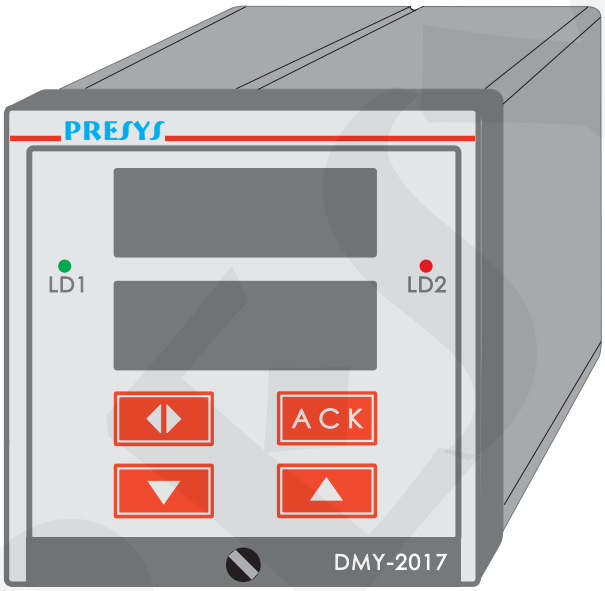
PRESYS | Instruments

Pressure Indicator DMY-2017



TECHNICAL MANUAL

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1 - Introduction

1.1 - Description

PRESYS DMY-2017 Indicator is microprocessor-based instrument that shows all kind of industrial process variable, such as: temperature, pressure, flow and level. It has non-volatile internal memory (E2PROM) to store calibration values. Its high accuracy is warranted by autocalibration techniques based on high thermal stability voltage reference.

It can communicate with computers by optional communication module RS-232 or RS-422/485.

The Indicator is able to monitor two inputs simultaneously. Channel 1 (upper display) is always a pressure input and channel 2 (lower display) can be either a pressure input or a universal analog input.

Thus, the Indicator can accept one or two inputs of gage or absolute pressure or vacuum. There are versions available for use with air and inert gases or sealed for fluids compatible with 316L stainless steel. In the version of single pressure input, the second input accepts 4-20mA, 1-5VDC, 0-10VDC, thermocouple and RTD.

Thermocouples and RTD inputs are linearized automatically by tables stored in EPROM memory. A 24Vdc voltage source isolated from output and with short-circuit protection is provided for transmitter power supply.

Except for the pressure input, the channel 2 type of input can be selected by the user and enabled by jumpers and by the software configuration. All configuration data can be protected by a password system and are stored in the non-volatile memory in case of power failure.

According to modularity design concept, the instruments accept up to four output modules. The type of outputs are: retransmittion, SPDT relay, SPST relay and solid state relay. The outputs are isolated from the inputs.

It accepts 90 to 240Vac or 130 to 340Vdc (with any polarity) power supply.

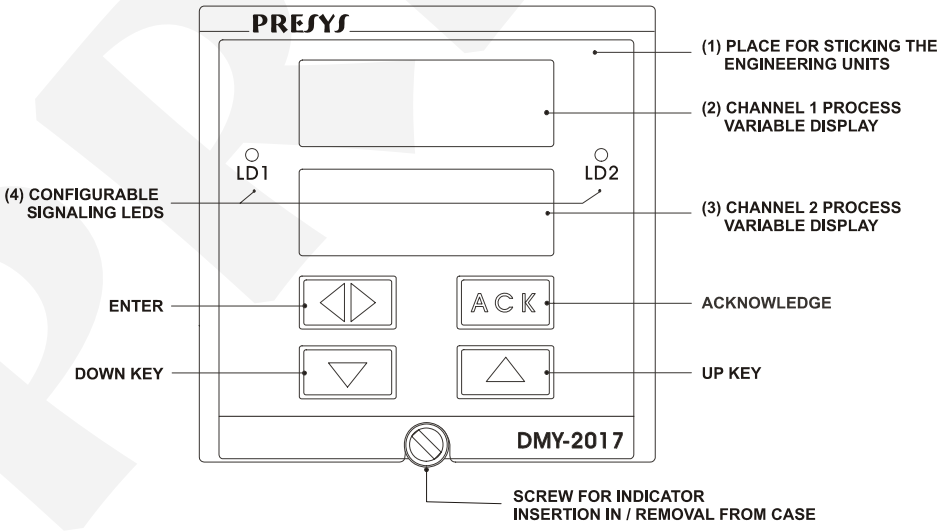


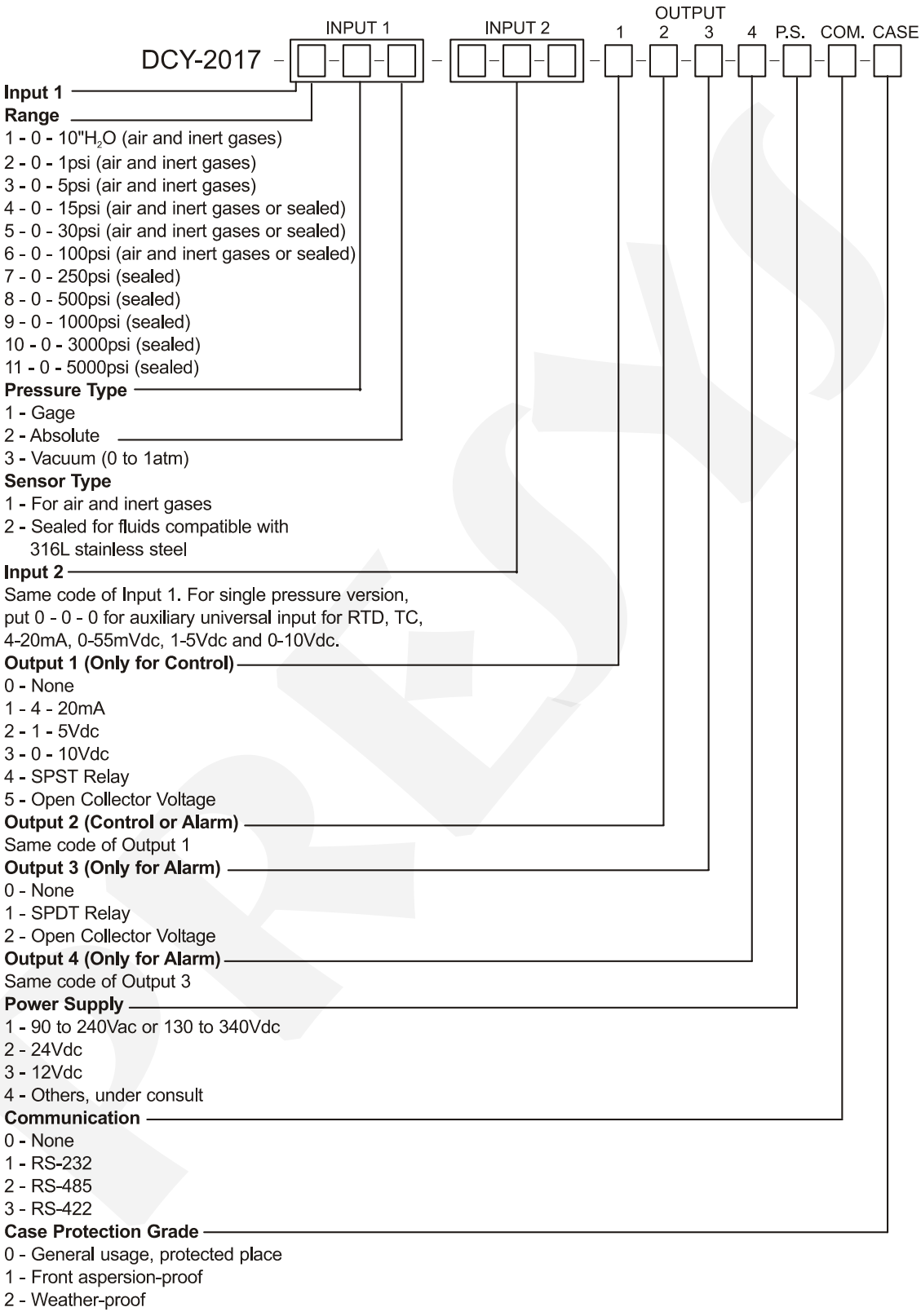
Figure 1 - DMY - 2017 Indicator front panel

The equipment has extruded aluminum case which avoids electrical noise, electromagnetic interference, radiofrequency interference, etc. and its robust construction makes it tough enough for the most hostile environments.

On the front panel of the instruments there are two displays configurable up to four high visibility digits which show the process variables of channel 1 (upper display) and channel 2 (lower display). During configuration, the display shows mnemonics and parameter values. The leds and the display can be used as a visual indication of alarm or they can be associated with the alarm outputs. So, there are up to seven alarm indications available (four alarm modules together with the display and leds). The alarm outputs can be configured, independently, to operate with latch, demanding the operator acknowledgement by means of the front panel keys in order to deactivate them after the process variable returns to normal condition.

Up to two rettransmitter outputs are available to provide a linear output signal from 4 to 20 mA, 1 to 5V or 0 to 10V proportional to the input process variable being measured. This signal allows the retransmissions of the variables to a distant location. When using only one analog output, up to three alarm modules can be used, and when using two analog outputs, up to two alarm modules can be used.

1.2 - Order code



Note 1 - Ranges and input types, indication, relay usage as alarms and alarm setpoints are, among other things, items that the user can program through the front panel keys (if wanted, specify such information so that all the configuration can be made by PRESYS).

Note 2 - Other hardware and software features can be available under previous consult.

Code example:

1) DMY - 2017 - 6 - 1 - 1 - 8 - 1 - 2 - 4 - 0 - 0 - 0 - 1 - 0 - 0

This code defines a DMY - 2017 Indicator with two pressure inputs, the first in the 0 to 100 psi range, gage pressure and use with air, the second in the 0 to 500 psi range, gage pressure and use with fluid. It provides one SPDT relay. The other outputs are not available. Power supply in the 90 to 240VAC ou 130 to 340VDC range, it does not use communication and is intended for use in a sheltered place.

1.3 - Technical Specifications

Inputs:

- One or two pressure inputs for gage, absolute or vacuum pressure. Ranges from 0 to 250 mmH_2O (0 to 10"H_2O), 0 to 1 psi, 0 to 5 psi, 0 to 15 psi, 0 to 30 psi, 0 to 100 psi, 0 to 250 psi, 0 to 500 psi, 0 to 1000 psi, 0 to 3000 psi and 0 to 5000 psi for gage pressure. For absolute pressure, ranges begin from 15 psi. Vacuum ranges are from 0 to 1 atm.

- Ranges up to 15 psi used with air and inert gases. From 15 psi up to 250 psi, sensors are available for fluids. They are sealed for use with fluids compatible with 316L stainless steel. Note: the sensor for fluids also accepts air / gases, but the opposite is not allowed.

- Auxiliar universal input, for the single pressure input version, configurable for thermocouple (J, K, T, E, R, S, under ITS - 90), RTD Pt - 100 under DIN 43760, 4 to 20mA, 0 to 55mVDC, 1 to 5VDC, 0 to 10VDC. Input impedance of 250Ω for mA, 10MΩ for 5VDC and 2MΩ above 5VDC.

- Table 1 shows the pressure range limits, thermocouple and RTD temperature range limits and the resolution for the linear input sensors.

Input Sensor	**Measuring Range Limits**			
Pressure	Sensor	lower limit psi	higher limit psi	
	250 mmH_2O	0	0.355	
	1 psi	0	1.000	
	5 psi	0	5.000	
	15 psi	0	15.00	
	30 psi	0	30.00	
	100 psi	0	100.0	
	250 psi	0	250.0	
	500 psi	0	500.0	
	1000 psi	0	1000	
	3000 psi	0	3000	
	5000 psi	0	5000	
Thermocouple	lower limit °F	higher limit °F	lower limit °C	higher limit °C
Type J	-184	1886.0	-120	1030.0
Type K	-346	2498	-210	1370
Type T	-418	752	-250	400
Type E	-148.0	1436.0	-100.0	780.0
Type R	-58	3200	-50	1760
Type S	-58	3200	-50	1760
RTD 2 or 3-wire Pt-100	-346.0	1256.0	-210.0	680.0*
Linear	Range		Resolution	
Voltage	0 to 55mV		6μV	
	0 to 5V		500μV	
	0 to 10V		1mV	
Current	0 to 20mA		2μA	

(*)including wire resistance

Table 1 - Measuring ranges for input sensors

Outputs:

- 4 to 20 mA, 1 to 5 Vdc, 0 to 10 Vdc Analog Retransmitter, with connection for up to two optional modules galvanically isolated of 300Vac from power supply and inputs.
- SPDT relay for alarm rated for 3A at 220Vac, or 10A at 220Vac under order. In this case alarm module is not connected, but soldered to the board. Connection for up to four modules (using both analog output connectors). In case of using one analog output, one can use three alarm modules, or whenever one uses two analog outputs, it is possible to have up to two alarm modules.
- 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:

Two 14mm red displays set with four digits, configured with decimal point.

Engineering Units:

psi, atm, inH_2O, kgf/cm^2, mH_2O, inHg, mmHg, cmHg, bar, mbar, kPa and mmH_2O.

Configuration:

By front-panel pushbuttons and internal jumpers.

Sampling rate:

120 ms for input indication in -999 to 9999 range. The display is updated each second.

Accuracy:

± 1 % of full scale for 0 to 250 mmH_2O range.

± 0.1% of full scale for other pressure ranges.

