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POWER FROM WITHIN

RN200 CONTROLLER

SMARTECH

USER MANUAL

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Table of Contents

INTRODUCTION

The manual must be kept with care and must always be available for quick reference.

The manual must be carefully read and understood in each of its paragraphs by the people who must use the device and who will carry out normal operations and periodic maintenance.

If the manual is lost or damaged, request a copy from the installer or manufacturer, providing the model, device code, serial number and year of construction.

1 Safety information

Many accidents are caused by insufficient knowledge and non-application of the safety rules, which must be put into practice during operation and/or maintenance operations.

To avoid accidents, before carrying out any operation and/or maintenance, read, understand and follow the precautions and warnings contained in this manual.

The following indications have been used to identify the safety messages included in this manual:

WARNING! This indication is used in safety messages for dangers which, if not avoided, can cause malfunctions or damage to property or persons.

INFORMATION! This term indicates that the message provides information useful for carrying out the operation in progress or for clarifying or specifying procedures.

2 Maintenance and cleaning

Maintenance of this device must be carried out by qualified personnel, in compliance with current regulations, in order to avoid damage to people or things.

The front panel can be cleaned only with a soft cloth, do not use abrasive products, liquid detergents or solvents.

3 Information concerning disposal

INFORMATION! Disposal of old electrical and electronic equipment (applicable in European countries that have adopted separate waste collection systems).

Products bearing the symbol of a crossed-out wheeled bin cannot be disposed of with normal household waste. Old electrical and electronic products must be recycled at a special facility capable of treating these products and disposing of their components. To find out where and how to deliver these products to the place closest to you, contact the appropriate municipal office. Proper recycling and disposal helps to preserve nature and prevent harmful effects on health and the environment.

4 General info

This manual describes the RN200 controller.

5 Definitions

BLOCK: it is used to indicate an anomaly that makes it impossible to use renewable sources, and causes the inverters to automatically switch off.

WARNING: it is used to indicate an anomaly that requires operator intervention, but which does not prevent the use of renewable sources.

MAINS: public electricity provider.

RENEWABLE SOURCES: identifies the set of real sources (photovoltaic, wind etc.) and the inverters that manage them.

GENERATORS: refers to synchronous generators, consisting of a combustion engine (diesel, gas, biogas etc.) and an alternator.

COMMON BARS: power line consisting of one or more generating sets and renewable sources.

MCB: circuit breaker connecting the mains to the loads.

GCB: circuit breaker connecting one generator to the common bars.

RNCB: circuit breaker that connects a group of renewable sources to the common bars.

MGCB: circuit breaker that connects the common bars to the loads.

CANBUS: communication interface used by all SICES controllers for the exchange of information between them.

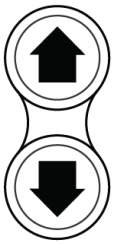
ISLAND: we mean a type of plant where the loads are powered by generators and renewable sources, but not by the mains.

PARALLEL TO THE MAINS: means a type of plant where the loads are powered by the mains, and possibly also (simultaneously) by the generators and renewable sources.

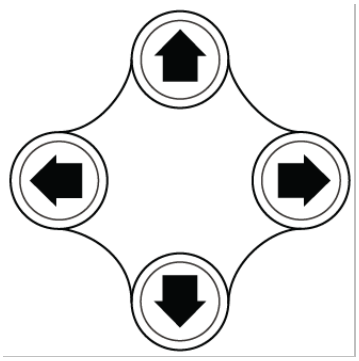
6 Main functions

6.1 Front panel

6.2 Buttons

Button		Function
MODE UP  **MODE DOWN**	**OFF/RESET** ***PROGRAM***	The inverters for the renewable sources are stopped. The **RNCB** circuit breaker is open. Parameters can be changed.
	MAN (Manual)	The controller is ready for manual use of renewable sources. Press the **START** button to start the inverters. Press the **STOP** button to stop the inverters. Press the **RNCB** button to open/close the RNCB circuit breaker.
	AUTO (Automatic)	The controller is ready for the automatic management of the inverters for the renewable sources, which will be started when the conditions of the system allow/require it.

Button	Function
 **ESC/SHIFT**	Allows to cancel the modification in progress on a parameter, go back to the upper menu, and exit programming. If pressed for two seconds from any menu, it allows to exit programming by storing the position, for a subsequent return to the same position. When pressed in any window it provides status information in the top row (alternating it cyclically). In the display pages which provide for timed rotation of the information displayed, it prevents rotation (keeps current information visible). Pressed together with the button **ACK/ENTER:** • Allows you to "accept" any anomalies on the non-volatile memory at power up. • Allows to perform a pending firmware update at power up. • According to the selected page, if pressed for at least 5 seconds it allows you to reset the counters, reload the default values for the parameters, delete the historical archives, force the exit from the BUS OFF mode of the Can Bus etc. Used in combination with the **LEFT** or **RIGHT** button, it allows contrast adjustment: • **ESC/SHIFT** + **LEFT**: to decrease the contrast (lighten). • **ESC/SHIFT** + **RIGHT**: to increase the contrast (darken). Pressed together with the button **UP** and **DOWN**: • Allows to change the brightness of the lamps. • Allows to change the parameters of 10 units at a time

	**Horizontal navigation buttons**:
	
	• They allow to select the previous or next display page.
	• When editing a text type parameter, they are used to position the cursor under the character to be edited.
	• In the display pages dedicated to the PLC, they allow to switch the display of resources between user-defined symbols and predefined symbols.
	• Used in combination with the **ESC/SHIFT** button, they allow contrast adjustment:
	  ○ **ESC/SHIFT** + **LEFT**: to decrease the contrast (lighten).
	  ○ **ESC/SHIFT** + **RIGHT**: to increase the contrast (darken).
	
	Vertical navigation buttons:
	
	• They allow to select the previous or next display mode (intended as a group of pages).
	• Pressed together with the **ESC/SHIFT** button, they allow to change the brightness of the lamps.
	• They allow to scroll through the anomalies if they are not on the display.
	• During the modification of a parameter, they are used to increase / decrease the value (or the selected character) of a unit (if pressed with the **ESC/SHIFT** button, the value is modified by 10 units).
	• While viewing the parameter menus or the historical archive, they allow you to go to the previous/next item.

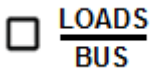
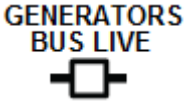
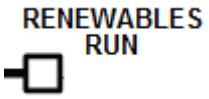
Button	Function
 **ACK/ENTER**	When an alarm or a warning occurs, a first press of the button deactivates the siren. A further press of the button recognizes the presence of anomalies and automatically removes the warnings (if the operating conditions have returned to normal). If kept pressed for 5 seconds, it performs a complete reset of the anomalies (including alarms). In the pages that display the board's analogue/digital inputs and outputs, it allows you to switch the display between logical, physical or function-related states. Activates the alarms scrolling mode if they do not fit in the display. While viewing the parameter menus or the historical archive, it allows to enter a submenu. While viewing the parameters, it allows to start and confirm a change operation. Pressed together with the button **ESC/SHIFT:** • Allows you to "accept" any anomalies on the non-volatile memory at power up. • Allows to perform a pending firmware update at power up. • According to the selected page, if pressed for at least 5 seconds it allows you to reset the counters, reload the default values for the parameters, delete the historical archives, force the exit from the BUS OFF mode of the Can Bus etc.
 **RNCB**	In the "**OFF/RESET**" and "**AUTO**" modes, the button is disabled. In "**MAN**" it is used to open and/or close the **RNCB** circuit breaker. When you want to open the circuit breaker, a single press first involves transferring the loads from the renewable sources to the generators or to the mains and then opening it; if you want to open RNCB immediately, press and hold the button for 1 second.
 **START**	In MAN mode it can be used to control the start-up of the inverters for the renewable sources. Note: starting of the inverters is only possible if **RNCB** is closed and the voltage on the common bars is present and within tolerance. When the controller is turned on: • Holding it together with the **STOP** button allows access to special functions.
 **STOP**	In **MAN** mode it is used to stop the inverters for the renewable sources. In **OFF/RESET** mode, it turns on all the lamps in order to check their efficiency (in this phase, the controller also activates the outputs configured with the DOF.3153 function, allowing you to also test the lamps on the panel). When the controller is turned on: • Allows to repeat the test of the non-volatile memory if there are errors. • Ignores any pending firmware update. • Holding it together with the **START** button allows access to special functions.

