Techsys Corporation

ORCA

MULTIPLE PUMP VFD CONTROL SYSTEM

Version 4311.01 **January 2015**

INTRODUCTION

ORCA Pump Controller

The ORCA pump control system is a fully integrated pump controller for one to six pumps to maintain a constant pressure.

The ORCA system requires only connection to power, wiring of pump motors, and attachment of a pressure tube to the discharge manifold for the system to be ready to run.

The ORCA controller starts and stops pumps according to information collected from a pressure transducer and compares this to a reference set point entered in the ORCA menu setting. The controller maintains the system pressure at the set point by varying the speed of the VFD pump and switching other pumps ON and OFF. When the system detects NO FLOW it will shut down until the pressure drops below a restart point.

The ORCA control logic reduces running costs by ensuring pumps runs as efficiently as possible and are shut down when not required.

Options can be requested to meet any application, including specific site requirements such as remote communication, environmental considerations and fault monitoring and reporting. The ORCA offers full telemetry outputs for simple integration into central control applications.

The ORCA has easily accessible menus that allows anyone to make adjustments to any pump application thus saving on potentially costly service calls when setting changes are required. The ORCA Pump Control system is a member of the Techsys Pump Control range that has a range of options to suit specific applications and user requirements. Options can be discussed your agent or Techsys staff prior to ordering to ensure your site application needs are fully met prior to commissioning.

Version History

This manual covers the software applications for Version No. 4311.00 or later.
Please contact your agent or Techsys Corporation to obtain verification of the currency of this manual for your application. Your application's software version is displayed briefly when the ORCA is switched on.

NOTE. Previous version notations have been included in this manual to enable the use of this manual with earlier version of firmware. These can be located by using the index (Previous Version Additions) to locate the new features. The most recent version prior to this was 2407.01

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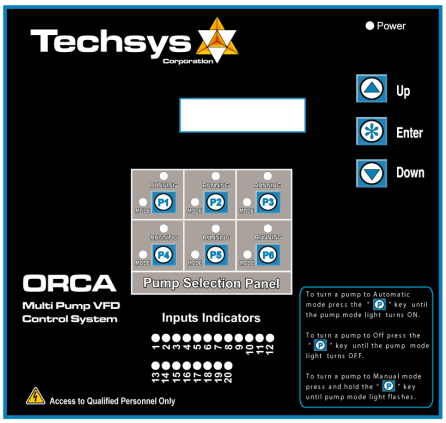
QUICKSTART



The following procedures are the minimum required to start and operate the ORCA.
Please read the entire manual before commissioning your Techsys controller and call your Techsys agent if you require further assistance. Your agent's contact details can be found in the supporting documentation. Please quote the 4 digit serial number of your application when making enquiries. .
The following ROTATION CHECK MUST be completed before any other commissioning steps begin.

The ROTATION CHECK confirms the operational directions of pumps and must be checked in both Manual and Automatic Modes.

WARNING! Only Electrically Qualified Personnel are to alter wiring connections; There is HIGH VOLTAGE WIRING within the switchboard.

*******IMPORTANT*******

Failure to follow this procedure will VOID WARRANTY and cause failure of the pump station.

1. Select OFF Mode for all pumps. (If Access Code is displayed, enter the number 21) ☐
2. Switch ON all circuit breakers in the cabinet. ☐
3. Press "P1" key. The MODE & RUNNING LEDs should illuminate and pump 1 should start. ☐
   Check Rotation against the pump manufacturer's directional arrow.
   After checking, turn Pump 1 to OFF by pressing "P1" again.
4. If the direction is correct go to Step 6. If the direction is not correct, contact your electrician, who can swap any two of the U, V, W wires from the VFD. ☐
5. Re-check direction ☐
6. Check direction of the ALL pumps as in step 3 by sequentially pressing the other "P" buttons and observing the rotation of each pump. If any of the pumps turn in the wrong direction, your electrician should change two of the wires connected to the motor in question. ☐
7. Check Pump 1 MANUAL Mode. ☐
   Press and hold "P1" for 3 seconds and the pump will start and run at full speed. The MODE LED will be flashing and the RUNNING LED will be on.
   Check Rotation against the pump manufacturer's directional arrow.
   After checking, turn Pump 1 OFF by pressing "P1" again.
   (When in manual mode, beware of possible damage to equipment through exceeding design pressure. Manual Mode may bypass "pump protection" and if so pump damage may result if pumps are permitted to run unmonitored.)
8. If the direction in "Manual" is OK go to Step 9. If the direction is not correct, contact your electrician to swap any two of the incoming main supply wires into the Main Isolator.
9. Check all pumps for direction in MANUAL mode as per Step 6 by sequentially pressing and holding each of the "P" buttons. ☐
10. Rotation check complete. ☐

Every ORCA control panel has push buttons for 6 pumps. It is not necessary to press/select buttons for pumps in excess of the actual number of pumps present. Selecting these pumps (those not present) will have no effect on the overall operation of the ORCA controller.

ADJUST SET POINT (OPERATING PRESSURE of your System).

1. Press the DOWN key until the Message “Access Code” is displayed.
2. Press the ENTER (*) key. The top line of the display will start flashing. Then press the UP key until the number 21 appears in the lower part of the screen.
   Press the ENTER (*) key again and the top line of the display will stop flashing.
   The access code is now entered.
3. Press the DOWN key once more. A menu named SETTINGS will appear.
4. Press the ENTER (*) key to access the SETTINGS Sub Menu.
5. Press the DOWN key until SET POINT screen is reached.
6. To adjust the SET POINT press the ENTER (*) key, then press the UP key to increase the setting and the DOWN key to decrease the setpoint.
   When the desired setting has been reached press the ENTER (*) key again.
7. * NOTE* If the desired Set Point is not able to be selected (pressing the DOWN key does not change the value) the “Low Pressure Shutdown” may need to be decreased. The set point value can not be set below the Low Pressure Shutdown value . After the adjustments have been made, press the DOWN key until the sub menu is exited and the SETTINGS main screen appears again.
8. To return to the main System Pressure display, press the Down OR Up key.

CALIBRATE PRESSURE TRANSDUCER

Calibration is only required if the pressure transducer was fitted on site.
For a full explanation go to the section marked CALIBRATION OF ANALOGUE SENSORS.

1. Press the DOWN key until you reach the Main Menu marked CONFIGURE.
2. Enter the CONFIGURATION sub menu by pressing the ENTER (*) key.
3. Go to the ZERO PRESSURE screen. To complete this step the pressure in the system must be zero. Remove the transducer tube to be sure.
4. “ZERO” the sensor using either AUTOMATIC or MANUAL options.

   Automatic Zero. *(Not included on previous versions)*

   Press ENTER (*) to begin editing the ZERO PRESSURE; then press and hold both UP and DOWN buttons together for 1 second or until “Finding Zero” is displayed on the screen.

   In 5-20 seconds zero will be displayed; press ENTER (*) to finish the operation.

   Manual Zero

   Press ENTER (*) and then the DOWN key to decrease the dispalyed value to ZERO. If “Value Too Low” appears, increase the value slowly by pressing the UP key until a zero value is obtained. *NOTE* The value does not change with each press of the UP/DOWN key. Press and hold the UP/DOWN key for rapid change and single press for small change.

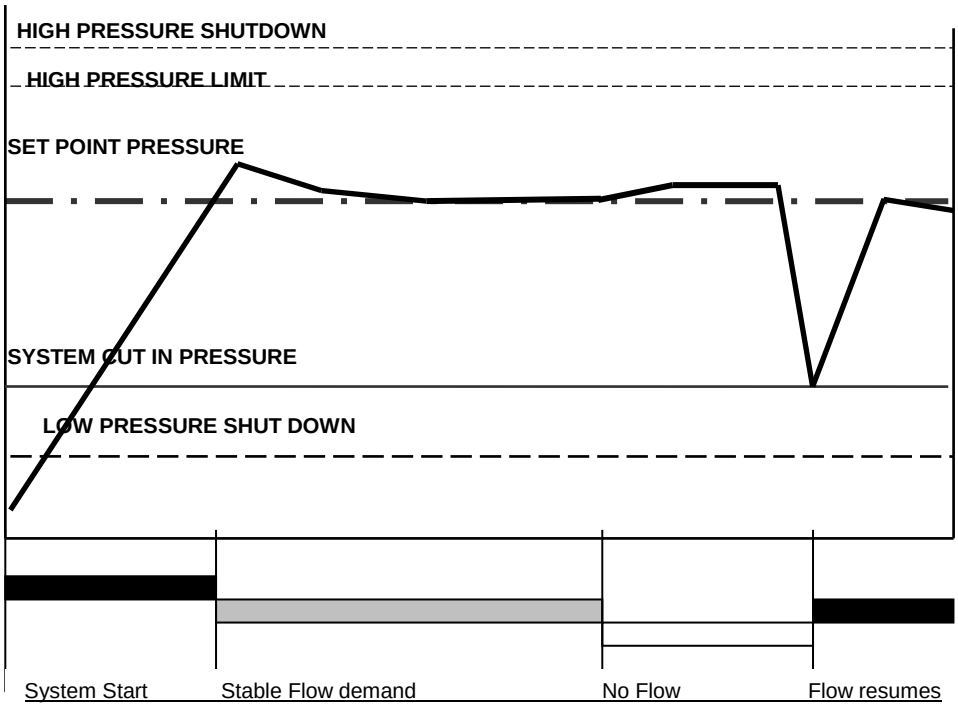
   When ZERO is displayed press ENTER (*) to finish the operation.
5. Press the DOWN key until you reach “ADJUST PRESSURE”. (At this point the sytem must have a stable pressure and preferably close to the desired set pressure.
6. Adjust the value in the ADJUST PRESSURE screen until the pressure on the system gauge is the same as the screen pressure. Press the ENTER (*) key and then the UP key to increase the dislay pressure or the DOWN key to decrease the display pressure. *NOTE* The value does not change with each press of the UP/DOWN key. Press and hold the UP/DOWN key for rapid change and single press for small change. When the displayed value is the same as the actual system pressure press ENTER (*) to finish the operation.
7. Press the DOWN key until the menu returns to the main CONFIGURE screen again.

   The Pressure Transducer is now calibrated.

8. To return to the main System Pressure display, press the Down OR Up key.

System Operation

The operating constraints for the system are detailed below.



When the system pressure drops below the SYSTEM CUT IN pressure setting, the ORCA will start the VFD to run the first pump and increases in speed until the SET POINT PRESSURE is reached. If one pump cannot satisfy the pressure requirement another pump will start. The VFD pump will continue to run until the SET POINT PRESSURE is achieved. This procedure is repeated until the set point is reached or all pumps are running. The controller will modulate the speed of the VFD pump to maintain the set point pressure.

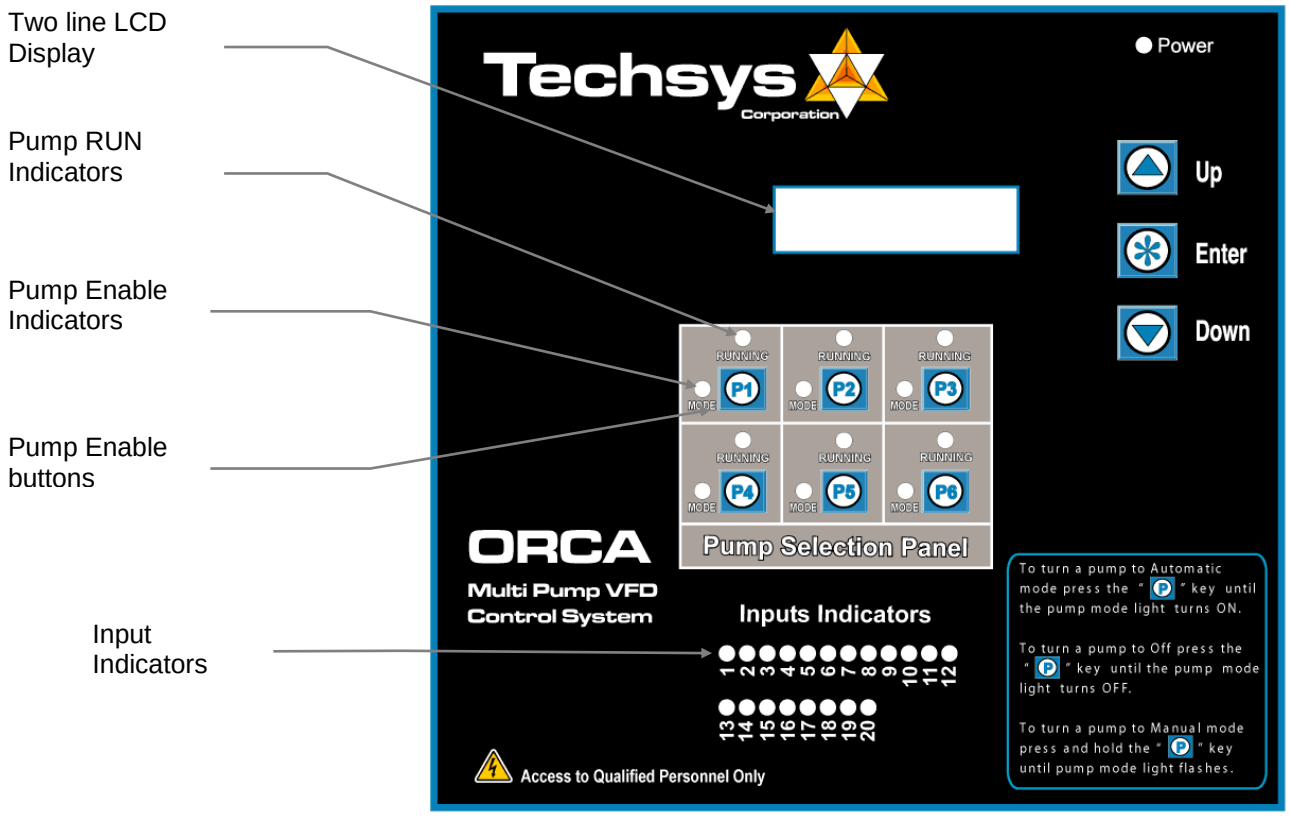
Cancelling audible beeper.

If during commissioning you wish to cancel the BEEP heard on key strokes go to the “Flow-Rate Vfd-Sp” menu and press *

(Not included on previous versions)

Pump Control Panel

The ORCA Control Panel allows the operator to edit settings and values in each menu.



To edit values and settings within menus
Press the ENTER (*) key when the desired menu is displayed. The top line will flash if the menu can be edited (some menus may be locked and unavailable). Use the UP and DOWN buttons to change the selection, then press ENTER (*) again to confirm the change.

Each pump is controlled by an individual "P" button. By default a valid Access Code is required to enable, or manually run a pump. Pumps can however be stopped and disabled without an Access Code. (Default is 21).

To enable a pump for operation
Press the "P" button and the associated mode indicator will light up. The selected pump is now available for operation in Automatic mode.

To disable a pump in Automatic Mode
Press the "P" button until the Pump ON/OFF indicator light turns off.

To operate a pump on Manual
Press and hold the "P" switch for 3 seconds to start a pump in "Manual".

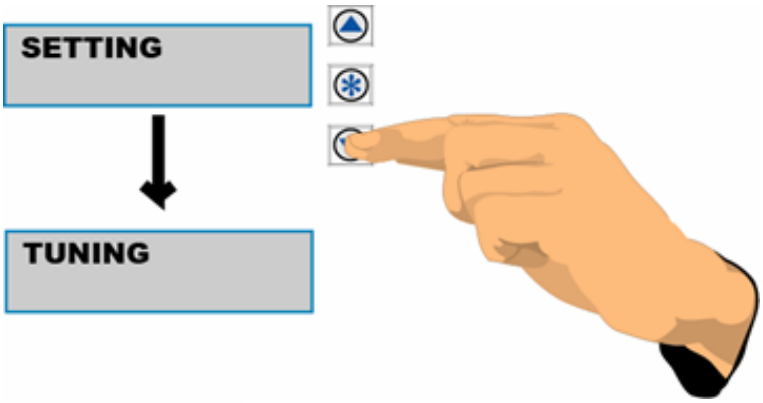
The Pump MODE light will be flashing and the RUN indicator will be on. To turn a manual pump off, press and release the "P" switch.
The RUN light turns off when the pump is disabled. To return it to Automatic press the "P" button again until the Mode indicator turns on.

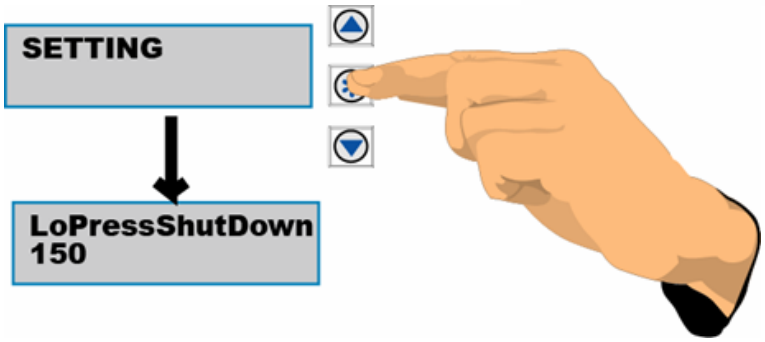
MANUAL MODE PROTECTION

Pump protection settings apply to all pumps including those in manual mode.
Unless specifically requested otherwise the ORCA controller will maintain pump protection and if active, will not allow pumps to run in manual when manual is selected.

Moving Around & Editing the Menu Items

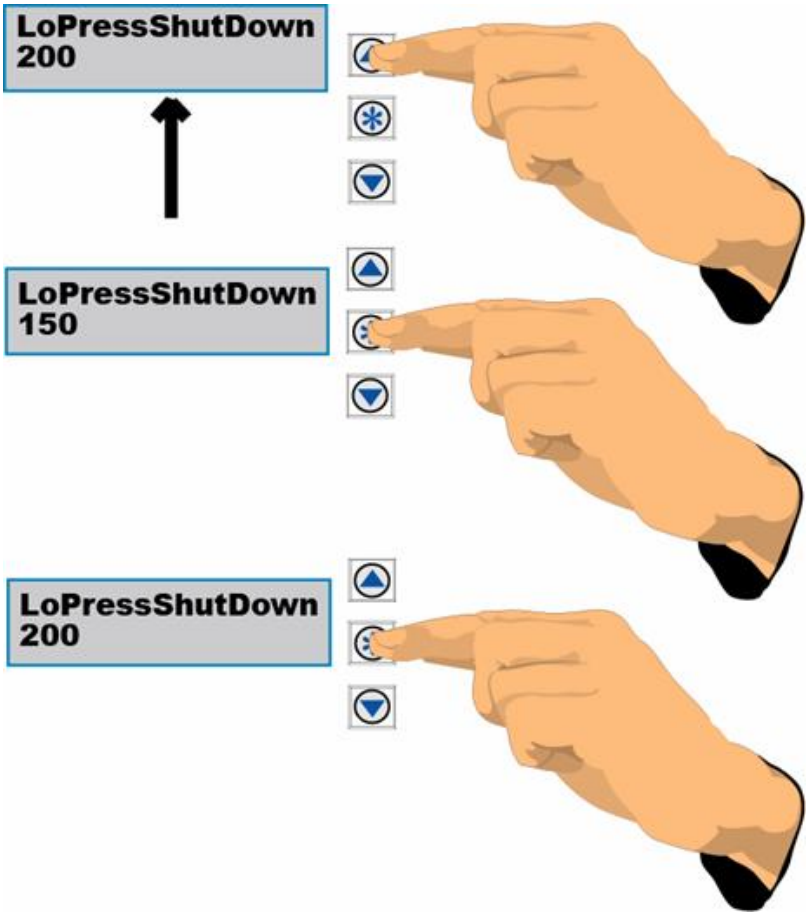
To move between the Main Menu screens press the UP or DOWN key.





Once the required Menu is selected press the ENTER (*) Key to enter the specific menu

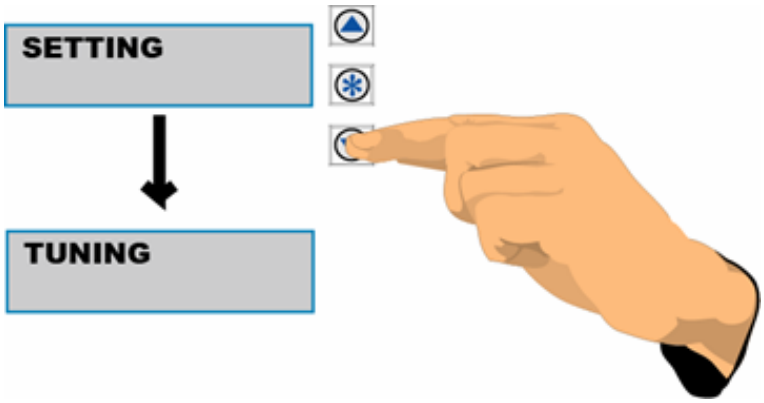
To edit a value, a valid Access Code needs to be entered. If the Access Code is not inserted correctly the system will inhibit menu selection and pump select keys.
To edit a value press the ENTER (*) key and then the UP or DOWN key until the desired value is displayed. Press the ENTER (*) Key again to save the value selected.

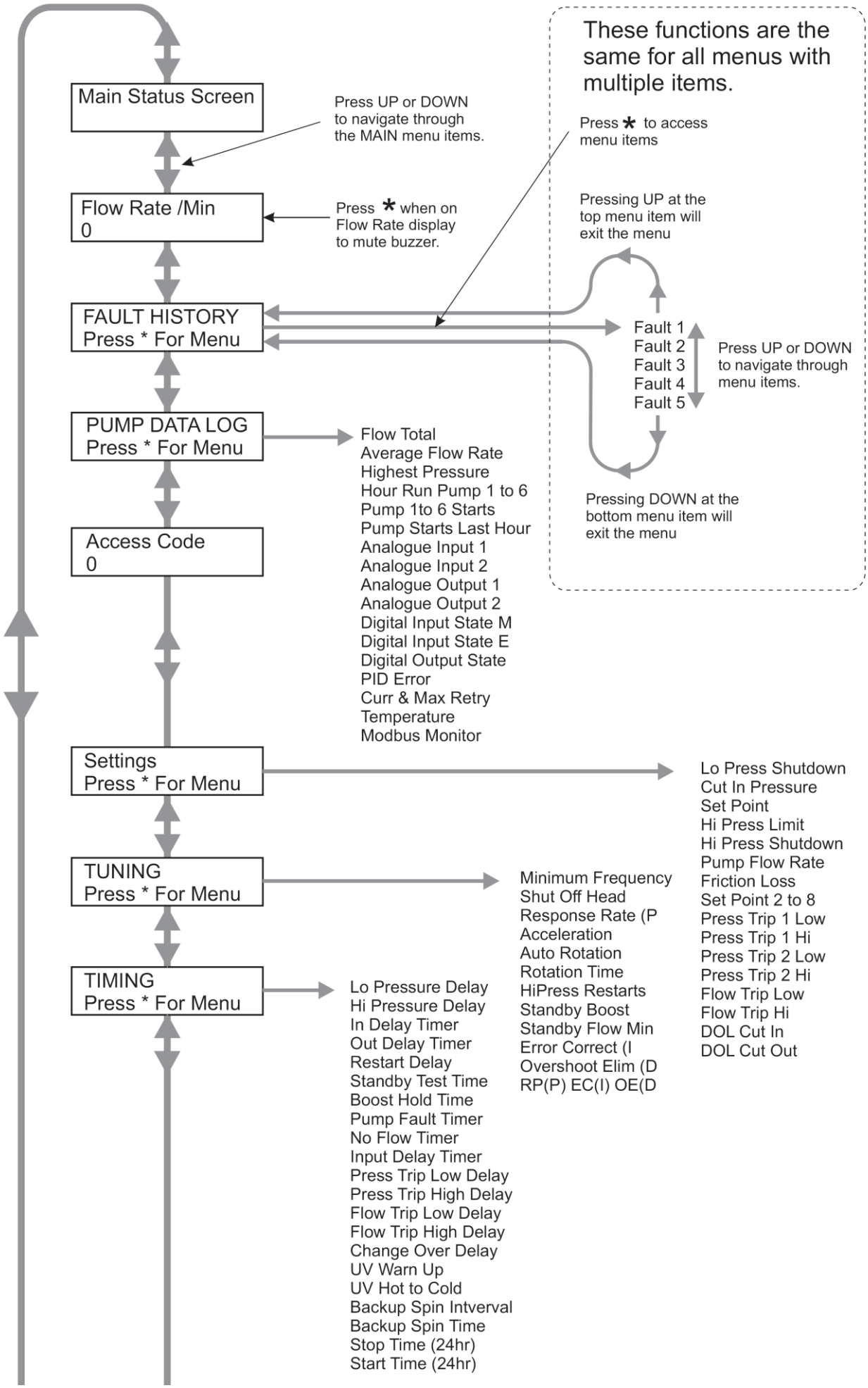


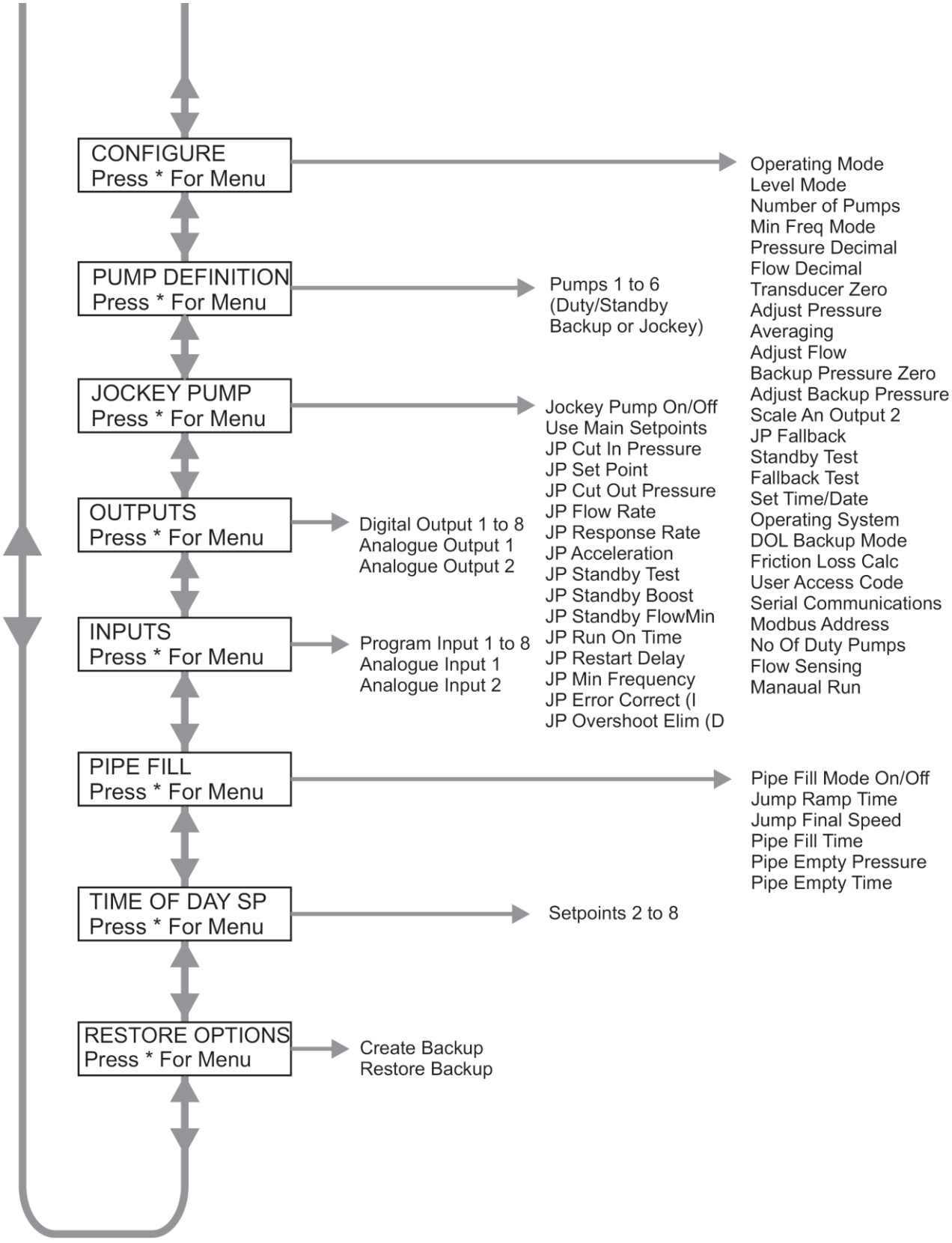
TO EXIT SUBMENUS
To move out of a submenu scroll to the top or bottom of the sub menu and the display will return to the main menu area.

