Hach Company

HQd Meter

Remote Command Set

Change Summary

V0.7 (15 April 2010)

- Added "Get Record Count", "Send Data Log" and "Delete Data Log" commands

V0.6 (2 April 2010)

- Fix description of "Read" command and added note section
- Fix error message syntax to include the underscore character, where missing
- Added further description to the "Start Auto-Send Reading Mode" section
- More description in "Meter Configuration" section

V0.5 (1 April 2010)

- Initial version for Alpha/Beta sites to review and use.

Introduction

In order to facilitate measurement automation, the Hach HQd Meter family implements a command set which can be used to perform minimal configuration and control of the instrument. In addition, the solution should not require administrative privileges on the controlling PC, as is the case with the USB Mass Storage command implementation previously available for the HQd meters.

Configuration Requirements

In order for the system of HQd meter and host to function, the following requirements in the meter and host must be met.

Meter Configuration

The meter must be connected to an AC/USB adapter with AC power supplied. The meter must also be configured manually to respond as a virtual serial USB (Communications Device Class) device. [**subject to change**] This operation is currently performed through the "Meter information" menu. When the USB device type is selected, and the "OK" button is pressed, the meter will power down. Upon power-up, the meter's USB Function stack will report that it is the newly-selected type of device when queried by a USB host.

Host Configuration

The host must support a USB device of the USB Communication Device Class (CDC) of subtype Abstract Control Model (ACM) (See USB CDC v1.1 specification). For a Microsoft Windows (XP and newer) system, this entails using the supplied ".INF" file to configure the Microsoft-supplied USBSER.SYS service. Installing this configuration file requires administrative privileges on the machine (I think?). For a Linux box, the cdc_acm kernel module is loaded automatically on most distros and shows up as */dev/tty/ACMx*.

Command Set

The HQd meter command set is divided in two types of commands. Meter configuration commands are used to configure the HQd meter or to determine its current configuration. Meter control commands are used to initiate a meter operation.

The command set is documented with the name of the command with the actual mnemonic in parentheses. The format of the command, including any arguments is noted next along with any constraints on the arguments. Following the command format, possible responses, including error messages are listed and described.

Syntax:

All commands are terminated with a linefeed character (0x0A), at a minimum. Command strings are not processed until a linefeed character is received by the meter. All carriage returns (0x0D), tabs (0x09), and spaces (0x20) are considered white space. Receipt of a backspace character (0x08) will not be stored in the command buffer, but will delete the last character in the buffer, recursively.

Any item between angle brackets (<>) should be replaced with a value

Capital letter "N" is used to denote an integer, 0-9

Capital letter "X" is used to denote any (Roman) alphanumeric character, i.e. 0-9, A-Z, a-z.

Any item specified with a "0xNN" or "0xNNNN" is the hexadecimal value representing a byte or word (short) respectively.

Operation Modes

The communication channel has two operating modes, configuration and reading data modes. When the configuration mode is active, the meter will not send any reading data. When in Reading-data Mode, the meter will ignore configuration and related query commands. This provides a structured separation of Unicode and ASCII responses from the meter.

Start Auto-Send Reading Mode (Remote off)

Use this command to set the meter in Auto-Send Mode. Once the meter confirms that Reading mode is active, all responses from the meter will be in Unicode (UTF-16), until the Start Configuration Mode command has completed. The meter will start in Reading Mode.

Command

```
ID499
```

Response

```
ID001 ID599 ID999 [0xFF 0xFE]
```

This response will be sent in ASCII (8-bit) characters. The two bytes following the ID999 will be the UTF-16 byte order mark (BOM, 0xFEFF). All subsequent data from the meter will be in Unicode (UTF-16). Subsequent configuration commands are not allowed, however control commands are allowed. If a configuration command (other than the Start Configuration command) is sent in this mode, the meter will

simply ignore it. All responses from the meter are localized in the language selected in the meter.

In this mode, any "Send" operations using the meter's keypad will command the meter to send the associated data. I.e., "Send Data Log" will send the data log to the USB host (PC); "Send Current Calibration" will retrieve the current calibration from the associated probe and send that information to the USB host.

Start Configuration Mode (Remote On) <default>

Use this command to set the meter in Configuration Mode. Once the meter confirms that Configuration Mode is active, no more reading data will be sent to the host computer, and all responses will be ASCII (8-bit) encoded.

