

RA440 Remote Wireless Modem

User Guide





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Chapter 1. Introduction

This manual explains the hardware aspects of Adcon's RA440 remote wireless modems, including installation issues and certain parameter configurations. The manual is divided as follows:

- *Introduction*, which gives some general information and document conventions.
- *Using the RA440*, which details the installation and use of the remote wireless modem.
- *Performing Advanced Functions*, which discusses connectors and controllers and provides other information for advanced users.
- *Specifications*, which describes operating parameters for the devices.

About the RA440 remote wireless modem

The RA440 remote wireless modem is a low-power, medium-range modem device that is capable of communicating with an A733 by using Adcon's radio protocol and an A850 Gateway over a GPRS connection to respond to data polling requests.

The unit incorporates an A431 radio module operating in the 432 to 470 MHz frequency range, making it adaptable to most radio communication regulations in the world. The output power is 500 mW, while the modulation is narrow-band FM (20 or 25 kHz channel spacing). Additionally the RA440 incorporates a GSM/GPRS module and uses the standard GSM network for retrieving commands (900/1800 MHz in Europe, 850/1900 MHz in the US).

Due to its construction as well as to the software controlling it, the power consumption is extremely low. The unit operates off an internal 6.2 volt rechargeable battery, which is charged either by a solar panel or an external power adapter. A special configuration can be implemented where an external 12 volt (rechargeable) battery can be used in addition to or instead of the internal rechargeable batteries. The external rechargeable battery will not be recharged by the RA440.

The RA440 is a ruggedized unit, complying with the IP65 environmental protection class (NEMA 4). You can easily install and integrate the unit into an Adcon A733 network. Depending on the topography, you can get a reliable wireless connection to an A733 series device up to 20 km (12 mi.) away. Under favorable conditions, the distance can be even farther. You should be aware that the RA440 operates within the GSM/GPRS network coverage provided by your local cellular provider.

Compliance statement and warnings

The RA440 remote wireless modem must not be used with any antenna other than the one supplied by Adcon (or an antenna with identical technical specifications). A minimum distance of 20cm (7.9 in.) to the antenna is required to guarantee compliance with basic safety restrictions.

In conformity with EC Parliament recommendation 1999/519/EG, 28V/m is the reference value for the frequency range used. By adhering to any and all recommended reference levels, you can ensure compliance to basic restrictions that protect the general public against electromagnetic fields.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:



1. This device must not cause harmful interference.
2. This device must accept any interference received, including interference that might cause undesired operation.

Changes or modifications not expressly approved by Adcon Telemetry for compliance could void your authority to operate the equipment.

Conventions

Certain conventions apply in this document.

<i>Italics</i>	Indicate that the text is variable and must be substituted for something specific, as indicated in the explanation. Italics can also be used to emphasize words as words or letters as letters.
Bold	Indicates special emphasis of the text. Also indicates menu names and items in a window.

<code>fixed font</code>	Indicates characters you must type or system messages.
File ▶ Save	Indicates menu selection. For example, select the File menu, then the Save option.
Note	Indicates information of interest. Notes appear after the information they apply to.
 CAUTION	Indicates that you may get unexpected results if you don't follow the instructions. Cautions appear before the information they apply to.
 WARNING	Indicates danger to yourself or damage to the device if you don't follow the instructions. Warnings appear before the information they apply to.

Chapter 2. Using the RA440

The RA440 remote wireless modem is part of Adcon's radio communication network. For testing purposes, you should have an A850 Telemetry Gateway preinstalled and an Adcon RTU next to you, before you install the RA440. An active SIM card is also necessary. For information about installing the A850, refer to device's user's guide.

Opening the package

The RA440 remote wireless modem package contains the following items:

- RA440 unit
- GSM/GPRS antenna (short antenna in the package)
- ISM antenna including a mounting bracket and a 3 m (9 ft.) cable
- three ring clamps (one for tightening the mounting bracket of the ISM antenna)
- several documents, including an installation guide and IMEI - notice

If ordered, the following items come in separate packaging:

- solar panel with ring clamp
- set of aluminum poles
- LED tool

Make sure you have received all the equipment and read through the instructions that follow. After proper understanding of all listed instructions, you are ready to install your RA440.

Installing the remote wireless modem

Two views of the RA440 are shown in Figure 1 and Figure 2.

The following restrictions apply:

- In general, the typical “line-of sight” distance the RA440 can communicate is 10 km (6 mi.). This is valid if both the ISM antenna of the remote wireless modem and the antenna of its partner device are mounted on a 3 m mast (9 ft.).



Figure 1. RA440 Remote Wireless Modem (bottom up)

Note: *The results may vary under different conditions, and you can sometimes achieve longer (or shorter) distances.*

The above does not apply for the transmission between the RA440 and the A850. In principle no distance limit exists for this transmission type as long as your cellular provider covers the area where the RA440 is installed.



Figure 2. RA440 Remote Wireless Modem (top down)

- The GSM/GPRS antenna and the ISM antenna must be separated by at least 1 meter (3 feet).
- As with all wireless communication devices, the higher the transmitter is installed, the better the communication will be.

Special notes on GSM/GPRS functionality

The RA440 incorporates a GSM/GPRS modem that uses a GSM cellular network to interact with the A850 gateway. The data is transmitted using a GPRS data transmission. Before you install the remote wireless modem you must make sure that a sufficient cellular network signal (including GPRS coverage) exists within the area you will use the RA440.

Note: *You can use a standard mobile phone operating with the planned cellular provider to determine whether you have the proper network coverage. Most mobile phones have some sort of symbol on their display to show if GPRS connectivity is available.*

You also need to insert that cellular provider's SIM card into the RA440's SIM card holder to enable proper operation. Follow these steps to do so:

1. Open the lid of the RA440 by unscrewing the four bolts in the corners of the unit and opening the lid onto the right side as shown in Figure 3 and Figure 4.

Note: *To open or close the lid of the RA440, use a 5mm hex key (also called an Allen wrench/key).*



Figure 3. Loosen the Bolts on the RA440



Figure 4. Lift the RA440 Lid

2. Locate the SIM card holder and open it by sliding it as indicated in Figure 5.



Figure 5. Open the SIM Card Holder

3. Raise the holder top and slide the SIM card into it (see Figure 6).



Figure 6. Insert the SIM Card into the Holder

4. Snap the holder top back on and slide it back as shown in Figure 7.

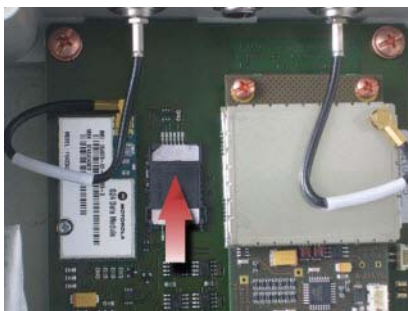


Figure 7. Close the SIM Card Holder

5. Close the lid, taking care that the rubber gasket seal is inside its track and free of dust or dirt.
6. Put the four screws back in place, applying moderate force, tightening crosswise. Be sure not to overtighten the screws or leave them too loose. For additional information, please contact

Adcon Telemetry or your local reseller of Adcon Telemetry products.

This completes the SIM-card installation. Now you need to activate the card by using a personal identification number (PIN). This number is in the package you received from your cellular service provider.

Before you can activate your card, the RA440 must be properly powered. As the units are delivered from the factory with the batteries uncharged (they have a longer shelf life in this state), you must charge the batteries first. The best way to do this is to attach the solar panel to the solar connector and expose the panel to sunlight for at least one hour. If the sky is overcast the battery will still charge, but at a lower rate; in this case allow at least four hours for charging.

To enter the PIN you need a serial adapter cable. If you do not have one, you can get it from Adcon Telemetry or your reseller. When you have the cable, proceed as follows:

1. Connect the serial cable from the COM port of your PC to the solar input of the RA440. Configure your terminal as follows:
 - 19200 baud
 - 1 stop bit
 - 8 data bits
 - no parity
 - no handshaking protocol (neither hardware nor software)For more details, see “Communicating with the RTU” on page 25. The unit will display a prompt, which is the unit's ID followed by a hash sign (#).
2. Enter the command `GSM PIN nnnn` (where *nnnn* is the PIN code). If the PIN conforms to the standard PIN format requirements, the modem will answer `ID GSM PIN #`, where the hash mark represents the modem's ID number (a zero indicates an invalid PIN, so check with your provider if you get a zero).

