

INSTRUCTION MANUAL



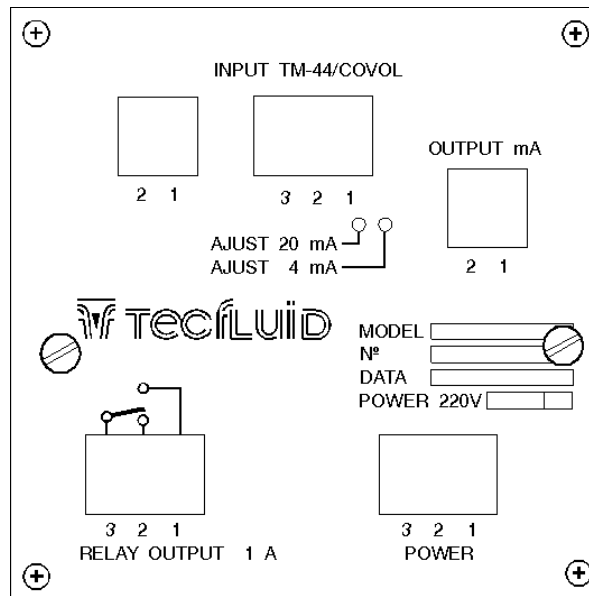
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1. INSTALLATION

1.1 Mounting

The MT-02 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 MT-02.



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 mm² cable.

When we refer to the positions of the connectors, it is looking at the back of the MT-02.

The connector for the mains power supply is marked "POWER" (situated on the bottom right-hand side), in which the power supply (voltage indicated above the connector) must be connected to terminals N°1 and N°2. Terminal N°3 should be connected to a good earth. The MT-02 has a F 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 OUTPUT 1A" (situated on the bottom left-hand side). The common contact of the relay is terminal N°3. The normally open contact (with the relay de-activated) is terminal N°1 and the normally closed contact is terminal N°2. There are no provisions for protection of the relay contacts inside the MT-02, 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 (flow meter) 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 N°1 on the input connector of the MT-02 which is marked "INPUT" "TM-44" or "COVOL" depending on the type of input pulse.

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

A. COVOL

MT-02 Terminal N°	to	COVOL connector terminal N°
1 Shield		1 Shield
2 Live		2 Live
3 No connection		

B. TM-44

MT-02 Terminal N°	to	TM-44 connector I N°
1 Shield		1 Shield
2 Live		2 Live
3 Live		3 Live

C. TTL

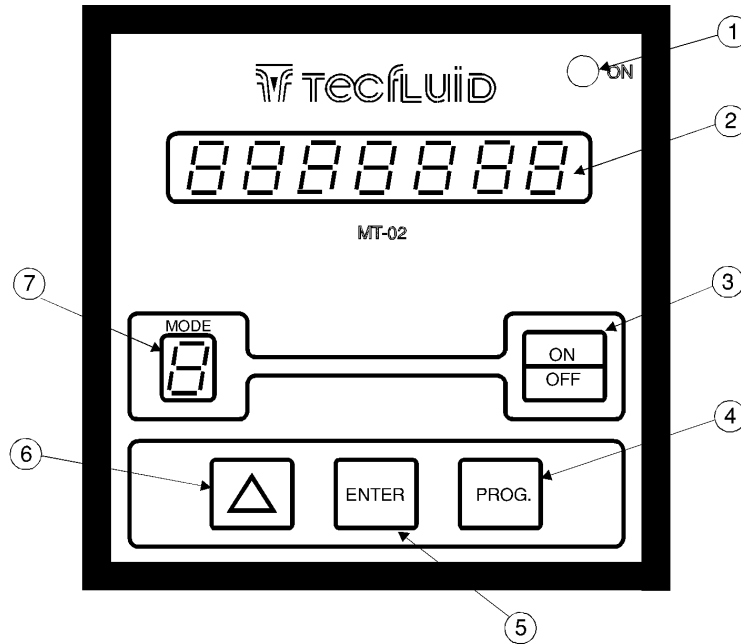
MT-02 Terminal N°	to	Signal generator
1 Shield		1 Common
2 Live		2 Live (+)
3 No connection		

The selection of the different types of inputs is made by changing the position of jumpers in the interior of the equipment. The MT-02 is supplied according to the clients specifications. The type of input can be changed, but this should be done by an authorised technical service.

1.5 Remote ON/OFF Connection

The input for the remote ON/OFF is intended for a normally open electrical contact connected between terminals N°1 and N°2 of the connector situated at the left of the connector marked "INPUT" "TM-44". 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 earth at both ends. 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 may induce interference 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. 7 Digit LED Display
3. "ON/OFF" Push-button
4. "PROG." Push-button
5. "ENTER" Push-button
6. Increment Data "Δ" Push-button
7. Working MODE Indicator

0	=	Standby
1	=	Batching
2	=	Total Volume Indication
L	=	Litres/pulse programming
P	=	Preset programming

The MT-02 has four Push-buttons to control the different working modes as explained in these instructions. The 7 segment Light Emitting Diode (LED) Display is used to visualise the working data. The "MODE" Indicator [7] is used to indicate in which of the different working modes the program is situated. 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, at first the equipment makes an auto-check of the display and then checks the memory (RAM) and the state of programming. In the event that the MT-02 has not been programmed or it finds that the internal memory has been altered and it is unable to recover correctly the data, then it will automatically go to the programming modes in order that the correct data can be entered.

All the data is stored in a non-volatile memory which keeps the data even in the absence of the mains supply. When the MT-02 has been previously programmed the MODE "0" will automatically appear except when there has been a failure of the mains voltage during a batching process, and then it will automatically go to MODE "1" and the display will blink.