Command

```
ID400
```

Response (UTF-16)

```
ID001 ID500 ID999 [0xEF 0xBB 0xBF]
```

The bytes following the ID999 are the byte order mark (BOM) for UTF-8, indicating a change from UTF-16 to UTF-8 (ASCII) characters. Subsequent commands to send data are not allowed. Manual control of the meter will not send reading data to the host PC while in Configuration mode. On restart, the meter returns to Reading Mode.

Note: the UTF-8 BOM will appear as a Unicode character, 0xBBEF on x86 machines. While

Meter Configuration

Use the following commands to configure the meter or to determine the current configuration of the meter.

Instrument Identification (IID)

Use this command to obtain the meter model number, serial number and number of probes that are attached. There are no arguments for this command.

Command

```
IID
ID403           (Get Device Name)
ID401           (Get Device Number)
ID404           (Get Version)
```

Response

```
HQ<NN>d <NNNNXXNNNNNN> <N>
ID001 ID058HQ<NN>d ID999
```

```
ID001 ID057<NNNNXXNNNNNN> ID999
ID001 ID059<N.N.N.NNN> ID999
```

ID058: Instrument Name
Model Numbers: HQ11d, HQ14d, HQ25d, HQ30d, HQ40d, etc.

ID057: Instrument (Serial) Number
Serial Number: will be a 12-character string, of which the fifth and sixth characters may be alphabetic, while the remainder will only be numeric.

ID059: Instrument application software version

Errors:

ID025Syntax_Error	The formulation of the command string was not recognized or incomplete

Probe Identification

Use this command to determine what probe is connected at each port. The probe enumeration command will result in all available ports listed with blank responses for the ports that have no probe attached.

Command

```
ID550            (Get number of Sensors)
ID551            (Enumerate: Get name and SN of probes)
```

Response

```
ID001 ID502<N> ID503<N> ID999
ID001 ID504<N> ID058<XXX-NNN> ID057<NNNNNNNNNNNN> ... ID999
```

Where <N> is a numeric character, 1-9. Port numbers start at 1 (one).

ID502: Number of Ports available

ID503: Number of Sensors/Probes attached
Number of ports / probes attached: will be an integer of the range 0-9

ID504: Port to which the probe is attached
ID058: Instrument/Sensor Name/Model (blank if no probe attached)
ID057: Instrument/Sensor (Serial) Number (blank if no probe attached)

Errors:

ID025System_Error	Meter encountered an internal error obtaining the probe identification information
ID025Syntax_Error	The formulation of the command string was not recognized or incomplete

Get Reading Mode

Use this command to determine the manner in which readings are initiated.

Command

```
ID552                    (Get Reading Mode)
```

Response

```
ID001 ID505<PTR|INT|CONT> (ID506<NNNNN> ID507<NNNNN>) ID999
```

PTR: Press-To-Read mode is active
INT: Interval reading mode is active
CONT: Continuous mode is active
ID505: Reading mode
ID506: Interval length in seconds
ID507: Duration length in seconds

If Interval mode is reported, the interval and duration will follow the reading mode string.

Errors:

ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters

Set Reading Mode

Use this command to set the manner in which the instrument initiates measurements, i.e. press-to-read, etc.

Command

```
ID553<PTR|INT|CONT>    (Set Mode)
ID554<NNNNNN>          (Set Interval)
ID555<NNNNNN>          (Set Duration)
```

PTR: Press-To-Read mode
INT: Interval reading mode
CONT: Continuous mode

If Interval mode is requested, the interval and duration setting commands should follow the reading mode command if Interval Mode is selected. If no Interval and duration values are ignored for Press-to-read and Continuous mode arguments.

The following are valid interval specifier strings:

10, 30, 60 (1 min), 300 (5 min), 900 (15 min), 1800 (30 min)

The following are valid duration specifier strings:

900 (15 min), 1800 (30 min), 3600 (1 h), 14400 (4 h), 28800 (8 h), 86400 (24 h), 172800 (48 h), 0 (Unlimited)

Response

```
ID001 ID3990 ID999     (status -> OK)
```

Errors:

ID025Invalid Interval	An interval was specified that was not one of the strings enumerated above. (Meter must be in Interval mode)
ID025Invalid Duration	A measurement duration was specified that was not one of the strings enumerated above. (Meter must be in Interval mode)
ID025Invalid Mode	Interval or duration command sent while meter is in Press-to-read or Continuous mode.
ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters, i.e. an interval was specified when "Continuous" mode was specified.

Get Local Storage mode

Use this command to determine whether the meter is storing measurement data in its data log or not.

