

RMU



Cathodic Protection Remote Monitoring Unit



Instruction Manual

Ver. 03/07/2012

RMU Instruction and Commissioning Manual

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2. SAFETY & WARNINGS

2.1 Safety

	1	Read this manual carefully before operating the equipment and follow its instructions.
	2	Installation, operation and maintenance must be in strict accordance with this manual, national codes and good practice.
	3	Installation or operation not performed in strict accordance with these instructions will void manufacturer's warranty.
	4	Disconnect all power inputs before servicing the RMU.
	5	After installation, check and verify that no parts (bolts, washers, etc.) have fallen into the RMU.

2.2 Warnings

	1	Internal components and PCBs are at mains potential when the RMU is connected to control voltage. This voltage is extremely dangerous and contact with it will cause death or severe injury.
	2	The RMU must be grounded to ensure correct operation, safety and to prevent damage.

The company reserves the right to make any improvements or modifications to its products without prior notice.

3. INTRODUCTION

3.1 Why Cathodic Protection?

Over the years efficiency, losses and nature preservation have become significant issues when designing new facilities.

Corrosion effects can be found in many applications such as:

- Pipes (water, oil, gas)
- Tanks (oil, gas, chemical liquids, etc.)
- Construction (bridges, docks, etc.)

Why do metals corrode?

Corrosion is nature's way of restoring the iron in steel to rust, which is iron oxide or native iron ore. The change from the metallic to the combined form occurs by an "anodic" reaction.

The most damaging type of corrosion is galvanic corrosion (also known as electrochemical corrosion), which involves the passage of electrical currents on a micro or macro scale. The current flowing through soil dissolves small particles of iron from the anodic surface of the metal, thus pitting it.

Passive cathodic protection connects an external anode to the protected metal and impresses an electrical DC current so that all areas of the metal surface become cathodic thus inhibiting the corrosive process.

The main advantage of **Impressed Current Cathodic Protection (ICCP)** over other forms of anti-corrosion treatment is that it allows you to control the voltage and the impressed current, thus allowing its use in almost any resistivity soil environment, bare or coated pipeline systems, and any size object to be protected.

3.2 Why RMU from Solcon?

Solcon Industries offers advanced Cathodic Protection **Remote Monitoring Unit** – the **RMU**.

The RMU is intending to monitor an ICCP power supply.

The RMU includes a wide range of protection and measurement features, thus providing the ultimate solution for continuous supervised operation of an ICCP power supply.

The RMU is designed and built according to the most stringent standards such as NACE and CE.

3.2.1 *Advantages at a Glance*

- Supervision of ICCP power supply unit.
- Current and voltage measurements
- Protected object Potential to Reference Cell measurement
- Control of external interrupter
- Control of external fan
- Irrigation system control
- Temperature sensor input
- Micro processor control
- Communications – GSM- control setting and feedback
- RS485 - Modbus
- GPS for time synchronization
- Built in LCD display with Voltage, Current, Energy and Potential measurements

3.2.2 *Protection Features*

- Detecting ICCP voltage fault
- Detecting ICCP voltage fault

3.2.3 *Alarm*

- High Temperature detection.

3.3 Block Diagram

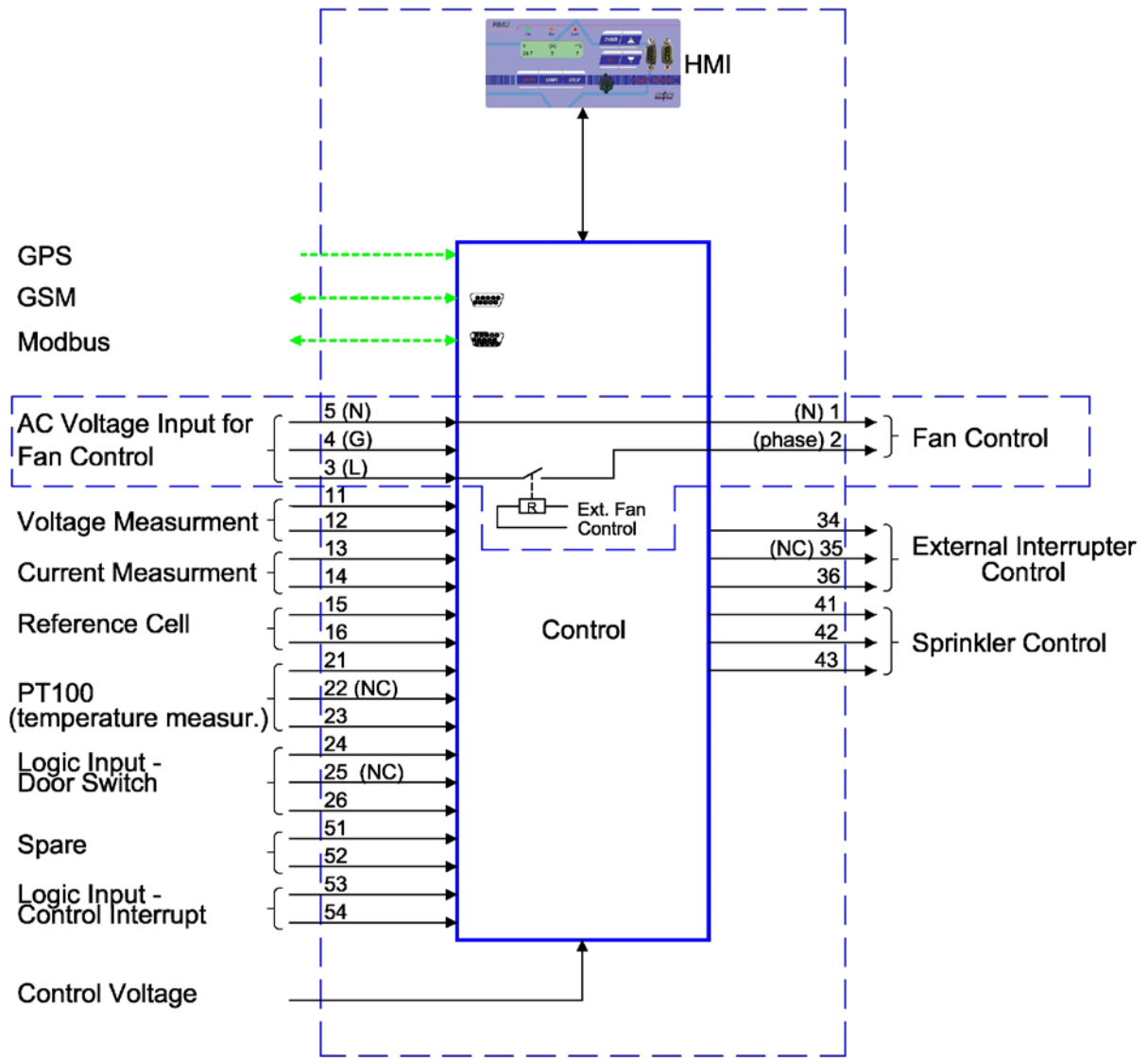


Figure 1 – Block Diagram of the RMU

3.4 Ordering Information

RMU **400-** **GPS-** **S**
 Unit Type Control Options Front Panel
 Voltage

Unit Type

Specify	Description
RMU	Remote Monitoring Unit

Control voltage

Specify	Description
90-240	Single phase 90~240V, 47~63Hz +10%, -15% (same unit for entire control voltage range)

Options

Specify	Description
0	No option
GPS	Time synchronization with GPS
Modem	Cellular communication

Front Panel


Specify	Description
S	Standard

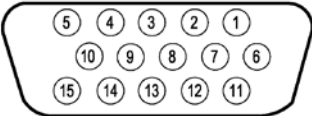
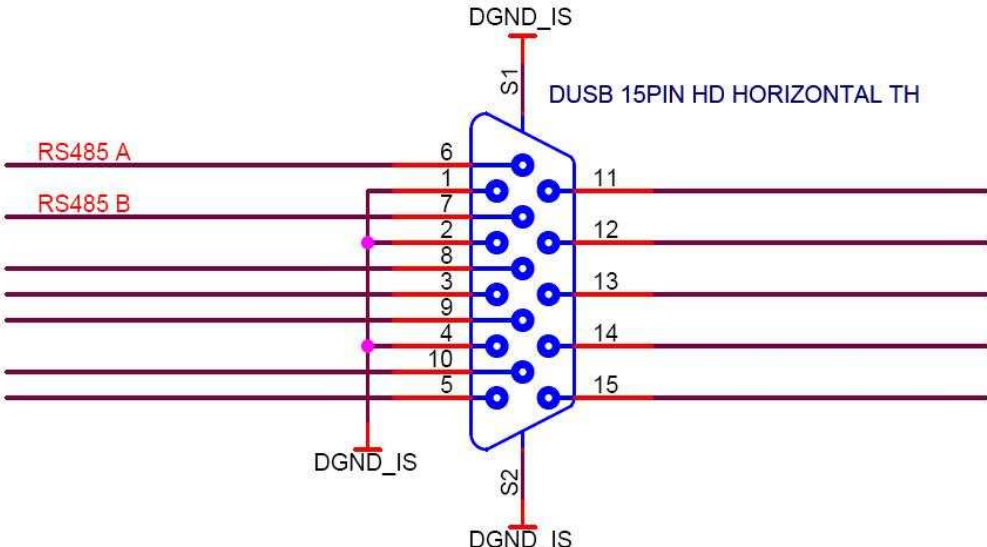
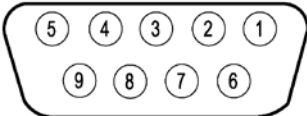
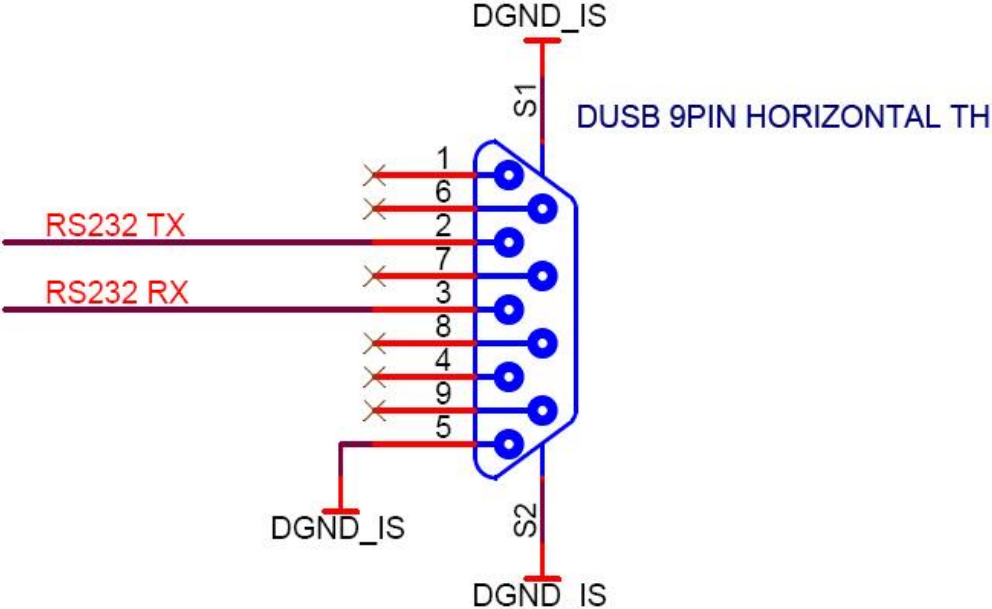

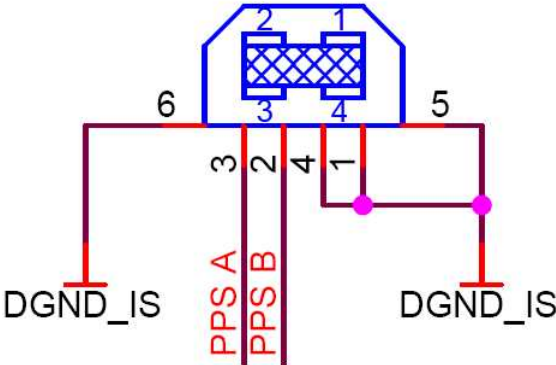
Ordering Example: RMU unit, control voltage 90-240VAC with GPS time synchronization, Standard front panel:

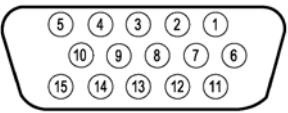
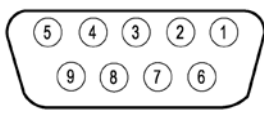
RMU 90~240 – GPS - S

4. TECHNICAL DATA

4.1 RMU Control wiring

Indication	Description
Control Power	Connect control voltage to the RMU to operate all internal control circuitry. Applicable control voltages: 115-230V 50/60Hz, L, N Gnd.
Fan control Input and output: Terminal 1 Terminal 2 Terminal 3 Terminal 4 Terminal 5	Fan control: Input terminal 3 (Line), 4 (ground) and 5 (neutral) are for the control voltage to operate an external fan. Output terminals 1 and 2 to control external fan when internal temperature exceeds 60°C. Terminal 1 is neutral (internally connected to terminal 5) and terminal 2 is controlled phase to operate the fan. Terminal 1 & 2 Contacts data: 8A, 250VAC, 2000VA max. Max. DC Load Breaking Capacity: 8A, 30VDC with resistive load.
Input: Terminal 11 (+) Terminal 12 (-)	Voltage input measurement of an external ICCP power supply unit.
Input: Terminal 13 (+) Terminal 14 (-)	Current input measurement from an external ICCP power supply unit. The measurement are from a series shunt, Voltage is in the range of 50-100mV.
Input from Reference Cell: Terminal 15 (+) Terminal 16 (-)	Connect shielded twisted pair of control wires from the Reference Cell and from the protected object. Note: If no Reference Cell is connected input terminals 15-16 must be shorted.
	Local ground for the shielding of the shielded twisted pair cable to the Reference Cell.
PT100 input: Terminal 21 Terminal 23	Input from PT100 to measure external temperature. Used to operate the fan via terminals 1-5.
Logic Input – Door Switch: Terminal 24 Terminal 26	Input of dry contact from an external switch to signal that cabinet door is opened or as required by the customer.
Logic Output – external interrupter Control: Terminal 34 Terminal 36	5V – TTL level to control an external interrupter.
Sprinkler control output: Terminal 41 (NO) Terminal 42 (Common) Terminal 43 (NC)	Voltage free contacts are energized when irrigation is required by the RMU. Typically connect this control output to the water solenoid. Contacts data: 8A, 250VAC, 2000VA max. Max. DC Load Breaking Capacity: 8A, 30VDC with resistive load.
Logic Input: Terminal 51 Terminal 52	Future enhancement.
Logic Input – Interrupter Control: Terminal 53 Terminal 54	Input of dry contact from an external source to open/close the external interrupter controlled by the RMU. When an “Open” signal is accepted by the RMU the RMU signals via terminals 34 & 36 to open the external interrupter and vice versa.

Indication	Description
 <p>Note: Connector shown is at the bottom of the unit (not on the front overlay).</p>	<p>15 pin D-type connector for Modbus communication (when the SCP-C is in stand alone operation) or for site connection of several Power Supply units for increased power.</p> 
 <p>Note: Connector shown is at the bottom of the unit (not on the front overlay).</p>	<p>9 pin D-type connector for GSM Modem connection and for software uploading.</p> 
	<p>4 pin USB Type B connector for PPS (Pulse Per Second) input from the GPS receiver.</p> 

Indication	Description
 <p>Note: Connector shown is on the front overlay.</p>	<p>15 pin D-type connector for factory use only.</p>
 <p>Note: Connector shown is on the front overlay.</p>	<p>9 pin D-type connector for factory use only.</p>

Note:
All other terminals/connectors (if exist) are not for customer use.

4.2 Bottom View of the RMU

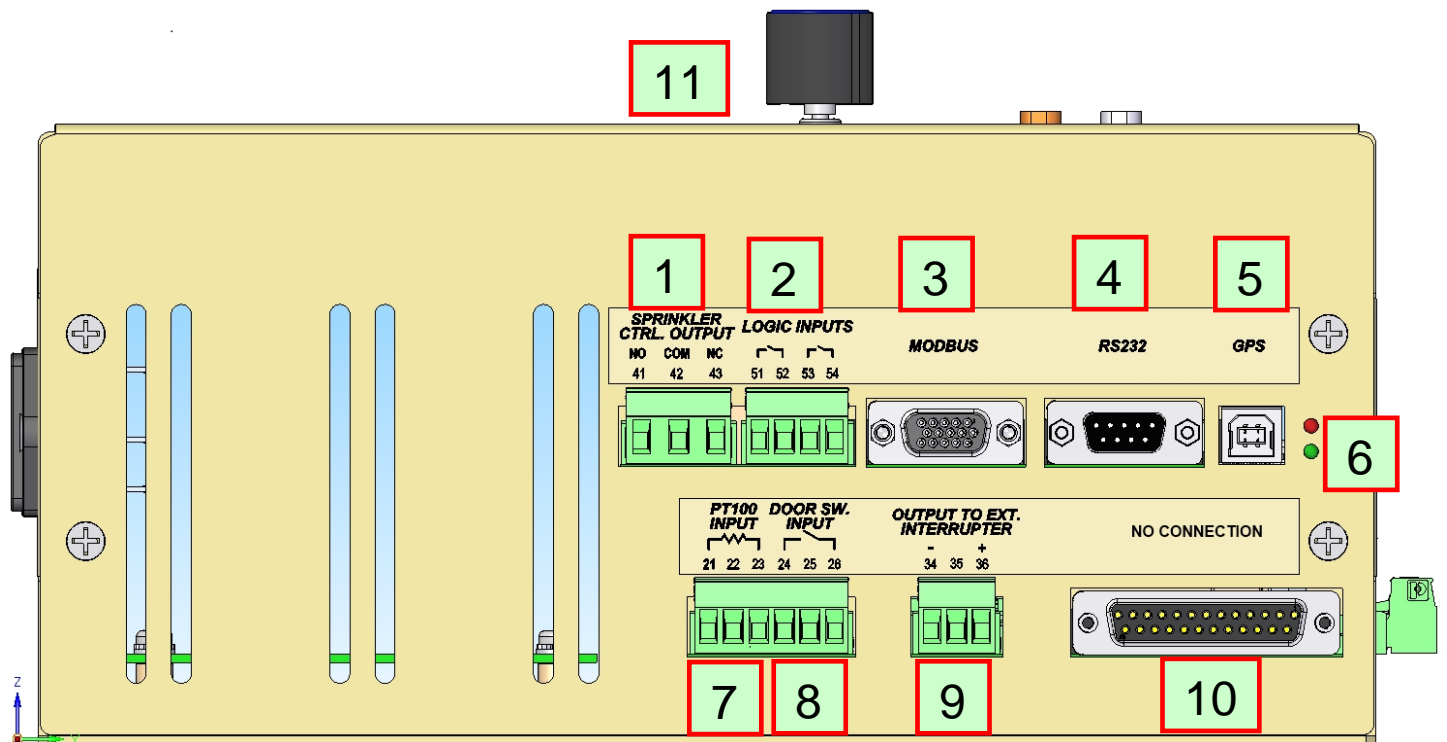


Figure 2 - Bottom View of the RMU

1. Output terminals 41-43: Output to control the irrigation system.
2. Logic Inputs: Terminals 51 & 52 are for future enhancement. Terminals 53 & 54 are to signal to the RMU to open/close the external interrupter controlled by the RMU.
3. 15 pin D-type connector for Modbus communication.
4. 9 pin D-type connector for GSM Modem connection and for software uploading.
5. 4 pin USB Type B connector for PPS (Pulse Per Second) input from the GPS.
6. Indication LEDs for communication:
Lower LED blinks when GSM connection is established.
Upper LED blinks when GPS signal is detected.
7. Terminals 21 & 23 -PT100 Input
8. Terminals 24 & 26 -Logic input to signal for a Door switch.
9. Terminals 34 & 36 - 5V – TTL level output to control external Interrupter.
10. 25 Pin connector for future enhancement
11. **Rotary knob** for reviewing and setting parameters.

4.3 Front View of the RMU

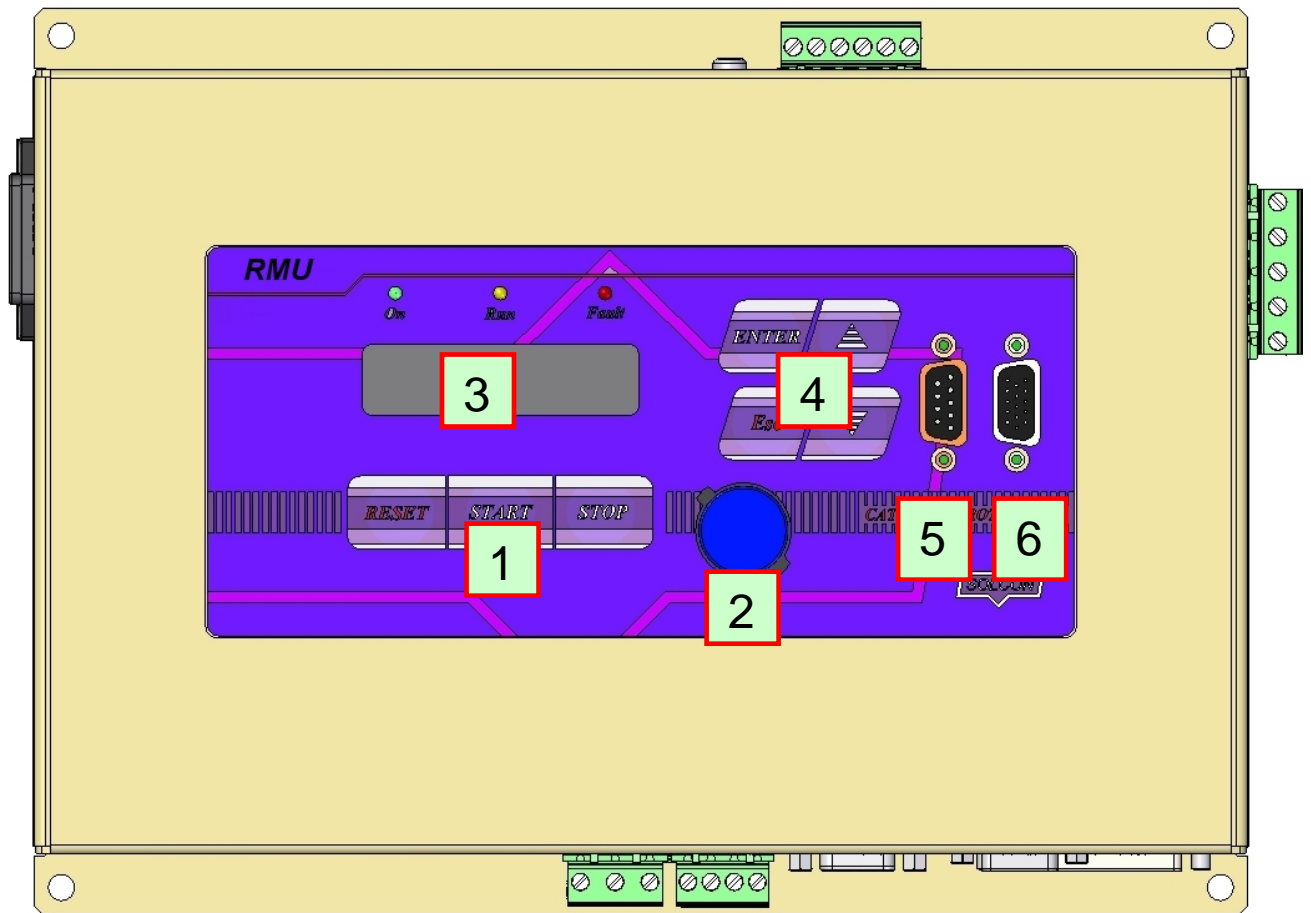


Figure 3 - Front View of the RMU

1. **Reset, Start** and **Stop** keys.
2. **Rotary knob** for reviewing and setting parameters.
3. 2 lines 16 characters display.
4. Settings keys.
5. 9 pin D-type connector for future enhancement.
6. 15 pin D-type connector for future enhancement.

