



Wireless Controller REC601/603 Product Guide

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1. Description

The Wireless Controllers REC601/603 are compact, solution based devices for remote controlling and monitoring of secondary substations such as network disconnectors, load break switches and Ring Main Units (RMU's) in distribution networks.

The Wireless Controllers REC601/603 enable the SCADA system to wirelessly monitor and control the field devices over the public communication infrastructure (GPRS).

The Wireless Controllers REC601/603 utilize the built-in GPRS features for reliable and secure end-to-end communication providing remote monitoring and control of a single object with Wireless Controller REC601, or up to three (3) objects with Wireless Controller REC603.

The use of Wireless Controllers REC601/603 in distribution networks improves the quality of power distribution and dramatically reduces the outage time in affected areas. Areas directly adjacent to these affected areas would also show reduced outages and overall effects. It also reduces the capital expenditures in the distribution network by limiting the replacement of legacy devices and contributes to more direct cost savings by facilitating preventative maintenance. Wireless Controllers REC601/603 are also ideally suited to be retrofitted to existing disconnectors and thus enabling remote control of these devices and further extending the life cycle of the disconnector.

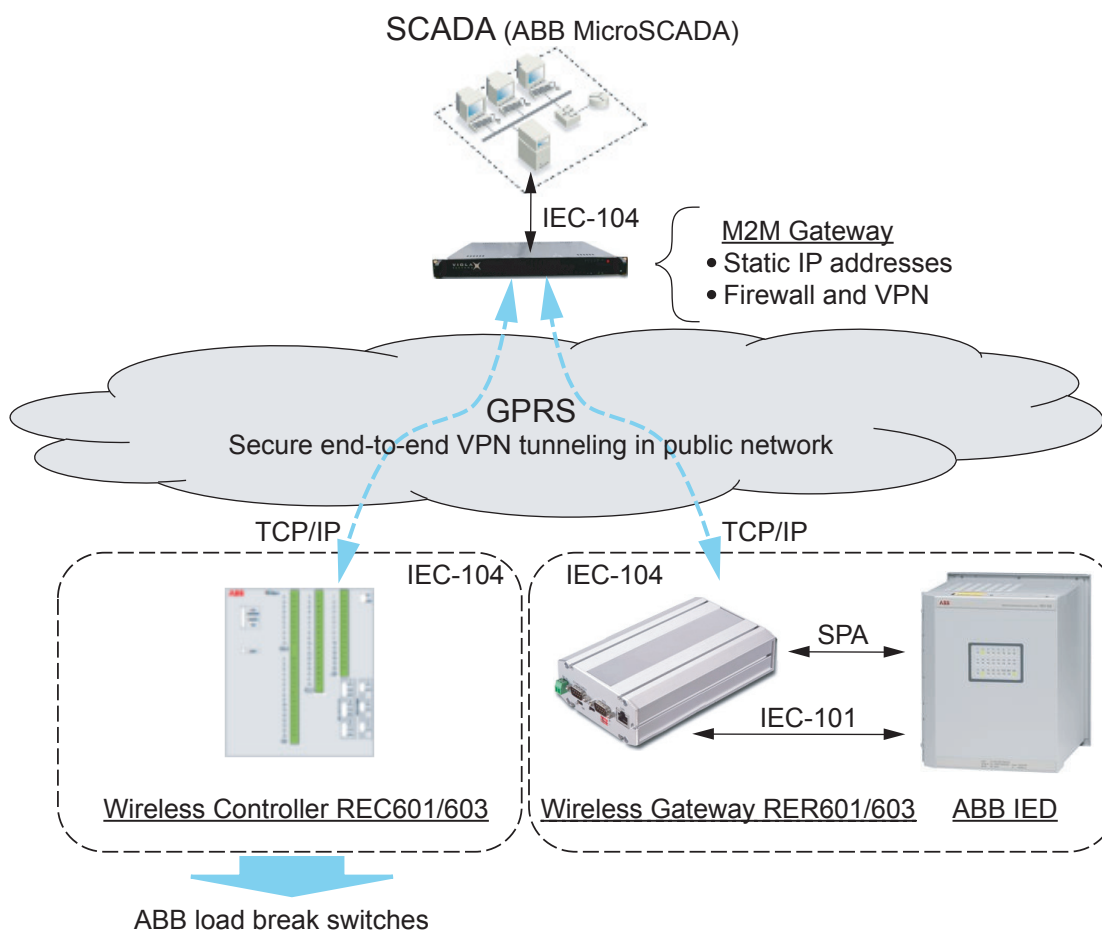


Figure 1. Typical communication system example - GPRS

For the existing installations with IEC101 line or modem, REC601/603 supports IEC101 communication (including dial-up) to SCADA system.

2. Applications

The Wireless Controllers REC601/603 are important and powerful components in an automated distribution network. Connected to the central control system (SCADA/DMS) that manages the utility network, they serve as the core of the secondary substation automation system. These devices are recommended devices for multiple disconnector or distribution transformer applications in distribution networks that require specifications and/or features like listed below.

- Highly reliable control and monitoring of upto three objects (per REC603)
 - Disconnector position indications with front LEDs
 - Separate LED indicators for earthing status
 - Supports both local and remote disconnector control
 - More than one Wireless Controller REC601/603 can be connected in a single location to facilitate the Ethernet enabled control and monitoring of more than three disconnectors
- Overload protection of actuator motors
 - Load current measured in the motor circuit
 - Measurement of object transition time
 - Energy limit based motor overload protection (“software fuse”)
- Fault Indicator support over Modbus for improved fault management

- Always on two-way communication based on GPRS through M2M gateway
 - Redundant IEC 60870-5-104 connections provide extra availability
 - Communication monitoring and automatic connection re-establishment
 - High level data security through internal VPN and Firewall
 - Support for Patrol communication status monitoring and diagnostics application
 - Possibility to act as an IEC 60870-5-101 master (router) for another communicating sub-device (for example metering unit or fault passage indicator)
- Built-in battery charger with advanced battery control
 - Temperature compensated charging
 - Battery monitoring/testing (condition monitoring)
 - Deep discharge protection
- IEC 60870-5-101 slave (including dial-up) to support existing system installations
 - Possibility for future migration from IEC101 to IEC104 is made possible as selection is done using parameter settings.
 - Operation mode - Unbalanced Slave
- Heater control to limit effects of ambient temperature variations, such as condensation, etc.
- Robust aluminium casing design for easy DIN rail mounting

