

OPERATING MANUAL
for
QUARTZDYNE®
Q-Link

QUARTZDYNE, INC.

A DOVER COMPANY

4334 W. LINKS DRIVE
SALT LAKE CITY, UTAH 84120-8202
USA
801-266-6958; FAX 801-266-7985
www.quartzdyne.com

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Quartzdyne Q-Link

Operating Manual

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1. INTRODUCTION

The QUARTZDYNE® Q-Link interface incorporates a microprocessor to compute pressure and temperature for up to four digital transducers. Multiple Q-Links can be connected to the same RS-232 bus. Flash memory is integrated for data logging and device settings. A real time clock is included for time stamping data. The Q-Link provides four digital transducer ports, one RS-232 communications port, and one power input port.



The serial computer interface allows the user to select the units of pressure and temperature, and permits zero and span adjustments. The user can select which data is transmitted to the computer. Q-Link automatically downloads any connected digital transducer's coefficient file. User-selected options (such as units of pressure and temperature) can be written to memory, so that the Q-Link operates in the desired mode on "power-up."

A user-friendly Q-Link update software package can be downloaded from www.quartzdyne.com. The software will automatically load the new firmware via RS-232 into the Q-Link's flash memory. Quartzdyne also provides a Q-Link interface software package that simplifies the setup.

2. ELECTRICAL SPECIFICATIONS

2.1 Absolute Maximum Ratings

Supply Voltage	0 to 6.8V*
Supply Current	300mA

2.2 Environmental

Operating Temperature.....	0 to 60°C
Storage Temperature.....	-40 to +80°C
Hermeticity	Dust Proof

2.3 Power Supply

Power Supply Connector	3.5 x 1.3 mm center positive P-7
Supply Voltage	3.6 to 6.3 VDC*
Supply Current	135 mA typical (Q-Link only)
.....	+10 mA per Digital Transducer
Recommended Power Supply	3.0 VDC @ 400mA Unregulated*

2.4 Serial Communication

RS232 (IBM AT compatible)	8 data bits, 1 stop bit, no parity, Up to 115.2Kbaud
Cable	9 pin DB9 M-F straight through, fully shielded. Max 15m.

2.5 I²C Communication

Input Voltage	3V Logic Levels
Internal Pull-Up Resistor	10 k Ω
Cable	Fully shielded. Max 2m

2.6 Data Logging

Flash RAM	896KB Storage Space
Data Points.....	229,376 Data Items
.....	76,458 data sets (time, pressure, temperature)
Data Retention	>10 Years

*Warning – Unregulated supplies may have dangerously high DC voltages. Do not use a supply that exceeds maximum voltage at minimum supply current. See section 3.3.

3. HARDWARE

3.1 Transducer Connections

The transducer interface is compatible with Q-Link Digital Transducers. Four female 6-Pin MiniDin Digital Transducer ports are located on the Q-Link back panel (see Table 1). Each connector is designed to be protected from reasonable static discharges. However, care should be taken to prevent static discharges to Q-Link’s connectors. Users should properly discharge potential static sources before handling any of Quartzdyne’s electronic devices.

Table 1. Transducer Connector Pinout

<p>6-Pin Mini DIN Connector</p>	Pin #	Label	Description
	1	A2	Device Address
	2	Vcc	3VDC Output
	3	A1	Device Address
	4	SCL	I ² C Clock 100KHz Max
	5	SDA	I ² C Data 100KHz Max
6	GND	Ground	

3.2 Serial Communications

Q-LINK can communicate with standard serial ports available on most PCs. Communication speeds from 1200baud to 115.2kbaud are supported, with 9600 baud as default. Other line settings are 8 data bits, 1 stop bit, and no parity. A multi-device network may be connected using a common serial port and a Y-Type cable for all devices. The total cable length in a multi-device network is the sum of the individual branch cables lengths. Longer cables will lower the network’s max baud rate.