6.3 Indicators

It is possible to change the brightness of the indicators (all together) using parameter P.0496: the greater the value of the parameter, the greater the brightness of the lamps. The value can be set between 1 and 10 (default value = 5).

Led off	Led on	Led blinking
☐	▣	⧈

Icon		Function
☐ PROGRAM / OFF/RESET	▣	Indicates that the operating mode is OFF/RESET.
	⧈	Indicates that the PROGRAMMING menu is being accessed.
	☐	The controller is in another operating mode.
☐ MAN.	▣	Indicates that the operating mode is MANUAL.
	☐	The controller is in another operating mode.
☐ AUTO / TEST	▣	Indicates that the operating mode is AUTOMATIC.
	⧈	Flashing 90% on: indicates that the operating mode is REMOTE START.
	☐	The controller is in another operating mode.
☐ ALARM ⚠	▣	Indicates the presence of at least one alarm.
	⧈	Indicates the presence of at least one warning.
	☐	There are no anomalies.
☐ RENEWABLE	▣	Indicates that at least one external device (inverter) is communicating correctly with RN200.
	☐	Indicates that no external device (inverter) is communicating correctly with RN200.
☐ PMCBUS	▣	Indicates that the Can Bus interface is active, functioning and in **ERROR-ACTIVE** mode.
	⧈	Flashing 25% on: indicates a communication anomaly: the interface is in **ERROR-PASSIVE** mode.
		Flashing 75% on: indicates a communication anomaly: the interface is in **BUS-OFF** mode.
	☐	Indicates that the Can Bus interface is disabled.
☐ MONITOR	▣	Indicates that a Modbus slave connection is active (serial ports, Ethernet or USB).

Icon		Function
	☐	Indicates that no Modbus slave connection is active (serial ports, Ethernet or USB).
	▣	Presence of voltage on the loads.
	☐	No voltage on the loads.
	▣	The voltages on the common bars are present and within the tolerance range.
	☐	No voltage on the common bars.
	▣	Flashing at 50%: in the transients between the two previous states.
		Flashing 25% on: the voltages on the common bars are present but below the tolerance range.
		Flashing 75% on: the voltages on the common bars are present but above the tolerance range.
	☐	The RNCB circuit breaker is open.
	▣	The RNCB circuit breaker is closed.
	▣	Flashing 25% on: when open with closing command.
		Flashing 75% on: when closed in the presence of an opening command.
	☐	All inverters are stopped.
	▣	At least one inverter is running.
	▣	Flashing 25% on: no inverter running in the presence of a start command.
		Flashing 75% on: at least one inverter running in the presence of a stop command.

6.4 Multifunctional display

6.4.1 Display lighting

The backlighting lamp is managed by the controller, which switches it off if no button is pressed within a configurable time (P.0492). To turn it back on, just press any button (it is advisable to use the **ESC/SHIFT** button which, when alone, does not perform any operation). It is possible to disable automatic shutdown by setting parameter P.0492 to 0.

By using parameter P.0493, it is possible to force the lamp always on when the inverters for the renewable sources are running.

6.4.2 Contrast adjustment

For a correct view of the display, depending on the ambient temperature conditions, the contrast adjustment may be necessary.

Press the **ESC/SHIFT +** ◄ button in sequence to decrease the contrast (lighten), press the **ESC/SHIFT +** ► button to increase the contrast (darken).

6.4.3 Colours scheme

By factory default, the controller shows information on the display using a blue background colour. However, this behaviour can be changed using parameter P.0499:

- P.0499 = 0: blue background.
- P.0499 = 1: black background.
- P.0499 = 2: white background.

The colour of the messages depends on the background colour selected and the type of information displayed.

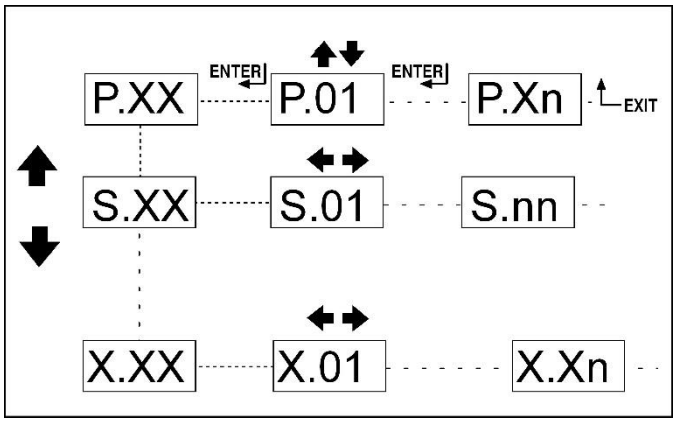
6.4.4 Mode navigation

The display has different viewing modes, each consisting of several pages.

Mode	Description	Page identifier
PROGRAMMING	Programming.	P.XX
PLC	Information on the PLC program.	L.XX
STATES	Status information.	S.XX
MEASURES	Electrical measurements.	M.XX
RENEWABLES	Measurements from the inverters for the renewable sources.	R.XX
PMCB	Pages related to the Can Bus PMCB communication interface	B.XX
HISTORY LOGS	Historical archives	H.XX

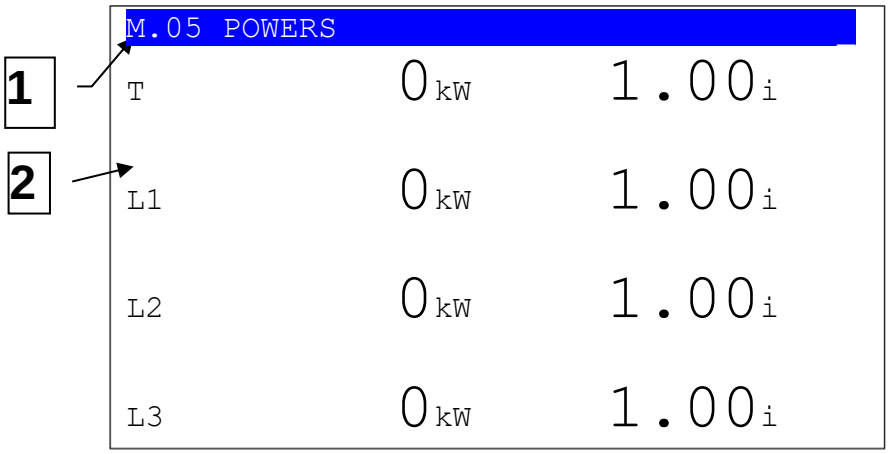
Generally, the navigation between the modes is done using the ▲ and ▼ buttons. To view the pages within a mode, use the ◄ and ► buttons. Some modes are organized in menus (P.XX and H.XX): in these cases, to view the pages, it is necessary to press the **ACK/ENTER** button and then the ▲ and ▼ buttons.

In the event that the ▲ and ▼ buttons are to be used to manage specific functions within a page, the **ACK/ENTER** buttons are required to activate these functions, the **ESC/SHIFT** buttons to deactivate them.



