "17.1.4.6 Pump Head enumeration table" on page 172	Pump Control
3	Set pump speed limit (deciRPM)	Write	UInt16	Speed set in Deci RPM. Max speed depends on head type. See "17.1.4.6 Pump Head enumeration table" on page 172	Pump Control
4	Set failsafe speed (deciRPM)	Write	UInt16	If the failsafe is enabled, pump will run continuously at selected speed in the event of a communications loss.	Pump Control
13	Flow calibration (µL/rev)	Read	UInt32	Reports Flow calibration value.	Pump Status
14	Run hours	Read	UInt32	Report number of hours pump has run	Pump Status
15	Reserved				
16	Reserved				
17	Reserved				
18	Reserved				
19	Reserved				
20	Reserved				
21	Reserved				
22	Reserved				
23	Reserved				
24	Reserved				
25	Total volume pumped (µL)	Read	UInt32	Displays totalised flow value	Pump Status
26	Pump Head revolution count	Read	UInt32	Displays revolution count in full rotations	Pump Status
27	Current pump speed (deciRPM)	Read	UInt16	Displays current pump speed set point	Pump Status
28	Pump speed limit (deciRPM)	Read	UInt16	Displays current speed limit set point	Pump Status

ADI	Name	Access	Type	Description	Module
38	Pump head	Read	UInt8 (Enum)	Displays currently selected pump head. See "17.1.4.6 Pump Head enumeration table" on page 172	Pump Details and Data
64	Acknowledge Error	Write	Unit8	Bit 0 = Acknowledge error, If set to 1 will acknowledge pump errors	Errors and Warnings
101	Control bitfield	Write	Unit16	Bit 0 = Set fail safe enable, Enabled the failsafe speed. If disabled, pump will stop in the event of a communications loss. If enabled, pump will run at the speed set in the “SetFailsafeSpeed” parameter Bit 1 = Set pump direction to anti-clockwise, if set, pump will run anti-clockwise. Pump defaults to clockwise rotation Bit 2 = Start pump, set to 1 (true) to allow pump to run. 0 will stop pump. Note that pump enable needs to be set Bit 3 = Enable pump, set to 1 to allow pump to run. Setting to 0 will stop pump and not allow pump to run. Bit 4 = Reset pump run hours to zero, Resets run hours accumulator Bit 5 = Unused Bit 6 =Reset flow totaliser to zero, set to 1 to reset Total volume pumped to 0. Set to 0 to allow Total volume pumped to accumulate Bit 7 = Reset revolution count to zero, set to 1 to reset Pump head revolution count to 0. Set to 0 to allow Pump head revolution count to increment.	Pump Control

ADI	Name	Access	Type	Description	Module
102	Error Bitfield byte 1	Read	Unit32	Bit 0 = Leak detected, Leak detect signal high requires clearing and acknowledging before pump can resume. Bit 1 = Motor Stall error active, If set, pump has a Motor Stall Error. Follow onscreen instructions Bit 2 = Motor Speed error. If set pump has a speed error. Follow onscreen instructions Bit 3 = Over Current error active. If set, pump has an over current error. Follow onscreen instructions Bit 4 = Over voltage error active. If set, pump has an over voltage error. Follow onscreen instructions Bit 5 = Unused Bit 6 = Reserved Bit 7 = Reserved	Errors and Warnings
	Error Bitfield byte 2	Read	Unit32	Bit 0 = Reserved Bit 1 = Reserved Bit 2 = Reserved Bit 3 = Reserved Bit 4 = Reserved Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved	Errors and Warnings
	Error Bitfield byte 3	Read	Unit32	Bit 0 = Reserved Bit 1 = Under Voltage Error Bit 2 = Over Temperature Error Bit 3 = Software Fault. If set, there is a software fault Bit 4 = Hardware Fault. If high, there is an Inverter Gate Drive Fault Bit 5 = Power supply over power error	Errors and Warnings
103	Status bit field	Read	Byte	Bit 0 = Pump running anti clockwise. If set, pump is running anti clockwise (Fluid recovery active) Bit 1 = Pump is currently running. If set pump is currently running	Pump Status

ADI	Name	Access	Type	Description	Module
109	Software Fault	Read	Bool	If set high, there is a software fault	Errors and Warnings
110	Hardware Fault	Read	Bool	If high ,there is an Inverter Gate Drive Fault	Errors and Warnings

17.1.4.5 Drive model enumeration table

Drive model	Abbreviation	Enum
QDOS Higher Flow	QHF	1

17.1.4.6 Pump Head enumeration table

Description	Enum	Maximum speed (DeciRPM)
ReNu 150 pumphead Santoprene / PFPE 7 bar (102 psi)	01	1300
ReNu 300 pumphead Santoprene / PFPE 5 bar (73 psi)	04	1600
ReNu 300 pumphead SEBS / PFPE 4 bar (58 psi)	05	1350
ReNu 600 pumphead Santoprene / PFPE 2.5 bar (36 psi)	06	1700

17.1.4.7 Acyclic parameters

The table below lists the PROFINET acyclic parameters and the functionality available through the interface

ADI	Name	Access	Type	Description	Module
37	Pump Model	Read	UInt8 (Enum)	Displays currently drive model See "17.1.4.5 Drive model enumeration table" above.	N/A
63	Asset number	Read	Unsigned8 array length 21 including NULL terminator (OctetString)	Read pump Asset number	N/A
108	Pump Serial Number	Read	Char21	Reports pump serial number	N/A

17.2 Part 2: Sub-Chapter installation procedures

17.2.1 Sub-Chapter pre-installation checklist

Prior to installing the control connections and wiring carry out the following pre-installation check:

- Ensure the pump has been installed in accordance with "9 Installation—Chapter 1: Physical" on page 52, "10 Installation—Chapter 2: Electrical power" on page 58 and "11 Installation—Chapter 3: Fluid path" on page 62
- Ensure all requirements of part 1 of this chapter have been met
- Ensure the power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required.
- Ensure the control cable(s) are not damaged
- Ensure items and tools for connection of the pump to the control system are to hand

If there is a problem with any of the pre-installation checklist items, do not proceed to the installation procedures in this chapter, until the matter is resolved.

17.2.2 Control connection precautions

When following the procedures below or wiring the control cables to the pinouts on the M12 connectors

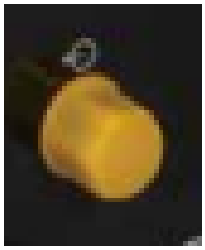
- Keep 4 20 mA and low voltage signals separate from power supply
- Only connect to external circuits, that are separated from mains voltages by reinforced insulation. All of the product input and output terminals are separated from mains circuits by reinforced insulation.
- Do not apply mains power voltages to any of the M12 control connection pins.

17.2.3 Installation of M12 control cables (M type)

17.2.3.1 Protective caps

The M12 control connections are covered with protective caps during manufacture

If any of the connections will not be used for control, leave the protective caps in place of a control cable for added protection of the product. A picture of the cap is illustrated in the picture:



17.2.3.2 M12 control cable installation procedure

Follow the procedure below to connect the M12 control cables.

1. Isolate the pump from its power supply
2. Carry out any control system wiring using the information in part 1 of this chapter
3. Connect the M12 connector to the appropriate location on the pump
4. Turn the screw thread by hand until it is tight
5. Check the cable is secure
6. Reconnect the power supply to the pump

17.3 Part 3: Sub-Chapter specific HMI set up

The sub-sections below provide information on PROFINET only related set up of the pump using the HMI.

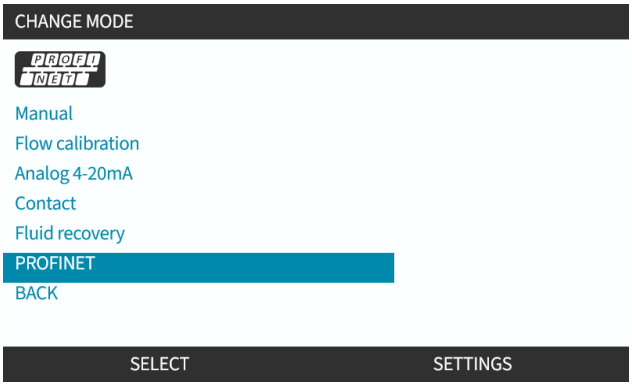
For full information on:

- Mode Menus: See "22 HMI: Using the MODE menu" on page 202
- Control settings: See "23 HMI: Control settings menu" on page 211

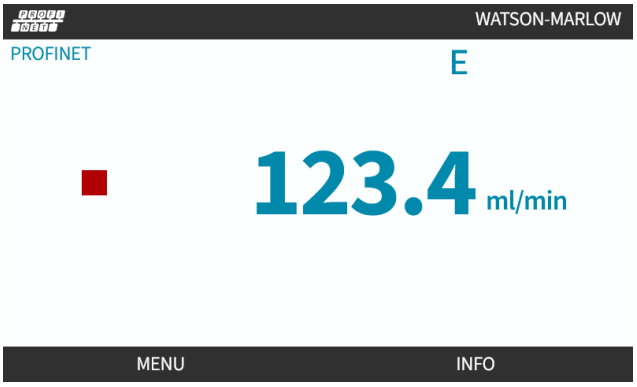
17.3.1 Procedure: Select PROFINET mode using the HMI

To select EtherNet/IP mode:

1. Press **MODE** key
2. Use **+/-** keys to scroll to **PROFINET**
3. SELECT −.



Pump will display the PROFINET home screen



17.3.2 Procedure: Set IP address using the HMI

Configuring the IP address can be undertaken by two methods:

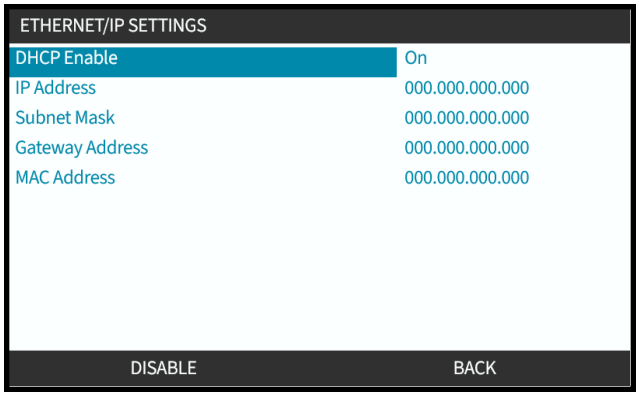
- Method 1: Set static IP Address (manual, DHCP disabled)
- Method 2: Set dynamic IP Address (automatic, DHCP enabled)

17.3.2.1 Procedure: Method 1: Static IP address.

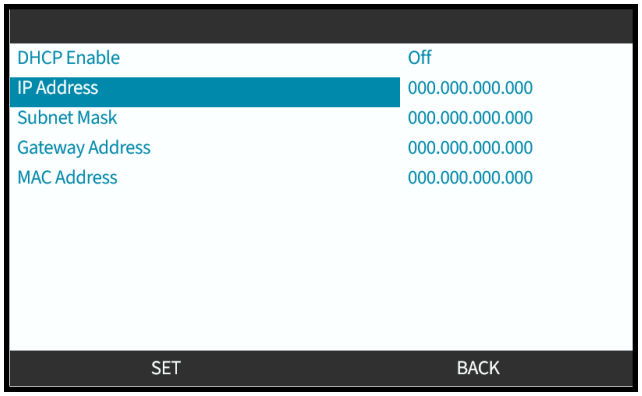
By default, DHCP is enabled. The means the drive will automatically receive an IP address when the drive is connected to a network.

If a static IP address is to be used, the DCHP must first be disabled. Follow the procedure to disable the DHCP and set a static IP address

1. Highlight the DHCP setting
2. Choose DISABLE −.



3. Select the IP address
4. Press SET −.



5. Use **+/-** keys to scroll to enter the highlighted values.
6. Use NEXT [−] to move to next value

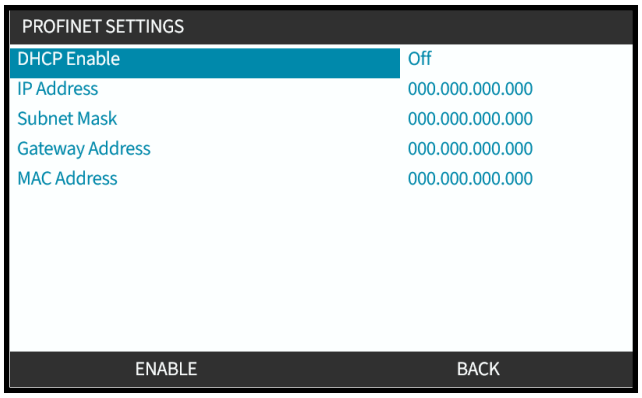
7. When final value is entered, choose ENTER [−] to commit setting.

To set the Subnet mask and Gateway address repeat steps 3 to 7.

17.3.2.2 Procedure: Method 2: Set dynamic IP Address (automatic, DHCP enabled)

DHCP is enabled by default, it is only necessary to re-enable DHCP if it was previously disabled when an IP address was manually set.

1. Highlight the DHCP setting
2. Ensure that DCHP is Enabled by pressing ENABLE −.
3. A DHCP server within the network allocates the drive an IP address based on the MAC address.

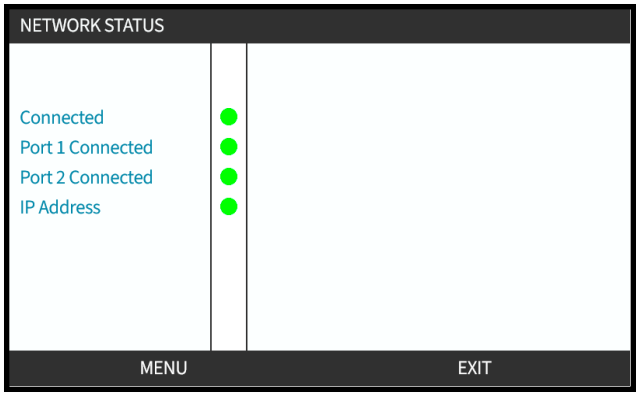


A DHCP server within the network will now allocate the drive an IP address based on the MAC address.

17.3.3 Network status screens

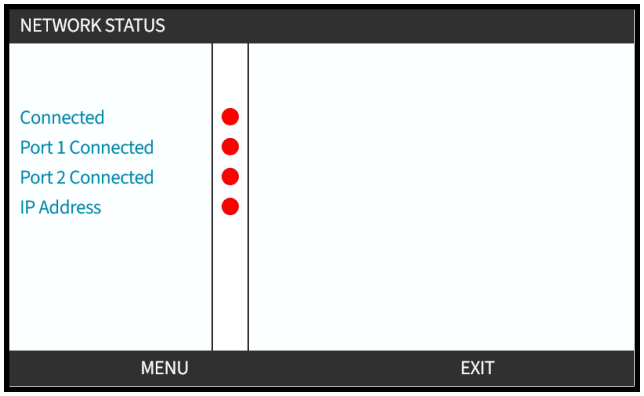
If the pump is not running and connections are made to ports, the IP address is assigned and the drive is connected to master.

The status screen of this will be shown below:



If the pump is not running with no connections made to ports, the IP address is not assigned and the drive is not connected to master.

The status screen of this will be shown below:



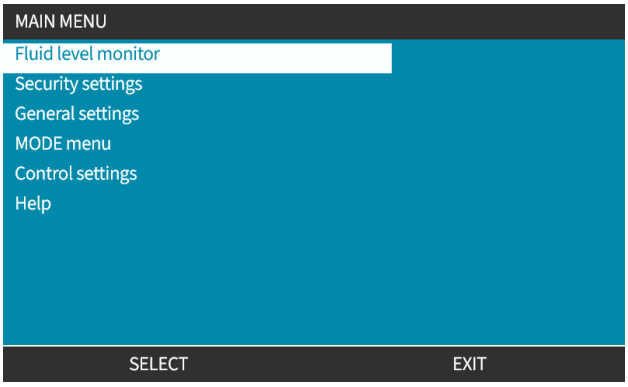
18 HMI set up: Overview

The set up of the HMI is split into the following sections based upon the **main menu order**:

Follow the sub-chapter based upon your requirement.

19 HMI: Fluid level monitor

Fluid level monitor is accessed from the **MAIN MENU** using the **+/-** keys.



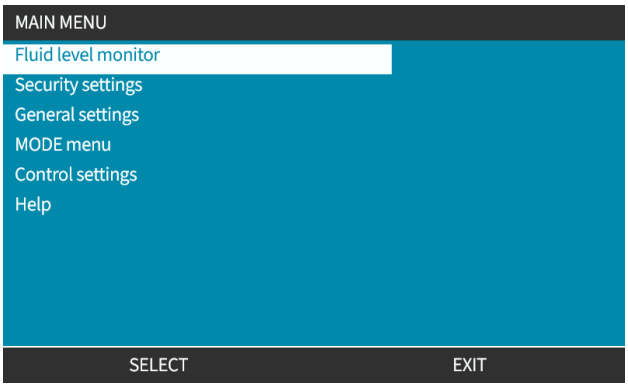
All models feature a fluid level monitor to monitor the fluid level (quantity) remaining in the inlet supply vessel during operation.

