

MainProbe User Manual

Revision 1.14

March 2023

Disclaimer

Mainstream Measurements reserve the right to make changes, corrections, enhancements, modifications, and improvements to our products and/or to this document at any time without notice.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2023 Mainstream Measurements Limited – All rights reserved

Contents

1: Introduction	5
2: Physical Interface Setup	6
3: MainProbe Communicator Software	7
3.1: Installing Communicator	7
3.2: .NET 5.x	7
3.3: Connecting to MainProbe	7
3.4: Communicator tabs	8
4: Modbus Interface	14
4.1: Supported Modbus function codes	14
4.2: Supported Modbus exception codes	14
4.3: Supported Data Types	14
4.4: Boundary checking	16
4.6: Supported Modbus holding registers	17
5: Taking a Measurement	26
6: Access Modes	27
6.1: The access modes (Passwords)	27
6.2: Access levels	27
6.3: Communications timeout	28
6.4: Changing access mode	28
6.4.1: Using the Modbus interface	28
6.4.2: Using Communicator	28
7: Mainstream Adaptive Measurement System (MAMS)	31
8: Diagnostics	32
8.1: Measurement	32
8.1.1: Signal Quality	33
8.1.2: Modbus/RS485 Communication	34
9: Updating MainProbe Firmware	36
10: Mechanical specifications	38
11: Installation of the MainProbe	39
11.1: Dimensions and fixing template	39

11.2:	Installation	39
11.3:	Equipment for installing the sensor	40
11.4:	Equipment for installing the sensor in circular pipe sections	40
12:	Technical reference.....	41
12.1:	Velocity sensor	41
12.2:	Temperature sensor.....	41
12.3:	Power supply sensor	41
12.4:	Miscellaneous	41
12.5:	Compliance.....	42
13:	Appendix – Best Use of The MainProbe	44
13.1:	Siting the MainProbe	44
13.2:	Power efficiency	44
13.3:	Measurement efficiency	44
14:	Appendix – Known Issues in Software and Firmware.....	44
14.1:	Modbus Address Handling	44
14.2:	Communicator: Disconnected Behaviour	45

1: Introduction

The MainProbe is an integrated measurement platform, meaning it requires no system unit or external processing module to support its operation. It is an invasive, ultrasonic probe intended for open-channel or part filled pipe flow solutions.

The MainProbe houses enough processing power to provide the standard functionality originally featured on Mainstream transmitters. While still maintaining the same ultrasound technology used in the previous Mainstream velocity probe. Technology known for its reliability, accuracy, and its proven track record in measurement applications throughout the world.

The MainProbe can be interfaced with using either a Modbus-RTU client or the MainProbe Communicator software. Both interfaces provide full access to all of the features available on the MainProbe, including full product configuration.

For information on how to interface with the MainProbe using the MainProbe Communicator software, see section 3.

For information on how to interface with the MainProbe using a Modbus-RTU client, see section 4.

2: Physical Interface Setup

Listed below are the functions for each wire contained in the MainProbe-V RS485 cable.

Insulation colour	Purpose
Yellow	RS485 Half Duplex B-
Brown	RS485 Half Duplex A+
Red	Power (+ve)
Black	Power (-ve)
Blue	Reserved/Not fitted
White	Reserved/Not fitted
Clear	Screen

Input voltage (1 device on bus): 5V – 28V

Input voltage (>1 device on bus): 7V – 28V

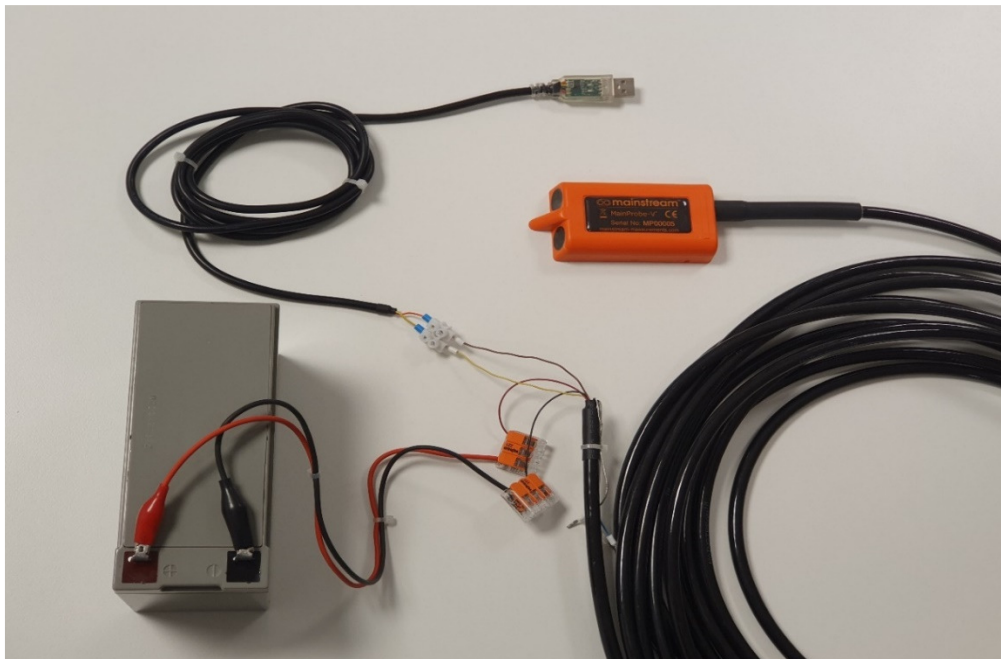
RS485 Drive capability: 10 unit loads RS485 Input impedance of device: $\frac{1}{8}$ unit load

Screen connection: Should be connected to 0V or terminated.

Line termination: See official Modbus documentation.

For additional details on maximum & minimum operating conditions, see section 12: .

Below, is an example of how the MainProbe should be connected to an RS485 to USB adapter cable.



As always when dealing with electrical connections, care must be taken to avoid short circuits etc when wiring up the MainProbe to the power supply.

3: MainProbe Communicator Software

MainProbe Communicator is Windows software which allows the MainProbe to be configured and managed. MainProbe Communicator acts as a Modbus client device.

MainProbe Communicator is either provided by USB drive, or from our web site.

3.1: Installing Communicator

Minimum system requirements: Windows 10, .NET 5.0.1(*) desktop runtime SDK.

(*) Or better. Some Windows PCs will have the .NET 5 desktop runtime SDK installed already. Some may require manual installation.

Any USB drive provided by Mainstream or "MainProbe Communicator.zip" file, will include a setup file for Communicator. This setup file will install Communicator in a folder of the user's choice.

3.2: .NET 5.x

If you install Communicator and try to run the software without the .NET 5.x installed, you will be shown an error message, prompting you to install the .NET runtime, clicking yes on this message will direct you to a Microsoft webpage where .NET can be downloaded. At time of writing this is <https://dotnet.microsoft.com/download/dotnet/5.0> . Ensure you download the **x64** SDK.

You can now run Communicator.

3.3: Connecting to MainProbe

After you have started Communicator, you will need to connect to the MainProbe device. The definitions below assume you have the correct physical connections to the MainProbe using an RS485 to USB converter to allow a connection to the product to be made via a PC.

Communications settings

On the left-hand side there are menu items to setup the communications between the device and your computer.

Scan – The **Port** box is used to specify which COM port the connection is on. The button to the right will scan the ports on your PC for appropriate connections.

The **Options** box is used to specify the usual COM port settings (Hint, press the button next to the Options box).

The **Modbus address** box is used to specify which Modbus Address the software should interrogate. The button next to it will trigger a sequence of Modbus messages which will interrogate the attached Modbus bus, to determine if one or more MainProbes are attached to the bus.

The address can be entered as a single number (between 1-247), for example, "1" or "123". Or the address can be entered as a range, for example, "1-3" or "100-120".

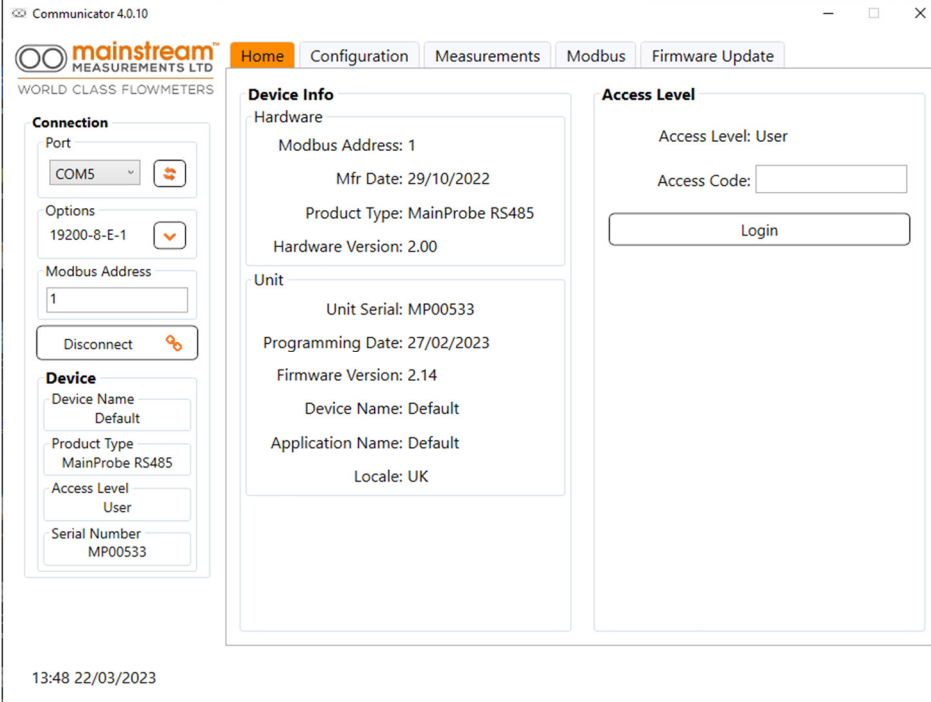
Scanning each address can take up to 3 seconds.

If a MainProbe is found during the scan, its details will be displayed in a panel on the left of the dashboard (pictured below).

