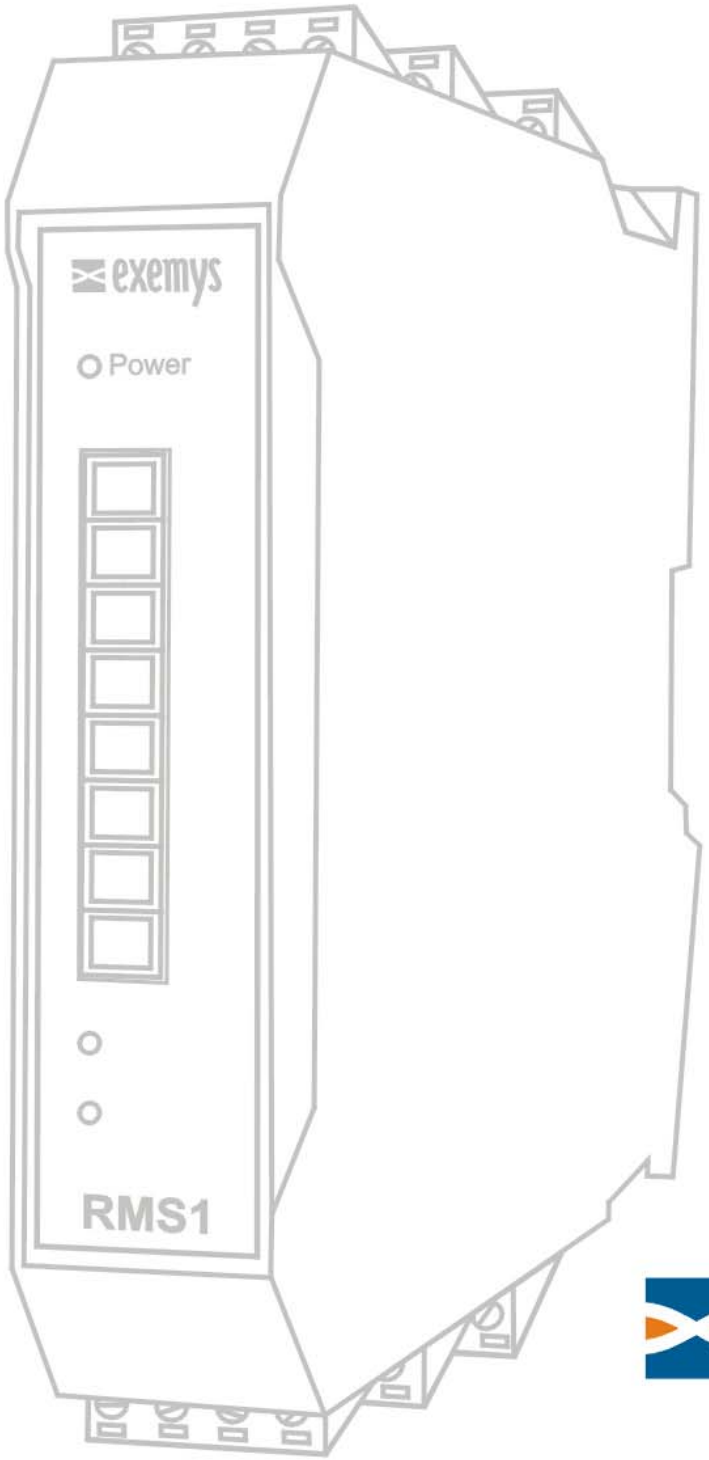
ANALOG VARIABLES ACQUISITION MODULE

# RMS1-AI

## Modbus ASCII / RTU
## Modbus Hostlink

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Rev. 2.0.2

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# Chapter 1

# Introduction

## 1.1 The manual

### 1.1.1 Purpose of this manual

The purpose of this manual is to provide instructions for easy and quick installation and operation of the RMS1-AI analog module.
The manual starts with the product description and then provides instructions for proper installation of its hardware. Later on, it includes detailed information on RMS1-AI configuration and operation.

### 1.1.2 Conventions, terms and acronyms

The acronyms used in this manual are listed in the following table.

**Table 1 - Acronyms**

| Acronym | Description |
|---|---|
| Bps | Bits per second |
| PC | Personal Computer |
| GND | Ground (Reference). |

The conventions listed below are used in this manual.

**Table 2 - Conventions**

| Convention | Description |
|---|---|
| `A\|B\|C` | A set of possible values for command parameters. You can type A, B or C. |
| `n..m` | A range of possible values. You can type any value in the range including n and m. |

## 1.2 Product Description

The RMS1-AI is an interface for your analog sensors.
It allows monitoring, from any PC connected to the RMS1-AI, analog devices with current loop or voltage range output.
The RMS1-AI works in differential mode, it means that it reads the difference between two signals.
The RMS1-AI has two different work modes: ***Modbus Slave*** and ***Hostlink Master***, so that the monitoring will be done through one of these interfaces.

