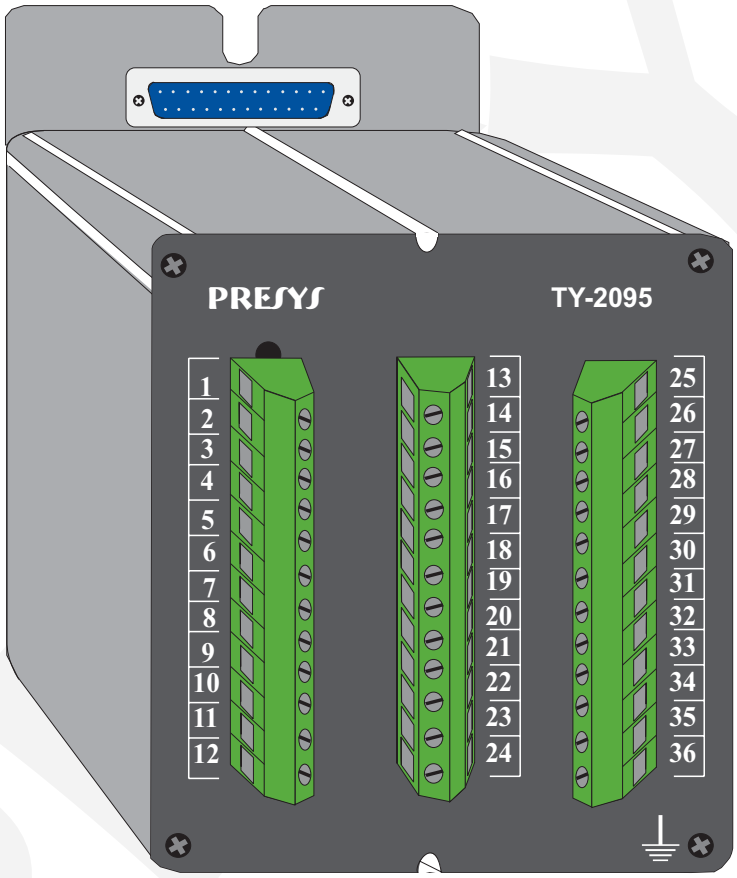
PRESYS | Instruments

TY-2095 Multi-Point Converter
Process Data Acquisition Module



TECHNICAL MANUAL

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1.0 - Introduction

1.1 - Description

PRESYS Digital Multi-Point Converter TY-2095 is a microprocessor-based instrument with up to 12 inputs for monitoring process variables found in industrial plants, such as, flow, level etc., and totalization of voltage and current linear inputs. It has non-volatile internal memory (E2PROM) to store calibration values. Its accuracy is warranted by autocalibration techniques based on a high thermal stability voltage reference.

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

The Converter presents specific models with 12 thermocouples or 8 RTD inputs for the monitoring of temperature, and 12 current (mA) or 12 voltage (V) linear signal inputs. There are also available models with two different types of input. Thermocouples and RTD inputs are linearized automatically by tables stored in the EPROM memory.

The totalization is performed independently for each channel of up to 8 linear inputs (mA current and V voltage), configured together with the number of decimals. The totalization counts do not decrease for signals under the zero scale defined by the user, and Reset can be applied to the totalization by means of the MCY-25 Configuration Module keys.

All configuration data can be protected by password and are stored in non-volatile memory in case of an external power failure.

According to modularity design concept, the Converter accepts up to two output alarm modules. The types of output are: SPDT relay and open collector voltage.

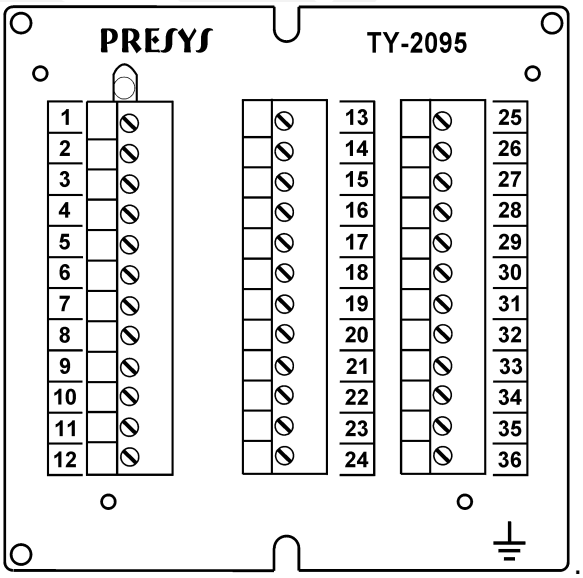


Fig. 1 - TY-2095 Converter front panel

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

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

1.2 - Order Code

TY-2095 - ___ - ___ - ___ - ___ - ___ - ___
A B C D E F

Field A		Inputs
	0	12 thermocouple inputs
	1	8 RTD inputs
	2	6 thermocouple and 4 RTD inputs
	3	12 current (mA) inputs
	4	12 voltage (V) inputs
	5	6 thermocouple and 6 current (mA) inputs
	6	6 thermocouple and 6 voltage (V) inputs
	7	6 current (mA) and 6 voltage (V) inputs
	8	6 current (mA) and 4 RTD inputs
	9	6 voltage (V) and 4 RTD inputs
Field B		Output 1
	0	Not used
	1	SPDT relay
	2	Open collector voltage
Field C		Output 2
	Same code of output 1	
Field D		Power Supply
	1	90 to 240VCA or 130 to 340VDC (any polarity)
	2	24VDC
	3	12VDC
Field E		Communication
	0	Not used
	1	RS-232
	2	RS-485
	3	RS-422
Field F		Case protection degree
	0	General usage, sheltered place, mounting on surface
	1	General usage, sheltered place, mounting on DIN rail
	2	Dust proof
	3	Weather proof

Note 1 - The indication, relay usage as alarms and alarm points are, among other things, items that the user can program through the MCY-25 Configuration Module (if wanted, specify these information so that all the configuration can be made by PRESYS).

Note 2 - Hardware and software features are available under previous consult.

Code Example:

1) TY-2095 - 0 - 1 - 1 - 1 - 0 - 0

This code defines a TY-2095 Converter for 12 thermocouple inputs with two SPDT relays which can be used as high and low alarm, 90 to 240VAC or 130 to 340VDC electric power supply, to be used in sheltered place with surface mounting.

1.3 - Technical Specifications

Inputs:

- Inputs for thermocouple (J, K, T, E, R, S, under ITS - 90).
- Inputs for Pt - 100 RTD under DIN 43760.
- Inputs for 4 to 20mA. 250Ω input impedance.
- Inputs for 1 to 5VDC. Input impedance above 10MΩ.

Table 1 shows the temperature ranges for thermocouples and RTD and the resolution for linear input sensors.

Input sensor	**Measuring Range limits**			
Thermocouple	lower limit °F	higher limit °F	lower limit °C	higher limit °C
Type J	-184.0	1886.0	-120.0	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 Pt-100 2 or 3 wires	-346.0	1256.0	-210.0	680.0*
Linear	Range		Resolution	
Voltage	0 to 5V		250μV	
Current	0 to 20mA		1μA	

(*) includes wire resistance

Table 1 - Measuring ranges for input sensors

Outputs:

- SPDT relays for alarm rated 3A 220VCA, or up to 10A 220VCA under order, In this case alarm module is not plugged through a connector, but connected to a base board. It is possible to use up to 2 alarm modules.
- Logic signal, open collector transistor, 24VDC, 40mA max. with isolation.

Serial Communication:

RS-232 or RS-422/485, with 50VDC isolation, as an optional module for connection in CPU board.

Indication:

Standard indication in -999 to 9999 range.

Totalization:

Totalization of up to 8 channels for linear inputs (mA current and V voltage) in 0 to 9999 range, configured with decimal point.

Configuration:

By RS-232 and RS-422/485 serial communication or through the MCY-25 Configuration Module.

Sampling rate:

480ms sampling rate, for indication of inputs in -999 to 9999 range. The display is updated each second.

Accuracy:

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

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.
Programmable "Cut - off" from 0 to 5 %.

Cold junction compensation:

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

Thermal stability:

±0.005 % / °C of span with reference to 25 °C ambient temperature.

Power supply:

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

Operating ambient:

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

Dimensions:

140 mm x 93 mm x 156 mm (height, width, depth).

Weight:

0.7 kg approx.

Warranty:

One-year warranty.

2.0 - Installation

2.1 - Mechanical Installation

TY-2095 Converter can be mounted on a surface or on all types of existing DIN rail, as illustrated in the figure below.

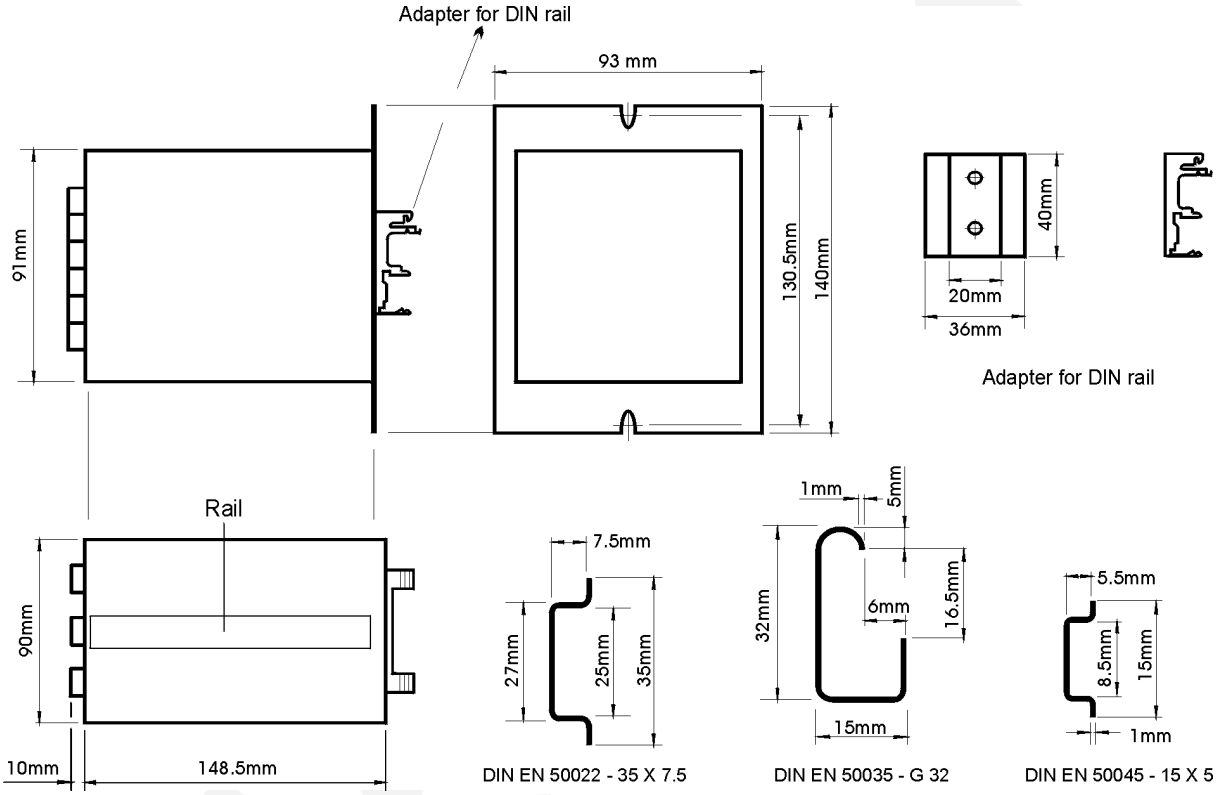


Fig. 2 - Dimensional drawing, panel cutout and side view

2.2 - Electrical Installation

TY-2095 Converter 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 of power supply, ground, communication, process input and output signals.

Signal wiring must be kept far away from power wires.

