Indicator N1500

UNIVERSAL PROCESS INDICATOR – INSTRUCTIONS MANUAL V2.0x

1. PRESENTATION

N1500 is a universal process indicator which accepts a large variety of input signals and sensors. A six-digit LED display shows measured value and all programming parameters.

Instrument configuration is achieved from the keyboard, without any hardware change. Thus, the selection of input type and type of alarms action, besides other special functions, are accessed and defined from the frontal keyboard.

The user should read this manual thoroughly before using the instrument. It must be handled with care and should be used accordingly for best results.

Some of the features of the basic version are:

- Universal input: Pt100, thermocouples, 4-20mA, 0-50mV, 0-5V and 0-10V
- 24Vdc power supply for remote transmitters excitation
- Memory for **maximum** and **minimum** values
- **Hold** and **peak hold** functions
- Digital input

Extra options are:

- Process Variable (PV) retransmission in 0-20mA or 4-20mA
- RS485 MODBUS RTU serial communication
- 3rd and 4th alarm relays

The front panel is shown below.

Figure 1 - Front panel identification

Display: Shows the process variable (PV) and the programming prompts.
A1, A2, A3 and A4: show active alarms
Rx and **Tx**: Indicate RS485 communication line is active

P **PROGRAM key** - This key is used to access different displays with the programmable parameters of the device.

◀‖ **BACK key** - This key is used to go back to the previous parameter displayed in the menu cycle.

MAX **UP / MAX** and MIN **DOWN / MIN key** – It is used to increase and decrease parameters values. These keys are also used to display maximum and minimum values stored in memory.

F **FUNCTION key** - This special function key is used for pre-programmed functions as explained in the SPECIAL FUNCTION KEY section of this manual.

2. SPECIFICATIONS

- Power: 85 to 250Vac/dc, 50/60 Hz (basic model);
  24 Vdc/ac, optional;
- Maximum consumption: 4VA
- Relays: ALM1 and ALM2: SPDT - 3A / 250Vac (3A / 30Vdc);
  ALM3 and ALM4: SPST – NA 3A / 250Vac (3A / 30Vdc) (optional);
- All input signals are factory calibrated. Thermocouples are calibrated according to NBS standards (NBR12771), RTD's NBR 13773/97 (IEC-751), (α=0.00385).
- Internal resolution: 128000 levels,
- Display resolution: 62000 levels (-31000 to 31000)
- Sampling rate: 5 measurements per second for TC and RTD
  15 measurements for 0-50mA, 4-20mA, 0-5V, 0-10V
- Accuracy: Thermocouples J, K, T , N: ± 0.25% of full scale +1°C.
  Thermocouples E, R, S, B: ± 0.25% of full scale +3°C.
  Pt100: 0.2% of full scale
  Current or voltage: 0.15% of full scale
- Cold junction compensation error: ± 1 °C
- Warm up time: 15 minutes
- Input impedance: 0-50mV, Pt100 and T/C: >10MΩ
  0-5V, 0-10V > 1MΩ
  4-20mA: 15Ω
- Pt100 measure: 3-wire circuit, 750µA excitation current.
- PV retransmission resolution: 4000 levels, 550Ω max.
- Working conditions: 0 to 55°C, 35 to 85% relative humidity.
- Protection: IP54 front panel
  IP30 case/box
- Enclosure: Frontal Panel: Polycarbonate, self-extinguishable
  Back Panel: ABS + PC, self-extinguishable
- Weight: 240g basic version; 265g with options
- Dimension: 48×96×92 mm
- Panel cut out: 45×93mm

3. PROCESS VARIABLE INPUT - PV

The type of process variable (PV) input should be keyboard programmed by the user according to the codes shown in table 1 (refer to INPUT TYPE parameter " **InTYP**").

All input types are factory calibrated and no additional calibration is required.

