FLUENTA

Document number: 72.120.601
Document title: FGM 160 Operating Instructions

Scope:	ISO 9001:2015 §8.6 Release of products and services

Additional Information (when applicable):

Due to Inmetro certification requirements any update to this document must be followed by Portuguese translation and update of document 72.120.613.

Rev. index	Issue date	Reason for issue	Author	Review	Review	Review by QA	Approved
G	2020.12.17	Updated dual-path terminology	SPA	ST	-	KO	ST
F	2019.03.15	Updated to include FGM 260 System	NB	MW	ST	MM	MM
E	2018.09.17	Updated Abbreviations and removed O&SC	AK	NB	MR	MM	MB
D	2014.01.20	Proofread and updated	JB	AP	CT	MB	MW
C	2013.01.30	Removed from User Manual, updated: changes in text formatting; modifying graphics in Appendix II and Electronic modules	MKJ	KH	-	MW	MW
B	2009.06.02	Updated information	AAJ	RT	N/A	N/A	AAJ
A	2007.11.30	Issued for Fluenta release; moved to User Manual	MS	RT	-	N/A	AAJ

Replacement for:	**n/a**	Total pages: **28**
Fluenta source doc. (for translations):	**n/a**	

TABLE OF CONTENTS

1. PURPOSE

This document describes the Fluenta Flow Computer, FGM 160, hardware and software, and includes instructions for operating the device.

The FGM 160 flow computer can used in a flare gas meter system which employs 1 pair of ultrasonic sensors (the FGM 160 Flare Gas Meter), or in a flare gas meter system which employs 2 pairs of ultrasonic sensors (the FGM 160 dual-path configuration).

2. ABBREVIATIONS/DEFINITIONS

2.1 Abbreviations

FGM	Flare Gas Meter
TFS	Transducer Full Size
DCS	Distributed Control System

2.2 Definitions

FGM 160	Fluenta FGM 160 flow computer
FGM 160 System	Fluenta FGM 160 flare gas meter (single pair of sensors)
FGM 160 Dual-Path Configuration	Fluenta FGM 160 flare gas meter (two pairs of sensors)
TFS Series	Ultrasonic sensors based on the TFS. See document 72.050.001 for details on this range
Transducer	The term ‘Transducer’ is used interchangeably with ‘Sensor’ in the context of the FGM160.

3. GENERAL INFORMATION

3.1 Hardware Description

The FGM 160 flow computer, illustrated in figure 1, is designed as a distributed system. The FGM 160 consists of five or six modules, the Digital Signal Processing (DSP) module, the Analog Front End (AFE) module, the Pressure & Temperature (P&T) module, Input/Output (I/O) module, Intrinsic Safe Barrier (IS Barrier) module, Surge Protection module and the Local Display. A distributed system gives several advantages. This design will be more flexible with respect to future expansions and modifications, as the total processing load for the system can be divided in several modules. Thus, the danger of overloading a single CPU unit is reduced.

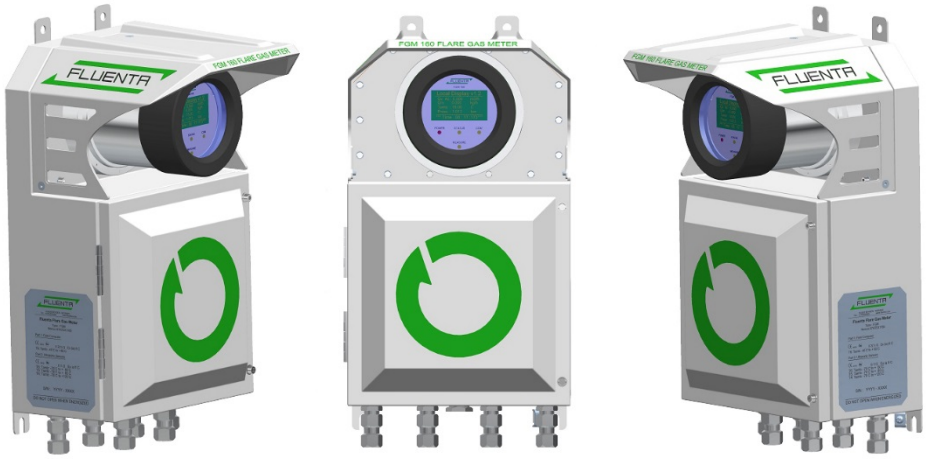


Figure 1: *FGM 160 Flow Computer*.

The FGM 160 is certified for operation in a Hazardous Area.

For detailed information regarding Hazardous Area installation and operation, please refer to Fluenta Doc. no. 62.120.006 (Hazardous Area Installation Guidelines [1]) and 75.120.215 (FGM 160 Hazardous Area Certificates [2]).

The FGM 160 flow computer is designed for use in flow measurement systems that employ 1 pair of ultrasonic sensors (a single path system) or two pairs of ultrasonic sensor a (a dual-path configuration). Simplified diagrams of the two configurations are shown in figure 2 and 3, respectively.

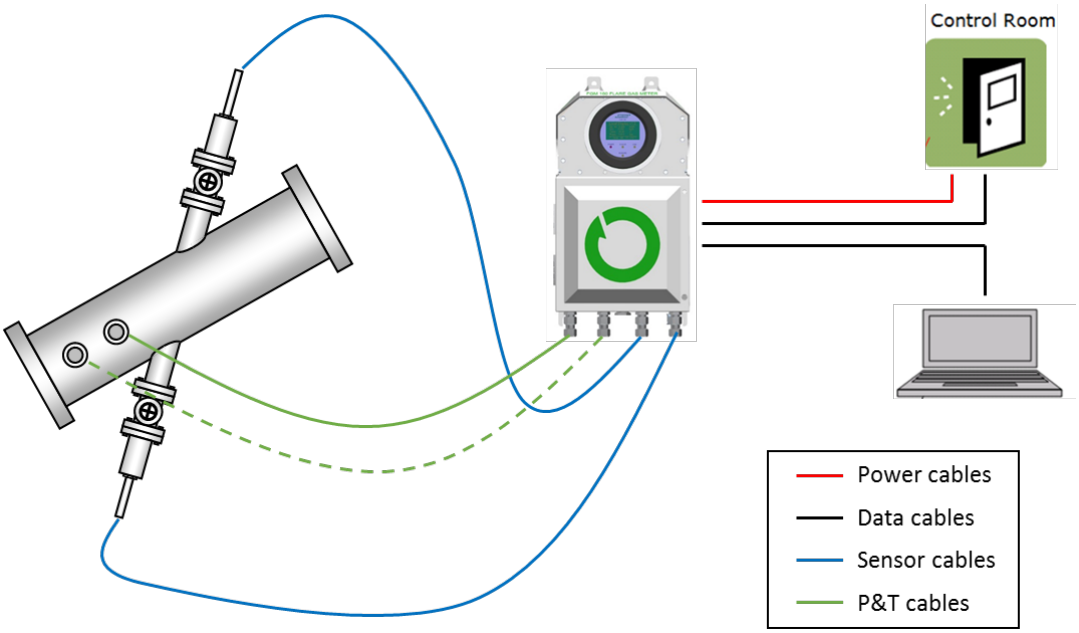


Figure 2: *FGM 160 Flare Gas Meter – hook-up diagram*.

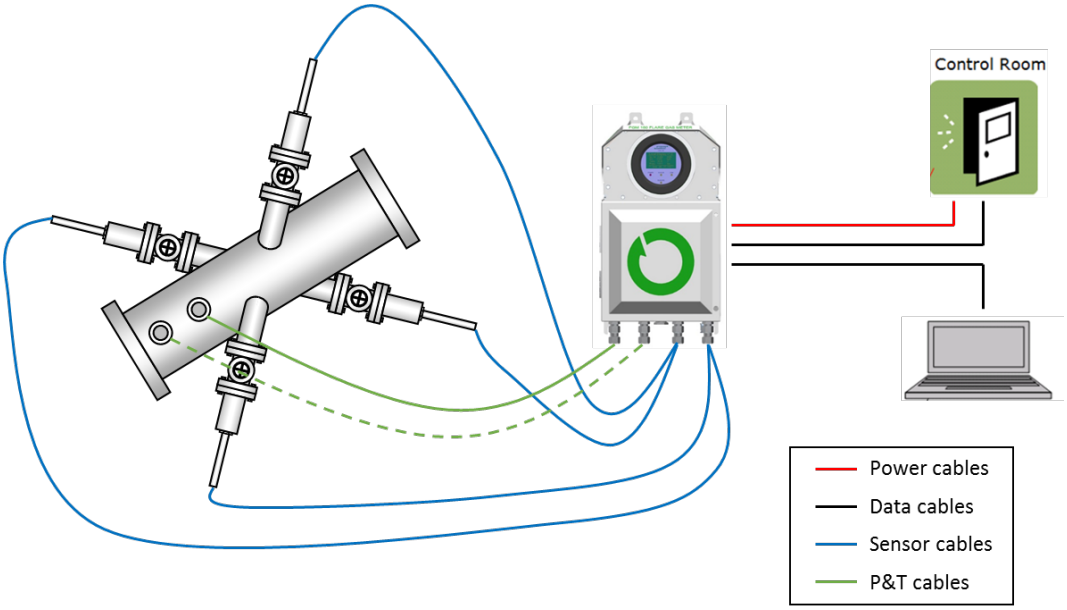


Figure 3: *FGM 160 Flare Gas Meter in dual-path configuartion – hook-up diagram.*

3.1.1 Electrical Connections

For detailed information regarding all electrical connections, please refer to Installation & Hook-Up Instructions [3].

