VERDERFLEX®



Peristaltic Cased Tube Pump

Appendices

Vantage 5000

Version 1.2v-05/2017

Print-No. 01



CE

VERDER
passion for pumps

Version 1.2v-05/2017
Print-No. 01

Vantage 5000

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Appendix A

1 Pump Specifications

1.1 Specification ratings

Size	Value
Operating temperature	+5 °C to +40 °C (41°F to 104 °F)
Storage temperature	-40 °C to +70 °C (40°F to 158 °F)
Humidity (non-condensing)	long—term ≤ 80 %
Maximum altitude	Setup height above sea level ≤ 2000 m (6560 ft)
Power consumption	<230 W
Supply voltage	100-240 VAC 50/60 Hz <230 W
Maximum voltage fluctuation	+/-10% of nominal voltage. A well regulated electrical mains supply is required along with cable connections conforming to the best practice of noise immunity
Installation category (overvoltage category)	II
Pollution degree	2
IP	IP66 to BS EN 60529. Equivalent to NEMA 4X as per NEMA 250 *(indoor use - protect from prolonged UV exposure)
dB rating	<70dB(A) @ 1.0m*
Control ratio	4000:1
Maximum speed	400 rpm

Table 1 Specification ratings

** Sound pressure level is measured by the responsible body at both operators position in normal use and at whatever point 1.0m from the enclosure of the equipment that has the highest sound pressure rating.*

1.2 Rotor options

Rotor Options	Tube Bore (mm)	Tube Type
LP 1.6WT Tube, Lower Pressure	1.6	Continuous Tubing; Tube Assemblies
	3.2	
	4.0	
	4.8	
	6.4	
	8.0	
LP 2.4WT Tube, Lower Pressure	3.2	Continuous Tubing; Tube Assemblies
	4.8	
	6.4	
	8.0	
	9.6	
MP 2.4WT Tube, 4 BAR Pressure	3.2	Tube Assemblies
HP 2.4WT Tube, 7 BAR Pressure**	3.2	Tube Assemblies

Table 2 Rotor options

*** Before using a new tube assembly, make sure the pump is run in the counter-clockwise direction for 1 minute.*

1.3 Tube options

For safety reasons we do not recommend pumping liquids greater than 80°C (176°F). The following criteria are important when selecting a tube:

- Chemical resistance
- Food grade quality
- Tube life
- Physical compatibility

Type	Feature
Verderprene	General purpose tubing
Silicone	High sterility tubing
Other	Others

Table 3 Verderflex Tube Variants

Appendix B

2 Spare Parts Replacement

DANGER

- Isolate the pump from the main power supply before opening the pump door or performing any positioning, removal or maintenance operation.

Note

Disconnect pump from pipework and close supply side values to prevent spillages.

2.1 Continuous Tube Replacement

1. Open the pump door.
2. Release the bottom tube clamp first by pressing up.
3. Remove the tube then release tube clamp.
4. Rotate the rotor assembly in a clockwise direction by hand, using the vertical guide rollers if necessary.
5. Release the top tube clamp to unlock the tube.
6. Remove the tube and release the tube clamp.

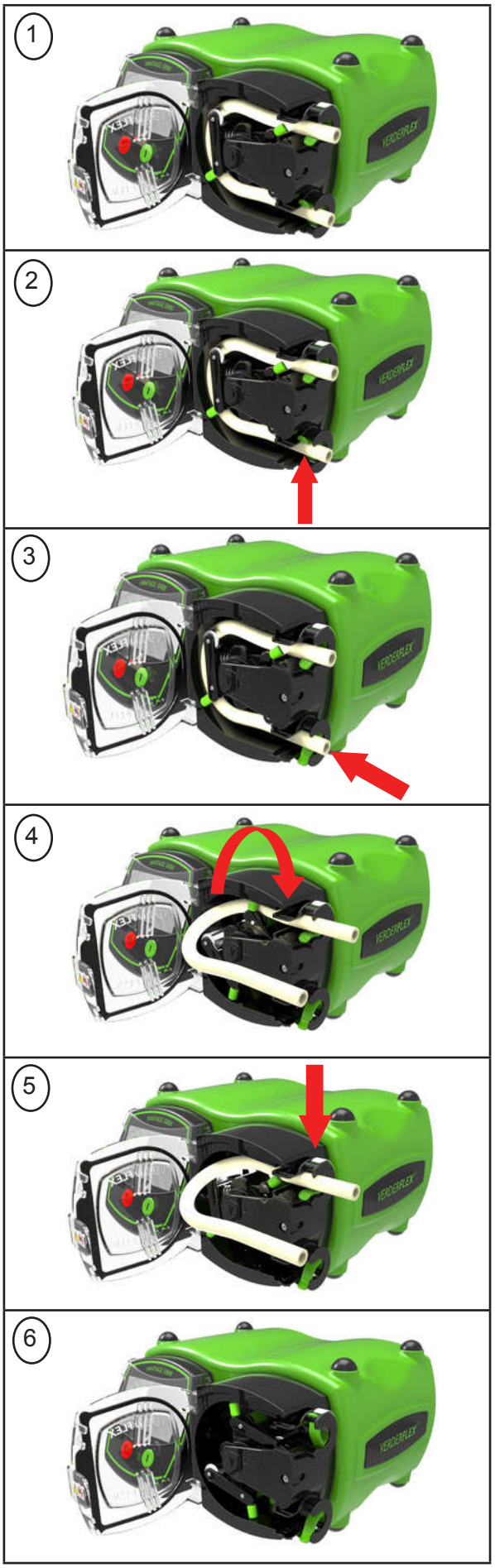


Figure 1 Continuous Tube Replacement

2.2 Tube Element Replacement

DANGER

- Isolate the pump from the main power supply before opening the pump door or performing any positioning, removal or maintenance operation.

Note

Disconnect the pump from pipework and close the supply side values to prevent spillage.

1. Open the pump door.
2. Slide the lower tube element housing out of the pump head.
3. Rotate the rotor assembly in a clockwise direction by hand, using the vertical guide rollers if necessary.
4. Gently pull the tube out while rotating.
5. Continue to turn the rotor assembly in clockwise direction.
6. Slide the tube element housing out of the pump head.

Note

If this is difficult a flat bladed screwdriver can be used. Remove the bearing strut plug and insert the screwdriver through into the groove in the rotor body.

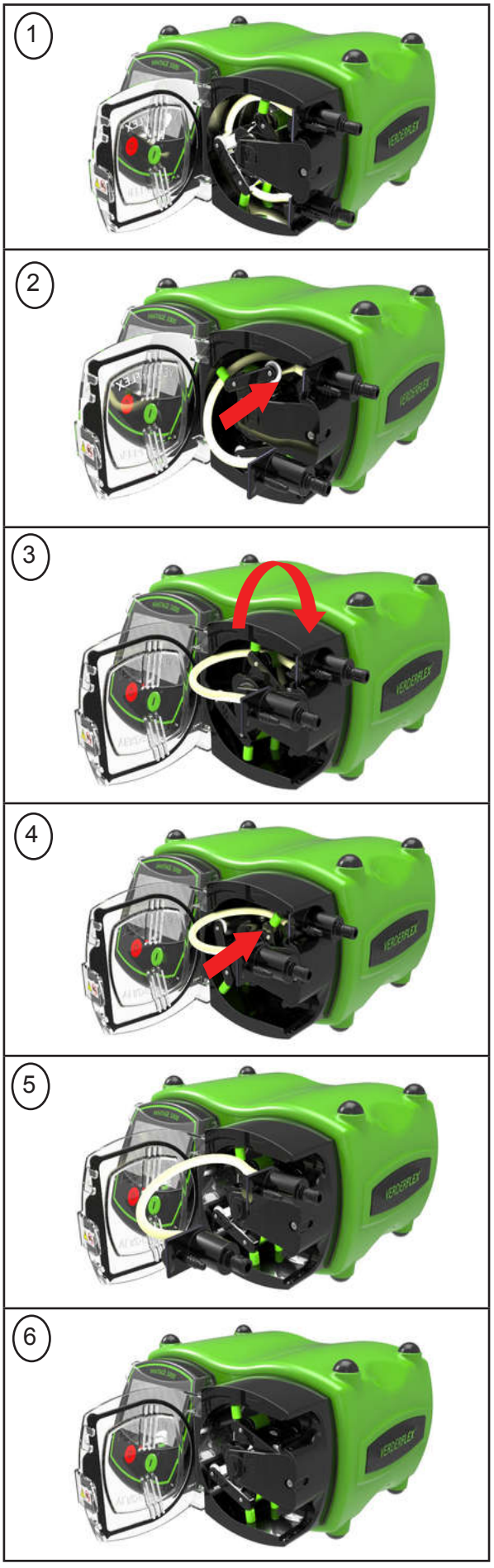


Figure 2 Tube Element Replacement

2.3 Rotor Assembly Replacement

DANGER

▶ Isolate the pump from the main power supply before opening the pump door or performing any positioning, removal or maintenance operation.

Note

Before removing the rotor assembly, make sure the tube has been correctly removed. (→ 2.1 Continuous Tube), (→ 2.2 Tube Element)

1. Unscrew the M4 bearing strut retaining screw using a screwdriver. (No.2 posidrive)
2. Remove the bearing strut.
3. Remove the rotor assembly by hand.

Note

This may take some effort due to assembly fit.

4. Bearing strut and rotor assembly have been removed.
5. Push replacement rotor into rear pump head bearing.

Note

Ensure the rotor assembly is fully pressed in.

6. Replace the bearing strut and thighten the retaining screw.

Note

The tightening torque value for the retaining is 1.5 Nm.

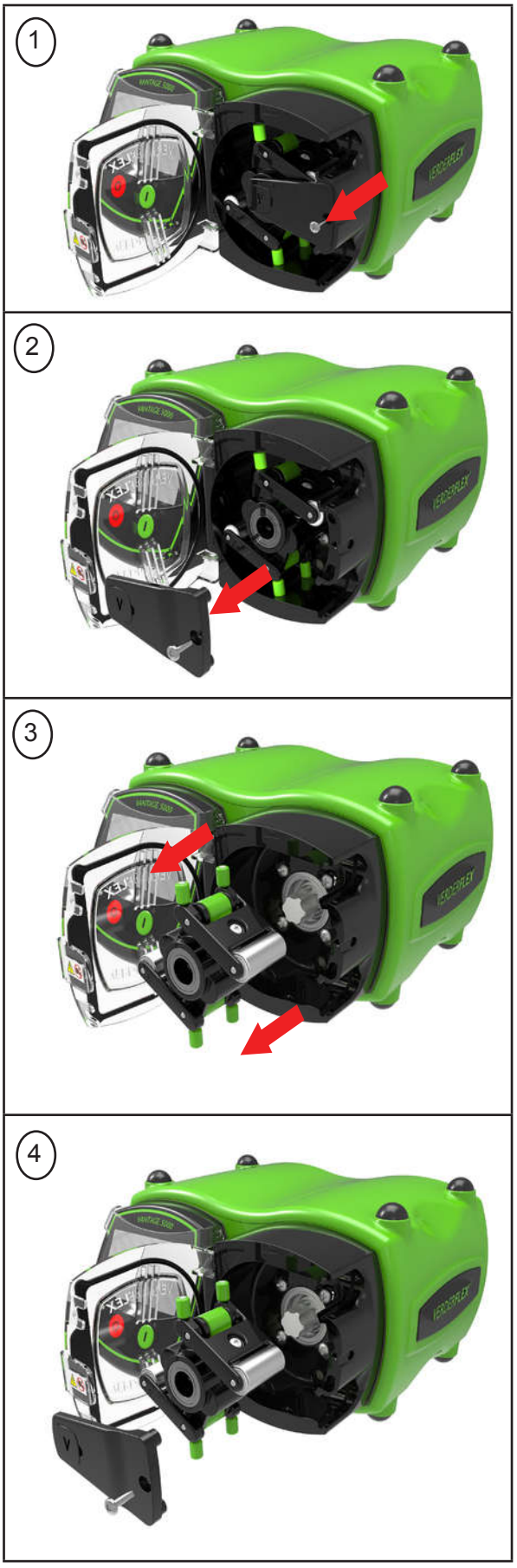


Figure 3 Rotor Assembly Replacement

Appendix C

3 Vantage 5000 Spare Parts List



Figure 1 Vantage 5000 Spare Parts List

1	Screen Protector	4	Rotor Assembly	7	Breakout Box
2	Pump Door	5	Tube Clamp*	8	Continuous Tube
3	Standard Feet Pack	6	USB Cover	9	Tube Element

*Only required loose tubing

3.1 Vantage 5000 Spare Parts List

Ref	Item		Part No	QTY	Image
1.	**Screen Protector**		159.5019	1	
2.	**Pump Door (Assembly)**		159.5022	1	
3.	**Standard Feet Pack**		159.5020	8	
3.1	**Stacking Feet Pack**	Optional Stacking Feet for Landscape Orientation	159.5018	4	
4.	**Rotor Assembly**	1.6WT TUBE, Lower Pressure, BLUE code	159.5000	1	
		2.4WT TUBE, Lower Pressure, GREEN code	159.5001	1	
		2.4WT TUBE, Medium Pressure, YELLOW code	159.5002	1	
		2.4WT TUBE, High Pressure, ORANGE code	159.5003	1	
5.	**Tube Clamp**		159.5004	1	
6.	**USB Cover**		159.5021	1	
7.	**Breakout Box**	24 VDC	159.5023	1	
		115 VAC	159.5024	1	

Table 1 - Spare Parts List

3.2 Vantage 5000 Continuous Tube Options

Material	Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	1.6 Lower Pressure	1.6	150.0603.1	1m Length	
			150.0603.15	15m Pack	
		3.2	150.0620.1	1m Length	
			150.0620.15	15m Pack	
		4.0	150.0643.1	1m Length	
			150.0620.15	15m Pack	
		4.8	150.0604.1	1m Length	
			150.0604.15	15m Pack	
		6.4	150.0605.1	1m Length	
			150.0605.15	15m Pack	
		8.0	150.0606.1	1m Length	
			150.0606.15	15m Pack	
Silicone	1.6 Lower Pressure	1.6	460.0006.1	1m Length	
			460.0006.15	15m Pack	
		3.2	460.0007.1	1m Length	
			460.0007.15	15m Pack	
		4.0	460.0051.1	1m Length	
			460.0051.15	15m Pack	
		4.8	460.0008.1	1m Length	
			460.0008.15	15m Pack	
		6.4	460.0009.1	1m Length	
			460.0009.15	15m Pack	
		8.0	460.0010.1	1m Length	
			460.0010.15	15m Pack	
Tygon R1000	1.6 Lower Pressure	1.6	150.0810.1	1m Length	
		3.2	150.0812.1		
		4.0	150.0814.1		
		4.8	150.0816.1		
Viton	1.6 Lower Pressure	1.6	150.0830.1		
		3.2	150.0832.1		
		4.0	150.0834.1		
		4.8	150.0836.1		

