PRESYS®

Flow Calculator

DMY-2030-CV

Technical Manual

EM0491-00

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1.0 - Introduction

1.1 - Description

The DMY-2030-CV Presys Flow Calculator is a microprocessed instrument that monitors flow, temperature, and pressure to calculate compensated flow and its totalization. It has non-volatile internal memory (EEPROM) for storing calibration values. Its high precision is guaranteed by the use of self-calibration techniques based on a reference of high thermal stability voltage.

It can communicate with the computer through the use of an optional RS-232 or RS-422/485 communication module. The instrument has the capacity to monitor three inputs, accepting direct connection of current (mA) or voltage (V). A 24V isolated voltage source, with short-circuit protection, is provided for transmitter power supply.

Totalization is applied only to the compensated flow value, with an eight-digit indication, configured along with the decimal point. The totalization does not decrease for signals smaller than the user-defined zero scale, and its reset can be applied by means of the instrument's front keys.

The type of input chosen by the user is enabled through jumpers and software configuration. All configuration data can be protected by a password system and stored in the non-volatile memory in case of power failure.

It was designed within the concept of modularity, accepting up to 4 output cards. Output types can be: retransmitter, SPDT relay, SPST relay, solid-state relay, and open collector voltage. Outputs are electrically isolated from inputs.

It allows universal power supply from 75 to 264 Vac or 100 to 360 Vdc (with any polarity).

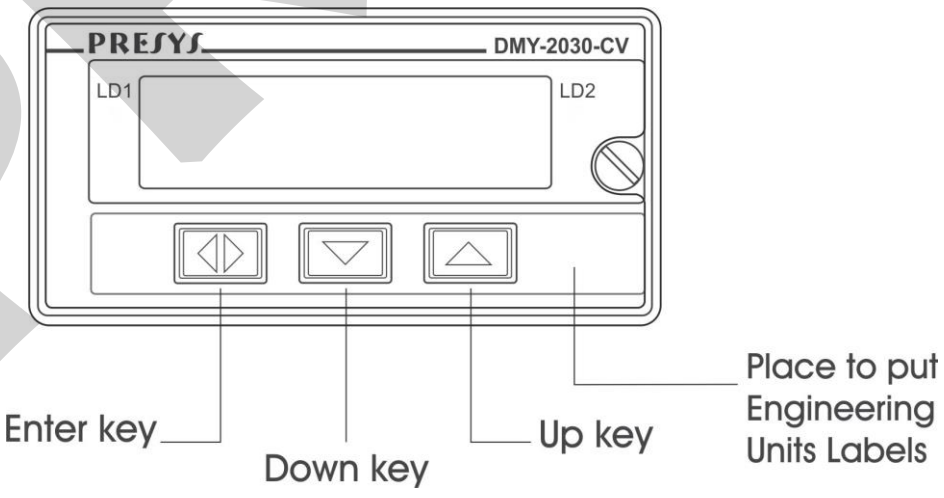


Fig. 1 - Front Panel of the DMY-2030-CV Flow Calculator

The instrument is housed in an extruded aluminum enclosure that makes it highly immune to electrical noise, electromagnetic interference, and resistant to the most severe industrial usage conditions.

On the front panel of the instrument, there is a configurable display with up to 8 digits of high visibility that can show process variables, using up to 4 and 1/2 digits, and flow totalization. During configuration, the display shows mnemonics and parameter values. Alarm outputs can be independently configured to operate with latching, requiring operator acknowledgment via the instrument's front keys to deactivate them after the process variable returns to normal conditions.

It is possible to include a retransmission output module which generates a linear signal of 4 to 20mA, 1 to 5V, or 0 to 10V directly proportional to the compensated flow value. This signal allows for the retransmission of compensated flow to a remote site. In case of using an analog output, up to three alarm outputs can be used.

1.2 - Order Code number

DMY - 2030 - CV - ___ - ___ - ___ - ___ - ___ - ___ - ___

A B C D E F G

Field A	Output 1
0	Not used
1	4 to 20 mA
2	1 to 5 V
3	0 to 10 V
4	SPST Relay
5	Open Collector Voltage
6	Solid State Relay

Field B	Output 2
0	Not used
1	SPST Relay
2	Open Collector Voltage
3	Solid State Relay

Field C	Output 3
0	Not used
1	SPDT Relay
2	Open Collector Voltage
3	Solid State Relay

Field D Output 4

Same coding as Output 3

Field E	Power Supply
1	75 to 264 Vac 50/60Hz or 100 to 360 Vdc (with any polarity)
2	24 Vac or 24 Vdc (±10%)
3	12 Vdc (±10%)
4	Other values, upon request
Field F	Communication
0	Not used
1	RS-232
2	RS-485
3	RS-422
Field G	Case Protection Grade
0	General usage, protected place
1	Front aspersion-proof
2	Weather-proof

Note 1 - The ranges and types of inputs, indication, totalization parameters, the use of relays as alarms, and alarm setpoints are, among other things, items that the user can program through the front keys (if wanted, specify such information so that all the configuration can be made by PRESYS).

Note: Other software or hardware features may be available under previous consult.

Code Example:

1) DMY-2030-CV-0-0-1-1-1-0-0 This code defines a DMY-2030-CV Flow Calculator with two SPDT relays that can be used as high and low alarms, with electrical supply in the range of 75 to 264 Vac or 100 to 360 Vdc, and protected field usage.

1.3 - Technical Specifications

Inputs:

- Three configurable inputs for 4 to 20mA and 1 to 5 Vdc. Input impedance of 250 Ω for mA and 10 MΩ for 5 Vdc. Table 1 provides the resolution for the linear input sensors.

Input Sensor	Range	Resolution
Voltage	0 to 5 V	250μV
Current	0 to 20 mA	1μA

Table 1 - Measurement ranges for input sensors

Outputs:

- Analog retransmission: 4 to 20 mA, 1 to 5 Vdc, 0 to 10 Vdc optional module with 300 Vac galvanic isolation from inputs and power supply.
- Alarms with SPDT or SPDT relays rated for 3A 220 Vac, or up to 10A 220 Vac under order. In the latter case, the alarm module is not inserted through a connector but soldered to the Power Supply Board. Provision for up to 4 alarm modules (with one module installed on the connectors of the analog output). In other words, when using an analog output, only three alarm modules can be used.
- Logic signal, open collector transistor, 24 Vdc, 40 mA maximum with isolation.
- Solid state relay rated for 2A at 250Vac with isolation.

Serial Communication:

RS-232 or RS-422/485, 50 Vdc isolation, optional module connected to the CPU Board.

Indication:

Standard indication with a maximum range of -999 to 19999.

Totalization:

Input totalization with 0 to 99999999 range, configured with decimal point.

Configuration:

By front-panel pushbuttons and internal jumpers.

Sampling rate:

130 ms for input indication in -999 to 19999 range. The display is updated each second for the indications and each scan for the totalizations.

Accuracy:

± 0.1% of full scale for mA and Vdc inputs.

± 0.5% of full scale for the analog retransmitter output, 750 Ω maximum load.

Square Root Extraction:

± 0.5 % of reading, for input above 10 % of span. 0 to 5 % of programmable Cut-off.

Thermal stability:

± 0.005 % / °C of span for 25°C ambient temperature.

Power Supply:

Universal from 75 to 264 Vac or 100 to 360 Vdc (any polarity), 10W nominal; 24 Vdc, 12 Vdc, or other values are optional.

Power Supply for Two-wire Transmitter:

24Vdc voltage and 50mA maximum, isolated from output, short-circuit protection.

Operating ambient:

0 to 50 °C temperature and 90 % maximum relative humidity.

Dimensions:

1/8 DIN (48 X 96 mm) with 162 mm depth, panel cutout of 45 X 92 mm.

Weight:

0.5 kg approx.

Warranty:

One-year warranty.

2 - Installation

2.1 - Mechanical Installation

The DMY-2030-CV Flow Calculator front panel has 1/8 DIN size (48 x 96 mm).
It is fixed by the rails which press it against the back side of the panel.
After preparing a 45 X 92 mm cut in the panel, remove the rails from the instrument and slide its rear through the cut until its front reaches the panel. Place the rails again in the instrument from the back of the panel and tighten the screws as shown in figure 2.

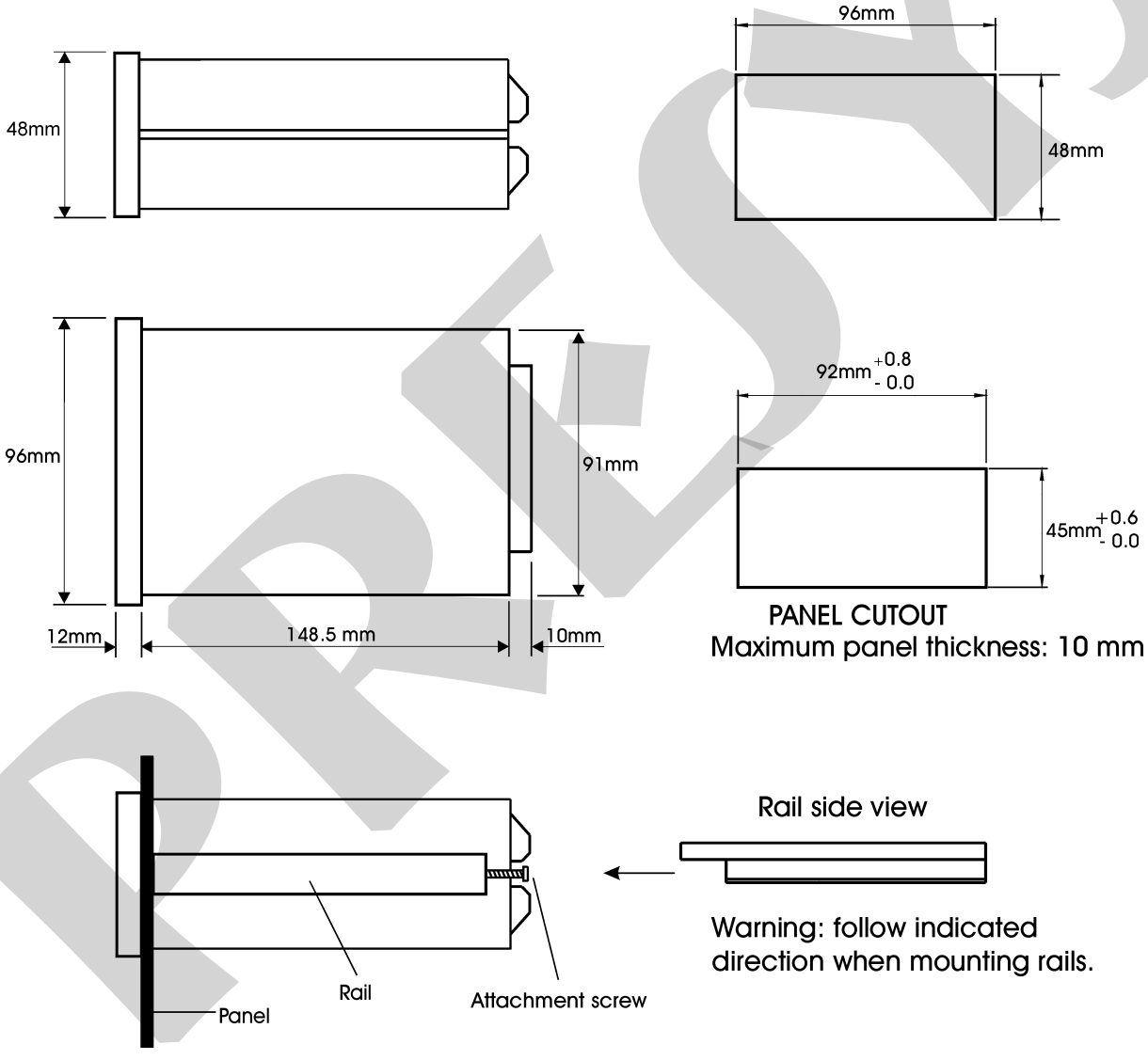


Fig. 2 - Dimensional drawing, panel cutout and side view.

2.2 - Electrical Installation

The Flow Calculator DMY-2030-CV can be powered with any voltage between 75 and 264 Vac or 100 to 360 Vdc, any polarity. Note that the voltage is always applied to the internal circuitry when the instrument is connected to the power supply.

Input and output signals must be connected to the instrument only when it is turned off.

Figure 3 shows the instrument rear terminals for connection of power supply, ground, communication, process input and output signals.

Signal wiring must be kept far away from power wires.

Due to its metal case the instrument ground should be connected to earth ground. Never connect the ground to neutral terminal.

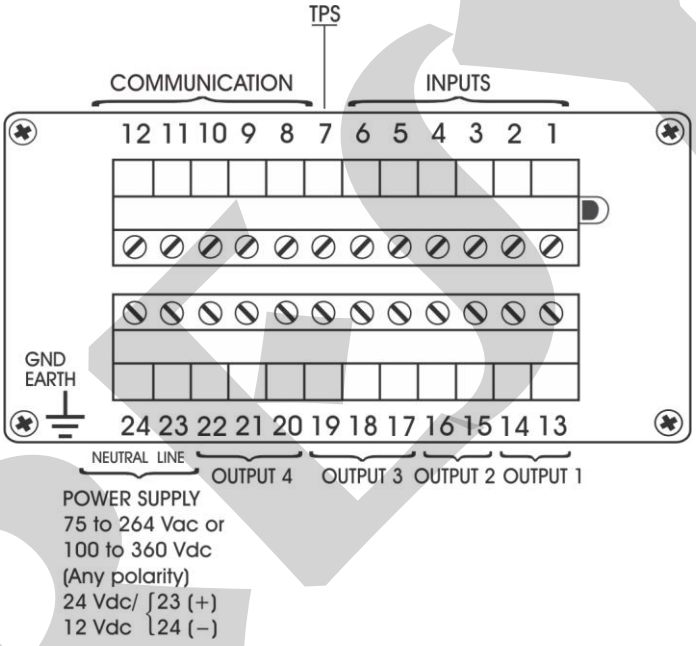


Fig. 3 - Instrument terminals

2.3 - Process Input Signal Connections

The three instrument inputs can be connected to current (mA) or voltage (V) signals. See the different types and ranges of input sensors in table 1, section 1.3 on Technical Specifications.

The input sensor is enabled by internal jumpers (see section 4.2 on Hardware Configuration) and by selection of the sensor in the software (see section 3.2 on Configuration). The connections explained below will have the desired result only if the instrument is correctly configured by software and hardware.

