DIGITAL PANEL METER N1500

USER GUIDE V2.3x Q

novus
We Measure, We Control, We Record

1. SAFETY SUMMARY

The symbols below are used on the equipment and throughout this document to draw the user's attention to important operational and safety information.

	
CAUTION: Read complete instructions prior to installation and operation of the unit.	**CAUTION OR WARNING:** Electrical shock hazard.

All safety related instructions that appear in the manual must be observed to ensure personal safety and to prevent damage to either the instrument or the system. If the instrument is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2. PRESENTATION

N1500 is a digital panel meter 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 keypad, without any hardware change. Thus, the selection of input type and alarms modes, besides other special functions, are accessed and defined from the frontal keypad.

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 are:

- Universal input: Pt100, thermocouples, 0-50 mV, 0-5 V, 0-10 V, 0-20 mA and 4-20 mA.
- Customized indications.
- 24 Vdc power supply for remote transmitter excitation.
- Memory for **maximum** and **minimum** values.
- **Hold** and **Peak Hold** functions.
- Digital input.
- Increasing or decreasing display.
- Process Variable (PV) retransmission in 0-20 mA or 4-20 mA (**optional**).
- RS485 MODBUS RTU serial communication (**optional**).
- 3rd and 4th alarm relays (**optional**).

3. PROCESS VARIABLE INPUT (PV)

The process variable (PV) input type is configured through the frontal keypad according to the codes shown in **Table 1** (refer to INPUT TYPE parameter (InLYP) in CONFIGURATION LEVEL):

TYPE	CODE	MEASURING RANGE
J	tc J	Range: -130 to 940 °C (-202 to 1724 °F)
K	tc h	Range: -200 to 1370 °C (-328 to 2498 °F)
T	tc t	Range: -200 to 400 °C (-328 to 752 °F)
E	tc E	Range: -100 to 720 °C (-148 to 1328 °F)
N	tc n	Range: -200 to 1300 °C (-328 to 2372 °F)
R	tc r	Range: 0 to 1760 °C (32 to 3200 °F)
S	tc S	Range: 0 to 1760 °C (32 to 3200 °F)
B	tc b	Range: 500 to 1800 °C (932 to 3272 °F)
Pt100	Pt 100	Range: -200.0 to 850.0 °C (-328.0 to 1562.0 °F)
0-50 mV (Linear)	0-50	Linear. Programmable indication.
0-5 V (Linear)	0-5	Linear. Programmable indication.
0-10 V (Linear)	0- 10	Linear. Programmable indication.
0-50 mV (No Linear)	c.0-50	Custom linearization, user configurable.
0-5 V (No Linear)	c.0-5	Custom linearization, user configurable.
0-10 V (No Linear)	c.0- 10	Custom linearization, user configurable.
4-20 mA (No Linear)	Ln J	T/C type J linearization. Range: -130 to 940 °C
	Ln h	T/C type K linearization. Range: -200 to 1370 °C
	Ln t	T/C type T linearization. Range: -200 to 400 °C
	Ln E	T/C type E linearization. Range: -100 to 720 °C
	Ln n	T/C type N linearization. Range: -200 to 1300 °C
	Ln r	T/C type R linearization. Range: 0 to 1760 °C
	Ln S	T/C type S linearization. Range: 0 to 1760 °C
	Ln b	T/C type B linearization. Range: 500 to 1800 °C
	LnPt	Pt100 linearization. Range: -200.0 to 850.0 °C
0-20 mA (Linear)	0-20A	Linear. Programmable indication.
4-20 mA (Linear)	4-20A	Linear. Programmable indication.
0-20 mA (No Linear)	c.0-20	Custom Linearization, user configurable.
4-20 mA (No Linear)	c.4-20	Custom Linearization, user configurable.

Table 1 – Input types

All input types are factory calibrated and no additional calibration is required. The user does not need to make any adjustments.

4. ALARMS

The digital panel meter has 2 alarm outputs in the basic version and up to 4 alarms outputs optionally.

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

4.1 ALARM FUNCTIONS

The alarms can be set to operate in seven different modes. These modes are shown in **Table 2** and described below. The alarm can also be set as 'disabled'.