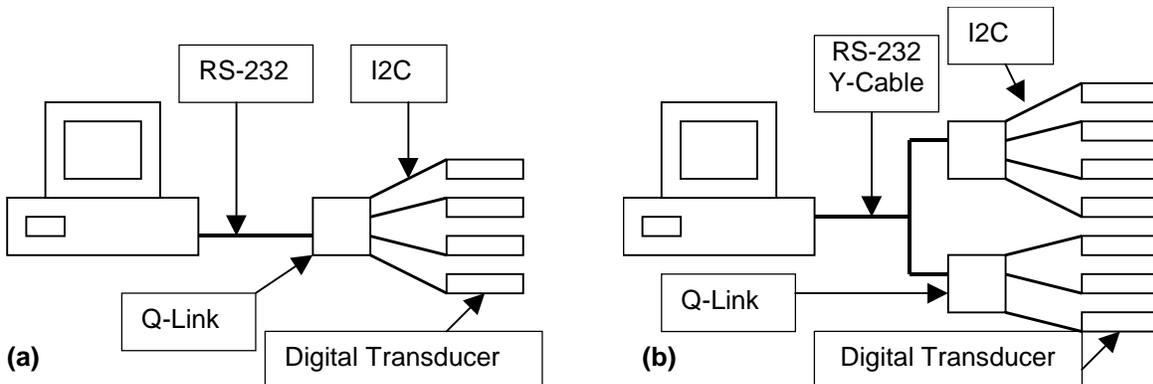


Figure 1. Connection Diagram (a) single Q-Link, (b) Multiple Q-Links.

The RS-232 port on the Q-Link is directly compatible with the standard IBM AT style (9-pin) serial port, see Table 4 for pin functionality. Note that the labeling of the RX and TX pins is relative to the device in question; thus RX on the host is connected to TX on the Q-LINK. The RS-232 cable supplied by Quartzdyne is a standard straight through DB-9P to DB-9P cable. Beware of commercially available RS-232 “null modem” cables where several of the pins are swapped.

Hardware handshaking is not required by the protocol. Since most AT type computers require DTR and CTS to be active, these lines are supported through a loop back. Communications are half-duplex (only one device may talk at a time).

Table 2. RS232 Cable Connections

Pin Number	RS232 DTE (IBM AT)	Transducer Interface (DCE)
1	*Receive Line Signal Detect	DSR/DTR
2	Receive Data (RXD)	Transmit Data
3	Transmit Data (TXD)	Receive Data
4	Data Terminal Ready (DTR)	DSR/DTR
5	Signal Ground	Signal Ground
6	Data Set Ready (DSR)	DSR/DTR
7	Request to Send (RTS)	CTS/RTS
8	Clear to Send (CTS)	CTS/RTS
9	*Ring Indicator (RI)	*N/A

* These lines are not required for communication.

3.3 Linear Wall Mount Power Supplies

Linear power supplies are simple devices rated to provide a voltage at a given current. Any linear power supply's output voltage will be greater than its rating when the load current is less than its rating. For example a 3.0DC@400mA supply will have a much higher output voltage if the load current is 50mA. This property could potentially create an over/under voltage problem if the power supply is not chosen carefully. Quartzdyne recommends a 3.0 Vdc @ 400mA supply, but we do recognize that this may not be possible for all customers. The following is a table of power supply ratings that should be compatible with the Q-LINK.

Table 3. Unregulated Power Supply Voltage vs. Current

Voltage(V)	Current(mA)
6.0	100
5.0	100-150
4.5	150-250
3.0	250-400

3.4 Battery Replacement

Warning! The Q-Link Digital Transducer Interface contains static sensitive devices. Use static prevention measures when accessing the inside of the case. Work only in an ESD safe work area.

To open the case, remove the four screws from the front end of the enclosure. Carefully slide the front panel and plastic trim from the enclosure exposing the electronics as shown in Figure 2. Insert a flat head screwdriver in the slot on the battery holder, and gently pry the battery up until it can be slid out of its socket. Insert the new battery with the “+” sign on the top. Use only Panasonic type BR2330 or equivalent batteries. Slide front panel and electronics into enclosure using the bottom PCB groove and insert and tighten the four screws.

