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# DQ-4000

## 4 Channel Frequency-to-Digital Load Cell Interface

## User's Guide

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### *Notes*

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### *Manual Part Number*

033-02061-Rev1 (September 2009)

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### *SAFETY INFORMATION*

#### General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operating instructions.

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Loadstar Sensors office for any required service and repair to ensure that safety features are maintained.

#### Instrument Grounding

If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

#### Cleaning

Clean the outside of the instrument with a soft lint-free, slightly dampened cloth. Do not use detergent or chemical solvents. Doing so may void your warranty.

***WARNING***

1. ***Do not use the DQ-4000 with the cover, or part of the cover removed or loose, as a hazardous condition may result. Inspect the case for cracks or missing plastic. Do not use if the DQ-4000 is damaged.***
2. ***Use only Loadstar recommended AC Adapter, which conforms to the DQ-4000 required voltage and current ratings.***
3. ***Do not operate the DQ-4000 in an explosive atmosphere, or in the presence of flammable gases or fumes.***
4. ***Do not immerse the DQ-4000 in liquid because the housing is not fluid-tight. Humidity specifications are specified as non-condensing only.***
5. ***Do not substitute parts or modify the DQ-4000 to avoid the introduction of additional hazards. Return the DQ-4000 to Loadstar for service and repair to insure all safety features are maintained.***
6. ***When the built-in Lithium Ion Polymer battery option is present, take care not to:***
    a. ***Operate or store in temperatures beyond -20C to 60C. Battery failure may occur.***
    b. ***Excessive barometric pressure changes may also cause the battery to fail or outgas. The DQ-4000 is not to be used within a pressure vessel, for example.***
    c. ***Excessive physical damage, or severe product impact, may cause battery failure. Physically damaged units should be returned to Loadstar for service and repair.***

***ROHS/WEEE COMPLIANCE STATEMENT***

***EUROPE***

Directive 2002/95/EC. Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment, as amended by EU Commission Decision 2005/95/EC.

***This product is RoHS Compliant 2005/95/EC***.

"RoHS Compliant 2005/95/EC" means that the product or part ("Product") does not contain any of the substances in excess of the maximum concentration values in EU Directive 2002/95/EC, as amended by Commission Decision 2005/618/EC, unless the substance is in an application that is exempt under EU RoHS. Unless otherwise stated by Loadstar Sensors in writing, this information represents Loadstar Sensors best knowledge and belief based upon information provided by third party suppliers to Loadstar Sensors.

In the event any product is proven not to conform with Loadstar Sensors Regulatory Information Appendix, then Loadstar Sensors entire liability and Buyer's exclusive remedy will be in accordance with Loadstar's Warranty Policy.

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The Waste Electrical and Electronic Equipment Directive (WEEE) applies to companies that manufacture, sell, and distribute electrical and electronic equipment in the E.U. It covers a wide range of large and small household appliances, IT equipment, radio and audio equipment, electrical tools, telecommunications equipment, electrical toys, etc.

The Directive aims to reduce the waste arising from electrical and electronic equipment, and improve the environmental performance of everything involved in the life cycle of electrical and electronic equipment. This is translated into the following requirements:

* Producers (manufacturers or importers) of electrical and electronic equipment will be required to register in their countries.

* Private households will be able to return their WEEE to collection facilities free of charge and producers will be responsible for financing these facilities.

* Producers will be required to achieve a series of demanding recycling and recovery targets.

* Wheeled bin emblem Producers will be required to mark their products with the 'crossed out wheeled bin'. This symbol indicates that the equipment carrying this mark must NOT be thrown into general waste but should be collected separately and properly processed under local regulations.

The WEEE directive has been transposed into each E.U. member state's legislation and so the exact timing and details will vary slightly from country to country, but the above principles will apply. In particular, the arrangements for the separate collection of WEEE will vary in each country but might include for example: public collection points, retailers take back schemes, collection from households, etc. The Directive encourages reuse, recycling and other forms of recovery in order to prevent WEEE. Users of electrical and electronic equipment in the E.U. can therefore play an important role in reducing WEEE and helping the environment by separating out WEEE and disposing of it properly. Consumers can ask the supplier from whom they purchased the Electronic & Electrical equipment from about local arrangements for the disposal of WEEE.

