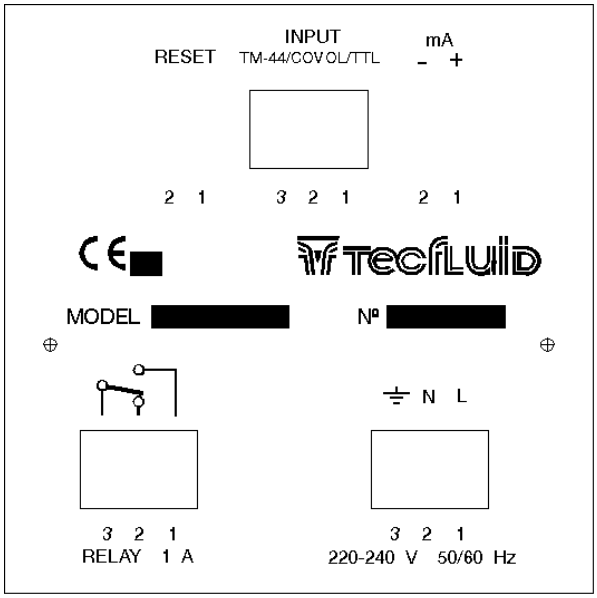
INSTRUCTION MANUAL FOR THE MC-01 CONTROL UNIT

TABLE OF CONTENTS

1 INSTALLATION

1.1 Mounting

The MC-01 control instrument is housed in a DIN 96 x 96 type plastic case intended to be mounted in a front panel of an electrical control panel via a 90 x 90 mm +0.5mm/-0mm square hole. The electrical control panel should have a minimum depth of 190 mm behind the front panel to take the MC-01.



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.

1.2 Mains Connection

The connection of the equipment is via plug-in connectors, polarized to avoid mistakes when plugged in. The connectors have screw terminals, as per VDE norms, to accept 1,5 mm^2 cable.

When we refer to the positions of the connectors, it is looking at the back of the MC-01.

The connector for the mains power supply is situated on the bottom right-hand side, in which the power supply (voltage indicated below the connector) must be connected to terminals Nº1 and Nº2. Terminal Nº3 should be connected to a good earth. The MC-01 has a Φ 5 x 20 mm mains fuse inside. The nominal rating of this fuse depends on the mains voltage.

1.3 Relay Connection

The connector for the Relay is marked "**RELAY 1A**" (situated on the bottom left-hand side). The common contact of the relay is terminal Nº3. The normally open contact (with the relay disactivated) is terminal Nº1 and the normally closed contact is terminal Nº2. There are no provisions for protection of the relay contacts inside the MC-01, neither fuse nor over-voltage protection (such as may be needed with inductive loads), and these must be provided externally as required.

1.4 Pulse Input Connection

The connection to the input from the pulse generator (flowmeter or volumetric counter) must be made using shielded cable with two live wires and the external shield. The external shield must be connected to the chassis of the pulse generator and to terminal Nº1 on the input connector of the MC-01 which is marked "**INPUT" "TM44"**, **"COVOL"** or **"TTL"** depending on the type of input pulse.

The input cables must not be installed close to power lines as these will induce interferences in the input lines causing errors in the readings.

A. COVOL

MC-01 Terminal Nº	to	COVOL connector terminal Nº
1 Shield		1 Shield
2 Live		2 Live
3 No connection		

B. TM-44

MC-01 Terminal Nº	to	TM44 connector terminal Nº
1 Shield		1 Shield
2 Live		2 Live
3 Live		3 Live

C. TTL

MC-01 Terminal Nº
1 Common
2 Live
3 No connection

1.5 4 - 20 mA Output Connection (optional)

The connections to the 4-20 mA output are made to the connector marked " **mA**" (situated on the top right-hand side). Terminal Nº1 is the positive of the output and terminal Nº2 is the negative.

The maximum passive load that can be applied to this output is 350 ohms. The use of higher resistive loads can cause saturation of the output and then you will not get the full 20 mA output.