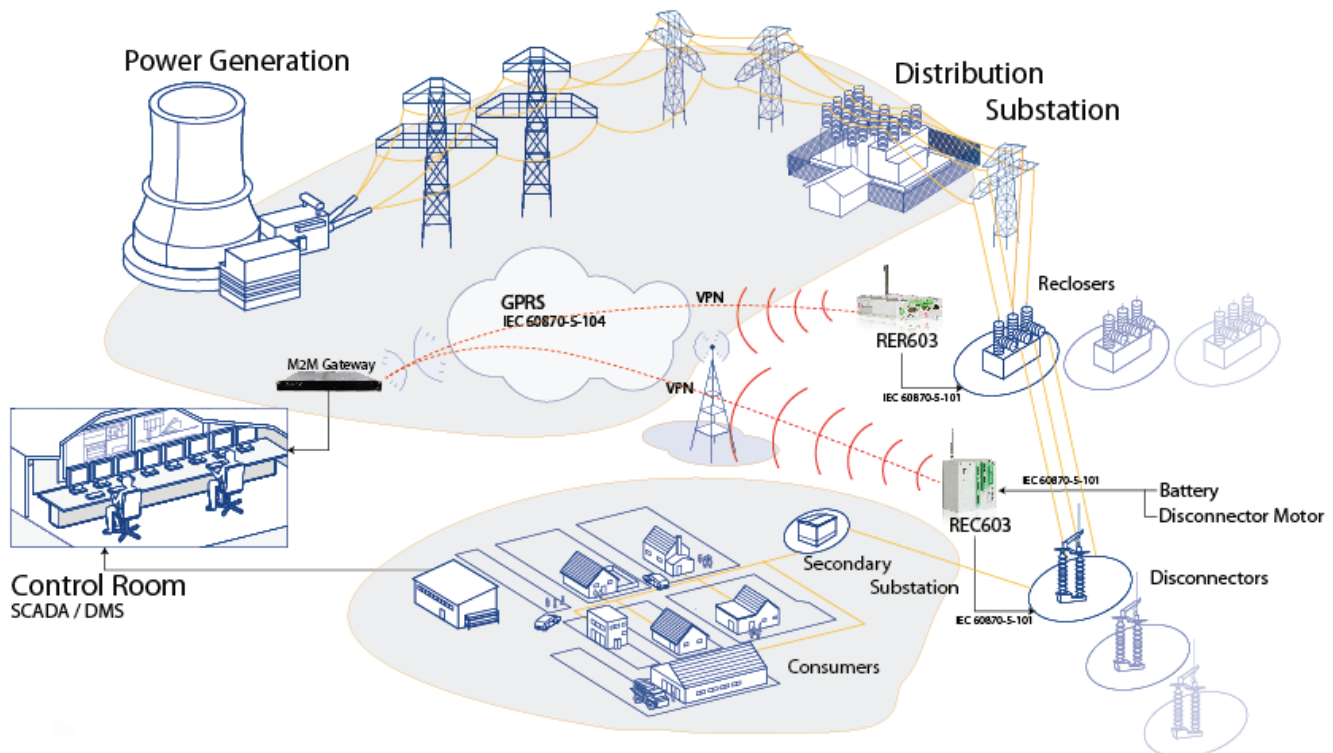


Figure 2. Distribution automation system overview

Application examples

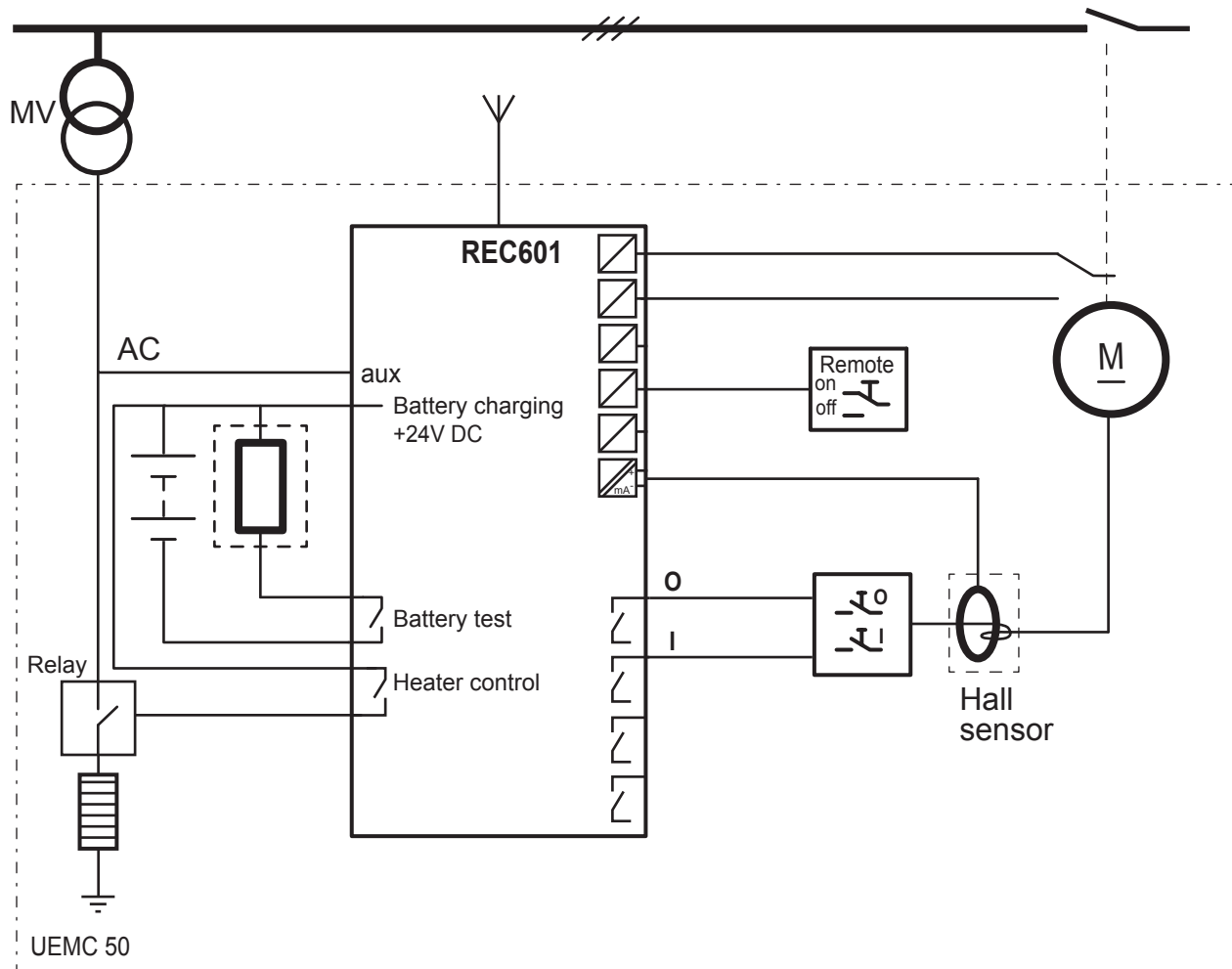
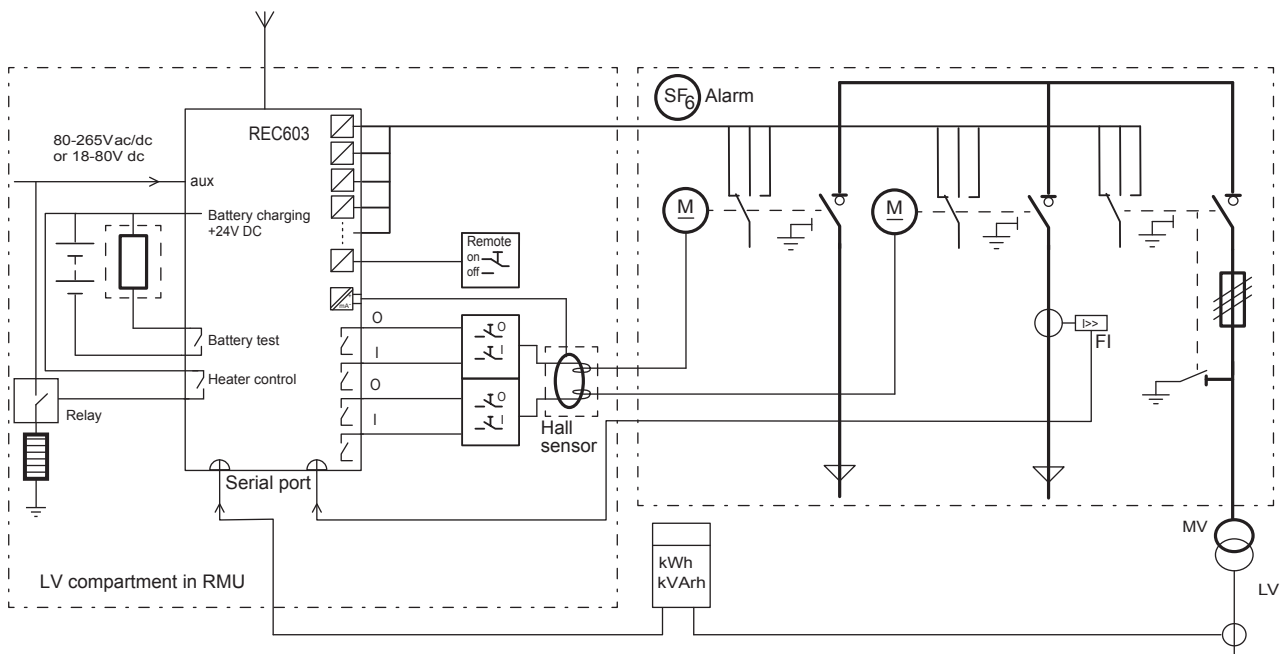


Figure 3. Within the UEMC 50 the REC601 unit is used for the remote control of a disconnector. The motor operating device is placed in the same UEMC 50 enclosure as the other equipment.



A REC603 unit used for remote control of a Ring Main Unit and fault indication.

Figure 4. A REC603 unit used for remote control of a Ring Main Unit and fault indication