This completes the PIN entry procedure. After a few minutes of initialization you can check the status of the RA440 at any time by entering the `GSMSTAT` command. This command returns a list of GSM parameters:

```
# gsmstat
42395 gsmstat
Power supply on: yes
DTR on: yes
DCD on: yes
RI on: no
RTS on: yes
CTS on: no
Modem on: yes
Modem present: yes
Modem initialized: yes
SIM card present: yes
```

```
PIN required: yes
PIN accepted: yes
PIN count: 3
PUK required: no
GSM network: registered
Operator: T-Mobile Austria
Signal quality: 31 99
Phone call: no
GPRS network: registered
IP address: no
TCP connection: no
0
#
```

The above system output shows that:

- The GSM/GPRS modem is present and activated.
- A valid SIM card is inserted.
- The SIM card was activated with the valid PIN code.

Note: *The user can enter the PIN code a maximum of three times. Because the PIN count in the example shows three entries left, the PIN code was correctly entered on the first try.*

- A GSM network was detected with the operator name *T-Mobile Austria*.
- The signal quality range is between 1 and 31, where 31 is the best possible cellular coverage.

Note: *The parameters GPRS network, IP address, and TCP connection change after the GPRS settings are entered.*

To enable the data connection between the A850 and the RA440, certain steps must be executed. These steps are split into three sections:

1. Configuring the GPRS parameters
2. Configuring the TCP parameters
3. Configuring the A850-RA440 Connection settings

Configuring the GPRS parameters

Prepare the GPRS parameters provided by your cellular network provider to enable proper GPRS operation of the RA440. Following are the GPRS configuration settings:

```
GPRSAPNSERV "[servername]"
```

where *[servername]* is the name of the network provider's GPRS access server (required)

```
GPRSAPNUN "[username]"
```

where *[username]* is the name of the GPRS user's name for the network provider (might be optional)

```
GPRSAPNPW "[password]"
```

where *[password]* is the password for the GPRS user (might be optional)

The following examples show the GRPS parameters for an Austrian mobile phone services provider:

```
GPRSAPNSERV "A1.net"
```

```
GPRSAPNUN "ppp@Alplus.at"
```

```
GPRSAPNPW "ppp"
```



CAUTION

Parameter values are case sensitive. Be sure to correctly spell the values of the GPRS parameters and use the appropriate case. Misspelled names/entries could cause the RTU not to connect to the GPRS network or A850.

Configuring the TCP Parameters

The RA440 will connect to the A850 only if the following TCP connection parameters are set properly:

```
GPRSCONNADDR "[a850-ipaddress]" "[portnumber]"
```

where *[a850-ipaddress]* is the IP address of the A850 the RA440 has to connect to and

[portnumber] is the port number where the communication with the gateway will occur; the IP address parameter must be in decimal dotted notation, e.g. 198.182.196.56 (required)

```
GPRSDNS "[ipaddress]"
```

where *[ipaddress]* is the DNS server address of your GPRS network operator (optional)

Note:

*When using an Internet firewall in front of the LAN where the A850 Telemetry Gateway resides, be careful to properly configure the firewall and the GPRSCONNADDR parameters *[a850-ipaddress]* and *[portnumber]*. This is particularly important if you use NAT (network address translation) on your firewall.*



CAUTION

If you are using an Internet firewall in front of your A850 Telemetry Gateway, allow connection to devices only with IP addresses from your GPRS network operator's IP networks to your A850 Telemetry Gateway. When your GPRS network operator's IP network addresses changes, you must adjust your firewall's filters appropriately.

Configuring the RA440 GPRS connection settings

Use the following commands to define the intervals the RA440 will wake up and connect to the A850 Telemetry Gateway:

- GPRSCONNALIGN** [*align*]
alignment of calls in seconds (default: 0, i.e. 00:00 = midnight)
- GPRSCONNINT** [*interval*]
interval in seconds between two connection attempts (default: 3600)
- GPRSSECRET** [*secret*]
this 32-bit integer (0 -4294967295) has to be set for the RA440 and the gateway; this is a shared "secret" or password
- GPRSTMOUT** [*interval*]
idle timeout in seconds (default: 3600); connections that are idle this long will be terminated by the RA440

Set these parameters according to the needs of your application. Make sure you choose the proper parameters for GPRSTMOUT (to allow for appropriate idle times, but not ones that are too long), GPRSCONNALIGN, and GPRSCONNINT (for specifying the proper connect times of the RTU). Also take into account that the RA440 will be polled for data requests by the Adcon Telemetry Gateway within the GPRSTMOUT time.

After entering all parameters correctly, you can check your settings at any time by entering the **GSMSTAT** command again. With the GPRS parameters set, the response will be similar to the following:

```
# gsmstat
42395 gsmstat
Power supply on: yes
DTR on: yes
DCD on: yes
RI on: no
RTS on: yes
CTS on: no
Modem on: yes
Modem present: yes
Modem initialized: yes
SIM card present: yes
PIN required: yes
PIN accepted: yes
PIN count: 3
PUK required: no
GSM network: registered
Operator: T-Mobile Austria
Signal quality: 31 99
Phone call: no
```



```
GPRS network: registered
IP address: 172.19.0.1
TCP connection: 172.17.1.153:83
0
#
```

Field installation

Installing a preset RA440 in the field is a fairly simple process. By performing a connectivity check using an LED tool (not included in the delivery of a RA440, but available from Adcon), you will be able to prove connectivity to the A850 gateway.

The LED tool is shown in Figure 8.



Figure 8. LED Tool

Note: *The LED tool is a blind plug to be connected to the SOLAR connector.*

Follow these steps to install an RA440 in the field:

1. Review the installation area and choose the best site.
2. Perform a connectivity check using the LED tool:
 - a. Insert the LED tool into the SOLAR connector and wait up to 10 seconds.

Note: *The LED tool will light up for several seconds, followed by rapid flashes. This indicates that the unit has passed to its booting phase.*

- b. Keep observing the LED tool. The RA440's blink codes indicate the unit's connection state. Table 2.1 describes what the number of blinks of the RA440 means during connection to the A850.

Table 1. Blink Codes of the RA440 Connecting States

Blink code	Connection State
1x	GSM/GPRS modem is on
2x	GSM network provider found
3x	GPRS network found
permanently	successfully connected to the A850

3. Unpack the pole set.
4. Using a sledge hammer, drive the base pole (pointed tip) into the ground until it is securely and tightly seated. To prevent damage to the top of this pole, be sure to put a protective cap on top of it prior to pounding it in. Such a pole pounder can be ordered from your Adcon distributor (item number 900.000.014).
5. Using a ring clamp, fasten the solar panel onto the aluminum pole. Make sure that the panel is facing south (north if you are located in the southern hemisphere) and out of the way of the RA440 or its antennas.

Note: *The solar panel can be mounted under or behind the RA440, but be sure that the unit does not shadow the panel. You can avoid certain communication problems by not settling the panel directly behind one of the antennas.*

6. Fasten the external ISM antenna's mounting bracket to the top of the pole using another ring clamp and place the RA440 at least 1 meter (3 feet) under the ISM antenna. Adcon recommends that you perform another connectivity test, if you can, to check the positioning of the device.

Note: *If you incorporate the RA440 into an existing Adcon network, Adcon strongly recommends that you perform connection checks to nearby RTUs (see "Performing connectivity checks" on page 51 for details).*

7. Attach the solar panel to the SOLAR CELL connector by turning the plugs' fastening screws clockwise until secure.
8. Secure the extra length of the cable to the pole with UV-resistant cable ties.

Note: *Regardless of how you will power your RA440, you should connect the LED tool first. Using the internal batteries to power the unit enables you to see the full startup phase that is initiated by the LED tool. When you use the RA440 with an external 12 volt rechargeable battery, the unit starts to operate at the same time you connect your battery to the DC INPUT and you might miss the beginning of the startup phase.*

This completes the installation of your RA440. If the SOLAR CELL connector or the DC INPUT connector is left unused, use the cap provided to protect it against moisture and dust. Be sure to keep the following information in a place you can remember:

- Serial number of the RA440 and the A440 (both are printed on the type plate)
- Location of the RA440

Note: *This information will be necessary during the configuration of the device at the A850 Gateway.*

More about the LED tool

The LED tool allows you to rapidly check the status of an RA440. After you insert the LED tool into the SOLAR CELL connector, the unit tries to reconnect to the A850 gateway configured previously on the RA440. Table 1 on page 17 describes the LED blinking codes for the RA440.

If the RA440 is not connected to the A850, the unit flashes rapidly to let you know the unit is alive. These flashes occur every half second.

