pulsar®
PROCESS MEASUREMENT

Zenith 140 (UL)

INSTRUCTION MANUAL

ZENITH 140 UL (FIFTH EDITION REV 3)

February 2020

Part Number M-140-5-005-3U

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Contents

Chapter 1 Start Here

Congratulations on your purchase of a Pulsar **Zenith 140 Pump Controller**. This quality system has been developed over many years and represents the latest in high technology ultrasonic level measurement and control.

It has been designed to give you years of trouble-free performance, and a few minutes spent reading this operating manual will ensure that your installation is as simple as possible.

About this Manual

It is important that this manual is referred to for correct installation and operation.

There are various parts of the manual that offer additional help or information as shown:

Tips

TIP

At various parts of this manual you will find tips to help you.

Additional Information

Additional Information

At various parts of the manual, you will find sections like this that explain specific items in more detail.

References

See Also

References to other parts of the manual

About the Zenith 140 Pump Controller

The ***Zenith 140*** is a state of the art pump, and level controller, that provides advanced operating routines suitable for an extremely wide variety of applications. The system combines premium specification with high performance even in the most arduous applications where high turbulence and foam or froth is present.

Functional Description

The ***Zenith 140*** level and pump controller is a highly developed ultrasonic level measurement system which provides non-contacting sophisticated pump and level control routines suitable for an extremely wide variety of applications.

Easy calibration and maintenance free “fit and forget” performance mean that you can install the Zenith 140 pump controller rapidly and with confidence. Six user-definable relays with adjustable, individual on and off points, seven user-definable digital inputs, isolated mA output, RS 232 and intelligent performance logging software features provide the user with a superior pump management system and comprehensive level measurement information.

The ***Zenith 140*** operates on the principle of timing the echo received from a measured pulse of sound transmitted in air and utilises the unique DATEM software (Digital Adaptive Tracking of Echo Movement). This is an entirely new digital mapping technique developed especially for the Pulsar *ultra* range.

It gives the system the edge when identifying the "true target level" in the face of competing echoes from pipes, pumps or other obstructions. When coupled with the powerful, long range abilities of the all new dB transducer range, the ***Zenith 140*** level and pump controller has no equal.

The ***Zenith 140*** can measure from zero to 131 feet (40m) from the face of the transducer to the surface being monitored, dependent on the transducer used.

The ***Zenith 140*** can show **level**, **space, distance,** on the display. The relays can be programmed to activate alarms, pump starters, or other control equipment. In addition, the digital inputs can be used to modify pump and control regimes in order to optimise performance. There is an isolated 4-20 mA output that can be connected to a recorder or PLC, to monitor level, space or distance, independently from that shown on the display. There is an RS232 port, so that the ***Zenith 140*** can be operated remotely by a PC or other equipment.

The ***Zenith 140*** is programmed by the built-in keypad or by PC via the RS 232 Serial Interface (optional). All the parameters are stored in non-volatile memory, so are retained in the event of power interruption. A second backup copy of all parameters can also be retained in the ***Zenith 140***, in case a previous set of parameters needs to be restored.

Product Specification

Physical	
Fascia Mount	
Outside dimensions	7.87 x 4.41 x 4.25 inches (200 x 112 x 108mm)
Weight Nominal 2.87lbs (1.3kg)	
Enclosure material/description	Stainless Steel back, Polycarbonate UL94-V0 front and bezel
Transducer cable extensions	3-conductor 20AWG screened
Maximum separation	3,680 ft (1000 m), 1,640 ft (500m) for dBR16 & dBR8
Environmental	
Mounting – Fascia Mount	Indoor
Relative Humidity (IP Rating)	
- Fascia Mount	**(**IP64 from front panel) <35ºC (95ºF) at 93% relative humidity Pollution Degree 2
Altitude	2000m maximum
Max. & Min. temperature (electronics)	-4ºF to 140ºF (-20ºC to +50ºC)
Flammable atmosphere approval	Safe area: compatible with approved dB transducers (see transducer spec' sheet)
Approvals	
UL	Certificate Number E257330
CE approval	See EU Declaration of Conformity
Performance	
Accuracy	0.25% of the measured range or 0.24" (6 mm) whichever is greater. ± 2mm for dBR16 & dBR8
Resolution	0.1% of the measured range or 0.08" (2 mm) whichever is greater
Max. range	Dependant on transducer maximum 131.28ft (40m) dB40
Min. range	Dependent upon transducer minimum zero dB Mach 3
Rate response	Fully adjustable
Echo Processing	
Description	DATEM (**D**igital **A**daptive **T**racking of **E**cho **M**ovement)
Outputs	
Analogue output	Isolated (floating) output of 4-20 mA or 0-20 mA into 500Ω (user programmable and adjustable) 0.1% resolution
Digital output	Full Duplex RS232
Volt-free contacts, number and rating	6 form "C" (SPDT) rated at 5A at 115V AC

Display	6 digits plus 12-character text, plus bar graph with direction indicators, remote communicator identifier, and program/run/test mode indicators

Analog Input

Available as an Optional input only	
0-20 or 4-20mA	Isolated (floating) 4-20mA or 0-20mA source, open circuit voltage 33V, 22V at 4mA, 14V at 20mA (user programmable and adjustable) 0.1% resolution

Digital Inputs

7 Digital Inputs	Min. Input Voltage 4.5VDC Max. Input Voltage 30VDC (Max Current 3mA) 24VDC Input Supply maximum total current 24mA.

Programming

On-board programming	By integral keypad
PC programming	via RS232
Programming security	Via passcode (user selectable and adjustable)
Programmed data integrity	Via non-volatile RAM, plus backup

Supply

Power supply	115V AC +5% / -10% 50/60 Hz, dc 18 - 30V (If using a battery then 24V minimum 1AH, dependant on life required, externally fused with 1A fast blow fuse. 10W maximum power (typically 6W)
Overvoltage Category	II
Fuses	
Mains (F1)	125 mA T at 115V AC
DC (Battery) (F2)	1A Thermal (self-resetting after power removed). Not user replaceable
Transducer (F3, F5 Ch.1 & F4, F6 Ch. 2)	Littelfuse 242 series 100mA Part No. 0242.100. This fuse is not user replaceable and has a 4000A breaking capability to comply with certification of the Exm version of dB series transducers.

Pulsar Process Measurement Limited operates a policy of constant development and improvement and reserve the right to amend technical details as necessary.

EU Declaration of Conformity

EU DECLARATION OF CONFORMITY

P U L S A R Ultra Fascia Mount

This declaration of conformity is issued under the sole responsibility of the manufacturer

Relevant Directive(s)	2014/30/EU - EMC Directive and its amending directives 2014/35/EU - Low Voltage Directive and its amending directives 2011/65/EU - RoHS Directive and its amending directives
Manufacturer's Name	Pulsar Process Measurement Ltd
Manufacturer's Address	Cardinal Building, Enigma Business Commercial Centre, Sandy's Road, Malvern, Worcestershire, WR14 1JJ, UK
Apparatus	Pulsar Ultra Fascia including Quantum, Zenith, Ultra 3 & 5, dB Transducer series
Type of Equipment	Measurement and process control
Standards Applied	EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use EN 61326-1:2013 Equipment class, industrial

Signed *JR Allan* Name: Jeff Allan (BSc.) Engineer Pulsar Process Measurement Ltd	Date: 20th June 2017 Rev 4.0

Unpacking

Important Information

All shipping cartons should be opened carefully. When using a box cutter, do not plunge the blade deeply into the box, as it could potentially cut or scratch equipment components. Carefully remove equipment from each carton, checking it against the packing list before discarding any packing material. If there is any shortage or obvious shipping damage to the equipment, report it immediately to Pulsar Process Measurement Limited.

Power Supply Requirements

The ***Zenith 140*** can operate from AC supply or from a DC battery and is designed for use in temperatures between -4ºF to +140ºF (-20ºC to +50ºC). The **AC** is **115V +5% / -10% 50/60Hz**. The **DC** is **18-30V**. In all cases the Zenith 140 will typically consume 6W of power, with a maximum of 10W. If ***Zenith*** has both an AC and DC supply available then the AC supply source will be automatically sensed and used, should the AC supply be removed for any reason then the DC supply will take over.

The AC and DC wiring should be completed using either 16 – 14AWG (1.5–2.5mm^2) stranded or 16 – 14AWG (1.5–4mm^2) solid wire, with all terminals being tightened to 4.5in. lbs. (0.5Nm).

An external supply isolator/circuit breaker (AC or DC) must be fitted near to the unit and labelled to identify the instrument to which it refers.

Safety Symbols

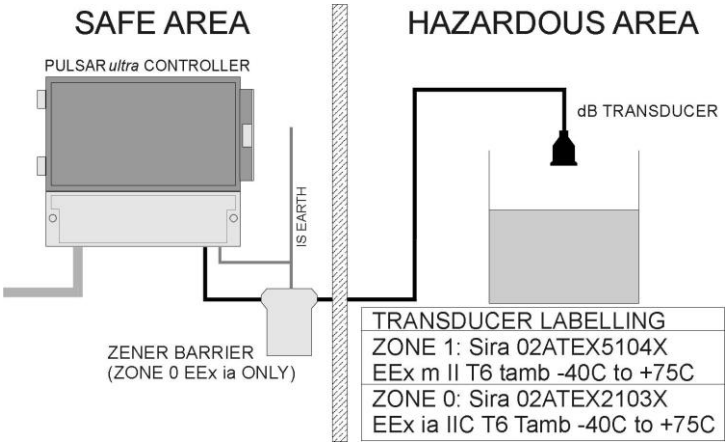
Detailed below are descriptions and meanings of safety/warning symbols that are used on the ***Zenith*** and in this manual.

	Direct Current
	Alternating Current
	Protective Conductor Terminal
	Caution (Refer to accompanying Documents)

Location

> *All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.*

The ***Zenith 140*** must be mounted in a non-hazardous (safe) area, and the transducer fitted in the hazardous area.



FM APPROVED TRANSDUCERS
Class I, Div. 1, Group A, B, C & D
Class II, Div. 1, Group E, F & G

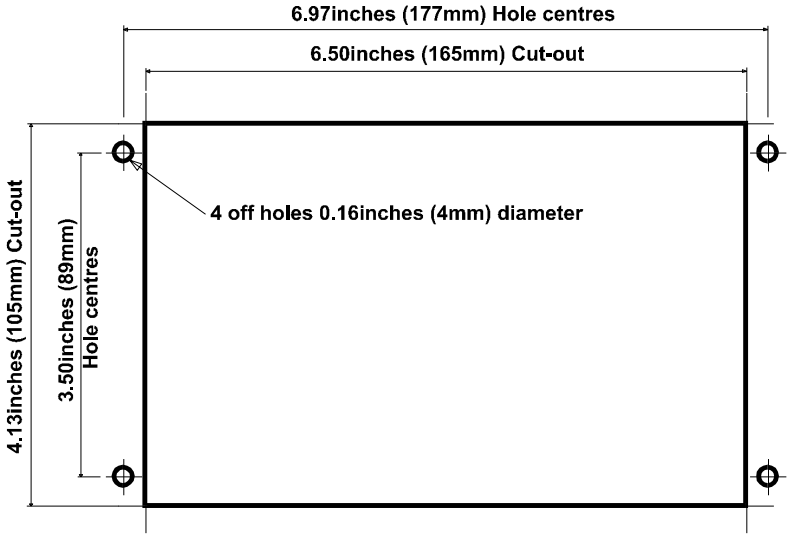
When choosing a location to mount the enclosure, bear in mind the following:

- Ensure that the ***Zenith 140*** is installed in a "Safe", non-hazardous, area.
- For a clear view of the LCD display it is recommended that it is mounted at eye level.
- The mounting surface is vibration-free.
- The ambient temperature is between -4ºF and 140ºF (-20ºC and 50ºC).
- There should be no high voltage cables or inverters close by.

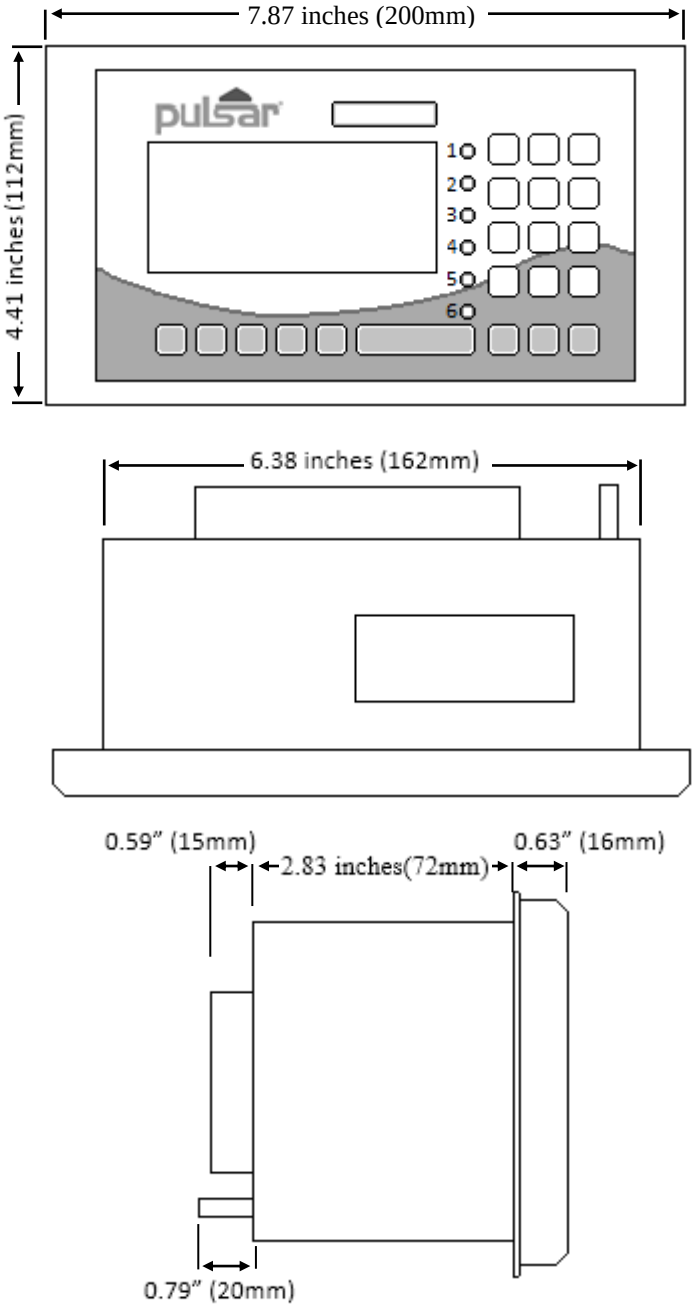
Dimensions

Fascia mount

The fascia mount ***Zenith 140*** should be installed by cutting a hole in the panel as detailed below and securing the unit with the fixings supplied.



The full dimensions of the fascia mount enclosure are as shown below.



Important Information

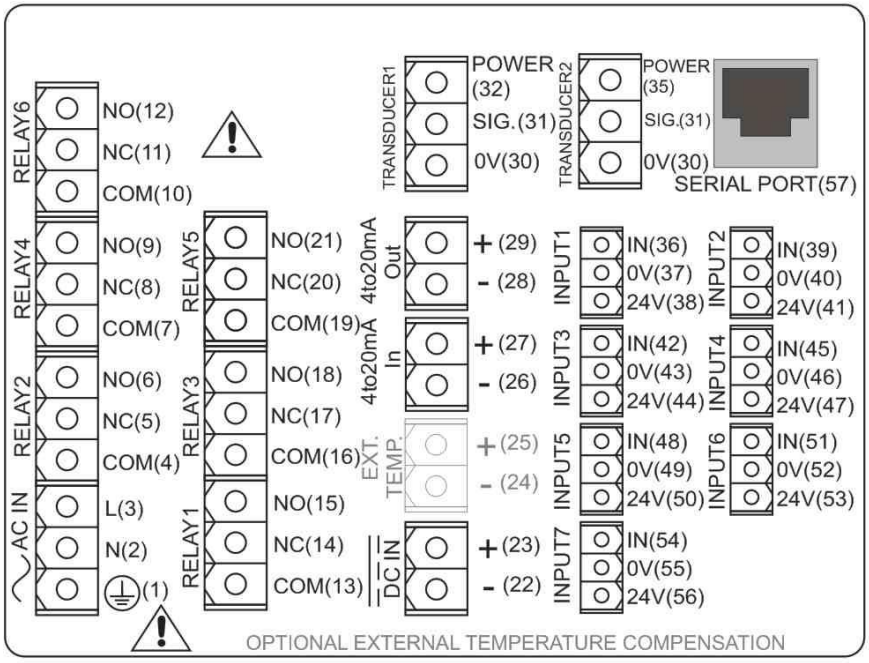
When mounting the fascia mount unit into a panel, in order to maintain the panel IP rating the panel should be of smooth/painted finish and be machined, as per the details contained in this manual.

Fit the unit through the hole then, using the components supplied place a plain washer then a spring washer followed by an elongated nut to each of the 4 off M3 threaded studs and tighten to 2.5lb in. (0.28Nm)

Care should be taken not to overtighten the screws.

Terminal Connection Details

Fascia Mount



Terminal Connections

Important Information

All terminal connection screws should be tightened to 4.5in.lbs. (0.5Nm).

Care should be taken not to overtighten the screws.

Power

The Zenith can operate from mains AC and automatically from DC or battery backup in the event of power failure or can be operated permanently from DC or batteries.

Important Information

The protective earth must be connected prior to any other cabling taking place. In the case of the fascia unit the earth should be connected to the stud at the rear of the enclosure and tightened to 7.4lbF/10Nm.

The AC and DC wiring should be completed using either 16 – 14AWG (1.5–2.5mm^2) stranded or 16 – 14AWG (1.5–4mm^2) solid wire.

An external supply isolator/circuit breaker (AC or DC) must be fitted near to the unit and labelled to identify the instrument to which it refers.

Transducer

The transducer should be installed, and connected, in accordance with the installation instructions contained in the Transducer User Guide.

The entire range of, standard dB transducers are certified for use in hazardous areas and different models, for each, are available for use in Zone 1 or Zone 0.

Wire the transducer to the Zenith's transducer terminals, as follows:

Transducer 1

Terminal Connection Details			
Red Power	White Signal	Black 0 volts	Green Screen
32	31	30	30

Transducer 2

Terminal Connection Details			
Red Power	White Signal	Black 0 volts	Green Screen
35	34	33	33

If splicing, it is recommended using a junction box with standard twisted, shielded pair at 20 AWG.

When using 2 core screened extension cable, the Black and Green wires of the transducer should be connected to the screen of the extension cable, which in turn should be connected to the relevant 0 volts terminal (Terminal 30 or 33)

When installing a transducer in a hazardous area use an approved transducer suitable for the proposed application as detailed below:

FM

For **EEx m** (**Zone 1)** applications a transducer certified to **FM Class I Div 1 Group A, B, C & D, ClassII Div 1 Group E, F & G, Class III** is used, and must be supplied via a 1500A breaking fuse, which is fitted as standard to the Zenith 140.

Restrictions do not use in the presence of these groups of Chemicals, Aliphatic Hydrocarbons, Ketones or Esters

For **EEx ia** (**I.S.)** a transducer certified to **FM Class I Div 1 Group A, B, C & D, ClassII Div 1 Group E, F & G** is used, which must be connected to the Zenith 140 via an external Zener barrier.

ATEX

For **EEx m** (**Zone 1)** applications a transducer certified to **Sira 02ATEX5104X** is used, and must be supplied via a 4000A breaking fuse, which is fitted as standard to the Zenith 140.

For **EEx ia** (**Zone 0)** a transducer certified to **Sira 02ATEX2103X** is used, which must be connected to the Zenith 140 via an external Zener barrier.

See transducer label for certification details.

Important Information

Please note that if the output of the ultrasonic transducers used with the ***Zenith 140*** are capable of emitting sound pressure levels in excess of 85dBA (above a reference sound pressure level of 20µPA), then the Zenith 140 must be located remote from the transducer such that a sound pressure level of 85dBA is not exceeded when standing at the Zenith 140 in the operator's position.

Single Transducer mode is used to measure space, level, distance or volume and the transducer should be **connected** to **Transducer 1** input terminals.

Dual Transducer mode is used to measure **Differential** and **Average**. For **Differential**, the **upstream** transducer should be **connected** to **Transducer 1** input terminal and the **downstream** transducer to **Transducer 2** input terminal. In cases where the ***Zenith*** is required to measure **Average**, then transducers can be **connected to either one**.

Relay Outputs

The six relays can be programmed for a variety of alarms, pump control, or other process functions. The relay contacts are all rated at 5A at 115V AC.

Wiring should be completed by using suitable cable, to meet the specified 115V AC 5A contact rating, up to maximum size of 14AWG.

All connections should be such that the short circuit capacity of the circuits to which they are connected, is limited by fuses rated so that they do not exceed the relay rating.

Current Output

This is an isolated (floating) mA output (to 150V) of 4 - 20mA or 0 - 20mA and the load should not exceed 500 Ω.

Current Input

The current input is an isolated (floating) mA input (to 150V), 4 - 20mA or 0 -20mA source, open circuit voltage 33V; 22V at 4mA; 14V at 20mA.

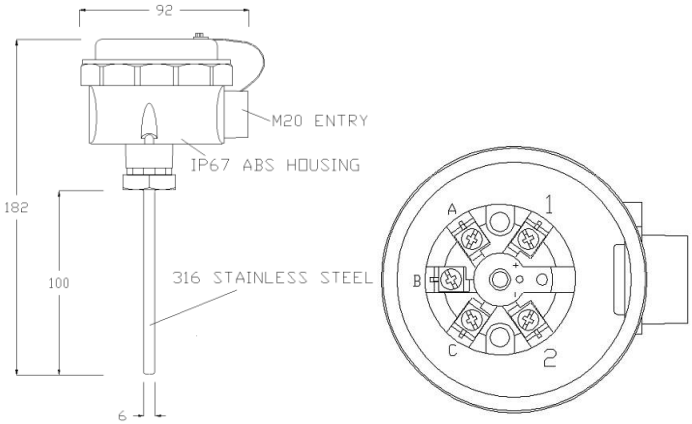
Temperature Input (Optional)

The external temperature sensor allows more localised compensation of the measured distance due to changes in temperature.

There are two models, Type A and Type B as follows:

Type A	-25ºC to 50ºC
Type B	-25ºC to 125ºC

The temperature sensor should be placed close to the point of measurement.



The unit is connected as follows:

Description	Temperature Sensor	Zenith Fascia Mount
Power Supply	Terminal 1	Terminal 25
Return	Terminal 2	Terminal 24

Temp Source (P852), should be set to option 4 or 5 depending on the sensor range, set 4 for type A and 5 for type B (see above), the range is specified on the label of the sensor.

Digital Inputs

Where the ***Zenith 140*** is required to provide power for a Device Input the appropriate Digital Input should be wired between the 24VDC supply terminal and the IN terminal. (TOTAL maximum current available, for all seven digital inputs, from the 24VDC supply is 24mA). When Device Inputs are self powered, connection of the device should be made between the Common terminal and the IN terminal. (Min Input voltage 4.5VDC and Maximum Input voltage 30VDC with a maximum current of 3mA).

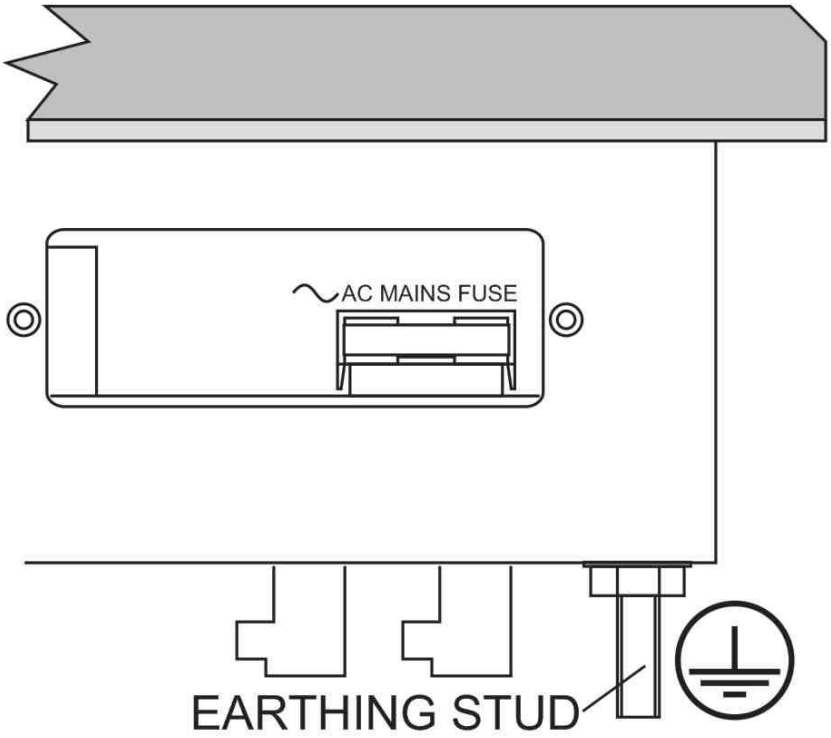
RS232 Serial Interface

If required, you can connect to the serial interface, to operate your ***Zenith 140*** remotely.

Fuse Location

Fascia mount

The fuse is located under the removable cover at the bottom of the unit, as illustrated below.



Important Information

The rear metal case of the fascia unit must be connected to earth via the earthing stud located on the rear of the unit, see drawing above, using wiring to meet local requirements.

Before applying AC power (mains), make sure the supply is 115V AC.

Never operate the ***Zenith 140*** with terminal access exposed.

An external switch or circuit breaker should be installed near to the Zenith to allow the supply to be removed during installation and maintenance. In addition, the relay contacts should also have a means of isolating them from the Zenith.

Interconnecting cables must be adequately insulated in accordance with local regulations. Strip back 30 mm of the outer insulation of the cable. Strip 5 mm of insulation from the end of each conductor. Twist all exposed strands of the conductor together. Insert the stripped conductor into the terminal block as far as it will go and tighten the terminal block screw. Ensure that all strands are firmly clamped in the terminal block and that there is no excess bare conductor showing, and no stray strands.

Important Information

If the equipment is installed or used in a manner not specified in this manual, then the protection provided by the equipment may be impaired.

Preparation for Operation

Before switching on, check the following:

- ✓ Zenith is mounted correctly and is in a 'safe' area.
- ✓ The power supply is correctly installed.
- ✓ The relays are connected correctly.

Maintenance

There are no user serviceable parts inside Zenith, except the mains fuse. If you experience any problems with the unit, then please contact Pulsar Process Measurement for advice.

Important Information

Please note that the on-board Lithium battery, mounted to the processor PCB, is not user serviceable.

To clean the equipment, wipe with a damp cloth. Do not use any solvents on the enclosure.

