dBi-M

Instruction Manual

dBi-M (FIRST EDITION REV 4)

October 2024

Part Number M-dBiM-0-001-4P

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

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CHAPTER 1 START HERE

Congratulations on your purchase of a Pulsar dBi-M. This quality system has been developed over many years and represents the latest in high technology 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: Look for this icon throughout your Pulsar Measurement manual to find helpful information and answers to frequently asked questions.

Additional Information

Additional Information

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

About the dBi-M

Functional Description

The dBi-M transducer range has been specified and designed to meet the demanding requirements of today's process level measurement applications for liquids and solids.

The transducers are compatible with RS-485 Modbus communications. They can be easily set-up using a PC with an RS-485 adapter and Pulsar dBi-M PC software.

Easy calibration and maintenance free "fit and forget" performance meaning that you can install the dBi-M transducer level monitoring system rapidly and with confidence, with calibration being achieved either by using a Modbus RTU programmer/calibrator, or via Pulsar's free dBi-M PC software.

The dBi-M units are based on a PZT ceramic transducer element. The nominal beam angle is 10° (-3dB). When coupled with the DATEM® signal processing they provide unmatched performance in industrial process level measurement. All transducers have integral temperature compensation.

Optional submersion shields are available to prevent spurious signals if the transducer becomes submerged. A range of flange mounting options are available, with optional PTFE facing for improved chemical resistance.

The dBi-M series of transducers have an RS485 digital output which can be programmed to give readings according to **level, space, distance, or volume**.

Product Specification

PHYSICAL

Transducer housing material	PVDF or Valox 357 PBT
Weight	**dBi-M3:** 1kg (2.2lbs), **dBi-M6:** 1.2kg (2.7lbs), **dBi-M10:** 1.3kg (2.9lbs), **dBi-M15:** 1.4kg (3.1lbs)
Dimensions & Mounting	**dBi-M3:** 77mm dia x 134mm high (3 x 5.31") 1" BSP/NPT **dBi-M6 & dBi-M10:** 86mm dia x 121mm high (3.38 x 4.75") 1" BSP/NPT rear thread **dBi-M15:** 86mm dia x 134mm high (3.38 x 5.32") 1"BSP/NPT rear thread.
Standard Cables lengths	5m (16.4ft), 10m (32.8ft), 20m (65.6ft) or 30m (98.4ft)
Transducer Cable Extensions	4-core screened.
Maximum Separation	500m (1,640 ft)

ENVIRONMENTAL

IP Rating	IP68 / NEMA 6P
Max. & min. temperature (electronics)	-40°C to +80°C (-40°F to 176°F)
Flammable atmosphere approval	Compatible with approved transducers (see spec. sheets)
CE Approval	See DoC in this manual for details
Explosive atmosphere approvals	
IECEx, UKEx & ATEX	Zone 0 : II 1 G Ex ia IIC T4 Ga, Zone 20 : II 1 D Ex ia IIIC T130°C Da, Tamb= -40°C to +80°C. Also suitable for zones 1,2,21,22.

PERFORMANCE

Measurement Range	**dBi-M3:** 0.125m (0.41 ft) to 3m (9.84 ft) **dBi-M6:** 0.3m (0.98 ft) to 6m (19.69 ft) **dBi-M10:** 0.3m (0.98 ft) to 10m (32.81 ft) **dBi-M15:** 0.5m (1.64 ft) to 15m (49.21 ft)
Accuracy	**dBi-M3:** 2mm (0.08") **dBi-M6:** 4mm (0.16") **dBi-M10:** 3mm (0.12") up to 6m (19.69 ft), 6mm (0.24") over 6m range. **dBi-M15:** 5mm (0.2") up to 10m (32.81 ft), 10mm (0.36") over 10m range.
Frequency	**dBi-M3:** 125kHz **dBi-M6:** 75kHz **dBi-M10:** 50kHz **dBi-M15:** 41kHz

Beam Angle	**dBi-M3, dBi M6 & dBi-M10:** <10° **dBi-M15:** <8° (all beam angles are inclusive)
Rate Response	Fully adjustable
Resolution	**dBi-M3:** 1mm (0.04") **dBi-M6:** 2mm (0.08") **dBi-M10:** 3mm (0.12") **dBi-M15:** 5mm (0.2")

OUTPUTS

Digital Communications	Non-isolated RS485
Communication Protocol	Modbus RTU

PROGRAMING

PC Programming (via RS485 converter)	PC setup, installation, echo profiles, cloning and troubleshooting)
Programming security	Via passcode
Program integrity	Via non-volatile memory

SUPPLY

Operating Voltage	5-15 VDC
Current Consumption	Average 14mA, 0.006 mAh per measurement.
Boot Time	1 second for warm bootup (within 12 hours), 2 seconds cold bootup (after 12 hours).

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

EU & UK Certificate of Conformity

pulsar
MEASUREMENT

EU & UK DECLARATION OF CONFORMITY

P U L S A R dBi-M & dBi-T ranges.

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

Relevant legislation;	2014/35/EU	SI 2016/1101	LVD, safety regulations & amendments.
	2014/30/EU	SI 2016/1091	EMC directive, regulations & amendments.
	2014/34/EU	SI 2016/1107	ATEX directive, UKEx regulations & amendments.
	2011/65/EU	SI 2012/3032	RoHS directive, regulations & amendments.

Manufacturer	Pulsar Process Measurement Ltd
Address	Cardinal Building, Enigma Commercial Centre, Sandy's Road, Malvern, Worcestershire, WR14 1JJ, UK.
Apparatus	DC powered level measurement sensor utilising ultrasonic technology.
Models	dBi-M3, dBi-M6, dBi-M10, dBi-M15, dBi-T3, dBi-T6, dBi-T10, dBi-T15.
Equipment type	Measurement and process control.
Standards applied	EN61010-1:2010+A1:2019 Safety requirements for electrical equipment for measurement, control & laboratory use.
	EN61326-1:2013 Electrical equipment for measurement, control & laboratory use, EMC requirements.
	EN60079-0:2018 Explosive atmospheres. Equipment general requirements.
	EN60079-11:2012 Explosive atmospheres. Equipment protection by intrinsic safety 'i'.
Certification body	Element Materials Technology Ltd., EMT. IECEx EMT20.0005X
Approved body	Element Materials Technology Ltd., #0891. EMA 21UKEX0037X
Notified body	Element Materials Technology Rotterdam B.V., #2812. ERO 20ATEX0005X

I declare that the apparatus named above has been tested and complies with the relevant sections of the above referenced standards & legislation.

Signed for and on behalf of;

1ST December 2021
Rev. 3.0

Name & function: Tim Brown, electronics engineer. Pulsar Process Measurement Ltd.

CE 2813   UKCA 0518

CHAPTER 2 INSTALLATION

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 your local Pulsar Measurement Partner.

Power Supply Requirements

The dBi-M series intelligent transducer operates from a supply voltage of 5 to 15V DC, and typical draw on average over 900ms is 14mA, peak is 100mA at start up for 5ms.

The compact one-piece construction of the dBi-M series intelligent transducer can be mounted easily using wither the 1" BSP/NPT rear mounting thread or the integral 1.5" or 2" BSP/NPT front nose thread (dependent on model).

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

Location

When choosing a location to mount the transducer, please bear in mind the following:
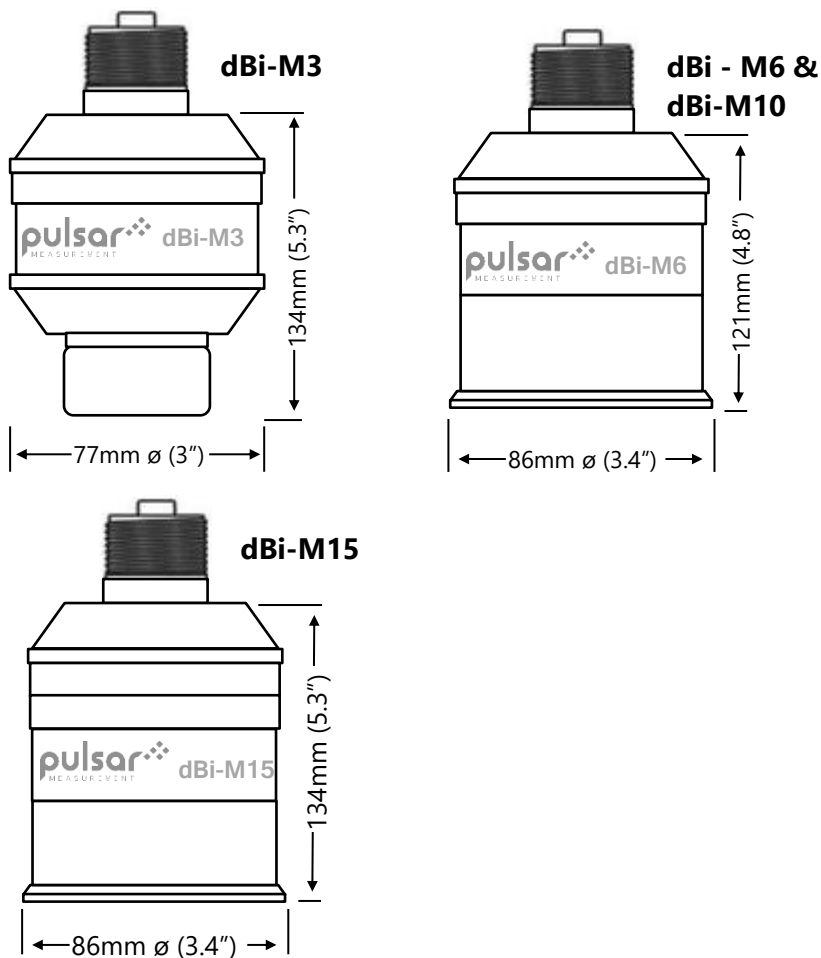
- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
- The dBi-M3 should be mounted at least 12.5cm (0.41 feet) above the maximum level of the material and be perpendicular to the surface. While the dBi-M6 and 10 should be mounted at least 30cm (0.98 feet) above the maximum level of the material and be perpendicular to the surface. And the dBi-M15 should be mounted at least 50cm (1.64 feet) above the maximum level of the material and again should be perpendicular to the surface.