3.4: Communicator tabs

Home tab

The Home tab shows Device information once connected and provides the interface for users to login to the Probe.



Communicator 4.0.10

mainstream
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus Firmware Update

Connection

Port: COM5

Options: 19200-8-E-1

Modbus Address: 1

Disconnect

Device

Device Name: Default

Product Type: MainProbe RS485

Access Level: User

Serial Number: MP00533

Device Info

Hardware

Modbus Address: 1

Mfr Date: 29/10/2022

Product Type: MainProbe RS485

Hardware Version: 2.00

Unit

Unit Serial: MP00533

Programming Date: 27/02/2023

Firmware Version: 2.14

Device Name: Default

Application Name: Default

Locale: UK

Access Level

Access Level: User

Access Code:

Login

13:48 22/03/2023

Access Level – The Login button is used to change the access mode of the connected MainProbe, you must be connected to a MainProbe before clicking this button. Initially the software will log you in as a **User**.

Once connected to a MainProbe, Communicator will issue regular messages to the MainProbe to prevent the firmware from reaching its communications timeout. If the communications timeout (2 minutes 30 seconds) elapses without a message being sent to the MainProbe, the probe will automatically return itself to Read-Only mode.

Enter a 4-digit, numerical Access Code into the **Access Code** text box before clicking the Login button.

Upon clicking the Login button, the MainProbe will evaluate the access code you have submitted. If the MainProbe determines the access code submitted is valid, it will automatically update to the Access Mode, this change will be reflected on the Communicator interface, in the **Access Mode** text box. Shown on the right, is a successful login, to Admin mode.

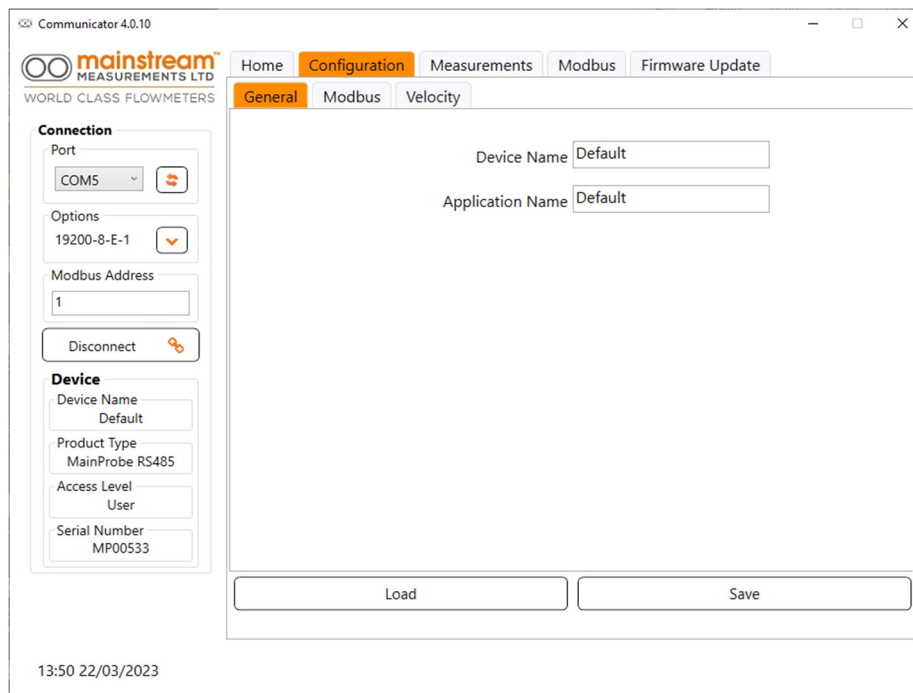
If an invalid Access Code is entered, the MainProbe will return to Read-Only mode.

Valid Access Codes are listed below:

Access Mode	Access Code	Description
Read-Only	0000	Used to force measurements, edit measurement units, and view the device configuration.
Admin/Advanced	5678	Same as Engineer mode + used to modify all other configurable settings.

Configuration tab: General

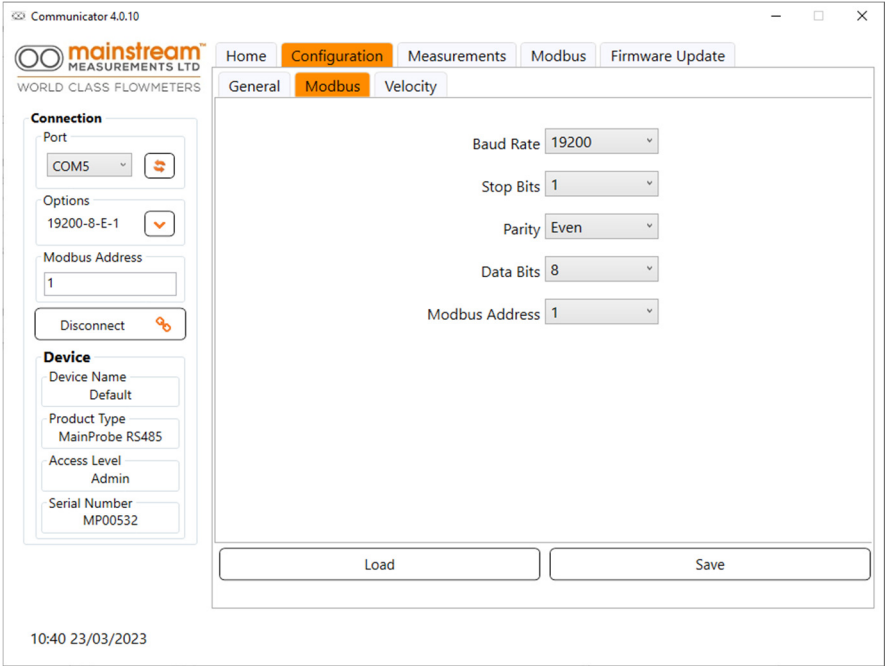
This tab features three sub-tabs. The General Tab is used to configure the two alphanumeric ID labels, these can be set to whatever the user requires. They are comment fields which can help the user provide location or comment labels for their installation.



The screenshot shows the 'Communicator 4.0.10' software window. The 'Configuration' tab is selected, and the 'General' sub-tab is active. The interface includes a left sidebar with 'Connection' and 'Device' sections. The 'Connection' section shows 'Port' set to 'COM5', 'Options' set to '19200-8-E-1', and 'Modbus Address' set to '1'. The 'Device' section shows 'Device Name' as 'Default', 'Product Type' as 'MainProbe RS485', 'Access Level' as 'User', and 'Serial Number' as 'MP00533'. The main area contains 'Device Name' and 'Application Name' fields, both set to 'Default'. At the bottom are 'Load' and 'Save' buttons. The status bar at the bottom left shows the time '13:50' and date '22/03/2023'.

Configuration tab: Modbus

The Modbus-RTU sub-tab is used to configure the Modbus communications system on the MainProbe, providing access to parameters used to control the RS485 driver and to adjust the Modbus address of the MainProbe. These are the settings which will be written into the memory of the MainProbe. This is a different menu to that used to connect to the MainProbe, but of course there must be a correlation between the settings to be set to communicate to the MainProbe, and the settings in the MainProbe itself as they are on the same RS485 bus.



The screenshot shows the 'Communicator 4.0.10' software window. The 'Configuration' tab is selected, and within it, the 'Modbus' sub-tab is active. The interface is divided into three main sections: 'Connection', 'Device', and a large central area for Modbus settings.

Connection Section:

- Port: COM5 (dropdown menu)
- Options: 19200-8-E-1 (dropdown menu)
- Modbus Address: 1 (text input)
- Disconnect button (with a red icon)

Device Section:

- Device Name: Default (text input)
- Product Type: MainProbe RS485 (text input)
- Access Level: Admin (text input)
- Serial Number: MP00532 (text input)

Modbus Settings Section:

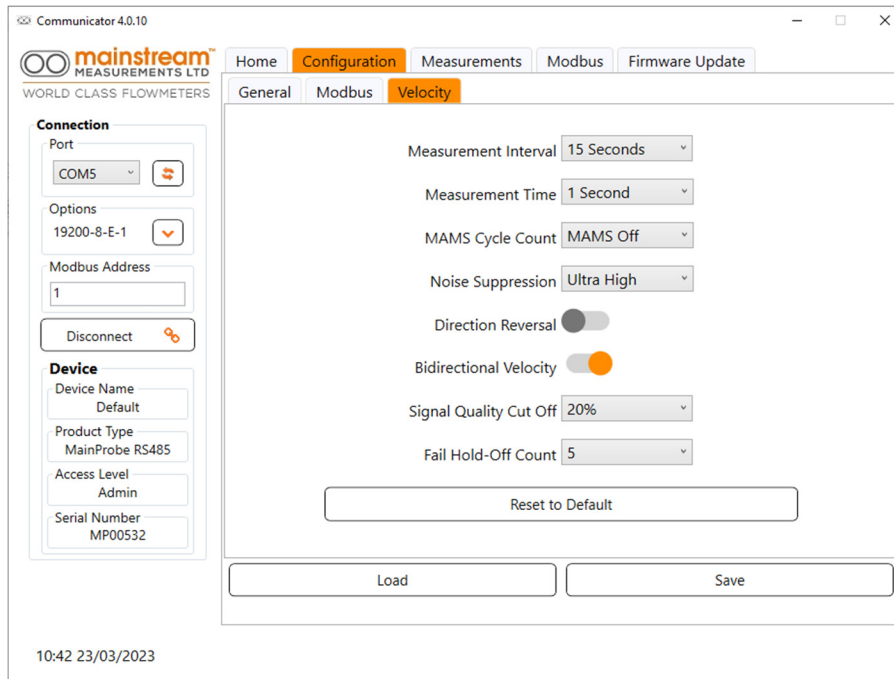
- Baud Rate: 19200 (dropdown menu)
- Stop Bits: 1 (dropdown menu)
- Parity: Even (dropdown menu)
- Data Bits: 8 (dropdown menu)
- Modbus Address: 1 (text input)

At the bottom of the Modbus settings area are two buttons: 'Load' and 'Save'.

The bottom left corner of the window displays the timestamp: 10:40 23/03/2023.