4.4 Top View of the RMU

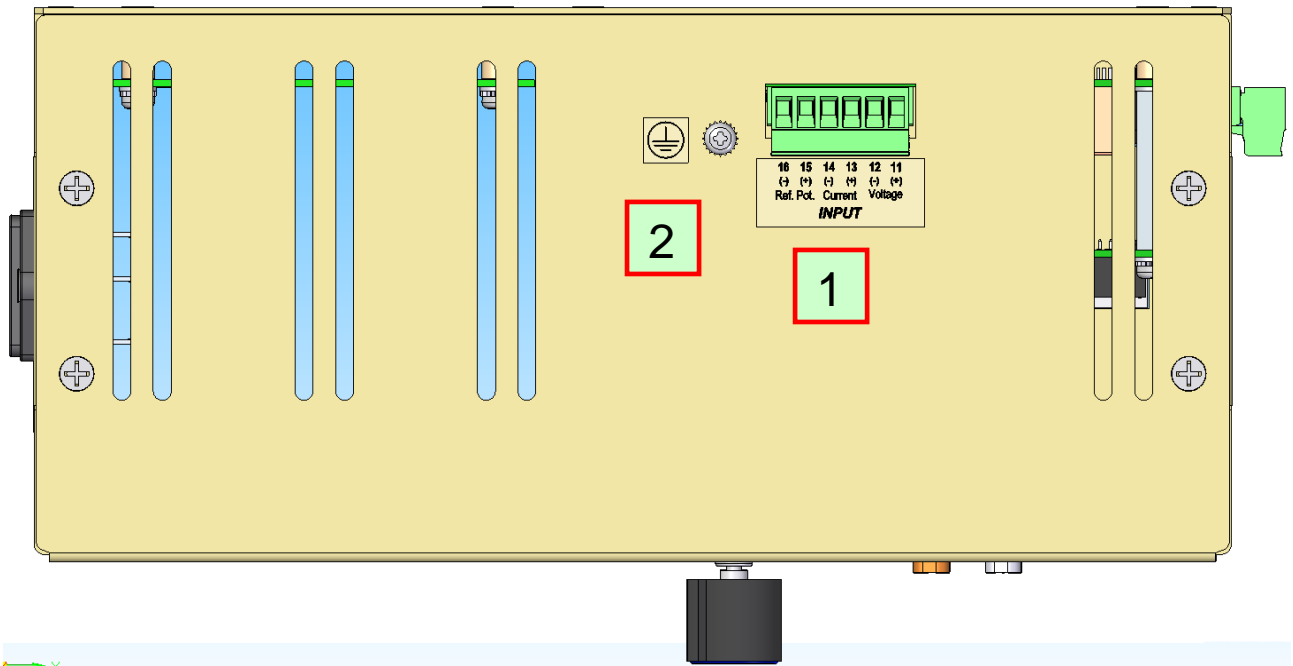


Figure 4 - Top View of the RMU

1. Input terminals 11-16: Terminals 11-12 are for voltage measurement. Terminals 13-14 are for current measurement. Terminals 15-16 are input from a Reference Cell. This input is used to measure the potential of the protected object in reference to the Reference Cell.

Note:

If no Reference Cell is connected, input terminals 15-16 must be short connected.

2. Local ground for the shielding of the twisted shielded cable to the Reference Cell

4.5 Right and Left Views of the RMU

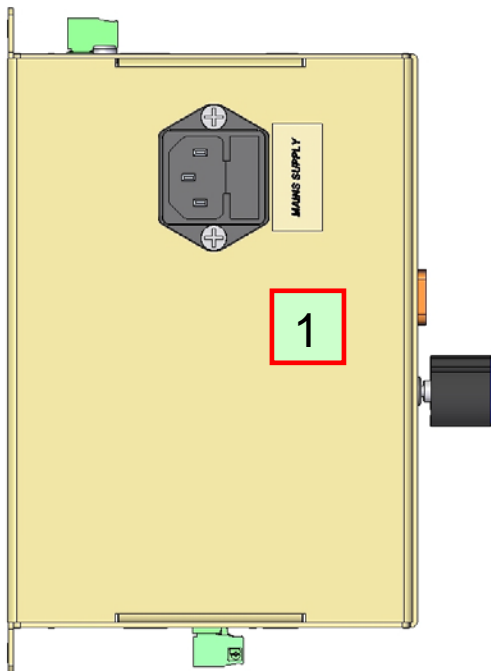


Figure 5 - Left View of the RMU

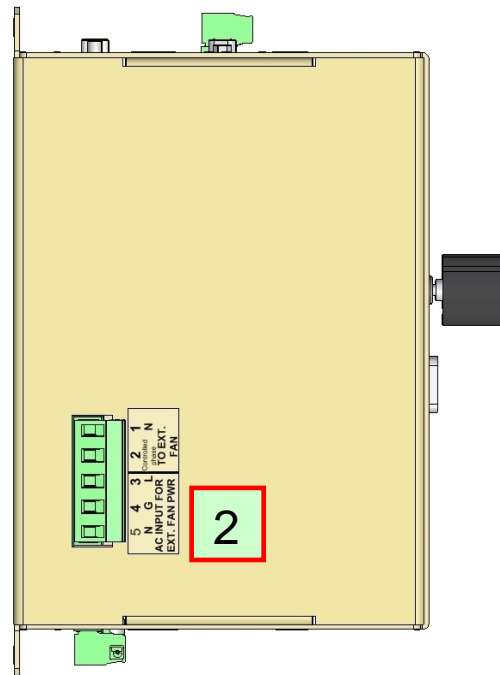


Figure 6 - Right View of the RMU

1. Input for control voltage.
2. Fan control: Input terminal 3 (Line), 4 (ground) and 5 (neutral) are for the control voltage to operate an external fan. Output terminals 1 and 2 to control external fan when measured temperature exceeds 60°C. Terminal 1 is neutral (internally connected to terminal 6) and terminal 2 is controlled phase to operate the fan.

5. TYPICAL CONNECTION DIAGRAMS

5.1 Basic Connection Diagram

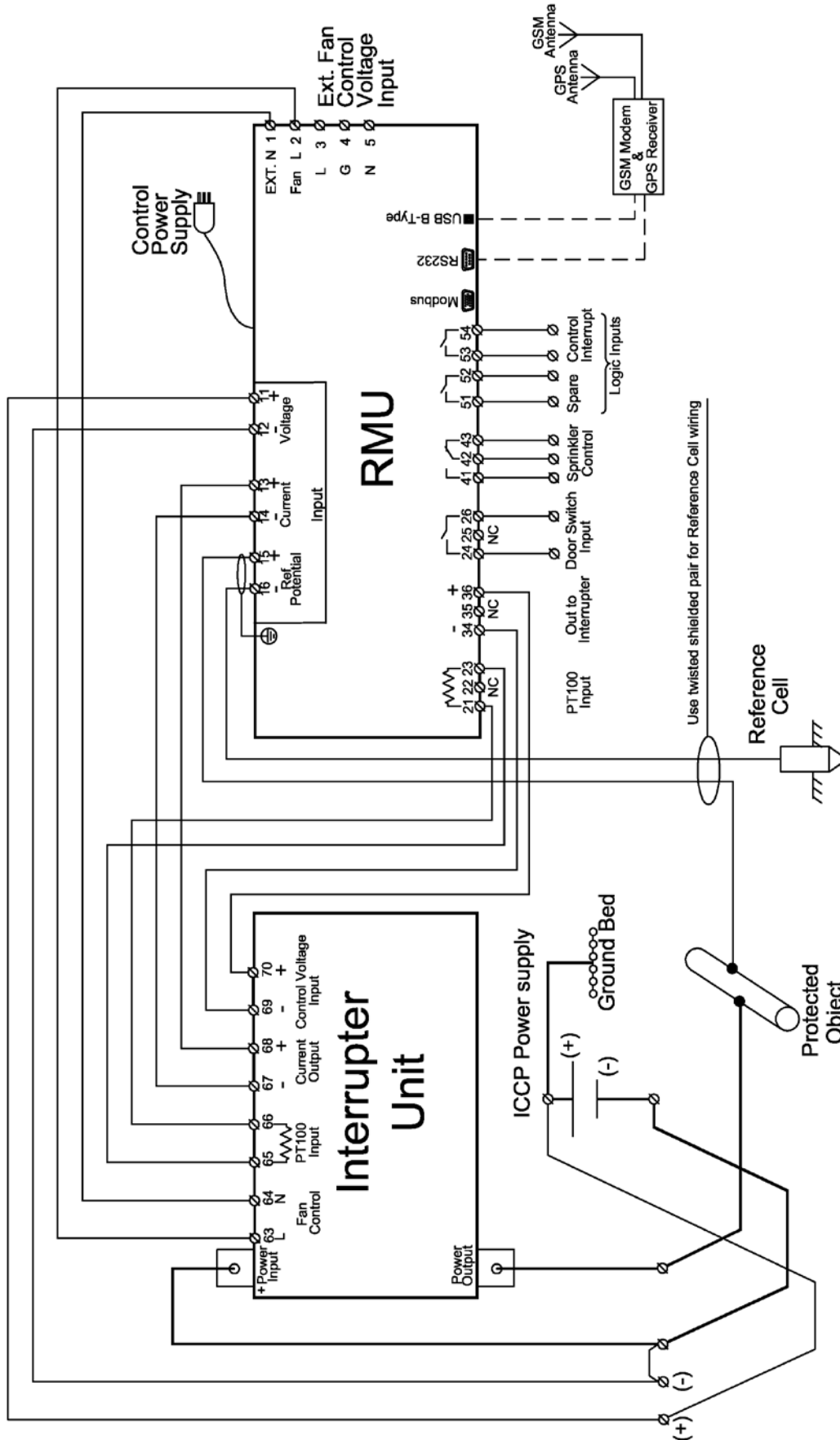


Figure 7 – Basic Connection Diagram of the RMU Along With ICCP Power Supply and Interrupter

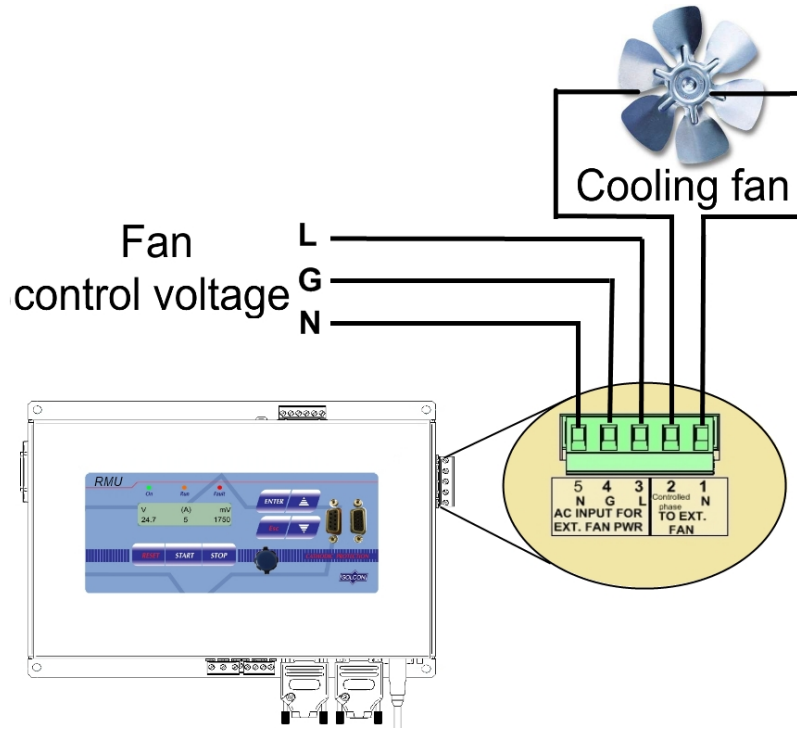


Figure 8 – Fan Control by the RMU

6. CONTROL KEYPAD

The control keypad is the interface between the RMU and the user.

