RB600

USER MANUAL

GSM / GPRS

TELEORIGIN
UNIQUE TECHNOLOGY FOR TELEMETRY

Elproma Elektronika Sp. z o.o.
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Contents

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1. Overview

The RB600 Terminal is the complete modem solution for wireless m2m applications. Based on the high quality module, it is available as quad-band version and offers high level GSM/GPRS communication and GNSS receiver in a compact plastic housing with all the standardized interfaces. Together with its small size and wide supply voltage range, it is easy to integrate into all kinds of machines.

The RB600 terminal utilises TCP/UDP data transmission, SMS and SMTP communication. It is a universal solution for all low-volume M2M and mobile data applications including metering, traffic systems, transportation and logistics, security, vending machines and facility management.

Device can be controlled by standard AT commands or by customer's application, thus making it the smallest, complete SMT platform for m2m solutions.

This document contains full description of the RB600 modem and gives information about installation and using it.

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2. References

[1] Quectel_MC60_Series_AT_Commands_Manual_V1.0

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3. Package

3.1 Box

On the original box of the product you can find a product sticker. It should match the sticker on the modem. This is verification that your modem is an original product. More information about stickers in **Product sticker**.

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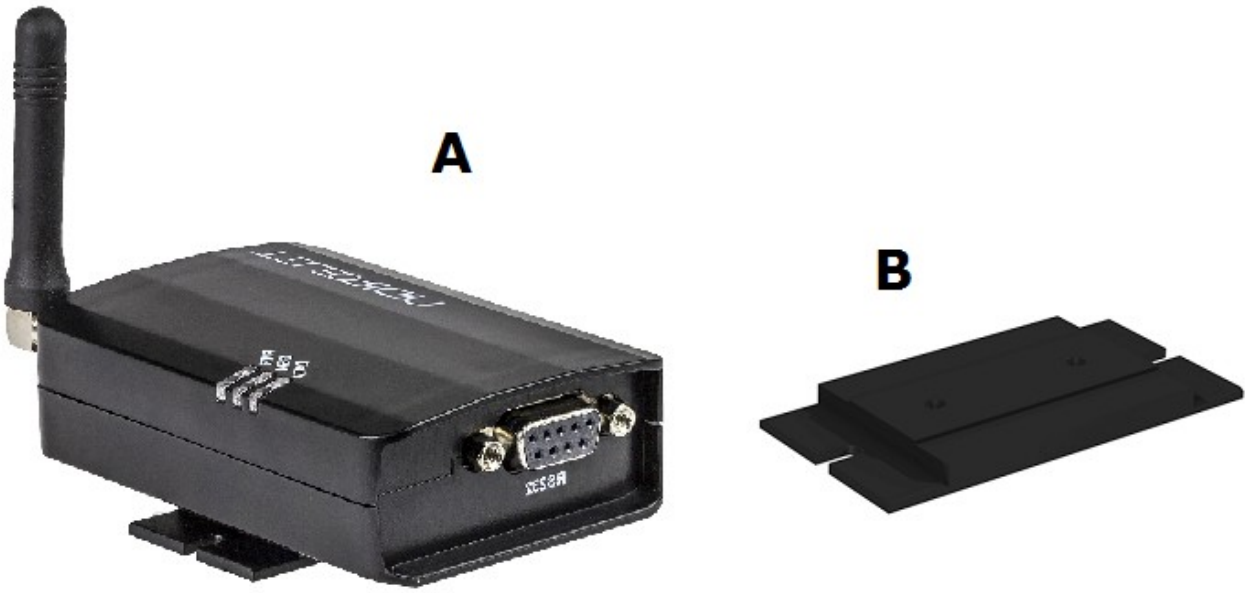
4. Complete package contents



Complete package contains:

- RB600 terminal (item A)
- Wall mounting bracket (item B)

