pulsar®
PROCESS MEASUREMENT

blackbox 130 UL

INSTRUCTION MANUAL

BLACK BOX LEVEL 130 UL (THIRD EDITION REV 1)

April 2020

Part Number M-130-0-003-1U

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

The blackbox shown on the cover of this manual is used for illustrative purposes only and may not be representative of the actual blackbox supplied.

COMMENTS, SUGGESTIONS AND TECHNICAL ENQUIRIES

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Contents

Chapter 1 Start Here...

Congratulations on your purchase of a Pulsar blackbox 130 Level System. 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

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 things in more detail.

References

See Also

References to other parts of the manual

About the Blackbox range

The Pulsar blackbox is a non-contact Level Control System. It has been designed to provide a new concept in low cost maintenance-free fit and forget level measurement without any compromise on performance.

The blackbox is ideally suited to applications where level monitoring, reporting, control or logging is required, with or without the need for a local display.

The blackbox level system is available in a variety of different versions offering a wide choice of output options.

The blackbox is very easy to use and may be calibrated quickly and simply via a laptop, using the software supplied with the unit, or alternatively by using the optional hand-held calibrator, which connects to the unit via the RS232 interface, and provides an on-board LCD display. Certain models are also available with an optional LCD display and integral keypad fitted.

All models of the blackbox range can be used with any of the extensive range of Pulsar dB transducers for distances up to 131ft (40m).

The blackbox range is designed to provide you with highly reliable measurement in a robust and functional package that is easy to use and low in cost.

Functional Description

The blackbox ultrasonic Level System sends a transmit pulse to the transducer, which emits an ultrasonic pulse perpendicular to the transducer face, and the returned echo is sent back to the blackbox. The time taken to receive the echo is measured and the distance from the transducer face to the surface being monitored is calculated.

The blackbox utilises the unique DATEM software (**D**igital **A**daptive **T**racking of **E**cho **M**ovement). This is a unique digital mapping technique developed especially for Pulsar's range of ultrasonic level and control systems. It gives the system edge when identifying the "true target level" in the face of competing echoes from pipes, pumps or other obstructions.

The blackbox can measure from 0.252ft (0.077m) to 131 feet (40m) from the transducer to the surface being monitored, dependent on the application and transducer used.

The blackbox can measure **level**, **space or distance** and provide a representative output. When fitted with the **optional display and keyboard** it can also measure and provide an output representative of **volume**. There are two user definable relays, with individual setpoints, which can be programmed to activate alarms or control functions, a mA output that can be used for remote indication purposes and a RS232 port, so that the blackbox can be programmed or monitored remotely by a PC or other equipment.

The blackbox can be programmed either by PC, via the RS 232 Serial Interface, using the supplied software (standard) or by hand held calibrator (optional) which is connected to the blackbox via the RS 232 interface.

Those units fitted with the optional on-board display can be programmed via the integral keyboard.

All the parameters are stored in non-volatile memory, so are retained in the event of power interruption.

Product Specification

Physical	
Standard Wall Mount Enclosure	
Outside dimensions	5.9 x 5.1 x 2.5 inches (150 x 130 x 64 mm)
Weight	Nominal 1.4lbs (0.65 kg)
Cable entry detail	underside fitted with 3 x M20, nylon cable glands
Weight	Nominal 1.54lbs (0.7 kg)
Cable entry detail	underside fitted with 3 x M20, nylon cable glands
Enclosure material/description	Polycarbonate flame resistant, UL94-V0
Transducer cable extensions	3 conductor 20AWG screened
Nominal separation	3,280 ft. (1000m). 1.640 ft. (500m) for dBR16 and dBR8
Environmental	
Mounting	Indoor
Relative Humidity (IP Rating)	IP67 (NEMA 4X enclosure) <35ºC (95ºF) at 93% relative humidity Pollution Degree 2
Altitude	2000m maximum
Max. & min. temperature (electronics)	-4ºF to 122ºF (-20 ºC to +55 ºC)
Flammable atmosphere approval	Safe area: compatible with approved dB transducers (see transducer spec' sheet)
Approvals	
UL	File 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)
Resolution	0.1% of the measured range or 0.08" (2 mm) (whichever is greater). ±2mm for dBR16
Max. range	Dependant on transducer (maximum 131ft (40m) dB40)
Min. range	Dependent upon transducer (minimum 0.2521ft (0.077m) dBR16 & dBR8)
Rate response	fully adjustable
Echo Processing	
Technology	Ultrasonic and FMCW Radar
Description	DATEM (**D**igital **A**daptive **T**racking of **E**cho **M**ovement)
Outputs	
Analogue output	Isolated (floating) or non-isolated output of 4-20 mA or 0-20 mA into 1KΩ (user programmable and adjustable) 0.1% resolution

Serial Port (Digital output)	Full Duplex RS232 for programming and data extraction
Volt free contacts, number and rating	2 form "C" (SPDT) rated at 2A at 115V AC
Display (optional)	2 x 12 alpha numeric

Programming

PC programming (standard)	via RS232 using supplied software
Remote programming (optional)	via RS232 using optional hand-held calibrator
On board programming (optional)	via integral keypad
Programming security	via passcode (user selectable and adjustable)
Programmed data integrity	via non-volatile RAM

Supply

Power supply	115 VAC +5% / -10% 50/60 Hz, dc 10 - 28V 10W maximum power (typically 5W)
Overvoltage Category	II
Fuses	
Mains (F1)	100 mA T at 115V AC
DC (Battery) (F2)	1A Thermal (self-resetting after power removed). Not user replaceable
Transducer (F3, F5)	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.

Remote Communicator

Power Supply	Power supplied via blackbox RS232 interface.

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 *Blackbox series*

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 Blackbox 130, 133, 134, 135, 136 range
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 PR Allan Name: Jeff Allan (BSc.) Engineer Pulsar Process Measurement Ltd	Date: 22nd June 2017 Rev 5.0

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 blackbox 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%**. The **DC** is **10-28V**. In all cases the blackbox will typically consume 5W of power, with a maximum of 10W. If the blackbox 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 and labelled to identify the instrument to which it refers.

Safety Symbols

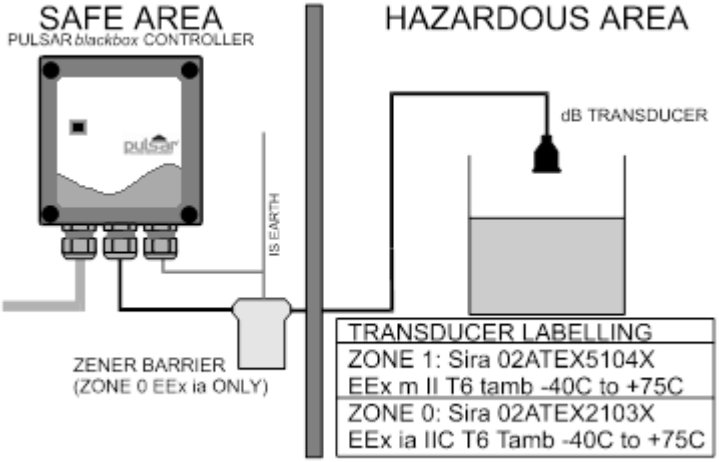
Detailed below are descriptions and meanings of safety/warning symbols that are used on the blackbox 130 and in this manual.

	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 blackbox level controller must be mounted in a non-hazardous (safe) Area, and the transducer fitted in the hazardous area.



Note: The blackbox shown in the above diagram is for illustrative purposes only and may not be representative of the actual blackbox supplied.