The RMU control keypad features:

- (1) Three indication LEDs (**On, Run, Fault**).
- (2) Two lines of 16 alphanumeric characters each.
- (3) Three keys for controlling the unit (**Reset, Start, Stop**).
- (4) Four keys for setting (**Enter, Escape, Up (▲)** and **down (▼)** keys) for reviewing and setting parameters.
- (5) Two D-type connectors: 9 pins (left) and 15 pins (right) for future enhancement.
- (6) **Rotary knob** for reviewing and setting parameters.

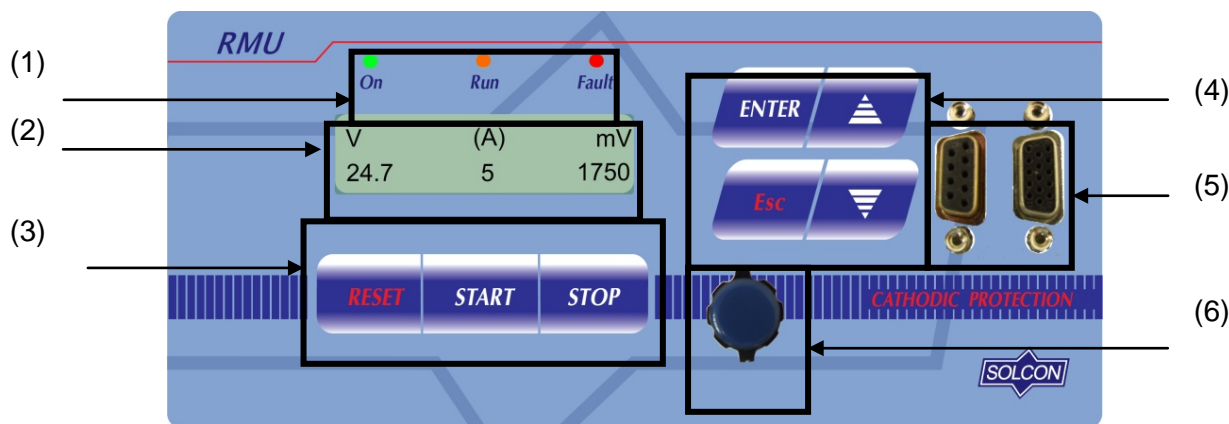


Figure 9 – Control Keypad

6.1 Status LEDs

	Green	On	Lights when the control voltage is connected to the RMU.
	Orange	Run	Lights during Run operation of the RMU.
	Red	Fault	Lights upon operation of any of the built-in protections. Flashes when in warning status.

6.2 LCD Arrangement

Set Time 16:54:42

Upper line displays function.

Lower line displays setting and/or measured values.

LCD display illuminates upon pressing any of the keys or rotating the **Rotary knob**.

30 seconds after not pressing any of the controls the LCD turns off.

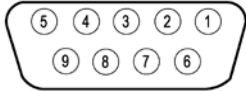
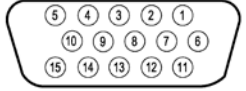
6.3 Control Keys

Start	Initiate an On signal via terminals 34 & 36 to close the external interrupter (if exists). Overrides the parameters settings in INTERRUPT PARAMETERS.
Stop	Initiate an Off signal via terminals 34 & 36 to close the external interrupter (if exists). Overrides the parameters settings in INTERRUPT PARAMETERS.
Reset	Resets the RMU after a fault has been dealt with. This cancels the fault displayed and allows you to restart the unit by pressing the Start key.


6.4 Setting Keys

Enter	<p>When a mode page is displayed, pressing the Enter key moves the display one level down. First parameter of the mode page is displayed. Pressing the Enter key again enables the user to modify this parameter with the ▲ and ▼ keys or with the Rotary knob. Pressing the Enter key again saves the displayed setting and moves to the next parameter display.</p> <p>Note: Modifying parameters without saving them will not remain in effect after mains voltage is cycled.</p>
▲	<p>Allows the operator to browse through the mode pages. While parameter is displayed allows the operator to increment adjusted values shown in the display.</p>
▼	<p>Allows the operator to browse through the mode pages. While parameter is displayed allows the operator to decrement adjusted values shown in the display.</p>
Esc	<p>Press the Esc to move the display one level up.</p>

6.5 Communication D-type Connectors

	<p>9 pin D-type connector for future enhancement.</p>
	<p>15 pin D-type connector for future enhancement.</p>

6.6 Rotary Knob for Reviewing and Setting Parameters

	<p>The Rotary knob enables the user to browse through the mode pages and, by pushing the Rotary knob, to go one level down, displaying the parameters. Moving one level up is only by pressing the Esc key. while parameter is displayed it can be increased/decreased by pushing the Rotary knob and rotating it right/left. After modifying the parameter you can save the modified setting by pushing the Rotary knob. Parameter is saved and next parameter/display is displayed.</p> <p>Note: Modifying parameters without saving them will not remain in effect after mains voltage is cycled.</p>
-------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

6.7 Reviewing and Modifying Parameters

Upon start-up of the RMU the LCD displays: Output voltage (in Volts), Output current (in Amperes), Reference Cell voltage (in mV) and system mode of operation (by the parentheses location/blinking):

(V)	I	mV
25.7	8	1750

You can review all mode pages by pressing the **Esc** key once and rotating the **Rotary knob** clockwise (or pressing the **▼** or **▲** keys):

OPERATION MODES ***PARAMETERS***
RMU ***PARAMETERS***
INTERRUPT ***PARAMETERS***
GPS & GSM ***PARAMETERS***
GLOBAL ***PARAMETERS***
I/O PROGRAMMING ***PARAMETERS***
IRRIGATIO CTRL ***PARAMETERS***
FAULT *****DATA*****
ABOUT _*****_

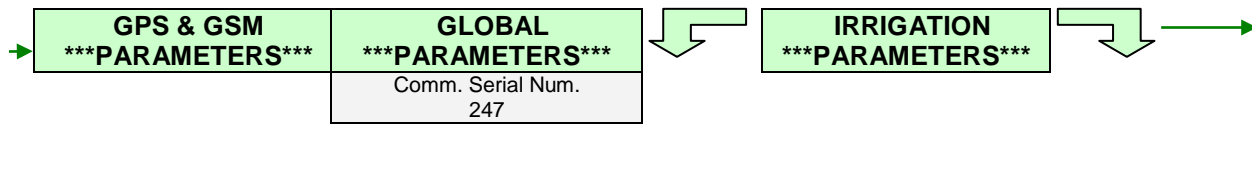
Push the **Rotary knob** or press the **Enter** key to review parameters in each mode page.

Once you reach the required parameter, rotate the **Rotary knob** or press the **▼** or **▲** keys to modify its value. To store the new parameters, push the **Rotary knob** or press the **Enter** key. A DATA SAVED OK message displays for about 1 second.

6.8 Overview of All Mode Pages

MEASUREMENTS - ***** -	RMU ***PARAMETERS***	INTERRUPT ***PARAMETERS***
Refer to section 6.8.1 page 20	Refer to section 6.8.2 page 22	Refer to section 6.8.4 page 23
V (A) mV 25.7 7 1750	CURR. FULL SCALE 12 [A]	Interrupt Mode Internal
Amb. Temp. 27 [C]	SHUNT 4 [mV/A]	On – Off Time 10 – 3 [Sec]
CPU Temp. 35 [C]		Start Interrupt 08:30 09/07/09
Pot. Comp. Value + 1 [mV]		Stop Interrupt 16:45 09/07/09
Last Pot Measure 45 [mV]		
Load Resistance 0.04 [oHm]		
Max Amb. Temp. 35 [C]		
Max Voltage 25 [V]		
Max Current 8 [A]		

GPS & GSM ***PARAMETERS***	GLOBAL ***PARAMETERS***	IRRIGATION ***PARAMETERS***	
Refer to section 6.8.5 page 24	Refer to section 6.8.6 page 27		
GPS Init OK	Set Time 16:51:00	RESIRTANCE MODE - ***** -	TIMER MODE - ***** -
		Refer to section 6.8.7.1 page 29	Refer to section 6.8.7.2 page 29
Time Zone (GMT +2)	Set Date 11/06/09	Resistance Limit Off; 0-6 [Ohm]	Days Interval Off; 1-7 [Days]
GPS PPS 0	LCD Intensity [■■■■□□□□]	Duration Time 10 [Min]	Duration Time 10 [Min]
Time 16:51:00	LCD Contrast [■■■■□□□□]		Irrig. StartTime 00:00~23:00
Pin Code [****]	Working Hours 0.00		
GSM Freq. Band Auto Scan	Output kW*Hour 0.00		
GSM Init. Not Connected	Output AMP*Hour 0.00		
	Language English		
	Open Door Warn. DISABLE		
	AMB Temp. Warn. DISABLE		
	Screen Saver 1[MIN]		
	Config Out Relay IRRIGATION		
	Comm. Baud Rate 9600		



FAULT *****DATA*****		ABOUT _*****_
		Refer to section 6.8.9 page 31
FAULTS HISTORY _*****_	WARNINGS HISTORY _*****_	Software Version 11/06/09 1.44
Refer to section 6.8.8.1 page 30	Refer to section 6.8.8.2 page 30	
1) AC Fault 09/07/09 12:34	1) High Temp. 09/07/09 12:55	Hardware Version 1.00
2) AC Fault 11/06/08 07:31	2) High Temp. 09/07/08 13:35	Power Version 1.00
.	.	Power Type 24 [A]
.	.	
.	.	Checksum 0x293f
9) AC Fault 11/11/07 07:31	9) High Temp. 09/12/07 13:35	

6.8.1 MEASUREMENTS – Page 0

MEASUREMENTS _*****_	Description
Display	
(V) I mV 25.7 7 1750	Displays operating current, voltage and Reference Cell voltage readings. Note: This display is the default display of the RMU. When any mode page is displayed and if any control key is not pressed for 60 seconds, the RMU moves to this default display.
Amb. Temp. 27 [C]	Displays the temperature measured by the PT100 connected to RMU. Note that when the ambient temperature exceeds 60°C, a command is initiated via terminals 1 and 2 to operate the external fan cooling the power section.
CPU Temp. 27 [C]	Displays the temperature in the CPU of the RMU. Note that maximum temperature allowed for the CPU is 120°C.
Pot. Comp. Value + 1 [mV]	Displays the compensation value of the Reference Cell voltage. When in this display user can compensate for differences between Reference Cell mV readings of an external meter to that displayed on the RMU (see above first display). For example: External measurement is 100mV and 30mV is displayed, set Pot. Comp. Value to +70mV. To set the compensating value push the Rotary knob (or press Enter key), the compensating value blinks. Set the compensating value by right/left rotating the Rotary knob or by pressing the ▼ or ▲ keys. When completed push the Rotary knob (or press the Enter key).
Last Pot Measure 45 [mV]	Displays last voltage measurement of the Reference Cell. • When the RMU is in Interrupt Mode - Internal displayed value is Reference Cell's voltage after a fixed time of 120mS. (refer to section 6.8.4 page 23)
Load Resistance 0.01 [oHm]	Displays the resistance of the load connected. This is a result of a calculation of V_{output}/I_{output} .