Important Information

The unique DATEM software comes into operation as soon as power is applied and is designed to monitor a **moving level** or **target** with the **transducer** in a **fixed position.**

If, after any period of use, it should become necessary to move the transducer, for any reason, from its original operating position, switch off the ***Zenith 140***, before proceeding, in order to prevent any undesirable updates to the DATEM trace. If after moving the transducer the reading is not as expected, please refer to **Chapter 7 Troubleshooting**.

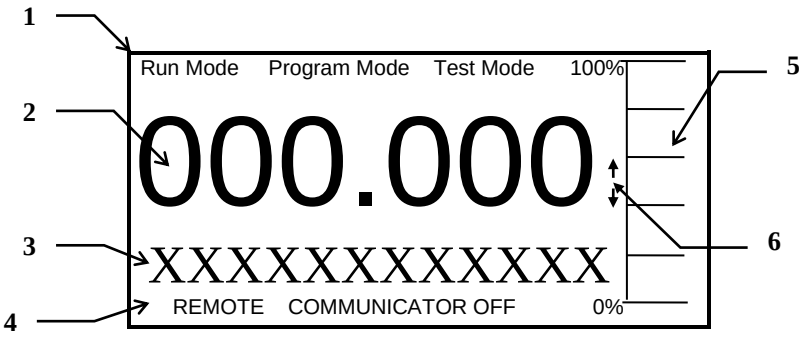
Quick Setup

If you are already familiar with the controls of the ***Zenith 140***, go straight to the quick setup guide in Chapter 4.

Operating the Controls

Display

The display provides information on the current mode of operation, and status of the remote communication. While in the Run Mode it will display the current level reading and its units of measure, along with status messages with regards to the Transducer, Echo reception and Fail-Safe Mode. Additionally, it can be programmed to provide status messages on alarms, pumps etc. When in the Program Mode the display is used to read information on the Menu System, Parameter Number and parameter details and values, which can be entered. During Test Mode, the display is used to monitor the simulated level. A bar graph is also provided which will provide a visual reading of the level, in percentage of span.



1) Mode status enunciator displays the current mode of operation.

2) Main 6-digit display:
Run Mode - current measurement displayed, dependent on mode and measurement unit's chosen, and value of Hot Key function selected.
Program Mode - displays parameter number and values entered for parameters.
Test Mode - displays simulated level.

3) Auxiliary Display (scrolling twelve-digit display)
Run Mode - displays measurement units (P104), status messages on signal and transducer and detail of Hot Key function selected. It can also be programmed to provide notification messages on alarms, pumps etc. (For full details please refer to ***Display Parameters*** in Chapter 5.)
Program Mode - displays Menu and Sub Menu headings, parameter details and options.

4) Communicator status enunciator displays the current status of optional remote PC connection.

5) Bargraph display gives visual indication of measurement in % of span.

6) Level indicators
Run Mode - indicates in which direction the level is moving.
Program Mode - indicates at which level, of the menu system, you are currently at.

There are two main operating modes for your ***Zenith 140***, **Run Mode** and **Program Mode**. There is also a **Test Mode**, used for checking the set-up. All modes are now described.

Run Mode

This mode is used once the ***Zenith 140*** has been set up in program mode. It is also the default mode that the unit reverts to when it resumes operation after a power failure.

When the ***Zenith 140*** is switched on for the first time, it will display, in metres, the distance from the transducer face to the target. All relays by default are switched off.

After programming is complete, any relays that are set will operate when the level reaches the relevant setpoint, and the LED's will change colour (unless specifically switched off).

Program Mode

This mode is used to set up the ***Zenith 140*** or change information already set. You must use either the built-in keypad (standard) or alternatively the unit can be set up with a PC via the RS 232 Serial Interface (optional).

Entering a value for each of the parameters that are relevant to your application provides all the programming information.

How to Access Program Mode

To enter **program mode**, you simply enter the passcode, via the keypad, followed by the ENTER key. The **default passcode** is **1997**, so you would press the following:

Note

There is a time-out period of 15 minutes when in **program mode**, after which time **run mode** will be resumed if you do not press any keys.

Hot Keys

There are five hot keys on the keypad, which can be used to quickly access common parameters for viewing only, while in Run Mode. Pressing the hot key once will display the first parameter, then repeated pressing will display the others, after which the Zenith reverts to Run Mode. In Program Mode, they have different functions, the functions are shown below.

Hot Key	Run Mode	Program Mode
	Total pump running hours and individual pump running hours.	Not used in ***Zenith 140***.
	Displays echo confidence, echo strength, H.A.L.L., average noise, peak noise.	Not used in ***Zenith 140***.
	Total number of pump starts, and individual pump starts.	Reset parameter to default setting.
	Instantaneous mA output.	Not used in ***Zenith 140***.
	Dependant on application displays Distance, Level, Space, Volume or rate of change of level.	Toggles the relay setpoints between units of measure and % of span.
	Reset for digital inputs	Takes you to the last parameter edited, when you first enter program mode.
	Gives details of unit type, software revision and serial number.	Enter Decimal Point

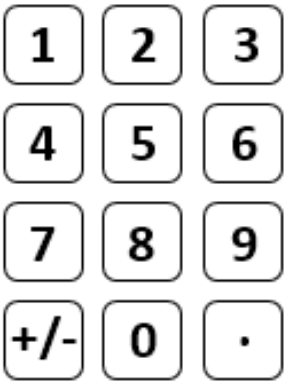
Menu Keys

The menu keys are used to navigate around the built in menu system and have the following functions:

Menu Key	Function
	1) Arrow keys for moving left and right around the menu system. 2) Used in test mode to simulate the level moving up and down.
	1) Used to confirm each action (for example select a menu option) or when entering a parameter number or value. 2) Used to confirm questions asked by your Zenith 140 such as before restoring factory defaults.
	1) Used to navigate up a level in the menu system, and back to run mode. 2) Used to cancel a value entered in error.

Numeric Keys

These keys are used for entering numerical information during programming.

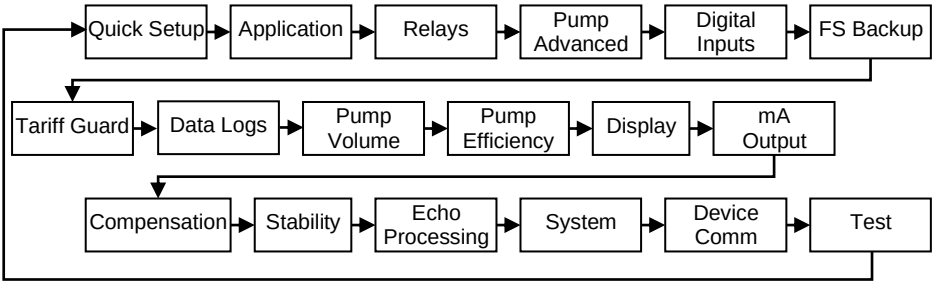


There are two means of editing parameters; directly or using the menu system. Each is now described below.

Using the Menu System

The menu system has been designed to make the changing of parameters very simple. There are two levels of menu: **Main Menu** and **Sub Menu**.

On the display, there is a line of text that displays the menu system. Pressing the arrow keys scrolls the display between the top-level menu items, (as shown below, starting at Quick Setup).



As you press the cursor keys to scroll left and right between these, you can press **ENTER** at any time to select it and take you to the sub-menu.

Each of these options, along with their sub-menus are described in Chapter 5, **Error! Reference source not found.**. When you move down into the sub-menu, you can scroll round using the arrow keys, and press **ENTER** to go to the required section of parameters.

Once you have reached the relevant section, scroll through the parameters, and enter the necessary information. To enter the information, use the numeric keys and press **ENTER** when you will see the message "**Saved**!" If you press **CANCEL**, then the change you made will not be saved, and the message "**Unchanged**!" will be displayed.

When you have finished, press **CANCEL** to go back to the previous level. When you have reached the top level, then the Zenith 140 will ask for confirmation before allowing you to go back into run mode. This is done by pressing **ENTER** at the display prompt.

Note

You can tell which part of the menu system you are in, as the up/down arrows next to the bar graph will indicate as follows:

- **Top level menu**: **Down arrow on**, to indicate you can move down.
- **Sub-menu**: **Up and Down arrows on**, to indicate you can move up to the top level, and down to parameter level.
- **Parameter Level**: **Up arrow on**, to indicate you can move up to sub-menu level.
- **Parameter Editing**: **No arrows** on.

Directly Editing Parameters

If you already know the number of the parameter that you wish to look at or edit, simply type the number in at any time while you are in the menu system. Thus, if you are in either the menu or sub-menu level, by pressing a numeric key you can enter the parameter number directly and jump straight there. You cannot type a parameter number while at parameter level, only at one of the two menu levels.

When you are at a parameter the text line rotates automatically displaying the parameter name, number, the applicable units and the maximum and minimum figure you can enter. The top line shows the value you are setting.

Once you have accessed a parameter you can either just look at it, or change it.

Once a parameter has been changed, press **ENTER** and you will see the message "**Saved!**". If you press **CANCEL**, then the change you made will not be saved, and the message "**Unchanged!**" will be displayed.

When you have saved a parameter, you are automatically moved to the next one on the list.

TIP

You can jump straight to the last parameter you edited, by pressing '+/-' when you first enter program mode.

Test Mode

Test mode is used to simulate the application and confirm that all parameters and relay setpoints have been entered as expected. During simulation there is a choice of whether the relays will change state (hard simulation) or not (soft simulation), but the LED's will always change colour as programmed, and the mA output will change in accordance to the chosen mode of operation. If you wish to test the logic of the system that the **relays are connected** to then select **hard simulation**, but if you **don't want to change the relay state**, then select a **soft simulation**.

There are two simulation modes, automatic and manual. Automatic simulation will move the level up and down between empty level or the pre-determined **Start Level (P983)** and Pump/Control relay switch points, if you wish to change the direction of the level movement e.g. to go beyond relay setpoints, this can be done by using the arrow keys. In manual simulation, using the arrow keys will allow you to move the level up and down as required.

To enter simulation, first go to **program mode.** Then, using the menu system, select menu item '**Test**', then sub-menu item '**Simulation**'. Simply change the value of the parameter **P980** to one of the following:

1= Manual soft simulation
2= Automatic soft simulation
3= Manual hard simulation
4= Automatic hard simulation

To return to program mode, press **CANCEL** and test mode will end.

When in **manual** simulation, by default test mode will move the level by 0.328 feet steps. Altering the **increment (P981)** will change this value.

In **automatic** mode, the rate at which the level moves up and down is set by the **increment** (**P981**) in feet, and the **rate** (**P982**) in minutes, which can be changed to make the level move up and down faster. E.g. if **increment** (**P981**) is set to 0.328 feet and **rate** (**P982**) is set to 1 min then the level will increase or decrease at a rate of 0.328feet/min. To make the simulated level move slower, decrease the value in **increment** (**P981**) or increase the value in **rate** (**P982**). To make the simulated level move faster, increase the value in **increment** (**P981**) or decrease the value in **rate** (**P982**).

While in Automatic hard simulation (**P980 = 4**) the switching of digital inputs can be simulated by pressing the corresponding numeric key to the input to be switched, each time the numeric key is pressed it will toggle the input between On and Off.

Using the RS232 Serial Interface

The RS232 serial interface is used to communicate between the ***Zenith 140*** and a PC using the optional Ultra PC and other associated Pulsar software packages, to obtain information such as data logging and view echo traces upload, download and save parameter files. In addition, it can also be used to control or obtain information using a standard PC or other computer based equipment. To do so, the settings for control are as follows: **baud rate 19,200**, **8 data bits**, **no parity**, **1 stop bits**.

The device should be connected, via the serial port, as shown in **Chapter 2 Installation**.

To use the device remotely, you need to **log on** to start, and **log off** when finished. When **logged on**, ***Zenith 140*** will show '**Remote ON**' on the display, and "**Communicator OFF**" when **logged off**.

All commands should be followed by a carriage return.

The unit will respond either OK (or a value) if the command is accepted, or NO if it is not.

To log on, send the command

/ACCESS:pppp where pppp is the passcode (P922).

To log off, send the command

/ACCESS:OFF

To read a parameter value, send the command

/Pxxx where xxx is the parameter you wish to read, and the ***Zenith 140*** will respond with the parameter value.

To set a parameter, send the command

/Pxxx:yy where xxx is the parameter number, and yy is the value you wish to set it to.

Examples of other commands you can use are:

/LEVEL (shows current level)

/SPACE (shows current space)

/TEMPERATURE (shows current temperature)

/CURRENTOUT (show the mA output value)

/CURRENTIN (show the mA input value)

/BACKUP1 (take backup of parameters to area 1)

/BACKUP2 (take backup of parameters to area 2)

/RESTORE1 (restore parameters from area 1)

/RESTORE2 (restore parameters from area 2)

Factory Defaults

Factory Defaults

When first installing the ***Zenith 140***, or subsequently moving or using the unit on a new application, before proceeding to program the unit for its intended application it is recommended that you ensure that all parameters are at their default values by completing a **Factory Defaults P930,** as described in Chapter 5 **Parameter Guide**.

When you first switch the ***Zenith 140*** on, it will be reading the **distance** from the face of the transducer to the surface. It will be indicating in **metres**, as shown on the display. All relays are set OFF.

The **date** (P931) and **time** (P932) in the ***Zenith 140*** were set at the factory, but may need checking, and amending if, for example the application is in a time zone other than GMT, see Chapter 5 **Parameter Guide** for full details.

TIP

In some applications, it is simplest to empty the vessel, take a reading from the *Zenith 140* for distance and then setup the empty level to this figure.

Once you are satisfied with the installation, and the ***Zenith 140*** is reading what you would expect in terms of distance from the face of the transducer to the material level, then you can proceed with programming, for the intended application. It is sensible to program all of the required parameters at the same time. The system will be then set-up.

Note that the span is automatically calculated from the empty level, so the empty level should be entered first.

This quick set-up guide shows you how to get up and running in a few minutes in just four easy steps after installing your ***Zenith 140***.

Enter Program Mode

First you need to go from run mode into program mode. Assuming the passcode is the default 1997, then you should enter this.

Choose Quick Setup

Now you need to go into the quick setup. You will see on the menu the words 'Quick Setup', which is the first item on the menu system. Try pressing the two arrow keys to see some more menu options, but return to Quick Setup, and press

This takes you to the common applications parameter (P200).

This takes you to the common applications parameters, and you will see some options appearing on the display.

Note

If you have already setup a common application, then there will be a number shown other than 0, and you will see messages showing what the current setup is. If you want to reset this and start again, press 0 (which will reset all the quick setup parameters), otherwise pressing ENTER will allow you to edit the parameters that have been set.

Choose Your Application

There are four categories of application, which are all described at the end of this chapter. They are **level**, **pump down** (sump control), **pump up** (reservoir control) or **customised**, all with the choice of alarms and a number of pumps, dependant on application.

If you want to set-up a basic **level monitoring** application, as described in the following **example 1**, then choose 1. You then need to decide the **number of alarms** required and their **function** and choose the appropriate options.

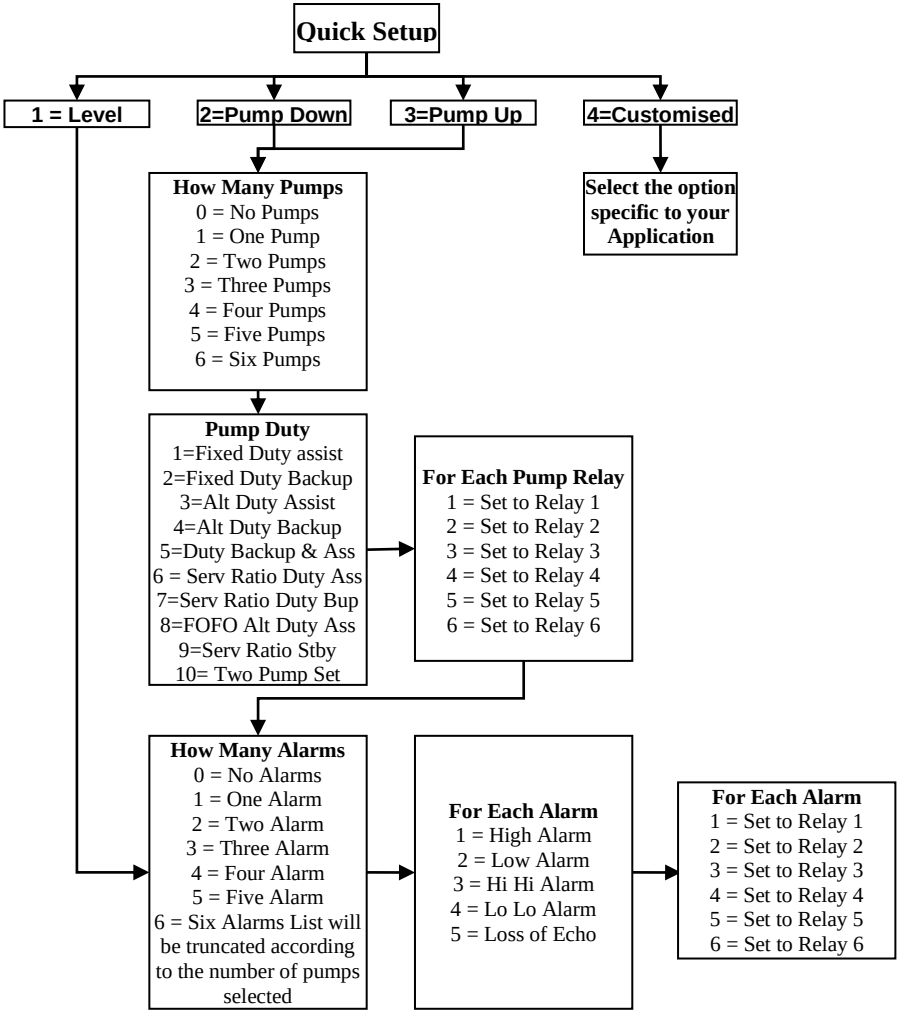
If you want to set-up a **pump down** (sump control) application, as described in the following **example 2**, then choose 2. You then need to decide the **number of pumps** required the **pump duty** and any requirement for **alarms** and choose the appropriate options.

If you want to set-up a **pump up** (reservoir control) application, then choose 3. You then need to decide the **number of pumps** required the **pump duty,** and any requirement for **alarms**, and choose the appropriate options.

In certain cases, the Quick Setup Menu has been **customised** for particular customer specific applications, to choose one of these options press 4 and select the appropriate **customised** application and enter the details required as prompted.

Once you have chosen your application you will be asked a series of questions which are answered by choosing the appropriate option as detailed in the flow charts that follow. Once all the questions have been answered you will be prompted to provide further information, as detailed in the tables that follow, in order to complete the programming of the unit.

The Quick Setup Menu detailing the questions you are asked, when setting up your ***Zenith 140***, via the Quick Setup is shown below.



Choose Your Application

Once you have chosen the application, you will see a '**Wait**…' message while the parameters are all calculated and stored. Next you will see the parameters needed to finalise your application, in turn, as shown below. If you know you don't need to change from the default, you can use the right arrow key to scroll through them, but if you want to view or change each one, just press ENTER.

Parameter	Default	Description
P101 Transducer	2 = dB6	Type of transducer being used.
P104 Measurement Units	4 = feet	Select units to be used for programming measurement information.
P105 Empty Level	19.685 feet	Distance from the face of the transducer to the material at the bottom of the vessel.
P106 Span	18.701 feet	Distance from the empty level (0% full) to span (100% full).

Now you will see a scrolling message that says '**Hit Enter for More Details**'. If you press ENTER, you will then see more parameters, specific to the application you have chosen, these are all factory preset. If you press any other key you will return to the Quick Setup menu, where you can press CANCEL to return to run mode.

If you want to change any of the factory preset parameters, then you can do so, referring to the relevant page of Chapter 5**, Parameter Guide**, in this handbook for detailed information. The parameters concerned are as follows:

Parameter	Default	Description
P213 / P214 Relay 1 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Level control. Depends on application.
P223 / P224 Relay 2 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Level control. Depends on application.
P233 / P234 Relay 3 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Level control. Depends on application.
P243 / P244 Relay 4 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Level control. Depends on application.
P253 / P254 Relay 5 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Pump control. Depends on application.
P263 / P264 Relay 6 ON/OFF setpoints	Factory preset as a % to appropriate level according to the span already entered. See tables below	Either Alarm or Level control. Depends on application.
P830 mA Out Range	2= 4 to 20 mA	Determines the mA output range. 0 = Off, 1 = 0 to 20mA, **2 = 4 to 20mA**, 3 = 20 to 0mA, 4 = 20 to 4mA.
P870 Fill Damping	32.80 feet/min	Rate of maximum fill rate (set above the actual fill rate of the vessel).
P871 Empty Damping	32.80 feet/min	Rate of maximum empty rate (set above the actual empty rate of the vessel).

The default values used for determining the relay setpoints, when setting alarms and pumps, via the Quick Setup menu are entered as a % of span and are as follows.

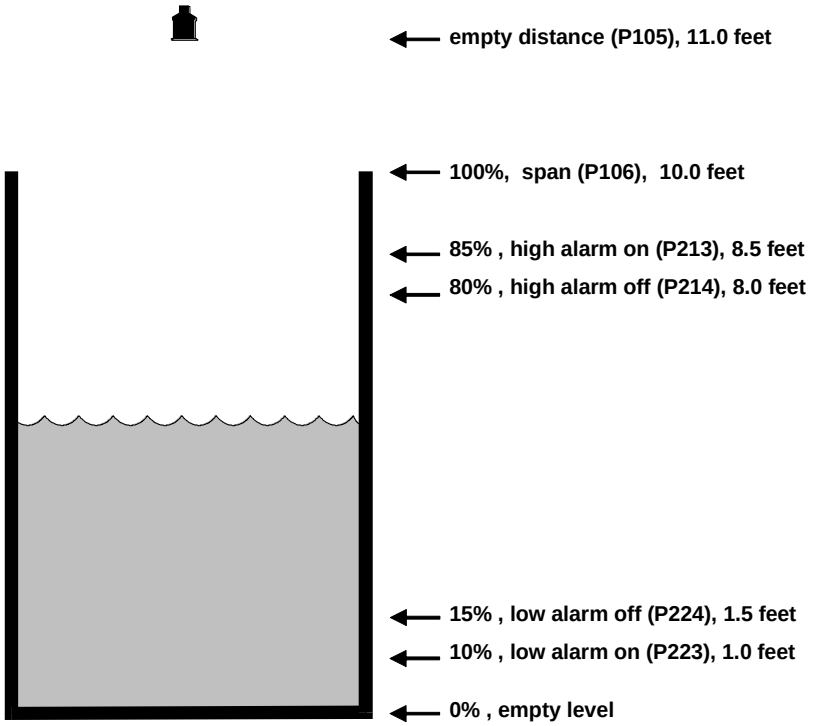
Application	Number of Pumps	Pump Number	On Setpoint	Off Setpoint
Pump Down	One	Pump 1	50%	20%
Pump Down	Two	Pump 1 Pump 2	50% 70%	20% 20%
Pump Down	Three	Pump 1 Pump 2 Pump 3	50% 60% 70%	20% 20% 20%
Pump Down	Four	Pump 1 Pump 2 Pump 3 Pump 4	40% 50% 60% 70%	20% 20% 20% 20%
Pump Down	Five	Pump 1 Pump 2 Pump 3 Pump 4 Pump 5	40% 50% 60% 70% 75%	20% 20% 20% 20% 20%
Pump Down	Six	Pump 1 Pump 2 Pump 3 Pump 4 Pump 5 Pump 6	40% 50% 60% 70% 75% 80%	20% 20% 20% 20% 20% 20%

Application	Number of Pumps	Pump Number	On Setpoint	Off Setpoint
Pump Up	One	Pump 1	50%	80%
Pump Up	Two	Pump 1 Pump 2	50% 30%	80% 80%
Pump Up	Three	Pump 1 Pump 2 Pump 3	50% 40% 30%	80% 80% 80%
Pump Up	Four	Pump 1 Pump 2 Pump 3 Pump 4	60% 50% 40% 30%	80% 80% 80% 80%
Pump Up	Five	Pump 1 Pump 2 Pump 3 Pump 4 Pump 5	60% 50% 40% 30% 25%	80% 80% 80% 80% 80%
Pump Up	Six	Pump 1 Pump 2 Pump 3 Pump 4 Pump 5 Pump 6	60% 50% 40% 30% 25% 20%	80% 80% 80% 80% 80% 80%

Relay Function	Relay I.D.	On Setpoint	Off Setpoint
Alarm	HiHi	90%	85%
Alarm	High	85%	80%
Alarm	Low	10%	15%
Alarm	LoLo	5%	10%

Example 1 Level Monitoring with Alarms

A vessel, containing a liquid that has a variation in level that is to be monitored, with a high-level alarm set on Relay 1, and low-level alarm set on Relay 2.



In this example, when the level rises to 8.5 feet relay 1 will come on until the level drops to 8.0 feet when it will turn off. If the level drops to 1.0 feet, then relay 2 will come on until it rises 1.5 feet when it will turn off.

The display will show the level in the tank.

The mA output will be representative of level where 4mA = empty level (0%) and 20mA = 10.0 feet (100%).

To program the ***Zenith 140*** for **Example 1 Level Monitoring with alarms** by using the **Quick Setup** menu proceed as follows.

Access the **Program Mode**

Key in the **passcode** 1997 and press **ENTER**

At the **Quick Setup** menu press **ENTER** and as prompted, by the questions, select the relevant option and **ENTER**.

Question	Option
Level/Pump/Custom	1 = Level App.
No. of Alarms	2 = 2 Alarms
Type Alarm 1	1 = High
Alarm No 1	1 = Set Relay 1
Type Alarm 2	2 = Low
Alarm No 2	2 = Set Relay 2
Xducer (P101)	2 = dB6
Material (P102)	1 = Liquid
Measnt Units (P104)	4 = Feet
Empty Level (P105)	11.0 (feet)
Span (P106)	10.0 (feet)

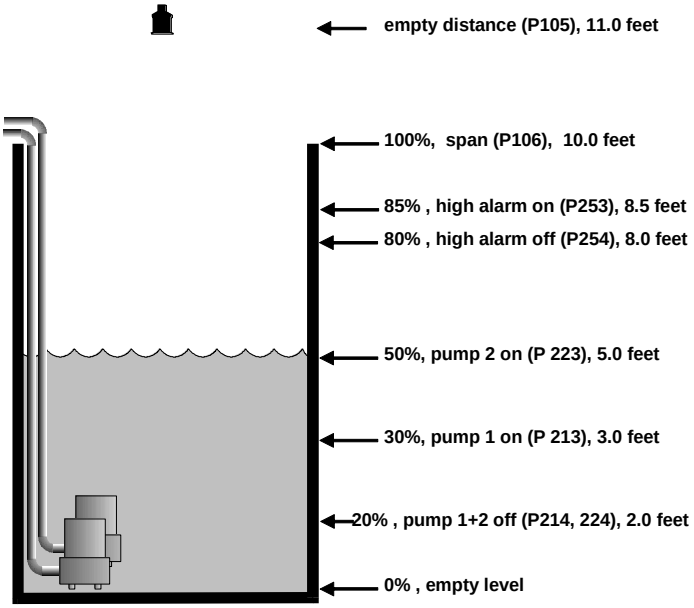
Programming is now complete, and the unit can be returned to the run mode, press **CANCEL** until **Run Mode?** Is displayed on the LCD press **ENTER**, and the Zenith 140 will return to the **Run Mode**.