If the internal battery levels drop below 5.6 volts and the external battery drops below 11 volts, the unit will enter the *misery* state. In this state the unit reduces its activities to a minimum. The radio unit is turned off, the GPRS connection to the A850 gateway is terminated, and communication over the serial communication cable is impossible. Only the internal real-time clock is maintained and the power management functions are performed.

If the internal battery levels drop below 5.2 volts and the external battery drops below approximately 10 volts, the system switches completely off, effectively decoupling itself from the battery in order to protect it.

Note: *If the LED tool was connected to the RA440 when the unit shut down, the LED tool will restart the RA440, which will initiate a shutdown again. If this happens to you, disconnect the LED tool and replace/recharge the batteries. (This does not apply if a solar panel is connected to the SOLAR connector.)*

Configuring an RA440 in the telemetry gateway

To configure the RA440 with an A850 Telemetry Gateway, refer to the *A850 Telemetry Gateway User's Guide*.

Maintaining and servicing the remote wireless modem

An RA440 needs virtually no maintenance. It is waterproof and designed to withstand harsh environmental conditions (-30 to +70 °C, or -22 to 158 °F), high RH values, water, and other non-corrosive liquids. It conforms to the European protection class IP65. This applies also to the connectors, as long as they are mated. Don't let unmated connectors on the RA440 be exposed to the environment for extended periods of time as this might seriously affect their functionality.

The RA440 internal batteries

The internal batteries supply 6.2 volts and consist of one or two NiMH packs.

Note: *The RA440 is shipped with one battery pack, but will hold two packs. The book documents the use of the RA440 with two NiMH battery packs.*

The internal electronics manage the batteries' charging/discharging process, ensuring a long lifetime. This approach, coupled with a remarkably low average power consumption, allows an RA440 to operate approximately one week on two fully charged battery packs, under the following conditions:

- The radio quality of the GPRS cellular network and the Adcon proprietary network is classified as good. Following conditions classify the radio quality as good:
 - GPRS cellular network quality is greater than 29.
 - The network quality is readable at the response of the `GSMSQ` command at signal quality (1st parameter).
 Adcon's proprietary network signal quality might get by using the `INFO` command (see page 43).
- The channel used for your Adcon proprietary network has moderate radio activity, with requests every 15 minutes.

Table 2 shows the device's expected operation time on a fully charged battery under various conditions.

Table 2. Device Operation Time

Radio Activity	Connected Batteries (Internal)	Average Consumption (mA)	Estimated Operation (days)
No	1	15.625	8
Yes	1	35.715	3.5
No	2	15.625	16
Yes	2	35.715	7

Note: "Radio activity" means that one base station and one to five RTUs are active on the same operating frequency and within the transmission distance of the RA440.

The operation time might differ due to the individual setting of A440TMOU and the polling cycle of the connected RTUs.

However, if for some reason (wear-out or accident) the batteries lose their capacity (noted in the software with repeated "Battery low" messages), they must be replaced. Make sure, though, that the problem is really due to the batteries and not to a defective or dirty solar panel.

Adcon highly recommends that you frequently check and clean your solar panels. Rain and dust can cover the solar panel's surface with a thin layer of dirt, effectively reducing its power output. Surrounding vegetation can also lower panel efficiency.

Replacing the internal battery

If you have verified that the batteries need to be replaced, follow these steps to do so:

1. Open the lid of the RA440 by unscrewing the four bolts in the corners of the unit and opening the lid onto the right side, as shown in Figure 3 on page 11 and Figure 4 on page 11.
2. The battery packs are connected to the electronics board by means of a PCB connector. Remove the plug of each pack from the PCB connector, as shown in Figure 9.



Figure 9. Unplugging the PCB Connectors

3. Loosen all four screws of the battery holder that keeps the batteries in place, then remove the cover and the batteries.
4. Remove the expired battery packs and replace them with new ones (obtainable from Adcon).
5. Replace the battery packs and the battery holder and fasten the four screws.
6. Insert the battery plug of both PCBs into the PCB connectors.



WARNING

Be sure to mount the rubber gasket properly, so that the unit's IP65 environmental protection is not affected. You must also be sure to not squeeze the battery cable.

7. Close the lid, taking care that the rubber gasket sealing the box is correctly in place and free of dirt and soil.
8. Put the four cover bolts back in place, applying a moderate force and tightening crosswise.

Chapter 3. Performing Advanced Functions

With the appropriate knowledge, you can configure RA440 remote wireless modems in the field by using a hyperterminal window. To configure the devices, you will need a special serial cable adapter (not supplied, but available from your Adcon distributor).



CAUTION

Do not try to configure your devices if you are not sure what to do—the unit might not communicate with the remote measuring station or function with the addVANTAGE software.



WARNING

Tampering with parameters for the devices may void your warranty or damage the device. In general, the commands described in this chapter are intended for technical support staff and users with a great deal of highly technical hardware and software experience.

In the system architecture, the base station and RA440 are both considered to be nodes. The base station is called the master node, or *master*, while the RA440 is called the slave node, or *slave*. The RA440 includes a base station and a virtual RTU (maintaining only, no sensor data). Thus, to configure the RA440, you will need to insert two nodes into your A850 Telemetry Gateway configuration.

Understanding connectors

The devices have cable attachments called *connectors*. The connector type determines how the device communicates with the sensors or the computer.

The SOLAR CELL connector

The RA440 remote wireless modem has a SOLAR CELL connector used to interact with the device. The connector features the following pins:



CAUTION

To charge the unit without causing damage to the batteries or the charging circuit, the following electrical characteristics must be maintained:

- Solar Input, which enables charging the internal batteries.
- operating input voltage: 9 -10V
- maximum input current: 100 -300mA
- Battery, which enables powering external circuits. This pin is an output-only pin. The maximum current drawn by the attached circuit must not exceed 500 mA.
- RxD and TxD, which are used for serial communication (19200 baud) with the RA440. The pinout of the SOLAR CELL connector is shown in Figure 10.

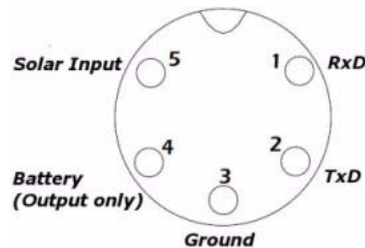


Figure 10. The Solar Cell Connector

Note: Unlike the usual power connectors, the RA440 SOLAR CELL connector features no external battery power supply. Thus, the unit must be used with an installed internal battery or an external battery connected to the DC INPUT connector.



WARNING

The serial communication line is 3V CMOS compatible. Therefore, a special adapter cable must be used to reach the RS-232 levels.

You might want to charge the RA440 with something other than the standard solar panel. In this case you must provide the electrical characteristics and configuration shown in Figure 11.

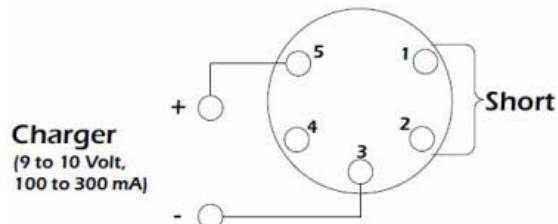


Figure 11. Configuration for Charging the RA440

The DC INPUT connector

The DC INPUT connector enables the RA440 devices to power the unit by an external power supply or battery. This function mode is restricted by the following statements:

- The external supply circuit in the RA440 is designed for a standard 12 volt rechargeable battery. To ensure proper functionality of the RA440, the following behavior was integrated into the input circuit of the connector:
 - To enable power supply from an external power source, the input voltage must be greater than approximately 11.5 volts.
 - After activation the power source may drop the voltage to approximately 9.5 volts without deactivating the external input.
 - By running under the lower threshold, the input circuit detaches the power source from the RA440 and uses the internal batteries as the power supply.



CAUTION

If the voltage of the external power source exceeds 18 volts, the RA440 might be permanently damaged.

- The DC INPUT connector is an input only. It will not charge the external battery.
- The external battery will not charge the internal batteries. Thus, if you are using internal batteries in addition to an external one, you must provide a separate charger, such as an Adcon solar panel, to back up the internal batteries.



CAUTION

To avoid damaging your RA440, be sure the charger you select does not exceed the maximum output voltage.

Figure 12 displays the pinout of the DC INPUT connector.