An overview of the fluid level monitor HMI submenu is provided in the table below:

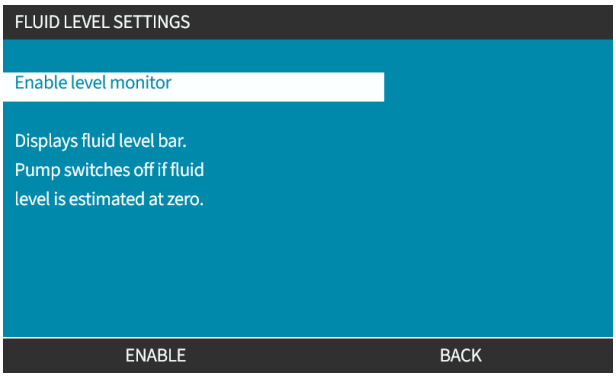
Fluid level monitor menu overview	
Enable level monitor	Activates feature. When this feature is enabled, a ‘progress' bar displayed on home screen indicates an estimated volume of fluid remaining in supply container. When fluid level is estimated at zero pump will stop
Disable level monitor	De-activates feature
Fluid volume unit	Choose US Gallons or Liters
Configure level monitor	Enter fluid container level and set up alarm output. To ensure pump does not run dry—An alarm output can be configured to trigger when a defined level of fluid is reached. Warning an operator to change/refill fluid supply container.
Adjust level	Adjust fluid volume if different to maximum container volume

19.1 To enable/disable the Fluid level monitor

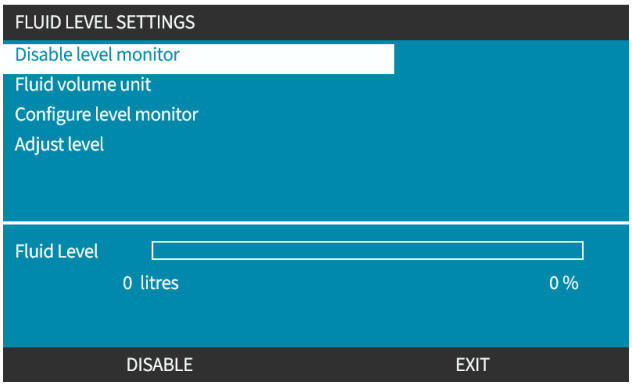
1. Choose **Fluid Level Monitor** from **MAIN MENU**.



2. Use the +/- keys to highlight options.
3. Enable level monitor will already be highlighted.
4. Press ENABLE 



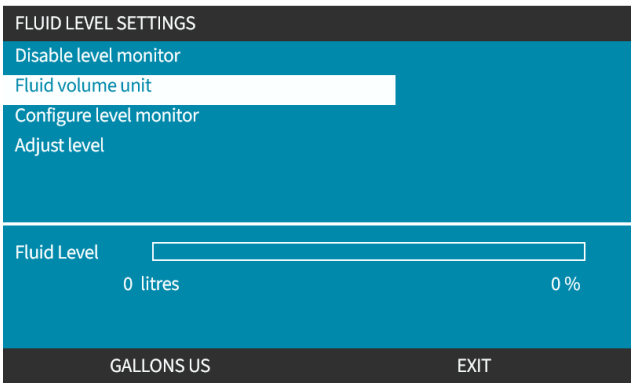
5. Fluid volume level will display on **HOME** screen
6. Choose DISABLE  to deactivate the fluid level monitor.



7. Fluid volume level will no longer appear on the **HOME** screen

19.2 To change fluid volume unit of measure:

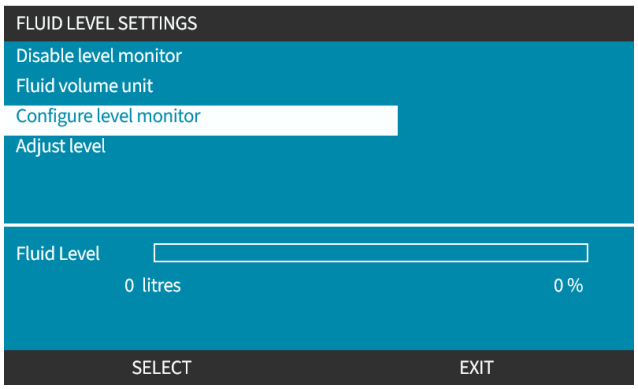
1. Choose **Fluid Volume Unit** from **FLUID LEVEL SETTINGS**.



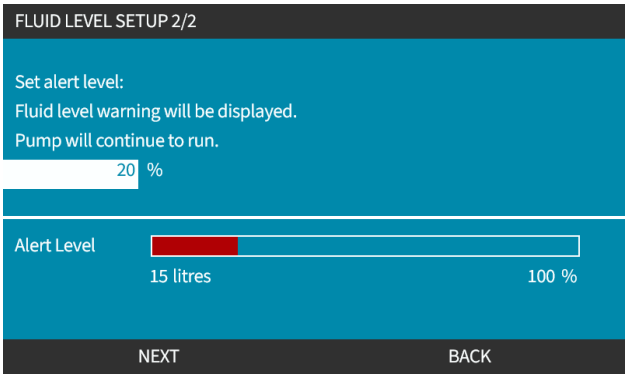
2. Use [−] key to toggle between US GALLONS or LITRES

19.3 To configure the level monitor:

1. Choose **Configure Level Monitor**



2. Press SELECT
3. Use +/- keys to enter maximum volume of supply container.
4. Press NEXT when correct amount is entered.
5. Use +/- keys to set **Alert Level**.

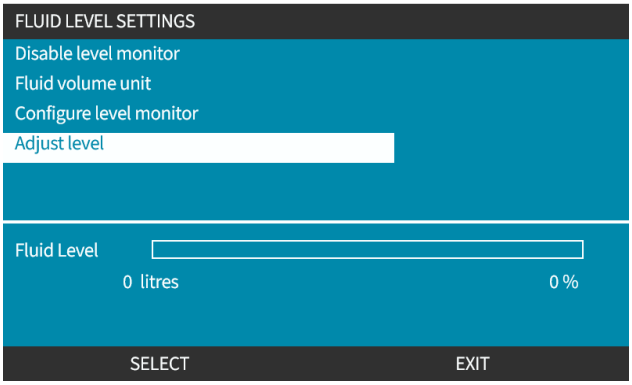


6. Press SELECT to return to **FLUID LEVEL SETTINGS**

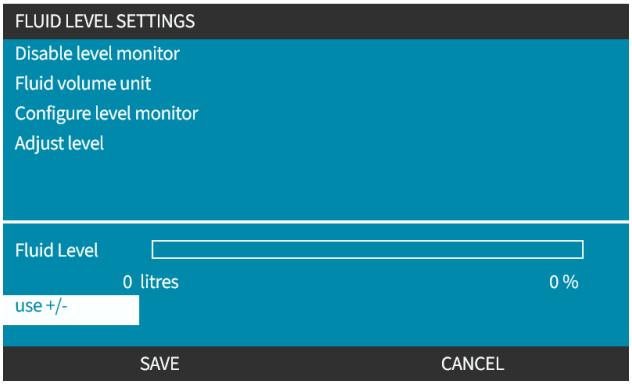
19.4 To adjust fluid volume if different to maximum container volume (e.g., after partial refill)

Accuracy of fluid level monitor will improve with regular calibration of the pump.

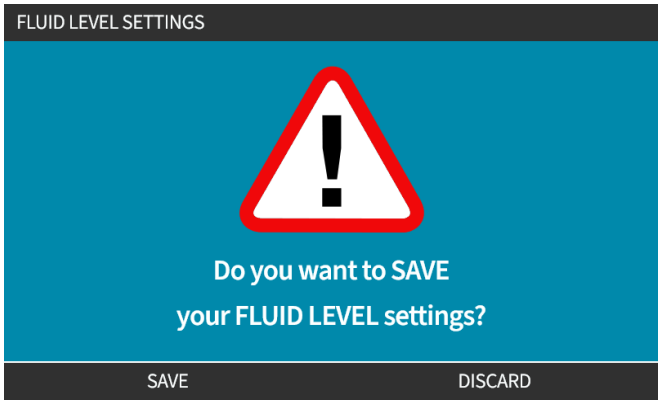
1. Choose **Adjust Level** from **FLUID LEVEL SETTINGS**.



2. Use +/- keys to set volume of fluid in container.



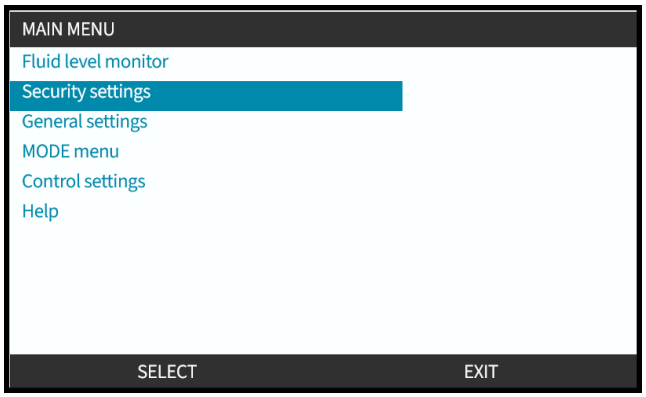
3. Press SAVE to confirm setting.



20 HMI: Security settings

20.1 Security settings overview

Security Settings are accessed from the **MAIN MENU** using the **+/-** keys.

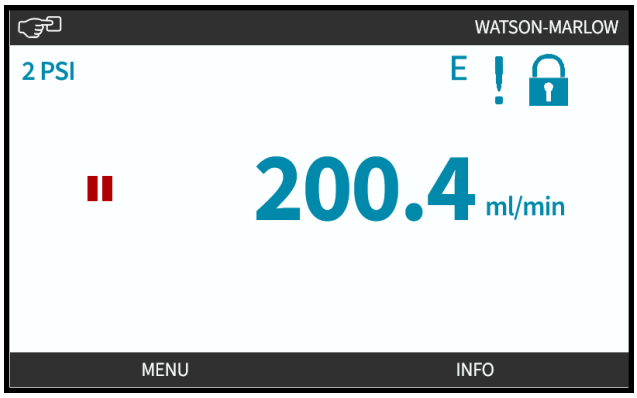


The following security settings may then be selected and adjusted. A summary is provided in the table below:

Security setting	Summary
Auto keypad lock	When active, keypad will lock after 30 seconds of inactivity.
PIN protection	When active, PIN protection will request a PIN before allowing any change of operating mode settings or entry to menu.

20.1.1 Security settings>Auto keypad lock

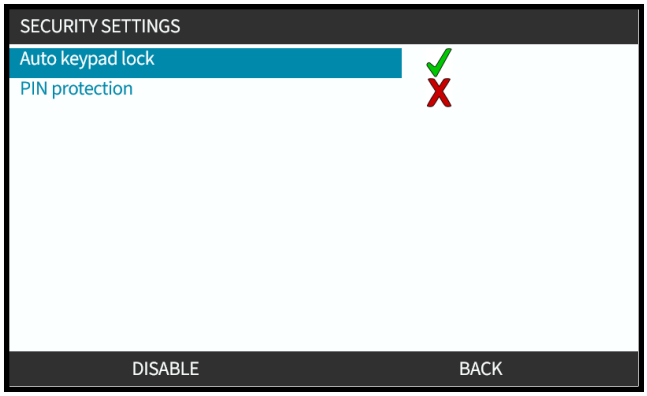
- When active, keypad will lock after 30 seconds of inactivity.
- When **Auto Keypad Lock** enabled; a message displays if any key is pressed
- STOP Key will continue to function when **Auto Keypad Lock** enabled.
- Padlock icon displays on home screen to indicate **Auto Keypad Lock** activated



20.1.1.1 To enable the Auto keypad lock:

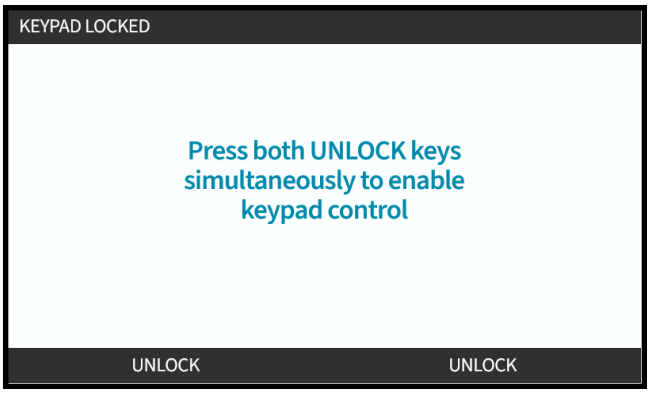
1. Highlight **Auto Keypad Lock** option
2. Press ENABLE

Status symbol displays



20.1.1.2 To access keypad functions:

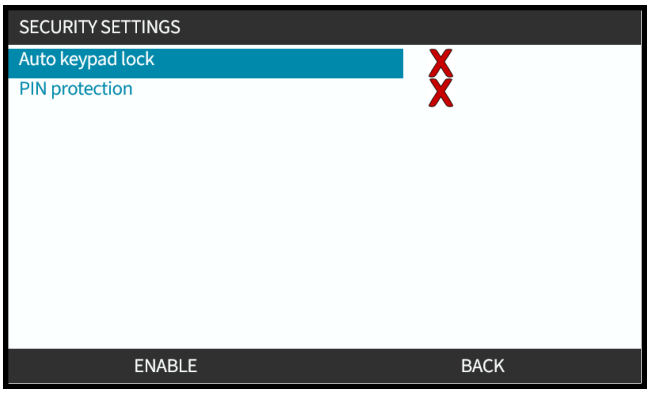
1. Simultaneously press UNLOCK keys [−] [−] together.



20.1.1.3 To disable the Auto keypad lock:

1. Highlight **Auto Keypad Lock** option.
2. Press DISABLE [−]

Status symbol X displays.



20.1.2 Security settings>PIN protection

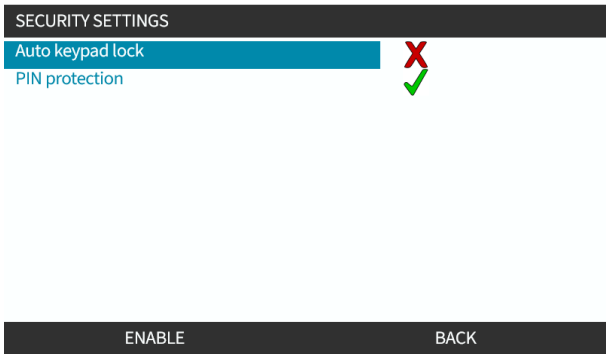
- When active, PIN protection will request a PIN before allowing any change of operating mode settings or entry to menu.
- Once correct PIN has been entered all menu options can be accessed.
- PIN protection re-activates after 30 seconds of no keypad activity.

20.1.2.1 Activate PIN protection:

1. Highlight **PIN Protection** option.
2. Press ENABLE

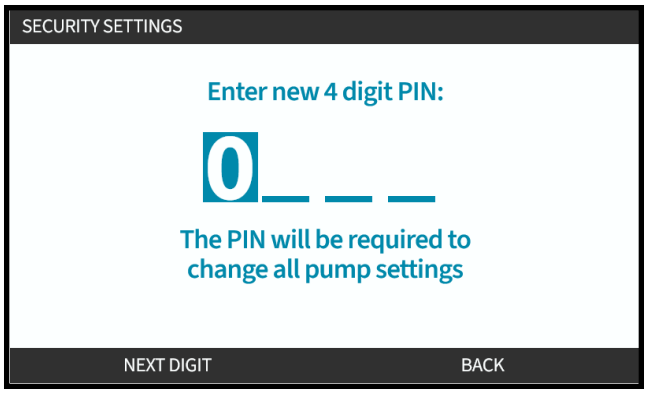
Status symbol ✓ displays.

There is a 30 second delay before PIN protection is active.

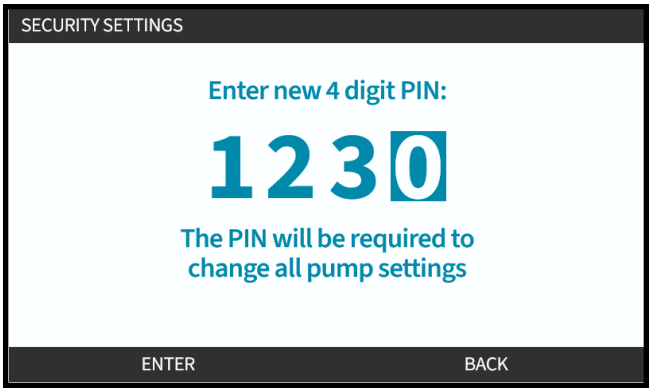


20.1.2.2 Define four-digit number for your PIN:

1. Use **+/-** to select each digit from 0-9.
2. Use NEXT DIGIT key to cycle through digit entry locations

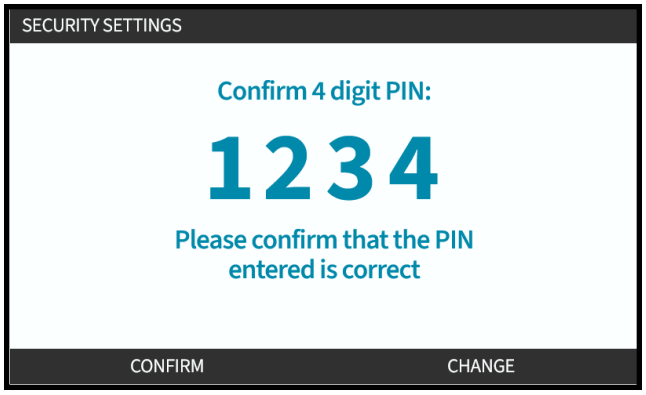


3. After selecting fourth digit press ENTER

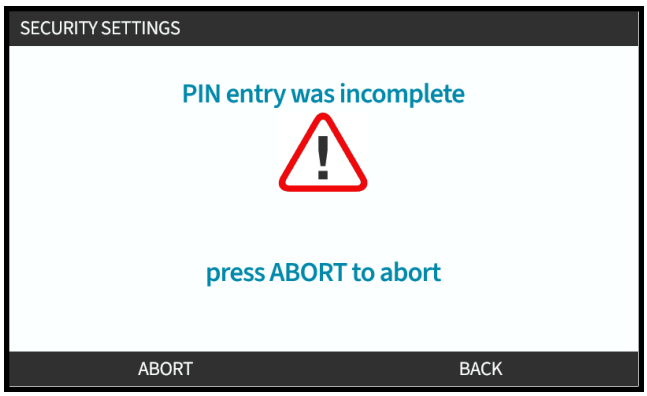


4. Check number entered is correct, then:

Press CONFIRM to store PIN. Pin protection will take 30 seconds before it becomes active.