3.1.2 Power Supply

The FGM 160 flow computer requires 24 Vdc power supply (nominal). If 24 Vdc is not available, an optional 110-230 Vac/24 Vdc converter can be supplied by Fluenta.
For detailed equipment information and equipment ratings, please refer to Hazardous Area Installation Guidelines [1].

3.1.3 Input Signals

3.1.3.1 Ultrasonic Transducers

FGM 160 ultrasonic transducers are connected to the FGM 160 flow computer by means of prefabricated signal cables included.

3.1.3.2 Pressure and Temperature Transmitters

The FGM 160 flow computer can be configured to accept analog 4-20 mA transmitters or HART compatible transmitters. The pressure and temperature transmitters may be omitted if the system is configured to get the pressure and temperature data from the DCS system (Modbus communication link).

3.1.4 Output Signals

3.1.4.1 Modbus Communication (RS-485)

The FGM 160 flow computer has two separate Modbus communication ports.
One is dedicated for communication with a DCS system. The second is a service port for configuration and monitoring of the FGM 160 system.
In the FGM 160 Foundation Fieldbus configuration, DCS Output is disabled.

3.1.4.2 Foundation Fieldbus Output

A maximum of four (4) parameters can be predefined according to customer requirements. The list of parameters available for the customer can be found in Fluent AS doc. No. 72.120.305 (all parameters available by using Modbus Serial Interface are accessible using Foundation Fieldbus output).

3.1.4.3 Current Loop Outputs

Up to six (6) current loop outputs are available for output of selectable parameter values, where three (3) analog outputs are configured as the default. The 4-20 mA current loop output channels can be configured as active or passive outputs.
4-20 mA Outputs are replaced by FF Outputs in FGM 160 Foundation Fieldbus Configuration.

3.1.4.4 HART Output

One of the current loop outputs can be also configured for HART output communication. Refer to HART Output Interface Specification [5] for details.

3.1.4.5 Pulse/Frequency Output

The FGM 160 flow computer can be also configured to provide a pulse or frequency output signal. The pulse output will represent an incrementation of the totalizer (of e.g. volume or mass), whereas the frequency output will represent a process parameter (e.g. volume flow rate, mass flow rate etc.)

3.1.5 Electronic Modules in FGM 160 Flow Computer

3.1.5.1 Digital Signal Processing (DSP) Module

The Digital Signal Processing module is the processing module in the system. The DSP Module generates the ultrasound measurement signals and controls the measurement sequences. It collects data from the other module registers and performs flow calculations based on this data. All calculated parameters are stored in defined registers. All of these registers are available for UFM Manager software through the Modbus service port at the I/O Module. A selection of these registers is also available for the DCS system (through the DCS port at the I/O Module).

3.1.5.2 Analog Front End (AFE) Module

The Analog Front End Module is the interface between the DSP Module and the ultrasonic transducers via the IS-Barrier unit. At the AFE Module, measurement signals are multiplexed and switched between upstream and downstream direction.

3.1.5.3 Pressure & Temperature (P&T) Module

The Pressure & Temperature Module collects pressure and temperature information from external sensors via 4-20 mA current loop or HART Interface. All pressure and temperature data are stored in predefined registers available for the DSP Module. Accordingly, the DSP unit can retrieve P&T parameters in a minimum amount of time.

3.1.5.4 Input/Output (I/O) Module

The Input/Output Module is the interface between the FGM 160 flow computer in hazardous areas and equipment in safe areas. At the I/O Module, 24 VDC (nom.) supply voltage is converted to the required operational voltages for the other modules. Furthermore, all signals and communications to and from the DCS system and UFM Manager are handled by this unit.

3.1.5.5 Intrinsic Safety Barrier (IS Barrier) Module

The Intrinsic Safety Barrier Module ensures the intrinsic safety for operation of the ultrasonic sensors mounted in hazardous area. In addition, the IS-Barrier Module includes safety barriers for the P&T transmitters. Therefore, the P&T transmitters with “Ex i” certification can be interfaced directly to the FGM 160. For specifications regarding the P&T transmitter barriers, please refer to Hazardous Area Installation Guidelines [1].

3.1.5.6 Surge Protection Module

The Surge protection Module protects the power input and the signal output lines from externally generated spikes, surges and overvoltage.

3.1.5.7 Local Display Module

The Local Display (LD) Module is the front unit, visible through the Ex-d safety glass. At the LD, a set of predefined metering process parameters can be viewed. In addition, four LEDs give the status of Power, Alarms, Measurement and Communication.

3.1.6 Non-Resettable Counter Function

The non-resettable counter function will record and keep the totalized volume and mass. The totalized values are accessible through the DCS Modbus interface or through UFM Manager.

Figure 4: *FGM 160 flow computer electronic modules*.

3.2 Firmware Description

In the following sections a general description of the firmware for the different modules is outlined.

3.2.1 DSP Module

- The DSP Module initializes the system at start-up. Tasks are set to initial states and the system is ready for operation.
- The signals transmitted by the ultrasound transducers are generated by the DSP Module. The sequencing is controlled by this module, and, depending on the velocity of the medium in the pipe, either both Chirp and CW signals or just Chirp signals are used for the flow measurements. One ultrasonic transit time measurement is always succeeded by an ultrasonic transit time measurement in the opposite direction.
- Data sampling and signal processing are carried out after a specified number of sequences. Then, the DSP module calculates the difference in transit time measurements and calculates the parameters available in the FGM system.
- Flow velocity and volume flow rate calculations run continuously, calculating new values based on data from the P&T module and transit time measurements from the ultrasonic transducers.
- Gas density and mass flow calculations are calculated based on calculated velocity of sound and measured pressure and temperature.
- Volume and mass totalizing calculations are continuously updated based on volumetric and mass flow rate calculations.
- All system configuration parameters are stored in the Flash memory (non-volatile memory) at the DSP Module.

- The DSP Module carries out self-checking and evaluation of input and calculated parameters.

3.2.2 P&T Module

- The P&T Module continuously collects pressure and temperature values from the external pressure and temperature transmitters mounted downstream of the FGM 160 flow computer. These readings are used in calculations performed by the DSP module.
- In addition to the external temperature reading, the P&T also reads the internal temperature value. This value is used to monitor the internal temperature in the Ex-d enclosure.

3.2.3 I/O Module

- The I/O Module handles all signals and communication with systems in Safe Area.
- Data requests and commands from UFM Manager are processed by the I/O Module. A predefined number of accessible parameters are available from the FGM. Accessible parameters depend on whether 4-20 mA, HART or Modbus is utilized.
- Software downloads to the DSP-, P&T- and I/O Module are carried out by the I/O-module.
- All data requests from DCS system are handled by the I/O Module; either through Modbus or HART interfaces.

3.3 Device Integrity

3.3.1 Self-Checking

The FGM 160 flow computer performs a self-checking sequence, where it checks that inputs from the transducers and Temperature and Pressure transmitters are within a valid range, and that other functions are operating as intended.

3.3.2 Watchdog Timer

The Watchdog Timer is initialized at start-up, and cannot be disabled, ensuring that in the unlikely situation of system hang-up occurring, the Watchdog Timer will reset the system forcing a complete reboot and start-up.

3.3.3 Flash Memory

System configuration is stored in Flash Memory (non-volatile memory). In case of a power break, all system configurations are reloaded from the Flash memory

3.4 Configuration and Operating Software

Via the Ultrasonic Flare Meter Manager software (UFM Manager), the operator can monitor process data, configure the meter and specify process data to be saved to a data log file for later analysis. UFM Manager further enables the operator to operate the meter remotely, by using e.g. a RS 485/TCP/IP converter and remote-control software.
It should be noted, UFM Manager is required to replace the default settings with actual applicable settings provided by customer. Fluenta service engineers and partners will always

set up the FGM 160 system according to the latest submitted parameters from the Client during installation and commissioning. Fluenta service engineers and partners always have the UFM Manager with them.

4. OPERATING PROCEDURE

4.1 Introduction

This section provides information about how to operate the FGM 160 flow computer. The FGM 160 flow computer does not require any safe area communication device in order to operate. However, in order to continuously monitor data and the meter performance, it is recommended to use the UFM Manager software package. This program will provide hands-on process and status data continuously with possible remote access to the FGM 160 flow computer from any remote system with the appropriate remote-control software installed.

4.2 Power-Up Sequence

The power-up sequence describes the necessary handling of the FGM 160 flow computer in order to ensure correct operation. The power-up sequence is as follows:

1. Connect all power, input and output signals and communication cables according to the project specification and all relevant procedures and instructions.
2. Make sure that the power cable is connected to a suitable power source, either directly to a 24 Vdc supply or through a 110-240 Vac/24 Vdc converter.
3. Turn on the power to the FGM 160 flow computer. There is no power switch on the FGM 160 flow computer, so the power must be switched by an external switch or similar, preferably in safe area.
4. On startup, the FGM 160 will go through a boot and an initialization sequence before entering the standard operational (measurement) mode.
5. When the FGM 160 has entered the standard operational (measurement) mode, the meter will, according to the system configuration, carry out transit time measurements, retrieve pressure and temperature data, calculate volumetric and mass flow rates and either actively output a set of predefined parameters at the analog 4-20mA outputs, or make a set of process parameters available for DCS HART or Modbus communication.

4.3 Flow Computer Configuration

The FGM 160 flow computer can be configured by using UFM Manager. During manufacturing, default configuration is entered into the flow computer. The system configuration will be modified by Fluenta service engineers or partners when installing and commissioning the meter. This configuration can be changed at any time by using The UFM Manager software. All system configuration parameters are stored in a non-volatile memory, ensuring that no configuration parameters are lost in case of power loss. Appendix II explains how to insert or modify system configuration according to a Client parameter list.