6.4.5 Structure of display areas

LEGEND:
1 – Status bar
2 – Data area



6.4.6 Upper status bar

The upper status bar contains navigation, time and/or some status information.

From left it contains:

- The current mode identifier ("M" in the example ").
- The current page identifier, in the selected mode ("05" in the example ").
- A title ("POWERS" in the example) that briefly describes the content of the page. The title is translated into the language selected by the operator.

The mode identifier, together with the page identifier ("M.05" in the example) allows to refer unambiguously to a page.

The title can be replaced with information relating to the status of the system. You can do it in three ways:

- By holding down the **ESC/SHIFT** button. The title will be shown again when you release the button.

- With a double click of the **ESC/SHIFT** button. The title will be shown again when selecting a new page or a new display mode.
- By activating bit 6 of parameter P.0495. If there are status messages that contain a waiting time (countdown), the controller always displays these messages instead of the title; in case of page change (user manual navigation), the title of the new page will be displayed for two seconds and then return to display the status message requested by the sequence.

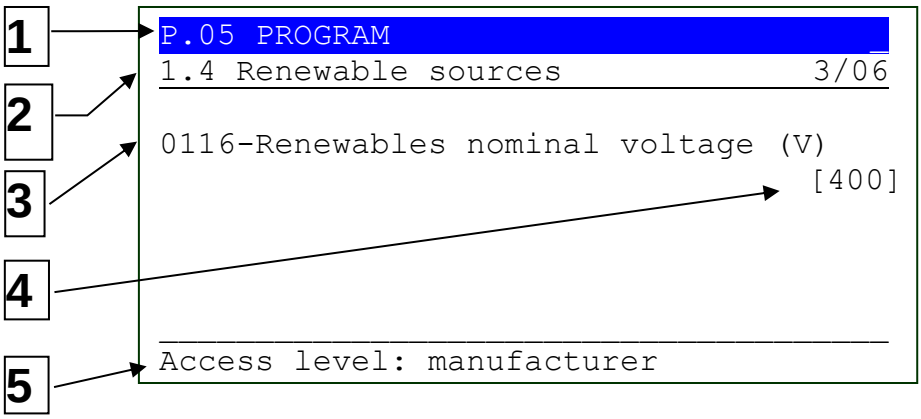
6.5 Display modes

6.5.1 Programming (P.XX)

This mode allows the display and change of the programming parameters.

WARNING! Assigning an incorrect value to one or more parameters can cause malfunctions, damage to things or injury to people. The parameters must only be changed by qualified personnel. Parameters may be password protected (see par. 6.5.1.1).

LEGEND:
1 – Title bar
2 – Current menu
3 – Current parameter
4 – Parameter value
5 – Access level



Each parameter (3) is associated with a 4-digit numeric code ("0116" in the example) which allows to identify it regardless of the language used. The current value of the parameter ("400") is shown in brackets below the description ("Renewables nominal voltage (V)").

The first line below the title bar (2), allows you to identify the current menu by means of a numeric identifier ("1.4") and a language-dependent description ("Renewable sources"). In this row a pair of numbers (“3/06”) is displayed on the right. The first number indicates which menu item is selected, the second indicates how many items are present in the menu.

Pressing **ESC/SHIFT** 

button, the first line (1) is temporarily substituted with a status message.

6.5.1.1 Changing one parameter

Use the ▲ and ▼ buttons to select the programming mode (press them until "PROGRAM" appears on the display). Then press the **ACK/ENTER** button to access the programming menus.

After this operation, the controller will show the last parameter or the last menu used by the operator. If it is not what you want, use:

- The ▲ and ▼ buttons to select a submenu or parameter.
- The **ESC/SHIFT** button to go back to the upper menu.
- The **ACK/ENTER** button to enter a submenu.

When the display shows the parameter to be modified, the current value of the parameter is shown in square brackets, for example "[0400]". If instead it is enclosed in the symbols "<>" (for example "<400>"), it means that you do not have the rights to modify the parameter. This may depend on:

- The device is not in OFF/RESET mode. In fact, most of the parameters can only be changed in this mode.

- The parameter is protected with a password: to modify the parameter, first enter the required password in parameter "0000" (see later).

To modify a parameter, press the **ACK/ENTER** button: the square brackets flash. Use the ▲ and ▼ buttons to change the value and press **ACK/ENTER** to confirm or **ESC/SHIFT** to cancel the change.

To exit the programming menu, press the **ESC/SHIFT** button several times until you return to the main page (which displays the word PROGRAM in the centre).

6.5.1.2 Direct access to the previous page

You can directly access the last programming page displayed. This is possible if, when leaving the programming, instead of going back up the menus to the exit, keep the **ESC/SHIFT** button pressed for about 2 seconds (or change the operating mode from OFF/RESET to MAN or AUTO) .

6.5.1.3 String programming

Some parameters are represented with alphanumeric or hexadecimal strings. In this case, when the **ACK/ENTER** button is pressed, in addition to flashing the square brackets that enclose the value, the controller displays a cursor under the first character of the string.

With the ◄ and ► buttons it is possible to move the cursor under the character to be modified. Subsequently, using the ▲ and ▼ buttons it is possible to modify the selected character. The operation is to be repeated for all the characters to be changed.

Press **ACK/ENTER** to confirm or **ESC/SHIFT** to cancel the change.

6.5.1.4 Access codes

Changing the parameters can be limited by means of four different protection levels, listed in order of priority.

- SICES password.
- MANUFACTURER password.
- INSTALLER password.
- USER password.

If a password is equal to 0, it is considered "unassigned". By default, all passwords are set at "0", except for the password for the SICES level.

Each level of protection allows you to view a subset of the controller's parameters. It also allows you to view the parameters associated with a lower protection level. For example, the INSTALLER can view and modify all the parameters of his own protection level, but also those associated with the USER level. Each level also allows you to change your password and the passwords of the lower levels.

The SICES protection level also allows you to view and modify some critical system configuration parameters. This password is not configurable, but is supplied together with the controller.

If a password is lost, you can reconfigure it by logging in with the higher level password. In case of loss of the "manufacturer" password, contact support.

To modify a password-protected parameter, first enter the required password in parameter "**0000 - Access code**", found in the "**1.1.1 Authentication**" menu. To be able to access it, it is necessary to enter the various menus and submenus following the path "**PROGRAM → 1 SYSTEM → 1.1 Security → 1.1.1 Authentication**". Use the **ESC/SHIFT** button to go back to the upper menu, the **ACK/ENTER** button to enter a submenu.

The access code set remains valid for about 10 minutes from the end of programming. After this period, the access code must be reset to access programming again.

After authenticating with a password, it is possible to modify or reset it in the "**PROGRAM → 1 SYSTEM → 1.1 Security → 1.1.2 Password**" menu

6.5.1.5 Parameters for protections and alarms

The protections and alarms are generally configurable by means of specific parameters. As a rule, the trip time associated with the protection can also be configured.

INFORMATION! By setting the tripping time equal to 0, the protection is disabled.

6.5.2 PLC (L.XX)

Pages L.01 to L.07 contain information related to PLC logic and they are displayed only if a valid PLC program has been downloaded to the controller. Refer to specific manuals for information on the PLC.

6.5.2.1 L.01 PLC.

This page contains the identification information of the PLC program installed in the controller, such as:

- The title and description of the PLC program.
- The date of the last modification.
- The firmware version of PLC, compiler and editor.
- The average and maximum execution time. These times are automatically reset when the PLC program is transmitted to the controller, or it is possible to force the reset by pressing the **ACK/ENTER** + **ESC/SHIFT** buttons simultaneously for 5 seconds).

