N1540 DIGITAL PANEL METER

USER GUIDE V2.1x G

We Measure, We Control, We Record

1. SAFETY ALERTS

The symbols below are used in the device and throughout this manual to draw the user's attention to valuable information related to device safety and use.

	
CAUTION: Read the manual fully before installing and operating the device.	**CAUTION OR HAZARD:** Risk of electric shock.

All safety recommendations appearing in this manual must be followed to ensure personal safety and prevent damage to the instrument or system. If the instrument is used in a manner other than that specified in this manual, the device's safety protections may not be effective.

2. PRESENTATION

N1540 is an extremely versatile process controller. It has several types of input, with thermocouples, resistance thermometers and linear voltage and current signals that allow the equipment to indicate the most diverse variables.

In addition, it has different alarm functions, display Offset, configuration password protection, serial communication, display in Celsius (°C) or Farenheit (°F) degrees, among other features.

Configuration can be carried out directly on the digital panel meter or, once the **QuickTune** software has been installed on the computer to be used, via the USB interface. When the device is connected to USB, it will be recognized as a serial communication port (COM) operating with the Modbus RTU protocol.

Through the USB interface, even when disconnected from the power supply, the configuration performed on one device can be saved in a file and repeated on other devices that require the same configuration.

3. FEATURES

3.1 INPUT SIGNAL

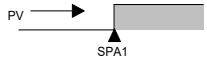
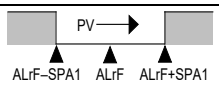
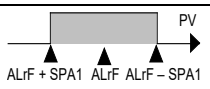
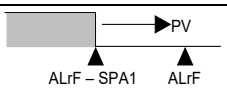
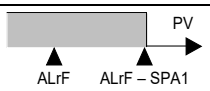
When configuring the device, the input type must be defined. **Table 1** shows the options available:

TYPE	CODE	MEASUREMENT RANGE
J	tc J	Range: -110 to 950 °C (-166 to 1742 °F)
K	tc K	Range: -150 to 1370 °C (-238 to 2498 °F)
T	tc t	Range: -160 to 400 °C (-256 to 752 °F)
N	tc n	Range: -270 to 1300 °C (-454 to 2372 °F)
R	tc r	Range: -50 to 1760 °C (-58 to 3200 °F)
S	tc S	Range: -50 to 1760 °C (-58 to 3200 °F)
B	tc b	Range: 400 to 1800 °C (752 to 3272 °F)
E	tc E	Range: -90 to 730 °C (-130 to 1346 °F)
Pt100	Pt	Range: -200 to 850 °C (-328 to 1562 °F)
0-20 mA	L0.20	Analog Linear Signal Adjustable range between -2000 and 30000.
4-20 mA	L4.20	
0-50 mV	L0.50	
0-5 Vcc	L0.5	
0-10 Vcc	L0.10	
4-20 mA NO LINEAR.	LnJ	Non-Linear Analog Signal Indication range in accordance with the associated sensor.
	Ln K	
	Ln t	
	Ln n	
	Ln r	
	Ln S	
	Ln b	
	Ln E	
	LnPt	

Table 1 Input types

3.2 ALARMS

The equipment has 2 alarms. Each alarm is associated to an output with the same name: ALM1 and ALM2. These alarms can be configured to operate in the functions described in **Table 2**:

<table>
<tr><td>oFF</td><td colspan="2">Alarm off.</td></tr>
<tr><td>Lo</td><td>Absolute minimum value alarm.
Turns on when the value of the measured variable (PV) is below the value set by the alarm Setpoint (SPA1 or SPA2).</td><td> 
</td></tr>
<tr><td>HI</td><td>Absolute maximum value alarm.
Turns on when the value of the measured variable (PV) is above the value set by the alarm Setpoint.</td><td> 
</td></tr>
<tr><td rowspan="3">dIF</td><td colspan="2">Differential value alarm.
In this function, the SPA1 and SPA2 parameters represent errors (difference) between PV and an ALrF reference value.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>positive SPA1</td><td>negative SPA1</td></tr>
<tr><td rowspan="3">dIFL</td><td colspan="2">Absolute minimum value alarm.
Triggers when the PV value is below the point set by ALr-SPA1 (using alarm 1 as an example):</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>positive SPA1</td><td>negative SPA1</td></tr>
</table>

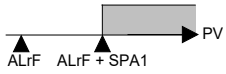
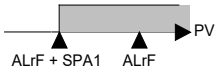
d IFH	Absolute maximum value alarm. Triggers when the PV value is above the point set by ALr+SPA 1 (using alarm 1 as an example):	
		
	positive SPA1	negative SPA1
IErr	Sensor Break Alarm. Acts when the input has problems such as a broken sensor, poor connection, etc.	

Table 2 Alarm functions

Note: The figures also apply to Alarm 2 (SPA2).