Note

If relay setpoints do not meet the exact requirements of the application, they can be modified to suit by pressing ENTER when, "For More Options Hit Enter", is displayed, and entering new values to relay setpoints as required. Alternatively, the relevant relay setpoint can be accessed either by the main menu system or directly via parameter number and changed as necessary.

Example 2 Sump Control (pump down)

A sump is typically used to temporarily hold water or effluent, and when the level reaches a specific point, the sump is pumped down, with the fluid being transferred to another process.



In this example, there are two pumps, which will be set to **alternate duty assist**, so they come on alternately. Pump 1 is to be set to relay 1, pump 2 to relay 2, and the high-level alarm to relay 5.

This will operate as follows. During normal operation, **pump 1** will come on at 3.0 feet, and pump down to 2.0 feet. The setpoints are then shifted to **pump 2**, which will come on first next time.

During peak periods, when **pump 1** cannot cope, **pump 1** will come on at 3.0 feet, **pump 2** will come on at 5.0 feet, and pump down to 2.0 feet. The setpoints are then shifted to **pump 2**, which will come on **first next time**.

If neither pump can cope, and the level rises to 8.5 feet, then the alarm relay (relay 5) will come on and go off when the level falls to 8.0 feet. This will indicate insufficient capacity of the pumps.

The display will show the level in the sump and the mA output will be representative of level where 4mA = empty level (0%) and 20mA = 10.0 feet (100%)

To program the Zenith 140 for **Example 2 Sump control (pump down)** using the **Quick Setup** menu proceed as follows.

If required access the **Program Mode**

Key in the **passcode** 1997 and press **ENTER**

Using the 'right' arrow key go to **Quick Setup** menu press **ENTER** and as prompted, by the questions, select the relevant option and **ENTER**.

Question	Option
Level, Pump Up or Down	2 = Pump Down
No. of Pumps	2 = 2 Pumps
Pump Duty	3 = Alt DutAss
Pump No. 1	1 = Set to Relay 1
Pump No. 2	2 = Set to Relay 2
No. of Alarms	1 = 1 Alarm
Type Alarm 1	1 = High
Alarm No.1	5 = Set to Relay 5
Xducer (P101)	2 = dB6
Measnt Units (P104)	4 = feet
Empty Level (P105)	11.0 (feet)
Span (P106)	10 (feet)

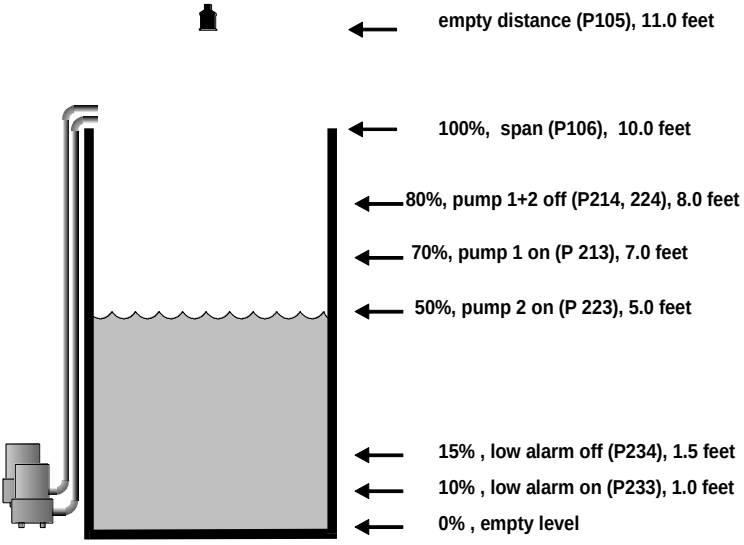
Programming is now complete, and the unit can be returned to the run mode, press **CANCEL** until **Run Mode?** Is displayed on the LCD press **ENTER**, and the Vantage 100 will return to the **Run Mode**.

Note

If relay setpoints do not meet the exact requirements of the application, they can be modified to suit by pressing ENTER when, "For More Options Hit Enter", is displayed, and entering new values to relay setpoints as required. Alternatively, the relevant relay setpoint can be accessed either by the main menu system or directly via parameter number and changed as necessary.

Example 3 Reservoir Control (pump up)

A reservoir is typically used to temporarily hold liquid, and when the level reaches a specific low point, the reservoir is pumped up.



In this example, there are two pumps, which will be set to alternate duty assist, so they come on alternately. Pump 1 is to be set to relay 1, pump 2 to relay 2, and the low-level alarm to relay 3.

This will operate as follows:

During normal operation, **pump 1** will come on at 7.0 feet, and pump up to 8.0 feet. The setpoints are then shifted to **pump 2**, which will come on **first next time**.

During peak periods, when **pump 1** cannot cope, **pump 1** will come on at 7.0 feet, **pump 2** will come on at 5.0 feet and pump up to 8.0 feet. The setpoints are then shifted to **pump 2**, which will come on **first next time**.

If both pumps cannot cope, and the level falls to 1.0 feet, then the alarm relay (relay 3) will come on and go off when the level rises to 1.5 feet. This will indicate insufficient capacity of the pumps.

The display will show the level in the sump and the mA output will be representative of level where 4mA = empty level (0%) and 20mA = 10.0 feet (100%)

To program the Zenith 140 for **Example 3 Reservoir Control (pump up)** by using the **Quick Setup** menu proceed as follows.

If required access the **Program Mode**

Key in the **passcode** 1997 and press **ENTER**

Using the 'right arrow key, go to **Quick Setup** menu press **ENTER** and as prompted, by the questions, select the relevant option and **ENTER**.

Question	Option
Level, Pump Up or Down	3 = Pump Up
No. of Pumps	2 = 2 Pumps
Pump Duty	3 = Alt DutAss
Pump No. 1	1 = Set to Relay 1
Pump No. 2	2 = Set to Relay 2
No. of Alarms	1 = 1 Alarm
Type Alarm 1	2 = Low
Alarm No.1	3 = Set to Relay 3
Xducer (P101)	2 = dB6
Measnt Units (P104)	4 = feet
Empty Level (P105)	11.0 (feet)
Span (P106)	10 (feet)

Programming is now complete, and the unit can be returned to the run mode, press **CANCEL** until **Run Mode?** Is displayed on the LCD press **ENTER**, and the Vantage 100 will return to the **Run Mode**.

Note

If relay setpoints do not meet the exact requirements of the application, they can be modified to suit by pressing ENTER when, "For More Options Hit Enter" is displayed, and entering new values to relay setpoints as required. Alternatively, the relevant relay setpoint can be accessed either by the main menu system or directly via parameter number and changed as necessary.

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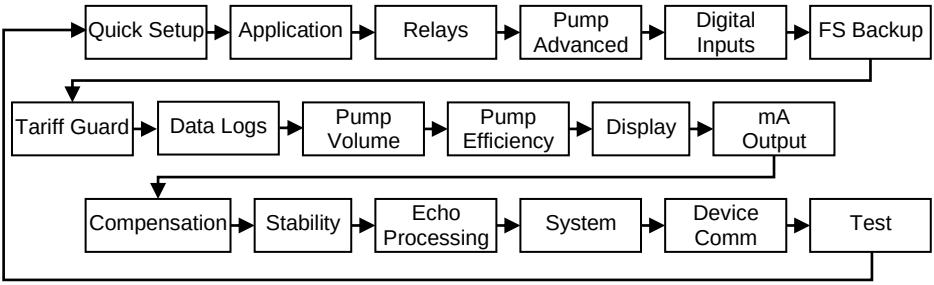
Chapter 5 Parameter Guide

This chapter describes all of the parameters in your Zenith 140, in numerical order.

Menu System Diagrams

Shown below is a set of charts to show you how all the various parts can be found using the menu system.

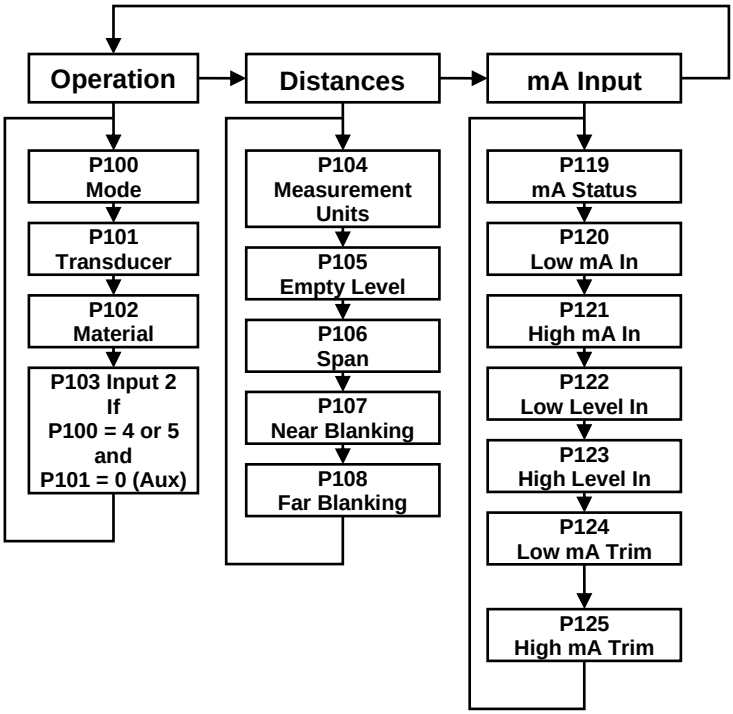
Top Level Menu



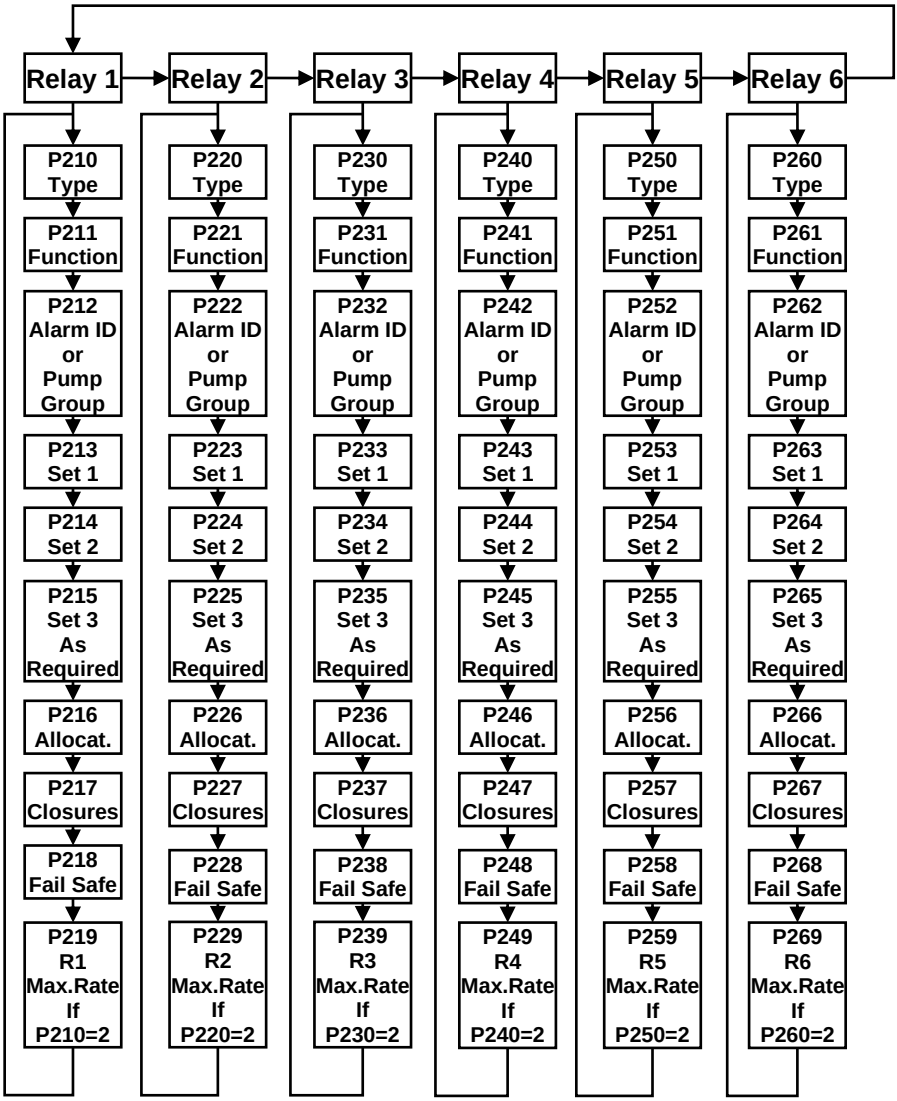
Note

FS Backup is only available in units with firmware version 7.4.3 and higher.

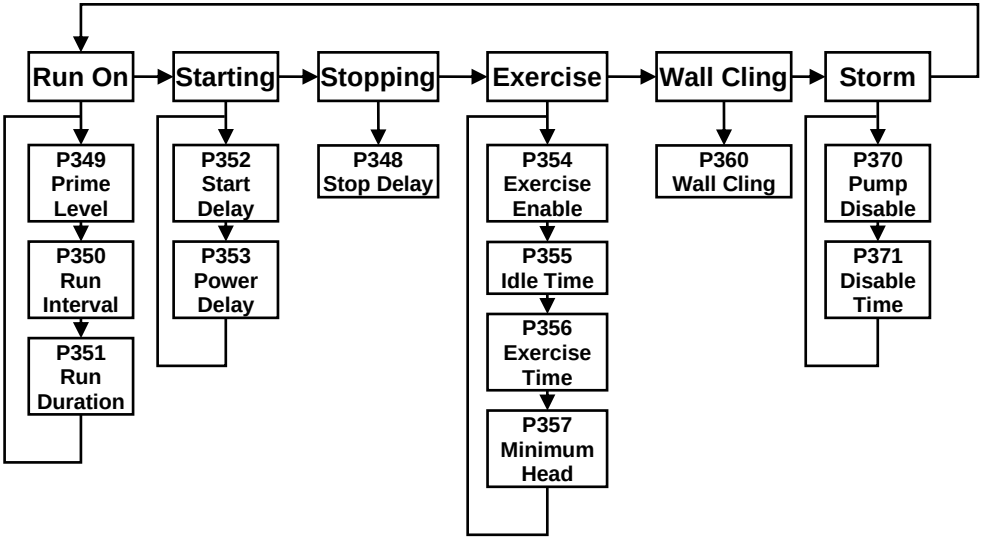
Application Menu



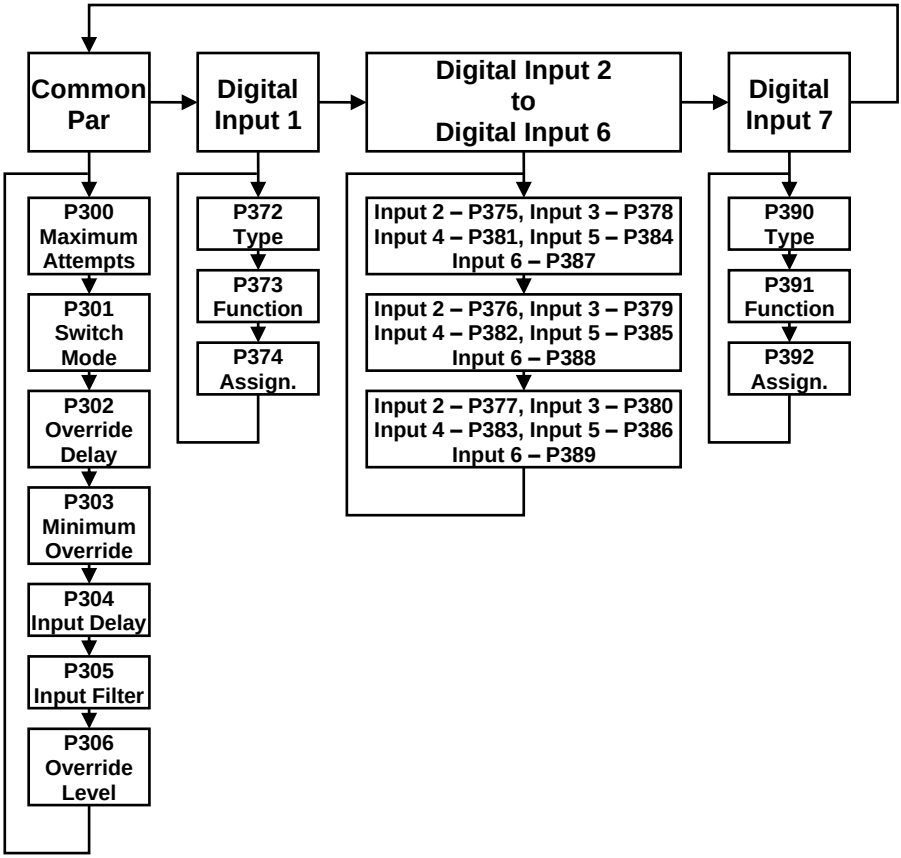
Relays Menu


Relay 1
Relay 2
Relay 3
Relay 4
Relay 5
Relay 6
P210 Type
P211 Function
P212 Alarm ID or Pump Group
P213 Set 1
P214 Set 2
P215 Set 3 As Required
P216 Allocat.
P217 Closures
P218 Fail Safe
P219 R1 Max.Rate If P210=2
P220 Type
P221 Function
P222 Alarm ID or Pump Group
P223 Set 1
P224 Set 2
P225 Set 3 As Required
P226 Allocat.
P227 Closures
P228 Fail Safe
P229 R2 Max.Rate If P220=2
P230 Type
P231 Function
P232 Alarm ID or Pump Group
P233 Set 1
P234 Set 2
P235 Set 3 As Required
P236 Allocat.
P237 Closures
P238 Fail Safe
P239 R3 Max.Rate If P230=2
P240 Type
P241 Function
P242 Alarm ID or Pump Group
P243 Set 1
P244 Set 2
P245 Set 3 As Required
P246 Allocat.
P247 Closures
P248 Fail Safe
P249 R4 Max.Rate If P240=2
P250 Type
P251 Function
P252 Alarm ID or Pump Group
P253 Set 1
P254 Set 2
P255 Set 3 As Required
P256 Allocat.
P257 Closures
P258 Fail Safe
P259 R5 Max.Rate If P250=2
P260 Type
P261 Function
P262 Alarm ID or Pump Group
P263 Set 1
P264 Set 2
P265 Set 3 As Required
P266 Allocat.
P267 Closures
P268 Fail Safe
P269 R6 Max.Rate If P260=2