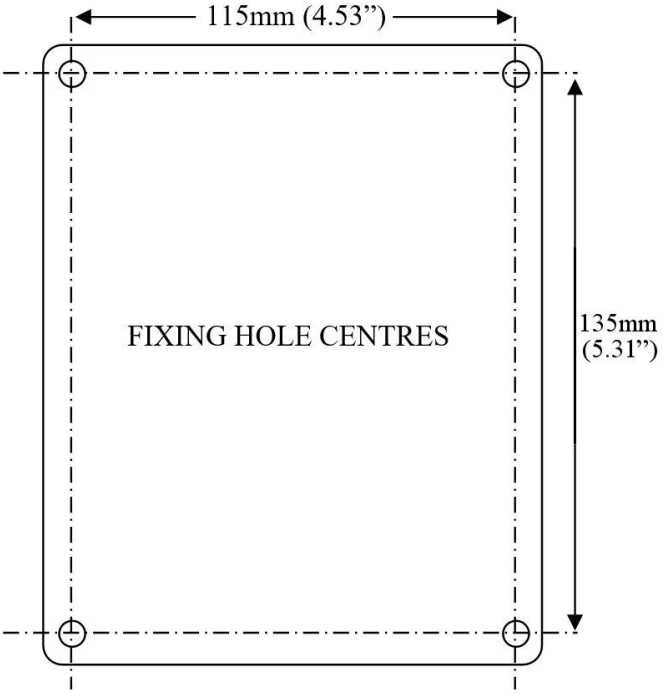
FM APPROVED TRANSDUCERS
Class I, Div. 1, Group A, B, C & D
Class II, Div. 1, Group E, F & G
Class III

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

- Ensure that the blackbox is installed in a “Safe”, non-hazardous, area.
- Easy access to the enclosure is maintained.
- The mounting surface is vibration-free.
- The ambient temperature is between -4ºF and 122ºF (-20ºC and 55ºC)
- There should be no high voltage cables or inverters close by.

Standard Enclosure

The dimensions of the mounting holes are as shown below.



The blackbox should be mounted by drilling four holes suitable for size 8 pan or round headed screws. The screw length will be dependent on the wall to which the blackbox is to be mounted to, if it is unclad use 1.5" long screws with suitable wall fixings, if the wall is clad add the cladding thickness to the 1.5" screw length.

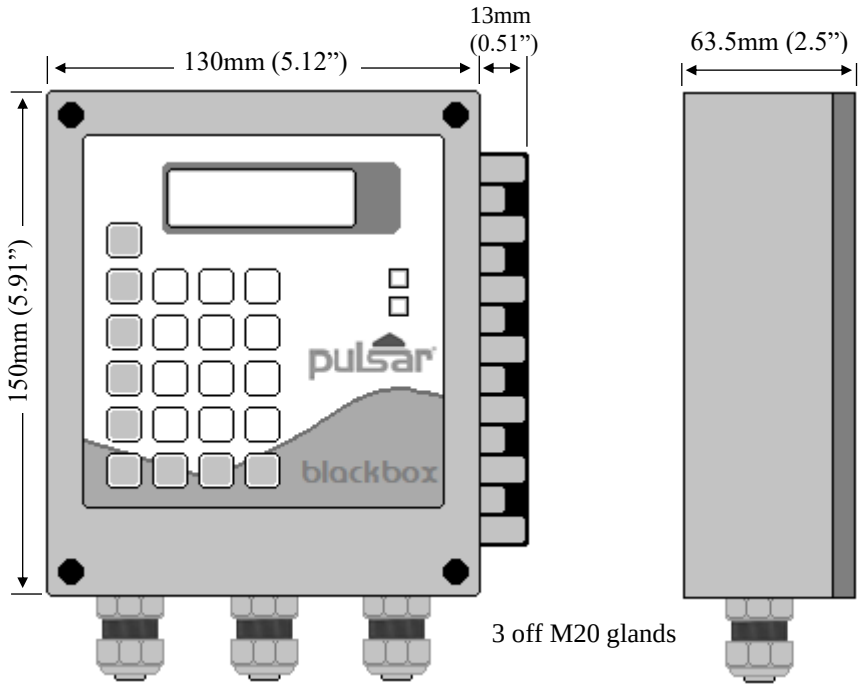
Fit all four screws by removing the top cover to access the pre-moulded mounting holes which are located in the corners of the base of the enclosure, under the lid retaining screws.

Important Information

The enclosure lid screws should be tightened to 0.5Nm.

Care should be taken not to over tighten the screws.

The full dimensions of the enclosure are as shown below.

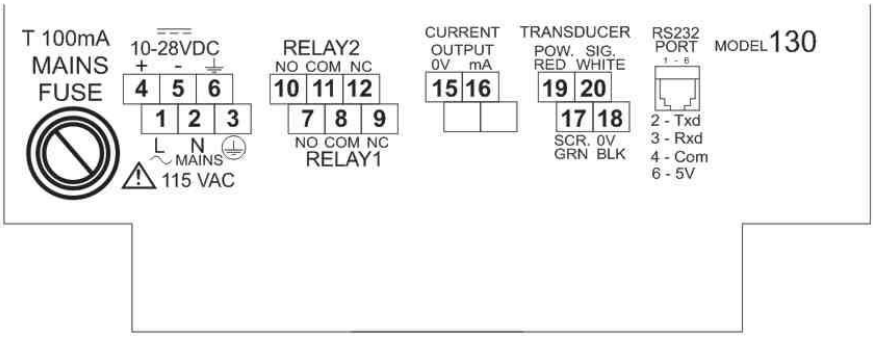


Cable Entry

There are 3 x 20mm (0.79") cable glands, suitable for 6 – 12mm (0.24" – 0.5") overall cable diameter. The gland cable nuts require a 24mm A/F spanner; tighten to a torque of 2Nm.

Terminal Connection Details

The terminal strip is as detailed below. There is also a wiring diagram attached to the board directly underneath the terminal strip.



Important Information

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

Care should be taken not to over tighten the screws.

Terminal Connections

Power

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

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 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 EEx m (Zone 1) or EEx ia (Zone 0).

Wire the transducer to the blackbox transducer terminals as detailed below:

Red = Power (Terminal 19)

White = Signal (Terminal 20)

Black = 0 volts (Terminal 18)

Green (screen) = SCR (Terminal 17)

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 and connected to the 0 volts' terminal (Terminal 18).

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 blackbox level controller.

Restrictions do not use in the presence of these groups of Chemicals, Aliphatic Hydro Carbons, 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 blackbox 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 blackbox level controller.

For **EEx ia** (**Zone 0)** a transducer certified to **Sira 02ATEX2103X** is used, which must be connected to the blackbox 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 blackbox are capable of emitting sound pressure levels in excess of 85dBA (above a reference sound pressure level of 20µPA), then the blackbox must be located remote from the transducer such that a sound pressure level of 85dBA is not exceeded when standing at the blackbox in the operator's position.

Relay Outputs

The two relays can be programmed to a variety of alarm and control functions. The relay contacts are all rated at 2A at 115V AC. Wiring should be completed by using suitable cable, to meet the specified 115V AC 2A contact rating, up to maximum size of 14AWG. All connections should be such that the short circuit capacity of the circuit to which they are connected, is limited by fuses rated so that they do not exceed the relay rating.

Current Output

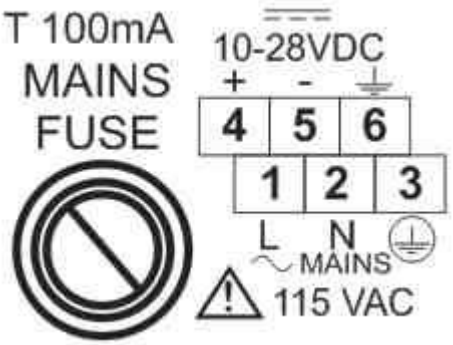
This is an isolated mA output of 4 - 20mA or 0 - 20mA, and the load should not exceed 1KΩ.

RS232 Serial Interface

The serial interface is used to programme the blackbox either via a PC (standard) using the software supplied or alternatively using the hand-held calibrator (optional).

Fuse Location

The mains fuse is located, on the bottom board, to the left of the mains terminals, as illustrated below.



Important Information

Before applying AC power (mains), make sure the supply is 115 VAC +5% / -10%

Never operate the blackbox with terminal access exposed.

An external switch or circuit breaker should be installed near to the blackbox 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 blackbox.

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:

- ✓ The blackbox 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 your blackbox, except the mains power fuse. If you experience any problems with the equipment, 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 or transducer.

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 blackbox, before proceeding, to prevent any undesirable updates to the DATEM trace. If after moving the transducer the reading is not as expected, please refer to **Chapter 6 Troubleshooting**.