Important note: Alarms configured with the H I, d IF and d IFH functions also activate the related output when a sensor fault is identified and signaled by the digital panel meter. For example, a relay-type output, configured to act as a Maximum Alarm (H I), will act when the SPAL value is exceeded and when the sensor connected to the input is broken.

3.3 ALARM INITIAL BLOCK

The Initial Block option inhibits the alarm from being activated if there is an alarm condition in the process when the equipment is turned on. The alarm will only be enabled after the process has passed through a non-alarm condition.

The Initial Block is useful, for example, when one of the alarms is configured as a minimum value alarm, which can cause the alarm to be triggered as soon as the process starts (an often-undesirable behavior).

The initial block is not valid for the IErr (Open Sensor) function.

3.4 OFFSET

Feature that allows you to make a small adjustment to the PV indication. This makes it possible to correct measurement errors that appear, for example, when replacing the temperature sensor.

3.5 MINIMUM AND MAXIMUM

The digital panel meter is continuously storing the extreme values of its PV measurements (maximums and minimums values). If you press the F1 (maximum) and F2 (minimum) keys for 3 seconds, you can view these extreme values at any time.

To delete stored values and start a new extreme monitoring cycle, simply press the F1 and F2 keys simultaneously. This information will not be saved when the equipment is turned off.

3.6 CUSTOM LINEARIZATION

A feature that allows accurate measurement of input signals with non-linear features.

Linearization consists of dividing the input signal into ten segments. Each segment is made up of a start point and an end point (InP.xx). For each point on the segments, you must define a corresponding display value in ouP.xx.

The input signal must always be rising.

Custom linearization is only valid for input types 0-20 mA, 4-20 mA, 0-50 mV, 0-5 V, and 0-10 V.

3.7 AUXILIARY SUPPLY – 24 VDC

The auxiliary supply is another feature available. It is suitable for feeding the process transmitters that generate the input signal for the digital panel meter.

Available on terminals 11 and 13 of the rear connector.

3.8 SERIAL COMMUNICATION

For complete information, see APPENDIX 1 – COMUNICATION PROTOCOL.

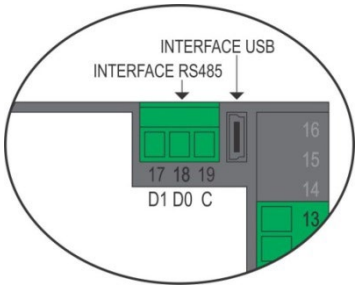


Figure 1 Serial communication

3.9 ELECTRICAL CONNECTIONS: RS485 INTERFACE

The RS485 signals are:

D1	D	D+	B	Bidirectional data line.	Terminal 17
C				Optional connection that improves communication performance.	Terminal 19
GND					
D0	$\overline{D}$	D-	A	Inverted bidirectional data line.	Terminal 18

Table 3 RS485

3.10 USB INTERFACE

The USB interface is used to CONFIGURE, MONITOR, or UPDATE THE FIRMWARE of the equipment. To do this, you must use the QuickTune software, which offers features for creating, viewing, saving, and opening settings from the device or from files on your computer.

Saving and opening settings in files allows you to transfer settings between devices and make backup copies.

For specific models, **QuickTune** allows you to update the equipment's firmware (internal software) via the USB interface.

To MONITOR, you can use any supervisory (SCADA) or laboratory software that supports Modbus RTU communication over a serial communication port. When connected to the USB of a computer, the controller is recognized as a conventional serial port (COM x).

You must use the **QuickTune** software or consult the DEVICE MANAGER in the Windows Control Panel to identify the COM port assigned to the controller.

It is necessary to consult the Modbus memory mapping in the controller's communication manual and the documentation for its supervisory software.

To use the USB communication of the device, follow the procedure below:

1. Download the free **QuickTune** software from our website and install it on the computer to be used. In addition to the chosen software, the USB drivers needed to operate the communication will also be installed.
2. Connect the USB cable between the device and the computer. The equipment does not need to be powered. The USB will provide sufficient power for communication operation (other functions of the device may not operate).
3. Run the **QuickTune** software, configure communication, and start equipment recognition.

The USB interface IS NOT ISOLATED from the signal input (PV) and the digital inputs and outputs of the equipment. Its purpose is temporary use during CONFIGURATION and MONITORING periods.

For the safety of people and equipment, it should only be used when the device is completely disconnected from the input/output signals. In any other connection condition, the use of USB is possible, but requires careful analysis by the person responsible for its installation.

For MONITORING over long periods and with inputs and outputs connected, we recommend using the RS485 interface, available or optional on most of our products.

3.11 PV RETRANSMISSION

The digital panel meter can feature an analog output that retransmits the measured process variable (PV) values. Analog retransmission is scalabl. It has minimum and maximum limits, which define the retransmission range, configured in the **rtLL** and **rtHL** parameters.

The digital panel meter allows you to create a connection between display range and output current with inversely proportional behavior (**rtLL** > **rtHL**).