± 0.1 % of full scale for TC, RTD, mA, mV, Vdc input.

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

Linearization:

± 0.1 °C for RTD and ± 0.2 °C for TC.

Square root extraction:

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

Cold junction compensation:

± 2.0 °C in the range from 0 to 50°C ambient temperature.

Thermal stability:

± 0.01 % / °C of span for pressure inputs

± 0.005 % / °C of span for the other inputs

Power supply:

90 to 240VAC or 130 to 340VDC (any polarity), 10W nominal; 24VDC, 12VDC and other values are optional.

2-wire transmitter power supply:

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

Operating ambient:

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

Dimensions:

1/4 DIN (96 × 96 mm) with 162 mm depth, panel cut of 92 × 92 mm.

Weight:

1.0 kg nominal.

Warranty:

One-year warranty.

2 - Installation

2.1 - Mechanical Installation

The front panel of the DMY - 2017 Indicator has 1/4 DIN size (96 × 96 mm).

The Indicator is fixed by the rails which press it against the back side of the panel.

After preparing a 92 × 92 mm cut in the panel, remove the rails from the Indicator and slide its rear through the cut until its front reaches the panel. Place the rails again in the Indicator from the back of the panel and tighten the screws as shown in figure 2.

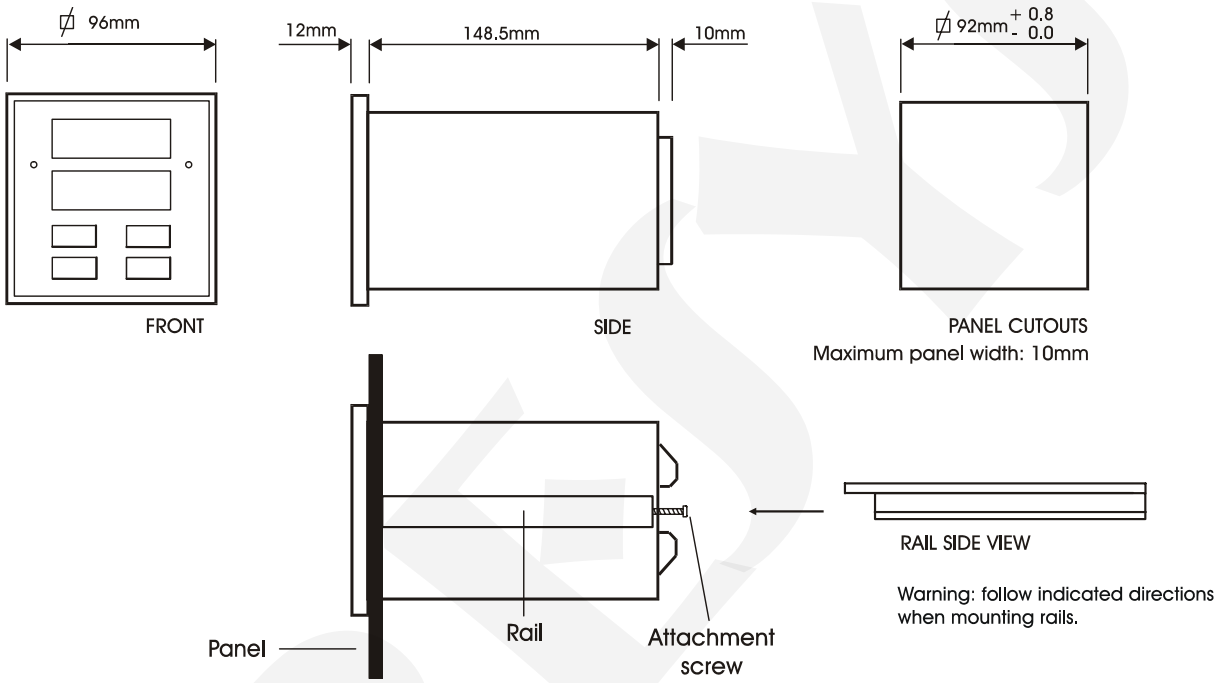


Figure 2 - Dimensional drawing, panel mounting cutout and side view

2.2 - Electrical Installation

DMY - 2017 Indicator may be powered by voltage between 90 and 240Vac or 130 to 340Vdc, any polarity. Remember that the internal circuit is powered whenever the instrument is connected to the external 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 to 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.

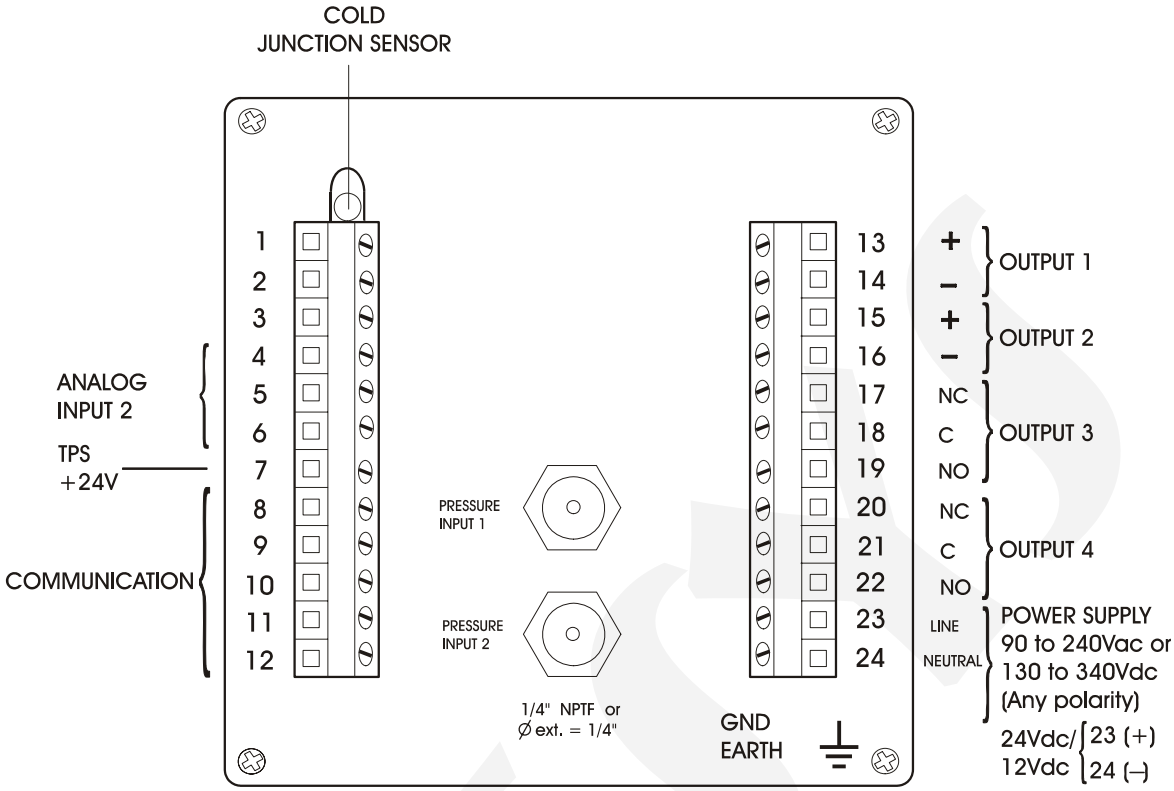


Figure 3 - Indicator Terminals

2.3 - Process Input Signal Connections.

Pressure inputs 1 and 2 (optional), shown in figure 3, require pneumatic / hydraulic connection with junction for 1/4” plastic tube for use with air or 1/4” NPTF for use with other fluids.

The single pressure version of the Indicator accepts connection to thermocouples, 2 or 3-wire RTDs, mA, mV or V. In order to know the input sensor types and spans refer to table 1, section 1.3 on Technical Specifications.

Each type of input sensor is enabled by means of internal jumpers (refer to section 4.2 on Hardware Configuration) and by the proper sensor selection in configuration mode (refer to section 3.2 on Configuration). Therefore, the connections explained below shall only become effective if the instrument hardware and software are correctly configured.

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 INDICATOR.

2.3.1 - Thermocouple Input

Connect the thermocouple to terminals 5 (+) and 6 (-) of input 2 as shown in figure 4.

Use appropriate compensating cables with the same material of the thermocouple in order to connect it to the instrument. Check if the thermocouple polarity is equal to those of the terminals.

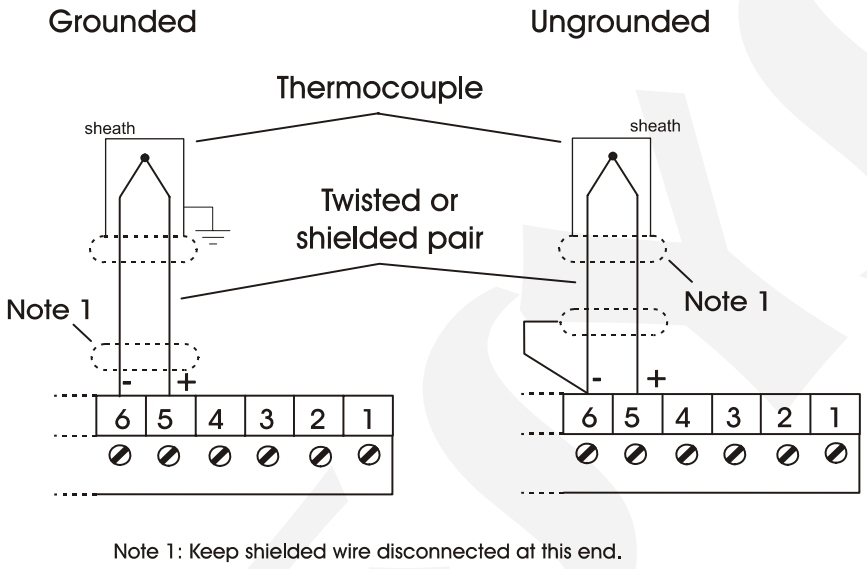


Figure 4 - Thermocouple Input

2.3.2 - RTD Input

An RTD input device may be a 2-wire, 3-wire or 4-wire RTD. All types of connection are shown in figure 5.

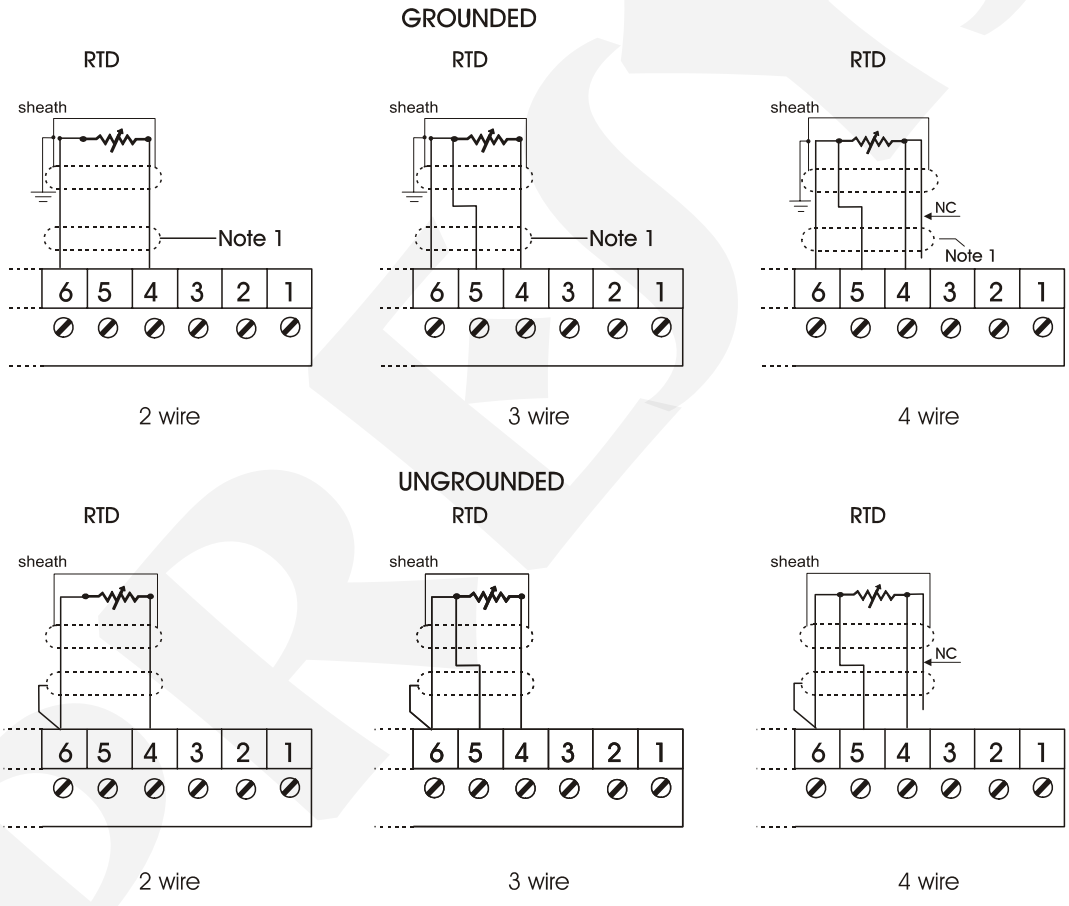
A 2-wire RTD is connected to terminals 4 and 6 as shown in figure 5.

A 3-wire RTD is connected in the same way as explained for a 2-wire RTD, adding the connection of the compensation wire to terminal 5 as shown in figure 5.