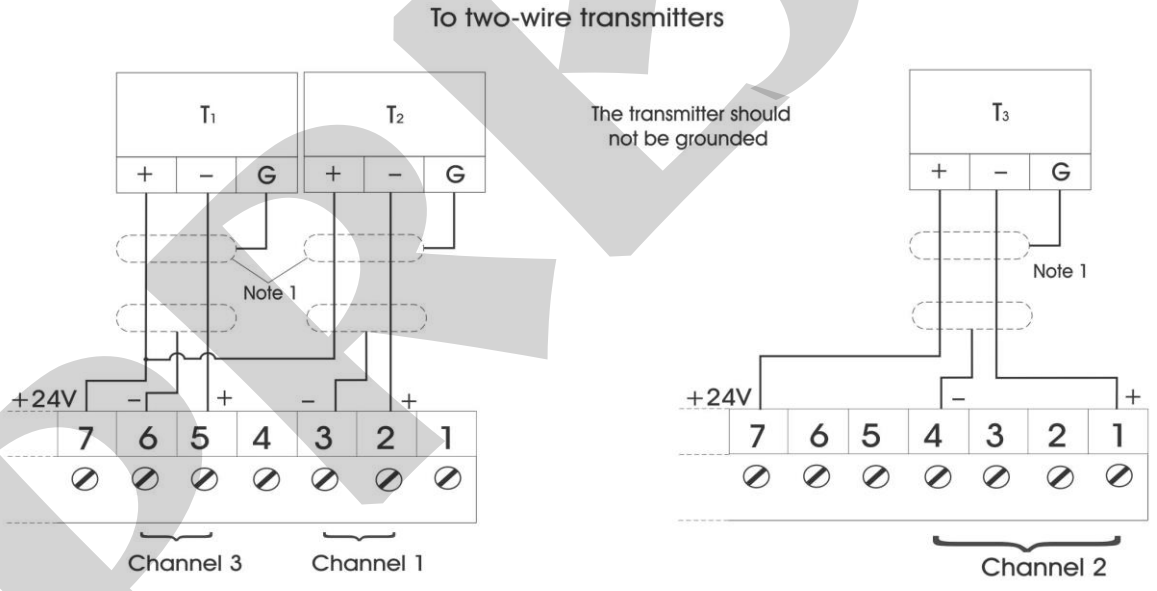
The connection of a type of sensor to one input does not restrict the simultaneous use of another sensor, of the same type or different, for the other inputs.

In order to avoid noise in the wiring, use twisted pair cable and cross sensor connection wire inside a metallic tube or use shielded cable. Make sure to connect only one shield wire end either to board terminal or to sensor ground, as shown in the next items.

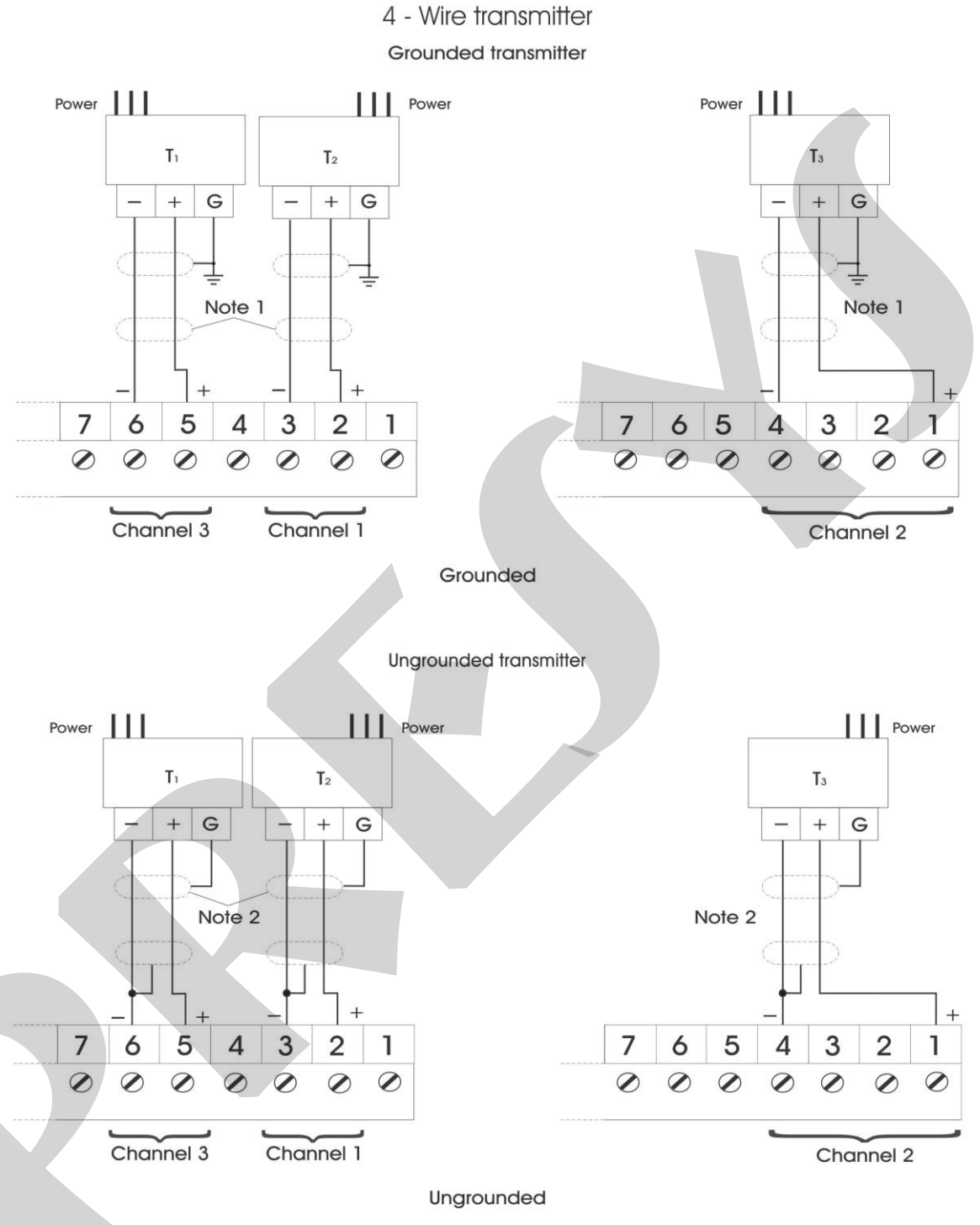
WARNING: GROUNDING TWO SHIELD WIRE ENDS MAY CAUSE NOISE IN THE INSTRUMENT.

2.3.1 - Milliampere Input

A standard current source of 4 to 20 mA can be applied to terminals 2(+) and 3(-) for input 1, terminals 1(+) and 4(-) for input 2, and terminals 5(+) and 6(-) for input 3. This current signal can be generated by a transmitter with an external power supply. In case of using the 24 Vdc internal voltage source from the instrument to power a two-wire transmitter, the current is received only by terminal 2(+) for input 1, terminal 1(+) for input 2, and terminal 5(+) for input 3. Figure 4 shows these possibilities of connection.



Note 1: Connect the shield wire to the transmitter's ground terminal. If there is no ground terminal, leave the shield wire disconnected at this end."



Note 1: Shield to be left unconnected at this end.
Note 2: Connect the shield wire to the transmitter ground. If there is no ground terminal, let the shield wire disconnected at this end.

Fig. 4 - Current source connection

2.3.2 - Voltage Input

0 to 5Vdc signal must be applied to terminals 2(+) and 3(-) for input 1, terminals 1(+) and 4(-) for input 2, and terminals 5(+) and 6(-) for input 3. These connections are shown in Figure 5.

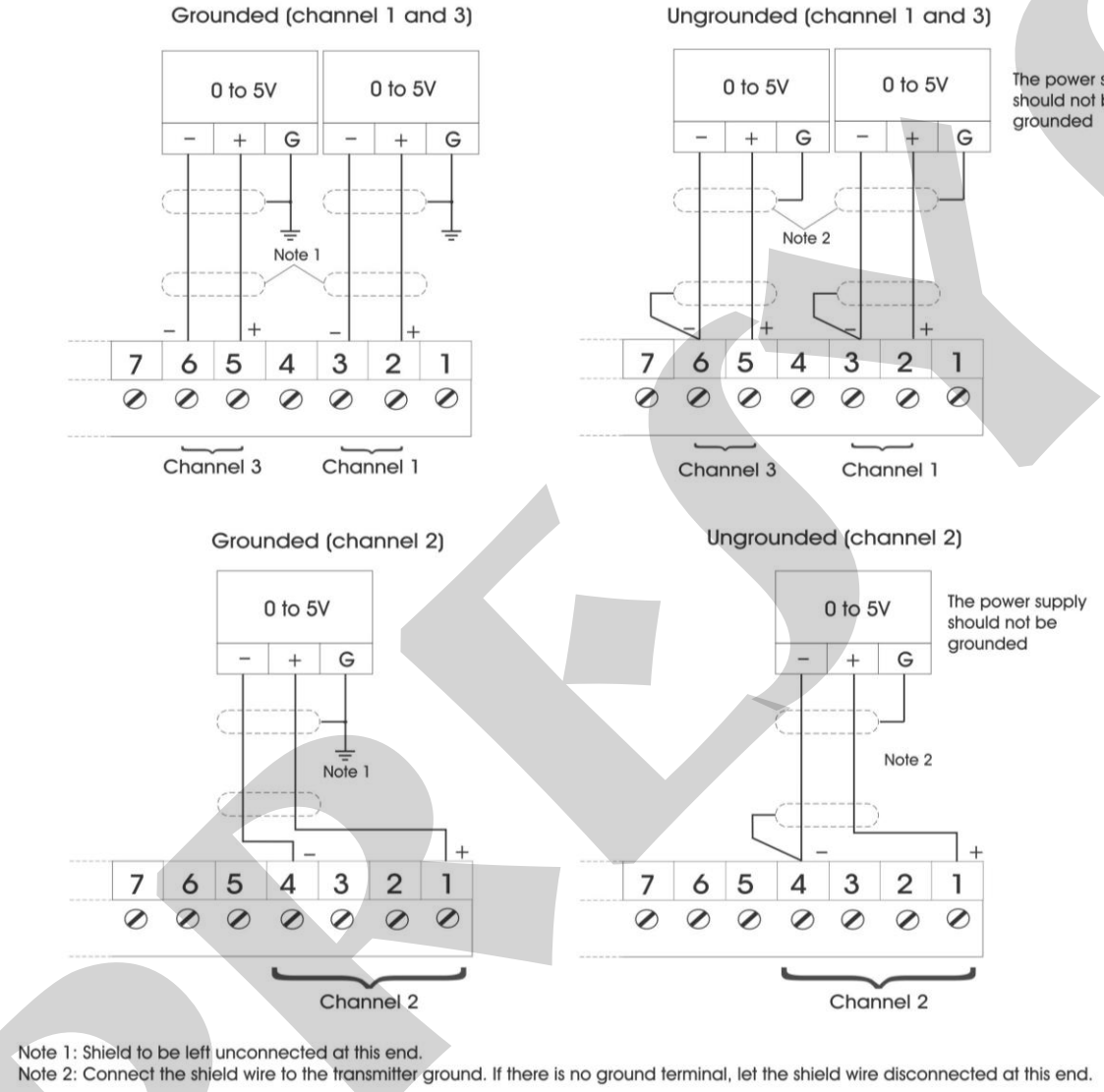


Fig. 5 - Voltage source connection

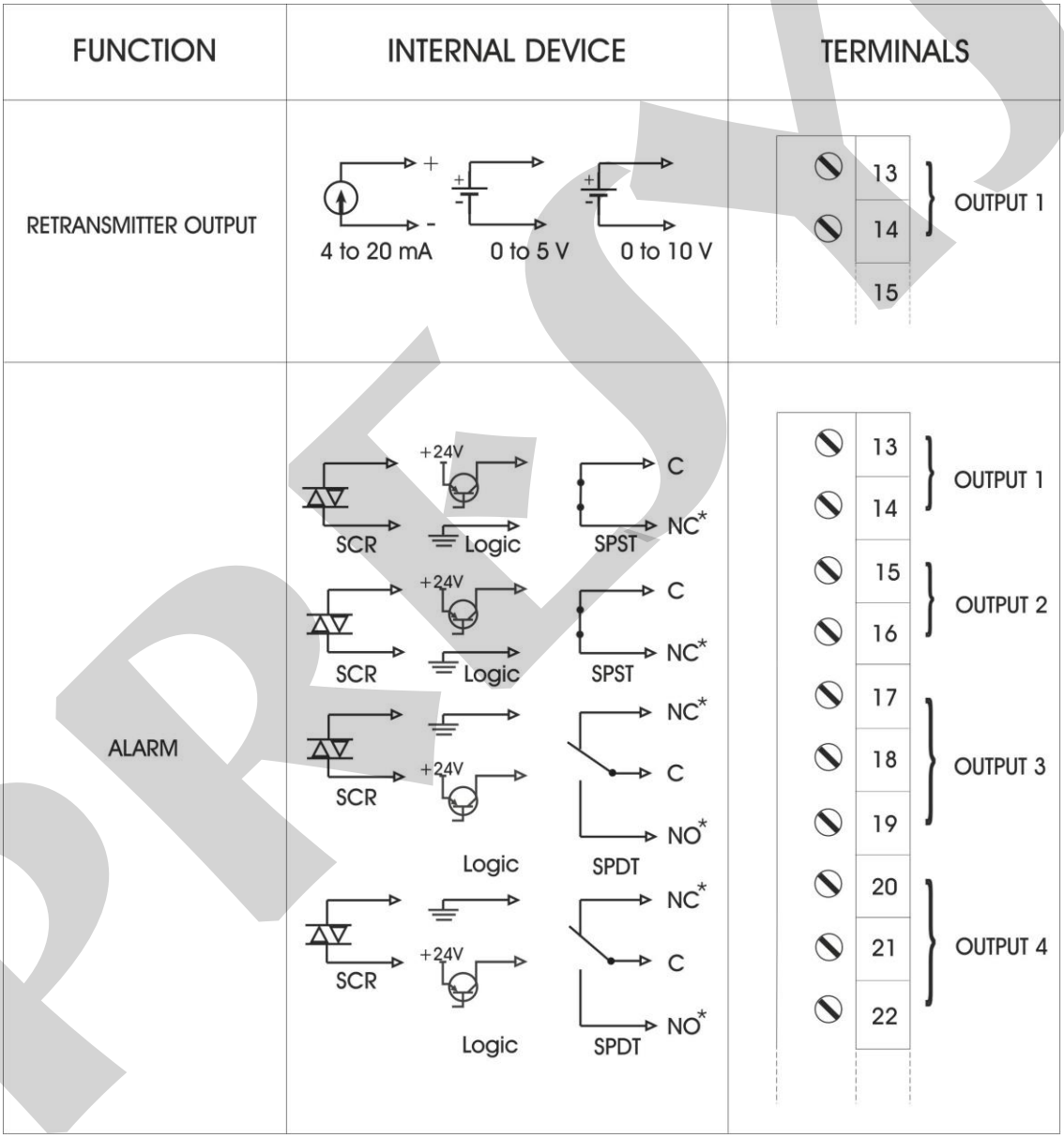
2.4 - Output Signal Connections

The instrument can have up to four output signals: output 1, output 2, output 3, and output 4. Output 1 is used as retransmission or alarm output. Outputs 2, 3, and 4 are used only as alarm outputs.

For output 1, there are six different types of outputs available: retransmitter (4 to 20 mA, 0 to 5Vdc, or 0 to 10Vdc), SPST relay, open collector voltage, and solid-state relay.

For output 2, there are three different types of outputs: SPST relay, open collector voltage, and solid-state relay. And for outputs 3 and 4, there are also three different types of outputs: SPDT relay, open collector voltage, and solid-state relay. Figure 6 shows the intrument output types.

