smar - RP303

USER´S MANUAL

PROFIBUS-DP/MODBUS RTU REPEATER

JAN/15

RP303

PROFIBUS®

RP303ME

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Up-to-date address information is available on our website.

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AVOIDING ELECTROSTATIC DISCHARGES

ATTENTION

Electrostatic discharges may damage semiconductor electronic components in printed circuit boards. They usually occur when touching components or connector pins from modules and racks, without wearing the appropriate equipment to prevent discharges. It is recommended to take the following precautions:

- ✓ Before handling modules and racks, remove the electrostatic charge from your body by wearing a proper wristband or touching grounded devices;
- ✓ Avoid touching electronic components or connector pins from racks and modules.

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RP303 –PROFIBUS-DP/MODBUS RTU REPEATER

Description

RP303 is an active element serving as interface between segments on Profibus network and ensures adequate signal levels, while guarantees the communication signal integrity. The repeater prevents signal deterioration in long distances. Essentially it receives the signal from a network segment, cleans, amplifies and transmits it to other segments. This way, the original message is preserved for all network segments. The RP303 executes this function bidirectionally. In addition, serves to galvanically isolate the segments.

The RP303 uses the same technology of RHP303 (Repeater Hub Profibus, with 5 channels) and is the most cost effective solution with 1 channel. It is an isolated and transparent galvanic repeater that regenerates the electrical signal. The communication rate is identified automatically.

As RP303 creates insulated segments, the devices can be removed and inserted during the operation. Likewise, electric bus problems and EMC disturbances on a spur do not spread to other segments.

The RP303 has a differential feature that is to work in Modbus for two communication rates in manual mode: 9.6 Kbps and 19.2 Kbps. To help installation, a terminator is integrated and can be turned on or off. For faults identification, it has LED that indicate channel status.

The RP303 increases the availability of Profibus-DP network.

Figure 1 – RP303

Main features

- IP 20 classification;
- 1 insulated channel;
- Transparent for all PROFIBUS-DP protocol versions;
- RS-485 specifications;
- Maximum 12 Mbps communication rate;
- Supports up to 31 devices;
- Supports up to 1200 m length of spur line;
- No address required;

- Integrated terminator;
- Supports Modbus protocol in manual mode on 9.6 Kbps and 19.2 Kbps;
- Ideal for applications in areas susceptible to EMI;
- Allows expansion of the PROFIBUS-DP/Modbus RTU network with reliability;
- Regenerates PROFIBUS-DP/Modbus RTU signals that were affected by capacitive effects;
- Insertion and removal of slave equipment during the operation;
- Protection against short circuit and indication;
- Compact and robust construction;
- Status and error display;
- Compatible with all DP cables;
- Easily extensible installations;
- DB9 connector available for diagnostics;
- Redundant power supply (20 to 30 Vdc).

Examples of Application

- Dynamic spur lines for actuators, flow meters and pH analyzers;
- Inverters and motors;
- Motor control centers;
- Barrier for galvanic and non-insulated equipment;
- Large star/tree structured networks.

Reliable expansion of PROFIBUS-DP/ Modbus RTU networks

The figure below shows a general RP303 application. The insulated channel prevents short circuit propagation to trunk and allows expansion of up to 1200m per segment.

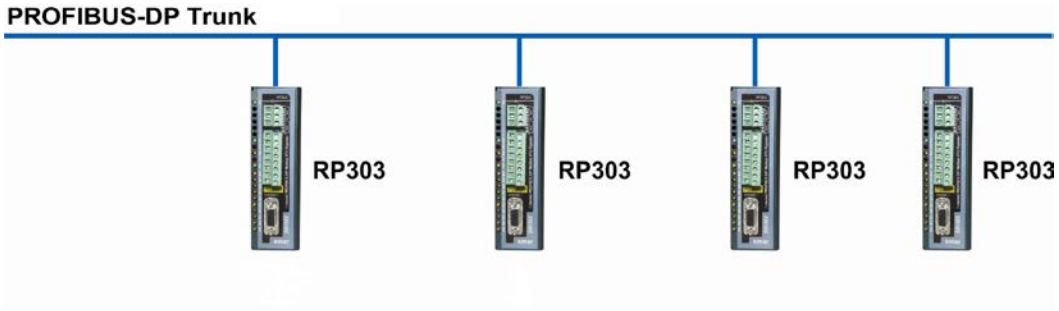


Figure 2 – General application

Expansion of PROFIBUS-DP/Modbus RTU networks in tree or star topology, without limits for RP303 in cascade

Various RP303 can be installed in cascade, thereby increasing the distances and isolating areas. The main trunk enters the channel 0 of a RP303 and goes to the channel 0 of the other RP303. See the following figures.

