A73x addWAVE

User Guide

Valid for A731, A732, A733 and A733GSM RTUs
Release 2.0 and higher

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Table of Contents

1 Introduction

This manual explains the hardware aspects of Adcon's A733, A732, A731, and A733GSM/GPRS remote telemetry units (hereafter referred to as A73x), including installation issues and certain parameter configurations. The manual is divided as follows:

- "Introduction," which gives some general information and document conventions.

- "Using the A73x RTU," which details the installation and use of the remote telemetry unit.

- "Performing Advanced Functions," which contains technical information for the advanced user.

- "Specifications," which describes operating parameters for the devices.

1.1 About the A73x RTU family

The A731, A732, and A733 RTUs incorporate an A431 radio module operating in the 430 to 470 MHz range, making it adaptable to most radio communication regulations in the world. The output power is variable up to 0.5 W, while the modulation is narrow-band FM (6.25, 12.5 or 25 kHz channel spacing). The A733GSM/GPRS RTU incorporates a GSM module and uses the standard GSM network for retrieving telemetry data (900/1800 MHz in Europe, 850/1900 MHz in the US).

The A73x is a rugged RTU, complying with the IP65 ingress protection class (NEMA 4). Depending on topography it ensures a reliable wireless connection to other A73x RTUs, an A730MD or A730SD device, or an A840 Telemetry Gateway over a distance of up to 20 km (12 miles). The A733GSM/GPRS has no such limitations; however, your cellular service provider must cover the site where you want to install the RTU. The A733GSM/GPRS operates in conjunction with the A840 Telemetry Gateway only.

1.2 Compliance Statement and Warnings

The A73x addWAVE (radio version) 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 18 cm 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 was notified by Adcon Telemetry in the following countries (as of this release of the manual) with the respective radio authorities:

> Australia, Austria, Belgium, Germany, Denmark, Finland, France, Greece, Hungary, Italy, Ireland, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, USA

Countries not mentioned above might be covered by a type of approval acquired by our distribution partner.

In some countries individual user licenses and frequency allocations need to be applied for. Please consult your dealer for further information.

Note: *The above paragraphs are not applicable to the A733GSM/GPRS RTU.*

The A733GSM/GPRS is available for the European 900 MHz and 1800 MHz networks as well as for the 850 MHz and 1900 MHz infrastructure in the US and several other countries.

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

1. The device may not cause harmful interference,

2. The device must accept any interference received, including interference that may cause undesired operation,

3. Any changes to the device other than those mentioned in this manual void the FCC type of approval.

1.3 Conventions

Certain conventions apply in this documentation.

Italics	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.
`fixed font`	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.

2 Using the A73x RTU

The A73x series of remote telemetry units (RTUs) is part of the A730 series. For testing purposes, you should have an A730SD/A730MD and/or an A840 Telemetry Gateway installed before you install your A73x RTU. For information about installing the A730SD or A730MD, refer to the *addVANTAGE A730 User Guide Version 3.4x*. For information about installing the A840, refer to the *Base Station, A840 Telemetry Gateway and Wireless Modem A440 User Guide*. The A733GSM/GPRS RTUs operates in conjunction with an A840 Telemetry Gateway only.

2.1 Opening the packages

The A73x RTU package contains the A73x RTU, an antenna, and a pipe clamp. If ordered, the following items come in separate packaging:

- A solar panel with pipe clamp

- A set of aluminum poles

- An LED tool

- Sensors and cables, one box for each sensor, and fastening ties in each sensor box

Make sure you have received all the equipment and read through the instructions that follow. When you are sure you understand them, you are ready to install your RTU.

Fig. 1 and Fig. 2 show the top and bottom view of an A733 addWAVE RTU.

Fig. 1:   addWAVE RTU (top)

Fig. 2:   addWAVE RTU (bottom)

2.2 Installing the RTU

The following restrictions apply:

- In general, the typical "line-of sight" distance the RTU can communicate is 10 km (6 miles). This is valid if both the RTU and its partner device are mounted on a 3 m mast (9 ft.); the results may vary under different conditions, and you can sometimes achieve greater distances.

Note: *The above does not apply to the A733GSM/GPRS RTU. In principle there is no distance limit for this type of device as long as your cellular provider covers the area where it is installed.*

- As with all wireless communication devices, the higher the transmitter is, the better the communication will be.

- All A73x devices accept the standard Adcon sensors (A731 excluded), which are different from the A730MD series in that they provide IP65 class protection. All Adcon sensors are delivered by default with this new type of connector. An adapter cable is optionally available to connect current sensors to the RJ-12 ports of the A730MD stations.

Note: *For technical reasons, Adcon cannot provide adapters for the RJ-12 connector to the A73x devices.*

2.3 Special notes for the A733GSM/GPRS RTU

The A733GSM/GPRS RTU is based on a GSM module which employs a GSM cellular network to transmit the telemetry data. Before you install such a device, you must make sure a sufficient signal for proper operation of the RTU on the site where you plan to use it exists; you can do this by using a standard cellular phone operated by the same cellular provider. You can also verify that you can communicate with the RTU simply by calling it as you would a normal cellular phone.

The two ways to operate your A733GSM/GPRS RTU are as follows:

1. GSM mode: In this case please ask whether your provider offers CSD connections.

   Most cellular/GSM providers use a different telephone number for data communication than for voice communication. Don't forget to ask for this data number when you order your SIM card, if you do not use the RTU in GPRS mode!

   When your modem calls the RTU from a land line, use the data number: else the RTU will answer, but immediately send a busy tone, as the voice call cannot connect to a data terminal. Voice calls cannot connect to a data terminal, so you need to set up your modem to use the data number when calling the RTU from a land line.

2. GPRS mode: Please make sure your SIM card is well suited for GPRS operation.

You also need to insert your SIM card into the SIM holder inside your A733GSM/GPRS RTU by following these steps:

1. Open the lid of the A733GSM/GPRS RTU by unscrewing the four bolts in the corners of the RTU and then remove the lid as shown in Figure 3 .
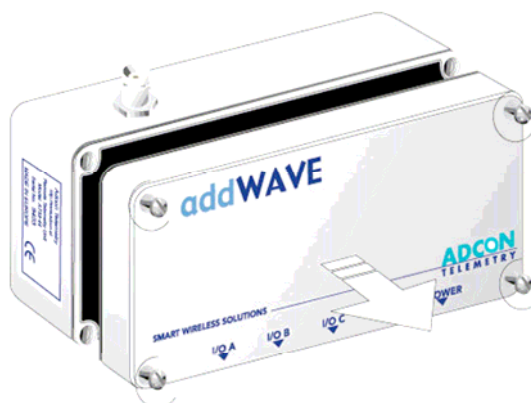

Fig. 3:   Removing the A73x Lid

Note: You don't have to remove the battery plug from the base board during this operation, but make sure nothing is attached to the POWER connector.

Fig. 4:   Installing the SIM card in the A733GSM/GPRS RTU

2. Locate the SIM card holder and open it by sliding it as indicated by the red arrow (see Fig. 4, left).

3. Raise the holder top and slide the SIM card into it (Fig. 4, center).

4. Snap the holder top back on and slide it back as shown again by the red arrow depicted in Fig. 4, right.

5. Remount the lid, taking care that the rubber gasket sealing the box is not out of place and is free of dust or dirt.

💣 *WARNING*:   *Be sure to mount the rubber gasket properly, so that the unit's IP65 environmental protection is not affected.*

6. Put the four screws back in place, applying moderate force (approximately 150 to 200 Ncm), tightening crosswise. For additional information, please contact Adcon Telemetry or your local reseller of Adcon Telemetry products.

This completes the SIM-card installation. Now you will need to activate the card by using a personal identification number (PIN). You will find this number in the package that you got from your cellular service provider.

Before you can activate your card, the A733GSM/GPRS must be properly powered. As the RTUs 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 power connector and expose the RTU to the 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.

You need a serial adapter cable to enter the PIN; you can get the cable from Adcon Telemetry or your reseller. When you have the cable, you can proceed as follows:

1. Connect the serial cable from the COM port of your PC to the RTU. 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 27.

2. Make sure that you can communicate with the RTU by pressing the enter key: the device will answer with its own ID number and a hash sign (#).

3. Type the command GSMPIN nnnn (where *nnnn* is the PIN code) and press enter. If the PIN is conforming to the standard PIN format requirements the RTU will answer *id* gsmpin 0, where *id* is its ID number (this is NO PIN check with your provider!).

This completes the PIN entry procedure. You can check the status of the A733GSM/GPRS RTU at any time by typing the **GSMSTAT** command. This command returns a list of GSM parameters:

```
#gsmstat
26142 gsmstat
  GSM modem on:    Yes
  SIM card found:  Yes
  PIN set:         Yes
  PIN accepted:    Yes
  Sleepmode OK:    Yes
  PUK required:    No
  Default IMEI nr: No
  GPRS:            Yes
  GPRS IP conn.:   No
Attempts left to enter PIN: 3, PUK: 10
0
#
```

The above shows that:

- The GSM modem is on.

- A valid SIM card is inserted.

- The SIM card was activated with a valid PIN code.

- The GPRS feature is enabled.

- The GPRS connection is not established.

The GPRS-related lines from the above-displayed output of the **GSMSTAT** command are shown only by RTU firmware versions capable of the GPRS communication mode (for version information see below).

Other information is also listed, but it is of no concern to the user, except the **PUK required** entry. If this parameter is *Yes*, it can be the result of entering a wrong PIN three times in a row. You can see this also in the last string displayed by the **GSMSTAT / GPRSSTAT** command (number of retries left).

To reactivate the card you will need its PUK number, which you also get from your cellular provider with the SIM card. To reactivate the card, enter the command **GSMPUK *pppppppp nnnn*** (where *pppppppp* is the PUK code and *nnnn* is the new PIN). Note that the new PIN is used immediately to activate the SIM card.