Connect a 4-wire RTD as indicated for a 3-wire RTD and keep its forth wire disconnected. See figure 5.

The use of a 3-wire RTD provides a better precision than a 2-wire RTD.

The RTD wiring should be of the same material, length and gauge to ensure proper resistance compensation on all terminal connections. The maximum connecting wire resistance is 10 Ω per wire. The minimum wire gauge should be 18 AWG for distances of up to 50 meters and 16 AWG for distances above 50 meters.

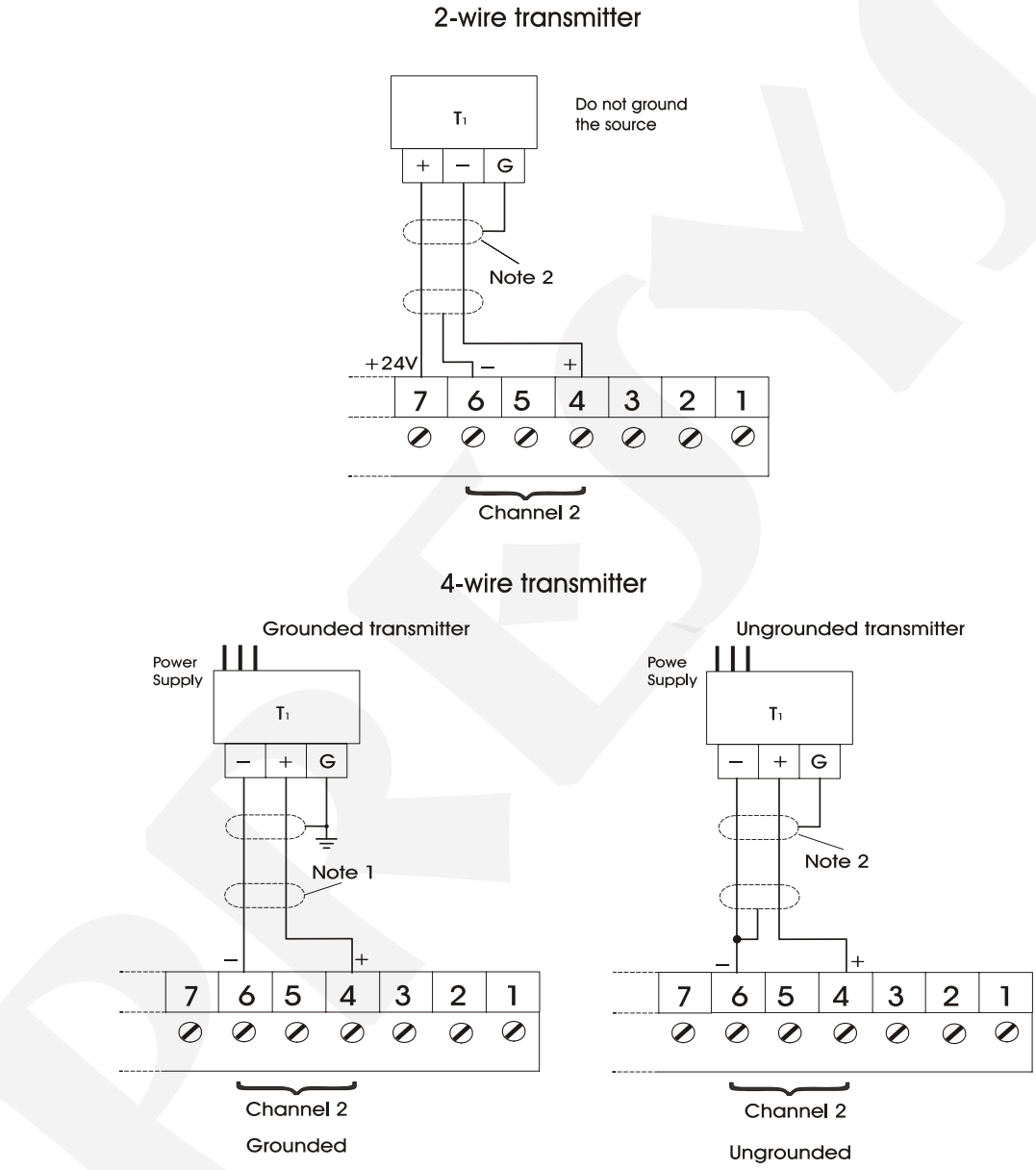


Note 1: Shield to be left unconnected at this end.

Figure 5 - RTD Input

2.3.3 - Milliampere Input

A current source of 4 to 20 mA must be applied to terminals 4(+) and 6(-) of input 2. The 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 Indicator to power a two-wire transmitter, the current is received only by terminal 4(+). Figure 6 shows both possibilities of connection.

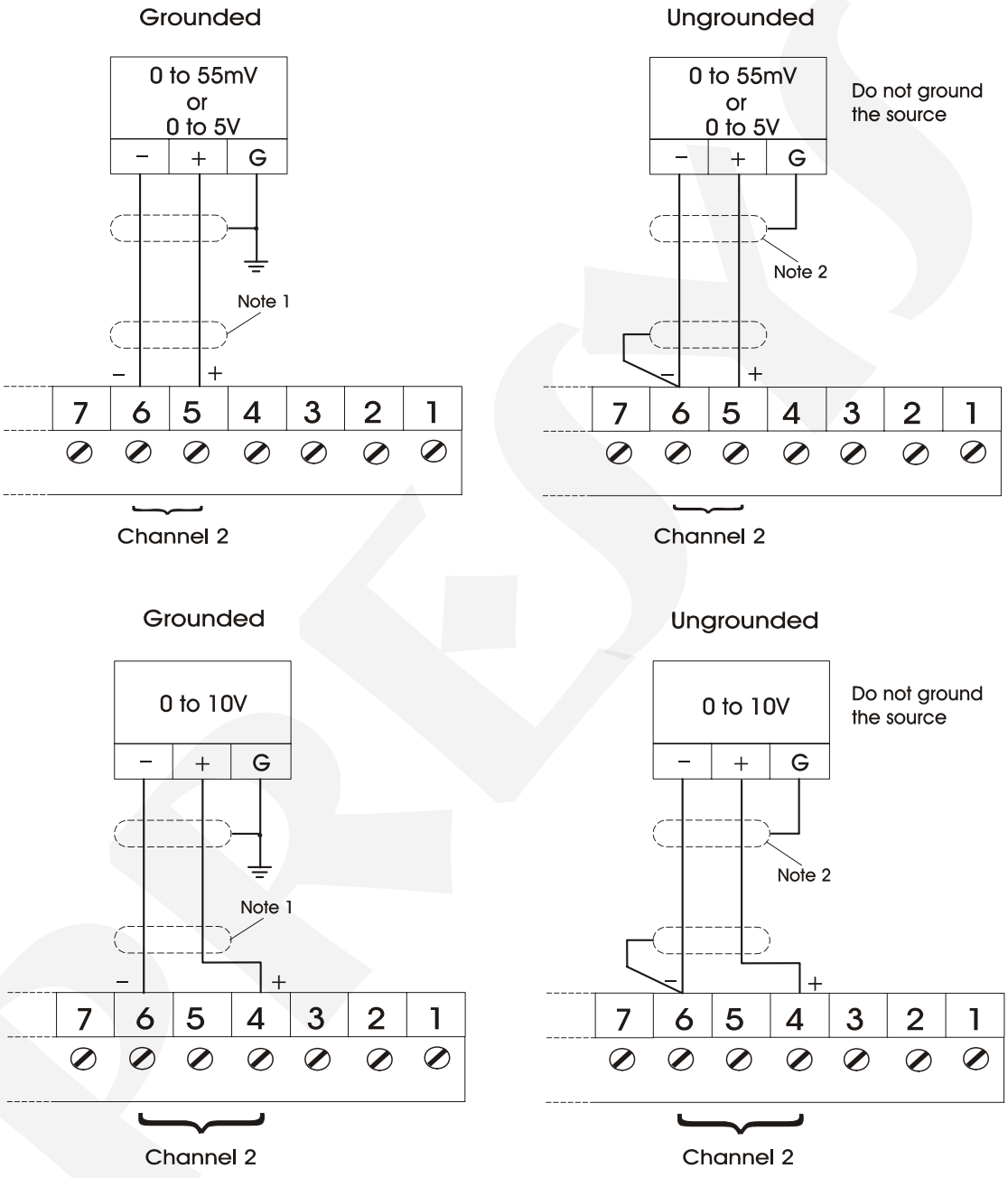


Note 1: Shield to be left unconnected at this end.
Note 2: Connect the shield wire to the transmitter ground. If there is no ground terminal, let the shield wire disconnected at this end.

Figure 6 - Milliampere Input

2.3.4 - Volt or Millivolt Input

Either a 0 to 55 mVDC or a 0 a 5 VDC voltage may be applied to terminals 5(+) and 6(-) of input 2. A 0 to 10 VDC voltage is applied to terminals 4(+) and 6(-) of input 2. The connections are shown in figure 7.



Note 1: shield to be left unconnected at this end.
Note 2: connect the shield wire to ground terminal.

Figure 7 - Volt or millivolt Input

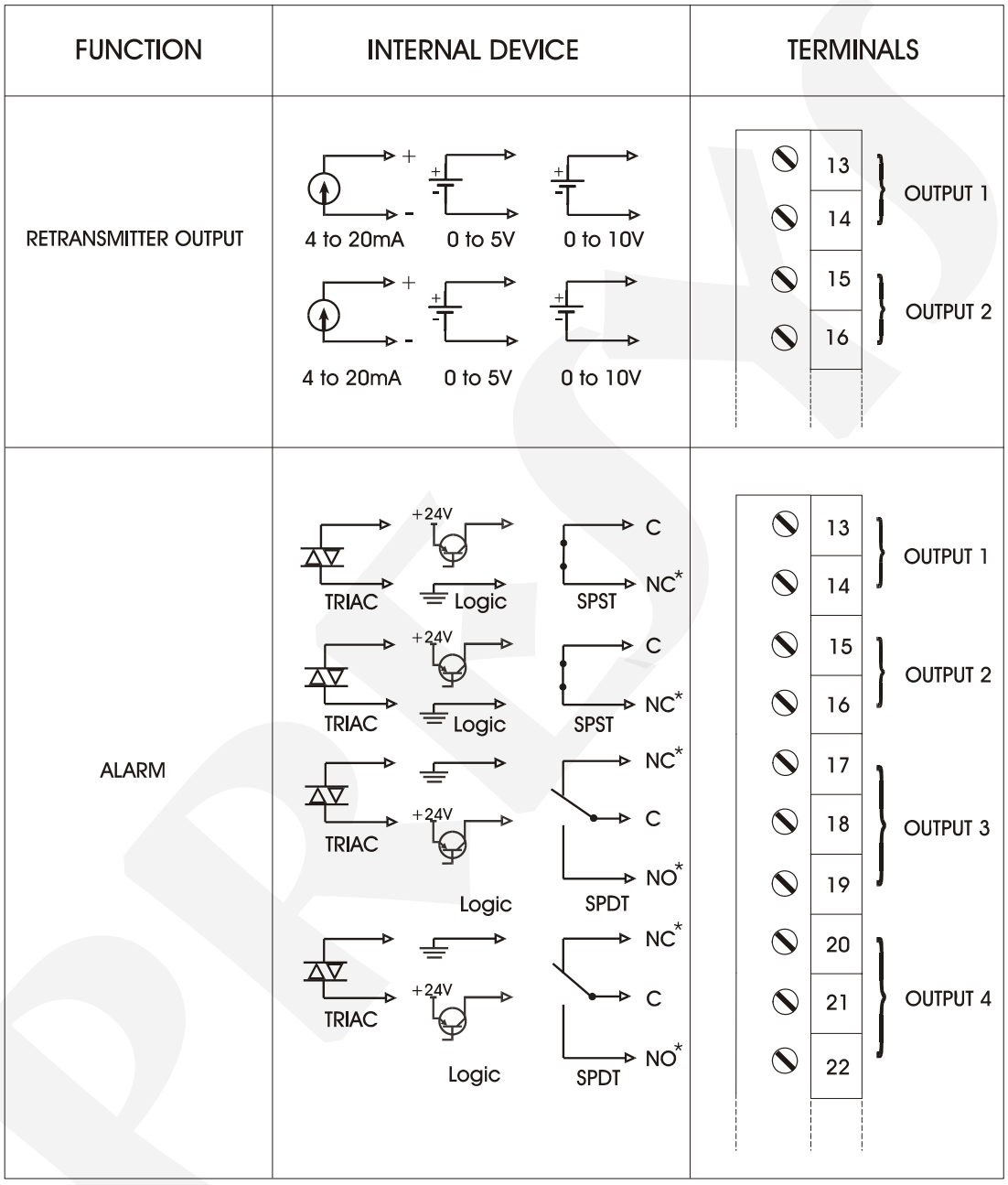
2.4 - Output Signal Connections

The Indicator can be provide with up to four output signals: output 1, output 2, output 3 and output 4. Outputs 1 and 2 are used as retransmitter or alarm outputs. Outputs 3 and 4 are used only as alarm outputs.

For outputs 1 and 2, there are six different types of outputs available: retransmitter (4 to 20mA, 0 to 5Vdc or 0 to 10Vdc), SPST relay, open collector voltage, and solid state relay.

For outputs 3 and 4, there are three different types of outputs: SPDT relay, open collector voltage, and solid state relay. Figure 8 shows the Indicator output types.

