PRESYS®

Universal Smart Transmitter

TY-2090 **Energy**

TECHNICAL MANUAL

EM0319-00

CAUTION!

In case of failure, the instrument can provide AC voltage levels in its metal box, which for safety reasons must always be connected to an effective ground point. To this end a suitable terminal is provided on the back of the box identified as GND. Never connect this terminal to the neutral terminal of power supply.

It is recommended the use of an external fuse (2 A) on the power input of the instrument. There is an internal fuse.

Operation of relays - Important Note!

When the instrument has relay module for alarm or control, you must follow the instructions in this manual in the maintenance section on the snubber use.

The snubber is a protection against noise coming from the opening / closing of the relay contacts, but depending on the application may be necessary to remove this snubber!

CAUTION!

The instrument described in this manual is a device for use in specialized technical area. The user is responsible for configuration and selection of values of the instrument parameters. The manufacturer warns of the risks of occurrences with damage to both the person and the property resulting from the incorrect use of the instrument. The information and specifications in this manual are subject to change without previous notice.

Table of Contents

1.0 - Introduction

1.1 - Description

The TY-2090-Energy transmitter is ideal for security applications in turbines, hydroelectric plants and thermoelectric generators. It is a microprocessor-based instrument which receives any process variable found in industrial plants such as: temperature, pressure, flow, level etc. It has a non-volatile internal memory (E2PROM) for storing calibration values.

It can communicate with a computer through an optional RS-232 or RS-422/485 Communication Module.

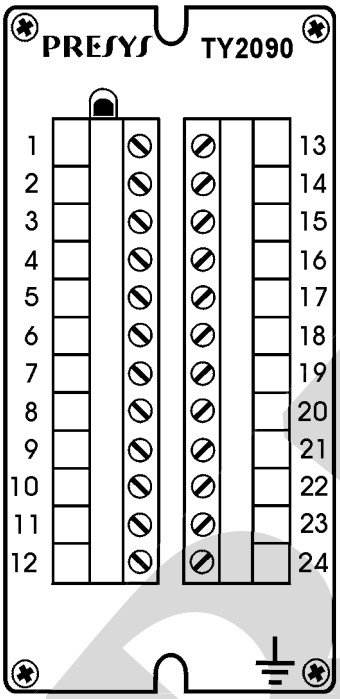


Fig. 1 - Front view of the TY-2090-Energy Transmitter

The Transmitter is capable of monitoring two universal standard inputs, accepting direct connection of thermocouples, RTDs, current (mAdc) and voltage (mVdc, Vdc). The RTD inputs are automatically linearized by means of tables stored in the EPROM. A 24 Vdc power supply, isolated from the output and with short circuit protection, is provided to power up standard field two-wire instruments.

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

Designed within the concept of modularity, the transmitter accepts up to 4 output cards. The possible output types are analog, SPDT relay, SPST relay, solid-state relay and open collection voltage.

In case of input sensor breaking, the trip alarms are not triggered (configurable for 4-20 mA and RTD inputs) and the analog outputs assume preconfigured safety values. The alarm outputs can be independently configured to work in latch mode, demanding the acknowledgement by the operator through the MCY-20 configurator keys or via communication in order to be disabled after the return of the process variable to the normal condition. The outputs are electrically isolated from the inputs. In addition to the high and low alarms, the transmitter can be set for failure alarms (watchdog) triggered by the detection of broken sensors connected to the current or RTD inputs.

It allows the use of a universal power supply from 75 to 264 Vac 50/60Hz or 100 to 360 Vdc (any polarity).

The instrument has an extruded aluminum case which makes it highly immune to electrical noise, electromagnetic interference and resistant to the most severe conditions of industrial usage.

1.2 - Order Code

TY - 2090 - ____ - ____ - ____ - ____ - ____ - ____ - ____ - E
A B C D E F G H

Field A	Output 1 (Retransmission or Alarm)
0	None
1	4 to 20 mAdc
2	1 to 5 Vdc
3	0 to 10 Vdc
4	SPST Relay
5	Open Collector Voltage
6	Solid State Relay
Field B	Output 2 (Retransmission or Alarm)
	Same code as Output 1
Field C	Output 3 (Alarm or trip)
0	None
1	SPDT Relay
2	Open Collector Voltage
3	Solid State Relay
Field D	Output 4 (Alarm or trip)
	Same code as Output 3
Field E	Power Supply
1	75 to 264 Vac 50/60Hz or 100 to 360 Vdc (any polarity)
2	24 Vac or 24 Vdc (± 10 %)
3	12 Vdc (± 10 %)
4	Other, upon request
Field F	Communication
0	None
1	RS-232
2	RS-485
3	RS-422
Field G	Case Protection Grade
0	General usage, sheltered place, surface mounting
1	General usage, sheltered place, DIN rail mounting
2	Weather-proof
3	Explosion-proof (BR-Ex d IIB T6 IP 65), without display (*)
4	Dust proof
	(*) Explosion proof box: Dimensions: 310x310x200 mm (HxWxD) Weight: 11kg nominal
Field H	Application
E	Energy

Note - Ranges and input types, the use of relays as alarms and alarm setpoints are, among others, items that the user can program through the MCY-20 Configuration Module (if desired, specify such information so that all programming may be previously done by PRESYS).
Note: Any other desired software or hardware feature may be available upon request.

Code Example:
1) TY - 2090 - 1 - 0 - 1 - 0 - 1 - 0 - 0 - E
This code defines a TY-2090-Energy transmitter with output 1 for 4-20 mA, output 2 not used, SPDT relay for use as alarm with configurable trip function, power supply for the range 75-264 Vac 50/60Hz or 100-360 Vdc, without serial communication, for use in a sheltered place and surface mounting.

1.3 - Technical Specifications

Inputs:

Pt-100 RTD under DIN 43760, 4 to 20 mA, 0 to 500 mVdc, 1 to 5 Vdc, 0 to 10 Vdc. Input impedance of 250 Ω for mA, 10 MΩ for 5 Vdc and 2 MΩ above 5 Vdc. Table 1 shows the temperature ranges for RTD and the resolution for linear input sensors.

Input sensor	**Range**			
RTD	lower limit °F	upper limit °F	lower limit °C	upper limit °C
Pt-100 (2 or 3 wires)	-346.0	752.0	-210.0	400.0*
Linear	**Range**		**Resolution**	
Voltage	0 to 500 mV		25 μV	
	0 to 5 V		250 μV	
	0 to 10 V		500 μV	
Current	0 to 20 mA		1 μA	

(*)including wire resistance

Table 1 - Input Sensor Measuring Range

Note: The specifications in Table 1 refer to analog/digital conversion and are accessed by RS-232 and RS-422/485 serial communication. For the analog outputs, the resolution is 0.075 % of full scale.

Outputs:

- Analog retransmitter output for 4-20 mA, 1 to 5 Vdc, 0 to 10 Vdc, use of optional cards, with installation of up to two modules, galvanically isolated (300 Vac) from inputs and power supply.
- Alarm outputs for up to two SPDT relays and two SPST relays rated 3 A/220 Vac.
- Logic Level, open collector transistor, 24 Vdc, 40 mA maximum with isolation.
- Solid-state relay, rated 2A/250 Vac with isolation.

Serial Communication:

RS-232 or RS-422/485 with 50 Vdc isolation, as an optional module installed on the CPU board. MODBUS® - RTU Communication Protocol.

Configuration:

Via RS-232, RS-422/485 serial communication or the MCY-20 Configuration Module.

Scanning Time:

120 ms, standard.

Accuracy:

± 0.1 % of full scale for RTD, mA, mV and V inputs with acquisition via RS-232 and RS-422/485 serial communication.

± 0.2 % of full scale for analog outputs and 750 Ω maximum load.

Linearization:

± 0.1 °C for RTD.

Square Root Extraction:

± 0.5 % of reading for input above 10 % of span.

0 to 5 % programmable cut-off.

Stability at ambient temperature:

± 0.005 % / ºC of span referred to 25 ºC ambient temperature for acquisition via RS-232 and RS-422/485.

± 0.015 % / ºC of span referred to 25 ºC ambient temperature for analog outputs.

Power Supply:

75 to 264 Vac 50/60Hz or 100 to 360 Vdc (any polarity), 10 W nominal; 24 Vac/dc (± 10 %); 12 Vdc (± 10 %).

2-Wire Transmitter Power Supply:

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

Operating ambient:

0 to 50ºC temperature and 90% maximum relative humidity.

Dimensions:

140 mm x 53 mm x 175 mm (HxWxD).

Weight:

0.5 kg nominal.

Warranty:

One year.

2.0 - Installation

2.1 - Mechanical Installation

The TY-2090-Energy Transmitter can be mounted on a surface or on all types of existing DIN rails, by means of an optional adapter, as illustrated in the figure below.

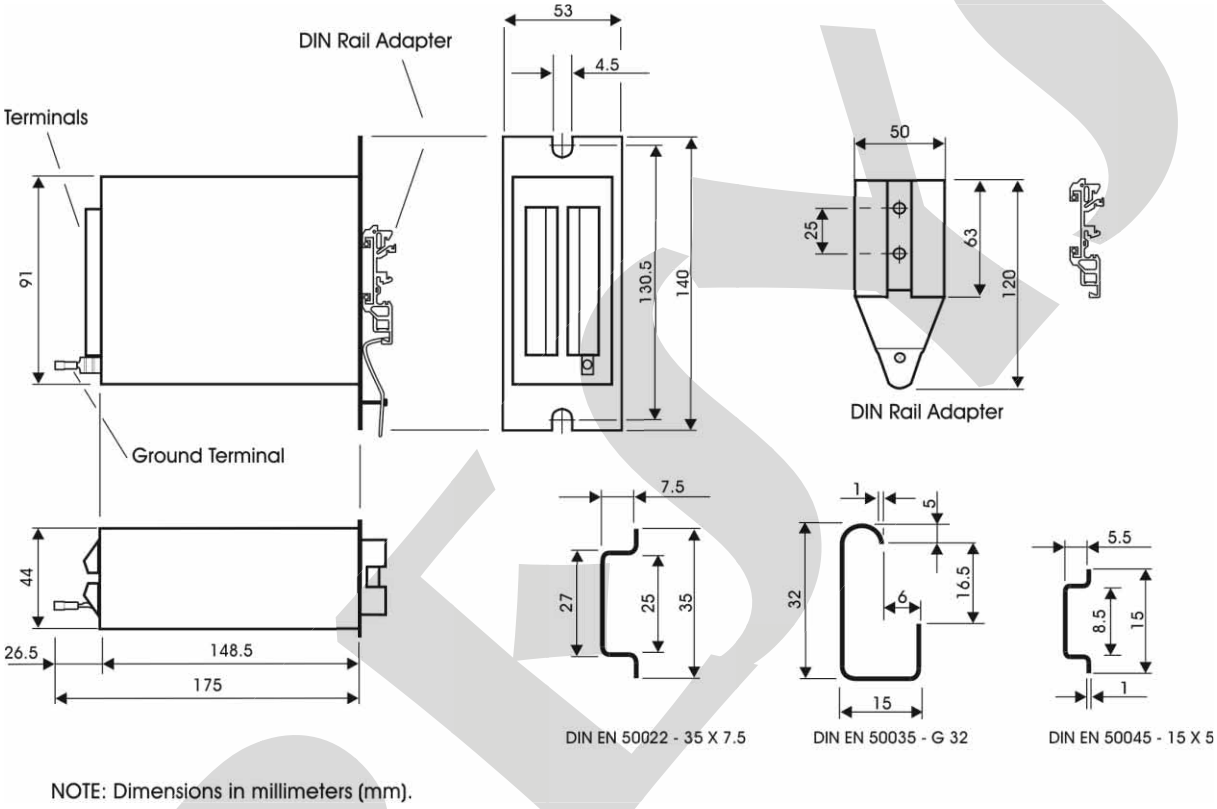


Fig. 2 - Dimensional drawing and detail of the adapter for DIN rail

2.2 - Electrical Installation

The TY-2090-Energy Transmitter may be powered up by voltage between 75 and 264 Vac or 100 to 360 Vdc, any polarity. Remember that the internal circuit is powered whenever the instrument is connected to the external power supply.

Connections of process input and output signals should only be done with the instrument turned off.

Figure 3 shows the instrument I/O terminal scheme with all designations for power supply, grounding, communication and process input and output signals.

Signal wires must be kept far away from power supply wires.

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

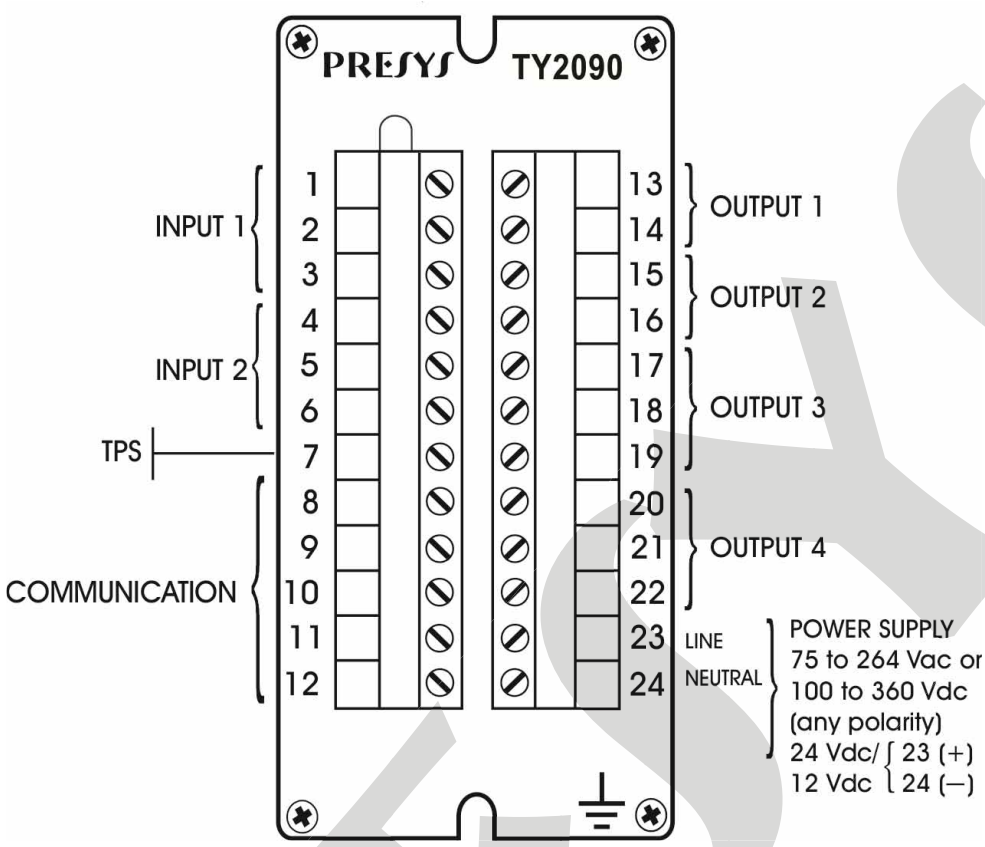


Fig. 3 - Transmitter terminals

2.3 - Process Input Signal Connections

The Transmitter, in its two standard universal inputs, can be connected to 2 or 3-wire RTDs, mA, mV or V. In order to know the input sensor types refer to Table 1, section 1.3 on Technical Specifications.

The selection of a certain type of input sensor is enabled by means of internal jumpers (refer to section 4.2, Hardware Configuration) and by a proper selection of the sensor in configuration time (refer to section 3.2, Configuration). Therefore, the connections explained below will only become effective if the instrument is correctly configured in terms of hardware and software.

The wiring of a type of sensor to input 1 does not restrict the simultaneous use of another sensor, of the same type or different type, for input 2.

