![Pulsar Process Measurement logo]

IMP+ i.s.

INSTRUCTION MANUAL

IMP I.S. (FOURTH EDITION REV. 3)

February 2020

Part Number M-081-0-004-3P

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Contents

Congratulations on your purchase of a Pulsar IMP+ is. Level Monitoring 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

TIP

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

Additional Information

Additional Information

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

About the ɪᴍᴘ+ i.s. Level Monitoring System

Functional Description

The ɪᴍᴘ+ i.s. level monitoring system is a highly developed ultrasonic level measurement system which provides non-contacting level measurement for a wide variety of applications in both liquids and solids located in hazardous areas. It is a 2 wire (loop powered) device.

Easy calibration and maintenance free "fit and forget" performance mean that you can install the ɪᴍᴘ+ is. Level Monitoring System rapidly and with confidence. The measured distance, level or space is indicated by the current drawn by the unit, fault conditions can be indicated by 3.5 or 22mA.

The ɪᴍᴘ+ is. operates on the principle of timing the echo received from a measured pulse of sound transmitted in air and utilises "state of the art" echo extraction technology.

ɪᴍᴘ+ is. comes in three models IMP 3 i.s. with a range from 0.20m (0.66 feet) to 3.00m (9.84 feet), IMP 6 i.s. with a range of 0.3m (0.98 feet) to 6.00m (19.69 feet) and IMP 10 i.s. with a range of 0.3m (0.98 feet) to 10.00m (32.81 feet).

The ɪᴍᴘ+ is. can show **level**, **space, distance**, on the display. The current loop can be connected to a remote chart recorder or PLC that has a current input, to monitor level, space or distance, dependant on the measurement mode selected, and provides a 'fault condition' alarm of either 3.5mA or 22mA.

The ɪᴍᴘ+ is. lid has an integral LCD display and 4 buttons which are used for programming purposes when in Program Mode and as hot keys providing additional information whilst in Run Mode.

Product Specification

Physical	
Dimensions	O/A height 186mm (5.24 inches) x O/A diameter 133mm (7.32 inches)
Mounting	1.5" BSP/NPT (IMP3 and 6 models) 2" BSP/NPT (IMP10)
Weight	Nominal 1kg
Cable entry	2 off cable glands 4.5 – 10mm. (torque to 2NM)

Environmental	
IP Rating	IP67
Min & Max Temperature (Ambient)	-40 to +65°C (-40 to 149°F)
Min & Max Temperature (Transducer)	-40 to +80°C (-40 to 176°F)

Approvals	
CE Approval	See EU Declaration of Conformity

Performance	
Beam Angle	<10° inclusive
Operating frequency	Imp 3 125kHz, Imp 6 75kHz, Imp 10 41kHz
Range	Imp 3 0.2 – 3m (0.66 – 10ft)
	Imp 6 0.3 – 6m (0.98 – 20ft)
	Imp 10 0.3 – 10m (0.98 – 33ft)
Digital echo processing	
Accuracy	± 0.25% or 6mm (0.24 inches) whichever is greater
Resolution	± 0.1% or 2mm (0.08inches) whichever is greater
4-20mA output	Resolution 5µA
Temperature compensation	via internal temperature sensor (± 0.5°C accuracy)
Response time	Power up to stable reading = 10 seconds
Input voltage range	12 – 26V DC at the IMP+ is (not at the barrier)
Current output	3.5 – 22mA
Voltage input to IS barrier	20 – 24V DC

Programming	
On-board programming	via the 4-button keypad and 4-digit LCD display

pulsar
PROCESS MEASUREMENT

EU DECLARATION OF CONFORMITY

P U L S A R *Imp 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
	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 Imp, Imp Lite, Imp i.s.
Type of Equipment	Measurement and process control
Standards Applied	EN 61326:2013 Equipment class, industrial

Signed	Date:
P R Allan	20th June 2017
	Rev 3.2
Name: Jeff Allan (BSc.) Engineer	
Pulsar Process Measurement Ltd	

Hazardous Area Installation

If the unit is to be used in a hazardous area, then power to the unit must pass through an approved safety barrier or approved IS PSU.

Information specific to Hazardous Area Installation

(Reference European ATEX Directive 2014/34/EU, Annex II, 1.0.6.)

The following instructions apply to equipment covered by certificate number Sira 06ATEX2014X:

1. The equipment may be used with flammable gases and vapours with apparatus groups IIC, IIB, and IIA with temperature classes; T1, T2, T3, T4 maximum ambient temperature range -40°C to +80°C.
2. The equipment is only certified for use in ambient temperatures in the range -40°C to +80°C and should not be used outside this range
3. Installation shall be carried out in accordance with the applicable code of practice by suitably-trained personnel
4. Repair of this equipment shall be carried out in accordance with the applicable code of practice.
5. Certification marking as detailed in drawing number D-804-0648-D.
6. If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.
Aggressive Substances - e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
Suitable Precautions - e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

7. The certificate number has an 'X' suffix that indicates that the following special condition of certification applies;

In the case of IMP+ i.s. due to the housing and labels being non-conductive plastic care needs to be taken with regards electrostatic charge. The equipment shall not be installed if the conditions are conducive to the buildup of electrostatic charge. Additionally, the equipment should only be cleaned with a damp cloth.