The command GPRSSTAT is a synonym for GSMSTAT.

 WARNING: *Your A733GSM/GPRS RTU has an internationally unique identification number (IMEI). This number is on a leaflet packaged with your device, and you will need it if you lose the device. Please keep the number in a safe place.*

2.3.1 GPRS usage of an A733GSM/GPRS RTU

Configuring the GPRS Parameters

To configure your A733GSM/GPRS RTU for usage with GPRS, ensure that the module has firmware version 2.10 or above installed. If your A733GSM/GPRS RTU features a Motorola GSM/GPRS module, be sure to have firmware version 2.14 or higher installed.

Verify that you have configured the GSM Parameters as described in the previous section (GSMPIN, GSMROAM).

Note:　　　　　*If you want to use only the GSM features of the RTU, you have to set "GPRSPORT 0" to disable the GPRS capabilities. The power consumption will then be as low as with the older GSM-only units.*

Set/configure the following parameters through a terminal connection to enable GPRS connection to your ISP:

`GPRSAPNSERV "[servername]"`   where [servername] is the name of the ISP's GPRS access server (required)

`GPRSAPNUN "[username]"`   where [username] is the name of the GPRS user's name for the ISP (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@A1plus.at"

GPRSAPNPW "ppp"

Note: *Please take extreme care not to misspell the GPRS-parameter values, and not to switch the case of letters. Misspelled names/entries could cause the RTU not to connect to the GPRS network or A840.*

Configuring the TCP Parameters

The A733 GSM/GPRS RTU will only connect to the A840 Telemetry Gateway if the following TCP Parameters are set:

`GPRSHOST "[a840-ipaddress]"`   where [a840-ipaddress] is the IP address of the A840 Telemetry Gateway the RTU has to connect to. For RTUs with built-in Motorola GSM/GPRS modules, this parameter must be an IP address in decimal dotted notation, e.g. 123.45.23.45.

`GPRSPORT [portnumber]`   where [portnumber] is the port number where the communication with the A840 Telemetry Gateway will occur. If this parameter is set to 0, the RTU will operate only in GSM mode.

`GPRSDNS1 [dotted_dns_address]`   (optional) first DNS server address of your GPRS network operator (e.g. 123.34.2.34). This and the next command are not available on RTUs with built-in Motorola GSM/GPRS modules.

`GPRSDNS2 [dotted_dns_address]`   (optional) second DNS server address.

Note: *When using an Internet Firewall in front of the LAN where the A840 Telemetry Gateway resides, be careful to properly configure the firewall and the A733GSM/GPRS RTU connection parameters `[a840-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 A840 Telemetry Gateway, allow connection to devices only with IP addresses from your GPRS network operator's IP networks to your A840 Telemetry Gateway. When your GPRS network operator changes the addresses of his IP networks, you must adjust your firewall's filters appropriately.*

Configuring the RTU GPRS Connection settings

Use the following commands to define the intervals the RTU will wake up and connect to the A840 Telemetry Gateway:

GPRSCONNALIGN [align]   alignment of calls in seconds (default 28800, i.e. 8:00). NOTE: These wall clock times are either UTC or local time of your A840 Telemetry Gateway, depending on the setting of the "Wireless Network uses:" switch on your A840 Telemetry Gateway.

GPRSCONNINT [interval]   interval between two connection attempts in seconds (default 43200, i.e. 12 hours).

GPRSSECRET <secret>   this 32-bit integer (0 to 4294967295) has to be set for the RTU and the gateway. This is a shared "secret" or password.

GPRSTMOUT [interval]   idle time out in seconds (default 3600, i.e. 1 hour). Connections that are idle this long will be terminated by the RTU.

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 RTU will be polled for data by the Adcon Telemetry Gateway within the GPRSTMOUT time.

If you need your RTU to detect within an hour that the connection to the Adcon Telemetry Gateway is broken, set the GPRSTMOUT to 3600 seconds. But make sure, that the RTU is polled for data at least once within that time span.

Note: *Keep in mind that "calling" the A840 Telemetry Gateway costs battery power.*

Recommended Settings for A733 GSM/GPRS with WaveCOM Module:

On the RTU:

- GPRSCONNINT 3600 or 7200 or 10800 (1, 2, 3 hours connection interval)
- GPRSCONNALIGN is per default set to align the connection to 8:00 (UTC)

On the gateway:

- Check the "Close connection after poll" checkbox for the RTU

2.4 Field Installation

Installing A73x RTUs in the field is a fairly simple process. You'll perform a connectivity check with an LED tool (does not apply to A733GSM/GPRS RTUs). The LED tool is shown in Fig. 5.

Fig. 5:   LED Tool

Note: *The LED tool is a blind plug to be plugged into the POWER connector.*

Follow these steps to install an A73x RTU in the field:

1. Review the installation area and choose the best site (for the A733GSM/GPRS RTU, skip to Step 3).
2. Perform a connectivity check using the LED tool:
    a. Insert the LED tool into the POWER connector and wait up to 10 seconds. If the unit connects to at least one station (or a base station), it will light up the LED for about 4 seconds.
    b. Keep observing the LED tool and, after several more seconds, the LED will blink one or more times (the number of blinks indicates the number of stations it has successfully contacted).

Note: *For the A733GSM/GPRS, make sure that you have a sufficient RF signal from your cellular service provider. The simplest way to achieve this is to check a cellular phone operated by the same cellular service provider on the site where you want to install the RTU.*

3. Assemble your pole set.
4. Put an Adcon plastic cap into the top of the pole and secure it with a pie clamp to protect the top of the pole from damage.
5. Using a hammer, drive the 80 cm aluminum rod into the ground.
6. Using the pipe clamp supplied, fasten the solar panel onto the 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 A73x RTU.

Note: *The solar panel can be mounted under or behind the A73x RTU, but make sure that the RTU does not shadow the panel.*

7. Fasten the A73x RTU to the top of the pole with a pipe clamp. Adcon recommends that you perform another connectivity test (not for the A733GSM/GPRS), if you can, to check the positioning of the device.

💣**WARNING:**   *If you turn the fastening screws too tightly, you could damage the connectors.*

8. Attach the sensors to the I/O connectors and the solar panel to the POWER connector by turning the plugs' fastening screws clockwise until secure.
9. If you have SDI-12 sensors, attach the SDI-12 adapter and the respective sensors. For more details about installing the SDI-12 adapter, consult the leaflet that came with the adapter.
10. Secure the extra length of the sensor cables to the pole with cable ties.

This completes the installation of your A73x RTU. If one of the I/O connectors is left unused, use the cap specially provided to protect it against moisture and dust. Be sure to make a note of the following information because you'll need it when you configure the device in the software:

-   Serial number for each RTU (for the A733GSM/GPRS RTUs, the data telephone number also)

-   Type of sensors connected to each RTU and to which I/O port

2.5 More about the LED tool

The LED tool allows you to rapidly check the status of an A73x RTU. After you insert the LED tool into the POWER connector, the unit waits up to two seconds and then sends a broadcast frame (does not apply to the A733GSM/GPRS RTU). If a nearby listening station or receiver decodes the frame, it will answer back—this may take up to 10 seconds. When the RTU receives an answer, the LED tool lights up for about 4 seconds. After another few seconds, the LED lights up one or more times, depending on the number of stations/receivers that answered its broadcast frame.

In addition, the LED always blinks briefly at 0.5 second intervals to indicate that the unit is alive and the internal battery has enough energy to operate. If the blinking interval lengthens to 2 seconds, the battery has become undercharged (that is, under 5.6 volts but over 5.2 volts)—which is called the *misery* state. In this state, an A73x RTU reduces its activities to a minimum. The radio unit is switched off, the sensor sampling ceases, and no data is stored in the internal memory. Only the internal real-time clock is maintained and the power management functions are performed.

If the battery level drops below 5.2 volts, the system switches completely off, effectively decoupling itself from the battery to protect it. In this case the LED tool stays off permanently. An A73x RTU in such a situation will restart only after connecting it to an external power supply (even a solar panel under low light conditions).

Note: *New A73x RTUs are delivered with their internal batteries unformatted, meaning they are completely discharged, and you should install them only on sunny days. The battery will be fully charged after two consecutive sunny days, but you should get an LED light-up after several minutes of charging in the sunlight.*

Testing GSM/GPRS/A840 Connection with LED Tool

When the LED tool, the solar panel, or the SC cable is connected to the RTU, the modem starts and tries to connect to the gateway. When you connect an LED tool, the tool indicates the different states of the modem connection with blink-codes (for details see below). What happens after the GPRS unit successfully connects to the A840 Telemetry Gateway is determined by the configuration of the gateway. If the "Close connection after poll" check box is checked, a poll cycle is conducted immediately (and if the time is not yet set at the RTU, it will be set). If "Close connection after poll" is not selected, a poll cycle is conducted according to the poll settings on the gateway (either at the specified poll times or at the specified poll interval). In this mode the time on the RTU will be set on the first poll cycle.
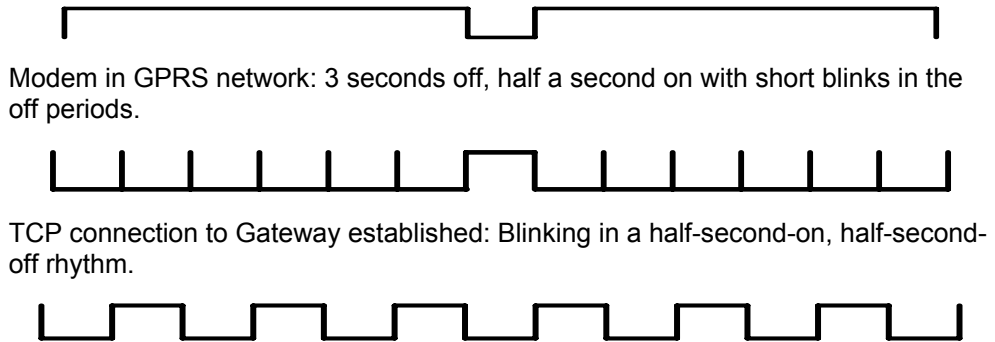
Misery state (battery voltage below 5.5V but above 5.2V): Short blink every other second.