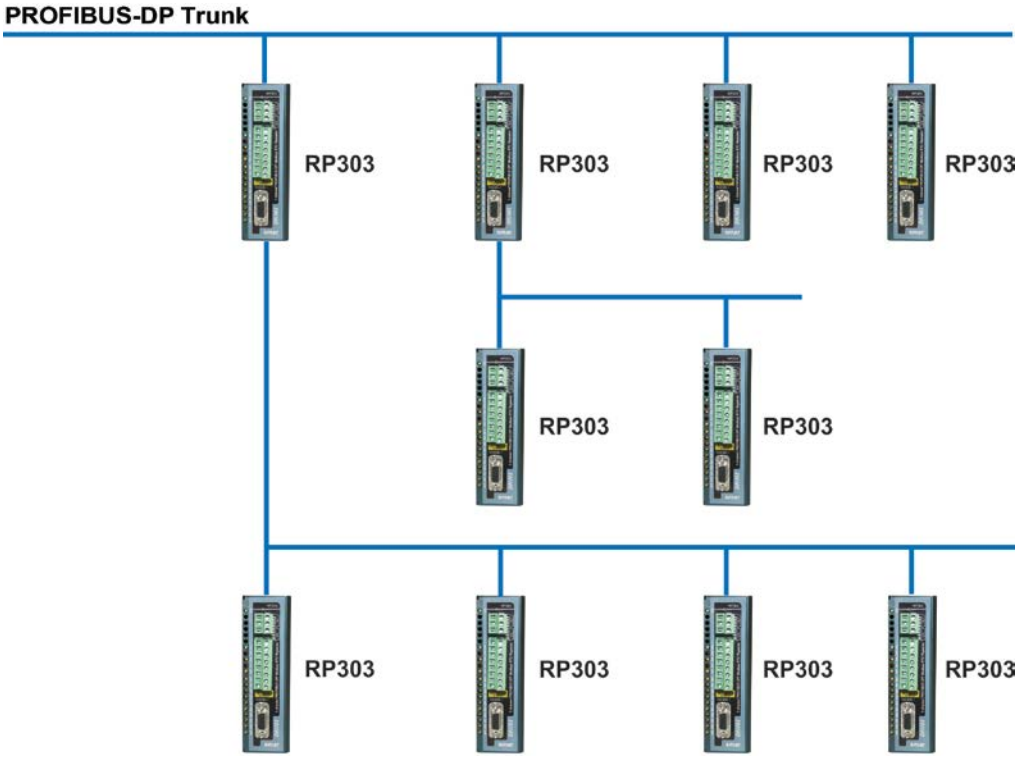


Figure 3 – Application with RP303 in cascade

Figure 4 – Detail of the main trunk connected to channel 0

Applications in installations with capacitive effect

Furthermore, the RP303 amplifies and corrects communication signals that are affected by capacitive effects on the segments. See example in the following figure a network affected by capacitive effect.

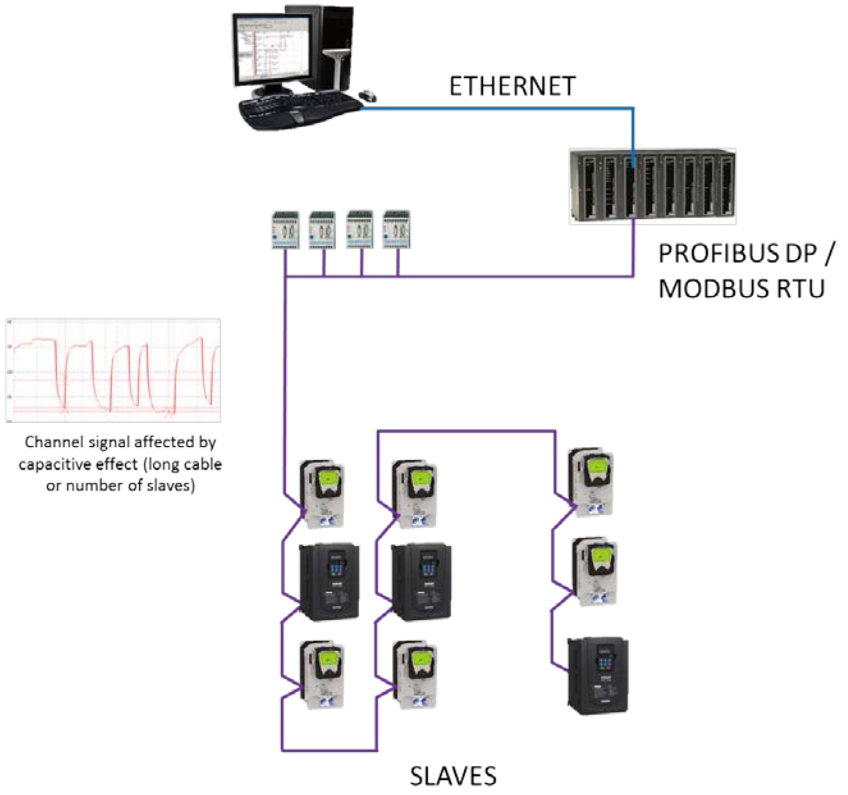


Figure 5 – Communication signals affected by capacitive effect

The following figure shows the communication signals recovered by RP303.