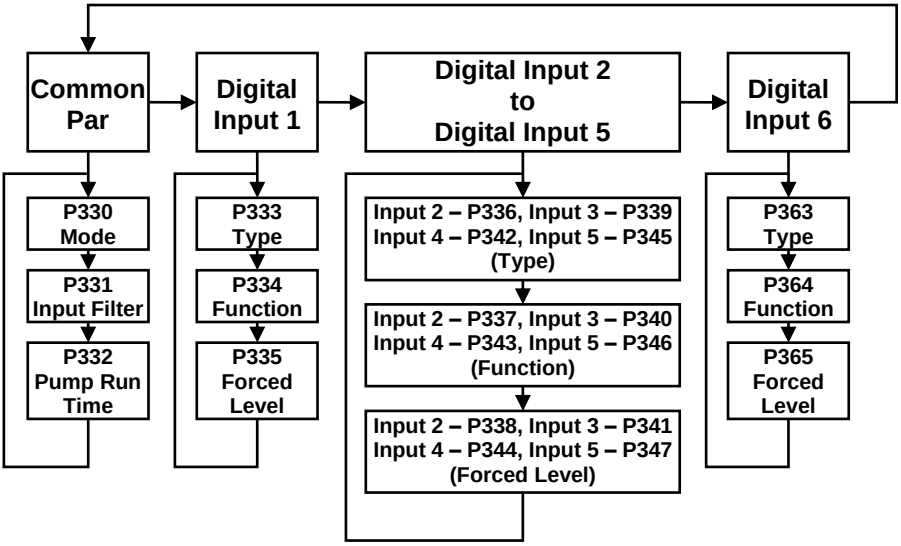
Pump "Advanced" Menu



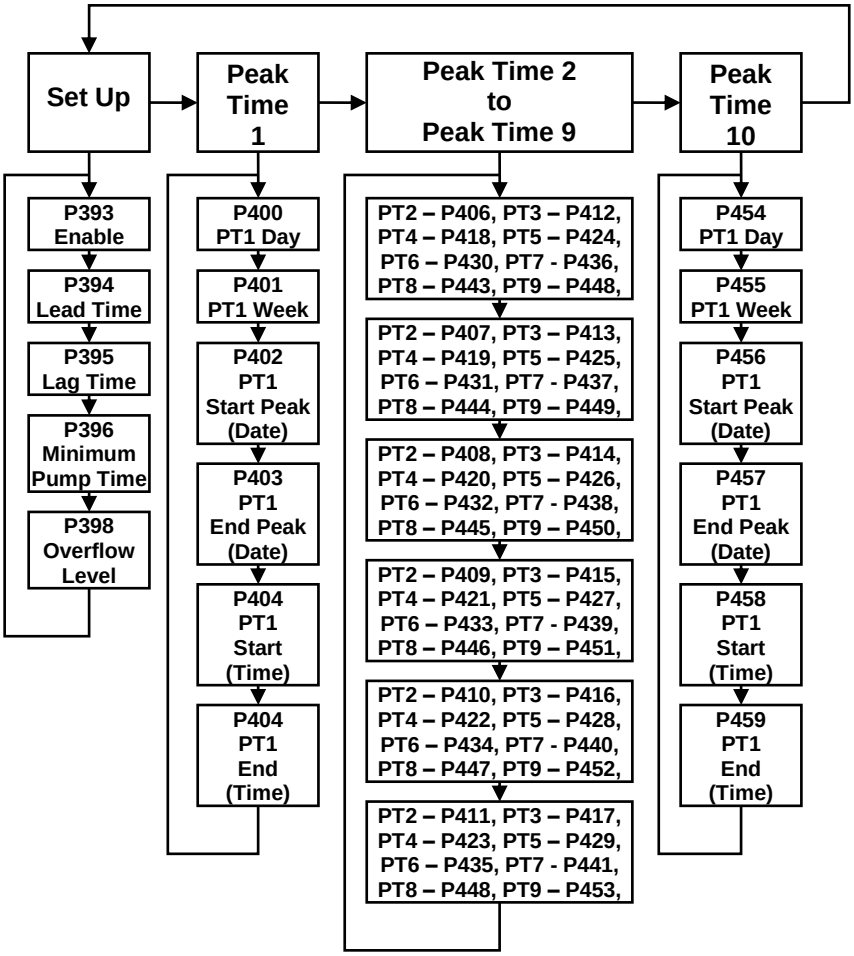
Digital Inputs Menu



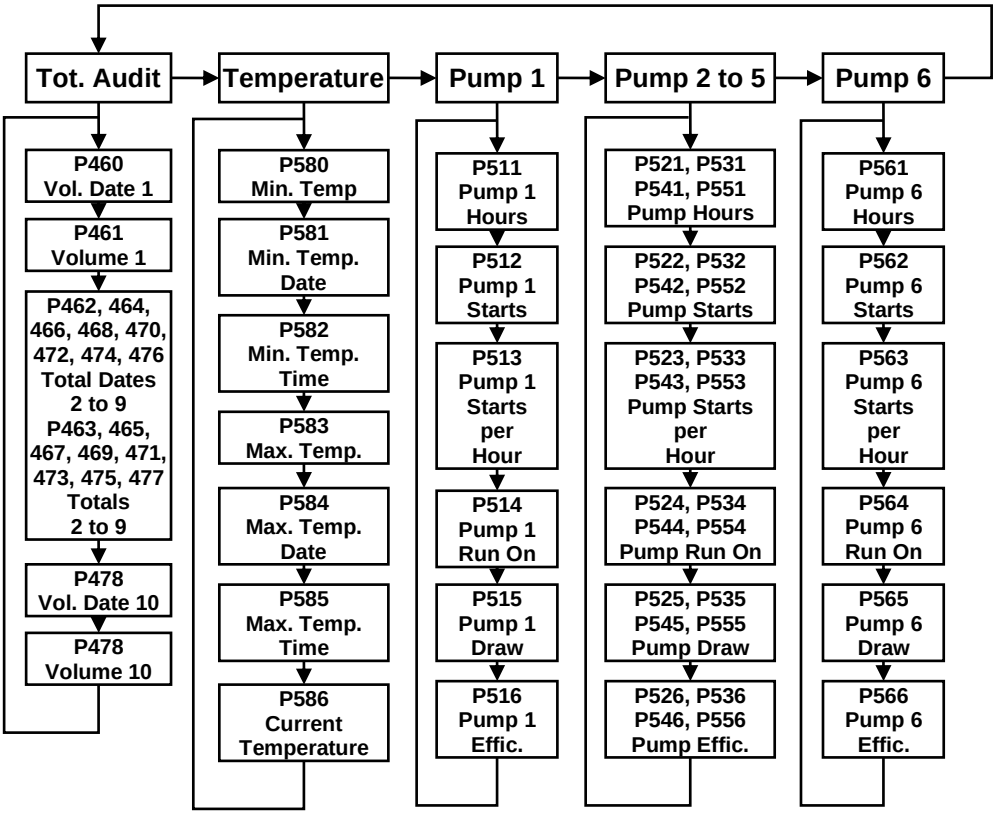
Float Switch Backup



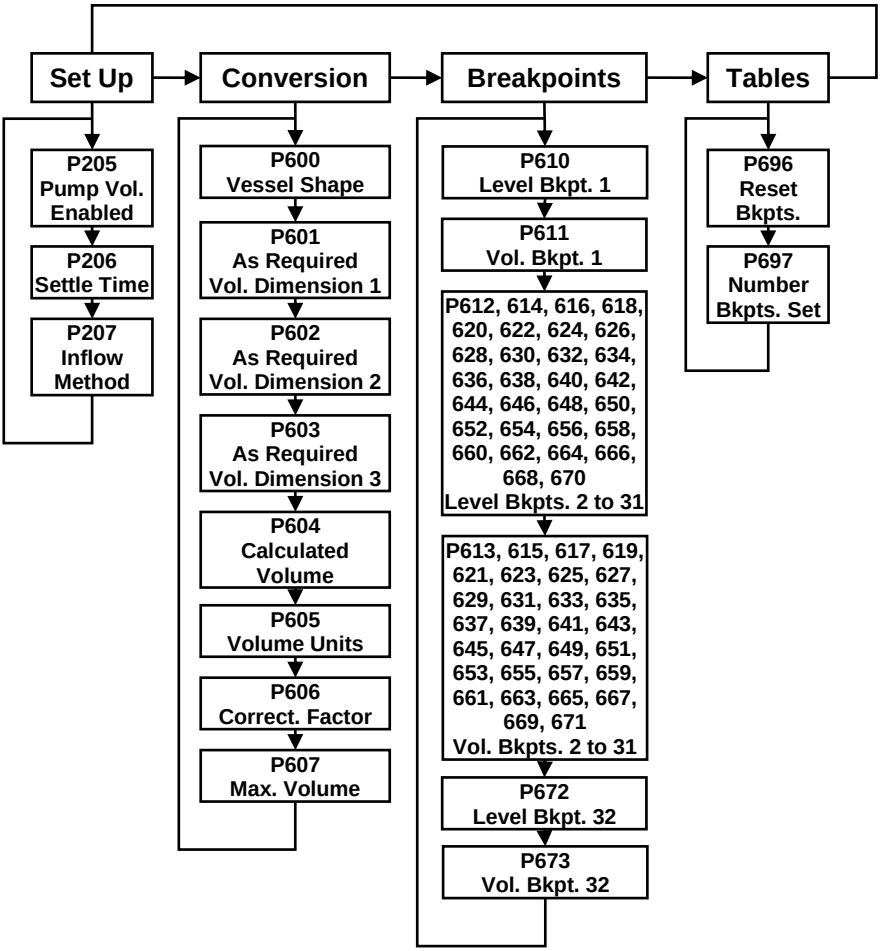
Tariff Guard Menu



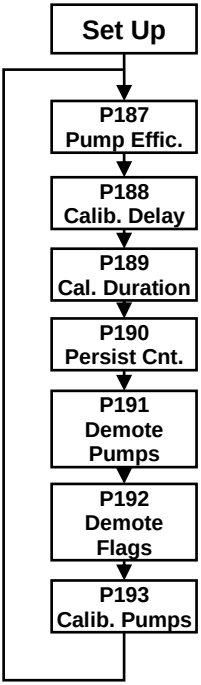
Data Logs Menu



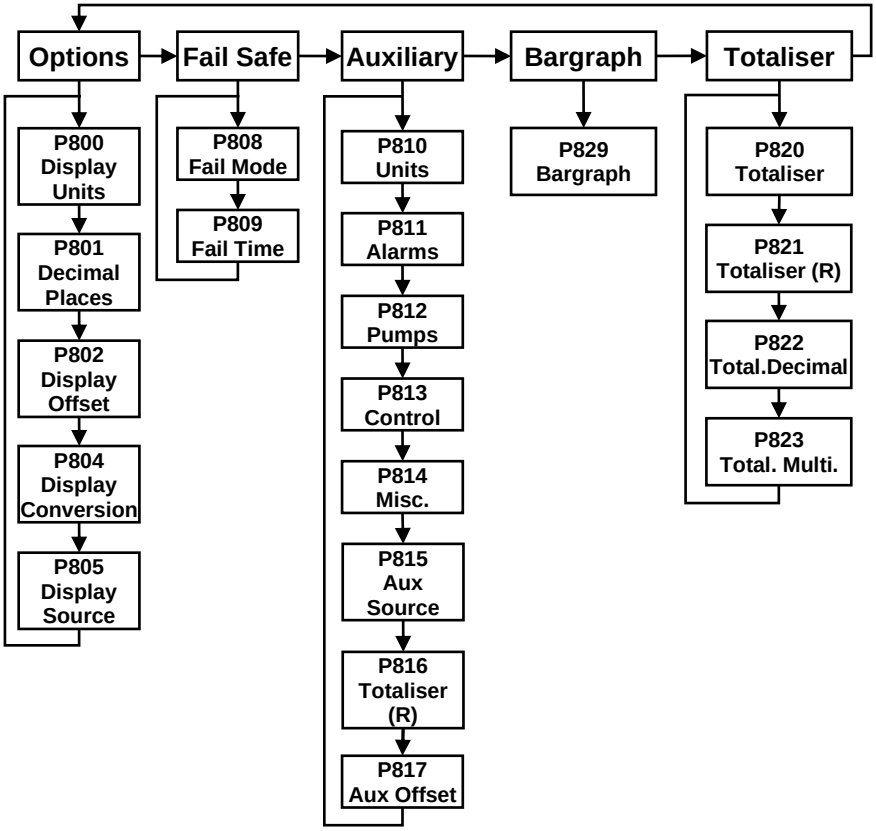
Pumped Volume Menu



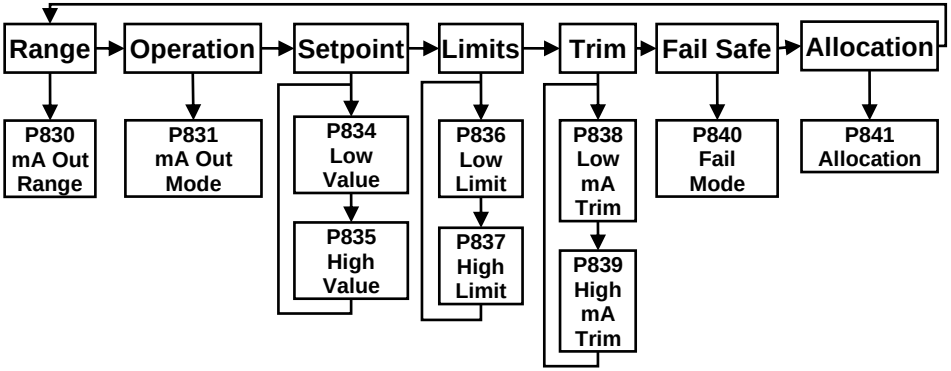
Efficiency Menu



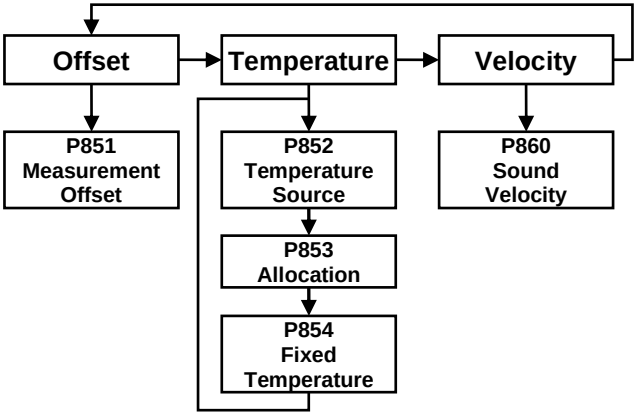
Display Menu



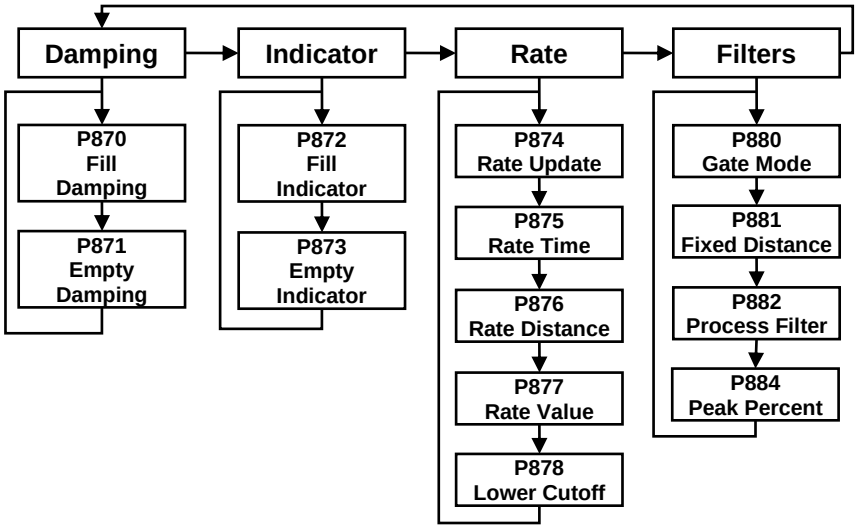
mA Output Menu



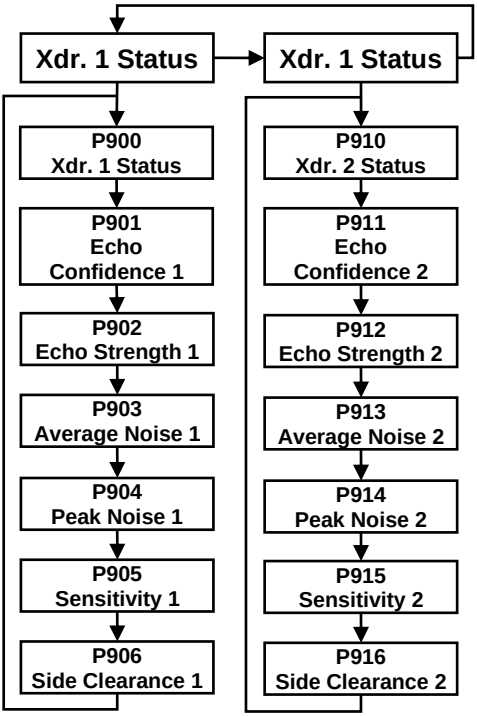
Compensation Menu



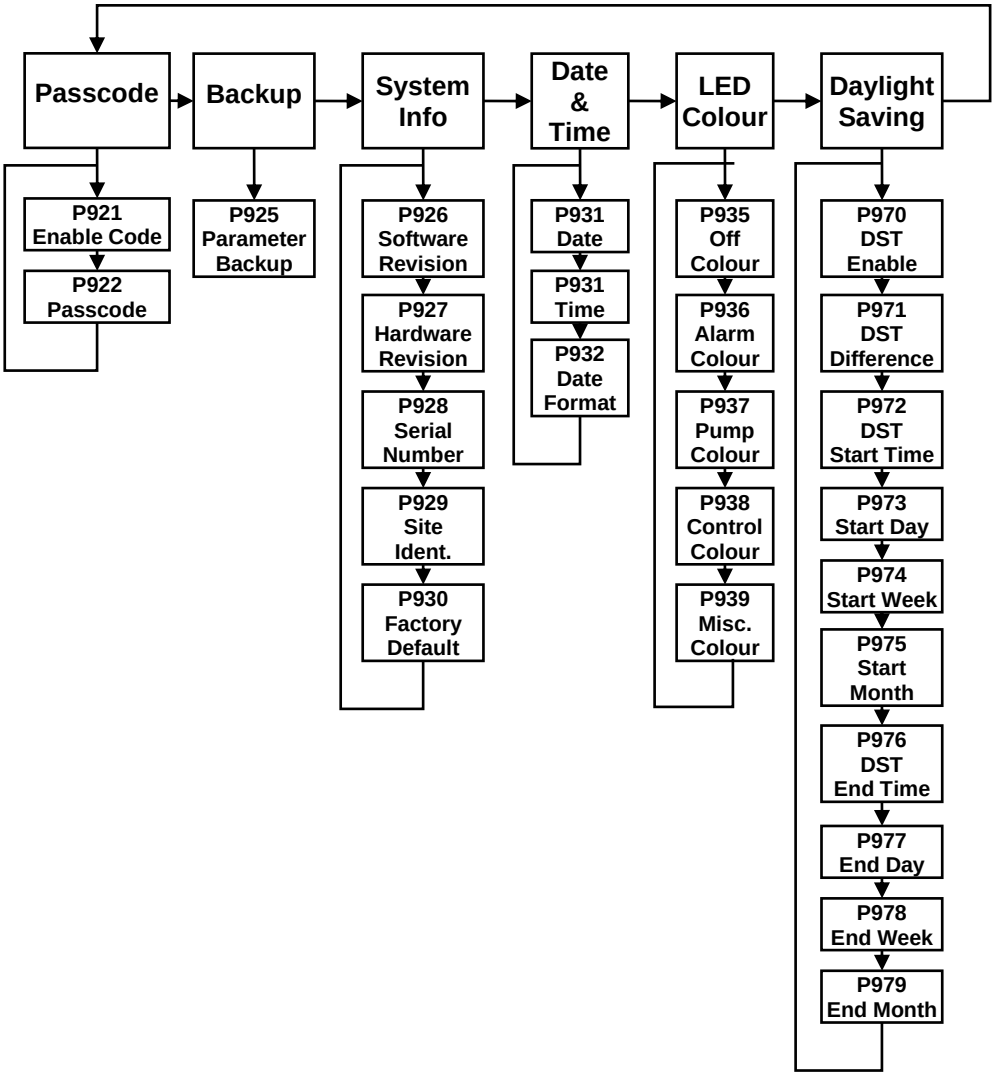
Stability Menu



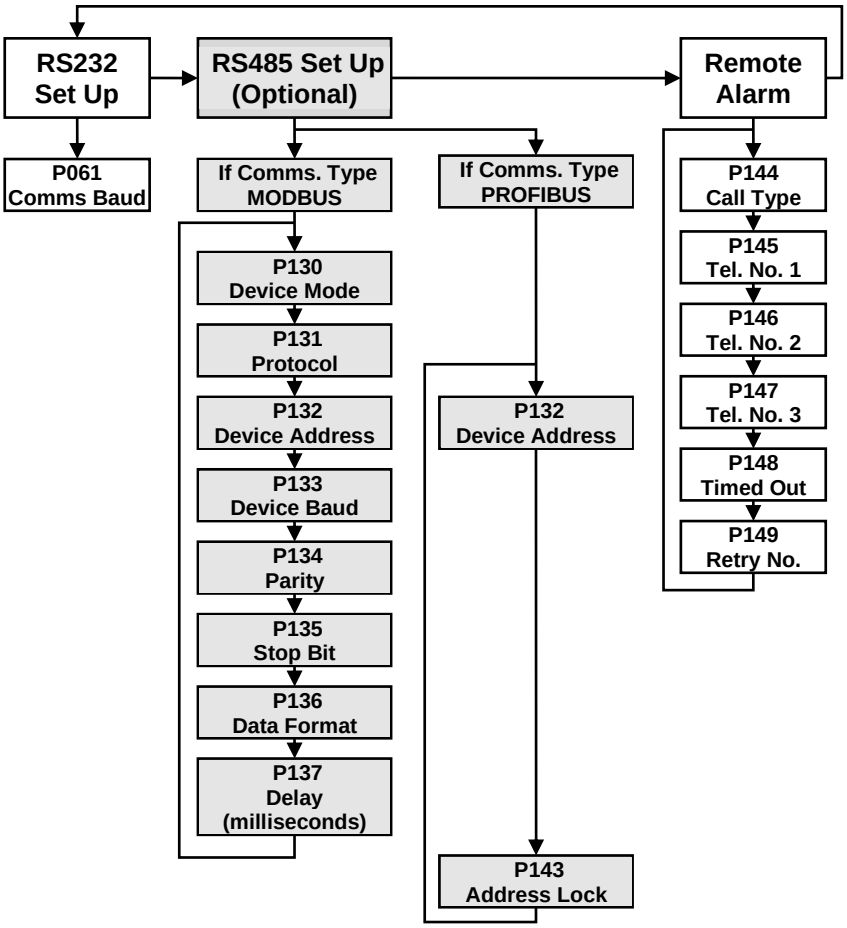
Echo Processing Menu



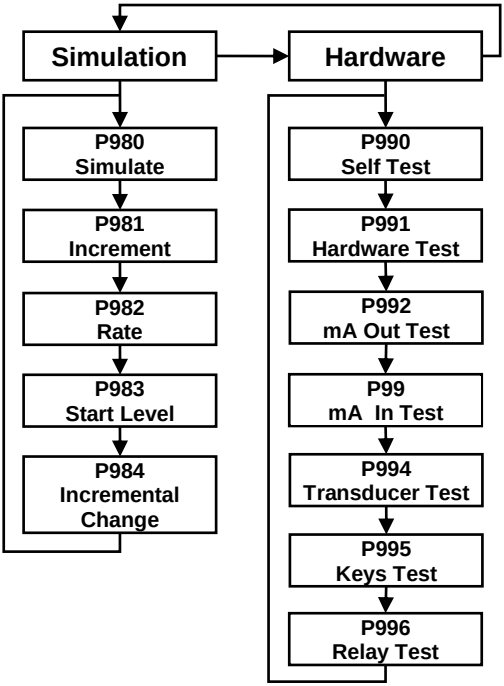
System Menu


Passcode
Backup
System Info
Date & Time
LED Colour
Daylight Saving
P921 Enable Code
P922 Passcode
P925 Parameter Backup
P926 Software Revision
P927 Hardware Revision
P928 Serial Number
P929 Site Ident.
P930 Factory Default
P931 Date
P931 Time
P932 Date Format
P935 Off Colour
P936 Alarm Colour
P937 Pump Colour
P938 Control Colour
P939 Misc. Colour
P970 DST Enable
P971 DST Difference
P972 DST Start Time
P973 Start Day
P974 Start Week
P975 Start Month
P976 DST End Time
P977 End Day
P978 End Week
P979 End Month

Device Comm Menu



Test Menu


Simulation
Hardware
P980
Simulate
P981
Increment
P982
Rate
P983
Start Level
P984
Incremental
Change
P990
Self Test
P991
Hardware Test
P992
mA Out Test
P99
mA In Test
P994
Transducer Test
P995
Keys Test
P996
Relay Test

Parameter Listing

This section describes all of the parameters. Any parameter can be reset to its default, by pressing the n hot key, whilst in program mode.

Application Parameters

Operation

P100 Mode of Operation

This parameter sets the mode of operation, when in run mode, and can be set to one of the following:

Option	Description
1= Distance (Default)	Display shows the distance from the transducer face to the surface.
2= Level	Display shows how full the vessel is.
3= Space	Display shows how empty a vessel is.
4=Average Level	Display shows the Average level of 2 points of measurement.
5= Differential	Display shows the Differential Level between 2 points of measurement.

P101 Xducer (Transducer)

This parameter should be set to the transducer being used with the unit, and can be set to one of the following:

Option	Description
0=Auxiliary	Use the mA input device.
1 = dB3	Transducer is a dB3. Range 0.410 to 9.843 feet
2 = dB6 (Default)	Transducer is a dB6. Range 0.984 to 19.685 feet
3= dB10	Transducer is a dB10. Range 0.984 to 32.808 feet
4= dB15	Transducer is a dB15. Range 1.640 to 49.213 feet
5= dB25	Transducer is a dB25. Range 1.969 to 82.021 feet
6 = dB40	Transducer is a dB40. Range 3.937 to 131.234 feet
7 = dBS6	Transducer is a dBS6. Range 0.656 to 19.685 feet
8 = dBMach3	Transducer is a dBMach3 Range zero to 7.956 feet
*11 = dBR16	Transducer is a mmWave Radar. Range 0.25 to 52.49 feet
*12 = dBR8	Transducer is a mmWave Radar. Range 0.25 to 26.25 feet

Important Information

*Please consult your local distributor for the versions of firmware that the mmWAVE Radar are available in.

P102 Material

This parameter should be set to the type of material being monitored.

Option	Description
1 = Liquid (Default)	Use for liquids and flat solid materials
2 = Solid	Solid material that is heaped or at an angle
3 = Closed Tank	Use for applications within a closed vessel or where a secondary echo response may become focussed to create a larger echo than the first.

P103 Input 2

The 4-20 mA input can be used to replace the transducer for applications where an ultrasonic transducer cannot be used.

Use this parameter to set the second input device when using in Average or Differential Mode, and **P101 Transducer = 1** (Optional Auxiliary Input).

Option	Description
0=None (Default)	Second transducer input not required
1 = dB3	Transducer is a dB3. Range 0.410 to 9.843 feet
2 = dB6	Transducer is a dB6. Range 0.984 to 19.685 feet
3= dB10	Transducer is a dB10. Range 0.984 to 32.808 feet
4= dB15	Transducer is a dB15. Range 1.640 to 49.213 feet
5= dB25	Transducer is a dB25. Range 1.969 to 82.021 feet
6 = dB40	Transducer is a dB40. Range 3.937 to 131.234 feet
7 = dBS6	Transducer is a dBS6. Range 0.656 to 19.685 feet
8 = dBMach3	Transducer is a dBMach3 Range zero to 7.956 feet
*11 = dBR16	Transducer is a mmWave Radar. Range 0.25 to 52.49 feet
*12 = dBR8	Transducer is a mmWave Radar. Range 0.25 to 26.25 feet

Important Information

*Please consult your local distributor for the versions of firmware that the mmWAVE Radar are available in.

Dimensions

P104 Measurement Units

This parameter sets the units you want to use for programming and display

Option	Description
1 = metres	All units of measure are **METRES**
2 = cm	All units of measure are **CENTIMETRES**
3 = mm	All units of measure are **MILLIMETRES**
4 = feet (Default)	All units of measure are **FEET**
5 = inches	All units of measure are **INCHES**

P105 Empty Level

This parameter is to be set to the **maximum distance** from the **face** of the transducer to the **empty point**, in **P104 Measurement Units**. Note this value affects span as well, (see important information below), so should be set before span.

Important Information

When using the **dB Mach 3** the **empty distance** is measured from the end of the **horn** to the **empty point** in **P104 Measurement Units**.

Important Information

When changing the Empty Distance (P105) you can also recalculate the values for the Span so that it equals the empty distance (P105) minus Near Blanking (P107) and the Relay Setpoints, so that they remain at the same percentage values of the empty distance as they were before you changed the empty distance (P105). You will be asked the question "Recalculate Span?" if you choose yes (enter 1), then the span will be recalculated. Any other answer will leave the span at its original value. You will then be asked if you want to "Recalculate Setpoints?", if you choose yes (enter 1), then all Relay Setpoints will be recalculated as a percentage of the new empty distance. Any other answer will leave the setpoints at their original values.

P106 Span

This parameter should be set to the maximum distance from the **Empty Level** (**P105**) to the maximum material level. It is automatically set to be equal to the **Empty Level** (**P105**) less the **Near Blanking** distance (**P107**), when you set the empty level.

P107 Near Blanking Distance

This parameter sets the distance from the face of the transducer that is not measurable and is pre-set to the minimum value dependant on the Xducer (P101) selected. It should not be set to less than this figure, but can be increased, typically to ignore close in obstructions.

Transducer	Near Blanking Distance
P101 = dBMach3 Transducer	Default Blanking Distance = 0.000 feet
P101 = dB3 Transducer	Default Blanking Distance = 0.410 feet
P101 = dB6 Transducer	Default Blanking Distance = 0.984 feet
P101 = dB10 Transducer	Default Blanking Distance = 0.984 feet
P101 = dB15 Transducer	Default Blanking Distance = 1.640 feet
P101 = dB25 Transducer	Default Blanking Distance = 1.969 feet
P101 = dB40 Transducer	Default Blanking Distance = 3.937 feet
P101 = dBS6 Transducer	Default Blanking Distance = 0.656 feet
P101 = dBR16 Radar	Default Blanking Distance = *0.252 feet
P101 = dBR8 Radar	Default Blanking Distance = *0.252 feet

*The signal emanates from the curved face of the Radar, but for the purposes of measurement it is taken from the drip shield.

P108 Far Blanking Distance

This is the distance (as a **percentage** of **empty level P105**) beyond the empty point that the unit will be able to measure, and by **default** is pre-set to **20%** of the empty level.

If the surface being monitored can extend beyond the **Empty Level** (**P105**) then the far blanking distance can be increased to a maximum of 100% of empty level.

This parameter is always entered as a % of empty level.

mA Input

*The **4-20 mA (Auxiliary) input** can be used to replace the transducer for applications where an ultrasonic transducer cannot be used.*

When using a **current input** device instead of an ultrasonic **transducer** it should be connected to the **mA input** terminals, **not** the **transducer** terminals, as described in **Chapter 2 Installation**.

P119 mA Status

If P101 (Xducer) = 0 (Auxiliary)

This indicates the current status of the Auxiliary input if selected

Option	Description
0 = mA OK (Default)	mA input present and functioning correctly
1 = mA Open	No input (device) is being detected
2 = mA Short	Input is indicating a fault condition

P120 Low mA in

This parameter sets the current (mA) input value that is used to represent empty when using a current (mA) input device, instead of an ultrasonic transducer**.**
Default = 4mA

P121 High mA in

This parameter sets the current (mA) input value that is used to represent span when using a current (mA) input device, instead of an ultrasonic transducer.
Default = 20mA

Important Information

When using the auxiliary input, all settings relating to measurement should be entered in relation to level i.e. zero (empty) to 100% (full) and not distance. This also means that the device you are connecting should provide an input that will change with level.

P122 Low Level in.

This parameter sets the level that is used to represent 0% of Span (empty) or the Low mA in (P120), when using the current input, (Aux. input) instead of an ultrasonic transducer.
Default = 0.00 metres

P123 High Level in

This parameter sets the level that is used to represent 100% 0f Span (Full) or the High mA in (P121), when using the current input, (Aux. input) instead of an ultrasonic transducer.
Default = 6.00 metres

If it is required to calibrate the *Zenith 140* to the device connected to the mA Input this can be achieved by using the **mA trim**.

P124 Low mA Trim

This parameter allows you to "calibrate" the *Zenith 140* to the **Low mA Input** from the device being used. If the expected low value, from the device connected to the mA Input, is not displayed, then you can trim it using this parameter.

P125 High mA Trim

This parameter allows you to "calibrate" the *Zenith 140* to the **High mA Input** from the device being used. If the expected high value, from the device connected to the mA Input, is not displayed, then you can trim it using this parameter.

Relay Parameters

All relay related parameters are prefixed with a **2****.

The second digit of the three-figure parameter number denotes the relay number as follows:

2 **1*** parameters for Relay 1

2**2*** parameters for Relay 2

2**3*** parameters for Relay 3

2**4*** parameters for Relay 4

2**5*** parameters for Relay 5

2**6*** parameters for Relay 6

The third digit is parameter specific and is the same for each relay resulting in the following parameter numbers for each relay.

Relay 1 21**0** to 21**9**

Relay 2 22**0** to 22**9**

Relay 3 23**0** to 23**9**

Relay 4 24**0** to 24**9**

Relay 5 25**0** to 25**9**

Relay 6 26**0** to 26**9**

P210, 220, 230, 240, 250, 260 Relay Type

This parameter defines what type each relay should be, see the table below for available options.