In order to prevent noise induction in the wire connecting the sensor to the I/O terminal, use twisted pair cable and run the sensor connection wires through a metallic conduit or use a shielded cable. Be sure to connect only one shielded wire end to the negative I/O terminal or to the sensor ground, as outlined in the following items.

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

2.3.1 - RTD Connections

The RTD can be connected with 2, 3 or 4 wires. All connection types are shown in figure 4.

For 2-wire RTD, connect the RTD between I/O terminals 1 and 3 to use input 1, or to terminals 4 and 6 to use input 2, as illustrated in figure 4.

For 3-wire RTD, connect the RTD in the same way as described for a 2-wire connection, and connect the third wire for RTD compensation to terminal 2 in case of input 1, and to terminal 5 in case of input 2, see figure 4.

A 4-wire RTD is connected to the Transmitter in the same way as a 3-wire RTD, except that the fourth wire is disregarded and left disconnected, see figure 4.

A 3-wire RTD provides greater accuracy than a 2-wire RTD.

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

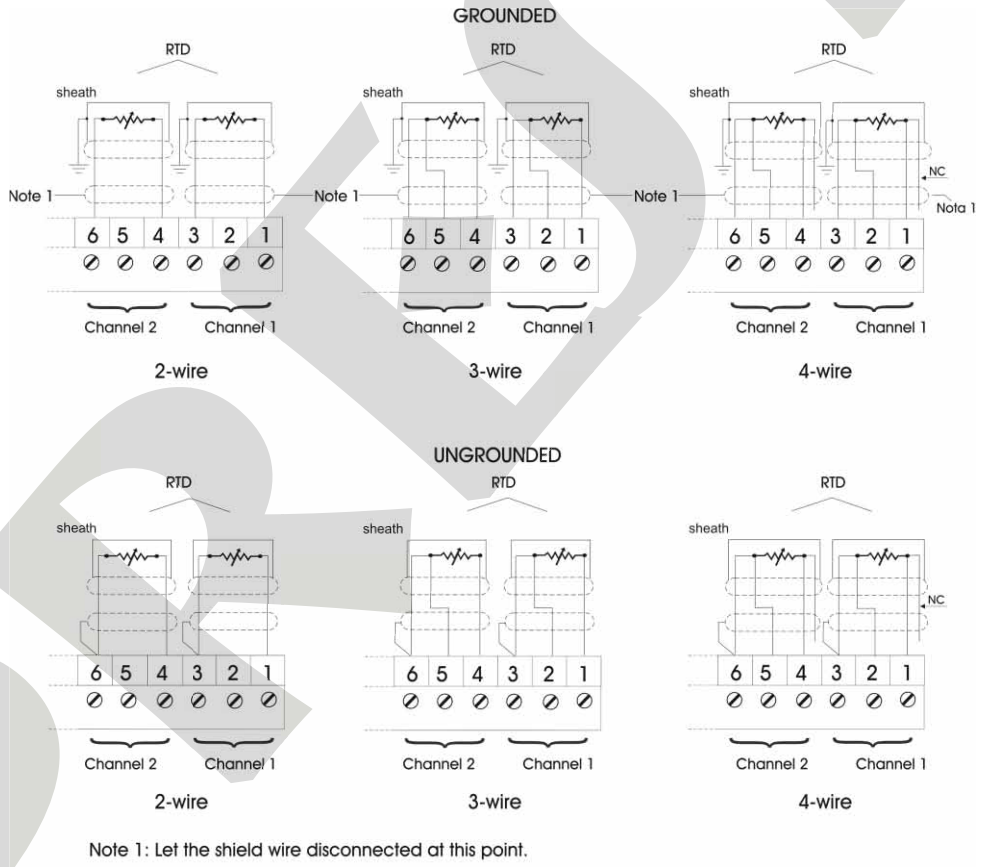
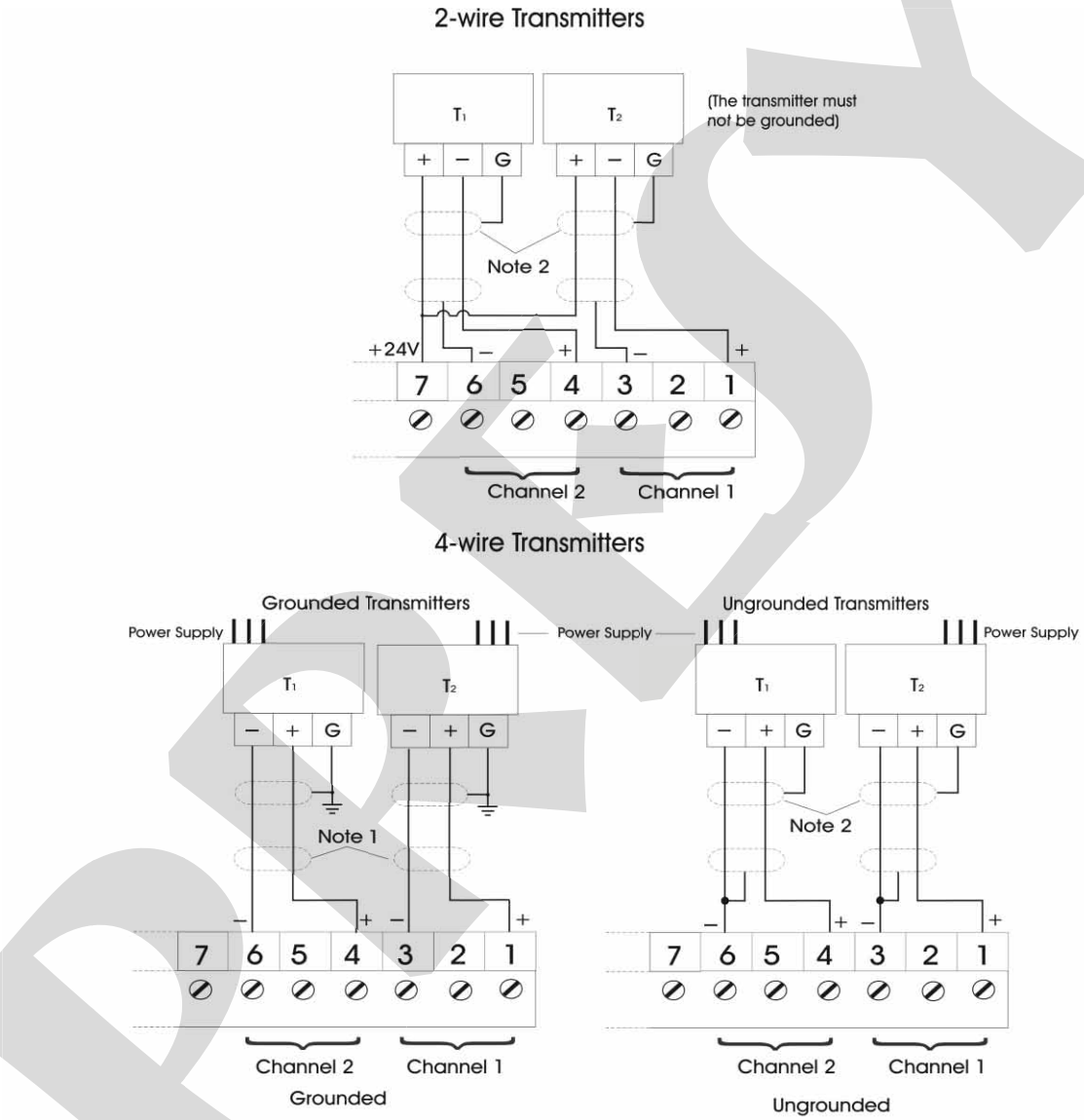


Fig. 4 - RTD Connection

2.3.2 - Current Input

A standard current source of 4 to 20 mA can be applied to terminals 1 (+) and 3 (-) in case of input 1, and to terminals 4 (+) and 6 (-) in case of input 2. Such current can be generated by a transmitter with external power supply.

When using the intrument's internal 24 Vdc source to power a 2-wire transmitter, the current is received only by terminal 1 (+) in case of input 1, and it is received only by terminal 4 (+) in case of input 2. Figure 5 illustrates both connection possibilities.



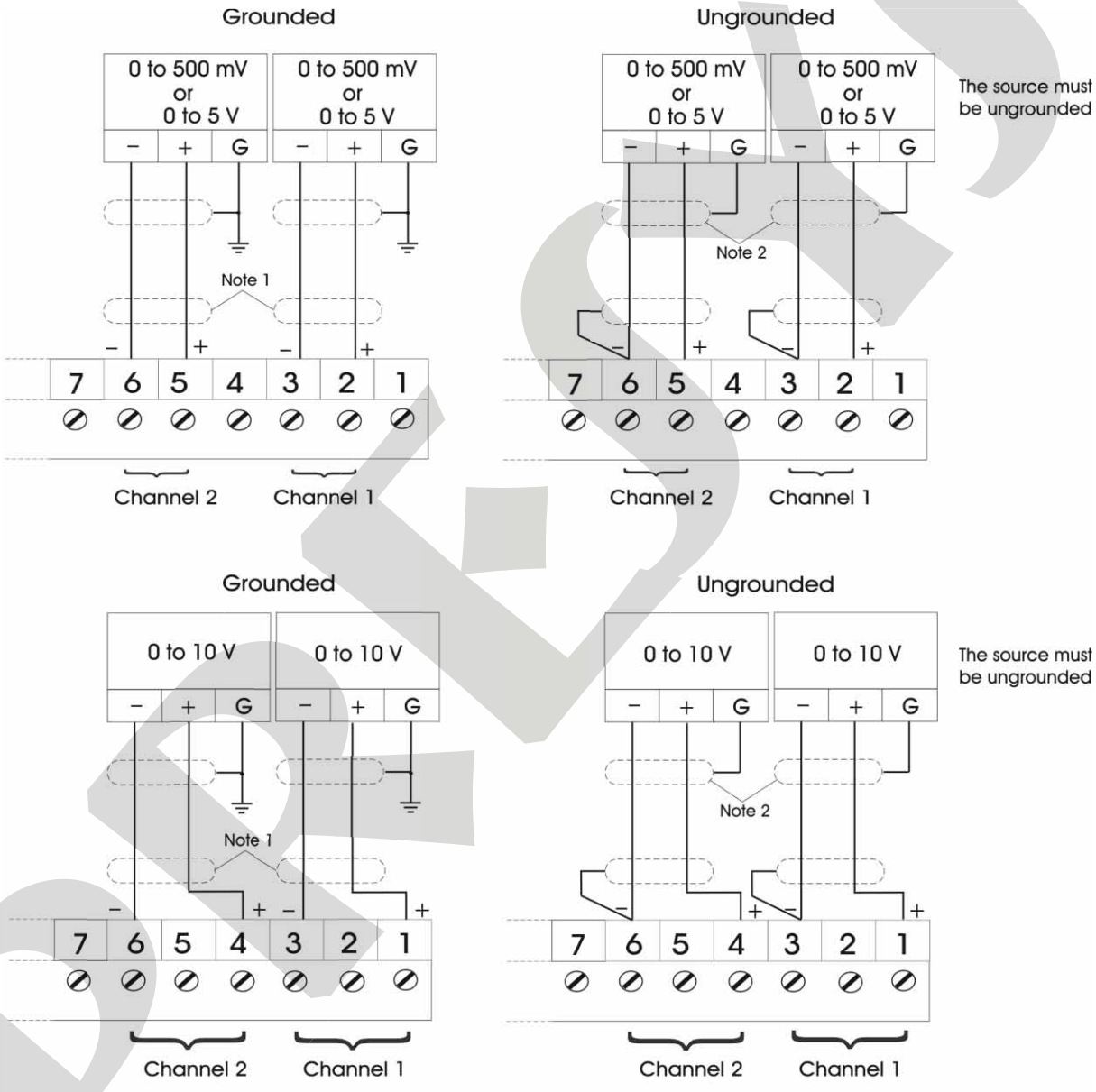
Note 1: Let the shield wire disconnected at this point

Note 2: Connect the shield wire to the ground terminal of the transmitter. If there is not a ground terminal, let the shield wire disconnected at this point.

Fig. 5 - Current Source Connection

2.3.3 - Voltage Inputs

Voltages from 0 to 500 mVdc or from 0 to 5 Vdc must be applied to terminals 2 (+) and 3 (-) in case of input 1, and to terminals 5 (+) and 6 (-) in case of input 2. Voltages from 0 to 10 Vdc should be applied to terminals 1 (+) and 3 (-) in case of input 1, and to terminals 4 (+) and 6 (-) in case of input 2. These connections are shown in figure 6.



Note 1: Let the shield wire disconnected at this point

Note 2: Connect the shield wire to the ground terminal of the transmitter. If there is not a ground terminal, let the shield wire disconnected at this point.

Fig. 6 - Voltage Source Connection

2.4 - Output Connections

The Transmitter, in its most complete version, can be provided with up to four output signals: output 1, output 2, output 3 and output 4. Outputs 1 and 2 are used as retransmission outputs or alarm outputs. Outputs 3 and 4 are used only as alarm outputs.

In case of outputs 1 and 2, there are six different output types, which can be obtained between I/O terminals: retransmission output (4 to 20 mA, 0 to 5 Vdc or 0 to 10 Vdc), SPST relay, open collector voltage and solid-state relay.

For outputs 3 and 4 there are three different output types: SPDT relay, open collector voltage and solid-state relay. Figure 7 shows the Transmitter outputs.

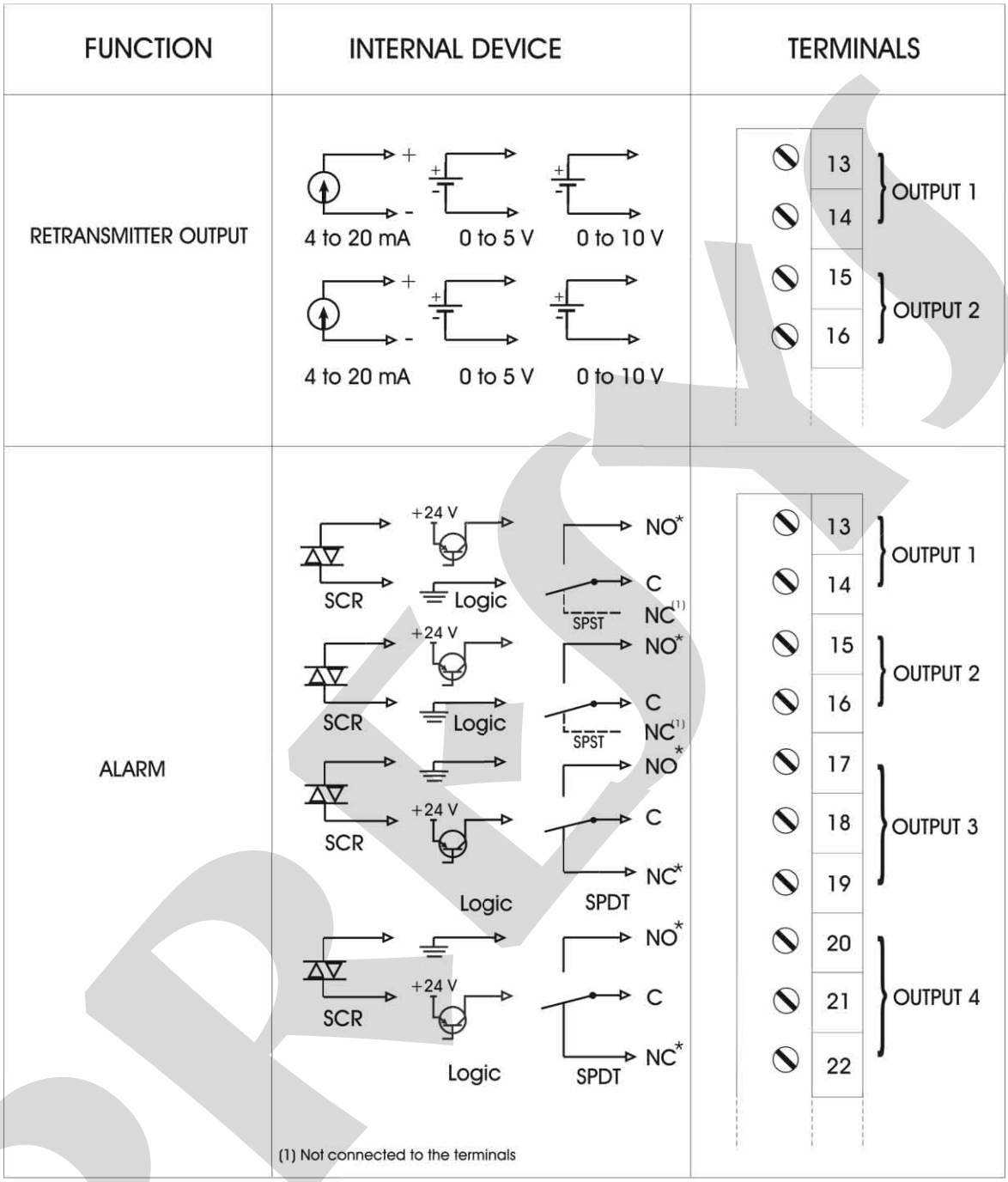
Notice that the I/O terminals will only show output signals if the corresponding optional module is installed and the output is correctly configured. In case of analog outputs, refer to sections 3.2 on Configuration and 4.4 on Optional Module Connection for details on installation and configuration of optional modules.