Normal mode, but GSM/GPRS modem not yet started: Short blink every half second.

Modem in GSM mode (mostly transitional mode): 3 seconds on, half a second off.

Modem in GPRS network: 3 seconds off, half a second on with short blinks in the off periods.

TCP connection to Gateway established: Blinking in a half-second-on, half-second-off rhythm.

2.6 Configuring an A73x RTU in the addVANTAGE software

To configure the A73x RTU with an A840 Telemetry Gateway and the addVANTAGE 4 Pro software, check the *Base Station, Telemetry Gateway A840 and Wireless Mode A440 User Guide*.

2.7 Maintaining and servicing the RTU

The A733 unit 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. These standards also apply to the connectors, as long as they are mated or capped. Don't let unmated/uncapped connectors on either the A73x RTU or the sensors be exposed to the environment for extended periods of time. When used in coastal areas with high salt content in the air, use an extra protective case to avoid corrosion. Avoid spraying agrochemicals on your RTU, as they might form very aggressive compounds.

2.7.1 The RTU battery

The internal battery supplies 6.2 volts and consists of either a NiCd (radio RTUs) or a NiMH (GSM/GPRS) battery pack. The internal electronics manage the battery charging/discharging process, ensuring it a long life. This approach, coupled with a remarkably low average consumption (6 mW for the standard RTU and 15 mW for the GSM RTU), allows an A73x RTU to operate at least two weeks on a fully charged battery, with the following conditions:

- The channel has moderate radio activity, with requests every 15 minutes.

- Total consumption of attached sensors is 100 mA.

- The sensors are sampled once every minute and an averaged slot is stored in the internal memory every 15 minutes.

Table 1 shows the A73x device's expected operation time on a fully charged battery under various conditions. The sensor consumption totals 100 mA.

Radio Activity	Sensor Sampling	Average Consumption (mA)	Estimated Operation (days)

	(samples/15 min)		
No	No sensors	0.85	132
Low	No sensors	2.8	40
Heavy	No sensors	5	22
Low	3	4.2	26
Low	15	6.3	17
Heavy	15	9	12

Table 1:   A73x Device Operation Time

Note: *Low radio activity means that one base station and between one and three A730MDs/A73xs or A730SDs are active on the same operating frequency as the A73x remote station under test. Heavy radio activity means that approximately 30 devices are on the same channel. However, no routing is used. Table 1 does not apply to the A733GSM/GPRS RTU.*

However, if for some reason (by wearing out or accident) the battery loses its capacity (noted in the software with repeated "Battery low" messages), it must be replaced. Make sure, though, that the problem is really due to the battery and not to a defective or dirty solar panel.

Adcon highly recommends that you check the solar panels' state and clean them often. The rain droplets can splash thin layers of soil on the panels, thus reducing their power output. The surrounding vegetation can also lower the panels' efficiency.

2.7.2 Changing the battery

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

1. Open the lid by unscrewing the four screws in the corners of the A73x RTU, then remove the lid as shown in Fig. 6.

Fig. 6:   Removing the A73x Lid

2. The battery pack is connected to the electronics board by means of a PCB connector. Remove the battery pack's plug from the PCB connector, as shown in Fig. 7.
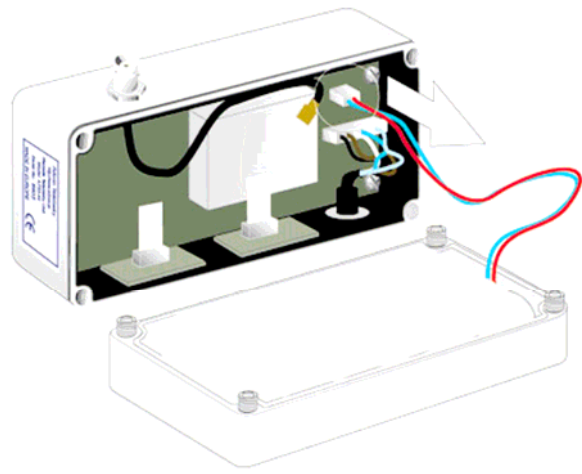
Fig. 7:   Unplugging the PCB Connector

3. Unscrew the four screws of the plastic cover that holds the battery pack in place, then remove the cover. Fig. 8 shows the A733 battery pack inside the RTU.
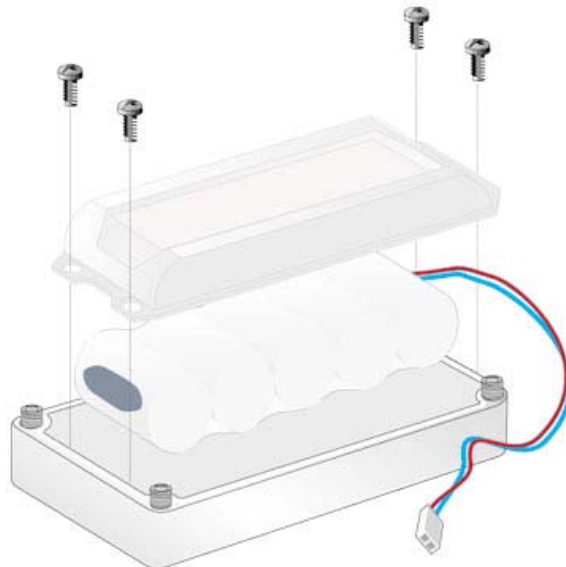
Fig. 8:   A733 Battery Pack

4. Remove the battery pack and replace it with a new one (obtainable from Adcon).
5. Replace the plastic cover and screw the four screws back in.
6. Carefully remove the rubber gasket in the lid and replace it with the one supplied with the battery.
7. Insert the battery plug into the PCB connector.
8. Remount the lid, taking care that the rubber gasket sealing the box is properly seated.

WARNING: *Be sure to mount the rubber gasket properly, so as to retain the unit's IP65 environmental protection.*

9. Screw the four screws back in, applying a moderate force.

3 Performing Advanced Functions

With the appropriate knowledge, you can configure the A73x devices in the field by using a HyperTerminal window. To configure the RTU, you need a special serial cable adapter (not supplied, but available from Adcon).

Do not try to configure your A73x 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.

Tampering with parameters for the A73x 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 RTU are both considered to be nodes. The base station is called the master node, or *master*, while the RTU is called the slave node, or *slave*.

3.1 Understanding connectors

The A73x devices have cable attachments called *connectors*. The connector type determines how the device communicates with the sensors or the computer.

3.1.1 The RTU connectors

The A73x RTU uses standard 7-pin sensors for all available I/O ports (A731 addRELAY excluded), model Binder 702 and 712 series or equivalent, that are identical. Each connector has three analog inputs (0 to 2.5 volt) and two digital input/outputs, one of which you can use as a pulse counter (for example, a rain gauge). Fig. 9 illustrates the individual pins of an I/O connector.
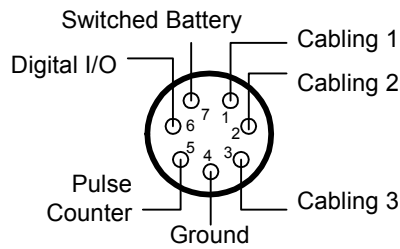
Switched Battery

Digital I/O

Cabling 1

Cabling 2

Pulse
Counter

Cabling 3

Ground

Fig. 9: Pins on an I/O Connector (Top View)

Using Adcon's 7-pin Y-cable lets you attach more than one sensor to one connector.

✎ CAUTION: *To avoid cabling conflicts, first verify in the addVANTAGE software that the sensor combination in the configuration you want is allowed. If you find no conflicts, you can physically attach the sensors to the A73x RTU.*

3.1.2 The POWER Connector

The A73x RTU also has a POWER connector, which allows for:

- External supply (battery or any DC source from 5.6 to 10 volts)

- External charge supply (either a solar panel or an AC adapter) if an internal rechargeable battery is used

- Communication over serial lines, at 19200 baud

Fig. 10 illustrates the connections available at the POWER connector.

Ext. Power

RxD

Battery

TxD

Ground
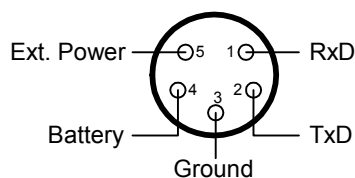
Fig. 10: A73x POWER Connector (Top View)

✎ WARNING: *The serial line is 3-volt CMOS compatible so you must use a special adapter cable to reach the RS-232 levels. Also, if you use an external battery, you must disconnect the internal battery.*

You might want to use the POWER connector with something other than the standard configuration. For example, to connect an external battery to the RTU, disconnect the internal battery and use the configuration shown in Fig. 11.

