


# 205S, 205U



## Declarations

<b>Declaration of conformity</b> 	<b>When this pump unit is used as a stand alone pump it complies with: Machinery Directive 2006/42/EC, EMC Directive 2004/108/EC.</b>
<b>Declaration of Incorporation</b>	<b>When this pump unit is to be installed into a machine or is to be assembled with other machines for installations, it must not be put into service until the relevant machinery has been declared in conformity with the Machinery Directive 2006/42/EC.</b>

Responsible person: Christopher Gadsden, Managing Director, Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Telephone 01326 370370 Fax 01326 376009.



## Two year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited, its subsidiaries, or its authorised distributors, to repair or replace free of charge, including labour, any part of this product which fails within two years of delivery of the product to the end user. Such failure must have occurred because of defect in material or workmanship and not as a result of operation of the product other than in accordance with the instructions given in this manual.

Conditions of and specific exceptions to the above warranty are:

- Consumable items such as tubing and rollers are excluded.
- Products must be returned by pre-arrangement carriage paid to Watson-Marlow Limited, its subsidiaries, or its authorised distributor.
- All repairs or modifications must have been made by Watson-Marlow Limited, its subsidiaries, or its authorised distributors or with the express permission of Watson-Marlow Limited, its subsidiaries, or its authorised distributors.
- Products which have been abused, misused, or subjected to malicious or accidental damage or electrical surge are excluded.

Warranties purporting to be on behalf of Watson-Marlow Limited made by any person, including representatives of Watson-Marlow Limited, its subsidiaries, or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow Limited unless expressly approved in writing by a Director or Manager of Watson-Marlow Limited.

## Information for returning pumps

Equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be decontaminated before it is returned to Watson-Marlow or its distributor.



A certificate included at the rear of these operating instructions, or signed statement, must be attached to the outside of the shipping carton.

This certificate is required even if the pump is unused. If the pump has been used, the fluids that have been in contact with the pump and the cleaning procedure must be specified along with a statement that the equipment has been decontaminated.

## Safety

In the interests of safety, this pump and the tubing selected should only be used by competent, suitably trained personnel after they have read and understood this manual, and considered any hazard involved.

Any person who is involved in the installation or maintenance of this equipment should be fully competent to carry out the work. In the UK this person should also be familiar with the Health and Safety at Work Act 1974.

 	<b>There are dangerous voltages (at mains potential) inside the pump. If access is required, isolate the pump from the mains before removing the cover.</b>
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## Recommended operating procedures

**DO** keep delivery and suction lines as short as possible using a minimum number of swept bends.

**DO** use suction and delivery pipelines with a bore equal to or larger than the bore of the tube fitted in the pumphead. When pumping **viscous** fluids, the losses caused by increased friction can be overcome by using pipe runs with a cross sectional area several times greater than the pumping element.

**DO** fit an extra length of pump tube in the system to enable tube transfer. This will extend tube life and minimise the downtime of the pumping circuit.

**DO** keep the track and rollers clean.

The self-priming nature of peristaltic pumps means valves are not required. Any valves fitted must cause no restriction to flow in the pumping circuit.

**When using Marprene tubing**, after the first 30 minutes of running, re-tension the tube in the pumphead by releasing the tube clamp on the delivery side a little and pulling the tube tight. This is to counteract the normal stretching that occurs with Marprene which can go unnoticed and result in poor tube life.

**Tube selection** The chemical compatibility list published in the Watson-Marlow catalogue is only a guide. If in doubt about the compatibility of a tube material and the duty fluid, request a tube sample card for immersion trials.

## Installation

The 205S and 205U are suitable for single phase mains electricity supplies only.

To ensure correct lubrication of the gearbox the pump should be run only while its feet are standing on a horizontal surface. The pump should be positioned to allow a free flow of air around it.

Set the voltage selector to either 120V for 100-120V 50/60Hz supplies or 240V for 220-240V 50/60Hz supplies.

A mains cable fitted with a moulded plug is supplied with the pump. The wires are colour coded in accordance with the following code:

- 220-240V: Live - Brown; Neutral - Blue; Earth - Green/Yellow.
- 100-120V: Live - Black; Neutral - White; Earth - Green.

## Troubleshooting

Should the pump fail to operate, make the following checks to determine whether or not servicing is required.

- Check that the power switch is on.
- Check the mains supply is available at the pump.
- Check the voltage selector switch is in the correct position.
- Check the fuse in the mains socket.
- Check that the pump is not stalled by incorrect fitting of tubing.