Command

```
ID556                  (Get meter-local storage mode)
```

Response

```
ID001 ID508<0|1> ID999
```

ID508: Meter-local measurement storage mode
1(ON): The meter will store measurement data in the meter's data log
0(OFF): The Meter will **not** store measurement data in the internal data log

Errors:

ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters

Set Local Storage mode

Use this command to control whether measurements are stored in the meter's non-volatile memory.

Command

```
ID557<0|1>
```

IID557: Set meter-local measurement data storage mode
1(ON): The meter will store measurement data in the meter's data log
0(OFF): The Meter will **not** store measurement data

Response

```
ID001 ID3990 ID999     (status -> OK)
```

Errors:

ID025Invalid_Parameter	An invalid command parameter was included with the command, i.e. something other than 1("ON") or 0("OFF").
ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters.

Get Meter Time

Use this command to retrieve the current time and date as set in the meter. The meter will return a POSIX time value for the local time. Since there is no facility in the meter for setting the time zone, there is no offset for/from GMT/UTC.

Note: POSIX time value is a 32-bit integer number of seconds since 0:00 1-January-1970.

Command

```
ID558                  (Get meter date/time value)
```

Response

```
ID001 ID510<NNNNNNNN> ID999
```

ID510: POSIX date/time value of meter
The meter returns a decimal numeric string containing the number of seconds since 0:00 1-January-1970, local time, as tracked by the Real-Time Clock (RTC) circuitry in the HQd meter.

Errors:

ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters

Set Meter Time

Use this command to set the current time and date in the HQd meter.

Command

```
ID559<NNNNNNNNNN>      (Set meter date/time value)
```

Argument is a decimal numeric, without spaces or punctuation, in the range of 1104537600-2147483647 (0:00:00 1-Jan-2005 to 03:14:07 19-Jan-2038) (0x41D5E800-0x7FFFFFFF)

Response

```
ID001 ID3990 ID999     (status -> OK)
```

Errors:

ID025Invalid_Parameter	An invalid command parameter was included with the command, i.e., a value beyond the range of 1104537600-2147483647 (0x7FFFFFF), contains characters outside the range of "0"-"9", contains more than 10 decimal numeric characters, or is missing entirely
ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters.

Meter Control

The following commands can be used to control the meter to perform specific operations. These include starting a measurement cycle, turning off the meter, and sending the entire measurement (including calibrations) data log.

Take Reading

Use this command to take a reading in current mode and send the reading data when available. All measurements will be sent as complete CSV records terminated with a line-feed character (0x0A). Measurement records could exceed 300 characters in length. The following table enumerates the meter behavior, depending on the measurement mode.

Mode	Behavior
Press-to-Read (PTR)	Meter starts a measurement cycle and sends all available measurement records once they are available. If more than one probe is connected, records will not be sent until all probes have stabilized the reading value. The time to stabilize may be from a few seconds to several minutes, depending on the conditions of the measurement sample.
Interval (INT)	Meter starts measuring with all attached probes on the selected interval (see Set Reading Mode) and will send measurement records when all measurements have stabilized. It will continue sending measurement records on the selected interval.
Continuous (CONT)	Meter immediately sends the currently captured measurement values for all connected probes, regardless of whether the reading / measurement has stabilized.

Command

```
ID023                    (Sample / Start Reading)
ID024                    (Stop sampling / reading)
```

ID023 (start): If the meter is in interval mode, the meter will start taking measurements on the configured interval, otherwise it will send the current reading record when acquired.
ID024(stop): If the meter is in interval mode, the meter will stop taking measurements.

Response

The response to the command will be one or more reading records, or an error message. Error messages will begin with "ID002". Otherwise, measurement records will return as noted above, and are terminated by linefeed (0x0A) characters. For the contents of the reading record, see the meter user manual.

Errors:

ID025No_Probe	The meter has no probe attached to it.
ID025Invalid_Mode	The meter is configured for interval mode and a "stop" command was sent when measurement has not started, or a "start" command was sent when already running interval mode.
ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters.

Note

When in Auto-reading mode (remote off), and the meter is not displaying the reading screen (i.e. data log or configuration menu), no reading will be taken in Interval or Push-to-read modes. In Continuous mode, the meter will send one and only one reading from each probe until the meter is returned to the reading screen.

Get Data Record Count

Use this command to retrieve the number of reading records stored in the meter. This can be useful to determine how many records will be sent by the *Send Data Log* command

Note: This command may be used in either Configuration Mode or Auto-Send Reading Mode.