Option	Description
0= Not In Use (Default)	Relay not in use or programmed, and LED will always be off.
1= Alarm	Relay is programmed as an alarm relay, which will **de-energise** to switch the alarm **ON**, and **energise** to switch the alarm **OFF**. This will ensure an alarm is raised if the power fails to the unit.
2= Pump	Relay is programmed as a pump relay, which will **energise** to switch the pump **ON**, and **de-energise** to switch the pump **OFF**.
3= Control	Relay is programmed as a control relay, which will **energise** to switch **ON**, and **de-energise** to switch **OFF**.
4= Miscellaneous	Relay is programmed as a miscellaneous relay, which will **energise** to switch **ON**, and **de-energise** to switch **OFF**.
5= Pump by time	Relay is programmed as a pump relay, which will **energise** at its **ON level** setpoint, and **de-energise** at its **OFF level** setpoint or after a predetermined **time** period, **whichever occurs first.**

Alarms

When P210, 220, 230, 240, 250, 260 =1 (Alarm)

The **second parameter** for each relay will determine the **function** of the alarm.

P211, 221, 231, 241, 251, 261 Relay Function

This parameter defines what **function** the **alarm** will respond to as follows.

Option	Description
0= Off (Default)	Relay will not operate.
1= Level	Alarm is based on the level in the vessel, and the type of level alarm (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**62**) and two setpoints must be set (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). Setpoints are entered in Display Units or % of span as referenced to Empty Level *.
2= Rate of Change	Alarm is based on the rate of change of level in the vessel, and the type of rate of change alarm (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2) and two setpoints must be set (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3/P2**1**4, 2**2**4, 2**3**4, 2**4**3, 2**5**3, 2**6**3).Setpoints are entered in Display Units per minute or % of span per minute and a negative value should be entered for a Rate Alarm on a de-creasing level, and a positive value for an increasing level.
3= Temperature	Alarm is based on the temperature, and the type of temperature alarm (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2) and two setpoints must be set (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). The temperature used depends on the temperature source (P852). Setpoints are entered in °C.
4= Loss of Echo	Alarm is raised if the **Failsafe Timer** (**P809**) expires. No setpoints are required.
5= Loss of Clock	Alarm is raised if the real time clock fails. No setpoints are required.

Option	Description
6= Pump Efficiency	When Pump Efficiency is enabled, Alarm is based on the Efficiency of the pump which is allocated to the relay I.D. (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2) and two setpoints must be set (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4). Setpoints are entered in %.
7 = Device Fail	Alarm is raised if a device, connected to the relay assigned in alarm ID (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2), fails. E.g. pump is put out of service. No setpoints are required.
8 = Device Alarm	Alarm is raised if a fail signal is detected on the digital input as assigned in alarm ID (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2) No setpoints are required.
15 = Tariff Alarm *(Available from firmware version 7.5.1)*	Alarm is raised when the unit enters Tariff Guard mode. **Tariff Guard enable (P393)** must be set to '1' for this option to be selectable. No setpoints are required.

- To set figures in % press the  hot key to show and enter % figure relative to empty level.

Note that the loss of echo and loss of clock will also be shown on the display as "LOST ECHO" and "LOST CLOCK" respectively.

P212, 222, 232, 242, 252, 262 Relay Alarm ID

The **third parameter** for each **alarm** relay determines the **ID** for the relay you wish to set.

When P211, 221, 231, 241, 251, 261 = 1 (Level) or **2 (Rate of Change)** or 3 **(Temperature)**

This parameter defines which **alarm type**, or **identification**, the relay should respond to, as follows.

Alarm ID	Description	Setpoints
1= General (Default)	Relay goes "ON" when the value rises to the ON setpoint and goes "OFF" when the value lowers to the OFF setpoint.	P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 is **ON** Setpoint; P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4 is **OFF** Setpoint
2= High	Relay goes "ON" when the value rises to the ON setpoint and goes "OFF" when the value lowers to the OFF setpoint.	**ON>OFF** Relay Setpoints P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 and P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4, Setpoints can be set in any order as the unit 'knows' that you are setting a high-level alarm.
3= Hi-Hi	Same as 2 = High, but different identifier.	
4= Low	Relay goes "ON" when the value lowers to the ON setpoint and goes "OFF" when the value rises to the OFF setpoint.	**ON<OFF** Relay Setpoints P2**1**3, 2**2**3, 2**3**3,2**4**3, 2**5**3, 2**6**3 and P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4, Setpoints can be set in any order as the unit 'knows' that you are setting a low-level alarm.
5= LoLo	Same as 4=Lo, but different identifier.	

Alarm ID	Description	Setpoints
6= In bounds	Relay goes "ON" if value is inside the zone between the two setpoints.	Relay Setpoints, P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 and P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4 Setpoints can be set in any order as the unit 'knows' that you are setting an inbounds alarm.
7= Out of bounds	Relay goes "ON" if value is outside the zone between the two setpoints.	Relay Setpoints, P21**3**, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 and P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4 Setpoints can be set in any order as the unit 'knows' that you are setting an out of bounds alarm.

When P211, 221, 231, 241, 251, 261 = 6 Pump Efficiency

This parameter assigns the **alarm** to the appropriate **pump relay a**s detailed below.

Option	Description
0=Off (Default)	Relay will not operate.
1 = Relay 1	Alarm is assigned to **pump** on **Relay 1**
2 = Relay 2	Alarm is assigned to **pump** on **Relay 2**
3 = Relay 3	Alarm is assigned to **pump** on **Relay 3**
4 = Relay 4	Alarm is assigned to **pump** on **Relay 4**
5 = Relay 5	Alarm is assigned to **pump** on **Relay 5**
6 = Relay 6	Alarm is assigned to **pump** on **Relay 6**
7 = All	Alarm is assigned to **relays** designated as **pump**

When P211, 221, 231, 241, 251, 261 = 7 (Device Fail)

This parameter defines which **failed device relay**, the **alarm** should respond to, as follows.

Alarm ID	Description	Setpoints
1 = Fail Rel.1 (Default)	Relay goes "**ON**" when a **device failure** is detected on **relay 1**.	None
2 = Fail Rel.2	Relay goes "**ON**" when a **device failure** is detected on **relay 2**.	None
3 = Fail Rel.3	Relay goes "**ON**" when a **device failure** is detected on **relay 3**.	None
4 = Fail Rel.4	Relay goes "**ON**" when a **device failure** is detected on **relay 4**.	None
5 = Fail Rel.5	Relay goes "**ON**" when a **device failure** is detected on **relay 5**.	None
6 = Fail Rel.6	Relay goes "**ON**" when a **device failure** is detected on **relay 6**.	None
7 = Any 1 Fail	Relay goes "**ON**" when a **device failure** is detected on **any 1 relay.**	None
8 = Any 2 Fail	Relay goes "**ON**" when **2 device failures** are detected on **any 2 relays**.	None

When P211, 221, 231, 241, 251, 261 = 8 (Device Alarm)

This parameter defines which **digital input**, the **alarm** should respond to, as follows.

Alarm ID	Description	Setpoints
1 = Fail Inp.1 (Default)	Relay goes "**ON**" when a **fail signal** is detected on **digital input 1**.	None
2 = Fail Inp.2	Relay goes "**ON**" when a **fail signal** is detected on **digital input 2**.	None
3 = Fail Inp.3	Relay goes "**ON**" when a **fail signal** is detected on **digital input 3**.	None
4 = Fail Inp.4	Relay goes "**ON**" when a **fail signal** is detected on **digital input 4**.	None
5 = Fail Inp.5	Relay goes "**ON**" when a **fail signal** is detected on **digital input 5**.	None
6 = Fail Inp.6	Relay goes "**ON**" when a **fail signal** is detected on **digital input 6**.	None
7 = Fail Inp.7	Relay goes "**ON**" when a **fail signal** is detected on **digital input 7**.	None

The **fourth parameter** and the **fifth parameter** for each relay set the **Alarm** "**ON**" and "**OFF**" points. For a ***high alarm*** the "**ON**" is set **higher than** "**OFF**". For ***low alarm*** then "**ON**" is set **lower than** "**OFF**". See the appropriate **alarm ID,** table (**P212, 222, 232, 242, 252, 262**) for further information.

When P211, 221, 231, 241, 251, 261 = 1 (Level), 2 (Rate of Change), 3 (Temperature) or **6 (Efficiency)**

P213, P223, P233, P243, P253, P253 - Relay Setpoint 1

Determines the "**ON**" or "**OFF**" point for the alarm according to the **ID** selected.

P214, P224, P234, P244, P254, P264 - Relay Setpoint 2

Determines the "**ON**" or "**OFF**" point for the alarm according to the **ID** selected.

Important Information

Setpoints are entered in values according to the **function** selected.

Level - entered in Measurement Units P104 or % of span as referenced to Empty Level.
Rate of Change - entered in Display Units per minute or % of span per minute. For an alarm on an increasing level enter setpoints as a positive value, for an alarm on a decreasing level enter setpoints as a negative value.
Temperature - entered in ºC.
Efficiency – entered in % value of efficiency.

See the appropriate **alarm function**, table (**P211, 221, 231, 241, 251, 261**) for further information.

When P211, 221, 231, 241, 251, 261 = 4 (Loss of Echo), 5 (Loss of Clock), 7 (Device Fail) or **8 (Device Alarm)**
This parameter has no function and will not be displayed.

* To set figures in % press the  hot key to show and enter % figure relative to empty level.

Pumps

When P210, 220, 230, 240, 250, 260 =2 (Pump)

When a relay is used for a **pump** function, then the **second parameter** determines the **pump duty** that will be used to control the operating cycle of the pump(s).

P211, 221, 231, 241, 251, 261 Relay Function,

This parameter defines which **pump duty** the relay should respond to as follows.

Pump Duty	Description
0= Off (Default)	Relay is always de-energised.
1= Fixed duty assist	All pumps are used to assist each other (run at the same time) and each pump has its own setpoints. (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).
2= Fixed duty backup	If a pump fails to meet the demand (due to malfunction, intake blockage etc.), then it is stopped, and another pump shall take over. Each pump has its own setpoints. (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).
3= Alternate duty assist	All pumps are used to assist each other (run at the same time) and each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). but each time all pumps have stopped, then the setpoints are sequentially rotated between the pumps to ensure equal pump use.

Pump Duty	Description
4= Alternate duty backup	If a pump fails to meet the demand (due to malfunction, intake blockage etc.), then it is stopped, and another pump shall take over. Each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). but each time all pumps have stopped, then the setpoints are sequentially rotated between the pumps to ensure equal pump use.
5= Duty backup and assist	First pump comes on, if it cannot cope, it goes off and next pump comes on (duty backup). This continues until the last pump comes on and if it cannot cope the first pump comes back on to assist the last pump (duty assist) if the level continues to rise all other pumps will come on (assist) in turn until the level decreases to the pump off points. Each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4,2**6**4).

Pump Duty	Description
6= Service ratio duty assist	All pumps are used to assist each other (run at the same time) and each pump has its own setpoints (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). And a service ratio setting. The third setpoint (P2**1**5, 2**2**5, 2**3**5, 2**4**5, 2**5**5, 2**6**5) is used to set the service ratio. Each time a pump is required to start then the pump with the least running hours (with respect to the service ratio) is started (i.e. the setpoints are re-assigned accordingly). For example, if two pumps A and B have the service ratio set to 2 and 1 respectively, then pump A will operate for twice as many hours as pump B.
7= Service ratio duty backup	If a pump fails to meet the demand (due to malfunction, intake blockage and so on), then it is stopped, and another pump shall take over. Each time a pump is required to start then the pump with the least running hours (with respect to the service ratio) is started (i.e. the setpoints are re-assigned accordingly). Each pump has its own setpoints (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). The third setpoint (P2**1**5, 2**2**5, 2**3**5, 2**4**5,2**5**5, 2**6**5) is used to set the service ratio. For example, if two pumps A and B have the service ratio set to 2 and 1 respectively, then pump A will operate for twice as many hours as pump B.

Pump Duty	Description
8= **F**irst **O**n **F**irst **O**ff, alternate duty assist	The first pump switched on is the first pump to be switched off, etc. regardless of the set points, so the setpoints are dynamically changed to enable this.
9 = Service Ratio Standby	When a service ratio duty is being used, on all other pumps in use, the standby pump can be started on a ratio basis only, when it will assume the setpoints of the next pump to start. The third setpoint (P2**1**5, 2**2**5, 2**3**5, 2**4**5,2**5**5, 2**6**5) is used to set the service ratio.
10 = Two Pump Sets	There are four pumps. Two rotate their start-up sequence with each other. If the two pumps cannot keep up, the level rises to the setpoints of the other two pumps, which take over and rotate their sequence with each other.

Important Information

The pumps are started and stopped at the "ON" and "OFF" setpoints. To *pump down* (reduce level) then set "ON" higher than "OFF". To *pump up* (increase level) then set "ON" lower than "OFF".

The **third parameter** for each relay determines the pump group. You can have two groups of pumps, and all similar duties within a group will operate together.

P212, 222, 232, 242, 252, 262 Relay Pump Group

By **default**, all pump groups are set to **1**, but if you want to have another group, then set this parameter to 2, for each pump relay that should operate together as part of a second group.

The **fourth parameter** and the **fifth parameter** for each relay set the **pump** "**ON**" and "**OFF**" points, which are entered in **Measurement units P104**. For ***pump down*** the "**ON**" is set **higher than** "**OFF**". For ***pump up*** then "**ON**" is set **lower than** "**OFF**". See the appropriate **pump duty,** function table (**P212, 222, 232, 242, 252, 262**) for further information.

P213, P223, P233, P243, P253, 263 - Relay Setpoint 1

This parameter will determine the "**ON**" point of the pump(s).

P214, P224, P234, P244, P254, 264 - Relay Setpoint 2

This parameter will determine the "**OFF**" point for the pump(s).

Relay setpoints 1 and 2 are entered in values of Measurement Units (P104) See the appropriate **pump duty** function, table (**P211, 221, 231, 241, 251, 261**), for further information.

The **sixth parameter** will determine the **service ratio** that will be used to switch the pump, when **pump duty** selected is a Service Ratio duty.

P211, 221, 231, 241, 251, 261 = 6, 7 or 9 (Service ratio)

P215, P225, P235, P245, P255, 265 - Relay Setpoint 3

This parameter determines the Service Ratio in values of %. See the appropriate **pump duty** function, table (**P211, 221, 231, 241, 251, 261**), for further information.

P219, P229, P239, P249, P259, 269 - Relay Max.Rate

This parameter will allow a **pump** to be **switched** at a pre-determined **Rate of change of Level**, irrespective of the "ON" level setpoint P213, 223, 233, 243, 253, 263. Once a pump relay has been switched "**ON**" by the pre-determined **Rate of Change**, it will remain energised until the level reaches the "**OFF**" level setpoint **P214, 224, 234, 244, 254, 264**.

Max. Rate is entered in Measurement Units (P104) per minute and can be entered as either positive (increasing level) or negative (decreasing level) values.

Control

When P210, 220, 230, 240, 250, 260 = 3 (Control)

When a relay is being set up as a **control** relay, the **second parameter** that will be displayed in the menu determines its **function.**

P211, P221, P231, P241, P251,261 Relay Function,

This function allows the relay to be assigned to specific **control** functions (other than pumps and alarms) several of these functions work in relation to time.

This can be used to activate devices based on elapsed time or running cycles, such as a timed rake control to keep a ram lubricated if idle for long periods, or flush valve operation.

Options	Description
0 = Off (Default)	Relay is always de-energised
1 = Time	Relay will **energise** "**ON**" after the **Cycle time** that is set in Relay **Setpoint 2** (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). And turns "**OFF**", **de-energises**, after the **On-Time Period** that is set in Relay **Setpoint 1** (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3)
2 = Storm	Relay will **energise** "**ON**" when storm conditions are in effect and, **de-energise** "**OFF**" when storm conditions cease. Two setpoints are required, Upper Storm "**ON**", (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3) and Lower Storm, "**OFF**" (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). This allows the relay to be used to activate a device as a result of high levels such as a storm condition e.g. opening a gate valve to divert storm overflow into a holding vessel.

Options	Description
3 = Aeration	Relay will **energise** "**ON**" after each **Cycle time** as set in Relay **Setpoint 2** (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). And turns "**OFF**", **de-energises**, after the set **On Time Period** as set in Relay **Setpoint 1** (P2**1**3, 2**2**3, 2**3**3, 2**4**3,2**5**3, 2**6**3). This can be used to activate a device based upon elapsed time since **All Pumps** have been "**OFF**", such as the introduction of fresh air to reduce gas concentration.
4 = Flush Valve	Relay will **energise** "**ON**" when Flush condition is in effect and goes off when Flush condition is cleared. A relay being used for Flush Valve/Pump must be assigned to one of the main pumps in use. Flush relay **Alarm ID** (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2) is used to enter the **relay number**, to which **the assigned pump is connected.** Flush Valve/Pump relay requires three setpoints. The first set point (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3) determines the **Flush Interval**, which is the number of main **pump cycles** that should occur before the Flush Valve/Pump operates. The second setpoint (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4), sets the number of **Flush cycles** the Flush Valve/Pump will operate for. This means that the Flush Valve will be operated for a number of main pump starts (**Flush Cycles**) after which the Flush Valve activity will cease until the **Flush Interval** comes around again. Setpoint three of the Flush Valve/Pump relay sets the **Flush Duration**, (P2**1**5, 2**2**5, 2**3**5, 2**4**5, 2**5**5, 2**6**5) this is the duration for Flush Cycle, in seconds.

Options	Description
5=Step Time	Step Time Control allows relays to be used to control a device, such as a motorised valve or gate, in order to maintain the level within two predetermined points. Relays will **energise** "**ON**" when Step Time condition is in effect and **de-energises** "**OFF**" when Step Time goes off. One relay will be required to control an increase in level, ('open' the device) and a second relay is required to control a decrease in level, ('close' the device). **Alarm ID** (P2**1**2, 2**2**2, 2**3**2, 2**4**2, 2**5**2, 2**6**2) is used to assign the relay to control either the **open** or **close** condition. Step Time Control relay requires three setpoints. The first set point (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3) determines the **level**, at which the relay is to be activated, (N.B. level setpoint for **open** relay, **increase** the level, must be **lower than** the setpoint for the **close** relay, **decrease** the level). The relay will **energise** "**ON**" after the **Limit time** that is set in Relay **Setpoint 3** (P2**1**5, 2**2**5, 2**3**5, 2**4**5, 2**5**5, 2**6**5). And turns "**OFF**", **de-energises**, after the **Drive Period** that is set in Relay **Setpoint 2** (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).
6 = Differential Control	Relay will **energise** "**ON**" when a differential condition is in effect and, **de-energise** "**OFF**" when the differential conditions cease. Two setpoints are required, **Differential** control "**ON**", (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3) and **Differential** control, "**OFF**" (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4). This allows the relay to be used to activate a device as a result of a differential level, between two points e.g. operate a rake on a screen.

The **third parameter** for each relay determines the **assignment** or **condition** of the relay, where required.

P212, P222, P232, P242, P252, P262 - Relay Alarm ID/Pump Group,

When P211, 221, 231, 241, 251, 261 = 1, 2, 3 or 6

This parameter has no function and will not be displayed.

P211, 221, 231, 241, 251, 261 = 4 (Flush Valve)

If the relay is selected for Flush Valve/Pump, then this parameter is used to determine to which pump the Flush function is assigned. Enter the **relay number to which the assigned pump is connected**.

P211, 221, 231, 241, 251, 261 = 5 (Step Time)

If the relay is selected for Step Time, then this parameter is used to assign the relay to the 0 = **Open** condition (increase level) or 1 = **Clos**e condition (decrease level).

The **fourth parameter**, **fifth parameter** and **sixth parameter** are set to determine the switch points, "**ON**" and "**OFF**" for the relay and where required the order of start. See **control function**, table (**P211, 221, 231**) for further information.

P213, P223, P233, P243, P253, P263 - Relay Setpoint 1

P211, 221, 231, 241, 251, 261 =1 (Time)

This parameter determines the "**Time Period**" that the relay will remain "**ON**".

Relay Setpoints are entered in Minutes.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 2 (Storm)

Relay Setpoint 1 is entered in values of **Measurement Units** (**P104**)

See the appropriate relay function tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 3 (Aeration)

Relay Setpoint 1 is entered in Minutes to set **Cycle Time**

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 4 (Flush Valve)

Relay Setpoint 1 is entered in Pump cycles to set **Flush Interval**.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 =5 (Step Time)

Relay Setpoint 1 is entered in values of **Measurement Units** (**P104**)

See the appropriate relay function tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 =6 (Differential)

Relay Setpoint 1 is entered in values of **Measurement Units** (**P104**)

See the appropriate relay function tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P214, P224, P234, P244, P254, P264 - Relay Setpoint 2

P211, 221, 231, 241, 251, 261 = 1 (Time)

This parameter determines the "**Cycle Time**" for the operation of the relay.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 2 (Storm)

Relay Setpoints are entered in values of **Measurement Units** (**P104**)

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 3 (Aeration)

Relay Setpoints are entered in Minutes to set **Time Period** that the relay will remain ON

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 4 (Flush Valve)

Relay Setpoints are entered in cycles to set the number of **Flush cycles**.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 5 (Step Time)

Relay Setpoints are entered in Seconds to set **Drive Period**, the time that the relay will remain ON

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 =6 (Differential)

Relay Setpoints are entered in values of **Measurement Units** (**P104**)

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P215, P225, P235, P245, P255, 265 - Relay Setpoint 3

P211, 221, 231, 241, 251, 261 = 4 (Flush Valve)

Enter desired **Flush duration** in seconds.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 5 (Step Time)

This parameter is used to determine the **Limit Time** between each Drive Period. Relay Setpoints are entered in Minutes, during which time the relay will remain OFF.

See the appropriate relay **Function** tables (**P211**, **221**, **231**, **241**, **251, 261**) for further information.

Miscellaneous

When P210, 220, 230, 240, 250, 260 = 4 (Miscellaneous)

When a relay is set to be a **miscellaneous** relay, the **second parameter** determines its **function**.

P211, 221, 231, 241, 251, 261 Relay Function,

This function allows the relay to work in relation to a clock and will be set to activate in relation to Real Time or to provide a pulsed output in relation to a predetermined count from the totaliser, the choices being as follows:

Options	Description
0 = Off (Default)	Relay **Off de-energised**
1 = Clock	Relay will **energise ON** at a specified time each day as set in Relay Setpoint 1 (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3). And turns **OFF**, **de-energises**, after the specified "On Time" period as set in Relay Setpoint 2 (P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4)
2 = Totaliser	Relay will **energise ON** momentarily each time the specified flow has passed as set in Relay setpoint 1 (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3), this parameter sets the multiplication factor which will be applied to the on board totaliser (P820) to determine the switch point of the relay. E.g. if the totaliser is set to totalise in cubic metres and the relay is required to provide a closure every 10,000 litres Relay setpoint 1 would be set to 10. Relay setpoint 2 (P2**1**4, 2**2**4, 2**3**4, 2**44**, 2**5**4, 2**6**4) can be used to select the time the relay will remain closed in seconds.

Important Information

When using a Relay to control a device at a specified time of day ensure that the **Time P932** is set correctly. And if required, enable **Daylight Saving** for the appropriate time difference **P970 – P979**.

The **third parameter** has **no function** when **miscellaneous relay** is chosen and will not be displayed.

The **fourth parameter**, and **fifth parameter**, are set to determine the switch points, "**ON**" and "**OFF**" for the relay. See **miscellaneous** function table (**P211, 221, 231, 241, 251, 261**) for further information.

P211, 221, 231, 241, 251, 261 = 1 (Clock)

P213, P223, P233, P243, P253, P263 - Relay Setpoint 1

Relay Setpoints are entered in Hours & Minutes (HH:MM) to set Time at which relay will energise. **Default = 00:00 (HH:MM)**

P214, P224, P234, P244, P254, P264 - Relay Setpoint 2

Relay Setpoints are entered in Minutes to set Time Period that the relay will remain ON. **Default = 0.00 mins.**

P211, 221, 231, 241, 251, 261 = 2 (Totaliser)

P213, P223, P233, P243, P253, P263 - Relay Setpoint 1

Relay Setpoints are entered as a factor by which the on board totaliser (P820) should be multiplied by to provide a relay closure. **Default = 0.00**

P214), P224, P234, P244, P254, P264 - Relay Setpoint 2

Relay Setpoints are entered in **seconds** to set the **time period** that the relay will remain **'**ON'. **Default = 0.00 secs.**

Pump by Time

When a relay is assigned to Pump by Time the pump will come on (energise) at its normal "**ON" level** setpoint, and de-energise at its **OFF level** setpoint, or after a predetermined **time** period, **whichever occurs first.**

When P210, 220, 230, 240, 250, 260 = 5 (Pump by Time)

When a relay is being used for a **pump by time** function, the **second parameter** determines the **pump duty** that will be used to determine the operating cycle.

P211, P221, P231, P241, P251, P261 - Relay Function,

This parameter defines which **pump duty** the relay should respond to as follows.

Pump Duty	Description
0= Off (Default)	Relay is always de-energised.
1= Fixed duty assist	All pumps are used to assist each other (run at the same time) and each pump has its own setpoints. (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).
2= Fixed duty backup	If a pump fails to meet the demand (due to malfunction, intake blockage etc.), then it is stopped and another pump shall take over. Each pump has its own setpoints. (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).
3= Alternate duty assist	All pumps are used to assist each other (run at the same time). Each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4) but each time all pumps have stopped, the setpoints are sequentially rotated between the pumps to ensure equal pump use.

Pump Duty	Description
4= Alternate duty backup	If a pump fails to meet the demand (due to malfunction, intake blockage etc.), then it is stopped, and another pump shall take over. Each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4) but each time all pumps have stopped, then the setpoints are sequentially rotated between the pumps to ensure equal pump use.
5= Duty backup and assist	First pump comes on, if it cannot cope, it goes off and next pump comes on (duty backup). This continues until the last pump comes on and if it cannot cope the first pump comes back on to assist the last pump (duty assist) if the level continues to rise all other pumps will come on (assist) in turn until the level decreases to the pump off points. Each pump has its own setpoints, (P2**1**3, 2**2**3, 2**3**3, 2**4**3, 2**5**3, 2**6**3 & P2**1**4, 2**2**4, 2**3**4, 2**4**4, 2**5**4, 2**6**4).

Important Information

The pumps are started and stopped at the "ON" and "OFF" setpoints. To *pump down* (reduce level) then set "ON" higher than "OFF". To *pump up* (increase level) then set "ON" lower than "OFF".

The **third parameter** for each relay determines the pump group. You can have two groups of pumps, and all similar duties within that group will operate together.

P212, P222, P232, P242, P252, P262 - Relay Pump Group

By **default**, all pump groups are set to **1**, but if you want to have another group, then set this parameter to 2, for each pump relay that should operate together as part of a second group.

The **fourth parameter,** and the **fifth parameter** for each relay set the **pump** "**ON**" and "**OFF**" points, which are entered in **Measurement units P104**. For ***pump down*** the "**ON**" is set **higher than** "**OFF**". For ***pump up*** then "**ON**" is set **lower than** "**OFF**". See the appropriate **pump duty,** function table (**P212, 222, 232, 242, 252, 262)** for further information.