TIPO	CÓD.	Faixa de Medição
J	tc J	faixa: -130 a 940 °C (-202 a 1724 °F)
K	tc h	Faixa: -200 a 1370 °C (-328 a 2498 °F)
T	tc t	faixa: -200 a 400 °C (-328 a 752 °F)
E	tc E	faixa: -100 a 720 °C (-148 a 1328 °F)
N	tc n	faixa: -200 a 1300 °C (-328 a 2372 °F)
R	tc r	faixa: 0 a 1760 °C (32 a 3200 °F)
S	tc S	faixa: 0 a 1760 °C (32 a 3200 °F)
B	tc b	faixa: 500 a 1800 °C (932 a 3272 °F)
Pt100	Pt 100	faixa: -200.0 a 850.0 °C (-328.0 a 1562.0 °F)
0 - 50mV	0-50	Linear. Indicação programável de -31000 a 31000
0 - 5V	0-5	Linear. Indicação programável de -31000 a 31000
0-10V	0- 10	Linear. Indicação programável de -31000 a 31000
0 – 50mV	c.0-50	Linearização definida pelo usuário.
0 - 5V	c.0-5	Linearização definida pelo usuário.
0-10V	c.0- 10	Linearização definida pelo usuário.
4-20mA	L in J	Linearização J. Faixa prog.: -130 a 940 °C
4-20mA	L in h	Linearização K. Faixa prog.: -200 a 1370 °C
4-20mA	L in t	Linearização T. Faixa prog.: -200 a 400 °C
4-20mA	L in E	Linearização E. Faixa prog.: -100 a 720 °C
4-20mA	L in n	Linearização N. Faixa prog.: -200 a 1300 °C
4-20mA	L in r	Linearização R. Faixa prog.: 0 a 1760 °C
4-20mA	L in S	Linearização S. Faixa prog.: 0 a 1760 °C
4-20mA	L in b	Linearização B. Faixa prog.: 500 a 1800 °C
4-20mA	L inPt	Linearização Pt100. Faixa prog.:-200.0 a 850.0 °C
0-20mA	0-20	Linear. Indicação programável de –31000 a 31000
4-20mA	4-20	Linear. Indicação programável de –31000 a 31000
0-20mA	c.0-20	Linearização definida pelo usuário.
4-20mA	c.4-20	Linearização definida pelo usuário.

Table 1 - Input type codes

4. ALARMS

The indicator has 2 alarm outputs in the basic version but up to 4 alarms outputs can be provided optionally.

Each alarm has a corresponding LED light in the front panel to show alarm status.

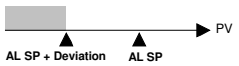
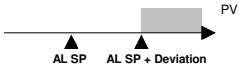
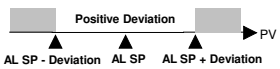
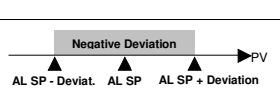
TYPE	PROMPT	ACTION
Disabled	oFF	Alarm is inactive
Sensor Break (input **Err**or)	tErr	Alarm will go ON if sensor breaks
Low Alarm (**Lo**w)	Lo	
High Alarm (**Hi**gh)	HI	
Differential Low (**diff**erential **Lo**w)	d iF.Lo	
Differential High (**diff**erential **Hi**gh)	d iF.HI	
Differential out of range (**dif**ferential out)	d iF.ou	
Differential within range (**diff**erential **With**in)	d iF. in	

Table 2 - Alarm functions

4.1 ALARM FUNCTIONS

The alarms can be set to operate in seven different functions. These functions are shown in table 2 and described below. The alarm can also be set as disabled.

4.1.1 Sensor break - **tErr**

The alarm is triggered whenever the sensor breaks or is badly connected.

4.1.2 Low alarm - **Lo**

The alarm relay is triggered whenever the measured value is below the alarm set point.

4.1.3 High alarm - **HI**

The alarm relay is triggered whenever the measured value is **above** the alarm set point.

4.1.4 Differential low – **d iF.Lo**

Deviation alarm. Alarm relay is triggered whenever the difference (deviation) between the value measured and the reference value (**rEF**) is beyond values defined in **SP.AL**. For this function, the triggering point is defined as:

(rEF – SP.AL)

4.1.5 Differential High – **d iF.HI**

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the value measured and the reference value (**rEF**) is beyond values defined in **SP.AL**. For this function, the triggering point is defined as:

(rEF + SP.AL)

4.1.6 Differential (or Band) out of range – **d iF.ou**

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the measured value and the reference value (**rEF**) is higher than the value defined in **SP.AL**. For this function, the triggering points are defined as:

(rEF – SP.AL) and (rEF + SP.AL)

4.1.7 Differential (or Band) within range – **d iF. in**

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the measured value and the reference value (**rEF**) is lower than the value defined in **SP.AL**. For this function, the triggering points are defined as:

(rEF – SP.AL) and (rEF + SP.AL)

4.2 ALARM TIMER

The alarms can be configured in the alarm timer. The user can set delays in the alarm action, define just one pulse for an alarm event, or make the alarm work in the form of sequential pulses.

