

Sema Ltd.

Water Pump Controller

V 2.10.0



For WPC's up to and including 7.5kw

Sema Part Numbers

WPC1-2.2 230 Vac single phase 2.2kw controller supplied with a Transducer

WPC1-4.0 230 Vac single phase 4.0kw controller supplied with a Transducer

Please note that the WPC1-4.0 does not have a built in EMC filter and so will require the external filter listed below

EMC1-25-IP66 230 Vac single phase EMC filter suitable for use with the WPC1-4.0

WPC3-2.2 400 Vac three phase 2.2kw controller supplied with a Transducer

WPC3-4.0 400 Vac three phase 4.0kw controller supplied with a Transducer

WPC3-7.5 400 Vac three phase 7.5kw controller supplied with a Transducer

WT Water pressure transducer. 0 to 12Bar 1/2" BSP

Please note that we do produce WPC's bigger than 7.5kw but they are covered by a separate manual

Contact details

Sema Ltd

P.O. Box 374 Pukekohe 2340 New Zealand

info@sema.co.nz

Fax: +64 9 8010031

Workshop and office phone 8.00a.m to 4.30pm +64 9 3580700

Maurice Coates DDI +64 9 3580800 or Mobile +64 27 9396240

www.sema.co.nz

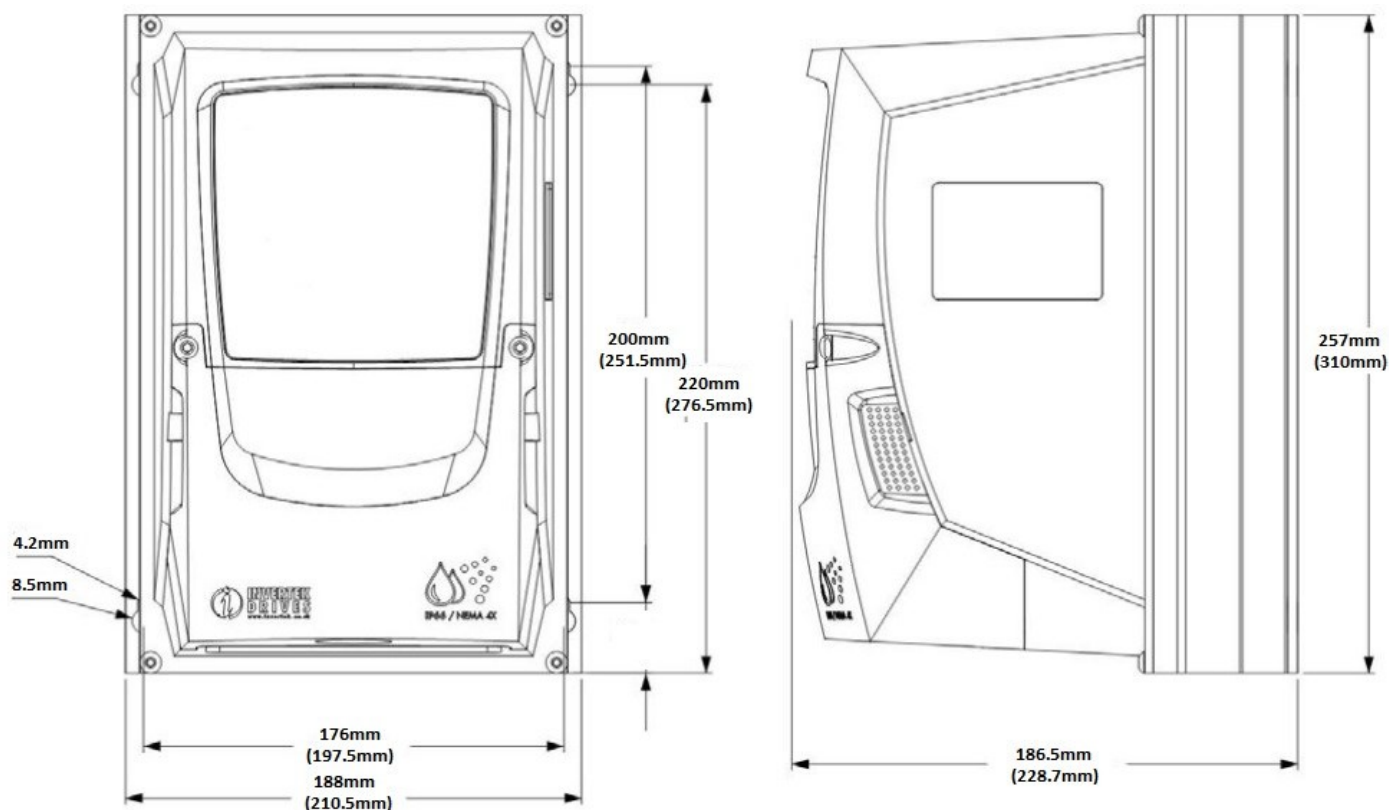
Index

Sema Part Numbers & Contact Details	2
Installation Instructions	4
Wiring	4-7
Control Wiring	6-7
Using the Keypad	8
Initial Setup	9-10
The Running Screen	11
Changing Parameters	11-14
Faults	15
Supplier Declaration of Conformity	16
Invertek Drives Manuals and Certifications	17
Parameter Table	18



Installing

Mounting



N.B. Dimensions outside of brackets refer to the WPC-2.2 & WPC-4.0 those enclosed in brackets refer to the WPC-7.5. If there are no brackets then the dimension is the same for both models.