6.5.2.2 L.02 PLC LOGIC

This page shows information related to a single PLC block.

```
L.02 PLC LOGIC
PLC block:                          [AND-001]
          |                         |
<out>     |DI_VIRTUAL_01            |        0
<in>      |DI_CONTROLLER_01         |        1
<in>      |DI_CONTROLLER_02         |        0
          |                         |
          |                         |
          |                         |
          |                         |
          |                         |
```

The second row (on the right) shows the selected block, with the format "TYPE-NUMBER". To select a block, press the **ACK/ENTER** button, then use the ▲ ▼ buttons to search for the desired block; confirm again with **ACK/ENTER**.

The following rows show all the parameters of the selected block (one row for each parameter):

- The first column identifies the type of parameter used (input / output).

- The second column identifies the resource associated to the parameter. The resources are normally shown with SICES codification (e.g. the digital input 1 is identified as DI_CONTROLLER_01). In the PLC program, it is possible to associate symbols (nicknames) to the resources. It is possible to view the symbols in the second column, in place of SICES codes: press **ACK/ENTER** (as to select a different PLC block) and press ◄►; confirm with **ACK/ENTER** button. See the PLC documentation for the description of the SICES codes for the identification of the PLC resources.
- The third column shows the current value of the resource. For digital resources, if the value is shown in REVERSE, it means that the relative parameter is denied.

6.5.2.3 L.03 VIRTUAL INPUTS

This page shows to status of all virtual digital inputs (that is, those inputs the status of which has not been acquired by the hardware, but is determined by the PLC program).

6.5.2.4 L.04 DIGITAL TEMPORARY

This page shows the status of all temporary digital variables (DT_XXX) available for the PLC program. Many pages which alternate every 2 seconds are available to view all digital flags. Keeping **ESC/SHIFT** pressed, you can stop the rotation of the pages (keeping on the display the page currently viewed).

6.5.2.5 L.05 DIGITAL STATE

This page shows the value of all the internal states of the controller (ST.XXX) available for the PLC program.

6.5.2.6 L.06 VIRTUAL ANALOGUE

This page shows the value of all the virtual analogue inputs of the controller (i.e. those inputs whose value is not acquired by the hardware but is determined by the PLC program).

6.5.2.7 L.07 NUMERICAL TEMPORARY

This page shows the status of all numeric temporary variables (AT_XXX) available for the PLC program. Several pages are available which alternate every 2 seconds to display all the numerical data. Pressing and holding the **ESC/SHIFT** button prevents pages from rotating (keeping the page currently displayed on the display).

6.5.3 Status information (S.XX)

This mode provides information on the system status. The different pages can be scrolled using the horizontal navigation buttons ◄ and ►.

6.5.3.1 S.01 STATO

The **S.01 (STATUS)** page displays system status information. Part of this information is also displayed on the top title bar if you hold down the **ESC/SHIFT** key. It Contains:

- The operating mode of the controller (MAN, AUTO etc.).
- The state (absent / present / in tolerance) of the voltages/frequency of renewable sources.
- The state (absent / present / in tolerance) of the voltages/frequency of common bars.
- The reasons that prevent the closure or force the opening of the RNCB circuit breaker.
- The status of the command sequence of the RNCB circuit breaker
- The reasons prevent starting or which force the inverter to stop.

- The status of the command sequence of the inverters.
- The possible activation of the OVERRIDE of the protections.

For some of this information, a time is also shown; for example, during the stop cycle of the inverters the time remaining at the end of this cycle is shown.

6.5.3.2 S.02 ANOMALIES

This page is automatically displayed in case of a new anomaly. For each anomaly, the following is shown:

- The date/time on which the anomaly was activated.
- A letter identifying its type:
  - "A": alarm.
  - "W": warning.
- A three-digit numeric code that uniquely identifies the anomaly. This code flashes if the anomaly has not yet been recognized with the **ACK/ENTER** button.
- An alphanumeric description, which depends on the language currently selected and which in some cases can be customized using the parameters of the controller.

Each anomaly uses at least two lines of the display. The anomaly shown above is the most recent in chronological order. If there is not enough space to view all the anomalies, only the most recent ones are shown. To see the others, you need:

- Press **ACK/ENTER button.**
- Use ▲▼ buttons to scroll among the anomalies.
- When finished, press the button **ESC/SHIFT**.

6.5.3.3 S.03 CONTROLLER STATUS

This page is dedicated to controller's information and contains:

- The current date and time in extended format (flashing if the clock is not valid, in REVERSE if summer time is active).
- The unique serial number of the controller (ID).
- The codes of the currently loaded software on the controller. If the main software code is displayed in REVERSE it means that a new version has been downloaded and the controllers is waiting to install it: to install it, you must disconnect the power to the controller, wait a few seconds, power it up again and follow the instructions on the display.
- The internal code required to obtain a temporary SICES level password (see **Error! Reference source not found.**).
- The internal temperature of the controller.
- The power supply voltage.
- The language currently used by the device. It is also possible to select a different language: press the **ACK/ENTER** button, select a language with the ▲ and ▼ buttons and confirm with the **ACK/ENTER button**. Note: RN200 is provided as standard only with the languages ENGLISH, ITALIAN. With the BoardPrg3 program it is possible to transfer other languages to the controller.

6.5.3.4 S.04 SERIAL COMMUNICATION

This page displays the communication status on the two serial ports and on the USB interface. In the event of communication problems, check the information on this page.

The status (idle, communication in progress, etc.) and the reception error counter are displayed for each communication interface. To reset an error counter, you need to:

- Press the **ACK/ENTER** button: the controller highlights the error counter of the first communication interface.
- Use ▲ and ▼ to highlight the counter you wish to reset.
- Press **ACK/ENTER** + **ESC/SHIFT** for 5 seconds: at the end the controller resets the counter.
- Press **ESC/SHIFT**.

If an external modem is connected to the controller, the following is also displayed:

- The model of the modem.
- In case of GSM modem:
  - The name of the mobile operator.
  - The level of the GSM signal.

6.5.3.5 S.05 NETWORK

This page is dedicated to the communication status of the Ethernet interface.

La controller shows:

- The connection status:
  - *"Idle"*: cable disconnected from the Ethernet network.
  - *"idle-linked"*: cable connected to the Ethernet network, but no communication in progress.
  - "*Communication in progress"*.
- The MAC address of the physical network interface.
- The name under which the controller registered on the network (if using DHCP).
- The IP address assigned to the controller.
- The address of the router/gateway of the network.
- The subnet-mask of the network.
- The address of the DNS server.
- The number of active "incoming" TCP connections (Modbus TCP slave).
- The number of active "outgoing" TCP connections (Modbus TCP master to inverter).

Some of these values can be set with the controller parameters, or acquired dynamically by the DHCP server.

6.5.3.6 S.07 CANBUS

This page displays the status of the Can Bus interfaces. RN200 has two interfaces. For each interface are displayed:

- The communication status. There are three possible indications:
  - ERROR-ACTIVE: normal operation
  - ERROR-PASSIVE: there are anomalies (errors) but the communication is still working.
  - BUS-OFF: the board has disconnected from the bus due to too many errors.
- The communication error counters. The instantaneous counters of transmission/reception errors and the maximum values reached by them are displayed. It is possible to reset the maximum values (and at the same time force the exit from the BUS-OFF state) by pressing the **ACK/ENTER** and **ESC/SHIFT** buttons simultaneously for 5 seconds. Since there are two CAN interfaces, you must first select the desired CAN interface and then reset the counters: to select an interface press the **ACK/ENTER** key and use the ▲ and ▼ keys.