Table 3 shows these advanced functions. Times T1 and T2 can be programmed from 0 to 6500 seconds (refer to item 8.2). Set 0 (zero) at the T1 and T2 to prompt for a normal non-timer alarm operation.

The LED lights will flash whenever there is an alarm condition regardless of the current alarm status which may be temporarily off because of the timer action.

4.3 ALARM INITIAL BLOCKING

The initial blocking option inhibits the alarm from being recognized if an alarm condition is present when the controller is first energized. The alarm will be triggered only after the occurrence of a non alarm condition followed by a new occurrence for the alarm.

The initial blocking is disabled for the **sensor break** alarm function.

Advanced Function	T1	T2	ACTION
Normal Operation	0	0	
Delayed	0	1s to 6500s	
Pulse	1s to 6500s	0	
Oscillator	1s to 6500s	1s to 6500s	

Table 3 - Timer Alarm Functions

5. SPECIAL FUNCTIONS

5.1 MAXIMUM AND MINIMUM

The indicator memorizes the measured maximum and minimum values (peak and valley). These two values are shown by pressing either the **MAX** or **MIN** keys. Pressing both keys simultaneously will clear the memory for a new peak and valley detection.

5.2 SPECIAL FUNCTION KEY AND DIGITAL INPUT

The **F** key (special function key) in the frontal panel and the optional digital input can execute special functions according to the user selection. Figure 8 shows how to activate the digital input. The special functions for the **F** key and for the digital input are explained as it follows.

HoLd - Freeze measured value

The **hold** function freezes the measured value showed in the display. Each time the **F** key or the digital input are selected alternates from **hold** to normal mode.

Whenever the indicator is in the **hold** mode a "**HoLd**" message is briefly displayed to show the operator that the displayed value is the frozen value and not the present reading.

PHoLd – Maximum value

The **Peak Hold** function shows the maximum value measured since the last time the F key was pressed or the digital input activated. Each activation of the **F** key or digital input triggers a new **Peak Hold** cycle and the display resets with a new peak value.

rESEt - Clears maximum and minimum

This function works the same way as the MAX and MIN keys pressed simultaneously, as explained in the 5.1 section.

If this "**rESEt**" function is programmed, every touch of the **F** key or activation of the digital input will clear the memory and a new cycle of maximum and minimum values memorization will start.

5.3 PROCESS VARIABLE RETRANSMISSION

As an option, the indicator can be supplied with an isolated 0-20mA or 4-20mA analog output for Process Variable (PV) retransmission.

The PV values that define the range of the 0mA/4mA to 20mA retransmission can be programmed by the user in the **high and low indication limits,** at configuration level.

When this option is available, retransmission will be always active, so that the user will not be required to turn it on or off.

For a voltage output signal an external shunt (calibrated resistor) should be installed at the analog output terminals.

5.4 EXTRA 24 VDC POWER SUPPLY – EXTRA P.S

The indicator provides a voltage power supply of 24 Vdc to excite the field transmitters with 25 mA current capacity. Available at the 16 and 17 terminals at the back panel.

5.5 CUSTOMIZED LINEARIZATION.

Three types of signals can be user-customized to fit special linearization profiles. This means that the operator can configure the instrument to read non-standard crescent non-linear signals with high accuracy.

6. INSTALLATION

The indicator must be attached to a panel. Remove the two plastic fixing clamps from the instrument. Insert the unit into the panel cut-out and put back the fixing clamps from the rear.

6.1 RECOMMENDATIONS FOR INSTALLATION

- Input signal wires should be laid out away from power lines and preferably inside grounded conduits.
- Instrument mains (line) supply should be suitable for this purpose and should not be shared.
- In controlling and monitoring applications, possible consequences of any system failure must be considered in advance. The internal alarm relay dos not warrant total protection.
- RC filters (47Ω and 100nF, serial) are highly recommended for valve and contactor coils, etc.

