

Q48 Cellular Remote Datalogger

User Guide

Q48 Cellular Remote Datalogger

Version 3.4



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Revision Details

- 1.03 Jan 2019 Reformatted, supports Firmware V1.05
- 2.0 Mar 2019 Added new SMS commands, plus ToC, supports Firmware V1.06
- 3.0 July 2019 Added new SMS command to debounce inputs, supports firmware V1.08
- 3.1 Jan 2020 Quick Start guide reformatted to User Guide. Added LE910 modem specifications
- 3.2 Oct 2020 added notes on use of debounce with PIR sensors.
- 3.3 Dec 2020 added troubleshooting section
- 3.4 May 2021 Updated power connector under "Technical Details"

Introduction

The QTech Q48 – Cellular Remote Datalogger (Q48-CRDL) comprises a sophisticated cellular datalogger. The Q48-CRDL uses the cellular network to transmit logged data back to the Base Station.



Each Cellular Remote Datalogger (Q48-CRDL) (P/N PD8600) is supplied with the following:

- 1x Cellular Remote Datalogger (Q48-CRDL)
- 1x Antenna (stub type), 2dBi gain (P/N PD9230)

Overview

Antenna Connection

Carefully connect the antenna. Do not operate the Q48-CRDL without an antenna connected.

Note: The reliability of all cellular products is dependent on good signal strength. Before deciding on the Telco to choose, please check coverage. We suggest that a cellular phone is taken to site, to check the signal strength, i.e. how many “bars” are displayed.

The supplied stub antenna (P/N PD9230) should be suitable for locations with good cellular coverage (full bars) and where the Q48 Cellular Remote Datalogger is in a non-conductive enclosure (plastic etc).

⚠️ If the Q48 Cellular Remote Datalogger is to be enclosed in a metal cabinet, or the site does not have full cellular signal, an optional external antenna will be required.

I/O & Wiring Configurations



Digital Inputs

The digital inputs are isolated, normally open inputs that can be connected to suitable mechanical switches, contacts and other closure devices. An input is active or ON when the input switch is closed, and inactive or OFF when the input switch is open. The digital input LED will light up when the input is ON.



Warning – Only mechanical switches or mechanical closure devices should be connected to the inputs. No external voltage or other electrical source are to be connected.

Digital Outputs and Analog I/O

These outputs and inputs are not used in this model of Q48 series product.

LED Indicators:

- **PWR** – Blue LED that illuminates when power is applied to the Q48-CRDL.
- **OK** – Green LED that flashes x6 quick flashes during reset and flashes slowly when the Q48-CRDL is operating correctly.
- **ERR** – Red Error LED that flashes and error code whenever the Q48-CRDL exhibits an abnormal operation.
- **COM** – Orange LED that indicates the current cellular connection state.
 - Off – The cellular state is currently disconnected.
 - Slow flash – The cellular state is currently connected to the SMS Network.
 - Fast flash – The cellular state is connecting to the data network to transfer data to the host.
 - On – Device is connected to the host
- **RXD** – Orange LED that flashes each time the Q48-CRDL receives an SMS Text Message or a packet from the Base Station.
- **TXD** – Orange LED that flashes each time the Q48-CRDL sends an SMS Text Message or a packet to the Base Station.
- **OUT-1 to OUT-8** – Yellow LEDs that illuminate whenever the associated Digital Output port is active.
- **IN-1 to IN-8** – Green LEDs that illuminate whenever the associated Digital Input port is active.
- **ANL-1 to ANL-4** – Yellow LEDs that illuminate whenever the associated Analogue Input/Output port is above zero input level. The associated LED will flash if an Analogue Input/Output port exceeds the maximum allowable level.

People Counting Application

The Device can be used as a general-purpose data logger connected to a server running a simple communications protocol to receive data records. However, a specific application includes people counting. The diagram below shows the Cellular Data Logger in this application mode connected to QTech’s People counting system DATAHost, which in turn posts data to a SQL Server installation at the customers premise.