Fig. 11:   A73x Connection with External Battery

To use the internal battery with a different power supply (charger) than the provided solar panel, disconnect the solar panel and use the configuration shown in Fig. 12.
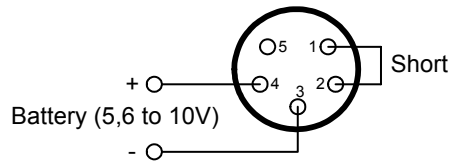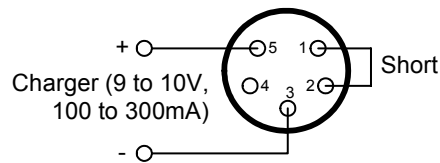

Fig. 12:   A73x Connection with External Power Supply

And to use an external battery with a different power supply (charger) than the provided solar panel, disconnect the internal battery and solar panel and use the configuration shown in Fig. 13.
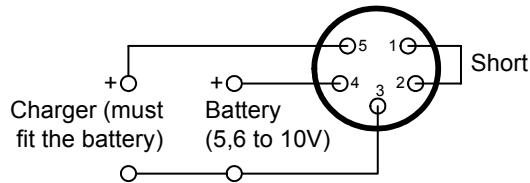
Fig. 13:   A73x Connection with External Battery and Power Supply

3.2 Communicating with the RTU

You can use a Windows HyperTerminal window to connect to the A73x RTU. After you have installed the system, follow these steps to configure the device and set the default parameters:

Note: *To configure the A73x RTU, you must have a special adapter cable (available from Adcon) and plug it into the POWER connector.*

1. Start a HyperTerminal session.
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.

3.3 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. When exchanging numbers, they are represented in decimal format. All commands are terminated with a CR/LF combination. All responses (answers) are terminated with the # character.

3.3.1 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 of 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 recognized 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.

3.3.2 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 be always 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 may 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 54.)

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

3.4 Using terminal commands

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.*

CMDS

AVAILABLE FOR	A731	A732	A733	A733GSM

DESCRIPTION   Returns a list of supported commands.

PARAMETERS   None.

RETURNS   A list of strings separated by spaces.

REMARKS   GET only.

REMOTE   No.

EXAMPLE
```
CMDS
9193 CMDS CMDS ID PMP RSSI TIME FREQ SLOT DATA INFO RX TX
FDEV 0
#
```

TIME

AVAILABLE FOR	A731	A732	A733	A733GSM

DESCRIPTION   Sets/returns the real time clock.

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

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

REMARKS   GET/SET.

REMOTE   No.

EXAMPLE
```
TIME 12/12/1999 22:10:10
9193 TIME 0
#

TIME
9193 TIME 12/12/1998 22:10:10 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 could also violate the applicable radio-communications laws in your country. Depending on the destination country, some models might also return an error message.*

AVAILABLE FOR	A731	A732	A733	~~A733GSM~~

DESCRIPTION   Sets/returns the operating frequency.

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

RETURNS   The actual frequency and step, in Hz.

REMARKS   GET/SET. Not applicable to the A733GSM/GPRS.

REMOTE   Yes, SET only.

EXAMPLE   **FREQ 433925000 25000**
                 9193 FREQ 0
                 #

                 FREQ
                 9193 FREQ 433925000 25000 0
                 #

RSSI

A731	A732	A733	~~A733GSM~~ v

AVAILABLE FOR

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

PARAMETERS   The threshold value. For the A73x non-GSM RTU, it can take values from 0 to 255;
                 it is typically factory set to 42.

RETURNS   The instant RSSI value and the programmed threshold.

REMARKS   GET/SET. Not applicable to the A733GSM/GPRS.

REMOTE   No.

EXAMPLE   **RSSI 42**
                 9193 RSSI 0
                 #

                 RSSI
                 9193 RSSI 34 42 0
                 #

Note: *The values of the RSSI threshold have no units, they are arbitrary. However, a*
                 value of 160 corresponds approximately to the maximum value allowed in the
                 addVANTAGE software (that is, 8 µV).

ID

A731	A732	A733	A733GSM

AVAILABLE FOR

DESCRIPTION   Sets/returns the node's ID.

PARAMETERS   The node ID.

RETURNS   The node ID.

REMARKS   GET/SET.

REMOTE   Yes, SET only.

EXAMPLE   **ID 4557**
                 9193 ID 0
                 #

                 ID
                 4557 ID 4557 0
                 #

SLOT

CAUTION	*Changing these parameters might adversely affect the ability of the device to operate for extended periods under low solar radiation conditions.*
AVAILABLE FOR	~~A731~~ A732 A733 A733GSM
DESCRIPTION	Sets/returns the node's sampling interval and rate.
PARAMETERS	The interval (60 - 65535) and rate (0 - 255). The interval represents the time (in seconds) elapsed between two slots stored in the internal memory, while the rate represents the numbers of samples used to build the average that will be stored.
RETURNS	The interval and rate.
REMARKS	GET/SET. The default interval is 900 (15 minutes) and rate is 15 (15 samples per quarter of an hour).
REMOTE	Yes, SET only.
| EXAMPLE | ```
SLOT 900 15
9193 SLOT 0
#

SLOT
9193 SLOT 900 15 0
#
``` |

SST

AVAILABLE FOR	~~A731~~ A732 A733 A733GSM
DESCRIPTION	Sets/returns the RTU sensor's settling time, which is the time that elapses between powering the sensors and sampling them. Default value is 2 seconds.
PARAMETERS	The settling time in seconds.
RETURNS	The current settling time.
REMARKS	GET/SET.
REMOTE	Yes, SET only.
| EXAMPLE | ```
SST 3
9193 SST 0
#
SST
9193 SST 3 0
#
``` |

PMP

AVAILABLE FOR	A731 A732 A733 A733GSM
DESCRIPTION	Sets/returns the node's Power Management Parameters (switches on/off the battery charge).
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 NiCd battery). From these values, other thresholds are internally computed.
RETURNS	The lower (switch on) and the higher limit (switch off), both in volts x 10.
REMARKS	GET/SET.

REMOTE | Yes, SET only.

EXAMPLE
```
PMP 65 72
9193 PMP 0
#
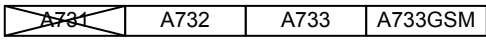
PMP
9193 PMP 65 72 0
#
```

ANLG

AVAILABLE FOR

~~A731~~	A732	A733	A733GSM

DESCRIPTION | Sets/returns various parameters of the analog subsystem (for example, the sampling/averaging method used for individual data acquisition channels).

PARAMETERS | A control byte specifying the command and the analog input channel number the command is acting on:
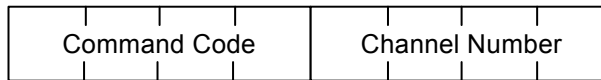
Command Code	Channel Number

Fig. 14:   The ANLG Control Byte Layout.

Some commands may also require one or two additional 12-bit parameters representing threshold values.

- The Channel Number selects the analog channel that will be affected by the command. For the A733, only 0000 to 1011 are accepted (only 12 analog channels are available).

- The Command Code specifies the operation that will be applied to the selected channel. They are described in Table below.

Code	Description	Parameters	Returns
0000	RSM – Read Sampling Method. This command reads the current programmed sampling method for all analog input channels.	None	The current sampling methods and the result (OK or ERROR); see also the sampling table below
0001	SSMMI – Set Sampling Method to Minimum. The specified analog channel is instructed to store the lowest sampled value.	The channel number	Result (OK or ERROR)
0010	SSMMA – Set Sampling Method to Maximum. The specified analog channel is instructed to store the highest sampled value.	The channel number	Result (OK or ERROR)
0011	SSMS – Set Sampling Method to Sum. The specified analog channel is instructed to store the sum of all sampled values.	The channel number	Result (OK or ERROR)
0100	SSMAA – Set Sampling Method to Arithmetic Average. The specified analog channel is	The channel number	Result (OK or ERROR)

Code	Description	Parameters	Returns
	instructed to store the arithmetic average of all sampled values.		
0101	SSMCA – Set Sampling Method to Circular Average. The specified analog channel is instructed to store the circular average of all sampled values.	The channel number	Result (OK or ERROR)
0110	SSMF – Set Sampling Method to First. Only the first sampled value is stored in each slot.	The channel number	Result (OK or ERROR)
0111	SSML – Set Sampling Method to Last. Only the last sampled value is stored in each slot.	The channel number	Result (OK or ERROR)
1000	RNS – Read Notification Status[1]. If no notification was pending, this command returns an error. If one was pending, the last valid timestamp is returned and the notification is cleared.	The channel number	Returns the time when the threshold was reached (in standard time format) and the result (OK or ERROR)
1001	RPNNER – Read the Pending Notifications and the Notification Enable Register. This command returns the 16-bit Pending Notifications and the Notification Enable Registers; the channel Number has no significance for this command.	None	Two 16-bit integers (first the NE and then the PN register) and the result (OK or ERROR)
1010	DAN – Disable Any Notification.	The channel number	Result (OK or ERROR)
1011	RNTTL – Read Notification Type and Thresholds/Limits.	The channel number	One 8-bit char (Notification Type), two 16-bit integers (first the lower limit and then the higher limit), and the result (OK or ERROR); if only a threshold was set, the second 16-bit integer is irrelevant
1100	ENOPTR – Enable Notify On Positive Threshold Reached.	The channel number and the threshold (16 bit value)	Result (OK or ERROR)
1101	ENONTR – Enable Notify On Negative Threshold Reached.	The channel number and the threshold (16 bit value)	Result (OK or ERROR)

[1] See also "Notifications" on page 54.

Code	Description	Parameters	Returns
1110	ENOL – Enable Notify if Out of Limits.	The channel number and the limit values (16 bit value), first the lower and then the higher limit	Result (OK or ERROR)
1111	ENIL – Enable Notify if Inside the Limits.	The channel number and the limit values (16 bit value), first the lower and then the higher limit	Result (OK or ERROR)

Sampling methods are defined by three bits, as follows.

Sampling method	Binary value	Description
Reserved	000	Not defined
Minimum	001	If more than one sample per slot is performed, the lowest value is stored.
Maximum	010	If more than one sample per slot is performed, the highest value is stored.
Sum	011	The sum of all samples for a certain slot is stored.
Average (arithmetic)	100	If more than one sample per slot is performed, the arithmetic average of all samples is stored.
Average (circular)	101	If more than one sample per slot is performed, the average computed on a circle is stored (i.e. on a 0 to 359 degree circle, overflow occurs at the 359 degree value).
First sample	110	If more than one sample per slot is performed, the first value is stored. All other samples are discarded.
Last sample	111	If more than one sample per slot is performed, the last value is stored. All other samples are discarded.

Following notification types can be returned when issuing the RNTTL command:

Value	Notification Type
00	Notify On Positive Threshold.
01	Notify On Negative Threshold.
10	Notify if Out of Limits.
11	Notify if Inside the Limits.

RETURNS   The return result depends on the control byte (see *Value* in the table above). However, whatever the return result is, it includes the control byte.

REMARKS   The general behavior is that an ANLG command issued on a certain input channel will override any previous ANLG commands affecting that channel.

REMOTE   The A733 cannot issue ANLG commands remotely, but can execute them.

EXAMPLE

For **RSM**

