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Remote Terminal Unit Configuration and Application Program Interface specifications

This document describes UP 2015, the Remote Terminal Unit for telecontrol and supervision of Medium Voltage distribution network; it provides functional and construction requirements for the provision.

Countries' I&N – NT/RCP	Elaborated by	Verified by	Approved by
Argentina			-
Brazil			Victor Manuel Galvao Macedo Costa
Chile			Hans Christian Rother Salazar
Colombia			Cesar Augusto Rincon Alvarez
Iberia			Maria Avery Fernandez
Italy			Lilia Consiglio
Peru			Roberto Leonidas Sanchez Vargas
Romania			Marius Mihai Domnicu

	Elaborated by	Verified by	Approved by
Global I&N – NT/RCP	Di Lembo/Consiglio	Maria Avery Fernandez Calero Aparicio José Luis	Giorgio Di Lembo

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1 ACRONYMS

OP	Open/Opening
CL	Closed/Closing
RCP	Reclosing Cycle in Progress
DP	Double Point
DFPI	Directional Fault Passage Indicator
DTR	Data Terminal Ready, i.e. a control signal in RS-232 serial communications, transmitted from DTE.
DTE	Data Terminal Equipment
FPI	Fault Passage Indicator
FW	Firmware
LVCB	Low Voltage Circuit Breaker
NA	Normally-open(referred to a contact)
NA	Non-Applicable
NC	Normally Closed
NE	Non-Editable
SG	Switchgear
PC	Personal Computer
FCI	Fault-Current Indicator
RTU	Remote Terminal Unit
LVI	AC LINE VOLTAGE INDICATOR
SD	Switch Disconnecter
SP	Single Point
SW	Software
RC	Remote Control
TM	Telemeasuring/Telemeasurement
STM	Spare Telemeasuring
RS	Remote Signalling-Remote Signal
SRS	Spare Remote Signalling - Spare Remote Signal
RTU	Remote Terminal Unit
SSCB	MV Secondary Substation Circuit Breaker without protection equipment

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2 OBJECT AND SCOPE

The Remote Terminal Unit Peripheral units (RTU) for the remote control of the secondary substations are configurable either locally or remotely. This is performed through transmission of a binary structured file. This document explains the user interface, and the software requirements for the local configuration of the RTU, the structure of the configuration file, and the overall list of parameters configurable either locally or remotely (from the Center).

3 STRUCTURE OF THE CONFIGURATION FILE

The configuration file is binary. The structure is made up of a presentation header, followed by the individual structured item containing a header which identifies the single parameter of the RTU, and the value to be set. The order which the individual item is sent is unimportant. The RTU must verify the consistency of the information contained in the files received before applying the configuration and respond with a specific error code.

Table 1 and Table 2 describe the structure of the file header:

Presentation header		
Length [byte]	Denomination	Description
2	protocol	Protocol identifier
2	source	Sender identifier
2	destination	Receiver identifier
2	Item Num	Number of following Items

Table 1– Structure of the file header

Item header		
Length [byte]	Denomination	Description
2	Item ID	Parameter identifier (see the ItemID column of the excel file)
1	code	Additional encoding of the parameter (see the ItemID column of the excel file)
1	size	Size of the structure of the specific ITEM (including the item header)

Table 2– Structure of the header common to all items

The different types of item utilized for the configuration of the parameters are shown in Table 3.

ItemType	Data Type	Length [byte]	Description
Time Item	Struct header	4	Tab. 2
	UInt32	4	Time [ms]



Bool Item	Struct header	4	Tab. 2
	UInt8	1	It extracts the values which are indicated in the excel file: 0=FALSE; 1=TRUE; for booleans.
Short Item	Struct header	4	Tab. 2
	UInt16	2	It extracts the values which are indicated in the excel file.
Long Item	Struct header	4	Tab. 2
	UInt32	4	It extracts the values which are indicated in the excel file.
String Item	Struct header	4	Tab. 2
	Array[32] of UInt8	32	String
Long String Item	Struct header	4	Tab. 2
	Array[128] of UInt8	128	String

Table 3– Structure of the different types of items.

The configuration file can be sent to the RTU either locally, via the USB port (utilizing the software described in the following paragraphs), or remotely (utilizing the file transfer procedure provided in the IEC 60870-5-101/104 protocols).




In the latter option, three types of files are provided, as a function of the subgroup of parameters to be sent, as summarized in Table 4:

ID	FILE NAME (IEC protocol)	
1	RTU_CONFIG_FILE_2008=5	Full hardware configuration
2	AUTOMATION_CONFIG_FILE_2008=6	Full automation configuration
3	RTU_UPD_CONFIG_FILE_2008=7	Update of: <ul style="list-style-type: none"> • RECALL_TIME • MAX_RECALL • SYNC_VALID_TIME • SEL_TO_EXEC_TIME • EV_BUFFER_THRESHOLD • TREND_THRESHOLD_1 • TREND_THRESHOLD_2 • SPONT_DIAG_TRANSMISSION • PLANT_ALARM_TIME • DOOR_ALARM_TIME • OPEN_IMS_TRANSF_TIME • DAYLIGHT_DESC • CENTR_STAT_PHONE_NUM • CENTR_STAT_PHONE_I_NUM • CENTR_STAT_PHONE_II_NUM • CENTR_STAT_PHONE_POLICY

Table 4 Files to be transferred to the RTU in the case of remote configuration

All of the programmable parameters of the RTU, related to files with an ID equal to 1 and 3, must be stored onto non-volatile memory. The parameters related to the automatism for the faulty branch selection (files with an ID equal to 2) must be programmed on the RTU remotely only (from the Center) and must be stored onto a volatile memory. After transmitting the configuration file of an ID equal to 1, the RTU must be restarted.

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4 LIST OF CONFIGURABLE PARAMETERS ON THE RTU

The operation of the Configuration of the RTU represents the data-entry phase of the programmable parameters of the apparatus.

The data specifying the characteristics and modes of functioning must be provided to the RTU, in order to embed the RTU itself into a system, which includes the communication network for the connection between the Center and the apparatus.

Datasheets must be provided in order to allow the user to perform data entry, as detailed in the successive chapters.

The configuration of the RTU is constituted by a series of parameters uniquely determined by the couple (itemid; code) described in the structure of Table 2, in the previous paragraph.


For a full list of the configuration parameters, see the “GSTR001_1_A2.xlsx” Excel file in the appendix of the GSTR001/1 specification.

The GSTR001_1_ANNEX2.xlsx” Excel file (see excerpt in Table 5) describes all of the configurable parameters of the RTU, and provides the indications needed to characterize the items which are structured according to the descriptions made available in the above Table 2 and Table 3.

The columns ITEM_ID, CODE and TYPE characterize the parameter indicated in the column entitled “Field Name”, according to the data structures of the configuration file previously described. The columns CC and CL indicate the reading and writing properties of the parameter, from the Center and the local configurator respectively. The column “Dependency” indicates the connection with the settings of other configuration parameters (i.e. the column provides either the existence or the absence of the parameter according to the related hardware typology) The columns I.V. and P.V. indicate the default and the settable values of the parameter, respectively.

ITEM_ID	CODE	Type	CC	CL	MEM	Field Name	Dependency	I.V.	P.V.	Description
i_DEF_TIPO_UE_HW=102	RTU_GENERAL=100	BOOL_ITEM	R	R	ROM	HW UE	HW Equipment	NA	NA	It indicates the type of hardware and cannot be modified
i_DEF_TIPO_UE=101	RTU_GENERAL=100	BOOL_ITEM	RW	RW	ROM	UE Type	HW Equipment		UE8 / UE16	UE typology (standard, extended)
i_LANGUAGE=300	RTU_GENERAL=100	BOOL_ITEM	R	RW	ROM	Language	None	EN	EN, IT, ES, PT	It allows for the selection of either the language of the RTU interface or of the default values

Table 5– Excerpt of the file “GSTR001_1_A2.xls

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5 SOFTWARE FOR LOCAL CONFIGURATION

This documentation describes the Application Program Interface specifications of the software for the configuration of the remote terminal unit - RTU. Nonetheless, the RTU must also be configurable from the Center.

The configuration program must operate on a personal computer containing Windows 7 O.S., and must create the Basic Configuration of the RTU (i.e. the configuration that allows the device to work and properly manage the controlled field and the communication with the Center). On the contrary, this application doesn't allow to program the local automatism to be programmed, this being a concern of the Center only.

The data base which represents the basic configuration of the RTU apparatus must be generated, tested, and loaded onto the non-volatile memory of the Processing Unit (UE) of the RTU, using the notebook or tablet PC onto which the configuration program is installed. The data base upload must be executed through the USB port for which the UE is especially equipped.

By way of example but not limited thereto, this document describes:

- ◇ the Windows operator user interface and the modes of program use, especially by means of the mouse and the visual tools;
- ◇ the Tabs for the insertion of the data useful for the RTU customization;
- ◇ the checks carried out on the data entered, in order to ensure the accuracy of the generated configuration;
- ◇ the printing procedures of the stored configuration data;
- ◇ the modes of configuration upload onto the RTU apparatus;

5.1 Functions


The configuration software of the RTU apparatus must allow:

1. the generation of the configuration data base and the verification of its consistency;
2. the upload of a configuration from a RTU apparatus and the creation of the corresponding data base;
3. the compilation and transfer of the configuration data base onto the RTU apparatus;
4. the storage and printing of the various configuration data base;
5. the update of the application firmware of the RTU apparatus;

The program must allow the step-by-step creation of the *basic configuration* of the RTU apparatus and the commissioning of it inside to the secondary substation.

The basic configuration includes the:

- ◇ identification parameters of the apparatus;
- ◇ general operating parameters;
- ◇ communication parameters;
- ◇ hardware equipment;
- ◇ switchgears;
- ◇ spare Remote Signalling;
- ◇ spare Telemeasuring;
- ◇ digital outputs;

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In order to facilitate and speed up the configuration operations, where possible, the program must provide default values for the configuration parameters.

At the beginning of each connection with the RTU, the program must always proceed with the upload of the prior configuration which exists on the RTU itself. All changes will thus be made on the latest current configuration into the RTU, avoiding the risk of working with outdated data.

The program must perform a set of checks in order to ensure the creation of a correct and coherent configuration from the time of the insertion of the parameters.

5.2 Structure of the user interface

Access to the program must be password protected.

After the start up, the menus and the icons on the Toolbar must be enabled as a function of the context.

With the exception of the introduction of alphanumeric characters (which is limited to the keyboard), all of the activities must be controlled using the mouse.

The program must allow the use of the right mouse button, to which the typical functions of Cut, Copy, Paste, and Delete are associated.


The following keys, with the corresponding functions, must also be active:

Key combination	Functionality
Up/Down Arrows	In the drop-down menu, they allow for navigating through the options; the "wrap around" function is available. Inside the edit boxes, they allow cursor movement from one character to another, within a field or the inside any list.
Left/Right Arrows	Inside the edit boxes, they allow cursor movement from one character to another, within a field or the inside any list.
<Canc>	Deletes the characters to the right of the cursor or the entire contents of a selected field.
<Back Space>	Deletes the characters to the left of the cursor or the entire contents of a selected field.
<Home>	Places the cursor to the left of the first character, within a field, in order to enter the alphanumeric values.
<End>	Places the cursor to the right of the last character, within a field, in order to enter the alphanumeric values
<Tab>	Allows to switch through the fields of the form, with the functionality of data entering confirmation; it also allows shifting through functional buttons
<Shift><Tab>	Just as the <Tab>button, but in the opposite direction.

5.2.1 Toolbar

A selection of the most frequently used commands must be available on the Toolbar, with the possibility to activate them by the use of the mouse.

Icon	Associated commad
------	-------------------

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Opens a new apparatus configuration.



Opens a configuration of the apparatus previously saved onto the disk.



Save As, It allows to make a copy of a configuration by saving it with another name.



Deletes a configuration of the apparatus previously saved to the disk.



Opens the table for the *Header* configuration.



Opens the table for the configuration of the general *Parameters*.



Opens the table for the configuration of the *hardware Equipment*.



Accesses the *Print* functions.



Accesses the Compile and Download functions.




5.2.2 Main Menu

The program must be organized using menus and sub-menus, all accessible from a "Main Menu".

The hierarchical organization of these menus is shown below:

MAIN MENU (Lev. 1)	SUB-MENUS (LIV. 2)
<u>F</u> ILE	<i>New</i> <i>Open ...</i> <i>Close</i> <i>Save As ...</i> <i>Delete...</i> <i>Exit</i>
<u>C</u> ONFIGURATION	<i>Header</i> <i>General Parameters</i> <i>Communication Parameters</i> <i>Switchgear</i> <i>Spare RS</i> <i>Spare TM</i> <i>Digital Outputs</i>
<u>S</u> ERVICES	<i>Print</i> <i>Change Password</i> <i>Compilation Download</i> <i>Firmware Download</i> <i>Upload and reverse Compilation</i>
<u>H</u> elp	<i>Help on Line</i> <i>About ...</i>

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5.2.2.1. FILE Menu

All of the functions must be made available in the "File" submenu, located below the main menu of the RTU configurator, in order to:

- ◇ Create a new configuration data base of, by using the "New" or the "Save As" menu options;
- ◇ Open an existing data base, in order to view/edit its contents by using the "Open" menu option;
- ◇ Close and save the current configuration, by using the "Close" menu option;
- ◇ Make a copy of a data base of an existing configuration, by using the "Save As" menu option;
- ◇ Delete an existing configuration, by using the "Delete" menu option.

When a data base configuration is "open", its name appears on the bar of the main window, as the latest data base.

5.2.2.2. New

Through this option, the program prepares the file for the data base of configuration, by creating a new data base file with a specified name.

For the creation of a new configuration of the apparatus, the following information must be introduced:

- Name to be assigned to the new data base;
- Path (step-by-step with directories and subdirectories) of where to store the new data base.

The data base file designed to contain the new configuration of RTU must be initialized, whenever possible, with the default values.

5.2.2.3. Open

Through this option, the user must be able to select a data base of configurations among those which are stored into the systems archive, as default, or, rather, "browse" either the directories of the PC the hard disk or in the network, or even on mass storage devices, in order to find the desired configuration.

For the opening of an existing data base, the following information must be incorporated:

- Name of the data base;
- Path (drive, directories, and subdirectories) where the new data base is to be stored.

In order to open a file, the mouse cursor must be placed on the file name, followed by a right "click" of the mouse button and the selection of the "Open" option.

5.2.2.4. Close


Through this option, the user can close an open data base so that another data base can be opened without exiting the program. At each closing, all of the parameters must be saved.

Following the request to close the data base, the program performs the following actions:

1. update the bar of the main window by removing the file name of the data base;
2. prepare the active and inactive menu options, to the same status which appears at the program login, when no data base has yet been opened.

5.2.2.5. Save As

This function must allow the creation of a new data base of configuration, starting from an existing one; that is, it must create a copy of a data base of configuration, leaving the data base source unchanged and letting the program operate on the copy that it just generated.

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In order to save a data base of configuration with a new name, the following information must be specified:

- Name to be assigned to the new data base;
- Path (drive, directories, and subdirectories) where the new data base is to be stored.

