14.25 SPEED_ALARM

A GPS measurement completed and a speed violation occurred. The parameter [0-15] indicates which Sensor Table was used.

14.26 TIMER

This occurs when a software timer expires. The parameter [0-39] indicates which timer expired. Timers may be set, examined and read using function calls such as `TIMER_set()`, `TIMER_clear()`, `TIMER_checkWakeup()`, `TIMER_setDuration()` and `TIMER_getRemaining()`. Note that in making calls to the timer utilities, a particular timer must be selected. It is important to select a timer with the appropriate type for the intended use. The types and properties of all timers are shown in Table 14-1.

Table 14-1: Timer types and properties

Timer Numbers	Timer Type	Description / Notes
0 - 9	**Volatile**	Value and status of these timers are lost when the modem powers down. These timers should be used for general purpose timing requirements. On power-up, all Volatile timers are set to disabled.
10 - 19	**Non-Volatile**	Value and status of these timers are stored in NVM. This type of timer is used when timing data relating to an event or action must be maintained during power off. When a Non-Volatile timer expires, it does not cause a wake up of the modem, but *does* cause a timer event to be sent to the application on the next power on.
20 - 29	**Wake-Up**	Wake-up timers are like nonvolatile timers, except that when a power down is called, the Real-Time Clock (RTC) is programmed to wake up at the timer expiration time (if this time is less than the specified power down interval).
30 - 39	**Time-Of-Day**	These timers are identical to Wake-Up timers, except that the duration of the timer is specified as an absolute time of day rather than relative to the current time. Time-Of-Day Timers always expire within 24 hours.

14.27 TIME_SYNC

The time has been received from a source such as a satellite or GSM and the real-time clock has been updated to the new time. Parameter one is the value of the change and should be converted to a signed 32 value to ensure negative adjustments are accounted for.

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14.28 USER_CMD

An Over-The-Air command was received. The parameter [0-255] indicates which action to take. This is currently supported for ORBCOMM and GSM/GPRS networks.

When a USER_CMD is sent, byte 0 of the data represents how many user commands will be sent. This is based on User Data Bytes 1-4 content in conjunction with User Byte 0's value.

For example, using:

USER DATA BYTES	0	1	2	3	4

Example. 1: If the data bytes sent were 0x01 0xFF 0x00 0x00 0x00

- One USER_CMD event would be sent to the application.
- It would be USER_CMD 255.
- Notice that User Data Bytes 2-4 have no meaning.

Example. 2: If the data bytes sent were 0x02 0xFF 0x00 0x00 0x00

- Two USER_CMD events would be sent to the application.
- They would be USER_CMD 255 and USER_CMD 0.
- In this case User Data Bytes 3 and 4 have no meaning.

Example. 3: If the data bytes sent were 0x03 0x01 0x02 0x03 0x00

- Three USER_CMD events would be sent to the application.
- They would be USER_CMD 0, USER_CMD 1 and USER_CMD 3.
- In this case User Byte 4 has no meaning.

Example. 4: If the data bytes sent were 0x04 0x01 0x02 0x03 0x0A

- Four USER_CMD events would be sent to the application.
- They would be USER_CMD 1, USER_CMD 2, USER_CMD 3, and USER_CMD 10.

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15 QUAKE firmware and APIs

Figure 15-1 shows the software architecture of the modem. The customer can write applications that reside in the user space of the modem. The application makes use of the QUAKE Application Programming Interface (API) to connect to the various tasks and drivers operating on the modem. The custom application is either developed by the customer utilizing QUAKE's API, or by QUAKE's engineering development services.

