MC608A/B
Electromagnetic Transmitter

Installation, Operation and Maintenance Manual

FTI FLOW TECHNOLOGY™

TM-100467, Rev P

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1 INTRODUCTION

1.1 Scope

This manual provides information and guidance for personnel responsible for the installation, operation, and maintenance of the MC608A/B Electromagnetic Flow Meter Transmitter supplied by Flow Technology, Inc.

1.2 Purpose

The contents of this manual are for general information and to describe the operational characteristics of the MC608A/B transmitter. This manual does not include instructions for special application or factory repair.

1.3 Description

An Electromagnetic Flow Meter works off the principal of Faraday's Law. In this application of the principal the flow meter creates an electromagnetic field perpendicular to the fluid flowing through the meter housing. An electromotive force (voltage) is generated in a conductive medium when it passed through a magnetic field. The voltage created is directly proportional to the density of the magnetic field and the velocity of the conductive medium. Since the conductive medium is the liquid whose flow is to be measured, and the length between the electrodes and the electromagnetic field strength is known, therefore the signal generated is proportional to the velocity of the liquid in the pipe.

In order for this technology to operate correctly the fluid to be measured does need to be conductive. The minimum fluid conductivity required is 5 µS/cm for most fluids and 20 µS/cm for DI water.

The electromagnetic flow meters are composed of:

The ***sensor*** that must be mounted between two portions of pipe by flanges, threaded joints, or triclamp fittings.

The ***converter*** which drives the sensor and displays or transmits data.

The MC 608A/B converter is provided in a cylindrical aluminum instrument enclosure and can be interfaced to all Flow Technology magnetic flow meters. It can be mounted directly on top of the flow meter or remote from the flow meter connected through a pair of cables, whose maximum length depends on the conductivity of the liquid.

The flow meter Ka and Kb coefficients are established during the factory flow meter calibration. These factors are normally programmed into the MC 608A/B converter at the factory prior to shipment, however the key pad of the converter allows the user to enter or modify these coefficients. This key pad also allows the user to set the full scale flow rate, define the scaled pulse output, adjust alarm set points, and adjust dosage volume.

The MC608 is available in two main versions:

MC608A – Mains powered 90…264Vac or 12/24 Vac/dc
MC608B – Battery powered or 12/24Vac/dc

2 INSTALLATION

2.1 Inspection

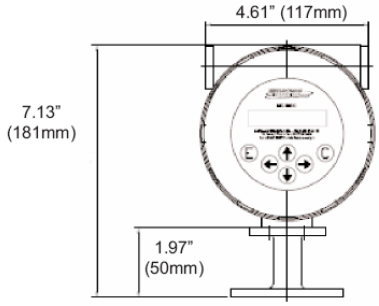
Verify that all parts listed on the packing list are included with your shipment. Note that there may be more than one package for your shipment. Please check the factory set up sheet and verify the meter size, full scale flow rate, and analog/pulse output are set up as required.

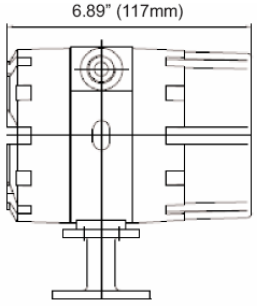
2.2 Mechanical Installation of the transmitter to the flow meter

2.2.1 Compact (mounted on flow meter)

The MC 608A/B converter is supplied mounted directly to the flow meter junction box. In this configuration all interconnection wiring between the flow meter sensor and the converter have been completed at the factory. Upon flow meter installation, external wiring for power input and signal outputs will need to be completed. For optimum installation flexibility the converter display is capable of rotating up to 180˚.

Figure 1 – MC608A – Mains Powered Unit





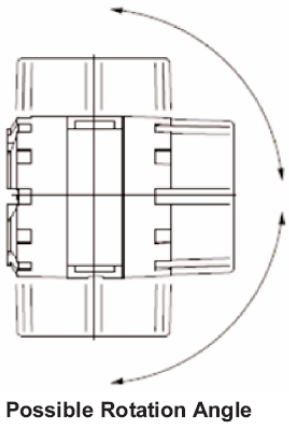
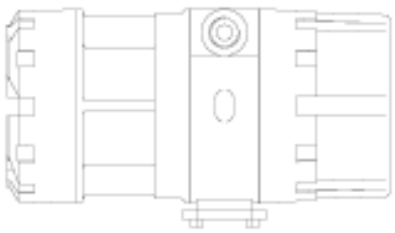


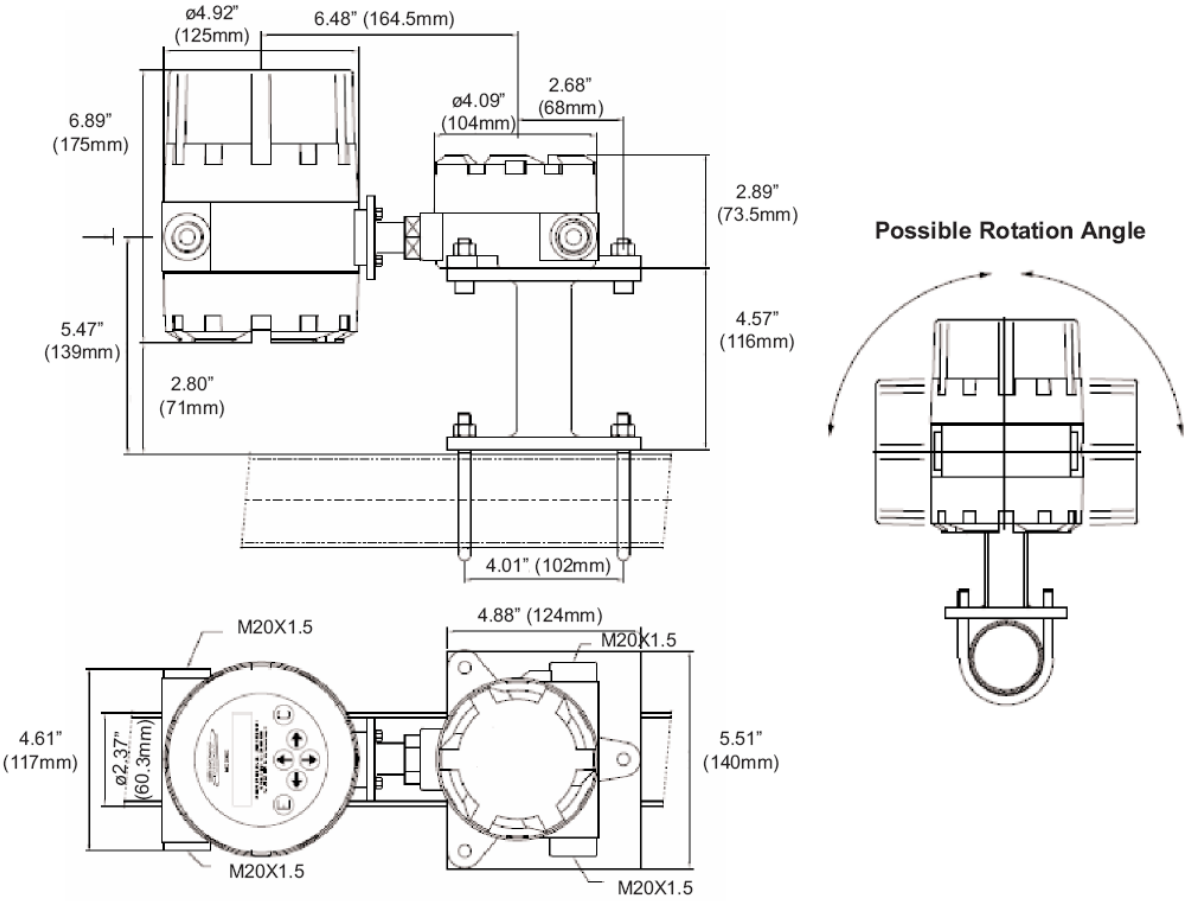
Figure 2 – MC608B – Battery Powered Unit



2.2.2 Separate (remote mounted from flow meter)

The MC 608A and MC 608B converters can be mounted up to a maximum of 328 feet (100 meters) and 98 feet (30 meters) respectively from the flow meter, dependent on fluid conductivity. When supplied for remote mounting, the flow meter can optionally be purchased with various cable lengths for interconnection to the converter. This interconnection cable can be supplied attached to and resin sealed in the flow meter junction box or the cables can be supplied separately and attached and sealed in the field. For optimum installation flexibility the converter display is capable of rotating up to 180˚.

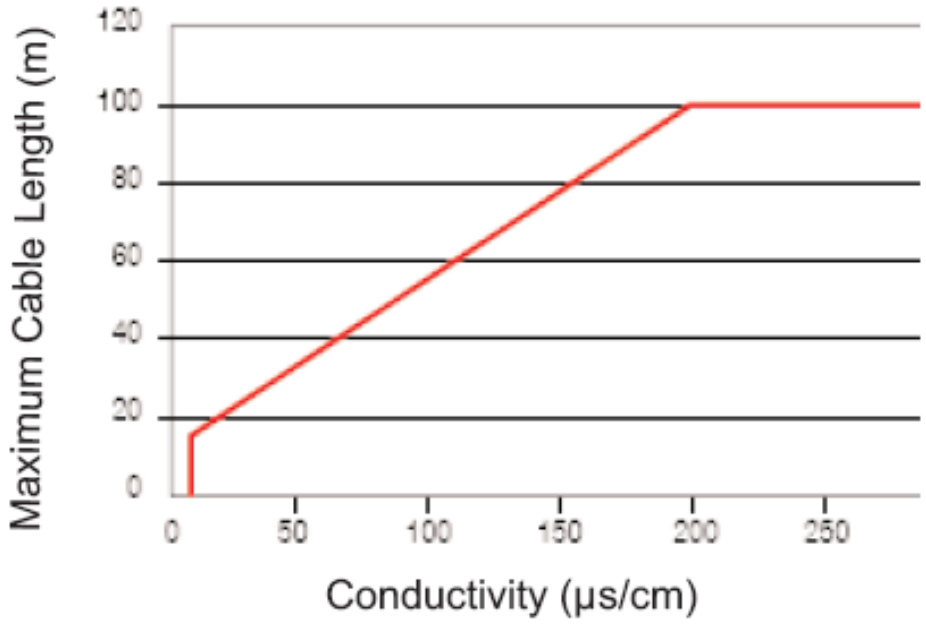
Figure 3 – Remote mounting



2.2.3 Maximum cable length

When the converter is to be mounted remote from the flow meter, the maximum cable distance is limited by the conductivity of the fluid to be measured. The maximum distance is 328 feet (100 meters). Below is a chart to determine maximum cable length based on the installation operating conditions.

Figure 4 – Cable length vs. conductivity



2.2.4 Grounding

The sensor and converter must be properly grounded to earth potential for the system to operate correctly. Earth potential is the reference parameter for the flow meter and without proper grounding issues with zero offset, or flow indication at zero flow will occur. The sensors and converters all have earth grounding points that can be used to insure a direct contact with earth ground.

The Flow Technology electromagnetic flow meters are equipment with a third ground electrode that eliminates the need for grounding rings when installing the flow meter in insulating piping.

2.3 Electrical Installation

This section provides the professional installer with information for connecting the MC608A/B to the user's system.

WARNING:

Verify that the power is off before connecting or servicing!
Electrical connection of the device must be carried out by properly trained personnel!

2.3.1 MC608A/B terminal locations

Figure 5- High voltage: 90 – 264 Vac (PCBA up to version 6-2)

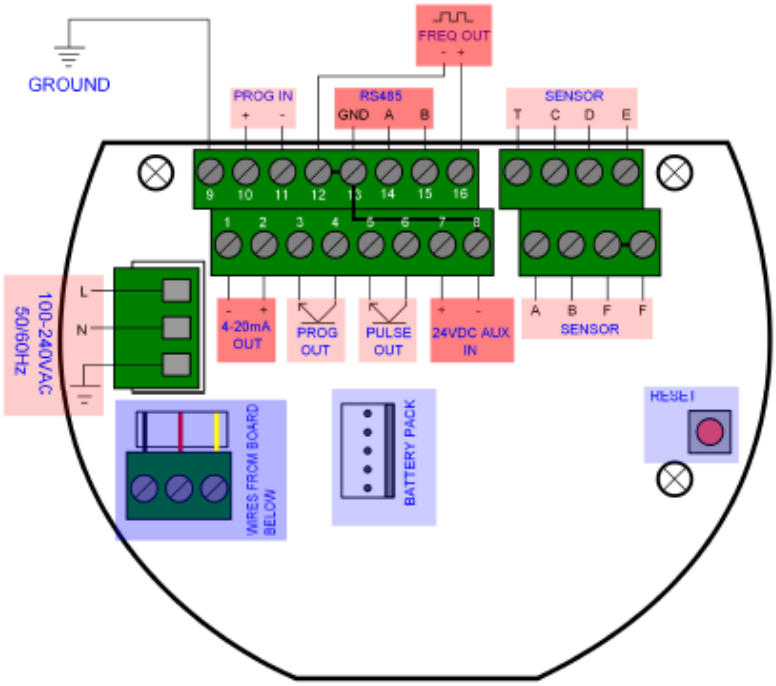


Figure 6 – Low voltage: 12 – 24 VDC/Vac (PCBA up to version 6-2)