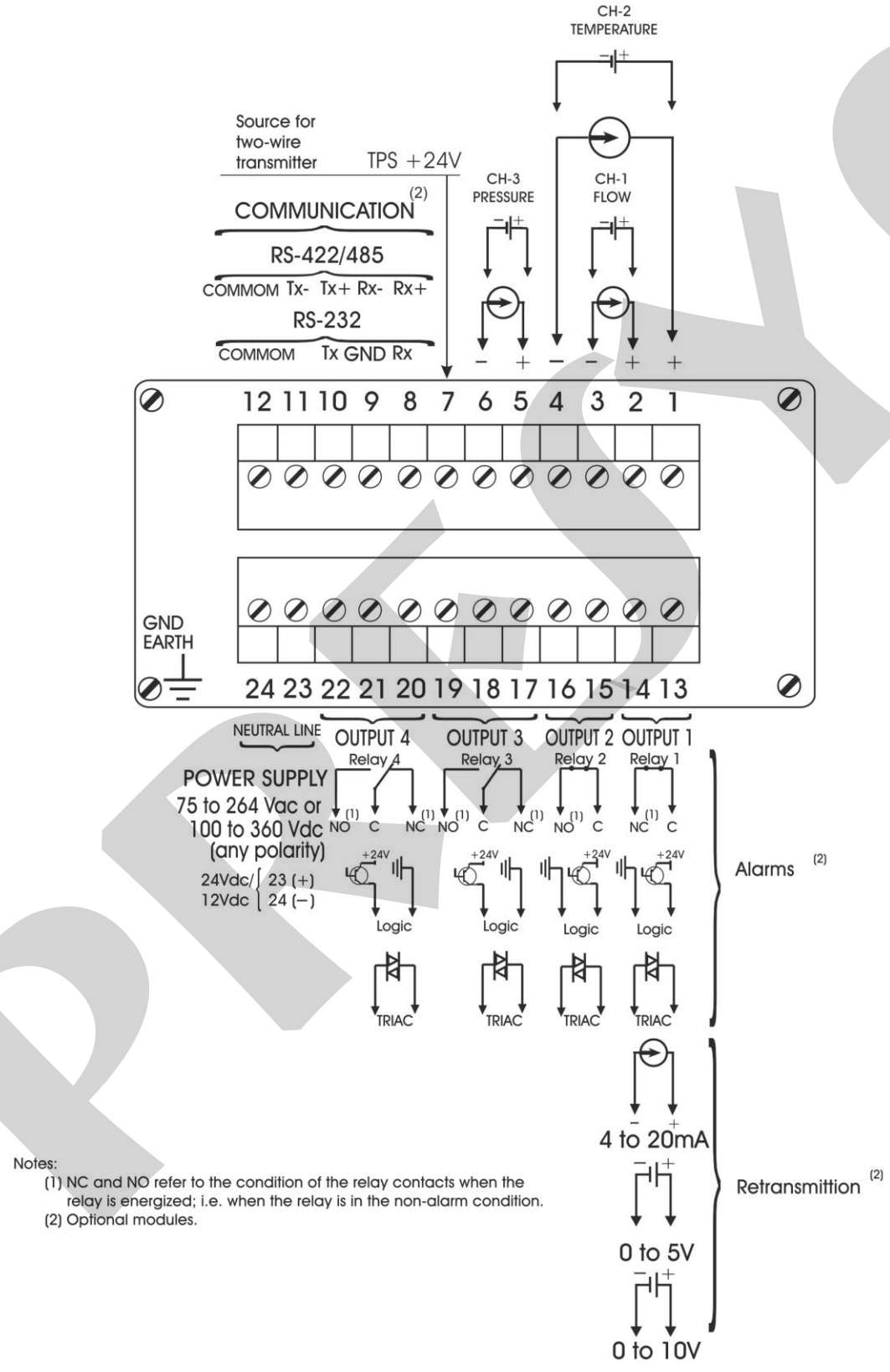
Note that the output terminals will present the corresponding output signals only if the optional modules are installed and the output is correctly configured. For analog outputs, refer to section 3.2 on Configuration and section 4.4 on Optional Module Connection for details on installation and configuration of optional modules.



(*) Relay contact states shown are valid for SAFE option selected (see section 3.2 on Configuration), instrument powered on and non-alarm condition. Positions of the contacts are changed in alarm condition (with SAFE option selected) or when the instrument is turned off.

Fig. 6 - Output Connection

2.5 - Connection Diagram



Notes:
(1) NC and NO refer to the condition of the relay contacts when the relay is energized; i.e. when the relay is in the non-alarm condition.
(2) Optional modules.

2.6 - Communication

The DMY-2030-CV Flow Calculator communicates with computers through RS-232 or RS-422/485 and with use of a MODBUS protocol communication software, when the optional communication module is installed and the communication parameters are configured.

Specific information on communication and signal connection is described in the communication manual.

2.7 - Engineering Unit

A label with several Engineering Units is supplied with each instrument. Select the one corresponding to the variable shown on the display and stick it to the front panel of the instrument.

3 - Operation

3.1 - Normal Operation

The DMY-2030-CV Flow Calculator has two operating modes: normal operation and configuration mode.

In normal operation mode, the instrument monitors the process variable values from inputs 1 to 3 (UN.FLOW, TEMP, and PRESSURE), the compensated flow value (FLOW), and the totalization of compensated flow (TOTAL); it checks alarm conditions and activates its four outputs, when necessary.

Configuration mode is used to select and configure all the instrument parameters.

The normal operation mode, in which the instrument is to be found most of the time, is called level zero. In this level, the three front panel keys have the following functions:

ENTER	Key	changes level zero to level 1 or asks for the password, when configured.
UP	Key	changes the indication shown in the display.
DOWN	Key	When showing the flow, temperature, pressure, or compensated flow indications, it presents the alarm outputs which require acknowledgment to return to normal state (*). When showing the totalization, it allows access to a menu with options for configuring preset mode (automatic or manual) and preset setpoint, alarm setpoints for the indication alarms already configured, besides applying reset to totalization and to the accumulated totalization (**).

(*) In order to view the monitored variable, continue to press the UP key. In case there are no activated relays, the **No.Ac.** message will be shown.

(**) The presentation of each of these options (RESET, SP, MODE, TOT.AC. and ALARM mnemonics) in the operating level is configured by the user in the OPER option in the GENERAL configuration level. See figure 7 where all the options are selected.

The green LED (LED1) turns on when the display shows the compensated flow (FLOW), and the red LED (LED2) turns on when the display shows the totalization of the compensated flow (TOTAL).

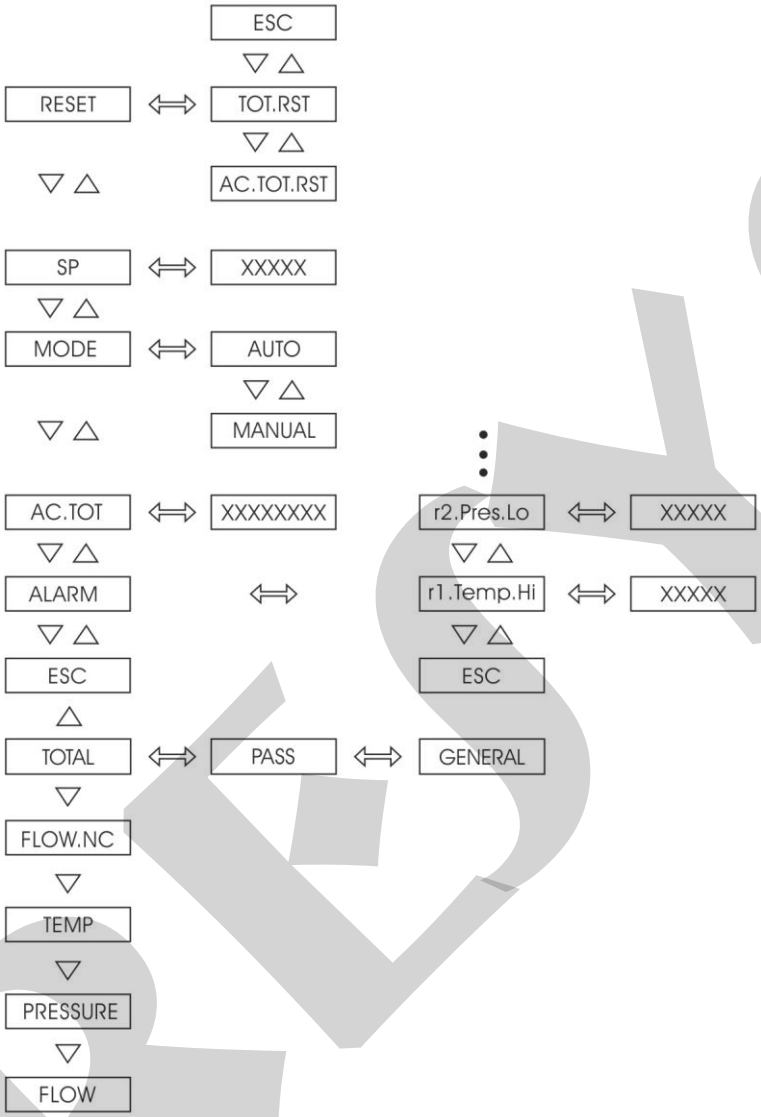


Fig. 7 - Options of the operation level with configurable presentation

3.2 - Configuration

In order to access configuration mode the operator is required to provide a password which avoids a non-authorized person to change any critical parameters of the process.

So, when ENTER is pressed within the normal operation mode, one of the following events can happen, depending on the current configuration:

i) To access directly level 1 (GENERAL) of configuration mode, which indicates the instrument was not configured with a password system.

ii) To display the PASS warning, indicating that the instrument is provided with a password system (a key sequence or a value), according to figure 8.

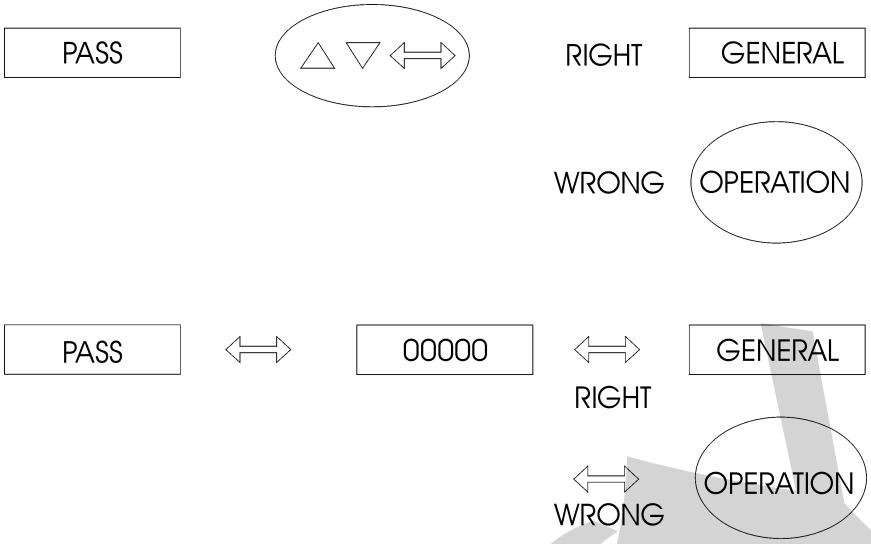


Fig. 8 - Password through key sequence or value

In case of a key sequence password, the user should press the UP, DOWN and ENTER keys (exactly in this order) to access the configuration levels.

For a value password, the user must press the ENTER key for a second time in order to view the number 00000 with the right end digit blinking. The position which is blinking indicates the digit in the number to be changed by the user with the UP and DOWN keys. Move to the digits on the left by pressing ENTER. After entering all digits, press ENTER again. If the password is correct level 1 is accessed; otherwise, it returns to normal operation (see figure 8).

The user can choose also both password systems, key and value. In this case, if the user provides an incorrect sequence of keys, the display goes immediately to the value password system.

The password number may be chosen by the user (personal) or it could be used the number 2030. Note that the number 2030 is always accepted by the value password system, which helps the user in case he forgets his password. In order to enter a number for password or for any other parameter use the instrument front panel keys with the following functions:

UP	key	Increases values being set
DOWN	key	Decreases values being set
ENTER	key	Changes position to the left digit

The procedure above is valid for providing any other parameter with 5 digits. The only exception is COUNT parameter, in Totalization level, for which it is possible to change all the 8 digits of the display.

All configuration parameters are stored in the non-volatile memory and determine the normal operation of the instrument. With these parameters the user can adjust the instrument to his needs, when it is necessary to change the configuration from factory.

Configuration parameters are distributed in seven hierarchical levels shown in figure 9.

In order to move through the levels and access the parameters of any one of them, use the front panel key which have the following functions:

ENTER	key	Moves into the indicated level
UP	key	Moves to higher levels
DOWN	key	Moves to lower levels

Warning: In the diagrams below, the rectangles represent the display appearance after selection of the ENTER, UP and DOWN keys.

The hierarchical levels are presented in sequence. The options of each level are explained step by step with all their corresponding parameters.

Inside each level, the front panel keys have the following functions:

UP	key	Moves the options in increasing direction
DOWN	key	Moves the options in decreasing direction
ENTER	key	Confirm or advance options inside a level, if the display does not show ESC. When ESC is shown, it goes back one or more positions.

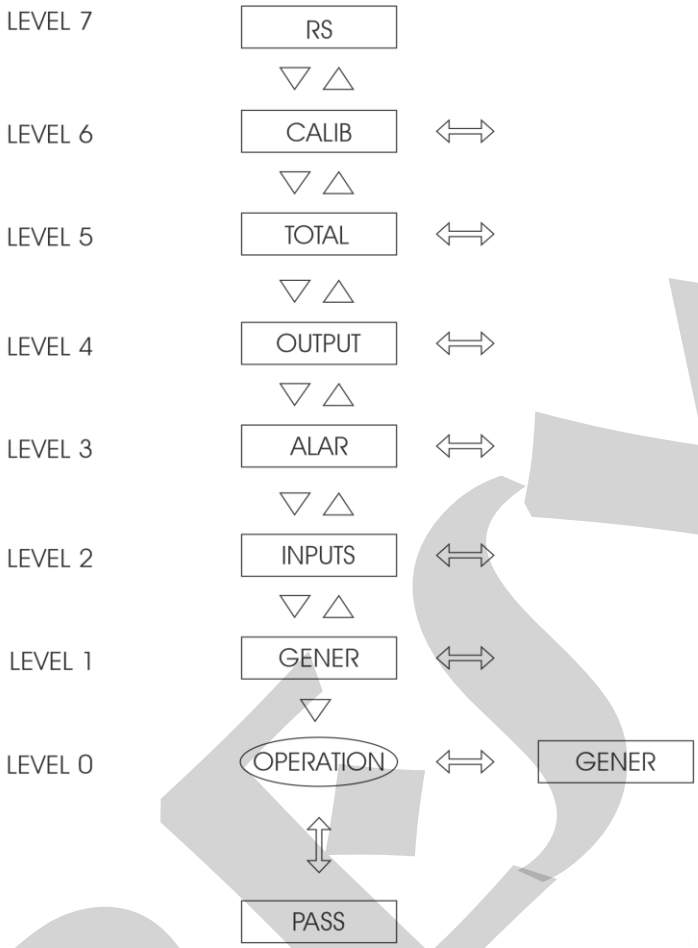


Fig. 9 - Parameter levels diagram

Level 1 - General

GENERAL level presents the options: TAG, SOFT, PASS, INDIC, OPER, COMP, ALPHA, COMP.Z, REF.Z, REF.T, REF.PRES.A, and REF.DENS (see figure 10).

TAG - consists in an numeric identification for the instrument. The procedure to enter the tag or any other parameter is the same as described previously for the password (refer to value password for the functions of the ENTER, UP and DOWN keys).

SOFT - shows software version.

PASS - allows the user to enable or disable the password system for accessing the configuration mode. The password system may be chosen as a key sequence, a value (number chosen by the user and number 2030) or both. The correct key sequence is obtained by pressing the UP, DOWN and ENTER keys in this order.

INDIC - allows configuring the presentation mode of mnemonics at the operating level: either by rotating the mnemonics with a predetermined time for the presentation of each one or statically presenting only those desired.

OPER - enables the presentation of each one of its options in operation level, namely, RESET (reset of the totalization and accumulated totalization), SP (preset setpoint), MODE (reset mode for preset), AC.TOT (indication of accumulated totalization) and ALARM (alarm setpoints).