Table 2 - 1.6mm WT Lower Pressure Continuous Tube

** The tube wall thickness should be matched to the rotor for optimum tube life and performance.*

Material	Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	2.4 Lower Pressure	3.2	150.0644.1	1m Length	
			150.0644.15	15m Pack	
		4.8	150.0625.1	1m Length	
			150.0625.15	15m Pack	
		6.4	150.0623.1	1m Length	
			150.0623.15	15m Pack	
		8.0	150.0626.1	1m Length	
			150.0626.15	15m Pack	
		9.6	150.0627.1	1m Length	
			150.0627.15	15m Pack	
Silicone	2.4 Lower Pressure	3.2	460.0052.1	1m Length	
			460.0052.15	15m Pack	
		4.8	460.0053.1	1m Length	
			460.0053.15	15m Pack	
		6.4	460.1032.1	1m Length	
			460.1032.15	15m Pack	
		8.0	460.0705.1	1m Length	
			460.0705.15	15m Pack	
		9.6	460.1034.1	1m Length	
			460.1034.15	15m Pack	
Viton	2.4 Lower Pressure	6.4	150.0840.1	1m Length	
		8.0	150.0842.1		

Table 3 - 2.4mm WT Lower Pressure Continuous Tube

** The tube wall thickness should be matched to the rotor for optimum tube life and performance.*

3.3 Vantage 5000 Tube Element

1.6 mm WT Lower Pressure Tube Element

Material		Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	Quick Release Connector (QR)	1.6 Lower Pressure	1.6	159.5005	1	
			3.2	159.5006	1	
			4.0	159.5007	1	
			4.8	159.5008	1	
			6.4	159.5009	1	
			8.0	159.5010	1	
	3/4" Mini Tri-clamp Connector (TR)	1.6 Lower Pressure	1.6	159.5025	1	
			3.2	159.5026	1	
			4.0	159.5027	1	
			4.8	159.5028	1	
			6.4	159.5029	1	
			8.0	159.5030	1	

Table 4 - 1.6 mm WT Lower Pressure Tube Element

2.4 mm WT Lower Pressure Tube Element

Material		Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	Quick Release Connector (QR)	2.4 Lower Pressure	3.2	159.5011	1	
			4.8	159.5014	1	
			6.4	159.5015	1	
			8.0	159.5016	1	
			9.6	159.5017	1	
	3/4" Mini Triclamp Connector (TR)	2.4 Lower Pressure	3.2	159.5031	1	
			4.8	159.5034	1	
			6.4	159.5035	1	
			8.0	159.5036	1	
			9.6	159.5037	1	

Table 5 - 2.4 mm WT Lower Pressure Tube Element

** The tube wall thickness should be matched to the rotor for optimum tube life and performance.*

2.4 mm WT Medium Pressure Tube Element

Material		Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	Quick Release Connector (QR)	2.4 Medium Pressure 4 bar (60 PSI)	3.2	159.5012	1	
	3/4'' Mini Triclamp Connector (TR)	2.4 Medium Pressure 4 bar (60 PSI)	3.2	159.5032	1	

Table 6 - 2.4 mm WT Medium Pressure Tube Element

2.4 mm WT High Pressure Tube Element

Material		Wall Thickness (WT) (mm) *	Tube Bore (ID) (mm)	Part No	QTY	Image
Verderprene	Quick Release Connector	2.4 High Pressure 7 bar (105 PSI)	3.2	159.5013	1	
	3/4'' Mini Triclamp Connector	2.4 High Pressure 7 bar (105 PSI)	3.2	159.5033	1	

Table 7 - 2.4 mm WT High Pressure Tube Element

** The tube wall thickness should be matched to the rotor for optimum tube life and performance.*

3.4 Vantage 5000 Optional Accessories

Ref	Item	Part No	QTY	Image
1.	**25 WAY Remote I/O Connector Lead (5 m)**	159.5040	1	
2.	**IP 44 Non-Latching Footswitch**	159.5041	1	
3.	**IP 44 Latching Footswitch**	159.5042	1	
4.	**IP 65 Non-Latching Footswitch**	159.5043	1	
5.	**IP 65 Latching Footswitch**	159.5044	1	
6.	**Modbus® 5m Extension Lead**	159.5048	1	

Table 8 - Vantage 5000 Optional Accessories

Appendix D

4 Remote Control Options

4.1 Speed Control Method (local speed control)

4.1.1 HMI

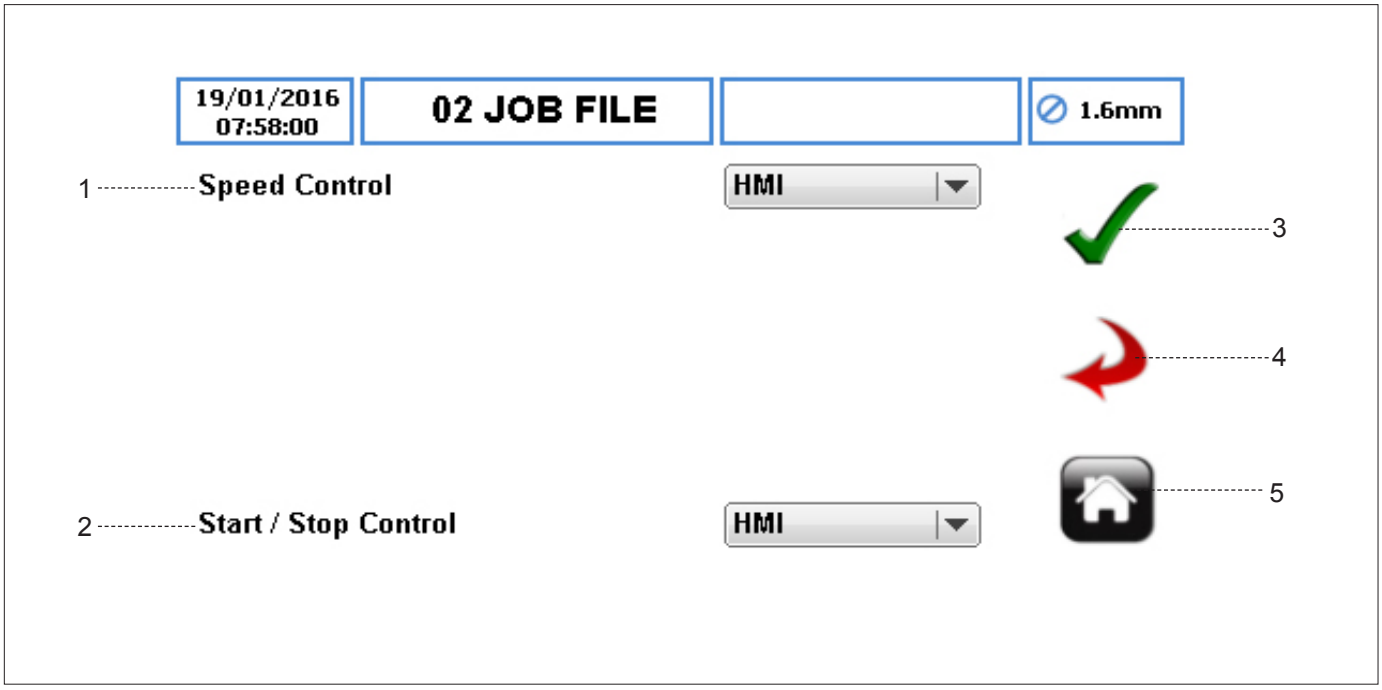


Figure 1 HMI Speed Control

1. SPEED CONTROL – enables the speed functionality via the HMI.
2. START/STOP CONTROL – sets the start/stop control method separately of the speed control.
3. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
4. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
5. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.1.2 4-20mA Speed Control

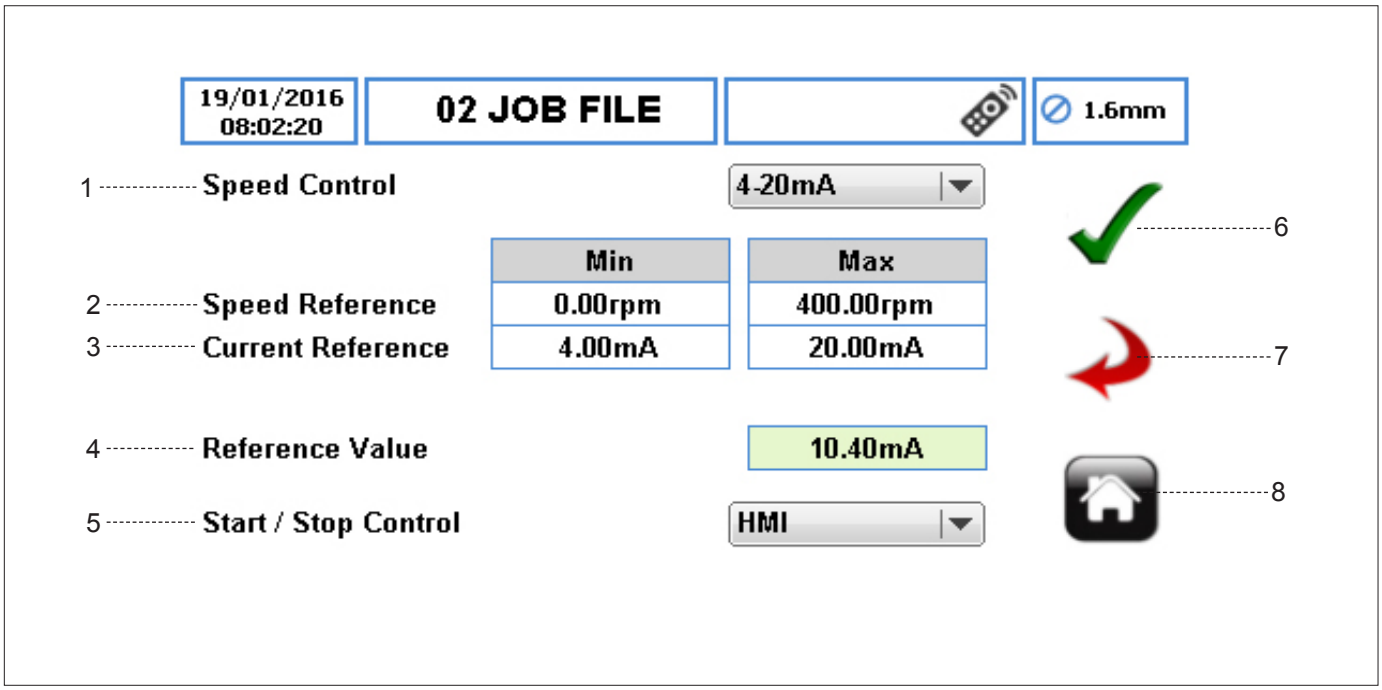


Figure 2 4-20 mA Speed Control

1. SPEED CONTROL – sets the speed control reference via the 4-20mA input pins on the 25WAY REMOTE I/O CONNECTOR (→ Appendix E).
2. SPEED REFERENCE – sets the minimum and maximum pump speed.
3. CURRENT REFERENCE – sets the minimum and maximum current references.

Note

With the default settings the 4 mA will correspond to 0 rpm and the 20 mA will correspond to 400 rpm. These settings can be reversed (minimum 20 mA and maximum 4 mA).

4. REFERENCE VALUE – indicates the measured current coming into the pump via the 25WAY REMOTE I/O CONNECTOR. It is a read-only value.
5. START/STOP CONTROL – sets the start/stop control separately from the speed control.
6. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
7. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
8. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.1.3 0-10V Speed Control

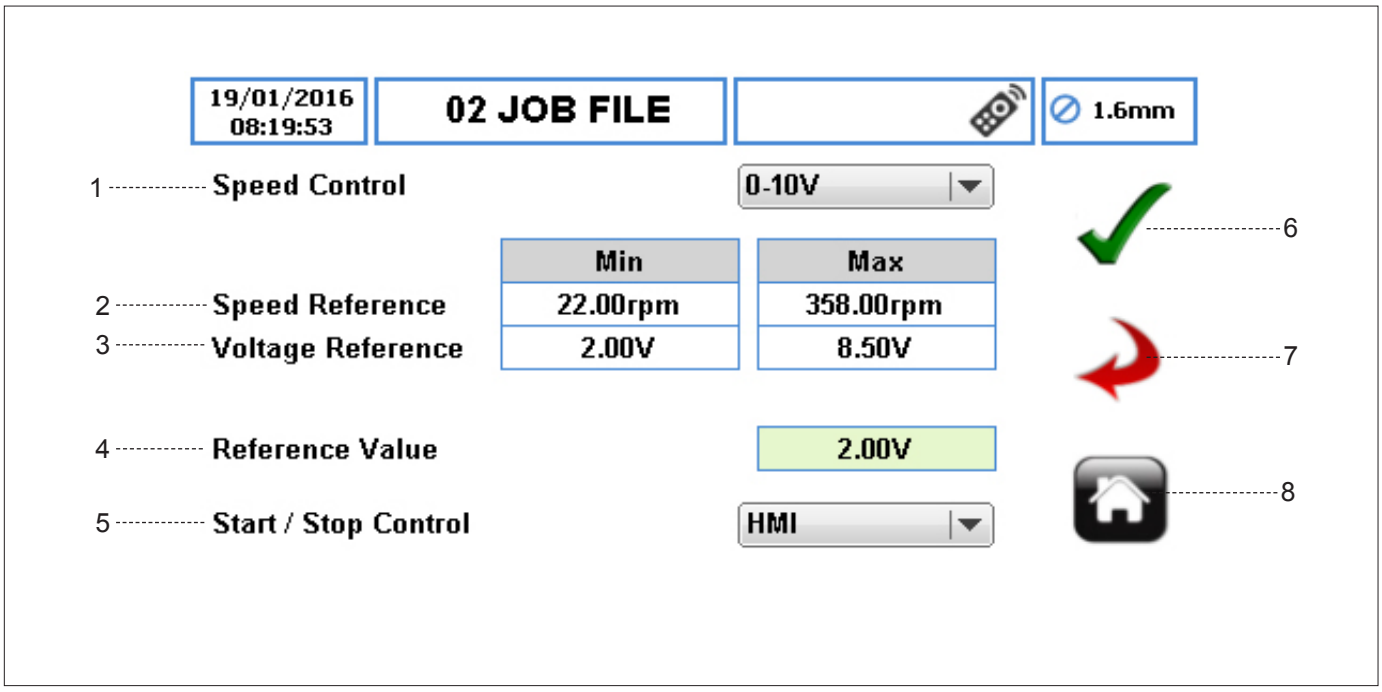


Figure 3 0-10V Speed Control

1. SPEED CONTROL – sets the speed control reference via the 0-10V input pins on the 25WAY REMOTE I/O CONNECTOR (→ Appendix E).
2. SPEED REFERENCE – sets the minimum and maximum pump speed.
3. VOLTAGE REFERENCE – sets the minimum and maximum voltage references.