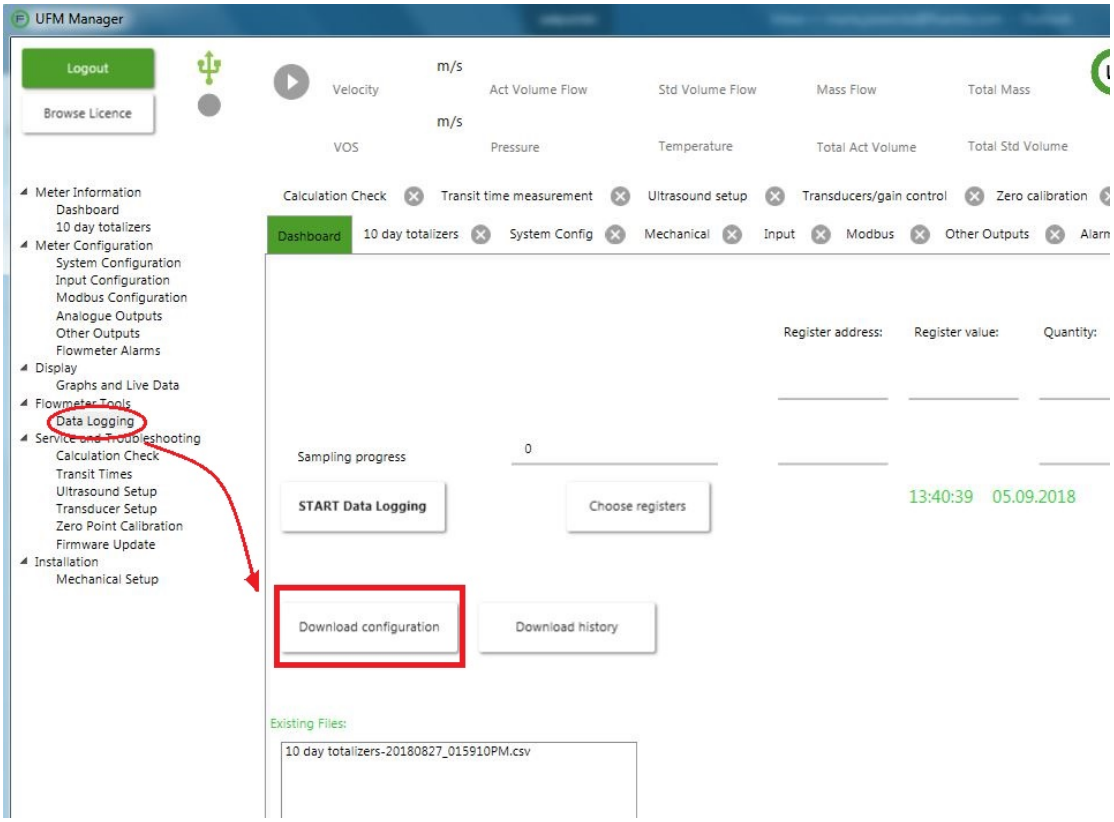


Figure 5: *Download of system configuration using the UFM Manager*.

The system configuration parameter file can be downloaded from the FGM 160 flow computer using the UFM Manager (figure 4) by pressing the “Download configuration” button in the “Data Logging” tab. The system configuration can either be copied to the clipboard and pasted into a document or saved directly to a file.

For a full listing of a system configuration file, refer to Appendix I.

Some of the system configuration parameters are also available through the DCS Modbus registers. However, parameters that should only be accessed by authorized personnel are not accessible through this communication line. For a full listing of accessible configuration parameters through the DCS Modbus interface, refer to DCS Modbus Interface Specifications [4].

4.4 Local Display Functions

The FGM 160 flow computer is equipped with a local LCD display mounted at the front, and visible through the Ex-d safety glass. The display shows predefined process parameters from the FGM 160. Further, 4 status LEDs are visible at the front for the following status information:

- **Power**
  This LED will have a green light when the system power is ON.

- **Status**
  This LED will light:
  GREEN; if no Alarms are active (system status OK).

- **Comm**
  This LED will light:
  GREEN; during Modbus frame reception or sending.

- **Meas**
  This LED will blink GREEN at a regular cycle, indicating that ultrasonic measurement cycle sequence is active.

4.5 Error Check and Troubleshooting

The operator should not perform extensive troubleshooting beyond the scope that is described in this section. For repair and module replacement, contact Fluenta AS.

Fluenta AS
Haraldsgate 90
P.O. Box 420
N-5501 Haugesund
NORWAY

Phone: +47 21 02 19 27
E-mail: support@fluenta.com

NOTE!

Before any work can be carried out with the FGM 160 flow computer, a hot work permit must be obtained.

Do not connect or disconnect any signal wires unless the power is turned OFF!

Do not open the Ex-d enclosure containing the field electronics in hazardous area, without making sure first that the conditions permit such action. Preferably, and as a general rule; the Ex-d enclosure should only be opened indoors in e.g. a workshop in safe area.

4.5.1 Error Check with Local Display

As described in Section 4.4, Four (4) LEDs are visible at the front with status information. If one or more of these LEDs do not have a GREEN light color indicating OK status, the following status is present, and actions should be taken:

- **Power**
  Indication: The LED is not ON (no green light).
  Status: System Power is OFF, or LED does not work.
  Action: Check that the system Power wires are connected and that 24 VDC is present at the power input terminals.

- **Meas**
  Indication: The LED is steady OFF or steady GREEN.
  Status: The FGM 160 is not in standard operational (measurement) mode.

Action: Check the Alarm log for any error messages indicating any cause for the problem. Turn the system Power OFF and ON again. If the situation remains unchanged, contact Fluenta AS for guidance.

4.5.2 Error Check with UFM Manager

Via the UFM Manager, data can be logged for trend analysis and evaluation.

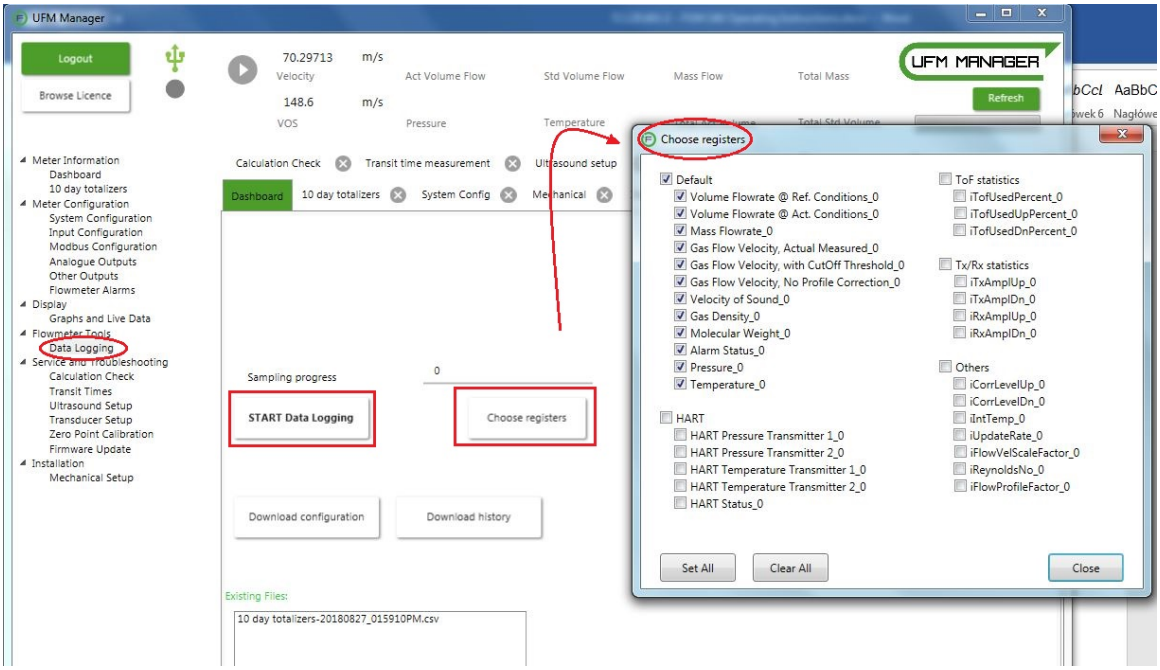


Figure 6: *By pressing the "START Data Logging" button at the "Data Logging" tab, any or most parameters can be logged to a data file. The data log file name will be generated automatically based on the current date and time. The registers for the data log can be chosen by pressing the "Choose registers" button.*

5. REFERENCES

[1] FGM 160 – Hazardous Area Installation Guidelines
[2] FGM 160 – Hazardous Area Certificates
[3] FGM 160 – Installation & Hook-Up Instructions
[4] FGM 160 – DCS Modbus Interface Specifications
[5] FGM 160 – HART Output Interface Specification

6. APPENDIX I – SYSTEM CONFIGURATION FILE

```
**********************************************************
**********************************************************
******************                                ***************
******************          Fluenta AS            ***************
******************    FGM 160 parameter list      ***************
******************                                ***************
**********************************************************
**********************************************************

UFM Manager ver.:          1.040

Field Computer, date and time: 2011-01-17   09:13:25

***************************************
********** System Parameters **********
***************************************
Field Computer Type:       FGM 160
Serial number:                  2006-0102
Tag number:                1-TAG-1
Company:                        FLUENTA AS
Installation:                   Sandbrekkeveien 85
Description:                    10" LP Flare

System Configuration:           Single system (ch1)
Local Display:             Not installed <- You have to change it manually
SW Version DSP:                 0.052           to version number that is installed
SW-app Version I/O:        1.007           using AVR Studio
SW-boot Version I/O:       0.006
SW-app Version P&T:             0.257
SW-boot Version P&T:            0.005


*****************************************
********** Communication Parameters **********
*****************************************

**************** DCS communication **********
-------------------------------------------------------------
DCS Modbus Communication:       Enabled
Slave address:                  224
Type:                           RTU
Baud rate:                      38400
Data bits:                      8
Parity:                    No Parity
Stop bit:                       2
Register Values:                32 bit floating point (IEEE-754)
Register size in request:       32 bits
Register base address:          1000

**************** HART communication **********
-------------------------------------------------------------
```