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5. General presentation

5.1 Product pictures

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5.2 External connections

5.2.1 GSM antenna connector

The SMA antenna input is used to connect an external GSM antenna. To establish a connection with GSM network, an external antenna must be used. The type of antenna depends on GSM coverage. In good circumstances (level of received signal is high) use antenna which is included in the package. If the range of GSM is low or zero, an outdoor or indoor (for instance in a place where GSM range is sufficient) antenna should be used.
Note: *If there is no antenna connected to the SMA connector, connection with a GSM network is impossible.*

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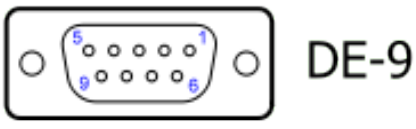
5.2.2 RS-232 Interface (EIA574)

RB600 terminal is equipped with an RS-232 interface (as shown below). A DE9 DSUB socket is connected via a voltage level translator circuit to the GSM module.

Table of RS-232 DB9 pins:

Pin No.	Name	Dir	Description
1	DCD	IN	Data Carrier Detect. Raised by DCE when modem synchronized.
2	RD	IN	Receive Data (a.k.a RxD, Rx). Arriving data from DCE.
3	TD	OUT	Transmit Data (a.k.a TxD, Tx). Sending data from DTE.
4	DTR	OUT	Data Terminal Ready. Raised by DTE when powered on. In auto-answer mode raised only when RI arrives from DCE.
5	SGND	-	Ground
6	DSR	IN	Data Set Ready. Raised by DCE to indicate ready (optionally RS485 A)
7	RTS	OUT	Request To Send. Raised by DTE when it wishes to send. Expects CTS from DCE.
8	CTS	IN	Clear To Send. Raised by DCE in response to RTS from DTE.
9	RI	IN	Ring Indicator. Set when incoming ring detected - used for auto-answer application. DTE raised DTR to answer (optionally RS485 B)

DE-9 (EIA/TIA 574)
View of the female connector



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5.2.3 Power supply connector

The power supply connector is a 2-pin connector for an external DC power supply connection, which can handle voltage from range 5..30 V DC, 2.5 W max. continuous power.

No.	Singal	I/O	Description
+	V+BATTERY	I	5 V – 30 V DC
-	GND	-	Ground

Attention!
An attempt to power up the terminal from a DC source outside of 5..30 V range may result in the physical destruction of the device.

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5.2.4 SIM card holder

A SIM card holder is placed at the front of RB600 terminal (as shown below) and is accessible externally. To insert a SIM card into the holder, press the **yellow button**, eject the little drawer, place the SIM card inside and insert the drawer into the modem (you will hear a click). To operate the module in a GSM network, it is necessary to insert a SIM card obtained from the network operator.

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5.3 Product sticker

Product stickers are on the modem and on the box of the product.
A product sticker includes the following information:

- product serial number (IMEI) and model signature
- manufacturer address
- the CE marking
- the 15-digit bar code (box sticker only)

Device sticker

Box sticker

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6. Basic features and services

Basic features and available services for the RB600 are contained in the table below.

Feature/service	Description
Standard	Supported Bands: GSM/GPRS Quad-band 850/900/1800/1900 Mhz Physical: • 83 x 53,5 x 25 mm • Weight 89 g
Speed	GPRS class 33 CSD up to 9.6 kbps DTM (Dual Transfer Mode)
Interfaces	Connectors • SMA antenna SIM Card • 3.0V / 1.8V • STK 3.1 Connectivity • UART: BR from 300 bps to 115.2 Kbps • Auto BR
SMS	• MO / MT Text and PDU mode • Cell broadcast • SMS over GPRS
GSM supplementary services	• USSD phase II • Advice of charge
GPS receiver	Oprional
Power supply	5V – 30V DC