```
ANLG 0
9999 ANLG 0 5 5 5 5 5 5 5 5 4 4 5 5 0
#
```

For **SSMAA** (on channel 4)

```
ANLG 68
9999 ANLG 68 0
#
```

For **DAN** (on channel 0)

```
ANLG 160
9999 ANLG 160 0
#
```
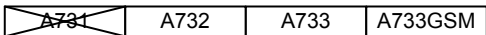
For **RNTTL** (on channel 2)

```
ANLG 178
9999 ANLG 178 340 3900 0
#
```

For **ENOPTR** (on channel 10)

```
ANLG 202 1000
9999 ANLG 202 0
#
```

ANRT

AVAILABLE FOR

~~A731~~	A732	A733	A733GSM

DESCRIPTION Sets/returns the routing of the hardware analog inputs to frame positions. This command allows you to change the assignment of physical analog input ports to data frame positions.

PARAMETERS None for inquiry. Position of value in frame and input channel for rerouting operations.

RETURNS List of current routings.

REMARKS On inquiry the input channels are output in the order of their position within the data frame (note: input channel numbers start with 0).

On changing the input channel routings, the first parameter specifies which data frame position to use for the data value, and the second parameter determines which input channel to use. The input channels on A733 and A733GSM/GPRS are numbered from 0 to 11, but on A732 and A723 they are numbered from 0 to 5. Input channels 0 to 2 are taken from I/O A, cabling 1 to 3; input channels 3 to 5 are taken from I/O B, cabling 1 to 3; and so on. Two special input channels exist:

> 16 the value from the RTU's internal temperature sensor (raw values are in the range of 0 to 4095, which describe temperature values from -68 to 332 degree Celsius)

17 the value from the RTU's internal battery voltage sensor (raw values are in the range of 0 to 4095, which describe voltage levels from 0 to 20 Volts)

When any non-default routing of analog inputs was active when a data frame was sampled and saved, this is indicated in the data frame's digibyte in bit number 4 (value 16).

REMOTE	Yes.
EXAMPLE	Show which analog input is routed to which position in the data frame:

ANRT
26151 ANRT 0 1 2 3 4 5 6 7 8 9 10 11 0
#

(This example shows the default output of the ANRT command.)

Route the internal temperature sensor value (16) to the position of analog 0 in the data frame:
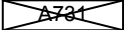
ANRT 0 16
26151 ANRT 0
#

💣 *CAUTION*	*New analog routings will **not** take effect immediately, but after the current data slot is saved by the device.*
Note:	*The last digit in the command reply is the status code (in this case 0, which means: successful completion of the command).*

DATA

AVAILABLE FOR	~~A731~~ A732 A733 A733GSM
DESCRIPTION	Returns data stored for a certain device.
PARAMETER	The ID of the device for which the data is requested and the date/time (in the standard format) the data was stored. If missing, it refers to the data of the local device.
RETURNS	A data block.
REMARKS	GET only. If the date/time parameter is not included, the latest data is returned. If the date/time parameter is included, the date and time closest to, but later than, the given date/time is returned.
REMOTE	Yes, for a GET, but only one frame at a time. The A733 can issue the command only for itself, locally.
EXAMPLE	**DATA 9193 1/3/2000 12:12:12** **9193 DATA b1 b2 b3 ... bn 0** **#**

The data block returned typically contains a number of data frames (telegrams). The structure of a block is as follows:

The data block returned typically contains a number of data frames (telegrams). The structure of a block is as follows:

```
dd mm yyyy hh mm ss si ft d1 d2 ... dn dd mm yyyy ... dn cs
```

where:

- *dd mm yyyy* is the date

- *hh mm ss* is the time

- *si* is the size of the frame (21 for frame type 37, 13 for frame type 38)

- *ft* is the frame type (37 for the A733, 38 for A732 and A731)

- *d1 d2 ... dn* are the data values (the frame content)

- *cs* is a 16-bit checksum obtained by summing the bytes and discarding the carries over *0xFFFF*

The A733 devices always respond with a type 37 data frame. The A731 and A732 respond with a type 38. The composition of the data blocks of such frames (the values marked as d1, d2... dn) is depicted in Fig. 15, while the digibyte is depicted in Fig. 16.

A733
RF incoming
RF outgoing
Digibyte
I/O A Pulse Counter
I/O B Pulse Counter
I/O C Pulse Counter
I/O D Pulse Counter
Battery
I/O A Cabling 1
I/O A Cabling 2
I/O A Cabling 3
I/O B Cabling 1
I/O B Cabling 2
I/O B Cabling 3
I/O C Cabling 1
I/O C Cabling 2
I/O C Cabling 3
I/O D Cabling 1
I/O D Cabling 2
I/O D Cabling 3

A732 / A731
RF incoming
RF outgoing
Digibyte
I/O A Pulse Counter
I/O B Pulse Counter
Battery
I/O A Cabling 1
I/O A Cabling 2
I/O A Cabling 3
I/O B Cabling 1
I/O B Cabling 2
I/O B Cabling 3

Fig. 15:   Frame 37 (left) and Frame 38 (right) description

b7							b0
SC	Dig6	Dig5	Dig4	Dig3	Dig2	Dig1	Dig0

SC-Battery Charge (0-off, 1-on)   Dig n – Digital I/O n
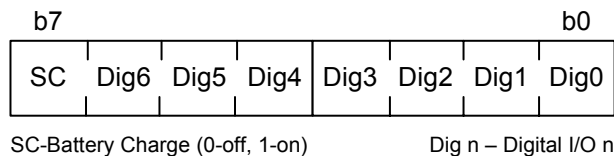
Fig. 16:   The Digibyte

The remote version is limited to a single frame. An example of such a command is given below:

```
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
#
```

Notice that if you need to get data that is not the last (newest) slot remotely from a device, you must supply the ID twice. If you need to get the last slot stored, you can ignore the ID and the date/time parameters:

```
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
#
```

IMME

AVAILABLE FOR	~~A731~~	A732	A733	A733GSM

DESCRIPTION Samples all inputs and immediately returns the sampled data.

PARAMETER The ID of the requested subsystem; default is the standard A/D subsystem of the A733 (ID=0).

Note: *Currently only the default subsystem is implemented on the A73x.*

RETURNS A data block (see also "DATA" on page 36).

REMARKS GET only. The command needs a certain delay to execute (for example, for the standard subsystem this delay amounts to two seconds. The delay is necessary to allow for the sensors to settle after applying power to them.

REMOTE No.

EXAMPLE
```
IMME
15695 IMME 26 5 2003 17 18 28 21 37 0 0 127
0 554 0 0 84
0 0 0    1016 2048 3072      0 0 0       0 0 0
9056 0
#
```

FDEV

AVAILABLE FOR	A731	A732	A733	A733GSM

DESCRIPTION Formats the internal memory (destroys all the data).

PARAMETER If the parameters are missing, the command destroys all the data in the EEPROM file. If a parameter is given, the EEPROM type is defined (data won't be destroyed). Following EEPROM types are currently defined:
- 0 – 16 Kbytes (e.g. model 25128)
- 1 – 32 Kbytes (e.g. model 25256)

RETURNS Nothing.

REMARKS SET only.

REMOTE Yes, SET only.

EXAMPLE
```
FDEV 1
```