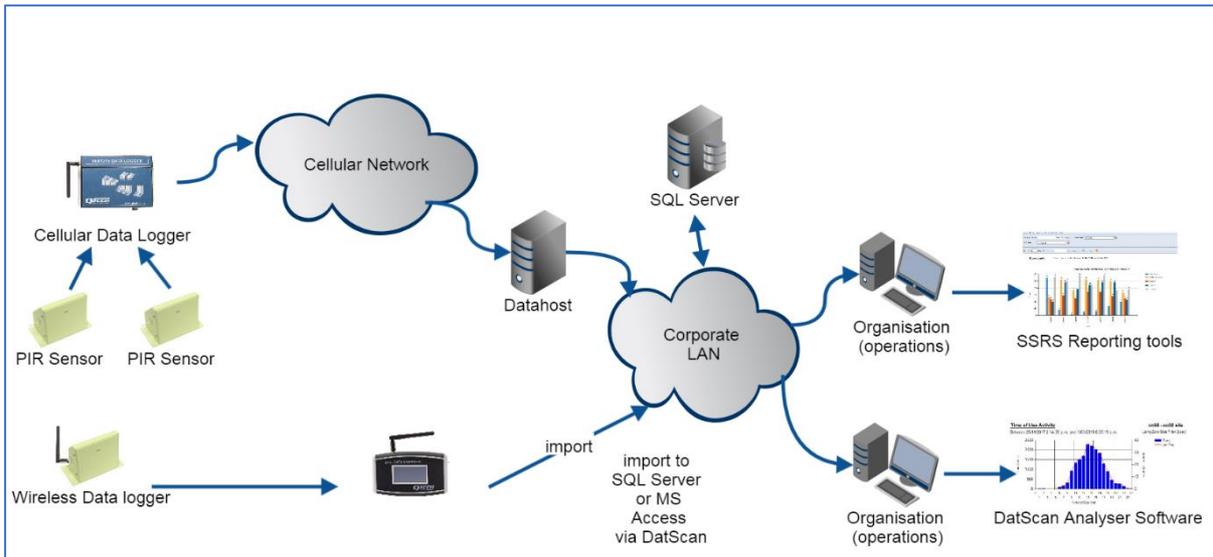


Figure 1

In a people counting system the device is configured with the IP address of the DATAHost server and the IP port number. Data records are exchanged by connecting to the server then following a predefined protocol to transfer log records which are then posted to an archive database such as SQL Server.

Getting Started

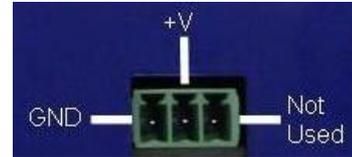
Power Supply Connections – Q48 – Cellular Remote Datalogger (Q48-CRDL)

The Q48-CRDL is powered from an external 12-30 V DC supply.

Connect the supply to the power connector, positive to the “+V” terminal, negative to “GND”.

The third terminal on the right is not used.

We recommend the QTech plug pack P/N PD5412.



 **Warning – Do NOT use Switch Mode Power Supplies (SMPS) with this product. The DC power supply used for this product MUST have a grounded negative or be a “linear” transformer based plug pack. The reason is that the antenna, programming port and external connections can provide exposed earth points and the SMPS can impose an AC voltage on the DC ground, which can lead to damage. Suitable cost effective plug packs are available from QTech P/N PD5412, PD5413 & PD5414.**

System Requirements

The device can be configured via SMS message but is initially set up using QTech’s Workbench application software. The current version of QTech Workbench configuration software is available for download at www.qtech.co.nz

Software Installation

This will install the Workbench software in your Program Files folder, create a desktop shortcut and install the required USB driver.

Power up the Controller and connect it to the PC using the supplied USB cable (type A to B). Within a minute you should see a message bubble displayed in the system tray saying “Found New Hardware”. The installation is automatic and a few seconds later you will see a further message bubble saying “Hardware is installed and ready for use”.

