# Indicator N1500-LC

UNIVERSAL INDICATOR – INSTRUCTIONS V2.1x

## 1. INTRODUCTION

N1500 is a universal indicator for use with load cells. It accepts a wide variety of electric signals. A six-digit LED display shows measured value and all programming parameters of the instrument.

Configuration can be entirely made through the keyboard, no circuit changes are required. Selection of input and output types, alarms configuration, and other especial functions are accessed and programmed through the frontal keypad.

Users are advised to read the manual thoroughly before use. The indicator must be handled with care and should be used accordingly for best results.

Some of the features of the basic version are:

- Input: 4-20mA, 0-20mA, 0-50mV, 0-20mV and –20 a 20mV;
- 10Vcc power supply for load cells;
- Memory for maximum and minimum values;
- Hold, peak hold, tare, zero tare and automatic zero functions;
- Digital Input;

### 1.1. EXTRA OPTIONS

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

The frontal panel is shown below.


Figure 1 – Frontal panel

Display It displays the variable measured (PV) and the device programming prompts.

A1, A2, A3 and A4: show the active alarms.
Rx and Tx: Indicate that the RS485 communication line is active.

P Key - This key is used to access different displays with the programmable parameters of the indicator.

BACK key - Returns to the previous parameter shown in the parameter display.

INCREMENTS/ZERO key and DECREMENTS/ZERO key – They make possible the change the parameter values. They are also used to display maximum and minimum values stored in memory.

Special 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 supply: 85 to 250Vca, 50/60 Hz (locked source)
- Max. consumption: 4VA
- Relays: SPDT-NA - 3A / 250Vca
- All inputs are factory calibrated.
- Internal resolution: 128000 levels.
- Display resolution: 62000 levels (-31000 to 31000);
- Sampling rate: 15 samples per second;
- Maximum error: 0.15 of the maximum range;
- Warm up time: 15 minutes
- Input impedance 0-50mV, 0-20mV, -20 to 20mV: > 10 MΩ
  4-20mA, 0-20mA: 15Ω
- PV retransmission resolution: 4000 levels, max. 550Ω
- Working temperature: 0 to 55°C, humidity 35 to 85%;
- Protection rate Frontal panel: IP65
  Rear panel: IP30
- Enclosure:
  Frontal panel: Polycarbonate, self-extinguishable
  Rear panel: ABS+PC, self-extinguishable
- Approximate weight: 240g basic version; 265g with extras
- Dimensions: 48×96×92mm
- Slot for panel mounting 45×93 mm

## 3. PROCESS VARIABLE (PV) INPUT

The type of process variable input should be keyboard-programmed by the user according to the codes shown in Table 1 (see INPUT TYPE parameter "**in.typ**" in the programming section of this manual).

All input types are factory adjusted and no further calibration is required.

| TYPE | CODE | Measurement Range |
|---|---|---|
| 0 –20mV | 20 | Linear. Programmable indication from: –31000 to 31000. |
| -20 to 20mV | -20 20 | Linear. Programmable indication from: –31000 to 31000. |
| 0 - 50mV | 0-50 | Linear. Programmable indication from: –31000 to 31000. |
| 0 – 20mV | C.20 | User-defined linearization. |
| -20 to 20mV | c.-20 | User-defined linearization. |
| 0 – 50mV | c.50 | User-defined linearization. |
| 0-20mA | 0-20 | Linear. Programmable indication from: –31000 to 31000. |
| 4-20mA | 4-20 | Linear. Programmable indication from: –31000 to 31000. |
| 0-20mA | c.0-20 | User-defined linearization. |
| 4-20mA | c.4-20 | User-defined linearization. |

Table 1 – Input type codes

## 4. ALARMS

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

Each alarm has a corresponding LED light in the frontal panel that shows the alarm status.