Available on terminals 18 (+) and 19 (-) of the rear connector of the **N1540-RT** and **N1540-RT-24V** models.

The user can set the retransmission signal between the options 0 to 20 mA and 4 to 20 mA.

To obtain retransmission at an electrical voltage of 0 to 10 V, it is necessary to install a shunt resistor (500 Ω max.) on the analog output terminals and select the 0 to 20 mA signal as the electrical retransmission signal.

The relay output is electrically isolated from the other circuits.

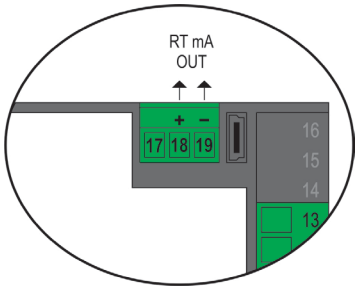


Figure 2 PV Retransmission Terminals (RT mA OUT)

Note: The RS485 Communication and PV Retransmission features are mutually exclusive.

4. INSTALLATION / CONNECTIONS

The equipment must be fixed to the panel, following the sequence of steps below:

- Make a 93.0 x 45.5 mm cut-out in the panel.
- Remove the mounting clamp from the equipment.
- Insert the equipment into the cut-out through the front of the panel.
- Replace the mounting clamp on the equipment, pressing until it is firmly attached to the panel.

4.1 ELECTRICAL CONNECTIONS

The layout of the features on the rear panel is shown in **Figure 3**:

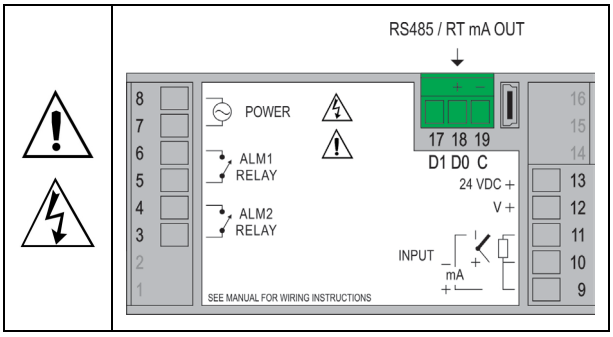


Figure 3 Rear panel

It is necessary to pay attention to the polarity when connecting the power supply line in 24 V models: Terminal 18 = (+) and terminal 19 = (-).

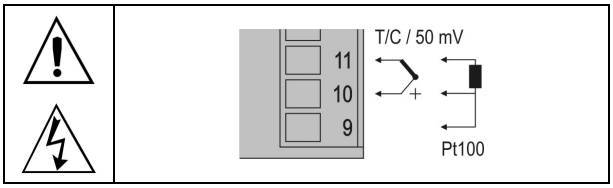


Figure 4 Three-wire Pt100 connections, thermocouples, and 50 mV signal

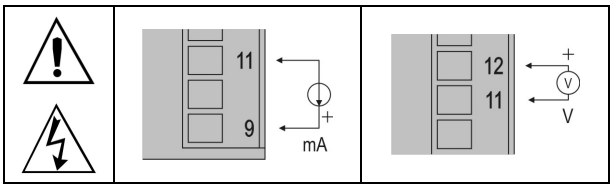


Figure 5 Current (mA) and voltage (V) signal connections

A typical application for the auxiliary voltage source is to supply field transmitters (type 4-20 mA, two-wire). **Figure 6** shows the connections required for this application:

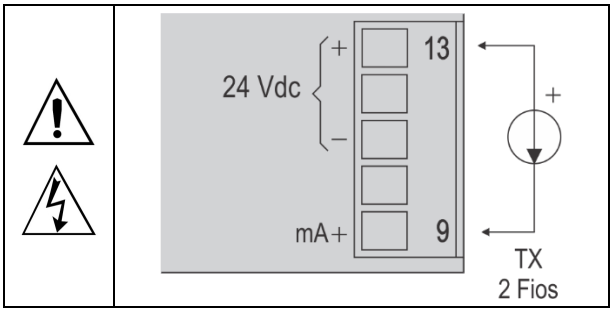


Figure 6 Example of using the 24 Vdc supply with a 2-wire transmitter (passive, Sink type)

4.2 INSTALLATION RECOMMENDATIONS

- Input signal conductors should run through the plant separate from output and supply conductors. If possible, in grounded conduits.
- The power supply for electronic instruments must come from a network specific to the instrumentation.
- It is recommended to use RC FILTERS (noise suppressors) in contactor coils, solenoids, etc.
- In control applications, it is essential to consider what can happen when any part of the system fails. The internal devices of the equipment do not guarantee full protection.

5. OPERATION

The figure below shows the front panel:

Figure 7 Identification of the front panel parts

Display: Displays the measured variable, configuration parameter symbols and their respective values/conditions.

A1 and A2 flags: Signal the occurrence of an alarm condition.

P key: Key used to advance through the successive parameters and parameter levels.