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

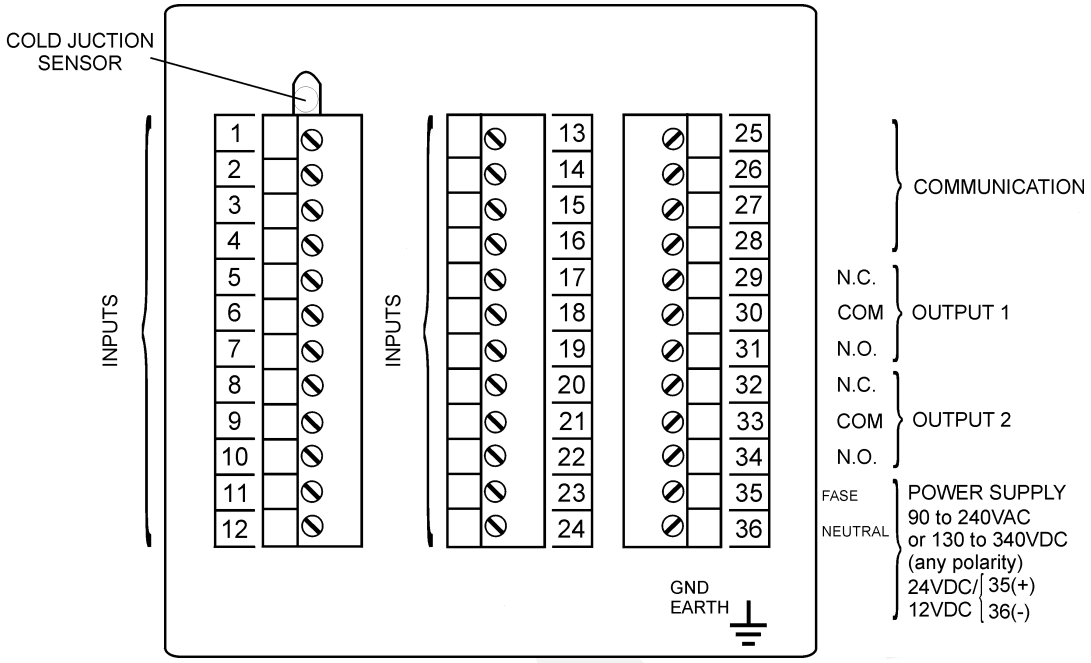


Fig. 3 - Converter terminals

2.3 - Process Input Signal Connections

The Converter presents specific inputs for connection of thermocouples, RTD, current (mA) or voltage (V). See the different types and ranges of input sensors in table 1, section 1.3 on Technical Specifications.

The connections explained below refer to the different types of input which exist in the several models of the TY-2095 Converter. Make only the connections allowed by the specific inputs in your instrument.

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 CONVERTER.

2.3.1 - Thermocouple Input

When using only one thermocouple, connect it to input 1, in order to get a better precision in the temperature measurement, since the cold junction sensor is placed near input 1.

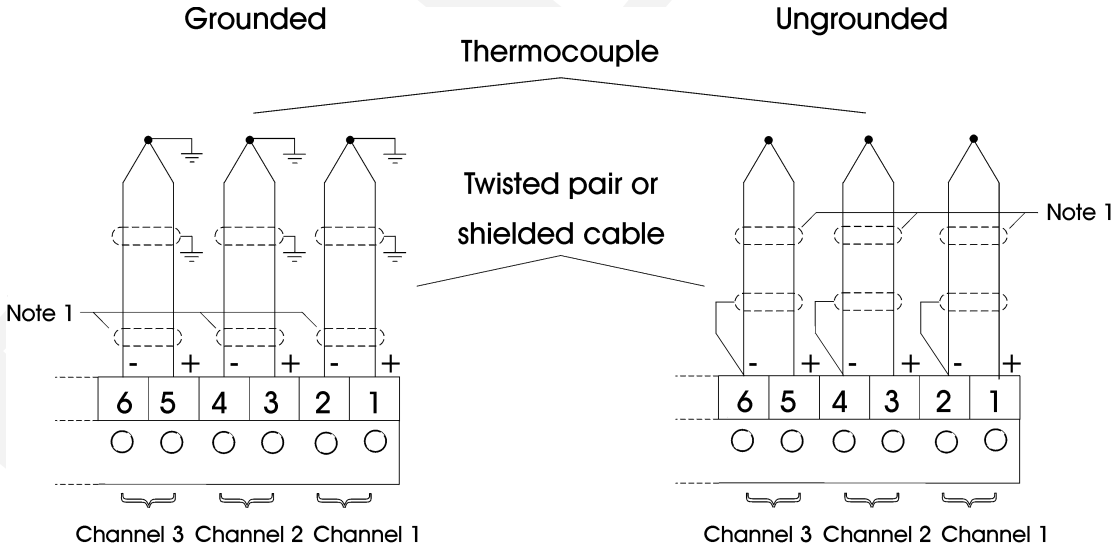
In order to reduce the error due to cold junction compensation, use thermal paste in the rear, at the terminals where the thermocouple is connected to the cold junction sensor.

Connect the thermocouples to the terminals shown below in table 2 for each channel:

Channel	Terminals
1	1(+) and 2(-)
2	3(+) and 4(-)
3	5(+) and 6(-)
4	7(+) and 8(-)
5	9(+) and 10(-)
6	11(+) and 12(-)
7	13(+) and 14(-)
8	15(+) and 16(-)
9	17(+) and 18(-)
10	19(+) and 20(-)
11	21(+) and 22(-)
12	23(+) and 24(-)

Table 2 - Thermocouple input terminals

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.



Note 1: Keep the shielded cable disconnected at this end.

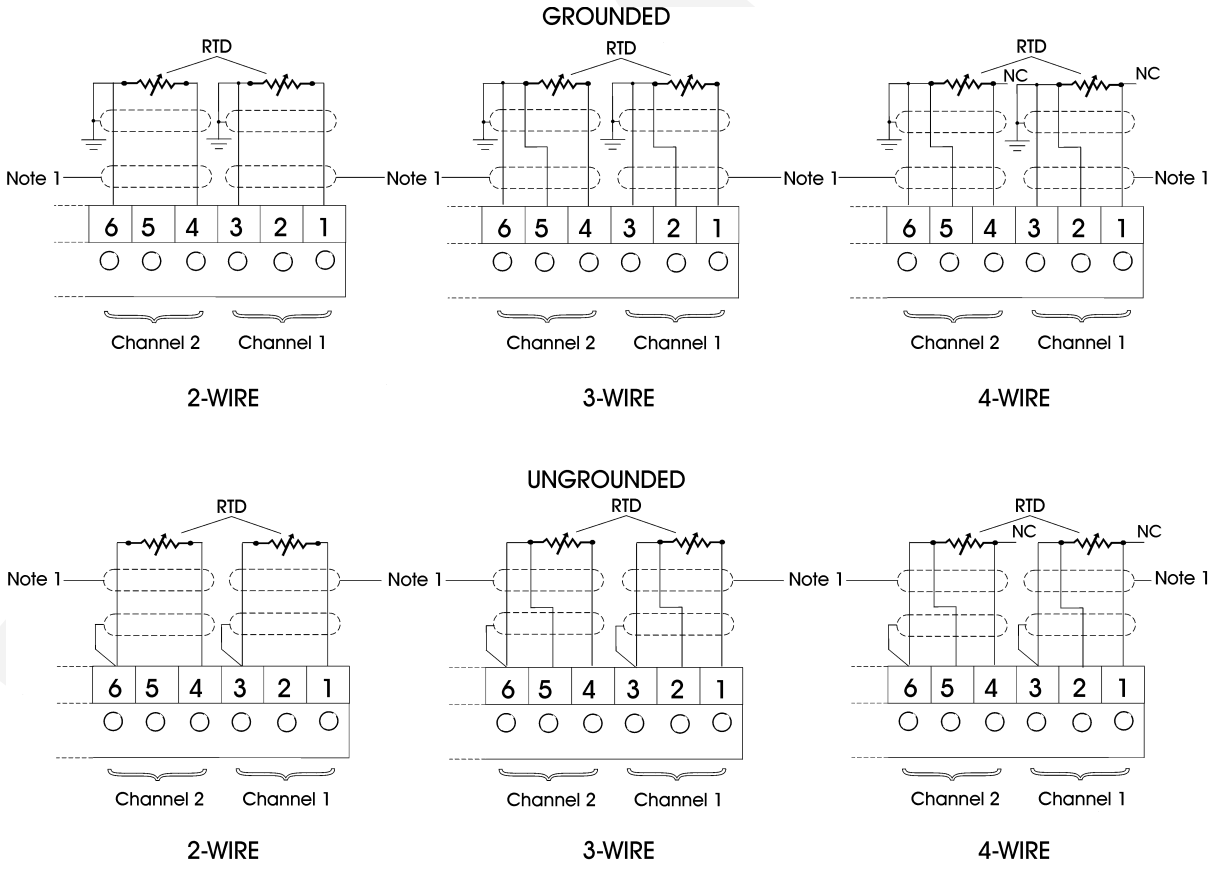
Fig. 4 - Thermocouple connection

2.3.2 - RTD Input

Connection is allowed for 2, 3 or 4 wires RTD. All types of connection are shown in figure 5, and the connection terminals for RTD are described in table 3 below for each channel.

Channel	Terminals	3rd wire Terminal
1	1 and 3	2
2	4 and 6	5
3	7 and 9	8
4	10 and 12	11
5	13 and 15	14
6	16 and 18	17
7	19 and 21	20
8	22 and 24	23

Table 3 - RTD input terminals



Note 1: Keep the shielded cable disconnected at this end.

Fig. 5 - RTD connection

An RTD input device may be a 2-wire, 3-wire or 4-wire RTD.

A 2-wire RTD is connected, for example, to terminals 1 and 3 when using input 1 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 2 for input 1.

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

With a 3-wire RTD one gets a better precision than with a 2-wire RTD.

Use wires of same material, gauge and length on all 3 terminals of each channel for compensating resistance. The maximum resistance of each connection wire must be 10 Ω. Use 18 AWG wire (minimum) for distances up to 50 m and 16 AWG for distances greater than 50 m.

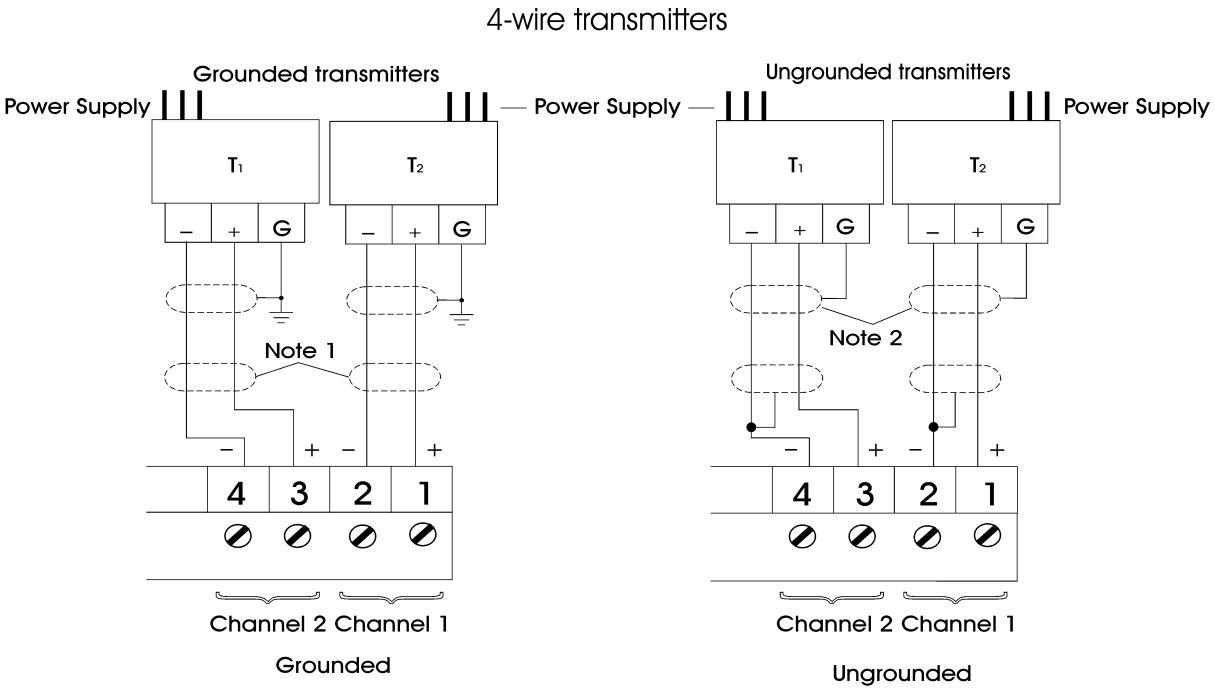
2.3.3 - Milliampere Input

Apply 4 to 20mA current signal to the terminals listed below in table 4 for each channel:

Channel	Terminals
1	1(+) and 2(-)
2	3(+) and 4(-)
3	5(+) and 6(-)
4	7(+) and 8(-)
5	9(+) and 10(-)
6	11(+) and 12(-)
7	13(+) and 14(-)
8	15(+) and 16(-)
9	17(+) and 18(-)
10	19(+) and 20(-)
11	21(+) and 22(-)
12	23(+) and 24(-)

Table 4 - Current input terminals

Figure 6 below shows the connections of current sources.