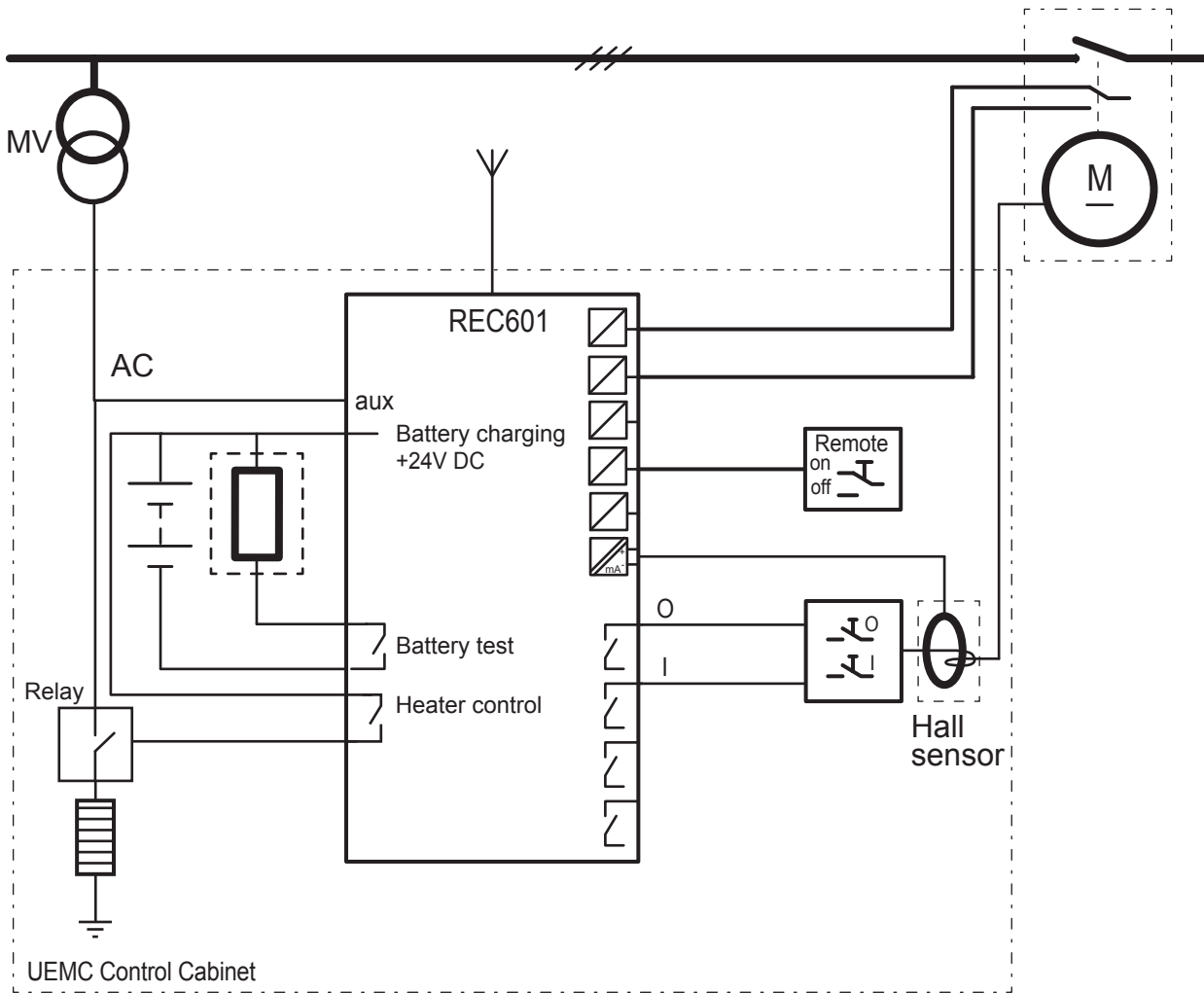


Figure 5. Within the UEMC control cabinet the REC601 unit is used for remote control of a disconnector. The motor operating device is fitted to the disconnector.

3. Battery condition monitoring

The Wireless Controllers REC601/603 are equipped with condition based functionality that make the conditioning monitoring of the built-in battery of the device possible and optimize the lifetime and maintenance intervals of the back-up batteries in the control assembly.

The back-up battery could periodically (scheduled by operator) be tested by switching off the charger and switching on the dummy load. Current and voltage measurements are taken for a defined period of time (discharging time period). Based on these measurements of the battery's current and voltage levels, an assessment is made regarding the battery's condition and remaining operational capacity (in Ah). If the assessment shows that the battery has a significant depletion in capacity an IEC

60870-5-104 alarm event would then be generated in the system.

Also the Wireless Controllers REC601/603 feature the ability to protect the battery against complete discharge. This is achieved by the fact that the battery voltage is always measured in network fault conditions (primary power source is disconnected). If the measured battery voltage level is below a defined limit (assumed as a "battery failure") an IEC 60870-5-104 alarm event would then be generated in the system and the load is disconnected from the battery.

4. Motor overload protection

The Wireless Controllers REC601/603 are equipped with condition based functionality that assists in the monitoring and management of the disconnector motor by using over

current detection and shut down of the motor that is connected to the device.

The over current detection is initialized as soon as a switch-on command is received by the motor. This overload detection process is based on measurements done by a Hall-Effect Current Transducer (optional accessory) for load current and control duration measurements. As soon as a predefined energy limit is exceeded, as shown by the mentioned measurements, the motor is shut down by disconnecting it via the relay output on the Wireless Controllers REC601/603.

5. Inputs and outputs/Physical interfaces

The Wireless Controllers REC601/603 are equipped with numerous input and output connections to manage control operations that are communicated via the wireless (GPRS) capabilities of the devices.

Wireless Controller REC603 has 15 binary inputs (REC601 has five) for monitoring and alarms, and six binary outputs for disconnecter (open/close) control (REC601 has two).

REC601 and REC603 devices have binary output and analog input for battery condition monitoring function (test load and

load measurement). Additionally, they have binary outputs (relay out, normally closed) for overcurrent motor control (load cut) and external heater control. In the default configuration, there are also two binary inputs, one relay output and one analog input free for other use.

Additionally the devices are equipped with a transducer input and heater control output.

The Wireless Controllers REC601/603 also has two serial ports (with DIP switches for serial port 2 hardware configuration) and an Ethernet connector for communication and data transfer. There is also a SIM card insertion slot with SIM card tray and antenna connector.

The status of the operational system is shown by various groupings of LED light indicators. More detailed information can be sourced via the supported Web HMI.

Front panel LEDs

The Wireless Controllers REC601/603 are equipped with eight groups of LEDs indicating the complete operational status of the device. They are located on the device's front panel and are identified by accompanying labels.

