# MICROFLOW

## INSTRUCTION MANUAL

## MICRO FLOW (FIRST EDITION REV. 3)

June 2017

Part Number M-dRF-S-001-3P

## COPYRIGHT

## WARRANTY AND LIABILITY

Pulsar Process Measurement Limited guarantee for a period of 2 years from the date of delivery that it will either exchange or repair any part of this product returned to Pulsar Process Measurement Limited if it is found to be defective in material or workmanship, subject to the defect not being due to unfair wear and tear, misuse, modification or alteration, accident, misapplication or negligence.

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Every effort has been made to ensure accuracy of this documentation, but Pulsar Process Measurement Limited cannot be held liable for any errors.

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

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

## TECHNICAL ENQUIRIES

Please contact Pulsar Process Measurement Limited for technical support.

## COMMENTS AND SUGGESTIONS

If you have any comments or suggestions about this product, then please contact:

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# Contents

## Chapter 1      Start Here...

Congratulations on your purchase of a Pulsar *MicroFlow*. This quality system has been developed over many years and represents the latest in high technology flow monitoring.

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 may find tips to help you.

### Additional Information

**Additional Information**

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

### References

See also text in **Bold** as these may be references to other parts of this or another manual.

### Drawings

It should be noted that drawings or pictures shown in this manual may not be to scale.

# About the *MicroFlow*



The *MicroFlow* is a non-contacting velocity sensor. The sensor provides reliable flow velocity measurements using short pulses of micro-waves, which are transmitted by an enclosed antenna. When reflected off a moving surface, the signal experiences a shift in frequency characteristics. The reflected signal is captured by the on-board microprocessor via the antenna, and analysed to determine the velocity.

The *MicroFlow's* compact and versatile design makes it easy to install and ideal for confined spaces. Housed in a robust enclosure coupled with a fully encapsulated microwave antenna, it provides an effective fit-and-forget flow velocity solution.

PC software is available to allow setup and run diagnostics using *MicroFlow PC* via a RS 485 connection. The *MicroFlow* is compatible for use with Pulsar's**, FlowCERT, Velocity Interface** and **Ultimate** controllers to obtain velocity readings. The *MicroFlow* can also be retrofitted to replace existing in-process contacting sensors.

Overall the device has outstanding stability, accuracy and repeatability.

## Benefits

Combined with the ease of programming there are many other benefits to using the *MicroFlow*, these are listed below:

- Non-contact velocity measurement.
- Retro-fit capability and low-cost installation.
- Hazardous area approval (Ex mb) for Zone 1.
- Monitors flow over natural channels such as streams and rivers.
- 'See through' capability for enclosed plastic pipes and concrete (not reinforced) channels.
- Suitable for abrasive and aggressive materials.
- Resilient to liquid vapour, wind or temperature.
- No minimum liquid level required for measurement
- Virtually maintenance free; not affected by sedimentation, so there is no need for regular cleaning.
- Compatible with Pulsar's **FlowCERT**, **Velocity Interface** and **Ultimate** controllers, with retrofit capability for in-contact sensors.
- Can be installed in addition to existing in process contact measuring devices.
- Easily setup using *MicroFlow PC*.
- The sensor is capable of monitoring flow of very shallow liquid, mitigating the constraint associated with in-liquid techniques.

### Functional Description

Based upon state-of-the-art micro-wave sensing technology, the *MicroFlow* integrates Pulsar's innovative and award winning DSP (Digital Signal Processing) platform, offering you a cost effective solution with excellent reliability and performance.

The Pulsar *MicroFlow* has been designed to provide maintenance free performance.

The *MicroFlow* automatically matches to the protocol and Baud rate of the controller. When it is connected to a controller and powered up, after approx. 20 seconds the sensor will adjust to the Baud rate of the controller it is connected to.

### Limitations of use

1. The MicroFlow must be routinely inspected to avoid the build-up of dust layers when installed in to Zone 21 & Zone 22.

2. Electrostatic hazard – The MicroFlow must only be wiped with a damp or antistatic cloth.

3. Only leaded little fuses (0242 series) of 100mA should be used with the Ex mb approved MicroFlow.

4. The outer enclosure is made from Valox357U, consider the performance of this material with respect to chemicals that may be present in the hazardous area.

5. The equipment should not be used if there are any cracks/damage to any part of the enclosure.

## Product Specification

### *Physical*

| | |
|---|---|
| **Sensor body material** | Valox 357U |
| **Mounting Connection** | Via 1" BSP or NPT back mounted thread, 45° Angled Mounting bracket (optional). |
| **Mounting angle:** | 45° optimum and mounted at the centre line of the channel with clear uninterrupted flow |
| **Sensor body dimensions** | Diameter 90mm x height 140mm |
| **Sensor body weight** | Nominal 0.7 kg |
| **Transducer cable extensions** | 5-core screened |
| **Maximum separation** | Up to 500m |

### *Environmental*

| | |
|---|---|
| **Enclosure protection** | IP68 |
| **Max. & min. temperature (electronics)** | -20 °C to +60 °C (-4°F to +140°F) |

### *Approvals*

| | |
|---|---|
| **CE and Radar Approval** | See EU Certificate of Conformity |
| **ATEX Approval** | CML 16ATEX2331X, IECEx CML 16.105X |
| | II 2 G Ex mb IIC T4 Gb |
| | II 2 D EX mb IIIC T135°C Db Tamb -20°C to +60°C |

### *Performance*

| | |
|---|---|
| **Velocity Range** | 0.2 – 6.0 m/s (0.66 ft/s – 19.7 ft/s) |
| **Accuracy** | Greater of +/- 0.5% or 0.05 m/s (0.1 ft/s) |
| **Optimum installation** | Install at an angle of 45° in line with flow. For more information, see 'Locating the MicroFlow sensor' section of this manual |
| **Maximum channel width per sensor** | 1.5m |
| **Radar** | K-Band (ISM) |
| **Transmitter Power** | <15 dBm |
| **Beam width** | 20° inclusive |

### *Outputs*

| | |
|---|---|
| **Communication** | RS485 and Modbus RTU– integrates with compatible Pulsar controllers. |

### *Programming*

| | |
|---|---|
| **PC programming** | Via RS485 Modbus |
| **Programmed data integrity** | Via non-volatile memory |
| **PC setup and monitoring software** | MicroFlow PC – compatible with XP (service pack3), Win 7, Win 8, Win 10 |

### *Supply*

| | |
|---|---|
| **Operating Voltage** | 10 – 28 V DC |
| **Power Consumption** | 0.36W |

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

**EU Declaration of Conformity**



# EU DECLARATION OF CONFORMITY

## P U L S A R MicroFlow

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

| | |
|---|---|
| Relevant Directive(s) | 2014/30/EU - EMC Directive and its amending directives |
| | 2014/53/EU - R&TTE Directive and its amending directives |
| | 2014/35/EU - Low Voltage Directive and its amending directives |
| | 2014/34/EU – ATEX 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 Non-contacting MicroFlow Loop-powered Microwave Sensor |
| Type of Equipment | Measurement and process control |
| Standards Applied | EN 61010-1  Safety requirements for electrical equipment for measurement, control, and laboratory use |
| | EN 62311:2008  Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz) |
| | EN 300 440-1:V1.6.1, EN 300 440-2:V1.4.1  Electromagnetic compatibility and radio spectrum matters; short range devices; radio equipment to be used in the 1 GHz to 40 GHz frequency range |
| | EN 61326:2013  Equipment class, industrial |
| | EN 60079-18 (Ex mb) |

| Signed | Date: |
|---|---|
| Name: Dr. Andrew Foo | 20th June 2017 |
| Pulsar Process Measurement Ltd | Rev 2.0 |

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## Unpacking

**Important Information**

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

## Power Supply Requirements

The *MicroFlow* can operate from a DC supply of 10 to 28V. In all cases the unit typically consumes 0.36W of power.

## Cable screen and Earth Requirements

A screened 5-core cable should be used (minimum conductor size of 0.5mm²) and connected to a compatible Pulsar controller, if extending the cable (up to 100m).
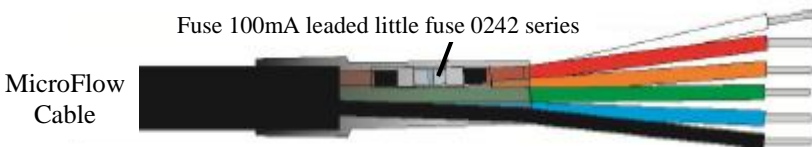
Fuse 100mA leaded little fuse 0242 series

MicroFlow
Cable



| Cable colour | Cable details |
|--------------|---------------|
| Red | (Power) +10-28 VDC |
| Black | 0 volts |
| Orange | RS485+ |
| White | RS485- |
| Blue | RS485 Common |
| Green | Cable screen |

## Location

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

When choosing a location to mount the bracket and *MicroFlow*, note the following:

- For optimum readings, it is recommended that the *MicroFlow* should be positioned at a 45° angle to the surface of the material being measured.
- The mounting surface must be vibration-free.
- The ambient temperature should be between -20ºC and 60ºC.
- Ensure that the Pulsar Controller is installed in a "Safe", non-hazardous, area.

> **Important Information**
> When installing the *MicroFlow* it is recommended that it is mounted at least 1m away from moving persons or machinery.
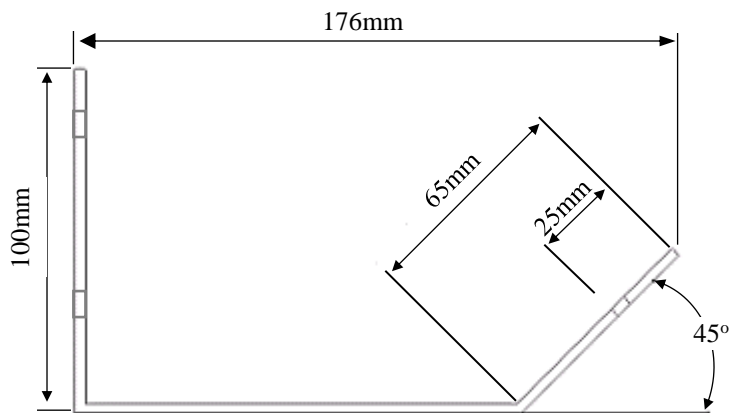
## Mounting

For the best results, it is highly recommended to use the *MicroFlow* angled bracket, which is available from your Pulsar distributor, which will ensure that the *MicroFlow* can be correctly installed. The bracket can be used if the *MicroFlow* sensor is to be mounted on its own in a specific location or along with a Pulsar dB transducer. Please see '**Angled Mounting Bracket**' for dimensions of this bracket, please note that the drawing is not to scale.