Upon confirmation of the path and name of the data base, the program must perform the following actions:

1. check that the directory chosen as the path to the new data base does not contain another data base with the same name; if a data base with the same name already exists the user must be asked whether to overwrite it or to go back in order to enter a different name or path;
2. if the path and name are accepted, it must create a new data base file with a name chosen by the user, where the back-up of the overall data base source is filed;
3. update the name of the data base currently displayed on the bar of the main window;
4. prepare to operate on the current generated data base of configuration.

The original data base will remain unchanged, since no processing actions are taken.

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5.2.2.6. Delete

Through this option the user must be able to select a data base from those already existing and delete it from the hard disk.

For the elimination of an existing data base, the following information should be introduced:

- Name of the data base to be deleted;
- Path (drive, directories, and subdirectories) where the new data base is to be stored.

If the user wants to delete a data base which is not contained in the default directory, the "Search ..." button must be available on the dialog box, in order to search for the desired file.


Once the user has selected the data base to be deleted, the program must perform the following actions:

1. check that the data base to be deleted exists and is not "open";
2. perform the deletion of the data base from the physical storage unit onto which it is stored;
3. return the control to the main menu.

To delete a file, the mouse cursor must be positioned on the file name, followed by a right "click" on the mouse button and the selection of the "Delete" option.

5.2.2.7. Exit

Through this option the user must be able to exit from the configuration program of the RTU apparatus and return to the operating system. Just like most of the Windows programs, the selection of the "X" button on the toolbar of the main window, as well as the <Alt><F4> sequence, allow to exit the program.

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5.2.3 Configuration Menu

Upon the selection of a Tab, the related form must be shown; the fields of the selected Tab may contain:

- ◇ initialization values which the program assigns by default to the fields of the Tab when this has not yet been customized;
- ◇ the initial values which the program reads from the data base containing the latest introduced customization, in the case of a data base change of an existing configuration.

Whenever possible, the choice of the parameters to be entered in a field must be driven by the program automatically, with the suggestion of a list of the possible values.

In the remainder of the document, for each Tab available, a detailed description is provided for each field, which includes:

Name: that is the name of the field, as presented on the screen in the Tab;

Dependency: this information is significant only in the case in which the visualization or the meaning of that field is dependent on previous choices; in this case, the column shows the name of the conditioning field as well as the values it takes in this status;

I.V.: is the Initialization value of the field (by default);

P.V. is the set of possible values that the field can take;

Description: it shows, briefly, either the field meaning or the eventual indication of a "Non-Editable"(NE) field.

Two levels of verification must be executed on the Data entered in the general Datasheet:

1. A *Local Control on the Tab* (upon closure and subsequent backup of the Tab)
2. A *Cross-check among Tabs*.

Specifically, the local controls on a Tab must be carried out:

- ◇ upon confirmation of data entry in a field (in order to ensure that the value introduced belongs to a range of possible values);
- ◇ upon confirmation of all of the contents of the Tab (in order to ensure that the values entered in the various fields are all consistent with each other).

5.2.3.1. Header

This Tab allows to configure or modify a set of general information about the configuration of the apparatus and its location in the secondary substation.

The form for the *Header* Tab must be as the one demonstrated in Figure 1.

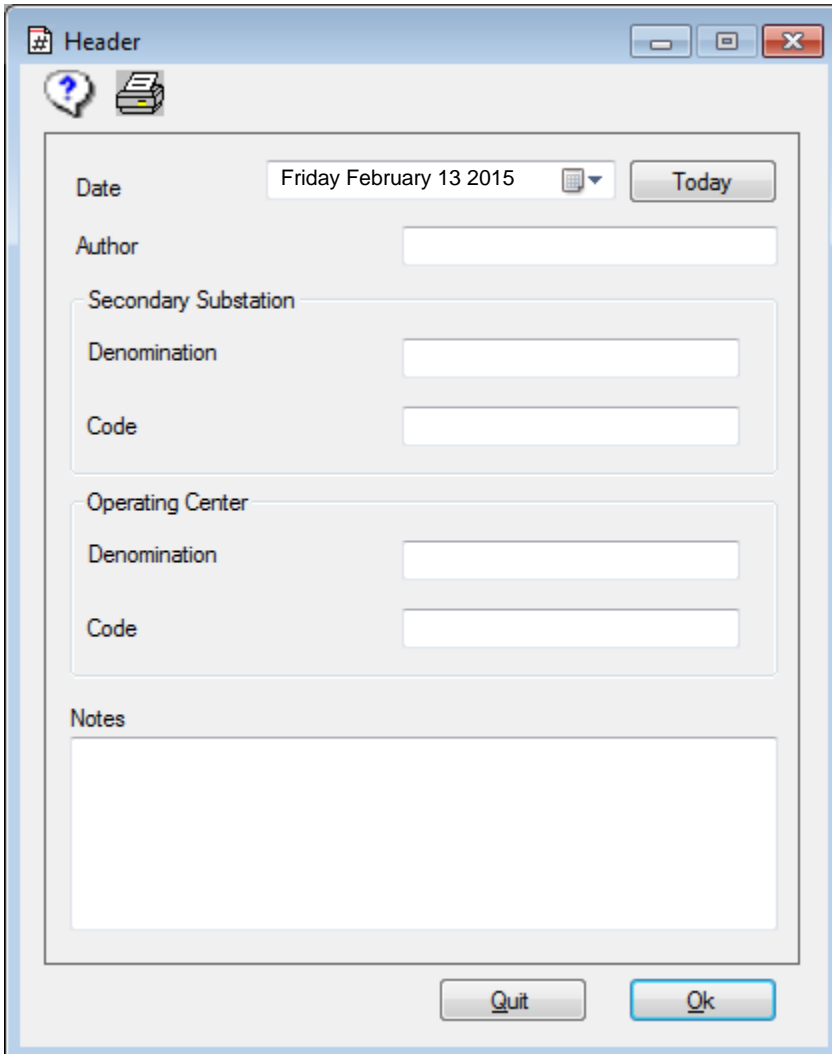


Figure 1– *Header* Single-Tab form

The configurable parameters of the *Header* Tab are listed in Table 6, including a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Date	None	Blank	mm/dd/yyyy	It shows the date of generation of the configuration



				(manually managed by the user)
Author	None	Blank	16 alpha-numeric characters	Author of the configuration.
Secondary Substation				
Denomination	None	Blank	15 alpha-numeric characters	Full Name of the Secondary Substation in which the RTU will be installed.
Code	None	Blank	6 alpha-numeric characters	Management code of the Secondary Substation. Mandatory field.
Operation Center				
Denomination	None	Blank	25 alpha-numeric characters	Name of the Center which remotely controls the Secondary Substation in which the RTU will be installed.
Code	None	Blank	4 alpha-numeric characters	Center Code.
Notes	None	Blank	256 alpha-numeric characters	Free Notes field

Table 6- Configurable parameters in the *Header* Tab

The content of the above mentioned fields must not be transferred to the RTU, but it must be stored in the local data base as documentation of the configuration of the apparatus.

5.2.3.2. General Parameters

Through this Tab, it must be possible to configure or modify a set of general information needed by the RTU for its proper operation.

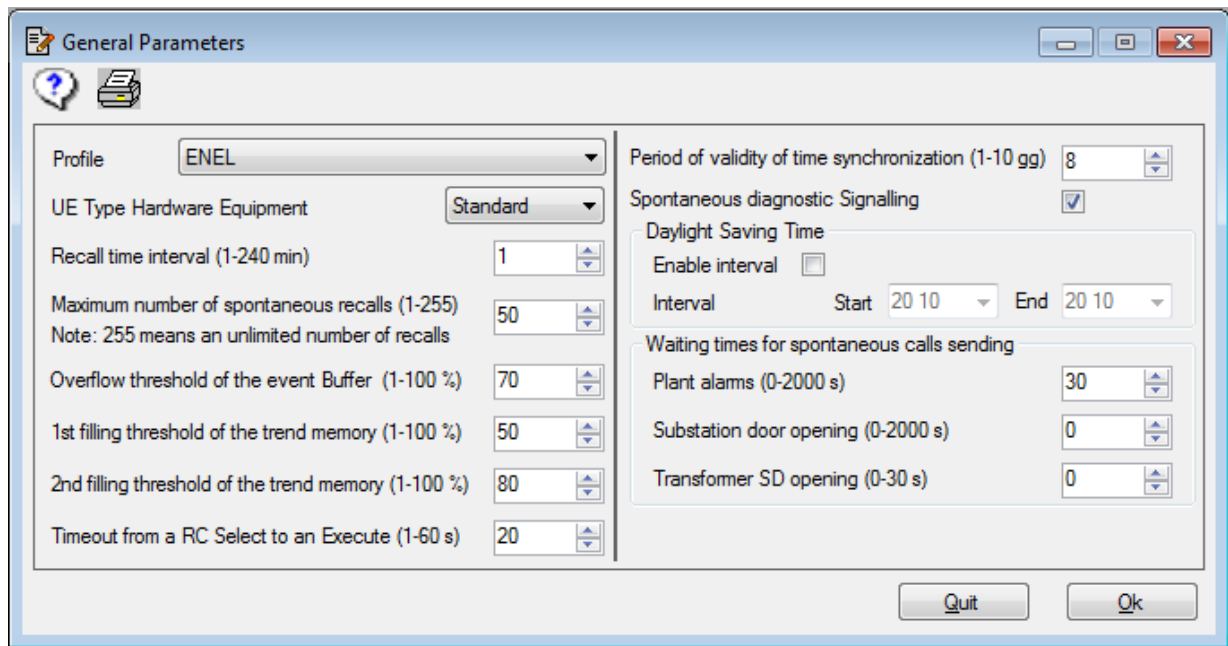


Figura 1 - General Parameters Form

The configurable parameters, in the *General Parameters* Tab, are listed in Table 7, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
UE Type	HW Equipment		UE8 / UE16	UE Tipology (standard / extended)
Language	None	EN	EN, IT, SP, PT	It allows for the selection of either the language of the RTU interface, or of the default values
IEC Profile to manage (ENEL, ENDESA, ...)	None	ENEL	ENEL, ENDESA	It allows for the selection of either the interoperability profile, or the IEC data base to be managed
Recall time interval (min)	None	2	1÷240 step 1	Waiting time between an unsuccessful spontaneous call to the next. Only applicable in the presence of switched network.
Maximum number of spontaneous recalls	None	50	1÷254 step 1 Unlimited	Maximum number of unsuccessful spontaneous recalls, from which the RTU apparatus will not issue any other spontaneous call.
Overflow threshold of the event Buffer (%)	None	70	1÷100 step 1	Percentage of the event buffer replenishment to which the apparatus issues a spontaneous call in order to allow for the emptying of the buffer and avoid the risk of the loss of events.
1st replenishment	None	50	1÷100 step 1 Disabled	First replenishment percentage threshold of the buffer, containing the 10' average values of the measurements, at which the apparatus issues a spontaneous call to



threshold of the trend memory (%)				allow for the emptying of the buffer.
2nd replenishment threshold of the trend memory (%)	None	80	1÷100 step 1 Disabled	Second replenishment percentage threshold of the buffer, containing the 10' average values of the measurements, at which the apparatus issues a spontaneous call to allow for the emptying of the buffer.
Spontaneous diagnostic transmission	None	Yes	Yes/No	It allows for the enabling/disabling of the spontaneous calls, as a result of diagnostic events of the apparatus.
Timeout from a RC Select to an Execute (sec)	None	20	1÷60 step 1	Timeout activated upon receipt of a Select message for the execution of a remote control. Once it has expired, the verification is aborted, without having received the next Execute message.
Period of validity of time synchronization (days)	None	8	1÷10 step 1	Time interval from the last time the synchronization was received (from the Center) following when the events timestamp is declared "suspected of error."
Daylight Savings Time Interval	None	000000 00	00000000 01010101-31123112	The format is the following: MMDDMMDD, with the first and the last four characters corresponding to the month/day of Daylight Savings time beginning and ending, respectively. By default, this field is set to 00000000, i.e. Daylight Savings Time Interval is not configured.
Waiting times for the issue of general spontaneous calls				
System Alarms (s)	None	30	0÷2000 step 1	Time interval starting from the generation of a system alarm, after which the apparatus issues a spontaneous call without the alarm itself being switched off.
Substation door opening (s)	None	0	0÷2000 step 1	Time interval starting from the generation of the <i>substation door opening alarm</i> , after which the apparatus issues a spontaneous call without the alarm itself being switched off.
Transformer SD opening (s)	None	0	0÷30 step 1	Time interval starting from the generation of the transformer SD opening alarm, after which the apparatus issues a spontaneous call without the alarm itself being switched off.

Table 7- Configurable parameters in the *General Parameters* Tab

5.2.3.3. *Communication Parameters*

Through this multi-Tab, it must be possible to configure or modify a set of parameters to let the RTU communicate with the Center.

The multi-Tab in question must include two Control Tabs: "*General*", "*DCE Setup*". The parameters displayed in the tab "DCE Setup" depends on the type of DCE selected.

With reference to the *General* Tab, the multi-Tab form of the *Communication Parameters* must be as the one demonstrated in Figure 2.



Communication Parameters

General GSM-DCS1800 Setup

UE IEC Address	2000
DCE Type	GSM-DCS1800
Asdu Address Size	2
Info Object Addr. Size	3
Cot Size	2
Max Asdu Size	249
Cycle Period (s)	132

Quit Ok

Figure 2 –Communication Parameters multi-Tab Form – General Tab



The configurable parameters on the *General Tab* of the *Communication Parameters* multi-Tab form are listed in Table 8, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
IEC address of the RTU	None	2000	1÷65534 step 1	Address of the Peripheral Unit utilized for communication with the Center by either the IEC870-5-101 or the IEC870-5-104 protocols (Station Address).
DCE type	None	GSM-DCS1800	GSM-DCS1800 PSTN DEDICATED IEC104-ETH IEC104-RS232 IEC104-GPRS	It indicates either the type of DCE, or the type of communication network utilized. - GSM-DCS1800 -> GSM Modem - IEC101 protocol; - PSTN - 56k modem - IEC101 protocol; - DEDICATED—direct serial connection - IEC101 protocol; - IEC104-ETH - direct Ethernet connection- IEC104protocol; - IEC104-RS232 - direct serial connection - IEC104 protocol; - IEC104-GPRS - GPRS modem connection- with IEC104 protocol (PPP protocol, TCP/IP stack managed by the RTU)
ASDU address size	None	2	1,2	size of the common address of Application Service Data Units (ASDU)
IOA size	None	2	1,2,3	Information Object Address (IOA) size
COT size	None	1	1,2	Cause of Transmission size
max ASDU size	None	249	1÷255 step 1	max length of ASDU
Cyclic Period	None	600 s	1÷86400 step 1	cyclic period for measures sending

Table 8 - Configurable parameters on the *General Tab* of the *Communication Parameters* multi-Tab form

The *DCE Setup* Tab of the *Communication Parameters* multi-Tab form changes depending on the value specified for the "communication type" field.

In the case that the type of communication chosen is either GSM-DCS1800, or PSTN, od DEDICATED the *DCE Setup* Tab must be as the one demonstrated in Figure 3.