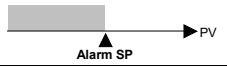
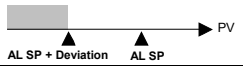
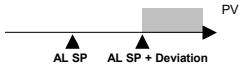
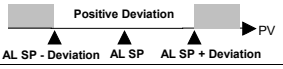
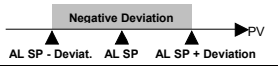
TYPE	PROMPT	ACTION
Disabled	oFF	Alarm is inactive
Break Alarm (*input* ***Err****or*)	iErr	Alarm will go ON if sensor breaks
Low Alarm (***Lo****w*)	Lo	
High Alarm (***Hi****gh*)	Hi	
Differential Low (***diff****erential* ***Lo****w*)	diFLo	
Differential High (***diff****erential* ***Hi****gh*)	diFHi	
Differential out of range (***diff****erential out*)	diFou	
Differential within range (***diff****erential* ***With****in*)	diF. In	

Table 2 – Alarm functions

4.1.1 BREAK ALARM – iErr

The break alarm is triggered whenever the input 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 – diFLo

Deviation alarm. Alarm relay is triggered whenever the difference (deviation) between the Process Variable and the reference value (**RLrEF**) is lower than the values defined in **SPAL**. For this function, the triggering point is defined as:

(RLrEF – SPAL)

4.1.5 DIFFERENTIAL HIGH – diFHi

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (**RLrEF**) is greater than the value defined in **SPAL**. For this function, the triggering point is defined as:

(RLrEF + SPAL)

4.1.6 DIFFERENTIAL (OR BAND) OUT OF RANGE – diFou

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (**RLrEF**) has its modulus greater than the value configured in **SPAL**. For this function, the triggering point is defined as:

(RLrEF – SPAL) and (RLrEF + SPAL)

4.1.7 DIFFERENTIAL (OR BAND) WITHIN RANGE – diF. In

Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (**RLrEF**) has its modulus lower than the value defined in **SPAL**. For this function, the triggering points are defined as:

(RLrEF – SPAL) and (RLrEF + SPAL)

4.2 ALARM TIMER

The alarms can be configured to perform timing functions. The configuration allows the alarm output to be delayed, or to deliver a single pulse or a train of pulses. The delay, the pulse width and the period are defined by the user.

Table 3 shows these advanced functions. Times T1 and T2 can be programmed from 0 to 6500 seconds and are define during configuration (see ALARM LEVEL section). Programming 0 (zero) in the timer parameters T1 and T2 disables the timer function.

The leds associated with the alarm always light up when the alarm condition occurs, regardless of the current state of the output relay, which may be de-energized momentarily due to a time delay.

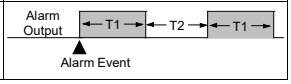
ADVANCED FUNCTION	T1	T2	ACTION
Normal Operation	0	0	
Delayed	0	1 s to 6500 s	
Pulse	1 s to 6500 s	0	
Oscillator	1 s to 6500 s	1 s to 6500 s	

Table 3 – Timer alarm functions

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 **Break Alarm** function.

5. SPECIAL FUNCTIONS

5.1 MAXIMUM AND MINIMUM

The digital panel meter memorizes the measured maximum and minimum values (peak and valley). These two values are shown when pressing 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.

5.2.1 HoLd – FREEZE MEASURED VALUE

The **Hold** function freezes the measured value showed in the display. This function is toggled each time the F key is pressed, or the digital input is selected.

Whenever the digital panel meter 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 current input reading.

5.2.2 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** level and the display resets with a new peak value.

5.2.3 rSt – CLEARS MAXIMUM AND MINIMUM

This function works the same way as the **MAX** and **MIN** keys pressed simultaneously, as explained in the MAXIMUM AND MINIMUM section.

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

5.3 PROCESS VARIABLE RETRANSMISSION

As an option, the digital panel meter can be supplied with an isolated 0-20 mA or 4-20 mA analog output for Process Variable (PV) retransmission. Available at the back panel terminals 29 and 30. When this option is available, retransmission will be always active, so that the user will not be required to turn it on or off.

The PV values that define the scale of the 0 mA / 4 mA to 20 mA retransmission can be programmed by the user in the **high and low output limits** (**OuLoL** and **OuHiL**), at configuration level. High and low limits can be freely programmed, even with a low limit higher than high limit, resulting in a reversed retransmission signal (decreasing signal when PV increases).

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

5.4 AUXILIARY 24 VDC POWER SUPPLY – AUXILIARY P.S.

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

5.5 CUSTOMIZED LINEARIZATION

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

6. INSTALLATION

The digital panel meter is designed to be panel mounted. Remove the two plastic fixing clamps from the instrument, insert the unit into the panel cut-out and slide firmly the fixing clamps from the rear against the panel.