The controller must be mounted vertically with sufficient clearance above and below the drive to allow air to circulate freely through the fins.

The operating temperature range is -10°C to 40°C .

Wiring

All wiring must be performed by a suitably qualified person who is familiar with, and ensures compliance with, the appropriate Electrical Wiring Regulations.

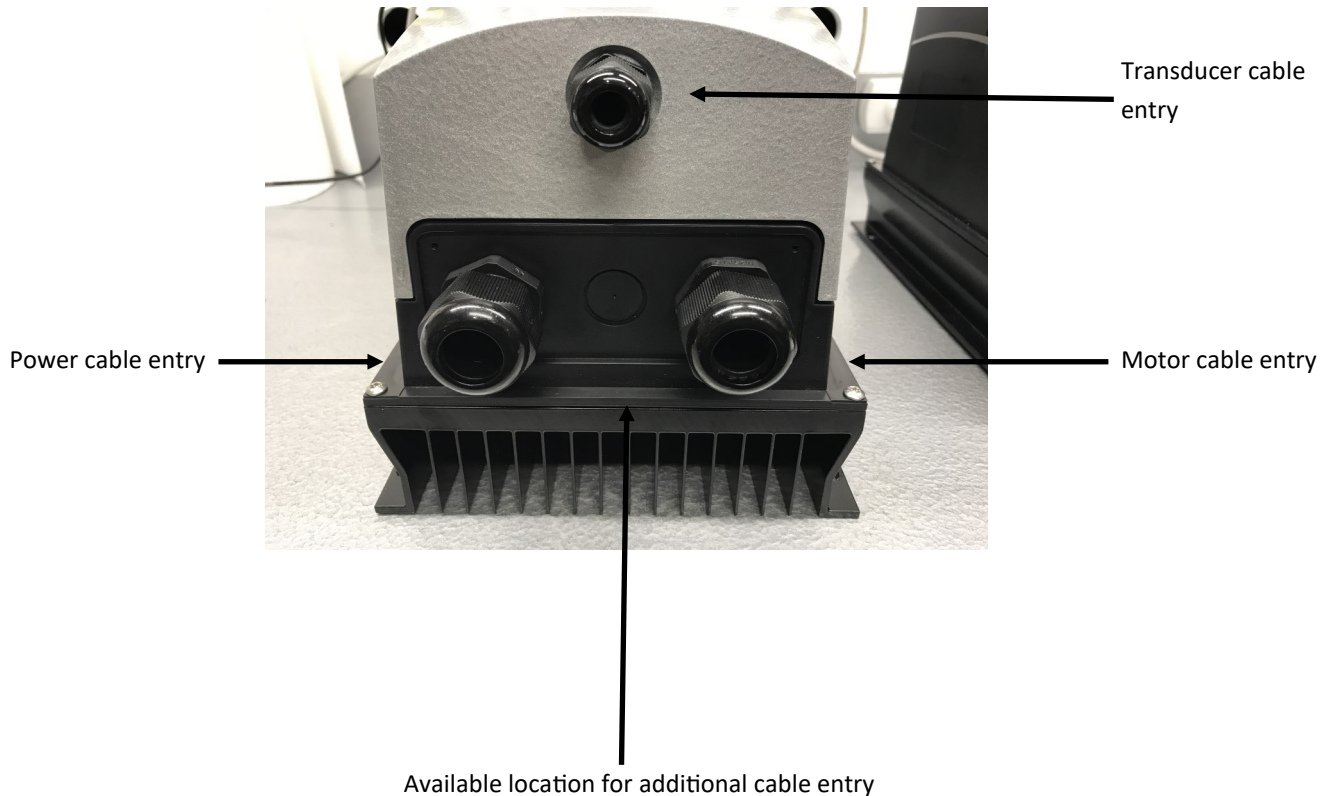
For single phase WPC1-2.2 units use a 32 Amp 'C' curve MCB and size the mains cabling appropriately for the length of the run.

For three phase WPC3 –2.2 units use a 10 Amp 'C' curve MCB and size the mains cabling appropriately for the length of the run.

For three phase WPC3 –7.5 units use a 25 Amp 'C' curve MCB and size the mains cabling appropriately for the length of the run.

EMC screened cable must be used to connect the controller and motor. An EMC gland must be fitted to the motor and the pre-installed EMC clamp or brushed lock-ring must be used in the controller. All wiring that exits the controller including low voltage control cabling must be screened.