The state of the relay contacts illustrated in Figure 7 assume that the instrument is powered off. When powered on, the status (open or closed) depends on the SAFE configuration and if the instrument is or is not in alarm condition. Table 2 summarizes the state of the relay contacts in all conditions.

Power Supply	SAFE	Alarm Condition	Relay 1 Terminals 13 and 14	Relay 2 Terminals 15 and 16	Relay 3 Terminals 17 and 18	Relay 4 Terminals 20 and 21
OFF	---	---	OPEN	OPEN	OPEN	OPEN
ON	YES	NO	CLOSED	CLOSED	CLOSED	CLOSED
ON	YES	YES	OPEN	OPEN	OPEN	OPEN
ON	NO	NO	OPEN	OPEN	OPEN	OPEN
ON	NO	YES	CLOSED	CLOSED	CLOSED	CLOSED

Table 2 - Relays State in All Possible Conditions of the Instrument

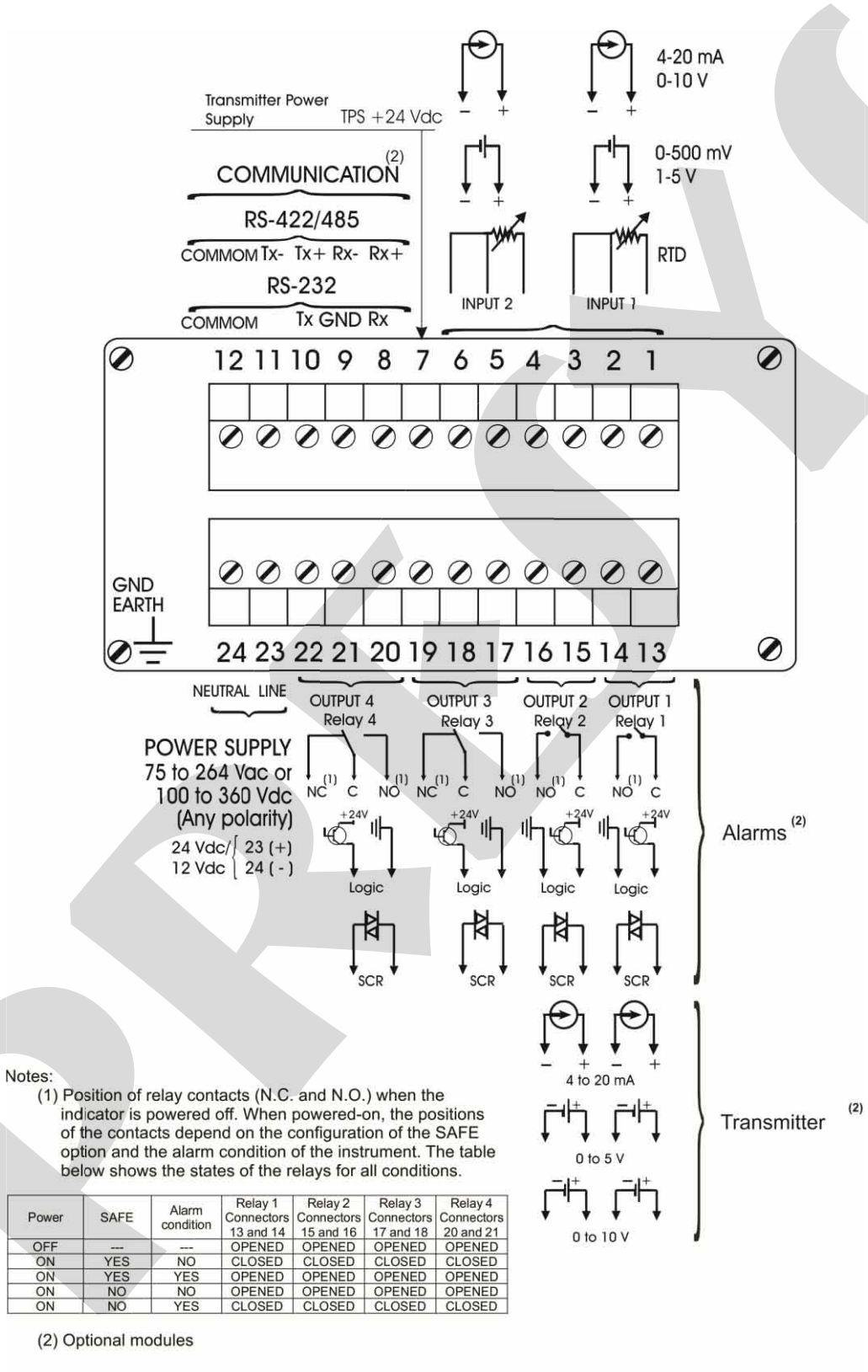
The factory setting for the relay is SAFE = "NO" for trip relays and SAFE = "YES" for the other relays.



(*)The relay contacts assume that the instrument is powered off.

Fig. 7 - Output Connections

2.5 - Connection Diagram



Notes:

(1) Position of relay contacts (N.C. and N.O.) when the indicator is powered off. When powered-on, the positions of the contacts depend on the configuration of the SAFE option and the alarm condition of the instrument. The table below shows the states of the relays for all conditions.

Power	SAFE	Alarm condition	Relay 1 Connectors 13 and 14	Relay 2 Connectors 15 and 16	Relay 3 Connectors 17 and 18	Relay 4 Connectors 20 and 21
OFF	---	---	OPENED	OPENED	OPENED	OPENED
ON	YES	NO	CLOSED	CLOSED	CLOSED	CLOSED
ON	YES	YES	OPENED	OPENED	OPENED	OPENED
ON	NO	NO	OPENED	OPENED	OPENED	OPENED
ON	NO	YES	CLOSED	CLOSED	CLOSED	CLOSED

(2) Optional modules

2.6 - Communication

The TY-2090-Energy Transmitter can communicate with computers via RS-232 or RS-422/485 provided the optional communication module is installed and the proper communication parameters are configured via software.

Specific information about communication and signal connection can be found in the Communication Manual and on section 5.0 - MODBUS Communication.

2.7 - Engineering Units

A label with several Engineering Units is supplied with each transmitter. Choose the one corresponding to the variable shown in the configurator MCY-20 of the transmitter.

3.0 - Operation

3.1 - Normal Operation

The TY-2090-Energy Transmitter has two operation modes: normal operation and operation in configuration time.

In normal operation the Transmitter retransmits the process variable to a remote point either through its two analog outputs 1 and 2, or via RS-232 or RS-422/485 communication. The analog outputs 1 and 2 can retransmit input 1 as well as input 2. The two analog outputs can even retransmit the same input. Moreover, the Transmitter checks the alarm conditions and activates the alarm outputs 3 and 4 if it is the case.

The Transmitter has a portable configuration unit, MCY-20, which is connected to it by means of a DB-25 connector, as illustrated in figure 8 below.

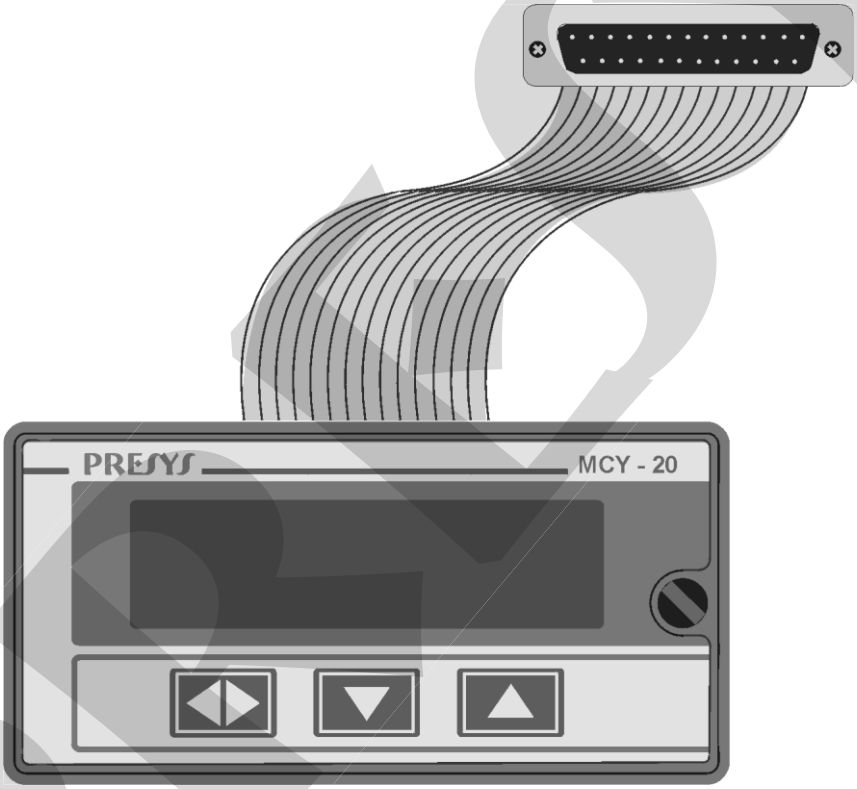
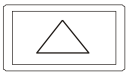
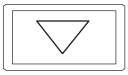
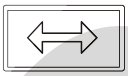


Fig. 8 - MCY-20 Portable Configuration Module

When the MCY-20 Configuration Module is connected to the Transmitter under normal operation, the instrument begins to function as a transmitter and as a process monitor as well, through the Module display.

Under configuration time operation mode the user, through the MCY-20 Configuration Module, selects and assigns values to the parameters which regulate the Transmitter functioning, when in normal operation. Such parameters are, among others, alarm setpoint values, retransmission output range, etc.

The normal operation mode, in which the Transmitter operates most of the time, will be called level zero. At this level, the keys on the panel of the MCY-20 Configuration Module have the following functions:

Key		Function
UP		Presents the corresponding mnemonics for: - Trip alarm relays disabled due to input sensor break (R.3.OUT and R.4.OUT); - Instrument power-up event (AC.P.UP); - Channels associated with relays triggered by a failure alarm (AL.CH.1 and AL.CH.2) or relays that have already passed an alarm condition (AC.CH.1 and AC.CH.2); and - Latch configured relays in alarm state (AL.RL.1 to AL.RL.4) or which require acknowledgment to return to the normal state (AC.RL.1 to AC.RL.4) (*)
DOWN		Changes the channel shown on the display. If the display shows channel 1 (2), after pressing the DOWN key, the display changes to the measured variable of channel 2 (1).
ENTER		Changes from level zero to 1 (configuration mode) or asks for a password depending on the configuration. When a mnemonic accessed by the UP key is presented: - Re-enable a trip alarm relay that has been disabled due to an input sensor break (R.3.OUT and R.4.OUT); - Acknowledges an instrument power-up event (AC.P.UP); - Acknowledges a channel associated with relays with failure alarms after returning to the normal condition (AC.CH.1 or AC.CH.2); and - Acknowledges a latch configured relay after the alarm condition ceased (AC.RL.1 to AC.RL.4).

(*) In order to show again the value of the measured variable, continue to press the UP key. If there is no latched relay, the display shows No.Ret.

In the operation mode it is possible to re-enable the trip alarms configured with failure manual reset (see section 3.2 - Configuration: Level 3 - Alarms) by following the procedure below:

(i) The display shows a blinking B.OUT.1 / 2 mnemonic (for channel 1 / 2 with RTD input) or the BRK.1 / 2 mnemonic (for 4-20 mA current input), indicating that the sensor is broken and the TRIP alarms are disabled;
(ii) Reconnect the sensor to the instrument terminals;
(iii) The display shows alternatively the indication value and the RL.OUT mnemonic (relays 3 and/or 4 disabled);
(iv) Enable the relays with TRIP alarms according to the steps below:

1. Press the UP key during the exhibition of the process variable in order to show the mnemonic of the disabled relay (R.3.OUT or R.4.OUT);
2. Press ENTER;
3. The R.3.OUT or R.4.OUT mnemonic disappears;
4. The display shows the next disabled relay mnemonic, if present, or the mnemonics for the power up event (AC.P.UP), failure alarm (AC.CH.1 or AC.CH.2) or for the relay alarms (AC.RL.1 to AC.RL.4) which require acknowledgement in order to return to normal state (latch condition).

In order to pass to the next mnemonic without re-enabling the trip relay or acknowledging an alarm relay under latch condition, one must press the UP key once again. After all available mnemonics are shown, the display returns to the process variable indication.

Note: If both relays 3 and 4 are disabled, relay 3 will be re-enabled first (by pressing ENTER for the R.3.OUT mnemonic) and then relay 4 is re-enabled (ENTER for the R.4.OUT mnemonic).

3.2 - Configuration

To have access to the configuration mode, one should provide the password configured with the purpose of preventing unauthorized people from altering the critical parameters of the process.

Therefore, whenever the ENTER key is pressed under normal operation mode, one of the following cases might occur:

i) Enter directly into level 1 (GENERAL) of configuration mode, indicating that the instrument was not configured with a password system.

ii) The Module display shows the PASSWORD warning, indicating that the instrument has a password system by key or by value, as illustrated in figure 09.

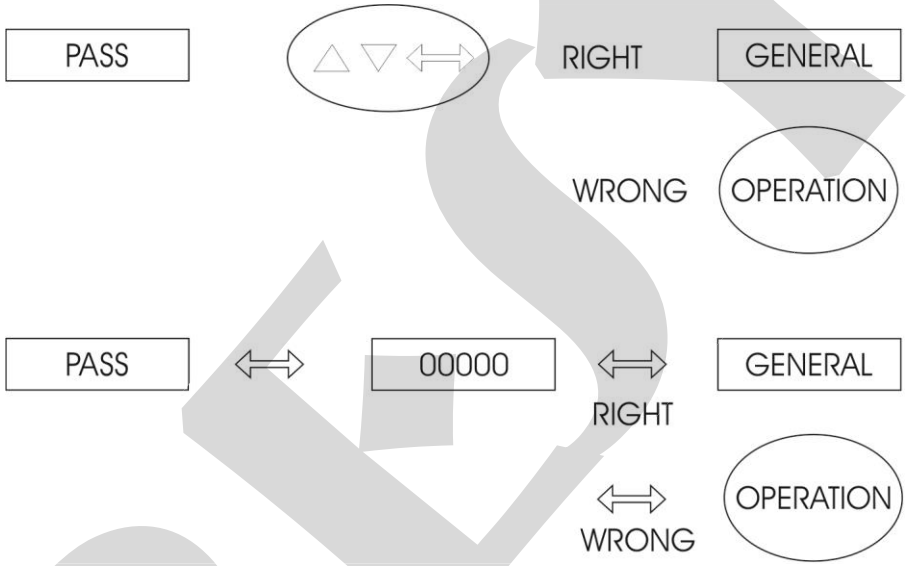


Fig. 9 - Password system by key and by value

In case of password by key, the user should press the UP, DOWN and ENTER keys in sequence to enter the configuration levels.

