SLICE User's Manual

Version 1.0e
25 August 2011

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1. Contacting Technical Support

DTS is a world leader in ultra-small, low power, high shock rated, high sample rate data acquisition and sensing systems.

DTS is based in Seal Beach, California, USA, just south of Los Angeles. DTS has offices in 6 times zones for fast, expert technical support.

1.1. DTS Technical Support

For the fastest technical support, please contact your local DTS technical support engineer or e-mail support@dtsweb.com.

1.2. DTS Web Site

For the most up to date specifications, user's manuals and other information, please go to www.dtsweb.com.

1.3. DTS Offices

United States
Eastern Standard Time (EST) (GMT-5)
Please call DTS North American Technical Center
+1 248 427-0045
7:00 AM - 5:00 PM, Monday through Friday
After hours, please e-mail support@dtsweb.com

Pacific Standard Time (PST) (GMT-8)
Please call DTS Corporate Headquarters
+1 562 493-0158
7:00 AM - 5:00 PM, Monday through Friday
After hours, please e-mail support@dtsweb.com

Japan
(GMT+9)
Please contact DTS Japan Technical Center
Rihito Shoji
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After hours, please e-mail support.japan@dtsweb.com

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Please contact Dave Martin, European Regional Manager
+49 17 11 286 033 (German and English language support)
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+61 438 507 449
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After hours, please e-mail support@dtsweb.com

2. SLICE Overview

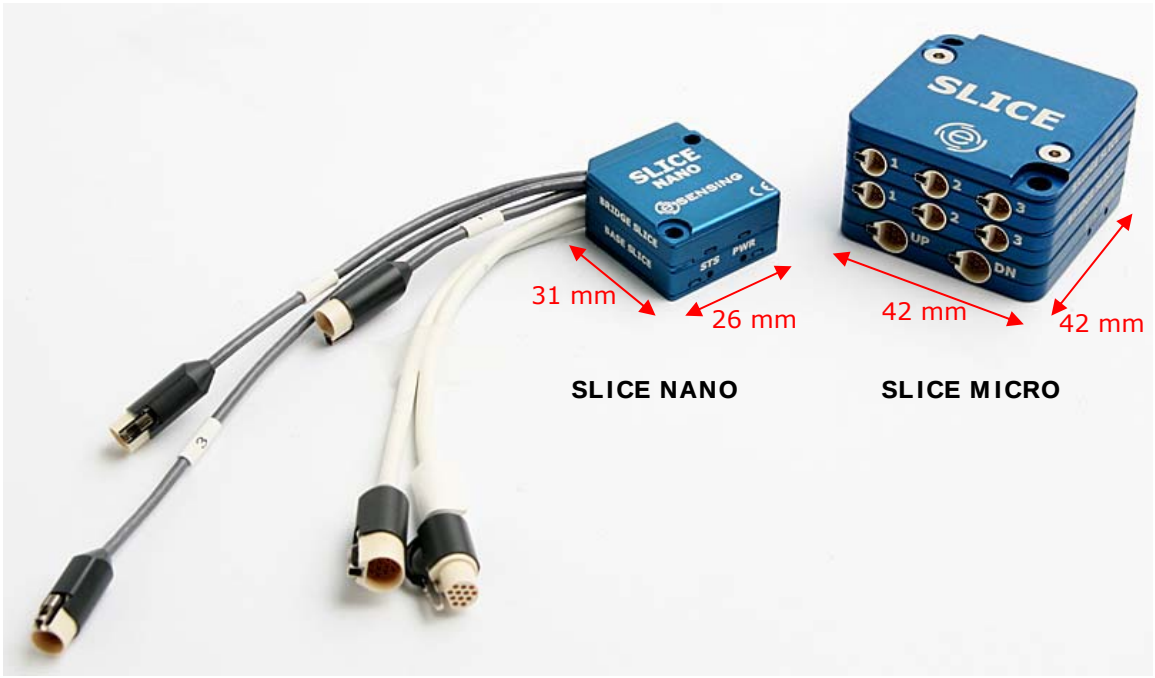
SLICE is an ultra small, low power, high shock rated data acquisition system. SLICE is a standalone system with microprocessor, memory, sensor excitation and signal conditioning with options for built-in battery and internal sensors. Systems from 3 to hundreds of channels can be built-up in 3 channel increments.

2.1. SLICE MICRO and SLICE NANO

SLICE comes in two sizes:

- SLICE MICRO (42 x 42 mm)
- SLICE NANO (26 x 31 mm)

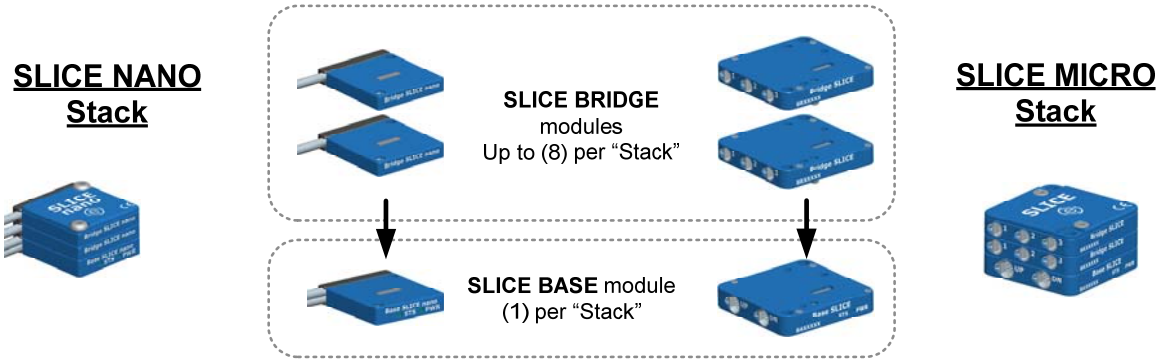
They have the exact same function and circuit boards inside. SLICE MICRO has built-in connectors; SLICE NANO has wires with connectors.