Note 1: Keep the shielded cable disconnected at this end.
Note 2: Connect the shielded cable to transmitter ground terminal.
When there is no ground terminal, keep the shielded cable disconnected at this end.

Fig. 6 - Current source connection

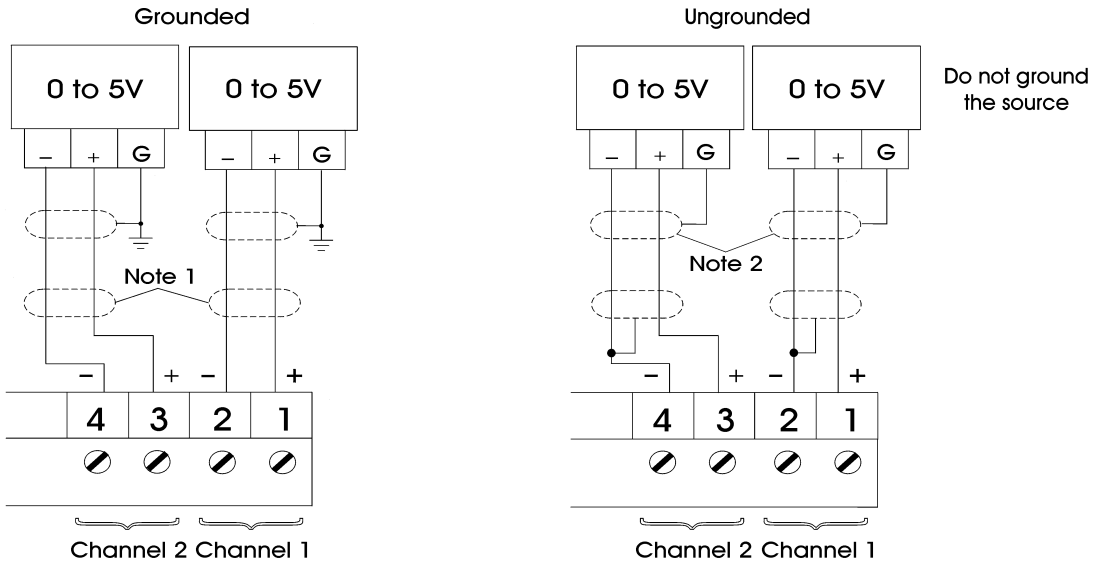
2.3.4 - Volt Input

Apply 1 to 5V voltage signal to the terminals listed in table 5 below for each channel:

Channel	Terminals
1	1(+) and 2(-)
2	3(+) and 4(-)
3	5(+) and 6(-)
4	7(+) and 8(-)
5	9(+) and 10(-)
6	11(+) and 12(-)
7	13(+) and 14(-)
8	15(+) and 16(-)
9	17(+) and 18(-)
10	19(+) and 20(-)
11	21(+) and 22(-)
12	23(+) and 24(-)

Table 5 - Voltage input terminals

Figure 7 below shows the connections of voltage sources.



Nota 1: Keep the shielded cable disconnected at this end.

Nota 2: Connect the shielded cable to source ground terminal.
When there is no ground terminal, keep the shielded cable disconnected at this end.

Fig. 7 - Voltage source connection

2.3.5 - Connection for Converters with different input types

The available models for TY-2095 Converter with different types of input are listed below together with the corresponding terminals and channels for each input. The connections of the sources or temperature sensors are made according to the instructions described on sections 2.3.1 to 2.3.4.

Converter Type	Input	Terminals
TC / RTD	TC	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and10 (CH5), 11 and 12 (CH6)
	RTD	13 to 15 (CH7), 16 to 18 (CH8), 19 to 21 (CH9), 22 to 24 (CH10)
TC / mA	TC	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and10 (CH5), 11 and 12 (CH6)
	mA	13 and 14 (CH7), 15 and 16 (CH8), 17 and 18 (CH9), 19 and 20 (CH10), 21 and 22 (CH11), 23 and 24 (CH12)
TC / V	TC	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and 10 (CH5), 11 and 12 (CH6)
	mA	13 and 14 (CH7), 15 and 16 (CH8), 17 and 18 (CH9), 19 and 20 (CH10), 21 and 22 (CH11), 23 and 24 (CH12)

Table 6 - Terminals for Converters with different input types

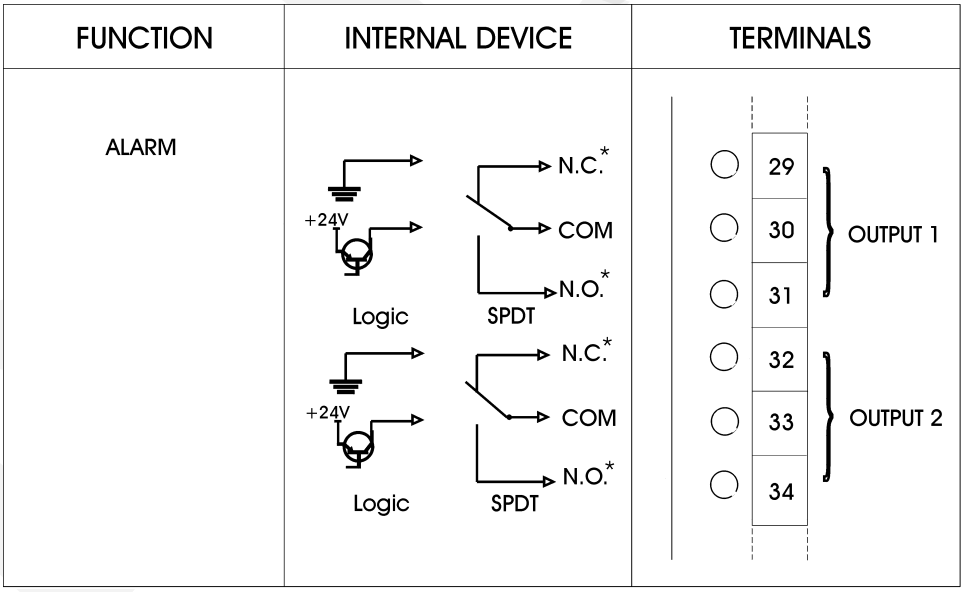
Converter Type	Input	Terminals
mA / V	mA	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and10 (CH5), 11 and 12(CH6)
	V	13 and 14 (CH7), 15 and 16 (CH8), 17 and 18 (CH9), 19 and 20 (CH10), 21 and 22 (CH11), 23 and 24 (CH12)
mA / RTD	mA	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and10 (CH5), 11 and 12 (CH6)
	RTD	13 to 15 (CH7), 16 to 18 (CH8), 19 to 21 (CH9), 22 to 24 (CH10)
V / RTD	V	1 and 2 (CH1), 3 and 4 (CH2), 5 and 6 (CH3), 7 and 8 (CH4), 9 and10 (CH5), 11 and 12 (CH6)
	RTD	13 to 15 (CH7), 16 to 18 (CH8), 19 to 21 (CH9), 22 to 24 (CH10)

Table 7 - Terminals for Converters with different input types

2.4 - Alarm Output Connection

The Converter presents up to two alarm outputs obtained through the installation of modules with SPDT relay or open collector voltage. Figure 8 illustrates the Converter outputs.

See sections 3.2 on Configuration and 4.3 on Optional module Connection for details on configuration and installation of optional modules.

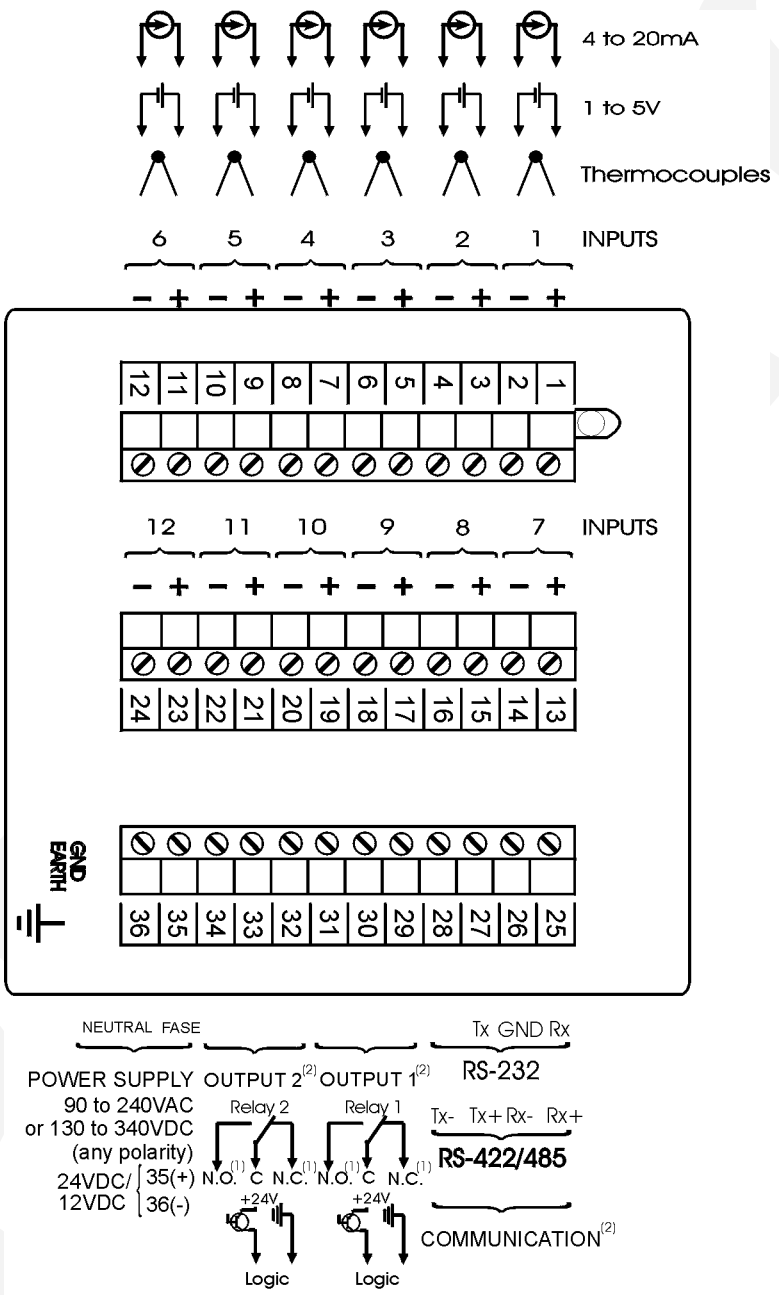


(*) Relay contact states shown are valid for SAFE option selected (see section 3.2 on Configuration), instrument powered on and non-alarm condition. Position of the contacts are changed in alarm condition (with SAFE option selected) or when the instrument is turned off.

