RCU-8951 TECHNICAL MANUAL

Firmware Version 9.4
Manual revision 006

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1 – Overview

The GSM remote control RCU-8951 is based on the ATMEL Microcontroller AT89C51AC3, of the latest generation, complemented by a GSM/GPRS industrial modem that is equipped with an RS232C serial port and allows to activate up to 8 electrical remote equipments, by simply sending an SMS from a cell phone. The RCU-8951 remote control is equipped with an LCD module 4x20 with LED back-light for detailed viewing of all operational phases and messages received from the modem and allows the reading of 8 analogic voltage inputs (0 ... 3 V) with a resolution of 10 bits, dedicated to the acquisition from sensors and remote transducers, for example, temperature, humidity, liquid level, pressure, etc. It is possible to program up to 8 alarms generated by the exceeding of max and min thresholds, both for the tensions that for temperatures. Also available are 8 TTL digital inputs, whose change of state (of one or more inputs) determines the sending of an SMS alarm, with reading of all the inputs status.

The management of the analog and digital alarms is very complete and allows a precise analysis of remotely controlled environmental conditions. An alarm cycle is generated upon exceeding the predetermined threshold, in temperature or in voltage and the alarm status is stored on the EEPROM; if and when the sensor reading returns to a normal state, namely within the pre-set limits, there is a second cycle of alerts (SMS or calls) to notify the return to the state of alarm. The digital alarms, managed in polling, are generated by the opening of a normally closed line to ground and are equipped with a warning delay adjustable from 0 to 255 s, by which there is no generation of an alarm, but only the pre-alarm status displaying the open line on the LCD. After the pre-set time delay, it is generated an alarm cycle with event storage; if and when the line is closed to ground you have a new message via the SMS notifying the end of the alarm status. There is also one line for alarm controlled by interrupt with a very rapid response alarm line (10 ms), suitable for alarm sensors that have a pulsed output having a very short pulse duration.

The remote control unit RCU-8951 automatically sends a ring or, alternatively, a SMS as confirmation to the caller for command execution , only to the registered user; all the SMS sent by unregistered users are ignored and deleted; all the SMS containing a valid command sent by registered users are executed and then automatically deleted from the SIM.

The output relays are of the 2-way switch type single-pole (SPDT) and therefore have 3 contacts each: common (COM), normally open (NO) and normally closed (NC), reported to the 12-pin terminal is accessible on the board. The max switching power on resistive load is 2500 W. The quality standard of the product is industrial grade and its applications are innumerable and in general RCU-8951 finds application in all cases where it is necessary to activate remote operation of electrical equipments and receiving a feedback from ON-OFF sensors and readings from remote sensors of physical variables. Typical application areas of the RCU 8951 are remote activation of boilers, air conditioners, lighting, irrigation, burglar alarm systems, etc.. and the opening of doors and gates, as well as the control of remote environments, with the possibility of receiving alarms generated by environmental sensors and reading of sensors and transducers. The RCU-8951 manages the program variables in EEPROM memory to ensure the maintenance of the parameters and user data even in the event of a main power black-out.

1.1 - Local automatic control ON-OFF

The remote control RCU-8951 offers autonomous functions for ON-OFF automatic control; enabling the necessary user parameters stored on the EEPROM, it is possible to implement a controller driving up to eight relays, as a function of the relative temperatures or 8 input voltages, prefixing the min and max thresholds set-point. To optimize the adjustment and avoid oscillations around the threshold value, there are two correction factors hysteresis, low and high, separately settable by the user, the default value set at the factory is fixed to the value of 5% (= 0.95 ISTlow, ISThigh = 1.05). The enabling for customized different alarms are carried out by writing the appropriate parameters in its EEPROM locations, as indicated in the following paragraphs. The command used is **WB** (initials of Write Bit), to set and reset every bit of the variable.

1.2 - General enabling for analog alarms

All alarm types have a group of parameters for a general enabling, which in the absence of other specific setting, only allow the alarm status displaying on the LCD without generating alarms via SMS or calls; this general enabling is useful during installation and set up of the system, for checking the correct setting of user parameters and for the operation of the regular test of the alarms in relation to the set thresholds, or the opening of the digital inputs.

- min temperature threshold alarm enabling   EEPROM add. = 011
- max temperature threshold alarm enabling   EEPROM add. = 012
- min voltage threshold alarm enabling   EEPROM add. = 013
- max voltage threshold alarm enabling   EEPROM add. = 014

1.2.1 - ON-OFF control with min temperature threshold

It can be set up to 8 min temperature thresholds with hysteresis; the program performs a reading on each analog input and when the value is lower than the min reference threshold multiplied by the low hysteresis factor, are generated two different alarm types, which can be individually enabled or disabled; They are indicated below the respective locations of the EEPROM to be written with the WB command, setting to one the input bit that you want to enable. When the input controlled returns to a value equal to the min reference threshold multiplied by the High hysteresis factor , is generated a new SMS (if enabled) and the relays (if enabled) returns to the idle state.

- Send text message to ADMIN numbers   EEPROM add. = 018
- relay activation related to input line in alarm EEPROM add. = 019

1.2.2 - ON-OFF control with max temperature threshold

it is possible to set up to 8 max temperature thresholds with hysteresis; the program performs a test on the analog inputs and when the current value is greater than the max reference threshold multiplied by the high hysteresis factor, generates two different types of alarms, which can be individually enabled or disabled; They are indicated below the respective locations of the EEPROM to be written with the WB command, setting to one the input bits that you want to enable. When the input controlled returns to a value equal to the max reference threshold multiplied by the hysteresis factor low, is generated a new SMS (if enabled) and the relays (if enabled) returns to the idle state.

- enabling alarm SMS to ADMIN numbers   EEPROM add. = 020
- enabling relay activation by the alarm line   EEPROM add. = 021

1.2.3 - ON-OFF control with min voltage threshold

it is possible to set up to 8 max temperature thresholds with hysteresis; the program performs a test on the analog inputs and when the current value is greater than the max reference threshold multiplied by the low hysteresis factor, generates two different types of alarms, which can be individually enabled or disabled; They are indicated below the respective locations of the EEPROM to be written with the WB command, setting to one the input bits that you want to enable. When the input controlled returns to a value equal to the min reference threshold multiplied by the high hysteresis factor, is generated a new SMS (if enabled) and the relay (if enabled) return to the idle state.

- enabling alarm SMS to ADMIN numbers   EEPROM add. = 022
- enabling relay activation by the alarm line   EEPROM add. = 023

1.2.4 - ON-OFF control with max voltage threshold

It is possible to program up to 8 max voltage thresholds with hysteresis; the program performs a test on the analog inputs and when the current value is greater than the max reference threshold multiplied by the high hysteresis factor, generates two different types of alarms, which can be individually enabled or disabled. They are indicated below the respective locations of the EEPROM to be written with the WB command, setting to one the input bits that you want to enable. When the input controlled returns to a value equal to the max reference threshold multiplied by the low hysteresis factor, is generated a new SMS (if enabled) and the relay (if enabled) returns to the idle state.

- enabling alarm SMS to ADMIN numbers   EEPROM add. = 024
- enabling relay activation by the alarm line   EEPROM add. = 025

1.2.5 - Setting the hysteresis factors IST_low and IST_high
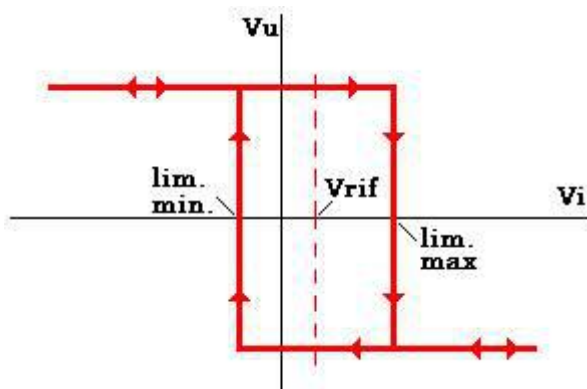
To ensure the stability of the ON-OFF automatic control and avoid too rapid oscillations around the set-point resulting in too frequent switching of the output relays, it can be set two hysteresis factors, which, starting from the set-point Vref determine the two actual switching thresholds (min and max).

The area contained in the diagram characterizes the insensitivity area in the neighbourhood of the reference value. Analytically the two switching levels are determined by the following equations:

- Min Threshold = IST_low * Vref
- Max Threshold = IST_high * Vref

therefore, to calculate the two hysteresis factors, starting from the reference value Vref (set-point) and the desired switching thresholds, you must use the two inverse relations:

$$IST\_low = \frac{Min\_threshold}{Vref} \qquad \text{(EEPROM address = 240, default value = 0.95)}$$

$$IST\_high = \frac{Max\_threshold}{Vref} \qquad \text{(EEPROM address = 244, default value = 1.05)}$$

1.3 - Alarms digital lines in the polling mode

The digital input lines are divided into two groups of 4 lines each, physically corresponding to ports P3.4...P3.7 and P4.0...P4.3 of the Microcontroller. The control logic considers the idle state the one in which the lines are closed to GND (0V); This convention allows to detect any sabotage actions, such as cutting of the wires of the sensor and/or sensor faults, because in case of opening, the internal resistance of pull-up of the Microcontroller leads to high level (alarm condition) the line . The digital lines are read in a cyclic scan (polling mode) and the minimum acquisition time, which is optimized to reject any impulsive noise, is about 2 s (it can be increased), which is therefore equivalent to the minimum required time duration of the pulse sent by the sensor for generating an alarm (magnetic contacts, PIR detectors, photocells, etc.). The relay (if enabled) is activated when the corresponding input line is opened, after the pre-alarm time, if present; It is also sent a SMS and /or ring to all the ADMIN numbers. When the line returns to the stand-by state, the relay (if enabled) will be released and it will send a new SMS and/or confirmation ring. In standard version of the remote control RCU-895 the four digital lines P3.4 ... P3.7 are used for the encoded keyboard, and therefore it is not possible the simultaneous use of the keyboard and alarm inputs on these lines: if you want to use these lines for alarms, the keypad must be disconnected (even temporarily). It is possible, by setting the appropriate parameters, enable the activation of the relay according to the state of the digital lines, and then to repeat one line on the corresponding alarm relay (e.g. when line 1 is open, relay 1 is activated). All phases of entry and exit from the analogic and digital alarms are indicated on the LCD display.

1.3.1 - Alarm line in interrupt mode

The P3.2 line is used as alarm input in interrupt mode, dedicated to sensors with very short duration output pulse (<100 ms) e.g.. PIR sensors, photocells, microwave, etc. The P3.2 line is enabled by setting the corresponding bit and is reset automatically after every alarm cycle. The logic of this input is opposite to that of all the others digital lines: the idle state is the one with the line connected to + 5V (or open), while connecting line P3.2 to GND, is generated an alarm.

1.3.2 - General Digital Alarm Setting

You can set the different pre-alarm delays for the two groups of 4 3.x and 4.x lines, writing the value with the **WY** command (**W**rite **B**yte) , in seconds, from 0 to 255 in the following locations:

- Pre-alarm duration for digital inputs P3.x in seconds EEPROM address = 009
- Pre-alarm duration for digital inputs P4.x in seconds EEPROM address = 016

1.3.3 - Enabling digital lines P3.x alarm

- sending alarm ring by digital input lines   P3.x   EEPROM add. = 026
- sending alarm SMS by digital input lines   P3.x   EEPROM add. = 027
- activating alarm relays by digital input lines P3.x   EEPROM add. = 028

1.3.4 - Enabling digital lines P4.x alarm

- sending alarm ring by digital input lines   P4.x   EEPROM add. = 029
- sending alarm SMS by digital input lines   P4.x   EEPROM add. = 030
- activating alarm relays by digital input lines P4.x   EEPROM add. = 031

2   – Installation

The RCU-8951 GSM remote control unit, in RLK version (or RL) is assembled in a robust shielded steel enclosure, and is suitable for a wall mounting; It must be installed by choosing a location that is covered by a sufficient GSM field intensity for the used network and at the same time convenient for short connections to the devices to be controlled, to analogue and digital sensors and to the 220 Vac mains power supply. The built-in antenna, connected to the GSM module through the SMA connector is sufficient for most applications. For installation in zones away from repeaters or in shielded environments, it is appropriate to use an external GSM antenna (omni-directional or high-gain directional) available on request. The RCU-8951RLK has a built-in regulated switching power supply with mains transformer 220 Vac and output for automatic charging of the backup battery, which is useful in the event of a blackout. The IP67 compact versions of RCU-8951 require an external power supply able to provide 1 A at 12V DC , linear or switching type and <u>it is recommended to use even for the versions IP67 a power supply with backup battery </u>of 12 VDC 1Ah.
The power supply with backup battery, which is generally used to ensure a reliable functioning of the standard alarm systems and telephone dialers, offers important advantages, such as:

- the continuity of overall functionality and of alarms generation even in case of main black-out
- elimination of possible micro-rapid main power interruptions, potentially dangerous for the integrity of data in the Flash memory of the Microcontroller and the GSM module.