ALPHA - Multiplicative factor for the compensated flow, configured from 0.000 to 10.000.

COMP.Z - Compressibility factor value of the gas under operating conditions, configured from 0.001 to 9.999.

REF.Z - Compressibility factor value of the gas under reference conditions, configurable from 0.001 to 9.999.

REF.T - Reference temperature.

REF.PRES.A - Reference pressure in absolute value, in the pressure unit configured in the Pressure option of the INPUTS level.

REF.DENS - Density under reference conditions in kg/m3, configured from 0.0001 to 99.9999.

COMP - Compensation method for the calculation of FLOW. It presents four options: SQRT, TEMP, PRESSURE and CUR.VAP.

Configure the option SQRT = NO to obtain the following formula:

$$FLOW = ALPHA \times \frac{REF.Z}{COMP.Z} \times \left[\frac{REF.T + 273.15}{TEMP + 273.15}\right]^{(*)} \times \left[\frac{PRES + PRES.A}{REF.PRES.A}\right]^{(**)} \times UN.FLOW$$

(*) Factor present if TEMP = YES; (**) Factor present if PRESSURE = YES.

Configure the option SQRT = YES to obtain the following formula:

$$FLOW = ALPHA \times \sqrt{\frac{REF.Z}{COMP.Z}} \times \left[\sqrt{\frac{REF.T + 273.15}{TEMP + 273.15}}\right]^{(*)} \times \left[\sqrt{\frac{PRES + ATM.PRES}{REF.PRES.A}}\right]^{(**)} \times UN.FLOW$$

(*) Factor present if TEMP = YES; (**) Factor present if PRESSURE = YES.

The table below refers to the ranges of the parameters shown in figure 10.

Mnemonic	Parameter	Range	Factory Value	Unit
TAG	Instrument identification	0 to 30000	2030	----------
SOFT	Software version	----------	2.23	----------
VALUE	User password	-9999 to 30000	0	----------
T.UN.FLOW	Uncompensated flow exhibition time	0 to 3000	2	seconds
T.TEMP	Temperature exhibition time	0 to 3000	2	seconds
T.PRES	Pressure exhibition time	0 to 3000	2	seconds
T.FLOW	Compensated flow exhibition time	0 to 3000	5	seconds
T.TOTAL	Compensated flow totalization exhibition time	0 to 3000	10	seconds
ALPHA	Multiplication factor	0.000 to 10.000	0	----------
COMP.Z	Gas compressibility (operation) factor	0.001 to 9.999	1.000	----------
REF.Z	Gas compressibility (reference) factor	0.001 to 9.999	1.000	----------
REF.T	Reference temperature	-99.99 to 300.00	0.00	°C or °F
P.REF.A	Reference absolute pressure	0.001 to 99.999	1.000	EU*
REF.DENS	Reference density	0.0001 to 9999.9999	1.0000	kg/m^3

(*) EU - Engineering Unit

Fig. 10 - Options of the General level

For the CUR.VAP option configured as YES, it is calculated the temperature (if the TEMP input is disabled at the INPUTS level) or the pressure (if the PRESSURE input is disabled at the INPUTS level). If both TEMP and PRESSURE inputs are disabled, the temperature is calculated based on the P.NOMINAL mnemonic configured at the INPUTS / PRESSURE level. This calculation is based on the Pressure x Temperature curve for water vapor.

The totalization and the retransmitter output apply only to the compensated flow value (FLOW).

Level 2 - Inputs

The INPUTS level allows the configuration of the inputs for the uncompensated gas flow, temperature, and pressure.

Flow

The type of input signal for the uncompensated flow is configured in the SENSOR mnemonic as current (mA) or voltage (V).

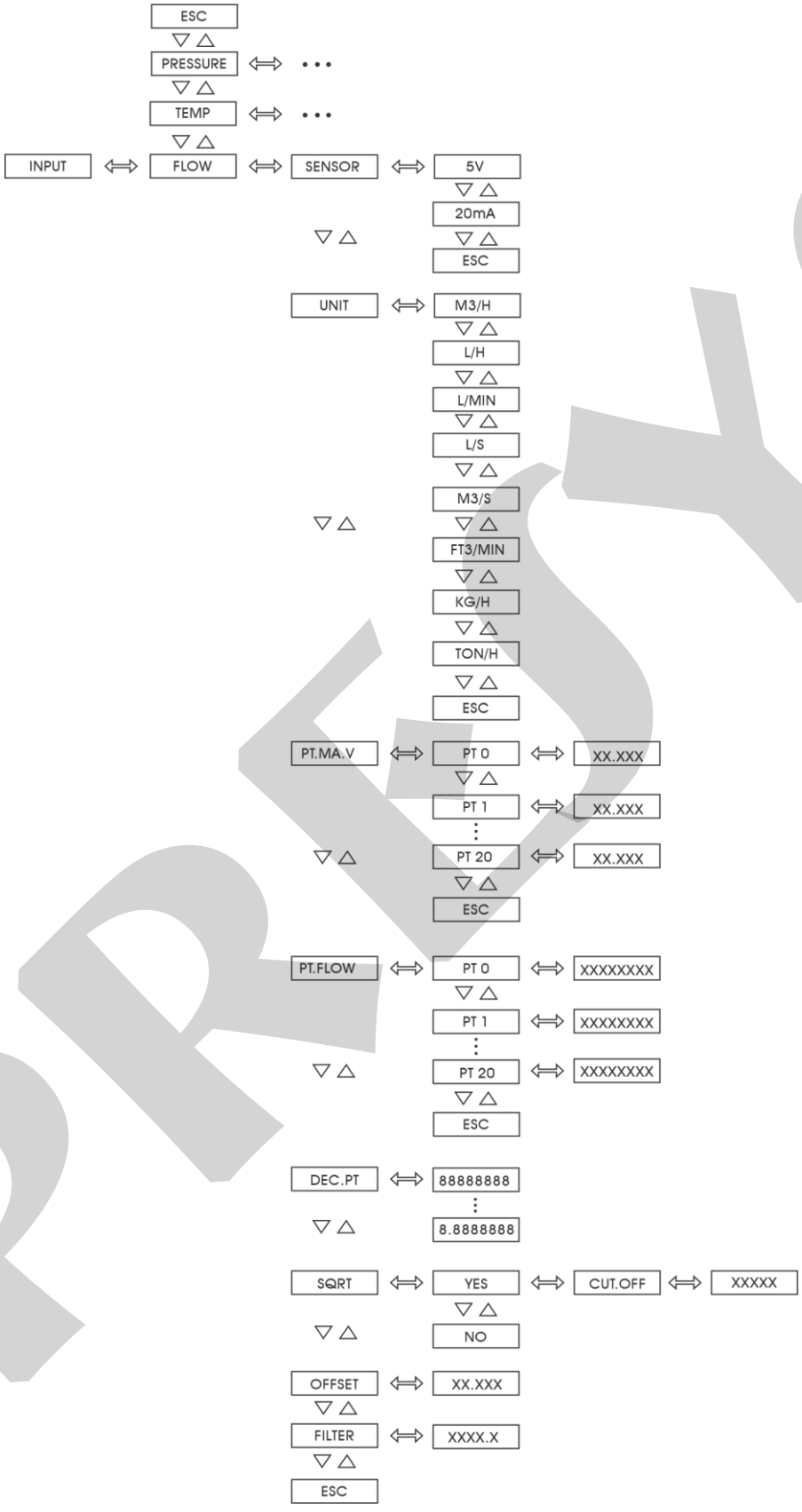


Fig. 11 - Flow options in the INPUTS level

The flow input accepts linearization of up to 21 points. This configuration is done through the PT.0 to PT.20 mnemonics of the PT.MA.V and PT.FLOW options. Refer to figure 11 for the flow configuration options.

Point values from PT.0 to PT.20 of PT.MA.V are given in mA or V with three decimal places, and the point values from PT.0 to PT.20 of PT.FLOW correspond to the flow indication for the respective signal in mA given in the unit configured by the UNIT mnemonic (m^3/h, l/h, l/min, l/s, ft^3/min, kg/h, or ton/h). Refer to figure 12. The configuration of the flow signal is associated with the reference temperature REF.T (GENERAL level).

	Input Signal (mA)	Flow Indication
Point 0	4.000	0
Point.1	4.800	2700
Point.2	5.600	4400
Point.3	8.000	8300
Point.4	8.800	9197
Point.5	0.000	XXXX

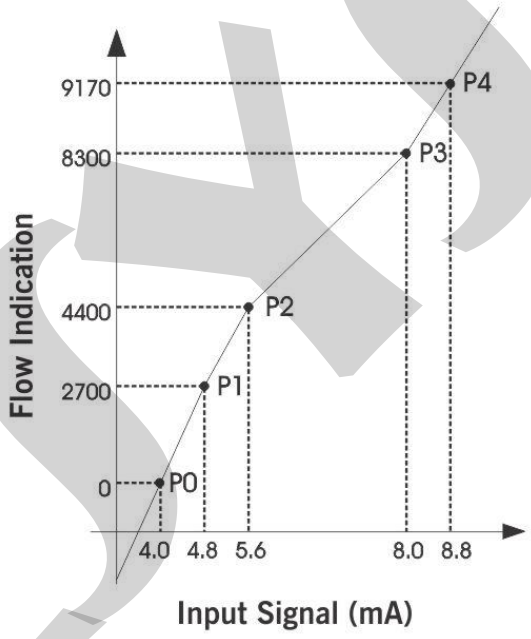


Fig. 12 - Flow Input Linearization

It is not necessary to fill in all the points. Only the points with values in mA/V that appear in ascending order are considered. Remember to configure the decimal places first (mnemonic DEC.PT).

The OFFSET mnemonic must be provided in mA or V with three decimal places.

Temperature

Refer to figure 13 for the configuration options of the temperature input.

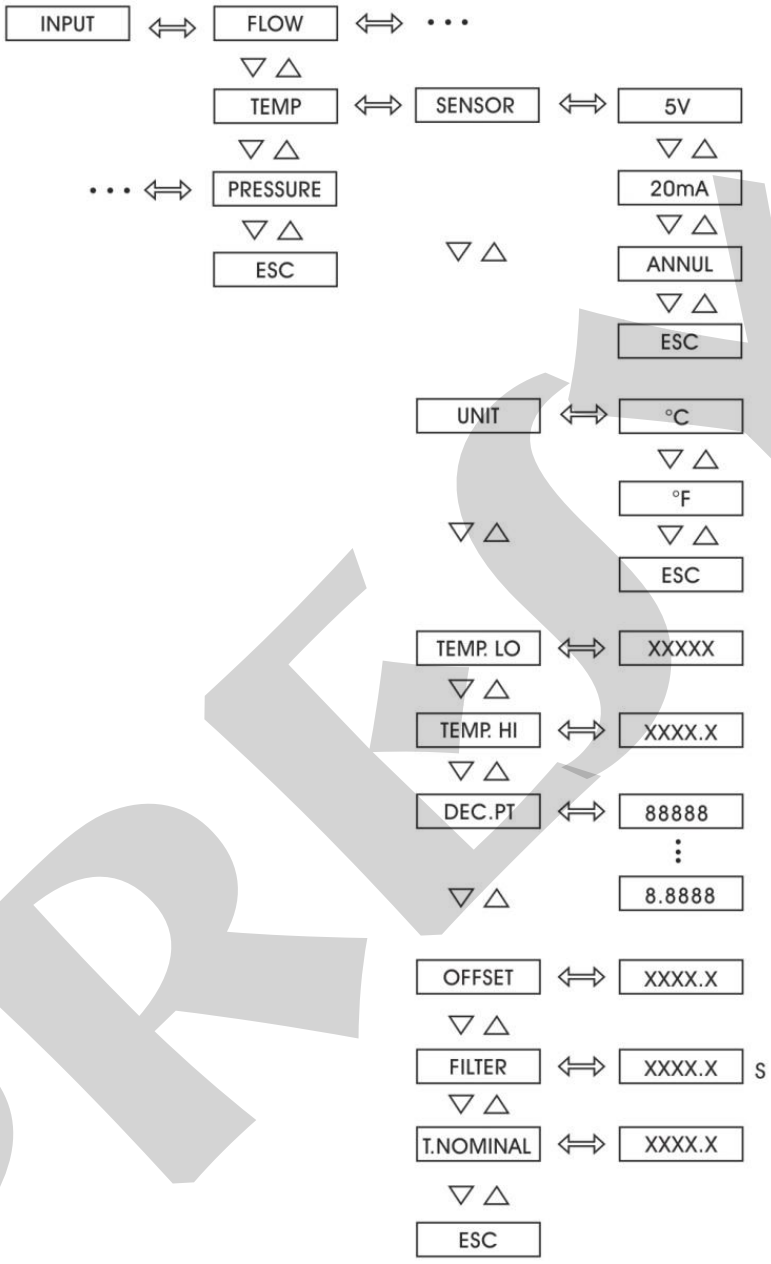


Fig. 13 - Temperature options in the INPUTS level

SENSOR - allows the temperature input to be configured as mA or V.
UNIT - temperature unit (ºC or ºF).
TEMP.LO - temperature corresponding to the 4 mA or 1 V signal.
TEMP.HI - temperature corresponding to the 20 mA or 5 V signal.
DEC.PT - number of decimal places.
T.NOMINAL - temperature value used if the temperature input is disabled and CUR.VAP is configured as NO.

Pressure

Refer to figure 14 for the configuration options of the pressure input.

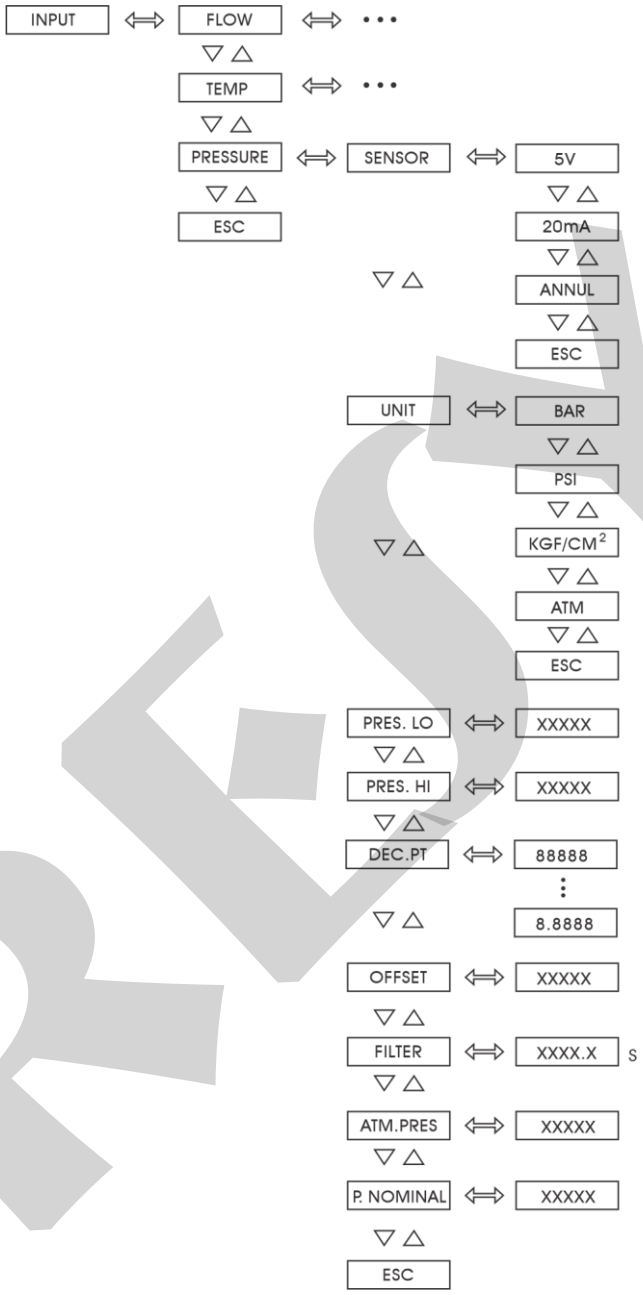


Fig. 14 - Pressure options in the INPUTS level

SENSOR - allows the pressure input to be configured as mA or V.
UNIT - pressure unit (bar, psi, kgf/cm^2 or atm).
PRES.LO - pressure corresponding to the 4 mA or 1 V signal.
PRES.HI - pressure corresponding to the 20 mA or 5 V signal.
DEC.PT - number of decimal places.
ATM.PRES - local atmospheric pressure in the unit configured in UNIT.
P.NOMINAL - pressure value used if the pressure input is disabled and CUR.VAP is configured as NO.