Fig. 8 - Alarm output connection

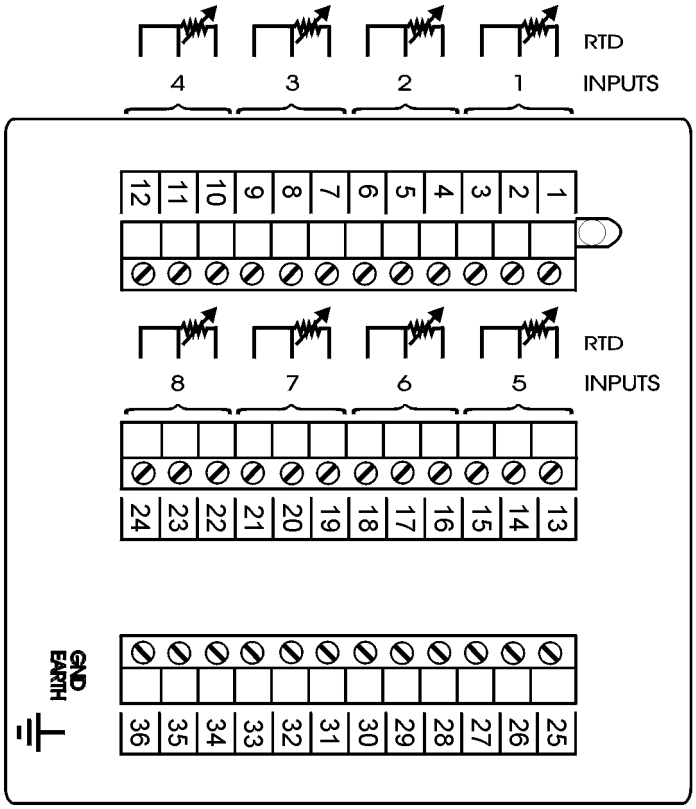
2.5 - Connection Diagrams

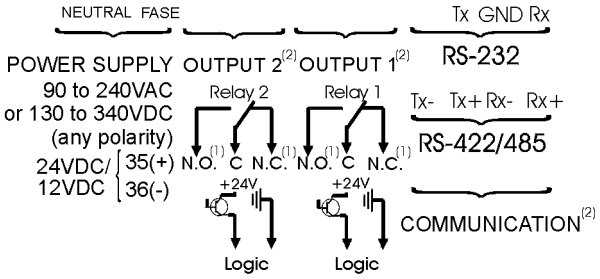
2.5.1 - Converters with 12 thermocouples, current or voltage inputs and their combinations



Note:
(1) Position of relay contacts (N.C. and N.O.) when the converter is powered and in non-alarm condition
(2) Optional modules

2.5.2 - Converters with 8 RTD inputs



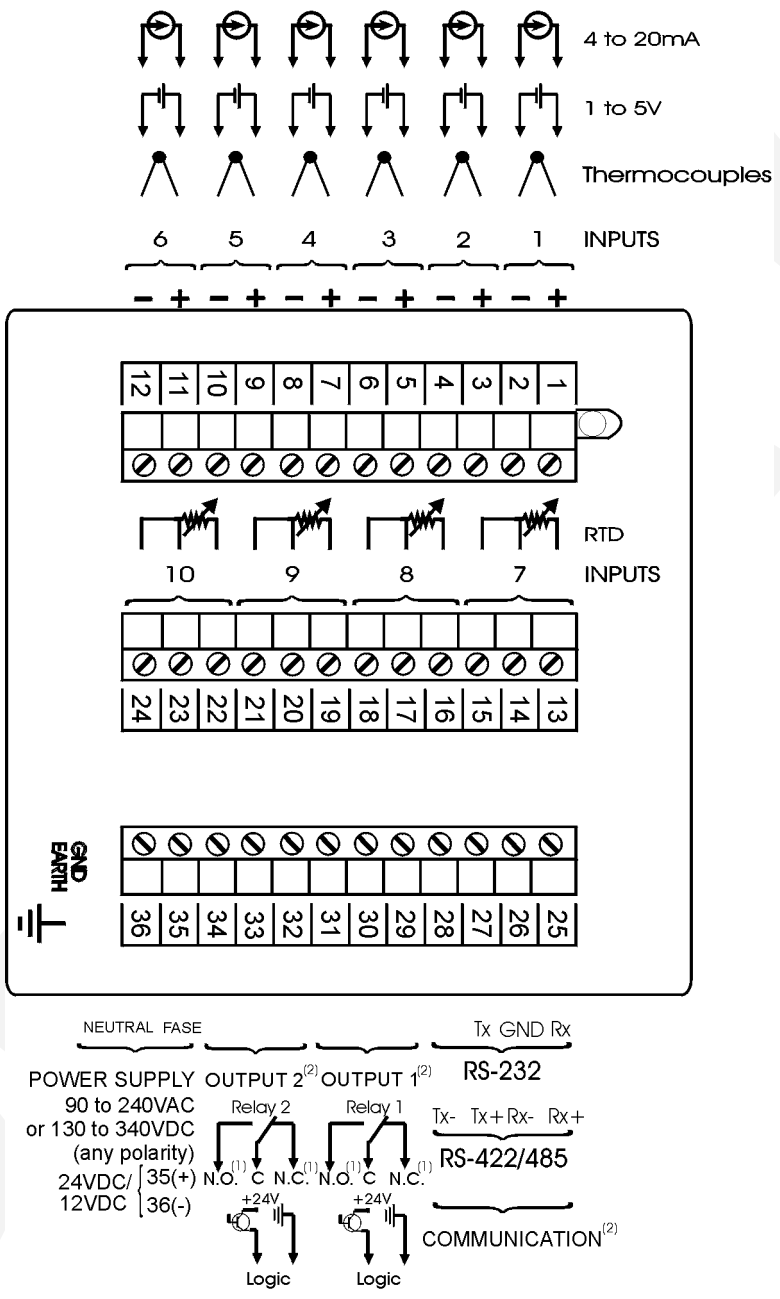


Note:

(1) Position of relay contacts (N.C. and N.O.) When the converter is powered and in non-alarm condition

(2) Optional modules

2.5.3 - Converters with 6 thermocouples, current or voltage inputs and 4 RTD inputs



Note:
(1) Position of relay contacts (N.C. and N.O.) when the converter is powered and in non-alarm condition
(2) Optional modules

2.6 - Communication

TY-2095 Converter communicates with computers through RS-232 or RS-422/485 and with use of a MODBUS protocol communication software, when the optional communication modules are installed and the communication parameters are configured.

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

3.0 - Operation

3.1 - Normal operation

TY-2095 Converter has two modes of operation: normal mode and configuration mode.

During normal operation, the Converter monitors the inputs, verifies alarm conditions and activates the alarm outputs when necessary.

The Converter has a portable configuration unit, MCY-25, which is connected to it by means of a DB-25 connector, as illustrated in figure 9 below.

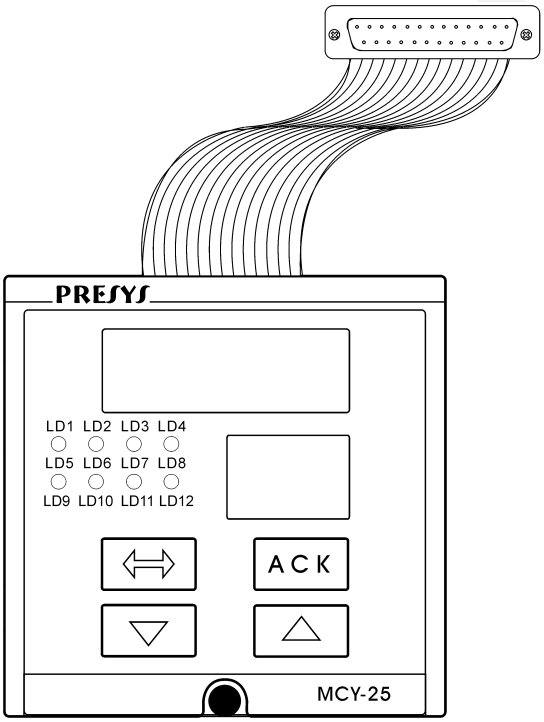


Fig. 9 - MCY-25 Portable Configuration Module

When the MCY-25 Configuration Module is connected to the Converter under normal operation, the instrument begins to function as a process monitor, through the Module display.

Under configuration time operation mode the user, through the MCY-25 Configuration Module, selects and assigns values to the parameters which regulate the Converter functioning, when in normal operation. Such parameters are, among others, alarm setpoint values, input range, and so on.

The normal operation mode, in which the Converter operates most of the time, will be named level zero. At this level, the keys on the MCY-25 Configuration Module front panel have the following functions:

ENTER	Key	changes level zero to level 1 or asks for the password, when configured.
UP	Key	changes the channel or totalization (when enabled for a linear input) shown in the display in increasing order.
DOWN	Key	changes the channel or totalization (when enabled for a linear input) shown in the display in decreasing order.
ACK	Key	When showing the indication of a channel, it presents the alarm outputs which require acknowledgment or accept reset to return to normal state, besides the leds turned on which have the LATCHED function enabled (*). It applies Reset to the totalization presented in the display (when this function is enabled for use in the operation mode).

(*) In order to view the monitored variable, continue to press the ACK key. In case there are no activated relays or leds with LATCHED function enabled, or relays which accept reset, 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) Level 1 (GENERAL) of configuration mode is directly accessed, which indicates the instrument was not configured with a password system.
ii) The PASS warning is displayed, indicating that the instrument is provided with a password system (a key sequence or a value), according to figure 10.

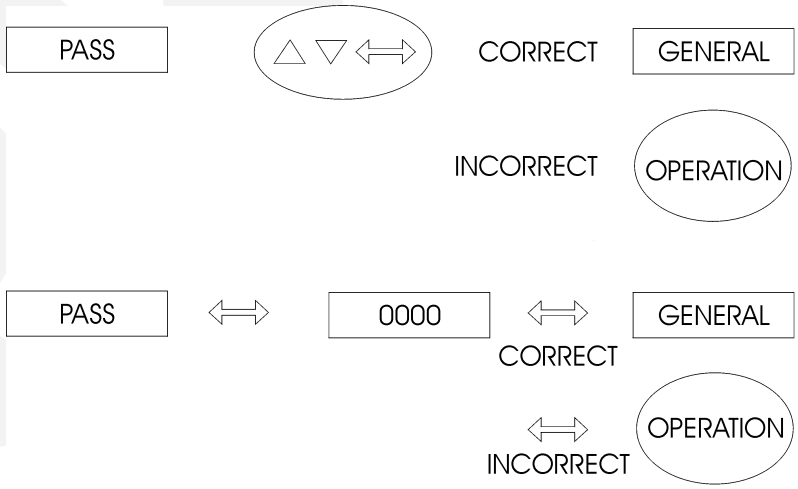


Fig. 10 - Password through key sequence or value

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 in the number to be changed by the user with the UP and DOWN keys. Move to the digits on the left by pressing ENTER. After entering all digits, press ENTER again. If the password is correct level 1 is accessed; otherwise, it returns to normal operation (see figure 10).

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 2095. Note that the number 2095 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 Module 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

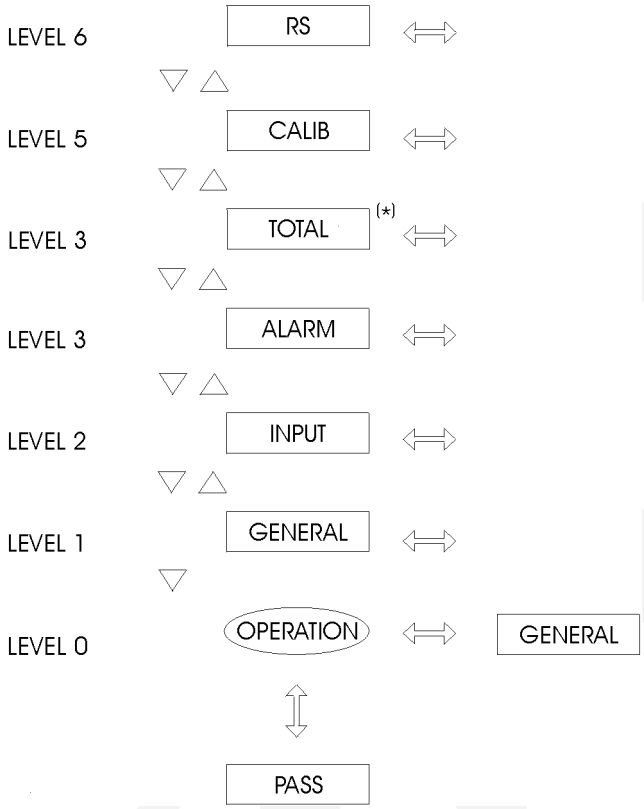
All configuration parameters are stored in the non-volatile memory and determine the normal operation of the instrument. With these parameters the user can adjust the instrument to his needs, when it is necessary to change the configuration from factory.

Configuration parameters are distributed in six hierarchical levels shown in figure 11.

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

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

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



(*) Totalization level presented only by the instruments:
TY-2095 mA, V, TC/mA, TC/V, mA/V, mA/RTD and V/RTD.

Fig. 11 - 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 Module 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, PASS and INDC (see figure 12).

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 2095) or both. The correct key sequence is obtained by pressing the UP, DOWN and ENTER keys in this order.

INDC - is an option for the visualization of the measured variables and totalizations on the display of MCY-25 Module. It allows the user to view the values of different channels only by pressing the UP and DOWN keys, or it sets the instrument to change automatically the indication and totalization of different measured variables among some selected channels. In order to enable the automatic scan mode, choose the YES option for INDC and provide the exhibition times (given in seconds) for viewing each channel (channel 1 is the only one whose time cannot be zero). The exhibition time configured for a channel refers to the indication of the measured variable and to its totalization (when enabled).