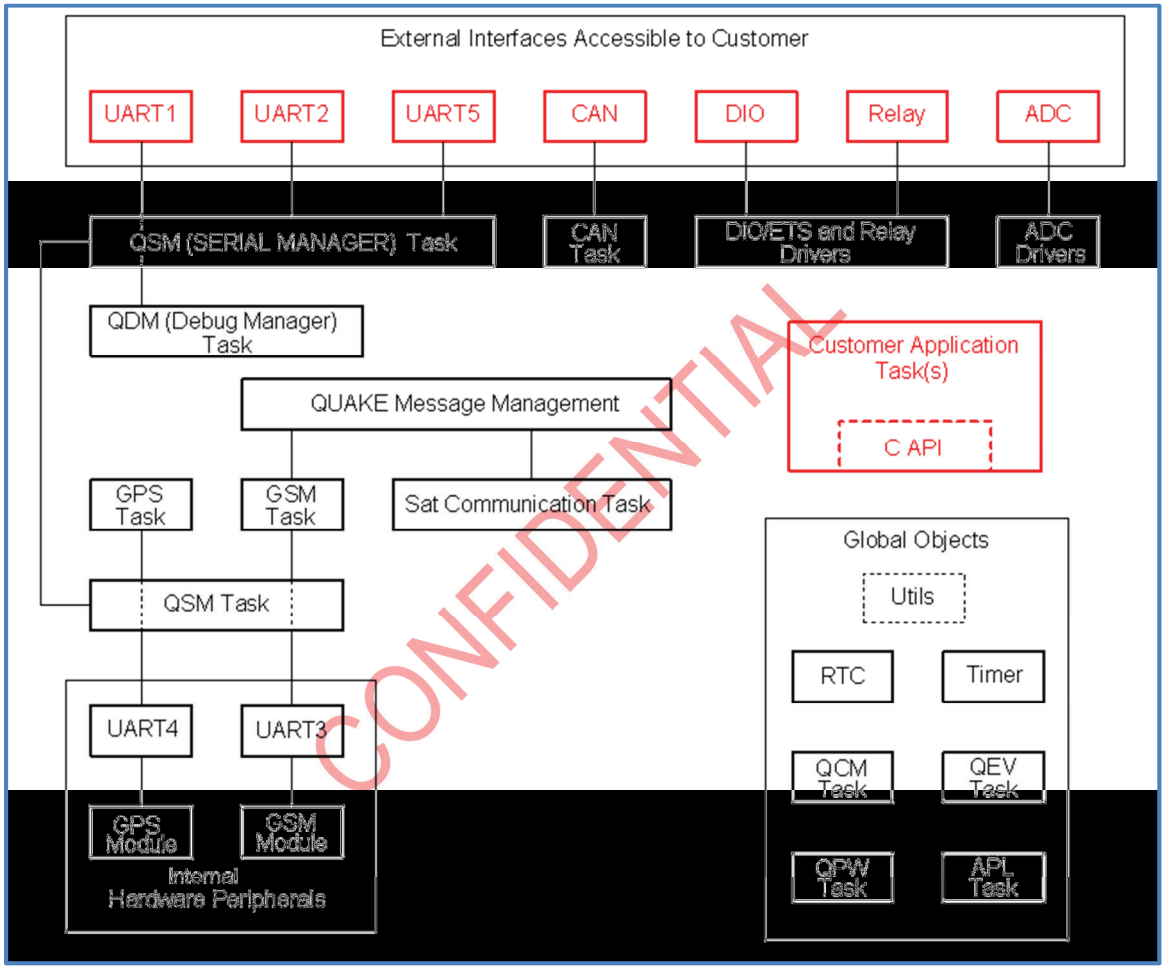

Figure 15-1: Software block diagram for fully loaded modem

The QUAKE foundation is statically linked as a single module. Only one customer module may be dynamically linked to the foundation at a time. If a customer requires dynamically linked modules in their application, they must design their own methods for linking in multiple objects. Global variables are not linked between modules; however, customers may define and use their own global variables. APIs must be explicitly declared by placing them in the function table and the application cannot link to functions that are not provided in the API, even if they are in the code. To add more functions, the user may build their own function table in memory and then pass that address to other modules. That same mechanism can be used to create a 'global structure' that contains all 'global variables' that can be passed to all modules.

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Please see the API Function Reference for detailed explanations on how to make function calls to all the various tasks, drivers and objects operating on the modem.

QUAKE modems contain factory-installed foundation firmware that consists of the following components:

- QUAKE Real-Time Operating System (RTOS)
- QUAKE Flash File System (FFS)
- Hardware drivers (ADC, DIO, Relay, Serial Ports, GPS, etc.)
- QUAKE foundation software RTOS tasks
- Digital Signal Processing executables
- QUAKE code providing the event and application frameworks

It is not necessary to understand the operation of each of these modules in detail. The API Function Reference provides the information that an application programmer is likely to need, listing the functions available, information about the parameters and returns for the functions, as well as additional notes and example code. A brief overview of the firmware modules, including an overview of the module's purpose and description of the more common calls, is provided below.

15.1 ADC module (Analog to Digital Converter)

The ADC module provides access to the analog to digital converter hardware on the Q4000/QPRO. The value of external analog inputs in the range 0 to 3.5 V applied to pins 29 and 31 of the external connector, may be read using the `ADC_readChannel()` function. As noted in the API Function Reference, `ADC_readChannel()` should be called from a single task, usually the application task.

15.2 APL module (Applications)

The APL module implements certain features which may be needed by specific applications. If an application is designed to handle a specific AT command set, such as from an external modem, `APL_registerATCmdHandler()` is used to register the handler for that device. Messages specific to that type of AT command are sent to the application using the queue set up by the function `APL_msgQueueCreate()`. Executables that an application needs to download can be transferred into application memory via `APL_loadObjects()`. Other related APIs are provided by the module described in the API Function Reference.

15.3 DIO module (Digital Input/Output)

There are 8 digital input/output lines on the Q4000/QPRO, accessed through pins 32-39. The DIO module provides APIs to manipulate this hardware. Lines may be configured individually as either inputs or outputs using the `DIO_config(chan, direction)` function, where the second parameter may be either `DIO_INPUT` (0) or `DIO_OUTPUT` (1). All DIOs configured as inputs have a weak pull-down resistor in the input circuitry, so an open is reliably sensed as low. The 8 lines may be read as a group using `DIO_readAll()`. The nth bit in the value returned by the call will be 1 or 0 when the nth channel is high or low, respectively. Lines configured as outputs may be written by `DIO_writeChannel()`.

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15.4 FFS module (Flash)

The Q4000/QPRO uses a FLASH File System (FFS). This FFS was designed specifically to be robust and immune to problems encountered during uncontrolled power downs. FFS calls are abstracted through a QUAKE FFS_ layer similar to the SYS layer, with calls such as `FFS_open(), FFS_read(), FFS_write(), FFS_close()`. The application does not need direct access to the FFS. However, the FFS_ calls are available if a custom application requires them, and are intended to provide the same types of standard 'C' calls that are available for accessing a UNIX file system

15.5 FTP module (File Transfer)

The FTP module implements the file transport protocol for transferring files, typically containing large amounts of data, on terrestrial networks. Currently, FTP transfers are supported only on the terrestrial network. The supported functions are described in the API Function Reference.

15.6 GPS module (Global Positioning System)

The GPS module supports finding the location, speed, heading, and altitude of the Q4000/QPRO using the Global Positioning System. In addition, for Q4000/QPROs so equipped, the GPS is used to obtain an accurate time to synchronize the real-time clock. Use of the GPS module is demonstrated in the Turnkey sample application (see Section 2.6); however, the call to the key GPS function `GPS_read()` is also made routinely in all the DemoAppXXX sample applications. As seen in those examples, `GPS_read()` does everything needed to set up the GPS engine and get a valid fix. When the fix is found, a `POSITION_FIX` event is posted to the application so that the application can take appropriate action. Once a position fix has been made, the application can retrieve the fix information using `GPS_getPosData()` to retrieve all the GPS information into a structure of type `GPS_Sample`.

In addition, the GPS module provides a number of utility functions related to the GPS facility. These are described in detail in the API Function Reference.

15.7 TERR module (Terrestrial)

The Terrestrial module supports communication over the terrestrial GSM/GPRS/GSM/TCP/UDP/SMS networks. For sending a message from the application, the module provides `MSG_sendTerr();` for receiving a message, the application calls `MSG_receiveTerr()`. Note also the event `CELL_NET_IN_VIEW` which provides information to the application about the status of the cellular/GSM network and the fact that a `MSG_ACK` event is posted when a GSM message has been successfully sent. The module provides a number of additional utilities which may be useful in special circumstances which are described in the API Function Reference.

15.8 ORBCOMM modules

OSI modules provide ORBCOMM support. The OSI module implements code to support the ORBCOMM Serial Interface and related features. It is available on Q4000/QPROs with the ORBCOMM satellite transceiver. The OSI is described in the ORBCOMM Serial Interface Specification. A typical use of the module and transceiver is shown in the DemoAppGSM sample application in Section 12.4.1.

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An ORBCOMM packet is constructed specifying a particular type of ORBCOMM message, based on packet descriptions in the ORBCOMM Serial Interface Specification. The packet is queued to the OSI using `MSG_queueOsiPkt()`. The module contains utilities as well as functions to read and write ORBCOMM parameters (`CFG_getValOrb()` and `CFG_setValOrb()`). The QUAKE event structure provides the application easy access to much of the ORBCOMM functionality; for example, in the `SAT_IN_VIEW`, `MESSAGE_ACK`, and `RX_SER_PKT` cases, which are executed when the corresponding event is posted. A message received by the Q4000/QPRO is handled by the application in the appropriate sub-case of the `RX_SER_PKT` case.