Internally, RN200 uses a third CAN interface for communication between its microcontrollers. If necessary, the status of the third interface can also be displayed by activating bit 8 of parameter P.0495.

6.5.3.7 S.08-09-10 SYSTEM STATUS

These pages are dedicated to the display of the generic states acquired through the digital inputs, configured with the functions DIF.3201 and DIF.3202 (page 1), DIF.3203 and DIF.3204 (page 2), DIF.3205 and DIF.3206 (page 3).

The page uses one row for each configured input. If more than 9 inputs are configured on each page, the controller displays them all by rotating them (9 at a time) every two seconds: holding the **ESC/SHIFT** button stops rotation. If there are no inputs configured on a page, the page is not displayed.

On each row, the controller shows the text configured for the digital input and the logical status of the input.

If the DIF.3202, DIF.3204 and DIF.3206 functions are used, when the input is activated, the controller forces the display of the relative page.

6.5.3.8 S.11-S12 DIGITAL INPUTS

The page **S.11** displays the status of:

- The digital inputs of the controller.
- The analogue inputs used as digital (dashes are displayed if they are not used as digital inputs).
- Virtual digital inputs.

The page **S.12** is displayed only if DITEL modules have been configured. It displays the status of the digital inputs acquired by the DITEL modules. If a DITEL module does not communicate correctly, the controller displays dashes instead of the state of the inputs.

By pressing the **ACK/ENTER** button, the inputs can be shown in three different ways:

- **LOGICAL STATE**: the controller shows the logic level of the input (active or inactive) used in the management of the operating sequence.

- **PHISICAL STATE**: the controller shows the electrical level (active or inactive, or high or low) actually present on the input; it can be opposite to the corresponding logical state. It is displayed in REVERSE.
- **BY FUNCTION**: the controller shows a list of the functions actually associated with the digital inputs, displaying the logical status (1/0) relating to each function, regardless of the input actually associated with the functions. If more than 8 functions are used for the digital inputs, the controller displays them all by rotating them (8 at a time) every two seconds: holding the **ESC/SHIFT** button stops rotation.

6.5.3.9 S.13-S14 DIGITAL OUTPUTS

The page **S.13** displays the status of the digital outputs of the controller.

The page **S.14** is displayed only if DITEL modules have been configured. It displays the status of the digital outputs of the DITEL modules. If a DITEL module does not communicate correctly, the controller displays dashes instead of the state of the outputs.

By pressing the **ACK/ENTER** button, the inputs can be shown in three different ways:

- **LOGICAL STATE**: the controller shows the logic level of the output (active or inactive) used in the management of the operating sequence.
- **PHISICAL STATE**: the controller shows the electrical level (active or inactive, or high or low) actually present on the output; it can be opposite to the corresponding logical state. It is displayed in REVERSE.
- **BY FUNCTION**: the controller shows a list of the functions actually associated with the digital outputs, displaying the logical status (1/0) relating to each function, regardless of the output actually associated with the functions. If more than 8 functions are used for the digital outputs, the controller displays them all by rotating them (8 at a time) every two seconds: holding the **ESC/SHIFT** button stops rotation.

6.5.3.10 S.15-S.16-S.17 ANALOGUE INPUTS

The page **S.15** displays the electrical value of the analogue inputs of the controllers (connectors JU, JK and JJ), including the emergency stop (EM-S). By pressing the **ACK/ENTER** button you can view the inputs in two different ways:

- **PHISICAL STATE**: the measurement in VDC is displayed for each input.
- **PER FUNZIONE**: the controller shows a list of the functions actually associated with the analogue inputs, displaying the relative value acquired in VDC, regardless of the input actually associated with the functions. If more than 8 functions are used for the analogue inputs, the controller displays them all by rotating them (8 at a time) every two seconds: holding the **ESC/SHIFT** button stops rotation.

The page **S.16** is displayed only if DITHERM or DIGRIN modules have been configured. In the left part it shows the type of module actually connected (DIGRIN, DITHERM or "DITEMP" if the module does not communicate correctly). On the right side it shows the temperatures acquired by the modules. They can be replaced by:

- "------": if the expansion module does not transmit the measurement.
- "OPEN": if the expansion module signals that the sensor is disconnected.
- "+OVER": if the module signals that the input signal is too high, a symptom of a fault.
- "-OVER": if the module signals that the input signal has a too low value, a symptom of a fault.

The page **S.17** is displayed only if DIVIT modules have been configured. On the right side it shows the measurements acquired by the modules (without any conversion). They can be replaced by:

- "------": if the expansion module does not transmit the measurement.
- "OPEN": if the expansion module signals that the sensor is disconnected.
- "+OVER": if the module signals that the input signal is too high, a symptom of a fault.
- "-OVER": if the module signals that the input signal has a too low value, a symptom of a fault.

6.5.3.11 S.18-S19 ANALOGUE OUTPUTS

The page **S.18** normally shows the percentage value currently associated with the two analogue outputs of the controller. Pressing the **ACK/ENTER** button, the controller shows the outputs by function: the controller shows a list of the functions actually associated with the analogue outputs, displaying the analogue value for each function, regardless of the output actually associated with the functions. If more than 8 functions are used for the analogue outputs, the controller displays them all by rotating them (8 at a time) every two seconds: holding down the **ESC/SHIFT** key stops rotation.

The page **S.19** is displayed only if DANOUT modules have been configured. It shows the percentage value currently associated with the four analogue outputs of each DANOUT module (the real corresponding electrical measurement depends on the configuration made within the DANOUT module). The values are displayed in REVERSE if the DANOUT module is not communicating correctly.

6.5.3.12 S.20 SHARED DIGITAL INPUTS

This page **S.20** displays the status of the controller's shared digital inputs They are displayed in groups of 16 inputs and only those used (by the controller or received via PMCB).

6.5.3.13 S.21 SHARED ANALOGUE INPUTS

This page **S.21** displays the status of the controller's shared analogue inputs. Only those used (by the controller or received via PMCB) are displayed.

6.5.4 Electrical measures (M.XX)

In this mode, the measurements made by the controller on the electrical lines are fully displayed. The different pages can be scrolled using the horizontal navigation buttons ◄ and ►.

Under some electrical measures, the controller also displays a bar showing graphically the value measured compared to the rated power: on the bar are also one or more notches representing the eventual thresholds. The colour with which the band is filled is green if the measure is in tolerance, yellow if the measure is out of tolerance.

6.5.4.1 M.01 SYSTEM

It shows the layout of the system in a single-line format, highlighting:

- Renewable sources, generators, utilities, mains and any storage system.
- The RNCB, GCB (cumulative), MGCB and MCB circuit breakers.
- The power flows, displayed with arrows in the various parts of the plant.
- The measurement of active and reactive power in the various parts of the plant.

This page is automatically adapted to the real conditions of the system. For example, the mains and the MCB circuit breaker are automatically hidden if there are no MC200 controllers connected via Can Bus PMCB.

6.5.4.2 M.02 RENEWABLE SOURCES

This page displays the voltages, frequency and phase's sequence of the renewable sources. The information really displayed depends on the configuration:

- Three-phase system (P.0119=3) with neutral connected to the controller (P.0129=1). The controller displays the three L-L voltages, the frequency, the phases sequence and the neutral-B- voltage. By pressing the **ACK/ENTER** button, the L-N voltages are displayed instead of the L-L voltages (press **ACK/ENTER** again to return to the L-L)
- Three-phase system (P.0119=3) without neutral (P.0129=0). The controller displays the three L-L voltages, the frequency, the phase's sequence.
- Single phase system (P.0119=1). The controller displays the L-N voltage, frequency and neutral-B- voltage.

At the bottom right, an icon for the RENEWABLE SOURCES is shown, allowing you to immediately detect which is the source of the shown measurements.