Configuration tab: Velocity

The Velocity Sensor sub-tab provides access to configuration parameters for the ultrasonic velocity sensor on the MainProbe, allowing factors such as the measurement interval and measurement time, to be adjusted.

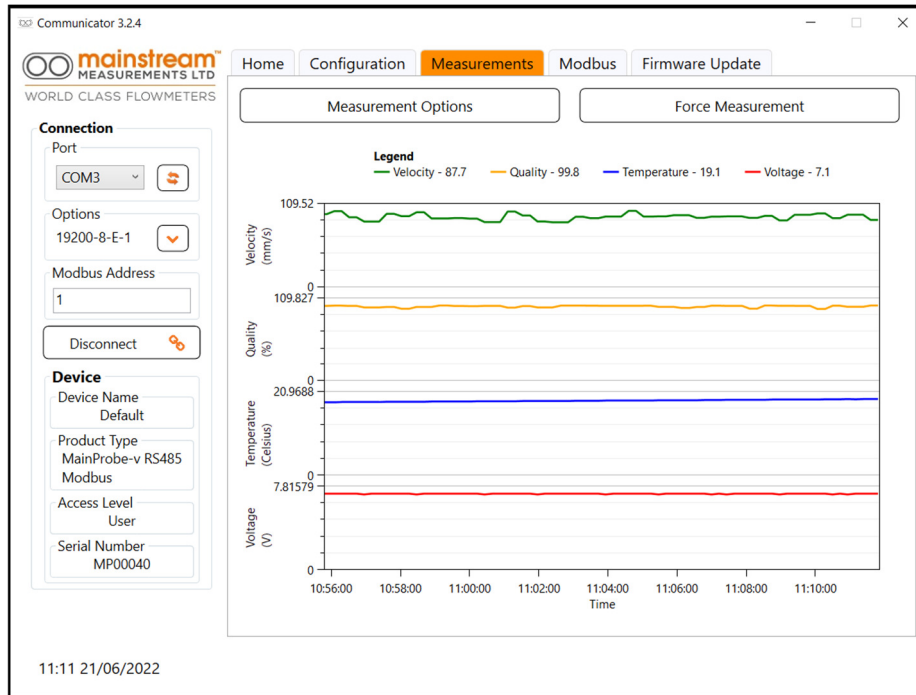


The screenshot shows the 'Communicator 4.0.10' window. The top navigation bar includes 'Home', 'Configuration' (selected), 'Measurements', 'Modbus', and 'Firmware Update'. The 'Configuration' tab has three sub-tabs: 'General', 'Modbus', and 'Velocity' (selected). On the left, the 'Connection' section shows 'Port' as COM5, 'Options' as 19200-8-E-1, and 'Modbus Address' as 1. The 'Device' section shows 'Device Name' as Default, 'Product Type' as MainProbe RS485, 'Access Level' as Admin, and 'Serial Number' as MP00532. The 'Velocity' sub-tab contains the following settings: 'Measurement Interval' (15 Seconds), 'Measurement Time' (1 Second), 'MAMS Cycle Count' (MAMS Off), 'Noise Suppression' (Ultra High), 'Direction Reversal' (toggle off), 'Bidirectional Velocity' (toggle on), 'Signal Quality Cut Off' (20%), and 'Fail Hold-Off Count' (5). A 'Reset to Default' button is located below these settings. At the bottom are 'Load' and 'Save' buttons. The status bar at the bottom left shows the time '10:42' and date '23/03/2023'.

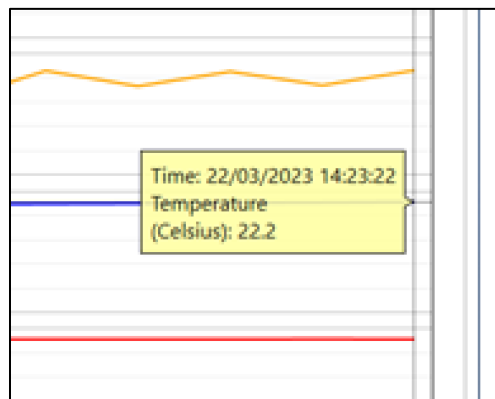
The different parameters which can be configured are discussed in the Modbus Interface section below.

Measurements tab

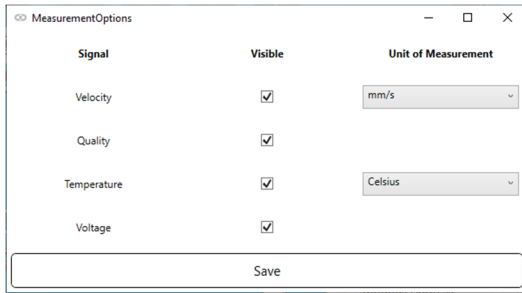
This tab provides access to the data from the MainProbe. The tab features four graphs. These show the current (and recent past) state of the velocity, temperature, signal quality and voltage of the MainProbe.



Clicking on a graph line will give the value at that moment.

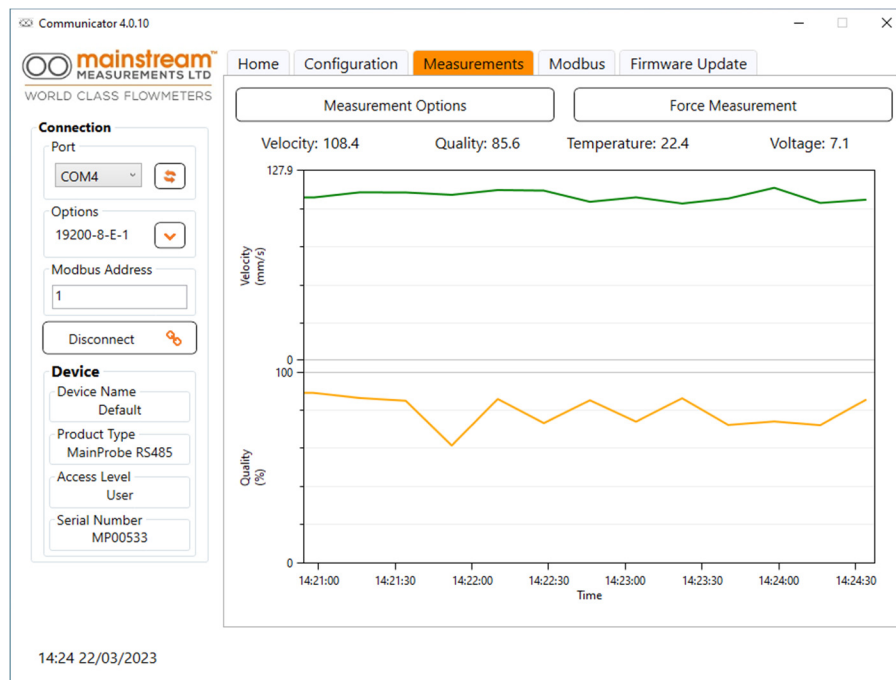


The Measurement Options button allows the user to select which graphs are to be displayed, the units used to express the velocity and temperature can also be changed in this menu. The screen below shows the graphs with the temperature and voltage charts removed.



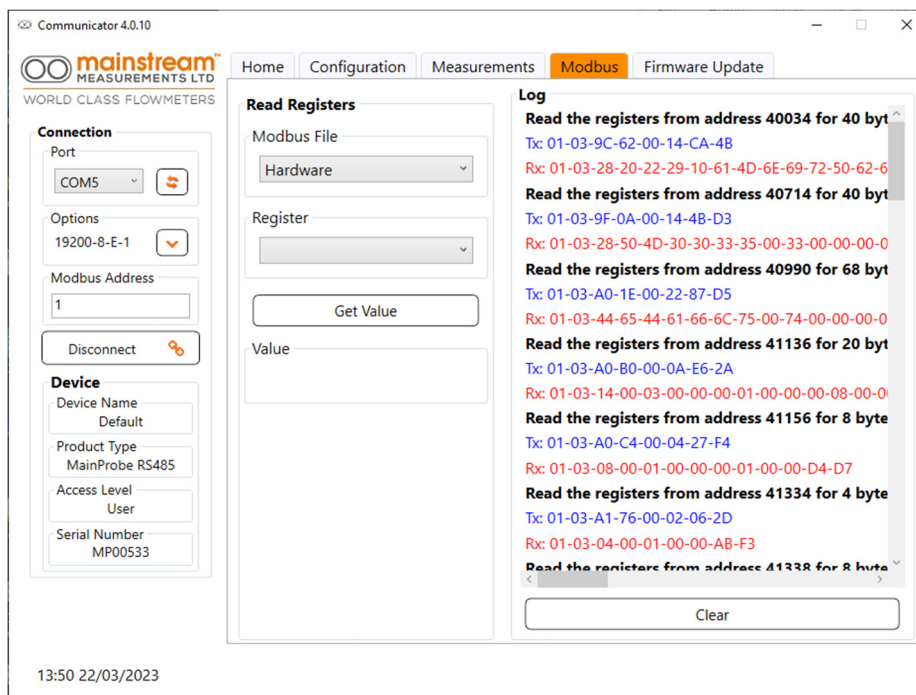
Signal	Visible	Unit of Measurement
Velocity	<input checked="" type="checkbox"/>	mm/s
Quality	<input checked="" type="checkbox"/>	
Temperature	<input checked="" type="checkbox"/>	Celsius
Voltage	<input checked="" type="checkbox"/>	

Save



Modbus tab

This tab shows a log of Modbus messages send and received from the MainProbe. A control on the tab allows for simple format Modbus messages to be sent to the MainProbe. These are grouped into Hardware, Configuration, Unit and Measurements and simulate the normal operation of the Communicator. This feature may be used to help set-up or debug the MainProbe.