In order to view or change parameter values one of the following methods must be used:

PC Handheld Programmer (Standard)

The blackbox 130 comes complete with the PC Handheld Programmer software, contained on CD. Insert the CD into the CD drive of the PC intended to be used to carry out the programming of the blackbox and install the software, following the on-screen instructions. Once the software is installed connect the computer via its serial port to the blackbox RS232 serial interface RJ11 connector, located on the terminal connector strip, inside the blackbox enclosure. Double click the 'Handheld Programmer' icon, installed on your desktop and the PC will automatically connect to the blackbox. Once connected you will briefly see the message illustrated on the display below which, after connecting successfully, will then change to display the current measurement, dependent on mode and measurement unit's chosen. When using the PC Handheld Programmer software, keypad input can be achieved by using a 'mouse' or similar device to place the cursor over the relevant key followed by a 'left' click, alternatively numeric detail can be entered directly from the PC keyboard as can 'ENTER' and 'CANCEL' (Esc. Key).

Communication Port Configuration

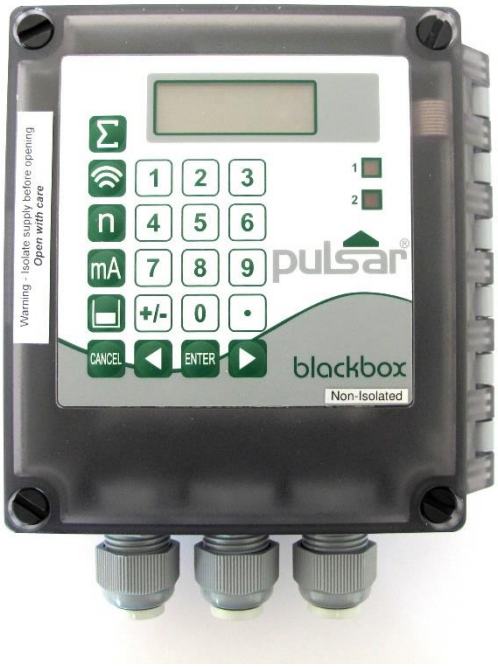
If the PC Handheld Programmer fails to connect to the blackbox unit you may need to change the communications port that is being used, to do this 'right click' on the PC Handheld Programmer keypad and a 'pop up' menu will appear allowing you to select the appropriate communications port.

Handheld Communicator (Optional)

The optional Handheld communicator can be used to programme any number of blackbox units and works in a similar way to the PC Software. Connect the Handheld Communicator, with the cable supplied, to the RS232 interface via the RJ11 connector located on the terminal connector, inside the blackbox enclosure. Once connected you will briefly see a message, similar to that as seen when using the PC Software which, after connecting successfully, will then change to display the current measurement, dependent on mode and measurement unit's chosen.

On board integral Keypad and Display (Optional)

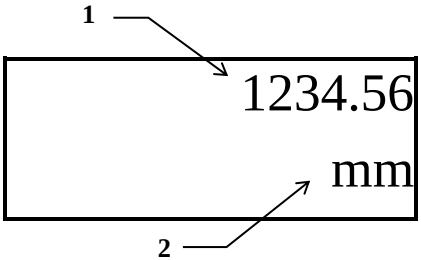
When fitted, the blackbox can be programmed directly via the integral keypad.



Display

The display in all cases is identical, the only difference being is that both the PC Programming Software (standard) and the Hand-Held Calibrator (optional) need to be connected to the blackbox via the RS232 interface, whereas the on-board keypad and display (optional) are permanently connected to the blackbox provides information on the current mode of operation.

When 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. 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.



1) **Main Display**, 6-digit numeric 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.

2) **Auxiliary Display**, scrolling twelve-digit alpha numeric display
   Run Mode, displays measurement units (P104), status messages on signal and transducer, detail of Hot Key function selected.
   Program Mode, displays Menu and Sub Menu headings, parameter

Keypad

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 subsequent parameters, as available, then the blackbox reverts to Run Mode. In program mode, they have different functions, the functions are shown below.

Hot Key	Run Mode	Program Mode
	Not used with blackbox 130.	Not used with blackbox 130.
	Displays echo confidence, echo strength, H.A.L.L., average noise, peak noise or temperature.	Not used with blackbox 130.
	Not used with blackbox 130.	Reset parameter to default setting.
	Instantaneous mA output.	Not used with blackbox 130.
	Dependant on application displays Distance, Level, Space or Volume (optional) in units of measurement.	Not used with blackbox 130.
	Not used with blackbox 130.	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.

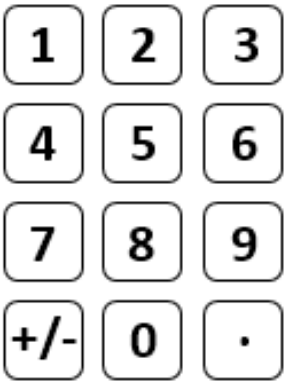
Menu Keys

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 blackbox such as before restoring factory defaults.
	Used to navigate up a level in the menu system, and back to run mode. Used to cancel a value entered in error.

Numeric Keys

These keys are used for entering numerical information during programming.



There are two main operating modes for your blackbox, **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 blackbox 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 blackbox is switched on for the first time, it will provide an output proportional to the distance from the transducer to the target, in feet. All relays by default are switched off.

If either the PC Programming Software (standard) or the Hand-Held Calibrator (optional), are connected to the blackbox, via the RS232 interface, while the blackbox is in the RUN mode then the current measurement will be displayed, dependent on mode and measurement unit's chosen. Models fitted with the optional LCD display and integral keypad will also display the current measurement, dependent on mode and measurement unit's chosen.

After programming is complete, any relays that are set will operate when the measurement reaches the relevant setpoint.

LED's

There are two LED's which can be seen through the lid, of the blackbox enclosure, which will indicate the operational **status** of the unit when in **RUN** mode, as follows:

Blackbox without on board display (standard).

LED 1 Green	LED 2 Red	Run Mode
Off	Off	No power to unit
Constant On	Constant On	Internal Error
Slow Flashing	Slow Flashing	Transducer fault
Off	Slow Flashing	Failed Safe /Loss of Echo
Slow Flashing	Off	Healthy signal unit working normally.

Blackbox with on board display (optional).

LED 1	LED 2	Run Mode
Off	Off	**Relays** are in there **OFF** state.
Constant On	Off	**Relay 1** in its **ON** state
Off	Constant On	**Relay 2** in its **ON** state

Program Mode

This mode is used to set up the blackbox or change information already set. You must use either the PC Software supplied (standard) or alternatively the unit can be set up with a Hand-Held Calibrator (optional), both of which must be connected to the blackbox via the RS 232 Serial Interface.

Those models fitted with the optional display can be set up by using the integral keypad on the unit.

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 on the PC Programming Software (standard), Hand Held Calibrator (optional) or integral keypad (optional), followed by the ENTER key. The **default passcode** is **1997**, so you would press the following:

Note

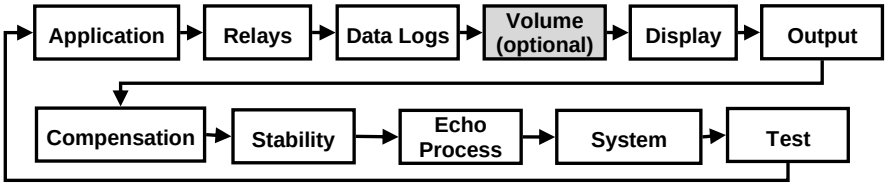
There is a time-out period of 15 minutes when in **program mode**, after which time **run mode** will be resumed if you do not press any keys.

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

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 shows the menu system. Pressing the arrow keys scrolls the display between the top-level menu items, (as shown below, starting at Application).



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, **Parameter Guide**. When you move down into the sub-menu, you can scroll round using the arrow keys, 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 and you will see the message "**Saved!**", if you press CANCEL, then no change will be made, 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 blackbox will ask for confirmation before allowing you to go back into run mode. This is done by pressing ENTER at the display prompt.

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 no change will be made, and the message "**Unchanged!!**" will be displayed.

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 physically change state (hard simulation) or not (soft simulation), the LED's will always change state to indicate that the relay setpoints have been activated, and the 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 and maximum span, whereas **manual** simulation will allow **you** to move the level up and down using the arrow keys.

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 0.25m 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 for 0.25ft and **rate** (**P982**) is set to 1 min then the level will increase or decrease at a rate of 0.25ft/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**).

LED's

There are two LED's which can be seen through the lid, of the blackbox enclosure, which will indicate the **status** of the **relays** when in **simulation** as follows:

Blackbox without on board display (standard).