Business users are advised to ensure that WEEE, which is not suitable for reuse or recycling, be disposed of properly via approved authorized treatment facilities. The Producer in your country may be able to assist you.

Loadstar Sensors is dedicated to minimizing the impact our products have on the environment and to comply with the WEEE Directive.

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In the event any product is proven not to conform with Loadstar Sensors Regulatory Information, as provided herein, then Loadstar Sensors entire liability and Buyer's exclusive remedy will be in accordance with Loadstar's Warranty Policy.

China RoHS is a two-step process that identifies concentration limits of certain hazardous substances in electronic information products that are sold into China. Per the deadline set by the Chinese government, March 1, 2007, Loadstar Sensors has implemented step one of China RoHS, self declaration of hazardous materials and marking of the product. Loadstar Sensors products that are sold into the China market have the required marking on the product designating that the product meets the China RoHS requirements.

The second step involving a testing obligation is currently under development. Full compliance will follow once it has been finalized.

# Table of Contents

1 INTRODUCTION ..... 9
2 MODULE DETAILS ..... 10
2.1 DQ-4000 External Connections ..... 10
2.2 DQ-4000 Mechanical Dimensions ..... 11
3 OPERATION GUIDE ..... 12
3.1 Install the software driver for the device ..... 12
3.2 Attach Loadstar frequency-based load cells to the sensor input ports ..... 12
3.3 Connect the uplink port to your computer's USB port ..... 13
3.4 Communicate with the DQ-4000 ..... 13
3.5 Terminal command line operation ..... 14
4 COMMAND SUMMARY ..... 15
4.1 S# Command ..... 15
4.2 CT0 & CT1 Commands ..... 16
4.3 O0S0 & O0S1 Commands ..... 16
4.4 O0W0 and O0W1 Commands ..... 17
4.5 O0X0 & O0X1 Commands ..... 17
4.6 O0T0 & O0T1 Commands ..... 17
4.7 CSS (Sample Size) Command ..... 18
4.8 CPS (Packet Size) Command ..... 18
4.9 SLC (Load Capacity) Command ..... 19
4.10 CN0, CN1, CP0, CP1, CAZ, FAZ, CLA & CTA Commands ..... 19
4.11 CK0 Command ..... 19
4.12 CS0 & CS1 (ID Strings) Commands ..... 20
4.13 FIT Command ..... 20
4.14 CQA, CQB, CQC, TQA, TQB & TQC Commands ..... 20
4.15 CCA, CCB, CCC, CCD, TCA, TCB, TCC & TCD Commands ..... 21
4.16 SST (Sensor Status) Command ..... 21
4.17 SETTINGS Command ..... 21

# List of Figures

Figure 1: Front View – With Sensors Attached ..... 10
Figure 2: Rear View – With DC-IN and USB Uplink attached ..... 10
Figure 3: Mechanical Top Dimension ..... 11
Figure 4: Mechanical Front Dimension ..... 11
Figure 5: Front View – Sensor Input Ports ..... 12
Figure 6: Back View – DC-IN, USB Uplink, LCD Contrast & Pushbutton ..... 13

# 1 INTRODUCTION

The Loadstar Sensors DQ-4000 4-Channel Frequency to USB module provides a convenient method to convert the outputs from up to four of Loadstar's frequency-output load cells into a PC friendly USB digital output. Attach the cable of iLoad-Mini (or other Loadstar frequency load cells) to one of the four sensor input ports on the DQ-4000 and connect the USB uplink output to your computer's USB port for a complete Windows PC based weighing system. No additional power beyond that supplied by the USB port is needed for a DQ-4000 equipped with up to 4 load cells.