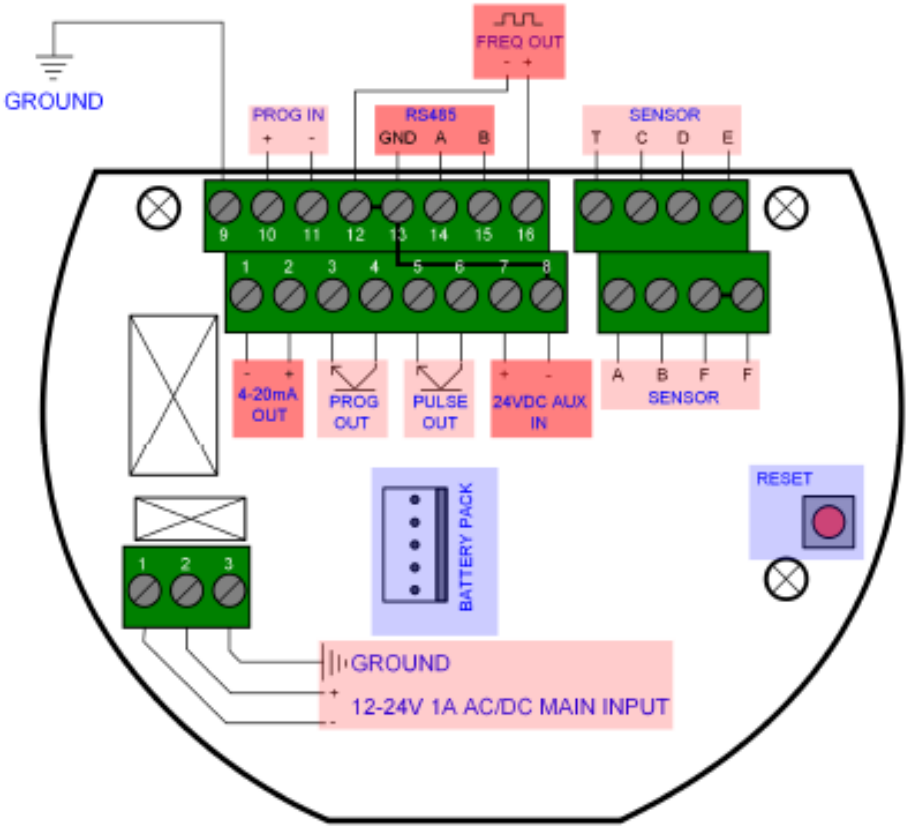


Figure 7- Low and high voltage (PCBA version 6-3)

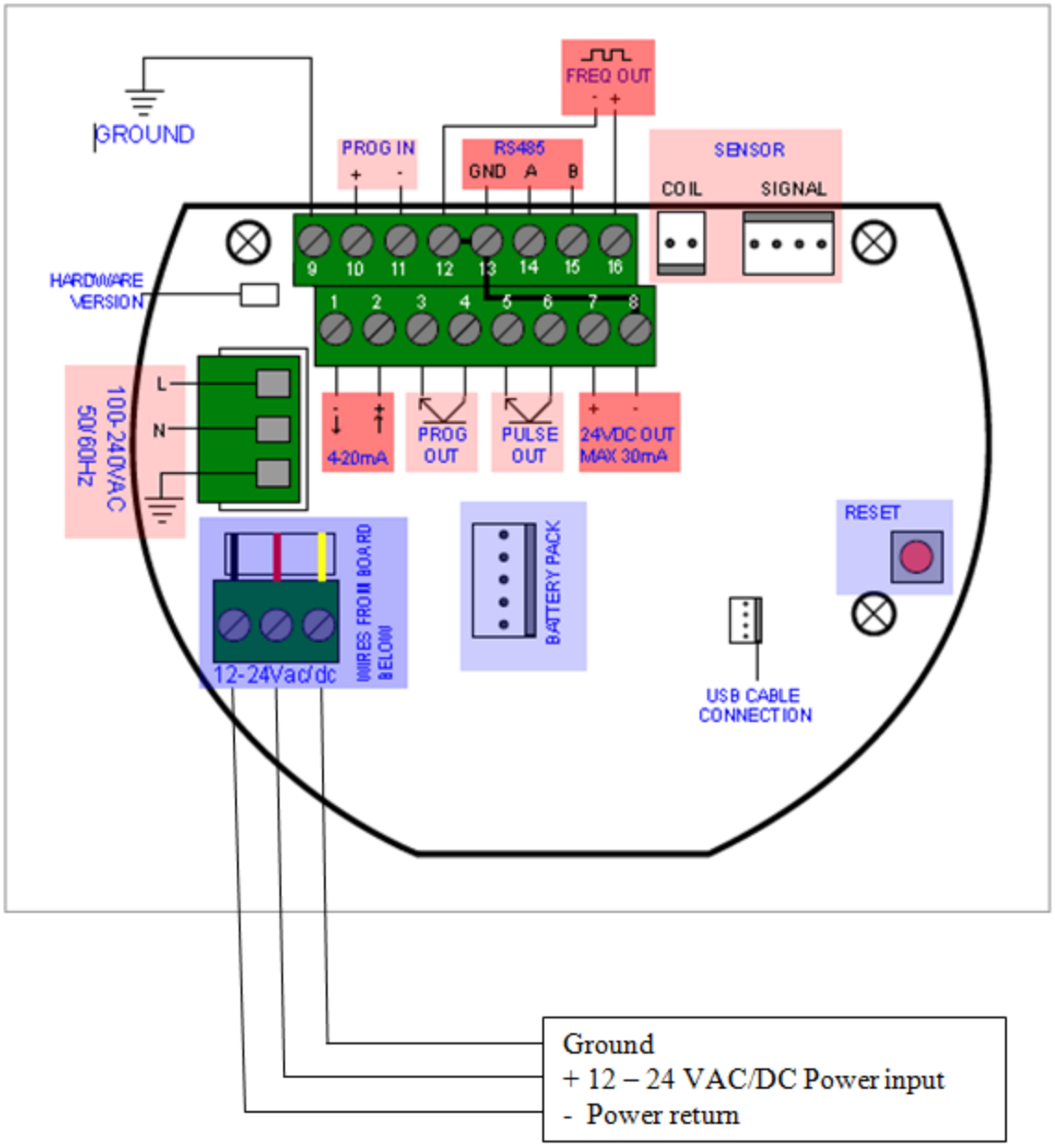
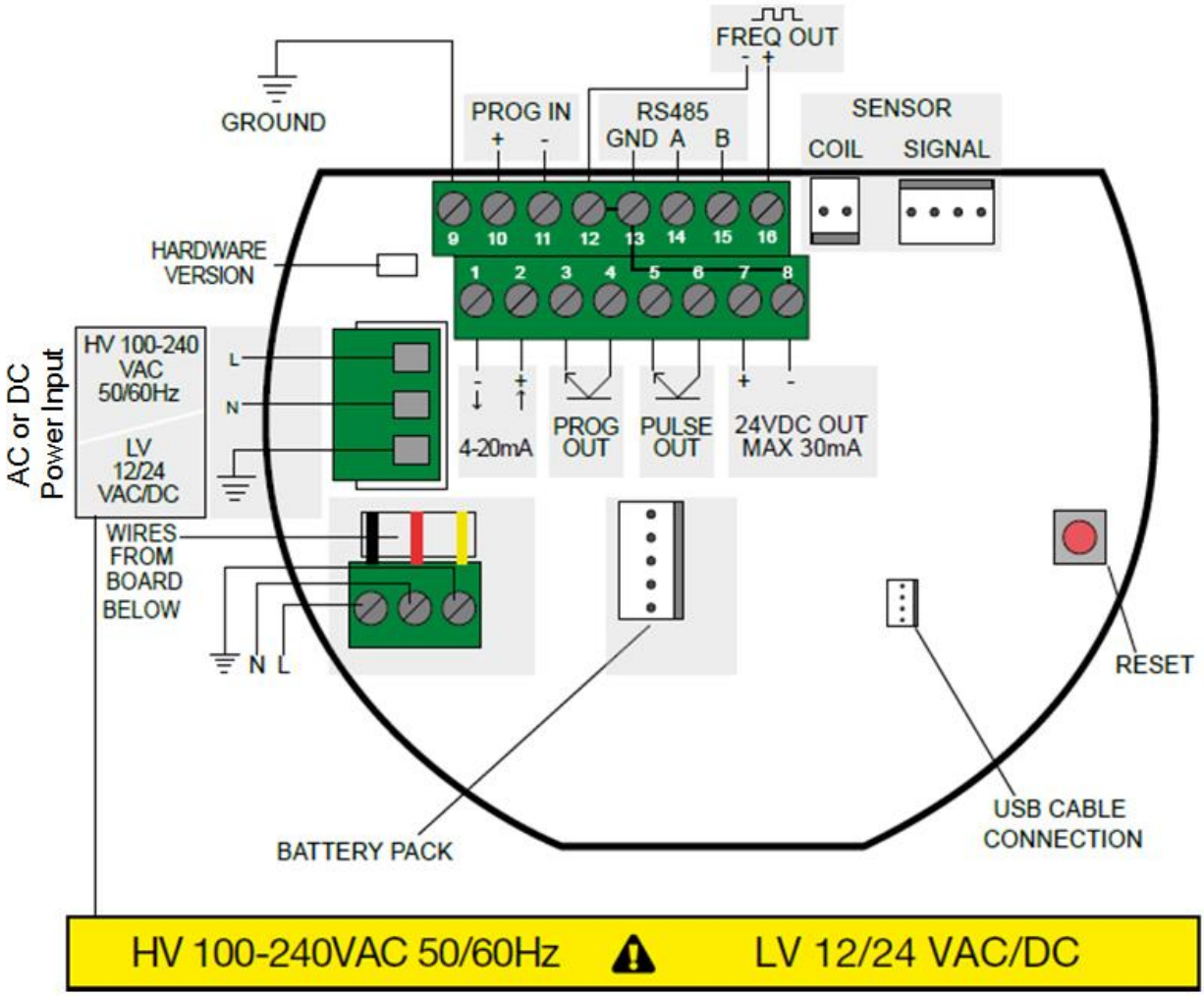


Figure 8- Low and high voltage (PCBA from version 6-4)

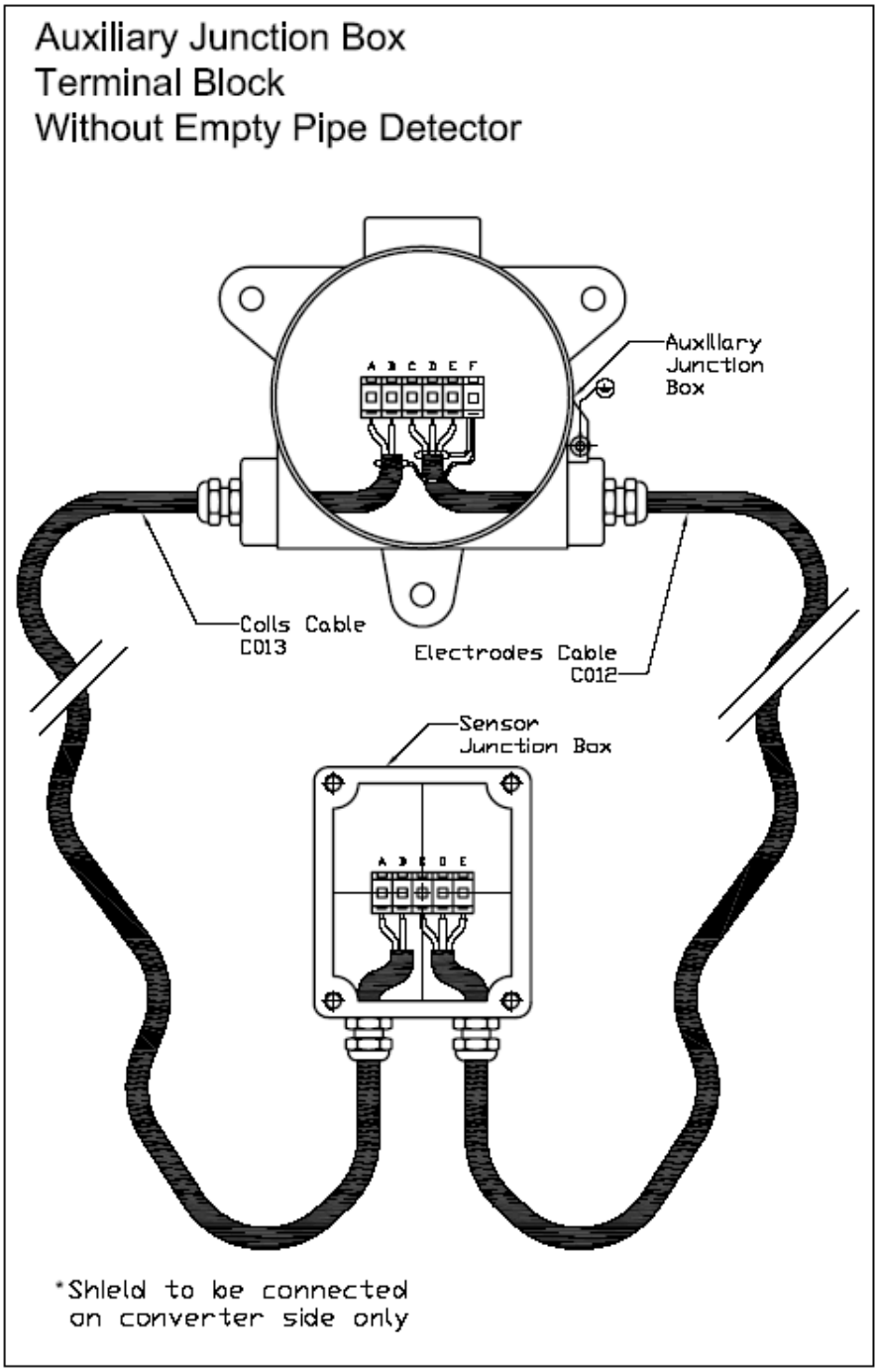


Note: Line (L) and Neutral (N) terminals are not polarity sensitive when used with DC power.