'**Mounting sensor to a bracket**' illustrates how you would install the sensor to one of Pulsar's angled brackets.
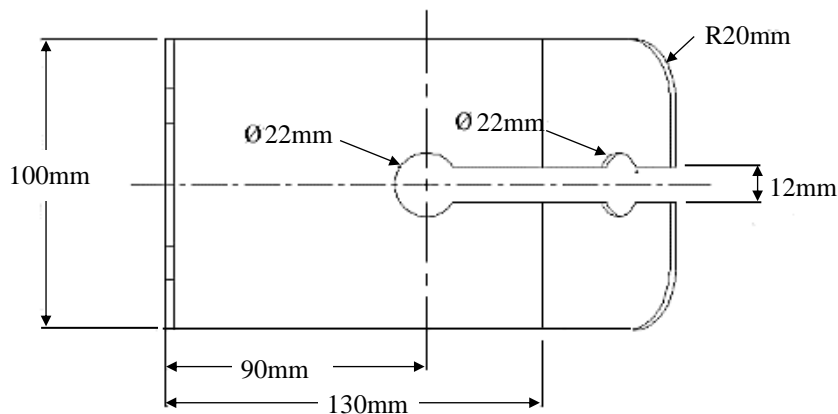
The *MicroFlow* angled bracket should be mounted by marking and drilling the holes suitable for fixing your screws/bolts (length to suit your application) and then fixing the bracket in place.
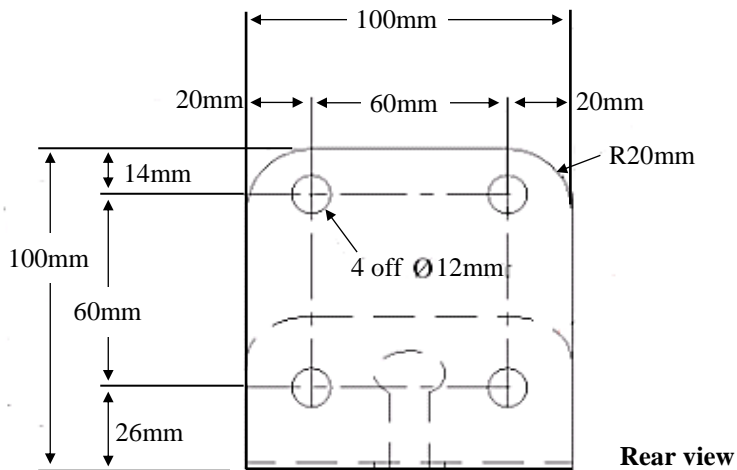
## Angled Mounting Bracket

Part number: dBA0008MF

176mm

100mm

65mm

25mm

45º

**Side view**

R20mm

Ø22mm

Ø22mm

100mm

12mm

90mm

130mm

**Top view**

100mm

20mm ← → | ← 60mm → | ← → 20mm

R20mm

14mm

100mm

60mm

4 off Ø12mm

26mm

**Rear view**

**Important Information**

Using a spirit level, ensure that the Mounting Bracket is level **before** attaching the sensor to the bracket.

## MicroFlow sensor

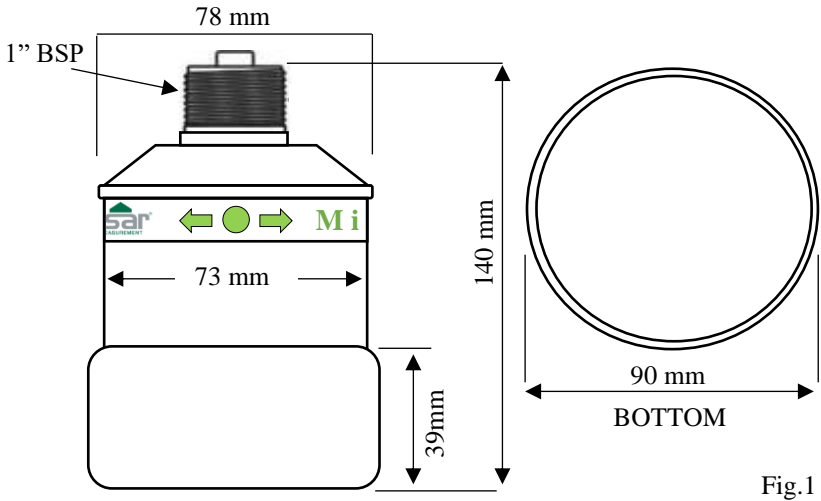The dimensions of the sensor body are shown below in Fig.1 and Fig.2:
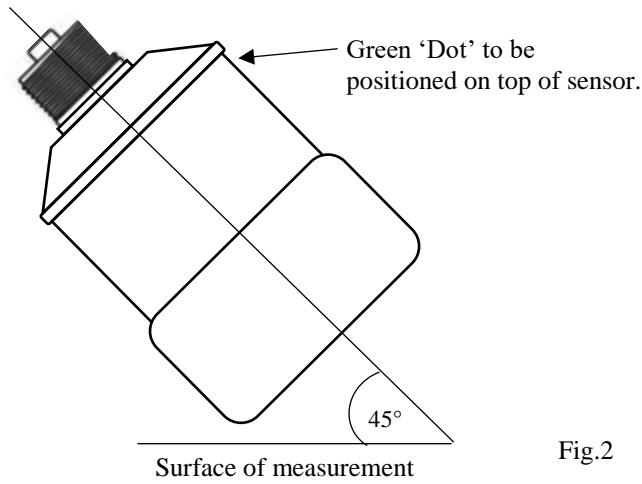


Fig.1



Surface of measurement

Fig.2

To obtain the most accurate results, ensure the device is mounted at a 45° angle to the surface being measured.

## Mounting sensor to a bracket

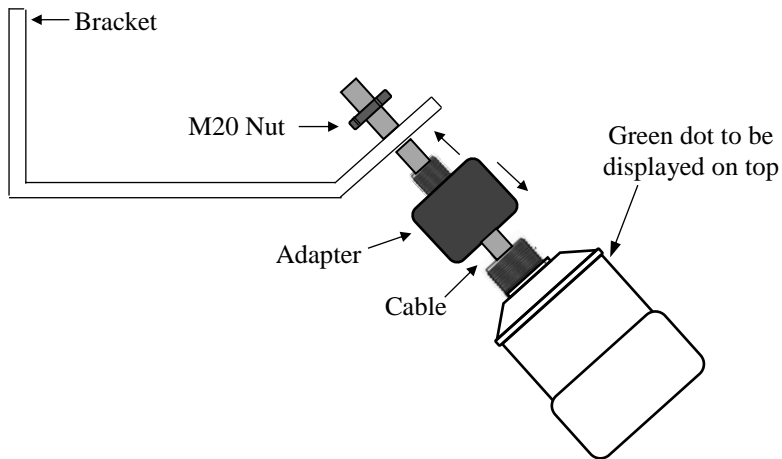Mounting the sensor to the 45° angled bracket is done via an adapter and M20 nut, as shown in Fig.3:



Fig.3

For correct installation, we recommend that the adapter is threaded on the cable, and carefully screwed onto the *MicroFlow* before fitting to the bracket. This will reduce the risk of any 'twisting' in the cable.
Ensure that the sensor is tightened and the dot is in the correct position.

**Important Information**

When fixing the sensor to the adapter, ensure that care is taken when pulling the sensor cable through. And once attached to the adapter, and the M20 nut is tightened, the green dot should be central to the movement of flow as shown in Fig.4.
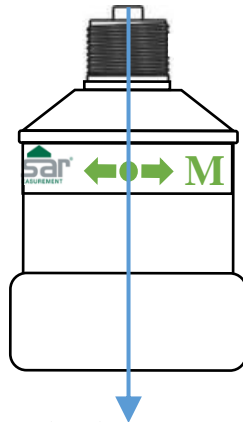
Fig.4

Central to the movement
of flow in channel.

**Care should be taken not to overtighten the sensor when everything is connected, as seen in Fig.5 below, as this could cause damage to the housing.**



305mm

215mm

205mm

Fig.5

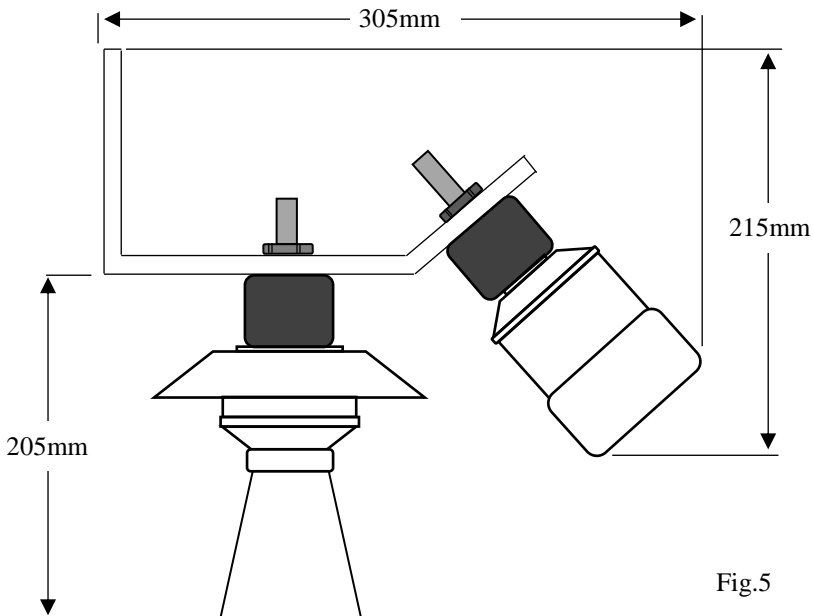When the sensor is mounted on the bracket with dB series level transducer, you are able to position the bracket in a way where the *MicroFlow* is obtaining measurements following the direction of the flow, or facing the direction of flow. Fig.6 and Fig.7 illustrate the correct positioning of the devices according to the direction of flow:
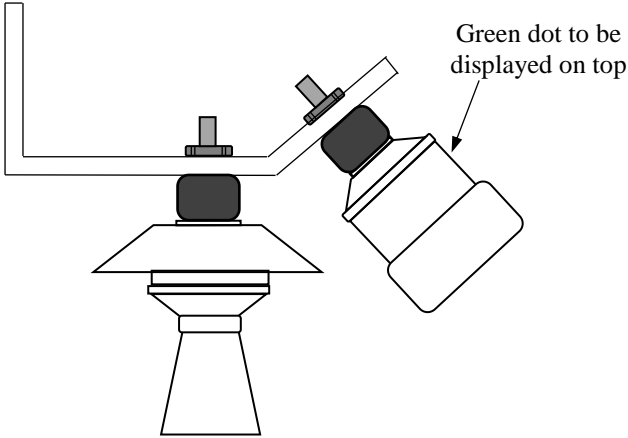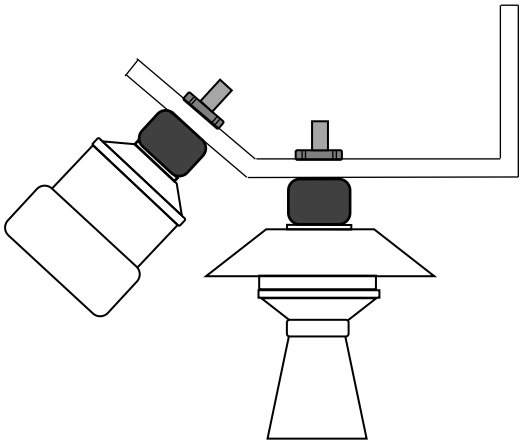
Green dot to be displayed on top