The DS-4000 comes equipped with a *backlit two-line LCD to view the load on each channel or the total load of all connected load cells.*

In addition the DQ-4000/DS-4000 can be equipped with the following optional features:

- *Lithium Ion Polymer battery for power backup.*
- *ZigBee wireless network communication.*

***Standard Module Features:***

- *Powered by the USB bus. No external power is needed when DQ-4000 is equipped with up to 4 iLoad Mini series load cells.*
- *Supports all Loadstar frequency-output sensors including the iLoad Mini series.*
- *All user input program parameters stored in non-volatile flash memory.*
- *Built in text-based programming interface makes it convenient to use with Terminal Emulation programs (such as Windows' HyperTerminal) or to integrate into your own custom software applications written in various environments (including Visual Basic, Java, C, C++, LabVIEW, etc.) that are compatible with virtual COM ports.*
- *Complete LoadVUE software compatibility.*

***Optional Module Features**:*

- *ZigBee wireless networking.*
- *External 9V to 12V wall adapter (to power the ZigBee wireless and the local LCD).*
- *Internal Lithium Ion Polymer battery, for power backup. Internal battery is automatically recharged when sufficient external power is available.*
- *In the DS-4000, an LCD screen to display loads from any connected sensor or all connected sensors.*
- *In the DS-4000, a pushbutton to scroll between individual sensor weights and the total weight of all sensors on the LCD. The pushbutton also allows locally taring (i.e., zeroing) of the currently displayed sensor(s).*
- *In the DS-4000, a potentiometer to adjust the contrast of the local LCD.*

# 2 MODULE DETAILS

## 2.1 DQ-4000 External Connections

The front view below shows 4 USB Type-B input connections for the iLoad frequency-based sensors.

Figure 1: Front View – With Sensors Attached

The rear view below shows the power input, the USB uplink to the host PC, access to contrast adjustment for the optional LCD, and a pushbutton to scroll through the LCD or to tare the load.

Figure 2: Rear View – With DC-IN and USB Uplink attached

## 2.2 DQ-4000 Mechanical Dimensions

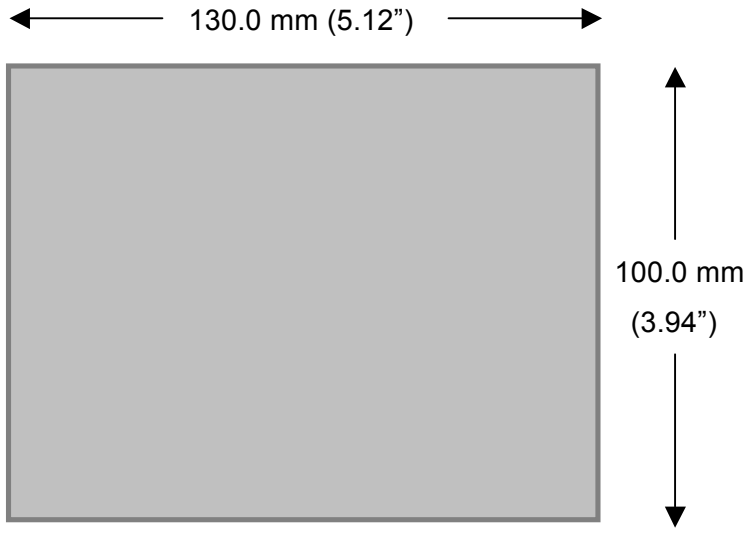


Figure 3: Mechanical Top Dimension

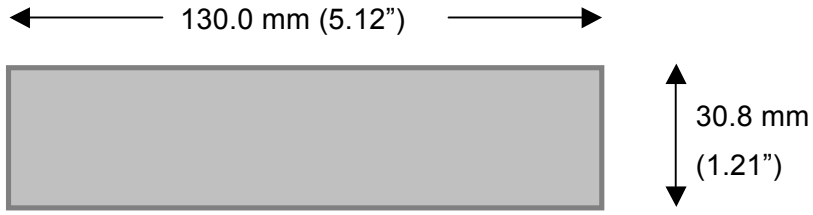


Figure 4: Mechanical Front Dimension

# 3 OPERATION GUIDE

## 3.1 Install the software driver for the device

If ordered without LoadVUE software, the DQ-4000 is shipped with a software driver installation disc. Please follow the instructions in the accompanying document to install the driver before you connect the DQ-4000 to your PC.

If you ordered the DQ-4000 with LoadVUE, the LoadVUE disc contains the drivers. Please install LoadVUE and follow the onscreen instructions to also load the drivers.

## 3.2 Attach Loadstar frequency-based load cells to the sensor input ports

The picture below shows the front view of the DQ-4000. If you ordered with only one load cell, plug it in Sensor 1 port. If you ordered multiple load cells, plug them per the serial numbers and the markings on the cable.