Communicator 4.0.10

mainstream MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements **Modbus** Firmware Update

Read Registers

Modbus File

Hardware

Register

Get Value

Value

Log

Read the registers from address 40034 for 40 byt

Tx: 01-03-9C-62-00-14-CA-4B

Rx: 01-03-28-20-22-29-10-61-4D-6E-69-72-50-62-6

Read the registers from address 40714 for 40 byt

Tx: 01-03-9F-0A-00-14-4B-D3

Rx: 01-03-28-50-4D-30-30-33-35-00-33-00-00-00-0

Read the registers from address 40990 for 68 byt

Tx: 01-03-A0-1E-00-22-87-D5

Rx: 01-03-44-65-44-61-66-6C-75-00-74-00-00-00-0

Read the registers from address 41136 for 20 byt

Tx: 01-03-A0-B0-00-0A-E6-2A

Rx: 01-03-14-00-03-00-00-00-01-00-00-00-08-00-0

Read the registers from address 41156 for 8 byte

Tx: 01-03-A0-C4-00-04-27-F4

Rx: 01-03-08-00-01-00-00-00-01-00-00-D4-D7

Read the registers from address 41334 for 4 byte

Tx: 01-03-A1-76-00-02-06-2D

Rx: 01-03-04-00-01-00-00-AB-F3

Read the registers from address 41338 for 8 byte

Clear

13:50 22/03/2023

4: Modbus Interface

4.1: Supported Modbus function codes

All data in the MainProbe is stored in **16-bit holding registers**, these can be accessed using the following function codes.

3 – Read multiple holding register(s)

6 – Write to single holding register

Note that only one holding register can be written to, per Modbus message. Function code 16 (write multiple holding registers) is not available.

4.2: Supported Modbus exception codes

Exception code 1 - Illegal Function - The function code received in the query is not supported by the server.

Exception code 2 - Illegal Data Address - The data address received in the query is not an allowable register address for the server. More specifically, the combination of register address and register count is invalid. For a controller with 100 registers, (first register addressed as 0, and the last, as 99). If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 "Illegal Data Address" since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.

Exception code 3 - Illegal Data value - Exception code 3 is used to help express violations to the permissions system. If the user requests a register that they do not have permission to access in their current user mode, exception code 3 is sent.

4.3: Supported Data Types

Byte arrangement is fixed to a **low word first, high byte first** configuration.

This means that for every 16-bit word requested from the device, of the two bytes received, the **most significant byte** will be sent **first**.

When more than one 16-bit register is requested, these 16-bit words are arranged into 32-bit values. Within each 32-bit value, the **pairs of words** are sent in reverse order. So, the **least significant word**, is sent **first** (this is because the least significant word holds the lowest value Modbus address, thus the). This has been set in accordance with the demands of most Modbus client requirements.

float- Constructed using 2, concatenated 16-bit registers:

The floating-point number:	"212.549530"	(ABCD)
Can be expressed as the bytes:	"43 54 8C AE"	(ABCD)
These will be received from the MainProbe as:	"8C AE 43 54"	(CDAB)
The register addresses for this data would be:	"8C AE = 4xxxx"	(CD)
	"43 54 = 4xxxx+1"	(AB)

int32 – Constructed using 2, concatenated 16-bit registers:

The 32-bit integer decimal number:	"305419896"	(ABCD)
Can be expressed as the bytes:	"12 34 56 78"	(ABCD)
These will be received from the MainProbe as:	"56 78 12 34"	(CDAB)
The register addresses for this data would be:	"12 34 = 4xxxx"	(CD)
	"56 78 = 4xxxx+1"	(AB)

Many of the registers in the device are listed as 32-bit integers, many of them will never reach values which require more than 16 bits to express, for these registers it is simpler to only read the least significant 16-bits of these 32-bit values.

string – Standard string storage format is used, where bytes are stored in 32-bit words, each segment in reverse order (little endian). These strings are null terminated.

The ASCII string:	"V e l o"	(ABCD)
Will be received from the MainProbe as:	"e V o l"	(BADC)
Translated as	"65 56 6F 6C"	(BADC)

The register addresses for this data would be:	"65 56 = 4xxxx"	(BA)
	"6C 6F = 4xxxx+1"	(DC)

Mnemonic – A big-endian string format used to store specific character strings not more than 32-bits in length. Usually used to represent parameters such as firmware version numbers. Because these are fitted into a 32-bit word they are not null-terminated.

The ASCII string:	"V e l o"	(ABCD)
Will be received from the MainProbe as:	"l o V e"	(CDAB)
Translated as	"6C 6F 56 65"	(CDAB)

The register addresses for this data would be:	"65 56 = 4xxxx"	(CD)
	"6C 6F = 4xxxx+1"	(AB)

MML Date Format – A representation of a UK format date. Hexadecimal numbers are used to represent decimal values – example 0x31 is used to represent 31(decimal). This is usually used to represent parameters such as the MainProbe manufacture date.

The date:	"31 st April 2021"	(UK Date format)
Will be sent from the MainProbe as:	"31 04 20 21"	(Hexadecimal)

4.4: Boundary checking

Some holding registers on the MainProbe have maximum and minimum values to which they are restricted.

If the user writes a value to one of these parameters (assuming they have permission to write to the given parameter in their current access mode) which exceeds the below specified boundaries, the MainProbe will restore the default value for that parameter.

Parameter	Maximum value	Minimum value	Default value
Restore Default Hardware Settings	1 (Restore defaults)	0 (Do nothing)	0 (Do nothing)
Restore Default Unit Settings	1 (Restore defaults)	0 (Do nothing)	0 (Do nothing)
Baud Rate	6 (115200 Baud)	0 (2400 Baud)	3 (19200 Baud)
Stop Bits	2 (2 Stop bits)	1 (1 Stop bit)	1 (1 Stop bit)
Data Bits	8 (8 Data bits)	7 (7 Data bits)	8 (8 Data bits)
Parity	2 (Even parity)	0 (No parity)	2 (Even parity)
Modbus Server Address	247	1	1
Measurement Interval	10 (1 Hour)	0 (On demand)	2 (30 Seconds)
Measurement Time	10 (10 Seconds)	1 (1 Second)	1 (1 Second)
Bi-Directional Velocity	1 (Enabled)	0 (Disabled)	1 (Enabled)
Noise Suppression	2 (High)	0 (Low)	1 (Medium)
MAMS Cycle Count	3 (High Limit)	0 (MAMS Off)	2 (Medium Limit)
Velocity Direction Reversal	1 (Enabled)	0 (Disabled)	0 (Disabled)
Restore Default Configuration Settings	1 (Restore defaults)	0 (Do nothing)	0 (Do nothing)
Measurements Complete	1 (MainProbe has completed its most recent measurement.)	0 (MainProbe busy taking a measurement.)	1 (MainProbe has completed its most recent measurement.)
Restore Default Measurement Settings	1 (Restore defaults)	0 (Do nothing)	0 (Do nothing)

4.6: Supported Modbus holding registers

To extract a 32-bit data types, 2 holding registers should be requested.

The MainProbe-V RS485 features an access mode system which allows access to be granted and revoked to different parameters on the product, to allow varying types of users to operate the product, without the risk of misconfiguration. The permissions are assigned to each parameter and listed below. For more information on this system, see section 6:

Parameter Name	Modbus Register Address / Reg. Count	Description / Data type / Default value /	Access Mode		
			Adv.	Basic	Read Only
Hardware File					
Hardware Manufacture Date	40034 / 2	Hexadecimal representation of the date upon which the product was assembled in the Mainstream factory. Data type: MML Date Format Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Product Type	40036 / 16	Description of the specific product variant within the MainProbe product range. Data type: String Default value: "MainProbe-V RS485"	Rd. Only	Rd. Only	Rd. Only
Hardware Version	40052 / 2	Describes the version number of the circuit board contained in the probe. Data type: Mnemonic Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Restore Default Hardware Settings	40710 / 2	Reserved for future use, has no effect on the above parameters. Data type: Int32 Default value: 0 Upon being written to, this parameter will immediately restore itself to its own default value.	Rd. Wr.	Rd. Only	Rd. Only
Unit File					
Unit Serial Number	40714 / 16	Unique, factory assigned serial number for the probe. Data type: String Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Unit Manufacture Date	40730 / 2	Hexadecimal representation of the date upon which the assembly of the product was finished. Data type: MML Date Format Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Firmware Version	40732 / 2	Describes the version number of the firmware currently running on the probe. Data type: Mnemonic Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Device Name	40990 / 16	User configurable, 32-character string used to identify an individual probe. Data type: String Default value: "Default"	Rd. Wr.	Rd. Wr.	Rd. Only

Application Name	41006 / 16	User configurable 32-character string used to identify the name of the application at which the probe is situated. Data type: String Default value: "Default"	Rd. Wr.	Rd. Wr.	Rd. Only
Device Locale	41022 / 2	Integer value representing the factory fixed locale the probe has been assigned. 0 = UK. 1 = FR. 2 = IT. 3 = CL. 4 = JP. 5 = ES. 6 = US. 7 = KR. Data type: Int32 Default value: Specific to unit.	Rd. Only	Rd. Only	Rd. Only
Restore Default Unit Settings	41130 / 2	When this parameter is set to a 1 the following parameters will be restored to their default values. Device Name Application Name Upon being written to, this parameter will immediately restore itself to its own default value. Data type: Int32 Default value: 0	Rd. Wr.	Rd. Only	Rd. Only
Configuration File					
Access Mode	41132 / 2	Integer value that represents the current access mode of the probe, for more information on the MainProbe access mode system please see section 6: 0 = Read-Only mode. 2 = Advanced mode. Data type: Int32 Default value: 0 (Read-Only Mode)	Rd. Only	Rd. Only	Rd. Only
Access Code	41134 / 2	Upon writing a valid access code to this parameter, the MainProbe will automatically update its access mode to correspond with the access code submitted. Access code for Read-Only mode = 0x00000000 Access code for Basic mode = 0x00001234 Access code for Advanced mode = 0x00005678 If an invalid access code is written, the probe will automatically return to Read-Only mode. Parameter will accept any 32-bit value. Data type: Int32 Default value: Parameter will always read as 0x50415353 (Or, "PASS" in ASCII).	Rd. Wr.	Rd. Wr.	Rd. Wr.
Baud Rate	41136 / 2	Integer value that represents the baud rate selected by the user for the serial communications.	Rd. Wr.	Rd. Wr.	Rd. Only