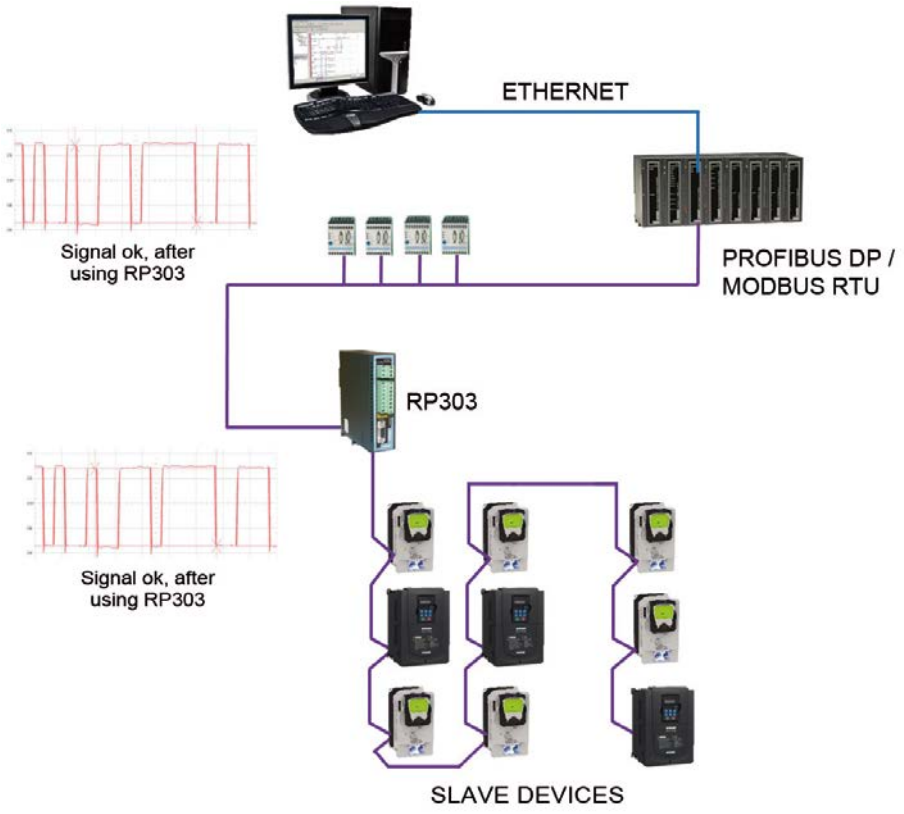


Figure 6 – Communication signals recovered by RP303

Application in areas susceptible to electromagnetic interference

The RP303 increases the network availability by filtering EMI noises so that the channel does not interfere with the main trunk. The isolated RP303 spur ensure that common noise in critical areas, such as MCCs, does not interfere in the remaining areas.