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7. Using the modem

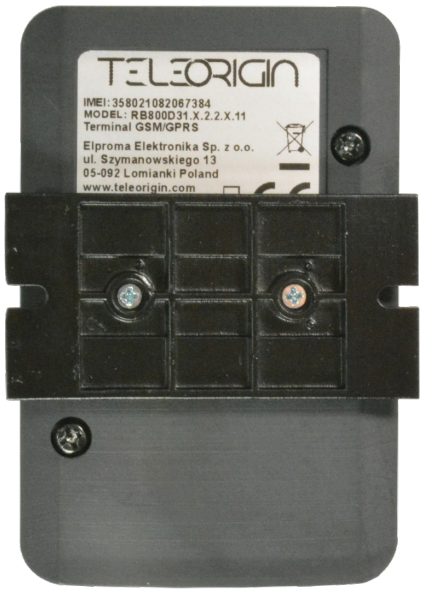
7.1 Setting up the modem

To set up the modem, do the following steps:

- Eject the SIM card holder using the yellow button and pull out the drawer.
- Insert your SIM card into the drawer.
- Make sure the SIM card fits into the drawer properly.
- Insert the drawer into the modem. Connect the antenna to the SMA connector
- Optionally, the modem can be connected using the RS-232 interface
- Plug the power supply cable to the power supply input
- **Now the modem is ready to work.**

7.2 Mounting the modem on the wall

To mount the modem on the wall, install the wall mounting bracket as shown below:



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7.3 Checking the communication with the modem

Once the modem is connected, you can check communication between the RB600 terminal and the PC using Telit AT Controller available here:
http://teleorigin.com/file_upl/pliki/1/Telit_AT_Controller.zip
Alternatively, you can use any Terminal program. Configuration of the DTE (port COM) should be as follows:

- Bits per second: **115200 bps**,
- Data bits: **8**,
- Parity: **None**,
- Stop bits: **1**,
- Flow control: **hardware**.

To communicate with the modem, use software such as Hyperterminal (AT commands) or use the attached Telit AT Controller.

Using a communication software such as Hyperterminal, enter the ***AT*** and **push 'enter'** button. The response of the terminal should be '***OK'*** displayed in the Hyperterminal window.

If the connection with the modem cannot be established do the following:

- Check if the modem is connected with your PC via RS-232 or USB.
- Check the configuration of the COM port.
  Examples of AT commands:
- ***ATE1*** enables modem echo function,
- **AT+CGMI** modem answers “Quectel” when the connection is OK.
- **AT+CPIN?** shows the current status of the SIM card
- **AT+CPIN=xxxx** enter your PIN, where 'xxxx' are digits
- **AT+CSQ** to verify received signal strength
- **ATD<phone_number>;** to initiate a voice call
- **ATH** to hang up a voice call

For further information about AT commands and their usage, refer to [1].

7.4 Status of the modem (LEDs)

The operational status of the RB600 Terminal is shown by external LEDs placed on the front panel of the modem.

The table below shows the meaning of the LEDs.

LED name	LED colour	Description
DATA	blue	Software controlled using AT
GSM	orange	Off – GSM module is not running 64ms On/800ms Off – module is not synchronized with network 64ms On/2000ms Off – module is synchronized with network 64ms On/600ms Off – GPRS data transmission after dialing the PPP connection
PWR	green	Lights when modem is power on

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7.5 Disabling and enabling echo function

If echo is not displayed when entering an AT command, that means:

- The local echo function in software (such as Hyperterminal) is disabled
- The echo function of the modem is disabled

To enable echo function of the modem enter the ***ATE1*** command.

In Machine to Machine communication it is recommended to disable echo function (type ***ATE0***) in order to avoid non-essential CPU usage.

For further information about the ***AT*** commands and their usage, refer to [1].

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7.6 Verifying the signal strength

The RB600 terminal can establish a connection with a network if the received signal strength is sufficiently strong.

To verify the signal strength and bit error rate, do the following:
Using software such as Hyperterminal enter ***AT+CSQ***. This command displays the received signal strength indication <rssi> and channel bit error rate <ber>. The modem answers as follows:

+CSQ: <rssi>,<ber>
OK

<parameter>	Description
<rssi>	0 through 31 - covers the range of -113 dbm (or less) to -51dbm (or greater)
<ber>	Channel bit error rate (in percent) 0–7 RXQUAL values in the GSM 05.08 table 99 Unknown or not detectable

For further information about ***AT*** commands and their usage, refer to [1].