- The ambient temperature is between -40ºC and 80ºC (-40°F to 176°F).
- There should be no high voltage cables or electrical wiring near the transducer cabling.
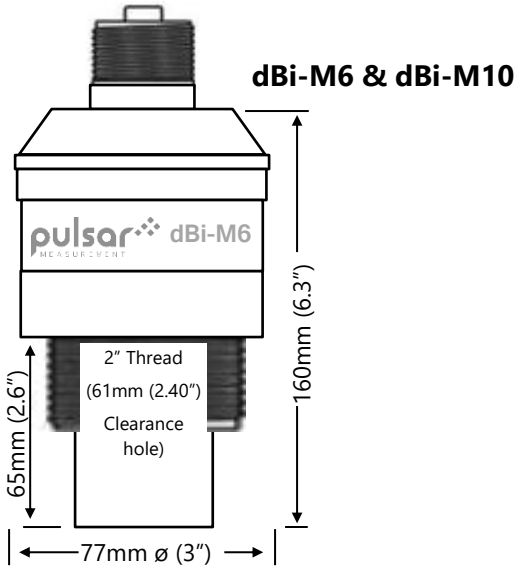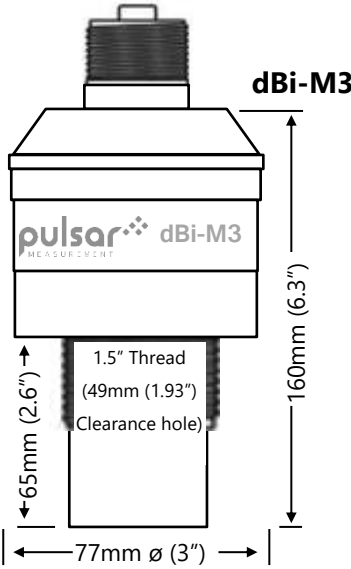
Dimensions

The dimensions of the dBi-M Series Intelligent Transducerw are shown below:

Rear Thread Mount

dBi-M3

134mm (5.3")

77mm ø (3")

dBi - M6 & dBi-M10

121mm (4.8")

86mm ø (3.4")

dBi-M15

134mm (5.3")

86mm ø (3.4")

Front Thread Mount

dBi-M3

pulsar dBi-M3

160mm (6.3")

65mm (2.6")

1.5" Thread (49mm (1.93") Clearance hole)

77mm ø (3")

dBi-M6 & dBi-M10

pulsar dBi-M6

160mm (6.3")

65mm (2.6")

2" Thread (61mm (2.40") Clearance hole)

77mm ø (3")

Outdoor and Open Vessel Installation

The dBi-M Series Intelligent Transducer can be simply mounted on a bracket, suitable for the application and secured using either the 1" BSP/NPT rear thread or via the 1½" or 2" front thread, dependant on model.

Care should be taken to ensure that the dBi Series Intelligent Transducer is not installed in direct sunlight, 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.

DBI MODEL	RANGE	L = BLANKING
dBi-M3	3 metres (9.84 feet)	125mm (0.41 feet)
dBi-M6	6 metres (19.69 feet)	300mm (0.98 feet)
dBi-M10	10 metres (32.18 feet)	300mm (0.98 feet
dBi-M15	15 metres (49.21 feet)	500mm (1.64 feet)

'L' (Blanking) should, as a minimum be at least that as detailed in the table above but can be greater if required.
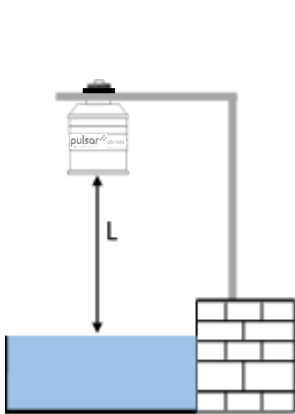
Mounted via Rear 1"BSP/NPT Thread
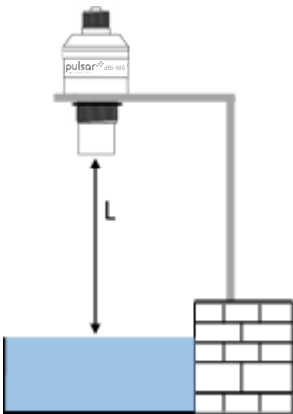
Mounted via optional Front Thread

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 dBi Series Intelligent Transducer can be simply screwed into a flange and secured using the rear 1" BSP/NPT rear thread or via the 1½" or 2" front thread, dependant 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 dBi Series Intelligent Transducer and the connection to the vessel.
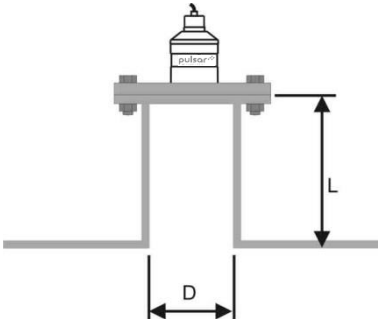
Standpipe Installations

When mounting the dBi Series Intelligent Transducer 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	
mm	inches	mm	inches
80	3	220	8
100	4	300	12
150	6	420	16
200	8	560	22
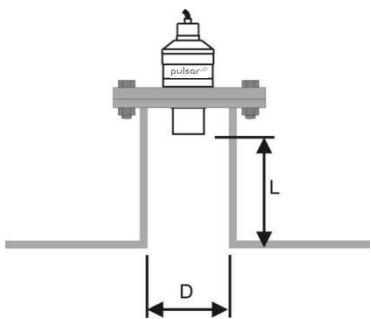
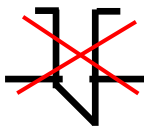dBi Flange mounted via Front Thread

Optional Flange Mounted dBi

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. 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°.
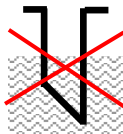
| The maximum level (100% of Span) is inside the Blanking Distance. | Pipe should be free of obstructions such as weld seams. | Correct standpipe installation |

When using the dBi-M Series Intelligent Transducer to measure 'aggressive, materials such as 'alkaline' and 'acids' it is recommended that either a PVDF or an optional PTFE faced Flanged Transducer is used. Please consult Pulsar Measurement for a full availability of options.
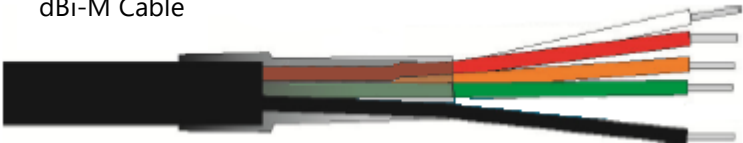
Cable

The dBi-M Series Intelligent Transducer comes with a fitted integral cable, if this cable is extended then the total capacitance must not exceed the limits for the voltage applied.

Wiring detail

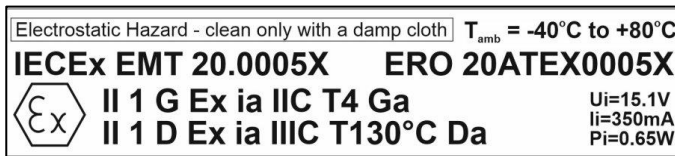| COLOUR	DESCRIPTION	LIMITS
Red	Power	15V max.
Orange	RS485 +	5V Nom.
White	RS485 –	5V Nom.
Black	0V DC	
N/A	Cable Screen	

dBi-M Cable

Hazardous area location

Ex ia (Intrinsically Safe) dBi-M transducers are certified for use in hazardous zones 0, 1, 2 (gas) & 20, 21, 22 (dust).

The installation must comply with local regulations and the power supply cable to the transducers shall meet the relevant requirements of clause 9 of IEC60079-14:2013 / EN60079-14: 2014. The dBi-M series intelligent transducer has bare wires; ensure that suitably specified barriers are employed.
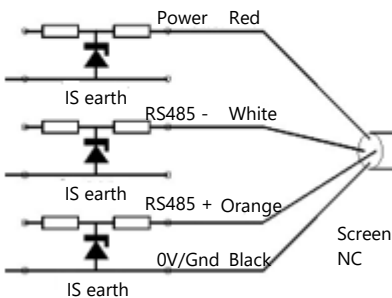
Marking for the dBi-M transducer:

Electrostatic Hazard - clean only with a damp cloth	T_{amb} = -40°C to +80°C
IECEx EMT 20.0005X	**ERO 20ATEX0005X**
⟨Ex⟩ **II 1 G Ex ia IIC T4 Ga**	Ui=15.1V Ii=350mA
II 1 D Ex ia IIIC T130°C Da	Pi=0.65W

Zener Barriers

Zener barriers

Power:
Uo max. = 15.1V, R.min = 44.6R

Signal: RS485 -, RS485 +
Uo max. = 10.3V, R.min = 49R

Power   Red
IS earth
RS485 -   White
IS earth
RS485 +   Orange
0V/Gnd   Black
IS earth

Entity parameters:

Power:
Ui = 15.1V
Li = 350mA
Pi = 0.65W

Signal:
Ui = 10.3V
Li = 350mA
Pi = 0.65W
Uo = 6.51V
Lo = 132mA

Screen
NC

dBi-M transducer

Safe Area
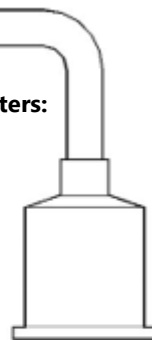
Hazardous area
Zones 0, 1, 2 (gas) & 20, 21, 22 (dust)

Preparation for Operation

Before switching on, check the following:

- ✓ The dBi Series Intelligent Transducer is mounted correctly.
- ✓ The power supply is correctly installed.