## 1.3 Example of connection for Modbus Slave

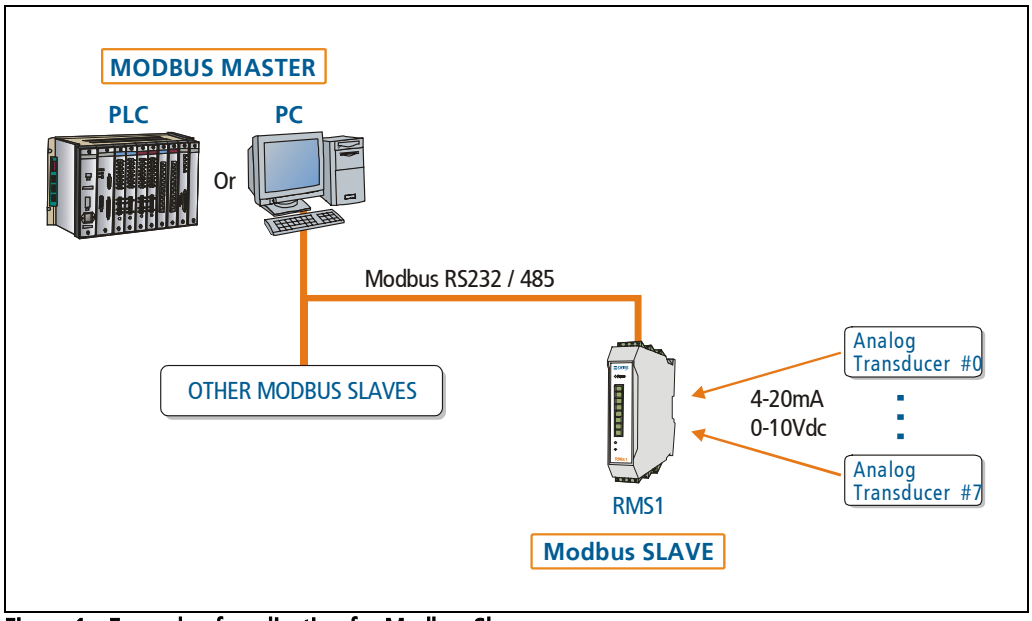



**Figure 1 - Example of application for Modbus Slave**

## 1.4 Example of connection for Hostlink Master

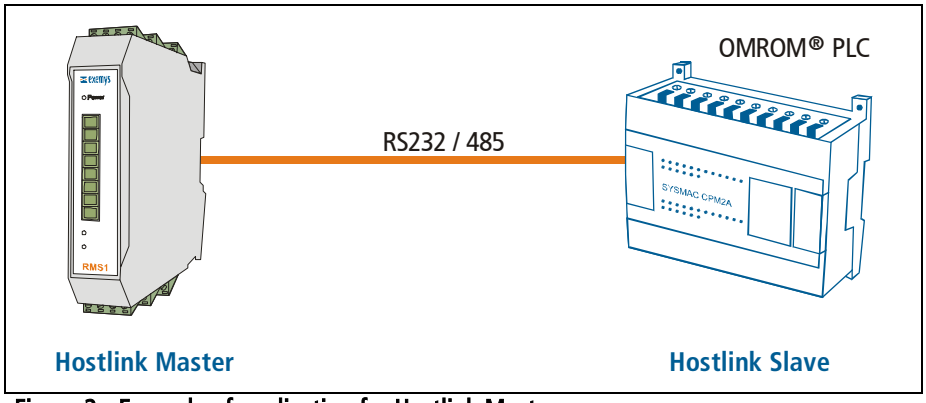



Figure 2 - Example of application for Hostlink Master

## 1.5 RMS1-AI Product Codification

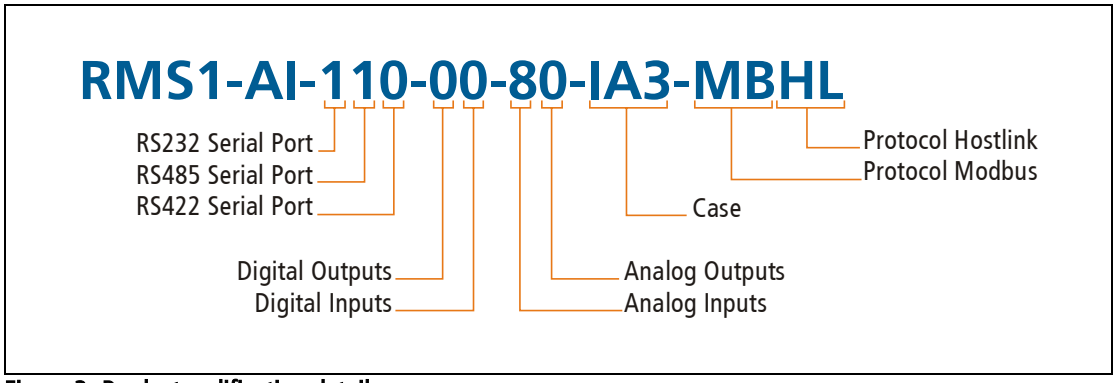



Figure 3- Product codification detail

# Chapter 2

# Installation

## 2.1 General Diagram of connectors

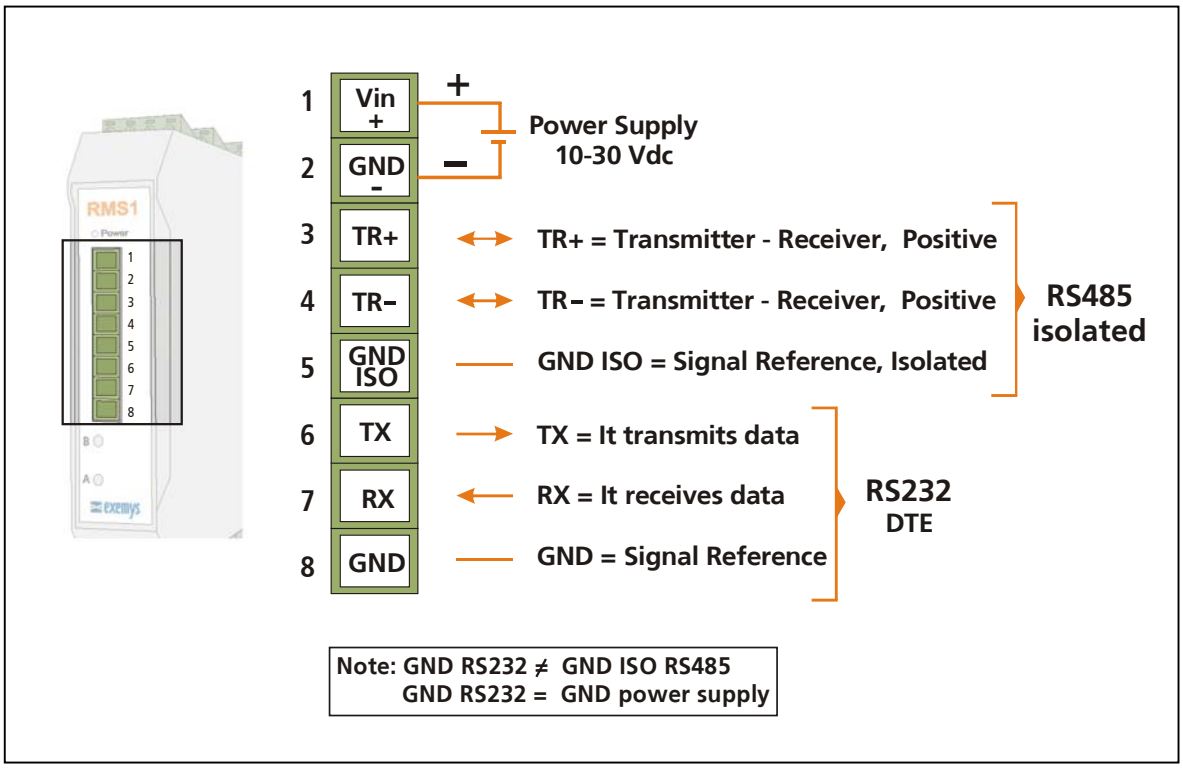



Figure 4- Frontal Connector Diagram

## 2.2 Power connection

In the figure 5 you can see how to connect the power.
It is placed in the first two terminals called **Vin(+)** and **GND (-)**.
The RMS1-AI power connection has polarity and it accepts the range of 10-30V DC.

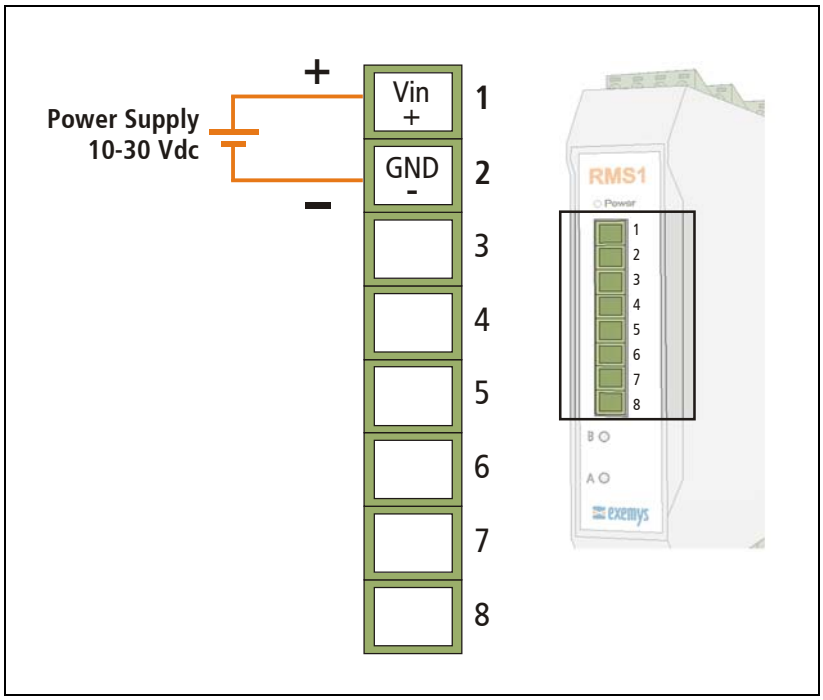


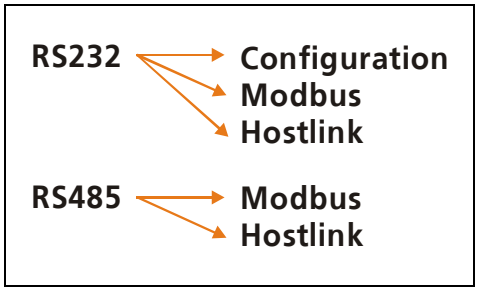

**Figure 5 – Power connection**

## 2.3 Serial connection

The RMS1-AI has 2 serial ports. A **RS232** port and a **RS485** port.