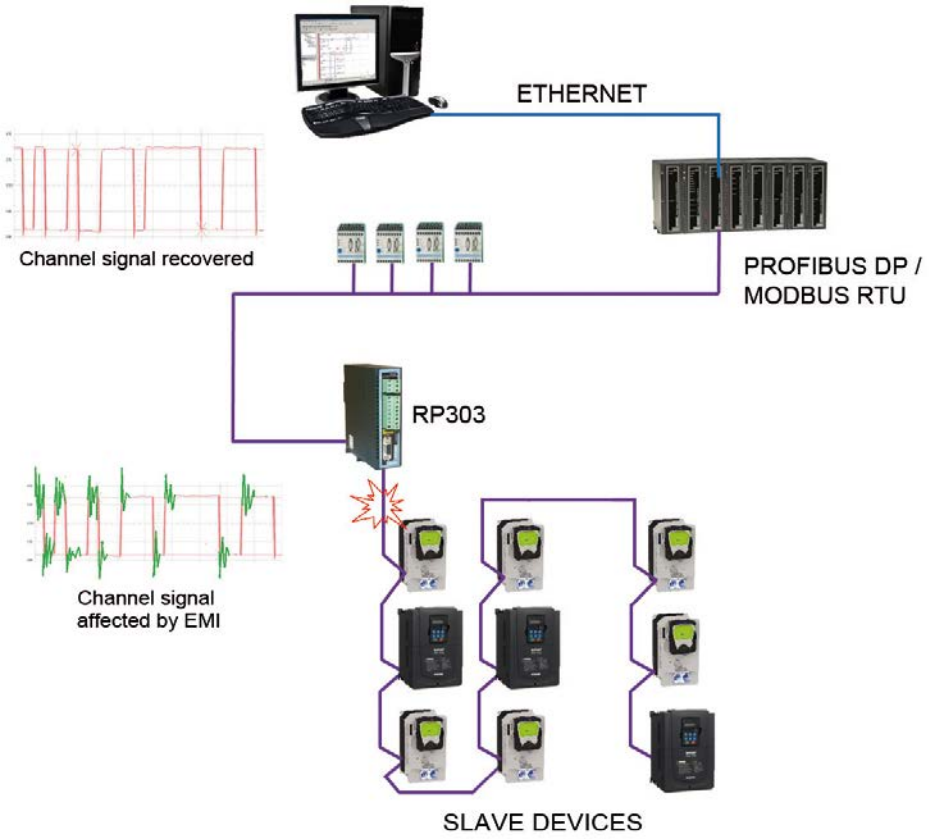


Figure 7 – Application in areas susceptible to electromagnetic interference

Applications with PROFIBUS-DP and Modbus

Profibus-DP/Modbus RTU networks can be expanded in tree or star topology, without limits for RP303 in cascade. Thus it is possible to increase channel length and its number of devices with communication signal integrity. See the next figure.

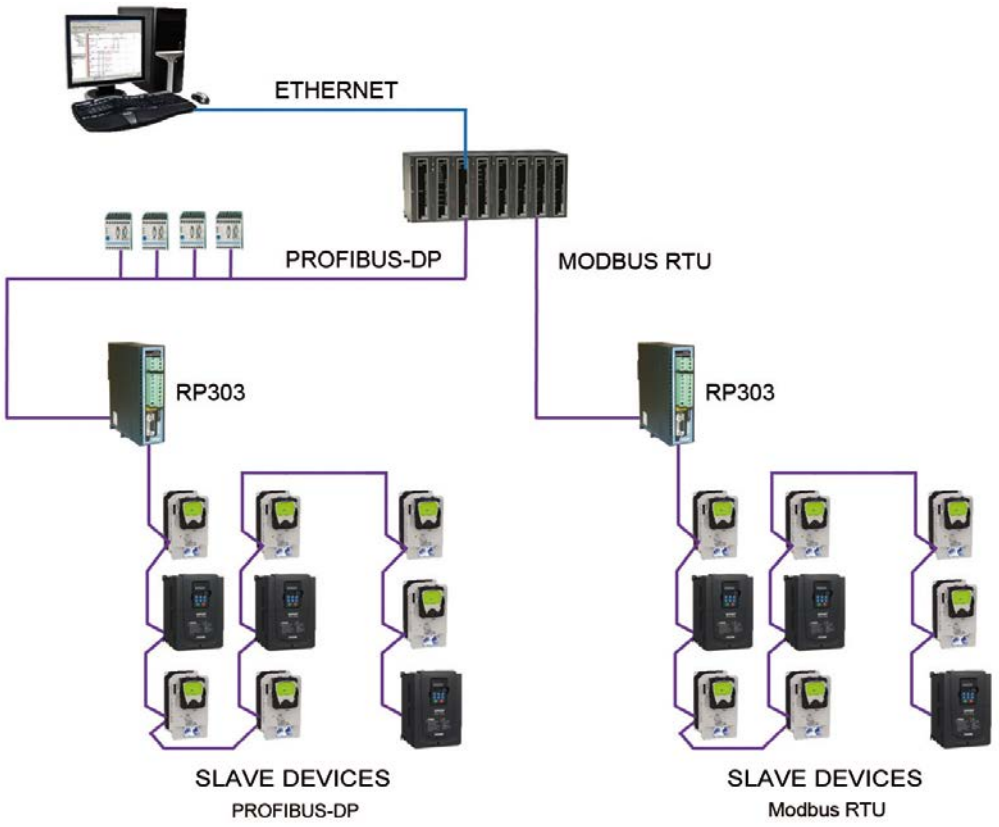


Figure 8 – Expansion of PROFIBUS-DP and Modbus RTU networks

PROFIBUS-DP cable lengths

See on the table below the relation between the several communication rates and the allowed lengths. Make sure the cables on the main channel (0) and the derived channel (1) comply with the PROFIBUS-DP cable specifications for the RS-485.

Baud rate (kbps)	9,6	19,2	45,45	93,75	187,5	500	1500	3000	6000	12000
Segment length (m)	1200	1200	1200	1200	1000	400	200	100	100	100
Segment length (feet)	3940	3940	3940	3940	3280	1310	656	328	328	328

Baud Rate LEDs

The BD0 to BD9 LEDs blink in yellow to indicate the baud rate used by the RP303 according to the next figure. The baud rate will be the same for every channel.