Table 1. Description of available LEDs on the front panel

LED	LED status	Description
VPN	On	VPN connection is up
	Blink	VPN connection is starting
	Off	VPN connection is disabled
Power/Error	On	Operating power is turned on
	Off	Operating power is turned off
Function	On	Device is starting
	Blink	Device is operating normally
Eth	On	Ethernet link is up
	Blink	Ethernet link is transferring data
	Off	Ethernet link is down
GPRS	Blink	GPRS is starting or transferring data
	Off	GPRS is inactive
AC and LINK LEDs	AC	Connected to AC power
	LINK	IEC 60870-5-104 control link to SCADA is active
Disconnectors ¹⁾	OPEN	Open position indication
	CLOSE	Close position indication
	LOCAL/REMOTE	Local/remote control indication
Grounding disconnectors ²⁾	OPEN	Open position indication
	CLOSE	Close position indication

1) Applicable for disconnectors 1, 2 or 3 (for REC603 – REC601 only has 1 disconnector)

2) Applicable for grounding disconnectors 1, 2 or 3 (for REC603 – REC601 only has 1 grounding disconnector)

Front panel description

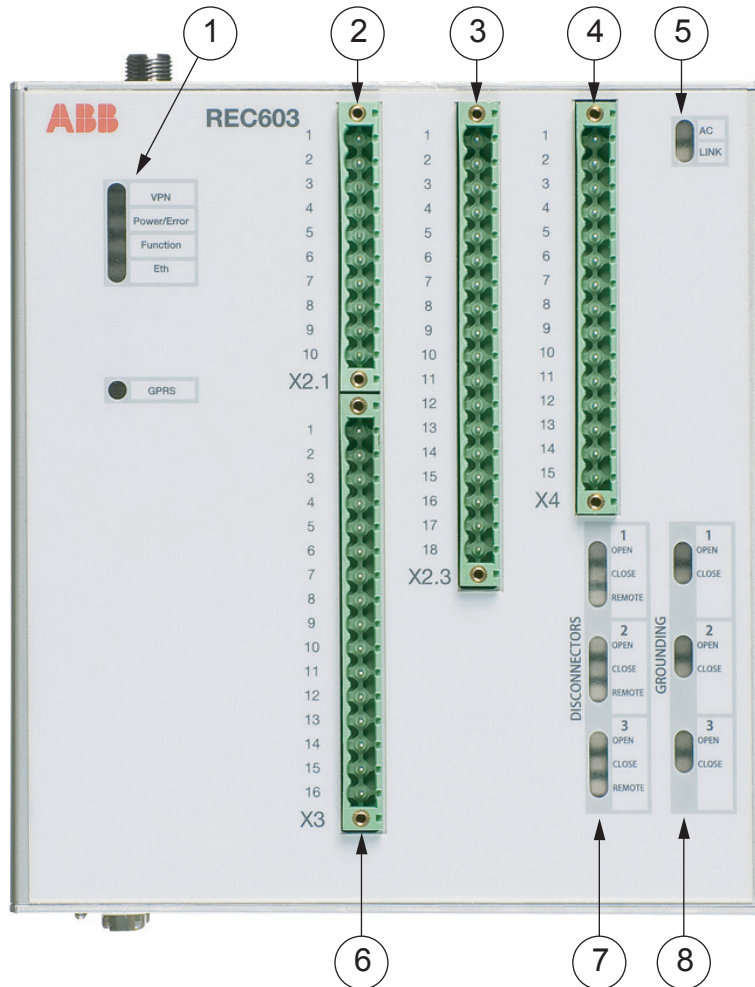


Figure 6. Front panel

1. System status LEDs
2. X2.1 connector
3. X2.3 connector
4. X4 connector
5. AC and LINK LEDs
6. X3 connector
7. Disconnector status LEDs
8. Grounding disconnector status LEDs

Serial panel description

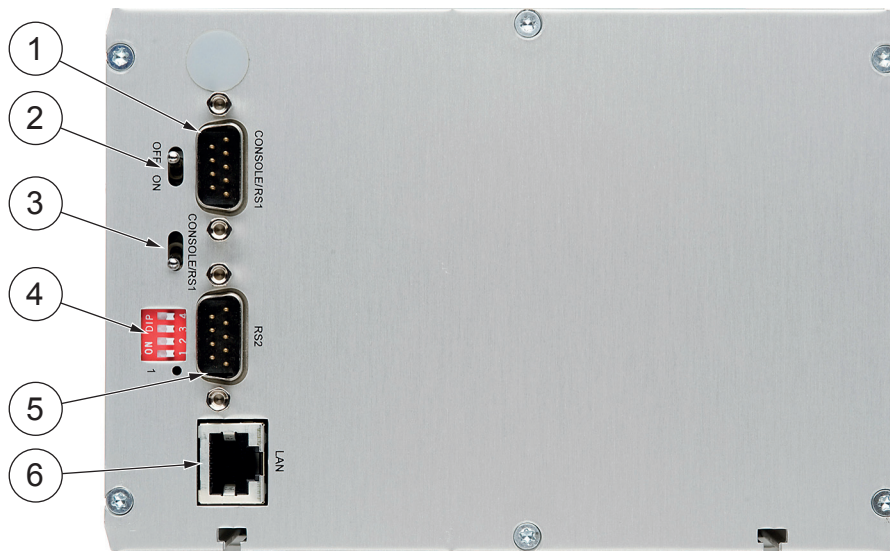


Figure 7. Serial panel

1. Console serial port (DIP switch selectable application or console port RS1)
2. Power switch
3. Serial console switch (RS1)
4. Serial port 2 hardware configuration DIP switches
5. Serial port 2
6. Ethernet connector

Antenna panel description

Both Wireless Controllers REC 601/603 have a SIM card insertion slot with SIM card tray and antenna connector on the antenna panel.



Figure 8. Antenna panel

1. SIM card tray connector
2. SIM card tray release button
3. Antenna connector (FME male)

6. Communication

The Wireless Controllers REC601/603 have wireless functionality that allows the use of wireless applications within the customer defined operator's network. High-speed wireless data transfer speed can be supported if needed, however the practical data transfer rates depend on the subscription details and wireless network capacity and bandwidth.

Operating within these wireless networks (GPRS/GSM) the Wireless Controllers REC601/603 may utilize the supported communication protocols. This offers flexibility in system design, allowing users to develop solutions for their own applications with high data availability and reliability. The devices are designed to withstand the operational requirements of most secondary substation environments and offer industrial quality connectivity devices for the IEC 60870 protocol family. The IEC 60870 protocol family is a vendor-independent communication standard for the power distribution industry.