Fig.6

Direction of flow

Fig.7

Direction of flow

## Terminal Connections

### *Power*

The *MicroFlow* operates from a DC voltage supply of 10-28 volts, and should be installed and connected in accordance with '**Chapter 2–Power supply requirements**' and the instructions below. When wiring the *MicroFlow* the cable used is of a multicore design. The wire coding is shown below for ease of use when connecting the *MicroFlow* to a device to monitor flow velocity:
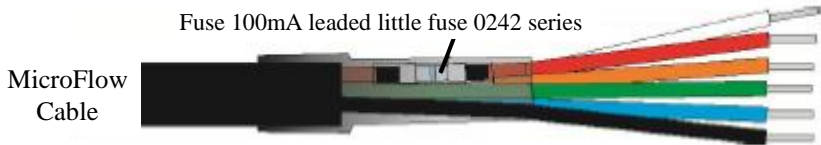


Fuse 100mA leaded little fuse 0242 series

MicroFlow
Cable

| Cable colour | Cable details |
|---|---|
| Red | (Power) +10-28 VDC |
| Black | 0 volts |
| Orange | RS485+ |
| White | RS485- |
| Blue | RS485 Common |
| Green | Cable screen |

The *MicroFlow* can be used with the following Pulsar controllers to obtain flow and velocity readings:

- FlowCERT wall mount unit.

- Velocity Interface wall mount unit.

- Ultimate Controller fascia and wall mount unit with firmware version 1.5.2 and greater.

You can also use Pulsar's *MicroFlow PC* software to interrogate and obtain readings from the device. Please refer to **Chapter 6 MicroFlow PC** Software for more details on how to use it. The RS485 termination is electronically controlled by parameter 57 (P57). Please refer to '**Chapter 7 Parameter Listing and Descriptions** - **RS485 Communications and Modbus**'.

**Important Information**

Power to the controller should be disconnected until the MicroFlow is connected correctly. 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.

## FlowCERT Wall Mount

The terminal strip is as detailed below. There is also a wiring diagram inside the terminal access cover of the FlowCERT unit. For further information on how to operate a FlowCERT unit, please refer to the separate FlowCERT user manual. To set up a *MicroFlow* sensor with the FlowCERT please refer to **Chapter 5 – Setting up your MicroFlow** of this manual. The FlowCERT manual is also available for download from the Pulsar website: https://www.pulsar-pm.com/support/downloads/manuals.aspx.
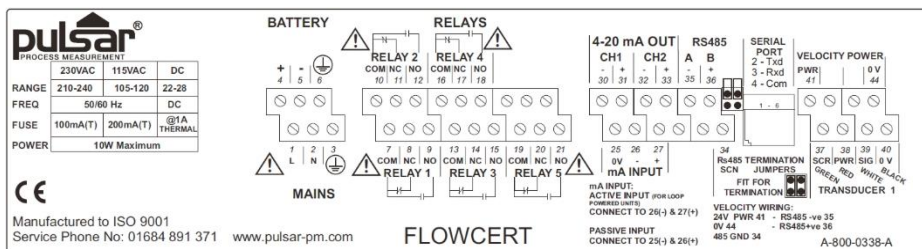


Wire the *MicroFlow* sensor to the FlowCERT terminals as follows:

| Terminal Connection Details | | | | | |
|---|---|---|---|---|---|
| Cable Type | Red Power | Black 0 volts | Orange RS485+ (B) | White RS485- (A) | Blue RS485 Common |
| Terminal no. | 41 | 44 | 36 | 35 | 34 |

The Green cable (cable screen) should be connected to Earth such as terminal 44 (0V).

## Velocity Interface

The Terminal strip is detailed as below. There is also a wiring diagram attached to the board directly underneath the terminal strip. For further information on how to setup a Velocity Interface unit, please refer to the Velocity Interface user manual. To set up a *MicroFlow* sensor with the Velocity Interface please refer to **Chapter 5 – Setting up your MicroFlow** of this manual. The Velocity Interface manual is also available for download from the Pulsar website: https://www.pulsar-pm.com/support/downloads/manuals.aspx.
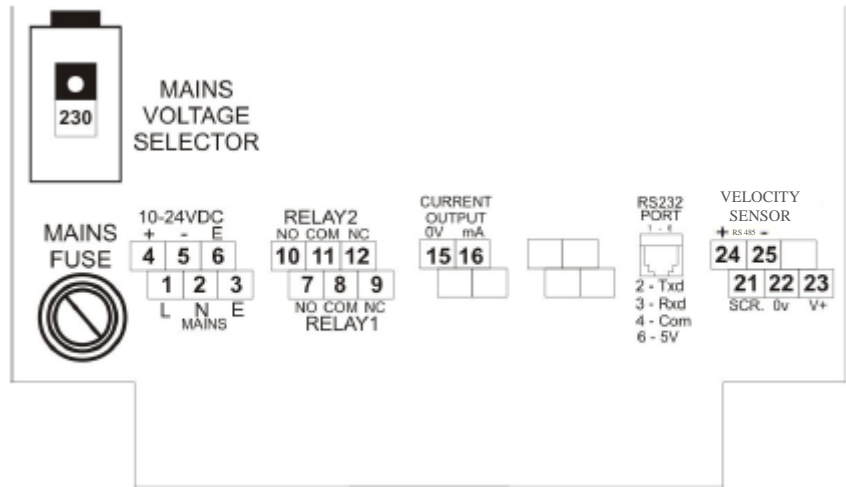


Wire the *MicroFlow* sensor to the Velocity Interface terminals as follows:

| Terminal Connection Details | | | | | |
|---|---|---|---|---|---|
| Cable Type | Red Power | Black 0 volts | Orange RS485+ (B) | White RS485- (A) | Blue RS485 Common |
| Terminal no. | 23 | 22 | 24 | 25 | 21 |

The Green cable (cable screen) should be connected to Earth such as terminal 22 (0V).

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**Important Information**

If you require help in connecting the *MicroFlow* to any of the Pulsar controllers mentioned in this manual, then please contact your local Pulsar Distributor for assistance.

## Ultimate Controller (Fascia)

The Terminal strip is detailed as below. For further information on how to setup an Ultimate Controller unit, please refer to the Ultimate Controller user manual. To set up a *MicroFlow* sensor with the Ultimate Controller please refer to **Chapter 5 – Setting up your MicroFlow** of this manual. The Ultimate Controller manual is also available for download from the Pulsar website: https://www.pulsar-pm.com/support/downloads/manuals.aspx.

Wire the *MicroFlow* sensor to the Ultimate Fascia terminals as follows:

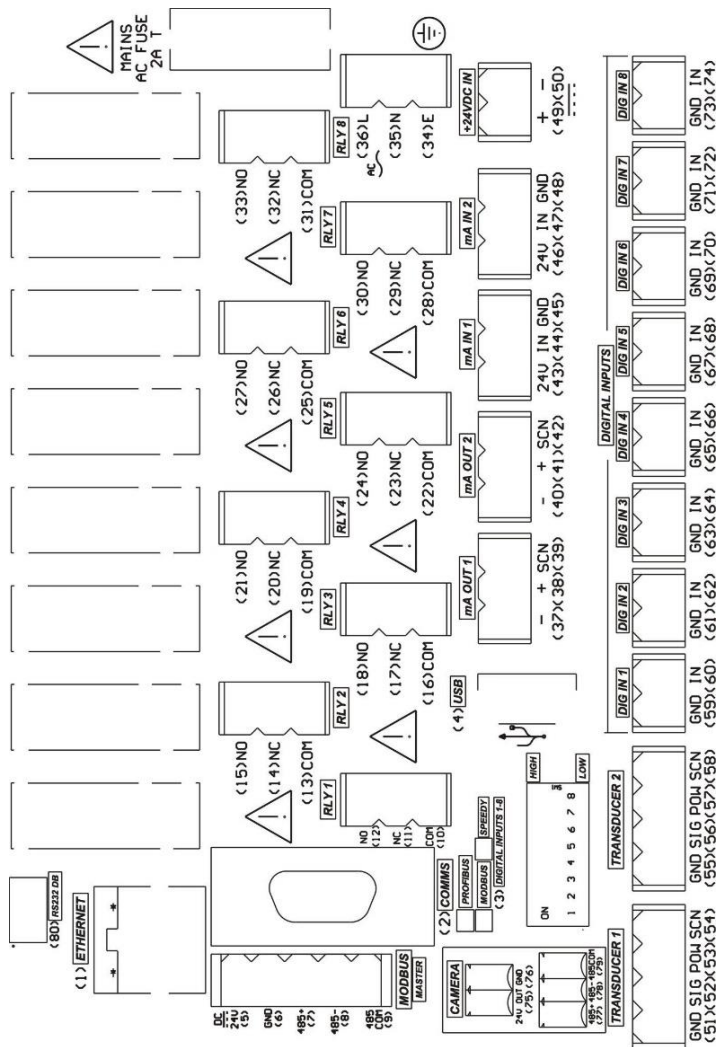| Terminal Connection Details | | | | | |
|---|---|---|---|---|---|
| Cable Type | Red Power DC 24V | Black 0 volts GND | Orange RS485+ (B) | White RS485- (A) | Blue RS485 Common |
| Terminal no. | 5 | 6 | 7 | 8 | 9 |

The Green cable (cable screen) should be connected to Earth such as terminal 6 (0V).