Maintenance

There are no user serviceable parts inside your dBi-M Series Intelligent Transducer, if you experience any problems with the unit, then please contact Pulsar Measurement for advice.

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

Parameter Defaults

Factory Defaults

When first installing the dBi-M Series Intelligent Transducer, 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 Default P930,** as described in the relevant unit type **parameter guide**. This can be done by using the free dBi-M PC software.

Once you are satisfied with the installation, and the dBi-M Series Intelligent Transducer is reading what you would expect in terms of distance from the face of the transducer to the material. Then you can proceed with any programming, required for the intended application. It is sensible to program all required parameters at the same time as soon as programming is complete the system will then be setup ready for use.

CHAPTER 3 GETTING RESULTS WITH DBI-M TRANSDUCERS

This chapter explains how to undertake the various functions of your dBi-M Series Intelligent Transducer. Where specific parameters are used, please refer to Chapter 5 Parameter Guide.

Setting up Your Application

Empty Distance

Empty Level (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 dBi-M Series Intelligent Transducer 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 dBi-M Series Intelligent Transducer 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.

Resetting Factory Defaults

If you need to restore parameters to their original factory settings, then access parameter **P930**, which is the factory defaults parameter, change the value to **1** and **ENTER**. Or access the **Transfer menu** option and select '*Set Factory Default*' and all parameters, will be restored to the factory settings (including the DATEM trace) and on completion.

Checking Information Specific to your dBi-M Intelligent Transducer

There are some parameters dedicated to each individual dBi-M Series Intelligent Transducer, such as the firmware revision and the unit's serial number.

Checking the Firmware Revision and Serial Number

If you need to identify the serial number of the unit or the current level of firmware in your dBi Series Intelligent Transducer, the following parameters can be used. Select parameter **P926** to view the identity of the current **firmware revision** or **P928** for the **serial number** of the unit.

CHAPTER 4 DBI-M PC SOFTWARE

The free dBi-M PC Software is a powerful tool that can be used to aid you in getting the most from your dBi-M Series Intelligent Transducer.

It can be used to record all the Parameters for your applications, which can be saved to a PC or USB and stored for future reference. All parameters can be changed and downloaded to an instrument via your laptop. Remember it is most important to note that Parameters downloaded to an instrument must be extracted from the same firmware version as the system to which they are downloading otherwise errors due to incompatibility may occur.

The PC software can also be used to record and view Echo Profiles from your applications, these can be saved for your records or sent via e-mail back to Pulsar Measurement for our engineers to analyse. dBi-M PC software can also be used to re-program your unit to the latest version of firmware, with any enhancements that it may contain. Please consult Pulsar Measurement for further information on re-programming if it is required.

dBi-M RS485 Connector

To connect to the dBi-M intelligent transducer to the free dBi-M PC Software, you will need to use Pulsar's RS485 Connector and wire the transducer to the connecting terminals as shown below:
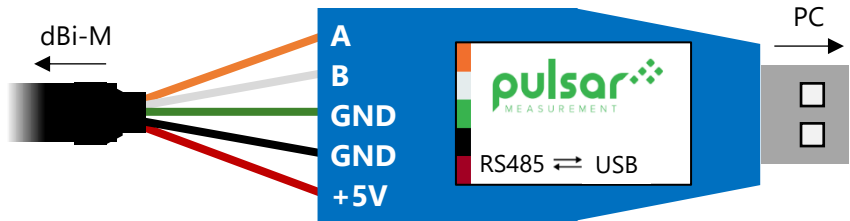

Wiring Detail

The label on the RS485 connector depicts the order the dBi-M cables are connected to the connector. The table below also assists to show which cables are connected to which terminal.

COLOUR	DBI-M	RS485 CONNECTOR TERMINAL
Orange	RS485 +	A
White	RS485 −	B
Green	Cable Screen	SCN/GND
Black	0V DC	0V/GND
Red	Power	+5V

Opening dBi-M PC

Once the dBi-M PC software has been installed on to your local machine, double click on the dBi-M PC shortcut and a window will appear prompting you to enter a passcode (as shown below).
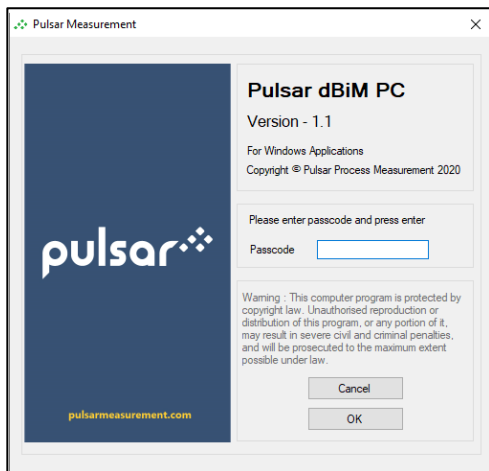
The password to enter the PC software is **1997**, once typed in press enter and the PC software will open and be ready for use.
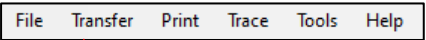
Using dBi-M PC

Please note that the software requires the sensor connected, to be in 'Little Endian' format mode for it to work effectively.
For further information please consult your local Pulsar distributor for details.

dBi-M PC Opening Screen

Menu Strip

Shortcut Icons

Toggle parameter list

Main screen selection tabs

Main Screen

Common Controls

Menu Strip

None of the menu strip drop down menus can be accessed if you are viewing echo profiles. To access these menu options, change regular echo to '**Off**'.

File

The top left hand dropdown menu is **File**. Selecting this drop-down menu will give you the option of opening a previously stored parameter file, opening a previously stored echo file, saving parameters to file (provided you have first uploaded them from your dBi-M).

You can also select to restart the dBi-M PC software.

Transfer

The **Transfer** menu enables you to get parameters from the unit, send parameters to the unit, and program single parameters. These three options are mimicked by the icons with the Computer and Ultra motif. For sending and receiving parameters follow the on-screen commands. When you have uploaded the parameters from your dBi-M, pressing the toggle parameters icon will show all parameters, clear the screen, and show changed parameters again.

For single parameter programming, press the icon with the Ultra motif with a red and blue arrow. From the drop-down menu, select the required parameter number and press the read button , to view the details and current value of a parameter. Change the value to the required amount and then press enter, the change is then verified by the PC software. You can select to default the unit to its factory set parameters.

Note: Pressing the Factory Default (P930) will restore the sensor to its factory settings. All changed parameters on your sensor and information will be lost if not previously saved.

Parameters

The **Parameters** menu gives you three options (options 1 & 2 are easily accessed with the Tools button):

1. View (all) parameters in the dBi-M. A list will appear on the right-hand side in a table showing all parameters (highlighted in yellow are parameters where their values have been changed from default).
2. View only the parameters that have had their values changed from default.
3. Print parameters opens up a new window, giving you further options on whether to print all parameters, changed parameters to a printer (or print to PDF). In addition, you can save the parameters to a file, which saves the information as a .doc file.

The best way to obtain a hard copy of your parameter list is to print the parameters to a file (save as a .doc file). The list can then be printed out at your convenience.

Trace

The **Trace** menu gives you four options:

1. Save trace images to file captures the current echo trace displayed on the graph and save it as a .jpg file.

2. Save trace to clipboard, saves the current viewed echo profile onto your clipboard, from there it can be pasted into a document such as word for recording, viewing, or reporting.

3. Print echo traces will open a preview of the current displayed profile which you can alter to suit your requirements before printing.

4. Zoom full allows you to zoom out to the maximum range, enabling you to view the echo trace being displayed on the main graph.

Tools

The **Tools** menu enables you to open up the Comport settings window, enabling you to select the comport that the dBi-M is connected to. If using firmware v1.0.16 and above, you can also select the endianness format that your sensor is set at to make a connection to the software.

Or if a dBi-M is already connected to the PC software, you can close the com port ending your session with the dBi-M series intelligent transducer.

Re-program option will be greyed out as this requires service access, this will allow you to re-program the dBi-M with up-to-date firmware. Please consult Pulsar Measurement for assistance in carrying out this operation.

Modbus Poll allows you to view the Modbus register information in the dBi-M Series Intelligent Transducer. Function allows you to select between Function 03 - Holding Register (Runtime registers) which are read only, and Function 04 - Input Register (Configuration parameters) which are read/write.

The address is used to select the register address that you wish to view/edit. Please refer to Chapter 6 Modbus for a full list of available registers for the dBi-M Series Intelligent Transducer.