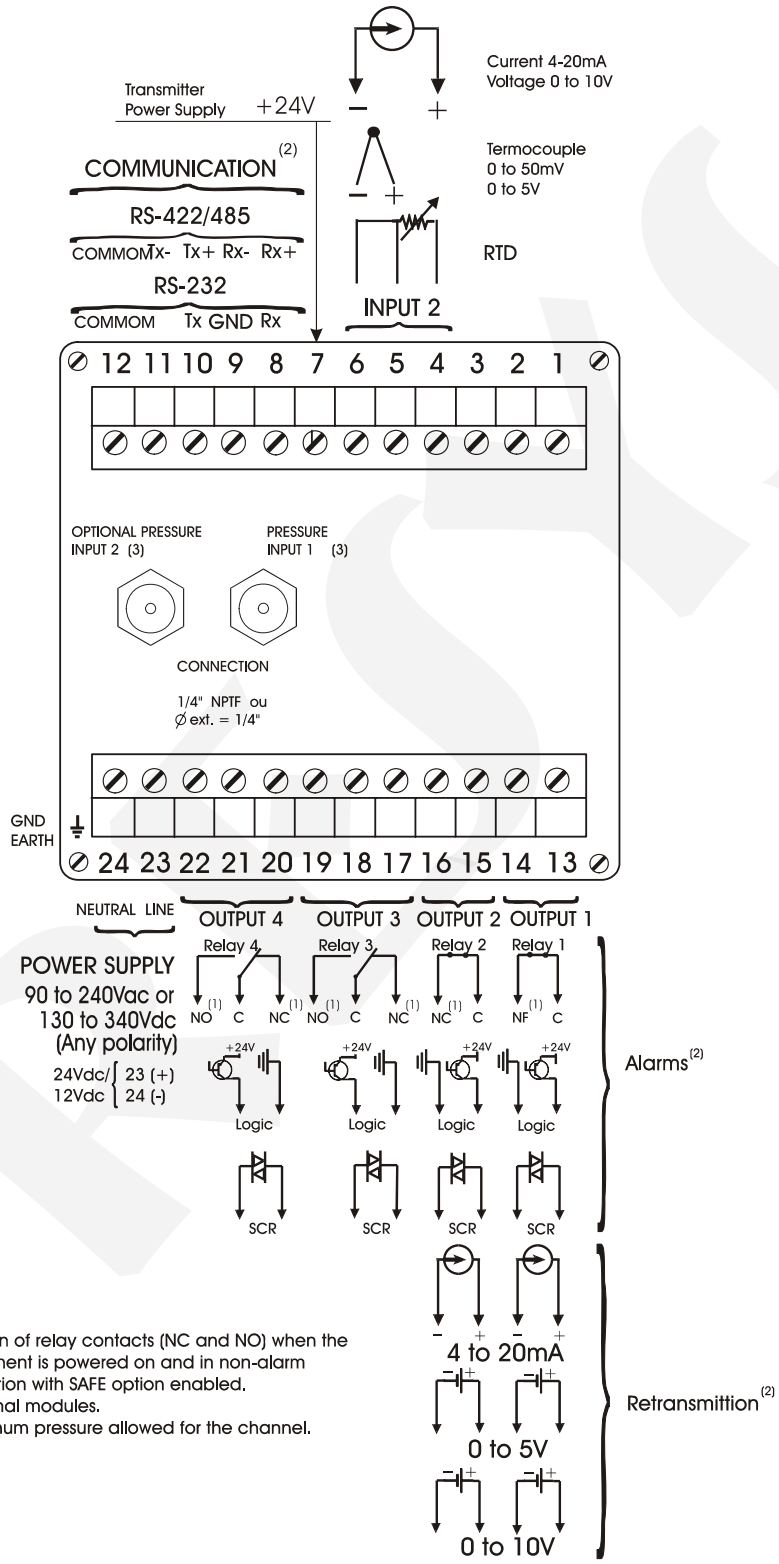
Note that the output terminals will present the corresponding signals only if the optional modules are installed and the output is correctly configured. For analog outputs, refer to section 3.2 on Configuration and section 4.3 on Optional Module Connection for details on installation and configuration 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.

Figure 8 - Output Connection

2.5 - Connection Diagrams



Note:
(1) Position of relay contacts (NC and NO) when the instrument is powered on and in non-alarm condition with SAFE option enabled.
(2) Optional modules.
(3) Maximum pressure allowed for the channel.

2.6 - Communication

DMY-2017 Indicator can communicate with computers through RS-232 or RS-422/485 using 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 Units

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

3 - Operation

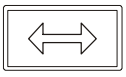
3.1 - Normal Operation

DMY-2017 dual indicator has two modes of operation: normal operation and configuration mode.

During normal operation, the Indicator monitors the two inputs, verifies alarm conditions and activates the four outputs if necessary.

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

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

ENTER	Key		Changes level zero to level 1 or asks for the password, when configured.
ACK	Key		Presents the alarm outputs which require acknowledgment to return to normal state (*).

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

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 9.

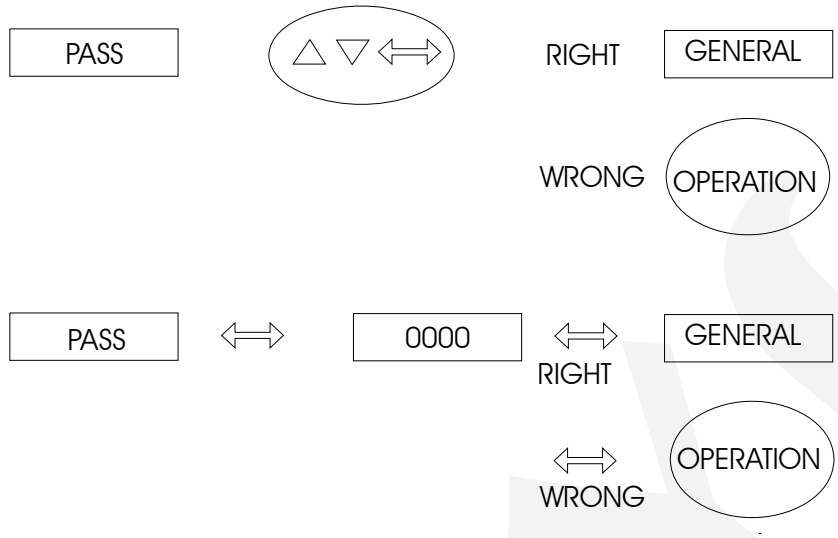


Figure 9 - Password through key sequence or value

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 0000 with the right end digit blinking. The position which is blinking indicates the digit 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 9).

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 2017. Note that the number 2017 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 Indicator 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

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 six hierarchical levels shown in figure 10.

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

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

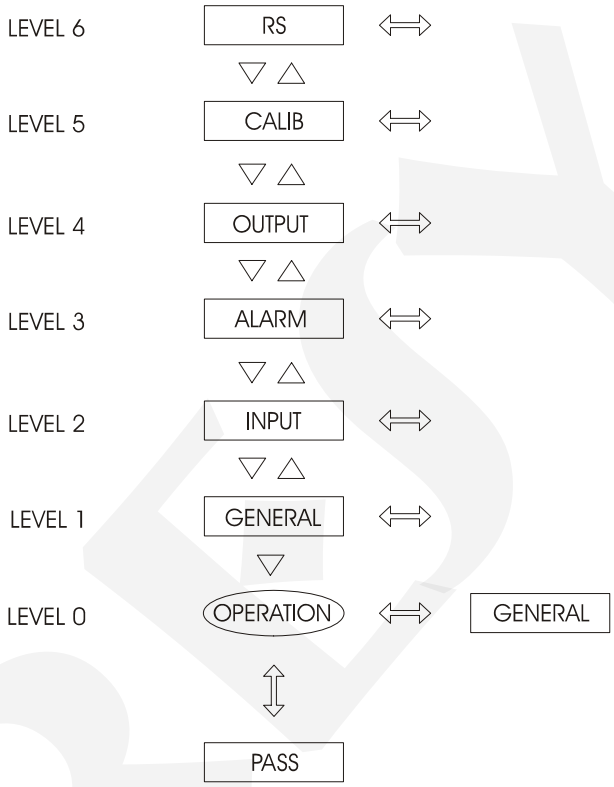


Figure 10 - Parameter levels diagram.

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.

Level 1 - General

Level 1 presents the options: TAG, SOFT and PASS (see figure 11).

TAG - consists in an alphanumeric 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 2017) or both. The correct key sequence is obtained by pressing the UP, DOWN and ENTER keys in this order.

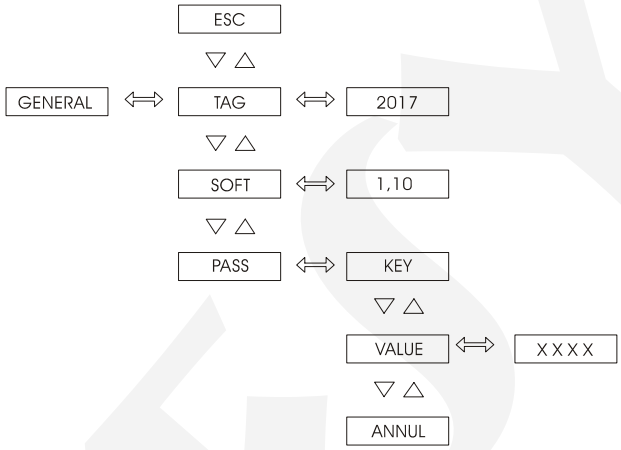


Figure 11 - GENERAL level options

The table below refers to the ranges of the parameters shown in figure 11.

Mnemonic	Parameter	Range	Factory Value	Units
TAG	instrument identification	————	2017	————
SOFT	software version	————	1.10	————
VALUE	user password	-999 to 9999	0	————

Level 2 - Input

The Input Level allows to enable or disable (by means of the option ANNUL) the type of sensor for channel 1 and 2. The type of sensor for channel 1 is always pressure. For channel 2, the type of sensor can be either pressure (in case the pressure sensor is installed) or a universal analog signal (terminals 4, 5 and 6). The channel 2 sensor type is configured in factory, according to the order code, or by the client.

There are three types of input signals: pressure, temperature (thermocouple or RTD) and the linear ones (0 to 55mV, 0 to 10V, 0 to 20mA) as shown in figure 12.

Input from 4 to 20mA belongs to option 20mA.
Input from 1 to 5Vdc belongs to option 5Vcc.

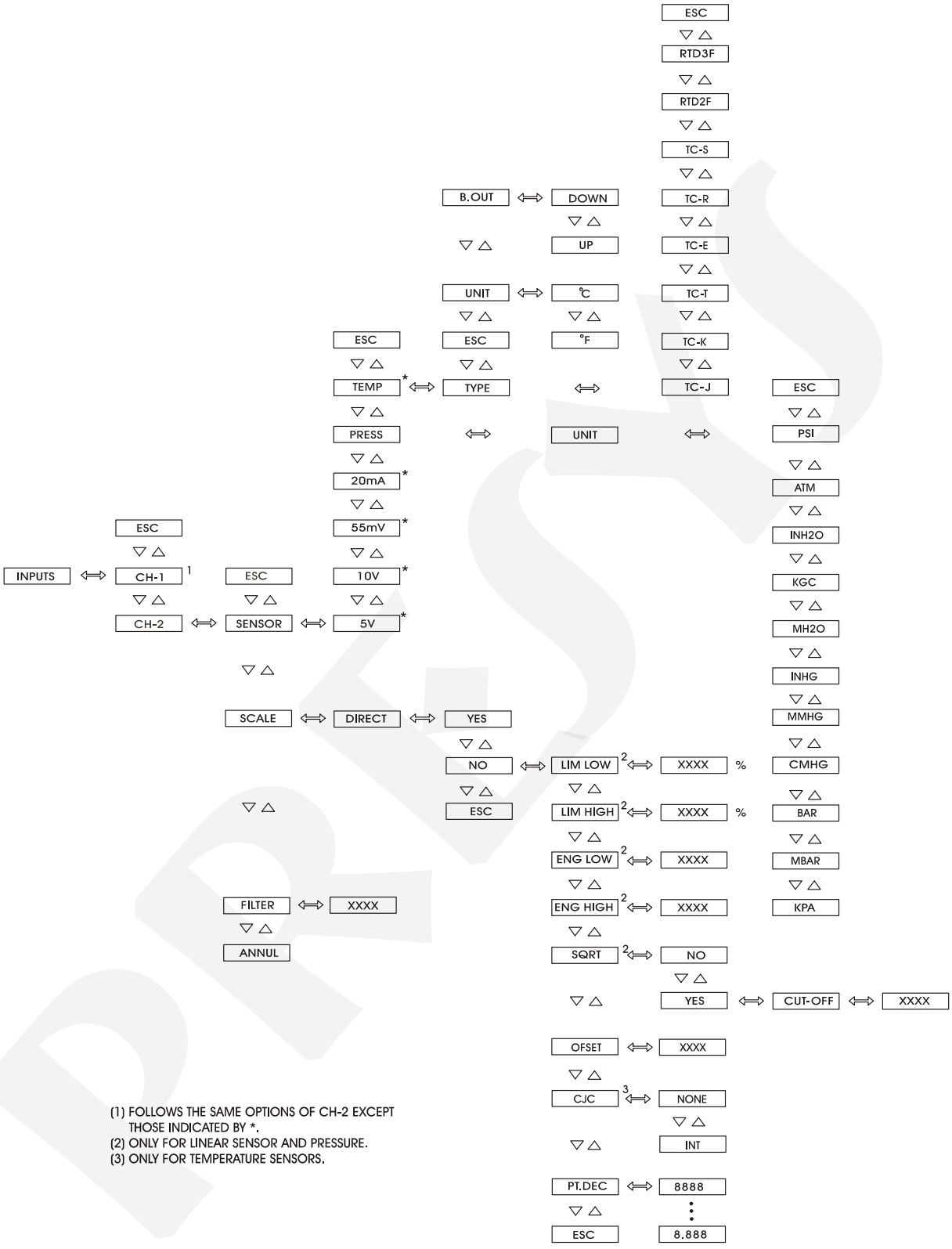


Figure 12 - INPUT level options

DIRECT - enables or disables the configuration of the pressure input range by the user. When option YES is selected, the display indication range is the natural range of the pressure sensor (for instance: 0 to 5.000 psi; 0 to 250.0 psi etc). In case of option NO, the display indication range corresponds to the range defined by the mnemonics LIM LOW, LIM HIGH, ENG LOW and ENG HIGH. For instance, in a process in which the pressure varies from 3 to 15 psi and the user requires indication from 0 to 100.0%, the configuration should be LIM LOW = 20.0%, LIM HIGH = 100.0%, ENG LOW = 0.0% and ENG HIGH = 100.0%. Note that LIM LOW and LIM HIGH are expressed as % of the sensor full scale (15 psi, in this case). Option NO applies to pressure input and to linear inputs.