MENUS

- Navigating the through the menus is very simple.
  - Press UP or Down button to navigate the Main menu set to find the appropriate sub menu.
  - Press the * to enter any Sub menu.
  - Then press down to find the required menu item.
  - When the required menu is displayed, press the * button, the display will flash. The UP or DOWN button can then be used to change the value.
  - Press * again to lock in the data.
  - Pressing either the UP or DOWN button continuously will eventually return to the main menu.




These functions are the same for all menus with multiple items.
Main Status Screen
Press UP or DOWN to navigate through the MAIN menu items.
Press * to access menu items
Flow Rate /Min
0
Press * when on Flow Rate display to mute buzzer.
Pressing UP at the top menu item will exit the menu
FAULT HISTORY
Press * For Menu
Fault 1
Fault 2
Fault 3
Fault 4
Fault 5
Press UP or DOWN to navigate through menu items.
PUMP DATA LOG
Press * For Menu
Flow Total
Average Flow Rate
Highest Pressure
Hour Run Pump 1 to 6
Pump 1to 6 Starts
Pump Starts Last Hour
Analogue Input 1
Analogue Input 2
Analogue Output 1
Analogue Output 2
Digital Input State M
Digital Input State E
Digital Output State
PID Error
Curr & Max Retry
Temperature
Modbus Monitor
Pressing DOWN at the bottom menu item will exit the menu
Access Code
0
Settings
Press * For Menu
Lo Press Shutdown
Cut In Pressure
Set Point
Hi Press Limit
Hi Press Shutdown
Pump Flow Rate
Friction Loss
Set Point 2 to 8
Press Trip 1 Low
Press Trip 1 Hi
Press Trip 2 Low
Press Trip 2 Hi
Flow Trip Low
Flow Trip Hi
DOL Cut In
DOL Cut Out
TUNING
Press * For Menu
Minimum Frequency
Shut Off Head
Response Rate (P
Acceleration
Auto Rotation
Rotation Time
HiPress Restarts
Standby Boost
Standby Flow Min
Error Correct (I
Overshoot Elim (D
RP(P) EC(I) OE(D
TIMING
Press * For Menu
Lo Pressure Delay
Hi Pressure Delay
In Delay Timer
Out Delay Timer
Restart Delay
Standby Test Time
Boost Hold Time
Pump Fault Timer
No Flow Timer
Input Delay Timer
Press Trip Low Delay
Press Trip High Delay
Flow Trip Low Delay
Flow Trip High Delay
Change Over Delay
UV Warn Up
UV Hot to Cold
Backup Spin Intverval
Backup Spin Time
Stop Time (24hr)
Start Time (24hr)



This is the full list of menu items. Some menus only appear when a particular option is set.

The ORCA controller has menus to allow the system to be tuned for different applications.
These menus are listed below and explained in detail later in this manual.

If an option is not needed and disabled in its Menu, screens associated with that option will not appear. For example if 3 pumps are selected the menu options for pumps 4 to 6 will be hidden.

Main Menu	Sub Menu	Units	Range	Defaults
Set Point & Actual Pressure		number	0 - 9999 0 - 9999	Display only
Flow Rate/ min & VFD Speed		number	0 - 9999 0 - 100	Display only

FAULT HISTORY

F1	message	Type/Time/Date AND Low Press Shutdown, High Press Shutdown, No Flow Shutdown, VFD Fault, Pump 1[JP] to 6 Fault, Pump 1[JP] to 6 Protection, High Temperature, Auto Reboot, Power Failure, Power glitch, Analog1 Error, Analog2 Error, AnComms Fault	Display only
F2	message		
F3	message		
F4	message		
F5	message		

If “RTC ERROR” is displayed at any time, it indicates that the real time clock had not been set when the fault occurred.
To set the clock, go to the “Configure” menu and sub menu “Set Time/Date”

	Sub Menu	Units	Range	Defaults

PUMP DATA LOG

	Flow Total	Unitless	0 - 9999999	display
	Average Flow Rate	/Sec	0 - 9999	display
	Average Pressure	Unitless	0 - 9999	display
X	Highest Pressure	Unitless	0 – 9999	display
	Hours Run 1	hours	0 - 65535	display
!	Hours Run 2	hours	0 - 65535	display
!	Hours Run 3	hours	0 - 65535	display
!	Hours Run 4	hours	0 - 65535	display
!	Hours Run 5	hours	0 - 65535	display
!	Hours Run 6	hours	0 - 65535	display
	Pump Starts 1	number	0 - 65535	display
!*	Pump Starts 2	number	0 - 65535	display
!*	Pump Starts 3	number	0 - 65535	display
!*	Pump Starts 4	number	0 - 65535	display
!*	Pump Starts 5	number	0 - 65535	display
!*	Pump Starts 6	number	0 - 65535	display
	Pump Starts Last Hr	number	0 - 65535	display
	Analogue Input 1	%	Disabled, 0.00 - 100.00	display
*	Analogue Input 2	%	Disabled, 0.00 - 100.00	display
*	Analogue Output 1	%	0.00 - 100.00	display
*	Analogue Output 2	%	0.00 - 100.00	display
*	Digital Input State M	1 - 12	X for Active	display
***1**	Digital Input State E	13 - 20	X for Active	display
*	Digital Output State	1 - 8	X for Active	display
*	PID Error	%	0.00 - 100.00	display
	Current & maximum retry	number	0 – 50 0 – 50	display
*	Temperature	degrees C	0 - 999	display
X	Modbus monitor	Rx, Tx, Err	0-9999 0-9999 0-9999	display

* These menus are related to other settings. They are not visible unless relevant settings are enabled

*1 This menu is shown if the expansion board is present
(4 to 6 pumps or more than 3 outputs are utilised).

! These menus may be hidden depending on the number of configured pumps.

X *(Not included on previous versions)*

Access Code

Access Code	number	0 - 250	0

	Sub Menu	Units	Range	Defaults

SETTINGS

*1	Low Press Shutdown	% or Units	From 0 to Cut In Pressure	50.0%
*2	Cut In Pressure	%	From Low Pressure Shutdown to 99.9% of Set Point	75.0%
	Set Point	Unitless	0 - 9999	300
*2	High Pressure Limit	%	100.1% of Set Point to High Press Shutdown	150.0%
*2	High Press Shutdown	%	High Pressure Limit to 300%	200.0%
	Pump Flow Rate	/Sec	0 - 9999, Flow Meter	99
*	Friction Loss	Unitless	0 - 999	0
*	Set Point 2	Unitless	0 - 9999	400
*	Set Point 3	Unitless	0 - 9999	400
*	Set Point 4	Unitless	0 - 9999	400
*	Set Point 5	Unitless	0 - 9999	400
*	Set Point 6	Unitless	0 - 9999	400
*	Set Point 7	Unitless	0 - 9999	400
*	Set Point 8	Unitless	0 - 9999	400
*	Pressure Trip 1 Low	Unitless	0 - 9999	100
*	Pressure Trip 1 High	Unitless	0 - 9999	200
*	Pressure Trip 2 Low	Unitless	0 - 9999	500
*	Pressure Trip 2 High	Unitless	0 - 9999	600
*	Flow Trip Low	/Sec	0 - 9999	100
*	Flow Trip High	/Sec	0 - 9999	200
*	DOL Cut In	Unitless	0 - 9999	200
*	DOL Cut Out	Unitless	0 - 9999	400

* These menus are related to other settings. They are not visible unless related settings are enabled

*1 Low pres shutdown can either be a fixed pressure value or a proportion of the set point. Pressing Up and Down together will toggle between fixed and proportional mode. Default is proportional mode.

*2 These menus are proportions of set point; They show a computed pressure in brackets to the right of the second line of the display. This computation is always based on Set Point 1. However if an alternate setpoint is selected (2-8) the value will be calculated from the new setpoint.

*1 & *2 *(Proportional Settings Not included on previous versions)*

	Sub Menu	Units	Range	Defaults
TUNING				
*1	Minimum Frequency	%	0.0 - 100.0	45.0
*1	Shutoff Head	Unitless	0 - 9999	1924
*2	Response Rate (P	%	0.1 - 100.0	2.0
	Acceleration	%/second	1 - 100	20
	Auto Rotation	selection	Full, 1 - 6, At Specific Time, Low Hours	Full
*3	Rotation Time	time (24hr)	0:00-> 23:59	0:00
	Hi Press Restarts	number	Off, 1 - 250	Off
X	Standby Boost	% of Setpoint	10 - 250	20
*6	Standby Flow Min	/Sec	0 - 9999	200
*5	Fallback FlowMin	Unitless /Sec	1 - 9999	200
*2	Error Correction (I	seconds	Off, 0.1 - 100.0	3.0
*2	Overshoot Elimination (D	%	Off, 0.1 - 50.00	15.0
*4	RR(P) EC(I) OE(D)	Numbers x 3	-1000, 1000	Display only

*These menus are related to other settings. They are not visible unless related settings are enabled

*1 Either Minimum Frequency or Shutoff Head will be displayed depending on what the required method for obtaining the point at which the pump will not contribute flow. This will either be “Calculated” via the “Shutoff Head” or “Fixed” via a “Minimum frequency” and is set in the Configure Menu. (Shutoff Head *Not included on previous versions)*

*2 The effect of changing values in these menus are instantaneous. The system will respond as these values are changed. These menus also show the current pressure to the right in brackets to assist tuning.

*3 The Rotation Time menu will only be displayed if Auto Rotation is set to be “At a Specific Time”.
(Not available on previous versions)

*4 These three menu items are displayed on single screen.

*5 Fallback FlowMin is only displayed if “JP Fallback” is set to “On” in the CONFIGURE Menu.

*6 Standby FlowMin is only displayed if “JP Fallback” is set to “Off” and the “Standby Test” is set to “Flow Rate” in the CONFIGURE Menu.

X (Standby Boost is a fixed value and not a % on previous versions)

TIMING

	Sub Menu	Units	Range	Defaults
	Lo Press Delay	seconds	Off, 0 - 250	120
	Hi Press Delay	seconds	Off, 0 - 250	4
	In Delay Timer	seconds	0 - 999	4
	Out Delay Timer	seconds	0 - 999	1
	Restart Delay	seconds	0 - 999	0
***1**	Standby Test Time	seconds	0 - 999	10
***5 X**	Fallback Delay	seconds	0 - 999	10
***2**	Boost Hold Time	seconds	Off, 1 - 250	15
	Pump Fault Timer	seconds	0 - 250	10
	No Flow Delay	seconds	0-250	10
	I/P Delay Timer	seconds	0 - 999	120
*****	Press Trip Low Delay	seconds	0 - 999	0
*****	Press Trip High Delay	seconds	0 - 999	0
*****	Flow Trip Low Delay	seconds	0 - 999	0
*****	Flow Trip High Delay	seconds	0 - 999	0
***3**	Change Over Delay	seconds	0.00 - 10.00	0.30
***6 X**	UV Warm Up	seconds	0-99999	120
***6 X**	UV Hot to Cold	seconds	0-9999	900
***7 X**	Backup Spin Intv	DD:HH	01 Hour - 45 Days	4 Days
***7 X**	Backup Spin Time	Seconds	1 – 60	5
***4 X**	Stop Time (24hr)	HH:MM	Disabled, 0:00 -> 23:59	Disabled
***4 X**	Start Time (24hr)	HH:MM	0:01 -> 00:00	0

*These menus are related to other settings. They are not visible unless related settings are enabled

*1 “Standby Test Time” is shown depending on the setting of “Standby Test” in the CONFIGURE Menu.

*2 “Boost Hold Time” is shown in pressure mode when “Standby Test” (in CONFIGURE Menu) is set to Boost.

*3 “Change Over Delay” is not shown when operating in all VFD mode (Operating System in CONFIGURE menu).

*4 If “Stop Time” is before “Start Time” then the Backup will run through midnight. Start Time is hidden if Stop Time is disabled. *(Not included on previous versions)*

*5 “Fallback Delay” is shown if “JP Fallback” setting is “On” in the CONFIGURE Menu.

*6 Visible when an output is set to be UV Bypass.

*7 Visible when a pump is defined as a Backup pump.

X *(Not included on previous versions)*

	Sub Menu	Units	Range	Defaults

CONFIGURE

	Operating Mode	selection	Pressure, Level,	Pressure
*1	Level Mode	selection	Std An:Tank Fill, Std An:TankEmpty, Rev An:Tank Fill, Rev An:TankEmpty	Std An:TankEmpty
	Number of pumps	number	1 – 6	3
	Min Freq Mode	selection	Fixed, Calculated	Fixed
	Press Decimal	number	0 – 3	0
	Flow Decimal	number	0 – 3	0
*2 *3	Transducer Zero	Unitless	0 - 9999	*3
*2 *3	Adjust Pressure	Unitless	0 - 10000	*3
	Averaging	number	Disabled, 1 - 50	5
*4	Flow Meter Zero	/Sec	0 - 9999	0
*4	Adjust Flow	/Sec	0 - 10000	1000
X*9	Backup Pres Zero	Unitless	0 - 9999	0
X*9	Adjust Backup Pr	Unitless	0 - 9999	0
*5	Scale An output 2	number	100 – 10000	1000
	JP Fallback	selection	On. Off	Off
*6	Standby Test	selection	Boost, Flow Switch, Flow Rate, Off	Boost
X*8	Fallback Test	selection	Flow Switch, Flow Rate	Flow Rate
	Set Time/Date	selection	00:00 2000 Jan 1 -23:59 2099 Dec 31.	00:00 2000 Jan 1
	Operating System	selection	Cascading, Lead VFD Lag, All VFD	Lead VFD Lag
	DOL Backup Mode	selection	On, Off	Off
*6	Friction Loss Calc	selection	Linear, Exponential	Linear
*7	Access Code	number	Off, 0 - 250	21
	Serial Comms	selection	Output Cont Data 2400, 4800, 9600, 1920, Modbus Protocol 2400, 4800, 9600, 1920	Modbus Protocol 9600
X	Modbus Address	number	1 - 31	1
X	No Of Duty Pumps	number	1 – 6	3
X	Flow Sensing	selection	Calculated, Scaled AnInp2, Digital Pulse	Calculated
X	Manual Run	selection	Input or Button, Input Only	Input or Button

* These menus are related to other settings. They are not visible unless related settings are enabled

*1 Only shown if Operating Mode is set to Level.

*2 These menus show a value that is decoupled from the value that you are changing. Thus one press up and one press down may not corresponded to +1 or -1 change in value.

*3 These settings are by default setup for a 4-20ma sensor with the range of 0-25bar (2500 kpa). However it is still highly recommended that you calibrate the Orca for your sensor.

*4 These menus are only visible when one of the Analogue inputs is configured as a flow meter.

*5 Menu hidden when Analogue output 2 is configured as VFD speed.

*6 Menu hidden when in level mode.

*7 The Access Code allows you to change the access code and also determine which features require you to enter an access code.

*8 Menu hidden unless “JP Fallback” is set to “On” in the CONFIGURE Menu.

*9 Menu hidden unless “Analogue Input 2” is set to “Backup Pressure” in the CONFIGURE Menu.

X *(Not included on previous versions)*

Sub Menu	Units	Range	Defaults

PUMP DEFINITION

	Pump 1	selection	Duty/Standby, Backup, Jockey	Duty/Standby
*	Pump 2	selection	Duty/Standby, Backup	Duty/Standby
*	Pump 3	selection	Duty/Standby, Backup	Duty/Standby
*	Pump 4	selection	Duty/Standby, Backup	Duty/Standby
*	Pump 5	selection	Duty/Standby, Backup	Duty/Standby
*	Pump 6	selection	Duty/Standby, Backup	Duty/Standby

* Whether or not these options are shown depend on how many pumps are configured in the Configuration Menu.
(Not included on previous versions- Originally Duty or Backup, no standby feature)

Sub Menu	Units	Range	Defaults

JOCKEY PUMP

*	Jockey Pump Mode	selection	Main VFD, Separate VFD, DOL	Main VFD
*	JP Cut In Pressure	% of JP Setpoint	0 – 9999	83.3
2	JP Cut Out Pres	Unitless	0 – 9999	300
* 3, 5	JP Set Point	Unitless	0 – 9999	300
* 5	JP Flow Rate	/Sec	0 – 9999	50
* 3	JP Response Rate	%	0.1 – 100.0	3.0
*	JP Acceleration	%/second	1 – 100	20
* 3, 5	JP Standby Test	selection	Off, Boost, Flow Switch, Flow Rate	Boost
* 1, 3	JP Standby Boost	% of JP Setpoint	5 – 250	6.6
* 1, 3, 5	JP Stdby FlowMin	/Sec	0 – 250	5
*	JP Run On Time	seconds	0 – 999	1
*	JP Restart Delay	seconds	0 – 999	0
* 3, 5	JP Use Main SP	selection	Yes, No	No
* 3	JP Min Frequency	%	0.0 – 100.0	10
* 3	JP ErrorCorr't (I	seconds	Off, 0.1- 100.0	15
* 3	JP OverShtElim (D	%	Off, 0.01 – 50.00	4

* All of these menus are not visible unless Pump 1 is configured to be a Jockey Pump
1 Menu only visible if the JP Standby Test mode is set to the matching function.
2 Appears when Jockey Pump Mode is set to DOL
3 When Jockey Pump Mode is set to DOL this optional has no function and will not be visible
4 Not visible when JP Use Main SP) Set Point) is set to YES
5 *(Not included on previous version)*

OUTPUTS

	Sub Menu	Units	Range	Defaults
	Digital Output 1	selection	Any of the following can be selected on any output and used multiple times Shutdown Fault, Lo Press Fault, Hi Press Fault, Any Alarm, Pump 1 – 6 Run, Pump 1 – 6 Fault, System Paused, Any Pump Shutdown, Any Pump Running, No Flow Shutdown, VFD Fault, Pressure Trip 1 – 2, Alternate Trip, Flow Trip, All Pumps On, Aux Output 1 – 3, Set Point Output 1-8 Any Fault UV Bypass	Pump 1 Run
	Digital Output 2	selection		Any Pump Shutdown
	Digital Output 3	selection		VFD Fault
	Digital Output 4	selection		System Paused
*	Digital Output 5	selection		Any Pump Run
*	Digital Output 6	selection		Shutdown Fault
*	Digital Output 7	selection		
*	Digital Output 8	selection		
^ ^ ^				
	Analogue Output 1	selection	VFD Speed.	VFD Speed
	Analogue Output 2	selection	VFD Speed, Flow Rate, System Pressure	System Pressure

*These menus are related to other settings. They are not visible unless related settings are enabled.
^ *(Not included on previous versions)*

	Sub Menu	Units	Range	Defaults

INPUTS

	Program Input 1	selection	Any of the following can be selected on any input and used multiple times Not selected, Set Point 2 - 8, Soft Pause, Soft Pause JP Run, Emergency Stop, Pump 1[JP]- 6 Prot(Pause) Pump 1[JP] - 6 Stop Pump 1[JP] - 6 Manual Run, Fire Mode, Cycle Pumps, Shutdown Verify, VFD Fault, Reset, No Flow, Aux Input 1 - 3, Pump 1[JP] - 6 Fault(Stop), Flow Pulse, Low Level Pause Schedule override	VFD Fault
	Program Input 2	selection		No Flow
	Program Input 3	selection		Pump 1 Manual Run
	Program Input 4	selection		Pump 1 Stop
	Program Input 5	selection		Not selected
	Program Input 6	selection		Not selected
	Program Input 7	selection		Reset
	Program Input 8	selection		Soft Pause
	Program Input 9	selection		Emergency Stop
	Program Input 10	selection		Pump 1 Protection
	Program Input 11	selection		Cycle Pumps
	Program Input 12	selection		Soft Pause JP Run
#	Program Input 13	selection		Not selected
#	Program Input 14	selection		Not selected
#	Program Input 15	selection		Not selected
#	Program Input 16	selection		Not selected
#	Program Input 17	selection		Not selected
#	Program Input 18	selection		Not selected
#	Program Input 19	selection		Not selected
#	Program Input 20	selection		Not selected
	(Flow Pulse, Low Level Pause & Scdule Override Not included on previous versions			
	Analogue Input 1	selection	Disabled, Control Pressure, Flow Mtr, Set Point Input	Pressure
	Analogue Input 2	selection	Disabled, Control Pressure, Flow Mtr, Set Point Input, Backup Pressure	Disabled,
^	Validate AnInput	selection	NO	NO, YES

For 1-3 pumps there are 12 standard programmable inputs. An add-on PCB (Techsys Expansion Board) is supplied with 4-6 pump options which will allow inputs 13 to 20 to be used.
^ *(Not included on previous versions)*

	Sub Menu	Units	Range	Defaults

PIPE FILL

	Pipe Fill Mode	selection	On, Off	Off
^ *	Jump Ramp Time	seconds	Off, 1 - 999	Off
^ *	Jump Final Speed	%	1-100%	Off
*****	Pipe Fill Time	seconds	5 - 999	100
*****	Pipe Empty Pressure	Unitless	0 - 9999	200
*****	Pipe Empty Time	seconds	0 - 999	200

* These menus are related to other settings. They are not visible unless related settings are enabled.
(Jump Speed feature not included on previous versions)
^ *(Not included on previous versions)*

Sub Menu		Units	Range	Defaults

RESTORE OPTIONS

	CREATE BACKUP			
*1	RESTORE BACKUP			

*1 The Restore Backup menu item is only shown when there is a valid backup present.
(This function was not included on previous version)

Sub Menu		Units	Range	Defaults

TIME OF DAY SP

^	Set Point 2 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 3 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 4 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 5 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 6 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 7 Time	time	Disabled, 00:00 – 23:59	Disabled
^	Set Point 8 Time	time	Disabled, 00:00 – 23:59	Disabled

^ *(Not included on previous versions)*

SYSTEM DISPLAY MENUS

Set-Pr Actual –Pr	number	0 – 9999	0 – 9999	display
Flow-Rate VFD-Sp	number	0 – 9999	0 – 100	display

Set Point and Actual Pressure

Set-Pr	**Actual-Pr**
XXXX	**XXXX**

The Actual Pressure is measured in the discharge pipeline of the system by the pressure transducer and is displayed on the ORCA Pressure status screen (Actual-Pr), next to the Pressure Set Point (Set-Pr).

If the jockey pump is running on the main VFD, then the jockey pump set point will appear. This will be denoted by "JP" alongside the value.

The Pressure Status screen is the ORCA default display. Other messages are displayed when activated; these include in order of priority: Emergency Stop, Hi Press Shutdown, Lo Press Shutdown, No Flow Shutdown, VFD Shutdown, DOL Backup Mode, New Fault, Lo Flow Detected, Pipe Fill Mode, Pause On JP Run, Pause Activated, Paused Low Level and High Press Limit.

After 25 minutes from the last key press the ORCA will revert to Pressure Status screen automatically.

Flow Rate and VFD Speed

Flow-Rate	**VFD-Sp**
XXXXX*	**XXX%**

The ORCA can operate on a calculated flow rate or via a 4-20mA input from a flow meter or a flow meter with a digital output. The Flowrate is displayed in this screen and will show "*" adjacent to the Flowrate number if the Flowrate is a calculated flow. If the flow input is determined from a flow meter the flow is displayed without the asterisk.