```
9193 FDEV 0
#
```

INFO

AVAILABLE FOR

A731	A732	A733	A733GSM

DESCRIPTION Returns various status information.

PARAMETER None.

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 (irrelevant for the A733GSM/GPRS)

- *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 A733 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)

- *temp* as internal temperature in the A733 housing, which is device dependent. The precision of the sensing element is low (±2°C), but it is sufficient for battery power management (charge/discharge). To compute the actual value (in °C), the following equation must be used:

$$\text{Temp} = \frac{\text{internalTemp} * 400}{255} - 68$$

- *days_uptime* in days; together 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 (irrelevant for the A733GSM/GPRS)

- *pmp_low* and *pmp_high* are the programmed values with the PMP command (irrelevant for the A733GSM/GPRS)

- *type* is used to represent the device type; 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

- *slot* and *samples* are the actual values programmed by using the SLOT command

- *po* is the power output of the device during the last frame sent; this value is relative (50 mW corresponds to a value of approx. 25, while 500 mW corresponds to a value of approx. 200) (this parameter is irrelevant for the A733GSM/GPRS)

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

REMARKS   GET only.

REMOTE   Yes, GET only. The A733 can issue the command both remotely and locally.

EXAMPLE   **INFO**
                 9193 INFO 255 0 18/4/1999 21:5:11 1.3 0 0 0 91 72 40 1:46 58
                 65 72 3 900 15 175 0
                 #

PORT

AVAILABLE FOR | A731 | A732 | A733 | A733GSM |

DESCRIPTION   A complex command acting upon the I/O ports of a device.

PARAMETERS   A control byte specifying the command, the bit of the port the command is acting on, and two 16-bit parameters, depending on the control byte; for some commands, one or both of them may be missing. However, if they are needed for a certain command but not given, null values are implied.

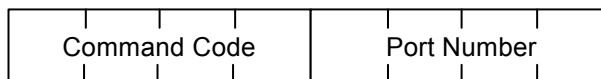The control byte's significance is shown in Fig. 17.

Command Code	Port Number

Fig. 17:   The Control Byte Layout

- The **Port Number** selects the port that will be affected by the command. For the A733, only 0000 to 0011 are accepted (only four ports are available).

- The **Command Code** specifies the operation that will be applied to the selected port. They are explained in the table below.

Code	Description	Parameters	Returns
0000	RDP – Read Data Port. This command reads the whole 16-bit port and returns its value; the Port Number has no significance for this command.	None	A 16-bit integer and the result (OK or ERROR). Only the lowest four significant bits reflect valid ports for the A733.

Code	Description	Parameters	Returns
0001	RDDR – Read Data Direction Register. This command reads the whole 16-bit Data Direction Register and returns its value; the Port Number has no significance for this command.	None	A 16-bit integer and the result (OK or ERROR).
0010	CAI – Configure the port specified by Port Number as input (acts upon the Data Direction Register).	The port number	Result (OK or ERROR).
0011	CAO – Configure the port specified by Port Number as output (acts upon the Data Direction Register).	The port number	Result (OK or ERROR).
0100	RBV – Read the specified bit.	The port number	Bit value and the result (OK or ERROR).
0101	RNS – Read the notification[2] status. If no notification was pending, this command returns an error. Even in this case the time stamp of the last valid notification is returned. If a notification was pending, it will be cleared.	The port number	Returns the time of the last port change in standard time format and the result (OK or ERROR).
0110	DNOPC – Disable Notify On Port Change.	The port number	Result (OK or ERROR).
0111	ENOPC – Enable Notify On Port Change.	The port number	Result (OK or ERROR).
1000	RPNNER – Read the Pending Notifications and the Notification Enable Register. This command returns the 16-bit Pending Notifications and the Notification Enable Registers; the Port Number has no significance for this command.	None	Two 16-bit integers (first the PN and then the NE register) and the result (OK or ERROR).
1001	CB – Clear the specified bit.	The port number	Result (OK or ERROR).
1010	SB – Set the specified bit.	The port number	Result (OK or ERROR).
1011	XB – Exclusive Or the specified bit.	The port	Result (OK or

---

[2]   See also "Notifications" on page 54.

Code	Description	Parameters	Returns
		number	ERROR).
1100	MFR – Monostable function, start with the specified bit in OFF state (reset).	The port number, the OFF and the ON times (in seconds), both as 16-bit integers	Result (OK or ERROR).
1101	MFS – Monostable function, start with the specified bit in ON state (set).	The port number, the ON and the OFF times (in seconds), both as 16-bit integers	Result (OK or ERROR).
1110	MVFR – Multivibrator function, start with the specified bit in OFF state (reset).	The port number, the ON and the OFF times (in seconds), both as 16-bit integers	Result (OK or ERROR).
1111	MVFS – Multivibrator function, start with the specified bit in ON state (set).	The port number, the ON and the OFF times (in seconds), both as 16-bit integers	Result (OK or ERROR).

RETURNS   The return result depends on the control byte. However, whatever the return result is, it includes the control byte.

REMARKS   The general behavior is that a PORT command issued on a certain port bit will override any previous PORT commands. For example, if a port was configured as input and then an MFR (monostable function) was issued, the port automatically switches to output. A new MFR or similar function clears the status of the port and starts from scratch, even if the previous command was not finished.

After power loss all port are set to be input ports, only notification settings are kept in non-volatile memory and thus newly occurring notification conditions are recorded and reported. Monostable- or multivibrator-function settings are lost.

When entering misery state, the RTU stops monostable or multivibrator functions in the state they are when entering misery state, and when leaving misery state the monostable or multivibrator functions are continued where left off.

EXAMPLE   For **RDP**:

```
PORT 0
9193 PORT 0 1 0
#
```

For **RDDR**:

```
PORT 16
9193 PORT 16 0 0
#
```

For **ENOPC**:

```
PORT 112
9193 PORT 112 0
#
```

For **RPNNER**:

```
PORT 128
9193 PORT 128 0 1 0
#
```

For **RNS**:

```
PORT 80
9193 PORT 80 7/5/1999 18:34:22 0
#
```

RX

AVAILABLE FOR	A731	A732	A733	A733GSM

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

PARAMETERS   None.

RETURNS   Nothing.

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

REMOTE   No.

EXAMPLE
```
RX
9193 RX 0
#
```

TX

AVAILABLE FOR	A731	A732	A733	A733GSM

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

PARAMETERS   None (sends an unmodulated carrier), 1 (sends a 1 kHz modulated carrier), 0 (sends a 2 kHz modulated carrier), or 5 (sends a mixed 1 + 2 kHz modulated carrier).

RETURNS   Nothing.

REMARKS   The system stops and exits the command only when a key is pressed. This command returns no message. Not applicable to the A733GSM/GPRS.

REMOTE   No.

EXAMPLE
```
TX
9193 TX 0
#
```

```
TX 1
9193 TX 0
#

TX 5
9193 TX 0
#
```

B

AVAILABLE FOR	A731	A732	A733	~~A733GSM~~

DESCRIPTION   Sends a broadcast frame.

PARAMETERS   None.

RETURNS   A data block.

REMARKS   After the device sends the broadcast frame, it will listen for answers. All valid answers will be listed with their IDs. Not applicable to the A733GSM/GPRS.

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 heard stations with their RF levels will be updated in the memory and available whenever the BLST command is issued.

EXAMPLE
```
B
9193 B 0
#234 BA 0
#7851 BA 0
```

BLST

AVAILABLE FOR	A731	A732	A733	~~A733GSM~~

DESCRIPTION   Lists the stations heard after the last broadcast command was issued.

PARAMETERS   None.

RETURNS   The date and time when the broadcast was performed, the number of stations heard, and a list with the heard stations' IDs and their respective RF levels. The first column shows the stations' IDs, the second column the RSSI value the reply of the remote station was received with, and the third column the RSSI value the broadcast was received with by the remote station.

REMARKS   GET only. Not applicable to the A733GSM/GPRS.

REMOTE   Yes. The remote version lists only the first 9 stations heard.

EXAMPLE
```
BLST
9193 BLST 10/12/1999 12:15:04 4
2008 150 163
2003 177 168
6883 168 170
4027 220 215
#
```

VER

AVAILABLE FOR	A731	A732	A733	A733GSM

DESCRIPTION   Requests the firmware version of the device.

PARAMETERS	None.
RETURNS	The current version.
REMARKS	GET only.
REMOTE	No.
EXAMPLE	**VER** **9193 VER 1.0.17 0** **#**

Note: *This command is provided only for compatibility with older units. The host software may use this command to identify the unit it is communicating with. After detecting that the device supports this protocol, the INFO command must be used for further details, if available.*

SDI

AVAILABLE FOR
A731	A732	A733	A733GSM

DESCRIPTION   A complex command that can be used to check the status of the SDI-12 subsystem, as well as configure it.

PARAMETERS   The command has a multitude of options. If issued without parameters, the GET variant is implied, i.e. the status of the SDI-12 subsystem will be returned (see also below). The full extent of the commands is not given here as the the SDI-12 subsystem is configured via the wireless link by using the GUI configurator in the A840 Telemetry Gateway. Additional information can be obtained from Adcon Telemetry upon request.

RETURNS   Following information is supplied in the form of a string of characters (the GET variant):

- a/A — The presence of the SDI-12 adapter: a absent, A present

- w/W — The system is in wait state: w not waiting, W waiting for an SDI-12 sensor

- m/M — Measurement command started: m no measurement is being done, M a measurement is in progress

- v/V — Values for storage available: v no values are available, V values are available for local storage

- d/D — autodiscovery initiated: d no autodiscovery pending, D autodiscovery pending (will be done at the next sensor poll cycle)

In addition, for every programmed SDI-12 sensor, following information will be listed:
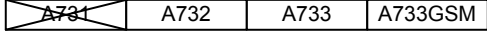
- sensor id — the sensor ID in ASCII (0 - 9, A - Z and a - z)

- method + CRC — the measuring method, either M (normal) or R (continuous), optionally followed by the CRC flag (C)

- index — the indices used (in hexadecimal), e.g. 0x3 if indices 0 and 1 are used

Note: *For further information about the significance of the above terms please refer to the SDI-12 standard specification, version 1.3 (http://www.sdi-12.org).*

REMARKS   SET/GET.

REMOTE   Yes.

EXAMPLE   **12225 sdi**