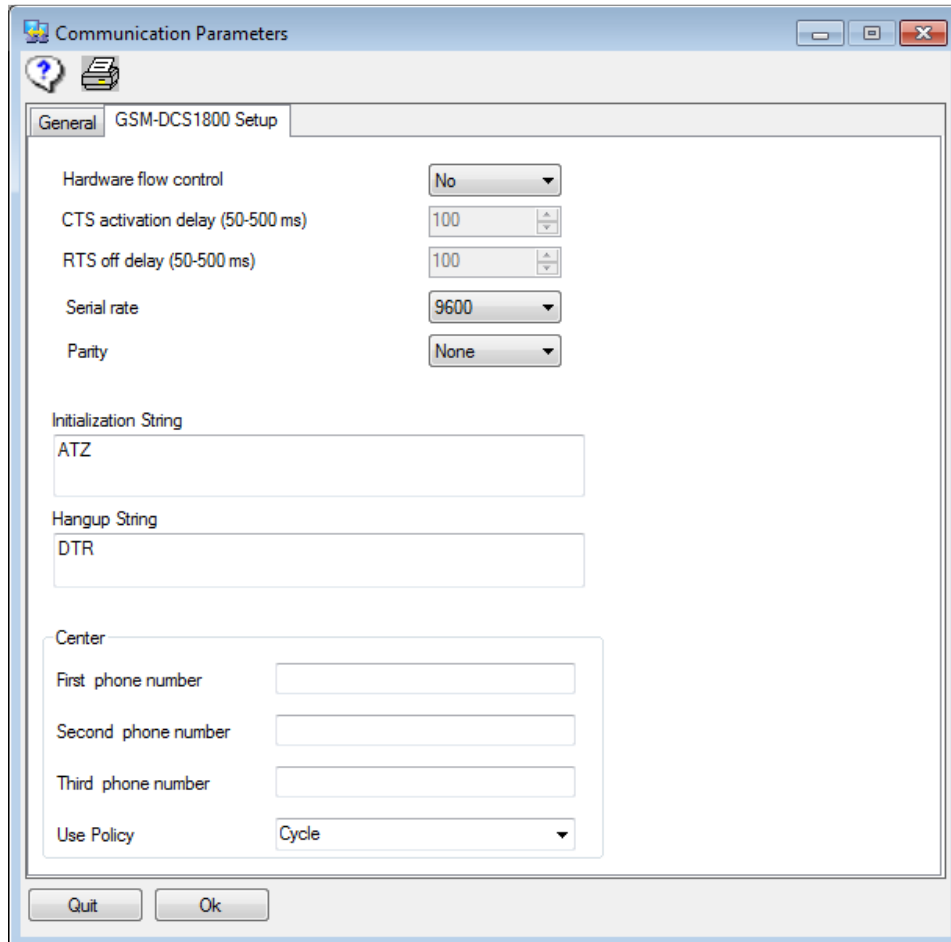


Figure 3 – Communication Parameters multi-Tab Form - Modem PSTN/GSM Tab

The configurable parameters on the *DCE Setup* tab of the *Communication Parameters* multi-Tab form are listed in Table 9, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Serial Rate	None	9600	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps	Serial port rate
Parity Bit		none	none/even/odd	Parity Bit
HW Control Flow	None	No	Yes/No	It allows the hardware flow control to be enabled
CTS Activation delay (ms)	Significant in the presence of HW flow control only.	100	50÷500 step 50	It sets the maximum waiting time, in ms, for the activation of the CTS signal.
RTS Off Delay (ms)	Significant in the presence of HW	100	50÷500 step 50	It sets the delay, in ms, for the deactivation of the RTS signal at the end of the write operation to the serial port.



	flow control only.			
Initialization string	Only for GSM-DCS1800 or PSTN DCE selection	ATZ	128 alphanumeric characters	DCE Initialization string. It is sent to the DCE upon initialization. The user must introduce a string consistent with the type of DCE utilized. As an example, a possible initialization string for a PSTN modem is provided: AT\$0 = 2 AT\$6 = 3 AT\$4 AT & C1 AT & D2 AT \ N3 AT L1 AT\$7 = 15 <i>NOTE: The initialization string for the DCE must not be inserted if the DCE is already configured and its configuration is made permanent (AT&W control).</i>
Hang-Up String	Only for GSM-DCS1800 or PSTN DCE selection	DTR	DTR 128 alphanumeric characters	It allows the hang-up mode to be configured onto the DCE. As an alternative to the use of the by default DTR criterion, it is possible to request that the release of the telephone line is made by sending an AT command (i.e. ATH0), following the "+++" escape sequence.
Primary phone number of the Center	Only for GSM-DCS1800 or PSTN DCE selection	Blank	max 32 digits	First phone number that the RTU apparatus must dial to call the Mini Central System.
Secondary phone number of the Center	Only for GSM-DCS1800 or PSTN DCE selection	Blank	max 32 digits	Second phone number that the RTU apparatus must dial to call the MiniCentral System.
Usage policy of the phone number to call	Only for GSM-DCS1800 or PSTN DCE selection	1	1+2	Usage Policy of the phone numbers: 1 – in cycle, according to the predefined order, 2 - Primary number (see the RCS-RTU Communication Management document)

Table 9- Configurable parameters on the *DCE Setup* Tab of the *Communication Parameters* multi-Tab form

When the IEC104-GPRS protocol is selected, the GPRS modem will offer the management of the TCP/IP: the text fields must be available in order to enter the parameters needed for the initialization of the modem (Parameters related to the APN), as shown in Figure 4.



Communication Parameters

General IEC104_GPRS Setup

Hardware flow control: No

CTS activation delay (50-500 ms): 100

RTS off delay (50-500 ms): 100

Serial rate: 9600

Parity: None

PPP Parameters

APN: APN.Name

User: username Password: 123456

GPRS Init String

ATZ

Center

CC Settings..

NTP

Server (Stratum) 1: 10 . 0 . 0 . 172 Sync Period (h): 6 Sync N Retries: 3

Server (Stratum) 2: 10 . 0 . 0 . 44 Sync Timeout (s): 10 Sync Retry Timeout (s): 10

IEC 60870-5-104

T1 (s): 55

T2 (s): 15

T3 (s): 240

K: 6

W: 3

Max Connections: 5

TCP Setup

MTU (bytes): 1500

Max TCP Timeout(s): 15

TCP Num Retry: 20

TCP Rx Window Size: 256

Quit Ok

Figure 4 – Communication Parameters multi-Tab Form - GPRS Modem, IEC104-RS232 Tab



Field Name	Dependency	I.V.	P.V.	Description
Serial Rate	Only for IEC104-GPRS or IEC104-ETH DCE selection	9600	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps	Serial port rate
Parity Bit	Only for IEC104-GPRS or IEC104-ETH DCE selection	none	none/even/odd	Parity Bit
HW Flow Control	Only for IEC104-GPRS or IEC104-ETH DCE selection	No	Yes/No	It allows the hardware flow control to be enabled
CTS Activation delay (ms)	Significant in the presence of HW flow control only.	100	50÷500 step 50	It sets the maximum waiting time, in ms, for the activation of the CTS signal.
RTS Off Delay (ms)	Significant in the presence of HW flow control only.	100	50÷500 step 50	It sets the delay, in ms, for the deactivation of the RTS signal at the end of the write operation to the serial port.
Initialization string	Only for IEC104-GPRS or IEC104-ETH DCE selection		128 alphanumeric characters	
IP	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	-	-	LAN IP address of the RTU
Netmask	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	-	-	LAN mask
Gateway	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	-	-	LAN Gateway IP address
MAC	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	-	-	MAC address of network card
MTU	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	1500	-	MTU (Maximum Transmission Unit) of the TCP
Timeout	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	15	-	timeout for a TCP packet
N° Retries	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	20	-	maximum number of retries of a TCP packet
Window	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS239	256	-	Maximum receive window size (bytes) that can work with the RTU
T1	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS232	55		Time out for frames types SEND / TEST
T2	enabled if DCE=IEC104-ETH or IEC104-GPRS or	10		Time out for ACKs if there is nothing to transmit



	IEC104-RS233			
T2	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS234	1200		Time to send out TEST frames (T3> = T1)
K	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS235	4		Number of messages received without being validated (sending ACK)
W	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS236	2		Maximum number of messages transmitted without knowing before stopping transmission
Max IEC104 Connections	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS237	2		Maximum number of active connections with the IEC104 protocol
IP Address of the NTP server	None	-	-	IP address of the NTP server for clock synchronization
IP Address of the NTP server	None	-	-	IP address of the NTP server for clock synchronization
time synchronization with NTP server	None			time synchronization with NTP server
connection timeout with the server ntp	None			connection timeout with the server ntp
number of attempts to reconnect with the NTP server	None			number of attempts to reconnect with the NTP server
waiting time for reconnection with the NTP server	None			waiting time for reconnection with the NTP server

Table 10 – Parameters for GPRS

When the IEC104-ETH is selected, it must be possible to make changes to the parameters shown in Figure 5.



Communication Parameters

General IEC104_ETH Setup

Ethernet Configuration

IP	192 . 168 . 2 . 100
MASK	255 . 255 . 255 . 0
GATEWAY	192 . 168 . 2 . 254
MAC	00:FF:9C:5A:E5:81

IEC 60870-5-104

T1 (s)	55
T2 (s)	15
T3 (s)	240
K	6
W	3
Max Connections	5

TCP Setup

MTU (bytes)	1500
Max TCP Timeout(s)	15
TCP Num Retry	20
TCP Rx Window Size	256

Center

CC Settings..

NTP

Server (Stratum) 1	10 . 0 . 0 . 172	Sync Period (h)	6	Sync N Retries	3
Server (Stratum) 2	10 . 0 . 0 . 44	Sync Timeout (s)	10	Sync Retry Timeout (s)	10

Quit Ok

Figure 5 - Communication Parameters multi-Tab Form – Ethernet configuration Tab

In the only case in which the IEC104 protocol is selected, the CC configuration Tab is available for the multisession configuration as shown in Figure 6.

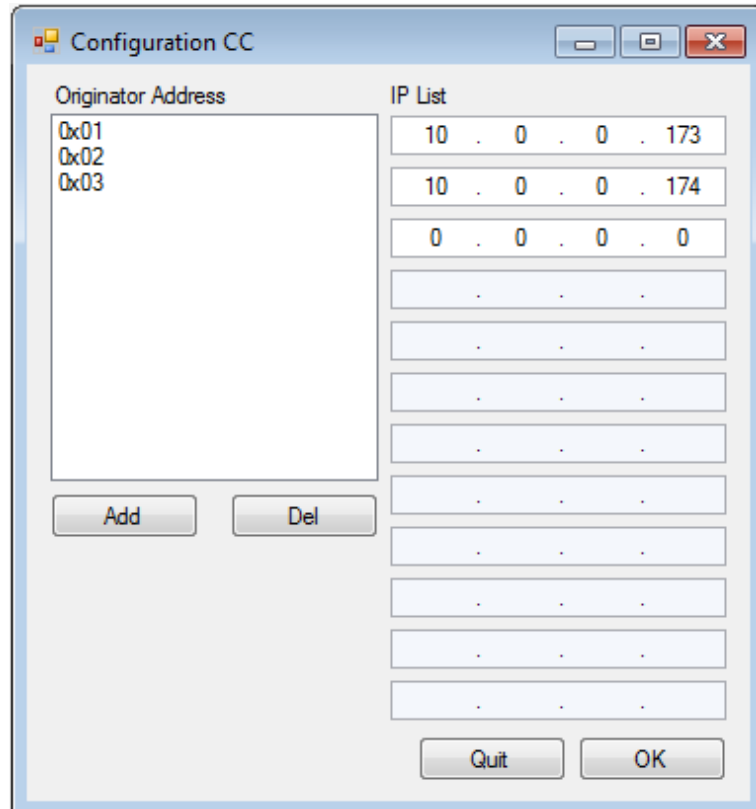



Figure 6 - Communication Parameters multi-Tab Form – CC Configuration. Tab for the configuration of the originator address of Centers.

Field Name	Dependency	I.V.	P.V.	Description
CC Source address	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS232	1	1-6	Source address of the control center on the remote control (maximum 6 possible)
CC IPs	enabled if DCE=IEC104-ETH or IEC104-GPRS or IEC104-RS232	-	-	List associated with the source address of the command control center on remote IP addresses (up to 12 addresses) – IPs must be send as bytes array (e.g 10.0.0.173 10.0.0.174 -> 0a0000ad0a0000ae

Table 11 – Advanced Settings for IEC104 multisession.

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	Remote Terminal Unit Configuration and Application Program Interface specifications	GSTR001/1 Annex1 Rev. 00 01/06/2015

The default parameters related to either the IEC870-5-101 or the IEC870-5-104 protocols, must be set according to the following default values (see interoperability profile of GSTR001/1/A3 for further information):

IEC 870-5-101:

Number of bytes of the	ENEL	ENDESA
• Address field of link	2	2
• Common address of ASDU	2	2
• Information object address	2	3
• Cause of transmission	1	2

IEC870-5-104:

Number of bytes of the	ENEL	ENDESA
• Common address of ASDU	2	2
• Information object address	3	3
• Cause of transmission	2	2

5.2.3.4. Switchgear

This Tab allows to configure or change the number of switchgears, referred to as SDs (Switch Disconnectors), SSCBs (MV Secondary Substation circuit breakers without protection equipment), Reclosers (MT circuit breakers with protection equipment), LV circuit breakers protection managed by the apparatus, according to the constraints imposed by the hardware equipped (UE8 or UE16).

An SD is the typical switchgear of the secondary substations. The only features which can be controlled are the movements or even the signals of the Fault Passage Indicator (FPI) of either the overcurrent to the zero sequence current, which can be configured as a function of the line energy flow direction. Where the SD utilizes the Digital Output also, the operator must configure this independently, by means of the appropriate form (see section 6.8). In this case, the Digital Output for the control of the directionality of the RGDAT is used in status mode.

The SSCB is a equipped with a capacitive voltage divider and a connector for the connection to the RTU.

Recloser is a circuit breaker equipped with internal protections and reclosing device which are entirely similar to those used in the primary substation. It is characterized by the set of I/O signals which are typical of these devices (Op, Cl, 51S, 67S, RCP, etc.) for the management of specific functions. In addition to the commands of open, closed, inclusion and exclusion of the reclosure functionality by the RTU Digital Outputs, the operating mode (protections included/excluded and possibly directionality) of the Recloser is also governed.



The number of switchgears that are attestable to the RTU apparatus depends upon the type of UE.

The relationship between the type of UE and number of controllable switchgears is the following:

- UE8 up to 8.
- UE16 up to 16.

The configurable parameters in the *Switchgear Configuration* Tab are listed in Table 12, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Switchgear 1	None	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number 1 and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.
Switchgear 2	None	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number 2 and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.
...	None	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number ... and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.
Switchgear 9	Field enabled only if the UE16 is equipped with 2 Interface cards	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number 9 and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.
...	Field enabled only if the UE16 is equipped with 2 Interface cards	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number ... and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.
Switchgear 16	Field enabled only if the UE16 is equipped with 2 Interface cards	0	1=SD 2=SSCB 3=REC 4=LVCB	It allows for the management of, or not, the switchgear number 16 and its consequent usage as SD, SSCB, Recloser, or LVCB, to be configured.

Table 12 - Configurable parameters in the *Switchgear Configuration* Tab

Setting a switchgear to "in operation" creates the section of the database of the configuration parameters related to the switchgear. Conversely, if a switchgear is placed to "not in operation" the RTU will ignore either the status or the changes of the digital input points, as well as the open/close operating controls, which act on the switchgear itself.