## 205S / 205U Manual operation

- Press the **Man/Auto** key (205U). When the AUT symbol is not flashing the pump is in manual mode.
- Change the set speed by pressing the  $\blacktriangle$  or  $\blacktriangledown$  key. The 205S & 205U speed control ratio is 180:1. This will give a minimum gearbox speed of 0.5rpm and a maximum of 90rpm.
- Change direction by pressing the **CW/CCW** key. Check the flashing **CW/CCW** symbol for actual direction setting (**CW**: clockwise **CCW**: counter clockwise).
- Select the maximum speed: press the  $\blacktriangle$  key and the **Max** key together.
- Select the minimum speed: press the  $\blacktriangledown$  key and the **Max** key together.
- Select the low pulse speed (approx 0.01rpm) indicated by "Lo" on the display by pressing the  $\blacktriangledown$  key again. One more press of the  $\blacktriangledown$  key and the pump will stop and display 0.0rpm.
- The keypad has a locking facility to avoid resetting or tampering. If the pump is stopped, press **Stop** until the padlock symbol illuminates. If the pump is running, press **Start** until the padlock symbol illuminates. All keys will be disabled except for **Start** and **Stop**. Press these keys until the padlock symbol extinguishes to unlock the keypad.
- The pump can be set to automatically restart in its operating state set prior to interruption, or set so that after power is reconnected the pump will remain stopped. To invoke the Auto-restart facility switch off power to the pump at the mains supply. Press the **Start** key down when the mains supply is switched back on until the **!** symbol illuminates. Now press **Start** to start the pump. This facility can be cancelled by turning the mains supply off and then pressing the **Stop** key whilst turning the mains supply back on. The **!** symbol will not be illuminated.
- Press **Start** to start the pump. Press **Stop** to stop the pump.

## 205U Automatic operation

Press the **Man/Auto** key. When the **AUT** symbol flashes the pump is in manual mode.

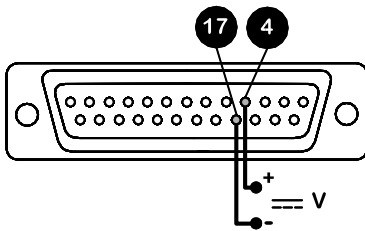
The pump is controllable by an analogue process signal of up to 30V or 32mA. The pump will provide an increasing flow rate for rising control signal (non-inverted response) or an increasing flow rate for falling control signal (inverted response).

- **Signal offset** is the process signal level which has to be reached in order for the pump rotor to start rotating.
- **Signal range** is the change in process signal level necessary to produce the required change in pump rotor speed.

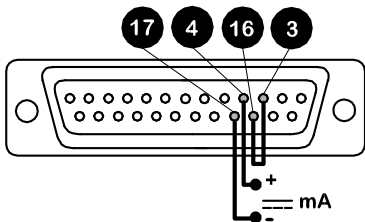
For example, when using a 4mA to 20mA process signal:

Pump response	Signal offset	Signal range
Non-Inverted	4mA	16mA
Inverted	20mA	16mA

For voltage modes a stable variable DC voltage source can be used in conjunction with a DC voltmeter, (maximum 30V DC). (Refer to 25D pin connector wiring detail as an example of control circuitry) Circuit impedance 100 kohms. Polarity set for non-inverted response. Reverse polarity for inverted response.



For current modes the same DC source can be used in conjunction with a DC milliamperemeter, (maximum 32mA). (See 25 pin Dee connector detail). Circuit impedance 250 ohms. Polarity set for non-inverted response. Reverse polarity for inverted response.



**Never apply mains voltage across any pins on the 25D socket. Up to 30V may be applied across pins 4 and 17, and 5V TTL on pins 7 and 5, but no voltage should be applied across other pins. Permanent damage, not covered by warranty may result in both instances. Do not use the mains power switch to control the pump for a high repetition of stop/starts. The auto-control facility should be used.**

## Calibration procedure

- Turn the signal offset potentiometer (marked "Offset" on back panel) clockwise until the slider traverse limit is reached and is signified by a clicking noise. Now turn the potentiometer ten turns anticlockwise. Repeat for the signal range potentiometer. This ensures correct potentiometer set up for calibration.
- Set the process signal offset.
- Turn the signal offset potentiometer clockwise to set the drive shaft speed to the desired minimum.
- Set the process signal at its upper range limit (not exceeding 30V or 32mA).
- Turn the signal range potentiometer (marked "Range" on back panel) clockwise to set the drive shaft speed to the desired maximum.

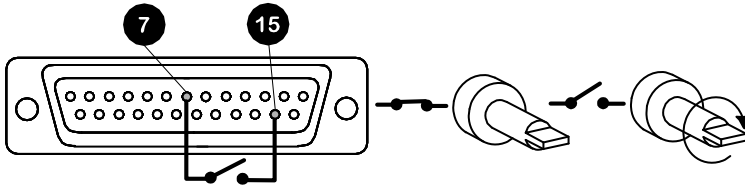
If the process signal or drive speed are set above their designated maximums the drive will be overloaded which is signified by the flashing of **AUT**. This is an indication of the limiting control and speed levels of the drive. Reset to operate within these levels.