And the length of bytes is set to 4 as every register is in a 32-bit float format (which is 4 bytes in length), and are formatted as Little Endian.

Parameters/Registers List when selected opens a new option on the main screen selection tabs, which allows you to select one of four options:

1. View list of parameters with short description: This option displays a table with all the parameters in the dBi-M and a brief description of what the parameter is.

2. View list of parameters with full description: This option displays a table that allows you to view all the parameters in the dBi-M with a full description of the options available for them (where applicable).

3. View list of parameters read with values: This option displays a table with all parameters that are programmed into the dBi-M, along with the current value set and the default value.

4. View list of runtime registers with description: This option displays a table with all the runtime registers, their index number, units of measurement and a description of each register.
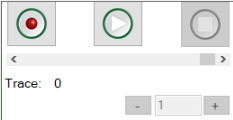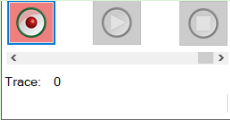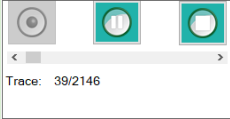
Note: To view the updated information in the sensor please ensure a connection is made, and an echo is obtained.

The clean all option removes any values that are currently displayed in the parameter boxes on the PC software. This does not default the unit, just clears the information in the parameter value boxes.

Help

This displays information about the dBi-M PC software.

Shortcut Icons

NAME	ICON	DESCRIPTION
File		Allows you to search for any parameter file that you wish to open, view, and examine. Parameter files are saved in a .xml format.
Save to Clipboard		Selecting this icon will paste the current viewed echo profile onto your clipboard, from there it can be pasted into a document such as word for recording, viewing, or reporting.
Record & Playback		When this option is selected, a window will appear with a record button (green circle with a red dot in the centre), a play button (green circle with a triangle in the centre), and a stop button. **Record/Playback Controls** When recording an echo trace, you will first be prompted to save the echo recording on to your PC. When done, the record button and status bar will turn red, indicating that recording is underway. When finished, select the record button again to stop. **Recording Controls** To replay a saved echo trace, select the play button and choose the relevant echo file (.hir) to replay. The play/pause button, stop button and status bar will turn turquoise to indicate that an echo is being replayed. **Playback Controls** You can also pause and move the slider to a specific position of the total trace recordings (ideal for long recordings).

NAME	ICON	DESCRIPTION
Upload		This enables you to download all parameters that are currently in the dBi-M that is connected to the PC software. You will be prompted to save the parameters when the download is complete.
Send Parameters to Unit		This allows you to send all parameters at once in the PC software to the dBi-M that is connected.
Single Programming		This enables you to program one parameter at a time. Press the single programming icon and, when the Interactive Programming display window appears, press the connector icon, this will connect PC to dBi-M. Key in the parameter number required, and press the read key. Change the value to the required amount and press send, the change is then verified. **Note:** Pressing the Hard Default or Factory Default icons will restore factory parameters to your unit and information will be lost if not previously saved.
Status Display		Selecting this icon enables a small list of information about the performance of the unit. This includes: Level, Distance, Volume, Temperature, Noise, Strength, and Status.
System Information		This enables you to view the current firmware version, Hardware version and serial number of the dBi-M connected to the PC software.
Exit		Selecting this will exit your current session from the PC software. Please ensure any unsaved parameters are uploaded to the dBi-M prior to selecting this option.

Factory Defaults

If an icon is greyed out then that function is not accessible, for example, if you are viewing echoes then you cannot access files, to access files you must click 'Off' in the regular echo box then a file can be accessed.

Toggle Parameter List

When you have uploaded the parameters from the connected dBi-M (or from your laptop), a list of changed parameters will appear in the right-hand side of your screen.

Pressing the toggle parameters icon [icon] will alternately show all parameters, (with the changed parameters highlighted in yellow), show only the changed parameters and then hide the table from view.

Main Screen Selection Tabs

Echo

This provides a graph and controls for viewing echo traces.

Parameters

dBi-M parameters can be viewed in a table format, and in relational groups. A single parameter can be viewed or all parameters from that group can be changed. You can also view the individual parameters options, change them, and default them to their factory values.

For further information on the parameters available in each section and their options, please refer to chapter 5 Parameter Guide.

Selecting this icon in the parameter group, will download the values of the parameters for that section. The value boxes will then be highlighted in green, signifying that the values have been downloaded correctly.

Selecting this icon next to a parameter, will download the values for the parameter only. The value box is then highlighted in green, signifying that the value has been downloaded correctly.

Selecting this icon next to a parameter, will enable you to view the options available for that parameter. You can choose to select a different value for the parameter or default it to its factory setting.

Main Screen

The main screen is used to display real time echo trace diagnostic information from the dBi-M transducer connected or replay recorded echo traces previously saved.

Echo traces

To request an echo trace from the dBi-M, select the Regular Echo 'Off' button, this will turn on and an echo will be presented on the main screen.

The X axis represents the **distance** in **measurement units** (**P104**) defined by the dBi-M transducer. The Y axis represents the **signal strength** in mV, on the status display this is represented as a percentage (0mV = 0% and 1,000mV = 100%). Example of an echo trace is shown below:
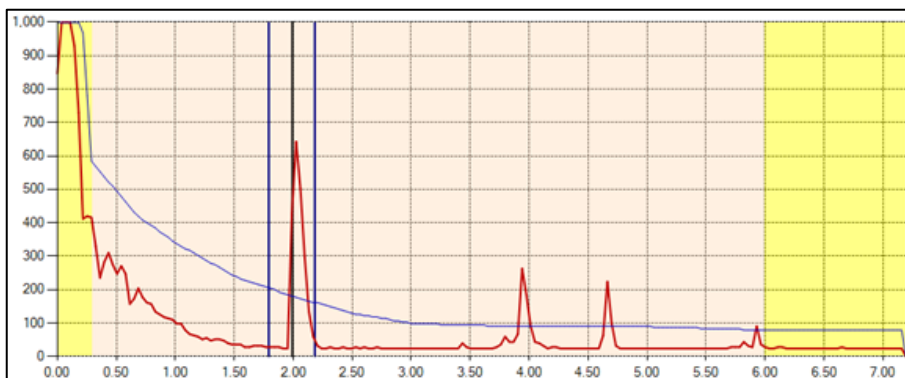
Raw Echo

The Raw echo is shown in red. It shows signals (echoes) reflected from objects as peaks in the trace.

The higher the peak of the echo, the stronger the echo is. The far-left portion of the raw echo trace is known as the ringdown. It is a result of the ceramic crystal still vibrating from the transmit pulse when the receiver is switched on. The ringdown region is the reason for the near blanking dead band. As a target moves further away from the transducer, the signal strength of the returned echo will reduce.

Gate and Measurement line

The distance line shows which echo is being selected for the measurement.

The vertical blue lines remain fixed at either side of the distance line, and act as a stability mechanism to filter out any momentary echoes from passing machinery/stirrers etc.


Measurement marker

Gate
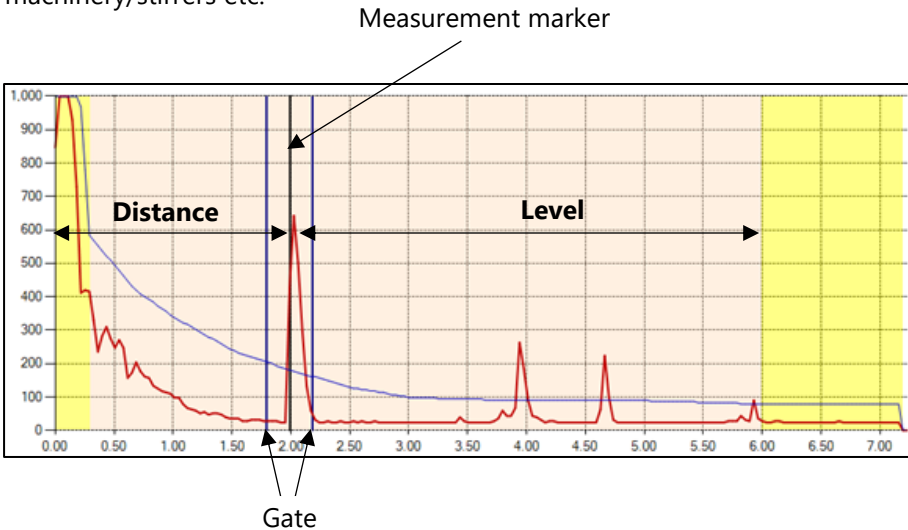
DATEM (Digital Adaptive Tracking of Echo Movement)

The (Blue) DATEM trace acts as a threshold which defines if echoes are considered as candidates for measurement. Any echo whose peak is below the DATEM line, will not be considered for measurement. In effect the transducer will not "see" it.
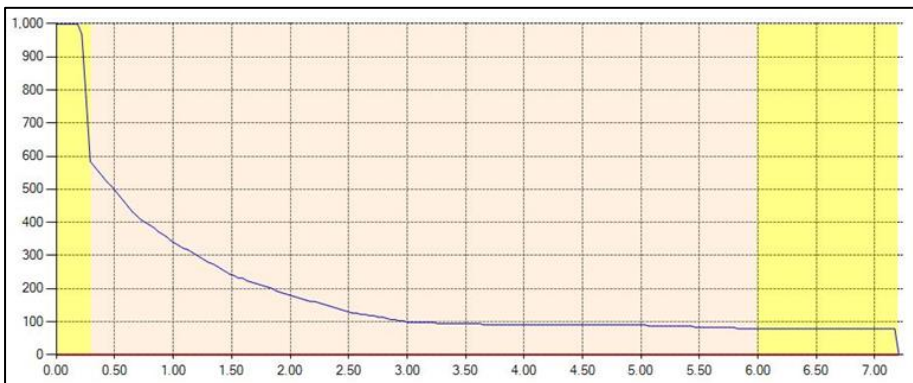
By default, the DATEM in dBi transducers is ACTIVE which means it will grow to cover any fixed obstructions in front of the current measurement echo.