HART Output Communication: Enabled
Poll address: 1
Primary Variable: Total Volume @ Ref. Conditions
Secondary Variable: Volume Flowrate @ Ref. Conditions
Tertiary Variable: Temperature
Quaternary Variable: Pressure

********** Service port **********

Slave address: 1
Type: RTU
Baud rate: 38400
Data bits: 8
Parity: None
Stop bits: 2
Register Values: 32 bit floating point (IEEE-754)

****
********** System Configuration **********
****

Pipe diameter: 0.3800 m
Transducer distance (M): 0.5370 m
Transducer angle: 45.0 deg

******* Units *******
Velocity: m/s
Volume: m3
Volume flow: m3/h (Cubic meter pr. hour)
Mass: kg
Mass flow: kg/h
Pressure: BarA
Temperature: Celsius

Log time for 24h acc. values: 06:00:00

****
********** Input Signal Parameters **********
****
Pressure input Current Loop (4-20mA)
Temperature input Current Loop (4-20mA)
Current loop ranges
Temperature, 4mA value: 255.15 [Kelvin]
Temperature, 20mA value: 533.15 [Kelvin]
Pressure, 4mA value: 1.013 [BarA]
Pressure, 20mA value: 12.044 [BarA]

Current loop calibration coefficients
Temperature, offset: 0.0070

Temperature, scale: 0.9963
Pressure, offset: 0.0220
Pressure, scale: 0.9980

Alarm limits
Temperature, Hi limit: 533.15 [Kelvin]
Temperature, Lo limit: 255.15 [Kelvin]
Pressure, Hi limit: 12.044 [BarA]
Pressure, Lo limit: 1.013 [BarA]

****
********** Output signal parameters **********
****

******** Current loops, 4-20mA ********
Current loop 1, Parameter: Volume Flowrate @ Act. Conditions
Current loop 2, Parameter: Molecular Weight
Current loop 3, Parameter: Testvalue Current Loop 3
Current loop 4, Parameter: Testvalue Current Loop 4
Current loop 5, Parameter: Testvalue Current Loop 5
Current loop 6, Parameter: Testvalue Current Loop 6

Current loop ranges
Current loop 1, 4mA value: 0.00
Current loop 1, 20mA value: 2124000.00
Current loop 2, 4mA value: 0.00
Current loop 2, 20mA value: 50.00
Current loop 3, 4mA value: 4.00
Current loop 3, 20mA value: 20.00
Current loop 4, 4mA value: 4.00
Current loop 4, 20mA value: 20.00
Current loop 5, 4mA value: 4.00
Current loop 5, 20mA value: 20.00
Current loop 6, 4mA value: 4.00
Current loop 6, 20mA value: 20.00

Current loop calibration coefficients
Current loop 1, offset: -0.1217
Current loop 1, scale: 0.9980
Current loop 2, offset: -0.1647
Current loop 2, scale: 1.0045
Current loop 3, offset: -0.1633
Current loop 3, scale: 1.0018
Current loop 4, offset: -0.2105
Current loop 4, scale: 1.0025
Current loop 5, offset: -0.0232
Current loop 5, scale: 1.0078
Current loop 6, offset: -0.1358
Current loop 6, scale: 1.0058

****
******** Measurement/Signal Parameters *******
****

CW velocity limit up (CW/Chirp -> Chirp): 15 m/s
CW velocity limit down (Chirp -> CW/Chirp): 14 m/s
Chirp Pattern: LinFM
Chirp Limit1 (ArcTan FM -> Lin FM): 25 m/s
Chirp Limit2 (Lin FM ->ArcTan FM): 50 m/s

Low cutoff velocity: 0.05 m/s
Max. velocity: 100 m/s
Min. velocity: 0 m/s
Max. velocity jump: 50 m/s

Max. sound velocity: 500 m/s
Min. sound velocity: 250 m/s
Max. sound velocity jump: 70 m/s

Historical sound vel. weight factor: 40.0

Z Standard: 1.000
Z Operational: 1.000
Ref Temperature (std. conditions): 15.00 ºC
Ref Pressure (std. conditions): 1.01325 BarA

****
******** Sensor Calibration Parameters *******
****

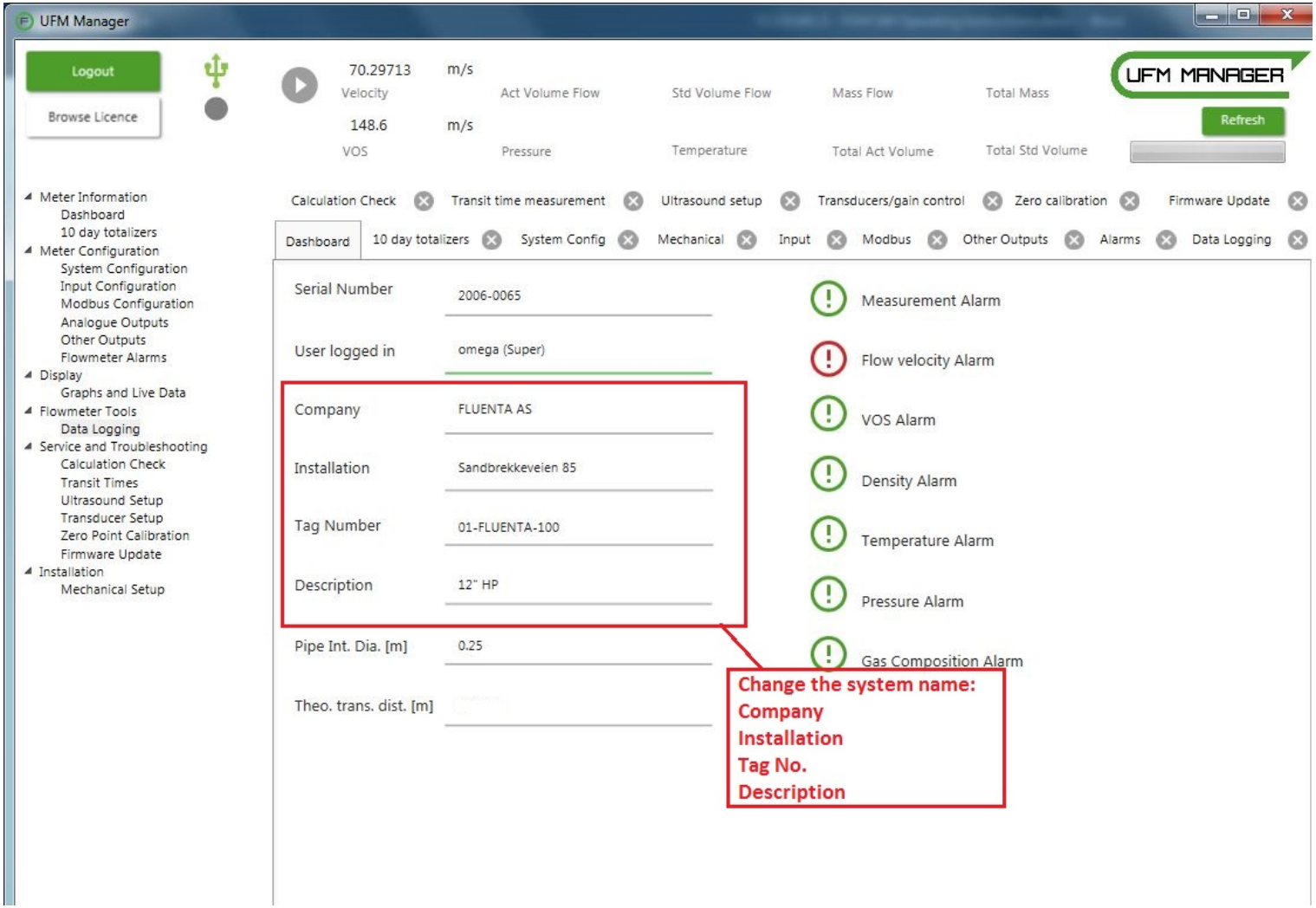
Serial No., Upstream Transducer (A): 022U-11
Serial No., Downstream Transducer (B): 022D-11