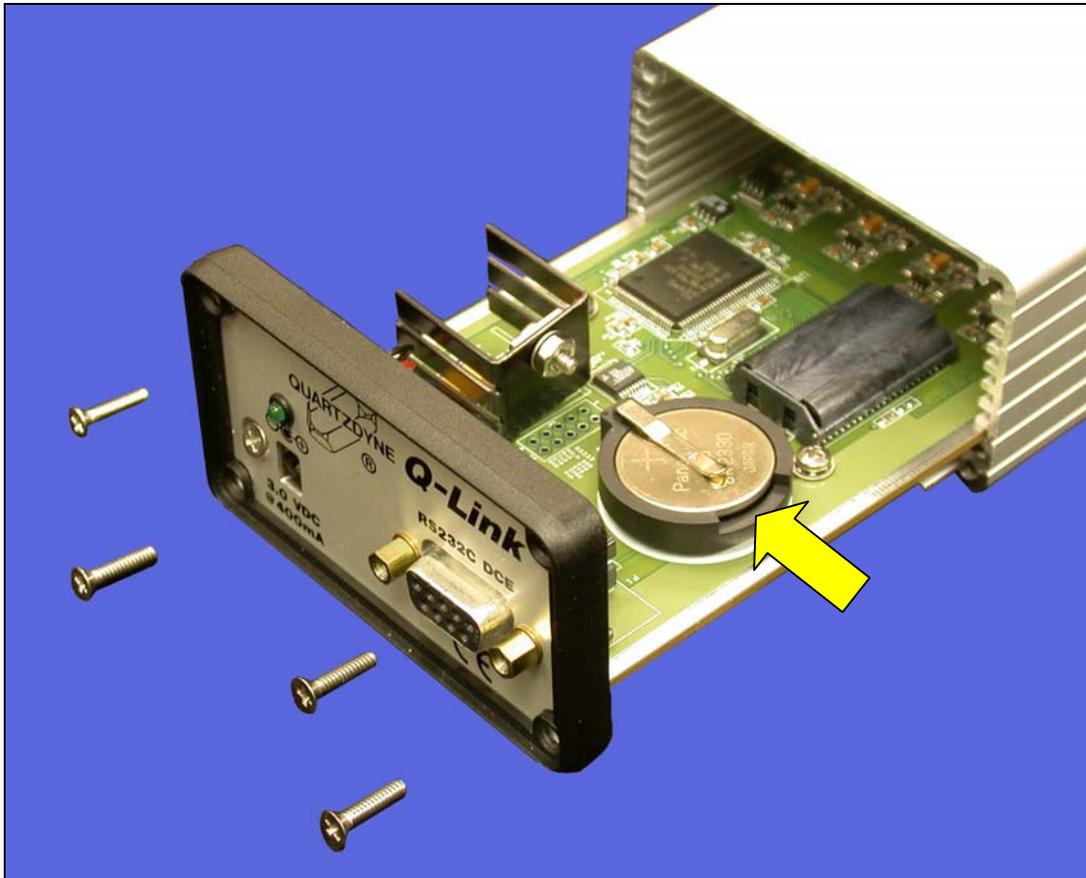


Figure 2. Battery Replacement

4. COMMUNICATIONS PROTOCOL

Any commercially available terminal emulator can be used to communicate with the Q-Link. The program "LTalk.exe" available from Quartzdyne is specifically tailored for this use. The Windows program "QConsole.exe", also available from Quartzdyne implements all of the commands listed below with a simple windows interface.

4.1 Command Structure

In the command documentation square brackets ([]) indicate optional parameters; a vertical bar (|) indicates alternate parameters. Uppercase letters indicate literal expressions, lowercase letters indicate data formats and italics represent data values and descriptions. The "->" character indicates a CR-LF sequence.

Commands are prefixed by the hash character (#) followed by two numeric digits, which indicate the address. Up to four devices may be connected to each Q-Link. Because each device must have its own unique address, the Q-Link will occupy a range of four consecutive addresses on the bus. For example, if the Q-Link is set at address #01 (the default), its four devices can be accessed using addresses #01 through #04. The connector on the left, labeled 'A', will be associated with the lowest address, and so forth. Address #00 is an all-call, or global command; all Q-Link modules on the bus will execute the command, but none will reply. If multiple Q-Link modules are to be used on the same serial port, their addresses must include unique ranges. For example, a second Q-Link could be set to use addresses #05-#08. The Q-Link base address may be changed by issuing the AD (set address) command. Please refer to **Section 4.6.1** for more details about the AD command.

Commands and responses are terminated by a CR-LF (->) sequence. The null command (#nn->) can be used to repeat the previous command. The equal sign (=) is used to program a value. Data items within a command or response are separated by commas (,). Multiple commands may be sent in a single command line with each command separated by a semicolon (;). The responses will be comma separated (see example). Braces ({}) are used to enclose commands that include CR-LF sequences such as the contents of log data or a calibration file. Invalid commands or data respond with "ERROR nn->", where nn indicates the particular error (See **Section 6**). A typical command/response sequence is shown.

```
#01D1;D2->
4522.45,120.24->
#01->
4522.47,120.22->
```

A copy of all programmable data is stored in nonvolatile memory. On power-up, defaults are assigned based on the contents of this memory. The contents of this memory are accessed using EEPROM commands (See **Section 4.7.1**).

4.2 Data Access Commands

4.2.1 Read Data

D[1]->	±nnnnn.nnn	<i>Primary Output (Pressure)</i>
D2->	±nnnnn.nnn	<i>Secondary Output (Temperature)</i>
D3->	Nnnnnnnnn	<i>Frequency Ratio 1</i>
D4->	Nnnnnnnnn	<i>Frequency Ratio 2</i>

Data commands are used to read the intelligent transducer data. Only fresh data will be sent (i.e. data which hasn't already been read), so there may be a delay of up to one gatetime before the response is sent. If data is not available for any other reason, an appropriate error indicator will be sent.