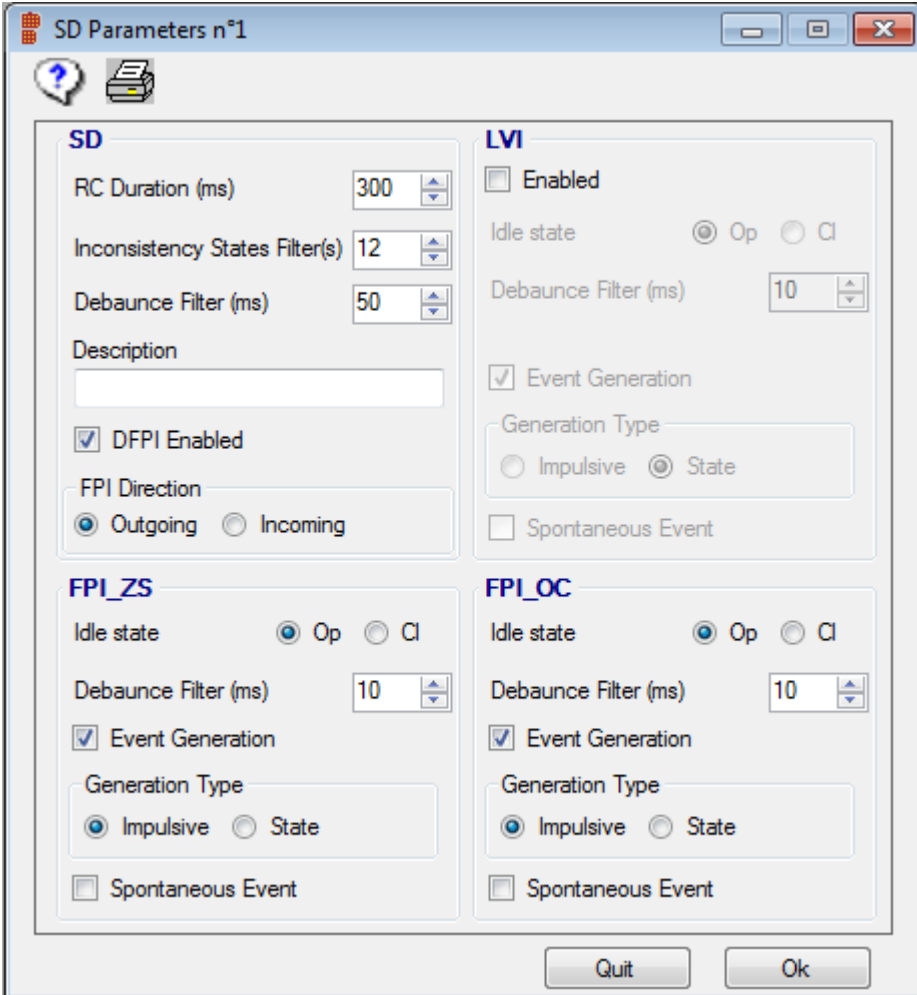
For each switchgear considered in the configuration, a "Configure" button is also enabled which allows its complete parameterization.

If the switchgear to be configured is the nth, with n odd, it is possible to configure it as an SD, SSCB, Recloser or LVCB. Otherwise, if n is even, it cannot be configured as Recloser, because the Recloser works in pairs of switchgears. In order to define a Recloser, a switchgear with an odd index must be selected, and a form will be shown to set up both the odd and even switchgears.

In the case a switchgear with an odd n index is defined as a Recloser, the switchgear with the index n + 1 is preselected as Recloser but it cannot be configured. For more details, see the Recloser section.

5.2.3.5. Switch Disconnecter (SD)

The form showing the SD Parameters Tab must appears as shown in Figure 7



The screenshot shows a software window titled "SD Parameters n°1". It contains the following configuration options:

- SD Section:**
 - RC Duration (ms): 300
 - Inconsistency States Filter(s): 12
 - Debaunce Filter (ms): 50
 - Description: (empty text box)
 - DFPI Enabled
 - FPI Direction: Outgoing, Incoming
- LVI Section:**
 - Enabled
 - Idle state: Op, Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive, State
 - Spontaneous Event
- FPI_ZS Section:**
 - Idle state: Op, Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive, State
 - Spontaneous Event
- FPI_OC Section:**
 - Idle state: Op, Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive, State
 - Spontaneous Event

Buttons for "Quit" and "Ok" are located at the bottom right of the window.

Figure 7 – SD Parameters single-Tab Form



Four distinct sections are highlighted in the *SD Parameters* Tab of Figure 7, which allows to configure:

- the parameters related to the SD;
- the parameters related to the Zero Sequence current Directional Fault Passage Indicator;
- the parameters related to the Overcurrent Directional Fault Passage Indicator;
- the parameters related to the AC Line Voltage Indicator.

The configurable parameters in the *SD Parameters* Tab are listed in Table 13, along with a brief description.

Field Name	Dependency	I.V.	P.V.	Description
RC Duration (ms)	None	300	200÷2000 step 100	It allows for the duration of the Opening or Closing remote control of the SD to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to each of the two digital inputs which indicate the status of the SD to be configured.
Incongruent Status Filters (sec)	None	12	12÷30 step 1	It allows for the duration of the filter to be applied once there is a variation of the input signals which report the status of the SD in order to avoid the transmission of transient states of inconsistency to the Center to be configured.
Description	None	Blank	30 alphanumeric characters	It allows to assign a full name to the SD for a clearer identification. The field content is not transferred to the non-volatile memory of the apparatus and is conversely stored in the source data base for documentation purposes.
DFPIEnabled	None	Yes	Yes/No	It indicates the Enabled or Disabled status of the DFPI (zero sequence, Overcurrent, LVI).
DIR_SET	Enabled if DFPI Enabled is Yes	0	0 = Outgoing 1 = Incoming	It defines the normal status of the direction of the protection.
FPI_ZS (enabled if DFPI Enabled=Yes)				
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact showing the intervention of the zero sequence current DFPI to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the status change from idle to active of the DFPI, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If the value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
FPI_OC (enabled if DFPI Enabled=Yes)				
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact showing the intervention of the Overcurrent DFPI to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.

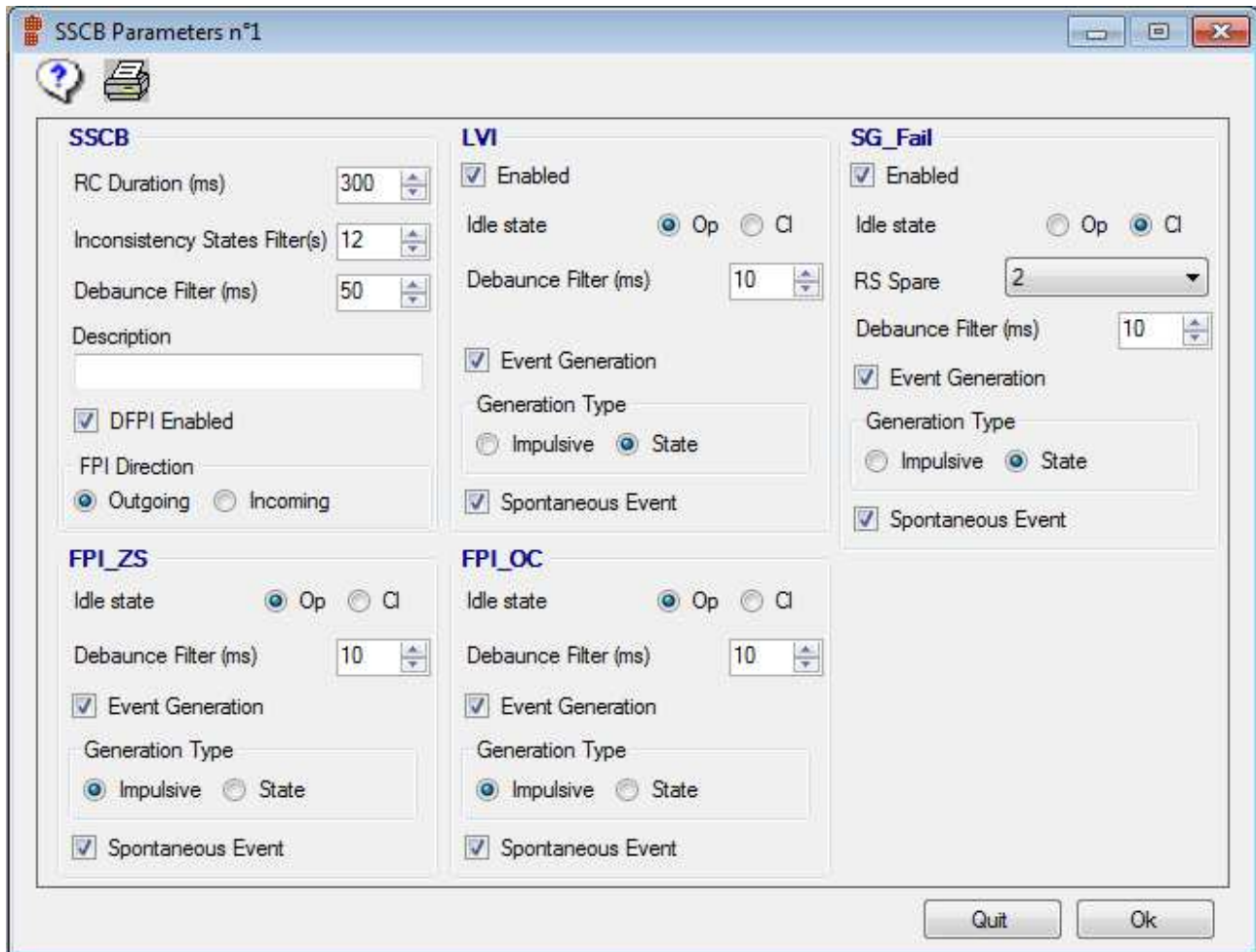


Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
LVI				
Enabled	None	No	Yes/No	It allows for the Enabled or Disabled status of the line voltage indicator (LVI) to be configured. The management of the LVI involves the unavailability of the corresponding Spare RS.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact showing the presence of the line voltage to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the status change from idle to active status of the LVI, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.

Table 13- Configurable parameters in the *SD Parameters* Tab

5.2.3.6. Secondary Substation Circuit Breaker (SSCB)

The SSCB parameters single-Tab form is as shown in Figure 8.



The screenshot shows a software window titled "SSCB Parameters n°1" with a standard Windows interface (minimize, maximize, close buttons). The window contains several configuration panels:

- SSCB Panel:**
 - RC Duration (ms): 300
 - Inconsistency States Filter(s): 12
 - Debaunce Filter (ms): 50
 - Description: (empty text box)
 - DFPI Enabled
 - FPI Direction: Outgoing Incoming
- LVI Panel:**
 - Enabled
 - Idle state: Op Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive State
 - Spontaneous Event
- SG_Fail Panel:**
 - Enabled
 - Idle state: Op Cl
 - RS Spare: 2
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive State
 - Spontaneous Event
- FPI_ZS Panel:**
 - Idle state: Op Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive State
 - Spontaneous Event
- FPI_OC Panel:**
 - Idle state: Op Cl
 - Debaunce Filter (ms): 10
 - Event Generation
 - Generation Type: Impulsive State
 - Spontaneous Event

At the bottom right of the window, there are "Quit" and "Ok" buttons.

Figure 8 – SSCB Parameters single-Tab form

The configurable parameters in the *SSCB Parameters* single- Tab form are listed in Table 14, along with a brief description of their use.



Field Name	Dependency	I.V.	P.V.	Description
SSCB Parameters				
RC Duration (ms)	None	100	100÷2000 step 100	It allows for the duration of the Opening or Closing remote control of the SSCB to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to each of the two digital inputs which indicate the status of the SSCB to be configured.
Inconsistency status filter (sec)	None	12	12÷30 step 1	It allows for the duration of the filter to be applied once there is a variation of the input signals which report the status of the SSCB in order to avoid the transmission of states of transient inconsistency to the Center to be configured.
Description	None	Blank	30 alphanumeric characters	It allows to assign a full name to the SSCB for a clearer identification. The field content is not transferred to non-volatile memory of the apparatus and is conversely stored in the source data base for documentation purposes.
DFPI Enabled	None	Yes	Yes/No	It indicates the enabled/disabled status of the signals related to the DFPI (zero sequence current, Overcurrent, LVI).
DIR_SET	Enabled if DFPI Enabled is equal to Yes	0	0 = Outgoing 1 = Incoming	It defines the normal status of the direction of the protection.
FPI_ZS (enabled if DFPI Enabled=Yes)				
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the intervention of the zero sequence current DFPI to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If the value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
FPI_OC (enabled if DFPI Enabled=Yes)				
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the intervention of the Overcurrent DFPI to be configured.
Debounce Filter	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter



(ms)				applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
LVI				
Enabled	None	No	Yes/No	It enables/disables the signal related to the line voltage indicator. The management of the LVI involves the unavailability of the corresponding Spare RS.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the presence of the line voltage to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
SG_Fail				
Enabled	None	No	Yes/No	It enables/disables a RS related to a circuit breaker failure. The management of the SGFail involves the unavailability of the corresponding Spare RS.
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	0	1..16	The field indicates the value of the Spare RS to be used for SG_Fail. This remote signal must not be used by a LVI already.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the presence of the line voltage to be configured.



Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.