6.5.4.3 M.03 BUSBARS

This page displays the voltages, frequency and phase's sequence of the common bars. The information really displayed depends on the configuration:

- Three-phase system (P.0101=3) with neutral connected to the controller (P.0128=1). The controller displays the three L-L voltages, the frequency, the phases sequence and the neutral-B- voltage. By pressing the **ACK/ENTER** button, the L-N voltages are displayed instead of the L-L voltages (press **ACK/ENTER** again to return to the L-L)
- Three-phase system (P.0101=3) without neutral (P.0128=0). The controller displays the three L-L voltages, the frequency, the phase's sequence.
- Single phase system (P.0101=1). The controller displays the L-N voltage, frequency and neutral-B- voltage.

At the bottom right, an icon for the COMMON BARS is shown, allowing you to immediately detect which is the source of the shown measurements.

6.5.4.4 M.04 CURRENTS

This window displays the phase currents (one or three) measured by the controller. The symbol of the RENEWABLE SOURCES or of the LOADS is displayed at the bottom right in order to identify the real source.

For three-phase systems, the negative sequence current is also displayed.

If the fourth current is properly configured, the controller also displays:

- **Ax**: auxiliary current (visible if P.0131=1 or P.0131=4).
- **An**: neutral current (visible if P.0131=2).

6.5.4.5 M.05 POWERS

This page shows the active powers (kW), the power factors and the load types for the single phases and total (for single-phase systems, the information relating to phases 2 and 3 are replaced by dashes). Normally the powers are displayed in kW, they automatically switch to MW if 4 digits are exceeded

The symbol of the RENEWABLE SOURCES or LOADS is shown at the bottom right in order to identify the real source.

6.5.4.6 M.06 POWERS

This page shows the reactive (kvar) and apparent (kVA) powers, on the single phases and total (for single-phase systems, the information relating to phases 2 and 3 are replaced by dashes). Normally the powers are displayed in kvar and kVA, they automatically switch to Mvar and MVA if 4 digits are exceeded

The symbol of the RENEWABLE SOURCES or LOADS is shown at the bottom right in order to identify the real source.

6.5.4.7 M.07 ENERGY METERS

This page shows the meters for exported energy (produced) from the renewable sources (active and reactive, partial and total meters).

Partial counters can be reset individually from this page. To do this you need to:

- Press the **ACK/ENTER** button: one of the counters will be highlighted.
- Use the vertical scroll buttons ▲ and ▼ to select the counter you wish to reset.
- Press the **ACK/ENTER** and **ESC/SHIFT** buttons for five seconds.
- Press the **ESC/SHIFT** button.

These counters are protected with the password configured with parameter P.0001 (protection level: user). If a password has been configured in P.0001, in order to reset the counters, you must first enter it (login) in parameter P.0000 ("access code").

6.5.4.8 M.08-09-10 EXTERNAL MEASURES

These pages are dedicated to displaying the measurements acquired by the analogue inputs configured as a "generic sensor". The operator has the right to acquire measures that are in no way related to the functioning of the controller, and to view them on the display. It can also group them (with any criteria), displaying them on one of the three available pages.

The subdivision of the measurements on the different pages is done through the function configured in the analogue inputs:

- AIF.2001: page M.08.
- AIF.2003: page M.09.
- AIF.2005: page M.10.

The controller shows one measurement per line: it shows the text configured for the analogue input (P.4002 for analogue input 1), followed by the measurement. If more than 9 measurements are associated with one of these pages, the controller shows them all, rotating them on the display every two seconds: press and hold the **ESC/SHIFT** button to stop the rotation on the current display.

6.5.5 Renewable sources (R.XX)

This mode displays all the information relating to the management of the inverters for the renewable sources. The different pages can be scrolled using the horizontal navigation buttons ◄ and ►.

6.5.5.1 R.01 COMM. WITH INVERTERS

It shows the status of the communication to the configured inverters. It uses one display line for each inverter. If more than 8 inverters are configured, the controller shows them all, rotating them on the display every two seconds: keep the **ESC/SHIFT** button pressed to stop the rotation on the current display.

For each inverter it shows:

- Its numeric ID (2 digits).
- When the communication is in progress:
  - Counter of messages correctly exchanged with the inverter.
  - Communication errors counter.
  - Cyclically:
    - The IP address of the inverter (only if connected via Ethernet).
    - The inverter manufacturer
    - The inverter model
    - Some options read by the inverter.
- When the communication is not in progress:
  - It shows the status (port opening, address acquisition etc.).

The communication counters can be reset (all together) by holding down the **ACK/ENTER** and **ESC/SHIFT** buttons for 5 seconds:

6.5.5.2 R.02 kW INVERTER

It shows information regarding the active power for the configured inverters. It uses one display line for each inverter. If more than 7 inverters are configured, the controller shows them all, rotating them on the display every two seconds: keep the **ESC/SHIFT** button pressed to stop the rotation on the current display. If some measures are not available, they are displayed with dashes.

The upper part contains the total information (sum of all inverters). This information is always present, even if the communication with the inverters is set in BROADCAST mode. It contains:

- The total rated active power of the running inverters (W).
- The total active power supplied by the inverters (W and %).
- The total active power setpoint (W and %).

The following lines are related to the individual inverters. The specific information of an inverter is available only if the communication is set in NON-BROADCAST mode. For each inverter it shows:

- Its numeric ID (2 digits).
- The rated active power (W).
- The active power supplied (W and %).
- The active power setpoint (W).

The information of an inverter is shown in red if the inverter signals a serious anomaly, in yellow if it signals a warning.

The active power setpoints (both the total and that of the individual inverters) are displayed with dashes if at that moment the inverter is unable to supply the required active power (i.e. it is producing the maximum possible, which, based on the environmental conditions, it is lower than the required setpoint). So, the dashes indicate that no active power limitation is active on the inverter.

6.5.5.3 R.03 kvar INVERTER

It shows information regarding the reactive power for the configured inverters. It uses one display line for each inverter. If more than 7 inverters are configured, the controller shows them all, rotating them

on the display every two seconds: keep the **ESC/SHIFT** button pressed to stop the rotation on the current display. If some measures are not available, they are displayed with dashes.

The upper part contains the total information (sum of all inverters). This information is always present, even if the communication with the inverters is set in BROADCAST mode. It contains:

- The total nominal reactive power of the running inverters (var). The nominal of quadrant 1 is shown if the total reactive is positive, otherwise the nominal of quadrant 4.
- The total reactive power supplied by the inverters (var and %).
- The total reactive power setpoint (var and %).

The following lines are related to the individual inverters. The specific information of an inverter is available only if the communication is set in NON-BROADCAST mode. For each inverter it shows:

- Its numeric ID (2 digits).
- The nominal reactive power (var). The nominal of quadrant 1 is shown if the reactive power supplied by him is positive, otherwise the nominal of quadrant 4.
- The reactive power supplied (var and %).
- The reactive power setpoint (var).

The information of an inverter is shown in red if the inverter signals a serious anomaly, in yellow if it signals a warning.

The reactive power setpoints (both the total and that of the individual inverters) are displayed with dashes if at that moment the inverter is unable to supply the required reactive power (i.e. it is producing the maximum possible, which, based on the environmental conditions, it is lower than the set point). So, the dashes indicate that no reactive power limitation is active on the inverter.

6.5.5.4 R.04 INVERTER DETAILS

It shows in detail all the information about an inverter. In the upper part it is possible to select the desired inverter: press **ACK/ENTER**, use ▲ and ▼ to select the inverter, confirm with **ACK/ENTER**.