Baudrate	LEDS									
	BDO	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9
9,6 Kbps	ON	off	off	off	off	off	off	off	off	off
19,2 Kbps	off	ON	off	off	off	off	off	off	off	off
45,45 Kbps	off	off	ON	off	off	off	off	off	off	off
93,75 Kbps	off	off	off	ON	off	off	off	off	off	off
187,5 Kbps	off	off	off	off	ON	off	off	off	off	off
500 Kbps	off	off	off	off	off	ON	off	off	off	off
1,5 Mbps	off	off	off	off	off	off	ON	off	off	off
3,0 Mbps	off	off	off	off	off	off	off	ON	off	off
6,0 Mbps	off	off	off	off	off	off	off	off	ON	off
12 Mbps	off	off	off	off	off	off	off	off	off	ON

Figure 9 – LEDs BD0 to BD9

Status LEDs (ST)

Each RP303 channel has a ST LED. The red ST LED indicates the channel status.

If the LED is off, the channel is good. If it is on, the channel has some fault. It can be caused by a cable short circuit or any other problem that may degrade the signal until it is no longer recognized by the RP303.

Channel Status	ST LED
Good	Off
Faulty	On

Figure 10 – Status LEDs

RX LEDs

Each RP303 channel has a RX LED. The yellow RX LED indicates the reception by the channel.

When turned off, the channel is not receiving a valid signal. When turned on, the channel is receiving a valid signal.

Reception	RX LED
Invalid or non-existing signal	Off
Receiving a valid signal	On

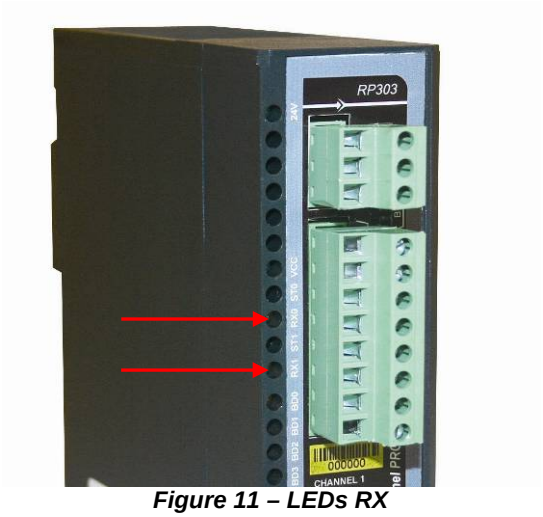


Figure 11 – LEDs RX

Installation

The RP303 can be installed anywhere in a non-hazardous area and on the specified temperature range of 0 to 60ºC.

The RP303 must be installed on DIN rail, with the connector cable on the bottom part. In this position the cables go down.

Figure 12 – RP303 installed on DIN rail

NOTE
The installation must be executed by qualified technicians with a PROFIBUS Installer or a PROFIBUS Engineer certificate.

Power supply

The power supply connector, a 3-pin terminal block, is located on the RP303 upper left corner. The power supply must comply with the Technical Specifications topic. The module can also be powered by IMB.

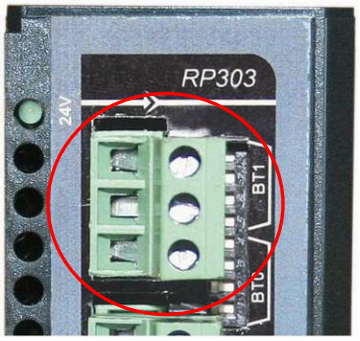


Figure 13 – Detail of the power supply connector

1	+24V
2	-24V
3	GND

Redundant Power Supply Operation

The RP303 supports redundant power supply in order to provide continuous operation when the 24 Vdc power supply fail. To use this redundant power supply mode, install the module in the rack DF1A/R700-4 and connect a power supply of +24 Vdc to the module's input at the power terminals, as described in the previous section of this manual. In this configuration, the module is energized by the power supply of +24 Vdc, using the rack power as backup. Note that when both power supplies,

the rack and external, are present, the +24 Vdc will always be the main power supply.

Spur Segments

Connect the spur segments on the connectors of channel 0 and 1, according to the table below.

PIN	SIGNAL
B (+)	Positive
A (-)	Negative
REF	GND
SHD	Shield

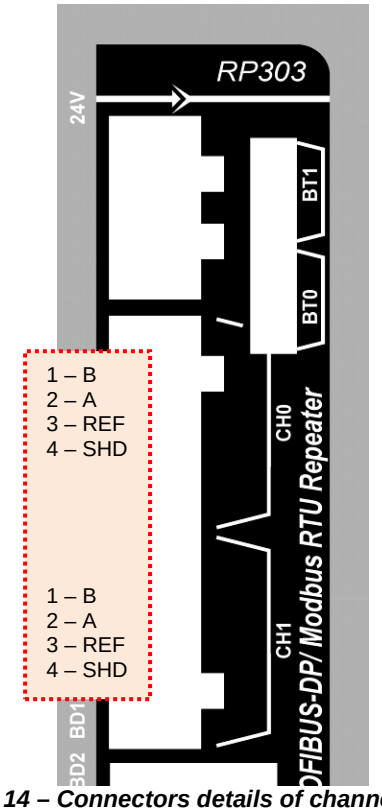


Figure 14 – Connectors details of channels 0 and 1

Terminators

All RP303 channels have configurable terminators. The main channel termination is adjusted in OFF by default. If the RP303 is the last or the first segment device, the termination must be adjusted in ON.