The **RS232** port can be used for configuration of the device or for the transmission – reception of Modbus or Hostlink packets depending on the work mode the device is working.

The **RS485** port can be used only for transmission – reception of Modbus or Hostlink packets. This serial port is isolated from the rest of the device.



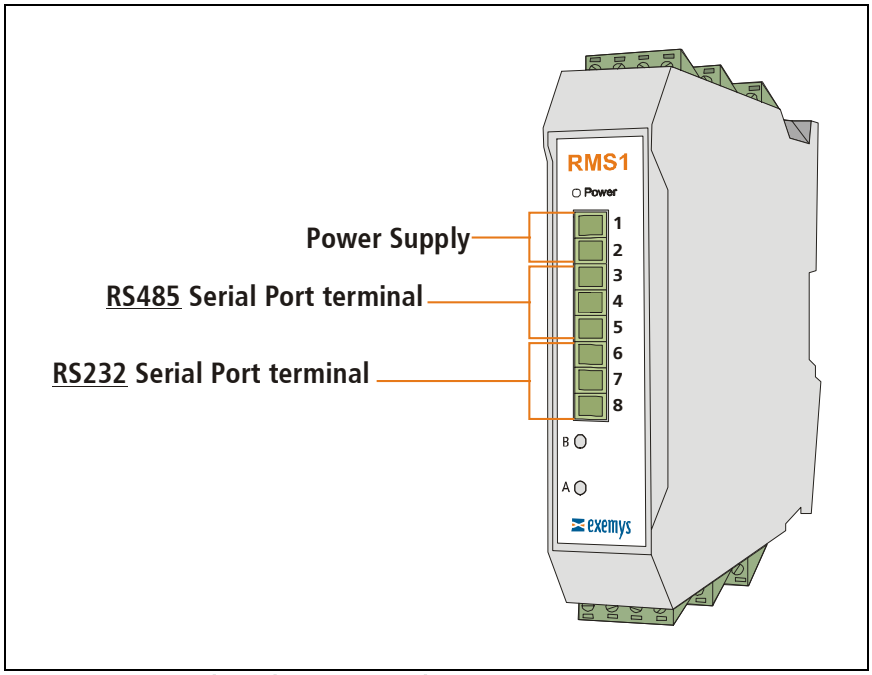




**Figure 6– Power and serial ports terminals.**

### 2.3.1 RS232 port connection

The **RS232** port can be used for configuration of the device or for the transmission – reception of Modbus or Hostlink.

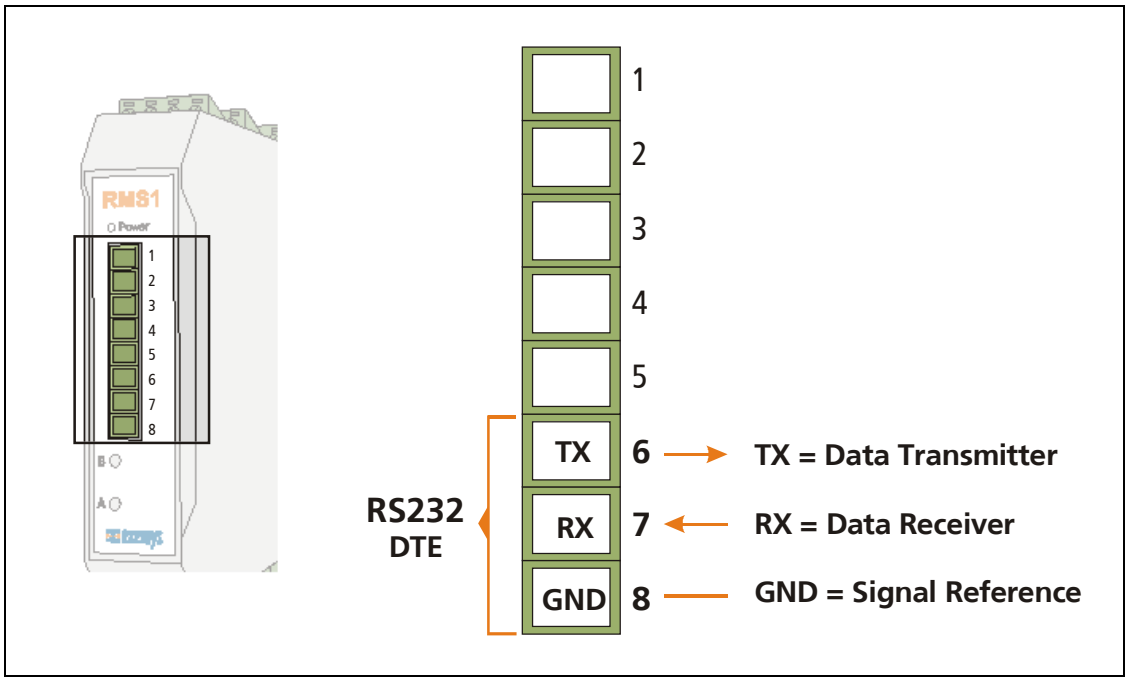



Figure 7 - RS232 port Terminal detail.

For configuration you can use a cable as it is shown in figure 8.

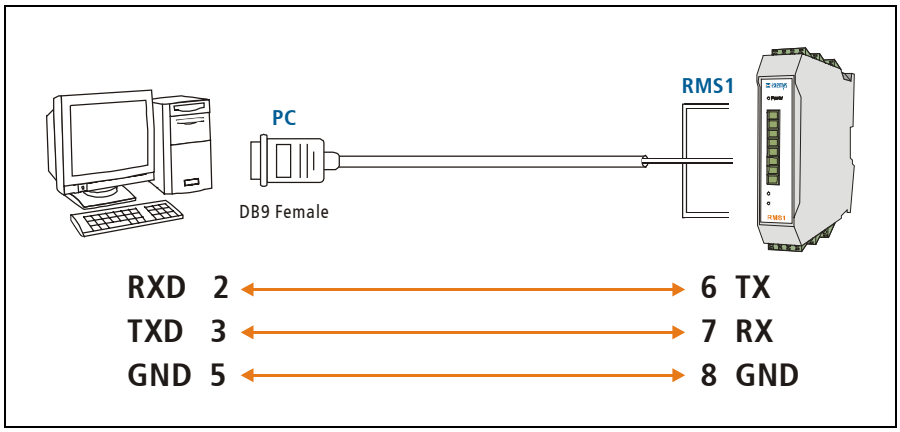



Figure 8 - RS232 connection to a PC

For Hostlink communication you can use a cable as it is shown in figure 9.