8. The manufacturer should note that, on being put into service, the equipment must be accompanied by a translation of the instructions in the language or languages of the country in which the equipment is to be used and by the instructions in the original language.

Hazardous Area Specific Power Supply and barrier Requirements

The IMP+ i.s. operates from a DC supply of 12 –26V and will typically draw less than 22mA. **The unit must be powered from an approved i.s. safety barrier or approved i.s. Power supply with the following limits:**

IS Safety Barrier – Uo >= 28V, Io >=93mA, Pi >= 0.65W

IS Power Supply – Uo >= 25.2V, Io >=162mA, Pi >= 1.03W
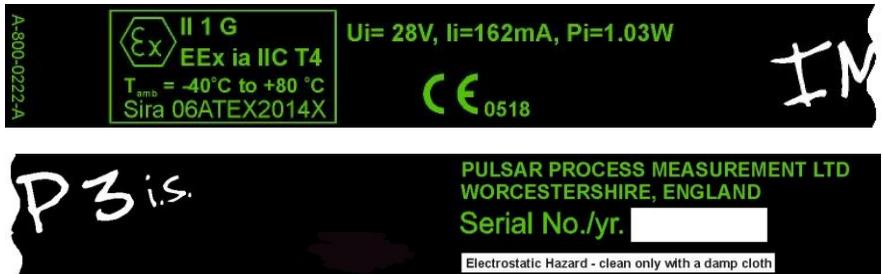
Label from IMP3 i.s. showing certification details (6 & 10 are the same)

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

Cable Entry

The IMP+ i.s. Series has two M16 cable entries, fitted with a suitable gland, to ensure moisture protection is maintained.

Terminal Connection Details

The **IMP+** is is a 2 wire (loop powered) unit, the terminal connections for **IMP+** is. is detailed below. Wiring details are also given on the terminal label under the access cover.

Terminal 1   + ve: Direct Current (DC) input (12-26VDC) via barrier

Terminal 2   - ve: Ground side

Voltage drop due to i.s. safety Zener barrier

The **IMP+is.** are 2 wire, 4-20mA loop powered devices. If used with a Zener barrier (which contains resistors in series with the output) you will experience a voltage drop across the barrier. The **IMP+is.** range can be powered from 12-24VDC, but as the drop across the barrier can be up to 9V depending on the barrier you are using and the current being drawn (worst case 22mA). You must also allow for any voltage drops in the cabling from the barrier to the **IMP+is.**

For example, if an **IMP+is.** was supplied via a dual Zener barrier with 24V on the safe side of the barrier then if the unit was drawing 4mA the drop would be approx. 2V, if the current was 22mA then this would be approx 9V. So as the **IMP+is.** requires a minimum of 12V to function correctly, the supply to the **IMP+is.** at 22mA would be: 24 – 9 = 15V, this means that you could cope with a voltage drop in the cabling of 3V.

Consideration should be given to any voltage drop in the measuring device.

If you consider say 16/0.2 (0.5mm[2)]) conductor, this has a resistance of 39ohms/km, so the maximum length of cable would be as follows:
Maximum voltage drop allowed = 3V

Maximum current = 22mA. So, allowable resistance = 3V / 22mA = 136ohms

Therefore, if you were using 16/0.2 conductors you could use the following maximum length of cable:

16/0.2 cable resistance = 39ohms/km
You must double this as you have to account for the full length (there and back) giving 78ohms/km. So, absolute maximum cable length = 136 / 78 = 1.7km

In practice allow a reasonable margin.

If you are using a galvanic isolator then you do not have to consider the drop across the barrier, but you must consider losses in the cable.

2 Wire (loop powered) *IMP+i.s.* wiring detail

SAFE AREA — PSU AND SIGNAL INTERPRETATION — BARRIER — I.S. EARTH

HAZARDOUS AREA — *IMP+ i.s.* — +mA / −

WIRING OF HAZARDOUS VERSION OF IMP
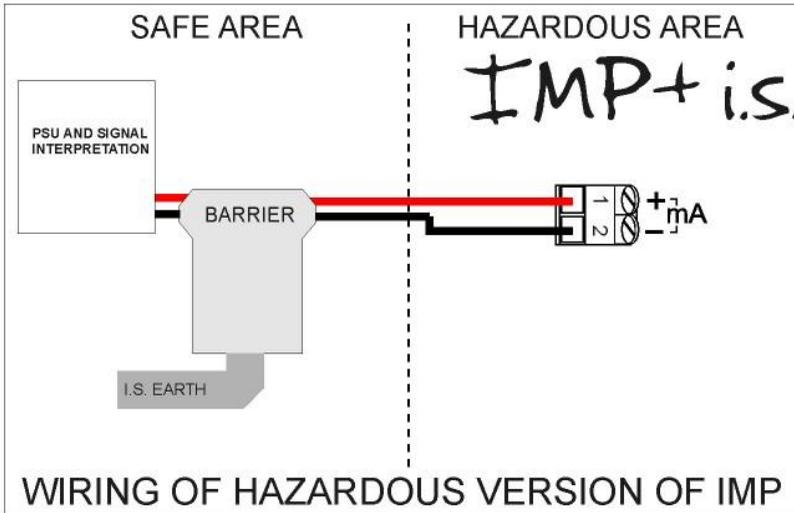
Important Information

The *IMP+i.s.* when installed in a hazardous area must be supplied through an approved safety barrier or approved i.s power supply.

