N2000 CONTROLLER

USER GUIDE V3.0x N

Medimos, Controlamos, Registramos

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.	**ATTENTION** Electrostatic-sensitive device. Make sure you take the necessary precautions before handling it.

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 protection may not be effective.

2. PRESENTATION

N2000 is a controller with universal features. In a single model, it accepts most sensors and signals used in industry and provides the main types of output to act on several processes.

There are 2 ways to configure it:

1. Directly on the controller or
2. Using the **QuickTune** software, which must be installed on the computer to be used. 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.

Its main features are:

- Universal multi-sensor input with no hardware changes.
- Relay, 4-20 mA and pulse control outputs (all available).
- Auto-tuning of PID parameters.
- Automatic / Manual function.
- 4 alarm outputs with minimum, maximum, differential (deviation), open sensor, and event functions (basic version).
- Timer for 4 alarms.
- PV or SP retransmission in 0-20 mA or 4-20 mA.
- Input for remote Setpoint.
- Digital input with 5 functions.
- Programmable Soft Start.
- Ramps and soaks with 7 concatenable 7-segment programs.
- RS485 serial communication, Modbus RTU protocol.
- Password to protect the keyboard.
- Dual-voltage power supply.

3. OPERATION

The front panel can be seen in the figure below:

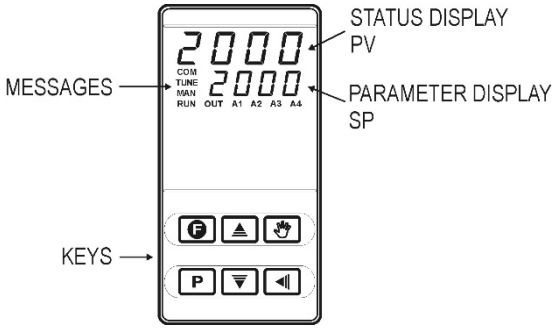


Figure 1

PV / Programming Display: Displays the current PV value (Process Variable). When in operation or in programming mode, it displays the mnemonic of the parameter being presented.

SP / Parameters Display: Displays the value of SP (Setpoint) and other programmable parameters of the controller.

COM flag: Blinks whenever the controller changes data with the exterior.

TUNE flag: Turns on when the controller is running the auto-tune operation.

MAN flag: Indicates that the controller is in manual control mode.

RUN flag: Indicates that the controller is active, and the control output and alarms are enabled.

OUT flag: For Relay or Pulse control outputs, the **OUT** flag represents the immediate status of this output. When the control output is set to analog (0-20 mA or 4-20 mA), this flag remains constantly on.

A1, A2, A3, and A4 flags: Indicate the occurrence of an alarm condition.

P **PROG key:** Key used to display the successive programmable parameters of the controller.

◄ **Back key:** Key used to go back to the parameter previously displayed.

▲ **Increment key and** ▼ **Decrement key:** Keys used to change parameter values.

Auto / Man key: Special function key that switches the control mode between Automatic and Manual.

F **Special Function Key:** Key used to perform the **run**, **rSP**, **HPrG**, and **Pr 1** functions.

When the controller is turned on, the display will show the version of the internal software during the first 3 seconds. It then starts operating, showing the process variable (PV) on the upper display and the control Setpoint value on the lower display. The outputs are enabled at this point.

To operate properly, the controller needs a minimum initial configuration:

- Input type (Thermocouples, Pt100, 4-20 mA, etc.)
- Control Setpoint (SP) value
- Control output type (Relay, 0-20 mA, 4-20 mA, pulse)
- PID parameters (or hysteresis if using ON / OFF control)

The configuration parameters are grouped into cycles. Each message displayed is a parameter to be set. The 7 parameter cycles are:

CYCLE	ACCESS
1 – Operation	Free access
2 – Tuning	Restricted access
3 – Programs	
4 – Alarms	
5 – Input configuration	
6 – I/O	
7 – Calibration	

Table 1

The Operation Cycle (1st cycle) is freely accessible. To access other cycles, you must use a combination of keys:

◄ and P keys pressed simultaneously

Once you are in the desired cycle, you can scroll through all the parameters of that cycle by pressing the P key (or press the ◄ key to go back in the cycle). To return to the Operation Cycle, press P several times, until all parameters of the current cycle have been scrolled through.

The values of all parameters are saved in protected memory. The changed values are saved when moving on to the next parameter. SP value is also saved when changing parameters or every 25 seconds.

4. CONFIGURATION / FEATURES

4.1 INPUT SELECTION

The type of input to be used must be programmed in the **tYPE** parameter:

TYPE	CODE	FEATURE / 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)
0-50 mV	L.050	Analog linear signal. Adjustable range: -1999 to 9999.
4-20 mA	L.420	
0-5 Vdc	L05	
0-10 Vdc	L0.10	
4-20 mA	SQrt	With extraction of the square root. Adjustable range: -1999 to 9999.
4-20 mA NO LINEAR	Ln J	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 2

Notes: All input types are factory calibrated.

4.2 OUTPUT, ALARMS AND DIGITAL INPUTS SELECTION

The controller has input and output channels that can perform multiple functions: control output, digital input, digital output, alarm output, PV relay and SP. These channels are identified as **I/O1**, **I/O2**, **I/O3**, **I/O4**, **I/O5**, and **I/O6**.

The basic (standard) controller has the following features:

- I/O1 and I/O2 – SPDT relay output
- I/O3 and I/O4 – SPST-NO relay output
- I/O5 – Current output (0-20 mA or 4-20 mA), digital output, digital input
- I/O6 – Digital input and digital output

Note: When you select to run a function via Digital Input, the controller no longer responds to the command for the equivalent function from the keyboard.

The function assigned to each I/O channel is defined according to the options shown in the table below:

I/O FUNCTION	I/O TYPE	CODE
No function	-	oFF
Alarm 1 output	Output	A1
Alarm 2 output	Output	A2
Alarm 3 output	Output	A3
Alarm 4 output	Output	A4
LBD (Loop Break Detection) function output	Output	Lbd
Control output (Relay or Digital Pulse)	Output	ctrL
Switches to Auto/Man mode	Digital input	iAn
Switches to Run/Stop mode	Digital input	run
Selects Remote SP	Digital input	rSP
Freezes program	Digital input	HPrG
Selects program 1	Digital input	Pr 1
0 to 20 mA Analog Control Output	Analog output	C.020
4 to 20 mA Analog Control Output	Analog output	C.420
0-20 mA PV retransmission	Analog output	P.020
4-20 mA PV retransmission	Analog output	P.420
0-20 mA SP retransmission	Analog output	S.020
4-20 mA SP retransmission	Analog output	S.420

Table 3

4.3 I/O FUNCTIONS

- **oFF** – No function

The I/O channel programmed with **oFF** code will not be used by the controller.

Note: Although it has no function, this channel can be activated by commands via serial communication (Modbus Command 5).

- **A1**, **A2**, **A3**, **A4** – Alarm outputs

Available for all I/O channels.

Defines the programmed I/O channel to act as one of the 4 alarm outputs.

- **Lbd** – LBD Function (Loop Break Detector)

Available for all I/O channels.

Defines the I/O channel as the output of the LBD function.

- **CtrL** – PWM control output

Available for all I/O channels.

Defines the I/O channel to be used as the main control output, either relay or digital pulse (for solid-state relays). Pulse output is available on I/O5 and I/O6.

- **iAn** – Digital Input with **Auto/Manual** function

Available for I/O5, I/O6, and F key.

Defines the channel as Digital Input (DI) with the function of switching the control mode between **Automatic** and **Manual**.

Closed Contact: Manual control / **no**.

Open Contact: Automatic control / **YES**.

- **run** – Digital input with **run** function

Available for I/O5, I/O6, and F key.

Defines the channel as a Digital Input (DI) with the function of enabling or disabling the control and alarm outputs (**run** = **YES** / **no**).

Contact Closed: Outputs enabled / **YES**.

Open Contact: Outputs off / **no**.

- **rSP** – Digital input with **Remote SP** function

Available for I/O5, I/O6, and F key.

Defines the channel as Digital Input (DI) with the remote SP function.

Closed Contact: Uses the remote SP.

Open Contact: Uses the main SP.

- **HPrG** – Digital input with **Hold Program** function

Available for I/O5, I/O6, and F key.

Defines the channel as a Digital Input (DI) with the function of commanding the execution of the **program in progress**.

Closed: Enables program execution.

Open: Stops the program.

Note: When the program is interrupted, its execution is suspended at the point it is at (the control remains active). The program resumes normal operation when the signal applied to the digital input allows it (contact closed).

- **Pr 1** – Digital input with **Run program 1** function

Available for I/O5 and I/O6 (when available).

Defines the channel as Digital Input (DI) with the function of triggering the immediate running of **program 1**.

This function is useful when you need to switch between the main Setpoint and a second Setpoint defined by **program 1**.

Closed: Selects program 1.

Open: Selects the main Setpoint.

- **C.020** / **C.420** – Analog control output

Only available for I/O5.

Program the analog output to operate as a 0-20 mA or 4-20 mA control output.

- **P.020** / **P.420** – Current PV relay output

Only available for I/O5.