Or Press CHANGE to return to PIN Entry. Pressing **HOME** or **MODE** key at any time before confirming PIN will also abort process

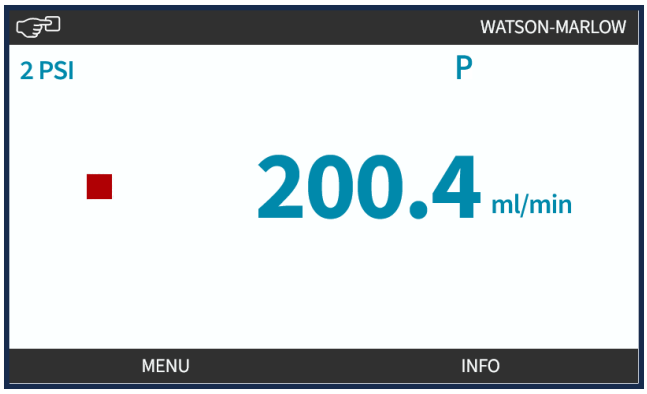


20.1.2.3 Use Security PIN to access pump:

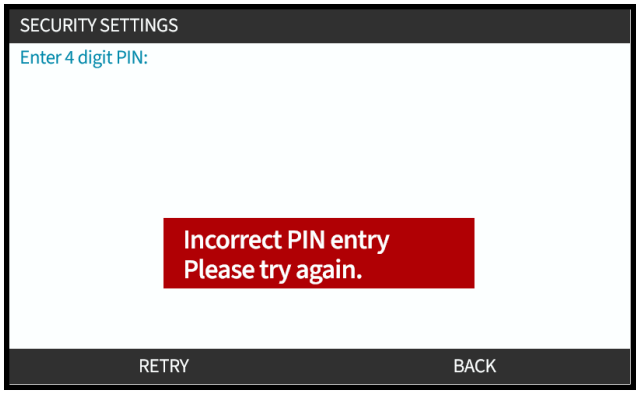
Enter the stored PIN to enable access

1. Use **+/-** to select each digit from 0-9.
2. Choose NEXT DIGIT key to cycle through digit entry locations.

If the PIN number is correct the HMI will display mode home screen.



If PIN number is incorrect the HMI will display the following screen.



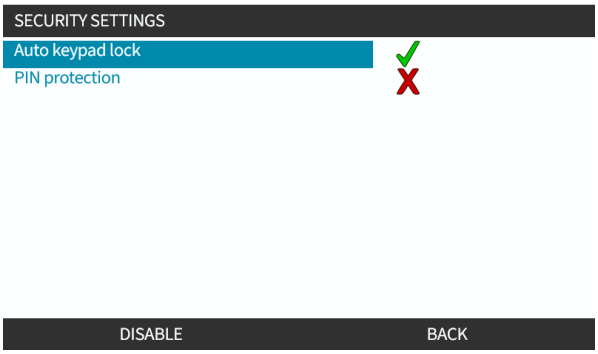
20.1.2.4 Forgotten PIN:

Contact your local Watson-Marlow representative for PIN reset instruction.

20.1.2.5 Deactivate PIN protection:

1. Highlight **PIN Protection** option
2. NEXT DIGIT

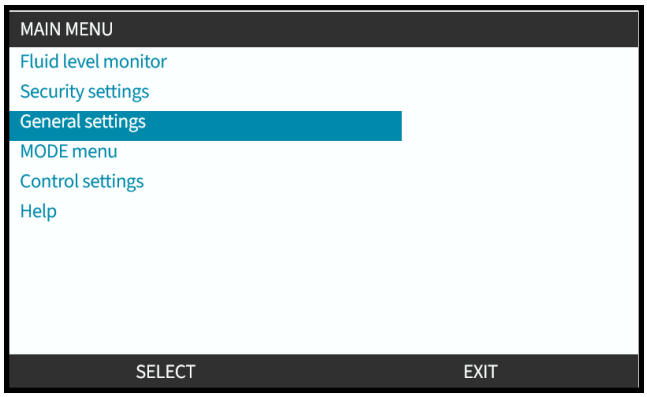
Status symbol ✗ displays.



21 HMI: General settings

21.1 General settings overview

General Settings are accessed from the **MAIN MENU** using the +/- keys



The **General settings** menu contains the following sub menus

General setting	Summary
Auto restart	Returns pump to previous operating state/mode after power loss
Flow units	Sets flow units display preferences
Asset number	User defined 10 digit alphanumeric number which is also displayed in the help screen
Pump label	User defined 20 digit alphanumeric label displayed on home screen header bar
Restore defaults	Restores all pump default settings including calibration and default manual mode
Language	Sets display language of pump
USB update	Used to update the pump software

These sub-settings are explained in the following sub-sections

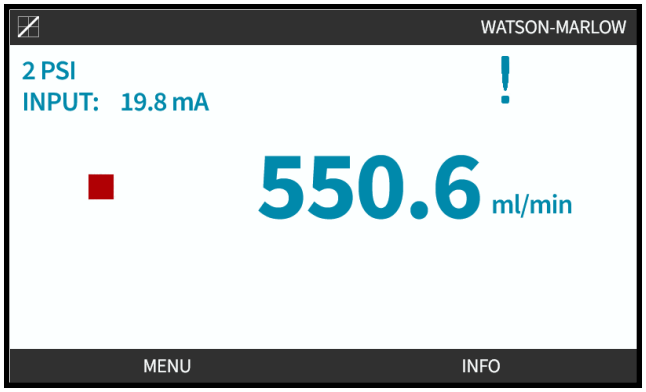
21.1.1 General settings>Auto restart.

This pump offers an auto restart feature. When enabled, the feature will allow the pump to return to the operating state (mode and speed) it was in when power was lost.

Example pumping scenarios using auto restart:

Before power loss	After power loss
Pump running in manual mode	Continues running at same speed
Pump running analog mode	Continue running proportional speed to analog input
Pumping running in contact mode	• Dosing resumed-interrupted dose will be remembered. • Any pulses stored in contact memory before power loss will be remembered. Pulses received during power loss will be lost
Network modes	Depends on configuration

The ! symbol will be displayed in the top right corner when auto-restart is enabled as illustrated below.



Once enabled, the ! is shown in all modes, as a warning that the pump can start at any time.

21.1.1.1 Using Auto Restart versus Start/Stop control

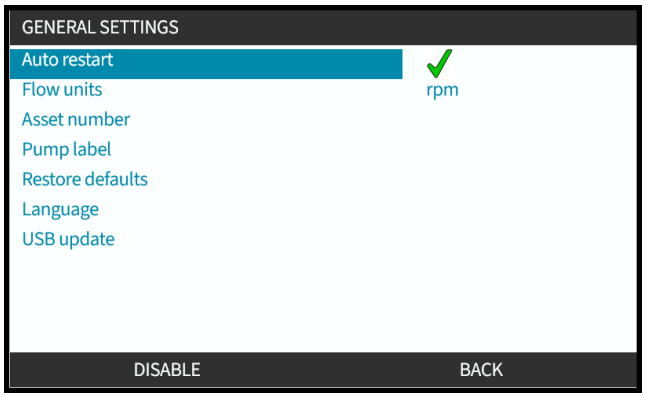
For applications that require the pump to be started and stopped regularly, START/STOP control should be used. The pump is not designed to be power cycled as a regular method of starting and stopping.

NOTICE

Do not power cycle the pump, either manually or by using the auto restart feature. This will reduce the operating life of the product

21.1.1.2 To select Auto restart:

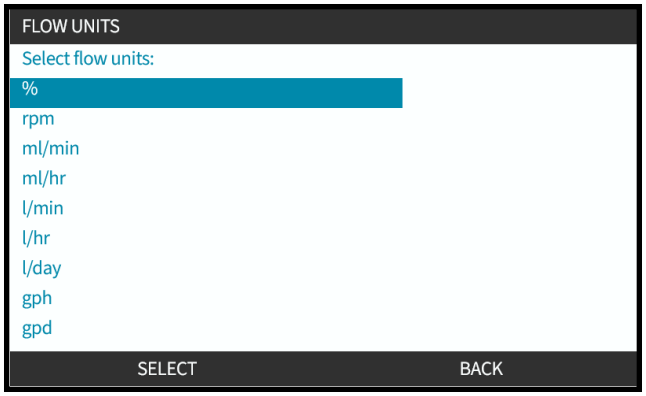
Press ENABLE/DISABLE to toggle Auto Restart on/off



21.1.2 General Settings>Flow units

Set displayed flow units for all pump displays.

1. Use the **+/-** keys to highlight preferred flow unit.
2. SELECT to store preference.



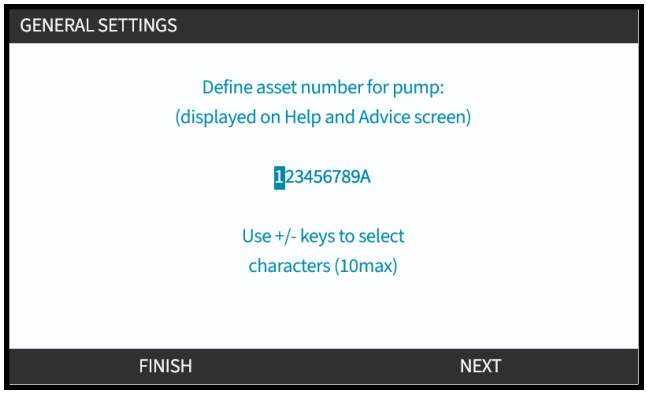
21.1.3 General Settings>Asset number

User defined 10 digit alphanumeric number which is also displayed in the help screen

To define/edit pump asset number:

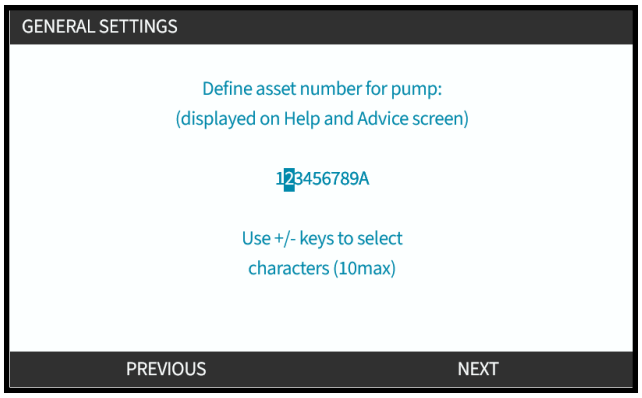
1. Highlight **Asset Number** option
2. SELECT
3. Use **+/-** keys to highlight characters for editing [1].

Available characters: 0-9, A-Z, and SPACE.

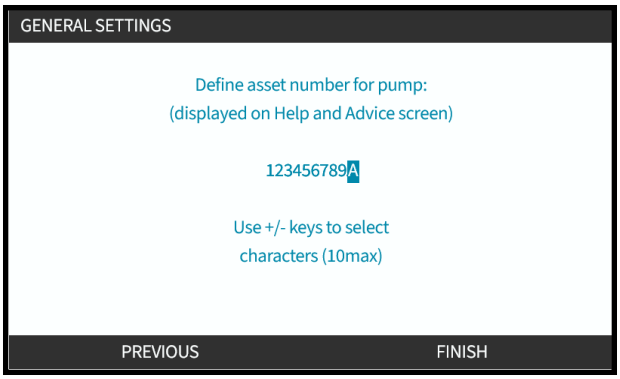


NOTE 1 Any previously defined asset number will be displayed on screen to allow editing

4. Choose NEXT/PREVIOUS to edit next/previous character.

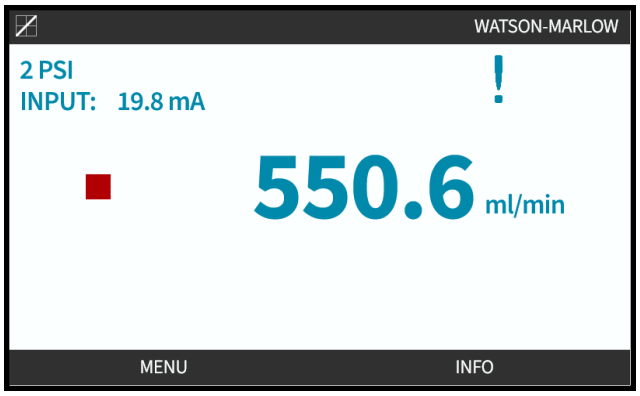


5. Choose FINISH to save and return to **General Settings** menu.


GENERAL SETTINGS
Define asset number for pump:
(displayed on Help and Advice screen)
123456789A
Use +/- keys to select
characters (10max)
PREVIOUS
FINISH

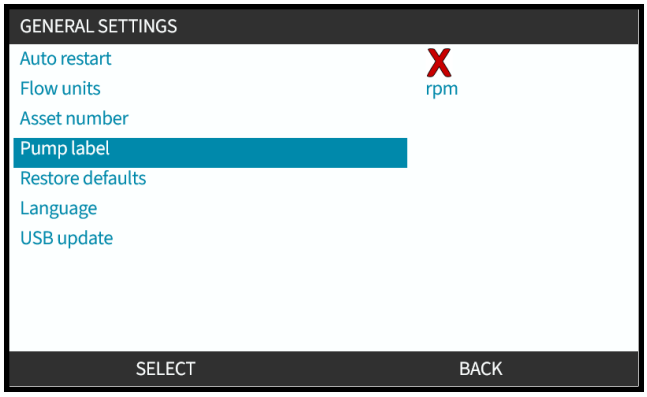
21.1.4 General Settings>Pump label

User defined 20 digit alphanumeric label displayed on home screen header bar in the right corner, as illustrated below.



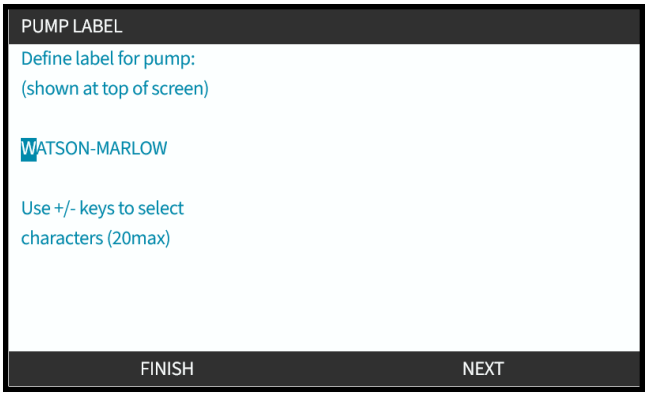
To define/edit the pump label:

1. Highlight **Pump Label** option.
2. SELECT −



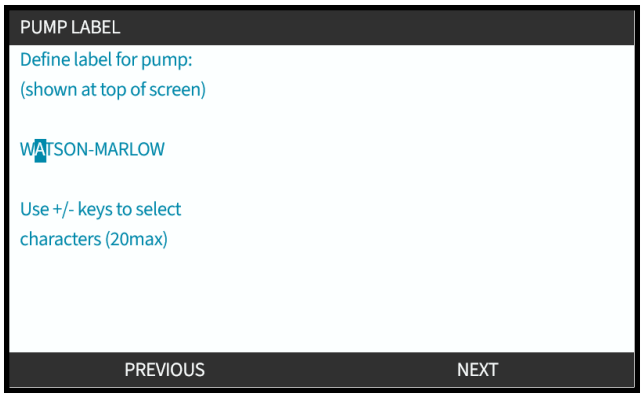
3. Use **+/-** keys to highlight characters for editing [1].

Available characters: 0-9, A-Z, and SPACE.

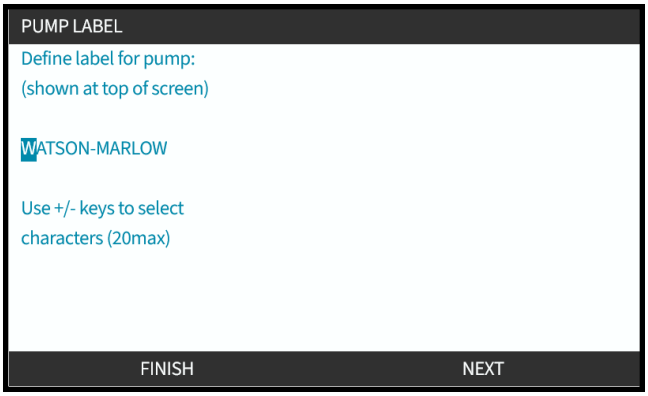


NOTE 1 Any previously defined asset number will be displayed on screen to allow editing

4. Choose NEXT/PREVIOUS − to edit next/previous character.



5. Choose FINISH − to save entry and return to **GENERAL SETTINGS** menu.



21.1.5 General Settings>Restore defaults

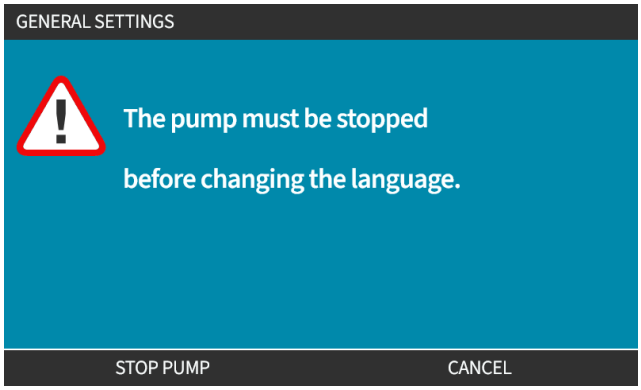
Restores all pump default settings including calibration and default manual mode

21.1.6 General Settings>Language

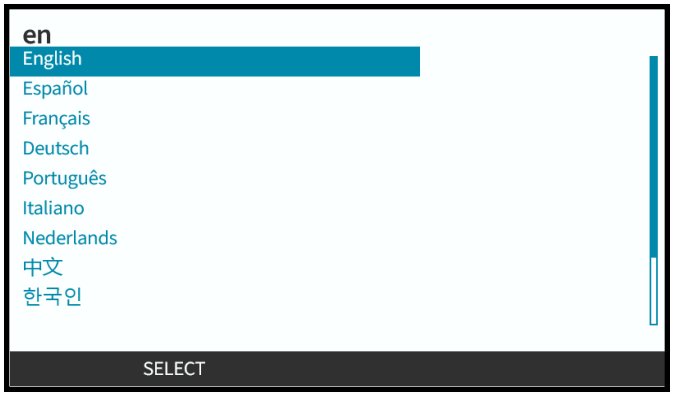
Sets display language of pump

To define/edit display language:

1. Highlight **Language** option.
2. SELECT
3. If the pump is running the screen below will show. Stop pump

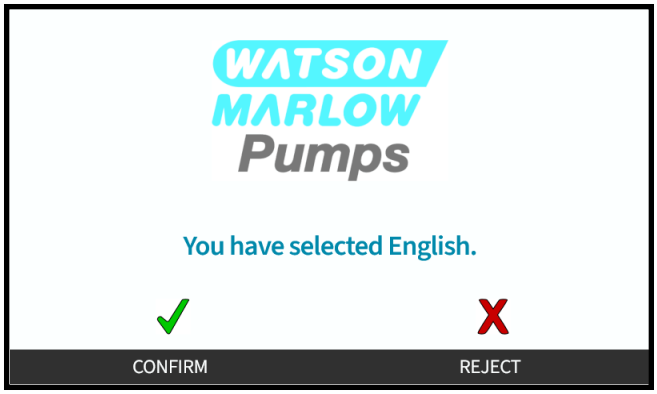


4. Use **+/-** keys to highlight required language.
5. SELECT.



6. CONFIRM to continue.

All display text will appear in chosen language

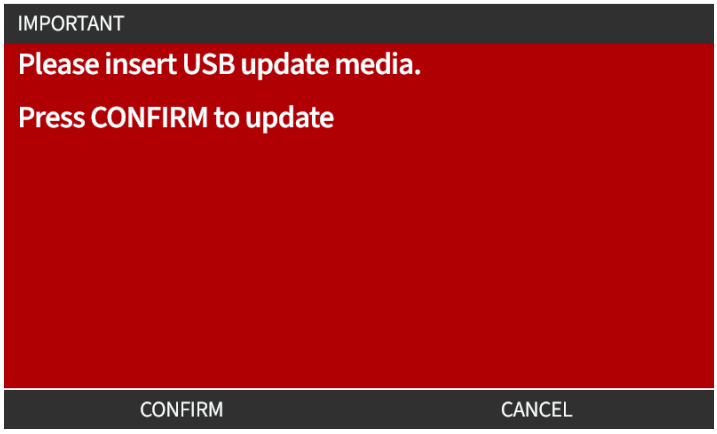


To cancel:

7. Choose REJECT to return to the **language** choice screen.

21.1.7 General Settings (USB update)

If a USB media update is required, contact your Watson Marlow representative for more details.