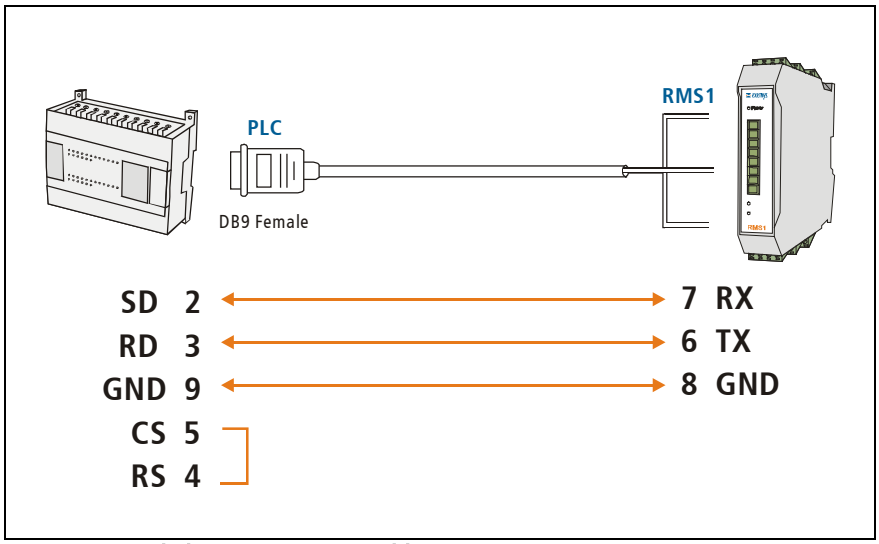



**Figure 9 – Hostlink communication cable**

It is important to recall that for a successful communication between the RMS1-AI and the PLC, the PLC must have one of these configurations in its serial port:

| Data Bits | Parity | Stop Bits |
|---|---|---|
| 7 | E (even) | 1 |
| 7 | E (even) | 2 |
| 7 | O (odd) | 1 |
| 7 | O (odd) | 2 |
| 7 | N (no parity) | 2 |

### 2.3.2 RS485 isolated port connection

The **RS485** port can be used only for transmission – reception of Modbus or Hostlink packets. This serial port is isolated from the rest of the device.

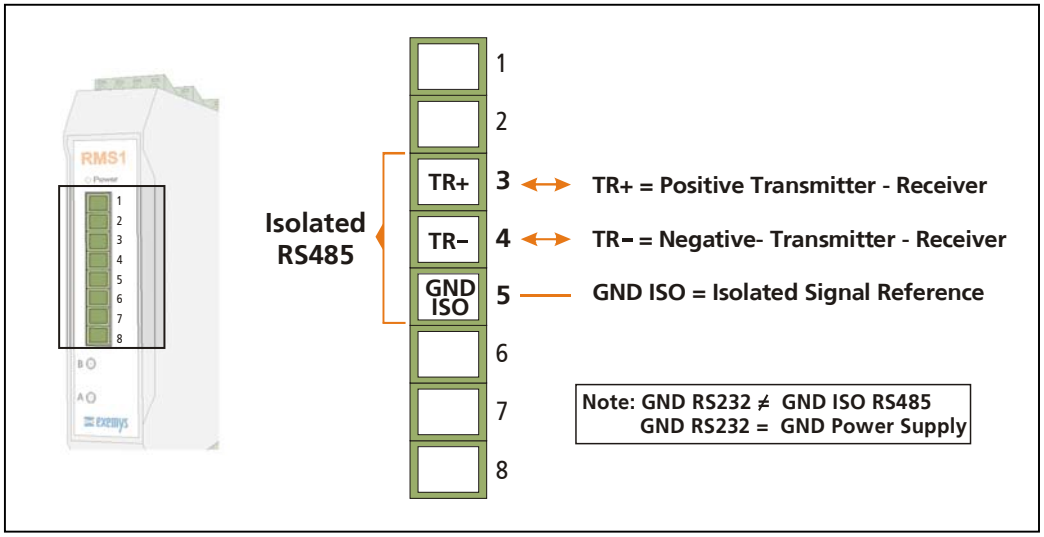



**Figure 10 - RS485 serial port detail.**

## 2.4 Analog Inputs Description

In the figure 11 you can see where the analog terminals of the RMS1-AI are placed. As you can see, the inputs are in columns and in both sides of the device.
The inputs start numbering from 0. So that the first channel is **CH0**.

In the same way, each Terminal is numbered for its function and the channel it belongs to.
So, the first terminal in channel 0 of the RMS1-AI is called **CH0 COM**, meaning: Common Terminal of Channel 0.

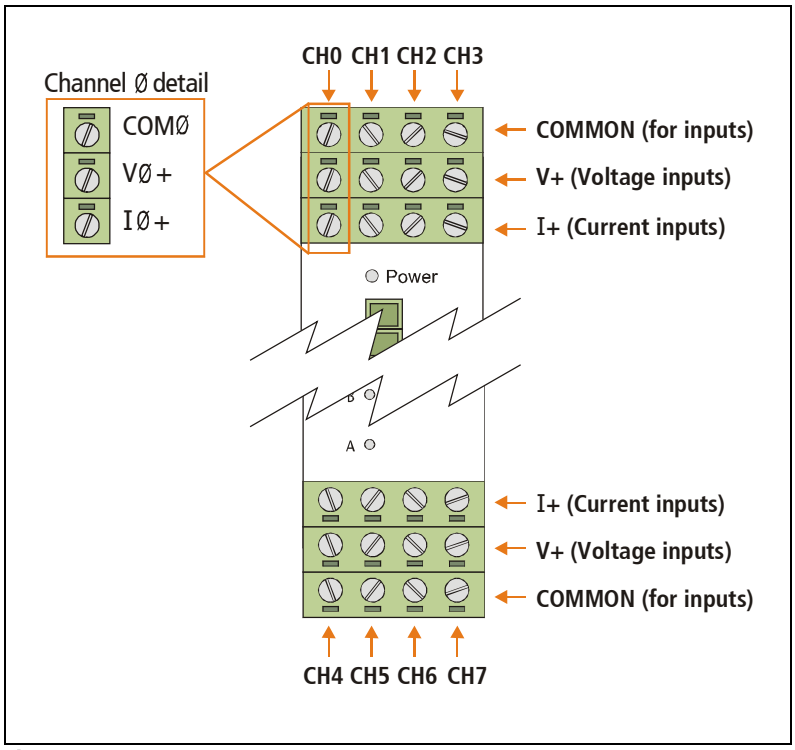



**Figure 11 – Disposition of the analog inputs**

## 2.5 Analog input connection

### 2.5.1 Voltage output sensor connection

Sensors with voltage outputs (from 0 up to 10Vdc) can be connected to the RMS1-AI as shown in the following figure. The eight channels of the RMS1-AI can be used for this type of sensors.

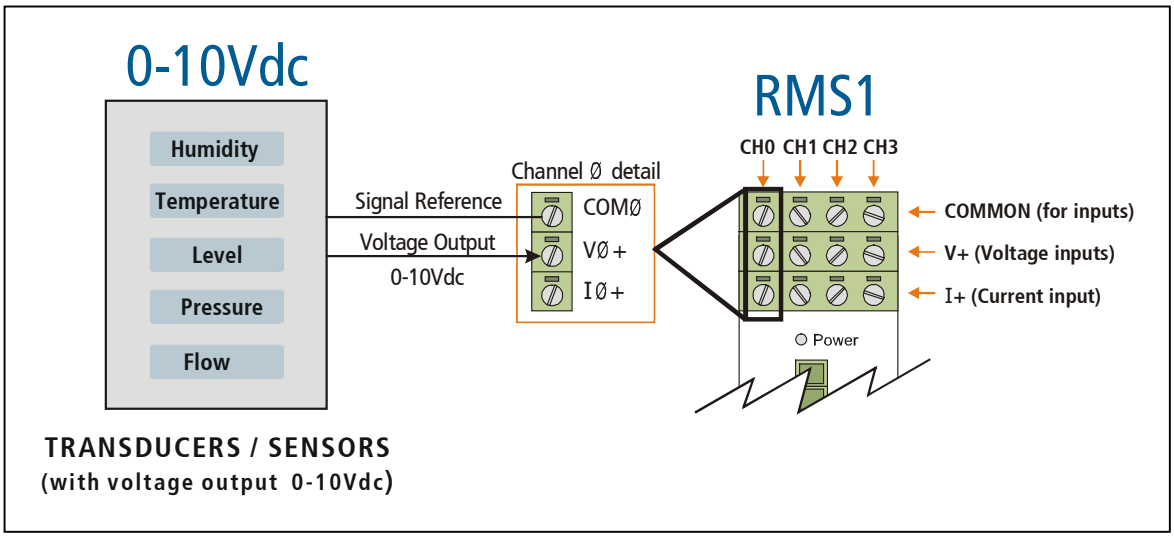



Figure 12 – Voltage output sensors connection

### 2.5.2 Current loop output sensor connection

Sensors with current loop outputs (4 - 20mA) can be connected to the RMS1-AI as shown in the following figure.
It is important to recall that for these type of sensors an extra connection between the current terminal (I+) and the voltage terminal (V+) must be done.
The eight channels of the RMS1-AI can be used for this type of sensors.