As supplied the controller is fitted with 3 glands. An additional gland hole can be drilled between the lower two 25mm glands which can be used for any additional wiring. It is **very** important that only one cable is fed through each gland so as to maintain the IP rating of the gland.



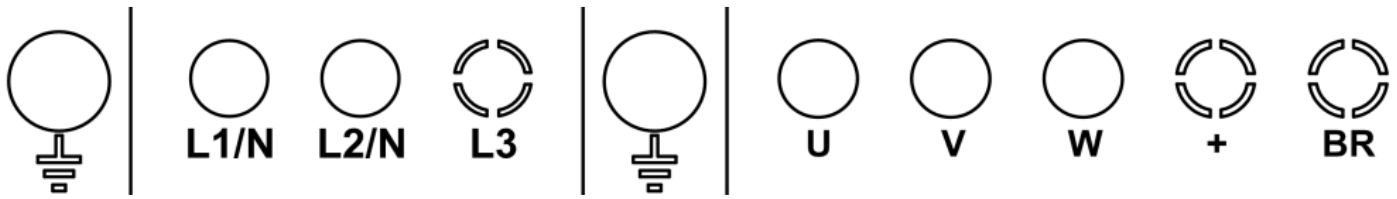
Please note that Sema Ltd has no objection to the glands being replaced with a flexible conduit fitting or any other fitting that the installing electrician would like to use provided that the fitting has an IP rating of at least IP66. Water damage caused by inadequate sealing in this area is not covered under warranty. If you are in doubt that a cable has a large enough cross section to seal in the gland please use a good quality silicon sealant to ensure water tightness.

The Right Hand cable gland has a brushed locknut fitted. To terminate the motor cable screen bare back approximately 15—20mm of the screen so that it makes contact with the brass brush inside the locknut.

Please note that the brushed locknut performs as well, if not better, than an EMC/VSD gland and has the added benefit of allowing an IP68 gland to be used. **There is absolutely no benefit to be gained by replacing this fitting with an EMC gland**



Controller, Power and Motor, Terminal Markings



Always connect the main power and motor cable earths to the terminals marked as earth.

For controllers with a single phase supply connect the Phase to L1 and the Neutral to L2.

For controllers with a three phase supply connect the incoming three phases to L1, L2 and L3.

Connect the three motor wires to U,V and W.

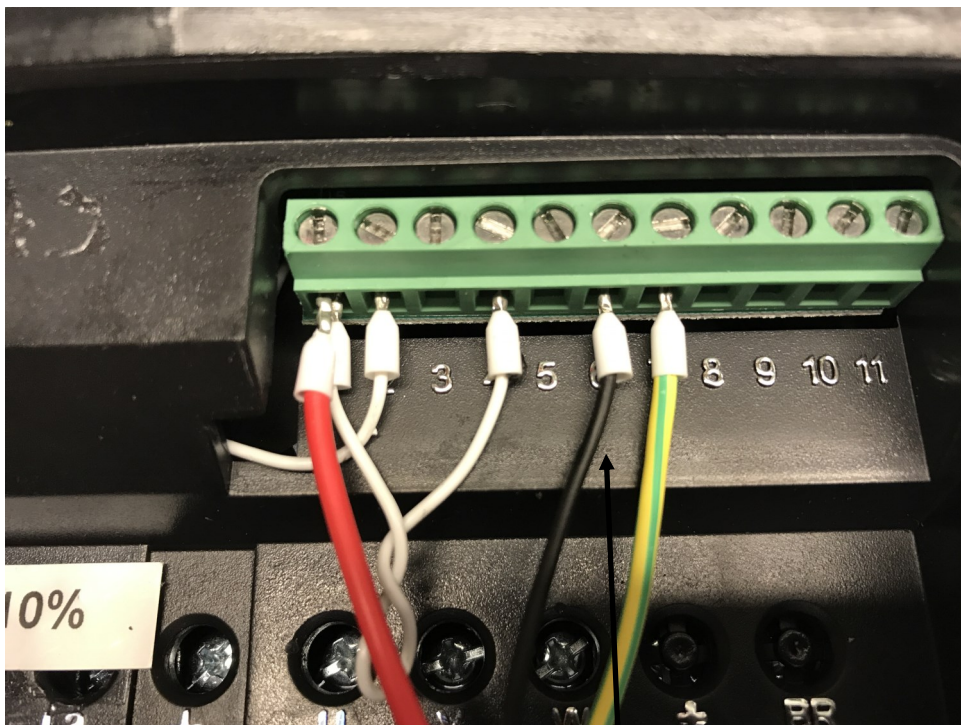
To reverse the direction of rotation of the motor change over any two of the three **motor** wires (U,V and W)

Do not make any connection to + or BR.

Ensure that the motor is connected in either Star or Delta as is appropriate to the voltage of the controller.