The table below refers to the ranges of the parameters shown in figures 11, 13, and 14.

Mnemonic	Parameter	Range	Factory Value	Units
PT.0 to PT.20	Flow input signal (PT.MA.V)	0.750 to 5.125 V, 3.000 to 20.500 mA	-----	V or mA
PT.0 to PT.20	Flow indication (PT.FLOW)	0 to 99999999	-----	UE*
TEMP.LO and TEMP.HI	Temperature indications relative to 4 mA/1 V and 20 mA/5 V inputs	-999 to 30000	-----	UE*
PRES.LO and PRES.HI	Pressure indications relative to 4 mA/1 V and 20 mA/5 V inputs	-999 to 99999	-----	UE*
CUT-OFF	Minimum value for square root extraction	0 to 5	0	%
OFFSET	Constant added to the display indication	-9999 to 30000	0	UE*
FILTER	First-order digital filter time constant	0.0 to 25.0	0.0	seconds

(*) EU - Engineering Unit

SQRT - allows displaying the square root of the flow signal. The Cut-Off parameter given in % of the input signal makes input values below PT.0 (PT.MA.V) + Cut-Off to be shown as PT.0. See figure 15.

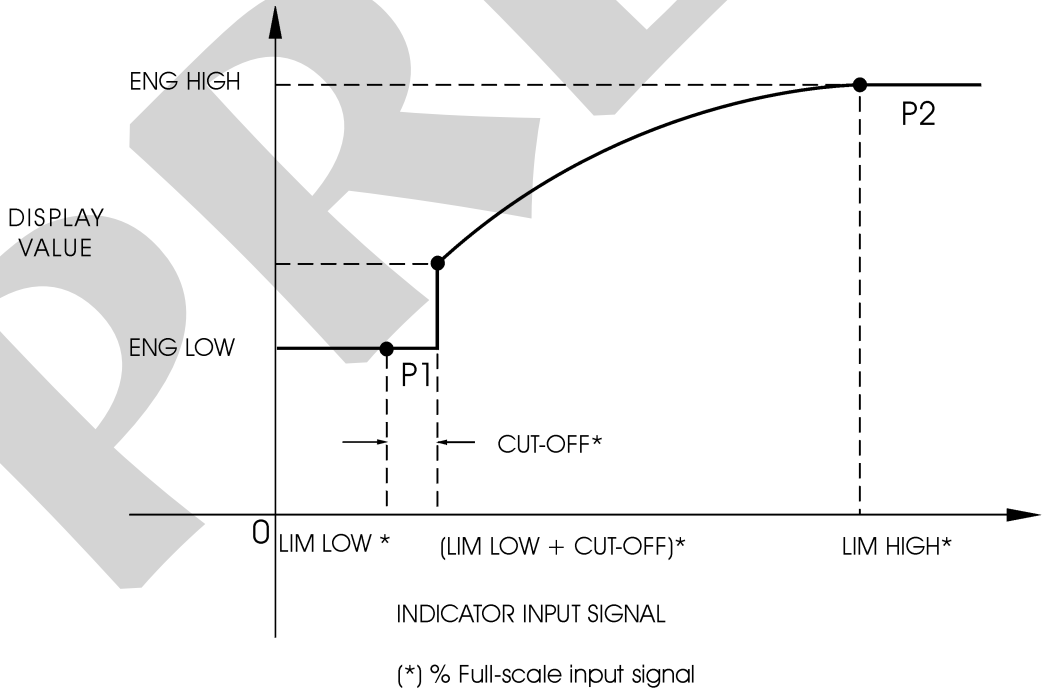


Fig. 15 - Input signal square root

DEC.PT - sets the decimal point position for visualization of Engineering units in display. There are up to four decimal places.

OFFSET - allows the user to enter an off-set value in Engineering Units to be added to the measured variable.

FILTER - this parameter provides the time constant of a first order digital filter associated to the selected input. In order to leave the signal without filter set this parameter to zero.

Level 3 - Alarms

The Flow Calculator has up to four alarm devices: outputs 1, 2, 3, and 4, which are respectively referred to as relay 1, relay 2, relay 3, and relay 4 (see figure 17). Relays 1 and 2 accept four types of alarms: low and high temperature indication and low and high pressure indication. Relays 3 and 4 accept two types of alarms: low and high compensated flow. For the configuration of all possible alarms, there are 12 alarm setpoint (SP) values with their respective hysteresis (HYST).

Once the alarm configuration is established (CONF option), it is possible to view or change only the values of alarm setpoints. Press the UP key while CONF option is shown, in order to have a quick access to the setpoints of all the alarms already configured. The mnemonics of alarm setpoints have a code which is explained through the following examples:

r1.Temp.Hi - Setpoint of the high temperature alarm associated with relay 1

r2.Pres.Lo - Setpoint of the low pressure alarm associated with relay 2

r4.Flow.L - Setpoint of the low compensated flow alarm associated with relay 4

LATCHED - configures the relay to be deactivated only after the end of the alarm condition and the operator has performed the acknowledge of this alarm. The acknowledgment of the alarm condition is performed within the normal operation mode by pressing the UP key until it is shown the mnemonic corresponding to the relay one is looking for. Note that it will be shown only the relays configured with latch operation which require acknowledgment in order to return to normal state. After reaching the relay, press the ENTER key. If there is no alarm condition for this relay, it will change its state. Continue pressing the UP key to return to operation mode.

DELAY - causes the relay to be activated only after a certain time interval defined by the user. Figure 16 below illustrates the delay operation for a high-alarm.

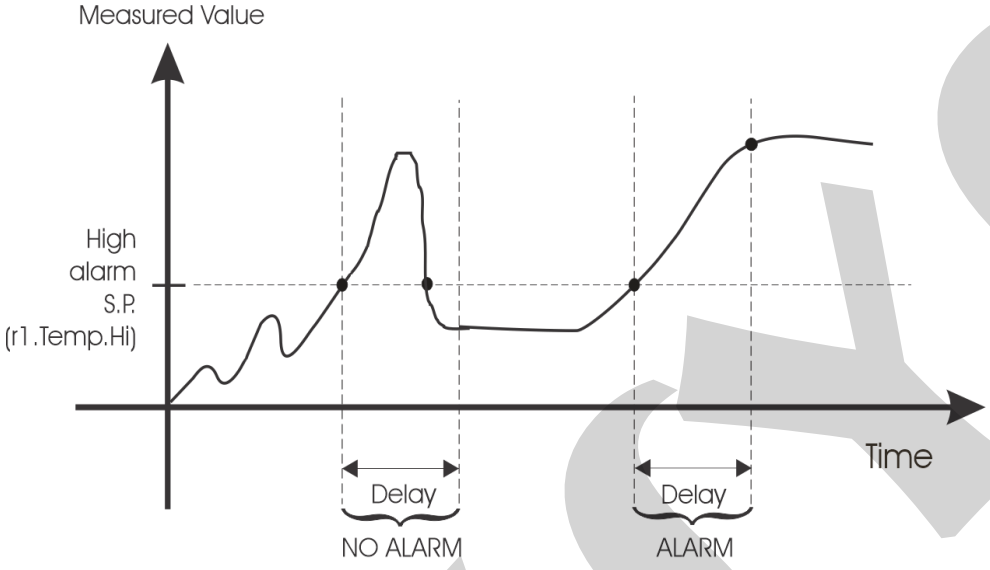


Fig. 16 - Relay with delay

SAFE - provides safety to relays. The safety condition means the relays are powered on when the instrument is on and there is no alarm condition, and the relays are powered off when in alarm condition or by relay activation due to presetting (see Totalization level 5) or in case of power failure.

Note: When replacing an analog output module (see level 4 - Output) by a relay module in the same position on the Power Supply Board, disable the output before installing the relay, otherwise it will be activated and deactivated continuously.

The table below refers to the ranges of the parameters shown in figure 17.

Mnemonic	Parameter	Range	Factory Value	Unit
SP	alarm setpoint	-1009 to 20019	25.0 - low alarm 75.0 - high alarm	UE
HYST	alarm hysteresis	0 to 250	1.0	UE
DELAY	delay for activating the relay	0.0 to 3000.0	0.0	seconds

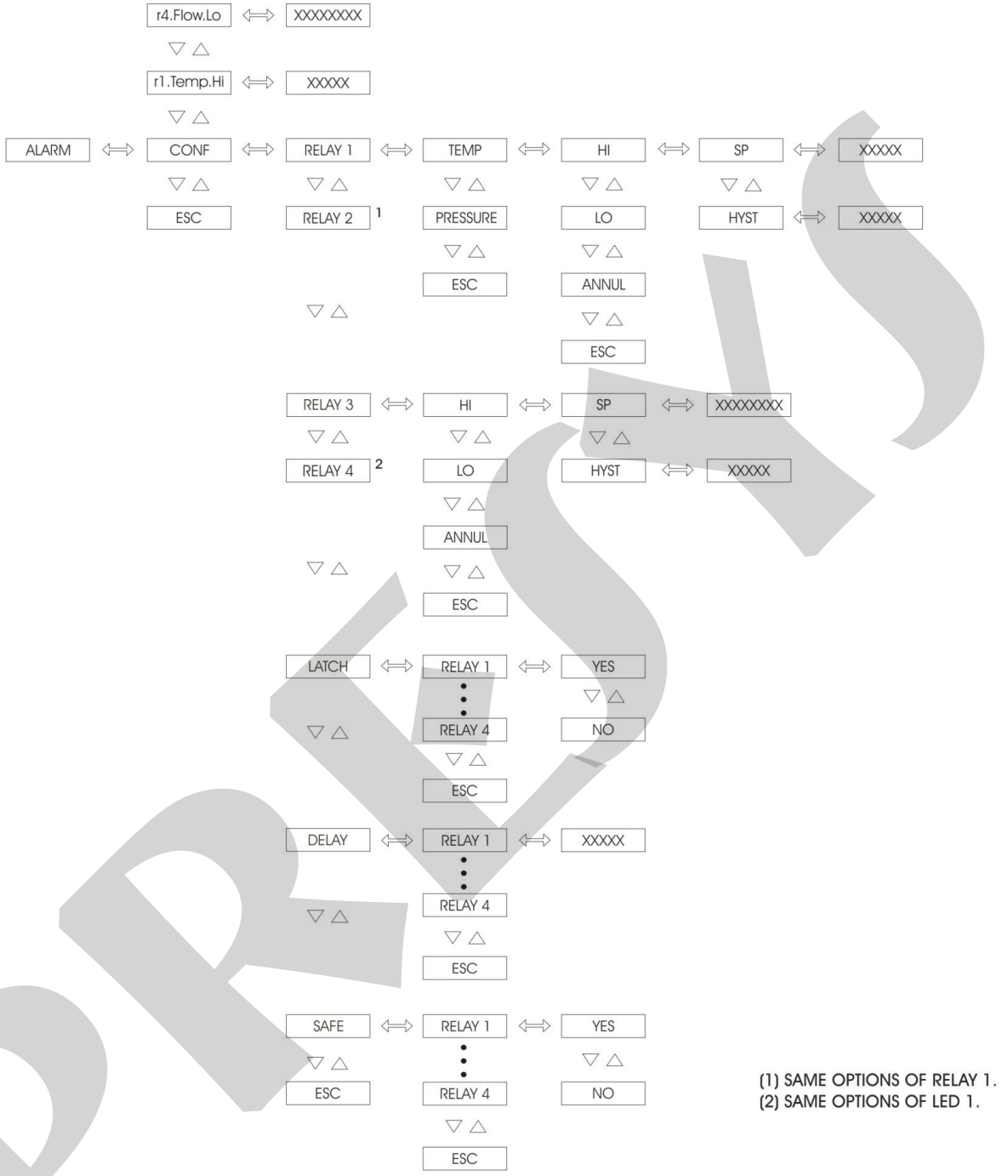


Fig. 17 - ALARM level options

Level 4 - Output

Level 4 allows the configuration of the analog output to retransmit the corrected gas flow (mnemonic FLOW in the operation level). See figure 18.

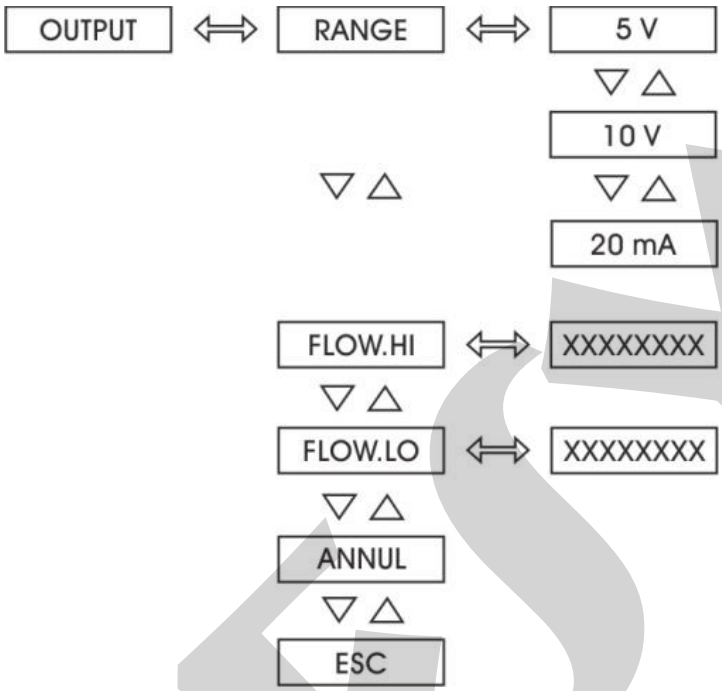


Fig. 18 - OUTPUT level options

RANGE - selects the range of the retransmission output as 20mA, 5V, and 10V. The output signal will always be from 4 to 20 mA (for the 20 mA range), 1 to 5V (for the 5 V range), and from 0 to 10 V (for the 10 V range).

FLOW.LO and FLOW.HI - define the gas flow values corresponding to the lower and upper limits of the retransmission signal. Note that the output signal saturates at these limits.

Below is the adjustable range of parameters shown in figure 18.

Mnemonic	Parameter	Range	Factory Value	Unit
FLOW.LO	display indication associated with the lower limit of the output	0 to 99999999	0	UE
FLOW.HI	display indication associated with the upper limit of the output	0 to 99999999	10000	UE

The analog output is enabled only after selecting the range of output retransmission from the RANGE mnemonic.

Level 5 - Totalization

The totalization is performed on the compensated gas flow (mnemonic FLOW from the operation level).

The totalization unit must be selected in the UNIT mnemonic among the options M3 (m^3), L (liters), CM3 (cm^3), FT3 (ft^3), IN3 (in^3), KG (kg), and TON (tons). The decimal point of the totalization is configured in DEC.PT for up to eight decimal places.