UNIT - When the input sensor is pressure and the mnemonic DIRECT is configured to YES, this option allows the automatic conversion of the signal to the following pressure units: psi, atm, inH_2O, kgf/cm^2, mH_2O or mwc, inHg, mmHg, cmHg, bar, mbar and kPa. If configured to NO, this option has no influence on the engineering unit configured. This option also applies to temperature indication and selects °C or °F.

The table below refers to the ranges of the parameters shown in figure 12.

Mnemonic	Parameter	Range	Factory Value	Units
LIM LOW	input signal associated with Eng Low	0.0 to 100.0	0.0	%
LIM HIGH	input signal associated with Eng High	0.0 to 100.0	100.0	%
ENG LOW	display indication associated with Lim Low	-999 to 9999	0.0	EU*
ENG HIGH	display indication associated with Lim High	-999 to 9999	100.0	EU*
CUT-OFF	minimum value for square root	0 to 5	0	%
OFFSET	constant added to display indication	-999 to 9999	0	EU*
FILTER	time constant of 1st order digital filter	0.0 to 25.0	0.0	seconds

(*) EU - Engineering Unit.

When selecting a linear sensor one must configure its scale (SCALE option). Define two points P1 (Lim Low, Eng Low) and P2 (Lim High, Eng High), as illustrated in figure 13. Lim Low represents the value of the electrical signal given in % of full scale associated with the Eng Low indication on the display, and Lim High corresponds to the value of the electrical signal given in % of full scale associated with the Eng High indication on the display.

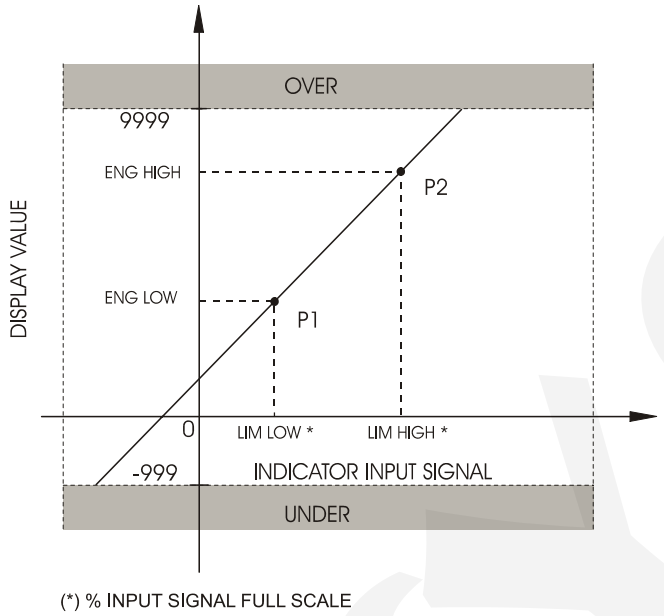


Figure 13 - Linear input configuration

SQRT - allows presenting on the display the squared root of a linear input signal. The Cut-Off parameter given in % of the input signal makes the input values below (Lim Low + Cut Off) be shown as Lim Low. See figure 14.

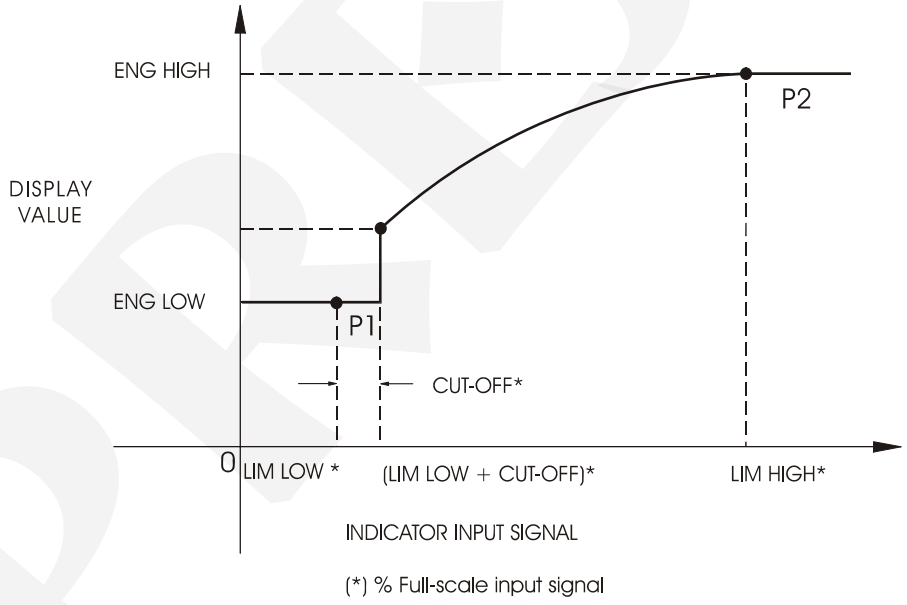


Figure 14 - Input signal square root

DEC.PT - sets the decimal point to exhibit the engineering units on the upper display. Up to three decimal places may be set for linear processes whereas temperature sensors may have one or no decimal place.

OFSET - allows the user to enter an off-set value in Engineering Units to be added to the measured variable. This parameter can be used to equalize measurements in different instruments.

CJC - cold junction compensation for thermocouples. Select INT for internal cold junction compensation; otherwise, select NO. Generally INT should be selected.

Input sensor types are described in table - 1 of section 1.3 on Technical Specifications.

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.

B.OUT - When temperature sensors break (thermocouple or RTD) or there are wires disconnected, the display indicates burn-out to the corresponding channel. In this case, choosing the UP option for this parameter activates the high-alarms and the DOWN option activates the low-alarms.

Level 3 - Alarm

The Indicator has up to seven alarm devices: four of them are the outputs 1, 2, 3 and 4 used as alarm outputs which are relay 1, relay 2, relay 3 and relay 4 (see figure 16). The other three devices are the couple of leds, LED 1 and LED 2, and the display which can operate independently from the relays. In this case, the INDEP option is selected. If the DEPEN option is selected for the leds and display, their operation is associated to that of the relays.

Each alarm module can perform up to four types of alarm: low alarm for channel 1, high alarm for channel 1, low alarm for channel 2 and high alarm for channel 2. When configuring the seven independent alarm devices for the indication, there are up to 28 setpoint alarms (SP) and their 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 alarms already configured. The mnemonics of alarm setpoints have a code which is explained through the two following examples:

1.H.r1 Channel 1 high-alarm setpoint associated to relay 1.

2.L.L1 Channel 2 low-alarm setpoint associated to led 1.

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 ACK 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 ACK key to return to operation mode.

DELAY - causes the relay to be activated only after a certain time interval defined by the user. Figure 15 below illustrates the delay operation for a high-alarm.

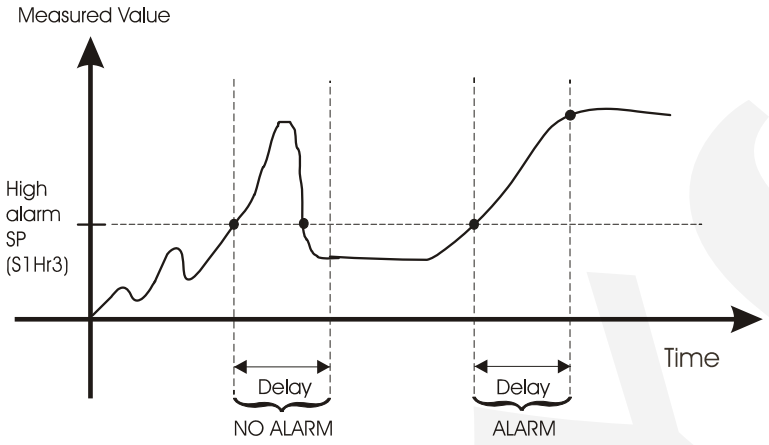


Fig. 15 - Relay with delay

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 in case of power failure.

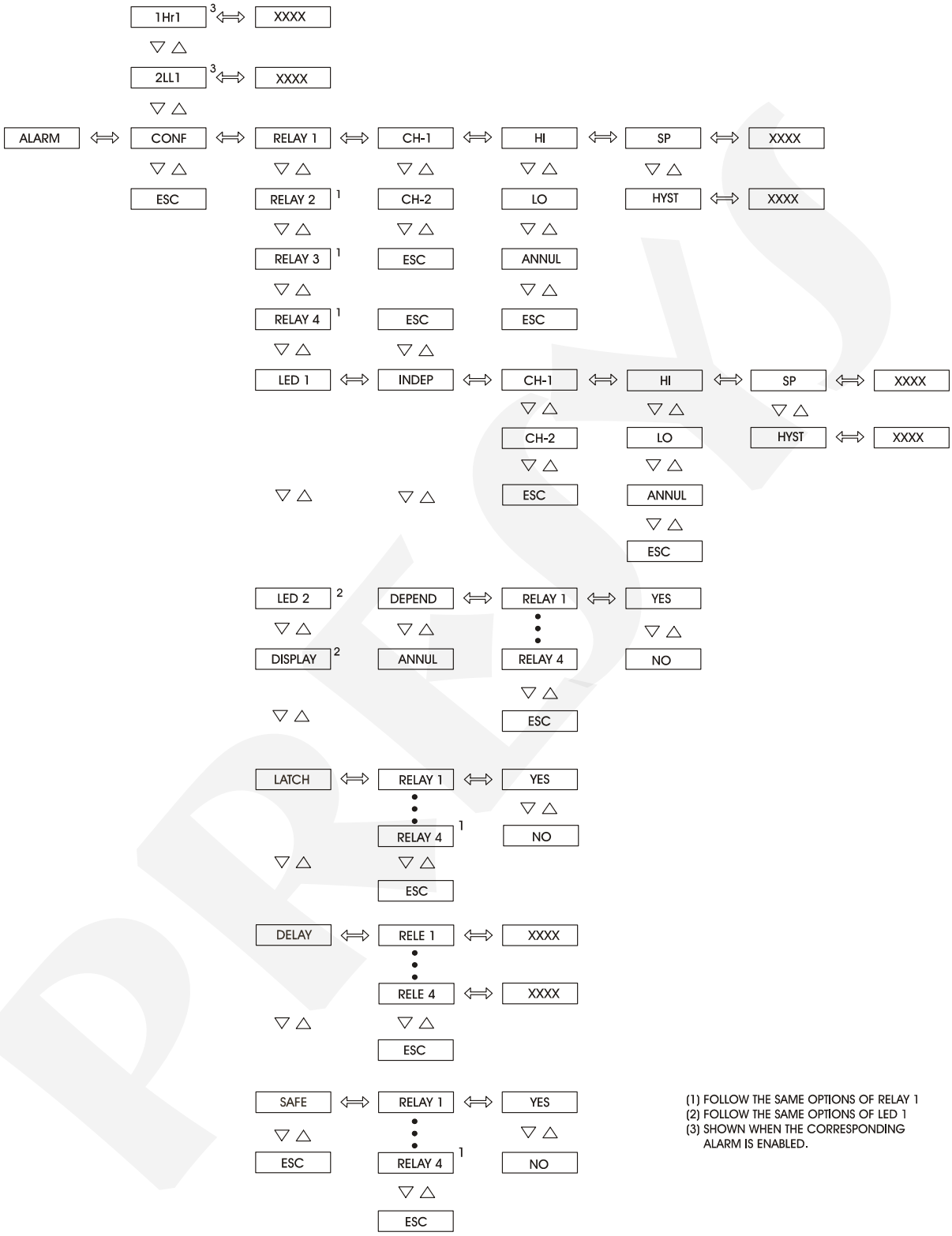


Figure 16 - ALARM Level Options

The table below refers to the ranges of the parameters shown in figure 16.

Mnemonic	Parameter	Range	Factory Value	Units
SP	high or low alarm setpoint	-999 to 9999	75.0	EU
HYST	alarm hysteresis	0 to 250	1.0	EU
DELAY	delay for activating the relay	0.0 to 999.9	0.0	seconds

Level 4 - Output

Level 4 allows the configuration of two analog outputs (Refer to figure 17).