6.1 INSTALLATION RECOMMENDATIONS

- 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, consequences of any system failure must be considered in advance. The internal alarm relay does not warrant total protection.
- Use of RC filters (47 R and 100 nF, serial) are highly recommended when driving solenoids, contactor coils or other inductive loads.

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 1**:

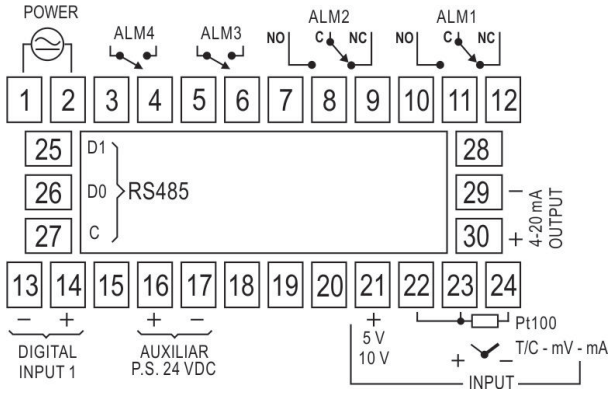


Figure 1 – Back panel terminals

6.3 POWER CONNECTION

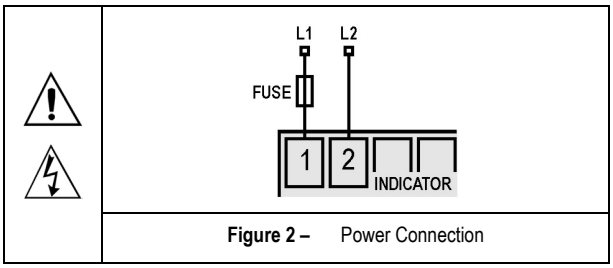


Figure 2 – Power Connection

6.4 SENSOR AND INPUT SIGNAL CONNECTIONS

These connections should be properly 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 22 and 23 should have the same electrical resistance (same wire gauge) for correct cable length 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 23 and 24.

The figures below show the connections relative to each type of input.

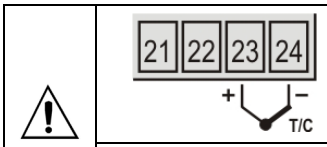


Figure 3 – Thermocouple input

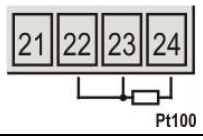


Figure 4 – 3-wire Pt100 input

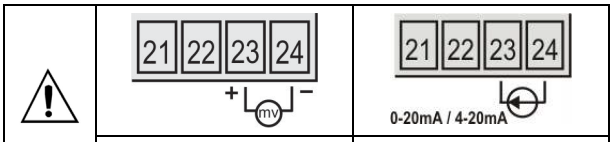


Figure 5 – Voltage input

Figure 6 – Current input

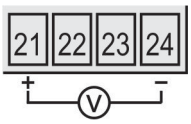


Figure 7 – Connection for 0-5 V or 0-10 V

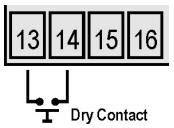


Figure 8 – Digital Input

Figure 9 shows the connections for a 4-20 mA transmitter powered by the 24 V power supply of the digital panel meter:

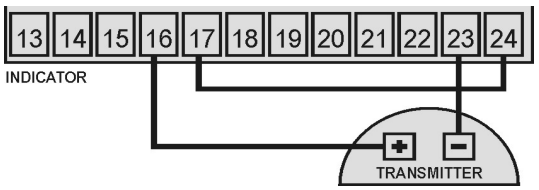


Figure 9 – 2-wire transmitter with internal power supply

6.5 DIGITAL INPUT (DIG IN)

The digital input is activated by connecting a switch (or equivalent) to its terminals, as shown in **Figure 8** above.

6.6 ANALOG OUTPUT

N1500 can deliver either 0-20 mA or 4-20 mA analog output, depending on how the instrument is configured. The output is available at terminals 29 and 30.