**Important Information**

If you require help in connecting the *MicroFlow* to any of the Pulsar controllers mentioned in this manual, then please contact your local Pulsar Distributor for assistance.

## Ultimate Controller (Wall Mount)

The Terminal strip is detailed as below. For further information on how to setup an Ultimate Controller unit, please refer to the Ultimate Controller user manual. To set up a *MicroFlow* sensor with the Ultimate Controller please refer to **Chapter 5 – Setting up your MicroFlow** of this manual. The Ultimate Controller manual is also available for download from the Pulsar website: https://www.pulsar-pm.com/support/downloads/manuals.aspx.

Wire the *MicroFlow* sensor to the Ultimate Wall Mount terminals as follows:

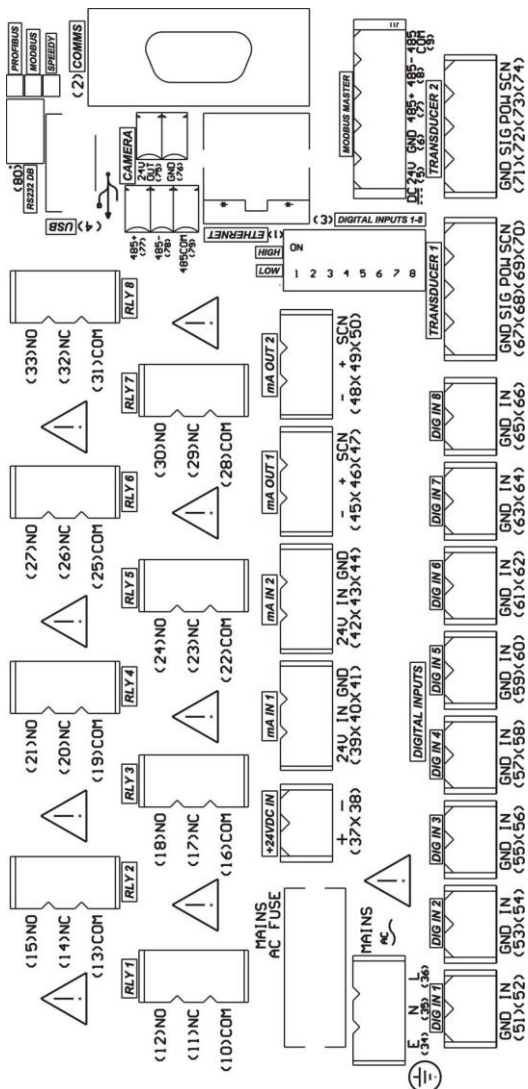| Terminal Connection Details | | | | | |
|---|---|---|---|---|---|
| Cable Type | Red Power DC 24V | Black 0 volts GND | Orange RS485+ (B) | White RS485- (A) | Blue RS485 Common |
| Terminal no. | 5 | 6 | 7 | 8 | 9 |

The Green cable (cable screen) should be connected to Earth such as terminal 6 (0V).

**Important Information**

If you require help in connecting the *MicroFlow* to any of the Pulsar controllers mentioned in this manual, then please contact your local Pulsar Distributor for assistance.

For optimum accuracy install the *MicroFlow* where the flow is not turbulent.  An ideal location for the sensor is in the centre of a long straight channel.  Vertical drops, baffles, curves or junctions can cause the velocity profile to be distorted.

### Locating the MicroFlow

- If the width of the channel exceeds 1.5m.  Multiple *MicroFlow* sensors are required to be used in conjunction with the Ultimate Controller with firmware version 1.5.2 and later.

- When a level measurement transducer is used and mounted on the same bracket as the *MicroFlow*.  Take into account, the 'blanking' distance of the transducer when mounting the bracket for the application.

- Ensure that there is an unobstructed path between the sensor and the surface of the moving liquid being measured.

- Position the sensor at a height of 250mm above maximum liquid level or up to two times the channel width from the minimum liquid level, whichever is greater.  As shown in Fig.8 below:
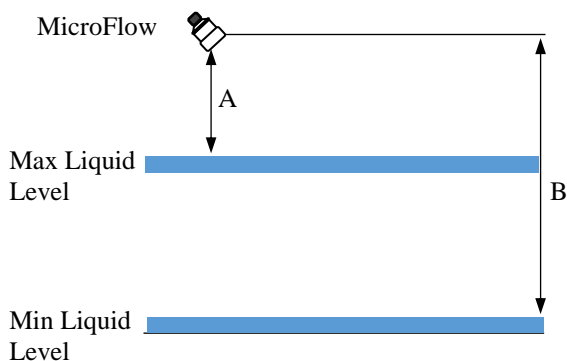


Fig.8

- A = Minimum 250mm above Maximum Liquid level.
- B = Maximum 3m above Minimum Liquid Level.

**Important Information**

If the maximum water height exceeds 2x width of the channel

OR

If the maximum water height in channel is less than 50% of the width of the channel.  Please consult Pulsar product support for assistance.

## Hazardous Area Installation

Not all MicroFlow models are ATEX certified, check label for approval details. The 'X' in the certifications number indicates that certain special conditions apply.

This version must be supplied from apparatus that provides protection from prospective short circuits up to 1500A. The fuse is fitted in the safe area end of the cable.

### Important Information

Below is an example of the wrap around label that is found on an ATEX approved MicroFlow. If this information does not appear on the label of your MicroFlow sensor it is not ATEX approved for hazardous area.

Electrostatic Hazard - clean only with a damp cloth | $T_{amb}$ = -20°C to +60 °C

**CML 16ATEX5332X     IECEx CML 16.0106X**
PROSPECTIVE SHORT
CIRCUIT CURRENT 1500A
**II 2 G Ex mb IIC T4 Gb**
**II 2 D Ex mb IIIC T135°C Db        Um=28V**



# Ex mb Version RS485

**SAFE AREA**

FlowCERT, Velocity Interface, Ultimate, PC or Modbus master

**HAZARDOUS AREA**

PC

RS485

PSU

+

V
24VDC

-
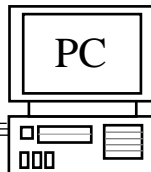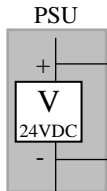
100Ma FUSE BREAKING CAPACITY 1500a PRE-FITTED IN CABLE

Um=28V
PROSPECTIVE SHORT CIRCUIT CURRENT 1500A

# Ex mb Version

**In the instance where there are vertical drops, baffles, curves or junctions. The sensor should then be positioned on a straight part of the channel, at a minimum distance that is at least five times the width of the channel before a bend, in order to obtain optimal velocity readings.** Examples of positioning the sensor are shown in diagrams 1 - 4 below:



Diagram 1

Distance

Distance



Distance

Distance

Diagram 2

Diagram 3



Diagram 4
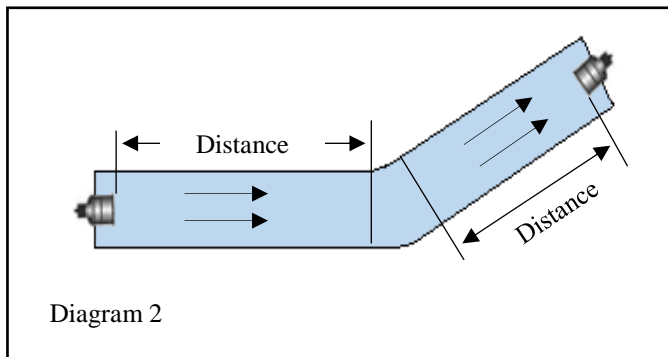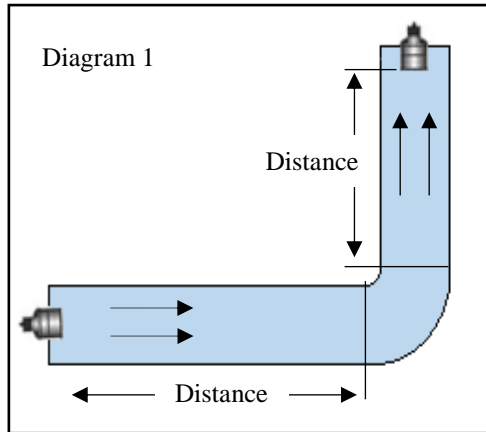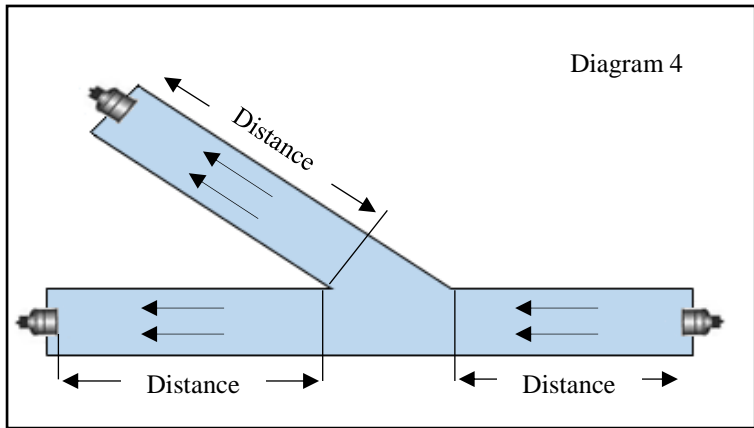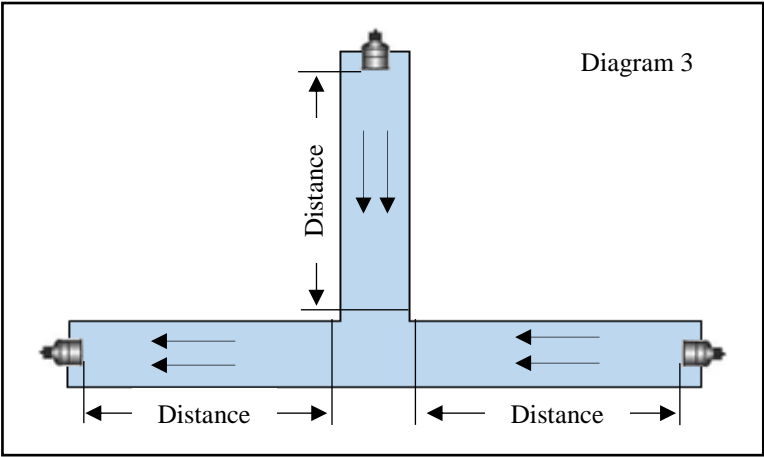
## Installing the Sensor

- The Sensor housing is designed to accept a 1 inch BSP female threaded coupler for pipe or conduit.