6.2 ELECTRICAL CONNECTIONS

The internal electronics can be removed from the front panel without any cable disassembly. The input signals and power connections are shown in Figure 2.

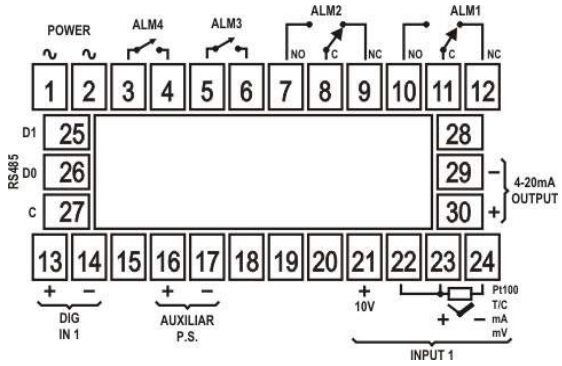


Figure 2 – Back Panel Terminals

SENSOR OR INPUT SIGNAL CONNECTION

These connections should be well done and terminals must be well tightened.

Thermocouples must be installed with proper extension or compensation cables.

Pt100 RTDs must be 3-wire connected and the wires connected to terminals 17 and 18 should have the same electrical resistance (same wire gauge) for proper cable distance compensation.

Four-wire RTDs can be connected by disconnecting the fourth wire. Two-wire RTDs can be connected by shortening terminals 22 and 23 and connecting the Pt100 to terminals 16 and 17.

Figures below show how connections are made for each type of input

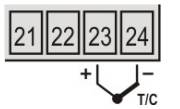


Figure 3 – Thermocouple Connection

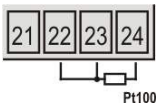


Figure 4 – 3 wire Pt100 Connection

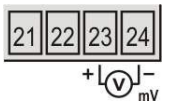


Figure 5 – Voltage Connection

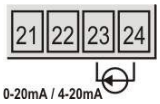


Figure 6 – Corrent Connection

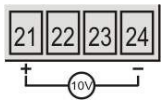
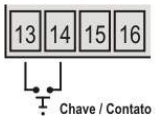


Figure 7 – Connection for 0-10V



Figurea 8 – Digital Input

Figure 9 shows connections made to measure signals from a 4-20mA transmitter supplied by the 24 V power supply the indicator provides.

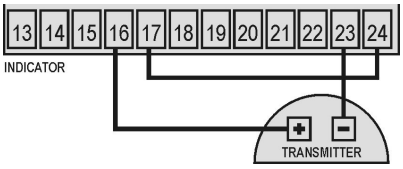


Figure 9 – Two-wire transmisttter with internal power suplay

6.2.1 Digital Input (Dig In)

The digital input can be used by connecting a switch (or equivalent) to its terminals, as shown in Figure 8 above.

6.2.2 Analog output

The analog output of N1500 can be 0-20 mA or 4-20mA, which can be selected during programming. This output is available at terminals 29 and 30.

7. OPERATION

For best results, this indicator requires correct setting of parameters as input type (T/C, Pt100, 4-20mA, etc), alarms triggering point, alarm function, etc.

These parameters are divided in five levels or groups of parameters which we will refer to as CYCLES.

Cycle	Access
1- Work	free access
2- Alarms	
3- Functions	
4- Configuration	reserved access
5- Customized Linearization	
6- Calibration	

Table 4 - Parameters Cycles

The work cycle has free access. All other cycles require a certain combination of key strokes to be accessed. The combination is:

P and ◄|| keys pressed simultaneously

Within the cycle chosen just press P to go to the subsequent parameters of this cycle. At the end of each cycle the display will go back to the work cycle.

After reaching the intended prompt just press the MIN or MAX key to change this parameter accordingly. All changes are recorded in non-volatile memory as we move to next prompt. After 25 seconds with no key pressed the indicator will return to the measuring cycle (work cycle).

7.1 CONFIGURATION PROTECTION

As safety measure, changes can be prevented by a combination of keys for each cycle.

The protected parameters could be still viewed but not changed.

To protect a cycle just press the ◄|| and MAX keys simultaneously for 3 seconds at the beginning of the referred cycle. To unlock this cycle just press the same keys again for 3 seconds.

The display will briefly flash confirming that the cycle was locked or unlocked.