Note

With the default settings the 0V will correspond to 0 rpm and the 10V will correspond to 400 rpm. These settings can be reversed (minimum 20 mA and maximum 4 mA).

4. REFERENCE VALUE – indicates the measured voltage read into the pump via the 25WAY REMOTE I/O CONNECTOR. It is read-only value.
5. START/STOP CONTROL – sets the start/stop control separately from the speed control.
6. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
7. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
8. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.1.4 Proportional Flow Mode (Tachometer)

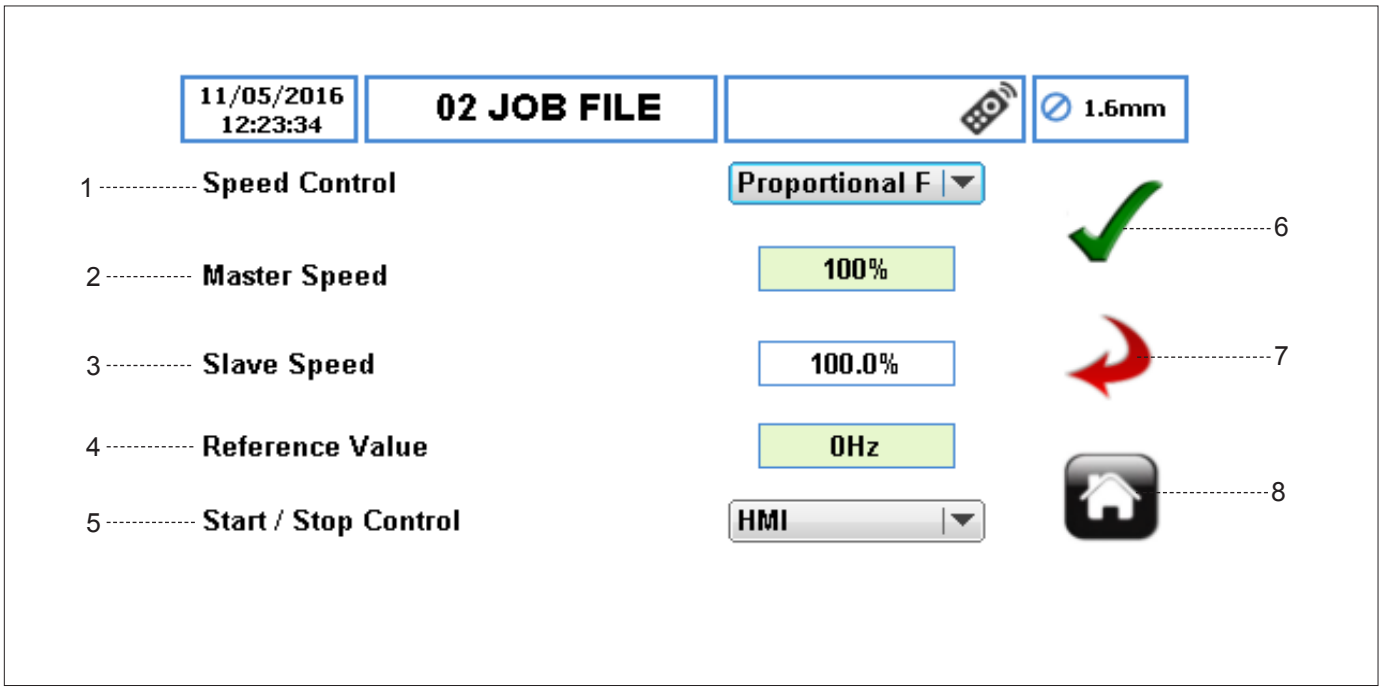


Figure 4 Proportional Flow Mode Speed Control

1. SPEED CONTROL – sets the speed control reference to come via the slave steps input pin on the 25WAY REMOTE I/O CONNECTOR (→ Appendix E).
2. MASTER SPEED – displays the master speed as a percentage of maximum pump speed. It is a ready-only value.
3. SLAVE SPEED – when the box is selected, a keypad will appear where the user can enter the percentage of the master speed.
4. REFERENCE VALUE – indicates the measured reference frequency coming from the master pump. It is a read-only value.
5. START/STOP CONTROL – sets the start/stop control separately from the speed control.
6. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
7. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
8. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.1.5 Fieldbus

To access the Modbus® settings, select Fieldbus from the dropped-down list. For more information see (Appendix J).

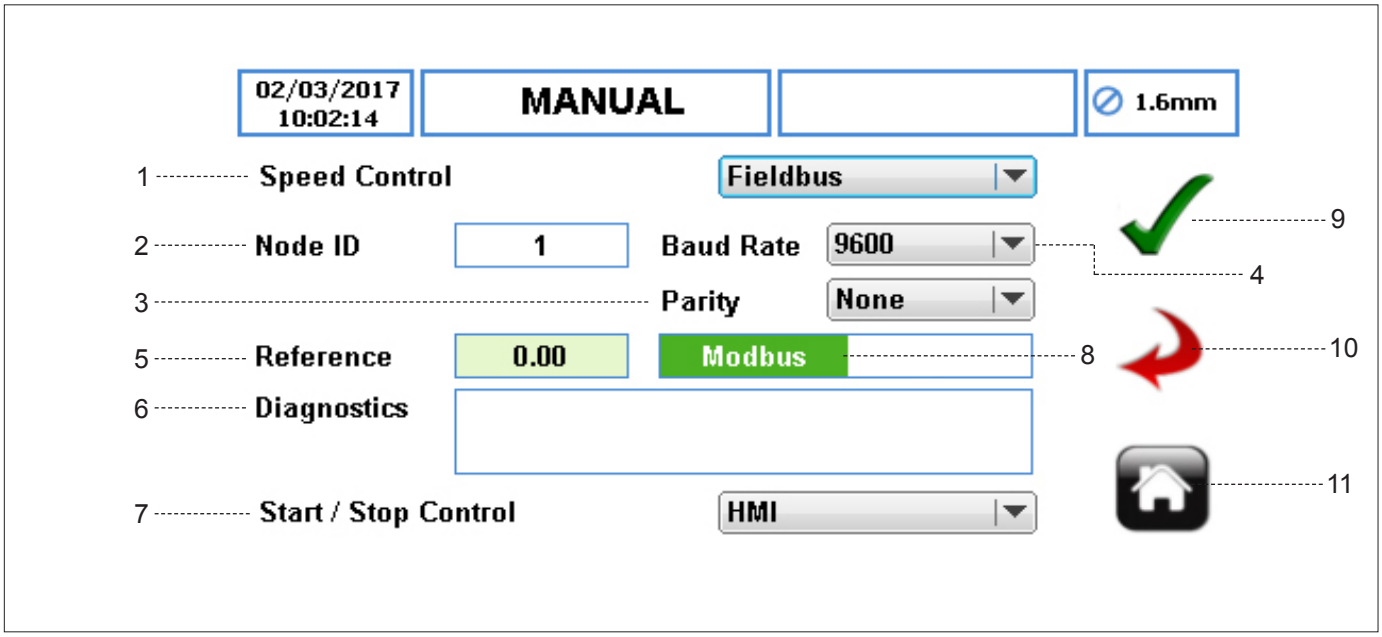


Figure 5 Fieldbus Speed Control

1. SPEED CONTROL – allows the user to set up the Modbus® protocol parameters.

Note

When the FIELDBUS option is selected then the value loaded into the 'Speed Set Point' register overrides all other speed setting sources.

2. NODE ID – although the node id values can be set between 0 and 255, but it is recommended 1 to 247.
3. PARITY – sets the parity from a drop-down list. The default is set to None.
    a. None
    b. Even
    c. Odd
4. BAUD RATE – sets the baud rate from a drop-down list. The default is set to 9600.

a.	1200	g.	57600
b.	2400	h.	115200
c.	4800	i.	230400
d.	9600	j.	460800
e.	19200	k.	921600
f.	38400		

5. REFERENCE – indicates the value of the 'speed set point' register.
6. DIAGNOSTICS – informs the user of the status of the Modbus® communications. If a valid, complete, Modbus® packet has been sent within a 10 second time window then the display will show 'Modbus® detected' in addition to the 'Min' and 'Max' speeds set in the pump, otherwise the display will show 'Modbus® Undetected'.
7. START/STOP CONTROL
    a. HMI – enables the start/stop functionality via the HMI.
    b. 25 WAY REMOTE I/O CONNECTOR – enables the start/stop functionality via the 25WAY REMOTE I/O CONNECTOR.
    c. FIELDBUS – enables the start/stop functionality via the 'Motor Run' control bit of the 'Control' register. If a valid Modbus® message is not detected within 10 seconds, the motor will stop running or, if the pump is set for 'Failsafe' operation, the pump will revert to failsafe conditions.
    d. FIELDBUS+D-SUB – allows the user to incorporate an external emergency STOP button, which will override the Fieldbus control of the 'Motor Run' command.

Note

The STOP button on the front of the pump will override all other control signals.

8. MODBUS – defines fieldbus protocol.
9. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
10. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
11. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.2 Start/Stop Control

4.2.1 HMI

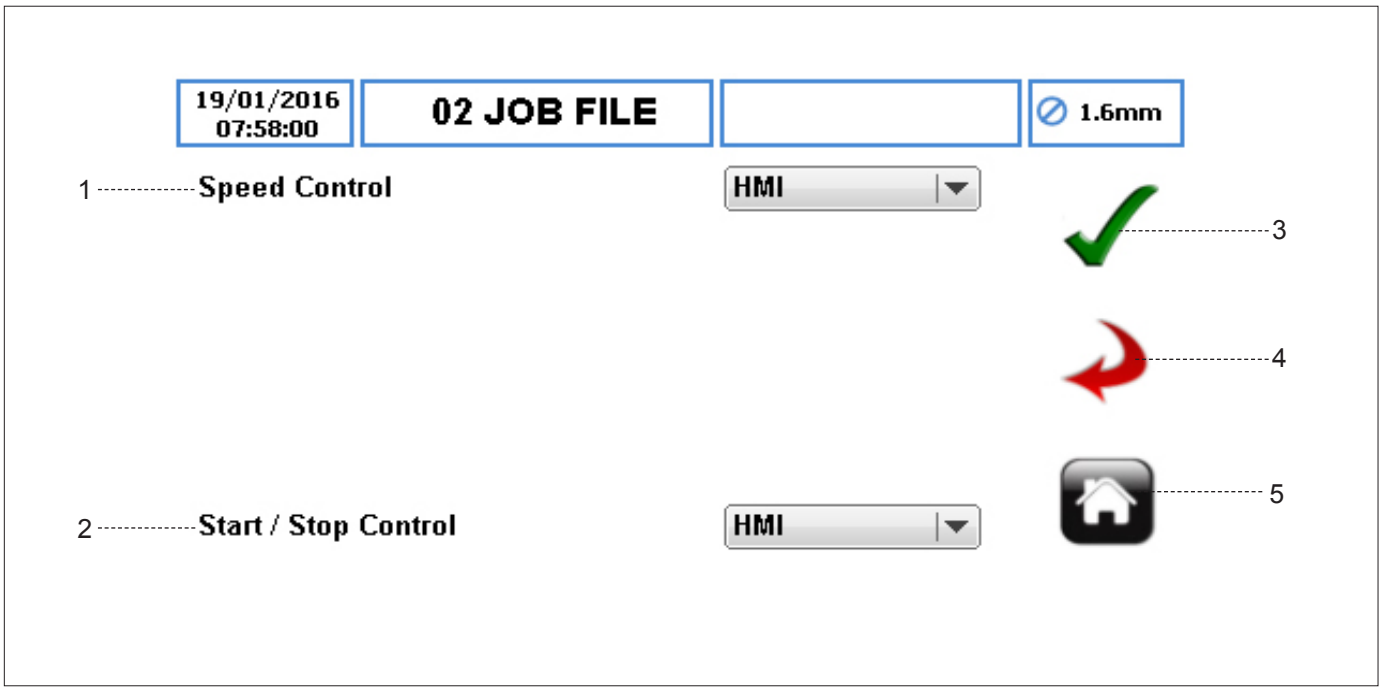


Figure 6 HMI Start/Stop Control

1. SPEED CONTROL – is not applicable.
2. START/STOP CONTROL – enables the start/stop functionality via the HMI.
3. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
4. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
5. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

4.2.2 25WAY REMOTE I/O CONNECTOR

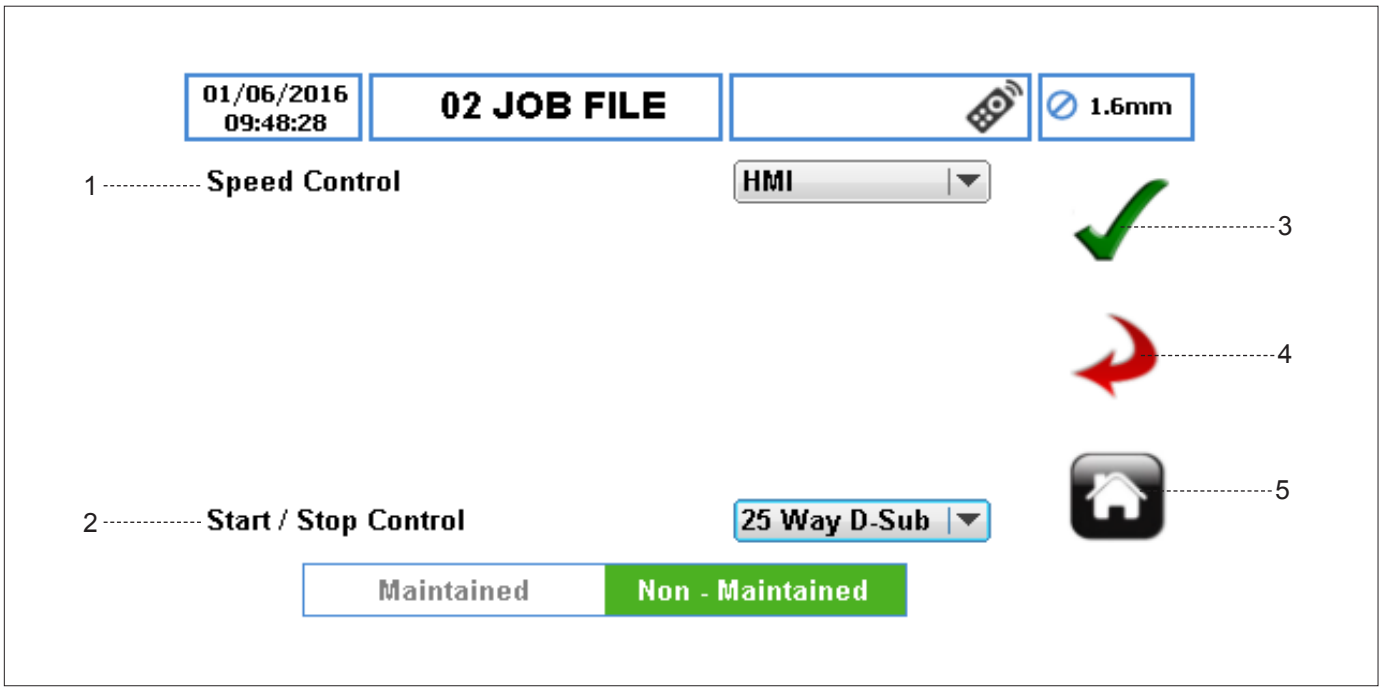


Figure 7 25WAY REMOTE I/O CONNECTOR Start/Stop Control

1. SPEED CONTROL – is not applicable.
2. START/STOP CONTROL – enables the start/stop functionality via the 25WAY REMOTE I/O CONNECTOR (→ Appendix E).
   a. Maintained – when selected, the start signal must be held on to run the pump.