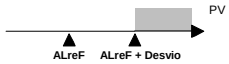
| TYPE | PROMPT | ACTION |
|---|---|---|
| Disabled | Off | Alarm is inactive |
| Open sensor (input Error) | ierr | Triggers if the sensor breaks |
| Minimum value (**Lo**w) | Lo |   |
| Maximum value (**Hi**gh) | Ki |   |
| Minimum differential (diFferential **Lo**w) | Dif.lo |   |
| Maximum differential (diFferential **Hi**gh) | Dif.ki |   |
| Differential out of range (**dif**ferential out) | Dif f |   |
| Differential within range (**dif**ferential **with**in) | Dif f |   |

Table 2 – Basic alarm functions

### 4.1. ALARM FUNCTIONS:

The alarms can be set to operate in six different functions: Open Sensor, Minimum Value, Maximum Value, Minimum Differential, Maximum Differential or Differential (Band). These functions are shown in table 2 and described below:

#### 4.1.1. Sensor break

The alarm is triggered whenever the input sensor is badly connected or broken.

#### 4.1.2. Minimum value

It is activated when the measured value is below the value defined in the alarm Set point.

#### 4.1.3. Maximum value

It is activated when the measured values are above the value defined in the alarm Set point.

#### 4.1.4. Differential (or Band) out of range

For this type of alarm, two parameters must be defined: Reference value for differential alarm (ALrEF) and Alarm differential set point (Deviation).

The differential alarm will be triggered when the measured value is out of the range defined by:

(**ALrEF** - Deviation) and (**ALrEF** + Deviation)

#### 4.1.5. Differential (or Band) out of range

Similar to the previous one, however, it works within the range defined above.

#### 4.1.6. Minimum differential

It is activated when the measured value is below the point defined in.

(ALrEF - Deviation)

#### 4.1.7. Maximum differential

It is activated when the measured value is above the point defined in.

(ALrEF + Deviation)

### 4.2. ALARM TIMER

The indicator can be programmed to have timer functions. The user can delay alarm activation, set one pulse per activation, or make the alarm signals operate in sequential pulses.

Figures shown in Table 3 represent these functions. T1 and T2 can be programmed from 0 to 6500 seconds. They are defined when the indicator is programmed (see item 8.2). Set 0 (zero) at the T1 and T2 to prompt for a normal non-timer alarm operation.

The LEDs associated to the alarms will flash whenever an alarm condition is acknowledged, regardless the actual state of the output relay, which may be temporarily off because of temporization.

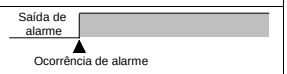
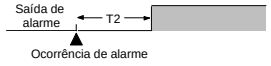
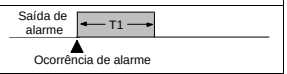
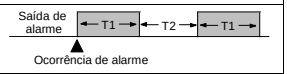
| Advanced Function | T1 | T2 | ACTION |
|---|---|---|---|
| Normal operation | 0 | 0 |   |
| Delay | 0 | 1 to 6500s |   |
| Pulse | 1 to 6500s | 0 |   |
| Oscillator | 1 to 6500s | 1 to 6500s |   |

Table 3 – Alarm timer functions

### 4.3. ALARM INITIAL BLOCKING:

The initial blocking option prevents the alarm from being triggered if an alarm condition is present when the controller is turned on for the first time. The alarm could be activated only after the occurrence of a non-alarm condition followed by a new occurrence of an alarm condition. The initial blocking is disabled for the sensor break alarm function.

## 5. SPECIAL FUNCTIONS

### 5.1. SPECIAL FUNCTION KEY AND DIGITAL INPUT

The F key (special function key) in the frontal panel of the controller as well as the Digital Input may be assigned different functions that will be chosen by the user during the setup: These functions can be chosen independently, both for the F key and the Digital Input. The F key and Digital Input functions are explained below.

#### 5.1.1. kold – Freeze measured value

The hold function freezes the measured value showed in the display. Each time the F key or the Digital Input is selected, there is a change from hold to normal mode.

Whenever the indicator is in the hold mode, the message "**koLd**" will be displayed so that the operator will be aware that the value displayed is the frozen value and not the current reading.