- Ensure that the sensor is positioned at a 45° angle to the surface of the measured application, as this will achieve the best results. An example of this is shown in the diagram below:
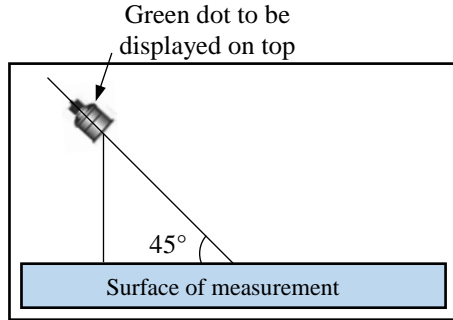


- When using one of the Pulsar Angled Mounting Brackets, secure the bracket using the correct size screws/bolts/U-bolts (12mm diameter thread).

- Tighten the sensor into the bend, and then screw the thread adapter onto the bracket using the nut supplied. **CAUTION: extreme over-tightening may crack or cause damage to the unit or bracket.**

- Position the sensor so the green 'dot' that is shown on the label between the two green arrows is on the top of the device, and is central to the movement of flow in the channel.

- If desired, the sensor cable may be extended up to a maximum of 100m. Install the sensor cables in grounded metal conduit. Do not run in cable trays or duct banks with variable frequency drives or other high voltage sources.

- When connecting multiple *MicroFlow* sensors for use with the Ultimate controller. Ensure that all wiring in any junction /connector box is correct.

- The sensor can be positioned to obtain readings following the direction of the flow. Or it can be positioned to measure the oncoming flow as seen below:
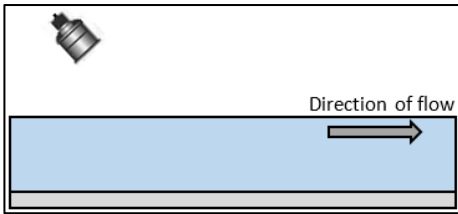


*MicroFlow* obtaining readings following the direction of the flow.
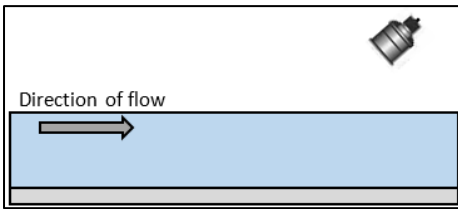


*MicroFlow* obtaining readings from the oncoming direction of the flow.

## Preparation for Operation

Before switching on, ensure that the following is checked:

- ✓ *MicroFlow* is mounted correctly and is secure.

- ✓ All wiring is correct to a Pulsar controller.

- ✓ The power supply is correctly installed.

## General Maintenance

There are no user serviceable parts inside *MicroFlow*. 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.

# Sensor Maintenance.

## *Procedure for the Removal of a MicroFlow Sensor*

From time to time it may be necessary to remove the transducer for cleaning or maintenance purposes, the below procedure is to ensure that this is done carefully with regard for the health and safety of the operator involved, and without damage to the sensor.

> **Important Information**
>
> Before attempting to remove the sensor for cleaning or any other purpose, the power to the unit should be disconnected.

If it is necessary to replace the sensor for any reason, the following procedure should be followed:

- Disconnect the transducer wiring from the controller or any junction box as shown in the **Terminal Connections** section of this manual, and remove the sensor cable from the controller/enclosure.

- Remove any bolts or fittings that the sensor may be attached to, allowing the cable to be pulled through with ease.

- If using a Pulsar angled bracket, the sensor head is mounted onto the end of the bend via its process fitting, this should be carefully unscrewed in an anticlockwise direction. Ensure that the sensor is not dropped or knocked as this can cause damage to the unit.

- When replacing the sensor, care must be taken not to over tighten the unit as this can cause damage. Hand tight is sufficient.

- Ensure that the green dot has been positioned in the direction of the flow of the vessel, this will obtain optimum velocity readings that are available. Please refer to '**Fig.3**' in '**Chapter 2-Installing the sensor**' section on how to do this.

- When the sensor has been replaced for the application, and re-connected to a controller and the power re-applied, the unit will re-initialise and will begin the process of acquiring flow and velocity readings.

- When refitting or replacing a sensor, ensure that it is installed in accordance with '**Chapter 2-Mounting a sensor to a bracket**'.

- When replacing the sensor for a new one, upon connecting the sensor to the Pulsar controller and powering the devices up, the new sensor will automatically adopt the Baud rate of the controller using the *MicroFlow* protocol. Allowing you to continue use without the need to change any parameters.

The correct PPE should be worn on site when performing maintenance on the system, if in doubt please contact your site Health and Safety Officer for further advice.

> **Important Information**
>
> Care should be taken when removing and cleaning so as to not damage the device.

To remove the sensor, first loosen any glands, couplers etc. that may connect it to the Mounting Bracket, and then lift the sensor body onto a safe place. Taking care not to damage the sensor housing or cable whilst performing this removal.

The sensor can then be safely inspected for damage or material fouling and can be carefully cleaned with a damp cloth to remove any foreign debris.

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## Chapter 4    Understanding how the MicroFlow operates

In order to set up and obtain readings from your application using the *MicroFlow*, it is advised to do this using a Pulsar controller.

### Measuring streamflow / open channel flow.

The calculation of flow using Area x Velocity is only possible when the *MicroFlow* sensor is used as part of an integrated system with either FlowCERT or Ultimate Controllers.

The calculation for the determination of discharge/flow in open channels consists of different factors:

- Velocity of the liquid in the channel.
- Depth of the liquid in the channel.
- Cross sectional channel dimensions.

The flow is then calculated using the formula $Q = V \times A(h)$

Where:     $Q$     = Flow rate
           $V$     = Velocity
           $A(h)$ = Area at head

Once the controller and the *MicroFlow* have been powered up, you can now begin to program the controller to work effectively with the *MicroFlow* device.

On the Velocity Interface and the FlowCERT, the display provides different levels of runtime information and a simple, progressive menu system in program mode.

On the Ultimate Controller you are able to allocate up to 2 AUX displays to show different levels of run time information

## MicroFlow Protocol

The *MicroFlow* uses a unique protocol which enables it to automatically work with the Baud rate of any appropriate Pulsar controller that it is connected to.

To enable the *MicroFlow* protocol to work successfully ensure that the controller's power is disconnected when connecting the sensor to it.

Once the sensor is connected to the controller and power is restored to the device, after a short period of time, the *MicroFlow* will automatically detect and adjust its protocol and Baud rate to match that of the appropriate Pulsar controller.

This chapter explains the quickest way in which to get your *MicroFlow* sensor working with the Pulsar controllers that the sensor operates with.

## FlowCERT setup

1. Install and connect your FlowCERT controller as outlined in the FlowCERT user manual.

2. Install and connect your *MicroFlow* sensor to the FlowCERT as described in **Chapter 2 - Installation - FlowCERT** of this manual.

3. Power up the unit and enter program mode by keying in '**1997**' and pressing Enter to set-up an application for 'area velocity'. This can be done by choosing option 4 in Quick set-up or directly changing **P700 to 4** = '**Area velocity**'.

4. Continuing with the Quick setup, you now need to select the Primary Measuring Device (PMD) for your application from the options displayed on screen.

5. Once you have selected your application you will then be asked a series of questions, which are answered by selecting the appropriate option you require. For further information on the Quick set-up of a FlowCERT please refer to **Chapter 6 Quick Set-up Guide** in the FlowCERT user manual.

6. Once you have selected area velocity, set **P130** '**Device Mode**' to **2** = '**Speedy**' ('**Velocity**' in Ultra firmware versions 7.4.4 and onwards) to enable the velocity parameters.

7. To change the maximum flow velocity of your application you will need to set **P683** '**Maximum flow velocity**' to the desired value (in m/s)

8. All other velocity parameters can be left at their default values or can be adjusted to suit the application, i.e. 'P688 Gain' and 'P684 Damping' can be altered to the value range outlined in **Chapter 7 – Parameter Listing and Descriptions** of this manual.

9. When a level transducer is also connected, to view the instantaneous flow velocity measurement on the auxiliary display of the FlowCERT, **P815** '**Auxiliary Source**' should be set to **1** = **Velocity**. The auxiliary display will then alternate between displaying the flow units and the current flow velocity. Please note that the instantaneous flow velocity cannot be displayed in the auxiliary display when the re-settable totaliser is selected.

10. If no further changes are required, return to run mode and after a short time the flow readings from the *MicroFlow* will be displayed on the FlowCERT screen.

## Velocity Interface setup

1. Install and connect your Velocity Interface controller as outlined in the Velocity Interface user manual.

2. Install and connect your *MicroFlow* sensor to the Velocity Interface as shown in **Chapter 2 - Installation – Velocity Interface** of this manual.

3. Power up the unit and enter program mode by keying in '**1997**' and pressing Enter to begin setting up the unit for measurement.

4. If you wish to change or view the velocity measurement units, set **P130** '**Measurement units**' to the selection of your choice from the options given in the parameter list shown on the screen.

5. To change the maximum flow velocity of your application you will need to set **P683** '**Maximum flow velocity**' to the desired value (in m/s).

6. To change the velocity at which the high mA output (20mA) will occur, you will need to set **P835** '**Output High Level**' to the value you require in measurement units (**P104**).

7. All other parameters can be left at their default values, or adjusted to suit the application, i.e. 'P688 Gain' and 'P684 Damping' can be altered to the value range outlined in **Chapter 7 – Parameter Listing and Descriptions** of this manual. For further information on the full parameter listing of a Velocity Interface, please refer to **Chapter 5 - Parameter Guide** in the Velocity Interface user manual.

8. If no further changes are required, return to run mode and after a short period of time, velocity and mA readings from the *MicroFlow* will appear on the Velocity Interface's screen.

## Ultimate Controller Fascia and Wall Mount setup

1.  Install and connect your Ultimate Controller as outlined in the Ultimate Controller user manual.

2.  Prior to installing and connecting your *MicroFlow* sensor to the Ultimate, you will need to set the sensors unique Modbus address by using *MicroFlow PC*. This is done by changing the Modbus ID value, which can be done by the Modbus ID box in the software, or using the manual parameter box and change P52 to between 2 & 125 (Ensure multiple sensors have different addresses). For further details on changing parameters and using *MicroFlow PC*, please refer to **Chapter 6 - MicroFlow PC** where details of how to use the software is explained.