Figure 5: Front View – Sensor Input Ports

## 3.3 Connect the uplink port to your computer's USB port

The picture below shows the back view of the DQ-4000. The host PC's USB port is sufficient to power the DQ-4000 and up to 4 frequency load cells, external DC-IN is not required.

If you ordered the DQ-4000 with ZigBee, LCD or battery backup option(s), a power adapter will be included. Plug the power-jack into DC-IN connector. The DC-IN power requirement is 9VDC-12VDC at 2W, with Positive VDC on the center pin.

Use the included cable to connect the USB uplink port to the host PC. The power indicator LED on the front of DQ-4000 should light up. You may also see messages on your computer indicating that a virtual COM port is being set up.

The LCD contrast adjustment access and the pushbutton are applicable only when the DQ-4000 is equipped with the LCD option.

Figure 6: Back View – DC-IN, USB Uplink, LCD Contrast & Pushbutton

## 3.4 Communicate with the DQ-4000

If you are using DQ-4000 with the LoadVUE program, just start LoadVUE while the DQ-4000 is connected to the PC. LoadVUE will automatically detect the DQ-4000 and any attached sensors.

You could communicate with and control the DQ-4000 using a terminal emulation program, such as HyperTerminal. You may also use the appropriate function calls from your software programming environment. The procedures described in the document "*Driver Installation and HyperTerminal Operation of iLoad Digital USB Sensors*" apply to the DQ-4000 for opening the COM port and communicating with it.

Please set your COM port baud rate (in Windows Device Manager) and the HyperTerminal baud rate to match with DQ-4000's baud rate. The specific commands applicable to the DQ-4000 are described in following sections.

## 3.5 Terminal command line operation

Once you are connected to the DQ-4000 via HyperTerminal or another terminal emulation program, press `[Enter]` several times. You should get an "`A`" returned on your PC monitor screen for every `[Enter]` pressed. You may now issue ASCII commands to the DQ-4000, to remotely monitor and control the attached sensors.

You may press "?" at any time to see the available command list. The available commands will be described in detail in the next chapter.

The `CONF` lists additional commands available to configure the interface. **CAUTION:** Please use the `CONF` commands only when you are very familiar with the operations of the DQ-4000, otherwise the DQ-4000 might display erroneous weight.

The `SETTINGS` lists the settings for currently selected channel(s). If an individual channel was selected using S1, S2, S3 or S4 command, the displayed values apply to the currently selected sensor. If all channels were selected using S0 command, the displayed values apply to the DQ-4000 as a whole.

# 4 COMMAND SUMMARY

Except as noted, the commands for the DQ-4000 can all be entered without parameters to have the DQ-4000 report back the value of the appropriate parameters in memory. For example, issuing `CS1 M3-2598 [Enter]` sets the string1 to "M3-2598". Now issuing `CS1 [Enter]` gets the DQ-4000 to respond with the currently set value, i.e. `M3-2598`.

**IMPORTANT NOTES**:

- All commands (except CT0) allow you to make changes to the operation of the DQ-4000 for the current session. When the power is removed, the settings will revert to the values previously saved in the flash memory. If you wish the effect of the command to persist to the next session, you will need to issue the SAVE command to save the changes permanently to the flash memory.
- The CT0 hard tare command would tare and automatically issue the SAVE command, so that the tare value is saved permanently to the flash memory.
- The DQ-4000 flash memory has minimum 10,000 erase/write cycles. However, if your operating environment requires a lot of tares, you should use CT1 soft tare command that doesn't write to flash memory.

## 4.1 S# Command

| ***Function:*** | ***Sets (returns) currently addressed channel*** |
|---|---|
| **Summary:** | Sets or displays the currently selected channel. All subsequent commands will apply only to the selected channel until the next S# command is issued.<br>S1, S2, S3 and S4 select their respective channels individually. The `S0` sets the DQ-4000 to address all channels together as a whole. |
| **Example:** | S1 (sets current channel to Channel 1)<br>S0 (sets to address all channels together)<br>S (displays the currently selected channel) |