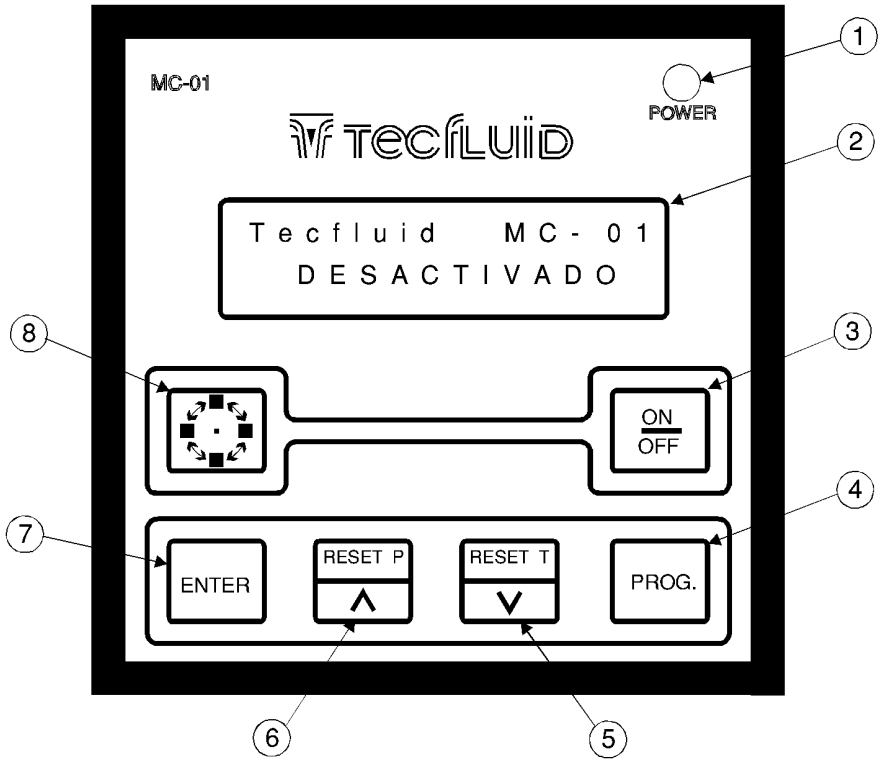
1.6 Remote Reset Connection (optional)

The input for the remote Reset is intended for a normally open electrical contact connected between terminals Nº1 and Nº2 of the connector situated at the left of the connector marked "**INPUT"**.

The connection to the input from the remote Reset must be made using shielded cable with two live wires and the external shield. The external shield must be connected to the chassis of the remote Reset and to terminal Nº1 on the input connector of the MC-01 which is marked "**INPUT"**. The two live wires are connected to the terminals of the remote Reset connector.

The input cables must not be installed close to power lines as these will induce interferences in the input lines causing errors in the equipment.

2 SETTING UP AND PROGRAMMING



2.1 Description of the front panel

1. Red LED power supply pilot light .
2. LCD Display (2 lines with 16 characters per line)
3. "ON/OFF" Push-button
4. "PROG." Push-button
5. "RESET T" or "Decrement Data" Push-button
6. "RESET P" or "Increment Data" Push-button
7. "ENTER" Push-button
8. "Rotation" Push-button

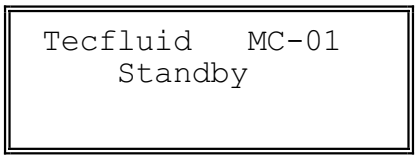
The MC-01 has six Push-buttons to control the different working modes as explained in these instructions. The Liquid Crystal Display (LCD) is used to visualize the working data and messages of the equipment. The LED pilot light is only for indicating the presence of mains supply voltage; in the event that the mains fuse blows, the pilot light will be off.

2.2 Starting up

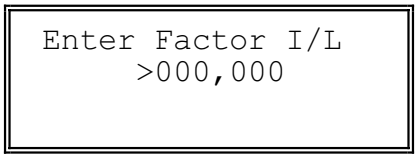
When the mains supply is connected and the MC-01 has been previously programmed the selected normal working screen will automatically appear. To program the MC-01 we must start from the "Standby" screen. If the normal working screen is displayed, by pressing the **"ON/OFF" [3]** push-button we will go back to the "Standby" screen for programming.