#### 5.1.2. Pkold – Maximum value

The indicator will automatically work in the Peak Hold mode whenever the F key or the Digital Input are programmed as "**PkoLd**".

While in this operation mode the indicator always shows the maximum value measured, since the last time the F key or the Digital Input were pressed.

Each activation of the F key or digital input triggers a new Peak Hold cycle and the display resets with a new peak value.

#### 5.1.3. xi – Displays Maximum

Displays the maximum (High) value the indicator measured since the last reset.

#### 5.1.4. Lo – Displays Minimum

Displays the minimum (Low) value the indicator measured since the last reset.

5.1.5. rESEt - Clears Maximum and Minimum

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

5.1.6. zero – Zero Function

Available only for the F key. It resets the scale. This function is used to eliminate the influence of interference or small deviations in the zero of a scale. Reset is only accomplished if the value shown in the scale is within 2% of the end of scale. Zero is not lost if the scale is turned off.

5.1.7. tarE –Tare function

It is available only in the Digital Input configuration or through the TARE key. It changes indication to zero (0000.0), regardless of the value applied to the input. It is used to eliminate indications of defined values. In order to eliminate the tare, the user must press the ZERO key.

5.2. TARE AND ZERO KEYS

The same Tare function available for the Digital Input can be quickly applied by using the TARE key, which does not need to be set up. The ZERO key is used to eliminate the tare applied.

The indicator accepts successive tares provided that the input signal (gross weight) does not exceed the equipment end of scale.

5.3. PROCESS VARIABLE RETRANSMISSION

The indicator can be offered with an optional 0-20mA or 4-20mA analog output, isolated from the rest of the device and suitable for the Process Variable (PV) retransmission. It is available in in terminals 1 and 2 at the rear panel.

The PV values that define the range of the 0mA/4mA minimum and 20mA maximum can be user-programmed in the High and Low indication limits during configuration.

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

To obtain voltage retransmission the user must install a shunt resistor in the analog output terminals.

5.4. POWER SUPPLY FOR LOAD CELLS (10 VDC)

N1500 provides a 10 Vdc (or 5Vdc) output to excite load cells. This power supply capacity is 30 mA.

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 accurate indications of electrical signals with non-linear characteristics.

## 6. INSTALLATION

6.1. PANNEL MOUNTING

The controller must be panel-mounted. 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.

6.2. INSTALLATION RECOMMENDATIONS

- Conductors of input signals must be distant from activation or high-tension/current conductors, preferably passing through grounded conduits.
- A specific electrical power supply network should be provided for instruments use only.
- In controlling and monitoring applications, possible consequences of any system failure must be considered in advance. The internal relay alarm does not provide total protection.
- RC filters (47Ω and 100nF, serial) in inductor charges (contactors, solenoids, etc.) are recommended.

6.3. ELECTRICAL CONNECTIONS

The internal part can be removed from the front panel without any cable disassembly. Figure 2 shows how signals are distributed in the controller rear panel.

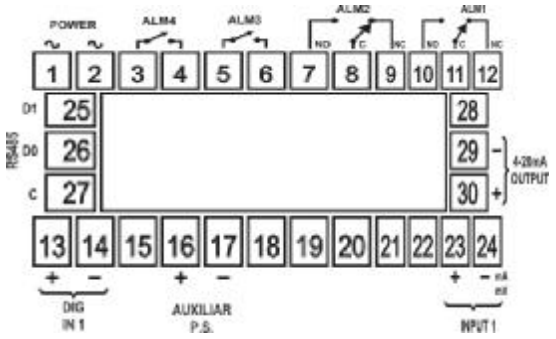



Figure 2 – Rear panel terminals

6.3.1. Input signal connection

It is important that they are very well connected, the sensor wires must be well fixed in the terminals of the rear panel.

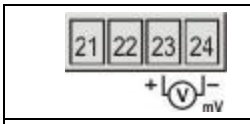



Figure 3 – voltage connection

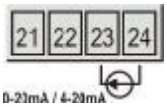



Figure 4 – current connection

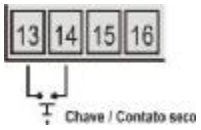



Figure 5 – Digital Input

6.3.2. Digital Input (Dig In)

To use the digital input, connect a switch (or equivalent) to its terminals, as shown in Figure 5 above.