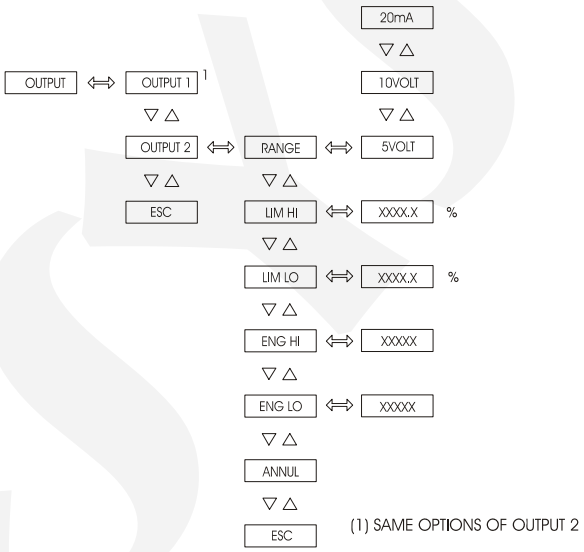


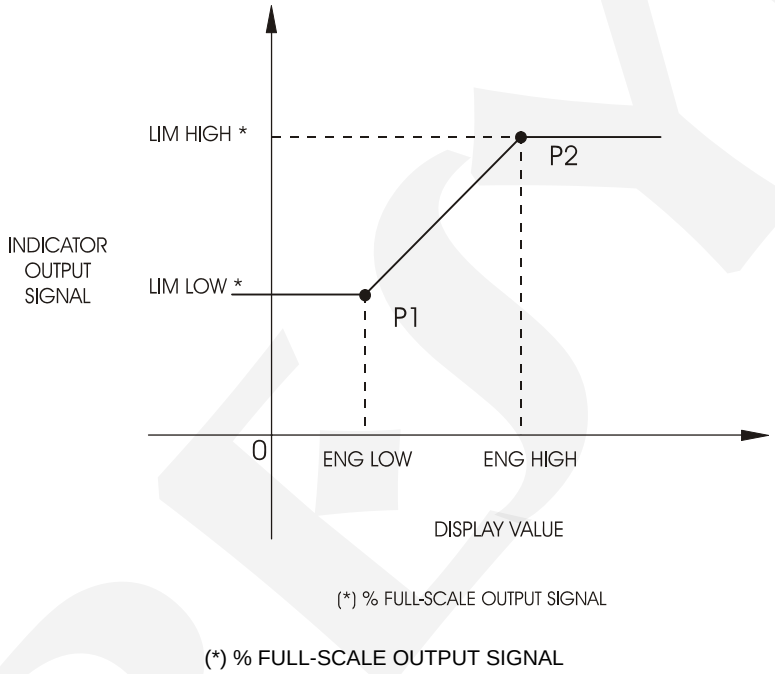
Figure 17 - OUTPUT level options

The table below shows the parameters of figure 17.

Mnemonic	Parameters	Range	Factory value	Unit
LIM LOW	output signal associated with Eng Low	0.0 to 100.0	0.0	%
LIM HIGH	output signal associated with Eng High	0.0 to 100.0	100.0	%
ENG LOW	display indication associated with Lim Low	-999 to 9999	0.0	EU
ENG HIGH	display indication associated with Lim High	-999 to 9999	100.0	EU

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

RANGE - selects the range of retransmission output as 20mA, 5V or 10V. The relation between the engineering unit and electric signal generated in the terminals is defined in the same way as shown for linear process scale configuration. Define two points P1 (Eng Low, Lim Low) and P2 (Eng High, Lim High) as it is illustrated in figure 18. Eng Low is the indication in the display in engineering units associated to the electric signal Lim Low, and Eng High is the indication in display in engineering units associated to the electric signal Lim High. Note that Lim Low and Lim High are defined in percentage of output range and that the output signal saturates in these points.



(*) % FULL-SCALE OUTPUT SIGNAL

Figure 18 - Analog output configuration

Level 5 - Calibration

Level 5 is described on section 4.5 on Calibration.

Level 6 - RS

Refer to the communication manual.

4 - Maintenance

4.1 - Indicator Hardware

The Indicator maintenance requires the user to have access to the hardware of the instrument. The Indicator 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 Indicator front-panel in order to remove the instrument from case.

The Display Board is located in the Indicator 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 Indicator 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 19.

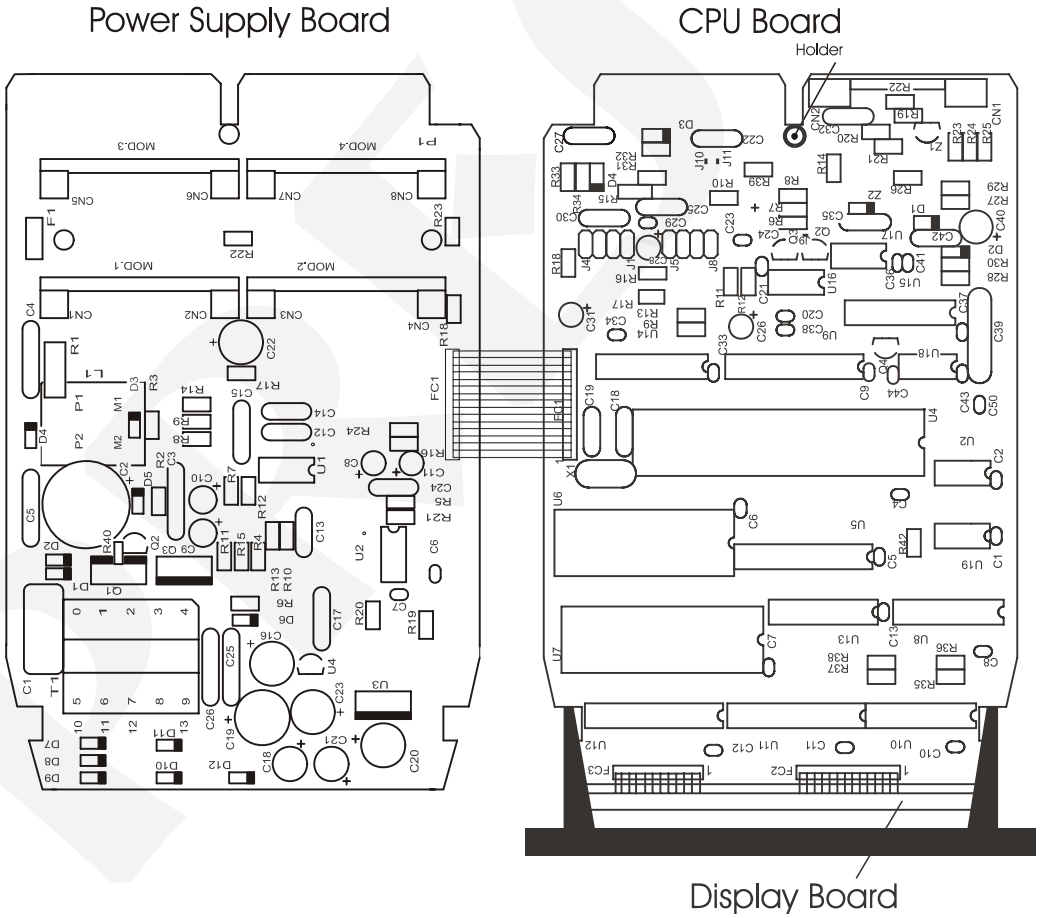


Figure 19 - Indicator hardware

4.2 - Hardware Configuration

This section applies only to the DMY-2017 indicators which do not have a pressure sensor installed in channel 2. In this case, this channel can be used as a universal analog input and must be configured as shown below.

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

There are four places for installation of jumpers for channel 2: J1, J2, J3 and J4. They are placed in the CPU Board as shown in figure 20.

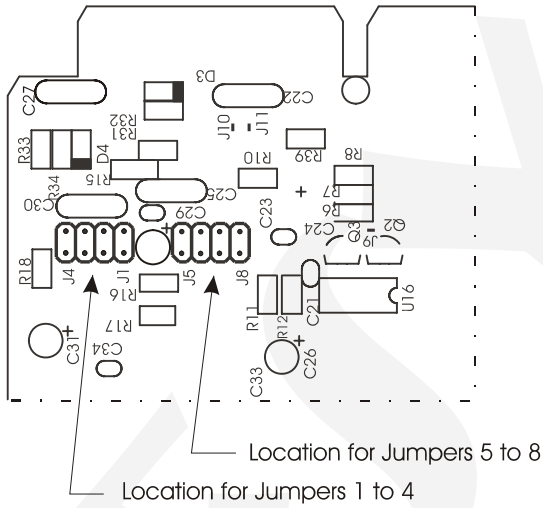


Figure 20 - Location of jumpers in CPU Board

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.

Input type	**Jumpers**			
	Channel 2			
Thermocouple	J1			J4
Voltage (0 to 55mV)	J1			J4
Voltage (0 to 5V)	J1			J4
Voltage (0 to 10V)*			J3	
2-wire or 3-wire RTD	J1	J2		
Current (0 to 20mA)			J3	J4

Table 2 - Jumpers for input type configuration

(*) For 0 to 10V input, the second jumper supplied by the factory must be kept by the user out of the instrument or placed on a connector as shown on Figure 21.

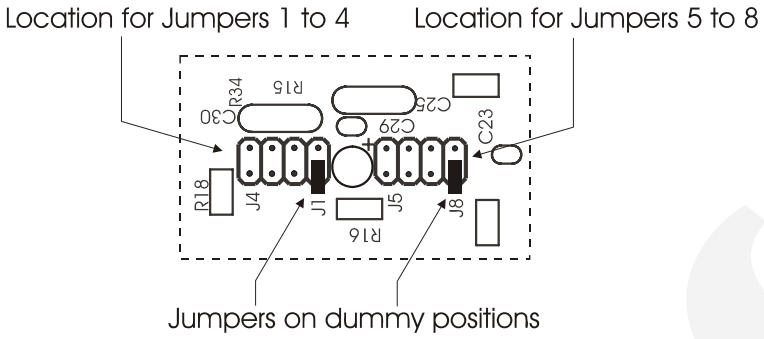


Figure 21 - Jumpers not used for 0 to 10V input placed in the board connector

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. Depending on the relay board version, the jumpers may be on the front or rear side.

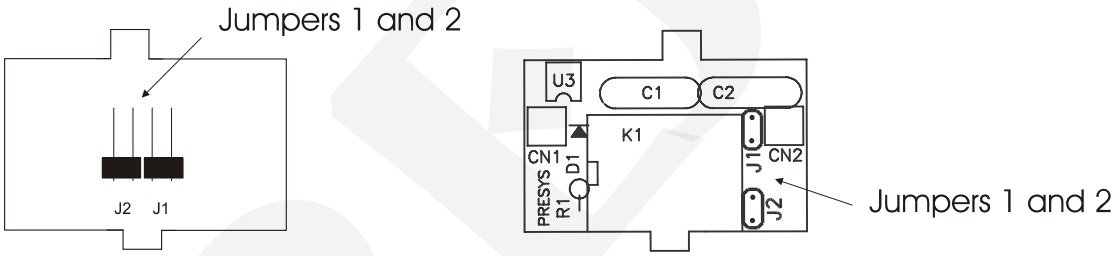


Fig. 22 - Jumpers for selection of snubbers on the relay board

Alarm and control relays are extremely critical in control and safety of industrial processes. 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.

4.4 - Optional Module Connection

DMY-2017 Indicator accepts up to five modules. Open the Indicator as shown in section 4.1 in order to access the positions of the four output modules in the Power Supply Board and the communication module in the CPU board. (Refer to Figure 23).

