USERS MANUAL FOR THE FLOMID-MC

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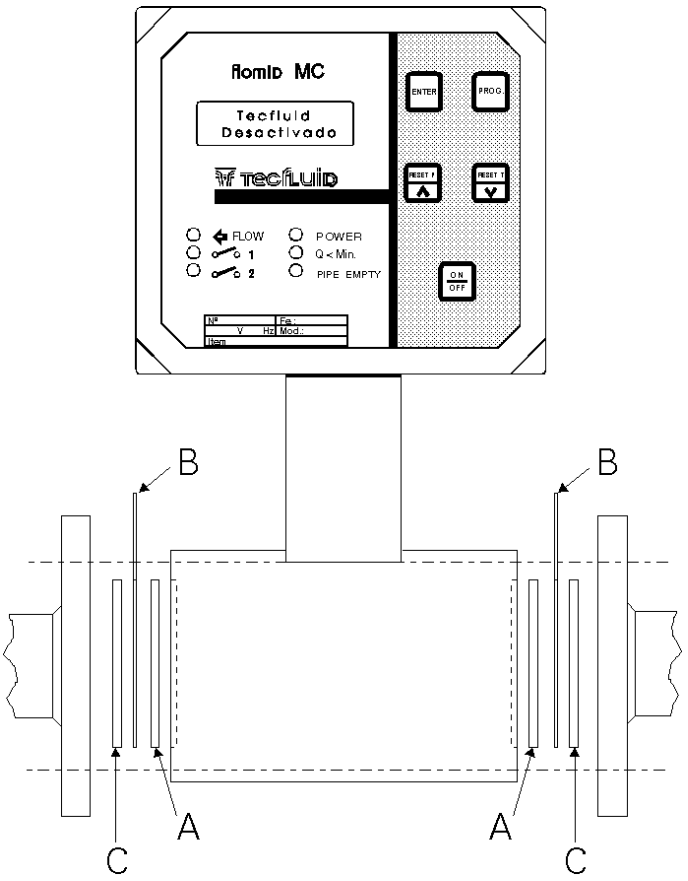
1. INTRODUCTION

The Flomid-MC is an electromagnetic flowmeter based on the latest microprocessor technology. The instrument has two microcontrollers, one which controls the analog signal from the electrodes, and the other takes care of the rest of the control functions of calculation, communication and interface with the user.

The whole of the analog signal circuit and flowmeter body are galvanically isolated from the rest of the output and con

2. INSTALLATION INSTRUCTIONS

2.1. Installation of the measuring body

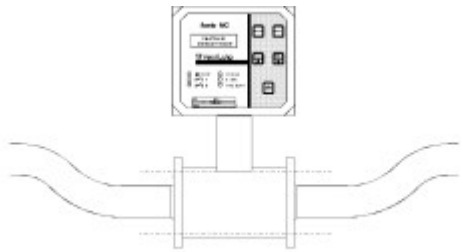


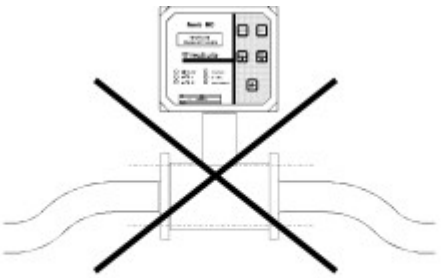
To guarantee the correct working of the instrument the following precautions must be taken when installing the equipment in the pipe.

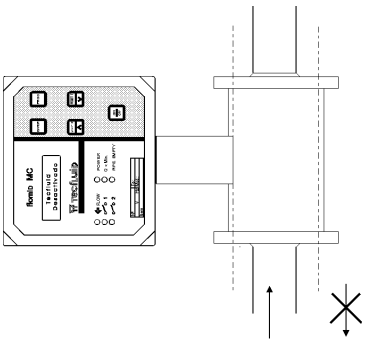
1. A good earth connection between the measuring body and the liquid can be considered as the most important factor for correct working of the unit. In the event that the pipe is made of electrically conductive material, just connect the two earth wires to the pipe flanges, one to each side of the instrument body. If the pipe is plastic (or any other non-conductive material) two earth discs (B) and two more rubber washers (C), one on each side of the body, must be installed and the earth wires connected to the earth discs. **This earth should be only used for the measuring body, do not connect other equipment to it** since electrical interferences may cause problems.

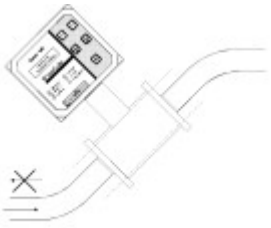
2. To avoid liquid getting into the body of the instrument, make sure that the rubber washers (**A**) fit inside the steel ring and are only pressured against the plastic body. If the rubber washer only seals against the steel part then liquid can be forced into the body, causing irreparable damage.

3. Liquid should always fill the metering tube and cover the electrodes which are in the side of the body. To obtain the best results it is recommended to install the instrument on a rising pipe, which guarantees that the pipe will always be full at the electrodes, avoiding accumulation of bubbles, which can cause incorrect readings.









2.2. Electrical Installation

A connection box, situated at the right of the instrument, is provided for the electrical connections.

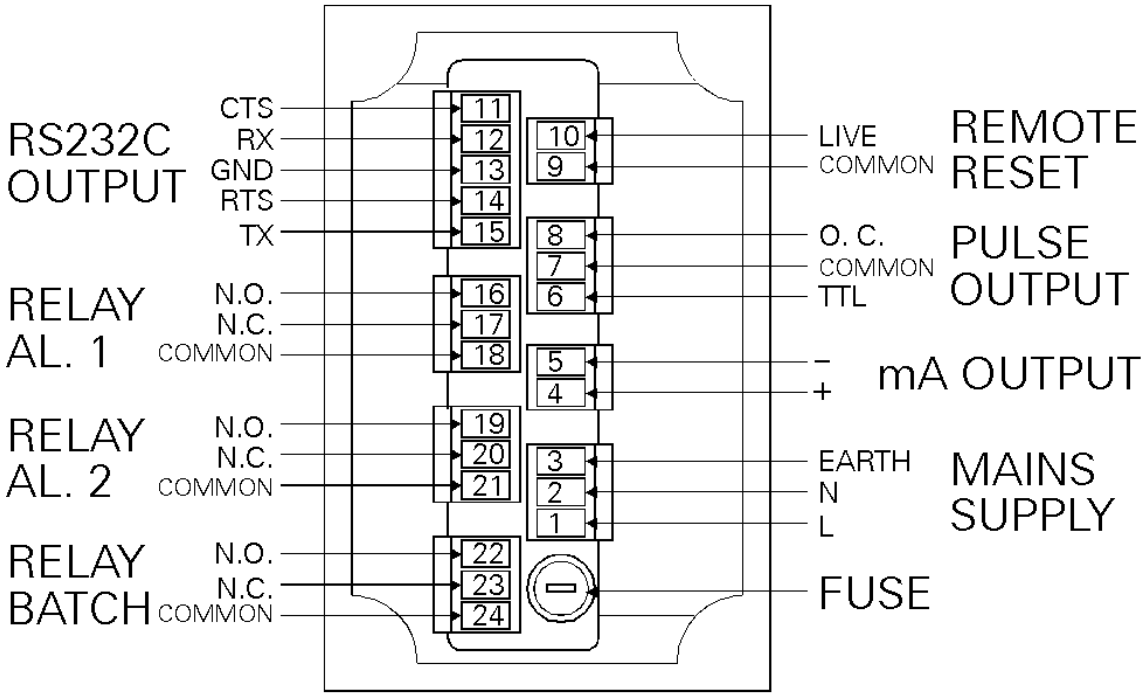
The cable glands should be fitted to the lid of the connection box with the idea that it makes it easier to disconnect the equipment for servicing, without needing to unscrew the cables from their terminals.