2.2. SLICE Modular Concept

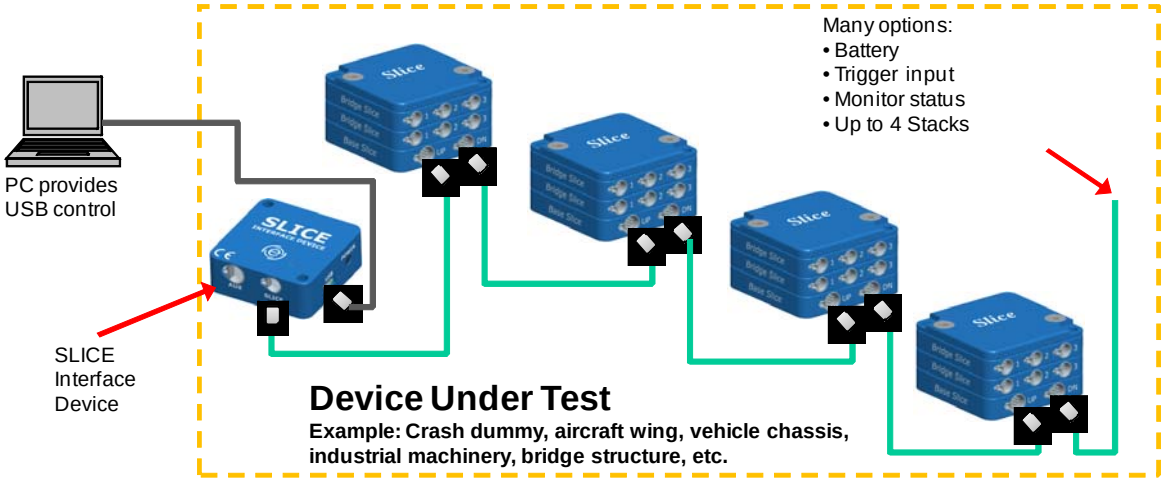
Modular system – Plug multiple SLICEs onto Base SLICE to make a Stack

- Each SLICE "Stack" can accommodate 8 sensor input SLICES. Each Bridge SLICE has 3 analog input channels. You may want multiple "Stacks" if more channels are needed or placement in different locations makes sense for your application.
- Each SLICE "Stack" consists of 1 Base SLICE and up to 8 additional sensor input SLICEs.



Example SLICE set-up with multiple Stacks:

- SLICE Stacks are mounted to the device under test and chained together.
- The End-of-Chain Terminal can be connected to a trigger, battery, or other devices.
- The beginning of the chain is connected to the SLICE Interface Device, SLICE Ethernet Interface, SLICE USB Interface or directly to the PC. PC can be disconnected after arming for standalone operation.
- Up to 4 SLICE Stacks can be in any one chain.
- SLICE Distributor (not shown) allows for up to 4 SLICE chains for hundreds of channel in one set-up.



2.3. SLICE Basic Hardware Components

Below are the basic components of a SLICE system. You will have some subset of these depending on your application or what was ordered.

The table below provides an overview of the types of SLICE modules available. Some modules are only available in the MICRO or NANO version.

SLICE Module	Description	MICRO	NANO
Base SLICE	One needed for each SLICE Stack	Yes	Yes
Bridge SLICE	3 channels of piezo-resistive and voltage sensor inputs.	Yes	Yes
IEPE SLICE	3 channels of piezo-electric sensor inputs	Yes	No
Accel SLICE	Bridge SLICE with integrated 3-axis accelerometer	Yes	No
ARS SLICE	Bridge SLICE with integrated 3-axis Angular Rate Sensor	Yes	No
Stack Battery	2-cell LiPo battery connected to bottom of Base SLICE	No	Yes

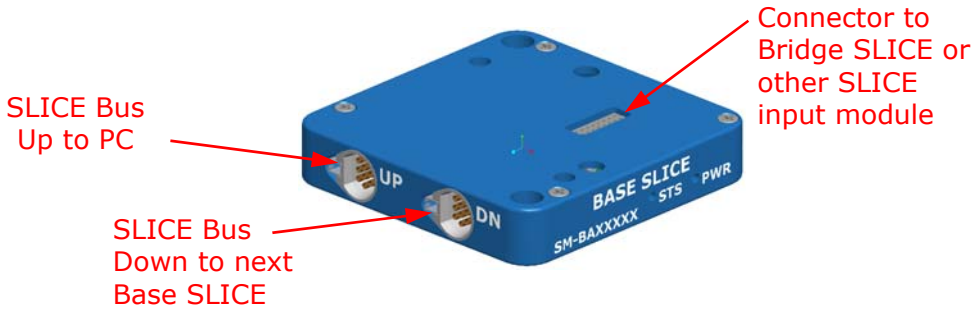
2.3.1. Base SLICE

See Appendix A for detailed specifications. See Appendix K for information on how to update firmware.

You must have at least one Base SLICE for any SLICE system. The Base SLICE is at the bottom of the SLICE Stack and has these components:

- Microprocessor
- 7 GB flash data memory standard (6.48 GB available for data storage)
- USB hub
- Power conditioning
- Control signals

A Base SLICE MICRO is shown below.



# of Channels*	Maximum Sampling Rate at Maximum Recording Time [9,000 sec (2.5 hours)]
3	120,000 samples per second (sps)
6	60,000 sps
9	40,000 sps
12	30,000 sps
15	24,000 sps
18	20,000 sps
21	17,000 sps
24	15,000 sps

* All channels are recorded even if they are not programmed.

How to Calculate Maximum Storage Times

With 6.48 GB available for data storage, there are a total of 3.24 G samples available in each Base SLICE (each 16-bit data sample requires two (2) bytes).