Table 14 - Configurable parameters in the *SSCB Parameters* single- Tab form

5.2.3.7. Recloser

The *Recloser Parameters* multi-Tab form consists of the *OP-CL* and *79X_E/79X_D* Tabs, as shown in Figure 9:

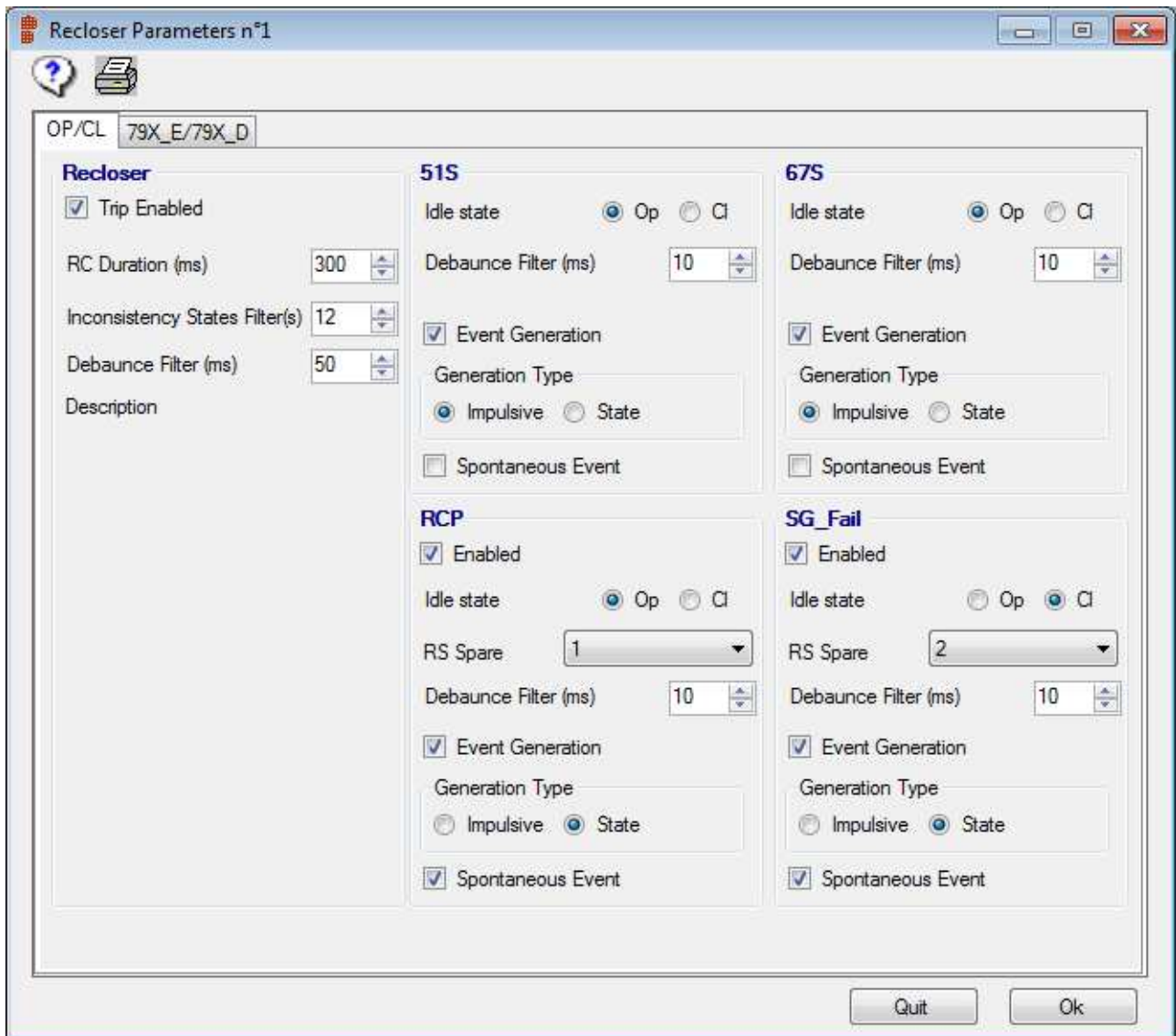


Figure 9–Recloser multi-Tab form-OP/CL Tab

The OP/CL Tab is provided with five distinct sections, that allow to configure the parameters related to the:

- Recloser OP-CL
- 51S signal
- 67Ssignal
- RCP signal



- SG_Fail signal

The configurable parameters in the *OP/CL* Tab are listed in Table 15, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Recloser (OP/CL)				
RC Duration (ms)	None	300	200÷2000 step 100	It allows for the duration of the Opening or Closing remote control of the Recloser to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to each of the two digital inputs which indicate the status of the Recloser to be configured.
Inconsistency state filter (s)	None	12	12÷30 step 1	It allows for the duration of the filter to be applied once there is a variation of the input signals which report the status of the Recloser in order to avoid the transmission of states of transient inconsistency to the Center to be configured.
Description	None	Blank	30 alphanumeric characters	It allows to assign a full name to the Recloser for a clearer identification. The field content is not transferred to non-volatile memory of the apparatus and is conversely stored in the source data base for documentation purposes.
Trip Enabled	None	Yes	Yes/No	It enables/disables the signals 51S and 67S, for odd n.
51S (enabled if Trip Enabled=Yes, for n odd)				
Idle Status	None	OP	OP/CL	It allows for the idle status related to the 51S signal to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the DebounceFilter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
67S (enabled if Trip Enabled=Yes, for n odd)				
Idle Status	None	OP	OP/CL	It allows for the idle status related to the 67S signal to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as



				Class 1 data.
RCP (for n odd)				
Enabled	None	No	Yes/No	It enables/disables the signal related to the RCP (Reclosure Cycle in Progress). The management of the RCP _n involves the unavailability of the RS defined in the field "Spare RS".
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	n	1..16	The field indicates the value of the unavailable RS. The default value is equal to n, i.e. the remote signal corresponding to the n-th RCP managed. Nonetheless, there is the possibility to configure it with a different value, defined here.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the presence of the line voltage to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
SG_Fail (for n odd)				
Enabled	None	No	Yes/No	It enables/disables an RS related to a circuit breaker failure. The management of the SG_Fail involves the unavailability of the corresponding Spare RS.
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	0	1..16	The field indicates the value of the Spare RS to be used for the SG_Fail. This remote signal must not be used by a RCP already.
Idle Status	None	CL	OP/CL	It allows for the idle status of the contact which provides the presence of the line voltage to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.

Table 15- Configurable parameters in the *OP/CL* Tab



The screenshot shows a software window titled "Recloser Parameters n°1" with a tab labeled "OP/CL 79X_E/79X_D". The window contains five main configuration sections:

- Recloser:** RC Duration (ms) is 300; Inconsistency States Filter(s) is 12; Debaunce Filter (ms) is 50; Description is empty.
- P_E/P_D:** Enabled (checked); Idle state is PE; RS Spare is 5; Debaunce Filter (ms) is 10; Event Generation (checked) with Impulsive (selected) and State (unselected) options; Spontaneous Event (unchecked).
- PaWa:** Enabled (checked); Idle state is Op; RS Spare is 7; Debaunce Filter (ms) is 10; Event Generation (checked) with Impulsive (selected) and State (unselected) options; Spontaneous Event (unchecked).
- LVI:** Enabled (checked); Idle state is Op; RS Spare is 3; Debaunce Filter (ms) is 10; Event Generation (checked) with State (selected) and Impulsive (unselected) options; Spontaneous Event (unchecked).
- DIR:** Enabled (checked); Idle state is Op; RS Spare is 4; Debaunce Filter (ms) is 10; Event Generation (checked) with State (selected) and Impulsive (unselected) options; Spontaneous Event (unchecked).

Buttons for "Quit" and "Ok" are located at the bottom right of the window.

Figure 10-Recloser Parameters multi-Tab form- RE/RD Tab



The *RE/RD* Tab is provided with five distinct sections that allow to configure the parameters related to the:

- Recloser **79X_E/79X_D**
- P_E/P_D signal
- PaWa signal
- DIR signal (direction of the protection)
- LVI signal

The configurable parameters in the **79X_E/79X_D** Tab are listed in Table 16, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Recloser (79X_E/79X_D)				
RC Duration (ms)	None	300	200÷2000 step 100	It allows for the duration of the Opening or Closing remote control of the Recloser to be configured.
Debounce Filter (ms)	None	50	50÷5000 step 10	It allows for the duration of the Debounce Filter applied to each of the two digital inputs which indicate the status of the Recloser to be configured.
Inconsistency status filter (s)	None	12	12÷30 step 1	It allows for the duration of the filter to be applied once there is a variation of the input signals which report the status of the Recloser in order to avoid the transmission of states of transient inconsistency to the Center to be configured.
Description	None	Blank	30 alphanumeric characters	It allows to assign a full name to the Recloser for a clearer identification. The field content is not transferred to non-volatile memory of the apparatus and is conversely stored in the source data base for documentation purposes.
P_E/P_D (for n-1 odd)				
Enabled	None	No	Yes/No	It enables/disables the signal related to the P_E/P_D (Protection Excluded/Protection Included). The management of the P_E/P_D involves the unavailability of the RS defined in the field "Spare RS".
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	n	1..16	The field indicates the value of the unavailable RS. The default value is equal to n, i.e. the DFPI RS corresponding to the n-th P_E/P_D managed. Nonetheless, there is the possibility to configure it with a different value, defined here.
Idle Status	None	P_D	P_E/P_D	It allows for the idle status of the protection to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	0	0 = Impulsive 1 = status	The default value is equal to impulsive, and an event is sent upon transition from the idle to the active status. If value is set to 1, an event is sent for any status transition.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as



				Class 1 data.
PaWa (for n-1 odd)				
Enabled	None	No	Yes/No	It enables/disables a RS related to a PaWa (Panel Warning). The management of the PaWa involves the unavailability of the corresponding Spare RS.
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	n	1..16	The field indicates the value of the unavailable RS. The default value is equal to n, i.e. the DFPI RS corresponding to the n-th PaWa managed. Nonetheless, there is the possibility to configure it with a different value, defined here.
Idle Status	None	OP	OP/CL	It allows for the idle status of the PaWa signal to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
LVI (for n-1 odd)				
Enabled	None	No	Yes/No	It enables/disables the signal related to the Line Voltage Indicator (LVI). The management of the LVI involves the unavailability of the corresponding Spare RS.
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	n	1..16	The field indicates the value of the Spare RS. The default value is equal to n, i.e. the DFPI RS corresponding to the n-th LVI managed. Nonetheless, there is the possibility to configure it with a different value, defined here.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact showing the presence of the line voltage to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
DIR (for n-1 odd)				
Enabled	None	No	Yes/No	It enables/disables the signal related to the Direction of the protection.



				The management of DIR involves the unavailability of the corresponding Spare TM.
Spare RS	Field enabled only if the "Enabled" field is set to "Yes"	n	1..16	The field indicates the value of the Spare RS to be used for DIR. This remote signal must not be already used by a LVI.
Idle Status	None	OP	OP/CL	It allows for the idle status of the contact which provides the presence of the line voltage to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.

Table 16 - Configurable parameters in the 79X_E/79X_D Tab

5.2.3.8. Low Voltage Circuit Breaker (LVCB)

The LVCB Parameters single-Tab form is shown in Figure 11:

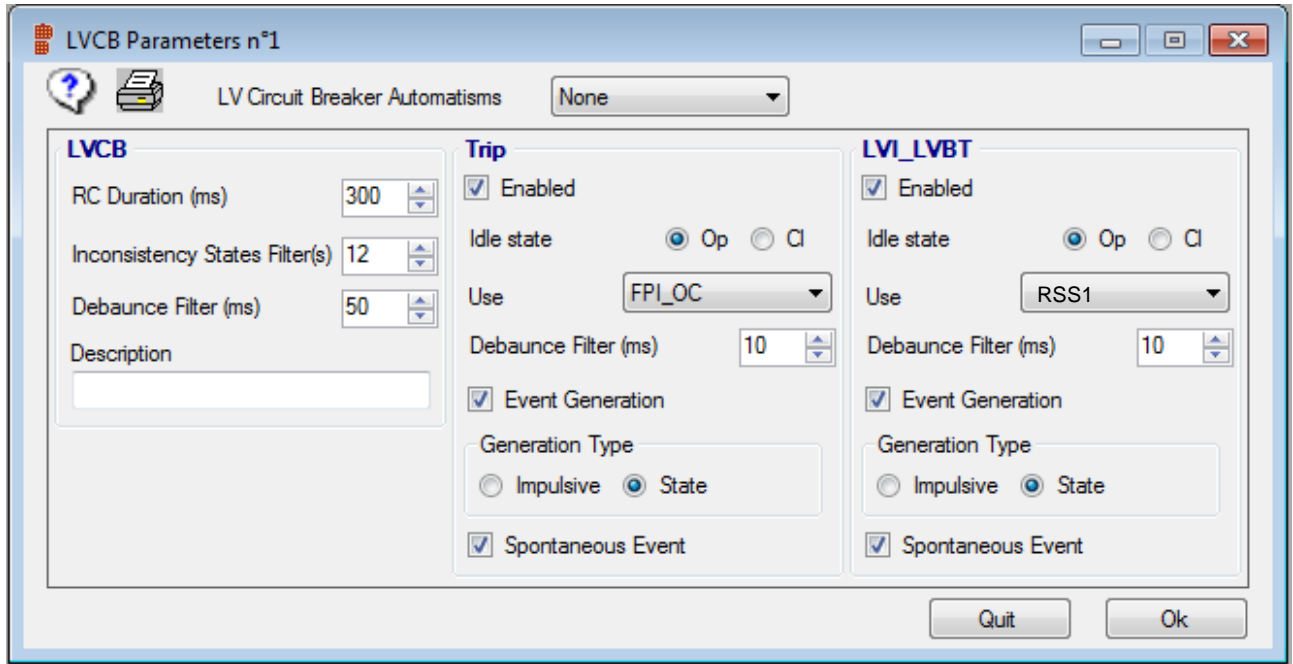


Figure 11- LVCB Parameters single-Tab form

The configurable parameters in the LVCB Parameters Tab are listed in Table 17, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
LVCB				
Automatism type	None	None	None LVCB_AI LVCB_R	It allows for the automatism type of the LVCB (Anti Islanding or Reclosing functionalities) to be selected.
RC Duration (ms)	None	600	200÷2000 step 100	It allows for the duration of the Opening or Closing remote control of the Switchgear to be configured.
Debounce Filter (ms)	None	50	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to each of the two digital inputs which indicate the status of the Switchgear to be configured.
Inconsistency status Filter (s)	None	12	12÷30 step 1	It allows for the duration of the filter to be applied once there is a variation of the input signals which report the status of the Switchgear in order to avoid the transmission of states of transient inconsistency to the Center to be configured.
Description	None	Blank	30 alphanumeric characters	It allows to assign a full name to the Switchgear for a clearer identification. The field content is not transferred to non-volatile memory of the apparatus and is conversely stored in the source data base for documentation purposes.
LVI_LVBT				
Enabled	None	No	Yes/No	It enables/disables the RS.
Usage	Field enabled only if the	RSSn	RSSn FPI_ZS	It indicates the hardware signal associated to the input.



	"Enabled" field is set to "Yes"		FPI_OC	
Idle Status	None	OP	OP/CL	It allows for the idle status of the input contact to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.
Trip				
Enabled	None	No	Yes/No	It enables/disables this signal.
Usage	Field enabled only if the "Enabled" field is set to "Yes"	FPI_OC	RSSn FPI_ZS FPI_OC	It indicates the hardware signal associated to the input.
Idle Status	None	OP	OP/CL	It allows for the idle status of the input contact to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Yes	Yes/No	Upon the signal of a status change, an event is issued if the parameter is set to yes.
Generation type	Field enabled only if the Event Generation field is set to "Yes"	1	0 = Impulsive 1 = status	The default value is equal to 1, which means that an event is sent for any status transition. If the value is set to 0, an event is sent upon transition from the idle to the active status.
Spontaneous event	Field enabled only if the Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise to no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN), otherwise the event is treated simply as Class 1 data.

Table 17- Configurable parameters in the *LVCB Parameters* Tab

At the reporting state, the " Spare Remote Signal" and "FPI OC" inputs will be respectively utilized to deliver the information of the LVI_LVCB and the Trip signals (Figure 11).

5.2.3.9. Spare Remote Signalling

This Tab must allow to either configure, or change the use of each Spare Remote Signal present on the RTU, as well as its related parameterization.

The number of the Spare RSs as well as their possible use depend upon the version of the UE utilized, as it is summarized in the following:

- UE8: up to 8 Spare RSs, which may be utilized as Line Voltage Indicators for as many SDs/SSCBs or as LVI_{LVs} or TRPDs for as many LV Circuit Breakers;



- UE16: up to 16 Spare RSs, which may be utilized as Line Voltage Indicators, for as many SDs/SSCBs, or as LVI_{LV} or TRP, for as many LV Circuit Breakers;

Each of the Spare RSs and which are not yet utilized as LVI, or LVI_{LV}, or as “Tripped” signal (for LVCB), are available to be utilized as a Busbar Voltage Indicator (BVI) or an Unbalanced Voltage Indicator (59v0). If an Spare RS (one and one only) is configured as a BVI, the "Mains Failure" signal, which is acquired by the Battery Charger, loses the similar meaning.