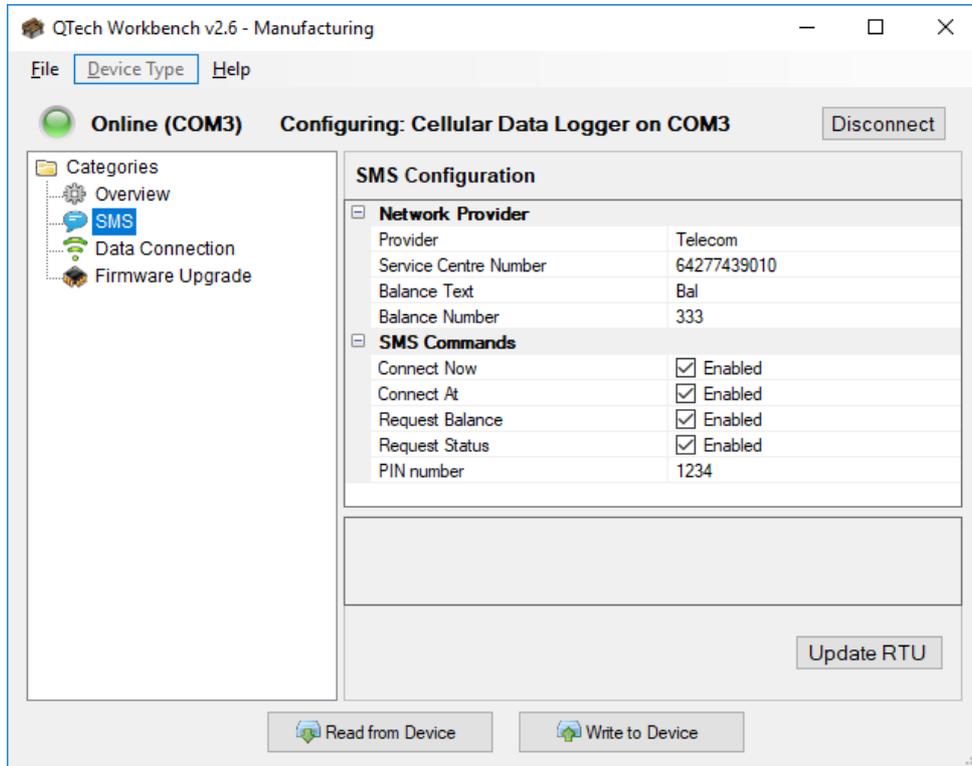
Note – Version v2.76 or above of QTech Workbench is required for configuration of the Q48-CRDL

Configuration Process

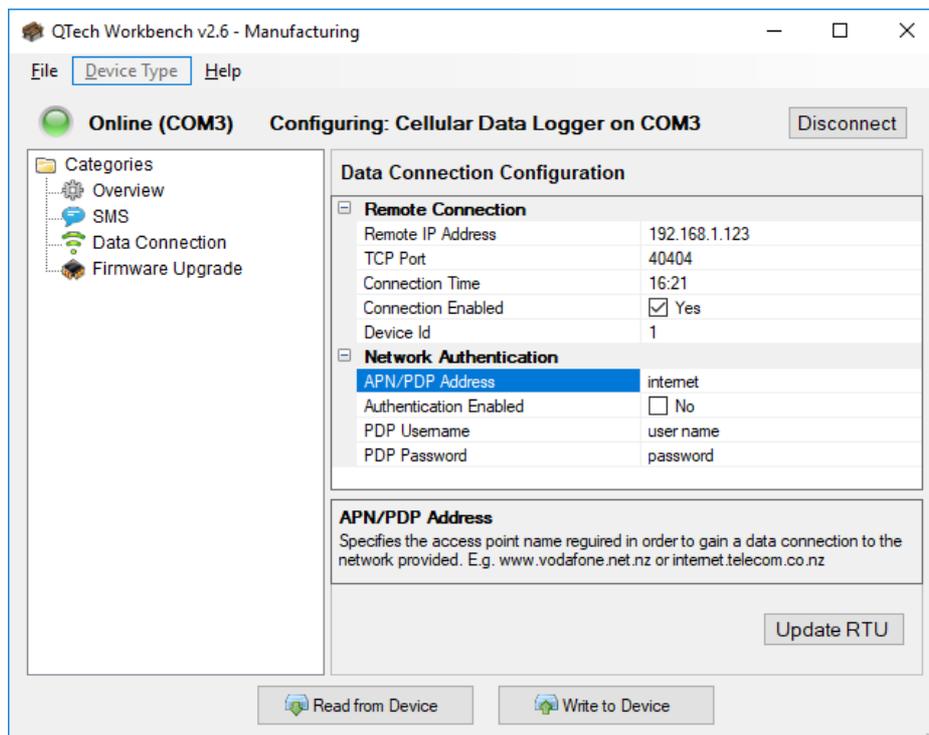
When preconfiguring using QTech Workbench.