2.1 – Getting Started

Use for the modem of the RCU REMOTE-8951 a GSM mini-SIM 2FF format (the micro-SIM 3FF and nano-SIM 4FF formats are not supported); you can choose any provider except H3G, which uses the USIM, then initialize the SIM card into a normal mobile phone with the following steps:
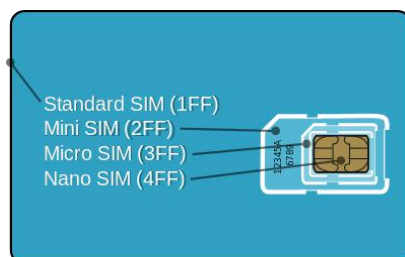
1)   Disable any PIN code to access the SIM card, otherwise the remote control does not work

2) Remove all messages received already on the SIM card, not to unnecessarily occupy the memory (max 25 to 50 SMS)
3) Delete (if present) all the contacts stored in the phone book of the SIM-card
4) Disable all the automatic messaging services possibly associated with the SIM card
5) Check the remaining credit
6) Save in user memory (MODEM or SIM) and phone numbers for system administrators (ADMIN), that privileged users who besides being enabled to send SMS commands, are the only ones to receive alarms generated by RCU-8951 884; administrators can be up to 9 (max), and must be stored in the first 9 memory locations, from 1 to 9. For the correct operation of the remote control, it is essential that it is stored at least corresponding to the number ADMIN1 in the first location; ADMIN1 has the distinction of receiving a short confirmation call of the program start-up, about 2 minutes after the starting of the device, in addition to be able to receive if enabled, a call notification whenever a registered user sends a command to the remote control, therefore offering to ADMIN1 the privileged supervisor function of the system.
7) Store in the subsequent phone book memory locations, from 10 to 250 (max) all phone numbers that you want to enable the sending of commands; alternatively it is possible to perform the insertion of the users in a second time, when the remote control is already operational, sending from the mobile phone to enable an SMS containing the modem IMEI number, the code that identifies the serial number of the product, composed of 15 digits , or by using the command WP (Write phone book), as described below. In order to prevent spam calls and random or intentional by unauthorized users is preferable, where possible, use a new SIM card, with unknown numbers to unauthorized users. The RCU-8951 REMOTE control filters however, all Messages from unauthorized users and all potential operating errors or other SMS, also enabled users, and automatically deleting them cyclically from the SIM card.

2.2.1 - SIM Card Insertion

◆ Remove the power all'RCU8951 and slide the reader's SIM card cover towards the outside, pressing gently with a pointed object on the release push-button yellow, (e.g.. Ballpoint pen), to allow the opening if the reader is of the sliding type (Wavecom) or fold the flap, if the hinged type (Siemens).
◆ Insert the SIM card in cover checking carefully the exact positioning.
◆ Close the cover by sliding it toward the inside, so as to block the closure.

2.2 - Electrical connections

For the wall mounting by means of screws or hooks to anchor, use the 2 holes with slot at the vertices of the cabinet, it is possible to fix also with a third screw the lower part of the cabinet wall.

It is advisable do not perform additional holes inside the cabinet, to avoid possible damage of the internal electronic components. Make the connections to the mains, including the earth, according to the drawing and tables in the Appendices, taking care to respect the polarity of the power cable, already connected to the internal terminal: black = GND red = + 12V. The digital inputs can be connected to any alarm sensor that has a "clean" (dry) contact normally closed, (magnetic contacts, infra-red radar, infra-red barriers, level sensors, thermostats ... etc.) In accordance with the standard logic used in the alarm systems, which allows, in addition to the sensor control, even a tamper control, to detect any interruption in the connection lines and send, even in this case, an alarm. It is essential to close all the 8 input lines to ground: those used, through its normally closed sensor and those not used by a jumper. The input line number 2.2, if connected to a switch, can enable, in the the start-up phase, the cyclic scan and displaying on the LCD module the RF field intensity received from the modem, to allow the searching for the maximum field position.

2.3 - Operating conditions

For IP56 and IP67 versions having no built-in power supply, and check the polarity of the supply voltage, which must be 12V DC and the power supply must be able to supply a peak current of 1 A.

The output of the regulator to +5.0 V is already connected and is reserved to supply the power to the Microcontroller board. The environmental conditions must be in the temperature range between -10 °C and +40° C. The max load (resistive) permissible on the relay contacts is 10 A at 250 V. Do not install this device in the areas made dangerous by the presence of flammable or combustible gases or. Do not use this remote control to activate electrical devices or systems with a high degree of danger, on the operation of which may depend the life or health of people.

3   - Start-up and initial configuration

Completed the operations described in paragraph 2 it is possible to supply the equipment and wait for the initialization phase, hardware test, EEPROM data control and registration of the modem to the network (operations indicated on the LCD module); about two minutes after the starting it is automatically generated a confirmation call to ADMIN1, with automatic disconnection. In particular, after the step of reading / EEPROM verification and modem initialization, the message "modem IMEI number" will be displayed for approximately 20 seconds; this number should be recorded and stored. because it can be used as SMS for register a new user, as described in the table 4.1. In the second line of the display displays the received field strength (RSSI) useful to try, if possible, the best position for the antenna in which this value reaches a maximum. The range of values defined for the modem varies from a minimum value of RSSI = 0, corresponding to a field intensity lower than or equal to -113 dBm, up to a max value of RSSI = 31, corresponding to a field strength greater than or equal to -51 dBm. As confirmation of the registration of the modem to the network, you can verify that the red LED flashes on the modem card slowly, thus indicating that the received field is sufficient and it is successfully connected. The lighting of the LED fixed instead indicate that the modem is not connected or that the SIM card is not inserted. If you connect a micro-switch on the line 2.2 and you open the contact, before powering up the unit, then you entry in set-up mode (local) of RCU-8951, as described in Appendix B. The closure of the switch to ground and resetting determines the start of the operative program and after a short time the RCU-8951 will be ready to receive commands and send alarms, as indicated by the display.

4   - Commands

The commands must be composed only with upper-case characters. There are two modes for controlling the output relays of the RCU-8951: in bistable mode, by sending SMS composed according to the table in section 4.1, or in the monostable mode, with programmable pulse duration from 1 to 255 seconds, via a call with automatic rejection and then at zero cost. The RCU-8951 automatically generates an alarm cycle, in the case that one or more digital input lines are open or in the case that the predetermined analog thresholds are exceeded. The alarm can be chosen by the user, sent via SMS or ring. In both cases, the alarm is sent in sequence to all the ADMIN numbers present in the phone-book, previously stored as indicated in paragraph 2.1. The IMEI code of the GSM modem to which is referring the command table 4.1 is used as code for new user adding, as an alternative to standard WP command described in the table 4.1. It is essential, in order to send executable commands, that the calling phone has the caller ID visible and not hidden, otherwise the user can not be recognized and the command is deleted and ignored.

4.1 - Commands set

After the main mnemonic codes, are indicated in parentheses the alternative commands that can be used also with the keyboard. For commands that perform assigning names to the inputs and to the outputs or to the entry in the phone-book memory, as you need an extended character set, the local keyboard is not enough and it is mandatory to use SMS or PC.

Syntax of the Command	Command Function	Confirmation Sent by RCU8951
IMEI (only the 15 digits)	Enabling number sending IMEI by SMS	Ring or SMS
AD (00)	Disable all analog and digital alarms	Ring or SMS
DE (01)	View on LCD EEPROM memory cells	LCD
HD (02)	Sets hysteresis default: ILOW = 0.95 IHIGH = 1.05	Ring or SMS
IN1=…..IN8=	Assign a name to the inputs 1 8	LCD
LN (03)	Set negative logic relays (OUT = 0 ON relay)	Ring or SMS
LP (04)	Set positive logic relays (OUT = 1 ON relay)	Ring or SMS
MO (16)	Set MODEM memory as a user directory	Ring or SMS
ONx (1Ax)	Activate the relay x (with x between 1 and 8)	Ring or SMS
OFx (0Ax)	Disable the relay x (with x between 1 and 8)	Ring or SMS
RA (05)	Reading System Administrator (ADMIN1 ... 9)	SMS
RC=	Assign a name to the remote control	LCD
RE (06)	Reads a digital inputs and relay status report	SMS
RFddd (2Addd)	Reads 8 type single variable address ddd	SMS
RI (A7)	Enable confirmation by ringing (ring)	Ring or SMS
RN1=…..RN8=	Assign the name to the relays 1 8	LCD
RS (08)	Generates a software reset	Ring or SMS
RU (09)	In set-up mode, starts operating program	LCD
RYddd (3Addd)	Reads 8 byte type variables address ddd	SMS
RT=yy.mm.dd,hh.mm.ss (9A=yy.mm.dd,hh.mm.ss)	Set Date & Time in Real Time Clock MODEM	Ring o SMS
SI (17)	Set the SIM memory as a user directory	Ring o SMS
SM (10)	Enable sending confirmations by text message	Ring o SMS
TD (11)	Set temperature slope at default (10mV/° C)	Ring o SMS
TE (12)	Reads temperatures of enabled inputs	SMS
TN1=…..TN8=	Assign named temp. T1 ..T8 ... (max 10 char.)	Ring o SMS
TSx,dd (4Ax,dd)	Set the temp. Tx = dd degrees reference	Ring o SMS
VD (13)	Set 8 voltage scale factors = 1.00 (default)	Ring o SMS
VE (14)	Reads the remote firmware	SMS
VO (15)	Reads the voltages of the analog inputs enabled	SMS
VN1=…..VN8=	Assign a name to the voltages V1 ... ..V8	LCD
WPddd (8A)	Cancel ddd position of the SIM phone-book	Ring o SMS
WPddd,nnnnnn=xx (7Addd,nnnnnn=xx)	writes in memory (SIM or MODEM) a user number (see App. A)	Ring o SMS
WPddd (7A)	Cancel ddd position of the SIM phone-book	Ring o SMS
WBddd,bbbbbbbb (5Addd,bbbbbbbb)	Writes 8-bit variable to EEPROM (see App.A)	Ring o SMS
WSddd,ffffff (6Addd,xxx)	Writes single variable to EEPROM (see App.A)	Ring o SMS
WYddd,xxx (8Addd,xxx)	Writing 1 BYTE variable on EEPROM (see App.A)	Ring o SMS
Direct call (ring command)	Activating selected relay in monostable mode	Ring o SMS

4.2 - Registering authorized users on the FLASH (SIM or MODEM)

Function of the command:

This command writes the telephone number "nnnnnn" in position "ddd" of the SIM memory phone-book (or MODEM memory) associated with the name "xx", overwriting any possible number already present. The name is mandatory and necessary for the proper functioning of the command.

Example: WP001,+3930083942=Elcosys

Description and command syntax:

- **WP** = **W**rite **P**hone-book command
- **001** = phone-book address (SIM or MODEM)
- **+39394176094** = user's telephone number to register
- **Elcosys** = name associated with the telephone number (max 10 characters)

The SIM phone-book location field is fixed to 3 decimal places it can be a variable number from 001 to 250. The phone number field must contain a valid number including country code and is separated by a comma. The field name has a max size of 10 characters and is separated by the symbol =

5   - Firmware Updates

The operational software of the REMOTE RCU-8951 is a resident entirely in the 64KB FLASH memory of the Microcontroller, and therefore can be easily updated with the appropriate kit hardware/software which allows downloading updates to the user, via a serial connection between the available port on the Microcontroller board and the RS232C serial port (or USB) to a PC via a special cable and an upload program for the PC supplied with the kit.