Typically a single phase 230Vac controller will require the motor to be connected in Delta and a three phase 400Vac controller will require that the motor is connected in Star. There are exceptions to this with some motors supplied from overseas so please check the motors nameplate.

Control Terminal Connections



Please note that, in some cables, this wire may be [BLUE](#)

Terminal Number	Signal	Description
1	+24 VDC	The RED Wire from the transducer is connected here. The Commons for the OPTIONAL emergency pressure switch (terminal 2) , the OPTIONAL pressure selector switch (terminal 3) and the OPTIONAL remote interlock are connected here.
2	EMERGENCY PRESSURE SWITCH	This terminal is used by the Sema controller as a safety shut down. Do not disconnect the pre-installed wire unless the transducer has failed and you wish to connect a Pressure switch to run the WPC in emergency mode. In this case the pressure switch is connected between terminals 1 and 2. The pre-installed wire can then either be removed or left in place.
3	Pressure selector switch	When this input is off Desired Pressure 1 is used, when it is on Desired Pressure 2 is used.
4	External Interlock or Remote Run	As supplied by Sema there is a link between terminal 1 and terminal 4. The function of this link is programable. It can either be used as a remote interlock, in which case the unit will trip out and display a fault if it is open, or it can be a remote run input.
5	No user connection	This terminal is not used by the Sema controller. Do not connect.
6	Analogue Transducer input	The BLACK (or, in some cables, BLUE) Wire from the transducer is connected here
7	0V	As both the 0V terminals are connected to ground any control cable screen may be connected to either 0V terminal
8	No user connection	This terminal is not used by the Sema controller. Do not connect.
9	0V	As both the 0V terminals are connected to ground any control cable screen may be connected to either 0V terminal
10	Relay	The operation of the relay is programmable. See function 6.
11	Relay	Contact 250VAC, 6A/ 30VDC, 5A

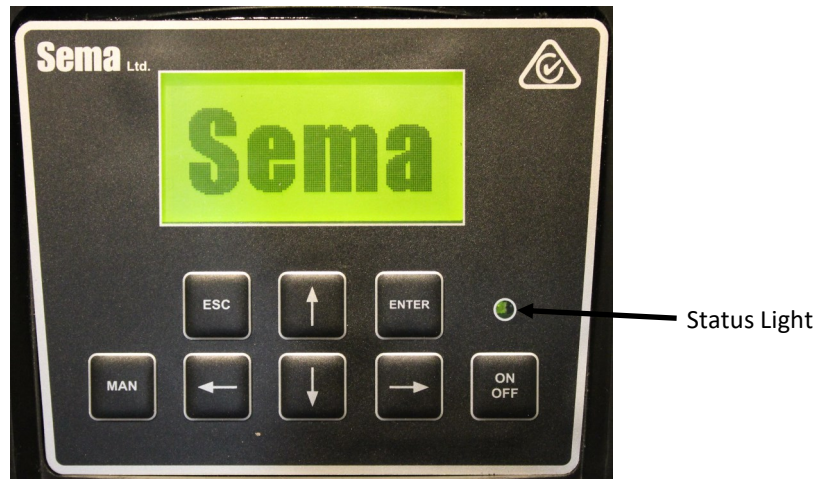
Emergency Mode: If the Transducer fails the WPC will stop. This is done to prevent possible over pressurising of the system. Because a Transducer isn't a device which is readily available in all parts of the world an Emergency Mode has been provided to enable the unit to run from a pressure switch.

To activate Emergency Mode:

1. Turn off the power and wait until the screen is dark .
2. Connect a Pressure Switch between terminals 1 & 2 (It doesn't matter whether you leave the pre-installed white wire in terminal 2 or not.)
3. Turn on the power and the unit will now detect the Pressure Switch, it will respond by activating its emergency mode and act as an on/off controller in response to the input from the pressure switch.

Setting up and Operation

Using the keypad



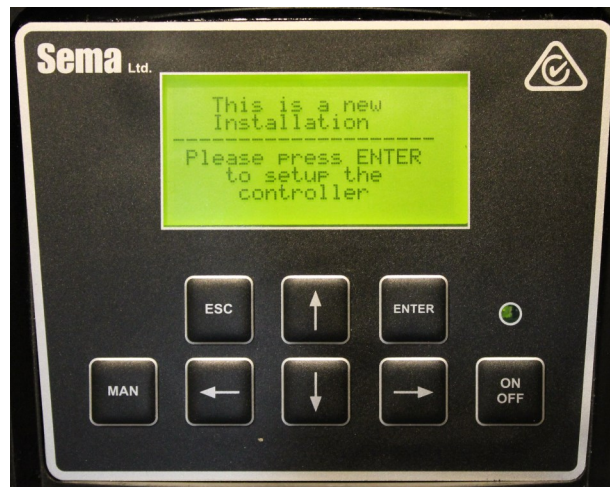
Description:

- ♦ **STATUS LIGHT** This is a high intensity L.E.D . designed to be as visible as possible
 1. **OFF** The controller will not start when the water pressure falls. It is either turned off or has a fault
 2. **FLASHING** The controller is not running but has no faults and will start as soon as the water pressure falls.
 3. **ON** The controller is running.
- ♦ **ESC** The escape key functions in the same manner as the escape key on a computer it allows you to exit without saving parameters and also allows you to go back a step when going through the initial setup routine.
- ♦ **UP ARROW** Increases the digit immediately above the cursor when entering parameter values and scrolls through a menu list.
- ♦ **ENTER** Accepts and saves a value which has been entered. ***Press and hold for 3 seconds to access the Function menu from the main running screen.***
- ♦ **MAN** Short for Manual this will run the pump manually for as long as it is pressed. It will also put the controller in 'Emergency' mode if it is held down when the power is turned on.
- ♦ **LEFT ARROW** Moves the cursor one position to the left when entering parameter values.
- ♦ **DOWN ARROW** Decreases the digit immediately above the cursor when entering parameter values and scrolls through a menu list.
- ♦ **RIGHT ARROW** Moves the cursor one position to the Right when entering parameter values.
- ♦ **ON OFF** Press once to turn the controller off, press again to turn the controller on. After power up the controller will always start in the 'on' state.

Hint: When entering numbers use the left and right arrow keys to move the cursor and the up and down arrow keys to change the number above the cursor.

Initial Set Up

A few seconds after powering the unit up for the first time, or after re-initialising it, the screen below will be displayed.



The only valid key which can be pressed is the ENTER key and the only way of stopping this screen from appearing is to complete the setup routine.

Please note that, if you make a mistake and enter the wrong value in one of the steps, the ESC key can be used to go back a step. You can go back as many steps as you like even right to the start of the setup routine if necessary.

The settings that you enter are only saved after you complete the last step so, providing you haven't completed the final step, you can always start setup again by turning off the power and then powering up again.

The controller can also be re-initialised. See the 'Changing Parameters' section for instructions on how to do this.

There are 12 steps in the setup routine and they are as follows:-

1. **ENTER THE MOTORS NAMEPLATE VOLTAGE:** Use the arrow keys to alter the value.
2. **ENTER THE MOTORS NAMEPLATE CURRENT:** Use the arrow keys to alter the value.
3. **ENTER THE MOTORS NAMEPLATE RPM:** Use the arrow keys to alter the value.
4. **ENTER THE MOTORS MAXIMUM SPEED:** Here you can enter the maximum operating RPM of the motor. This figure may be adjusted up to double the motors rated nameplate RPM but please note that very few pumps can be operated at this sort of speed. If you are in doubt about the maximum speed that your pump can be operated at then please set this figure to the same value as the Motors Rated Nameplate speed. Note that this is the value that appears by default.
5. **ENTER THE MOTORS MINIMUM SPEED:** This figure is also determined by the minimum speed that your pump can successfully run at. If you are in doubt then the default figure can safely be used.
6. **MOTOR DIRECTION CHECK:** Pressing the up arrow will cause the motor to run at low speed for a couple of seconds so that you can check that the direction of rotation is correct. If it isn't then turn off the power and, after the controller screen goes completely dark, remove the controller terminal cover and swap any two wires connected to U,V and W. Once this is done turn the power on again and you will be brought back to this step, all of your previous programming will have been saved. Confirm that the direction is now correct and then press ENTER to continue.

7. First Set-Point. Enter the pressure (in Bar) that you would like the system to operate at when the input connected to terminal 3 is OFF.

8. Second Set-Point. Enter the pressure (in Bar) that you would like the system to operate at when the input connected to terminal 3 is ON.

9. ENTER THE MAXIMUM ALLOWED RUN TIME. Enter the maximum time (in HOURS) that the controller is allowed to run continuously for before it will shut down and display an error. Setting this to 0 disables this function.

10. LoP (Loss of Prime). This step is for checking the current that the motor draws when the pump is not pumping water, you can run the pump by pressing and holding the MAN key. This figure can then be used in the next step as the Loss of Prime level for the motor . To obtain this figure either run the pump empty or block off its outlet so that it is not pumping water. Note that, if the feed to the pressure vessel cannot be shut off, then the pump must be run until the pressure vessel is completely up to pressure. You will be able to tell when this has happened as the motor current will stop reducing.

11. LoP Current Level. Enter the figure that was obtained in step 10. To turn off the LoP function set this figure to zero.