For the electrical installation it is recommended to use multiple conductor cables with individual cable sections in the order of 0.25 to 0.5 mm^2 in order to make it easier to close the connection box lid. It is better to maintain the cables with mains voltage (power supply, relays etc.) separated from the cables with low level signals (RS232C, 4-20 mA etc.)

Before starting the installation, check that the cable glands are the right size for the cables to be used, this will guarantee the instrument will stay water tight. Considering the small difference in cost it is better to use IP 67 cable glands.

To start the wiring, pass the cables through the cable glands in the box lid and push the lid along the cables to make wiring easier. Peel the outside insulation to free the inner cables to a length that will allow the end of the outside cover to just pass the cable glands when the lid is fitted. The fine cables should not be too short or too long. It is recommended to tin the ends of the wires to avoid loose ends.

Once the wiring is finished, slide the lid along the cables, screw in place and close the cable glands making sure that the cables are well griped by the cable glands.



Before starting to install the equipment, check that the supply voltage available is the same as marked on the front panel of the instrument.

2.2.1. Mains Supply Wiring

IMPORTANT : In order to comply with the electrical safety requirements as per IEC 1010-1, the installation of the equipment must take into account the following:

- The equipment must be installed in the front panel of an electrical mounting cabinet, leaving only the front of the equipment accessible to the operator.
- A mains switch must be provided to disconnect the equipment. This switch must be marked as the disconnecting device for the equipment and be within easy reach of the operator.
- The mains supply must have an earth line.

The mains supply is wired to terminals 1, 2 & 3. The Live is wired to terminal Nº 1, the neutral to Nº 2 and the mains earth to Nº 3. The mains earth is important for the line filter inside the instrument.

2.2.2. mA Output Wiring

The mA output is an active output, which means that the receiver instrument connected to it should have a passive input. It is recommended that the receiver should have an input resistance of less than 800 ohms to guarantee the full scale output.

The positive is connected to terminal Nº 4 and the common to terminal Nº 5.

In the event that the analog output is a voltage output instead of a current output the same connections are made. To change from a current output to a voltage output, jumpers inside the instrument must be changed. This should not be done by unauthorized persons; the type of output is set at factory as per the clients instructions. For the voltage output the load resistance should be greater than 10 KÙ. Any changes inside the instrument must be done by authorized technical personal.

2.2.3. Pulse Output Wiring

For the pulse output, two types of circuits are available to adapt to different requirements.

Firstly we have a TTL output which gives active pulses from 0 to 5 Volts. The minimum load resistance for this output is 10 KÙ, considering that the output resistance of the circuit is 1 KÙ. For this output the live should be connected to terminal Nº 6 and the common to terminal Nº 7.

Apart from the TTL output there is also an open collector output to terminal Nº 8. This output is an NPN transistor with the collector connected to terminal Nº 8 and the emitter connected to terminal Nº 7 (common). This output can support 100 mA maximum current and 40 Volts maximum voltage. It is potential free and does not have any protection of any kind, which must be provided externally as needed.

2.2.4. Remote Reset P. Wiring

Terminals Nº 9 & Nº 10 are for the remote Reset P input (partial counter reset), which can be used to start batching processes. To these terminals a **potential free**, **normally open**, push button contact can be connected. For this input a good quality snap-action push button should be used to guarantee a good contact at low working voltages and avoid contact bounce.

2.2.5. RS-232C Output Wiring

The wiring for the series communication for computers or Tecfluid's portable terminal **TPC-1** should be made as follows:

Flomid MC Terminal Nº	Function	Sub D 9 Terminal Nº
11	CTS - Clear To Send	8 (RTS)
12	RX - Reception Line	3 (TX)
13	GND - Common	5 (COMMON)
14	RTS - Request To Send	7 (CTS)
15	TX - Transmission Line	2 (RX)

When installing a series communication line, a shielded cable should be used to avoid pick up of electrical interferences. The external shield should be connected to the chassis of the Sub D connector.

2.2.6. Relay Wiring

The wiring of the relays is as following:

Terminal Nº	Contact	Relay
16	N.O. Normally Open	Alarm 1
17	N.C. Normally Closed	Alarm 1
18	Common	Alarm 1
19	N.O. Normally Open	Alarm 2
20	N.C. Normally Closed	Alarm 2
21	Common	Alarm 2
22	N.O. Normally Open	Batching
23	N.C. Normally Closed	Batching
24	Common	Batching

The state of the relay contacts is with the relay in repose.

The relay contacts are potential free.