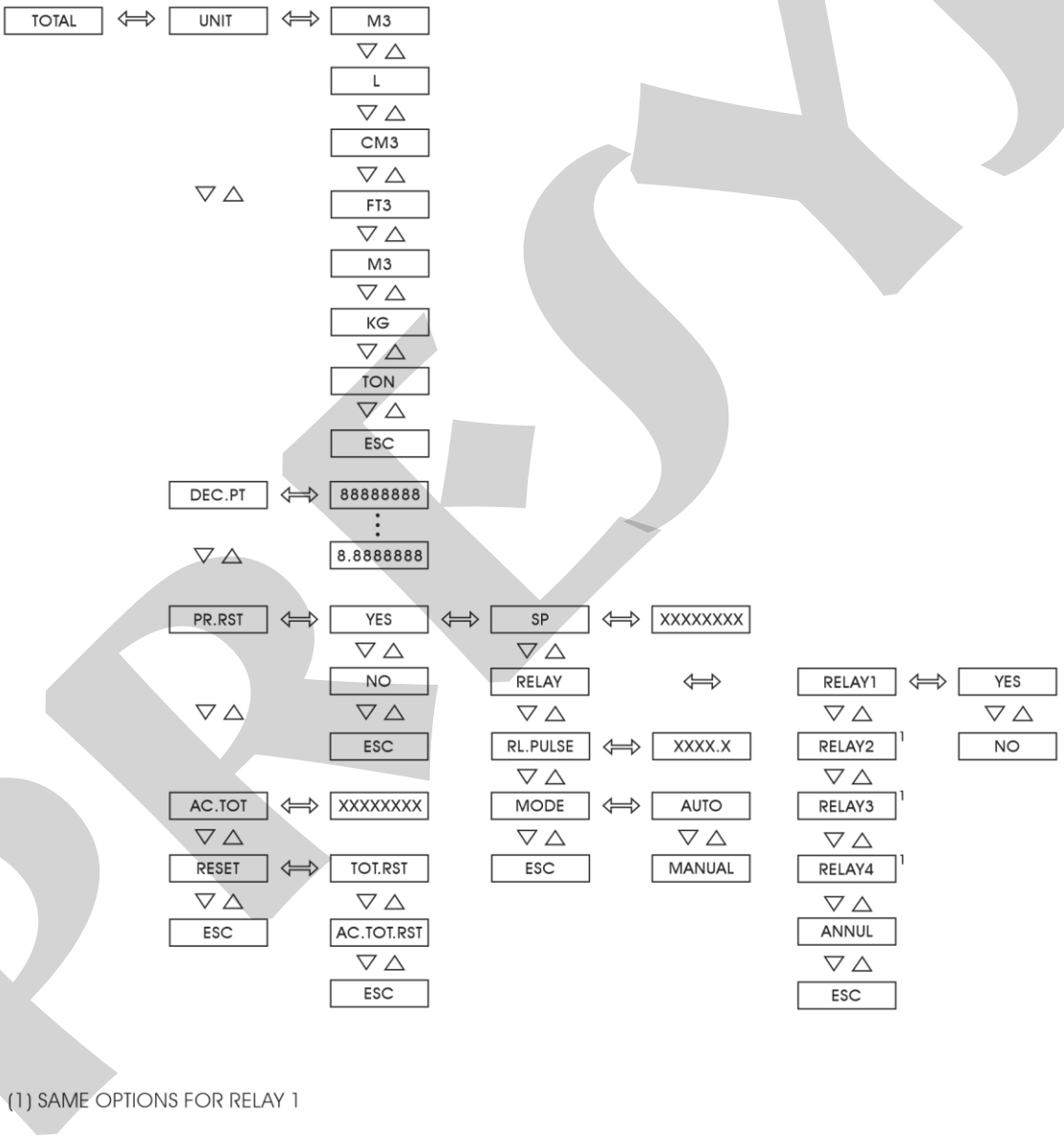


Fig. 19 - TOTAL level options

The table below refers to the ranges of the parameters shown in figure 19.

Mnemonic	Parameter	Range	Factory Value	Unit
SP	Count for the preset in order to reset the totalization and activate the relay.	1 to 99999999	100000	-----
RL.PULSE	Interval of time during which the relay remains activated after the SP count for the preset was reached (when operating in automatic mode).	0.1 to 3000.0	0.1	s

The totalization count of a channel may be reset by selecting the RST.TOT mnemonic from the RESET option in the Totalization Level or in normal operation level (this option is presented after pressing the UP key while the totalization is shown).

The PR.RST option for preset allows the configuration of a limit value for the totalization (preset setpoint SP) to activate one or more relays for a certain interval of time.

To associate the relay to a channel select the YES option for the mnemonics chosen among RELAY1 to RELAY4 in the RELAY option. For the preset to operate without relay, select the ANUL mnemonic.

The preset allows the reset of the totalizaton in automatic or manual mode, configured in the MODE option.

When the totalization of compensated flow reaches the preset setpoint SP in automatic mode, the totalization is reset, and the associated relays are activated during the time interval given by RL.PULSE parameter (in seconds).

In manual mode, the relays chosen in the RELAY option are activated when the totalization reaches the preset setpoint value specified by SP and are deactivated only when the totalization is reset by the operator in the instrument front panel. In this mode, RL.PULSE parameter has no function.

AC.TOT. (accumulated totalization) presents the input totalization performed continuously, i.e., independently from the reset of the totalization value shown in operation level. The accumulated totalization can be seen in operation level by pressing the UP key while the totalization is shown, and it is reset when choosing the RST.AC.TOT. mnemonic in the RESET option.

Note that the presentation of RESET, SP, MODE and AC.TOT. options in normal operation level must be enabled in the OPER option in GENERAL level.

Level 6 - Calibration

Level 6 is described on section 4.5 on Calibration.

Level 7 - RS

Refer to the communication manual.

4 - Maintenance

4.1 - Instrument Hardware

The Flow Calculator maintenance requires the user to have access to the hardware of the instrument. The instrument hardware consists of three main boards: Display Board, CPU Board and Power Supply Board. The three-board-system is fixed to the aluminum case by a screw on the right side of the front-panel. Loosen this screw and pull the instrument front-panel in order to remove the instrument from case.

The Display Board is located in the instrument front-panel. The front-panel has four internal staples in its four corners which keep together CPU and Power Supply Boards. The CPU and Power Supply Board are fixed by a spacer.

i) Remove the screw which fixes the spacer placed near the edge of the CPU and Power Supply Boards.

ii) Turn the instrument so that the display is on the opposite side for reading.

iii) Displace carefully the holder at the right top corner of the front-panel so that the Power Supply Board can be loosen.

iv) Move the Power Supply Board to the right and open the boards according to Figure 20.

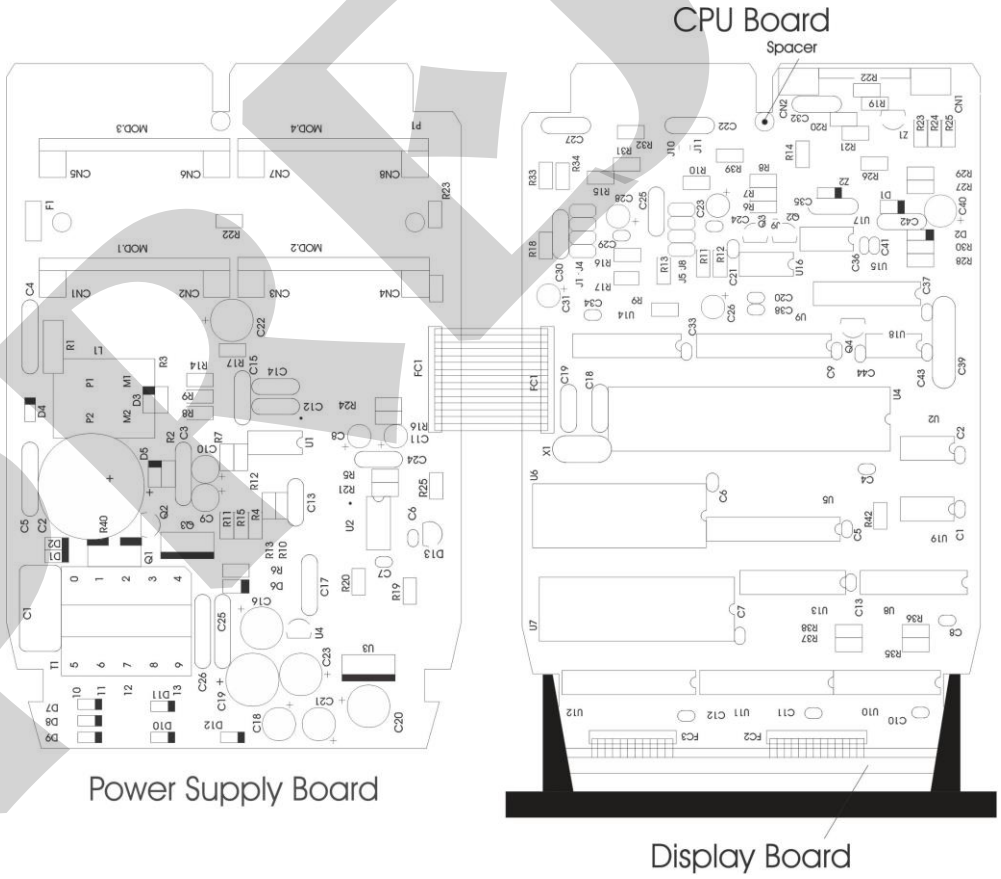


Fig. 20 - Instrument Hardware

4.2 - Hardware configuration

The software configuration level of input (level 2 - Inputs) must be complemented by hardware configuration, through internal jumpers.

There are three places for jumper installation for channels 1 to 3: J2, J3, and J6. They are placed in the CPU Board as shown in figure 21.

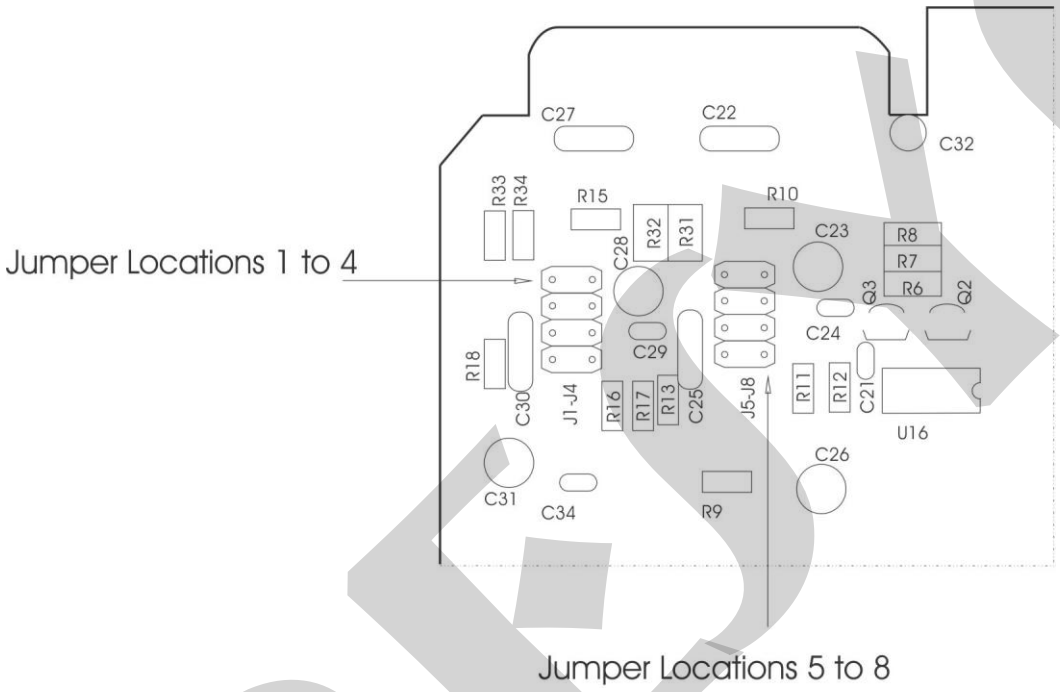


Fig. 21 - Location of jumpers in the CPU Board

Table 2 lists the jumpers that must be installed for each type of input. Verify the input type required and place the jumpers as specified below. Make sure to install only the jumpers required for the input.

Types of input	**Jumpers**		
	Channel 3	Channel2	Channel 1
Voltage(0 to 5V)	---	---	---
Current (0 to 20mA)	J3	J2	J6

Table 2 - Jumpers for input type configuration

(*) For the voltage input, the second jumper supplied by the factory must be kept by the user out of the instrument or placed on a conector as shown in Figure 22.

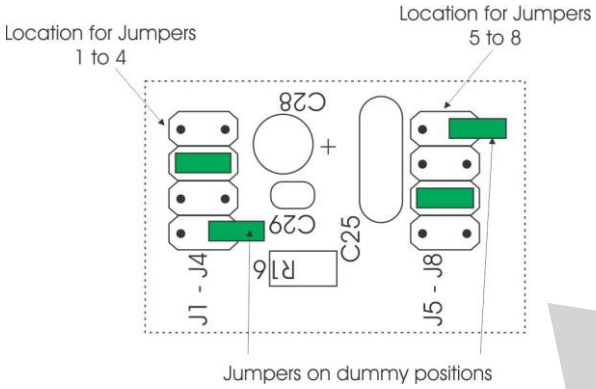


Fig. 22 - Jumpers not used for the 5V input placed in only one pin of the board conectors J1 and J8

4.3 - Snubber use for relay

Relay modules are provided with circuits for eliminating electrical arch (RC snubber). The snubbers are put in parallel with the relay contacts, by placing the jumpers J1 and J2 localized on the back of the relay board. When the jumpers are not placed, the relay contacts are kept without snubbers. The relay module is sent from factory with the jumpers placed.

Note the position of the jumpers in the following figure.

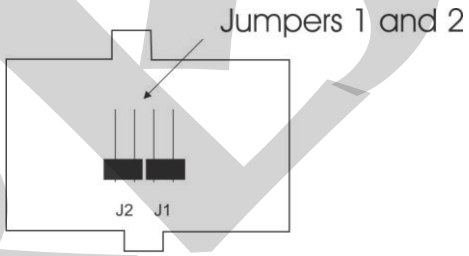


Fig. 23 - Jumpers for selecting snubbers on the relay board

Alarm relays are extremely critical in industrial process safety. In order to ensure the expected relay behaviour, consider the following two loading conditions.

- High currents circulating through the relay contacts (from 20mA to 3A). When the relay switches high currents there is the occurence of elecrical arch which damage quickly the relay contacts. Besides, electrical noise is generated. In these conditions, it is recommended to use the RC snubbers which come with the relay module (placed jumpers).

- Low currents circulating through the relay contacts (less than 20mA). The relays could not function properly when the jumpers are placed. In this case, the snubbers mantain a 4.5mAac/9.0mAac current when connected to a 120VAC/220VAC circuit. This current is enough, in certain casses, to power a horn or alarm lamps, preventing their deactivation. In this situation, there is no need to use the snubbers and the jumpers must be removed.

Note: If your relay module board does not have the mentioned jumpers, it is because it belongs to an older version. The same considerations explained earlier regarding the use of the RC snubber apply to it. However, in this case, to remove the snubbers, you should remove the two capacitors of 0.1nF x 250V located above the relay.

4.4 - Optional Module Connection

The DMY-2030-CV Flow Calculator accepts up to four output devices and communication, which must have the corresponding optional modules installed in the instrument. Open the instrument as shown in section 4.1 in order to access four connectors in the Power Supply Board and one connector in the CPU board. (Refer to Figure 24).