6   - Analog to digital converter Connector

The eight inputs of the analog / digital converter are reported to IDC 10-pin connector named "PORT-P1" in the design of Microcontroller board, according to the following table.

Important: The PIN 9, connected to the +5 V line of digital circuits supply, can be used as a power supply and/or reference voltage for the transducers or for conditioning boards (e.g. RTCBUF) that have a total absorption not exceeding 50 mA: care must be taken that any short circuits or abnormal loads between this line and ground could damage the integrated regulator on the I/O card.

Input Line	IDC connector PIN	address logical port
Analog Input 1 (0-3 V)	1 (black)	P1.0
analog input 2 (0-3 V)	2 (White)	P1.1
analog input 3 (0-3 V)	3 (gray)	P1.2
4 analog input (0-3 V)	4 (Purple)	P1.3
5 analog input (0-3 V)	5 (blue)	P1.4
6 analog input (0-3 V)	6 (green)	P1.5
7 analog input (0-3 V)	7 (yellow)	P1.6
8 analog input (0-3V)	8 (orange)	P1.7
+ 5V voltage output	9 (red)	
reference GND 0V	10 (brown)	

APPENDIX A – User parameters and variables

The RCU-8951 remote control stores the variables used by the program on the EEPROM to ensure the maintenance of the parameters and user data even in the event of a power failure. The overall space of the EEPROM memory is 2048 bytes, divided into eight areas 256 Byte. The contents of the address field in the user command is related to the single area, being fixed and consists of 3 decimal digits, with values from 001 to 255. The set of general commands described in Table 4.1 is then integrated by a group of specific commands that are described in detail in this appendix that allow direct writing in the locations of the EEPROM. These commands refer to the following data formats:

1. **BYTE** Variable decimal Length (e.g.. 0 ... 255)
2. **8-BIT** Variable binary Length (e.g.. 01010101)
3. **SINGLE** floating point Variable (es.123.4567)

All of the commands described below can be sent: or by remote via SMS, or locally via the built-in keyboard or by a PC connected via serial or USB port running communication program (like HyperTerminal) and must be entered exactly as shown, commas and periods included without adding spaces. The data field is always separated from the address field by a comma. In the following notes the function is enabled if the corresponding bit is set (bit = 1), while the same function is disabled if the corresponding bit is reset (bit = 0). The password, which is required when using the keyboard is set, by the factory, to the number "12345"; It can be modified, by writing the new value of five digits by the **WF** command in the EEPROM location **252** .

BYTE variables

The address field is fixed to 3 decimal places and may be a variable number from 001 to 255. The data field is variable and can be an integer from 0 to 255. The data field is separated from the address field by a comma.

Command Function

It writes the data "ddd" in the location "ddd" of EEPROM, and determines the functions in the following tables on the map currently used by the firmware addresses.

Example: **WY009,20** (set to 20 seconds the pre-alarm delay of P3.x digital inputs)

Description and command syntax

- **WY** = **W**rite **B**yte command
- **009** = EEPROM address
- **20** = data to be written into the pointed location

EEPROM address	User parameter (BYTE type) and corresponding function
009	duration of pre-alarm condition for digital inputs P3.x in seconds (1 ... 255)
016	duration of pre-alarm condition for digital inputs P4.x in seconds (1 ... 255)
010	delay of the second automatic impulse relay monostable in seconds (1 ... 255)
017	duration of relays activation in monostable mode in seconds (1 ... 255) (1 ° pulse)
032	duration of relays activation in monostable mode in seconds (1 ... 255) (2 ° pulse)

8 BIT binary variables

The address field is fixed to 3 decimal places and may be a variable number from 001 to 255. The data field is fixed, 8 binary digits that can assume values of 0 or 1. The data field is separated from the address field from a comma.

Command Function

It writes the data "bbbbbbbb" into location "ddd" of EEPROM, and determines the functions in the following tables on the map used by the firmware addresses. The locations denoted by "reserved to the" system are not normally user-writeable, but they can be viewed locally on the LCD for control purposes by means of the DE command (Dump EEPROM)

Example: **WB001,00000011**   (determines the activation of the relays 1 and 2)

Description and command syntax

- **WB** = **W**rite **B**it command
- **001** = EEPROM address
- **00000011** = data to be written into the pointed location

EEPROM ADDRESS (low Byte)	BIT User Parameters and corresponding functions
000	**Reserved to the system**
001	**Relays activation status**
	b7 b6 b5 b4 b3 b2 b1 b0 │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │-- if=1 → relay 1 is ON │ │ │ │ │ │ │------- if=1 → relay 2 is ON │ │ │ │ │ │------------ if=1 → relay 3 is ON │ │ │ │ │---------------- if=1 → relay 4 is ON │ │ │ │-------------------- if=1 → relay 5 is ON │ │ │------------------------ if=1 → relay 6 is ON │ │---------------------------- if=1 → relay 7 is ON │-------------------------------- if=1 → relay 8 is ON
002	**Digital lines alarm memory (reserved to the system)**
	b7 b6 b5 b4 b3 b2 b1 b0 │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │-- currently not used │ │ │ │ │ │ │------- currently not used │ │ │ │ │ │------------ currently not used │ │ │ │ │---------------- interrupt control line (for instant alarms) │ │ │ │-------------------- line of the parallel port P3.4 │ │ │------------------------ line of the parallel port P3.5 │ │---------------------------- line of the parallel port P3.6 │-------------------------------- line of the parallel port P3.7

003	User customization parameters

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling command confirmation by SMS
 |   |   |   |   |   |   |------- if=1→ enabling 2° relay pulse for monostable
 |   |   |   |   |   |----------- if=1→ display and threshold test temp.  1 - 4
 |   |   |   |   |----------------- if=1→ display and threshold test temp.  5 - 8
 |   |   |   |--------------------- if=1→ display and threshold test voltage 1 – 4
 |   |   |------------------------- if=1→ display and threshold test voltage 5 – 8
 |   |----------------------------- if=1→ enabling confirmation forwarding to Admin1
 |--------------------------------- if=1→ negative relay logic, if = 0 positive relay logic
```

004	Assigning monostable relay activation

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 for monostable command
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 for monostable command
 |   |   |   |   |   |----------- if=1→ enabling relay 3 for monostable command
 |   |   |   |   |----------------- if=1→ enabling relay 4 for monostable command
 |   |   |   |--------------------- if=1→ enabling relay 5 for monostable command
 |   |   |------------------------- if=1→ enabling relay 6 for monostable command
 |   |----------------------------- if=1→ enabling relay 7 for monostable command
 |--------------------------------- if=1→ enabling relay 8 for monostable command
```

005	minimum threshold alarm memory (reserved to the system)

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- min threshold alarm memory of temperature T1
 |   |   |   |   |   |   |------- min threshold alarm memory of temperature T2
 |   |   |   |   |   |----------- min threshold alarm memory of temperature T3
 |   |   |   |   |----------------- min threshold alarm memory of temperature T4
 |   |   |   |--------------------- min threshold alarm memory of temperature T5
 |   |   |------------------------- min threshold alarm memory of temperature T6
 |   |----------------------------- min threshold alarm memory of temperature T7
 |--------------------------------- min threshold alarm memory of temperature T8
```

006	max threshold alarm memory (reserved to the system)

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- max threshold alarm memory of temperature T1
 |   |   |   |   |   |   |------- max threshold alarm memory of temperature T2
 |   |   |   |   |   |----------- max threshold alarm memory of temperature T3
 |   |   |   |   |----------------- max threshold alarm memory of temperature T4
 |   |   |   |--------------------- max threshold alarm memory of temperature T5
 |   |   |------------------------- max threshold alarm memory of temperature T6
 |   |----------------------------- max threshold alarm memory of temperature T7
 |--------------------------------- max threshold alarm memory of temperature T8
```

007	min threshold alarm memory (reserved to the system)

b7 b6 b5 b4 b3 b2 b1 b0
```
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- min threshold alarm memory of voltage V1
 |   |   |   |   |   |   |------- min threshold alarm memory of voltage V2
 |   |   |   |   |   |----------- min threshold alarm memory of voltage V3
 |   |   |   |   |--------------- min threshold alarm memory of voltage V4
 |   |   |   |------------------- min threshold alarm memory of voltage V5
 |   |   |----------------------- min threshold alarm memory of voltage V6
 |   |--------------------------- min threshold alarm memory of voltage V7
 |------------------------------- min threshold alarm memory of voltage V8
```

008	max threshold alarm memory (reserved to the system)

b7 b6 b5 b4 b3 b2 b1 b0
```
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- max threshold alarm memory of voltage V1
 |   |   |   |   |   |   |------- max threshold alarm memory of voltage V2
 |   |   |   |   |   |----------- max threshold alarm memory of voltage V3
 |   |   |   |   |--------------- max threshold alarm memory of voltage V4
 |   |   |   |------------------- max threshold alarm memory of voltage V5
 |   |   |----------------------- max threshold alarm memory of voltage V6
 |   |--------------------------- max threshold alarm memory of voltage V7
 |------------------------------- max threshold alarm memory of voltage V8
```

011	Alarm enabling by min temperature threshold

b7 b6 b5 b4 b3 b2 b1 b0
```
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling alarm by min temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling alarm by min temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling alarm by min temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling alarm by min temp. threshold T4
 |   |   |   |------------------- if=1→ enabling alarm by min temp. threshold T5
 |   |   |----------------------- if=1→ enabling alarm by min temp. threshold T6
 |   |--------------------------- if=1→ enabling alarm by min temp. threshold T7
 |------------------------------- if=1→ enabling alarm by min temp. threshold T8
```

012	Alarm enabling by max temperature threshold

b7 b6 b5 b4 b3 b2 b1 b0
```
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling alarm by max temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling alarm by max temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling alarm by max temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling alarm by max temp. threshold T4
 |   |   |   |------------------- if=1→ enabling alarm by max temp. threshold T5
 |   |   |----------------------- if=1→ enabling alarm by max temp. threshold T6
 |   |--------------------------- if=1→ enabling alarm by max temp. threshold T7
 |------------------------------- if=1→ enabling alarm by max temp. threshold T8
```

013	**Alarm Enabling by min voltage threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling alarm by min voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling alarm by min voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling alarm by min voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling alarm by min voltage threshold V4
 |   |   |   |------------------- if=1→ enabling alarm by min voltage threshold V5
 |   |   |----------------------- if=1→ enabling alarm by min voltage threshold V6
 |   |--------------------------- if=1→ enabling alarm by min voltage threshold V7
 |------------------------------- if=1→ enabling alarm by min voltage threshold V8
```

014	**Alarm Enabling by max voltage threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling alarm by max voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling alarm by max voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling alarm by max voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling alarm by max voltage threshold V4
 |   |   |   |------------------- if=1→ enabling alarm by max voltage threshold V5
 |   |   |----------------------- if=1→ enabling alarm by max voltage threshold V6
 |   |--------------------------- if=1→ enabling alarm by max voltage threshold V7
 |------------------------------- if=1→ enabling alarm by max voltage threshold V8
```

015	**Digital lines P4 alarm memory (reserved to the system)**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- Parallel Port line P4.0
 |   |   |   |   |   |   |------- Parallel Port line P4.1
 |   |   |   |   |   |----------- Parallel Port line P4.2
 |   |   |   |   |--------------- Parallel Port line P4.3
 |   |   |   |------------------- currently not used
 |   |   |----------------------- currently not used
 |   |--------------------------- currently not used
 |------------------------------- currently not used
```

018	**enabling SMS by min temperature threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS by min temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling SMS by min temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling SMS by min temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling SMS by min temp. threshold T4
 |   |   |   |------------------- if=1→ enabling SMS by min temp. threshold T5
 |   |   |----------------------- if=1→ enabling SMS by min temp. threshold T6
 |   |--------------------------- if=1→ enabling SMS by min temp. threshold T7
 |------------------------------- if=1→ enabling SMS by min temp. threshold T8
```