- Repeat the procedure until pump response coincides exactly with the process signal.

## Remote control

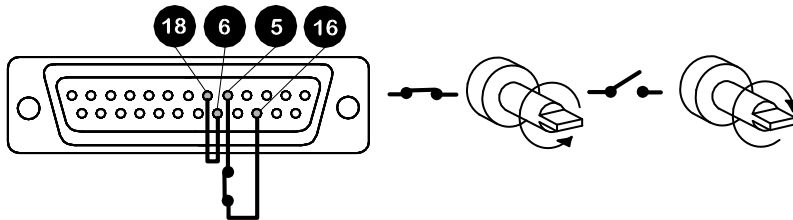
### Stop/Start

Connect remote switch between pins 7 and 15 of the 25D connector. A TTL compatible logic input (Low 0V, High 5V) may be applied to pin 7. Low input stops the pump, high input runs the pump. With no connection, the pump will default to running.



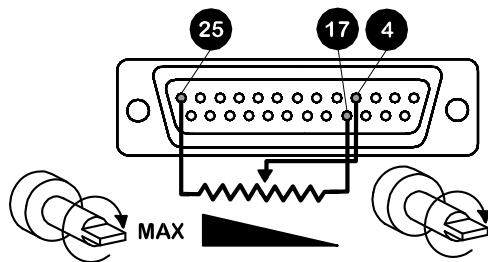
### Direction

Connect remote switch between pins 5 and 16 and disable the front panel reversing control by linking pins 6 and 18 of the 25D connector. Open switch for clockwise rotation, close for counter-clockwise. Alternatively a TTL compatible logic input (Low 0, High 5V) may be applied to pin 5. Low input will run the pump in a counter-clockwise direction, High input in a clockwise rotation. No connection; the pump will default to clockwise rotation.



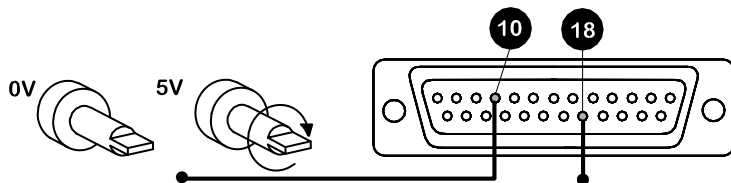
### Speed

A remote potentiometer with a nominal value of between 1k and 2k with a minimum of 0.25W should be wired as shown. When using a remote potentiometer, do not apply a voltage/current control input signal at the same time. The speed control signal will require calibration relative to the minimum and maximum settings of the potentiometer. Use the offset and range potentiometers as described under calibration.



### Strobe

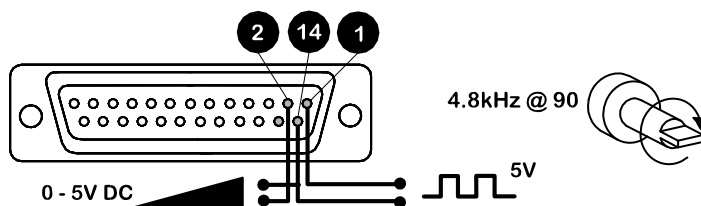
The state of the pump may be monitored by utilising a 5V Hi Lo signal available at the 25D remote socket on the pump rear panel. The strobe line will change state as soon as the motor starts or stops.



### Tachometer output

This facility can be used to indicate motor speed or total the number of motor revolutions.

- 90rpm 4.8 kHz



## Error messages

If a fault condition is detected in the drive unit it will stop, all keys will be disabled, and the display will flash:

<b>Er1</b>		Tachometer fault
<b>Er2</b>		Over temperature error
<b>Er3</b>		EEPROM error
<b>Er4</b>		EEPROM read error
<b>Er5</b>		EEPROM write error
<b>Er6</b>	EEPROM exhausted error. There is a maximum number of times the EEPROM can be written to. If Er6 is displayed, the EEPROM must be replaced.	
<b>Er9</b>		RAM corruption error

## Care and maintenance

The only scheduled maintenance of the 205S or 205U is to inspect the motor brushes and to replace them before their length is less than 6mm 1/4". The life of the brushes will depend on the duty of the pump, which is expected to be at least 3,000 hours at maximum speed. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents.

If the gearbox is rebuilt you should use 15 ml of the recommended lubricant, which is RD-105, this is a SAE 30 mineral oil loaded with molybdenum disulphide to form a soft fluid grease.