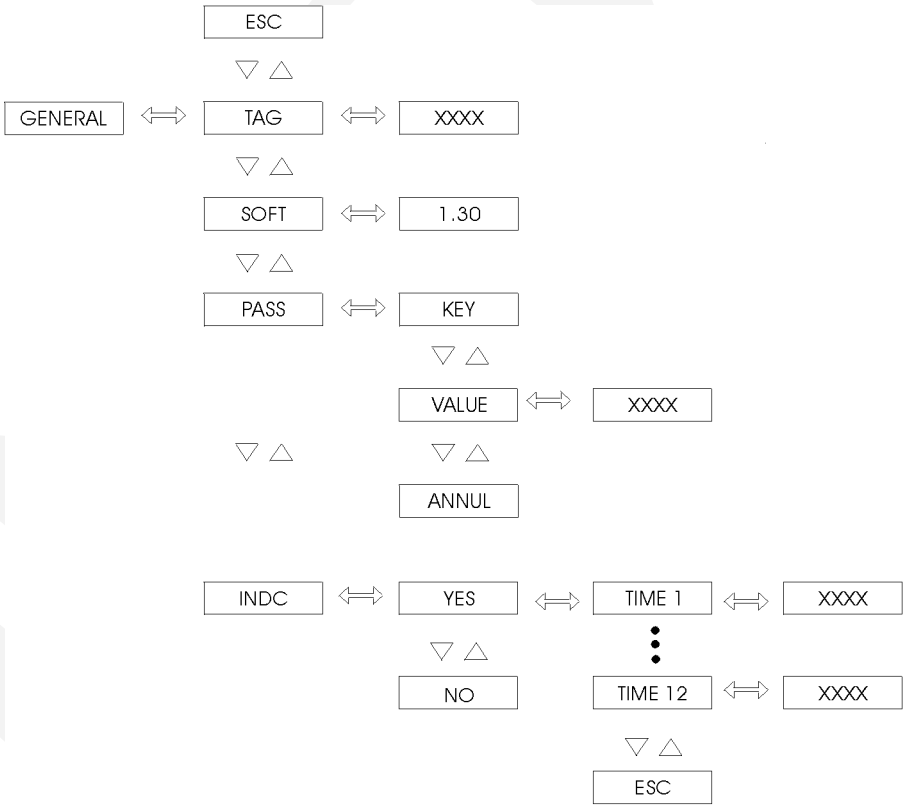


Fig. 12 - GENERAL level options

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

Mnemonic	Parameter	Range	Factory Value	Units
TAG	instrument identification	————	2095	————
SOFT	software version	————	1.30	————
VALUE	user password	-999 to 9999	0	————
TIME1	channel 1 exhibition time	1 to 250	5	seconds
TIME2 to TIME12	channels 2 to 12 exhibition time	0 to 250	1	seconds

Level 2 - Input

The Input Level allows to enable or disable (by means of the ANNUL option) the sensor type of each channel. The sensor type options are TC-J, TC-K, TC-T, TC-E, TC-R and TC-S for thermocouple inputs, 2 and 3-wire RTD for RTD inputs, 5V for voltage and 20mA for current, according to figures 12 and 13 for Converters with thermocouple and current inputs and for Converters with RTD and voltage inputs.

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

Mnemonic	Parameter	Range	Factory Value	Units
LIM LOW*	input signal associated to Eng Low	0.0 to 100.0	0.0	%
LIM HIGH*	input signal associated to Eng High	0.0 to 100.0	100.0	%
ENG LOW*	display indication associated to Lim Low	-999 to 9999	0.0	EU**
ENG HIGH*	display indication associated to Lim High	-999 to 9999	100.0	EU
CUT-OFF*	minimum value for square root	0 to 5	0	%
OFF SET	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

(*)Lim Low, Lim High, Eng Low, Eng High and Cut-Off options are presented only for linear inputs (current or voltage).

(**) EU - Engineering Unit.

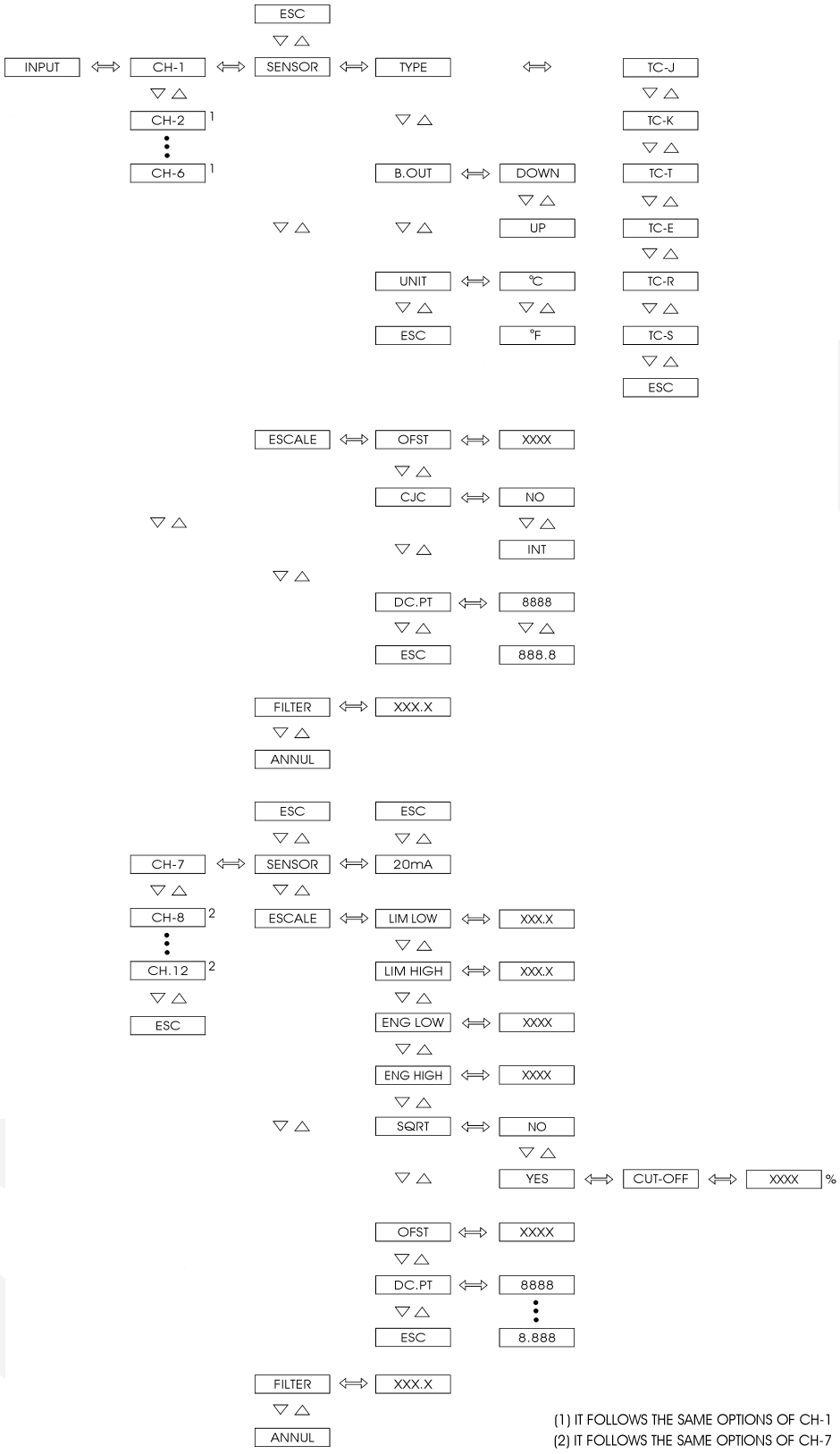


Fig. 13 - INPUT level options for Converters with thermocouple and current inputs

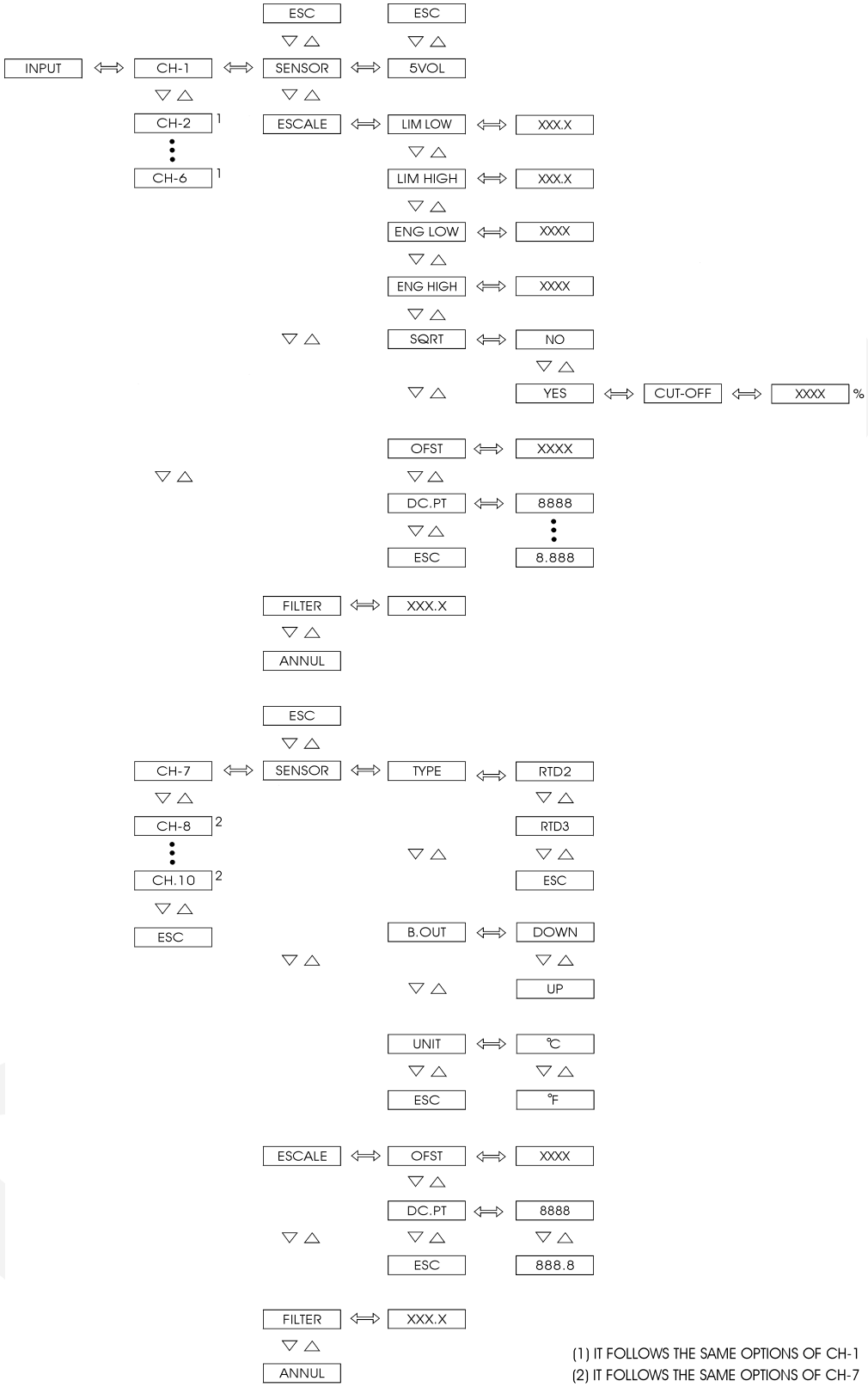


Fig. 14 - INPUT level options for Converters with voltage and RTD inputs

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 15. Lim Low represents the value of the electrical signal given in % of full scale associated to the Eng Low indication on the Module display, and Lim High corresponds to the value of the electrical signal given in % of full scale associated to the Eng High indication on the display.