D1 and D2 are the calculated Primary (Pressure) and Secondary (Temperature) outputs reported in either the default or alternate calibrated units as described in Section 4.2.2. D3 and D4 are 32-bit integers equal to 2³² times the sensor frequencies divided by the reference frequency. These numbers are used as the inputs to the polynomials defined by the coefficient files.

It may be useful to combine multiple data statements in the same command line so that one request for data will return all of the data needed. The data commands can be used in the global mode to set up a command format as illustrated below.

<u>Command</u>	<u>Response</u>	<u>Comments</u>
#00D3;D4↵		<i>global command for F1 and F2</i>
#01↵	13054114,32541297↵	<i>#01's response</i>
#02↵	12463731,31031324↵	<i>#02's response</i>

4.2.2 Select Units

UN[1][=n name]↵	<i>name↵</i>	<i>Primary Units (Pressure)</i>
UN2[=n name]↵	<i>name↵</i>	<i>Secondary Units (Temperature)</i>

UN selects the units to be used from the programmed units table. The units may be selected by name or number. The name of the currently programmed units is returned. The name search is not case sensitive. If the number is out of range [1-8] or the name cannot be found, an error is returned.

#01UN1=psi↵	psi↵	<i>Pressure Units to psi</i>
#01UN1=Bar↵	Bar↵	<i>Pressure Units to bar</i>
#01UN2=C↵	C↵	<i>Temperature Units to °C</i>
#01UN2=F↵	F↵	<i>Temperature Units to °F</i>

4.2.3 Program Units

UP[1][=name[,scale[,offset]]]↵	<i>name,scale,offset↵</i>	Units Program 1
UPn[=name[,scale[,offset]]]↵	<i>name,scale,offset↵</i>	Units Programs 2-8

The UPn command is used to program each of the eight available units programs. If n is not specified, 1 is assumed. The units program includes a name by which the units are referred (maximum 5 characters), a scale factor, and an offset. The scale factor defaults to 1.0 and the offset to 0.0. The output is computed based on the following equation where the units of each term is units of each term are shown in parentheses.

$$D_{out} (units) = scale (units / CU) \times D_{calc} (CU) + offset (units).$$

CU is the calibrated unit as specified in the coefficient file (See **Section 4.5.4**). For QUARTZDYNE® Pressure Transducers, the calibrated units are psi for D1 (primary output) and °C for D2 (secondary output). It is the user's responsibility to verify that the scale factors are appropriate for the calibration type. **Note:** Programming a unit does not select it! The Q-Link is initially programmed with the units conversion factors shown below. Any of these may be changed by the user. Each program can be used with either D1 or D2. Use the EW command (**Section 4.7.1**) to store the changes permanently.

<u>Program</u>	<u>Name</u>	<u>Scale</u>	<u>Offset</u>
UP1	psi	1.0	0.0
UP2	bar	0.0689476	0.0
UP3	MPa	0.00689476	0.0
UP4	mH ₂ O	0.70307	10.335
UP5	C	1.0	0.0
UP6	K	1.0	273.15
UP7	F	1.8	32
UP8	R	1.8	523.67

Example:

```
#01UP8=Atm,0.0680272-      Atm,0.0680272,0-      Units Program 8 to Atmospheres
#01UN1=8-                  Atm-                  Select Atm as Pressure units
```

4.3 Data Logging Commands

The QUARTZDYNE® Q-Link Interface is supplied with 1MB of flash memory, most of which is available for data logging. It also has a battery-backed timekeeping chip so that time information may be included in the data log. Q-Link's power must be on in order for data to be logged. Configuration and data are retained when power is removed. If power is removed during an active logging session, data logging will resume when power is restored. The Log data and Log configuration are stored separately from device configuration data. The EW and ER commands do not affect the data logger.

4.3.1 Time Commands

```
TM[=[yy]yy:mm:dd:hh:mm:[ss]]-      yyyy:mm:dd:hh:mm:ss-      Time
TS[=ts]-                            ts-                          Time in seconds
```

TM and TS set or report the setting of the timekeeping chip. TM uses an international 24 hour time format. TS reports/sets time in seconds since 12:00 Midnight on Jan. 1, 1970 (1970:01:01:00:00:00). The TM and TS commands are also used to determine the format of the LD command. The range of the TM format is as follows:

[yy]yy	[19]70-[20]69	Year
Mm	1-12	Month
Dd	1-31	Day of Month
Hh	0-23	Hours
Mm	0-59	Minutes
Ss	0-59	Seconds