Suitable recommended barriers:

Barrier Type	Suggested Barriers		See
	Pepperl & Fuchs	MTL	Fig.
Single Zener Barrier	Z728	7728+	1
Dual Zener Barrier	Z788	7788+	2
Galvanic Isolator source	KFD2-STC4-Ex1 (source only)	5041(source only)	3
Galvanic Isolator sink	KFD2-STC4-Ex1Y122583 (sink only)	5043(sink or source)	3

Source means the measuring **device applies a resistive load** and **sink** means the measuring **device supplies power.**
Barriers must be fitted with reference to the manufacturer's datasheets.

FIG.1. SINGLE ZENER BARRIER CURRENT SENSED IN +ve

FIG.2. SINGLE ZENER BARRIER CURRENT SENSED IN GROUND
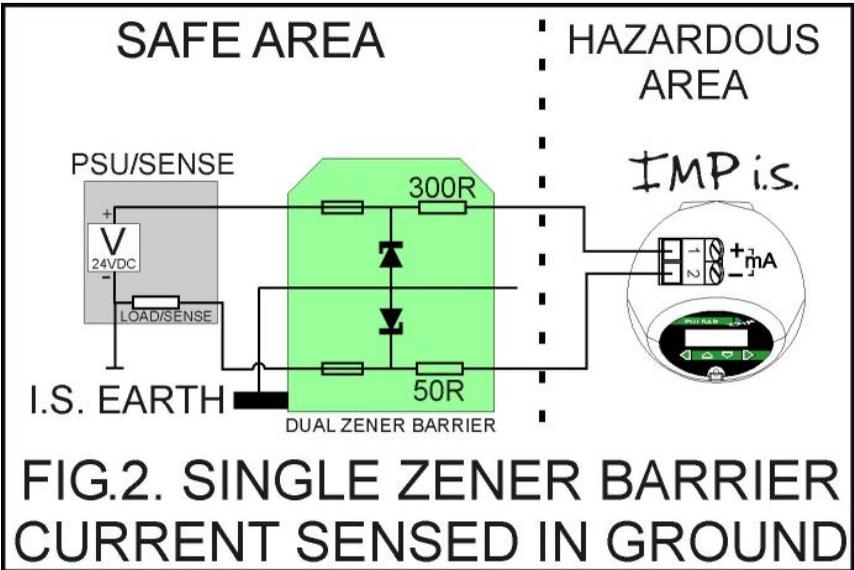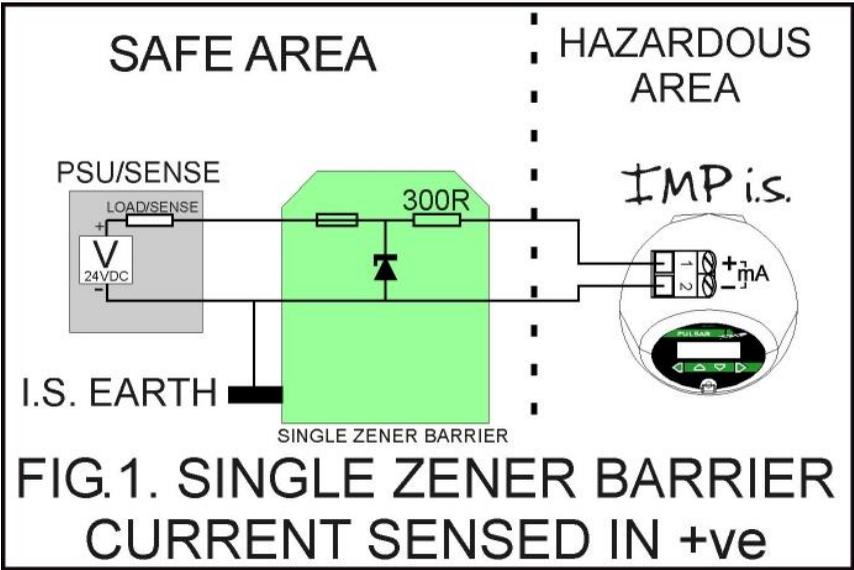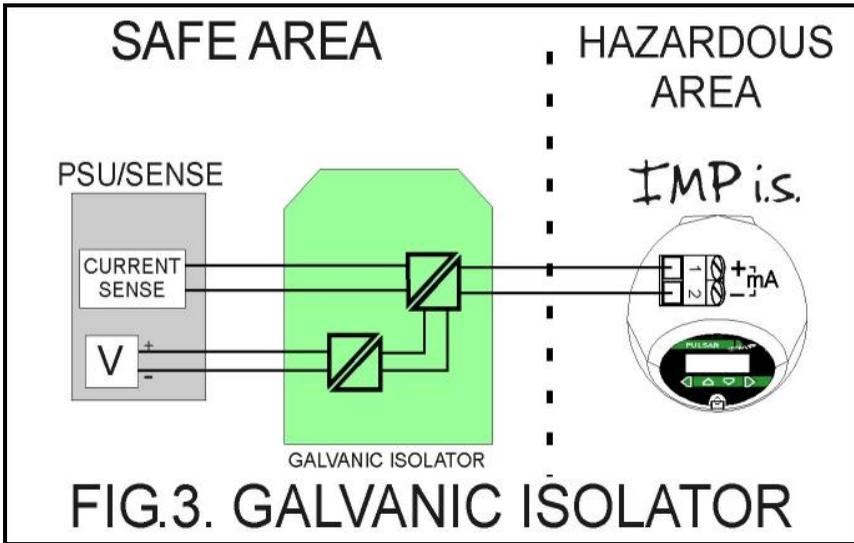
FIG.3. GALVANIC ISOLATOR