If the communication is set in NON-BROADCAST mode, much of the following information is read directly by the inverters. Otherwise, as far as possible, operator configurations are shown. The information shown is:

- The inverter manufacturer.
- The inverter model.
- Some specific inverter options.
- The presence and status of the grid relay inside the inverter that connects the voltage generated to the external terminals.
- The active (W), reactive (var) and apparent (VA) powers supplied by the inverter.
- The nominal powers of the inverter: active (W), apparent (VA), reactive quadrant 1 (var), reactive quadrant 4 (var).
- The active (W) and reactive (var) power setpoints. They are displayed with dashes if at that moment the inverter is not able to supply the required powers (i.e. it is producing the maximum possible, which, based on the environmental conditions, is lower than the expected setpoint). Therefore, the dashes indicate that no power limitation is active on the inverter.

6.5.6 Measurements from Can Bus PMCB (B.XX)

In this mode, the measurements and states acquired by the Can Bus PMCB, which connects all the SICES controllers, are displayed in a complete way.

6.5.6.1 B.01 DEVICES ON PMCB

This page shows the list of the controllers recognized on the Can Bus PMCB. It is useful for diagnostic purposes. For each controller, it shows its unique address.

The screen is organized into four bands, placed one above the other:

- MC (mains controllers).
- GC and DST (genset controllers).
- BTB (bus tie breaker controllers).
- RN (renewable sources controllers).

For each band, it shows the list of addresses of the relative controllers that communicate on PMCB. Therefore, some bands can also be empty.

6.5.6.2 B.02 GENERATORS

This page shows the significant data of each GC (genset controller) that communicates over the PMCB can bus. It uses one display line for each GC. If there are more than 7 GC, it shows them all, rotating them on the display every two seconds: press and hold the **ESC/SHIFT** button to stop the rotation on the current display. If some measures are not available, they are displayed with dashes.

The page is hidden if there are no GC controllers.

The upper part contains the total information (sum of all GC controllers). It is shown only if there are at least two GC controllers. It contains:

- The total rated active power of the running generators (kW).
- The total active power supplied by the generators (kW).
- The total reactive power supplied by the generators (kvar).

The following lines are related to the individual generators. For each generator it shows:

- Its address on PMCB (2 digits).
- Its rated active power (kW).
- The supplied active power (kW).
- The supplied reactive power (kvar).
- The engine operating hours.

6.5.6.3 B.03 MAINS

This page shows the significant data of each MC (mains controller) that communicates over the PMCB can bus. It uses one display line for each MC. If there are more than 7 MC, it shows them all, rotating them on the display every two seconds: press and hold the **ESC/SHIFT** button to stop the rotation on the current display. If some measures are not available, they are displayed with dashes.

The page is hidden if there are no MC controllers.

The upper part contains the total information (sum of all MC controllers). It is shown only if there are at least two MC controllers. It contains:

- The total active power imported or exported (kW).
- The total reactive power imported or exported (kvar).

The following lines are related to the single MC controller. For each MC it shows:

- Its address on PMCB (2 digits).
- The imported or exported active power (kW).
- The imported or exported reactive power (kvar).

6.5.6.4 B.04 RENEWABLES

This page shows the significant data of each RN (renewables controller) that communicates over the PMCB can bus. It uses one display line for each RN. If there are more than 7 RN, it shows them all, rotating them on the display every two seconds: press and hold the **ESC/SHIFT** button to stop the rotation on the current display. If some measures are not available, they are displayed with dashes.

The page is hidden if there are no RN controllers.

The upper part contains the total information (sum of all RN controllers). It is shown only if there are at least two RN controllers. It contains:

- The total active power supplied (kW and %).
- The total reactive power imported or exported (kvar and %).

The following lines are related to the single RN controller. For each RN it shows:

- Its address on PMCB (2 digits).
- The active power generated (kW and %). The measurement is followed by a "*" if the RN controller is limiting the active power production of its inverters.
- The imported or exported reactive power (kvar and %). The measurement is followed by a "*" f the RN controller is limiting the reactive power production of its inverters.

6.5.7 History logs (H.XX)

During operation, except in the OFF/RESET mode, the controller makes periodic or “on event” recordings, partially configurable with the programming parameters.

Four types of registrations are managed:

1. Event recordings.
2. Periodic registrations.
3. Recordings of peaks.
4. Diagnostic codes (DTC) of external devices (inverters).

The historical archives are accessible in any operating state of the controller. To enter the archives view, use the ▲ and ▼ buttons until the basic page of the HISTORY LOGS (H.01) is displayed.

Then press **ACK/ENTER** to view the list of archives.

Using the ▲ and ▼ buttons, select the desired historical archive. Then press the **ACK/ENTER** button to access it.

Using the ▲ and ▼ buttons, you can scroll through the different records in the archive. Each record is identified by a number and by the date and time of storage. The number is shown in the first line on the multifunctional display together with the total number of records and the maximum capacity of the archive.

Each recording can use multiple pages to show all the data (depends on the type of recording): in these cases use the ◄ and ► buttons to move between and various pages.

If the controller is in OFF/RESET mode, it is possible to "empty" the displayed archive by holding the **ACK/ENTER** and **ESC/SHIFT** buttons simultaneously for five seconds. **Attention: the operation is irreversible, a deleted archive cannot be recovered.**

Press the **ESC/SHIFT** button to return to the list of archives or to exit the historical archives view.

7 Operating principles

7.1 Connection to inverters

RN200 is able to exchange data with the inverters for the renewable sources, using the Modbus protocol. This is a binding limit: the inverter must implement this protocol.

RN200 can acquire the following measurements from inverters:

- Manufacturer, model, options.
- Nominal powers (apparent, active, and reactive in quadrants Q1 and Q4).
- Supplied powers (apparent, active, and reactive).
- Status of the grid relay (started/stopped).
- Diagnostics.

It can send the following commands:

- Start/stop.
- Limitation of the supplied active power.
- Setpoint for the supplied reactive power
- Anomaly reset.

The inverters can be connected to the RN200 with three different communication interfaces:

- The RS232 serial port (JA, Modbus RTU).
- The RS485 serial port (JW, Modbus RTU).
- The ETHERNET port (JY, Modbus TCP).

We recommend using the ETHERNET interface whenever possible, because it guarantees the best performance.

For the configuration of the communication ports and for selecting the type of inverter, refer to the technical manual.

Before proceeding with any type of command, both manual and automatic, check on the "R.XX" pages of the controller that communication with the inverters is working properly.

7.2 Operation modes

Four operating modes can be used by the controller:

- **OFF_RESET:** the inverters for the renewable sources are stopped (or in the shutdown phase), the anomalies are all cancelled and programming can be accessed to modify the parameters. The RNCB circuit breaker is open to insulate the inverters from the common bars.
- **MAN**: the start and stop of the inverters for the renewable sources, and the management of the RNCB circuit breaker (if present) are the responsibility of the operator (the controller does not automatically perform these operations): since the protections are activated, however, the controller can automatically open RNCB and/or stop the inverters if necessary. Access to programming is allowed, but only some parameters can be changed.

- **AUTO:** the start and stop of the inverters for the renewable sources, and the management of the RNCB circuit breaker (if present) are the responsibility of the controller (the operator cannot intervene). All protections are enabled. Access to programming is allowed, but only some parameters can be changed.
- **REMOTE START**: this mode of operation is almost identical to the AUTO. It differs only in the fact that the inverters are in any case started (automatically) even in the presence of start inhibitions; the controller automatically closes the RNCB circuit breaker (obviously if the system allows the connection of renewable sources). This mode has priority over AUTO (once REMOTE START is activated, any requests for automatic intervention are ignored). The operator does not have the right to manually operate the RNCB circuit breaker. Access to programming is allowed, but only some parameters can be changed.