- Load a functioning SIM card to the Q48-CRDL.
- Connect the USB of the Q48-CRDL to your laptop and open Workbench.
- Push the “Connect” button in the Workbench window.
- Workbench should detect the Q48-CRDL.
- If it does not, check the USB drivers have installed successfully, try unplugging, uninstalling the driver and reinstalling Workbench. Make sure you wait until the drivers are finished installing before proceeding to connect to the device. This is usually indicated in the system tray notification area on a windows PC.
- Email techsupport@qtech.co.nz or phone QTech if further assistance is required.

In the “Configuring Q48 REMOTE DATALOGGER” window (see image below), go to the SMS tab on the navigation panel on the left and select the cellular provider the SIM card in the Q48-CRDL is for.



Go to the Data Connection tab in the navigation panel on the left (see image below) and enter the public IP address of your DATAHost server in the Remote IP address line and the TCP Port of the DATAHost server in the TCP Port line.



The Connection Time is the time the Q48-CRDL calls the base station to upload its data to your server. Set this in 24 hour time. If you are configuring more than one unit, we recommend staggering the times by at least 30 minutes as several can be required by the firmware to completely close all connections.

If you do not want the Datalogger to automatically connect at a particular time but would prefer to also manually initiate the connection by texting the Datalogger, tick the “Connection Enabled” tick box.

The APN/PDP Address line needs to show the correct cellular provider’s settings. e.g., At time of writing, Vodafone is www.vodafone.net.nz, Spark and 2 Degrees use the word ‘internet’. Check with your provider as these may change from time to time.

If you have multiple devices give them a unique identifier number.

Push the “Write to device” button in the bottom right hand side of the Workbench window, and then disconnect.

Installation Checks

These checks are undertaken at the installation site.

Once inputs have been wired up and the base station configured the device can be tested to verify operation. The following sequence can be used.

1. Note the phone number of the sim being used. This will be used for SMS messages. Note the PIN number assigned to authenticate changes to the device settings otherwise the settings can’t be changed via SMS.
2. Close (short) an input pair to verify that the corresponding input led illuminates
3. SMS Request the config and check the base station settings, set them if required by changing a parameter using SMS. This step can be avoided if the device is preconfigured already using QTech Workbench
4. SMS Set the debounce time for the unit (use 1000 ms for starters)
5. Create a few log records by repeated closing and opening an input (to simulate say a door opening and closing)
6. SMS Request the status. Check that a number of records are created. One is created for every open or close
7. SMS Transfer the logs using Connect Now
8. Request the status after a few minutes (min 3m) to verify the logs were transferred, the log count should read 0 immediately after a transfer is completed
9. SMS set the schedule transfer time
10. Watch the TX and RX led when using SMS messages to verify that messages are received and responded to. Make sure the Error Led does not illuminate at any time

Troubleshooting

Try the following checks if these symptoms are evident:

Balance Checks

If the device does not provide its balance on request.

The facility to check the balance on an account varies across Mobile Network Operators (MNO) Configure the SMS text and number for the specific network (consult the MNO provider). Note that some MNOs only provide this information or respond to SMS balance requests on prepay accounts. Prepay accounts are not recommended for use with the logger for commercial operations.

Texting the balance request to the device (e.g. bal to 777 for Vodafone) will forward the message from the device to the cellular network and return the balance from that account back to the originating phone.

Note this facility is increasingly being replaced by a smartphone app provided by the MNO for checking the balance on accounts. This facility should be used in preference.

Device won't connect to server

If the device will not connect to the server then:

- If you receive a message to say that the connection is disabled ensure that the device connection is enabled and the connect now (and other SMS commands) are enabled in QTech workbench
- Check the SMS request config returns login enabled: true
- Check that the IP address and port number for the server is correct
- Use TCP/IP Ping to the remote server using a laptop if ping is enabled for the server
- SMS request debug. If the result returns no information (i.e. a list of numbers showing the progression of the connection process) then the port number for the base station server is probably closed. Check that the router on the base station is correctly configured to open the port.
- Check the APN settings (Network Authentication in QTech Workbench) provided by the MNO to ensure that data connections are configured correctly. These setting can also be individually configured via SMS configuration parameter changes messages
- Remove the power plug, open the case, insert the power plug and power up the device look on the small modem board. If it assumes a slow flash after 1 min then the modem has correctly registered on the cellular network. If not check that the sim is operational by trying it in a phone. Try sending it an SMS message.