Green	Red	Run Mode
Off	Off	**Relays** are in their **OFF** state.
Off	Constant On	**Relay 1** in its **ON** state
Constant On	Off	**Relay 2** in its **ON** state
Constant On	Constant On	**Relay 1** and **2** in their **ON** state

Blackbox with on board display (optional).

LED 1	LED 2	Run Mode
Off	Off	**Relays** are in their **OFF** state.
Constant On	Off	**Relay 1** in its **ON** state
Off	Constant On	**Relay 2** in its **ON** state
Constant On	Constant On	**Relay 1** and **2** in their **ON** state

Using the RS232 Serial Interface

The RS232 serial interface is used to program the blackbox and communicate between the blackbox and a PC using the optional blackbox 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 to the RS232 Interface via the RJ11 connector as shown in **Chapter 2 Installation**.

Factory Defaults

Factory Defaults

When first installing the blackbox, 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 blackbox on it will provide an output proportional to the **distance** from the face of the transducer to the surface. All relays are set OFF.

The **date** (P931) and **time** (P932) in the blackbox 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 blackbox for distance and then setup the empty level to this figure.

Once you are satisfied with the installation, and the blackbox 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 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.

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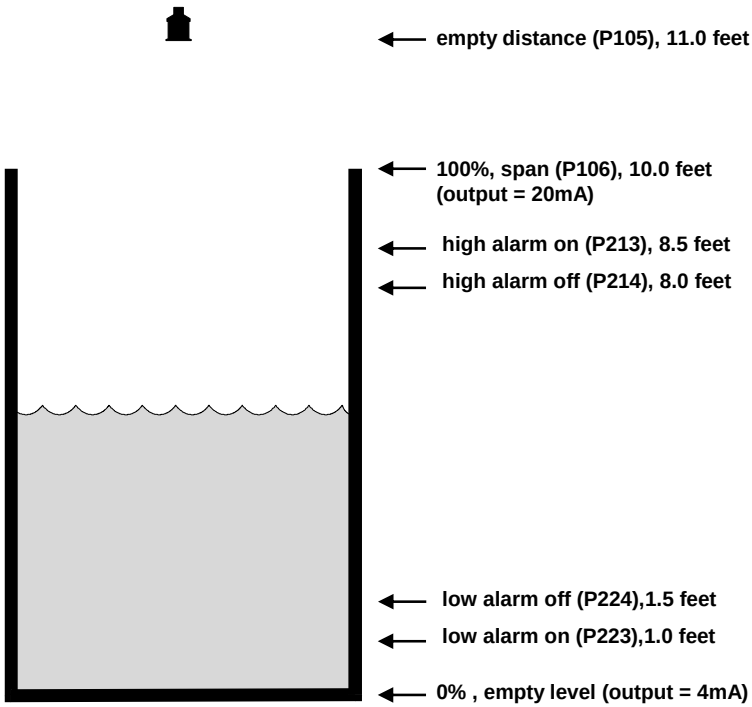
Level

Example 1 Level Measurement



In this example, the blackbox and dB6 is being used to monitor a moving level within a vessel and is required to provide a 4 to 20mA output proportional to the level, over a range of 10.0 feet. In addition, when the level rises to 8.5 feet, Relay '1' is required to give a high alarm and rest when the level falls to 8.0 feet. In the event that the level should fall to 1.0 feet then Relay '2' is to give a low alarm and reset once the level rises to 1.5 feet.

To program the blackbox for this **Example,** proceed as follows.

Access the **Program Mode**

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

Using the menu system access the parameters, as detailed below, and select the relevant options and **ENTER.**

Top Level Menu	Sub Menu	Parameter Detail	Selected Value
Application	Operation	P100 Mode	2 = Level
		P101 Xducer	2 = dB6
	Distances	P104 Measnt Units	4 = feet
		P105 Empty Level	11.0
		P106 Span	10.0
Relays	Relay 1	P210 Relay 1 Type	1 = Alarm
		P211 R1Function	1 = Level
		P212 R1 ID	2 = High
		P213 R1 Set 1	8.5
		P214 R1 Set 2	8.0
	Relay 2	P220 Relay 1 Type	1 = Alarm
		P221 R1Function	1 = Level
		P222 R1 ID	4 = Low
		P223 R1 Set 1	1.0
		P224 R1 Set 2	1.5

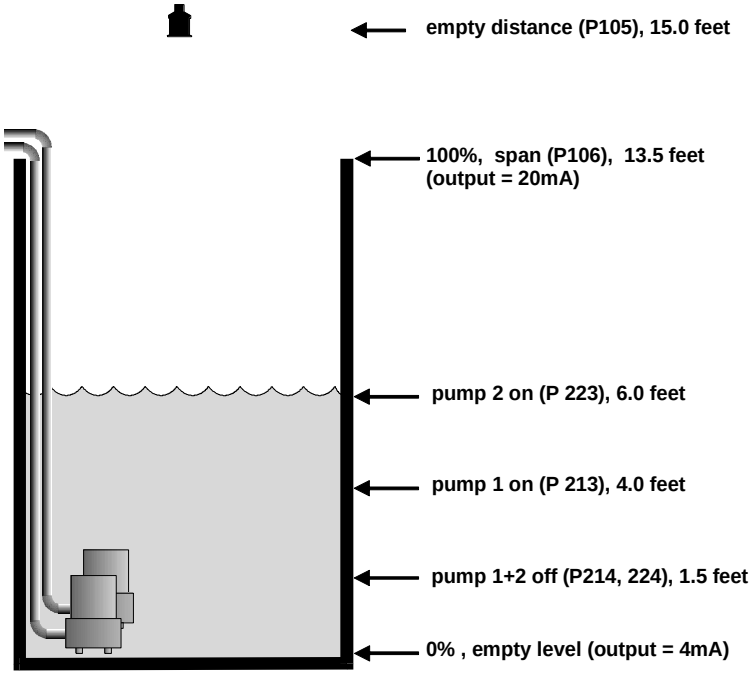
Programming is now complete and the unit can be returned to the run mode, press **CANCEL** until **Run Mode?** Is displayed on the display press **ENTER**, and the blackbox will return to the **Run Mode**.

Note

The 4 to 20mA output will be automatically set to the value of P106 Span, with 4mA being representative of 0% of Span (zero level) and 20mA 100% of Span (Full level).

Example 2 Alternating 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 a blackbox with dB6 is being used to control pumps on a **pump down** application, there are two pumps, and the **duty** pump is to be **alternated** between the pumps.

This will operate as follows. During normal operation, **pump 1** will come on at 4.0 feet, and pump down to 1.5 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 4.0 feet, **pump 2** will come on at 6.0 feet, and pump down to 1.5 feet. The setpoints are then shifted to **pump 2**, which will come on **first next time**.

The 4 to 20mA output will be representative of level.

To program the blackbox for this **Example,** proceed as follows.

Access the **Program Mode**

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

Using the menu system access the parameters, as detailed below, and select the relevant options and **ENTER.**

Top Level Menu	Sub Menu	Parameter Detail	Selected Value
Application	Operation	P100 Mode	2 = Level
		P101 Xducer	2 = dB6
	Distances	P104 Measnt Units	4 = feet
		P105 Empty Level	15.0
		P106 Span	13.5
Relays	Relay 1	P210 Relay 1 Type	2 = Control
		P211 R1Function	1 = General
		P212 R1 ID	2 = Alternate
		P213 R1 Set 1	4.0
		P214 R1 Set 2	1.5
	Relay 2	P220 Relay 1 Type	2 = Control
		P221 R1Function	1 = General
		P222 R1 ID	2 = Alternate
		P223 R1 Set 1	6.0
		P224 R1 Set 2	1.5

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

Note

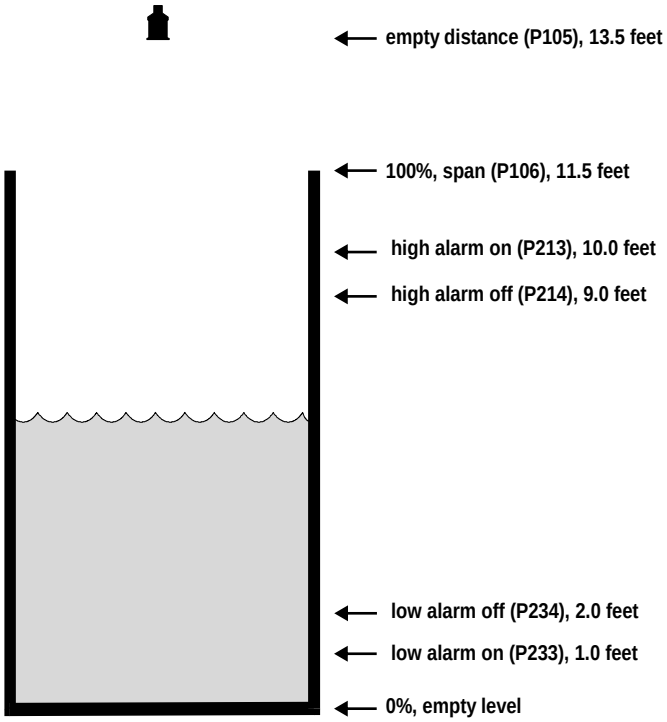
The mA output will be automatically set to the value of P106 Span, with 0 or 4 mA being representative of 0% of Span (zero level) and 20mA 100% of Span (Full level).