The termination of the other channels is adjusted in ON by default because the new segment is expected to be initiated on the RP303.

Do not forget to turn on the switch at the other segment end.

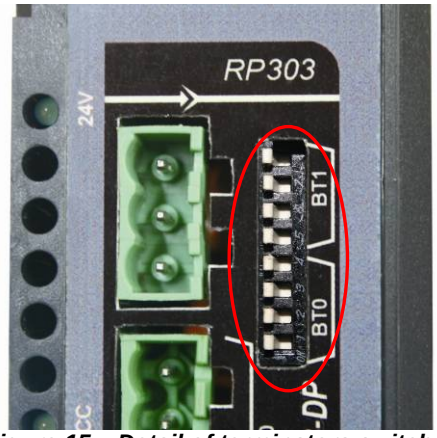
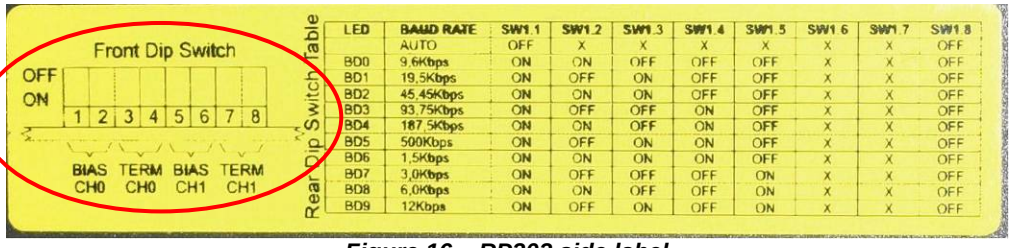


Figure 15 – Detail of terminators switches

The DIP switches to configure the terminators are located on the front of RP303 as shown in the previous figure. The module side label informs what each one represents. See the following figure.



LED	BAUD RATE	SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6	SW1.7	SW1.8
	AUTO	OFF	X	X	X	X	X	X	OFF
BD0	9,6Kbps	ON	ON	OFF	OFF	OFF	X	X	OFF
BD1	19,5Kbps	ON	OFF	ON	OFF	OFF	X	X	OFF
BD2	45,45Kbps	ON	ON	ON	OFF	OFF	X	X	OFF
BD3	93,75Kbps	ON	OFF	OFF	ON	OFF	X	X	OFF
BD4	187,5Kbps	ON	ON	OFF	ON	OFF	X	X	OFF
BD5	500Kbps	ON	OFF	ON	ON	OFF	X	X	OFF
BD6	1,5Kbps	ON	ON	ON	ON	OFF	X	X	OFF
BD7	3,0Kbps	ON	OFF	OFF	OFF	ON	X	X	OFF
BD8	6,0Kbps	ON	ON	OFF	OFF	ON	X	X	OFF
BD9	12Kbps	ON	OFF	ON	OFF	ON	X	X	OFF

Figure 16 – RP303 side label

Baud Rate Configuration

The RP303 recognizes the transmission speed by default. If necessary lock the RP303 on given transmission speeds, the switches 1 to 8 must be adjusted on the required value.

Figure 17 – Switches 1 to 8 for communication rate adjustment

The switches are used to select the baud rate used by the Profibus DP Repeater according to the next table. The baud rate selected will be the same for all channels. These baud rates are standardized by the PROFIBUS-DP protocol.

	BAUD RATE	SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6	SW1.7	SW1.8
	AUTO	OFF	X	X	X	X	X	X	OFF
MANUAL	9.6 Kbps	**ON**	**ON**	OFF	OFF	OFF	X	X	OFF
	19.2 Kbps	**ON**	OFF	**ON**	OFF	OFF	X	X	OFF
	45.45 Kbps	**ON**	**ON**	**ON**	OFF	OFF	X	X	OFF
	93.75 Kbps	**ON**	OFF	OFF	**ON**	OFF	X	X	OFF
	187.5 Kbps	**ON**	**ON**	OFF	**ON**	OFF	X	X	OFF
	500 Kbps	**ON**	OFF	**ON**	**ON**	OFF	X	X	OFF
	1.5 Mbps	**ON**	**ON**	**ON**	**ON**	OFF	X	X	OFF
	3.0 Mbps	**ON**	OFF	OFF	OFF	**ON**	X	X	OFF
	6.0 Mbps	**ON**	**ON**	OFF	OFF	**ON**	X	X	OFF
	12 Mbps	**ON**	OFF	**ON**	OFF	**ON**	X	X	OFF
	Firmware version	X	X	X	X	X	X	X	**ON**

Note: The "X" on the table means "The switch position is irrelevant".