3.  Once a Modbus address is set, install and connect your *MicroFlow* sensor to the Ultimate Controller as shown in **Chapter 2 – Installation – Ultimate Controller (Fascia** & **Wall Mount)** of this manual.

4.  Power up the unit and enter program mode by pressing 'Menu' and keying in '**1997**' and pressing Enter to begin setting up the unit for measurement.

5.  Select **Advanced Config.** > **Live List**, where the controller will now search for the Modbus ID of the *MicroFlow* unit(s) that have been connected.

6.  In **Advanced Config.** > **Modules**, Select the amount of *MicroFlow* sensors and press the '<' button so that they appear in the '**Added**' column. Now select each MFL (*MicroFlow*) and select '**Edit**' to change the Modbus ID to what has already been set and discovered in the **Live List**. The controller will now reboot.

7.  Re-enter program mode by pressing 'Menu' and keying in '**1997**'.

8.  Select '**Setup** > **Application** > **Operation**' and press the '+' button to add a point of measurement, which you can rename to something of your choice.

9.  Select '**Velocity**' where you will now be able to select the *MicroFlow* as a velocity measurement point.

10. Select '**Single**' when only using one sensor to obtain velocity measurements.

11. If more than one sensor is to be setup for different channels, then repeat '**step 8** and **9'** in these instructions. If multiple sensors are to be used on one channel, please select the appropriate sensors from the list on screen. You can now select '**Avg, Diff, or Sum**' as a mode of operation.

12. If no further changes are needed, you can exit the screen and save your changes.

13. Return to the '**Main menu**' and select '**Sensors** > **MicroFlow**' and enter the maximum velocity in m/s, and adjust any other settings that are required.

14. Touching the *MicroFlow* picture will allow you to access the sensors trace screen. Here you can see the velocity (m/s), signal strength and confidence of the current reading obtained.

15. Return to the '**Main menu**' and select '**OCM**'.

16. In '**PMD Type**' select Area Velocity.

17. Below you will need to select from the options available, in **Primary PMD** choose the type of measuring device from the list available.

18. In '**Allocation**', select the point of level measurement that your transducer has been assigned to.

19. On the image of the channel/measuring device, insert the dimensions as required in measurement units.

20. Select the drop down box '**Vel.Input**' and select the point of measurement that your *MicroFlow* has been assigned to.

21. If all other measurements have been applied, then a value will now appear in '**Max.Flow**'.

22. If no other changes are required, then exit the OCM setup and Save changes made.

23. To view the velocity obtained from the *MicroFlow(s)* on the main display in run mode, please continue to follow these instructions. If you do not require to view this information, and you have finished setting up your Ultimate then return to run mode.

24. To view the velocity and flow information obtained from your OCM application in run mode, from the '**Main menu**' select '**Display** > **Source**'. From the options available and select '**OCM Flow**'.

25. If no further programming is required exit the screen and save the changes made. Returning to run mode you will now see an image of your PMD and a *MicroFlow* symbol appear on the main display.

26. Once velocity and flow is obtained this information will appear on the screen. Flow will appear in **measurement units** and will appear as the main value, and velocity values will appear in the green boxes under the MicroFlow symbol and above your PMD.

27. To view the information from your velocity measurement point in an auxiliary display, select '**Display – Aux**', and in '**Source**' from the selection available, choose the point of measurement that the *MicroFlow(s)* are assigned to.

28. Exit the screen and save changes made, and return to run mode if no further programming is required.

**29.** Once velocity is detected then this information can be viewed in the auxiliary display.

**Important Information**

For further information on how to set up the individual controllers, please refer to that controller's instruction manual. All of Pulsar's product manuals are available from the Pulsar website:

https://www.pulsar-pm.com/support/downloads/manuals.aspx.

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The software that accompanies the *MicroFlow* can be used to setup, test, obtain and record readings from a sensor. To utilise the features of the software, a RS485 connector which is available from Pulsar (as shown in Fig.9 below), is required to communicate between the sensor and your machine.



Fig.9

If a Pulsar controller is installed, common setup parameters can be programmed directly from the controller, such as 'Gain' and 'Damping'. This chapter outlines how to install the software onto your machine and how to use it with your *MicroFlow* sensor.

### Software installation

Insert the CD that accompanies the *MicroFlow* sensor into your PC/Laptop. If you do not have a CD drive on your laptop, then this software can be downloaded from the Pulsar Process Measurement website: [www.pulsar-pm.com/support/downloads/software.aspx](http://www.pulsar-pm.com/support/downloads/software.aspx) and choose to download *MicroFlow PC* from the list which will then be downloaded onto your machine.

When setting up the RS485 connector for the first use, you will need to install the necessary drivers for it to operate correctly with your OS. These drivers can be installed from your installation disc. Run the *MicroFlow PC* Setup.exe from the CD, or from the downloaded file from our website to install the *MicroFlow PC* software correctly, which will automatically install the necessary drivers for your RS485 connector. Once downloaded, a shortcut icon will be created onto your Desktop for ease of use. Double click on this icon to launch the program.

For optimum installation insert your RS485 connector to your PC whilst installing the drivers, where your PC should assign it to a Com Port. Or if you have an internet connection, upon inserting the USB of the RS485 connector for the first time, Windows updates should install this onto your computer for you. Once the driver's installation has completed, remove the RS485 connector from your machine. Your RS485 connector is ready to be used when a connection to *MicroFlow PC* is required.

## Using MicroFlow PC

When connecting to the software using the RS485 connector, power to the sensor can be obtained from the compatible Pulsar controller it is connected to.

**Important Information**

Ensure that power to the controller/sensor is switched 'OFF' before removing cables and any connection is made.

With the two *MicroFlow* RS485 cables removed, connect the **Red** wire with the **Red** crocodile clip on the connector, to the **Orange** (RS485+) wire of the *MicroFlow*. And connect the **Blue** wire with the **Black** crocodile clip on the connector to the **White** (RS485-) wire of the *MicroFlow*, as shown below:

MicroFlow RS485+      RS485 Connector (+)

MicroFlow RS485-      RS485 Connector (-)
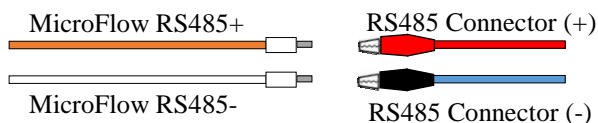
Once the sensor is connected to the RS485 connector, insert it into the PC/laptop ready for use, and ensure that your sensor is switched 'ON' to enable the software to communicate with the sensor.

If you know the Com port that the RS485 connector is assigned to, please select **Setup** > **Serial Port** to enter the Com port number to the device. If you are not aware of the Com port number, selecting 'Connect to device' will allow the software to automatically search and connect to the RS485 connector Com port.

After launching the program and connecting to the *MicroFlow*, the device's parameters will be automatically extracted once a connection is established.

Once connected you can now view the information received from the sensor on the Software's individual tabs: **Flow**, **Flow Record**, **Trace** and **Parameters**.

## Flow Tab
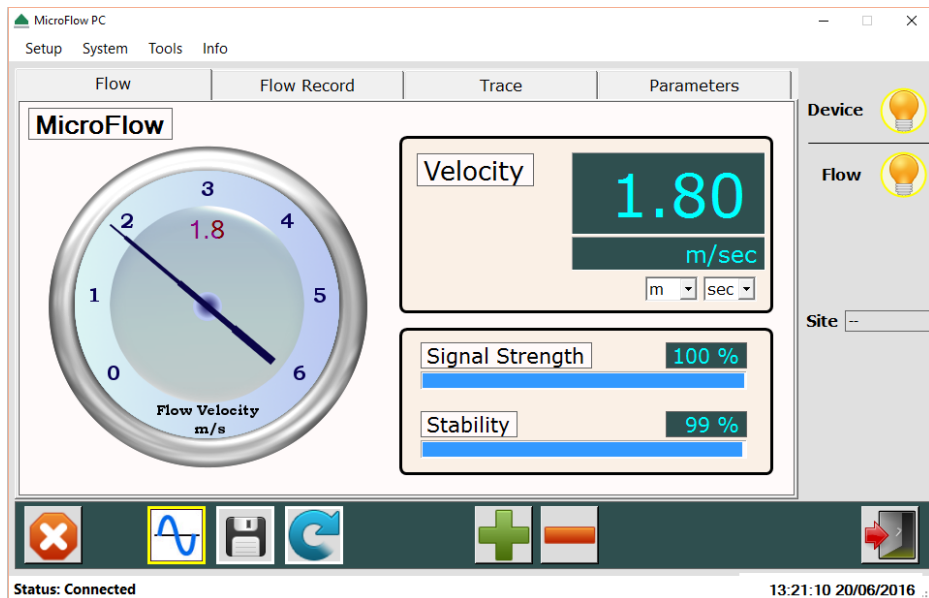


The above picture is the default screen of *MicroFlow PC*, which is the Flow tab. The dial on the left displays the linear flow velocity (up to 6m/s), which is in metres per second. While the numerical display on the right shows the velocity flow rate in different volume and time units. The values displayed here also appear on the PC software's other tabs to help diagnose the information seen on the individual tabs.

Below this display there are two drop down boxes where you can adjust the values to read different measurement units and/or time units. Measurement units can be changed to either metres, millimetres or feet. The time units can be changed to seconds, minutes or hours. The default for distance and time units is **m/s**.

### Signal Strength

The signal strength gives an indication of the actual strength of the velocity signal detected. A level of higher than 70% is desired for reliable operation.