P213, P223, P233, P243, P253, P263 - Relay Setpoint 1

This parameter determines the "**ON**" point of the pump.

P214, P224, P234, P244, P254, 264 - Relay Setpoint 2

This parameter determines the "**OFF**" point for the pump.

When a relay is being used for a **pump by time** function, then the **sixth parameter** will determine the maximum time the pump will be allowed to run before it is switched off and the next pump takes over.

P215, P225, P235, P245, P255 P265 - Relay Setpoint 3

This parameter determines the **Maximum Time** the pump will be allowed to **run** before being switched "**OFF**" and is entered in minutes.

The pump will switch off either at its "**OFF**" level **Relay Setpoint 2** (**P214, 224, 234, 244, 254, 264**) or its **Maximum Run Time Relay Setpoint 3** (**P215, 225, 235, 245, 255, 265**), whichever occurs **first**.

Common Parameters

P216, 226, 236, 246, 256, 266 Relay Allocation

This parameter determines which input the relay will act on, dependant on selected Mode (P100) and/or Transducer (P101). You can set it to the transducer (default), or the auxiliary (current) input, or an average of any two. In most cases, this will not need to be changed from the default.

Option	Description
1= Xducer 1 (Default)	Relay acts on Xducer 1calculated levels.
2= Xducer 2	Relay acts on Xducer 2 calculated levels.
3 = Auxiliary	Relay acts on optional current input levels
4 = Average of 1 & 2	Relay acts on the resulting average levels of two signal inputs.
5= Differential of 1 & 2	Relay acts on the resulting differential level of two signal inputs.

P217, 227, 237, 247, 257, 267 Relay Closures

The **Zenith** will record how many times each relay has operated, this parameter displays the number of times the relay has activated since the relay has been in use. It can be reset with any value.

P218, 228, 238, 248, 258, 268 Relay Fail Safe

Your **Zenith** has a general fail-safe parameter P808. However, this can be overridden so that each individual relay has its own independent fail-safe mode.

Option	Description
0 = Default	Relay assumes system default mode P808
1 = Hold	Relay will remain in its current state
2 = De-energise	Relay will De-energise
3 = Energise	Relay will Energise

Pump "Advanced" Parameters

The following parameters are used to set the "Advanced" Pump features.

Pump Run On

This feature is used to periodically allow the pumps to continue operating below their normal "OFF" point, in order to discharge any sediment that may have settled at the bottom of the vessel.

P349 Prime Level

Sets the required level to ensure pumps are fully primed after a pump run on has occurred. Following a pump run on, any pump, whose "ON" point is below the Prime Level will be held "OFF" until the Prime Level has been exceeded.

P350 Run Interval

Set required time period, in hours, at which pump run on should occur.

P351 Run Duration

This parameter sets the length of time, in seconds, that pumps will run on for, it should be noted that only one run on is allowed per Run Interval.

Starting

This feature is used to reduce the effects of power surges, caused by switching of pumps, in the following instances, (**P352**) **Power surge** (mains or hydraulic) that is generated when multiple pumps are started simultaneously, (**P353**) **Power resumption** following a power failure.

P352 Start Delay

Set the required time period, in seconds, that should elapse between pumps starting. **Default = 10 seconds.**

P353 Power Delay

Set the required time period, in seconds, that should elapse before pumps are allowed to start following a power failure. **Default = 10 seconds.**

Stopping

If required, this feature will **prevent** pumps, with a **common "OFF" point** being switched off all at the same time pumps will be switched **"OFF"** in turn as determined by the **delay** set in **P348 Stop Delay**.

P348 Stop Delay

Set the required time period, in seconds, that should elapse between pumps stopping. **Default = 0.0 seconds.**

Pump Exercising

This feature is used to reduce idle pump corrosion and sediment build up. Pumps are allowed to run after a specified **Idle Time** (**P355**) for a determined period of **Exercise time** (**P356**), providing a **Minimum head /level** (**P357**) is present and all other pumps are switched off.

P354 Exercise Enable

This parameter determines if Pump Exercising is enabled or disabled.

Option	Description
0 = No (Default)	Pump Exercising disabled
1 = Yes	Pump Exercising enabled

P355 Idle Time

Sets the Idle Time to elapse before Pump Exercising is to be activated.

Set the required time period in minutes. **Default = 720 minutes**

P356 Exercise Time

Set the required Exercise Time in seconds. **Default = 30 seconds**

P357 Minimum Head

To prevent the dry running and the possibility of cavitation, of the pump, enter the minimum level (head) of material, in **measurement units (P104),** that is to be present before permitting pump exercising to take place.

Wall Cling

To reduce material build up, (such as fat), on the wall of the sump or vessel, at the "normal" material level the pump setpoints can be varied within a specified band.

For Pump Down applications the relay setpoints for the pumps will be randomly varied within the band specified, somewhere below ON, but to a maximum of the setting, and somewhere higher than OFF, but to a maximum of the setting.

For Pump Up applications the relay setpoints for the pumps will be randomly varied within the band specified somewhere higher than ON, but to a maximum of the setting, and somewhere lower than OFF, but to a maximum of the setting.

P360 Wall Cling

Enter the maximum band, of variation, required in **measurement units (P104)**.

Storm

This facility enables all pumps to be **disabled** (**P370**) during a storm condition to prevent the futile running or potential damage due to the continued use of pumps during flood conditions. Provision is also made to allow a maximum **time period** (**P371**) for which pumps will remain disabled during such conditions. For this function to operate a relay must have been assigned to Storm and have Upper and Lower storm setpoints set. See **P210, 220, 230, 240, 250 = 3 (Control)** ***P211, 221, 231, 241, 251, 261 Relay Function =2 (Storm)*** for further details.

P370 Pump Disable

This parameter sets the action required during a flood condition.

Option	Description
0 = Disabled	Pumps Disabled during Storm condition.
1 = Normal (Default)	Normal Pump operation during Storm condition

P371 Disable Time

This parameter will set the maximum time pumps will remain disabled if P370 = 0 Enter desired time in minutes. **Default = 30 minutes**

About Digital Inputs

The digital inputs are used to provide the Zenith with information on the operational status and condition of pumps, valves, and other process control devices. Based on the information supplied, by the inputs, the Zenith, will make intelligent decisions and modify its control regime to meet the demand of the prevailing operational requirements.

The parameters used to program the Digital inputs are as follows:

Common Parameters P300 to **P306**

Digital Input 1 P372 to **374** **Digital Input 2 P375** to **377**

Digital Input 3 P378 to **380** **Digital Input 4 P381** to **383**

Digital Input 5 P384 to **386** **Digital Input 6 P387** to **389**

Digital Input 7 P390 to 392

Common Parameters Set-up

These parameters determine specific operational criteria for particular digital input functions and are common to each digital input.

Input Type

The digital inputs can be either voltage source, where Zenith will supply the switching voltage, or voltage synch, where the switching voltage is supplied by the input from the device, for full details see **Chapter 2 Installation.** Both voltage source and voltage synch. inputs can be configured for **N.O.** or **N.C.** operation as determined by the digital input **Type P372, 375, 378, 381, 384, 387, 390 w**hen set to **1= Input N.C.**, Zenith will recognise a **closed** condition, D.C. **signal** voltage **present** at input, as a healthy condition, alternatively, an **open** condition, D.C. **signal** voltage **not present** at input, indicating a healthy condition, can be chosen as a valid input by selecting **2=Input N.O**.

Input Function

Individual inputs can be configured for any one of a number of **Functions** as determined by **P373, 376, 379, 382, 385, 388, 391** these functions are as follows:

1 = Device Fail input will provide a signal indicating a "failure" or the presence of a "run" signal from the device. When using digital inputs to detect a "run" condition the input is assumed to be in its operational status until the expiry of **P304 Input Delay** which is used to determine the delay time that occurs from the time that the device is called to "run" and the digital input providing a signal appropriate to its operational status.

2 = Duty input will provide a signal to manually select the lead device.

3 = Override ON input will provide a signal to override all selected pump setpoints "ON".

4 = Override OFF input will provide a signal to override all selected pump setpoints "OFF".

5 = Reset input will provide a signal to reset all Device Fail signals.

Device Fail

The digital inputs are used to indicate a 'fail' situation which effect devices, which are connected to the relay outputs of the Zenith, e.g. failure of a pump, screen, valve, etc. This information is then used to initiate changes to the Zeniths control regime to meet the demands of the situation.

Let us consider the example of an application using 2 pumps, each pump has the capability to provide a signal indicating its 'run' status. Each pump is connected and controlled by one of the Zenith relay outputs, the duty and setpoints have been programmed as detailed in **Using the Relays**, earlier in this chapter. The signals providing details on the pumps 'run status' are connected to the digital inputs as described in **Chapter 2 Installation**, and the input **Type P372, 375, 378, 381, 384, 387, 390 is** configured as detailed in **Input Type**, earlier in this chapter.

Pump 1 is connected and programmed to operate on **Relay 1**

Pump 2 is connected and programmed to operate on **Relay 2**

Pump 1 Fail signal is connected to **Digital Input 1**

Pump 2 Fail signal is connected to **Digital Input 2**

Each digital input has to be assigned to the device relay output that it relates to, this is determined by **Assignment P374, 377, 380, 383, 386, 389, 392.** In the case of our example **Digital Input 1** will be assigned to **Relay 1 (P374 = 1)** and **Digital Input 2** will be assigned to **Relay 2 (P377 = 2)**.

When the level rises to the ON Setpoint of Relay 1, the relay will energise, and Pump 1 will 'start', in the normal manner. If the pump starts and runs correctly no change of 'run' status will be seen on the digital input and the pump(s) will be allowed to operate as programmed.

Should a pump **fail**, a change of 'run' status would be seen and a **Device Fail,** condition would be detected on the corresponding digital input, this will result in the relay for the 'failed' pump being de-energised, and the pump being switched OFF. The setpoints of the 'failed' pump will then be passed to the second pump, which will take over to complete the pumping operation.

The decision on whether or not to attempt to start the failed pump on subsequent pump cycles will be determined by **P300 Max. Attempts**. Once the number of attempts stipulated have been made the pump will be put out of service until such time the Device Fail input is cleared by a **Reset** (**P391 = 4)** on Digital Input 7. Alternatively, the +/- key can be used as a as a Hot Key, which when pressed, whilst the unit is in RUN, will give details of any **Device Fail** and provides prompts to **Reset** any failures to the **no fault** condition.

Duty

When this function is selected the digital inputs are used to determine, via an 'auto/manual' switch, which one of the devices, connected to the relay outputs of the Zenith, will be the "lead" or "duty" device.

Consider the example of an application using 2 pumps. Each pump is connected and controlled by one of the Zenith relay outputs, the pump duty and setpoints have been programmed as detailed in **Using the Relays**, earlier in this chapter. The signals providing details on the "lead" or "duty" pump 'status' are connected to the digital inputs as described in **Chapter 2 Installation**, and the input **Type P372, 375, 378, 381, 384, 387, 390 is** configured as detailed in **Input Type**, earlier in this chapter.

Pump 1 is connected and programmed to operate on **Relay 1**

Pump 2 is connected and programmed to operate on **Relay 2**

Pump 1 Duty signal is connected to **Digital Input 3**

Pump 2 Duty signal is connected to **Digital Input 4**

The type of switch to be used to determine the duty is selected and configured as detailed in **P301 Switch Mode**.

Standard Switch Mode (P301 = 0 Standard)

When a standard rotary type switch is used, to determine auto/manual duty one input per device is required, with each input being assigned to the appropriate device relay output that it relates to, this is determined by **Assignment P374, 377, 380, 383, 386, 389, 392.** In the case of our example **Digital Input 3** will be assigned to **Relay 1 (P380 = 1)** and **Digital Input 4** will be assigned to **Relay 2 (P383 = 2)**.

When the **duty switch** is in the "**auto**" position, no signals are present on either Digital Input 3 or Digital Input 4 and devices will run in the "auto" mode, as determined by the Zenith, in accordance with its programmed settings. If a signal is seen on Digital Input 3, **duty switch** selected for **Pump 1**, then the pump connected to Relay 1 will assume the role of "lead"/" duty" pump, regardless of the settings programmed in the Zenith.

When the level rises to the **ON Setpoint**, for the **first** pump, relay 1 will energise and Pump 1 will 'start', in the normal manner. If the level continues to rise, then relay 2 will energise and Pump 2 will start in accordance with the settings programmed for pump 2.

If a signal is seen on Digital Input 4, **duty switch** selected for **Pump 2**, then the pump connected to Relay 2 will assume the role of "lead"/" duty" pump, regardless of the settings programmed in the Zenith. When the level rises to the **ON Setpoint**, for the **first** pump, the relay 2 will energise and Pump 2 will 'start', in the normal manner. If the level continues to rise, then relay 1 will energise and Pump 1 will start in accordance with the settings programmed for pump 2.

Binary Switch Mode (P301 = 1Binary)

When a binary switch is used, to determine auto/manual duty, the number of inputs required will be dependent on the number of devices to be included in the duty selection. In this mode the duty device will be selected according to the binary input present on the appropriate inputs and there is therefore no requirement to assign the duty switch inputs to specific device relay. The selection of the Lead/Duty device is determined by the presence of an input as detailed in the table below, where **0** = **no input** present and **1** = **input** present

Duty Input 1	Duty Input 2	Duty Input 3	Lead/Duty Device
0	0	0	Auto
1	0	0	Relay 1
0	1	0	Relay 2
1	1	0	Relay 3
0	0	1	Relay 4
1	0	1	Relay 5
0	1	1	Relay 6

Consider the example of an application using 2 pumps. Each pump is connected and controlled by one of the Zenith relay outputs, the pump duty and setpoints have been programmed as detailed in **Relays**, earlier in this chapter. The signals providing details on the "lead" or "duty" pump 'status' are connected to the digital inputs as described in **Chapter 2 Installation**, and the input **Type P372, 375, 378, 381, 384, 387, 390 is** configured as detailed in **Input Type**, earlier in this chapter.

Pump 1 is connected and programmed to operate on **Relay 1**

Pump 2 is connected and programmed to operate on **Relay 2**

Duty Input 1 signal is connected to **Digital Input 3**

Duty Input 2 signal is connected to **Digital Input 4**

When no signals are present on either Digital Input 3 or Digital Input 4 then devices will run in the "**auto**" mode, as determined by the Zenith, in accordance with its programmed settings. If a signal is seen on Digital Input 3, **duty** selected for **Pump 1**, then the pump connected to Relay 1 will assume the role of "lead" / "duty" pump, regardless of the settings programmed in the Zenith. When the level rises to the **ON Setpoint**, for the **first** pump, relay 1 will energise and Pump 1 will 'start', in the normal manner. If the level continues to rise, then relay 2 will energise and Pump 2 will start in accordance with the settings programmed for pump 2.

If a signal is seen on Digital Input 4, **duty** selected for **Pump 2**, then the pump connected to Relay 2 will assume the role of "lead" / "duty" pump, regardless of the settings programmed in the Zenith. When the level rises to the **ON Setpoint**, for the **first** pump, the relay 2 will energise and Pump 2 will 'start', in the normal manner. If the level continues to rise, then relay 1 will energise and Pump 1 will start in accordance with the settings programmed for pump 2.

Override

A digital input can be assigned to receive an input, which will **override** the setpoints of the pumps and **start** them, as determined by the **Override Level (P306)** and providing the level is above **the Min. Override** (**P303**), immediately after the expiry of the **Override Delay** (**P302**). A digital input can also be assigned to receive an input, which will **override** the setpoints of the pumps and **stop** them immediately after the expiry of the **Override Delay** (**P302**).

Reset

This option is only available on Digital Input 7 **P391 = 5** when selected a valid signal received on this input will **Reset** all **Device Fail** signals to the **no fault** condition. When using this function, the unit will check all inputs for such conditions so there is no requirement to assign the input to a specific relay output. Alternatively, the +/- key has been allocated as a Hot Key, which when pressed will give details of any **Device Fail** and provides prompts to **Reset** any failures to the **no fault** condition.

Digital Input Parameters

Common Par.

These parameters are common to each of the seven digital inputs and set specific operational criteria for particular functions.

P300 Max.Attempts

When digital inputs are used to detect device failure this parameter determines the number of attempts that will be made before failing the device and putting it out of service. When the number of attempts is set to '0', there is no restriction on the number of starts. The digital inputs will provide a fail signal in the normal manner and initiate any action as required, but the device will not be put out of service. Any figure other than 0 will determine the number of attempts that will be made to start the device before putting it out of service until such time that the input is reset.

Set the number of attempts Min. 0, Max 99.

P301 Switch Mode

When an external duty switch is used this can be connected via the digital inputs and facilitate the selection of the duty device manually, thereby overriding the duty programmed within the unit.

This parameter determines the type of switch in use.

Option	Description
0 = Standard (Default)	A standard switch, e.g. rotary switch, can be used with one switch position and a digital input required for each pump.
1 = Binary	To reduce the number of digital inputs used, for manual duty selection, a binary switch can be supplied. Max. No. of digital inputs required being three.

P302 Override Delay

A digital input can be assigned to receive an input, which will override the setpoints of the pumps and start or stop them, immediately after the expiry of the Override Delay, dependent on the selected Digital Input **Function P373, 376, 379, 382, 385, 388, 391 = 3 (Override "ON")** or **4 (Override "OFF")** and providing the level is above the **Min. Override** (**P303**), when **Override "ON"** is selected.

Enter the required delay time in minutes.

P303 Min Override

Determines the minimum level required before an **Override Delay** (**P302**) will be in effect when Digital Input **Function P373, 376, 379, 382, 385, 388, 391 = 3 (Override "ON").**

Enter the required level in **Measurement Units** (**P104**).

P304 Input Delay

This parameter determines the delay applied, from the time a device (relay) is called to "run" and when the status of the digital input is recognised as a valid input. If the digital input is used to detect a "running" signal this parameter should be set to reflect the time it takes from the device being called to "run" to the input being in its operational status.

Enter the required time in seconds.

P305 Input Filter

This parameter is used to ignore spurious changes of state on the digital inputs and determines the time that a change of state has to be present before it is recognised as a valid input.

Enter the required time in seconds.

P306 Override Level

This parameter will determine which pumps setpoints will be overridden when Digital Input **Function P373, 376, 379, 382, 385, 388, 391 = 3 (Override "ON").** Only pumps with, **normal "ON",** setpoints **below** the **Override Level** will be activated when an **Override "ON"** condition exists and that the **Override Delay (P302)** and **Min Override (P303)**, where required, have been satisfied.

Enter the required level in **Measurement Units** (**P104**).

Digital Input

The following parameters are used to configure the use of the digital inputs.

P372, 375, 378, 381, 384, 387, 390 Type

Determines the way digital inputs will be recognised by Zenith.

Option	Description
1 = Input N.C. **(Default Input 1 – 6)**	Zenith recognises a **closed** condition, D.C. **signal** voltage **present** at the **input**, as a healthy/run condition.
2 = Input N.O. **(Default Input 7)**	Zenith recognises an **open** condition, D.C. **signal** voltage **not present** at the input, as a healthy/run condition.

P373, 376, 379, 382, 385, 388, 391 Function

This parameter will set the function of the digital Input.

Option	Description
1=Device Fail **(Default Input 1 – 6)**	Digital input is used to Fail, (put out of service), a device connected to the relay specified in **P374, 377, 380, 383, 386, 389, 392 Assignment**.
2 = Duty	Digital input is used to select the device, (pump), connected to the relay specified in **P374, 377, 380, 383, 386, 389, 392 Assignment** as the current duty device (pump).
3 = Override "ON"	Digital input is used to provide a signal to activate an **Override "ON"** condition of pumps as determined by **P302 Override Delay, P303 Min. Override** and **P306 Override Level**.
4 = Override "OFF"	Digital input is used to provide a signal to activate an **Override "OFF"** condition of pumps after the expiry of the delay time as determined by **P302 Override Delay**.
5 = Reset. **Digital Input 7 only.** **(Default Input 7)**	Input is used to **Reset** all **Device Fail** conditions. Alternatively, the +/- key can be used, whilst in RUN mode, to **Reset** any **Device Fail.**

P374, 377, 380, 383, 386, 389, 392 Assignment

This parameter assigns the digital input to the appropriate device relay that the **Function**, (**P373, 376, 379, 382, 385, 388, 391**), is to be applied, where appropriate.

Option	Description
0 = None (Default)	Digital Input is not assigned to any relay.
1 = Relay 1	Digital input is assigned to Device connected to Relay 1.
2 = Relay 2	Digital input is assigned to Device connected to Relay 2.
3 = Relay 3	Digital input is assigned to Device connected to Relay 3.
4 = Relay 4	Digital input is assigned to Device connected to Relay 4.
5 = Relay 5	Digital input is assigned to Device connected to Relay 5.
6 = Relay 6	Digital input is assigned to Device connected to Relay 6.
7 = All	Digital input is assigned to All relays with a Device connected.

Float Switch (FS) Backup

About Float Switch Backup

This digital feature is used with a float switch, where it can be used alongside a transducer or as a backup method for when a transducer goes into failsafe.

The high input will have a timer and a level set point, which will allow for the unit to power on every pump below the set point for the specified amount of time as set in **P332 Pump Run Time**.

The low input will simply switch off all the pumps that have been set on the controller.

Common Par

P330 Mode of Operation

Option	Description
0 = Off (default)	Float Switch Backup is not used
1 = Always	Backup will be active continuously and will respond to an input from a Backup device at all times.
2 = On Xdr Fail	Backup will only be active at times when the unit has gone into a Failsafe mode.

P330 Input Filter

This parameter can be used to ignore spurious changes of state on the digital inputs and determines the time that a change of state has to be present before it is recognised as a valid input.

Enter a value in seconds: Min = 1 (**Default**), Max = 999.

P330 Pump Run Time

This parameter tells the unit to switch the pumps off after the specified amount of time, if the level of the float switch has not been reached.

Enter a value in minutes: Min = 0.1 (**Default**), Max = 9999.

Digital Input

The following parameters are used to configure the use of the digital inputs.

P333, 336, 339, 342, 345, 363 Type

Determines the way digital inputs will be recognised by the Zenith.

Option	Description
1 = Input N.C. **(Default Input 1 – 6)**	Zenith recognises a **closed** condition, D.C. **signal** voltage **present** at the **input**, as a healthy/run condition.
2 = Input N.O.	Zenith recognises an **open** condition, D.C. **signal** voltage **not present** at the input, as a healthy/run condition.

P334, 337, 340, 343, 364 Function

This parameter is used to identify what the float switches function is to be.

Option	Description
1 = Off (**Default**)	Input is not used for Float Switch Backup
1 = Low	Float Switch is set at low level to turn pumps off.
2 = High	Float Switch is set at a high level to turn pumps on.

P335, 338, 341, 344, 365 Forced Level

This parameter is used to enter the value, in measurement units (**P104**) where in the event of a Backup condition '**Forced Level**' will determine the level that the unit will assume is present and switch on the pumps in accordance with their setpoints.

Enter a value in measurement units (**P104**): Min 0.1 (**Default**), Max = 9999

Important Information

When programming the unit and you use a digital input that has already been assigned, a message will appear on the display '**Change use**'. Pressing Enter will overwrite what the input has already been programmed to do or pressing Cancel won't and will allow you to use a different input for this feature.

Set Up

P393 Enable

This parameter determines if Energy Saving is in use or not.

Option	Description
0 = Off (Default)	Energy Saving is switched **Off**
1 = On	Energy Saving is switched **On**

'Tariff active' will appear on the Aux display of the unit when unit is in Tariff Guard mode. This feature is available from firmware version 7.5.1 and onwards.

P394 Lead Time

This parameter determines the time, prior to a High Tariff period, at which the vessel will be pumped down to the lowest pump OFF level.

Enter desired time in minutes.

P395 Lag Time

This parameter determines the time, after a High Tariff period, that the vessel will be pumped down, (if required), by the first duty pump to the lowest pump Off level. If after the Lag Time has expired the pump has not reached its Off point it will continue to pump until the Off point is reached. On expiry of the Lag Time all pumps will assume their normal operation and will be switched On and Off according to their respective setpoints.

Enter desired time in minutes.

P396 Min. Pump Run

This parameter determines the minimum amount of time that a pump will be allowed to run during a High Tariff period, if required, and is used to prevent excessive wear or damage to the pump.

Enter desired time in seconds.

P397 Minimum Head

This parameter determines the minimum head (level) of material required to be present before a pump will be allowed to run, if required, during a High Tariff period and is used to ensure that a prime level for the pumps is maintained.

Enter desired level in **Measurement Units** (**P104**).

P398 Overflow Level

This parameter determines the maximum level to which the vessel will be allowed to fill. Should this level be reached all pumps will be switched ON, to draw the level down, as required, irrespective of the control sequence in operation.

Enter desired level in **Measurement Units** (**P104**).

Peak Times

Up to ten separate Peak Tariff periods can be programmed in to the Zenith 140, these periods can be set for a specific date and time or at a specific time during a period of dates or on a daily or weekly basis. The following parameters are used to set these "Peak Times".

P400, 406, 412, 418, 424, 430, 436, 442, 448, 454 PT Day

This parameter sets the **day** on which the "Peak Time" will be in effect.

Option	Description
0 = Off (Default)	Peak Time not in effect.
1 = Every	Peak Time will be in effect **everyday**
2 = Monday	Peak Time will be in effect on **Monday**
3 = Tuesday	Peak Time will be in effect on **Tuesday**
4 = Wednesday	Peak Time will be in effect on **Wednesday**
5 = Thursday	Peak Time will be in effect on **Thursday**
6 = Friday	Peak Time will be in effect on **Friday**
7 = Saturday	Peak Time will be in effect on **Saturday**
8 = Sunday	Peak Time will be in effect on **Sunday**

P401, 407, 413, 419, 425, 431, 437, 443, 449, 455 PT Week

This parameter sets the **week** of the month in which the "Peak Time" will be in effect.

Option	Description
1 = First	Peak Time effective in **first** week of the month
2 = Second	Peak Time effective in **second** week of the month
3 = Third	Peak Time effective in **third** week of the month
4 = Fourth	Peak Time effective in **fourth** week of the month
5 = Last	Peak Time effective in **last** week of the month
6 = Every (Default)	Peak Time effective **every** week of the month

P402, 408, 414, 420, 426, 432, 438, 444, 450, 456 PT Start Pk.

This parameter sets the **date** on which the "Peak Time" will **start**.

Enter the desired Start **Date** in DD:MM format.

P403, 409, 415, 421, 427, 433, 439, 445, 451, 457 PT End Pk.

This parameter sets the **date** on which the "Peak Time" will **end**.

Enter the desired End **Date** in DD:MM format.

P404, 410, 416, 422, 428, 434, 440, 446, 452, 458 PT1 Start.

This parameter sets the **time** at which the "Peak Time" will **start**.