2.3.2 Remote mounted converter, without empty pipe detector

The remote mounted version of the MC 608A/B converter is supplied with an auxiliary junction box where cables, C012 and C013 from the flow meter junction box will need to be connected. The converter is normally supplied scaled for a specific flow meter. Please check the program sheet supplied with the equipment to ensure the converter is connected to the proper flow meter. Cables C012 and C013 are supplied with metal ends and identifying letters. Refer to the diagram below for correct terminal location.

Figure 9 – Remote mounted wiring



2.3.3 Powering the unit

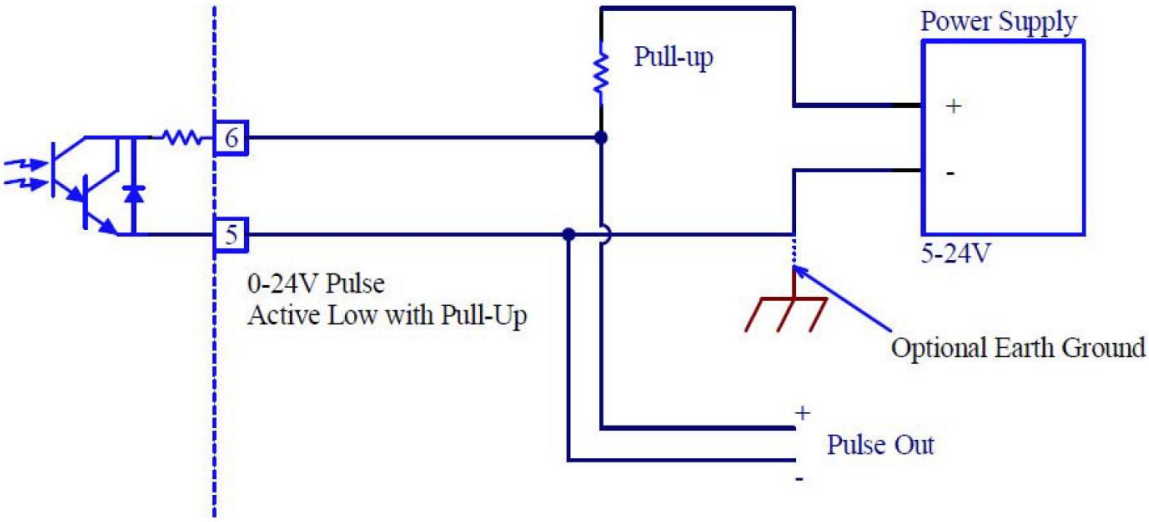
MC608A: 90 to 264 Vac, or 12 to 24 VAC/Vac
MC608B: Battery powered by lithium battery pack, or 12 to 24 VDC

2.3.4 Wiring of **Pulse Output**

Clean contact (MC608A/B)

The device connected (PLC/external pulse meter) supplies its digital input with the required voltage to detect the pluses. The MC608 acts as a digital switch. (Maximum voltage: 30VDC, 50mA maximum current)

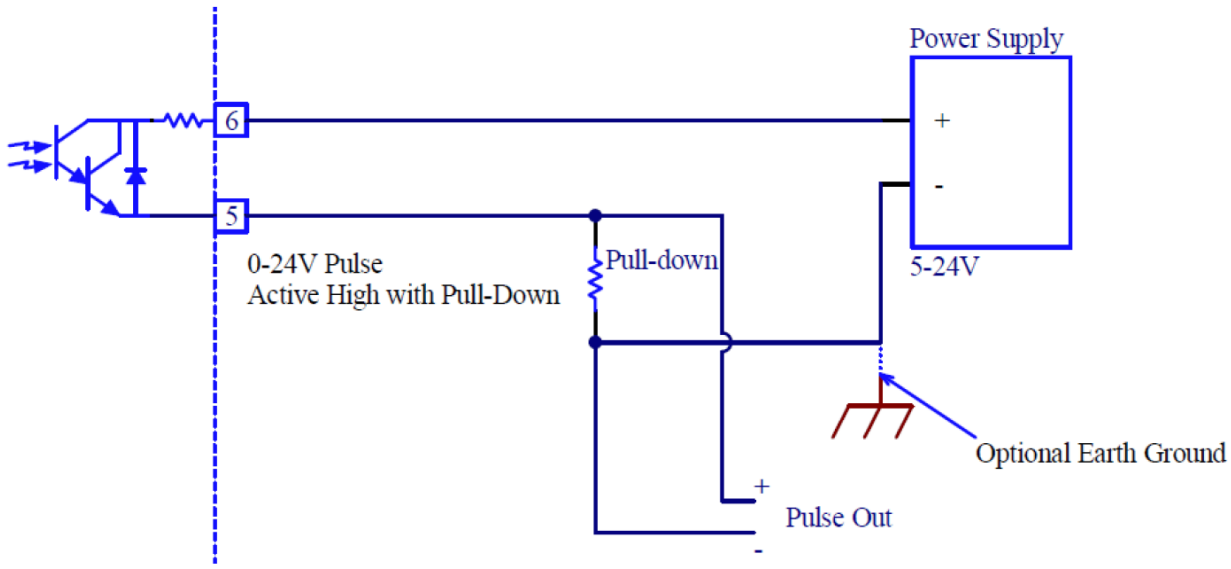
Figure 10 – Clean contact pulse output



Active 5-20 VDC (MC608A/B)

The device connected (PLC/external pulse meter) is a passive digital input that accepts the voltage supplied to it by the external supply system used. (Maximum voltage 5 – 30 VDC, maximum current 50mA)

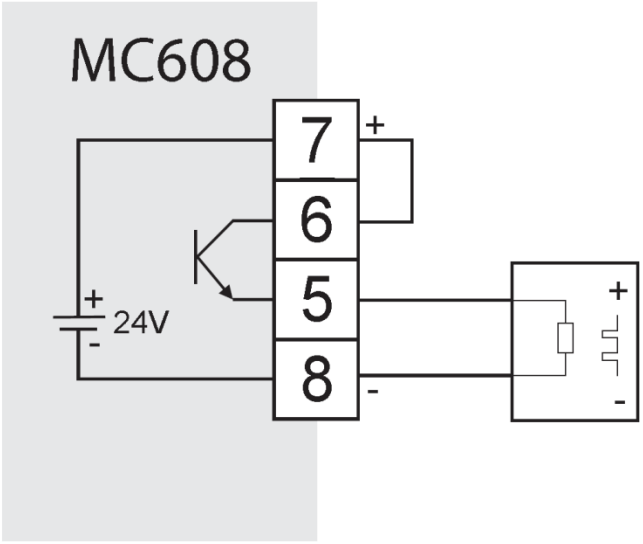
Figure 11 – Active 5 – 20 VDC pulse output



Active 24V self-powered (MC608A/B from version 6-3)

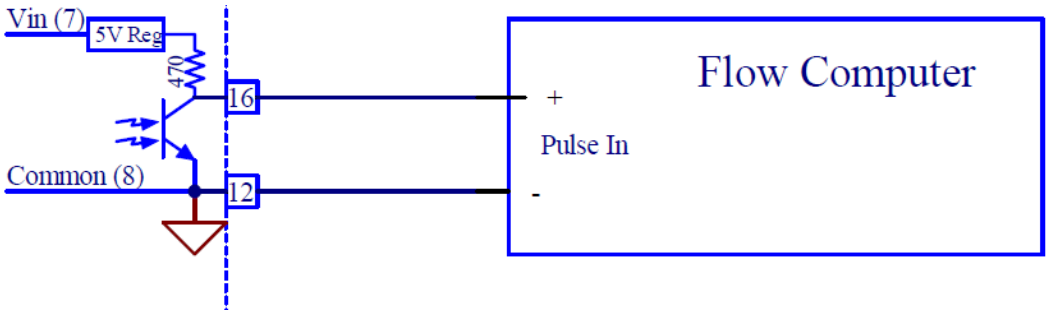
The device connected ((PLC/external pulse meter) is a passive digital input that accepts a 24V voltage level. It must not provide any additional voltage. The internal power supply 24 VDC is used to provide the necessary voltage. (Maximum voltage 24VDC, maximum current 30mA).

Figure 12 – Active self-powered from version 6-3



2.3.5 Wiring of **Frequency Output** (only available on MC608A version)

Figure 13 – Frequency output

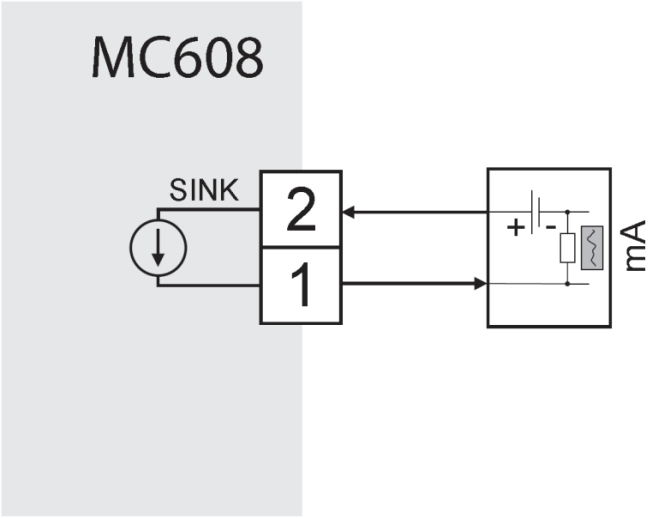


2.3.6 Wiring of **4 – 20mA Analog Output**

Loop powered (MC608 version 6-3 and later)

The connected 4-20mA receiver is a loop powered model, powering the current loop itself.

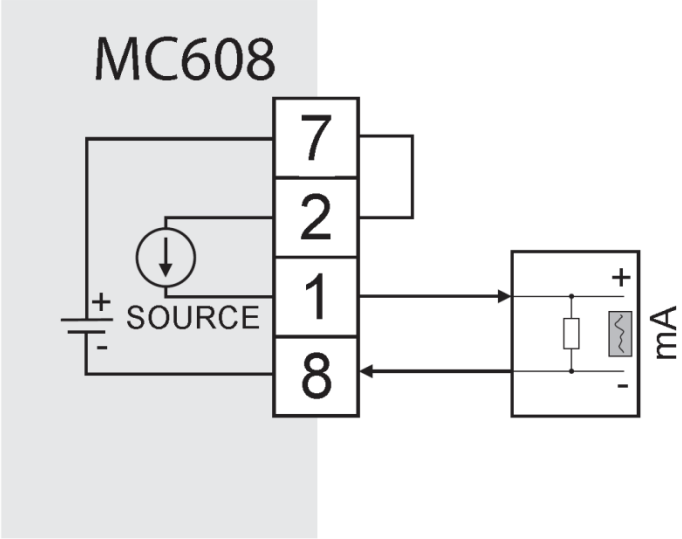
Figure 14 – Loop 4 – 20 mA output



Active (MC608 version 6-3 and later)

The connected 4-20mA receiver is a passive milliamp-meter; the internal MC608 24 VDC power supply must be connected as shown. (24VDC loop voltage of 24 VDC, maximum impedance of 800 ohm)

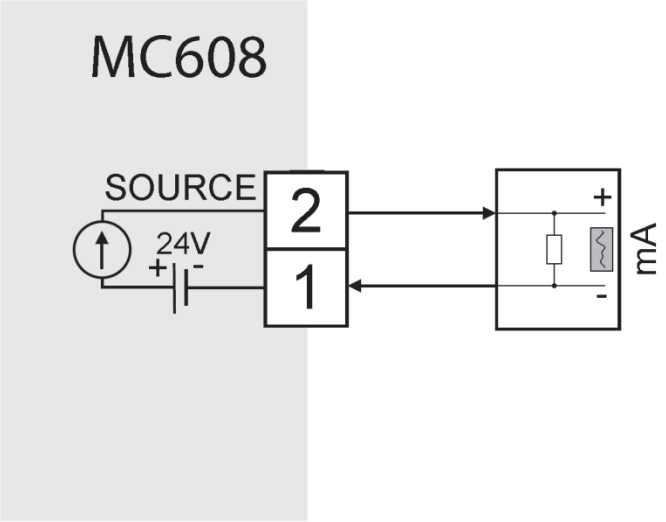
Figure 15 – Active 4 – 20 mA output



Active (MC608 version 6-1 and 6-2)

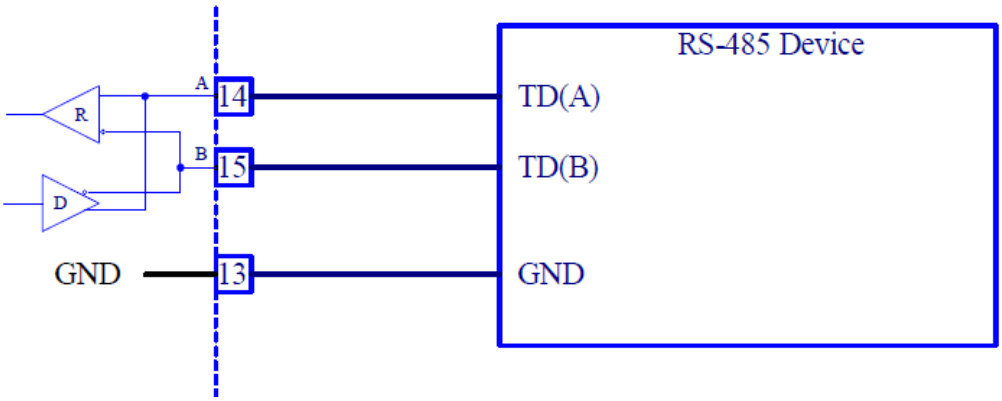
The connected 4-20mA receiver is a passive milliamp meter; the internal MC608 24 VDC power supply is internally connected. (24VDC loop voltage of 24 VDC, maximum impedance of 800 ohm.)