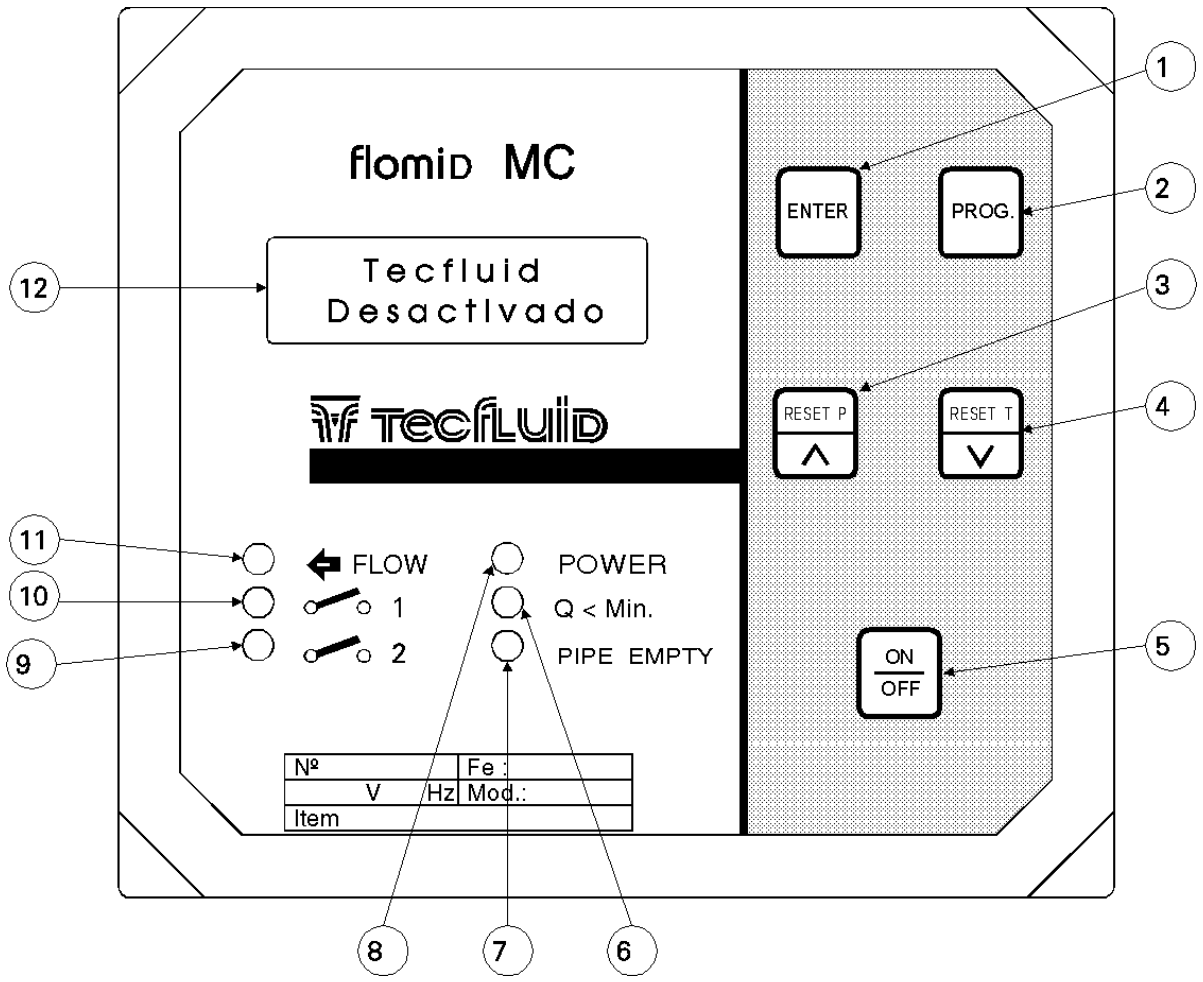
There are no protections provided for the relay contacts, and therefor these must be provided externally as required, taking into account the characteristics of the relay contacts. A fuse, or some type of short circuit protection, should always be provided. In the event of having inductive loads, it is recommended to use over-voltage protection for the relay contacts (VDR for AC loads and diodes for DC loads). If you have doubts on these protections, please get in contact with Tecfluid's after sales service.

3. SETTING UP INSTRUCTIONS

The FLOMID-MC has magnetically operated reed switches which perform the function of the push button switches for setting up and using the instrument. The switches are operated by means of a small magnet which should describe a perpendicular movement to touch the drawing of the push button in question on the face plate of the instrument. The big advantage of this system is that it is easy to gain access to the controls of the instrument without having to open sealed covers, which normally have to be screwed down to maintain an IP 65 seal. Another advantage of this system is that it is impossible to damage these switches by bad handling and the life expectancy is for more than 10,000,000 operations.

In these instructions these switches are called "push buttons", and when "press the push button" is stated , it means that the magnet must be moved towards and then away from the drawing of the "push button" in question.

3.1. Control Panel Description



1. "ENTER" Push button

Working State

- Used to change between the different working screens.
- When a batching process is started, it is used to confirm the order to start.

Standby State

- Together with the "PROG." push button, it is used to enter the basic set up program of the instrument.
- Together with the "RESET T" push button, it is used to reset the totalizing counter.

Configuration and Programming

- Used to select the digit to change or to select the option available.

2. "PROG." Push button

Working State

- Used to switch between the normal working screen and the Status screen.

Standby State

- Used to enter the set up of the alarm relays and the normal working screen.
- Together with the "ENTER" push button, it is used to enter the basic set up program of the instrument.

Configuration and Programming - Used to confirm the data entered.

3. "RESET P" "∧" Push button
   Working State
   - Used to start a batching process.
   Standby State
   - Used to enter the screen for programming the batch quantity.
   Configuration and Programming
   - Used to increase the value of a digit.

4. "RESET T" "∨" Push button
   Working State
   - Used to give the order to send data via the RS-232C series channel.
   Standby State
   - Together with the "ENTER" push button, it is used to reset the totalizing counter.
   Configuration and Programming
   - Used to reduce the value of a digit.

5. "ON/OFF" Push button
   Working State
   - Used to go to the **Standby State**
   Standby State
   - Used to go to the **Working State**
   Configuration and Programming
   - Used to leave a programming screen without saving changes made.

6. "Q < Min." LED - Flow rate below minimum pilot light.

7. "PIPE EMPTY" LED - Pipe empty pilot light.

8. "POWER" LED - mains voltage pilot light.

9. "σσ 2" LED - pilot light for alarm 2 active.

10. "σσ 1" LED - pilot light for alarm 1 active.

11. "← FLOW" LED - inverted flow pilot light.

12. LCD Display , 2 lines of 16 characters per line.

The instrument has five push buttons to set up and control the different working modes as given in the present instructions.
The LCD (Liquid Crystal Display) **[12]** is used by the instrument to indicate working data and to guide the setting up procedure.
The **"POWER" [8]** pilot light only indicates the presence of mains voltage, and in the event that the mains fuse blows, this light will go out.

3.2. Starting up

When the mains supply is connected to the instrument, and if the instrument has been previously programmed, the normal working screen will automatically appear. To program or configure the FLOMID-MC we must start from the "Standby" screen. If the normal working screen is displayed, by pressing the **"ON/OFF" [5]** push button we will go back to the "Standby" screen for programming or configuration. To simplify the use of the instrument the programming and set up has been split into three basic menus:

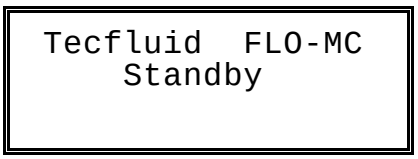
Basic Configuration	(See Part 3.3)
Secondary Configuration	(See Part 3.4)
Programming Batching	(See Part 4)

The access to the basic configuration menu must be made by the use of two push buttons (two magnets) with the idea of providing additional protection of basic configuration data.

Apart from being able to use the front panel push buttons for programming the instrument, the TPC-1 portable terminal can also be used on the RS-232C output. The only thing that has to be previously set up is the RS-232C configuration. These instructions are also valid when using the TPC-1. A computer can also be used to interface with the instrument, but then the user must install the Tecfluid communications software or make his own software.

3.3. Basic Configuration

The "Standby" screen must be displayed in order to be able to enter in the basic configuration screens.