MEASUREMENTS _*****_	
Display	Description
Max Amb. Temp. 150 [C]	<p>Displays the maximum ambient temperature from initial operation or since last reset.</p> <p>To reset the value stored: Press the Rotary knob (or press the Enter key), the display changes to:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">Reset Parameter? Yes:ENTER No:ESC</p> </div> <p>To reset press the Rotary knob (or press the Enter key), to abort Press Esc.</p>
Max. Voltage 25 [V]	<p>Displays the maximum output voltage from initial operation or since last reset. See above procedure top reset value.</p>
Max. Current 10 [A]	<p>Displays the maximum output current from initial operation or since last reset. See above procedure top reset value.</p>

Notes:

- In this page parameters cannot be programmed, except for the Pot. Comp. Value.
- Browsing the display in MEASUREMENTS mode page is possible by right/left rotating the Rotary knob or by pressing the ▼ or ▲ keys.

6.8.2 **RMU Parameters – Page 1****RMU
PARAMETERS**

In this Mode page you are able to set the parameters of the **RMU** regarding current measurements.

Display	Range	Description
CURR. FULL SCALE 12 [A]	10-100 A ⁽¹⁾	Sets the maximum value of the current. Set this parameter according to the maximum current of the external power supply.
SHUNT 4 [mV/A]	4- 10mV/A ⁽¹⁾	Set the value of the shunt.

Note:

(1) Values are limited as follows:

For CURR. FULL SCALE of 10A SHUNT value can be set to 5-10mV/A

For CURR. FULL SCALE of 100A SHUNT value can be set to 1mV/A

It is customer responsibility to verify that those limits are not exceeded.

6.8.3 INTERRUPT PARAMETERS – Page 2

INTERRUPT PARAMETERS

In this Mode page you are able to set the parameters of the **Interrupt Mode**.

Display	Range	Description
Interrupt Mode Internal	Internal/External	<p>With this parameters you are able to set the operation of the external interrupter controlled by the RMU.</p> <p>When set to Internal the RMU controls the external interrupter according to the parameters: On-Off Time, Start Interrupt and Stop Interrupt (See the following parameters).</p> <p>When set to External the RMU controls the external interrupter according to the opening or closing of the logic input – Control interrupt.</p> <p>The logic input – Control interrupt to the RMU is via terminals 53 & 54 at the bottom of the RMU.</p> <p><i>Open contact</i> signals to the RMU that the external interrupter should open.</p> <p><i>Close contact</i> signals that the external interrupter should close.</p> <p>The RMU activates the external interrupter to follow the external signal.</p> <p>When the external interrupter is open the Run LED on the front overlay turns off.</p> <p>When the external interrupter is close the Run LED on the front overlay turns on.</p>
On - Off Time 1 – 1 [Sec.]	1-1 – 60-60 [Sec.] When reaching 60 display changes to: 200-800[mS]- 800 – 200[mS]	<p>This parameter is only valid when Interrupt Mode is set to Internal.</p> <p>When the On-Off Time is in the range of 1–1 [Sec] to 60-60[Sec] you can set any combination of time intervals for the On/Off operation of the internal interrupt.</p> <p>However, when the upper limit of 60 seconds is reached, the display changes to 200-800[mS]. When in this range the interrupter cycle time is 1000 mS (1 second). You are able to control the On time only. Off time is automatically calculated for a cycle time of 1000mS.</p>
Start Interrupt 08:30 09/07/09		<p>This parameter is only valid when Interrupt Mode is set to Internal.</p> <p>Push the Rotary Knob or press the Enter key. the hour digits blinks.</p> <p>Rotate the Rotary Knob or press the ▼ or ▲ keys to set the hour.</p> <p>When you reach the required hour push the Rotary Knob or press the Enter key.</p> <p>The minutes digits starts blinking.</p> <p>Use the same procedure to set the minutes, day, month and year.</p>
Stop Interrupt 10:30 09/07/09		<p>This parameter is only valid when Interrupt Mode is set to Internal.</p> <p>Follow the same procedure for setting the Stop Interrupt as for the Start Interrupt.</p> <p>Verify that the Stop Interrupt setting is later than the Start Interrupt setting or an error message displays.</p>

Note:

⁽¹⁾ Upper value is limited by the parameter **Instant Off Mode**.

GPS & GSM PARAMETERS

In this Mode page you are able to set the parameters of the **GPS & GSM** connection modules of the unit. You are also able to view the current time.

Display	Range	Description
GPS Init OK	Fail/OK	<p>Enables the user to initiate the operation of the GPS system. Push the Rotary knob (or press the Enter key). The display changes to:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;">GPS INIT Please Wait</p> </div> <p>After trying to get a GPS signal for a certain time the display shows Fail (if no connection is detected) or OK (if a signal is detected). When GPS connection is detected, the upper LED at the bottom of the RMU blinks (refer to Figure 2 - Bottom View of the RMU, page 10).</p>
Time Zone (GMT +2)	GMT-12 to GMT+12	<p>Set the Time Zone where the RMU is installed.</p> <p>Note: Time Zone does not change automatically when local time is changed from Standard time to Daylight Saving time. This operation must be done manually.</p>
GPS PPS 0	-	Display only data. This is for technician usage only.
Time 10:30		<p>Display only data.</p> <p>If no GPS connection exists then the Time is set by the user (see section 6.8.6 page 27) and by an internal clock. If GPS is connected then the Time is synchronized by the GPS.</p>
Pin Code [****]		<p>Enables the user to set the Pin (Personal Identification Number) Code of the SIM card installed in the GSM Modem. Note that Pin Code is not always required. If not required do not set the Pin Code and skip this parameter.</p> <p>Push the Rotary Knob or press the Enter key. the left digit changes from * to zero.</p> <p>Rotate the Rotary Knob or press the ▼ or ▲ keys to set the first digit of the PIN Code. Push the Rotary Knob or press the Enter key when done. The next digit changes from * to zero.</p> <p>Use the same procedure to set the other 3 digits of the PIN Code.</p> <p>Always remember your pin number because if you lose it then your cellular connection will be probably blocked!</p>
GSM Freq. Band. Auto Scan	Auto Scan 900/1800[Mhz] 900/1900[Mhz] 850/1800[Mhz] 850/1900[Mhz]	<p>Enables the user to set current band of the GSM connection. When set to Auto Scan the bands are set automatically. Note that this process might take several minutes to complete. You can set the band manually by selecting one of the four optional bands.</p> <p>900/1800[Mhz] stands for GSM 900Mhz+DCS 1800Mhz. 900/1900[Mhz] stands for GSM 900Mhz+PCS 1900Mhz. 850/1800[Mhz] stands for GSM 850Mhz+PCS 1800Mhz. 850/1900[Mhz] stands for GSM 850Mhz+PCS 1900Mhz.</p>

GPS & GSM PARAMETERS	
GSM Init Not Connected	<p>Modem Ready/ Not Connected/ No SIM Inserted/ SIM Busy/ Pin Code Error</p> <p>Enables the user to initiate the operation of the GSM connection. Push the Rotary knob (or press the Enter key). The display changes to:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">GSM INIT Please Wait</p> </div> <p>After trying to get a GSM connection for a certain time the display will show either of the following messages:</p> <ul style="list-style-type: none"> • Modem Ready – if the initialization has succeeded and the modem is ready. • Not Connected – If the cable from the RMU to the GPS Modem is disconnected. • Pin Code Error - if Pin Code is not set correctly. See parameter above, Pin Code for Pin Code setting. • No SIM Inserted - if the SIM card is required but not inserted to the GSM Modem. • SIM Busy – if the SIM Card is busy. Push again the Rotary Knob or press the Enter key until Modem Ready is displayed. <p>When GSM connection is detected, the lower LED at the bottom of the RMU blinks (refer to Figure 2 - Bottom View of the RMU, page Error! Bookmark not defined.).</p> <p>Refer to section 6.8.5.1 here after for send/receive SMS messages from/to the RMU.</p>

Note:

⁽¹⁾ Upper value is limited by the parameter Instant Off Mode.

6.8.4.1 Send/Receive SMS Messages

With the SMS messages you are able to:

- Open and close the external interrupter (by Start Stop commands).
- Set the starting time and stop of the interrupter.
- Set the Master phone to the destination for sending SMS fault messages.
- Read all data.

Notes on Using SMS Messages:

- First power the GSM modem.
- Wait 30 seconds.
- Power the RMU.
- Go to **GPS & GSM PARAMETERS** verify that **GSM Init** is **Connected**.
If **Not Connected** push the **Rotary knob** to initiate the GSM connection.
Wait until **Connected** message is displayed.
- You can use either upper-case or lower-case letters when sending the SMS messages to the RMU.
- Fail message to the sending phone upon receiving an illegal message by the RMU.

SMS Message	Description
PH	<p>Sets the sending phone as the master phone. All faults messages sent from the SPC-C will be sent to this phone.</p> <p>Upon completion a "Done" message will be sent to the master phone.</p>

SMS Message	Description
ON	Turns the RMU on. Upon completion a "Done" message will be sent to the sending phone.
OFF	Turns the RMU off. Upon completion a "Done" message will be sent to the sending phone.
RD	Read message. In reply to this message the RMU sends to the sending phone all measured data of the RMU. The following message will be sent by the RMU to the sending phone: Voltage: xx.xx[V] Current: xx.xx [A] Potential: xxxx[mv] Temperature: xx[C] Last Pot Measure: xx[mV] WH: xxxx [H] KW x H : xxxx A x H : xxxx WH: xxxx [H] KW x H : xxxx A x H : xxxx
IONxxxx	Sets the start time to operate the interrupter. Starting time is defined by xxxx. Examples: ION1200 activates the interrupter at 12:00. ION1310 activates the interrupter at 13:10. Upon completion a "Done" message will be sent to the sending phone. Note: For this command to function properly, the time of the RMU must be set correctly!
IOFF	Stop the interrupter immediately. Upon completion a "Done" message is sent to the sending phone.
RST	Resets the RMU in case of an error. Upon completion a "Done" message is sent to the sending phone.

6.8.5 GLOBAL PARAMETERS – Page 4

GLOBAL
PARAMETERS

In this Mode page you are able to set and read general parameters of the RMU.

Display	Range	Description
Set Time 10:30:51		<p>Enables the user to set the current time. Note that when GPS signal are detected the time is set by the GPS.</p> <p>Push the Rotary Knob or press the Enter key. the hour digits blinks.</p> <p>Rotate the Rotary Knob or press the ▼ or ▲ keys to set the hour.</p> <p>When you reach the required hour, push the Rotary Knob or press the Enter key.</p> <p>The minutes digits starts blinking.</p> <p>Use the same procedure to set the minutes and seconds settings.</p>
Set Date 11/06/09		<p>Enables the user to set the current date. Note that when GPS signal are detected the date is set by the GPS.</p> <p>Push the Rotary Knob or press the Enter key. the days digits blinks.</p> <p>Rotate the Rotary Knob or press the ▼ or ▲ keys to set the days.</p> <p>When you reach the required day, push the Rotary Knob or press the Enter key.</p> <p>The month digits starts blinking.</p> <p>Use the same procedure to set the minutes and seconds settings.</p>
LCD Intensity [■■■■■■■■]	■□□□□□□□ To ■■■■■■■■	Enables the user to set the Intensity of the display.
LCD Contrast [■■■■■■■■]	■□□□□□□□ To ■■■■■■■■	Enables the user to set the Contrast of the display.
Working Hours 15.32		<p>Displays the Working Hours counter of the RMU since last reset of the Working Hours counter.</p> <p>To reset the Working Hours counter, push the Rotary knob (or press the Enter key).</p> <p>The display changes to:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;">Reset Parameter? Res: ENTER No: ESC</p> </div> <p>To reset the Working Hours counter, push the Rotary knob (or press the Enter key).</p> <p>The display changes to:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;">Working Hours 0.00</p> </div>

GLOBAL PARAMETERS		
Output AMP*Hour 189.40		<p>Displays the AMP*Hour counter of the RMU since last reset of the AMP*Hour counter.</p> <p>To reset the AMP*Hour counter, push the Rotary knob (or press the Enter key).</p> <p>The display changes to:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">Reset Parameter? Res: ENTER No: ESC</p> </div> <p>To reset the AMP*Hour counter, push the Rotary knob (or press the Enter key).</p> <p>The display changes to:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">Output AMP*Hour 0.00</p> </div>
Language English	English	Allows the user to select the interface language.
Open Door Warn. Enable	Enable/Disable	Enables the alarm when the external input to terminals 24 and 26 signals that an external door is opened
Comm. Baud Rate 19200	2400, 4800, 9600, 19200, 38400, 57600, 115200	Allows the user to select the baud rate of the Modbus communication link.
Comm. Serial Num. 129	1-248	Allows the user to select the serial communication port number

6.8.6 **IRRIGATION CTRL PARAMETERS – Page 5****IRRIGATION CTRL
PARAMETERS**

In this Mode page you are able to set the parameters of the irrigation control system.