Additionally, with the Wireless Controllers REC601/603 conventional IEC 60870-5-101 devices can be attached to a modern TCP/IP based IEC 60870-5-104 control system. Ethernet and GPRS/GSM data network interfaces provide a seamless communication solution for most of the applications.

REC 601/603 provides support for pre-selected Modbus parameters for Fault Passage Indicators. Currently, Horstmann Compass B and Kries IKI-50 are supported. The device polls the fault indicator devices using Modbus and converts the values to IEC 60870-5-104. Up to four fault indicators can be connected to the device.

IEC 60870-5-104 is used to communicate towards a SCADA via an approved M2M Gateway (available from ABB) over the available customer chosen GPRS/GSM data network. In the opposite direction IEC 60870-5-101 can be used to communicate with the devices in the field via the serial ports. This communication can also be done using the Ethernet port and a RJ-45 cable between the controlled device and the Wireless Controllers REC601/603.

The Wireless Controllers REC601/603 have two application serial ports. Serial port 1 is configurable to either console or data mode and supports only RS-232, while serial port 2 is configurable to multiple serial modes (RS-232/422/485). Serial port connectors are 9-pin D-sub (male) connectors.

More information is available in the Technical Data section of this product guide or technical manual available at www.abb.com/substationautomation.

7. Technical data

Table 2. Dimensions

Description	Value
Width x Height x Depth	150 x 177 x 135 mm (without antenna)

Table 3. Power Supply

Description	Value
Input voltage	85...200 VDC/ 90...264 VAC
Frequency range	45...65 Hz
Input current, 100% load, 230 VAC	0.8 A
Efficiency, typical (230 VAC, 100% load)	>83%
Isolation	Input / ground 1500 VAC RMS 50 Hz 1 min Input / output 3000 VAC RMS 50 Hz 1 min Output / ground 500 VDC
Inrush current 25°C, 230 VAC	<25 A <5 ms
Input fuse	T3.15 A high breaking
Overvoltage transient protection	VDR 275 VAC 72 J
Holdup time (230 V, 100% load)	>50 ms
Power consumption	10 W (not charging) ... 60 W (full charging)

Table 4. Battery recommendations

Description	Yasa NP 17-12	Yasa NPL 24-12
Rated voltage	12 V	12 V
Capacity	17 Ah	24 Ah long life
Weight	6.1 kg	9 kg
Size (LxWxH)	181 x 76 x 167 mm	166 x 175 x 125 mm

Table 5. Supply for external devices and input circuits (X2.1 pin 6)

Description	Value
Output voltage	21...29 V
Output current	1 A continuous, 3 A peak
Output overvoltage protection level	30.5 V

Table 6. Temperature-compensated charger for batteries

Description	Value
Rated charging voltage	27.4 V at 20 °C
Output power	60 W
Fuse	4 A
Temperature compensation	-40 mV/°C
Output overvoltage protection level	30.5 V

Wireless Controller	1MRS757423 C
REC601/603	
Product version: 1.2	

Table 7. Hardware

Description		Value
Processor Environment	Processor	32 bit RISC
	Memory	8 MB FLASH
		32 MB SDRAM
Other	Sensor	Temperature
	Internal clock	Real time
Approvals		CE
Environmental conditions	Temperature ranges	-40...+70 °C (operation)
		-40...+85 °C (transport and storage)
	Relative Humidity	5 to 85 % RH

Table 8. Software

Description	Value
Network protocols	PPP, IP, ICMP, UDP, TCP, ARP, DNS, DHCP, FTP, TFTP, HTTP, POP3, SMTP
Tunneling (VPN)	SSH-VPN client (requires M2M Gateway)
	L2TP-VPN client (requires M2M Gateway)
	SSH client
Management	WWW, SSH, Telnet and console FTP, TFTP and HTTP software update
Routing and firewall	Static routing, proxy ARP, port forwarding, IP masquerading/NAT, firewall
Serial device connectivity	Device server application (IEC 60870-5-104 GW)
	Simultaneous GPRS, CSD and SMS
	SMS configuration and status reporting
IEC 60870-5-104 and IEC 60870-5-101	IEC 60870-5-104 over TCP or UDP
	IEC 60870-5-101 FT 1.2 framing
	Local IEC 60870-5-101 polling
	ASDU replacer
	Packet compressor

Table 9. Physical interfaces

Description	REC601				REC603			
	Binary		Analog		Binary		Analog	
Inputs/Outputs	I	O	I	NTC	I	O	I	NTC
Physical signals	17	10	2	1	17	10	2	-
Application	RTU default configuration							
Disconnect control	-	2	-	-	-	6	-	-
Disconnect status	2	-	-	-	6	-	-	-
Grounding disconnect status	2	-	-	-	6	-	-	-
L/R status	1	-	-	-	3	-	-	-
Load control	-	1	-	-	-	1	-	-
Test load	-	1	-	-	-	1	-	-
Heater	-	1	-	-	-	1	-	-
Load measurement	-	-	1	-	-	-	1	-
Temperature measurement	-	-	-	1	-	-	-	1
General purpose input	12	-	1	-	2	-	1	-
General purpose output	-	5	-	-	-	1	-	-

Table 10. Digital inputs

Description	Value
Number of digital inputs	17
Operating range	18...60 VDC
Current drain	3.5...12.5 mA
Power consumption / input	< 0.8 W
Input polarity	Bipolar
Isolation	3 kV

Table 11. Digital outputs

Description	Value
Number of digital outputs	10
Max system voltage	110 VDC
Continuous carry 30 VDC	1 A
Continuous carry 110 VDC	0.3 A
Contact material	AgSnO ₂