To determine the maximum recording time, divide the number of samples by the product of the sampling rate and the number of available channels in the Stack.

$$\frac{3{,}240{,}000{,}000}{\text{Sampling rate (sps)} \quad X \quad \text{\# of channels in Stack}} = \text{\# of seconds}$$

Example 1: 10,000 sps using a 9-channel SLICE Stack

$$\frac{3{,}240{,}000{,}000}{10{,}000 \quad x \quad 9} = 36{,}000 \text{ sec (10 hours)}$$

Example 2: 1,000 sps using a 6-channel SLICE Stack

$$\frac{3{,}240{,}000{,}000}{1{,}000 \quad x \quad 6} = 540{,}000 \text{ sec (150 hours)}$$

Since the recording capacity of a SLICE system is very large, try to limit sampling rates and durations to the minimum necessary to avoid large and cumbersome data files. Large files take longer to download and may also be time-consuming to post-process or difficult to share with colleagues. Use of the Region of Interest (ROI) download can save a great deal of time if implemented properly.

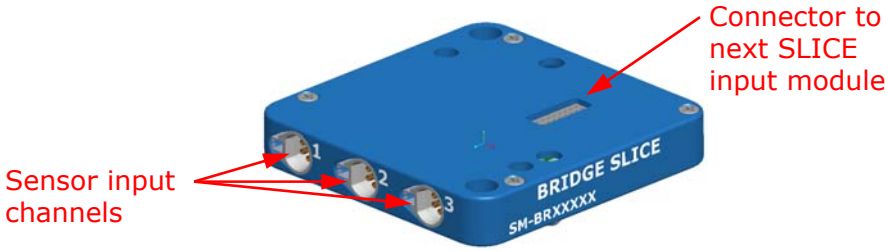
2.3.2. Bridge SLICE

See Appendix A for detailed specifications.

Up to 8 Bridge SLICEs can be stacked on top of the Base SLICE. Each Bridge SLICE has these components:

- 3 channels of analog input
- Sensor excitation
- 16-bit, 100 kHz ADC, one per channel
- Software adjustable gain, anti-alias filters, offset, and shunt check
- TEDS sensor ID

A Bridge SLICE MICRO is shown below.



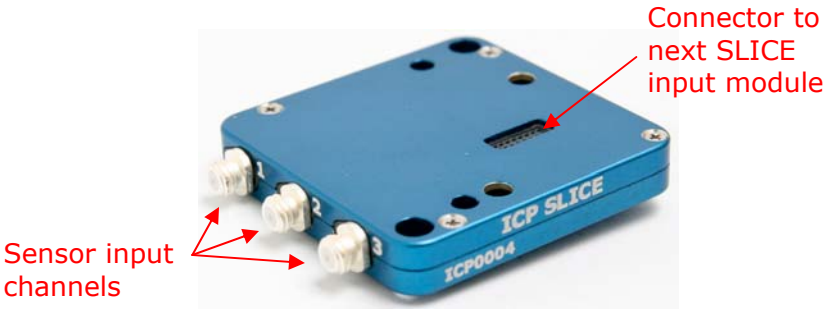
2.3.3. IEPE SLICE

See Appendix A for detailed specifications.

Features:

- 3 input channels
- One 2.2 mA constant-current source per channel at up to 24 V
- 16-bit, 100 kHz ADC, one per channel
- Software adjustable gain, anti-alias filters and offset
- TEDS sensor ID

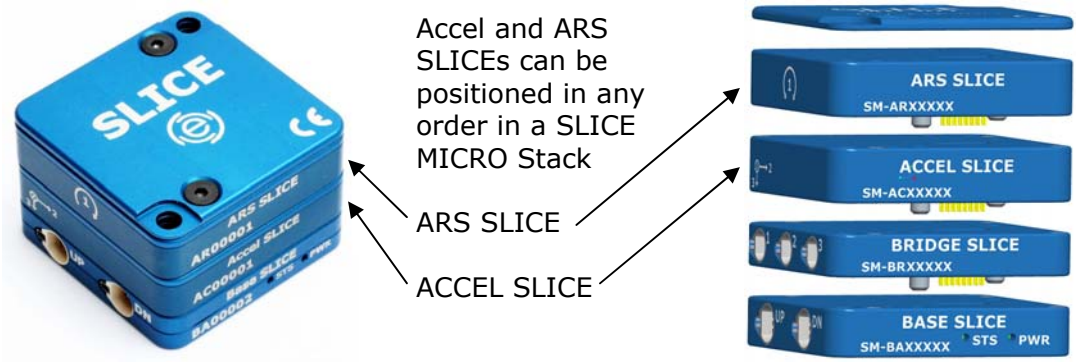
An IEPE SLICE MICRO is shown below.



2.3.4. ACCEL SLICE

The ACCEL SLICE has Bridge SLICE electronics with the addition of a built-in 3-axis accelerometer. The following specifications apply:

- MSI Model 3038 accelerometers are used (see www.meas-spec.com)
- Options from 50 to 500 g
- DC response



2.3.5. ARS SLICE

The ARS SLICE has Bridge SLICE electronics with the addition of a built-in 3-axis angular rate sensor. The following specifications apply:

- DTS ARS is used (see http://dtsweb.com/products/esensing_angular.php)
- Options from 300 to 50000 deg/sec
- DC response

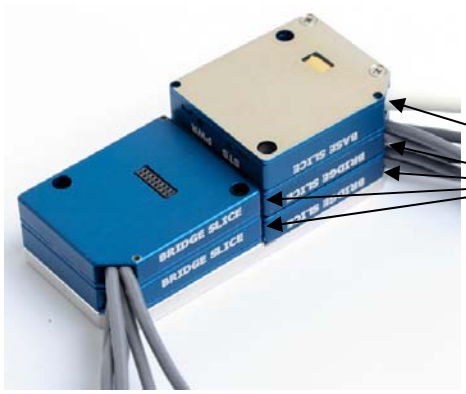
2.3.6. Battery SLICE

The Battery SLICE is connected to the bottom of the Base SLICE. It is only available in the SLICE NANO version. The Battery SLICE is only a back-up battery in case main power is lost. Specifications:

- 2-cell LiPo design, with charging directly from Base SLICE
- ~10 second run time
- Only 3.5 mm thick

2.3.7. Stack Extender

The Stack Extender is only available for the SLICE NANO package. The Stack Extender allows the user to create a flatter, longer package.