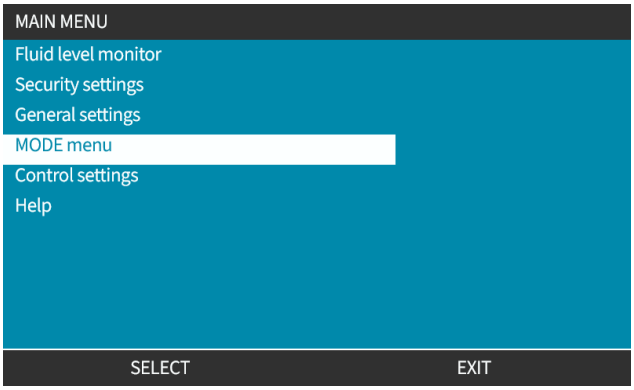


22 HMI: Using the MODE menu

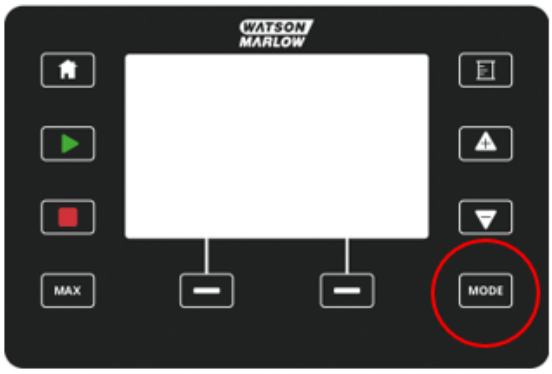
22.1 Mode menu overview

The **MODE Menu** can be accessed from either the **MAIN MENU** using the **+/-** keys, or using the **MODE** key.

Using MAIN MENU



Using MODE Key



The MODE menu contains the following sub menus[1].

Mode	Summary	Model exception[1]
Manual	Allows pump to be operated manually (Start/Stop/Speed). If manual MODE is selected while a pump is running, the pump will stop.	Pump can also be operated via Start/Stop input
Flow calibration	Flowrate is calibrated to the pump	ALL MODELS
Analog 4-20 mA	Pump speed is controlled by an Analog signal	Universal and Universal+ only
Contact mode	Pump will meter a specific dose of fluid when an external signal is received, or operator presses the green **START** button.	Universal and Universal+ model only
PROFIBUS	Allows data exchange	PROFIBUS only
Ethernet/IP	Allows data exchange	EtherNet/IP only
PROFINET	Allows data exchange	PROFINET only
Fluid Recovery	Allows pump to operate in reverse to recover fluid from discharge line.	All models

NOTE 1 Not all MODE sub menus are available on all models.

22.1.1 CHANGE MODE>Manual

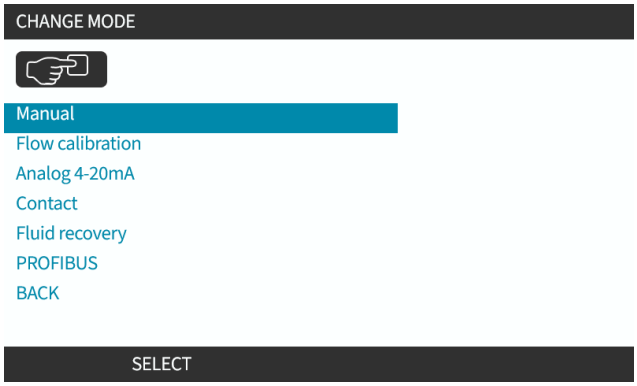
The manual mode is the default mode. Manual mode allows the drive to be operated from the HMI interface. In this mode the drive speed can be set from the keypad and the drive started and stopped from the keypad.

If manual MODE is selected while a pump is running, the pump will stop.

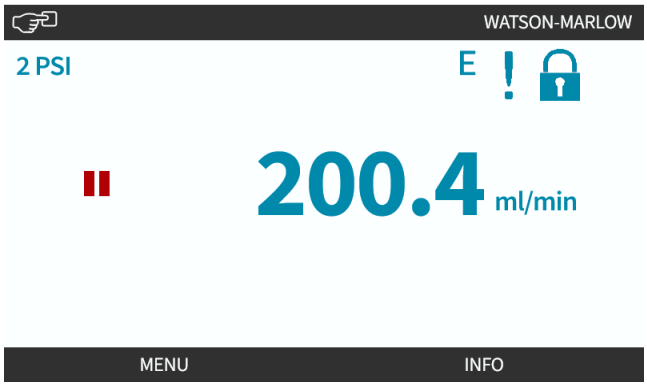
22.1.1.1 To access Manual mode:

From the **Mode Menu**

1. Use **+/-** keys to highlight **Manual** choice



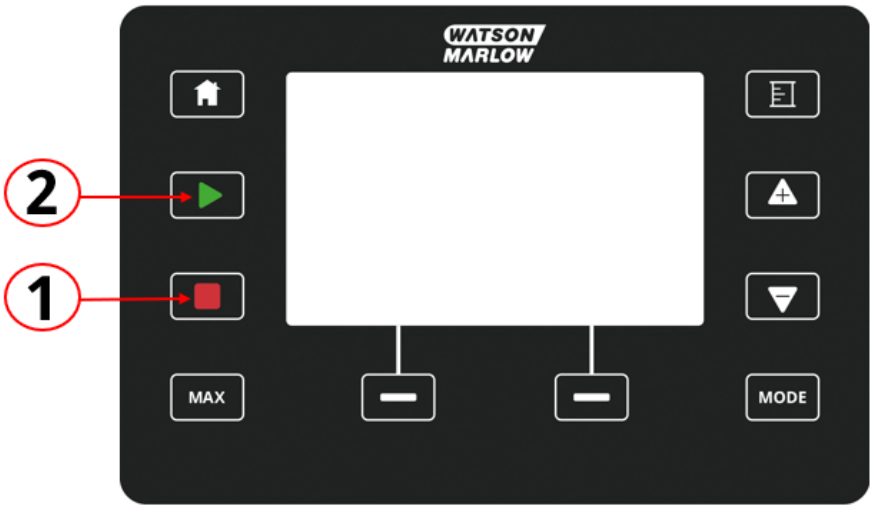
2. Press SELECT and **Manual** home screen will be displayed



For more information on the home screen see "4.9.2 HOME screen" on page 41.

22.1.1.2 Starting and stopping the pump

The pump can be stopped or started using the respective STOP or START key



Number	Name	Summary
1	**STOP**	Key will stop the pump
2	**START**	Key will • Start the pump at the set speed when in manual mode or during flow calibration. • Deliver a contact dose when in CONTACT mode. In all other control modes this key will not start the pump.

22.1.1.3 Change pump speed in manual MODE

The pump speed is changed by

22.1.1.3.1 Up and down keys

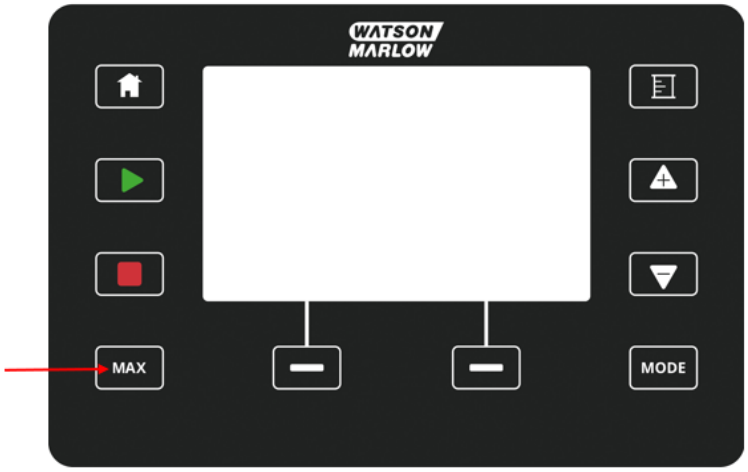
Key	Action
	Pressing Up arrow key to increase the drive set point speed by 0.1 rpm. • If held the set point speed increases using fast scrolling.
	Pressing Down arrow key to decrease the drive set point speed by 0.1 rpm. • If held the set point speed decreases using fast scrolling.

22.1.1.3.2 MAX key

Pressing and holding the MAX button, pump will run at the lower of two limts:

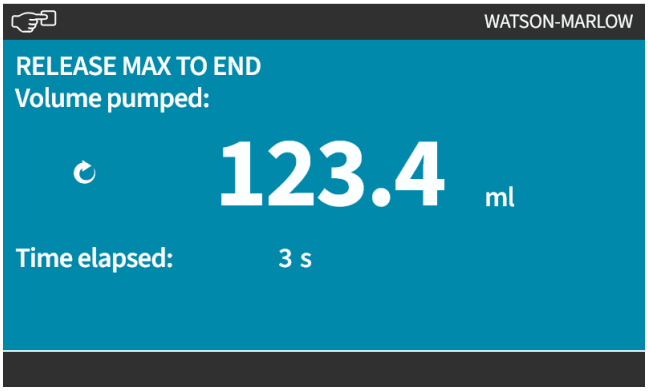
- Speed limit setting
- Maximum pump speed (set by pumphead RFID)

This function is useful for priming the pump.



During operation a blue screen is displayed, which shows:

- the delivered volume in real time
- running time in seconds, while holding the MAX key



22.1.2 CHANGE MODE>Flow calibration

Flow calibration should be undertaken.

- After first time pumphead and fluid path installation
- After maintenance
- After changing pumphead
- After changing process fluid
- After changing any connecting pipework.
- Periodically to maintain accuracy.

See "11.3.2 HMI—Calibrating the pump flowrate: MODE menu > Flow calibration" on page 72

22.1.3 CHANGE MODE>Analog 4-20 mA (Models: Universal and Universal+)

See "14.4.1 CHANGE MODE>Analog 4-20 mA" on page 108

22.1.4 CHANGE MODE>Contact mode (Models: Universal and Universal+)

See "14.4.2 CHANGE MODE>Contact mode" on page 114

22.1.5 CHANGE MODE>Fluid recovery

The fluid recovery mode allows pump to operate in reverse to recover fluid from discharge line. This is mainly used for maintenance purposes. The mode is feature of all models.

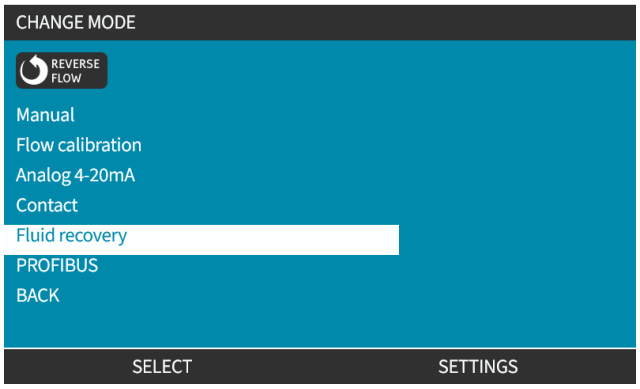
Fluid recovery can be undertaken as a manual operation or using analog signals (Universal, and Universal+ models only). Pump will operate at reversed set speed proportional to 4-20 mA input applied to configured pin.

NOTICE

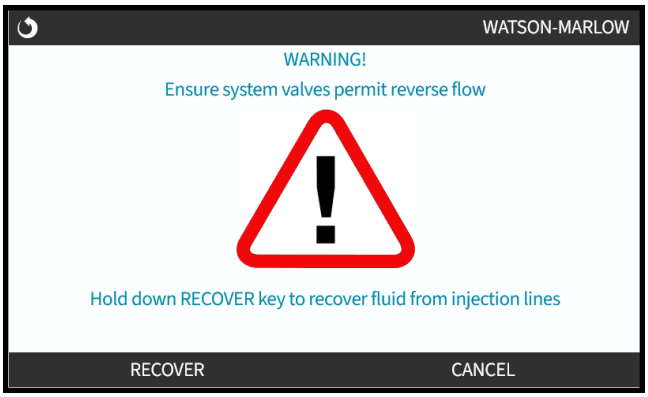
Remote fluid recovery should not be used for bulk fluid transfer

22.1.5.1 Fluid recovery: Manual operation

1. Stop pump
2. Press MODE key, Use **+/-** keys to highlight **Fluid Recovery Menu** option
3. Press SELECT.

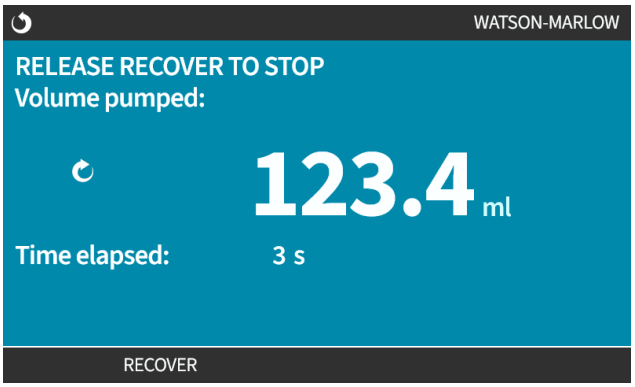


4. An instruction is now displayed. There is a warning to ensure that your system design permits reverse flow. If the flow path has unidirectional valves installed, then reverse flow will not function and the pump will build up excessive pressure within the pipework



5. Press and hold RECOVER to running the pump in reverse and recover fluid.

The screen below is displayed whilst RECOVER is held down. Fluid volume recovered and time elapsed will increase.

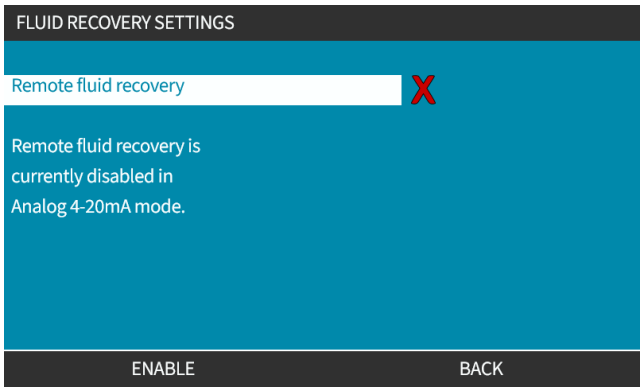


6. Release RECOVER to stop running pump in reverse

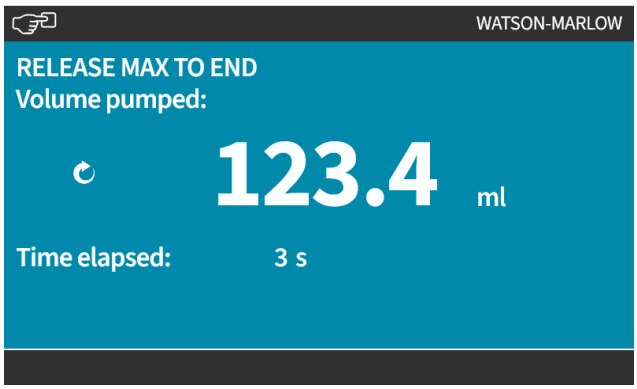
22.1.5.2 Fluid recovery: Analog control (Models: Universal and Universal+)

To run pump in reverse and recover fluid automatically in analog 4-20 mA mode:

1. Press **MODE** key.
2. Use **+/-** keys to highlight **Fluid Recovery**
3. SETTINGS
4. ENABLE



5. Once enabled, remote fluid recovery is ready for operation.



Remote fluid recovery must be operated in following sequence:

1. Configure an input for "remote fluid recovery"
2. Apply the remote stop signal
3. Apply the remote fluid recovery input
4. Remove the remote stop signal
5. Apply 4-20mA to the analog input (1). This will cause the pump to start
6. Apply remote stop signal when enough fluid has been recovered.
7. Remove the remote fluid recovery input
8. Remove the remote stop.