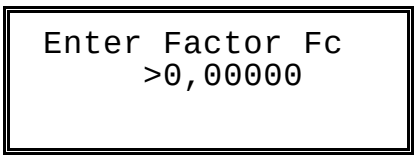


From this screen we can enter the basic configuration sequence by pressing the **"PROG." [2]** and **"ENTER" [1]** push buttons at the same time. Pressing these push buttons, the first screen for entering the measuring body calibration factor (Fc) will appear.

3.3.1. Adapting the body to the electronics

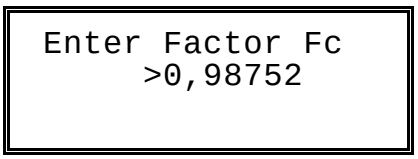
To start with, we must configure the instrument to adapt the measuring body to the electronics of the instrument.

In the first screen the calibration factor of the measuring body, which is given on the adhesive label on the body, must be introduced.



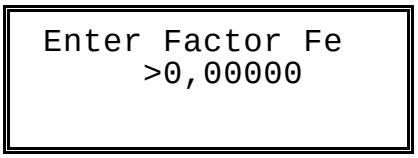
When the programming screen appears the cursor is below the first digit to modify. The "**RESET P**" "∧" **[3]** push-button is used to increase the value of the number and the "**RESET T**" **"Ú " [4]** is used to reduce its value. Once the desired value of the digit in question is achieved using the previously mentioned push-buttons, by pressing the "**ENTER" [1]** push-button the cursor will pass to the next digit to be modified. On the last digit, by pressing the "**ENTER" [1]** push-button the cursor will pass to the first digit on the screen. If the **"PROG." [4]** push-button is pressed the value displayed on the screen will be automatically saved in memory and the next programming screen will appear, this will occur even if the cursor has not reached the last digit. If you are not interested in modifying the value on a particular programming screen you can jump to the next screen by using the **"PROG." [2]** push-button instead of having to press the "**ENTER" [1]** push-button various times.

If you wish to jump to the next programming screen without modifying the previous value, although the values on the screen have been modified, this can be done by pressing the **"ON/OFF" [5]** push button. The **"ON/OFF" [5]** push button acts as an escape.

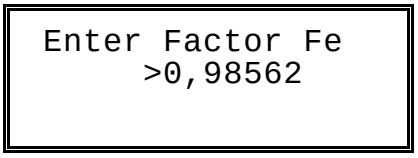


NOTE: For the calibration factors, Fc and Fe = 0.00000 will be rejected

Once the body calibration factor has been programmed, the next screen for the electronics calibration factor will appear. In this screen the calibration factor for the electronics "Fe", whose value will be found on the front panel of the instrument, must be entered.

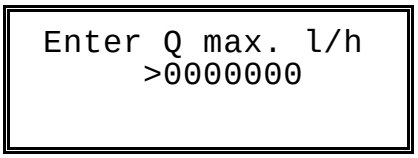


The use of the push buttons is the same as described before.

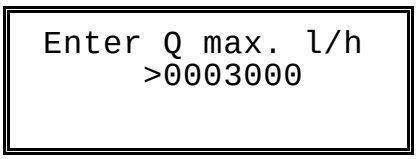


Once the electronics calibration factor has been programmed, the next screen for the measuring body flow rate will appear.

In this screen the "Qmax.", whose value will be found on the adhesive label on the measuring body, must be entered.



The use of the push buttons is the same as described before.



NOTE: The values of Fe, Fc and Qmax. must be the same values as found indicated on the front plate and on the measuring body. These values have been measured for a water velocity of 5 m/s. When using the instrument for higher flow rates the indication will be correct up to a maximum velocity of about 11 m/s.

Once the values for adapting the body to the electronics (Fe, Fc and Qmax) have been introduced, the screen for programming the pulse output will appear.

3.3.2. Pulse Output Configuration

In this screen the output frequency is selected. This output can be used as a simple frequency output to indicate the flow rate, for example 1000 Hz or 10,000 Hz at full scale (Qmax), or it can be used to generate pulses for an automat or electromechanical counter. In the case of using the pulse output as a simple frequency output just program the frequency wanted at Qmax.

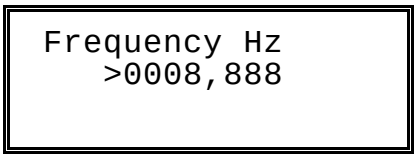
When a number of pulses per litre is wanted then the following calculation must be done:

The maximum flow rate (Qmax.)must de divided by 3600 and then multiplied by the pulses per litre wanted.

f = frequency to be introduced
Qmax = Maximum flow rate specified on the body (l/h)
IL = Pulses per litre wanted

$$f = \frac{Q_{max} \; x \; IL}{3600}$$

For example, if we have a measuring body which has specified Qmax = 3200 l/h and we want to have 10 pulses per litre for an automat, then we must introduce 8.888 Hz in this screen.



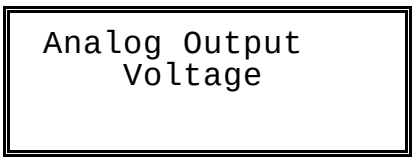
NOTE: The maximum output frequency is 10.000 Hz. (9.999,999 Hz). A value of 0000.000 Hz will be rejected

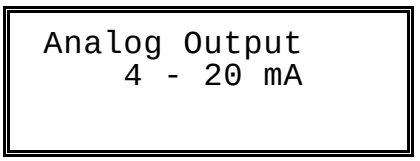
NOTE: In the event that the output is used for electromechanical counters check that the maximum output frequency is less than the maximum counting speed of the counter.

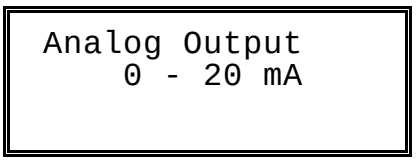
Once the pulse output frequency has been entered the first screen for the analog output will appear.

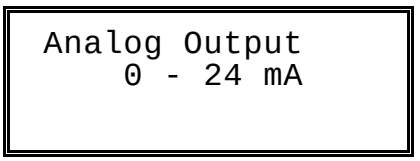
3.3.3. Analog Output configuration

At first the type of output must be selected, 0-20 mA, 4-20 mA, 0-24 mA or voltage output.







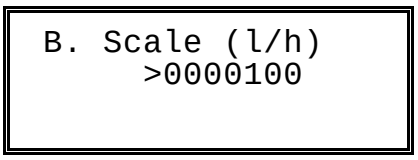


The first option to appear will be previously selected option or the voltage output option as the default option.

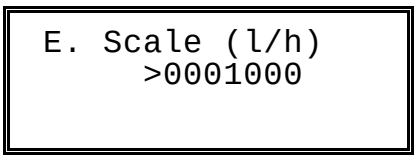
Rotate between the four options using the "**ENTER**" **[1]** push button and use the **"PROG." [2]** push button to select the desired option.