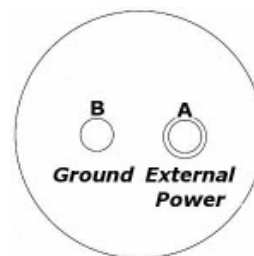


Figure 12. DC INPUT Connector

Note: *If you want to use an external power supply to power the RA440, you need to have a special power cable equipped with the plug that connects to the external DC INPUT. This cable is not included in the standard delivery package and must be ordered separately from your local Adcon distributor (order number: 800.440.001).*

Communicating with the RTU

You can use a Windows Hyperterminal window to connect to the RA440 remote wireless modem. After you have installed the system, follow these steps to configure the device and set the default parameters:

Note: *To configure the RA440, you must have a special adapter cable (item number 200.720.540 from your Adcon distributor) and plug it into the SOLAR CELL connector.*

1. Open a Hyperterminal window.
2. Select the appropriate serial port and click **OK**.
3. Configure your terminal as follows:
 - 19200 baud
 - 1 stop bit
 - 8 data bits
 - No parity
 - No protocol (neither hardware nor software)
4. Select **OK** to open the terminal window.
5. Press **Enter** to generate a response in the window.

Note: *The RA440 has two command line modes, **bootloader** and **firmware**.*

Booting the RA440

Note: *This section is included for informational purposes. You will rarely need to boot the RA440. However, when you do need to do so, you will work within a Windows Hyperterminal window on your computer.*

Bootloader mode

When the RA440 starts from a power-up reset (such as when you connect the battery to the unit), it enters the bootloader mode. If you press no keys in the interim, the RA440 enters the firmware mode in five seconds.

If you want to work with commands in the bootloader rather than continuing to the firmware mode, press ESC within five seconds after seeing the following sign-on message:

```
RA440 Bootloader V1.7
Copyright (C) Adcon Telemetry GmbH 2009
Press <ESC> within 5 seconds to start the commandline
interface...
```

You are in the command line interface of the bootloader. This interface enables you to perform certain commands such as upgrading to a new firmware or rebooting the device.

Note: *If you press no keys within 60 seconds, the bootloader command line interface will start firmware mode automatically.*

In bootloader mode, the command line interface's prompt is the character `>`. Therefore, to reboot the RA440 type the following after you see the `>` prompt:

```
reboot
```

An alternative way to boot the unit is to disconnect the battery and after a few seconds reconnect it.

For a list of the available commands, type `Help` at the `>` prompt.

```
Available commands:
```

```
upgrade [baudrate] ... upgrade from Y-modem download
version ... show the version of the bootloader
state ... show the board state
reboot [id] ... reboot the RA440
firmware ... start the firmware
help ... display this help text
```

Note: For some commands, such as the `reboot` command, you can supply the ID of the device.

Firmware mode

When you enter firmware mode, the following message is displayed in the Hyperterminal window:

```
Checking firmware ... firmware found!
41239 0
#
```

The bootloader scans the program memory for a valid firmware by testing the checksum, which takes a moment. If everything is correct, the "firmware found!" message appears.

After the initialization process is done, which may take a moment, the device's identification number (for example, 41239) and error code (in this example, 0) are displayed. After another moment, the firmware mode's command line interface prompt is displayed (`#`).

If you need to return to bootloader mode when you're in firmware mode, enter the `Reboot` command at the prompt.

See "Using terminal commands" on page 30 for commands available in firmware mode.

Upgrading the firmware

Note: This section is included for informational purposes. You will rarely need to upgrade the firmware. However, when you do need to do so,

you will work within a Windows HyperTerminal window on your computer.

Before upgrading the firmware, you must reboot the RA440 to access the bootloader mode's command line interface. Follow the procedure described under *Booting the RA440* to get into the bootloader.

Before you start the upgrade, it is very important that you copy the firmware image to the hard drive of the computer you use in the field.

You also need to know which version of the bootloader you are running. You can determine the version any of the following ways:

- Look at the bootloader's sign-on message when you start it.
- At the bootloader mode's `>` prompt, enter the `Version` command.
- In firmware mode, enter the `Reboot <ID>` command and look at the sign-on message.
- In firmware mode, enter `ver` at the `#` prompt.

Now you're ready for the upgrade.

1. At the `'>'` prompt, enter the following command:
`upgrade 115200`

The upgrade process starts.

Note: *For pre-1.7 versions of the bootloader, omit the speed parameter (115200 used to be the default). For 1.7 and later versions, include the 115200 baudrate parameter. If you do not specify a baudrate, the upload runs at the default 19200 baudrate.*

`Change the baudrate of your terminal to '115200' and hit <Return> to start flashing.`

2. Select **File** **»** **Properties** to open the hyperterminal's Properties dialog.
3. Select a com port for the **Connect using** field.

Note: *If your bootloader is version 1.7 or later and you used the `> update` command rather than the `> update 115200` command, you can skip Step 4 through Step 6. The bootloader will use a baud rate of 19200.*

4. Click the **Configure** button to display the com port's Properties dialog (Figure 13 shows a COM1 com port).

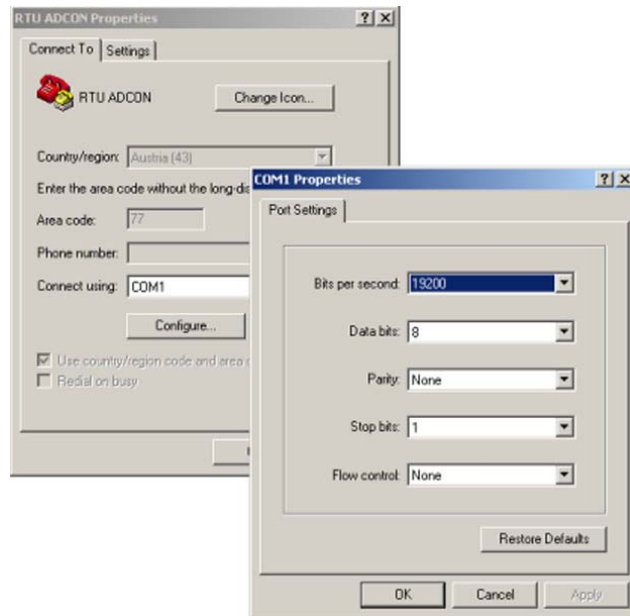


Figure 13. Hyperterminal and Com Port Properties Dialogs

5. In the **Bits per second** field, select **115200**.
6. Select **OK** in the com port's Properties dialog to close it.
7. Select **OK** in the hyperterminal's Properties dialog to close it.
8. Back in the hyperterminal window, press **Enter** to continue the upgrade.

The current firmware image must be erased for the upload.

If you continue now, you *MUST* upload a valid firmware image for an RA440!

Continue? [y/n]:



WARNING

When you continue with the upgrade process, any existing firmware image in the RA440's flash memory will be erased! You must supply a valid image for upload or the RA440 will have only bootloader capabilities (that is, it will have no radio capabilities).

9. Enter **Y** to continue the upgrade.

The bootloader starts sending the letter C (for connect)

```

Starting flash blankcheck and erase process. . . done
-----
Start the Y-modem upload now!
Starting CCCCC

```

- From the hyperterminal window's menu bar, select **Transfer ► Send File** to display the dialog shown in Figure 14.

Note: You must start the image upload within 60 seconds or a timeout will occur.

- Browse to and select the firmware image.
- Select the **Ymodem Protocol** and click **Send**.

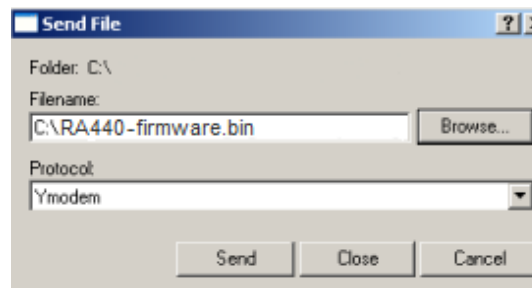


Figure 14. Dialog to Upload Firmware Image

- To start the new firmware, enter the following command:
`firmware`

Serial communication protocol

This protocol is based on a master sending commands and a node answering. The whole communication is conducted in plain ASCII, as strings, and numbers are represented in decimal format. All commands are terminated with a CR/LF combination. All responses (answers) are terminated with the **#** character.

General format of a command

The commands have the following format:

ID Command Param1 Param2 ... ParamN

- ID** is the destination device. If you include an ID as part of a command, the node checks whether `ID=ownID`. If it does, the node executes the command on itself. If the ID is not the node's ID, the node executes the command on a remote device, if such an ID exists. If the ID is missing, this implies that the command is addressed locally.

Note: Not all the commands can be relayed remotely.