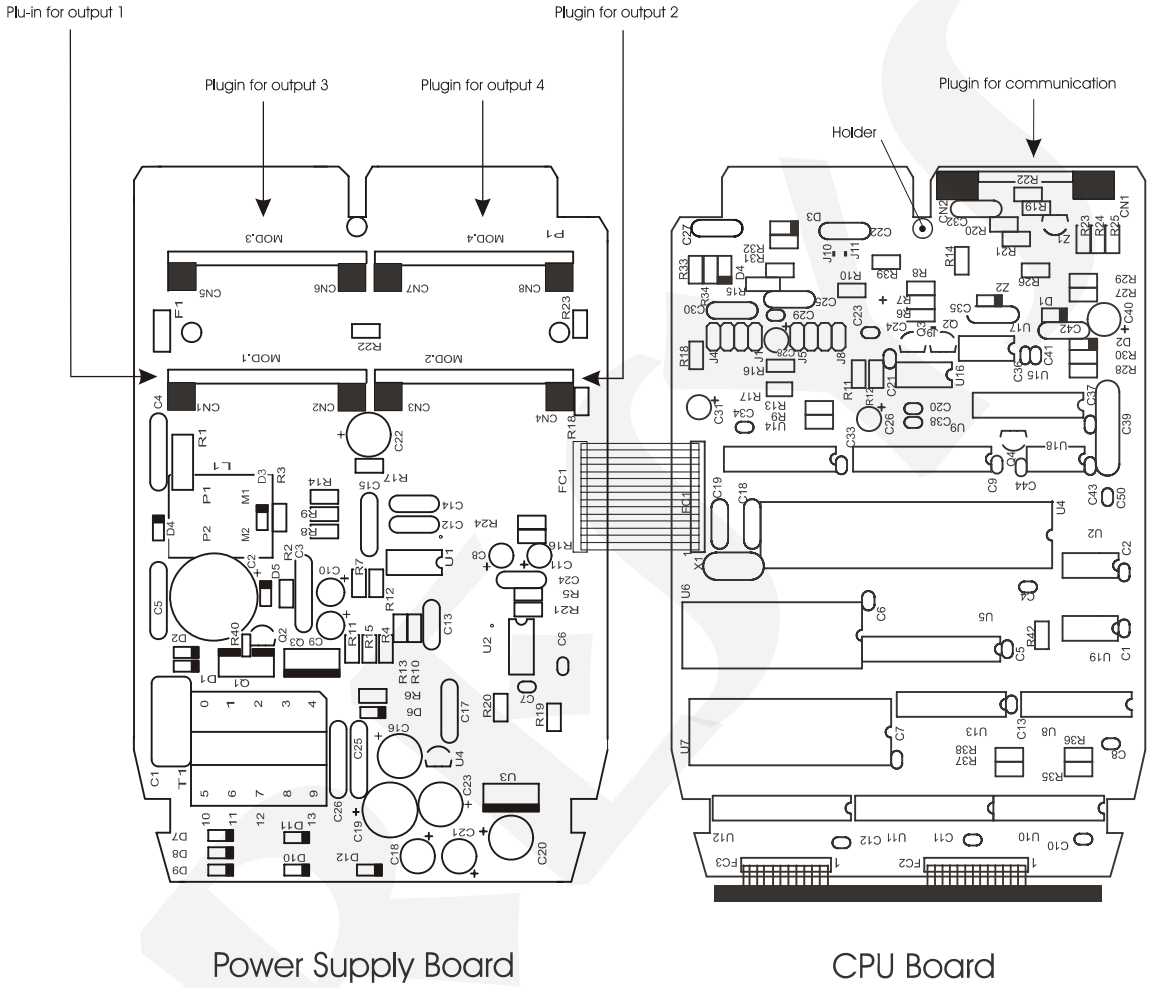


Figure 23 - Optional module connectors

The connectors in the Power Supply Board are called MOD 1, MOD 2, MOD 3 and MOD 4, and are associated, in this order, with output 1, output 2, output 3 and output 4 signals, in the Indicator 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 module must be always installed with the component side in the direction of the Display Board, as shown in figure 24.

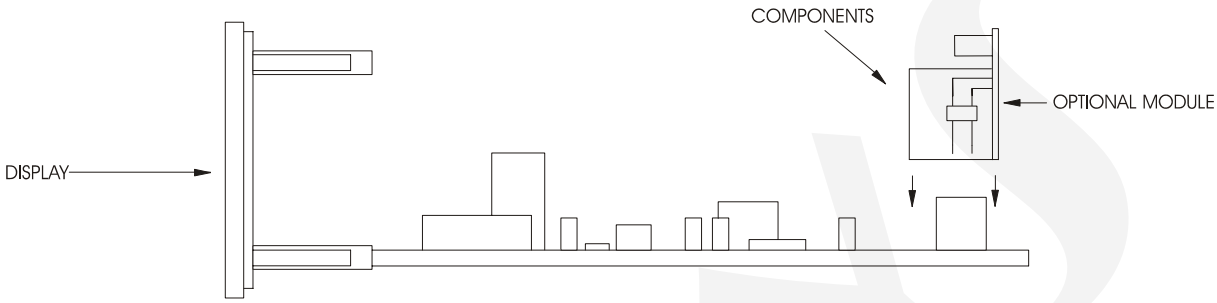


Figure 24 - Installation of optional modules

Outputs 1 and 2 as retransmitter outputs (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. If another retransmitter output is needed, connect the second module in the connector called MOD 2.

The output 1 retransmits the measured variable from input 1 while output 2 retransmits the measured variable from input 2.

The optional analog output module has two connectors for installation of jumpers: J1 and J 2, as shown in figure 25.

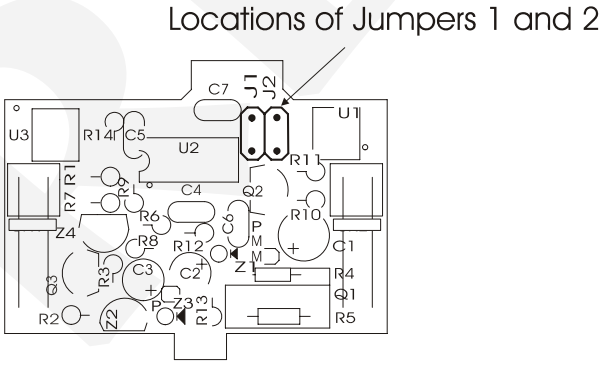


Figure 25 - Place of jumpers in analog output board

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.

Retransmission 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 21.

Outputs 1 and 2 as alarm outputs

If output 1 and output 2 are required to operate as alarms, connect the optional modules in the connectors called MOD 1 and MOD 2, respectively. The output type depends on the optional module installed in MOD 1 and MOD: 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

The outputs 3 and 4 operate as alarms when one connects the optional modules to connectors MOD 3 and MOD 4, respectively. There are three types of alarm outputs: SPDT relay, solid state relay and open collector voltage. The Alarm output type and the optional module correspondence are shown in the 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

DMY-2017 Indicator is accurately calibrated in factory and does not need periodic calibration in normal conditions. When calibration is required, follow the procedure below.

Disconnect the process signals of the 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 input 1 and input 2.

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

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 5 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 Indicator 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 26 shows input and output calibration options in level 5 of Calibration.

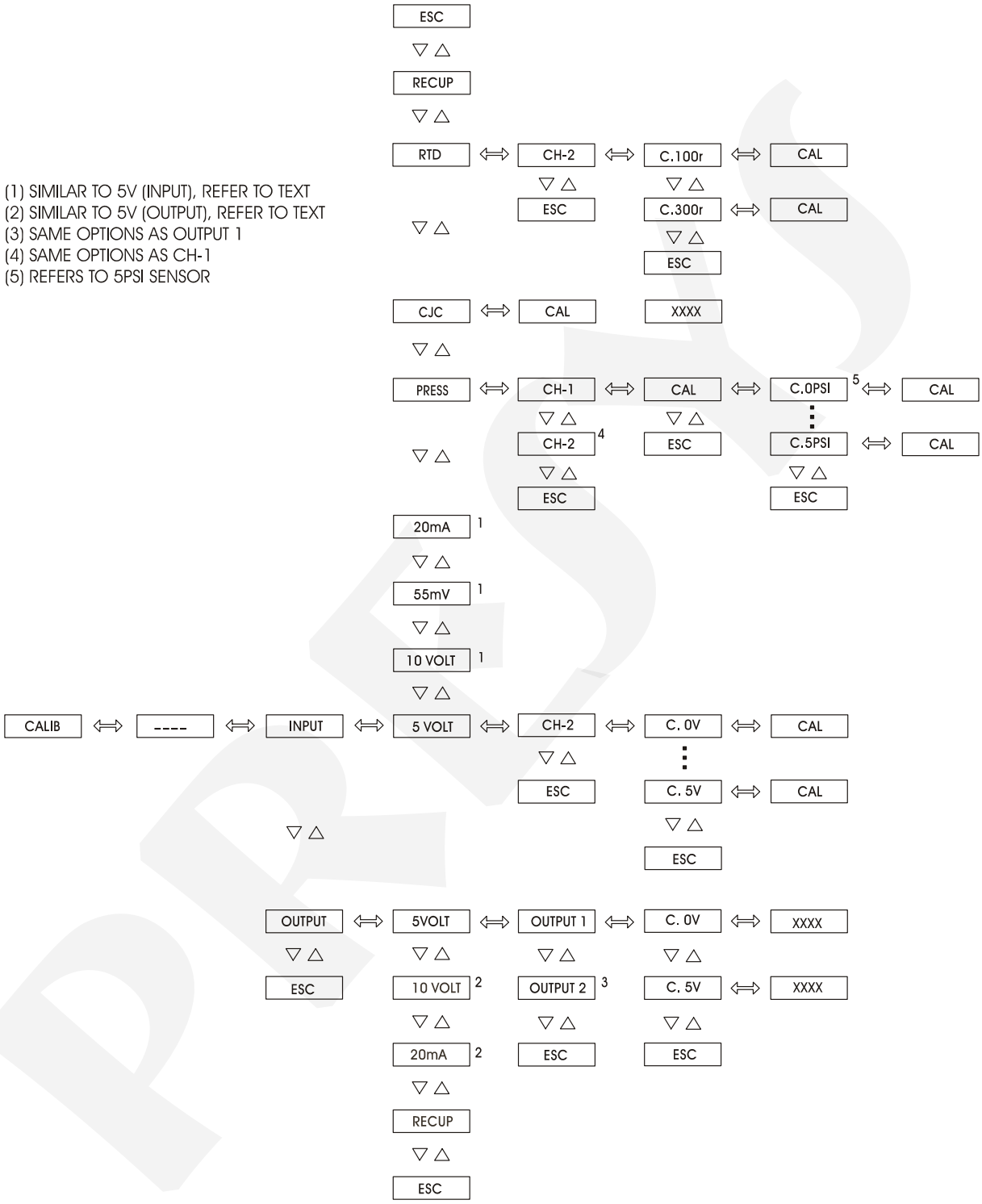


Figure 26 - CALIBRATION Level Options

Calibration of pressure input

To calibrate the pressure range, apply the proper pressure signal to the sensor to be calibrated.

Below are the references in psi / mmH_2O for each sensor range.

- Sensor 250 mmH_2O or 250 mmwc

Reference	Mnemonic
0.00 mmH_2O	0 mmH_2O
50.00 mmH_2O	50 mmH_2O
100.00 mmH_2O	100 mmH_2O
150.00 mmH_2O	150 mmH_2O
200.00 mmH_2O	200 mmH_2O
250.00 mmH_2O	250 mmH_2O

- Sensor 1 psi

Reference	Mnemonic
0.0000 psi	0psi
0.2000 psi	0.2psi
0.4000 psi	0.4psi
0.6000 psi	0.6psi
0.8000 psi	0.8psi
1.0000 psi	1.0psi

- Sensor 5 psi

Reference	Mnemonic
0.0000 psi	0psi
1.0000 psi	1psi
2.0000 psi	2psi
3.0000 psi	3psi
4.0000 psi	4psi
5.0000 psi	5psi

- Sensor 15 psi

Reference	Mnemonic
0.000 psi	0psi
3.000 psi	3psi
6.000 psi	6psi
9.000 psi	9psi
12.000 psi	12psi
15.000 psi	15psi

- Sensor 30 psi

Reference	Mnemonic
0.00 psi	0psi
6.00 psi	6psi
12.00 psi	12psi
18.00 psi	18psi
24.00 psi	24psi
30.00 psi	30psi

- Sensor 100 psi

Reference	Mnemonic
0.00 psi	0psi
20.00 psi	20psi
40.00 psi	40psi
60.00 psi	60psi
80.00 psi	80psi
100.00 psi	100psi

- Sensor 250 psi

Reference	Mnemonic
0.00 psi	0psi
50.00 psi	50psi
100.00 psi	100psi
150.00 psi	150psi
200.00 psi	200psi
250.00 psi	250psi

- Sensor 500 psi

Reference	Mnemonic
0.00 psi	0psi
100.00 psi	100psi
200.00 psi	200psi
300.00 psi	300psi
400.00 psi	400psi
500.00 psi	500psi

- Sensor 1000 psi

Reference	Mnemonic
0.0 psi	0psi
200.0 psi	200psi
400.0 psi	400psi
600.0 psi	600psi
800.0 psi	800psi
1000.0 psi	1000psi

- Sensor 3000 psi

Reference	Mnemonic
0.00 psi	0psi
600.00 psi	600psi
1200.00 psi	1200psi
1800.00 psi	1800psi
2400.00 psi	2400psi
3000.00 psi	3000psi

- Sensor 5000 psi

Reference	Mnemonic
0.00 psi	0psi
1000.00 psi	1000psi
2000.00 psi	2000psi
3000.00 psi	3000psi
4000.00 psi	4000psi
5000.00 psi	5000psi

Calibration of voltage input (0 to 55mV)

In a 0 to 55mV voltage input calibration connect a voltage source to channel 2 (terminals 5(+) and 6(-)). It is required 6 voltage references listed in table 6.

Reference	Mnemonic
0.000 mV	C. 0nV
10.000 mV	C.10nV
20.000 mV	C.20nV
30.000 mV	C.30nV
40.000 mV	C.40nV
50.000 mV	C.50nV

Table 6 - References for 0 to 55V input calibration

Calibration of voltage input (0 to 5V)

In a 0 to 5V voltage input calibration connect a voltage source to channel 2 (terminals 5(+) and 6(-)). It is required 6 voltage references listed in table 7.

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 7 - References for 0 to 5V input calibration

Calibration of voltage input (0 to 10V)

In a 0 to 10V voltage input calibration connect a voltage source to channel 2 (terminals 4(+) and 6(-)). It is required 6 voltage references listed in table 8.

Reference	Mnemonic
0.0000V	C. 0V
2.0000V	C. 2V
4.0000V	C. 4V
6.0000V	C. 6V
8.0000V	C. 8V
10.0000V	C.10V

Table 8 - References for 0 to 10V input calibration

Calibration of current input (0 to 20mA)

In a 0 to 20mA current input calibration connect a current source to the channel 2 (terminals 4(+) and 6(-)). It is required 6 current references listed in table 9.