Figure 16 – Active 4 – 20 mA output



2.3.7 Wiring of **RS485 Output** (only available on MC608A version)

Figure 17 – RS485 communication



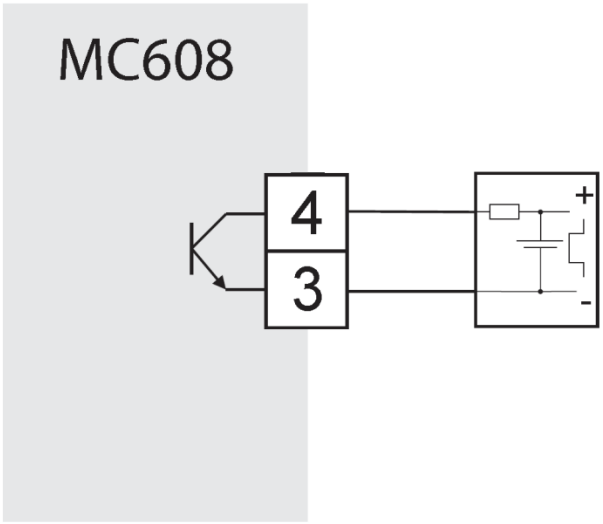
Note: The MC608 transmitter is not supplied with a PC to RS485 converter. If communication with the transmitter is require an aftermarket USB or RS232 to RS485 converter will be required.

2.3.8 Wiring of **Programmable Output**

Clean contact (MC608A/B)

The device connected provides its digital input with the required voltage to detect the logic level. The MC608 acts as a digital switch. (Maximum voltage: 30 VDC, 50mA maximum current)

Figure 18 – Clean contact programmable output

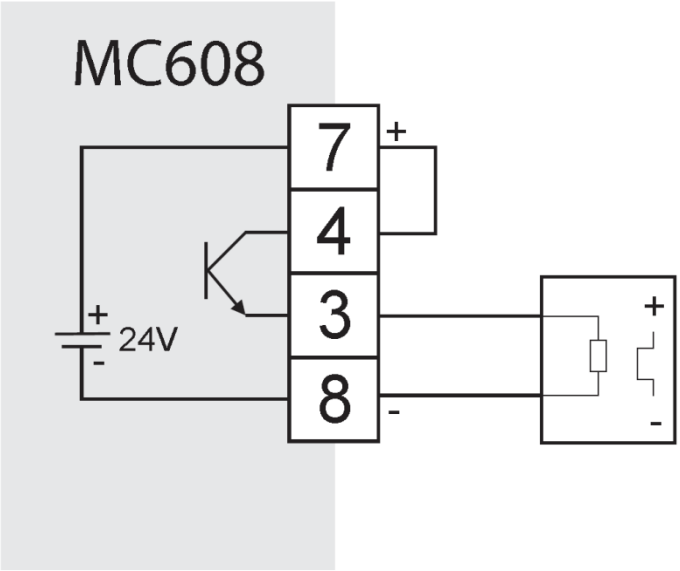


Active 24V self-powered (MC608 version 6-3 and later)

The device is connected to a passive input that accepts a digital voltage equal to 24 V. It must not provide any additional voltage.

The internal power supply 24 VDC is used to provide the necessary voltage. (Voltage 24V, maximum current 30mA)

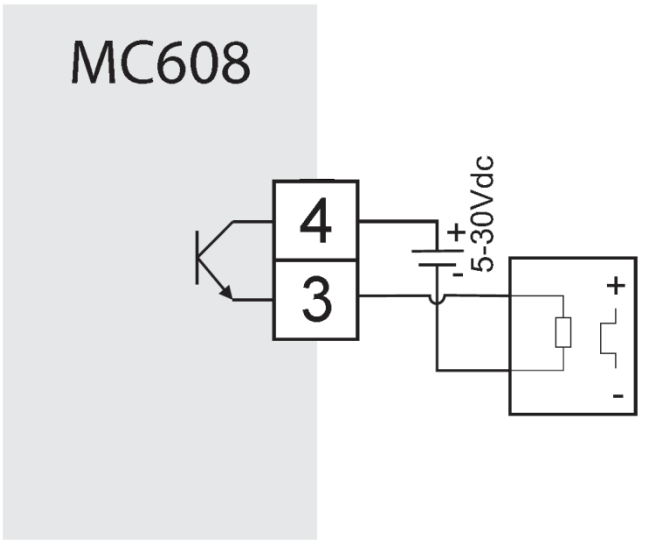
Figure 19 – Active 24 V self-powered programmable output



Active 5-30V (MC608A/B)

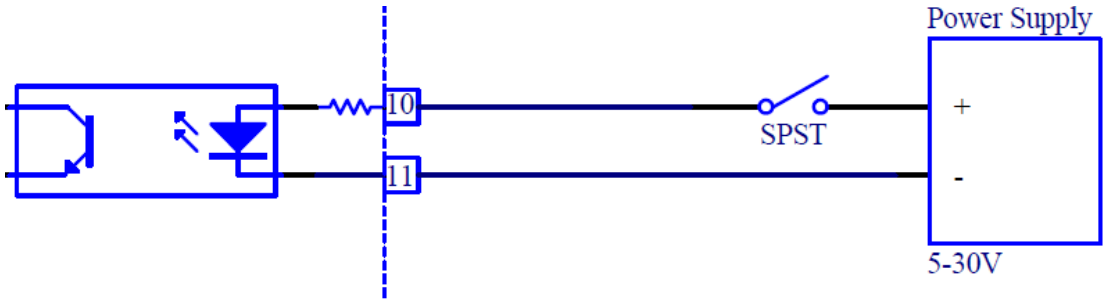
The connected device is a passive digital input that accepts the voltage level provided by the external power supply. (Voltage 5-30V, maximum current 50mA)

Figure 20 – Active 1-30V programmable output



2.3.9 Wiring of **Programmable Input**

Figure 21 – Programmable input



2.3.10 Output Notes

1) Connect only one output at a time with internal power supply. The maximum current on terminals 7 and 8 is 30 mA.
2) The battery powered MC608B is only equipped with a pulse output and the 4-20mA output in loop power mode.

3 PROGRAMMING THE MC608 CONVERTER

3.1 Programming Overview

The configuration of the MC608 can be performed in three different ways:

1. Through the 4 push buttons located on the front mask of the converter, accessed by unscrewing the front panel glass
2. Via PC through the RS485 MODBUS output and the configuration software program supplied by FTI. A USB or RS232 to RS485 converter is not supplied with the MC608 converter.
3. Via PC through the IrDA port located on the front of the converter on top of the display and the configuration software program.

3.2 Converter Passwords

The converter is built with three different levels of protection. Passwords can be modified.

Level I: 608111
Level II: 709222
Level III: 231042

3.3 Activating MC608B

Under normal operation the MC608B is operating in “sleep mode”. Sleep mode conserves battery life while continuing to functionally operate the unit.

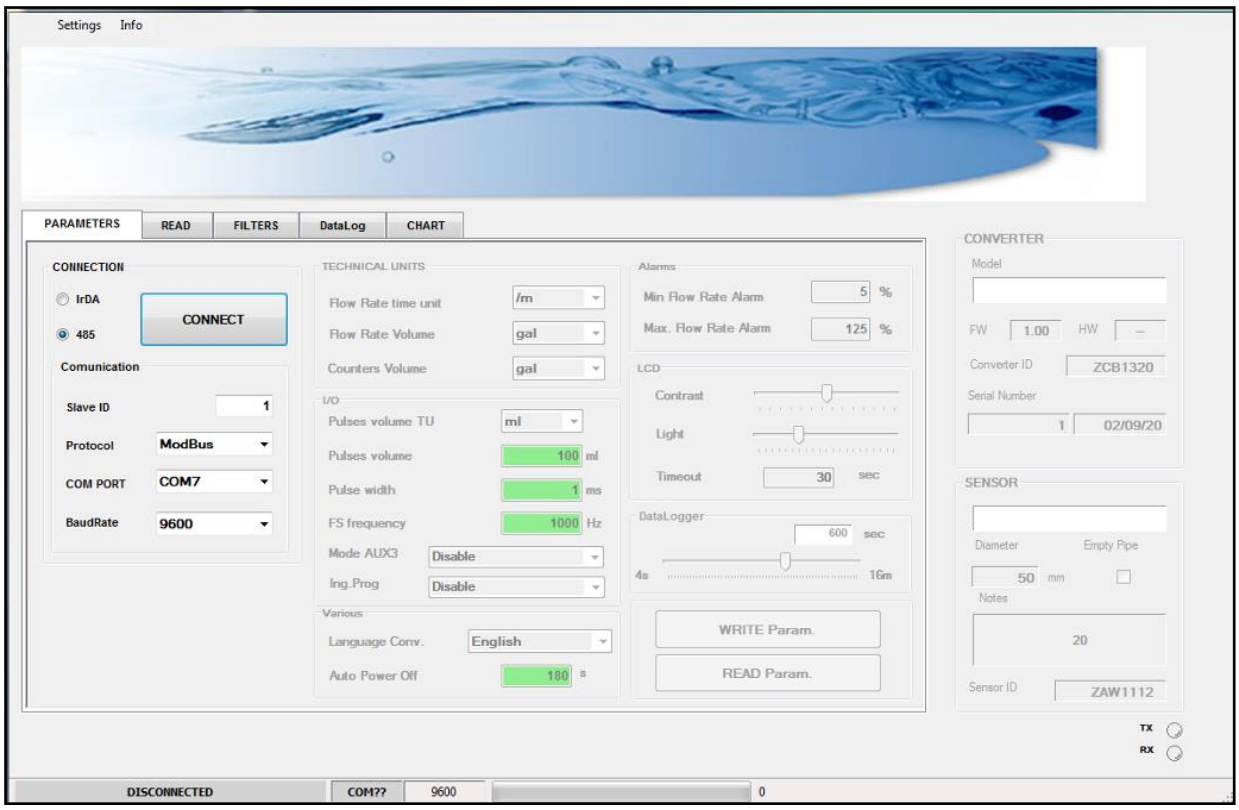
To wake the unit for programming or reading the values on the display, swipe the supplied magnet (black plastic housing in conduit opening) vertically on the front mask near the word “activate”.

3.4 MC608 Configuration via PC Using MC608 Programming Software

3.4.1 Initial Connection

Use a USB adapter for direct communication to a PC or an IrDA interface unit. Install the MC608 software and connect the unit to the PC and turn it on with the magnet (for MC608B), select RS485 or IrDA communication and press on the CONNECT button (see below screen shot of the MC608 program).

Figure 22 – Main Screen

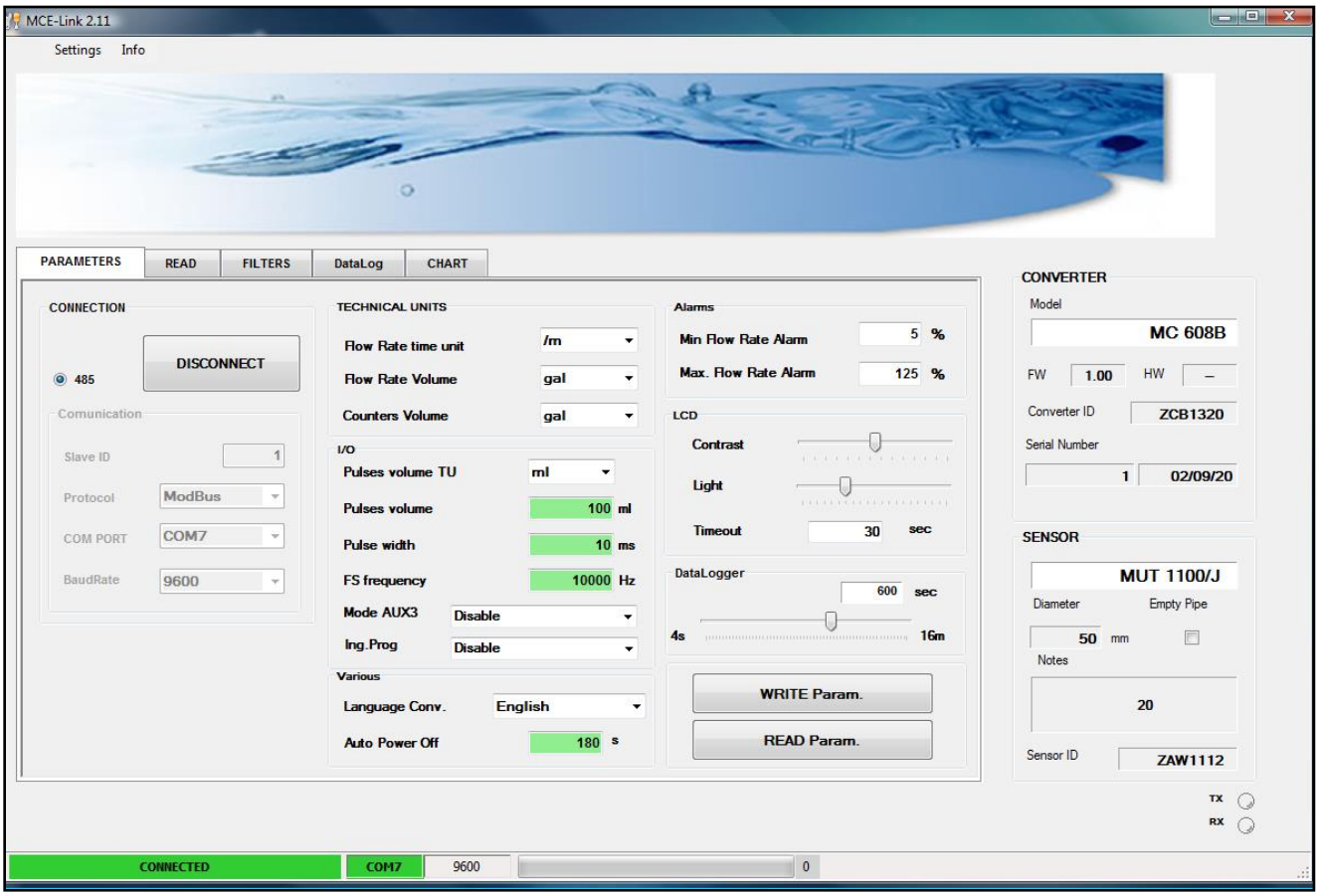


With the MC608 correctly connected the configuration parameters can now be read and modified. There are 5 menu screens:

1. PARAMETERS
2. READ
3. FILTERS
4. DATALog
5. CHART

3.4.2 Parameter Configuration

Figure 23 – Parameters Screen



Technical units define:

- The time base of measurement (seconds, minutes, hours, days)
- Flow Rate Volume defines the volumetric rate units of measure (Gals, Liters, Cubic meters, barrels etc.)
- Counters Volume defines the volumetric unit of measure for the counters/totalizers.