Program the analog output to retransmit PV or SP at 0-20 mA or 4-20 mA.

- **S.020** / **S.420** – SP retransmission output at 0-20 mA

Only available for I/O5.

Defines the channel to act as a retransmission output for SP values.

4.4 ALARM CONFIGURATION

The controller has 4 independent alarms. These alarms can be programmed to operate with 9 functions, shown in the table below.

- **oFF** – Alarm off.
- **lErr** – Sensor Break Alarm.

The open sensor alarm triggers whenever the input sensor is poorly connected or broken.

- **rS** – Program event alarm

It allows you to set the alarm to go off when a specific segment of the running ramps and soaks program is reached. See RAMPS AND SOAKS PROGRAM chapter.

- **Lo** – Absolute minimum value alarm.

It is triggered when the measured PV value is **below** the value defined by the alarm Setpoint.

- **HI** – Absolute maximum value alarm.

It is triggered when the measured PV value is **above** the value defined by the alarm Setpoint.

- **dIF** – Differential value alarm.

In this function, the **SPA1**, **SPA2**, **SPA3** and **SPA4** parameters represent the deviation of the PV from the main SP.

Using Alarm 1 as an example: For positive **SPA1** values, the Differential alarm goes off when the PV value is **outside** the range defined by:

(SP – SPA1) to (SP + SPA1)

For a negative value in SPA1, the Differential alarm goes off when the PV value is **within** the range defined above.

- **dIFL** – Differential minimum value alarm.

It is triggered when the measured PV value is **below** the point defined by:

(SP – SPA1)

Using Alarm 1 as an example.

- **dIFH** – Differential maximum value alarm.

It is triggered when the measured PV value is **above** the point defined by:

(SP + SPA1)

Using Alarm 1 as an example.

The table below shows the different possible alarm functions:

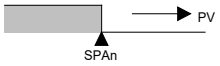
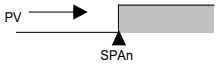
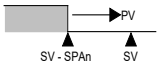
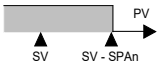
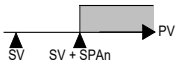
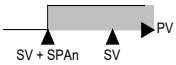
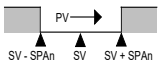
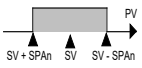
TYPE	SCREEN	PERFORMANCE	
Off	oFF	The output is not used as an alarm.	
Open sensor (Input Error)	IErr	It is triggered when the input signal has connection problems.	
Event (Ramp and Soak)	rS	It is triggered in a specific program segment.	
Minimum value (Low)	Lo		
Maximum value (High)	HI		
Differential Minimum (Differential Low)	d IFL		
		positive SPAn	negative SPAn
Differential Maximum (Differential High)	d IFH		
		positive SPAn	negative SPAn
Differential	d IF		
		positive SPAn	negative SPAn

Table 4

Where SPAn refers to Alarm Setpoints SPA1, SPA2, SPA3, and SPA4.

4.5 ALARM TIMERS

There are 4 alarm activation modes:

- Activation for an indefinite period (normal)
- Timed activation
- Delayed activation
- Intermittent activation

The figures in the table below show the behavior of the alarm outputs with the activation variations defined by the time intervals **t1** and **t2** available in the parameters A1t1, A2t1, A3t1, A4t1, A1t2, A2t2, A3t2, A4t2:

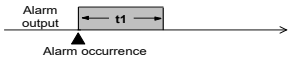
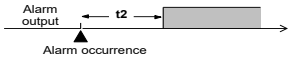
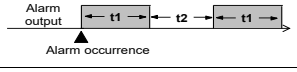
OPERATION	T 1	T 2	PERFORMANCE
Normal operation	0	0	
Timed activation	1 to 6500 s	0	
Delayed activation	0	1 to 6500 s	
Intermittent actuation	1 to 6500 s	1 to 6500 s	

Table 5

The flags linked to the alarms light up whenever an alarm condition occurs, regardless of the status of the alarm outputs.

4.6 ALARM INITIAL BLOCK

The **Initial Block** function inhibits the alarm from being activated if there is an alarm condition in the process when the controller 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 Open Sensor function.

4.7 EXTRACTION OF THE SQUARE ROOT

Feature available by selecting the Sqrt option in the input type. In this case, the controller displays the value corresponding to the square root of the current signal applied to the input terminals.

4.8 PV AND SP ANALOG RETRANSMISSION

The controller has 1 analog output (I/O5) that can relay 0-20 mA or 4-20 mA proportional to the PV or SP values set. Analog retransmission is scalable. It has minimum and maximum limits, which define the retransmission range, configured in the **SPLL** and **SPHL** parameters.

To obtain voltage retransmission, you must install a shunt resistor (550 Ω max.) on the analog output terminals. The value of this resistor depends on the desired voltage range.

4.9 SOFT START

Feature that prevents abrupt variations in the power delivered to the load by the controller's control output.

A time interval (in seconds) defines the maximum rate of increase of the power delivered to the load, where 100 % of the power will only be reached at the end of this interval.

The amount of power delivered to the load is still determined by the controller. The **Soft Start** function simply limits the speed at which this power value rises over the time interval set by the user.

The **Soft Start** function is normally used in processes that require a slow start, where the instantaneous application of 100 % of the available power to the load could damage parts of the process.

Notes:

1. Function only available for PID control mode.

2. When you set the time interval to 0, the function will be disabled.

4.10 REMOTE SETPOINT

It is possible to set the SP value via a remotely generated 4-20 mA current signal. This feature can be enabled in 2 ways:

1. Through I/O5 or I/O6 channels, using them as a digital input and configuring them with the **rSP** function (Remote SP Select) or

2. When configuring the **Er SP**.

The signals accepted are 0-20 mA, 4-20 mA, 0-5 V and 0-10 V.

For the 0-20 and 4-20 mA signals, you should mount a **100 Ω** shunt resistor externally, next to the terminals of the controller.

Note: When Remote Setpoint is enabled, the ramps and soaks program is not started.

4.11 LBD FUNCTION – LOOP BREAK DETECTION

The **Lbdt** parameter allows you to set a maximum time interval (in minutes) for the PV to react to the command from the control output. If the PV does not react minimally and adequately over this interval, the controller will signal the occurrence of an LBD event, which indicates problems in the control loop.

The LBD event can also be directed at one of the controller's I/O channels. To do this, simply configure the desired I/O channel with the **Ldb** function, which triggers the corresponding output when this event occurs.

When set to 0, the function will be disabled.

This function allows you to detect problems in the installation, such as a defective actuator, failure in the power supply to the load, etc.

4.12 KEY FUNCTIONS

The F key (special function key) can perform the **run**, **rSP**, **HPrG**, **Pr 1** functions. The function of the key is defined in the **F Key Function** (**FFun**) parameter.

4.13 KEY

The key allows you to execute the **MAn** function, switching the control mode between manual and automatic. To use it, you must first enable it in the **AuEn** parameter.

The **MAN** indicator lights up when the control switches to Manual mode.

4.14 24 VDC AUXILIARY SUPPLY

The controller provides a 24 Vdc voltage source to excite field transmitters. The current capacity of this source is 25 mA.

Available on terminals 17 and 18.

4.15 USB INTERFACE

The USB interface is used to CONFIGURE, MONITOR, or UPDATE THE FIRMWARE of the controller. 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 controller'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 software, the USB drivers needed to operate communication will also be installed.
2. Connect the USB cable between the device and the computer. The controller 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 device recognition.

The USB interface IS NOT ISOLATED from the signal input (PV) and the digital inputs and outputs of the controller. 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.

5. 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 controller 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.

The internal circuitry of the controller can be removed without undoing the connections on the rear panel. The layout of the signals on the rear panel of the controller is shown in the figure below:

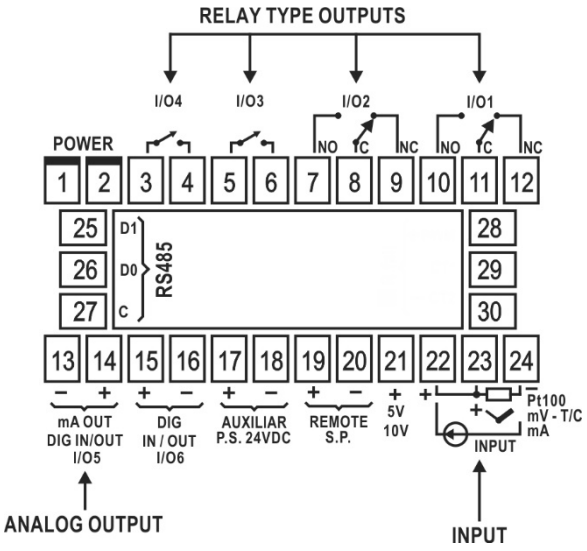
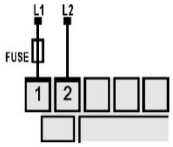


Figure 2

5.1 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.
- In control applications, it is essential to consider what can happen when any part of the system fails. The internal alarm relay does not guarantee full protection.
- It is recommended to use RC FILTERS (noise suppressors) in contactor coils, solenoids, etc.