Location and mounting information

The compact one-piece construction of the IMP+i.s. can be mounted easily using the integral nose thread (1.5" or 2" BSP/NPT, dependent on model).

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

- For access to the LCD display and programming buttons it is recommended that you mount it in an area which is easily accessible.

- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.

- The IMP3 should be mounted at least 20cm (0.66 feet) above the maximum level of the material and be perpendicular to the surface. Whilst the IMP 6 and 10 should be mounted at least 30cm (0.98 feet) above the maximum level of the material and be perpendicular to the surface.

- The ambient temperature is between -20ºC and 65ºC.

- There should be no high voltage cables or electrical inverters close by.

Dimensions

The dimensions of the IMP+ i.s. are as shown below.
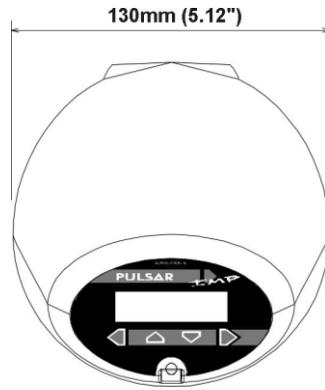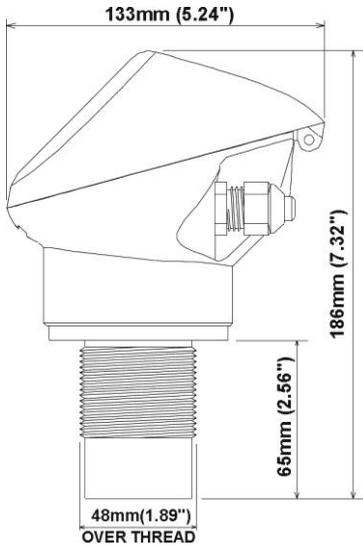
1.5" BSP/NPT – IMP 3 & 6 i.s.
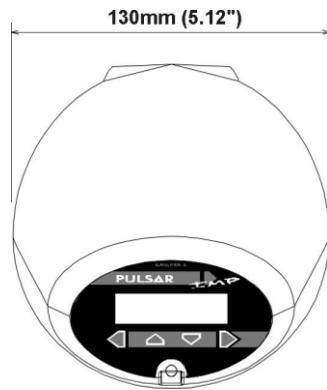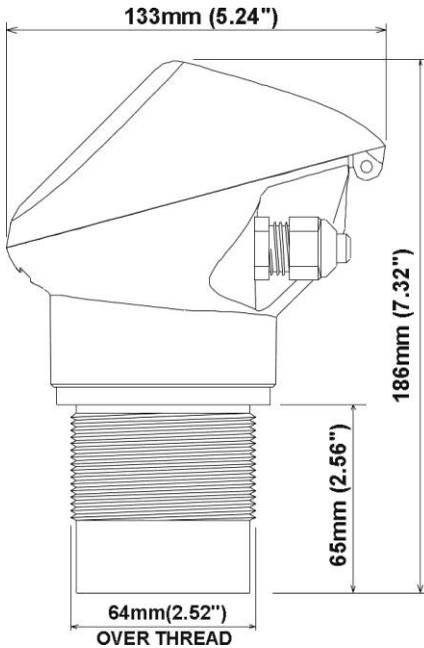
2" BSP/NPT – IMP 10 i.s.

Outdoor and Open Vessel Installation

The IMP+is. can be simply mounted on a bracket, suitable for the application and secured using the thread located at the top of the transducer (2"BSP/NPT).

Care should be taken to ensure that the IMP+is. is not installed in direct sunlight, in order to avoid errors in the measurement of ambient temperature.

Attention should also be taken, when mounting the unit, to ensure that strong windy conditions are avoided, wherever possible, to prevent abnormal operation.
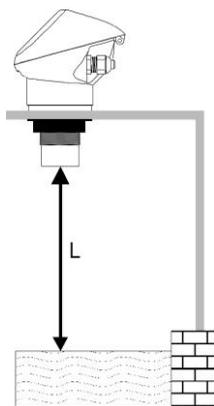
IMP+is. Model	Range	L = Blanking
Imp 3 i.s.	3 metres (9.84 feet)	200mm (0.66 feet)
Imp 6 i.s.	6 metres (19.69 feet)	300mm (0.98 feet)
Imp 10 i.s.	10 metres (32.81 feet)	300mm (0.98 feet)

"L" should as a minimum be at least that as detailed in the table above but can be greater if required.