The I/O section defines:

- Pulses volume TU – unit of measure for the pulse & frequency outputs.
- Pulse volume – defines the volume per unit pulse.
- Pulse width
- FS Frequency defined the output frequency corresponding to full scale flow rate. The maximum frequency 10,000Hz.
- Mode AUX3 – programmable output used for high/low alarm or reverse flow.
- Ing. Prog. – programmable input used for reset of partial totals.

The Alarm section defines:

- Min Flow Rate Alarm. Defines the % of full scale flow such that if the flow rate falls below this set point an alarm will be activated.
- Max Flow Rate Alarm. Defines the % of full scale flow such that if the flow rate exceeds this set point an alarm will be activated.

The LCD section defines:

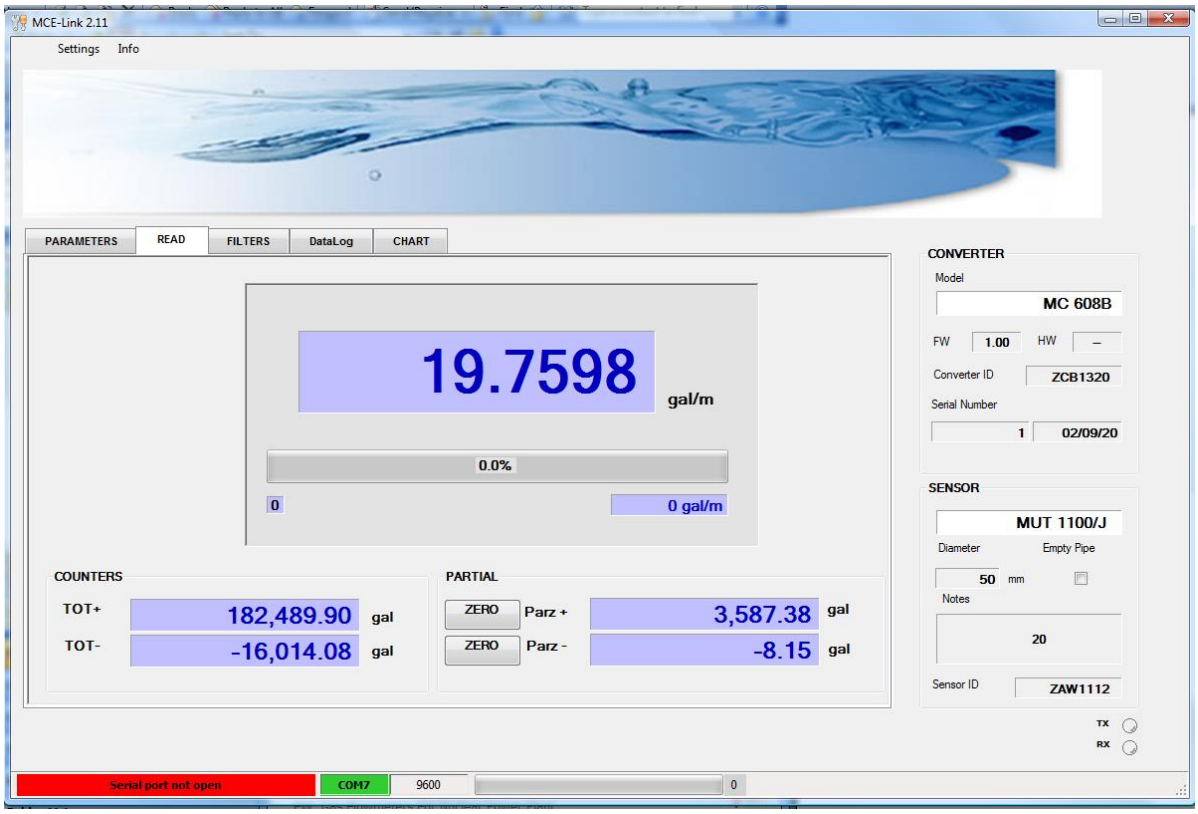
- Display contrast
- Backlight intensity
- How long the display will remain active.

The DataLogger section defines:

- The logging interval. This can be set from 4 seconds to 16 minutes.

3.4.3 Read Configuration

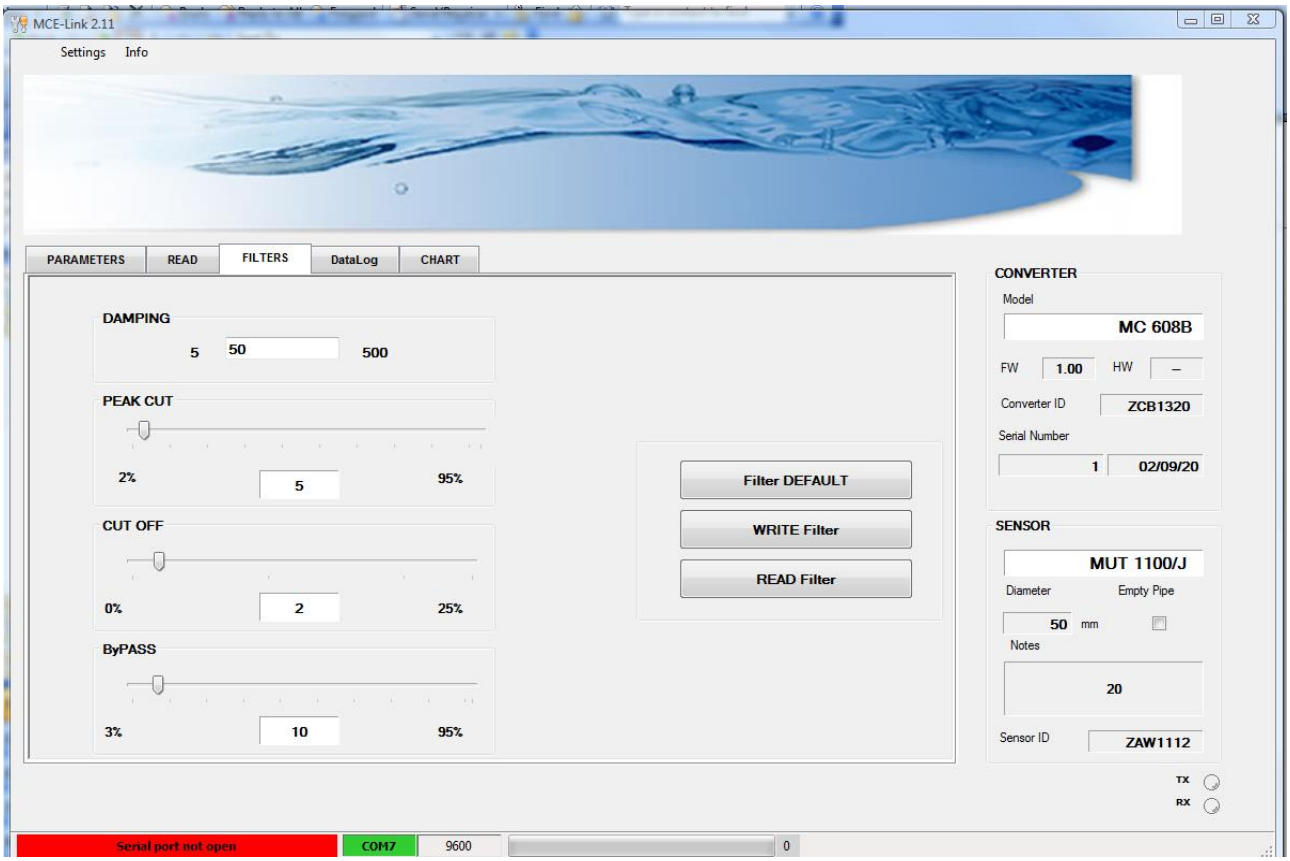
Figure 24 – Read Screen



On the “READ” configuration Tab the user can view the instantaneous flow rate and view the counters/totalizers. Only the “PARTIAL” totals can be reset to zero by pressing the respective zero button.

3.4.4 Filter Configuration

Figure 25 – Filter Screen



The following filters can be configured:

- Damping. Increasing damping increases the stability of the displayed value through increased averaging; the larger the number the higher the damping.
- Peak Cut: A peak cut off value can be set as a percentage of the full scale flow rate. If there are peaks in the flow rate measurement, their value will be limited to the value expressed. For example, by setting the value at 10%, any instantaneous spikes greater than 10% of the full scale value will be limited not to exceed the 10% value.
- Low Flow Cut Off. A low flow cut off value can be set as a percentage of the full scale flow rate. If the actual flow rate of the liquid is less than the low flow cut off value, then the instrument will display 0.
- Filter Bypass. Enter a value as percentage of full scale so that any instantaneous step changes greater than the set value will bypass the digital filter and display the actual flow. The filter bypass can be useful to speed the response of the meter to large changes in flow rate such as opening or closing valves and starting pumps.

For example, in the case that this parameter has a value of 50%

IF: The flow rate varies 50% more than the previous value.
THEN: The flow rate shown will reflect the actual step change

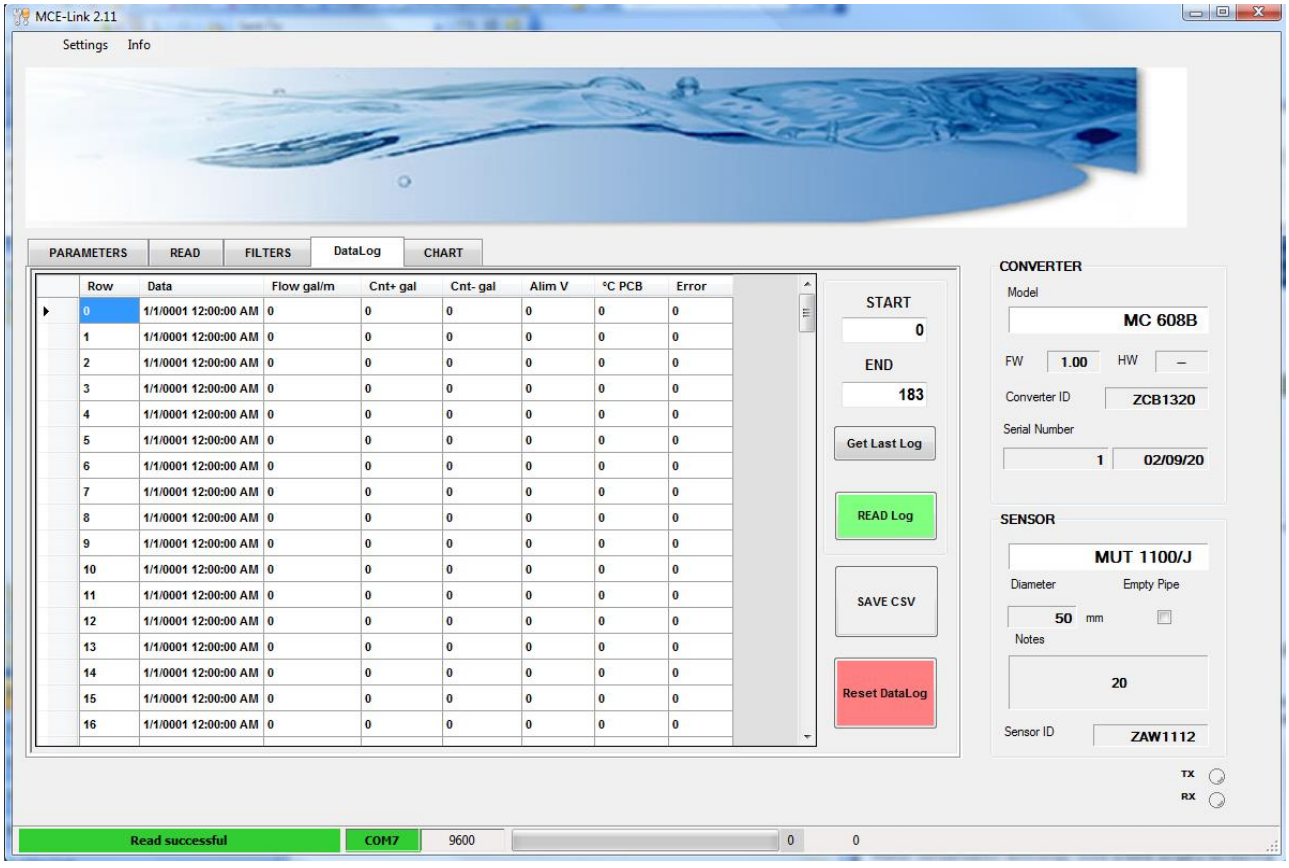
IF: The flow step change is less than 50% of the full scale value
THEN: The digital filter will be applied and the flow rate shown will slowly reach the actual value.