019	enabling relays by min temperature threshold

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 by min temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 by min temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling relay 3 by min temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling relay 4 by min temp. threshold T4
 |   |   |   |------------------- if=1→ enabling relay 5 by min temp. threshold T5
 |   |   |----------------------- if=1→ enabling relay 6 by min temp. threshold T6
 |   |--------------------------- if=1→ enabling relay 7 by min temp. threshold T7
 |------------------------------- if=1→ enabling relay 8 by min temp. threshold T8
```

020	enabling SMS by max temperature threshold

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS by max temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling SMS by max temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling SMS by max temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling SMS by max temp. threshold T4
 |   |   |   |------------------- if=1→ enabling SMS by max temp. threshold T5
 |   |   |----------------------- if=1→ enabling SMS by max temp. threshold T6
 |   |--------------------------- if=1→ enabling SMS by max temp. threshold T7
 |------------------------------- if=1→ enabling SMS by max temp. threshold T8
```

021	enabling relay by max temperature threshold

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 by max temp. threshold T1
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 by max temp. threshold T2
 |   |   |   |   |   |----------- if=1→ enabling relay 3 by max temp. threshold T3
 |   |   |   |   |--------------- if=1→ enabling relay 4 by max temp. threshold T4
 |   |   |   |------------------- if=1→ enabling relay 5 by max temp. threshold T5
 |   |   |----------------------- if=1→ enabling relay 6 by max temp. threshold T6
 |   |--------------------------- if=1→ enabling relay 7 by max temp. threshold T7
 |------------------------------- if=1→ enabling relay 8 by max temp. threshold T8
```

022	enabling SMS by min voltage threshold

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS by min voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling SMS by min voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling SMS by min voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling SMS by min voltage threshold V4
 |   |   |   |------------------- if=1→ enabling SMS by min voltage threshold V5
 |   |   |----------------------- if=1→ enabling SMS by min voltage threshold V6
 |   |--------------------------- if=1→ enabling SMS by min voltage threshold V7
 |------------------------------- if=1→ enabling SMS by min voltage threshold V8
```

023	**enabling relay by min voltage threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 by min voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 by min voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling relay 3 by min voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling relay 4 by min voltage threshold V4
 |   |   |   |------------------- if=1→ enabling relay 5 by min voltage threshold V5
 |   |   |----------------------- if=1→ enabling relay 6 by min voltage threshold V6
 |   |--------------------------- if=1→ enabling relay 7 by min voltage threshold V7
 |------------------------------- if=1→ enabling relay 8 by min voltage threshold V8
```

024	**enabling SMS by max voltage threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS by max voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling SMS by max voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling SMS by max voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling SMS by max voltage threshold V4
 |   |   |   |------------------- if=1→ enabling SMS by max voltage threshold V5
 |   |   |----------------------- if=1→ enabling SMS by max voltage threshold V6
 |   |--------------------------- if=1→ enabling SMS by max voltage threshold V7
 |------------------------------- if=1→ enabling SMS by max voltage threshold V8
```

025	**enabling relay by max voltage threshold**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 by max voltage threshold V1
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 by max voltage threshold V2
 |   |   |   |   |   |----------- if=1→ enabling relay 3 by max voltage threshold V3
 |   |   |   |   |--------------- if=1→ enabling relay 4 by max voltage threshold V4
 |   |   |   |------------------- if=1→ enabling relay 5 by max voltage threshold V5
 |   |   |----------------------- if=1→ enabling relay 6 by max voltage threshold V6
 |   |--------------------------- if=1→ enabling relay 7 by max voltage threshold V7
 |------------------------------- if=1→ enabling relay 8 by max voltage threshold V8
```

026	**enabling ring by digital lines alarm P3.x**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- reserved
 |   |   |   |   |   |   |------- reserved
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |--------------- reserved
 |   |   |   |------------------- if=1→ enabling ring by digital line P3.4
 |   |   |----------------------- if=1→ enabling ring by digital line P3.5
 |   |--------------------------- if=1→ enabling ring by digital line P3.6
 |------------------------------- if=1→ enabling ring by digital line P3.7
```

027	enabling SMS by digital lines alarm P3.x

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- reserved
 |   |   |   |   |   |   |------- reserved
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |---------------- reserved
 |   |   |   |--------------------- if=1→ enabling SMS by digital line P3.4
 |   |   |------------------------- if=1→ enabling SMS by digital line P3.5
 |   |----------------------------- if=1→ enabling SMS by digital line P3.6
 |--------------------------------- if=1→ enabling SMS by digital line P3.7
```

028	enabling relays by digital lines alarm P3.x

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- reserved
 |   |   |   |   |   |   |------- reserved
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |---------------- reserved
 |   |   |   |--------------------- if=1→ enabling relay 5 by digital line P3.4
 |   |   |------------------------- if=1→ enabling relay 6 by digital line P3.5
 |   |----------------------------- if=1→ enabling relay 7 by digital line P3.6
 |--------------------------------- if=1→ enabling relay 8 by digital line P3.7
```

029	enabling ring by digital lines alarm P4.x

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling ring by digital line P4.0
 |   |   |   |   |   |   |------- if=1→ enabling ring by digital line P4.1
 |   |   |   |   |   |----------- if=1→ enabling ring by digital line P4.2
 |   |   |   |   |---------------- if=1→ enabling ring by digital line P4.3
 |   |   |   |--------------------- reserved
 |   |   |------------------------- reserved
 |   |----------------------------- reserved
 |--------------------------------- reserved
```

030	enabling SMS by digital lines alarm P4.x

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS by digital line P4.0
 |   |   |   |   |   |   |------- if=1→ enabling SMS by digital line P4.1
 |   |   |   |   |   |----------- if=1→ enabling SMS by digital line P4.2
 |   |   |   |   |---------------- if=1→ enabling SMS by digital line P4.3
 |   |   |   |--------------------- reserved
 |   |   |------------------------- reserved
 |   |----------------------------- reserved
 |--------------------------------- reserved
```

031	**enabling relays by digital lines alarm P4.x**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling relay 1 by digital line P4.0
 |   |   |   |   |   |   |------- if=1→ enabling relay 2 by digital line P4.1
 |   |   |   |   |   |------------ if=1→ enabling relay 3 by digital line P4.2
 |   |   |   |   |---------------- if=1→ enabling relay 4 by digital line P4.3
 |   |   |   |-------------------- reserved
 |   |   |------------------------ reserved
 |   |---------------------------- reserved
 |-------------------------------- reserved
```

033	**Advanced user parameters**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ SMS enabled, if=0 SMS not sent to network
 |   |   |   |   |   |   |------- if=1→ line 3.7 enabled for RF test loop switch
 |   |   |   |   |   |----------- if=1→ line 3.7 enabled for dump EEPROM step
 |   |   |   |   |--------------- if=1→ monostable activation confirm by ring
 |   |   |   |------------------- if=1→ Interrupt INT 0 enabled (alarm line P3.2)
 |   |   |----------------------- if=1→ Interrupt INT1 enabled (keypad triggering)
 |   |--------------------------- if=1→ memory=MODEM, if=0 memory=SIM
 |------------------------------- reserved
```

034	**Advanced user parameters #1**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling unit state displaying
 |   |   |   |   |   |   |------- if=1→ enabling initial SMS erasing
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |--------------- if=1→ enabling command confirmation (SMS o ring)
 |   |   |   |------------------- reserved
 |   |   |----------------------- reserved
 |   |--------------------------- reserved
 |------------------------------- reserved
```

035	**Enabling SMS sending for LINK command by digital lines P3.x**

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- reserved
 |   |   |   |   |   |   |------- reserved
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |--------------- reserved
 |   |   |   |------------------- if=1→ enabling SMS for LINK command by line P3.4
 |   |   |----------------------- if=1→ enabling SMS for LINK command by line P3.5
 |   |--------------------------- if=1→ enabling SMS for LINK command by line P3.6
 |------------------------------- if=1→ enabling SMS for LINK command by line P3.7
```

036	Enabling SMS sending for LINK command by digital lines P3.x

```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS for LINK command by line P4.0
 |   |   |   |   |   |   |------- if=1→ enabling SMS for LINK command by line P4.1
 |   |   |   |   |   |----------- if=1→ enabling SMS for LINK command by line P4.2
 |   |   |   |   |---------------- if=1→ enabling SMS for LINK command by line P4.3
 |   |   |   |--------------------- reserved
 |   |   |------------------------- reserved
 |   |------------------------------ reserved
 |----------------------------------- reserved
```

SINGLE Variables

The address field is fixed to 3 decimal digits and can be any number from 001 to 255. The data field is variable from 1 up to 7 significant digits plus decimal point. The range of permissible values is between -4194303 and + 4194303.

Command function

Write the data "sssssss" in location "ddd" of the EEPROM, and determines the functions in the following tables on the map of the addresses currently used by the firmware. The location "reserved to the system " are usually not available for the user, but can be viewed locally on the LCD in order to control using the DE command (EEPROM Dump)

- Example 1: WS252,54321 (changing password to 54321)
- Example 2: WS040,20.5 (sets the minimum threshold for temperature T1 min at 20.5 ° C)

Description and command syntax:

- **WS** = **W**rite **S**ingle
- **252** = EEPROM address used for password
- **28831** = new password

Address (Low Byte) EEPROM	SINGLE variable parameter and corresponding function
040	min threshold for temperature T1
044	min threshold for temperature T2
048	min threshold for temperature T3
052	min threshold for temperature T4
056	min threshold for temperature T5
060	min threshold for temperature T6
064	min threshold for temperature T7
068	min threshold for temperature T8
072	max threshold for temperature T1
076	max threshold for temperature T2
080	max threshold for temperature T3
084	max threshold for temperature T4
088	max threshold for temperature T5
092	max threshold for temperature T6

096	max threshold for temperature T7
100	max threshold for temperature T8
104	multiplicative constant for the scaling of voltage V1
108	multiplicative constant for the scaling of voltage V2
112	multiplicative constant for the scaling of voltage V3
116	multiplicative constant for the scaling of voltage V4
120	multiplicative constant for the scaling of voltage V5
124	multiplicative constant for the scaling of voltage V6
128	multiplicative constant for the scaling of voltage V7
132	multiplicative constant for the scaling of voltage V8
136	angular coefficient for LM335 equation temperature 1 (default = -100)
140	angular coefficient for LM335 equation temperature 2 (default = -100)
144	angular coefficient for LM335 equation temperature 3 (default = -100)
148	angular coefficient for LM335 equation temperature 4 (default = -100)
152	angular coefficient for LM335 equation temperature 5 (default = -100)
156	angular coefficient for LM335 equation temperature 6 (default = -100)
160	angular coefficient for LM335 equation temperature 7 (default = -100)
164	angular coefficient for LM335 equation temperature 8 (default = -100)
168	min threshold for voltage V1
172	min threshold for voltage V2
176	min threshold for voltage V3
180	min threshold for voltage V4
184	min threshold for voltage V5
188	min threshold for voltage V6
192	min threshold for voltage V7
196	min threshold for voltage V8
200	max threshold for voltage V1
204	max threshold for voltage V2
208	max threshold for voltage V3
212	max threshold for voltage V4
216	max threshold for voltage V5
220	max threshold for voltage V6
224	max threshold for voltage V7
228	max threshold for voltage V8
232	Reserved
236	Reserved
240	Hysteresis factor IST_low (default = 0.95)
244	Hysteresis factor IST_high (default = 1.05)
248	Reserved
252	Password (factory setting = 12345)

APPENDIX B - SETUP Mode

In order to simplify the programming session, the parameter SETUP and the operation initial test, it is possible to connect to the serial interface of the Microcontroller, temporarily disconnecting the GSM modem, a PC running any generic serial communication program (e.g.. Hyperterminal, Procomm, etc.) to send commands and settings from your PC rather than via SMS. Completed the set up process it is necessary to turn off the remote control, reconnect the serial cable modem and then turn on the remote control in the remote operating mode. It is available on request a USB/ RS232 converter to use if your computer only has USB ports and not RS232C.