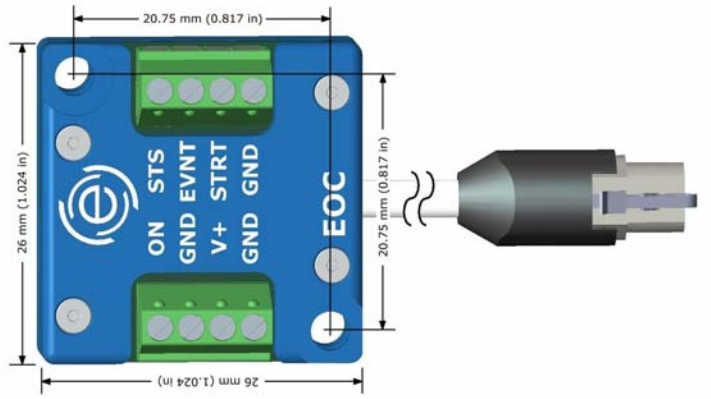
Stack Extender
- Example: 12 channel system
- 1 Base SLICE
- 4 Bridge SLICEs

2.3.8. End-of-Chain (EOC) Terminal

See Appendix B for detailed specifications.

The EOC Terminal provides the easiest method to attach a battery, trigger signal and status lamp to the SLICE system. It is ruggedized for high shock use.

Maximum channels:
1 chain x 2 Stacks x 8 Bridge SLICEs x 3 chan/Bridge = 48 channels



To DN port on Base SLICE MICRO or NANO

Connections:
- 2 SLICE Stack chain
- 9 to 15 VDC input power
- ON signal
- Status output, start record input and event input signals

2.3.9. SLICE System Interface

See Appendix C for detailed specifications.

The SLICE System Interface allows the connection of one SLICE chain. It is ruggedized for high shock use.

Maximum channels:
1 chain x 4 Stacks x 8 Bridge SLICEs x 3 chan/Bridge = 96 channels

Connections:
- 1 SLICE Stack chain
- USB communications
- 9 to 20 VDC input power
- ON/OFF switch
- AUX input (battery, trigger, etc.)

2.3.10. SLICE Distributor

See Appendix D for detailed specifications.

The SLICE Distributor allows the connection of up to four SLICE chains. It is ruggedized for high shock use. Note: When using the SLICE Distributor, only 3 Stacks per chain are allowed.

Maximum channels:
4 chains x 3 Stacks x 8 Bridge SLICEs x 3 chan/Bridge = 288 channels

Connections:
- 4 SLICE Stack chains
- Ethernet communications
- 9 to 20 VDC input power
- ON/OFF switch
- AUX input (battery, trigger, etc.)

2.3.11. SLICE USB Interface

See Appendix E for detailed specifications.

The SLICE USB Interface allows the connection of one SLICE chain. It is meant for bench-top use and is not ruggedized.

Maximum channels:
1 chain x 4 Stacks x 8 Bridge SLICEs x 3 chan/Bridge = 96 channels

Connections:

- 1 SLICE Stack chain
- USB communications
- 9 to 15 VDC input power
- ON/OFF switch
- Manual Start/Event
- AUX input (battery, trigger, etc.)

2.3.12. SLICE Ethernet Interface

See Appendix F for detailed specifications.

The SLICE Ethernet Interface allows the connection of two SLICE chains. It is meant for bench-top use and is not ruggedized.

Maximum channels:
2 chains x 3 Stacks x 8 Bridge SLICEs x 3 chan/Bridge = 144 channels

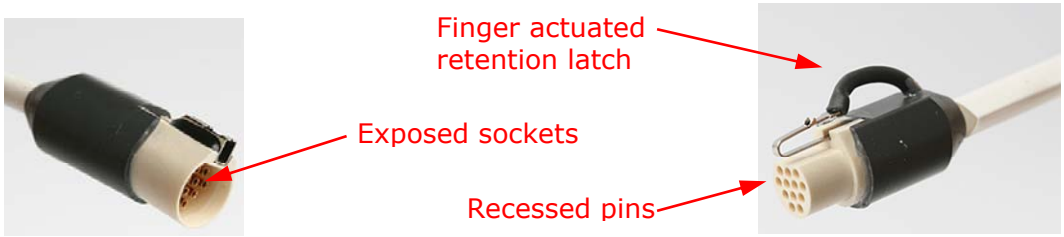
Connections:
- 2 SLICE Stack chains
- Ethernet communications
- 9 to 15 VDC input power
- ON/OFF switch
- Manual Start/Event
- AUX input (battery, trigger, etc.)

2.3.13. SLICE MICRO and NANO Connectors

See Section 3 for more connector information.

SLICE systems use lightweight, rugged plastic connectors with reliable, gold plated contacts. These are a MIL-STD-type pin and socket configuration where the socket is exposed, instead of the pin, which is mechanically more robust. For some bench-top units, LEMO-style as well as industry standard USB, Ethernet and SubD connectors are used.

A typical SLICE rugged plastic connector is shown below.



2.4. Batteries

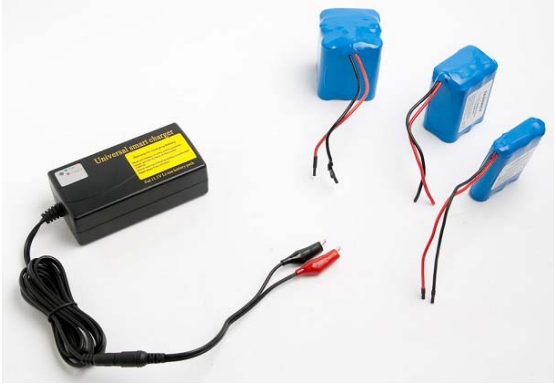
DTS offers some commercial-off-the-shelf batteries for operation of SLICE systems. Batteries must be disconnected from the SLICE system before connecting to a charger.

2.4.1. 9.6 V Rechargeable NiMH Batteries

- Allows up to 40 min runtime with a 6 channel SLICE System.
- Package of 4 batteries ensures you'll always have back-ups ready to use.