12. Select when the Relay (Terminals 10 & 11) turns on. Available options are:

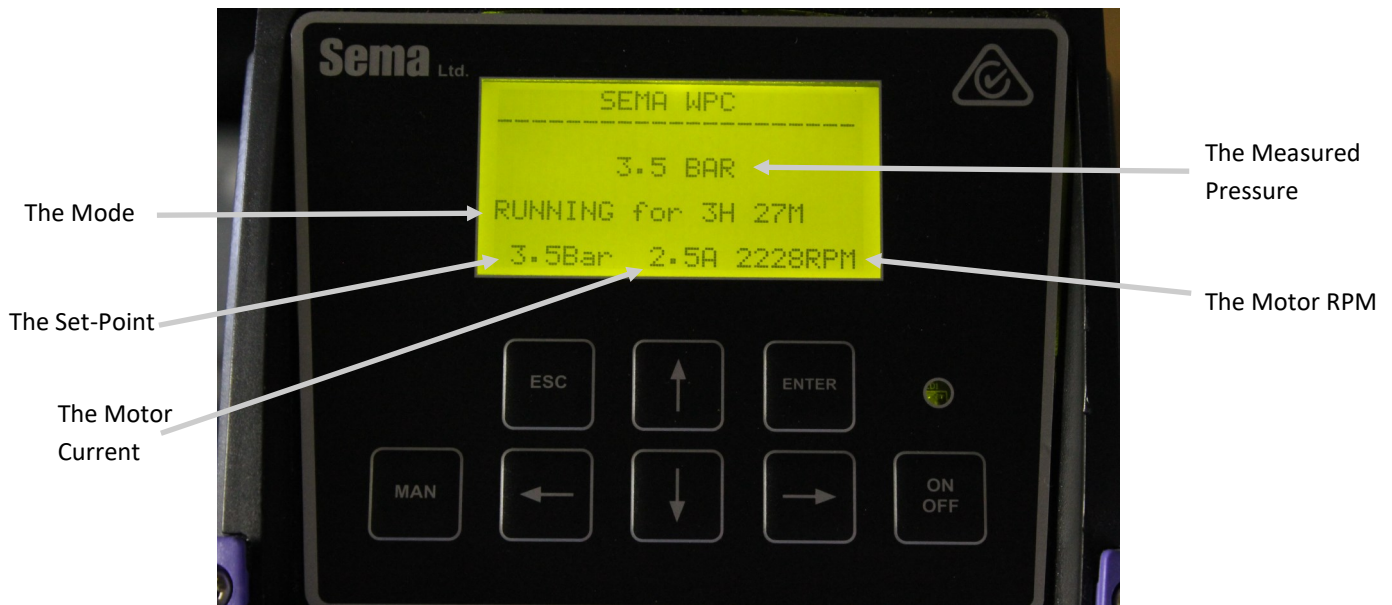
- 1.) When the pump runs
- 2.) When there is a fault
- 3.) To control a booster pump.

The first two options are self explanatory. When set to the third option the relay should be wired to control a booster pump. The WPC uses its own internal logic to determine if it cannot maintain the desired pressure and will then turn on the booster pump.

This completes setup, the controller is now fully configured and customised for this installation Please read the following sections which describe the running screen and how to alter parameters on a controller which has already been configured.

Running

The Running Screen:



MODE Six different modes may be displayed here:

1. **RUNNING** This is the normal mode which will be displayed when the pump is running. It also displays how long the unit has been running continuously for.
2. **READY TO RUN** If there is no demand for water the unit will stop the pump motor and display this message. This indicates that it is healthy and will start as soon as there is a demand for water
3. **STOPPED** The ON/OFF button has been pressed and the unit will not run. (Press the button again to put the unit in Run mode).
4. **MANUAL** The Manual Push Button is being held down.
5. **EMERGENCY MODE.** At power up the unit detected that there was a pressure switch connected between terminals 1 and 2. It has put itself into emergency mode and will turn on and off with the pressure switch. ***See Page 7 for a more detailed explanation of "Emergency Mode".***
6. **REMOTE STOP.** If the function of the link between terminals 1 and 4 is programmed in function 10 to act as a remote run input then the WPC will stop and display this message when there is no connection between terminals 1 and 4.

Changing Parameters:

To access the parameters (also called functions) menu press and HOLD the ENTER key for between 2 and 3 seconds.

There are seven parameters which can be altered without entering a password. These non password protected parameters may all be altered with or without the motor running.

Non Password Protected Parameters:

0.) Password Enter the password here which unlocks the protected parameters (17,18 & 19) **The password is 00004**

1.) Minimum Speed The minimum speed of the pump can be adjusted here.

2.) Maximum Speed The maximum speed of the pump can be adjusted here.

3.) Desired Pressure 1 This is the pressure set-point when the input to terminal 3 is OFF

4.) Desired Pressure 2 This is the pressure set-point when the input to terminal 3 is ON

5.) Maximum Run Time. This is the time in hours that the pump is permitted to run continuously for. If it is exceeded the pump will be stopped and an error message displayed. Set it to 0 to disable this function.

6.) Relay Mode. Available options are:

- 1.) When the pump runs
- 2.) When there is a fault
- 3.) To control a booster pump.