```
12225 sdi AWmVd 3 0 M0  0x9 0 M2  0x20 7 M5  0x1 0
OK
#
```

DATASDI

AVAILABLE FOR

| ~~A731~~ | A732 | A733 | A733GSM |

DESCRIPTION   Returns a slot of SDSI-12 sensor data, if any.

PARAMETERS   Offset and date/time, both optional. If an offset is specified, only the values after the offset are returned, all others are skipped. The date/time specifies the first slot to be retrieved that is strictly "younger" than the specified time stamp.

RETURNS   The data block returned will typically contain a number of data frames (telegrams). The structure of a block is as follows:
dd mm yyyy hh mm ss si ft d1 d2 ... dn dd mm yyyy ... dn cs

where:

- *dd mm yyyy* is the date

- *hh mm ss* is the time

- *si* is the size of the frame (variable for the SDI frames)

- *ft* is the frame type (60 or 61 for the A733)

- *d1 d2 ... dn* are the data values (the frame content)

- *cs* is a 16-bit checksum obtained by summing the bytes and discarding the carries over 0xFFFF

The composition of the data block of such a frame (the values marked as d1, d2... dn) is depicted in Fig. 18, while the digibyte is depicted in Fig. 19.

A733
RF incoming
RF outgoing
Digibyte
I/O A Pulse Counter
I/O B Pulse Counter
I/O C Pulse Counter
I/O D Pulse Counter
Battery
I/O A Cabling 1
I/O A Cabling 2
I/O A Cabling 3
I/O B Cabling 1
I/O B Cabling 2
I/O B Cabling 3
I/O C Cabling 1
I/O C Cabling 2
I/O C Cabling 3
I/O D Cabling 1
I/O D Cabling 2

A732 / A731
RF incoming
RF outgoing
Digibyte
I/O A Pulse Counter
I/O B Pulse Counter
Battery
I/O A Cabling 1
I/O A Cabling 2
I/O A Cabling 3
I/O B Cabling 1
I/O B Cabling 2
I/O B Cabling 3
SDI count
SDI offset
SDI available
SDI data block

I/O D Cabling 3
SDI count
SDI offset
SDI available
SDI data block

Fig. 18:   Frame 60,61 (left) and 62 (right) description

The frame is similar to the standard DATA frame, but has the SDI sensor values appended after the standard analog values. The frame type 60 contains SDI-12 data only.

SDI-12 specific parameters are explained below:

- `SDI count` —the number of SDI values following in the SDI data block.

- `SDI offset` — the offset in the SDI-12 frame. Usually it is 0 (no offset is used).

- `SDI available` —the number of SDI-12 sensor values effectively returned. The difference between the `SDI count` and `SDI available` indicates missing sensors (down or damaged). Usually these two values are equal.

- SDI values —a number of SDI-12 data blocks, each consisting of four values:

- SDI address

- SDI method

- SDI index

- SDI value (floating point)

You can also see the example below.

For additional information about the significance of the SDI address, method, and index, please refer to the SDI-12 standard specification (http:// www.sdi-12.org).

The digibyte is similar to the DATA command:

b7   b0

SC	Dig6	Dig5	Dig4	Dig3	Dig2	Dig1	Dig0

SC-Battery Charge (0-off, 1-on)   Dig n – Digital I/O n
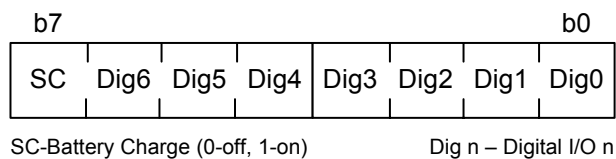
Fig. 19:   The Digibyte

The remote version is limited to a single frame.
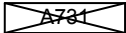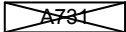
REMARKS   GET only.

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
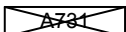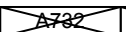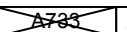**3.553500 3 0 8 0.037200 2953 0**
#

SDA

AVAILABLE FOR	~~A731~~	A732	A733	A733GSM

DESCRIPTION
Sets/returns the maximum delay for waiting awake (i.e. out of sleep mode) for a service request of an SDI-12 sensor. This parameter is set to 30 seconds by default. A larger value may lead to higher power consumption. This should be used in cases where an SDI-12 sensor needs large time values to return a sensor result. If you have such sensors and still want to use them, you need to change this parameter, but please be aware that the RTU's power consumption will be higher.

PARAMETERS
Maximum wake time in seconds (1 to 999).

RETURNS
The current value (in seconds).

REMARKS
SET/GET.

REMOTE
No.

EXAMPLE
```
SDA
29000 SDA 30 0
#

SDA 50
29000 SDA 0
#
```

FPC

AVAILABLE FOR	~~A731~~	A732	A733	A733GSM

DESCRIPTION:
This command allows the use of sensors that generate pulses with frequencies between 0.5Hz and 30Hz.

PARAMETERS:
0: let processor enter power save mode and thus not catch "fast" pulses.
1: enable RTU to count "fast" pulses.
NONE: display current setting.

RETURNS:
The current setting, or the command's success or error code.

REMARKS:
GET/SET, starting from RTU firmware version 2.2.0.

REMOTE:
No.

EXAMPLE:
```
FPC
193 FPC 0 0
#

FPC 1
193 FPC 0
#

FPC
193 FPC 1 0
#
```

GSMPIN

AVAILABLE FOR	~~A731~~	~~A732~~	~~A733~~	A733GSM

DESCRIPTION
Allows entering the PIN code for activating the SIM card.

PARAMETERS
The PIN code.

RETURNS
Result: success or error (error if the wrong PIN code was entered).

REMARKS	SET only. Valid for the A733GSM/GPRS RTU only.
REMOTE	No.

EXAMPLE	`GSMPIN 1234`
	`29000 GSMPIN 0`
	`#`

GSMPUK

AVAILABLE FOR	A731 A732 A733 A733GSM
DESCRIPTION	Allows entering the PUK code for recovering a lost PIN code.
PARAMETERS	The PUK and the PIN codes.
RETURNS	Result: success or error (error if the wrong PUK code was entered).
REMARKS	SET only. Valid for the A733GSM/GPRS RTU only.
REMOTE	No.

EXAMPLE	`GSMPUK 12345678 1234`
	`29000 GSMPUK 0`
	`#`

GSMSTAT/GPRSSTAT

AVAILABLE FOR	A731 A732 A733 A733GSM
DESCRIPTION	Returns GSM-module-related status information.
PARAMETERS	None.
RETURNS	Result: a list of current status parameters. The list is self-explanatory.
REMARKS	GET only. Valid for the A733GSM/GPRS RTU only. GPRSSTAT is a synonym for GSMSTAT.
REMOTE	No.

EXAMPLE	`GSMSTAT`
	`GSM modem on:    Yes`
	`SIM card found:  Yes`
	`PIN set:         Yes`
	`PIN accepted:    Yes`
	`Sleepmode OK:    Yes`
	`PUK required:    No`
	`Default IMEI nr: No`
	`GPRS:            Yes`
	`GPRS IP conn.:   No`
	`Attempts left to enter PIN: 3, PUK: 10`
	`0`
	`#`

Note: *The A733GSM/GPRS RTU can be called via the GSM interface from a standard modem. The command line interface is therefore remotely accessible. In this respect, many commands that are otherwise not as remotely accessible can be in fact accessed remotely.*

GPRSAPNSERV

AVAILABLE FOR	A731 A732 A733 A733GSM

DESCRIPTION   Sets/returns the GPRS operator network's Access Point Name parameter.

PARAMETERS   The GPRS operator network's Access Point Name parameter.

RETURNS   The current value.

REMARKS   SET/GET.

REMOTE   No.

EXAMPLE   **GPRSAPNSERV**
29000 GPRSAPNSERV "A1.net" 0

#

GPRSAPNSERV "web.one.at"

29000 GPRSAPNSERV 0

#

GPRSAPNUN

AVAILABLE FOR   ~~A731~~ ~~A732~~ ~~A733~~ A733GSM

DESCRIPTION   Sets/returns the GPRS operator network's Access Point Name User Name parameter.

PARAMETERS   The GPRS operator network's Access Point Name User Name parameter.

RETURNS   The current value.

REMARKS   SET/GET.

REMOTE   No.

EXAMPLE   **GPRSAPNUN**
29000 GPRSAPNUN "ppp@A1plus.at" 0

#

GPRSAPNUN "web"

29000 GPRSAPNUN 0

#

GPRSAPNPW

AVAILABLE FOR   ~~A731~~ ~~A732~~ ~~A733~~ A733GSM

DESCRIPTION   Sets/returns the GPRS operator network's Access Point Name Password parameter.

PARAMETERS   The GPRS operator network's Access Point Name Password parameter.

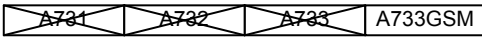RETURNS   The current value.

REMARKS   SET/GET.

REMOTE   No.

EXAMPLE   **GPRSAPNPW**
29000 GPRSAPNPW "ppp" 0

#

GPRSAPNPW "web"

29000 GPRSAPNPW 0

```
#
```

GPRSHOST

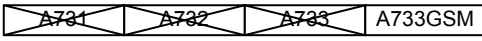| AVAILABLE FOR	~~A731~~ ~~A732~~ ~~A733~~ A733GSM
DESCRIPTION	Sets/returns the IP address of the A840 Telemetry Gateway.
PARAMETERS	The IP address of the A840 Telemetry Gateway.
RETURNS	The current value.
REMARKS	SET/GET.
REMOTE	No.
EXAMPLE	**GPRSHOST** **29000 GPRSHOST "123.34.56.34" 0** **#** **GPRSHOST "35.123.33.44"** **29000 GPRSHOST 0** **#**

GPRSPORT

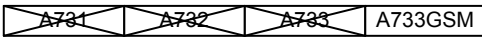| AVAILABLE FOR	~~A731~~ ~~A732~~ ~~A733~~ A733GSM
DESCRIPTION	Sets/returns the target port number where the A840 Telemetry Gateway can be reached.
PARAMETERS	The port number on the A840 Telemetry Gateway.
RETURNS	The current value.
REMARKS	SET/GET.
REMOTE	No.
EXAMPLE	**GPRSPORT** **29000 GPRSPORT 81 0** **#** **GPRSPORT 12345** **29000 GPRSPORT 0** **#**

GPRSDNS1/GPRSDNS2

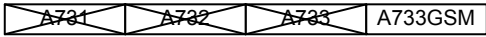| AVAILABLE FOR	~~A731~~ ~~A732~~ ~~A733~~ A733GSM
DESCRIPTION	Sets/returns the IP address of the GRPS network operator's DNS servers.
PARAMETERS	The IP address of the GRPS network operator's DNS servers.
RETURNS	The current value.
REMARKS	SET/GET. Available only for RTUs with built-in WaveCOM GSM module. Not recommended.
REMOTE	No.

EXAMPLE

```
GPRSDNS1
29000 GPRSDNS1 123.34.56.34 0

#

GPRSDNS1 35.123.33.44

29000 GPRSDNS1 0

#
```

GPRSSECRET

AVAILABLE FOR | A731 | A732 | A733 | A733GSM

DESCRIPTION | Sets/returns the secret value (a number in the range from 0 to 4294967295) used to authenticate the GPRS RTU against the A840 Telemetry Gateway.

PARAMETERS | The port number on the A840 Telemetry Gateway.

RETURNS | Success or error.

REMARKS | SET ONLY.

REMOTE | No.

EXAMPLE