		<p>Writing to this parameter will not affect the baud rate being used by the probe. To switch the baud rate used by the probe, to the baud rate you have written to this parameter, the "Update Communications" parameter must be set to a 1. This will trigger an update of the communications settings.</p> <p>0 = 2400 Baud. 1 = 4800 Baud. 2 = 9600 Baud. 3 = 19200 Baud. 4 = 38400 Baud. 5 = 57600 Baud. 6 = 115200 Baud.</p> <p>Setting this parameter to any value outside of the above listed values will return the parameter to its default value.</p> <p>Data type: Int32 Default value: 3 (19200 Baud).</p>			
Stop Bits	41138 / 2	<p>Integer value that represents the number of stop bits selected by the user for the serial communications.</p> <p>Writing to this parameter will not affect the number of stop bits being used by the probe. To switch the number of stop bits used by the probe, to the number you have written to this parameter, the "Update Communications" parameter must be set to a 1. This will trigger an update of the communications settings.</p> <p>1 = 1 Stop bit. 2 = 2 Stop bits.</p> <p>Setting this parameter to any value outside of the above listed values will return the parameter to its default value.</p> <p>Data type: Int32 Default value: 1 (1 Stop bit).</p>	Rd. Wr.	Rd. Wr.	Rd. Only
Data Bits	41140 / 2	<p>Integer value that represents the number of data bits selected by the user for the serial communications.</p> <p>Writing to this parameter will not affect the number of data bits being used by the probe. To switch the number of data bits used by the probe, to the number you have written to this parameter, the "Update Communications" parameter must be set to a 1. This will trigger an update of the communications settings.</p> <p>7 = 7 Data bit. 8 = 8 Data bits.</p> <p>Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Currently, only 8-bit communications are available, this parameter cannot be written to.</p> <p>Data type: Int32 Default value: 8 (8 Data bits).</p>	Rd. Only	Rd. Only	Rd. Only

Parity	41142 / 2	<p>Integer value that represents the type of parity selected by the user for the serial communications.</p> <p>Writing to this parameter will not affect the type of parity being used by the probe. To switch the type of parity used by the probe, to the type of parity you have written to this parameter, the "Update Communications" parameter must be set to a 1. This will trigger an update of the communications settings.</p> <p>0 = No parity. 1 = Odd Parity. 2 = Even Parity.</p> <p>Setting this parameter to any value outside of the above listed values will return the parameter to its default value.</p> <p>Data type: Int32 Default value: 2 (Even parity).</p>	Rd. Wr.	Rd. Wr.	Rd. Only
Modbus Server Address	41144 / 2	<p>Integer value that represents the current Modbus server address for the MainProbe, unlike the other communications parameters, this value does not require the "Update Communications" parameter to be set to alter the address used by the probe, writing to this parameter will have an immediate effect on the probe.</p> <p>Valid address values are 1-247 (inclusive).</p> <p>Setting this parameter to any value outside of the above listed values will return the parameter to its default value.</p> <p>Data type: Int32 Default value: 1 Please see Known Issues Appendix</p>	Rd. Wr.	Rd. Wr.	Rd. Only
Update Communications	41146 / 2	<p>Set this register to any value other than its default value to trigger an update of the probe's serial communications.</p> <p>Power cycling the MainProbe will also have the same effect as setting this parameter to a 1.</p> <p>This will ensure the values you have written to the following parameters:</p> <p>Baud Rate Stop Bits Data Bits Parity</p> <p>Are used for serial communications.</p> <p>Once the probe's serial communications have been updated, this parameter is immediately restored to its own default value.</p> <p>Data type: Int32 Default value: 1</p>	Rd. Wr.	Rd. Wr.	Rd. Only
Measurement Time	41156 / 2	<p>Integer value representing the duration of each ultrasonic velocity measurement.</p> <p>Valid measurement time values: 1 – 10 (inclusive).</p>	Rd. Wr.	Rd. Only	Rd. Only

		Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: Int32 Default value: 1 (1 Second).			
Measurement Interval	41158 / 2	Integer value representing the time interval between the start of each measurement. 0 = On demand (No regular measurement is taken measurements must be manually invoked, see section 0 for more information on triggering measurements). 1 = 15 Seconds. 2 = 30 Seconds. 3 = 1 Minute. 4 = 2 Minutes. 5 = 5 Minutes. 6 = 10 Minutes. 7 = 15 Minutes. 8 = 20 Minutes. 9 = 30 Minutes. 10 = 1 Hour. Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: Int 32 Default value 2 (30 Seconds).	Rd. Wr.	Rd. Wr.	Rd. Only
Bi-Direction Velocity	41334 / 2	Integer value that controls how reverse flow velocities are interpreted. 0 = Disabled. Reverse flow velocities are represented as positive numbers. Forward flow velocities are also represented as positive numbers. 1 = Enabled. Reverse flow velocities are represented as negative numbers. Forward flow velocities are represented as positive numbers. (The above assumes that "Velocity Direction Reversal" is disabled.) NOTE: This function should not be enabled if it is likely that the flow will not be clearly in one direction or the other. Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: int32 Default value: 1 (Enabled).	Rd. Wr.	Rd. Only	Rd. Only
Noise Suppression	41338 / 2	Used to help reduce the impact of noise in difficult, or turbulent flow applications. Adjusting the noise suppression level can contribute to an increased signal quality. 0 = Low. 1 = Medium. 2 = High.	Rd. Wr.	Rd. Only	Rd. Only

		Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: Int32 Default value: 1 (Medium Noise Suppression).			
MAMS Cycle count	41340 / 2	Used to adjust the quantity of information required for MainProbe to automatically end a measurement before the specified measurement time has elapsed. For more information on MAMS see section 7. 0 = MAMS Off. 1 = High limit. 2 = Medium limit. 3 = Low limit. Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: Int32 Default value: 2 (Medium limit).	Rd. Wr.	Rd. Only	Rd. Only
Signal Quality Cut Off	41344 / 2	If the signal quality drops below this value, the velocity reading will be considered a failure and the velocity will read as 0. 0=5% 1=10% 2=15% 3=20% 4=20% 0 = 5% 1 = 10% 2 = 15% 3 = 20% 4 = Data type: int32 Default value: 0	Rd. Wr.	Rd. Only	Rd. Only
Fail Holdoff Count	41352 / 2	Represents the number of velocity failures that can occur before the velocity measurand is set to 0, if a failure occurs, the previous velocity value is held until the count is reached. This avoids any minor flow abnormalities being interpreted as valid data. Data type: int32 Default value: 0	Rd. Wr.	Rd. Only	Rd. Only
Velocity Direction Reversal	41354 / 2	When enabled the MainProbe will perform an additive inversion (sign change) on the velocity value for all following velocity measurements. This allows the MainProbe to be installed facing downstream or upstream. 0 = Disabled. Use this setting when the probe is mounted with its nose facing upstream. 1 = Enabled. Use this setting when the probe is mounted with its nose facing downstream. Setting this parameter to any value outside of the above listed values will return the parameter to its default value.	Rd. Wr.	Rd. Only	Rd. Only

		Data type: int32 Default value: 0			
Reboot Product	41370 / 2	When this parameter is set to any value other than its default value the MainProbe firmware will reboot, this parameter will immediately be returned to its default value. Data type: Int32 Default value: 0	Rd. Wr.	Rd. Wr.	None
Restore Default Configuration Settings	41372 / 2	When this parameter is set to a 1 the following parameters will be restored to their default values. Baud Rate Stop Bits Data Bits Parity Modbus Server Address High Byte First High Word First Measurement Time Measurement Interval Bi-Directional Velocity Noise Suppression MAMS Cycle Count Signal Quality Cut Off Velocity Fail Holdoff Count Velocity Direction Reversal Upon being written to, this parameter will immediately restore itself to its own default value. Data type: Int32 Default value: 0	Rd. Wr.	Rd. Only	Rd. Only
Measurements File					
Measurements Complete	41374 / 2	Provides an indication as to whether the probe is currently busy taking a measurement or if the probe has completed taking a measurement. If measurements are requested while the MainProbe is busy taking a measurement, the readings from the previous measurement will be returned. This parameter can be used to ensure that only up-to-date measurements are read. This parameter can also be used to manually force the MainProbe to take a measurement by setting the parameter to a 0. For more information on taking a measurement see section 0. 0 = MainProbe busy taking a measurement. 1 = MainProbe has completed its most recent measurement and the measurands can be read. Set parameter to a 0 to force the probe to take a measurement. Setting this parameter to any value outside of the above listed values will return the parameter to its default value. Data type: Int32	Rd. Wr.	Rd. Wr.	Rd. Wr.

		Default value: 1 (Measurements complete).			
Velocity (mm/s)	41376 / 2	Returns the most recent velocity measurement in mm/s. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity (cm/s)	41378 / 2	Returns the most recent velocity measurement in cm/s. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity (M/s)	41380 / 2	Returns the most recent velocity measurement in M/s. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity (in/s)	41382 / 2	Returns the most recent velocity measurement in in/s. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity (ft/s)	41384 / 2	Returns the most recent velocity measurement in ft/s. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity (ft/min)	41386 / 2	Returns the most recent velocity measurement in ft/min. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Signal quality (%)	41388 / 2	Returns the signal quality of the most recent velocity measurement in %. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Temperature (°C)	41390 / 2	Returns the most recent temperature reading in degrees Celsius. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Temperature (°F)	41392 / 2	Returns the most recent temperature reading in degrees Fahrenheit. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Supply Voltage (V)	41394 / 2	Returns the most recent supply voltage reading in Volts. Data type: Float Default value: 0.0	Rd. Only	Rd. Only	Rd. Only
Velocity signals	41468 / 500	A snapshot of the ultrasonic signals received by the probe during its last measurement. These can be viewed using the MainProbe Communicator software or by manually interpreting the data stored in this parameter. For further details on how this data is structured see section 8: Data type: Int16 Default value: 0	Rd. Only	Rd. Only	Rd. Only
Restore Default Measurement Settings	42624 / 2	When this parameter is set to a 1 the following parameters will be restored to their default values. Measurements Complete Velocity (mm/s) Velocity (cm/s) Velocity (M/s)	Rd. Wr.	Rd. Only	Rd. Only

		Velocity (in/s) Velocity (ft/s) Velocity (ft/min) Signal Quality (%) Temperature (°C) Temperature (°F) Supply Voltage (V) Velocity Signals Histogram If the probe has been connected to the MainProbe Communicator software and you have altered the any of the units in the "Measurements" tab, these units will also be restored to their default settings. Upon being written to, this parameter will immediately restore itself to its own default value. Data type: Int32 Default value: 0			
--	--	--	--	--	--

5: Taking a Measurement

When a “measurement” is taken, the MainProbe will perform a full set of sensor readings and update every measurand on the product.