2.4.2. 11.1 V Rechargeable Lithium-Polymer Batteries

- Available in 3 capacities: 2200, 4400, and 6600 mAh



2.5. SLICE Software

See Section 4.0 for detailed software information. See Appendices I, J and K for information regarding file formats and how to update the Base SLICE firmware.

The SLICEWare software application allows for easy:

- Test set-up
- Sensor database management
- Real-time sensor check-out
- Test execution
- Data download and viewing
- Data export

A SLICE API (Application Programmers Interface) and LABView driver are also available.

Please contact technical support (support@dtsweb.com) for the latest update to your software version.

3. Mounting and Connecting SLICE Hardware

This section gives details on how to connect your SLICE hardware. Choose the connection method you have from the options below for the quickest information.

3.1. General Connection Guidelines

Great care should always be taken when connecting any power, switch, sensor or any other device to the SLICE system.

- DO NOT exceed the rated voltage input range for the device. Whenever possible use the power supply or battery pack supplied with your SLICE system.
- DO NOT connect directly to vehicle power or other noisy power sources.
- ALWAYS disconnect the battery from the SLICE system before connecting to a battery charger.
- ALWAYS use SLICE NANO with a heat sink as the SLICE NANO case is very thin aluminum with very little heat sinking ability. Never use SLICE NANO mounted to a thermally non-conductive surface like wood or plastic.
- *Refer to proper grounding procedures described in Appendix G.*
- Check that all cables show no signs of physical damage.
- Be sure all sensors have their cable shields ungrounded at the sensor end and grounded at the SLICE input connector. (SLICE DAS units have grounded enclosures. Sensors should be floating.)

3.2. Guidelines for High Shock and Vibration Testing

SLICE MICRO and SLICE NANO components can generally be used in test environments with maximum acceleration levels as high as 500 g. If you have purchased a

specialized high g SLICE NANO system, it can be used in environments up to 5,000 g if proper care is taken. Please contact DTS if you have any questions about using SLICE in high g environments.

Proper mounting of the SLICE system, cables, and accessories is critical to successful testing.

- DO NOT mount SLICE components in an area where they may be directly impacted by an object.
- Use damping material whenever possible to help protect the SLICE system from excessive shock or vibration, but remember that SLICE NANO requires a heat sink.
- Be sure that connectors and wiring are properly secured.

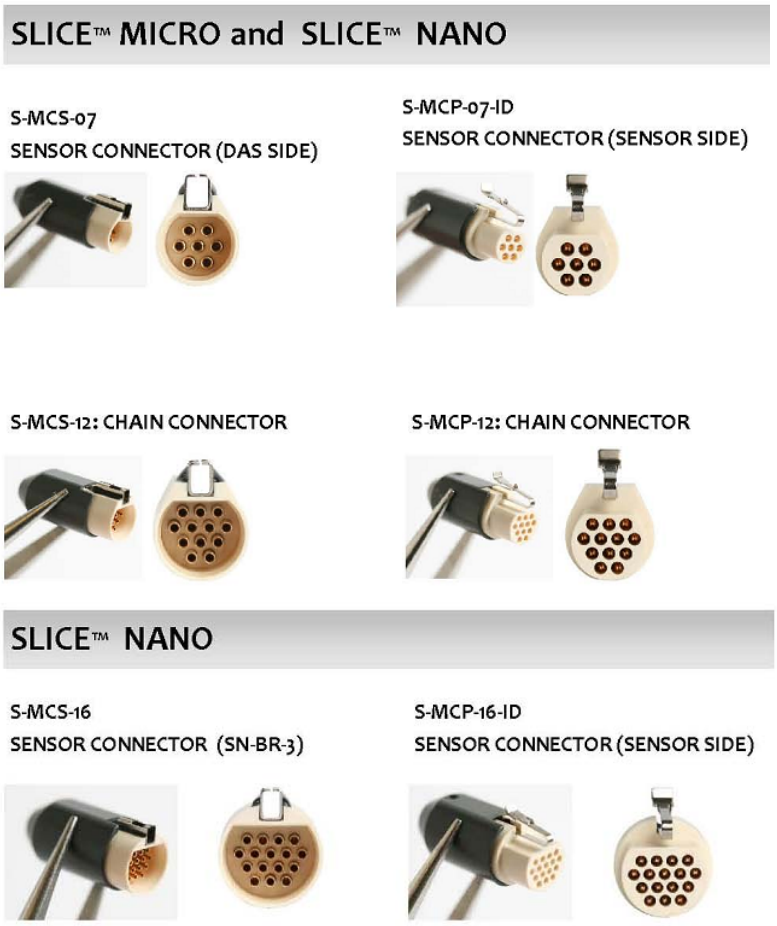
3.3. SLICE Connectors and Cables

3.3.1. SLICE Connectors

SLICE is an ultra small data acquisition system. One challenge with a small system is electrical connections. Although connectors such as Bendix, Amphenol, and LEMO are common for instrumentation, all of these are much too large to be practical for SLICE.

The SLICE system uses circular plastic connectors manufactured by Omnetics Corporation (www.omnetics.com). These connectors use high-quality, machined contacts and are used in many military, aerospace and other high shock applications. Connectors are available direct from Omnetics or can be purchased from DTS.

Below are the connector types used by SLICE. See Appendix A for complete DTS part number information.



3.3.2. SLICE Cables

DTS provides a number of different SLICE cable options depending on the connection needs. SLICE Stack-to-Stack connection cables are shown below.

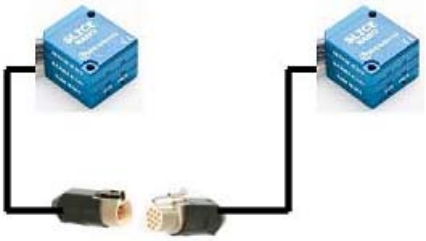
SLICE MICRO Base units can be connected together via a daisy-chain cable. SLICE NANO Base units can be connected to each other directly or via a daisy-chain extension cable.