      The pump will stop in maintained mode if an additional stop condition is detected or the start signal is removed.

   b. Non-Maintained – when selected, the start signal can be a momentary pulse to run the pump.

      The pump will only stop in non-maintained mode if an additional stop condition is detected.
3. ACCEPT – accepts all changes within the Job File. Changes made on this screen are not saved until this icon is pressed.
4. GO BACK/CANCEL – cancels any changes and return to the Job File Menu. If the user has made changes, there will be a prompt asking the user if the changes should be saved.
5. HOME – returns the user to the Home Screen. If the user has made changes, there will be a prompt asking if the changes should be saved.

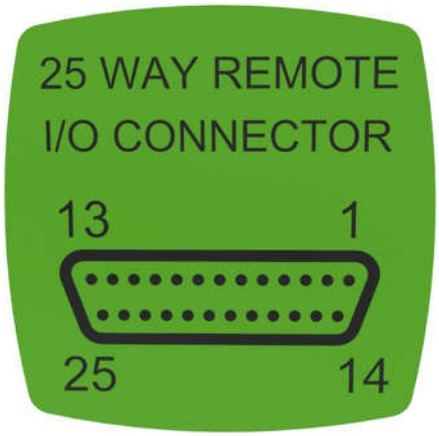
Appendix E

5 25 WAY Remote I/O Connector

5.1 Description of PINs

The PINs on the 25 WAY Remote I/O connector can be grouped into:

1. Power Supply
2. Digital Input Wiring
3. Digital Output Wiring
4. Proportional Flow Mode
5. Analogue Wiring



PIN	Description	PIN	Description
1	Manual/Auto	14	Start
2	Stop	15	Product Source Empty
3	Product Destination Full	16	Direction Input
4	Slave Steps Input	17	Bund Detection
5	General Purpose Output 3	18	Master Steps Output
6	General Purpose Output 4	19	NC (Not Connected)
7	General Purpose Output 2	20	0-10V Output
8	General Purpose Output 1	21	4-20mA Output
9	4-20mA Input	22	0-10V Input
10	Remote I/O +24V	23	+24V Pump Supply
11	+10V Analogue Supply	24	NC (Not Connected)
12	0V Analogue Supply	25	0V Pump Supply
13	Remote I/O 0V		

Figure 1 25 WAY Remote I/O Connector - Diagram & Description of PINs



** The 25 WAY Remote I/O Connector Lead is an optional accessory.*

PIN	Wire Colour	PIN	Wire Colour
1	Red	14	Green/Red
2	Blue	15	Yellow/Red
3	Green	16	White/Red
4	Yellow	17	Red/Black
5	White	18	Red/Brown
6	Black	19	Yellow/Blue
7	Brown	20	White/Blue
8	Violet	21	Blue/Black
9	Orange	22	Orange/Blue
10	Pink	23	Orange/Green
11	Turquoise	24	White/Green
12	Grey	25	Yellow/Green
13	Red/Blue		

Figure 2 25 WAY Remote I/O Connector Lead - Wire Colour

5.2 Power Supply

The Vantage 5000 features optically-isolated input/output lines for using the 25 WAY Remote I/O connection. The user has two different options available for supplying the power to the isolated I/O:

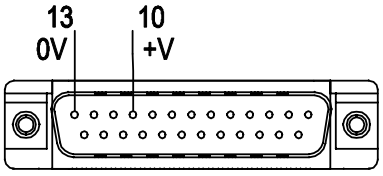
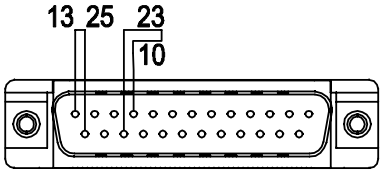
Function	Description	Wiring Diagrams
User provided +24V Pump Supply through pins 13 and 10	- a separate power supply can be fed into pins 13 and 10	
Onboard +24V Pump Supply through pins 23 and 25	- the on-board supply can be used from pins 23 and 25	

Table 1 Power Supply

5.3 Digital Input Wiring

In order to use the digital inputs, the power must be provided to pins 13 and 10 as per (→ 5.2 Power Supply). The digital inputs are activated by connecting the corresponding input pin to ground. These are normally open signals.

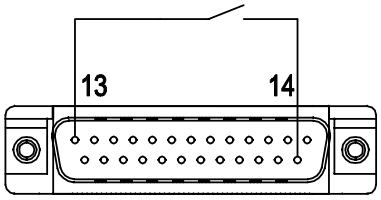
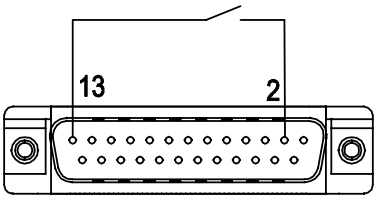
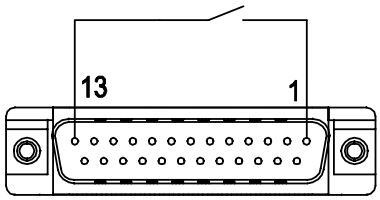
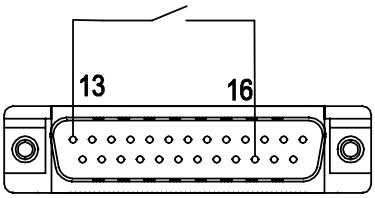
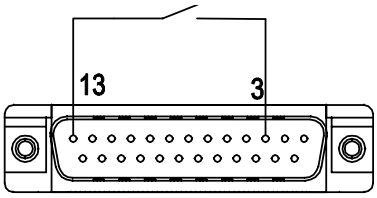
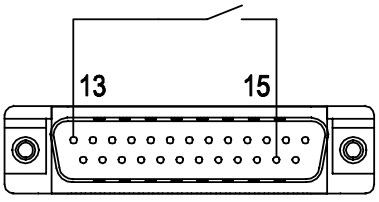
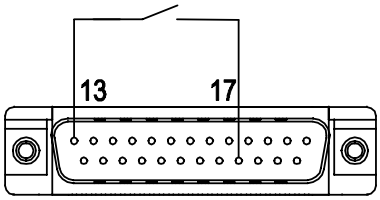
Function	Description	Wiring Diagrams
Start (pin 14)	- will START the pump running. - the STOP signal MUST be closed. - there MUST be no other inhibit errors/signals present. - link pins 14 and 13 (→*Figure 11*). - can be done through a volt-free contact.	
Stop (pin 2)	- will STOP the pump running. - the STOP signal MUST be closed before the pump will respond to a START signal. - link pins 2 and 13 (→*Figure 11).* - can be done through a volt-free contact.	
Manual/Auto (pin 1)	- enables/disables the 25 WAY digital inputs and outputs. - the MANUAL/AUTO signal MUST be closed before the pump will respond to a START signal. - link pins 1 and 13 (→*Figure 11*). - can be done through a volt-free contact.	
Direction Input (pin 16)	- will change the pump direction of operation after the MANUAL/AUTO and STOP signals are closed. - STOP the pump before a direction change will be registered. - when OFF/open, the pump will operate in a clockwise direction. - when ON/closed, the pump will operate in a counter-clockwise direction. - link pins 16 and 13 (→*Figure 11*). - can be done through a volt-free contact.	
Product Destination Full (pin 3)	- will notify the pump that the product destination is full. - will alert the user to the alarm signal through a dialog box. - will raise the GENERAL ALARM signal (pin 7). - link pins 3 and 13 (→*Figure 11*). - can be done through a volt-free contact.	
Product Source Empty (pin 15)	- will notify the pump that the product source is empty. - will alert the user to the alarm signal through a dialog box. - will raise the GENERAL ALARM signal (pin 7). - link the pins 15 and 13 (→*Figure 11*). - can be done through a volt-free contact.	
Bund Detection (pin 17)	- will notify the pump when the bund detects product - will alert the user to the alarm signal through a dialog box. - will raise the GENERAL ALARM signal (pin 7). - link pins 17 and 13 (→*Figure 11*). - can be done through a volt-free contact.	

Table 2 Digital Input Wiring

5.4 Digital Output Wiring

In order to use the digital outputs, the power must be provided to pins 13 and 10 as per (→ 5.2 Power Supply). They are all open collector form.

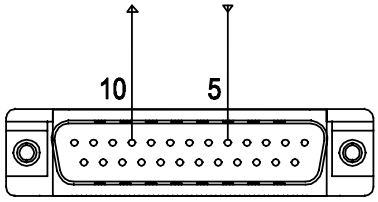
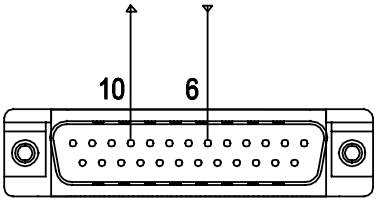
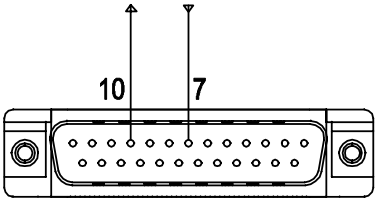
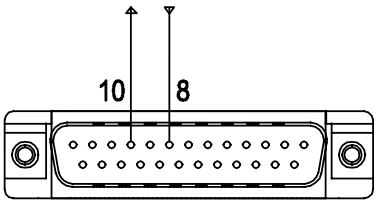
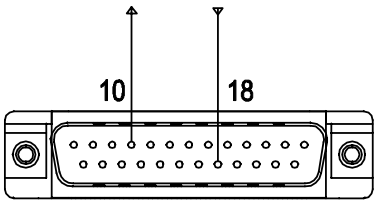
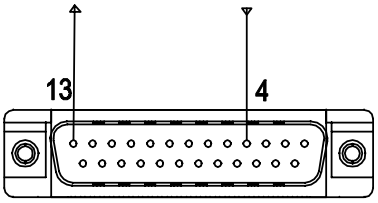
Function	Description	Wiring Diagrams
General Purpose Output 3 (pin 5)	- for more information refer to (→ Vantage 5000 selectable output control functionality and setup). - the maximum current draw for pin 5 is 20 mA.	
General Purpose Output 4 (pin 6)	- for more information refer to (→ Vantage 5000 selectable output control functionality and setup). - the maximum current draw for pin 6 is 20 mA.	
General Purpose Output 2 (pin 7)	- for more information refer to (→ Vantage 5000 selectable output control functionality and setup). - the maximum current draw for pin 7 is 20 mA.	
General Purpose Output 1 (pin 8)	- for more information refer to (→ Vantage 5000 selectable output control functionality and setup). - the maximum current draw for pin 8 is 20 mA.	
Master Steps Output (pin 18)	- will notify the user of the pump's rotational speed. - the output is a clock operating between 0-1024Hz, scaled with the pump operating speed. - use pins 10 and 18 to determine what output speed the pump is running. - the maximum current draw for pin 18 is 20 mA. - typically this is linked to the SLAVE STEPS INPUT signal on a second pump to provide a Master/Slave arrangement from a different pump.	
Slave Steps Input (pin 4)	- will control pump speed as a proportion of input signal - the output is a clock operating between 0-1024Hz, scaled with the pump operating speed. - use pins 13 and 4 to drive the slave pump. - typically this is linked to the MASTER STEPS OUTPUT signal from another pump to provide a Master/Slave arrangement from a different pump.	

Table 3 Digital Output Wiring

5.5 Analogue Wiring

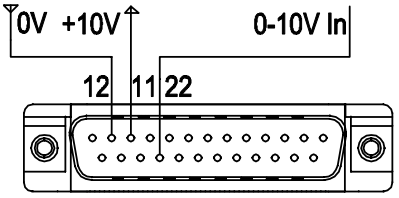
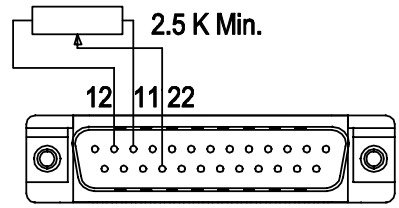
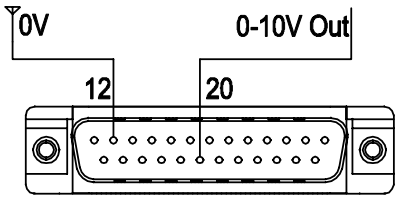
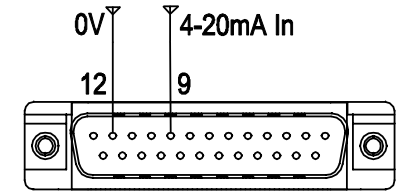
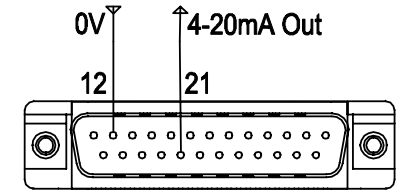
Function	Description	Wiring Diagrams
0-10V Input (pin 22)	- is provided for 0-10V Input speed control. - use the 0-10V INPUT LINE for controlling pump speed operation through pin 22. - +10V Analogue Supply is provided through pin 11. - 0V Analogue Supply is provided through pin 12.	
	Example: 0-10V speed control using a 2.5kΩ potentiometer. A MINIMUM of 2.5kΩ resistor must be used to prevent damage to the pump.	
0-10V Output (pin 20)	- use the 0-10V Output to monitor the rotational speed of the pump. - is provided between pins 20 and 12 - the pump will provide the excitation for a 0-10V Output	
4-20mA Input (pin 9)	- is provided for 4-20mA Input speed control through pin 9. - the 4-20mA loop is provided for analogue ground through pin 12. - this can be scaled in the software. - the 4-20mA has an impedance of 100 Ω. - make sure the loop supply voltage is not too great to damage the pump.	
4-20mA Output (pin 21)	- use the 4-20mA output to monitor the rotational speed of the pump. - output is provided between pins 21 and 12. - the pump will provide the excitation for a 4-20mA output. - will not function correctly with a separate loop voltage supply. - If a 4-20mA output is required to run over a considerable distance/line resistance, a 4-20mA repeater may be required.	