```
GPRSSECRET
29000 GPRSSECRET 5

#

GPRSSECRET 12345

29000 GPRSSECRET 0

#
```

GPRSCONNINT

AVAILABLE FOR | A731 | A732 | A733 | A733GSM

DESCRIPTION | Sets/returns the connection setup interval in seconds. This value and **GPRSCONNALIGN** determine when the GPRS RTU will contact the A840 Telemetry Gateway. A value of 3600 seconds means that a connection to the A840 Telemetry Gateway will be established every hour.

PARAMETERS | The connection setup interval in seconds (value in the range from 0 to 4294967295).

RETURNS | The current value.

REMARKS | SET/GET.

REMOTE | No.

EXAMPLE

```
GPRSCONNINT
29000 GPRSCONNINT 3600 0

#

GPRSCONNINT 7200

29000 GPRSCONNINT 0

#
```

GPRSCONNALIGN

AVAILABLE FOR	~~A731~~ ~~A732~~ ~~A733~~ A733GSM
DESCRIPTION	Sets/returns the connection setup alignment point in time. This value and **GPRSCONNINT** determine when the GPRS RTU will contact the A840 Telemetry Gateway. A value of 3600 seconds means that the alignment the points in time for a connection to the A840 Telemetry Gateway is 1:00 in the morning.
PARAMETERS	The connection setup alignment point in time in seconds in the range from 0 to 4294967295.
RETURNS	The current value.
REMARKS	SET/GET.
REMOTE	No.

EXAMPLE	`GPRSCONNALIGN`
	`29000 GPRSCONNALIGN 3600 0`
	
	`#`
	
	`GPRSCONNALIGN 7200`
	
	`29000 GPRSCONNALIGN 0`
	
	`#`

GPRSTMOUT

AVAILABLE FOR	~~A731~~ ~~A732~~ ~~A733~~ A733GSM
DESCRIPTION	Sets/returns the idle timeout in seconds, after which the RTU should assume the connection is broken.
PARAMETERS	The idle timeout in seconds in the range from 0 to 4294967295.
RETURNS	The current value.
REMARKS	SET/GET.
REMOTE	No.

EXAMPLE	`GPRSTMOUT`
	`29000 GPRSTMOUT 3600 0`
	
	`#`
	
	`GPRSTMOUT 7200`
	
	`29000 GPRSTMOUT 0`
	
	`#`

3.5 Notifications

Notifications are frames sent asynchronously by devices that are otherwise slaves. The notifications are received by a device closest to the host and then sent to the host. If the host is not available, the receiving device stores the notification and waits until the host questions it. At this point, the device informs the host that it has a notification. It is then the task of the host to issue a command to read the respective notification.

Before a device can issue a notification, the notification must first be enabled. Special frames are used to this end, depending on the notification type. If an end device is not able to send a notification due to radio propagation or other kinds of communication problems, it will store the date/ time when the notification took place. As soon as the communication is re-established, the device tries to send the notification again.

Note: *To avoid collisions, the device waits a random time (up to 10 seconds) before sending the notification frame.*

The following notifications are currently implemented for the A733 device:

- NOPC—Notification On Port Change (see "PORT" on page 40);
- NOTR—Notification On Threshold Reached (see "ANLG" on page 32).

Note: *The A733GSM/GPRS RTU currently does not support notifications when used in GSM operation mode.*

3.6 Returned errors list

Following are error messages you might get.

3.6.1 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 checksum number

9 — command not supported in this configuration

3.6.2 Device descriptors 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)

3.6.3 Real time clock

20 — incorrect time supplied (conversion to `time_t` was not possible)

3.6.4 Radio interface

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, just making the request round)

37 — time stamp of a frame is too far in the future

38 — general modem error

39 — "unknown modem" error

3.6.5 Notifications

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

4 Specifications

The A733 was intended to fulfill the specification of the EN 300 220-1, and ETSI 300 113, as well as the FCC Part 90, Subpart J of the CFR 47. Table. 2 shows the main operational parameters of the A733.

Note: *The parameters below are measured with an A733 + A431 combination.*

Parameter	Min	Typ	Max	Unit
Common				
Supply	5.6	6.2	10.0	V
Operating Temperature	-30		+70	°C
Operating Temperature GSM/GPRS	-20		+70	°C
Full GSM spec. operating Temp.	-20		+55	°C
Relative Humidity			99	%
Class Protection		IP65		
Data Rate (Using the on-board software modem)[3]	1000	1500	2000	bps
Data Rate GSM		9600	14400	bps
Data Rate GPRS (Class 10) TX, upload			24	kbps
Dimensions	16(L) x 8(W) x 6(D) 6.25 x 3.15 x 2.4			cm in
Weight		1.15 3		kg lb
Data Acquisition Subsystem				
Analog Inputs	12 (A733 and A733GSM/GPRS) 6 (A732) 0 (A731)			
Analog Inputs Resolution		10		bits

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[3] Data rate is content dependent.

Parameter	Min	Typ	Max	Unit
Analog Inputs Accuracy		0.1		%
Analog Input Range	0		2.5	V
Digital I/O	4 (A733 and A733GSM/GPRS) 2 (A732) 0 (A731)			
Output high voltage at -500µA	2.76			V
Output lov voltage at +500µA			0.525	V
Input Digital I/O Zero Level			0.66	V
Input Digital I/O One Level	1.98			V
Pulse Counters	4 (A733 and A733GSM/GPRS) 2 (A732) 0 (A731)			
Pulse Counter Speed			2	pulses/s
Pulse Counter Input Levels (Counting on Leading Edge)	0		3.3+0.5	V
Sensor Supply Current (Switched Output)			500	mA
Sensor Settling Time		2		s
Data Memory Size		1024		Slots
Sampling Rate	0		255	samples /slot
Storage Interval	60		65535	s
Other Interfaces				
Serial Interface (3V TTL) Zero Level			0.66	V
Serial Interface (3V TTL) One Level	1.98			V
Battery Management Charge Current (External Battery)			0.8	A
Radio Subsystem (Receive / Transmit – Not Valid for A733GSM/GPRS)				
Operating Frequency (low-band version)[4]	430		450	MHz
Operating Frequency (high-band version)	450		470	MHz
Frequency Stability (-20 to +50 C)			±1.5	kHz
Frequency Stability (-30 to +60 C)			±2.5	kHz

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[4] This parameter represents the alignment range; the switching range can be limited in the software to a narrower space (even to the extent of a single channel).

Receiver (Not Valid for A733GSM/GPRS)				
Sensitivity (12 dB S/S+N)		-118		dBm
Image Frequency Attenuation (1st IF=45MHz)	-70			dB
Local Oscillator Leakage			2	nW
Adjacent Channel Attenuation	-70			dB
RSSI dynamic	90			dB
Operating current (incl. On-board microcontroller)			32	mA
Receiver A733GSM/GPRS				
Sensitivity EGSM 900/GSM 850	<= 102			dBm
Sensitivity GSM 1800/1900	<= 102			dBm
Operational current (ready to receive call)		3.5		mA
Transmitter (all measurements made on 50Ohm resistive load – not Valid for A733GSM/GPRS)				
Output power	24	26	27	dBm
Spurious Radiation			200	nW
Adjacent Channel Power (12,5kHz mode)			-34	dBm
Adjacent Channel Power (25kHz mode)			-44	dBm
Operating current(incl. On-board microcontroller)			600	mA
Transmitter A733GSM/GPRS				
Output power EGSM 900/GSM 850	5dBm ± 5dB		33dBm ± 2dB	
Output power GSM 1800/1900	0dBm ± 5dB		30dBm ± 2dB	
Operational current (avg. communication 1RX/1TX at PCL 5)			310	mA
Peak Current (TX Bursts at PCL0) EGSM 900/GSM 850			2.0	A
Peak Current (TX Bursts at PCL0) GSM1800/1900			1.7	A
SIM Interface	GSM 11.11			
SIM Voltage		3		V

Table. 2:   Operational Parameters

5 APPENDIX

5.1 Upgrading an older A733 GSM

If you want to update an older A733 addWAVE GSM RTU for use with GPRS, first make sure that the GSM module features the proper firmware. This chapter applies only to RTUs with WaveCOM GSM-modules (serial numbers below 35.000). To check the firmware version of the RTU:

– connect your computer via Adcon A720SC cable to the RTU

– type INFO and look for the version number, which must be at least 2.10:

```
26151 info 0 0 22/3/2006 13:15:17 2.10 ...
```

– enter GSMX at the command prompt

```
#GSMX
```

Input will now be sent directly to the GSM modem. Press <ESC> to exit.

Now enter the command

```
ATI3
```

The output should be something like

```
641b09gg.Q2406B 1339080 041604 16:04
```

The first 3 digits have to be "641" or higher. If not, you need to upgrade the module firmware. You can also verify that the module is suited for an upgrade. The "Q2406B" after the period is the module type, which can be either Q2406B or Q2426B. Other modules such as the Q2403A cannot be upgraded.

Then enter

```
at+wopen=2
```

and you should get

```
+WOPEN: 2,"AT  v02.10","AT  v02.10"
```

If one of the version numbers is different, or "AT v02.10" is shown only once, the IP stack is missing in the GSM module.

Then enter

`at+wopen=1`

and you should get

`OK`

If you get any other message than "OK," the IP stack needs to be enabled. You need a special code to do so.

Then enter

`AT#VVERSION`

and the reply should be

`#VERSION: "eDsoft-W302_V2.10 116686 Dec 10 2003 12:20:17"`

If not, you have to put the proper IP stack into the module.

If all of the above tests pass, then upgrade the GSM-RTU's firmware to 2.10.0, using Adcon's A903 Programming device..

6 Index