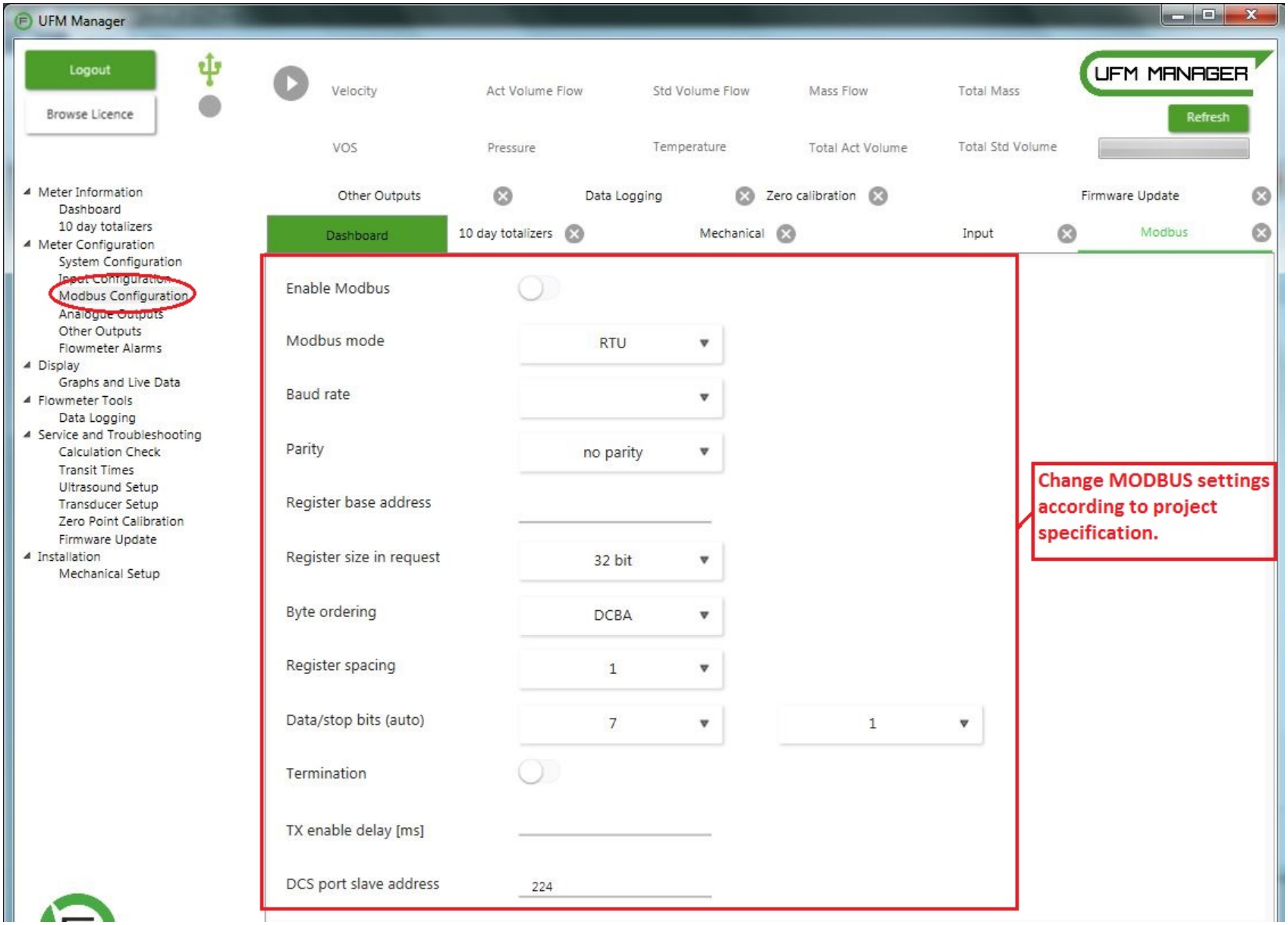
CW frequency: 68.00 kHz

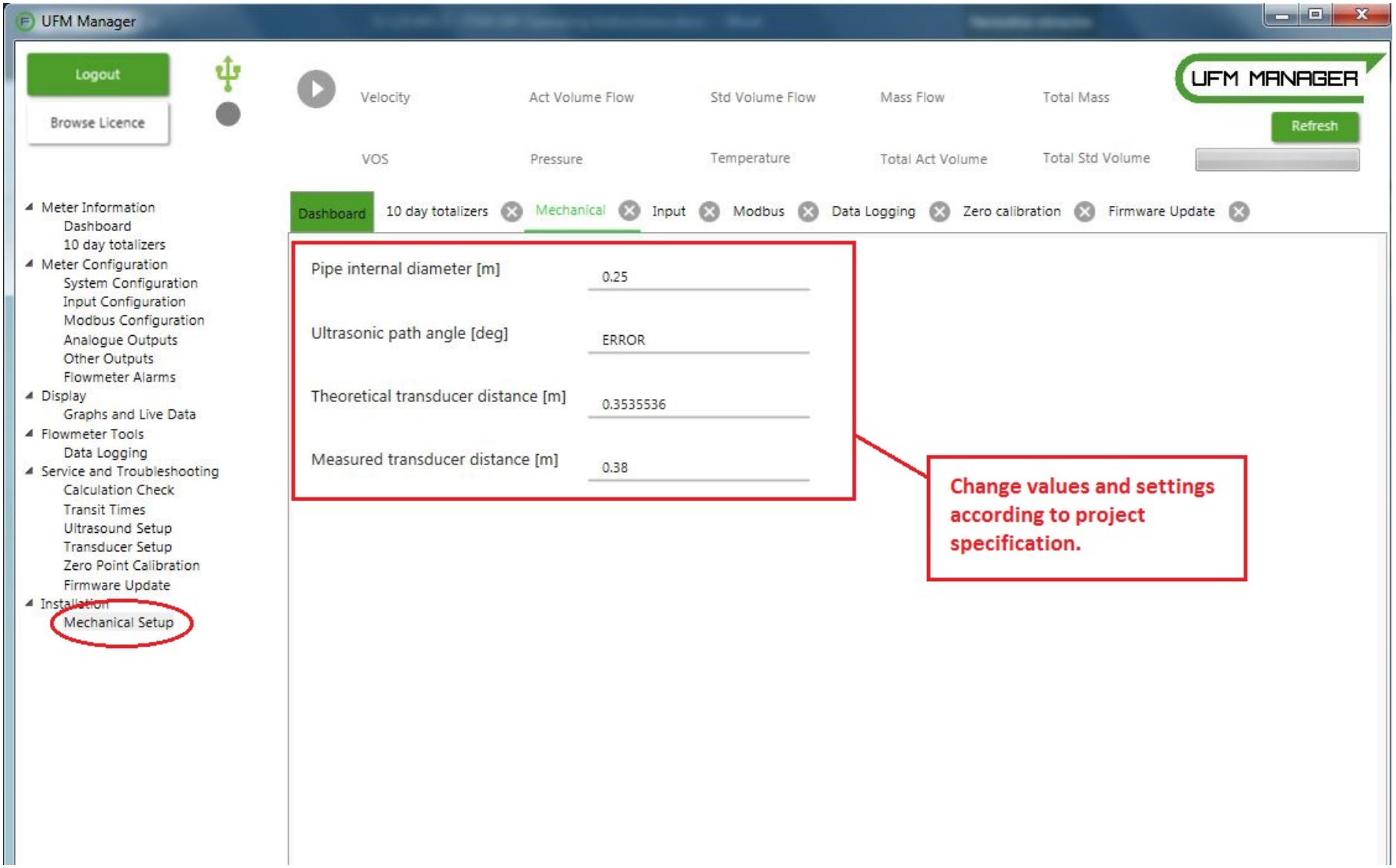
*** Transducer delays (calibration coefficients) ***
Chirp upstream: 31818.0 nsec
Chirp downstream: 33318.0 nsec
CW upstream: 12557.0 nsec
CW downstream: 12576.0 nsec
Delta CW correction: 0.0 nsec