Closed Vessel Installation

"L" should as a minimum be at least that as detailed in the table above but can be greater if required. The IMP+is. can be simply screwed into a flange and secured using the thread located at the top of the transducer (1.5" or 2"BSP/NPT, dependent on model).

Where possible use, a flange made of a synthetic material such as PVC, in cases where a metal flange is used it is advisable to fit a suitable gasket between the flange of the IMP+is. and the connection to the vessel.

Standpipe Installations

When mounting the IMP+ is to a standpipe care should be taken to ensure that the standpipe is of sufficient diameter with reference to its length, see the table below for details:
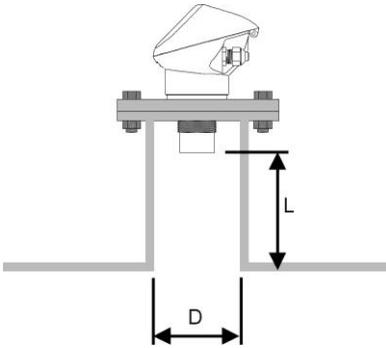
Dia. (D)		Max. Length (L)	
mm	inches	mm	inches
80	3	220	8
100	4	300	12
150	6	420	16
200	8	560	22

When using a standpipe, fixed to the top of a vessel, ensure that the open end of the standpipe is clear of any obstructions such as weld seams, gaskets etc. in order to avoid unwanted signal returns.

If using standpipes which extend into the vessel, beyond the blanking distance, but not as far as the empty level, then the open end of the standpipe should be cut to an angle of 45°.

The maximum level (100% of Span), is inside the blanking distance

Pipe should be free of obstructions such as weld seams

Correct standpipe installation

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 safety barrier
- ✓ The power supply is correctly installed.
- ✓ The IMP+is is mounted correctly.

Maintenance

There are no user serviceable parts inside your IMP+is, if you experience any problems with the unit, then please contact Pulsar Process Measurement for advice.

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

Operating the Controls

Display

Whilst in the Run Mode, the 4-digit LCD, by default, will display the current level reading in metres, the display will also alternate between the reading and "LOE" when a fault condition (Loss Of Echo) is detected. When in the Program Mode the display is used to read information on the Menu Options and the values entered.

There are two operating modes for your IMP+is, **Run Mode** and **Program Mode**.

Run Mode

This mode is used once the IMP+is 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 IMP+is is switched on for the first time, it will display, in metres, the distance from the transducer face to the target.

After you have set up the relevant parameters the 4-20mA drawn by the unit will be proportional to the measured level.

Program Mode

This mode is used to set up the IMP+is or change information already set, this is achieved by using the 4 push buttons located below the display.

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

Button Functions

There are 4 push buttons located under the display. Their name and functions are as follows:

Button	Run Mode	Program Mode
ESC ◀	Displays details of unit Serial No. and Software Version	Used to Navigate out of the Menu System and return to Run Mode. Also, used to Cancel a Parameter Value entered in error.
UP ▲	Displays Current Temperature	Used for Navigating around Menu System and Increasing Menu Option Values.
DOWN ▼	Displays Current Echo Strength (dB's)	Used for Navigating around Menu System and Decreasing Menu Option Values.
ENTER ▶	Displays current mA output	Used to confirm an action such as entering a Menu Option or Enter a Parameter Value.

How to Access Program Mode

To access the **Program mode,** press the "**ESC**" and "**Enter**" button simultaneously, where upon the display will show **PASS** on the LCD display briefly, to prompt you to enter the password, the display will now show **0000**, and the left-hand digit will flash.
By using the UP and DOWN keys to increment or decrement the digit, and the ENTER key to shift the flashing digit to the next position.

Assuming the passcode is the default 1997, then you should enter this:

1 9 9 7

The ESC key can be used to go back to the previous digit. Finally, when you have selected all digits pressing the ENTER key again will input the selected pass code to the IMP+is; if successful the display will show APP (Application). If, however you input the wrong pass code the IMP+is LCD display will show Fail for 2 seconds and will revert to run mode.

Using The Menu System

The menu system has been designed to make the changing of parameters very simple. Once in the **Program Mode** the display will show a line of text that displays the menu system. Pressing the **Up** and **Down** buttons will scroll the display between the menu items, (as shown below, starting at APP).

```
┌─→ ┌──────────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────────┐
│   │     APP      │──→│    rL    │──→│   UoL    │──→│   DiSP   │──→│  LOOP (mA    │
│   │ (Application)│   │ (Relays) │   │ (Volume) │   │ (Display)│   │   Output)    │
│   └──────────────┘   └──────────┘   └──────────┘   └──────────┘   └──────────────┘
│          │                                                              │
│   ┌──────────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐        │
│   │     Cop      │──→│   StA    │──→│   SyS1   │──→│   tESt   │        │
│   │(Compensation)│   │(Stability)│   │ (System) │   │  (Test)  │        │
│   └──────────────┘   └──────────┘   └──────────┘   └──────────┘        │
│                                                                         │
└─────────────────────────────────────────────────────────────────────────┘
```

As you press the UP and DOWN buttons to scroll left and right between the menu options, you can press ENTER at any time to select a specific menu which will then take you to the parameters within the selected menu.