There are three possible trigger sources that can result in the MainProbe taking a measurement.

- 1: Powering the MainProbe.**
- 2: The measurement interval timer elapsing.**
- 3: Writing a 0 to the “Measurements Complete” parameter.**

When the MainProbe is initially powered, it will automatically take a measurement (Measurement time and all other configuration settings are retained throughout a power cycle, therefore, the measurement will be taken as per any previous configuration). The start-up measurement feature can save power in various scenarios. For example, where a third-party device is used to power the MainProbe at a regular interval and leave the probe unpowered during the interval between measurements.

The interval timer can be set to a variety of intervals, once this interval has elapsed, a measurement is taken (**velocity, signal quality, temperature and supply voltage**).

When a measurement is being taken, the “Measurements Complete” parameter, is set to a **0**, it can be used as an indicator to determine when a measurement has been completed.

Writing a **0** to the “Measurements Complete” parameter will force the device to take a measurement, provided the device is not already busy taking a measurement.

If the “Measurements Complete” parameter is set to a 0 (measurement in progress), and the user also tries to set the parameter to a 0, no additional measurement will be forced or queued. The user should check that the Measurements Complete parameter is set to a 1 (no measurement in progress) before attempting to force a measurement.

Similarly, if the user manually invokes a measurement using the Measurements Complete parameter and the measurement interval timer then elapses, triggering a measurement. This second, interval triggered, measurement will not be performed, and the device will wait for the next interval to elapse before performing another measurement.

The procedure for manual measurement taking should be as follows:

- 1: Check the “Measurements Complete” parameter is set to a 1 (No measurement in progress).
- 2: Write a 0 to the “Measurements Complete” parameter.
- 3: Read the “Measurements Complete” parameter periodically (1s intervals), until the parameter reads back a 1, velocity should not be read.
- 4: If the measurement time is known to the user, you can reduce bus accesses by waiting for at least this duration of time to elapse before re-checking the Measurements Complete parameter.
- 5: Once the measurements are ready the user can read the velocity and the signal quality. Thus if readings are below the desired signal quality they can be discarded.

For standard applications where a velocity reading is taken regularly, it is simpler to set the MainProbe to a preset measurement interval and poll velocity at a regular interval controlled by the Modbus master device. The previously described sequence is only recommended where longer or abnormal durations are required between measurements and the user does not wish to waste any power taking additional measurements. Note that during high measurement times with short intervals, the device may be busy more often than it is not, making access difficult. If it can be avoided, it is better to avoid sending large data requests to the device during a measurement.

6: Access Modes

The MainProbe features an access mode system, the system uses a password (or Access Code) input to provide varying levels of access to the MainProbe's configuration. This means the product can be passed between different users, without the risk of accidental misconfiguration.

6.1: The access modes (Passwords)

- Read Only (0000)**
- User is "Logged out" of the product, although the password "0000" can be used to access this mode, if a wrong password is entered, the MainProbe will default to Read-Only mode. Hence, this mode can be considered as unprotected. In Read-Only mode, no write access is given to any configuration parameters. The user can read measurement data and force measurements (see section 0). This access mode is intended for providing base functions without compromising security or configuration.
 - If an incorrect access code (password) is entered, the MainProbe will automatically default to Read-Only mode.
 - Upon powering-up, the unit will automatically default to Read-Only mode.
 - When the MainProbe Communicator software is closed, the MainProbe is set back to Read Only Mode.

Admin/Advanced (5678)

- An access mode intended for experienced users, or distributors operating a rental service. This access mode provides maximum access to the MainProbe's configuration. Some parameters will still appear as read only. These parameters are intended to be educational, providing feedback to the user as to the configuration of the product. This is a password protected mode.

6.2: Access levels

- Read / write**
- A parameter with this access level will allow the user to see and modify its value in the MainProbe Communicator software and will allow the user to access it using Modbus function codes 03 and 06.
- Read only**
- A parameter with this access level will allow the user to see its value in the MainProbe Communicator software and will allow the user to access it using Modbus function code 03. If the user attempts to access a read only parameter using Modbus function code 06 (write to holding register)

exception code 03 will be returned to the user exception code 03 is used to express a permission violation, (for further details on exception codes, see section 4.2:).

6.3: Communications timeout

To avoid a user leaving the probe logged into Basic mode or Advanced mode, the MainProbe features a communications timeout system. This system monitors the serial communications lines of the product. If a duration of more than **2 minutes 30 seconds** elapses since any data was sent to the MainProbe the unit will default back to Read-Only mode.

6.4: Changing access mode

The MainProbe can be accessed via multiple interfaces, the Access Modes system is governed by the probe itself (not the MainProbe Communicator Software).

Any time an Access Code is submitted to the MainProbe, a request is issued to change the Access Mode. If the MainProbe finds the Access Code submitted to be valid for one of its Access Modes, it will automatically switch to that Access Mode.

There is no issue with entering an Access Code for the Access Mode the MainProbe is currently in (for example, switching from, Basic mode, to Basic mode).

6.4.1: **Using the Modbus interface**

The below sequence is the recommended method for changing the MainProbe Access Mode using a Modbus client device. The Modbus register addresses for each parameter can be found in section 0


- 1: Read the current "Access Mode" and ensure the MainProbe is not already in the desired Access Mode.
- 2: Write a valid Access Code to the least significant word (lowest Modbus Register Address) of the Access Code parameter. The Access Code should be written in hexadecimal format. For an Access Code of "5678" (Admin mode), register 41134, should be set to a value of 22136 (0x5678 in decimal).
- The reply received from the MainProbe when writing to this register, will not echo the value you have written, the Access Code is always masked when read out (see section 0).
- 3: Read the current "Access Mode" to see if the MainProbe has accepted your Access Code. If your Access Code has been accepted the MainProbe will have automatically switched its Access Mode.

For details on the values read out from the Access Mode register, see section 0.

6.4.2: **Using Communicator**

To change Access Mode using Communicator, you must first Scan for your MainProbe and Connect to it, (for more information on connecting to a MainProbe, see section 3). Once connected, navigate to the "Home" tab on Communicator, where you will be shown the current Access Mode, type a valid Access Code into the Access code field and click the Login button (or press the return key).

Communicator 3.1.1

 **mainstream**
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus

Connection

Port: COM3

Options: 19200-8-E-1

Modbus Address: 1

Disconnect

Device

Device Name: Default

Product Type: MainProbe-v RS485 Modbus

Access Level: User

Serial Number: MP00028

Device Info

Hardware

Modbus Address: 1

Mfr Date: 06/05/2021

Product Type: MainProbe-v RS485 Modbus

Hardware Version: 1.02

Unit

Unit Serial: MP00028

Unit Mfr Date: 09/03/2022

Firmware Version: 1.03

Device Name: Default

Application Name: Default

Locale: UK

Access Level


Access Level: User

Access Code: 0000

Login

12:06 30/03/2022

Communicator 4.0.10

 **mainstream**
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus Firmware Update

Connection

Port: COM5

Options: 19200-8-E-1

Modbus Address: 1

Disconnect

Device

Device Name: Default

Product Type: MainProbe RS485

Access Level: User

Serial Number: MP00533

Device Info

Hardware

Modbus Address: 1

Mfr Date: 29/10/2022

Product Type: MainProbe RS485

Hardware Version: 2.00

Unit

Unit Serial: MP00533

Programming Date: 27/02/2023

Firmware Version: 2.14

Device Name: Default

Application Name: Default

Locale: UK

Access Level

Access Level: User


Access Code: 0000

Login

13:51 22/03/2023

After approximately 3 seconds the MainProbe will report a successful change in Access Mode.

Communicator 3.1.1

 **mainstream**
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus

Connection

Port: COM3

Options: 19200-8-E-1

Modbus Address: 1

Disconnect

Device

Device Name: Default

Product Type: MainProbe-v RS485 Modbus

Access Level: Admin

Serial Number: MP00028

Device Info

Hardware

Modbus Address: 1

Mfr Date: 06/05/2021

Product Type: MainProbe-v RS485 Modbus

Hardware Version: 1.02

Unit

Unit Serial: MP00028

Unit Mfr Date: 09/03/2022

Firmware Version: 1.03

Device Name: Default

Application Name: Default

Locale: UK

Access Level


Access Level: Admin

Access Code: 5678

Login

12:25 30/03/2022

Communicator 4.0.10

 **mainstream**
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus Firmware Update

Connection

Port: COM5

Options: 19200-8-E-1

Modbus Address: 1

Disconnect

Device

Device Name: Default

Product Type: MainProbe RS485

Access Level: Admin

Serial Number: MP00533

Device Info

Hardware

Modbus Address: 1

Mfr Date: 29/10/2022

Product Type: MainProbe RS485

Hardware Version: 2.00

Unit

Unit Serial: MP00533

Programming Date: 27/02/2023

Firmware Version: 2.14

Device Name: Default

Application Name: Default

Locale: UK

Access Level

Access Level: Admin

Access Code: 5678

Login

13:51 22/03/2023

If an invalid code is entered, the MainProbe will default back to Read-Only mode and this will be shown on the user interface.

7: Mainstream Adaptive Measurement System (MAMS)

MAMS is a feature new to the MainProbe and allows the probe to adapt to the environment in which it is operating, automatically reducing its power consumption where possible. While still upholding the same reliable measurement standards found on all Mainstream products.

Fundamentally, the MAMS system allows the MainProbe to finish a measurement early if a suitable amount of velocity information has been acquired by the sensor.

The MainProbe measures the flow velocity by processing the ultrasound signals reflected from tracers (air bubbles & particulate matter etc.) carried by the flow.