The irrigation system can be controlled either in **RESISTANCE MODE** or in **TIMER MODE**, in both controls or in none of them.

In **RESISTANCE MODE** the RMU calculates the soil resistance with the measured values of the current and voltage at its output. When the calculated value exceeds the set level the RMU via its output relay (terminals 41, 42, 43) signals to start the irrigation.

In **TIMER MODE** the RMU control the irrigation by a timer set of parameters.

The RMU controls the irrigation by the parameters set to the **TIMER MODE** and the **RESISTANCE MODE**.

If, for example, both are set to Off – no irrigation control at all. If both are set to On then both will control the irrigation system: the timer settings in the **TIMER MODE** or the soil resistivity sets in the **RESISTANCE MODE**, which ever control the irrigation to ON. In this case if in according to the timer the irrigation system is in OFF but the soil resistance is above the set limit in the **Resistance Limit**, the irrigation system will be turn ON.

6.8.6.1 **RESISTANCE MODE– Page 6.1****RESISTANCE MODE

Display	Range	Description
Resistance Limit 4.2 [Ohm]	Off, 0.1-6.0 Ohm	Sets the resistance upon which the RMU starts the irrigation system by controlling output terminals 41, 42, 43. The irrigation starts whenever the calculated value of the resistance is higher than the set value of Resistance Limit . When set to Off the irrigation is not controlled by the calculated value of the resistance.
Duration Time 10[Min]	5-300 Min	Sets the duration of the irrigation. This is the time length that the irrigation is active when the resistance exceeds the Resistance Limit .

6.8.6.2 **TIMER MODE– Page 6.2****TIMER MODE

Display	Range	Description
Days Interval 2 [Days]	Off, 1-7	Sets the days of the week upon which the RMU starts the irrigation system by controlling output terminals 41, 42, 43. When set to Off the irrigation is not controlled by the timer. When set to 1, the irrigation system starts irrigation every day at the set time in Irrig. StartTime parameter for a time length set to Duration Time . (See next 2 parameters) When set to 2 the irrigation system starts irrigation every 2 days and so on. When set to 7 the irrigation system starts irrigation every 7 days. That means once a week.
Duration Time 10[Min]	5-300 Min	Sets the duration of the irrigation. This is the time length that the irrigation is active each day at the time set by Irrig. StartTime .
Irrig. StartTime 16:00	00:00 – 23:00	Sets the time at which the irrigation system turns on when the RMU is in TIMER MODE .

Note:

⁽¹⁾ Minutes can not be set in **Irrig. StartTime** parameter.

6.8.7 **FAULT DATA – Page 6**

FAULT DATA	
In this Mode page you are able to review the FAULTS HISTORY and WARNINGS HISTORY .	

6.8.7.1 FAULTS HISTORY– Page 6.1

FAULTS HISTORY _*****_	
Display	Description
1) VOLT. OUT ERROR 09/09/2009 12:31	Last 9 faults are listed with their time stamp.
• • • •	
2) CURR. OUT ERROR 19/09/09 14:51	

6.8.7.2 WARNINGS HISTORY– Page 6.2

WARNINGS HISTORY _*****_	
Display	Description
1) High Temp. 09/09/2009 17:52	Last 9 warnings are listed with their time stamp.
• • • •	
9) OPEN DOOR 19/09/09 19:01	

.6.8.7.2.1 List of RMU Faults

VOLT. OUT ERROR	Signals for a fault (via SMS and Fault LED) that the measured voltage is zero.
CURR. OUT ERROR	Signals for a fault (via SMS and Fault LED) that the measured current is zero.
AMB TEMP.	Signals for a fault (via SMS and Fault LED) that the Ambient Temperature is higher than 100°C (upon this fault the Interrupter is opened as well)

.6.8.7.2.2 List of RMU Warnings

HIGH TEMP.	Alarms when the ambient temperature exceeds 60°C.
OPEN DOOR	Alarms when the external input to terminals 24 and 26 signals that an external door is opened

6.8.8 **ABOUT – Page 7****ABOUT**

In this page parameters can viewed, but not modified.

When contacting the factory for trouble shooting it is important to mention the data below.

Display	Description
Software Version 11/06/09 1.44	Displays Software Version in a dd/mm/yy format as well as in a numbered format. This data is for factory use.
Hardware Version 1.00	Displays Hardware Version of the unit. This data is for factory use.
Power Version 1.00	Displays Power Version of the unit. This is the power section version of the unit. This data is for factory use.
Power Type 24 [A]	Displays Power Type of the unit. This is the maximum available output current of the unit. When the RMU consists of multiple power supply units, Power Type indicates the sum of the connected Power Supply units rated currents. For example if three 50A units are connected than Power Type should read 150A.
Checksum 0x293f	Displays the checksum of the internal software. This data is for factory use.

7. STARTING PROCEDURE

- Unpack the unit and visually inspect the unit. Verify that the unit was not damaged during transportation and/or installation.
- Make all mechanical and electrical connections.
Remember to short the Reference Cell input (terminals 15 & 16) if the Reference Cell is not connected.
- Power the Hardware interface unit (if installed).
- Wait 30 seconds.
- Power the RMU unit.
- Verify that the RMU is in the Off mode (On LED=On, Run LED=Off, Fault LED=Off).
If the Run LED=On press the Stop key to stop the unit.
- Go to **GLOBAL PARAMETERS** (refer to section 6.8.6 page 27) and do the following:
 - Set **Set Time** and **Set Date** properly.
 - Reset **Working Hours**, **Output kW*Hour** and **Output Amp*Hour**.
 - Set Modbus parameters: **Comm. Baud Rate** and **Comm. Serial Num** (If a Modbus connection exists)
- Go to **GPS & GSM PARAMETERS** (refer to section 6.8.5 page 24)
 - Verify that **GPS INIT=OK** (If a GPS receiver is installed). If not connected Initiate this connection.
 - Set **Time Zone** as required. (Note that the **Time Zone** does not change automatically from/to Standard and Daylight Saving Time! This modification must be done manually)
 - Set **Pin Code** if required.
 - Set **GSM Freq. Band** as required. If not known leave this parameter in **Auto Scan**. Note that, when in **Auto Scan**, identifying the frequency band might take several minutes to complete.
 - Verify that **GSM Init=Connected** (If a GSM receiver is installed). If not connected Initiate this connections.

8. RMU COMMUNICATION (MODBUS PROTOCOL)

8.1 Introduction

The RMU unit has one serial link for Modbus or other protocols.
The Serial Link is RS485 type and the connector is D-type 15 pins.

Features:

- * RS485 Hardware for serial link.
- * Asynchronous serial link.
- * Half duplex.
- * Format: - **Modbus RTU Mode (Remote Terminal Unit Mode)**.
 - Binary,
 - Each character includes 11 bits:
 - 1 Start bit
 - 8 Data bits, least significant bit sent first.
 - None Parity bit.
 - 1 Stop bit.
 - **Cyclical Redundancy Check (CRC)**, 16 bits.
- * Baud Rates:
Modbus serial link (programmed): 2400, 4800, 9600, 19200, 38400, 57600, 115200 bits per second.
- * Response time of the Power Supply:
 - Normally, Response Time $\leq 20\text{ms}$.
- * After storing setting parameters, it is forbidden to retransmit to the same RMU unit in less than 1 Sec.
- * Broadcast commands: not supported.

8.2 Basic Structure of The Serial Link Frame

Modbus RTU frame has the same principal structure for both the "Query" transmission from the Master to the RMU, and the Response transmission from the RMU to the Master:

"Sync": Silent time of at least 3.5 character (3.5 * 11 bit times).
 Byte 1: Serial Link No. (= Slave Address) (1..247)
 Byte 2: Function (3,4,6,16 are supported)
 Byte 3: Data Bytes (\$XX)
 . (\$XX)
 . (\$XX)
 . (\$XX)
 Byte n-1: CRC_Low (\$XX)
 Byte n : CRC_High (\$XX)
 "Sync": Silent time of at least 3.5 character (3.5 * 11 bit times).

8.2.1 Sync (Silent Interval)

In RTU mode, messages "synchronize" by a "Silent Interval" of more than 3.5 character times. This Silent Interval separates between transmission frames.

The entire frame must be transmitted as a continuous stream. A silent time of more than 3.5 character times during frame transmission causes the receiving device to ignore the incomplete frame. Next byte is assumed to be the Serial Link No. of the next frame.

The same result, of ignoring the frame, can occur if a second message is transmitted before 3.5 character times from the end of the previous one. This causes the receiving device to consider it as a continuation of the first frame, resulting in a CRC error.

8.2.2 Serial Link No. (Slave Address)

Contains Power Supply Slave Number (1..247) on the serial link. The Power Supply default value is 248, which is the communication OFF condition. Serial Link No. is used as the first byte in both the "Query" transmission from Master to Slave and in Response transmission from Slave to Master.

8.2.3 **Function**

The Function code informs the RMU of the requested action to take. In normal cases, Function is used as the second byte in both the "Query" transmission from Master to Slave and in Response transmission from Slave to Master.

LIST OF FUNCTIONS SUPPORTED BY THE RMU

Function	Modbus Name	Use in RMU
03	Read Holding Registers.	Read Setting Parameters. Read Actual Data (for Modbus Plus users)
04	Read Input Registers.	Read Actual Data.
06	Preset Single Register.	Write One Setting Parameter.
16	Force Multiple Registers	Write Setting Parameters Control Commands

8.2.4 **Data**

Data field includes information transferred to and from the Power Supply. The specific data format is changed with Function. While Word data parameters are transmitted, High Byte is transmitted first, followed by the Low Byte.

8.2.5 **CRC**

The CRC (Cyclic Redundancy Check) two bytes (16 bit) are used to check the entire frame bytes. It is generated in the master device and transmitted as the last two bytes of the frame (Low byte is appended first, followed by the High byte). The slave device generates the CRC bytes again and compares it to the received CRC bytes. If the CRC bytes are not identical, the frame is flushed and no response is transmitted to the master.

RMU MEMORY ORGANIZATION

The RMU memory is organized according to the common Modbus addresses as follows:

RMU Use	Memory Type	Max Query/Response Parameters
Actual Data	3X References	256 Registers, # 1..256, addressed 0..255.
	4X References	256 Registers, # 257..512, addressed 256..511
Setting Parameters	4X References	256 Registers, # 1..256, addressed 0..255

Notes:

- Actual Data parameters can be read both at 3X references starting at parameter #1, or (same parameters) at 4X references starting at parameter #257 (100 hex higher). The additional mapping in 4X references is designed for the convenience of Modbus Plus users.
- Cathode protection Power Supply can be controlled by writing to setting parameter #1 with function 6 or 16.

8.3 Actual Data (3x References & 4x References)

Actual Data includes measured values such as Voltages, Currents and Power. It includes also Calculated, Logic and Statistic information. All parameters are **word** or **float** (two bytes) parameters. The protocol supports Reading (only) of these parameters.