- In local mode you can write variables to EEPROM and run the command tests
- The command syntax is equal to that used for SMS
- To end the local way and start the program, type end

The operating mode is selected, during the initial start-up or after a RESET, in relation to the logic state of the P2.2 line, in the standard version RCU-8951 that line is already connected to the micro-switch actuated by opening the front cover of the cabinet, therefore switching ON the Sentinel with the cover open, it automatically enters in the SETUP mode.

In details, the two modes of operation are as follows:

- Starting with P2.2 line to GND (closed panel) ------> Normal operating mode
- Starting with P2.2 line open (open panel) -------> SETUP mode

To enter in the set-up mode, you must follow the following steps:

1) Turn OFF the Remote
2) Disconnect the RS232 connector 4 modem pin from the microcontroller card (RS232 Figure D1) and connect in its place, using the serial cable supplied, the serial port of a PC by running a serial communication program (e.g.. Hyper-terminal, Pro-comm, etc.) set to 9600 - N - 8 - 1.
3) Open the digital line P2.2 input, thus obtaining the logical level 1 given by the pull-up resistor: in detail you must disconnect from GND pin 2 of the IDC 10-pin connector connected to port P2. This operation takes place, in the RCU-8951 version by opening the front panel, thanks to the built-in microswitch that performs the switching of the above.
4) Turn ON the Remote control
5) Perform a Hard Reset, pressing the S2 button (the one next to the serial connector)
6) The smooth start of the set-up program is indicated on the LCD and on the terminal.

Now you can run the SETUP by initializing the parameters you want and you can also send commands and verify the regular execution.

SUMMARY OF THE CONTROLS FOR WRITING THE VARIABLES ON EEPROM

- **WBddd, bbbbbbbb** - writes the binary variable at bbbbbbbb ddd (1-255)
- Example: **WB001,00000001** - sets to ON the first relay

- **WYddd, ddd** - writes the Byte type variable (0-255) at ddd (1-255)
- Example: **WY010,120** - sets the delay of the second pulse monostable to 120 s

- **WFddd, sss.ssss** - writes Single Variable (-4194303 <Single <4194303) at ddd (1-255)
- Example: **WF100,124.557** – writes 124,557 scaling factor for the voltage V1

In SETUP mode all the standard commands given in Table 4.1 are available, including the RUN command, which allows you to start the operation of the program in local mode, with the cyclical scanning of the inputs and ADC readings on the display and alarm management; the command is very useful in the phase of installation for the testing of the digital inputs and for any of the sensors of temperature tests and the inputs in voltage. The only commands not available all obviously those referring to the reading or writing of the MODEM flash, as MODEM in SETUP mode is disconnected.

To exit SETUP, you must perform the following steps:

1) Turn OFF the RCU-8951
2) Disconnect the PC and reconnect the GSM modem to the RS232 serial port.
3) Reconnect to the 3.2 line GND (logic level 0), and in detail, it is necessary to connect the pin 3 to pin 10 of the IDC connector 10 of the port P3 poles.
4) Turn ON the RCU-8951

APPENDIX C - conditioning board for analog signals

In order to use the maximum precision permitted by the ADC (10 bit), it is recommended to interface the analog inputs of RCU-8951 and the sources of voltage and/or measuring transducers with a suitable input signal conditioning circuit that performs in addition to the function of impedance matching between the signal source and the sample & hold circuit of the ADC module also a low-pass filter function to eliminate any possible EM interference and noise. The notes that follow, are referring to RTCBUF module, available as optional, which has an input network suited for LM335 temperature sensor and a voltage divider to measure voltages up to a maximum of 300 VDC. To allow the placement of the board RTCBUF the most close as possible to the measurement transducers and thus decrease the possible electromagnetic interference induced on high input impedance lines, RTCBUF module is single-channel and therefore it's need to use one module for each transducer used. The output lines directed to the remote control input, having very low impedance may also be, if necessary, very long, of the order of hundreds of meters. For very long lines it is recommended to use a wire to the negative pole of a separate signal from the negative power, and then a total of four-poles cable connection line between the RTCBUF board and the RCU-8951. Before using RTCBUF board you need to perform the calibration procedure described in the following notes. It is important to note that it can only be inserted one jumper: or the one for the measurement of temperatures or the one for the measurement of voltage. The jumpers may be optionally substituted by a switch or a SPST relay, to switch the desired type of measurement remotely.

Voltage measurement

- Insert the jumper for measuring the voltage
- Connect RTCBUF card to a 5V source
- Connect a digital multimeter to the output terminal
- Connect the source of the voltage to be measured by adjusting it to its maximum value Vin_max
- Adjust the divider trimmer to have 3.0V output, in correspondence with the maximum value to be measured Vout_max
- Calculate and annotate the ratio Vin_max / Vout_max, which will then act as the multiplicative constant for reading the input voltage (see p. 14). This coefficient, by definition, is equal to the inverse of the ratio of used partition and therefore returns the correct reading of the voltage present at the input of the RTCBUF board.

Temperature measurement

- Insert the jumper for the measurement of temperatures
- Connect the LM335 transducer to the input terminal, with the flat part of the case facing upwards
- connect RTCBUF card with a 5V source
- Connect a digital multimeter to the output terminal
- Place the contact LM335 transducer of a standard thermometer probe
- Wait for stabilization time of isothermal temperatures of the two probes
- Read the temperatures Tc and derive the output voltage Vu by the following relation:

$$Vu = \frac{-Tc}{100} + 2{,}2685 \qquad\qquad (1)$$

For example, if the temperatures detected is 25° C, the output voltage must be:

$$Vu = \frac{-25}{100} + 2{,}2685 = -0{,}25 + 2{,}2685 = 2{,}0185 \text{ V}$$

- Adjust the trimmer of temperatures up to read the voltage obtained with the (1)

Once completed this adjustment of the trimmer at any temperature, the measurement, according with the inherent linearity of the transducer LM335, will be right in the entire measurement range, from -40°C to + 100° C (single point calibration).

APPENDIX D - Map of I/O addresses

The read-out on the LCD and SMS messages relating to the state of the digital inputs and outputs (relays) refers to the actual physical address of the Microcontroller ports, in order to obtain the maximum clarity and also to avoid possible ambiguity due to conventional numbering of the I/O lines.

The map of I/O ports used in the Remote Control RCU-8951 (all versions) is as follows:

- Output relays: P0.0, P0.1, P0.2, P0.3, P0.4, P0.5, P0.6, P0.7
- Analog inputs: P1.0, P1.1, P1.2, P1.3, P1.4, P1.5, P1.6, P1.7
- Auxiliary line: P2.0 = output pulse of enabling modem (e.g.. for MODEM TC35)
- LCD Module: P2.1 = RS, PIN5 = RW = GND, EN = P2.3, P2.4 ... ..P2.7 = D4 D7 ......
- LCD Module: LCD PIN 5 not connected to the P2.2 (isolate the flat cable line 5)
- Set-up Switch : P2.2 (grounded --> operative mode, open --> set-up mode)
- Hex keyboard: P3.3 = enable (INT1), P3.4, P3.5, P3.6, P3.7 = Data
- Alarm input (interrupt): P3.2 (INT0 response time <100 ms)
- Alarm input (polling): P3.4, P3.5, P3.6, P3.7 (response time <4s)
- Alarm input (polling): P4.0, P4.1, P4.2, P4.3 (response time <4s)
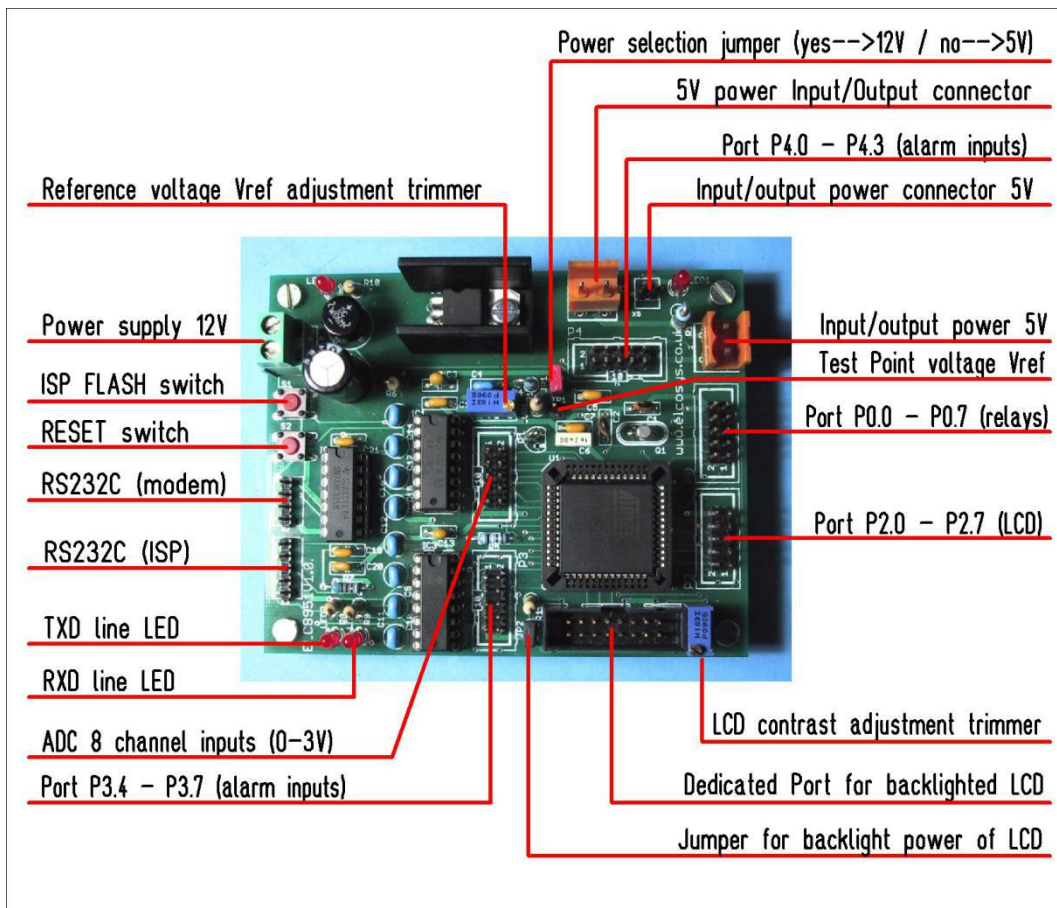
APPENDIX E - example of writing 8 BIT binary variable

In the following example, is indicated the composition of the binary data to be used in the SMS command that determines a custom setting for display of the temperatures T1-T4, referring directly to the table on page 16 of the manual for the EEPROM address 003. It's important to note that it is necessary to write the byte-data of the SMS command with bit 7 in the first position to the left (MSB), bit 6 in the second position, the bit 5 in the third position .... and so up to bit 0 in the eighth position on the right (LSB).

```
1   1   0   0   0   1   0   0

b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- SMS confirmation not enabled
 |   |   |   |   |   |   |------- 2° relay pulse in monostable not enabled
 |   |   |   |   |   |------------ display / test temp. 1 - 4 enabled
 |   |   |   |   |----------------- display / test temp. 5 - 8 not enabled
 |   |   |   |--------------------- display / test voltage 1 – 4 not enabled
 |   |   |------------------------- display / test voltage 5 – 8 not enabled
 |   |----------------------------- confirmation forwarding to Admin1 enabled
 |--------------------------------- negative logic relays selected
```
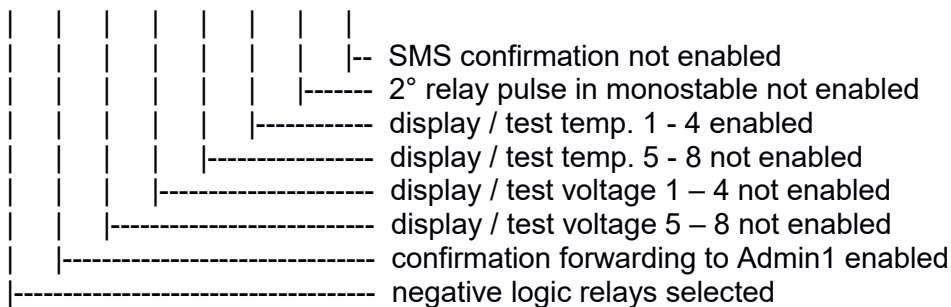
also sending the command:

WB003,11000100

You will get the following setting of the parameters:

- Bit 7 = 1 → negative logic controlled relay
- Bit 6 = 1 → command confirmation forwarded to admin1
- Bit 5 = 0 → 5-8 voltage are not displayed
- Bit 4 = 0 → 1-4 voltage are not displayed
- Bit 3 = 0 → 5-8 temperatures are not displayed
- Bit 2 = 1 → 1-4 temperatures are displayed
- Bit 1 = 0 → the second pulse monostable is not enabled
- Bit 0 = 0 → SMS command confirmation not enabled

APPENDIX F - technical features

- **GSM/GPRS module**: RS232 port with industrial grade SMA antenna connector
- **Microcontroller**: ATMEL AT89C51AC3 FLASH 64 kB, 2.4 kB RAM, EEPROM 2KB
- **SIM card reader**: suitable for mini-SIM format 2FF built-in the GSM module
- **Power outputs**: 8 relays with contacts 10A 250V, driven by means of optocouplers
- **Analog Inputs**: 8 analog inputs with 10 bit resolution, voltage of 0 to 3 V
- **Digital Inputs**: 8 digital inputs with reading was enabled sending alarms
- **Status LED**: 8 LED to display the status of each relay
- **LED RS232 control**: two LEDs for indication of RD and TD door
- **GSM LED control**: 1 LED for modem control and status of the network registration
- **Remote control**: of any device or system equipped with electric activation
- **impulsive Command**: for the activation (e.g.. Door-opener) with a phone call at zero cost
- **Users enabling (mode 1)**: up to 250 users with registration in the SIM card
- **Users enabling (mode 2)**: up to 50 users with registration in the Flash MODEM
- **Automatic answer**: with call and / or SMS confirmation to the caller's number
- **Hardware**: Modular Microcontroller board, relay board, DC converter, serial modem
- **Firmware OS**: completed and resident of 64k FLASH memory (upgradeable)
- **Dimensions vers. metal**: metal cabinet IP20 215x225x80 mm - weight 2.7 kg
- **Dimensions vers. IP67**: polycarbonate enclosure IP65 207x184x104 mm - Weight 800 g
- **Dimensions vers. Rack**: metal enclosure for 19 "rack 2U x 280 mm - weight 4 Kg
- **Power vers. RCU-8951**: 220 VAC, transformer, switching + 12V battery 1.2Ah
- **Power vers. IP67** power supply and / or external battery (not included) 12 VDC 1 A
- **4x20 LCD illuminated**: for execution control program and reading inputs and outputs
- **Alphanumeric keyboard**: 16 keys for entering commands and real-time programming
- **RS232C serial interface**: GSM modem and flash upgrade from PC
- **analog inputs Connector**: IDC 10 poles on Microcontroller board

APPENDIX G - additional technical data

LM335 temperature Sensor and A/D converter

The LM335 sensor, a well known industry standard component, has a nominal sensitivity of 10 mV / ° C; since the resolution of the A/D converter of the Microcontroller AT89C51AC3 is 10 bit that correspond, with the default reference at 3.00 V, to steps of 2.93 mV (3/1024); also in terms of temperature steps, the effective resolution is about 0.29 ° C over the whole measuring range from -40° C to + 100° C; therefore It is significant and displayed only the first decimal place, relative to tenths of a degree. The measurement of each A/D converter channel is implemented using multiple acquisition up to 50 readings with the average value calculation. This type of acquisition performs the function of an effective software low pass filter that completely eliminates the random noise and various types of perturbations that, when added to the signal may cause annoying fluctuations in the readout.

The fine tuning of the LM335 sensor can be carried out with two different operating modes:

1) **Hardware mode**: by means of the calibration of the RTCBUF tab trimmer according to the procedure indicated in Appendix C, leaving unchanged the default angular coefficients value (-100), stored in the EEPROM (addresses 136 ...164).

2) **Software mode**: you must use a precision reference thermometer placed in contact with the LM335 sensor to be calibrated and, at thermal stabilization occurred, use the value measured by the reference thermometer as data in the command **TSx**, with **x** index between 1 and 8. For example, if the temperature measured by the thermometer in contact with the channel 1 sensor is 22.5° C, you should execute the command: **TS1,22.5**. The execution of this command results in the automatic recalculation and replacement of the nominal angular coefficient (10 mV / °C) with the real one calculated from the experimental measurement; this correction is valid in the whole measurement range (-40 °C ... + 100 ° C). This calibration mode is made possible by the fact that, for the special constructive characteristics the LM335 sensor has a through-linear transfer function for the zero (0°K correspond to 0V) and therefore it is sufficient to the correction for the only angular coefficient.

Customizing the alarm messages

The text of alarm messages can be customized with strings of length up to 20 characters stored in RAM. At the start all the input/output names are initialized with default strings, which can be overridden with user-defined strings. We should pay particular attention to the fact that the total length of the response SMS remote control can not exceed 160 characters!

The customization command messages are 5: **INx =, RNX=, TNx=, VNX=, RC=**.

The following section shows the example commands for channel 1, to be repeated for each channel (max text length = 20 characters):

- **IN1=kitchen** → to assign a name to the input
- **RN1=boiler** → to assign a name to the relay outputs
- **TN1=living room** → to assign a name to the temperature input
- **VN1=battery** → to assign a name to the voltage input
- **RC=Mountain House** → to define the name that identifies the plant

APPENDIX H - Wiring diagrams

ELC8951 - Microcontroller Board AT89C51AC3
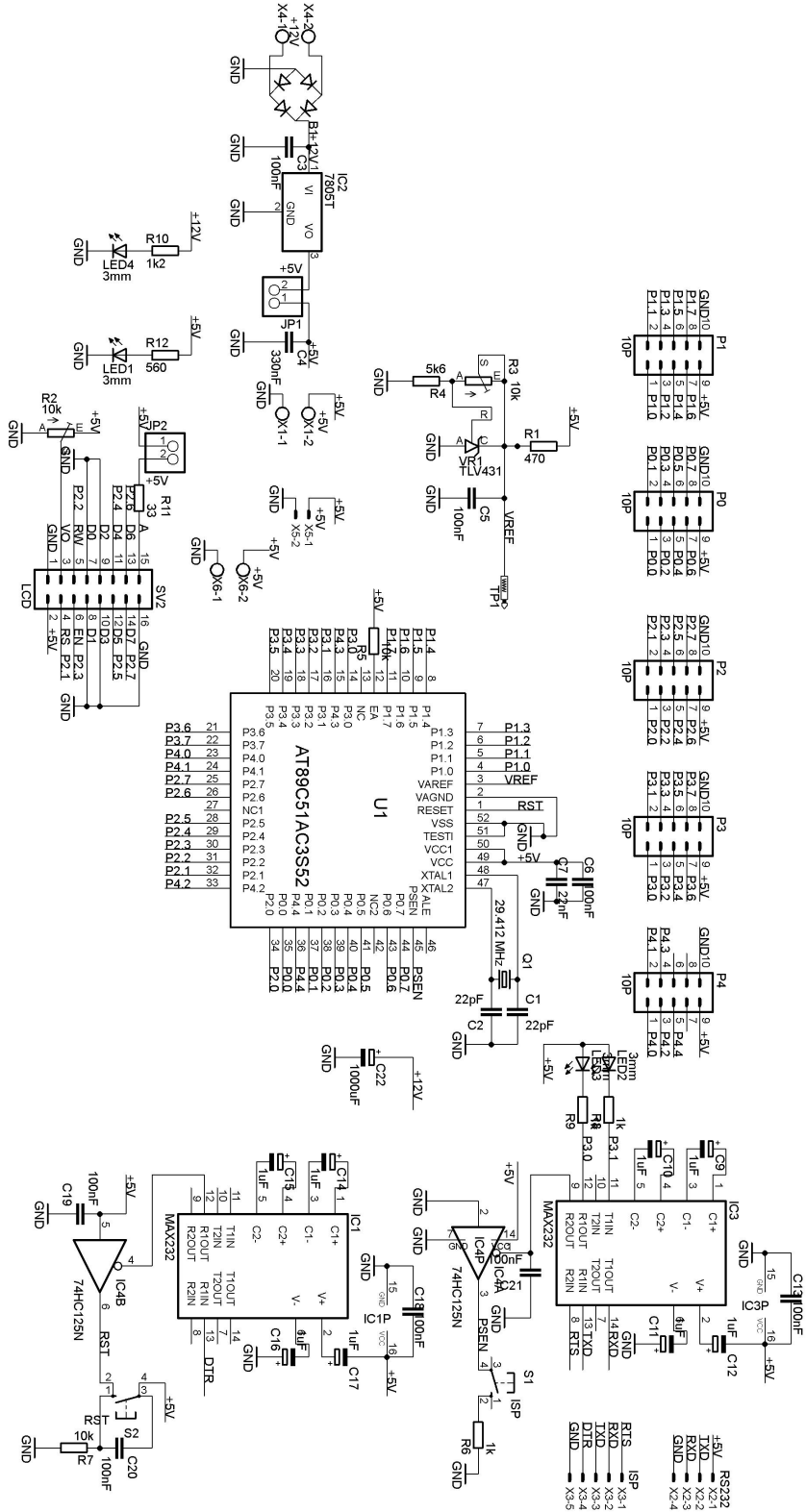
RTCBUF – Analog signal conditioning module
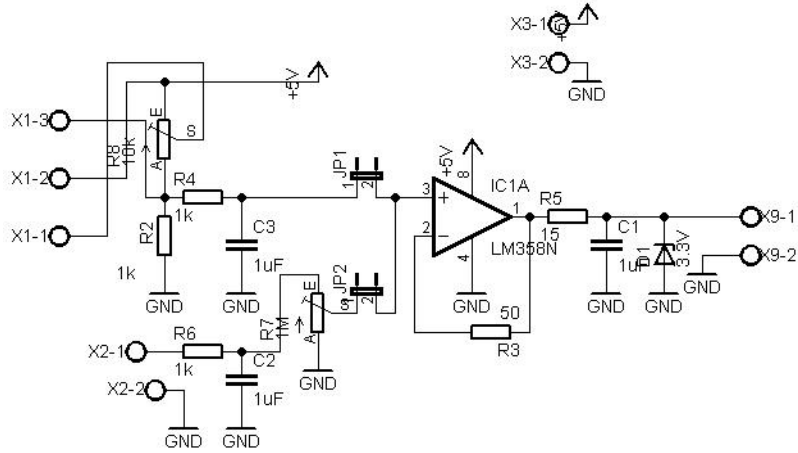
OPTORELAY4 – 4 relays board
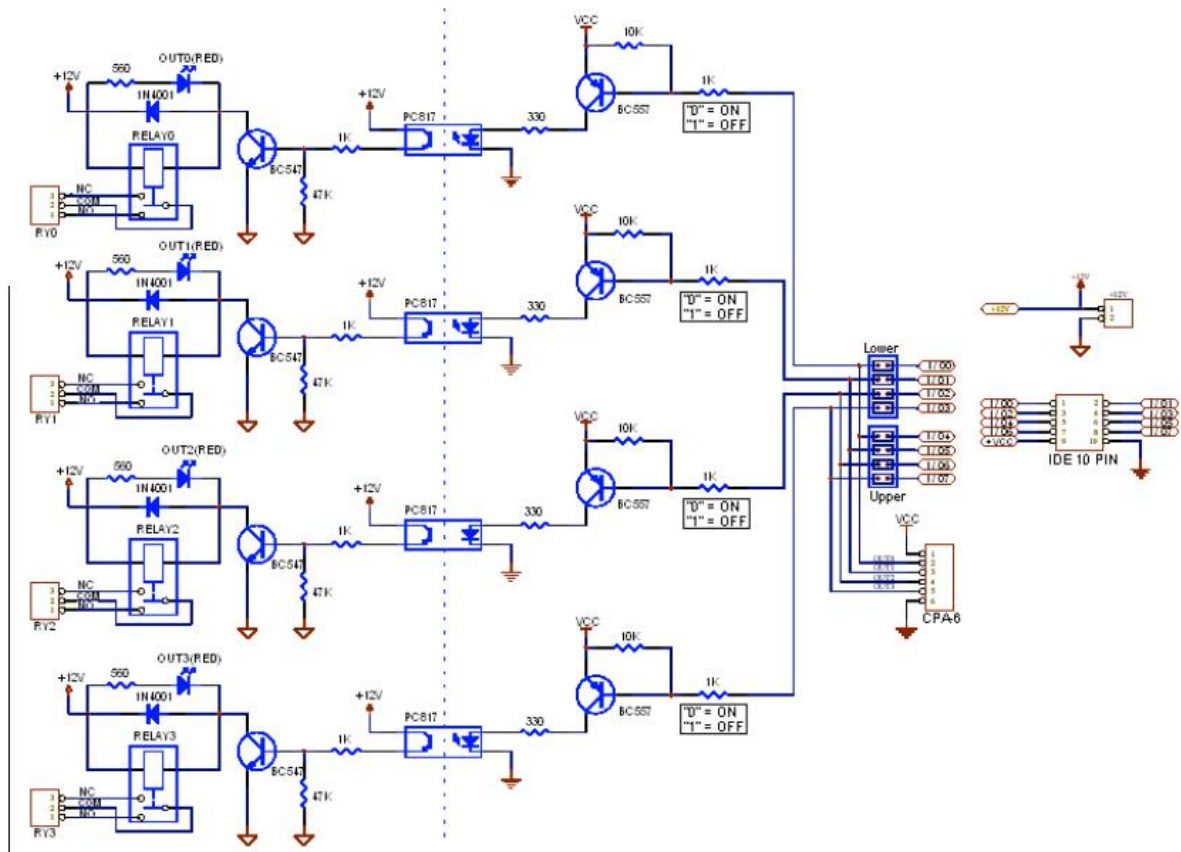
ELC51RL4D4 - 4 relays + 4 digital inputs board