Volume (Optional)

Example 3 Volume Application

Only available on blackbox 130D, fitted with optional LCD display and integral keypad.

A cylindrical tank with a diameter of 2m and a flat base that is typically used to temporarily hold liquid, and you wish to know the volume of liquid. You also require a high and low alarm.



In this example, if the level rises to 10.0 feet, then the high-level alarm (relay 1) will come on until the level drops to 9.0 feet. If the level falls to 1.0 feet, then the low-level alarm (relay 2) will come on until the level rises to 2.0 feet.

The display will show the volume of fluid in the tank and the mA output will be representative of Volume where 4mA = empty (0%) and 20mA = Max Volume (100%).

To program the blackbox for this **Example,** proceed as follows.

Access the **Program Mode**

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

Using the menu system access the parameters, as detailed below, and select the relevant options and **ENTER.**

Top Level Menu	Sub Menu	Parameter Detail	Selected Value
Application	Operation	P100 Mode	5 = Volume
		P101 Xducer	2 = dB6
	Distances	P104 Measnt Units	4 = feet
		P105 Empty Level	13.5
		P106 Span	11.5
Relays	Relay 1	P210 Relay 1 Type	1 = Alarm
		P211 R1Function	1 = Level
		P212 R1 ID	2 = High
		P213 R1 Set 1	10.0
		P214 R1 Set 2	9.0
	Relay 2	P220 Relay 1 Type	1 = Alarm
		P221 R1Function	1 = Level
		P222 R1 ID	4 = Low
		P223 R1 Set 1	1.0
		P224 R1 Set 2	2.0
Volume	Conversion	P600 Vessel Shape	0 = Cyl.Flat Base
		P601 – P603 Vessel Dimensions	Enter dimensions as required
		P604 Calc. Volume	Shows the volume as calculated by the blackbox
		P605 Volume Units	Select as required
		P606 Correction Factor	Enter value of any correction factor e.g. specific gravity of material
		P607 Max. Volume	Displays the Max. Vol. as calculated by the blackbox

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

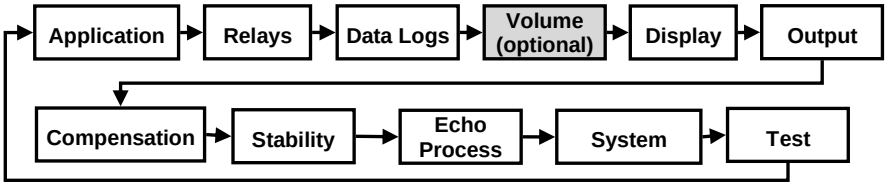
Chapter 5 Parameter Guide

This chapter describes all of the parameters contained in your blackbox.

