Reference Manual

DriveSure ADC
DriveSure En
DriveSure Pn

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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.

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2 INTRODUCTION TO THE DOCUMENT

2.1 User groups

These instructions are the installation and maintenance instructions for a Watson-Marlow DriveSure (ADC, En, or Pn) pump, for reference during the product's life cycle.

There are two main user groups, as defined below:

User group	Definition
Responsible Person	A competent person who is in, or acting on behalf of, the user's organisation, responsible for: Product application selection, installation, safe use of the product by operators, cleaning, maintenance, troubleshooting, or decommissioning.
Operator	A person operating the product for its intended use.

2.2 Responsibility

These instructions may only be referenced by a responsible person. A responsible person must produce final safety information (1) and instructions (installation, operation, and maintenance) for the piece of equipment into which a DriveSure pump will be integrated.

An operator must not use these instructions for reference.

NOTE (1)	The form and format of the final safety information and instructions are dependent upon the final design, residual risks, and certification requirements of the piece of equipment into which a DriveSure pump will be integrated.

Prior to an intended task, a responsible person must use these instructions to:

- Ensure the product is suitable for an intended task.
- Do a risk assessment to identify hazards, and methods to reduce risks, in accordance with the user organisation's control measures, such as working procedures and suitable Personal Protective Equipment.
- Approve water as a cleaning agent for use if required: see section 17.
- Train an operator to perform a hazardous task.

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

2.3 Information types

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

Information type	Explanation
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.

3 SAFETY

3.1 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 (PPE) must be worn prior to a task.
 Either symbol	**Rotating parts**	Either symbol indicates rotating parts which should not be touched without following a safety instruction.
 Either symbol	**Potential hazard**	Either symbol indicates a safety instruction must be followed or potential hazard exists.

The instruction documentation must be consulted in all cases where any safety symbol is shown to find details of potential hazards and actions to avoid.

3.1.1 Instructions for renewing safety symbols

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

3.2 Safety alerts

Safety alerts indicate a possible hazard.

3.2.1 Safety alerts—With risk of personal injury

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

CAUTION

The word CAUTION 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

3.2.2 Safety alerts—With risk of equipment or property damage

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

NOTICE

The word NOTICE 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

3.3 Personal Protective Equipment (PPE)

The following minimum PPE will be required for any task or procedure in these instructions:

1. Safety glasses.
2. Safety boots.
3. Gloves chemically compatible with the chemicals being pumped.

A risk assessment by a responsible person must be undertaken to identify:

- The suitability of PPE for any task or procedure in these instructions.
- If additional PPE is required for any task or procedure in these instructions.

4 PRODUCT OVERVIEW

This section provides a product and specification overview.

4.1 Introduction

Watson-Marlow DriveSure integrates motor, mounting, our latest generation control technology, and WM Connect PC software to deliver powerful performance. DriveSure is designed for integration into equipment, such as a cabinet or casing. All DriveSure models are positive displacement peristaltic pumps, fully tested and certified, ensuring reliability in a range of applications.

As a complete panel-mount solution, DriveSure helps OEMs to reduce time-to-market and achieve competitive gain by simplifying each stage of the development process.

DriveSure features our next generation digital, closed-loop control technology, which delivers enhanced speed control for accurate flow rates, coupled with cool and quiet performance.

High speed accuracy and stability across the range is achieved by tuning specifically for peristaltic pump applications.

Cool running is achieved by continuously adjusting motor phase current in response to the torque requirement, avoiding excess current and therefore heat. If the load increases unexpectedly due to changes in the application, DriveSure can manage higher than expected loads in a controlled and safe manner through its closed-loop control.

4.2 WM Connect PC Software

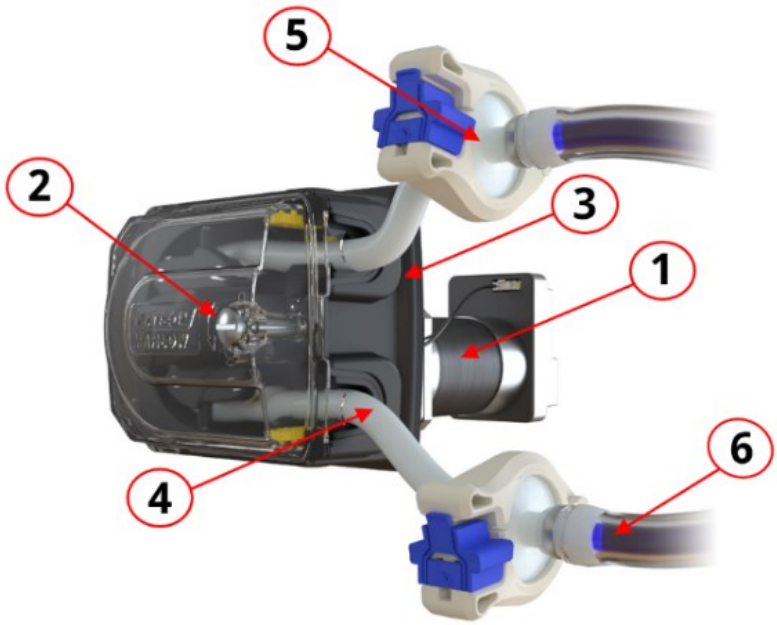
The WM Connect software is available for use with DriveSure. It may be used for:

- Configuring pump control and performance settings.
- Manual override for testing performance and simulating errors.
- Viewing pump status information.
- Load/save pump configurations.
- Performing pump firmware updates.
- Viewing pump log.

See section 15 for full information.

4.3 General arrangement

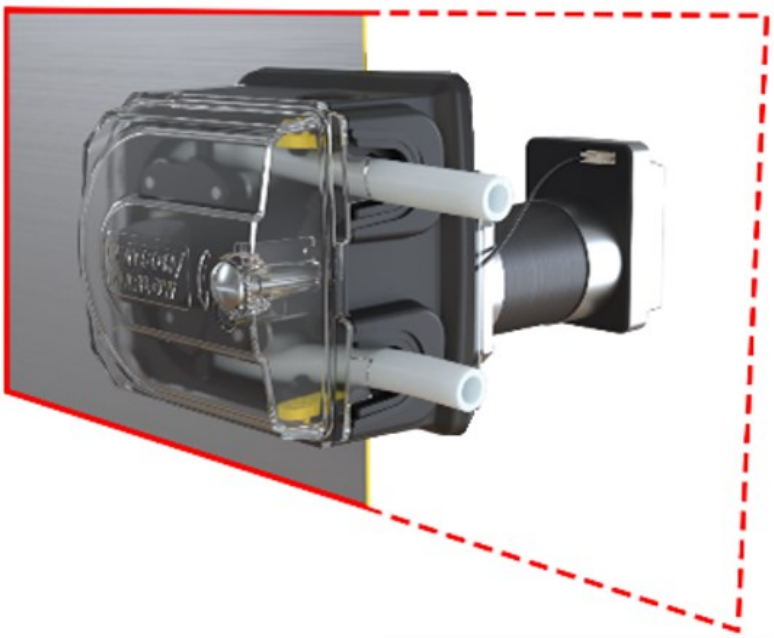
A general arrangement illustration is provided below:



Item Number	Name
1	Pump drive
2	Peristaltic pumphead
3	Pumphead mounting plate
4	Peristaltic (tubing or element)
5	Connection to process fluid path
6	Process fluid path

4.4 Intended mounting

The pump is designed for installation through a panel to separate the environment of the pumphead from that of the drive unit. The panel is represented by the red outline in the image below:



4.5 Intended use

All DriveSure models are designed as components requiring integration into other equipment or system prior to use, to provide controlled fluid (2) movement, in accordance with this reference manual or an addendum or supplement to this reference manual, in ordinary safe locations, except fluids or applications listed below.

4.5.1 Prohibited use:

- Environments that require explosion proof certification.
- Flammable fluids.
- Applications which are directly life sustaining.
- Applications within a Nuclear Island.

NOTE (2)	A procedure for checking chemical compatibility with fluids is provided: see section 20

4.6 Pump models

A DriveSure pump is a combination of:

- A DriveSure drive model.
- A pumphead mounting plate.
- A Watson-Marlow pumphead model.

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

4.6.1 Drive—Models

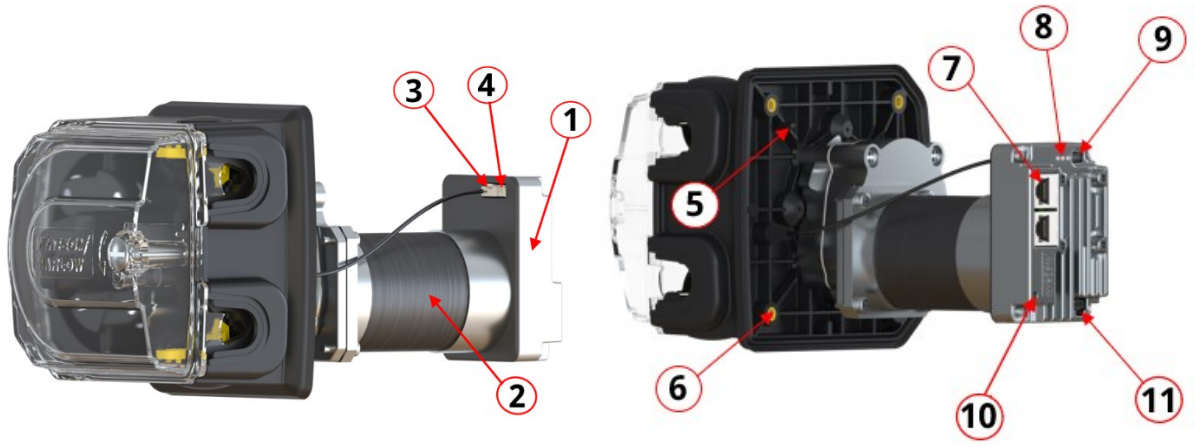
There are 3 models of drive:

- DriveSure ADC model:
  - Analogue control: 4–20 mA [(3)], 0–10 V
  - Digital control: 2–2000 Hz
  - Fixed speed
- DriveSure En model: Network control by EtherNet/IP
- DriveSure Pn model: Network control by PROFINET

NOTE [(3)]	4-20 mA input is the default control mode. To use 0-10 V, frequency, or a fixed speed, set the **Inactive/Active** toggle to **Active** in the related control sub-tab of the WM Connect PC software. See section 15.5.2.1.

4.6.2 Drive—General arrangement

The general arrangement of a DriveSure drive is illustrated below:



520R2 DriveSure En 2.4 mm WT model shown. The exact appearance and arrangement will vary with model.

Item Number	Name
1	Integrated Controller
2	Motor
3	Connection for integrated cover-open sensor cable
4	Connection for prime switch cable
5	Mounting plate alignment features
6	Threaded brass inserts for pump mounting bolts
7	Remote control connection
8	Status LEDs
9	USB-C connection for WM Connect PC software
10	Functional earth terminal (4)
11	Power supply connection

NOTE (4)	An M4 x 0.7 threaded hole (4.0 mm thread depth) is provided as an optional functional earth terminal.

4.6.3 Pumphead—Models

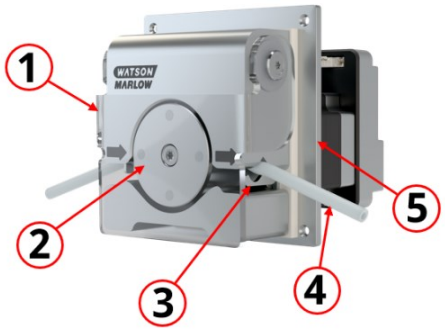
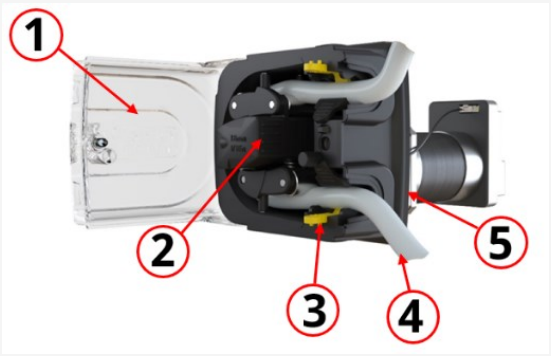
A DriveSure pump may be ordered with any of the following Watson-Marlow pumpheads:

Pumphead Series	Pumphead models	Image
100 Series	• 114DV • 114DVP • 116DV • 116DVP	
300 Series	• 313D • 313D2 • 314D • 314D2 • 316D • 318D	
400/RXMD	• RXMD	
500 Series	• 520R • 520R2 • 520REL • 520REM	

4.6.4 Pumphead—General arrangement

The general arrangement of a pumphead is provided in the image below:

100 Series	300 Series
	

400/RXMD	500 Series
	

Item Number	Name
1	Pumphead cover [5]
2	Rotor
3	Tubing clamps [6]
4	Peristaltic tubing (or element)
5	Pumphead mounting plate

NOTE [5] Tool unlockable (500 Series only).

NOTE [6] Continuous tube only.

4.6.5 Holding torque

When the pumphead cover is open, the pump is stopped and the pumphead rotor is free to turn with no holding torque.

When the pumphead cover is closed, the holding torque and running state varies depending on the control input:

4.6.5.1 DriveSure ADC

Speed signal (Pins 5,6, or 8)	Brake/Run (Pin 4)			Running state when pumphead cover is closed
	State	Logic	Logic voltage	
= 0 RPM	Brake	Low	0 to 9.2 V	The pump is stopped with holding torque on the pumphead rotor.
> 0 RPM	Brake	Low	0 to 9.2 V	
= 0 RPM	Run	High	10.4 to 30 V	
> 0 RPM	Run	High	10.4 to 30 V	The pump runs at set speed.

4.6.5.2 DriveSure En, Pn

Run enable (index 8)	Run (index 7)	Running state when pumphead cover is closed
Enable (ADI 101/Bit 3)	Start Pump (ADI 101/Bit 2)	
Controls power to motor coils	Stops/starts pump	
0	0	The pump is stopped and the pumphead rotor is free to turn with no holding torque.
0	1	
1	0	The pump is stopped with holding torque on the pumphead rotor.
1	1	The pump is stopped with holding torque on the pumphead rotor if speed is set to 0 deciRPM
1	1	The pump runs at set speed.

4.6.6 Pumphead—Tubing

A Watson-Marlow pumphead provides fluid flow by the principle of positive displacement using a Watson-Marlow peristaltic tube installed inside the pumphead.

4.6.6.1 Tubing—Types

Watson-Marlow pumpheads are designed for use with two main types of peristaltic tubing:

Tubing type name	Fluid connection style	Picture
Continuous tube type	A continuous tube, available in various lengths, to be cut to size for use in an applicaton.	
LoadSure tubing element type	A set length, with built in fluid connectors, for fast and accurate tube changes without the need to set tubing clamps or tension tube.	

4.6.6.2 Tubing—Materials

Tubing is available in the following main materials:

Tubing name	Material
Marprene	Thermoplastic elastomer
Bioprene	Thermoplastic elastomer
Pumpsil	Platinum cured silicone
PureWeld XL	SEBS
STA-PURE PCS	ePTFE and platinum-cured silicone composite
STA-PURE PFL	ePTFE and platinum-cured perfluoroelastomer
Tygon E-LFL	PVC
Tygon E-3603	PVC

4.6.6.3 LoadSure element—Sub-types

LoadSure elements are divided further into two sub-types:

Element Sub-type name	Fluid connection style	Picture
Sanitary	For use with a fluid connector gasket and outer connection clamp.	
Industrial	For use with a click fit female fluid connector.	

4.6.6.4 Tubing—Size

Tubing and element sizes are referenced by the bore (internal diameter) dimension followed by wall thickness.

Example: 6.4 mm bore x 1.6 mm wall thickness

Specific tubing sizes may only be installed in specific pumpheads:

Tubing	Suitable pumphead
Continuous tubing with a 1.6 mm wall thickness	114DV, 114DVP, 116DV, 116DVP, 313D, 314D, 316D, 318D, RXMD, 520R
Continuous tubing with a 2.4 mm wall thickness	313D2, 314D2, 520R2
Watson-MarlowLoadSure TL elements	520REL
Watson-MarlowLoadSure TM elements	520REM

Not all tubing is available in all materials, all sizes, all lengths, or all types (continuous, element). Contact your local Watson-Marlow representative for more information.

4.7 Accessories

A DriveSure pump is available with the following Watson-Marlow accessories:

Type	Product name	Product code
Control cable (7)	Ethernet Cable, RJ45 to RJ45, CAT 5e SHIELDED, 3m (9.84 Ft)	059.9123.000
	PROFINET Cable, RJ45 to RJ45, CAT 5e SHIELDED, 3m (9.84 Ft)	059.9128.000
Cable pack (8)	DriveSure cable pack - 24 V power supply/USB-C - trials only	009.24CP.DVS
	DriveSure cable pack - 48 V power supply/USB-C - trials only	009.48CP.DVS

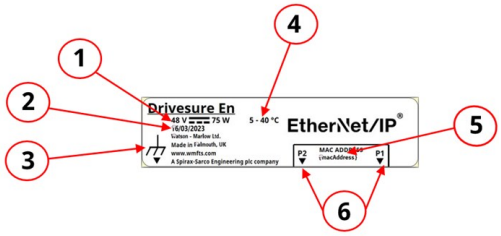
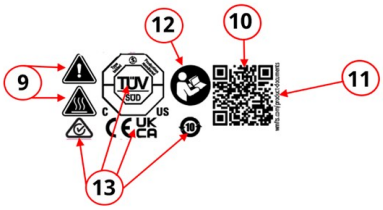
NOTE (7) DriveSure En or Pn pumps are not supplied with a control cable. DriveSure ADC includes the control cable with corresponding 8-pin connector.

NOTE (8) The cable pack is for trial use only. It includes an AC to DC power adapter and USB-C cable. The power adapter in the cable pack does not include the mains power lead. These can be ordered separately with the correct country plug. Contact your local Watson-Marlow representative for more information.

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

4.8 Product labels

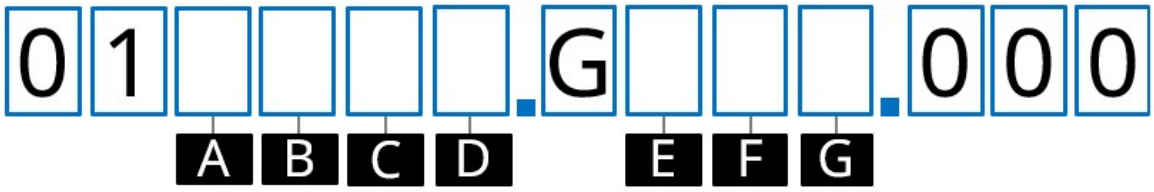
3 labels are provided on the product (DriveSure En model shown):

Number	Name	Picture
1	DC Power supply requirement	
2	Date of manufacture	
3	Functional earth terminal	
4	Ambient operating temperature	
5	Network MAC Address	
6	Network port numbers	
7	Product serial number	
8	Product part number	
9	Safety symbols	
10	QR code for instructions	
11	Website address for instructions	
12	Symbol: refer to these instructions	
13	Compliance symbols	

4.9 Product code

A DriveSure pump product code is a unique string of numbers, as illustrated by the graphic and tables below:

4.9.1 100 series



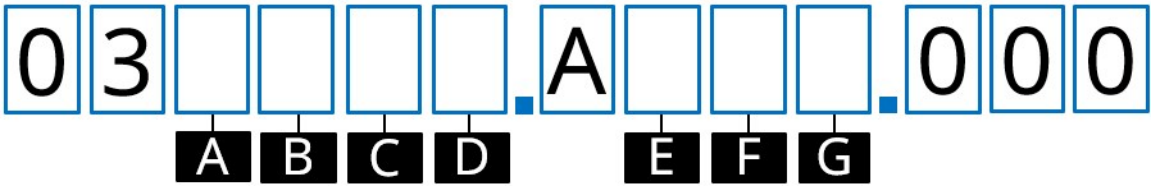
A	B	C	D
Product	**Control**	**Included cable length** [9]	**Pumphead colour**
0 = Complete pump	4 = ADC	1 = 1 m (3.28 ft) cable	0 = No pumphead
6 = Drive only	8 = En (EtherNet/IP)	3 = 3 m (9.84 ft) cable	1 = Standard colour
	9 = Pn (PROFINET)		2 = Black
			3 = White

E	F	G
Pumphead	**Pressure**	**Tube wall thickness**
0 = No pumphead	0 = No pumphead	0 = No pumphead
A = 114	S = Standard pressure	1 = 1.6 mm
B = 116	P = Plus pressure	

NOTE [9]

The included cable length applies to the power and control cable (ADC only). En and Pn models are not supplied with a control cable. Example: If position C = 3 then included cables are 3 m long.

4.9.2 300 series

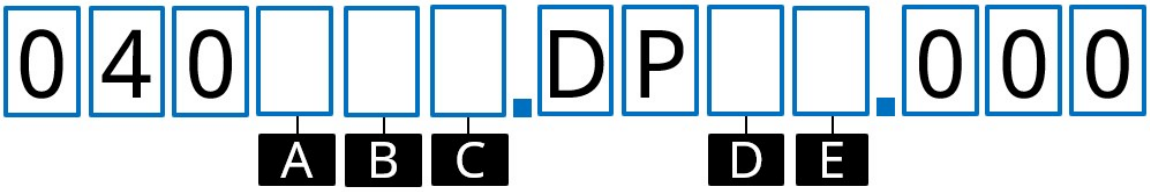


A	B	C	D
Product	**Control**	**Included cable length (10)**	**Pumphead colour**
0 = Complete pump	4 = ADC	1 = 1 m (3.28 ft) cable	0 = No pumphead
6 = Drive only	8 = En (EtherNet/IP)	3 = 3 m (9.84 ft) cable	1 = Standard colour
	9 = Pn (PROFINET)		2 = Black
			3 = White

E	F	G
Pumphead	**Tube clamp**	**Tube wall thickness**
0 = No pumphead	0 = No pumphead	0 = No pumphead
C = 313D/313D2	V = Variable	1 = 1.6 mm
D = 314D/314D2	C = Fixed 0.5 to 1.6 mm bore	2 = 2.4 mm
E = 316D	F = Fixed 3.2 mm bore	
F = 318D	K = Fixed 4.8 to mm bore	
	N = Fixed 6.4 to 8.0 mm bore	

NOTE (10)	The included cable length applies to the power and control cable (ADC only). En and Pn models are not supplied with a control cable. Example: If position C = 3 then included cables are 3 m long.

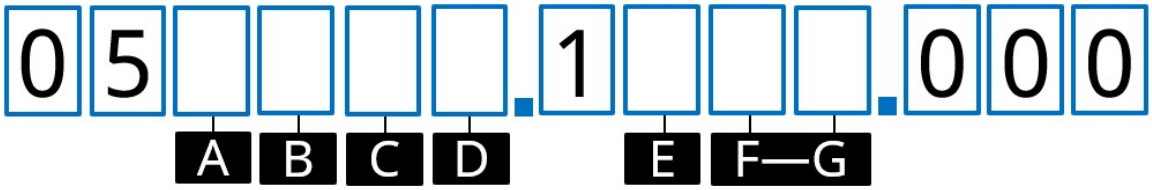
4.9.3 400/RXMD



A	B	C	D	E
Control	**Included cable length** (11)	**Direction**	**Max Pressure**	**Tube bore size**
4 = ADC	1 = 1 m (3.28 ft) cable	1 = Clockwise (CW)	4 = 4 bar	3 = 1.6 mm
8 = En (EtherNet/IP)	3 = 3 m (9.84 ft) cable	2 = Counter clockwise (CCW)	6 = 6 bar	4 = 3.2 mm
9 = Pn (PROFINET)				

NOTE (11) The included cable length applies to the power and control cable (ADC only). En and Pn models are not supplied with a control cable. Example: If position B = 3 then included cables are 3 m long.

4.9.4 500 series



A	B	C	D	E	F–G
Product	**Control**	**Included cable length (12)**	**Pumphead Colour**	**Pumphead**	**Pumphead Model**
0 = Complete pump	4 = ADC	1 = 1 m (3.28 ft) cable	0 = No pumphead	0 = No pumphead	00 = No pumphead
6 = Drive only	8 = En (EtherNet/IP)	3 = 3 m (9.84 ft) cable	1 = Standard colour	R = 500 Series	10 = 520R
	9 = Pn (PROFINET)				2L = 520R2
					EL = 520REL
					EM = 520REM

NOTE (12) The included cable length applies to the power and control cable (ADC only). En and Pn models are not supplied with a control cable. Example: If position C = 3 then included cables are 3 m long.

4.10 Specification overview

This section provides a specification overview. Detailed installation specification is provided when relevant to the installation task.

4.10.1 Performance overview

The flow rate of the pump depends on:

- Speed of the pump. (13)
- Pumphead.
- Tubing material.
- Direction of rotor rotation.
- Application pressure at pumphead inlet and discharge fluid path connections. (14)
- Fluid viscosity.

NOTE (13)	The maximum speed of the pump is dependent on power supply voltage, discharge pressure, and tubing material.

NOTE (14)	Pressures values in this section are root-mean-squared gauge pressures, measured inline immediately before the inlet and after the discharge tubing clamps.

4.10.2 100 Series performance

4.10.2.1 100 Series 48 V DC performance summary table

Flow rates in the table below are based on the following conditions:

- Pumping water at 20 °C in a 0 bar inlet and discharge pressure application.
- 48 V DC power supply.

Pumphead	Flow rate [15] (mL/min) by tube bore based on 0.1 rpm (Min) to 410 rpm (Max)													
	0.5 mm		0.8 mm		1.6 mm		2.4 mm		3.2 mm		4.0 mm		4.8 mm	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
114DV	0.002	9.3	0.004	17.4	0.014	57.4	0.029	118	0.048	195	0.068	277	0.085	349
114DVP	0.002	9.3	0.004	17.4	0.014	57.4	0.029	118	0.048	195	0.068	277	0.085	349
116DV	0.002	7.1	0.003	12.0	0.011	43.4	0.022	90.8	0.032	127	0.043	158	0.048	184
116DVP	0.002	7.2	0.003	12.1	0.010	43.5	0.021	88.1	0.031	127	0.040	152	0.046	167

NOTE [15] Reduce the flow rates in the table by 10% for Pumpsil tubing.

Refer to performance curves for graphical representation of flow rate versus application pressure under certain conditions.

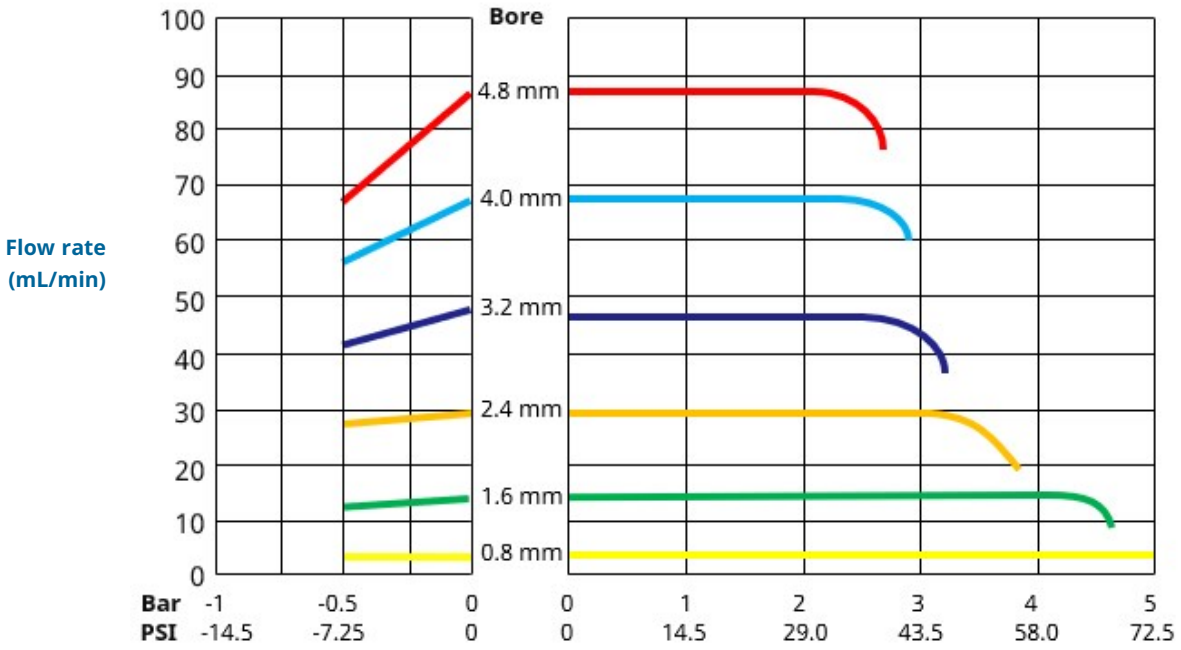
4.10.2.2 100 Series 48 V DC performance curve

The flow rate versus application pressure of a 114DV, 114DVP, 116DV, or 116DVP pumphead under the following conditions is shown in the performance curves below.

- 48 V DC power supply.
- Marprene tube.
- Pumping water at 20 °C.
- Counter-clockwise direction.
- 100 rpm.