NOTE : To change from a current output to the voltage output, jumpers have to be changed inside the instrument. There is one jumper which changes the output from current to voltage output and another which selects 0-5 V or 0-10 V. The jumpers are located in factory according to the clients specifications to avoid posterior manipulation inside the instrument. Any changes made inside the instrument should be made by authorized technical personnel.

After having selected the type of output, the beginning and end of the analog scale must be defined. First appears the screen to select the beginning of the analog scale. In this screen the flow rate must be entered (in litres/hour) which corresponds to the zero point of the analog scale. The zero point of the analog scale can be 0 mA, 0 V or 4 mA (in the case of a 4-20 mA output).



Once this value has been entered using the push buttons in the same way as previously described, the next screen will appear for entering the flow rate for the end of the analog scale (20 mA, 24 mA, 5 V or 10 V).



If the flow rate entered for the end of scale is the same as or less than the flow rate for the beginning of the scale then these values will be rejected and the screen to select the beginning of the scale will appear again.

Once the analog output is programmed the screens to program the working modes for the relays will appear.

3.3.4. Working Mode Relay Nº 1

In this screen we can select relay Nº 1 to work as a **flow rate alarm** or as an output for the **pipe empty** detection.

To change the working mode use the '**ENTER**" **[1]** push button to change from one option to another and then the **"PROG." [2]** push button to select the option shown on the display.

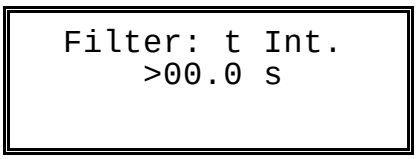
3.3.5. Working Mode Relay Nº 2

In this screen we can select relay Nº 2 to work as a **flow rate alarm** or as an output for the **inverted flow** detection.

To change the working mode use the '**ENTER**" **[1]** push button to change from one option to another and then the **"PROG." [2]** push button to select the option shown on the display.

3.3.6. Filter Set Up

The FLOMID-MC has an adaptive filter to obtain stable analog outputs and flow rate readings in spite of fluctuating flow patterns. Only the analog output and the display indications are affected by this filter. The rest of the outputs (pulse output, relays etc. are activated by instantaneous values of the flow rate. By selecting a filter with more or less integration time we can obtain a response to small changes in flow rate in more or less time. The response towards sudden changes in flow rate of more than 10% is fast (maximum 300 ms), independently of the integration time selected.

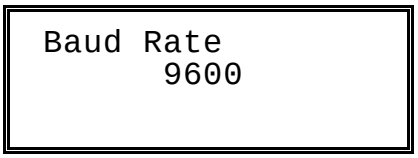


In this screen the integration time in seconds is selected. This integration time can be selected from 00.1 seconds to 25.5 seconds. If an integration time of 15 seconds is selected then the display will give the average flow rate during the last 15 seconds. This does not mean that the display is updated only once every 15 seconds, in fact the display is updated four times a second and each time a new value is calculated for the average of the last 15 seconds.

3.3.7. RS-232C Output

To set up the RS-232C output at first we have to select the baud rate (speed at which data is sent). The limits for the baud rate are 300 to 19200 bauds.

Using the '**ENTER**" **[1]** push button we can rotate between the different possibilities of baud rates. The selected baud rate is programmed using the **"PROG." [2]** push button.

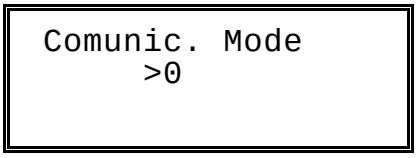


Next we have to select the communication mode. For the mode we have three options:

Mode 0 Continuous transmission of complete data ; flow rate, partial counter, totalizing counter and status.

Mode 1 Transmission of complete data only when the '**RESET T**" **"Ú" [4]** push button is pressed or when ordered by a remote terminal.

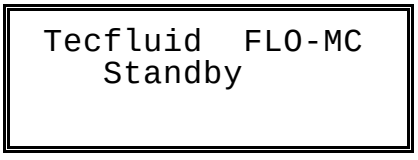
Mode 2 Continuous transmission of only flow rate data.



For more details on the RS232C output refer to Part 7 of this manual.

3.4. Secondary Configuration

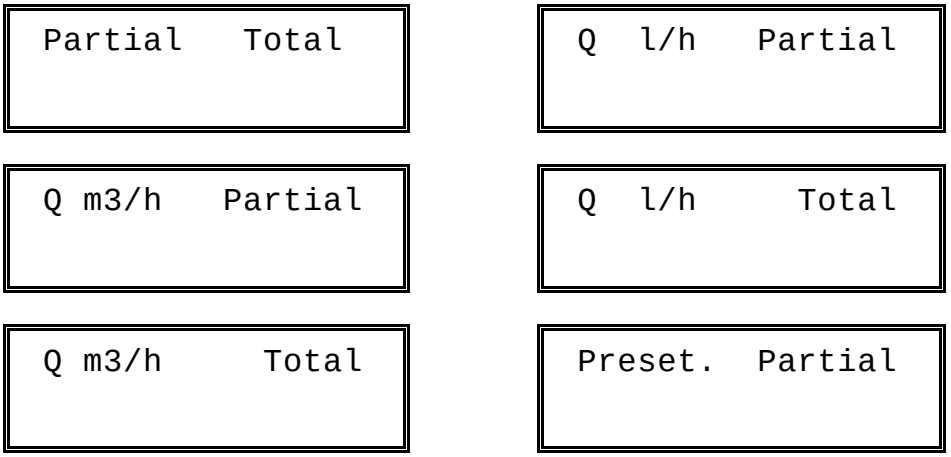
The "Standby" screen must be displayed in order to be able to enter in the Secondary Configuration screens.



From this screen we can enter the secondary configuration screens by pressing the **"PROG." [2]** push button.

3.4.1. Selecting the normal working screen

The normal working screen is the default screen which will appear when power is switched on. There are six options for this screen, of which we must select one.

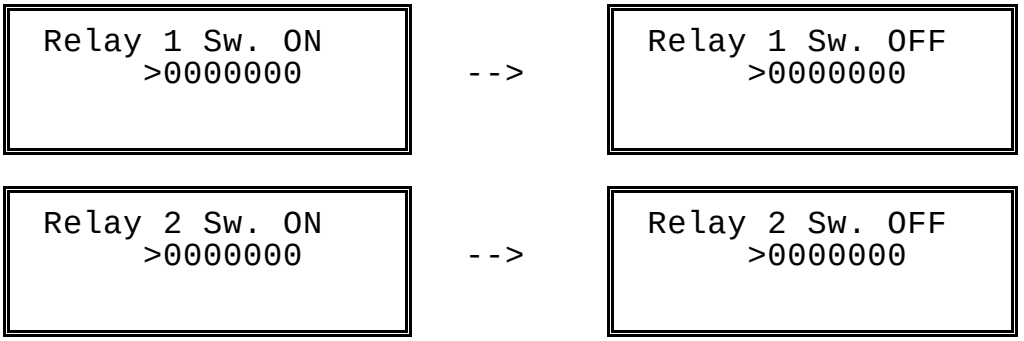


Using the **"ENTER" [1]** push button we can rotate between the six options until the wanted screen appears. In the six options one can see that when the flow rate is displayed we can select the flow rate in l/h or in m3/h. If we select the l/h option then the flow rate will be in l/h unless the flow rate exceeds 20,000 l/h and at this point it will automatically start to indicate in m3/h. In the case of having selected the m3/h option then the flow rate will be in m3/h unless it drops below 5 m3/h and will then be displayed in l/h. By means of the **"PROG." [2]** push button the selected working screen is programmed as the default working screen.