The estimated flow rate is calculated from information entered into the Pump Flowrate menu. This calculation automatically compensates for the number of pumps operating and the speed of the VFD pump – it is useful in determining the system capacity. The estimated flow for the VFD pump is calculated using the pump speed and mathematical Affinity Laws. This is a calculated flow and must be treated as such. The time base for this flow is in flow per ***MINUTES*** and is not adjustable.

The VFD Speed is displayed as a percentage of maximum speed and is for informational purposes only.

FAULT HISTORY

Sub Menu	Units	Message	Type
F1	message	Type/Time/Date AND	display
F2	message	Hi Press Shutdown, No Flow Shutdown,	display
F3	message	VFD Fault, Pump 1 – 6 Shutdown,	display
F4	message	Lo Press Shutdown, High Temperature,	display
F5	message	Auto Reboot, Power Failure.	Display

When a system fault is registered a "NEW FAULT" message will appear on the main screen. It will also be logged in the FAULT HISTORY menu. There is space for 5 faults. F1 is the most recent fault.

**** NEW FAULT ****

In the event of a new fault which has been automatically reset, the default screen will display the message "New Fault". Go to the FAULT HISTORY to view this fault. Faults that are active will remain live on the screen until the ENTER Key is pressed to clear the fault.

NOTE: When the power has been turned off for any reason, "POWER FAILURE" will be recorded and displayed. This does not mean the controller is faulty or the system not operating correctly.
The message is intended to alert the operator of an event/issue he otherwise may not be aware of.

Faults will appear in the sub menu in the following format with the time and date included on the screen.

F1 Hi PressShut
16/08/08 20:04

NOTE: The FAULT HISTORY menu is cleared when the system is first powered up.

If there is a problem with the clock or the clock hasn't been initialised correctly then "RTC ERROR" will appear along with the fault. See "Set Time and Date" in the CONFIGURE menu for more details.

"Pump 1 – 6 Shutdown" signifies that the corresponding "Pump protect 1-6" input has been activated for the period of the input delay time.

A HIGH TEMPERATURE fault is recorded when the temperature rises above 60 degrees C. This fault will continue to be updated if the temperature continues to rise along with the time and date that the highest temperature was recorded. This fault stops being updated when the temperature drops below 55 degrees C. After this a new fault will appear if the temperature rises above 60 degrees C.

F1 Hi Temp 69C
01/04/08 11:51

"Auto Reboot" denotes that the ORCA has automatically restarted due to an internal reset, whereas "Power Failure" records that the ORCA has recovered from a power supply problem.

The FAULT HISTORY menu is always accessible (no access code is required)

PUMP DATA LOG

Sub Menu	Units	Range	Type
Flow Total	Unitless	0 – 9999999	display
Average Flow Rate	/Sec	0 – 9999	display
Average Pressure	Unitless	0 – 9999	display
Highest Pressure	Unitless	0 – 9999	display
Hours Run 1	hours	0 – 65535	display
Hours Run 2	hours	0 – 65535	display
Hours Run 3	hours	0 – 65535	display
Hours Run 4	hours	0 – 65535	display
Hours Run 5	hours	0 – 65535	display
Hours Run 6	hours	0 – 65535	display
Pump Starts 1	number	0 – 65535	display
Pump Starts 2	number	0 – 65535	display
Pump Starts 3	number	0 – 65535	display
Pump Starts 4	number	0 – 65535	display
Pump Starts 5	number	0 – 65535	display
Pump Starts 6	number	0 – 65535	display
Pump Starts Last Hr	number	0 – 65535	display
Analogue Input 1	%	0.00 – 100.00	display
Analogue Input 2	%	0.00 – 100.00	display
Analogue Output 1	%	0.00 – 100.00	display
Analogue Output 2	%	0.00 – 100.00	display
Digital Input State M	1 – 12	X for Active	display
Digital Input State E	13 – 20	X for Active	display
Digital Output State	1 – 8	X for Active	display
PID Error	%	0.00 – 100.00	display
Curr & max retry	number	0-20 0-20	display
Temperature	degrees C	0 – 999	display
Modbus monitor	Rx, Tx, Err	0-9999	display

Flow Total

The Totalised Flow is displayed. It is calculated from the flow rate input and can be derived from a flow meter or the calculated “Flow Rate” figure set in the Pump Flow Rate Screen in SETTINGS.

Flow Total
XXXXXXX

If the ORCA uses Flow Rate/Sec to calculate “Total Flow”, the value is based on the Average Flow input into the system. The accuracy is dependent on the average flow information and is most often in the order of accuracy of ±5%. Site variations such as suction pressure can affect the accuracy of this figure. The FLOW TOTAL is updated every 1 minute and can be reset by pressing ENTER.

Average Flow Rate

The Average flow is calculated over the period since the last reset. The flow units are derived either from a calculated flow or the input from a flow meter.
To reset press ENTER.

Average Flow Rate
XXXX /Sec

Average Pressure

The Average Pressure calculated over the period since the last reset.
To reset press ENTER.

Average Pressure
XXXX

Highest Pressure

The Highest Pressure is the highest pressure point reached since the last reset of this log. *(Not included on previous versions)*
To reset press ENTER.

Highest Pressure
XXXX

Hours Run Pump 1-6

Each pump has an hour run meter.
The hour log displays the operation time for each pump in both AUTOMATIC and MANUAL modes.
To reset the time press ENTER.

Hours Run Pump1
XXXXX

Pump 1-6 Starts

The ORCA displays the number of starts for each pump. This can assist in the selection of run time settings. The starts do not increment when pumps are in MANUAL.
To reset press ENTER.

Pump Starts 1
XXXXX

Starts Last Hour

This is a totalisation of starts for all pumps over the past hour. This history can assist with tuning and trouble shooting. The value displayed is updated at ten minute intervals. The value will not be accurate or valid until 1 hour has elapsed since the last reset.
To reset press ENTER.

Starts Last Hour
XXXXX

Analogue Input 1

Displayed is the Analogue Input reading as percentage.
E.g. If the analogue input was 12mA on a 4-20mA selection then the reading in this screen would be 50.00 % - 12-4 =8….8/ (20-4)16=50%

Analogue Input 1
XXX.XX%

Analogue Input 2

As per Analogue Input 1.
See INPUTS for configuration options

Analogue Input 2
XXX.XX%

Analogue Output 1

Displayed is the Analogue Output as percentage.
This output is reserved for VFD speed and cannot be changed.

Analogue Output 1
XXX.XX%

Analogue Output 2

Displayed is the Analogue Output value as percentage.
This output can be configured.
See OUTPUTS for configurable options for this item.

Analogue Output 2
XXX.XX%

Digital Input State M (Main Inputs)

Displayed is the state of the Digital inputs
X = energised
- = de-energised
See INPUTS for configurable options for this item.

Digital Input M
X- - X- - - - X - - X

Digital Input State E (Expansion Board Inputs)

State of the Digital inputs on expansion board
X = energised
- = de-energised
See INPUTS for configurable options for this item.
Visible only when a Techsys Expansion Board is present.

Digital Input E
XX - X - - - X

Digital Output State

Displayed is the state of the Digital outputs
X = energized
- = de-energized
See OUTPUTS for configurable options for this item.

Digital Output
X - - X - - - -

PID Error

Displayed is the calculated error between the Set Point and actual pressure.

PID Error
XXX.XX %

Curr & Max Retry

The number under “Curr” is the current number of times the main processor has not been able to communicate with the analogue system. If it is not at Zero it indicates that the analogue system has been subject to noise and may have had to restart itself.
If this display continuously cycles from incrementing to 20 and resetting to 0, it indicates a malfunction with the analogue system (contact your dealer for advice).

Curr & Max Retry
XXX XXX

The number under “Max Retry” is the maximum number of times the main processor has not been able to communicate with the analogue circuitry. If it is at 20 there may have been a disruption in the analogue system and it was unable to restart itself. The main processor has forced it to restart.

Temperature

Displayed is the current temperature in degrees C,
read from the temperature sensor on the circuit board.

Temperature
XXX degrees C

Modbus monitor
Used to monitor serial communication data transmit & receive transaction and errors.
(Not included on previous versions)

ACCESS CODE

Access Code	**number**	**0 – 250**	**0**

Press ENTER to edit the Access Code

The Access Code enables access to the pump buttons and all menus.
The access code will have to be re-entered after 25 minutes of no operator activity. The system will then automatically lock the use of the keys which control the ON/OFF and AUTOMATIC and MANUAL functions. This is designed to protect the system from tampering.

Access Code
XXX

SETTINGS

Sub Menu	Units	Range	Default
Low Pressure Shutdown	Units or %	0.0% Cut In Pressure	50.0%
Cut In Pressure	% of Setpoint	Low Pressure Shutdown to 99.9%	75.0%
Set Point	Unitless	0 – 9999	300
High Pressure Limit	% of Setpoint	100.1% to High Pressure Shutdown	150.0%
High Pressure Shutdown	% of Setpoint	High Pressure Limit- 300.0%	200.0%
Pump Flow Rate	/Sec	0 – 9999, Flow Meter	99
Friction Loss	Unitless	0 – 999	0
Set Point 2	Unitless	0 – 9999	400
Set Point 3	Unitless	0 – 9999	400
Set Point 4	Unitless	0 – 9999	400
Set Point 5	Unitless	0 – 9999	400
Set Point 6	Unitless	0 – 9999	400
Set Point 7	Unitless	0 – 9999	400
Set Point 8	Unitless	0 – 9999	400
Pressure Trip 1 Low	Unitless	0 – 9999	100
Pressure Trip 1 High	Unitless	0 – 9999	200
Pressure Trip 2 Low	Unitless	0 – 9999	500
Pressure Trip 2 High	Unitless	0 – 9999	600
Flow Trip Low	/Sec	0 – 9999	100
Flow Trip High	/Sec	0 – 9999	200
DOL Cut In	Unitless	0 – 9999	200
DOL Cut Out	Unitless	0 – 9999	400

Low Pressure Shutdown

Low pressure Alarm. If any pump is running and the system falls below this pressure and remains there for the period of the "Lo Pressure Delay" time (Set in the TIMING Menu), then the system will then shut down.

LoPress Shutdown
XXXX

Lo Press Shutdown can be ether a fixed pressure or relative pressure calculated from the current Set Point. To toggle between fixed and relative, press <u>both</u> up and down. When Lo Press Shutdown is relative, the value is a percentage of the current set point. In relative mode a calculated pressure value (based off set point 1) is displayed in brackets on the right of the display).
(Relative pressure setting is not included on previous versions)

A fault message will show on the main screen showing that there is a low pressure shutdown fault.
The fault is also recorded in the FAULT HISTORY.
To clear the fault and restart the system press the ENTER key.

LO PRESS SHUTDWN

NOTE: All pumps will be shut down including manual pumps.

Cut In Pressure

When the system pressure falls below the "Cut In Pressure" the system will restart.
This pressure must be higher than the Low Pressure Shutdown and lower than 99.9%. On the right of the display a value in brackets indicates the calculated pressure based on set point 1.
(This setting is an adjustable value and not a % on previous versions)

Cut In Pressure
XXX.X % (XXXX)

Set Point

The Set Point is the pressure that the system will maintain. This set point is unit-less and is determined by the operator and the setting of the pressure transducer.

Set Point
XXXX

High Pressure Limit

The High Pressure Limit is the pressure point that stops pumps if the pressure rises above this limit.

HiPress Limit
XXX.X % (XXX)

Once the pressure rises above this figure the fixed speed pumps will shut down and the VFD rapidly decelerates. If the system pressure falls to below the High Pressure Limit the ORCA will restart and function normally.
This setting is limited to a value that is lower than the High Pressure Shutdown and higher than the highest Set Point. (This includes all other Set Points 2 to 8). On the right of the display a value in brackets indicates the calculated pressure based on set point 1.

When a full speed pump is turned off, the following message will be displayed on the main screen for 5 seconds.

HIGH PRESS LIMIT

If the pressure is above the High Pressure Limit, turning pumps to MANUAL is also disabled.

(This setting is an adjustable value and not a % on previous versions)

High Pressure Shutdown

The High Pressure Shutdown shuts down the system if any pump is running, and the pressure rises above this pressure for longer than the "High Pressure Delay" time.

HiPress Shutdown
XXX.X % (XXX)

The High Pressure Shutdown value is limited to a value higher than the High Pressure Limit.
High Pressure Shutdown can be set for auto reset.
Set for Auto reset in the "Fault Re-start Screen" or set to OFF.

On the right of the display a value in brackets indicates the calculated pressure based on set point 1.
NOTE: On reaching the High Pressure Shut Down all pumps will be shut down including manual pumps.

(This setting is an adjustable value and not a % on previous versions)

Pump Flow Rate

There are two options for the Flow rate figure:
Actual Flow rate
Calculated Flow rate

Pump Flow Rate
XXXX /Min

ACTUAL FLOW RATE
The analogue input programmed for Flow rate Input can read the input from a Flow Meter to register the flow. This input is a 4-20mA analogue or pulsed signal. *(Pulsed Signal is not included on previous versions)*

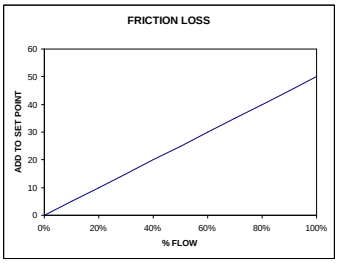
See Flow Meter Calibration (CONFIGURE) for additional information.

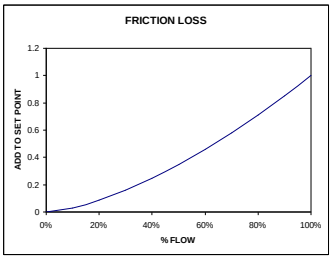
CALCULATED FLOW RATE
This figure is the flow rate of the pump at the nominated set point at full motor speed. It is read from a manufacturer's pump curve and input as a flow rate / minute. Any units can be used for this figure however the time units are fixed at MINUTES.
Each time the Set Point is changed this figure must be modified to maintain accuracy.
The calculation is done on the number of pumps running at any time with an adjustment for pump speed on the VFD pump based on "Affinity Law" calculations.

Friction Loss

Friction Loss
XXX

Friction loss is the figure that is added to the Set Point to compensate for Friction in a pipeline. The setting increases the Set Point Pressure based on the calculated flow rate. The increase in Set Point is proportional to the calculated flow rate. The input figure is the total additional pressure required when all of the nominated pumps are operating.





Linear Friction Loss

Exponential Friction Loss

NB. Make sure that the friction loss figure is less than the difference between the highest Set Point and High Pressure Limit.

Set Point 2-8

Set Point 2
XXXX

The ORCA has the option to set 8 Set Points that can be triggered by a Digital Input or via a time of day event.
This allows a variation to the main Set Point to be made remotely.
It changes the main Set Point to the value nominated in alternate Set Points 2 through 8. To select this option, an input is programmed to function as Set Point 2 to 8 and is activated by closing the contact between the nominated input and the Input Common OR by using the timed Set Point feature.

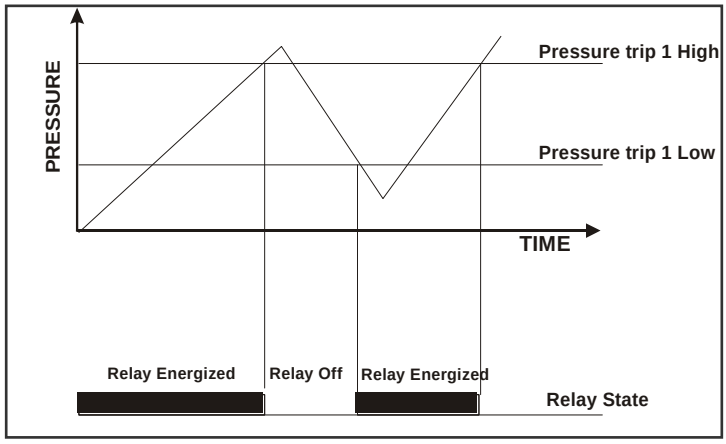
Screens Set Point 2 – 8 are hidden unless an input is nominated as the corresponding set point within the INPUTS menu or a timed set point option is set.

Pressure Trip 1 Low

Press Trip 1 Low
XXXX

The ORCA has the ability to energise an output relay based on a nominated system pressure. This can be useful to signal other elements of a system not under control of the ORCA. See Output Relays for information on how to set this feature.

Pressure Trip 1 – the designated relay will energize on reaching Pressure Trip 1 entered value (either Pressure Trip Low and/or Pressure Trip 1 High).

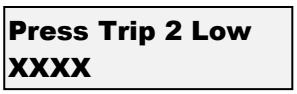


Pressure Trip 1 High

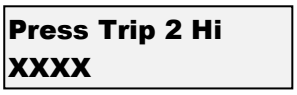
The High Trip point has a matching low Trip point. If a single trip point is required, set the High and Low trip points to the same value. Note: The settings of Trip high must be greater than or equal to Trip low. The system does not allow settings to be selected outside this range.

The “Pressure Trip 1 Low” and “Pressure Trip 1 High” screens will only appear if an output is set to “Pressure Trip 1” within the OUTPUTS menu.

Pressure Trip 2 Low
Operates as per Pressure Trip 1 Low.



Pressure Trip 2 High
Operates as per Pressure Trip 1 High.
The “Pressure Trip 2 Low” and “Pressure Trip 2 High” screens will only appear if an output is set to “pressure trip 2” within the OUTPUTS menu.



Flow Trip Low

This setting is used to energise an output relay if the flow rate is below this figure. The delay time for this setting is defined in the TIMING Menu under Flow Trip Low Delay Time. See OUTPUTS for additional information.

Flow Trip High

Low Trip High can be set to deactivate an output relay if the flow rate exceeds a nominated value. The delay time for this setting is defined in the TIMING menu under “Flow Trip High Delay Time”. See OUTPUTS for additional information.

The “Flow Trip Low” and “Flow Trip High” screens will only appear if an output is set to “flow trip” within the OUTPUTS menu.

DOL Cut In

In the event of a VFD failure the ORCA has the option to select DOL Backup Mode and revert to a switched pressure system.
When DOL Backup Mode is selected to “ON” the ORCA maintains pressure between the DOL Cut In and DOL Cut Out pressure settings.
Refer to DOL Backup Mode in CONFIGURE for a fuller description.

DOL Cut In must always be higher than Low Pressure Shutdown and less than DOL Cut Out.
All delay timers operate as per normal when DOL mode is running.

DOL Cut Out

Operates as per DOL Cut in – see above

The screens “DOL Cut In” and “DOL Cut Out” will appear when DOL Backup Mode is enabled within the CONFIGURE menu.

DOL Cut Out must always be lower than High Pressure Limit and greater than DOL Cut In.

TUNING

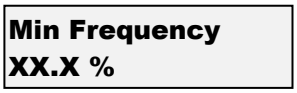
Sub Menu	Units	Range	Default
Minimum Frequency	%	0.0 – 100.0	45.0
Shutoff Head	Unitless	0 – 9999	1924
Response Rate	%	0.1 – 100.0	2.0
Acceleration	%/second	1 – 100	20
Auto Rotation	selection	Full, 1 – 6, At Specific Time, Low Hours	Full
Rotation Time	time (24hr)	0:00-> 23:59	0:00
High Press Restarts	number	Off, 1 – 250	Off
Standby Boost	% of Setpoint	10 – 250	20
Standby Flow Min	/Sec	0 – 9999	200
Error Correction (I	seconds	Off, 0.1 – 100.0	3.0
Overshoot Elimination (D	%	Off, 0.1 – 50.00	15.0
RP(P) EC(I) OE(D	number	-1000, 1000	display

Minimum Frequency or Shutoff Head

The minimum frequency is the lowest setting at which a pump will begin to contribute to the system pressure. This value is expressed as a percentage.
This is the minimum frequency at which the ORCA determines that a pump is to be stopped as at this speed it is not contributing flow.

There are two ways to setup the Minimum Frequency,
"Fixed" or **"Calculated"**; this is selected by editing the "**Min Freq Mode"** option In the **Configuration Menu**.

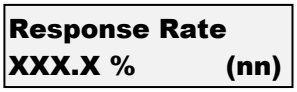
Fixed – A fixed valve is selected for all set points.
The pump minimum frequency (Hz) can be found in your pump's data sheet. Divide this minimum value by the maximum speed of the pump (Hz) and multiply the result 100 to get minimum frequency (%). Enter this value



Calculated – The Shutoff Head of the pump is entered and the Min Frequency is then calculated based on the Shutoff Head value and the current set point. The actual calculated minimum pump speed is shown on the right hand side of the display.
(This feature is not available on previous versions)

Response Rate (Proportional)

The response rate is a figure used to set the speed of reaction of the system. It is expressed as a percentage ranging from 0.1 – 100.0.
is the slowest response and 100.0 the fastest.
The current pressure reading is also displayed to assist while tuning – Shown above as "nn"

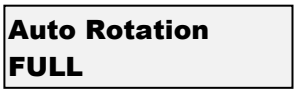


Acceleration

The acceleration of the VFD can be limited by this figure. It is designed to brake the PID control. It is used in cases where the Acceleration needs to be dampened.
The figure is input in %/second.

Auto-Rotation

The ORCA can start-up on a different pump (Lead Pump) at each re-start or time interval. *Note- Auto rotation can only occur on LLA & All VFD systems.*
The lead pump is the first auto pump to start (if available).
The options are Full, 1, 2, 3, 4, 5, 6, Time of Day or Low Hours.



Pump "1-6" – The selected pump (1-6) will nominate a particular pump to always be the lead pump.

Full – the lead pump will cycle after each system standby, shutdown or *PAUSE.*
Time – once every 24 hours at a specified time the system will shutdown (including the jockey pump, if present) and the lead pump will rotate on restart. *(The specific timed feature is not available on previous versions)*
Low Hours – will start the pump with the lowest hours according to the pump run Hour Run meters (see PUMP DATA LOG).
Forced rotation - set one of the programmable inputs to **"Cycle Pumps"** and activating this input will cycle the pumps – see Programmable Inputs.
If a jockey pump is fitted, the jockey pump will be designated Pump 1 and will not auto-rotate.
See JOCKEY PUMP and PUMP DEFINITION for more information.

Rotation Time

When Auto rotation is set to a specific time; this is the time at which the rotation occurs at. Be sure to set the clock in the configuration menu.
(The specific timed feature is not available on previous versions)

Auto Rotation
XX:XX (hh:mm)

High Pressure Restarts

This setting allows the operator to set the number of times that the system can shutdown and automatically restart after a High Pressure Shutdown.
The range is from Off to 1-250.

HiPress Restarts
XXX

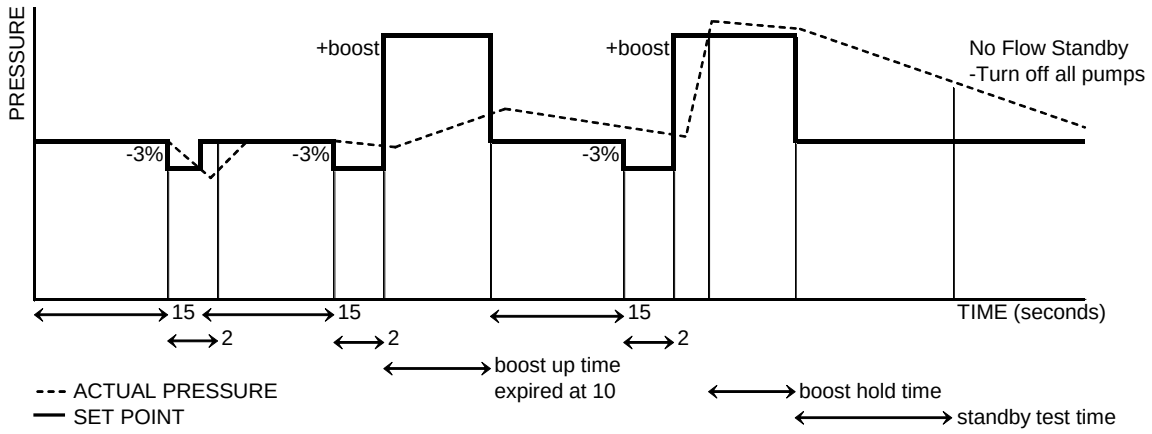
"Off"- the system shuts down after the High Pressure delay timer trips (default).
"Automatic restart" – (per hr) The ORCA will allow "X" restarts in an hour commencing from the first High Pressure Fault. A message **"New Fault"** appears on the main screen on each restart and is logged in the fault log.

Standby Boost / Standby Flow Min

The ORCA uses one of three methods to determine if there is "no flow". The options detailed below are selected via the **"Standby Test"** screen, which is in the CONFIGURE menu. Each test is only carried out if there is **1 pump running**, **not at maximum speed** and the **system pressure is at or above the Set Point**.

Standby Boost
XXX

Boost: The ORCA tests for **"No Flow"** by boosting the system pressure to a new pressure, typically 5% (adjustable) higher than the set pressure (**"Standby Boost")** for a period of time (**"Boost Hold Time")** and then tracks the system pressure to see if it falls back to normal within a prescribed period of time (**"Standby Test Time")**. The "Standby Boost" pressure sets the amount the Set Point pressure is boosted by. The Boost Hold time ensure the system will be totally pressurised. The time that it takes to drop back to the Set Point pressure is referenced against the Standby Test time. If the time to return to **"Set Point"** is less than the **"Standby Test"** the system continues to operate.
If the system pressure does not drop to the set point within the test time setting, the ORCA assumes there is "NO FLOW" and will place the system in standby mode until the system pressure falls below cut in pressure point, which wakes the ORCA to restart pressure control again.



In this mode the "Standby Boost" screen will be visible and "Standby Flow/Sec" will be hidden.

Flow Switch: If an ORCA input is programmed to **"No Flow".** The flow switch is connected to the selected ORCA input and when activated the ORCA will turn off the pump after a period nominated by the standby test time. In this mode both the "Standby Boost" and "Standby Flow/Sec" screens will be hidden.