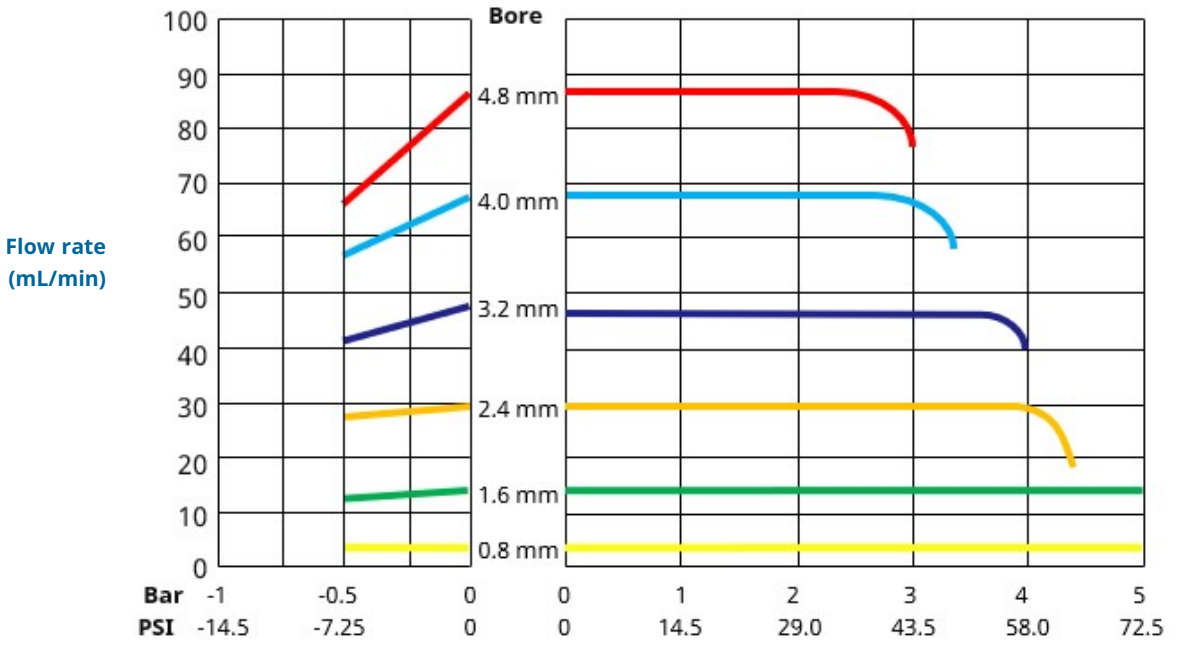
114DV Pumphead

Marprene, water, 100 rpm, counter-clockwise



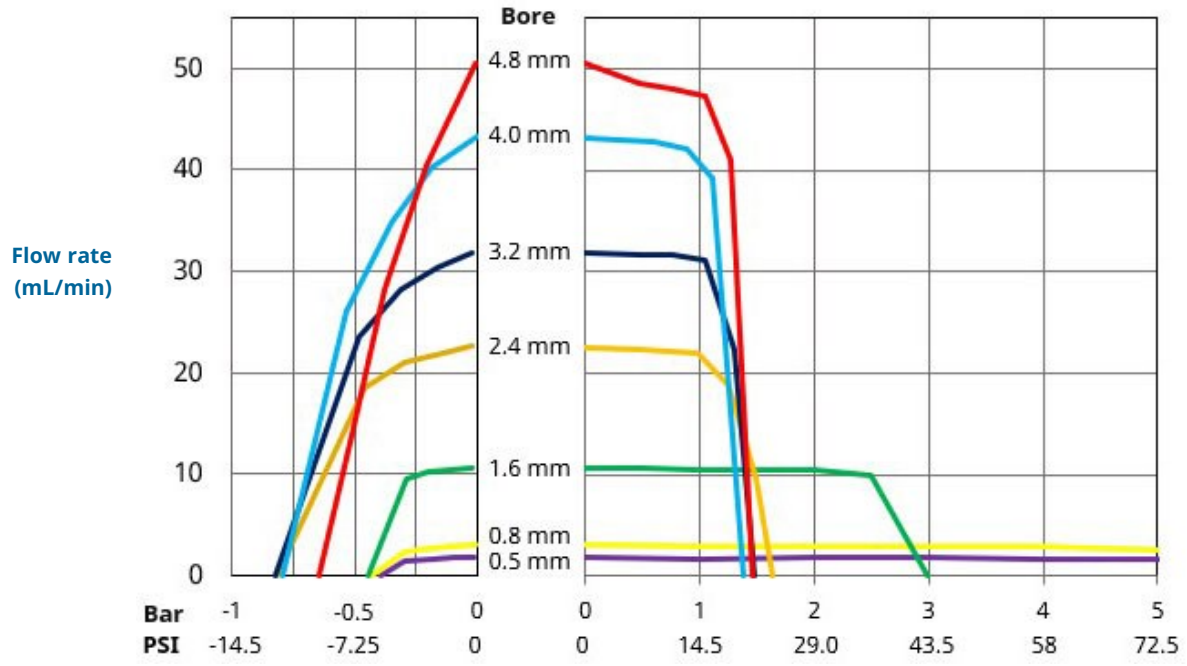
114DVP Pumphead

Marprene, water, 100 rpm, counter-clockwise



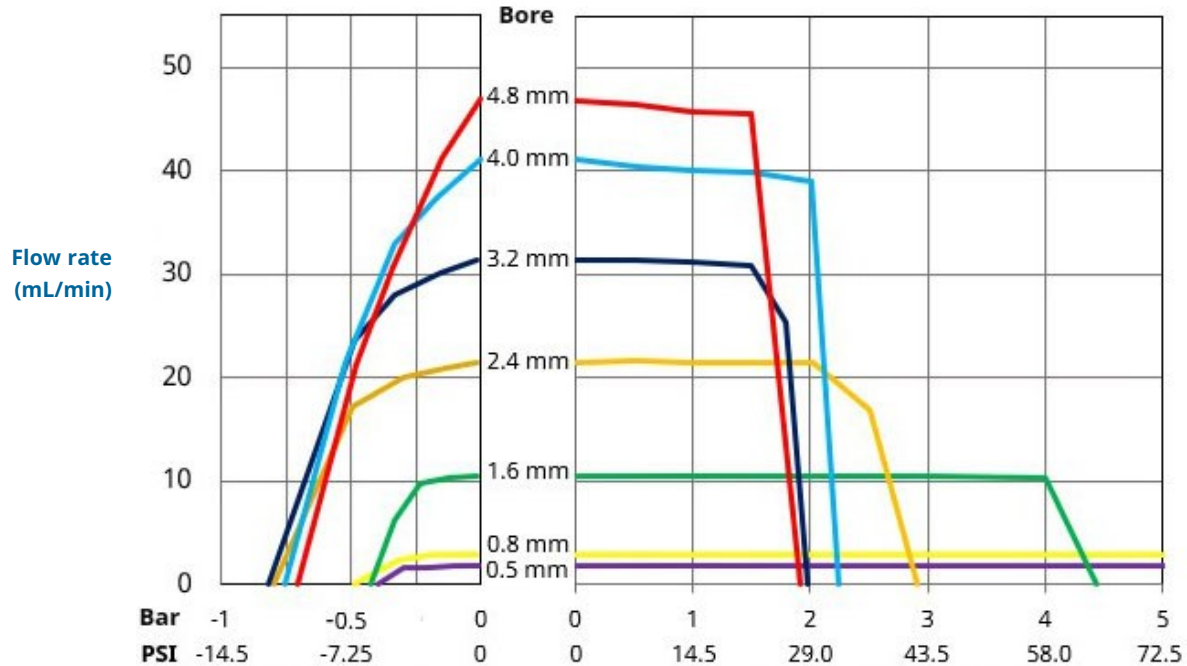
116DV Pumphead

Marprene, water, 100 rpm, counter-clockwise



116DVP Pumphead

Marprene, water, 100 rpm, counter-clockwise



The following conditions may influence achievable flow rates:

- Other power supply voltages.
- Other fluid viscosities.
- Other tubing materials.
- Different speeds than 100 rpm.
- A clockwise direction.

Achievable flow rates should be determined in a user's system through application testing.

4.10.3 300 Series performance

4.10.3.1 300 Series 48 V DC performance summary table

Flow rates in the table below are based on the following conditions:

- Pumping water at 20 °C in a 0 bar inlet and discharge pressure application.
- 48 V DC power supply.

Pumphead	Flow Rate (mL/min) by tube bore based on 0.1 rpm (Min) to 410 rpm (Max)													
	0.5 mm		0.8 mm		1.6 mm		3.2 mm		4.8 mm		6.4 mm		8.0 mm	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
313D	0.003	12.1	0.007	29.1	0.027	112.5	0.100	410	0.221	904	0.368	1507	0.500	2050
313D2					0.026	108.0	0.100	418	0.196	890	0.308	1382		
314D	0.003	12.1	0.006	24.1	0.025	102.5	0.086	352	0.191	784	0.300	1230	0.400	1640
314D2					0.025	103.3	0.092	376	0.176	782	0.269	1191		
316D					0.019	80.8	0.071	287	0.115	575	0.149	719	0.210	577
318D					0.018	71.9	0.059	249	0.094	428	0.115	398	0.134	305

Refer to performance curve for graphical representation of flow rate versus application pressure under certain conditions.

4.10.3.2 300 Series 48 V DC performance curve

The flow rate versus application pressure of a 313D, 314D, 313D2, 314D2, 316D, or 318D pumphead under the following conditions is shown in the performance curves below.

- 48 V DC power supply.
- Marprene tube.
- Pumping water at 20 °C.
- Counter-clockwise direction.
- 100 rpm.

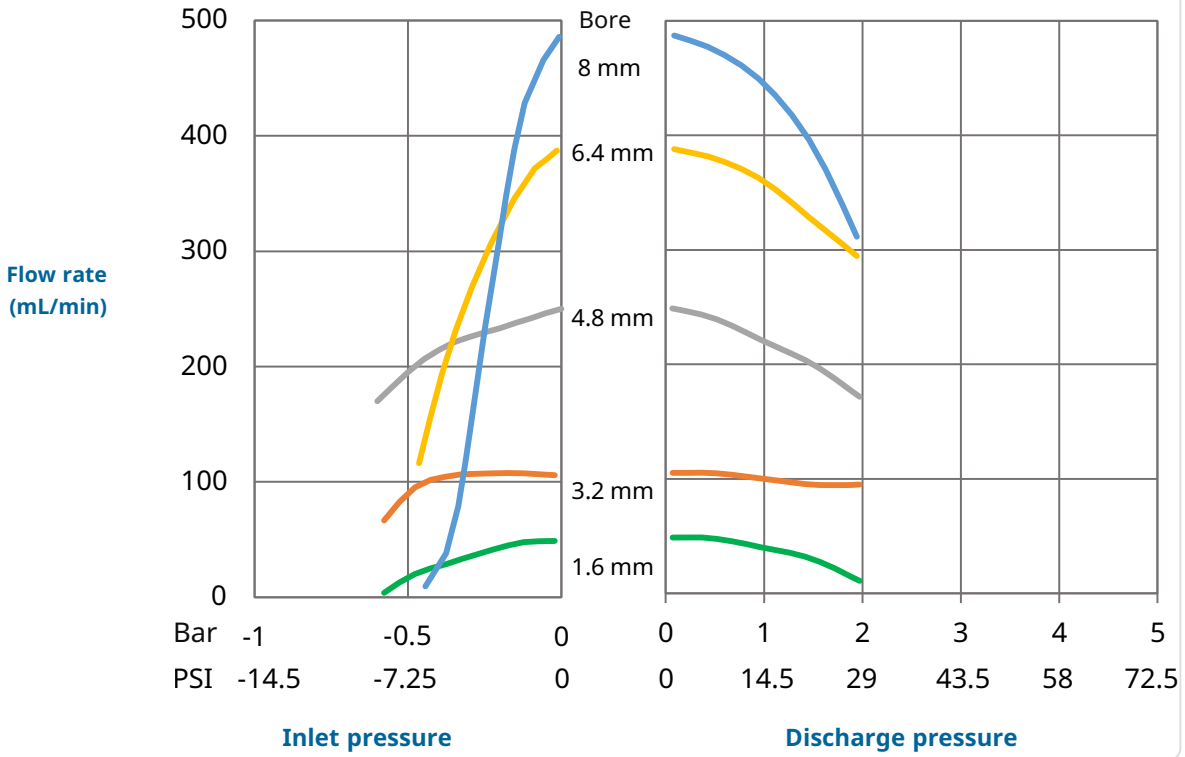
The following conditions may influence achievable flow rates:

- Other power supply voltages.
- Other fluid viscosities.
- Other tubing materials.
- Different speeds than 100 rpm.
- A clockwise direction.

Achievable flow rates should be determined in a user's system through application testing.

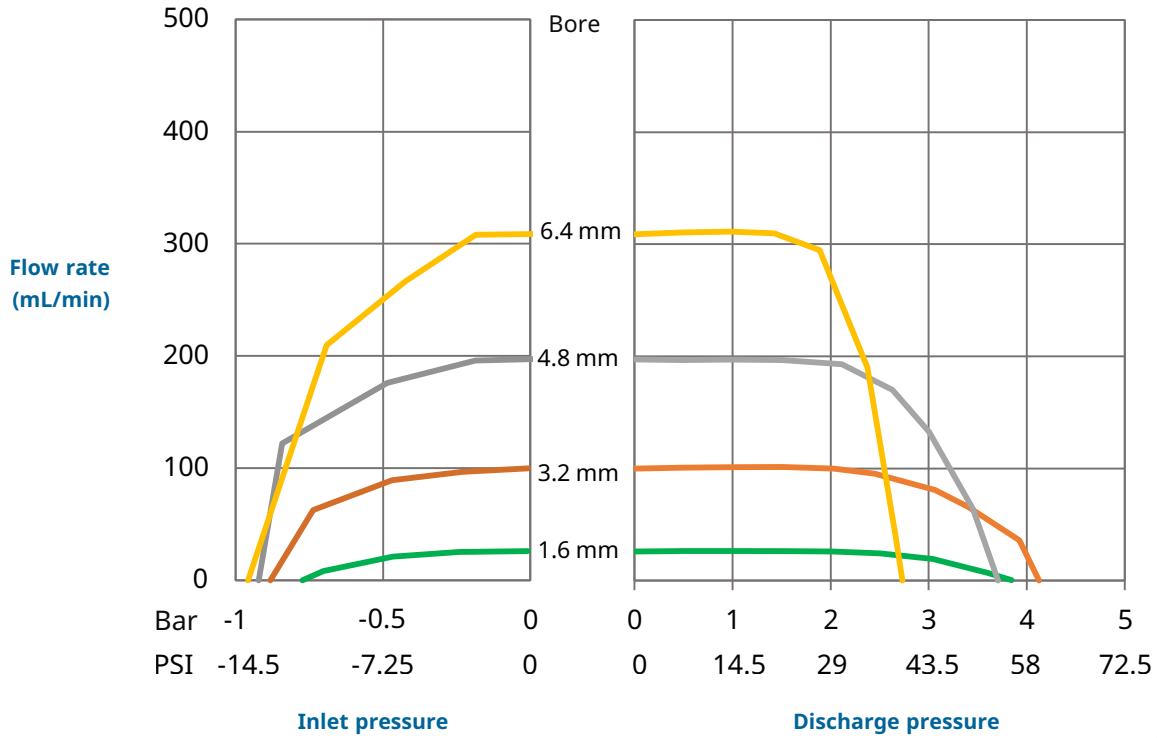
313D Pumphead

Marprene, water, 100 rpm, counter-clockwise



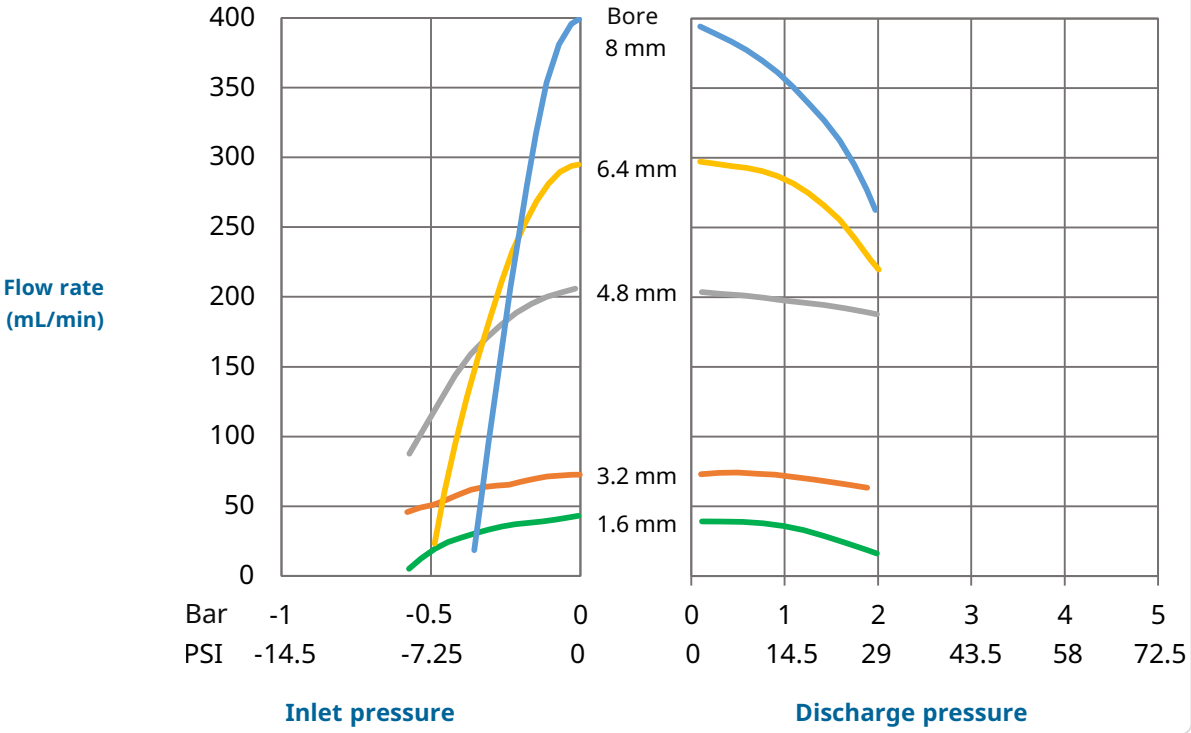
313D2 Pumphead

Marprene, water, 100 rpm, counter-clockwise



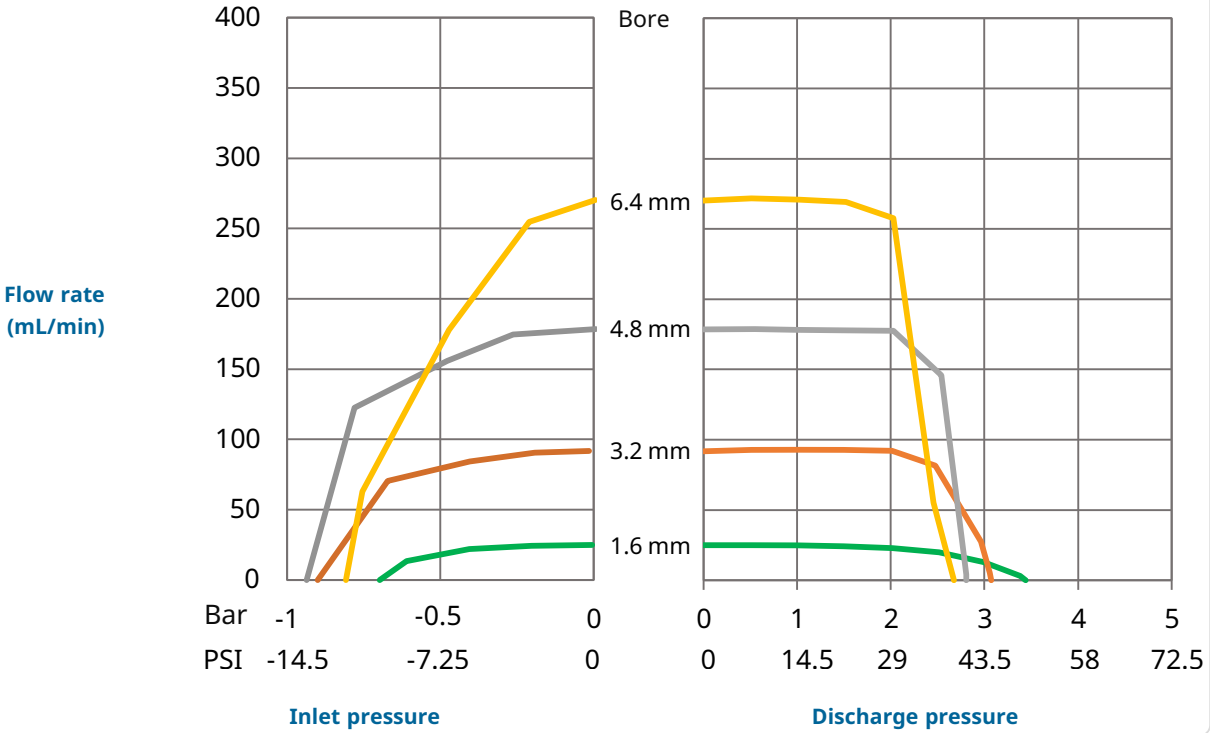
314D Pumphead

Marprene, water, 100 rpm, counter-clockwise



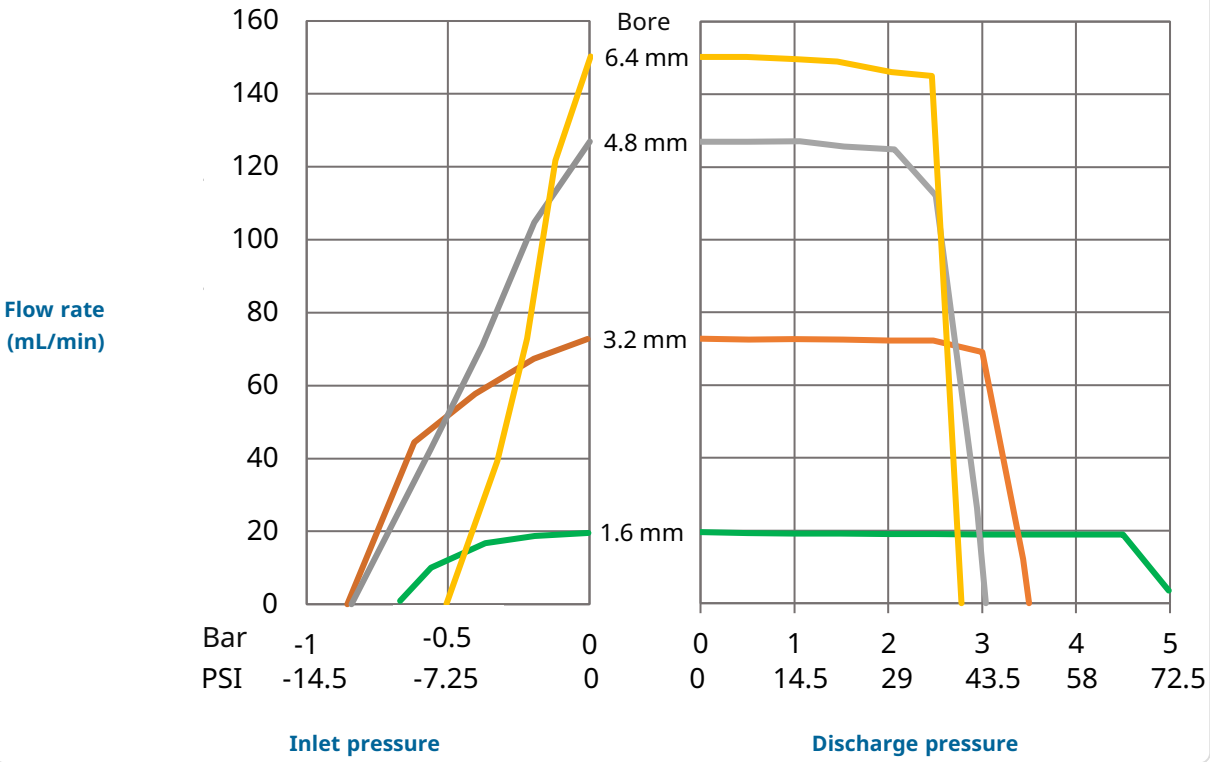
314D2 Pumphead

Marprene, water, 100 rpm, counter-clockwise



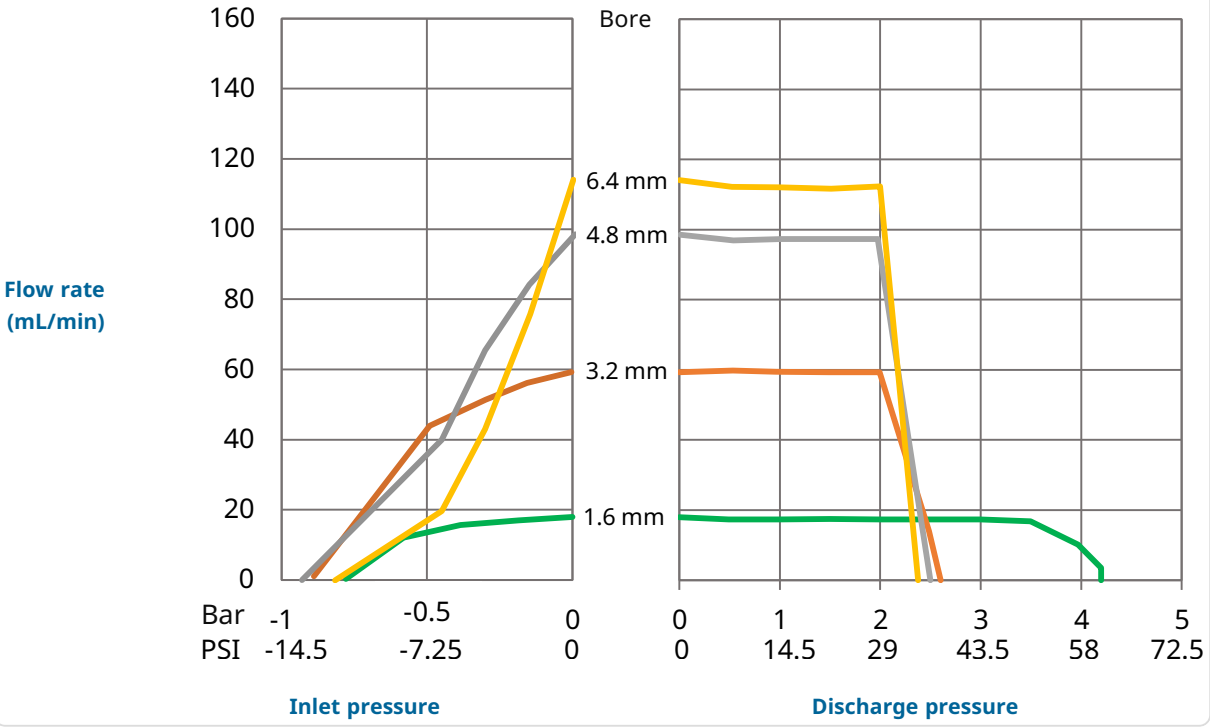
316D Pumphead

Marprene, water, 100 rpm, counter-clockwise



318D Pumphead

Marprene, water, 100 rpm, counter-clockwise



4.10.4 400/RXMD performance

4.10.4.1 400/RXMD 48 V DC performance summary table

Flow rates in the table below are based on the following conditions:

- Pumping water at 20 °C in a 0 bar inlet and discharge pressure application.
- 48 V DC power supply.
- Tygon E-3603 tubing.

Pumphead	Flow Rate (mL/min) by tube bore based on 0.1 rpm (Min) to 550 rpm (Max)			
	1.6 mm		3.2 mm	
	Min	Max	Min	Max
RXMD	0.025	137	0.091	500

Refer to performance curve for graphical representation of flow rate versus application pressure under certain conditions.

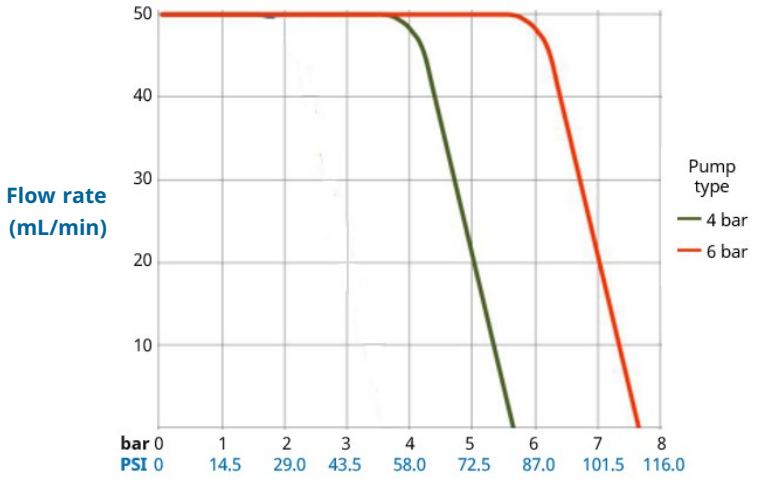
4.10.4.2 400/RXMD 48 V DC performance curve

The flow rate versus application pressure of a RXMD pumphead under the following conditions is shown in the performance curves below.

- 48 V DC power supply.
- Tygon E-3603 tubing.
- Pumping water at 20 °C.
- 200 rpm.

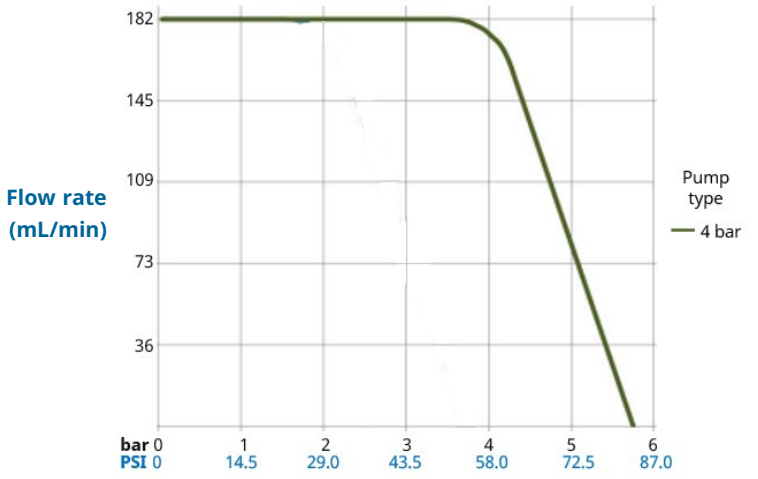
RXMD Pumphead, 1.6 mm Bore

Tygon E-3603, water, 200 rpm



RXMD Pumphead, 3.2 mm Bore

Tygon E-3603, water, 200 rpm



The following conditions may influence achievable flow rates:

- Other power supply voltages.
- Inlet pressure.
- Other fluid viscosities.
- Other tubing materials.
- Different speeds than 200 rpm.

Achievable flow rates should be determined in a user's system through application testing.

4.10.5 500 Series performance

4.10.5.1 500 Series 48 V DC performance summary table

Flow rates in the tables below are based on the following conditions:

- Pumping water at 20 °C in a 0 bar inlet and discharge pressure application.
- 48 V DC power supply.

4.10.5.1.1 520R PUMPHEAD FOR CONTINUOUS TUBING (1.6 MM WALL THICKNESS) UP TO 2 BAR (29 PSI)

Tube	Flow Rate (mL/min) by tube bore from 0.1 rpm (Min) to 220 rpm (Max)													
	0.5 mm		0.8 mm		1.6 mm		3.2 mm		4.8 mm		6.4 mm		8.0 mm	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Pumpsil	0.004	9.5	0.011	24	0.04	97	0.18	390	0.40	870	0.70	1500	1.10	2400
STA-PURE PCS														
STA-PURE PFL														
Marprene	0.004	9.0	0.011	24	0.04	92	0.17	370	0.38	830	0.67	1500	1.10	2300
Bioprene	0.004	9.0	0.011	24										
PureWeld XL	0.004	9.0												

4.10.5.1.2 520R2 PUMPHEAD FOR CONTINUOUS TUBING (2.4 MM WALL THICKNESS) UP TO 2 BAR (29 PSI)

Tube	Flow Rate (mL/min) by tube bore from 0.1 rpm (Min) to 220 rpm (Max)															
	0.5 mm		0.8 mm		1.6 mm		3.2 mm		4.8 mm		6.4 mm		8.0 mm		9.6 mm	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Pumpsil	0.004	9.5	0.011	24	0.04	97	0.18	390	0.40	870	0.70	1500	1.10	2400	1.60	3500
STA-PURE PCS																
STA-PURE PFL																
Marprene					0.04	92	0.17	370	0.38	830	0.67	1500	1.10	2300	1.50	3300
Bioprene																
PureWeld XL																

4.10.5.1.3 520REL PUMPHEAD FOR LOADSURE TL ELEMENTS UP TO 2 BAR (29 PSI)

LoadSure Element	Flow Rate (mL/min) by tube bore from 0.1 rpm (Min) to 220 rpm (Max)					
	3.2 mm		6.4 mm		9.6 mm	
	Min	Max	Min	Max	Min	Max
Pumpsil STA-PURE PCS STA-PURE PFL	0.18	390	0.70	1500	1.60	3500
Marprene TL Bioprene TL	0.17	370	0.67	1500	1.50	3300

4.10.5.1.4 520REM PUMPHEAD FOR LOADSURE TM ELEMENTS UP TO 4 BAR (58 PSI)

LoadSure Element	Flow Rate (mL/min) by tube bore from 0.1 rpm (Min) to 220 rpm (Max)			
	3.2 mm		6.4 mm	
	Min	Max	Min	Max
Marprene TM	0.18	390	0.70	1500
Bioprene TM	0.17	370	0.67	1500

Refer to performance curve for graphical representation of flow rate versus application pressure under certain conditions.