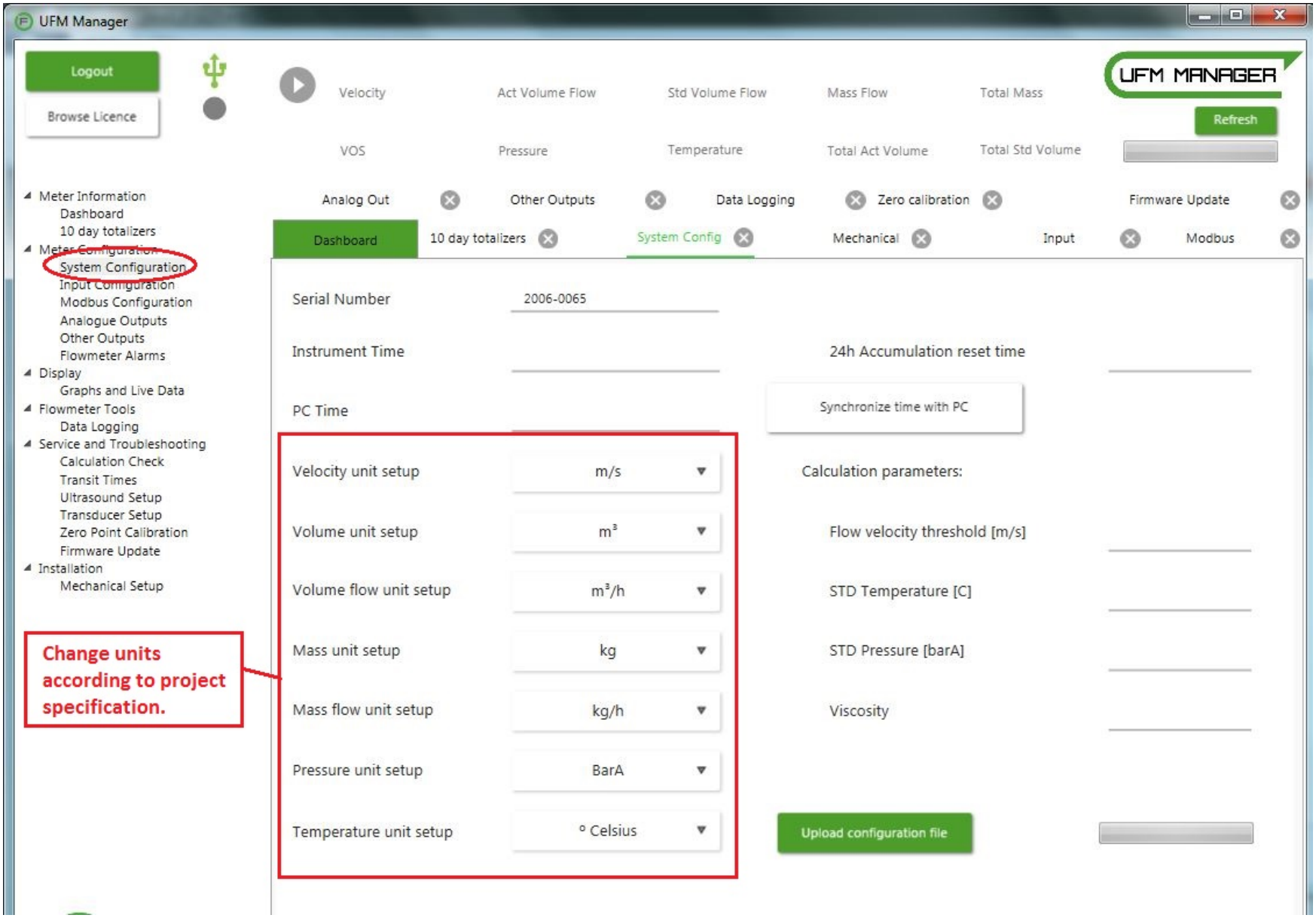
---------- END ----------

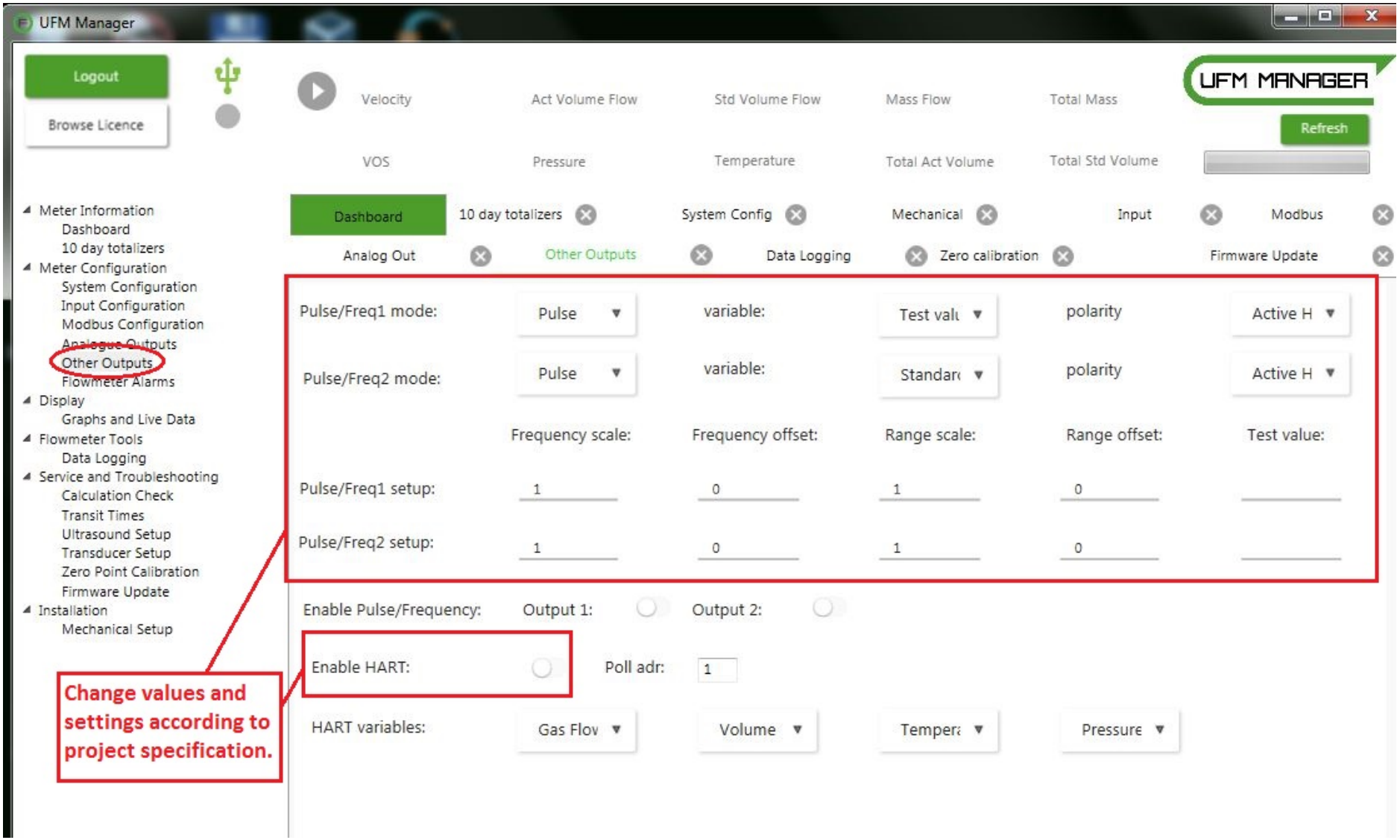
7. APPENDIX II – INSERTING SETTINGS FROM CLIENT PARAMETER LIST

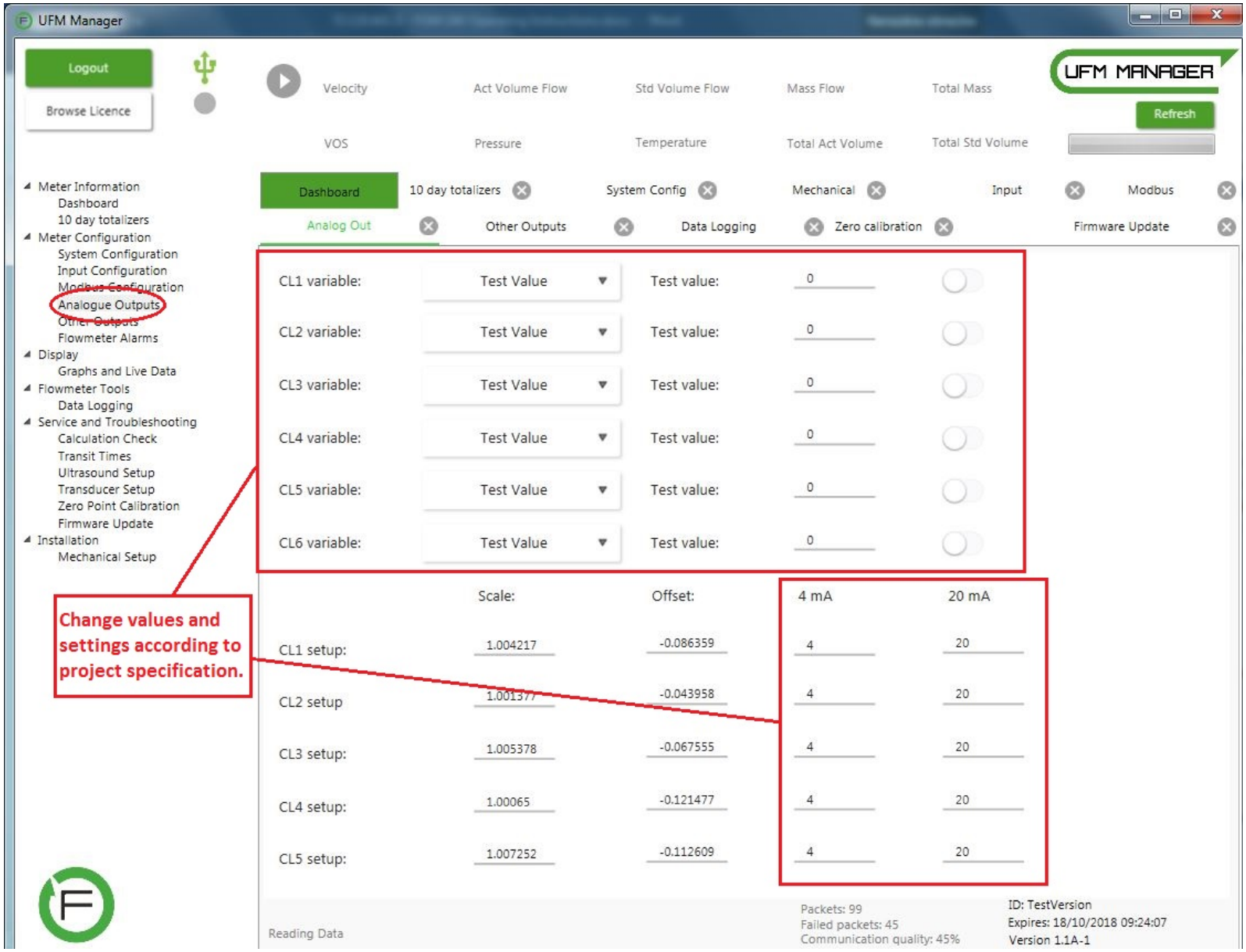


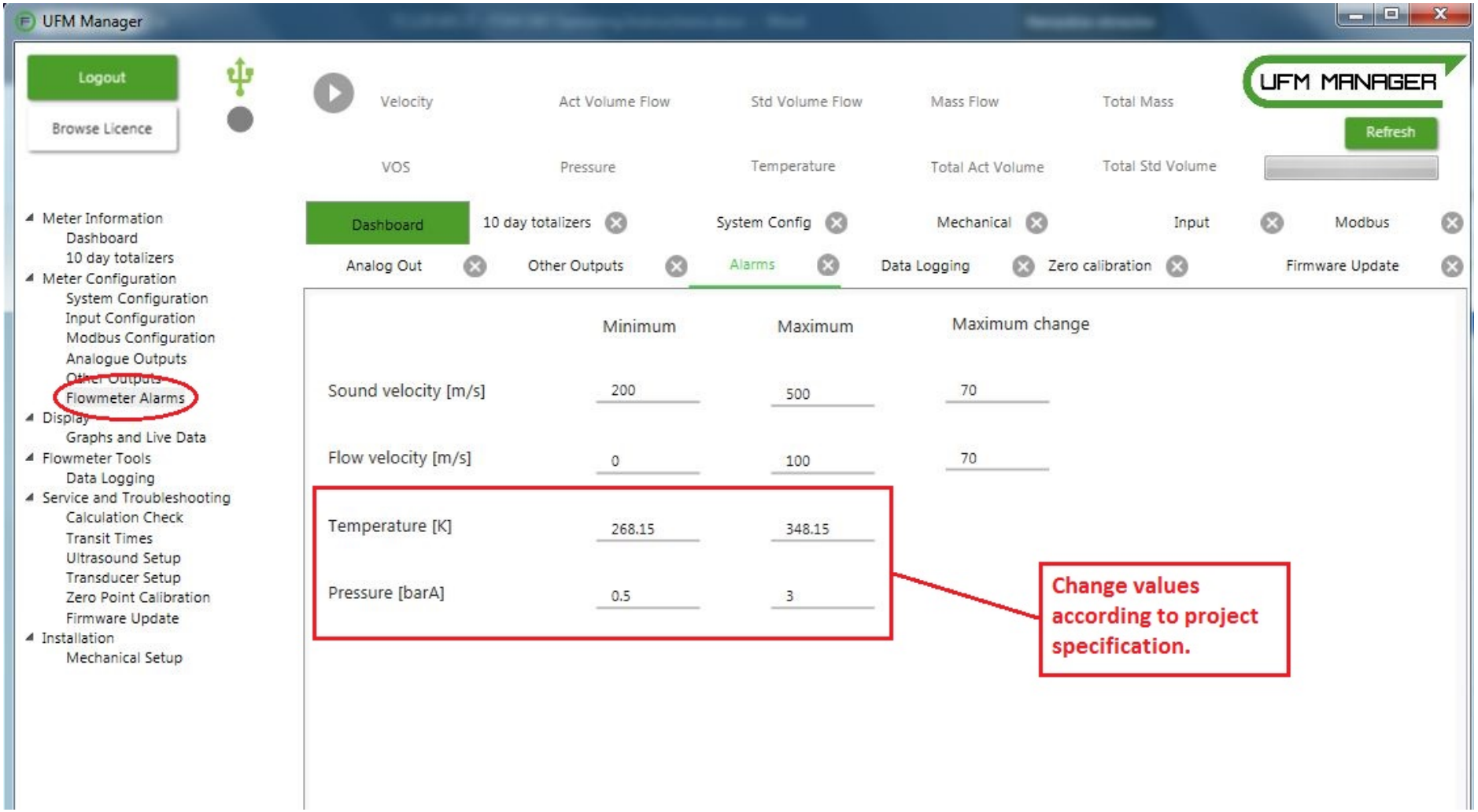

UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Other Outputs
Data Logging
Zero calibration
Firmware Update
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
Mechanical
Input
Modbus
Enable Modbus
Modbus mode
RTU
Baud rate
Parity
no parity
Register base address
Register size in request
32 bit