3.4.2. Alarm Configuration

These screens appear only if the relay has been programmed as a flow rate alarm. Here we have to select the switching points for the flow rate alarms and the hysteresis. By "hysteresis" we mean the difference between the flow rate when the relay switches on to when it switches off. It is most normal that the flow rates in a pipe are not perfectly constant, this can be due to pumps, turbulent flow in the pipes and other factors. If we program a relay to switch on at a flow rate of 1000 l/h and to switch off at 999 l/h, we have programmed only 1 l/h of hysteresis. What would almost certainly happen would be that when the flow rate reaches 1000 l/h this relay would be continuously switching on and off due to flow rate fluctuations. To avoid this effect we must program the relay with a greater hysteresis so that normal flow rate fluctuations will not provoke continuously switching of the relay.

In the following screens we must program the two switching points for the flow rate alarm relays. The relays have not been pre-defined as Max. or Min. alarms, we can make the relays act as we wish just by defining if the switch on point is higher or lower than the switch off point. The program will not accept the same value for the two points. If we define the switch on point as 100 l/h and the switch off point as 50 l/h, then the relay will switch on when the flow rate reaches 100 l/h and will not switch off again until it drops below 50 l/h. If we define the switch on point as 50 l/h and the switch off point as 100 l/h, then the relay will switch on when the flow rate drops below 50 l/h and will not switch off again until it reaches 100 l/h.

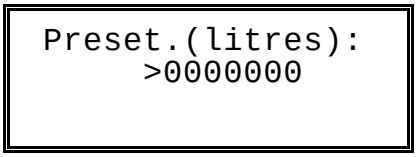


When the relays have been programmed the standby screen will appear.

4. BATCHING

4.1. Entering the Preset Value

Starting from the "Standby" screen, by pressing the "**RESET P**" "Ù" **[3]** push-button we can enter in the screen to program the preset value in litres for batching.

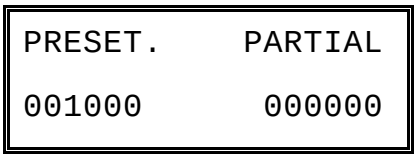


When the programming screen appears the cursor is below the first digit to modify. The "**RESET P**" "∧" **[3]** push-button is used to increase the value of the number and the "**RESET T**" **"Ú" [4]** is used to decrease its value. Once the desired value of the digit in question is achieved using the previously mentioned push-buttons, pressing the "**ENTER" [1]** push-button the cursor will pass to the next digit to be modified. On the last digit, by pressing the "**ENTER" [1]** push-button the cursor will pass to the first digit on the screen. If the **"PROG." [4]** push-button is pressed the value displayed on the screen will be automatically saved in memory and the "Standby" screen will appear, this will occur even if the cursor has not reached the last digit.

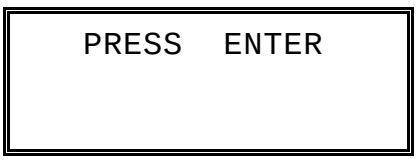
If you wish to leave this screen without modifying the previous value, although the values on the screen have been modified, this can be done by pressing the **"ON/OFF" [5]** push button. The **"ON/OFF" [5]** push button acts as an escape.

4.2. Batching

From the "standby" screen, we press the "**ON/OFF**" **[5]** push-button to enter the normal working screen. The normal working screen will appear, selected as per instructions **3.4.1**, for example:-



To start the batching process, first we press the "**RESET P**" **[3]** push-button to clear the partial counter, and the following screen will appear, but the relay will not yet be activated:



In the instant that the "**ENTER**" **[1]** push-button is pressed the relay is activated and the batching process begins, counting the volume passing through the flowmeter and adding it to the partial and total counters. When the partial counter reaches the preset value the relay is deactivated and the batching process finishes.

If the "**ON/OFF" [5]** push-button is pressed during the batching process, the relay is deactivated and the process is aborted. In this case, instead of showing the normal working screen, the "Standby" screen appears. By pressing the **ON/OFF" [5]** push-button we get back to the normal working screen. This screen always shows the state at which the batching was finished. In the event that one needs to finish a batch which was stopped, by pressing the **ON/OFF" [5]** push-button or by a power failure, one must enter a preset value equal to the difference between the original preset value and the value of the partial counter when the process was stopped. During a batching process the "**RESET P**" **[3]** push button is inoperative.

The batching process can also be started by means of the remote "**RESET P**" input, and in this case the batching process will start as soon as the switch is closed without the "PRESS ENTER" screen.

5. TOTALIZING COUNTER

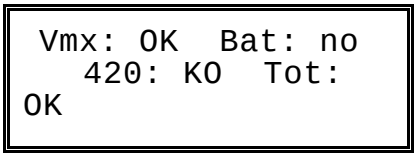
The total counter shows the total volume that has passed through the flowmeter, independently of the use or not of the batching option.

To clear the totalizing counter, we must go to the "Standby" screen and press the **"RESET T"[4]** and **"ENTER" [1]** push-buttons at the same time. This requires the use of two magnets, which is a protection against accidental clearing of the counter.

If the totalizing counter has overflown indicating in litres (more than 10,000,000 litres) it will automatically start to indicate in cubic meters without loosing the data, and in this case the letter "m" will be seen after the number. In this case it is advisable to put the counter to zero in order not to loose precision in the reading, also, the counter will go to zero when it reaches 100,000 m^3.

6. STATUS INDICATION

During the normal working of the instrument (not in the standby state), if the **"PROG." [2]** push button is pressed the screen will indicate the status of the instrument.



The status indicates the basic working state of the following parts of the instrument:

232: Indicates if the Flomid-MC is connected to a computer or terminal and if it is ready to receive data.
- OK = affirmative
- KO = negative

Bat: Indicates if there is a batching in process.
- ye = affirmative
- no = negative

420: Indicates if the mA current loop is correct.
- OK = the circuit is closed
- KO = the circuit is open

NOTE: For the current loop output status this is only valid when working with a current loop and it will only detect an open circuit in the loop, a short circuit will not be detected as there is no lower limit for the output resistance. In the case of having selected a voltage output then the status will always be "OK".