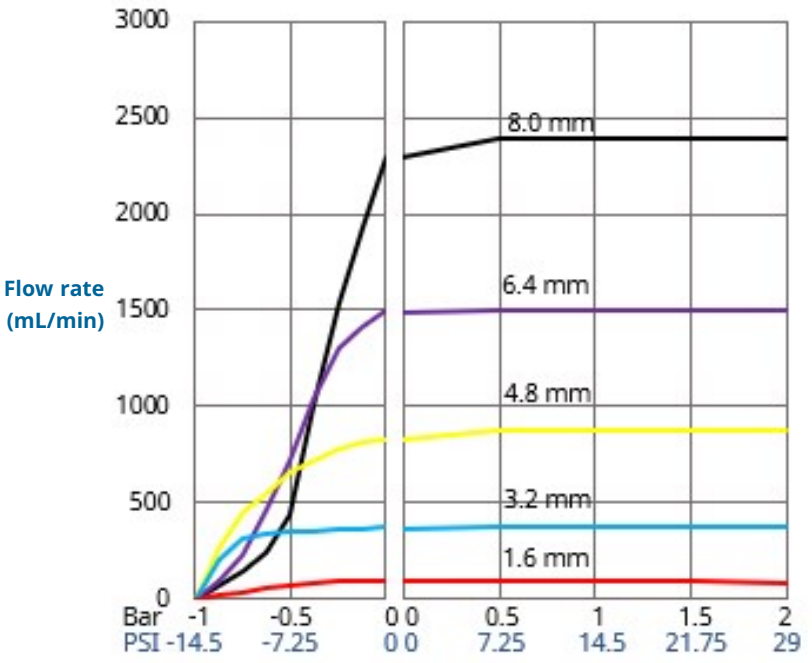
4.10.5.2 500 Series 48 V DC performance curve

The flow rate versus application pressure of a 500 Series pumphead under the following conditions is shown in the performance curves below.

- 48 V DC power supply.
- Marprene tube.
- Pumping water at 20 °C.
- Counter-clockwise direction.
- 220 rpm.

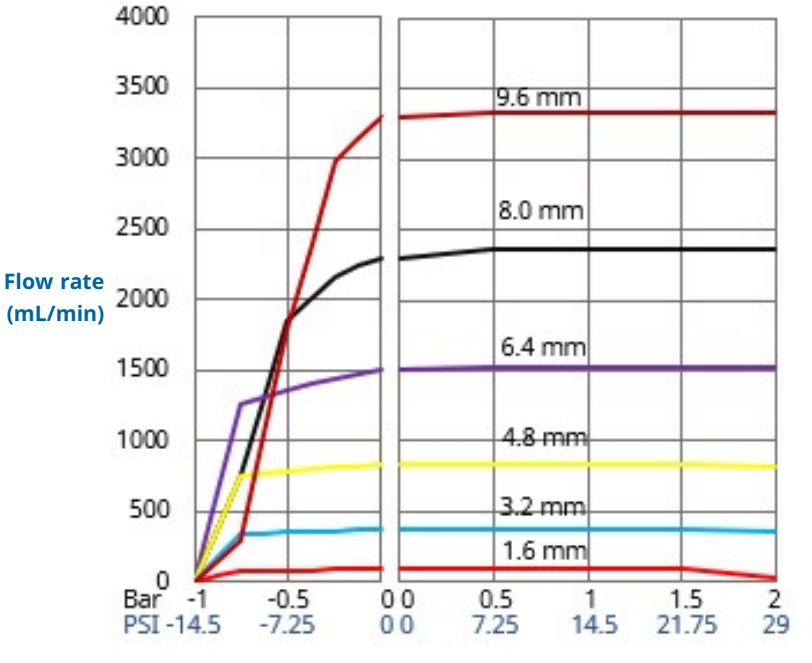
520R Pumphead

Marprene, water, 220 rpm, counter-clockwise



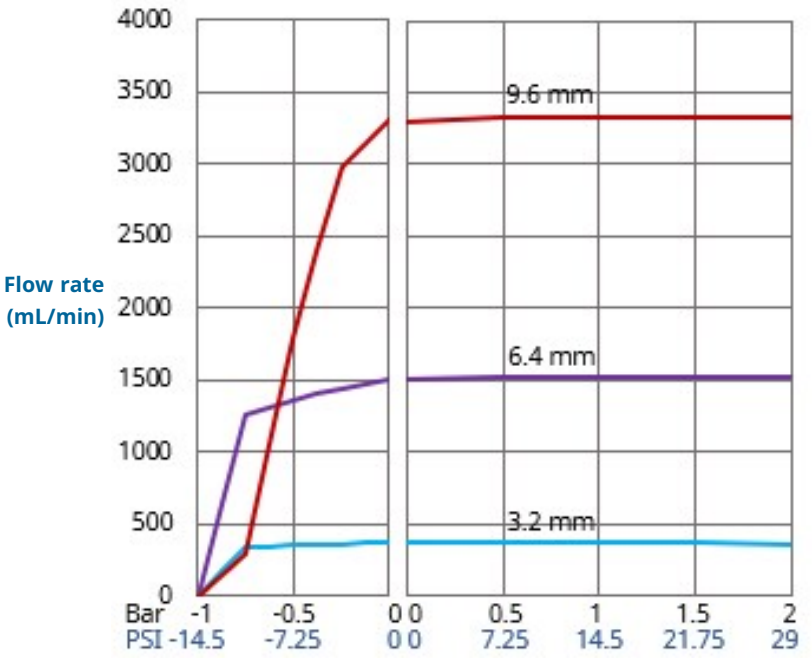
520R2 Pumphead

Marprene, water, 220 rpm, counter-clockwise



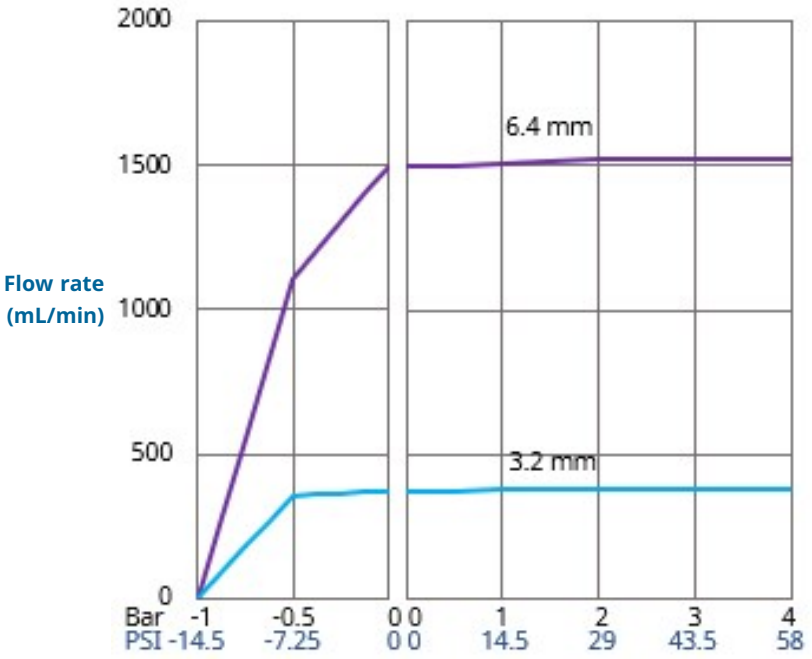
520REL Pumphead

Marprene, water, 220 rpm, counter-clockwise



520REM Pumphead

Marprene, water, 220 rpm, counter-clockwise



The following conditions may influence achievable flow rates:

- Other power supply voltages.
- Other fluid viscosities.
- Other tubing materials.
- Different speeds than 220 rpm.
- A clockwise direction.

Achievable flow rates should be determined in a user's system through application testing.

4.10.6 Physical specification

4.10.6.1 Environmental and operating conditions

Name	Specification
Ambient temperature range	5 °C to 40 °C (41 °F to 104 °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
Location	Indoor

4.10.6.2 Ingress protection

100, 300, and 500 series DriveSure models are capable of passing an IP66 test when correctly mounted in a suitable enclosure. In isolation, these models do not have an Ingress Protection (IP) rating.

400/RXMD DriveSure models require additional measures to achieve an IP rating.

For more information, contact your local Watson-Marlow representative.

4.10.6.3 Noise

	100 Series	300 Series	400/RXMD	500 Series
Noise	<60 dB(A) at 1m	<67 dB(A) at 1m	<70 dB(A) at 1m	<65 dB(A) at 1m

4.10.6.4 Panel thickness

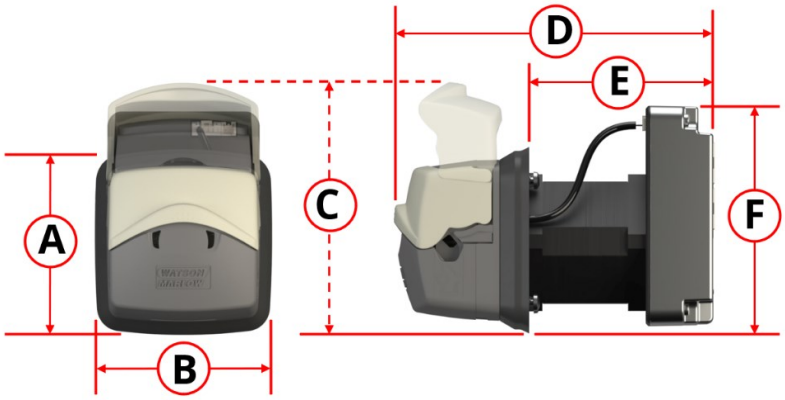
Mounting plate and fixing bolts have been designed to the following panel thickness:

Panel thickness	Unit	
	mm	In
Minimum panel thickness	1.5	0.059
Maximum panel thickness	3.0	0.118

This is to ensure sealing between the mounting plate and the panel. Panels outside of this should be assessed for overall mounting and sealing, such as mounting bolt length and mounting plate size/support.

4.10.6.5 Dimensions—100 Series

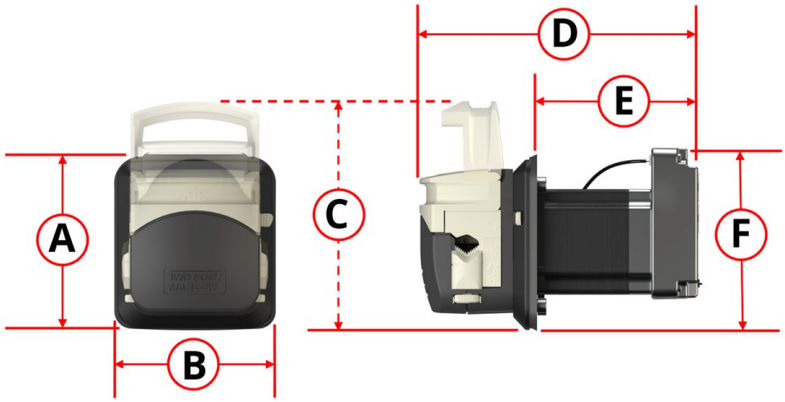
The dimensions of the product are provided in the illustration and table below:



A		B		C		D		E		F	
mm	In	mm	in	mm	in	mm	in	mm	in	mm	in
73	2.87	74	2.91	98	3.85	128	5.04	73	2.87	89	3.50

4.10.6.6 Dimensions—300 Series

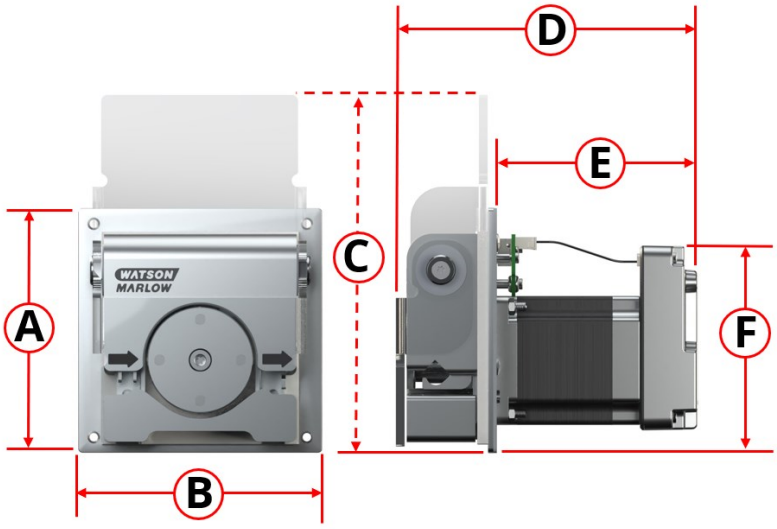
The dimensions of the product are provided in the illustration and table below:



A		B		C		D		E		F	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
101	3.98	93	3.68	128	5.04	160 190	6.30 7.48	92 123	3.62 4.82	103	4.06

4.10.6.7 Dimensions—400/RXMD

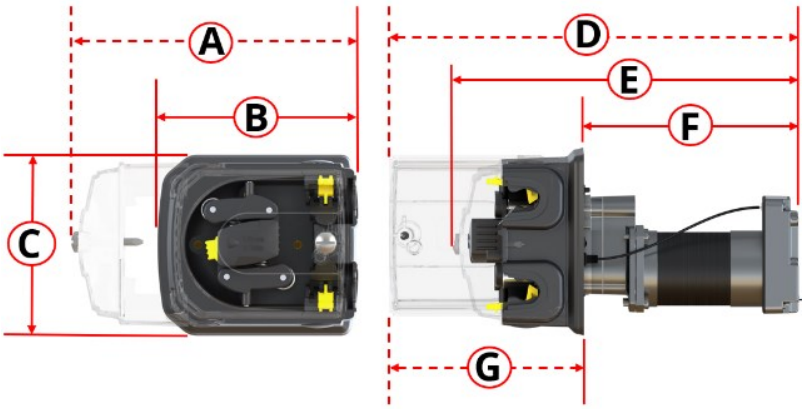
The dimensions of the product are provided in the illustration and table below:



A		B		C		D		E		F	
mm	In	mm	in	mm	in	mm	in	mm	in	mm	in
114	4.49	114	4.49	167	6.57	142	5.39	96	3.78	97	3.82

4.10.6.8 Dimensions—500 Series

The dimensions of the product are provided in the illustration and table below:



A		B		C		D		E		F		G	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
212	8.35	150	5.91	132	5.20	318	12.52	260	10.24	161	6.34	157	6.18

4.10.6.9 Weight—100 Series

Item	with 1 m cables [16]		with 3 m cables [16]	
	kg	lbs	kg	lbs
Drive only (all models)	0.6	1.323	0.7	1.543
Complete pump (all models)	0.8	1.764	0.9	1.984

NOTE [16] In addition to the power cable, an ADC model is supplied with a control cable of the same length. En and Pn models are not supplied with a control cable.

4.10.6.10 Weight—300 Series

Item	with 1 m cables [16]		with 3 m cables [16]	
	kg	lbs	kg	lbs
Drive only (all models)	1.3	2.866	1.4	3.086
Complete pump (all models)	1.7	3.748	1.8	3.968

NOTE [17] In addition to the power cable, an ADC model is supplied with a control cable of the same length. En and Pn models are not supplied with a control cable.

4.10.6.11 Weight—400/RXMD

Item	with 1 m cables [18]		with 3 m cables [18]	
	kg	lbs	kg	lbs
Drive only (all models)	1.1	2.425	1.2	2.646
Complete pump (all models)	1.8	3.968	1.9	4.189

NOTE [18] In addition to the power cable, an ADC model is supplied with a control cable of the same length. En and Pn models are not supplied with a control cable.

4.10.6.12 Weight—500 Series

Item	with 1 m cables [19]		with 3 m cables [19]	
	kg	lbs	kg	lbs
Drive only (all models)	1.7	3.748	1.8	3.968
Complete pump (all models)	2.9	6.393	3.0	6.614

NOTE [19] In addition to the power cable, an ADC model is supplied with a control cable of the same length. En and Pn models are not supplied with a control cable.

4.10.7 Electrical power specification

The power supply specifications are provided in the table below:

Parameter	Limits			Units	Comment
	Min	Nom	Max		
Absolute maximum input voltage range	0		60	V DC	
Operational input voltage range	10.8		52.8	V DC	12 V ± 10 % to 48 V ± 10 %
Recommended input voltage range	12	24	48	V DC	
Rated power			75	W	
Overvoltage category		I			

NOTICE

Voltage beyond the absolute maximum input voltage range (0 V to 60 V DC) may cause permanent damage to the device. Do not provide a voltage to the device outside of this range.

5 STORAGE

5.1 Storage conditions

A DriveSure pump or tubing should be stored in accordance with the information in this table:

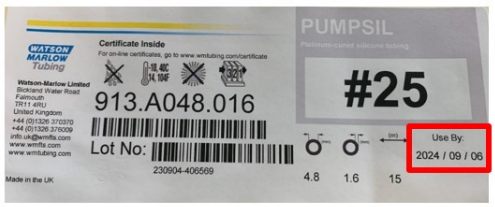
Name	Specification
Ambient temperature range	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity (non-condensing)	80 % up to 31 °C (88 °F), decreasing linearly to 50 % at 40 °C (104 °F)
Conditions	Not in direct sunlight
Location	Indoor

5.2 Tubing and element shelf life from date of manufacture

Product	Shelf life (20)
Pumpsil	5 years
Marprene	5 years
Bioprene	5 years
PureWeld XL	5 years
STA-PURE PCS	4 years
STA-PURE PFL	4 years

NOTE (20)

The shelf life is incorporated into the use by date provided on the label fixed to the product packaging.



6 UNPACKING

6.1 Components supplied

The pump is supplied with the following items:

- Pump. (21)
- Power cable.
- Control cable (DriveSure ADC only). (22)
- Safety information booklet (with link to these instructions).
- Pump mounting bolts.

NOTE (21)	The 300 Series, 400/RXMD, and 500 Series pumps are supplied with the pumphead mounted to the drive unit. For installation reasons, the 100 Series pumps are supplied with the pumphead, mounting plate, and drive unit unassembled.

NOTE (22)	A control cable is supplied with a DriveSure ADC pump only. EtherNet/IP and PROFINET control cables are available as optional accessories.

6.2 Unpacking, inspection, and packaging disposal

1. Carefully remove all parts from the packaging.
2. Check that all components are present.
3. Inspect components for damage in transit.
4. If anything is missing or damaged, contact your local Watson-Marlow representative immediately.
5. Dispose of the cardboard packaging according to local procedures.

7 INSTALLATION CHAPTER OVERVIEW

7.1 Installation chapter sequence

Installation is provided in the following sequence:

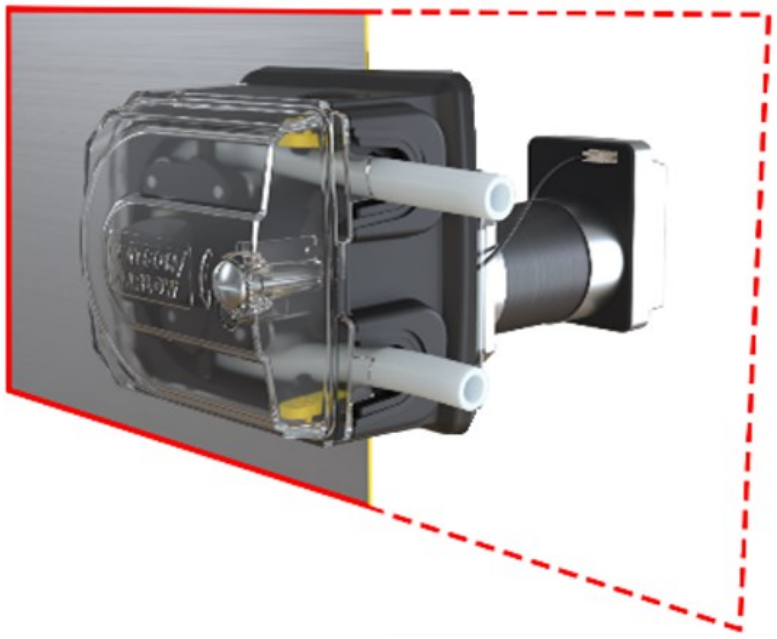
1. Install—Location and mounting. See section 8.
2. Install—Electrical Power. See section 9.
3. Install—Remote Control: ADC (Analogue Digital control). See section 10.
4. Install—Remote Control: En (EtherNet/IP). See section 11.
5. Install—Remote Control: Pn (PROFINET). See section 12.
6. Install—Local control. See section 13.
    - Integrated cover-open sensor
    - Prime switch
7. Install—Fluid path. See section 14.

Follow the installation in the specific sequence above. The instructions have been written in this order to minimise hazards.

8 INSTALLATION—LOCATION AND MOUNTING

8.1 Intended mounting

The pump is designed for installation through a panel to separate the environment of the pumphead from that of the drive unit. The panel is represented by the red outline in the image below.



8.1.1 Installation through the panel

300 Series, 400/RXMD, and 500 Series DriveSure models are designed to be installed as a complete pump through the aperture in the panel. The 100 Series DriveSure model is not installed in the same way.

300 Series	400/RXMD	500 Series
		

8.2 Intended environment

Name	Specification
Ambient temperature range	5 °C to 40 °C (41 °F to 104 °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
Location	Indoor

8.2.1 Ingress protection

100, 300, and 500 series DriveSure models are capable of passing an IP66 test when correctly mounted in a suitable enclosure. In isolation, these models do not have an Ingress Protection (IP) rating.

400/RXMD DriveSure models require additional measures to achieve an IP rating.

For more information, contact your local Watson-Marlow representative.

8.3 Panel characteristics

8.3.1 Surface characteristics

The panel which the pump will be mounted to must be:

- Rigid.
- Flat.
- Chemically compatible with the pumped fluid.
- Capable of supporting the product weight including the full fluid path.
- Free from excessive vibration.

8.3.2 Panel thickness

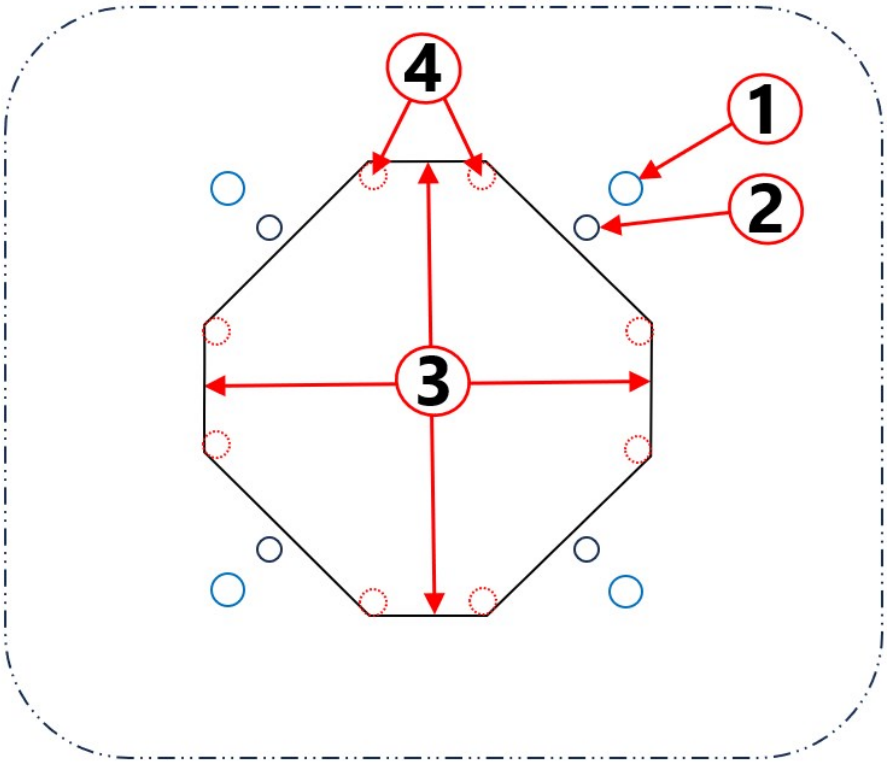
Mounting plate and fixing bolts have been designed to the following panel thickness:

Panel thickness	Unit	
	mm	In
Minimum panel thickness	1.5	0.059
Maximum panel thickness	3.0	0.118

This is to ensure sealing between the mounting plate and the panel. Panels outside of this should be assessed for overall mounting and sealing, such as mounting bolt length and mounting plate size/support.

8.3.3 Panel preparation for installation

The panel will require the following features for installation of a DriveSure pump:



Item number	Item name	Comment
1	Mounting bolt holes	
2	Mounting plate alignment holes	500 series only
3	Aperture	
4	Aperture dotted line holes	Dotted holes shown on the drawings are to facilitate manual cutting of an aperture, and provide a rounded aperture corner. 

8.4 Specific tools required for chapter installation procedures

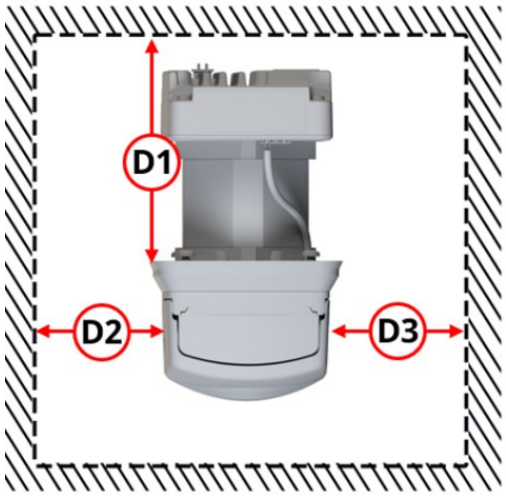
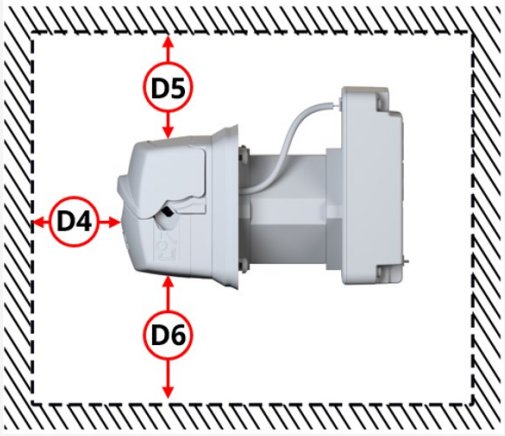
To complete the installation procedures in this chapter, the following tools are required:

100 Series	300 Series	400/RXMD	500 Series
Torque wrench suitable for 1.0 to 2.1 Nm	Torque wrench suitable for 5.0 Nm	Torque wrench suitable for 1.8 Nm	Torque wrench suitable for 5.0 Nm
T15 and T20 male Torx bit	T25 male Torx bit		T25 male Torx bit
Flat head screwdriver			Flat head screwdriver

8.5 Mounting—100 Series

8.5.1 Minimum area—100 Series

The following minimum area is required:

Top view	Side view
	

Dimension	Minimum clearance		Comment
	mm	in	
D1	175	6.89	To install drive, cable connections, and protect cable bend radius
D2	100	3.94	To install or replace the tubing/fluid path connections
D3	300	11.81	To install or replace the tubing/fluid path connections
D4	500	19.69	To install or replace the tubing inside pumphead
D5	100	3.94	To allow the pumphead cover to be opened and allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary
D6	100	3.94	To allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary

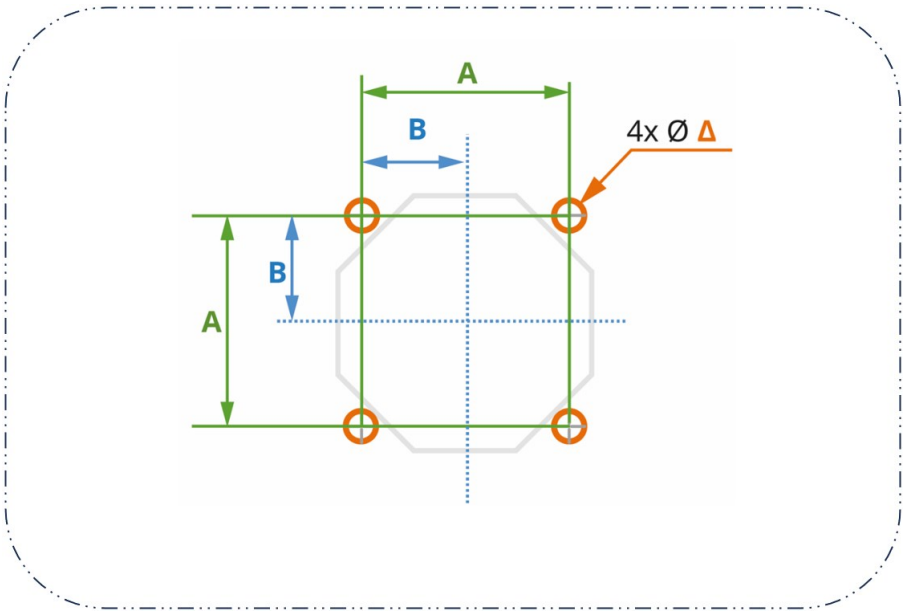
It may be necessary to increase these minimum dimensions in a user's installation to:

- Ensure there is enough space to connect the cables (power, control, USB, integrated cover-open sensor cable, prime switch).
- View the status LEDs on the controller and connection ports.
- Access the drive labels (MAC address, etc).
- Ensure the drive will not exceed its ambient temperature and humidity range.