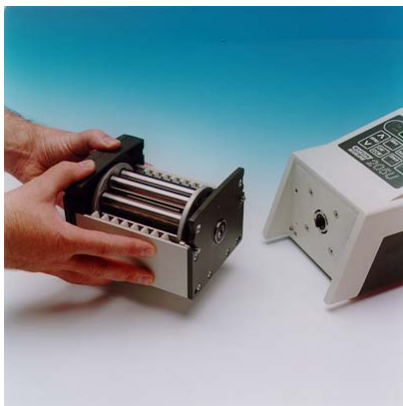
## 205S / 205U Specification

Maximum rotor speed	90rpm
Minimum rotor speed	0.5rpm
Voltage/frequency	100-120/220-240V 50/60Hz
Power consumption	100VA
Shaft Torque	2.2Nm
Operating temperature range	5 to 40C
Storage temperature range	-40C to 70C
Weight	3.8kg (8.4lb)
Noise	<70dBA at 1m
Standards	IEC 335-1, EN60529 (IP31) Machinery Directive 2006/42/EC EMC Directive 2004/108/EC

## Pumphead installation

If the pumphead is fitted ignore this section (applicable for all cassette pumpheads).

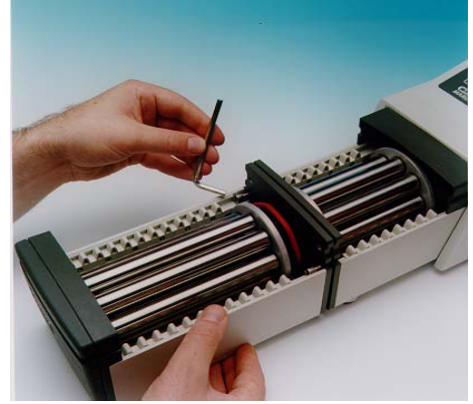
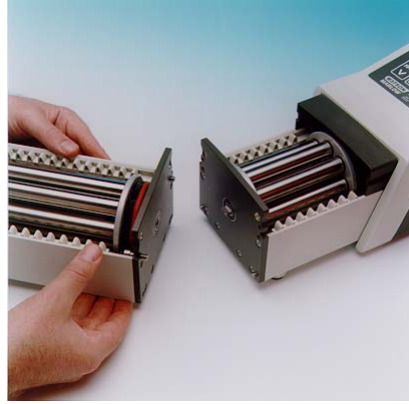
- Remove the planetary gear system cover by pulling gently towards the front of the pumphead.
- Apply grease to the drive tongue, align to pumphead centre shaft and locate together.
- Tighten the socket head retaining screws at each side of the pumphead with a 5mm A/F ball ended Allen key. Replace the cover.





### Fitting an extension pumphead

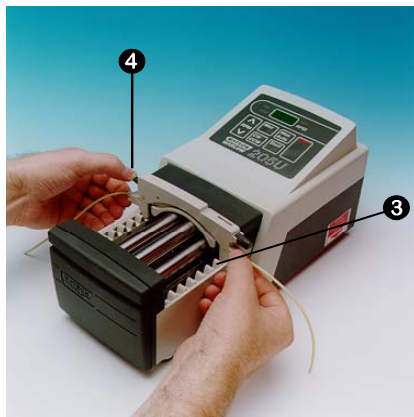
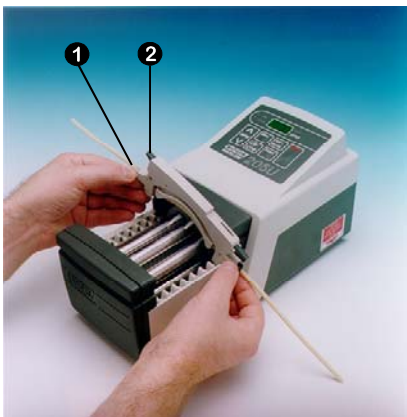
- Remove the front cover plate.
- Remove the end plate using a No.2 Pozi screwdriver on the first pumphead to expose the two locating pins and drive shaft slot.
- Remove the planetary gear system cover from the extension pumphead.
- Fit the extension pumphead onto the two locating pins, ensuring the tongue of its drive shaft aligns with the pumphead centre shaft.
- Tighten the socket head retaining screws on the right and left of the extension pumphead. Fit the end plate to the last pumphead and replace the covers.



### CA cassette loading

Only use cassettes with manifold tubing.

- Place the tube into the tube retaining slots without twisting or stretching it, 1.
- Lift the cassette release lever 2.
- Load the cassettes into the pumphead, ensuring that they are engaged on to the cassette guides at each end, 3.
- Ensure that both retaining lips are engaged and then squeeze the cassette release lever and the tube retaining lug together, until you hear a click, 4.