### Stability

The stability level is an indication of the consistency of flow reading, as derived from the combination of signal strength and statistical fluctuations of the flow reading. A high level of stability would indicate optimum condition, and relatively healthy flow within the channel and indicate higher levels of repeatability and better flow tracking. The stability does not necessarily indicate the accuracy of the flow reading, as this is subject to calibration.

| | |
|---|---|
| ✔ | **Connect:**  Click to connect to the *MicroFlow* device.<br>• If known set the serial port (Setup > Serial Port) for your RS485 connector.  Otherwise the software will search for and connect to it automatically.<br>• The MicroFlow is interfaced using Modbus via the RS485 terminals.  The default Modbus Slave ID is 126. |
| ✖ | **Disconnect:**  This appears after a connection is established.  Click this icon to disconnect from the MicroFlow. |
| ∿ | **Diagnostic Trace:** Requests for a diagnostic trace to be taken.<br>• When activated, this icon border will light up yellow and 'live' traces can be observed on the 'Trace' tab.<br>Click again to deactivate. |
| 💾🟨 | **Save Data to File:**  Click to record data from the *MicroFlow* device.<br>When activated, this icon will light up yellow, clicking again will deactivate the feature.<br>• In order to record diagnostic traces along with the flow data, please ensure that the trace icon is active and live traces are shown on the trace tab and a site ID has been entered.<br>• The recording interval is set via the *Setup>Recording Interval* menu.  The default is one record in every 2 seconds.<br>• Files are automatically named with "MicroFlow…" prefix followed by the current date & time stamp.  Example: MicroFlow-20-01-2015-08-30-00.MLG.<br>• If recording over a long duration, a new file will be automatically generated after 30 minutes.<br>• The recorded data files are stored in the MicroFlow PC installation folder by default.<br>• When recording is active, click on the icon again to stop. |

| | |
|---|---|
| | **Replay Recorded Data:** Click to replay recorded data. This can be performed without a connection to a *MicroFlow* sensor. <br> • The program will disconnect from a sensor during replay. <br> • A prompt will appear for choosing the data files to play. <br> • Select the data files to replay, ensure that on MicroFlow PC recorded data files are selected. <br> • To replay more than one file, select multiple files by holding down the 'CTRL' key on the keyboard while clicking additional files. <br> • Recorded traces are shown in the Trace tab and the recorded flow is shown in the Flow tab. <br> • During replay, click on the icon again to stop. |
| | **Increase Replay Speed:** During replay mode, clicking this icon will increase the replay speed. A prompt will appear when the maximum replay speed has been reached. |
| | **Decrease Replay Speed:** During replay mode, clicking this icon will decrease the replay speed. A prompt will appear when the minimum replay speed has been reached. |
| | **Exit:** Click on this icon to exit the program. |

## Setup Menu

This menu option enables you to perform the following actions:

### Clear Flow Record

This option allows you to clear the Flow Record chart that has been obtained from the sensor since its connection.

### Recording Interval

This controls the time interval before a new flow record and trace is saved to file when the save-to-feature is in use.

### Serial Port

This allows you to setup the RS485 port. The default setting when interfacing with the software is 19200 Baud rate, 8 bits, No Parity, 1 Stop bit. There is normally no requirement to change the default parameters, as the COM port number is automatically detected.

### Work Folder

Allows you to select the default folder for where the data files are to be saved to.

## System menu

This menu provides the options to perform the following actions:

### Save Device Parameters

Extract parameters configured on the sensor and save them to PC as a parameter file. This will be saved to MicroFlowPC installation folder, and prefixed with 'ParamMicroFlow'.

### Load Parameters to Device

Load the parameters from a saved parameter file onto the MicroFlow sensor. This should only be used with a file prefixed with 'ParamMicroFlow'.

### *Bootloader Control

This launches the Bootloader PC program, allowing you to upgrade the firmware on the MicroFlow sensor. Any customised parameters will be erased during a firmware upgrade, it is recommended to save parameters before performing an upgrade.

### *Switch Device into Bootloader

Resets the MicroFlow into Bootloader mode. The Bootloader PC program must be used to connect to the sensor in this mode. The MicroFlow will resume normal operation if no connection is established after approximately 30 seconds.

### Parameter Factory Reset

This resets all of the *MicroFlow* sensor's parameters to their factory default values.

> **Important Information**
>
> *These options are only available via service code access. If you require help in connecting the *MicroFlow* then please contact your local Pulsar Distributor for assistance.

## Tools menu

This menu option allows you to choose the following options:

### Export data to CSV

This allows you to export a saved data file (.MLG only) into CSV format. And once opened in Excel, the information recorded in this file can be viewed and each section is labelled at the top of the row: **Date**, **Time**, **Flow velocity (m/s)**, **Signal Strength** and **Stability**. This information from the MicroFlow could then be placed into a chart/graph format.

### Chart Data file

This opens up the directory folder on your computer where *MicroFlow* data is currently stored.

## Info menu

Selecting this will allow you to view the following information:

### MicroFlow PC

This displays information showing the version of software currently being used.

### MicroFlow Device

When connected to a *MicroFlow* sensor the information regarding the firmware, hardware and the serial number of the device currently connected are displayed here.

### Data Folder Path

This shows where all data files are currently stored when saved to your machine.

## Flow Record Tab

The flow record provides a record of the flow over time. Each point on the graph represents a 1.2 second interval. However when the trace button has been pressed and a trace is being retrieved from the sensor, this slows down and a point on the graph now represents a 2 second interval.
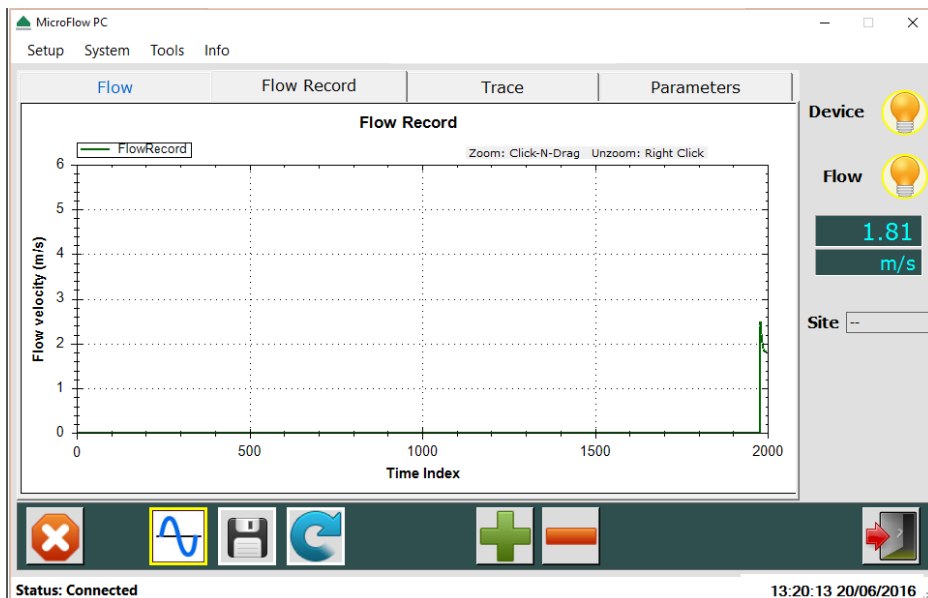


You can zoom in by clicking and holding the mouse to draw a box over the region to zoom in on. Zooming out can be done by right clicking on the chart and selecting "Undo All Zoom".

To clear the Flow Record chart, select Setup > Clear Flow Record Chart, while the chart is inactive.

### Important Information

When the save data to file function is being used, flow information and traces will be written to file, at the fixed interval selected via 'Setup > Recording Interval'. See '**Recording Interval**' in the '**Using MicroFlow PC**' section of this manual.

## Trace Tab
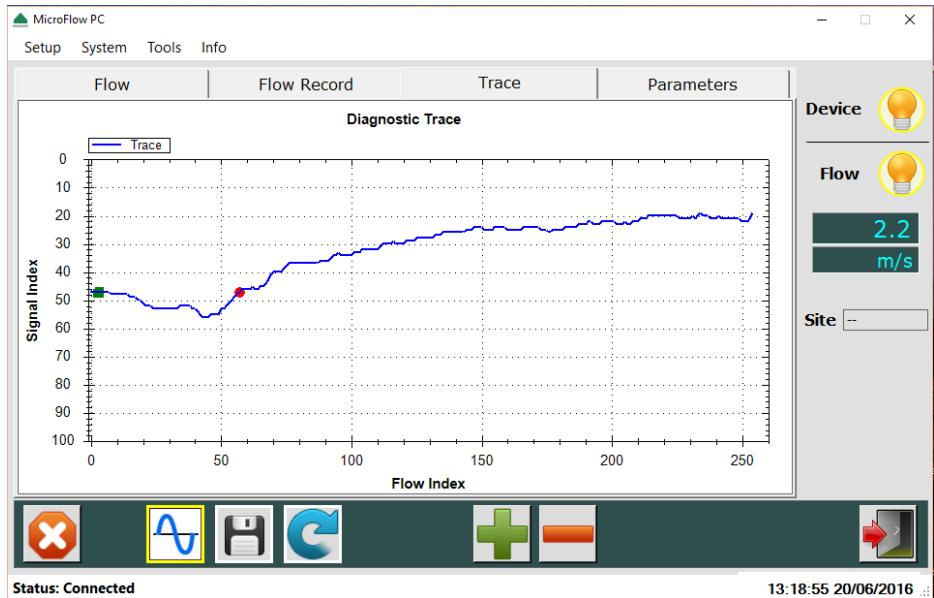


This displays the diagnostic traces from the sensor when the trace button is activated or when replaying a saved file.

The vertical axis is related to the signal strength, while the horizontal axis is related to the detected flow.

When a signal is received, the '**green square indicator**' will move down from 10 on the vertical axis. The further the '**green square indicator**' moves from 10, the larger the strength of the received signal. During flow condition, the '**green square indicator**' will normally be within the range of 30 to 70. Under no-flow conditions the '**green square indicator**' will remain at 10.

When flow is detected, the '**red circle indicator**' will move horizontally to indicate flow detection. The '**red circle indicator**' should stay at 0 under no-flow conditions, and move along the horizontal axis when flow is detected.

Under flow condition, the line should still approach and flatten out at just below the signal index 10 line.

If the trace remains flat or the indicators struggle to remain stable during flow, then increase the 'Gain' (P102) setting.

You are also able to see the current velocity measurement obtained by the sensor in the chosen volume and time units selected.

## Parameter Tab



This tab enables the user to change parameter settings in the *MicroFlow* sensor. It is important to note the following to ensure that the sensor is correctly programmed.

Upon every connection to the sensor, *MicroFlow PC* will synchronise the values on the Parameter tab to that currently stored on the sensor, including the Modbus ID of the sensor. Changing a parameter can be done in one of two ways:

1. Selecting the parameter and then entering/choosing a value from the options available when highlighting the box.

2. Using the Manual Setting parameter box.

> **Important Information**
>
> Ensure that the correct parameter/register number is known before making changes to any of the parameters and their values.

