FLOMOTION SYSTEMS

MC 308 CONVERTER
MUT SERIES FLOWMETERS

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FLOMOTION SYSTEMS

MC 308 CONVERTER MANUAL

Including Installation Instructions for

MUT 500, 501, 1000, 1100, 2200, 2400, 2500 & 2660 ELECTROMAGNETIC FLOWMETERS

CE

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1 - SYMBOLS MEANING

WARNING: please refer to the documentation enclosed with the product.

WARNING: electric shock danger
Operations with this symbol must be performed by skilled technicians only.

* * *

2 - REQUIRED SECTIONS

The sections of this operating manual that must be read before installing the flowmeter are:

Paragraph	Subject
4.1	Liquid direction inside the sensor.
4.3	Grounding.
5.1.C	MC 308 Electrical connections
5.3	Grounding of the converter.
5.4	Power Supply Connections
6	MC 308 Converter Programming.
6.3	Examples of Programming.

PLEASE REVIEW THE **FACTORY SETTINGS SHEET** INCLUDED WITH THE SENSOR. IT CONTAINS THE MAIN PARAMETER VALUES SET AT THE FACTORY.

PLEASE CHECK CAREFULLY THAT THE FOLLOWING PARAMETERS ARE CORRECTLY PROGRAMMED FOR YOUR APPLICATION:

parameters	MENU	SUBMENU
Full scale flow rate (f.s.)	FUNDAMENTALS	Full scale
DN	FUNDAMENTALS	Diameter
Volume per pulse	FUNDAMENTALS	Pulse quantity

(see paragraphs 6.7 and the MENU TABLE flow chart in section 6.1).

The flowmeters referenced in this manual satisfy the Standard EN 50082-2 (immunity) and EN50081-2 (emission) and belongs to class A.

3 - SENSOR INFORMATION

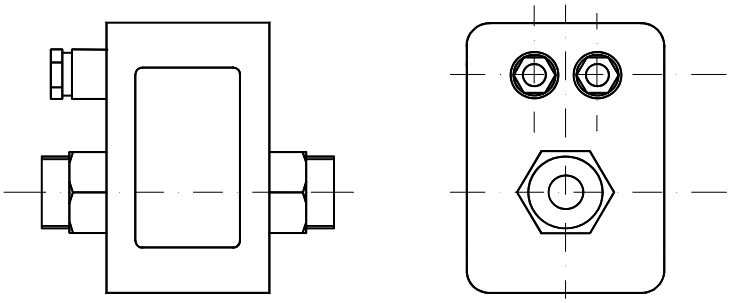
Electromagnetic flowmeters are composed of:

the ***sensor*** - that must be mounted between two flanges, threaded joints or tri-clamp fittings.

the ***converter*** - that can be mounted on the sensor (compact version) or nearby wall (separate version); in this case it is connected to the sensor by two cables C012 and C013.

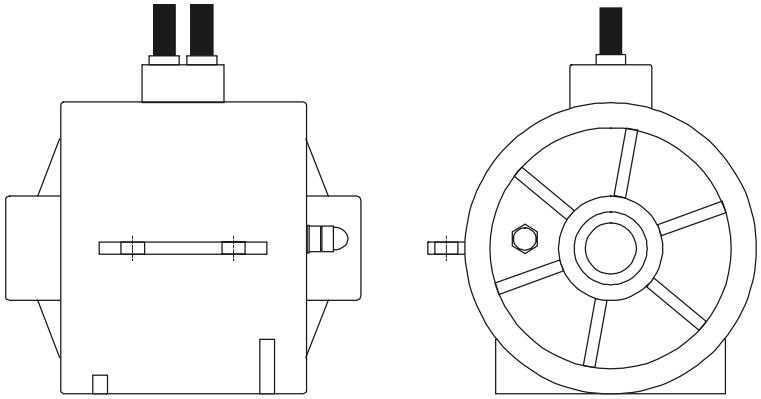
This manual relates to the following sensor models:

3.1 - MUT 500



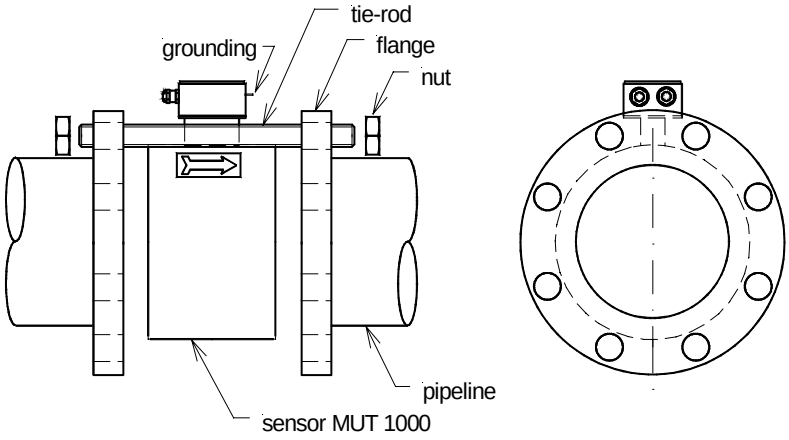
- Body and connections in 316 SS (process connections in Hastelloy, or Titanium on request).
- Threaded male NPT or optional Tri-Clamp process connections.
- Available diameters: 1/8” 1/4” 3/8” 1/2" 3/4" (DN 3, 6, 10, 15, or 20mm)
- Lining: PTFE (white).
- Pressure Rating: 230 psi (PN16) (higher pressure ratings upon request).
- 316 SS Electrodes (Hastelloy C or Titanium optional)

3.2 - MUT 501



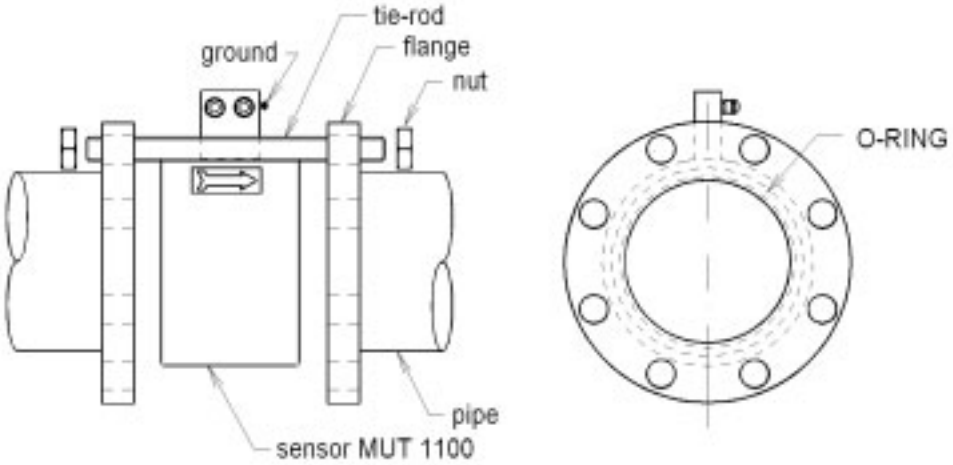
- Body and connections in Polypropylene.
- Threaded female NPT.
- Available diameters: 1/8”, 1/4”, 3/8”, 1/2", 3/4" (DN 3, 6, 10, 15, 20, 25mm)
- Lining: Polypropylene (optional PVC)
- Pressure Rating: 150 psi (PN10) @ 70º F
- 316 SS Electrodes (Hastelloy C optional)

3.3 - MUT 1000 (WAFER)



- Available diameters from 1-1/2” to 12” (DN 40 to DN 300)
- Installed between two counter-flanges (see table 1)
- Tightened by threaded tie-rods (see table1)
- Lining is PTFE (white)
- 316 SS Electrodes (Hastelloy C optional)
- Pressure Ratings:
  - 1-1/2” to 6”: 600 psi
  - 8” to 12”: 225 psi

3.4 - MUT 1100 (WAFER)

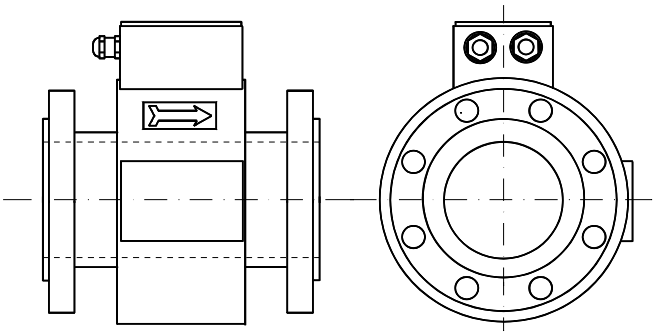


- Available diameters from 1.5” (DN 40) to 8” (DN 200).
- Installed between two counter-flanges (see table 1).
- Tighten by threaded tie-rods (see table 1).
- Lining is polypropylene.
- 316 SS Electrodes (Hastelloy C optional)
- Pressure Rating: 150 psi (PN10) @ 70º F

Table 1

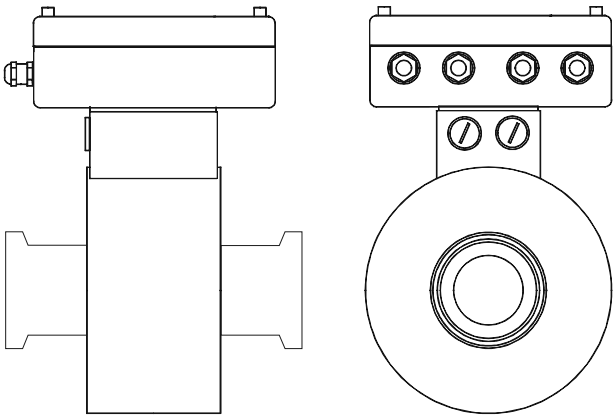
SENSOR SIZE		USABLE FLANGES, DIAMETERS AND NUMBER OF TIE-RODS				SENSOR LENGTH	
Mm	Inches	ANSI 150#		ANSI 300#		MUT 1000	MUT 1100
40	1 ½ ”	5/8"	4	5/8"	4	100 mm (3.94 in)	103 mm (4.06 in)
50	2	5/8"	4	5/8"	4	100 mm (3.94 in)	109 mm (4.29 in)
80	3	3/4"	8	3/4"	8	150 mm (5.90 in)	150 mm (5.90 in)
100	4	3/4"	8	3/4"	8	150 mm (5.90 in)	160 mm (6.29 in)
150	6	3/4"	8	3/4"	12	180 mm (7.09 in)	180 mm (7.09 in)
200	8	3/4"	8	7/8”	12	200 mm (7.87 in)	200 mm (7.87 in)
250	10	3/4"	8	7/8”	12	250 mm (9.84 in)	na
300	12	3/4"	8	7/8”	12	300 mm (11.81 in)	na

3.5 - MUT 2200



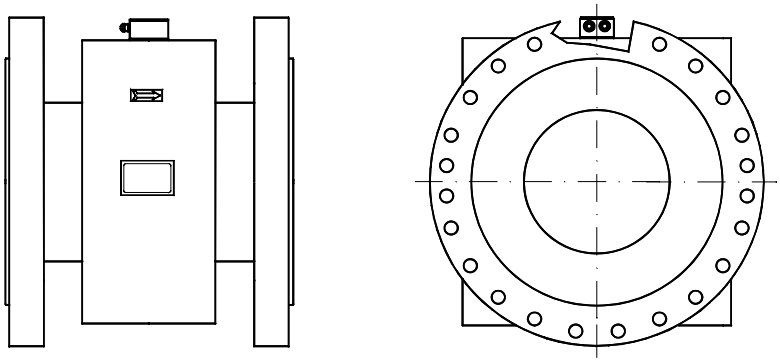
- Flanged connections.
- Available diameters from 1” to 16” (DN 25 to DN 400)
- Lining standard:
  - PTFE (white) 1” to 6” (DN 25...150)
  - Hard Rubber (black) 8” to 16” (DN 200...400)
- Standard Pressures:
  - 1” to 2” (DN 25...50) 580 psi (PN 40)
  - 2-1/2” to 6” (DN 65...150) 230 psi (PN 16)
  - 8” to 16” (DN 200...400) 145 psi (PN 10)
    (higher pressure ratings on request)
- Body and Flanges: Epoxy Coated Carbon Steel (Stainless Steel on request)
- 316 SS Electrodes (Hastelloy C or Titanium optional)

3.5 - MUT 2400



- Tri-clamp connections: 316 S.S.
- Body in 304SS.
- 316 SS Electrodes
- Available diameters from 1” to 4” (DN 25 to DN 100)
- Lining standard: PTFE (white)
- Standard Pressures: 360 PSI (PN25) 1” to 2” (DN 25...50), 230 PSI (PN16) 2-1/2, 3” & 4” (DN 65-80-100)

3.6 - MUT 2500



- Flanged connections.
- Available diameters: From 10” to 42” (DN 250 to DN 1050)
- Lining standard: Hard Rubber (black) on request PTFE (white)
- 316 SS Electrodes (Hastelloy C or Titanium optional)
- Standard Pressures:
  - 230 PSI (PN16),
  - 930 PSI (PN64) on request
  - ANSI 150 on request
- Body and Flanges: Epoxy Coated Carbon Steel (Stainless Steel on request)

3.7 MUT 2660 - INSERTION MAGNETIC FLOW METER

1. This flowmeter can be installed in pipes with a maximum liquid pressure of 150 PSI (10 bar).
2. It is necessary that the pipe is empty during installation.
3. Locate the installation point according to the hydraulic demands (see Fig. 1)

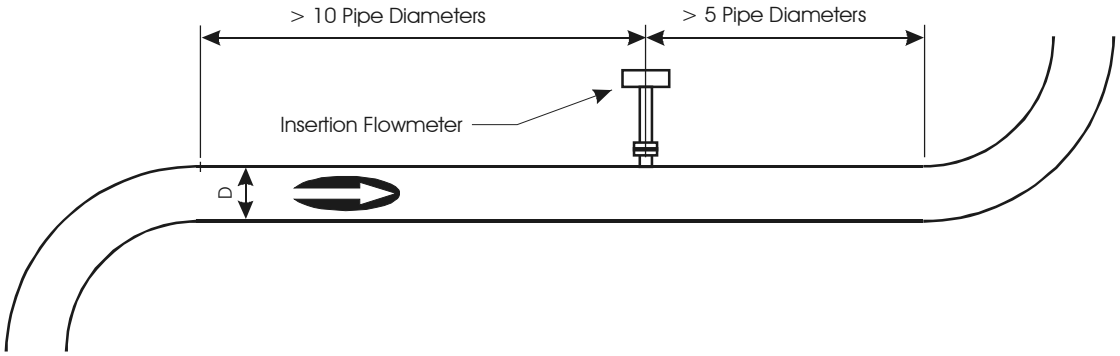


Fig. 1

4. Make a 1.50” diameter circular hole on the top of the pipe.
5. Install a suitable pipe saddle (Fig. 2) with a 1-1/2” female fitting (or weld a 1-1/2” Female NPT female coupling into the pipe.)
6. Insert the flow meter in the 1-1/4” NPT connection as shown in Fig. 2.
7. Suggestion for measurement of the internal pipe diameter (D):
    a. Measure the external piping circumference (in mm) by using a small string.
    b. Divide this measure by 3.14
    c. Subtract from the result the doubled thickness “s” (in mm) of the pipe wall.
    d. The result obtained is the diameter value in millimeters.
8. Use the equation below to calculate the distance RL to know the exact insertion depth of the sensor (see Fig. 2)

$$RL = Ls - s - 1/8 * D - L_c$$

Where:
Ls = Sensor Length (310 or 460mm)
s = thickness of the pipe wall in mm
D = internal Diameter of the pipe measured as in step 8 above.
Lc = Connection length (see Fig. 2)

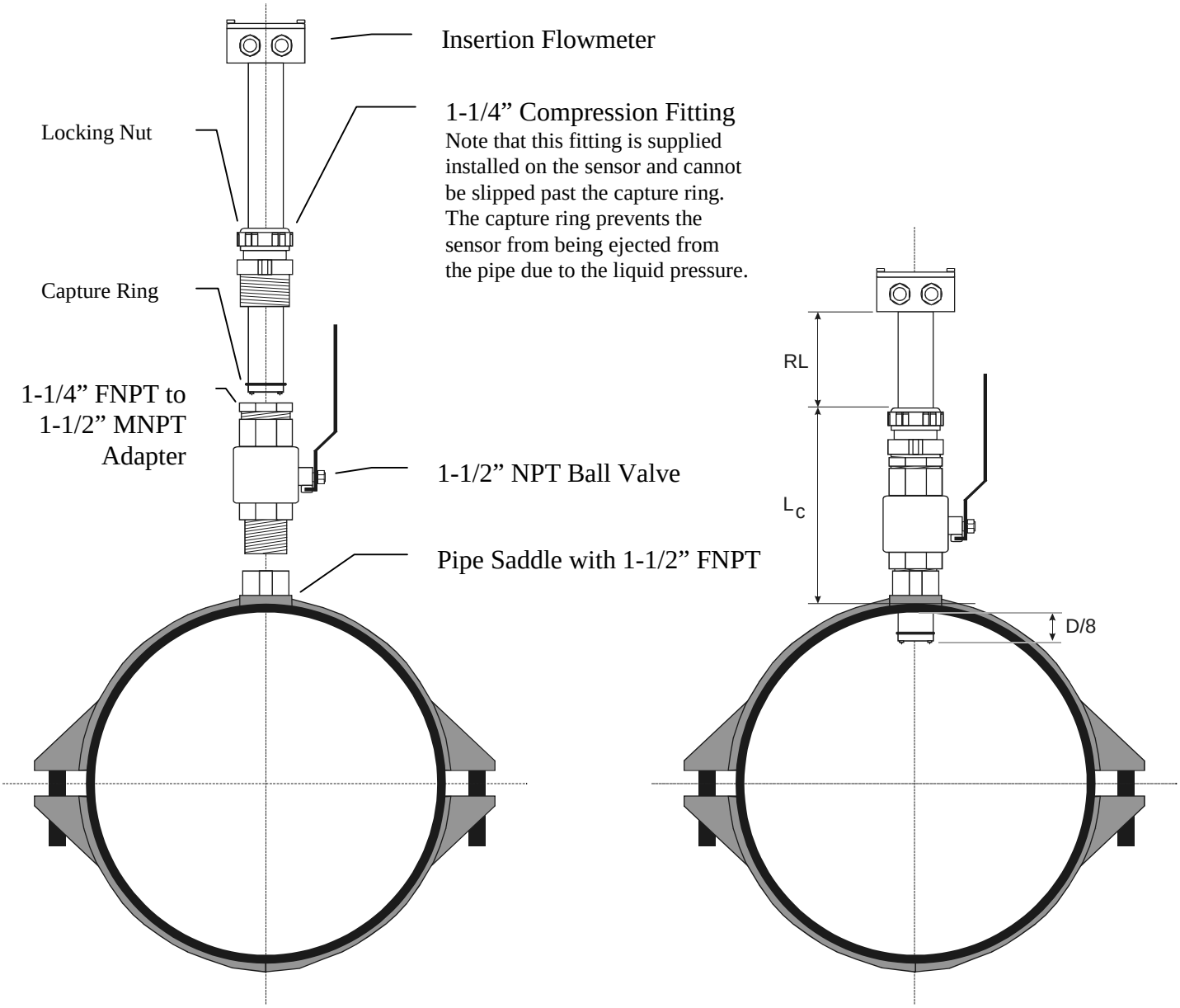


Fig. 2

9. Sealing of the sensor: Tighten the locking nut only after checking the correct orientation of the sensor. The junction box must be parallel to the pipe axis. Note the cable fittings in the position shown in Fig. 3.