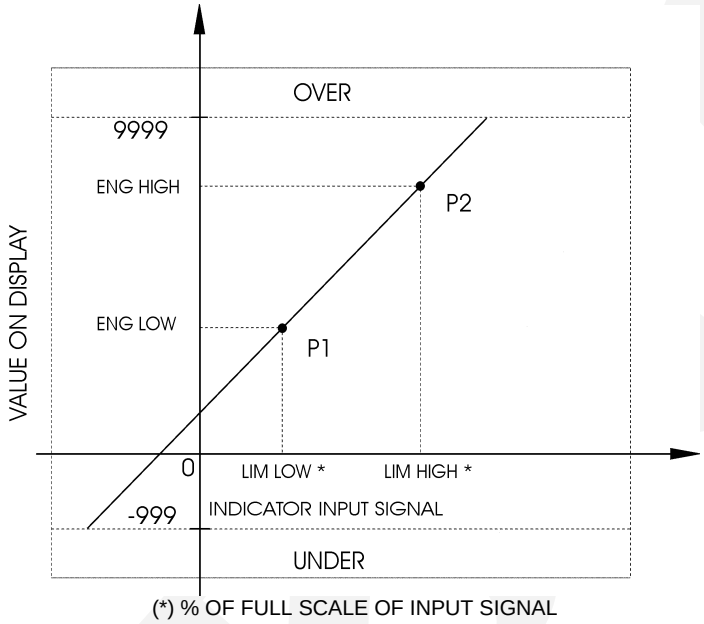


Fig. 15 - Linear input configuration

SQRT - allows presenting on the display the squared root of the linear input signal. The Cut-Off parameter given in % of the input signal makes input values below (Lim Low + Cut Off) be shown as Lim Low. See figure 16.

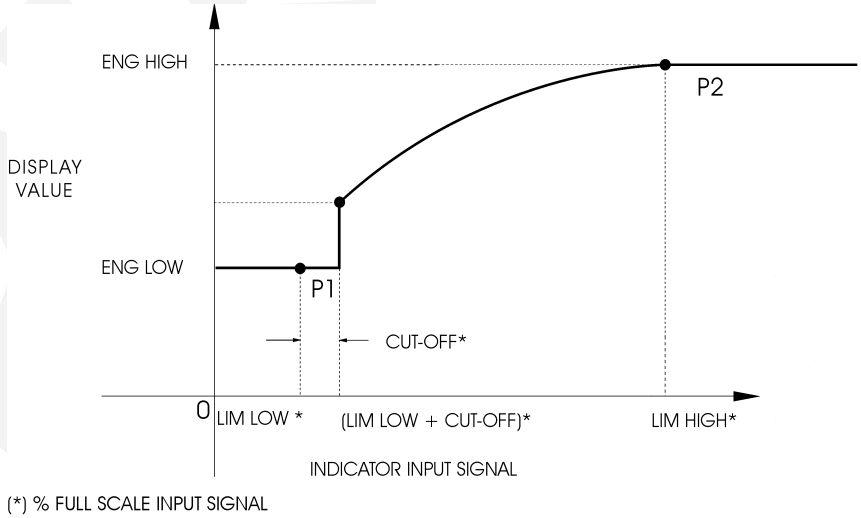


Fig. 16 - Input signal square root

DC.PT - sets the decimal point position for visualization of Engineering units in display. There are up to three decimal places for linear signals, and for temperature sensors there is one decimal place or none.

OFST - 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.

UNITS - selects °C or °F for temperature indication.

Level 3 - Alarm

The Converter has up to two alarm devices (see figure 17) followed by the leds associated to each channel.

Each alarm device can support any combination of high and low alarms of the channels.

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:

1H.r1	Channel 1 high-alarm setpoint associated to relay 1.
4L.r2	Channel 4 low-alarm setpoint associated to relay 2.

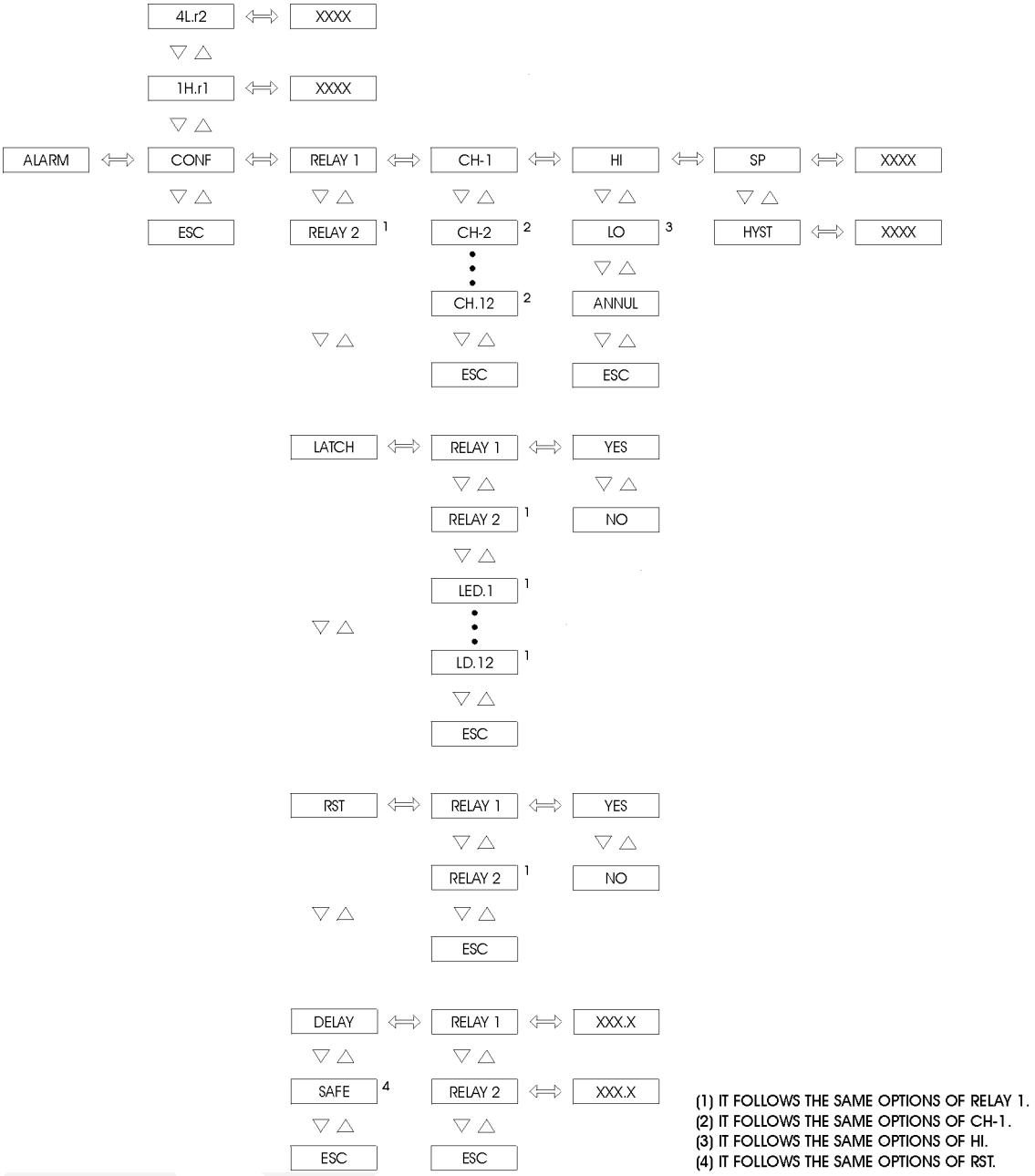


Fig. 17 - ALARM level options

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

Mnemonic	Parameter	Range	Factory Value	Units
SP	alarm setpoint	-999 to 9999	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 999.9	0.0	seconds

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.

The LATCHED option is also allowed for leds. When the latched function is enabled for a led and the channel to which the led is associated enters in alarm condition, the led is turned on and remains in this state even after the alarm condition is over. In order to turn the led off, one must press ACK when in operation level, choose the mnemonic corresponding to the led and press ENTER. Continue pressing the ACK key to return to operation mode.

RST - it allows the relays to be deactivated even when the alarm condition which activated these relays is still present (relay reset).

In order to deactivate a certain relay with RST function enabled, one must press ACK when in operation level, and choose the mnemonic corresponding to the activated relay by pressing ENTER. Continue pressing the ACK key to return to operation mode.

The relay will be activated again if the current alarm condition finishes and then returns, or in case of occurrence of other alarm conditions which were not presented before.

DELAY - causes the relay to be activated only after a certain time interval defined by the user. Figure 18 below illustrates the delay operation for a high-alarm.

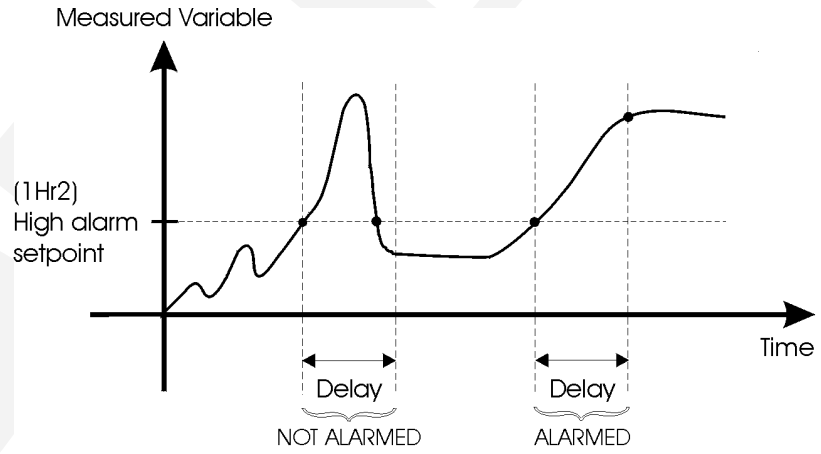


Fig. 18 - Relay with delay

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.

Level 4 - Totalization

In level 4, it is configured the totalization of the process variables of the first 8 channels with linear input. When the totalization of a certain channel is enabled, the Converter shows the value of the process variable and its totalization in the operation level. If the totalization is disabled its value is not shown.

The integration is performed according to the percentage of the input signal in relation to the range limited by the parameters Eng Low and Eng High configured for the channel. In order to determine the totalization of a signal, it is necessary to provide the parameters corresponding to the counts CONT which results from the integration of an input signal of 100% FS of the chosen channel (whose indication is given by Eng High) within an interval of time configured by TIME, given in minutes. The decimal point for the totalization is configured in the DC.PT option.

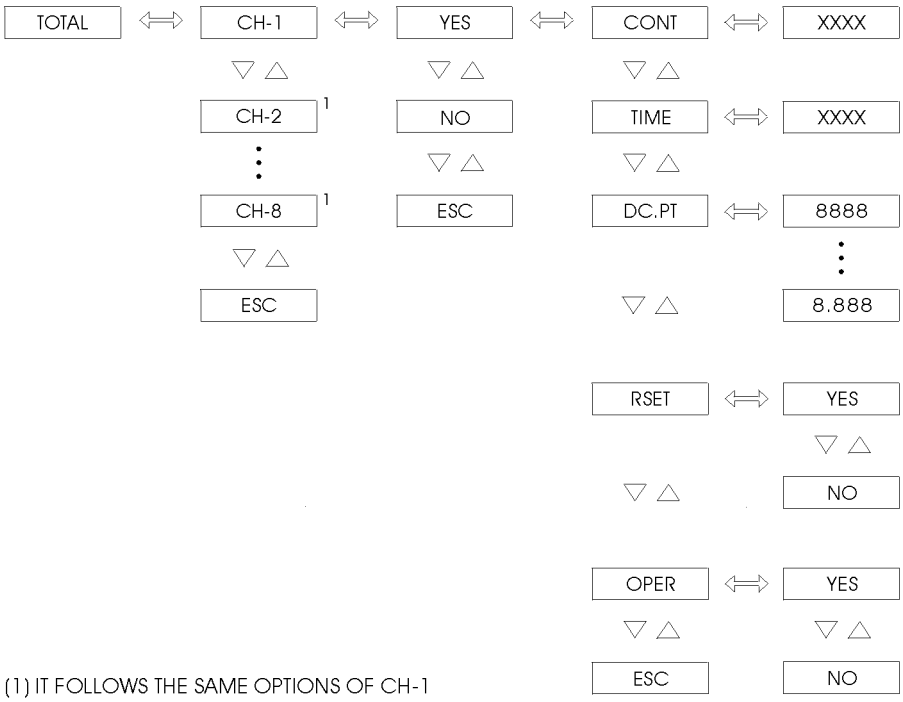


Fig. 19 - TOTALIZATION level options

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

Mnemonic	Parameter	Range	Factory Value	Unit
CONT	Counts added to the totalization after an interval of time (TIME), when there is a signal of 100% FS in the input.	0 to 9999	0	------
TIME	Interval of time after which the totalization is increased by CONT, when there is a signal of 100% FS in the input.	0 to 9999	0	min

The integration function is described by:

$$TOTAL(t) = \frac{CONT}{TIME}\int \frac{E(t) - ENGLOW}{ENGHIGH - ENGLOW}dt$$

Notice that any signal under the input zero scale (low limit of the range or Eng Low) is not integrated, that is, the totalization does not decrease.