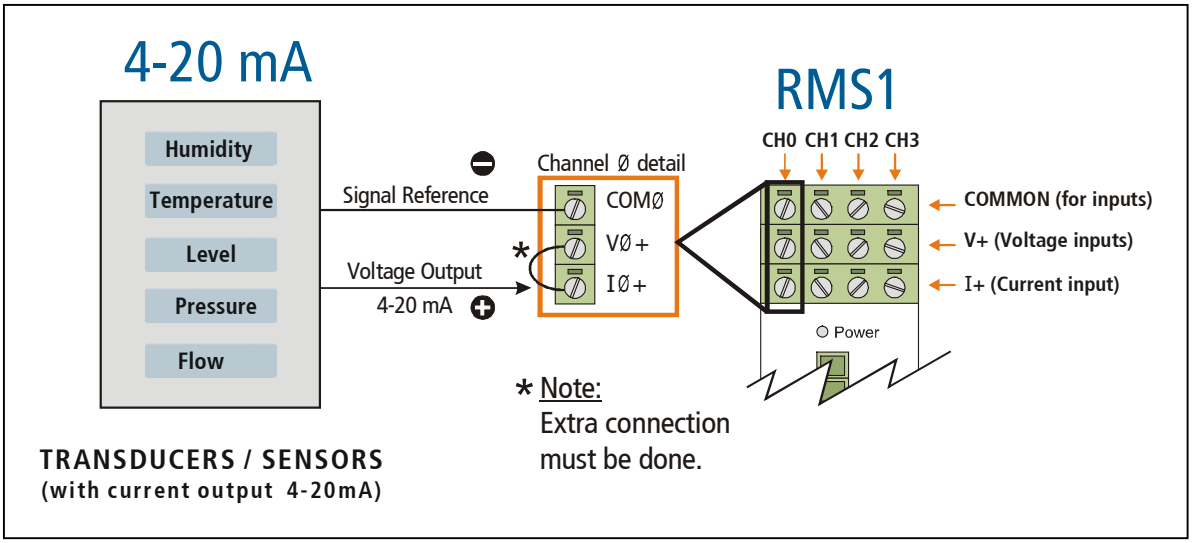



Figure 13 – Current loop sensors connection.

IMPORTANT

**Don't exceed the signal limits for each case (+10 Vdc or 20 mA respectively). Signal level excess may damage the device.**

## 2.6 Indicator Leds codes

The RMS1-AI has three indicator Leds: Power, A and B.
The Power led indicates that the device is turned on.
The B led shows the general working order of the device.
The A led indicates data incoming status.

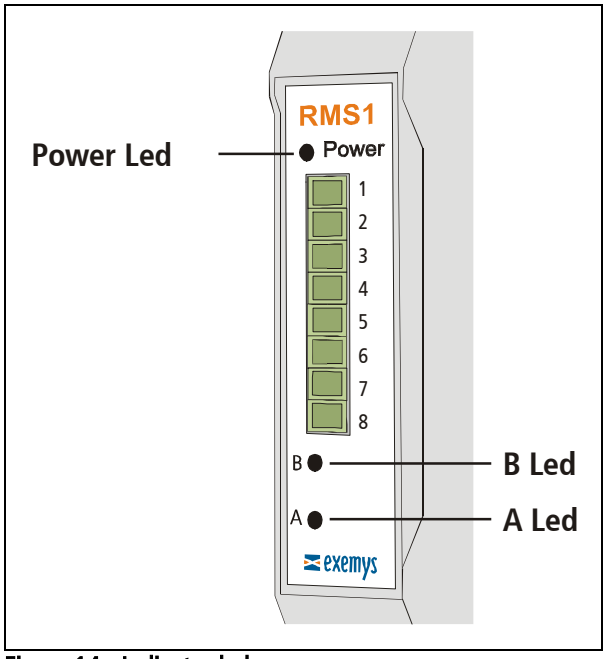



Figure 14 - Indicator leds

Table 3 – Indicator Leds

| Led B | Led A | Description |
|---|---|---|
| It flashes alternately with led A | It flashes alternately with led B | Critical failure. Contact Exemys at support@exemys.com |
| It is steady on | | Some RMS1-AI inputs configured as a current loop input is open. |
| | It is ½ second on and ½ second off. | The RMS1-AI is waiting for the CFG command, or the configuration console is opened. |
| | It is steady on and it turns off for short periods of time. | The RMS1-AI has detected data in one of its connections. |

# Chapter 3

# Configuration and Operation in MODBUS SLAVE work mode

## 3.1 Changing the work mode

If you want the device to work in Modbus Slave mode, you must connect to the device through the command console and type the following command:

**MODE: MS**

The RMS1-AI will restart and begin working in Modbus Slave mode.

## 3.2 Configuration command console

The device can be configured through the command console in the serial port. You must connect the RMS1-AI serial port to a PC RS-232 port. To such effect, you must have a serial terminal program (Windows HyperTerminal or similar).

The communication program must be set as follows: 9600 bps, Parity: None, Data bits: 8, Stop bits: 1, and flow control: none (9600,N,8,1).

**Table 4 –Communication program configuration**

| Parameter | Value |
|---|---|
| Baud Rate | 9600 |
| Parity | No parity |
| Data Bits | 8 |
| Flow Control | None |

You can enter the configuration mode through the serial port:

- Connect RMS1-AI to a PC and configure the terminal emulation program to 9600,N,8,1.
- Turn on RMS1-AI. During the first 7 seconds RMS1-AI will wait for the **CFG** command.
- Type **CFG** and press ENTER. The RMS1-AI will display a welcome message on the configuration command console.

```
RMS1-AI - Exemys (V2):
----------------------
>_
```


NOTE

If this doesn't happen, reset the device and repeat the previous steps.

### 3.2.1 Mode Command

You can change the work mode of the device with this command. The RMS1-AI can work in Hostlink Master or Modbus Slave mode.

| Command | Description |
|---|---|
| **MODE:***option* | Configures the work mode of the device.<br>Option: MS(Modbus Slave) or HM(Hostlink Master). |

### 3.2.2 Serial Command

You can change the RMS1-AI serial port parameters with this command.

| Command | Description |
|---|---|
| **SERIAL:***baud,parity,type* | Configures serial port parameters.<br>Baud: Baud Rate in Bps. (110, 300, 600, 1200, 2400, 4800, 9600, 19200, 32400, 57600, 115200)<br>Parity: 0=No parity, 1=Odd, 2=Even<br>Type: 0=RS-232, 1=RS-485. |

### 3.2.3 Modbus Command

You can change the MODBUS interface parameters with this command, the format, unit ID, exceptions and time between packets

| Command | Description |
|---|---|
| **MODBUS:***format,unit_ID,exceptions,gap* | Configures the Modbus interface parameters.<br>Format: A=ASCII, R=RTU.<br>Unit ID: 1 up to 247<br>Exceptions: E=enabled, D=disabled<br>Gap: Time between packets (in bytes) Only for RTU format |


IMPORTANT

If communication establishes in ASCII format, you have to configure Modbus Master communications with 2 stop bits.