ELC51RL4D4 – Scheda rele' e ingressi digitali
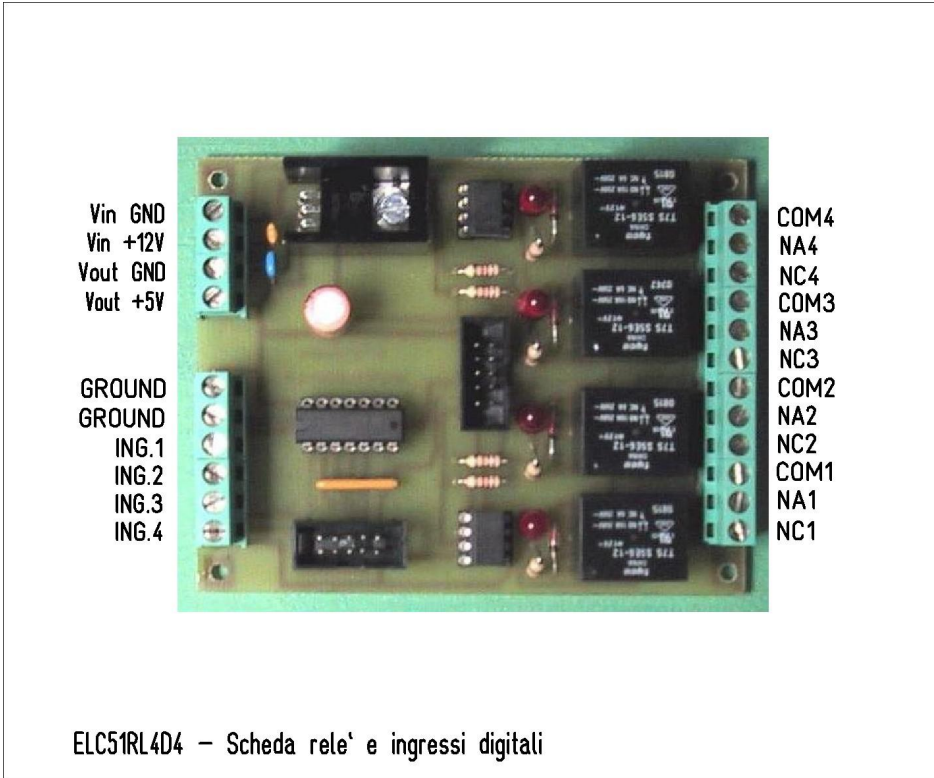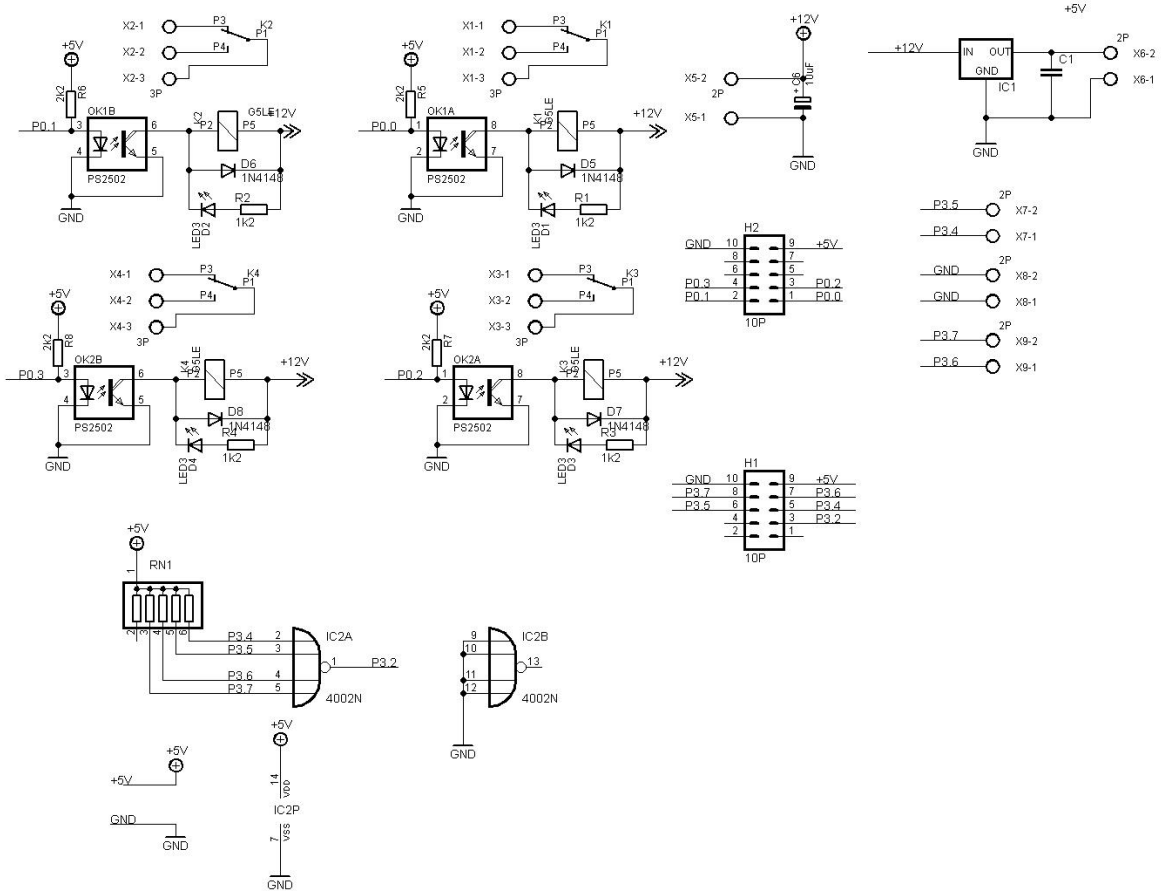
APPENDIX I - Encoded 16 keys Keypad

The RCU-8951version 9.x features the firmware suited for the encoded keypad with 16 standard telephone keys, included by default in version RLK and LK and assembled on the cabinet front panel. The keyboard allows the programming of the remote control and sending all data and commands without using a PC connected to the serial port or a phone to send commands via SMS. All commands, having to use the reduced set of characters on the keyboard, have a different syntax, as indicated in Table 4.1. You are prompted initially to enable password, consisting of 5 digits, factory set as default to 12345.
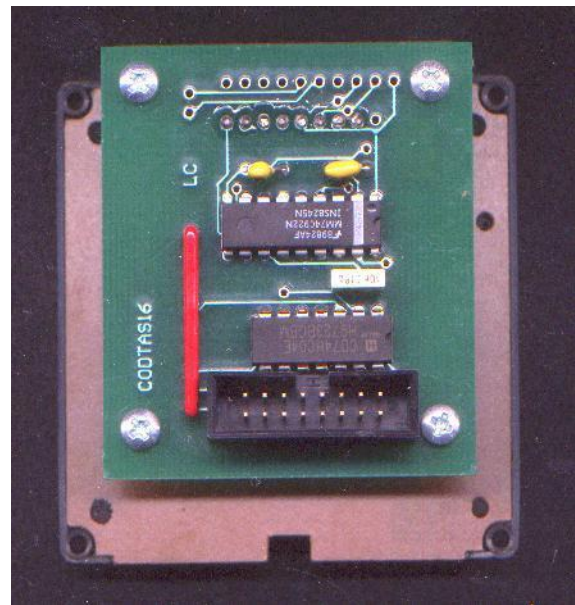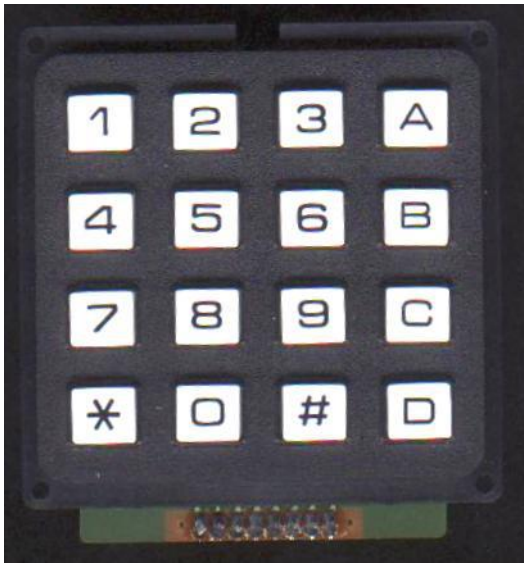
Keyboard encoding

Key 0 →   character = "**0**"
Key 1 →   character = "**1**"
Key 2 →   character = "**2**"
Key 3 →   character = "**3**"
Key 4 →   character = "**4**"
Key 5 →   character = "**5**"
Key 6 →   character = "**6**"
Key 7 →   character = "**7**"
Key 8 →   character = "**8**"
Key 9 →   character = "**9**"
Key A →   character = "**A**"
Key B →   character = "**=**"
Key C →   character = "**+**"
Key D →   character = "**,**"
Key * →   character = "**.**"
Key # →   character = "**enter**"

Appendix L - Pin-out Ports I / O and functional description
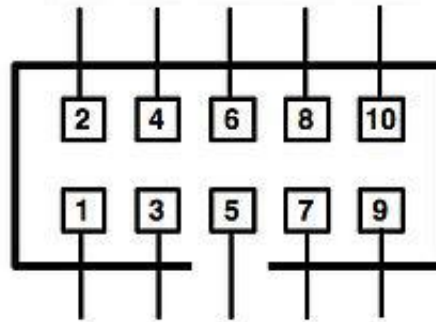
Port 0 – connector IDC P0

The P0 port is programmed as Open-Drain output port and makes available 8 output channels. The optimum load resistance for lines of this gate is comprised between 1 and 5 KOhm and the maximum deliverable current is about 7 mA. To ensure proper operation, the load resistors must be connected to + 5 V (pull-up).