Wireless Controller	1MRS757423 C
REC601/603	
Product version: 1.2	

Table 12. Network interfaces

Description	Value	
Ethernet	10/100 Base-T. Shielded RJ-45	
	1.5 kV isolation transformer	
	Ethernet IEEE 802-3, 802-2	
CSD (GSM data)	Up to 14.4 kbps	
	V.110	
	Non-transparent mode	
	USSD support	
	FME external antenna connector (50Ω) (Stub antenna included)	
GPRS	Bandwidth	Quad band (850/900/1800/1900 MHz)
	Module	Internal module and SIM card socket
	Class	Multi-slot class 20
		Mobile station class B
	Downlink speed	Max. 85.6 kbps
	Uplink speed	Max. 85.6 kbps
	Coding schemes	CS1...4
	Antenna connector	FME (50 Ω)
	Security	Via encrypted VPN
Serial Ports	Serial 1 / Console	RS-232
		IEC 60870-5-101 protocol support
	Serial 2	RS-232/422/485 (selectable)
		IEC 60870-5-101 protocol support

Table 13. Communication protocols

Master protocol	Slave protocol (RS1/RS2)
IEC 60870-5-104	IEC 60870-5-101
	Modbus profile for Kries IKI-50
	Modbus profile for Horstmann Compass B
	Serial gateway ¹⁾
IEC 60870-5-101	Modbus profile for Kries IKI-50
	Modbus profile for Horstmann Compass B

1) Serial port data stream is sent over TCP/IP

Table 14. Electromagnetic compatibility tests

Description	Type test value	Reference
Electrostatic discharge test:		EN 61000-4-2
• Contact discharge:	4 kV	
• Indirect contact discharge:	4 kV	
Conducted RF Immunity test:		EN 61000-4-6
• 150 kHz...80 MHz	3 V (rms)	
Radiated RF Immunity test:		EN 61000-4-3
• 80...2700 MHz	3 V/m (rms)	
Fast transient disturbance tests:		EN 61000-4-4
• All ports	1 kV	
Surge immunity test:		EN 61000-4-5
• AC power input ports	2 kV, line-to-earth 1 kV, line-to-line	
Voltage dips and short interruptions	0 % / 1 cycle 40 % / 10 cycles 70 % / 25 cycles	EN 61000-4-11
Emission tests:		CISPR 22 (EN 55022), Class B
• Conducted		
0.15...0.50 MHz	< 66 dB(μ V) quasi peak < 56 dB(μ V) average	
0.5...5 MHz	< 56 dB(μ V) quasi peak < 46 dB(μ V) average	
5...30 MHz	< 60 dB(μ V) quasi peak < 50 dB(μ V) average	
• Radiated		
30...230 MHz	< 35 dB(μ V/m) quasi peak, measured at 3 m distance	
230...1000 MHz	< 42 dB(μ V/m) quasi peak, measured at 3 m distance	
1000...3000 MHz	< 70 dB(μ V/m) quasi peak, < 50 dB(μ V/m) average, measured at 3 m distance	
3000...6000 MHz	< 74 dB(μ V/m) quasi peak, < 54 dB(μ V/m) average, measured at 3 m distance	

Table 15. EMC compliance

Description	Reference
Standard	ETSI EN 301489-1 (V1.8.1 2008-04) IEC 61000-6-1 (Second edition 2005-01) IEC 61000-6-3 (2006-07)

Table 16. RoHS and REACH compliance

Description
Complies with RoHS directive 2002/95/EC
Complies with REACH directive 2006/1907/EC

8. Mounting methods

The devices have been equipped with mounting arrangements that are specially designed to enable wall or rack DIN rail mounting inside the control cabinets. A set of DIN rail mounting clips is included with the devices. The specific mounting position is dependent on the intended application of the device, preferably inside a robust, weatherproof control cabinet.

As the device uses GPRS radio waves for data transmission, the surrounding environment can negatively affect the efficacy of these radio signals. Therefore, if you are using a device with the antenna mounted directly attached to the antenna connector (device with standard antenna without optional extension cable), try to avoid placing the unit in a location where the radio signal might be shadowed, and therefore deteriorated by nearby obstacles or enclosures.

Note also that large metallic surfaces, racks or walls with metallic structures (cabling, concrete iron, etc.) may degrade the antenna performance to a very high extent. In this case it is highly recommended to use the optional external antenna with appropriate cable. This allows for better positioning of the devices, antennas and thus optimal performance.

Another restriction to the positioning of the device, when installing it, is that it should be mounted in such a way that the required environmental conditions that are set in the Technical Data section of this Product Guide would also be met.

9. Ordering data

Product label is found on the top of the device and it contains the basic information about the product (for example product name) as well as unique data regarding the unit such as serial number and Ethernet MAC address.

The order number consists of a string of codes generated from the device's hardware and software modules.

Use the [ABB Library](#) to access the selection and ordering information and to generate the order number.

10. Accessories and ordering data

Certain equipment accessories can be attached to the devices to increase the flexibility and/or functionality of the devices according to the application requirements within the network. More information regarding these additions should be requested and discussed when planning and ordering the equipment from ABB Distribution Automation.

Replacement parts for the devices are also available from ABB. This includes all external parts or components of the

sold device that could have been damaged or lost. ABB does not supply internal components or parts. The external replacement parts, on the other hand, can be ordered from ABB After-Sales Service via Parts-OnLine www.abb.com/partsonline.

More information is also available from aftersales.relays@fi.abb.com

Table 17. Accessories

Item	Order number
Hall-effect current transducer	2RCA028227
Test load resistor	2RCA028171
Null-modem cable	2RCA027558
Roof antenna with 150cm cable	2RCA028207

Table 18. Supporting product

Item	Order number
M2M Gateway	2RCA028228
M2M Gateway Enterprise Edition	2RCA028229

11. Tools

The devices can be configured using a graphical user interface via a Web based browser (Internet Explorer 7 or later). A conventional console interface is also provided. Software updates or configuration adjustments for the devices can be made remotely by uploads over the network from the central control center.

For the purpose of configuring the device the default IP address configuration and configuration methods can be found from the Quick Start Guide provided with every device. All other documentation is available online from www.abb.com/substationautomation.