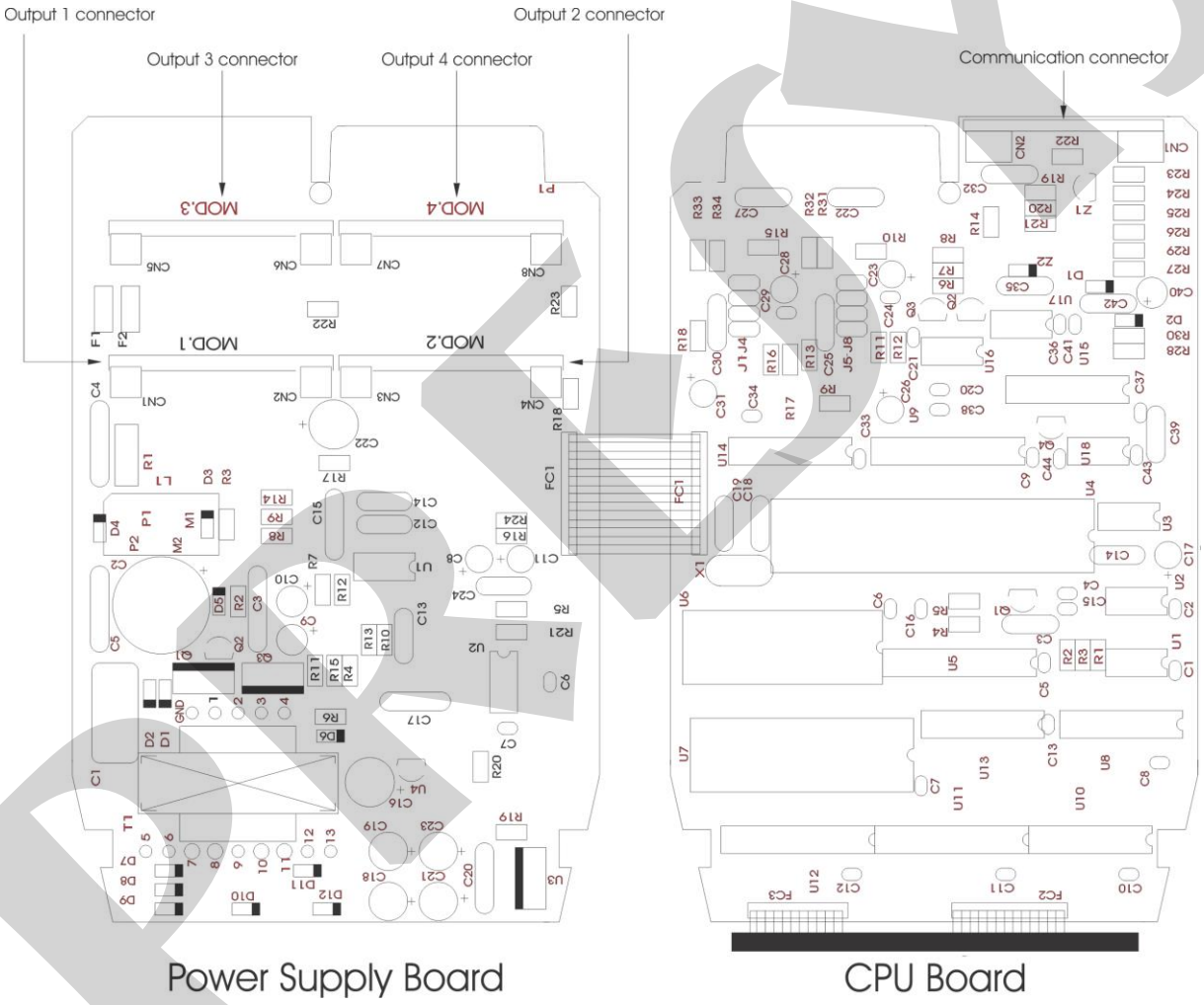


Fig. 24 - Optional module connectors

The connectors in the Power Supply Board are called MOD 1, MOD 2, MOD 3 and MOD 4, and are associated, in this order, to output 1, output 2, output 3 and output 4 signals, in the instrument output terminals as shown in Figure 3. The connector for the communication module is placed in the CPU Board and has no label. Any optional modu-

le must be always installed with the component side in the direction of the Display Board, as shown in figure 25.

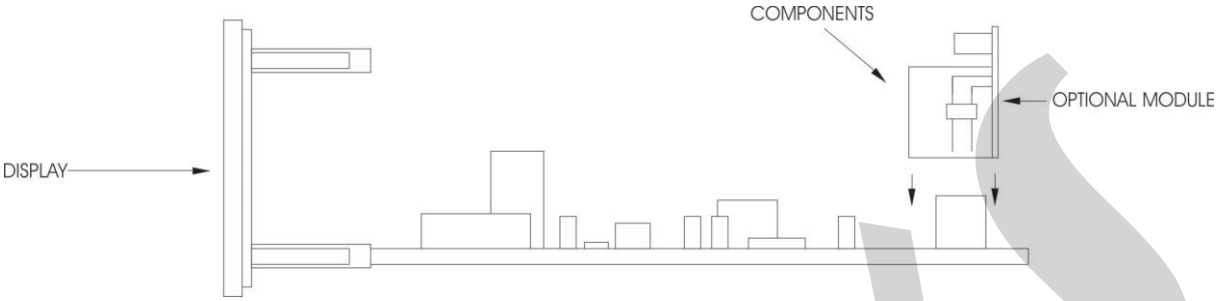


Fig. 25 - Installation of optional modules

Output 1 as a retransmitter output (optional module code: MSAN-20)

When it is required output 1 to be a retransmitter output (4 to 20mA, 1 to 5V, or 0 to 10V), connect the optional analog output module in the connector called MOD 1.

Output 1 retransmits only the compensated flow.

The optional analog output module has two connectors for installation of jumpers: J1 and J 2, as shown in figure 26.

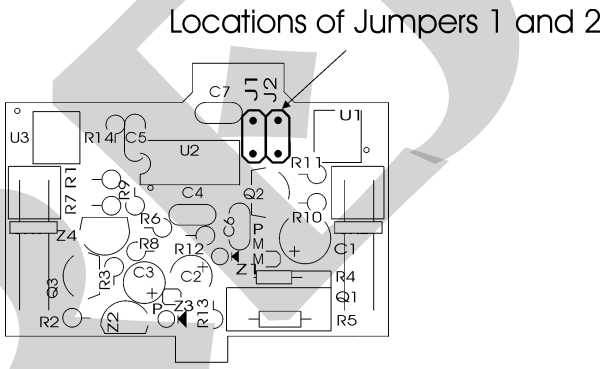


Fig. 26 - Place of jumpers in analog output board

In order to configure the optional analog output module as a retransmitter output for 4 to 20mA, 1 to 5V or 0 to 10V, install the jumper according to table 3.

Retransmitter Output Type	Jumpers	
4 to 20mA*		
1 to 5V	J1	
0 to 10V		J2

Table 3 - Jumper for retransmitter output type configuration

(*) In case of 4 to 20mA current retransmitter output, keep the jumper out of the instrument or put it on only one pin of the connector, as shown in Figure 22.

Outputs 1 and 2 as alarm outputs

If output 1 or output 2 is required to operate as alarm, connect the optional module in the connectors called MOD 1 and MOD 2, respectively. The output type depends on the optional module installed in MOD 1 and MOD 2: SPST relay, the solid state relay and the open collector voltage. The alarm output type and the optional module code are listed in table 4.

Alarm Output Type	Optional Module Code
SPST Relay	MALRE - 20
Solid state relay	MALRS – 20
Open collector voltage	MSD – 20

Table 4 - Types of alarm output for outputs 1 and 2

Outputs 3 and 4 as alarm outputs

Outputs 3 and 4 are used as alarms when the optional modules corresponding to connectors MOD 3 and MOD 4 are installed. There are three types of alarm output available: SPDT relay, solid state relay and open collector voltage. The Alarm output type and the optional module correspondence are shown in table 5.

Alarm Output Type	Optional Module Code
SPDT Relay	MALRE - 20
Solid state relay	MALRS - 20
Open collector voltage	MSD - 20

Table 5 - Alarm output types for outputs 3 and 4

4.5 - Calibration

The DMY-2030-CV Flow Calculator is accurately calibrated in factory and does not need periodic calibration in normal conditions. When calibration is required, follow this procedure below.

Disconnect the process signals of I/O terminals.

Before calibrating the instrument, keep it turned on for at least 30 minutes for warm up.

This section contains two parts: input calibration and output calibration.

Input Calibration

This section describes the procedure for calibration of the inputs.

The accuracy and precision of the calibrator used for generating references must be at least two times better than the specifications of the instrument.

The following tables list the references related to the type of input to be calibrated. The left column shows the mnemonics presented on the display during the calibration process.

Check if the internal input jumpers are properly placed.

To perform the calibration, enter level 6 of Calibration. The calibration level has a password system which avoids someone to enter this level accidentally and damage any calibration parameter. **The password for entering this level is number 5.**

Once the correct password is provided, select the input type to be calibrated. Choose the channel to be calibrated by pressing ENTER. The display shows the mnemonics related to the references required for the calibration process. The references must be applied before selecting the corresponding mnemonic shown on display. When the reference is stable, start the calibration by pressing ENTER. At this moment the intrument begins the calibration process while the mnemonic CAL blinks on the display.

While the display is blinking the reference must remain connect to the input channel being calibrated.

When the display stops blinking and presents the mnemonic corresponding to the reference, the calibration process of the first calibration point will be finished.

Change to the next reference and press DOWN to select another point. Between any two calibration points wait 1 minute at least. After this time is elapsed, press ENTER to start calibrating this point.

After performing all references on the table related to the input type to be calibrated, the calibration process will be finished.

It is possible to calibrate only one point without rendering invalid the other points already calibrated, in case the calibration of this point was not carried out properly.

In order to return to normal operation move back through the hierarchical levels until reaching level zero.

Figure 27 shows input and output calibration options in level 6 of Calibration.

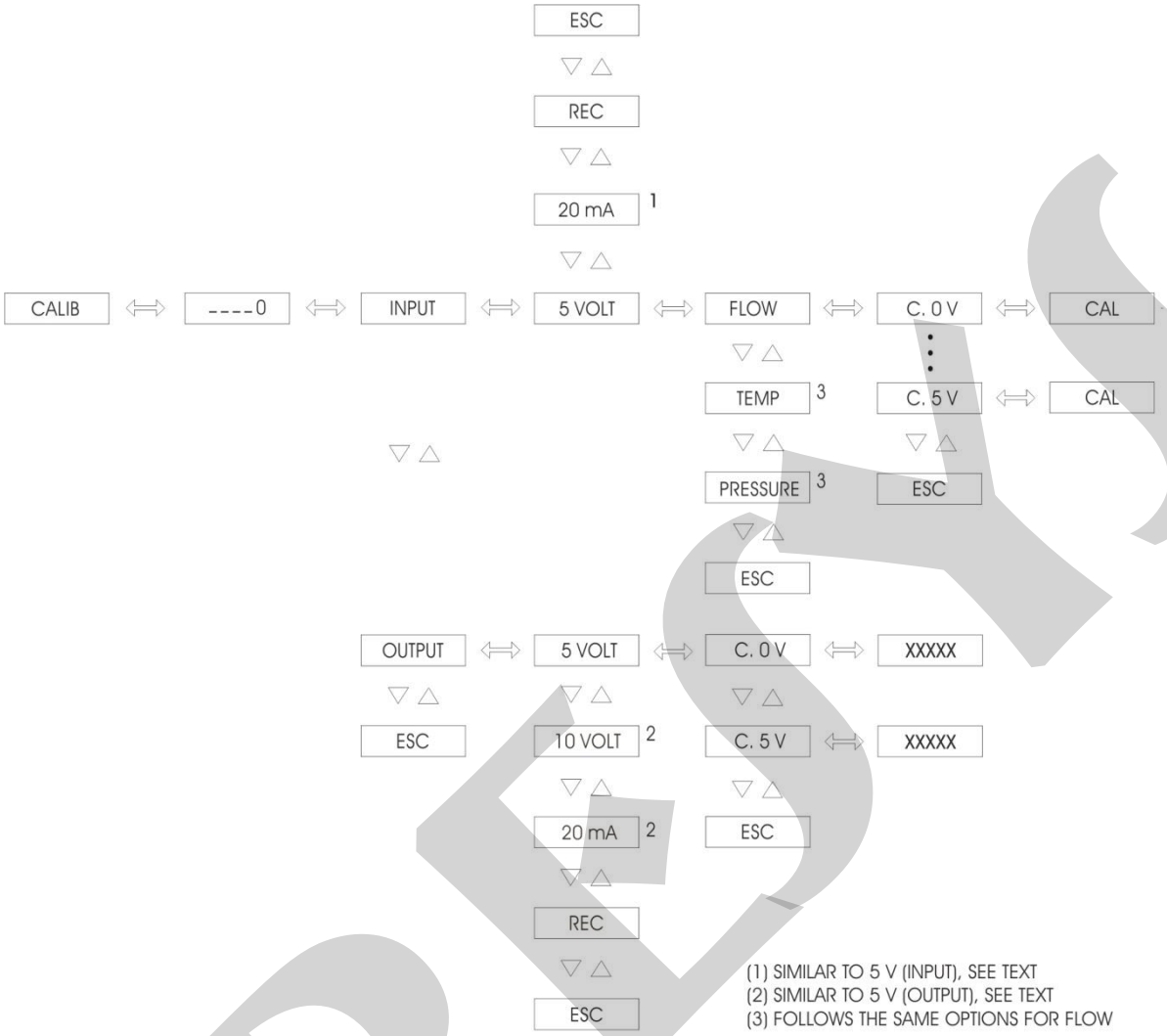


Fig. 27 - CALIBRATION level options

Calibration of voltage input (0 to 5V)

In a 0 to 5V voltage input calibration connect a voltage voltage source to the channel to be calibrated (terminals 2(+) and 3(-) for flow channel 1, 1(+) and 4(-) for temperature channel 2, or 5(+) and 6(-) for pressure channel 3). It is required 6 voltage references listed in table 6.

Reference	Mnemonic
0.0000V	C. 0V
1.0000V	C. 1V
2.0000V	C. 2V
3.0000V	C. 3V
4.0000V	C. 4V
5.0000V	C. 5V

Table 6 - References for 0 to 5V input calibration

Calibration of current input (0 to 20mA)

In a 0 to 20mA current input calibration connect a current source to the channel to be calibrated (terminals 2(+) and 3(-) for flow channel 1, 1(+) and 4(-) for temperature channel 2, or 5(+) and 6(-) for pressure channel 3). It is required 6 current references listed in table 7.

Reference	Mnemonic
0.000 mA	C. 0nA
4.000 mA	C. 4nA
8.000 mA	C. 8nA
12.000 mA	C.12nA
16.000 mA	C.16nA
20.000 mA	C.20nA

Table 7 - References for 0 to 20mA input calibration

Output calibration

For the calibration of the transmitter output, it is necessary to use a measuring instrument with greater or equal precision than the output specifications of the instrument.

Then enter level 6 of Calibration and select the output to be calibrated. Choose the type of output (0 to 20mA, 0 to 5V or 0 to 10V) and press ENTER .

The display will show the mnemonic related to the first point of calibration. There are only two points for output calibration.

For current output, the mnemonics are related to 0 and 20mA electric signals. For voltage output, the mnemonics are related to 0 and 5V or 0 and 10V signals.