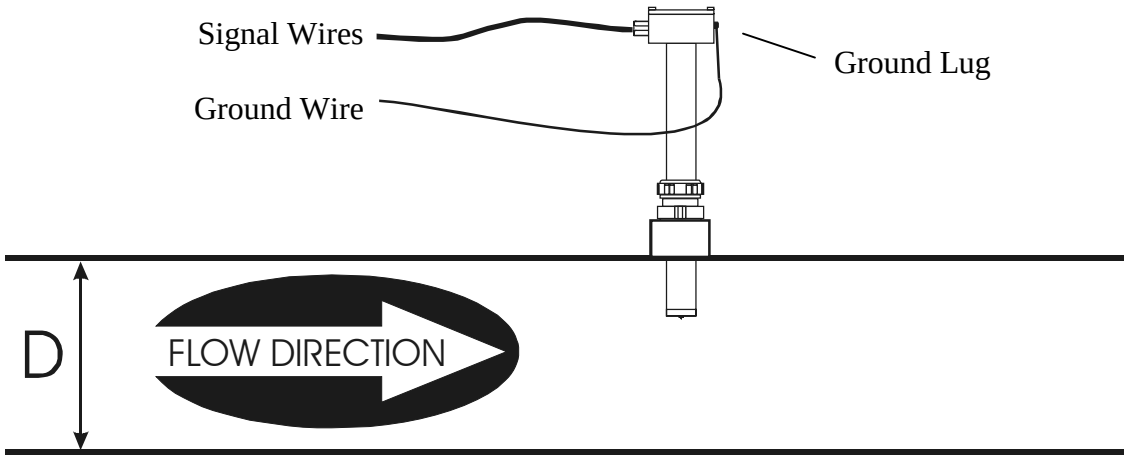


Fig. 3

Important:

- Grounding: place a ground wire from the sensor's junction box to a known earth ground.
- Remember that the piping must be completely full of liquid, so it is necessary to take suitable precautions in the choice of the sensor location.
- For the connection between the sensor and converter please refer to the sensor wiring section of this manual for the converter you have chosen.

5 - MC308 CONVERTER

5.1. MC308 INSTALLATION

5.1.A - COMPACT VERSION

The two connectors that are used for electrodes and coils in the remote model are not used and should remain plugged.

5.1.B - SEPARATE VERSION

5.1.B1 - Coupling

- Note the Converters power input; 90-260VAC **OR** 24VAC/VDC
- Read the number in the "COUPLING" box on the converter nameplate.
- This is the serial number of the sensor with which this converter must be coupled.
- If no number is present in the COUPLING box, the converter can be coupled to any Flomotion sensor **but must be programmed for that sensor**.

5.1.B2 – Converter Dimensions. The converter can be easily wall mounted.

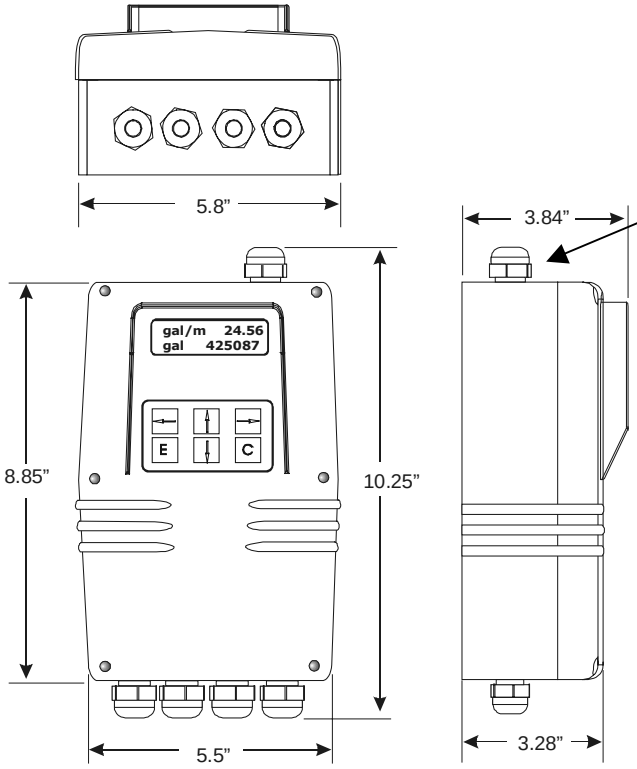


FIG. 2 – MC-308 OVERALL DIMENSIONS
(Non-metallic enclosure)

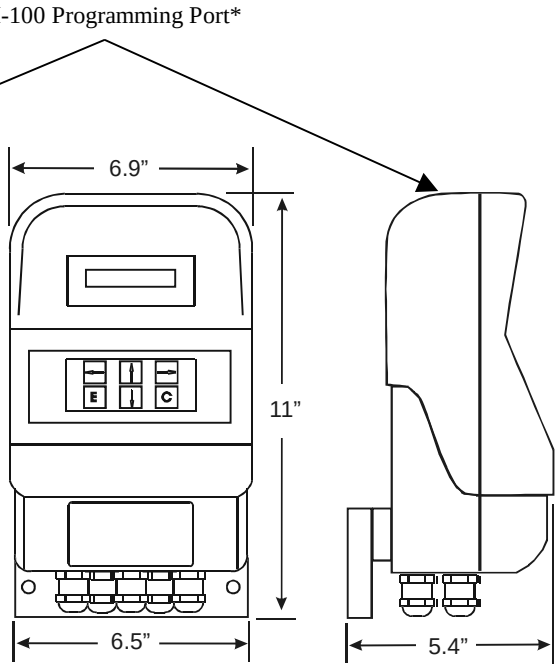
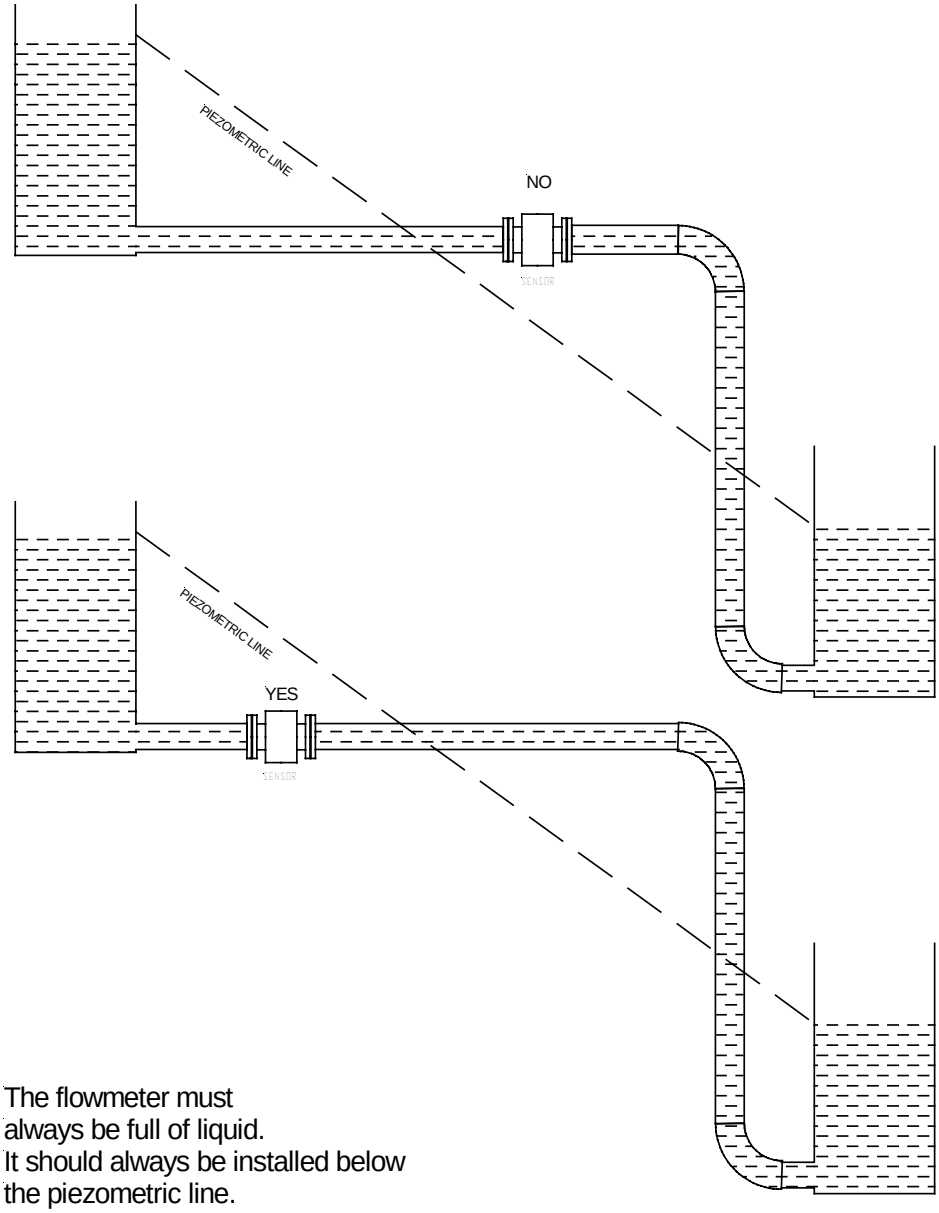


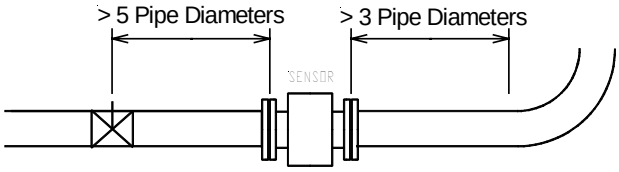
FIG. 2 – MC-308 OVERALL DIMENSIONS
(Die-cast aluminium enclosure)

*Note: The use of a TRM-100 Programmer is not required on the MC-308 Converters that have internal six-position keypad.

4 - SENSOR INSTALLATION



The flowmeter must
always be full of liquid.
It should always be installed below
the piezometric line.



A straight section of pipe (without valves, curves, etc.) with a length equal to at least three diameters should be left upstream of the meter.

4.2 - LIQUID DIRECTION

Understanding The Double Arrow

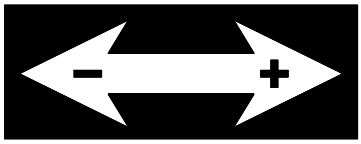
If the liquid being measured runs following the arrow direction with the - symbol, then the flow rate is negative and a negative number is displayed.

If the liquid being measured runs following the arrow direction with the + symbol, then the flow rate is positive and a number with no sign is displayed.

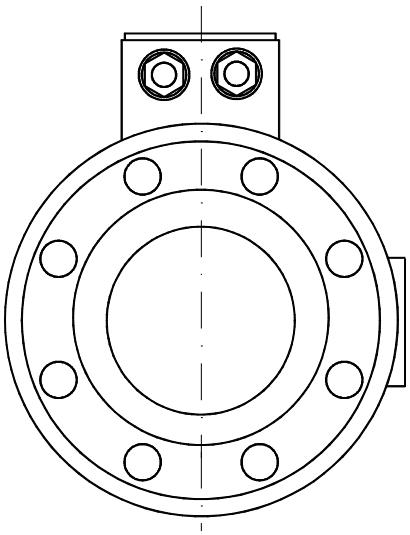
Reverse flow rate
Minus sign displayed

Forward flow rate
No sign displayed

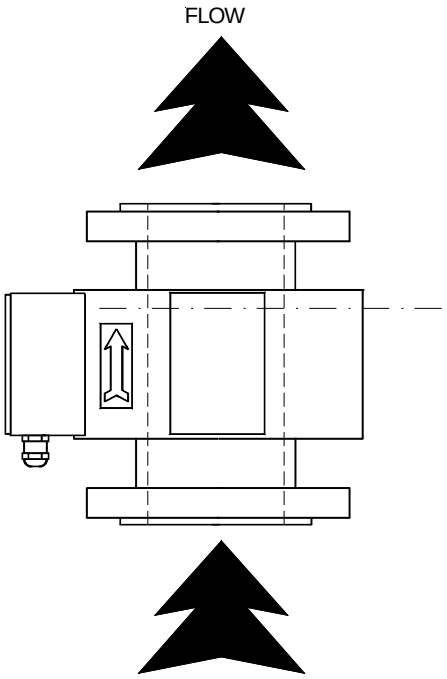
or



4.3 - OTHER RULES FOR A CORRECT INSTALLATION



Horizontal mounting.
If the meter is mounted on a horizontal pipe, the converter (or junction box) must be mounted above, at the 12 o'clock position as shown.



Vertical mounting.
If the meter is mounted on a vertical pipe, the liquid must flow from the bottom up. Vertical mounting with the flow going down is not recommended

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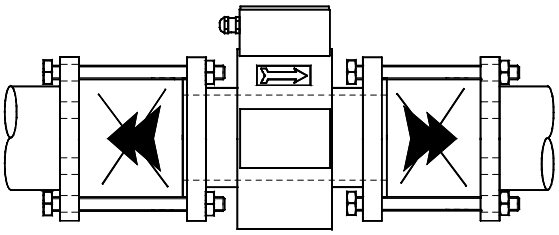
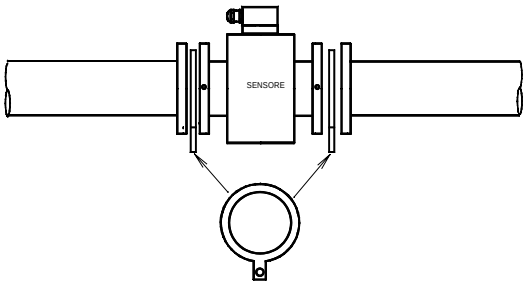


When mounting the meter between pipe counter-flanges, do not attempt to bring the two halves of the pipe closer together by tightening the bolts. **This may cause serious damage to the sensor!**



Grounding Rings

If the pipe is non-metallic (such as PVC) or has an internal lining, two metallic ground rings must be inserted between the meter and the counter-flanges.

Notes:

- Your meter may have a third internal ground electrode that eliminates the grounding ring requirement.

- Failure to properly ground your sensor may result in incorrect flow readings

4.4 - GROUNDING

MAKE THE GROUND CONNECTIONS AS SHOWN IN FIGURES S1, S2 & S3:
WITHOUT PROPER GROUNDING THE FLOWMETER WILL NOT WORK PROPERLY!