The BVI signal must comply with the requirement of uniqueness: it must not be possible to configure more than one BVI signal at a time. The 59v0 signal must comply with the requirement of uniqueness: it must not be possible to configure more than one 59v0 signal at a time. The configurable parameters in the *Spare RS* Tab are listed in Table 18, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Spare RS 1	Field enabled only if one of the two following conditions occurs: theLVI1 is not enabled, or the related SG is not a LVCB.	No	Yes/No LVI BVI 59v0 TR1-SG TR2-SG	It allows for whether to use or not the Spare RS 1, or to operate it as BVI, 59v0, TR1 or TR2 . The possible use as a LVI1 or “Tripped” is displayed also.
Spare RS 2	Field enabled only if one of the two following conditions occurs: theLVI2 is not enabled, or the related SG is not a LVCB.	No	Yes/No LVI BVI 59v0 TR1-SG TR2-SG	It allows for whether to use or not the Spare RS 2, or to operate it as BVI, 59v0, TR1 or TR2 . The possible use as a LVI2 or “Tripped” is displayed also.
Spare RS n	Field enabled only if one of the two following conditions occurs: the LVIn is not enabled, or the related is not a LVCB.	No	Yes/No LVI BVI 59v0 TR1-SG TR2-SG	It allows for whether to use or not the Spare RS n, or to operate it as BVI, 59v0, TR1 or TR2 . The possible use as a LVIn or “Tripped” is displayed also.
Spare RS 16	Field enabled only if one of the two following conditions occurs: the LVI16 is not enabled, or the related is not a LVCB.	No	Yes/No LVI BVI 59v0 TR1-SG TR2-SG	It allows for whether to use or not the Spare RS 16, or to operate it as BVI, 59v0, TR1 or TR2 . The possible use as a LVI16 or “Tripped” is displayed also.

Table 18 - Configurable parameters in the *Spare RS* Tab

For each Spare RS, a "Configure" button must be also provided, which allows the complete the RS parameterization.

The *Spare RS Parameters* single-Tab form must be as shown in Figure 12.

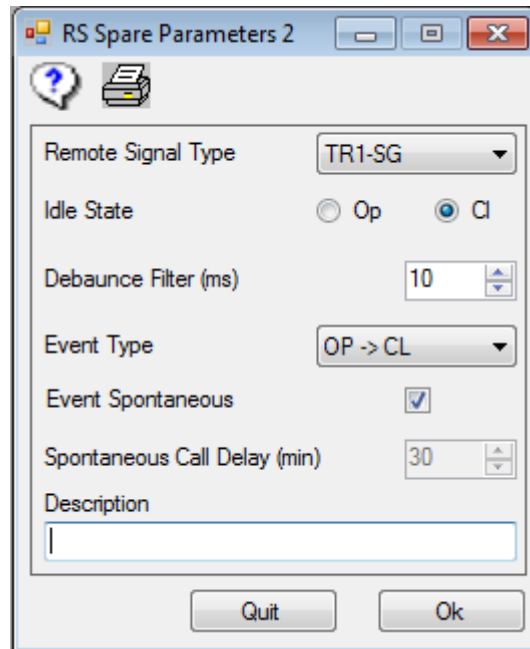


Figure 12 - Spare RS Parameters single-Tab form

The configurable values in the *Spare RS Parameters* Tab are listed in Table 19, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Enabled status and type of Remote Signal	SG associated	0	YES=0 NO=1 BVI=2 59v0=3 TR1-SG=4 TR2-SG=5	The value 0 (YES) indicates that the RS is available; The value 1 (NO) indicates that the RS is associated to a SG; The value 2 (BVI) indicates that an external Voltage Indicator has been assigned; The value 3 (59v0) indicates that it has been assigned to a LVCB with function 59v0. The value 4 (TR1-SG) indicates that it has been assigned to a LVCB with function TR1-SG. The value 5 (TR2-SG) indicates that it has been assigned to a LVCB with function TR2-SG.
Idle Status	None	OP	OP/CL	It allows for the idle status of the input contact to be configured.
Debounce Filter (ms)	None	10	10÷5000 step 10	It allows for the duration of the Debounce Filter applied to the input to be configured.
Event Generation	None	Always	OP->CL CL->OP Always Never	It allows for the issue of an event upon a change from the idle to the active status of the signal, or vice versa to be configured.
Spontaneous event	Field enabled only if the preceding Event Generation field is set to "Yes"	No	Yes/No	If the generation of an event must cause a spontaneous call to the Center, it is set to yes, otherwise no. This information is applicable only if the network communication with the Center is switched (GSM/PSTN).
Delay in the sending of a spontaneous call	Field enabled only if the preceding	0	1÷500 step 1	It allows for the delay, with respect to the time of the change of status considered to be significant ,after which the spontaneous call to the Center is issued to



(min)	Event Generation field is set to "Yes" Field not present if the RS is configured as a BVI or a 59v0.			be configured. This delay must be intended as a filter time, i.e. if the signal returns to the preceding value within this time interval, then the spontaneous call is not issued. <i>Note: If the RS is configured as either a BVI or a 59v0, the delay in the sending of a spontaneous call is that defined for the System Alarms, within the Form "General Parameter"</i>
Description	None	Blank	30 alpha-numeric characters	It assigns a full name to the Spare RS for its clearer identification. The content of the field is not transferred to the non-volatile memory of the UE, but rather remains stored in the database source for documentation purposes .

Table 19- Configurable values in the *Spare RS Parameters Tab*

5.2.3.10. Spare TM

This Tab must allow to either configure, or change the use of each Spare TM present on the RTU, as well as its related parameterization.

The number of Spare TM that can be utilized depends upon either the type of RTU or the number of interface cards equipped. The relationship between the interface cards and the number of TM that can be utilized is the following:

- UE8 9 Spare TMs (1÷9)
- UE16 17 Spare TMs (1÷17)

The configurable parameters in the *Spare TM Tab* are listed in Table 20, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Spare TM 1	None	No	Yes/No	It allows to either configure the management or of the Spare TM 1 or to ignore it.
Spare TM 2	None	No	Yes/No	It allows to either configure the management or of the Spare TM 2 or to ignore it.
...				
Spare TM 9	Field enabled only for the UE16 version	No	Yes/No	It allows to either configure the management or of the Spare TM 9 or to ignore it.
...	Field enabled only for the UE16 version	No	Yes/No	It allows to either configure the management or of the Spare TM or to ignore it.
Spare TM 16	Field enabled only for the UE16 version	No	Yes/No	It allows to either configure the management or of the Spare TM 16 or to ignore it.
T_{amb}	None	Yes	Yes/No	It allows to either configure the management or of the T _{amb} Spare TM (utilized in order to measure the ambient temperature of the secondary substation) or to ignore it.

Table 20 - Configurable parameters in the *Spare TM Tab*

For each Spare TM, a "Configure" button must be also provided, which allows the complete TM parameterization.

The *Spare TM Parameters* single-Tab form must be as shown in Figure 13.

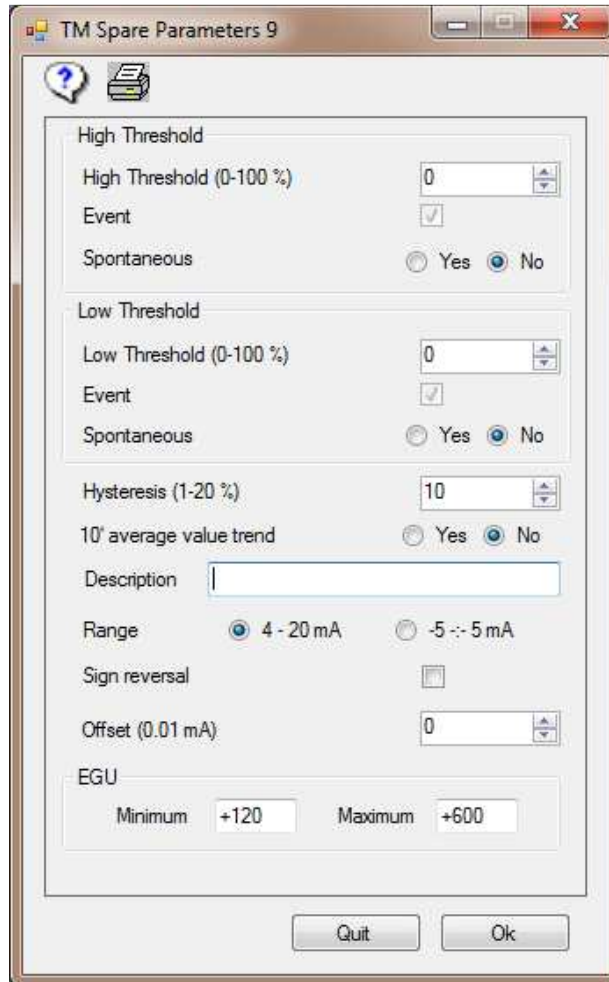


Figure 13 - Spare TM Parameters single-Tab form

The configurable values in the *Spare TM Parameters* Tab are listed in Table 20 - Configurable parameters in the Spare TM Tab, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Description	None	Blank	30 alpha-numeric characters	It assigns a full name to the Spare TM for its clearer identification. The content of the field is not transferred to the non-volatile memory of the UE, but rather remains stored in the database source for documentation purposes.
Measurement Range	None	4-20mA	4÷20mA/±5mV/-20÷80°C	It allows for the type of measurement acquired by the channel to be selected.
Sign Reverse	None	No	Yes/No	It reverses the sign of the measurement.
Measurement offset	None	0	-999÷999 E-2 mA	Correction of the measurement offset.
High Threshold (%)	It must be greater than the Low Threshold.	0	1÷100 step 1 0= disabled	It allows for a "high" threshold for the measurement. If the threshold is exceeded, it is possible to issue an event and a possible spontaneous call.
Event upon High Threshold	Field enabled only if the "High Threshold" field is	Yes	Yes/No	It allows for whether or not the exceeding of the High threshold, in both directions, issues an



	enabled.			event.
Spontaneous call upon High Threshold Event	Field enabled only if the preceding field "Event upon High Threshold" is set to Yes.	No	Yes/No	It allows for whether or not the issue of an event must generate a spontaneous call to the Center. This information is applicable only if the communication network with the Center is switched.
Low Threshold (%)	None	0	1÷100 step 1 0= disabled	It allows for a "low" threshold for the measurement to be configured. If the threshold is exceeded, it is possible to issue an event and a possible spontaneous call.
Event upon Low Threshold	Field enabled only if the "Low Threshold" field is enabled.	Yes	Yes/No	It allows to configure for whether or not the exceeding of the Low threshold, in both directions, issues an event.
Spontaneous call upon Low Threshold Event	Field enabled only if the preceding field "Event upon Low Threshold" is set to Yes.	No	Yes/No	It allows for whether or not the issue of an event must generate a spontaneous call to the Center to be configured. This information is applicable only if the communication network with the Center is switched.
Hysteresis (%)	Field enabled only if at least one of the two Thresholds is enabled.	10	1÷20 step 1	It allows for the hysteresis to be applied upon the restoration of an exceeded threshold to be configured.
Trend of the 10' Average Value	None	No	Yes/No	It allows to enable or disable the storage of the 10' average values of the measurement.
Full scale Max	None	100	32767	It is the max full scale value of the measurement
Full scale Min	None	100	-32766	It is the min full scale value of the measurement

Table 21- Configurable values in the *Spare TM Parameters Tab*

Upon exiting the form, the program verifies that the "High Threshold greater than Low Threshold" condition is respected.

Note: *The measurements are configured as current inputs by default, and acquired in the range 4÷20 mA. However, it must be possible to configure the same inputs in the range -5÷+5mA.*

5.2.3.11. *Digital Outputs*

This Tab must allow to either configure or change the use of each Digital Output present on the RTU, as well as its related parameterization.

The *Digital Outputs* single-Tab form must be as shown in Figure 14 (for the UE8 version):

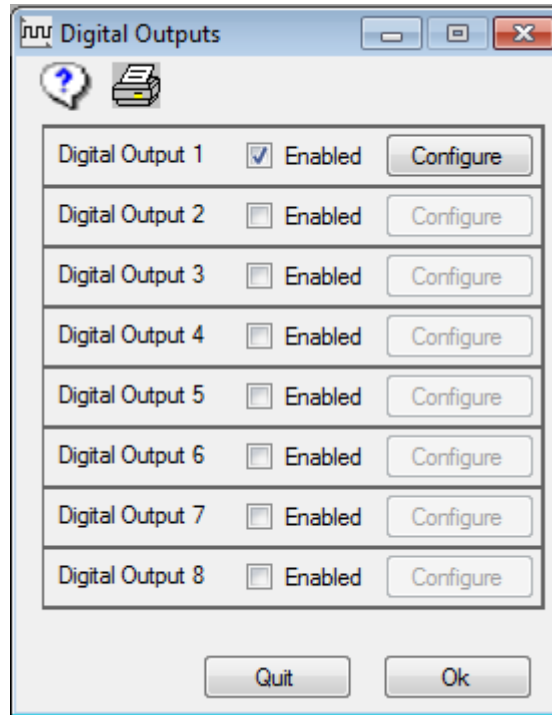


Figure 14 - Digital Outputs single -Tab form

The number of Digital Outputs that can be utilized depends upon the type of UE:

- UE8 8 DOs (1÷8)
- UE16 16 DOs (1÷16)

The configurable parameters in the *Digital Outputs Parameters* Tab are listed in Table 22, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Digital Output 1	None	No	Yes/No	It allows to configure or not the Digital Output 1. If the SG 1 is utilized as a Recloser, the use of the output is automatically set by the Program.
Digital Output 2	None	No	Yes/No	It allows to configure or not the Digital Output 2. If the SG 2 is utilized as a Recloser, the use of the output is automatically set by the Program.
....	None	No	Yes/No	It allows to configure or not the Digital Output If the SG ... is utilized as a Recloser, the use of the output is automatically set by the Program.
Digital Output 8	None	No	Yes/No	It allows to configure or not the Digital Output 8. If the SG 8 is utilized as a Recloser, the use of the output is automatically set by the Program.
Digital Output 9	Field enabled for the UE16 version only	No	Yes/No	It allows to configure or not the Digital Output 9. If the SG 9 is utilized as a Recloser, the use of the output is automatically set by the Program.
....	None	No	Yes/No	It allows to configure or not the Digital Output If the SG ... is utilized as a Recloser, the use of the output is automatically set by the

				Program.
Digital Output 16	Field enabled for the UE16 version only	No	Yes/No	It allows to configure or not the Digital Output 16. If the SG 16 is utilized as a Recloser, the use of the output is automatically set by the Program.

Table 22 - Configurable parameters in the *Digital Outputs Parameters Tab*

For each Digital Output, a "Configure" button must be also provided, which allows its complete parameterization.

The *Type Digital Output* single-Tab form must be as shown in Figure 15.

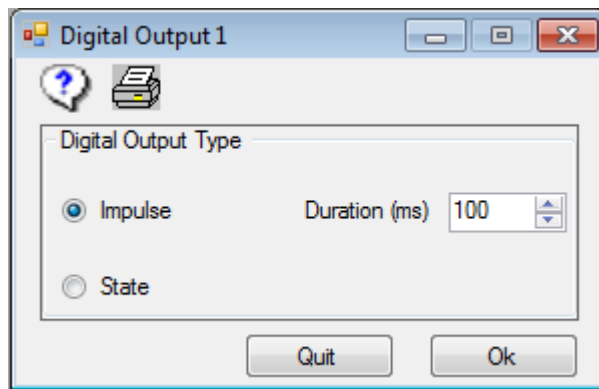



Figure 15–*Digital Output Type* single -Tab form


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The configurable parameters in the Type *Digital Outputs* Tab are listed in Table 23, along with a brief description of their use.