22.1.6 CHANGE MODE>PROFIBUS (Model: PROFIBUS)

See "15.4.1 Procedure: Select and enable PROFIBUS" on page 148

22.1.7 CHANGE MODE>EtherNet/IP (Model: EtherNet/IP)

See "16.3.1 Procedure: Select EtherNet/IP mode using the HMI" on page 161

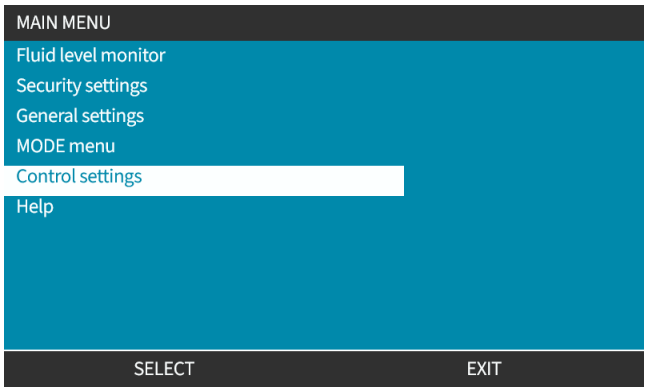
22.1.8 CHANGE MODE>PROFINET (Model: PROFINET)

See "17.3.1 Procedure: Select PROFINET mode using the HMI" on page 175

23 HMI: Control settings menu

23.1 Control settings overview

Control Settings are accessed from the **MAIN MENU** using the **+/-** keys.



Control settings contain the following sub-menus [1].

Setting	Action	Comment
Speed limit	User defined maximum pump speed limit	All models
Reset run hours	Zero`s run hours counter	All models
Reset volume counter	Zero`s volume counter	All models
Revolution counter	Allows user to set pump to indicate when the pumphead close to reaching a maximum number of revolutions.	All models
Configure Inputs	Allows user to select and configure inputs	Manual, Universal and Universal+ models
Configure outputs	Allows user to define function of each output	Universal and Universal+ models
Configure outputs>4-20 mA Output	Choose full scale 4-20 mA input or match input scaling to your 4-20 mA input.	Universal+ only
Scaling factor	Multiplies the speed by a chosen amount	Universal and Universal+
Floating ground	A single 4-20 mA signal could be connected to two or more pumps in series. This would allow both pumps to be controlled through one input signal whereby, if either of the pumps fails or is powered off, then another pump would receive the control signal	Universal and Universal+

NOTE 1 Not all Control settings are available on all models.

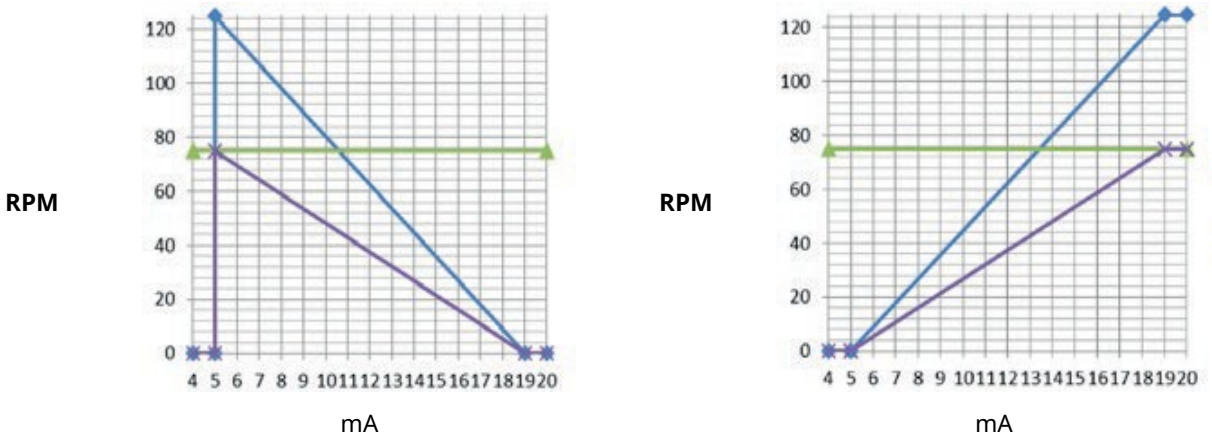
23.1.1 Control settings>Speed limit

The maximum pumphead speed limit may be changed. This limit is dependent on the pumphead which is fitted to the drive unit. The speed limit will be applied to all operating modes

Description	Maximum speed (rpm)
ReNu 150 pumphead Santoprene / PFPE 7 bar (102 psi)	130
ReNu 300 pumphead Santoprene / PFPE 5 bar (73 psi)	160
ReNu 300 pumphead SEBS / PFPE 4 bar (58 psi)	135
ReNu 600 pumphead Santoprene / PFPE 2.5 bar (36 psi)	170

23.1.1.1 Effect on 4-20 mA profile (Model: Universal, Universal+)

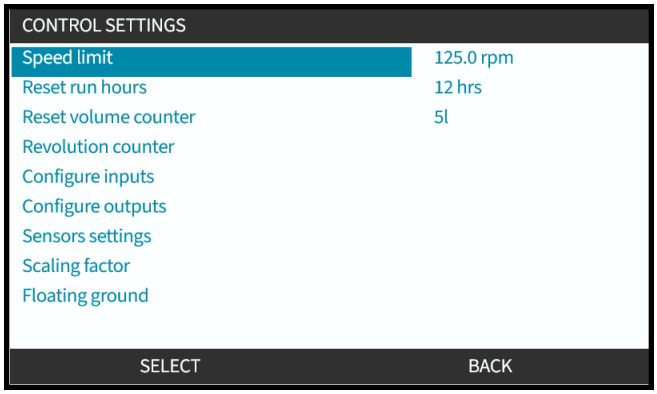
Applying speed limit automatically re-scales the analog speed control response. An example is shown below:



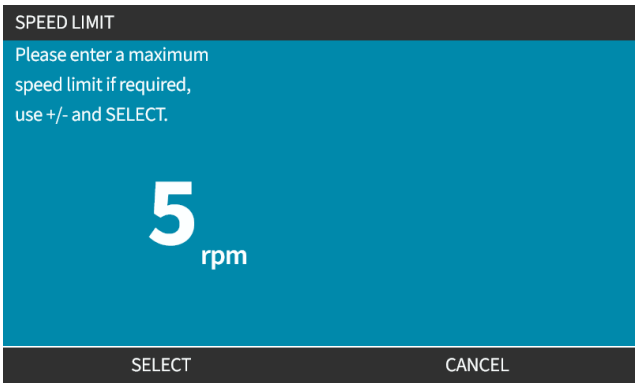
blue line	Calibrated 4-20 mA profile based on a 125 rpm speed limit
green line	User set 75 rpm speed limit
purple line	Re-calibrated 4-20 mA profile based on a 75 rpm speed limit

23.1.1.2 To change maximum speed limit:

1. Highlight **Speed Limit** option



2. Press SELECT.
3. Use **+/-** keys to adjust value
4. Choose SELECT to store new value. This speed limit will be applied to all operating modes



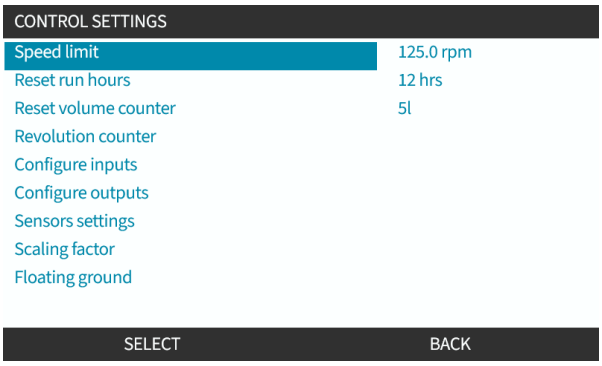
23.1.2 Control settings>Reset run hours

23.1.2.1 To view run hours counter

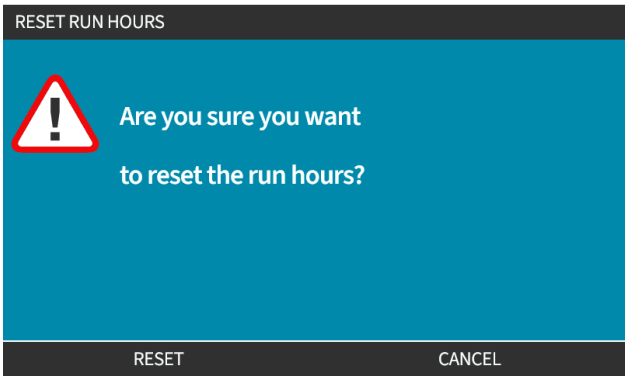
Choose **Info** from **HOME** screen.

23.1.2.2 To zero run hours counter:

1. Highlight **Reset Run Hours** option
2. Press SELECT.



3. Choose RESET and the following screen will be displayed.



4. Choose RESET to continue

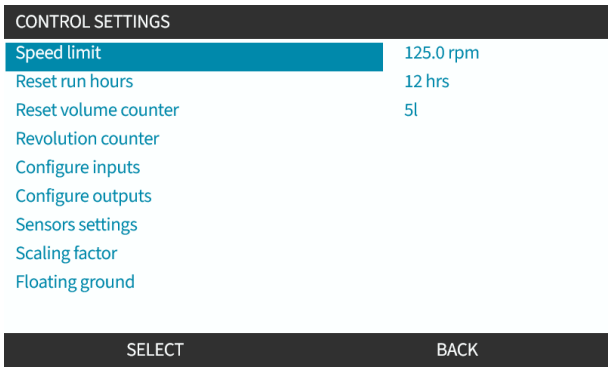
23.1.3 Control settings>Reset volume counter

23.1.3.1 To view volume counter

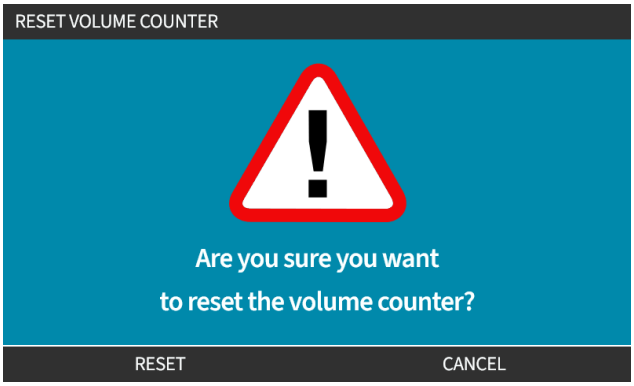
Choose **Info** from **HOME** screen.

23.1.3.2 To zero volume counter:

1. Highlight **Reset Volume Counter** option
2. Press SELECT.



3. Choose RESET and the following screen will be displayed.

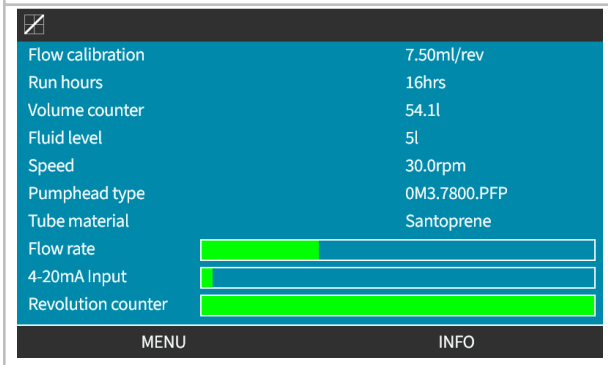
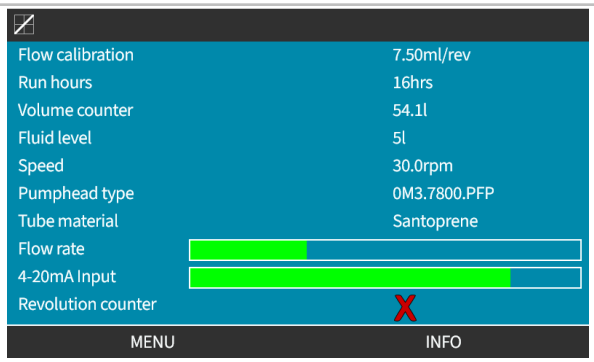


4. Choose RESET to continue

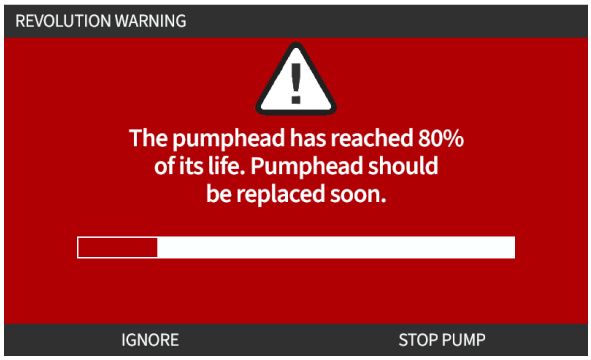
23.1.4 Revolution counter

The revolution counter is feature on all models, that allows a user to set the number of revolutions at which they would like a warning to change the pumphead before it reaches its end of life.

A revolution counter indicator bar is shown on the INFO screen when this feature is enabled. The indicator bar full in a green colour:

Revolution counter enabled	Revolution counter not enabled
	

As the pumphead revolutions take place, the bar decreases until 80% of the revolutions have taken place. At this point the bar changes to red, and the following screen is shown:

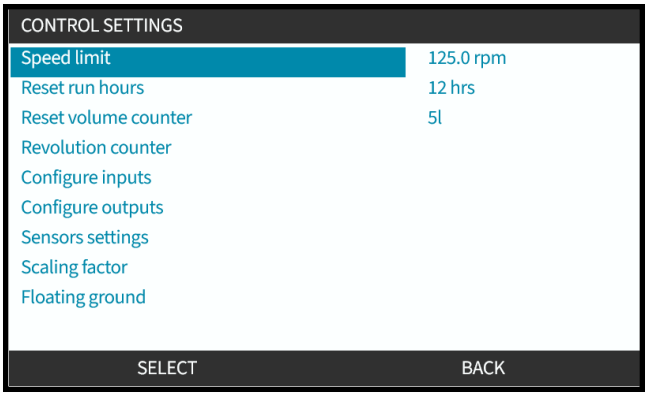


Once the pumphead ryeaches the user set revolution count (100% used) the following screen will display:

In both cases of the red screen above, the pump will always continue to run. It will only stop, if the STOP PUMP soft key is pressed.

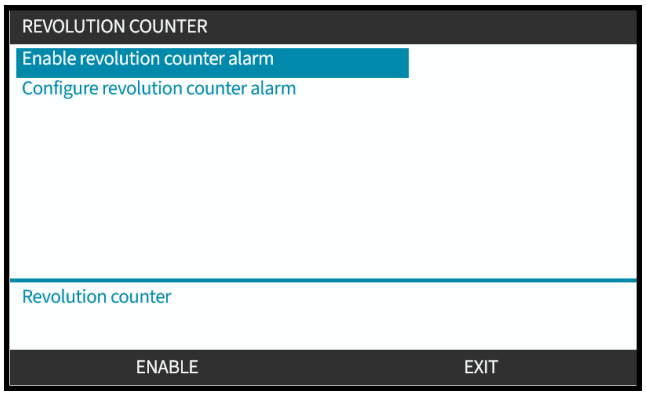
23.1.4.1 To select Revolution counter:

1. Highlight **Revolution Counter** option from the control settings menu
2. Press SELECT.



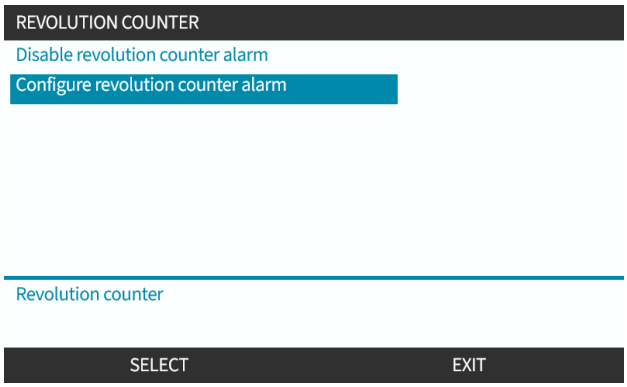
23.1.4.2 To enable: Revolution counter alarm:

1. Use **+/-** keys to highlight **Enable revolution counter alarm** option
2. Press ENABLE.

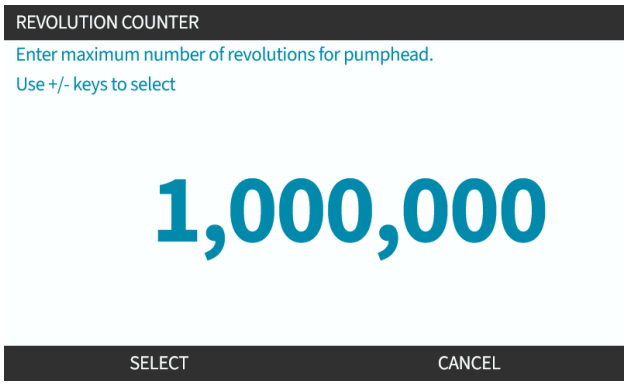


23.1.4.3 To configure: Revolution counter alarm:

1. Use +/- keys to highlight **Configure revolution counter alarm** option
2. Press SELECT



Revolution count max limit setting screen is displayed



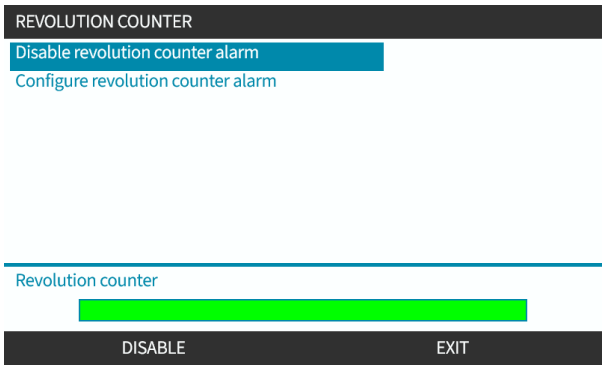
3. Use **+/-** keys to highlight characters for editing. Available characters: 0-9
4. Choose NEXT/PREVIOUS to edit next/previous character.
5. Use **+/-** keys to highlight characters for editing. Available characters: 0-9
6. Press FINISH to save the set value

23.1.4.4 To reset: Revolution counter:

1. Use **+/-** keys to highlight **Reset revolution counter** option
2. Press SELECT to reset to zero

23.1.4.5 To disable: Revolution counter alarm:

1. Use +/- keys to highlight **Disable revolution counter alarm** option
2. Press DISABLE.



23.1.5 Control settings>Configure inputs

See "14.4.3 Control settings>Configure inputs" on page 118

23.1.6 Control settings>Configure outputs

See "14.4.4 Control settings>Configurable outputs" on page 124

23.1.7 Control settings>Scaling settings

See "14.4.5 Control settings>Scaling factor" on page 128

23.1.8 Control settings>Floating ground

See "14.4.6 Control Settings>Floating ground" on page 131

24 Operation

24.1 Pre-operation checklist

Ensure the pump has been installed correctly: Carry out the following pre-operation checks to ensure:

- A responsible person has installed the pump in accordance with all installation chapters
- A responsible person has provided training on the automatic operation of the pump by the control system in all modes of pump operation.
- Power cable is not damaged
- The electrical power supply disconnecting device is easy to reach and operate for electrical power isolation when required.
- Installed control cable(s) are not damaged
- There are no leaks of fluid from any fluid path connection.
- Pump language has been correctly set to your language.