In case of password by value, the user should press the ENTER key a second time to obtain the number 00000, with the last digit blinking on the right. The blinking digit indicates the position where the digit of a 4-digit number will be entered by the user. In order to move to the next digits on the left, the user should press the ENTER key. After entering all digits, the user can press the ENTER key once more to switch to level 1 in case the password is correct, otherwise the system reverts to normal operation (see figure 9).

The user can even select both password systems, by key and by value. In such case, if upon receiving a request for a password the user enters a wrong key sequence, he will be immediately reverted to password by value.

The password can be a number chosen by the user (customized) or the number 2090. Notice that in case of password by value the number 2090 is always enabled, serving as a help to the user in case he forgets his password. In order to enter a password number or any other parameter value, the user can use the front Module keys, which have the following functions:

Key	Function
SOBE	Increases the digit
DESCE	Decreases the digit
ENTER	Moves to digit on the left

All configuration parameters are stored in the non-volatile memory and determine the instrument normal operation. Through such parameters the user can adapt the instrument according to his requirements, if he desires to change the factory configuration.

The configuration parameters are distributed over six increasing hierarchical levels, as shown in figure 10.

In order to go through those levels and access the corresponding parameters the user may use the Module front keys with the following functions:

Key	Function
ENTER	Choose the level
UP	Switches to a higher level
DOWN	Switches to a lower level

Note: in the following diagrams, the Module display is represented by rectangles in response to the selection of ENTER, UP and DOWN keys.

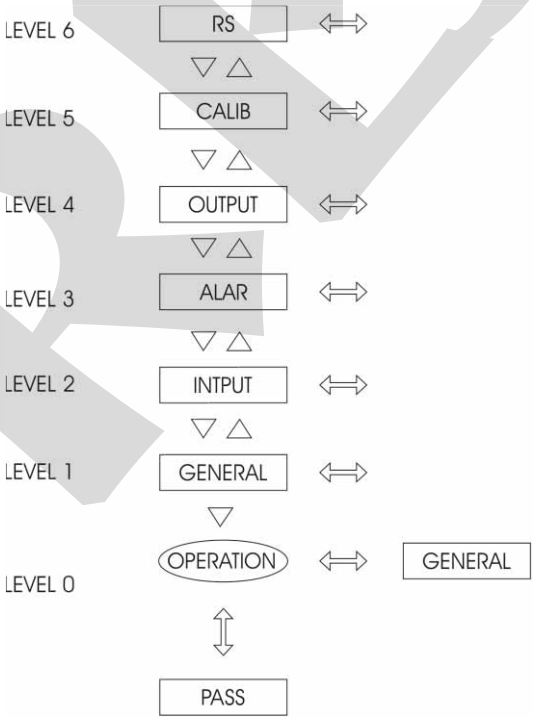


Fig. 10 - Diagram of parameter levels

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

Within each level, the front panel keys of the MCY-20 Configuration Module have the following functions:

Key	**Function**
UP	Scrolls the options in ascending order
DOWN	Scrolls the options in descending order
ENTER	Confirms or advances the options within the level whenever the display does not show ESC. When the display shows ESC, one goes back one or more positions.

Level 1 - General

In level 1 we have the options: TAG, V.SFT, PASSWORD, DSP.FL and DSP.P.U (see figure 11).

TAG - Enables an alphanumeric identification for the instrument. The procedure used to enter a TAG or any other parameter is the same as for the previously described password (see the functions of ENTER, UP and DOWN keys under password by value).

V.SFT - Shows the software version number.

PASSWORD - Allows whether to define or not a password system to access the configuration mode. The password system can be defined by key, by value (number chosen by the user and the number 2090) or both. The key sequence for defining a password by key is, as explained above, to press the UP, DOWN and ENTER keys in that order.

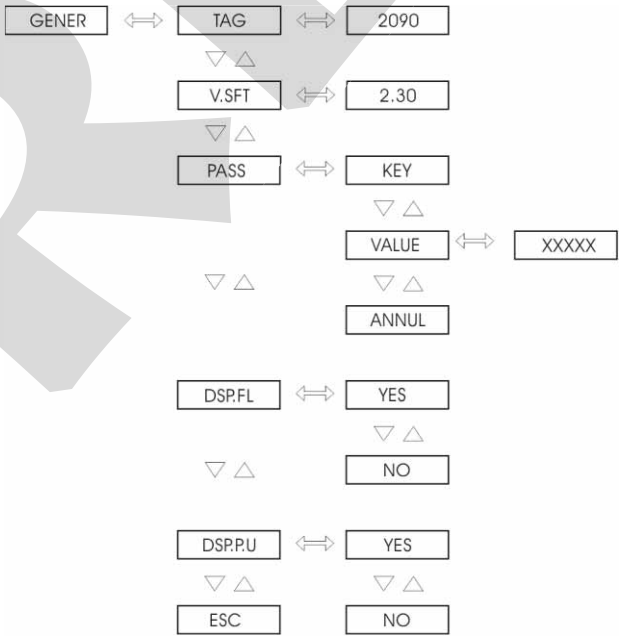


Fig. 11 - GENERAL Level Options

The adjustable parameter range shown in figure 11 is given below.

Mnemonic	Parameter	Adjustable Range	Factory Value	Unit
TAG	instrument identification	————	P2090	————
V.SFT	software version	————	2.30	————
VALOR	user password	-9999 to 99999	0	————

The DSP.FL and DSP.P.U options from the GENERAL level allow configuring the display to indicate that a failure alarm occurred or that the instrument was recently powered up, so that the operator acknowledgement becomes necessary.

The DSP.FL option allows the display to continue to indicate the failure alarm occurrence even after the sensor is reconnected. While the alarm condition is maintained, the display keeps B.OUT.1 / 2 (for RTD) or BRK.1 / 2 (for mA) blinking and, when the UP key is pressed, one has access to the AL.CH.1 or AL.CH.2 mnemonic, according to the channel with failure. After reconnecting the sensor, the display continues to blink when the process variable is shown. In order to stop this indication, one must press the UP key and acknowledge the failure event by means of the AC.CH.1 or AC.CH.2 mnemonic.

When the DSP.EN option is enabled, the display blinks as soon as the instrument is powered up. In order to make the display to return to regular indication of the process variable, one must press the UP key and search for the AC.P.Up to acknowledge the event. If any trip relay is configured with manual reset and need to be re-activated, instead of flashing, indicating the process variable alternating with the "FAIL" mnemonic. This type of indication is useful to shown that the instrument power supply has been re-established after an interruption.

Level 2 - Inputs

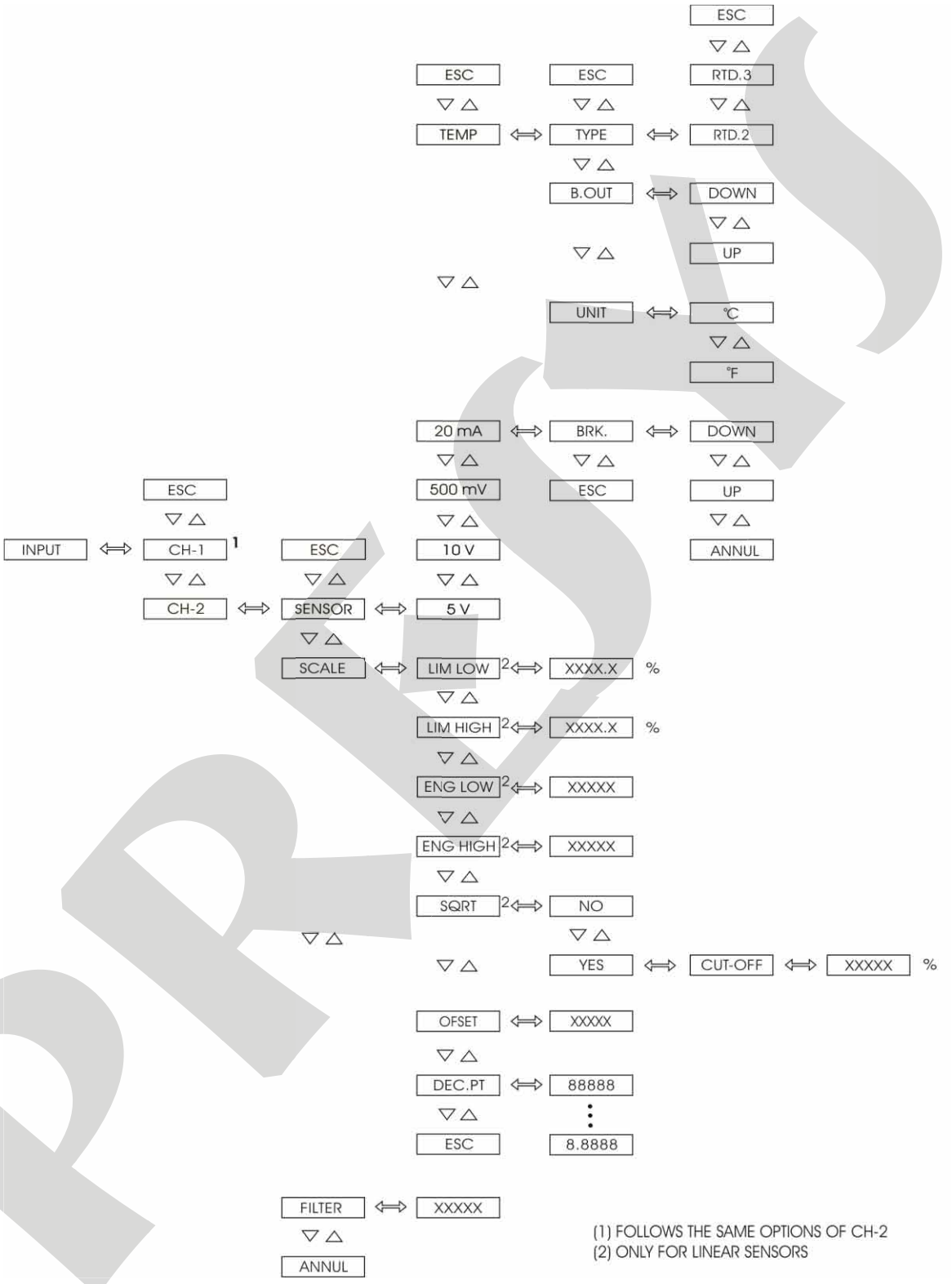


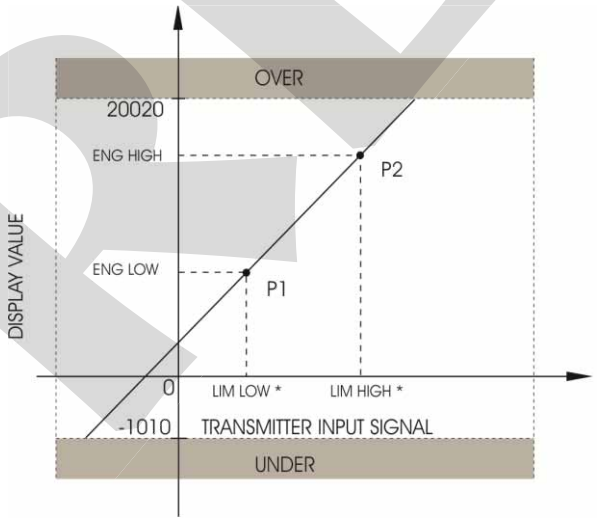
Fig. 12 - INPUTS Level Options

The adjustable parameter range shown in figure 12 is given below.

Mnemonic	Parameter	Adjustable Range	Factory Value	Unit
LIM LOW	input signal corresponding to Eng Low	0.0 to 100.0	20.0	%
LIM HIGH	input signal corresponding to Eng High	0.0 to 100.0	100.0	%
ENG LOW	display indication associated to Lim Low	-1009 to 20019	0.0	EU*
ENG HIGH	display indication associated to Lim High	-1009 to 20019	100.0	EU*
CUT-OFF	minimum value for square root extraction	0 to 5	0	%
OFF SET	constant added to display indication	-9999 to 30000	0	EU*
FILTER	Time constant of first order digital filter	0.0 to 25.0	0.0	seconds

(*) EU - Engineering Units

Whenever a linear sensor is selected, the scale should be configured (option SCALE). For that purpose it is necessary to define two points: P1 (Lim Low, Eng Low) and P2 (Lim High, Eng High), as illustrated in figure 13. Lim Low represents, in %, the value of the electric signal associated to the “Eng Low” indication on Module display, and Lim High corresponds to the value, in %, of the electric signal associated to the “Eng High” indication on Module display.



(*) % OF INPUT FULL SCALE

Fig. 13 - Linear input Configuration

SQRT - Shows the square root of the instrument input signal on display. The Cut-Off parameter, expressed as a % of the input signal, forces the lower value inputs (Lim Low + Cut Off) to behave as Lim Low. See illustration on figure 14:

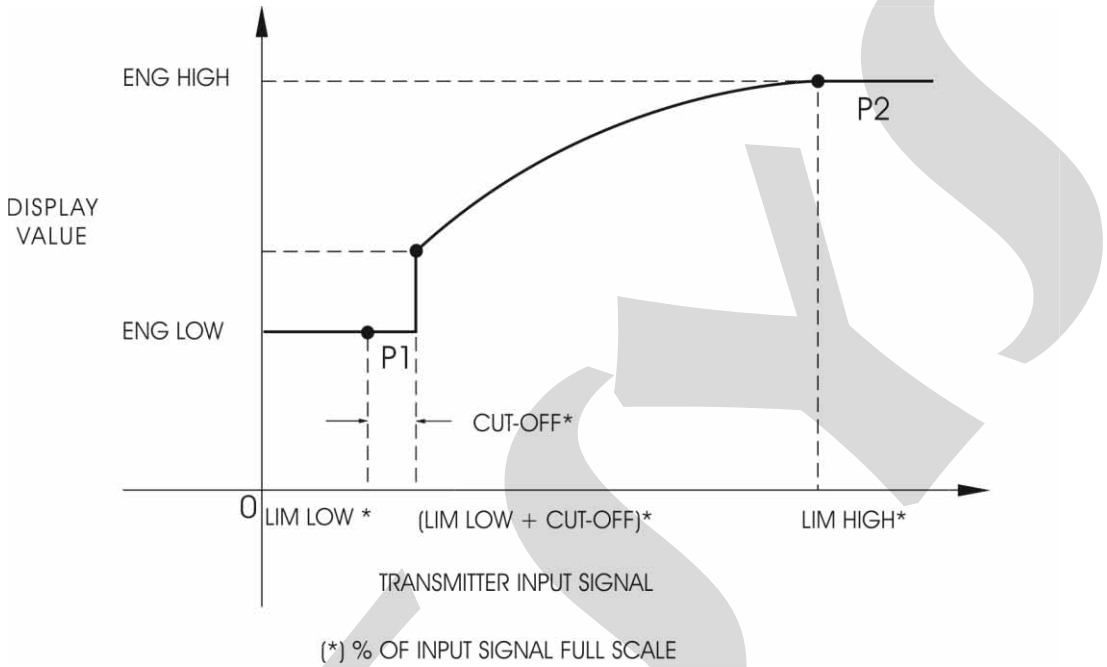


Fig. 14 - Square root extraction of an input signal

DEC.PT - Sets the decimal point to exhibit the engineering units on Module display. Up to four decimal digits can be set for linear processes, whereas temperature sensors can have one or no decimal digit.

OFSET - (as shown on Module display) - Allows the user to enter a fixed off-set value, in engineering units, in addition to value shown on display. It is a useful option when we have several instruments monitoring the same process variable, but with slightly different readings. The OFSET parameter can be used to equalize instrument readings.