The option for manually setting the parameters can be done by utilising the Manual Setting terminal on the parameters tab, as shown below:



All parameters can be queried by entering the parameter address in the Parameter field and then clicking on the Query button. The *MicroFlow* will then reply with the current value of that parameter.

For setting a parameter, both the Address and Value must be entered before clicking on the Set button. 'User' will show the value you have changed in the manual setting box. And 'UI' will appear when changing a parameter via one of the parameter drop down selection boxes. The appropriate access levels are required for setting parameters. After changing any parameter, the 'SAVE' button must be clicked to send and save the new values to the device. If the change is not successful, then the values that are shown on the Parameter tab will reflect the current parameter value on the sensor.

The values need to be valid and within the allowed range for that particular parameter for the change to be successful. Please refer to '**Chapter 7 Parameter listing and Descriptions**' in this manual, on the parameters available and the range each one can be set between. If a parameter has been incorrectly set, highlighting the 'Default' box and selecting any of the options from the drop down list will display that particular parameters default box. This shows the parameter number, its current value and the default value of that individual parameter. Select 'OK' and then 'SAVE' to store that value.

If the MicroFlow is being controlled simultaneously on both *MicroFlow PC* and RS485 via Modbus interface, the values on the Parameter tab will not be instantly updated on MicroFlowPC if a parameter change is instructed via the RS485 Modbus.

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# Chapter 7    Parameter Listing and Descriptions

## Parameter Access

All of the *MicroFlow sensor* parameters have factory default values which the user receives upon first use, or when the sensor is reset. The parameters consist of two main types: Output parameters and Configuration parameters.

Output parameters are read only and cannot be set by the user. Examples are the stability and signal strength. Configuration parameters can be queried and set, there is also an associated access level required for setting, either 'User' or 'Service'. Upon connection to a sensor, the access level is defaulted to 'User'.

The parameters are always stored and entered as whole numbers, please refer to the individual parameter for its individual value range.

The naming syntax for the parameters is with a prefix of 'P' before the address. For example, a parameter at address 102 is "P102". The value/content of the parameter is delimited by a colon ":", such that "P102:20" indicates that the parameter at address 102 has a value of 20.

The terms "parameter" and "register" are used interchangeably as the parameter number is the actual address of the storage register.

The parameters on the *MicroFlow* can be accessed using either:

● The parameters tab on *MicroFlow PC*.

● Modbus RTU communication protocol (RS485).

It is recommended that only one method of access is used at any point in time.

## Output parameters

Using a Modbus Master, output parameters can be polled using Read Input Registers. For example: to view the flow velocity, you would read register (parameter) addresses 30020 and 30021.

### *Flow Velocity P20 and P21*

The current flow velocity can be read from registers 20 and 21, in the following format:
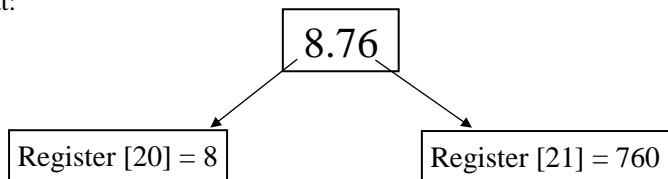


P20 contains the whole number part of the flow reading, while P21 contains the fractional part of the flow reading. P21 is stored as a whole number from 0 – 999 (allowing a fractional representation of 0.001 to 0.999).

### *P22 Signal Strength*

This is a 'read only' parameter and gives you the current signal strength in a percentage, from 1 to 100.

### *P23 Stability*

This is a 'read only' parameter and gives you the current stability in a percentage, from 1 to 100.

## Configuration parameters

### *RS485 Communication and Modbus*

Use these parameters to setup the *MicroFlow* device to the appropriate Pulsar controller.

| Name | Parameter No. | Options | Default | Description |
|---|---|---|---|---|
| *MicroFlow* Sensor Address | 52 | 1 – 127 | 126 | Unique Modbus device ID. |
| Modbus Terminations | 57 | 0 = Off 1 = On | 1 | Select 1 = On, if termination is required. |

### *Device Information Parameters*

These parameters are read-only.

| Name | Parameter No. | Description |
|---|---|---|
| Serial Number | 240 & 241 | Registers 240 & 241 form a 32-bit number. Register 240 = Most significant 16-bit. Register 241 = Least significant 16-bit. |
| Firmware ID | 261 | A number associated with the version of firmware that is currently programmed onto the sensor. |
| Hardware ID | 262 | A number associated with the version of hardware that is currently used with the sensor. |

### Processing Parameters

The following parameters relate to the detection and processing of the flow velocity signal.

| Name | Parameter No. | Options | Default | Notes |
|------|---------------|---------|---------|-------|
| Gain | 102 | 1 - 16 | 10 | Used to enter a fixed gain (sensitivity) value, a higher number means higher gain. |
| Cal Factor | 108 | 1 – 500 | 100 | In percentage terms, default is 100, for 100%. 50% would half and 200% would double. |
| Damping | 109 | 0 - 28 | 24 | This sets the damping applied to the MicroFlow sensor. A higher number represents more damping. |
| Damp Persist | 116 | 0 - 18 | 12 | This is the number of measurements that the sensor acquires, before switching into Step Response Mode. |
| Step Response Mode | 113 | 0 = Off 1 = On | 1 | When turned off, no damping by pass will be performed. |
| Step Persist | 115 | 0 - 18 | 12 | This is the number of measurements that the sensor acquires, before switching into damping mode. Diagnostic trace can be used to adjust this. |
| MinFlowCutOff | 120 | 10-4000 | 150 | In units of mm/s velocity for user input |

| | | | | |
|---|---|---|---|---|
| Response | 125 | 0 = Slow<br>1 = Fast | Slow | Changing this to 'Fast' will automatically calibrate parameters in the MicroFlow sensor to track measurements faster. This is recommended for Pumped flow. 'Slow' is recommended when there is natural flow, as measurements will be tracked at a slower pace. |

If using the *MicroFlow* on an application where Flow type is changed to 'Fast', this will reduce the damping to obtain better results. If there is natural flow and 'Slow' is chosen, then damping is increased to obtain better results.

## Saving & Loading parameters

For a device where parameters are heavily customised, the user may wish to replicate such customisation on a second device. Saving and loading parameters can be used to avoid having to set-up the parameters individually again:

1. Connect *MicroFlow PC* to the first device, then select System->Save Device Parameters.
2. A confirmation message will appear and the parameters saved to a file within the default folder (use Info > Data Folder Path to see the folder location). The filename is prefixed by "ParamMicroFlow-" followed by the date and time.
3. Connect the second device to *MicroFlow PC*, in order to load the parameters on to. Select 'System > Load Parameters to Device', then choose the parameter file to load.
4. The unit will disconnect from the software, and a message box will appear asking to confirm the parameter change, and once completed another message box will appear informing you that the parameters have been loaded onto the sensor correctly.
5. Once the parameters have been loaded onto the sensor, it will automatically re-connect to the *MicroFlow PC* software, where you are able to see the new parameter values.

## Firmware Upgrade

Ensure that any customised parameters are saved before any firmware upgrade is undertaken. Firmware upgrades are performed in 'Bootloader' mode. Note that all flow measurement and output operation will be halted when the sensor is in the 'Bootloader'. Please follow these steps:

1. Please ensure that the sensor is connected to a PC via the RS485 port. Prior to reprogramming, you will need the firmware file, and the COM port number of the RS485 connector.

2. Establish a connection to the sensor, and it is advisable to save any customised parameters before beginning an upgrade.

3. You will require Service access to switch the device into Bootloader mode, and to activate Bootloader control.

4. First place the device into bootloader mode by selecting System > Switch Device into Bootloader.

5. Select System > Bootloader control, which will launch the Bootloader interface. As seen in Fig.9.

6. Once connected click 'Load Hex file', and choose the firmware file you are using to upgrade the sensor.

7. Click 'Erase-Program-Verify', and await for the process to finish.

8. When the 'Verification Successful' message is displayed, click 'Run firmware' and the Bootloader Interface will close down.

9. Select the 'connect' button on the software, and the sensor will reconnect to *MicroFlow PC* with the new firmware installed.
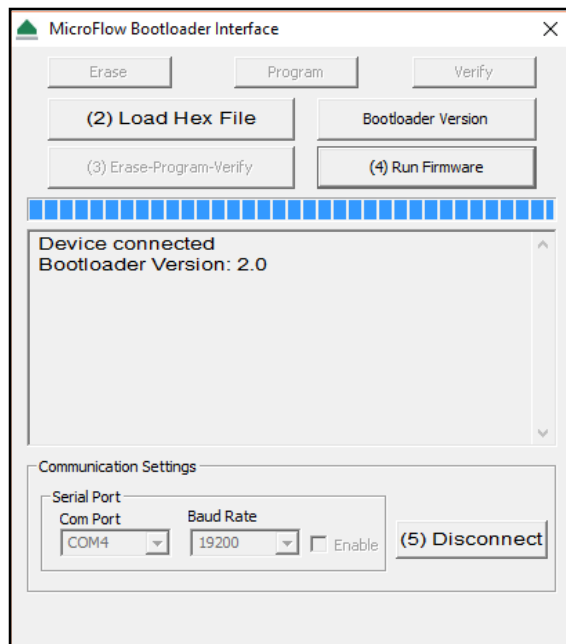
Fig.9

**Important Information**

If the sensor does not connect to the device within 40 seconds, it will resume its normal operation with its current firmware.
Do not switch off supply to the unit or close down the software during the firmware upgrade.

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

| Symptom | What to Do |
|---|---|
| FlowCERT/Velocity Interface/Ultimate shows "Lost comms" | Check power supply.  Check wiring to the *MicroFlow* sensor.  If sensor has been connected to a new unit, then it may require power cycling to sync with the controllers Baud rate. |
| Current velocity reads zero, but you know that there is flow movement. | Ensure that the sensor is mounted correctly in accordance with Chapter 2. |
| Current velocity reading is higher/lower than know movement of flow. | Check that the sensor is mounted correctly.  Adjust the Gain (P102) or Damping (P109) parameters to obtain correct measurements. |
| Unable to connect to *MicroFlow PC*. | Check that wiring to the RS485 connector is correct.  Close *MicroFlow* PC, cycle power on the sensor re-open *MicroFlow* PC and retry connection. |
| FlowCERT reading is incrementing slow on display. | Adjust 'P687 Stability' on the FlowCERT controller, to a smaller number than 12, i.e. 8. |

**Important Information**

If you experience any issues with our equipment, then please contact your local Pulsar Distributor for assistance.

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