Pin 1   = P0.0 = open-drain out 1
Pin 2   = P0.1 = open-drain out 2
Pin 3   = P0.2 = open-drain out 3
Pin 4   = P0.3 = open-drain out 4
Pin 5   = P0.4 = open-drain out 5
Pin 6   = P0.5 = open-drain out 6
Pin 7   = P0.6 = open-drain out 7
Pin 8   = P0.7 = open-drain out 8
Pin 9   = reference voltage +5V
Pin 10 = reference 0V (GND)

Port 1 – connector IDC P1

The port P1 is programmed and used as input for the A/D Converter to implement 8 analog channels in the range 0 ... 3 V with the precision reference generator to 3.00 V on-board.

Pin 1   = AN0 = analog input channel 1
Pin 2   = AN1 = analog input channel 2
Pin 3   = AN2 = analog input channel 3
Pin 4   = AN3 = analog input channel 4
Pin 5   = AN4 = analog input channel 5
Pin 6   = AN5 = analog input channel 6
Pin 7   = AN6 = analog input channel 7
Pin 8   = AN7= analog input channel 8
Pin 9   = +5V voltage reference
Pin 10 =   0V voltage reference (GND)

Port 2 – connector IDC P2

The port P2 is a bi-directional I/O port with internal pull-up resistors. It is used by the RCU-8951 firmware as follows:

Pin 1   = P2.0 = 500 ms pulse output for modem enabling (ex. IGT per TC35)
Pin 2   = P2.1 = LCD module RS line
Pin 3   = P2.2 = Set-up switch: GND → operational mode, OPEN → set-up mode
Pin 4   = P2.3 = LCD module EN line
Pin 5   = P2.4 = LCD module data line D4
Pin 6   = P2.5 = LCD module data line D5
Pin 7   = P2.6 = LCD module data line D6
Pin 8   = P2.7 = LCD module data line D7
Pin 9   = +5V voltage reference
Pin 10 =   0V voltage reference (GND)

Port 3 – connector IDC P3

The port P3 is a bi-directional I/O port with internal pull-up resistors. It is used by the RCU-8951 firmware as follows:

Pin 1   = P3.0 = UART RxD
Pin 2   = P3.1 = UART TxD
Pin 3   = P3.2 = INT0 interrupt alarm input
Pin 4   = P3.3 = INT1 keyboard strobe signal input
Pin 5   = P3.4 = D0 keyboard data line (or alarm input line 5)
Pin 6   = P3.5 = D1 keyboard data line (or alarm input line 6)
Pin 7   = P3.6 = D2 keyboard data line (or alarm input line 7)
Pin 8   = P3.7 = D3 keyboard data line (or alarm input line 8)
Pin 9   = +5V voltage reference
Pin 10 =   0V voltage reference (GND)

Port 4 – connector IDC P4

The port P4 is a bi-directional I/O port with internal pull-up resistors. It is used by the RCU-8951 firmware as follows:

Pin 1   = P4.0 = alarm input line 1
Pin 2   = P4.1 = alarm input line 2
Pin 3   = P4.2 = alarm input line 3
Pin 4   = P4.3 = alarm input line 4
Pin 5   = P4.4 = not used
Pin 6   = not used
Pin 7   = not used
Pin 8   = not used
Pin 9   = +5V voltage reference
Pin 10 =   0V (GND) voltage reference

LCD Port – Connector IDC SV2

The port dedicated for the LCD module is shared with the P2 connector and derived from the corresponding port and is connected according to the scheme of the application modules with industry standard Hitachi HD44780 or equivalent controller in the 4-bit mode; The following symbols refer to the data sheet.

Pin 1   = GND
Pin 2   = +5V
Pin 3   = VO (contrast adjustment, connected to on-board trimmer)
Pin 4   = P2.1 => RS
Pin 5   = P2.2 => RW (<u>this pin is not connected and RW line of LCD module must be to GND</u>)
Pin 6   = P2.3 => EN
Pin 7   = D0 => GND (4-bit mode)
Pin 8   = D1 => GND (4-bit mode)
Pin 9   = D2 => GND (4-bit mode)
Pin 10 = D3 => GND (4-bit mode)
Pin 11 = P2.4 => data line D4
Pin 12 = P2.5 => data line D5
Pin 13 = P2.6 => data line D6
Pin 14 = P2.7 => data line D7
Pin 15 = A (LED back-light supply)
Pin 16 = GND (LED back-light 0V)

Port RS232C – Molex X2 connector

The Molex 4-pin connector is connected to the UART's Microcontroller through the line driver/ receiver industry standard MAX232. The two LEDs on the board indicate the activity of the UART of the microcontroller: the yellow LEDs for TxD line and blue LEDs for RxD line. When the PC is connected to the serial port, to enter manually in the ISP mode, press both the RESET buttons (S2) and ISP (S1) and then released before the RESET and then the ISP, so that the microcontroller enters the ISP mode and it is ready to receive the file in HEX format from your PC.

Pin 1 = +5V voltage reference
Pin 2 = TXD (PC port as DTE and RCU8951 port as DCE)
Pin 3 = RXD (PC port as DTE and RCU8951 port as DCE)
Pin 4 = 0V (GND) voltage reference

ISP Port - Molex X3 Connector

The Microcontroller Atmel AT89C51AC3 has the boot-loader feature UART with automatic ISP and allows using standard software ATMEL Flip Software to enter ISP mode automatically controlling the RTS line and DTR and in this way it is not necessary to use the RESET and ISP buttons.

Pin 1 = RTS
Pin 2 = RXD (PC port as DTE and RCU8951 port as DCE)
Pin 3 = TXD (PC port as DTE and RCU8951 port as DCE)
Pin 4 = DTR
Pin 5 = GND

Power - Connectors with screw terminals X1 and X4

X4 = 7 … 12 V DC / AC (with jumper JP1 inserted)
X1 = 5V DC (without jumper JP1)

Jumper table and test point

Reference	function	description	default
JP1	Supply Voltage selection	inserted: 7...12 V AC/DC supply Not inserted: 5VDC supply	Inserted
JP2	LCD illumination	inserted: back-light ON Not inserted: back-light OFF	Inserted
TP1	Voltage reference for ADC	Adjustable by trimmer R3	3.00 V

Appendix M - Examples of commands sent by SMS or by keyboard

Note:
In the examples shown in the following table, if the command involves an alphanumeric data, a dummy data is inserted by way of example which then must be replaced with the specific parameter requested by the user application.

Command function	Command syntax by SMS or PC	Command syntax by keypad
Adding new user By IMEI sending (ex. 251342513515245)	**251342513515245**	**Not available**
Disabling all the Analog and digital alarms	**AD**	**00#**
Displaying the EEPROM locations	**DE**	**01#**
setting Hysteresis factor at default (Ilow=0,95 IHigh=1,05)	**HD**	**02#**
Assigning name To digital input (ex. boiler to IN1)	**IN1=boiler**	**Not available**
Setting negative logic for relays activation (OUT=0 → relay ON)	**LN**	**03#**
Setting positive logic for relays activation (OUT=1 → relay ON)	**LP**	**04#**
Setting MODEM memory as default	**MO**	**16#**
Output relay activation (ex. relay 1 ON)	**ON01**	**1A01#**
Output relay deactivation (ex. relay 1 OFF)	**OF01**	**0A02#**
Reading ADMIN number (position 1 to 9)	**RA**	**05#**
Assigning name To RCU-8951 (ex. mycontrol)	**RC=mycontrol**	**Not available**
Reading digital inputs and relays state	**RE**	**06#**
Reading 8 variables single from EEPROM (ex. address 040)	**RF040**	**2A040#**
Enabling command confirmation by ring	**RI**	**A7#**
Assigning name to output relay (ex. boiler to relay 1)	**RN1=boiler**	**non available**

Software RESET	**RS**	**08#**
Starting program in set-up mode (for test)	**RU**	**09#**
Reading 8 variables Byte from EEPROM (ex. address 000)	**RY000**	**3A000#**
Setting real time clock (ex. 06/10/2016 at 17.45)	**RT=16.10.06,17.45.00**	**9A=16.10.06,17.45.00#**
Setting SIM memory as default	**SI**	**17#**
Enabling command confirmation by SMS	**SM**	**10#**
setting angular coefficient of LM335 at default (10mV/°C)	**TD**	**11#**
Reading temperatures	**TE**	**12#**
Assigning name to temperature (ex. Kitchen toT1)	**TN1=kitchen**	**Not available**
Setting reference measured temperature (Ex. T1 = 20.5° C)	**TS1,20.5**	**4A1,20.5#**
Setting voltage scale factor to default (1.00)	**VD**	**13#**
Reading (SMS) Firmware version	**VE**	**14#**
reading 8 input voltage	**VO**	**15#**
Assigning name to voltage input (ex. battery to V1)	**VN1=BATTERY**	**Non available**
Deleting one user from memory (ex. location 1)	**WP001**	**7A001#**
Adding user to Phone-book memory (ex. location 1)	**WP001,+393930083942=Elcosys**	**7A001,+393930083942**
Writing 8 bit variable on the EEPROM (ex. address 030)	**WB030,01010011**	**5A030,01010011#**
Writing Single variable on the EEPROM (ex. address 040)	**WS040,20.5**	**6A040,20.5#**
Writing Byte variable on the EEPROM (ex. address 016)	**WY016,5**	**8A016,5#**

Appendix N - USE OF RCU-8951 in LINK MODE

The "LINK" mode, available with remote controls RCU8951 SENTINEL SMS with firmware ver. 9.3 and later, allows the use of two paired units in which, the status changes on the digital inputs of a remote control are repeated on the outputs of the other relays, acting in totally symmetrical, asynchronous and automatic mode. For the setting of two units in "LINK" mode you must perform the operations listed below. Registering more than one numbers on the memory of a unit acting as a master, this unit can control up to nine slave units.

1) The alarm LINK mode, which requires Firmware Ver. 9.3 and later requires some default settings in particular these three points are important:
2)   **a)** Alarms must all be disabled, except LINK SMS alarm
3)   **b)** In the location 1 of the phone-book (SIM or MODEM) of each RCU8951 must be stored the number of the coupled RCU8951 for matching the link.
4)   **c)** In the memory locations 10 and higher, it must be stored at least one telephone number from which it is possible to store or replace the ADMIN numbers, or sending commands and settings without receiving the LINK commands that are sent only to the first 9 numbers stored in the phone-book.
5) The transmission time of the LINK command/execution is about 30 seconds
6) To ensure total reliability of operation and maintain the LINK synchronism are stored up to 10 SMS messages that are read in a "deferred mode" even in the case in which the receiver remote control to be temporarily switched off or go out of service during the transmission of commands from the corresponding: to recovery will run all commands sent earlier, up to a maximum of 10. the SMS, once executed, they will be deleted from the SIM.
7) The setting of alarms in EEPROM LINK mode must be performed in accordance with the following tables. (8 input lines all enabled to control 8 corresponding outputs).

035	Enabling SMS sending for LINK command by digital lines P3.x
| | ```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- reserved
 |   |   |   |   |   |   |------- reserved
 |   |   |   |   |   |----------- reserved
 |   |   |   |   |----------------- reserved
 |   |   |   |--------------------- if=1→ enabling SMS for LINK command by line P3.4
 |   |   |------------------------- if=1→ enabling SMS for LINK command by line P3.5
 |   |----------------------------- if=1→ enabling SMS for LINK command by line P3.6
 |--------------------------------- if=1→ enabling SMS for LINK command by line P3.7
``` |
| 036 | Enabling SMS sending for LINK command by digital lines P4.x |
| | ```
b7  b6  b5  b4  b3  b2  b1  b0
 |   |   |   |   |   |   |   |
 |   |   |   |   |   |   |   |-- if=1→ enabling SMS for LINK command by line P4.0
 |   |   |   |   |   |   |------- if=1→ enabling SMS for LINK command by line P4.1
 |   |   |   |   |   |----------- if=1→ enabling SMS for LINK command by line P4.2
 |   |   |   |   |----------------- if=1→ enabling SMS for LINK command by line P4.3
 |   |   |   |--------------------- reserved
 |   |   |------------------------- reserved
 |   |----------------------------- reserved
 |--------------------------------- reserved
``` |