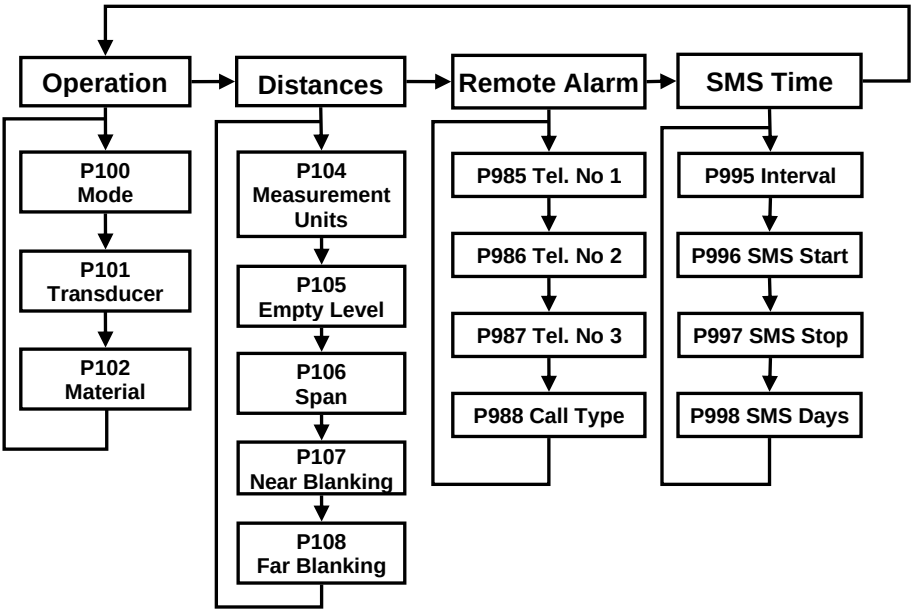
Menu System Diagrams

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

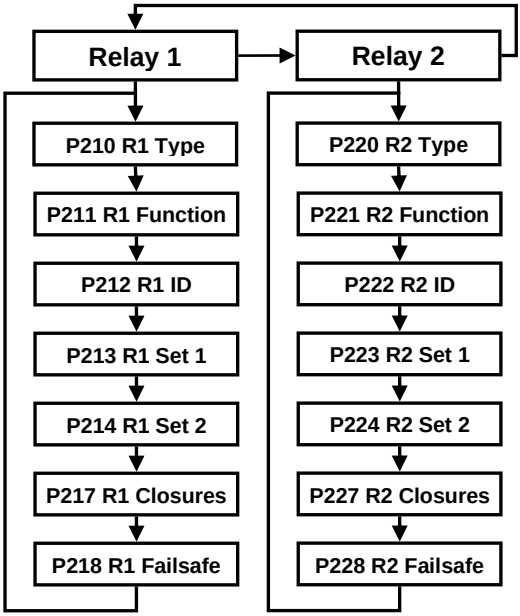
Top Level Menu



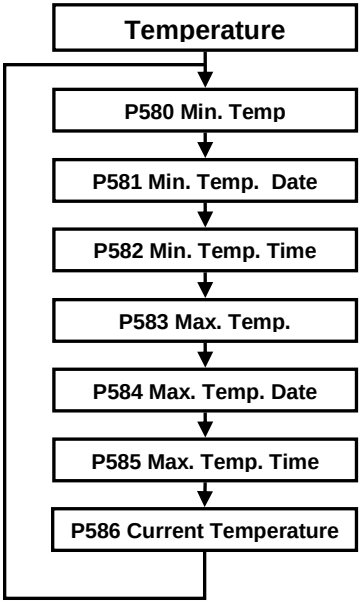
Application Menu



Relays Menu

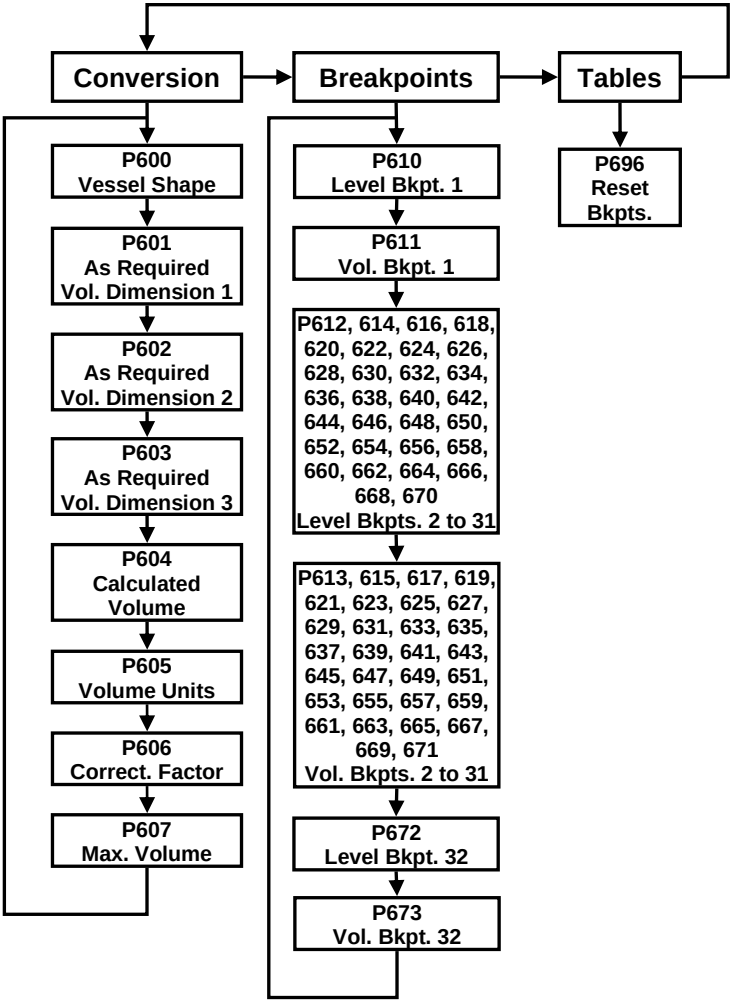


Data Logs Menu

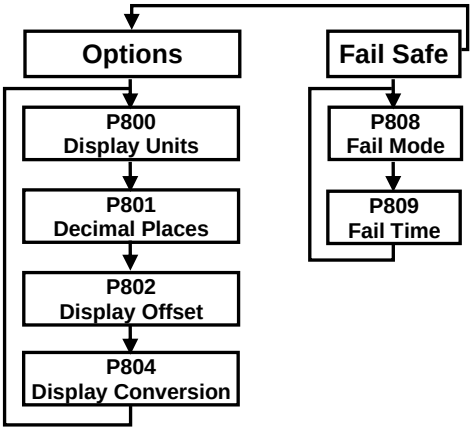


Volume Menu

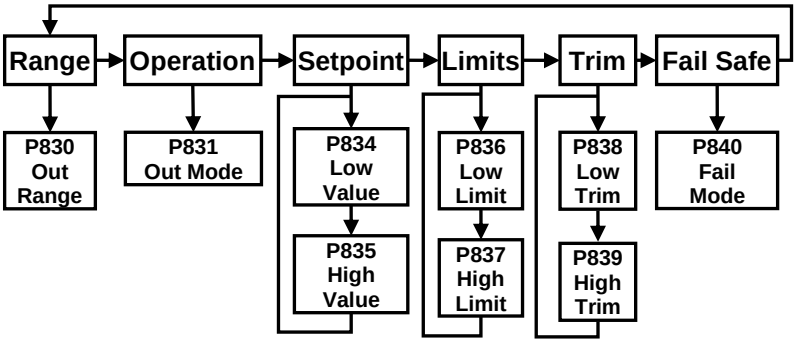
Only available on blackbox 130D, fitted with optional LCD display and integral keypad.



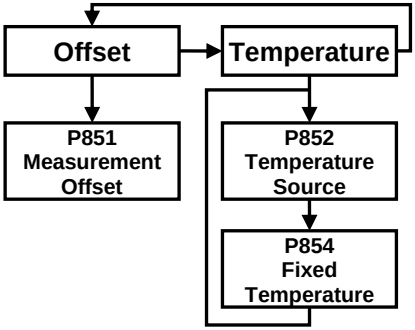
Display Menu



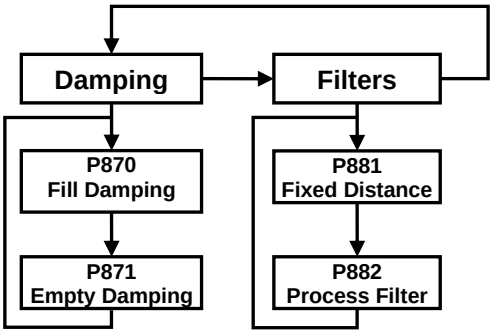
Output Menu



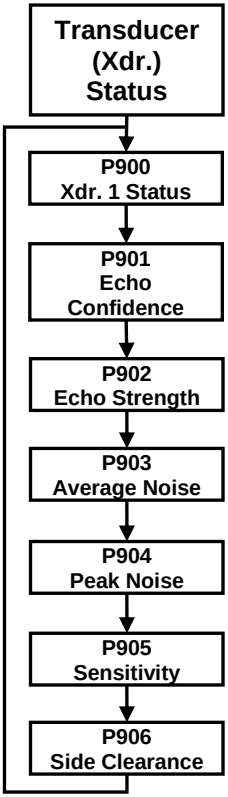
Compensation Menu



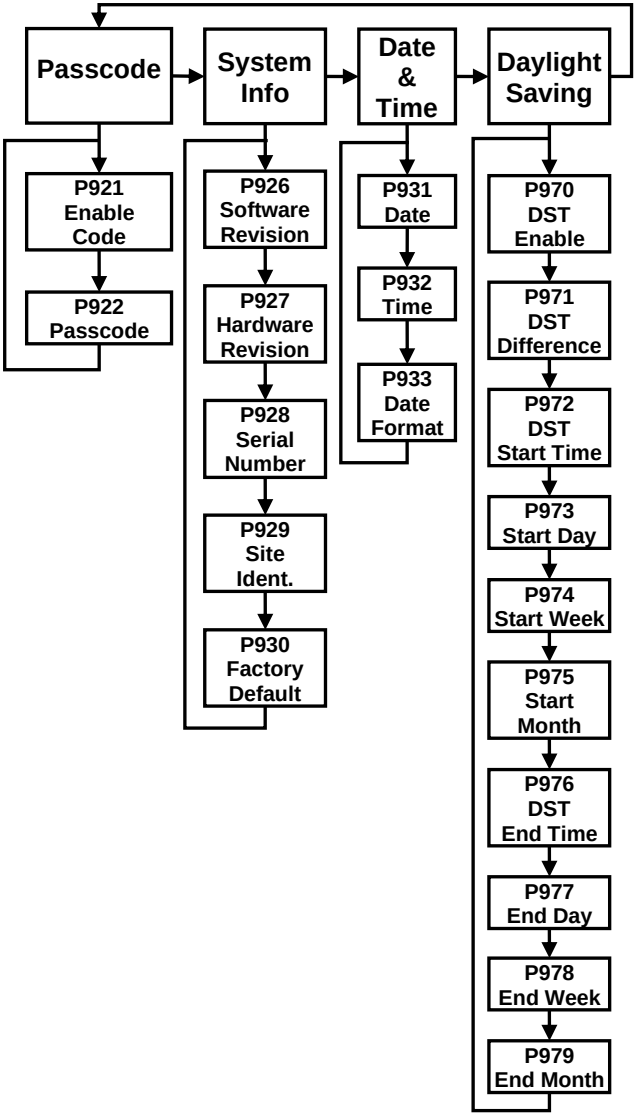
Stability Menu



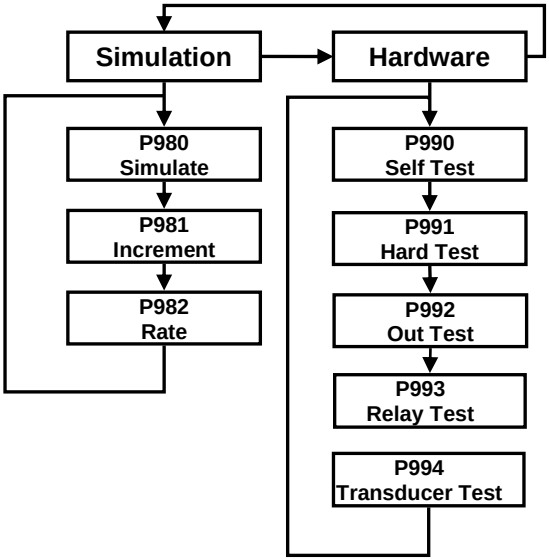
Echo Processing Menu



System Menu


Passcode
System Info
Date & Time
Daylight Saving
P921 Enable Code
P922 Passcode
P926 Software Revision
P927 Hardware Revision
P928 Serial Number
P929 Site Ident.
P930 Factory Default
P931 Date
P932 Time
P933 Date Format
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

Test Menu


Simulation
Hardware
P980
Simulate
P981
Increment
P982
Rate
P990
Self Test
P991
Hard Test
P992
Out Test
P993
Relay Test
P994
Transducer Test

Parameter Listing

This section describes all of the parameters. Any parameter can be reset to its default, by pressing the n hot key, while 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 and Output relative to the **distance** from the transducer to the surface.
2 = Level	Display and Output relative to how **full** the vessel is.
3 = Space	Display and Output relative to how **empty** a vessel is.
When fitted with optional display and integral keypad	
5 = Volume	Display and Output relative to **volume** of material in the vessel.