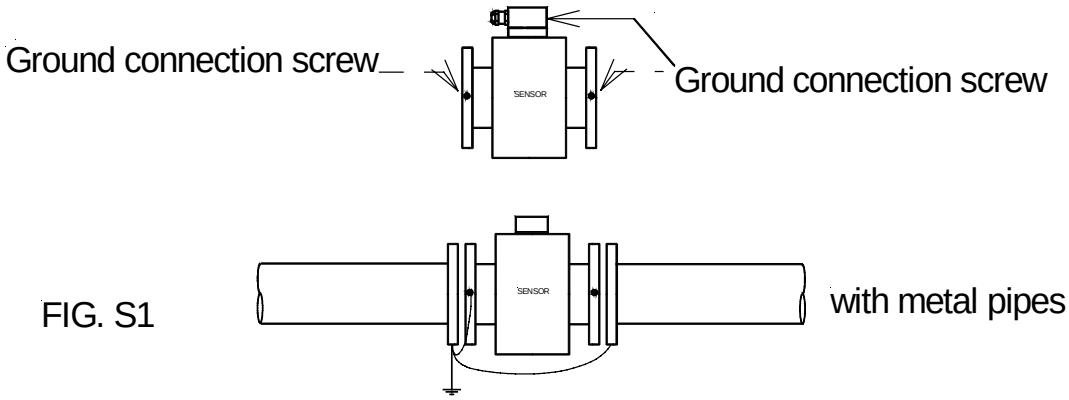


FIG. S1

FIG. S2

Special installation requirements for
piping systems with cathode protection

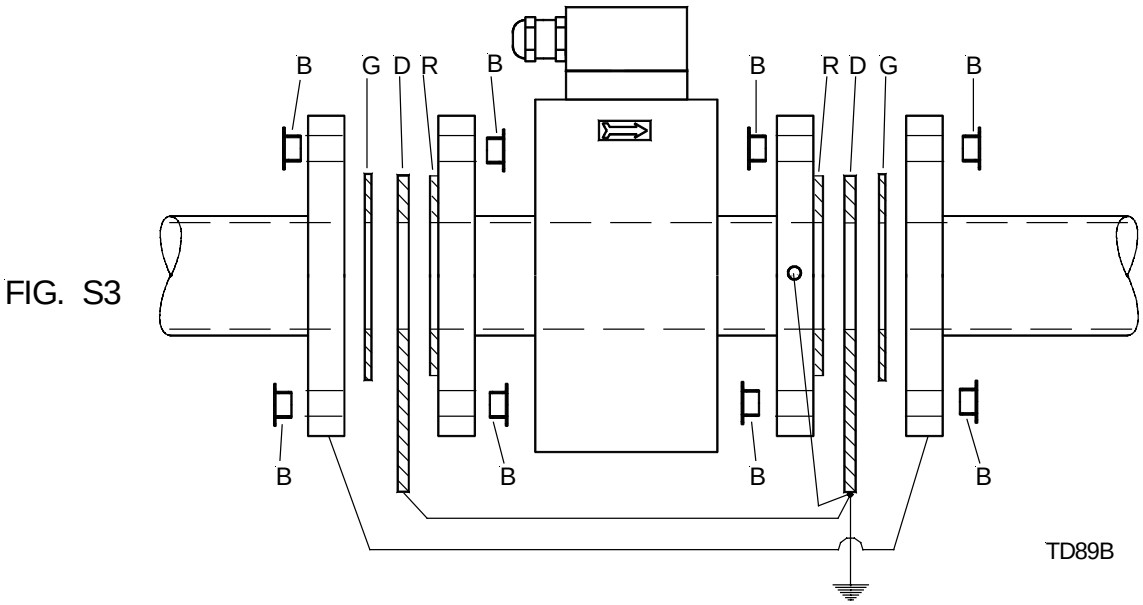


FIG. S3

B insulating bushings
G insulating gasket
D metal grounding ring
R sensor insulation lining

Grounding of the MUT2660 Electromagnetic Flow Meter

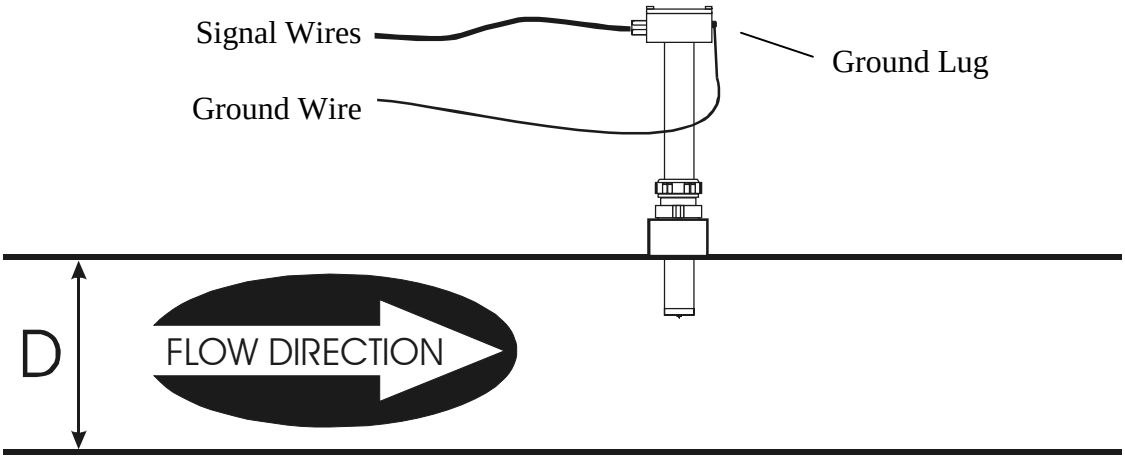


Fig. 3

Important:

Place a ground wire from the sensor's junction box ground lug to a known earth ground.

5.1.C - MC 308 ELECTRICAL CONNECTIONS

The access to the connection box is for skilled technicians only.
The access to the connection box is possible by removing the six screws from the front panel of the non-metallic enclosure (see fig. 1), or by removing the four screws from the access panel on the front of the aluminium enclosure.

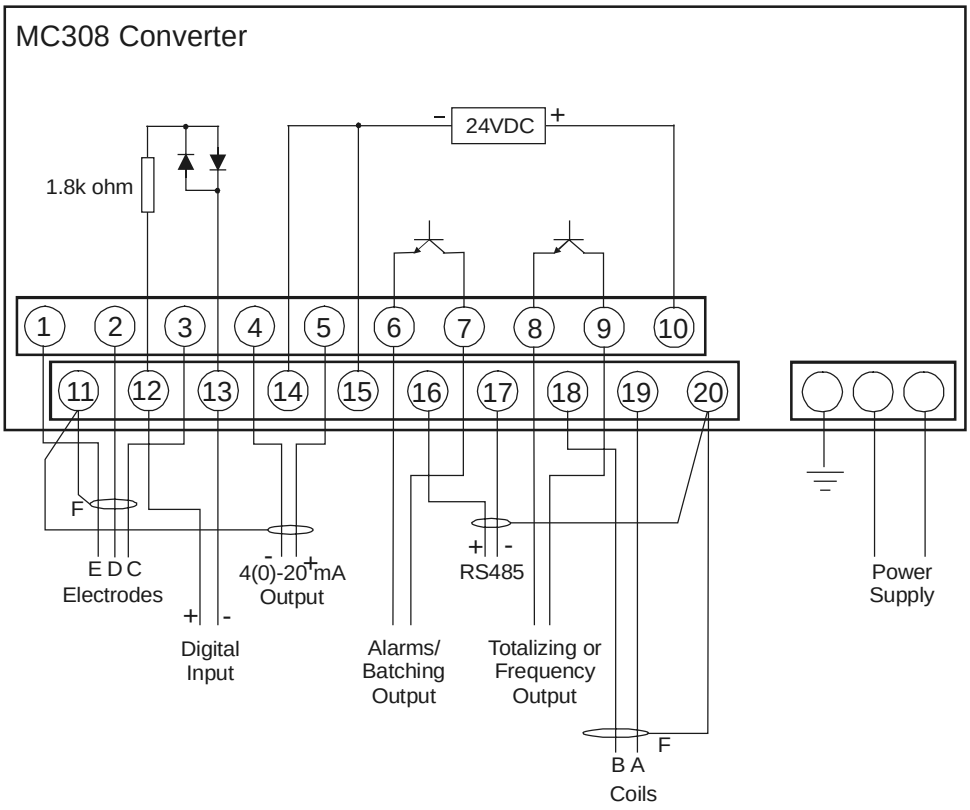


FIG. 3A – MAIN TERMINAL BOARD

Fig. 3a shows the basic terminal board and the function of each terminal. If your converter is equipped with the universal empty tube alarm module (“MC 308/TBC”) then the terminal board is shown in fig. 3b.

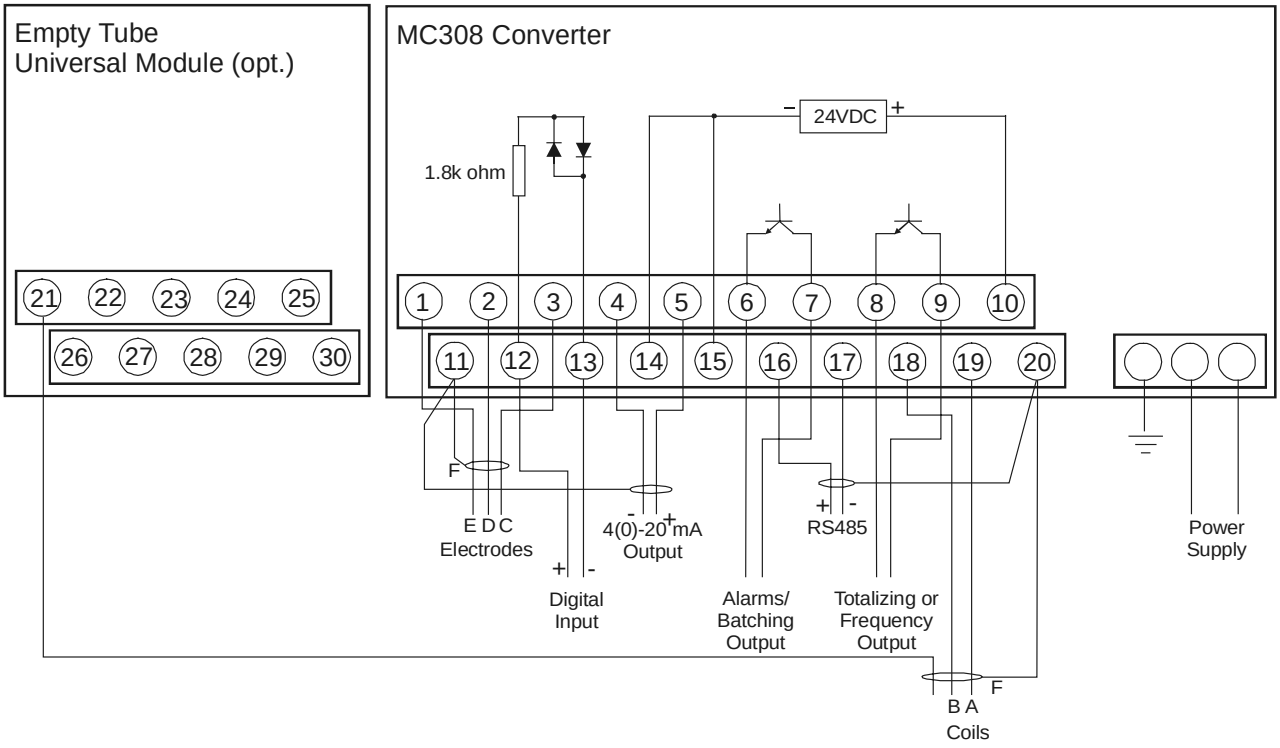


FIG. 3B – TERMINAL BOARD WITH UNIVERSAL EMPTY TUBE ALARM MODULE

If “MC 308/TVO” is written on the data plate of your converter, the diagram of the terminal board is shown in the fig. 3c.

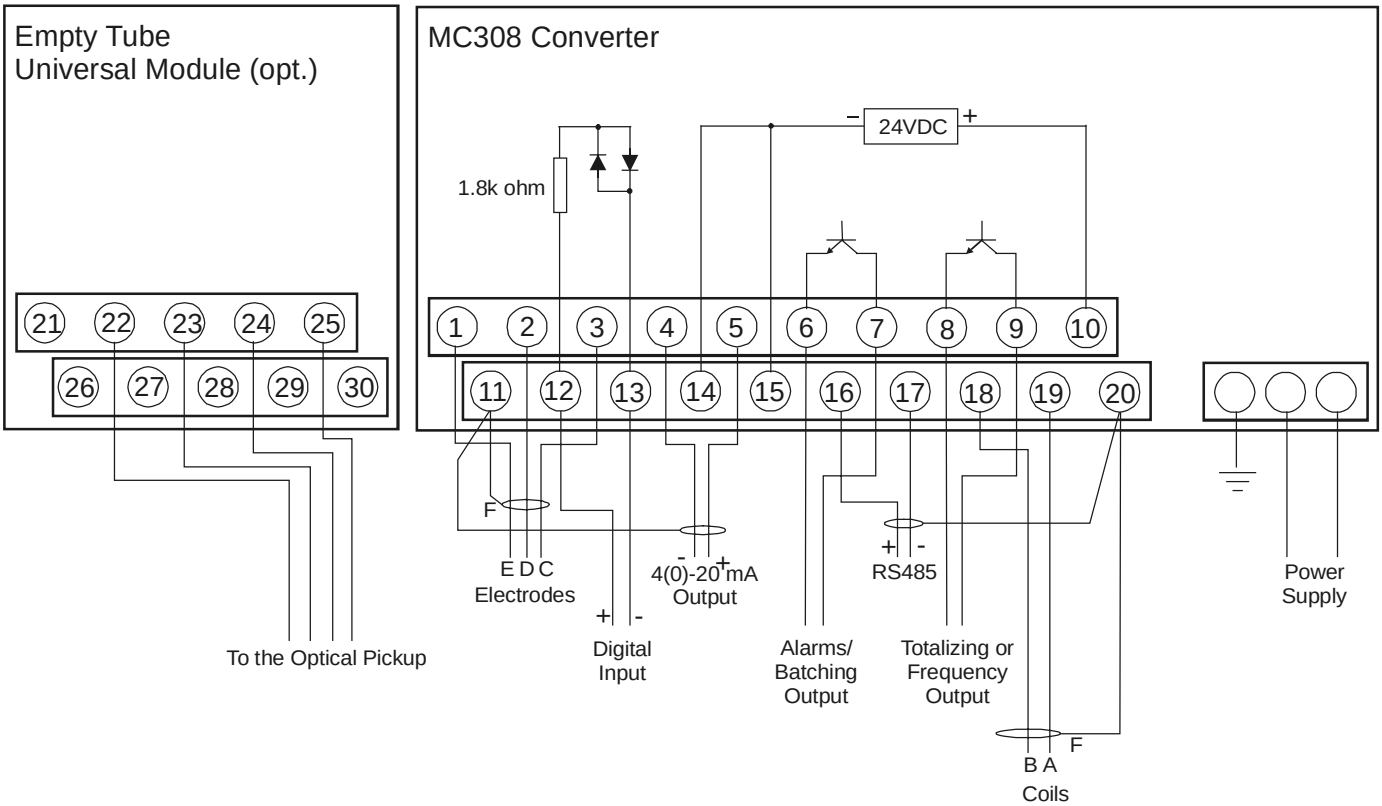
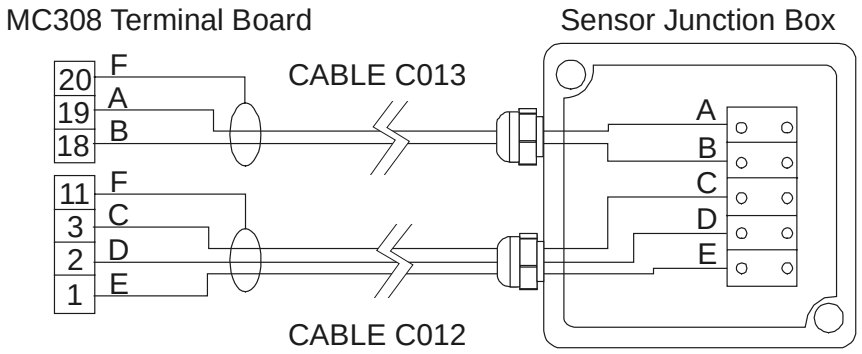


FIG. 3C – TERMINAL BOARD WITH OPTICAL EMPTY TUBE ALARM MODULE

The following diagrams show each connection in detail.

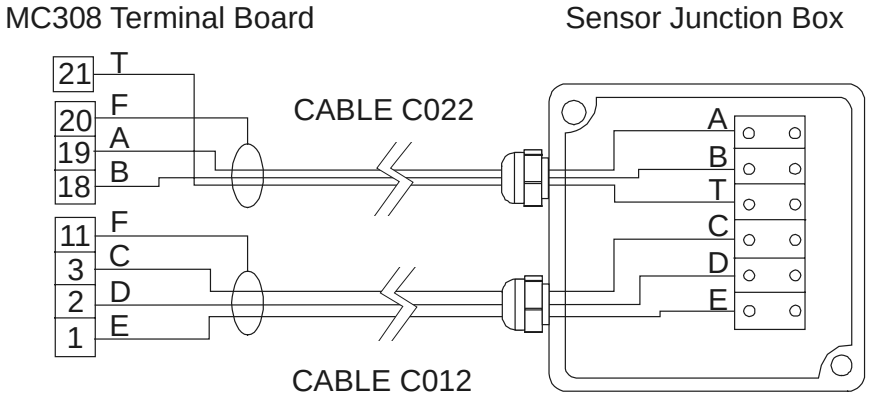
5.1.C1 – MC 308 CONNECTIONS BETWEEN CONVERTER AND SENSOR

The two cables supplied make the connection between converter and sensor. Please follow the instructions carefully in fig. 4a, 4b or 4c.