8.5.2 Panel mounting dimensions—100 Series

8.5.2.1 Mounting bolt holes—100 Series

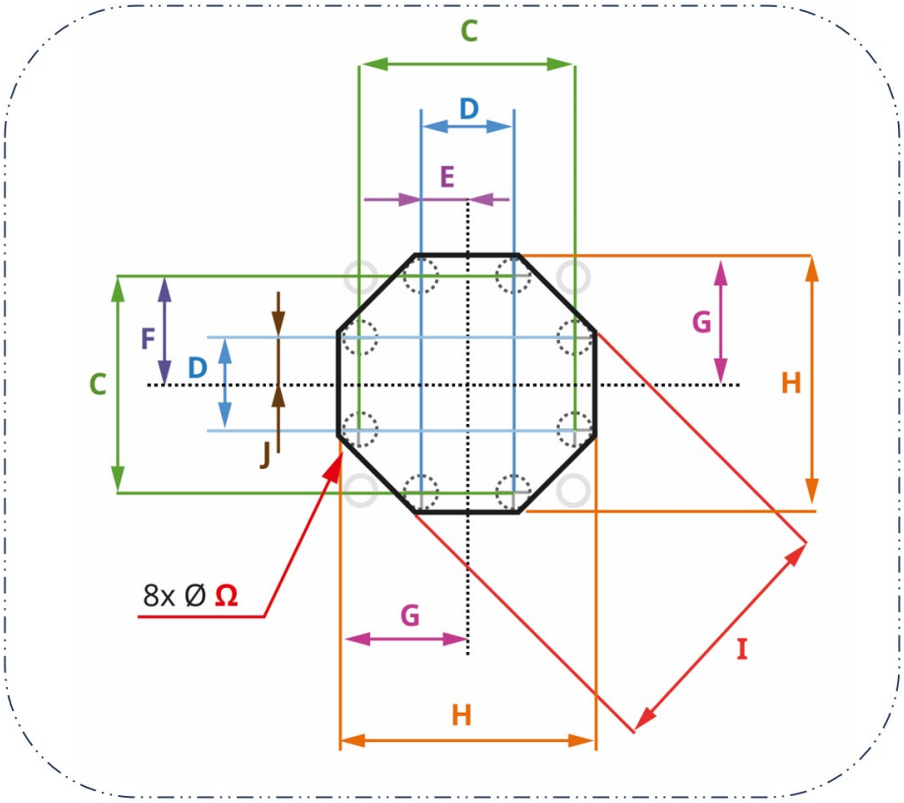
The mounting bolt holes must be prepared in the panel prior to pump installation, using the dimensions below:



Dimension	Unit	
	Dimension	mm
A	48	1.89
B	24	0.94
Δ	5	0.20

8.5.2.2 Panel aperture dimensions for—100 Series

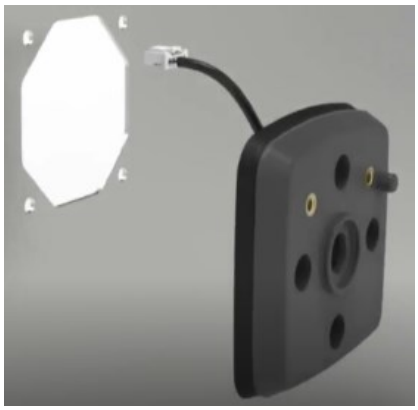
The required dimension of the aperture are provided in the image below. The 8 holes at the intersection of C and D (Ω) are provided to aid manual cutting of the aperture.

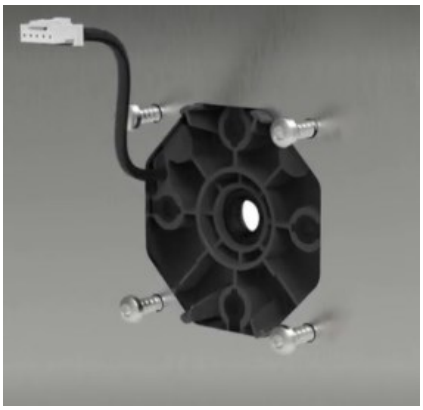


Dimension	Unit	
	mm	in
C	49	1.93
D	21	0.83
E	10.5	0.413
F	24.5	0.965
G	27.5	1.08
H	55	2.17
I	55.25	2.1752
Ω	6	0.24

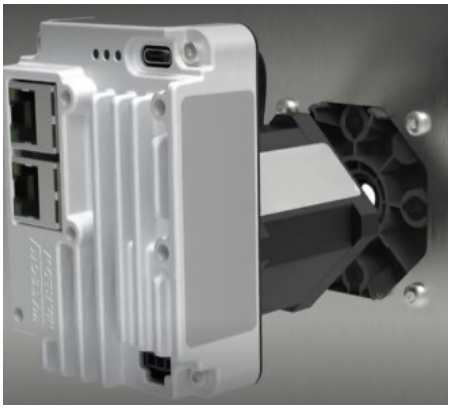
8.5.3 Procedure—100 Series mounting

1. Attach mounting to panel with 4 mounting plate bolts.





2. Check the integrated cover-open sensor cable is not trapped or touching the edge of the aperture.
3. Torque the 4 mounting plate bolts to 2.1 Nm. Use a diagonal sequence.
4. Attach drive to mounting using the 4 drive mounting bolts.



5. Torque the 4 drive mounting plate bolts to 1.0 Nm. Use a diagonal sequence.
6. Attach pumphead to mounting using the 2 pumphead mounting bolts.

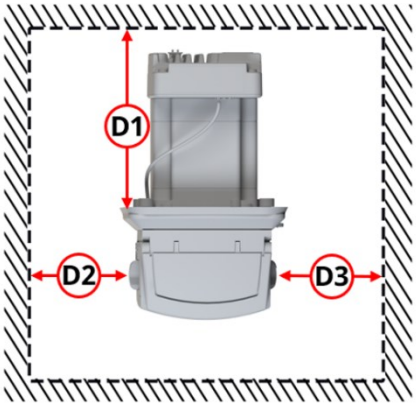
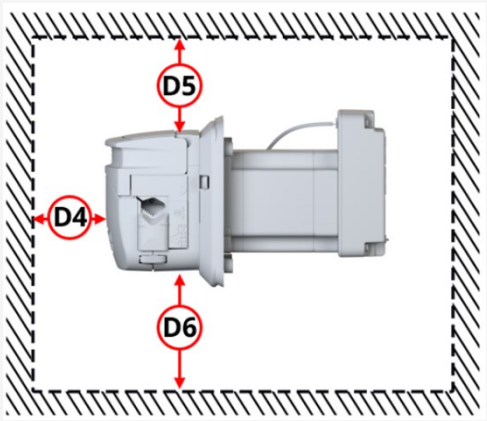
7. Torque the 2 pumphead mounting bolts to 1.7 Nm.

8. Plug pumphead integrated cover-open sensor cable into the back of the controller.

8.6 Mounting—300 Series

8.6.1 Minimum area—300 Series

The following minimum area is required:

Top view	Side view
	

Dimension	Minimum clearance		Comment
	mm	in	
D1	175	6.89	To install drive and cable connections, and to protect cable bend radius
D2	100	3.94	To install or replace the tubing/fluid path connections
D3	300	11.81	To install or replace the tubing/fluid path connections
D4	500	19.69	To install or replace the tubing inside pumphead
D5	100	3.94	To allow the pumphead cover to be opened and allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary
D6	100	3.94	To allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary

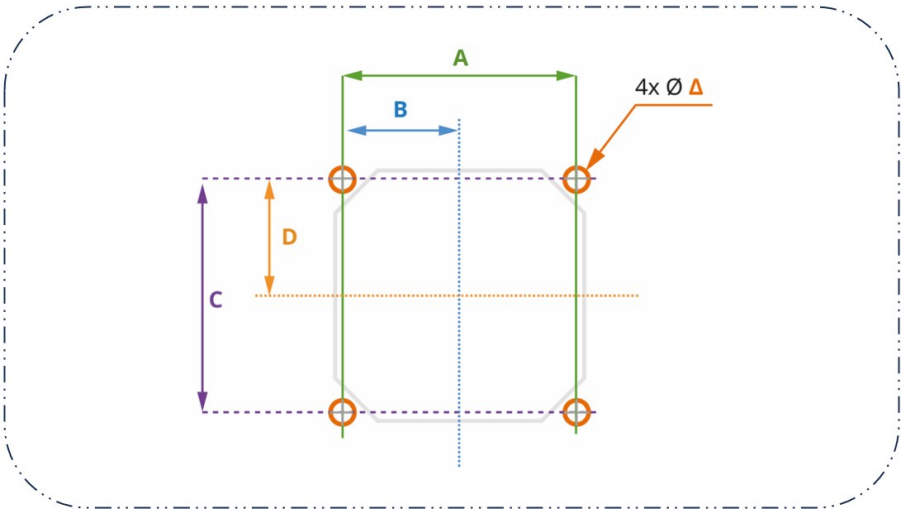
It may be necessary to increase these minimum dimensions in a user's installation to:

- Ensure there is enough space to connect the cables (power, control, USB, integrated cover-open sensor cable, prime switch).
- View the status LEDs on the controller and connection ports.
- Access the drive labels (MAC address, etc).
- Ensure the drive will not exceed its ambient temperature and humidity range.

8.6.2 Panel mounting dimensions—300 Series

8.6.2.1 Mounting bolt holes—300 Series

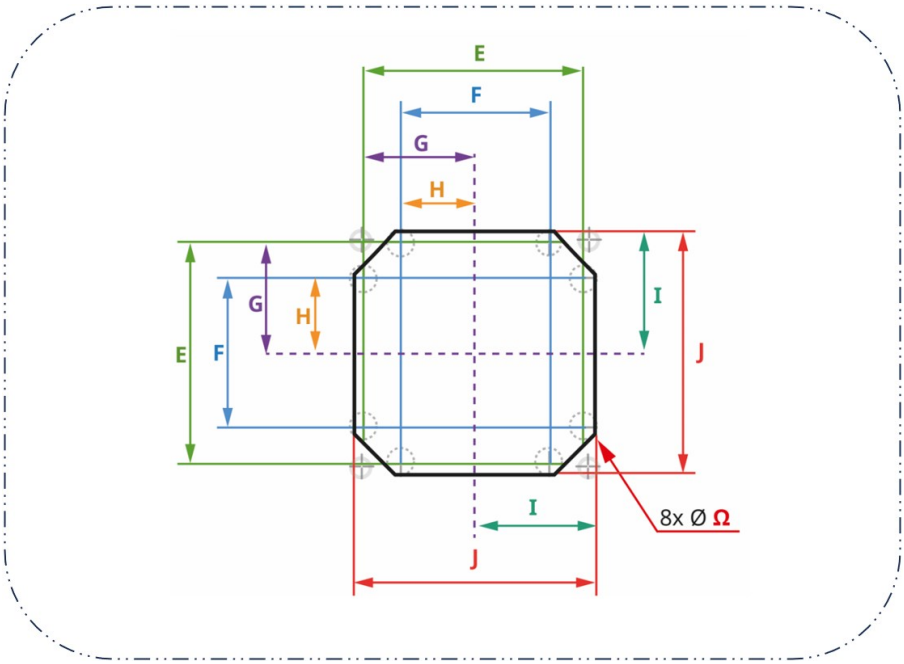
The mounting bolt holes must be prepared in the panel prior to pump installation, using the dimensions below:



Dimension	Unit	
	Dimension	mm
A	69.6	2.740
B	34.8	1.370
C	69.6	2.740
D	34.8	1.370
Δ	5	0.20

8.6.2.2 Panel aperture dimensions—300 Series

The required dimension of the aperture are provided in the image below. The 8 holes at the intersection of E and F (Ω) are provided to aid manual cutting of the aperture.



Dimension	Unit	
	mm	in
E	68	2.68
F	46	1.81
G	34	1.34
H	23	0.91
I	37	1.46
J	74	2.91
Ω	6	0.24

8.6.3 Procedure—300 Series mounting

1. Pass the controller end of the pump through the aperture in the panel, until the pumphead mounting plate sits against the panel.

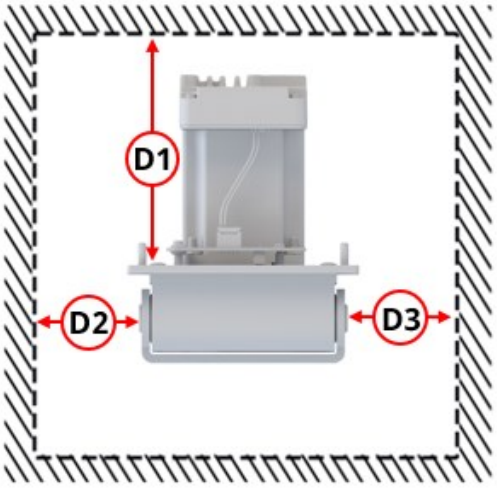
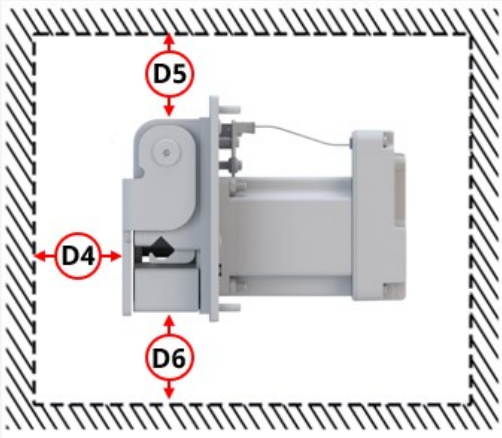
2. Install 4 mounting bolts hand tight.

3. Check the integrated cover-open sensor cable is not trapped or touching the edge of the aperture.
4. Torque the 4 mounting bolts to 5.0 Nm. Use a diagonal sequence.
5. Check the pumphead mounting plate is evenly pressed against the pumphead side of the panel, with no visible gap.

8.7 Mounting—400/RXMD

8.7.1 Minimum area—400/RXMD

The minimum area provided in the table below is required:

Top view	Side view
	

Dimension	Minimum clearance		Comment
	mm	in	
D1	175	6.89	To install drive and cable connections, and to protect cable bend radius
D2	100	3.94	To allow the pumphead cover to be opened
D3	300	11.81	To install or replace the tubing/element fluid path connections
D4	500	19.69	To install or replace the tubing/element inside pumphead
D5	100	3.94	To allow the pump to be installed through the panel aperture, by turning or tipping the pump as necessary
D6	100	3.94	To allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary

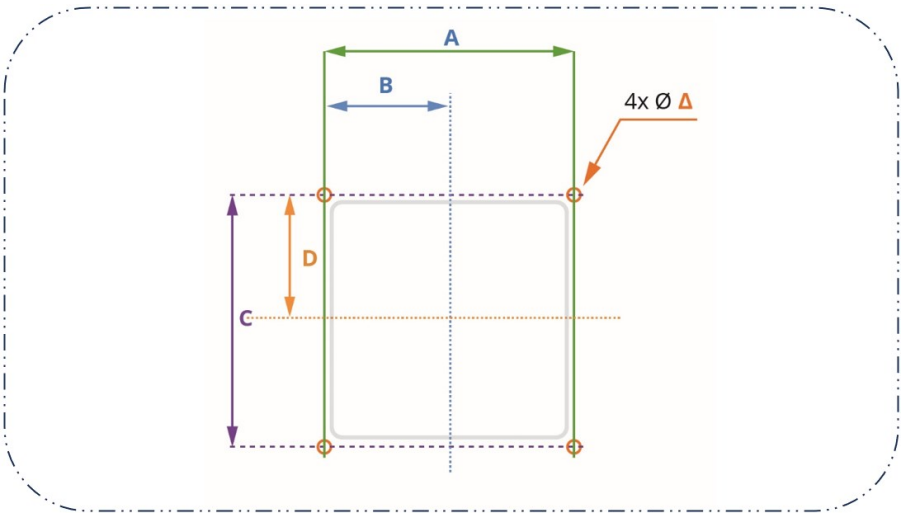
It may be necessary to increase these minimum dimensions in a user's installation to:

- Ensure there is enough space to connect the cables (power, control, USB, integrated cover-open sensor cable, prime switch).
- View the status LEDs on the controller and connection ports.
- Access the drive labels (MAC address, etc).
- Ensure the drive will not exceed its ambient temperature and humidity range.

8.7.2 Panel mounting dimensions—400/RXMD

8.7.2.1 Mounting bolt holes—400/RXMD

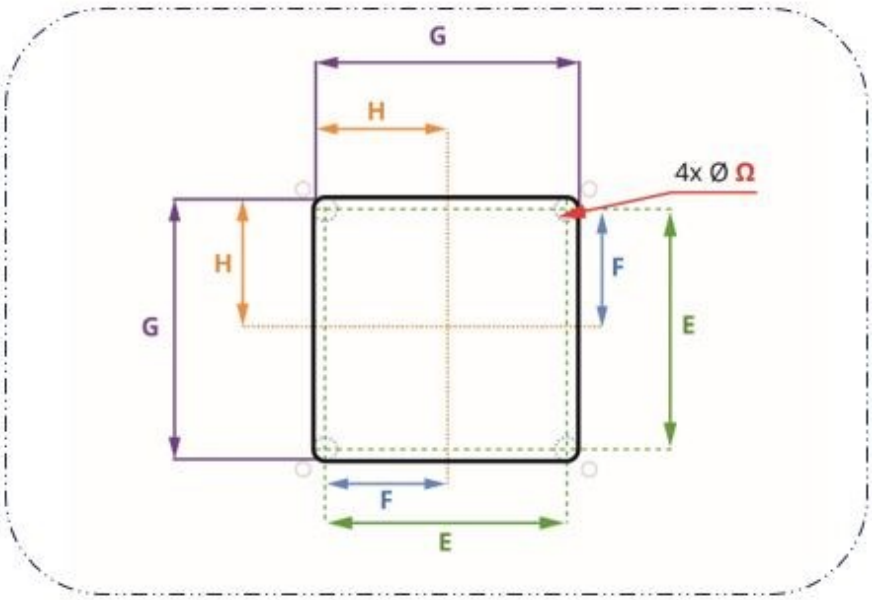
The mounting bolt holes must be prepared in the panel prior to pump installation, using the dimensions below:



Dimension	Unit	
	mm	in
A	98	3.83
B	49	1.93
C	98	3.83
D	49	1.93
Δ	4.5	0.177

8.7.2.2 Panel aperture dimensions—400/RXMD

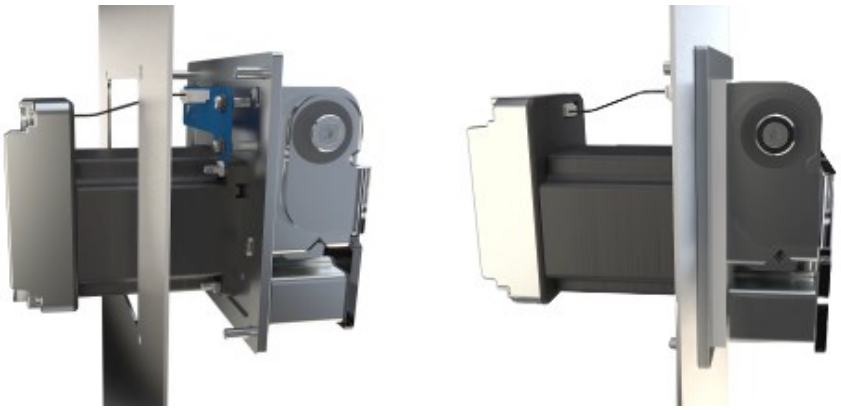
The required dimension of the aperture are provided in the image below. The 4 holes at the intersection of E and F (Ω) are provided to aid manual cutting of the aperture.



Dimension	Unit	
	mm	in
E	86	3.39
F	43	1.69
G	94	3.70
H	47	1.85
Ω	4	0.16

8.7.3 Procedure—400/RXMD mounting

1. Pass the controller end of the pump through the aperture in the panel, until the pumphead mounting plate sits against the panel.



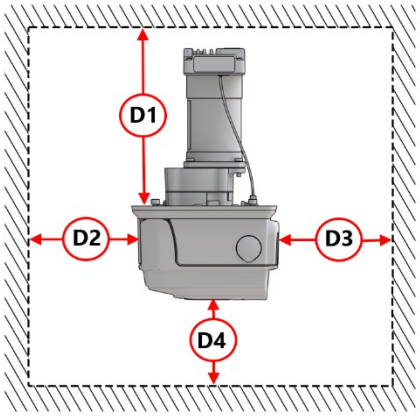
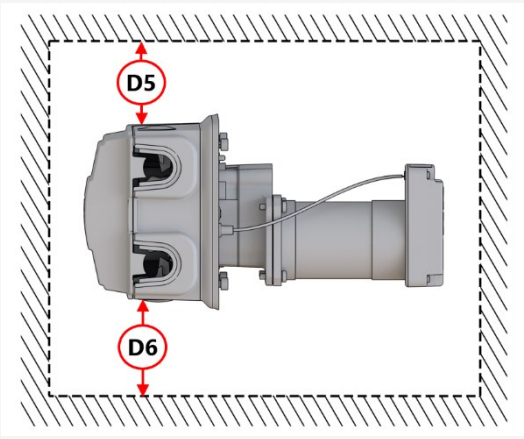
2. Install the 4 mounting nuts hand tight.

3. Check the integrated cover-open sensor cable is not trapped or touching the edge of the aperture.
4. Torque the 4 mounting bolts nuts to 1.8 Nm. Use a diagonal sequence.
5. Check the pumphead mounting plate is pressed against the pumphead side of the panel, with no visible gap.

8.8 Mounting—500 Series

8.8.1 Minimum area—500 Series

The following minimum area is required:

Top view	Side view
	

Dimension	Minimum clearance		Comment
	mm	in	
D1	200	7.87	To install drive and cable connections, and to protect cable bend radius
D2	100	3.94	To allow the pumphead cover to be opened
D3	300	11.81	To install or replace the tubing/element fluid path connections
D4	500	19.69	To install or replace the tubing/element inside pumphead
D5	100	3.94	To allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary
D6	100	3.94	To allow the pump to be installed through the panel aperture by turning or tipping the pump as necessary

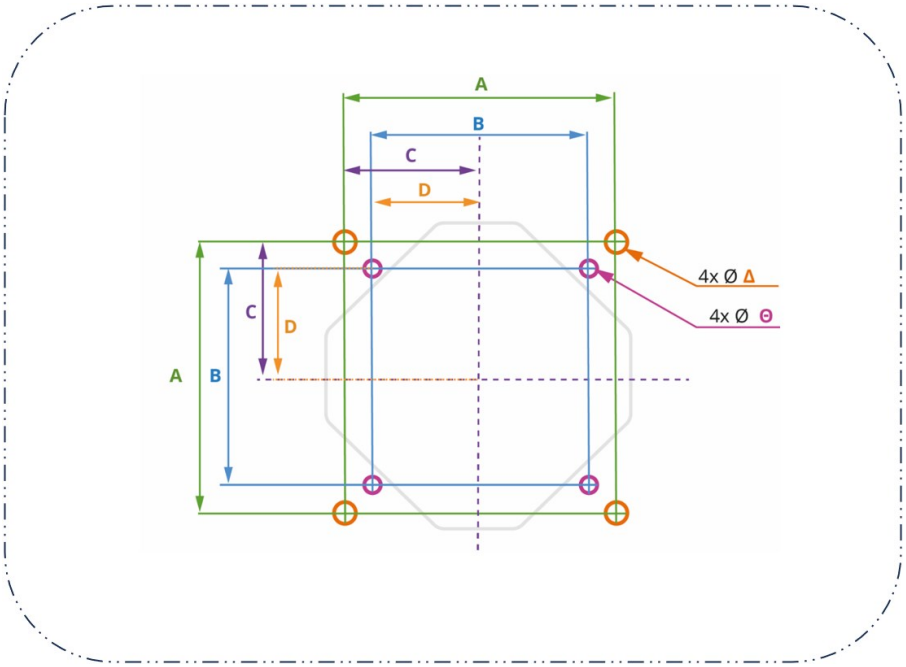
It may be necessary to increase these minimum dimensions in a user's installation to:

- Ensure there is enough space to connect the cables (power, control, USB, integrated cover-open sensor cable, prime switch).
- View the status LEDs on the controller and connection ports.
- Access the drive labels (MAC address, etc).
- Ensure the drive will not exceed its ambient temperature and humidity range.

8.8.2 Panel mounting dimensions—500 Series

8.8.2.1 Mounting bolt and alignment pin holes—500 Series

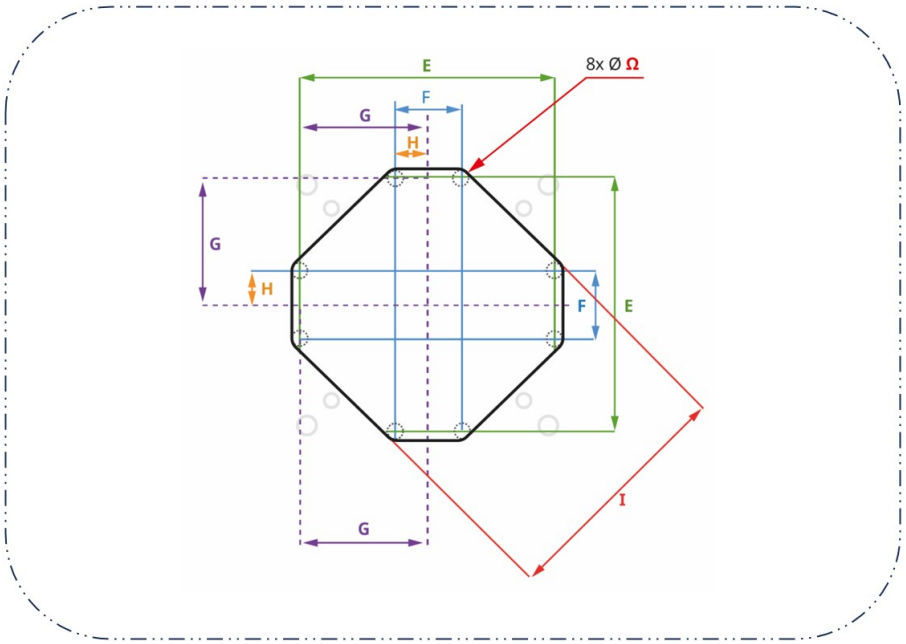
In addition to mounting bolt holes, the 500 Series requires holes for the mounting plate alignment pins. These holes must be prepared in the panel prior to pump installation, using the dimensions below:



Dimension	Unit	
	mm	in
A	100	3.94
B	80	3.15
C	50	1.97
D	40	1.57
Δ	5	0.20
Θ	4	0.16

8.8.2.2 Panel aperture dimensions—500 Series

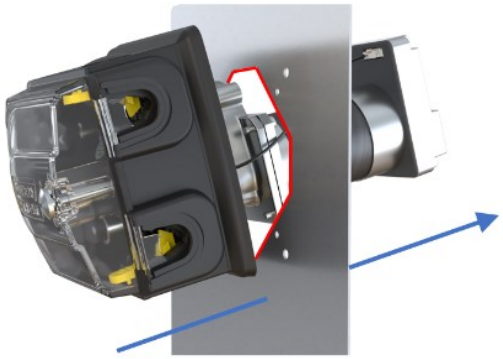
The required dimension of the aperture is provided in the image below. The 8 holes at the intersection of E and F (Ω) are provided to aid manual cutting of the aperture.



Dimension	Unit	
	mm	in
E	106	4.17
F	28	1.10
G	53	2.09
H	14	0.55
I	101	3.98
Ω	6	0.24

8.8.3 Procedure—500 Series mounting

1. Pass the controller end of the pump through the aperture in the panel, until the pumphead engages the pre-drilled alignment pin holes.



2. Install the 4 mounting bolts hand tight.
3. Check the integrated cover-open sensor cable is not trapped or touching the edge of the aperture.
4. Torque the 4 mounting bolts to 5.0 Nm. Use a diagonal sequence.
5. Check the pumphead mounting plate is evenly pressed against the pumphead side of the panel, with no visible gap.

9 INSTALLATION—ELECTRICAL POWER

9.1 Safety—Power cycling

Regular starting and stopping of the pump must be undertaken using control signals. Do not use electrical power as a method of regular starting and stopping of the pump; electrical power is reserved as a method of stopping the pump in an emergency only.

9.2 Electrical power supply requirements

The pump requires electrical power by Direct Current (DC) within the following specification:

Parameter	Limits			Units	Comment
	Min	Nom	Max		
Absolute maximum input voltage range	0		60	V DC	
Operational input voltage range	10.8		52.8	V DC	12 V ± 10 % to 48 V ± 10 %
Recommended input voltage range	12	24	48	V DC	
Rated power			75	W	
Overvoltage category		I			

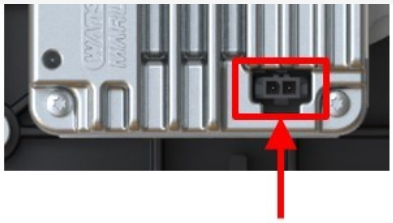
NOTICE

Voltage beyond the absolute maximum input voltage range (0 to 60 VDC) may cause permanent damage to the device. Do not provide a voltage to the device outside of this range.

9.2.1 Connection and cable specification

NOTICE

The controller does not have polarity protection. The black wire of the Watson-Marlow power cable must only be connected to negative DC (-) voltage.

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Location of connection</td><td>  </td></tr>
<tr><td>Connection on controller</td><td>FEMALE, Molex, 2 wire, Molex part number: 43650-0228</td></tr>
<tr><td>Connector pin order</td><td> 
</td></tr>
<tr><td>Connector pin name</td><td>
<table>
<tr><th>Pin</th><th>Name</th><th>Pin</th><th>Name</th></tr>
<tr><td>1</td><td>Negative (-) DC voltage connection</td><td>2</td><td>Positive (+) DC voltage connection</td></tr>
</table>
</td></tr>
<tr><td>Connection on cable</td><td>MALE, Molex, 2 wire, Molex part number: 43645-0200, Housing with 43030-0002 Crimp 20-24 AWG</td></tr>
<tr><td>Cable specification</td><td>2 core screened red/black 22 AWG 300 V VW-1 ALPHA WIRE 2402C SL005 UL STYLE 2092. Black wire on left for negative DC (-), and red wire on right for Positive DC (+)</td></tr>
<tr><td>Cable Length</td><td>1.0 m (3.28 ft) or 3.0 m (9.84 ft) depending on pump product code.</td></tr>
</table>

9.2.2 Procedure—Connecting to DC power

1. Isolate the power supply.
2. Depress the retaining latch on the power cable connection.
3. Push the power cable connection into the controller.
4. Release the retaining latch.
5. Check the power cable is securely connected to the controller.
6. Turn on the power supply.

NOTICE

Turn on the power supply only after the cable is securely connected—do not 'hot plug' the power cable into a DriveSure pump, doing so may damage the internal circuitry.

NOTICE

The controller does not have polarity protection. The black wire of the Watson-Marlow power cable must only be connected to negative DC (-) voltage.

9.3 External devices

9.3.1 Overcurrent protection

The DriveSure pump has comprehensive software control of a robust motor drive to auto detect and shut down the pump safely because of overloading, or over-temperature.