6.3.3. 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 basic setting of parameters or a definition for parameters displayed. it is necessary to define, for example: Type of input, triggering point, alarm function, etc.

In order to make this task easier, parameters are divided in five levels (or groups) named CYCLES.

| Cycle | Access |
|---|---|
| 1 - work | Free access |
| 4 - Alarms | Reserved access |
| 3 - Functions | |
| 4 - Configuration | |
| 5 - Customized Linearization | |
| 6 - Calibration | |

Table 4 - parameter cycles

The work cycle has free access. All the other cycles require a keystroke combination to enable access. Press

P and ◄| 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 [ZERO] or [TARE] keys to change the parameter condition. All changes are recorded in non-volatile memory when the prompt is changed.

After 25 seconds with no key pressed the indicator will return to the measuring cycle (first level or work cycle)

7.1. CONFIGURATION PROTECTION

As a safety measure, changes can be prevented by a combination of keys for each cycle Parameters can be seen but not changed.

To protect a cycle just press the [ZERO] and [◄|] keys simultaneously for 3 seconds at the beginning of the referred cycle

To unlock this cycle (and allow for changes) just press the [TARE] and [◄|] keys for 3 seconds.

Displays will flash briefly to confirm locking or unlocking operation.

Within the controller, the PROT key completes the locking function. When PROT is OFF the user is allowed to lock and unlock the cycles. When PROT is ON changes are not allowed. if cycles are protected, protection cannot be removed, if there aren't cycles protection, they cannot be made.

## 8. PROGRAMMING THE INDICATOR

8.1. WORK CYCLE

This is the first level cycle. When it is turned on, the indicator displays the PV value. The alarm triggering points are also displayed in this cycle (alarm set points). To run through the cycle press the [P] key.

| PROMPT | PARAMETER DESCRIPTION |
|---|---|
| 8.8.8.8.8. | Measure prompt - Shows the variable measured according to the limits defined in the "**in.LoL**" and "**in.kiL**" prompts.<br>If the *Hold* function is programmed, the display shows the frozen variable measure alternating it with the " **koLd**" message.<br>If the *Peak Hold* function is programmed, the display shows maximum variable measured alternating it with the "P.koLd" message.<br>Should any failure occur, the indicator will display an error message, which is described in 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.al1<br>Sp.al2<br>Sp.al3<br>Sp.al4 | SP of Alarms 1, 2, 3 and 4 – Value that defines the alarms triggering points programmed with "**Lo**" or "**ki**" functions.<br>Note: For alarms programmed with differential functions, the alarm SP value can not be changed, and the "diF" message is displayed. The value of differential SP (deviation) is defined in the Alarms Cycle.<br>NOTE: The SP adjustment parameters are presented only if the corresponding alarm function is configured. |

8.2. ALARM CYCLE

| | |
|---|---|
| fV.al1<br>fV.al2<br>fV.al3<br>fV.al4 | Alarm Function – Defines the alarm functions: 1, 2, 3 or 4, as defined in item 4.1.<br>**oFF** : Alarm is inactive<br>**iErr** : Broken or shorted sensor.<br>**Lo** : Minimum value<br>**Ki** : Maximum value<br>**DiFL** : Minimum differential<br>**DiFH** : Maximum differential<br>**DiF f** : Differential out of range<br>**DiF d** : Differential within range |
| Ky.al1<br>Ky.al2<br>Ky.al3<br>ky.al4 | Alarm hysteresis<br>Defines the difference between the value at which the alarm is turned on and the value at which it is turned off. |
| Bl.al1<br>Bl.al2<br>Bl.al3<br>bl.al4 | Initial blocking function<br>It makes possible to prevent alarms activation at the process start, when all the system is powered. See item 4.3. |
| Al1t1<br>Al1t2<br>Al2t1<br>Al2t2<br>Al3t1<br>Al3t2<br>Al4t1<br>Al4t2 | Alarm Timer:<br>Prompts that define time T1 and T2, in seconds, shown in table 3. They allow the user to delay the alarm triggering, to activate alarms momentarily or sequentially.<br>To disable timer function, just set zero for T1 and T2. |