If there is a problem with any of the pre-installation checklist items, do not proceed to operate the pump, and instruct that the pump is removed from service, until the matter is resolved.

24.2 Safety

24.2.1 Hazards that may occur during operation

The following hazards may occur during operation of the pump.

24.2.1.1 Risk of burns

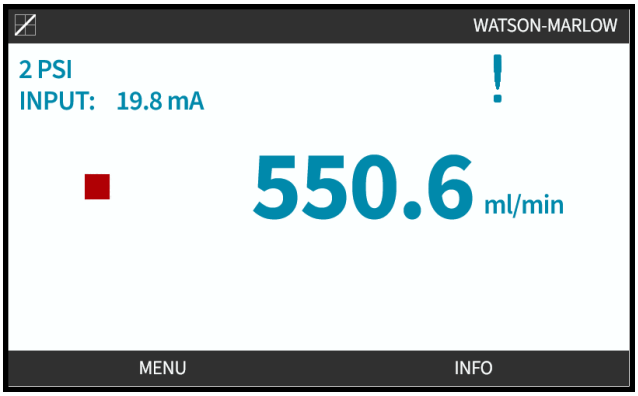
CAUTION

Risk of injury due to burns. The exterior of the pump can get hot during operation. Stop the pump and let the pump cool before handling.

24.2.1.2 Unexpected operation

All pump models may operate automatically either in response to the control system or because of the auto-restart feature (start-up following a power cut) is enabled.

This expected behaviour is indicated as a warning on the screen using the ! symbol as illustrated in the image below.



24.2.1.3 Limits of operation—Dry running

The pump can be run dry for short time periods, such as during priming (air bubbles) or when there is fluid with pockets of gas.

NOTICE

Risk of damage to the pump or pumphead. The pumphead is not designed to be run dry for extended periods of time. Dry running will generate excessive heat. Do not run the pump dry for extended periods.

24.3 Pump operation

The following operations are explained in this section after an overview of the HMI.

- Switching the pump on and off in subsequent power cycles from first time installation.
- Changing pump MODE
- Starting and stopping the pump
- Change pump speed in manual MODE
- Using the MAX key in manual MODE

24.3.1 Using the HMI for operation

Refer to "4.9 HMI Overview" on page 39 for an overview of the HMI to operate the pump.

24.3.2 Switching pump on in subsequent power cycles after installation

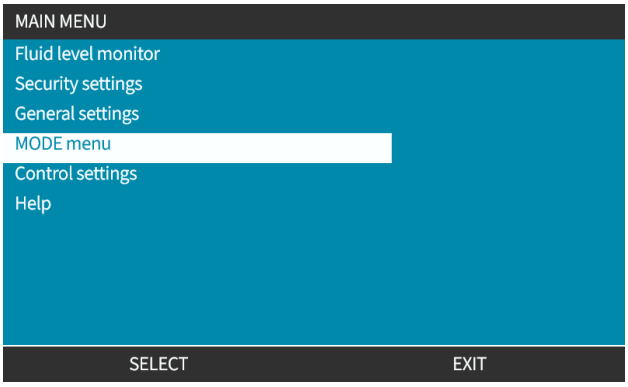
First time power up, required the language to be set. Subsequent power up sequences show the home screen. The following takes place during this sequence:

1. Pump runs power-on test confirming proper functioning of memory and hardware.
2. Faults display error codes, if any are present.
3. Watson-Marlow Pumps logo displayed for three seconds.
4. Home screen displayed.

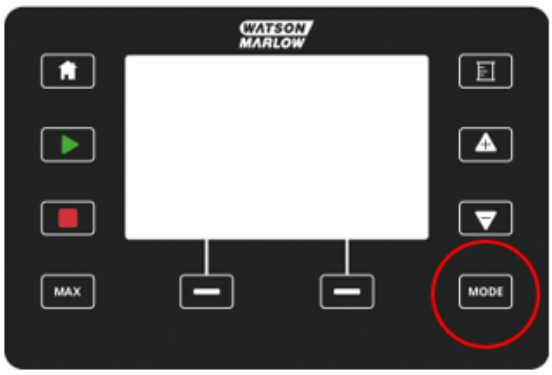
24.3.3 Changing pump operating MODE

To change the pump MODE, access the **MODE Menu** from either the **MAIN MENU** using the **+/-** keys, or using the **MODE** key.

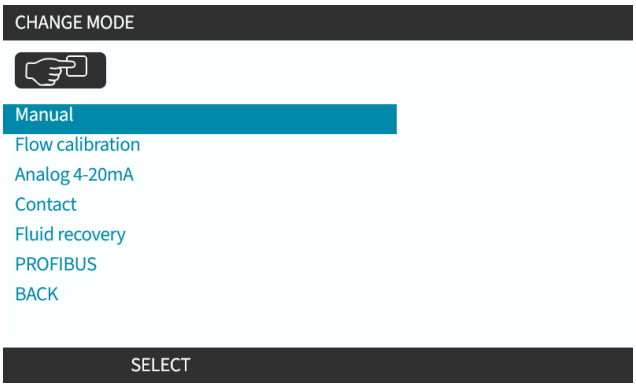
Using MAIN MENU



Using MODE Key

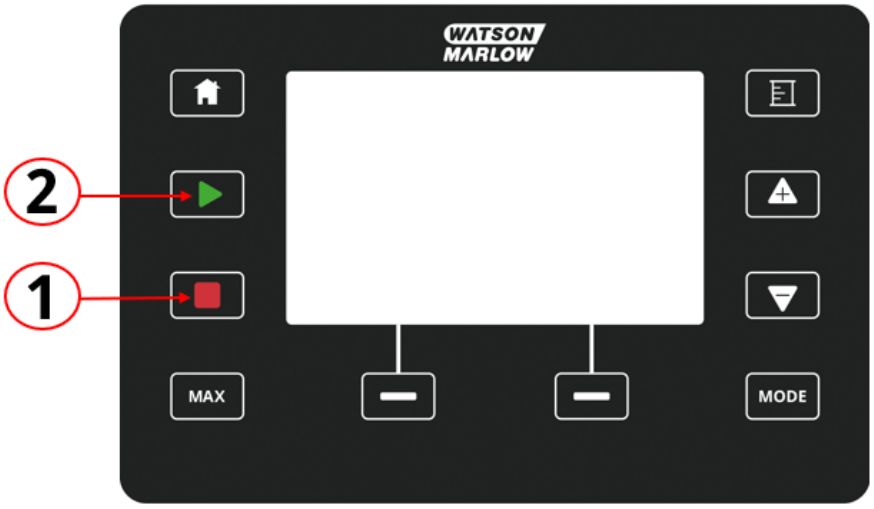


Press select to choose the operating MODE from the mode menu



24.3.4 Starting and stopping the pump

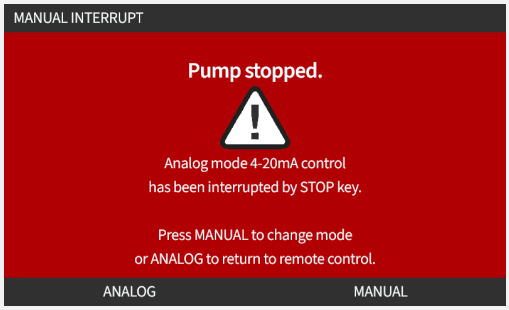
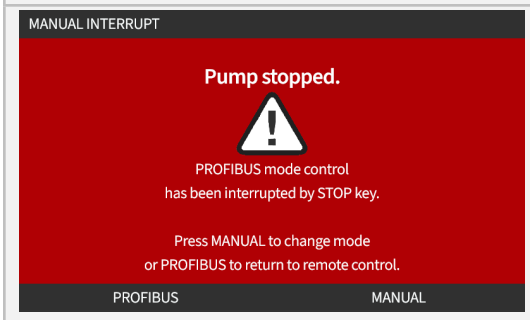
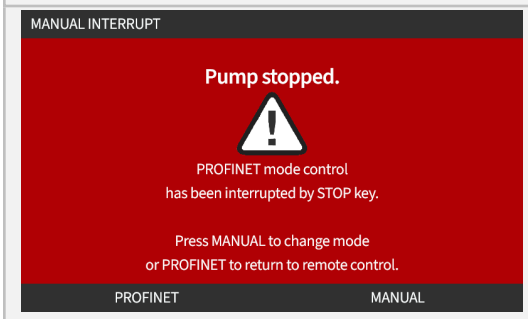
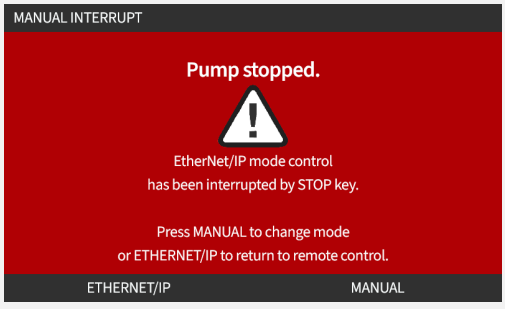
The pump can be stopped or started using the respective STOP or START key

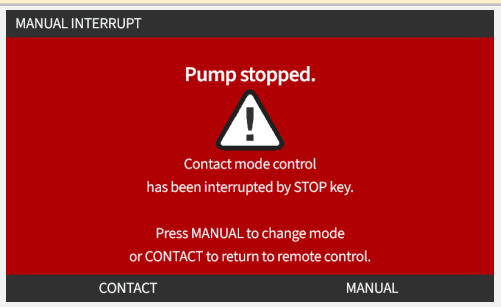


Number	Name	Summary
1	**STOP**	Key will stop the pump
2	**START**	Key will • Start the pump at the set speed when in manual mode or during flow calibration. • Deliver a contact dose when in CONTACT mode. In all other control modes this key will not start the pump.

24.3.4.1 Manual Interrupt screens

If keypad ‘STOP’ is pressed during pump operation, drive will stop and following messages will display dependant on mode:

The Manual interrupt screen	Condition	Suggested action
	Analog mode 4 - 20 mA control interrupted by STOP key	Press MANUAL to change mode or ANALOG to return to remote control
	PROFIBUS mode control interrupted by STOP key	Press MANUAL to change mode or PROFIBUS to return to remote control
	PROFINET mode control interrupted by STOP key	Press MANUAL to change mode or PROFINET to return to remote control
	EtherNet/IP mode control interrupted by STOP key	Press MANUAL to change mode or EtherNet/IP to return to remote control

The Manual interrupt screen	Condition	Suggested action
	CONTACT mode control interrupted by STOP key	Press MANUAL to change mode or CONTACT to return to remote control

24.3.4.2 Change pump speed in manual MODE

The pump speed is changed by

24.3.4.2.1 Up and down keys

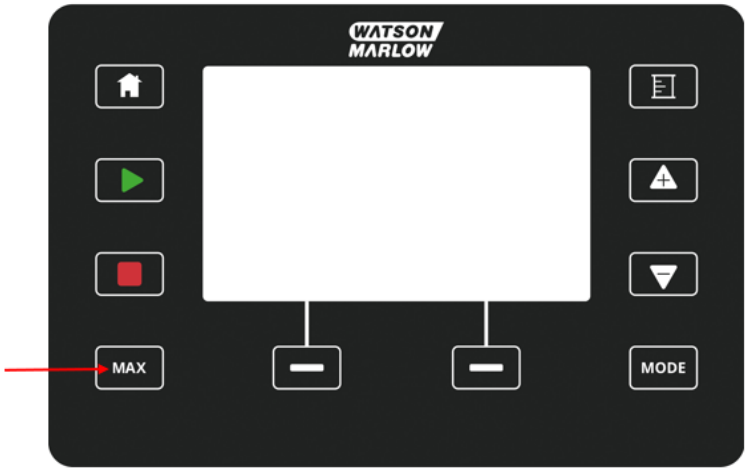
Key	Action
	Pressing Up arrow key to increase the drive set point speed by 0.1 rpm. • If held the set point speed increases using fast scrolling.
	Pressing Down arrow key to decrease the drive set point speed by 0.1 rpm. • If held the set point speed decreases using fast scrolling.

24.3.4.2.2 MAX key

Pressing and holding the MAX button, pump will run at the lower of two limits:

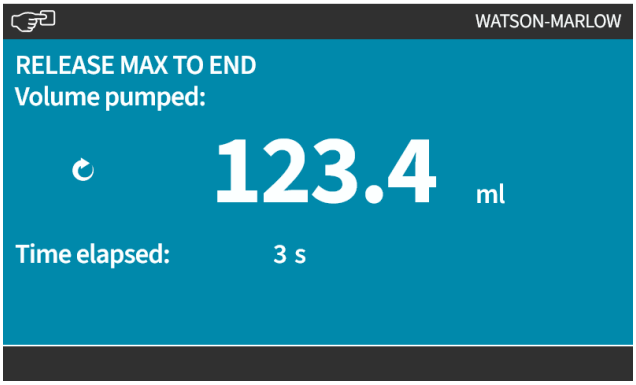
- Speed limit setting
- Maximum pump speed (set by pumphead RFID)

This function is useful for priming the pump.



During operation a blue screen is displayed, which shows:

- the delivered volume in real time
- running time in seconds, while holding the MAX key



25 Cleaning

25.1 Overview

Watson-Marlow confirm that fresh water is compatible with all exposed pump surfaces. No other cleaning agents or chemicals are approved for use.

Responsible person must:

- Carry out a risk assessment to approve fresh water as suitable cleaning agent. Consider potential compatibility with:
    - process chemicals
    - residue or other material deposits on pump surfaces and installation area.
- Create a specific procedure for your application, using the general procedure provided below as guidance.

25.2 General procedure for guidance

1. Stop the pump
2. Isolate from power supply
3. Clean the pump by wiping all exposed surfaces with a dry cloth or cloth dampened with water (as approved). Repeat until all residue has been removed.
4. Allow any remaining water to evaporate from surfaces
5. Reconnect the power supply
6. Bring pump back into operation

If pump is not operating as intended after cleaning:

1. Stop the pump
2. Isolate power supply
3. Instruct a responsible person to remove pump from service.

26 Maintenance

26.1 Replacement pumpheads

Name	Part number
ReNu 150 Santoprene	0M3.6200.PFP
ReNu 300 Santoprene	0M3.7200.PFP
ReNu 300 SEBS	0M3.7800.PFP
ReNu 600 Santoprene	0M3.8200.PFP

26.2 Replacement accessories

Item	Product code
Qdos H-FLO Fluid connector (Hydraulic Connection), PVC-U 3/4'' NPT (F)	0M9.601H.U03 [1]
Qdos H-FLO Fluid connector (Hydraulic Connection), PVC-U RP 3/4''	0M9.601R.U03 [1]
Qdos H-FLO Connection Collar, PVC-U 25mm	0M9.601R.U0E [1]
Qdos H-FLO Control cable - General I/O M12A 8W Cable Straight F Connection, 3m (10ft) Length, Unshielded 24AWG	0M9.603Z.0CF [2]
Qdos control cable for manual model, M12A 5 Pin Yellow Insert , 3m (10ft) Length	0M9.203Y.000 [3]
Profibus Terminating Plug M12B 4W Male	0M9.603W.0EN
Qdos H-FLO Pressure Sensing Kit	0M9.605K.FTA [4]
Qdos H-FLO Pressure Sensing Kit - Gland Version U and U+	0M9.605K.FTT [4]

NOTE 1	The fluid connector and connection collars are supplied as a pair (2 off)
NOTE 2	The M12 8W (8 wire) control cable is for the Universal/Universal+ models only
NOTE 3	The control cable for use with the manual model features a 5 pin female m12 connector, This 5 pin connector will connect to male 4 pin, M12 connector of the manual model. The 5th pin (centre) is not used.
NOTE 4	The pressure sensing kit will be available for purchase Q2, 2024. The kit includes the relevant control cable .

Do not fit any devices or accessories other than those approved by Watson-Marlow or as specified in these instructions

26.3 Electrical maintenance

26.3.1 Drive maintenance

There are no replaceable or serviceable parts within the drive. If the pump drive is damaged remove the pump from service and contact your Watson-Marlow representative to discuss how the pump can be repaired or replaced.

Do not attempt to remove the pump casing to inspect the internal parts within the drive. Do not attempt to repair or replace any part of the drive.