Once you have reached the relevant menu, scroll through the parameters, and enter the necessary information. To enter the information, use the UP and DOWN keys to increment or decrement the digit, and the ENTER key to shift the flashing digit to the next position, once you have completed entering the value required pressing the ENTER button again will save the value.
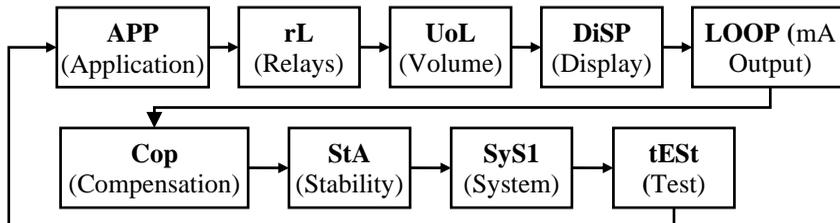
When you have finished, press ESC to go back to the previous level. When you have reached the top level, then the IMP+ is will ask for confirmation before allowing you to go back into run mode. This is done by pressing ENTER at the display prompt.

Parameter Defaults

<u>**Factory Defaults**</u>

> **Factory Defaults**
>
> When first installing the 𝗜𝗠𝗣+𝗶𝘀, 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 𝗜𝗠𝗣+𝗶𝘀 on, it will be reading the **distance** from the face of the transducer to the material surface. It will be indicating in **metres**, as shown on the display.

TIP

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

Once you are satisfied with the installation, and the 𝗜𝗠𝗣+𝗶𝘀 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.

This chapter will explain how to undertake the various functions of your IMP+ is. Where specific parameters are used, consult Parameter Guide in Chapter 5.

Setting up Your Application

Empty Distance

Empty Distance (P105) is the distance from the face of the transducer to the material at the bottom of the vessel.

Span

Span (P106) is the distance from the empty level (0% full) to span (100% full).

Near and Far Blanking

Near blanking (**P107**) is the distance from the face of the transducer that the IMP+ is. will not record a level nearer than. A typical reason to increase this from the default value would be if you wish to ignore close in obstructions.

Far blanking (**P108**) is the distance (as a percentage of empty level) beyond the empty level that the IMP+ is. will read, the default is plus 20% of empty level. If you wish to monitor further than the **empty level**, then increase this figure, so that the **empty level** plus the **far blanking** figure (as % of empty level) is greater than the surface being measured, within the capability of the transducer being used.

The 4-20 mA Output

The mA output can be used to monitor remotely what the IMP+ is is showing, so it can be displayed remotely, integrated into a PLC, or used to generate a record using a chart recorder or similar.

By default, the IMP+ is. will provide a 4-20 mA output that represents what is displayed on the IMP+ is., but these parameters can be overwritten as follows.

By default, the 4-20 mA will represent the empty level (4mA) and 100% of the operational span (20mA), but you may wish to only represent a section of the operational span. For example, the application may have an operational span of 6 metres, but you may only wish to represent empty level to 5 metres. If so, change **P834 (Low Value)** to **0**, and **P835 (High Value)** to **5.0.**

If the device connected to the mA output is out of calibration, and cannot be calibrated, then the low and high current levels can be trimmed by altering **P838 (Low Trim)** and **P839 (High Trim)**. To do this, simply enter the value that ensures that 4 mA or 20 mA respectively are shown on the remote device. You can use the left/right menu keys to alter the value until the correct reading is shown on the remote device, rather than typing in a value.

Setting Security Passcodes

A passcode is used to switch the ɪMP+ ɪs from **Run Mode** into **Program Mode**.

You can set a new passcode to prevent anyone changing any of your settings within your ɪMP+ ɪs. The default **passcode** is **1997**, but this may be changed as follows.

> **Additional Information**
>
> The passcode is also used for remote access using the RS232, so if this is being used, be sure to ensure any additional equipment using this feature is changed accordingly.

Using A Passcode

If you don't want to use a passcode, you can disable it as follows. First, enter **Program Mode** and go to the **SyS1** (System**)** menu. Select **P921** which is the **passcode enable** parameter.

As shown on the display, setting the passcode enable to '**0**' will **disable** it, or '**1**' will **enable** the use of passcode.

> **Additional Information**
>
> If the use of a passcode has been disabled, then you can move straight into Program Mode from Run Mode by pressing the ESC and ENTER button simultaneously.

Changing the Passcode

You can set the **passcode** to any number from 0000 to 9999. To do this, enter **Program Mode** and go to **SyS1** (System) menu. Select **P922** which is the **Passcode** parameter which can be changed as required.

Resetting Factory Defaults

If you need to restore parameters to their original factory settings, then enter **Program Mode** go to the **SyS1** (System) menu and **ENTER**. Using the UP and DOWN buttons, go to parameter **P930**, and **ENTER**, **P930** is the factory defaults parameter, change the value to **1** and **ENTER** , all parameters, with the exception of the mA trims, will be restored to the factory settings (including the DATEM trace) and on completion Stor (Store) will be displayed after which you can ESC out of this parameter and continue programming the IMP⁺is for the required application.