The types of input sensors are described in Table 1 of section 1.3, Technical Specifications.

FILTER - This parameter provides the time constant of a first order digital filter coupled to the selected input. When no filtering of the measured signal is desired, zero should be assigned to this parameter. If the trip alarm is enabled, set the filter value to 0.5 seconds.

B.OUT – When there is a temperature sensor break (RTD) or an open connection wire, the Module display indicates the burn-out for the corresponding channel. In this case, configuring B.OUT with the UP (upscale) option triggers the high alarms, while the DOWN (downscale) option triggers the low alarms.

UNIT - Selects ºC or ºF for temperature indication.

BRK (break) - determines the change of the indication value (not shown on the display) when detecting a sensor break associated with a 4-20 mA input, that is, for a signal less than 3 mA (when Lim Low ≥ 20.0%) or greater than 21 mA. This option is set as DOWN (downscale), UP (upscale) or NONE (no change). It is used to prevent the triggering of high or low alarms, associated with relays 1 and 2, in case of a sensor break.

Level 3 - Alarms

The transmitter can have up to four alarm outputs, using the outputs 1, 2, 3 and 4, which are assigned as relay 1, relay 2, relay 3 and relay 4, respectively (see figure 16). In this case, the transmitter will not have retransmission analog output.

Each relay can be associated with up to six alarms: channel 1 low, channel 1 high, channel 1 failure, channel 2 low, channel 2 high and channel 2 failure. The failure alarm (FAIL mnemonic) is activated by an input sensor break, when configured as a temperature sensor (RTD) or 4-20 mA current.

In order to prevent the activation of relays 1 and 2 with high or low alarm by a sensor break, one can make use of the BRK (for current) or B.OUT (RTD) options of the INPUT level.

Up to sixteen setpoint values (SP) with their respective hysteresis (HIST) can be available for high and low alarms. These parameters are not configured for the failure alarms.

Relays 3 and 4 may be configured as trip relays for temperature (RTD) or 4-20 mA current inputs, preventing the alarm to be triggered in case of a sensor break or when the sensor wires are re-connected. The TRIP option allows the configuration of a relay as a high (HI) or low (LO) trip alarm. In order to disable the trip function, one must configure TRIP as NO, so that relay 3 or 4 operates as relays 1 and 2 do.

Once the trip type is selected for a certain relay, one must configure the parameters of the same type of alarm (HI or LO) for at least one channel. Thus, if a high trip is selected, for example, one must configure the high alarm (HI) and its parameters (SP and HYST) for channel 1 and/or 2. In this case, when one tries to select the low (LO) or the failure (FAIL) alarms, the display presents the ERR.06 mnemonic.

Note: Configure SAFE as NO for relays with trip alarms.

When there is a sensor break in a channel associated with a relay with trip, the alarm ceases to be checked temporarily (*relay disabled*), although it remains configured in the ALARM level. Right after the relay is disabled, the state of the alarm is determined by the RL.F option. When configuring RL.F as RLS (release), the relay is released from the alarm state of the input with the broken sensor (maintaining the contact in the non-alarm position) so that the relay state is determined by the remaining channel, if enabled. When LAST is selected for RL.F, the relay maintains the last alarm state presented by the input with the broken sensor. In this way, for relay 3 with a high trip alarm for both channels and in alarm condition due to channel 1, for instance, the sensor break would

change the relay contact to the non-alarm position for RLS, while its position would be maintained for LAST.

After the proper re-connection of the sensor to the input, one must apply a reset to the disabled relay so that the instrument continues to check the alarm which was disabled. The reset mode is defined by the RST.F option as automatic (AUTO) or manual (MANU). RST.F is shown together with the CH-1, CH-2, and RL.F mnemonics after the selection of the relay. For the automatic reset mode, the alarm relay is re-enabled as soon as the instrument detects the sensor connection, while the manual reset mode requires the operator to apply the reset in the operation level of the instrument. For the latter case, the end of the break condition makes the display to alternate between the process variable indication and the RL.OUT mnemonic. One must then press the UP key in order to show the mnemonic for the first disabled relay (R.3.OUT or R.4.OUT) and apply the reset by pressing ENTER. Press again the UP key to pass to the next mnemonic, be it the second disabled relay (R.4.OUT) or those for alarm or led acknowledgement. After presenting all available mnemonics, the display returns to the process variable exhibition.

Note that the trip function does not apply to the 5 V, 10 V, and 500 mV inputs. It is only possible to configure the failure alarm for relays 3 and 4 with the trip function disabled.

After configuring the alarms (CONF option) the operator can have direct access to the setpoint values of the high and low alarms to check or even change them. For this, one must go to the CONF mnemonic and then press the UP key, so that the setpoints of all configured alarms are accessed. The alarm setpoint mnemonics and the failure alarm mnemonics (the latter are shown only to indicate that the alarms are enabled) are explained according to the examples below:

Simbol	Description
S.1F.r2	Channel 1 failure alarm associated with relay 2 (no setpoint)
S.1H.r3	Setpoint of the channel 1 high alarm associated with relay 3
S.2L.r4	Setpoint of the channel 2 low alarm associated with relay 4

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. If the trip function is enabled, the delay value must be set to 5.0 seconds for temperature inputs, and 2.0 seconds for current inputs.

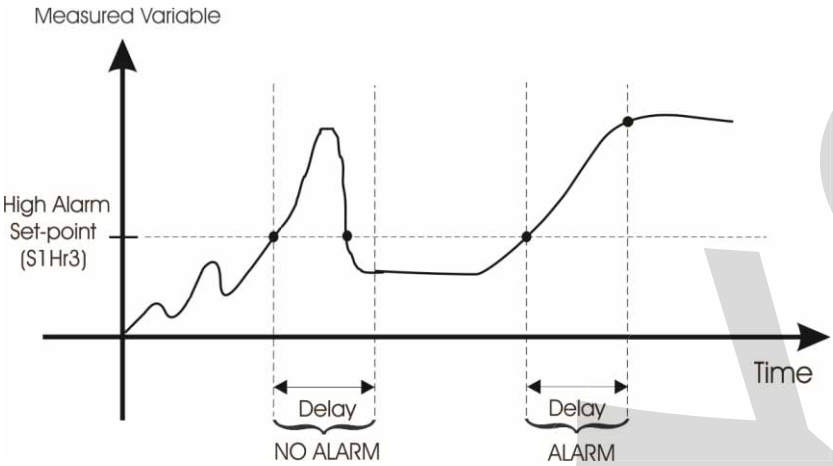


Fig.15 - Relay with Delay

LATCH - 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 DOWN 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 DOWN key to return to operation mode.

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.

Note: Configure SAFE as NO if the corresponding relay is set as trip alarm.

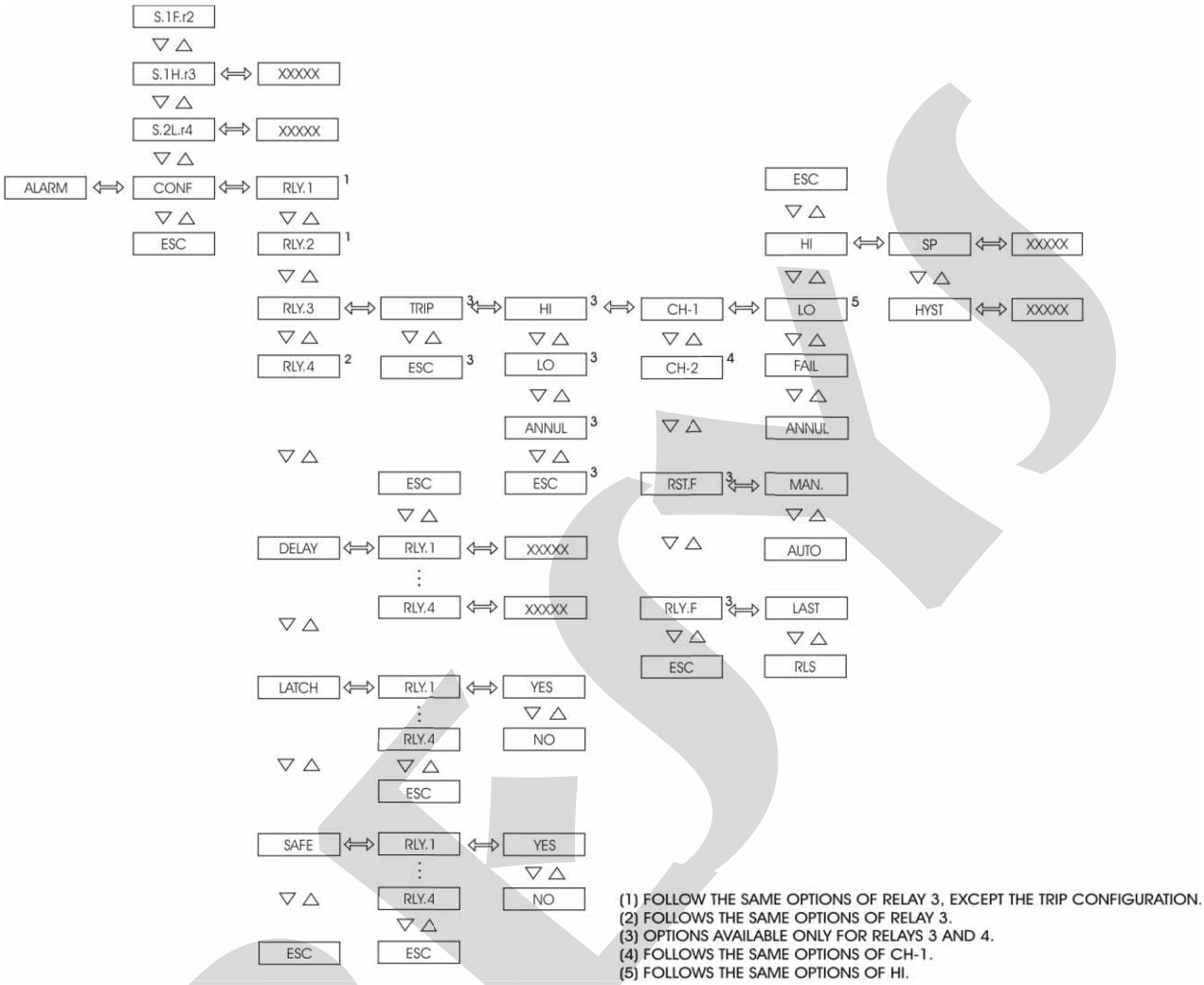


Fig. 16 - Alarm level options

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

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

(*) EU - Engineering Units

Note: When replacing an analog output module (see Level 4 - Outputs) 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.

Level 4 - Outputs

Level 4 allows the configuration of two possible analog outputs (see figure 17).

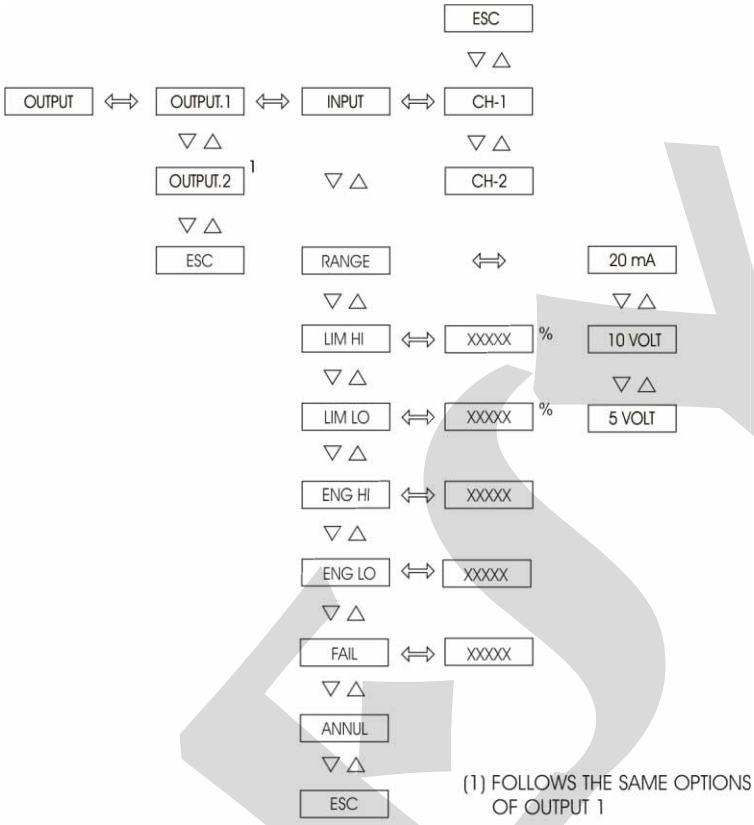


Fig. 17 - Output Level Options

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

Mnemonic	Parameter	Adjustable Range	Factory Value	Unit
LIM LOW	output signal corresponding to Eng Low	0.0 to 100.0	0.0	%
LIM HIGH	output signal corresponding to Eng High	0.0 to 100.0	100.0	%
ENG LOW	display indication associated with Lim Low	-1009 to 20019	0.0	EUE*
ENG HIGH	display indication associated with Lim High	-1009 to 20019	100.0	EU*
FAIL	output signal in case of sensor break in the associated input	0 to 105	15	%

(*)EU - Engineering Units

INPUT - Associates analog output 1 or 2 with input 1 or 2 to be retransmitted. Notice that outputs 1 and 2 can be retransmitting the same input (1 or 2).

The analog output is enabled only after the retransmission output range is selected in the RANGE mnemonic.

RANGE - Selects the retransmission output range for 20 mA, 5 V and 10 V. The relationship between the engineering unit and the electric signal which comes from the transmitter I/O terminals is defined similarly to the linear process scale configuration. In this case, the points P1 (Eng Low, Lim Low) and P2 (Eng High, Lim High) are also defined, as illustrated in figure 18. Eng Low is the indication on Module display, in engineering units, associated to the Lim Low electric signal and Eng High is the indication on display, in engineering units, associated to the Lim High electric signal. Notice that Lim Low and Lim High are expressed in percentage of output range and the output signal saturates at those points.

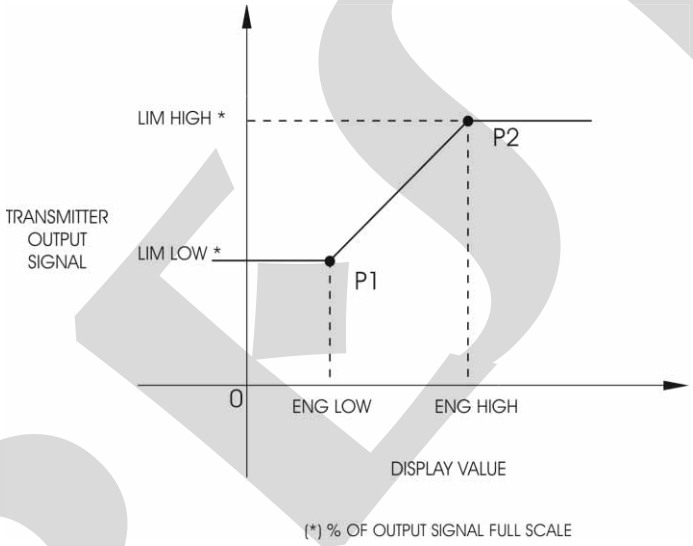


Fig. 18 - Analog Output Configuration

FAIL - sets a safety value that the analogical output must transmit in case the input sensor breaks (RTD or 4-20 mA). For the 4-20 mA current input, the sensor break is detected when the input signal is less than 3 mA (for LIM.LOW ≥ 20.0%) or is greater than 21 mA. The value configured in FAIL is given in percentage of the output Full Scale (%FS), within the allowed value range between 0% and 105%. For example, in case of a 4-20 mA output range and FAIL=15%, the output transmits 3 mA at the moment the input sensor break is detected.