### CA cassette removal

- Lift the cassette release lever and pull out the cassette.
- With care, a single cassette can be removed for tube changing without stopping the drive and disturbing the pumping action of other cassettes.



***All cassettes should be in position in the pumphead during normal running, even if some do not contain tubing. Do not place fingers inside the pumphead.***

### CA Cassette adjustment and flow rates

- Flow rates for pumping water at 20C with zero suction and delivery pressure in PVC tubing, with clockwise rotation of the pumphead are published at the back of this manual.
- Dedicated occlusion adjustment with a vernier indicator has been incorporated into the cassette. This is to enable repeatable accurate flow rates despite variations that may be caused by the system or when pumping fluids other than water.
- The track geometry has been designed so that when the indicator is at the centre position it is indicating the normal set-up.
- To adjust, pull out the adjusting knob and turn. To lock, push back.
- Moving the indicator towards the '+' will increase the track occlusion (reduced roller/track gap) enabling higher pressures to be obtained without a fall off in flow rate.
- Moving the indicator towards the '-' will reduce the occlusion. Remember that higher the occlusion, the shorter the tube life.
- The mechanism also enables small adjustments in the flow rate. This is particularly useful when using a number of channels where the inter channel flow rate is critical. As a guide only, one graduation move will vary the flow by approximately 1%