When exceeding the maximum limit of counts (9999), the most significant digits which would appear in the totalization are ignored, but it is kept the last increment calculated, in order not to loose precision in the counts after passing by successive “overflows”.

The totalization count of a channel may be reset by the RSET option in the Totalization Level, or by pressing the ACK key when the totalization is shown in the operation level. Note that the use of the ACK key for reset must be enabled by the OPER option.

Level 5 - Calibration

Level 5 is described on section 4.4 on Calibration.

Level 6 - RS

Refer to the communication manual.

4.0 - Maintenance

4.1 - Converter Hardware

The Converter maintenance requires the user to have access to the hardware of the instrument. The Converter hardware consists of four main boards: Display Board, CPU Board, Power Supply Board and Input Board. The Display Board is located inside the MCY-25 Configuration Module. The CPU, Power Supply and Input Boards are located inside the TY-2095 Converter.

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

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

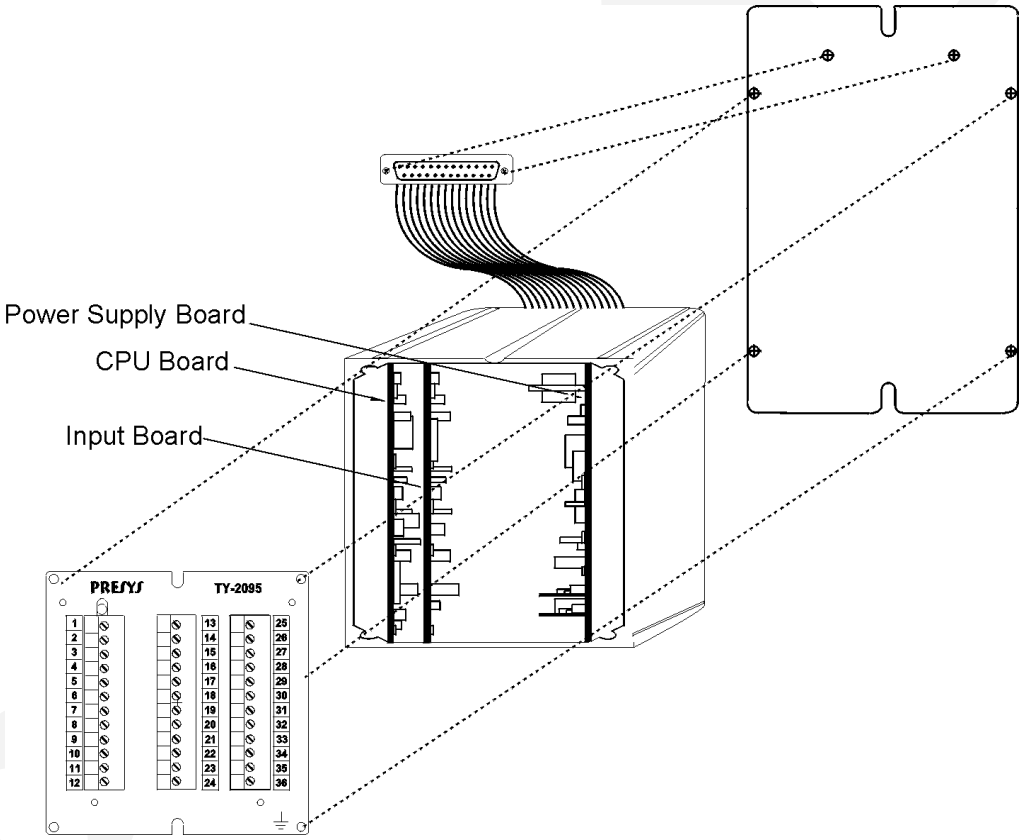


Fig. 20 - Converter Dismounting Scheme

ii) Slide the CPU, Input and Power Supply Boards out of the aluminum case, together with the DB-25 Terminal. Notice that all circuit boards are united by holders among them. Remove the screws which fasten the holders and open the boards as illustrated in figure 21.

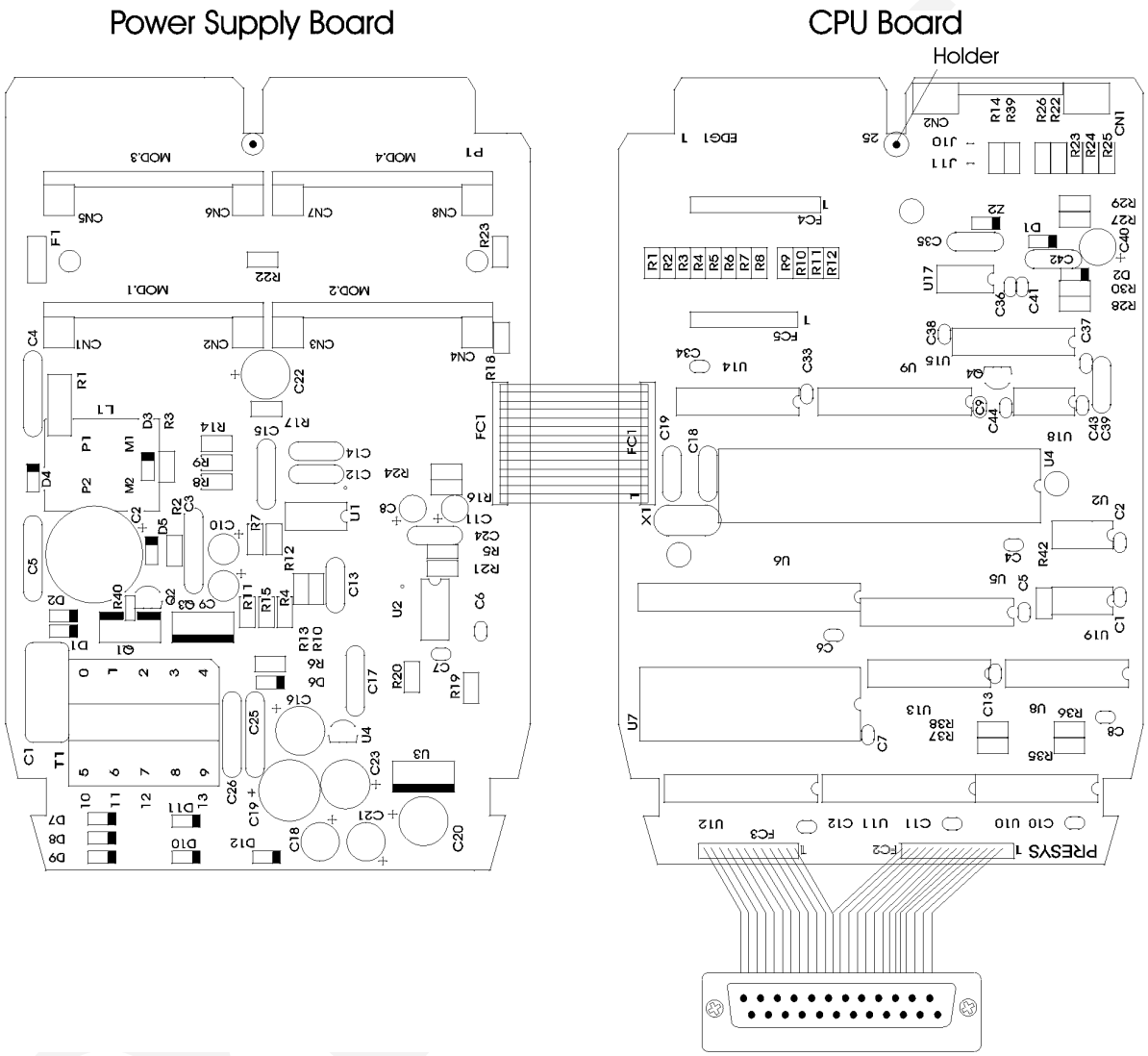


Fig. 21 - Converter Hardware

4.2 - Snubber use for relay

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

Note the position of the jumpers in the following figure.

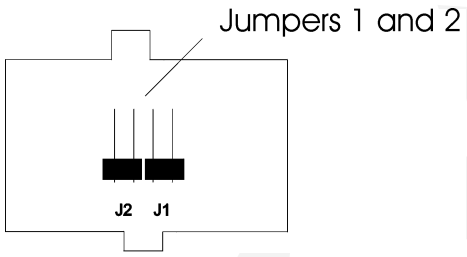


Fig. 22 - Jumpers for selection of snubbers on the relay board

Alarm and control relays are extremely critical in control and safety of industrial processes. In order to ensure the expected relay behavior, 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 occurrence of electrical 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 maintain a 4.5mAac/9.0mAac current when connected to a 120VAC/220VAC circuit. This current is enough, in certain cases, 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.

4.3 - Installation of optional modules

The TY-2095 Converter accepts up to two alarm devices and communication, which must have the corresponding optional modules installed in the instrument. Open the Converter as shown in section 4.1 in order to access the connectors in the Power Supply Board, and the connector in the CPU Board (see figure 23).

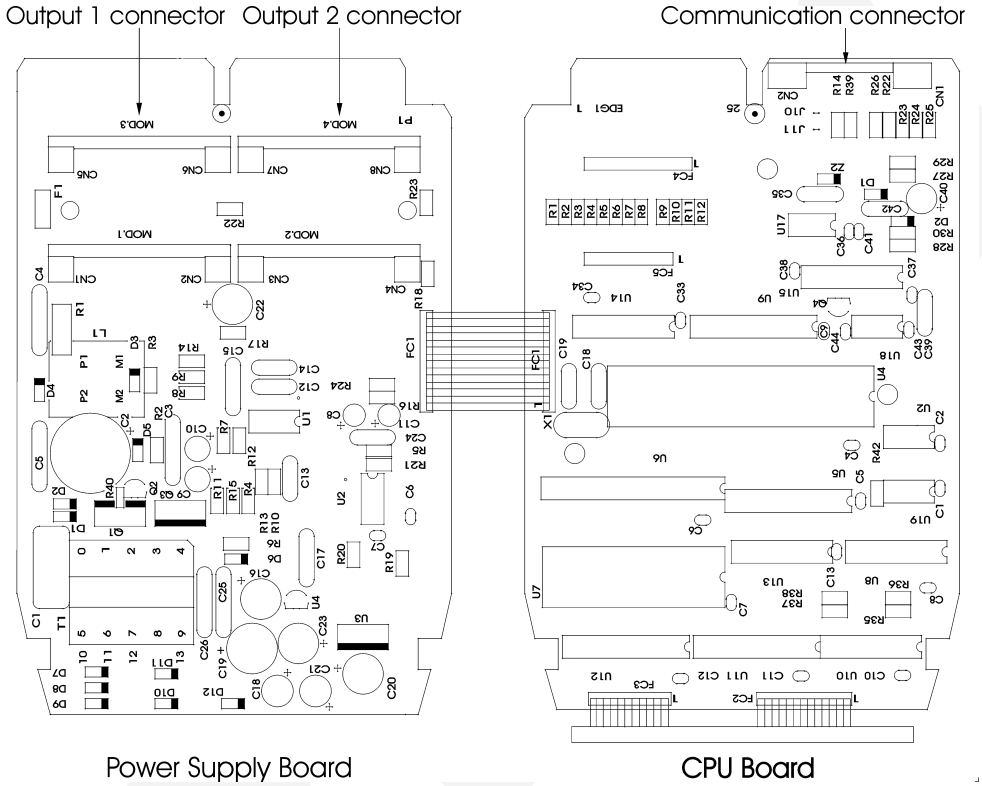


Fig. 23 - Optional module connectors

The connectors in the Power Supply Board corresponding to outputs 1 and 2 (figure 3) are called MOD 3 and MOD 4. 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.