Table 4 Analogue Wiring

Appendix F

6 Breakout Box

The breakout box has been provided to allow the user to make easy connections to all the remote input/output lines on the 25 WAY Remote I/O Connector on the back of the Vantage 5000. For the connector number's function, see *Table 1*.

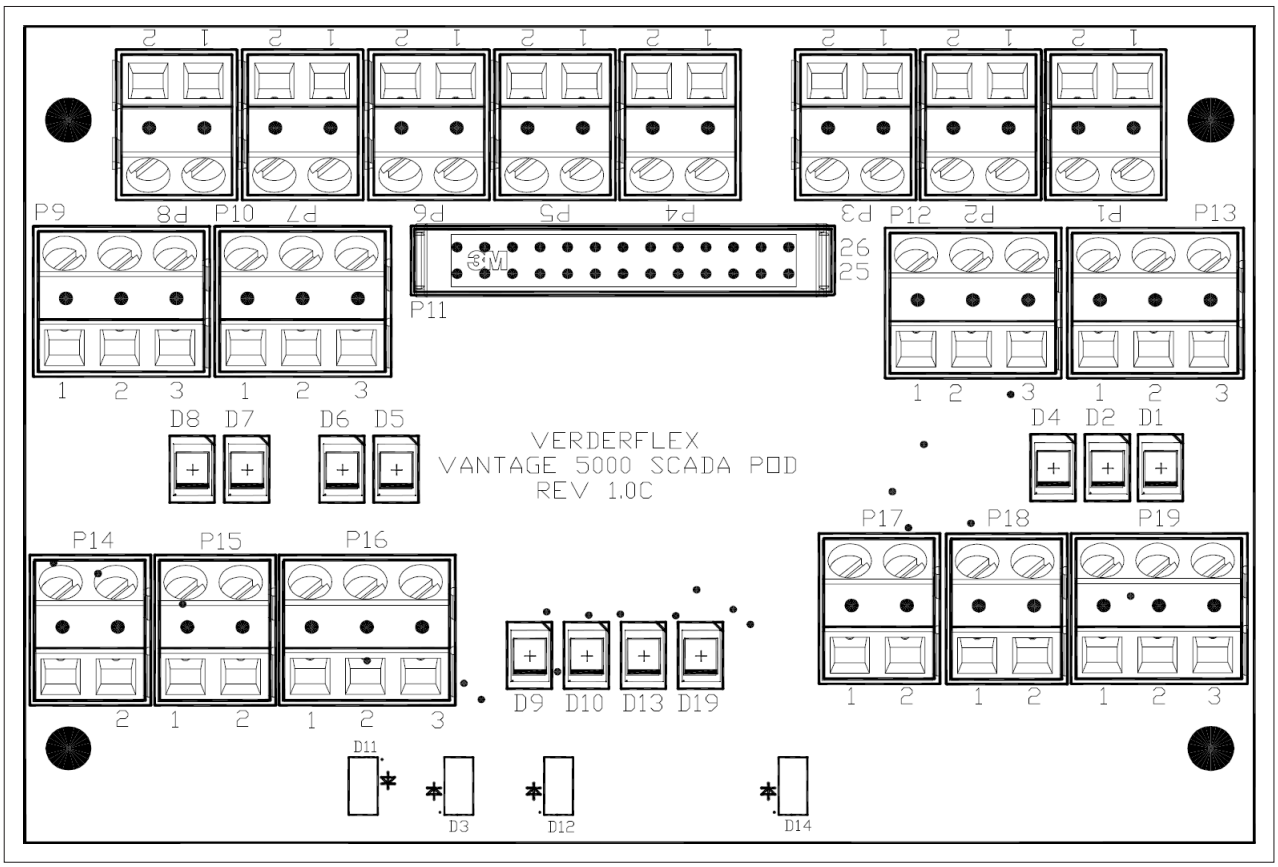


Figure 1 Breakout Box Diagram

Connector Number	Function	Type	Pin number	Signal
P1	START	Input	1	+24V Relay Supply
			2	0V Relay Supply
P2	MANUAL/AUTO	Input	1	+24V Relay Supply
			2	0V Relay Supply
P3	SLAVE STEPS	Input	1	Slave Steps Signal
			2	0V Power Input Rail
P4	BUND DETECT	Input	1	Bund Detect Signal
			2	0V Power Input Rail
P5	PRODUCT DESTINATION FULL	Input	1	Product Destination Full Signal
			2	0V Power Input Rail
P6	PRODUCT SOURCE EMPTY	Input	1	Product Source Empty Signal
			2	0V Power Input Rail
P7	DIRECTION IN	Input	1	+24V Relay Supply
			2	0V Relay Supply
P8	STOP	Input	1	+24V Relay Supply
			2	0V Relay Supply
P9	GENERAL PURPOSE OUTPUT 3	Output	1	Normally Closed
			2	Normally Open
			3	Common
P10	GENERAL PURPOSE OUTPUT 4	Output	1	Normally Closed
			2	Normally Open
			3	Common
P12	ANALOGUE IN	Input	1	0-10V Input
			2	0V Analogue Ground
			3	4-20mA Input
P13	GENERAL PURPOSE OUTPUT 2	Output	1	Normally Closed
			2	Normally Open
			3	Common
P14	EXTERNAL POWER	Power	1	+24V Power Input Rail
			2	0V Power Input Rail
P15	+24V PUMP SUPPLY	Power	1	+24V Pump Power Rail
			2	0V Pump Power Rail
P16	ANALOGUE OUT	Output	1	0-10V Output
			2	0V Analogue Ground
			3	4-20mA Output
P17	MASTER STEPS	Output	1	+24V Power Input Rail
			2	Master Steps Signal
P18	+10V PUMP SUPPLY	Power	1	+10V Pump Power Rail
			2	0V Analogue Ground
P19	GENERAL PURPOSE OUTPUT 1	Output	1	Normally Closed
			2	Normally Open
			3	Common

Table 1 Description of Connector Numbers

6.1 Installing the Breakout Box

6.1.1 Parts for Reference

Ref	Item		QTY	Image
1.	Breakout Box	24 VDC	1	
		115 VAC	1	
2.	Breakout Board Fixing Assembly	M4 x 8	4	
3.	Gland Blanking Plugs with Retaining Nuts		4	
4.	Bulkhead Cable Glands with Retaining Nuts		4	
5.	5.6 mm x 4-40 UNC D Type Connector Fixing Screws		2	
6.	Breakout Box Fixing Assembly	M5 x 12	2	
7.	Blanking Plugs		2	

Table 2 Breakout Box - Parts for Reference

6.1.2 Installation Instructions

Note

The following installation instructions images relate to interfacing a remote start/stop cable connection via a 24VDC breakout board powered from the local 24VDC supply of the Vantage 5000.

1. Remove the four M4 x 8 breakout board fixing screws to release the board from the breakout box.
2. Wire up the breakout board as required; this example shows the unit wired for remote start/stop control.
3. Remove the required number of gland blanking plugs and replace with the bulkhead cable glands.
4. Feed the external cables through the glands. Fix the breakout board back into the breakout box and tighten the cable retaining grommet nuts.
5. Attach the 25 WAY Remote I/O Connector to the back of the Vantage 5000 with the two 5.6mm x 4-40 UNC fixing screws.
6. Fix the breakout box onto the back of the pump with the two M5 x 12 screws, having first adding the seal washers. Press fit the hole blanking plugs onto breakout box.

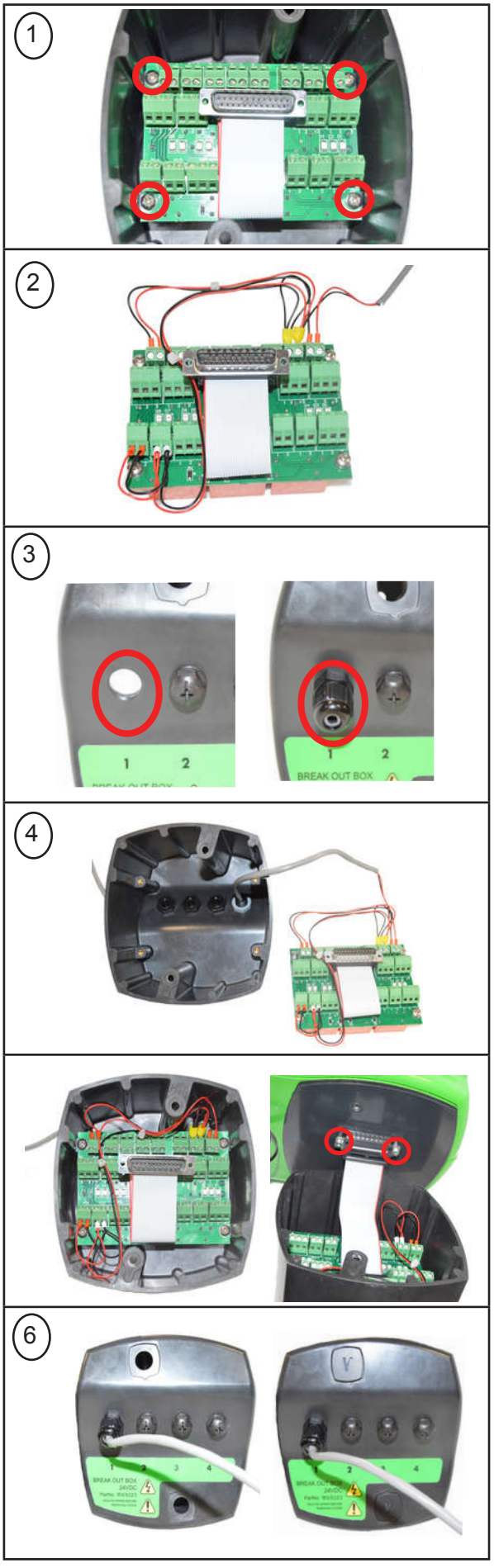


Figure 2 Installation Instructions

6.2 Functionality

The following table shows the Vantage 5000 features on the 25 WAY Remote I/O Connector that are provided with the breakout box.

6.3 Voltage Supplies

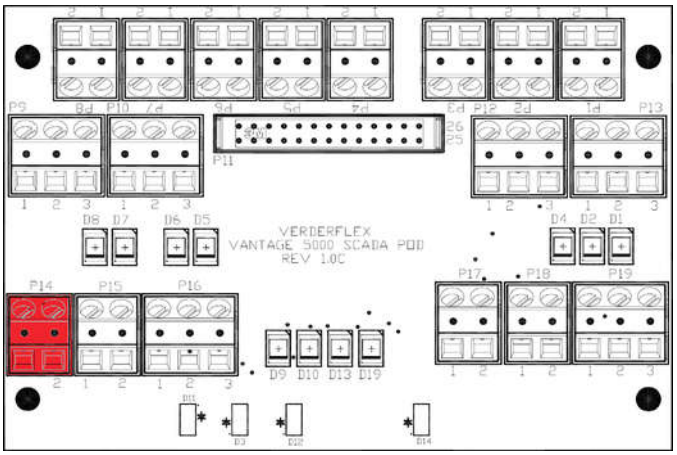
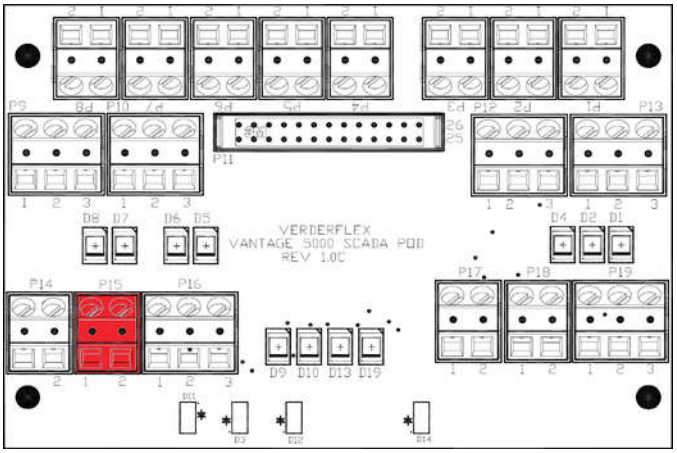
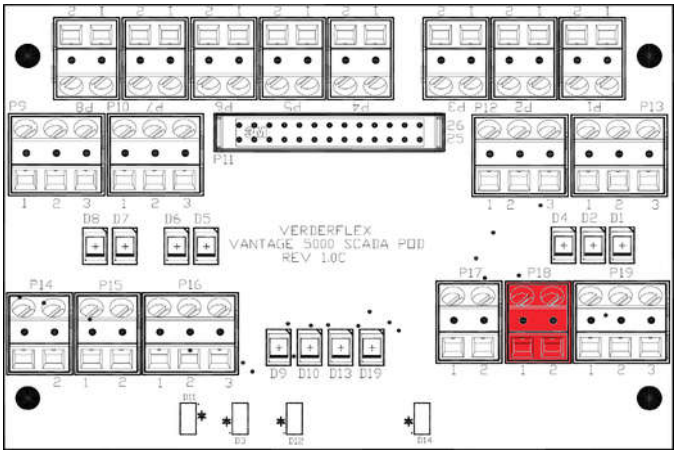
Function	Connector Number	Description	Graphic
+24V Pump Supply (INPUT)	P14	- In order to use the break-out box, a +24V Pump Supply must be connected through P14. This can either be supplied through P15 or from an external supply.	
+24V Pump Supply (OUTPUT)	P15	- is available from the Pump though loads must be restricted to <100mA.	
+10V Pump Supply	P18	- is available from the Pump for Analogue Input Control and this must be restricted to <100mA.	

Table 3 Voltage Supplies

6.4 Applied Voltage Signals

The following signals all require the application of either 24 VDC or 115 VAC (model dependant).