Field Name	Dependency	I.V.	P.V.	Description
Type Digital Output	Field enabled only if the Digital Output is not utilized in connection with a Recloser	Status	Impulse Status	It allows for the type of Digital Output to be set on the field to be configured. If the Digital Output is utilized in connection with a Recloser ¹ , the supply to the field is impulsive.
Duration (ms)	Field enabled if one of the two following conditions occurs: - the Digital Output is not utilized in connection with a Recloser, or - the preceding field "Type digital Output" is set equal to "Impulse".	100	100÷3000 step 100	It allows for the duration of the impulse to be provided to the Output to be configured.

Table 23- Configurable parameters in the Type *Digital Outputs* Tab

¹ The connection Switchgear-Digital Output is severe: if a switchgear is utilized, the Digital Output of equal index must be considered connected to that switchgear.

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5.2.4 Services Menu

5.2.4.1. Printing

The printing function must allow for the printing of all of the parameters stored into the latest data base configuration.

All of the printing options must coincide with those which are set on the default printer device connected to the PC. Nonetheless, just as any application in Windows, the printing options must be able to be modified at the time of printing.

The printing function must be allowed for at least the following logical groups:

- ◇ General (Header, General parameters, Communication parameters);
- ◇ Switchgears;
- ◇ Spare RSs;
- ◇ Spare TMs;
- ◇ DOs;

There must be a header on each page of the print-out report, which must include the following items at least:

- Date;
- name of the database ;
- author;
- page number;
- name of the table printed;

In addition, on each form of the configurator, the printer icon must be provided, which must allow to activate the “send for printing” function of the hard copy.

5.2.4.2. Password Change

This function must allow the user to change the login password to access program.

The *Change Password* form must be as in Figure 16:

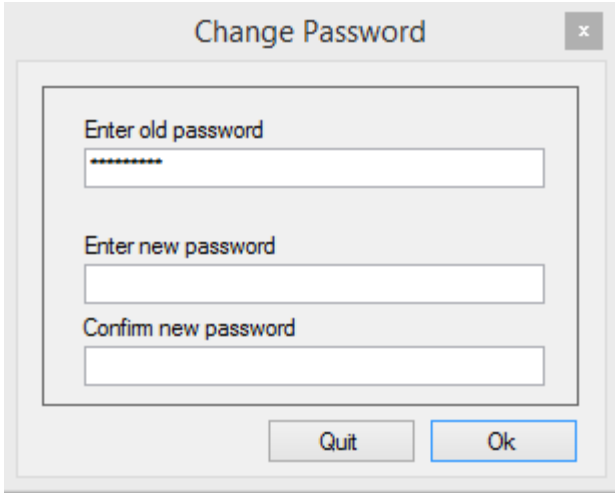


Figure 16 - Change Password- single-Tab form


The fields to to be compiled on the *Change Password* form are listed in Table 24, along with a brief description.

Field Name	Dependency	I.V.	P.V.	Description
Old password	None	Blank	9 alpha-numeric characters	Password to be used in order to access the program. Please note: the password is "case sensitive" which means that capital and lower case letters have different values.
New Password	None	Blank	9 alpha-numeric characters	New password, which will become active at the next program start up.
Confirm new password	None	Blank	9 alpha-numeric characters	Confirmation of the new password requested upon re-entry.

Table 24- Fields to to be compiled on the *Change Password* form

During either the introduction of both the "old password" and the "new password" screen, or upon the command to "confirm password", the program must display an asterisk (" * ") in the place of each character typed.

If the password is incorrect, the user must repeat the operation, where there is no limitation in the number of attempts.

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5.2.4.3. *Compilation-download*

This service must allow to initialize the compilation of a source database, and the subsequent transfer to the RTU of the configuration parameters needed for its operation.

"Compilation" refers to the verification of the accuracy of the configuration data entered, and the necessary processing that allows to obtain the file to be transferred to the RTU. The program must generate such a file only if no data inconsistency is detected, during the processing.

The verification of the accuracy of the configuration parameters in the files of the database must provide for either cross-checking or for the generation of error messages upon detection of any inconsistency; these messages must allow to trace the incorrect data.

Only the latest data base, whose name appears on the Tool Bar, may be compiled, and the compilation may be launched only if there are no Tabs open.

5.2.4.4. *Upload and reverse compilation .*

This service allows the basic configuration to be received from the RTU, and saves it on the PC's hard disk, either in the default directory or in another one chosen by the user.

During the upload, the RTU must operate regularly.

The transfer progress must be indicated by the number of bytes transferred, and the end of the operation must be communicated properly.

The user must be able to adjust the latest configuration obtained, and transfer it back to the UP, if necessary, as with any other configuration.

5.2.4.5. *Firmware download*

This service allows to locally upload the firmware (i.e. the application software), on the RTU.

The transfer progress must be indicated by the number of bytes transferred, and the end of the operation must be communicated properly.

The accidental interruption of the firmware updating procedure must not compromise the correct operation of the RTU .

5.2.4.6. *Additional modules Menu*

The following paragraphs describe the additional modules to be integrated into the configuration software, which deal with the functionalities of RTU monitoring, and firmware update of the UE and the PSCB.

5.2.4.7. *Viewer*

This service is utilized for the monitoring of both of the input and output signals, the automatism of the RTU, as well as, for the transmission of the controls to the UE and the downloading of the event and measurement buffers.

The functions available are:

- Monitoring the states of the digital and analogue inputs;
- Monitoring the status of either the control output (relays) or the digital outputs;
- Monitoring the transition states (offline and online) of either the automatism for each switchgear, with the possibility to save and upload on/from an Excel file, or the physical and logical inputs of the automatism;
- Possibility to send commands to the outputs of the UE, for each switchgear.
- Local download of the Event Buffer and the Measurements Buffer.

- Reading of either the RTU calendar, the IEC address, the version of the latest firmware on the UE, or the status of communication with the Center.

Possible communication states are:

- Connected
- Disconnected
- Waiting for a call (with indication of the remaining time until the successive redial attempt, and the number of attempts remaining).

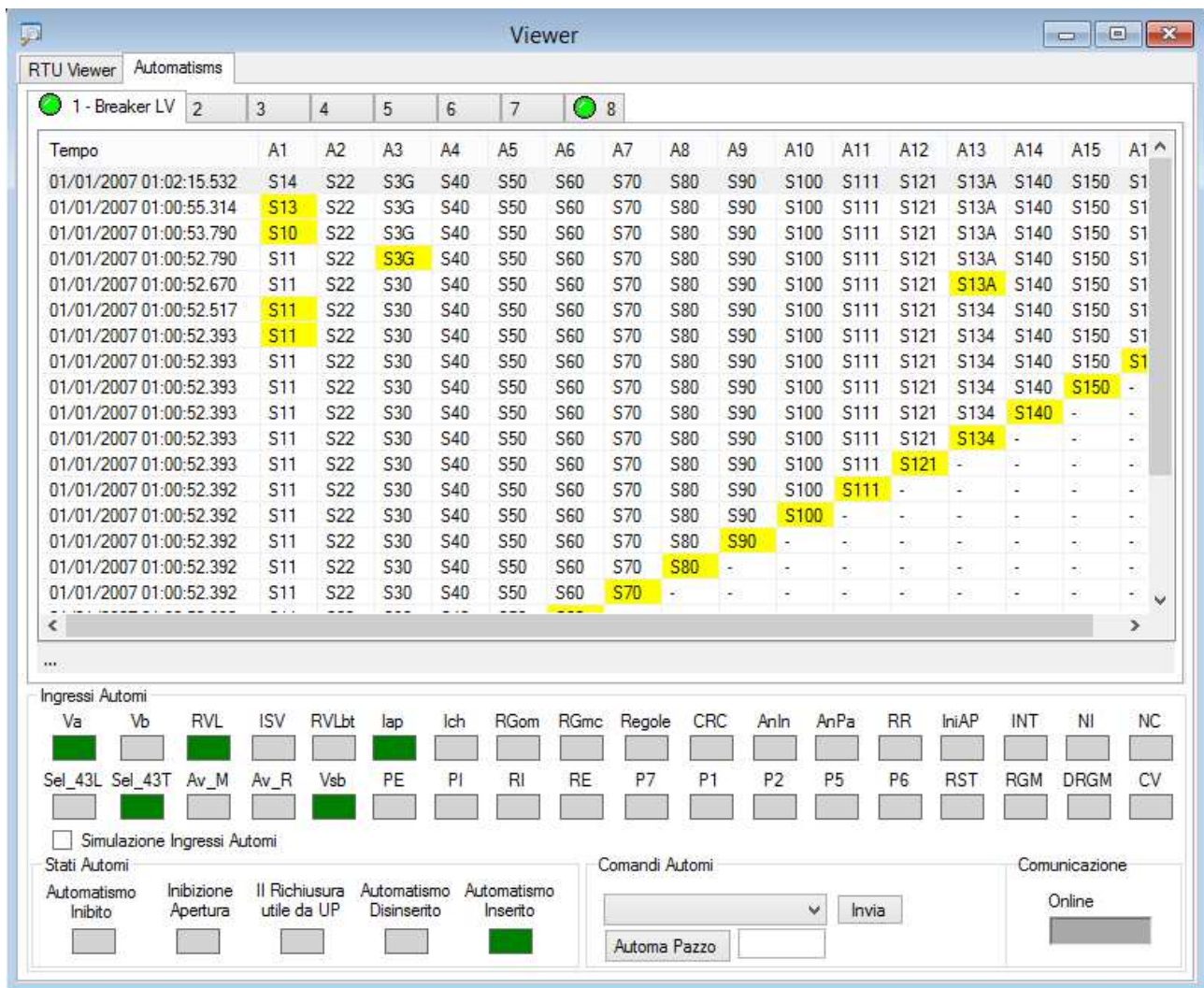
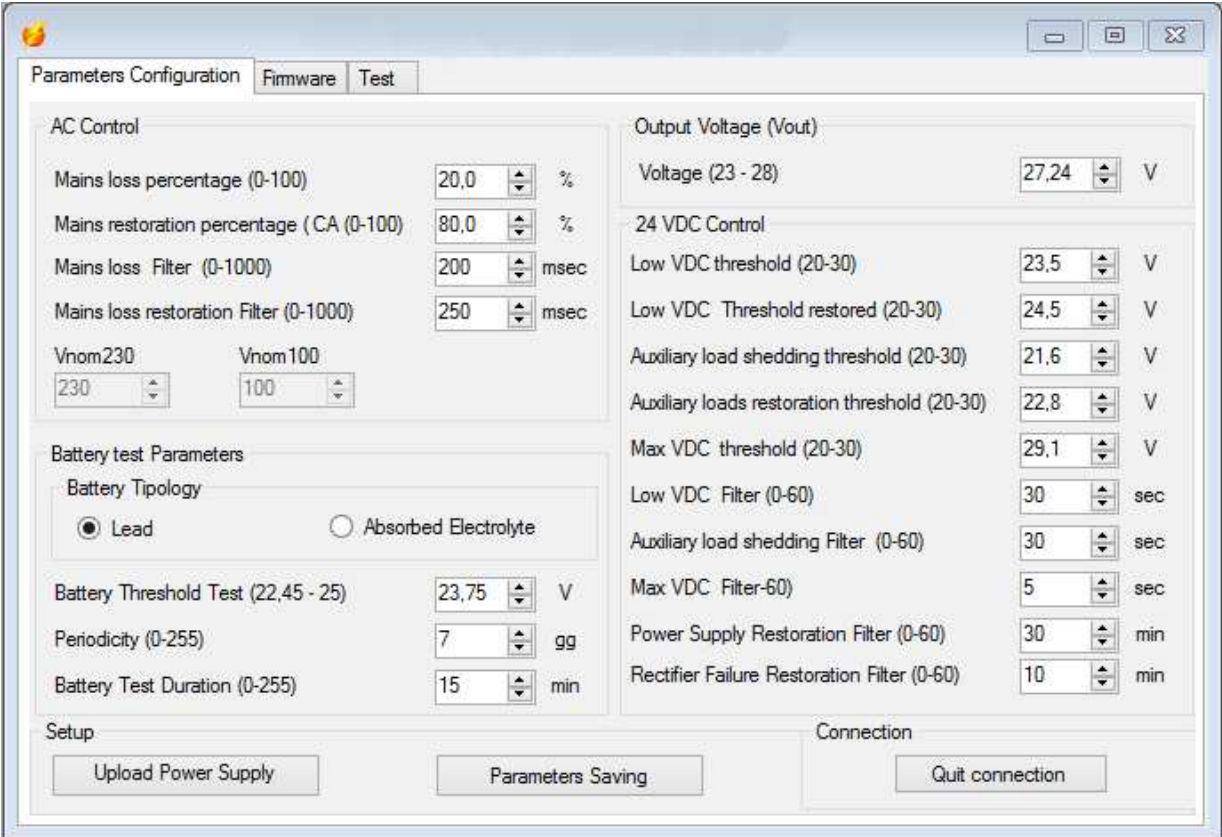


Figure 17 –An example of viewer of the transition of the input states of the automatism².

²A time-stamp with a 1 millisecond resolution is associated to each state transition (highlighted with a different colour with respect to the preceding row). In the lower part, the states of either the automatism or the inputs are displayed.

5.2.4.8. Power Supply

This service allows to manage and configure the RTU power supply. Upon opening the form, the program will connect to the PSBC (by means of USB port) updating the interface after having read all of set values. The *Power Supply* form has three tabs: “Parameters Configuration”, “Firmware”, and “Test”, as shown in Figure 18.



The screenshot shows the 'Parameters Configuration' tab of the Power Supply form. It includes the following sections and parameters:

- AC Control:**
 - Mains loss percentage (0-100): 20,0 %
 - Mains restoration percentage (CA (0-100)): 80,0 %
 - Mains loss Filter (0-1000): 200 msec
 - Mains loss restoration Filter (0-1000): 250 msec
 - Vnom230: 230
 - Vnom100: 100
- Battery test Parameters:**
 - Battery Tipology: Lead, Absorbed Electrolyte
 - Battery Threshold Test (22,45 - 25): 23,75 V
 - Periodicity (0-255): 7 gg
 - Battery Test Duration (0-255): 15 min
- Output Voltage (Vout):**
 - Voltage (23 - 28): 27,24 V
- 24 VDC Control:**
 - Low VDC threshold (20-30): 23,5 V
 - Low VDC Threshold restored (20-30): 24,5 V
 - Auxiliary load shedding threshold (20-30): 21,6 V
 - Auxiliary loads restoration threshold (20-30): 22,8 V
 - Max VDC threshold (20-30): 29,1 V
 - Low VDC Filter (0-60): 30 sec
 - Auxiliary load shedding Filter (0-60): 30 sec
 - Max VDC Filter-60): 5 sec
 - Power Supply Restoration Filter (0-60): 30 min
 - Rectifier Failure Restoration Filter (0-60): 10 min


At the bottom, there are three buttons: 'Upload Power Supply', 'Parameters Saving', and 'Quit connection'.