Flow Rate: If a flow meter is connected to an analogue or a pulsed input and set up properly and the flow rate is below the nominated amount in this menu for the period of the standby test time the system will placed in standby mode. In this mode the "Standby Flow Min" screen will be visible and "Standby Boost" will be hidden.

Standby Flow Min
XXXX /min

Error Correction (Integral Time)

The error correction time is the time taken to convert a constant error of 1% to a 1% change on the output. The error correction component is proportional to the tracking error and increases linearly with time. It is useful when trying to close the gap on small errors that cannot be eliminated through the use of the response rate alone.
It is expressed as a percentage ranging from Off, 0.1 – 100.0. Off will disable this part of the PID equation.
The current pressure reading is also displayed to assist while tuning – Shown above as "nn"

Error Correct (I
XXX.X secs (nn)

Overshoot Elimination (Derivative Gain)

The overshoot elimination gain provides a damping effect to eliminate system oscillation and to minimize overshoot.
It is expressed as a percentage ranging from Off, 0.01 – 50.00. Off will disable this part of the PID equation.
The current pressure reading is also displayed to assist while tuning – Shown above as "nn"

OvershootElim (D
XX.XX % (nn)

RR(P) Proportional Output
Displays the proportional component within the PID equation. Proportional is another name for "**Response Rate"**.

RR(P) EC(I) OE(D
XXX XXX XXX

EC(I) Error Correction
Displays the error correction component within the PID equation.

OE(D) Overshoot Elimination
Displays the overshoot elimination component within the PID equation.
These three "Output" display values help in the tuning of the Orca. Each has a range of -1000 to 1000.
See PID Control for more information.

TIMING

Sub Menu	Units	Range	Default
Low Pressure Delay	Seconds	Off, 0 – 250	120
High Pressure Delay	seconds	Off, 0 – 250	4
In Delay Timer	seconds	0 – 999	4
Out Delay Timer	seconds	0 – 999	1
Restart Delay	seconds	0 – 999	0
Standby Test Time	seconds	0 – 999	10
Boost Hold Time	seconds	Off, 1 – 250	15
Pump Fault Timer	seconds	0 – 250	10
Now Flow Delay	seconds	0 – 250	10
Input Delay Timer	seconds	0 – 999	120
Pressure Trip Low Delay	seconds	0 – 999	0
Pressure Trip High Delay	seconds	0 – 999	0
Flow Trip Low Delay	seconds	0 – 999	0
Flow Trip High Delay	seconds	0 – 999	0
Change Over Delay	seconds	0.00 – 10.00	0.30
Backup Spin Intv	DD:HH	01 Hour – 45 Days	4 Days
Backup Spin Time	seconds	1 – 60	5
Stop Time (24hr)	HH:MM	Disabled, 0:00 – 23:59	Disabled
Start Time (24hr)	HH:MM	0:01 -> 00:00	Disabled

Low Pressure Shutdown Delay

Time delay for the “Low Pressure Shutdown”.
The range for this is “OFF, 0-250 sec”.
OFF – The system will ignore any low-pressure shutdown commands.

LoPressure Delay
XXX seconds

**** CAUTION**** low pressure faults can be caused by systems failures. Forcing pumps to run in the presence of faults can cause damage to pumps and equipment. The Low & High Pressure delay timers are independent of each other and can be set to suit individual needs.

High Pressure Shutdown Delay

Delays the response “High Pressure Shutdown”.
The range for this is “OFF, 0-250 sec”.
OFF – The system will ignore any high-pressure shutdown commands. **

HiPressure Delay
XXX seconds

CAUTION** High pressure faults can be caused by systems failures. Forcing pumps to run in the presence of faults can cause damage to pumps and equipment. The Low & High Pressure delay timers are independent of each other and can be set to suit individual needs.

In Delay Timer

The **“IN DELAY TIMER”** is used to delay the starting of additional pumps. When the system pressure drops below the “Cut In Pressure” the system starts the first pump according to the “restart timer”.
Additional pumps start when called upon after the **“In Delay Timer”** has elapsed.
This timer is designed to assist in the reduction of Short Cycling by allowing the system to stabilise before additional pumps are started.

In Delay Timer
XXX seconds

Out Delay Timer

When the pumps are called to shut down, a delay can be set using the **“OUT DELAY TIMER”.**
****CAUTION**** Take care in setting this timer as the increase in pressure due to this delay can cause pressure spikes.

Out Delay Timer
XXX seconds

Restart Delay

When the system pressure drops below the Cut In Pressure the ORCA restart will be delayed by the RESTART DELAY.

Restart Delay
XXX seconds

Standby Test Time

The **“Standby Test Time”** selects how long the pressure should take to drop back down to the setpoint after a Standby Boost to determine if there is little or no flow.

Standby Test Tm
XXX seconds

- If the Boost Pressure” drops back to the “Set Point” within the “Standby Test Time” then the ORCA determines that there must be flow and continues to operate.
- If the “Boost Pressure” does not drop down to the “Set Point Pressure” within the “Standby test Time” the ORCA detects “NO FLOW” and the system will placed in Standby mode..

Boost Hold Time

This timer will hold the Boost Set pressure at the boosted value for the time nominated to ensure that all mainlines, pressure tanks etc are fully pressurised. This screen is visible when “Boost” is selected in the Standby Test screen within the CONFIGURE menu.

Boost Hold Time
XXX seconds

Pump Fault Timer

If an input is programmed to become “P1 to 6 Fault(Stop)”, this timer will delay the actiavtion of the fault. It is typically used with flow switches for pump loss of prime detection.

Pump Fault Timer
XXX seconds

No Flow Timer

This timer delays a “No Flow” shutdown by the given entered value in seconds .

No Flow Timer
XXX seconds

Input Delay Timer

This timer sets the delay for reaction to inputs: NO FLOW and PUMP 1-6 PROTECTION.

I/P Delay Timer
XXX seconds

Pressure Trip Low Delay

Delays the activation of the ORCA Output Relay when programmed for Pressure Trip (both Pressure Trip 1 & 2)

Pres Trip Lo Dly
XXX seconds

Pressure Trip High Delay

Delays the deactivation of the relevant Output relay if programmed for Pressure Trip (both Pressure Trip 1 & 2)

Pres Trip Hi Dly
XXX seconds

The screens “Pressure Trip Low Delay” and “Pressure Trip High Delay” are only visible if at least one output is set to “pressure trip 1” or “pressure trip 2” in the OUTPUTS menu.

Flow Trip Low Delay

Delays the activation of the relevant ORCA Output if programmed for Flow Trip. This delay timer is relevant for the Low Flow Trip setting.

Flow Trip Lo Dly
XXX seconds

Flow Trip High Delay

Delays the deactivation of the relevant ORCA Output relay if programmed for Flow Trip. This delay timer is relevant for the High Flow Trip setting.

Flow Trip Hi Dly
XXX seconds

The screens “Flow Trip Low Delay” and “Flow Trip High Delay” are only visible if an output is set as “flow trip” in the OUTPUTS menu.

Change Over Delay

This delay is used to allow sufficient time for the VFD to reset when the Jockey pump is enabled to run from the main VFD.
(On previous versions it has not been used for the Jockey Pump change over)

Change Over Dly
XX.XX seconds

Backup Spin Interval

The **“backup spin”** feature of the Orca, allows pumps set to Backup to be spun up every “Backup Spin Interval (Intv)”. Eg. 1 day will give the backup pumps to spin once a day. Backup pumps will only be started if there is another pump running to eliminate the possibility over pressurising the system.

Backup Spin Intv
XX:XX (dd:hh)

- This option will be displayed when one or more pumps have been selected as a backup pump.

(This feature is not available on previous versions)

Backup Spin Time

Backup Spin Time is the time a pump is run when the backup spin is instigated.

- This option will be displayed when one or more pumps have been selected as a backup pump. *(This feature is not available on previous versions)*

Backup Spin Time
XX seconds

Stop Time (24hr) and Start Time (24hr)

The "Stop Time" and "Start Time" option allows a period of time to be set where the system will be paused.

Stop Time (24hr)
XX:XX (hh:mm)

For Example:

1. Stop Time: 15:00 – Start Time: 16:00
   The system pauses at 3:00 pm each day for 1 hour.
2. Stop Time: 23:00 – Start Time: 6:00
   The system pauses at 11:00 pm each day and starts again at 6:00 am the next day.

Start Time (24hr)
XX:XX (hh:mm)

The "Stop Time" and "Start Time" requires the current time and date be set correctly in the configure **menu.** *(This feature is not available on previous versions)*

CONFIGURE

Sub Menu	Units	Range	Default
Operating Mode	selection	Pressure, Level, Flowrate, Temperature	Pressure
Level Mode	selection	Std An:Tank Fill, Std An:TankEmpty, Rev An:Tank Fill, Rev An:TankEmpty	Std An:Tank
Number of pumps	number	1 – 6	3
Min Freq Mode	selection	Fixed, Calculated	Fixed
Press Decimal	number	0 – 3	0
Flow Decimal	number	0 – 3	0
Transducer Zero	Unitless	0 – 9999	
Adjust Pressure	Unitless	0 – 10000	
Averaging	number	0 – 50	5
Flow Meter Zero	/Sec	0 – 9999	
Adjust Flow	/Sec	0 – 10000	
Backup Pres Zero	Unitless	0 – 9999	0
Adjust Backup Pr	Unitless	0 – 9999	0
Scale An output 2	Number	100 – 10000	1000
JP Fallback	selection	On. Off	Off
Standby Test	selection	Boost, Flow Switch, Flow Rate	Boost
Set Time/Date	selection	00:00 2000 Jan 1 -23:59 2099 Dec 31.	00:00 2000 Jan 1
Operating System	selection	Cascading, Lead VFD Lag, All VFD	Cascading
DOL Backup Mode	selection	On, Off	Off
Friction Loss Calc	selection	Linear, Exponential	Linear
Access Code	number	Off, 0 – 250	21
Serial Comms	selection	Output Cont Data, Modbus Protocol	Modbus Protocol
Modbus Address	number	1 – 31	1
No Of Duty Pumps	number	1 – 6	3
Flow Sensing	selection	Calculated, Scaled AnInp2, Digital Pulse	Calculated
Manual Run	selection	Input or P_But'n, Input Only	Input or P_But'n

Operating Mode

Select the Control Parameter relevant to the operation.
The options are:

- Pressure Control
- Level Control

Operating Mode
Pressure

When the relevant selection is made the menu screens will change to reflect the control parameters.

Level Mode

Level Mode selects whether the ORCA is associated with a “Tank Filling” or “Tank Emptying” application and the level sensing set up.

Level Mode
Std An:Tank Fill

- Std An:Tank Fill – Tank Filling with a sensor that increases output signal as the tank fills.
- Std An:Tank Empty – Tank Emptying with a sensor that decreases output signal as the tank empties.
- Rev An: Tank Fill – Tank Filling with a sensor that decreases output signal as the tank fills.
- Rev An: Tank Empty – Tank Emptying with a sensor that increases output signal as the tank empties.

Number of Pumps

Select the number of pumps in the system.
Related menus will appear in other menus.

Number of Pumps
X

Note: This number includes the Jockey Pump if selected.

Minimum Freq Mode

The Minimum Frequency Mode selector determines how the minimum frequency is set.

Min Freq Mode
Fixed

- **Fixed mode** – Minimum frequency is manually determined and the value entered in the **“TUNING”**. See TUNING

Calculation – Minimum frequency is calculated from the SETPOINT (in settings menu) and the shutoff head (in tuning menu). *(This feature is not available on previous versions)*

Pressure Decimal Places

Decimal resolution for all pressure display.
Please note, this affects how pressure values are displayed and does not effect the ORCA functionality in any way.
(This feature is not available on previous versions)

Press Decimal
X

Flow Decimal Places

Decimal resolution for flow display.
Please note, this affects how flow values are displayed and does not affect the ORCA functionality in any way.
(This feature is not available on previous versions)

Flow Decimal
X

Transducer Zero

The Transducer Zero adjusts the zero offset in the pressure sensor.
Remove pressure in the system and disconnect the pressure tube.

Transducer Zero
XXXX

Automatic Zero.

Press ENTER (*) to begin editing the ZERO PRESSURE; then press and hold both UP and DOWN buttons together for 1 second or until “Finding Zero” is displayed on the screen.

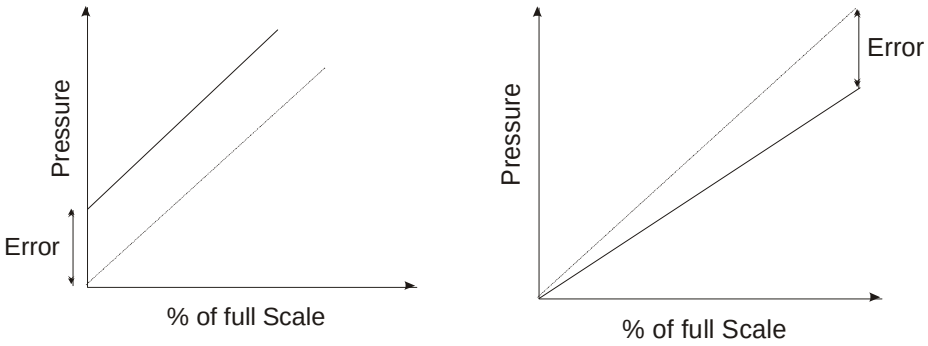
In 5-20 seconds zero will be displayed; press ENTER (*) to finish the operation.
(This feature is not available on previous versions)

Manual Zero (Primary Transducer)

Press ENTER (*) and then the DOWN key to decrease the dispalyed value to ZERO. If “Value Too Low” appears, increase the value slowly by pressing the UP key until a zero value is obtained. *NOTE* The value does not change with each press of the UP/DOWN key. Press and hold the UP/DOWN key for rapid change and single press for small change.

When ZERO is displayed press ENTER (*) to finish the operation.

Reconnect pressure tube before re-enabling pumps.



Adjust Pressure (Primary Transducer)

The calibration of the analogue sensors is achieved by adjusting the pressure reading on this screen to match a reading from a pressure gauge. This will only need to be done if a new or non-standard Techsys transducer is fitted.

Adjust Pressure
XXXX

Once the system pressure has stabilised, press the ENTER key and then either UP or DOWN keys to match the reading on this screen to suit a pressure gauge reading. Once the readings are matched the system pressure is calibrated. Press ENTER again and then exit the menu to store the data.

Transition to the new reading may take some time to settle, wait for 5 seconds before accepting the adjustment.

Averaging

The displayed pressure responsiveness is dampened to reduce fluctuations in the readout.
Decrease Responsiveness with a higher ”AVERAGING” value and increase responsiveness with a lower number.

Averaging
XX

Flow Meter Zero OR Backup Pres Zero (Backup Transducer)

Flow
The Flow Meter Zero adjusts the zero in the Flow Meter input. With no flow press ENTER and then the UP or DOWN keys to set the reading to “0”. Be sure that the flow meter is connected to the relevant input. If the value input is too low then the message “VALUE TOO LOW” will appear. If this has occurred press the UP key until a zero value appears. Press ENTER again and then exit out of the menu to initiate a store of the “zero” value.

Flow Meter Zero
XXXXX /Sec

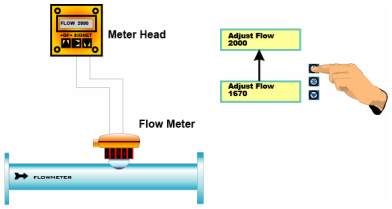
Backup
If Analogue input is configured to be a backup pressure transducer then this display will be displayed instead of Flow. When the backup transducer is selected it will automatically swap between transducers should one transducer become out of range. Out of range is defined as a reading greater than 95% or less than 18%. For it to work effectively it has to be zeroed exactly the same as the primary transducer.

Backup Pres Zero
XXXX

Adjust Flow OR Adjust Backup Pr (Backup Transducer)

Flow

The calibration of the analogue sensors is achieved by adjusting the ORCA Flow Meter reading to match the reading from the system Flow Meter.



Adjust Flow
XXXXX /min

Backup

If the Analogue input is configured to be a backup pressure transducer then this display will be displayed instead of Flow. When the backup transducer is selected it will automatically swap between transducers should one transducer become out of range. Out of range is defined as a reading greater than 95% or less than 18%. For it to work effectively it has to be adjusted exactly the same as the primary transducer.

Adjust Backup Pr
XXXX

Scale An Output

This allows the analogue input to be re-scaled and sent to other devices.
1000 =1:1, 2000 = 2:1
(Output twice the input value).
Refer to Outputs to select either Flow, Pressure or VFD Speed references

Scale An Output
XXXXX

Standby Test

The ORCA uses one of three methods to detect **"NO FLOW"**

Standby Test
Boost

- **Boost** – Add extra pressure to the system and time how long it takes to fall back to the set point.
- **Flow switch** – If a flow switch closes the contact an ORCA input programmed to "No Flow" then the system shuts down. This shut down reason is NOT registered as a fault.
- **Flow Rate** – If the flow rate in the system is below the nominated amount in this menu the system will shut down. A flow meter is required for this selection.

For more information see "Standby Boost" in the TUNING section.

JP Fallback

If ORCA pump 1 is configured as a Jockey Pump and the "Standby Test" option method is set to "Flow Switch" or "Flow Rate" then the system can be configured to automatically fall back to operate on the Jockey Pump when a flow switch input is sensed OR the flow rate is the flow is below the "Fallback FlowMin" setting in the TUNING menu.
When fallback is enabled there is a delay timer associated with this action, it is the "Fallback Delay" and is in the TIMING menu.

JP Fallback
On

Set Time / Date

Select a field and press the ENTER key. Set the time or date field and press the ENTER KEY again. This will highlight the next set of numbers. A flashing cursor will signal which field is being edited.

Set Time/Date
12:00 2010 Jul 01

If the screen reads **"00:00 2000 Jan 01"** (the default), then the time and date need to be initialised. Set the relevant fields as above.

Operating System

Select the type of operation that is required for the system.

Operating System
Lead VFD Lag

Options:
- Cascading
- Lead VFD Lag
- All VFD

CASCADING

DO NOT USE CASCADING UNLESS UPGRADING AN EXISTING CASCADING SYSTEM EG TECHSYS MARLIN.
The ORCA starts the first pump via the VFD and continues to accelerate until the pump reaches full speed. If the system is not at the set point the controller then VFD cycles to the next pump and switches the initial pump to full speed. This operation continues until the Set Point is reached or all pumps are running. The reverse occurs as the demand reduces.
One VFD and bypass contactors for each pump are supplied for this option.

LEAD VFD LAG

The ORCA starts the first pump via the VFD and continues to accelerate until the pump reaches full speed. If the system is not at the Set Point the controller starts a LAG pump to make up for the flow demand. This is typically via a soft starter. This operation continues until the set point is reached or all pumps are running. The reverse occurs as the demand reduces.
One VFD and backup soft starters are supplied for this option.

Select this option for **Lead Lag Autorotate** also.

ALL VFD

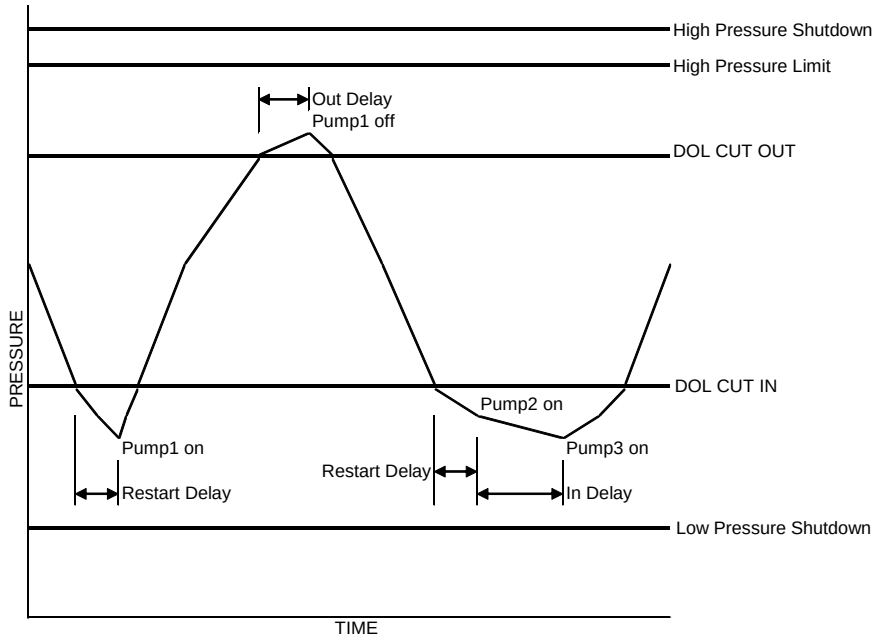
The ORCA starts the first pump via the VFD1 and continues to accelerate until the pump reaches full speed. If the system is not at the Set Point the ORCA then starts the next pump (Pump 2) via VFD2. This operation continues until the Set Point is reached or all pumps are running. The reverse occurs as the demand reduces.
One VFD per pump is supplied for this option.

DOL Backup Mode

In the event of a VFD failure the ORCA has the option to select DOL Backup Mode which allows the system to function as a switched pressure system. To enable DOL Backup Mode set this screen as ON, before a VFD failure has occurred.

DOL Backup Mode
----------OFF----------

If the system experiences a VFD failure the ORCA will control between the CUT IN and CUT OUT pressure whilst in VFD Fail mode. To reset this mode, turn off the power and restart.



Low Pressure Shutdown, High Pressure Limit and High Pressure Shutdown are active within this mode.

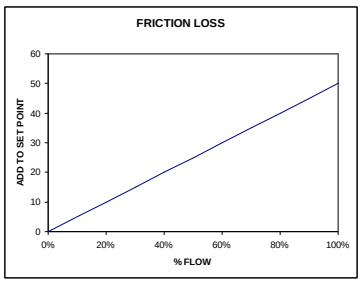
Friction Loss Calculation

Friction Loss
Linear

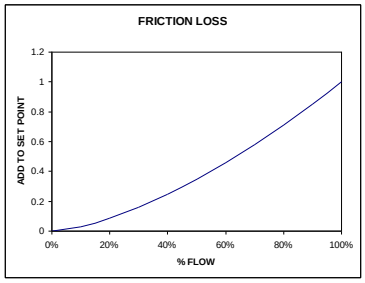
There are two methods of calculating the pressure loss.

- Linear progression.
- Exponential extrapolation.

Friction loss is the figure that is added to the Set Point to compensate for Friction in a pipeline. The result of this setting is to increase the Set Point Pressure based on the flow rate calculated.
The input figure is the total additional pressure required when all of the nominated pumps are operating.



Linear Friction Loss



Exponential Friction Loss

Exponential extrapolation
Select this option to vary the set point based on the basis of the flow to the power of 1.52.

Set Point = $\%Flow^{1.52}$

User Access Code

The access code is used to limit access to the settings menus.
The user access code has the range “off, 0 – 250”.
Off will disable the access code and allow unlimited access.

Access Code
XXX

Once a number is selected then access to the settings screens or any other editable screen will require the inputting of this number before progressing further.
To edit press enter and then up or down keys to edit the new number.
Press enter again and exit the menu to store the changes.
WARNING. If the Access Code is changed from the default of 21 and then forgotten it may restrict access to other authorised users. Ensure that the new Access Code is recorded in the Site Record section of this manual AND if necessary another safe place.

Serial Comms

Serial Comms selects how the onboard RS-485 serial port is used.

Serial Comms
Modbus 9600

- Output Cont Data options is a data logging option that allows the pump station to be remotely or locally logged.
- Modbus Protocol allows modbus compatible interfaces to monitor and adjust values during operation.

** Please make inquired to Techsys to obtain the relevant manuals and datasheets for the Orca’s modbus interface. *(This feature is not available on previous versions)*

Modbus Address

The Modbus Address setting allows changes to the ORCA’s address when installed on network of modbus devices. This allows more than one device to be used on a network to avoid conflicts with other modbus devices.

Modbus AddressXX

(This feature is not available on previous versions)

Number of Duty Pumps

The Number of Duty Pumps determines how many of the “Duty / Standby” pumps that are in auto mode can be running at the same time.

No of Duty PumpsX

For example: A 3 pump system, with the “Number of Duty Pumps” set to 2 will only allow 2 pumps to run at the same time. Which two pumps is defined by the Auto Rotation setting (in tuning menu).

> **Warning:** If “No of Duty Pumps” doesn’t equal Number of Pumps and “Auto Rotation” setting isn’t either “Full”, “Low Hours” or “At Specific Time” then one or more pumps will never run and remain redundant.

(This feature is not available on previous versions)

Flow Sensing

The “Flow Sensing” setting allows the user to select how the flow rate is determined. Options are Calculated, Scaled AnInp2 or Digital Pulse.

Flow Sensing
Calculated

- “Calculated” uses the flow rate setting “Pump Flow Rate” in the settings menus to calculate the current Flow Rate.
- “Scaled AnInp2” uses an analogue sensor (ether current-loop or variable voltage) to determine the current Flow Rate.
- Digital Pulse uses a compatible digital output flow meter to determine the current Flow Rate.

(This feature is not available on previous versions)

Manual Run

On particular applications it is necessary to prevent an operator from running a pump manually which would normally be done by pressing and holding the "P" button.

When "Input or Button" is selected both manual pump run actions are available.
When "Input Only" is selected to run a pump manually an input programmed to be pump manual run is required and activated via an external switch. A typical application would be a pump Auto/Off/Manual switch.

(This feature is not available on previous versions)

PUMP DEFINITIONS

Sub Menu	Units	Range	Default
Pump 1	selection	Duty/Standby, Backup, Jockey	Duty/Standby
Pump 2	selection	Duty/Standby, Backup	Duty/Standby
Pump 3	selection	Duty/Standby, Backup	Duty/Standby
Pump 4	selection	Duty/Standby, Backup	Duty/Standby
Pump 5	selection	Duty/Standby, Backup	Duty/Standby
Pump 6	selection	Duty/Standby, Backup	Duty/Standby

Each pump can be defined as:

- Duty/Standby
- Backup

Pump 1 can also be configured as a jockey pump.