13000-3005x: SLICE MICRO Chain Cable

- 12-pin to 12-pin locking connector
- Data, power, and control signals

13000-3006x: SLICE NANO Chain Cable

- 12-pin to 12-socket locking connector
- Data, power, and control signals



Connections less than 8 inches

Connections from ≥8 inches to ≤2 m

A longer, more robust version of the SLICE NANO Chain Cable is available for connections from >2 m to ≤5 m (DTS P/N 13000-3007x). (Note: the rated maximum separation between Stacks is 5 m.)

3.4. Power Requirements

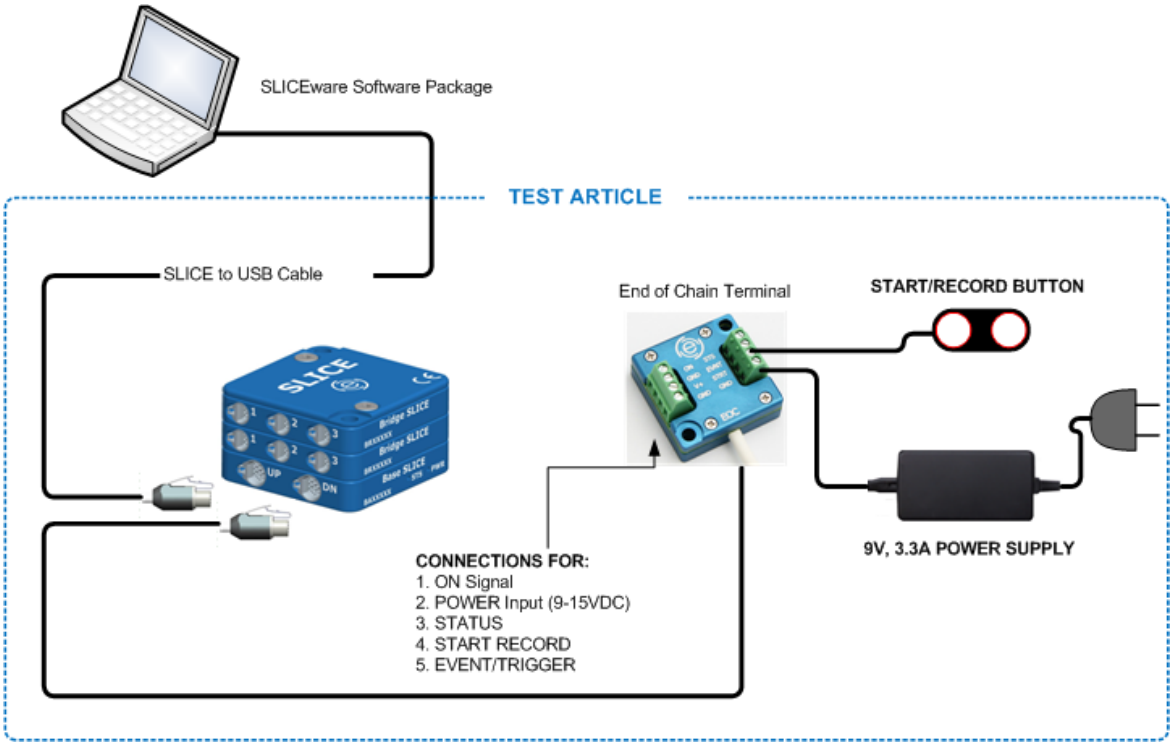
The SLICE system runs on DC power. Acceptable input power can range from 9 V minimum to 15 or 20 V maximum, depending on the accessories used with your system. Do not exceed the maximum input power for the accessory you are using.

To calculate the rough power needs for a particular system, use the information below:

POWER REQUIREMENTS		
10 V POWER INPUT/5 V SENSOR EXCITATION	IDLE	RECORDING
BASE SLICE	40 mA	110 mA
BRIDGE SLICE	2 mA	55 mA
SENSOR LOAD (350 ohm/5 V SENSOR EXCITATION)	0 mA	50 mA
SINGLE STACK POWER CONSUMPTION AT 5 V SENSOR EXCITATION	**TOTAL**	
BASE (QTY)	1	
BRIDGE (QTY)	2	
SENSOR LOAD (% of 350 ohm)	100	
IDLE CURRENT	44 mA	
IDLE POWER	330 mW	
RECORD CURRENT	320 mA	
RECORD POWER	2400 mW	

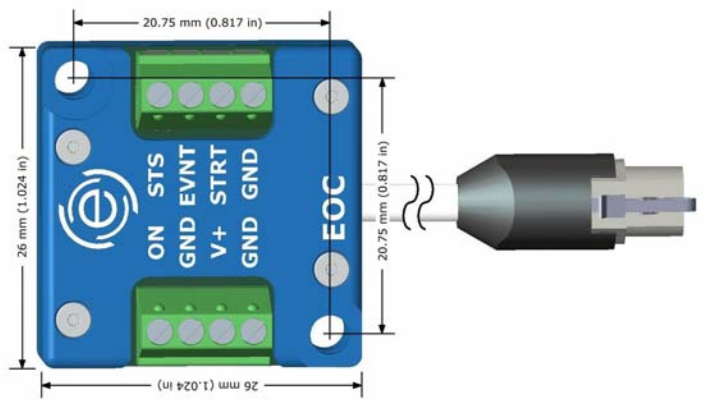
3.5. Using the End-of-Chain (EOC) Terminal

A diagram showing connections using the EOC Terminal is shown below.



Notes:

- Although this shows a SLICE MICRO system, connections with a SLICE NANO are similar.
- The EOC Terminal is a shock rated item.
- Voltage input can be provided via the included power supply, a battery or any voltage source between 9 and 15 VDC. Warning: Do not exceed the 15 VDC input voltage range as damage may result.
- The ON terminal must be connected to the GND on the EOC Terminal for the SLICE unit to turn on.
- If you connect an LED between the STS and GND terminals, you will get a Status light when the system is armed.