The first two options are self explanatory. When set to the third option the relay should be wired to control a booster pump. The WPC uses its own internal logic to determine if it cannot maintain the desired pressure and will then turn on the booster pump.

Password Protected Parameters:

Once the password has been entered correctly in Parameter 0 the password protected functions 14 to 19 become visible. Some of them require the pump to be stopped before they can be adjusted, if you try to adjust one of these with the pump running you will be asked to stop it before proceeding

Leaving the parameter menu resets the password.

10.) LINK FUNCTION. When you receive your WPC there will be a link installed between terminals 1 and 4. This can be removed and any type of switch may be installed in it's place. By default, when this switch is off, the WPC will stop and display a message that the remote interlock is open, the WPC will not restart until either the power is turned off and then on again or the on/off button on the keypad is pressed. In function 10 the effect that opening this connection has can be changed between the default and another mode called Remote Run. In remote run mode the switch connected between these terminals will stop and start the drive.

11.) CUT-IN MODE. How the WPC restarts after it has switched off can be selected here. The default is automatic, in this mode the WPC uses its own logic to calculate if there is enough water usage to justify a re-start. There are two alternative modes provided in this function; the unit can be set to turn on at a pre-set pressure or at an offset below whatever the setpoint pressure is.

12.) CUT-IN PRESSURE. If function 11 is set to anything other than automatic the cut-in pressure or the cut in offset can be entered here.

13.) RIPPLE OVERSHOOT. If the control method is set to Ripple Control in function 14 the amount of ripple overshoot can be entered here.

14.) Control Method. By default this is set to 'Ripple Control' a Sema Ltd., invention which introduces a small pressure ripple into the pressure set-point and measures the time that it takes for the pressure to drop to determine if there is sufficient demand for water for the pump to be kept running. If you would like to operate the pump conventionally (without the ripple) then change this mode to 'Conventional'.

15.) Pressure Averaging. By default the WPC performs a rolling average of multiple readings from the pressure transducer over a 2 second period to determine the water pressure. This is to make the reading more stable and reduce the influence of air bubbles in the water stream. If this is considered undesirable it can be turned off here.

16.) Control Loop Delay. The WPC waits for this length of time after starting before it tries to control the pressure. This is to give it a few seconds of 'settling time' at minimum speed. This time may be adjusted here or even set to 0 if this is considered desirable.

17.) Lop (Loss of Prime) Current. This is set to the current that the motor draws when the pump is not pumping (i.e. when it is running dry) If the motor current is at or below this figure for more than 10 seconds the pump will be stopped and an error message displayed.

18.) Motor Current Adjust the motor current here if necessary to avoid nuisance tripping.

19.) Re-Initialise If the controller is moved to a new pump shed or a new pump is installed on the same controller then the controller should be re-initialised and the setup routine redone. Follow the prompts on the screen to achieve this.

The parameters numbered 20 to 26 are special purpose parameters which are "hidden" and require a special password to access. If you feel that you have the need to use one of these parameters please contact Sema for an access code (It's Free).

20.) Pulses per Day There is a special model of the WPC which can count pulses from a water meter and shut itself down once the number of pulses entered here have been used in a 24 hour period. This model has substantial hardware modifications and must be manufactured by us especially for this purpose.

21.) Continuous Run Time If a time is entered here (in minutes) the WPC will shut down after it has run continuously for this period and will remain stopped for the length of time entered into function 22.

22.) Pause Time If the WPC stops for any reason it will remain stopped for the length of time entered here. If after this time has elapsed the WPC is still up to pressure it will not start until the pressure drops.

23.) Restart Attempts **Be extremely careful in the use of this function, it is only intended for use in situations where potential damage to the pump and/or motor is preferable to loss of water supply. In other words it is a “run to destruction” function.** When any figure other than 0 is entered here the WPC will attempt to reset and restart itself that number of times when a fault occurs.

24.) Restart Interval If a time is entered here (in minutes) and function 23 is set to any number except 0 the WPC will wait for this period of time before resetting itself and attempting a restart. If this function is set to 0 the WPC will attempt and instantaneous reset and restart.

25.) Major Leak RPM When a figure is entered here the WPC will trip out and display the fault “Major Leak Detected” if it runs above this RPM for the time entered in function 26.

26.) Major Leak Delay If a time is entered here (in minutes) the WPC will shut down after it has run continuously above the RPM entered in function 25 and display the fault “Major Leak Detected”.

FAULTS

If a fault occurs that stops the controller running the backlight on the screen will flash rapidly and the fault description and fault number will be displayed. Please write down this number as it will provide Sema Ltd., with important information about the cause of the fault.

If a fault occurs turn off the power, wait until the controller screen is completely dark and then turn the power back on again. If the fault is still present then contact your Dealer or Sema Ltd.

Possible Faults:

Short Circuit. Check the motor cable and the motor for electrical faults

Motor Overloaded. Check that the pump isn't jammed. Attempt a reset by turning the power off and back on again. When the motor starts observe its running current (middle figure on the main running screen) and ensure that it is less than the nameplate current.