## 4.2 CT0 & CT1 Commands

| *Function:* | *Tares (zero) the selected load cell* |
|---|---|
| **Summary:** | The load on the selected load cell is set as the zero values and all subsequent load readings are relative to this gross zero value. CT0 is a "hard" tare that saves the values to the flash memory. While CT1 is a "soft" tare that the value is not preserved when the power is lost. The commands are issued without any other parameters. |
| **Example:** | CT0 (tares currently selected sensors and save the value to the flash memory)<br>CT1 (tares currently selected sensors, but without saving the values to the flash memory) |

## 4.3 O0S0 & O0S1 Commands

| *Function:* | *Output the raw data (frequencies and temperature) for the currently selected channel* |
|---|---|
| **Summary:** | These commands output the raw data read from the selected sensor. The data is output in 6 columns: Compensated frequency, Sensor frequency, Reference frequency, Temperature (ºC x 100), millisecond timer, and Computed load (millipounds).<br>O0S0 outputs the data continuously, while O0S1 outputs it once. The streaming data generated by an O0S0 can be stopped by pressing [Enter].<br>The O0S0 and O0S1 are valid when individual sensor is selected, using S1, S2, S3 or S4 command. It is not valid when all sensors are selected using S0 command. |
| **Example:** | O0S0 (Starts streaming raw data from current channel) |

## 4.4 O0W0 and O0W1 Commands

| *Function:* | *Output the gross load for the currently selected channel* |
|---|---|
| **Summary:** | These commands output the load of the currently selected channel(s).The load is relative to the gross tare set by previous CT0 or CT1 command. The data is output in a single column: Computed load (millipounds).<br>O0W0 outputs the data continuously, while O0W1 outputs it once. The streaming data generated by an O0W0 can be stopped by pressing [Enter]. |
| **Example:** | O0W0 (Starts streaming computed load from currently selected channel) |

## 4.5 O0X0 & O0X1 Commands

| *Function:* | *Output the gross load for all 4 channels + the total* |
|---|---|
| **Summary:** | These commands output loads (in millipounds) for each channel as well as for the sum of all four channels. These loads are relative to the gross tare set by the previous CT0 or CT1 command. The data is output in 5 columns: each column is the computed load for its respective channel. Column 5 contains the sum of all channels. Any disconnected channel is displayed as 0 millipounds.<br>O0X0 outputs the data continuously, while O0X1 outputs it once. The streaming data generated by an O0X0 can be stopped by pressing [Enter]. |
| **Example:** | O0X0 (Starts streaming computed load from all channels) |

## 4.6 O0T0 & O0T1 Commands

| *Function:* | *Output the gross load for all 4 channels + the total* |
|---|---|
| **Summary:** | These commands output load relative to the gross tare set by the previous CT0 or CT1 command. The data is output in 2 columns: a millisecond timer and the computed load (millipounds) of the currently selected channel(s).<br>O0T0 outputs the data continuously, while O0T1 outputs it once. The streaming data generated by an O0T0 can be stopped by pressing [Enter]. |
| **Example:** | O0T0 (Starts streaming millisecond timer and computed load from the currently selected channel(s)). |

# CONF COMMANDS

***CAUTION: The following commands are used to set the configuration of the DQ-4000 and should not be changed until you have a thorough understanding of the operation of the instrument and the effect of these parameters. The DQ-4000 would display erroneous load, if the parameters are not set correctly.***

## 4.7 CSS (Sample Size) Command

| ***Function:*** | ***Sets (or reports) the sample size to average for noise reduction*** |
|---|---|
| **Summary:** | The DQ-4000 performs sample averaging to reduce noise that may be present in the raw data. You may set the sample size to average to any number in the range 1 to 15. Note that higher values may reduce the data rate of the output.<br>The CSS command is valid for when individual sensor is selected using S1, S2, S3 or S4 command. It is not valid when all sensors are selected using S0 command. |
| **Example:** | CSS 10 (sets the averaging sample size to 10)<br>CSS (reports the currently set value of CSS) |

## 4.8 CPS (Packet Size) Command

| ***Function:*** | ***Sets (or reports) the packet size*** |
|---|---|
| **Summary:** | Sets or reports the packet size used in the process of generating the measured frequencies. In general, a larger packet size will let you obtain finer resolution. However, the larger packet sizes will reduce the sampling rate of your measurements.<br>The CPS command is valid for when individual sensor is selected using S1, S2, S3 or S4 command. It is not valid when all sensors are selected using S0 command. |
| **Example:** | CPS 32 (sets packet size to 32)<br>CPS (reports currently set packet size) |