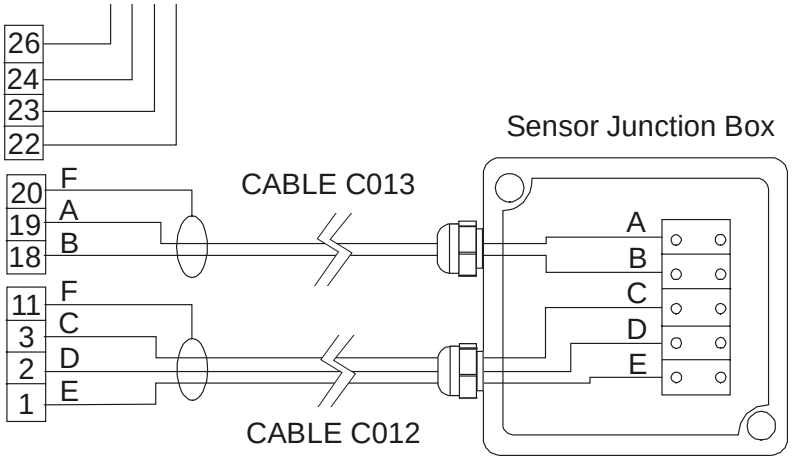
Note: Attach shields to MC308 side only

Fig. 4a CONNECTION OF THE MC 308 CONVERTER WITH THE SENSOR



Note: Attach shields to MC308 side only

Fig. 4b CONNECTION OF THE MC 308/TBC CONVERTER WITH THE SENSOR



Note: Attach shields to MC308 side only

Fig. 4c CONNECTION OF THE MC 308/TVO CONVERTER WITH THE SENSOR

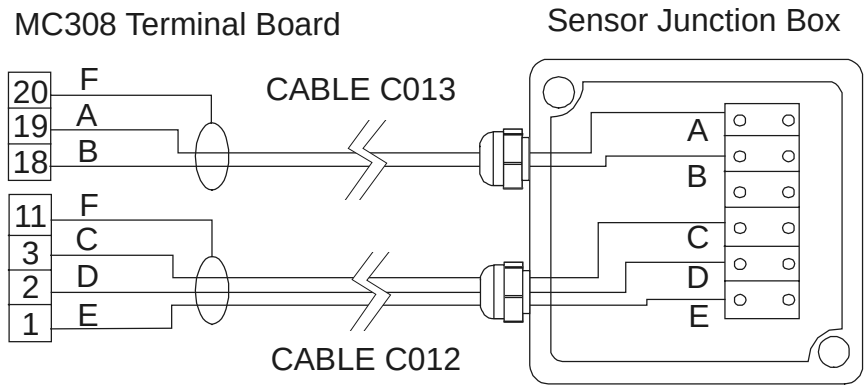


FIG. 4d –CONNECTION OF THE MC 308 CONVERTER STANDARD WITH 6 TERMINAL SENSORS

NOTES

The sensor junction box is rated NEMA 6 / IP 68) for permanent submersion of the sensor with a head of water of 5 feet (1.5 meters).

This rating may only be obtained if, after the cable connections are made, the cable connectors and the screws closing the housing are suitably fastened.

In order to avoid possible faults during submerged conditions, it is necessary to fill up the connection box with the optional compound supplied with the flowmeter, only after *correct* cable connections are verified.

Before connecting the meter to the power supply electrical network you must close the junction box with its cover.

5.1.C3 – CONNECTING MUT 500, 501 AND 1100 TO THE CONVERTER

Sensors MUT 500, MUT 501 and MUT 1100 are supplied with cables C012 and C013 (or C022) already connected (no junction box). In their free ends, these cables are equipped with small rings marked with characters which will help with the connection to the converter. Refer to the diagrams in fig. 4a, 4b, 4c or 4d.

5.1.C4 - BASIC CONNECTIONS

If your converter is remote from the sensor, you must connect them using the two supplied cables. Fig. 5a shows the connections of cables C012 and C013 (see fig. 4a).

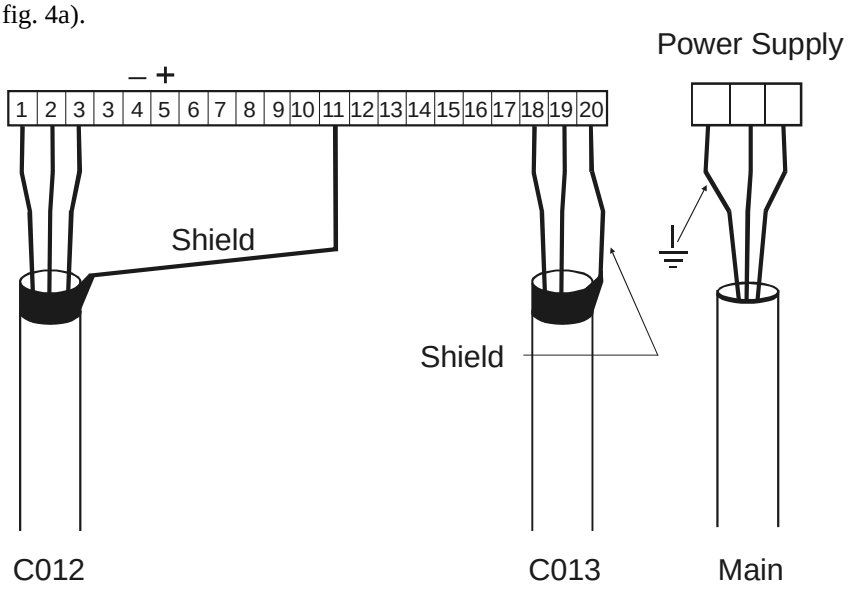


Fig.5a

If the sensor has 6 terminals, these connections are shown in the fig. 5b.

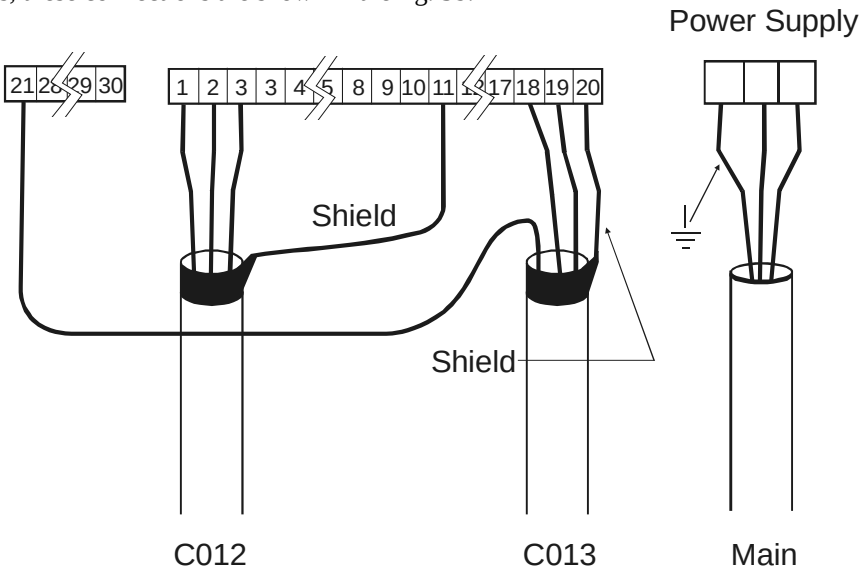


Fig. 5b

5.1.D - ON/OFF OUTPUTS

Two open collector outputs are available in the MC 308 converter. Several types of receivers can be connected to these outputs. We summarize In fig. 6 the main connection types.

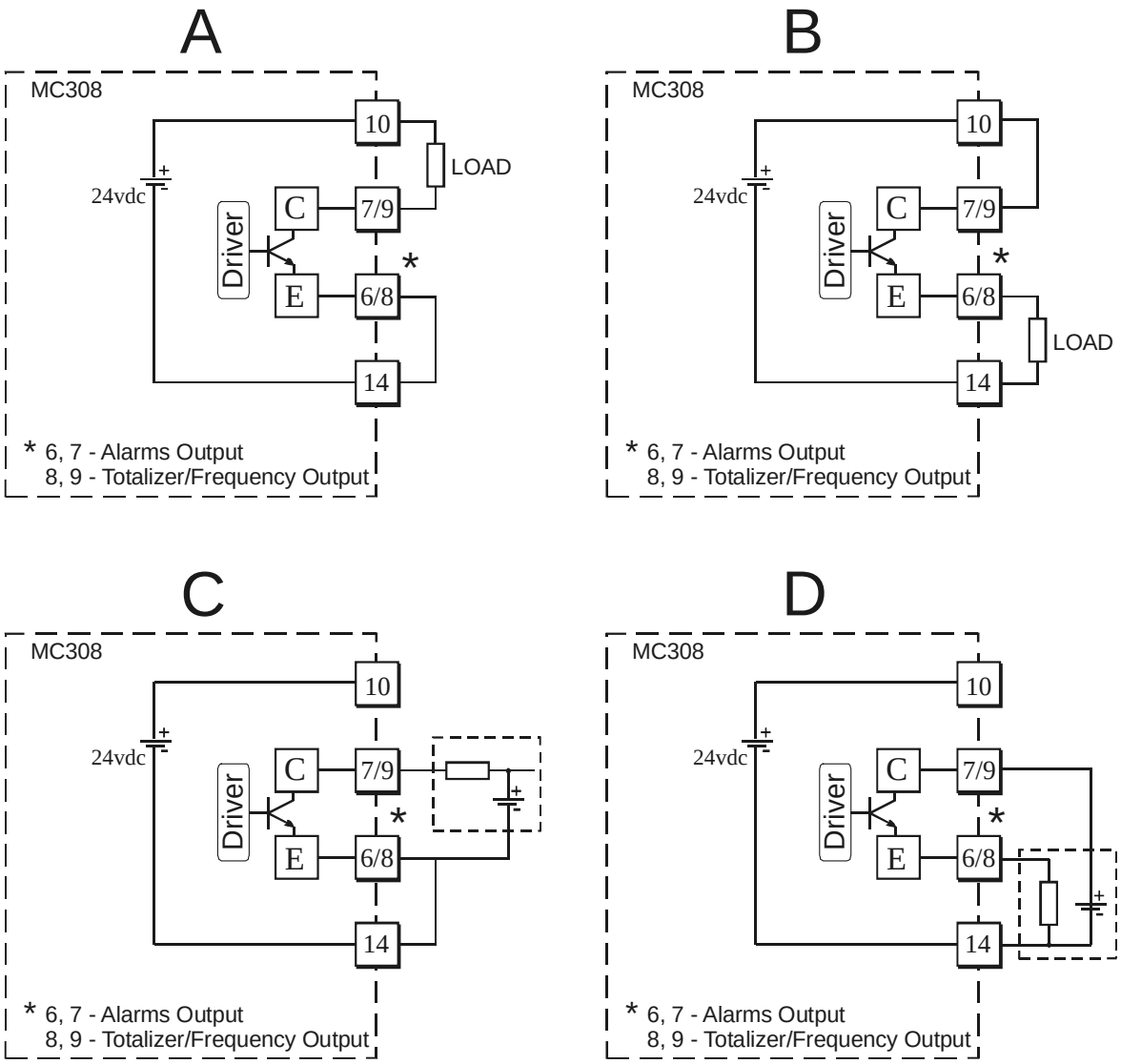


Fig. 6

If you are using this output for a pulse counter or an electromechanical pre-selector (24 VDC) it must be connected in place of the "load" as in A above. Remember the connection between the emitter of the solid-state transistor and terminal 14. Connections A or B can be used when your receiver requires "negative" pulses (A) or "positive" pulses (B). If you have to use an electronic counter or a PLC having a powered input, you can use diagram C or D.

NOTE. The total load of the ON/OFF outputs must not exceed 100 mA.

5.1.E - TOTALIZER / FREQUENCY OUTPUT

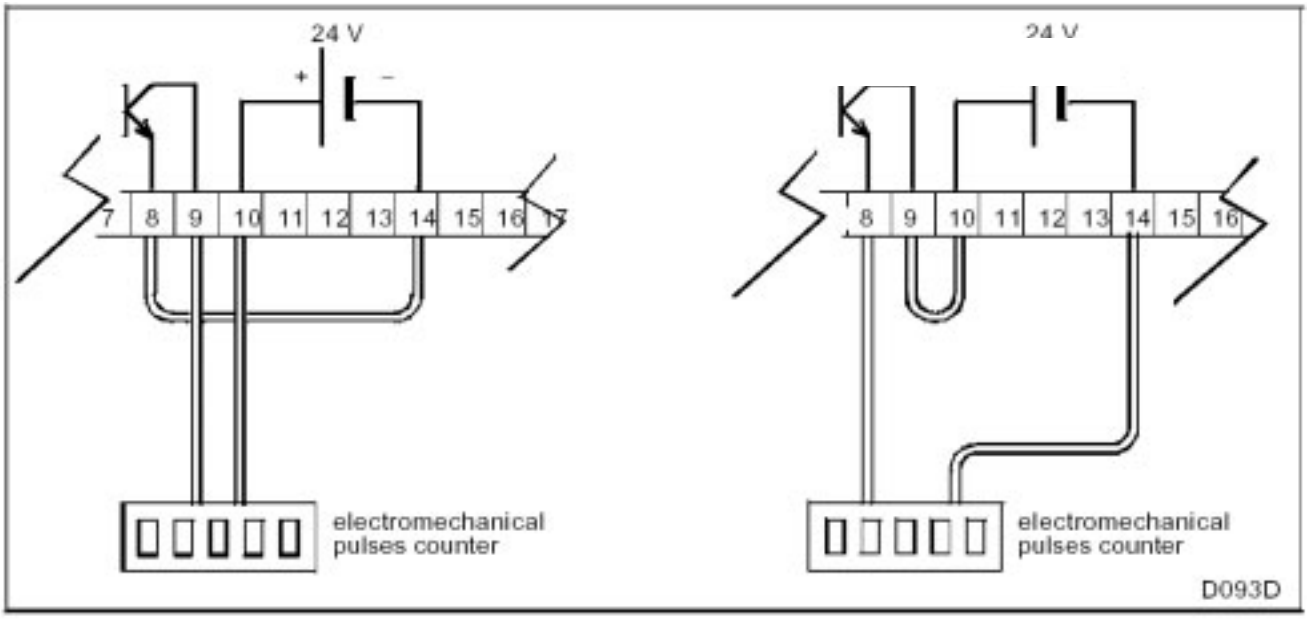


Fig. 7

Fig. 7 shows two possible connections of a pulse counter or an electromechanical pre-selector, which needs a 24 VDC power supply. If you have to use an electronic counter or a PLC, refer to their data sheet and to the examples of fig. 6.

Please remember the pulse counter you use must be able to count pulses at the frequency you set in the converter parameters.

These parameters are:
(for details on the menus and submenus see paragraph 8.2 page C 13)

level	PARAMETERS	MENU	SUBMENU
0	Volume of one pulse	Fundamentals	Pulse quantity
0	Duration of each pulse	Fundamentals	Pulse duration
1	Frequency output full scale (FS)	Advanced	Frequency FS
1	Output signal (frequency or pulses)	Advanced	Output mode

When the converter generates a frequency output it automatically sets the pulse width.
It results to be, at any frequency f,:

$$t_1 = 1000 / 2\,f \qquad \text{[milliseconds]} \qquad (1)$$

Otherwise, when the converter generates a pulse output, the width t_1 is set by entering the **Fundamentals –> Pulse duration**.

Calling Q_{max} = max flow rate (in selected engineering units)
V_1 = volume corresponding to 1 pulse.
t_1 = width of 1 pulse (in milliseconds)

the frequency f_{max} that can be reached at the max. flow rate is

$$f_{max} = Q_{max} / V_1 \qquad \text{[pulses per second]} \qquad (2)$$

This frequency can't be reached if you select a too long pulse width t_1.

The maximum width of t_1 that is possible to input in order to reach the frequency given by (2) is

$$t_1 = 1000 / 2\, f_{max} \quad \text{[milliseconds]} \qquad (3)$$

When choosing the pulses counter it is necessary to verify:

a) if it is able to reach the frequency given by (2)
b) if it is able to work with a pulse width smaller or equal to value given by (3).

If one or more conditions are not verified,

it is necessary to increase V1
or
you must change the pulses counter

Examples:

Pulse output:

Flow rate full scale (F.S.) = 2.7 m^3/h = 0.75 litres per second
To have 1 pulse each cc (V_1 = 0,001 litres) the maximum frequency f_{max} will be

$$f_{max} = 0.75 / 0{,}001 = 750 \text{ Hz}$$

The pulse width must be smaller or equal to

$$t_1 = 1000 / 2\, f_{max} = 0{,}67 \text{ ms}$$

The pulse counter must be able to work at 750 Hz and with pulses at maximum 0.67ms long.