4.3.2 Log Initialize/Delete

```
LI=[dd[,dd][,dd][,dd]]-          TM|TS[,D1] ... [,D4]-          Initialize Log
```

LI initializes the data logging functions for a channel (or all channels if #00LI is used), and programs which data items will be stored. This command may take several seconds to complete, because it may have to erase the flash memory, which is a time consuming process. The response will come after any erasing of memory is finished. The data in the log is stored as 4 byte floating point numbers. Time is always stored, in addition to at least one of the data items D1-D4. The table below shows how many points can be stored depending on how many data items are stored. Note that there are four independent channels (A-D) which share this memory space, so if you log data on more than one channel, the number of points per channel is reduced accordingly. Within the data logging memory are fourteen sectors. Each of these sectors is allocated to one of the four channels on a 'first come, first served' basis. A sector cannot be shared by more than one channel. This means that one channel might report that its log is full (Error 14), while other channels still have room for more data points. Use the #00LI= command to erase logged data for all channels, ensuring that the maximum amount of space is available for subsequent data logging. After the log is initialized, the log rate and start/stop time must be set for logging to commence. Power must be on for data to be logged. The log settings and logged data are preserved during power down. (See example in **Section 4.3.7.**)

Number of Data Items	Example Command	Points per Sector	Points per Full Log (14 Sectors)
1	#01TM,D1	8192	114688
2	#01TM,D1,D2	5461	76454
3	#01TM,D1,D3,D4	4096	57344
4	#01TM,D1,D2,D3,D4	3276	45864

4.3.3 Log Rate

LR[=*nsec*[AND|OR Dn=*step*]]- *nsec*[AND|OR Dn = *step*]- *Logging rate*

Data is stored at time intervals specified in seconds. Optionally a condition may be included based on one of the logged data items. In the AND mode, data will be logged at the time interval only if the data Dn has changed by at least the value of *step*. In the OR mode data will be logged at the time interval OR if the data has changed by at least *step* since it was last logged. If the number of seconds is set to zero, all data points will be logged as they become available (at the gatetime rate). The logging rate may be changed while data is being logged. (See example in **Section 4.3.7.**)

4.3.4 Log Start/Stop

LS[=START|*start*[,*stop*]]STOP]- *start*[,*stop*]]STOPPED- *Start/Stop times*

Data logging will commence when the time programmed by *start* is reached and continue until the time specified in *stop*. If no stop time is specified, logging will continue until the log is full. To start/stop data logging immediately, use the words START or STOP instead of the actual times. The times will be reported as in TM or TS depending on the last format used. Logging may be stopped and started at will without destroying previously logged data. Only the most recently programmed start and stop times are reported. (See example in **Section 4.3.7.**)

4.3.5 Log Length

LL- *nnnnn*- *Log Length*

Reports the number of data sets currently stored in the log.

4.3.6 Log Dump

LD[n1[,n2]]- *time*,*nnnn*.*nn*[,*nn* ...]-| {- *Dump Log*
time,*nnnn*.*nn*[,*nn* ...]
.
}-

Dumps data from the log in the format specified above. When more than one line of data is returned, braces will enclose the response. Time will be reported in the most recently used format (LI, TM or TS). All other items will be dumped in the currently programmed units and with currently programmed scale and offset. Units may be changed during the data logging. A single data set is transmitted if only n1 is specified. The range of data sets from n1 to n2 is transmitted if both n1 and n2 are specified. n1 can range from 1 to the number returned by LL. n2 can range from n1 to the number returned by LL. If neither n1 nor n2 are specified, the entire data log will be dumped. Data logging will be suspended during log dumps.

Please note that serial communications handshaking is not supported by the Log Dump function. This means that there is a chance that characters will be lost if the receiving program cannot keep up with the character stream being sent by the Q-Link. If you find that some lines of data are missing characters, try dumping at a slower baud rate, or try dumping the log in smaller pieces. Also, the only way to abort a log dump is to cycle the power on the Q-Link.

4.3.7 Data Logging Example

The following example demonstrates how to program the data log to store Time, D1 and D2. In this example, data will be stored if D1 changes by at least 1.0, but no more than once every 10 seconds. Data logging is started immediately and continues until 7:00 a.m. on Christmas morning or until the log memory is full. Commands and responses are on alternating lines. Comments are in italics.

```
#01LI=TM,D1,D2-           Initialize Logging for time, D1 and D2
TM,D1,D2-                There may be a delay before this response
#01LR=10 AND D1=1.0      Set Logging Rate and Conditions
10 AND D1=1-
#01LS=START,2003:12:25:07:00:00-   Start logging and set stop time.
2003:12:24:16:59:59,2003:12:25:05:00:00-   Start and Stop times confirmed.
#01LL-                   Some time later log length is checked.
15-
#01LD 11,15-            Read last 5 log entries.
{-
2003:12:24:23:59:45, 1012.21, 1.512-
2003:12:24:23:59:55, 1018.32, 1.513-
2003:12:25:00:00:10, 1017.31, 1.514-
2003:12:25:00:05:23, 1016.31, 1.515-
2003:12:25:00:05:33, 1013.15, 1.516-
}-
```