### 3.2.4 Factory Reset command

At any time, RMS1-AI administrator may reset the original manufacturer's configuration. This option may be executed through the command console with the FACTRESET command.

| Command | Description |
|---|---|
| **FACTRESET** | Resets the original manufacturer's configuration. |

### 3.2.5 Reset command

From the command console, you may reset RMS1-AI by executing the RESET command.

| Command | Description |
|---|---|
| **RESET** | Resets RMS1-AI. |

### 3.2.6 Analog Input command

You can change the filter and type of each analog input with this command.
From the command console you may type the **AINPUT** command followed by the number of input you want to configure (0-7) and the type of input (0 = 4-20mA, 1 = 0-10V) and filter (1, 5, 10, 20, 50 or 100 samples)

| Command | Description |
|---|---|
| **AINPUTn:*type,filter*** | Changes the type of input and the filter for the analog input n.<br>n (0,7)<br>type: 0 (4-20mA) , 1 (0-10V).<br>Filter: 1,5 , 10 , 20 , 50 or 100 (samples) |

### 3.2.7 Scaling command

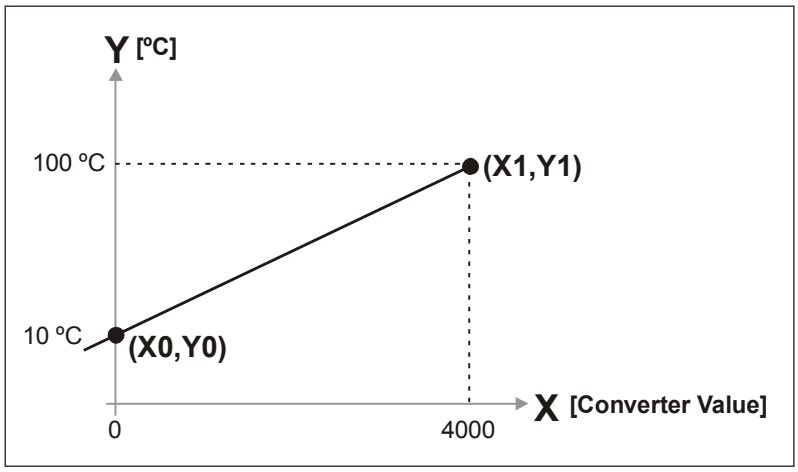
RMS1-AI can acquire a value and make a simple calculation before assign it to the final value. This is helpful for scaling factors and other simple calculation.
It supports the Linear (Y=aX+b) function, where X (abscissa) is the acquired value and Y (ordinate) will be the value assigned to a bank of memory called scaled value.
The factory default is a straight line which slope is 1 and passes through the origin (0; 0).

You can modify the scaling configuration of each analog input with the **SCALING** command.
You must specify two coordinates of the plane X, Y through which passes the scaling straight line.

| Command | Description |
|---|---|
| **SCALINGn:*X0,Y0,X1,Y1*** | Changes the scaling of the analog input n to a straight line that passes through the coordinates (X0, Y0) , (X1, Y1) and n (0,7) |

| | Range |
|---|---|
| X0 | 0 up to 4095 (4000 for 10V or 20mA) |
| Y0 | -32767 up to 32767 |
| X1 | 0 up to 4095 (4000 for 10V or 20mA) |
| Y1 | -32767 up to 32767 |

For example:
Suppose that you have a sensor that will output 0V for 10ºC and 10V for 100ºC.
If you want to see temperature values multiplied by 10 directly in RMS1-AI, the scaling configuration must be:
X0=0 Y0=10 X1=4000 Y1=1000




### 3.2.8 More Configuration commands

The following commands allow asking for help, listing the configuration and saving the configuration in device's memory.

| Command | Description |
|---|---|
| **HELP** | Lists help for the configuration commands |
| **LIST** | Lists the device's configuration |
| **END** | Ends configuration and goes to RUN mode. |

## 3.3 Operation for Modbus Slave mode

### 3.3.1 Introduction

In RMS1-AI each one of the analog inputs, match with one Modbus Holding Register. So that, once the communication has been established, data is moved in a transparent way from the analog inputs to the corresponding Modbus ASCII / RTU address.

| MODBUS Register | Description |
|---|---|
| 40.001 up to 40.008 | Analog value (Input value in voltage or current multiplied by 100). |
| 40.009 up to 40.016 | Status (Shows the status of each analog input, for current inputs), for current inputs.<br>0: Normal.<br>1: Below minimum value.<br>2: Over maximum value.<br><br>**Note**: The registers that goes from the 8 to the 15 , are equal to 0 when inputs are configured in voltage |

| | |
|---|---|
| 40.017 up to 40.024 | Scaled value (Engineering units value). |
| 40.025 up to 40.032 | Value (Analog to Digital converter value, 0 if analog input values is 0V or 0mA, 4000 if analog input values is 10V or 20mA) |

| | |
|---|---|
| 40.101 | Firmware Version. |
| 40.102 | Hardware Version. |

| | |
|---|---|
| 40.201 up to 40.208 | Input Type (0 (4-20mA) , 1 (0-10V)) |
| 40.209 up to 40.216 | Filter (1, 5 ,10 , 20 , 50 or 100 samples) |
| 40.217 up to 40.224 | Abscissa zero (X0) |
| 40.225 up to 40.232 | Ordinate zero (Y0) |
| 40.233 up to 40.240 | Abscissa one (X1) |
| 40.241 up to 40.248 | Ordinate one (Y1) |

Registers with gray background are read only registers

Registers from 40.033 up to 40.100 and from 40.106 up to 40.200 are reserved bank of memory.

Registers from 40.001 up to 40.032 are read only and show information about each analog input status.

Registers from 40.009 up to 40.0016 (status field) are equal to 0 (zero) when inputs are configured in voltage type.

Registers from 40.101 up to 40.105 are read only and show information about the product.

And registers from 40.201 up to 40.248 contain the following information about the analog inputs configuration:

- **Input type**: Voltage or current loop.
- **Filter**: Samples to take before determining the value.
- **Scaling:** RMS1-AI supports, pointing out two coordinates of a straight line (x0, y0; x1, y1), to make a linear scaling of each one analog input.

# Chapter 4

# Configuration and Operation in HOSTLINK MASTER work mode

## 4.1 Changing the work mode

If you want the device to work in Hostlink Master mode, you must connect to the device through the command console and type the following command:

**MODE: HM**

The RMS1-AI will restart and begin working in Hostlink Master mode.

## 4.2 Configuration command console

The device can be configured through the command console in the serial port. You must connect the RMS1-AI serial port to a PC RS-232 port. To such effect, you must have a serial terminal program (Windows HyperTerminal or similar).
The communication program must be set as follows: 9600 bps, Parity: None, Data bits: 8, Stop bits: 1, and flow control: none (9600,N,8,1).