- `Command` is the command proper, which can be composed of a variable string of characters (for example, `SLOT`). Each node can implement a set of commands depending on the functionality of the node itself. However, as a minimum requirement, a node recognizes the `CMDS` command, which returns a list with the commands accepted by the node.
- `Param1 Param2 ... ParamN` represent the parameters, which are command dependent. If you type no parameters when you issue a command, it is the equivalent of querying for information (the **GET** version of a command). If you type parameters, you are issuing the **SET** version of a command and are setting the command to the parameters you typed.

General format of an answer

The answers have the following format:

`ID Command Result1 Result2 ... ResultN ErrResult #`

- `ID` is the answering device. If a command was further routed, it is the ID of the end device. The answer must always contain the ID on return.
- `Command` is the string representing the original command. It is supplied so that a master can distinguish between the answers it is waiting for, and out-of-band notifications (which may come, for example, over the radio port of a node). As with the ID, the command name must always be supplied.
- `Result1 Result2 ... ResultN` are the result values returned by the remote node. If the `ErrResult` is not zero, all other possible characters and/or strings until the end of the line might be ignored.
- `ErrResult` shows whether the command was successfully executed. If this value is 0, the command was successfully executed. If this value is other than 0, the command failed. The number may further indicate the error type. (See also "Returned errors list" on page 50.)

The answer string may contain any number of spaces or CR/LF characters between its components. However, after the terminator (`#`), no other characters are allowed.

Using terminal commands

The RA440 remote wireless modem firmware is based on the firmware used in the Series 4 RTUs. Therefore the RA440's commands are very similar to the Series 4 commands.

Note: *As mentioned before, the RA440 incorporates an A440 as the Adcon Telemetry Network modem. For directing commands to the incorporated A440 you must prefix the A440's ID in front of the command.*

Following is a list of available commands and an explanation of their use.

Note: You can type uppercase or lowercase characters because the commands are not case sensitive.

A440TMOUT

AVAILABLE FOR	RA440
DESCRIPTION	Sets a timeout, after which the RA440 will turn on the A440, if no communication to the device occurs and a command for the unit is pending.
PARAMETERS	The time in seconds.
REMARKS	SET/GET.
RETURNS	Error code or the seconds set.
REMOTE	Yes.
EXAMPLE	<pre># A440TMOUT 60 441 A440TMOUT 0 # # A440TMOUT 441 A440TMOUT 60 0 #</pre>

B

AVAILABLE FOR	A440
DESCRIPTION	Sends a broadcast frame.
PARAMETERS	None.
REMARKS	After the device has sent the broadcast frame, it will listen for answers. All valid answers will be listed with their IDs.
RETURNS	A data block.
REMOTE	Yes. A device getting this frame would have to wait for a random time (2 to 10 seconds) before performing the actual broadcast; if no terminal is active, no results will be listed. A list of stations heard, with their RF levels, will be updated in the memory and will be available when the BLST command is issued.
EXAMPLE	<pre># B 442 B0 # 42340 BA 0 # 34781 BA 0 #</pre>

BLST

AVAILABLE FOR	A440
DESCRIPTION	Lists the stations heard after the last broadcast command was issued.
PARAMETERS	None.
REMARKS	GET only.
RETURNS	The date and time the broadcast was performed, the number of stations heard, and a list with the heard stations' IDs and their respective RF levels.
REMOTE	Yes. The remote version will list only the first nine stations heard.
EXAMPLE	<pre># BLST 442 BLST 08/05/2009 15:56:04 4 42340 235 255 34781 255 255 #</pre>

CMDS

AVAILABLE FOR	RA440 A440
DESCRIPTION	Returns a list of supported commands.
PARAMETERS	None.
REMARKS	GET only.
RETURNS	A list of strings separated by spaces.
REMOTE	Yes.
EXAMPLE	<pre># cmds 441 cmds A440TMOUT A440X ANLG AUTH CALC DPE DYN SLOT FDEV GPRSAPNPW GPRSAPNSERV GPRSAPNUN GPRSCONN GPRSCONNADDR GPRSCONNALIGN GPRSCONNINT GPRSDNS GPRSPING GPRSSE CRET GPRSTMOUT GSMDIALIN GSMOPER GSMPIN GSMPOWERSAVE GSMPUK GSMROAM GSMSQ GSMSTA T GSMTMOUT ID INFO LVA PMP PORT SBAT SLOT SST TIME TYPE VER XCONF XDATA XIMME 0 #</pre>

DATA

AVAILABLE FOR	A440
DESCRIPTION	Retrieves data frames from RTUs earlier than Series 4.
PARAMETERS	See the manual for the appropriate pre Series 4 RTU.

REMARKS Remote only. Support for pre Series 4 RTUs.

RETURNS A pre Series 4 data frame.

REMOTE Yes.

EXAMPLE

```
# 9999 DATA
9999 DATA
13 9 1999 19 26 36 21 37 255 255 79 0 0 0 0 87 148 149 15 0
0 0 0 0 0 0 0 0 3148 0
#
# 9999 DATA 9999 30/9/1999 14:50:00
9999 DATA 30 9 1999 14 54 55 21 37 255 255 77 0 0 0 0 89
156 126 20 0 0 0 0 0 0 0 0 0 3197 0
#
```

DATASDI

AVAILABLE FOR A440

DESCRIPTION Retrieves SDI-12 data frames from RTUs earlier than Series 4.

PARAMETERS See the manual for the appropriate pre Series 4 RTU.

REMARKS Remote only. Support for pre Series 4 RTUs.

RETURNS A pre Series 4 data frame.

REMOTE Yes.


EXAMPLE

```
# 12800 DATASDI
12800 DATASDI
16 5 2003 20 14 49 44 60 255 255 127 87 9 0 9 3 0 0
74.379401 3 0 1 68.117003 3 0 2 58.832397 3 0 3 51.611795 3
0 4 38.346400 3 0 5 19.800799 3 0 6 14.895999 3 0 7 3.553500
3 0 8 0.037200 2953 0
#
```

FDEV

AVAILABLE FOR RA440

DESCRIPTION Formats the internal memory (might destroy all the data).

 **WARNING** *The chip configuration setting (first parameter of the command) depends on the current hardware version and must not be altered. Please contact our support team for further information.*

PARAMETERS If the parameters are missing, the command will show the current settings. To format the internal memory (all data will be lost) with the current settings, use 0 as the first parameter. The storage organization (the index size only), can be optimized for your specific application. The first parameter for this command is the chip

configuration and second parameter is the index size. The RA440 factory setting is:

- 1st parameter: 1
- 2nd parameter: 384

REMARKS

GET/SET.

RETURNS

Current memory setting.

REMOTE

Yes.

EXAMPLE

```
# 441 FDEV
441 FDEV 1 16+0 64..1024 384/383 9216/9192 0
#
# 441 FDEV 1 384
441 FDEV 0
#
```

FREQ**CAUTION**

Do not change the frequency of your device without reason. Apart from the fact that it might not communicate in the network anymore, you might also violate the applicable radiocommunications laws in your country. Depending on the destination country, some models may also return an error message.

AVAILABLE FOR

A440

DESCRIPTION

Sets/returns the operating frequency.

PARAMETERS

The operating frequency and step (Hz), or none in the **GET** version.

REMARKS

GET/SET.

RETURNS

The actual frequency and step, in Hz.

REMOTE

Yes, **SET** only.

EXAMPLE

```
# FREQ 433925000 25000
442 FREQ 0
# FREQ
442 FREQ 433925000 25000 0
#
```

GPRSAPNPW

AVAILABLE FOR

RA440

DESCRIPTION

Sets/returns the GPRS operator network's access point password.

PARAMETERS

None or the GPRS operator network's access point password.

REMARKS

GET/SET.

RETURNS If no parameter was entered, the current access point password is returned. Otherwise the error code of the operation is returned.

REMOTE No.

EXAMPLE

```
# GPRSAPNPW "t-mobile"
441 GPRSAPNPW 0
#
# GPRSAPNPW
441 GPRSAPNPW "t-mobile" 0
#
```

GPRSAPNSERV

AVAILABLE FOR RA440

DESCRIPTION Sets/returns the GPRS operator network's access point name.

PARAMETERS None or the GPRS operator network's access point name.

REMARKS **GET/SET.**

RETURNS If no parameter was entered, the current access point name is returned. Otherwise the error code of the operation is returned.

REMOTE No.

EXAMPLE

```
# GPRSAPNSERV "apnserv.t-mobile.at"
441 GPRSAPNSERV 0
#
# GPRSAPNSERV
441 GPRSAPNSERV "apnserv.t-mobile.at" 0
#
```

GPRSAPNUN

AVAILABLE FOR A440

DESCRIPTION Sets/returns the GPRS operator network's access point user name.

PARAMETERS None or the GPRS operator network's access point user name.