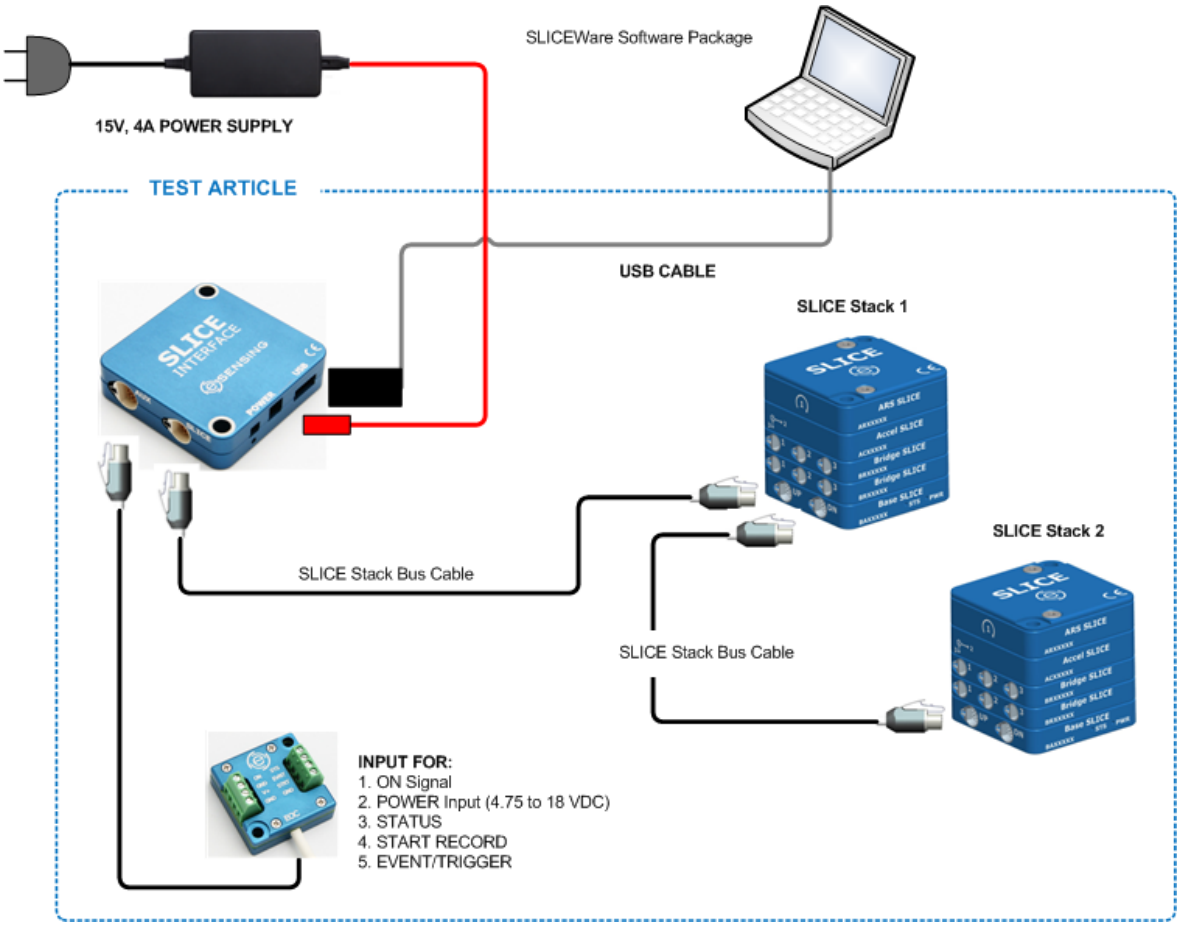


To DN port on the last Base SLICE MICRO or NANO in a SLICE chain

See Appendix B for detailed information on the SLICE End-of-Chain Terminal.

3.6. Using the SLICE System Interface

The SLICE System Interface is similar to the EOC Terminal except it is used between the first/only SLICE Stack and the PC. See the example diagram below.