Table 5 –Communication program configuration

| Parameter | Value |
|---|---|
| Baud Rate | 9600 |
| Parity | No parity |
| Data Bits | 8 |
| Flow Control | None |

You can enter the configuration mode through the serial port:

- Connect RMS1-AI to a PC and configure the terminal emulation program to 9600,N,8,1.
- Turn on RMS1-AI. During the first 7 seconds RMS1-AI will wait for the **CFG** command.
- Type **CFG** and press ENTER. The RMS1-AI will display a welcome message on the configuration command console.

```
 RMS1-AI - Exemys (V2):
 ----------------------
>_
```

NOTE

**If this doesn't happen, reset the device and repeat the previous steps**

### 4.2.1 Mode Command

You can change the work mode of the device with this command. The RMS1-AI can work in Hostlink Master or Modbus Slave mode.

| Command | Description |
|---|---|
| **MODE:*option*** | Configures the work mode of the device.<br>Option: MS(Modbus Slave) or HM(Hostlink Master). |

### 4.2.2 Serial Command

You can change the RMS1-AI serial port parameters with this command.

| Command | Description |
|---|---|
| **SERIAL:*baud,parity,type*** | Configures serial port parameters.<br>baud: Baud Rate in Bps. (110, 300, 600, 1200, 2400, 4800, 9600, 19200, 32400, 57600, 115200)<br>parity: 0=No parity, 1=Odd, 2=Even<br>type: 0=RS-232, 1=RS-485. |

### 4.2.3 Hostlink command

You can change the HOSTLINK interface parameters with this command, unit ID, the DM start address and time between packets

| Command | Description |
|---|---|
| **HOSTLINK:*unit_ID,dm_start,timeout*** | Configures the Hostlink interface parameters.<br>unit_ID: 00 up to 99<br>dm_start: first address of the DM zone (0-9967)<br>timeout: Time between packets (50-2000 miliseconds) |

### 4.2.4 Factory Reset command

At any time, RMS1-AI administrator may reset the original manufacturer's configuration. This option may be executed through the command console with the FACTRESET command.

| Command | Description |
|---|---|
| **FACTRESET** | Resets the original manufacturer's configuration. |

### 4.2.5 Reset command

From the command console, you may reset RMS1-AI by executing the RESET command.

| Command | Description |
|---|---|
| **RESET** | Resets RMS1-AI. |

### 4.2.6 Analog Input command

You can change the filter and type of each analog input with this command.
From the command console you may type the **AINPUT** command followed by the number of input you want to configure (0-7) and the type of input (0 = 4-20mA, 1 = 0-10V) and filter (1, 5, 10, 20, 50 or 100 samples)

| Command | Description |
|---|---|
| **AINPUTn:*type,filter*** | Changes the type of input and the filter for the analog input n.<br>n (0,7)<br>type: 0 (4-20mA) , 1 (0-10V).<br>filter: 1 , 5 , 10 , 20 , 50 or 100 (samples) |

### 4.2.7 Scaling command

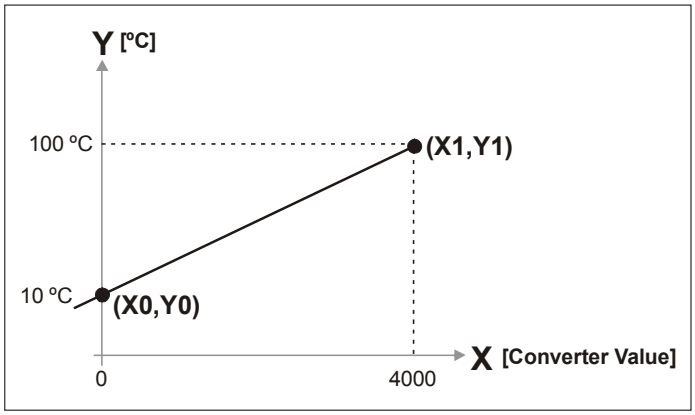
RMS1-AI can acquire a value and make a simple calculation before assign it to the final value. This is helpful for scaling factors and other simple calculation.
It supports the Linear (Y=aX+b) function, where X (abscissa) is the acquired value and Y (ordinate) will be the value assigned to a bank of memory called scaled value.
The factory default is a straight line which slope is 1 and passes through the origin (0; 0).

You can modify the scaling configuration of each analog input with the **SCALING** command.
You must specify two coordinates of the plane X, Y through which passes the scaling straight line.

| Command | Description |
|---|---|
| **SCALINGn:*X0,Y0,X1,Y1*** | Changes the scaling of the analog input n to a straight line that passes through the coordinates (X0, Y0) , (X1, Y1).<br>n (0,7) |

| | Range |
|---|---|
| X0 | 0 up to 4095 (4000 for 10V or 20mA) |
| Y0 | -32767 up to 32767 |
| X1 | 0 up to 4095 (4000 for 10V or 20mA) |
| Y1 | -32767 up to 32767 |

For example:
Suppose that you have a sensor that will output 0V for 10ºC and 10V for 100ºC.
If you want to see temperature values multiplied by 10 directly in RMS1-AI, the scaling configuration must be:
X0=0 Y0=10 X1=4000 Y1=1000




### 4.2.8 More Configuration commands

The following commands allow asking for help, listing the configuration and saving the configuration in device's memory.

| Command | Description |
|---|---|
| **HELP** | Lists help for the configuration commands |
| **LIST** | Lists the device's configuration |
| **END** | Ends configuration and goes to RUN mode. |

## 4.3 Operation for Hostlink Master mode

### 4.3.1 Introduction

**ATTENTION**: the PLC must be in **MONITORING** or **STOP** mode in order to be able to communicate with the module.

In RMS1-AI each one of the analog inputs, match with one DM zone Hostlink Register. So that, once the communication has been established, data is moved in a transparent way from the analog inputs to the corresponding DM address.
The following table describes the Hostlink registers in which RMS1-AI writes, the reference is the DM_start address configured. In the original manufacturer's configuration this address is DM 950.

| HOSTLINK Register | Description |
|---|---|
| 0 up to 7 | Analog value (Input value in voltage or current multiplied by 100). |
| 8 up to 15 | Status (Shows the status of each analog input, for current inputs), for current inputs.<br>0: Normal.<br>1: Below minimum value.<br>2: Over maximum value.<br><br>**Note**: The registers that goes from the 8 to the 15 , are equal to 0 when inputs are configured in voltage |
| 16 up to 23 | Scaled value (Engineering units value). |

| | |
|---|---|
| 24 up to 31 | Value (Analog to Digital converter value, 0 if analog input values is 0V or 0mA, 4000 if analog input values is 10V or 20mA). |

Appendix A

# A.Appendix

## A.1. Mounting

The RMS1-AI should be mounted on a DIN rail (as shown in figure 14), to allow it to place on electric panel, control panel cabinets, and interconnection cases.
Make the upper side of the device fit the DIN rail (A) and then push gently until you hear a Click! (B).