Duty/Standby

If a pump is defined as **Duty/Standby,** then the relevant pump will be **available** for operation, however if the number of Duty/Standby pumps is more than the "No of Duty Pumps" (in Configuration Menu) then the system will only simultaneously operate up to the number of pumps as detrmined by the "No of Duty Pumps". The remaining pump/s will be rotated depending on the setting of the "Auto Rotation" menu (in TUNING Menu).

(This feature is not available on previous versions – Only Duty and Backup were available)

Backup

If a pump is defined as a **Backup** pump it will remain **dormant** unless one of the **Duty/Standby pumps faults** (via pump protect input). It will then automatically become a Duty/Standby pump until the fault has been removed.

When a pump is setup as backup the pump mode light will flash every five seconds..

The number of pumps visible in these screens is determined by the "number of pumps" screen within the CONFIGURE menu.

(Not included on previous versions - Originally Duty or Backup, no standby feature)

JOCKEY PUMP

If pump 1 is defined as Jockey the “JOCKEY PUMP” menu will become visible.

Sub Menu	Units	Range	Default
Jockey Pump Mode	selection	DOL, Main VFD, Separate VFD	Main VFD
JP Cut In Pressure	% of JP Setpoint	0 – 9999	250
JP Cut Out Press	Unitless	0 – 9999	300
JP Set Point	Unitless	0 – 9999	300
JP Flow Rate	/Sec	0 – 9999	50
JP Response Rate	%	0.1 – 100.0	3.0
JP Acceleration	%/second	1 – 100	20
JP Standby Test	selection	Off, Boost, Flow Switch, Flow Rate	Boost
JP Standby Boost	% of JP Setpoint	5 – 250	5
JP Stdby FlowMin	/Sec	0 – 250	5
JP Run On Time	seconds	0 – 999	1
JP Restart Delay	seconds	0 – 999	0
JP Use Main SP	selection	Yes, No	No

The Jockey pump is typically a smaller auxiliary pump that is outside the flow range of the main pumps. The jockey pump will turn on when there are no main pumps running and the pressure is below Jockey “Cut-In” Pressure.
The Jockey pump can be set up to “run-on” after the main pumps start but it will eventually be turned off. Once the main pump/s are running, they will then meet the increased demand. Should the demand then drop to a point where the main pump become inefficient then the system can be configured to fall back to the Jockey pump. To do this, set the “Standby Test” in CONFIGURE to “Flow Rate”. The “JP Fallback” option screen can then be changed from Off to On, this screen is also in CONFIGURE. The correct main pump flow rate has to be entered or alternatively a flow meter attached, then a minimum flow rate is set in the “Fallback FlowMin” screen which is in the TUNING menu.

Jockey Pump Mode

The jockey pump can function on any of the settings below:

Jockey Pump Mode
Main VFD

Main VFD
The Jockey pump will be run from the main VFD. It will try to maintain SET POINT via the response rate, error correction time and overshoot elimination gain. In this mode the jockey pump will turn off whenever any main pumps start.

Separate VFD
The Jockey pump will run on its own dedicated VFD. It will try to maintain SET POINT via the response rate, error correction time and overshoot elimination gain. In this mode when a main pump starts the jockey pump CAN continue to run at maximum speed until the Jockey Pump “Run on timer” expires.

DOL
The Jockey pump will be run from a DOL contactor. It will run as a switched type pressure control system with JP Cut In and Cut Out determining when the jockey pump turns on and off . In this mode when a main pump starts the jockey pump CAN continue to run while the run on timer is active.

JP Cut In Pressure

JP Cut In Press
XX % (123)

The “JP Cut In Press” is the Pressure which the pump defined as Jockey pump will restart. This value cannot be set above the JP Set point and typically it is set at around 90% of the JP Set point and also above the main pump Cut In Pressure by at least 10%. If set below the main pump cut in setting the Jockey pump will never operate. The number in bracket on the RHS of the bottom line is the actual pressure setting based on the percentage setting.
(This percentage feature is not on previous versions)

JP Set Point / Cut Out

The pressure the Jockey Pump will maintain. This value will be constrained by HIGH PRESSURE LIMIT.

JP Set Point
XXXX

This screen will appear as “JP Cut Out Press” when Jockey Pump Mode is set as DOL.

JP Cut Out Press
XXXX

JP Flow Rate

The jockey pump is typically much smaller than the main pumps therefore the appropriate pump flow rate needs to be entered to obtain a more accurate calculated flow rate and min flow requirements.

JP Flow Rate
XX/Sec

(This feature is not available on previous versions)

JP Response Rate

Set the reaction rate (responsiveness) of the system. This value is specific to the jockey pump if the Jockey Pump is running on the VFD.
It is expressed as a percentage ranging from 0.1 – 100.0
is the slowest response and 100.0 the fastest.

JP Response Rate
XX.X %

JP Acceleration

The acceleration of the VFD can be limited by this figure. It is designed to brake the PID control. It is used where the Acceleration needs to be dampened. The figure is input in %/second.

JP Acceleration
XXX %/second

JP Standby Test

This option allows the Jockey Pump a number of different modes to determine if the system should be placed in standby mode.
Off- Standby test is disabled therefore the system will always run unless controlled by an external signal.
Boost- Operates as detailed in other parts of this manual.
Flow Rate- If set to this mode, when the calculated or actual flow rate falls below the value “JP Stdby FlowMin” for a period greater than set in the “Standby Test Time” which is in the TIMING menu then the system is placed in standby mode.
Flow Switch- If set to this mode, when an input is programmed to become the flow switch input and this input is activated for a period greater than set in the “Standby Test Time” which is in the TIMING menu then the system is placed in standby mode.

JP Test
Boost

(This feature is not available on previous versions)

JP Standby Boost

The ORCA tests to see if the system flow has stopped by boosting the system pressure. The “Standby Boost” pressure sets the pressure boost.
The time that it takes to drop back to the SET POINT is compared to the “Standby Test” timer. If the time to return to the SET POINT is greater than this time, then the system shuts down. If the time to return to SET POINT is less than the “Standby Test” time then the system continues to operate.

JP Standby Boost
XXX

JP Stdby FlowMin

Should the calculated or actual Jockey Pump flow rate fall below the "JP Stdby FlowMin" value for a period greater than set in the "Standby Test Time" which is in the TIMING menu, then the system is placed in standby mode.
(This feature is not available on previous versions)

JP Stdby FlowMin
XXX

JP Run On Time

The Jockey pump can be forced to keep running for a set period of time after the main system has started.

JP Run On Time
XXX seconds

NB. The jockey pump will not "run on" when selected as MAIN VFD in the JOCKEY PUMP MODE menu. Instead it will instantly turn off when an auto pump starts. A VFD can only run one pump at any time.

JP Restart Delay

When the pressure drops below the JP Cut In
Pressure and remains there the Jockey pump will start after this period.
Given no auto pumps have started.

JP Restart Delay
XXX seconds

JP Min Frequency

This is the minimum frequency specific to the Jockey pump. See MINIMUM FREQUENCY in TUNING menu for more information.

JP Min Frequency
XX.X %

JP Error Correction (Integral Time)

The error correction is the time it will take to convert a constant error of 1% to a 1% change on the output. This is useful when trying to close the gap on small errors that can not be eliminated through the use of the response rate alone.
This value is specific to when the jockey pump is running on the VFD.

JP ErrorCorr't (I
XX.X seconds

It is expressed as a percentage ranging from OFF, 0.1 – 100.0. OFF will disable this part of the PID equation.

JP Overshoot Elimination (Derivative Gain)

The overshoot elimination gain is used to provide a damping effect to eliminate system oscillation and to minimise overshoot. This value is specific to when the jockey pump is running on the VFD.

JP OvershtElim (D
XX.XX %

It is expressed as a percentage ranging from OFF, 0.01 – 50.00. OFF will disable this part of the PID equation.

OUTPUTS

Sub Menu	Units	Range	Default
Digital Output 1	selection	Any output can be programmed to one of the following. Shutdown Fault, Lo Press Fault, Hi Press Fault, Any Alarm, Pump 1[JP]– 6 Run, Pump 1[JP]– 6 Fault, System Paused, Any Pump Shutdown, Any Pump Running, No Flow Shutdown, VFD Fault, Pressure Trip 1 – 2, Alternate Trip, Flow Trip, Aux Output 1 – 3 Any fault UV Bypass	Pump 1
Digital Output 2	selection		Any Pump Shutdown
Digital Output 3	selection		VFD Fault
Digital Output 4	selection		System Paused
Digital Output 5	selection		Any Pump Run
Digital Output 6	selection		Any Alarm
Digital Output 7	selection		
Digital Output 8	selection		
Analogue Output 1	selection	VFD Speed. VFD Speed, Flow Rate, System Pressure	VFD Speed
Analogue Output 2	selection		System Pressure

The ORCA has four main programmable outputs that can be used to communicate with external sources such as Telemetry or Building Management Systems (BMS). As each system requires different combinations of information all output relays are configurable in software. All outputs are Voltage Free – Change Over contact outputs and capable of 5 amps 240 VAC. If the expansion board is fitted four more programmable outputs are available.
To view which outputs are currently activated view the PUMP DATA LOG menu, under Digital Output State. The status of the analogue outputs is also available within this menu.

Digital Output Options

No	Option	Delay
1	Shutdown Fault	As per delay timers
2	Low Pressure Fault	As per delay timers
3	High Pressure Fault	As per delay timers
4	Any Alarm	Instantaneous
5	Pump 1 Run	Instantaneous
6	Pump 2 Run	Instantaneous
7	Pump 3 Run	Instantaneous
8	Pump 4 Run	Instantaneous
9	Pump 5 Run	Instantaneous
10	Pump 6 Run	Instantaneous
11	Pump 1 Fault	As per Input Delay Timer
12	Pump 2 Fault	As per Input Delay Timer
13	Pump 3 Fault	As per Input Delay Timer
14	Pump 4 Fault	As per Input Delay Timer
15	Pump 5 Fault	As per Input Delay Timer
16	Pump 6 Fault	As per Input Delay Timer
17	System Paused	Instantaneous
18	Any Pump Shutdown	As per Input Delay Timer
19	Any Pump Running	Instantaneous
20	No Flow Shutdown	As per Input Delay Timer
21	VFD Fault	Instantaneous
22	Pressure Trip 1	As per Press Trip delay timers
23	Pressure Trip 2	As per Press Trip delay timer
24	Alternate Trip	Instantaneous
25	Flow trip	As per Flow trip delay timers
26	Jockey Pump Run	Instantaneous
27	Aux Output 1	Instantaneous
28	Aux Output 2	Instantaneous
29	Aux Output 3	Instantaneous
30	SP 1 Output	Instantaneous
31	SP 2 Output	Instantaneous
32	SP 3 Output	Instantaneous
33	SP 4 Output	Instantaneous
34	SP 5 Output	Instantaneous
35	SP 6 Output	Instantaneous
36	SP 7 Output	Instantaneous
37	SP 8 Output	Instantaneous
38	Any Fault	Instantaneous
38	UV Bypass	As per UV Hot to Cold Timer

- **Shutdown Fault**

This output is used to indicate that there has been an event that has shut down the system. This can be a High or Low-Pressure Shutdown, No Flow Shutdown or VFD Shutdown.

- **Low Pressure Fault**

A shutdown based on a Low Pressure Shutdown.

- **High Pressure Fault**

A shutdown based on a High Pressure Shutdown.

- **Any Alarm**

If there are any conditions that MAY cause a shut down (Eg. Low or High Pressure) or Fault Re-starts active this output will activate.

- **Pump 1-6 Run**

Activates when the relevant pump is running.

- **Pump 1-6 Shutdown**

Pump 1-6 shutdown on individual pump protection activation.

- **System Paused**

Either “system pause” or “system pause JP run” inputs have been activated

- **Any Pump Shutdown**

Any pump shutdown will activate the relay.

- **Any Pump Running**

Any pump running will activate the relay.

- **No Flow Shutdown**

The No Flow Shutdown action is active.

- **VFD Fault**

Output is on when the VFD is being tested or the VFD has shutdown.

- **Pressure Trip 1**

When the system pressure reaches the nominated Pressure Trip 1 Low and High, this relay will energise or de-energise. See Pressure Trip in SETTINGS.

- **Pressure Trip 2**

When the system pressure reaches the nominated Pressure Trip 2 Low and High, this relay will energise or de-energise. See Pressure Trip in SETTINGS.

- **Alternate Trip**

Each time the system shuts down the energized state of the relay will change. E.g. If the relay on one cycle is closed during operation then the next cycle this relay will be open.
The relay will change on the following: - Low Pressure Shutdown, High Pressure Shutdown, No Flow Shutdown and VFD Shutdown.

- **Flow Trip**

  When the system flow reaches the nominated Flow Trip points Low or High, this relay will energise or de-energise. See Flow Trip in SETTINGS.

- **Aux Outputs 1 – 3**

  Any output can be set to be an auxiliary output. Setting an output to become an auxiliary output allows the ORCA to use an input to turn on a Digital Output. To do this the input has to be set up to be an Auxiliary input. There are three auxiliary functions available.
  Aux Input 1 operates Aux Output 1
  Aux Input 2 operates Aux Output 2
  Aux Input 3 operates Aux Output 3

- **Set Point Output 1-8 (SP 1-8 Output)**

  Outputs are activated depending on which set point is the current set point. The current Set Point can be set by ether configuring an input or setting a time of day event.

  (Not included on previous versions)

- **Any Fault**

  Outputs are activated for any fault condition

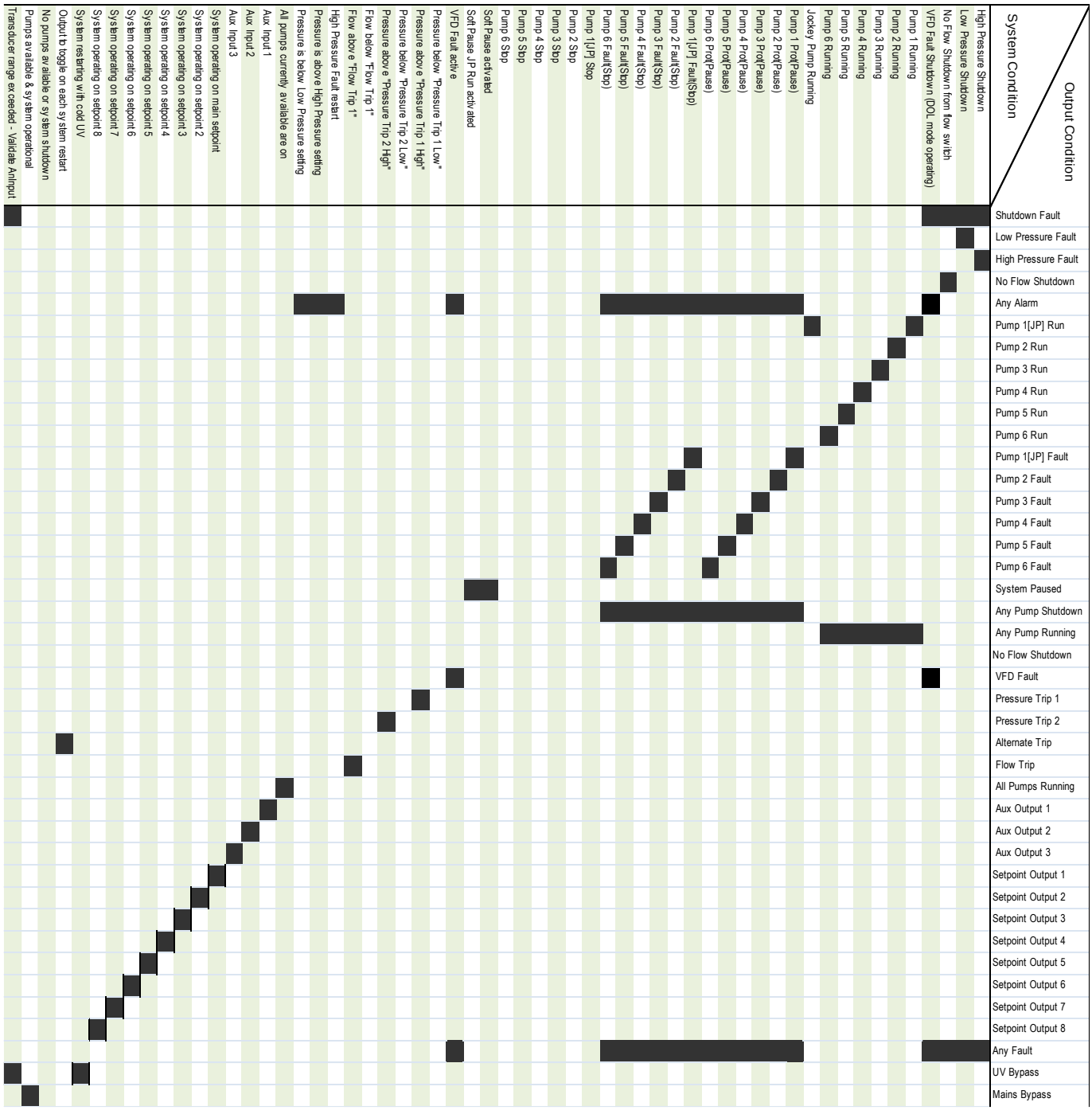
- **UV Bypass**

  Used to control a the warm up cycle of a UV lamp if utilized in conjunction with the pump controller. If the system is placed on standby for longer than the period set for the “UV Hot to Cold” timer then the next time the system restarts the output will activate, it will stay activated for the period set in “UV WarmUp” which facilitates the use of valves etc to bypass the flow until the UV lamp is up to temperature.

  (Not included on previous versions)

* RELAY RATINGS

The relays are rated at 5 amp 250VAC. Consideration of inrush current, inductive loads and cycling must be taken into account when applying current to these relays.



INPUTS

Sub Menu	Units	Range	Default
Program Input 1	selection	Not selected, Set Point 2 - 8, Soft Pause, Sft Pause JP Run, Emergency Stop, Pump 1[JP] - 6 Prot(Pause) Pump 1[JP] - 6 Stop, Pump 1[JP] - 6 Manual Run, Fire Mode, Cycle Pumps, VFD Fault, Reset, No Flow, Aux Input 1 - 3, Pump 1[JP] - 6 Fault(Stop), Low Level pause, Schedule override	VFD Fault
Program Input 2	selection		No Flow
Program Input 3	selection		Pump 1 Manual Run
Program Input 4	selection		Pump 1 Stop
Program Input 5	selection		Not selected
Program Input 6	selection		Not selected
Program Input 7	selection		Reset
Program Input 8	selection		Soft Pause
Program Input 9	selection		Emergency Stop
Program Input 10	selection		Pump 1 Protection
Program Input 11	selection		Cycle Pumps
Program Input 12	selection		Soft Pause JP Run
Program Input 13	selection		Not selected
Program Input 14	selection		Not selected
Program Input 15	selection		Not selected
Program Input 16	selection		Not selected
Program Input 17	selection		Not selected
Program Input 18	selection		Not selected
Program Input 19	selection		Not selected
Program Input 20	selection		Not selected
Analogue Input 1	selection	Disable, Control Pressure, Control Level, Control Flow, Flow Mtr, Set Point, Backup Pressure	Control Pressure,
Analogue Input 2	selection	Disable, Control Pressure, Control Level, Control Flow, Flow Mtr, Set Point, Backup Pressure	Disable,
Validate AnInput	selection	NO, YES	NO

There are 12 main inputs with the ORCA that control external sensing functions. If an expansion board is fitted there are 8 more inputs are available.
All inputs are programmable to suit various applications.
They all require ***VOLTAGE FREE*** contacts and as such should ***NOT HAVE ANY VOLTAGE APPLIED.***

- All inputs operate on a ***CLOSED CONTACT*** for activation. This contact needs to be made between the input common and the relevant input. There are three terminals for the input Common to allow for multiple connections.

You can view which inputs are activated by the Indicators on the front of the unit and also within the PUMP DATA LOG menu under the “Digital Input State” screens. See PUMP DATA LOG for more information.

Each Input can now have inverted logic.
Normally if an input is connected via a switch or sensor between the input common and a programmable input it is deemed to be ON and the input LED will be illuminated.
With inverted logic when an input is activated the controller will read this as OFF but the input LED will be illuminated to indicate the actual state of the input.
Inverted inputs have a number of uses and the main use would be to provide fail safe activation of an input. Eg. If an programmable input is set to pause the system on low level, then a normal input would provide an ON signal to pause the system, should that input be disconnected or broken the system would not shut down resulting in damage to the pumps. If the input is inverted the float can be wired to close the input connection for system run & open for system pause. (Fail Safe)

To invert an input, firstly have the required input on the display, press the Enter button and then press the Up & Down buttons simultaneously, the Input should now show (INV) on the top line. The change it back complete the same procedure.

Analogue inputs cannot be inverted.

(Note- This option is not included on previous versions)

PROGRAMMABLE INPUT OPTIONS

	Option	Delay time	Duration
1	Not selected	Instantaneous	Continuous
1	Set Point 2	1 second	Continuous
2	Set Point 3	1 second	Continuous
3	Set Point 4	1 second	Continuous
4	Set Point 5	1 second	Continuous
5	Set Point 6	1 second	Continuous
6	Set Point 7	1 second	Continuous
7	Set Point 8	1 second	Continuous
8	Soft Pause	1 second	Continuous
9	Soft Pause JP Run	1 second	Continuous
10	Emergency Stop	Instantaneous	Continuous
11	P1[JP] Prot(Pause)	Input delay	Continuous
12	P2 Prot(Pause)	Input delay	Continuous
13	P3 Prot(Pause)	Input delay	Continuous
14	P4 Prot(Pause)	Input delay	Continuous
15	P5 Prot(Pause)	Input delay	Continuous
16	6 Prot(Pause)	Input delay	Continuous
17	Pump 1[JP] Stop	Instantaneous	Continuous
18	Pump 2 Stop	Instantaneous	Continuous
19	Pump 3 Stop	Instantaneous	Continuous
20	Pump 4 Stop	Instantaneous	Continuous
21	Pump 5 Stop	Instantaneous	Continuous
22	Pump 6 Stop	Instantaneous	Continuous
23	Pump 1[JP] Manual Run	Instantaneous	Continuous
24	Pump 2 Manual Run	Instantaneous	Continuous
25	Pump 3 Manual Run	Instantaneous	Continuous
26	Pump 4 Manual Run	Instantaneous	Continuous
27	Pump 5 Manual Run	Instantaneous	Continuous
28	Pump 6 Manual Run	Instantaneous	Continuous
29	Fire Mode	1 second	Continuous
30	Cycle pumps	1 second	Rising edge
31	VFD Fault	1 second	Continuous
32	Reset	1 second	Rising edge
33	No Flow	Input delay	Continuous
34	Aux Input 1	Instantaneous	Continuous
35	Aux Input 2	Instantaneous	Continuous
36	Aux Input 3	Instantaneous	Continuous
37	Pump1[JP] Fault(Stop)	Pump Fault Delay	Continuous
38	Pump2 Fault(Stop)	Pump Fault Delay	Continuous
39	Pump3 Fault(Stop)	Pump Fault Delay	Continuous
40	Pump4 Fault(Stop)	Pump Fault Delay	Continuous
41	Pump5 Fault(Stop)	Pump Fault Delay	Continuous
42	Pump6 Fault(Stop)	Pump Fault Delay	Continuous
43	Flow Pulse	Instantaneous	Rising edge
44	Low Level Pause	1 second	Continuous
45	Schedule Override	Instantaneous	Continuous

Not Selected

When this is selected the input will not respond to activation.

Set Point 2-8

Closing of the contact to either of these inputs will activate the alternate set points 2 to 8. If two inputs are activated at the same time, then the Set Point with the highest number will be the selected option. Eg If Set Points 2 and 6 are activated Set Point 6 pressure setting will be used.
The Set-Pr will also change on the main display.

Soft Pause

An external sensor can be used to PAUSE the system. When the system receives a PAUSE command the system will shut down in a controlled manner based on the rates set in the response rates menu.

PAUSE ACTIVATED

The system will slowly drop the pressure causing all pumps running to turn off one at a time and a message will be shown on the main screen.

After the PAUSE input has been deactivated the system will restart under normal operations. If the Auto-rotation is selected to FULL the lead pump will rotate.

Soft Pause JP Run

This is the same as Soft Pause except the jockey pump will continue to operate if fitted.

PAUSE ON. JP RUN

Emergency Stop

An external sensor can be used to STOP the system. This is particularly useful for sites with suction tanks to halt the pumping operation until the tank is allowed to reach a suitable level for pumping. There are numerous other applications for the system pause function.

EMERGENCY STOP

When the system receives a STOP command the system will immediately shut down all pumps and indicate a message.

After the STOP input has been deactivated the system will restart under normal operations and return pumps to the modes they were before the “stop”. Pumps in MANUAL mode will automatically restart after deactivation of the input. If the Auto-rotation is selected to FULL the lead pump will rotate.

Pump 1, 2, 3, 4, 5 and 6 Prot(Pause)

The ORCA has inputs for each pump to allow for individual pump protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the Input Delay Timer.

The pump will become available again when the Input contact is opened.
This protection is ideal for the following pump protection sensors:

- Temperature probes
- Thermal Overloads
- Any individual pump protection device that will auto reset with causing damage to the pump or motor is restarted.

Pump 1, 2, 3, 4, 5 and 6 Stop

Activation of this input will instantly stop the operation of the relevant pump. This can be used as an “Off override” switch in the system or if remote control of a pump is required. This input will override the relevant “Pump 1-6 Manual Run” input when both are active.

Pump 1, 2, 3, 4, 5 and 6 Manual Run

Activation of this input will instantly start the relevant pump. All automatic control of the pump is ceased at this stage.
This action can cause an alarm or shutdown condition. (See Manual operation)

Fire Mode

FIRE MODE directs the ORCA to ignore all shutdown alarms/faults and the pumps will continue under all conditions. The following protection features are disabled:

- High Pressure Shutdown
- Low Pressure Shutdown
- System Pause
- No Flow
- Individual Pump Protection
- Pump 1-6 Stop

**Be sure to understand the possible repercussions of activating this Input.
Forcing pumps to run in the presence of system faults can damage pumps and equipment. FIRE MODE should be used only if the risk of the pump stopping is greater than letting it run to destruction.