An external fuse is required with the following specifications:

Protective component	Power supply		Approvals	Comment
	12 to 24 V DC	25 to 48 V DC		
Fuse	T 5 A H 250 V	T 3.15 A H 250 V	UL Category Control Number: JDYX/JDYX2 IEC 60127	T = Time Delay H = High Breaking Capacity
Fuse holder	-	-	UL Category Control Number: IYXV/IYXV2, IEC 60695-11-10 min V-1 flammability	-

9.3.2 In-rush current protection

The pump is not designed such that a live power supply cable may be connected to the DriveSure pump. This restraint also applies to a DC power supply connected through a relay.

Consider the use of in-rush current protection in your design if a hot-switch is required.

9.3.3 Electrical isolation

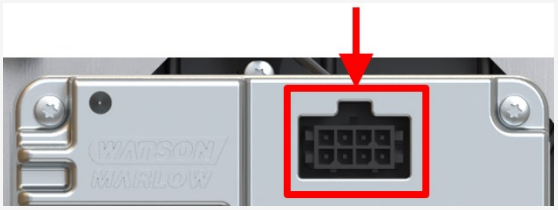
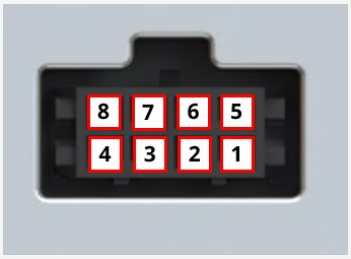
The product does not come with an external supply isolation device. An electrical power supply isolation device must be:

- Included in the electrical power supply circuit.
- Always easily accessible.
- Marked as the disconnecting device for the equipment.
- Of a rating suitable for the power specification.

10 INSTALLATION—REMOTE CONTROL: ADC (ANALOGUE DIGITAL CONTROL)

This chapter details the remote control of a DriveSure ADC pump.

10.1 Connection and cable specification

<table>
<tr><th>Item</th><th>Information</th></tr>
<tr><td>Location of connection</td><td>  </td></tr>
<tr><td>Connection on controller</td><td>FEMALE Molex, 8 wire, Molex part number 43045-0813</td></tr>
<tr><td>Connector pin order</td><td> 
</td></tr>
<tr><td>Connector pin name</td><td>
<table>
<tr><th>Pin</th><th>Name</th><th>Pin</th><th>Name</th><th>Pin</th><th>Name</th><th>Pin</th><th>Name</th></tr>
<tr><td>8</td><td>Frequency</td><td>7</td><td>Signal Ground (GND)</td><td>6</td><td>4-20 mA</td><td>5</td><td>0-10 V</td></tr>
<tr><td>4</td><td>Brake/Run</td><td>3</td><td>Direction</td><td>2</td><td>Tacho</td><td>1</td><td>Error</td></tr>
</table>
For full information see section: 10.2
</td></tr>
<tr><td>Cable specification</td><td>MALE Molex Housing, 8 wire, Molex part number 43025-0800, 8 CORE, 24 AWG 300V VW-1 ALPHA WIRE M38908</td></tr>
<tr><td>Cable Length</td><td>1.0 m (3.28 ft) or 3.0 m (9.84 ft) depending on pump product code.</td></tr>
</table>

10.2 Input and Output

10.2.1 Overview

<table>
<tr><th>Pin</th><th>Name</th><th>Type</th><th>Input or output</th><th>Comment</th><th>Control cable wire colour</th></tr>
<tr><td>1</td><td>Error</td><td>Open drain</td><td>Output</td><td>Generic error signal (23)</td><td>Black</td></tr>
<tr><td>2</td><td>Tacho (24)</td><td>Open drain</td><td>Output</td><td></td><td>Brown</td></tr>
<tr><td>3</td><td>Direction</td><td>Digital</td><td>Input</td><td><table><tr><th>Name</th><th>Logic level</th><th>Voltage</th></tr><tr><td>Clockwise (CW)</td><td>Low</td><td>0 to 9.2 V</td></tr><tr><td>Counter clockwise (CCW)</td><td>High</td><td>10.4 to 30 V</td></tr></table></td><td>Red</td></tr>
<tr><td>4</td><td>Brake/Run</td><td>Digital</td><td>Input</td><td><table><tr><th>Name</th><th>Logic level</th><th>Voltage</th></tr><tr><td>Brake</td><td>Low</td><td>0 to 9.2 V</td></tr><tr><td>Run</td><td>High</td><td>10.4 to 30 V</td></tr></table></td><td>Orange</td></tr>
<tr><td>5</td><td>0-10 V</td><td>Analogue</td><td>Input</td><td></td><td>Yellow</td></tr>
<tr><td>6</td><td>4-20 mA</td><td>Analogue</td><td>Input</td><td>Default (25)</td><td>Green</td></tr>
<tr><td>7</td><td>Signal Ground (GND)</td><td></td><td></td><td></td><td>Blue</td></tr>
<tr><td>8</td><td>Frequency</td><td>Digital</td><td>Input</td><td></td><td>Violet</td></tr>
</table>

NOTE (23)

There are 7 error types, indicated through the number of drive status LED flashes (see section 10.4). The error output does not provide the error type, only the indication that an error is present. The error type can be determined by connecting to the WM Connect PC software or drive status LED.

NOTE (24)

The tacho output (Hz) is a measure of the pumphead speed (0.1 RPM). **0.1 RPM = 1 Hz**.

This output is produced by the integrated controller software through smoothing and moving average filtering of the internal encoder signal. There is no direct encoder signal output from the drive.

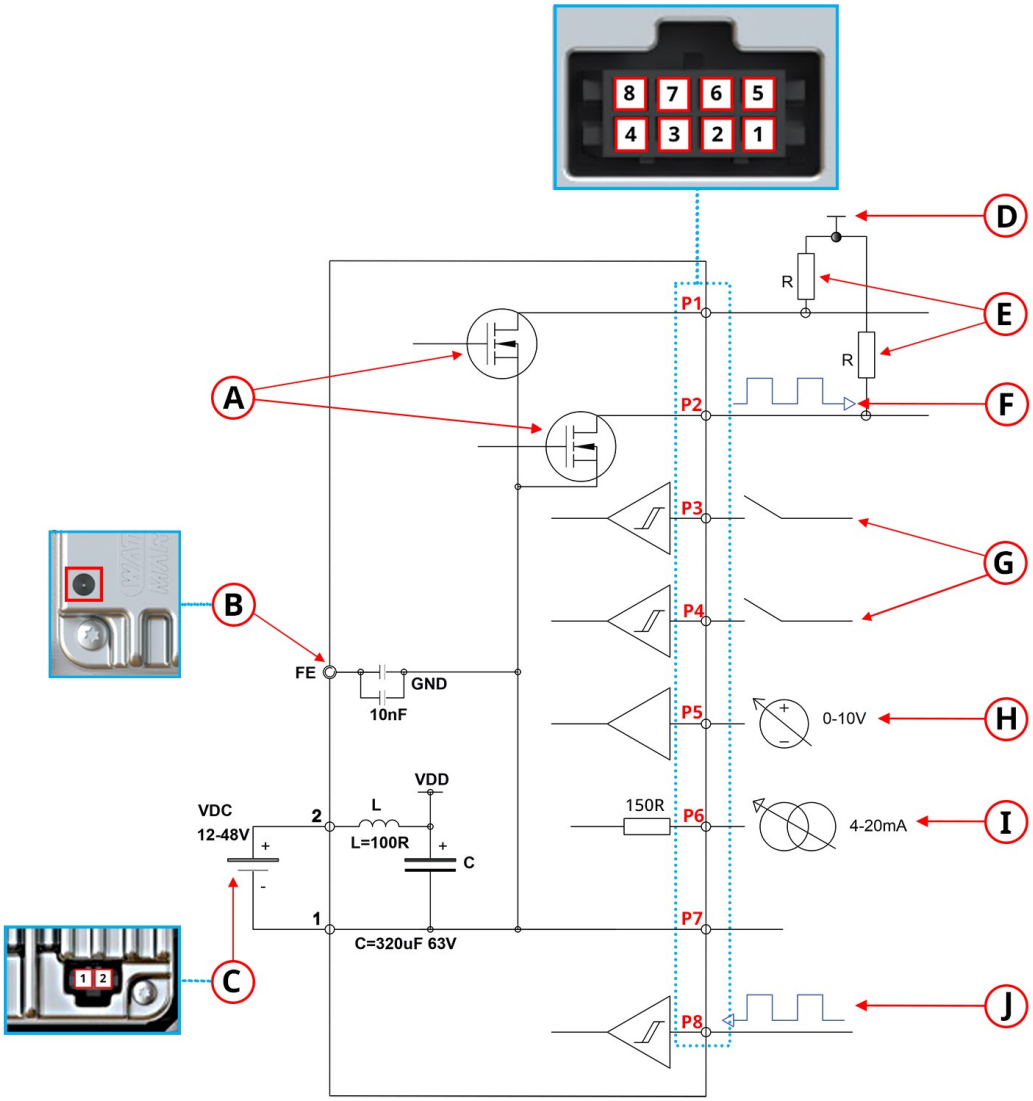
NOTE (25)	4-20 mA input is the default control mode. To use 0-10 V, frequency, or a fixed speed, set the **Inactive/Active** toggle to **Active** in the related control sub-tab of the WM Connect PC software. See section 15.5.2.1.

10.2.2 Electrical characteristics

Do not exceed the input and output limits provided in the table below:

Parameter	Sym	Limits			Units	Comment
		Min	Nom	Max		
Digital Input Voltage High	VD_{IH}	10.4		30	V	IEC 61131-2 Type 3, voltage limits for frequency input
Digital Input Voltage Low	VD_{IL}	0		9.2		
Digital Input Abs Max Voltage	VD_{in}	-60		60	V	Non operational
Digital Input Current Limit	ID_{in}		2.25		mA	IEC 61131-2 Type 3
Digital Frequency	F_{in}	2		2000	Hz	Duty cycle: Fixed 50%
4-20 mA Input Measurement Range	I_{in}	0		25	mA	
4-20 mA Input, Abs Max Current	IA_{in}	-0.01		33	mA	Internally limited to max voltage
4-20 mA Input, Abs Max Voltage	Ia_{in}	-36		36	V	Internally limited to max voltage
4-20 mA Input Resistance	RI_{in}		150	200	Ω	150R Sense Res.
0-10V Input Measurement Range	V_{in}	0		10.56	V	
0-10V Input, Abs Max Voltage	VA_{in}	-36		36	V	
0-10V Input Resistance	RV_{in}		20		KΩ	
Analogue Input Temp Error	TC_A		±0.04		%/C	
Open Drain Current	IL			1	A	Resistive load
Open Drain Voltage	V_{OH}		24	36	VDC	60V Abs Max

10.2.3 Typical connections



P1 to P8 in the image above relate to the control connector pin number: see section 10.2.1.

Label	Name	Comment
A	Open drain outputs	Fault and tacho
B	Functional earth	Case and motor
C	Power supply	12 to 48 V
D	Logic voltage	3 V to 36 V
E	Pull-up resistor	Typically 10k
F	Tacho output	Pumphead 0.1 RPM = 1 Hz

Label	Name	Comment
G	Logic input signal	Low = 0 to 9.2 V High = 10.4 to 30 V
H	Voltage control input	0 to 10 V
I	Current control input	4 to 20 mA
J	Frequency input	2 to 2000 Hz

10.2.4 Control cable—Unused input wires

Unused inputs wires can be left unconnected in the control cable. However it is best practice to ground unused inputs to pin 7 (Signal GND), to prevent these inputs acting as an EMI aerial.

10.2.5 Galvanic isolation

The power input 0 V is internally connected to the Analogue control connector 0 V and USB-C 0 V. Avoid inadvertent ground (0 V) loops when connecting controllers or other equipment. Consider galvanic isolation if required.

10.2.6 Procedure—Connect the control cable

1. Isolate the pump from its power supply.
2. Push the control cable into the control cable connection until an audible click is heard.
3. Re-connect the power supply to the pump.
4. Observe the status LED on the controller.
5. Ensure the pump operates in accordance with the control system design (wiring and signals).

10.3 Holding torque

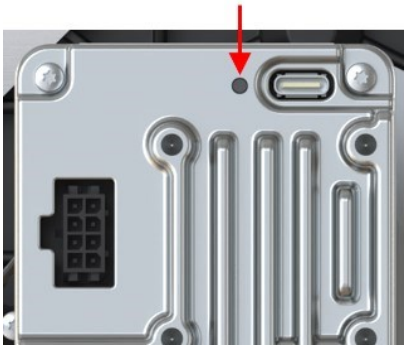
When the pumphead cover is open, the pump is stopped and the pumphead rotor is free to turn with no holding torque.

When the pumphead cover is closed, the holding torque and running state varies depending on the control input:

Speed signal (Pins 5,6, or 8)	Brake/Run (Pin 4)			Running state when pumphead cover is closed
	State	Logic	Logic voltage	
= 0 RPM	Brake	Low	0 to 9.2 V	The pump is stopped with holding torque on the pumphead rotor.
> 0 RPM	Brake	Low	0 to 9.2 V	
= 0 RPM	Run	High	10.4 to 30 V	
> 0 RPM	Run	High	10.4 to 30 V	The pump runs at set speed.

10.4 Status LED (Integrated controller)

The controller has an LED light which provides an indication of status and errors.



<table>
<tr><th>Status LED colour</th><th>Description</th></tr>
<tr><td>No colour (off)</td><td>No power</td></tr>
<tr><td>Green</td><td>Pumphead cover closed, normal operation</td></tr>
<tr><td>Amber</td><td>Pumphead cover open</td></tr>
<tr><td>Red, Flashing</td><td>
<table>
<tr><th>Flashes (Red LED)</th><th>Error</th><th>Reason for error</th></tr>
<tr><td>1</td><td>Overvoltage</td><td>Power supply voltage > 52.8 V DC (48 V DC +10%).</td></tr>
<tr><td>2</td><td>Undervoltage</td><td>Power supply voltage < 10.8 V DC (12 V DC -10%).</td></tr>
<tr><td>3</td><td>Overcurrent</td><td>Excessive current detected on drive.</td></tr>
<tr><td>4</td><td>Software</td><td>Pump firmware error.</td></tr>
<tr><td>5</td><td>Stall</td><td>Drive cannot rotate when driven at maximum torque.</td></tr>
<tr><td>6</td><td>Over Temperature</td><td>PCB temperature sensor > 85 °C.</td></tr>
<tr><td>7</td><td>Hardware</td><td>Drive internal fault.</td></tr>
</table>
</td></tr>
</table>

10.5 Defaults

A DriveSure ADC pump is programmed with the following defaults. These defaults can be changed in the WM Connect PC software: see section 15.

Defaults		Series			
		100	300	400/RXMD	500
Current [26]	Max speed (rpm)	410	410	550	220
	Min speed (rpm)	0			
	Max input (mA)	20			
	Min input (mA)	4			
	Filter sample counts	16			
Voltage	Max speed (rpm)	410	410	550	220
	Min speed (rpm)	0			
	Max input (V)	10			
	Min input (V)	0.1			
	Filter sample counts	16			
Frequency	Max speed (rpm)	410	410	550	220
	Min speed (rpm)	0			
	Max input (Hz)	2000			
	Min input (Hz)	2			
Fixed speed	Speed (rpm)	100			
Acceleration	Speed per second (rpm/s)	900 rpm/s			
Deceleration	Speed per second (rpm/s)	1800 rpm/s			

NOTE [26] 4-20 mA input is the default control mode. To use 0-10 V, frequency, or a fixed speed, set the **Inactive/Active** toggle to **Active** in the related control sub-tab of the WM Connect PC software. See section 15.5.2.1.

11 INSTALLATION—REMOTE CONTROL: En (EtherNet/IP)

This chapter details the remote control of a DriveSure En pump for EtherNet/IP control.

11.1 Specific responsible person

All EtherNet/IP systems must be installed or certified by an EtherNet/IP approved installation engineer.

11.2 Network parameters

The network parameters for communication of the pump with the network:

Parameter	Address
IP Address	0.0.0.0
Subnet mask	0.0.0.0
Default gateway	0.0.0.0
DHCP	Enabled

These network parameters can be manually configured or the DHCP disabled (automatic IP address), using either the network PC software or WM Connect PC software: see section 15.5.3.

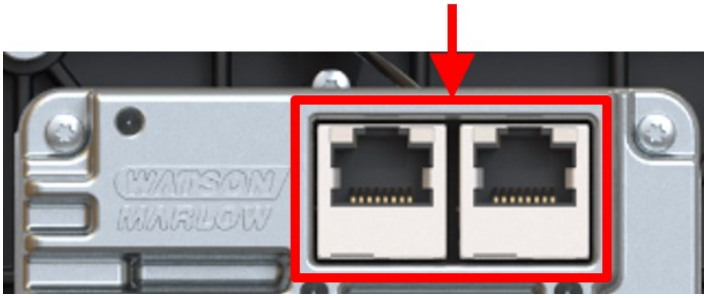
11.3 EDS File

The EDS file is packaged together with all related software in a ZIP file which can be downloaded from the Watson-Marlow website:

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

11.4 Network control connection location

The location of the network control cable connection is shown below:



11.5 Network control cable specification

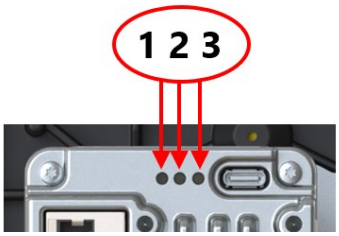
A Category 5E shielded ethernet cable with a male RJ45 connector is required to connect and control a DriveSure En drive.

11.6 Procedure—Connect the network control cable

1. Isolate the pump from its power supply.
2. Push the network control cable(s) into the network control cable connection until a click is heard.
3. Connect the power supply to the pump.
4. Observe the status LEDs on the network control connections.
5. Observe the status LEDs on the controller.
6. Ensure the pump operates in accordance with the control system design (network commands).

11.7 Status LEDs (Integrated controller)

The controller has LEDs which provide an indication of status and errors:

LED number	LED function	Picture showing LED number
LED 1	Module status	
LED 2	Network status	
LED 3	Drive status	

The behaviour of the LEDs is explained below.

11.7.1 LED 1: Module Status

LED Colour	Description
No colour (off)	No power
Green	Controlled by a scanner in run state and, if CIP sync is enabled, time is synchronised to a grandmaster clock
Green, flashing	Not configured, scanner in idle state, or, if CIP sync is enabled, time is synchronised to a grandmaster clock
Red	Major error (EXCEPTION-state, FATAL error, etc)
Red, flashing	Recoverable error(s). Module is configured, but stored parameters differ from currently used parameters

11.7.2 LED 2: Network status

LED Colour	Description
No colour (off)	No power, or no IP address
Green	Online, one or more connections established (CIP class 1 or 3)
Green, flashing	Online, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP class 1 or 3)

11.7.3 LED 3: Drive status

Status LED colour	Description
No colour (off)	No power
Green	Pumphead cover closed, normal operation
Amber	Pumphead cover open

<table>
<tr><th>Status LED colour</th><th>Description</th></tr>
<tr><td>Red, Flashing</td><td>
<table>
<tr><th>Flashes (Red LED)</th><th>Error</th><th>Reason for error</th></tr>
<tr><td>1</td><td>Overvoltage</td><td>Power supply voltage > 52.8 V DC (48 V DC +10%).</td></tr>
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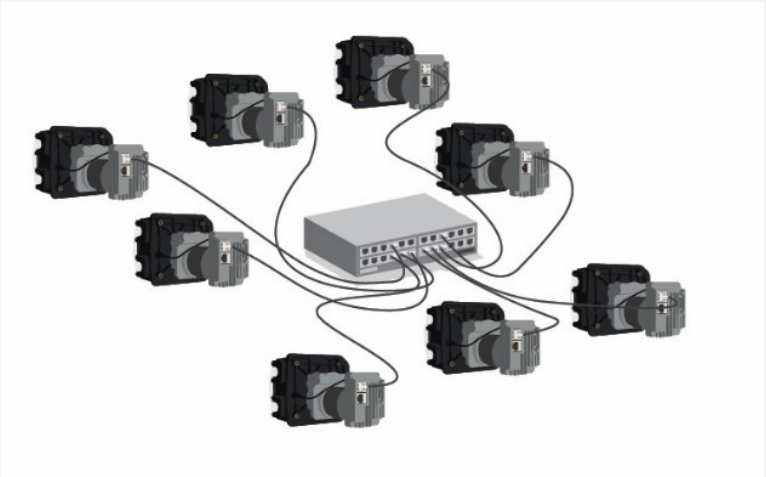
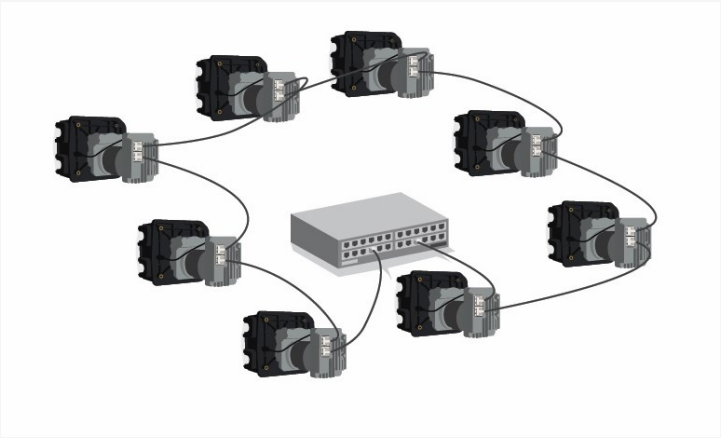
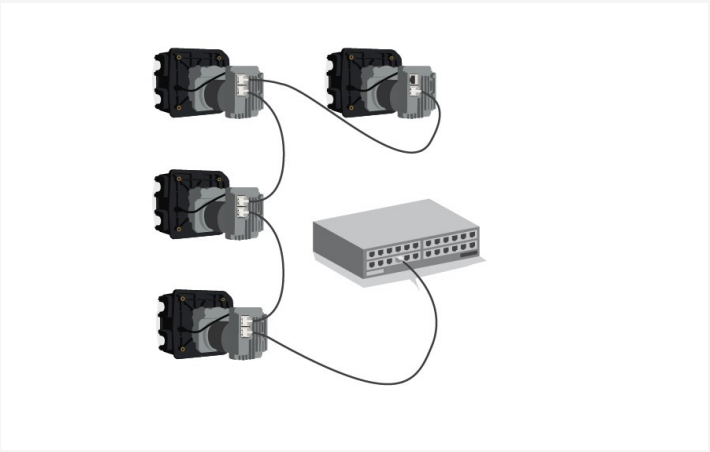
<tr><td>7</td><td>Hardware</td><td>Drive internal fault.</td></tr>
</table>
</td></tr>
</table>

11.8 Network arrangement

A DriveSure En pump may be connected in any of the following 3 network arrangements:

Star topology	
Ring topology	
Line topology	

The number of pumps connected in the images above may be exceeded.

11.9 Use of deciRPM

deciRPM is used as a network speed parameter in place of RPM to avoid software complications with the decimal point.

1 deciRPM = 0.1 RPM. For example: 1200 deciRPM = 120 RPM.

11.10 Pumphead enumeration table and maximum design speed

Output value	Pumphead	Max speed (deciRPM)
1	114DV	4100
2	114DVP	4100
3	116DV	4100
4	116DVP	4100
8	313D	4100
9	313D2	4100
12	314D	4100
13	314D2	4100
16	520R	2200
17	520R2	2200
19	520REL	2200
20	520REM	2200
26	RXMD 4 bar CW	5500
27	RXMD 4 bar CCW	5500
28	RXMD 6 bar CW	5500
29	RXMD 6 bar CCW	5500
30	316D	4100
31	318D	4100

If a pump speed limit is set higher than the maximum design speed, the pump will not exceed its maximum design speed.

11.11 Cyclic parameters

ADI	Name	Access	Type	Description
2	SetSpeed	Write	UInt16	Pump speed is set in deciRPM. Max speed depends on model. See "SetSpeedLimit".
3	SetSpeedLimit	Write	UInt16	Pump speed limit is set in deciRPM. Max speed depends on model. See pumphead enumeration table in section 11.10.
4	SetFailsafeSpeed	Write	UInt16	If failsafe is enabled, the pump will run continuously at the specified speed in the event of a communications loss.
5	SetFailsafeEnable	Write	Bool	Set failsafe enable. If set to 1, failsafe speed is enabled. Under loss of communication, pump will run at failsafe speed. If set to 0, failsafe speed is disabled. Under loss of communication, pump will stop.
6	SetReverse	Write	Bool	Set pump direction to anti-clockwise. If set, the pump will run anti-clockwise. Pump defaults to clockwise rotation.
7	Run	Write	Bool	Run. If set to 1, pump will start, subject to “RunEnable” parameter. If set to 0, pump will stop.
8	RunEnable	Write	Bool	RunEnable pump. If set to 1, pump will start, subject to “Run” parameter. If set to 0, pump will stop.
9	ResetRunHours	Write	Bool	Reset pump run hours to zero. If set to 1, “Run hours” accumulator will be reset.

ADI	Name	Access	Type	Description
12	ResetRevolutionCount	Write	Bool	If set to 1, the pumphead revolution count is reset to 0. Set to 0 to allow the pumphead revolution count to increment.
14	RunHours	Read	UInt32	Reports the number of hours the pump has run for.
26	RevolutionCount	Read	UInt32	Reports the revolution count of the pumphead, in full rotations.
27	PumpSpeed	Read	UInt16	Reports the current pump speed, based on encoder reading.
28	SpeedLimit	Read	UInt16	Reports the current speed limit set point.
29	GeneralAlarm	Read	UInt16	Bit 0 = Motor Stall Error Bit 1 = Unused Bit 2 = Over Current Error Bit 3 = Over Voltage Error Bit 4 = Cover Open Bit 5 = Unused Bit 6 = Unused Bit 7 = Unused Bit 8 = Under Voltage Error Bit 9 = Over Temperature Error Bit 10 = Software Error Bit 11 = Hardware Error Bit 12 = Unused Bit 13 = Unused Bit 14 = Unused Bit 15 = Unused
37	PumpModel	Read	Enum	Unused.
38	PumpHead	Read	Enum	Displays the currently selected pumphead. See pumphead enumeration table in section 11.10.
43	Reverse	Read	Bool	If set to 1, reports pump running anti-clockwise.
44	Running	Read	Bool	If set to 1, reports pump is currently running.

ADI	Name	Access	Type	Description
46	MotorStallError	Read	Bool	If set to 1, a motor stall error has occurred.
48	OverCurrentError	Read	Bool	If set to 1, an over current error has occurred.
49	OverVoltageError	Read	Bool	If set to 1, an over voltage error has occurred.
50	Integrated cover-open sensor	Read	Bool	If set to 1, the pump will report that the pumphead cover has been opened.
61	AnybusNetworkMode	Read	Bool	If set, the pump is in EtherNet/IP mode.
62	AnybusNetworkActive	Read	Bool	If set, EtherNet/IP is active on the device.
64	ErrorAcknowledge	Write	Bool	If set to 1, pump errors will be acknowledged. Errors will only be cleared if the error condition no longer exists.
107	PumpTemperature	Read	SInt8	Reports the pump internal temperature.
109	SoftwareError	Read	Bool	If set to 1, a software error has occurred.
110	HardwareError	Read	Bool	If set to 1, a hardware error has occurred.
112	UnderVoltageError	Read	Bool	If set to 1, an under voltage error has occurred.
113	OverTemperatureError	Read	Bool	If set to 1, an over temperature error has occurred.
114	PrimeSwitchActive	Read	Bool	If set to 1, prime switch is active.
200	RPIrange	Read	SInt32	Reports the timings for cyclic data access.

11.12 Acyclic data records

Index	Name	Access	Type	Description
108	SerialNumber	Read	Char21	Reports the pump serial number

11.13 Holding torque

When the pumphead cover is open, the pump is stopped and the pumphead rotor is free to turn with no holding torque.

When the pumphead cover is closed, the holding torque and running state varies depending on the control input:

Run enable (index 8)	Run (index 7)	Running state when pumphead cover is closed
Enable (ADI 101/Bit 3)	Start Pump (ADI 101/Bit 2)	
Controls power to motor coils	Stops/starts pump	
0	0	The pump is stopped and the pumphead rotor is free to turn with no holding torque.
0	1	
1	0	The pump is stopped with holding torque on the pumphead rotor.
1	1	The pump is stopped with holding torque on the pumphead rotor if speed is set to 0 deciRPM
1	1	The pump runs at set speed.

11.14 Defaults

A DriveSure En pump is programmed with the following defaults. These defaults can be changed in the WM Connect PC software: see section 15.

Item	Default setting
Acceleration (rpm/s)	900 rpm/s
Deceleration	1800 rpm/s

12 INSTALLATION—REMOTE CONTROL: Pn (PROFINET)

This chapter details the remote control of a DriveSure Pn pump for PROFINET control.

12.1 Specific responsible person

All PROFINET systems must be installed or certified by a PROFINET approved installation engineer.

12.2 Network parameters

The network parameters for communication of the pump with the network:

Parameter	Address
IP Address	0.0.0.0
Subnet mask	0.0.0.0
Default gateway	0.0.0.0
DHCP	Disabled

These network parameters can be manually configured or the DHCP enabled (automatic IP address), using either the network PC software or WM Connect PC software: see section 15.

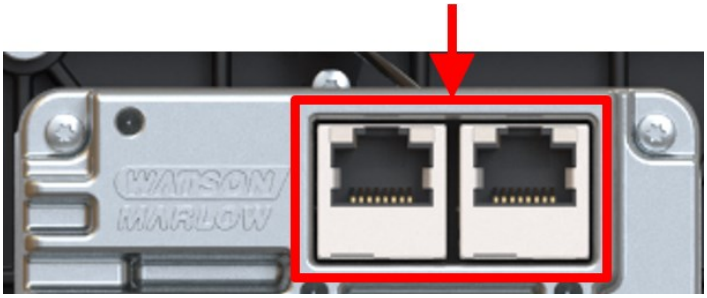
12.3 GSDML File

The GSDML file is packaged together with all related software in a ZIP file which can be downloaded from the Watson-Marlow website:

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

12.4 Network control connection location

The location of the network control cable connection is shown below:



12.5 Network control cable specification

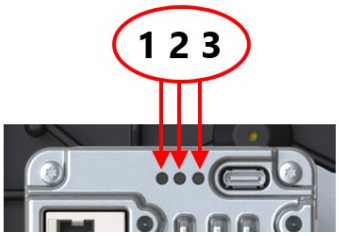
A Category 5E shielded cable PROFINET cable with a male RJ45 connector is required to connect and control a DriveSure Pn drive.

12.6 Procedure—Connect the network control cable

1. Isolate the pump from its power supply.
2. Push the network control cable(s) into the network control cable connection until a click is heard.
3. Connect the power supply to the pump.
4. Observe the status LEDs on the network control connections.
5. Observe the status LEDs on the controller.
6. Ensure the pump operates in accordance with the control system design (network commands).

12.7 Status LEDs (Integrated controller)

The controller has LEDs which provide an indication of status and errors:

LED number	LED function	Picture showing LED number
LED 1	Module status	
LED 2	Network status	
LED 3	Drive status	

The behaviour of the LEDs is explained below.