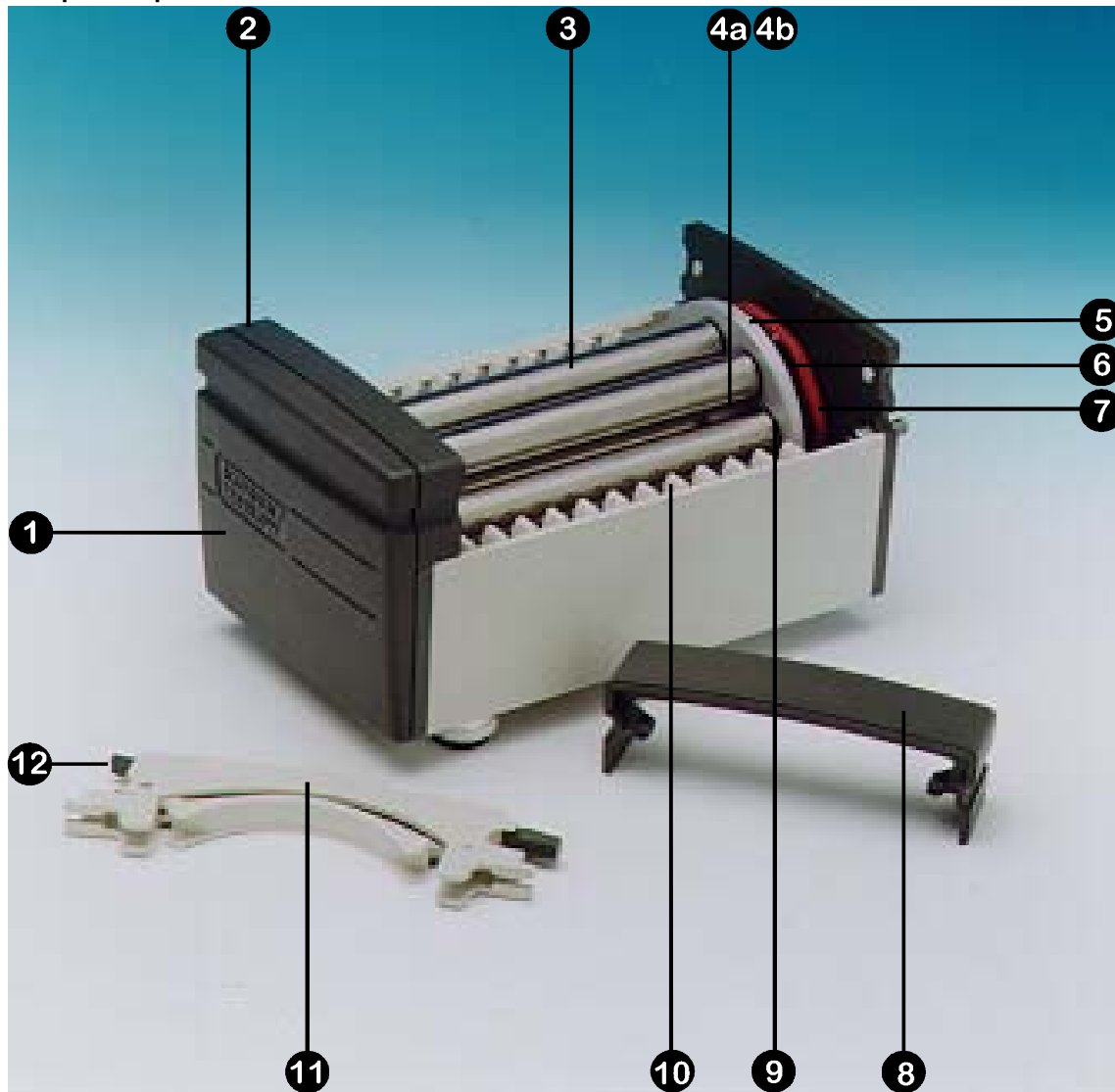
### Care and maintenance

When the pumphead needs cleaning, switch the drive off and isolate it from the mains. Remove the cassettes from the pumphead and remove the tubing. Wash the cassettes in water and mild detergent.

If fluid has been spilled into the pumphead, removal of the pumphead from the drive will make cleaning easier. Periodically, inspect all moving parts for wear and ensure all bearings and rollers are free to rotate.

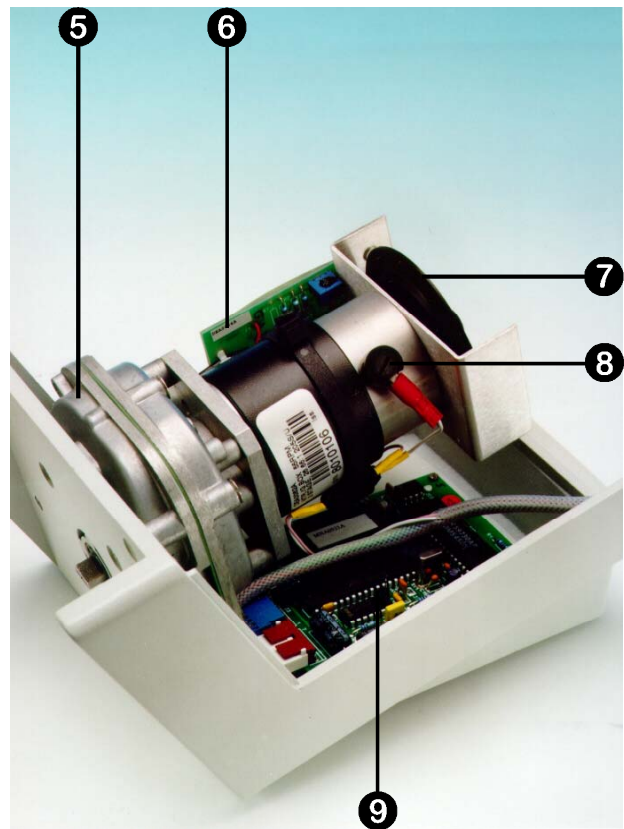
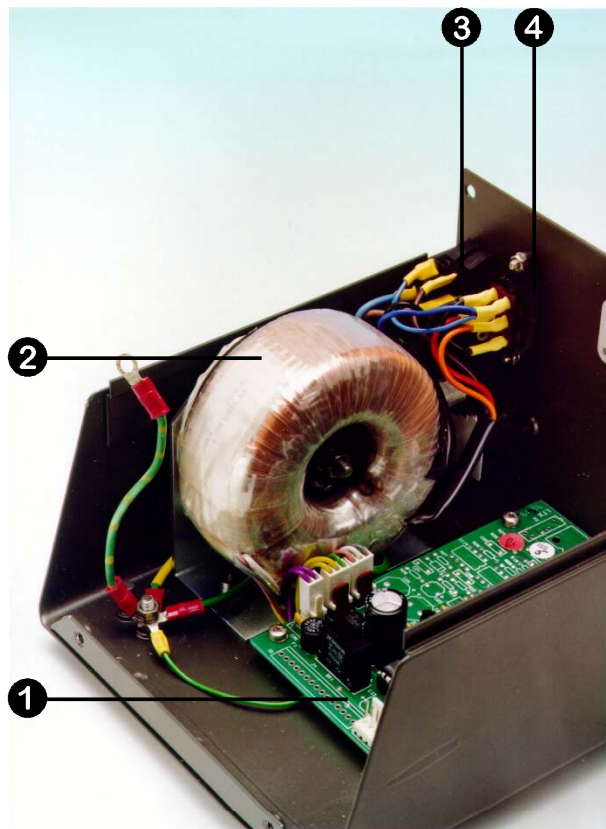