Logs Not transferred

A device with a number of records to transfer (not thousands) responds to connect now SMS and appears to complete the process but a subsequent status request reveals the log count has not changed (reduced to zero or near zero)

- Verify the base station IP and port number are configured and the port is open
- Check the firmware version installed on the device (request status). Contact QTech to ensure that it is the latest. Open the case and note the make and model of the small Cellular modem board inside. QTech will verify that the version running is appropriate for the modem type
- SMS request debug and forward the resulting number string to QTech for analysis. In general, a successful data transfer will list a set of numbers from 0 to 14 separated by commas, returning to 0
- If the device is also not responding to SMS look to see if the error led on the device is flashing red. If so, repower the device (remove and reinsert the green power connector) and try sending a status request. If it is not forthcoming or if the error led is red again then the cellular coverage for the device may be too marginal for reliable operation.
- Independently check that cellular coverage in the area is acceptable. If it is then check that the antenna connection to the device and consider using a higher gain antenna or relocating the antenna.

- Keep the antenna cable length less than 4m
- If the device is responding to SMS ok but fails during data transfer (the comms, rx and tx led appear to flash often indicating data transfer starts) then cellular communications may be too marginal to sustain communications for long enough to retrieve the logs. Contact QTech to see if there is a newer or later model cellular modem that should be fitted

Large Log files not transferred

If large log files (tens of thousands of records) cannot be transferred check the following:

- Sufficient cellular coverage in the area especially if small log files are ok
- If multiple devices (Q48 CRDL devices) are in use in the system stagger the connect at times so that each device has at least 30 mins between connection attempts during the day to avoid two sites attempting connections at the same or overlapping times
- Send the debug log string to QTech for analysis. (SMS Request debug)
- Consult QTech to see if the log file can be retrieved via USB to Workbench to avoid data loss.

Too many or too few log records created

If the number of records does not seem to match expected usage (e.g. people entering and exiting toilets then:

- Change the debounce time. Set it larger if too many records are being produced and smaller if too few records are being produced
- Verify after power up or remote reboot or after firmware upgrade that the debounce time has been set. It defaults to 10s which is too long for most systems. Use SMS request config to get the current debounce setting
- Check that the reed switch on the door is correctly installed and operating the magnetic coupling reliably and the reed and the magnet are not set too far apart.
- Check the PIR settings on wireless systems to ensure that the data is being received by the device. Watch the input leds to see them activating. The PIR settings may need to change to set the pulse output correctly

Not responding to SMS messages

If the device does not respond to SMS messages with any kind of txt response:

- Make sure there is sufficient cellular coverage (use the signal bars on a phone as a first indicator)
- If SMS connect now has been sent or a scheduled connection to the base station is occurring then wait for at least 5 mins, up to 15 if tens of thousands of records are being transferred, then try again to request the status
- Check the error led if it is flashing red then repower the device, try again and if unsuccessful note the firmware version of the device and the cellular modem board model (inside the case) and report the issue to QTech
- Make sure the correct phone number of the device sim is being used and the sim has been registered. Some sims (for some MNOs) require an online registration process to be completed in order to be issued a phone number.
- Make sure there is sufficient balance, SMS and data available on the account

Log does not transfer at the scheduled time

If logs transfer using SMS connect now but not at the scheduled time:

- Verify the time is correct (SMS request status LgTm must be set to the desired time). Set the time using SMS Connect at hh:mm e.g. connect at 13:15
- Make sure scheduled connection at is enabled in QTech Workbench

- Stagger the connection times if multiple logger devices are used in the system are deployed, by at least 30mins to ensure no overlap

Typical Operation

At power-up the blue PWR LED will illuminate and the green OK LED will flash rapidly 6 times then flash slowly and continuously.