F1 / ▲ Increment key and F2 / ▼ Decrement key: Keys used to change parameter values.

◀ **Key:** Key used to go back parameters during configuration.

5.1 START UP

When the equipment is turned on, the display will show the version of the internal software during the first 3 seconds. It will then show the value of the measured process variable (PV) on the display. This is the **Indication Screen**.

To be used in a process, the equipment needs to be configured. To configure it, you must set the parameters displayed by the equipment.

The configuration parameters are grouped into affinity groups called Parameter Cycles. The 5 parameter cycles are:

– Operation
  – Alarms
    – Input
      – Linearization
        – Calibration

The **P** key gives access to the cycles and their parameters.

By holding down the **P** key, the equipment will jump from one cycle to another every 2 seconds, displaying the first parameter of each cycle:

PV >> FuA1 >> tYPE >> LEnbL >> PASS >> PV ...

To enter the desired cycle, simply release the **P** key when the first parameter is displayed. To advance through the parameters of this cycle, press the **P** key briefly. To go back parameters, use the ◀ key.

After the last parameter, the equipment will return to the PV **Indication Screen**.

Each parameter is shown on the display alternately with its value or condition.

According to the protection configuration adopted, the **PASS** parameter is displayed as the first parameter of the cycle where protection starts. See CONFIGURATION PROTECTION chapter.

6. PARAMETER DESCRIPTIONS

6.1 OPERATION CYCLE

PV	**PV Indication Screen.** Value of the measured variable.
SPA1 **SPA2** *Setpoint Alarm*	Alarm Setpoint. Value that defines the point at which alarms are triggered. For alarms configured with Differential type functions, these parameters define the maximum accepted difference between PV and a reference value defined in the **ALrF** parameter. Parameters shown in this cycle only when enabled in the **SP 1E** and **SP2E** parameters.

6.2 ALARM CYCLE

FuA1 **FuA2**	Functions of Alarms 1 and 2. Allows you to define the alarm functions from the options in **Table 2**.
ALrF *Alarm Reference*	Reference value for alarms with differential function, minimum differential or maximum differential.
SPA1 **SPA2** *Setpoint Alarm*	Alarm Setpoint. Value that defines the trigger point for the alarm outputs. For alarms programmed with Differential type functions, these parameters define deviations. This parameter is not used for the **1Err** alarm function.
SP 1E **SP2E** *SP Enable*	The **SPA1** and **SPA2** parameters can also be displayed in the Operation Cycle: **YES** Displays **SPA1**/**SPA2** in the Operation Cycle. **no** DOES NOT display **SPA1**/**SPA2** in the Operation Cycle.
bLA1 **bLA2** *Blocking Alarm*	Allows you to enable the initial blocking of alarms: **YES** Enables the initial block. **no** Inhibits the initial block.
HYA1 **HYA2** *Alarm Hysteresis*	Alarm hysteresis. Allows you to define the difference between the PV value at which the alarm is switched on and the value at which it is switched off.
FLSh *Flash*	Allows you to signal the occurrence of alarm conditions by flashing the PV indication on the display screen: **YES** Enables alarm signaling by flashing PV. **no** Does not enable alarm signaling by flashing PV.

6.3 INPUT CYCLE

tYPE *Type*	Input type. Allows you to select the input type to be used by the equipment. See **Table 1**.
FLtr *Filter*	Digital input filter. Used to improve the stability of the measured signal (PV). Adjustable between 0 and 20. At 0 means that the filter is off. At 20 means that the filter is at maximum. The larger the filter, the slower the response of the measured value.
dPPo *Decimal Point*	Allows you to define how the decimal point will be displayed. When configuring the input (**tYPE**) 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 (**tYPE**) with linear signals (mA, mV, V), the **dPPo** parameter establishes the position of the decimal point of the measured value (XXXX, XXX.X, XX.XX, X.XXX).
unit *Unit*	Allows you to define the temperature unit to be used: **C** Indication in Celsius. **F** Indication in Fahrenheit.
OFFS *Offset*	Allows you to correct the indicated PV value.
inLL *Input Low Limit*	Allows you to set the lower value of the display range when configuring the 0-20 mA, 4-20 mA, 0-50 mV, 0-5 V, and 0-10 V input types.
inHL *input High Limit*	Allows you to set the upper value of the display range when configuring the 0-20 mA, 4-20 mA, 0-50 mV, 0-5 V, and 0-10 V input types.
rEtr *Retransmission*	Allows you to set the PV retransmission mode: **0-20** It determines the retransmission in 0-20 mA. **4-20** It determines the retransmission in 4-20 mA. This parameter will be displayed when PV retransmission is available on the digital panel meter.

rtLL *Retransmission Low Limit*	Allows you to set the lower limit of the PV retransmission range. This parameter will be displayed when PV retransmission is available on the digital panel meter.
rtHL *Retransmission High Limit*	Allows you to set the upper limit of the PV retransmission range. This parameter will be displayed when PV retransmission is available on the digital panel meter.
bAud *Baud Rate*	Allows you to set the communication Baud Rate (in kbps): 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, and 115.2. This parameter will be displayed when serial communication is available on the digital panel meter.
PrtY *Parity*	Allows you to define the parity of serial communication: nonE No parity. E'En Even parity. Odd Odd parity. This parameter will be displayed when serial communication is available on the digital panel meter.
Addr *Address*	Allows you to define the communication address. Number between 1 and 247 that identifies the equipment on the serial communication network. This parameter will be displayed when serial communication is available on the digital panel meter.