2.3 Basic Configuration of the equipment

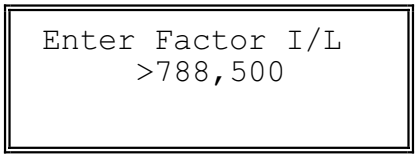
The "Standby" screen must be displayed in order to be able to enter in the programming screens.



From this screen we can enter the basic configuration sequence by pressing the **"PROG." [4]** push-button. Pressing this push-button, the first screen for programming the pulses per litre (Factor I/L) appears.

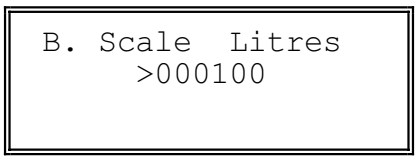


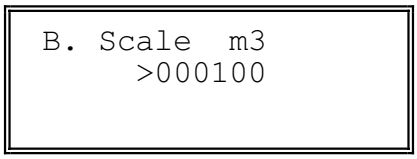
When the programming screen appears the cursor is below the first digit to modify. The "**RESET P**" "∧" **[6]** push-button is used to increase the value of the number and the "**RESET T**" "∨" **[5]** is used to reduce its value. Once the desired value of the digit in question is achieved using the previously mentioned push-buttons, by pressing the "**ENTER" [7]** push-button the cursor will pass to the next digit to be modified. If a value of less than 1 is introduced, the flow-rate will be displayed in cubic meters per hour instead of litres per hour. The preset value will always be in litres (see part 3.1). When the **"PROG." [4]** push-button is pressed the value displayed on the screen will automatically be saved in memory and the next programming screen will appear.



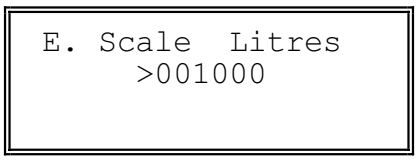
2.4 Programming the 4 - 20 mA Output

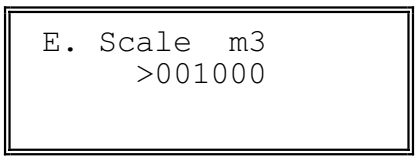
In the event that the MC-01 has a 4-20 mA output the following screens will appear to program the beginning and end of the analog output scale. First will appear the screen to program the beginning of the analog scale (flow-rate for 4 mA).





The value of the flow-rate must be entered in litres per hour or in cubic meters per hour depending on the indication of the screen. Once this data has been entered, using the push-buttons in the same way as previously described for entering the I/L Factor, the next screen will appear to enter the flow-rate for the end of the scale for 20 mA output.

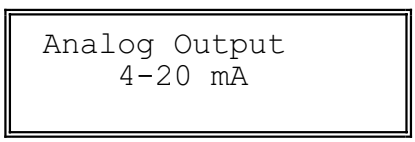


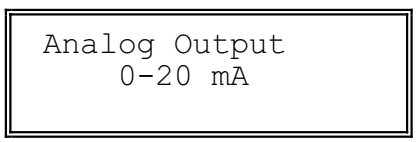


In this screen we must enter the flow-rate for a 20 mA output. Once this data has been entered, using the push-buttons in the same way as previously described for entering the I/L Factor, the next screen will appear to select the normal working screen.

2.5 Selection of the analog output range

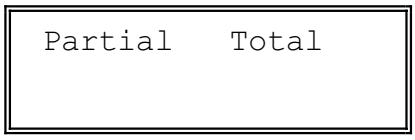
The analog output range is selected using the **"ENTER" [7]** push-button to select one or other options and the **"PROG." [4]** push-button to validate the option selected.





2.6 Selection of the normal working screen

In this part of the programming sequence we select the screen that will appear when the equipment is turned on. There are six possible screens of which we must select one.



Using the **"Rotation" [8]** push-button we can rotate between the six options until the desired screen appears. By pressing the **"ENTER" [7]** push-button the displayed screen will be selected as the normal working screen,the programming sequence will finish and the "Standby" screen will appear.