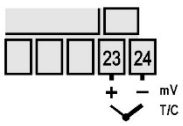
5.2 POWER SUPPLY CONNECTIONS

Check the required supply voltage	 **Figure 3**

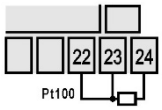
5.3 INPUT CONNECTIONS

It is important that these connections are made properly, with the sensor or signal wires securely attached to the terminals on the rear panel.

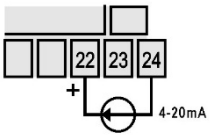
THERMOCOUPLE (T/C) AND 50 mV

	 **Figure 4**	The opposite figure shows how to make the connections. If it is necessary to extend the length of the thermocouple, use appropriate compensating cables.

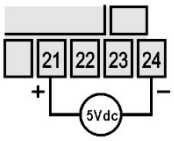
RTD (Pt100)

	 **Figure 5**	It uses a 3-wire circuit. The wires must have the same resistance value to avoid measurement errors due to the length of the cable (use conductors of the same gauge and length). If the sensor has 4 wires, leave one disconnected next to the controller. For a 2-wire Pt100, make a short circuit between terminals 22 and 23.

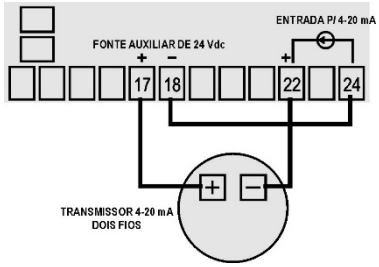
4-20 mA

	 **Figure 6**	Connections for 4-20 mA current signals should be made as shown in the figure opposite.

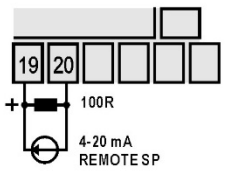
0-5 Vdc

	 **Figure 7**	Connections for 0-5 mA voltage signals should be made as shown in the figure opposite.

4-20 mA 2-WIRED WITH AUXILIARY VOLTAGE SOURCE

	 **Figure 8**	The connections must be made according to the figure opposite.

REMOTE SETPOINT

	 **Figure 9**	Feature available on terminals 19 and 20. It must be enabled via the I/O5 or I/O6 channels (when they are used as a digital input and configured with the **rSP** function). The input impedance of this resource is 100 R (Zin = 100 R).

5.4 I/O5 CONNECTION AS DIGITAL OUTPUT

When channel I/O5 has been programmed as a digital output, its load capacity limit must be respected, in accordance with the specification.

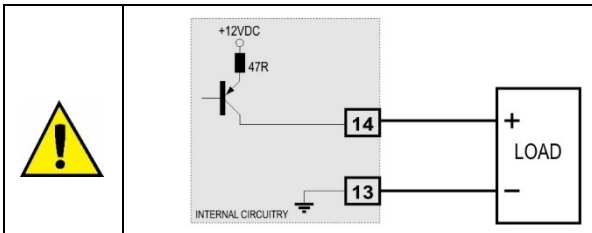


Figure 10

5.5 DIGITAL INPUTS

To activate I/O5 and I/O6 as a digital input, connect a switch or equivalent (dry contact) to their terminals.

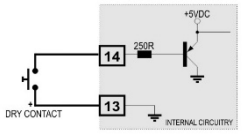


Figure 11

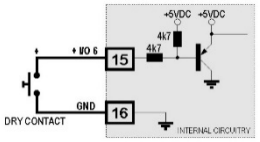


Figure 12

6. CONFIGURATION PROTECTION

The controller 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 cycles, as shown in the table below:

PROTECTION LEVELS	PROTECTED CYCLES
1	Only Calibration Cycle is protected.
2	I/O and Calibration cycles.
3	Scale, I/O, and Calibration cycles.
4	Alarm, Scale, I/O, and Calibration cycles.
5	Programs, Alarm, Scale, I/O, and Calibration cycles.
6	Tuning, Programs, Alarm, Scale, I/O, and Calibration cycles.
7	Operation (except SP), Tuning, Programs, Alarm, Scale, I/O, and Calibration cycles.
8	Operation (including SP), Tuning, Programs, Alarm, Scale, I/O, and Calibration.

Table 6

6.1 PASSWORD

When accessed, the protected cycles ask for 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.

In the **Password Change** parameter (**PASC**), present in the Calibration cycle, you can change the access password.

The equipment leaves the factory with the password **1111**.

6.2 PASSWORD PROTECTION

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

6.3 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**), defining a new password for the controller.

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

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

Note: It is recommended to disable or suspend control (**run** = **no**) whenever you need to change the configuration.

7. PARAMETER DESCRIPTIONS

7.1 OPERATION CYCLE

PV Indication (Red display) SV Indication (Green display)	**PV / SP Indication Screen.** The upper display shows the current PV value. The lower display shows the value of the control SP adopted.
Auto *Control*	Allows you to set the control mode: **YES** Automatic control mode. **no** Manual control mode.
PV Indication (Red display) MV Indication (Green display)	**PV / MV screen.** The upper display shows the current PV value. The lower display shows the percentage value applied to the control output (MV). In automatic control mode, the MV value can only be displayed. In manual control mode, the MV value can be changed. To differ from the PV / SP display screen, the MV value flashes constantly.
Pr n *Program number*	Allows you to select the program of ramps and soaks to run: **0** It does not run any programs. **1** to **7** Number of the program to run.
P.SEG	Informative screen. Displays the current segment number of the running program.
t.SEG	Informative screen. Displays the time remaining until the end of the current segment.
run	Allows you to enable control outputs and alarms: **YES** This means that control and alarms are enabled. **no** This means that control and alarms are disabled.

7.2 TUNING CYCLE

Atun *Auto-tune*	Allows you to enable the automatic tuning of PID parameters: **YES** Performs automatic tuning. **no** Does not perform automatic tuning.
Pb *Proportional Band*	Proportional Band. Allows you to set the value of the **P** term of the PID control mode. When set to 0, this defines the ON / OFF control mode.
Ir *Integral Rate*	Integral Rate. Allows you to set the value of the **I** term of the PID control mode. Displayed only if proportional band ≠ 0.
dt *Derivative Time*	Derivative Time. Allows you to set the value of the **D** term of the PID control mode. Displayed only if proportional band ≠ 0.
Ct *Cycle Time*	Allows you to set the PWM Cycle time. Displayed only if proportional band ≠ 0.
HYSt *Hysteresis*	Control hysteresis. Allows you to set the hysteresis value for the ON / OFF control mode. Displayed only if proportional band = 0.
Act *Action*	Allows you to define the control logic: **rE** Control with Reverse Action (**heating**). **d Ir** Control with Direct Action (**refrigeration**).
b IAS	Bias function. Allows you to change the percentage value of the control output (MV) by adding a value between -100 % and 100 %. When set to 0, the function will be disabled.
ouLL *Output Low Limit*	Lower limit for the control output. Allows you to set the minimum percentage value to be adopted by the control output when the controller is in automatic and PID mode. Typically set to **0.0 %**.
ouHL *Output High Limit*	Lower limit for the control output. Allows you to set the maximum percentage value to be adopted by the control output when the controller is in automatic and PID mode. Typically set to **100.0 %**.
Lbdt *Loop Break Detection Time*	Allows you to set the time interval of the LBD function. In minutes.
SFSt *Soft Start*	Soft Start function. Allows you to set the time interval (in seconds) during which the controller will limit the rise speed of the control output (MV). When set to 0, the function will be disabled.

SPA1 SPA2 SPA3 SPA4 *Alarm* Setpoint	Alarm Setpoint. Allows you to set the trigger point for alarms programmed with **Lo** or **HI** functions. For alarms programmed with **Differential** functions, these parameters define deviations between PV and SP. These parameters are not used for the other alarm functions.

7.3 PROGRAM CYCLE

t.bAS *Program time base*	Allows you to define the time base to be adopted by programs being edited and those already created: **SEC** Time base in seconds. **Min** Time base in minutes.
Pr n *Program number*	Program being edited. Allows you to select the ramps and soaks program to be defined in the following screens of this cycle. There are 7 programs.
PtoL *Program Tolerance*	Allows you to define the maximum deviation that will be allowed between the PV and SP values. If exceeded, the program will be suspended (stop counting time) until the deviation is within the permitted deviation range. When set to 0, the function will be disabled.
PSP0 PSP7 *Program* SP	Program SPs. 0 to 7. Allows you to define the set of SP values that determine the profile of the ramps and soaks program.
Pt1 Pt7 *Program Time*	Time of the program segments. 1 to 7. Allows you to set the duration (in seconds or minutes) of each of the 7 segments of the program being edited.
PE1 PE7 *Program event*	Event alarm. 1 to 7. Allows you to define which alarms should be triggered while a certain program segment is running. The alarms adopted must be configured with the **rS** Event Alarm function.
LP *Link Program*	Program link. When a program has finished running, it is possible to immediately run any other program. **0** Do not link it to any other program. **1 to 7** Number of the program to be connected.