15.9 J1939 module (Controller Area Network - CAN)

The J1939 module supports use of the Controller Area Network (CAN) hardware, and the protocols using CAN. Currently, J1939 is the only CAN protocol supported. Most calls to setup and configure the CAN hardware and J1939 stack are handled automatically by the foundation code. Typically, an application would request a J1939 message containing a particular Parameter Group Number (PGN) using the call `J1939_getPgnMsg()`.

The structure for a QCAN_J1939Msg can be found in `User_libQuake.h`. The offsets for various SPNs (Suspect Parameter Numbers) in the message data buffer are specified by the Society of Automotive Engineers (SAE), and described in their document, J1939-71. In the DemoAppCAN example, the application requests and receives a specific PGN and SPN from the message. The application structure is set to field a `CAN_MSG` event, in the corresponding `CAN_MSG` case. In the rare case in which a desired PGN is not spontaneously transmitted on the bus, an request for that PGN must be transmitted, using the API call `J1939_txRequestMsg()`.

15.10 QCFG module (Configuration)

The QCFG module provides an interface to manipulate QUAKE's configuration parameters. The current set of QUAKE parameters may be viewed from the Logger port of the Q4000/QPRO; in the Logger type 'U' 'C' 'v'. Parameters may be numeric or strings. The API call to this module is `QCfg_getQCfgPtr()`, which returns a pointer to the configuration structure.

15.11 QEV module (Events)

The QEV module implements functions related to QUAKE's event processing. The application relies on the event processing supported in the foundation code, by executing code when specific events are posted to the application. This activity can be seen in all of the DemoApps in Section 12.4. In addition, the application may post an event by calling `QEV_sendEvent()`. The public APIs in this module also provide the utility, `QEV_getEventDefinition()`, which returns a pointer to the name of the event whose number is passed as a parameter.

15.12 QLM module (Logger)

The Logger port of the QUAKE modems provides a wealth of information and functionality. Typically, messages about modem status such as downlink information, state transitions, or error messages are printed to the Logger port. Debug and Utility menus and features are accessed from the Logger port. The QLM module's public APIs allow the application to post messages to the Logger using `LOG_print()` or to suspend Logger output entirely using `LOG_suspend()`. The function, `LOG_logErrorMsg()` provides a way to print error messages to the Logger,

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complete with the name of the function in which the error occurred, the line number, and a string identifying the type of error.

Note: The message packet should not be freed by the application; this is done by the foundation code.

15.13 QMM module (Messages)

The QMM module implements QUAKE's Message Manager. The firmware code in the module checks for network availability, and handles the details of transferring messages from one network to another based on availability. This is all transparent to the application. The primary public API implemented in this module is `MSG_send()`; this and other APIs for actions such as deleting messages and getting a current message count are described in the API Function Reference.

15.14 SYS module (System)

On the Q4000/QPRO, the Real-Time Operating System (RTOS) is abstracted to QUAKE calls so that regardless of any changes to the underlying RTOS calls, the APIs available on QUAKE modems remain constant. This abstraction is performed by the SYS module. Functionality to manage tasks and message queues is provided with names like `SYS_taskCreate()` or `SYS_taskSuspend()` which clearly indicate the functionality to any application developer familiar with using an RTOS on an embedded target. For most applications, no direct calls to the SYS module need to be made since the foundation code and the event driven architecture allow complex applications to be developed without direct calls to the RTOS. For those applications that need direct RTOS access, however, it is provided by the SYS module.

`SYS_pwrDown()` is used to power down the Q4000/QPRO in a controlled fashion. Everything is shut off cleanly in the correct order, ensuring that on a subsequent reboot no data will have been lost and the Q4000/QPRO is in an appropriate state.

15.15 SERIAL module

Access to the serial ports is provided by the QUAKE Serial Manager module. One goal in developing SERIAL was to provide a high-level serial interface that allows different tasks, such as OSI, QCT, or an AT protocol, that are managing different serial protocols, to share a single physical serial port. These sorts of activities are handled by the foundation and should not be needed by the application. Calls to `SERIAL_readBytes()` and `SERIAL_write()` allow the application to read and write to the serial ports. The `UARTPORTS` are enumerated in User_libQuake.h. `SERIAL_openPort` and `SERIAL_closePort` are provided, as well as `SERIAL_portFlush`, and are described in the API Function Reference.

15.16 RELAY module

The RELAY module provides access to the relay hardware on the Q4000/QPRO. Four relay lines are implemented. Two of them, UBATT0 and UBATT1, when asserted, provide closure to the supply voltage at pins 25 and 27, respectively. The other two, GND0 and GND1, when asserted, provide closure to ground at pins 26 and 28. The `RELAY_CHAN_NAME` type is enumerated in User_libQuake.h. The RELAY module APIs allow the application to read the state of the lines or assert or deassert the lines by individual channel number.

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15.17 UART module

The UART module provides direct access to the serial hardware on the Q4000/QPRO. Application access to the serial ports should be made through the SERIAL module, described in Section 15.15. SERIAL allows the foundation firmware to exercise more control and oversight. For those applications requiring more direct access, the public API to the UART module is `UART_ioctl()`, which allows the parity, stop bits and baud rate to be set for serial ports.

15.18 UTL module (Utilities)

The UTL module proves a number of utility functions. Some allow manipulation of the QUAKE software counters and timers, such as `CNTR_set()`, and `CNTR_read()` or the system's real-time clock, such as `SYS_readSeconds()`. The API Function Reference should be consulted for a current list with complete descriptions.

15.19 VSWR module (Voltage Standing Wave Ratio)

The single public API in the VSWR module is `ANT_readVswrOrb()`. This reports the last VSWR reading of the ORBCOMM antenna. Notes in the API Function Reference give details on interpreting the reading.

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Appendix A - ORBCOMM configuration parameters