4.4 Frequency Counter Commands

4.4.1 Gatetime

GA[=*gatetime*]- nn- *Gatetime in seconds*

The gatetime command allows variable gatetimes for the counters ranging from 0.01 to 2 seconds. Communications protocols and internal processing capabilities may limit throughput at faster gatetimes. The frequency counter resolution and therefore the calculated output resolution will be affected by the gatetime. Shorter gatetimes will yield proportionately less resolution than longer gatetimes.

4.4.2 Trigger

TR- TR- *Trigger Counters*

The trigger command synchronizes the frequency counter gate with the software command. The command is most useful when several transducers are monitoring a process which is changing rapidly. In this case the command should be sent in the global mode. All intelligent transducers will invalidate any current data, and begin the next gate cycle immediately. Synchronized data will be available after the gate closes and calculations are completed. Once synchronized, the transducers should remain synchronized for several minutes.

4.5 Calibration Commands

4.5.1 Span and Zero

S[1|2][=*span*[,*range*]]- *span*- *Span Adjust*
 Z[1|2][=*zero*]- *zero*- *Zero Adjust*

The S and Z commands set the span and zero for two point calibrations. S[1] and Z[1] refer to the primary output (pressure). S2 and Z2 refer to the secondary output (temperature). Zero and span are input in the current units. They are adjusted automatically when units are changed. The span adjustment is the desired change at full scale. If a value other than full scale is used to calculate the span adjustment, include that value in the range argument. The following equation is used to calculate the interface output.

$$D_{out} = \left(1 + \frac{span}{D_{max}} \right) \times (D_{calc} + zero).$$

In a typical two point calibration, the span and zero are initially set to zero. Data is taken at the zero point and zero is calculated as:

$$zero = D_{actual} - D_{measured}.$$

Enter the zero using the Z command.

```
#01Z1=zero↵          zero↵
```

Next, data is taken at a known point near full scale. Span is calculated as:

$$span = D_{actual} - D_{measured}.$$

Enter the span adjustment using the S command.

```
#01S1=span,Dmeasured↵      span↵
```

The returned span will have been adjusted for the calibrated full scale load. Use the EW command (**Section 4.7.1**) to store the changes permanently.

```
#01EW↵          0↵
```

Note: Two point calibration trimming is not generally recommended for QUARTZDYNE® Transducers.

4.5.2 Full Calibration

```
CA[L][={file contents}]↵      {↵file contents}↵          Full Calibration
```

CA accepts and echoes a hex coefficient file in the format provided by Quartzdyne. The format of this file is described in the digital transducer user's manual and documentation disk. The file contents are sent with surrounding braces ({}). Both primary and secondary coefficients are included in the hex coefficient file. If the file's format is incorrect, or if its checksums are not received correctly, an error will be returned and the coefficients will be marked as invalid. Coefficients may be restored to a valid state by sending a correct coefficient file via the the CA command.

Note that the CAL command reads (or stores) coefficients from (or in) Q-Link RAM, which is only temporary. To copy the coefficients to the non-volatile memory in the transducer itself, making them more permanent, use the CW command described below. In the example below, the full command is sent before any response is received. Previous coefficients may be restored by rebooting Q-Link or by issuing the CG command.

<u>COMMAND</u>	<u>RESPONSE</u>	<u>MEANING</u>
#01CA={↵ FileContents }↵	{↵ FileContents }↵	Calibration
#01CW↵	0↵	Store Permanently

4.5.3 Get and Write Coefficients

CG-	channel status-	<i>Get Coefficients</i>
CW-	channel status-	<i>Write Coefficients</i>

CG copies coefficients from the non-volatile memory of a transducer into Q-link's RAM, where it will be used for calculating pressure and temperature. This function is performed automatically for each attached transducer on boot-up. During normal operation, Q-Link polls all inactive I2C channels on approximately a one-second interval to see if a new transducer has been plugged in. If a transducer is discovered on a formerly inactive channel, its coefficients are automatically read.

CW copies coefficients from Q-Link's RAM to the non-volatile memory of the transducer.

Both CG and CW return the channel status for the channel that the transducer is connected to. A status of 0 is normal. A non-zero status indicates an error.