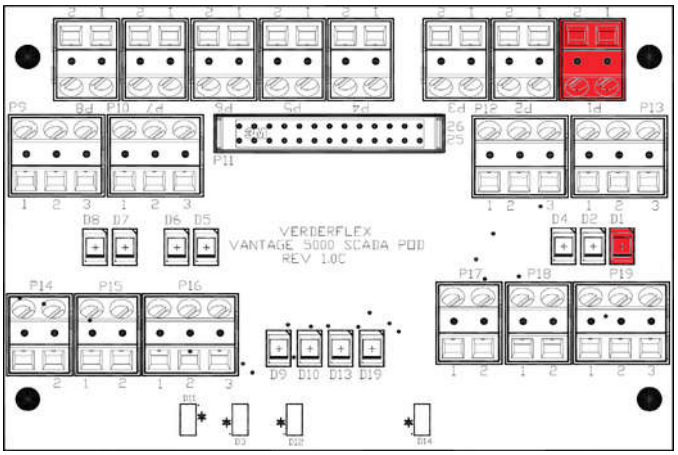
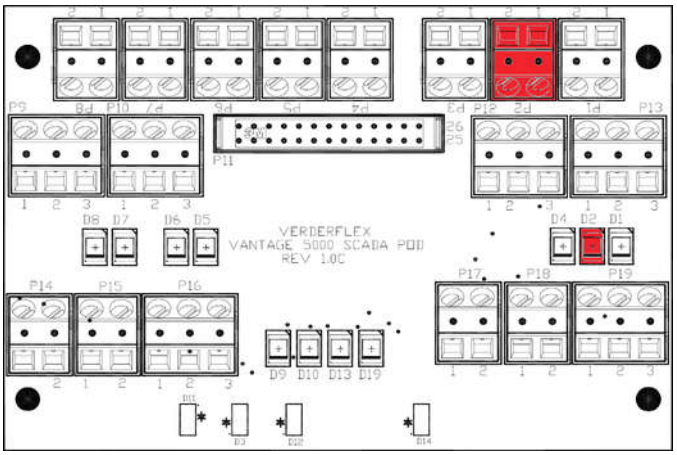
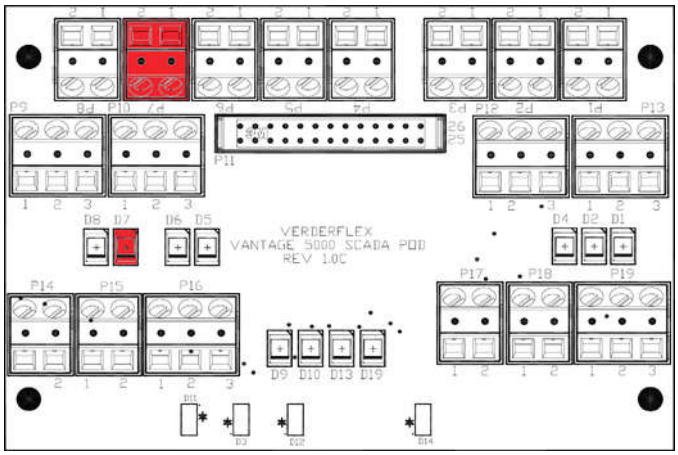
Function	Connector Number	Description	Graphic
Start	P1	- will turn ON the relay and drive the pump start signal which will start the pump. - the signal will respond differently depending on the settings in *Appendix E (5.3 Digital Input Wiring)*. - when the signal is switched ON, the LED D1 will light up.	
MANUAL/ AUTO	P2	- will enable the remote I/O and enable the user to use the remote start/stop functionality. - when the signal is switched ON, the LED D2 will light up.	
DIRECTION IN	P7	- will change the pump direction. - the direction change will only occur when the pump is stopped. - when the signal is switched ON, the LED D7 will light up.	

Table 4 Applied Voltage Signals

6.5 'Volt-free' Signals

The following signals do not require the application of any voltage. Pins 1 and 2 need to be linked together to switch the corresponding functionality. This could be done either through a mechanical switch, a relay or some other volt-free device.

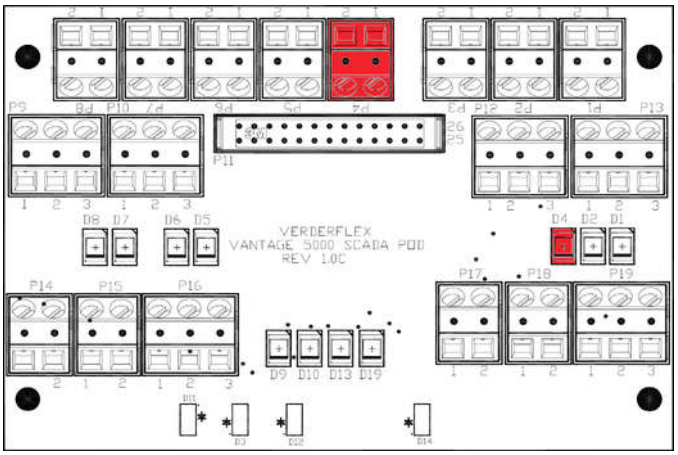
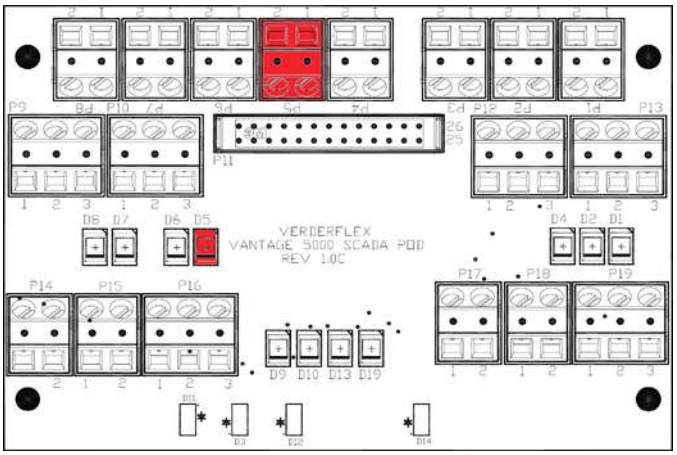
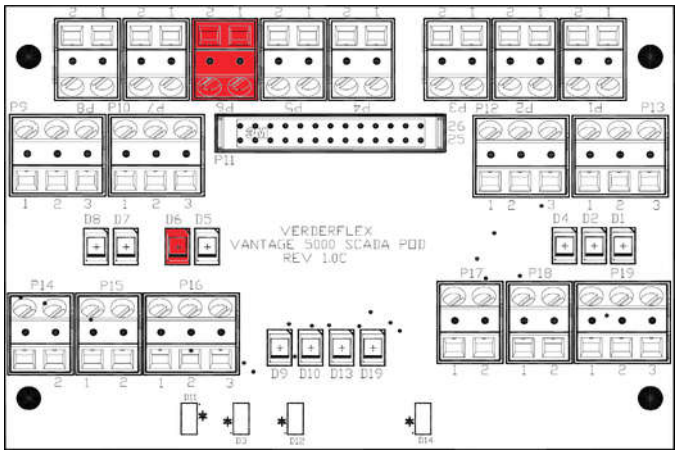
Function	Connector Number	Description	Graphic
Bund Detect	P4	- when pins 1 and 2 are shorted together on P4, the pump will respond to a bund detection event and stop the pump. - when the signal is switched ON, the LED D4 will light up.	
Product Destination Full	P5	- when pins 1 and 2 are shorted together on P5, the pump will respond to a product destination full detection event and stop the pump. - when the signal is switched ON, the LED D5 will light up.	
Product Source Empty	P6	- when pins 1 and 2 are shorted together on P6, the pump will respond to a product source empty detection event and stop the pump. - when the signal is switched ON, the LED D6 will light up.	

Table 5 'Volt-free' Signals

6.6 Output Signals

There are a number of “volt-free” outputs provided on the breakout box for the user to wire into.

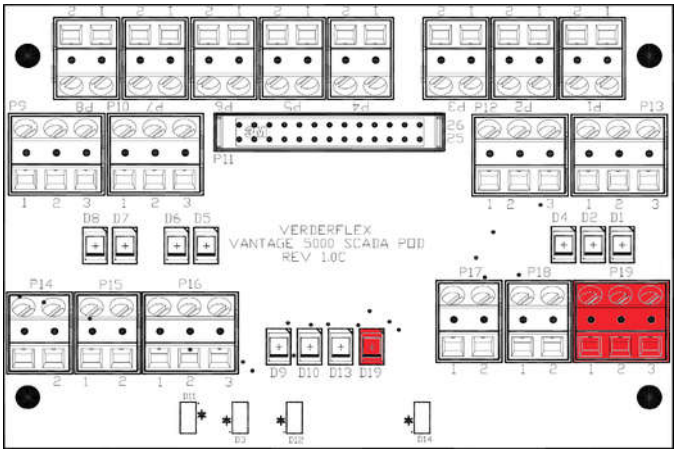
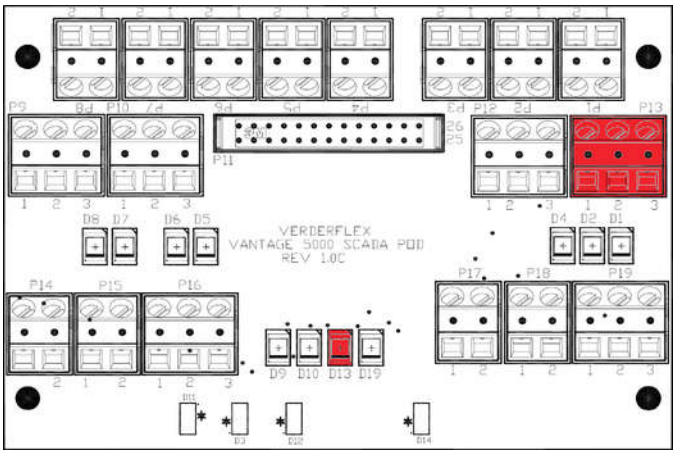
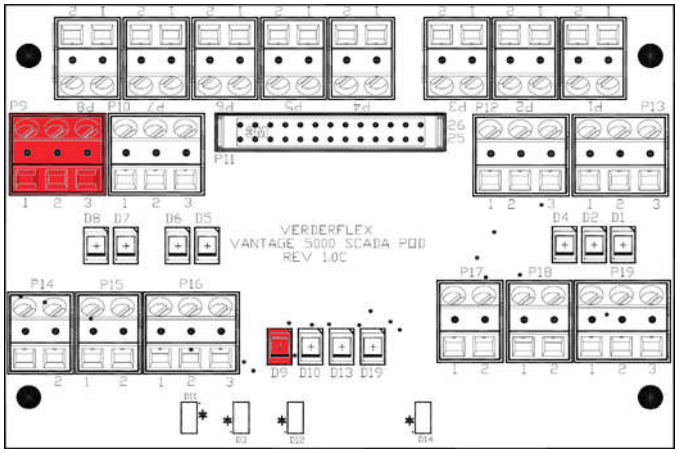
Function	Connector Number	Description	Graphic
Output 1	P19	- when the signal is switched ON, the LED D19 will light up.	
Output 2	P13	- when the signal is switched ON, the LED D13 will light up.	
Output 3	P9	- when the signal is switched ON, the LED D9 will light up.	

Table 6 Output Signals

6.6 Output Signals *(Continued)*

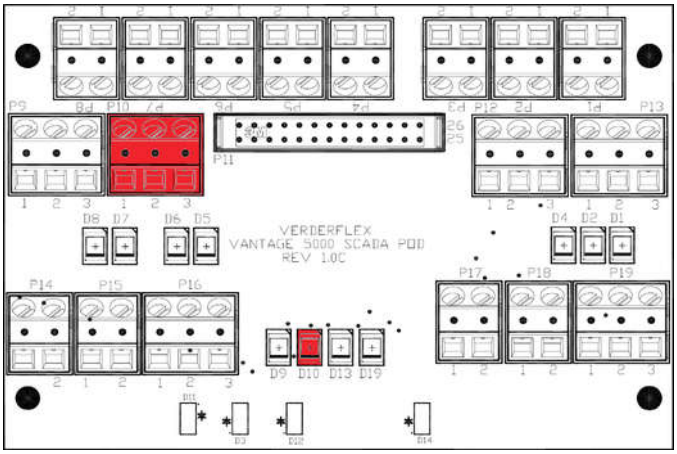
Function	Connector Number	Description	Graphic
Output 4	P10	- when the signal is switched ON, the LED D10 will light up.	

Table 6 Output Signals (continued)

6.5 Analogue signals

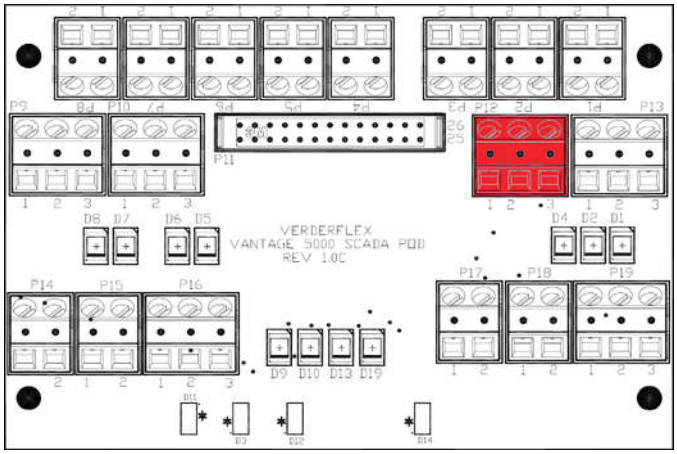
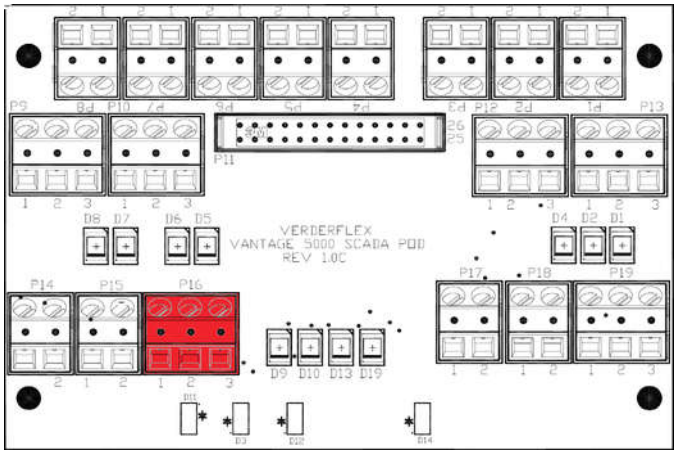
Function	Connector Number	Description	Graphic
Analogue Input	P12	- the pump will accept either 0-10V or 4-20mA signals, with **pin 2** as the 0V analogue rail. - the analogue common should be kept separate to the 0V analogue rail.	
Analogue Output	P16	- the pump will accept either 0-10V or 4-20mA signals, with **pin 2** as the analogue common. - the analogue common should be kept separate to the 0V analogue rail.	