## Pumphead spares



Number	Spare	Description
1	DE 0410M	End plate
2	DE 0412M	Front cover plate
3	DE 0416T	Roller 4 way
	DE 0417T	Roller 8 way
	DE 0418T	Roller 12 way
	DE 0419T	Roller 16 way
4a	BB 0038 (2 off)	Center shaft bearing
4b	BB 0014 (2 off)	Center spacer bearing
5	DE 0429T	Center gear
6	MN 0983M	Roller gear
7	OS 0047	Friction O ring
8	DE 0411M	Planetary system gear cover
9	BB 0034 (2 per roller)	Roller bearing
10	DE 0407M	Cassette guide
11	DEA0080A	Cassette PVDF (option)
	DEA0081A	Cassette Acetal (standard)
12	N/A	Cassette release lever

## Drive spares



Number	Spare	Description
1	DEA0065A	205S Control PCB
1	DEA0066A	205U Control PCB
2	DEA0068A	Transformer
3	SW 0147	On/Off switch
4	SW 0086	Voltage selector swith
5	DEA 0062A	Motor/gearbox
6	DEA0063A	205S Tacho PCB assembly
6	DEA0064A	205U Tacho PCB assembly
7	MN 0787A	Tacho disc
8	BM0014	Motor brush
9	DEA0067A	205S CPU/Display PCB
9	MNA0431A	205U CPU/Display PCB
	DE 0306B/ DE 0307B	205S/ 205U Membrane keypad
	FS 0003	Mains fuse 1A T type

Specific drive performance details such as loaded drive speed variation against mains supply voltage fluctuation and drive stability from a cold start to normal operating temperature are available on request. For further information please contact Watson-Marlow Technical Support.

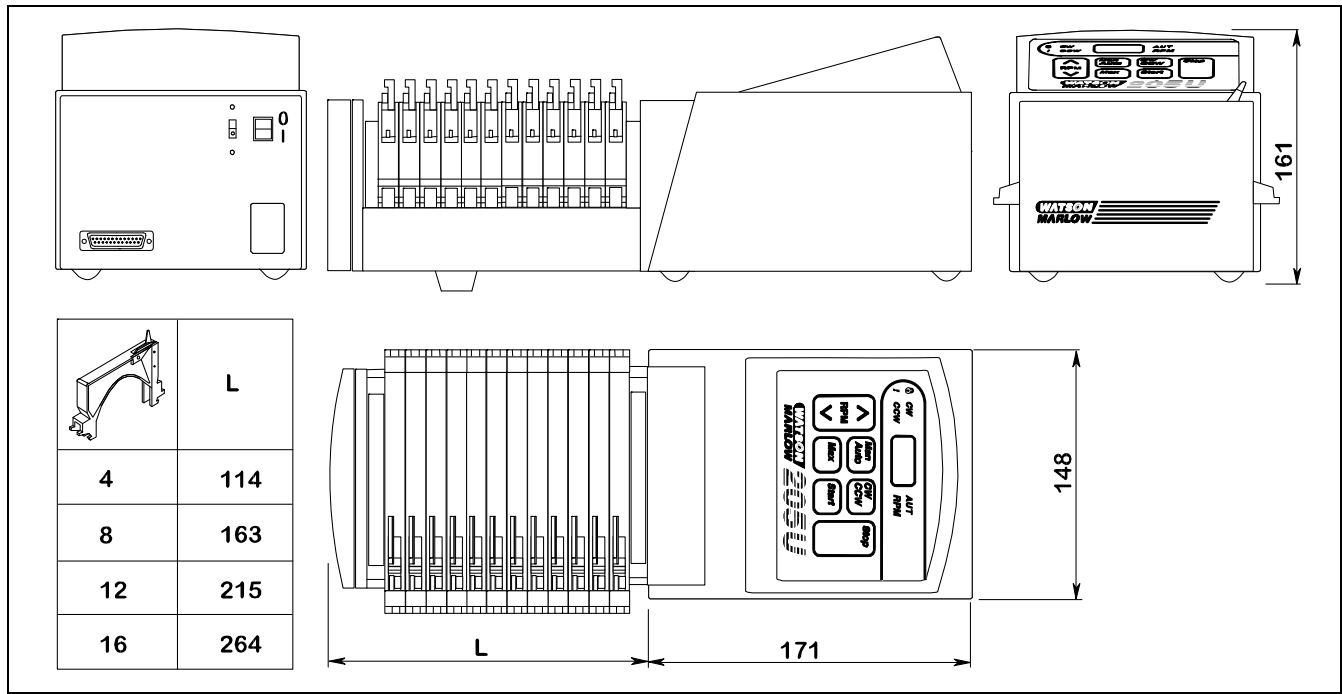
**205S/CA and 205U/CA flow rates (ml/min)**