- Measurement Average. This option increases the stability of the reading by enlarging the actual measurement filter.

3.4.5 Data Logger

The data logger that was configured on the PARAMETERS tab displays: Date, time, counter, instantaneous flow rate, temperature and battery condition.

Figure 26 – Data Logger Screen



To read and download the data from the memory of the flow meter select the START and END row to read the data. The “Get Last Log” will load the last available log.

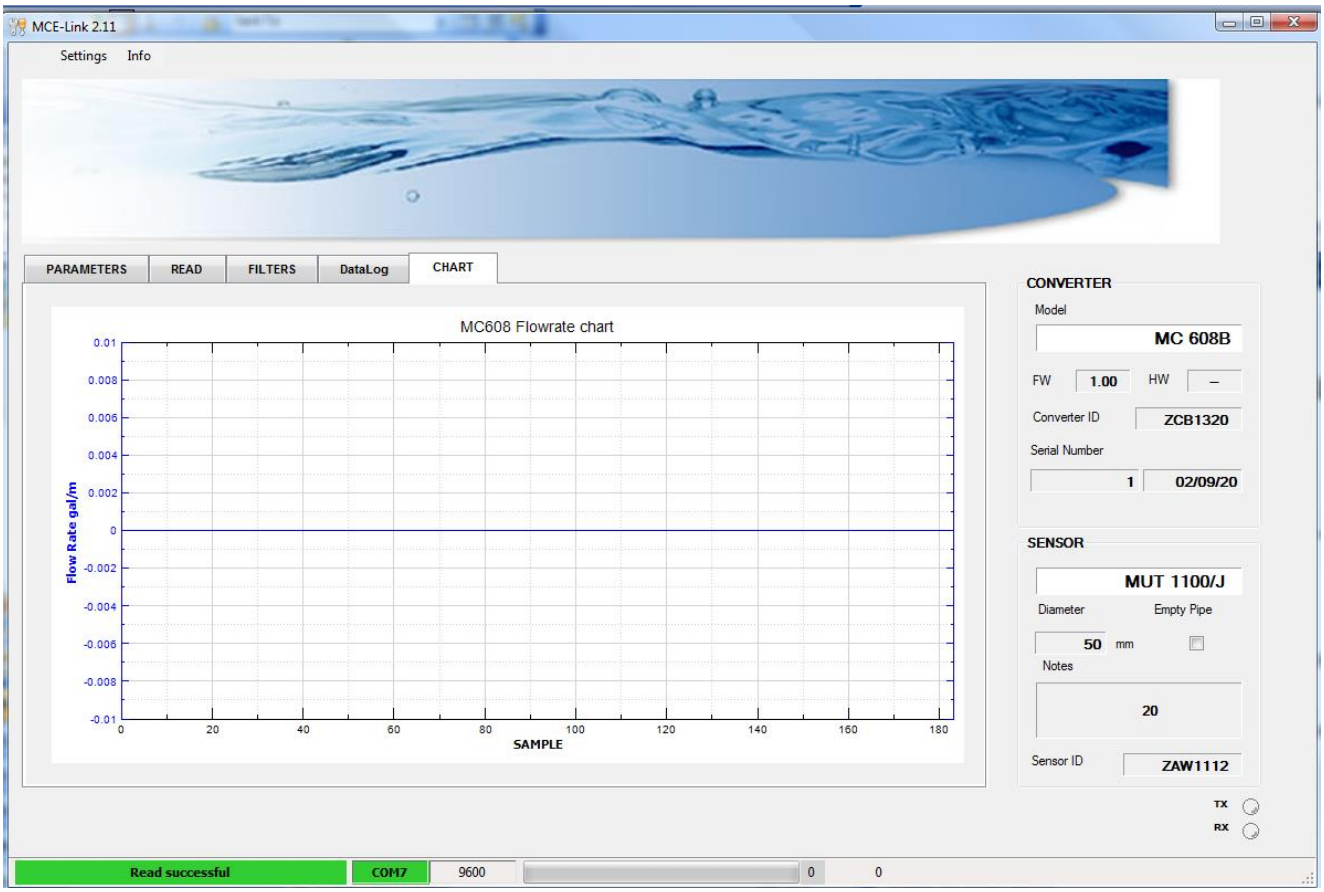
Press the READ Log button to download the data,

Press SAVE CSV to save the data to your PC in CSV format.

Press “Reset Data Log” button to erase the memory of the converter.

After reading the data, the data is displayed graphically by going to the CHART tab, see picture below:

Figure 27 – Chart Display Screen



3.5 MC608 Configuration via the Local Display

3.5.1 Overview

The MC608 can be configured using the 4 push buttons located on the front mask of the converter: To access unscrew the front cover.

The programming menu is simply accessed by pressing the Menu button. The menu has been divided into the following groups:

- Options

- Counters
- Parameters
- I/O
- Others
- Memory

Follow the chart below for an overview of the available functions.

OPTIONS

Technical units
- Flow rate units
- Flow rate time base.
- Counters module
- Pulses unit
- Specific weight
- Temperature unit

Measurement frequency
- Measuring time

Display
- LCD backlight lev
- Backlight off
- LCD contrast

View options
- Last row

Full scale flow

Language

COUNTERS

T+

P+ (set zero)

T-

P- (set zero)

PARAMETERS

Ka setup

Diameter Setup

Filters setup
- Flow cut off
- Damping
- Bypass
- Peak cut
- Measure average

Line frequency

Zero calibration

Flow rate alarms
- MAX flow th.
- MIN flow th.

Empty Pipe th.

I/O

Pulses OUT
- Pulse quantity
- Pulses time ON
- Reverse flow rate
- Pulses out enable

Frequency output
- Full scale freq.
- Frequency output enable

Program. output
- Enabled/disabled
- Reverse Flow
- MAX flow th.
- MIN flow th.
- MAX/MIN flow th.
- Batching
- Excitation failure
- Empty Pipe

Program. input
- Enabled/disabled
- Zeroing p+
- Zeroing p-
- Zeroing p+/p-

Batching

Progr. output logics

OTHERS

System info

Time/Date

Reserved

Graph

Simulation

Communications
- Baud rate RS485
- MODBUS address
- Data connection

MEMORY

Load user copy

Save user copy

Factory settings

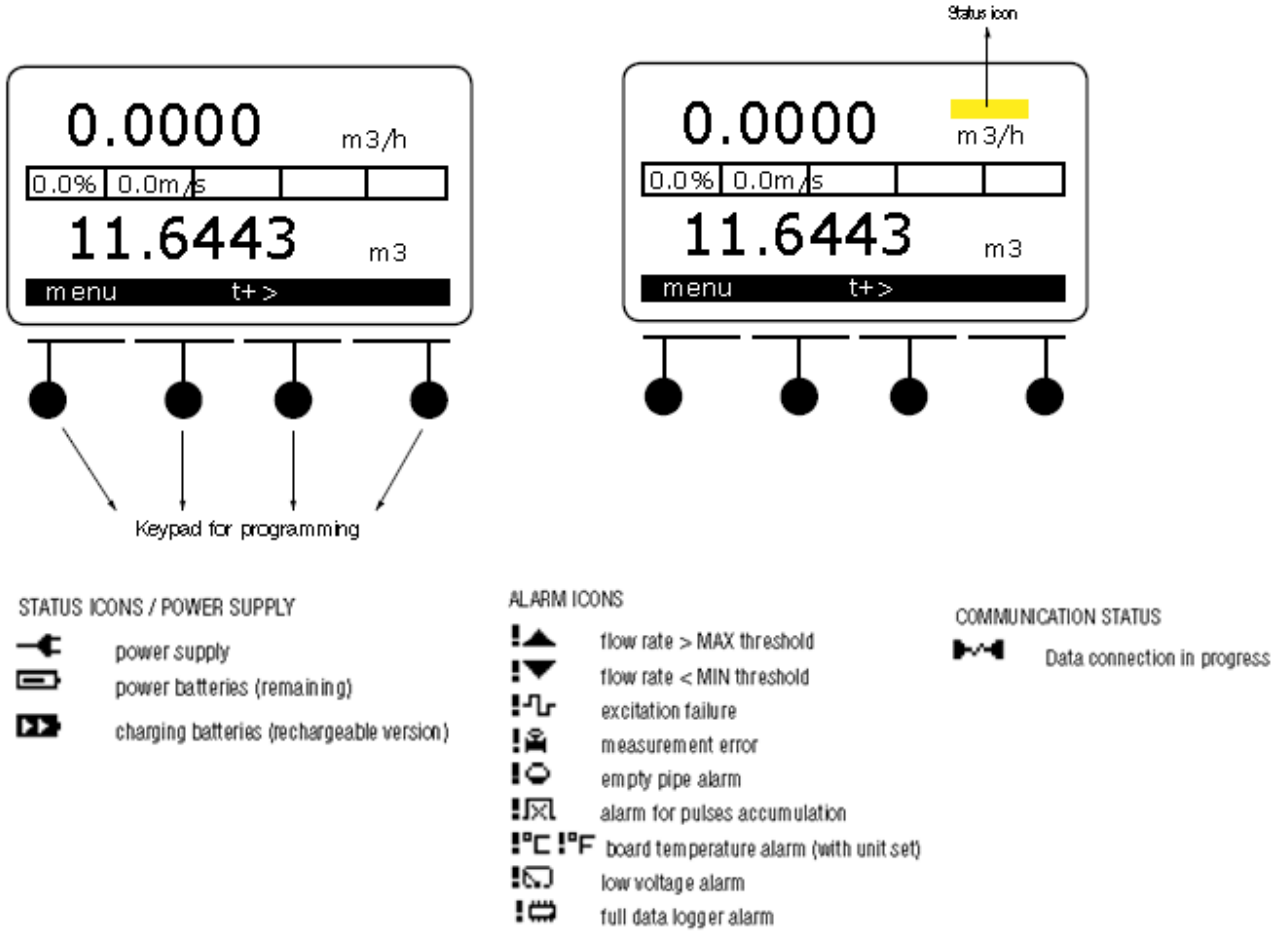
Data logger
- Show last row
- Full erase
- LOG range

Password setup

3.5.2 Data to be Displayed

- The display is divided into 3 mil areas.
- The top area shows the symbols for status information, together with the indication on the duration of the battery (MC608B), or power indication (MC608A), as well as the alarm symbols and instantaneous reading of the flow rate.
- The central area shows a linear graph of the flow rate shown in percentage on the full scale flow rate.
- The area at the bottom can be selected by the customer and the possible options are:
    - T+ total positive counter
    - P+ partial positive counter
    - T- total negative counter
    - P- partial negative counter
    - Date and time
- To select the required value simply click on the button corresponding to the arrow and make your selection, or select Menu > Options > View > Options > Last row.

Figure 28 – Display Overview



3.5.3 Options

3.5.3.1 Technical Units

- Flow rate volume: Select the volume technical unit for the instantaneous flow rate
- Flow time base: Select the time base for the instantaneous flow rate.
- Counter volume: Select the volume technical unit for the counters
- Pulse volume: Select the volume unit for the pulses.

3.5.3.2 Measurement Frequency

- Measuring time. If operating in battery powered mode, select the measuring time of the system between 16 and 120 seconds.

  Note: The factory setting is 32 seconds. Any reduction of the factor will affect battery life when using MC608B in battery mode.

3.5.3.3 Display

- LCD Backlight Level. Increase or decrease the level of the backlight.
- Backlight off. Increase or decrease shut off time of the backlight of the display.
- LCD contrast. Modify the contrast of the display.

  Note: Any modification of the display can affect battery life when using the MC608B in battery mode.

3.5.3.4 View Options

- Defines the default display information with selection between:
  - T+ total positive counter
  - P+ partial positive counter
  - T- total negative counter
  - P- Partial negative counter
  - Date & time

3.5.3.5 Language

- The following languages may be selected:
  - English
  - Spanish
  - Portuguese
  - Italian

3.5.4 Counters

Four different counters are available in the MC608 converter. Two positive counters, and two negative counters. Only partial counters can be set to zero.

3.5.5 Parameters

3.5.5.1 Ka Setup

- KA is the main calibration factor of the flow meter – this location allows the user to modify the calibration factor if required.

  Note: Only authorized personnel should change the Ka factor. The Ka factor must be the same as the flow meter sensor. Check the Ka factor on the flow meter name plate.

3.5.5.2 Diameter Setup

- This location allows the user to set the diameter of the flow meter.