12.7.1 LED 1: Module Status

LED Colour	Description
No colour (off)	No power
Green	Controlled by a scanner in run state and, if CIP sync is enabled, time is synchronised to a grandmaster clock
Green, flashing	Not configured, scanner in idle state, or, if CIP sync is enabled, time is synchronised to a grandmaster clock
Red	Major error (EXCEPTION-state, FATAL error, etc)
Red, flashing	Recoverable error(s). Module is configured, but stored parameters differ from currently used parameters

12.7.2 LED 2: Network status

LED Colour	Description
No colour (off)	No power, or no IP address
Green	Online, one or more connections established (CIP class 1 or 3)
Green, flashing	Online, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP class 1 or 3)

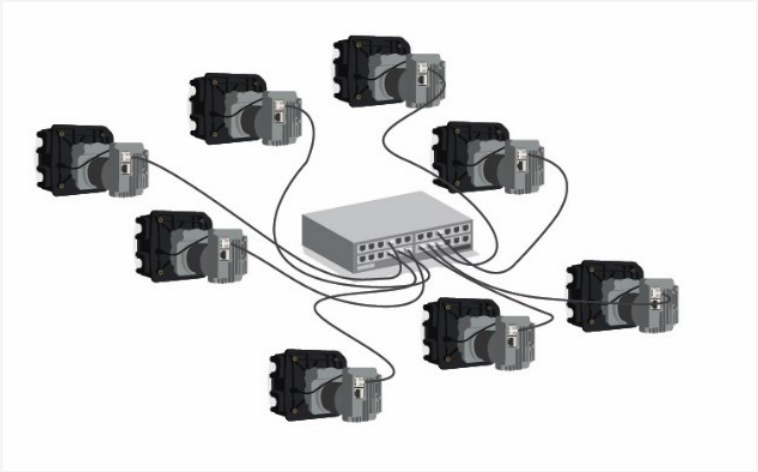
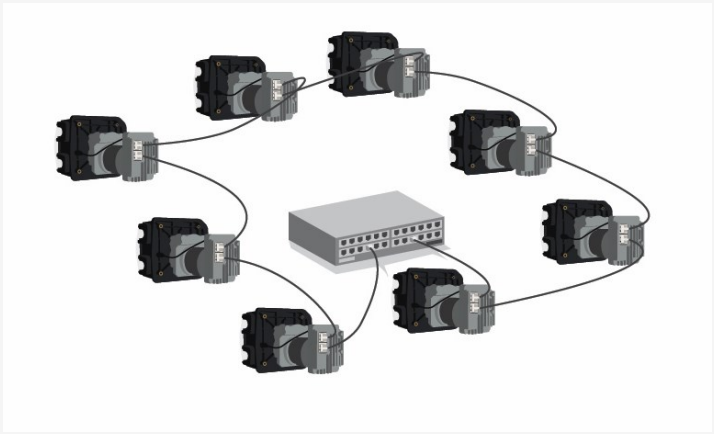
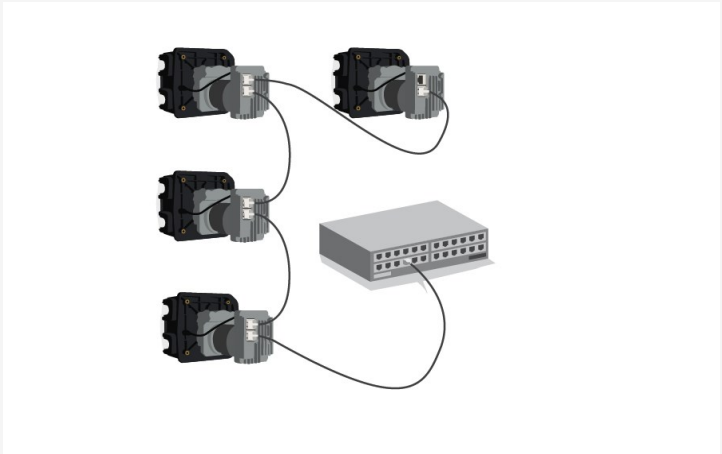
12.7.3 LED 3: Drive status

Status LED colour	Description
No colour (off)	No power
Green	Pumphead cover closed, normal operation
Amber	Pumphead cover open

Status LED colour	Description		
Red, Flashing	**Flashes (Red LED)**	**Error**	**Reason for error**
	1	Overvoltage	Power supply voltage > 52.8 V DC (48 V DC +10%).
	2	Undervoltage	Power supply voltage < 10.8 V DC (12 V DC -10%).
	3	Overcurrent	Excessive current detected on drive.
	4	Software	Pump firmware error.
	5	Stall	Drive cannot rotate when driven at maximum torque.
	6	Over Temperature	PCB temperature sensor > 85 °C.
	7	Hardware	Drive internal fault.

12.8 Network arrangement

A DriveSure Pn pump may be connected in any of the following 3 network arrangements:

Star topology	
Ring topology	
Line topology	

The number of pumps connected in the images above may be exceeded.

12.9 Use of deciRPM

deciRPM is used as a network speed parameter in place of RPM to avoid software complications with the decimal point.

1 deciRPM = 0.1 RPM. For example: 1200 deciRPM = 120 RPM.

12.10 Pumphead enumeration table and maximum design speed

If a pump speed limit is set higher than the maximum design speed, the pump will not exceed its maximum design speed.

Output value	Pumphead	Max speed (deciRPM)
1	114DV	4100
2	114DVP	4100
3	116DV	4100
4	116DVP	4100
8	313D	4100
9	313D2	4100
12	314D	4100
13	314D2	4100
16	520R	2200
17	520R2	2200
19	520REL	2200
20	520REM	2200
26	RXMD 4 bar CW	5500
27	RXMD 4 bar CCW	5500
28	RXMD 6 bar CW	5500
29	RXMD 6 bar CCW	5500
30	316D	4100
31	318D	4100

12.11 Cycle time

Minimum device interval 32 ms.

12.12 Pump details and set up

ADI	Name	Access	Type	Description
38	Pump head	Read	UInt8	Displays the currently selected pumphead. See pumphead enumeration table on page 110
37	PumpModel	Read	UInt8 (Enum)	Unused.

12.13 Pump status

ADI	Name	Access	Type	Description
14	Run hours	Read	UInt32	Reports the number of hours the pump has run for.
26	Total number pumphead revolutions	Read	UInt32	Reports the revolution count of the pumphead, in full rotations.
27	Current pump speed (deciRPM)	Read	UInt16	Reports the current pump speed, based on encoder reading (1 deciRPM = 0.1 RPM).
28	Pump speed limit (deciRPM)	Read	UInt16	Reports the current speed limit set point in deciRPM (1 deciRPM = 0.1 RPM). See pumphead enumeration table on page 110
103	Pump status bitfield	Read	Byte	Bit 0 = Pump running anti-clockwise. If set to 1, reports pump running anti-clockwise. Bit 1 = Pump is currently running. If set to 1, reports pump is currently running. Bit 2 = Prime switch is active. If set to 1, prime switch is active.
107	Pump temperature (deg C)	Read	SInt8	Reports the pump internal temperature

12.14 Pump control

ADI	Name	Access	Type	Description
2	SetSpeed (deciRPM)	Write	UInt16	Pump speed is set in deciRPM. Max speed depends on model. See "SetSpeedLimit".
3	SetSpeedLimit (deciRPM)	Write	UInt16	Pump speed limit is set in deciRPM. Max speed depends on model.See pumphead enumeration table in section 12.10
4	SetFailsafeSpeed (deciRPM)	Write	UInt16	If failsafe is enabled, the pump will run continuously at the specified speed in the event of a communications loss.

ADI	Name	Access	Type	Description
101	Control bitfield	Write	UInt16	Bit 0 = Set fail-safe enable. If set to 1, fail safe speed is enabled. Under loss of communication, pump will run at fail safe speed. If set to 0, fail safe speed is disabled. Under loss of communication, pump will stop. Bit 1 = Set pump direction to anti-clockwise. If set, pump will run anti-clockwise. Pump defaults to clockwise rotation. Bit 2 = Run. If set to 1, pump will start, subject to “RunEnable” parameter. If set to 0, pump will stop. Bit 3 = RunEnable. If set to 1, pump will start, subject to “Run” parameter. if set to 0, pump will stop. Bit 4 = Reset pump run hours to zero. If set to 1, “Run hours” accumulator will be reset. Bit 5 = Unused. Bit 6 = Unused. Bit 7 = Reset revolution count to zero. If set to 1, resets the pumphead revolution count to 0. Set to 0 to allow the pumphead revolution count to increment.

12.15 Errors and warnings

ADI	Name	Access	Type	Description
102	Error bitfield byte 1	Read	UInt32	Bit 0 = Unused. Bit 1 = Motor Stall Error active. If set to 1, a motor stall error has occurred. Bit 2 = Unused. Bit 3 = Over Current Error active. If set to 1, an over current error has occurred. Bit 4 = Over Voltage Error active. If set to 1, an over voltage error has occurred. Bit 5 = Cover Open. If set to 1, the pump will report that the pumphead cover has been opened. Bit 6 = Unused. Bit 7 = Unused.
	Error bitfield byte 2	Read		Bit 8 = Unused. Bit9 = Under Voltage Error active. If set to 1, an under voltage error has occurred. Bit10 = Over Temperature Error. If set to 1, an over temperature error has occurred. Bit11 = Software Error active. If set to 1, a software error has occurred. Bit12 = Hardware Error. If set to 1, a hardware error has occurred. Bit13 = Unused. Bit14 = Unused. Bit15 = Unused.
64	Acknowledge error	Read	UInt8	Bit 0 = Acknowledge Error. If set to 1, pump errors will be acknowledged. Errors will only be cleared if the error condition no longer exists.

12.16 Acyclic parameters

ADI	Name	Access	Type	Description
108	Pump serial number	Read	Char21	Read the pump serial number

12.17 Holding torque

When the pumphead cover is open, the pump is stopped and the pumphead rotor is free to turn with no holding torque.

When the pumphead cover is closed, the holding torque and running state varies depending on the control input:

Run enable (index 8)	Run (index 7)	Running state when pumphead cover is closed
Enable (ADI 101/Bit 3)	Start Pump (ADI 101/Bit 2)	
Controls power to motor coils	Stops/starts pump	
0	0	The pump is stopped and the pumphead rotor is free to turn with no holding torque.
0	1	
1	0	The pump is stopped with holding torque on the pumphead rotor.
1	1	The pump is stopped with holding torque on the pumphead rotor if speed is set to 0 deciRPM
1	1	The pump runs at set speed.

12.18 Defaults

A DriveSure Pn pump is programmed with the following defaults. These defaults can be changed in the WM Connect PC software: see section 15.

Item	Default setting
Acceleration (rpm/s)	900 rpm/s
Deceleration	1800 rpm/s

13 INSTALLATION—LOCAL CONTROL

The information in this chapter covers the following:

- Integrated cover-open sensor.
- Prime switch connection.

13.1 Integrated cover-open sensor

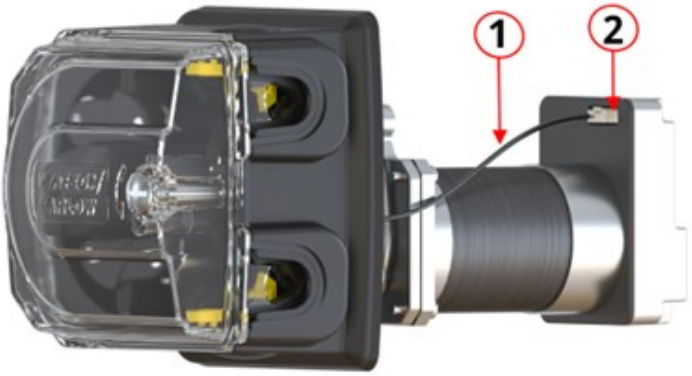
13.1.1 Functional overview

The position of the pumphead cover (open or closed) is sensed by the integrated cover-open sensor to enable or disable the pump, as follows:

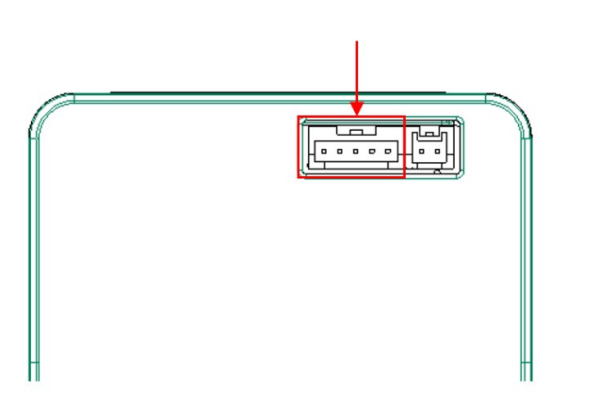
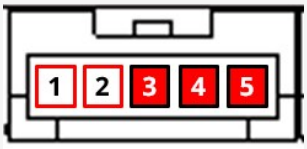
- If the pumphead cover is closed, the pump can run.
- If the pumphead cover is open while the pump is stopped, the microprocessor will not let the motor run.
- If the pumphead cover is opened while the pump is running, the microprocessor will stop the motor.

Also, when the pumphead cover is opened, the motor drive circuit will be hardware disabled after a 0.8 second delay, independent of the microprocessor.

The sensor cable is connected to the controller as illustrated below:

Item number	Name	Picture showing items
1	Integrated cover-open sensor cable (pumphead to controller)	
2	Integrated cover-open sensor cable connection	

13.1.2 Connection

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Connection on controller</td><td>JST 5W B05B-PASK-1</td></tr>
<tr><td>Connection on cable</td><td>JST 5W PAP-05V-S housing with SPHD-002T-P0.5 Crimp</td></tr>
<tr><td>Connector Location</td><td>  </td></tr>
<tr><td>Connector pin outs</td><td> 
</td></tr>
<tr><td>Wiring information</td><td>
<table>
<tr><th>Pin</th><th>Comment</th></tr>
<tr><td>1 to 2</td><td>Voltage-free integrated cover-open sensor connection. Do not bypass or connect any external voltage to either pin (1 or 2).</td></tr>
<tr><td>3 to 5</td><td>Pins 3 to 5 are reserved for Watson-Marlow use only.</td></tr>
</table>
</td></tr>
</table>

13.1.3 Installation of the integrated cover-open sensor

The integrated cover open sensor cable is pre-installed during production of the 300 Series, 400/RXMD, and 500 Series pumps.

For the 100 Series pumps, this cable connection is installed during mounting procedure: see section 8.5.3.

13.1.3.1 Testing the integrated cover-open sensor

During the installation sequence, the operation of the integrated cover-open sensor must be tested. This is undertaken as follows:

With the pump powered up and operating:

1. Open the cover in accordance with the table below:

100 Series, 300 Series and 400/RXMD	500 Series
Lift the cover 	Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise with a flat-head screwdriver. 

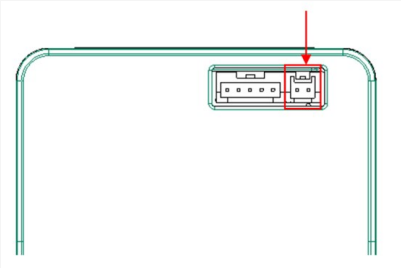
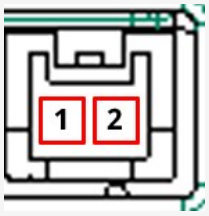
2. The pump should immediately stop. The status LED nearest the USB-C port will illuminate and for En and Pn drives, a pump status update will be sent over the network.

   If these actions do not happen, the integrated cover-open sensor is not functioning correctly and the installation must not continue until rectified.

13.2 Prime switch connection

A prime switch connection is provided to allow the pump to run at a set speed while a switch is activated, such as for priming of the pump.

13.2.1 Connection and cable specification

Item	Specification
Connection on controller	JST 2W B02B-PASK-1
Connection required on cable (27)	JST 2W PAP-02V-S housing with SPHD-002T-P0.5 Crimp
Connector Location	
Connector pin outs	
Wiring information	A voltage-free switch connection must be made between pin 1 and 2 to activate the prime feature. Do not connect any external voltage to either pin (1 or 2).

NOTE (27) A prime switch cable with required connector is not available as a Watson-Marlow accessory.

13.2.2 Set up

The prime speed can be set up using WM Connect PC software. Network software may also be used for Pn and En models using the network parameters.

13.2.3 Procedure: Connect the prime switch

If a prime switch connection will be used, carry out the following procedure to connect to the pump:

1. Isolate the pump from its power supply.
2. Push the prime switch connection into the prime switch connector on the controller until a secure connection is made.
3. Connect the power supply to the pump.
4. Ensure the pump operates in accordance with the prime switch activation and deactivation method.

14 INSTALLATION—FLUID PATH

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.

14.1 Overpressure safety device

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

- The pumphead tubing, element, or ancillary device ruptures, leaks, or otherwise fails.
- The fluid path pipework or ancillary device ruptures, leaks, or otherwise fails.
- The drive fails.

Install an overpressure safety device that can automatically activate in an overpressure event. This device must:

- Be set to a pressure that is lower than the pressure rating of the system.
- Be able to stop the pump, or divert the fluid to a safe location, when triggered.
- Have a failsafe feature.

14.2 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 if there is a pumphead tube or element failure. If the pump will be operated in reverse, the non-return valve will need to be bypassed during this operation to avoid becoming a blockage.

14.3 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 before replacing the pumphead tubing or element.
- Where procedures require the pump to be removed from service.

The pump will act like a valve when stopped, preventing fluid from flowing through the pumphead. However, as the tubing, element, or pumphead wears, there can be flow through the pumphead. In applications where unintentional flow through the pumphead is unwanted, or would create a hazard, isolation valves must be installed.

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

14.4 Inlet and discharge pipework

Inlet and discharge pipes should:

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

14.5 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.

14.6 Procedure—Installation of the peristaltic tubing into the pumphead for the first time

The first-time installation of the peristaltic tubing or element varies by model of pumphead. Some pumphead models require adjustment of the tube clamps prior to installation of the tubing. The table below explains which models this applies to:

Pumphead	Requires tube clamp adjustment?
114DV	Yes
114DVP	Yes
116DV	Yes
116DVP	Yes
313D (28)	Yes (28)
313D2(28)	Yes (28)
314D (28)	Yes (28)
314D2(28)	Yes (28)
316D(28)	Yes (28)
318D(28)	Yes (28)
RXMD	No
520R	Yes
520R2	Yes
520REL	No
520REM	No

NOTE (28) Some models of 313D, 313D2, 314D, 314D2, 316D, and 318D have fixed tube clamps. These models do not require tube clamp adjustment prior to installation of the tube.

Follow the procedures in this section to install peristaltic tubing in the pumphead for the first time. If the peristaltic tubing needs to be replaced for maintenance reasons, follow the replacement peristaltic tubing procedure: see section 18.3.2.

14.6.1 100 Series Pumphead tube clamp settings

Prior to installation of tubing, the tubing clamp setting must be correctly set. The tube clamps holder is factory set to Outer Position (Large bore).

The tubing clamps can be adjusted to accommodate 1.6 mm wall tubing in sizes from 0.5 mm bore to 4.8 mm bore.

Tube Bore	0.5 mm	0.8 mm	1.6 mm	2.4 mm	3.2 mm	4.0 mm	4.8 mm
Inner	•	•	•	•	•		
Outer				•	•	•	•

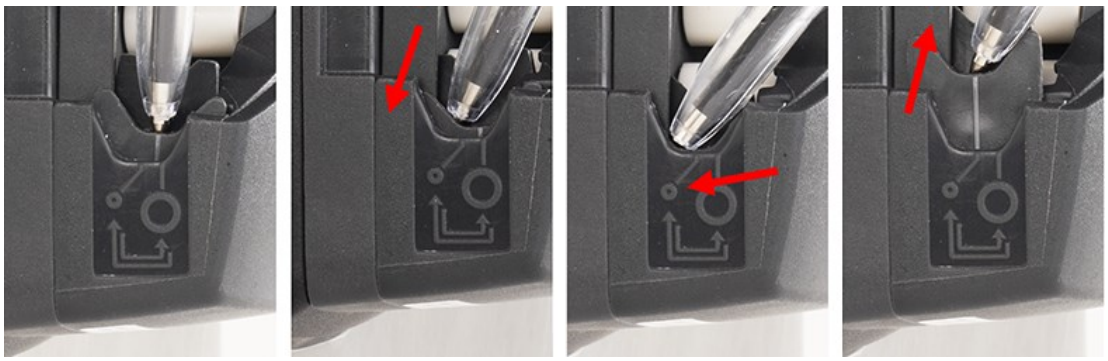
Position	Picture	Comment
Inner Position (Small bore)		The inner position is used to prevent the risk of tube slipping through the clamps and wandering across the rollers when using 0.5 mm, 0.8 mm and 1.6 mm bore tubes.
Outer Position (Large bore)		The outer position is used to prevent flow rate being excessively reduced when using 4.0 mm and 4.8 mm bore tubing.

Tubing bores of 2.4 mm and 3.2 mm can use either setting.

The inner setting clamps the tube harder, reducing slip but marginally reducing flow rate. The outer setting will optimise flow rate but will increase risk of slip.

14.6.1.1 Change from large to small tube setting

1. Isolate from power supply.
2. Use a pointed device like a ball-point pen to reposition the lower tube holders on both sides.
3. Fully open flip top cover.
4. Place pointed device down into the small depression as shown in first picture.



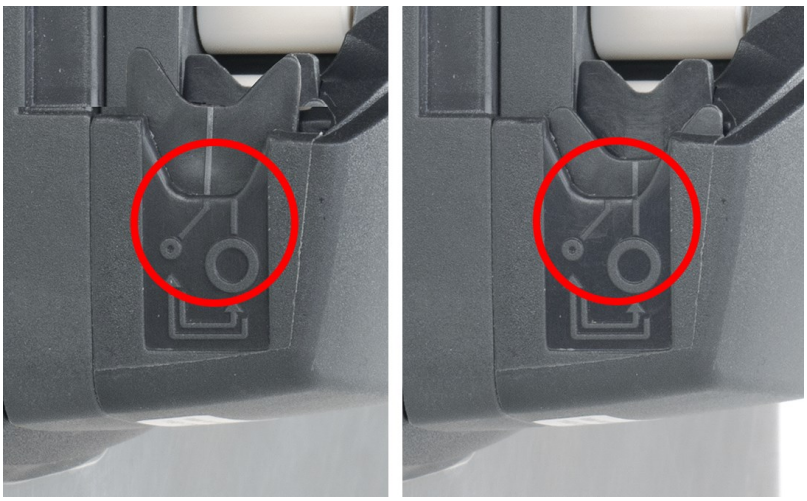
5. Press down and slightly away from the front of the pumphead, as shown above.
6. Maintain the angled downward pressure and push away from the front of the pumphead so the lower tube holder moves towards the back of the pumphead into its new position.
7. Release pressure, and check that the jaw rises into its correct alignment as shown below.

8. If it does not, repeat the procedure, being sure to maintain downward pressure until release.
9. Adjust the tube holder on the other side of pumphead in the same way.

14.6.1.2 Change from small to large tube setting

1. Isolate from power supply.
2. Use a pointed device like a ball-point pen to reposition the lower tube holders on both sides.
3. Fully open flip top cover.
4. Place pointed device down into the small depression as shown in first picture.

5. Press down and slightly away from the back of the pumphead as shown above.
6. Maintain the angled downward pressure and push away from the back of the pumphead as the lower tube holder moves towards the front of the pumphead into its new position.
7. Release pressure, and check that the jaw rises into its correct alignment as shown below.



8. If it does not, repeat the procedure, being sure to maintain downward pressure until release.
9. Adjust the tube holder on the other side of pumphead in the same way.

14.6.2 100 Series pumphead first time tube installation

1. Isolate pump from electrical power supply.
2. Fully open the flip top cover.

3. Ensure the tube clamps are correctly set for size of tube.
4. Place tube between rotor rollers and track and press against inner wall.

5. Check that tube is not twisted or stretched and is inside the tube clamps.

6. Lower flip top cover to fully closed position, this will automatically tension the tube correctly.

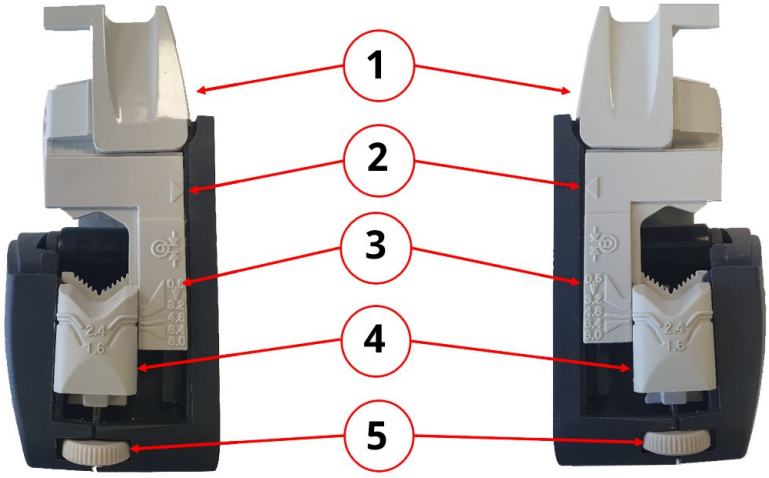
7. Check that tubing is in the position shown. Do not add extra tension to the tube.

8. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
9. Bring the pump into service, checking for any leaks from fluid path connections.
10. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

14.6.3 300 Series pumphead tube clamp setting

300 Series pumpheads with adjustable tube clamps require setting prior to installation of the tubing. For the fixed clamp versions this is not necessary.

The tube clamps are located on each side of the pumphead. The location and description of the individual items is provided below:

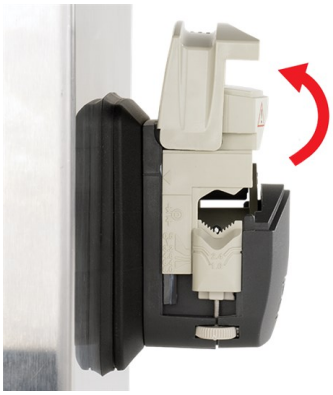


Item	Description
1	Flip top cover
2	Slider arrow
3	Tube bore indicator
4	Tube wall thickness indicator
5	Tube clamp adjustment wheel

The tubing clamps can be adjusted to accommodate 1.6 mm and 2.4 mm tubing wall thickness, and tubing bore sizes from 0.5 mm to 8.0 mm.

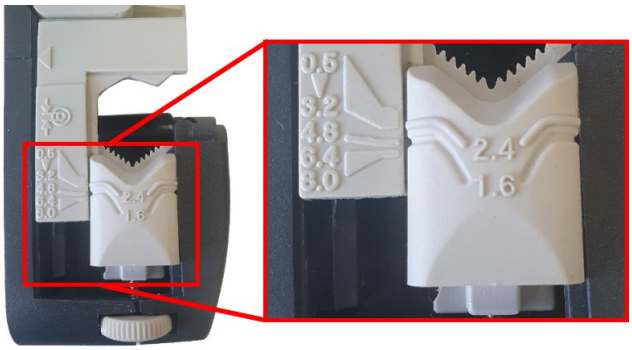
14.6.3.1 To set or adjust the tube clamp.

1. Isolate pump from electrical power supply.
2. Fully open the flip top cover.



3. Ensure that the arrow on slider aligns with the line on body.

4. Rotate adjusting wheel on the clamp assembly so that the required tube wall thickness aligns with the required tube bore size. Adjusting wheel operates clockwise to lower and anti-clockwise to raise. Adjustment for 1.6 mm wall thickness and 4.8 mm tube bore size shown.



5. Carry out step 4 on opposite side clamp.

14.6.4 300 Series pumphead first time tube installation

1. Isolate the pump from the electrical power supply.
2. Fully open the flip top cover.

3. Ensure that tube clamps are correctly set for size of tube.
4. Place tube between rotor rollers and track (ensure it is pressed against inner wall).

5. Check that tube is not twisted or stretched and is inside the tube clamps.

6. Lower flip top cover to fully closed position, this will automatically tension the tube correctly.

7. Check that tubing is in the position shown. Do not add extra tension to the tube.

8. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
9. Bring the pump into service, checking for any leaks from fluid path connections.
10. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

14.6.5 400/RXMD pumphead tube clamp setting

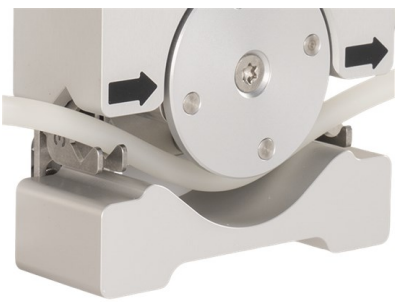
RXMD pumpheads do not have adjustable tube clamps. Proceed to section 14.6.6.

14.6.6 400/RXMD pumphead first time tube installation

1. Isolate pump from electrical power supply.
2. Fully open the flip top cover.

3. Ensure the correct tubing size for the tube clamps will be installed.
4. Place tube between rotor rollers and track, ensuring that tubing is seated closing the cover.

5. Check that tube is not twisted or stretched and is inside the tube clamps.



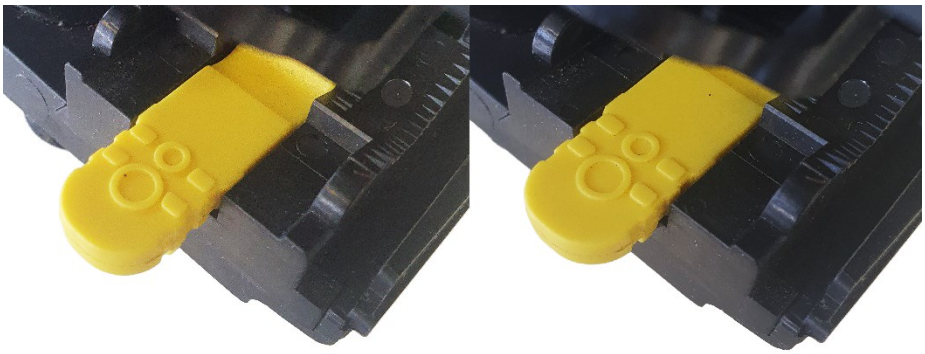
6. Lower flip top cover to fully closed position, this will automatically tension the tube correctly. Do not add extra tension to the tube.

7. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
8. Bring the pump into service, checking for any leaks from fluid path connections.

14.6.7 500 Series tube clamp adjustments R and R2

The pumpheads are fitted with spring-loaded tube clamps which must grip the tubing tightly enough to stop it moving in and out of the pumphead but must not over-squeeze the tube and throttle fluid flow. The tubing clamps are fitted with yellow sliders which can be clicked into two positions while the clamps are held open.

The outer position allows the clamps to grip the tube tightly, and the inner will grip the tube loosely. Adjust the sliders to prevent tube movement during a few trial rotations of the rotor.



Outer position **Inner position**

Final tube clamp setting will be made during the tubing installation procedure.