For further protection, the unlock operation through the keypad may be disabled by changing the position of an internal strap inside the indicator:

When **PROT** is **OFF**, the user is allowed to lock and unlock the cycles using the keypad as explained above. If **PROT** is **ON**, the cycles lock/unlock operation is disable.

8. PROGRAMMING THE INDICATOR

8.1 WORK CYCLE

This is the first cycle. At power up the indicator will display the Process Variable (PV). The alarm triggering points are also displayed at this cycle (alarm Setpoints). To run through this cycle just press the P key.

TELA	PROMPT PARAMETER DESCRIPTION
8.8.8.8.8.	**Measure**. Shows the measured variable. For Pt100 or thermocouples the display will show the absolute temperature value. For 4-20mA, 0-50mV, 0-5V and 0-10mV inputs the display shows the values defined in the **in.LoL**" and " **InH IL** " prompts. With the **hold** function programmed the display shows the frozen variable and alternates with the message "**HoLd**". Likewise, with ***Peak Hold*** function programmed the high limit is displayed with the "**P.HoLd**" prompt alternately. Should any fault situation occur the indicator will display an error message which can be identified at item 11 of this manual.
AL.rEF	**Differential Alarm Reference Value** - This prompt is shown only when there is an alarm programmed with differential function. Value used as a reference for differential alarms triggering.
SP.AL 1 SP.AL2 SP.AL3 SP.AL4	**Set Points of Alarms 1, 2, 3 and 4** - Defines the operation point of each alarm programmed with "**Lo**" or "**H I**" functions. When the alarms are programmed with differential function, the alarm setpoint value represents the deviation value of these alarms.

8.2 ALARM CYCLE

Fu.AL 1 Fu.AL2 Fu.AL3 Fu.AL4	**Alarm Function** - Defines the alarms 1, 2, 3 and 4 function, as defined in item 4.1 **oFF** : Alarm off **iErr** : Broken or Shorted Sensor **Lo** : Low value **H I** : High value **d IF.Lo** : Differential low **d IF.h I** : Differential high **d IF.ou** : Differential out of range **d IF. In** : Differential within range
HY.AL 1 HY.AL2 HY.AL3 HY.AL4	**Alarm Hysteresis** This is the difference from the measured value to the point where the alarm is turned ON and OFF.
bL.AL 1 bL.AL2 bL.AL3 bL.AL4	**Alarm Blocking** Should any alarm condition occur, each alarm can be disabled when energizing the indicator. Refer to item 4.3.
AL 1t 1 AL 1t2 AL2t 1 AL2t2 AL3t 1 AL3t2 AL4t 1 AL4t2	**Alarm Timer** The user can set delayed, momentarily or sequential alarms as shown in table 3 by defining times T1 and T2. To disable this function just set zero for T1 and T2.

8.3 FUNCTION CYCLE

F.Func	**F KEY FUNCTION** – Defines functions for F Key. Options are **oFF** - Key not used. **hoLd** - Hold PV **rSt** - Resets Peak and Valley **PHoL** - Peak Hold These functions are described in item 5.2.
d IG. In	**Digital Input Function** – Defines the function for the digital input. Options are: **oFF** - **koLd** - **rESEt** - **PHoLd** Refer to item 5.2.
F ILtr	**Input Digital Filter** - Adjustable from 0 to 20, this is used to reduce instability of the measured value. 0 means the filter is off and 20 means maximum filtering. The higher the filter value the lower is the measured value response.
oFSEt	**Display Offset** - This a value which is added to the PV to offset any measurement deviation or sensor error. The offset is shown directly in the programmed engineering unit. For °F measurements the null reference is at 32°F.
bAud	**Baud Rate** - Serial digital communication speed in **bps**. Programmable: 1200, 2400, 4800, 9600, 19200, 38400 and 57600 bps.
AdrES	**Communication Address** - A number that identifies the instrument in a multidrop network.