Level 5 - Calibration

Level 5 is described in section 4.5, Calibration.

Level 6 - RS

Refer to the Communication Manual and see section 5 - MODBUS Communication.

4.0 - Maintenance

4.1 - Hardware

The transmitter maintenance requires the user to have access to the instrument hardware. The instrument hardware consists of three main boards: Display Board, CPU Board and Power Supply Board. The Display Board is located inside the MCY-20 Configuration Module. The CPU and Power Supply Boards are located inside the TY-2090-Energy Transmitter.

To have access to the CPU and Power Supply Boards, follow the instructions below:

Remove all screws indicated by a dashed line according to figure 20 below, totaling 10 screws

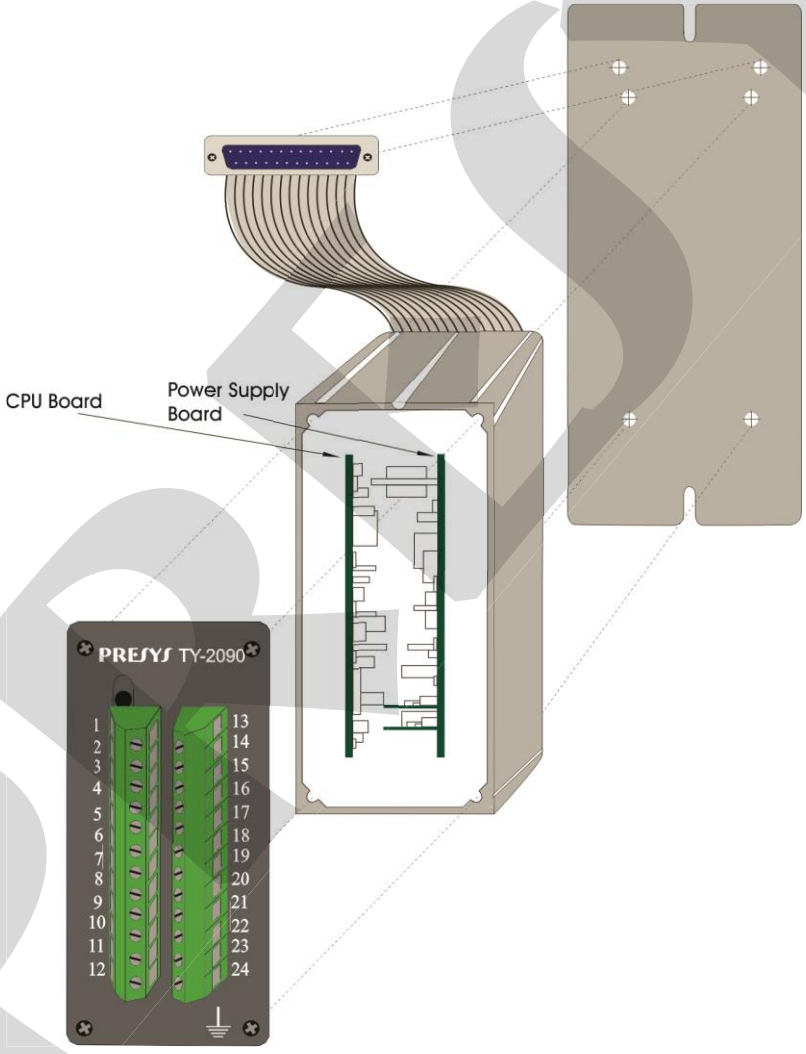


Fig. 19 - Transmitter Dismounting Scheme

Slide the CPU and Power Supply Boards out of the aluminum case, together with the DB-25 Terminal. Notice that both boards are united by a screwed spacer between them. Remove the screw which fastens one of the holder sides and open the boards as illustrated in figure 20.

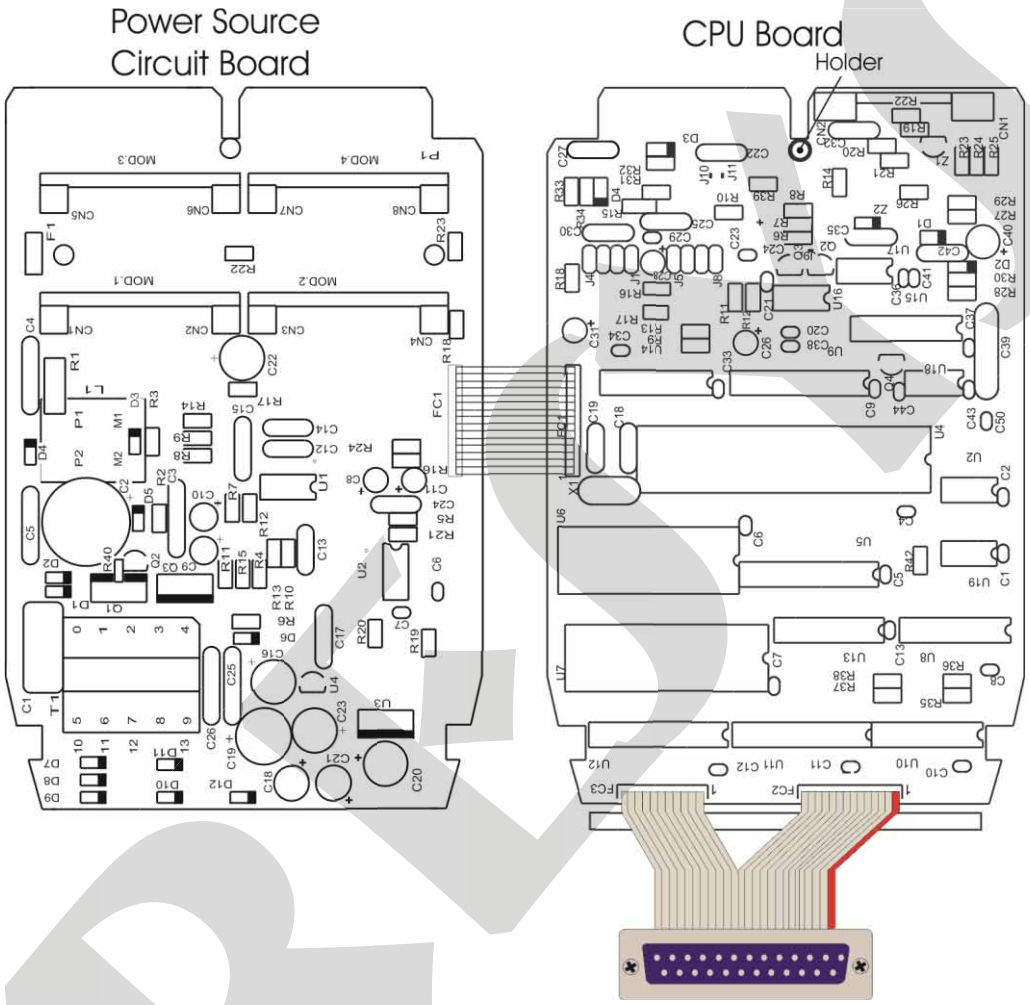


Fig. 20 - Transmitter Hardware

4.2 - Hardware Configuration

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 1: J5, J6, J7 and J8; and four places for installation of jumpers for channel 2: J1, J2, J3 and J4. They are located on the CPU Board as illustrated in figure 21.

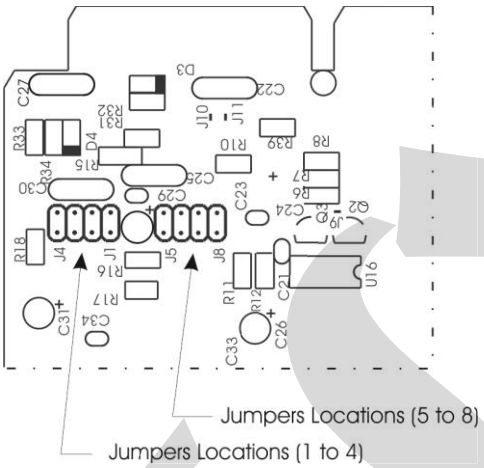


Fig. 21 - Jumper Locations on the CPU Board

Table 3 shows 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				Channel 1			
Voltage (0 to 55 mV)	J1			J4	J5		J7	
Voltage (0 to 5 V)	J1			J4	J5		J7	
Voltage (0 to 10 V)*			J3			J6		
2-wire or 3-wire RTD	J1	J2			J5			J8
Current (0 to 20 mA)			J3	J4		J6	J7	

(*) For 0 to 10 V 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.

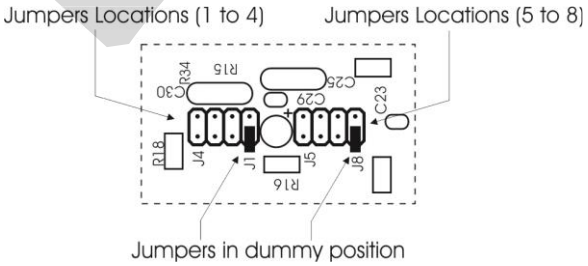


Fig. 22 - Jumpers not used for 0 to 10V input placed in the board conector

4.3 - Using Snubber with relays

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.

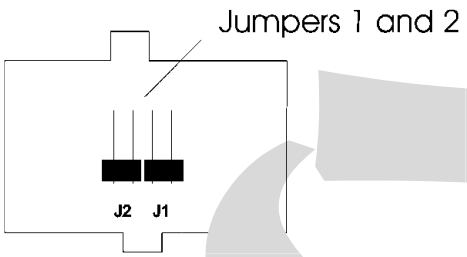


Fig. 23 - Jumpers for the selection of snubbers on the relay board

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 Modules Installation

The TY-2090-Energy transmitter accepts up to four output devices and communication, which must have the corresponding optional modules installed in the instrument. Open the transmitter 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).

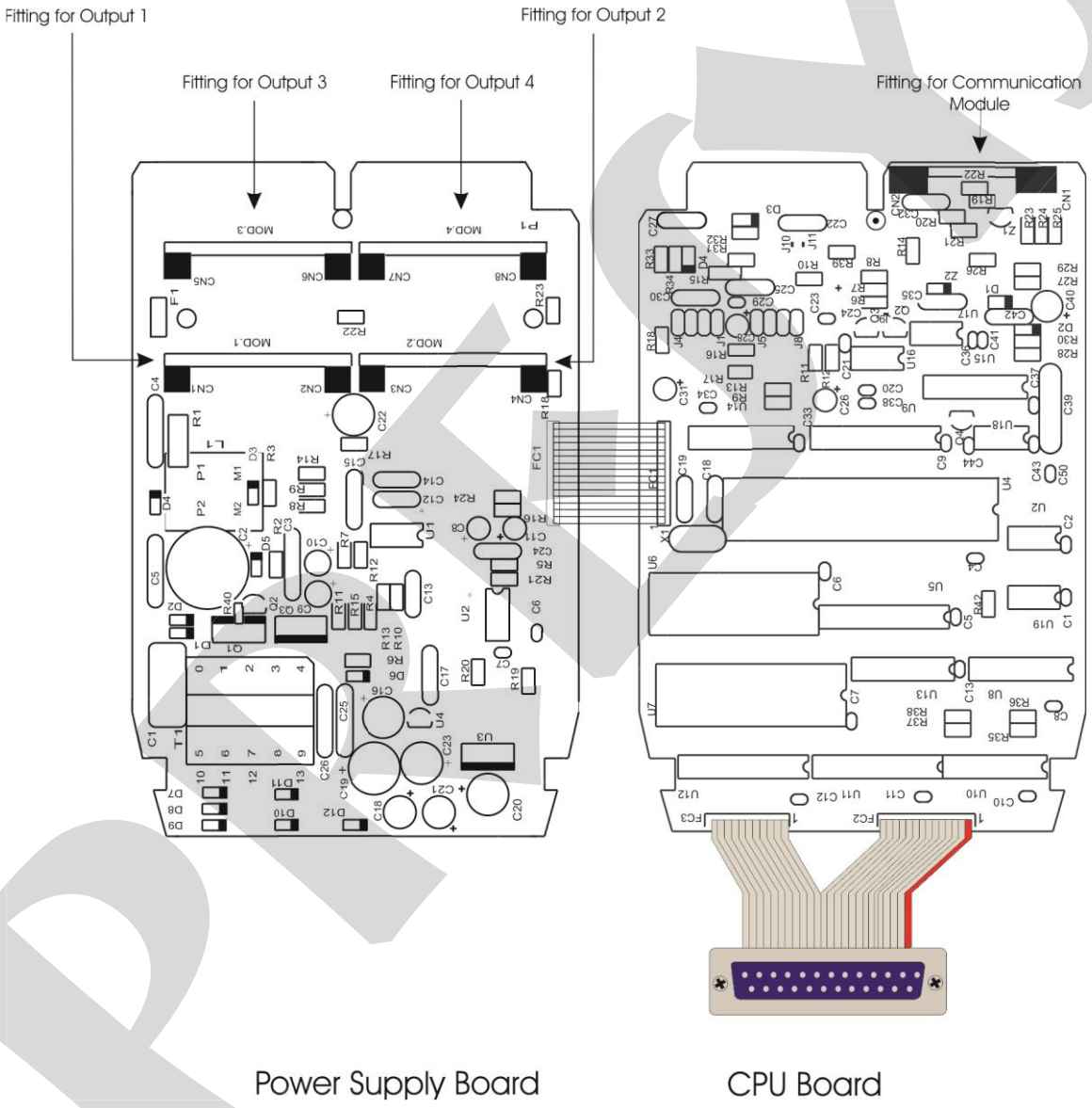


Fig. 24 - Optional Module Connections

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 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 25.

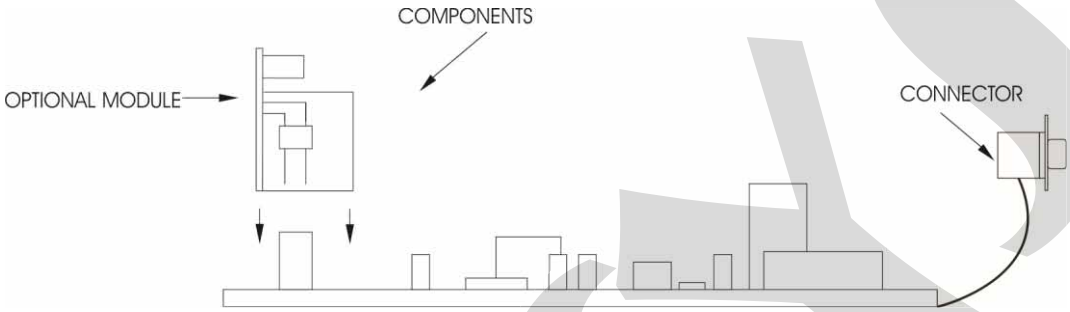


Fig. 25 - Optional Module Installation

Outputs 1 and 2 as retransmission outputs (optional module code: MSAN-20)

Whenever output 1 is required to be a retransmission output (4 to 20 mA, 1 to 5 V or 0 to 10 V), connect the optional analog output module in the connector called MOD 1. If another retransmitter output is needed, connect the second module in the conector called MOD 2.

The optional analog output module has two connectors for installation of jumpers: J1 and J2, as illustrated in figure 26.

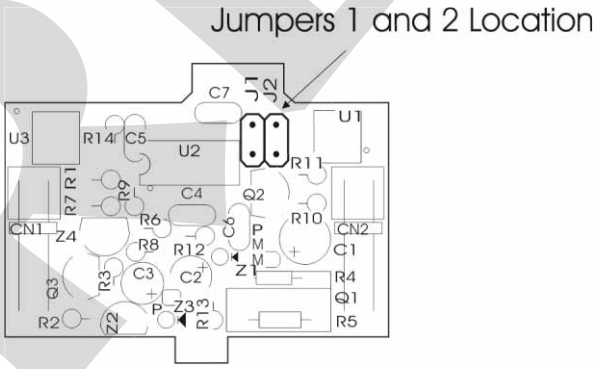


Fig. 26 - Jumper locations on analog output board

In order to configure the optional analog output module for retransmission output of 4 to 20 mA, 1 to 5 V or 0 to 10 V, install the jumper according to Table 4.