Enter the desired Start **Time** in HH:MM format.

P405, 411, 417, 423, 429, 435, 441, 447, 453, 459 PT1 End

This parameter sets the **time** at which the "Peak Time" will **end**.

Enter the desired End **Time** in HH:MM format.

Data Log Parameters

The data log parameters contain the following information.

Totaliser Audits

When Pump Volume Enabled (P252 = 1)

P460 to P479 Total Audits

Parameters **P460**-**P479**show the **date** and pumped **volume** total for the last **ten days**, the first on the list are the most recent and last ones are the oldest. When all ten total audits are full the oldest is pushed out and all totals increment through to allow the new days total to be registered in the first day's total audit parameter allocation.

P480 Clear Logs

This parameter enables **all** of the Total Audits (P460 – P479) to be cleared to factory default values.

Important Information

In order to ensure the accuracy of pumped Volume, during a 24-hour period, the **Time P932** must be set correctly. And if required, enable **Daylight Saving** for the appropriate time difference **P970 – P979**.

Temperature

The following parameters give information on temperature conditions seen by the **Temperature source** (**P852**) in ºC. All of these parameters are read only and cannot be changed, though if P852 is changed they will be reset.

P580 Minimum Temperature

This parameter displays the minimum temperature recorded.

P581 Minimum Temperature Date

This parameter displays the date when the minimum temperature was recorded.

P582 Minimum Temperature Time

This parameter displays the time when the minimum temperature was recorded.

P583 Maximum Temperature

This parameter displays the maximum temperature recorded.

P584 Maximum Temperature Date

This parameter displays the date when the maximum temperature was recorded.

P585 Maximum Temperature Time

This parameter displays the time when the maximum temperature was recorded.

P586 Current Temperature

This parameter displays the current temperature.

Pump Logs

P510 Pump 1 Hours

This parameter displays the current total running hours for Pump 1. Any value from 0 - 9999 can be entered to facilitate any update to the stored total for any reason e.g. a replacement pump being fitted.

P511 Pump 1 Starts

This parameter displays the current total pump starts for Pump 1. Any value from 0 - 9999 can be entered to facilitate any update to the stored total for any reason e.g. a replacement pump being fitted.

P512 Pump 1 Starts/Hour

This parameter displays the current pump Starts/Hour for Pump 1. Any value from 0 - 9999 can be entered to facilitate any update to the stored total for any reason e.g. a replacement pump being fitted.

P513 Pump 1 Run On

This parameter displays the current number of Pump Run On, which have occurred, for Pump 1. Any value from 0 - 9999 can be entered to facilitate any update to the stored total for any reason e.g. a replacement pump being fitted.

P514 Pump 1 Draw

This parameter displays the current Draw Rate for Pump 1, which is used to calculate the pump efficiency. Any value from 0 - 9999 can be entered to facilitate any update to the stored total for any reason e.g. a replacement pump being fitted.

P515 Pump 1 Efficiency

This parameter displays the current value for Pump 1 Efficiency, which is used to calculate the pump efficiency and will update with any change to the **Pump Draw Rate (P515)**.

P516 - P521 Pump 2

These parameters contain the same information as above for Pump 2.

P522 - P527 Pump 3

These parameters contain the same information as above for Pump 3.

P528 - P533 Pump 4

These parameters contain the same information as above for Pump 4.

P534 - P539 Pump 5

These parameters contain the same information as above for Pump 5.

P540 - P545 Pump 6

These parameters contain the same information as above for Pump 6.

Set Up

P205 Pump Vol. Enable

This parameter determines if Pumped Volume is in use or not.

Option	Description
0 = Off (Default)	Pumped volume calculation is switched **Off**
1 = On	Pumped volume calculation is switched **On**

P206 Settle Time

This parameter determines the time allowed for the level to settle after all pumps have switched Off, in order to avoid any effects of flow back or turbulence, before calculating the Inflow Rate.

Enter desired time in minutes. **Default = 1 minute**.

P207 Inflow Method

This parameter determines which method is used to calculate the inflow of material during a pump down cycle.

Option	Description
0 = No Inflow	Inflow during Pumping is not calculated
1 = Avg. Inflow (Default)	Average between Inflow at time pump started and Inflow after Settle Time used to calculate Inflow during pumping.

Volume

Your **Zenith** provides a variety of volume calculation features, **with 11** pre-programmed **vessel shapes**. See V**essel Shape** (**P600**) for more information. For each vessel you will need to know the **dimensions** (**P601-603**) in **Measurement Units** (**P104**) which are required to calculate the **volume** (**P604**) which will be displayed in the selected **Volume Units** (**P605**).

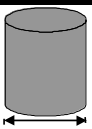
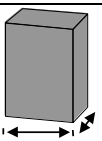
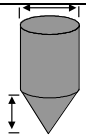
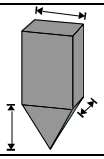
If your vessel shape does not correspond with any of the pre-programmed vessel shapes, then you can use the **universal calculations**. For this you will need a level/volume graph or chart provided by the vessel manufacturer or you can create one based on the dimensions of the vessel. You can enter up to 32 pairs of breakpoints, and the more you enter, the greater accuracy of the volume calculation will be.

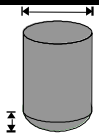
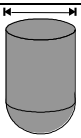
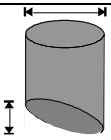
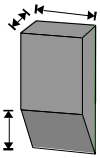
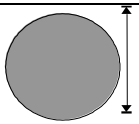
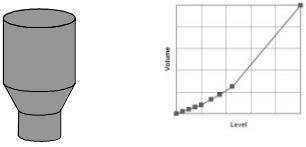
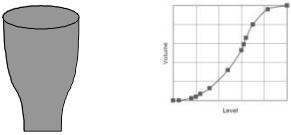
Conversion

P600 Vessel Shape

This parameter determines which vessel shape is used when utilising "Volume Conversion".

The choices are as shown in the table below, along with the **dimensions** that are required to be entered (**P601**-**P603**).

Vessel Shape	P600 Value	Dimensions
	P600=0 Cylindrical Flat base (Default)	Cylinder diameter
	P600=1=Rectangular Flat base	Width and Breadth
	P600=2 Cylindrical Cone base	Cylinder diameter and height of bottom
	P600=3 Rectangular Pyramid base	Width and Breadth of rectangular section and height of bottom

Vessel Shape	P600 Value	Dimensions
	P600=4 Cylindrical Parabola base	Cylinder diameter and height of bottom
	P600=5 Cylindrical Half-sphere base	Cylinder Diameter
	P600=6 Cylindrical Flat sloped base	Cylinder diameter and height of bottom
	P600=7 Rectangular Flat sloped base	Width and Breadth of rectangular section and height of bottom
	P600=8 Horizontal cylinder with flat ends	Cylinder diameter and tank length
	P600=9 Horizontal cylinder with parabolic ends	Cylinder diameter, length of one end section, and tank length
	P600=10 Sphere	Sphere diameter
	P600=11 Universal Linear	No dimensions required, level and volume breakpoints used.
	P600=12 Universal Curved	No dimensions required, level and volume breakpoints used.

P601-P603 Vessel Dimensions

These three parameters are used to enter the dimension required to calculate the volume. The dimensions required are as shown below and are entered **Measurements Units** (**P104**).

Vessel Shape	P601	P602	P603
P600=0 Cylindrical Flat base	Cylinder Diameter		
P600=1 Rectangular Flat base		Width of rectangle	Breadth of rectangle
P600=2 Cylindrical Cone base	Height of base	Cylinder Diameter	
P600=3 Rectangular Pyramid base	Height of base	Width of rectangle	Breadth of rectangle
P600=4 Cylindrical Parabola base	Height of base	Cylinder Diameter	
P600=5 Cylindrical Half-sphere base	Cylinder Diameter		
P600=6 Cylindrical Flat sloped base	Height of base	Cylinder Diameter	
P600=7 Rectangular Flat sloped base	Height of base	Width of rectangle	Breadth of rectangle
P600=8 Horizontal cylinder flat ends	Length of Cylinder	Cylinder Diameter	
P600=9 Horiz. Cyl. parabolic ends	Length of Cylinder	Cylinder Diameter	Length of one end
P600=10 Sphere	Sphere Diameter		

P604 Calculated Volume

This parameter displays the maximum volume that has been calculated by the Zenith pump controller and is a Read Only parameter. The volume displayed will be shown in **volume units (P605)** and is the total volume available between **empty level** (**P105)** and 100% of **span** (**P106**).

P605 Volume Units

This parameter determines the units that you wish to display, for volume conversion. It is used in conjunction with **P607** (**maximum volume**), and the units are shown on the display (subject to P810). The choices are:

Option	Description
0 = No Units	Volume will be totalised with **no units**
1 = Tons	Volume will be totalised in **Tons**
2 = Tonnes	Volume will be totalised in **Tonnes**
3 = Cubic metres	Volume will be totalised in **cubic metres**
4 = Litres	Volume will be totalised in **litres**
5 = UK Gallons	Volume will be totalised in **UK Gallons**
6 = US Gallons	Volume will be totalised in **US Gallons**
7 = Cubic feet (Default)	Volume will be totalised in **cubic feet**
8 = Barrels	Volume will be totalised in **barrels**
9 = lbs (pounds)	Volume will be totalised in **lbs** (pounds)

P606 Correction Factor

This parameter is used to enter a correction factor, when required, such as the specific gravity of the material so that the volume calculated is relative to the actual amount of material that can be contained between **empty level** (**P105)** and 100% of **span** (**P106). Default = 1**

P607 Max Volume

This parameter displays the actual maximum volume that has been calculated by the Zenith, i.e. **P604 Calculated Volume x P606 Correction Factor**, and is a Read Only parameter. The volume displayed will be shown in **P605 Volume Units** and is the total volume available between **empty level** (**P105)** and 100% of **span** (**P106**).

Breakpoints

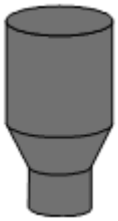
P610-P673 Level/Volume Breakpoints

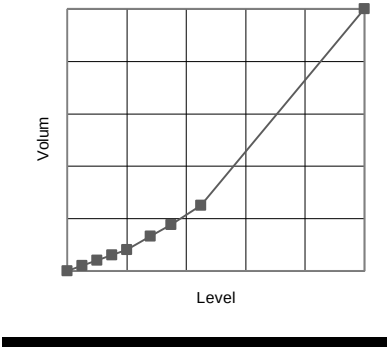
These parameters are used to create a profile of the vessel when **P600**=**11** (**universal linear**) or **P600**=**12** (**universal curved**). You should enter breakpoints in pairs, a reading for level and its corresponding volume. The more pairs you enter, the more accurate the profile will be. In the case of universal linear, then enter the level/volume at each of the points where the vessel changes shape. In the case of the universal curved, enter values around each arc tangent, as well as at the top and bottom.

You must enter at least two pairs, and you can enter up to 32 pairs.

Universal Linear (P600=11)

This volume calculation creates a linear approximation of the level/volume relationship and works best if the vessel has sharp angles between each section.

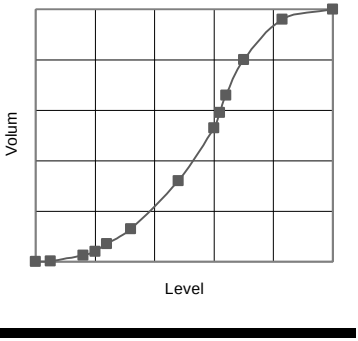




You should enter a level/volume breakpoint for each place where the vessel changes direction, and several where the section is slightly curved (mostly linear but has got a small arc). You can enter any number of pairs between 2 and 32.

Universal Curved (P600=12)

This volume calculation creates a curved approximation of the level/volume relationship, and works best if the vessel is non-linear, and there are no sharp angles.



You should enter 2 level/volume breakpoints at the minimum and maximum levels, and several for each place where the vessel has got an arc. You can enter any number of pairs between 2 and 32.

Tables

P696 Reset Breakpoints

This parameter allows the resetting, to the default value, of all previously set breakpoints (P610-673), without having to access them individually. When it is necessary to reset or amend particular breakpoints this can be achieved by directly accessing the desired parameter (P610-673) and changing as required.

P697Number of Breakpoints Set

This parameter allows you to review the number of breakpoints that have been set, without the need to access each individual one in turn, this is a "Read Only" parameter and no values can be entered.

Pump Efficiency

Set Up

P187 Pump Eff.

This parameter determines whether pump efficiency is enabled or disabled.

Option	Description
0 = Off (Default)	Pump efficiency is **disabled**
1 = On	Pump efficiency is **enabled**

P188 Calib. Delay

This parameter is used to set a delay, after all pumps have stopped, to allow for any turbulence of the material surface to settle prior to monitoring the level in the vessel and determining the inflow before the next pump cycle commences. The delay time is entered in seconds. **Default = 45 seconds**.

Important Information

When setting the **time period** for the **Calibration Delay** (P188) it is important that it does not **exceed** the **time from** when all pumps switch **Off** to the first pump **Start** during **normal operation** as it will prevent **determining** the **Inflow** and any subsequent **calculation of Efficiency**.

P189 Cal. Duration

This parameter sets the time duration over which the pumps performance will be monitored, and the resulting efficiency is calculated.

Important Information

When setting the **time period** for the **Calibration Duration** (P189) it is important that it does not **exceed** the **time from** one pump **Start** to the next pump **Start** during **normal operation** as it will abort any subsequent **calculation of Efficiency**.

P190 Persist Cnt.

If an alarm is to be used to indicate when the Pump efficiency falls below a predetermined level, this parameter determines the number of consecutive times the pump will be allowed to run, at the reduced efficiency, before the alarm will be activated. The Persist Count can be set to Min. 0, Max 99. **Default = 6**

P191 Demote Pumps.

When an efficiency alarm is being used, this parameter will determine if a pump is to be demoted to the last pump in the duty cycle on activation of the alarm. When Demote Pump is enabled, and the efficiency alarm is activated after the predetermined Persist Count (P190) the pump duty will default to a fixed duty regime with the inefficient pump being set to the last pump in the cycle which will be called to start if the level reaches the on point for that pump. A pump which has been demoted will be indicated by the relevant "pump" relay LED "flashing" RED.

Option	Description
0 = Off (Default)	Demote Pump is **disabled**
1 = On	Demote Pump is **enabled**

P192 Demote Flags

This parameter will indicate, in a binary number format as detailed below, which pumps, if any, have been demoted. Any demoted pump(s) can be reset by entering "0".

0 = None	32 = Pump 6
1 = Pump 1	33 = Pump 1 + 6
2 = Pump 2	34 = Pump 2 + 6
3 = Pump 1 + 2	35 = Pump 1 + 2 + 6
4 = Pump 3	36 = Pump 3 + 6
5 = Pump 1 + 3	37 = Pump 1 + 3 + 6
6 = Pump 2 + 3	38 = Pump 2 + 3 + 6
7 = Pump 1 + 2 + 3	39 = Pump 1 + 2 + 3 + 6
8 = Pump 4	40 = Pump 4 + 6
9 = Pump 1 + 4	41 = Pump 1 + 4 + 6
10 = Pump 2 + 4	42 = Pump 2 + 4 + 6
11 = Pump 1 + 2 + 4	43 = Pump 1 + 2 + 4 + 6
12 = Pump 3 + 4	44 = Pump 3 + 4 +6
13 = Pump 1 + 3 + 4	45 = Pump 1 + 3 + 4 + 6
14 = Pump 2 + 3+ 4	46 = Pump 2 + 3 + 4 + 6
15 = Pump 1 + 2 + 3 + 4	47 = Pump 1 + 2 +3 + 4 + 6
16 = Pump 5	48 = Pump 5 + 6
17 = Pump 1 + 5	49 = Pump 1 + 5 + 6
18 = Pump 2 + 5	50 = Pump 2 + 5 + 6
19 = Pump 1 + 2 + 5	51 = Pump 1 + 2 + 5 + 6
20 = Pump 3 + 5	52 = Pump 3 + 5 + 6
21 = Pump 1 + 3 + 5	53 = Pump 1 + 3 + 5 + 6
22 = Pump 2 + 3 +5	54 = Pump 2 + 3 + 5 + 6
23 = Pump 1 + 2 + 3 + 5	55 = Pump 1 + 2 + 3 + 5 + 6
24 = Pump 4 + 5	56 = Pump 4 + 5 + 6
25 = Pump 1 + 4 + 5	57 = Pump 1 + 4 + 5 + 6
26 = Pump 2 + 4 + 5	58 = Pump 2 + 4 + 5 + 6
27 = Pump 1 + 2 + 4 + 5	59 = Pump 1 + 2 + 4 + 5 + 6
28 = Pump 3 + 4 + 5	60 = Pump 3 + 4 + 5 + 6
29 = Pump 1 + 3 + 4 + 5	61 = Pump 1 + 3 + 4 + 5 + 6
30 = Pump 2 + 3 + 4 + 5	62 = Pump 2 +3 + 4 + 5 + 6
31 = Pump 1 + 2 + 3 + 4 + 5	63 = Pump 1 + 2 + 3 + 4 + 5 + 6

P193 Calib. Pumps

This parameter is used to calibrate the pumps and determine the optimum (100%) efficiency of the pump from which all subsequent efficiency calculations will be derived. You can either choose to "calibrate" an individual pump or alternatively have each pump "calibrated" in turn automatically.
When selecting pumps to be calibrated individually (Option 1 to 5), it is essential that the level in the vessel is above the relevant pump start point to ensure correct calibration. Once you have selected the pump to be "calibrated" you will be prompted to return to the RUN mode, there will then be a delay before the pump starts which is equal to the **Calib. Delay** (**P188**) the display will show the time being counted down time to the pump start. Once the pump has started the display will show a countdown time equal to the **Cal. Duration** (**P189**), calculation of pump efficiency will be complete on the expiry of the count and the unit will return to normal operation.
If you choose to "calibrate" the pumps automatically (Option 7) then when the unit is returned to the RUN mode each pump will be "calibrated" in turn as and when it is next called to run.

Display Parameters

Options

P800 Display Units

This parameter determines whether the reading displayed is in **Measurement Units** (**P104**), or as a **percentage of span.**

Option	Description
1 = Measured (Default)	Display is in selected unit's dependant on Mode (**P100**)
2 = Percentage	Display is in **percentage** of span dependent on Mode (**P100**).

P801 Decimal Places

This parameter determines the number of decimal places on the reading during run mode.
Minimum = 0 (No decimal places), Maximum 3 = (3 decimal Places)

P802 Display Offset

The value of this parameter is added to the reading before it is displayed, in **Measurement Units** (**P104**).

It does not affect the relay setpoints or the mA output, only the reading on the display.

You could use this feature if for example you wanted to reference the reading to sea level, where you would enter the distance between **Empty Level** (**P105**) and sea level. If the empty level point is below sea level, then enter a negative value.

P804 Display Conversion

The reading is multiplied by the value of this parameter before being displayed. The default is 1.0, but if for example you wanted to display the reading in yards, then set the **Measurement Units** (**P104**) to feet and set **P804** to **3**.

P805 Display Source

This parameter determines which input the display will relate to, it is automatically set to the correct option when selecting the **Mode P100** and **Xducer** (**P101**), and under normal circumstances will not require changing.

Option	Description
0 = Default (Default)	Displays reading obtained from selected **Mode** (**P100**).
1 = Aux	Displays level from Aux. Input.
2 = Xducer 1	Displays level from Xducer 1
3 = Xducer 2	Displays level from Xducer 2.

Failsafe

P808 Fail-safe Mode

By default, if a fail-safe condition occurs, then the display, relays and the mA output are held at their last **known** values until a valid reading is obtained. If required, then you can change this so that the unit goes to **high** (100% of span), or **low** (empty) as follows:

Option	Description
1 = Known	Remain at the last **known** value
2 = High	Will fail to the **high** value (100% of Span).
3= Low	Will fail to the **low** value (empty)

See Also P218, P228, P238, P248, P258, P268 Relay Fail-safe and P840 mA Output Fail-safe

Important Information

In the event of a **fail-safe** condition occurring, the display, relays and mA Output can be configured to fail to a condition which is independent of each other. To set independent **Relay Failsafe** see **P218, 228, 238, 248, 258, 268**. And for independent **mA Output Failsafe** see **P840.**

P809 Fail-safe Time

In the event of a fail-safe condition occurring the fail-safe timer determines the time before fail-safe mode is activated. **Default = 2 mins**.

If the timer activates, the unit goes into **fail-safe**, as determined by **P808**, (**Display**), **P218, 228, 238, 248, 258, 268**, (**Relays**) and **P840** (**mA Output**). When this happens, you will see the message "**Failed Safe!**" on the display, along with a message explaining why (lost echo or transducer fault, for example)

When a valid measurement is obtained then the display, relays and mA output will be restored and the timer is reset.

Auxiliary

P810 Units

This parameter determines whether the **Measurement units** (**P104**) are displayed on the auxiliary line of the display in run mode.

Option	Description
0 = No	Measurement units **will not** be displayed
1 = Yes (Default)	Measurement units **will** be displayed

P811 Alarms Messages

This parameter determines whether notification messages are displayed on the auxiliary line of the display in run mode when an alarm relay is switched on or off. The message is in the form "Alarm High ON", where the 'High' is determined by the setting of the relay **Alarm ID** (**P212, 222, 232, 242, 252, 262**).

Option	Description
0 = No (Default)	Alarm messages **will not** be displayed
1 = Yes	Alarm messages **will** be displayed

P812 Pumps Messages

This parameter determines whether notification messages are displayed on the auxiliary line of the display in run mode when a pump relay is switched on or off. The message is in the form "Pump 1 ON", where the number displayed is the number of the relay.

Option	Description
0 = No (Default)	Pump messages **will not** be displayed
1 = Yes	Pump messages **will** be displayed

P813 Control Messages

This parameter determines whether notification messages are displayed on the auxiliary line of the display in run mode when a control relay is switched on or off. The message is in the form "Time ON".

Option	Description
0 = No (Default)	Control messages **will not** be displayed
1 = Yes	Control messages **will** be displayed

P814 Miscellaneous Messages

This parameter determines whether notification messages are displayed on the auxiliary line of the display in run mode when a miscellaneous relay is switched on or off. The message is in the form "Clock ON".

Option	Description
0 = No (Default)	Misc. messages **will not** be displayed
1 = Yes	Misc. messages **will** be displayed

P815 Auxiliary Source

When **P100** = **4 (Average)** or **5 (Differential)** the auxiliary display line can be used to display the **level** on any of the two points of measurement.

The options are as follows:

Option	Description
0 = Off (Default)	Auxiliary display not used to display levels
1 = Aux	Displays level from Aux input.
2 = Xducer 1	Displays level from Xducer 1
3 = Xducer 2	Displays level from Xducer 2.

P816 Totalisier (R)

When Pump Volume Enabled (P205 = 1)

This parameter determines whether or not the resettable totaliser will be displayed in the auxiliary line of the display during RUN mode. When selected, the auxiliary display will scroll between the resettable totaliser and the units selected. **Default = 0 (Off)**.

P817 Auxiliary Offset

The value of this parameter is added to the reading of the auxiliary display before it is displayed, in **Measurement Units** (**P104**).

Totaliser

When Pump Volume Enabled (P205 = 1)

P820 Totaliser

Displays the current value of the, non-resettable totaliser. During run mode, this totaliser can be viewed via the "Totaliser" hot key,  Unlike the resettable totaliser this totaliser cannot be reset whilst in run mode, it can however be reset whilst in program mode by accessing **P820 Totaliser** and entering **zero**.

P821 Totaliser (R)

Displays the current value of the, resettable totaliser. This **totaliser** can be allocated to appear, during **run mode**, on the auxiliary display line (**P816**) or alternatively via the "Totaliser" hot key.

P822 Totaliser Decimal Places

This parameter determines the number of decimal places in the totaliser during run mode. It can be set between 1 and 3. **Default = 2**

P823 Totaliser Multiplication Factor

Use this parameter if the totaliser increments by to large or small amount, enter the factor by which the actual flow rate is multiplied by before incrementing the totaliser.

E.g. if flowrate is being calculated and displayed in ltrs/second and it is desired to increment the totaliser in cubic metres select 7 = *1000.
When viewing, the totaliser display will state, "Units are: L*1000", and the totaliser will be incremented every 1000 litres

Options are:

Option	Description
1= 1/1000	Totaliser will increment every 1/1000th units of flow
2= 1/100	Totaliser will increment every 1/100th units of flow
3= 1/10	Totaliser will increment every 1/10th units of flow
4= 1 (Default)	Totaliser will increment every 1 units of flow
5= 10	Totaliser will increment every 10 units of flow
6= 100	Totaliser will increment every 100 units of flow
7= 1,000	Totaliser will increment every 1000 units of flow
8= 10,000	Totaliser will increment every 10,000 units of flow
9= 100,000	Totaliser will increment every 100,000 units of flow
10= 1,000,000	Totaliser will increment every 1,000,000 units of flow

Bargraph

P829 Bargraph

By default, the bar graph will be representative of the reading obtained, as determined by the **Mode P100**. When **P100** = **4 (Average)** or **5 (Differential)** the bar graph can be assigned to be representative of the **level** on any of the two points of measurement. This parameter is automatically set to the correct default option when selecting the **Mode P100** and **Xducer** (**P101**), and under normal circumstances will not require changing.

The options, dependant on the **value** entered for **Mode P100**, are as follows:

Option	Description
1 = Auxiliary	Bargraph will be representative of levels obtained from optional Aux. Input.
2 = Xducer 1 (Default)	Bargraph will be representative of levels obtained from Xducer 1.
3 = Xducer 2	Bargraph will be representative of levels obtained from Xducer 2.
4 = Avg. Level or Diff. 1/2	Bargraph will be representative of the Avg Level or Differential of two points of measurement, as selected in **Mode P100**.

mA Output Parameters

Range

P830 mA Range

This parameter determines the range of the mA output, from the following.

Option	Description
0= Off	mA output disabled.
1= 0 to 20 mA	mA output directly proportional to the **mA mode** (**P831**), so if the reading is 0% the output is 0mA. If the reading is 100% the output is 20mA.
2= 4 to 20 mA (Default)	mA output directly proportional to the **mA mode** (**P831**), so if the reading is 0% the output is 4mA. If the reading is 100% the output is 20mA.
3= 20 to 0 mA	mA output inversely proportional to the **mA mode** (**P831**), so if the reading is 0% the output is 20mA. If the reading is 100% the output is 0mA.
4= 20 to 4 mA	mA output inversely proportional to the **mA mode** (**P831**), so if the reading is 0% the output is 20mA. If the reading is 100% the output is 4mA.