P101 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
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
*9 = dBR16	Transducer is a mmWave radar. Range 0.252 to 52.49 feet
*10 = dBR8	Transducer is a mmWave radar. Range 0.252 to 26.25 feet

Important Information

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

P102 Material

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

Option	Description
1 = Liquid	Use for liquids and flat solids
2 = Solid	Solid material that is heaped 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.

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 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 is 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, typical to ignore close in obstructions.

Transducer	Near Blanking Distance
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.

Remote Alarm

When a Modem is connected to the blackbox, via the RS232 port, (Consult Pulsar or your local distributor for further details), the following parameters are used to set up the blackbox 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.

P985 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.

P986 Tel. No2

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 6 digits following the '0's, then just enter the digits required, if there are more than 6 digits following the '0's then enter the first 6 digits and then proceed to P987 and enter the remaining digits.

P987 Tel. No3

This parameter is used to enter any remaining digits of the telephone number to be dialled after completion of P985 and P986 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).

P988 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.

SMS Time

The following parameters determine when and how often a SMS message is to be sent.

P995 SMS Interval

This parameter determines how often a SMS message will be sent. If the time interval is set at '0.00 mins.' then a SMS message will only be sent when an alarm condition occurs, when the time interval is set to anything other than zero then a SMS message will be sent at the relevant interval detailing the current level and/or any alarm condition present at that time.

Entered in minutes. Min = 0.000, Max = 1440mins. Default = 0.00 mins.

P996 Start Time

Sets the time at which the SMS Interval is to Start.

Entered as time. Min = 00:00, Max = 23:59 Default = 00:00

P997 Stop Time

Sets the time at which the SMS Interval is to Stop.

Entered as time. Min = 00:00, Max = 23:59 Default = 23:59

P998 SMS Days

This parameter will determine on which days the SMS message is active and is entered as a Boolean value equating to the total of the days that the SMS message is required to be active.

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	4	8	16	32	64

Add together any combination up to a maximum of 127 (every day).

Examples:

21 = Mon, Wed, Fri.,

31 = Mon to Fri.,

10 = Tue and Thu.

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

The third digit selects specific parameters for the setting up of the relays, which can be selected individually and results in the following parameter numbers for each relay.

Relay 1 21**0** to 21**8**

Relay 2 22**0** to 22**8**

Relay Type

P210, P220 - Relay Type

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

Option	Description
0= Not In Use (Default)	Relay not in use or programmed.
1= Alarm	Relay is programmed as an alarm relay, which will **de-energise ON**, and **energise OFF**. This will ensure an alarm is raised if the power fails to the unit.
2= Control	Relay is programmed as a control relay, which will **energise ON**, and **de-energise OFF**.

Alarms

P210, P220 =1 (Alarm)

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

P211, P221 - 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) and two setpoints must be set (P2**1**3, 2**2**3 & P2**1**4, 2**2**4). Setpoints are entered in Display Units as referenced to Empty Level.
2= Temperature	Alarm is based on the temperature, and the type of temperature alarm (P2**1**2, 2**2**2) and two setpoints must be set (P2**1**3, 2**2**3 & P2**1**4, 2**2**4). The temperature used depends on the temperature source selected (P852). Setpoints are entered in ^{o}C.
3= Loss of Echo	Alarm is raised if the **Failsafe Timer** (**P809**) expires. No setpoints are required.
4= Loss of Clock	Alarm is raised if the real-time clock fails. No setpoints are required.

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

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

P212, 222 - Relay Alarm ID

When P211, P221 = 3 (Loss of Echo) or 4 (Loss of Clock)

This parameter has no function and will not be displayed.

When P211, P221 = 1 (Level) or 2 (Temperature)

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

Alarm ID	Description	Setpoints
1=General (Default)	Relay goes "ON" when the value reaches the ON setpoint and goes "OFF" when the value reaches the OFF setpoint.	P2**1**3, 2**2**3 is ON Setpoint; P2**1**4, 2**2**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 and P2**1**4, 2**2**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 and P2**1**4, 2**2**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 and P2**1**4, 2**2**4 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 and P2**1**4, 2**2**4 can be set in any order as the unit 'knows' that you are setting an out of bounds alarm.

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**) for further information.

When P211, P221 = 3 (Loss of Echo) or 4 (Loss of Clock)

This parameter has no function and will not be displayed.

When P211, P221 = 1 (Level) or 2 (Temperature)

P213, P223 - Relay Setpoint 1

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

P214, P224 - 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 Display Units as referenced to Empty Level.
Temperature - entered in ºC.

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

Control

P210, P220 = 2 (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 - Relay Function,

This function is used, where it is required to **energise** the relay to switch a device, such as a pump, **ON** and **de-energise** the relay to switch the device **OFF**.

Options	Description
0 = Off	Relay is always de-energised
1 = General	Relay will **energise** "**ON**" as set in Relay **Setpoint 1** (P2**1**3, 2**2**3). And turns "**OFF**", **de-energises**, as set in Relay **Setpoint 2** (P2**1**4, 2**2**4).

Important Information

A control relay is started and stopped at the "ON" and "OFF" setpoints. To *control down* (reduce level) then set "ON" higher than "OFF". To *control up* (increase level) then set "ON" lower than "OFF". For relay 1 "ON" is P213, "OFF" is P214 and for relay 2 "ON" is P223, "OFF" is P224

The **third parameter** determines if the control is fixed or alternating.

P212, 222 Relay Control ID

P210, 220 = 2 (Control)

P211, 221 = 1 (General)

ID	Description
1= Fixed	All control devices are used to assist each other (run at the same time) and each device has its own setpoints. ('ON' P2**1**3, 2**2**3 & '**OFF**' P2**1**4, 2**2**4).
3= Alternate	All control devices are used to assist each other (run at the same time). With each device having its own setpoints, ('**ON**' P2**1**3, 2**2**3 & '**OFF**' P2**1**4, 2**2**4) but each time all devices have stopped, then the setpoints are sequentially rotated between the devices to ensure equal usage.

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

P213, P223 - Relay Setpoint 1

This parameter determines the "**ON**" point for the control relay.

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

P214, P224 - Relay Setpoint 2

This parameter determines the "**OFF**" point for the control relay.

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

Common Parameters

P217, P227 - Relay Closures

The blackbox, will record how many times each relay is 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, P228 - Relay Fail Safe

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

This parameter determines what the relay will do in the event of the **Failsafe Time** (**P809**) expiring.

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

Data Log Parameters

The data log parameters contain the following information.

Temperature

The following parameters give information on temperature conditions seen by the **Temperature source** (**P852**) in ºC. 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.

Volume (Optional)

Only available on blackbox 130D, fitted with optional LCD display and integral keypad and 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**).