Table A-1: ORBCOMM configuration parameters

Num	Name	Def. Value	Min Value	Max Value	DTE Access	Description
0x00	pin_code	1234	0	9999	R/W	Personal Identification Number, used as a security measure
0x01	desired_gwy_id	1 (U.S.)	0	255	R/W	Instructs modem to acquire satellite connected to this ORBCOMM Gateway
Additional notes: This parameter should be set according to where the application/modem will be located. If the modem is only used in North or South America this parameter should be set to 1. If the application/modem is located in Japan, it should be 130. The rest of the world should be set to 120. For mobile applications that are not specific not one area please consider use of the Auto-roaming feature (parameter 0x8b). More information on this feature may be found below.						
0x02	def_polled	0	0	1	R/W	Modem-Originated messages polled by ORBCOMM Gateway or initiated by modem (see *OSI* Section 3.2, note 1). Type Codes 1, 4, and 5 are supported.
0x03	def_ack_level	2	0	4	R/W	Default acknowledgement level for messages (see *OSI* Section 3.2 note 3). Note: Values other than 2 are not recommended.
0x04	def_rep_or_ind	1	0	3	R/W	Default Report O/R Indicator (see *OSI* Section 3.2, note 4)
Additional notes: This parameter is used for setting the O/R indicator that will be associated with the 'Default Report' message type. All Default Reports will be routed to the specified O/R indicator.						
0x05	def_msg_or_ind	1	0	15	R/W	Default Message O/R Indicator (see *OSI* Section 3.2, note 4)
Additional notes: This parameter is used for setting the O/R indicator that will be associated with the 'Default Message' message type. All Default Messages will be routed to the specified O/R indicator.						
0x06	def_priority	1	0	3	R/W	Default Priority Level (see *OSI* Section 3.2 note 5)
0x07	def_msg_body_type	14	0	15	R/W	Default Priority Level (see *OSI* Section 3.2 note 6). Note: Only values 0 and 14 are supported.
Additional notes: This parameter primarily comes into play when using email as a delivery method for modem-O messages. The only two supported modes are 0 (data will be received in the form of AmodemII text within the email message body) or 14 (data will be received as a binary data attachment to the email). If using direct IP a setting of 14 should be used.						
0x08	def_serv_type	2	0	15	R/W	Default Service Type for reports (see *OSI* Section 3.2 note 2). Note: Values other than 2 are not recommended.
0x09	gwy_search_mode	0	0	4	R/W	0=continuously search downlink band for desired GWY; 1=search band once for desired GWY, if not found then maintain lock with first discovered downlink; 2=maintain lock with first discovered downlink; 3=search band once for desired GWY, if found, open search to include any ORBCOMM GWY, if none found, maintain lock with first discovered downlink; 4=search band once for desired GWY, if not found, continuously search band for downlink having no ORBCOMM Gateway or desired GWY

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Num	Name	Def. Value	Min Value	Max Value	DTE Access	Description
Additional notes: This parameter defines the way in which the modem will connect to satellites as they come into view. It works in conjunction with parameter 0x01 (desired_gwy_id). By default the modem will only connect to satellites that are attached to the desired gateway. If using global grams a setting of 3 or 4 is recommended so that the modem can connect with satellites that are not attached to a gateway (this condition is required to send a global gram). Using a setting of 3 or 4 in conjunction with Auto Roaming (0x8b) enabled will allow the modem to connect and send messages to different gateways automatically (see Auto Roaming description for more information).						
0x0a	ob_route	2	0	2	R/W	Route outbound messages/ commands to: 0=local application task; 1=serial port; 2=both. **This value should be 0 for QCP.**
0x0b	inactive_interval	0	0	86400	R/W	NOT SUPPORTED
0x0c	sc_state	0	0	10	R	State of modem message transport processes: 0=Idle; 1=Sending modem-Originated message; 2=Sending modem-Originated report; 3=Sending modem-Originated Globalgram; 4=Receiving modem-Terminated message; 5=Receiving modem-Terminated command; 6=Receiving modem-Terminated Global Gram; 7=Performing self-test; 8=Performing local loop-back; 9=performing ORBCOMM Gateway loop-back test (may require a minute or two, depending on Satellite availability)
0x0d	sc_diag_code	0	---	---	R	modem Diagnostics Result Code (See *OSI* Section 3.2 note 9)
0x0e	active_mha_ref_num	0	0	255	R	Active MHA Message Reference number (255 = no messages)
0x0f	sat_in_view	0	0	255	R	Number of Current Satellite in View (0 if no satellite in view). Note: Currently this parameter returns only 0 or 1 (0=no satellite in view, 1=satellite in view)
0x10	gwy_id_list	---	---	---	R	List of IDs of ORBCOMM Gateways connected to the current satellite
0x11	min_gwy_pri_list	---	---	---	R	List of minimum acceptable message priorities for each Gateway identified in parameter 0x10, in the same order as the Gateways identified in param0x10
Number	**Name**	**Def. Value**	**Min Value**	**Max Value**	**DTE Access**	**Description**
0x12	msg_queue_size	---	---	---	R	NOT SUPPORTED
0x13	sco_msg_queue_size	---	---	---	R/W	NOT SUPPORTED
0x14	sct_msg_queue_size	---	---	---	R/W	NOT SUPPORTED
0x15	queue_ob_msgs	---	---	---	R	Number of modem-Terminated messages in queue
0x16	queue_ib_msgs	---	0	---	R	Number of modem-Originated messages in queue
0x17	week_bytes	---	0	---	R/W	UTC time week (0 = week starting Sunday January 6, 1980 00:00:00 UTC)
0x18	time_bytes	---	0	604799	R/W	24-bit integer representing the number of seconds since 00:00:00 UTC of the previous Sunday (resets 12:00 A.M. Saturday night / Sunday morning)
0x19	total_sats	---	---	---	R	Total number of satellites in system
0x1a	stored_sats	0	0	---	R	NOT SUPPORTED
0x1b	pos_calc_active	1	0	1	R/W	NOT SUPPORTED
0x1c	pos_age	---	0	65535	R	NOT SUPPORTED