8.4 CONFIGURATION CYCLE

In.tYP	**Input Type** - Selects the input signal or sensor type to be connected to the PV terminals. Refer to table 1 for options. Changing this parameter will change all other parameters related to PV and alarms, therefore it should be the first parameter to be set.
dP.PoS	**Decimal Point Position** - Defines the decimal point position in the displayed value. It is displayed when linear input types 0-50mV, 4-20mA, 0-5V or 0-10V are selected at the " **In.tYP**" prompt.
un It	**Temperature Unit** - Selects °C or °F indication. This prompt is not shown for input types 0-50mV, 4-20mA, 0-5V or 0-10V are selected at the " **In.tYP**" prompt.
S.root	**Square Root** - This prompt is only shown for input types 0-50mV, 4-20mA and 0-5V are selected at the " **In.tYP**" prompt. Set "**YES**" and the square root will be applied to the measured value within the limits programmed in " **In.LoL**" and " **InH IL**". The display will show the low limit value should the input signal be below 1% of the range.
In.LoL	**Input Low Limit** - Sets the low limit for input type 0-50mV, 4-20mA, 0-5V or 0-10V. When the **PV Retransmission** is used this limit defines the corresponding 4mA (or 0mA) in relation to the input value.
InH IL	**Input High Limit** - Sets the high limit for input type 0-50mV, 4-20mA, 0-5V or 0-10V. When the **PV Retransmission** is used this limit defines the corresponding 20mA in relation to the input value.
out.tY	**Analog Output Type** - Selects the analog output type to either 0- 20mA or 4-20mA.
out.Er	**4-20 mA Output behavior in case of failures** – Defines the output as 4-20 mA when there is an error in the indication. **do** – Applies a value < 4 mA; **UP** – Applies a value > 20 mA

8.5 CUSTOMIZED LINEARIZATION CYCLE

inP.01 inP.20	**Defines the extreme points (lower and upper) of the customized linearization. Values must be in the input signal unit:** 0-50 mV, 4-20mA or 0-5V. For 0-10V select 0-5V.
out.01 out.20	Defines the proportional indications in respect to each segment of the customized linearization. Values are in desired indication unit (within the **Indication Lower and Upper Limits**).

Figure 10 shows the sequence of cycles and parameters presented in the indicator display. There are parameters that must be defined for each alarm available

Work cycle	Alarm cycle	Function cycle	Configuration cycle	Cstomized linearization cycle	Calibration cycle
8.8.8.8.8.	* FuAL 1	F.FunC	In.tYP	inP.01 - inP.30	In.LoC
AL.rEF	* dF.AL 1	d IG. In	dP.PoS	out.01 - out.30	InH IC
* SP.AL 1	* HY.AL 1	F ILtr	un It		ou.LoC
	* bL.AL 1	oFSEt	S.root		ouH IC
	* AL. It 1	bAud	In.LoL		CJ Lo
	* AL. It2	AdrES	InH IL		HtYPE
			out.tY		
			out.Er		

Figure 10

8.5 CUSTOMIZED LINEARIZATION CYCLE

inP.01 inP.20	**Defines the extreme points (lower and upper) of the customized linearization. Values must be in the input signal unit:** 0-50 mV, 4-20mA or 0-5V. For 0-10V select 0-5V.
out.01 out.20	Defines the proportional indications in respect to each segment of the customized linearization. Values are in desired indication unit (within the **Indication Lower and Upper Limits**).

8.6 CALIBRATION CYCLE

All input types are factory calibrated. Should it be required, calibration should only be done by experienced personnel.

If this cycle is accidentally accessed do not touch the MIN or MAX keys. Just go through all cycles until the display shows the main or operation menu.

inLoC	**Input Low Calibration** - Sets the Process Variable low calibration (offset). Several key strokes at MAX or MIN might be necessary to increment one digit.
inH iC	**Input Hi Calibration** - Sets the Process Variable span calibration (gain).
ouLoC	**Analog Output Low Calibration** - Sets the analog current output low calibration (offset).
ouH iC	**Analog Output Span Calibration** - Sets the analog current output high calibration (span) of the analog output (20mA).
CJ Lo	**Cold Junction Calibration** - Allows the user to adjust this calibration directly in degrees, of temperature in the indicator terminals.
HtYPE	Hardware Type - These parameters adapt the software to the hardware available and should not be changed by the user. **0**- 2 Alarms = 3 **1**- 2 Alarms and 4-20mA = 19 **2**- 2 Alarms and RS485 = 35 **3**- 2 Alarms and 4-20mA e RS485 = 51 **4**- 4 Alarms = 15 **5**- 4 Alarms and 4-20mA = 31 **6**- 4 Alarms and RS485 = 47 **7**- 4 Alarms and 4-20mA e RS485 = 63

9. PROBLEMS WITH THE INDICATOR

Connection errors or improper configuration will result in malfunctioning of the indicator. Carefully revise all cable connections and programming parameters before operating the unit.