6.4 CUSTOM LINEARIZATION CYCLE

LEnbL	Allows you to enable custom linearization. By enabling this parameter, the display will follow the configuration established by the points defined below.
inP.00 inP. 10	Allows you to define the endpoints of the ten possible segments for custom linearization. Values in the unit of the input signal: mA, mV, or V.
ouP.00 ouP. 10	Allows you to define the indications corresponding to the extremes of the ten custom linearization segments defined in the parameters (inP.xx) above. Values in the desired display unit.

6.5 CALIBRATION CYCLE

All input types are factory calibrated. When a recalibration is necessary, it must be performed by a specialized professional.
If you access it by accident, do not change its parameters.

PASS *Password*	Allows you to enter the password. This parameter is displayed before the protected levels. See CONFIGURATION PROTECTION chapter.
CAlib *Calibration*	Allows you to enable the calibration of the equipment. If calibration is not enabled, the related parameters will remain hidden.
inLC *Input Low Calibration*	Declaration of the calibration signal indicating the start of the range applied to the input.
inHC *Input High Calibration*	Declaration of the calibration signal indicating the end of the range applied to the input.
rStr *Restore*	Allows you to recall the factory calibrations of the input, disregarding any changes made by the user.
CJ *Cold Junction*	Cold Joint temperature of the equipment.
PASC *Password Change*	Allows you to set a new password, always different from 0.
Prot *Protection*	Allows you to set the Protection Level. See **Table 3**.
FrEQ *Frequency*	Allows you to set the frequency of the local power grid.
Sn H *Serial Number High*	Displays the first 4 digits of the serial number.
Sn L *Serial Number Low*	Displays the last 4 digits of the serial number.

7. CONFIGURATION PROTECTION

The equipment allows you to protect the configuration, preventing undue changes.

The **Protection** (*Prot*) parameter in the Calibration Cycle defines the level of protection to be adopted, limiting access to the levels, as shown in the table below:

PROTECTION LEVELS	PROTECTED CYCLES
1	Only Calibration Cycle is protected.
2	Linearization and Calibration are protected.
3	Input, Linearization, and Calibration are protected.
4	Alarm, Input, Linearization, and Calibration are protected.

Table 4 Configuration protection levels

7.1 PASSWORD

When accessed, the protected cycles ask for an access which, if entered correctly, allows you to change the configuration of the parameters of these cycles.

The access password is entered in the *PASS* parameter, which is displayed on the first of the protected cycles. Without the password, you can only view the parameters of protected cycles.

The access is defined in the **Password Change** parameter (*PASC*), present in the Calibration Cycle.

The equipment leaves the factory with password 1111.

7.2 PASSWORD PROTECTION

The equipment features a security system that helps prevent numerous passwords from being entered in an attempt to guess the correct one. When you enter an incorrect password 5 consecutive times, the equipment will prevent new attempts for 10 minutes.

7.3 MASTER PASSWORD

If you forget your password, you can use the Master Password. When entered, this password allows you to change the **Password Change** parameter (*PASC*), enabling you to set a new access password for the equipment.

The master password is composed of the last 3 digits of the serial number of the equipment **plus** the number 9000.

The master password for an equipment with serial number 07154321 is: 9321.

You can get the serial number of the equipment by pressing the ◄ key for 5 seconds.

7.4 INPUT CALIBRATION

All input types are calibrated at the factory. Recalibration is not recommended for inexperienced operators.

If recalibration is necessary, proceed as described below:

1. Set the input type to be calibrated.
2. Program the lower and upper display limits to the extremes of the measurement range of the input type.
3. Apply to the input a signal corresponding to a known indication and just above the lower indication limit.
4. Access *InLC* parameter. Use the ▲ and ▼ keys to make the display show the expected value. Then press **P**.
5. Apply to the input a signal corresponding to a known indication and just below the upper indication limit.
6. Acess *InHC* parameter. Use the ▲ and ▼ keys to make the display show the expected value. Then press **P**.
7. Validate the calibration performed.

Note: When checking or calibrating the equipment, check that the Pt100 excitation current required by the calibrator is compatible with the Pt100 excitation current used in this instrument: 0.170 mA.