8.3. FUNCTION CYCLE

| | |
|---|---|
| f.fvnc | F Key function – Makes possible to define the F key function. Available functions:<br>**oFF** - Key not used;<br>**kold** - Hold PV<br>**RESEt** - Resets maximum and minimum values<br>**PkoLd** - Peak Hold<br>**XI** - Displays maximum<br>**LO** - Displays minimum<br>**ZERO** - Automatic zero<br>These functions are described in item 5.2. |
| Dig.in | Digital input function – Makes possible to define the digital input function. Functions available are the same as the ones available for the F key, except for the Zero function, replaced by the Tare function.<br>**oFF - kold - rESEt - PkoLd – XI - LO - tare**<br>These functions are described in item 5.2. |
| filtr | Input digital filter - It is used to reduce instability of the measured value.<br>Adjustable between 0 and 60. 0 when the filter is off and 60 for the maximum filtering. The higher the filter value, the lower is the measured value response. |
| ofset | Displayed offset – This is a value added to the measured value to shift PV indication. The offset is shown in the programmed unit. For °F indications the zero reference is at 32°F. |
| En A.z. | Enables auto zero - Enables the auto-zero function of the indication. The indication will turn to zero if the input value is within the programmed range in AZ LEV for 3 seconds. Auto-zero occurs when the indication is relatively stable. It is used to eliminate the influence of interference or small deviations in the zero of a scale. |
| A.Z.rAn | Maximum level for zero - Maximum level of the scale zero deviation, where auto-zero is activated. This value can be programmed up to 2% of the end of scale. |

| | |
|---|---|
| Bavd | *Communication Baud-Rate* – Transmission rate used in the serial communication of the device (RS-485), in bps. Available rates are: 1200, 2400, 4800, 9600,19200, 38400 and 57600 bps. |
| Adres | Communication address – Number that identifies the indicator in a network. |

8.4. CONFIGURATION CYCLE

| | |
|---|---|
| In.typ | Input type - Selection of the type of signal or sensor connected to the PV input. Table 1 presents options available.<br>The alteration of this parameter causes changes in all other parameters related with the PV and alarms. This must be the first parameter to be set up. |
| Dp.pos | Decimal point position - Defines the decimal point position in the displayed value. |
| In.lol | Input Low Limit – Determines the minimum limit for input signals.<br>When the PV retransmission is used, this value defines the point that will correspond to the 4mA (or 0mA) for any type of programmed input. |
| In.kil | Input High Limit – Determines the maximum limit for input signals.<br>When the PV retransmission is used, this value defines the point that will correspond to the 20mA for any type of programmed input. |
| Ovt.ty | Analog output type – Selects the analog output signal available. 0 to 20mA or 4 to 20mA Hz. |
| Ovt.er | 4-20 mA output signaling – Defines the analog output status when there is a retransmission error (beginning or end of scale). |

8.5. CUSTOMIZED LINEARIZATION CYCLE

| | |
|---|---|
| Inp.01<br>Inp.30 | Defines the extreme points (lower and upper) of the customized linearization. Values must be in the input signal unit. |
| Ovt.01<br>Ovt.30 | Defines the proportional indications in respect to each segment of the customized linearization. Values are in the intended 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 | Customized linearization cycle | Calibration cycle |
|---|---|---|---|---|---|
| 8.8.8.8.8. | * Fv.al1 | f.fvnc | In.typ | Inp.01 -inp.30 | In.lo( |
| Al.ref | * Ky.al1 | Dig.in | Dp.pos | OVt.01 - ovt.30 | In.ki( |
| * Sp.al1 | * Bl.al1 | Filtr | In.lol | | Ov.lo( |
| | * Al.1t1 | Ofset | In.kil | | Ov.ki( |
| | * Al.1t2 | En AZ | OVT.TY | | (j lo |
| | | AZ LEV | OVT.er | | k.type |
| | | Bavd | | | |
| | | adres | | | |

Figure 7 - Sequence of cycles and parameters presented in the indicator display

Parameters that must be defined for each alarm available.