Operation

P831 mA Mode

This parameter determines how the ma Output relates to what is measured. By **default**, it operates exactly the same as the display (**P100**), but it can be set to operate as follows:

Option	Description
0 = Default	mA output relative to **Mode** (**P100**)
1 = Distance	mA output relative to **distance**.
2 = Level	mA output relative to **level**.
3 = Space	mA output is relative to **space**.
4 = Avg. Level	mA output is relative to the **average level** of two points of measurement. **P100 = 4**
5 = Differential	mA output is relative to the **differential** between two points of measurement. **P100 = 5**

Setpoint

By **default,** the mA Output will represent the **empty** (**0** or **4mA** dependant on (**P830**) **mA Range**) and **100%** of the operational **span** (**20mA**), but you may wish to have the output represent a section of the operational span. For example, the application has an operational span of 6 metres, but **output** is to **represent empty** (**0** or **4mA** dependant on (**P830**) **mA Range**) to a **level** of **5 metres** (**20mA)**. If so P834 (Low Level) should be set to 0.00 metres and P835 (High Level) should be set to 5 metres.

P834 mA Low Value

This parameter sets, in **Measurement Units (P104),** the value of 'level', 'distance', 'space', 'average level' or 'differential level', depending on the selected **mA Out Mode** (**P831**), at which the low mA output will occur (**0** or **4mA** dependant on (**P830**) **mA Range**)
Default = 0.000m

P835 mA High Value

This parameter sets, in **Measurement Units (P104),** the value of 'level', 'distance', 'space', 'average level' or 'differential level', depending on the selected **mA Out Mode** (**P831**) at which the high mA output will occur (**20mA**). **Default = 6.000m**

Limits

P836 mA Low Limit

This parameter sets the lowest value that the mA output will drop to, the default is 0mA, but you can override this if the device you connect to cannot for example accept less than 2mA, yet you want to use the 0-20mA range. **Default = 0.00mA**

P837 mA High Limit

This parameter sets the highest value that the mA output will rise to, the default is 20 mA, but you can override this if the device you connect to cannot for example accept more than 18 mA, yet you want to use the 0-20 mA range. **Default = 20.00mA**

Trim

P838 mA Low Trim

If the remote device you are connected to is not calibrated, and not showing the correct **low value** (reading), then you can trim it using this parameter. You can either type in the offset directly or use the arrow keys to move the output up and down until you get the expected result (reading) on the remote device that the mA output is connected to.

P839 mA High Trim

If the remote device you are connected to is not calibrated, and not showing the correct **high value** (reading), then you can trim it using this parameter. You can either type in the offset directly or use the arrow keys to move the output up and down until you get the expected result (reading) on the remote device that the mA output is connected to.

Failsafe

P840 mA Fail-safe Mode

This parameter determines what happens to the mA output in the event of the unit going into fail-safe mode. The **default** is to do the same as the **system fail-safe** (**P808**), but this can be overridden to force the mA output to an independent fail-safe mode as follows:

Option	Description
0 = Default	mA output will fail as per **P808**.
1 = Hold	mA output will retain its last known value.
2 = Low	mA output will fail to its **low** condition.
3 = High	mA output will fail to its **high** condition.

Allocation

P841 mA Allocation

By default, the mA output will be representative of the reading obtained, as determined by the **Mode P100**. When **P100** = 4 **(Average)** or **5 (Differential)** the mA output can be assigned to be representative of the **level** of either of the two points of measurement This parameter is automatically set to the correct default option when selecting the **Mode P100** and **Xducer** (**P101**), and under normal circumstances will not require changing.

The options, dependant on the **value** entered for **Mode P100**, are as follows:

Option	Description
1 = Auxiliary	mA output relates to the auxiliary input **level**.
2 = Xducer 1 (Default)	mA output relates to Xducer 1 **level**.
3 = Xducer 2	mA output relates to Xducer 2 **level**.
4 = Avg. Level	mA output relates to the **average level** of two points of measurement. **P100 = 4**
5 = Differential	mA output relates to the **differential** level of two points of measurement. **P100 = 5**

Offset

P851 Measurement Offset

The value of this parameter is added to the measured distance, in **Measurement Units** (**P104**).

This Offset will be added to the level, as derived from the transducer, and will affect everything including the reading on the display, the relay setpoints and the mA output.

Temperature

P852 Temperature Source

This parameter determines the source of the temperature measurement. By **default**, it is set to automatic (**P852=1**), which will automatically detect if a temperature sensor is available from the transducer. If for any reason, no temperature input is received, then the **Fixed Temp** value is used, as set by **P854**.

The temperature source can be specifically set as follows:

Option	Description
1 = Automatic	Will automatically select transducer temperature sensor, if available, or fixed temperature (P854) if no temperature sensor found.
2 = Xducer 1	Always uses temperature reading from transducer.
3 = Fixed	Always uses fixed temperature (P854)
4 = Ext Range "A" (Optional)	Uses an optional external temperature sensor with an operating range of -25°C to 50°C.
5 = Ext Range "B" (Optional)	Uses an optional external temperature sensor with an operating range of -25°C to 125°C.

P853 Allocation

This parameter allows the temperature reading to be allocated to either transducer when **Mode P100** = **4** (**Avg. Level**) or **5** (**Diff Level**) and **P101** = **Xducer.**

Option	Description
0 = Xducer 1 (Default)	Temperature reading will be obtained from Xducer 1.
1 = Xducer 2	Temperature reading will be obtained from Xducer 2.

P854 Fixed Temperature

This parameter sets the temperature, in degrees centigrade to be used if **P852** (**Temperature Source**) =**3**. **Default = 20°C**.

Velocity

P860 Sound Velocity

This parameter allows for the velocity of sound to be changed according to the atmosphere the transducer is operating in. By **default**, the velocity is set for sound travelling in air at an ambient temperature of 20 degrees centigrade. **Default = 342.7m/sec.**

Stability Parameters

Damping

Damping is used to damp the display, to enable it to keep up with the process but ignore minor surface fluctuations.

P870 Fill Damping

This parameter determines the **maximum rate** at which the unit will respond to an **increase in level**. It should be set slightly higher than the maximum vessel fill rate. **Default = 32. 8084.ft/min**

P871 Empty Damping

This parameter determines the **maximum rate** at which the unit will respond to a **decrease in level**. It should be set slightly higher than the maximum vessel empty rate. **Default = 32. 8084.ft/min**

Indicator

P872 Fill Indicator

This parameter determines the rate at which the LCD **fill** indicator activates. **Default = 32. 8084.ft/min**

P873 Empty Indicator

This parameter determines the rate at which the LCD **empty** indicator activates. **Default = 32. 8084.ft/min**

Rate

P874 Rate Update

This parameter determines the way in which the rate is calculated. If set to **continuous** (**P874**=**0**), then the rate is calculated and displayed continuously, i.e. any change seen from shot to shot is calculated and displayed, but if set to use **values P874**=**1(Default)** then the **values** set in **P875** and **P876** are used to calculate and display the rate.

P875 Rate Time

This parameter is the period (in seconds) over which the material level rate of change is averaged before the **Rate Value** (**P877**) is updated. If the **Rate Distance** (**P876**) is exceeded before the **Rate Time** (**P875**) has expired, then the **Rate Value** (**P877**) will be updated immediately. **Default = 60sec.**

P876 Rate Distance

This parameter is the rate in **Measurement Units** (**P104**) over which the material level must change before the **Rate Value** (**P877**) is updated. If the **Rate Time** (**P875**) expires before the **Rate Distance** (**P876**) is exceeded, then the **Rate Value** (**P877**) will be updated immediately. **Default = 0.164 feet**

P877 Rate Value

This parameter displays the current rate of change of material level, in **Measurement Units** (**P104)** per minute. It is read only.

P878 Lower Cutoff

This parameter is used to select the minimum Rate to be calculated and can be used to eliminate unwanted updates from effects of ripples/waves on the surface of the material.

Filters

The following parameters can be used to filter out unwanted changes of level caused by a 'rippled' or agitated surface.

P881Fixed Distance

This parameter determines the width of gate to be used in tracking an echo and under normal circumstances will not require changing, but it can be increased in the cases where the surface is moving extremely fast (in excess of 32.8084 ft./min) to ensure smooth processing of the changing level.

P882 Process Filter

This parameter determines the number of 'cycles' that will be taken before a change in level is processed and the display updated.

Option	Description
1 = Fast	level will be updated every cycle
2 = Medium	level will be updated every 8 cycles
3 = Slow (Default)	level will be updated every 16 cycles

Echo Processing Parameters

Transducer 1 Status

P900 Transducer 1 Status

This parameter shows the current state of the transducer. The value means the following.

Option	Description
0= OK	Transducer working correctly.
1= Disabled	Transducer is not being used (mA input is being used instead, so P101=1)
2= Stuck High	Indicates that the power and signal lines on the transducer terminals are crossed over, or the signal line is shorted to earth.
3= Not Found	No transducer is detected.

P901 Echo Confidence 1

This parameter displays the most recent echo confidence from the transducer. It is useful to help find the best mounting location for the transducer, where you should aim to get the highest figure. It is a percentage of confidence, that the echo reporting the level is the correct one.

P902 Echo Strength 1

This parameter displays the most recent echo strength figure for the transducer, where a higher figure indicates a better returned echo.

P903 Average Noise 1

This is the mean noise reading for the transducer. It is measured while the transducer is not firing and gives an indication of the average amount of electrical noise present on the cabling.

P904 Peak Noise 1

This is the peak noise reading for the transducer. It is measured while the transducer is not firing and gives an indication of the maximum amount of electrical noise present on the cabling.

Transducer 2 Status

P910 - P916 Transducer 2

When Mode (P100) = 4 (Average Level) or 5 (Differential).

These parameters contain the same information as detailed in Transducer 1 Status, but for transducer 2.

System Parameters

Passcode

P921 Enable Code

Enables the passcode (**P922**), which means the passcode must be entered to go into program mode. If **disabled** (set to **0**), then no passcode is required, and ENTER is used to enter program mode. **Default = 1 (Enabled)**

P922 Passcode

This is the passcode that must be used to enter program mode. The **default** is **1997**, but this can be changed to another value from 0 to 9999.

Backup

P925 Parameter Backup & Restore

This parameter is used to make a backup of all parameters, for example to ensure a default set is maintained within the unit. If alterations are made to the parameters that do not work as intended, then the backup set can be restored into the unit.

You can make two separate backup copies if you wish, called backup 1 and backup 2, and restore from either.

The options are:

Option	Description
1= Backup 1	Make backup to area 1 of all parameters
2= Backup 2	Make backup to area 2 of all parameters
3= Restore 1	Restore all parameters from area 1
4= Restore 2	Restore all parameters from area 2

System Information

The following three parameters do not affect how the unit performs, but details, contained in them, may be required, by Pulsar, when making technical enquiries.

P926 Software Revision

This parameter will display the current software revision. It is read only and cannot be changed. The **Software Revision** can also be checked, whilst in **RUN** Mode, by pressing the **decimal point** key.

P927 Hardware Revision

This parameter will display the current hardware revision. It is read only and cannot be changed.

P928 Serial Number

This parameter will display the serial number of the unit. It is read only and cannot be changed. The **Serial Number** can also be checked whilst in **RUN** Mode by pressing the **decimal point** key.

P929 Site Identification

This parameter allows you to give each unit an individual reference number, for identification purposes. You can set any number between 1 and 99999.

P930 Factory Defaults

This parameter resets all parameter values to the original Factory Set values that were installed when the unit was tested, before despatch to you.

To **reset** parameters, enter **1** (**Yes**), and press ENTER, then you will see a message "**Entr if sure**", you should press ENTER again. If you press any other key at this point, the parameters will not be reset, and you will see a message confirming this.

Once you have done this, program the unit to the desired application.

Date & Time

The date and time are used to, control specific relay functions and date stamp certain events that are contained in the Data Logs. It is also used in conjunction with the system watchdog that monitors the times the unit has been started.

P931 Date

This parameter displays the **current date**, in the format as set by **P933** (**Date Format**) and can be reset if required.

P932 Time

This parameter displays the **current time** and can be reset if required, in the format HH: MM (24-hour format). This is set initially at the factory for UK time.

P933 Date Format

This parameter allows you to alter the format that the date is displayed to your choice of DD: MM: YY, MM: DD: YY or YY: MM: DD. **Default = MM:DD:YY.**

LED Colour

Each relay has an associated LED, located on the unit's front panel, which indicates the status of the relay. By default, the LED of any relay that has been programmed but is in its "OFF" state will be illuminated 'yellow'. When "**ON**" **alarm** relays will cause the **LED** to illuminate **Red** and **pump**, **control** and **miscellaneous** relays will cause the **LED** to illuminate **green**. LED's of any relays that have not been programmed will not be illuminated. Customised settings for the colour of LED's can be achieved by using the following parameters.

P935 Off Relay Colour

This parameter selects the colour that a **programmed relay** should be when it is in its "**OFF**" state. The **default** is **3 = yellow**, but can be changed to 'no colour', red or green.

P936 Alarm Relay Colour

This parameter selects the colour that an **alarm** relay should be when it is in its "**ON**" state. The **default** is **1 = red**, but can be changed to 'no colour', green or yellow.

P937 Pump Relay Colour

This parameter selects the colour that a **pump** relay should be when it is in its "**ON**" state. The **default** is **2 = green**, but can be changed to 'no colour', red or yellow.

P938 Control Relay Colour

This parameter selects the colour that a **control** relay should be when it is in its "**ON**" state. The **default** is **2 = green**, but can be changed to 'no colour', red or yellow.

P939 Miscellaneous Relay Colour

This parameter selects the colour that a **miscellaneous** relay should be when it is in its "**ON**" state. The default is **2 = green**, but can be changed to 'no colour', red or yellow.

All relays that are not programmed will show 'no colour', i.e. they are OFF

Additional Information

When a relay has been failed, due to a fail signal having been received on its associated digital input, the relay LED will **flash** on and off, between **yellow** and **red**, to indicate that the **relay** has been **failed** but not put out of service. After the **maximum attempts P300** have been made to start the device **relay** and it is put **out of service** then the relay LED will remain lit on **red** until such time that the input is reset.

Watchdog

You can check how many times the unit has been switched on and look at the date and time of the last ten starts. This can be useful if there have been power failures or if for any reason the Zenith restarts due to a fault condition. The Zenith can be backed up from a battery which automatically cuts in during power failure, battery backed up units will continue uninterrupted operation and therefore will not register a loss of mains power. If, however, the battery was to fail during a mains power interruption, a start-up would be recorded once power has been restored.

The following parameters can be accessed by directly entering the parameter number. To do this, enter the **program mode** and then **type** in the appropriate **parameter number**.

P940 Number of Starts

This parameter shows how many times the unit has been powered up.

P941-P960 Start Date & Time

Parameters **P941** and **P942** show the **date** and **time** that the unit was last started. There are **ten start dates & times** recorded which are detailed in parameters **P943 - P960**. The first on the list are the most recent, and the last ones are the oldest. These are read only and cannot be changed.

Daylight Saving Time

Important Information

In order to ensure the correct operation of Daylight Saving Time **P932 Time** should be checked, and adjusted if necessary, to ensure that it is set for the current valid time.

P970 DST Enable

When **Enabled** (set to **1**) the internal clock will be automatically adjusted to compensate for the difference between standard time and **Daylight Saving Time. Default = 1 (Yes)**

P971 DST Difference

This parameter sets the time difference between standard time and **Daylight Saving Time.** The time difference is entered in HH: MM. **Default = 01:00**

P972 DST Start Time

This parameter is used to set the **time** of day at which **Daylight Saving Time** will **start**, the time is entered in the format HH: MM (24-hour format). **Default = 02:00**

P973 Start Day

Use this parameter to enter the **day** of the week (**P974**) that **Daylight Saving Time** is to **start**.

Option	Description
2= Monday	**DST** will **start** on a **Monday**
3= Tuesday	**DST** will **start** on a **Tuesday**
4= Wednesday	**DST** will **start** on a **Wednesday**
5= Thursday	**DST** will **start** on a **Thursday**
6= Friday	**DST** will **start** on a **Friday**
7= Saturday	**DST** will **start** on a **Saturday**
8= Sunday (Default)	**DST** will **start** on a **Sunday**

P974 Start Week

This parameter will determine the **week** of the month (**P975**) in which **Daylight Saving Time** is to **start**.

Option	Description
1= Week 1	**DST** will **start** on **day** (**P973**) in the **first** week (**P974**) of the **month** (**P975**).
2= Week 2	**DST** will **start** on **day** (**P973**) in the **second** week (**P974**) of the **month** (**P975**).
3= Week 3	**DST** will **start** on **day** (**P973**) in the **third** week (**P974**) of the **month** (**P975**).
4= Week 4	**DST** will **start** on **day** (**P973**) in the **fourth** week (**P974**) of the **month** (**P975**).
5= Last (Default)	**DST** will **start** on **day** (**P973**) in the **last** week (**P974**) of the **month** (**P975**).

P975 Start Month

This parameter is used to select the **month**, in which **Daylight Saving Time** will **start**.

Option	Description
1= January	**DST** will **start** during the month of **January**
2= February	**DST** will **start** during the month of **February**
3=March (Default)	**DST** will **start** during the month of **March**
4= April	**DST** will **start** during the month of **April**
5= May	**DST** will **start** during the month of **May**
6= June	**DST** will **start** during the month of **June**
7= July	**DST** will **start** during the month of **July**
8= August	**DST** will **start** during the month of **August**
9= September	**DST** will **start** during the month of **September**
10= October	**DST** will **start** during the month of **October**
11= November	**DST** will **start** during the month of **November**
12= December	**DST** will **start** during the month of **December**

P976 DST End Time

This parameter is used to set the **time** of day at which **Daylight Saving Time** will **end**, the time is entered in the format HH: MM (24-hour format). **Default = 02:00.**

P977 End Day

Use this parameter to enter the **day** of the week (**P974**) that **Daylight Saving Time** is to **end**.

Option	Description
2= Monday	**DST** will **end** on a **Monday**
3= Tuesday	**DST** will **end** on a **Tuesday**
4= Wednesday	**DST** will **end** on a **Wednesday**
5= Thursday	**DST** will **end** on a **Thursday**
6= Friday	**DST** will **end** on a **Friday**
7= Saturday	**DST** will **end** on a **Saturday**
8= Sunday (Default)	**DST** will **end** on a **Sunday**

P978 End Week

This parameter will determine the **week** of the month (**P975**) in which **Daylight Saving Time** is to **end**.

Option	Description
1= Week 1	**DST** will **end** on **day** (**P977**) in the **first** week (**P978**) of the **month** (**P979**).
2= Week 2	**DST** will **end** on **day** (**P977**) in the **second** week (**P978**) of the **month** (**P979**).
3= Week 3	**DST** will **end** on **day** (**P977**) in the **third** week (**P978**) of the **month** (**P979**).
4= Week 4	**DST** will **end** on **day** (**P977**) in the **fourth** week (**P978**) of the **month** (**P979**).
5= Last (Default)	**DST** will **end** on **day** (**P977**) in the **last** week (**P978**) of the **month** (**P979**).

P979 End Month

This parameter is used to select the **month**, in which **Daylight Saving Time** will **end**.

Option	Description
1= January	**DST** will **end** during the month of **January**
2= February	**DST** will **end** during the month of **February**
3= March	**DST** will **end** during the month of **March**
4= April	**DST** will **end** during the month of **April**
5= May	**DST** will **end** during the month of **May**
6= June	**DST** will **end** during the month of **June**
7= July	**DST** will **end** during the month of **July**
8= August	**DST** will **end** during the month of **August**
9= September	**DST** will **end** during the month of **September**
10= October (Default)	**DST** will **end** during the month of **October**
11= November	**DST** will **end** during the month of **November**
12= December	**DST** will **end** during the month of **December**

RS232 Set Up

P061 Comms Baud

This parameter is used to set the speed (Baud Rate) of the RS232 communications and can be changed to suit the connecting device. **Default = 19200**

RS 485 Set Up (Optional)

Please refer to the relevant communications manual for availability of parameters and details of options.

Remote Alarm

When a Modem is connected to, via the RS232 port, (Consult Pulsar or your local distributor for further details), the following parameters are used to set up the Zenith so that when the level reaches a specific alarm point, as determined by the setting of the relay(s) the unit will dial and connect to a remote telephone number to provide details of the event.

P144 Call Type

This parameter determines what type of connection is made via the modem.

Option	Description
0= Off (Default)	Remote alarm function is disabled
1 = Ring	This option initiates a connection to a remote modem/computer which will then allow remote communication with the unit. Please consult Pulsar or your local distributor for further details.
2= SMS	This option initiates a predetermined message which is sent to the remote telephone number detailing date and time the alarm was initiated, the site ID, alarm condition and level at the time the alarm was initiated.

P145 Tel. No.1

This parameter is used to enter the number of '0's that appear at the beginning of the telephone number to be dialled that is to receive the message.

Option	Description
0= None	No '0's present at the beginning of the telephone number to be dialled.
1 = Add 0 (Default)	1 '0' present at the beginning of the telephone number to be dialled.
2= Add 00	2 '0's present at the beginning of the telephone number to be dialled.

P146 Tel. No2

How This parameter is used to enter to enter the next 6 digits, following the '0's, of the telephone number to be dialled. If there are less than 8 digits following the '0's, then just enter the digits required, if there are more than 8 digits following the '0's then enter the first 6 digits and then proceed to P147 and enter the remaining digits.

P147 Tel. No3

This parameter is used to enter any remaining digits of the telephone number to be dialled after completion of P145 and P146 above.

Example

Telephone number to be dialled is: 0 1234 123456

P985 Tel. No. 1 = 1(One '0' at the beginning of the telephone number)

P986 Tel. No. 2 = 123412 (The next 6 digits following the '0's).

P987 Tel. No. 3 = 3456 (Remaining digits of telephone number).

Simulation

P980 Simulate

Test mode is used to simulate the application and confirm that all parameters and relay setpoints have been entered as expected. During simulation, there is a choice of whether the relays will change state (hard simulation) or not (soft simulation), but the LED's will always change colour as programmed, and the current output will change. If you want to test the logic of the system that the relays are connected to then select a hard simulation, but if you don't want to change the relay state, then select a soft simulation.

There are two simulation modes, **automatic** and **manual**. Automatic simulation will move the level up and down between empty level or the pre-determined **Start Level (P983)** and Pump/Control relay switch points, if you wish to change the direction of the level movement e.g. to go beyond relay setpoints, this can be done by using the arrow keys. In manual simulation, using the arrow keys will allow you to move the level up and down as required.

The choices for you to enter are as follows.

1= Manual soft simulation
2= Automatic soft simulation
3= Manual hard simulation
4= Automatic hard simulation

Whilst in Automatic hard simulation (**P980 = 4**) the switching of digital inputs can be simulated by pressing the corresponding numeric key to the input to be switched, each time the numeric key is pressed it will toggle the input between On and Off.

To return to program mode, press CANCEL and test mode will end.

Note

Pump start delay (which by default is 10 seconds) is set to 0 during simulation.

P981 Increment

By **default**, simulation mode will move by **0.328ft** steps in manual simulation and by 0.328ft/min in automatic simulation. Altering the increment can change this value.

P982 Rate

In automatic mode, the rate at which the level will move up and down, is determined by distance, **P981 Increment** and the time, **P982 Rate** which by **default** is set to **1min** and can be changed as required. To increase the rate at which the level moves increase the **Increment (P981)** or decrease the **Rate (P982)**. To decrease the rate at which the level moves decrease the **Increment (P981)** or increase the **Rate (P982)**.

P983 Start Level

When using automatic simulation this parameter can be used to pre-determine the point at which the simulated level will start at and return to. This can be used to simulate the lowest point to which the level would normally operate.

P984 Inc. Change

When using automatic simulation, you can incrementally increase or decrease the rate whilst running simulation. The rate is increased /decreased incrementally by the value **P984 (Incremental Change)** by using the "**decimal point**" key to **increase** and the "**plus/minus**" key to **decrease** the rate of change. **Default = 0.328ft**

P990 Self Test

If you enter 1 for this parameter, then the unit will perform a self-test. This will confirm that the various parts of the circuitry are working correctly. You will see confirmation messages that the clock and the EEPROM are working correctly, and error messages for any parts that fail.

P991 Hard Test

When this parameter is selected, the unit will test the following in turn.

* **LED's**. Watch them change colour as shown on the display, and press, ENTER, if they operated as shown.

* **Relays**. Press a numeric key corresponding to the number of the relay you wish to test, and the relay will change state each time the key is pressed. If you press any other key, other than a valid relay number, then the test will end.

* **Segments**. All the segments on the LCD are lit up, so you can see if they all work. Press, ENTER, to end the test. The LED's all go green at the same time.

* **Keys**. You should press each key, to confirm it works, with a counter showing how many more keys you have to press. Be sure to press the **CANCEL** key last, as this will show if all keys were pressed or not. If they were not, then an error message is displayed.

P992 mA Out Test

This parameter will allow you to force a specified current on the mA output, to test the equipment that it is connected to, and to make sure the unit is working correctly. The figure you enter will be generated by the mA output.

P993 mA In Test

This parameter will allow you to test the mA input, by injecting a known mA signal from an external source you can check the unit is working correctly and as expected.

P994 Transducer Test

If you enter 1 for this parameter it will continually fire the transducer, so you can check the wiring, until you press any key to cancel.

P995 Keys Test

You should press each key, to confirm it works, with a counter showing how many more keys you have to press. Press the **CANCEL** key last, as this will confirm if all keys were pressed or not. If they were not, then an error message is displayed.

P996 Relay Test

Press the numeric key corresponding to the number of the relay you wish to test, and the relay will change state each time the key is pressed.

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This section describes many common symptoms, with suggestions as to what to do.

Symptom	What to Do
Display blank, transducer not firing.	Check power supply, voltage selector switch and fuse.
Displays “No Xducer”	Check wiring to transducer.
Displays “Xducer Flt”	There is a fault with the transducer wiring, so check wiring to transducer.
Incorrect reading being displayed for current level.	Measure actual distance from transducer face to surface of material. Enter Program Mode and directly access P21 (Set Distance) type in the measured distance, press ENTER and ENTER again, when prompted, wait until SET is displayed and return to Run Mode, display will now update to the correct reading.
Material level is consistently incorrect by the same amount.	Check empty level (P105), display offset (P802) and measurement offset (P851).
LED’s change colour at relevant relay switch points but relays do not change state.	Check supply, to unit, and ensure voltage selector set to correct position.

Incorrect disposal can cause adverse effects to the environment.

Dispose of the device components and packaging material in accordance with regional environmental regulations including regulations for electrical \ electronic products.

Transducers

Remove power, disconnect the Transducer, cut off the electrical cable and dispose of cable and Transducer in accordance with regional environmental regulations for electrical \ electronic products.

Controllers

Remove power, disconnect the Controller and remove battery (if fitted). Dispose of Controller in accordance with regional environmental regulations for electrical \ electronic products.

Dispose of batteries in accordance with regional environmental regulations for batteries.

EU WEEE Directive Logo

This symbol indicates the requirements of Directive 2012/19/EU regarding the treatment and disposal of waste from electric and electronic equipment.

Notes