Some VFD's have a similar function and will override the protections within the VFD if an input is toggled. Contact your local dealer for further information regarding this feature.

Hardware items such as circuit breakers, Thermal Overloads and any other switchgear protection is not affected by this mode.

Cycle pumps

Activation of this input will shutdown and then cycle the pumps to the next available pump as the lead pump. If pump 1 started first on the last start-up, the toggling of this input will switch the lead pump to pump 2 instantly on receipt of this signal.

VFD Fault

In the event of a VFD fault this input will initiate a “retry cycle” to attempt to reset the VFD. On receipt of this signal the system will attempt to clear the fault by sending a reset message to the VFD after a **15 second delay**. This will be repeated until the VFD is restored to an operational level.

During this cycle the Low-Pressure Shutdown protection is disabled to allow the system to recover automatically. De-powering and then re-energising the switchboard will generally clear VFD faults. See *VFD Fail* for more configuration information

Reset

The reset input allows remote resetting of ORCA after a shutdown fault. If ORCA has shutdown due to a fault (for any reason) closing the reset contact will reset all current faults and restart the system. (VFD Fault excluded)

No Flow

If the system detects that there should be flow but there is a No Flow signal from an external flow switch, the ORCA will display the message "Low Flow Detected". Once system detects a closed contact on this input the ORCA will time out and shut down. This is optional and requires a flow switch to feedback into the No Flow Input and will only operate if there is at least 1 pump selected to AUTO.

Low Flow Detected
XXXXX

The system will only shut down if the system pressure is lower that the set point. ORCA assumes that if pressure is at set point then the system is in standard operation mode.

Once the No Flow Delay Timer has expired then the screen message changes to:

No Flow Shutdown
XXXXX

The system pressure at the time of shutdown is displayed on this screen also. The system will not restart until ENTER is pressed to clear the fault.

Aux Inputs 1, 2 and 3

Any input can be set to be an auxiliary input. Setting an input to become an auxiliary input allows the ORCA to use this input to turn on a Digital Output. To do this the output has to be set up to be an Auxiliary output. There are three auxiliary functions available.
Aux Input 1 operates Aux Output 1
Aux Input 2 operates Aux Output 2
Aux Input 3 operates Aux Output 3

Pump 1, 2, 3, 4, 5 and 6 Fault(Stop)

The ORCA has the capability to assign an input for each pump to allow for individual pump fault protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the Pump Fault Input Delay Timer (In Timing Menu).

Program Input X
PX Fault(Stop)

The pump will not be available until the fault has been reset by the operator on the status screen.

Flow Pulse

When the input is programmed to this mode a digital output flow meter can be connected. Volume per pulse information need to be entered and then the actual flow can be displayed and logged on the ORCA.

(Not included on previous versions)

Low Level Pause

An external sensor can be used to Low Level Pause the system. When the system receives a Low Level Pause command the system will shut down in a controlled manner based on the rates set in the response rates menu.
The system will slowly drop the pressure causing all pumps running to turn off one at a time and a message will be shown on the main screen.

PAUSED LOW LEVEL
XXX

After the Low Level Pause input has been deactivated the system will restart under normal operations. If the Auto-rotation is selected to FULL the lead pump will rotate.

(Not included on previous versions)

Schedule Override

When an input is programmed to this mode, activation of the input will then override any scheduled time event that has caused the system to pause allowing the system to then run until the input is released.

(Not included on previous versions)

External contacts must be VOLTAGE FREE - any applied voltage can cause damage to the system. The ORCA will supply a control voltage to the external contact.

ANALOGUE INPUTS

The standard transducer fitted to the ORCA is rated to 25Bar.

External Analogue Input

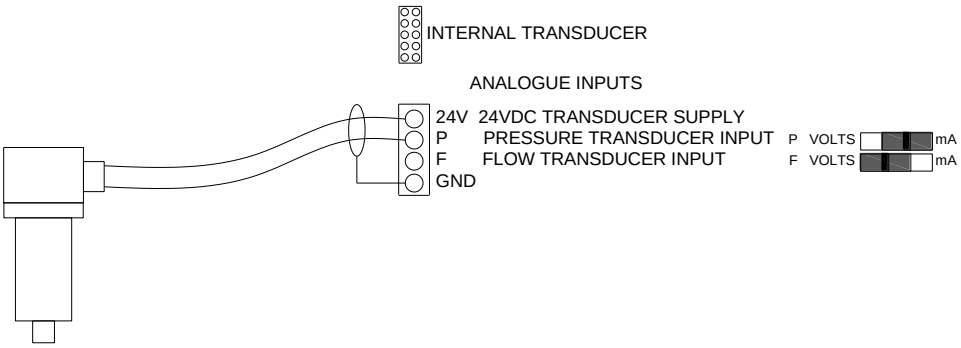
The analogue terminals are located on the left hand side of the PCB near the top.

The use of 4 – 20mA and 0-10V transducers require the slide switches to be placed to match the input. This allows the system to read the correct input from the transducers.

Volts = 0-500mVDC,0-5VDC,0-10VDC etc
mA= 0-20mA,4-20mA etc
4-20 mA is a standard analogue signal from a pressure transducer.

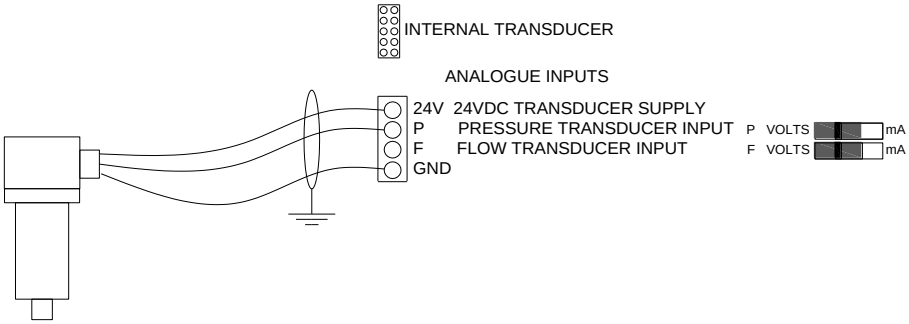
To use this input note the wiring requirements on the PCB. A 24VDC power supply is available on board for 2-wire configuration
Typical 4-20mA application shown.

Note switch settings.



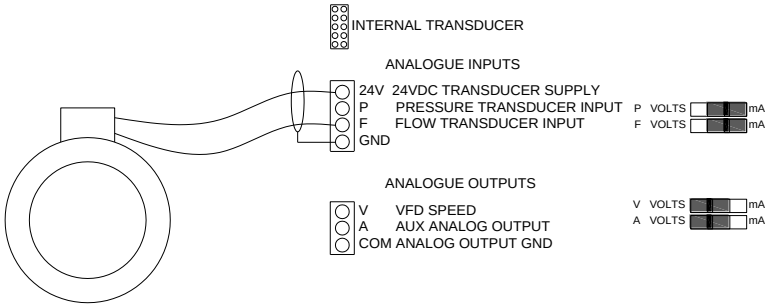
Three wire transducers are typically 0-10 V or 0-5V output.

Note switch settings.



FLOW METER INPUTS

ORCA can accept a 0-10VDC or 4-20mA signal from flow meters.



Validate AnInput

If set to YES then any analogue input used to control or monitor a signal will be monitored for a signal that is deemed to be outside of the normal operating range – This is less than 15% (3mA) and greater than 95% (19mA). This function is only usable for 4-20mA transducers.

(Not included on previous versions)

PIPE FILL MODE

Pipe Fill Mode	selection	On, Off	Off
Jump Ramp Time	seconds	Off, 1 - 999	Off
Jump Final Speed	%	0-100%	Off
Pipe Fill Time	seconds	5 - 999	100
Pipe Empty Pressure	unitless	0 - 9999	200
Pipe Empty Time	seconds	0 - 999	200

When a system has been idle for a period of time there may be loss of water in the system and a need to start the pumps slowly to reduce the possibility of Water Hammer. The Pipe Fill Control will override the SET POINT control in these circumstances. Pipe Fill will accelerate all pumps one at a time to full speed governed by the "Pipe Fill Time" parameter or until the "Cut In" pressure is reached.

Pipe Fill Mode

Pipe Fill Mode
=======On======

This screen will enable or disable the mode.
If Pipe Fill Mode is set to "OFF" then the next three screens ("Pipe Fill Time, Pipe Empty Pressure and Pipe Empty Time"), will be hidden.

Jump Ramp Time

Jump Ramp Time
XXX seconds

In certain situations it is necessary to accelerate the first pump faster up to a certain speed to facilitate cooling or lubrication of bush type bearings. In this situation the "Jump Ramp Time" defines how long the first pump takes to accelerate to the Jump Final Speed, after the first pump has reached this speed normal pipe fill will commence.
(Not included on previous versions)

Jump Final Speed

Jump Final Speed
XX %

In certain situations it is necessary to accelerate the first pump faster up to a certain speed to facilitate cooling or lubrication of plain bearings. In this situation the "Jump Final Speed" set the final speed this pump will reach before normal pipe fill commences.
(Not included on previous versions)

Pipe Fill Time

Pipe Fill Time
XXX seconds

Nominates the maximum time to fill the reticulation pipe work. The OCRA will increase the VFD from zero to maximum frequency based on the time nominated. The Pipe Fill Time is the time taken to accelerate all pumps to maximum frequency.

Pipe Empty Pressure

Pipe Empty Press
XXXX

In order for this mode to be initiated the system must have been below the Pipe Empty Pressure for at least the Pipe Empty Time.

Pipe Empty Time

Pipe Empty Time
XXX seconds

Once the "System Cut In Pressure" is reached or all available pumps are on and running at 100% the Pipe Fill Mode will automatically cease and normal pressure control functions will operate.

Whilst in Pipe Fill Mode the main screen will flash the message "Pipe Fill Mode" to inform the operator that there is a control over-ride functioning.

To disengage Pipe Fill Mode select "OFF" in the first screen of this section.
Whilst in Pipe Fill Mode the Low Pressure Shutdown is disabled.

TIME OF DAY SET POINTS

TIME OF DAY SP

Set Point 2 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 3 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 4 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 5 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 6 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 7 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled
Set Point 8 Time	time (hh:mm) (24)	Disabled 00:00 – 23-59	Disabled

Set Point 2, 3, 4, 5, 6, 7 and 8 Time

Time of day set points allow different set points to be active at a particular time of day. For example if you enable “Set Point 2 Time” to be “9:00 -> 10:00”, at 9:00 am Set Point 2 will come into effect, and after 10:00 am the default set point (Set Point 1) will be used again.

Set Point 2 Time
XX:XX -> XX:XX

Note:
Set Point inputs will override time of day set point selection.
If two or more timed setpoints overlap, then the setpoint that has highest number has priority (2-8 Eight has the highest priority then 7, then 6 etc).

(Not included on previous versions)

RESTORE OPTIONS

Create Backup	*operation*		
Restore Backup	*operation*		

The Orca can backup settings.
A backup can be created at any time via the “Create Backup” option in the **“Restore Options”** menu.

Create Backup

A backup is created and stored on the system. This will over write any previously stored backup. Only 1 backup set of data is possible.

Create Backup
Press * to Backup

Restore Backup

The backup is restored on the system. This item will be present only if a valid backup is available.

Restore Backup
Press * to Restore

When restoring the backup, the system will overwrite the current settings with the backup and restart.
CAUTION The backup will restore system status to the time of the back up.
If a pump was running when the backup was made it will be running when the backup is restored.

(Not included on previous versions)

PUMP PROTECTION

The ORCA has numerous safety features built into the system to protect the pumps from damage. Some of these shut down all operations and some are designed to halt operations until the system can stabilise. The user determines the selection of each of these.

Description	Screen Message	Action
High Pressure Shutdown	HiPress Shutdown	Shutdown - Restart Automatically or Manually
Low Pressure Shutdown	LoPress Shutdown	Shutdown - Manual restart
No Flow Shutdown	Low Flow Detected No Flow Shutdown	On first detecting a “No Flow Input” Shutdown- Manual Restart
Emergency Stop	Emergency Stop	Halts the system until contacts opened again.
Individual Pump Protection(Pause)	P X Protection	Pump 1-6 Halted until fault is removed
Individual Pump Fault (Stop)	P X Fault	Pump 1-6 Shutdown, requires operator reset

High Pressure Shutdown

If the system pressure exceeds the High Pressure Shutdown setting for a period of time set by the High Pressure Delay, the ORCA will shutdown the system until manually reset. The pressure reached will stay on the display until the fault is reset.
There is the option to allow a number of automatic restarts after this shutdown.
There are 0-250 restarts possible and are set in the “High Pressure Restarts” screen within the TUNING menu.

Low Pressure Shutdown

If the system drops under the specified Low Pressure Shutdown setting for a period of time set by the Low Pressure Delay the ORCA will shutdown the system until manually reset. Retries are not available for this Fault.

Individual Pump Protection - P 1[JP]-6 Prot(Pause)

The ORCA has inputs for each pump to allow for individual pump protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the Input Delay Timer.
The pump will automatically restart when the Input contact is opened.
This protection is ideal for the following pump protection sensors:

- Temperature probes
- Thermal Overload
- Thermistor

The individual pump Mode LED’s will flash when a pump

Individual No flow Pump Protection P 1[JP]-6 Fault(Stop)

ORCA has inputs for each pump to allow for individual No Flow pump protection. In the event of a pump going into a fault condition the input for that pump should close. This will shut down the pump after the time set by the No Flow Delay Timer.
The pump will NOT automatically restart when this event occurs.
This protection is ideal for the following pump protection sensors:

- Temperature probes
- Loss of prime flow switches
- Thermal Overload
- Thermistor

ALL FAULTS CAN BE REMOTELY RESET FROM THE “RESET INPUT”

CALIBRATION OF ANALOGUE SENSORS

The ORCA can accept most analogue signals from sensors and requires that a calibration routine be run to set both SCALING and ZERO OFFSET of these sensors.
Go to the CONFIGURE Menu and press the Enter Key.

ZERO ERROR

The Zero Error routine should be done *BEFORE* using the "Adjust Pressure" screen.

The zero error offset is trimmed out on the "Transducer Zero" screen. Make sure there is no pressure in the system or in the tube leading to the transducer.

Zeroing the transducer can be done two ways. Either via automatic method or manual method.

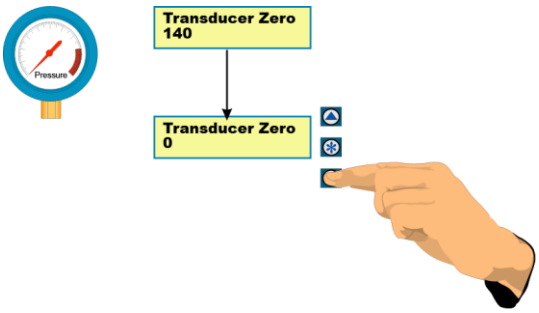
Automatic Method

On the "Transducer Zero" screen press ENTER to edit the data. Then press and hold both up and down for 2 seconds then release. On the screen should read "Finding Zero – Please Wait", this will take about 5-20 seconds depending on the value you have set for averaging. After it finishes it should show the value 0, if it shows 1 or VALUE TOO LOW, then a minor amount of fine tuning will be required. The fine tuning is accomplished using the Manual Method Below, In short press the down button to decrease the value, and if the screen shows "VALUE TOO LOW" press the UP button until zero appears.

(Not included on previous versions)

Manual Method

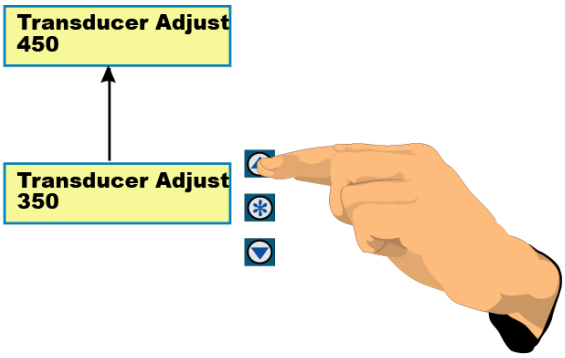
On the "Transducer Zero" screen press ENTER to edit the data and then DOWN to make the reading go to "0". Wait for 5 seconds for the reading to stabilise. Take care when running this procedure to reduce to the "zero" value slowly as the possibility of running past is high.



The pressure readings are averaged so the readings can lag behind the key presses. Always allow the system to stabilise prior to completing this procedure.
If the value input is lower than Zero a message stating, "VALUE TOO LOW" will appear on the screen. Press the UP key until a "zero" value appears.
Once completed, press ENTER again and back out of the menu to initiate a store of the "zero" value.

PRESSURE ADJUSTMENT

For this routine it is necessary to have a reference pressure that can be used to compare the system pressure to the pressure that the ORCA senses.



To calibrate the scaling for the analogue sensor apply a pressure to system and allow it to stabilise. This can be done by manually starting one pump and then closing the main isolation vale and shutting down the pump. This should hold system pressure and remove any fluctuations that are prevalent when pumps are running.

The system pressure should be set at least two times higher than the standard operating pressure, as the calibration routine works best with an end of scale reading.

Go to the “Adjust Pressure” screen. The pressure on this screen should match the pressure on a pressure gauge in the system. If it does not, press ENTER and then either UP or DOWN to move the displayed pressure to match the gauge pressure.

There is a buffer that takes approximately 5 seconds to stabilise so wait for this period to make sure that the reading is stable before accepting or editing the settings.

Once the readings match and are steady then the scaling is calibrated. Press ENTER again and back out of the menu to initiate a store of the “Adjust Pressure” value.

FLOW METER ADJUSTMENT

Flow Meter Zero

The “Flow Meter Zero” adjusts the zero offset in the Flow Meter input. Make sure there is zero flow in the system before attempting to zero the flow meter. Be sure that the flow meter is connected to the relevant input.

Flow Meter Zero
XXXXX /min

Zeroing the flow meter can be done two ways. Either via automatic method or manual method.

Automatic Method

On the “Flow Meter Zero” screen press ENTER to edit the data. Then press and hold both up and down for 2 seconds then release. On the screen should read “Finding Zero – Please Wait”, this will take about 5-20 seconds depending on the value you have set for averaging. After it finishes it should show the value 0, if it shows 1 or VALUE TOO LOW, then a minor amount of fine tuning will be required. The fine tuning is accomplished using the Manual Method Below, In short press the down button to decrease the value, and if the screen shows “VALUE TOO LOW” press the UP button until zero appears.

(Not included on previous versions)

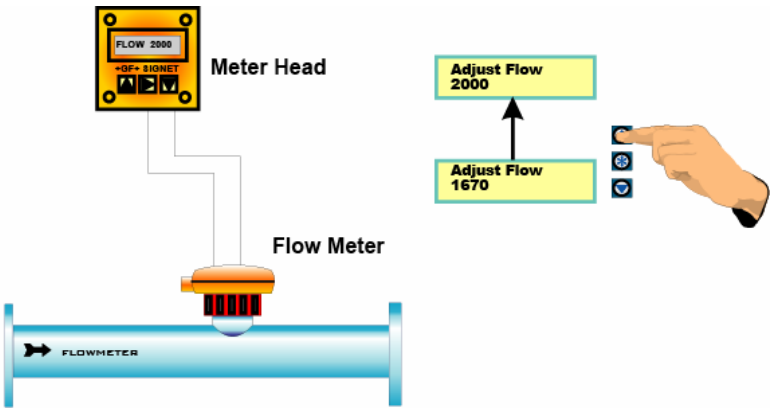
Manual Method

With no flow rate in the system trim the display by pressing ENTER and then the UP or DOWN keys to set the reading to “0”. Once calibrated press ENTER again and exit the CONFIGURE sub menu to store the value.

Adjust Flow

The calibration of the analogue sensors is achieved by adjusting the Flow meter reading on this screen to match a reading from the Flow Meter output screen.

Adjust Flow
XXXXX /min



GENERAL

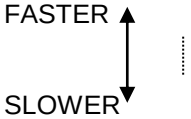
The basis for calibration is that the sensors have linear response. If the instrument being used has non-linear response the system readings will be inaccurate.
The standard transducer used with the ORCA has linear characteristics and has temperature compensation to eliminate transducer error over a wide temperature span. Standard transducers have an accuracy of ± 0.5% under normal conditions.
It is recommended that in cases where the normal system pressure in excess of 80% of the maximum pressure to consider a different range transducer. Pressure shock can damage a transducer and render it unserviceable.

PID Control

SYSTEM TUNING

Response Rate

The ORCA has an on board PID controller that calculates the required VFD speed to maintain pressure at Set Point. This calculation is based on the actual system pressure being read and the speed of any one pump. Adjustment of the response of the system to varied flows can be made by using the “Response Rate” (Proportional gain) menu item located in the TUNING menus.



100%

0.1

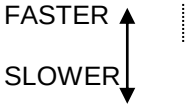
The scale for Response Rate is 0.1 – 100%.

Additional to this control there is the ability to dampen the response of the system by limiting the “Acceleration” (located in the TUNING menu). This will limit the acceleration rate of the system. It is a BRAKING method only.

Error Correction (Integral Time) and Overshoot Elimination (Derivative Gain) are both found in the TUNING menu and can be used to further fine tune your system.

Error Correction

The Error Correction is the time it will take to convert a constant error of 1% to a 1% change on the output. The error correction component is proportional to the tracking error and increases linearly with time. This is useful when trying to close the gap on small errors near the setpoint that cannot be eliminated through the use of the response rate alone.



0.1 sec

100

The scale for Error Correction is OFF, 0.1 – 100 seconds.

Overshoot Elimination

The Overshoot Elimination is used to provide a damping effect to eliminate system oscillation and to minimize overshoot.

50%

0.1

The scale for Overshoot Elimination is OFF, 0.1 – 50%.

On start-up the ORCA will accelerate the pump at 100% to minimum frequency. From this point on the PID will control the actual speed of reaction of the controller to the system.

In an attempt to give pump control users better understand PID control Techsys has labelled the relevant items accordingly.

Proportional Gain = Response Rate

Integral Time = Error Correction

Derivative Gain = Overshoot Elimination

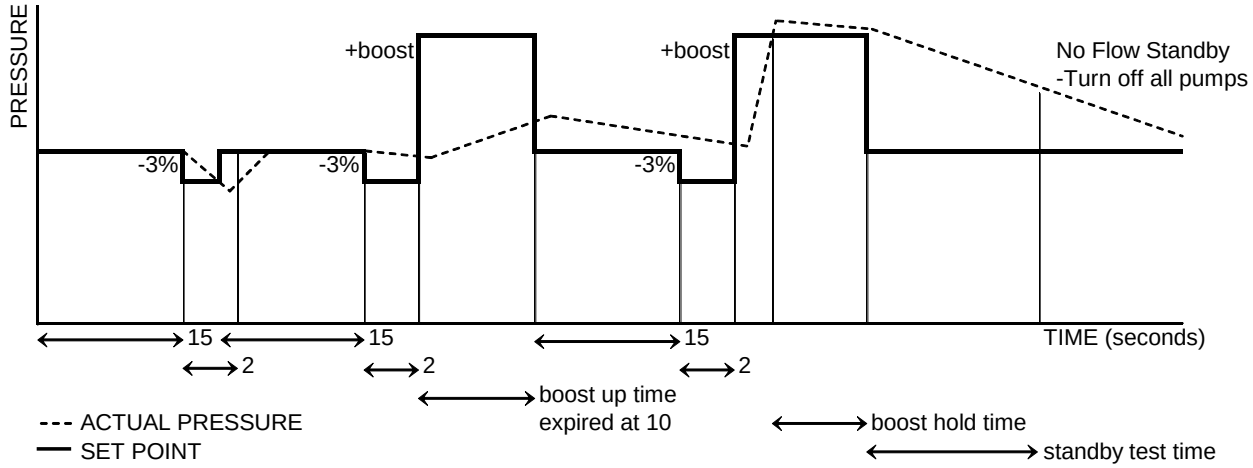
STANDBY (Sleep) METHODS

The ORCA tests for flow rate continuously and will determine if the pump system is contributing to the system flow.

The ORCA uses one of three methods to determine if there is no flow in the reticulation. The options detailed below are selected via the “Standby Test” screen, which is in the CONFIGURE menu.

Each test is only carried out if there is only 1 pump running, it’s not at maximum speed and the system pressure is at or above 3% of the Set Point.

Boost: The ORCA tests to see if the system flow has stopped by boosting the system pressure. The “Standby Boost” pressure sets the amount the Set Point pressure is boosted by. The time that it takes to drop back to the Set Point is compared to the Standby Test time. If the time to return to Set Point is less than the “Standby Test” time then the system continues to operate.



In this mode the “Standby Boost” screen will be visible and “Standby Flow/Sec” will be hidden.

Flow Switch: If a flow switch closes the contact between the No Flow input then the system assumes that there is no flow and shuts down after the period nominated by the standby test time.

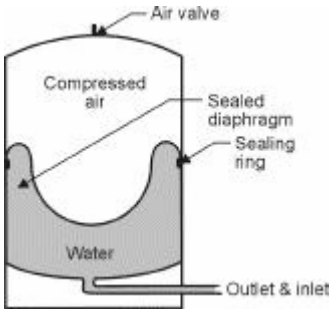
In this mode both the “Standby Boost” and “Standby Flow/Sec” screens will be hidden.

Flow Rate: If the flow rate in the system is below the nominated amount in this menu for the period of the standby test time the system will shut down.

Standby Flow Min
XXXX /min

In this mode the “Standby Flow Min” screen will be visible and “Standby Boost” will be hidden.