Tot: Indicates if the totalizing counter has overflown and zeroed. (>100.000 m^3)
- OK = no overflow
- KO = overflown

7. RS-232C COMMUNICATION PROTOCOL

The communication between the Flomid-MC and a remote instrument (computer or **TCP-1** terminal) is by means of a standard bidirectional series channel (RS-232C).

Hardware Protocol:

The transmission and reception of data are full duplex, which means that the instrument is capable of transmitting and receiving data at the same time.

The communication has the following data format:

10 bit data word, the first bit is the start bit (0), then 8 bits of data (LSB first), and then the stop bit (1).

The transmission speed (Baud Rate) is selected in the main configuration menu as explained in part 3.3.7

The data is sent in ASCII code.

As explained in part 3.3.7, there are three transmission modes, two of which are continuous transmission modes and one mode transmits on user petition.

Mode 0: The flow rate, totalizing counter, partial counter and status are continuously transmitted.

Mode 1: The previously mentioned data is transmitted when the user makes the request by means of the **"RESET T**" "**Ú**" **[4]** push button or via the RS232C channel by sending the corresponding character for the **"RESET T**" "**Ú**" **[4]** push button.

Mode 2: This mode is identical to Mode 0 except that only the flow rate data is transmitted.

The status byte has the following bit meaning. Each bit indicates the status a different parameter.

Bit 0 = Alarm Relay 1 (0=disconnected, 1=connected)
Bit 1 = Alarm Relay 2 (0=disconnected, 1=connected)
Bit 2 = Batching Relay (0=disconnected, 1=connected)
Bit 3 = Q<Min. (0=above minimum, 1=below minimum)
Bit 4 = Flow direction (0=reverse, 1=normal)
Bit 5 = Empty Pipe (0=empty, 1=full)
Bit 6 = Current loop (0=normal, 1=open circuit)
Bit 7 = Totalizer overflow (0=overflow, 1=normal)

Software Protocol:

Here we can split the protocol into two separate parts, standby and normal working modes.

7.1. Standby mode.

When the Flomid-MC is in the standby mode and the configuration or programming menus are entered then the communication protocol is the following:

When pressing a push button in the Flomid-MC.

The code of the corresponding push button will be sent with the following format:

{STX}{push button}{ETX}

Where:

{STX} (Start of text) is the code for the start of a text (ASCII 02).
push button is the code of the push button pressed.
{ETX} (End of text) is the code for the end of a text (ASCII 03).

Once the computer receives the data it must reply with the **{ACK}** (Acknowledge) code, which is the confirmation code (ASCII 15).

In the event that the Flomid-MC does not receive the **{ACK}** (Acknowledge) code, it will re-transmit the data until correct communication is established.

When the action of a push button is to start a program menu (push button PROG or PROG + ENTER), then the Flomid-MC will send the following data:

{STX}{header}{value}{ETX}

Where:

{STX} (Start of text) is the code for the start of a text (ASCII 02).
header (one byte) indicates the data which is being sent (body factor, current screen, etc...). The data is sent in ASCII format.
value is the numerical value of the data. The data is sent in ASCII format.
{ETX} (End of text) is the code for the end of a text (ASCII 03).

Again after sending the data the computer must send the **{ACK}** code, if the Flomid-MC does not receive the **{ACK}** (Acknowledge) code, it will re-transmit the data until correct communication is established.

The different formats that the Flomid-MC can send are the following (x is the numerical data):

a) In Basic configuration of the instrument

{STX}Ux.xxxxx{ETX}			Body Calibration Factor
{STX}Ex.xxxxx{ETX}			Electronics Calibration Factor
{STX}Xxxxxxxx{ETX}			Maximum Flow Rate
{STX}Yxxxx.xxx{ETX}			Maximum Output Frequency
{STX}Ox{ETX}			Analog output Type
x:	0h	:	Voltage output
	40h	:	4 - 20 mA output
	80h	:	0 - 20 mA output
	c0h	:	0 - 24 mA output
{STX}Lxxxxxxx{ETX}			Beginning of Analog Scale
{STX}Fxxxxxxx{ETX}			End of Analog Scale
{STX}Ix{ETX}			Relay 1 Mode
{STX}Jx{ETX}			Relay 2 Mode
{STX}Nxx.x{ETX}			Filter Integration time

{STX}Bx{ETX}			Baud rate
x:	30h	:	300 bauds
	31h	:	600 bauds
	32h	:	1200 bauds
	33h	:	2400 bauds
	34h	:	4800 bauds
	35h	:	9600 bauds
	36h	:	19200 bauds

{STX}Cx{ETX}	Communication Mode

b) In Secondary Configuration

{STX}Vx{ETX}	Normal Working Screen
{STX}Hxxxxxxx{ETX}	Relay 1 connect
{STX}Mxxxxxxx{ETX}	Relay 1 disconnect
{STX}Zxxxxxxx{ETX}	Relay 2 connect
{STX}Kxxxxxxx{ETX}	Relay 2 disconnect

c) In Batching preset

{STX}Axxxxxxx{ETX}	Preset Value

¡Error! Argumento de modificador desconocido..¡Error! Argumento de modificador desconocido..¡Error! Argumento de modificador desconocido. When pressing a push button on the computer.

The order will be sent to the Flomid-MC, which will act accordingly to the push button activated. The Flomid-MC will **not** send an **{ACK}** code back to the computer, the confirmation of push button will be the "{STX}{header}{value}{ETX}" message which the Flomid-MC will send to indicate the change in screen.

7.2. Working Mode.

When the Flomid-MC is in the normal working mode, the data is sent to the computer in a unidirectional way, with no need for an **{ACK}** code by the computer. Only when a push button is pressed (change of screen, batching or go to standby) the protocol requires confirmation.

The different codes which the Flomid sends to the computer are the following (the numerical values are just examples):

{STX}P 114{ETX}	Partial Counter
{STX}T 244739{ETX}	Totalizing Counter
{STX}Q 5133{ETX}	Flow Rate
{STX}Sx{ETX}	Status
{STX}D{ETX}	Change to Standby
{STX}Vx{ETX}	Change of Screen
{STX}G{ETX}	Partial Reset
{STX}R{ETX}	Status Screen
{STX}W0001000{ETX}	Preset Value

Initialize communication

To establish correct communication, the computer or terminal should be connected when the Flomid is switched on (plugged into the mains).

When the terminal is connected, it must send the **{ENQ}** (Enquire) code to open communication.

If the Flomid-MC receives this code, it will send the code of the present situation (standby or present screen).

If you need more details on the RS232C Protocol, please contact a Tecfluid after sales service.

8. USEFUL EXAMPLES OF CALCULATIONS

Measurement error corrections

The calibration of flowmeters is accomplished using, for the liquid, water at 20 ^{o}C thus obtaining a calibration for a liquid of density 1 kg/l and viscosity of 1 mPas. If the flowmeter is used with a liquid of other characteristics from the above specified o for reasons of turbulences in the flow, measurement errors can be induced.

To correct these types of errors we can modify the value of the body calibration factor Fc introduced in the basic configuration of the instrument.