Looking at the trace below, the only echo which can be "seen" by the echo selection algorithm is the current selected echo at 4.2 metres.
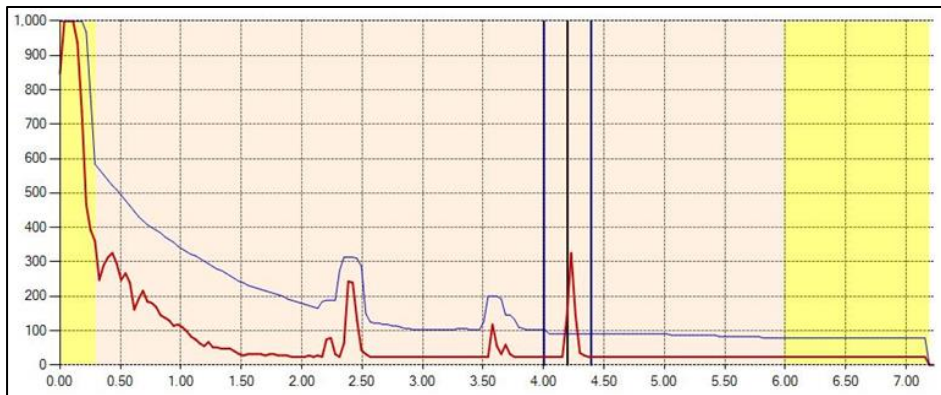
Zooming

You can zoom into an echo trace by clicking and dragging a window from Top Left to Bottom Right across the area you want to zoom into.
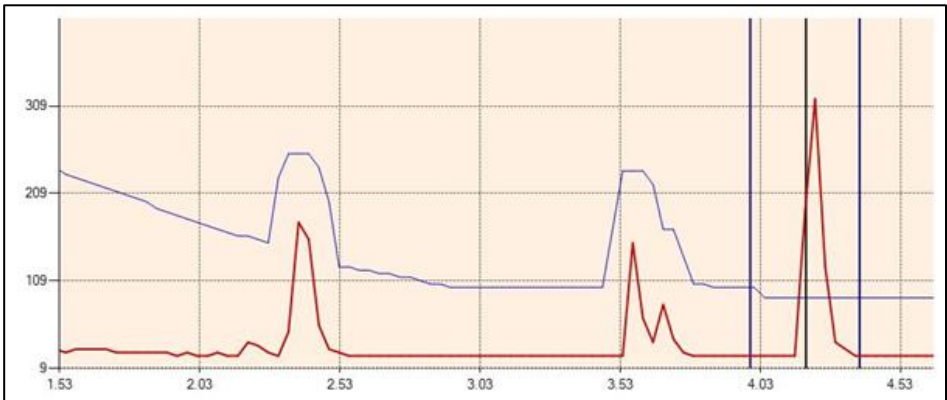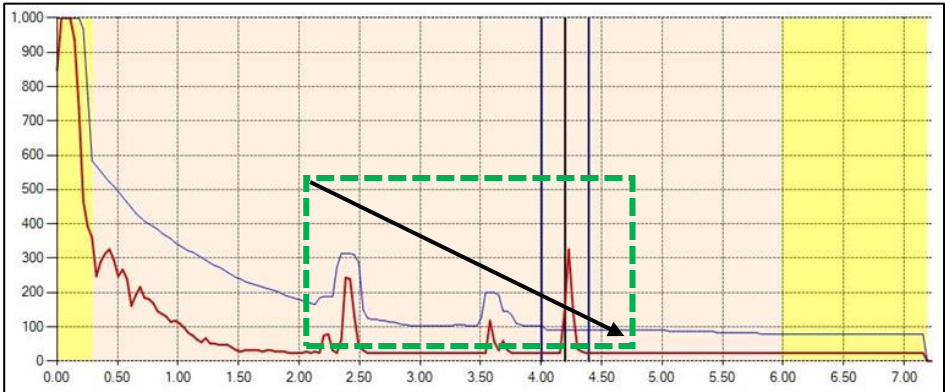
To zoom out, simply draw a box from the bottom right to top left or select **Trace > Zoom Full** from the menu options.
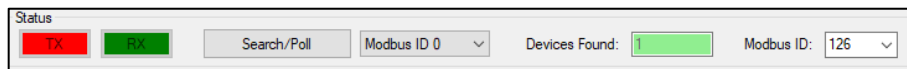
> **Important Information**
>
> If you are connecting to multiple devices that are to be placed onto a Modbus network, the Modbus ID/address of each sensor will need to be changed from the default value of 126. Please use P133 to change the address of each sensor.

Common Parameters

This section of the screen is visible at all times and has controls for scanning and connecting to dBi-M transducers, obtaining echoes, manipulating DATEM, progress bar indication and cursor positioning on the echo screen.

Status
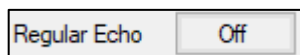
From the left of the status section, the transmit (TX) and receive data (RX) from the dBi Series Intelligent Transducer, when it is communicating with the PC software. They will flash red/green when communication is being made (dBi-M PC tries to connect automatically when the software is first opened).

You can search/poll a dBi-M transducer after confirming the comport you are connecting to is setup correctly. When a dBi-M transducer is connected, the 'Devices found box' will display how many dBi-M Series Intelligent Transducers have been found and the Modbus addresses of the dBi-M transducer(s). You can select the value of the dBi-M you wish to communicate with, within the Modbus ID value box.
When Search/Poll is selected, the Modbus ID is always unknown. With the option Modbus ID 0 a broadcast is done once, if a reply is received and there is no error, then only one device is connected. If there is an error then you can select to search Modbus ID addresses in an incremental or decremental format.
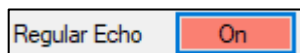
Trace

To request echo traces from the dBi Series Intelligent Transducer, change regular echo from Off:

To On:

When the regular echo is turned on, the regular echo selection box will highlight red indicating a trace is being obtained and displayed. When obtaining a trace for the first time it will take approx. 7 seconds to retrieve the information, after this the trace will continue to display live information from the dBi-M every 2 seconds.

DATEM

Note: This feature is only available when in service mode. Please consult a Pulsar Measurement engineer for further assistance.

The DATEM line can be adjusted manually, by selecting the 'view DATEM points' box.

When selected a purple line will appear on the echo trace graph with a number of moveable points.

The points can be clicked on and dragged in order to manipulate the DATEM line to cover any unwanted echoes you want to hide from the echo selection algorithm. Once the line is in its final position, click the

 button and the new values will be transferred to the real time DATEM line.
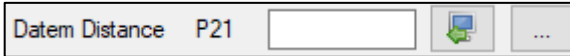
When finished and a regular echo is selected, the DATEM line will have changed to wrap around the echoes hidden from the movement of the points.
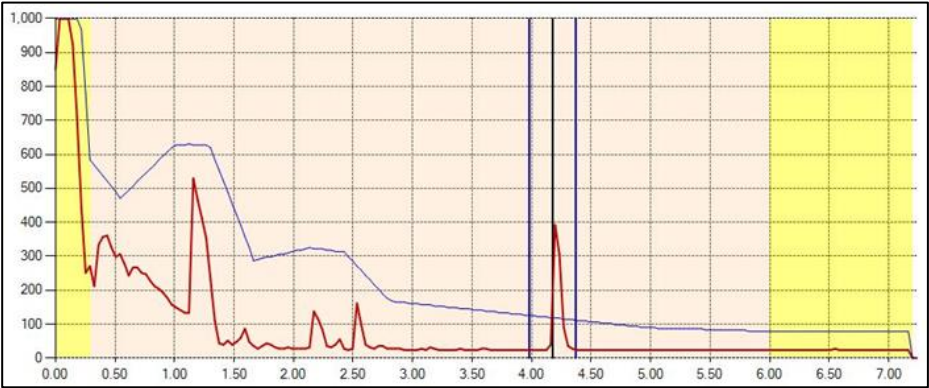
To undo the manipulation of the DATEM points, select the Set Default Datem Points , and the DATEM line will assume its default value:
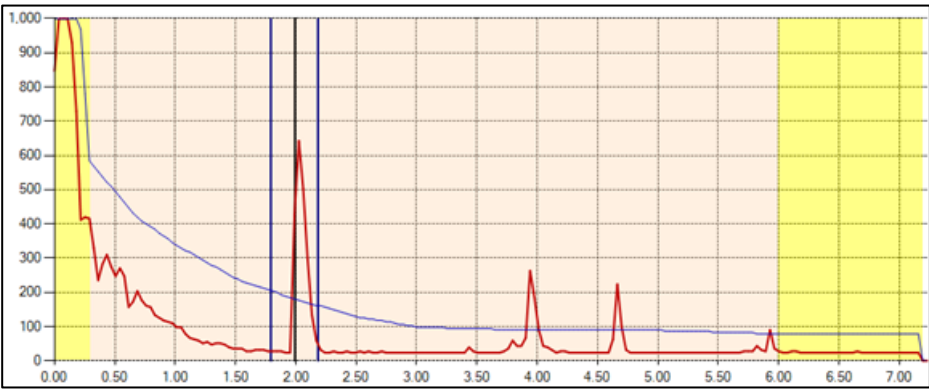
P21 DATEM Distance

Allows the user to determine which echo is to be displayed. On start-up, if the dBi-M is showing an incorrect reading, then simply enter the distance from the transducer to the required level and, if an echo is present at this point, the Gate will establish itself around the chosen echo, DATEM will update in front of the Gate and reference out any other unwanted echoes.