PRESSURE TANK REQUIREMENTS



As with all pressure systems a pressure tank is recommended for use in systems with VFD pumps. The pressure tank is used to:

- Reduce the effects of Water Hammer
- Provide supplemental pressure in the system to reduce the cycle time of the pump starts.

The size of the pressure tank is based on the number of starts required at very low flows. As the VFD Pump will take up the lower flows the only requirement for the pressure tank is to supplement the pressure when the VFD is at rest awaiting the system restart.

Be sure to have a full diameter pipe between the reticulation and the pressure tank. Do not install any restrictors in this line.

PRE-CHARGE PRESSURE

Set the air pressure in the pressure tank at 10% below the System Cut-In Pressure. This must be done when there is no pressure in the reticulation.

VFD SETTINGS

The ORCA can be used with most brands of VFD as all of the intelligence for operating the system is held within the controller itself. Nonetheless the VFD needs to be set so that it will receive the correct control signals from the ORCA. There are some important settings
VFD Rates
- VFD Inputs/Outputs
- Acceleration
- Deceleration
- Maximum Speed

VFD Inputs
- Digital input
- Digital Output

VFD Inputs/Outputs
1. Analogue Input - Set to VFD Speed reference - 0-10VDC
2. Digital input - Set to Start/Stop/Reset - Close contact for run - Open Stop/Reset
3. Digital Output - Set to VFD fault - Close contact for fault

There are configuration sheets for most brands of VFD's. Contact your local agent for detailed information about your specific VFD.

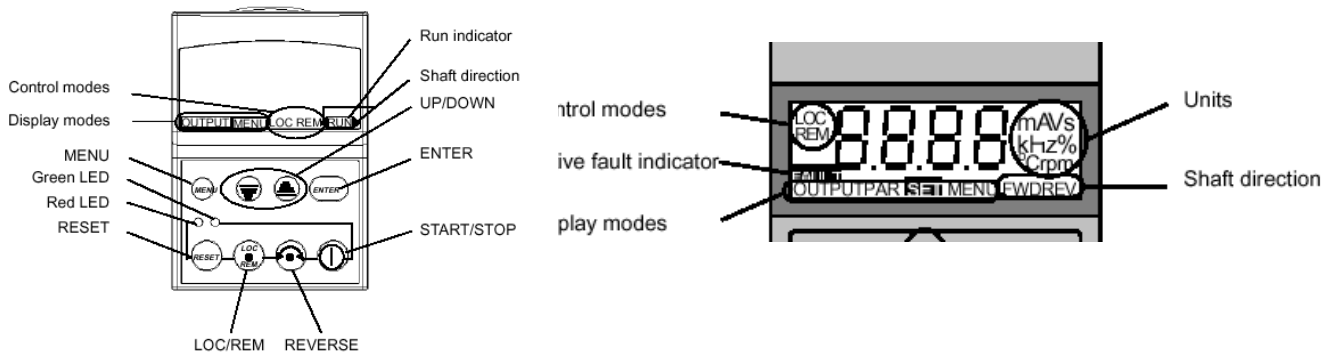
ABB ACS400
ORCA parameters for use with **ABB ACS400** VFD. Listed below are the standard settings for this VFD.

PARAMETER	DESCRIPTION	ABB DEFAULT	ORCA Setup
Group 99	START-UP DATA		
9901	language	0 (English)	0 ENGLISH
9902	applic macro	6 (PID CTRL)	STANDARD
9905	motor nom volt	230/400 V *)	415
9906	motor nom curr	IN **)	Motor Nameplate
9907	motor nom freq	50 Hz	50 Hz
9908	motor nom speed	1440 rpm	Motor Nameplate
9909	motor nom power	2-110 Kw ***)	Motor Nameplate
9910	motor cos phi	0.83	Motor Nameplate
Group 14	RELAY OUTPUTS		
1401	Relay Output 1	[1] Ready	Fault -1
Group 16	SYSTEM CONTROLS		
1601	run enable	4 (DI4)	NOT SELECTED
1604	fault reset sel	0 (KEYPAD)	START / STOP
1605	local lock	0 (open)	1 (LOCK)
Group 20	LIMITS		
2003	max current	1.5*IN **)	Set To suit
Group 22	ACCEL/DECEL		
2201	acc/dec 1/2 sel	0 (NOT SEL)	0 (NOT SEL)
2202	acceler time 1	5 s	1
2203	deceler time 1	5 s	5
2206	ramp shape	0 (linear)	
Group 26	MOTOR CONTROL		
2603	Ir compensation	10 V	10 V
2606	U/f ratio	1 (linear)	SQUARED (2)
2607	slip comp ratio	0%	100%

To adjust the VFD control parameters the screen on the front of the VFD must be accessed. To scroll between adjustments press the MENU key to gain access to the Menu Headings.
To obtain access to the menus press ENTER and scroll to the relevant menu

To edit the items press ENTER.
To modify settings hold down the UP or DOWN keys.

VFD Control Panel



The ABB must be in Remote Mode to operate with the ORCA.
To reset defaults change Par 99.02 to any other setting – save it and then change it back to Standard

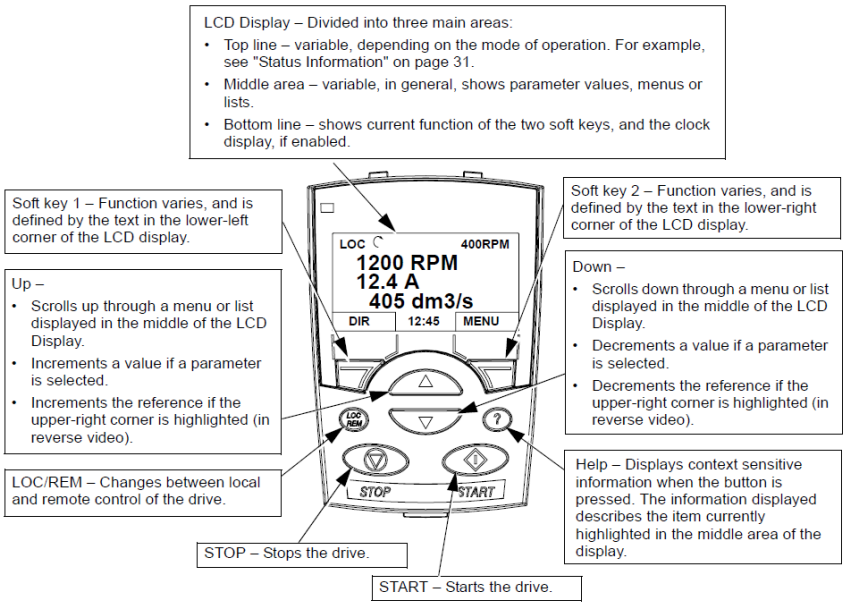
ABB ACS550
ORCA parameters for use with **ABB ACS550**VFD. Listed below are the standard settings for this VFD.

Parameters	DESCRIPTION	ABB DEFAULT	ORCA Set-up
Group 99	START-UP DATA		
9902	Applic Macro	STANDARD (1)	STANDARD (1)
9904	Motor Ctrl Mode	Vector Speed (1)	Scalar Frequency (3)
9905	Motor Nom Volt	230/400 V *)	415
9906	Motor Nom Curr	IN **)	Motor Nameplate
9907	Motor Nom Freq	50 Hz	50 Hz
9908	Motor Nom Speed	1440 rpm	Motor Nameplate
9909	Motor Nom Power	0.75…90 kW	Motor Nameplate
9910	Motor ID Run	OFF (0)	OFF (0)
Group 10	Start/Stop/Dir		
1001	Ext1 Commands	DI1,2 (2)	DI 1 (1)
1003	Direction	Request (3)	FORWARD (1)
Group 12	CONSTANT SPEEDS		
1201	Const Speed Sel	DI3,4 (9)	DI3(3)
1202	Const Speed 1	5 Hz	50 Hz
Group 14	RELAY OUTPUTS		
1401	Relay Output 1	Ready (1)	FAULT -1 (3)
Group 16	SYSTEM CONTROLS		
1601	Run Enable	Not Selected (0)	NOT SELECTED (0)
1604	Fault Reset Sel	Keypad (0)	START / STOP (7)
1606	Local lock	Not Selected (0)	On (7)
Group 20	LIMITS		
2003	Max Current	0…1.8 * I2hd	Motor Name +10%
Group 21	START/STOP		
2108	Start Inhibit	Off (0)	OFF (0)
Group 22	Accel/Decel		
2201	ACC/DEC ½ Sel	DI5 (5)	NOT SELECTED (0)
2202	Acceler Time 1	5 s	1 s
2203	Deceler Time 1	5 s	1 s
Group 26	MOTOR CONTROL		
2603	IR Compensation	50 V	0 V
2605	U/F ratio	Linear (1)	SQUARED (2)
2608	Slip Comp Ratio	0 %	100 %

To reset defaults change Par 99.02 to any other setting – save it and then change it back to Standard.
To adjust the VFD control parameters the screen on the front of the VFD must be accessed. To scroll between adjustments press the MENU key to gain access to the Menu Headings.
To obtain access to the menus press ENTER and scroll to the relevant menu.

To edit the items press ENTER.
To modify settings hold down the "UP" or "DOWN" keys.

VFD Control Panel



Danfoss VLT6000

ORCA parameters for use with **Danfoss VLT6000**VFD. Listed below are the standard settings for this VFD.

No.	Description	Default	ORCA Setup
001	Language	English	
100	Configuration	Open loop	Open loop
101	Torque characteristics	Auto Energy Optimization	Multiple Motors
102	Motor power	Depends on the unit	
103	Motor Voltage	Depends on the unit	
104	Motor Frequency	50Hz	
105	Motor Current	Depends on the unit	Name plate + 10%
106	Rated motor speed	Depends on the unit	
206	Ramp up time	Depends on the unit	1
207	Ramp down time	Depends on the unit	1
209	Jog frequency	10Hz	50
308	Terminal 53 input voltage	Reference	Reference
309	Terminal 53 min scaling	0.0V	0.0V
310	Terminal 53 Max scaling	10.0V	10.0V
326	Relay 2 Function	Running	Alarm

To reset the VLT6000 to factory settings:-

1. Power down system.
2. On power up depress “Display Mode”, ”Change data” & “OK”

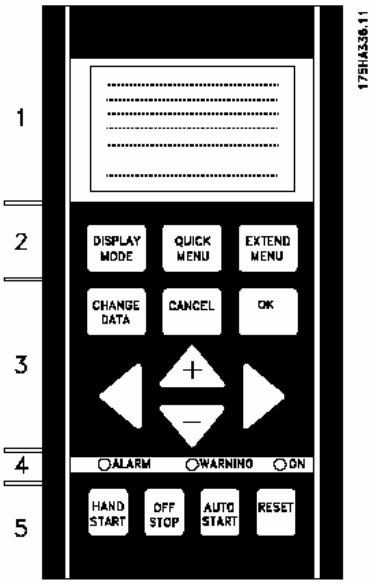
Control unit LCP (Local Control Panel)

The front of the frequency converter features a control panel - LCP(Local Control Panel). This is a complete interface for operation and programming of the frequency converter.

The control panel is detachable and can - as an alternative – be installed up to 3 metres away from the frequency converter, e.g. on the front panel, by means of a mounting kit option.

The functions of the control panel can be divided into five groups:

1. Display
2. Keys for changing display mode
3. Keys for changing program parameters
4. Indicator lamps
5. Keys for local operation



All data are indicated by means of a 4-line alphanumeric display, which, in normal operation, is able to show 4 operating data values and 3 operating condition values continuously. During programming, all the information required for quick, effective parameter Setup of the frequency converter will be displayed.

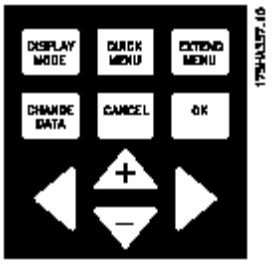
As a supplement to the display, there are three indicator lamps for voltage (ON), warning (WARNING) and alarm (ALARM), respectively.

All frequency converter parameter Setups can be changed immediately via the control panel, unless this function has been programmed to be *Locked* [1] via parameter 016 *Lock for data change* or via a digital input, parameters 300-307 *Data change lock*.

■Control keys for parameter setup

The control keys are divided into functions. This means that the keys between display and indicator lamps are used for parameter Setup, including selecting the display indication during normal operation.

[DISPLAY MODE] is used for selecting the indication mode of the display or when returning to the Display mode from either the Quick menu or the Extend menu mode.



Altivar 28

ORCA parameters for use with Schneider Altivar 28 VFD. Listed below are the standard settings for this VFD

Code	Default	ORCA Setting	Site Setting
Menu I/O			
tCC	2C		
L12	rrS		
L13	PS2	PS2	
L14	PS4		
AIC	SAI		
CrL	4		
CrH	20		
AO	rFr		
Aot	0		
r2	SrA		
Add	1		
bdr	19.2		
Menu Drive DrC			
UnS		240	
FrS	50		
tUn	no		
tFr	60	50	
Uft	n	P	
brA	YES		
Frt	0		
SFr	4.0		
nrd	YES		
Atr	no	Yes	
OPL	YES		
IPL	YES		
StP	no		
FLr	no		
drn	no		
SdS	30		
FCS	no		
MENU Settings SET			
LFr			
rP1	0		
ACC	3	1.5	
dEC	3	1.5	
AC2	5		
dE2	5		
LSP	0		
HSP			
ItH			
UFr	20		
SLP			
FLG	33		
IdC			
tdC	0.5		
JPf	0		
JOG	10		
rPG	1		
rIG	1		
FbS	1		
PIC	no		
SP2	10	50	
SP3	15		
SP4	20		
SP5	25		
SP6	30		
SP7	35		
Ftd			
Ctd			
ttd	100		

Danfoss FC51
ORCA parameters for use with Danfoss FC51 VFD

Param-eters	Description	DEFAULT	ORCA Set-up	Commissioning Date & Data
1-00	CONFIGURATION MODE	Open Loop	Open Loop	
1-01	MOTOR CONTROL PRINCIPLE	VVC+	VVC+	
1-03	TORQUE CHARACTERISTICS	Constant Torque	Constant Torque	
1-20	MOTOR POWER		**Motor Name Plate**	
1-22	MOTOR VOLTAGE		**Motor Name Plate**	
1-23	MOTOR FREQUENCY	50Hz	50Hz	
1-24	MOTOR CURRENT		**Motor Name Plate**	
1-25	RATED MOTOR SPEED		**Motor Name Plate**	
1-90	MOTOR THERMAL PROTECTION	NO PROTECTION	None	
3-03	MAXIMUM REFERENCE	50Hz	50Hz	
3-11	JOG SPEED Hz	5.0Hz	50Hz	
3-15	REFERENCE 1 SOURCE	Analogue Input 53	Analogue Input 53	
3-16	REFERENCE 2 SOURCE	Analogue Input 60	Analogue Input 60	
3-17	REFERENCE 3 SOURCE	Local Bus Reference	Local Bus Reference	
3-41	RAMP UP TIME		1 Sec	
3-42	RAMP DOWN TIME		3 Sec	
3-80*	JOG RAMP TIME	3 Sec	5 Sec	
4-14	MOTOR HIGH FREQUENCY	65	50	
5-12	TERMINAL 27 INPUT	RESET	[3] COAST & RESET INV	
# 5-40	RELAY 2 FUNCTION	[0] No operation	Alarm	
# 5-40	RELAY 2 FUNCTION	[0] No operation	No Alarm	
6-10	TERMINAL 53 MIN SCALING	0.7V	0.0V	
6-11	TERMINAL 53 MAX SCALING	10V	10V	
6-14	TERMINAL 53 LOW REFERENCE	0	0	
6-15	TERMINAL 53 HIGH REFERENCE	50	50	
8-01	CONTROL SITE	Digital and Word Control	Digital and Word Control	

NOTE Parameter 5-40 is set to No Alarm only when the “VFD Fault” Input on the ORCA is Inverted (INV). The (INV) feature was not available on previous versions therefore the “ALARM” setting needs to be used on older versions of the software.

Recommended initialisation (via par.14-22 Operation Mode)

1. Select par.14-22 Operation Mode
2. Press [OK]
3. Select “Initialisation”
4. Press [OK]
5. Cut off the mains supply and wait until the display turns off.
6. Reconnect the mains supply - the frequency converter is now reset.
7. Change par.14-22 Operation Mode back to Normal Operation.

Danfoss FC102 & FC202

ORCA parameters for use with Danfoss FC102 & FC202 VFD

Param-eters	Description	DEFAULT	ORCA Set-up	Commissioning Date & Data
0-02	REGIONAL SETTINGS	International	International	
1-00	CONFIGURATION	OPEN LOOP	OPEN LOOP	
1-03	TORQUE CHARACTERISTICS	AUTO ENERGY OPTIMISATION	VARIABLE TORQUE	
1-20	MOTOR POWER		Motor Name Plate	
1-22	MOTOR VOLTAGE		Motor Name Plate	
1-23	MOTOR FREQUENCY		Motor Name Plate	
1-24	MOTOR CURRENT		Motor Name Plate	
1-25	RATED MOTOR SPEED		Motor Name Plate	
3-03	MAXIMUM REFERENCE	50HZ	50HZ	
3-11	JOG FREQUENCY	5Hz	50Hz	
3-15	REFERENCE 1 SOURCE	Analogue Input 53	Analogue Input 53	
3-16	REFERENCE 2 SOURCE	Digital Potentiometer	Digital Potentiometer	
3-41	RAMP UP TIME		1 Sec	
3-42	RAMP DOWN TIME		5 Sec	
3-80	JOG RAMP TIME	3 Sec	5 Sec	
4-14	MOTOR SPEED HIGH LIMIT	25Hz	50Hz	
5-12	TERMINAL 27 INPUT	RESET	[3] COAST &RESET INVERSE	
# 5-40 [0]	RELAY 1 FUNCTION	Alarm	No Alarm	
5-40 [1]	RELAY 2 FUNCTION	Running	Alarm	
6-10	TERMINAL 53 MIN SCALING	0.7V	0.0V	
6-11	TERMINAL 53 MAX SCALING	10V	10V	
6-14	TERMINAL 53 LOW REFERENCE	0	0	
6-15	TERMINAL 53 HIGH REFERENCE	50	50	
8-01	CONTROL SITE	Digital and Word Control	Digital and Word Control	

NOTE Parameter 5-40 is set to No Alarm only when the “VFD Fault” Input on the ORCA is Inverted (INV). The (INV) feature was not available on previous versions therefore the “ALARM” setting needs to be used on older versions of the software.

Recommended initialisation (via par.14-22 Operation Mode)

1. Select par.14-22 Operation Mode
2. Press [OK]
3. Select “Initialisation”
4. Press [OK]
5. Cut off the mains supply and wait until the display turns off.
6. Reconnect the mains supply - the frequency converter is now reset.
7. Change par.14-22 Operation Mode back to Normal Operation.

Danfoss FC101

ORCA parameters for use with Danfoss FC101 VFD

Param-eters	Description	DEFAULT	ORCA Set-up	Commissioning Date & Data
0-02	MOTOR SPEED UNIT	RPM	Hz	
1-00	CONFIGURATION	OPEN LOOP	OPEN LOOP	
1-03	TORQUE CHARACTERISTICS	AUTO ENERGY OPTIMISATION	VARIABLE TORQUE	
1-20	MOTOR POWER		DEPENDS ON MOTOR SIZE	
1-22	MOTOR VOLTAGE		DEPENDS ON MOTOR	
1-23	MOTOR FREQUENCY		DEPENDS ON MOTOR	
1-24	MOTOR CURRENT		DEPENDS ON MOTOR SIZE	
1-25	RATED MOTOR SPEED		DEPENDS ON MOTOR	
1-90	MOTOR THERMAL PROTECTION		NO PROTECTION	
3-03	MAXIMUM REFERENCE		50Hz	
3-11	JOG FREQUENCY	5Hz	50Hz	
3-15	REFERENCE 1 SOURCE	Analogue Input 53	Analogue Input 53	
3-41	RAMP UP TIME		1 Sec	
3-42	RAMP DOWN TIME		3 Sec	
3-80	JOG RAMP TIME		5 Sec	
4-14	MOTOR SPEED HIGH LIMIT	25Hz	50Hz	
5-12	TERMINAL 27 INPUT	RESET	[3] COAST &RESET INVERSE	
5-13	TERMINAL 29 DIGITAL INPUT	[14] JOG	[14] JPG	
# 5-40 [0]	ITEM [0] - RELAY 1 FUNCTION	[9] ALARM	[160] NO ALARM	
5-40 [1]	ITEM [1] - RELAY 2 FUNCTION	[0] NO OPERATION	[9] ALARM	
6-10	TERMINAL 53 MIN SCALING	0.7V	0.0V	
6-11	TERMINAL 53 MAX SCALING	10V	10V	
6-15	TERMINAL 53 HIGH REFEENCE		50.00hZ	
8-01	CONTROL SITE		[0] DIGITAL AND CONTROL WORD	

NOTE Parameter 5-40 is set to No Alarm only when the “VFD Fault” Input on the ORCA is Inverted (INV). The (INV) feature was not available on previous versions therefore the “ALARM” setting needs to be used on older versions of the software.

Vacon Drive Settings

Vacon 20

ORCA parameters for use with Vacon 20 VFD

Vacon 20 VFD Settings for Orca			
Parameters	Description	Vacon 20 Default	VFD Setting for Orca
P17.1	Application Type	[0] Basic	[1] Pump
P17.2	Parameter Conceal	[1] Only Quick Setup	[0] All Parameters Visible
P1.1	Motor Nominal Voltage [Volts]	Depends on Pump Size	Motor Name Plate
P1.2	Motor Nominal Frequency [Hz]	Depends on Pump Size	Motor Name Plate
P1.3	Motor Nominal Speed [RPM]	Depends on Pump Size	Motor Name Plate
P1.4	Motor Nominal Current [Amps]	Depends on Pump Size	Motor Name Plate
P1.7	Current Limit [Amps]	0 Amps	Maximum Motor Current
P2.4	I/O Start / Stop Logic	[2] FWD Edge / BWD Edge	[0] Forward / Reverse
P3.2	Max. Frequency [Hz]	50.00 Hz	50.00 Hz
P3.5	Preset Speed 1 [Hz]	10.00 Hz	50.00 Hz
P4.2	Acceleration Time 1	3.00 sec	1.00 sec
P4.3	Deceleration Time 1	3.00 sec	5.00 sec
P5.1	I/O Control Signal 1	[1] DI1 Terminal 8	[1] DI1 Terminal 8
P5.6	Fault Reset	[3] DI3 Terminal 10	[3] DI3 Terminal 10
P5.8	Preset Speed B0	[4] DI3 Terminal 14	[4] DI4 Terminal 14
P8.1	RO1 Relay 1 Function	[2] Run	[4] Fault Inverted
P14.1	Automatic Reset	[0] Disabled	[1] Enable
P14.2	Wait Time	0.50	0.30

To Reset the Vacon 20 to Factory Default Settings

1. Run Wizard First. Parameter Sys = S-P4.2 [1] Restores Factory Defaults for all Parameters. Note: Running the Start-Up Wizard will always return all parameter settings to factory defaults

Vacon Drive Settings

Vacon 100 Flow

ORCA parameters for use with Vacon 100 Flow VFD

Vacon 100 Flow VFD Settings for Orca			
Parameters	**Description**	**Vacon 100 Flow Default**	**VFD Setting for Orca**
103	Acceleration Time	5 second	1 second
104	Deceleration Time	5 second	1 second
105	Preset Frequency	10 Hz	50 Hz
107	Current Limit	IL	Motor Name Plate +10%
110	Nominal Motor Voltage	230-400V	Motor Name Plate
111	Nominal Frequency	50.00 Hz	Motor Name Plate
112	Nominal Motor Speed	1440	Motor Name Plate
113	Nominal Motor Current	IL	Motor Name Plate
379	AI1 Signal Range	0V-10V/0-20mA	0V-10V/0-20mA
1101	Relay Output 1 Function	Ready	Fault Invert

To Reset the Vacon 100 Flow to Factory Default Settings

1. Press Function Button
2. Select Quick Edit
3. Type in 831
4. Default Should be [0], Change to [1] to Reset to Default

SIEMENS MICROMASTER 440

Parameters	Description	Danfoss Default	Orca Set-up	COMMISIONING DATA
				/ /
P0003	User Access Level	[1] Standard	[3] Expert	
P0004	Parameter Filter	[0] All Parameters	[0] All Parameters	
P0100	Europe / North America	[0] Europe KW 50Hz	[0] Europe KW 50Hz	
P0300	Inverter Application	[0] Constant Torque	[1] Variable Torque	
P0304	Rated Motor Voltage[Volts]		Motor Name Plate	
P0305	Rated Motor Current [Amps]		Motor Name Plate	
P0307	Rated Motor Power [KW]		Motor Name Plate	
P0310	Rated Motor Frequency [Hz]	50.00Hz	Motor Name Plate	
P0311	Rated Motor Speed [RPM]		Motor Name Plate	
P0640	Motor Overload Factor	150%	110%	
P0701	Function Digital Input 1	[1] On/Off 1	[1] On/Off 1	
P0702	Function Digital Input 2	[12] Reverse	[9] Fault Acknowledge	
P0703	Function Digital Input 3	[9] Fault Acknowledge	[10] Jog Right	
P0731	BI :Function Of Digital Output 1	[52:3] Drive Fault Active	[52:3] Drive Fault Active	
P0732	BI: Function Of Digital Output 2	[52:7] Drive Warning Active	[52:2] Drive Running	
P0761	Width Of ADC Dead band [Volts]	0.0V	0.5V	
P1120	Ramp Up Time	10.00 Seconds	1.00 Seconds	
P1121	Ramp Down time	10.00 seconds	5.00 seconds	
P1058	Jog Frequency Right [Hz]	5.00Hz	50.00Hz	
P1060	Jog Ramp Up Time	10.00 Seconds	5.00 seconds	

TO RESET THE MICROMASTER 440 TO FACTORY SETTINGS

Parameter P0970 [1]

SPECIFICATIONS

Item	Description
Power supply - control	1. Control 240VAC 50-60Hz single phase 2 amp Single pole circuit breaker protected 2. 24VDC – 250mA 3. 18VAC
External transducer power supply	24 VDC 100mA max. Auto reset fuse protected
EMC/ EMI filtering	Designed to minimize conducted and radiated emissions.
Transducer-on board	0-25 Bar ±0.5% accuracy temperature compensated. Temp max 80 degC 50 Bar burst pressure
Time based functions	±.05% of real time
Output Relays	5 amp 250VAC changeover software configurable. Common input for all pump control relays.
Switched inputs	Voltage free - internal supply 24VDC - activation threshold - 2mA
Operating temperature	0 to 45 degC
Over voltage protection	Varistor protection. Clamp voltage 275V - 4500 amps 1 amp - IEC127-2/3
Enclosure	IP54 not certified
Contactor	Rated voltage - 690Vac Coil - as per control Voltage cycles mech. - 10x 10^6 elec. - 2 x 10^6 cycles/hr - 3600 Auxiliary contacts - 1 x NO Standard - IEC947
Motor circuit breakers	Standard - IEC947
Wiring	Standard - AS3000
Input supply Voltage - 3 phase	230 OR 440V
Input supply tolerance - 3 phase	-20% + 10%
Input frequency range	48 to 62 Hz
Typical system Weights	1.1– 4kW 2 pump 30kg 5.5 – 11kw 2 pump 35kg 15kW 2 pump 48kg

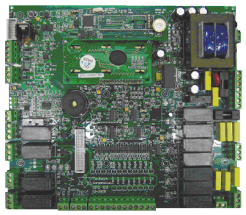
SPARE PARTS

The typical spare parts required for ORCA are detailed in the table below.
Please refer to Techsys Corporation for confirmation of parts type and suitability for use with specific projects.