It can be seen that there are options to select the flow-rate (Q) to be given in litres per hour (l/h) or in cubic meters per hour (m3/h). If the l/h option is selected, the flow-rate will be given in litres per hour unless the flow-rate reaches 20,000 l/h and above which it will be displayed in cubic meters per hour. If the m3/h option is selected, the flow-rate will be given in cubic meters per hour unless the flow-rate drops to 5 m3/h and below which it will be displayed in litres per hour.

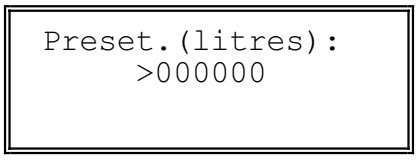
In the event that the "Factor l/L" is less than one, there will be only four options to select the normal working screen; given that the flow-rate will always be in m3/h.

This selection of the normal working screen is only to select the screen that will appear when the power is switched on, or when one changes from the "Standby" screen to the working screen. When in a working screen, it can be changed for another by using the **"Rotation" [8]** push-button, without having to enter the programming sequence.

3 BATCHING

3.1 Entering the preset value

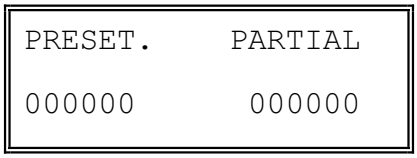
Starting from the "Standby" screen, by pressing the **"Rotation" [8]** push-button we can enter in the screen to program the preset value in litres for batching.



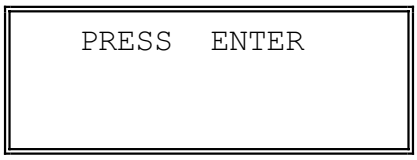
The use of the push-buttons is as explained in part 2.3

3.2 Batching

From the "standby" screen, we press the "**ON/OFF**" **[3]** push-button to enter the normal working screen. The normal working screen will appear, selected as per instructions **2.4**, for example:-



To start the batching process, first we press the "**RESET P**" **[6]** 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**" **[7]** 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 disactivated and the batching process finishes.

If the "**ON/OFF" [7]** push-button is pressed during the batching process, the relay is disactivated and the process is aborted. In this case, instead of showing the normal working screen, the "Standby" screen appears. By pressing the **ON/OFF" [7]** 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" [7]** 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.

4 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"[5]** and **"ENTER" [7]** push-buttons at the same time.

If the totalizing counter has overflown indicating in 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.

5 ERROR MESSAGES

If at some time the input pulses have gone above the maximum input frequency (1900 Hz) an asterisk will appear between the two blocks of numbers on the bottom half of the screen. In the event that the input frequency supersedes the maximum input frequency, it can introduce errors in the results of the calculations of volume.

To clear this error indicator one must press the **"ON/OFF" [3]** push-button twice to pass to the "Standby" screen, and then again back to the normal working screen.

6 USEFUL EXAMPLES OF CALCULATIONS

6.1 Measurement error corrections

The calibration of the mechanical flowmeters is accomplished using, for the liquid, water at 20 °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 pulses per litre (Factor I/L) programmed in the MC-01.

Example 1 - Shortage of volume

If we have a flowmeter which specifies 200 pulses per litre, 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:

Fn = Factor Pulses per litre (new) = ? (210,526)
F = Factor pulses per litre (original) = 200
V = Expected Volume = 100
Vr = Real Volume = 95

$$F_n = \frac{F \quad x \quad V}{V_r}$$

In this case counting 200 pulses per litre for 100 litres (total of 20.000 pulses) we have been given in fact 95 litres, thus we must increase the value of pulses per litre to 210,526.

Example 2 - Excess of volume

If we have a flowmeter which specifies 200 pulses per litre, 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:

Fn = Factor Pulses per litre (new) = ? (190,476)
F = Factor pulses per litre (original) = 200
V = Expected Volume = 100
Vr = Real Volume = 105

$$F_n = \frac{F \quad x \quad V}{V_r}$$

In this case counting 200 pulses per litre for 100 litres (total of 20.000 pulses) we have been given in fact 105 litres, thus we must decrease the value of pulses per litre to 190,476.