26.3.2 Replacement of power cable

qdos pumps do not have detachable power cables. If the power cable becomes damaged, remove the pump from service and contact your Watson Marlow representative to discuss how the pump can be repaired.

Do not attempt to replace or repair the power cable. This requirement is to protect against inadequately rated cables, and or incorrect polarity of the wiring

26.3.3 Replacement of fuses

26.3.3.1 Drive fuse: Internal

There are no user serviceable fuses located inside the drive casing. Do not remove or disassemble the drive.

26.3.3.2 Power cable fuse (UK Model only)

The UK model contains a 5 A fuse in the power plug for the AC electrical supply models.

26.4 Pumphead maintenance

There are no user serviceable items within the pumphead. The pumphead can only be replaced. Instructions for replacement of the pumphead are in this section:

26.4.1 Life of pumphead

The pumphead is a key consumable item. It is not possible for Watson-Marlow to predict the precise life of a pumphead due to multiple factors such as speed, chemical compatibility, pressure amongst other factors.

Either of the following are an indication of pumphead which is near its end of life:

- The flowrate drops from its normal rate of flow, which is otherwise unexplained (i.e not due to a change in fluid viscosity, or inlet pressure, discharge pressure, etc.)
- The pumphead begins to allow fluid to leak past it when stopped.

A responsible person must carry out a risk assessment to determine hazards, such as fluid leaks or chemical incompatibility with materials of construction (See "28 Chemical compatibility" on page 250), that may occur as a result of operating the pumphead to the point of failure.

The pump has the following 3 features:

- Run hours counter
- Volume counter
- Revolution counter

  To assist with monitoring the life of a pumphead, so that it may be changed prior to failure. .

26.4.2 Replacement of pumphead

In the section below, these instructions detail the removal and replacement of a left-hand mounted pumphead. Replacing the right-hand mounted pumphead is the identical procedure on the right-hand side.

WARNING

There can be harmful chemicals inside the pumphead that can cause serious injury or damage to equipment if spilled. Wear PPE and follow your organisations procedures when undertaking any task in this section.

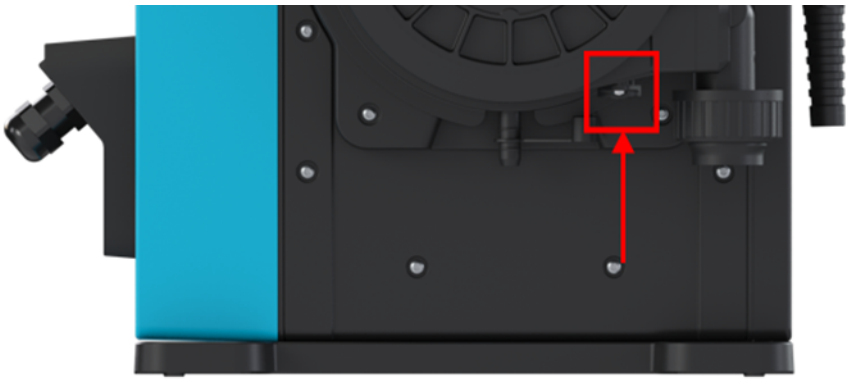
When the pumphead has failed. A leak detection will be triggered and the following screen displayed:

26.4.2.1 Removing pumphead

CAUTION

Risk of injury due to burns. The exterior of the pump and driveshaft can get hot during operation. Stop the pump and let the pump cool before handling.

1. Stop pump.
2. Isolate pump from electrical power.
3. Release pressure in fluid path and drain down fluid path in accordance with your organisation's procedure for this step.
4. Remove the fluid path connections and safety overflow connection, from pumphead ensuring that the pump is protected from any fluid spillages.
5. Fit safety overflow rubber cap to the safety overflow of the pumphead.
6. Release the pumphead locking lever by hand. **Do not** use tools to move the locking lever.
7. Disengage the pumphead from drive by rotating it in a clockwise direction by approximately 15°.
8. Remove the pumphead, being aware residual chemicals will remain inside the pumphead tubing/fluid connection ports, which will require draining, in accordance with your organisation's procedure for this step.
9. Check that the leak detect sensor and driveshaft are both clean and free from process chemical. If any evidence of chemical residue is found, remove pump from service and contact your local Watson-Marlow representative for advice.
10. If the pumphead had not failed, dispose of the pumphead in accordance with local regulations. If the pumphead failed, carry on to step 11
11. Drain the pumphead of chemicals and pumphead lubricant of residual chemicals in accordance with your organisations procedure for this step, by unscrewing the drain valve shown in the picture below:



12. Dispose of the pumphead in accordance with local regulations.

26.4.2.2 Fitting new pumphead

This procedure is written for a new pumphead which would not contain any previous chemical.

Do not fit a used pumphead.

1. Remove the new pumphead from its packaging and re-cycle in accordance with your organisation's procedures.
2. Align the new pumphead with the pump drive shaft and slide into position on the pump housing.
3. Rotate the pumphead in an anti-clockwise direction by approximately 15° to engage the retaining lugs.

4. Check that the embossed arrow on pumphead is pointing upwards.

5. Lock the pumphead into position with pumphead locking lever by hand. Do not use tools to move the locking lever.
6. Connect the input and output connections to the pumphead.
7. Reconnect the electrical power to the pump
8. The RFID antenna will read the pumphead RFID label to confirm which pumphead has been fitted and the relevant advice screen will be displayed.
9. Do one of the following procedures dependent on the type of pumphead fitted.

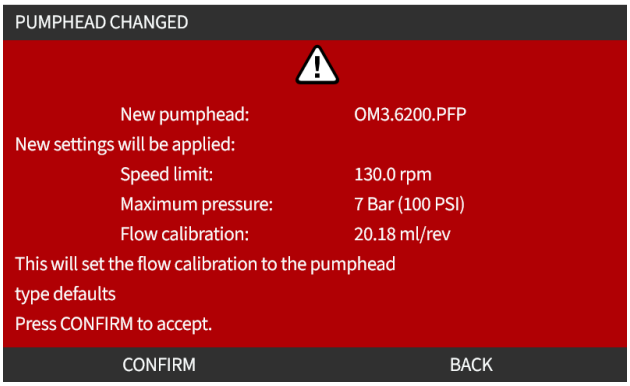
26.4.2.2.1 Pumphead of the same type fitted

1. Press ACKNOWLEDGE.

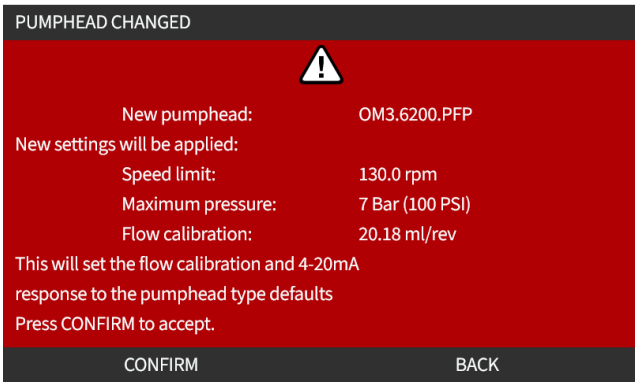
2. When acknowledged, the home screen of current operating mode is displayed.
3. Bring pump back into operation.
4. Re-calibrate the flow, follow the flow calibration procedure in "11.3.2 HMI—Calibrating the pump flowrate: MODE menu > Flow calibration" on page 72.

26.4.2.2.2 Pumphead of the different type fitted

1. Press ACCEPT NEW HEAD.
2. **PUMPHEAD CHANGED** screen will be displayed.
3. Press CONFIRM.



NOTE: Analog calibration reset to default on Universal and Universal+ only.



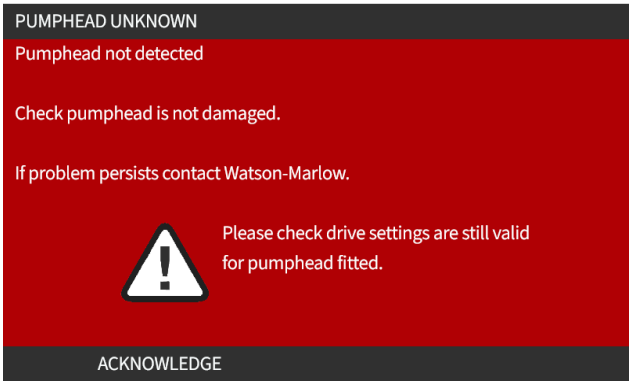
4. Bring pump back into operation.
5. Re-calibrate the flow, by following flow calibration procedure in "11.3.2 HMI—Calibrating the pump flowrate: MODE menu > Flow calibration" on page 72.

26.4.2.2.3 Pumphead of unknown type fitted

PUMPHEAD UNKNOWN screen displays warning to check settings.

Previous pump head settings (Speed limit, pressure limit, analog calibration) are retained.

1. Press ACKNOWLEDGE to continue with current configuration.



2. Bring pump back into operation.
3. Re-calibrate the flow, by following flow calibration procedure in "11.3.2 HMI—Calibrating the pump flowrate: MODE menu > Flow calibration" on page 72.

27 Errors, breakdown and troubleshooting

27.1 Section overview

This section will provide information on errors or a breakdown which may occur during operation, along with possible causes to assist with troubleshooting.

If the problem cannot be solved, information on how to seek technical support along with our comprehensive warranty is provided at the end of this section.

27.2 Errors

The pump has an inbuilt function to report errors as summarised by the table below:

Code	Condition	Suggested action
Err	General Error	Turn pump off / seek advice
Err0	FRAM write error	Attempt to reset by switching power OFF / ON.
Err1	FRAM corruption	Attempt to reset by switching power OFF / ON.
Err2	FLASH write error	Attempt to reset by switching power OFF / ON.
Err3	FLASH corruption	Attempt to reset by switching power OFF / ON.
Err4	FRAM shadow error	Attempt to reset by switching power OFF / ON.
Err9	Motor stalled	Stop pump immediately. Check pumphead and tube. Power OFF / ON may reset.
Err10	Tacho fault	Stop pump immediately. Power OFF / ON may reset.
Err14	Speed error	Stop pump immediately. Power OFF / ON may reset.
Err15	Over current	Stop pump immediately. Check system. Power OFF / ON may reset.
Err16	Over voltage	Stop pump immediately. Check supply. Power OFF / ON may reset.
Err17	Under voltage	Stop pump immediately. Check supply. Power OFF / ON may reset.
Err19	Over temperature	Stop pump immediately. Turn OFF.
Err20	Signal out of range	Check analog control signal range. Trim signal as required.
Err21	Over signal	Reduce the analog control signal
Err30	Overpower	Excessive power consumption. Turn OFF power supply. Check supply and system conditions.
Err50	Internal Comms error	Attempt to reset by switching power OFF / ON.

27.3 Error reporting

If any unexpected faults or failures are experienced report them to your Watson-Marlow representative.

27.4 Breakdown

27.4.1 Leak detection message

If leak detected, pump display following message:

27.4.2 Leak detection procedure

As soon as a leak is detected either as a result of a message on the screen or observing a fluid leak from the pumphead. The following procedure must be immediately followed:

1. Isolate the pump from electrical power
2. Remove the pump from service in accordance with the user's organisations procedure
3. Determine the cause of the leak
4. Follow the procedure provided in maintenance to replace the pump head. This procedure includes an inspection for chemical residue.
5. Bring the pump back into service
6. Reconnect electrical power to the pump
7. Reset the leak detection message

WARNING

Operating the pumphead to the point of failure may result in a flow of chemicals from the inside of the pumphead into the pumphead to drive interface area, as a result of aggressive chemicals which are not compatible with the internal pumphead materials.

Chemicals could attack the materials in this area and enter the drive. The internal parts of the drive unit contain Aluminium which may react with some aggressive chemicals to form an explosive gas.

If you are pumping a chemical that may react with Aluminium to form an explosive gas, do not operate the pump to the point of pumphead failure. In addition, you must ensure the chemicals being pumped are chemically compatible with the materials of construction in the pumphead to drive interface area: Drive casework, Drive casework seals, Drive shaft, Drive shaft seal.

In the event of a pumphead failure or a leak detection notification event. Stop the pump, remove from service and follow the pumphead replacement procedure (See "26.4.2 Replacement of pumphead" on page 234).

27.5 Troubleshooting

27.5.1 Pumphead end of life

The pumphead will fail due to:

1. Wear – The pumphead has reached its normal end of life point due to wear of components.
2. Overpressure – As a result of being subjected to a pressure greater than the maximum rating of the pumphead.
3. Chemical incompatibility – being used with chemicals which are incompatible with the pumphead fluid path which are normally wetted in normal use.

27.5.2 Flowrate

The flowrate of the pump is dependent on:

- Inlet and discharge pressure
- Speed of the pump
- Viscosity of the fluid
- Condition of pumphead

Actual flow rates achieved may vary to those displayed on the screen because of changes in temperature, viscosity, inlet and discharge pressures, system configuration and pumphead performance against time.

For the highest accuracy it is advisable to calibrate the pump on a regular basis.

To determine the cause of the flowrate problem, refer to the performance curves in "4.8.1.2 Performance curve" on page 33and determine where on the curve the pump is operating to determine the cause of the problem.

27.5.3 Leak detection message

If, after pumphead replacement, the leak detection message is repeated when the power is cycled, or after the leak detection reset button has been pressed, follow this procedure:

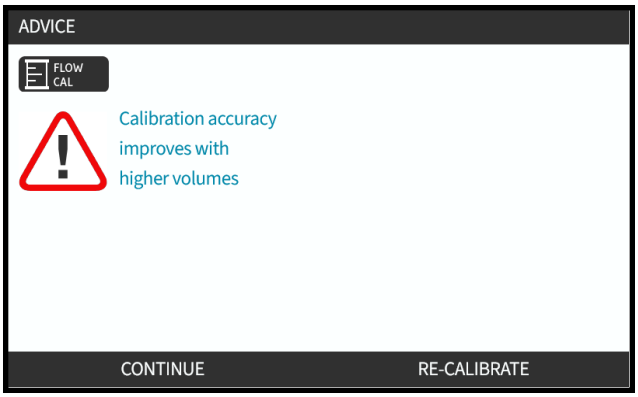
1. Remove the pumphead.
2. Check that the mounting face is clean and free of debris.
3. Refit the pumphead, making sure it is correctly oriented with the arrow pointing upwards.

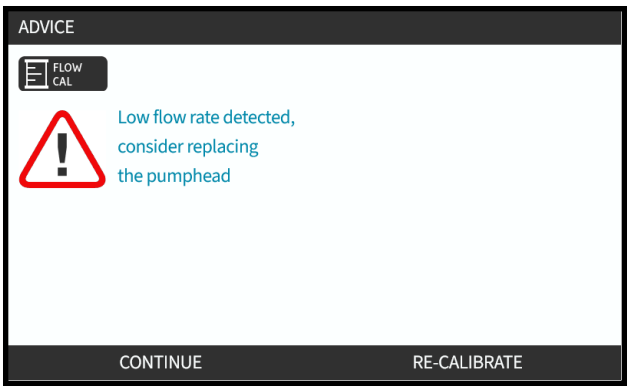
If the message continues to appear after several pumphead installations, there may be a problem with the leak detection sensor. In this case, please contact your local Watson-Marlow representative for further troubleshooting or repair.

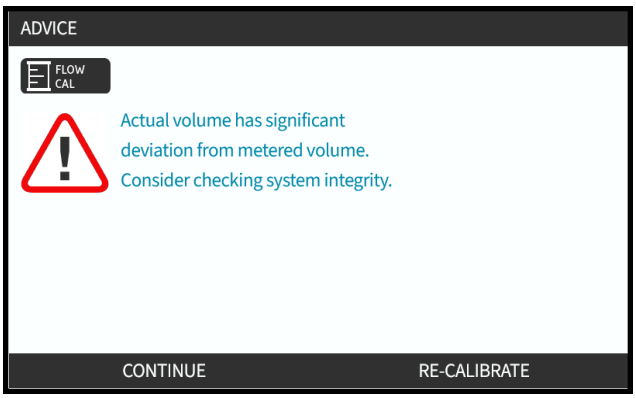
27.5.4 Flow calibration

The following advice screens may appear during calibration.

To clear, use either CONTINUE or, RE-CALIBRATE.



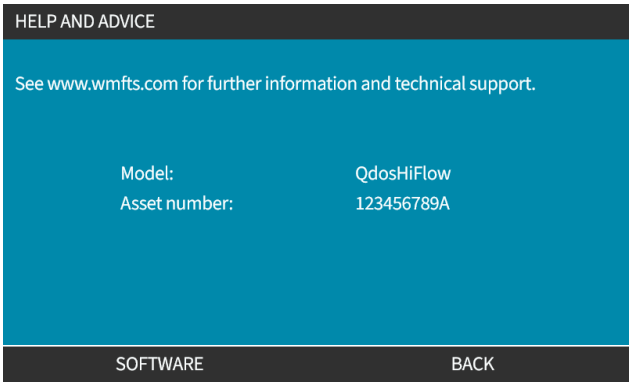


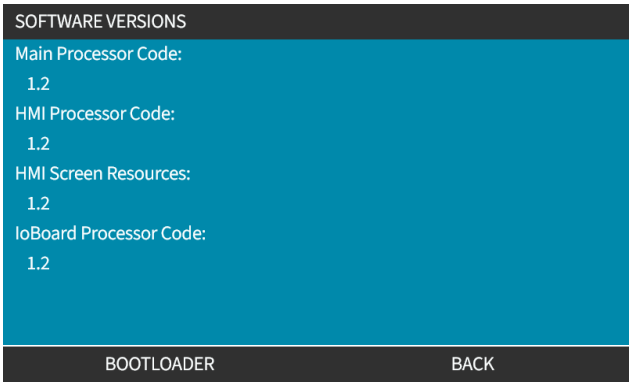


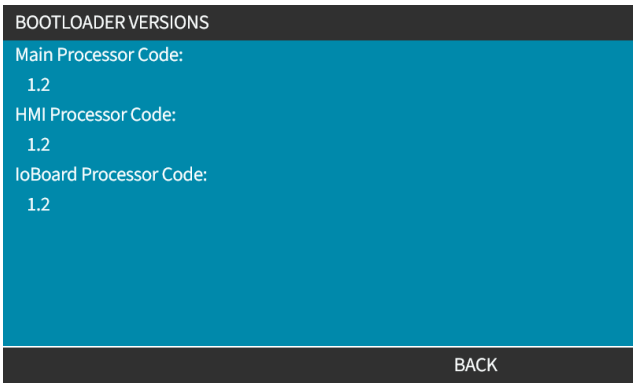
27.5.5 General pump help

The pump contains a help menu which provides information on the software in the pump. This information may be required when discussing technical support with Watson-Marlow as detailed in the section below.