7.4 ALARM CYCLE

FuA1 FuA2 FuA3 FuA4 *Function Alarm*	Allows you to set the alarm functions: **oFF**, **tErr**, **rS**, **Lo**, **HI**, **d IFL**, **d IFH**, **d IF**. See ALARM CONFIGURATION section.
bLA1 bLA2 bLA3 bLA4 *Blocking Alarm*	Initial blocking of alarms. Allows you to define the initial block function for alarms 1 to 4: **YES** Enables the initial block. **no** Disables the initial block.
HyA1 HyA2 HyA3 HyA4 *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. A hysteresis value must be set for each alarm.
A1t1 A2t1 A3t1 A4t1 *Alarm Time* **t1**	Allows you to set the time interval **t1** for the timing of alarm triggers. In seconds. When set to 0, the function will be disabled.
A1t2 A2t2 A3t2 A4t2 *Alarm Time* **t2**	Allows you to set the time interval **t2** for the timing of alarm triggers. In seconds. When set to 0, the function will be disabled.
FLSH *Flash*	The display flashes when the device is in alarm. Allows you to signal the occurrence of alarm conditions by flashing the PV indication on the display screen. You must select the alarm numbers that will have this feature.

7.5 INPUT CONFIGURATION CYCLE

tYPE *Type*	Input type. Allows you to select the input type to be used by the controller. See INPUT SELECTION section. **The first parameter to be configured.**
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*	Decimal point position. Allows you to define the position of the decimal point in the display. 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: Celsius or Fahrenheit. Parameter displayed only when using a temperature sensor.
OFFS *Offset*	Allows you to correct the indicated PV value.
SPLL Setpoint *Low Limit*	Allows you to define the lower limit to adjust SP. For linear **analog signal inputs** (0-20 mA, 4-20 mA, 0-50 mV and 0-5 V), it sets the minimum value of the PV indication range. It also limits the SP setting. It also defines the lower limit of the PV and SP retransmission range.
SPHL Setpoint *High Limit*	Allows you to define the upper limit to adjust SP. For linear **analog signal inputs** (0-20 mA, 4-20 mA, 0-50 mV and 0-5 V), it sets the maximum value of the PV indication range. It also limits the SP setting. It also defines the upper limit of the PV and SP retransmission range.
E.rSP *Enable Remote SP*	Allows you to enable remote SP: **YES** Enables the function. **no** Does not enable the function. This parameter will not be displayed when the remote SP selection is set by the Digital Inputs.
rSP *Remote SP*	Allows you to define the type of signal for remote SP: **0-20** 0-20 mA current **4-20** 4-20 mA current **0-5** 0-5 V voltage **0- 10** 0-10 V voltage This parameter will be displayed if the remote SP function is enabled.
rSLL *Remote SP Low Limit*	Allows you to set the value scale of the remote SP. Determine the minimum value of this scale. This parameter will be displayed if the remote SP function is enabled.
rSHL *Remote SP High Limit*	Allows you to set the value scale of the remote SP. Determine the maximum value of this scale. This parameter will be displayed if the remote SP function is enabled.
IEou	Allows you to set the percentage value to be applied to the MV when using the **Safe Output** function. If set to 0, the function will be disabled, and the outputs will switch off when a sensor failure occurs.
bAud *Baud Rate*	Allows you to set the communication Baud Rate. Available in the following baud rates (in kbps): 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, and 115.2.
PrtY *Parity*	Allows you to define the parity of serial communication: **nonE** No parity. **EVEn** Even parity. **Odd** Odd parity.
Addr *Address*	Allows you to define the communication address. Number between 1 and 247 that identifies the controller on the serial communication network.

7.6 I/OS CYCLE (INPUTS AND OUTPUTS)

io 1	Allows you to set the function of the I/O1 channel.
io 2	Allows you to set the function of the I/O2 channel.
io 3	Allows you to set the function of the I/O3 channel.
io 4	Allows you to set the function of the I/O4 channel.
io 5	Allows you to set the function of the I/O5 channel.
io 6	Allows you to set the function of the I/O6 channel.
F.Fnc	Allows you to define a function for the F key: oFF Key not used. run Enables control (run parameter). rSP Selects Remote SP. HPrG Freezes program. Pr 1 Selects program 1.
AuEn	Allows you to enable the key. Thus, you can quickly switch between automatic and manual control modes. YES Enables the use of the key. no Does not enable the use of the key.

7.7 CALIBRATION CYCLE

All input and output types are calibrated at the factory. Recalibration is not recommended. When recalibration is necessary, it must be performed by a specialized professional.

If you access it by accident, do not press and keys or go through all the screens until you return to the Operation Cycle.

PASS *Password*	Password entry. This parameter is displayed before the protected cycles. See CONFIGURATION PROTECTION chapter.
CAL Ib *Calibration*	Allows you to calibrate the controller: YES Calibrate the controller. no The controller is not calibrated.
InLC *Input Low Calibration*	Declaration of the calibration signal indicating the start of the range applied to the analog input. See INPUT CALIBRATION section.
InHC *Input High Calibration*	Declaration of the calibration signal indicating the end of the range applied to the analog input. See INPUT CALIBRATION section.
rSLC *Remote SP Low Calibration*	Declaration of the calibration signal indicating the start of the range applied to the remote SP input. See INPUT CALIBRATION section.
rSHC *Remote SP High Calibration*	Declaration of the calibration signal indicating the end of the range applied to the remote SP input. See INPUT CALIBRATION section.
ouLC *Output Low Calibration*	Declaration of the value present on the analog output. See ANALOG OUTPUT CALIBRATION section.
ouHC *Output High Calibration*	Declaration of the value present on the analog output. See ANALOG OUTPUT CALIBRATION section.
rStr *Restore*	Allows you to restore the factory calibrations of the analog input and output and remote SP, disregarding any changes made by the user: YES Restores the factory settings. no Maintains the current calibration.
CJ *Cold Junction*	Allows you to set the Cold Junction temperature of the controller.
PASC *Password*	Allows you to set a new password, always different from 0.
Prot *Protection*	Allows you to establish the level of protection. See CONFIGURATION PROTECTION chapter.

7.8 COMPLETE TABLE OF CYCLES

The table below shows the sequence of levels and parameters shown on the controller's display. Some parameters must be set for each available alarm.

OPERATION CYCLE	TUNING CYCLE	PROGRAM CYCLE	ALARM CYCLE	SCALE CYCLE	I/OS CYCLE	CALIBRATION CYCLE
PV / SP	AtUn	tbAS	FuA1 – FuA4	tYPE	Io1	PASS
Auto	Pb	Pr n	bLA1 – bLA4	FLtr	Io2	InLC
PV / MV	Ir	PtoL	HYA1 – HYA4	dPPo	Io3	InHC
Pr n	dt	PSP0 – PSP7	A1t1	un It	Io4	rSLC
P.SEG	Ct	Pt1 – Pt7	A1t2	oFFS	Io5	rSHC
t.SEG	HYSt	PE1 – PE7	A2t1	SPLL	Io6	ouLC
run	ACt	LP	A2t2	SPHL	F.Fnc	ouHC
	b1AS		FLSH	Er SP	AuEn	rStr
	ouLL			rSP		CJ
	ouHL			rSLL		PASC
	Lbdt			rSHL		Prot
	SFSt			IE.ou		
	SPA1 – SPA4			bAud		
				PrtY		
				Addr		

Table 7

8. RAMPS AND SOAKS PROGRAM

It allows you to create a behavioral profile for the process. Each program is formed by a set of up to **7 segments**, called a RAMPS AND SOAKS PROGRAM, which is defined by SP values and time intervals.

Once you have defined the program and run it, the controller will generate the SP according to the program.

When the program has finished running, the controller will turn off the control output (**run** = **no**).

You can create up to **7 different ramps and soaks programs**. The figure below shows a program model:

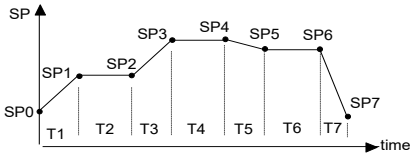


Figure 13

To run a program with fewer segments, simply program 0 for the time values of the segments following the last segment to be run.

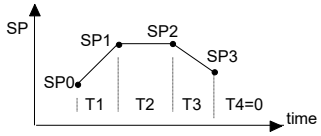


Figure 14

The **PtoL** program tolerance function allows you to set the maximum deviation between PV and SP when the program is running. If this deviation is exceeded, the program will be interrupted until the deviation returns to the programmed tolerance (disregards time). When programmed with 0, the program will run continuously, even if the PV value does not follow the SP value (it only considers time).

8.1 PROGRAM LINK

It is possible to create a large, more complex program with up to 49 segments, linking the 7 programs. Thus, when one program finishes running, the controller will immediately start running another.

On the **LP** screen, you can define whether a program will be linked to another.

For the controller to run a specific program or programs continuously, simply connect a program to itself or the last program to the first.

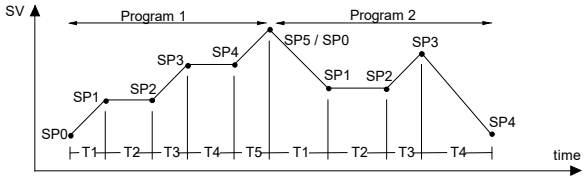


Figure 15

8.2 EVENT ALARM

The Event Alarm function allows you to program the triggering of alarms in specific segments of a program. For this function to operate, you must set the function of the alarms to be triggered to **rS**. They are configured in parameters **PE 1** to **PE 7**.