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Num	Name	Def. Value	Min Value	Max Value	DTE Access	Description
0x1d	lat_code	---	0	0xffffff	R/W	Coded geodetic latitude 0: North Pole, 0xffffff: South Pole
0x1e	lon_code	---	0	0xffffff	R/W	Coded geodetic longitude 0: Greenwich Median, increasing in eastern direction
0x1f	msg_requeue_opt	1	1	1	R/W	NOT SUPPORTED - DO NOT MODIFY
0x20	poll_response_timeout	5	2	30	R/W	NOT SUPPORTED
0x21	ser_max_retries	0	0	255	R/W	Number of successive packet retries without receiving valid ACK before discarding packets
Additional notes: This parameter works in conjunction with parameter 0x22 (ser_pkt_timeout). It specifies the number of attempts the modem will make to re-send a packet (to the application) that it does not receive a valid Link Level Acknowledgement (LLACK) packet for. For example: The modem receives a modem-T message from the network and ser_max_retries (0x21) is set to a value of 3. The modem will make its initial attempt to send this packet to the application. If the application does not return a valid LLACK packet, the modem will wait X number of seconds (specified by parameter 0x22) and then try to resend the packet. In this example, it would retry 3 times before discarding the packet.						
0x22	ser_pkt_timeout	3	1	30	R/W	Number of seconds modem waits for ACK after sending last byte of a packet before resending
Additional notes: As mentioned above, this parameter specifies the number of second the modem will wait between retrying to send a packet to the application that it did not receive a valid LLACK packet for.						
0x23	abort_response	0	0	1	R/W	Abort Response 0: do nothing, 1: send abort report
0x24	abort_report	---	---	---	W	Abort Report values of ncc_id, polled, serv_type, or_ind, and info bytes 0-5 for abort report
0x25	ops_mode	0	0	2	R/W	NOT SUPPORTED
0x26	ob_flow_cntl	3	0	3	W	Sending packets/bytes to DTE: 0: deactivated DTR stops it 1: activated RTS stops it 2: either 3: no outbound flow control
0x27	ib_flow_cntl	3	0	3	W	NOT SUPPORTED
0x28	DSR_treatment	0	0	1	W	0: Not enabled 1: DSR activated if one or more modem-Terminated messages queued in modem (Used with parameter 0x26)
0x29	baud_rate	4	4	10	R/W	DTE baud rate (MTS Port) 4: 4800, 5: 9600, 6: 19200, 7: 38400, 8: 57600, 9: 76800, 10: 115200
Additional notes: This parameter can be used to modify the baud rate of the MTS port.						
0x2a	parity_bits	0	0	2	R/W	DTE parity 0: none, 1: odd, 2: even
0x2b	stop_bits	1	1	2	R/W	DTE stop bits
0x2c	data_bits	8	7	8	R/W	DTE data bits
0x2d	duplex	1	0	2	R/W	NOT SUPPORTED (MTS Port is full duplex)
0x2e	test_mode	0	0	4	R/W	Test Mode 0: normal operation 1: echo downlink data to DTE 2: echo uplink data to DTE 3: echo both to DTE 4: echo DTE to uplink as reservation burst
0x2f	pwr_down_mode	1	0	1	W	0: receiver power controlled by DTE DTR signal 1: receiver power controlled by rcvr_power parameter
Additional notes: When this parameter is set to 0 the modem will power down when DTR is deasserted.						
0x30	active_set_id	1	0	1	R/W	NOT SUPPORTED
0x31	serial_num	---	---	---	R	modem Serial Number

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Num	Name	Def. Value	Min Value	Max Value	DTE Access	Description
0x32	sw_version	---	---	---	R	Modem software version. For example, July 5, 2005 will return decimal 7055.
0x33	hw_version	---	---	---	R	NOT SUPPORTED
Number	**Name**	**Def. Value**	**Min Value**	**Max Value**	**DTE Access**	**Description**
0x34	ser_spec_rev	'G'	'G'	---	R	modem Serial Interface Specification revision supported
0x35	manu_id	4	4	4	R	4: QUAKE Global, Inc.
0x36	pos_det_supported	1	0	1	R	NOT SUPPORTED
0x37	most_recent_dl	---	50	349	R	Most recent downlink channel
0x38	dl_chan_list	---	---	---	R	NOT SUPPORTED
0x39	debug_lvl	5	0	5	R/W	NOT SUPPORTED
0x3a	rcvr_power	2	0	2	R/W	0. Receiver OFF 1. Listen to DL 6/16 2. Receiver continuously ON
0x3b	send_pass_predict	0	1	0	W	When 1, passes Ephemeris, Satellite plane orbital elements packets to Application/DTE
0x3c - 0x72	RESERVED FOR FUTURE ORBCOMM USE	---	---	---	---	---
0x73	initial_pos_det	0	0	1	W	NOT SUPPORTED
0x74 - 0x78	DOPPLER POSITIONING PARAMETERS	---	---	---	---	NOT SUPPORTED
0x79 - 0x7f	BYTE MODE PARAMETERS	---	---	---	---	NOT SUPPORTED
0x80 - 0xff	See Appendix B - QUAKE's ORBCOMM configuration parms (QCFG)	---	---	---	---	QUAKE-specific configuration parameters

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Appendix B - QUAKE's ORBCOMM configuration parms (QCFG)

Table B-1: QUAKE's ORBCOMM configuration parameters

Num	Name	Def Val	Min Val	Max Val	DTE Access	Description
0x80	QCFG_LOG_DEBUG_LEVEL	4	0	6	R/W	Logger Port log level
0x81	QCFG_GPS_LOGGING	0	0	1	R/W	GPS Task debug logging enable
0x82	QCFG_TL_LOGGING	0	0	1	R/W	0: Not enabled 1: Enable Transport Layer debug logging (must be set for prms 0x83-0x88 to take effect)
0x83	QCFG_DLEVPROC_LOG_LEVEL	0	0	5	R/W	Downlink Event Proc Task debug level
0x84	QCFG_ULMGR_LOG_LEVEL	0	0	5	R/W	Uplink Mgr Task debug level
0x85	QCFG_SPP_LOG_LEVEL	0	0	5	R/W	Serial Pkt Proc Task debug level
0x86	QCFG_MODEM-TMGR_LOG_LEVEL	0	0	5	R/W	modem-T Msg Mgr Task debug level
0x87	QCFG_MODEM_LOG_LEVEL	0	0	5	R/W	TL modem Task debug level
0x88	QCFG_OSPM_LOG_LEVEL	0	0	5	R/W	OB Serial Pkt Mgr Task debug level
0x89	QCFG_MSN_SAVE_OPTION	0	0	1	R/W	0: Save MSN data to flash on [controlled] power down only 1: Save MSN data to flash on any change
0x8b	QCFG_MTS_AUTO_ROAMING_ENA	0	0	1	R/W	0: Not enabled 1: Enable Auto-Roaming for message packets received on MTS Port
0x8c	QCFG_QLM_LOG_MASK	-	-	-	-	Not supported
0x8d	QCFG_DUPL_USR_CMD_TIME_S	900	30	3600	R/W	Number of seconds for which User Command duplicates will be discarded
0x8e	QCFG_POWER_SAVING_MASK	-	-	-	-	Not supported
0x90	QCFG_PREF_NETWORK	0	0	3		0 – GSM first 1 – ORBCOMM first 2 – GSM only 3 – ORBCOMM only
0x92	QCFG_MDMIF_PORT	3	0	3		Do not change
0x94	QCFG_DBG_UTILITY_LEVEL	5	0	5	R/W	Debug mode log level
0x95	QCFG_MTS_ARCHIVING_ENA	0	0	1	R/W	0: Not enabled 1: Enable message archiving to flash memory of message packets received on MTS port
Additional notes: When this parameter is enabled modem-O messages will be stored in NVM. If the modem loses power or is put into sleep mode it will retrieve any unsent messages at boot up and return them to the message queue.						
0x98	QCFG_MODEM_APN_USER	None				User login name if required