7. OPERATION

The front panel is shown below:

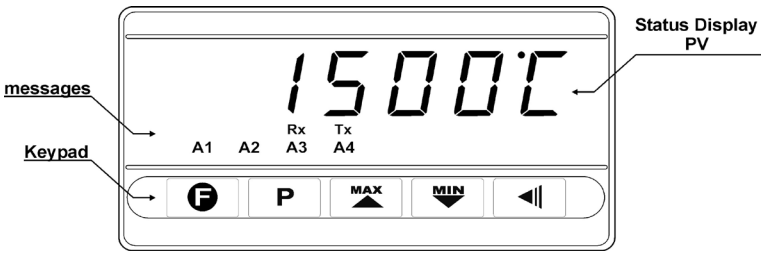


Figure 10 – Front panel identification

Status Display: Shows the process variable (PV) and the programming prompts.

Indicators A1, A2, A3, and **A4**: Show active alarms.

Indicators Rx and **Tx**: Indicate RS485 communication line is active.

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

◄|| **key**: This key is used to go back to the previous parameter displayed in the menu level.

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

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

The digital panel meter requires that the internal parameters be properly configured such as to fit the application need. These parameters are the input type (T/C, Pt100, 4-20 mA, etc), alarms triggering points, alarm functions, etc.

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

LEVEL	ACCESS
1 − Work	Free access
2 − Alarms	Reserved access
3 − Functions	
4 − Configuration	
5 − Customized Linearization	
6 − Calibration	

Table 4 – Parameters levels

The work level has free access. All other levels require a certain combination of keystrokes to be accessed. The combination is:

P and ◄|| keys pressed simultaneously

Once within a level, just press P to move to the subsequent parameters of this level. At the end of each level the display will go back to the work level.

Note: To access the calibration level, however, it is required to press the keys P and ◄|| simultaneously for 10 seconds. The first parameter in this level is presented (InLoc) indicating that the calibration level is enabled.

After reaching the intended prompt just press the MIN or MAX keys 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 digital panel meter will return to the measuring level (work level).

7.1 CONFIGURATION PROTECTION

As safety measure, parameter changes can be prevented by a combination of keys, valid for each level. The protected parameters can be inspected but not modified.

To protect a level, press the ◄|| and MAX keys simultaneously for 3 seconds while in the level. To unlock the level, press ◄|| and MIN for 3 seconds.

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

For further protection, the keypad unlock operation can be disabled by changing the position of an internal strap inside the digital panel meter:

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

Note: It is recommended to disable/suspend the control whenever it is necessary to change the device settings.

8. PROGRAMMING THE DIGITAL PANEL METER

8.1 WORK LEVEL

This is the first level. At power up the digital panel meter will display the Process Variable (PV). The alarm triggering points are also displayed at this level (alarm Setpoints).

To advance in this level simply press P.

SCREEN	PROMPT PARAMETER DESCRIPTION
88888	PV measurement. Shows the measured variable. For Pt100 or thermocouples the display will show the absolute temperature value. For 0-50 mV, 0-5 V, 0-10 V, 0-20 mA and 4-20 mA inputs the display shows the values defined in the InLoL and InHIL parameters. 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 PHoLd prompt alternately. Should any fault situation occur the digital panel meter will display an error message which can be identified at the PROBLEMS WITH THE DIGITAL PANEL METER section of this manual.
RLrEF	Differential alarm reference value. This prompt is shown only when there is an alarm programmed with differential function. This value is used as a reference for differential alarms triggering.
SPAL 1 SPAL2 SPAL3 SPAL4	Alarms Setpoints 1, 2, 3 and 4. Defines the operation point of each alarm programmed with Lo or HI functions. When an alarm is programmed with a differential function, the alarm setpoint value represents the deviation value of the alarm relative to the reference RLrEF.

8.2 ALARM LEVEL

FuAL 1 FuAL2 FuAL3 FuAL4	Alarm function. Defines functions for the alarms 1, 2, 3 and 4, configured in ALARM FUNCTIONS section. oFF Alarm off. IErr Broken or Shorted Sensor. Lo Low value. HI High value. diFLo Differential low. diFHI Differential high. diFou Differential outside the range. diF.In Differential within range.
HYAL 1 HYAL2 HYAL3 HYAL4	Alarm hysteresis. This is the difference from the measured value to the point where the alarm is turned ON and OFF.
bLAL 1 bLAL2 bLAL3 bLAL4	Alarm blocking. Should any alarm condition occur, the alarms can be individually disabled when energizing the digital panel meter.
AL 1t 1 AL 1t2 AL2t 1 AL2t2 AL3t 1 AL3t2 AL4t 1 AL4t2	Alarm timer. The user can set delayed, momentary, or sequential alarms by configuring times T1 and T2 according to **Table 3**. To disable this function just set zero for T1 and T2.