8.6. CALLIBRATION CYCLE

All input and output types are factory calibrated. Recalibration is not recommended. If necessary, recalibration must be performed by specialized personnel.

If this cycle is accessed by mistake, do not press ZERO or TARE keys, go all through the screens up to the operation cycle is reached again.

| | |
|---|---|
| In.lol | Zero input calibration Makes possible to calibrate the PV offset. To change one digit, many keystrokes at ZERO or TARE may be necessary. |
| In.ki( | Input span calibration Makes possible to calibrate the PV offset. |
| Ov.lo( | Analog output zero calibration - Value for analog output offset calibration. |
| Ov.Ki( | Analog output span calibration - Value for analog output offset calibration (20mA). |
| (J lo | Cold junction calibration - It allows the user to adjust the temperature value, in degrees, in the indicator terminals. |
| k.type | Hardware type – These parameters adapt the software to the hardware available and should not be changed by the user. |

## 9. PROBLEMS WITH THE CONTROLLER

Connection errors and inadequate programming are the most common errors found during the controller operation. A final review may avoid loss of time and damages.

The controller displays some messages to help the user identify problems.

| Message | Problem |
|---|---|
| VVVV<br>V | 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 signal. |

Different messages other than the ones above should be reported to the manufacturer. Inform also the device serial number. To find out the serial number, press  for more than 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

In case recalibration of any scale is necessary, proceed as it follows:

a) Set up the input type to be calibrated
b) Set the lower and upper limits (**in.lol** e **in.kil**) of indication for the extremes of the input type
c) Apply a signal to the input that corresponds to a known value and a little bit over the lower limit of the indication.
d) Access the "inLo(" parameter. Using the MIN and MAX keys select the expected value that will appear in the parameters display.
e) Apply a signal to the input that corresponds to a known value and a little bit under the lower limit of the indication.
f) Access the "inki(" parameter. Using the MIN and MAX keys select the expected value that will appear in the parameters display.
g) Repeat c to f up to no new adjustment is necessary.

## 10. SERIAL COMMUNICATION:

An optional master-slave RS485 serial communication interface can be provided. It is used for communication with a supervisor machine (master). The controller is always the slave.

Communication starts only with the master, which sends a command to the slave address with which it wants to communicate. The slave takes the command and sends the correspondent response to the master.

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

### 10.1. FEATURES

Signals compliant to the RS-485 standard. Two-wire connection between the master and up to 31 instruments in bus topology (it may address up to 247 instruments). Maximum cable length: 1000 meters Time to disconnect from the controller. Maximum 2ms after the last byte.

Communication signals are electrically isolated from the rest of the device, speed options are 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 of response transmission start: Maximum 100ms after receiving the command.
- Protocol used: MODBUS (RTU)

### 10.2. ELECTRICAL CONNECTIONS RS485 INTERFACE

RS-485 signals are:

D: Bidirectional data line

$\overline{D}$: Inverted bidirectional data line

$\perp$: Ground. Optional connection to improve communication performance

If the supervisor computer does not have a RS-485 interface, an external RS232↔RS485 converter should be used.

Two parameters must be configured for serial use: The communication Baud-Rate (parameter **bavd**) and the Communication address (parameter **adres**).

## 11. WARRANTY

Novus Produtos Eletrônicos Ltda. products are covered by a 12-month warranty provided the purchaser presents the purchase receipt/invoice and the following conditions are met:

- The warranty period starts at the receipt date.
- Within this period, warranty against defects in material and workmanship under normal use and service is free.
- For repair, send the product and the sales receipt to our address in Porto Alegre.
- Expenses and transportation risks are under the owner's responsibility
- This warranty does not cover any damage due to accident, misuse, abuse, or negligence.