During normal operation the red ERR LED should remain extinguished. If the ERR LED flashes the code 2; this indicates that the Q48-CRDL was unable to establish a data connection with the Cellular Provider.

Whenever the Q48-CRDL is in the idle logging state, then, an SMS Network connection will be established and maintained. Whenever an SMS Text Message is received the orange RXD LED will flash briefly. The orange TXD LED will flash briefly whenever an SMS Text Message response is sent.

The Q48-CRDL logs onto the base station at the predetermined time each day unless this function is disabled. When the Q48-CRDL is required to connect to the base station either at the predetermined login time or by SMS Text Message connection request the orange COM LED will flash slowly when a data network connection is established.

Whenever a Base Station packet is received the orange RXD LED will flash briefly.

The orange TXD LED will flash briefly whenever a packet is sent to the Base Station. During data transfers the COM led may appear to flash quickly (lots of brief flashes as each record is transferred).

If the orange COM LED does not illuminate after a minute or so this indicates a problem with the Q48-CRDL connecting to the cellular network during the data transfer phase.

When the device is transferring data records to the base station (data transfer mode) the device does not respond to SMS messages. Any SMS sent during this time may be disregarded by the device. Once data transfer completes then new SMS messages are processed. It can take at least 3 minutes to transfer logs and if thousands of logs are transferred the user may need to wait up to 15m before attempting SMS communications (subject to the number of records in the log to transfer). Therefore, using the “connect now” message care should be taken to wait sufficient time before sending “request Status”.

Input Debouncing

Inputs support the use of PIR devices and contact closures using reed or relay switch contacts. The default input debounce time is 10ms. Debouncing is used to avoid switch chatter or doors not closing fully and subject to movement in windy conditions. Debouncing is also used to avoid overcounting the number of people using the door. Debouncing means the signal will be detected on the first (edge) transition then the new state (level) will be sampled again at the end of the debounce time and this state will be used.

Inputs can use longer debounce times in the range of 10-10,000 ms via sending an SMS message to the device.

Values less than 10 or greater than 10,000 as the debounce time will use 10 and 10,000 respectively. If the debounce message is sent without a value the command is ignored.

Debouncing applies to all inputs. Care should be taken not to set long debounce times for inputs that are used for other purposes.

For door reed switches in windy locations a debounce time of 3-5s is recommended otherwise a debounce time of 1s is usually sufficient

Or PIR sensors the PIR pulse generated when a person is detected is re-triggerable but can last only a second or two. Long debounce times (greater than 2s) are not recommended or there is a risk of not detecting the door open event and thus not counting it. 500ms-1s is normally sufficient but should be adjusted if “overcounting” is experienced.

 **Warning –After firmware upgrade the debounce time must be explicitly set using the SMS message, irrespective of door reed or PIR sensor use.**

SMS Text Messages

Several commands and requests can be sent to the Q48-CRDL via SMS Text Messages. These Text Messages are not case sensitive.

Summary of functions:

SMS Function	Purpose
Request Status	Return current status information from the device, including number of records
Request Config	Return the current configuration including the IP and port address of DATAHost (the records database)
Request Debug	Return diagnostic information to determine if data records transfers are occurring correctly
Connect now	Transfers all log records to the server immediately
Connect at	Sets the time of day for each scheduled transfer of records
Change Config	Changes a configuration parameter such as the IP address of the destination base station server
Set Debounce	Used to filter out spurious rapid changes in inputs to detect real events
Reboot Device	Remote reinitialization of the device (if it is receiving SMS messages ok)

SMS Message formats

These include (the quote marks are not required in the message):

Request the device Status

“Request status” – This command requests the Q48-CRDL’s current status. The Q48-CRDL’s status is returned in a Text Message to the sender in the form:

```
Addr: 1 // TheQ48-CRDL’s Device Number
Vers: 1.01 // TheQ48-CRDL’s software revision number
Time: 12:10 // TheQ48-CRDL’s current time
Date: 18/12/12 // TheQ48-CRDL’s current date
LgTm: 02:00 // The logon to base station time
Last: 17/12/12 // The last logon to base station date
Recds: 1257 // The number of logging records currently stored
Gprs: ON // This indicates that the logon to base function is enabled
Rssi: -51dBm // The cellular network signal strength
```

Transfer logs immediately

“Connect now” – This command requests that the Q48-CRDL logon to the base station immediately. A reply text message of **“Connecting to Database now”** will be received.