8.3 FUNCTION LEVEL

FFunc	F key function. Defines functions for the F key. The available options are: oFF Key not used. HoLd Hold PV. rSt Resets Peak and Valley (MAX and values). PHoL Peak Hold. These functions are described in detail in the SPECIAL FUNCTION KEY AND DIGITAL INPUT section.
diG In	Digital input function. Defines the function for the digital input. The available functions are the same as for F key: oFF - HoLd - rSt - PHoLd These functions are described in detail in the SPECIAL FUNCTION KEY AND DIGITAL INPUT section.
FiLtr	Input digital filter. Adjustable from 0 to 60, this is used to reduce instability of the measured value. 0 means the filter is off and 60 means maximum filtering. The higher the filter value, the slower the 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 in the programmed engineering unit. For °F measurements the null reference is at 32 °F.
bAud	Baud Rate. Serial digital communication speed in **kbps**. Programmable: 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 (no parity). 1.2P, 2.4P, 4.8P, 9.6P, 19.2P, 38.4P, 57.6P and 115.2P (with EVEN parity).
AdrES	Communication address. A number that identifies the instrument in a multidrop network.

8.4 CONFIGURATION LEVEL

InTyP	Input type. Selects the input signal or sensor type to be connected to the PV terminals. Refer to **Table 1** for options. Changing the input type causes all other parameters related to PV and alarms to be changed as well, therefore, this parameter shall be the first to be set.
dPPoS	Decimal point position. Defines the decimal point position in the displayed value. When configuring the input (InTyP) with temperature sensors (J, K, Pt100, etc), in addition to the integer part of the measurement, the dPPo parameter will only display decimal values (XXX.X). When configuring the input (InTyP) with linear signals (mA, mV, V), the dPPo parameter determines the position of the decimal point of the measured value (XXXX, XXX.X, XX.XX, X.XXX).
Unit	Temperature unit. Selects °C or °F indication. This prompt is not shown for input types 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA are selected at the InTyP prompt.
Sroot	Square root. This prompt is only shown when input types 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA are selected at the InTyP prompt. Set YES and the square root will be applied to the measured value within the limits programmed in InLoL and InHiL. The display will show the low limit (InLoL) value should the input signal be below 1 % of the range.
ScALE	Scale. Defines the indication range for linear inputs (0-50 mV, 0-5 V, 0-10 V, 0-20 mA and 4-20 mA). 0 Configurable indication from – 31000 to + 31000. 1 Configurable indication from 0 to + 60000. 2 Configurable indication from 0 to +120000. Only even values will be displayed (resolution is not improved). The selected scale affects values of PV, alarm setpoints and Offset.
InLoL	Input low limit. Sets the low limit for input type 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA. The range created may have increasing or decreasing behavior in relation to the input signal behavior.
InHiL	Input high limit. Sets the high limit for input type 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA. The range created may have increasing or decreasing behavior in relation to the input signal behavior.
OutTy	Analog output type. Selects the analog output type to either 0-20 mA or 4-20 mA.
OuLoL	Low limit for analog retransmission. Defines the PV value that results in a 4 mA (or 0 mA) analog output current.
OuHiL	High limit for analog retransmission. Defines the PV value that results in a 20-mA analog output current.
outEr	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 LEVEL

inP.01 inP.30	Defines the *initial* and *end* analog input values for each custom segment line. The values must be entered in the input signal unit: 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA. For 0-10 V, select 0-5 V.
out.01 out.30	Defines the corresponding indication that each custom segment is to show. Values are expressed in the desired indication unit (within the **Indication Lower and Upper Limits**).

Table 5 shows the sequence of levels and parameters presented in the display. There are parameters that must be defined for each alarm available.

WORK LEVEL	ALARM LEVEL	FUNCTION LEVEL	CONFIGURATION LEVEL	CUSTOMIZED LINEARIZATION LEVEL	CALIBRATION LEVEL
88.88.8.	* FuAL 1	F.FunC	Inty P	inP.01 - inP.30	InLoC
ALrEF	* dFAL 1	d iG. In	dP.PoS	out.01 - out.30	InH iC
* SPAL 1	* HYAL 1	F iLtr	Un it		ouLoC
	* bLAL 1	oFSEt	Sr oot		ouH iC
	* AL. It 1	bAud	ScALE		C J Lo
	* AL. It2	AdrES	InLoL		HtYPE
			InH iL		
			OutY		
			OuLoL		
			OuH iL		
			outEr		

* Parameters that require definition for each available alarm.