It should be noted that DATEM will reset to default values whilst performing this function, and reform itself once it has selected an echo.

Enter distance from the face of transducer to the target in **Measurement Units** (**P104**).

Selecting this icon displays the value for the parameter. If a value has been sent successfully this should return as 0.

Selecting this icon next to the parameter, enables you to view the options available, you can choose to select a different value for the parameter or default it to its factory setting.

Progress Bar

The progress bar displays information such as devices found, parameter changes, and colour the changes to indicate different actions are being performed.

Receiving and Sending Information

Obtaining an echo for the first time, uploading, or downloading parameters from the dBi-M, the progress bar will increment in green to signify an action is being performed:
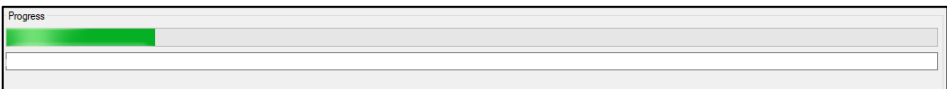
When the initial trace has been received the PC software will indicate the information received from the dBi-M in the information box below the progress bar, such as 'Get Echo trace' and 'Get Datem trace'.

When uploading or downloading parameters from the dBi-M, the information box will display the parameters and their values being sent or received from the dBi-M.
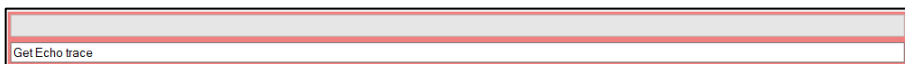
Replaying Echo Trace

When replaying an echo trace, the progress bar will turn turquoise:
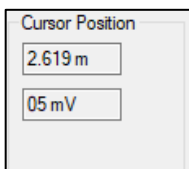
Get Datem trace

During the playback of the echo trace, you are unable to select the option to view a regular echo.

When recording an echo trace, the progress bar will turn red:

Get Echo trace

During the recording, the ability to upload/download parameters is unavailable.

Cursor Position

Cursor Position
2.619 m
05 mV

When hovering the mouse pointer on the echo trace graph, the pointer position will be updated in the **Measurement Units (P104)** and mV in the cursor position value boxes.

Transducer

Echo Trace

This option displays the Raw echo when selected, if unselected the Raw echo will be hidden from view on the echo trace graph.

Show Gate

This option displays the Gate when selected, if unselected the Gate will be hidden from view on the echo trace graph.

DATEM Trace

This option displays the DATEM line when selected, if unselected then DATEM will be hidden from view on the echo trace graph.

Show Distance

This option displays the Measurement Marker line when selected, if unselected the Measurement Marker will be hidden from view on the echo trace graph.

CHAPTER 5 PARAMETER GUIDE

This chapter describes all the parameters contained in the dBi-M Series Intelligent Transducer.

Application

Included in this tab is a diagram to help with setting up your application.

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	Display shows the distance from the transducer face to the surface of the material measured.
2 = Level (Default)	Shows how full a vessel is.
3 = Space	Shows how empty a vessel is.
4 = Volume	Display shows volume of the vessel.

P102 Material

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

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

Distance

P104 Measurement Units

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

OPTION	DESCRIPTION
1 = metres (Default)	All units of measurement are **Metres**
2 = cm	All units of measurement are **Centimetres**
3 = mm	All units of measurement are **Millimetres**
4 = feet	All units of measurement are **Feet**
5 = inches	All units of measurement 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: dBi-M3 = 3.00m (9.84 feet), dBi-M6 = 6.00m (19.69 feet), dBi-M10 = 10.00m (32.81 feet) and dBi-M15 = 15.00m (49.21 feet)**.

P106 Span

This parameter should be set to the maximum distance from the **Empty Level** (**P105**) to the maximum material level. It must be set at least to be equal to the **Empty Level** (**P105**) less the **Near Blanking** distance (**P107**) when you set the empty level. **Default dBi-M3 = 2.875m (9.43 feet), dBi-M6 = 5.70m (18.70 feet), dBi-M10 = 9.70m (31.82 feet) and dBi-M15 = 14.5m (47.57)**

P107 Near Blanking

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 dBi-M Series Intelligent Transducer being used. It should not be set to less than this figure but can be increased.

DBI VERSION	NEAR BLANKING DISTANCE
dBi-M3 metre	Default Blanking Distance = 0.125m (0.41 feet)
dBi-M6 metre	Default Blanking Distance = 0.3m (0.98 feet)
dBi-M10 metre	Default Blanking Distance = 0.3m (0.98 feet)
dBi-M15 metre	Default Blanking Distance = 0.5m (1.64 feet)

P108 Far Blanking

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 **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.

Data Logs

The data log parameters contain the following information:

Temperature

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

P583 Maximum Temperature

This parameter displays the maximum temperature recorded.

P586 Current Temperature

This parameter displays the current temperature.

Transducer Power Information

P940 Number of Starts

This parameter displays the number of times that the unit has been powered since leaving the factory.

Compensation

Application	Data Logs	Compensation	Stability	System	Datem

Compensation

Meas.Offset	P851	
Temp.Source	P852	
Fixed Temp	P854	
Velocity m/s	P860	
Vapour Comp Cm	P645	

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 of the PC software and Modbus registers.

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 = Automatic (Default)	Will automatically select transducer temperature sensor, if available, or fixed temperature (P854) if no temperature sensor found.
2 = Transducer	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 **20°C**.

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.

OPTION	DESCRIPTION
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

Damping

Damping is used to damp the reading displayed, 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 = 10.000 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)**

Filters

P881 Fixed 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 (more than 10m/min) to ensure smooth processing of the changing level.

P884 Peak Percentage

When P102 = 2 (Solids), this parameter can be used to determine the point at which the measurement is taken, within the established gate of the selected echo, to compensate for any error that maybe caused by "angles of repose" presented by the way the material settles. Please consult Pulsar Measurement for further information and assistance on changing the value of this parameter.

System

> ### Important Notice
>
> Parameters 926, 927 and 928 are **read only parameters** and do not affect how the unit performs, but details contained in them may be required, by Pulsar, when making technical enquiries.

System Information

P926 Firmware Revision
This parameter will display the current firmware revision.

P927 Hardware Revision
This parameter will display the current hardware revision.

P928 Serial Number
This parameter will display the serial number of the unit.

Defaults

P930 Factory Defaults
This parameter resets all parameter values to the original Factory Set values that were installed when the unit was tested prior to its dispatch to you.

To **reset** parameters, Set P930 to 1, or go to *Transfer → Set Factory Default Values.*

Modbus Poll Address

P133 Poll Address

This parameter sets the Modbus address for the dBi-M Intelligent Transducer. **Default = 126**

Alarm limits

The dBi-M series intelligent transducer stores an echo trace internally when the Alarm condition is triggered. When requesting an echo trace the Alarm trace will be displayed on the graph.

The dBi-M can be set up to capture an echo trace under certain alarm conditions; **Alarm Trace** (activates within the setpoints set in (**P951** and **P952**) or **LOE Trace**.

P951 Low Limit

This parameter sets the low value (in **P104 measurement units**) for the alarm setpoint.

P952 High Limit

This parameter sets the high value (in **P104 measurement units**) for the alarm setpoint.

P953 Alarm Save Trace Mode

This parameter sets the frequency at which a trace is saved to the dBi-M's internal memory in an alarm condition.

OPTION	DESCRIPTION
0 = Off (Default)	Trace mode is turned off.
1 = Once	When an alarm condition is activated, the dBi-M will save the first trace in its internal memory.
2 = Repeatedly	When an alarm condition is activated, the dBi-M will save the trace in its internal memory overwriting the previous trace for the new one.

P950 Save Trace on LOE

The dBi-M series intelligent transducer stores an echo trace internally when the LOE (Loss of Echo) condition is triggered. When requesting an echo trace the LOE trace will be displayed on the graph. This parameter sets the frequency at which a trace is saved to the dBi-M's internal memory in a LOE condition.

OPTION	DESCRIPTION
0 = Off	Trace mode is turned off.
1 = Once	When the dBi-M goes into LOE, the dBi-M will save the first trace in its internal memory.
2 = Repeatedly	When the dBi-M goes into LOE, the dBi-M will save the trace in its internal memory overwriting the previous trace for the new one.

Datem

P20 Reset Datem

This parameter allows the DATEM to be reset to its default value, just DATEM points or alternatively allow the user to perform a 'blank tank'. It should be noted that when using the 'blank tank' option, all echoes will be eliminated by DATEM.

OPTION	DESCRIPTION
0 = Off	Trace mode is turned off.
1 = Once	When an alarm condition is activated, the dBi-M will save the first trace in its internal memory.
2 = Repeatedly	When an alarm condition is activated, the dBi-M will save the trace in its internal memory overwriting the previous trace for the new one.