If the connection to base function is disabled, then a reply text message of **“Base Logon DISABLED”** will be received.

Set the log transfer time

“Connect at hhmm” – This command requests that the Q48-CRDL logon to the base station at a defined time each day. Where **“hh”** is the hours value (in 24-hour format) and **“mm”** is the minutes value of the time to logon at. A reply text message of **“New connect time accepted”** will be received.

If an invalid logon time is specified, then a reply text of **“Invalid connect time specified”** will be received.

Show the device configuration

“Request config” – This command reads the currently configured settings for communication to DATAHost including the IP address and port number of the DATAHost Server, so that log records can be uploaded.

The Packet data Protocol (PDP settings may be required by the Cellular network provider to enable mobile data connections to be routed onto the internet. These settings are normally prescribed by the network provider.

The DATAHost connection can be enabled or disabled, this is listed as the Login enabled setting. The scheduled connection time (which can be changed using the “connect at” message) is listed as Login Time.

e.g., the response looks like:

```
IP addr: 192.168.0.0:1000
Use PDP: false
PDP addr: www.vodafone.net
PDP user: username
PDP pwd: password
```

Login enabled: true
Login time: 12:00
Debounce: 10000 (this is 10s by default)

Change a configuration setting

“<pin> <setting> <value>” - This command sets a configuration per the settings returned in the **request config** command above.

e.g. "1234 ip addr 192.168.0.1:43210"
e.g. "1234 login time 13:00"

The pin number is as specified in QTech Workbench in the initial configuration of the device. It cannot be changed via SMS to minimise unauthorised access. In this example it is 1234.

The setting name and value format is the same as that in the request config message (case insensitive). Eg. PDP pwd is the same as pdp pwd. In the example above the Datahost server IP address is changed from 192.168.0.0 port 1000 to 192.168.0.1 port 43210

When changing a setting issue the request config afterwards to confirm the setting has changed.

Set the Input Debounce time

“<pin> **Debounce** <time>” – this command will set the input debounce time for all inputs, where the time value is in milliseconds, e.g. **debounce 5000** will set a 5s debounce time. As with other configuration settings the command is prefaced with the pin number.

Setting a longer debounce time is useful in situations if wind is likely to affect door reed switches making them chatter. The debounce time can also be used to minimise the effects of lots of foot traffic near a door but not actually passing through it.

Troubleshooting Aids

“**Request Debug**” – This command is used primarily by Technicians and QTech to verify that the connection process to DATAHost is proceeding as expected. The response will contain a list of numbers which represent the connection state machine traversal sequence. This information can be provided to QTech to determine if there is a network issue connecting to DATAHost and may indicate that the cellular connection is marginal.

The response includes:

- The date, time of last attempt to contact the server
- The transition values of the internal state machine. Normally this is an ordinal sequence of numbers starting at 0 and ending at 14.

“<pin> **Reboot**” - forces the device to execute a warm restart, which will reinitialise communications modems.

Technical Details

Operating Voltage ¹ :	12 – 24 Volts DC
Power Connector:	3 pin screw terminal Short circuit and reverse polarity protection
Operating Current:	~14mA @ 12V ~10mA @ 24V
Antenna ² :	50 Ohms, SMA connector
USB Port ³ :	Type B socket
RS232 Port ⁴ :	DB9 female connector
Environmental:	0 - 65°C operating and storage temperature 90% humidity, non-condensing IP20, Water contact must be avoided
Case Size:	112 x 75 x 25mm (Overall)
Weight:	261 grams (with supplied antenna)
Mounting Holes:	Qty 4x M4 mounting holes at ~102 x 50mm centres
RSM SCN:	R-NZ
Modem specifications ⁵ :	3G bands (MHz): B1(2100), B5(850), B8(900) 4G bands (MHz): B1(2100), B3(1800), B5(850), B8(900) B28(700)

Additional Information and Support

If you have problems or need more information try the following:

- Visit the QTech website for application notes and User Guides
- Refer to the troubleshooting section if one is present in a User Guide
- Contact the support desk via email or by phone

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