At a high flow velocity more tracers are carried past the sensor in a time interval than at a low velocity. Consequently, at a high flow velocity the sensor receives information at a higher rate than at a low velocity. It may be possible to reduce the sampling time (and therefore the power used) by reducing the MAMS Cycle Count parameter so that the optimum number of readings are taken for that particular environment.

MAMS works by basing each velocity measurement on processing the same fixed quantity of information. When this information limit has been reached the measurement is terminated (regardless of whether the probe has been run for the full specified measurement time). Thus, as the velocity increases, MAMS automatically reduces the measurement time.

By basing each velocity measurement on a fixed quantity of information, the MAMS feature ensures that Mainstream delivers consistent measurement performance under all flow conditions and, whenever possible, reduces the measurement time which saves power.

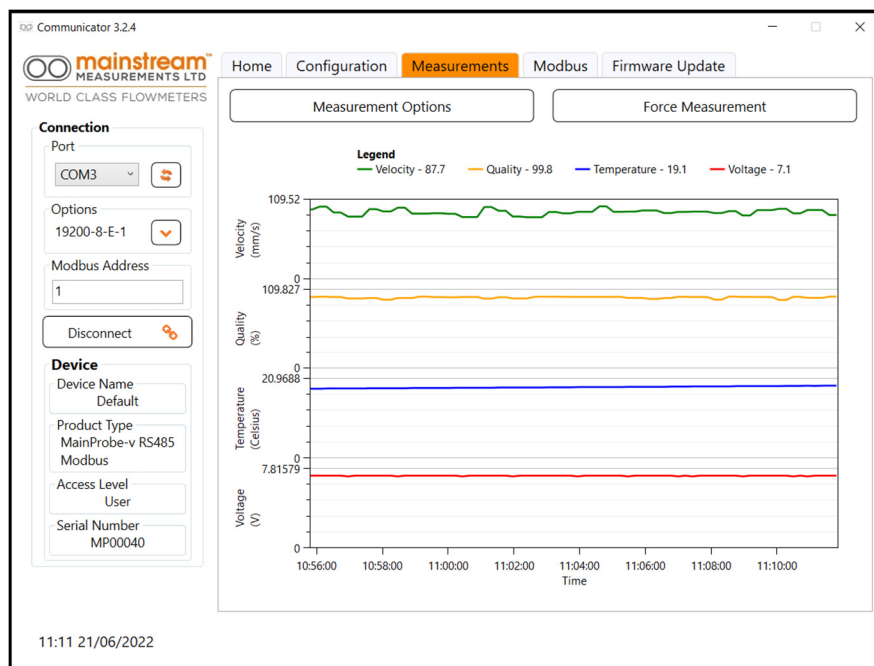
This fixed quantity of information required to complete a measurement can be controlled by the user using the MAMS Cycle Count parameter, more information on how to access this parameter can be found in section 0.

8: Diagnostics

There are tools in Communicator to aid installation and check the correct running of the MainProbe. Even if using a RTU or data logger after set-up by Communicator. These can be split into 2 areas, measurement and communication.

8.1: Measurement

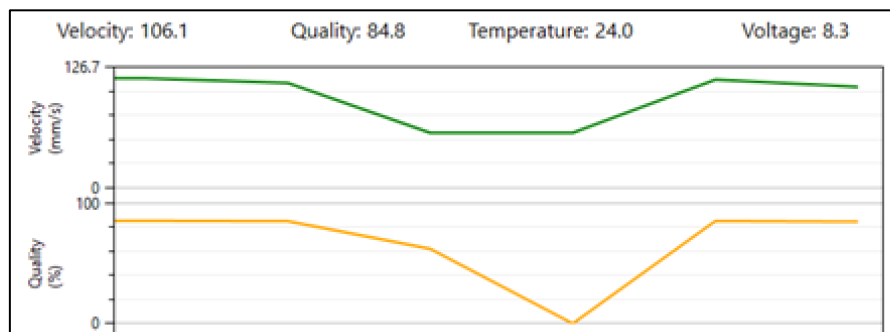
The Measurements tab as described in section 3, shows a collection of real-time data collected since the Communicator was connected to the MainProbe.



By selecting which graphs are displayed an operator can focus on one particular aspect and have an increased X-Axis.

8.1.1: Signal Quality

The Quality Graph shows the Signal Quality that the MainProbe has associated with the velocity measurements it has taken at that moment (the time being indicated at the bottom of the graph).



The graph will update automatically, and hence it will easily show if poor signal quality has been achieved. It will be possible to move the MainProbe and check the effect on the graph until Quality improves, or at least is at its maximum for any particular installation.

During the installation phase (as always) it is possible to press Force Measurement to make the probe carry out a measurement after having moved the probe.

The example above shows a dip in the signal quality at 14:54:15 which then resolves some seconds later. Although the velocity also drops at the same moment one can infer that this is because the quality has dropped also.

Possible issues seen with these diagnostics:

- The probe itself may be faulty.
- If the quality level goes to zero then check that the probe is submerged.
- If the graph changes level showing differing values over a short time then the probe may be submerged in silt/sludge or similarly obscured..

8.1.2: Modbus/RS485 Communication

The probe provides a clear way to debug Modbus communications. There is a Modbus tab which provide access to a real-time display of Modbus messages going to and from the Probe.

The MainProbe is a Modbus slave device so all communication is initiated by the Master (In this context Communicator).

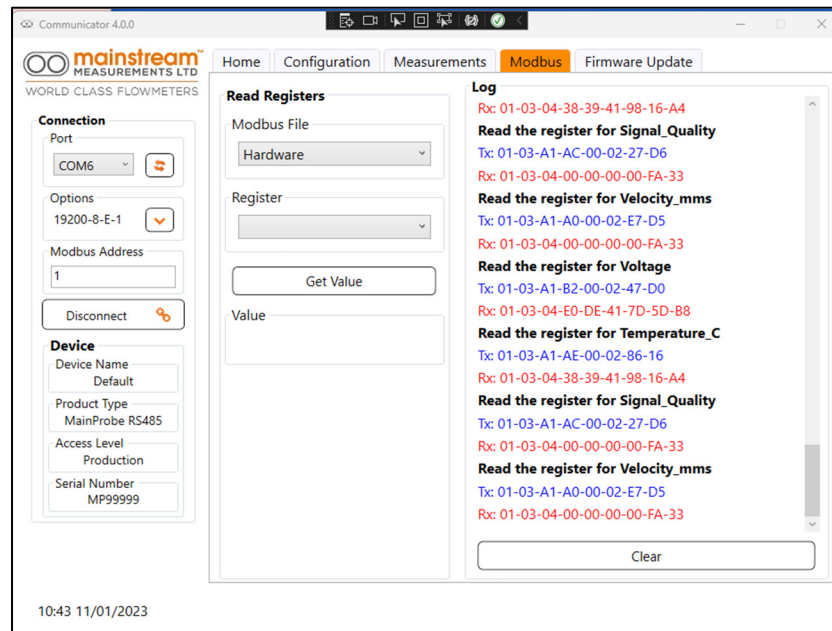
The on-screen log will display messages given by the following example:

Read the register for Velocity_mms

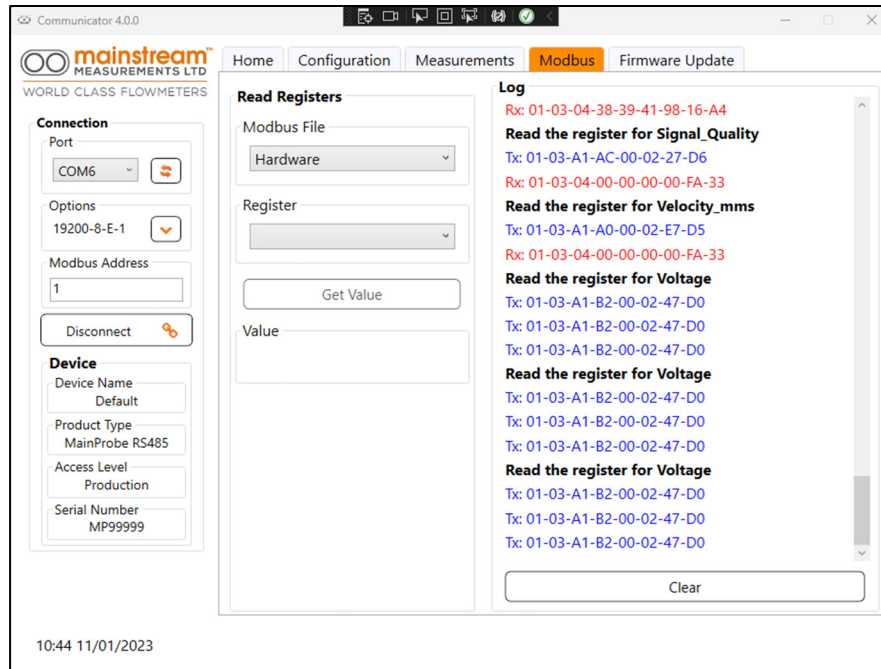
Tx: 01-03-A1-A0-00-02-E7-D5

Rx: 01-03-04-00-00-00-00-FA-33

Here the outgoing (Communicator to Probe) message is in red, and the response is in blue. More examples in the screen below.



When the bus fails Communicator will retry (up to its retry count), and this is shown here:



This screen shows the Read Voltage Register message failing because the communication bus has been severed. The outcome is the log shows only outgoing blue messages and no incoming red ones.

If the Communicator has not been Disconnected by the user then when the bus is restored, Communicator will automatically continue.

9: Updating MainProbe Firmware

It may be necessary to upgrade the firmware on your MainProbe.

You will be supplied firmware by Mainstream Measurements. This firmware should be placed in the Binaries folder under the Communicator software.