5.1.F - ALARM OUTPUT

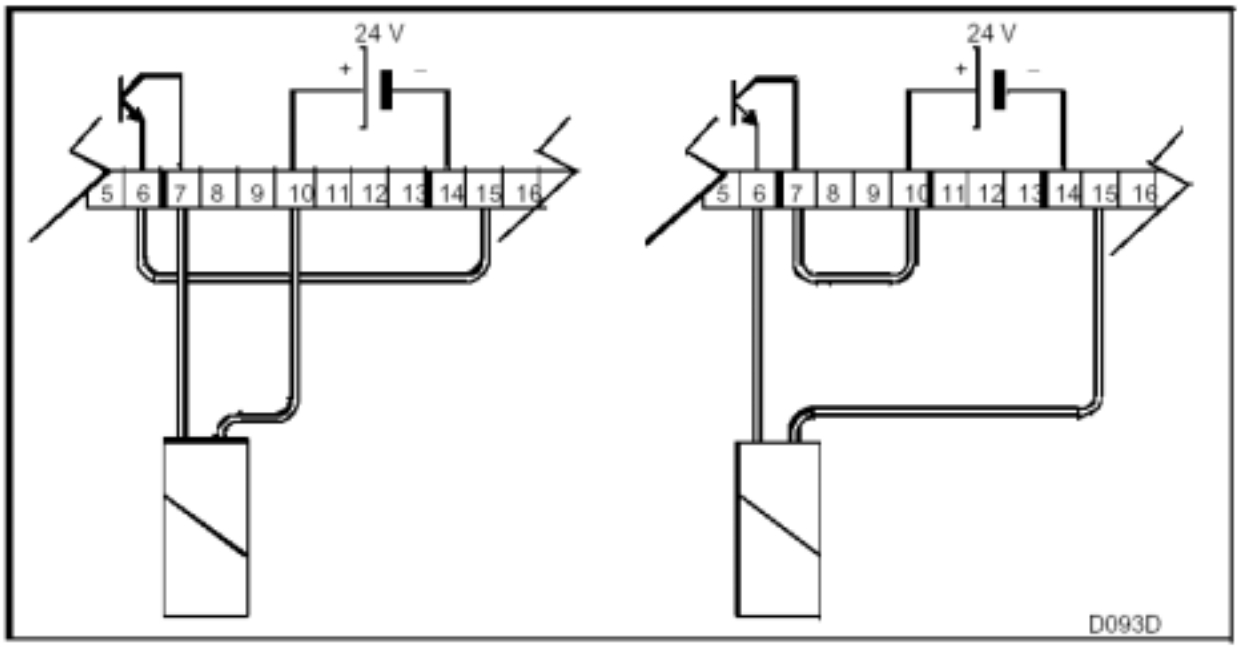


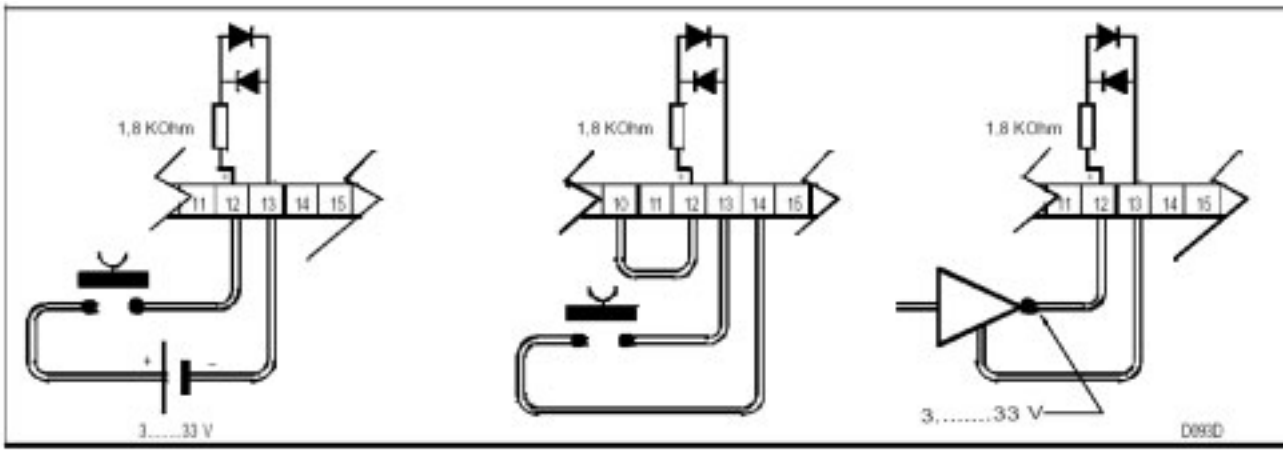
Fig. 8

The state of this output is ON when one or more of the following conditions occur (if enabled; see the submenus of the menu ALARMS and SPECIAL FUNC):

MAX. FLOW RATE ALARM
MINIMUM FLOW RATE ALARM
EMPTY TUBE ALARM
OVERFLOW ALARM
BATCHING IN PROGRESS

If none of these functions are enabled, the transistor is on when the flow rate is reverse.

5.1.G - RESET INPUT / INTERNAL TOTALIZERS STOPPING



10a) 10b) 10c)

This input allows the zeroing or the stopping of the internal totalizers by a remote signal (see the submenu of the menu TOTALIZERS). If you enable “batching mode” (see SPECIAL FUNC) this input is used for the start of the batching to be executed. In addition, it is possible to use this input for the self-calibration of the zero. (see SYSTEM, ext zero calib). This command must be a DC voltage included between 3 and 33 V. The input resistance is 1800 Ohm.

Fig. 10a) shows a drive built with a pushbutton and external voltage source:
Fig. 10b) shows the same drive, but using the 24 V voltage available between terminals no. 10 and no. 14;
Fig. 10c) shows a reset (or block) control from a digital device.

5.2 - STANDARD INTERFACE RS 485

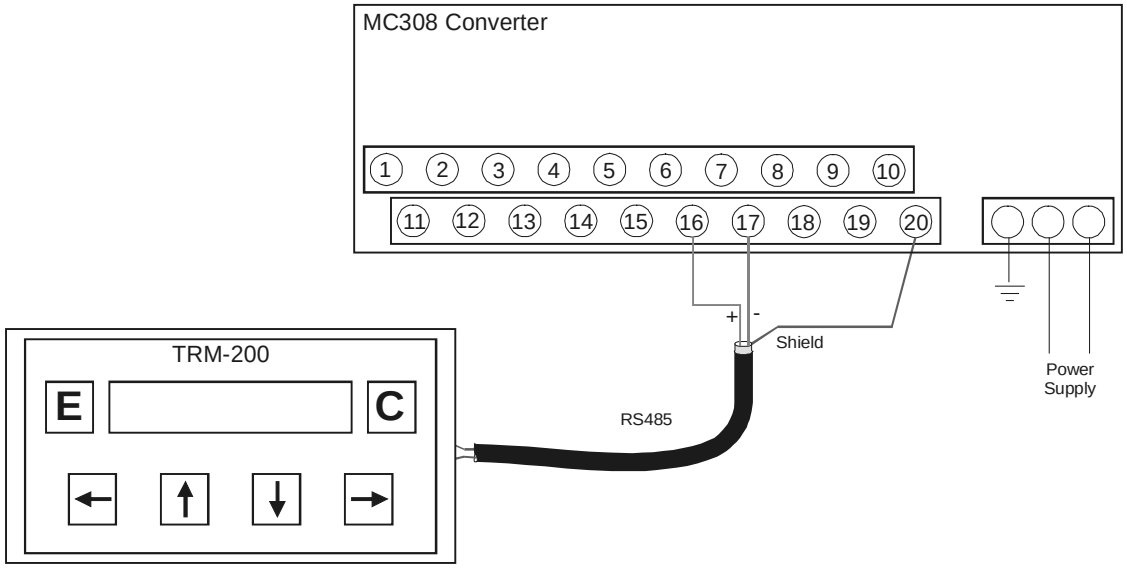


Fig. 9

Between the terminals 16 and 17 (shield on 20) the standard RS 485 output is available.

For example, it may be used to input and receive data from the TRM 200. The MC 308 has to be connected to the TRM 200 through a cable C021. Its length is not to exceed 330 feet.

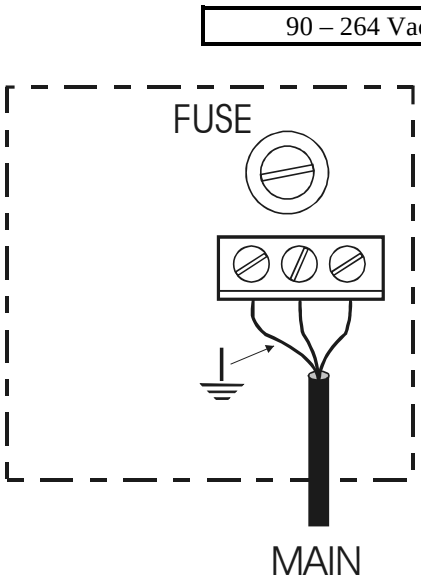
5.3 - GROUNDING OF THE CONVERTER

A point of the electrical circuit **must** be grounded.

It is possible to do it by grounding the ground terminal (the first on the left) through a copper wire (the third wire of the power supply cable, for instance).

5.4 - POWER SUPPLY CONNECTIONS

This operation must be performed by skilled technicians only.
After performing all the other connections, connect the converter to the power line.
The power supply voltage is marked on the terminal strip (See fig. 10).



If 90…264 Vac is indicated, the device can be powered by voltages from 90 up to 264 V (50....60 Hz)

If 24 V is indicated, the device can be powered by
- Alternating voltage from 20.8 up to 27.6 VAC (50-60 Hz)
- Direct voltage from 19 up to 33 VDC

Fig. 10 - Power supply

5.4.A – FUSE

It must be replaced by skilled technicians only

The fuse is located on the terminal board, to the right of the power supply terminals. It is the 5 x 20 type: 250 V FAST.

Its value is:

for AC power supply voltage

90 - 264 Vac	Or	24 V
⇓		⇓
1 A fast		**3.15 A fast**

6 - PROGRAMMING

TRM-100 Programmer

You can use the built-in keypad and display to program the MC308 or you can use a TRM-100 Portable Programming Terminal. The TRM-100 contains a numeric keypad in addition to the arrow and function keys that are found on the MC308 front panel.

It is useful to review the flow chart (Menu Table) in section 6.1 in order to review the functions of the converter. There you can see a **main menu** (along the left edge) and various **submenus**.

To reach the functions of the main menu push **E**: on the first line of the display you'll see one of the items of the main menu:

- Fundamentals
- Advanced
- Totalizers
- Alarms
- Main setup
- Special func
- System

With the right arrow → you can choose the item of the main menu you want; with the left arrow ← you can choose the item of the submenu you want. The "Fundamentals" submenu contains the most important and most used items. You can read them (not modify) by selecting them through the left arrow ← and by pushing **E**.

When you have to modify these parameters you must enter a *password*.

Some programming examples are shown on the following pages.

6.0b –Selecting The Desired Readings To Display

Note: You do not need to enter a password to select the display readings. The converter's display shows the readings:

In the **upper line** the display can show one of the following quantities (to select with the arrow →):

1. Flow rate in technical units
2. Positive total volume
3. Positive partial volume
4. Negative total volume
5. Negative partial volume

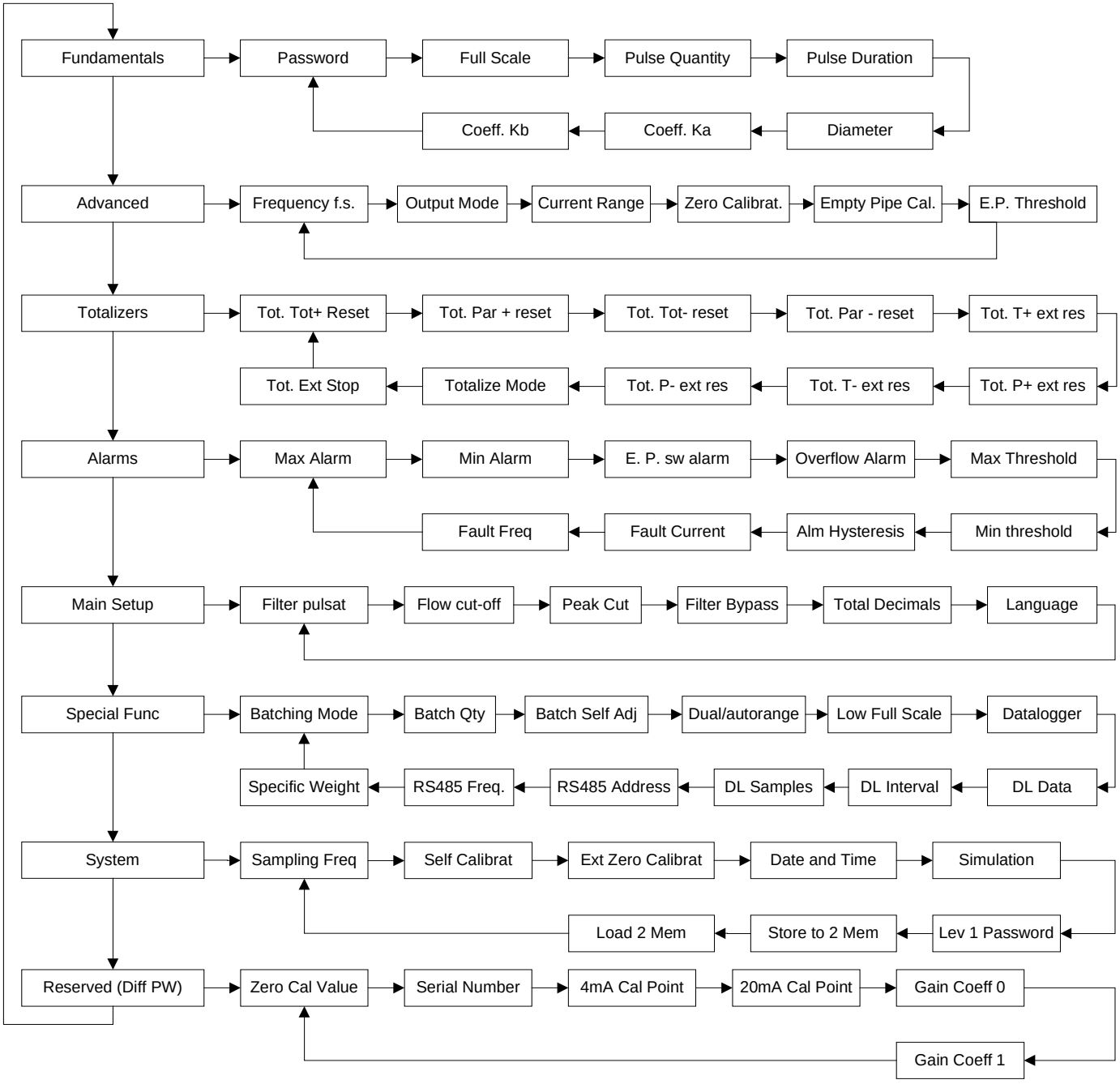
Once the quantity to display has been selected, confirm it by pushing **E**.

In the **lower line** it can show one of the following quantities (to be selected with the arrow ←):

1. Flow rate in technical units
2. Flow rate in % of full scale
3. Positive total volume
4. Positive partial volume
5. Negative total volume
6. Negative partial volume

Once the quantity to display has been chosen, confirm it by pushing **E**.

6.1 - MC 308 MENU TABLE



6.2 - ALPHABETIC LIST OF PROGRAMMING FUNCTIONS

1 – Please find in the column "submenu" the function you are looking for
2 - Read on the column "main menu" the item you have to enter into using the → key
3 – Browse items in the menu by pushing the ← arrow

SUBMENU	MAIN MENU
Alm hysteresis	Alarms
Coeff Ka	Fundamentals
D.L. data	Special func
D.L. interval	Special func
D.L. samples	Special func
Datalogger	Special func
Date and time	System
Diameter	Fundamentals
Dual/AutoRange	Special func
E.P. sw alarm	Alarms
E.P. threshold	Advanced
Empty pipe cal	Advanced
Ext zero calib	System
Fault freq	Alarms
Filter bypass	Main setup
Filter pulsat	Main setup
Flow cut-off	Main setup
Frequency F.S.	Advanced
Full scale	Fundamentals
Language	Main setup
Lev 1 password	System
Load 2 mem	System
Low full scale	Special func
Max alarm	Alarms
Max threshold	Alarms
min alarm	Alarms
min threshold	Alarms

SUBMENU	MAIN MENU
Offset Kb	Fundamentals
Output mode	Advanced
Overflow alarm	Alarms
Password	Fundamentals
Peak cut	Main setup
Pulse duration	Fundamentals
Pulse quantity	Fundamentals
RS485 address	Special func
RS485 freq	Special func
Sampling freq	System
Self calibrat	System
Simulation	System
Specific Weight	Special func
Store to 2 mem	System
Tot. ext stop	Totalizers
Tot.P- ext res	Totalizers
Tot.P+ ext res	Totalizers
Tot.Par- reset	Totalizers
Tot.Par+ reset	Totalizers
Tot.T- ext res	Totalizers
Tot.T+ ext res	Totalizers
Tot.Tot- reset	Totalizers
Tot.Tot+ reset	Totalizers
Total decimals	Main setup
Totaliz mode	Totalizers
Zero calibrat	Advanced

6.3 - PROGRAMMING EXAMPLES

Example Number 1 – Choice Of The Readings To Be Displayed

(The letter X means any message that is not relevant in this example)

button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
	X	X	**Assuming the flow measurements are displayed**
→…→	Flow rate U.T.	Flow rate in %	The actual set up of the display appears: during the functioning, the first line will show the flow rate (for instance: 100 m3/h) and the second one will show the flow rate in percent. (for example: 50%).
→…→	Total total pos	Flow rate in %	We have now set up the quantity you'll read on the first line of the display.
←…←	Total total pos	Total total neg	We have now set up the quantity you'll read on the second line of the display.
E	X	X	You can now read on the first line the total value of the positive totalizer (direct flow) and on the second line the total value of the negative totalizer (reverse flow).