7.7 PIN code status

To check PIN code status enter ***AT+CPIN?*** Command.
The table below shows the most interesting responses of the modem:

Answer	Description
+CPIN: SIM PIN	PIN code has not been entered
+CPIN: READY	PIN code has been entered correctly

For further information about ***AT*** commands and their usage, refer to [1].

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7.8 Network registration

7.8.1 GSM network registration

To check the *GSM* network registration status enter ***AT+CREG?*** into the software (for instance Hyperterminal). The modem will answer in the following format:

+CREG: <n>,<stat>[,<lac>,<ci>]
OK

The following table shows the *+CREG* parameters:

<parameter>	Description
<n>	**0** Disables the network registration unsolicited result code. **1** Enables the network registration unsolicited result code +CREG: <stat>. **2** Enables the network registration and location information in unsolicited reports and Read command +CREG:<stat>[,<lac>,<ci>]. The default is **0**.
<stat>	**0** Not registered, and the ME is not currently searching for a new operator to which to register. **1** Registered, home network. **2** Not registered, but the ME is currently searching for a new operator to which to register. **3** Registration denied.* **4** Unknown. **5** Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format
<ci>	Two-byte cell ID in hexadecimal format.

*To manage connecting to a network, SIM card inserted into the modem must be valid.
For further information about ***AT*** commands and their usage, refer to [1].

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7.9 GPRS network registration

To check *GPRS* network registration status enter ***AT+CGREG?*** into the software (for instance Hyperterminal) Modem will answer in the following format:

+CGREG: <n>,<stat>[,<lac>,<ci>]
OK

The following table shows the *+CGREG* parameters:

<parameter>	Description
<n>	**0** Disables the network registration unsolicited result code. **1** Enables the network registration unsolicited result code +CGREG: <stat>. **2** Enables the network registration and location information in unsolicited reports and Read command +CGREG:<stat>[,<lac>,<ci>]. The default is **0**.
<stat>	**0** Not registered, and the ME is not currently searching for a new operator to which to register. **1** Registered, home network. **2** Not registered, but the ME is currently searching for a new operator to which to register. **3** Registration denied.* **4** Unknown. **5** Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format
<ci>	Two-byte cell ID in hexadecimal format.

*To manage connecting to a network SIM card inserted into the modem must be valid.

For further information about ***AT*** commands and their usage, refer to [1].

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7.10 AT commands summary

As a conclusion table below shows most common and useful AT commands.
For more AT commands refer to [1].

Action	Syntax	Response	Comments
Echo enable	**ATE1**	OK	Typed text is seen.
Echo disable	**ATE0**	OK	Typed text is not seen.
Voice call	**ATD<phoneNo>;** Remember of ';'	OK	Call initiated.
		NO CARRIER/BUSY/NO ANSWER	Connection failure.
		+CME ERROR: <err>	General error*
		OPERATION NOT ALLOWED	Security reason (such as SIM card not inserted)
		UNKNOWN CALLING ERROR	Unknown reason
Hung up call	**ATH**	NO CARRIER	Connection is hanged up.
Receiving call	**ATA**	OK	Call is answered.
Communication loss		NO CARRIER	
Enter PIN code	**AT+CPIN=[<puk> or <pin>], [<newpin>]**	OK	Set PIN or PUK or new PIN code.*
		+CME ERROR: <err>	General error*
Check PIN code status	**AT+CPIN?**	+CPIN: <code> OK	Returns status of PIN. e.g. READY or SIM PIN
		+CME ERROR: <err>	General error*

*Refer to [1].

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8. Troubleshooting

8.1 No connection/communication with the modem

If there is no communication with the modem following these steps:

- Check all external connections on the modem (RS-232 or USB, Power supply)
- Verify if power supply is correct (see **Power supply**)
- Check if COM port is correctly parametrized
- Check if the program used for communication works properly and if there is no other program interfering. If yes, close the interfering program.