Retransmission Output Types	Jumpers	
4 to 20 mA*		
1 to 5 V	J1	
0 to 10 V		J2

(*) 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.

Table 4 - Configuration Jumper for Retransmission Output Types

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: SPST relay, the solid state relay and the open collector voltage. The alarm output type and the optional module code are listed in table 5.

Alarm Output Type	Optional Module Code
SPST Relay	MALRE - 20
Solid-state Relay	MALRS - 20
Open Collector Voltage	MSD - 20

Table 5 - 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 6

Alarm Output Type	Optional Module Code
SPDT Relay	MALRE - 20
Solid-state Relay	MALRS - 20
Open Collector Voltage	MSD - 20

Table 6 - Alarm output types for outputs 3 and 4

4.5 - Calibration

Warning: Only enter the following options after understanding them perfectly. Otherwise, it may be necessary to return the instrument to the factory for recalibration. Calibration in this manual means adjustment.

The TY-2090-Energy transmitter is accurately calibrated in factory and does not require regular calibration under normal conditions. If, for any reason, a recalibration is required, follow the procedure described below.

- Disconnect process signals from the Transmitter I/O terminals.
- Connect the MCY-20 Configuration Module to Transmitter.
- Before carrying out the calibration, allow the instrument to warm up for at least 30 minutes to ensure it reaches stable operating conditions.

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

Input Calibration

The input calibration describes the procedure to be followed when calibrating input 1 and input 2.

The accuracy of the equipment used for generating the references for calibration should be at least twice better than the Transmitter specifications.

References are related to the type of input to be calibrated, and are shown on the following tables. The column on the right shows the mnemonics displayed on Module display in the calibration process.

Always check that internal jumper configuration correctly matches the input type to be calibrated.

Before carrying out the calibration, it is necessary to access Calibration Level 5. The calibration level has a password system to prevent the inadvertent access to this level, which could damage the calibration parameters of the transmitter.

The password for accessing this calibration level is number 5.

Once the calibration password is provided, select the input type to be calibrated within the INPUT option. Select the channel to be calibrated by pressing ENTER. The MCY-20 Module display will show the mnemonics corresponding to the references required for the calibration process. The references should be entered before the corresponding mnemonic appears on display, and the calibration is started by pressing the ENTER key. At this time the Transmitter starts the calibration procedure with the CAL mnemonic blinking on the Module display.

When the display stops blinking and the corresponding mnemonic is back on screen, the calibration process for the first point will have finished.

Change to the next reference and press the DOWN key to select the next point. Always wait 1 minute between two calibration points. After this time is elapsed, press ENTER to start calibration of the second 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 recalibrate only one point, without affecting 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 the input and output calibration options for Calibration Level 5.

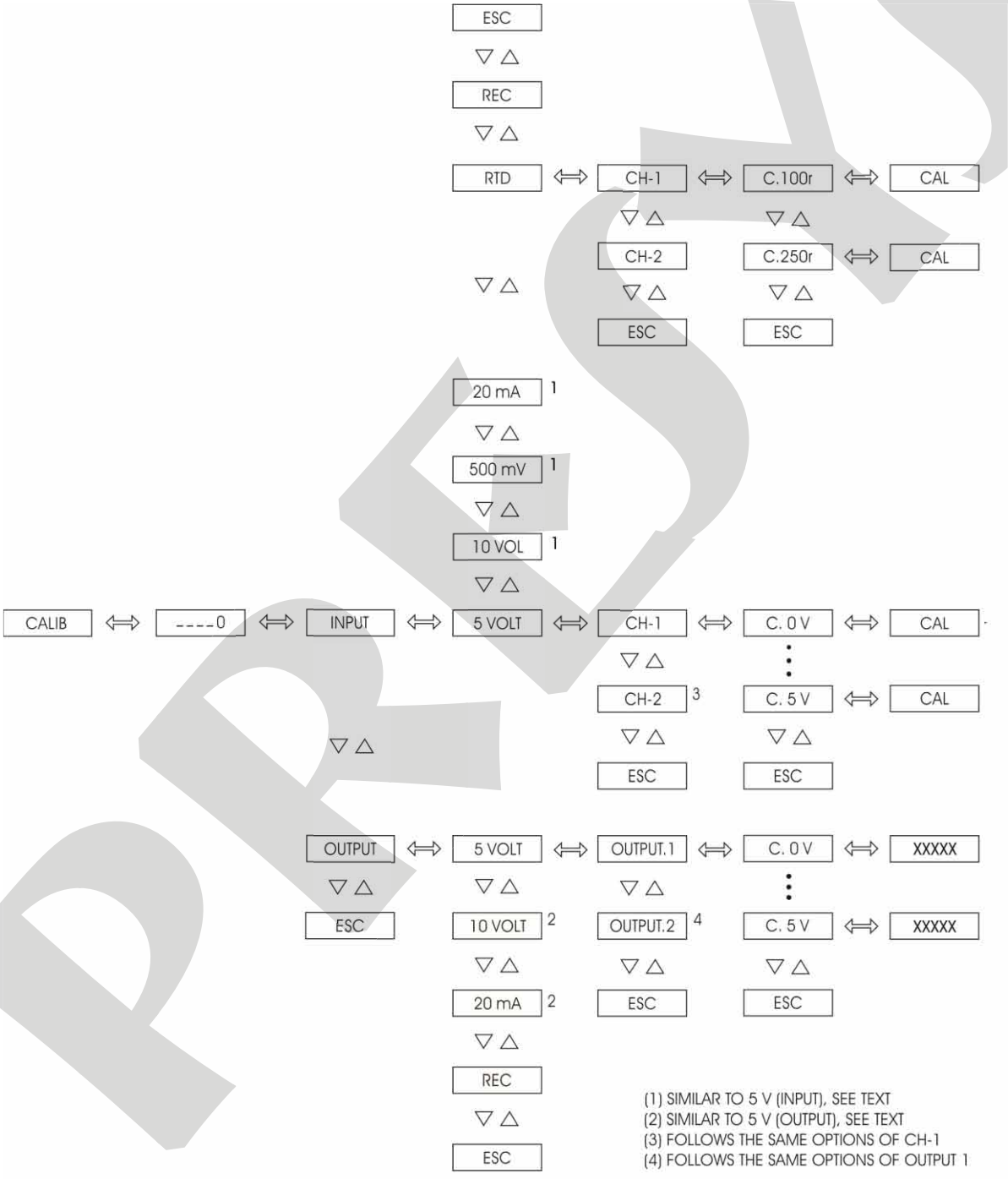


Fig. 27 - CALIBRATION Level Options

Calibration of Voltage Input (0 to 500 mV)

In order to calibrate a voltage input from 0 to 500 mV, connect an accurate voltage source to the channel to be calibrated (terminals 2 (+) and 3 (-) for channel 1, or 5 (+) and 6 (-) for channel 2). It is required 6 voltage references listed in table 7.

Reference	Mnemonic
0.00 mV	C. 0n
100.00 mV	C.100n
200.00 mV	C.200n
300.00 mV	C.300n
400.00 mV	C.400n
500.00 mV	C.500n

Table 7 - References for 0 to 500mV input calibration

Calibration of Voltage Input (0 to 5 V)

In order to calibrate a voltage input from 0 to 5 V, connect an accurate voltage source to the channel to be calibrated (terminals 2 (+) and 3 (-) for channel 1, or 5 (+) and 6 (-) for channel 2). It is required 6 voltage references listed in table 8.

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

Table 8 - References for 0 to 5V input calibration

Calibration of Voltage Input (0 to 10 V)

In order to calibrate a voltage input from 0 to 10 V, connect an accurate voltage source to the channel to be calibrated (terminals 1 (+) and 3 (-) for channel 1, or 4 (+) and 6 (-) for channel 2). It is required 6 voltage references listed in table 9.

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

Table 9 - References for 0 to 10V input calibration

Calibration of Current Input (0 to 20 mA)

In order to calibrate a current input from 0 to 20 mA, connect an accurate current source to the channel to be calibrated (terminals 1 (+) and 3 (-) for channel 1, or 4 (+) and 6 (-) for channel 2). It is required 6 current references listed in table 10.

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 10 - References for 0 to 20 mA input calibration

Calibration of 2 or 3-wire RTD input

In order to calibrate the 3-wire RTD input, connect precision resistors of values listed in table 11 to the channel to be calibrated (terminals 1 and 2 with terminals 2 and 3 short-circuited for channel 1; or terminals 4 and 5 with terminals 5 and 6 short-circuited for channel 2).

In case a precision decade is available, make sure that the three connection wires have exactly the same length, gauge and material.

There is no calibration procedure for the 2-wire RTD input. This is automatically carried out when the 3-wire RTD is calibrated.

Reference	Mnemonic
100.000 Ω	C.100r
250.000 Ω	C.250r

Table 11 - References for 3-wire RTD input calibration

Output Calibration

This topic describes the procedure to be followed in order to calibrate the retransmission outputs 1 and 2.

The retransmitter output will be calibrated by using the transmitter inputs.

Output 1 will be calibrated by input 1, and output 2 will be calibrated by input 2.

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 transmitter 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 for the output calibration has already been properly calibrated.

Make the connections listed in table 12 according to the output module and output type to be calibrated.

Output type	Output 1 with Input 1	Output 2 with Input 2
current (0 to 20 mA) voltage (0 to 10 V)	terminal 13 (+) with 1 (+) terminal 14 (-) with 3 (-)	terminal 15 (+) with 4 (+) terminal 16 (-) with 6 (-)
voltage (0 to 5 V)	terminal 13 (+) with 2 (+) terminal 14 (-) with 3 (-)	terminal 15 (+) with 5 (+) terminal 16 (-) with 6 (-)

Table 12 - I/O terminal connections for output calibration

Enter Calibration level 5 and select which of the two outputs will be calibrated. Then, select the output type (0 to 20 mA, 0 to 5 V or 0 to 10 V) and press ENTER.

The Module display will show the mnemonic corresponding to the first calibration point. There are six output calibration points.

In case of current output, the mnemonics correspond to the electric signals 0, 4, 8, 12, 16 and 20 mA. In case of voltage, the mnemonics correspond to the signals 0, 1, 2, 3, 4 and 5 V or 0, 2, 4, 6, 8 and 10 V.

By pressing ENTER after the mnemonic corresponding to the calibration point is displayed, the Module display will show the output value. Then, it will be possible to adjust the output value for the electric level presented by the mnemonics through the UP and DOWN keys. After adjusting, press ENTER. **When calibrating the first point (0 mA, 0 V), be careful to avoid output signal saturation.**

Return to normal operating level by reverting to level zero.

Return to factory calibration

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

In case of a poor performance of the instrument due to an incorrect calibration, use the RECUP option (see figure 28).

RECUP - This option allows the recovering of factory calibration values. It is valid for both the inputs and outputs.

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 Indicator:

Instrument indicating error on display of the MCY-20 Configuration Module

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 and ERR.06 error messages.

The ERR.03 message is shown 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 relays 1 and 2 before enabling analog output 1 and 2 and vice-versa.

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

The ERR.06 message is shown when trying to configure a relay as a trip alarm while it is configured as a failure alarm or vice versa.

Instrument with the MCY-20 Module display off

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

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 28 are close to the values in table 13 and if they reach the CPU Board.

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

Table 13 - Inspection points of voltage on flat cable 1

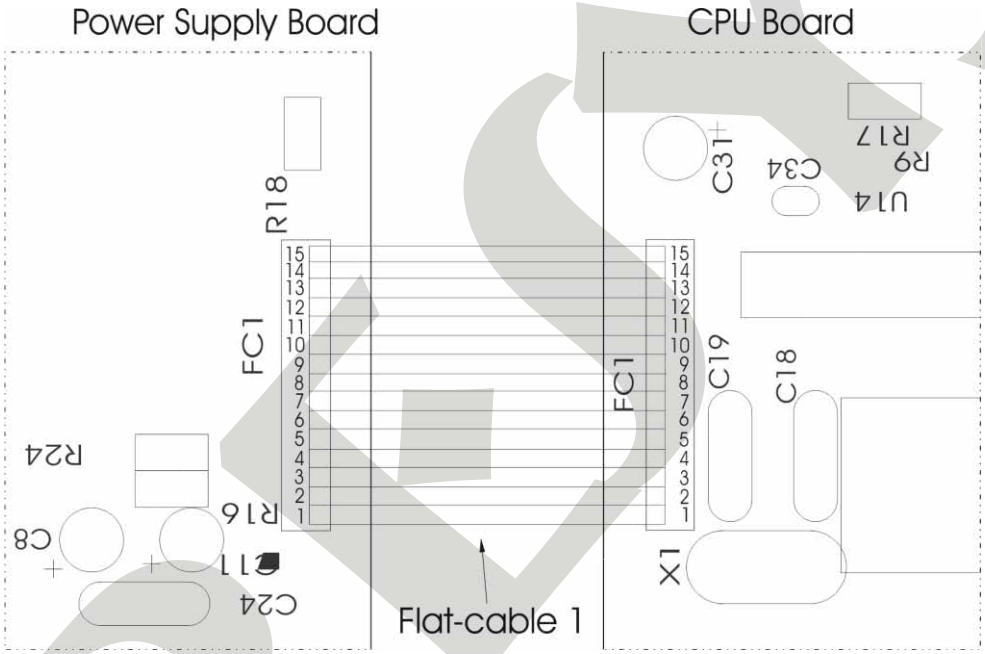


Fig. 28 - Voltage test points of the Transmitter

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

4.7 - List of Components

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
01.01.0028-21	78L24	U 4
01.04.0007-21	Diode 1N4007	D 1, 2, 3, 4
01.04.0008-21	Diode 1N4936 / 1N4937	D 5, 6, 7, 8, 9, 10, 11, 12
01.03.0009-21	Disc Ceramic Capacitor 100 pF x 100 V - Thomson	C 12, 13, 14
01.03.0036-21	Multilayer Ceramic Capacitor 0.01 µF x 63 V (VP 42 UMA)	C 24
01.03.0035-21	Multilayer Ceramic Capacitor 0.1 µF x 63 V (VP 42 UMA)	C 6, 7
01.03.0039-21	Polyester Capacitor 0.1 µF x 250 V (5141)	C 1, 3
01.03.0022-21	Polyester Capacitor 0.01µF x 100V	C 15, 17
01.03.0041-21	Polyester Capacitor 0.01µF x 250V J	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
01.03.0043-21	Radial Electrolytic Capacitor 100µF x 35V	C 16, 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 1R 5%	R 1
01.02.0111-21	Resistor 220R 5%	R 15
01.02.0126-21	Resistor 270R 5%	R 10
01.02.0114-21	Resistor 470R 5%	R 4
01.02.0074-21	Resistor 1K 5%	R 17, 18, 22, 23
01.02.0075-21	Resistor 4K7 5%	R 16, 24
01.02.0080-21	Resistor 10K 5%	R 8, 12
01.02.0082-21	Resistor 18K 5%	R 5, 20, 21
01.02.0116-21	Resistor 20K 5%	R 7
01.02.0083-21	Resistor 27K 5%	R 11
01.02.0110-21	Resistor 47K 5%	R 14
01.02.0085-21	Resistor 150K 5%	R 3
01.02.0106-21	Resistor 470K 5%	R 9
01.02.0088-21	Resistor 20R 1%	R 2
01.02.0006-21	Resistor 2K32 1%	R 6
01.02.0183-21	Resistor 15K4 1%	R 13
01.02.0108-21	Transformer for source 110/220Vca	R 19
01.06.0003-21	Source Coil	T 1
01.06.0018-21	Connector	L 1
01.13.0004-21	Resistor 1R 5%	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
01.01.0016-21	EPROM 27C512	U 7
01.01.0050-21	MB84256-10L-SK	U 6
01.01.0044-21	E2PROM X25C43P	U 19
01.01.0034-21	NVRAM X24C45P	U 2
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 5, 9, 11, 12
01.01.0045-21	80C32	U 4
01.01.0026-21	AD706	U 16
01.01.0027-21	AD 712 JN	U 17
01.16.0001-11	Crystal 11.0592 MHz	X 1
01.09.0013-21	Transistor BC 327	Q 4
01.04.0003-21	Diode 1N4148	D1, 2
01.04.0006-21	Zener BZX 79/C6V2	Z 2
01.03.0067-21	Disk Ceramic Capacitor 56pF x 50V (4mm)	C 18, 19
01.03.0035-21	Multilayer Ceramic Capacitor 0.1 µF x 63 V (VP 42 UMA)	C 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, C 20, 21, 22, 24, 25, 27, 29, 30, C 32, 33, 34, 35, 36, 37, 38, 41, C 42, 43, 44
01.03.0039-21	Polyester Capacitor 0.1 µF x 250 V (5141)	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, 15, 18, 35, 36, 37, 38
01.02.0119-21	Resistor 15K 5%	R 42
01.02.0089-21	Resistor 1M 5%	R 11, 12, 16, 17
01.02.0098-21	Resistor 10M 5%	R 31, 33
01.17.0002-21	Jumper (w/o stem)	Selected
01.17.0003-21	Bar MSO 22J04	J 1-J4, J5-J8
01.13.0043-21	Socket 28 pins	U 7
01.13.0005-21	Connector	CN 1, 2
01.14.0011-21	Flat-Cable 12 ways	FC 3
01.14.0025-21	Flat Cable 13 ways	FC 2
01.14.0026-21	Flat Cable 15 ways	FC 1