Example Number 2 – How To Change The Sensor's Diameter

button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
E	Fundamentals	X	
←…←	Fundamentals	Password	
E	Level 0	Password=+0̲00000	Input the Password (208000 Factory Default)
↑	Level 0	Password=+1̲00000	
↑	Level 0	Password=+2̲00000	
→	Level 0	Password=+20̲0000	
→	Level 0	Password=+200̲000	
↑…↑	Level 0	Password=+208000	
E	Fundamentals	Password	The password has been confirmed.
←	Fundamentals	Full scale	With the arrow you scan the submenus until you find "Diameter" on the second line of the display.
←…←	Fundamentals	Diameter	
E	Diameter	DN(mm)=+0̲00040	Preset diameter. Now with the arrows ↑ and ↓ you can change the value of each figure; with the arrows → and ← you can move the cursor on the figure to be modified. You can introduce a number in the range 1…2000 mm
E	Full scale	l/s 3.00000	This is the previous full scale flow rate, or it correspond to a velocity of 10 m/s. In any case you may update it.
E	Fundamentals	Full scale	
C	X	X	

Example Number 3 – How To Set The Full Scale Flow Rate

If two minutes have not passed from a previous change to the parameters, you can proceed as written below. Otherwise, before this procedure, you have to re-enter the password.

button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
E	Fundamentals		
←…←	Fundamentals	Full scale	
E	Full scale	LPM 1280,00	Existing flow rate and units. Now using the arrows ↑ and ↓ you can change the value of each digit or the measuring unit; with the arrows → and ← you can move the cursor.
↑ ↓ → ←	Full scale	GPM 25.0000	The new full scale and measuring unit have been confirmed.
E	Fundamentals	Full scale	
C	X	X	The display shows the new measurements.

NOTE.
The factory default password is 208000. This can be user modified (menu SYSTEM, submenu "Pass level 1").

IMPORTANT If you change the password write it down!

Example Number 4 – How To Set The Totalizer's Measuring Unit

button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
E	Fundamentals	X	
←…← →…→	Fundamentals	Password	
E	Level 0	Password=+000000	You must input the password (i.e. 2086000)
↑	Level 0	Password=+100000	
↑	Level 0	Password=+200000	
→	Level 0	Password=+200000	
→	Level 0	Password=+200000	
↑…↑	Level 0	Password=+208000	
E	Fundamentals	Password	
←…←	Fundamentals	Pulse quantity	
E	Pulse quantity	l 1000,00	You can read on the display the **measuring unit** used to express the pulse quantity. This unit will be used for the internal totalizers too.
←…←	Pulse quantity	l 1000,00	Now the cursor is placed on the **measuring unit**.
↑↓	Pulse quantity	m3 1,00000	Changing the measuring unit the numeric value is automatically updated.
E	Fundamentals	Pulse quantity	
C	X	X	The display shows the current **measurements again**.

Example Number 5 – How To Set The Totalization Pulse Duration

button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
	X	X	We suppose the current measurements are displayed.
E	X	X	
→…→	Fundamentals	X	
←…←	Fundamentals	pulse duration	
E	Pulse Duration	T(ms)=+10.000	This is the preset duration. After 2 seconds:
	Password needed		It means that you have to input the password to change the pulse duration. After 1 second:
	Fundamentals	password	The converter asks for the password
C	X	X	The display shows the current measurements again.

Example Number 6 – Setup of Optional 4 Electrode Sensor Empty Tube Detection

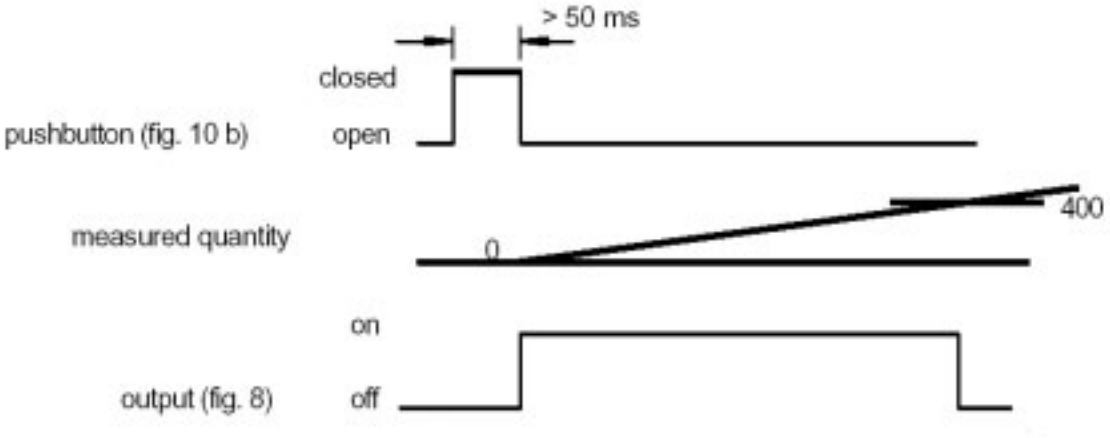
button	first line of display (MENU)	2nd line of display (SUBMENU)	notes
	X	X	The display shows the measurements.
E	X	X	
→…→	Fundamentals	X	
←…←	Fundamentals	Password	
E	Level 0	Password=+000000	You have to enter the level 1 password (208000)
←…→ ↑…↓	Level 0	Password=+208000	
E	Fundamentals	Password	
→…→	Alarms	X	
←…←	Alarms	E.P. sw alarm	
E	Alarms TV sw	X	
←…→	Alarms TV sw	disabled	You have disabled the software detection of empty tube condition.
E	Alarms	E.P. sw alarm	
→…→	Advanced	X	
←…←	Advanced	E.P. threshold	
E	E.P. threshold	X	You can see the value of the empty tube threshold on the display . In this example the threshold is preset at 7, which is the typical value for drinkable water.
←…→ ↑…↓	E.P. threshold	Limit=+000007	
E	Advanced	E.P. threshold	
C	X	X	The display shows the current measurements.

Example Number 7 – Batching of 400 Gallons Per Minute (GPM)

1. Enable the function "batching “
2. Introduce the quantity to batch
3. Give the START signal

The START control is given either with the outside pushbutton to be connected in the terminal board as in the fig. 10a), or 10b), or with a digital signal applied between the terminals 12 and 13 (see fig. 10c).

NOTE. The START pulse must last more than 50 ms.
With the START signal the transistor, which is connected to the terminals 6 and 7, switches on and remains in this status till the inside counter reaches the volume to be batched (the connection of a relay to this transistor is shown in fig. 8). If the START signal is given again during the batching, this is stopped at once (batching manual stop).
Fig. 13 shows the time sequence of the START control and the output.

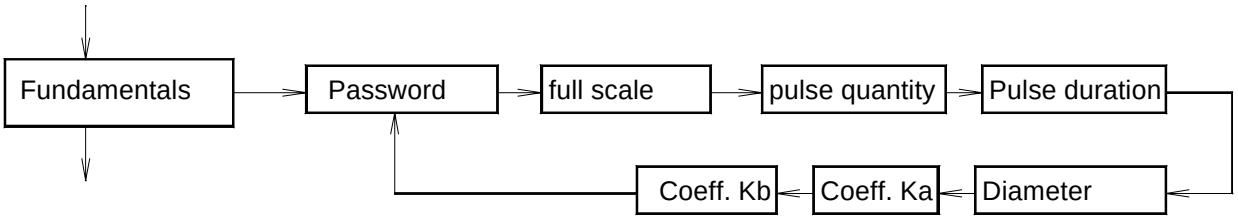


6.4 - ALARM READOUT AFTER PROGRAMMING

When the symbol "**!**" appears on the display, it means that there are one or more alarm messages. Pushing the **C** key displays all the messages.

7 – DESCRIPTION OF THE SUBMENUS

7.1 – MENU "FUNDAMENTALS"



PASSWORD

In this submenu you can input the password to modify the converter parameters. The password set in the factory is 208000, but it is changeable by the customer by using Menu "**System**" → "**Lev 1 password**".

IMPORTANT If you change the password write it down!

FULL SCALE FLOWRATE

With this function you can set up the full scale flow rate with the following units:

Unit	Equivalence
m *	(Velocity is shown)
cm3	0.001 dm3
ml	0.001 dm3
dm3	1 dm3
l	1 dm3
dal	10 dm3
hl	100 dm3
m3	1000 dm3
Ml	1000000 dm3
in3, cubic inches	1.63871e-2 dm3
oz UK, fl.oz UK	0.02841 dm3
pt UK, pints UK	0.5679 dm3
qt UK, quarts UK	1.1359 dm3
gal UK, gallons UK	4.545771 dm3
gal US, gallons US	3.785333 dm3

Unit	Equivalence
ft3, cubic feet	28.31685 dm3
bbl, std barrel	119.238 dm3
bbl oil, oil barrel	158.984 dm3
hcf, hundred cubic feet	2831.685 dm3
kgl, US, kilo gallon US	3785.333 dm3
Mgl US, Mega gallon US	3785333 dm3
g	0.001 kg
hg	0.1 kg
kg	1 kg
q	100 kg
t	1000 kg
oz, once	0.028350 kg
lb, libbre	0.45359 kg
ton, short ton	907.18 kg

* By choosing m (meter) , the liquid velocity will be shown instead of the flow rate.

The time units available are: second (s), minute (m), hour (h) and day (d)

You can set up the F.S. flow rate between 4% and 100% of the maximum flow rate (which is equivalent to a liquid velocity of 10 m/s or 33 ft/second).

NOTE. With the menu "Special func" it is possible to enable dual range.

PULSE QUANTITY

The totalization pulse volume can be set in one of the units shown in the description **Fundamentals → Full scale.** It is also possible to express for example the flow rate in litre/second but to set the pulse value at 1.5 m3. The numerical range is 0.00001 ÷ 99999.9.

The measurement unit used to set the pulse volume will also be used to display the totalizer counts on the converter.

PULSE DURATION

The totalizing pulse duration can be set as desired between a minimum of 0.42 and a maximum of 10000.00 milliseconds. To obtain the maximum output frequency, that is to say to use very short pulses, the output transistor must be connected to a common emitter with the load on the collector. For the calculation to set the minimum pulse duration, look at the example in paragraph 8.1.C5.1

DIAMETER

This allows the input of the sensor nominal diameter (see sensor nameplate data). The range is: 1…2000 mm
If it is an **insertion** flow meter (MUT 2660, 2700 or 2770), you have to input the value (in mm) of the actual internal diameter of the piping. Getting out of this submenu the program will show you the actual full scale to confirm that it remains valid or to apply changes.

COEFF KA

This allows the sensor's Ka coefficient (see sensor nameplate data) to be entered in a range of values of –9.9999…+9.9999.

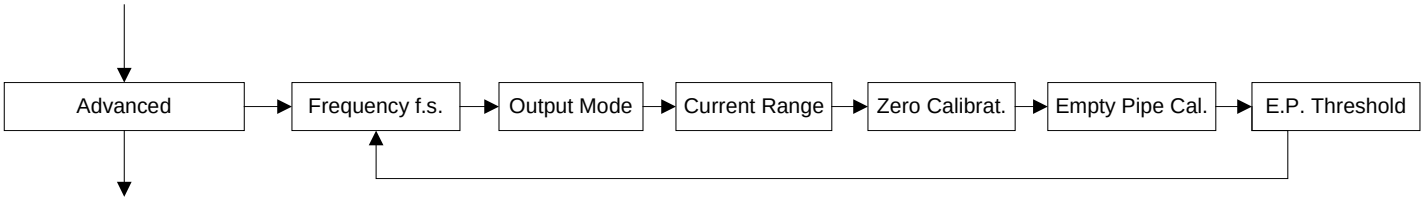
> NOTE
> If the Ka coefficient is preceded by the - sign select the - sign with the use of the cursor; if the coefficient is preceded by the + sign or there is no sign at all, then choose the sign + by moving the cursor.

COEFF KB

This function allows the sensor's Kb coefficient (see sensor nameplate data) to be entered in a range of values of –999999…+999999.

> NOTE
> If the Ka coefficient is preceded by the - sign select the - sign using the cursor; If the coefficient is preceded by the + sign or nothing at all, then select the + sign using the cursor.

7.2 – MENU "ADVANCED"



FREQUENCY F.S.

Whenever the frequency output instead of the pulse output is chosen (**Advanced → Output mode**), it is possible to set the frequency of full scale between 1 and 1000 Hertz. For example, if this parameter is set at 500Hz then when the flow rate is 50% of the full scale there will be an output of 250Hz.

OUTPUT MODE

Enables you to choose either an output signal proportional to the flow rate (FREQUENCY) or scaled pulses per unit volume (pulses). The choices are PULSES and FREQUENCY.

CURRENT RANGE

Enables the range for the current output. The choices are:

1. 0-20 mA
2. 4-20 mA

ZERO CALIBRATION

Used to perform the instrument zero calibration. After making sure that…

1. the sensor is full of liquid
2. the liquid must be completely stopped in the sensor!
3. the sensor is properly grounded
4. to carry out the calibration it is necessary to press the "E" key twice in rapid succession. The display should read the following:

   ZERO CALIBRAT
   . . . . . .

5. After the periods (….) scroll from the left to the right the display returns to the **Advanced → Zero Calibrat** display.

EMPTY PIPE CAL

Used to perform the empty pipe calibration. You must determine how many electrodes your sensor is equipped with.

Four (4) Electrode Sensor

1. The sensor **must** be completely filled with liquid. The liquid may be stationary or moving.
2. The **ALARMS → E.P.** sw alarm function must be disabled.
3. To carry out the empty pipe calibration it is necessary to press the "E" key twice in rapid succession. The display will read the following for a short period of time:

   WAIT …..

4. The display returns to:

   ADVANCED →
   EMPTY PIPE CAL ←

5. The value of this function is now stored in the **ADVANCED → EP THRESHOLD** function. For drinking water the limit value is 7 to 10.

Two (2) or Three (3) Electrode Sensor

1. The sensor **must** be completely filled with liquid.
2. The **ALARMS → E.P.** sw alarm function must be enabled.
3. To carry out the empty pipe calibration it is necessary to press the "E" key twice in rapid succession.
4. The display reads:

   PRESS A BUTTON
   WHEN EMPTY

5. Completely empty the pipe then press any key on the keypad.
6. The display will read: **WAIT …..**
7. The display returns to:

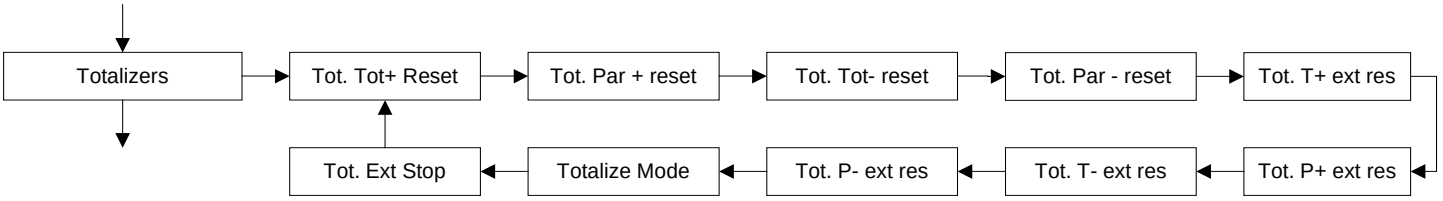
   ADVANCED →
   EMPTY PIPE CAL ←

8. The value of this function is now stored in the **ADVANCED → EP THRESHOLD** function.

E.P. THRESHOLD

This parameter contains the threshold value that will change the alarm output state, cause the flow rate to remain at zero (no drift) and show an exclamation point (!) on the display. If the empty pipe alarm is not required enter 065535 as the limit to disable it.

7.3 – MENU "TOTALIZERS"



TOTALIZER TOT+ RESET

This submenu resets the positive total totalizer. To carry out the zero-setting press the E key TWICE in rapid succession.

TOTALIZER PAR+ RESET

This submenu zeroes the positive partial totalizer. To carry out the zero-setting press the E key TWICE in rapid succession.

TOTALIZER TOT- RESET

Using this submenu it is possible to zero set the negative total totalizer. To carry out the zero setting it is necessary to press the E key TWICE in rapid succession.

TOTALIZER PAR- RESET

Use this submenu to set the negative partial totalizer to zero. To do this press the E key TWICE in rapid succession.

TOTALIZER T+ EXTERNAL RESET

Using this submenu it is possible to zero set the positive total totalizer using an external control sent by serial communications.

TOTALIZER P+ EXTERNAL RESET

Using this submenu it is possible to zero set the positive partial totalizer using an external control sent by serial communications.

TOTALIZER T- EXTERNAL RESET

Using this submenu it is possible to zero set the negative total totalizer using an external control sent by serial communications.