Table 7 Analogue Signals

Appendix G

7 Error, Warning, Event Codes and Descriptions

Code	Type of Error	Description
100	Error	General Error Detected
101	DoorOpenRunning	Door Has Been Opened Whilst Pump is Running
102	DoorOpenStopped	Door Has Been Opened When Pump is Stopped
103	TubeBurst	Tube Burst Has Been Detected
104	MotorAlarm	Motor Alarm Has Been Triggered - Generally a Stall Event
105	SourceEmpty	Source Empty Alarm Has Been Triggered
106	DestinationFull	Destination Full Alarm Has Been Triggered
107	Bund Detect	Bund Full Detection Has Been Triggered
109	PowerFail	Power Failure Has Been Detected
110	OverTemperature	Pump Has Detected an Over Temperature
111	CommunicationError	General Communications Error

Table 1 Error codes and description

Code	Type of Warning	Description
200	Warning	General Warning Detected
201	DoorOpenRunning	Door Has Been Opened Whilst Pump is Running
202	DoorOpenStopped	Door Has Been Opened When Pump is Stopped
203	TubeBurst	Tube Burst Has Been Detected
204	MotorAlarm	Motor Alarm Bas Been Triggered - Generally a Stall Event
205	SourceEmpty	Source Empty Alarm Has Been Triggered
206	DestinationFull	Destination Full Alarm Has Been Triggered
207	Bund Detect	Bund Full Detection Has Been Triggered
209	PowerFail	Power Failure Has Been Detected
210	OverTemperature	Pump Has Detected an Over Temperature
211	CommunicationError	General Communications Error

Table 2 Warning codes and description

Code	Type of Event	Description
301	SystemPowerLoss	System Power Loss Detected
302	SystemBoot	System Has Booted
303	Login	User Has\Logged in Successfully
304	UnsuccessfulLogin	User Has Not Logged in Successfully
305	LoginWithoutPasscode	User Has Logged in Without a Passcode
306	TubeLifeLow	Control Interval Alarm Has Triggered
308	PumpStart	Pump Has Started Running
309	PumpAntiDripStart	Pump Anti-Drip Has Started
310	PumpStop	Pump Has Stopped Running
311	ImportSettings	Pump Settings Have Been Imported
312	ImportJobs	All Job Files Have Been Imported
313	ImportSingleJob	One Job File Has Been Imported
314	ExportSettings	Pump Settings Have Been Exported
315	ExportJobs	All Job Files Have Been Exported
316	ExportSingleJob	One Job File Has Been Exported
317	ExportEvents	Event Log Has Been Exported
318	AutoRestart	Pump Has Auto-Restarted After a Power Loss
319	PumpCalibration	Pump Has Been Calibrated
320	JobCopy	Job File Has Been Copied
321	JobDelete	Job File Has Been Cleared
322	JobActivate	Job File Has Been Activated
323	JobEdited	Job File Has Been Edited
324	ControlMaintainedModeChanged	Remote Start/Stop Control Mode Maintained Option Has Been Changed
325	ControlSpeedModeChanged	Remote Speed Control Mode Has Been Changed
326	ControlStartStopModeChanged	Remote Start/Stop Control Mode Has Been Changed
327	ControlParameterChanged	Remote Speed Control Mode Has Had Parameters Changed
328	PasscodeSystemEnabled	Passcode System Has Been Enabled
329	PasscodeSystemDisabled	Passcode System Has Been Disabled
330	PasscodeSupervisorRequestChanged	Passcode Supervisor Passcodes Option Has Been Changed
331	PasscodeOperatorRequestChanged	Passcode Operator Passcodoes Option Has Been Changed
332	PasscodeUserNameChanged	User Name Has Been Changed in Passcode System
333	PasscodePINChanged	User Passcode Has Been Changed
334	PasscodeAccessLevelChanged	User Access Level Has Been Changed
335	SettingsDateChanged	Pump Date Has Been Changed
336	SettingsTimeChanged	Pump Time Has Been Changed
338	SettingsLanguageChanged	Pump Language Has Been Changed
339	SettingsFactoryReset	Pump Has Been Factory Reset

Table 3 Event codes and description

Appendix H

8 Formatting the USB drive

The USB update procedure is detailed as follows:

1. Software can only be updated using a FAT32 formatted USB flash drive. If the drive is already formatted to FAT32, the user can skip to *step 9*.
2. To verify if the drive is formatted using FAT32, insert the memory stick into a Windows PC.
3. Open the 'Computer' folder and highlight the memory stick.

Note: If using Windows 7, the file system will be displayed as per *Figure 1*. If the file system is not displayed, right-click on the USB drive and select 'Properties'.

4. When 'Properties' has been selected the window will be opened as shown in *Figure 2*.
5. If the file system is not FAT32, the user will need to format the USB drive.

⚠ WARNING

Formatting will destroy all data!

Do not perform unless you do not need the data on the drive.

6. To format, close the properties page.
7. Right-click on the drive and select the option marked 'Format'. The window will open as per *Figure 3*.
8. Ensure the "File system" reads "FAT32", then the user can press the 'Start' button.
9. Once formatting is complete, copy the firmware file to the roote path on the drive.

Note

If the USB drive is added as drive 'G', the firmware path would be '*G:\Jupiter.bin*'.

10. Make sure firmware file is named ***'Jupiter.bin'***. Any other name will result in the pump not updating (e.g ***'Jupiter.bin.bin')***.
11. Safely remove USB stick from computer.

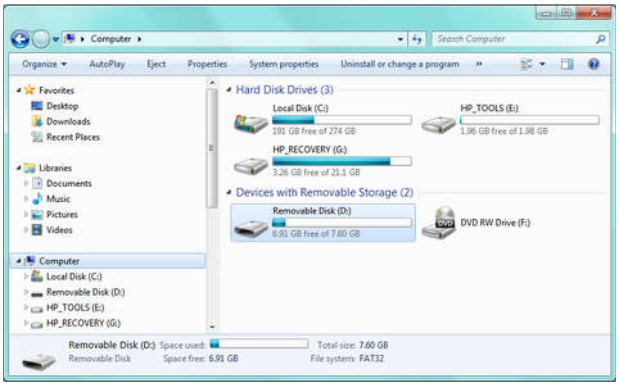


Figure 1 'Computer' Folder Opened

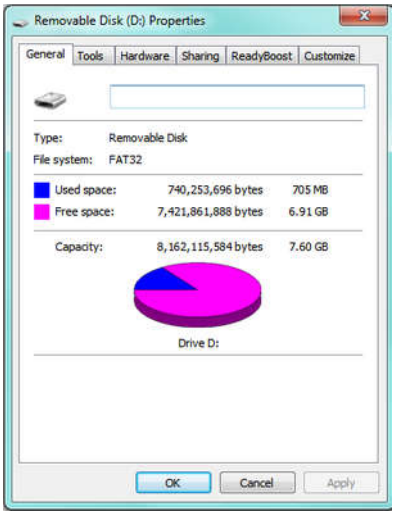


Figure 2 Properties of the USB Drive

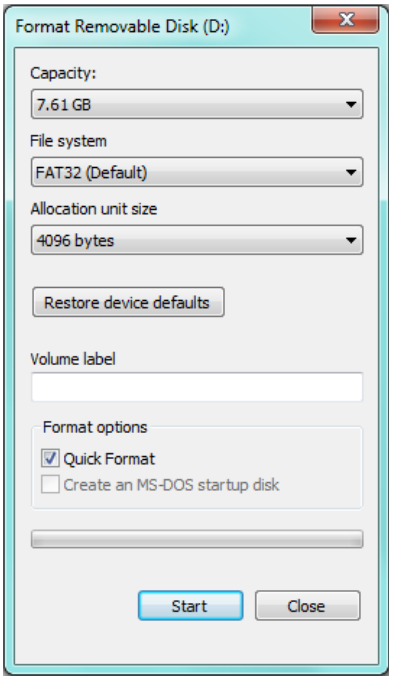


Figure 3 Format the USB Drive

Appendix I

9 Standards

Item	EC Harmonised Standards / Other Standards	Title
1	BS EN 60204-1	Safety of Machinery - Electrical Equipment of Machines
2	BS EN 61010-1 + A2 Category 2, Pollution degree 2	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
3	BS EN 809	Pumps and Pump Units for Liquids - Common Safety Requirements
4	BS EN 61000-4-2, called by BS EN 61000-6-1	ESD Immunity
5	BS EN 61000-4-3, called by BS EN 61000-6-1	Radiated Immunity
6	BS EN 61000-4-4, called by BS EN 61000-6-1	Fast Transient Burst
7	BS EN 61000-4-5, called by BS EN 61000-6-1	Surge Immunity
8	BS EN 61000-4-6, called by BS EN 61000-6-1	Conducted RF Immunity
9	BS EN 61000-4-11, called by BS EN 61000-6-1	Voltage Dips and Interruptions
10	ANSI C63.4-2009, called by 47CFR15 part 15	Federal Communications Commission (FCC)
11	BS EN 55016-2-3, called by BS EN 61000-6-3 + A1	Radiated Emissions
12	BS EN 55016-2-1, called by BS EN 61000-6-3 + A1	Conducted Emissions
13	BS EN 61000-3-2, called by BS EN 61000-6-3 + A1	Harmonic Emissions
14	BS EN 61000-3-3, called by BS EN 61000-6-3 + A1	Flicker
15	UL 61010A-1	UL Standard for Safety Electrical Equipment for Laboratory Use
16	CAN/CSA-C22.2 No 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
17	NEMA 4X to NEMA 250 (indoor use)	Enclosures for Electrical Equipment (1000 Volts Maximum) NEMA 250-2014

Table 1 Standards

Appendix J

10 Modbus® RTU

Modbus® is a registered trademark of Schneider Electric, licensed to the Modbus Organization, Inc.

10.1 Introduction

For Modbus® operation, the pump must have an M12 connector on the back of the pump and should be a Vatange 5000 M version.

The Modbus® interface within the Vantage 5000 uses galvanic isolated semiconductor technology that facilitates high differential potentials across a network without creating current loops.

The communication is based around a master/slave system where the Vantage 5000 acts as a slave device and uses RS485 electrical connectivity via A/B terminals. The maximum differential voltage should not not exceed +/- 12V.

The Modbus® protocol used is Modbus® RTU.

Note

Calibration of the Vantage 5000 cannot be performed when Modbus® has been enabled. Make sure the pump is in HMI mode for 'Speed' and 'Start/Stop' control when performing a pump calibration.

10.2 Modbus® Connection

The Modbus® is interfaced to the Vantage 5000 via an Amphenol M series A Type 5 WAY Connector positioned on the back of the pump.

The mating female connector (manufacturer part number is 12-05BFFA-SL8001) can be supplied from Digi-key (part number APC1734-ND). The pin assignments are as follows:

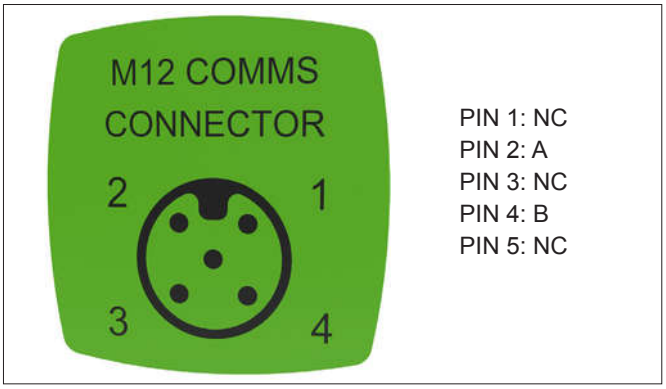


Figure 1 M12 Comms Connector Label



Figure 2 Back of the Pump - Vantage 5000 M

10.3 Failsafe Operation

A valid Modbus® function must be sent at least once every 10 seconds for the pump to maintain a defined operational state. If no valid Modbus® packet is detected the pump will revert to a set of default conditions defined by the settings in the 'Failsafe Setup Word' and the 'Failsafe Speed'.
These registers can be read from:

- Read Only, Current Status, 'Input Register', (→ 10.4.1 Input Registers)
- Read/Write, Pending Status, 'Holding Register', (→ 10.4.2 Holding Registers)

10.3.1 Failsafe Setup Word

Type: Holding Register
Address: 0x205 (decimal 517)

Modbus® Function Code: 0x06 (decimal 6), Write single
Modbus® Function Code: 0x10 (decimal 16), Write multiple

Bit Number	Function	State Description
0	Failsafe Pump Speed	Bit State: Action 0: Pump off 1: Pump continues at the last demanded speed
1	Failsafe Speed Source	Bit State: Action 0: Use settings defined in bit number 0 above 1: Pump continues at the speed defined in 'Failsafe Speed' as shown in the 'Holding Registers' and 'Input Registers'
2-15	Not Used	

Table 1 Failsafe Operation

10.4 Modbus® Data/Address Field Information

The Modbus® communication protocol allows for the reading or writing of single or multiple registers and the reading or writing of single bit registers known as 'Coil' registers, depending on the code specified in the code field of a Modbus® message.

10.4.1 Input Registers

Input registers reflect the actual active state of the pump.

Type: Input Registers
Modbus® Function Code: 0x04 (decimal 4), Read

Note

The register address is read-only data. Each address holds data that is word length (16 bits wide).