Figure 18- Configuration Parameters Tab of the *Power Supply* form

The *Parameters Configuration* Tab makes it possible to modify the parameters values within the ranges specified, and to later save the configuration on the UE via the button entitled "Save parameters".

The “Cancel connection” button allows the disconnection of the Power Supply to be forced in the case any error is detected.

The “Send Firmware” button of the Firmware Tab allows the firmware of the Power Supply to be updated.

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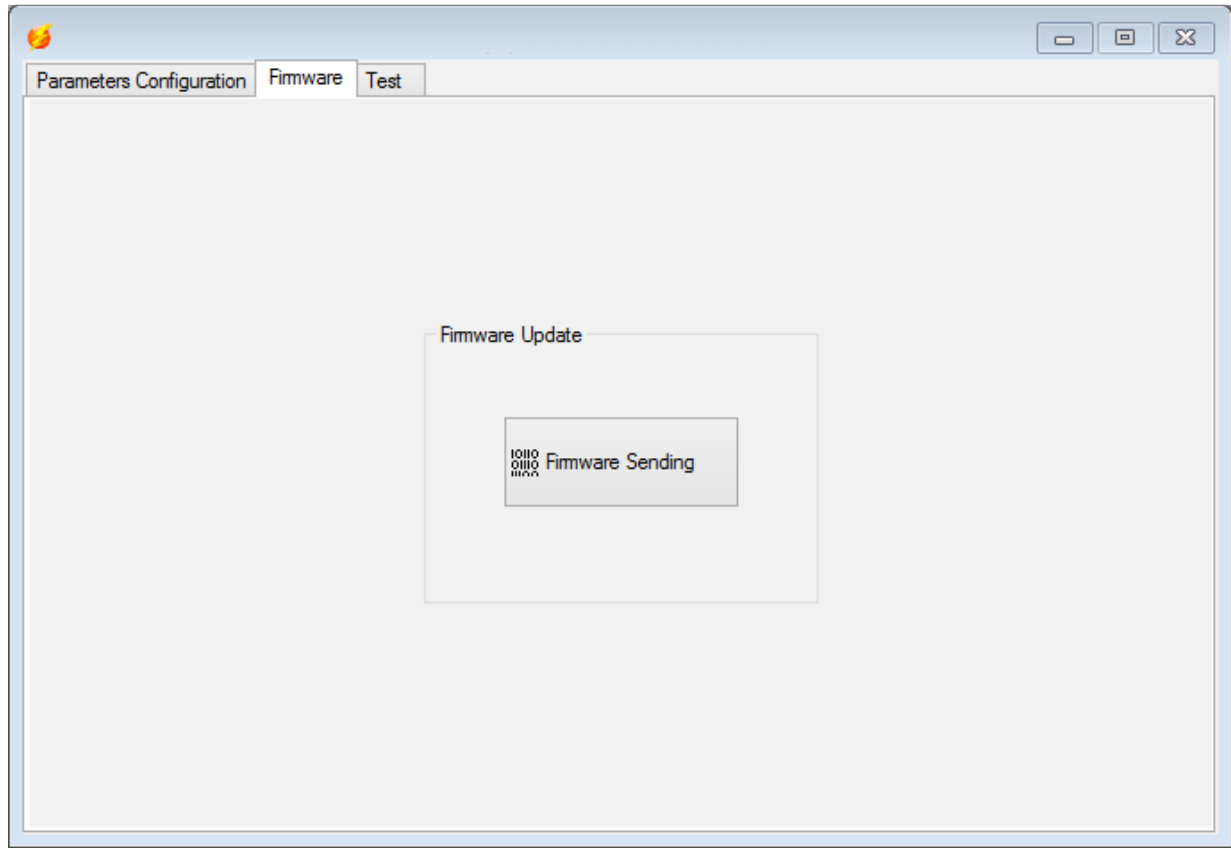


Figure 19- *Firmware Update* section of the *Firmware* Tab of the *Power Supply* form

Finally, through the *Test* Tab, it is possible to execute a set of tests on either the Leds or the Relays, as well as to modify the output voltage V_{Out} .



Parameters Configuration | Firmware | Test

Led Status Change

- Mains
- VDC Enabled
- Low VDC
- Max VDC
- Battery Failure

Send Command

Relay Status Change

- Mains Failure
- Low 24 VDC
- 24 VDC Enabled
- Battery Failure
- Rectifier Failure

Send Command

Change Vout

Value
24.00

Send Command

Figure 20- Test Tab of the *Power Supply* form

This Tab shows the commands which allow the device to be tested (just select one or more tests and send the command).

Commands are grouped as follows:

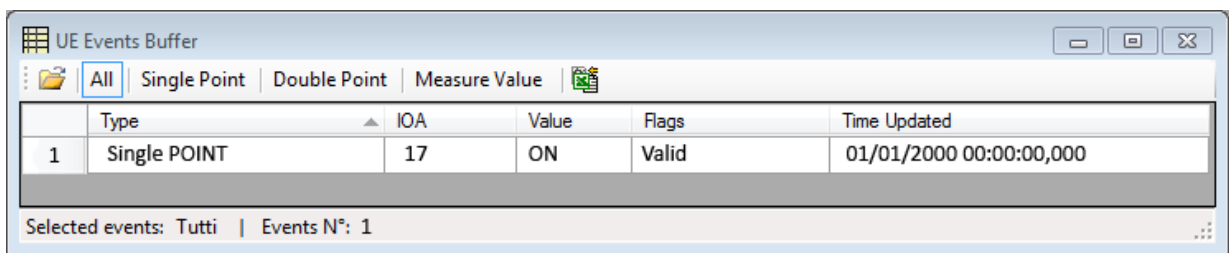
- Relays status;
- Leds status;
- Modify V_{Out} ;

5.2.4.9. Events Buffer Viewer

The Events Buffer contains all of the new events that have not yet been downloaded from the RTU. In order to download the Events Buffer, the local downloading function must be available.

During the download of the Events buffer, the number of bytes read over the total number of bytes to be read must be shown.

Once the download has been completed, a window must appear which contains a grid of the events downloaded by the UE, chronologically, as the one provided in Figure 21.



	Type	IOA	Value	Flags	Time Updated
1	Single POINT	17	ON	Valid	01/01/2000 00:00:00,000

Selected events: Tutti | Events N°: 1

Figure 21 - Grid which demonstrates the Events Buffer download

A filter must be provided, in order to visualize either the events according to their type (*Single Point*, *Double Point*, *Measure Value*) or all at once.

5.2.4.10. Measurements Buffer Viewer

The measurements files contain the 10' average values. The file header contains the following:

- 2 bytes, which are utilized for the Information Object Address (which identifies the measuring channel);
- 7 bytes, which are utilized for the first (the oldest) date/time stamp measurement, according to the CP56Time2a format compliant with the 611870-5-101/104 protocols;
- 2 bytes, which provide the number of values present in the file;

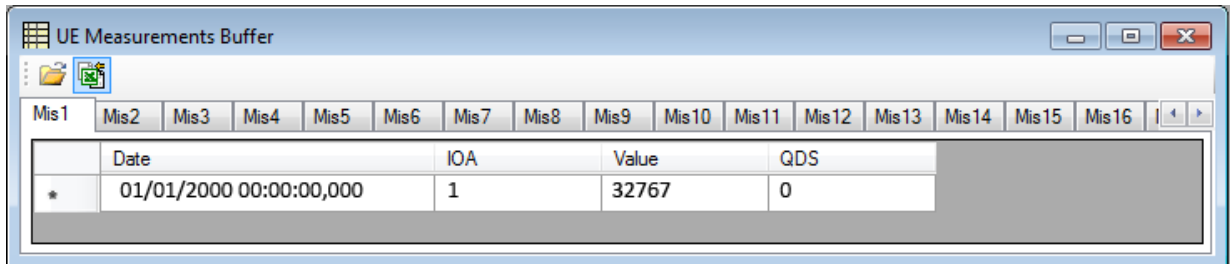
Next come all of the measurements of each single channel, up to 2016 values (i.e. 6 measurements/hour x 24 hours x 14 days). The format of the measurement field is of 3 bytes (2 bytes for the value + 1 byte for the QDS).

In the case that the number of measurements exceeds the maximum capacity for each individual file, the oldest data will be overwritten and the value of the date/time stamp of the header must be updated.

The local downloading function of the measurements files must be provided in order to download the Measurements Buffer.

During the download of the Measurements buffer, the number of bytes read over the total number of bytes to be read must be shown.

Once the download has been completed, a window must be shown which contains a grid with the events downloaded by the UE, chronologically, as the one provided in Figure 22.



Mis1	Mis2	Mis3	Mis4	Mis5	Mis6	Mis7	Mis8	Mis9	Mis10	Mis11	Mis12	Mis13	Mis14	Mis15	Mis16
	Date	IOA	Value	QDS											
*	01/01/2000 00:00:00,000	1	32767	0											

Figure 22 - Grid which demonstrates the Measurements Buffer download

5.2.4.11. Firmware multiple downloading

A software module for the automatic update of the firmware of multiple UEs must be provided. Such a module must contain either the Save function for the list of UEs whose firmware must be updated, or the download of a previously saved list.

The list of UEs to be updated is identified by the telephone number/IEC address, as to the 611870-5-101 protocol, and via the IP address/IEC address, as to the 611870-5-101 protocol.

The software will then demonstrate a table (which can be exported like a file), which summarizes all of the fields shown in Figure 23:

- Name of the UE;
- IEC address;
- Telephone number of the UE/IP address;
- latest version of the firmware;
- file transfer status;
- connection status;
- Date/time at the beginning of the connection;
- Date/time at the end of the connection.

The application must allow to read only of the latest version of the firmware, without any file transfer.

The file transfer of the firmware must be provided only **if the version which is going to be transferred is greater than the one which is currently in use on the UE, which is under examination.**

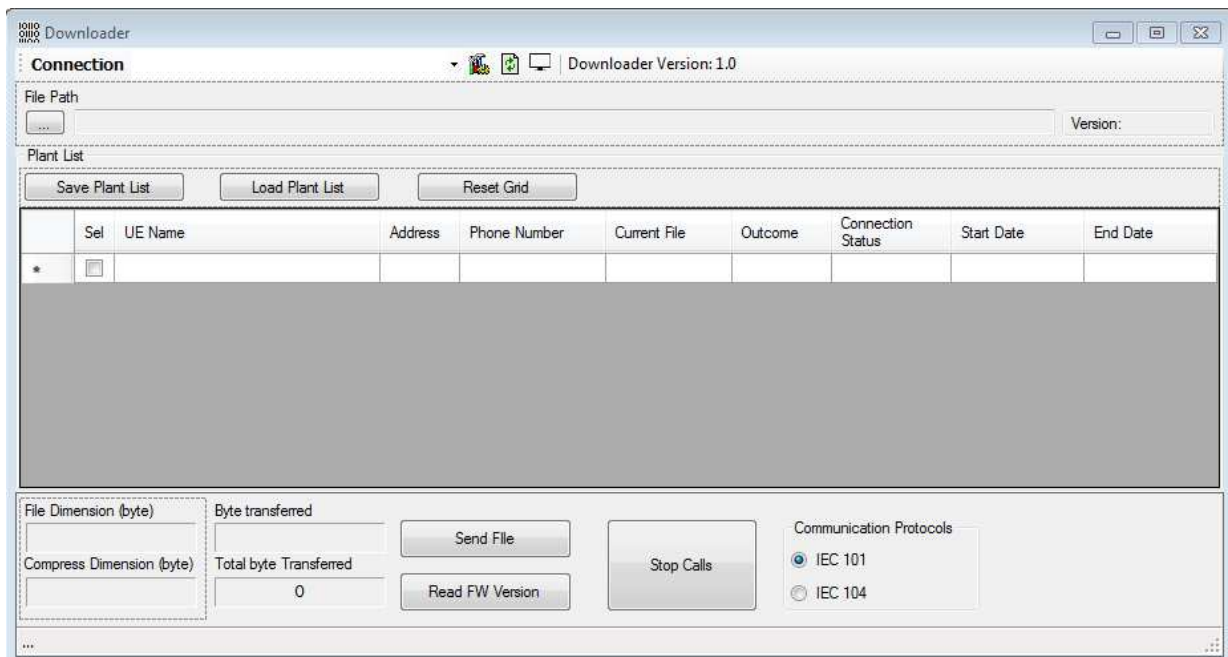



Figure 23– Example of the interface of the multiple downloader of the firmware

The connection to the RTU must take place according to the same process utilized for the Center. During the file transfer of the firmware, to avoid the download of the events currently present onto the RTU, this last must be denied in order to proceed with the transfer of any event.

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5.2.5 Information Menu

This menu shows (Figure 24) information about the versions of the software modules, the UE and PSCB firmware as well.

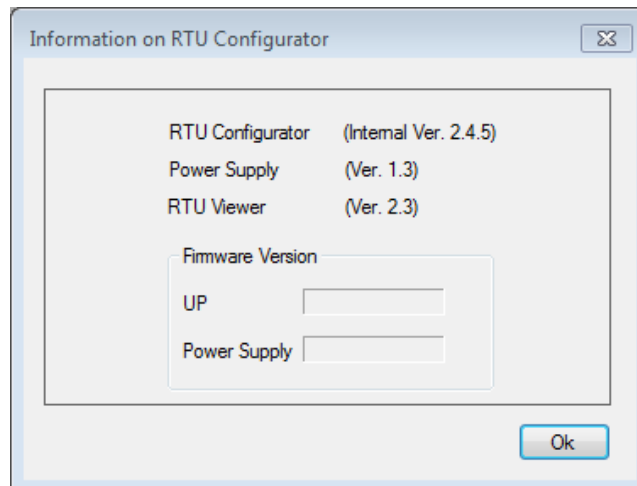



Figure 24 - Info form.

6 SOFTWARE REQUIREMENTS

All of the user application software provided must meet the following requirements:

- Compatibility with OS Windows 7;
- Availability of "silent-mode" installation and update, through Software Delivery, by means of setup launch with a proper parameter and, finally, definition of the installation path. The wizard-guided installation must start automatically if no additional parameter is utilized. The default installation folder must be: C:\Program Files\UP\SoftwareNameUP_provider_vX.YY\;
- The name of the program must clearly show the name of the provider and the versioning progressive number. (eg.: UEConfigurator_provider_v1.00.exe);
- The same nomenclature must be adopted in the "install/uninstall applications" service of the control panel;
- Usage of Windows 7-certified USB driver;
- Autodiscovery of the COM port, providing also the possibility of an eventual manual change, in the case of failure of the autodiscovery procedure;
- Absence of either error messages or long waiting in the case of start of the application while the RTU is disconnected ;
- Presence of a "Firmware" folder placed at the same level hosting of the executable of the RTU configurator. This path must be suggested by default, upon selection of the Firmware Download service;
- Presence of a folder where to save the configuration files of the plants, which must not be deleted in the case of the RTU configurator uninstall.
The path must be D:\Programs\ApplicationData\RTUConfigurations_Provider\. This path must be suggested by default, upon selection of the Open File option.

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7 MOBILE APPLICATION

A mobile application (ANDROID 4.2) must be also provided, useful to either configure the UE or update the firmware locally, by means of the UE USB port. In order to facilitate the user in the configuration via mobile, the application will be provided with a set of standard configurations, which will be retrieved from the APP interface and sent to the UE, after the modification of the system parameters such as: IEC index of the device, IP; and phone numbers of the supervision center.