8.2 Receiving an ERROR message

The modem answers ***ERROR*** on AT command in following cases:

- The syntax of typed AT command is incorrect – check the command syntax in [1]
- The parameters of typed AT command are incorrect – type ***AT+CMEE=1*** to enable an accurate description of the error that occurred. The response will now be in this format:

  ERROR
  +CME ERROR: <err>
  where <err> is a description of the error that has occurred
- Refer to [1] for further details about occurred error

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8.3 Receiving NO CARRIER message

There are some common cases when modem answers ***NO CARRIER:***

- If a data/voice/fax connection cannot be established
- Right after hanging up the data/voice/fax connection
- If there is no connection with a network – check antenna and registration status (see **Network registration**)
- If there is no power supply (see **Power supply)**

If modem answers ***NO CARRIER*** in some cases, you can have extended error code using ***AT+CEER.*** The table below shows some of the codes which may appear.

Error code	Description
1	Unassigned or unallocated number
3	No route to destination
6	Channel unacceptable
8	Operator determined barring
16	Normal call clearing
17	User busy
18	No user responding
19	User alerting, no answer
21	Call rejected
22	Number changed
27	Destination out of order
28	Invalid number format (incomplete number)
34	No circuit/channel available
38	Network out of order
41	Temporary failure

For further information about ***AT*** commands and their usage, refer to [1].

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9. Technical characteristics

9.1 Mechanical characteristic

Max. dimensions	72 x 53.5 x 26 mm (w/o connectors) 83 x 53.5 x 26 mm (w/ connectors)
Weight	≈ 89 g
Volume	100 cm^3 (w/o connectors)

9.2 Housing description (dimensioning diagram)

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10. Electrical characteristic

10.1 Power supply

- Nominal voltage range: 5..30 V, 10%
- Maximum continuous (average) supply power: 2.5 W
- Maximum continuous (average) supply current: 200 mA at 12V

10.2 RF characteristics

Mode	Freq. TX (MHz)	Freq. RX (MHz)	Channels (ARFC)	TX - RX offset
GSM 850	824.2-848.8	869.2-893.8	124 ÷ 251	45 MHz
EGSM 900	890.0 - 914.8	935.0 - 959.8	0 ÷ 124	45 MHz
	880.2 - 889.8	925.2 - 934.8	975 ÷ 1023	45 MHz
DCS-1800	1710.2 - 1784.8	1805.2 - 1879.8	512 ÷ 885	95 MHz
PCS1900	1850.2-1909.8	1930.2-1989.8	512 ÷ 810	80 MHz

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10.3 External antenna

The external antenna is connected to the modem via a SMA connector.
The antenna must have parameters as shown below in the table.

Antenna frequency range	Dual-band GSM 900/1800 MHz
Impedance	50 Ω
DC impedance	0 Ω
Gain	0 dBi w/o cable; 2dBi w/ cable
VSWR (with cable)	-10 dB

The antenna chosen for working with the modem should best fit to the circumstances of the environment it is used in. When the modem is placed in a room or somewhere where the range of networks signal is too low, the outdoor or a suitable indoor antenna should be used to boost the strength.

10.4 Environmental specification

The table below gives the environmental operating conditions of the RB600 terminal.

Attention!
Exceeding the values may result in permanent damage of the module.

Parameter	Conditions	Min	Max	Unit
Ambient Operating Temperature		-20	60	°C
Storage Temperature		-40	85	°C
ESD	At antenna connector Contact Air At interface connector		 ± 6 ± 15 ± 1	KV
Humidity		5	85	%

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11. Safety recommendations

11.1 General Safety

Please follow the safety regulations regarding the use of radio equipment due to the possibility of radio frequency interference. Read given information carefully.

Switch ***off*** GSM terminal when:

- in an aircraft – using cellular telephones in aircraft may endanger the operation of the aircraft; it is illegal
- at a refuelling point
- in any area with a potentially explosive atmosphere which could cause an explosion or fire
- in hospitals and any other places where medical equipment is in use

Respect restrictions on the use of radio equipment in any area or place where there are signs stating that the use of cellular telephones is forbidden or dangerous.