7.5 ANALOG OUTPUT CALIBRATION

If recalibration is necessary, proceed as described below:

1. Set the retransmission type (*rEtr* = *P.020*).
2. Install a milliammeter on terminals 18 (+) and 19 (-).
3. Enter the Calibration Cycle.
4. Select *ouLC* parameter.
5. Press ▲ or ▼.
6. Read the current value indicated on the milliammeter. Use the ▲ and ▼ keys to adjust the value shown on the digital panel meter. It must match the value shown on the milliammeter.
7. Press the **P** key to save and access the *ouHC* parameter.
8. Press ▲ or ▼.

9. Read the new current value indicated on the milliammeter. Use the ▲ and ▼ keys to adjust the value shown on the digital panel meter. It must match the value shown on the milliammeter.
10. Read the current indicated on the milliammeter and, using the ▲ and ▼ keys, indicate it in the **ouHc** parameter.
11. Exit the Calibration Cycle.
12. Validate the calibration performed.

8. SPECIFICATIONS

DIMENSIONS: ..... 96 x 48 x 34 mm
Panel cutout: ..... 93.0 x 45.5 mm
Approximated weight: ..... 75 g
POWER SUPPLY: ..... 100 to 240 Vac/dc (±10 %), 50/60 Hz
Optional 24 V: ..... 12 to 24 Vdc / 24 Vac (-10 % / +20 %)
Maximum consumption: ..... 6 VA
ENVIRONMENTAL CONDITIONS:
Operating temperature: ..... 0 to 50 °C
Relative humidity: ..... 80 % @ 30 °C
For temperatures above 30 °C, decrease by 3 % per °C.
Indoor use | Installation category II | Pollution degree 2 | Altitude < 2000 meters.
INPUT ..... According to **Table 1**
Internal resolution: ..... 32767 levels (15 bits)
Display resolution: ..... 32000 levels (from -2000 to 30000)
Resolution for temperature: ..... 0.1 / 1 °C / °F
Input reading rate: ..... Up to 55 per second
Accuracy: ..... Thermocouples J, K, T, E: 0.25 % F.S. ±1 °C
..... Thermocouples N, R, S, B: 0.2 % F.S. ±3 °C
..... Pt100: 0.2 % F.S.
..... 0-20 / 4-20 mA, 0-50 mV, 0-5 V, 0-10 V: 0.2 % F.S.[1]
Input impedance: ..... Pt100, termopares, 0-50 mV: > 10 MΩ
..... 0-5 V, 0-10 V: > 500 kΩ
..... 0-20 / 4-20 mA: 15 Ω
Pt100 measurement: ..... 3-wire type, (α = 0.00385)
With cable length compensation, 50 meters max., 0.170 mA excitation current.
OUTPUT (ALM1): ..... SPST-NO Relay, 240 Vac / 30 Vdc / 1.5 A
OUTPUT (ALM2): ..... SPST-NO Relay, 240 Vac / 30 Vdc / 1.5 A
RETRANSMISSION (mA RT - OUTPUT): ..... 0-20 mA / 4-20 mA
Accuracy (25 °C): ..... 0.15 % F.S.
Maximum impedance: ..... 500 Ω (10 V máx.)
Thermal coefficient: ..... 0.0004 mA / °C
Resolution: ..... < 0.0005 mA
AUXILIARY SUPPLY: ..... 24 Vdc (± 10 %) 20 mA max.
HOUSING: ..... IP65, Polycarbonate (PC) UL94 V-2
CONNECTORS: ..... ABS+PC UL94 V-0
USB INTERFACE: 2.0, CDC class (Virtual serial port), Modbus RTU protocol.
STARTUP: 3 seconds after power up.
CERTIFICATIONS:

[1] F.S.: Full Scale.

9. IDENTIFICATION

MODEL	DESCRIPTION
N1540	Basic version.
N1540-24	Basic version with 24 V power supply.
N1540-485	RS485 version.
N1540-485-24V	RS485 version and 24 power supply.
N1540-RT	Version with PV Retransmission.
N1540-RT-24V	Version with PV retransmission and 24 V power supply.

Notes:

1. The communication signals are electrically isolated from the other circuits.

2. The analog output circuit is electrically isolated from the other circuits.

3. The RS485 Communication and PV Retransmission features are mutually exclusive.

10. MAINTENANCE

Connection errors and improper programming represent most problems encountered when using the equipment. A final review can prevent wasted time and damage.

The equipment displays some messages to help you identify problems:

MESSAGE	PROBLEM DESCRIPTION
----	Open input. No sensor or signal.
Err 1	Connection and/or configuration problems. Check the connections and configuration.

Table 5 Error messages

Other error messages displayed by the equipment represent internal damage that necessarily means the device must be sent for maintenance.

11. WARRANTY

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

12. APPENDIX 1 – COMUNICATION PROTOCOL

12.1 COMMUNICATION INTERFACE

The RS485 serial interface allows you to address up to 247 digital panel meters on a network, communicating remotely with a computer or master digital panel meter.