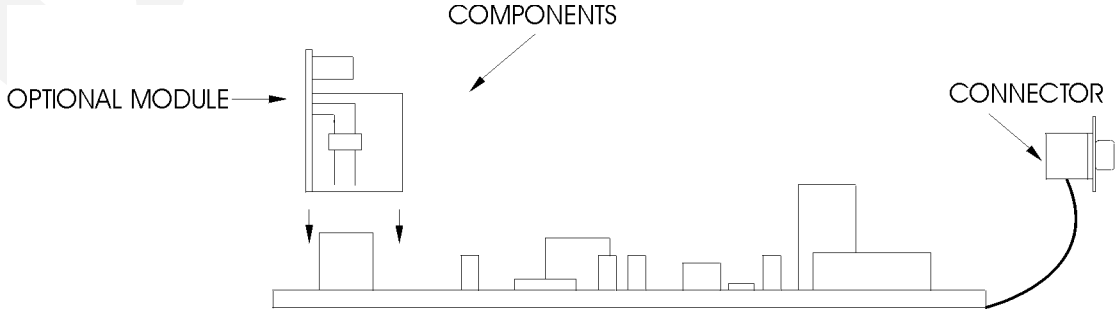


Fig. 24 - Installation of optional modules

Alarm outputs 1 and 2

Outputs 1 and 2 are used as alarms when the optional modules corresponding to connectors MOD 3 and MOD 4 are installed. There are two types of alarm output available: SPDT relay and open collector voltage. The Alarm output type and the optional module correspondence are shown in table 9.

Alarm output type	Optional module code
SPDT Relay	MALRE - 20
Open collector voltage	MSD - 20

Table 9 - Alarm output types

4.4 - Calibration

TY-2095 Converter is accurately calibrated in factory and doesn't need periodic calibration in normal conditions. When calibration is required, follow this procedure below.

Disconnect the process signals of I/O terminals.

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

The accuracy and precision of the calibrator used for generating references must be at least twice as good as the specifications of the Converter.

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

Before performing 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 the corresponding mnemonic is shown on display. When the reference is stable, start the calibration by pressing ENTER. At this moment the Converter begins the calibration process while the mnemonic CAL blinks on the display.

While the display is blinking the reference must be connect to the input channel you want to calibrate.

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 25 shows the calibration options for an instrument with thermocouple (channels 1 to 6) and RTD (channels 7 to 10) inputs.

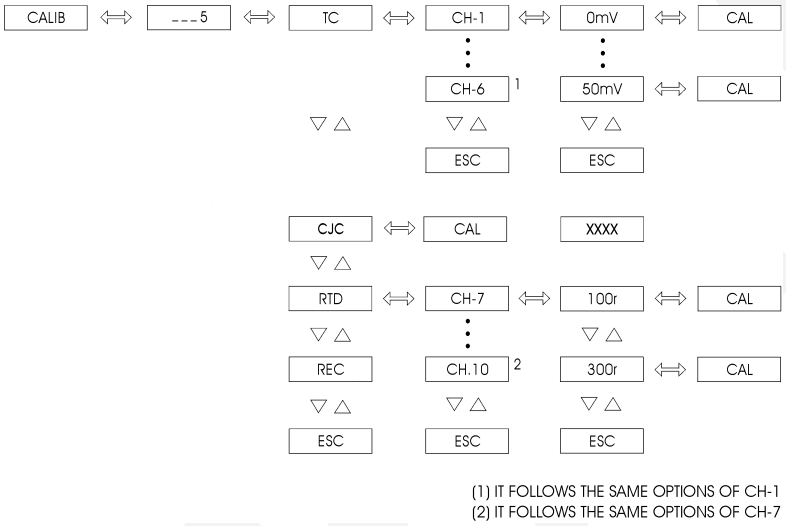


Fig. 25 - CALIBRATION level options

Calibration of thermocouple input

In order to calibrate thermocouple inputs connect a voltage source to the channel to be calibrated (see the terminals corresponding to each channel in table 2 on section 2.3.1 - Thermocouple Input or tables 6 and 7 on section 2.3.5 - Connection for Converters with different input types). It is required 6 voltage references listed in table 10.

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

Table 10 - Voltage references for thermocouple input calibration

Once the calibrations with mV are done, access the CJC mnemonic inside INPT option of level 5 for cold junction calibration.

Cold junction calibration

The CJC mnemonic must be accessed, which corresponds to the cold junction temperature of the Converter.

Pressing ENTER after the CJC mnemonic is reached starts the automatic calculation of the cold junction temperature. 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.

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

Calibration of 2 and 3-wire RTD input

In a 3-wire RTD input calibration connect precision resistances with the values listed in table 11 to the channel to be calibrated. For channel 1, for instance, the resistance must be connected to terminals 1 and 2, with terminals 2 and 3 short-circuited. See the terminals for RTD connection on table 3, section 2.3.2 on RTD Input, or tables 6 and 7 on section 2.3.5 - Connection for Converters with different input types.

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 accomplished together with the 3-wire RTD calibration.

Reference	Mnemonic
100.000 Ω	100r
300.000 Ω	300r

Table 11 - Resistance references for 3-wire RTD input calibration

Calibration of current input (0 to 20mA)

In a 0 to 20mA current input calibration connect a current source to the channel to be calibrated (see the terminals corresponding to each channel in table 4 on section 2.3.3 - Milliampere Input or tables 6 and 7 on section 2.3.5 - Connection for Converters with different input types). It is required 6 current references listed in table 12.

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 12 - References for current input calibration

Calibration of voltage input (0 to 5V)

In a 0 to 5V voltage input calibration connect a voltage source to the channel to be calibrated (see the terminals corresponding to each channel in table 5 on section 2.3.4 - Voltage Input or tables 6 and 7 on section 2.3.5 - Connection for Converters with different input types). It is required 6 voltage references listed in table 13.

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 13 - References for voltage input calibration

Return to factory calibration

The Converter stores the factory calibration parameter values on the non-volatile memory, which may be always recovered by Converters with RTD input.

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

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

Enter level 5 of Calibration, select the REC option and press ENTER in order to recover the values from factory.

4.5 - Hardware maintenance instructions

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

Instrument with error indication on the display of MCY-25 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:

Er. 01 - RAM error

Er. 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 repeatedly. If the error remains, return the instrument to factory.

Instrument with the MCY-25 Module display off

Check if power supply voltage is provided to terminals 35 and 36 of the Converter.

Verify the integrity of fuse F1 of 2.0 A placed in the Power Supply Board as shown in figure 21. 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 Converter is configured correctly.

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

Check if the voltages on flat cable 1 as shown in figure 26 are close to the values in table 14 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 14 - Inspection points of voltage on flat cable 1

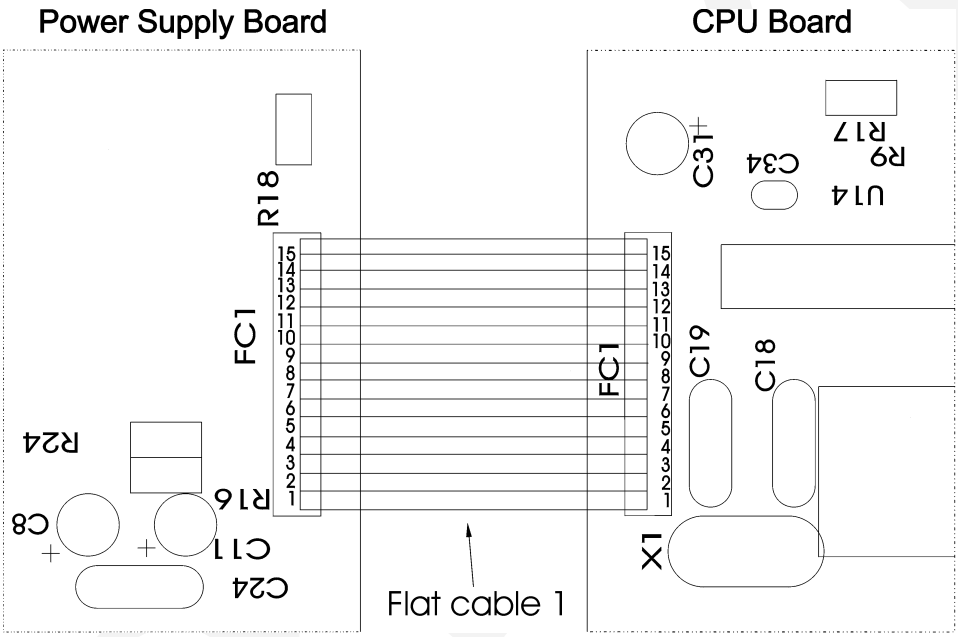


Fig. 26 - Voltage test points of the Converter

Measure voltages on flat cable 5, which connects the CPU and Input Boards, check if they are close to the values in table 15.

Test points on flat cable 5	Voltage
Between point 12(-) and point 13(+)	8V
Between point 12(-) and point 11(+)	-8V
Between point 12(-) and point 3(+)	0V

Table 15 - Inspection points of voltage on flat cable 5

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

4.6 - 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	U3
01.01.0051-21	LM358N	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
01.03.0035-21	Ceramic Multilayer Capacitor 0.1µF x 63V	C6,7
01.03.0036-21	Ceramic Multilayer Capacitor 0.01µF x 63V	C24
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
01.03.0042-21	Radial Electrolytic Capacitor 22 µF x 25 V	C9,C10
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	C8,11,20,23
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
01.02.0183-21	Resistor 2K32 1%	R13
01.02.0108-21	Resistor 15K4 1%	R19
01.02.0131-21	Resistor 4K99 5%	----------
01.04.0005-21	Reference Diode LM336/5V	----------
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
01.01.0050-21	MB84256-10L-SK	U6
01.01.0044-21	E2PROM X25C43P	U19
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
01.01.0027-21	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
01.04.0006-21	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, 13,33,34,35,36,37,38,41, 42,43,44
01.03.0039-21	Polyester Capacitor J(5%) 0.1 µF x 250 V	C39
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%	R29
01.02.0102-21	Resistor 442R 1%	R23
01.02.0019-21	Resistor 1K 1%	R22,30
01.02.0024-21	Resistor 2K 1%	R27
01.02.0104-21	Resistor 3K32 1%	R25
01.02.0036-21	Resistor 8K66 1%	R28
01.02.0046-21	Resistor 40K2 1%	R26
01.02.0038-21	Resistor 10K 1%	R35,36,37,38,39
01.02.0040-21	Resistor 15K 1%	R42
01.02.0098-21	Resistor 10M 5%	R1,2,3,4,5,6,7,8,9,10, 11,12
01.13.0043-21	DIP socket	U7
01.13.0005-21	Connector	CN1,2

Code	Components	Reference
01.14.0010-21	Flat Cable 15 Circuits	FC1
01.14.0030-21	Flat Cable 13 Circuits	FC2
01.14.0029-21	Flat Cable 12 Circuits	FC3
01.14.0044-21	Flat Cable 16 Circuits	FC4
01.14.0043-21	Flat Cable 13 Circuits	FC5

Input Board

Code	Components	Reference
01.05.0082-20	Input Board	----------
01.01.0019-21	CD4051BE	U2,4,6,8
01.01.0026-21	AD 706 JN	U1,3,5,7
01.09.0013-21	Transistor BC 327	Q1,2,3,4,5,6,7,8
01.04.0005-21	Reference Diode LM336/5V	D1,2
01.03.0035-21	Ceramic Multilayer Capacitor 0.1µF x 63V	C1,2,3,5,7,9,11,12,13,14, 15,17,19,21,23,24,25,26, 27,29,31,33,35,36,37,38, 39,41,43,45,47,48,49
01.03.0062-21	Tantalum Capacitor 22µF x 16V	C4,6,8,10,16,18,20,22,28, 30,32,34,40,42,44,46
01.02.0010-21	Resistor 100R 1%	R30
01.02.0038-21	Resistor 1K 1%	R1,3,6,7,8,9,12,13,14,15, 18,19,20,21,24,25,26,27, 28,29
01.02.0030-21	Resistor 4K42 1%	R2,5,10,11,16, 17,22,23
01.02.0031-21	Resistor 4K99 1%	R4

I/O Terminal Board

Code	Components	Reference
01.05.0081-20	I/O Terminal Board - TY2095	----------
01.09.0015-21	BC 337	Q1
01.02.0010-21	Resistor 100R 1%	R2,4,6,8,10,12,14,16,18, 20,22,24
01.02.0011-21	Resistor 150R 1%	R1,3,5,7,9,11,13,15,17, 19,21,23
01.13.0002-21	Terminal Block	CN1,2,3
01.13.0003-21	Board-to-board Connector	P1,2

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	Right Angle Pitch Header 2x2	CN3,4

4.7 - List of recommended spare components

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

Power Supply Board

IRF 822	Q3
UC 3842	U1
Fuse 2A	F1
LM 358N	U2

I/O Terminal Board

BC 337	U1

CPU Board

4051	U14
4053	U15

Input Board

Reference diode LM336/5V	D1,2

Engineering Units Label
Code 02.10.0003.21

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