Command

```
ID561                    (Get meter date/time value)
```

Response

```
ID001 ID511<NNN> ID999
```

ID511: The number of reading records currently stored in the meter reading data log

The character encoding of the message is determined by the transfer mode of the meter. Thus for Configuration Mode the response will be encoded in ASCII/ANSI characters, in Auto-Send Reading Mode the response will be encoded in UTF-16 characters.

Errors:

ID025System_Error	Meter encountered an internal error performing the command
ID025Syntax_Error	The formulation of the command string was not recognized or had extraneous characters

Send Data Log

Use this command to prompt the meter to send all of the measurement records that are stored in its data log. Note that this will send all records, starting with the field labels

(column headers) for each field (column) if enabled. The records are sent in inverse chronological order, i.e., LIFO.

Command

```
ID562
```

Response

The response to the command will be one to 500 reading records, or an error message. For this command, error responses will start with the word `ID002`. Otherwise, measurement records will be sent as a continuous text stream, each terminated by a UTF-16 linefeed (0x000A) character. For the contents of the reading record, see the meter user manual.

Errors:

`ID025Empty_Log`	The data log in the meter is empty, i.e. contains no measurement records.
`ID025System_Error`	Meter encountered an internal error performing the command
`ID025Syntax_Error`	The formulation of the command string was not recognized or had extraneous characters.

Delete Data Log

Use this command to prompt the meter to delete all of the measurement records that are stored in its data log. Note that this will delete all reading records, but will not affect calibration information and history stored in the IntelliCal probes. This command may be used in either Configuration Mode or Auto-Send Reading Mode.

Command

```
ID563
```

Response

The response to the command will be:

```
ID001 ID3990 ID999     (status -> OK)
```

or an error message. For this command, error responses will start with the word `ID002`. The character encoding of the message is determined by the transfer mode of the meter. Thus for Configuration Mode the response will be encoded in ASCII/ANSI characters, in Auto-Send Reading Mode the response will be encoded in UTF-16 characters.

Errors:

`ID025System_Error`	Meter encountered an internal error performing the command
`ID025Syntax_Error`	The formulation of the command string was not recognized or had extraneous characters.

Power Off

Use this command to turn off the meter. The meter will only turn on when the power button has been physically pressed.

Command

```
ID560                    (Power-off the instrument)
```

Response

The response to the command will be to power off. Any characters after the command string are ignored by the meter.

Errors:

`ID025System_Error`	Meter encountered an internal error performing the command. I.e., the meter could not turn off for some reason.
`ID025Syntax_Error`	The formulation of the command string was not recognized. I.e., characters preceded the command.

SEnd current CALibration (Not implemented)

Use this command to obtain the current calibration for the probe selected as part of the command. The current calibration will be sent as a complete CSV record terminated with a line-feed character (0x0A). Calibration records could exceed 300 characters in length.

Command

`IDNNN<N>`

Port number: The port number, 1-9, of the probe from which to send the current calibration.

Response

The response to the command will be one calibration record, or an error message. For this command, error responses will start with the word `Error:`. Otherwise, measurement records will return as noted above, and are terminated by linefeed (0x0A) characters. For the contents of the calibration record, see the meter user manual.

Errors:

`No Probe`	The selected port has no probe attached to it.
`Invalid port`	Meter does not have that many ports
`Invalid Parameter`	An invalid command parameter was included with the command. I.e., the argument was not a numeric character from 1-9
`System Error`	Meter encountered an internal error performing the command
`Syntax Error`	The formulation of the command string was not recognized or had extraneous characters.

SEnd Calibration HIStory (Not implemented)

Use this command to obtain the calibration history for the probe selected as part of the command. All calibrations in the history file of the probe will be sent as complete CSV records terminated with a line-feed character (0x0A). Calibration records could exceed 300 characters in length.

Command

`IDNNN<N>`

Port number: The port number, 1-9, of the probe from which to send the calibration history.

Response

The response to the command will be one or more reading records, or an error message. For this command, error responses will start with the word `Error:`. Otherwise, calibration history records will return as noted above, and are terminated by linefeed (0x0A) characters. For the contents of the calibration history record, see the meter user manual.

Errors:

`No Probe`	The selected port has no probe attached to it.
`Invalid port`	Meter does not have that many ports
`Invalid Parameter`	An invalid command parameter was included with the command. I.e., the argument was not a numeric character from 1-9
`System Error`	Meter encountered an internal error performing the command
`Syntax Error`	The formulation of the command string was not recognized or had extraneous characters.