2.3 Basic Configuration of the equipment

To program the MT-02 we must start from MODE "0", from this mode we can enter the different programming modes.

There are two basic pieces of data which must be introduced for the equipment to be able to work. At first we must enter the litres per pulse, for which we press the "ENTER" [5] push-button and the MODE Indicator will change to "L", indicating that we are in the litres per pulse programming mode. There are two integer numbers and five decimal points which means that we have a limit of 99.99999 litres per pulse with a resolution of 0.01 ml per pulse. If the flow meter is specified in "pulses per litre", we must calculate the reciprocal of the value in order to change to litres per pulse, for example, if we have a flow meter which gives 450 pulses per litre, the pulses per litre will be 0.00222 and this number must be entered in this program mode.

$$\frac{l}{i} = \frac{l}{i} = \frac{l}{450} = 0,00222$$

When the litres per pulse programming mode is entered the least significant digit blinks to indicate that one can change the value of this digit. To change the value of a digit we use the "Δ" [6] push-button. Every time we press this push-button the value of the digit is increased until it reaches nine, and then goes back to zero. By pressing the "ENTER" [5] push-button we go to the next digit to modify. If the "PROG." [4] is pressed then the value on the display will be saved in the memory and the instrument will go back to MODE "0". If we press the "ON/OFF" [3] push-button while in a programming mode then the instrument will go back to MODE "0" but the data on the display will not be saved in memory and it will keep its previously programmed value. The MT-02 will not accept "0000000" as a valid value and will not come out of a programming mode unless it has a valid value.

3. BATCHING

3.1 Entering the preset value

Starting from the "0" MODE, by pressing the "PROG." [4] push-button we can enter in the mode to program the preset value in litres for batching, and the MODE Indicator will change to "P" to indicate the Preset programming mode. The use of the push-buttons is identical as for programming the litres per pulse. In this mode we must introduce the litres required for the batch.

3.2 Batching

From mode "0" press the "ON/OFF" [3] push-button to enter the batching mode. When the ON/OFF" [3] push-button is pressed the partial counter will be cleared, the mode indicator will go to "1" and the relay will be activated to start the batch. While in the batching mode, if the ON/OFF" [3] push-button is pressed, the relay will be de-activated and the display will start to blink, indicating that the process has been stopped before finishing. From this situation we can do one of two things:

1. Press again the **ON/OFF" [3]** push-button and the process will continue from where it was stopped.
2. Press the **"Δ" [6]** push-button and the instrument will go to MODE "0", aborting the process.

In the event that there has been a mains failure during a batching process, when the mains comes back the MT-02 will automatically go to MODE "1" with the display blinking. We can use one of the previous two options to continue the batch or abort.

The counters are always working in modes "0" and "1", and therefore if the elements which cut-off the flow are slow-acting, one can find that the partial counter may indicate a little more volume than was programmed for the batch.

4 TOTALIZING COUNTER

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

To visualise the value of the totalizing counter, whilst in MODE "0", we must press the "D" [6] push-button and the MODE indicator will go to "2", indicating that the value displayed is the total volume.

To get back to mode "0" without clearing the totalizing counter we must press the "D" [6] push-button.

To clear the totalizing counter, whilst in MODE "2" we must press "PROG" [4] and "ENTER" [5] at the same time, and the instrument will automatically go back to mode "0".

5 USEFUL EXAMPLES OF CALCULATIONS

5.1 Measurement error corrections

The calibration of the mechanical flow meters is realised 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 flow meter is used with a liquid of other characteristics from the above specified for reasons of turbulence in the flow, measurement errors can be induced. To correct these types of errors we can modify the litres per pulse programmed in the MT-02.

Example 1 - Shortage of volume

If we have a flow meter 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:

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

$$F_n = \frac{F \times V}{V_r}$$

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.

We must then calculate the reciprocal of this new value to introduce in the "L" mode.

Example 2 - Excess of volume

If we have a flow meter 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:

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

$$F_n = \frac{F \times V}{V_r}$$

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. We must then calculate the reciprocal of this new value to introduce in the "L" mode.

5.2. 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 kilos we must multiply the litres per pulse factor by the density of the liquid to obtain the new factor for programming the MT-02. For example, if the liquid has a density of 0.9 and the flow meter gives us 200 pulses per litre (0.005 litres/pulse) and we must batch in kilos; we will program the MT-02 using 0.00450 as the new litres/pulse factor to be able to preset directly in kilos.

L = Original Factor litres per pulse
 L_n = New Factor litres per pulse
 ρ = Density of the liquid in Kg/litre

$$L_n = L \times \rho$$

6 TECHNICAL CHARACTERISTICS

6.1 Power supply

The standard mains voltages for the MT-02 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 MT-02 consumes less than 1 VA with AC mains supply.

6.2 Signal Inputs

The MT-02 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 N°1 and N°2 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 pickup with a coil, connected to terminals N°2 and N°3 of the input connector. The input frequency is limited to about 1900 pulses per second.

3. The TTL input is designed for a TTL level input (0 to 5 V). This input has a 30% hysteresis, that means that the output will go to a high level when the input goes above about 3.4 V and will go to a low level when the input voltage drops below about 1,6 V. The input frequency is limited to about 10,000 Hz.

6.3 Auxiliary Inputs

An optional input exists for a remote "ON/OFF" to start batching processes. This input is designed to take a normally open electrical contact between terminals N°1 and N°2 of the connector. For this input to be effective it must be closed during about 200 milliseconds in order to start the batching process. When programming the MT-02 this input must remain open.

6.4 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 :	8 A
Maximum Power :	250 VA