## 4.9 SLC (Load Capacity) Command

| *Function:* | *Sets (or reports) load capacity of the load cell on the selected channel* |
|---|---|
| **Summary:** | Sets or reports the load capacity of the currently selected channel using S1, S2, S3 or S4 command. If S0 command was previously issued, SLC would return the total load capacity of all channels. |
| **Example:** | SLC 50 (sets load capacity to 50 lb)<br>SLC (reports current load capacity in lb) |

## 4.10 CN0, CN1, CP0, CP1, CAZ, FAZ, CLA & CTA Commands

| *Function:* | *Functions for manufacturer use only—do not change!* |
|---|---|
| **Summary:** | These commands are used to set parameters that affect the calibration of the sensors and are not to be changed except under the guidance of Loadstar Technical Support. The DQ-4000 will report erroneous load, if these parameters are not set correctly. |

## 4.11 CK0 Command

| *Function:* | *Sets (or reports) the current compensation factor* |
|---|---|
| **Summary:** | If you purchased your iLoad Mini (or other Loadstar frequency-output load cell) separately from the DQ-4000, you may be provided with a value of K0. Use this command to enter the value of K0 for the sensor connected to the selected channel. |
| **Example:** | CK0 1.43576 (sets K0 to be 1.43576) |

## 4.12 CS0 & CS1 (ID Strings) Commands

| *Function:* | *Sets (or reports) the value of two user settable ID strings, S0 and S1* |
|---|---|
| **Summary:** | Two user settable strings are provided for each channel of the DQ-4000. At the factory, CS0 is usually set to the Product Number of the load cell that is to be used with each channel, and CS1 is set to a condensed version of the unit serial number. The strings CS0 and CS1 may be 15 characters long. |
| **Example** | CS0 MFD-050-200-A (sets the CS0 string to be MFD-050-200-A) |

## 4.13 FIT Command

| *Function:* | *Changes (or reports) the polynomial fit to be used for calibration* |
|---|---|
| **Summary:** | Either a quadratic or a cubic fit is used to calibrate the load cells. This command allows you to choose the fit to be used. Typically, a cubic fit will give you better accuracy in steady state conditions near room temperature (~25C) while a quadratic fit had less sensitivity to changes in the calibration due to transient temperature changes or other perturbations. The fit can be specified separately for each channel. |
| **Example** | FIT C (sets the fit to Cubic)<br>FIT Q (sets the fit to quadratic)<br>FIT (displays currently chosen fit) |

## 4.14 CQA, CQB, CQC, TQA, TQB & TQC Commands

| *Function:* | *Set (or report) quadratic fit parameters for selected channel* |
|---|---|
| **Summary:** | Use these commands to set or list the various parameters for a quadratic fit. Typically, these values will be provided to you by Loadstar based on a factory calibration. Also, typically the parameters for the compression side and the tension side are the same (e.g., CQA and TQA will have identical values). However, in some applications, these parameters may be different. |
| **Example** | CQA 2.09876E-14 (sets the value of CQA to be 2.09876E-14<br>CQC (reports the value of CQC) |

## 4.15 CCA, CCB, CCC, CCD, TCA, TCB, TCC & TCD Commands

| *Function:* | *Set (or report) cubic fit parameters for selected channel* |
|---|---|
| **Summary:** | Use these commands to set or list the various parameters for a cubic fit. Typically, these values will be provided to you by Loadstar based on a factory calibration. Also, typically the parameters for the compression side and the tension side are the same (e.g., CQA and TQA will have identical values). However, in some applications, these parameters may be different. |
| **Example** | CCA 2.09876E-14 (set the value of CQA to be 2.09876E-14<br>CCD (report the value of CCD) |

## 4.16 SST (Sensor Status) Command

| *Function:* | *Returns the command summary* |
|---|---|
| **Summary:** | Use this command to display the whether the sensor is connected. A value of [0] means the sensor is disconnected. |
| **Example** | SST (displays which sensor is connected) |

## 4.17 SETTINGS Command

| *Function:* | *Returns all current setting values* |
|---|---|
| **Summary:** | Use this command to display the settings of the sensor parameters. |
| **Example** | SETTINGS (display currently selected channel) |