Select **Help** from main menu to access **HELP AND ADVICE** screens







27.6 Technical support

Should you be unable to resolve the error or breakdown, or have another query please contact us your Watson-Marlow representative for technical support.

27.6.1 Manufacturer

This product is manufactured by Watson-Marlow. For guidance or support of this product please contact:

Watson-Marlow Limited
Bickland Water Road
Falmouth, Cornwall
TR11 4RU
United Kingdom

Phone: +44 1326 370370
Website: *https://www.wmfts.com/*

27.6.2 Authorised EU Representative

Johan van den Heuvel
Managing Director
Watson Marlow Bredel B.V.
Sluisstraat 7
Delden
Netherlands
PO Box 47
Telephone: +31 74 377 0000

27.7 Warranty

Watson-Marlow Limited (“Watson-Marlow”) warrants this product to be free from defects in materials and workmanship for two 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 being 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.

27.7.1 Conditions

- Products must be returned by pre-arrangement to Watson-Marlow, or a Watson-Marlow approved service centre.
- All repairs or modifications must have been made by Watson-Marlow Limited, or a Watson-Marlow 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.
- All PROFIBUS systems must be installed or certified by a PROFIBUS approved installation engineer.
- All EtherNet/IP systems must be installed or certified by a EtherNet/IP approved installation engineer.
- All PROFINET systems must be installed or certified by a PROFINET approved installation engineer.

27.7.2 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 subjected 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.
- All ReNu pumpheads are excluded.
- 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.

27.7.3 Returning pumps

Before returning products, they must be thoroughly cleaned/decontaminated.

You are required to complete and return a decontamination declaration stating all fluids that have been in contact with the equipment being returned to us.

On receipt of the declaration, a Returns Authorisation Number will be issued. Watson-Marlow reserves the right to quarantine or refuse any equipment that is not displaying a Returns Authorisation Number.

Please complete a separate decontamination declaration for each product and use the correct form that denotes the location you wish to return the equipment to.

To obtain a decontamination declaration document for completion, contact your local Watson-Marlow representative.

27.8 Product end of life

Once the product has reached its end of life, a responsible person must remove the product from service to enable disposal.

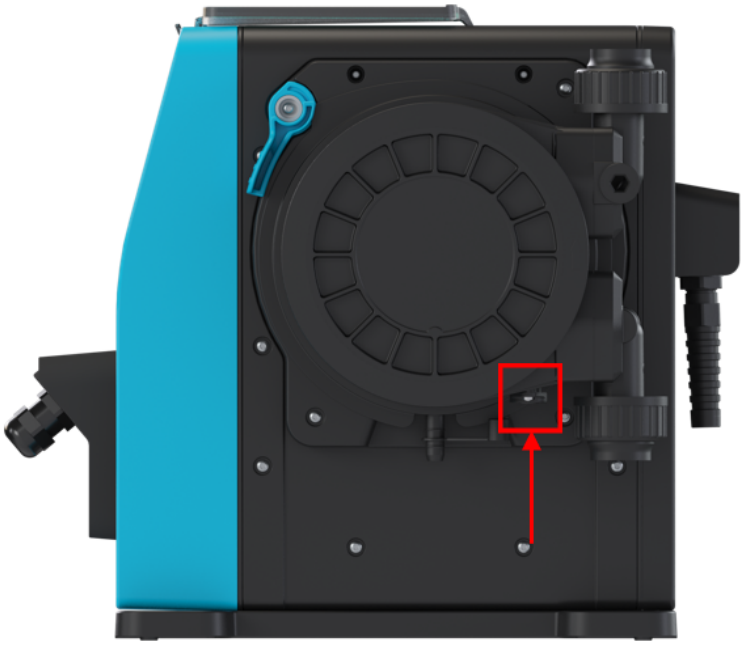
27.8.1 Drive

The drive must not be disassembled. It must be taken to an approved recycling centre for disposal. The materials of construction of the drive are provided in "28.1.4.2 Item group 4: Drive" on page 255.

27.8.2 Pumphead

The pumphead can contain up to 600 mL of pumped fluid

There is a drain port on the bottom of the pumphead, which can be unscrewed so that the pumphead may be drained prior to disposal



The pumphead must not be disassembled. After draining, it should be disposed of according to local regulations.

If the pumphead has been operated to the point of failure, drain any residual chemicals and lubricant from the safety overflow, then re-fit the rubber cap.

28 Chemical compatibility

Ensuring chemical compatibility is a requirement to determine if use of the product is within the definition of Intended Use (see "4.3 Intended use" on page 24).

A responsible person, must carry out a risk assessment, to determine the impact of fluids, coming into contact with Materials of Construction (MoC) of a qdos H-FLO pump in the following scenarios:

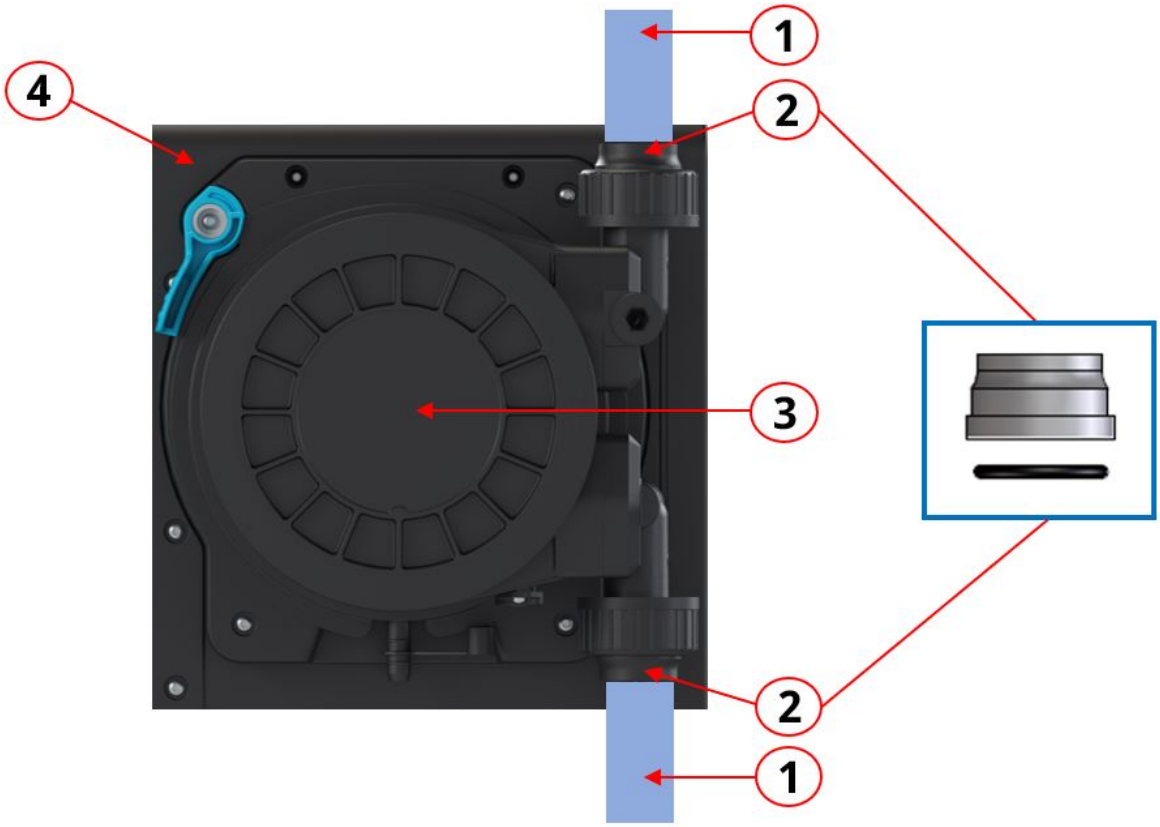
1. Normally wetted by the fluid path
2. Not normally wetted, but have the potential to be wetted by the following:
    - Spillage or leakage of the fluid path
    - By chemicals (liquid or gas) in the operating environment
    - If the pump is operated to the point that the tubing within the pumphead fails, resulting in spillage or leakage of the pumped fluid onto materials of construction.

Determine the MoC that may be affected by the above scenarios using "28.1 Materials of construction" on the next page, and then follow the procedure in "28.2 Procedure to check chemical compatibility" on page 256.

28.1 Materials of construction

28.1.1 Identification of item groups

Materials of construction are grouped according to the picture and table below:



Item group number	Item group name
1	Users fluid path tubing/pipework
2	Pumphead fluid path connections
3	Pumphead: • Item group 3A: Pumphead—Normally wetted by fluid path • Item group 3B: Pumphead—Not normally wetted by fluid path
4	Drive

28.1.2 Abbreviations (Materials of Construction)

The following abbreviations may be used in this section:

Abbreviation	Full name
FKM	**F**luorine **K**autschuk **M**aterial
HDPE	**H**igh **D**ensity **P**oly**e**thylene
NBR	**N**itrile rubber
PA6	Nylon 6
PC	**P**oly**c**arbonate
PET	**P**oly**e**thylene **T**erephthalate
PFPE	**P**er**f**luoro**p**oly**e**ther
PP	**P**oly**p**ropylene
PPE	**P**ersonal **P**rotective **E**quipment
PPS	**P**oly**p**henylene **s**ulphide
PS	**P**oly**s**trene
PVCu	**P**oly**v**inyl**c**hloride
PVDF	**P**oly**v**inylidene **dif**luoride
SEBS	**S**tyrene-**e**thylene-**b**utylene **s**tyrene

28.1.3 Materials of construction—Normally wetted by the fluid path

The following items/groups are normally wetted by the fluid path.

Item Group		Item	Material of construction	
1	Users fluid path tubing/pipework	Mixture	User specified	
2	Fluid path connections	Fluid connectors	PVCu	
		Fluid connector seals	FKM	
			ReNu Santoprene	**ReNu SEBS**
3A	Pumphead	Tubing	Santoprene	SEBS
		Fluid connection port	Glass filled polypropylene	PVDF
		Fluid connection port end plugs	Glass filled polypropylene	PVDF
		Fluid connection port end seals	FKM	FKM

28.1.4 Materials of construction—Not normally wetted by the fluid path

28.1.4.1 Item group 3B: Pumphead

The following pumphead items are not normally wetted by the fluid path, but could be wetted by the fluid path in some scenarios.

Item Group		Item	Material of construction
3B	Pumphead enclosure	Connection Collar	PVCu
		Pump Head Body	20% GF PPE+PS
		Outer Track Cover	20% GF PPE+PS
		Clear Cover	PC
		Rotor Seal	NBR and Steel
		Seal Ring	Stainless Steel
		Rotor Core	20% GF PPE+PS
		Information Label	Polyester, PET
		Screws	Stainless Steel
		Washer	Stainless Steel
		Spring	Stainless Steel
		NBR Washer	NBR
		Button	Noryl
		Shaft Seal	NBR
		Drain Cap	20% GF PPE+PS/ Santoprene
		Overflow cap	Santoprene
	Pumphead internals	Rotor Seal	NBR and Steel
		Seal Ring	Stainless Steel
		Rotor Core	20% GF PPE+PS
		Rotor	GF PA6/TPU
		Tube Baffle	HDPE
		Bearings	Steel
		O-Rings Seals	NBR
		Lubricant	PFPE based Lubricant
		Track inserts	PP
		Misc	Polyester, Loctite HY4090
	Pumphead to drive interface area	Rotor Seal	NBR and Steel
		Seal Ring	Stainless Steel
		Rotor Core	20% GF PPE+PS
		O-Rings Seals	NBR
		Outer Track Cover	20% GF PPE+PS
		Clear Cover	PC
		Button	Noryl

28.1.4.2 Item group 4: Drive

The following drive items are not normally wetted by the fluid path, but could be wetted by the fluid path in some scenarios.

Item Group		Item	Material of construction
4	Drive enclosure	Drive cosmetic casework & lock	GF PPE+PS
		Drive enclosure casework	Fire retardant GF PPE+PS
		Keypad/HMI	Polyester
		Leak detector housing	PC
		HMI Cover	PC
		Overlays	Polyester
		Cable glands	PA6
		O-rings	NBR
		Lock bushing	Polypropylene
		Drive case work seals	Silicone
		Screws	Stainless steel
		M12 input/output fittings	Zinc alloy, nickel plated, (M12 connector (M) model only)
		M12 O-rings	FKM (M12 connector (M) model only)
		Baseplate	20 % glass filled PPE/PS
	Pumphead to drive interface area	Drive enclosure casework	Fire retardant GF PPE+PS
		Drive case work seals	Silicone
		Drive shaft seal	Santoprene
		Drive shaft	Stainless steel 440C
	Information labels	Information labels	Polyester, PET
	Power cable (product code ending in A)	Outer sheath	PVC
	Power cable (product code ending in B, C, D, E, K, R, U, Z)	Outer sheath	PCP
	Drive internals	Mixture	Mixture of materials, including Aluminium

28.2 Procedure to check chemical compatibility

Follow the 3 step procedure to check chemical compatibility, each step has sub-steps (A and B)

1. Using the information in "28.1 Materials of construction" on page 251, Determine the materials of construction that would be wetted by the following scenarios:

   Step 1A: Items in "28.1.3 Materials of construction—Normally wetted by the fluid path" on page 253 (Group 1, 2 and 3A)

   Step 1B: Items in "28.1.4 Materials of construction—Not normally wetted by the fluid path" on page 254 (group 3B, and 4) Not normally wetted by the fluid path, but have the potential to be wetted by the following scenarios:

   - Spillage or leakage of the fluid path
   - By chemicals (liquid or gas) in the operating environment
   - If the pump is operated to the point that the pumphead tubing fails, resulting in spillage or leakage of the pumped fluid on to materials of construction such as the :
     - Pumphead internals
     - Pumphead to drive interface area

WARNING

Operating the pumphead to the point of failure may result in a flow of chemicals from the inside of the pumphead into the pumphead to drive interface area, as a result of aggressive chemicals which are not compatible with the internal pumphead materials.

Chemicals could attack the materials in this area and enter the drive. The internal parts of the drive unit contain Aluminium which may react with some aggressive chemicals to form an explosive gas.

If you are pumping a chemical that may react with Aluminium to form an explosive gas, do not operate the pump to the point of pumphead failure. In addition, you must ensure the chemicals being pumped are chemically compatible with the materials of construction in the pumphead to drive interface area: Drive casework, Drive casework seals, Drive shaft, Drive shaft seal.

In the event of a pumphead failure or a leak detection notification event. Stop the pump, remove from service and follow the pumphead replacement procedure (See "26.4.2 Replacement of pumphead" on page 234).

2. Determine chemical compatibility of the materials of construction identified in Step 1, using Step 2A and 2B:

   Step 2A: For products with a Watson-Marlow product code, use the Watson-Marlow chemical compatibility guide: *https://www.wmfts.com/en/support/chemical-compatibility-guide/*

   - For items in group 3A: A combined check of the items is undertaken using the pumphead name
     Example:
     Sodium Hypochlorite, ReNu SEBS (Qdos) = Grade A compatibility

   Step 2B: For products not purchased from Watson-Marlow, use supplier chemical compatibility guides

3. If the item is not chemically compatible, or chemical compatibility cannot be determined, then either:

   Step 3A: Select another material, for example a different pumphead, fluid connector, or etc.

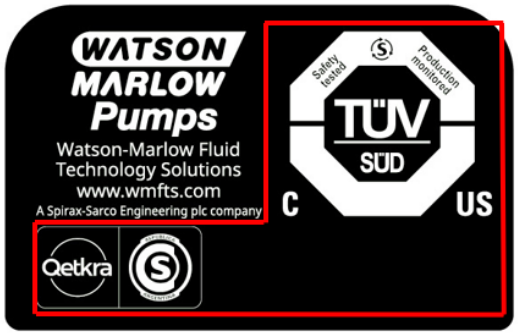
   Step 3B: Reassess the intended operation. For example, replacing the peristatic tubing or element after a set number of tested revolutions prior to pumphead failure, to avoid contact with materials of construction which would not normally be wetted by the fluid path.

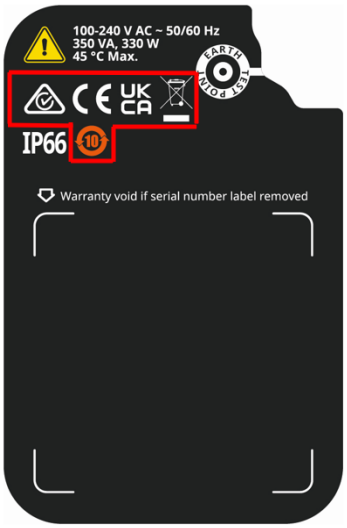
29 Certification

29.1 Compliance markings on the product

29.1.1 Location of compliance marking

The product is marked to demonstrate compliance. These markings may be identified on the product in the location, illustrated by the pictures below:





29.1.2 Description of compliance marking

Compliance mark	Description
CE	Complies with the applicable marking regulations, listed on the EU declarations.
UKCA	Complies with the applicable marking regulations, listed on the UKCA declarations.
TÜV SÜD C US	Certified by TUV to: • IEC 61010-1:2010/AMD1:2016 • EN 61010-1:2010/A1:2019 • UL 61010-1:2012/R:2019-07 • CSA C22.2 No. 61010-1-12/AMD1:2018
RCM	Complies to the applicable requirements of ACMA (Australian Communications and Media Authority)

29.2 Product certification

Printed conformance documents are supplied within product packaging.