Checking the Information Specific to your IMP⁺is

There are some parameters dedicated to each individual IMP⁺is, such as the software revision and the unit's serial number.

Checking the Software Revision and Serial Number

If you need to identify the serial number of the unit or the current level of software in your IMP⁺is, whilst in **Run Mode** press the **ESC** button and the serial number along with the software revision will be displayed. Alternatively enter **Program Mode** and select **SyS1 (**System**)** menu and **ENTER**. Select parameter **P926** to view the identity of the current firmware **revision** or **P928** for the **serial number** of the unit.

This chapter describes all the parameters in your ᛁMP+i.s.

Parameter Listing

This section describes all the parameters contained within the ᛁMP+i.s.

Application (APP) Menu

P100 Mode of Operation

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

Option	Description
1= **Distance (Default)**	Display shows the distance from the transducer face to the surface.
2= Level	Display shows how full the vessel is.
3= Space	Display shows how empty a vessel is.
4= Volume	Display shows volume of material in the vessel

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	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, so should be set before span. **Default: IMP 3 = 3.00m (9.94 feet), IMP 6 = 6.000m (19.69 feet)** and **IMP 10 = 10.00m (32.81 feet)**.

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. **Default IMP 3 = 2.80m (9.19 feet), IMP 6 = 5.70m (18.70 feet)** and **IMP 10 = 9.70m (31.82).**

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 version of IMP+ is being used. It should not be set to less than this figure but can be increased.

IMP+ is Version	Near Blanking Distance
IMP 3 metre	Default Blanking Distance = 0.2m (0.66 feet)
IMP 6 metre	Default Blanking Distance = 0.3m (0.98 feet)
IMP 10 metre	Default Blanking Distance = 0.3m (0.98 feet)

P108 Far Blanking Distance

This is the distance (as a **percentage** of empty level) beyond the empty point that the unit will be able to measure, and the **default** is pre-set to **10%** 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.
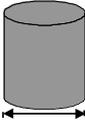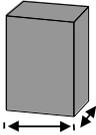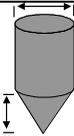
This parameter is always entered as a % of empty level.

Volume (UoL) Menu

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 Required
	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
	P600=4 Cylindrical Parabola base	Cylinder diameter and height of bottom
	P600=5 Cylindrical Half-sphere base	Cylinder Diameter
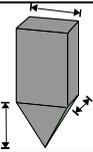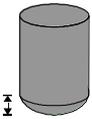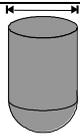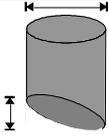
Vessel Shape	P600 Value	Dimensions Required
	P600=6 Cylindrical Flat sloped base	Cylinder diameter and height of bottom
	P600=7 Rectangular Flat sloped base	Width and Breadth of rectangular section and height of bottom
	P600=8 Horizontal cylinder with flat ends	Cylinder diameter and tank length
	P600=9 Horizontal cylinder with parabolic ends	Cylinder diameter, length of one end section, and tank length
	P600=10 Sphere	Sphere diameter
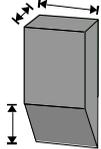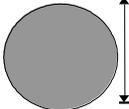
P601-P603 Vessel Dimensions

These three parameters are used to enter the dimension required to calculate the volume. The dimensions required are as shown below.

Vessel Shape	P601	P602	P603
P600=0 Cylindrical Flat base	Cylinder Diameter	Not Used	Not Used
P600=1 Rectangular Flat base	Not Used	Width of rectangle	Breadth of rectangle
P600=2 Cylindrical Cone base	Height of base	Cylinder Diameter	Not Used
P600=3 Rectangular Pyramid base	Height of base	Width of rectangle	Breadth of rectangle
P600=4 Cylindrical Parabola base	Height of base	Cylinder Diameter	Not Used
P600=5 Cylindrical Half-sphere base	Cylinder Diameter	Not Used	Not Used
P600=6 Cylindrical Flat sloped base	Height of base	Cylinder Diameter	Not Used
P600=7 Rectangular Flat sloped base	Height of base	Width of rectangle	Breadth of rectangle
P600=8 Horizontal cylinder with flat ends	Length of Cylinder	Cylinder Diameter	Not Used
P600=9 Horizontal cylinder with parabolic ends	Length of Cylinder	Cylinder Diameter	Length of one end section
P600=10 Sphere	Sphere Diameter	Not Used	Not Used

P604 Calculated Volume

This parameter displays the maximum volume that has been calculated by the ᴵᴹᴾ⁺ᶦˢ and is a Read Only parameter. The volume displayed will be shown in cubic meters and is the total volume available between **empty level** (**P105**) and 100% of **span** (**P106**).

P605 Volume Units

This parameter determines the units that will be used in calculating volume conversion. It is used in conjunction with **P607** (**maximum volume**), please note that there is no provision for the volume unit's descriptor to be shown on the display.

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	Volume will be totalised in **cubic feet**
8 = Barrels	Volume will be totalised in **barrels**

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 ꭲMP+is, 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**).

Display (DiSP) Menu

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 **Measurement Units** (P104)
2 = Percentage	Display is in **percentage** of span.