14.6.8 500 Series tube installation R and R2

1. Isolate the pump from the electrical power supply.
2. Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise with a flat-head screwdriver.

3. Open the cover to its full extent to create maximum clearance for the tube ports.

4. Mark a 225 mm length onto the section of the tubing which is to be located into the pumphead.

5. Open the lower spring-loaded tube clamp and locate tubing, with the first 225mm length mark aligned to the inside face of the spring-loaded part of the tube clamp. Release the clamp.

6. Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.

7. Feed the tubing around the pumphead track, turning the rotor as necessary. Make sure the tubing is not twisted.

8. Ensure that the second 225 mm mark is adjacent to the inner edge of the upper tube clamp. Open the upper spring-loaded tube clamp and locate the tubing into it, making sure there is no residual twist in the tubing, and that the tube sits centrally between the tube guide rollers. Release the clamp.

9. Check that the spring-loaded tube clamps grip the tubing tightly enough to stop it moving in and out of the pumphead but do not over-squeeze the tube. Adjust the sliders to prevent tube movement during a few trial rotations of the rotor. The outer position will allow the clamps to grip the tube tightly, and the inner will grip the tube loosely.

10. Close the cover, pushing it fully home until the latch engages.

11. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
12. Bring the pump back into service, checking for any leaks from fluid path connections.
13. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

14.6.9 500 Series tube element installation REL and REM

Tubing elements do not require tube clamp adjustment prior to the installation of the element.

1. Isolate the pump from electrical power.
2. Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise with a flat-head screwdriver.

3. Open the cover to its full extent to create maximum clearance for the tube ports.
4. Place one connector end of the element into the lower housing.

5. Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.

6. Feed the tubing element around the pumphead track, turning the rotor as necessary.

7. Place the opposite connector end of the element into the top housing. Making sure the element is not twisted and sits centrally between the rollers.

8. Close the cover, pushing it fully home until the latch engages.

9. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
10. Bring the pump back into service, checking for any leaks from fluid path connections.

15 WM CONNECT PC SOFTWARE

WM Connect can be used to:

- Set pump control and performance settings.
- Change defaults.
- Manually override settings to test performance and simulate faults.
- View pump status information.
- Change network settings for En and Pn models.
- Select the correct pumphead model.
- Do firmware updates.
- Load and save pump configurations.
- View the pump log.

15.1 Operating system requirements

WM Connect can be installed on a PC using Windows 10 or above.

15.2 Download

WM Connect can be downloaded from the Watson-Marlow website using the link that follows:

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

15.3 Connection requirements

To use WM Connect, make sure that you have:

- A DriveSure pump.
- A USB-C cable (29).
- Electrical power to the pump (29).
- A computer with WM Connect installed, ready for connection.

NOTE (29)	A cable pack, which includes a 24 V or 48 V power supply and USB-C cable, is available as an accessory for trial use only: see section 4.7.

15.4 Procedure—Connect to WM Connect

Connect the pump to WM Connect using the procedure that follows:

1. Open WM Connect on the PC. While the software looks for a pump, you will see an animated version of the following image:

2. Connect the USB-C cable between the pump and the PC using the USB-C connection:

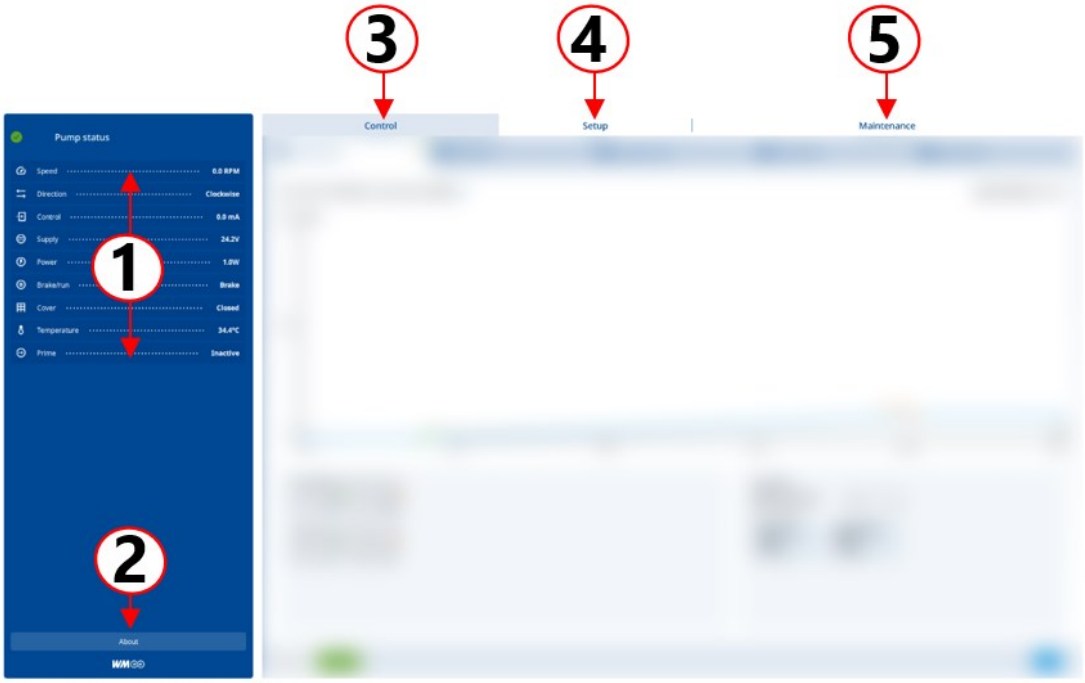
3. Connect the pump to the power supply.

When the software and pump are connected, the home page will open.

15.5 Software overview

15.5.1 Home page

The home page has the following areas:



Area		Function
Number	Name	
1	Pump status	Monitor real-time values (for example, speed and direction).
2	About button	Click to check information about the pump, software, and end-user license agreement.
3	Control tab	Set control parameters (1) or simulate faults.
4	Setup tab	Set speeds, select the correct pumphead, and edit network settings for DriveSure En and Pn.
5	Maintenance tab	Check and update the pump firmware version, access the pump configuration files, and view the pump log.

NOTE (30) You can only set a default control mode for DriveSure ADC.

15.5.2 Control tab

15.5.2.1 Control tab—Overview

The **Control** tab lets you manually set parameters to control the pump. The sub-tabs that are available depend on the DriveSure model.

DriveSure Model	Area		
	Number	Sub-tab	Function
ADC, En, Pn	1	App override	Override the control modes to directly control the pump and to simulate faults.
ADC only	2	Fixed speed	Set the pump to run at a fixed speed.
ADC only	3	Frequency (Hz)	Set the pump's response when it is controlled with a digital Frequency input.
ADC only	4	Voltage (V)	Set the pump's response when it is controlled with a Voltage input.
ADC only	5	Current (mA)	Set the pump's response when it is controlled with a Current input.

DriveSure Model	Area		
	Number	Sub-tab	Function
ADC, En, Pn	6	Inactive/Active toggle	Toggle **Active** to set the current sub-tab as the live control mode.(31) When **Inactive** is toggled, the pump will not respond to settings in the sub-tab.(32)
ADC only	7	Edit/Cancel/Apply button	Click **Edit** to change parameters on the **Current**, **Voltage**, **Frequency**, or **Fixed Speed** sub-tabs. Click **Apply** to apply changes or **Cancel** to discard them.

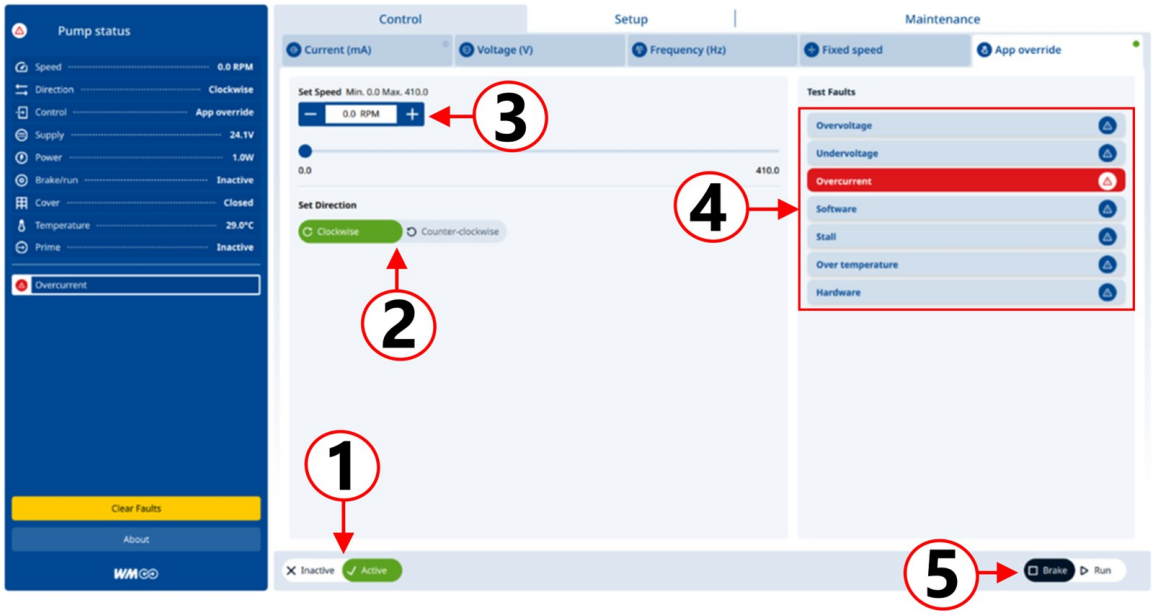
NOTE (31) For DriveSure ADC, 4-20 mA input is the default control mode. To use 0-10 V, frequency, or a fixed speed, set the **Inactive/Active** toggle to **Active** in the related sub-tab.

NOTE (32) If the **Inactive/Active** toggle is set to **Inactive** on all sub-tabs, the pump will not run. To run the pump, make sure that it is connected to WM Connect and then toggle a control mode to **Active**.

15.5.2.2 Control tab—App override

The **App Override** sub-tab lets you manually override other control modes using WM Connect.

Do not use App Override as the main method of pump control. WM Connect must only be used for configuration, optimisation, or troubleshooting.



Area		Function
Number	Name	
1	Inactive/Active toggle	Toggle **Active** to set **App Override** as the live control mode for testing. When **App Override** is **Active**, the selected parameters will override other control modes. (33) When **App Override** is **Inactive**, the pump will not respond to settings in this sub-tab. (34)
2	Set direction	Set the pump to run in a **Clockwise** or **Counter-clockwise** direction.
3	Set speed	Set the pump's speed using the minus or plus buttons, the slider, or by entering a numerical value.
4	Test faults	Simulate faults by selecting any of the listed **Test Faults**: see section 15.5.2.2.1.
5	Brake/Run	Toggle **Run** to start the pump with the parameters selected. Toggle **Brake** to stop the pump.

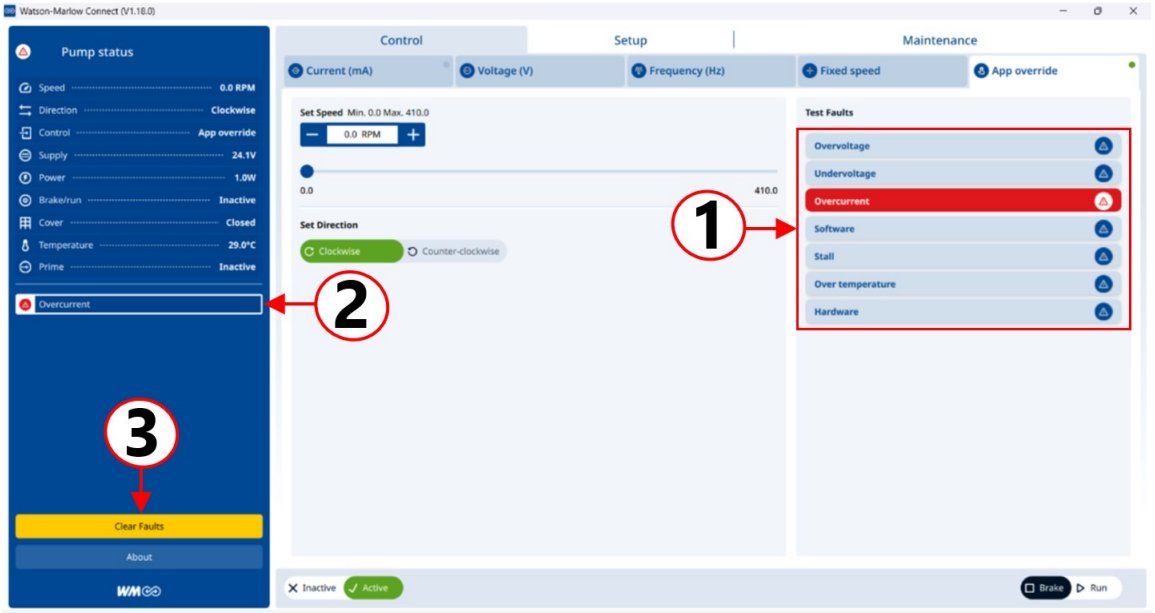
NOTE (33)	If the pump is disconnected while **App Override** is **Active**, the pump will continue running with the selected control mode. To go back to the previous control mode, power cycle the pump.

NOTE (34)	If the **Inactive/Active** toggle is set to **Inactive** on all sub-tabs, the pump will not run. To run the pump, make sure that it is connected to WM Connect and then toggle a control mode to **Active**.

15.5.2.2.1 APP OVERRIDE—TEST FAULTS

You can simulate the faults that follow by selecting them from the **Test Faults** list while **App Override** is **Active**. More than one fault can be simulated at the same time.

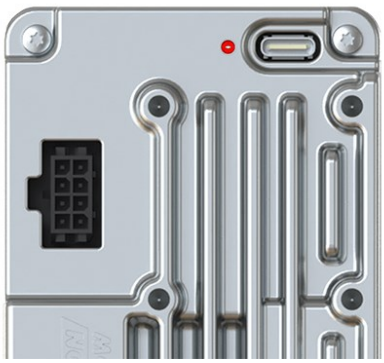
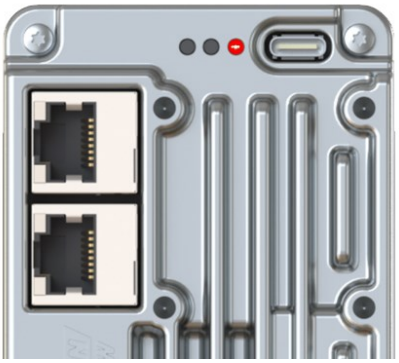
Flashes (Red LED)	Error	Reason for error
1	Overvoltage	Power supply voltage > 52.8 V DC (48 V DC +10%).
2	Undervoltage	Power supply voltage < 10.8 V DC (12 V DC -10%).
3	Overcurrent	Excessive current detected on drive.
4	Software	Pump firmware error.
5	Stall	Drive cannot rotate when driven at maximum torque.
6	Over Temperature	PCB temperature sensor > 85 °C.
7	Hardware	Drive internal fault.



Area		Function
Number	Name	
1	Test faults	Select a fault from the **Test Faults** list to simulate it on the pump. Selected test faults will be highlighted in red.
2	Pump status	Test faults that are selected in the **Test Faults** section will appear in the **Pump Status** bar.

Area		Function
Number	Name	
3	Clear faults	Click **Clear Faults** to remove all test faults and return the pump to its previous state.

The LED on the integrated controller will flash red in specific sequences to identify each selected test fault. For example, there will be one flash if you selected the first fault. If you also selected the third fault, there will be three more flashes after a pause, and so on.

DriveSure ADC	DriveSure En, Pn
	

15.5.2.3 Control tab—Current, Voltage, Frequency (DriveSure ADC only)

The **Current**, **Voltage**, and **Frequency** sub-tabs let you edit the response of the DriveSure ADC pump to the selected input and then view its performance.

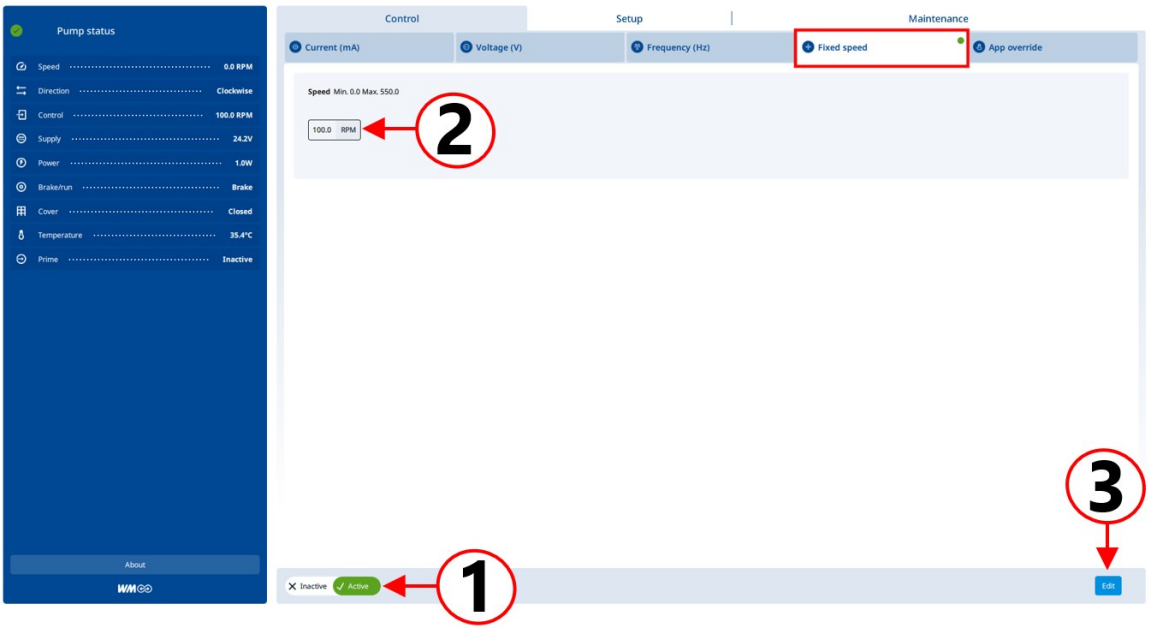
Area		Function
Number	Name	
1	Speed (RPM)	Set the pump's speed range. The maximum speed is set by the software and depends on the fitted pumphead.
2	Input (mA) (V) (Hz)	Set the Current, Voltage, or Frequency input range.
3	Actual input and resulting speed	View the actual Current, Voltage, or Frequency input, and the related speed of the pump.
4	Speed resolution	View the Speed Resolution value. This value is calculated using the **Speed** and **Input** parameters.
5	Input filter	Select a sample number between **1** and **64** to smooth Current or Voltage control signals before they are applied to the control circuitry. This option is only available on the **Current** and **Voltage** tabs.

Area		Function
Number	Name	
6	Graph	View the real-time graph of the input plotted against the pump's speed.
7	Inactive/Active toggle	Toggle **Active** to set the sub-tab (**Current**, **Voltage**, or **Frequency**) as the live control mode. When **Inactive** is toggled, the pump will not respond to settings in the sub-tab.

NOTE (35)	If the **Inactive/Active** toggle is set to **Inactive** on all sub-tabs, the pump will not run. To run the pump, make sure that it is connected to WM Connect and then toggle a control mode to **Active**.

15.5.2.4 Control tab—Fixed speed (DriveSure ADC only)

The **Fixed Speed** sub-tab lets you set a fixed speed for the DriveSure ADC pump.

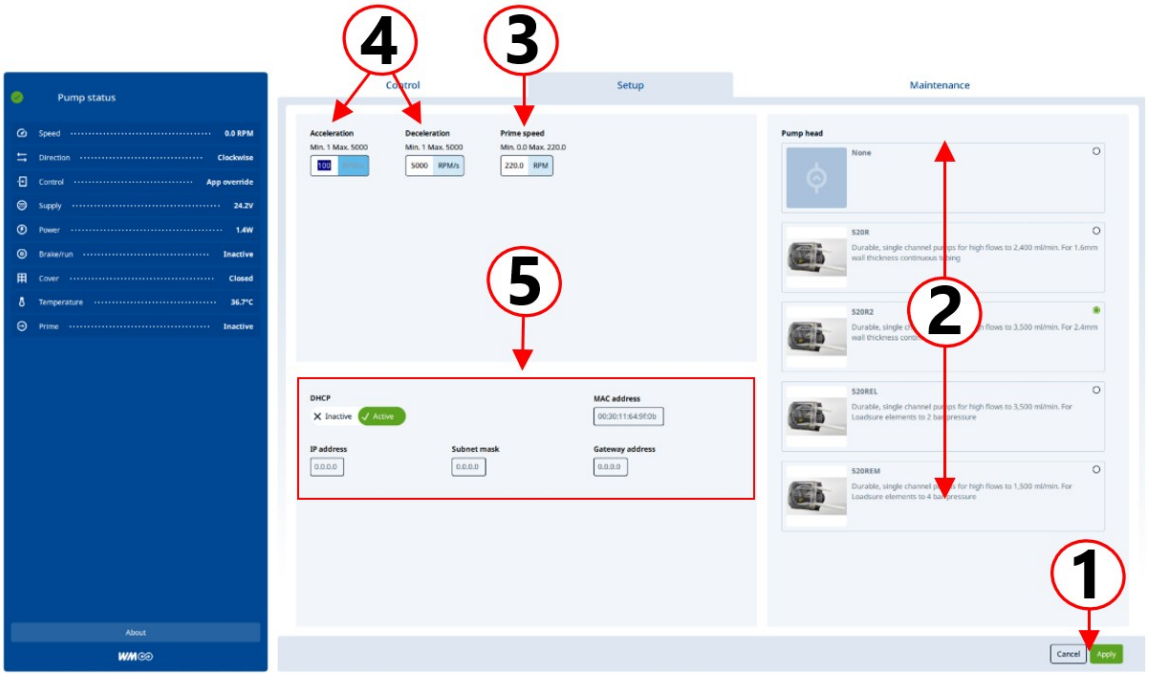


Area		Function
Number	Name	
1	Inactive/Active toggle	When **App Override** is **Active**, the selected parameters will override other control modes. Toggle **Active** to set the **Fixed Speed** sub-tab as the live control mode. When **Inactive** is toggled, the pump will not respond to settings in this sub-tab.(36)
2	Speed (RPM)	Set the pump's speed. The maximum speed is set by the software and depends on the fitted pumphead.
3	Edit/Cancel/Apply	Click **Edit** to change the **Fixed Speed**. Click **Apply** to apply changes or **Cancel** to discard them.

NOTE (36)	If the **Inactive/Active** toggle is set to **Inactive** on all sub-tabs, the pump will not run. To run the pump, make sure that it is connected to WM Connect and then toggle a control mode to **Active**.

15.5.3 Setup tab

The **Setup** tab lets you set the parameters for speed, select the correct pumphead, and edit network settings. The options that are available depend on the DriveSure model.



DriveSure Model	Area		
	Number	Name	Function
ADC, En, Pn	1	Edit/Cancel/Apply button	Click **Edit** to change parameters on the **Setup** tab. Click **Apply** to apply changes or **Cancel** to discard them.
ADC, En, Pn	2	Pumphead	Make sure that the correct pumphead is selected.
ADC, En, Pn	3	Prime speed (37)	Set the **Prime Speed** if a priming function has been set up on your device or system using the DriveSure prime switch input: see section 13.2.

DriveSure Model	Area		
	Number	Name	Function
ADC, En, Pn	4	Acceleration and Deceleration (37)	**Acceleration:** Set the time it takes for the pump speed to increase to its set speed. **Deceleration:** Set the time it takes for the pump speed to decrease to 0 RPM from its set speed.
En, Pn	5	Network settings	Toggle **Active** to set to **DHCP** mode. Toggle **Inactive** to set to **Static** mode (39) and to edit network parameters (**IP address**, **Subnet mask**, and **Gateway address**). (38)

NOTE (37) The pump must be stopped when speeds are set.

NOTE (38) If you enable DHCP, your static IP will not be stored.

NOTE (39) If you set a static IP address when the pump is not connected to the network, the values shown will change to 0.0.0.0 until connected. When the pump is connected to the network, the values entered will be used by the pump and shown in WM Connect.

15.5.3.1 Changing the programmed pumphead

Information about the installed pumphead is programmed into the drive to make sure that it does not run at more than its maximum design speed.

You can use WM Connect to select a different pumphead when:

- The drive is supplied without a pumphead.
- The pumphead model is changed.

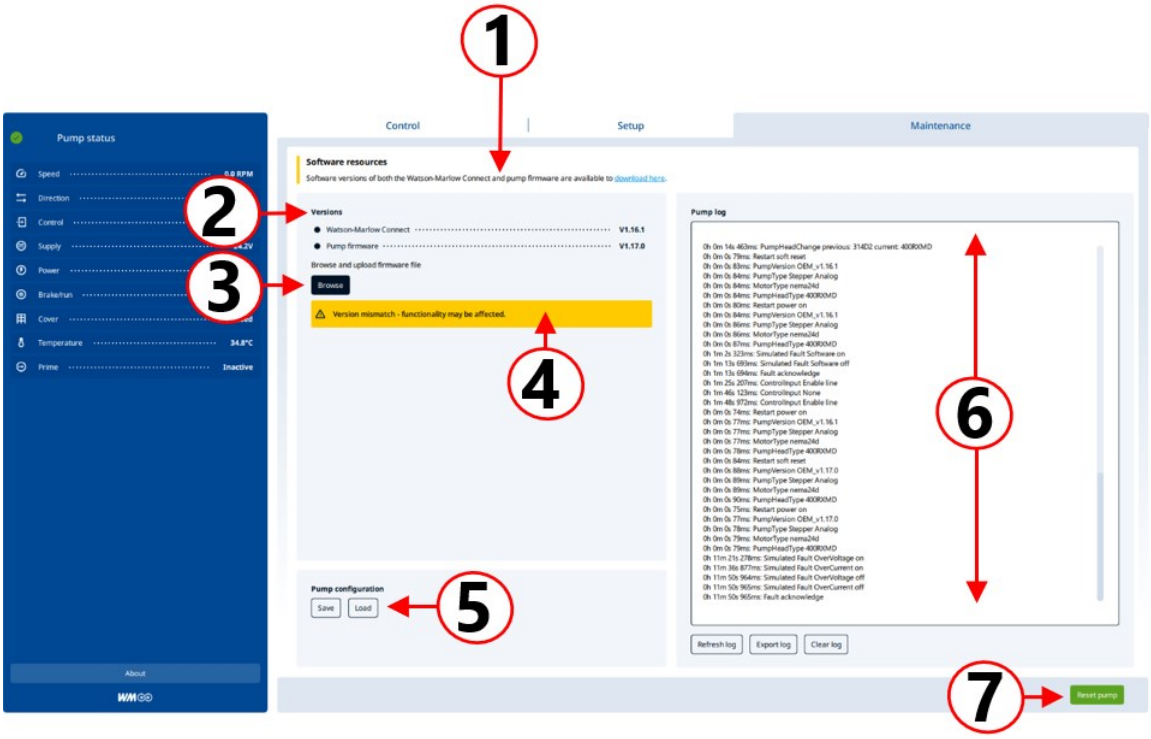
Under all other conditions, the programmed pumphead must not be changed using WM Connect.

CAUTION

Operating the pump with the incorrect pumphead programmed into the drive can cause the pumphead to run at more than its maximum design speed. This can cause pumphead failure, drive failure, or other hazards. Make sure that the pumphead model is the same as the programmed pumphead.

15.5.4 Maintenance tab

The **Maintenance** tab lets you check and update the firmware version, save and load pump configuration files, and view the pump log.



Area		Function
Number	Name	
1	Software resources	Download the latest software and pump firmware versions.
2	Versions	Check the pump firmware and software version numbers. If the version numbers are different, some functions may be degraded or unavailable.
3	Browse button	Click **Browse** to upload pump firmware files from your computer.
4	Version mismatch	A yellow **Version Mismatch** warning identifies that the pump firmware and software version numbers are different. A version mismatch is also identified by a red dot in the top-right corner of the **Maintenance**, **Control**, and **Setup** tabs.

Area		Function
Number	Name	
5	Pump configuration	Click **Save** to save the current pump configuration as a .JSON file. Click **Load** to load a configuration file that you have previously saved.
6	Pump log	The **Pump Log** holds a record of all events. Click **Refresh** to update the Pump Log. You can also **Export** or **Clear** the Pump Log.
7	Reset pump button	Click **Reset Pump** if the software operates unusually.

16 OPERATION

This section provides guidance to assist a responsible person with the preparation of operator instructions.

These instructions may only be referenced by a responsible person. A responsible person must produce final safety information [(40)] and instructions (installation, operation, and maintenance) for the piece of equipment into which a DriveSure pump will be integrated.

An operator must not use these instructions for reference.

NOTE [(40)]	The form and format of the final safety information and instructions are dependent upon the final design, residual risks, and certification requirements of the piece of equipment into which a DriveSure pump will be integrated.

16.1 Pre-operation checklist

A pre-operation checklist should consider the following points. Make sure that:

- Pump has been installed by a responsible person for each of the installation chapters.
- A responsible person can confirm:
    - Power cable is not damaged.
    - Control cable(s) is not damaged.
    - Integrated cover-open sensor cable is not damaged.
    - Integrated cover-open sensor system has been tested.
- Pumphead cover is closed.
- Leaks of fluid from any connection with the pump stationary.

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 by a responsible person until the matter is resolved.

16.2 Safety

16.2.1 Hazards that may occur during operation

The following hazards may occur during operation of the pump.

16.2.1.1 Rotating parts

CAUTION

Do not open the pumphead cover to stop a pump which is rotating. The pump must be stopped or started using the control system. In an emergency—stop the pump using the electrical power isolation switch.

16.2.1.2 Unexpected operation

CAUTION

Pump models which are controlled by a control system may operate unexpectedly in response to the control system. Obtain training from a responsible person on the expected operation of the pump by the control system prior to operation of the pump.

16.2.1.3 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.

16.2.1.4 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.

17 CLEANING

17.1 Overview

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

A responsible person must:

- Carry out a risk assessment to approve fresh water as a 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 the application, using the general procedure provided below as guidance.

17.2 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.

18 MAINTENANCE

18.1 Spare parts and accessories

A DriveSure pump is available with the following Watson-Marlow spare parts and accessories:

18.1.1 Drive

Type	Product name	Product code
Power cable	1 m (3.28 Ft) 12 to 48 V DC power cable	009.1PW.DVS
	3 m (9.84 Ft) 12 to 48 V DC power cable	009.3PW.DVS
Cable pack (41)	DriveSure cable pack - 24 V power supply/USB-C - trials only	009.24CP.DVS
	DriveSure cable pack - 48 V power supply/USB-C - trials only	009.48CP.DVS
Control cable (42)	DriveSure ADC 1m (3.28 ft) control cable	009.1CC.DVS
	DriveSure ADC 3m (9.84 ft) control cable	009.3CC.DVS
	Ethernet Cable, RJ45 to RJ45, CAT 5e SHIELDED, 3m (9.84 Ft)	059.9123.000
	PROFINET Cable, RJ45 to RJ45, CAT 5e SHIELDED, 3m (9.84 Ft)	059.9128.000

NOTE (41) The cable pack is for trial use only. It includes an AC to DC power adapter and USB-C cable. The power adapter in the cable pack does not include the mains power lead. These can be ordered separately with the correct country plug. Contact your local Watson-Marlow representative for more information.