To adjust the transmission speed, use a screwdriver.

NOTE

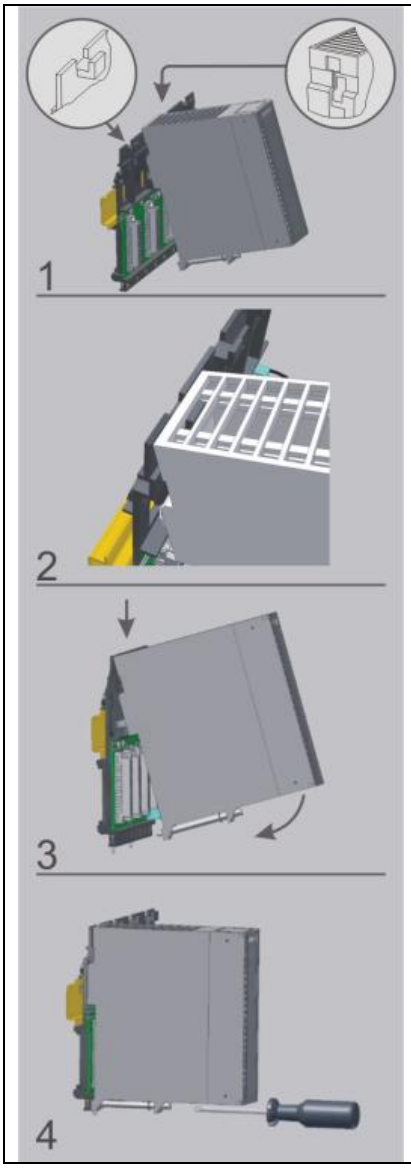
For the Modbus protocol, the available rates must be adjusted in "Manual": 9.6 Kbps and 19.2 Kbps.

Installing Module in the Rack

The RP303 can be installed in the rack DF1A/R700-4 being powered through it. It can be installed using DF9, in this case it is powered by an external power supply 24 Vdc. In both cases, when the module is powered up, the green LED (power indication "24V") will be on.

Installing a module in the rack

The rack DF1A/R700-4 is suitable for DIN rail mounting. Follow the steps below to install a module in the rack.

	Attach the top of the module (with a 45^{o} inclination) to the module support located on the upper part of the rack. Mounting detail. Push the module fixing it to the module connector. Next, fix the module to the rack using a screwdriver, and fasten the fixation screw at the bottom of the module.

Technical Specifications

EXTERNAL POWER SUPPLY	
Power connector	3-pin terminal block
Voltage	20 to 30 Vdc (24 Vdc nominal)
Typical current	100 mA @ 24 Vdc
Protection against reverse polarity	Yes
Wiring	< 2.5 mm^2

IMB POWER SUPPLY*	
Power supply	IMB
Voltage	5 Vdc
Typical current	280 mA

*Bus between modules

NOTE
The preferred power supply is the external of 24 Vdc.

FUNCTION SPECIFICATIONS	
Supported Protocols	Modbus, DP-V0, DP- V1, DP-V2, FDL, MPI, FMS, PROFIsafe, PROFIdrive and any other FDL-based protocol
Communication Rates (kbps)	9.6; 19.2; 45.45; 93.75; 187.5; 500; 1500; 3000; 6000 and 12000
Communication Rate detection	Self-detectable by default or switch configurable
Communication rate selection switch	0 = Self-detectable by default
Communication rate detection time	< 5 s (if self-detection selected)
Data delay time	1 Tbit for all rates
Jitter delay time	±0.1 Tbit for all rates
Terminator	Enabled via the channel key