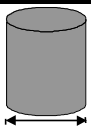
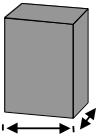
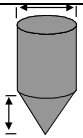
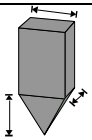
If your vessel shape does not correspond with any of the pre-programmed vessel shapes, then you can use the **universal calculations**. For this you will need a level/volume graph or chart provided by the vessel manufacturer or you can create one based on the dimensions of the vessel. You can enter up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

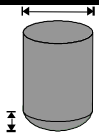
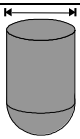
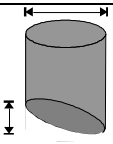
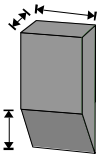
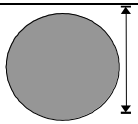
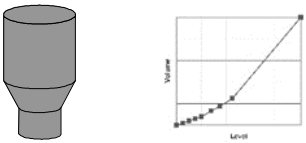
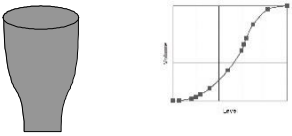
Conversion

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 blackbox 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 blackbox, 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

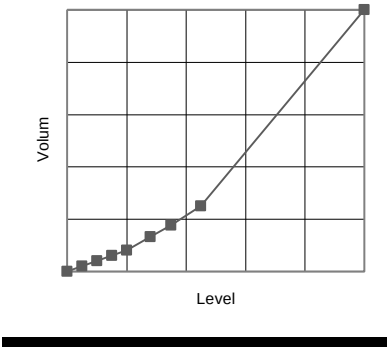
P610-P673 Level/Volume Breakpoints

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)

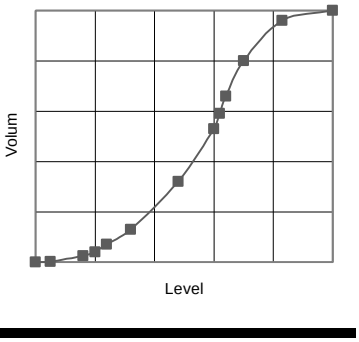
This volume calculation creates a linear approximation of the level/volume relationship and works best if the vessel has sharp angles between each section.



You should enter a level/volume breakpoint for each place where the vessel changes direction, and numerous 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.

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** dependant in Mode (**P100**)

P801 Decimal Places

This parameter determines the number of decimal places shown on the display of the PC Programming Software (standard), Hand Held Calibrator (optional) when connected, or on the on-board display (optional), while the blackbox is in the run mode.
Minimum = 0 (No decimal places), Maximum 3 = (3 decimal Places)
Default = 2 (**2 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 itself.
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 the parameter before being displayed. The default is 1.0 and will be applied when **P802 Display Offset** is set to a different value other than its default value of '0'.

Failsafe

P808 Fail-safe Mode

By default, if a fail-safe condition occurs, then the display and the 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 (Default)	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 (RL1), P228 (RL2) - Relay Fail-safe and P840 Output Fail-safe

Important Information

In the event of a **fail-safe** condition occurring, when the PC Handheld Communicator or the optional Handheld Communicator, are connected to the unit, or the optional on board display is fitted the Display and Output can be configured to fail to a condition which is independent of each other. To set independent **Output Failsafe** see **P840.**

P809 Fail-safe Time

In the event of a fail-safe condition the failsafe timer determines the time before fail-safe mode is activated. **Default = 1min.**

If the timer activates, the unit goes into **fail-safe**, as determined by **P808** (**Display**), **P218, 228** (**Relays**) and **P840** (**Output**). When this happens, if the PC Handheld Communicator or the optional Handheld Communicator, are connected to the unit, or the optional on board display is fitted, 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 and output will be restored and the timer is reset.

Output Parameters

Range

P830 Out 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 **out mode** (**P831**), so if the reading is 0% the output is 0 mA. If the reading is 100% the output is 20 mA.
2= 4 to 20 mA (Default)	mA output directly proportional to the **out mode** (**P831**), so if the reading is 0% the output is 4 mA. If the reading is 100% the output is 20 mA.
3= 20 to 0 mA	mA output inversely proportional to the **out mode** (**P831**), so if the reading is 0% the output is 20 mA. If the reading is 100% the output is 0 mA.
4= 20 to 4 mA	mA output inversely proportional to the **out mode** (**P831**), so if the reading is 0% the output is 20 mA. If the reading is 100% the output is 4 mA.

Operation

P831Out 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**.
When fitted with optional display and integral keypad	
5 = Volume	mA output is relative to **volume**.

Setpoint

By **default,** the mA output will represent the **empty** (**0** or **4mA** dependant on (**P830**) **Out 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 20 feet but **output** is to **represent empty** (**0** or **4mA** dependant on (**P830**) **Out Range**) to a **level** of **15 feet** (**20mA)**. If so P834 (Low Level) should be set to 0.00 feet and P835 (High Level) should be set to 15 feet.

P834 Out Low Value

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

P835 Out High Value

This parameter sets, in **Measurement Units (P104)**, the value of 'level', 'distance' or 'space', depending on the selected **Out Mode** (**P831**) at which the high mA output will occur (**20mA**).
Default = 19.685 feet

Limits

P836 Out 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 Out 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 Out 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 is connected.

P839 Out 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 is connected.

Failsafe

P840 Out Fail Mode

This parameter determines what happens to the 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 output to an independent fail-safe mode as follows:

Option	Description
0 = Default	output will fail as per **P808**.
1 = Hold	output will retain its last known value.
2 = Low	output will fail to its **low** condition.
3 = High	output will fail to its **high** condition (20mA maximum).
4 = Very Low	output will fail to its **lowest** or **fault** condition: **2mA** when Range is **4 to 20mA**. **0mA** when Range is **0 to 20mA**.
5 = Very High	output will fail to its **highest** or **fault** condition of greater than 20mA (22mA maximum).

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 any display in use, relay setpoints and the 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 (Default)	Will automatically select transducer temperature sensor, if available, or fixed temperature (P854) if no temperature sensor found.
2 = Fixed	Always uses fixed temperature (P854)

P854 Fixed Temperature

This parameter sets the temperature, in degrees centigrade to be used if **P852** (**Temperature Source**) =**2**. Default = 20°C

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 feet/minute**

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 feet/minute**

Filters

The following two 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 feet/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

Transducer Status

P900 Transducer Status

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

Option	Description
0= OK (Default)	Transducer working correctly.
1= Disabled	Transducer is not being used
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

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

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

P903 Average Noise

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

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.

P905 Sensitivity

This parameter determines the sensitivity of the unit. Please consult Pulsar for further information and assistance on changing the value of this parameter.

P906 Side Clearance

This parameter is used to set the distance by which the DATEM trace will "stand-off" from around unwanted echoes such as obstructions. Please consult Pulsar for further information and assistance on changing the value of this parameter.

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.

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 viewed, while in **RUN** mode, by pressing the **decimal point key** when using any of the display options.

P927 Hardware Revision

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

P928 Serial Number

This parameter will display the unit's serial number . It is read only and cannot be changed. The **serial number** can also be viewed, while in **RUN** mode, by pressing the **decimal point key** when using any of the display options.

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.

P931 Date

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

P932 Time

This parameter shows 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. The default is MM: DD: YY.

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 = 0 (Off)**

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**

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 switch according to how the relays have been programmed, and the output will change accordingly. 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 **manua**l. Automatic simulation will move the level up and down between empty and full level and activate the relay and/or corresponding LED at the switch points programmed, if you wish to change the direction of the level movement at any time 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

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

P981 Increment

By default, simulation mode will move by **0.328 feet** steps in manual simulation and by 0.328 feet/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 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)**.

Hardware

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

Dependant on model type, when this parameter is selected, the unit will test the following in turn.

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

2) **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.

3) **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.

4) **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 Output Test

This parameter will allow you to force a specified current on to the output to test any equipment that it is connected to. The figure you enter will be generated by the output.

P993 Relay Test

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.

P994 Transducer Test

Press any key on the keypad, other than 0, and the transducer will continually fire for 5 seconds, pressing 0 will terminate the test.

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

Symptom	What to Do
No reading being obtained, transducer not firing.	Check power supply. Check wiring to transducer.
Incorrect reading being obtained for current level.	Measure actual distance from transducer head to surface of material. Enter Program Mode and directly access P21 (Set Distance) type in the measured distance, press ENTER, when prompted press ENTER again, wait until SET displayed. Return to Run Mode, display should now update to 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.

Chapter 7 Disposal

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.

Appendix A: Aluminium wiring.

Aluminium wiring may be encountered in some circumstances; it is also available as copper-clad aluminium. Special precautions are necessary because it is inferior to copper in this application for the following reasons:

Resistance: Aluminium has 1.6x the electrical resistance of copper, so the conductor Cross Sectional Area (CSA) must be proportionally increased for the same current carrying capacity.

Corrosion: Aluminium has a high corrosion risk when in contact with many other common metals in exposed environments. This characteristic is defined by its electro-chemical potential. This means that it cannot be reliably used with most terminal blocks or crimps, which are intended for copper conductors.
Copper-clad aluminium does mitigate this problem.

Ductility: Aluminium is a more brittle material than copper, so is best avoided in applications where the conductor is vibrated or flexed.

Notes