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Num	Name	Def Val	Min Val	Max Val	DTE Access	Description
0x99	QCFG_MODEM_APN_PASS	None				User password if required
0x9a	QCFG_OSI_IB_ROUTE	1	0	2	R/W	Route inbound messages/commands to: 0=Application; 1=Transport Layer; 2=Both
0x9b	QCFG_MODEM_BAND	3	0	3		Not supported
0x9d	QCFG_MODEM_APN_ADDRESS					Network provider name. Default: ORBCOMM.t-mobile.com
0x9e	QCFG_MODEM_CONNECT_DUR_S	90	0	65535		If there's no data exchange within this timeout period (seconds) the connection is closed. 0 for no timeout
0x9f	QCFG_EXT_MODEM_ID_INTERVAL	0	0	65535	R/W	ID Message interval (in seconds).
0xa0	QCFG_MDMIF_BAUD_RATE	-	-	-	-	Not supported
0xa1	QCFG_REQUEST_GLOBALGRAMS	0	0	1	R/W	0: Not Enabled 1: Automatically send a Communications Command 2 (Request Globalgrams) to satellites that come into view
Additional notes: This parameter (0xa1) must be enabled in order to receive modem-T Globalgrams. When set to 1 the modem will send a request to each satellite passing over that is in Globalgram mode requesting any modem-T Globalgrams.						
0xa2	QCFG_POS_FILTER_MAX_VEL	50	0	65535	R/W	Max. allowed speed in GPS position samples (meters per Second). GPS samples with a larger speed will be discarded
0xa3	QCFG_POS_FILTER_MAX_DIFF	25	0	100	R/W	Max. allowed difference in *change in distance* vs. *speed × change in time* between successive GPS samples (%). Higher values (50-75%) can reduce average time-to-fix (particularly in high acceleration scenarios) but will reduce outlier rejection effectiveness. Set to 100 to disable this algorithm
0xa4	QCFG_SMTP_SERVER_ADDR	None				Address of SMTP mail server
0xa5	QCFG_SMTP_SERVER_PORT	25	0	65535		SMTP port (generally 25)
0xa6	QCFG_SMTP_USER	None				SMTP account user name
0xa7	QCFG_SMTP_PASS	None				SMTP account password
0xa8	QCFG_SMTP_TO_ADDR	None				Default email address to which to send messages
0xa9	QCFG_SMTP_SUBJ	None				Default subject of the email
0xaa	QCFG_POP_SERVER_ADDR	None	None	None	R/W	POP server address
0xab	QCFG_POP_SERVER_PORT	25	1	65535	R/W	POP port
0xac	QCFG_POP_USER	None	None	None	R/W	Pop username
0xad	QCFG_POP_PASS	None	None	None	R/W	Pop password

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Num	Name	Def Val	Min Val	Max Val	DTE Access	Description
0xae	QCFG_GLSS_CHAN	N/A	A	D	R/W	GlobalStar channel
0xaf	QCFG_GLSS_RETRY_COUNT	N/A	3	20	R/W	GlobalStar retry count
0xb0	QCFG_GLSS_MIN_INTERVAL_S	N/A	30	300	R/W	GlobalStar minimum interval
0xb1	QCFG_GLSS_MAX_INTERVAL_S	N/A	60	600	R/W	GlobalStar maximum interval
0xb2	QCFG_MDMIF_IRI_PORT	N/A	-	-	R/W	Iridium port
0xb3	QCFG_AUX_BAUD_RATE	19200	1200	115200	R/W	**Note that the maximum speed of the AUX is 57600 bps**
0xb4	QCFG_MTS_BAUD_RATE	4800	1200	115200	R/W	
0xb5	QCFG_POWER_DOWN_MODE	0	0	1	R/W	1=power down when DTR goes low
0xb6	QCFG_SOFTWARE_VERSION	1.2.345 6.789	-	-	R/W	Version 1.2, SVN (3456), Coverity (789)

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Appendix C - QUAKE's Iridium & Inmarsat config parms (QCFG)

Table C-1: QUAKE's Iridium and Inmarsat configuration parameters

Num	Name	Def Val	Min Val	Max Val	DTE Access	Description
0x80	QCFG_LOG_DEBUG_LEVEL	4	0	6		Level of logging messages output
0x81	QCFG_GPS_LOGGING	0	0	1	R/W	GPS Task debug logging enable
0x82	QCFG_TL_LOGGING	0	0	1	R/W	0: Not enabled 1: Enable Transport Layer debug logging (must be set for prms 0x83-0x88 to take effect)
0x83	QCFG_DLEVPROC_LOG_LEVEL	0	0	5	R/W	Downlink Event Proc Task debug level
0x84	QCFG_ULMGR_LOG_LEVEL	0	0	5	R/W	Uplink Mgr Task debug level
0x85	QCFG_SPP_LOG_LEVEL	0	0	5	R/W	Serial Pkt Proc Task debug level
0x86	QCFG_MODEM-TMGR_LOG_LEVEL	0	0	5	R/W	modem-T Msg Mgr Task debug level
0x87	QCFG_MODEM_LOG_LEVEL	0	0	5	R/W	TL modem Task debug level
0x88	QCFG_OSPM_LOG_LEVEL	0	0	5	R/W	OB Serial Pkt Mgr Task debug level
0x89	QCFG_MSN_SAVE_OPTION	0	0	1	R/W	0: Save MSN data to flash on [controlled] power down only 1: Save MSN data to flash on any change
0x8b	QCFG_MTS_AUTO_ROAMING_ENA	0	0	1	R/W	0: Not enabled 1: Enable Auto-Roaming for message packets received on MTS Port
0x8c	QCFG_QLM_LOG_MASK	-	-	-	-	Not supported
0x8d	QCFG_DUPL_USR_CMD_TIME_S	900	30	3600	R/W	Number of Seconds for which User Command duplicates will be discarded
0x8e	QCFG_POWER_SAVING_MASK	-	-	-	-	Not supported
0x90	QCFG_PREF_NETWORK	0	0	3		0 – GSM first 1 – Sat first 2 – GSM only 3 – Sat only
0x92	QCFG_MDMIF_PORT	3	0	4		
0x94	QCFG_DBG_UTILITY_LEVEL	5	0	5	R/W	Debug Mode log level
0x95	QCFG_MTS_ARCHIVING_ENA	0	0	1	R/W	0: Not enabled 1: Enable Message Archiving to flash memory of msg packets received on the MTS Port
Additional notes: When this parameter is enabled, modem-O msgs will be stored in NVM. If the modem loses power or is put into sleep mode it will retrieve any unsent msgs at boot up and return them to the msg queue.						
0x98	QCFG_MODEM_APN_USER	None				User login name if required
0x99	QCFG_MODEM_APN_PASS	None				User password if required