Table 5 – Sequence of levels and parameters displayed by the digital panel meter

8.6 CALIBRATION LEVEL

All input and output types are factory calibrated. This level should only be accessed by experienced personnel. If this level is accidentally accessed do not touch the MIN or MAX keys, just press the P key a few times to go back to the Work Level.

InLoC	Input low calibration. Sets the Process Variable low calibration (offset). Several keystrokes at MAX or MIN might be necessary to increment one digit.
InH iC	Input high 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 (20 mA).
C J Lo	Cold Junction calibration. Allows the user to calibrate the cold junction temperature (at the input terminals) directly in degrees.
HtYPE	Hardware type. This parameter adapts the firmware to the actual hardware (optional features) and should not be changed by the user. 2 Alarms .....**3** 2 Alarms and 4-20 mA.....**19** 2 Alarms and RS485 .....**35** 2 Alarms, 4-20 mA, and RS485 .....**51** 4 Alarms .....**15** 4 Alarms and 4-20 mA.....**31** 4 Alarms and RS485 .....**47** 4 Alarms, 4-20 mA, and RS485..... **63**

9. CONFIGURATOR SOFTWARE

Available for free download from the **NOVUS** website, **QuickTune** software is the ideal tool to configure the **N1500**. It also has diagnostic tools.

To configure the device, simply follow the procedure below:

1. Download and install the software on the computer to be used.
2. Run **QuickTune**, set up communication and start device recognition.

10. PROBLEMS WITH THE DIGITAL PANEL METER

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

Some error messages will help the user identify potential problems.

MESSAGE	POSSIBLE PROBLEM
uuuuu	Measured value is above the value allowed for the selected sensor or above the configured input signal limit.
nnnnn	Measured value is below the value allowed for the selected sensor or below the configured 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.

Table 6 – Error messages

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.

When not properly configured, the instrument may show false error messages, particularly those related to the type of input selected.

10.1 SPECIAL RECOMMENDATIONS

Should the digital panel meter 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.

10.2 INPUT CALIBRATION

All inputs are factory calibrated and recalibration should only be done by qualified personnel. If you are not familiar with these procedures do not attempt to calibrate this instrument.

The calibration steps are:

a) Select the input type to be calibrated.

b) Set the desired upper and lower display limits.

c) At the input terminals inject an electrical signal corresponding to a known indication value a little higher than the lower display limit.

d) Select the InLc prompt. Through the MIN and MAX keys adjust PV so that it matches the injected signal.

e) Inject a signal that corresponds to a value a little lower than the upper limit of the display.

f) Select the InHc prompt. Through the MIN and MAX keys adjust PV so that it matches the injected signal.

g) Repeat steps **c)** to **f)** until no further 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: 0.750 mA.

11. SERIAL COMMUNICATION

The digital panel meter can be supplied with an asynchronous RS485 digital communication interface for master-slave connection to a host computer (master).

The digital panel meter works as a slave only and all commands are started by the computer which sends a request to the slave address. The addressed unit processes the command and sends back the answer.

Broadcast commands (addressed to all units in a multidrop network) are accepted but no response is generated.

11.1 FEATURES

- RS485 compatibility with two-wire bus 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: 1000 m.
- Disconnection time: Maximum of 2 ms after the delivery of the last byte.
- Communication signals electrically isolated from the rest of the instrument.
- Baud rate: 1200, 2400, 4800, 9600, 19200, 38400 or 57600 bps.
- Number of data bits: 8, without parity.
- Number of stop bits: 1
- Time to start response transmission: 100 ms maximum delay after acknowledging the command.
- Protocol: MODBUS (RTU)

Two parameters must be configured to use the serial communication interface: Communications Baud Rate (**bRud**) and the Communication Address (**AdrES**).

11.2 RS485 INTERFACE

The RS485 signals are:

D1	**D**	**D +**	**B**	Bidirectional data line	Terminal 25
D0	$\overline{D}$	**D -**	**A**	Inverted bidirectional data line	Terminal 26
C				Optional connection. Improves communication performance for long cable runs.	Terminal 27

Table 7 – RS485

11.3 COMMUNICATION PROTOCOL

The MOSBUS RTU slave is implemented. All configurable parameters can be accessed for reading or writing through the communication port. Broadcast commands are supported as well (address 0).