ENVIRONMENT CONDITIONS	
Operation temperature	0 to 60 ºC
Protection degree	IP 20

DIMENSIONS AND WEIGHT	
Dimensions (LxWxH)	39.9 x 137.0 x 141.5 mm
Weight	357 g

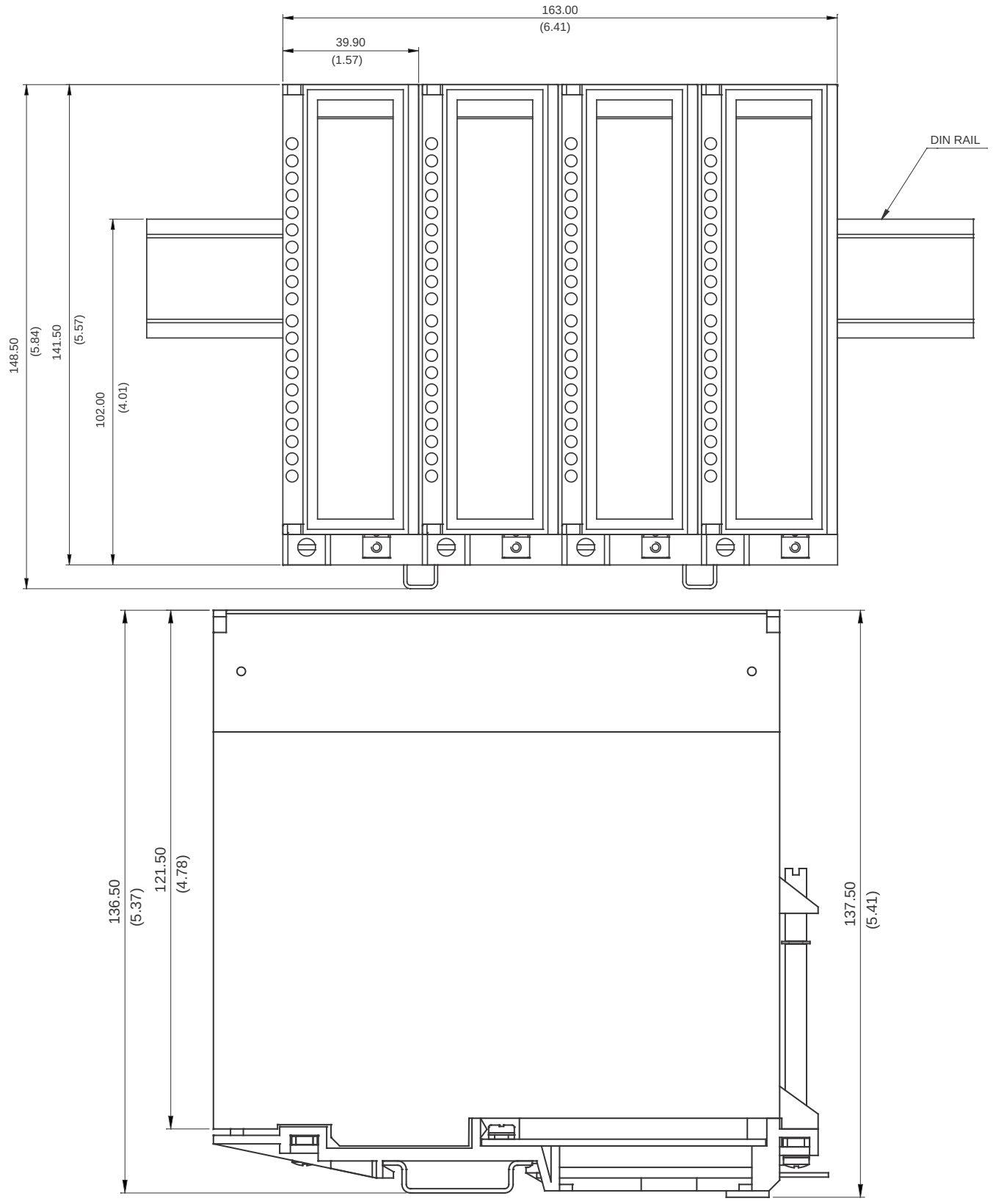
MOUNTING	
Support	DIN rail

Included Accessories

- 1 3-pin connector with 5.08 mm to connect the 24 Vdc external power supply to the module;
- 1 8-pin connector with 5.08 mm to connect the channels communication;
- 2 PROFIBUS-DP cable supports;
- 1 individual support DF9.

Dimensional Drawings

Dimensions are in millimeters and inches in brackets.



Appendix A

smar	SRF – SERVICE REQUEST FORM	
	RP303 – PROFIBUS-DP/Modbus RTU Repeater	Proposal Nº:

COMPANY INFORMATION

Company: _____
Unit: _____
Invoice: _____

COMMERCIAL CONTACT

Full Name: _____
Phone: _____ _____ _____ _____ **Fax:** _____
E-mail: _____

TECHNICAL CONTACT

Full Name: _____
Phone: _____ _____ _____ _____ **Extension:** _____
E-mail: _____

EQUIPMENT DATA

Model: _____
Serial Number: _____

PROCESS DATA

Process Type (Ex. boiler control)**:** _____
Operation Time: _____
Failure Date: _____

FAILURE DESCRIPTON

(Please, describe the failure. Can the error be reproduced? Is it repetitive?)

_____
_____
_____
_____

OBSERVATIONS

_____
_____
_____
_____

USER INFORMATION

Company: _____
Contact: _____
Section: _____
Title: _____ **Signature:** _____
Phone: _____ _____ _____ _____ **Extension:** _____
E-mail: _____ **Date:** _____/ _____/ _____

For warranty or non-warranty repair, please contact your representative.
Further information about address and contacts can be found on **www.smar.com/contactus.asp**