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Num	Name	Def Val	Min Val	Max Val	DTE Access	Description
0x9b	QCFG_MODEM_BAND	3	0	3		Not supported
0x9d	QCFG_MODEM_APN_ADDRESS					Network provider name Default: ORBCOMM.t-mobile.com
0x9e	QCFG_MODEM_CONNECT_DUR_S	90	0	65535		If there's no data exchange within this timeout period (seconds) the connection is closed. 0 for no timeout
0x9f	QCFG_EXT_MODEM_ID_INTERVAL	0	0	65535	R/W	ID Message interval (in seconds).
0xa0	QCFG_MDMIF_BAUD_RATE	-	-	-	-	Not supported
0xa1	QCFG_REQUEST_GLOBALGRAMS	0	0	1	R/W	This is not a valid parameter for non-ORBCOMM modems. It is ignored by them.
0xa2	QCFG_POS_FILTER_MAX_VEL	50	0	65535	R/W	Max. allowed speed in GPS position samples (meters per Second). GPS samples with a larger speed will be discarded
0xa3	QCFG_POS_FILTER_MAX_DIFF	25	0	100	R/W	Max. allowed difference in *change in distance* vs. *speed × change in time* between successive GPS samples (%). Higher values (50-75%) can reduce average time-to-fix (particularly in high acceleration scenarios) but will reduce outlier rejection effectiveness. Set to 100 to disable this algorithm
0xa4	QCFG_SMTP_SERVER_ADDR	None				Address of SMTP Mail Server
0xa5	QCFG_SMTP_SERVER_PORT	25	0	65535		SMTP Port (generally 25)
0xa6	QCFG_SMTP_USER	None				SMTP Account User Name
0xa7	QCFG_SMTP_PASS	None				SMTP Account Password
0xa8	QCFG_SMTP_TO_ADDR	None				Default email address to send messages to
0xa9	QCFG_SMTP_SUBJ	None				Default subject of the email
0xaa	QCFG_POP_SERVER_ADDR	None	None	None	R/W	POP server address
0xab	QCFG_POP_SERVER_PORT	25	1	65535	R/W	POP port
0xac	QCFG_POP_USER	None	None	None	R/W	Pop username
0xad	QCFG_POP_PASS	None	None	None	R/W	Pop password
0xb2	QCFG_MDMIF_IRI_PORT	4	-	-	R/W	Iridium port
0xb3	QCFG_AUX_BAUD_RATE	19200	1200	115200	R/W	**Note that the maximum speed of the AUX port is 57600 bps**
0xb4	QCFG_MTS_BAUD_RATE	4800	1200	115200	R/W	
0xb5	QCFG_POWER_DOWN_MODE	0	0	1	R/W	1=power down when DTR goes low
0xb6	QCFG_SOFTWARE_VERSION	1.2.34 56.789	-	-	R/W	Version 1.2, SVN (3456), Coverity (789)

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Appendix D - Debug and utility menus

QUAKE Global provides a large group of debug and utility menus which are accessible via the Logger port. These menus allow the user to send and receive messages and email, view operational performance, conduct serial tests and many more functions. Some of the menus require a password and are accessible to QUAKE personnel only. The menus are accessible from the Logger port using the following settings:

Baud rate: 115200 bps
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None

Two different commands can be used to enter the menus, either 'd' (debug) or 'U' (utility). Each command will display a listing of debug or utility menus respectively. Each menu can be entered by typing the corresponding letter code in the list. The list of letter codes for either menu can be displayed by typing '?'. For example, **'d' '?'** gives the list of letter codes (commands) for all the debug menus listed under 'd'.

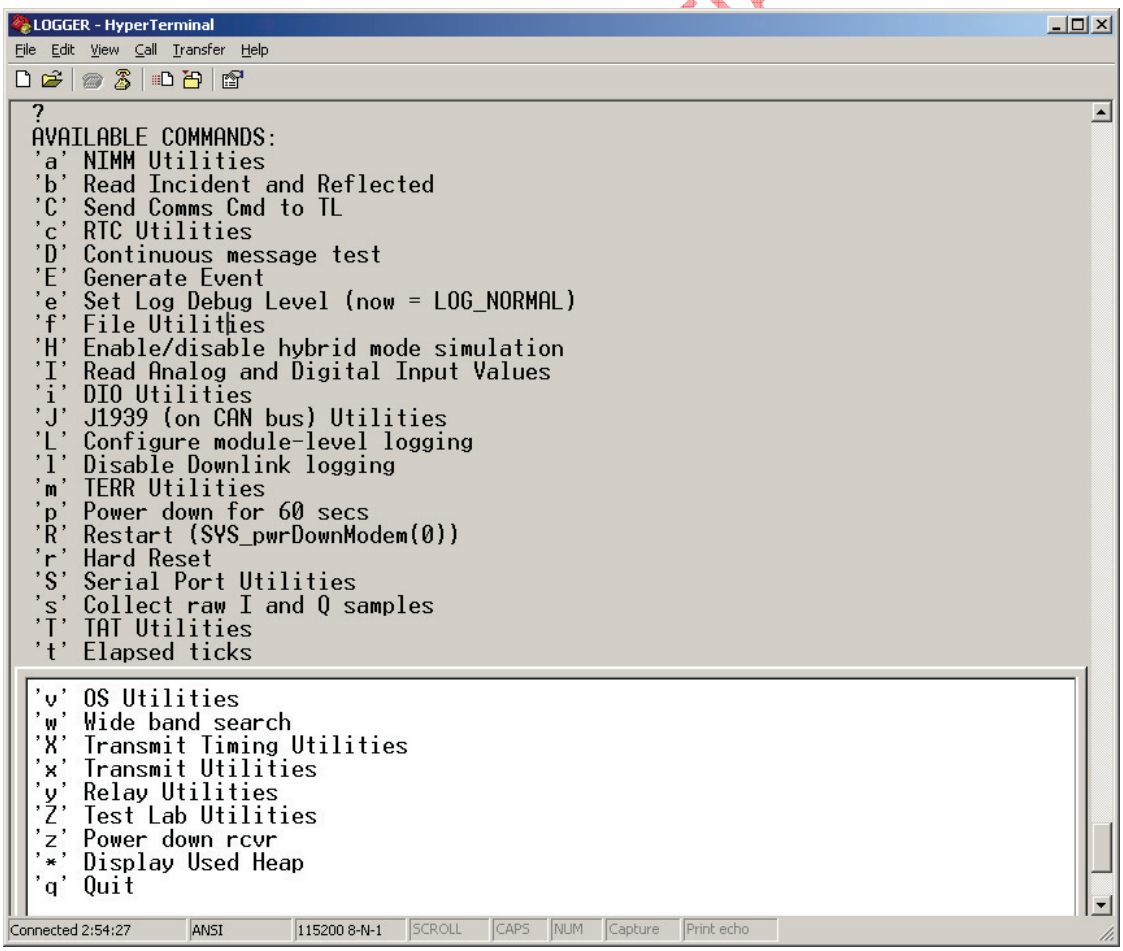

Figure E-1: Debug menus available from 'd' '?'