TOTALIZER P- EXTERNAL RESET

Using this submenu it is possible to zero set the negative partial totalizer using an external control sent by serial communications.

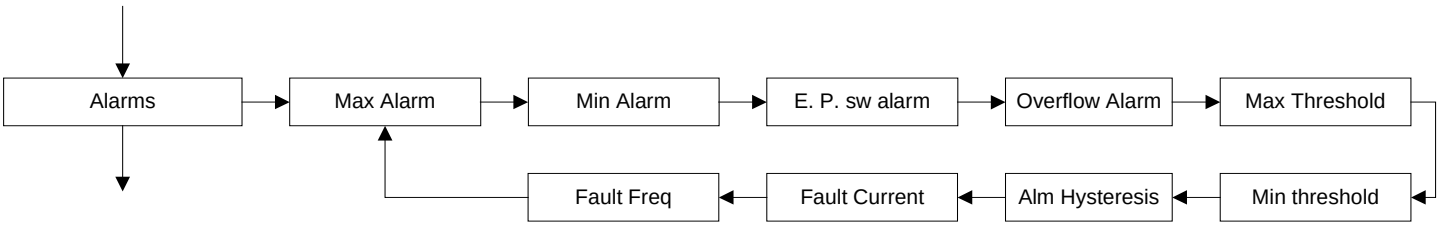
TOTALIZER MODE

If in this submenu you find MONODIR (unidirectional, positive only) then totalization pulses are emitted just when the flow rate is positive. If in this submenu you find BIDIR (bi-directional) then the totalization pulses are emitted when the flow rate is either positive or negative. NOTE the flow rate sign can be detected using the alarms output (see paragraph 5.1.F). This function does not influence the converters internal totalizers.

TOTALIZER EXTERNAL STOP

With this submenu it is possible to enable the shutdown of the four internal totalizers when the digital input of the converter is active. Look at the example in the paragraph 5.1.E to see how to connect an external button in order to shutdown the totalizers.

7.4 – MENU "ALARMS"



MAXIMUM FLOWRATE ALARM

Enables the max flow rate alarm: the alarm output will change it's state and the display will show a message whenever the flow rate is higher than the percentage (%) value set in **Alarms → MAX Threshold**

MINIMUM FLOWRATE ALARM

Enables the min. flow rate alarm: the alarm output will change its state and the display will show a message whenever the flow rate is lower than the percentage (%) value set in **Alarms → min. Threshold**

EMPTY PIPE SOFTWARE ALARM (E.P. sw alarm)

Four (4) Electrode Version
If you have a 4 electrode sensor this function is disabled. Go to **Advanced → Empty pipe cal.**

Two (2) or Three (3) Electrode Version
If you have a 2 or 3 electrode sensor this function is enabled. Go to **Advanced → Empty pipe cal.**

OVERFLOW ALARM

Enables the overflow alarm: the alarm output will change its state and a message will be shown on the display when the flow rate is higher than the full scale one which is set in **Fundamentals → Full scale**

MAXIMUM FLOWRATE THRESHOLD

When the maximum flowrate alarm is enabled the alarm output will change its state and the display will show a message whenever the flow rate is higher is higher then the value set. The value is a percentage (%) of the full-scale value set in the **Fundamentals → Full scale.**

MINIMUM FLOWRATE THRESHOLD

When the minimum flowrate alarm is enabled the alarm output will change its state and the TRM-100 display will show a message whenever the flow rate is lower than the value set. The value is a percentage (%) of the full scale value set in the **Fundamentals → Full scale.**

ALARM HYSTERESIS

Here you find the alarm threshold hysteresis. The values allowed are 0...25% of the full scale (**Fundamentals → Full scale**)

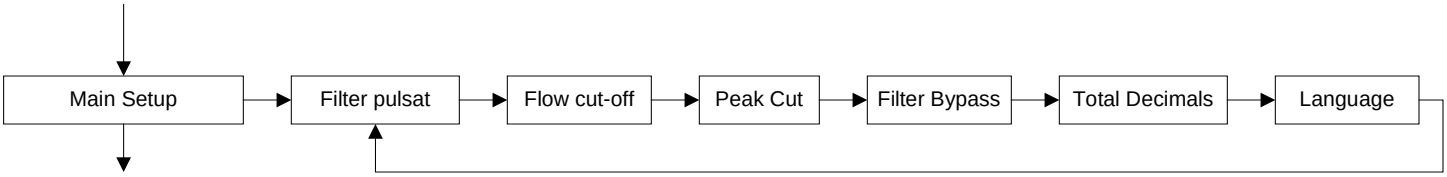
FAULT CURRENT

Whenever a hardware alarm has been triggered (empty pipe, coils interrupted, etc.) the output current goes to the value programmed by this function. This value is expressed as a percentage of the current range (**Advanced->Current range**).

FAULT FREQUENCY

Whenever a hardware alarm has been triggered (empty pipe, coils interrupted, etc.) the output (**Advanced → Output mode**) goes to the value programmed by this function. This value is expressed as percentage of the max. output frequency (**Advanced → frequency FS**).

7.5 – MENU "MAIN SETUP"



FILTER PULSATION

This parameter is the digital filter carried out in the converter. Entering a small value (for example 0,01) the measurements will be very stable and will slowly vary, while entering a high value (for example 3,00) the measurements will follow the quick changes of the liquid flow rate that is being measured.

LOW FLOW CUT-OFF

In this submenu you enter a value as a percentage of the full scale: if the real flow rate of the liquid is smaller then the value indicated in this submenu then the instrument will show 0, otherwise the instrument will show the real flow rate. For details on this parameter see appendix.

PEAK CUT

In this submenu you enter a value as percentage of the full scale. If in the flow rate measurement there are peaks, their value will be limited to the value expressed in this submenu. For example, setting the value 10%, some peaks on the flow rate signal will be cut in order not to exceed the 10% of the full scale.

FILTER BYPASS

In this submenu a value is entered as a percentage that represents a threshold on which the digital filter is NOT calculated. For example, in case this parameter has a value of 50%

IF (the flow rate varies 50% more than the previous value)
THEN the flow rate shown will take on a real value
OTHERWISE the digital filter will be applied, that is to say that the shown flow rate will slowly reach the real value.

TOTAL DECIMALS

In this submenu is entered the number of decimals that will be displayed on the 4 internal totalizers. Values allowed: 0, 1, 2 or 3.

LANGUAGE

In this submenu you can select the language that the converter will use to display the menu, messages, etc.

7.6 – MENU "SPECIAL FUNCTIONS"

BATCHING MODE

Enables the flow converter "batching". To set the quantity to be batched use Special Functions -> Batch Qty. The totalizer used to "count" the quantity to batch is the Total Positive Totalizer.

BATCH QUANTITY

In this menu the quantity of liquid to batch can be entered. This quantity is expressed using the same units as the internal totalizers (that is set in **Fundamentals->Pulse quantity**). See example No. 5 for use of the batching function.
NOTE: to move the "decimal" just position the cursor and press ↑↓.

BATCH SELF ADJUSTMENT

In this submenu you can enable or disable automatic correction of the quantity of batched liquid.
For example, if this function has been enabled and has been set a volume to be batched, equal to 100 gallons

- **IF** in the previous batching the actually batched quantity was 102 gallons (perhaps because it takes a long time for the batching valve to shut down)
- **THEN** during the next batching cycle, the converter will control the valve shut down when the measured quantity is 981, to set off the two gallons that will run because of the shut down delay. This way the batched value will be 100 gallons.

DUAL/AUTO RANGE

In this submenu the double instrument scale can be enabled or disabled. You can select the event that will cause the changing of scales. The possible choices are:

Disabled	It uses only the full scale set in **Fundamentals → Full scale.**
Flow rate	When the flow rate is higher than the smaller FS then the dual FS will be used, otherwise the lower FS will be used.
Flow rate sign	When the flow rate is positive the higher FS will be used, otherwise the lower FS will be used.
Outside control	If the digital input is ON the lower FS will be used otherwise the higher one will be used.
Keyboard	While the instrument is working, if you press the arrow ↑ you will select the higher FS otherwise if you press the arrow ↓ you will select the lower FS.

By enabling dual range it is possible to transmit the flow rate by using the frequency output scale with better resolution.

LOW FULL SCALE

In this submenu a low full scale is introduced, if **Special func → Dual/Auto range** is enabled .

DATALOGGER

In this submenu the converter internal data logger may be enabled.

D.L. DATA

In this submenu you select the kind of information to be recorded in the data logger: Flow Rate or Total.

D.L. INTERVAL

In this submenu you can select the sampling interval of the information selected in **Special func → D.L. data.** If a 5 minute time is set then the flow rate (or total) will be stored in the internal data logger every 5 minutes.

D.L. SAMPLES

In this submenu you can browse through the recorded data by simply using the arrows ↑↓.

RS 485 ADDRESS

In this submenu it is possible to enter the instrument address. This is useful when more instruments are connected in a network making it possible to identify a single flow meter through its address. The factory default is 0. Values allowed 0 - 31.

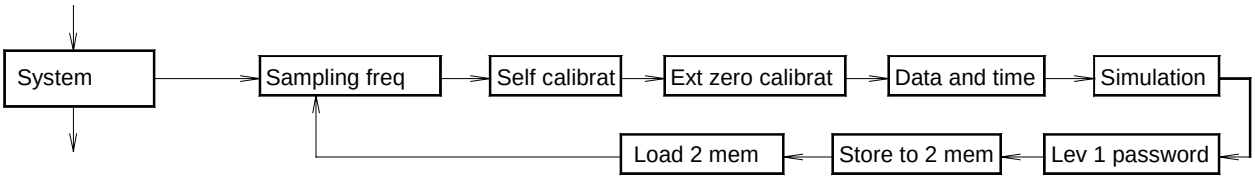
RS 485 FREQ.

In this submenu you can select the serial baud rate speed of the RS485. Obviously all devices that are connected to the flow meter are to be set in the same way. Factory default is 2400bps. Values allowed 1200/2400 bps.

SPECIFIC WEIGHT

It enables the introduction of the specific weight of the liquid to be measured, expressed in kg per dm^3. The value here entered is used to display the flow rate (**Fundamentals → Full scale**) and the inside totalizers (**Fundamentals → pulse quantity)**.

7.7 – MENU "SYSTEM"



SAMPLING FREQUENCY

It enables the selection of the instrument sampling speed. This affects the instrument resolution if the flow rate changes rapidly. The possible values are

AUTO: the converter automatically selects the sampling speed most suitable for the size sensor that it is connected to.

HIGH: the flow rate is measured 20 times per second.

LOW: the flow rate is measured 10 times per second.

1 min: the flow rate is measured at LOW speed for 10 seconds (On state) whereas for the next 50 seconds the flow rate is not measured (Sleep state). After the Sleep state the cycle will be repeated. During the Sleep state the converter assumes that the flow rate does not change.

5 min: the flow rate is measured at LOW speed for 10 seconds (On state) whereas for the next 290 seconds the flow rate is not measured (Sleep state). After the Sleep state the cycle will be repeated. During the Sleep state the converter assumes that the flow rate does not change.

10 min: the flow rate is measured at LOW speed for 10 seconds (On state) whereas for the next 590 seconds the flow rate is not measured (Sleep state). After the Sleep state the cycle will be repeated. During the Sleep state the converter assumes that the flow rate does not change.

The last three sampling frequency settings (1 min, 5 min, 10 min.) are very useful when you have to cut down on the instruments power consumption; because a good part of the power absorbed by the converter is used to supply the sensor, reducing the on-time of the sensor cuts down on the total power consumption of the instrument.

IMPORTANT: if you connect a converter to an insertion type sensor (MUT2700 or the like) the sampling frequency must be set to LOW.

SELF CALIBRATION

In this submenu you set the instrument auto-calibration. This is very useful when the instrument undergoes wide changes of temperature.

- **Disabled**
- **External**: it is carried out on an external control sent by serial input.
- Every **16 minutes**
- Every **64 minutes**

Because it takes 3 cycles of measurement for a calibration cycle, when batching is carried out it is best to disable it.

EXTERNAL ZERO CALIBRATION

In this submenu you can enable or disable the instrument zero calibration function on an external control sent by serial input.

DATE AND TIME

In this submenu you set the date and time of the instrument. When the power is switched off the internal clock stops. Then when you next switch on the instrument the difference between the real time and that shown by the instrument is the time during which the instrument remains without power.

SIMULATION

Entering this submenu it is possible to simulate a flow rate (±125%) of the full scale. Once the value desired has been entered and the E key has been pressed the converter will generate the pulse output equivalent to the set value.

LEV 1 PASSWORD

In this submenu you can set the password to allow entry into the functions and modify the parameters of level 1. The default value is 306000.

STORE TO 2 MEMORY

The converter has two memories: in the first one are memorized the current set parameters of the meter while in the second one the factory defaults are memorized. Once the converter is set (filters, alarms, etc.) it is possible to copy the parameters set in the factory default. This is useful in case the user changes the functioning parameters and all the changes introduced by the user are going to be cancelled.

LOAD 2 MEMORY

The converter has two memory areas: in the first one are stored the current set parameters of the meter while in the second one the factory defaults are stored. This procedure loads the factory default settings back into memory.

APPENDIX 1 – SIGNAL CONDITIONING

Main setup → Filter pulsat
Main setup → Flow cut-off
Main setup → Peak cut
Main setup → Filter bypass

The converter measures the flow rate at regular intervals of time called sampling cycles. During each cycle the voltage across the sensor's electrodes is sampled. Each sample is compared with the *previous flow rate measurement*. The difference that comes up (as total value and expressed as % of full scale) is compared with the value of **Main setup → Peak cut**.

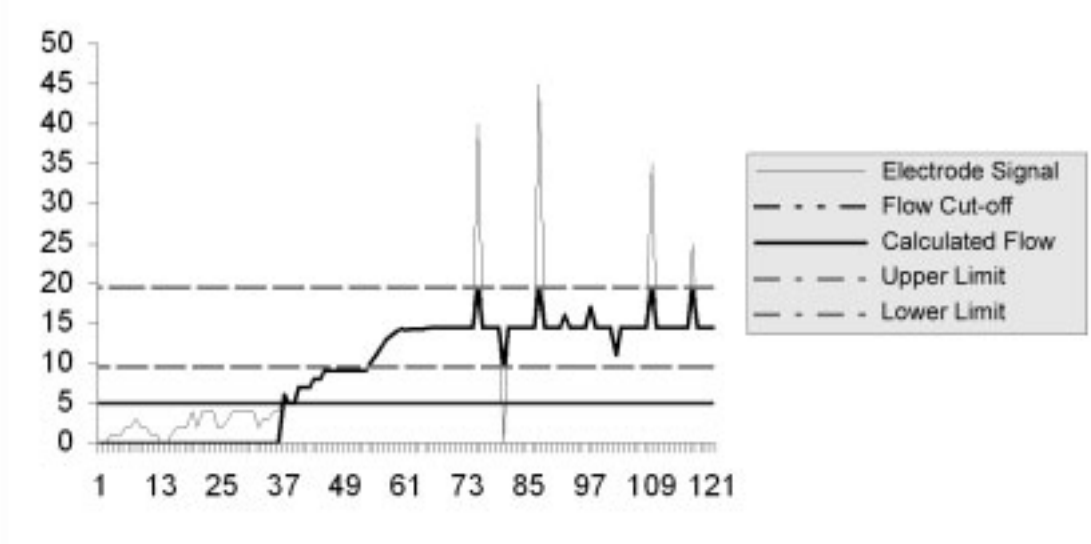
If the difference turns out to be bigger than the last measurement its value is limited to that of **Main setup → Peak cut.**

The same difference is then compared with **Main setup → Filter bypass**: if it turns out to be bigger, the *measure* takes immediately the value of the new sample, otherwise the value is slowly modified at a time regulated by **Main setup → Filter bypass**. This value is the pulse of the low-pass digital filter that will be calculated by the converter.

Furthermore, if the flow rate measured is smaller than **Main setup → Flow cut-off** then the flow rate displayed by the converter will be zero.

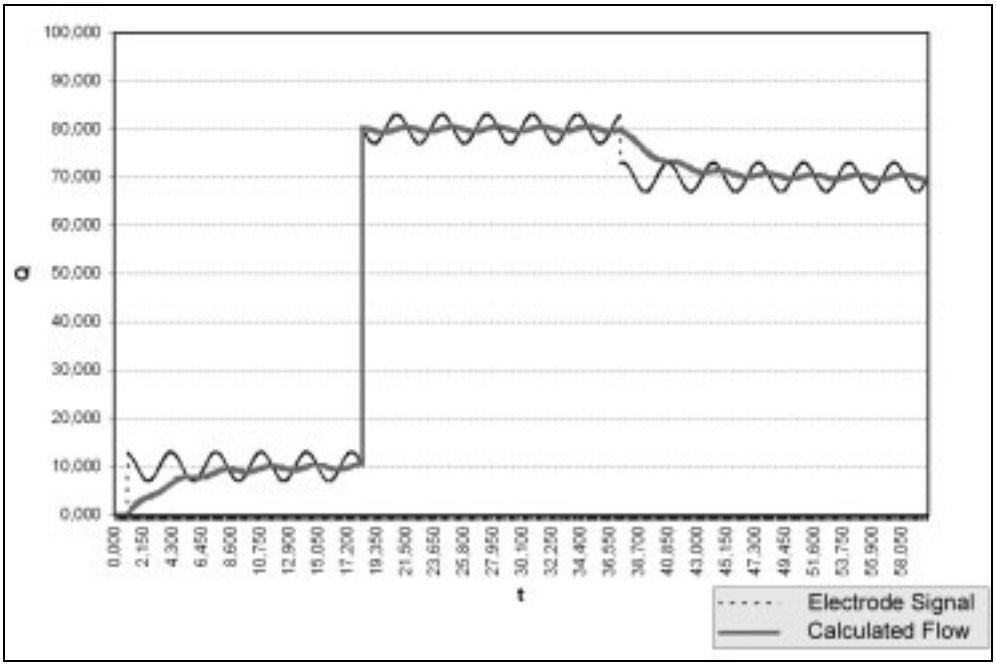
Example 1:

Main setup → **Flow cut-off** set at 5%: if the signal from the electrodes is less than 5%, the flow rate calculated will be 0.
Main setup → **Peak cut** set at 5%: signal peaks will be limited to 5% of the full scale.