3.5.5.3 Filter Setup

- Flow cutoff. A low flow cut off value can be set as a percentage of the full scale flow rate. If the actual flow rate of the liquid is less than the low flow cut off value, then the instrument will display 0.
- Damping. Increasing damping increases the stability of the displayed value through increased averaging; the larger the number the higher the damping.
- Peak Cut: A peak cut off value can be set as a percentage of the full scale flow rate. If there are peaks in the flow rate measurement, their value will be limited to the value expressed. For example, by setting the value at 10%, any instantaneous spikes greater than 10% of the full scale value will be limited not to exceed the 10% value.
- Filter Bypass. Enter a value as percentage of full scale so that any instantaneous step changes greater than the set value will bypass the digital filter and display the actual flow. The filter bypass can be useful to speed the response of the meter to large changes in flow rate such as opening or closing valves and starting pumps.

  For example, in the case that this parameter has a value of 50%

  IF: The flow rate varies 50% more than the previous value.
  THEN: The flow rate shown will reflect the actual step change

  IF: The flow step change is less than 50% of the full scale value
  THEN: The digital filter will be applied and the flow rate shown will slowly reach the actual value.

- Measurement Average. This option increases the stability of the reading by enlarging the actual measurement filter. To increase the stability, increase the value in this sub-menu.

3.5.5.4 Sensor Offset

- Displays the zero offset of the flow meter

3.5.5.5 Zero Finder

- This setting is used to perform the instrument zero calibration. Before performing the zero calibration ensure that:
  - The sensor is full of liquid
  - The liquid is perfectly stationary
  - The sensor has the correct electrical ground

3.5.5.6 Flow Rate Alarms

- Max flow: Set the maximum value of the flow rate as a percentage of the full scale value. The factor default setting is “disabled”. The max flow threshold by be set from 5% to 200% of the full scale value. Setting this parameter to 200% disables this function.
- Min flow: Set the minimum value of the flow rate as a percentage of the full scale value. The factor default setting is “disabled”. The min flow threshold by be set from 1% to 5% of the full scale value. Setting this parameter to 1% disables this function

3.5.6 I/O

3.5.6.1 Pulse Out

- Pulse Quantity

  Define the pulse significance i.e. volume / unit pulse. Note: pulse volume and duration settings differ between transmitter models MC608A and MC608B

  - MC608A (powered version) Parameter calculation.

    Vp = volume per pulse expressed in liters
    Tp = Pulse width expressed in seconds
    Q = flow rate in liters / second

    For a given pulse width (Tp): $Vp > Qmax*2Tp$
    For a given volume per pulse (Vp): $Tp < Vp/2Qmax$

  - MC608B (battery version) Parameter calculation.

    For a given pulse width (Tp): $Vp > Qmax*20Tp$
    For a given volume per pulse (Vp): $Tp < Vp/20Qmax$

- Pulse time on
  - Select the “on” time duration of the pulse on a range between 1 and 1999 ms.
- Reverse flow (off/on)

- Acting on this function, in the case of negative flow, the pulses will be enabled/disabled.

Note: High pulse output frequencies and “on” times longer than 100 ms will adversely affect battery life.

3.5.6.2 Frequency Output

- Full scale frequency: Set the maximum frequency corresponding to the full scale flow rate value. The selectable range is 100Hz to 10KHz.

3.5.6.3 Program Output

- The programmable status output can be set to:
  - Enable/disable
  - Reverse flow
  - Max flow alarm
  - Min flow alarm
  - Batching
  - Excitation failure
  - Empty Pipe

3.5.6.4 Program Input

- The programmable input can be set to:
  - External partial positive total zeroing
  - External partial negative total zeroing
  - External partial positive and negative total

3.5.7 Other

3.5.7.1 System Info

- Displays the system information. These values cannot be modified by the end user

3.5.7.2 Time/Date

- Shows the date, time, motherboard temperature, battery condition for the MC608B battery powered unit.

3.5.7.3 Graph

- Displays the graph of measured flow rate.

3.5.7.4 Simulation

- The MC608 has a built in flow simulator to verify and adjust the pulse output to any connected device.

Note: When using the flow simulation, the counters will not increase in value.

3.5.7.5 Communication

- Baud rate. Allows the adjustment of the RS485 baud-rate between the range 2400 and 115,700 bps.
- MODBUS address. Allows the adjustment of the MODBUS communication address between 1 and 255.

3.5.8 Memory

3.5.8.1 Load User Copy

- Allows to load customized settings

3.5.8.2 Save User Copy

- Allows to save customized settings

3.5.8.3 Load Factory Settings

- Allows to load factory settings

3.5.8.4 Data Logger

- Show last row: Displays last information logged. Date, time, counter, instantaneous flow rate, temperature, battery condition.

3.5.8.5 Full Erase

- Erases the memory of the converter

3.5.8.6 Log Interval

- Defines logging interval. 1 minute minimum / maximum 120 minutes

4 SPECIFICATIONS

Parameter	Specification
Converter Installation	Compact or remote versions • MC608A up to 100 meters from sensor • MC608B up to 30 meters from sensor
Converter Case	Aluminum epoxy painted IP68 rated to 1.5 meters, with front window in toughened glass. Note: Coolant version (MC608P) is IP66 rated.
Electrical Connections	Cable glands, plastic, M20x1.5
Connection Cables	Supplied by FTI
Power Supply	MC608A • 90…264Vac • 12/24 Vac/dc MC608B • Battery powered supply or 12/24Vac/dc • Expected life T=0/50°C – Internal battery pack 3-6 years; internal and external battery pack 6-10 years
Inputs / Outputs	• Active analog 4-20mA • Digital pulse output maximum 1000Hz duty cycle max 50% • Programmable digital output • Digital pulse output active frequency 0…10kHz (requires external 24VDC) • All outputs are optically isolated • Pulse output maximum capacity +/- 30VDC 50mA
Serial Communication	• MODBUS RTU interface on RS485 • IrDA interface for communicating with laptop or hand held device.
Temperature Range	Ambient: -20°C to 80°C (-4°F to 176°F) Storage: -30°C to 80°C (-22°F to 176°F)
Accuracy	0.20% of reading value (over calibrated range)
Repeatability	0.10% of reading value
Sampling Frequency	Programmable 5, 3, 1, 1/15, 1/30, 1/60, 1/120, 1/240, 1/480 Hz
Measuring Stability Time	3 seconds
Display	• Graphic LCD – 128x64 pixels, 50x25mm visual area • Programmable backlighting • Simultaneous display of rate, totals, status flags • Programmable display content

Parameter	Specification
Programming	• With push buttons on display PCB • By PC with dedicated software via RS485 MODBUS RTU communication protocol. • By Irda interface with laptop or hand held device
Units of Measure	Settable for individual counters, flow indication and pulse o/p • USgal, bbl, oz, gal, ft3, in3, m3,hl, dal, l, dl, cl, ml
Reference Time	Selectable time units: s, m, h, days
Process Data Logger	4MB flash memory, 200,000 lines of data (one line includes: instant flow, 2 counters, date, time, PCB temperature).
Diagnostic Data Logger	64Kb EEPROM, 2000 lines of data (one line includes: date, time, PCB temperature, error codes, user actions with changes made). Not programmable and tamper/reset proof.
Electrical Conductivity	5uS/cm, 20uS/cm minimum for DI water
Recommended Velocity	-10 to 10 m/s
Approvals	• MC 608 A/B meets all the requirements established by the EC directives. • Electromagnetic compatibility: Directive 2004/108/EC, Harmonized standards EN 61326-1:2006; EN 55011:2009; EN61000-3 (2/3); EN 61000-4 (2/3/4/5/6/8/11) • Low voltage directive: Directive 2006/95/EC

5 TROUBLESHOOTING

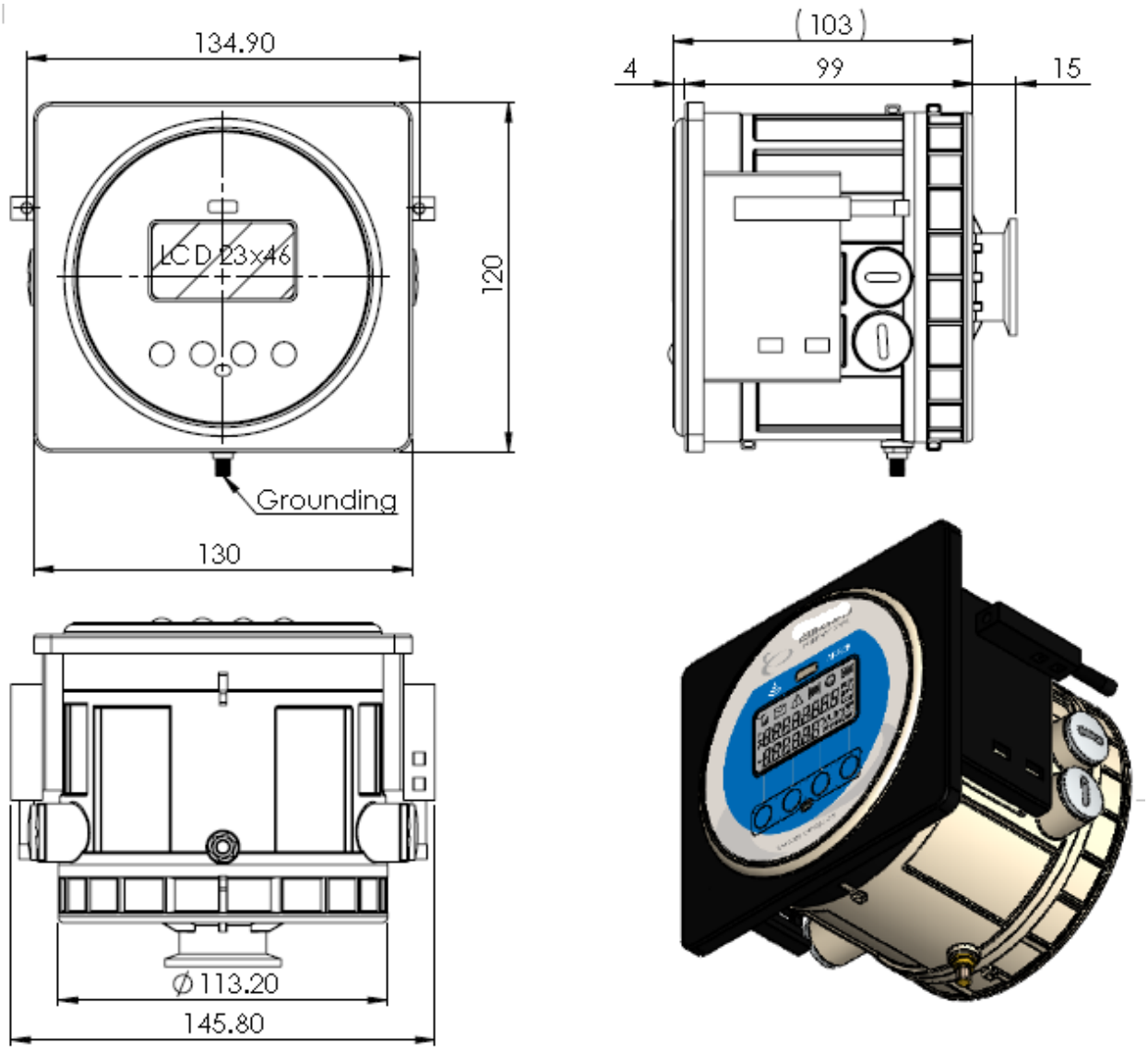
Symptom	Possible Remedies
Converter is showing a flow rate with no flow.	1) Check if the sensor and liquid are correctly grounded. 2) Check that the sensor is full of fluid. 3) Electrical conductivity of the fluid is too low or is not compatible with the material used for the sensor electrodes. 4) Perform manual zero finder. (Menu – Parameters, sub menu – zero finder) 5) Check value of low flow cut off.
Flow Reading is highly unstable.	1) Check if the sensor and liquid are correctly grounded. 2) There is air in the pipe. Avoid bubbles by selecting a more suitable position for the sensor. 3) Set filters as follows: • Set Damping to 150 • Reduce Peak Cut filter • Increase Bypass filter
External pulse totalizer shows results different from what is expected.	1) Test the output with the internal flow simulator and the converter pulse counter system simulating a flow rate with System – Simulator.
The display is off and does not turn on.	1) Check to insure supply voltage is available. 2) Check that supply voltage matches the name plate on the converter. 3) If the unit is a MC608B battery powered unit, check the battery life and replace as needed.
Liquid is flowing in pipe, but there is no display,	1) Reduce the low flow cut off filter (factory setting is 2% of the full scale)

6 ALARM MESSAGES

Alarm Message	Possible Cause and Solutions
Excitation failure 	1) Incorrect cable connections. 2) Sensor damaged. Damaged lining or electrodes. Possible infiltration of liquid inside the sensor. 3) Converter damaged. Recommend performing a test on the sensor circuit between coils A – B: 50 – 250 Ohm.
Measurement error 	1) Empty pipe 2) Air bubbles within the liquid 3) Incorrect electrical grounding Check for correct installation of sensor. With pipe full between a or B and ground > 100MOhm.
Empty Pipe 	1) Empty pipe detection This message is displayed with sensors that have 4 electrodes. Indicates the alarm of empty pipe, or partially empty. If the alarm is indicating the pipe is partially full when you are sure it is full, go to: Main Menu, Parameters, Empty Pipe Th. Move the slide bar toward the “F” and press “test”. The alarm should be removed.
Pulse accumulation 	1) Pulse frequency incorrect Change the volume and/or pulse duration settings.
Supply voltage 	1) Supply voltage out of operating range 2) Converter damaged Check the power supply network.
Data logger full 	1) Data logger memory full Download the data to a PC and erase the memory of the converter.