Parameter # is "1 based". The actual parameter address is 1 lower than parameter #. For example the address of Actual parameter #1 is 0 (30000).

The parameters have double mapping, at the following **3x & 4x** references:

Parameter	# (3x)	# (4x)	Comment
V	1	257	Output voltage in mv.
I(low)	2	258	Output Current in mA.
I(high)	3	259	Output Current in mA.
P	4	260	Potential in mV.
Temperature	5	261	Temperature in Celsius.
Errors	6	262	1- Over Voltage, 2 –Over voltage max, 3 – Over Current, 4 - over temp, 5 - over current max, 5- AC Fault , 6 – Ambient Temp, 7 – Load Shorted , 8 – load cut off, 9 – pot cut off
Input KW*hour low	7	263	low 32 bit float parameter
Input KW*hour high	8	264	high 32 bit float parameter
Working hour low	9	265	low 32 bit float parameter
Working hour high	10	266	high 32 bit float parameter
Amp*hour low	11	267	low 32 bit float parameter.
Amp*hour high	12	268	high 32 bit float parameter
RFU	13	269	
RFU	14	270	
Switcher status	15	271	0- Off, 1 On.
Instant off measured	16	272	Potential in mV after off time.
Time hours	17	273	current time of the Power Supply.
Time minutes	18	274	current time of the Power Supply.
Time Days	19	275	current time of the Power Supply.
Time month	20	276	current time of the Power Supply.
Time years	21	277	current time of the Power Supply.
RFU	22	278	
GPS Status	23	279	0 – fail 1 - ok
GSM Status	24	280	0 – not connected , 1 – no sim inserted 3 – Sim BUSY 4 – Modem ready 5 – sim need pin code and the Pin Code is Error
PPS Count	25	281	the count of the pulses that received from gps
Power Version	26	282	the power PCB version
Hardware version	27	283	the digital control PCB version
Software version	28	284	this parameter should divided by 100 (for example 193/100 = 1.93)

Note: It is never allowed to read more than 21 actual parameters together.

Example 1:

To read Actual parameters 1..3 (V,I addressed as 0..2) of RMU # 18 (its Serial Link No. = 18), the host computer should send following frame:

			Another Possibility (Modbus Plus users)
byte 1:	Serial Link No.	(\$12)	(\$12)
byte 2:	Function	(\$04) (04, Read Actual Data)	(\$03)
byte 3:	Starting Address High	(\$00) (Start from address 0)	(\$01)
byte 4:	Starting Address Low	(\$00)	(\$00)
byte 5:	No. of Points High	(\$00) (3 parameters)	(\$00)
byte 6:	No. of Points Low	(\$03)	(\$03)
byte 7:	CRC_Low	(\$XX)	(\$XX)
byte 8:	CRC_High	(\$XX)	(\$XX)

The RMU response, when voltage, current are 400, 402 mili, respectively, is:

byte 1:	Serial Link No.	(\$12)	(\$12)
byte 2:	Function	(\$04)	(\$03)
byte 3:	Byte Count	(\$06) (3 word parameters)	(\$06)
byte 4:	Data High, parameter # 1	(\$01) (400)	(\$01)
byte 5:	Data Low, parameter # 1	(\$90)	(\$90)
byte 6:	Data High, parameter # 2	(\$01) (402)	(\$01)
byte 7:	Data Low, parameter # 2	(\$92)	(\$92)
byte 8:	Data High, parameter # 3	(\$01) (0)	(\$00)
byte 9:	Data Low, parameter # 3	(\$8E)	(\$00)
byte 10:	CRC_Low	(\$XX)	(\$XX)
byte 11:	CRC_High	(\$XX)	(\$XX)

Note: \$xx indicates Hexadecimal byte.

8.4 Setting Parameters (4x References)

Setting parameters includes all parameters that can be set manually. These parameters determine the modes of operation of the RMU. All parameters are **word** (two bytes) parameters. The protocol supports both Reading and Modifying of (most of) these parameters.

The parameters have the following **4x** references:

Parameter	#	Range	Default
Control Register	1	1- 10(Note 6)	
RFU	2		
RFU	3		
RFU	4		
RFU	5		
Interrupter begin hours**	6	0- 23	
Interrupter begin Minutes**	7	0 - 59	
Interrupter begin Days**	8	1 - 31	
Interrupter begin mouths**	9	1-12	
Interrupter begin years**	10	00 -63	
Interrupter end hours*	11	0- 23	
Interrupter end Minutes*	12	0 - 59	
Interrupter end Days*	13	1 - 31	
Interrupter end mouths*	14	1-12	
Interrupter end years*	15	00 -63	
Interrupter on time	16	1 - 60	2 Second
Interrupter off time	17	1 - 60	8 Second
Interrupter mode	18	0 (External), 1(Internal)	1 (Internal)
GPS GMT***	19	0-24	12 (12 =0)
Language	20	0 -1	0 – English, 1 - Hebrew
RFU	21	100-2500	
RFU	22	30-800	
RFU	23	10- 1440	minutes
RFU	24	100-2500	
RFU	25	0-0	
RFU	26	1-60	
RFU	27	1-60	
RFU	28	1 - 10	
RFU	29	0 - 400	200 (200 = 0)
Modbus Comm Parm Baud	30	2400 - 57600	
Modbus Serial link	31	1-248	
Irrigation Resistance	32	0-60	0 – 6 oHM
RFU	33	0 -1	
RFU	34	1 - 20	
RFU	35	1-6000	
Irrig. Resistance duration time	36	1 – 300	1 – 300 minutes
Irrigation Days Interval	37	0 – 7	0 –off ; 1 – 7 days
RFU	38	0 -0	
RFU	39	1-0	
RFU	40	1- 0	
Irrigation Mode Time duration time	41		1 – 300 minutes
Irrigation start time	42		0 – 24
SIM PIN Code	43	0-9999	
****GSM Band	44	0-4	

** The time to begin of the interrupter must be later than the current time of the RMU,

* The time to end of the interrupter must be later than the time to begin of the interrupter

*** The GPS GMT time range is between -12 to +12 GMT and represent with range between 0 – 24
Which 0 is -12 and 24 is +12.

Example 2:

To Read Setting parameters # 5 - 7, addressed as 4 - 6 of RMU # 96, the host computer should send following frame:

byte 1:	Serial Link No.	(\$60)	
byte 2:	Function	(\$03)	(Read Setting Parameters)
byte 3:	Starting Address High	(\$00)	(04, Address of first parameter)
byte 4:	Starting Address Low	(\$04)	
byte 5:	No. of Registers High	(\$00)	(3 parameters to read)
byte 6:	No. of Registers Low	(\$03)	
byte 7:	CRC_Low	(\$XX)	
byte 8:	CRC_High	(\$XX)	

The RMU normal response:

byte 1:	Serial Link No.	(\$60)
byte 2:	Function	(\$03)
byte 3:	Byte Count	(\$06)
byte 4:	Data High	(\$00)
byte 5:	Data Low	(\$1E)
byte 6:	Data High	(\$00)
byte 7:	Data Low	(\$0A)
byte 8:	Data High	(\$00)
byte 9:	Data Low	(\$01)
byte 10:	CRC_Low	(\$XX)
byte 11:	CRC_High	(\$XX)

Example 3 :

To write one setting parameter (Voltage = 10V) to Setting Parameter # 2 (addressed as 1) of Power Supply # 5, the host computer should send following frame:

byte 1:	Serial Link No.	(\$05)	
byte 2:	Function	(\$06)	(06, Write one setting parameter)
byte 3:	Starting Address High	(\$00)	(\$02 = 2)
byte 4:	Starting Address Low	(\$02)	
byte 5:	Preset Data High	(\$27)	(\$2710 =10000mv)
byte 6:	Preset Data Low	(\$10)	
byte 7:	CRC_Low	(\$XX)	
byte 8:	CRC_High	(\$XX)	

The Power RMU response is an echo of the query:

byte 1:	Serial Link No.	(\$05)
byte 2:	Function	(\$06)
byte 3:	Starting Address High	(\$00)
byte 4:	Starting Address Low	(\$02)
byte 5:	Preset Data High	(\$27)
byte 6:	Preset Data Low	(\$10)
byte 7:	CRC_Low	(\$XX)
byte 8:	CRC_High	(\$XX)

Example 4 :

To write a few Setting Parameters to Setting Parameters # 16-19 (Addressed as 15-18) of Power Supply # 32, the host computer should send the following frame:

byte 1:	Serial Link No.	(\$20)	(32)
byte 2:	Function	(\$10)	(16, Preset multiple setting parameters).
byte 3:	Starting Address High	(\$00)	(First parameter address is 15)
byte 4:	Starting Address Low	(\$0F)	
byte 5:	No. of Registers High	(\$00)	(Four parameters to preset)
byte 6:	No. of Registers Low	(\$04)	
byte 7:	Byte Count	(\$08)	(8, 2 bytes for each one of the 4 parameters)
byte 8:	Data High	(\$01)	(Parameter # 1 = \$190 = 400)
byte 9:	Data Low	(\$90)	
byte 10:	Data High	(\$00)	(Parameter # 2 = \$32 = 50)
byte 11:	Data Low	(\$32)	
byte 12:	Data High	(\$00)	(Parameter # 3 = 45)
byte 13:	Data Low	(\$2D)	
byte 14:	Data High	(\$01)	(Parameter # 4 = 500)
byte 15:	Data Low	(\$F4)	
byte 16:	CRC_Low	(\$XX)	
byte 17:	CRC_High	(\$XX)	

The RMU normal response:

byte 1:	Serial Link No.	(\$20)
byte 2:	Function	(\$10)
byte 3:	Starting Address High	(\$00)
byte 4:	Starting Address Low	(\$00)
byte 5:	No. of Registers High	(\$00)
byte 6:	No. of Registers Low	(\$04)
byte 7:	CRC_Low	(\$XX)
byte 8:	CRC_High	(\$XX)

Note 6:**8.5 Control Register Write (4x Reference)**

The Power Supply incorporates **one** Control register intended for the control function.

Address: The Control register is register # 1 addressed as 0.

This register is writing only.

In order to control the RMU using the Control register:

- * Use Function 6 or function 16.
- * Use Address_High (page) = 0
- * Use Address_Low = 0 (000H).
- * Write to one register only.
- * Use data_high (ms-byte of data) = 00H.

Controls register data options:

06 – Turn on interrupter (after this command the Power Supply load all the setting parameters of the interrupter if there are not parameters to load or the parameters are illegal the interrupter stays off)

07 – Turn off interrupter

10 – Reset faults

Example 5 :

To reset RMU # 5, using function 6, the host computer should send the following Query frame:

byte 1:	Serial Link No.	(\$05)	
byte 2:	Function	(\$06)	(06, Write one setting parameter)
byte 3:	Starting Address High	(\$00)	(\$0000)
byte 4:	Starting Address Low	(\$00)	
byte 5:	Preset Data High	(\$00)	(10)
byte 6:	Preset Data Low	(\$0a)	
byte 7:	CRC_Low	(\$XX)	
byte 8:	CRC_High	(\$XX)	

The RMU normal response is an echo of the query:

(\$05,\$06,\$00,\$00,\$00,\$0A,\$XX,\$XX)

Example 6- Control Register Write:

To turn on Power Supply # 11, the host computer should send the following Query frame:

byte 1:	Serial Link No.	(\$0B)	
byte 2:	Function	(\$10)	Bytes 2..8 must be as in this example!!!
byte 3:	Starting Address High	(\$00)	
byte 4:	Starting Address Low	(\$00)	
byte 5:	No. of Registers High	(\$00)	
byte 6:	No. of Registers Low	(\$01)	
byte 7:	Byte Count	(\$02)	
byte 8:	Data High	(\$00)	
byte 9:	Data Low	(\$01)	
byte 10:	CRC_Low	(\$XX)	
byte 11:	CRC_High	(\$XX)	

The RMU normal response:

byte 1:	Serial Link No.	(\$0B)
byte 2:	Function	(\$10)
byte 3:	Starting Address High	(\$00)
byte 4:	Starting Address Low	(\$00)
byte 5:	No. of Registers High	(\$00)
byte 6:	No. of Registers Low	(\$01)

byte 7: CRC_Low (\$XX)
 byte 8: CRC_High (\$XX)

8.6 Exception Responses

When the master sends a query frame to the RMU, one of the following four responses from the RMU is possible:

1. When no communication error is detected in the query, and no mistake is found by the communication program module in the RMU, a Normal response is returned.
2. If the RMU does not receive the query frame (for example because of disconnected serial link cable) then no response is returned by the RMU. After proper time, the master causes a timeout condition.
3. If the RMU receives the query, but faulty CRC bytes and / or Parity bits are detected, then no response is returned by the RMU. After the allotted time, the master causes a timeout condition.
4. If no communication error is detected in the query, but the DMP communication program module finds an error such as illegal Function, data address or data value; or if the RMU is Busy, then an Exception response is returned. The Exception response includes an Exception Code to inform the master about the type of the error.