Example 2:

Main setup → Filter pulsat an elevated value to reduce the flow rate variations
Main setup → Filter bypass set at 25% so that the meter can react quickly when big changes in the flow rate occur (bigger than 25% of the full scale)



In summary:

Main setup → Peak cut is useful to reduce peaks in the flow rate caused by interferences: changes bigger than the set parameter will be ignored by the meter.

Main setup → Filter bypass is useful to *speed* the response of the meter to big changes in the flow rate, like opening or closing of valves, start and stop of pumps, etc.

Main setup → Filter pulsat is useful to dampen small changes in the flow rate, thus allowing a stable and precise measurement.

Main setup → Flow cut-off is useful to eliminate noise or data scatter at zero flow; this ensures that the converter will not totalize whenever the liquid stops flowing.

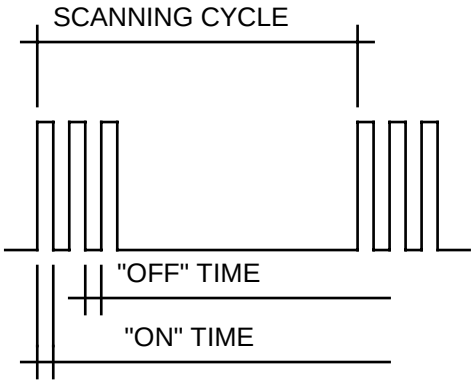
If you calibrate these functions properly when installing the meter you can achieve excellent results in stability, speed and reduction of hydraulic inconsistencies.

APPENDIX 2 – EXTERNAL FLOW OUTPUT SIGNAL

A2.2 – Advanced → Output mode (pulses or frequency)

The meter can generate two kinds of output signals, Pulses or Frequency that are selected in the **Advanced → Output mode.**

1. PULSES: **Fundamentals → Pulse quantity** defines the volume/weight of liquid represented by each pulse. The converter calculates the volume of the liquid passed through the sensor at equal intervals of time that is at each *sampling cycle*. This quantity is compared with **Fundamentals → Pulse quantity**, fixing the number of pulses to be emitted. The pulses are emitted during the next cycle. The time ON of the pulses is equal to the time OFF and it can be modified in **Fundamentals → Pulse duration**. See the following graphic:

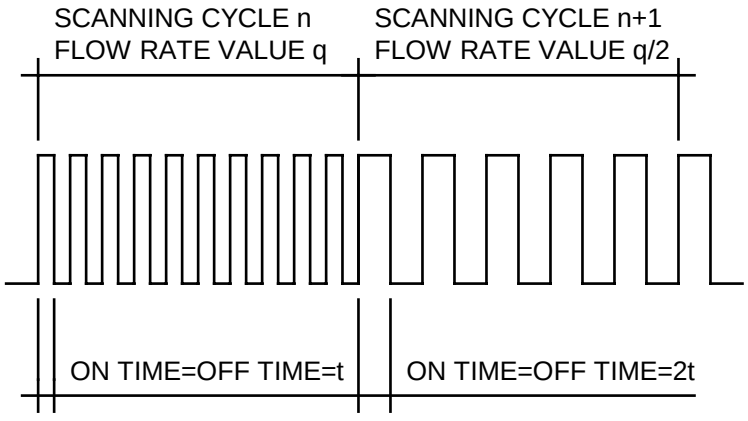


You can see that the pulses are generated like "packets" at every sampling cycle so as to be sent in the least time possible.

When the pulses are too numerous to cover the entire sampling cycle, the *maximum output frequency* can be reached, or rather the maximum number of pulses that can be generated by the device in a *second*. In this case, if you increased the flow rate, or the unit volume, the number of pulses to generate would further increase. When it is not possible for the pulses to be sent then the converter will store them and it will be forced to emit the pulses with delay, as soon as the flow rate diminishes.

To eliminate this situation you have to properly set the length and volume of the pulse. For a detailed description and a practical example look at the paragraph **8.1.C5.1**

2. FREQUENCY: the submenu **Advanced → Frequency F.S.** enables associating a frequency value to the flow rate full scale. The signal generated is a symmetrical square wave (duty cycle=50%) whose frequency is updated at each sampling cycle.



The minimum frequency to be generated is 0.5 Hz, the maximum is 1000 Hz (for alarms up to 1250 Hz).

APPENDIX 3 - ERROR & ALARM MESSAGES

A3.1 - The following error messages are displayed after the [C] key is depressed when the symbol "!" appears on the display: In the event more messages are present, they will appear one after the other.

MESSAGE	CAUSES	SOLUTIONS
EXCITAT.FAILURE	The excitation circuitry (connecting cables and/or sensor's coils) signals are interrupted. In this case the flow rate measurement is not possible.	Check the integrity of the connecting cables between the sensor and the converter, the tightness of the wires on the terminals, the resistance value of the sensor's coils (between 30 and 300 ohms).
FLOW MAX	This message does not indicate an error condition but it means that the flow rate is over the programmed max. alarm threshold and the relative alarm/batching output is ON.	Modify the max. alarm threshold or disable the alarm. See submenus: **Alarms → Max alarm** **Alarms → Max threshold**
FLOW < MIN	This message does not indicate an error condition but it means that the flow rate is under the programmed min. alarm threshold and the relative alarm/batching output is ON.	Modify the min. alarm threshold or disable the alarm. See submenus: **Alarms → Min alarm** **Alarms → Min threshold**
EMPTYPIPE	The measuring pipe (sensor) is empty, the electrodes connecting cable is broken, the "universal empty pipe" additional module is not correctly connected, the sensor or liquid grounding is poor or inefficient, the empty pipe detection circuitry is not correctly calibrated.	Check carefully if the sensor is COMPLETELY filled with liquid, check the integrity of the electrodes, "univ. empty pipe" module and the ground cables and the tightness of the terminal wires. If the connections are OK and the sensor is filled, calibrate the empty pipe detection circuitry. See: **Advanced → Empty pipe cal** **Advanced → EP threshold** **Alarms → EP sw alarm**
FLOW F.S.	The measured flow rate value is greater than the full scale set.	Modify the full-scale value. See: **Fundamentals → Full scale**
LOW SCALE	The converter is using the low scale selected with: **Special func→ Dua/Autorange** **Special func→ Low full scale**	
EEPROM BUSY	The memory that contains the flow meter parameters and the totalizers doesn't answer.	The memory or the watchdog timers is not operating correctly. Contact the factory for repair.
NOT STORED	The memory that contains the flowmeter parameters and the totalizers doesn't work correctly.	The memory or the watchdog timers is not operating correctly. Contact the factory for repair.
DELAYED PULSES	The parameters set in the converter cause the generation of a number of totalizing pulses greater than that which the instrument can deliver. In this situation the pulses are accumulated in memory and they are delivered as soon as possible.	Increase the volume corresponding to one pulse or reduce the pulse duration accordingly with the external pulse-counter. See: **Fundamentals→ Pulse quantity** **Fundamentals→ Pulse duration**

ADC OVERFLOW	The sensor is empty, the electrodes connecting cable is broken, the liquid or the sensor grounding is poor or inefficient, the empty pipe detection circuitry is not correctly calibrated, the measurement is strongly disturbed by external interference.	Check carefully that the sensor is COMPLETELY filled with liquid, check the integrity of the electrodes, univ. empty tube module, the ground connecting cables and the tightness of the terminal wires. If the connections are OK and the sensor is filled, calibrate the empty pipe detection circuitry. See: **Advanced→ Empty pipe cal** **Advanced→ EP threshold** **Alarms→ EP sw alarm**

APPENDIX 4 - TROUBLE SHOOTING AND SOLUTIONS

SYMPTOMS	DIAGNOSIS AND SOLUTIONS
When the liquid is still, the meter indicates a flow rate which is different from zero.	Verify the sensor and liquid grounding. See chapter 5.3. Check that the sensor is full of liquid. Set **Main setup→ Flow cut-off** to at least 2%. Carry out a zero calibration. See **Advanced→ Zero calibrat.** The electrical conductivity of the liquid is either too low or it is not compatible with the sensor's electrodes.
The indication of the flow rate is very unstable.	Verify the sensor and the liquid grounding. See chapter 5.3 There is air in the flow or out-gassing from nearby pumps or pressure drops. Choose a more **suitable position** for the sensor (see chapter 4). Sometimes the problem can be solved temporarily by partially closing a valve downstream of the meter. It is also possible to stabilize the measurement with the software filters: Halve the value of **Main setup→ filter pulsat** Diminish the value of **Main setup→ Peak cut** for example set it at 5% Increase the value of **Main setup→ Filter Bypass** for example set it to the maximum Finally, set **System→ Sampling frequency** on "Low". The electrical conductivity of the liquid is either too low or it is not compatible with the sensor's electrodes.
The external counter does not count, even if there is flow in the pipe.	**If the display shows a flow rate different from zero** a) The pulse quantity is too small: increase the volume unit (**Fundamentals→ Pulse quantity**) in order to reach a frequency which matches the counter used. See chapter 7.1. b) a pulse duration has been fixed which is too long for the frequency to be reached, or too short for the counter chosen. Calculate the values again looking at the chapter 7.1and then set **Fundamentals→ Pulse duration** c) The counter has not been connected properly. Verify the electrical connections as per paragraph 7.1. d) Check that **Advanced→ Output mode** is set at "Pulses". **Otherwise, if the display shows zero** i) Check that **Main setup→ Flow cut-off** is not bigger than the current flow rate. In this case it is best to reduce the **Main setup→ Flow cut-off.** ii) The zero of the instrument is not correct. Calibrate it as described in submenu **Advanced → Zero calibrat**. iii) If the display shows the symbol "**!"** then press C to see the alarm message(s). For example, if the message "emty pipe" appears then the converter thinks that the sensor is empty. If that is not the case, then you have to calibrate the empty pipe detection system as explained in **Advanced → Empty pipe cal.**

	Note that it is possible to check the converter-counter system simulating a flow rate with **System Simulation.**
The display is off.	There is no main power. Check the value on the data plate of the converter. The fuse may be blown. Disconnect the converter power supply, change the fuse as shown in chapter 4.5.A, close the terminal cover and switch on the converter again.
With empty piping the display shows flow rate and the totalizer is counting.	See **Alarms → EP sw alarm** **Advanced → Empty pipe cal** **Advanced → EP threshold**

APPENDIX 5 – RS 485 SERIAL COMMUNICATIONS PROTOCOL

A technical explanation of the RS-485 Serial Communications is contained in manual TD155/ENG. It is available from Flomotion Systems, Inc

FLOMOTION SYSTEMS, Inc.
586 N. French Rd., Suite 6
Amherst, NY 14228-2103
Toll Free: 800.909.FLOW (3569) (USA & Canada only)
Phone: 716.691.3941
Fax: 716.691.1253
Email: info@flomotionsystems.com

APPENDIX 6 – TRANSFORMATION FROM COMPACT TO REMOTE MOUNTED CONVERTER

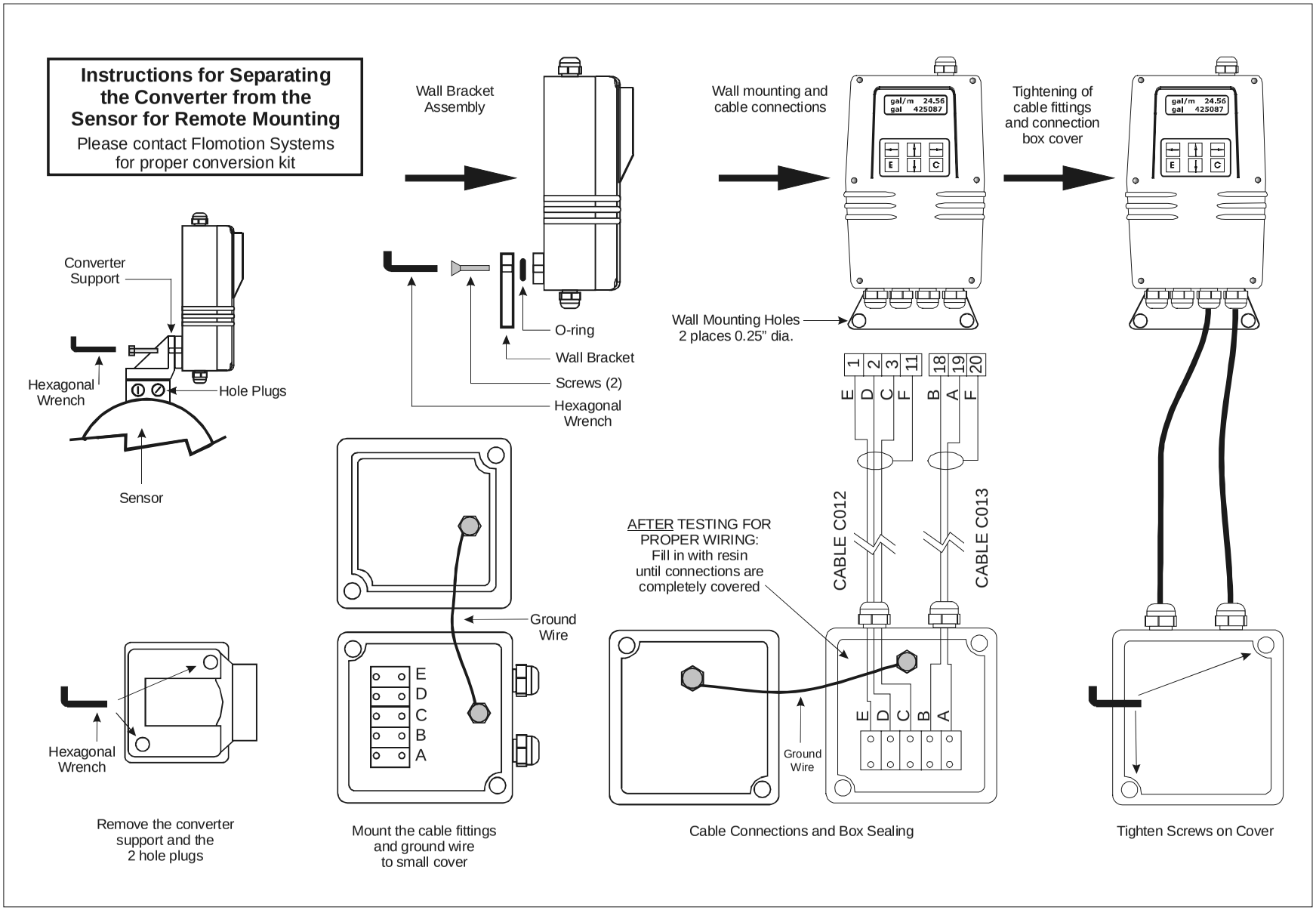
If you wish to convert your compact mounted converter (sensor mounted) to a remote (wall mount) version please obtain KIT# K108 and cables #C012 and #C013 and follow the instruction on the following page.

Please remember that the optimal cable length should not exceed 10 m.

The KIT K108 includes:

- Wall bracket to fasten the converter MC 308 to the wall
- Small cover with screws to close the connection box
- 5 MA nut with washer
- 4 mm hexagonal wrench
- 5 mm hexagonal wrench
- O-ring R25 to insert between support and converter
- 2 screws 6 MA x 20 (hexagonal wrench)
- 1 packet of sealing resin SIP1 necessary to seal the connection box, once the cables C012 and C013 are properly connected **NOTE: Cable functionality MUST be tested PRIOR to sealing!**

See drawing on the following page.


Instructions for Separating the Converter from the Sensor for Remote Mounting
Please contact Flomotion Systems for proper conversion kit
Converter Support
Hexagonal Wrench
Hole Plugs
Sensor
Remove the converter support and the 2 hole plugs
Wall Bracket Assembly
O-ring
Wall Bracket
Screws (2)
Hexagonal Wrench
Ground Wire
E D C B A
Mount the cable fittings and ground wire to small cover
Wall mounting and cable connections
Wall Mounting Holes 2 places 0.25" dia.
AFTER TESTING FOR PROPER WIRING: Fill in with resin until connections are completely covered
CABLE C012
CABLE C013
1 2 3 11
E D C F
18 19 20
B A F
Ground Wire
E D C B A
Cable Connections and Box Sealing
Tightening of cable fittings and connection box cover
Tighten Screws on Cover

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