P21 Set Distance

Allows the user to determine which echo is to be displayed. On start-up, if the unit displays an incorrect reading, then simply enter the distance from the transducer to the required level and, if an echo is present at this point, the Gate will establish itself around the chosen echo, DATEM will update in front of the Gate and reference out any other unwanted echoes.

It should be noted that DATEM will reset to default values whilst performing this function, and reform itself once it has selected an echo.

Enter the distance from the face of transducer to the target in **Measurement Units** (**P104**).

P905 Peak Clearance

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

P70 DATEM Speed

This parameter is used to the speed in which the DATEM trace will react. Please consult Pulsar Measurement for further information and assistance on changing the value of this parameter.

OPTION	DESCRIPTION
0 = Slow (Default)	Datem updates to changes on an echo at a slow rate.
1 = Medium	Datem updates to changes on an echo at a medium rate.
2 = Fast	Datem updates to changes on an echo at a fast rate.

Volume

The dBi-M allows the user to select from a variety of volume calculation features, with 11 programmable 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**).
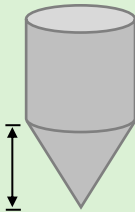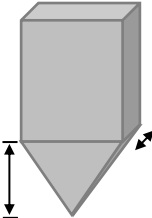
If your vessel shape does not correspond with any of the programmable vessel shapes, then you can use the **universal calculations**. For this you will need a level/volume graph or chart provided by the vessel manufacturer or you can create one based on the dimensions of the vessel. You can enter up to 32 pairs of breakpoints, and the more you enter, the greater accuracy of the volume calculation will be.
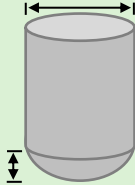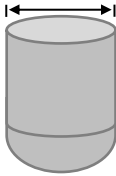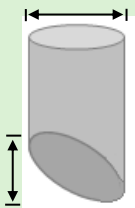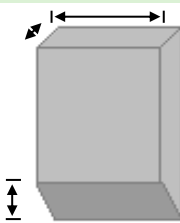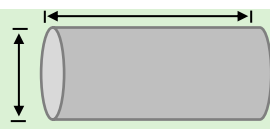
Conversion
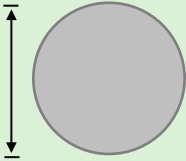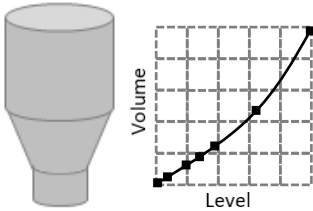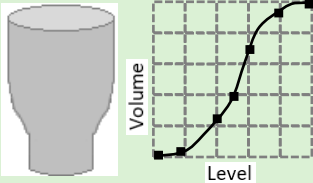
P600 Vessel Shape

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 DESCRIPTION	DIMENSIONS
	P600 = 0 (**Default**) Cylindrical Flat Base	Cylinder diameter
	P600 = 1 Rectangular Flat Base	Width and Breadth
	P600 = 2 Cylindrical Cone Base	Cylinder diameter and height of bottom
	P600 = 3 Rectangular Flat Base	Width and Breadth

VESSEL SHAPE	P600 VALUE DESCRIPTION	DIMENSIONS
	P600 = 4 Parabola Base	Cylinder diameter and height of bottom
	P600 = 5 Cylindrical half-sphere Base	Cylinder diameter
	P600 = 6 Cylindrical 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 and section, and tank length

VESSEL SHAPE	P600 VALUE DESCRIPTION	DIMENSIONS
	P600 = 10 Sphere	Sphere diameter
	P600 = 11 Universal linear	No dimensions required as level, and volume breakpoints are used
	P600 =12 Universal curved	No dimensions required as level, and volume breakpoints are 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	Not required	Not required
P600 = 1 Rectangular flat base	Not required	Width of rectangle	Breadth of rectangle
P600 = 2 Cylindrical cone base	Height of base	Width of rectangle	Not required
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 required
P600 = 5 Cylindrical half sphere base	Cylinder diameter	Not required	Not required
P600 = 6 Cylindrical flat sloped base	Height of base	Cylinder diameter	Not required
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	Not required
P600 = 9 Horizontal cylinder parabolic ends	Length of cylinder	Cylinder diameter	Length of one end
P600 = 10 Sphere	Sphere diameter	Not required	Not required

P604 Calculated Volume

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

Breakpoints

P610-P641 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 16 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.
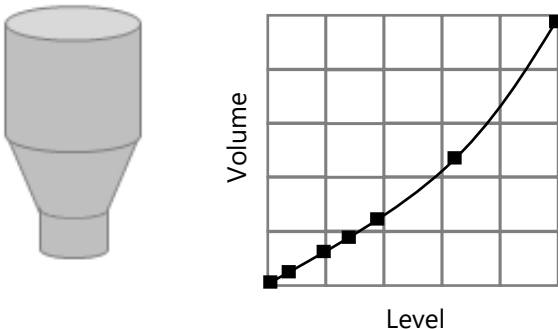
You should enter a level/volume breakpoint for each place where the vessel changes direction, and numerous where the section is slightly curved (mostly linear but has got a small arc). You can enter any number of pairs between 2 and 16.

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.
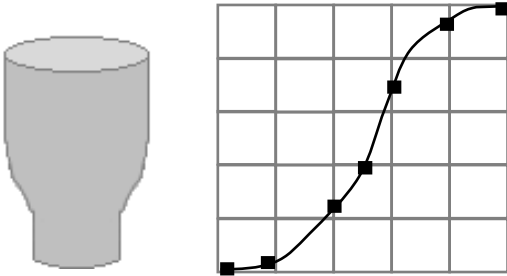
You should enter 2 level/volume breakpoints at the minimum and maximum levels, and several for each place where the vessel has got an arc. You can enter any number of pairs between 2 and 16.

P696 Reset Breakpoints

This parameter allows the resetting, to the default value, of all previously set breakpoints (P610-641), without having to access them individually. When it is necessary to reset or amend breakpoints this can be achieved by directly accessing the desired parameter (P610-641) and changing as required.

P697 Number of Breakpoints Set

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

CHAPTER 6 MODBUS

Important Notice

> Out of the box the dBi-M is set to the following Modbus Protocol:
> Modbus ID = 126
> Serial setup: 19200 – 8 – E - 1
> **Note:** Only Slave operation with Modbus RTU is available.

Modbus Protocol

The exchange of information between Master and Slave devices is done using the Modbus RTU communication protocol (19200-8E1). This protocol allows read and write operations over Registers allocated in the dBi-M unit. The protocol includes (among others) an 8-bit field defined as Device Address, a 8-bit field defined as Function Code, a 16-bit field defined as Register Address, and 32-bit field(s) defined as Register(s).

Device Address

Each Modbus slave has a unique Modbus address. The Modbus protocol defines the address range limits as 1 to 247. However, the dBi-M Series will support an address range of 1 to 126. The device address used by the dBi-M is set using the parameter shown below:

PAR. NO.	OPTIONS	DESCRIPTION	2X 16BIT REGISTER ADDRESS
P133	1 to 126	Device Address – Enter the Modbus device number for the dBi-M transducer.	2116-2117

Function Codes

Pulsar dBi-M Modbus Protocol supports functions 3, 4, 6 and 16. These registers are listed below:

FUNCTION CODE	FUNCTION DESCRIPTIONS	PLC ADDRESS
03	Read holding registers	40XXX
04	Read Input registers	30XXX
06	Write to a single register	40XXX
16	Write to multiple registers	40XXX

Register Address

The register address is a unique identification of a register in the unit. The addresses of different types of registers are listed in the following sections. It is worth to mention that some Modbus Master modules could implement an offset of 1 in the addressing system (Base 0 or Base 1). If this is the case and you want to read/write a register with address X, you must set in your system the address X+1.

Registers

Every Register in the dBi-M is a 32-bit float (4 bytes length) formatted as little endian (little endian registers, little endian bytes in the register). Even the integer registers must be read in the same format (4 bytes float little endian). In other words, for the registers with an integer value, you must expect an integer value in float format.

There are two types of Registers in the unit, defined as *Runtime Registers* and *Configuration registers* (or *Parameters*). Each of these types or registers are stored in different memory maps inside the dBi-M unit, and they are accessed (write/read operations) with different Modbus Function Codes.

Addressing 32-bit Registers on dBi-M

The floating registers can be alternatively accessed using the mirrored addresses above 2000.

The following information and examples depict how to read/write to the 32-Bit dBi-M registers using 16-Bit registers.

Reading/Writing 32-Bit dBi-M registers using 16-Bit registers

Non-consecutive addresses

Holding Registers

Variable Name	dBiM 32-bit Register Address	Bytes 1-2	Bytes 3-4
Measurement unit	104	A1	A2

Variable Name	16-bit Register Address	16 Bit Register (2 Bytes)
Measurement unit	104	A1
	104+1	A2

Variable Name	dBiM 32-bit Register Address	Bytes 1-2	Bytes 3-4
Near Blanking	107	A1	A2

Variable Name	16-bit Register Address	16 Bit Register (2 Bytes)
Near Blanking	107	A1
	107+1	A2

Consecutive addresses

Holding Registers

Variable Name	dBiM 32-bit Register Address	Bytes 1-2	Bytes 3-4
Measurement unit	104	A1	A2
Empty Level	105	B1	B2
Span	106	C1	C2
Near Blanking	107	D1	D2
Far Blanking	108	E1	E2

Variable Name	16-bit Register Address	16 Bit Register (2 Bytes)
Measurement unit	104	A1
	104+1	A2
Empty Level	104+2	B1
	104+3	B2
Span	104+4	C1
	104+5	C2
Near Blanking	104+6	D1
	104+7	D2
Far Blanking	104+8	E1
	104+9	E2

Configuration Registers:

- P0 to P999 (P= Parameter)
- **Read** using the FC 3 (Function Code) – Read Holding Registers.
- **Write** using:
  - o FC 6 – Cannot be used to write 32-bit registers.
  - o FC 16 – Write single or multiple 32-bit registers.