4.5.4 Calibration Information

CD-	dd mmm yyyy-	<i>Calibration Date</i>
CU[1 2]-	<i>Default units,alternateunits, alternate units-</i>	<i>Calibrated Units</i>
CR-	<i>Pmax, Pmin, Smax, Smin-</i>	<i>Calibration Range</i>
CT[1 2]-	<i>Pressure Temperature Other-</i>	<i>Calibration Type</i>

The CD, CU, CR, and CT commands return specific information from the programmed calibration file. CR will return the primary range (*Pmax* and *Pmin*) in the default units for D1 and the secondary range (*Smax* and *Smin*) in the default units for D2. The calibration type returned by CT is the name of the parameter being measured as specified in the coefficient file. CU returns the name of the default and alternate calibrated units from the calibration file. For QUARTZDYNE® Pressure Transducers, the standard calibration types and units are Pressure in psi or Bar and Temperature in C or F.

4.5.5 Transducer Information

M-	nnnnn-nnnn-	<i>Model Number</i>
ID-	nnnnnnnn-	<i>Serial Number</i>

The M and ID commands return the model and serial number as downloaded in the coefficient file.

4.6 Communications Protocol Commands

4.6.1 Device Address

AD[=address] -	nn-	<i>Q-Link Base Address</i>
----------------	-----	----------------------------

The address command sets the Q-Link base address. The response will be the new address. Base addresses are limited to numbers between 01 and 96. Because the Q-Link has four device ports, and because each device requires its own unique address, each Q-Link uses a range of four consecutive addresses beginning with the base address. For example, if the Q-Link address is set to 01 (the default), the devices connected to it may be accessed using addresses 01-04, with 01 corresponding to the port labeled 'A' and so forth. If multiple Q-Link modules are to be connected to the same serial port, they should be programmed to unique address ranges. In other words, assuming that the base address of the first Q-Link is 01, a second Q-Link connected to the same serial port should be set to address 05 or greater to avoid the overlapping of address ranges. To avoid conflict, the address of a second Q-Link must be changed from the default of 01 while it alone is connected to the serial port.

#00AD=05-		<i>Global: Assumes only 1 device on bus</i>
#05AD-	05-	<i>Confirm change</i>
#05EW-	0-	<i>Permanently store new address</i>

4.6.2 Baud Rate

BR[= <i>baud</i>]-	nnnn-	<i>Baud Rate</i>
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The baud rate command allows communications at any of the following baud rates: 1200, 2400, 4800, 9600 (the default), 19200, 38400, 57600, and 115200. The command will reply at the old baud rate to allow verification that the baud rate has been changed. It is recommended that an EW command be issued (at the new baud rate) after setting this command. If the baud rate of a device is not known, it will be necessary to issue a series of command requests at the baud rates listed above until a valid response is obtained.

#01BR-	1200-	<i>Communicating at 1200 Baud</i>
#01BR=9600-	9600-	<i>Set 9600 Baud (reply still at 1200)</i>
		<i>Change Baud rate of host to 9600</i>
#01EW-	0-	<i>Store new baud rate at 9600 Baud</i>

4.6.3 Reset

X-	<i>Reset</i>
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This command cycles power to the I2C ports A-D, resetting all attached transducers. Following this, a watchdog timeout is forced on Q-Link itself, rebooting it. The purpose of this command is to allow the operator to remotely cause a full reset in case of a transducer or Q-Link glitch.

4.6.4 Firmware Version

VE[R]-	Ver 2.01 03/02/03 (c) 1996 Quartzdyne, Inc.-	<i>Q-Link Version</i>
VF-	0D020201	<i>Device FPGA Version</i>

4.7 Hardware Commands

4.7.1 EEPROM (Flash) Read, Write

ER-	<i>status-</i>	<i>Read Non-Volatile Memory</i>
EW	<i>status-</i>	<i>Write Non-Volatile Memory</i>

Certain key Q-Link parameters are stored in non-volatile (Flash) memory, so that they persist even after power down. These parameters (and their related commands) include: Gatetime (GA), Device Address (AD), Baud Rate (BR), Units (UN and UP), and Span and Zero (S and Z). The ER command copies all of these parameters from Flash to RAM. The ER command is invoked automatically on power up. The EW command copies all of these parameters from RAM to Flash, making them permanent. In order to avoid permanently changing a parameter that you didn't intend to, we recommend that you use the following procedure to change only one parameter at a time: First call ER to get Q-Link into a known state. Then change the one parameter. Finally, call EW to make that change permanent. Both the ER and the EW commands return the status of the hardware flags. This is the same status given by the ES command (see **Section 4.7.2**).