Summary

Ethernet

GPRS

Dial-in

SSH-VPN

L2TP-VPN

GRE tunnel

Monitor

Routing

S-NAT

D-NAT

DNS Update

DynDNS client

NTP client

SMS Config

Commit

Reboot

Logout

Ethernet Settings

Override Ethernet configuration by DHCP?	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
Host name	<input type="text" value="ABB"/>
Domain name	<input type="text" value="(none)"/>
Ethernet IP address	<input type="text" value="10.10.10.10"/>
Network mask	<input type="text" value="255.0.0.0"/>
Use Ethernet as default route (usually No)	<input type="text" value="Yes"/> <input type="button" value="v"/>
Default router IP address	<input type="text" value="10.10.10.1"/>
MTU	<input type="text" value="1500"/>
DNS servers (optional)	<input type="text"/>
MAC address	00:06:70:02:09:C9

Apply

Reset

Figure 9. REC601/603 WebHMI

12. Terminal diagrams

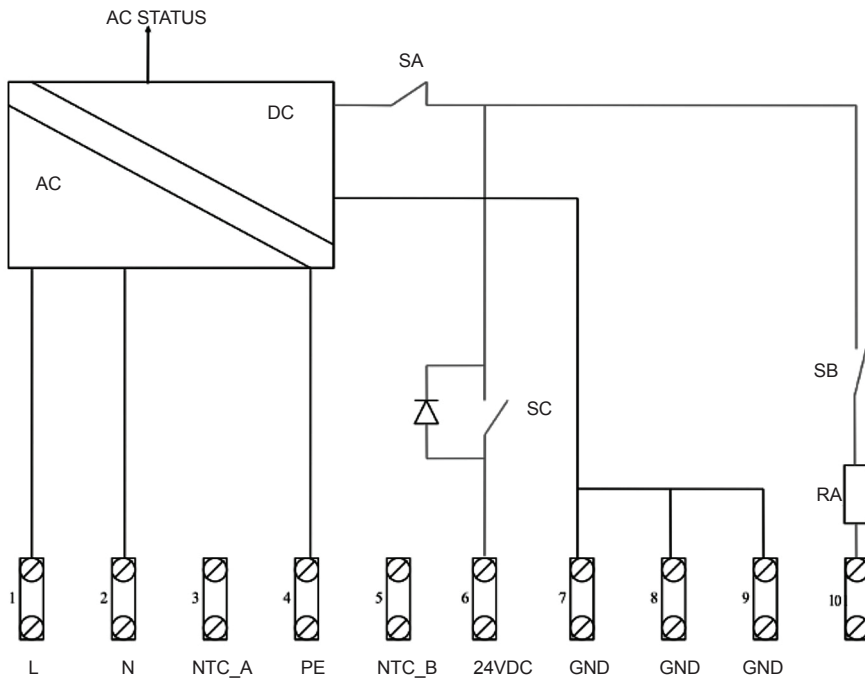


Figure 10. X2.1 connector schematics

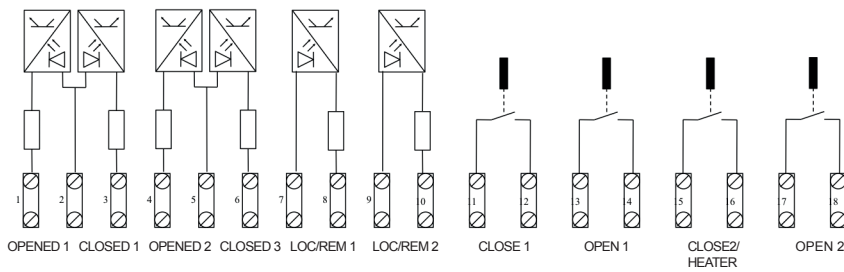


Figure 11. X2.3 connector schematics

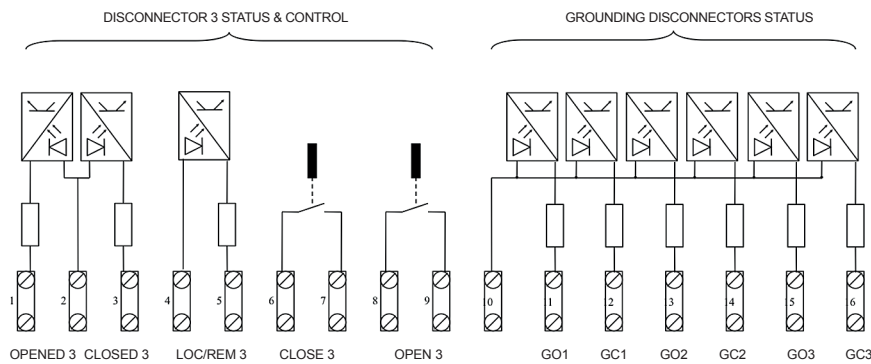


Figure 12. X3 connector schematics

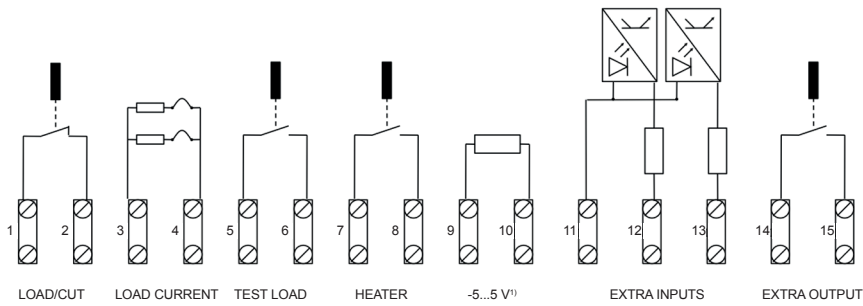


Figure 13. X4 connector schematics

1) Can be used as a 4...20 mA input using external resistor

13. References

The www.abb.com/substationautomation portal offers you information about the distribution automation product and service range.

You will find the latest relevant information on the above mentioned devices on the product pages.

The download area on the right hand side of the Web page contains the latest product documentation. The selection tool on the Web page helps you find the documents by the document category and language. The Features and Application tabs contain product related information in a compact format.

14. Document revision history

Document revision/date	Product version	History
A/2011-09-02	1.0	First release
B/2013-02-15	1.1	Content updated
C/2014-08-18	1.2	Content updated

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