Runtime Registers:

- R0 to R255 (R = Register)
- **Read** using the FC 4 – Read Input Register
- Read Only

Runtime Registers (Input Registers)

The first table below presents the unit symbols and their corresponding descriptions for the *Runtime Registers*. The second table shows the addresses, descriptions, and units of the *Runtime Registers*. These registers are 'Read Only' and can be accessed using the Function Code 4.

Example:

You wish to know the current value for Distance.

Search for register address 4 using the Function code 4 and the information will then be displayed.

UNIT	DEFINITION
U_NO	None
U_MU	Measurement Unit
U_PC	Percentage
U_VU	Volumetric Unit
V_TP	Degree C
U_MN	Minutes

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
000	2000-2001	Level	U_MU
001	2002-2003	Echo Status	U_NO
002	2004-2005	Echo strength	U_PC
003	2006-2007	Temperature	U_TP
004	2008-2009	Distance	U_MU
005	2010-2011	Volume	U_MN
006	2012-2013	Space	U_MU
007	2014-2015	Level/Distance/Space or Volume (dependent on what P100 is set to)	U_MU or U_VU
016	2032-2033	Minimum Temperature	U_TP
017	2034-2035	Maximum Temperature	U_TP
200	*2200	Transducer Type (P101)	U_NO

*This 16bit integer register is formatted as big endian (big endian bytes in the register).

Configuration/Holding Registers (Parameters)

The first table presents the unit symbols and their corresponding descriptions for the *Configuration Registers* (Parameters). The second table shows the addresses, descriptions, and units of the *Configuration* Registers. These registers are read/write (see Chapter 5 for details of each parameter), and can be accessed using the Function Codes 3, 6 and 16.

Example:

You wish to know the current value for Empty Level. Search for register address 105 with Function 3 and the information will then be displayed.

UNIT	DEFINITION
U_NO	None
U_MU	Measurement Unit
U_PC	Percentage
U_VU	Volumetric Unit
U_TP	Degree C
U_MN	Minutes
U_VEL	m/sec
U_MV	Millivolt

Application

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
100	2052-2053	Mode	U_NO
101	2054-2055	Transducer	U_NO
102	2056-2057	Material	U_NO
104	2058-2059	Measurement Unit	U_NO
105	2060-2061	Empty level	U_MU
106	2062-2063	Span	U_MU
107	2064-2065	Near blanking	U_MU
108	2066-2067	Far blanking	U_PC

Data Logs

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
580	2118-2119	Minimum Temperature	U_TP
583	2124-2125	Maximum Temperature	U_TP
586	2130-2131	Current Temperature	U_TP
940	2266-2267	Number of Starts	U_NO

Compensation

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
851	2228-2229	Measurement Offset	U_MU
852	2230-2231	Temperature Source	U_NO
854	2232-2233	Fixed Temperature	U_TP
860	2234-2235	Velocity	U_VEL
645	2212-2213	Vapour Compensation	U_NO

Stability

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
870	2236-2237	Fill Damping	U_MU
871	2238-2239	Empty Damping	U_MU
881	2240-2241	Fixed Distance	U_MU
884	2242-2243	Peak Percentage	U_NO

System

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
808	2218-2219	Failsafe Mode	U_NO
809	2220-2221	Failsafe Timer	U_MN
930	2258-2259	Default Parameters	U_NO
951	2278-2279	Alarm Low Limit	U_MU
952	2280-2281	Alarm High Limit	U_MU
953	2282-2283	Alarm Save Trace	U_NO
133	2116-2117	Poll Address	U_NO
950	2276-2277	LOE Save Trace	U_NO
246	2284-2285	Baud rate (0=19200, 1=9600)	U_NO

DATEM

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
020	2012-2013	Reset Datem	U_NO
021	2014-2015	Set Distance	U_MU
905	2244-2245	Peak Clearance	U_NO
906	2246-2247	Side Clearance	U_MU
070	2034-2035	Datem Speed	U_NO

Volume

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
600	2132-2133	Vessel Shape	U_NO
601	2134-2135	Vessel Dimension A	U_MU
602	2136-2137	Vessel Dimension B	U_MU
603	2138-2139	Vessel Dimension C	U_MU
604	2140-2141	Cal Vol m^3 (Read Only)	U_VU
605	2142-2143	Volume Units	U_NO
606	2144-2145	Correction Factor	U_NO
607	2146-2147	Max Volume (Read Only)	U_VU
610	2148-2149	Level Breakpoint 1	U_MU
611	2150-2151	Volume Breakpoint 1	U_VU
612	2152-2153	Level Breakpoint 2	U_MU
613	2154-2155	Volume Breakpoint 2	U_VU
614	2156-2157	Level Breakpoint 3	U_MU
615	2158-2159	Volume Breakpoint 3	U_VU
616	2160-2161	Level Breakpoint 4	U_MU
617	2162-2163	Volume Breakpoint 4	U_VU
618	2164-2165	Level Breakpoint 5	U_MU
619	2166-2167	Volume Breakpoint 5	U_VU
620	2168-2169	Level Breakpoint 6	U_MU
621	2170-2171	Volume Breakpoint 6	U_VU
622	2172-2173	Level Breakpoint 7	U_MU
623	2174-2175	Volume Breakpoint 7	U_VU
624	2176-2177	Level Breakpoint 8	U_MU
625	2178-2179	Volume Breakpoint 8	U_VU
626	2180-2181	Level Breakpoint 9	U_MU
627	2182-2183	Volume Breakpoint 9	U_VU
628	2184-2185	Level Breakpoint 10	U_MU
629	2186-2187	Volume Breakpoint 10	U_VU
630	2188-2189	Level Breakpoint 11	U_MU
631	2190-2191	Volume Breakpoint 11	U_VU
632	2192-2193	Level Breakpoint 12	U_MU

32BIT REGISTER ADDRESS	2X 16BIT REGISTER ADDRESS	DESCRIPTION	UNIT
633	2194-2195	Volume Breakpoint 12	U_VU
634	2196-2197	Level Breakpoint 13	U_MU
635	2198-2199	Volume Breakpoint 13	U_VU
636	2200-2201	Level Breakpoint 14	U_MU
637	2202-2203	Volume Breakpoint 14	U_VU
638	2204-2205	Level Breakpoint 15	U_MU
639	2206-2207	Volume Breakpoint 15	U_VU
640	2208-2209	Level Breakpoint 16	U_MU
641	2210-2211	Volume Breakpoint 16	U_VU
697	2216-2217	Reset Breakpoints	U_NO

Echo Status (register 1)

BIT	NAME	VALUE 0 DESCRIPTION	VALUE 1 DESCRIPTION
1	Voltage	Voltage is greater than or equal to 4V DC	Voltage is less than 4V DC
2	Temperature Error When P852 = 3 (Fixed) Or P852 = 1 (Automatic) or 2 (Transducer)	When P852 = 3 (Fixed) Or P852 = 1 (Automatic) or 2 (Transducer) and is inside limits (-45°C< to <85°C)	When it is outside its limits
3	LOE	Signal is valid	LOE Fail (after P809 has expired)
4	Fail Safe	Signal is valid	Failed safe condition (after P809 has expired)
5	LOE High	Signal is valid	LOE fail (after P809 has expired) and P808 = 2 (Fail high)
6	LOE Low	Signal is valid	LOE fail (after P809 has expired) and P808 = 3 (Fail low)
7	Alarm	When P953 is set to 0 (On alarm save trace to flash is OFF) Or P953 is not 0 (Once) or 2 (Repeatedly) when R7 is inside limits (P951 <=R7 <= P952)	When R7 is outside its limits

CHAPTER 7 TROUBLESHOOTING

This section describes many common symptoms, with suggestions as to what to do. If the issue persists, please contact your local Pulsar Measurement Partner.

SYMPTOM	WHAT TO DO
Transducer not firing.	Check power supply to the transducer, and any cable extensions.
Unable to connect to dBi-M PC	Ensure the dBi-M connections are correct, the comport is set correctly. And search/poll has been pressed. If issue persists, try another comport for connecting the interface cable.
Unable to view echo trace	Ensure that the transducer is connected and has been polled. Press the Regular Echo Off button.
dBi-M does not appear on Modbus list	Ensure that the poll address is different to the master and any other slave addresses connected. By default, the dBi-M address is set to 126. This can be changed in P133.
Incorrect reading being displayed for current level.	Make a connection to dBi-M PC, measure actual distance from transducer head to surface of material. Use the function P21 in common settings to set the distance that is required to be measured.
Material level is consistently incorrect by the same amount.	Check empty level, (P105), Span (P106) and measurement offset (P851).

If you experience any other issues that are not mentioned in the above troubleshooting guide, please contact your local Pulsar Measurement Partner for further assistance.

CHAPTER 8 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.

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