#01EW-	Error 19, 0	<i>Clear Error State (?)mg</i>
#01CA={ <i>cffile</i> }-	{ <i>cffile</i> }-	<i>Download Coefficient File</i>
#01EW-	0-	<i>Save settings in non volatile memory</i>

5. COMMAND SUMMARY

D[1]-	±nnnnn.nnn	Primary Data (Pressure)
D2-	±nnnnn.nnn	Secondary Data (Temperature)
D3-	nnnnnnnnn	Frequency Ratio 1
D4-	nnnnnnnnn	Frequency Ratio 2
UN[1][=n name]-	name-	Primary Units (Pressure)
UN2[=n name]-	name-	Secondary Units (Temperature)
UP[n][=name[,scale[,offset]]]-	name,scale,offset-	Unit Program (1-8)
S[1 2][=span[,range]] -	span-	Span Adjust
Z[1 2][=zero] -	zero-	Zero Adjust
CA[L][={file contents}]-	{-cfile contents}-	Full Calibration
CD-	dd mmm yyyy-	Calibration Date
CU[1 2]-	default units,alternateunits, alternate units-	Calibrated Units
CR-	Pmax, Pmin, S max, Smin-	Calibration Range
CT[1 2]-	Pressure Temperature Other-	Calibration Type
M-	nnnnn-nnnn-	Model Number
ID-	nnnnnnnn-	Serial Number
CG-	channel status-	Get Coefficients
CW-	channel status-	Write Coefficients
GA[=gatetime]-	0.01 up to 2-	Gatetime in Seconds
TR-	TR-	Trigger Counters
VF-	nnnnnnnn-	FPGA Revision
VE[R]-	revision message-	Software Revision
AD[=address] -	nn-	Response Address
BR[=baud]-	nnnn-	Baud Rate
X-		Reset
EM[nn]-	message-	Error Message
ES-	status-	Hardware Status
ER-	status-	Read Configuration from Flash
EW	status-	Write Configuration to Flash
TM[=yy]yy:mm:dd:hh:mm:[ss]	yyyy:mm:dd:hh:mm:ss-	Time
-		
TS[=ts]-		Time in seconds
LI[=dd[,dd][,dd][,dd][,dd]]-	TM TS[,D1] ... [,D4]-	Initialize Log
LR[=nsec[AND OR Dn=step]]-	nsec[AND OR Dn = step]-	Logging rate
LS[=START start[,stop]]STOP]-	start[,stop]]STOPPED-	Start/Stop times
LL-	nnnnn-	Log Length
LD[n1[,n2]]-		Dump Log

6. ERROR MESSAGES

Error	Description	Possible Causes/Relevant Commands
Error 0	No Error	
Error 1	Bad Coefficients	<i>Download using CAL1={file contents}</i>
Error 2		<i>N/A</i>
Error 3	Unrecognized Command	<i>Semicolon instead of comma Missing characters in host serial software</i>
Error 4	Invalid Data	<i>Numeric data out of range String data contains too many characters</i>
Error 5	Named Units Not Found	<i>UN[1 2]=name - name not found in units table Use UPn to program units into the units table</i>
Error 6	Numeric Overflow	<i>Inappropriate Coefficients (CA) Transducer readings out of range</i>
Error 7	Command Too Long	<i>Try shorter commands</i>
Error 8	Response Too Long	<i>N/A</i>
Error 9	Serial Port Overrun Error	<i>Try shorter commands, slower baud rate (BR)</i>
Error 10	Serial Port Parity Error	<i>N/A</i>
Error 11	Serial Port Framing Error	<i>Incorrect Baud Rate (BR) Polarity Reversal ESD Event Break Character Sent</i>
Error 12	Log Hardware Not Installed	<i>Timekeeper Chip not responding (TM, TS, LI)</i>
Error 13	Log Initialization Error	<i>No log settings, try setting log.</i>
Error 14	Data Log is Full	<i>N/A</i>
Error 15	Data Log is Empty	<i>N/A</i>
Error 16	Protocol Overrun	<i>Characters sent by host or other device before addressed device responded- Host time-out shorter than gatetime (GA) Multiple devices set to same address (AD) Too much time between CR and LF</i>
Error 17	Hardware Error - Check Status (ES)	<i>See Table 4 Consult Factory</i>
Error 18	Sensor Frequency or Timebase Error	<i>See Table 4 Consult Factory</i>
Error 19	Memory Checksum Error	<i>EEPROM Data corrupt, See Table 4 EEPROM Data corrupt (ESD Damage)</i>
Error 20	Battery Low Error	<i>N/A Replace Battery</i>
Error >2021	Software ErrorHardware Error (Number = ES)	<i>See Table 4 Consult Factory</i>