To configure and run a ramps and soaks program:

- Program tolerance values, program SPs, time and event.
- When using an alarm with the event function, set its function to Event Alarm.
- Set the control mode to automatic.
- On the **rS** screen, enable program execution.
- On the **run** screen, start the control.

Note: Before starting the program, the controller will wait until the PV value reaches the initial Setpoint (**SP0**). When returning from a power outage, the controller will continue running the program from the beginning of the segment that was interrupted.

9. AUTO-TUNING OF THE PID PARAMETERS

During automatic tuning, the process is controlled in ON / OFF mode at the programmed SP. According to the features of the process, large oscillations can occur above and below SP. In some processes, automatic tuning can take many minutes to complete.

It is recommended to follow the procedure below:

- Disable process control (**run** = **no**)
- Set operation to automatic mode (**Auto** = **YES**)
- Set the value of the proportional band > 0 (**Pb** > 0)
- Disable the Soft Start function (**SFSt** = 0)
- Disable the Ramps and Soaks function (**Pr n** = 0)
- Select the SP value close to the desired value for the process
- Enable auto-tuning (**Atun** = **YES**)
- Enable control (**run** = **YES**)

The **TUNE** flag will remain on during the tuning process.

For relay control output or current pulses, automatic tuning calculates the highest possible value for the PWM period. If there is slight instability, this value can be reduced. For solid-state relays, it is recommended to reduce this to 1 second.

If tuning does not result in satisfactory control, the table below provides instructions on how to correct the behavior of the process:

PARAMETER	VERIFIED PROBLEM	SOLUTION
Proportional Band	Slow response	Decrease
	Great oscillation	Increase
Integration Rate	Slow response	Increase
	Great oscillation	Decrease
Derivative Time	Slow response or instability	Decrease
	Great oscillation	Increase

Table 8

10. MAINTENANCE

10.1 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 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.
5. Apply to the input a signal corresponding to a known indication and just below the upper indication limit.
6. Access **InHc** parameter. Use the [▼] and [▲] keys to make the display show the expected value.
7. Repeat **3** to **6** until no further adjustment is required.

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

10.2 ANALOG OUTPUT CALIBRATION

1. Set I/O5 to value 11 (0-20 mA) or 12 (4-20 mA).
2. Mount a milliammeter on the analog control output.
3. Disable the Automatic Tuning and Soft Start functions.
4. On the **ouLL** screen, set the MV lower limit to 0.0 %. On the **ouHL** screen, set the MV upper limit to 100.0 %.
5. On the **Auto** screen, program **no** in manual mode.
6. On the **run** screen, start the control.
7. Program MV at 0.0 % in the Operation Cycle.
8. Select the **ouLc** screen. Press the [▼] and [▲] keys so that the milliammeter reads 0 mA (or 4 mA for type 12), and then move it closer to this value.
9. In the Operation Cycle, set MV to 100.0 %.
10. Select the **ouHc** screen. Press the [▼] and [▲] keys to obtain a reading of 20 mA, approximating below this value.
11. Repeat **7** to **10** until no further adjustment is required.

10.3 PROBLEMS WITH THE CONTROLLER

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

The controller displays some messages to help you identify problems.

MESSAGE	PROBLEM DESCRIPTION
----	Open input. No sensor or signal.
nnnn	The input signal is beyond the accepted upper limit.
uuuu	The input signal is beyond the accepted lower limit.
Err 1 Err6	Connection and/or configuration problems. Check the connections. Check the configuration.

Table 9

Other error messages displayed by the controller represent internal damage that necessarily means the device must be sent for maintenance. You must inform the serial number of the device, which can be obtained by pressing the [◄] key for more than 3 seconds.

The controller also shows a visual alarm (the display flashes) when the PV value is outside the range set by **SPHL** and **SPLL**.

11. SERIAL COMMUNICATION

The controller can optionally be supplied with a RS485 asynchronous serial communication interface, master-slave type, for communication with a supervisor (master) computer. The controller always acts as a slave.

Communication is always initiated by the master, which transmits a command to the address of the slave it wishes to communicate with. The addressed slave takes over the command and sends the corresponding response to the master.

The indicator accepts Broadcast type commands.

For more information, see ATTACHMENT 1.

11.1 FEATURES

- Signals compatible with the RS485 standard. Modbus (RTU) protocol.
- 2-wire connection between 1 master and up to 31 (it can address up to 247) indicators in bus topology. The communication signals are electrically isolated from the rest of the equipment.
- Maximum connection distance: 1000 meters.
- Controller disconnection time: Maximum 2 ms after last byte.
- Programmable speed: 1200, 2400, 4800, 9600 or 19200 bps.
- Number of data bits: 8, no parity.
- Number of Stop bits: 1.
- Response transmission start time: Maximum 100 ms after receiving the command.

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 that improves communication performance.	Terminal 27
GND					

Table 10

11.2 SERIAL COMMUNICATION CONFIGURATION

To use the serial, 3 parameters must be configured:

bAud: Communication speed.

PrtY: Communication parity.

Addr: Communication address of the controller.

12. SPECIFICATIONS

DIMENSIONS: ..... 48 x 96 x 92 mm (1/8 DIN).

Approximated weight: ..... 250 g

PANEL CUTOUT: ..... 23 x 46 mm (+0.5 -0.0 mm)

POWER SUPPLY: ..... 100 to 240 Vac/dc (±10 %), 50/60 Hz

Optional 24 V: ..... 12 to 24 Vdc / 24 Vac (-10 % / +20 %)

Maximum consumption: ..... 9 VA

ENVIRONMENTAL CONDITIONS:

Operating temperature: ..... 5 to 50 C°

Relative humidity: ..... Maximum: 80 % up to 30 °C

For temperatures above 30 °C, decrease by 3 % per °C.

Indoor use | Installation category II | Pollution degree 2 | Altitude < 2000 meters.

INPUT:

Types ..... See **Table 1**

Internal resolution: ..... 32767 levels

Display resolution: ..... 12000 levels (from -1999 to 9999)

Input reading rate: ..... Up to 5 per second

Accuracy: ..... Thermocouples **J**, **K**, **T**: 0.25 % of span ± 1 °C

..... Thermocouples **N**, **R**, **S**, **B**: 0.25 % of span ± 3 °C

..... Pt100: 0.2 % of span

..... 4-20 mA, 0-50 mV, 0-5 Vdc: 0.2 % of span

Input impedance: ..... 0-50 mV, Pt100, and thermocouples: > 10 MΩΩ

..... 0-5 V: >1 MΩ

..... 4-20 mA: 15 Ω (+2 Vdc @ 20 mA)

Pt100 measurement: ..... 3-wire type, with cable length compensation, (α = 0.00385), 0.170 mA excitation current

All input types are factory calibrated.

Thermocouples according to NBR 12771/99; RTD's NBR 13773/97.

DIGITAL INPUT: ..... I/O5 and I/O6: Dry Contact or NPN Open collector

ANALOG OUTPUT: ..... I/O5: 0-20 mA or 4-20 mA, 550 Ω max.

1500 levels, isolated, for control or PV and SP retransmission.

CONTROL OUTPUT: ..... 2 SPDT Relays (I/O1 and I/O2): 3 A / 240 Vac, general use

..... 2 SPST-NO Relays (I/O3 and I/O4): 1.5 A / 250 Vac, general use

..... Voltage pulse for SSR (I/O5): 10 V max / 20 mA

..... Voltage pulse for SSR (I/O6): 5 V max / 20 mA

REMOTE SP INPUT: ..... 4-20 mA current

AUXILIARY SUPPLY: ..... 24 Vdc (± 10 %) 25 mA

FRONT PANEL: ..... IP65, Polycarbonate UL94 V-2

HOUSING: ..... IP20, ABS+PC UL94 V-0

ELECTRICAL COMPATIBILITY: ..... EN 61326-1:1997 and EN 61326-1/A1:1998

EMISSION: CISPR11/EN55011

IMMUNITY: ..... EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8 and EN61000-4-11

SAFETY: ..... EN61010-1:1993 and EN61010-1/A2:1995 (UL file E300526)

USB INTERFACE: ..... 2.0, CDC CLASS (VIRTUAL SERIAL PORT), MODBUS RTU PROTOCOL.

CONNECTIONS SUITABLE FOR 6.3 MM PIN TERMINALS.

PROGRAMMABLE PWM CYCLE FROM 0.5 TO 100 SECONDS.

START OF OPERATION: ..... 3 seconds after the device is connected to the power supply.

CERTIFICATIONS: ..... CE / UKCA / UL (FILE: E300526)

13. IDENTIFICATION

N2000 -	485 -	24V
A	B	C

A Model: **N2000**

B Digital communication: **Blank** (basic version, without serial communication)

485 (version with RS485, Modbus protocol)

C Power supply: **Blank** (basic version, 100 to 240 Vac/dc)

24 V (version with 12 to 24 Vdc / 24 Vac power supply)

14. WARRANTY

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

15. ATTACHMENT 1 – COMMUNICATION PROTOCOL

15.1 COMMUNICATION INTERFACE

The optional serial interface RS485 allows addressing up to 247 controllers in a network communicating remotely with a host computer or master controller.