Appendix A Coolant Flow Meter Transmitter (MC608P)

The EL4000 series coolant meters have a unique transmitter configuration and enclosure. The flow meter and transmitter come prewired with six meters of cable and a cable interconnection a short distance from the flow meter. The transmitter enclosure is light weight plastic which can be panel or wall mounted. The wiring and programming of the coolant transmitter (MC608P) is the same as the MC608A version defined in this manual. Dimensional information for the transmitter housing is provided below.



Appendix B Modbus Input Registers - Function Code 04

FC04 Read Input Registers (read-only variables)

MODBUS REGISTER	MODBUS ADDRESS	Num. Bytes	Data Type	Description	DATA TYPE	Access (Read/Write)
3:0001	0000	4	FLOAT	Instantaneous measurement fluid velocity in m/s	m/s	R
3:0003	0002	4	FLOAT	Instantaneous measurement flow rate in m^3/s	m^3/s	R
3:0005	0004	4	FLOAT	Instantaneous measurement flow rate in kg/s	kg/s	R
3:0007	0006	4	FLOAT	Counter total positive in m^3	m^3	R
3:0009	0008	4	FLOAT	Counter total negative in m^3	m^3	R
3:0011	0010	4	FLOAT	Counter partial positive in m^3	m^3	R
3:0013	0012	4	FLOAT	Counter partial negative in m^3	m^3	R
3:0015	0014	4	FLOAT	Specific weight set for mass counters in kg/m^3	kg/m^3	R
3:0017	0016	4	FLOAT	Counter total positive in kg	kg	R
3:0019	0018	4	FLOAT	Counter total negative in kg	kg	R
3:0021	0020	4	FLOAT	Counter partial positive in kg	kg	R
3:0023	0022	4	FLOAT	Counter partial negative in kg	kg	R
3:0025	0024	2	INT16	Index volume unit current flow rate	See volume units table	R
3:0026	0025	2	INT16	Index volume unit current time flow rate	See time units table	R
3:0027	0026	4	FLOAT	Measure instantaneous fluid flow in the units set	Reg-0024 / reg-0025	R
3:0029	0028	2	INT16	Index volume unit counter current set	See volume units table	R
3:0030	0029	4	FLOAT	Counter total positive in the current volume unit	reg-0028	R
3:0032	0031	4	FLOAT	Counter total negative in the current volume unit	reg-0028	R
3:0034	0033	4	FLOAT	Counter partial positive in the current volume unit	reg-0028	R
3:0036	0035	4	FLOAT	Counter partial negative in the current volume unit	reg-0028	R
3:0038	0037	4	FLOAT	Pulse volume in m^3	m^3	R
3:0040	0039	2	INT16	Pulse volume in the current volume unit	See volume units table	R
3:0041	0040	4	FLOAT	Pulse volume in the set volume unit	reg-0039	R
3:0043	0042	4	FLOAT	PCB temperature	°C/°F	R
3:0047	0046	2	INT16	Sampling Frequency	0: Continuous * 1: Battery * 2: Any 3: Continuous 4: Seconds	R
3:0048	0047	2	INT16	Current year	YY	R
3:0049	0048	2	INT16	Current month	MM	R
3:0050	0049	2	INT16	Current day	DD	R
3:0051	0050	2	INT16	Hours	hh	R
3:0052	0051	2	INT16	Minutes	mm	R
3:0054	0053	4	FLOAT	Full scale (FS) in the current volume unit *	reg-0024/reg-0025	R
3:0056	0055	4	FLOAT	Actual flow rate % on the FS *	%	R

(*)FW version 3.00 and later

Appendix C Modbus Holding Register Function Codes 03 & 16

FC03 – Read Holding Register

FC16 – Write Holding Register

MODBUS REGISTER	MODBUS ADDRESS	Num. Bytes	Data Type	Description	DATA TYPE	Access (Read/Write) CMD16 (*)
4:1002	1001	2	UINT	Firmware version FW	0207hex=2.07	R
4:1003	1002	2	UINT	Hardware version HW	0501hex=5.01	R
4:1004	1003	2	UINT	Baudrate (TIA-485)	Default 9600	R
4:1005	1004	2	BYTE	Device Modbus 1-255	Default 1	R
4:1006	1005	2	BOOL	Format FLOAT on Modbus	0=FLOAT (default) 1=Reverse FLOAT	R/W
4:1011	1010	2	BYTE	Reserved	Reserved	R/W
4:1012	1011	2	UINT	Reserved	Reserved	R/W
4:1020	1019	8	ASCII	Converter model	8 digits - ex.: “MC 608B”	R
4:1024	1023	10	ASCII	Converter’s part number	Factory value (9 digits)	R
4:1029	1028	4	ULONG	Converter’s serial number	Progressive production number	R
4:1031	1030	12	UINT	Coupled sensor model	12 digits - ex.: “MUT1100J”	R
4:1037	1036	10	ASCII	Sensor’s part number	Factory value (9 digits)	R
4:1042	1041	2	UINT	Coupled sensor’s diameter	Diameter (1 - 4000) mm	R
4:1043	1042	2	BYTE	Empty pipe	1=available; 0=not available	R
4:1045	1044	20	BYTE	Note	Internal references	R
4:1055	1054	4	FLOAT	Full scale m^3/h	Referent value alarms/display	R/W
4:1061	1060	2	BYTE	Percentage back light level display	0 - 100 %	R/W
4:1062	1061	2	BYTE	Time-out back light display	0 - 30 second >30 always on	R/W
4:1063	1062	2	BYTE	LCD contrast	24 - 50	R/W
4:1064	1063	2	BYTE	Language display	0=English 1=Italian 2=Spanish 3=Portuguese 4=French *	R/W
4:1065	1064	2	BYTE	Set last line of the display	0=Total positive counters; 1=Partial positive counters; 2= Total negative counters; 3=Partial negative counters; 4=Date; * 5 = Exp; *	R/W
4:1066	1065	2	BYTE	Flow rate volume	See volume units table	R/W
4:1067	1066	2	BYTE	Time base flow rate time	See time units table	R/W
4:1068	1067	2	BYTE	Totalizers volume	See volume units table	R/W
4:1069	1068	2	UINT	Liquid specific weight value *	kg/m^3	R/W
4:1070	1069	2	BYTE	Temperature units *	0 = °C 1 = °F	R/W
4:1071	1070	2	BYTE	Visualized pulses on display	See volume units table	R/W
4:1072	1071	4	FLOAT	Pulse volume in ml	Value x 0.1 * Value	R/W
4:1074	1073	2	UINT	Pulses time ON	(value +1) x 0.5 mS * 1 - 1999 mS (def 10)	R/W

4:1077	1076	2	BYTE	Pulses/frequency output Mode *	0= Out pulses + Out Freq : PWM 1 = Only frequency Out	R/W
4:1078	1077	2	BYTE	Enable pulses also with negative flow *	0 = Off 1= On	R/W
4:1081	1080	2	BYTE	Programmable input setup	*0=Disabled* *1=Set zero P-* *2=Set zero P+* *3=Set zero P+ e P-*	R/W
4:1082	1081	2	BYTE	Programmable output setup	0=Disabled 1=Reverse flow 2= Max flow threshold 3= Min flow threshold 4= Max/min threshold 5= Dosage * 6 = Excitation failure * 7 = Empty pipe alarm *	R/W
4:1083	1082	2	UINT	Frequency out full scale	100 - 10000 Hz	R/W
4:1084	1083	2	BYTE	Programmable output logic *	0 = Norm. Open 1 = Norm. Closed	R/W
4:1085	1084	4	FLOAT	Dosage volume *	1 - 1000000 (TU Counters)	R/W
4:1101	1100	2	UINT	Damping Filter (average number of samples visualized) **	5 - 500 1 – 500 *	R/W
4:1102	1101	2	BYTE	Percentage cut-off	0 - 50 % FS (def 2%)	R/W
4:1103	1102	2	BYTE	Percentage by-pass filter	2 - 95 % FS (def 10%)	R/W
4:1104	1103	2	BYTE	Percentage peak-cut	1 - 25 % FS (def 5%)	R/W
4:1105	1104	2	BYTE	Line frequency 50hz/60Hz	50Hz , 60Hz	R/W
4:1106	1105	2	UINT	Average filter	1 - **Damping	R/W
4:1111	1110	2	BYTE	Flow rate alarm (MAX) on the FS	5% - 100% *(MIN + 5%) - 100% 255 = OFF	R/W
4:1112	1111	2	BYTE	Flow rate alarm (MIN) on the FS	1% - (MAX – 5%) *0% - (MAX – 5%) 255 = OFF	R/W
4:1132	1131	2	BYTE	Datalogger sampling frequency	Value (1 - 240) x 4 sec * 1 - 120 minutes	R/W

(*) FW version 3.00 and later

FS = Full scale

Appendix D Volume and Time Base Units Charts

Volume Units	1	2	3	4	5	6	7	8	9	10	11	12	13
	ml	cl	dl	l	dal	hl	m^3	Ml	in^3	ft^3	gal	bbl	oz

Time Units	1	2	3	4
	/s	/min	/h	/GG

Appendix E Examples

Address 1005 - FLOAT ON MODBUS FORMAT

This setting inverts the order of the two words making up the 32-bit FLOAT and allows you to read and write data as FLOAT or FLOAT reverse

Address 1005=03EDh Reading required description

Query chart

address	function	register word 03EDhex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID (1-255)	**03**	**03h**	**EDh**	**00**	**1**	**CRC16**	

Read response explanation

Response example chart

address	function	data BYTE count	register 00AFhex word value		CRC 16 word	
			data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID	**03**	**2**	**00**	**0=FLOAT 1=FLOAT reverse**	**CRC16**	

Write request description

Query chart

address	function	register word 03EDhex		data count word 0001hex		data BYTE count	register 00AFhex word value		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW		data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID (1-255)	**16**	**03h**	**EDh**	**00**	**01h**	**2h**	**00**	**0=FLOAT 1=FLOAT reverse**	**CRC16**	

Write response explanation

Response example chart

address	function	register word 03EDhex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID	**16**	**03h**	**EDh**	**00**	**01h**	**CRC16**	

Example R/W BYTE Register

Address 1010 – AUTOMATIC POWER OFF TIME (batteries)
This value represents the time (in seconds) of the automatic power-off, exclusively for the version with battery power supply

Address 1010=03F2h Read request description
Query chart

address	function	register word 03F2hex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID (1-255)	**03**	**03h**	**F2h**	**00**	**1**	**CRC16**	

Write request description
Response example chart

address	function	data BYTE count	register 03F2hex word value		CRC 16 word	
			data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID	**03**	**2**	**00**	**20 - 240 s**	**CRC16**	

Write request description
Query chart

address	function	register word 03F2hex		data count word 0001hex		data BYTE count	register 03F2hex word value		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW		data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID (1-255)	**16**	**03h**	**F2h**	**00**	**01h**	**2h**	**00**	**20 - 240 s**	**CRC16**	

Write request description
Response example chart

address	function	register word 03F2hex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID	**16**	**03h**	**F2h**	**00**	**01h**	**CRC16**	

Example R/W Unit Register

Address 1041 – SETTING THE COUPLED SENSOR DIAMETER

This value indicates the diameter of the coupled sensor in mm

Address 1041=0411h Read request description

Query chart

address	function	register word 0411hex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID (1-255)	**03**	**04h**	**11h**	**00**	**1**	**CRC16**	

Read request description

Response example chart

address	function	data BYTE count	register 0411hex word value		CRC 16 word	
			data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID	**03**	**2**	**1 - 4000 mm**		**CRC16**	

Write request description

Query chart

address	function	register word 0411hex		data count word 0001hex		data BYTE count	register 0411hex word value		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW		data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID (1-255)	**16**	**04h**	**11h**	**00**	**01h**	**2h**	**1 - 4000 mm**		**CRC16**	

Write request description

Response example chart

address	function	register word 0411hex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID	**16**	**04h**	**11h**	**00**	**01h**	**CRC16**	

Example R/W FLOAT Register

Address 1054 – FULL SCALE m^3/h

The purpose of this function is to set the FS full scale (always expressed in m^3/h), to which all the settings relative to the latter will make reference.

Address 1054=041Eh Read request description

Query chart

address	function	register word 041Ehex		data count word 0001hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID (1-255)	**03**	**04h**	**1Eh**	**00**	**2**	**CRC16**	

Read request description

Response example chart

address	function	data BYTE count	register 041Ehex word value		register 041Fhex word value		CRC 16 word	
			data BYTE HI	data BYTE LOW	data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID	**03**	**4**	**word LOW word HI (FLOAT reverse)**		**word HI word LOW (FLOAT reverse)**		**CRC16**	

Write request description

Query chart

address	function	register word 041Ehex		data count word 0002hex		data BYTE count	register 041Ehex word value		register 041Fhex word value		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW		data BYTE HI	data BYTE LOW	data BYTE HI	data BYTE LOW	CRC LOW	CRC HI
Device ID (1-255)	**16**	**04h**	**1Eh**	**00**	**02h**	**4h**	**word LOW word HI (FLOAT reverse)**		**word HI word LOW (FLOAT reverse)**		**CRC16**	

Write request description

Response example chart

address	function	register word 041Ehex		data count word 0002hex		CRC 16 word	
		data start address HI	data start address LOW	data BYTE count HI	data BYTE count LOW	CRC LOW	CRC HI
Device ID	**16**	**04h**	**1Eh**	**00**	**02h**	**CRC16**	