Using a GSM modem close to other electronic equipment may also cause interference if the equipment is inadequately protected. It may lead to damage or failure of GSM modem or the other equipment.

11.2 Care and Maintenance

The RB600 terminal is an electronic product that should be treated with care. Please follow the suggestions shown below.

- Do not expose the RB600 to any extreme conditions like high temperatures or high humidity
- Do not keep modem in dirty and dust places
- Do not disassemble the RB600 modem
- Do not expose the modem to any water, rain or steam
- Do not drop, shake or knock your modem
- Do not place your modem close to magnetic devices – credit cards, etc
- The use of third party equipment or accessories, not made or authorized by Elproma Electronics may invalidate the warranty of the modem and/or cause failure or permanent damage to the modem
- Do not expose the modem to children under 3 years of age

11.3 Responsibility

The modem is your responsibility. Please treat it with care, and respect local regulations. This is not a toy – keep it out of the reach of children.

It is recommended to use the security features (PIN etc.) to block unauthorized use or theft.

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12. Conformity Assessment Issues

The RB600 has been assessed in order to satisfy the essential requirements of the RED 2014/53/EU to demonstrate the conformity with the harmonised standards with the final involvement of a Notified Body.

CE

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13. Safety Recommendations

READ CAREFULLY

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc
- Where there is a risk of explosion such as gasoline stations, oil refineries, etc

It is the sole responsibility of the user to enforce the country's regulations and the specific environment regulation.

Do not disassemble the product; any sign of tampering will compromise the warranty validity.

We recommend following the instructions of the hardware user guides for a correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conform to the security and fire prevention regulations.

The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. The same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product; therefore, care has to be taken to the external components of the module, as well as of any project or installation issue, because the risk of disturbing the GSM network or external devices or having an impact on security. Should there be any doubt, please refer to the technical documentation and the current regulations in force.

Every module has to be equipped with a proper antenna with the correct specifications. The antenna has to be installed with care, in order to avoid any interference with other electronic devices, and has to maintain a minimum distance from people (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulations.

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14. List of Acronyms

ACM	Accumulated Call Meter
ASCII	American Standard Code for Information Interchange
AT	Attention commands
CB	Cell Broadcast
CBS	Cell Broadcasting Service
CCM	Call Control Meter
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CMOS	Complementary Metal-Oxide Semiconductor
CR	Carriage Return
CSD	Circuit Switched Data
CTS	Clear To Send
DAI	Digital Audio Interface
DCD	Data Carrier Detected
DCE	Data Communications Equipment
DRX	Data Receive
DSR	Data Set Ready
DTA	Data Terminal Adaptor
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Equipment Institute
FTA	Full Type Approval (ETSI)
GPRS	General Radio Packet Service
GSM	Global System for Mobile communication
HF	Hands Free
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IRA	Internationale Reference Alphabet
ITU	International Telecommunications Union
IWF	Inter-Working Function
LCD	Liquid Crystal Display

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LED	Light Emitting Diode
LF	Linefeed
ME	Mobile Equipment
MMI	Man Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
OEM	Other Equipment Manufacturer
PB	Phone Book
PDU	Protocol Data Unit
PH	Packet Handler
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PUCT	Price per Unit Currency Table
PUK	PIN Unblocking Code
RACH	Random Access Channel
RLP	Radio Link Protocol
RMS	Root Mean Square
RTS	Ready To Send
RI	Ring Indicator
SAR	Specific Absorption Rate (e.g. of the body of a person in an electromagnetic field)
SCA	Service Center Address
SIM	Subscriber Identity Module
SMD	Surface Mounted Device
SMS	Short Message Service
SMSC	Short Message Service Center
SPI	Serial Protocol Interface
SS	Supplementary Service
TIA	Telecommunications Industry Association
UDUB	User Determined User Busy
USSD	Unstructured Supplementary Service Data

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15. On-line support

Elproma provides a range of on-line support which includes:

- the latest version of this document
- the latest drivers for the RB600
- technical support

This information can be found on our web sites at **www.teleorigin.com**

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