REMARKS **GET/SET.**

RETURNS If no parameter was entered, the current access point user name is returned. Otherwise the error code of the operation is returned.

REMOTE No.

EXAMPLE

```
# GPRSAPNUN "t-mobile"
441 GPRSAPNUN 0
#
# GPRSAPNUN
```

```
441 GPRSAPNUN "t-mobile" 0
#
```

GPRSCONN

AVAILABLE FOR	RA440
DESCRIPTION	Enable/Disables the GPRS functionality.
PARAMETERS	<ul style="list-style-type: none"> • None • 1 enables GPRS function. • 0 disables GPRS function.
REMARKS	SET only.
RETURNS	The error code.
REMOTE	No.
EXAMPLE	<pre># GPRSCONN 441 GPRSCONN 0 #</pre>

GPRSCONNADDR

AVAILABLE FOR	RA440
DESCRIPTION	Sets/returns the IP address and the port of the A850 Telemetry Gateway.
PARAMETERS	None or the IP address and the port of the A850 Gateway and optionally the connection preference. The user may specify by entering a new IP address and port if the new connection is primary or a secondary is used. If the index is left, the connection type will be taken as primary.
REMARKS	GET/SET.
RETURNS	If no parameter was entered, the A850's IP and Port is returned. Otherwise the error code of the operation is returned.
REMOTE	No.
EXAMPLE	<pre># GPRSCONNADDR "172.17.5.99" 81 441 GPRSCONNADDR 0 # # GPRSCONNADDR 441 GPRSCONNADDR 172.17.5.99 81 0 0 #</pre>

GPRSCONNALIGN

AVAILABLE FOR	RA440
DESCRIPTION	Sets/returns the connection setup alignment point, in seconds, from 0:00 (UTC). This value and GPRSCONNINT determine when the device checks the connection to the A850 Telemetry Gateway and eventually reestablishes it.
	<i>Note:</i> A value of 3600 seconds means that the alignment point for the first connection check with the A850 Telemetry Gateway is at 1:00 (UTC) in the morning.
PARAMETERS	The connection setup alignment point in time in seconds. The range is limited to 0 to 4294967295.
REMARKS	GET/SET.
RETURNS	The current value.
REMOTE	Yes.
EXAMPLE	<pre># GPRSCONNALIGN 1800 441 GPRSCONNALIGN 0 # # GPRSCONNALIGN 441 GPRSCONNALIGN 1800 0 #</pre>

GPRSCONNINT

AVAILABLE FOR	RA440
DESCRIPTION	Sets/returns the connection setup interval in seconds. This value and GPRSCONNALIGN determine when the device checks the connection to the A850 Telemetry Gateway and eventually reestablishes it.
	<i>Note:</i> A value of 3600 seconds means that the connection to the A850 Telemetry Gateway will be checked every hour.
PARAMETERS	The connection setup interval in seconds. The range is limited to 0 to 86399.
REMARKS	GET/SET.
RETURNS	The current value.
REMOTE	Yes.
EXAMPLE	<pre># GPRSCONNINT 900 441 GPRSCONNINT 0 # # GPRSCONNINT</pre>

```
441 GPRSCONNINT 900 0
#
```

GPRSDNS

AVAILABLE FOR RA440

DESCRIPTION Sets/returns the IP address of the GPRS network operator's DNS servers.

Note: You can enter two different DNS servers that are indexed. If the first DNS server is unreachable, the second one will be contacted.

PARAMETERS None or the IP address followed by the index of the DNS server.

REMARKS **GET/SET.**

RETURNS If no parameter was entered, the set DNS server IPs are returned. Otherwise the error code of the operation is shown.

REMOTE No.

EXAMPLE

```
# GPRSDNS "172.17.4.89" 0
441 GPRSDNS 0
#
# GPRSDNS "172.17.4.90" 1
441 GPRSDNS 0
#
# GPRSDNS
441 GPRSDNS
0 172.17.4.89
1 172.17.4.90
0
#
```

GPRSPING

AVAILABLE FOR RA440

DESCRIPTION Pins a specific host.

Note: You can enter two different DNS servers that are indexed. If the first DNS server is unreachable, the second one will be contacted.

PARAMETERS The hosts IP the ping count (Range:1 -10), and the ping timeout (Range: 1 -10).

REMARKS **SET** only.
The command works only if no GPRS connection has been established.

RETURNS Nothing if failed or the ping number, IP, and response time.

REMOTE No.

```
EXAMPLE      # GPRSPING "172.17.5.99" 3 5
              441 GPRSPING
              1: 172.17.5.99 833ms
              2: 172.17.5.99 445ms
              3: 172.17.5.99 398ms
              0
              #
```

GPRSSECRET

AVAILABLE FOR RA440

DESCRIPTION Sets/returns the secret value. This secret is used to authenticate the device at the A850 Telemetry Gateway.

PARAMETERS The chosen secret. The range is limited to 0 to 4294967295.

REMARKS **GET/SET.**

RETURNS The current value.

REMOTE No.

```
EXAMPLE      # GPRSSECRET 441441
              441 GPRSSECRET 0
              #
              # GPRSSECRET
              441 GPRSSECRET 441441 0
              #
```

GPRSTMOUT

AVAILABLE FOR RA440

DESCRIPTION Sets/returns the timeout in seconds, after which the device should assume that the connection to the A850 Telemetry Gateway is broken.

Note: Adcon recommends that you set the GPRSTMOUT to a value that is at least twice that of GPRSCONNINT.

PARAMETERS The timeout in seconds. The range is limited from 0 to 4294967295.

REMARKS **GET/SET.**

RETURNS The current value.

REMOTE Yes.

```
EXAMPLE      # GPRSTMOUT 3600
              441 GPRSTMOUT 0
              #
              # GPRSTMOUT
              441 GPRSTMOUT 3600 0
              #
```

GSMOPER

AVAILABLE FOR	RA440
DESCRIPTION	Returns the currently used cellular network operator.
PARAMETERS	None.
REMARKS	GET only. The command works only if no GPRS connection has been established. If a GPRS connection has been established, use GSMSTAT instead.
RETURNS	The current network operator.
REMOTE	No.
EXAMPLE	<pre># GSMOPER 441 GSMOPER "T-mobile Austria" 0 #</pre>

GSMPIN

AVAILABLE FOR	RA440
DESCRIPTION	Sets the PIN-code of the SIM-card or returns the SIM-card unlock state.
PARAMETERS	The new PIN-code, or none (for SIM-card check).
REMARKS	GET/SET.
RETURNS	If no parameter was entered following messages may get displayed: "Ready" The used PIN code was accepted. "PIN required" No or false PIN was entered. Reenter the correct PIN-code. "PUK required" The false PIN was entered too often. The module has locked the SIM-card. To open the lock, enter the PUK-code of the SIM-card. If the new PIN-code was entered as a parameter of the command, returns the error code.
REMOTE	No.
EXAMPLE	<pre># GSMPIN 441 GSMPIN Ready 0 # # GSMPIN 1234 441 GSMPIN 0 #</pre>

GSMPUK

AVAILABLE FOR	RA440
DESCRIPTION	Sets a new PIN-code for the SIM-card or returns the SIM-card unlock state.
PARAMETERS	The PUK-code and the new PIN-code, or none (for SIM-card check).
REMARKS	GET/SET.
RETURNS	Refer to the command GSMPIN.
REMOTE	No.
EXAMPLE	<pre># GSMPUK 441 GSMPUK Ready 0 # # GSMPUK 56789 1234 441 GSMPUK 0 #</pre>

GSMSQ

AVAILABLE FOR	RA440
DESCRIPTION	Returns the signal quality and the bit error rate of the used cellular network.
PARAMETERS	None.
REMARKS	GET only. The command works only if no GPRS connection has been established. If a GPRS connection has been established, use GSMSTAT instead.
RETURNS	The signal quality parameter.
REMOTE	No.
EXAMPLE	<pre># GSMSQ 441 GSMSQ 31 99 0 #</pre>

GSMSTAT

AVAILABLE FOR	RA440
DESCRIPTION	Displays the status of the GSM module.
PARAMETERS	None.
REMARKS	GET only.
RETURNS	A list of various status information of the current module state.

```

REMOTE          Yes.

EXAMPLE        # gsmstat
                441 gsmstat
                Power supply on:  yes
                DTR on:           yes
                DCD on:           no
                RI on:            no
                RTS on:           yes
                CTS on:           no
                Modem on:         yes
                Modem present:    yes
                Modem initialized: yes
                SIM card present: yes
                PIN required:     yes
                PIN accepted:     yes
                PIN count:        3
                PUK required:     no
                GSM network:      registered
                Operator:         T-mobile Austria
                Signal quality:    31 99
                Phone call:       no
                GPRS network:     registered
                IP address:       no
                TCP connection:   no
                0
                #

```

ID

```

AVAILABLE FOR  RA440
                A440

DESCRIPTION    Sets/returns the node's ID.

PARAMETERS     The node ID.

REMARKS        GET/SET.

RETURNS        The node ID.

REMOTE         Yes, SET only.

EXAMPLE        # ID 445
                441 ID 0
                #
                # ID
                445 ID 445 0
                #

```

INFO

AVAILABLE FOR RA440
A440

DESCRIPTION Returns various status information.