15.1.1 RS485 INTERFACE

- Compatible line signals with RS485 standard.
- 3-wire connection between the master and up to 31 slave controllers in bus topology. It is possible address 247 nodes with multiple outputs converters.
- Maximum communication distance: 1000 meters.
- 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 that improves communication performance.	Terminal 27
GND					

Table 11

15.1.2 GENERAL CHARACTERISTICS

- Optical isolation on serial interface.
- Programmable speed: 1200 to 11.200.
- Data Bits: 8.
- Parity: None.
- Stop Bits: 1.

15.1.3 COMMUNICATION PROTOCOL

The Modbus RTU slave protocol is supported, available in most SCADA software on the market.

All configurable parameters can be accessed (for reading or writing) through the Registers Table. In Broadcast mode, it is also allowed to write to the Registers, using the address 0.

The available Modbus commands are:

03	*Read Holding Register*
05	*Force Single Coil*
06	*Preset Single Register*

The registers are arranged on a table, so that it is possible to read several registers in the same request.

15.2 CONFIGURATION OF THE SERIAL COMMUNICATION PARAMETERS

To use serial communication, two parameters must be configured:

bAud: Baud rate. All devices with the same Baud Rate.

Addr: Device communication address. Each device must have a unique address.

15.4 REGISTERS TABLE

Equivalent to Holding Registers (reference 4x).

The Holding Registers are the internal indicator parameters. From address 12, all registers can be written and read. Up to this address, most registers are read-only. It is necessary to check each case.

Each table parameter is a 16-bit word with a sign represented in addition to 2.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0000	Active SV	Read: Active control Setpoint (From the main screen, Ramps and Soaks or Remote Setpoint). Write: Control Setpoint on the main screen. Range: From **SPLL** to the configured value in **SPHL**.
0001	PV	Read: Process Variable. Write: Not allowed. Range: Minimum is the value set in **SPLL** and maximum is the value set in **SPHL**. The decimal point position depends on the **dPPo** screen.
0002	MV	Read: Output Power in automatic or manual mode. Write: Not allowed. See address 29. Range: 0 to 1000 (0.0 to 100.0%).
0003	-	Reserved.
0004	Display value	Read: Current value shown on display. Write: Current value shown on display. Range: -1999 to 9999. The range depends on the displayed parameter.
0005	Prompt index	Read: Current screen number. Write: Not allowed. Range: 0000 h to 060 Ch. Screen number format: XXYYh, where: **XX** → Menu cycle number. **YY** → Screen number.
0006	Status Word 1	Read: Status bits. Write: Not allowed. Read Value: See **Table 13**.
0007	Software Version	Read: Controller software version. Write: Not allowed. Read Values: If the device version is V1.00, for example, 100 will be read.
0008	ID	Read: Controller identification number. Write: Not allowed. Read Values: **2** → N2000. Other values: Special devices.
0009	Status Word 2	Read: Status bits. Write: Not allowed. Read Value: See **Table 13.**
0010	Status Word 3	Read: Status bits. Write: Not allowed. Read Value: See **Table 13.**
0011	**Ir**	Integral Rate (In repetitions/min). Range: 0 to 3000 (0.00 to 30.00).
0012	**dt**	Derivative Time (In seconds). Range: 0 to 250.
0013	**Pb**	Proportional Band (In percentage). Range: 0 to 5000 (0.0 to 500.0)
0014	**tbAS**	Program time base. **0** → Seconds. **1** → Minutes.
0015	**ct**	Cycle Time (PWM, in seconds). Range: 5 to 1000 (0.5 to 100.0).
0016	-	Reserved.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0017	HYSt	On/Off Control Hysteresis (In selected type engineering unit). Range: 0 to SPHL – SPLL.
0018	-	Reserved.
0019	ouLL	Output Low Limit (Minimum output power). Range: 0 to 1000 (0.0 to 100.0%).
0020	ouHL	Output High Limit (Minimum output power). Range: 0 to 1000 (0.0 to 100.0%).
0021	AuEn	Auto/Man key Enable – ✋: **1**→ Key enabled. **0** → Key disabled.
0022	F.Func	Allows defining a function for the F key: **0** → Not used. **7** → Controller start/stop. **8** → Select remote SP. **9** → Ramp and Soak hold. **10** → Select program 1.
0023	Serial Number H	Serial Number High (Upper display). Range: 0 to 9999. Read only.
0024	Serial Number L	Serial Number Low (Lower display). Range: 0 to 9999. Read only.
0025	SV	Control Setpoint (Screen Setpoint). Range: From SPLL to SPHL.
0026	SPLL	Setpoint Low limit. Range: Minimum value depends on the input type selected in tYPE to SPHL.
0027	SPHL	Setpoint High limit. Range: Minimum value is SPLL and maximum depends on the input type selected in tYPE.
0028	Manual MV	Manual output power (In percentage). Range: 0 to 1000 (0.0 to 100.0%).
0029	oFFS	PV offset. Range: From SPLL to SPHL.
0030	dPPo	PV decimal point position. Range: 0 to 3. **0** → X.XXX. **1** → XX.XX. **2** → XXX.X. **3** → XXXX.
0031	SPA1	Alarm preset 1. Range: Between SPLL and SPHL for non-differential alarm. SPLL - SPLH for differential alarm.
0032	SPA2	
0033	SPA3	
0034	SPA4	
0035	FuA1	Alarm Function. Range: 0 to 7. **0** → oFF. **1** → lErr. **2** → rS. **3** → Lo. **4** → H I. **5** → d IFL. **6** → d IFH. **7** → d IF.
0036	FuA2	
0037	FuA3	
0038	FuA4	
0039	HyA1	Alarm Hysteresis. Range: 0 to 9999 (0.00 to 99.99%).
0040	HyA2	

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0041	HYA3	
0042	HYA4	
0043	tYPE	Input Type. tc J → (J) -110 to 950 °C | -166 to 1742 °F. tc K → (K) -150 to 1370 °C | -238 to 2498 °F. tc t → (T) -160 to 400 °C | -256 to 752 °F. tc n → (N) -270 to 1300 °C | -454 to 2372 °F. tc r → (R) -50 to 1760 °C | -58 to 3200 °F. tc S → (S) -50 to 1760 °C | -58 to 3200 °F. tc b → (B) 400 to 1800 °C | 752 to 3272 °F. tc E → (E) -90 to 730 °C | -130 to 1346 °F. Pt → Pt100 -200 to 850 °C | -328 to 1562 °F. L.0.50 → (0-50 mV) -1999 to 9999. L.4.20 → (4-20 mA) -1999 to 9999. L.0.5 → (0-5 V) -1999 to 9999. L.0.10 → (0-10 V) -1999 to 9999. Srt → (Square root) -1999 to 9999.
0044	Addr	Communication slave address. Range: 1 to 247.
0045	bAud	Communication Baud Rate. Range: 0 to 7. **0** → 1200. **1** → 2400. **2** → 4800. **3** → 9600. **4** → 19200. **5** → 32400. **6** → 57600. **7** → 115200.
0046	Auto	Control Mode. Range: **0** → Manual. **1** → Automatic.
0047	run	Enable control. Range: **0** → No. **1** → Yes.
0048	Act	Control action. Range: **0** → Reverse. **1** → Direct.
0049	Atun	Enable Auto-tune. Range: **0** → No. **1** → Yes.
0050	bLA1	Initial Alarm Blocking. Range: **0** → No. **1** → Yes.
0051	bLA2	
0052	bLA3	
0053	bLA4	