NOTE (42) DriveSure ADC pump is supplied with a control cable, which is also available as a spare part. A DriveSure En or Pn pump is not supplied with a control cable, these cables may only be purchased as an accessory.

18.1.2 Pumphead

Type	Product name	Product code
Pumphead mounting plate	100 Series pumphead mounting plate	019.IPMP.DVS
	300 Series pumphead mounting plate	039.IPMP.DVS
	400/RXMD pumphead mounting plate (43)	Not applicable
	500 Series pumphead mounting plate	059.IPMP.DVS
Tubing	Contact your local Watson-Marlow representative for product code	
Fluid connectors	Contact your local Watson-Marlow representative for product code	

NOTE (43) 400/RXMD pumpheads mounting plates are not replaceable by a user. If a new mounting plate is required, remove the pump from service and contact your local Watson-Marlow representative to discuss the replacement of the mounting plate by Watson-Marlow.

18.2 Electrical maintenance

18.2.1 Drive maintenance

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

Do not attempt to repair or replace any part of the drive.

18.2.2 Replacement of power cable

The power cable is detachable. If the power cable or power cable connection becomes damaged, remove the pump from service and contact your local Watson-Marlow representative to order a new power cable.

Do not replace the power cable with a non-Watson-Marlow power cable. This requirement is to protect against either inadequately rated cables, or incorrect polarity.

18.2.3 Replacement of fuses

A DriveSure pump does not contain any replaceable fuses. Overcurrent protection, such as an external replaceable fuse in the electrical power supply circuit, is a requirement of the users electrical installation: see section "Installation—Electrical power " on page 82.

18.3 Pumphead maintenance

18.3.1 Life of peristaltic tubing

The peristaltic tubing used in the pumphead is a key consumable item. It is not possible for Watson-Marlow to predict the precise life of the tubing due to multiple factors including speed, chemical compatibility, and pressure.

Either of the following are an indication that the tubing is near its end of life:

- The flow rate 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 the tubing roller pinch points when the pump is stopped.

These indications can be used to monitor the life of a tubing so that it may be changed prior to failure.

18.3.2 Replacing the peristaltic tubing in the pumphead

Follow these procedures to replace the tubing or element with the same size and material tubing which has been used. If a different size or material is used, it will be necessary to re-adjust the tube clamps, and the procedure for installing the tubing for the first time should be used instead: see section 14.6.

18.4 100 Series: Replacing the peristaltic tubing

1. Stop pump and isolate from electrical power.
2. Drain down and disconnect the fluid path in accordance with your organisation's procedure.
3. Fully open the flip top cover.

4. Ensure that tube clamps are correctly set for size of tube.
5. Place tube between rotor rollers and track, and press against inner wall.

6. Check that tube is not twisted or stretched and is inside the tube clamps.

7. Lower flip top to fully closed position, this will automatically tension the tube correctly.

8. Check that tubing is in the position shown. Do not add extra tension to the tube.

9. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

18.5 300 Series: Replacing the peristaltic tubing

1. Stop pump and isolate from electrical power.
2. Drain down and disconnect the fluid path in accordance with your organisation's procedure.
3. Fully open the flip top cover.

4. Ensure that tube clamps are correctly set for size of tube.
5. Place tube between rotor rollers and track and press against inner wall.

6. Check that tube is not twisted or stretched and is inside the tube clamps.

7. Lower flip top cover to fully closed position, this will automatically tension the tube correctly.

8. Check that tubing is in the position shown. Do not add extra tension to the tube.

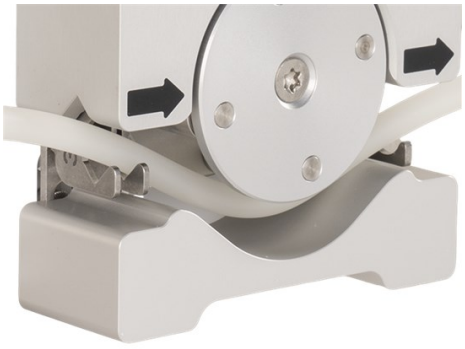
9. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

18.6 400/RXMD: Replacing the peristaltic tubing

1. Stop pump and isolate from electrical power.
2. Drain down and disconnect fluid path in accordance with your organisation's procedure.
3. Fully open flip top cover.

4. Ensure the correct tubing size for the tube clamps will be installed.
5. Place tube between rotor rollers and track, ensuring that tubing is seated.

6. Check that tube is not twisted or stretched and is inside the tube clamps.



7. Lower flip top cover to fully closed position, this will automatically tension the tube correctly. Do not add extra tension to the tube.

8. Connect the peristaltic tubing to the fluid path in accordance with your organisation’s procedure.
9. Bring the pump into service, checking for any leaks from fluid path connections

18.7 500 Series tube replacement R and R2

1. Stop the pump.
2. Isolate the pump from electrical power.
3. Drain down the fluid path in accordance with your organisation's procedure.
4. Disconnect the peristaltic tubing from the fluid path, in accordance with your organisation's procedure.
5. Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise with a flat-head screwdriver.

6. Open the cover to its full extent to create maximum clearance for the tube ports.

7. Unclip the tubing from the top and bottom tubing clamps.
8. Remove tubing from around the rotor, being careful with any remaining fluid which may create a hazard.
9. Safely dispose of the used tubing according to local health and safety regulations for contaminated items.
10. Check the rotor rollers spin freely.
11. Check the rotor is clean.
12. Check the pumphead is clean.
13. Mark a 225 mm length onto the section of the tubing which is to be located into the pumphead.

14. Open the lower spring-loaded tube clamp and locate tubing, with the first 225 mm length mark aligned to the inside face of the spring-loaded part of the tube clamp. Release the clamp.

15. Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.

16. Feed the tubing around the pumphead track, turning the rotor as necessary. Make sure the tubing is not twisted.

17. Ensure that the second 225 mm mark is adjacent to the inner edge of the upper tube clamp. Open the upper spring-loaded tube clamp and locate the tubing into it, making sure there is no residual twist in the tubing, and that the tube sits centrally between the tube guide rollers. Release the clamp.

18. Check the spring-loaded tube clamps grip the tubing tightly enough to stop it moving in and out of the pumphead but do not over-squeeze the tube. Adjust the sliders to prevent tube movement during a few trial rotations of the rotor. The outer position will allow the clamps to grip the tube tightly and the inner will grip the tube loosely.

19. Close the cover, pushing it fully home until the latch engages.

20. Reconnect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
21. Bring the pump back into service, checking for any leaks from fluid path connections.
22. If using Marprene or Bioprene, re-tension the tubing after the first 30 minutes of operation, as the tube may grow in length during this bedding in time. Repeat all previous steps in this procedure to re-tension the tube.

18.8 500 Series tube element replacement – REL and REM pumpheads

1. Isolate the pump from electrical power.
2. Drain down the fluid path in accordance with your organisation's procedure.
3. Disconnect the peristaltic tubing from the fluid path, in accordance with your organisation's procedure.
4. Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise with a flat-head screwdriver.

5. Open the cover to its full extent to create maximum clearance for the tube ports.
6. Place one connector end of the element into the lower housing.

7. Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.

8. Feed the tubing element around the pumphead track, turning the rotor as necessary.

9. Place the opposite connector end of the element into the top housing. Making sure the element is not twisted and sits centrally between the rollers.

10. Close the cover, pushing it fully home until the latch engages.

11. Connect the peristaltic tubing to the fluid path in accordance with your organisation's procedure.
12. Bring the pump back into service, checking for any leaks from fluid path connections.

18.9 Replacing the pumpheads

Follow the procedures below to replace entire pumpheads. If a different pumphead than the original pumphead is required, contact your local Watson-Marlow representative for advice on what pumphead may be installed. For information about programming a new pumphead to the drive, see section 15.5.3.1.

CAUTION

Operating the pump with the incorrect pumphead programmed into the drive can cause the pumphead to run at more than its maximum design speed. This can cause pumphead failure, drive failure, or other hazards. Make sure that the pumphead model is the same as the programmed pumphead.

18.10 100 Series pumphead

1. Isolate pump from power supply.
2. Fully open flip top cover and remove the 2 retaining fasteners.

3. Disengage the pumphead from mounting plate and replace with new pumphead.

4. Secure the replacement pumphead to mounting plate with 2 retaining fasteners.

18.11 300 Series pumphead

1. Isolate pump from power supply.
2. Press down clip-on right side of mounting plate and rotate pumphead anticlockwise to disengage from mounting plate.

3. Place new pumphead on to mounting plate and rotate clockwise until the clip moves up and engages the pumphead.

18.12 400/RXMD pumphead

400/RXMD pumpheads are not replaceable. If the RXMD pumphead requires replacement, remove the pump from service and contact your local Watson-Marlow representative to discuss how the pump can be repaired or replaced.

Do not attempt to repair or replace the RXMD pumphead.

18.13 500 Series pumphead

1. Isolate pump from power supply.
2. Unlock the pumphead cover by turning the cover fastener ¼ turn anticlockwise.

3. Remove rotor hub by lifting dust cover and removing the securing fastener.

4. Remove the 4 securing fasteners.

5. Remove pumphead from mounting plate and replace with new pumphead.

6. Secure replacement pumphead to mounting plate with 4 retaining fasteners.

7. Attach rotor hub by lifting dust cover and installing securing fastener.

8. Close the pumphead cover and lock by turning the cover fastener ¼ turn clockwise.

19 ERRORS, BREAKDOWN, AND TROUBLESHOOTING

This section will provide information on errors or a breakdown which may occur during typical operation of the pump, along with potential causes to assist with troubleshooting. It is not possible to provide comprehensive information on errors, breakdown, or troubleshooting, due to the partially completed nature of the product.

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

19.1 Errors

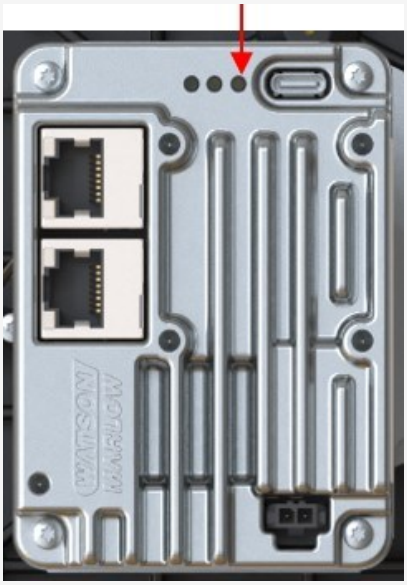
19.1.1 Error indication

All models of a DriveSure pump feature indication of an error:

Indication precision	Indication source	Model
Precise error specified	Integrated controller drive status LED	All models
	WM Connect PC Software	All models
	Network reporting	DriveSure En, Pn only
General error, indicating that 1 of the 7 error types is present	From error signal output (pin 1)	DriveSure ADC only

19.1.2 Error indication from integrated controller status LED

The integrated controller has a status LED which indicates status and errors. The location of this LED is the same on all models.

DriveSure ADC	DriveSure En, Pn
	

19.1.3 Status LED and error types

<table>
<tr><th>Status LED colour</th><th>Description</th></tr>
<tr><td>No colour (off)</td><td>No power</td></tr>
<tr><td>Green</td><td>Pumphead cover closed, normal operation</td></tr>
<tr><td>Amber</td><td>Pumphead cover open</td></tr>
<tr><td>Red, Flashing</td><td>
<table>
<tr><th>Flashes (Red LED)</th><th>Error</th><th>Reason for error</th></tr>
<tr><td>1</td><td>Overvoltage</td><td>Power supply voltage > 52.8 V DC (48 V DC +10%).</td></tr>
<tr><td>2</td><td>Undervoltage</td><td>Power supply voltage < 10.8 V DC (12 V DC -10%).</td></tr>
<tr><td>3</td><td>Overcurrent</td><td>Excessive current detected on drive.</td></tr>
<tr><td>4</td><td>Software</td><td>Pump firmware error.</td></tr>
<tr><td>5</td><td>Stall</td><td>Drive cannot rotate when driven at maximum torque.</td></tr>
<tr><td>6</td><td>Over Temperature</td><td>PCB temperature sensor > 85 °C.</td></tr>
<tr><td>7</td><td>Hardware</td><td>Drive internal fault.</td></tr>
</table>
</td></tr>
</table>

19.1.4 Error reporting

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

19.2 Breakdown

19.2.1 Tubing/Element end of life

Peristaltic tubing or element will reach its end of life due to:

- **Wear**—The tubing or element has reached its normal end of life point due to wear.
- **Overpressure**—As a result of being subjected to a pressure greater than the maximum rating of the tubing or element.
- **Chemical incompatibility**—As a result of being used with chemicals which are incompatible with the tubing.

If the tubing or element has failed, follow the procedure in the maintenance section for the replacement of the peristaltic tubing or element.

19.3 Troubleshooting

Problem	Possible cause	Solution
Failure to start	No power to drive	Check the power supply is switched on and the cable is connected.
	Integrated cover-open sensor not connected to the integrated controller	Check the cable connection is securely attached.
	Pumphead cover open	Close the cover.
	Default setting	Make sure that the correct control mode is set to **Active** in WM Connect. See section 15.5.2.1.
	App override	WM Connect lets users override the pump's controls for testing and to simulate faults. Make sure that the **Inactive/Active** toggle is set to **Inactive** in **App Override**. See section 15.5.2.2.
	Version mismatch	Check the pump firmware and software version numbers in the **Maintenance** tab of the WM Connect PC software. If the version numbers are different, some functions may be degraded or unavailable. See section 15.5.4.
	Control signal or network command	Check the control cable is securely connected, and a valid signal is applied within the correct range onto the correct control pin.
	Network command	Check the control cable is securely connected, and the correct network command has been programmed.
Pump temperature high	Pump speed too high	Reduce pump speed.
	Interruption to power supply resulting in localised excess heating from flow interruption	• Check power supply is within specification. • Check power supply cable is securely connected to pump.

Problem	Possible cause	Solution
Reduced fluid flow	Tubing or element bore too small	Increase bore size of tubing or element.
	Torque too high, resulting in drive unable to produce its highest possible speed for the pumphead	• Increase power supply voltage to 48 V DC . • Change tube material. • Reduce discharge pressure. Contact your local Watson-Marlow representative for information on how maximum speeds are reduced due to power supply voltage or torque (tubing material/pressure).
	Inlet pressure too low	• Increase fluid path bore. • Decrease fluid path length. • Decrease fluid viscosity. • Check for fluid path restriction.
	Discharge pressure too high	• Increase fluid path bore. • Decrease fluid path length. • Decrease fluid viscosity. • Check for fluid path restriction.
	Tube clamps not correctly adjusted	Check tubing clamp adjustment using procedures in section 14.6.
Vibration	Pump speed too high	Reduce pump speed. The same flow rates at lower speeds may be achieved by using a larger tube or element bore.
	Peak pulsation pressure too high	• Reduce pump speed. • Increase fluid path bore. • Reduce fluid path length.
	Fluid path not secured	Secure fluid path correctly.

Problem	Possible cause	Solution
Short tube life	Chemical in-compatibility	Check chemical compatibility of pumped fluid with tubing or element material.
	Pump speed too high	Reduce pump speed. The same flow rates at lower speeds may be achieved by using a larger tube or element bore.
	Discharge pressure too high	• Increase fluid path bore. • Decrease fluid path length. • Decrease fluid viscosity. • Check for fluid path restriction.
	Occlusion of tubing incorrect	Check tube clamp setting.

19.4 Technical support

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

19.4.1 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/*

19.4.2 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

19.5 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:

- shall the cost of the customer’s exclusive remedy exceed the purchase price of the product;
- 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.

19.5.1 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 with Watson-Marlow recommendations.
- 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.

19.5.2 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.
- 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.

19.6 Returning products

Before returning products, they must be thoroughly cleaned/decontaminated. A decontamination declaration, confirming this must be completed and returned to us in advance of the item being shipped.

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.

A copy of the appropriate decontamination declaration can be downloaded from the Watson-Marlow website at https://www.wmfts.com/decon/

If you have any queries, then please contact your local Watson-Marlow representative for further assistance at www.wmfts.com/contact.

20 CHEMICAL COMPATIBILITY

20.1 Overview

Chemical incompatibility with product materials of construction, could result in the creation of a hazard which would affect the pump, personnel or the operating environment.

A responsible person, must follow the chemical compatibility procedure in section "Procedure to check chemical compatibility" on page 194 to determine if the product is suitable for the intended application in accordance with the user organisations policies and risk control methods.

The material of construction by item group concept is introduced prior to reference during the chemical compatibility procedure in section "Procedure to check chemical compatibility" on page 194

20.2 Materials of construction

20.2.1 Abbreviations (sub section)

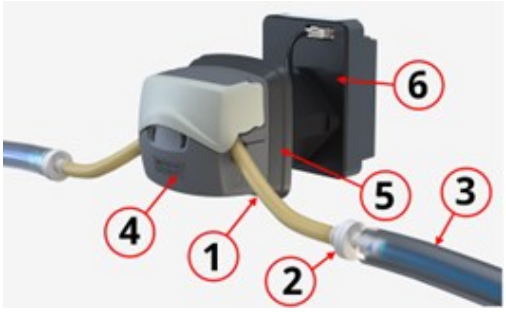
The following abbreviations may be used in this section:

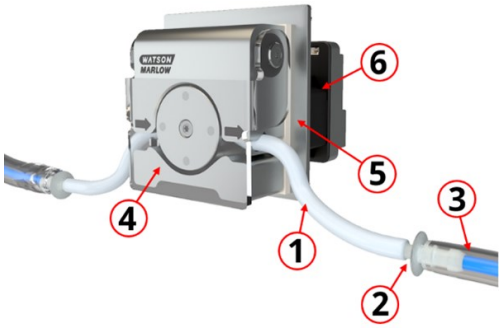
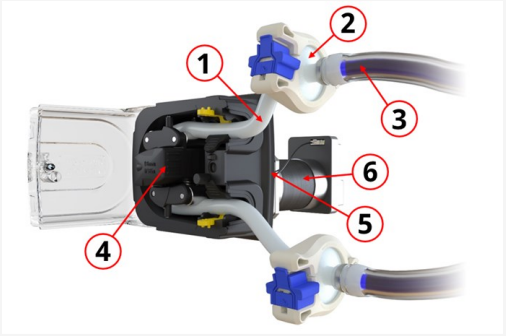
Abbreviation	Full name
ABS	**A**crylonitrile **b**utadiene **s**tyrene
ePTFE	**E**xpanded **P**oly**t**etra**f**luoro**e**thylene
PARA	**P**oly**a**c**r**yl**a**mide
PBT	**P**oly**b**utylene **T**erephthalate
PC	**P**oly**c**arbonate
PPS	**P**oly**p**henylene **s**ulphide
PTFE	**P**oly**t**etra**f**luoro**e**thylene
PVC	**P**oly**v**inyl**c**hloride
PVDF	**P**oly**v**inylidene **di**fluoride
SEBS	**S**tyrene-**e**thylene-**b**utylene **s**tyrene

20.2.2 Identification of item groups

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

he general arrangement of a pumphead is provided in the image below

100 Series	300 Series
	

400/RXMD	500 Series
	

Item Number	Name
1	Peristaltic tubing (or element)
2	Fluid path connection
3	Fluid path tubing/pipework
4	Pumphead
5	Pumphead mounting plate assembly
6	Drive

20.2.3 Materials of construction of item groups

The material of construction of each item group is provided in the sub sections below:

20.2.3.1 Item group 1: Peristaltic tubing (or element tubing)

Tubing name	Material
Marprene	Thermoplastic elastomer
Bioprene	Thermoplastic elastomer
Pumpsil	Platinum cured silicone
Pureweld XL	SEBS
Sta-Pure PCS	ePTFE and platinum-cured silicone composite
Sta-Pure PFL	ePTFE and platinum-cured perfluoroelastomer
Tygon E-LFL	PVC
Tygon E-3603	PVC

20.2.3.2 Item group 2: Fluid path connection

For applications using a fluid path connection, the materials of construction of this connection must be considered.

The fluid connection may be a single item such as tube to tube barb, or may be a multi part item including a

- Fluid connector (44)
- Fluid connector gasket
- Clamp or other fastener to bind connections

For Watson-Marlow supplied product contact your local Watson-Marlow representative to discuss the materials of construction of this item group.

NOTE (44)	In addition to the tubing material, LoadSure elements, which are used with the 520REL and 520REM pumpheads, have PVDF fluid connectors built into it.

20.2.3.3 Item group 3: Fluid path tubing/pipework

The fluid path tubing or pipework may be single or multi material item. For Watson-Marlow supplied product contact your local Watson-Marlow representative to discuss the materials of construction of this item group.

20.2.3.4 Item group 4: Pumphead

<table>
<tr><th rowspan="2">Subcomponent name</th><th colspan="5">Material</th></tr>
<tr><th>100 Series</th><th colspan="3">300 Series</th><th>400/RXMD</th><th>500 Series</th></tr>
<tr><td rowspan="4">Pumphead body assembly</td><td rowspan="2">Grilamid PA12</td><td colspan="3" rowspan="2">Glass filled polypropylene</td><td rowspan="4">Anodised Aluminium</td><td>Acetal</td></tr>
<tr><td>Aluminium</td></tr>
<tr><td rowspan="2">PARA (IXEF)</td><td colspan="3">PARA (IXEF)</td><td>Aluminium alloy</td></tr>
<tr><td colspan="3">Stainless steel</td><td>Brass</td></tr>
<tr><td rowspan="2">Pumphead rotor assembly</td><td rowspan="2">PARA (IXEF)</td><td>Glass filled nylon</td><td>Aluminium</td><td>Aluminium</td><td rowspan="2">Anodised Aluminium</td><td>PPS</td></tr>
<tr><td colspan="3">Electroless nickel plated hardened steel</td><td>Stainless steel 316</td></tr>
<tr><td>Pumphead roller assembly</td><td>PTFE filled PBT</td><td>MoS2 filled Nylon 6 (Nylatron)</td><td>Rollers (Nylatron GS)</td><td>Rollers Acetal (Polyoxymethylene/POM)</td><td>Stainless Steel</td><td>MoS2 filled Nylon 6 (Nylatron)
PPS
Stainless steel 316</td></tr>
<tr><td>Pumphead cover</td><td>PARA (IXEF)</td><td colspan="3">PARA (IXEF)</td><td>Acrylic Glass</td><td>PC</td></tr>
<tr><td>Intgrated cover-open sensor magnet</td><td colspan="6">Nickel coated neodymium</td></tr>
<tr><td>Pumphead track</td><td>PARA (IXEF)</td><td colspan="3">PARA (IXEF)</td><td>Anodised Aluminium</td><td>PPS</td></tr>
</table>

20.2.3.5 Item group 5: Pumphead mounting plate assembly

Subcomponent name	Material of construction			
	100 Series	300 Series	400/RXMD	500 Series
Mounting plate	PARA (Halogen free, UL94 V-0 rated)	PARA (Halogen free, UL94 V-0 rated)	Aluminium	PARA (Halogen free, UL94 V-0 rated)
Mounting plate seal	Thermoplastic elastomer (TPE)	Thermoplastic elastomer (TPE)	N/A	Thermoplastic elastomer (TPE)
Shaft seal	Nitrile	Nitrile	N/A	Nitrile
Gearbox fixing screws	N/A	N/A	N/A	Stainless steel
O-ring seal	N/A	N/A	N/A	Nitrile

20.2.3.6 Item group 6: Drive

Subgroup	Subcomponent name	Material			
		100 Series	300 Series	400/RXMD	500 Series
Motor	Motor endcaps	Aluminium			
	Driveshaft	Plasma nitride coated stainless steel			N/A
Gearbox	Gearbox casing	N/A	N/A	N/A	Aluminium
	Driveshaft	N/A	N/A	N/A	Stainless steel
	Driveshaft seal	N/A	N/A	N/A	Nitrile
Controller	Housing (Rear)	ABS/PC, Aluminium			
	Housing (Front)	Aluminium			
	Light pipe	PC			
	Fixing screws	Stainless steel			

20.3 Procedure to check chemical compatibility

1. Using section "Materials of construction of item groups" on page 191, Determine the materials of construction that would be wetted by scenario 1A and 1B:

   1A: Item group 1, 2 and 3: Normally wetted by the fluid path

   1B: Item group 4, 5 and 6: Not normally wetted, or 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 or element fails, resulting in spillage or leakage of the pumped fluid onto materials of construction in item group 4 (pumphead), item group 5 (pumphead mounting plate assembly

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

   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 tubing and elements, use the tubing name.

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

3. Do a risk assessment to determine the effect, and risk control methods a responsible person may take as a result of failure due to chemical incompatibility with the materials of construction, resulting in the following hazards:

   - Chemical hazard from release of chemicals
   - Physical hazard from the release of pressure or material fragments
   - Other hazards not listed here

4. Using the hazard analysis and identified risk control methods in step 3, in accordance with the users organisations policies, a responsible person must decide if the product is suitable for the intended application.

21 COMPLIANCE

21.1 Compliance marking

21.1.1 Location of compliance marking

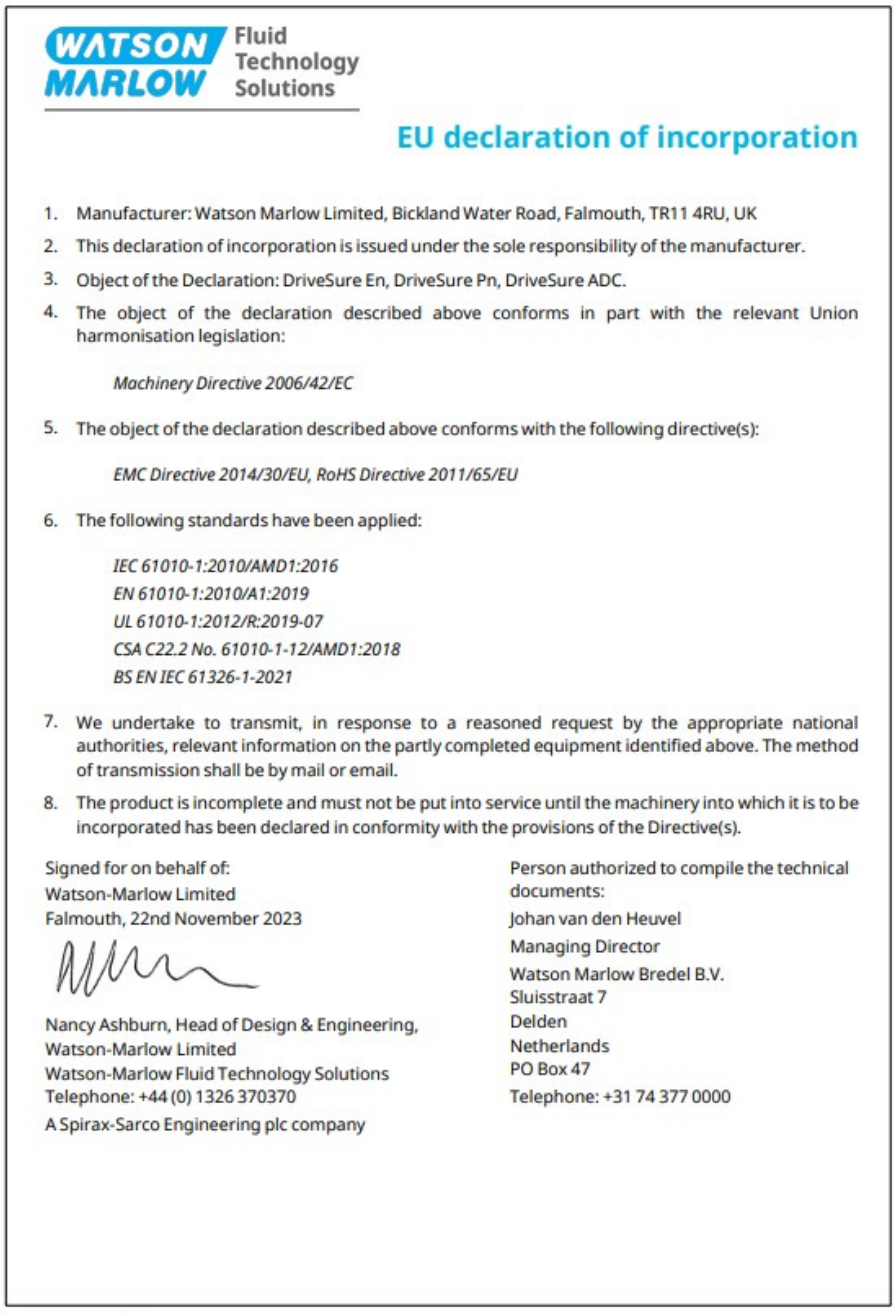
The product is marked to demonstrate compliance. These markings may be identified on the product in the location, illustrated by the picture below:

21.1.2 Description of compliance marking

Compliance mark	Description
CE	Complies with the applicable marking regulations, listed on the Declaration of Incorporation.
UK CA	Complies with the applicable marking regulations, listed on the Declaration of Incorporation.
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
	Complies to the applicable requirements of ACMA (Australian Communications and Media Authority)

21.2 Certification and declaration

21.2.1 EU declaration of incorporation



WATSON MARLOW Fluid Technology Solutions

EU declaration of incorporation

1. Manufacturer: Watson Marlow Limited, Bickland Water Road, Falmouth, TR11 4RU, UK
2. This declaration of incorporation is issued under the sole responsibility of the manufacturer.
3. Object of the Declaration: DriveSure En, DriveSure Pn, DriveSure ADC.
4. The object of the declaration described above conforms in part with the relevant Union harmonisation legislation:

   Machinery Directive 2006/42/EC

5. The object of the declaration described above conforms with the following directive(s):

   EMC Directive 2014/30/EU, RoHS Directive 2011/65/EU

6. The following standards have been applied:

   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
   BS EN IEC 61326-1-2021

7. We undertake to transmit, in response to a reasoned request by the appropriate national authorities, relevant information on the partly completed equipment identified above. The method of transmission shall be by mail or email.
8. The product is incomplete and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive(s).

Signed for on behalf of:
Watson-Marlow Limited
Falmouth, 22nd November 2023

Nancy Ashburn, Head of Design & Engineering,
Watson-Marlow Limited
Watson-Marlow Fluid Technology Solutions
Telephone: +44 (0) 1326 370370
A Spirax-Sarco Engineering plc company

Person authorized to compile the technical documents:
Johan van den Heuvel
Managing Director
Watson Marlow Bredel B.V.
Sluisstraat 7
Delden
Netherlands
PO Box 47
Telephone: +31 74 377 0000

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