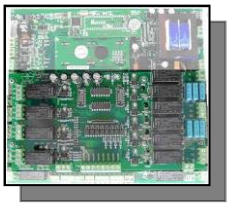
Part	Code
0-25 Bar Standard pressure transducer	PS25B
PCB Board	3PC
PCB Expansion board	3PEX
Retrofit panel	OR-RF
Manual	ORCA Manual
Lexan	Orca Lexan
ORCA 3 Pump panel mount retrofit kit*	ORCA_Retrofit
ORCA 6 Pump panel mount retrofit kit*	ORCA_E_Retrofit

*For use when retrofitting the ORCA to an existing system for fitting to new switchboard. Includes:

- ORCA Base PCB mounted to panel
- SS Retrofit panel
- ORCA Lexan



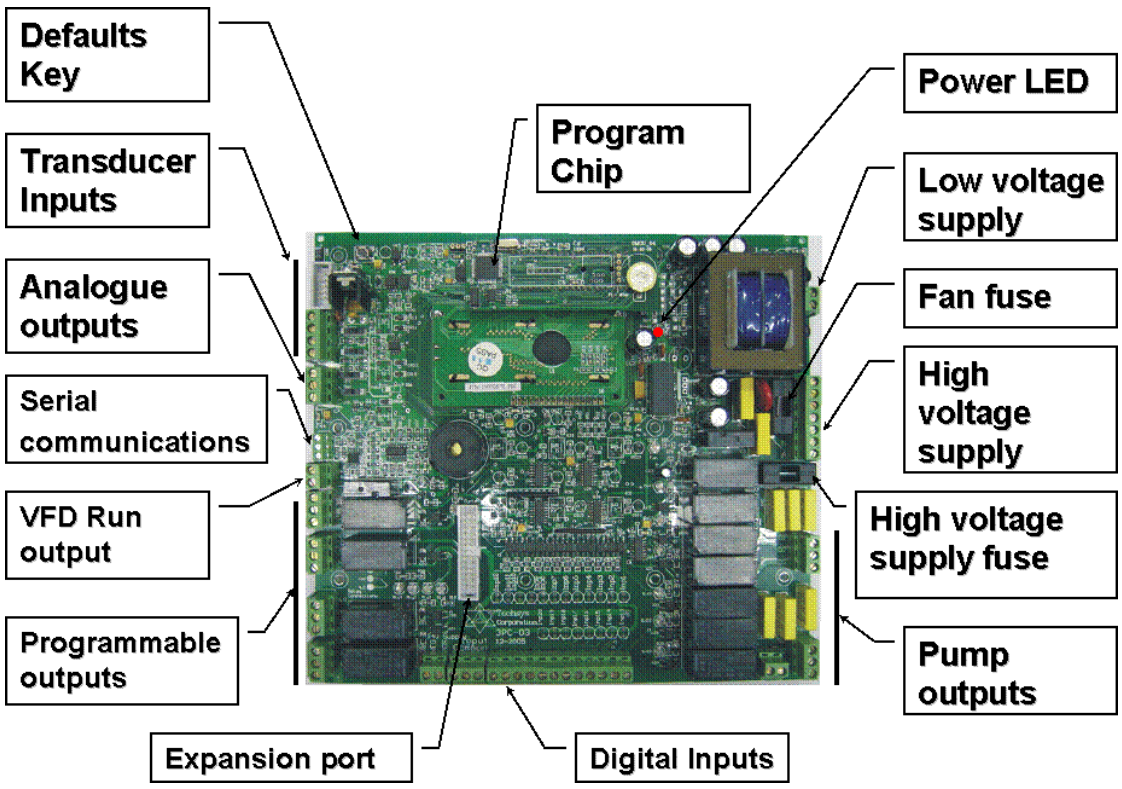
ORCA PCB BOARD



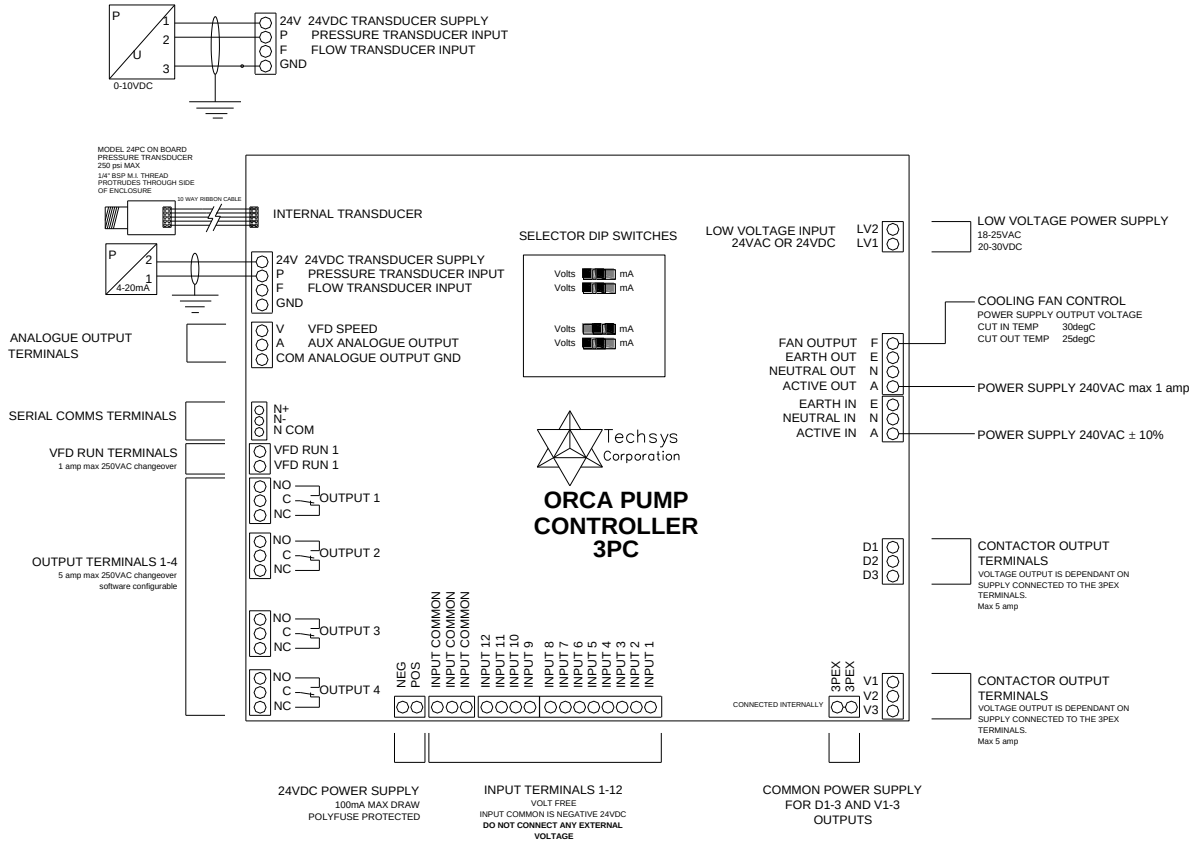
ORCA EXPANSION BOARD

ORCA RETROFIT KIT

PCB HARDWARE & SPECIFICATIONS



CONNECTIONS



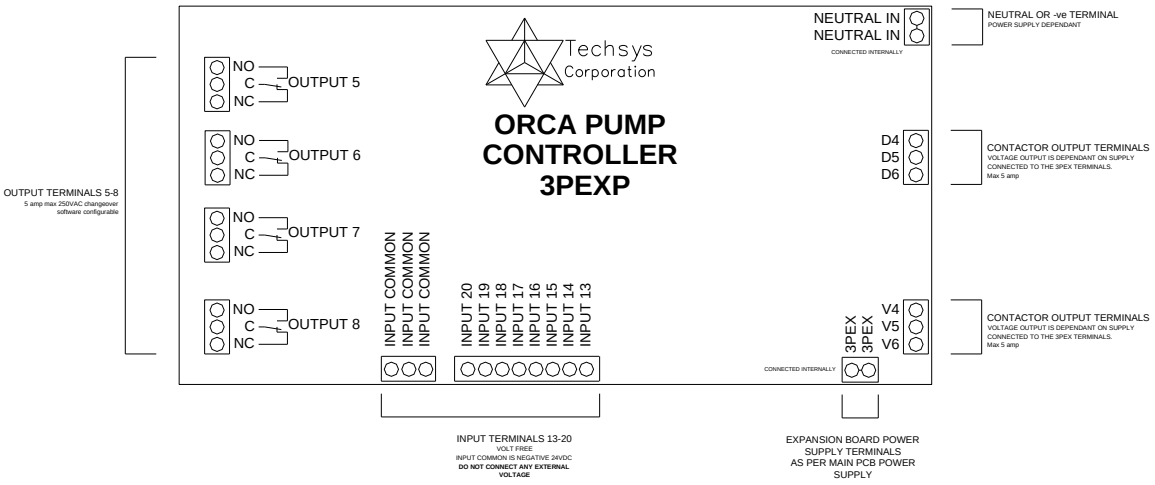
Detailed above are the locations for the components for the ORCA Printed Circuit Board (PCB)

EXPANSION BOARD

For applications where there are more than 3 pumps the ORCA uses an add on Expansion board. This board carries additional components to allow the system to run up to 6 pumps including a Jockey Pump.

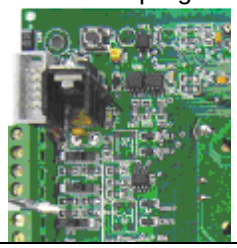
The expansion board adds an additional

- 3 pump capacity
- 4 Programmable outputs
- 8 extra programmable inputs



TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Can't Stop or Start pumps	• Screen Stated – "Access Code:" • One of the Inputs is set to operate the Pump causing override.	• Input Access Code- factory setting is 21 • Check Input LED's for activation.
Pump won't start	• Pump "P" button not selected • Motor circuit breaker tripped or off • Control circuit breaker tripped or off • VFD faulted • Pressure above Cut In pressure • System Pause Active	• Select ON for at least 1 pump • Reset circuit breaker • Reset Circuit breaker • De-power and re-power the system. • Allow the system pressure to drop • Reset Input
Pump won't turn off	• Manual selected for that pump • Pump Manual Run input active • Shutdown Timer too long	• Select OFF or AUTO for that pump. • Remove input • Adjust shutdown timer
No display screen	• Control circuit breaker tripped • High voltage has tripped the surge protection fuse • Temperature within the enclosure in excess of 50degC	• Reset Circuit breaker • Replace fuse on the PCB • Lower internal temperature
No pressure or wrong pressure displayed	• Incorrect Sensing Input selected • Calibration incorrect for sensor	• Change Sensing Input to suit sensor used • Calibrate sensor
Pumps cycling excessively	• Minimum frequency set too high • IN delay too low • High Pressure limit being hit • Pause Input tripping • Voltage being applied to the Inputs. • Response rate too high	• Adjust Minimum frequency to a lower number • Adjust IN Delay timer • Check system pressures - Adjust HP Limit if necessary • Check Pause input • Make sure the Inputs are Voltage Free • Lower Response Rate

PROBLEM	CAUSE	SOLUTION
Pump shutting down on Pump Protection	• Fault in protection sensor	• Replace or adjust sensor
Controller powers on and off continuously	• Voltage being applied to the Inputs. • Excessive current being drawn from the external pressure sensor	• Make sure that the Inputs are Voltage Free • Check external sensor current 100mA max.
Can't tune the set point above/Below a number	• The set point must be between the Cut In pressure and the High Pressure limit	• Adjust HP limit or Cut In pressure to allow the Set point to move • Check Set Point 2 & 3 to make sure that they are not above HP Limit or below Cut In pressures
System Displays wont initialise Loading Data message cycles continuously	• System needs to be initialised.	• Press the "Commissioning Button" on the PCB whilst powering up the system to initialise the program • 
System Pressure not displaying	• Analogue circuits not functional	• There are 2 LED's located on the front top right of the PCB. One is for Power which should be flashing – the other is for indication that the analogue circuit is operational which also should be flashing. Solid light or no light means inoperative.

INSTALLATION NOTES

General Installation information can be obtained from Techsys Corporation regarding the site-specific requirements however, there are some "GOLDEN RULES" in site installation that should be followed.

Site Installation

- The ORCA requires a NEUTRAL
- Select the site most shaded and out of direct sunlight. Heat is a VFD killer.
- Allow the airflow from the fans to be unimpeded.
- The earth needs to be nearby and not laid parallel with High Voltage cables.
- Always connect the motor earth directly to the earth within the VFD.

- **Inputs**
- Connect the shield to EARTH and one end only.
- Never apply voltage to the Inputs.
- Take care in running inputs for long distances.
- The inputs use a 24VDC signal as the carrier voltage - use compliant sensors.

- **Outputs**
- 5 amp maximum switching load.
- Check the programming on each output before trying to troubleshoot.

- **Start-up**
- CHECK ROTATION - CHECK ROTATION - CHECK ROTATION - CHECK ROTATION - CHECK ROTATION

All these items are site related.

Fault Messages Explained

- Low Press Shutdown
  - If the pressure is lower than the “LoPress Shutdown” Setting for a period greater than the valued entered in “LoPressure Delay” timer, then the system will be shutdown and LOW PRESSURE SHUTDOWN message will be displayed and a fault log entry will also be stored indicating the time that the fault occurred. This fault can be cleared by pressing the * button or activating the reset input.
- High Press Shutdown
  - If the pressure is Higher than the “HiPress Shutdown” Setting for a period greater than the valued entered in “HiPressure Delay” timer, then the system will be shutdown and HIGH PRESSURE SHUTDOWN message will be displayed and a fault log entry will also be stored indicating the time that the fault occurred. This fault can be cleared by pressing the * button or activating the reset input.
- Lo Flow Detected
  - If a system flow switch is installed and connected to an input which in turn is programmed to be “No Flow” then whilst any pump is running and the pressure is lower than the set point then the controller expects to see the flow switch input to be off, however If the input is on the “Lo Flow Detected will be displayed and the No Flow Timer will be started. If the No Flow input stays on the No Flow Timer will eventually expire and a No Flow Shutdown will occur – See also No Flow Shutdown.
- No Flow Shutdown
  - If a system flow switch is installed and connected to an input which in turn is programmed to be “No Flow” then whilst any pump is running and the pressure is lower than the set point then the controller expects to see the flow switch input to be off. If the switch is on as per the condition described above, for a time greater than the duration of the “No Flow Timer”, then the system will be shutdown and NO FLOW SHUTDOWN message will be displayed and a fault log entry will also be stored indicating the time that the fault occurred. This fault can be cleared by pressing the * button or activating the reset input.
- VFD Shutdown/ VFD Fault
  - If a VFD fault is received the controller will stop the VFD, reset the VFD and attempt to restart the VFD again, this will occur three times and if the VFD fails to restart after the third time then the system will be shutdown and VFD SHUTDOWN message will be displayed and a fault log entry will also be stored indicating the time that the fault occurred. This fault can only be cleared by turning off the power, waiting 20 seconds and then turning the power back on.
- Pump 1[JP] to 6 Fault
  - If an individual pump flow or temperature switch is installed and connected to an input which in turn is programmed to be “Px Fault(Stop)”, then whilst the associated pump is running the controller expects to see the flow switch input to be off. If the switch is on as per the condition described above for a time greater than the duration of the “Pump Fault Timer”, then the pump will be disabled and the NEW FAULT message will be displayed, also a fault log entry will also be stored indicating the time that the fault occurred. This fault can be cleared by pressing the * button or activating the reset input but unless the input/fault is not rectified it will occur again.
- Pump 1[JP] to 6 Protection
  - If an individual pump protection or isolation device is connected to an input which in turn is programmed to be “Px Prot(Pause)”. If the input is on for a time greater than the duration of the “Input Delay Timer”, then the pump will be disabled and the NEW FAULT message will be displayed, also a fault log entry will also be stored indicating the time that the fault occurred. This fault will automatically be cleared when the input/fault is rectified.
- High Temperature
  - Every time the controller detects that the temperature is above 50C it is recorded in the Fault Log, no further action is taken. If the VFD gets too hot it will shutdown and thus a VFD fault will then also be registered.
- Auto Reboot
  - If an exceptionally hi DV/DT power disturbance event occurs it can cause corruption, this event is detected and the system will automatically reboot. No action needs to be taken unless it is occurring very frequently or it is causing supply issues.
- Power Failure
  - Each time the power is turned off, the event is recorded, when the power is turned back on the POWER FAILURE message will be displayed, this is to purely indicate there has been a event that may be of interest, the message can be cleared by pressing the * key but this is not essential for the system to operate.

- Power glitch
    - If the power is off for only 100mS (One tens of a second) then this will be logged in the fault register. It is very unlikely that this will ever happen on a system but from experience when it does it shows an underlying power supply issue that may need to be addressed.
- Transducer Shutdown
    - See Analog1&2 Error
- Analog1 Error
    - If the “Validate AnInput” option in the Input menu is set to YES and Analogue 1 is used to control or monitor a signal, it will continually be monitored for a signal that is deemed to be outside of the normal operating range – This is less than 15% (3mA) and greater than 95% (19mA). This function is only usable for 4-20mA transducers. If Analogue 1 does fall outside these values then the TRANSDUCER SHUTDOWN message will be displayed, the system will be shutdown (Shutdown will not occur if the other Analogue input is used as a backup control sensor) and the fault will be logged along with the time it occurred.
- Analog2 Error
    - If the “Validate AnInput” option in the Input menu is set to YES and Analogue 2 is used to control or monitor a signal, it will continually be monitored for a signal that is deemed to be outside of the normal operating range – This is less than 15% (3mA) and greater than 95% (19mA). This function is only usable for 4-20mA transducers. If Analogue 1 does fall outside these values then the TRANSDUCER SHUTDOWN message will be displayed, the system will be shutdown (Shutdown will not occur if the other Analogue input is used as a backup control sensor) and the fault will be logged along with the time it occurred.
- Analogue Shutdown
    - See AnComms Fault
- AnComms Fault
    - There are two independent micro processors operating on this board, should the main processor not be able to communicate with the Analogue processor it attempts to restart it, if this fails after 20 attempts the system is shutdown, an ANALOGUE SHUTDOWN message is displayed and the fault is recorded along with the time it occurred.
- RTC ERROR
    - An RTC ERROR is displayed in the fault log when the clock (Real Time Clock) has not been set or has reset due to the battery being flat.
- Pipe Fill Mode
    - If Pipe Fill mode is enabled this message is displayed when the pipe fill sequence is in operation.
- DOL Backup Mode
    - If DOL Backup Mode is enabled and the VFD has failed to restart, then this message will be displayed when the system is operating in DOL mode.
- Pause Activated.
    - If an input is programmed to be Soft Pause and the input is activated, then all pumps will ramp down and stoped and Pause Activated will be displayed.
- Pause Low Level
    - If an input is programmed to be Low Level Pause and the input is activated, then all pumps will ramp down and stoped and Low Level Pause will be displayed.
- Time OFF
    - If the system has been programmed to operate on scheduled time events then during the OFF time the TIME OFF message will be displayed.

Site Record

Main Menu	Sub Menu		Date	
		/ /	/ /	/ /
Set Point & Actual Pressure				
Flow Rate/ min & VFD Spd				
FAULT HISTORY	Fault 1			
	Fault 2			
	Fault 3			
	Fault 4			
	Fault 5			

PUMP DATA LOG	Flow Total			
	Average Flow Rate			
	Average Pressure			
	Highest Press			
	Hours Run 1			
	Hours Run 2			
	Hours Run 3			
	Hours Run 4			
	Hours Run 5			
	Hours Run 6			
	Pump Starts 1			
	Pump Starts 2			
	Pump Starts 3			
	Pump Starts 4			
	Pump Starts 5			
	Pump Starts 6			
	Pump Starts Last Hr			
	Analogue Input 1			
	Analogue Input 2			
	Analogue Output 1			
	Analogue Output 2			
	Digital Input State M			
	Digital Input State E			
	Digital Output State			
	PID Error			
	Curr & max retry			
	Temperature			
	Modbus Monitor			
Access Code	21			

SETTINGS	LoPress Shutdown			
	Cut In Pressure			
	Set Point			
	HiPress Limit			
	HiPress Shutdown			
	Pump Flow Rate			
	Friction Loss			
	Set Point 2			
	Set Point 3			
	Set Point 4			
	Set Point 5			
	Set Point 6			
	Set Point 7			
	Set Point 8			
	Pressure Trip 1 Low			
	Pressure Trip 1 High			
	Pressure Trip 2 Low			
	Pressure Trip 2 High			

Main Menu	Sub Menu		Date	
	Flow Trip Low			
	Flow Trip High			
	DOL Cut In			
	DOL Cut Out			

TUNING	Minimum Frequency			
	Shutoff Head			
	Response Rate (P			
	Acceleration			
	Auto Rotation			
	Rotation Time			
	HiPress Restarts			
	Standby Boost			
	Standby Flow Min			
	Error Correct (I			
	OvershootElim (D			
	RR(P) EC(I) OE(D)	N/A	N/A	N/A

TIMING	LoPressure Delay			
	HiPressure Delay			
	IN Delay Timer			
	Out Delay Timer			
	Restart Delay			
	Standby Test Time			
	Fallback Delay			
	Boost Hold Time			
	Pump Fault Timer			
	Input Delay Timer			
	Press Trip Low Delay			
	Press Trip High Delay			
	Flow Trip Low Delay			
	Flow Trip High Delay			
	Change Over Delay			
	UV Warm Up			
	UV Hot to Cold			
	Backup Spin Intv			
	Backup Spin Time			
	Stop Time			
	Start Time			

CONFIGURATION	Operating Mode			
	Level Mode			
	Number of pumps			
	Min Freq Mode			
	Press Decimal			
	Flow Decimal			
	Transducer Zero			
	Adjust Pressure			
	Averaging			
	Flow Meter Zero			
	Adjust Flow			
	Backup Pres Zero			
	Adjust Backup Pr			
	Scale An output2			
	Standby Test			
	Fallback Test			
	Set Time/Date			

Main Menu	Sub Menu		Date	
	Operating System			
	DOL Backup Mode			
	Friction Loss Calc			
	Access Code			
	Serial Comms			
	Modbus Address			
	No Of Duty Pumps			
	Flow Sensing			
	Manual Run			

PUMP DEFINITION	Pump 1			
	Pump 2			
	Pump 3			
	Pump 4			
	Pump 5			
	Pump 6			

JOCKEY PUMP	Jockey Pump Mode			
	JP Cut In Pres			
	JP Set Point			
	JP Cut Out Pres			
	JP Flow Rate			
	JP Response Rate			
	JP Acceleration			
	JP Standby Test			
	JP Standby Boost			
	JP Standby Flow			
	JP Run On Time			
	JP Restart Delay			
	JP Use Main SP			
	JP Min Frequency			
	JP ErrorCorr't (I			
	JP OverShtElim (D			

OUTPUTS	Digital Output 1			
	Digital Output 2			
	Digital Output 3			
	Digital Output 4			
	Digital Output 5			
	Digital Output 6			
	Digital Output 7			
	Digital Output 8			
	Analogue Output 1			
	Analogue Output 2			

INPUTS	Program Input 1			
	Program Input 2			
	Program Input 3			
	Program Input 4			
	Program Input 5			
	Program Input 6			
	Program Input 7			
	Program Input 8			
	Program Input 9			
	Program Input 10			
	Program Input 11			

Main Menu	Sub Menu		Date	
	Program Input 12			
	Program Input 13			
	Program Input 14			
	Program Input 15			
	Program Input 16			
	Program Input 17			
	Program Input 18			
	Program Input 19			
	Program Input 20			
	Analogue Input 1			
	Analogue Input 2			
	Validate AnInput			

PIPE FILL	Pipe Fill Mode			
	Jump Ramp Time			
	Jump Final Speed			
	Pipe Fill Time			
	Pipe Empty Pressure			
	Pipe Empty Time			

TIME OF DAY SET POINTS	Set Point 2 Time			
	Set Point 3 Time			
	Set Point 4 Time			
	Set Point 5Time			
	Set Point 6 Time			
	Set Point 7 Time			

RESTORE OPTIONS	CREATE BACKUP			
	RESTORE BACKUP			
	CREATE BACKUP			
	RESTORE BACKUP			

NOTES

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