The operating mode can be selected in three different ways:

- Using the "**MODE UP**" and "**MODE DOWN**" buttons on the controller. The buttons must be pressed consecutively for at least half a second to force the change of mode. The buttons are disabled (a flashing key icon is shown on the first line of the display) if at least one of the inputs described in the following point exists and is active.
- Using one or more digital inputs properly configured.
- By sending Modbus commands through the communication interfaces.

To activate the "**REMOTE START"** mode, instead, the controller must first be in AUTO. You can switch to REMOTE START in these ways:

- By configuring a digital input on the controller. If this input is active, the controller switches to REMOTE START, when deactivated it returns to AUTO.
- Through a suitable command via. In this case the controller switches to REMOTE START as soon as it receives the SMS, and returns to AUTO when it receives the opposite command.
- Using parameters P.0426, P.0427 and P.0428 it is possible to define weekly time bands in which the controller automatically switches to REMOTE START mode.
- By sending Modbus commands through the communication interfaces. The controller switches to REMOTE START as soon as it receives the command, returns to AUTO when it receives the opposite one (remains in REMOTE START if the serial connection is interrupted before receiving the opposite command).

7.3 Manual commands

7.3.1 RNCB circuit breaker

The operator can act on the RNCB button to control the manual opening or closing of the relative circuit breaker, but **only if** the controller is in the MAN operating mode. The button acts as a closing command if the circuit breaker is open, as an opening command if it is closed.

As an alternative to the button, the controller also accepts to use:

- Digital inputs: only one input can be used which, like the button, acts both as a closing and an opening command; alternatively, two inputs can be used, one for the opening command and one for the closing command.
- Commands through the communication ports (two separate commands are provided for closing and opening).

Note: in MAN RN200 it will never automatically close the switch; however, it can open it, because its protections are also active in this operating mode.

7.3.1.1 Opening

You can always open the circuit breaker.

When the operator presses the RNCB button, the controller always tries to open the circuit breaker without load. Therefore, it tries to transfer the power from the inverters to the generators (or to the mains) before opening the circuit breaker. If you want to open the RNCB circuit breaker immediately (without waiting for the load transfer), just hold the button down for at least 1 second.

If the button is pressed again while the controller is transferring the load to the generators or to the mains, the previous opening command is simply cancelled.

7.3.1.2 Closing

The circuit breaker can be closed only if the following conditions are all verified:

- There are no blocks.
- The voltages and the frequency of the common bars are within tolerance for an appropriate time. **In fact, closing of the circuit-breaker with voltages on the bars out of tolerance is never allowed**.
- If no generator is in a "GCB not open" condition (or if this function is disabled).

If the conditions are verified, the controller commands the closure of RNCB as soon as the operator presses the button. **Note: in this phase the inverters are stopped, because they cannot be started if there is no voltage on the connection point (mains or generators).**

7.3.2 Inverter

The operator can use the START and STOP buttons to control the manual start or stop of the inverters, but **only if** the controller is in the MAN operating mode.

As an alternative to the button, the controller also accepts to use:

- Commands through the communication ports (two separate commands are provided for starting and stopping).

Note: in MAN RN200 it will never automatically start the inverters; however, it can stop them, because its protections are also active in this operating mode.

7.3.2.1 Stopping

Inverters can always be stopped.

When the operator presses the STOP button, the controller always tries to stop the inverters without load. It then tries to transfer the power from the inverters to the generators (or to the mains) before stopping them. If you want to stop the inverters immediately (without waiting for the load transfer), just press the STOP button again.

If the START button is pressed while the controller is transferring the load to the generators or to the mains, the previous stop command is simply cancelled.

7.3.2.2 Starting

Inverters can **only** be started if the following conditions are all verified:

- There are no blocks.

- The RNCB circuit breaker is closed (or does not exist). **In fact, the inverters can only produce power in parallel to another source, which does not happen if RNCB is open**.
- The voltages and the frequency of the common bars are within tolerance for an appropriate time. **In fact, closing of the circuit-breaker with voltages on the bars out of tolerance is never allowed**.

If the conditions are verified, the controller commands the start-up of the inverters as soon as the operator presses the START button.

7.4 Most important parameters

7.4.1 Minimum power for generators

In order to keep the generators efficient and reduce periodic maintenance, RN200 is able to limit the power supplied by the inverters (if needed), to keep the generators at an adequate power level. This function is configured with parameter P.9811 ("Minimum power for generators", menu 2.2). It is a percentage value. It is applied to the nominal power of all the running generators.

To set this parameter, refer to the documentation of the generating sets. Set a value that does not penalize too much the penetration of renewable sources, but at the same time allows long-term operation of the generators without excessive wear.

7.4.2 Spinning reserve for generators

Renewable sources are not considered stable and safe sources. Their production capacity is influenced by external factors (clouds, wind etc.). For this reason, they are never used alone, but always in combination with other sources of energy (generators, mains, accumulators), which can integrate their production if it is not sufficient.

The production of a renewable source can also drop very quickly (for example in the case of a cloud that covers the photovoltaic panels). In these situations, there is no physical time to start up new generators to supply the loads: there is a risk of overloading the running generators and inverters, and therefore generating a black-out.

The concept of SPINNING RESERVE does this. It is basically a "power reserve" that must be guaranteed by the generators: they, as a whole, must be able to supply a further amount of active and reactive power (in addition to what they are already supplying), just as backup for sudden decreases in renewable sources.

The difficulty is to estimate the maximum drop that the renewable sources can suffer. Theoretically, they could go from maximum production to zero power in a matter of seconds. However, it is not possible to maintain a power reserve on the generators to support a total loss of renewable sources: it would mean keeping all the generators running at all times. This would be uneconomical from the point of view of fuel, but also from the point of view of the use of the renewables, which should necessarily be limited to maintain a minimum power level on the generators.

RN200 provides two parameters, which allow the operator to set a SPINNING RESERVE for the generators in two different situations:

- P.9821: used when generators and renewable sources operate in island mode.
- P.9822: used when generators and renewable sources operate in parallel to the mains.

Normally P.9822 can be set to a value lower than P.9821, because the mains should always be able to transiently supply the power "lost" from renewable sources (waiting for the start of the generators). In the reality, there may be limitations related to the power of the mains transformer.

Both parameters are expressed as a percentage of the active power supplied by renewable sources. For example, if you set P.9821 to 50%, it means estimating that, in the worst situation, renewable sources can halve their production (in the time required to start up new generators).

The choice of value for these parameters should be the consequence of a long-term observation of the production of renewable sources in the plant. Only in this way is it possible to find the lowest possible value that still keeps the system safe.

8 Special setting

8.1 Selecting the language

The controller has the possibility to display the texts in different languages.

To select a language other than the current one, go to the "S.03 CONTROLLER" screen using the ▲ ▼ and ◄ ► buttons. To change the language, press the **ACK/ENTER** button: the square brackets [] become flashing. Use the ▲ and ▼ buttons to select the desired language and press **ACK/ENTER** to confirm or **ESC/SHIFT** to cancel the change.

8.2 Date/time setting

The controller includes a clock/calendar used mainly for the functions:

- Weekly working time of the inverters.
- Recording of events with date and time in historical archives.

The setting of the date/time is possible in all operating modes. To update the time and/or date of the controller, access the programming menu "4.7.1 Date - Time" (see chapter 6.5.1). The complete path is "**PROGRAM → 4 AUXILIARY FUNCTIONS → 4.7 Device → 4.7.1 Date-Time**".

The controller provides 6 parameters that allow you to change the year, month, day of the month, hours, minutes and seconds respectively. Follow the instructions contained in chapter 6.5.1 to modify the parameters.

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