Byte ordering
DCBA
Register spacing
1
Data/stop bits (auto)
7
1
Termination
TX enable delay [ms]
DCS port slave address
224
Change MODBUS settings according to project specification.

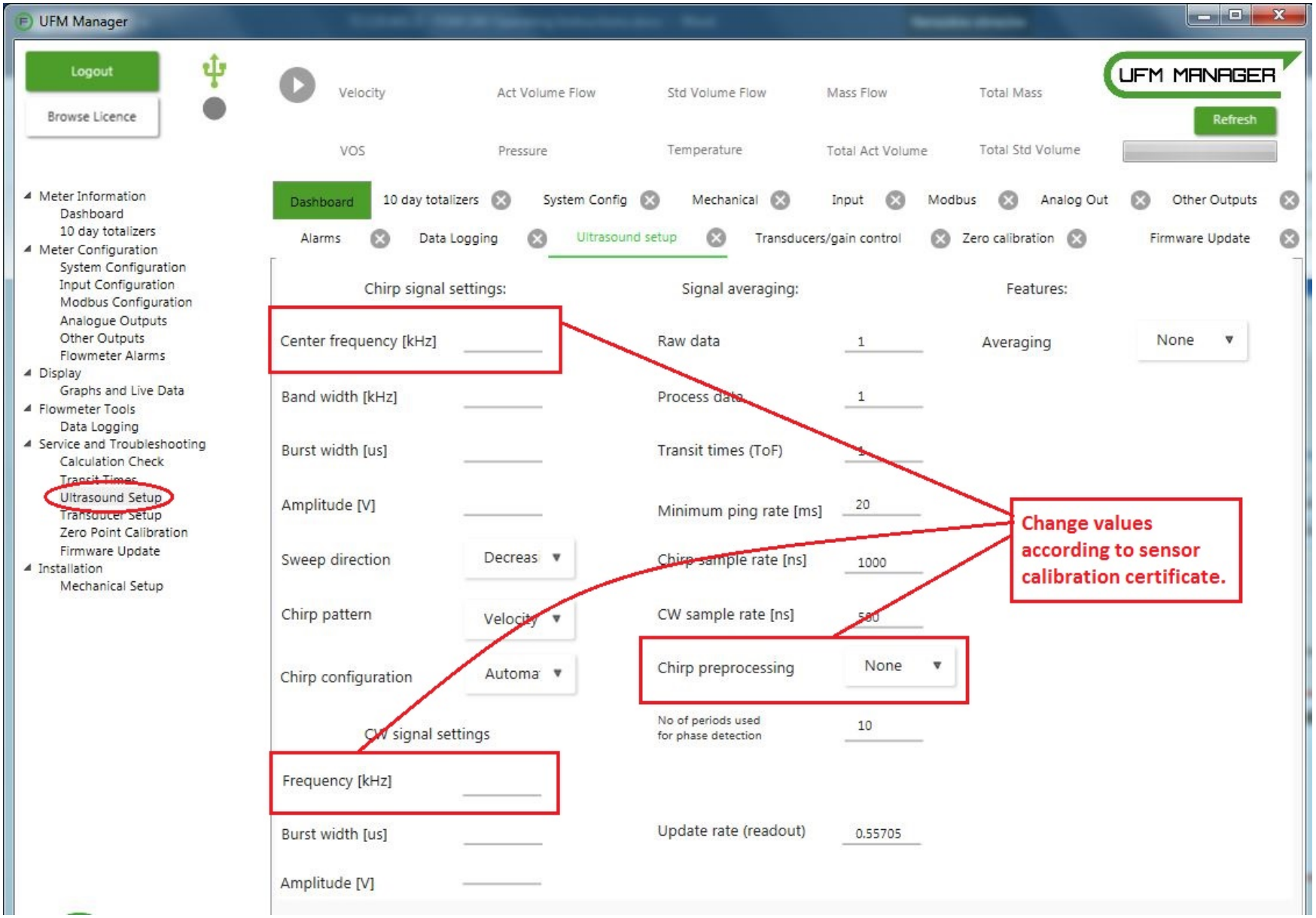

UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
Mechanical
Input
Modbus
Data Logging
Zero calibration
Firmware Update
Pipe internal diameter [m]
0.25
Ultrasonic path angle [deg]
ERROR
Theoretical transducer distance [m]
0.3535536
Measured transducer distance [m]
0.38
Change values and settings according to project specification.