Over Voltage. Contact your power company. This will damage the controller if it's allowed to continue.

Under Voltage. The controller cannot run because there is insufficient power. Contact your power company.

Too Hot. The controller is overheated. Check that the cooling fins are not blocked and that the air temperature is not above 40 degrees Celsius.

Too Cold. The controller must be above -10 degrees Celsius before it will start. If the air temperature is less than this then gently warm the controller until it is able to start, once it has started it should generate enough internal heat to keep running.

Maximum Run Time Exceeded. The pump has run continuously for more than the maximum allowed run time. Usually this is caused by a water leak. Pushing the on/off button restarts the pump and resets the timer.

LoP (Loss of Prime or Pump Running Dry). Make sure that the pump has water available. Press the On/Off button to restart the pump.

External Cut-out Tripped. One or more of the external cut-outs connected between terminals 1 and 4 has tripped. Typically these will be things like a low water level sensor or a pump thermal trip.

Transducer Fault. Either the Transducer is faulty or there is a fault in the Transducer wiring (Might pay to check the plug on the transducer to make sure that it's properly plugged in!). If you can't rectify the problem then you can run the controller in 'Emergency Mode' from a pressure switch. See page 8.

SUPPLIER DECLARATION OF CONFORMITY (SDoC)

In accordance with ISO/IEC 17050-1:2004

SDoC Identification Number¹: Sema Pump Controllers

Issuer details

Name² (of New Zealand manufacturer or importer):

Sema Ltd.

Telephone:

+64 9 3580800

New Zealand Company No. (if applicable):

4305878

Email Address:

info@sema.co.nz

Contact Address:

P.O.Box 374
Pukekohe
Auckland 2340

Medium Risk Article – Details³ (Product name, type, rating, brand, model, batch numbers, and serial numbers, as applicable):

This document covers all Sema product which is based upon the 'Invertek' brand of Variable Speed Drives.

Namely:

MPC, WPC, VPC, EPC, FPC and DPC. It also covers any Invertek drives that are used as slaves to any of the products mentioned above or that are used as stand-alone VSD's.

The Medium Risk Article listed above, fully complies:

With cited standard(s), as listed⁴:

Standard number and issue year:

As/Nzs 3100:2001

Edition / Amendment status:

1

Standard title:

General requirements for electrical equipment

Standard number and issue year:

Edition / Amendment status:

Standard title:

AS/NZS ZZ modified

Yes ☐

No ☐

N/A ☐

AS/NZS ZZ modified

Yes ☐

No ☐

N/A ☐

OR Complies with the Conformity Cooperation Agreement⁵

Yes ☐

No ☐

Names and addresses of any testing organisation or body

Name(s):

Address(es):

Name(s):

Address(es):

Reference to relevant test reports/certification and the issue date that show how compliance is achieved

Standard(s) or document(s) used, to show how compliance with cited standard is achieved:

Declarations of Conformity from Invertek Drives Ltd

Extensive compliance and conformity documentation is available from Invertek Drives limited.

Report Certification or Document reference N°(s):

1.03

Issue date(s):

01/10/2007

Reference to any management quality system involved:

ISO 9001

Additional information⁶:

Declaration (signed for and on behalf of)

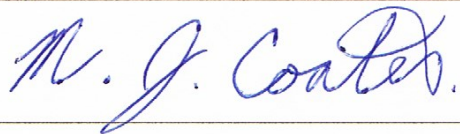
Name and position as authorized by the issuer⁷:

Maurice Coates (Director)

Issuer Identification (as affixed to the article):

Sema Ltd.

Signature:



Date:

14/September/2014

EMC Compliance

The current range of Sema product is based on the Invertek Drives range of variable speed drives. Units of 7.5kw and below use the E3 series of drives and units above 7.5kw use the P2 series.

Manuals and compliance information for these drives can be found at www.sema.co.nz or scan the QR codes below to be taken straight to the relevant document.

For information on how to perform a CE EMC compliant installation please view or download the appropriate Invertek manual and look in its index for the page labelled "**EMC Compliant Installation**".

Invertek E3 Conformity Certificate



Invertek E3 Manual



Invertek P2 Conformity Certificate



Invertek P2 Manual



Parameter Table

Function No.	Description	Value
	Motors Nameplate R.P.M.	
1	Minimum Speed	
2	Maximum Speed	
3	Desired Pressure 1	
4	Desired Pressure 2	
5	Maximum Run Time (Hours)	
6	Relay mode	
10	Link Function	
11	Cut in mode	
12	Cut in pressure	
13	Ripple overshoot	
14	Control method	
15	Pressure averaging	
16	Control loop delay	
17	Lop Current	
18	Motor Current	
20	Pulses per day	
21	Continuous run time	
22	Pause time	
23	Restart attempts	
24	Restart interval	
25	Major Leak RPM	
26	Major Leak delay	