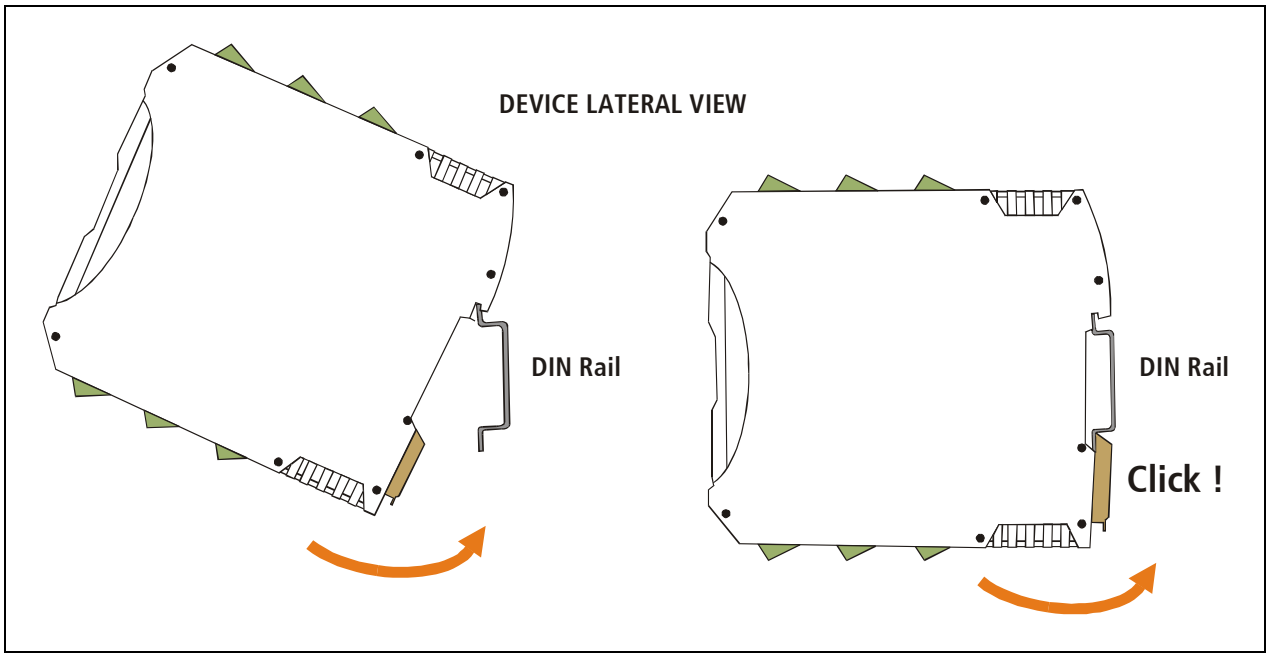



**Figure 15 - Assembly of the device on DIN rail**

To disassemble the device of the rail DIN (figure 15), pull down the metallic clip and then remove it (C).

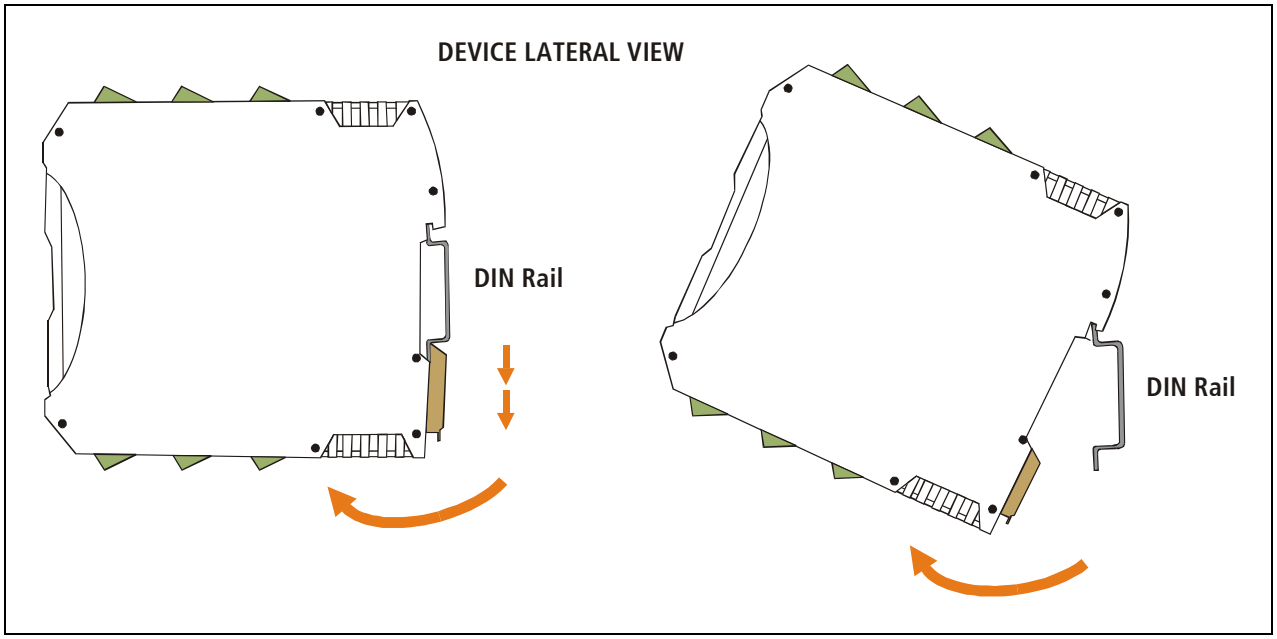



Figure 16 - Disassembling of the device

## A.2. Original manufacturer's configuration

**Table 6 – Commands Table**

| Description | Syntax | Value |
|---|---|---|
| Work mode | **MODE:*xx*** | **ms (Modbus Slave)**<br>hm (Hostlink Master) |
| Modbus Format<br>(only if **mode:ms**) | **MODBUS:*format,unit, exceptions,gap*** | **format**: A=ASCII, **R=RTU**.<br>**unit**: 1 up to 247 **(1)**<br>**exceptions**: E=enabled, **D=disabled**<br>**gap**: from 3 up to 50 **(4)** |
| Hostlink Master<br>(only if **mode:hm**) | **HOSTLINK:*unit,dm_start, timeout*** | **unit**: 0 a 99 **(0)**<br>**dm_start**: 0 up to 9967 **(950)**<br>**timeout**: 50 up to 2000 ms **(500)** |
| Serial port configuration | **SERIAL:*baud,parity,type*** | **baud**: 110, 300, 600, 1200, 2400, 4800, **9600** , 19200, 32400, 57600, 115200<br>**parity**: **0=No** , 1=odd, 2=even<br>**type**: **0=RS-232**, 1=RS-485. |
| Input type | **AINPUTn:*type,filter*** | n (0,7)<br>**type**: **0 (4-20mA)**, 1 (0-10V).<br>**filter**: 1, **5**, 10 , 20 , 50 ó 100 (samples) |
| Scaling | **SCALINGn:*X0,Y0,X1,Y1*** | n (0,7)<br>**X0**: 0 up to 4095 **(0)**<br>**Y0**: -32767 up to 32767 **(0)**<br>**X1**: 0 up to 4095 **(1)**<br>**Y1**: -32767 up to 32767 **(1)** |

**NOTE**: Original manufacturer's parameters have **gray background**

# Technical Specifications

| | |
|---|---|
| • **Analog / Digital resolution:** | 12 bits, 4096 steps. |
| • **Sampling Rate:** | 10 samples per second, per channel. |
| • **Analog Inputs:** | 4-20mA (Zi=150Ω), 0-10Vdc or 0-100V. |
| • **Input type and quantity:** | 8 Differential mode analog inputs. |
| • **Serial Protocol:** | - Modbus ASCII / RTU Slave in RS485 or RS232.<br>- Hostlink Master (OMROM®)in RS485 or RS232.<br>- Galvanic Isolation in RS485 port. |
| • **Supported Devices:** | Any device with analog outputs, that requires remote supervision. |
| • **Managment:** | Serial console RS232. |
| • **Indicators:** | Power Led.<br>Data Led.<br>Fail Led. |
| • **Power Supply:** | 10 a 30 Vdc.<br>Current sink: 200mA @ 10 Vdc<br>90mA @ 30 Vdc |
| • **Isolation:** | 2500 Vrms (1 minute) |
| • **Dimension / Weight:** | 100mm x 22,5mm x 112mm (Height x Width x Length). |
| • **Temperature:** | Operating Temperature: -5 a 65ºC<br>Storage Temperature: -40 a 75ºC |
| • **Guarantee / Soport:** | 1 year guarantee. Technical support included. |