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0054	Key	Key press remote action. Range: 0 to 9. **1** → P key. **2** → ∧ key. **4** → ∨ key. **8** → < key. **9** → P and < keys.
0055	rSLL	Remote Setpoint Low limit. Range: The minimum depends on the type of input configured in tYPE. The maximum is the value configured in rSHL.
0056	rSHL	Remote Setpoint High limit. Range: The minimum is the value set in rSLL. The maximum depends on the input type configured in tYPE.
0057	Io 1	Channel function I/O.
0058	Io 2	
0059	Io 3	
0060	Io 4	
0061	Io 5	
0062	A1t1	Alarm 1 Time 1. Range: 0 to 6500 s.
0063	A1t2	Alarm 1 Time 2 (in seconds). Range: Same as in A1t1.
0064	A2t1	Alarm 2 Time 1 (in seconds). Range: Same as in A1t1.
0065	A2t2	Alarm 2 Time 2 (in seconds). Range: Same as in A1t1.
0066	SFSt	Soft Start time (in seconds). Range: 0 to 9999.
0067	unit	Temperature unit. Range: 0 to 1. **0** → °C. **1** → °F.
0068	bIAS	Bias. Range: -100 to +100%.
0069	Io 6	Channel function I/06.
0070	R&S Segment	Ramp and Soak segment being executed (read only). Range: 0 to 7.
0071	Pr n	Ramp and Soak segment to be viewed or edited. Range: 1 to 7.
0072	Pr n	Ramp and Soak segment to be executed. Range: 0 to 7.
0073	PE1	Segment 1 Event of R&S Program 1. Range: 0 to 15.
0074	PE2	Segment 2 Event of R&S Program 1. Range: Same as in PE1.
0075	PE3	Segment 3 Event of R&S Program 1. Range: Same as in PE1.
0076	PE4	Segment 4 Event of R&S Program 1. Range: Same as in PE1.
0077	PE5	Segment 5 Event of R&S Program 1. Range: Same as in PE1.
0078	PE6	Segment 6 Event of R&S Program 1. Range: Same as in PE1.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0079	PE7	Segment 7 Event of R&S Program 1. Range: Same as in PE 1.
0080	PE 1	Segment 1 Event of R&S Program 2. Range: 0 to 15.
0081	PE2	Segment 2 Event of R&S Program 2. Range: Same as in PE 1.
0082	PE3	Segment 3 Event of R&S Program 2. Range: Same as in PE 1.
0083	PE4	Segment 4 Event of R&S Program 2. Range: Same as in PE 1.
0084	PE5	Segment 5 Event of R&S Program 2. Range: Same as in PE 1.
0085	PE6	Segment 6 Event of R&S Program 2. Range: Same as in PE 1.
0086	PE7	Segment 7 Event of R&S Program 2. Range: Same as in PE 1.
0087	PE 1	Segment 1 Event of R&S Program 3. Range: 0 to 15.
0088	PE2	Segment 2 Event of R&S Program 3. Range: Same as in PE 1.
0089	PE3	Segment 3 Event of R&S Program 3. Range: Same as in PE 1.
0090	PE4	Segment 4 Event of R&S Program 3. Range: Same as in PE 1.
0091	PE5	Segment 5 Event of R&S Program 3. Range: Same as in PE 1.
0092	PE6	Segment 6 Event of R&S Program 3. Range: Same as in PE 1.
0093	PE7	Segment 7 Event of R&S Program 3. Range: Same as in PE 1.
0094	PE 1	Segment 1 Event of R&S Program 4. Range: 0 to 15.
0095	PE2	Segment 2 Event of R&S Program 4. Range: Same as in PE 1.
0096	PE3	Segment 3 Event of R&S Program 4. Range: Same as in PE 1.
0097	PE4	Segment 4 Event of R&S Program 4. Range: Same as in PE 1.
0098	PE5	Segment 5 Event of R&S Program 4. Range: Same as in PE 1.
0099	PE6	Segment 6 Event of R&S Program 4. Range: Same as in PE 1.
0100	PE7	Segment 7 Event of R&S Program 4. Range: Same as in PE 1.
0101	PE 1	Segment 1 Event of R&S Program 5. Range: 0 to 15.
0102	PE2	Segment 2 Event of R&S Program 5. Range: Same as in PE 1.
0103	PE3	Segment 3 Event of R&S Program 5. Range: Same as in PE 1.
0104	PE4	Segment 4 Event of R&S Program 5. Range: Same as in PE 1.
0105	PE5	Segment 5 Event of R&S Program 5. Range: Same as in PE 1.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0106	PE6	Segment 6 Event of R&S Program 5. Range: Same as in PE 1.
0107	PE7	Segment 7 Event of R&S Program 5. Range: Same as in PE 1.
0108	PE 1	Segment 1 Event of R&S Program 6. Range: 0 to 15. See **Table 6** of the manual instructions
0109	PE2	Segment 2 Event of R&S Program 6. Range: Same as in PE 1.
0110	PE3	Segment 3 Event of R&S Program 6. Range: Same as in PE 1.
0111	PE4	Segment 4 Event of R&S Program 6. Range: Same as in PE 1.
0112	PE5	Segment 5 Event of R&S Program 6. Range: Same as in PE 1.
0113	PE6	Segment 6 Event of R&S Program 6. Range: Same as in PE 1.
0114	PE7	Segment 7 Event of R&S Program 6. Range: Same as in PE 1.
0115	PE 1	Segment 1 Event of R&S Program 7. Range: 0 to 15.
0116	PE2	Segment 2 Event of R&S Program 7. Range: Same as in PE 1.
0117	PE3	Segment 3 Event of R&S Program 7. Range: Same as in PE 1.
0118	PE4	Segment 4 Event of R&S Program 7. Range: Same as in PE 1.
0119	PE5	Segment 5 Event of R&S Program 7. Range: Same as in PE 1.
0120	PE6	Segment 6 Event of R&S Program 7. Range: Same as in PE 1.
0121	PE7	Segment 7 Event of R&S Program 7. Range: Same as in PE 1.
0122	PtoL	R&S Program 1 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL) value.
0123	LP	Program 1 Link (Ramp and Soak). Range: 0 to 7
0124	Pt 1	Time 1 of Program 1. Range: 0 to 9999 minutes.
0125	Pt2	Time 2 of Program 1. Range: 0 to 9999 minutes.
0126	Pt3	Time 3 of Program 1. Range: 0 to 9999 minutes.
0127	Pt4	Time 4 of Program 1. Range: 0 to 9999 minutes.
0128	Pt5	Time 5 of Program 1. Range: 0 to 9999 minutes.
0129	Pt6	Time 6 of Program 1. Range: 0 to 9999 minutes.
0130	Pt7	Time 7 of Program 1. Range: 0 to 9999 minutes.
0131	PSP0	Setpoint 0 of Program 1. Range: From SPLL to SPHL.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0132	PSP1	Setpoint 1 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0133	PSP2	Setpoint 2 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0134	PSP3	Setpoint 3 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0135	PSP4	Setpoint 4 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0136	PSP5	Setpoint 5 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0137	PSP6	Setpoint 6 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0138	PSP7	Setpoint 7 of Program 1 (Ramp and Soak). Range: Same as in PSP0.
0139	PtoL	R&S Program 2 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL) value.
0140	LP	Program 2 Link (Ramp and Soak). Range: 0 to 7.
0141	Pt1	Time 1 of Program 2. Range: 0 to 9999 minutes.
0142	Pt2	Time 2 of Program 2. Range: 0 to 9999 minutes.
0143	Pt3	Time 3 of Program 2. Range: 0 to 9999 minutes.
0144	Pt4	Time 4 of Program 2. Range: 0 to 9999 minutes.
0145	Pt5	Time 5 of Program 2. Range: 0 to 9999 minutes.
0146	Pt6	Time 6 of Program 2. Range: 0 to 9999 minutes.
0147	Pt7	Time 7 of Program 2. Range: 0 to 9999 minutes.
0148	PSP0	Setpoint 0 of Program 2. Range: From SPLL to SPHL.
0149	PSP1	Setpoint 1 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0150	PSP2	Setpoint 2 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0151	PSP3	Setpoint 3 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0152	PSP4	Setpoint 4 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0153	PSP5	Setpoint 5 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0154	PSP6	Setpoint 6 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0155	PSP7	Setpoint 7 of Program 2 (Ramp and Soak). Range: Same as in PSP0.
0156	PtoL	R&S Program 3 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL).
0157	LP	Program 3 Link (Ramp and Soak). Range: 0 to 7.
0158	Pt1	Time 1 of Program 3. Range: 0 to 9999 minutes.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0159	Pt2	Time 2 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0160	Pt3	Time 3 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0161	Pt4	Time 4 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0162	Pt5	Time 5 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0163	Pt6	Time 6 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0164	Pt7	Time 7 of Program 3 (Ramp and Soak). Range: Same as in Pt 1.
0165	PSP0	Setpoint 0 of Program 3. Range: From SPLL to SPHL.
0166	PSP1	Setpoint 1 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0167	PSP2	Setpoint 2 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0168	PSP3	Setpoint 3 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0169	PSP4	Setpoint 4 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0170	PSP5	Setpoint 5 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0171	PSP6	Setpoint 6 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0172	PSP7	Setpoint 7 of Program 3 (Ramp and Soak). Range: Same as in PSP0.
0173	PtoL	R&S Program 4 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL).
0174	LP	Program 4 Link (Ramp and Soak). Range: 0 to 7.
0175	Pt 1	Time 1 of Program 4 (Ramp and Soak). Range: 0 to 999 (In minutes).
0176	Pt2	Time 2 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0177	Pt3	Time 3 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0178	Pt4	Time 4 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0179	Pt5	Time 5 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0180	Pt6	Time 6 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0181	Pt7	Time 7 of Program 4 (Ramp and Soak). Range: Same as in Pt 1.
0182	PSP0	Setpoint 0 of Program 4. Range: From SPLL to SPHL.
0183	PSP1	Setpoint 1 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0184	PSP2	Setpoint 2 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0185	PSP3	Setpoint 3 of Program 4 (Ramp and Soak). Range: Same as in PSP0.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0186	PSP4	Setpoint 4 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0187	PSP5	Setpoint 5 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0188	PSP6	Setpoint 6 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0189	PSP7	Setpoint 7 of Program 4 (Ramp and Soak). Range: Same as in PSP0.
0190	PtoL	R&S Program 5 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL).
0191	LP	Program 5 Link (Ramp and Soak). Range: 0 to 7.
0192	Pt 1	Time 1 of Program 5 (Ramp and Soak). Range: 0 to 9999 (In minutes).
0193	Pt2	Time 2 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0194	Pt3	Time 3 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0195	Pt4	Time 4 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0196	Pt5	Time 5 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0197	Pt6	Time 6 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0198	Pt7	Time 7 of Program 5 (Ramp and Soak). Range: Same as in Pt 1.
0199	PSP0	Setpoint 0 of Program 5. Range: From SPLL to SPHL.
0200	PSP 1	Setpoint 1 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0201	PSP2	Setpoint 2 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0202	PSP3	Setpoint 3 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0203	PSP4	Setpoint 4 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0204	PSP5	Setpoint 5 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0205	PSP6	Setpoint 6 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0206	PSP7	Setpoint 7 of Program 5 (Ramp and Soak). Range: Same as in PSP0.
0207	PtoL	R&S Program 6 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL).
0208	LP	Program 6 Link (Ramp and Soak). Range: 0 to 7.
0209	Pt 1	Time 1 of Program 6 (Ramp and Soak). Range: 0 to 9999 (In minutes).
0210	Pt2	Time 2 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.
0211	Pt3	Time 3 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0212	Pt4	Time 4 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.
0213	Pt5	Time 5 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.
0214	Pt6	Time 6 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.
0215	Pt7	Time 7 of Program 6 (Ramp and Soak). Range: Same as in Pt 1.
0216	PSP0	Setpoint 0 of Program 6. Range: From SPLL to SPHL.
0217	PSP1	Setpoint 1 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0218	PSP2	Setpoint 2 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0219	PSP3	Setpoint 3 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0220	PSP4	Setpoint 4 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0221	PSP5	Setpoint 5 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0222	PSP6	Setpoint 6 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0223	PSP7	Setpoint 7 of Program 6 (Ramp and Soak). Range: Same as in PSP0.
0224	PtoL	R&S Program 7 Tolerance (Ramp and Soak). Range: 0 to (SPHL - SPLL).
0225	LP	Program 7 Link (Ramp and Soak). Range: 0 to 7.
0226	Pt1	Time 1 of Program 7 (Ramp and Soak). Range: 0 to 9999 (in minutes).
0227	Pt2	Time 2 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0228	Pt3	Time 3 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0229	Pt4	Time 4 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0230	Pt5	Time 5 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0231	Pt6	Time 6 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0232	Pt7	Time 7 of Program 7 (Ramp and Soak). Range: Same as in Pt 1.
0233	PSP0	Setpoint 0 of Program 7. Range: From SPLL to SPHL.
0234	PSP1	Setpoint 1 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0235	PSP2	Setpoint 2 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0236	PSP3	Setpoint 3 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0237	PSP4	Setpoint 4 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0238	PSP5	Setpoint 5 of Program 7 (Ramp and Soak). Range: Same as in PSP0.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0239	PSP6	Setpoint 6 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0240	PSP7	Setpoint 7 of Program 7 (Ramp and Soak). Range: Same as in PSP0.
0241	PrtY	Parity of serial communication.
0242	Prot	Sets up the Protection Level.
0243	Er.SP	Enables remote SP. **0** → Enables Remote SP. **1** → Does not enable Remote SP.
0244	r.SP	Defines the signal type for the remote SP. **0** → 0-20 mA. **1** → 4-20 mA. **2** → 0-5 V. **3** → 0-10 V.
0245-0253		Reserved.
0254	CJ	Cold Junction compensation temperature.
0255		Reserved.
0256	FLSh	Display flashes in alarm. Range: 0 a 15.
0257	A3t1	Time 1 temporization alarm 3 (In seconds).
0258	A3t2	Time 2 temporization alarm 3 (In seconds).
0259	A4t1	Time 1 temporization alarm 4 (In seconds).
0260	A4t2	Time 2 temporization alarm 4 (In seconds).
0261	t.SEG	Indicative screen. Shows the current segments remaining time.
0262		Reserved.
0263		Reserved.
0264	FLtr	Digital filter for input signals. Range: 0 to 20.
0265-0269		Reserved.
0270	IEou	Percentage to be applied when the MV function safe output value is adopted.
0271	Lbdt	Time interval LBD function. Range: 0 to 9999. In minutes.