Exception Code Response Frame:

Exception response frame holds the fix number of five bytes. The first one, the Slave Address field is the Serial link number (transmitted in the query frame and identical to RMU Serial Link No.). The second byte, the Function field returns the echo of the transmitted query function, but with the Most Significant Bit set to "1" (adding \$80 to the transmitted function code). The third byte is the Exception Code informing about the type of error. Last two bytes are the CRC bytes.

Exception Codes supported by the cathode Power Supply:

Exception Code	Type	Comment
01	Illegal Function	Requested Function is not supported. Functions 3, 4, 6, 8 or 16 are supported.
02	Illegal Data Address	Data address is not allowable.
03	Illegal Data Value	Data Value is not in allowable range.
06	Busy	Trying to Preset Multiple Registers while motor is not stopped (using Function 16). The master should transmit the message again later.

Example 7:

Master is trying to write 100 to setting parameter # 230 of RMU 16. The RMU incorporates less than 230 regs. Illegal Data Address Exception code is returned:

Query:

byte 1: Serial Link No. (\$10) (16)
 byte 2: Function (\$06) (06, Preset Single Register).
 byte 3: Starting Address High (\$00)
 byte 4: Starting Address Low (\$E6) (\$E6 = 230, Non existent Register)
 byte 5: Preset Data High (\$00)
 byte 6: Preset Data Low (\$64) (\$64 = 100)
 byte 7: CRC_Low (\$XX)
 byte 8: CRC_High (\$XX)

Exception response:

byte 1:	Serial Link No.	(\$10)	
byte 2:	Function	(\$86)	(Original + \$80)
byte 3:	Exception Code	(\$02)	(Illegal Data Address)
byte 4:	CRC_Low	(\$XX)	
byte 5:	CRC_High	(\$XX)	

Note:

There are cases where the RMU returns the Normal response, but the requested action cannot be performed, or is modified by the RMU. Few examples are:

Requested Action	Performed Action
Writing Setting parameter to Serial_Link_No	Ignored.
Writing meaningless discrete (coil) commands	limiting to allowed range.
Start command (Function 06 or 16) while Stop Hardwired Input is open	Command ignored

It is the user responsibility to verify that the requested action was performed, by reading the value of the modified parameters, status of the command Coils or Logic_Status Actual parameter.

9. DIMENSIONAL DRAWINGS

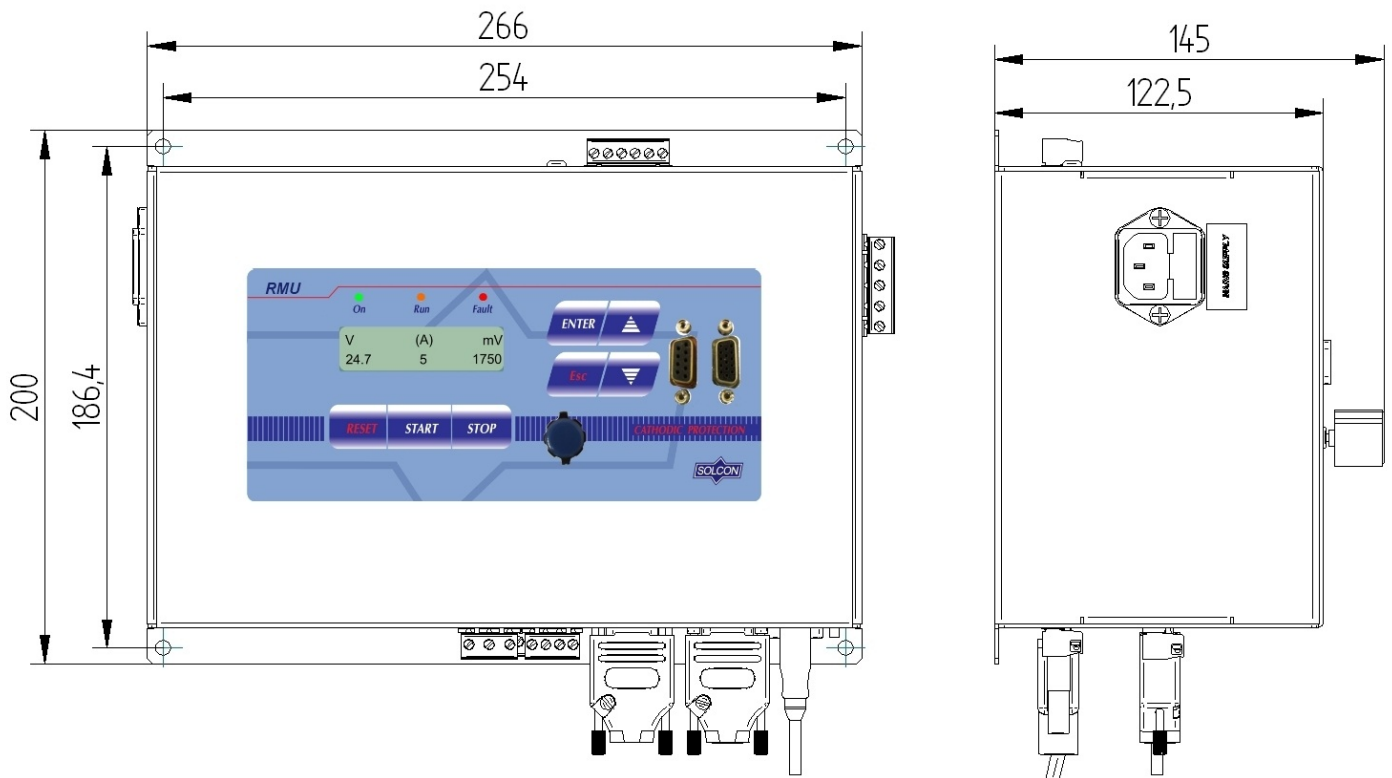


Figure 10 – RMU – Dimensional Drawing

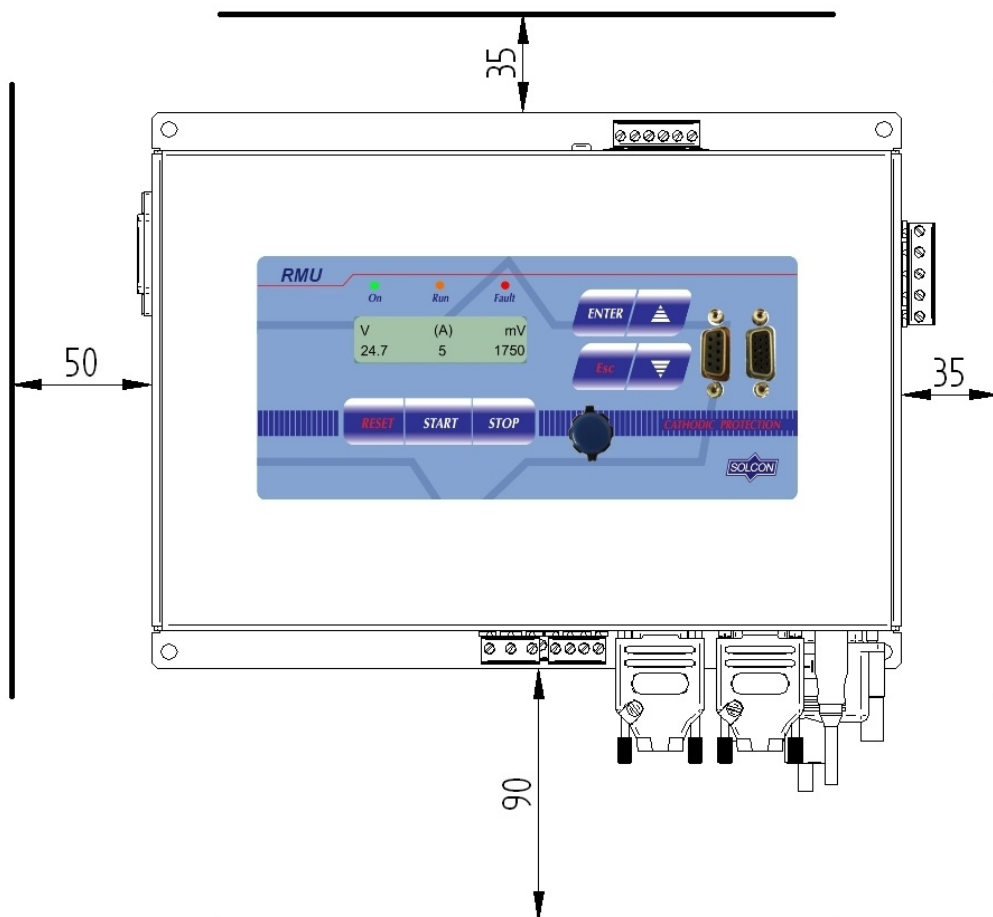


Figure 11 – RMU – Required Clearances

10. SPECIFICATIONS

Input Signals

Input from Reference Cell potential (measuring potential between the reference cell and the protected object): 0-3000mV.

Input from ICCP Power Supply: up to 50V

Input from ICCP Power Supply current measurement shunt: 50-100mV

Optional input from GPS time synchronization: 1ms resolution.

PT100 – Temperature measurement of external interrupter.

Output Signals

Voltage to operate external fan at 60°C: 8A, 250VAC, 2000VA max.

Max. DC Load Breaking Capacity: 8A, 30VDC with resistive load.

Change Over contacts to operate external irrigation system control solenoid: 8A, 250VAC, 2000VA max.; Max. DC Load Breaking Capacity: 8A, 30VDC with resistive load.

Control Voltage to Operate an External Interrupter: 5V-TTL Level

Control Functions Parameters and Display

10 mode pages: MEASUREMENTS, OPERATION MODES PARAMETERS, INSTANT OFF PARAMETERS, INTERRUPT PARAMETERS, GPS & GSM PARAMETERS, GLOBAL PARAMETERS, IRRIGATION PARAMETERS, FAULT DATA, ABOUT.

Communication.

Optional input/output via Modbus communication link: 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps .

Optional input/output via GSM modem.

Optional input from GPS for time synchronization.

Faults and Warnings.

10 last Warnings and 10 last Faults including time stamp.

The RMU is designed to meet the following Standards:

IEC/EN 61000-6-4 – Emission Standard for Industrial Environment.

EN-55022 Class A/FCC part 15-A - Electromagnetic Compatibility (EMC) Emission.

UL/EN 60950-1 – Safety (Output Reinforced Insulation is designed as SELV)

IEC 61312-3 – Lightning Protection Class 2.

IEC/EN 61000-4 – Input Electrical Immunity.

IEC/EN 61000-3 – Harmonic Current Emission.

Dimensions and Weights

For detailed dimensional drawings refer to section 9 page 43.

Unit	Dimensions (WxHxD) [mm]	Approximate weight [kg]
RMU	266x200x145	1.7