I/O Terminal Board

Code	Components	Reference
01.05.0049-20	I/O Terminal Board	----------
01.09.0015-21	BC 337	U 1
01.13.0002-21	Terminal TS 504-3	CN 1, 2
01.13.0003-21	Female Connector 26 - ES31B213	P 1, 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	Optical Coupler 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 BZX 79/C3V3	Z 1
01.04.0011-21	Zener 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	Multilayer Ceramic Capacitor 0,1μF x 63 V	C 5, 6
01.03.0011-21	Multilayer Ceramic Capacitor 220pF x 63V	C 4, 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	Bar MS0 22J02	J 1, 2
01.17.0004-21	Bar MSP 22J02	CN 1, 2
01.17.0002-21	Jumper MKB (w/o stem) 0020D	Selected
01.06.0004-21	Coil	----------

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	Bar MSP 22J02	CN 1, 2

4.8 - List of Recommended Spare Components

Power Supply Board

IRF 822	Q 3
UC-3842	U 1
Fuse 2A	F 1
LM-1458N	U 2

I/O Terminal Board

BC 337	Q 1

CPU Board

4051	U 14
4053	U 15
LM-336/5V	Z 1

Engineering Units Label
Code: 02.10.0003-21

5.0 - MODBUS Communication

Specific information about communication and connection of the signals is described in the communication manual.

5.1 - List of MODBUS Communication Registers

The table below lists all registers found in TY-2090-ENERGY, their respective addresses and ranges of allowed values.

Addr	Register	Value range
00	Process Variable of channel 1	Read-only (E.U.-Engineering Unit)
01	Process Variable of channel 2	Read-only (E.U.-Engineering Unit)
02	First character of TAG	(*i*)
03	Second character of TAG	(*i*)
04	Third character of TAG	(*i*)
05	Forth character of TAG	(*i*)
06	Fifth character of TAG	(*i*)
07	Address for communication (ADDRE mnemonic)	0 to 99
08	Transmission mode (PROT mnemonic)	0 - ASCII 1 - RTU
09	Baud rate (BAUD mnemonic)	0 - 300 bauds 1 - 600 bauds 2 - 1200 bauds 3 - 2400 bauds 4 - 4800 bauds 5 - 9600 bauds
10	Parity (PARIT mnemonic)	0 - no parity 1 - even parity 2 - odd parity
11	Channel 1 Input type	0 - 5V 1 - 10V 2 - 500mV 3 - 20mA 4 - temperature
12	Channel 2 Input type	See register 11
13	Type of RTD used for channel 1 (TYPE mnemonic)	6 - 2-Wire RTD 7 - 3-Wire RTD
14	Type of RTD used for channel 2	See register 13
15	Burn-out type of channel 1 (B.OUT mnemonic)	0 - downscale burn-out 1 - upscale burn-out
16	Burn-out type of channel 2	See register 15
17	Number of decimals for channel 1 (DEC.PT mnemonic)	0 - no decimal 1 - one decimal 2 - two decimals 3 - three decimals 4 - four decimals

18	Number of decimals for channel 2	See register 17
19	Temperature unit of channel 1 (UNIT mnemonic)	0 - Celsius degree 1 - Fahrenheit degree
20	Temperature unit for channel 2	See register 19
21	Minimum value for square root extraction for channel 1 (CUT-OFF mnemonic)	0 to 5 %
22	Minimum value for square root extraction for channel 2	0 to 5 %
23	Time constant value for the digital filter of channel 1 (FILTER mnemonic)	0.0 to 25.0 seconds
24	Time constant value for the digital filter of channel 2	0.0 to 25.0 seconds
25	Retransmission range of output 1 (RANGE mnemonic)	0 - 5V 1 - 10 V 2 - 20 mA
26	Retransmission range of output 2	See register 25
27	Input associated with output 1 (INPUT mnemonic in the OUTPUT level)	0 - input of channel 1 1 - input of channel 2
28	Input associated with output 2	See register 27
29	Hysteresis of channel 1 high alarm associated with relay 1 (HYST mnemonic)	0 to 250 E.U. channel 1
30	Hysteresis of channel 1 low alarm associated with relay 1	0 to 250 E.U. channel 1
31	Hysteresis of channel 2 high alarm associated with relay 1	0 to 250 E.U. channel 2
32	Hysteresis of channel 2 low alarm associated with relay 1	0 to 250 E.U. channel 2
33	Hysteresis of channel 1 high alarm associated with relay 2	0 to 250 E.U. channel 1
34	Hysteresis of channel 1 low alarm associated with relay 2	0 to 250 E.U. channel 1
35	Hysteresis of channel 2 high alarm associated with relay 2	0 to 250 E.U. channel 2
36	Hysteresis of channel 2 low alarm associated with relay 2	0 to 250 E.U. channel 2
37	Hysteresis of channel 1 high alarm associated with relay 3	0 to 250 E.U. channel 1
38	Hysteresis of channel 1 low alarm associated with relay 3	0 to 250 E.U. channel 1
39	Hysteresis of channel 2 high alarm associated with relay 3	0 to 250 E.U. channel 2
40	Hysteresis of channel 2 low alarm associated with relay 3	0 to 250 E.U. channel 2
41	Hysteresis of channel 1 high alarm associated with relay 4	0 to 250 E.U. channel 1
42	Hysteresis of channel 1 low alarm associated with relay 4	0 to 250 E.U. channel 1
43	Hysteresis of channel 2 high alarm associated with relay 4	0 to 250 E.U. channel 2
44	Hysteresis of channel 2 low alarm associated with relay 4	0 to 250 E.U. channel 2
57	Setpoint of channel 1 high alarm associated with relay 1 (SP mnemonic)	-1009 to 20019 E.U. channel 1
58	Setpoint of channel 1 low alarm associated with relay 1	-1009 to 20019 E.U. channel 1
59	Setpoint of channel 2 high alarm associated with relay 1	-1009 to 20019 E.U. channel 2
60	Setpoint of channel 2 low alarm associated with relay 1	-1009 to 20019 E.U. channel 2
61	Setpoint of channel 1 high alarm associated with relay 2	-1009 to 20019 E.U. channel 1
62	Setpoint of channel 1 low alarm associated with relay 2	-1009 to 20019 E.U. channel 1
63	Setpoint of channel 2 high alarm associated with relay 2	-1009 to 20019 E.U. channel 2

64	Setpoint of channel 2 low alarm associated with relay 2	-1009 to 20019 E.U. channel 2
65	Setpoint of channel 1 high alarm associated with relay 3	-1009 to 20019 E.U. channel 1
66	Setpoint of channel 1 low alarm associated with relay 3	-1009 to 20019 E.U. channel 1
67	Setpoint of channel 2 high alarm associated with relay 3	-1009 to 20019 E.U. channel 2
68	Setpoint of channel 2 low alarm associated with relay 3	-1009 to 20019 E.U. channel 2
69	Setpoint of channel 1 high alarm associated with relay 4	-1009 to 20019 E.U. channel 1
70	Setpoint of channel 1 low alarm associated with relay 4	-1009 to 20019 E.U. channel 1
71	Setpoint of channel 2 high alarm associated with relay 4	-1009 to 20019 E.U. channel 2
72	Setpoint of channel 2 low alarm associated with relay 4	-1009 to 20019 E.U. channel 2
85	Enables the trip alarm for relay 3	0 – Trip disabled 1 – Low trip alarm (LO) 2 – High trip alarm (HI)
86	Enables the trip alarm for relay 4	See register 85
87	Low limit of channel 1 input signal (LIM LOW mnemonic from INPUT level)	0.0 to 100.0 % (iv)
88	Low limit of channel 2 input signal	0.0 to 100.0 % (iv)
89	High limit of channel 1 input signal (LIM HIGH mnemonic from INPUT level)	0.0 to 100.0 % (iv)
90	High limit of channel 2 input signal	0.0 to 100.0 % (iv)
91	Display indication of channel 1 input signal low limit (ENG LOW mnemonic from INPUT level)	-1009 to 20019 E.U. channel 1
92	Display indication of channel 2 input signal low limit	-1009 to 20019 U.E. channel 2
93	Display indication of channel 1 input signal high limit (ENG HIGH mnemonic from INPUT level)	-1009 to 20019 E.U. channel 1
94	Display indication of channel 2 input signal high limit	-1009 to 20019 E.U. channel 2
95	Channel 1 Offset (OFSET mnemonic)	-9999 to 30000 E.U. channel 1
96	Channel 2 Offset	-9999 to 30000 E.U. channel 2
97	Display indication of output 1 retransmission signal low limit (ENG LOW mnemonic from OUTPUT level)	-1009 to 20019 E.U. channel 1 or 2 (iii)
98	Display indication of output 2 retransmission signal low limit	-1009 to 20019 E.U. channel 1 or 2 (iii)
99	Display indication of output 1 retransmission signal high limit (ENG HIGH mnemonic from OUTPUT level)	See register 97
100	Display indication of output 2 retransmission signal high limit	See register 98
101	High limit of output 1 retransmission signal (LIM HIGH mnemonic from OUTPUT level)	0.0 to 100.0 % (iv)

102	Low limit of output 1 retransmission signal (LIM LOW mnemonic from OUTPUT level)	0.0 to 100.0 % (iv)
103	High limit of output 2 retransmission signal (LIM HIGH mnemonic from OUTPUT level)	0.0 to 100.0 % (iv)
104	Low limit of output 2 retransmission signal (LIM LOW mnemonic from OUTPUT level)	0.0 to 100.0 % (iv)
105	Delay related to relay 1 (DELAY mnemonic)	0.0 to 3000.0 seconds
106	Delay related to relay 2	0.0 to 3000.0 seconds
107	Delay related to relay 3	0.0 to 3000.0 seconds
108	Delay related to relay 4	0.0 to 3000.0 seconds
109	Password (PASS mnemonic)	-9999 to 30000
110	Version (SOFT mnemonic)	Reading only
113	Transmission output 1 signal for an input failure	0 to 105%
114	Transmission output 2 signal for an input failure	0 to 105%
115	Change in the indication of channel 1 when the 20mA-current sensor breaks (BREAK mnemonic)	0 - downscale (DOWN) 1 - upscale (UP) 2 – none
116	Change in the indication of channel 2 when the 20mA-current sensor breaks (BREAK mnemonic)	See register 115

Notes:

- E.U. means Engineering Units;
- The value ranges of certain registers listed in the table above have decimals. For purposes of message formation, one should ignore that decimal point since it is fixed. So, in order to change the digital filter value (register 23) of channel 1 to 1.0 second, for example, it is necessary to change the register value to 10;

(i) The allowed values for TAG characters are the ASCII codes of the following characters: '-', '.', '_', ' ', '0' to '9' and 'a' to 'y' (excepting 'm', 'v', 'w' and 'x');

(ii) The low limit of input signal cannot be higher than the high limit;

(iii) For registers 97 and 98, the E.U. is dependent on registers 27 and 28, respectively;

(iv) The low limit of output retransmission signal cannot be higher than the high limit.

5.2 - List of Communication Coils

The table below lists all coils found in TY-2090-Energy.

End	Coils
1	Enables password by value (VALUE mnemonic)
2	Enables password by key (KEY mnemonic)
3	Enables safety condition of relay 1 (SAFE mnemonic)
4	Enables safety condition of relay 2
5	Enables safety condition of relay 3
6	Enables safety condition of relay 4
26	Enables channel 1 high alarm associated with relay 1
27	Enables channel 1 high alarm associated with relay 2
28	Enables channel 1 high alarm associated with relay 3
29	Enables channel 1 high alarm associated with relay 4
34	Enables channel 1 low alarm associated with relay 1
35	Enables channel 1 low alarm associated with relay 2
36	Enables channel 1 low alarm associated with relay 3
37	Enables channel 1 low alarm associated with relay 4
42	Enables channel 2 high alarm associated with relay 1
43	Enables channel 2 high alarm associated with relay 2
44	Enables channel 2 high alarm associated with relay 3
45	Enables channel 2 high alarm associated with relay 4
50	Enables channel 2 low alarm associated with relay 1
51	Enables channel 2 low alarm associated with relay 2
52	Enables channel 2 low alarm associated with relay 3
53	Enables channel 2 low alarm associated with relay 4
58	Status of relay 1 *(i):* 0 - normal status; 1 - alarm status
59	Status of relay 2 *(i)*
60	Status of relay 3 *(i)*
61	Status of relay 4 *(i)*
72	Enables input 1
73	Enables input 2
76	Enables square root extraction for channel 1 (SQRT mnemonic)
77	Enables square root extraction for channel 2 (SQRT mnemonic)
78	Enables output 1
79	Enables output 2
80	Enables latching for relay 1 (LATCH mnemonic)
81	Enables latching for relay 2
82	Enables latching for relay 3
83	Enables latching for relay 4
84	Alarm acknowledgement of relay 1 *(ii)*
85	Alarm acknowledgement of relay 2 *(ii)*
86	Alarm acknowledgement of relay 3 *(ii)*
87	Alarm acknowledgement of relay 4 *(ii)*

88	Enables channel 1 failure alarm associated with relay 1
89	Enables channel 1 failure alarm associated with relay 2
90	Enables channel 1 failure alarm associated with relay 3
91	Enables channel 1 failure alarm associated with relay 4
92	Enables channel 2 failure alarm associated with relay 1
93	Enables channel 2 failure alarm associated with relay 2
94	Enables channel 2 failure alarm associated with relay 3
95	Enables channel 2 failure alarm associated with relay 4
96	Resets (re-enables) relay 3, configured as trip alarm, when it is disabled and the input failure condition is over (RST.F mnemonic): 0 - manual 1- automatic
97	Resets (re-enables) relay 4, configured as trip alarm, when it is disabled and the input failure condition is over
98	State of relay 3, configured as trip alarm, at the moment an input failure is detected: 0 – last (it maintains its contact position) 1 – released / RLS (its contact is changed to a non-alarm position)
99	State of relay 4, configured as trip alarm, at the moment an input failure is detected
100	Enables display indication of failure alarm occurrence (DSP.FL mnemonic)
101	Enables display indication of the instrument power up event (DSP.EN mnemonic)

(i) reading only coil;
(ii) writing only coil.