6.2 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 (ρ).

To change from litres to kg we must divide the pulse per litre factor by the density of the liquid to obtain the new factor for programming the MC-01. For example, if the liquid has a density of 0.9 and the flowmeter gives us 200 pulses per litre and we must batch in kg; we will program the MC-01 using 222.222 as the new "Factor l/L" to be able to preset directly in kg.

Fnd = Factor pulses per litre for the new density
F = Original factor for pulses per litre
ρ = Density of the liquid in kg/litre

$$F_{nd} = \frac{F}{\rho}$$

7 TECHNICAL CHARACTERISTICS

7.1 Power supply

The standard mains voltages for the MC-01 are 240 V, 220 V, 110 V, 24 V AC - 50/60 Hz. The mains voltage must be specified on ordering.

On special order supply voltages of 12 or 24 V DC can be supplied.

The MC-01 consumes less than 3 VA with AC mains supply.

Fuse : 250 mA slow (T)

7.2 Signal Inputs

The MC-01 is designed to accept two types of inputs; on ordering the type must be specified given that there are differences between the two types.

1. The type of input called "COVOL" is designed to work with an electrical contact which closes its circuit between the terminals Nº1 and Nº2 of the input connector. Given that this type of input tends to be very slow, and in order to avoid bounce effects of the contacts, the input frequency is limited to about 200 pulses per second.

2. The type of input called "TM-44" is designed to work with an inductive pick-up with a coil, connected to terminals Nº2 and Nº3 of the input connector. The input frequency is limited to about 1900 pulses per second.

7.3 Auxiliary Inputs

An optional input exists for a remote "**RESET P**" to start batching processes. This input is designed to take a normally open electrical contact between terminals Nº1 and Nº2 of the connector. For this input to be effective it must be closed during about 200 milliseconds in order to start the batching process. In the event of using this input to start batching processes, the relay will be activated on closing the contact, without having the screen displaying "Press ENTER".

7.4 Relay Outputs

The output to control the batching processes is by means of an electro-mechanical relay with the following characteristics:

Maximum Voltage	:	250 V
Maximum Current	:	1 A
Maximum Power	:	30 VA

7.5 4 - 20 mA Output (Optional)

The MC-01 has a version with an analog output for 4-20 mA, 0-20 mA, 2-10 V, 0-10 V, 1-5 V o 0-5 V. The standard output is for 4-20 mA. The other options are available but must be specified with the order. It is possible to change the type of output configuration, but this must be done by an authorized technical service.

The analog outputs are active outputs, this means that the electrical current is supplied by the MC-01. The characteristics of the loads that can be applied to this output are the following:

0-20 mA y 4-20 mA = Maximum load resistance - 350 ohms

0-5 V y 1-5 V = Minimum load resistance - 100 KΩ

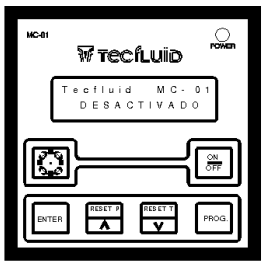
0-10 V y 2-10 V = Minimum load resistance - 200 KΩ

7.6 Working Conditions

Ambient Temperature : 0 to 60 ºC

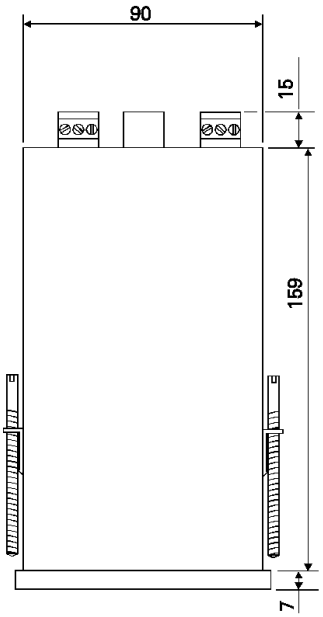
The housing is IP 30 at the rear and IP 50 at the front when mounted in a panel. An IP 65 protection is available for the front of the housing.

7.7 Dimensions



Taladro Panel

91 x 91 mm



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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