Register Address Hex (decimal)	Field Description	Example Value	Explanation of Field
0x00FF (255)	Pump Model	5000	The 16 bit integer value of the model number of the pump.
0x0100 (256)	Job Tube Size	4	The 16 bit integer value is derived from the following table:
0x0101 (257)	Software Version Number (Low Word)	194	The 32 bit integer value representing the Version number 1.9.4.
0x0102 (258)	Software Version Number (High Word)	0	
0x0103 (259)	Status Word		See (→ 10.4.4 System Status Word Register)
0x0104 (260)	Pump Speed	105	The 16 bit integer value that represents the value of the 'Applied Speed' when the pump is running. When the pump is not running this value returns to zero. The example represents the speed in tenths of RPM therefore 10.5 RPM.
0x0105 (261)	Pump Run Time (Low Word)	0x7E86	The 32 bit integer representing the total pump running time in seconds. For example 0x00017E86 (97926 in decimal) equates to 1 day, 3 hours, 12 minutes and 6 seconds.
0x0106 (262)	Pump Run Time (High Word)	0x0001	

Tube Size	Value
1.6 x 1.6 LP	1
3.2 x 1.6 LP	2
4.0 x 1.6 LP	3
4.8 x 1.6 LP	4
6.4 x 1.6 LP	5
8.0 x 1.6 LP	6
3.2 x 2.4 LP	7
4.8 x 2.4 LP	8
6.4 x 2.4 LP	9
8.0 x 2.4 LP	10
9.6 x 2.4 LP	11
3.2 x 2.4 MP	12
3.2 x 2.4 HP	13

Table 2 Input Registers

10.4.1 Input Registers *(continued)*

<table>
<tr><th>Register Address Hex (decimal)</th><th>Field Description</th><th>Example Value</th><th>Explanation of Field</th></tr>
<tr><td>0x0107 (263)</td><td>Job Run Time (Low Word)</td><td>0x5638</td><td rowspan="2">The 32 bit integer representing the total job running time in seconds. For example 0x00025638 (153144 in decimal) equates to 1 day, 18 hours, 32 minutes and 24 seconds.</td></tr>
<tr><td>0x0108 (264)</td><td>Job Run Time (High Word)</td><td>0x0002</td></tr>
<tr><td>0x0109 (265)</td><td>Tacho Counter (Low Word)</td><td>0x3278</td><td rowspan="2">The 32 bit integer representing the number of rotations of the rotor to the nearest whole number. For example 0x00013278 equates to 78456 rotations.</td></tr>
<tr><td>0x010A (266)</td><td>Tacho Counter (High Word)</td><td>0x0001</td></tr>
<tr><td>0x010B (267)</td><td>Displacements per Revolution (Low Word)</td><td>0xE6D7</td><td rowspan="2">The 32 bit floating point number based on the flow rate and the pump speed. For example 0x416D-E6D7 equates to 14.868857 units/rev.</td></tr>
<tr><td>0x010C (268)</td><td>Displacement per Revolution (High Word)</td><td>0x416D</td></tr>
<tr><td>0x010D (269)</td><td>Flow Rate (Low Word)</td><td>0x61DB</td><td rowspan="2">The 32 bit integer representing the flow rate x 1000. For example 0x000261DB (156123 in decimal)equates to 156.123 units as selected (e.g. ml/min).</td></tr>
<tr><td>0x010E (270)</td><td>Flow Rate (High Word)</td><td>0x0002</td></tr>
<tr><td>0x010F (271)</td><td>Job Mode</td><td>0</td><td>The 16 bit integer value derived from the following table:
<table><tr><td>Job mode</td><td>Value</td></tr><tr><td>Flow</td><td>0</td></tr><tr><td>Dose</td><td>1</td></tr><tr><td>Batch</td><td>2</td></tr></table></td></tr>
<tr><td>0x0110 (272)</td><td>Flow Rate Units</td><td>2</td><td>The 16 bit integer value derived:
<table><tr><td>Unit of Measure (UoM)</td><td>Value</td></tr><tr><td>ml/sec</td><td>1</td></tr><tr><td>ml/min</td><td>2</td></tr><tr><td>Grams/sec</td><td>3</td></tr><tr><td>Grams/min</td><td>4</td></tr><tr><td>l/hour</td><td>5</td></tr><tr><td>Pounds/hour</td><td>6</td></tr><tr><td>USG/hour</td><td>7</td></tr></table></td></tr>
<tr><td>0x0111 (273)</td><td>Calibration Date (Low Word)</td><td>0x0B39</td><td rowspan="2">The 32 bit integer value representing Unix time format i.e. the total number of seconds from Thursday, 1 January 1970. For example 0x581B0B39 (14781673553) equates to Thu, 03 Nov 2016 10:02:33 GMT.</td></tr>
<tr><td>0x0112 (274)</td><td>Calibration Date (High Word)</td><td>0x581B</td></tr>
<tr><td>0x0113(275)</td><td>Applied Calibration Factor (Low Word)</td><td>0xDD2F</td><td rowspan="2">The 32 bit floating point number representing the active calibration factor. For example 0x4064DD2F equates to 3.576.</td></tr>
<tr><td>0x0114(276)</td><td>Applied Calibration Factor (High Word)</td><td>0x4064</td></tr>
</table>

Table 2 Input Registers (continued)

10.4.1 Input Registers *(continued)*

Register Address Hex (decimal)	Field Description	Example Value	Explanation of Field
0x0115 (277)	Job Counter	45	The 16 bit integer representing the number of doses that a pump has delivered. This number is reset to zero when the 'Reset Job Counter' bit is set in the control word.
0x0116 (278)	Input States		See (→ 10.4.5 Input/Output Status Word Register)
0x0117 (279)	Output States		See (→ 10.4.5 Input/Output Status Word Register)
0x0118 (280) (1	Control Word Applied		See (→ 10.4.3 Control Word Register)
0x0119 (281) (1	Speed Applied	405	The 16 bit integer value representing the speed to be applied in tenths of RPM. The example represents 40.5 RPM.
0x011A (282) (1	Minimum Speed Applied	54	The 16 bit integer value representing the minimum speed setting in tenths of RPM. The example represents 5.4 RPM.
0x011B (283) (1	Maximum Speed Applied	2567	The 16 bit integer value representing the maximum speed setting in tenths of RPM. The example represents 256.7 RPM.
0x011C (284) (1	Failsafe Setup Word Applied	2	The example value indicates that if Modbus® fails then use the failsafe speed. (→ 10.3 Failsafe Operation)
0x011D (285) (1	Failsafe Speed Applied	135	The example value indicates the speed in tenths of RPM i.e. 13.5 RPM. (→ 10.3 Failsafe Operation)

Table 2 Input Registers (continued)

(1 These registers refer to the actual active settings and values of the pump, whereas their reflected registers, as seen in (→ 10.4.2 Holding Registers), are associated with pending values which will be updated when the pump is stopped. This differentiation is important for system programmers to understand since certain registers should not be dynamically updated whilst the pump is running.

10.4.2 Holding Registers

Data loaded into the holding registers does not immediately become active if the pump is performing some active function. The data read from these registers will reflect what has been written, not what the actual active registers are holding as read from the input registers (→ 10.4.1 Input Registers).

Type: Holding Registers
Modbus® Function Code: 0x03 (decimal 3), Read
Modbus® Function Code: 0x06 (decimal 6), Write single
Modbus® Function Code: 0x10 (decimal 16), Write multiple

Note

Each address holds data that is word length (16 bits wide).

Register Address Hex (decimal)	Field Description	Example Value	Explanation of Field
0x01FF (511) (1	Control Word	3	The example represents a requirement for the pump to run and in an anticlockwise direction. (→ 10.4.3 Control Word Register).
0x0200 (512)	Speed Set Point	237	The 16 bit integer value representing the required speed in tenths of RPM. The example shows a set point of 23.7 RPM.
0x0201 (513) (2	Calibration Factor (Low Word)	0x337D	The 32 bit floating point value which represents the calibration factor. The example shows a calibration factor of 0x3EB3337D equates to 0.3500022.
0x0202 (514) (2	Calibration Factor (High Word)	0x3EB3	
0x0203 (515) (3	Minimum Speed	115	The 16 bit integer representing the minimum speed in tenths of RPM therefore the minimum speed is set to 11.5 RPM. This will only be actioned if the Fieldbus min/max speed is enabled (→ 10.4.3 Control Word Register).
0x0204 (516) (3	Maximum Speed	2475	The 16 bit integer representing the maximum speed in tenths of RPM therefore the maximum speed is set to 247.5 RPM. This will only be actioned if the Fieldbus min/max speed is enabled (→ 10.4.3 Control Word Register).
0x0205 (517)	Failsafe Setup Word	2	The example defines that if Modbus® fails then use the failsafe speed. (→ 10.3 Failsafe Operation)
0x0206 (518)	Failsafe Speed	135	The example shows the failsafe speed in tenths of RPM i.e.13.5 RPM. (→ 10.3 Failsafe Operation)

Table 3 Holding Registers

(1 The Control Word is a volatile register. It does not hold its value when the pump is powered down.
(2 The Calibration Factor will not be updated until the 'Fieldbus Calibration Factor Load' flag in the 'Control Word' is set to 1, at which point this value will be readable in the 'Applied Calibration Factor' register so long as the pump is not running.
(3 Minimum and maximum speed must be enabled via the 'Control Word' register.

10.4.3 Control Word Register

The following bit functions will not take place if the pump is running at the time the command is sent, although the pump will remember that a flag has been triggered and the pump will update the relevant registers or actions as soon as the pump has stopped. This register is volatile i.e. it loses its value when the power is removed and will default to the value 0 on power up.

Type: Coil Registers (Volatile)
Modbus® Function Code: 0x01(decimal 1), Read
Modbus® Function Code: 0x05 (decimal 5), Write single
Modbus® Function Code: 0x0F (decimal 15), Write multiple

Note

This is a series of bit wide registers.

Register Address (decimal)	Function	Status Function
0x02FF(767)	Motor Run	0 = Motor not Running 1 = Motor Running
0x0300(768)	Direction	0 = Clockwise 1 = Anticlockwise
0x0301(769)	Tacho Reset	0 = Tacho Counter Unaffected 1 = Reset Tacho Counter
0x0302(770)	Fieldbus Min/Max Enable	0 = Min/Max Disabled 1 = Min/Max Enabled
0x0303(771)	Fieldbus Calibration Factor Load	0 = Do not Load Calibration 1 = Load Calibration Factor

Table 4 Control Word Definition

10.4.4 System Status Word Register

This is a read-only register and reflects the operational status of the Vantage 5000.

Type: Input Register
Address: 0x0103 (decimal 259)

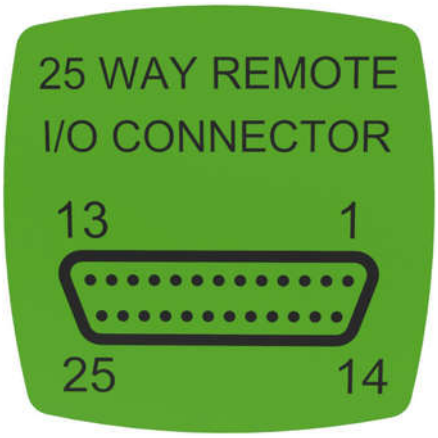
Modbus® Function Code: 0x04 (decimal 4), Read
Word length (16 bits wide)

Bit Number	Function	Status Function
0	Motor Running	0 = Motor Not Running 1 = Motor Running
1	Global Error Flag	0 = No Global Errors 1 = Global Error Detected
2	Fieldbus Enable	0 = Fieldbus Disabled 1 = Fieldbus Enabled
3	Door Open Error	0 = Door Closed 1 = Door Opened
4	Not Used	Default Value = 0
5	Not Used	Default Value = 0
6	Over Temperature Error	0 = Temperature Normal 1 = Over Temperature Detected
7	Motor Stalled	0 = Motor Running Normally 1 = Motor Stalled
8	Not Used	Default Value = 0
9	Tube Burst	0 = Tube Burst Not Detected 1 = Tube Burst Detected
10	Low Set Point Out of Range	0 = Low Set Point In Range 1 = Low Set Point Out of Range
11	High Set Point Out of Range	0 = Low Set Point In Range 1 = Low Set Point Out of Range
12	Fluid Level Alert	0 = Low Set Point In Range 1 = Low Set Point Out of Range
13	Not Used	Default Value = 0
14	Not Used	Default Value = 0
15	Not Used	Default Value = 0

Table 5 System Status Word Definition

10.4.5 Input/Output Status Word Register

The input and output status words address 0x0114 (decimal 276) and 0x0115 (decimal 277) respectively are read-only and represent the state of some of the input/output pins of the 25 WAY Remote I/O Connector as shown in the figure below.



PIN	Input/Output	Description	PIN	Input/Output	Description
1	Input (1	Manual/Auto	14	Input (1	Start
2	Input (1	Stop	15	Input (1	Product Source Empty
3	Input (1	Product Destination Full	16	Input (1	Direction
4	Input	Slave Steps Input	17	Input (1	Bund Detection
5	Output (1	General Purpose Output 1	18	Output	Master Steps
6	Output (1	General Purpose Output 2	19		NC (Not Connected)
7	Output (1	General Purpose Output 3	20	Output	0-10V
8	Output (1	General Purpose Output 4	21	Output	4-20mA
9	Input	4-20mA	22	Input	0-10V
10	Input	Remote I/O +24V	23	Output	+24V Pump Supply
11	Output	+10V Analogue Supply	24		NC (Not Connected)
12	Output	0V Analogue Supply	25	Output	0V Pump Supply
13	Input	Remote I/O 0V			

Figure 5 25 WAY Remote I/O Connector - Diagram & Description of PINs

(1 *I/O with status designation*

For an input to be activated it must be connected to the local or remote 0V depending on how the I/O has been powered. If an input pin is connected to 0V then the pin is considered to be active and will therefore show as a logic 1 in its corresponding status bit. An output that is not active is defined by a logic 0 in the status word, and a logic 1 when it has been activated.

10.4.5.1 Input Status Word Register

Type: Input Register
Address: 0x0114 (decimal 276)

Modbus® Function Code: 0x04 (decimal 4), Read
Word length 16 bits wide

Bit Number	Function	Status function
0	Manual/Auto	0 = Manual Operation 1 = Remote Control Operation
1	Stop	0 = Stop Input Not Active 1 = Stop Input Active
2	Start	0 = Start Input Not Active 1 = Start Input Active
3	Product Destination Full	0 = Product Destination Not Full 1 = Product Destination Full
4	Product Source Empty	0 = Product Source Not Empty 1 = Product Source Empty
5	Bund Detection Input	0 = No Bund Detection 1 = Bund Detected
6	Direction Input	0 = Clockwise Direction 1 = Counter Clockwise Direction
7 to 15	Not Used	Default Value = 0

Table 6 Input Status Word Register

10.4.5.2 Output Status Word Register

Type: Input Register
Address: 0x0115 (decimal 277)

Modbus® Function Code: 0x04 (decimal 4), Read
Word length 16 bits wide

Bit Number	Function	Status function
0	Output 1 Designation (2	0 = Designation Not Active 1 = Designation Active
1	Output 2 Designation (2	0 = Designation Not Active 1 = Designation Active
2	Output 3 Designation (2	0 = Designation Not Active 1 = Designation Active
3	Output 4 Designation (2	0 = Designation Not Active 1 = Designation Active
4 to 15	Not Used	Default Value = 0

Table 7 Output Status Word Register

(2 *Refer to the user manual (→ Vantage 5000 selectable output control functionality and setup).*

10.5. Cable Recommendation

2 Core, 24 AWG, Screened Twisted Pair.