PARAMETERS None.

REMARKS **GET** only.

RETURNS A list of a device's internal variables:

```
ID INFO rf_in rf_out date time ver clk stack cop batt temp
days_uptime hr:min_uptime rssi pmp_low pmp_high type slot
samples po err_level
#
```

The formats for the above parameters are as follows:

- *rf_in* and *rf_out* as a decimal.
- *date* as dd/mm/yyyy.
- *time* as hh:mm:ss.
- *ver* as x.x.
- *clk*, *stack*, and *cop* as decimal. They represent internal housekeeping parameters: the RA440/A440 uses *cop* to number watchdog occurrences, but *clk* and *stack* are currently undefined.
- *batt* as battery level, using the standard voltage conversion equation (0 is 0 volts, 255 is 20 volts).

Note: *This parameter has no relevance for the A440 (normally shows 0).*

- *temp* as internal temperature in the housing, which is device dependent. The precision of the sensing element is low ($\pm 2^{\circ}\text{C}$), but it is sufficient for battery power management (charge/discharge). To compute the actual value (in $^{\circ}\text{C}$), the following equation must be used:

$$Temp [^{\circ}\text{C}] = \frac{\text{internalTemp} \cdot 400}{255} - 68$$

Note: *This parameter has no relevance for the A440 (normally shows 0).*

- *days_uptime* in days; with *hr:min_uptime*, it represents the amount of time the device is up without a reset or watchdog.
- *hr:min_uptime* in hours:minutes format.
- *rssi* as decimal; it is the programmed value with the RSSI command.

Note: *This parameter has no relevance for the RA440 (normally shows 0).*

- *pmp_low* and *pmp_high* are the programmed values with the PMP command. However, because they have no relevance for the A440, they will always return zero values.

- *type* is used to represent the device type. The following types are assigned currently:
 - 0 for A730MD
 - 1 for A720
 - 2 for A730SD
 - 3 for A720B
 - 4 for A733
 - 5 for A723
 - 6 for A440
 - 7 for A733 GSM
 - 8 for A731
 - 9 for A732
 - 10 for A740
 - 11 for A740 GSM
 - 12 for A724
 - 15 for A723_Series 4
 - 16 for A724_Series 4
 - 21 for A753GSM
 - 24 fir RA440
- *slot* and *samples* are the actual values programmed by means of the SLOT command.

Note: *The "slot" parameter has no relevance for the A440. The "samples" parameter has no relevance for RA440 or the A440 (normally they show 0).*

- *po* is the relative output power of the device.

Note: *This parameter has no relevance for the RA440 (normally shows 0).*

- *err_level* is the error value; 0 means no error.

REMOTE

Yes, **GET** only.

EXAMPLE

```
# 441 info
441 info 0 31 01/01/1970 00:00:00 1.2 0 0 0 83 60 0 00:40 0
65 72 24 900 0 0 0
#
```

PMP

AVAILABLE FOR

RA440

DESCRIPTION

Sets/returns the node's Power Management Parameters (switches the battery charge on/off).

PARAMETERS

The lower (switch on) and the higher limit (switch off), both in volts x 10. Standard Values are 65 (for 6.5 volts) for switch on and 72 (for 7.2 volts) for switch off, for a standard 6.2 volt NiMH battery. From these values, other thresholds are internally computed.

REMARKS

GET/SET.

RETURNS The lower (switch on) and the higher limit (switch odd), both in volts x 10.

REMOTE Yes, **SET** only.

EXAMPLE

```
# PMP 65 72
441 PMP 0
#
# PMP
441 PMP 65 72 0
#
```

ROUTE

AVAILABLE FOR A440

DESCRIPTION Sets/returns the routing information of a device.

PARAMETERS None, or a route (with destination) containing up to eight intermediaries. When only the destination ID is given, the route for this device is deleted.

REMARKS **GET/SET.**

RETURNS The command's success or error code and the route table.

REMOTE Yes, but only to an A440 attached to an RA440.

EXAMPLE

```
For MFS:
# ROUTE 445 43
442 ROUTE 0
#
# ROUTE
442 ROUTE 445 43 0
#
```

RSSI

AVAILABLE FOR A440

DESCRIPTION Sets/returns the Relative Signal Strength Indicator threshold at which the RF receiver must wake up.

PARAMETERS The threshold value. For the A440, it can take values from 0 to 255; it is typically factory set to 50.

REMARKS **GET/SET.**

RETURNS The instant RSSI value and the programmed threshold.

REMOTE No.

```
EXAMPLE      # RSSI 50
              442 RSSI 0
              #
              # RSSI
              41239 RSSI 34 50 0
              #
```

Note: The values of the RSSI threshold are arbitrary and have no units.

RX

AVAILABLE FOR A440

DESCRIPTION Switches the unit to permanent receive mode (for tuning purposes).

PARAMETERS None.

REMARKS The system stops, and exits the command only when a key is pressed. This command returns no message.

RETURNS Nothing.

REMOTE No.

```
EXAMPLE      # 442 RX
              442 RX 0
              #
```

TIME

AVAILABLE FOR RA440
A440

DESCRIPTION Sets/returns the real time clock.

PARAMETERS The actual time, or none in the **GET** version.

REMARKS **GET/SET.**

RETURNS The actual time as *dd/mm/yyyy hh:mm:ss*.

REMOTE Yes.

```
EXAMPLE      # TIME 20/06/2009 12:10:10
              441 TIME 0
              #
              # TIME
              441 TIME 20/06/2009 12:10:10 0
              #
```

TX

AVAILABLE FOR A440

DESCRIPTION	Switches the unit to transmit mode (for tuning purposes).
PARAMETERS	<ul style="list-style-type: none"> • None (sends an unmodulated carrier) • 1 (sends a 1 kHz modulated carrier) • 0 (sends a 2 kHz modulated carrier) • 5 (sends a mixed 1 + 2 kHz modulated carrier)
REMARKS	The system stops, and exits the command only when a key is pressed. This command returns no message.
RETURNS	Nothing.
REMOTE	No.
EXAMPLE	<pre># TX 442 TX 0 # # TX 1 442 TX 0 # # TX 5 442 TX 0 #</pre>

TYPE

AVAILABLE FOR	RA440 A440
DESCRIPTION	Requests the hardware type information of the device.
PARAMETERS	None.
REMARKS	GET only.
RETURNS	The hardware type.
REMOTE	Yes.
EXAMPLE	<pre># TYPE 441 TYPE RA440 0 #</pre>

VER

AVAILABLE FOR	RA440 A440
DESCRIPTION	Requests the firmware version of the device.
PARAMETERS	None.
REMARKS	GET only.

RETURNS The current version.

REMOTE Yes.


EXAMPLE

```
# VER
441 VER 1.3.2 0
#
```

VERB

AVAILABLE FOR RA440
A440

DESCRIPTION Sets the verbosity level of the device. This command is used for debugging only.

 **WARNING** *The device will consume a lot more power when the verbosity level is greater than 0. This could discharge your battery and/or prevent proper operation.*

PARAMETERS A verbosity level (0...255).

REMARKS **SET** only.

RETURNS Error code.

REMOTE No.

EXAMPLE

```
# VERB 1
442 VERB 0
VERB 1 # src=43 dest=9002 type=? src=43 dest=9002 type=?
# VERB 0
442 VERB 0
#
```

XDATA

AVAILABLE FOR RA440

DESCRIPTION This command requests data for a list of logical channels for given timestamps.

PARAMETERS XDATA requires a lot of parameters for specifying what to retrieve. Please consult the *A740 User Manual* for detailed explanation of this command. The output of the command is not intended to be human readable.

REMARKS **GET** only. (This is a data retrieval command, local as well as remote.)

RETURNS A data block.