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 9 - References for 0 to 20mA input calibration

Input Calibration in thermocouple

There are two steps for calibrating the thermocouple input. First, calibrate the 0 to 55mV input and the 0 to 5V input for channel 2 (terminals 5(+) and 6(-)) according to tables 6 and 7. Once the mV calibration is done, access the CJC mnemonic in the INPUT option of level 5 for cold junction calibration.

The CJC mnemonic corresponds to the cold junction temperature of the Indicator.

By pressing ENTER after the CJC mnemonic is reached the automatic calculation of the cold junction temperature starts. Meanwhile the CAL mnemonic blinks on the display.

After a few seconds, the program finishes the cold junction temperature calculation and the display presents its value given in °C.

This value is a first approximation of the cold junction temperature. The user must measure the temperature I/O terminals and correct the value presented by the program following the same procedure for entering parameter values as explained on section 3.2 of Configuration.

When these two steps are done the input calibration for any type of thermocouple is accomplished.

Then return to normal operation mode by moving back until level zero.

Calibration of 2 or 3-wire RTD input

In a 3-wire RTD input calibration connect precision resistances with the values listed in table 10 to channel 2 (between terminals 4 and 5 with 5 and 6 short-circuited).

When using a resistance decade, make sure the three connection wires must have the same gauge, material and length.

There is no procedure for a 2-wire RTD calibration. It is already accomplished by the 3-wire RTD calibration.

Reference	Mnemonic
100.000 Ω	C.100r
300.000 Ω	C.300r

Table 10 - Resistance references for 3-wire RTD input calibration

Output Calibration

For the output calibration, follow this procedure for retransmitter outputs 1 and 2.

The retransmitter output can be calibrated by using the Indicator input.

When the Indicator is used to read the signal, both outputs 1 and 2 are calibrated by the input 2 of the instrument.

The hardware configuration for the input must be the same chosen for the output (0 to 5V, 0 to 10V or 0 to 20mA) since the Indicator will measure the output signal. Therefore, check if the configurations of internal jumpers from the optional output module and from the CPU board correspond to the same input and output types.

Make sure that the input type to be used was calibrated previously.

Make the connections listed in table 11 according to the output and output type to be calibrated.

Output Type	Output 1 and Input 2	Output 2 and Input 2
current (0 to 20mA) voltage (0 to 10V)	terminal 13 (+) and 4 (+) terminal 14 (-) and 6 (-)	terminal 15 (+) and 4 (+) terminal 16 (-) and 6 (-)
voltage (0 to 5V)	terminal 13 (+) and 5 (+) terminal 14 (-) and 6 (-)	terminal 15 (+) and 5 (+) terminal 16 (-) and 6 (-)

Table 11 - I/O Terminal Connections for Output Calibration

Enter level 5 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 calibration point (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 Indicator 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 (see figure 26).

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

Enter level 5 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 Indicator.

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 occur when trying to assign a different configuration (analog output, or alarm) to an output already configured and enabled. In order to avoid this error, do not forget to disable relays 1 and 2 before enabling analog outputs 1 and 2 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 Indicator.

Verify the integrity of fuse F1 of 2.0 A placed in the Power Supply Board as shown in figure 19. 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 Indicator 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 27 are close to the values in table 12 and if they reach the CPU Board.

Test points on flat cable 1	Voltage
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 12 - Inspection points of voltage on flat cable 1

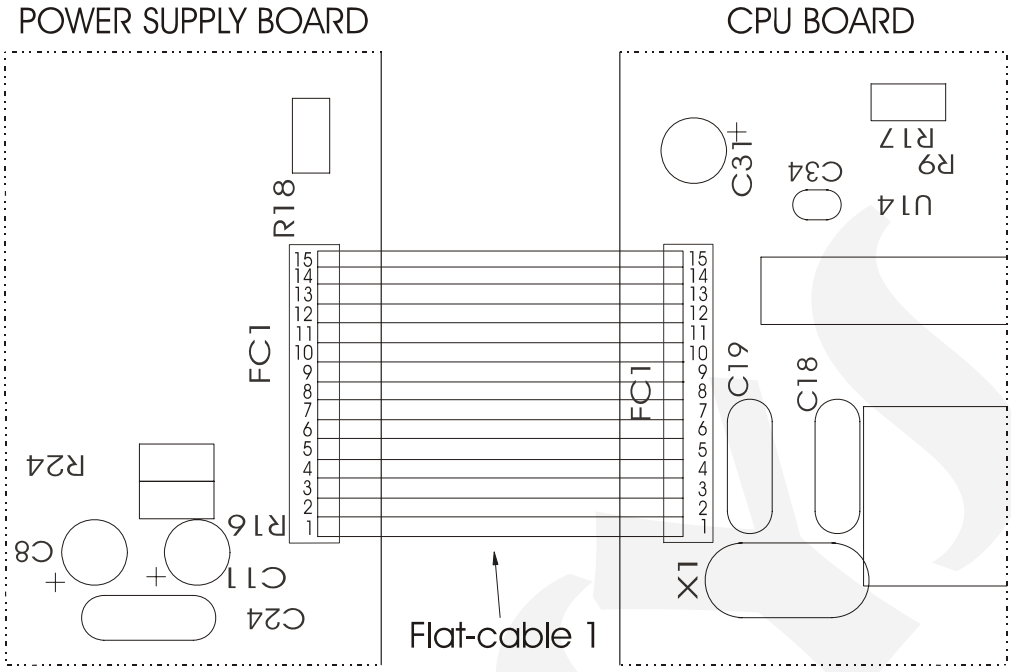


Figure 27 - Voltage test points of the Indicator

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

4.7 - List of components

Display Board

Code	Components	Reference
01.05.0050-20	Display Board - DMY-2017	----------
01.07.0002-21	Display 14mm	----------
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
01.15.0003-21	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	U3
01.01.0003-21	LM1458N	U2
01.01.0030-21	UC 3842	U1
01.09.0015-21	Transistor BC 337	Q2
01.09.0019-21	Transistor TIP 50	Q1
01.09.0020-21	IRF 822	Q3
01.02.0122-21	Fuse 2A	F1
01.01.0028-21	78L24	U4
01.04.0007-21	Diode 1N4007	D1,2,3,4
01.04.0008-21	Diode 1N4936	D5,6,7,8,9,10,11,12

01.03.0009-21	Ceramic Disc Capacitor 100 pF x 100V	C12,13,14
01.03.0036-21	Ceramic Multilayer Capacitor 0.01µF x 63V	C24
01.03.0035-21	Ceramic Multilayer Capacitor 0.1µF x 63V	C6,7
01.03.0039-21	Polyester Capacitor 0.1 µF x 250 V	C1,3
01.03.0022-21	Polyester Capacitor 0.01 µF x 100 V	C15,17
01.03.0041-21	Polyester Capacitor 0.01 µF x 250 V	C4,5
01.03.0038-21	Radial Electrolytic Capacitor 10 µF x 16 V	C8,11
01.03.0042-21	Radial Electrolytic Capacitor 22 µF x 25 V	C9,10
01.03.0027-21	Radial Electrolytic Capacitor 100 µF x 25 V	C18,21
01.03.0043-21	Radial Electrolytic Capacitor 100 µF x 35 V	C16,22
01.03.0044-21	Radial Electrolytic Capacitor 220 µF x 10 V	C20,23
01.03.0045-21	Radial Electrolytic Capacitor 22 µF x 350 V	C2
01.03.0002-21	Radial Electrolytic Capacitor 1000µF x 16V	C19
01.03.0068-21	Polyester Capacitor 4n7 x 400V	C25,26
01.02.0105-21	Resistor 18R x 2W	R1
01.02.0111-21	Resistor 1R 5%	R15
01.02.0126-21	Resistor 220R 5%	R10
01.02.0114-21	Resistor 270R 5%	R4
01.02.0074-21	Resistor 470R 5%	R17,18,22,23
01.02.0075-21	Resistor 1K 5%	R16,24
01.02.0080-21	Resistor 4K7 5%	R8,12
01.02.0082-21	Resistor 10K 5%	R5,20,21
01.02.0116-21	Resistor 18K 5%	R7
01.02.0083-21	Resistor 20K 5%	R11
01.02.0110-21	Resistor 27K 5%	R14
01.02.0085-21	Resistor 47K 5%	R3
01.02.0106-21	Resistor 150K 5%	R9
01.02.0088-21	Resistor 470K 5%	R2
01.02.0006-21	Resistor 20R 1%	R6
Code	Components	Reference
01.02.0183-21	Resistor 2K32 1%	R13
01.02.0108-21	Resistor 15K4 1%	R19
01.06.0003-21	Transformer 110/220Vac	T1
01.06.0004-21	Coil	L1
01.13.0004-21	Connector	CN1,2,3,4,5,6,7,8

CPU Board

Code	Components	Reference
01.05.0080-20	CPU Board	----------
01.01.0007-21	LM 311	U18
01.01.0016-21	EPROM 27C512	U7
01.01.0017-21	RAM 6516	U6
01.01.0044-21	E2PROM X25C43	U19
01.01.0034-21	NVRAM X24C45P	U2
01.01.0019-21	4051	U14
01.01.0020-21	TC-4053	U15
01.01.0021-21	74HC02	U13
01.01.0022-21	74HC138	U8
01.01.0023-21	74HC365	U10
01.01.0024-21	74HC373	U5,9,11,12
01.01.0045-21	80C32	U4
01.01.0026-21	AD 706	U16
01.01.0027-21	AD 712 JN	U17
01.16.0001-11	Crystal 11.0592 MHz	X1
01.09.0013-21	Transistor BC 327	Q4
01.04.0003-21	Diode 1N4148	D1,2

01.04.0005-21	Reference Diode LM336/5V	Z1
01.04.0006-21	Zener BZX 79/C6V2	Z2
01.03.0067-21	Ceramic Disc Capacitor 56pF x 50 V (4 mm)	C18,19
01.03.0035-21	Ceramic Multilayer Capacitor 0.1µF x 63V	C1,4,5,6,7,8,9,10,11,12, C13,20,21,22,24,25,27, C29,30,32,33,34,35,36, C37,38,41,42,43,44
01.03.0039-21	Polyester Capacitor J(5%) 0.1 µF x 250 V	C39
01.03.0038-21	Radial Electrolytic Capacitor 10µF x 16 V	C28,23,26,31
01.03.0027-21	Radial Electrolytic Capacitor 100µF x 25 V	C40
01.02.0103-21	Resistor 68R1 1%	R24
01.02.0010-21	Resistor 100R 1%	R21,29
01.02.0013-21	Resistor 249R 1%	R32,34
01.02.0102-21	Resistor 442R 1%	R23
01.02.0019-21	Resistor 1K 1%	R6
01.02.0104-21	Resistor 3K32 1%	R25
01.02.0030-21	Resistor 4K42 1%	R8,9
01.02.0031-21	Resistor 4K99 1%	R7
01.02.0036-21	Resistor 8K66 1%	R28
01.02.0038-21	Resistor 10K 1%	R20,39
01.02.0046-21	Resistor 40K2 1%	R26
01.02.0075-21	Resistor 1K 5%	R19,22,30
01.02.0078-21	Resistor 2K 5%	R27
01.02.0082-21	Resistor 10K 5%	R10,13,15,18,35,36,37,38
01.02.0119-21	Resistor 15K 5%	R42
01.02.0089-21	Resistor 1M 5%	R11,12,16,17
01.02.0098-21	Resistor 10M 5%	R31,33
01.17.0002-21	Jumper	----------
01.17.0003-21	Right Angle Pitch Header 2x4	J1-J4, J5-J8
01.13.0043-21	DIP socket	U7
01.13.0005-21	Connector	CN1,2
Code	Components	Reference
01.14.0029-21	Flat Cable 12 wires	FC3
01.14.0030-21	Flat Cable 13 wires	FC2
01.14.0010-21	Flat Cable 15 wires	FC1

I/O Terminal Board

Code	Components	Reference
01.05.0061-20	I/O Terminal Board	----------
01.01.0026-21	AD 706	U2,3
01.09.0015-21	BC 337	Q1
01.04.0005-21	Reference Diode LM336/5V	D1
01.04.0005-21	Zener Diode BZX 79C11	D2
01.03.0035-21	Ceramic Multilayer Capacitor 0,1µF x 63 V	C3,5,7,9
01.03.0011-21	Ceramic Multilayer Capacitor 220pF x 63V	C1,2,12,13,15
01.03.0037-21	Polyester Capacitor 0.1 µF x 100 V	C4,6,8,10,11
01.02.0017-21	Resistor 619R 1%	R18,28
01.02.0019-21	Resistor 1K 1%	R3,4,12
01.02.0029-21	Resistor 4K02 1%	R9
01.02.0043-21	Resistor 20K 1%	R10,11,23,24
01.02.0069-21	Resistor 1M 1%	R2,13,17,25
01.13.0002-21	Terminal Block	CN1,2,3
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	Tantalo 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	Connector 180º 2x2	J 1,2
01.17.0004-21	Connector 90º 2x2	CN 1,2
01.17.0002-21	Jumper	----------
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	U3
01.04.0001-21	Diode 1N4002	D1
01.03.0039-21	Polyester Capacitor 0.1 μF x 250 V	C1,2
01.02.0114-21	Resistor 270R 5%	R1
01.02.0072-21	Resistor 100R 5%	R2
01.12.0001-21	Relay 24 V	K1
01.17.0004-21	Connector 90º 2x2	CN3,4

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

I/O Terminal Board

BC 337	U1

CPU Board

4051	U14
4053	U15
Reference diode LM336/5V	Z1

Engineering Units Label
Code 02.10.0003.21

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