12.1.1 RS485 INTERFACE

- Signals compatible with the RS485 standard.
- 3-wire connection between the master and up to 31 digital panel meters in bus topology. By using multiple output converters, it is possible to reach up to 247 nodes.
- Maximum connection distance: 1000 meters.
- The RS485 signals are:

D1	**D**	**D +**	**B**	Bidirectional data line.
D0	**$\overline{D}$**	**D -**	**A**	Inverted bidirectional data line.
C				Optional connection that improves communication performance.
GND				

Table 6 RS485

12.1.2 GENERAL FEATURES

- Optical isolation on the serial interface.
- Programmable speed: 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps.
- Data Bits: 8.
- Parity: None, Even, Odd.
- Stop Bits: 1.

12.1.3 COMMUNICATION PROTOCOL

The device supports the Modbus RTU slave protocol, which is available in most supervisory software on the market.

Through the Register Table, you can access (read and/or write) all the configurable parameters. It is also possible to use address 0 to write to the registers in Broadcast mode.

The following Modbus commands are available:

03 – Read Holding Register

05 – Force Single Coil

06 – Preset Single Register

16 – Preset Multiple Register

The registers are arranged in a table so that several registers can be read in the same request.

12.1.4 SERIAL COMMUNICATION CONFIGURATION

To use the serial, three parameters must be configured:

bAud: Communication speed. All equipment has the same speed.

Addr: Communication address of the digital panel meter. Each equipment must have a unique address.

PrtY: Parity.

12.1.5 CONNECTIONS

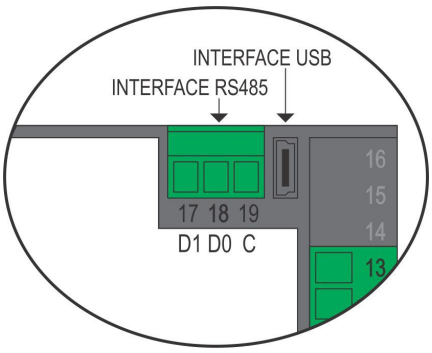


Figure 8 Serial communication

12.2 REGISTER'S TABLE

Equivalent to Holding Registers (reference 4X).

The registers are the internal parameters of the digital panel meter. Up to address 12, the registers are mostly read-only. Each parameter in the table is a 16-bit word with a 2's complement sign.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0000	PV	Reading: Process variable. Writing: Not allowed. When reading temperature, the value will always be multiplied by 10, regardless of the **dPPo** value.
0001	Minimum PV	Reading: Minimum PV value. Writing: Not allowed.
0002	Maximum PV	Reading: Maximum PV value. Writing: Not allowed.
0003		Reserved.
0004	Screen Value	Reading: Value on the current screen. Writing: Value on the current screen. Maximum range: -2000 to 30000. The range depends on the screen shown.
0005	Screen Number	Reading: Current screen number. Writing: Not allowed. Range: 0000 h to 060 Ch. Formation of the screen number: XXYYh, where: XX → Number of the screen cycle. YY → Number of the screen.
0006	Status Word 1	Reading: Status bits of the digital panel meter. Writing: Not allowed. Read value: Check STATUS WORDS section.
0007	Software Version	Reading: Software version of the equipment. Writing: Not allowed. Values read: If the device version is V1.00, for example, 100 will be read.
0008	ID	Reading: Equipment identification number: 69 (45 h). Writing: Not allowed.
0009	Status Word 2	Reading: Status bits of the digital panel meter. Writing: Not allowed. Read value: Check STATUS WORDS section.
0010	Status Word 3	Reading: Status bits of the digital panel meter. Writing: Not allowed. Read value: Check STATUS WORDS section.
0011	Key	Allows you to perform a keyboard simulation: 1 → Press the **P** key (Goes to the next parameter). 2 → Press the **F1** key. 4 → Press the **F2** key. 8 → Press the **<** key. 9 → Press the **P** key (Goes to the next Cycle).
0012	Serial Number H	Displays the first 4 digits of the serial number. Range: 0 to 9999. Read-only.
0013	Serial Number L	Displays the last 4 digits of the serial number. Range: 0 to 9999. Read-only.
0014~0016		Reserved.
0017	**ALrF**	Allows you to set a reference value for the differential alarm. Maximum range: From **SPLL** to the value set in **SPHL** or the interval of the sensor.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0018	SPA1	Allows you to set the alarm Setpoint.
0019	SPA2	
0020	SPA3	
0021	SPA4	
0022	FuA1	Allows you to set the alarm function: 0 → oFF. 1 → Lo. 2 → hi. 3 → diF. 4 → diFL. 5 → diFh. 6 → iErr.
0023	FuA2	
0024	FuA3	
0025	FuA4	
0026	HyA1	Allows you to set the alarm hysteresis.
0027	HyA2	
0028	HyA3	
0029	HyA4	
0030~0037		Reserved.
0038	bLA1	Allows you to set the alarm block: 0 → No. 1 → Yes.
0039	bLA2	
0040	bLA3	
0041	bLA4	
0042	SP1E	Allows you to enable the Alarm 1 Setpoint screen in the main cycle: 0 → Disable. 1 → Enable.
0043	SP2E	Allows you to enable the Alarm 2 Setpoint screen in the main cycle: 0 → Disable. 1 → Enable.
0044	FLSh	Allows you to signal the occurrence of alarm conditions by flashing the PV indication on the display screen: 0 → Disable. 1 → Enable.
0045~0049		Reserved.
0050	tYPE	Allows you to set the type of PV input sensor. Range: 0 to 22.
0051	unit	Allows you to set the temperature unit: 0 → °C. 1 → °F.
0052	dPPo	Allows you to set the position of the PV decimal point: 0 → X.XXX. 1 → XX.XX. 2 → XXX.X. 3 → XXXX.
0053	FLtr	Reading/Writing: Filter intensity on PV reading. Range: 0~20.
0054	FrE9	Reading/Writing: Mains frequency. Range: 0 → 60 Hz. 1 → 50Hz.
0055		Reserved.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0056	oFFS	Allows you to set the PV Offset value. Range: From SPLL to SPHL.
0057	inLL	Allows you to set the lower limit of the display range for inputs of the linear analog signal type.
0058	inHL	Allows you to set the upper limit of the display range for inputs of the linear analog signal type.
0059-0066		Reserved.
0067	Addr	Allows you to set the slave's address. Range: 1 to 247.
0068	bAud	Allows you to set the communication Baud Rate: 0 → 1200. 1 → 2400. 2 → 4800. 3 → 9600. 4 → 19200. 5 → 32400. 6 → 57600. 7 → 115200.
0069	PrtY	Allows you to set the parity of the serial channel: 0 → No parity. 1 → Even. 2 → Odd.
0070~0079		Reserved.
0080	Start of PV calibration	Allows you to set the calibration operator to enter the value of the beginning of the range, currently applied to the PV input.
0081	End of PV calibration	Allows you to set the calibration operator to enter the value of the end of the range, currently applied to the PV input.
0082	rStr	Allows you to restore the factory calibration: 0 → Does not restore calibration. 1 → Restores the calibration.
0083		Reserved.
0084	Prot	Allows you to set the level of password protection to be used. Range: 1 to 3.