Some error messages will help the user identify possible problems.

Message	Possible Problem
UUUUU	Measured value is above the programmed sensor or input signal limit.
nnnnn	Measured value is below the programmed sensor or input signal limit.
-----	Open input. No sensor is connected or the sensor is broken.
Err 1	Pt100 cable resistance is too high or the sensor is badly connected.

Different messages other than the ones above should be reported to the manufacturer. Please inform the serial number if this should occur. The serial number can be viewed at the display by pressing the ◄|| key for about 3 seconds.

The software version of the instrument can be viewed at the time the unit is powered.

The instrument might display false error messages especially concerning the type of input selected.

9.1 SPECIAL RECOMMENDATIONS

Should the indicator be repaired, some special handling care should be taken. The device must be withdrawn from the case and immediately placed in an anti-static wrap; protected from heat and humidity.

9.2 INPUT CALIBRATION

Should calibration of some scale be necessary, proceed as it follows:

a) Program the indicator with the type of input requiring calibration;

b) Program the high and low limits of the measure (**inLoL** and **inH iL**) for the extreme of the type of input programmed;

c) Assign the input a corresponding signal and a know indication/measure and slightly over the low limit of the indication/measure;

d) Access the " **inLo**(" parameter. Use the MIN and MAX keys to select the expected values;

e) Assign the input a corresponding signal and a known indication and slightly below the higher limit of the indication/measure;

f) Access the " **inH i**(" parameter. Use the MIN and MAX keys to select the expected values;

g) Repeat steps c to f until no new adjustment is necessary.

Note: When verifications are proceeded, note if the Pt100 excitation/activation current the calibrator requires is compliant to the Pt100 excitation current used in this instrument: 750µA

10. SERIAL COMMUNICATION

The indicator can be supplied with an asynchronous RS-485 digital communication interface for master-slave connection to a host computer (master).

The indicator works as a slave only and all commands are started by the computer which sends a request to the slave address. The addressed unit sends back the requested reply.

Broadcast commands (addressed to all indicator units in a multidrop network) are accepted but no reply is sent back in this case.

10.1 CHARACTERISTICS

RS-485 compatibility with two-wire connection from the host to up to 31 slaves in a multidrop network topology. Up to 247 units can be addressed by the MODBUS RTU protocol. Maximum network distance: 4,000 feet. Time of indicator disconnection: Maximum of 2ms after the last byte.

Te communication signals are electrically isolated from the rest of the instrument, and can be 1200, 2400, 4800, 9600, 19200, 38400, and 57600 bps.

- Number of data bits: 8, without parity or pair parity
- Number of stop bits: 1
- Time to start response transmission: up to 100ms after acknowledging the command.
- Protocol: MODBUS (RTU)

10.2 RS485 INTERFACE: ELECTRICAL CONNECTION

The RS-485 signals are:

D: Bi-directional data line.

$\overline{D}$: Inverted bi-directional data line.

⏚: Ground (optional). To be used in noisy environments for achieving best results.

Figure 11 shows an example of an RS-485 network. If the computer does not have an RS-485 port available an external RS232↔RS485 converter should be used.

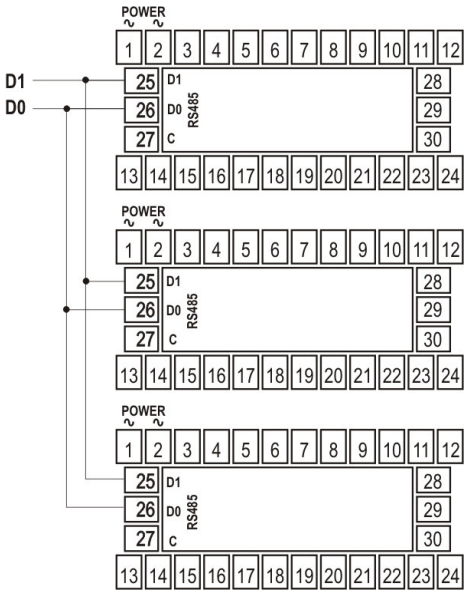


Figure 11 - RS-485 network connection