REMOTE Yes, for a **GET**, but only one frame at a time.


```
EXAMPLE # 441 XDATA 0 8 0 255 1 0
441 XDATA 0 199 0x18 0x4A4211BC 1 0 0xF6 :8F0384645739
0
#
```

XIMME

AVAILABLE FOR RA440

DESCRIPTION Samples all inputs and immediately returns the sampled data.

PARAMETERS First parameter specifies the sample mode, which has to be 2 for raw data. The second parameter sets the maximum packet size. If you specify the third parameter, you can select a specific input connector.

Note: Only sample mode 2 is supported on the RA440.

REMARKS **GET** only. The command needs a specific delay to execute. The delay depends on the setting at the SST command.

RETURNS A data block of logical channel, raw adc and counter values.

ID XIMME

int_chnl int_dig bat temp ext_volt 0

{chnl_nr dig_byte raw_cabl1 raw_cabl2 raw_cabl3 cnt}

The format of the above response is as following:

- *int_chnl* is the logical channel number of the internal connector (always 0).
- *int_byte* is a byte (0 to 255) and shows whether the SOLAR CELL is connected and if the charger is activated.
- *bat* is the measured battery value (for details see the INFO command).
- *temp* is the measured temperature value (for details see the INFO command).
- *ext_volt* is the external DC INPUT level using the following conversion:

$$DCInput_{[Volts]} = \frac{\text{ext_volt}}{255} \times 27.5$$

- *chnl_nr* is the logical channel of the shown connector:
 - 1 – IO-A
 - 2 – IO-B
 - 3 – IO-C
 - 4 – IO-D

The RA440 has no external sensor connectors. Therefore the values of the two batteries are shown on raw_cabl1 of IO-A and IO-B.

- *dig_byte* is the digital status byte.
- *raw_cabl1* is the raw value read on cabling 1 by the analog-digital converter.

- *raw_cabl2* is the raw value read on cabling 2 by the analog-digital converter.
- *raw_cabl3* is the raw value read on cabling 3 by the analog-digital converter.
- *cnt* is the current value of the counter.

Note: *The braces, {...}, show that this part may repeat, depending on the device type. For an RA440 the output will show the logical channels 0, 1, and 2.*

REMOTE

Yes.

EXAMPLE

```
# ximme 2
441 ximme
0 129 0 54 0 0
1 1 22272 0 0 0
2 1 22208 0 0 0
0
#
```

Returned errors list

Following are error messages you might get.

Command line interpreter

- 1 — nonexistent command
- 2 — command line buffer overflow (input line too long)
- 3 — internal error
- 4 — reserved
- 5 — missing or false parameters in command
- 6 — operation not implemented
- 7 — remote operation not allowed
- 8 — invalid IMEI Number
- 9 — command not supported in this configuration

Device descriptor and storage handler

- 10 — device not found (attempt to perform a command on a nonexistent device)
- 11 — device already exists
- 12 — reserved
- 13 — no more space for descriptors (too many devices)
- 14 — no more records for the specified device
- 15 — temporary communication break, no more data (the last request was not successful)
- 16 — time-out (the handler blocked or is busy)
- 17 — internal error

- 18 — attempt to insert a reserved device ID number (0 or 65535)

Real time clock

- 20 — incorrect time supplied (no conversion to time_t was possible)

Radio interface (including GSM/GPRS Modem)

- 30 — error at receive (CRC, etc.)
- 31 — unexpected frame received
- 32 — wrong length
- 33 — reserved
- 34 — reserved
- 35 — time-out (remote device not responding)
- 36 — receiver busy (for example, currently performing a polling series)
- 37 — time stamp of a frame is too far in the future
- 38 — general modem error
- 39 — “unknown modem” error

Notifications

- 40 — request to read a notification when no notification is pending

Performing connectivity checks

If you want to insert an RA440 Wireless Radio Modem into an existing Adcon radio network, you should consider performing connectivity checks before finishing installation of the device. Connectivity checks are similar to the RTU connection checks. Before performing these checks, you must have following items prepared:

- the A440 Serial number (printed on the type plate of the RA440)
- a serial communication cable (item number 200.720.540 from your Adcon distributor)

The following instructions show you how to perform the connectivity check:

1. After you check the connection to the A850 Telemetry Gateway using the LED tool, disconnect the LED tool. A few seconds later, connect your serial communication cable to the SOLAR CELL connector.
2. Make a broadcast by entering the `<A440_ID> B` command, where `A440_ID` is the serial number of your A440.
3. Wait at least 15 seconds.

4. Enter the `<A440_ID> BLST` command and wait for the response, which shows you the heard responses of the broadcast sent by the RA440.
5. Pick the RTUs that will communicate with the RA440. Check every RA440-RTU connection by entering the `<RTU_ID> INFO` command, where `RTU_ID` is the serial number of the RTU picked from the broadcast response list.
6. Check the radio link quality of the connection displayed at `rf_in` and `rf_out` at the ping response. For a good link quality to a Series 3 RTU, the value must be at least 200. See “INFO” on page 43 to pick the RF indicators.
7. If all of your ping commands respond with a good radio link quality, the proper function of the RA440 at this position is ensured. If one or more radio links did not pass the threshold, reposition your RA440 or route the communication via other, nearby, radio units.

Example:

```
# 442 B
# 442 BLST
442 BLST 08/05/2009 15:56:04 4
42340 235 255
34781 255 255
# 42340 INFO
42340 INFO 235 255 08/05/2009 15:57:35 3.3 0 0 0 83 60 0
00:40 0 65 72 4 900 0 0 0
# 34781 INFO
34781 INFO 255 255 08/05/2009 15:58:24 3.3 0 0 0 83 60 0
00:40 0 65 72 4 900 0 0 0
#
```

Appendix. Specifications

The RA440 remote wireless modem was intended to fulfill the specification of the ETSI 300 220, Class I, Subclasses a and b, but other national norms are similar to this (for example, the CFR 47, Part 90, Subpart J). Table 3 shows the main operational parameters of the RA440.

Table 3. Operational Parameters

Parameter	Min	Type	Max	Unit
Common				
Supply Voltage (internal battery)	+5.6		+10	V
Supply Voltage (external battery)	+11.5 ^a		+18	V
Operation Temperature	-20		+55	°C
Relative Humidity	10		99	% rH
Class Protection		IP65		
Data Rate (GSM/GPRS modem - GPRS mode)			multislot, class 10	
Data Rate (ISM modem)	1000	1500 ^b	2000	kbps
Operating Frequency (low-band version) ^c	432		450	MHz

Table 3. Operational Parameters (Continued)

Parameter	Min	Type	Max	Unit
Operating Frequency (high-band version) ^c	450		470	MHz
Frequency Stability (-20 to +50 °C / -4 to +122 °F)			±1.5	kHz
Frequency Stability (-30 to +60 °C / -22 to +140 °F)			±2.5	kHz
Receive Mode				
Sensitivity (12 db S/S+N)		-118		dBm
Image Frequency Attenuation (first IF = 45 MHz)	-70			dB
Local Oscillator Leakage			2	nW
Adjacent Channel Attenuation (12.5 kHz mode)	-57			dB
RSSI Dynamic	90			dB
Operating Current (including onboard microcontroller)			32	mA
Receive Mode (GPRS modem)				
Sensitivity EGSM 900 / GSM850	-102			dBm
Sensitivity EGSM 1800 / GSM1900	-102			dBm
Operating Current (DRX mode 9)		3.5		mA
Transmit Mode (all measurements made on a 50 Ohm resistive load)				
Output Power		+27		dBm
Spurious Radiation			200	nW
Adjacent Channel Power (20 kHz mode)			-34	dBm
Occupied Bandwidth (20 kHz version)			15	kHz
Operating Current (including onboard microcontroller)			600	mA
Transmit Mode (GPRS modem)				
Output Power EGSM 900 / GSM850			33dBm (± 2dB)	

Table 3. Operational Parameters (Continued)

Parameter	Min	Type	Max	Unit
Output Power EGSM 1800 / GSM1900			30dBm (± 2dB)	
Operating Current (avg. GPRS Class 10 - 2TX / 3RX)		450		mA
Peak Current (at TX burst)			2.0	A
SIM Interface				
Interface Type	GSM 11.11 & GSM 11.12			
SIM Card Voltage	1.8 / 3			V

- a. This value relates to the voltage needed to enable the DC INPUT connector circuit. After activation the voltage may drop to approximately 9.5 volts minimum before the DC INPUT circuit will shut down the connector to protect a connected rechargeable battery from deep discharge.
- b. Data rate is content dependent.
- c. This parameter represents the tuning range; the switching range may be limited in the software to a narrower space (even to the extent of a single channel).

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