For example, if Communicator is installed in:

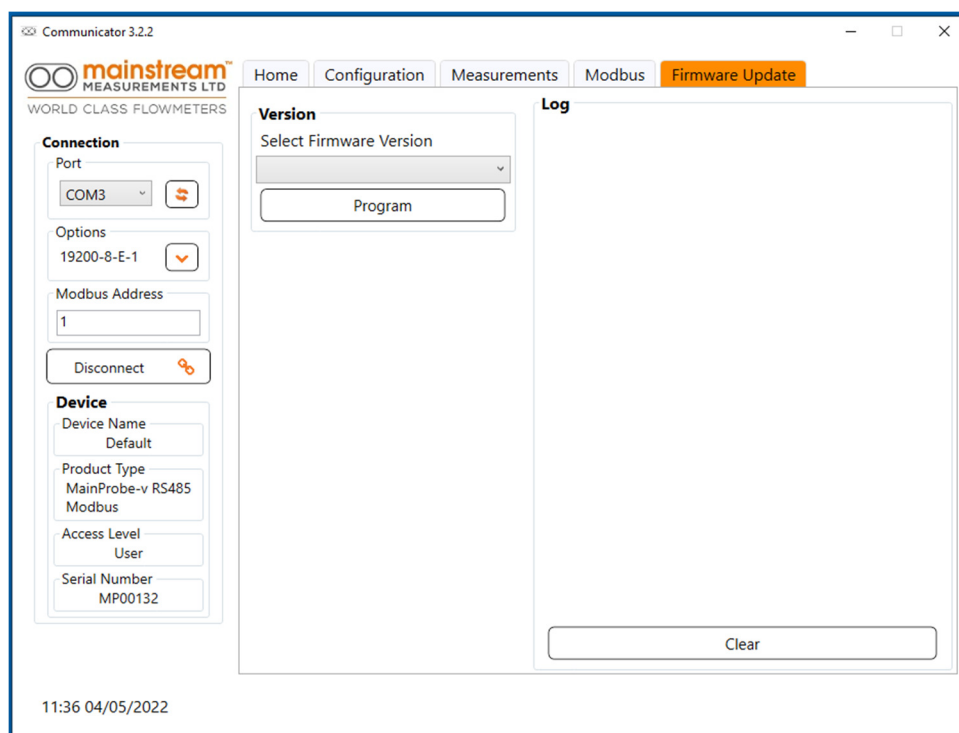
C:\Program Files\Mainstream Measurements\MainProbe Manager v4.0.9B

Then install the new firmware file into


C:\Program Files\Mainstream Measurements\MainProbe Manager v4.0.9B\Resources\Binaries

Once the file is stored in this folder you can run Communicator and navigate to the Firmware Update tab. In this tab you will be able to select the Firmware Version you require (usually the most up to date version) as per the figure below.

Once you press the Program button the software will take about 20 seconds to perform the update. During this time, you should not disconnect the MainProbe or power the MainProbe or the PC down.



Communicator 4.0.10

 **mainstream**TM
MEASUREMENTS LTD
WORLD CLASS FLOWMETERS

Home Configuration Measurements Modbus **Firmware Update**

Connection

Port
COM5

Options
19200-8-E-1

Modbus Address
1

Disconnect

Device

Device Name
Default

Product Type
MainProbe RS485

Access Level
Admin

Serial Number
MP00533

Version

Select Firmware Version

Program

Log

Clear

13:52 22/03/2023

Version

Select Firmware Version

MP1.03

MP1.04

10: Mechanical specifications

Materials: Streamlined PVC-U moulding and polyurethane cable

Dimensions: 105 mm long x 50 mm wide x 20 mm high

Cable: Six core with 2 x power; 2 x twisted pair comms; screened

Weight: 850 gm including standard 10 m cable length

Max cable length: 500 m

Environmental protection: Totally encapsulated to IP68

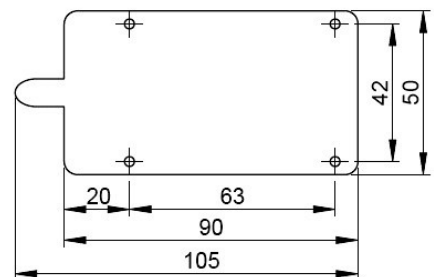
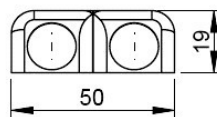
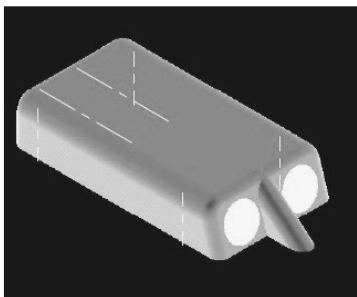
Operating temperature: -10°C to 80°C

11: Installation of the MainProbe

The Mainstream MainProbe sensor consists of a streamlined injection moulded μ PVC body 105 mm long x 50 mm wide x 19 mm high. The sensor operates immersed in the flowing liquid. The maximum working temperature of the sensor is 85°. At the front of the sensor facing in to the flow are two “eyes” which use ultrasound to interrogate the moving liquid. The sensor body contains circuits to generate this ultrasound and process the ultrasonic signals. The Mainstream velocity sensor is connected to the system unit via a reinforced cable that supplies electrical power to the velocity sensor and carries data back to the system unit. The standard length of velocity sensor cable is 10 metres. Sensors can be supplied with longer cable lengths up to a maximum of 500 metres. Increasing the length of the velocity sensor cable does not degrade flow measurement performance.

11.1: Dimensions and fixing template

Below are the dimensions of the velocity sensor in addition to centre distances for the M3 threaded inserts for fixing the sensor to the support used for installation. The M3 fixing screws for the sensor should of a length not greater than 4-5 mm + the thickness of the support plate used.



11.2: Installation

The velocity sensor is designed to operate immersed in liquid; therefore it is usually installed at the bottom of the channel or pipe where the measurement is to be taken. To this effect there are supports and accessories available depending on the installation required, i.e. for circular pipe sections, semi-circular pipe sections, and rectangular or trapezoidal channel sections.

11.3: Equipment for installing the sensor

To install the sensor in a flat-bottomed rectangular or trapezoidal channel, support plates are fixed to the bottom of the channel using bolts or brackets that meet the specific requirements.

To install the sensor in channels or pipes where it is not possible to stop flow, a support bracket can be used for the velocity sensor. The sensor is anchored to a square tube which will ensure the correct positioning of the sensor with respect to the flow and which can be easily removed for maintenance purposes.

11.4: Equipment for installing the sensor in circular pipe sections

To install the velocity sensor in circular pipe sections, suitable ring supports in stainless steel can be used, complete with an upper expander which allows the ring to be expanded against the internal walls of the pipe. (Please note we do not supply these)

The lower base of the ring has the sensor anchoring holes, and the cable should be fastened with cable ties along the ring perimeter, which exit from the upper part of the pipe, to avoid the creation of any obstructions to flow.

It is advisable to cover the semi-section of the ring where the cable passes with high strength adhesive tape, to protect the cable better and increase the hydrodynamics of the support.

The upper expander makes it possible to reduce the ring diameter for easy insertion into the pipe. Subsequently opening it provides a high level of strength combined with increased grip against the internal pipe surfaces. This makes it possible to keep the sensor in the correct position, with as little obstruction as possible in the pipe.

Visit the following URL link for examples of sensor installation and where to install the sensor.

<https://mainstream-measurements.com/wp-content/uploads/2021/01/Example-of-Sensor-Installation.pdf.pdf>

12: Technical reference

12.1: Velocity sensor

Resolution: 1mm/s

Operating range: -5 m/s to -10 mm/s and 10 mm/s to 5 m/s

Minimum operating depth: 30mm

Zone of inspection:

Processing time:

12.2: Temperature sensor

Resolution: 0.1°C

Accuracy: +/-0.5°C

Measurable temperature range: -10°C to 80°C

12.3: Power supply sensor

Resolution: 10mV

Accuracy: +/-100mV

12.4: Miscellaneous

Startup time: ~60ms

Measurement processing time: ~400ms (per 1 of measurement time.)

Power consumption: 31mA whilst measuring and less than 4.2mA idle

12.5: Compliance

MainProbe has been tested for compliance to CE and UKCA standards and the results are shown below:

Test	Standard	Level	Performance
Radiated Emission	EN 61326-1	30MHz to 1GHz	Class B
ESD	EN 61000-4-2	4kV contact, 8kV air	Criteria A
Radiated RF Immunity	EN 61000-4-3	80MHz to 2.7GHz @ 10V/m	Criteria A
EFT	EN 61000-4-4	1kV	Criteria A
Conducted RF Immunity	EN 61000-4-6	150kHz to 80MHz @ 10V	Criteria A

13: Appendix – Best Use of The MainProbe

13.1: Siting the MainProbe

For best results careful siting of the MainProbe is essential. We recommend the following

- If possible have around 2-3 metres of water without obstacles ahead of the Probe.
- Do not have the Probe within range of a pipe bend or other obstruction.
- Do not use more than one ultrasonic device in the same flow – unless they are pointing in different directions away from each other.
- For best results the water flow should be laminar.

13.2: Power efficiency

When controlled from the Communicator application the Probe will be powered continually, however using other equipment, for example an RTU, it may be possible to power-up the Probe, take a reading and power it down. Therefore, the average power consumption will be greatly reduced.

13.3: Measurement efficiency

The Probe takes approximately 1.7s to perform a measurement. Therefore, although setting a poll time of less than 2s is possible it is not effective.

14: Appendix – Known Issues in Software and Firmware

14.1: Modbus Address Handling

All versions of MainProbe firmware up to and including 1.04 have the following issue.

If resetting the Modbus address the MainProbe will immediately, upon writing to Register 41144 (Modbus Server Address), use that new Modbus address. Consequently, there will be a discontinuity between the communication settings of the host and the Probe and the two will disconnect.

To reconnect with your equipment (or Communicator) you must use the new Modbus Server Address in your Comms settings. You will then regain communication.

If you then want to change other comms settings (for example baud rate) you can do so, and then use the Update Communications register to action this (41146), alternatively you can use the Reboot Product register (41370) to perform a Probe reboot (This is very fast) which will accomplish the same thing.

14.2: Communicator: Disconnected Behaviour

When running Communicator, you should explicitly 'Disconnect' from the device when you need to. There is an issue where, if the device is powered down, Communicator will continue to operate as if it is connected. The consequence is that although readings will cease, when the unit is repowered Communicator will immediately resume. It will not show that there has been a dropout and will give the impression that the readings have been continuous.