Table 12

15.5 STATUS WORDS

REGISTER	VALUE FORMAT
Status Word 1	bit 0 – Alarm 1 (0 → Inactive | 1 → Active). bit 1 – Alarm 2 (0 → Inactive | 1 → Active). bit 2 – Alarm 3 (0 → Inactive | 1 → Active). bit 3 – Alarm 4 (0 → Inactive | 1 → Active). bit 4 – Input – I/O 5 (0 → Inactive | 1 → Active). bit 5 – Reserved. bit 6 – Input – I/O 6 (0 → Inactive | 1 → Active) bit 7 – Reserved. bit 8 – Hardware type. bit 9 – Hardware type. bit 10 – Reserved. bit 11 – Reserved. bit 12 – Reserved. bit 13 – Reserved. bit 14 – Reserved. bit 15 – Reserved.

REGISTER	VALUE FORMAT
Status Word 2	bit 0 – Automatic (0 → Manual | 1 → Automatic). bit 1 – Run (0 → Stop | 1 → Run). bit 2 – Control Action (0 → Reverse | 1 → Direct). bit 3 – Reserved. bit 4 – Auto-tune (0 → No | 1 → Yes). bit 5 – Alarm 1 power-up inhibit (0 → No | 1 → Yes). bit 6 – Alarm 2 power-up inhibit (0 → No | 1 → Yes). bit 7 – Alarm 3 power-up inhibit (0 → No | 1 → Yes). bit 8 – Alarm 4 power-up inhibit (0 → No | 1 → Yes). bit 9 – Unit (0 → °C | 1 → °F). bit 10 – Reserved. bit 11 – Output 1 status. bit 12 – Output 2 status. bit 13 – Output 3 status. bit 14 – Output 4 status. bit 15 – Output 5 status.
Status Word 3	bit 0 – Very low PV conversion (0 → No | 1 → Yes). bit 1 – Negative conversion after calibration (0 → No | 1 → Yes). bit 2 – Very high PV conversion (0 → No | 1 → Yes). bit 3 – Exceeded linearization limit (0 → No | 1 → Yes). bit 4 – Very high Pt100 cable resistance (0 → No | 1 → Yes). bit 5 – Self zero conversion out of range (0 → No | 1 → Yes). bit 6 – Self span conversion out of range (0 → No | 1 → Yes). bit 7 – Cold junction conversion out of range (0 → No | 1 → Yes). bit 8 – Reserved. bit 9 – Reserved. bit 10 – Reserved. bit 11 – Reserved. bit 12 – Reserved. bit 13 – Reserved. bit 14 – Reserved. bit 15 – Reserved.

Table 13

Writing to an output bit is only possible if the output has no function assigned to it (the output is configured to OFF in Alarm Cycle).

COIL STATUS	OUTPUT DESCRIPTION
1	Output 1 Status (I/O1).
2	Output 2 Status (I/O2).
3	Output 3 Status (I/O3).
4	Output 4 Status (I/O4).
5	Output 5 Status (I/O5).

Table 14

15.6 EXCEPTION RESPONSES – ERROR CONDITIONS

On receiving a command, the CRC check is performed on the received data block. No response will be sent to the master if there is a CRC error at reception. For commands received without error, a consistency of the command and the requested registers is made. If invalid, an exception response will be sent with the corresponding error code. For exception replies, the field corresponding to the Modbus command in the reply will be added up to 80 H.

If a WRITE command sends an out-of-range value to a parameter, the maximum allowed value for this parameter will be forced and this value will be returned as a response.

Broadcast read commands are ignored by the controller, so there will be no response. You can only write in Broadcast mode.

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

Table 15

15.7 CONFIGURATION PARAMETERS I/O

I/O FUNCTION	CODE		I/O TYPE
No Function	**0**	oFF	Digital Output
Alarm 1 Output.	**1**	A1	Digital Output
Alarm 2 Output.	**2**	A2	Digital Output
Alarm 3 Output.	**3**	A3	Digital Output
Alarm 4 Output.	**4**	A4	Digital Output
Time interval LBD function (*Loop Break Detection*)	**5**	Lbd	Digital Output
PWM Control Output	**6**	ctrL	Digital Output
Switch Automatic/Manual mode	**7**	MAn	Digital Input
Switch Run/Stop mode	**8**	run	Digital Input
Select the Remote SP	**9**	rSP	Digital Input
Holds the program	**10**	HPrG	Digital Input
Select program 1	**11**	Pr 1	Digital Input
0 to 20mA Analog control output	**12**	C.0.20	Analog Output
4 to 20mA Analog control output	**13**	C.4.20	Analog Output
0 to 20mA PV retransmission	**14**	P.0.20	Analog Output
4 to 20mA PV retransmission	**15**	P.4.20	Analog Output
0 to 20mA SP retransmission	**16**	S.0.20	Analog Output
4 to 20mA SP retransmission	**17**	S.4.20	Analog Output

Table 16