The available Modbus commands are:

01 – Read Coils *05 – Write Single Coil*

03 – Read Holding Register *06 – Write Single Register*

11.4 HOLDING REGISTER TABLE

Follows a description of the usual communication registers. For full documentation, download the **Registers Table for Serial Communication** in the **N1500** section of our web site.

All registers are 16-bit signed integers.

ADDRESS	PARAMETER	REGISTER DESCRIPTION
0000	PV	Read: Process variable. Write: Not allowed. Range: The minimum value is in **InLoL**. The maximum value is in **InH IL**. The decimal point position depends on **dPPoS**.
0003	PV	Read: Normalized Process Variable. Write: Not allowed. Maximum range: 0 to 120000.
0004	Display Value	Read: Current display value. Write: Current display value. Maximum range: -31000 to 31000. The range depends on the showed display.

Table 8 – Register table

12. SPECIFICATIONS

DIMENSIONS: 48 x 96 x 92 mm (1/8 DIN).
Approximate weight: 250 g
PANEL CUT-OUT: 45 x 93 mm (+0.5 -0.0 mm)
POWER: 100 to 240 Vac/dc ±10 %, 50/60 Hz
Optional 24 V: 12 to 24 Vdc / 24 Vac (-10 % / +20 %)
Max. Consumption: 7.5 VA
ENVIRONMENTAL CONDITIONS:
Operating temperature: 5 to 50 °C
Maximum RH: 80 % up to 30 °C
For temperatures above 30 °C, decrease 3 % per °C
Installation category II, pollution degree 2, altitude < 2000 m
INPUT: Keyboard selection of input type (refer to **Table 1**)
Internal resolution: 128000 levels
DISPLAY RESOLUTION:
Temperature: 1 / 0.1
Other measures: 1 / 0.1 / 0.01 / 0.001 / 0.0001
Input sample rate: 5 per second for Pt100 and T/C
15 per second to 0-50 mV, 4-20 mA, 0-5 V and 0-10 V
Accuracy: Thermocouples J, K, T, N: 0.25 % of span ±1 °C
Thermocouple E, R, S, B: 0.25 % of span ±3 °C
Pt100: 0.2 % of span
mA, mV, V: 0.2 % of span
Input impedance:
0-50 mV, Pt100 and thermocouples: >10 MΩ
0-5 V, 0-10 V: >1 MΩ
0-20 mA, 4-20 mA: 15 Ω (+2 Vdc @ 20 mA)
Pt100 measurement: DIN 43760 standard (α = 0.00385)
Excitation current: 0.750 mA. 3-wire circuit, cable resistance compensation
ANALOG OUTPUT: 0-20 mA or 4-20 mA, 500 Ω max.
4000 levels, Isolated
RELAY OUTPUT:
ALM1, ALM2: SPDT 3 A / 240 Vac (3 A / 30 Vdc Res.)
ALM3, ALM4: SPST-NO: 1.5 A / 250 Vac (3 A / 30 Vdc Res.)
AUXILIARY POWER SUPPLY: 24 Vdc, ±10 %; 25 mA
EMC: EN 61326-1:1997 and EN 61326-1/A1:1998
SAFETY: EN61010-1:1993 and EN61010-1/A2:1995
SPECIFIC CONNECTIONS FOR TYPE FORK TERMINALS OF 6.3 mm.
FRONTAL PANEL: IP65, polycarbonate UL94 V-2.
HOUSING: IP20, ABS + PC UL94 V-0.
START-UP: 3 seconds after power up.
CERTIFICATIONS:

13. ORDERING INFORMATION

N1500 -	4R -	RT -	485 -	24V
A	B	C	D	E

A: Series model: **N1500**

B: Relays outputs: **Blank** (2 relays); **4R** (4 relays)

C: Analog output: **RT** (Retransmission of the input signal) or **Blank**

D: Digital Communication: **485** (RS485, Modbus protocol) or **Blank**

E: Voltage rating: **Blank** (100-240 Vac/dc); **24V** (12 to 24 Vdc / 24 Vac)

14. WARRANTY

Warranty conditions are available on our website www.novusautomation.com/warranty.