		Bore mm	Bore "	0.5-90rpm			Bore mm	Bore "	0.5-90rpm
		0.13	0.005	0.0006-0.10			1.29	0.050	0.033-5.95
		0.19	0.007	0.0009-0.16			1.42	0.055	0.040-7.20
		0.25	0.010	0.0013-0.23			1.47	0.058	
		0.38	0.015	0.0036-0.65			1.52	0.060	0.043-7.69
		0.50	0.020	0.0056-1.01			1.65	0.065	0.051-9.12
		0.63	0.025	0.0083-1.49			1.85	0.070	0.063-11.3
		0.76	0.030	0.011-2.02			2.05	0.080	0.076-13.8
		0.88	0.035	0.016-2.92			2.38	0.095	0.092-16.5
		1.02	0.040	0.021-3.76			2.54	0.100	0.11-19.3
		1.14	0.045	0.026-4.68			2.79	0.110	0.12-22.0

**205 manifold tubing product codes**

		Bore mm	Bore "	Marpren	PVC	Silicone	Solvent resistant	Acid resistant
		0.13	0.005				984.0013.000	
		0.19	0.007				984.0019.000	
		0.25	0.010	978.0025.000	980.0025.000		984.0025.000	
		0.38	0.015	978.0038.000	980.0038.000		984.0038.000	
		0.50	0.020	978.0050.000	980.0050.000		984.0050.000	986.0050.000
		0.63	0.025	978.0063.000	980.0063.000	982.0063.000	984.0063.000	986.0063.000
		0.76	0.030	978.0076.000	980.0076.000	982.0076.000	984.0076.000	986.0076.000
		0.88	0.035	978.0088.000	980.0088.000	982.0088.000	984.0088.000	986.0088.000
		1.02	0.040	978.0102.000	980.0102.000	982.0102.000	984.0102.000	986.0102.000
		1.14	0.045	978.0114.000	980.0114.000	982.0114.000	984.0114.000	986.0114.000
		1.29	0.050	978.0129.000	980.0129.000	982.0129.000	984.0129.000	986.0129.000
		1.42	0.055	978.0142.000	980.0142.000	982.0142.000	984.0142.000	986.0142.000
		1.47	0.058			982.0147.000		
		1.52	0.060	978.0152.000	980.0152.000	982.0152.000	984.0152.000	986.0152.000
		1.65	0.065	978.0165.000	980.0165.000	982.0165.000	984.0165.000	986.0165.000
		1.85	0.070	978.0185.000	980.0185.000	982.0185.000	984.0185.000	986.0185.000
		2.05	0.080	978.0205.000	980.0205.000	982.0205.000	984.0205.000	986.0205.000
		2.38	0.095	978.0238.000	980.0238.000	982.0238.000	984.0238.000	986.0238.000
		2.54	0.100	978.0254.000	980.0254.000	982.0254.000	984.0254.000	986.0254.000
		2.79	0.110	978.0279.000	980.0279.000	982.0279.000	984.0279.000	986.0279.000

**Outline dimensions**



**Watson-Marlow, Bioprene and Marprene** are trademarks of **Watson-Marlow Limited**.

**Tygon** is a trademark of the **Norton Company**.

**Warning, These products are not designed for use in, and should not be used for patient connected applications.**

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

**Product use and decontamination declaration**

To comply with the UK Health & Safety at Work Act and the Control of Substances Hazardous to Health Regulations you, the user, are required to declare the substances which have been in contact with the product(s) you are returning to Watson-Marlow or any of its subsidiaries or distributors. Failure to do so will cause delays in servicing the product(s). Please complete this form to ensure that we have the information before we receive the product(s). A further copy must be attached to the outside of the packaging containing the product(s). The user is responsible for cleaning and decontaminating the product(s) before return.

Please complete a separate Decontamination Declaration for each pump returned. **RGA No:** .....

1 Company .....  
 Address .....  
 ..... Postcode .....  
 Telephone ..... Fax Number .....

2.1 Serial Number ..... (One product per declaration)

2.2 Has the Product been used?

Yes		No	
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If yes, please complete all the following Sections. If no, please complete Section 5 only

3 Details of substances pumped

4 I confirm that the only substances(s) that the equipment specified has pumped or come into contact with are those named, that the information given is correct, and the carrier has been informed if the consignment is of a hazardous nature.

3.1 Chemical names:

5 Signed .....

(a)..... Name .....

(b)..... Position .....

(c)..... Date .....

3.2 Precautions to be taken in handling these substances:

To assist servicing, please describe any fault condition(s) you have witnessed

(a) .....

(b) .....

(c) .....

3.3 Action to be taken in the event of human contact:

(a).....  
 .....

(b).....  
 .....

(c).....

3.4 Cleaning fluid to be used if residue of chemical is found: .....

(a).....  
 .....

(b).....  
 .....

(c).....