Table 7 Register's table

12.3 STATUS WORDS

REGISTER	VALUE FORMATION
Status Word 1	bit 0 → Alarm 1 (0 → Inactive / 1 → Active). Bit 1 → Alarm 2 (0 → Inactive / 1 → Active). Bit 2~7 → Reserved. Bit 8 → Value for hardware detection. Bit 9 → Value for hardware detection. Bit 10~15 → Reserved.
Status Word 2	bit 0~4 → Reserved. Bit 5 → Initial block of Alarm 1 (0 → No / 1 → Yes). Bit 6 → Initial block of Alarm 2 (0 → No / 1 → Yes). Bit 7~8 → Reserved. Bit 9 → Unit (0 → °C / 1 → °F). bit 10~15 → Reserved.
Status Word 3	bit 0 → PV conversion very low (0 → No / 1 → Yes). Bit 1 → Negative conversion after calibration (0 → No / 1 → Yes). Bit 2 → PV conversion very high (0 → No / 1 → Yes). Bit 3 → Linearization limit exceeded (0 → No / 1 → Yes). **Bit 4 → Pt100 cable resistance too high (0 → No / 1 → Yes).** Bit 5 → Auto Zero conversion out of range (0 → No / 1 → Yes). Bit 6 → Cold Junction conversion out of range (0 → No / 1 → Yes). Bit 7~15 → Reserved.

Table 8 Reading values for Status Words

Writing to the digital output bits is only possible when the outputs are set to "Off" in the I/O configuration on the equipment.

COIL STATUS	OUTPUT DESCRIPTION
0	Output 1 status (ALM1)
1	Output 2 status (ALM1)

Table 9 Output description

12.4 EXCEPTION RESPONSES — ERROR CONDITIONS

When receiving a command, the device performs a CRC check on the received data block. Reception errors are detected by the CRC, causing the equipment to discard the packet and send no reply to the master. If the command is received without errors, the requested commands and registers will be executed. If invalid, an exception response with the corresponding error code will be sent. In exception responses, the field corresponding to the Modbus command in the reply will be added to 80 H.

If a write command sends an out-of-range value for a parameter, the digital panel meter will set the value to the limits of the parameter range and respond with a value that reflects those same limits (maximum or minimum value allowed for the parameter).

The equipment ignores read commands in Broadcast. Thus, there will be no response. You can only write in Broadcast mode.

ERROR CODE	ERROR DESCRIPTION
01	Invalid or non-existent command.
02	Invalid or out-of-range register number.
03	Invalid or out-of-range register quantity.

Table 10 Error codes in exception response

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