Press ENTER after the display shows the mnemonic related to first or second point of calibration, so that the display starts to show the output value. Then use the UP and DOWN keys to set the output value to the electric level indicated by the

mnemonic. After the output value is set, press ENTER. During the first point calibration (0mA, 0V) be careful not to saturate the output signal.

Finally, return to normal mode by moving down through the levels until reaching level zero.

Return to factory calibration.

The instrument stores the factory calibration parameter values on the non-volatile memory, which may be recovered at any time.

In case of a bad performance of the instrument due to an incorrect calibration, use the REC option (figure 27).

REC - is the option that allows to recover the factory calibration.

Enter level 6 of Calibration, and choose the INPUT or the OUTPUT option. Select the REC option and press ENTER in order to recover the values from factory.

4.6 - Hardware Maintenance Instructions

Before sending the instrument back to factory check the following probable causes of a malfunctioning instrument.

Instrument with error indication on display

After turning the instrument on, it tests RAM and E2PROM integrity.

When at least one of these components presents some problem the display shows the following error codes:

Err. 01 - RAM error

Err. 02 - E2PROM error

In case of RAM error, turn the instrument off and on to check if the error message is displayed again. If the error remains, return the instrument to factory.

When there is E2PROM error, press the ENTER key and configure the instrument again. Turn the instrument off and on to check if the error message is displayed again. If the error remains, return the instrument to factory.

During configuration the display can show the Err.03 error message.

This error can happen when trying to assign a different configuration (analog output, alarm or preset) to an output already configured and enabled. In order to avoid this case, do not forget to disable relay 1 before enabling analog output 1 and vice-versa.

Note: When configuring a relay module as an analog output, the relay will be activated and deactivated continuously.

Instrument with the display out

Check if power supply voltage is provided to terminals 23 and 24 of the instrument.

Verify the integrity of fuse F1 of 2.0 A placed in the Power Supply Board as shown in figure 20. Due to its package it is necessary to check the fuse continuity in order to detect if it is broken.

Instrument malfunction

Check if the instrument is configured correctly by software and hardware (internal jumpers).

Examine if the optional modules are connected in the right spots.

Check if the voltages on flat cable 1 as shown in figure 28 are close to the values in table 8 and if they reach the CPU Board.

Test points on flat cable 1	Voltages
Between point 1(-) and point 2(+)	5V
Between point 9(-) and point 8(+)	8V
Between point 9(-) and point 1(+)	0V
Between point 9(-) and point 10(+)	- 8V
Between point 9(-) and point 13(+)	24V
Between point 12(-) and point 11(+)	5V

Table 8 - Inspection points of voltage on flat cable 1

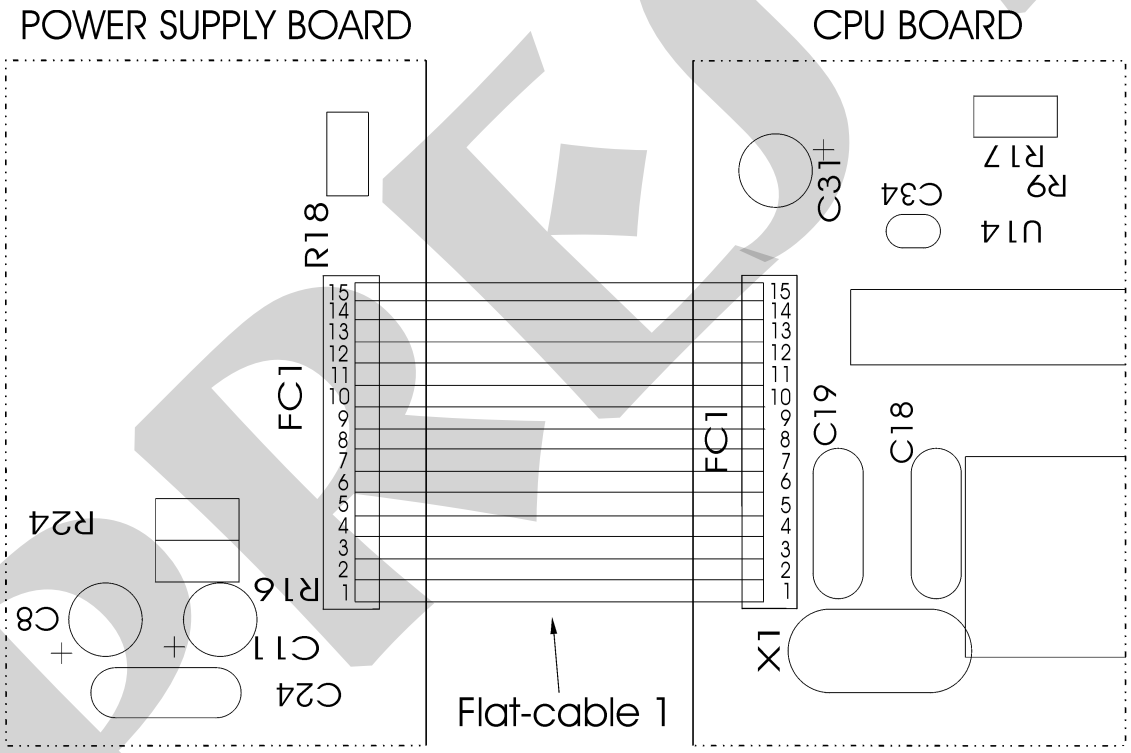


Fig. 28 - Voltage test points of the instrument

If the cause of the problem was not discovered, the instrument must be sent to factory.

4.7 - List of components

Display Board

Code	Components	Reference
01.05.0077-20	Display Board - DMY-2030-CV	----------
01.07.0003-21	Display 14mm	DP1,2,3,4,5,6,7,8
01.04.0001-21	Diode 1N4002	D1,2
01.07.0005-21	Led 3mm (red)	D4
01.07.0004-21	Led 3mm (green)	D3
01.09.0013-21	Transistor BC 327	Q1,2,3,4,5,6,7,8
01.02.0074-21	Resistor 470R 5%	R4
01.02.0082-21	Resistor 10K 5%	R1,2,3
01.15.0003-21	Push-button	CH1,2,3

Power Supply Board

Code	Components	Reference
01.05.0046-20	Power Supply Board	----------
01.01.0029-21	LM 2940CT - 5,0 V	U 3
01.01.0003-21	LM 1458	U 2
01.01.0030-21	UC 3842	U 1
01.09.0015-21	Transistor BC 337	Q 2
01.09.0019-21	Transistor TIP 50	Q 1
01.09.0020-21	IRF 822	Q 3
01.02.0122-21	Fuse 2A	F 1
01.04.0007-21	Diode 1N4007	D 1,2,3,4
01.04.0008-21	Diode 1N4936 / 1N4937	D 5,6,8,9, 0,11,12
01.04.0035-21	Diode MUR820	D 7
01.03.0009-21	Ceramic Disc Capacitor 100pF x 100V / 50V	C 12,13,14
01.03.0036-21	Ceramic Multilayer Capacitor 10KpF x 63V	C 24
01.03.0035-21	Ceramic Multilayer Capacitor 100KpF x 63V	C 6,7
01.03.0039-21	Polyester Capacitor 0,1µF x 250V	C 1,3
01.03.0022-21	Polyester Capacitor 0,01µF x 100V	C 15
01.03.0041-21	Polyester Capacitor 0,01µF x 250V	C 4,5
01.03.0038-21	Radial Electrolytic Capacitor 10µF x 16V	C 8,11
01.03.0042-21	Radial Electrolytic Capacitor 22µF x 25V	C 9,10
01.03.0027-21	Radial Electrolytic Capacitor 100µF x 25V	C 18,21
01.03.0001-21	Radial Electrolytic Capacitor 470µF x 35V	C 16
01.03.0043-21	Radial Electrolytic Capacitor 100µF x 35V	C 22
01.03.0044-21	Electrolytic Capacitor 220µF x 10V	C 20,23
01.03.0045-21	Radial Electrolytic Capacitor 22µF x 350V	C 2
01.03.0002-21	Radial Electrolytic Capacitor 1000µF x 16V	C 19
01.03.0068-21	Polyester Capacitor 4n7 x 400V	C 25,26
01.02.0105-21	Resistor 18R x 2W	R 1
01.02.0111-21	Resistor 1R 5%	R 15
01.02.0126-21	Resistor 220R 5%	R 10
01.02.0114-21	Resistor 270R 5%	R 4
01.02.0074-21	Resistor 470R 5%	R 17,18,22,23
01.02.0075-21	Resistor 1K 5%	R 16,24
01.02.0080-21	Resistor 4K7 5%	R 8,12
01.02.0082-21	Resistor 10K 5%	R 5,20,21
01.02.0116-21	Resistor 18K 5%	R 7
01.02.0083-21	Resistor 20K 5%	R 11
01.02.0110-21	Resistor 27K 5%	R 14
01.02.0085-21	Resistor 47K 5%	R 3
01.02.0106-21	Resistor 150K 5%	R 9
01.02.0088-21	Resistor 470K 5%	R 2
01.02.0006-21	Resistor 20R 1%	R 6

Code	Components	Reference
01.02.0183-21	Resistor 2K32 1%	R 13
01.02.0108-21	Resistor 15K4 1%	R 19
01.06.0003-21	Transformer 110/220Vac	T 1
01.06.0018-21	Coil	L 1
01.13.0004-21	Connector	CN 1,2,3,4,5,6,7,8

CPU Board

Code	Components	Reference
01.05.0048-20	CPU Board	----------
01.01.0007-21	LM 311	U 18
01.05.0244-20	F-RAM Adapter Board	U 19
01.01.0124-21	FM25C160B	U 19
01.01.0019-21	4051	U 14
01.01.0020-21	TC-4053	U 15
01.01.0021-21	74HC02	U 13
01.01.0022-21	74HC138	U 8
01.01.0023-21	74HC365	U 10
01.01.0024-21	74HC373	U 9,11,12
01.01.0095-21	AT89LP51ED2	U 4
01.01.0026-21	AD706	U 16
01.01.0027-21	AD 712	U 17
01.16.0001-11	Crystal 11.0592 MHz - 30	X 1
01.09.0013-21	Transistor BC 327	Q 2,4
01.04.0003-21	Diode 1N4148	D 1, 2
01.04.0005-21	Reference Diode LM336/5V	Z 1
01.04.0006-21	Zener Diode BZX 79/C6V2	Z 2
01.03.0067-21	Ceramic Disc Capacitor 56pF x 50V (4mm)	C 18, 19
01.03.0035-21	Ceramic Multilayer Capacitor 0,1µF x 63V	C 4,8,9,10,11,12, C 13,20,21,22,24,25, C 29,30,32,33,34,35,36, C 37,38,41,42,43,44
01.03.0039-21	Polyester Capacitor J(5%) 0,1µF x 250V	C 39
01.03.0038-21	Radial Electrolytic Capacitor 10µF x 16V	C 28,23,26,31
01.03.0027-21	Radial Electrolytic Capacitor 100µF x 25V	C 40
01.02.0103-21	Resistor 68R1 1%	R 24
01.02.0010-21	Resistor 100R 1%	R 21,29
01.02.0013-21	Resistor 249R 1%	R 32,34
01.02.0102-21	Resistor 442R 1%	R 23
01.02.0019-21	Resistor 1K 1%	R 6
01.02.0104-21	Resistor 3K32 1%	R 25
01.02.0030-21	Resistor 4K42 1%	R 8,9
01.02.0031-21	Resistor 4K99 1%	R 7
01.02.0036-21	Resistor 8K66 1%	R 28
01.02.0038-21	Resistor 10K 1%	R 20,39
01.02.0046-21	Resistor 40K2 1%	R 26
01.02.0075-21	Resistor 1K 5%	R 19,22,30
01.02.0078-21	Resistor 2K 5%	R 27
01.02.0082-21	Resistor 10K 5%	R 10,13,18,35,36,37,38
01.02.0119-21	Resistor 15K 5%	R 42
01.02.0089-21	Resistor 1M 5%	R 11,16,17
01.02.0098-21	Resistor 10M 5%	R 31, 33
01.17.0002-21	Jumper (without shank)	Selected
01.17.0003-21	Right Angle Pitch Header 2x4	J 1-J4, J5-J8
01.13.0043-21	28 Pin Socket	U 7
01.13.0005-21	Connector	CN 1,2
01.14.0011-21	Flat Cable 12 Wires	FC 3

Code	Components	Reference
01.14.0025-21	Flat Cable 13 Wires	FC 2
01.14.0026-21	Flat Cable 15 Wires	FC 1

Terminal Board

Code	Components	Reference
01.05.0049-20	I/O Terminal Board	----------
01.09.0015-21	BC 337	U1
01.13.0002-21	Terminal Block	CN1,2
01.13.0003-21	Board-to-board Connector	P1,2

Analog Output Board

Code	Components	Reference
01.05.0055-20	Analog Output Board	----------
01.01.0060-21	OP200GP	U 2
01.01.0065-21	Optocoupler LTV817	U 1,3
01.09.0006-21	TIP 117	Q 1
01.09.0015-21	Transistor BC 337	Q 2
01.09.0021-21	Transistor BF 245A	Q 3
01.04.0030-21	Zener Diode BZX 79/C3V3	Z 1
01.04.0011-21	Zener Diode BZX79/C3V9	Z 3
01.04.0005-21	Reference Diode LM 336 / 5.0 V	Z 2,4
01.03.0042-21	Radial Electrolytic Capacitor 22 µF x 25 V	C 1
01.03.0035-21	Ceramic Multilayer Capacitor 0,1µF x 63 V	C5,6
01.03.0011-21	Ceramic Multilayer Capacitor 220pF x 63V	C4,7
01.03.0050-21	Tantalum Capacitor 1µF x 35V	C 2, 3
01.02.0008-21	Resistor 49R9 1%	R 4
01.02.0010-21	Resistor 100R 1%	R 5
01.02.0013-21	Resistor 249R 1%	R 10,11
01.02.0115-21	Resistor 402R 1%	R 13
01.02.0024-21	Resistor 2K 1%	R 9
01.02.0029-21	Resistor 4K02 1%	R 2
01.02.0038-21	Resistor 10K 1%	R 3
01.02.0047-21	Resistor 49K9 1%	R 7,8
01.02.0059-21	Resistor 301K 1%	R 12
01.02.0069-21	Resistor 1M 1%	R 6
01.02.0109-21	Resistor 3K3 5%	R 14
01.02.0080-21	Resistor 4K7 5%	R 1
01.17.0001-21	Pin Header 180º 2x2	J 1,2
01.17.0004-21	Pin Header 90º 2x2	CN 1,2
01.17.0002-21	Jumper (without shank)	Selected
01.06.0004-21	Coil for Analog Output DMY/TY/DCY	----------

Alarm Board

Code	Components	Reference
01.05.0052-20	Alarm Board	----------
01.01.0033-21	Optical coupler 2502	U 3
01.04.0001-21	Diode 1N4002	D 1
01.03.0039-21	Polyester Capacitor 0,1 µF x 250 V	C 1,2
01.02.0072-21	Resistor 100R 5%	R 2
01.02.0114-21	Resistor 270R 5%	R 1
01.12.0001-21	Relay NBA - 3CS - 24V	K 1
01.17.0004-21	Pin Header 90º 2x2	CN 1,2

4.8 - List of recommended spare components

Display Board
Display DP1, 2, 3, 4, 5, 6, 7, 8

Power Supply Board

IRF 822	Q3
UC 3842	U1
Fuse 2A	F1
LM 1458N	U2

Terminal Board

BC 337	U1

CPU Board

4051	U14
4053	U15
Reference Diode LM-336/ 5V	Z1

Engineering Units Card
Cód. 02.10.0003-21