P801 Decimal Places

This parameter determines the number of decimal places on the reading during run mode.
Minimum = 0 (No decimal places), Maximum 3 = (3 decimal Places)
Default = 2

P808 Fail-safe Mode

By default, if a fail-safe condition occurs, then the display and the mA output are held at their last **known** values until a valid reading is obtained.

If required, then you can change this so that the unit goes to **high** (100% of span), or **low** (empty) as follows:

Option	Description
1 = **Known (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)

P809 Fail-safe Time

In the event of a fail-safe condition occurring the fail-safe timer determines the time before fail-safe mode is activated. **Default = 2.00 mins**

If the timer activates, the unit goes into **fail-safe**, as determined by **P808**, (**Display** and **P840** (**mA Output**). When this happens, you will see the message "**LOE!**" on the display.

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

mA Output (LOOP) Menu

P834 mA Low Level

This parameter sets, in **Measurement Units (P104)**, the value of 'level', 'space' or 'distance', depending on the selected **Mode of Operation (P100)**, at which 4mA will occur.

P835 mA High Level

This parameter sets, in **Measurement Units (P104)**, the value of 'level', 'space' or 'distance', depending on the selected **Mode of Operation** (**P100**), at which 20 mA output will occur**.**

P838 mA Low Trim

If the device you are connected to is not calibrated, and not showing the low value, 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 on the device that is connected.

P839 mA High Trim

If the device you are connected to is not calibrated, and not showing the high value, 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 on the device that is connected.

P840 mA Fail-safe Mode

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

Option	Description
0 = Default	mA output will fail as per **P808**.
1 = Hold	mA output will retain its last known value.
2 = Low	mA output will fail to its **low** condition. **3.5mA**
3 = High	mA output will fail to its **high** condition. **22mA**

Compensation (CoP) Menu

P851 Measurement Offset

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

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

P852 Temperature Source

This parameter determines the source of the temperature measurement. By **default,** it is set to internal (transducer) (**P852=1**), which will automatically detect the temperature 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 = **Internal (Default)**	Always uses temperature reading from transducer.
3 = Fixed	Always uses fixed temperature (P854)

P854 Fixed Temperature

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

P860 Sound Velocity

This option allows for the velocity of sound to be changed according to the atmosphere the transducer is operating in. By **default,** the velocity is set for **342.72m/sec** which is the speed of sound travelling in air at a temperature of **20ºC**.

The table below gives details of the velocity of sound in various gaseous atmospheres In all cases the velocity indicated is that in a 100% gaseous atmosphere at 0°C. In atmospheres less than 100% it may be necessary to check the level indicated at near empty and near full and compare with the actual level, several times, then adjust the **Sound Velocity** accordingly to obtain an accurately displayed reading.

Gas	Sound Velocity
Chlorine	206 m/sec
Argon	308 m/sec
Oxygen	316 m/sec
Air	331.5 m/sec
Ammonia	415 m/sec
Methane	430 m/sec
Helium	435 m/sec
Neon	965 m/sec

P645 Vapour Temperature Compensation

The sound velocity in air increases or decreases at a uniform rate of 60cm/sec. per °C, however in atmospheres other than air it will change at a different rate.

This option allows the rate of change in cm/sec. per °C to be set according to the atmosphere and temperature present. The level indicated, should be compared with the actual level, several times, then **Vapour Temperature Compensation** adjusted accordingly, to obtain an accurately displayed reading. **Default = 60 cm/sec. per °C**

Stability (StA) Menu

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 = 10.00 metres/minute (32.81 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 = 10.000 metres/minute (32.81 feet/minute)**

System (SyS1) Menu

The following parameters don't affect how the unit performs, but information within them may be required, by Pulsar, when making technical enquiries.

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 pressing ESC and ENTER button simultaneously will allow entry into the program mode.

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.

P926 Software Revision

This parameter will display the current software revision.

P928 Serial Number

This parameter will display the serial number of the unit.

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** and press **ENTER**, all parameters, except for the mA trims, will be restored to the factory settings (including the DATEM trace) and on completion Stor (Store) will be displayed after which you can ESC out of this parameter and continue programming the ᴉMP+ ᵢₛ for the required application.

Test (tESt) Menu

P991 Hard Test

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

- **Display**. All the segments on the LCD are lit up, so you can see if they all work. Press the **ENTER** button, to end the test.
- **Keys**. You should press each button, to confirm it works, with a counter showing how many more buttons you must press. Press **ESC** last, as this will show if all keys were pressed or not. If they were not, then an error message is displayed.

P992 mA Out Test

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

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

Symptom	What to Do
Display blank, transducer not firing.	Check power supply
Display shows "L0E".	No valid echo being received and unit has gone into fault condition. Check material level is not out of range, sensor is perpendicular to material surface.
Incorrect reading being displayed for current level.	Measure actual distance from transducer face to surface of material. Enter Program Mode and access **SyS1** menu, go to **P21** and press **ENTER** type in the **measured distance**, press **ENTER**, wait until "**Stor**" is displayed and return to Run Mode, display should now update to correct reading.
Material level is consistently incorrect by the same amount.	Check empty level (P105) correctly entered.

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.