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Additional utility commands are available by typing '**U**' '**?**':

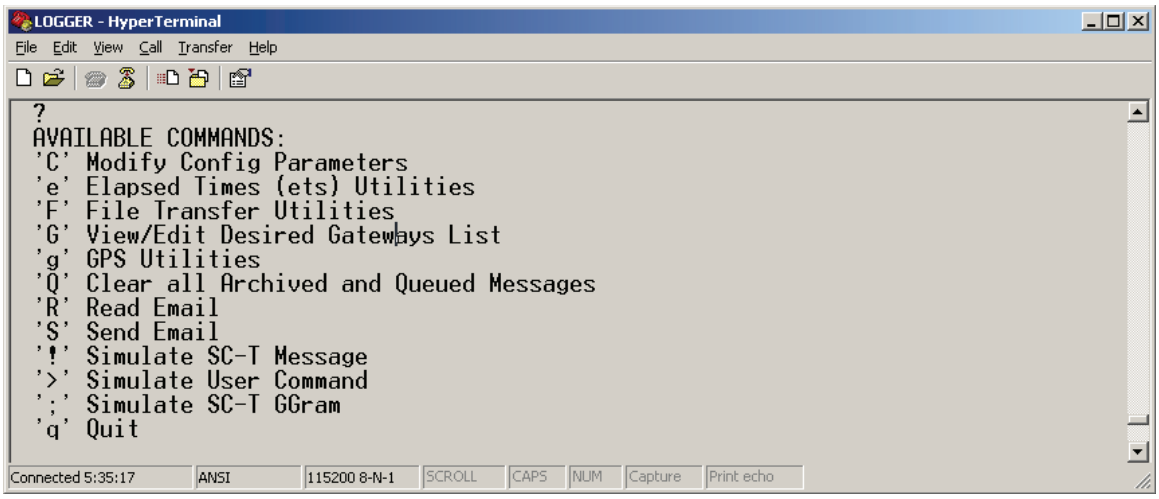

Figure E- 2, Debug menus available from 'U' '?'

Note: See section 7.2.1 for examples of using the menu commands on the Logger port.

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Appendix E - Software file naming convention

The name of a code file follows the format:

*<**Product Label**><**File Type**>-<**Hardware Features Label**>-aa.bb.cccc.dd-<**File Identifier**>.bin*

where:

- *Product Label* is defined in
- Table E-1
- *File Type* is defined in Table E-2
- *Hardware Features Label* is defined in

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- Table E-3
- *aa* is the Major version
- *bb* is the Minor version
- *cccc* is the Subversion build
- *dd* is the Coverity Checker ID
- *File Identifier* is defined in Table E-4

Example:

Q4Kf-HGT-2.20.5434.10452-ENC.bin

Table E-1: File naming – Product label

Product Label	Description
Q4K	Q4000
Q1K	Q1000
QPRO *(for applications and foundation code produced before 4/9/2011)*	QPRO-3G
Q4KI *(for applications produced before 4/9/2011)*	Iridium application

Table E-2: File naming – File type

File Type	Description
f	a Foundation image
a	an application image

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Table E-3: File naming – Hardware features label

Hardware Features Label	Description
ONN	ORBCOMM
GGT	Globalstar, GSM, Trimble
HGT	ORBCOMM, GSM, Trimble
IGT	Iridium, GSM, Trimble
H3T	ORBCOMM, 3G, Trimble
JGT	InmarSat, GSM, Trimble

Table E-4: File naming – File identifier

File Type	Description
ENC	an encrypted, loadable image
<App name>	the name of the application. If the app is customer-specific image the value will be the customer name.

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Appendix F - Glossary of terms

ADC	Analog to Digital Converter
API	Application Programming Interface
BPS	Bits per Second
CAN	Controller Area Network
CD	Carrier Detect Signal
CR	Carriage Return
DIO	Digital Input/Output
DTE	Data Terminal Equipment
DTR	Data Terminal Ready signal
EDA	Event Driven Architecture
FFS	Flash File System
FTP	File Transport Protocol
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
GUI	Graphical User Interface
ICD	Interface Control Drawing
IDE	Integrated Development Environment
IMS	International Mobile Subscriber identify
LEO	Low Earth Orbit
LF	Line Feed
LSB	Least Significant Bit
MHz	Megahertz
MID	Message Identification
MO	Mobile Originated (Iridium network)
MT	Mobile Terminated (Iridium network)
MTS	Main Transport Socket
NCC	Network Control Center
NVM	Non-Volatile Memory
O/R	Originator/Recipient
OSI	ORBCOMM Serial Interface
OTA	Over the Air
PGN	Parameter Group Number
POP	Post Office Protocol
QCFG	QUAKE Configuration Parameters
QCP	QUAKE Configuration Protocol
QCT	QUAKE Configuration Tool
QFFS	QUAKE Flash File System
QMM	QUAKE Memory Manager
QRTOS	QUAKE Real-time Operating System
RPM	Revolutions Per Minute
RTC	Real-time Clock
RTOS	Real-time Operating System

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SAE	Society of Automotive Engineers
SBD	Short Burst Data
SMTP	Simple Mail Transfer Protocol
UART	Universal Asynchronous Receiver/Transmitter
VSWR	Voltage Standing Wave Ratio
VHF	Very High Frequency

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16 Active Graveyard (where to place?)

16.1 DTR handling (used to be in 9.6 Working with Turnkey)

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17 Load conditions

The Q4000/QPRO can perform the following actions simultaneously:

- send messages on the GSM/GPRS port at 115200 bps continuously
- send messages via satellite network continuously
- use MTS port at 115200 bits per second (bps)
- use AUX port at 115200 bps

Note:

The AUX port
- maximum speed is 57600 bps
- may **not** be available on certain configurations of the Q4000/QPRO. The Q4000/QPRO with Iridium or Inmarsat, for example, does not have the AUX port available.

- continuously obtain GPS fixes
- run Logger port at debug level 6
- access CAN bus messages by providing the desired PGN.
  - As long as filtering is done in foundation, a fully loaded CAN bus at 250 Kbps is supported. Raw CAN bus filtering cannot be done at the application level because the input queue can quickly overflow if the ORBCOMM module is running (see **Note** below).
- continuously run OSI protocol at 115200
- perform OTA upgrades
- CPU load can reach 85-90% during these loading conditions.

Note:

For CAN usage:
- at high load and 30 PGNs, CPU usage is 26%
- at moderate load and 30 PGNs, CPU usage is 16%
- adding the reception of 10 PGNs per second increases the load by 2-3%.

Note:

The Logger port, if used by the customer to receive data, should not be run above 19200. It could drop bytes otherwise. The Logger port should be used for debugging purposes only.

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