Example 1 - Shortage of volume

If we have a flowmeter body which specifies Fc = 0.985, and when we check the volume of a batch, we find that instead of having 100 litres as programmed, we only have 95 litres (5% less) and we must apply the following correction:

Fcn = Calibration Factor (new) = ? (1.03684)
Fc = Calibration Factor (original) = 0.985
V = Expected Volume = 100
Vr = Real Volume = 95

$$F_{cn} = \frac{F_c \quad x \quad V}{V_r}$$

Example 2 - Excess of volume

If we have a flowmeter body which specifies Fc = 0.985, and when we check the volume of a batch, we find that instead of having 100 litres as programmed, we only have 105 litres (5% more) and we must apply the following correction:

Fcn = Calibration Factor (new) = ? (0.89545)
Fc = Calibration Factor (original) = 0.985
V = Expected Volume = 100
Vr = Real Volume = 105

$$F_{cn} = \frac{F_c \quad x \quad V}{V_r}$$

Change of units of measurement

In some cases we need to change the measurement units for batching, for example, instead of working in litres we need to work in kilograms. In this case we will need to know the density of the liquid (ñ).

To change from litres to kilos we must divide body calibration factor Fc by the density of the liquid to obtain the new factor for programming the instrument. For example, if the liquid has a density of 0.9 and the body calibration factor Fc = 0.985, and we must batch in kilos; we will have to introduce Fc = 1.09444 in the basic configuration to be able to preset directly in kilos.

Fcd = Calibration Factor (new density)
Fc = Calibration Factor (original)
ñ = Density of the liquid in Kg/litre

$$F_{cd} = \frac{F_c}{\rho}$$

9. TECHNICAL CHARACTERISTICS

9.1. Power supply

Supply Voltage:

Standard	: 220 VAC 50/60Hz
On Order	: 240 VAC, 110 VAC, 24 VAC 50/60 Hz

Power Consumption:

Less than 10 VA

NOTE: In the cases that the mains frequency is to be 60 Hz, this should be specified in the clients order since this implies a small change in the program of one of the microcomputers in order to minimize the effects of electrical noise from power lines.

9.2. Outputs

- User Programable Pulse Output

Maximum frequency	: 10.000 Hz
Minimum frequency	: 0.001 Hz
- TTL Output (0 a 5 V)	
Minimum Impedance	: 10 KÙ
- Open Collector Output	
Maximum current	: 100 mA
Maximum voltage	: 40 V

- Analog Output 4-20 mA

Current output options	: 0 - 20 mA
(Programable)	: 4 - 20 mA
	: 0 - 24 mA
Voltage output options	: 0 - 10 V
(Internal Jumpers)	: 0 - 5 V

- RS232C Series communication
- Alarm 1 Relay (flow rate alarm or pipe empty)
- Alarm 2 Relay (flow rate alarm or inverted flow)
- **Batching Relay**

Relay contact characteristics:

Maximum voltage	:	250 VAC , 200 VDC
Maximum current	:	2 A
Maximum power	:	500 VA

9.3. Display and pilot lights

- Display - LCD - 2 lines of 16 characters
- Empty Pipe LED
- Inverted Flow LED
- Power LED
- Flow rate below Min. LED
- Relay 1 activated LED
- Relay 2 activated LED

9.4. Inputs

- Remote Reset P

To be used with a potential free electrical contact

- User keyboard

By means of a magnetic pencil.

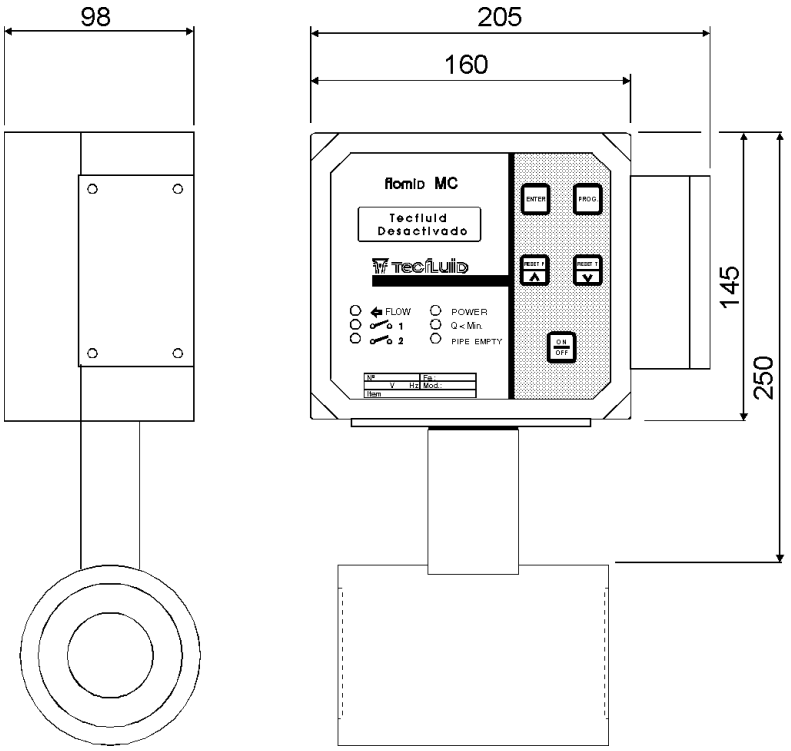
- LCD Contrast control

Only accessible from the inside of the instrument.

9.5. General Characteristics

Environment Protection	:	IP65
Working temperature range	:	0 - 60°C

9.6. Dimensions



9.7. Auxiliary equipment available

For remote communication with the FLOMID-MC the TPC-1 hand held terminal is available. This terminal allows us to perform all the functions of the FLOMID-MC and visualise all the data shown on the LCD display. The TPC-1 is powered by rechargeable NiCd batteries, which are charged when the case rests in its base. The base should be connected to the mains for the battery charger. To connect the TPC-1 to the FLOMID-MC all we need is a standard RS232C cable with a 9 pin Sub D connector as is used for PC computers.

A program for PC users is also available. This program allows us to perform all the configuration and control functions of the Flomid-MC.

WARRANTY

Tecfluid S.A. GUARANTEES ALL ITS PRODUCTS FOR A PERIOD OF 12 MONTHS, maximum 18 months after consignment, against all defects in materials and workmanship.

This warranty does not cover failures which can be imputed to misuse, use in an application different to that specified in the order, the result of service or modification by un-authorized persons, bad handling or accident.

This warranty is limited to cover the repair or replacement defective parts which have not been damaged by misuse.

This warranty is limited to the repair of the equipment and all further and eventually following damages are not covered by this warranty.

In the event of consignment of equipment to our factory, this should be done with the equipment well packed and prepaid transport. Tecfluid S.A. will not accept any responsibility for damage done during transport. Together with the equipment, a note should be enclosed indicating the failure observed, the name, address and telephone number of the sender.

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