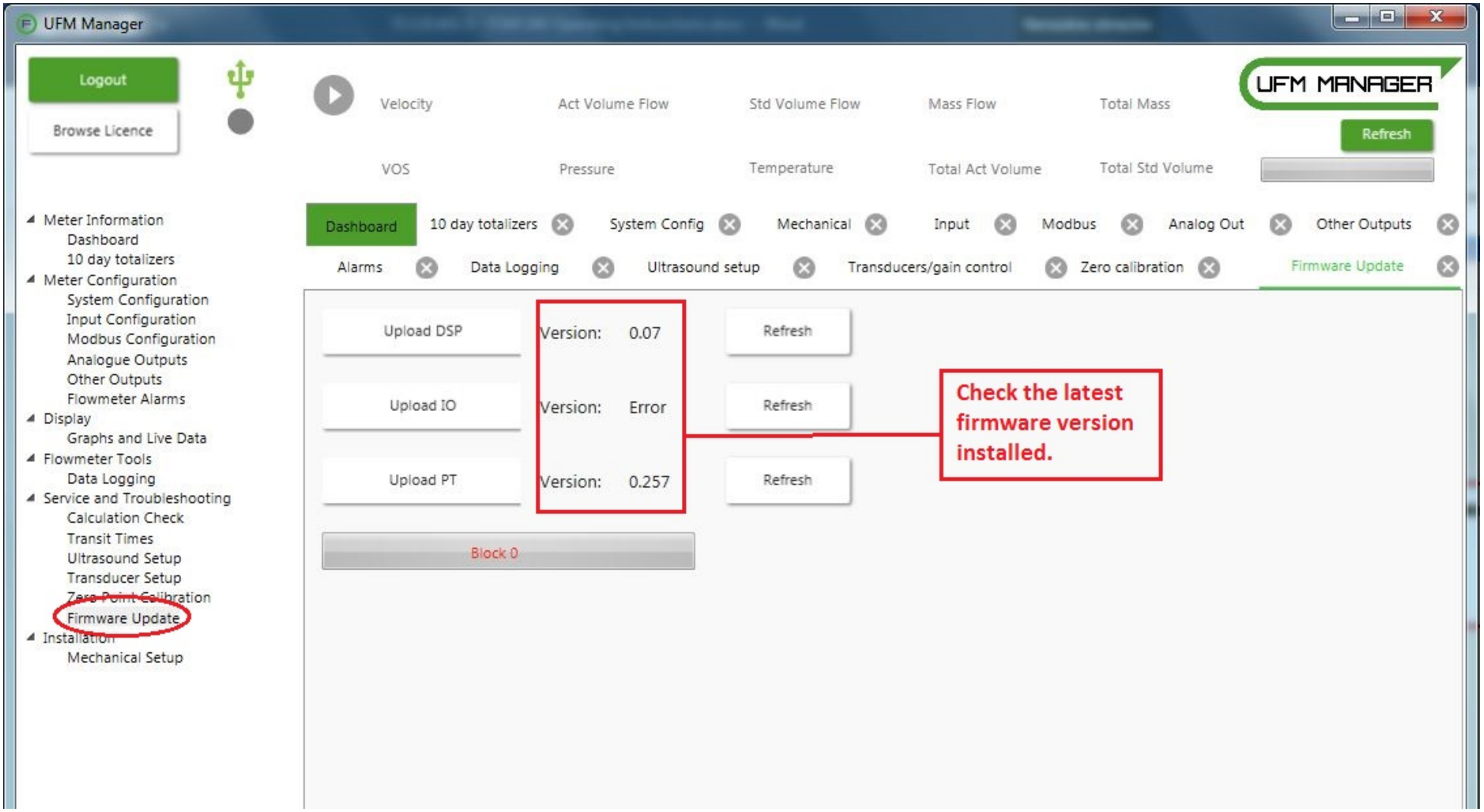

UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Analog Out
Other Outputs
Data Logging
Zero calibration
Firmware Update
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Serial Number
2006-0065
Instrument Time
24h Accumulation reset time
PC Time
Synchronize time with PC
Velocity unit setup
m/s
Volume unit setup
m³
Volume flow unit setup
m³/h
Mass unit setup
kg
Mass flow unit setup
kg/h
Pressure unit setup
BarA
Temperature unit setup
° Celsius
Calculation parameters:
Flow velocity threshold [m/s]
STD Temperature [C]
STD Pressure [barA]
Viscosity
Upload configuration file
Change units according to project specification.


UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Analog Out
Other Outputs
Data Logging
Zero calibration
Firmware Update
Pulse/Freq1 mode:
Pulse
variable:
Test val
polarity
Active H
Pulse/Freq2 mode:
Pulse
variable:
Standar
polarity
Active H
Frequency scale:
Frequency offset:
Range scale:
Range offset:
Test value:
Pulse/Freq1 setup:
1
0
1
0
Pulse/Freq2 setup:
1
0
1
0
Enable Pulse/Frequency:
Output 1:
Output 2:
Enable HART:
Poll adr:
1
HART variables:
Gas Flov
Volume
Temper
Pressure
Change values and settings according to project specification.

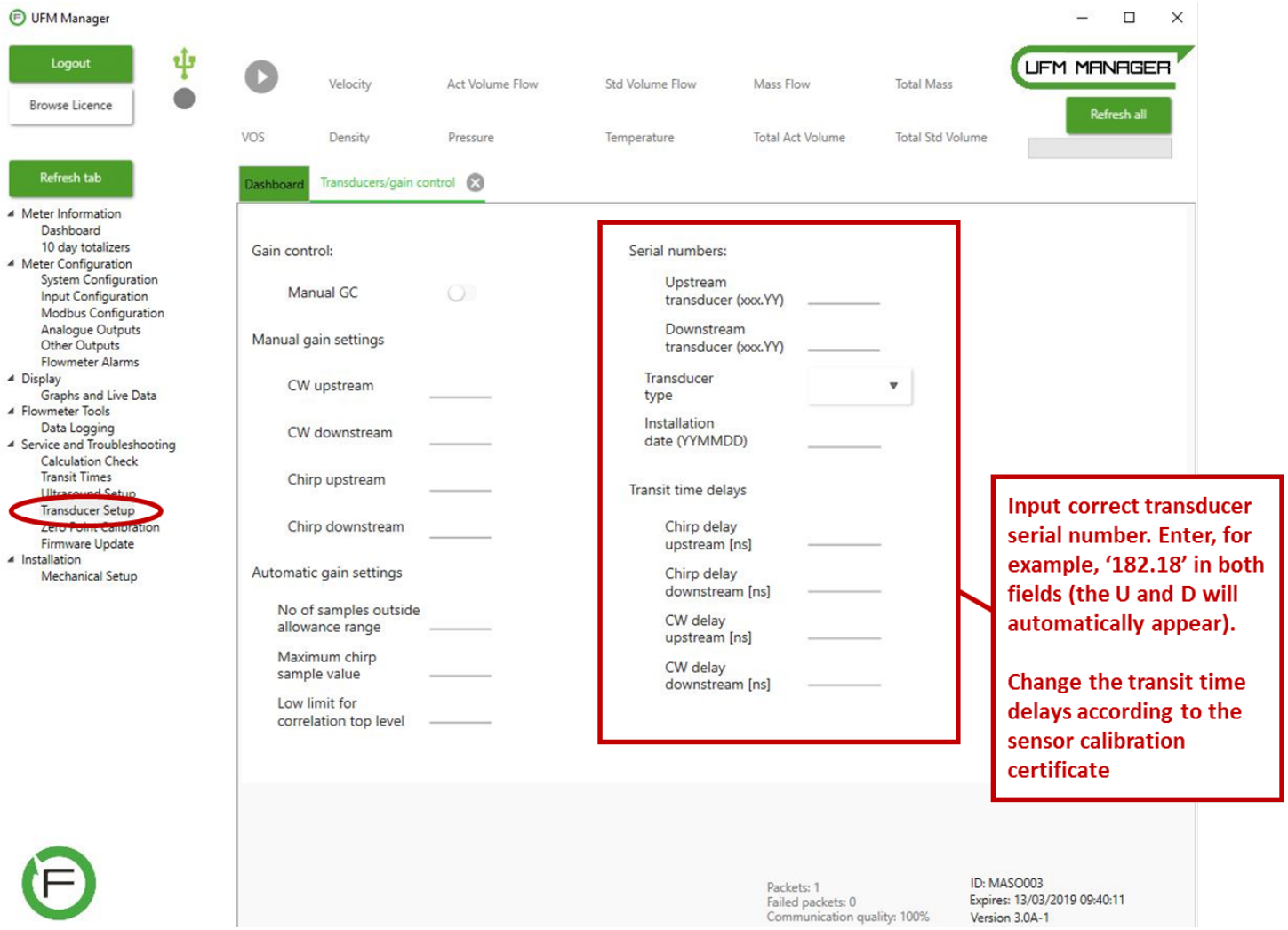

UFM Manager
Logout
Browse Licence
UFM MANAGER
Refresh
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Analog Out
Other Outputs
Data Logging
Zero calibration
Firmware Update
CL1 variable:
Test Value
Test value:
0
CL2 variable:
Test Value
Test value:
0
CL3 variable:
Test Value
Test value:
0
CL4 variable:
Test Value
Test value:
0
CL5 variable:
Test Value
Test value:
0
CL6 variable:
Test Value
Test value:
0
Change values and settings according to project specification.
Scale:
Offset:
4 mA
20 mA
CL1 setup:
1.004217
-0.086359
4
20
CL2 setup
1.001377
-0.043958
4
20
CL3 setup:
1.005378
-0.067555
4
20
CL4 setup:
1.00065
-0.121477
4
20
CL5 setup:
1.007252
-0.112609
4
20
Reading Data
Packets: 99
Failed packets: 45
Communication quality: 45%
ID: TestVersion
Expires: 18/10/2018 09:24:07
Version 1.1A-1


UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Analog Out
Other Outputs
Alarms
Data Logging
Zero calibration
Firmware Update
Minimum
Maximum
Maximum change
Sound velocity [m/s]
200
500
70
Flow velocity [m/s]
0
100
70
Temperature [K]
268.15
348.15
Pressure [barA]
0.5
3
Change values according to project specification.


UFM Manager
Logout
Browse Licence
UFM MANAGER
Refresh
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Analog Out
Other Outputs
Alarms
Data Logging
Ultrasound setup
Transducers/gain control
Zero calibration
Firmware Update
Chirp signal settings:
Center frequency [kHz]
Band width [kHz]
Burst width [us]
Amplitude [V]
Sweep direction
Decreas
Chirp pattern
Velocity
Chirp configuration
Automa
CW signal settings
Frequency [kHz]
Burst width [us]
Amplitude [V]
Signal averaging:
Raw data
1
Process data
1
Transit times (ToF)
Minimum ping rate [ms]
20
Chirp sample rate [ns]
1000
CW sample rate [ns]
Chirp preprocessing
None
No of periods used for phase detection
10
Update rate (readout)
0.55705
Features:
Averaging
None
Change values according to sensor calibration certificate.


UFM Manager
Logout
Browse Licence
Velocity
Act Volume Flow
Std Volume Flow
Mass Flow
Total Mass
UFM MANAGER
Refresh
VOS
Pressure
Temperature
Total Act Volume
Total Std Volume
Meter Information
Dashboard
10 day totalizers
Meter Configuration
System Configuration
Input Configuration
Modbus Configuration
Analogue Outputs
Other Outputs
Flowmeter Alarms
Display
Graphs and Live Data
Flowmeter Tools
Data Logging
Service and Troubleshooting
Calculation Check
Transit Times
Ultrasound Setup
Transducer Setup
Zero Point Calibration
Firmware Update
Installation
Mechanical Setup
Dashboard
10 day totalizers
System Config
Mechanical
Input
Modbus
Analog Out
Other Outputs
Alarms
Data Logging
Ultrasound setup
Transducers/gain control
Zero calibration
Firmware Update
Upload DSP
Version: 0.07
Refresh
Upload IO
Version: Error
Refresh
Upload PT
Version: 0.257
Refresh
Block 0
Check the latest firmware version installed.

Transducer set up for FGM 160 Flare Gas Meter (one pair of ultrasonic sensors):



Transducer set up for FGM 160 dual-path configuration (two pairs of ultrasonic sensors). The procedure for setting up the 2nd pair of transducers (system 2) is the same that used for setting up the 1st pair of transducers (system 1).