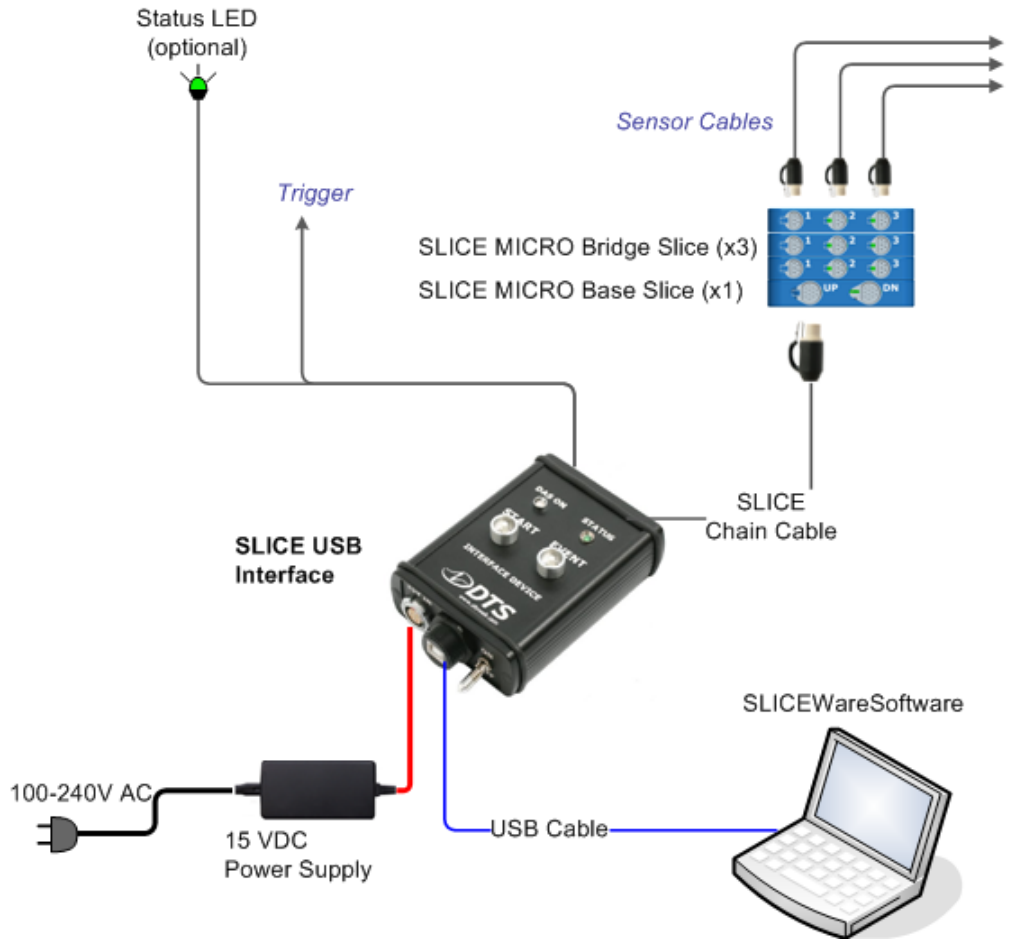


Notes:

- Although this shows a SLICE MICRO, connections with a SLICE NANO are similar.
- The SLICE System Interface is a shock rated item.
- The AUX Terminal can be used for easy connection to a battery, start record, trigger, and status signal.
- Voltage input through the SLICE System Interface can be provided via the included power supply a battery, or any voltage source between 9 and 20 VDC. Warning: Do not exceed the 20 VDC input voltage range as damage may result.
- The SLICE System Interface has a recessed ON switch. Alternately the ON signal can be connected to the GND on the EOC Terminal.
- If you connect an LED between the STS and GND terminals on the EOC Terminal you will get a Status light when the system is armed.

3.7. Using the SLICE USB Interface

The SLICE USB Interface is similar to the SLICE System Interface. The main difference is that the SLICE USB Interface is designed for bench-top, non-rugged use. See the example diagram below.

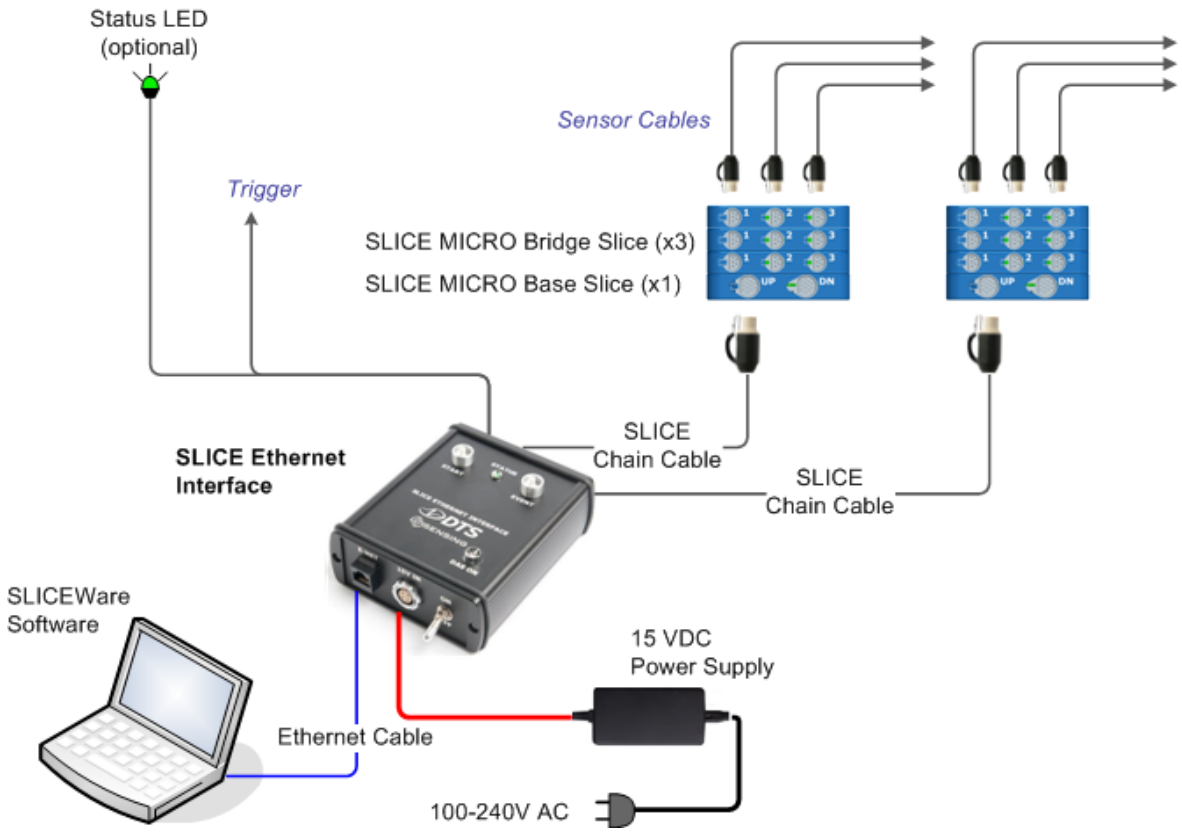


Notes:

- Although this shows a SLICE MICRO, connections with a SLICE NANO are similar.
- The SLICE USB Interface is NOT a shock rated item.
- Voltage input can be with the included power supply a battery, or any voltage source between 9 and 15 VDC. Warning: Do not exceed the 15 VDC input voltage range as damage may result.
- The AUX connector is a standard D-sub HD15. This can be used to hardwire a Start Record or Event switch or monitor the Status line.

3.8. Using the SLICE Ethernet Interface

The SLICE Ethernet Interface is similar to the SLICE USB Interface. The main difference is that the SLICE Ethernet Interface has an Ethernet connection to the PC instead of a USB connection. This allows for a longer communications cable between the PC and the SLICE system. The SLICE Ethernet Interface can also connect 2 SLICE chains for large system configurations. See the example diagram below.



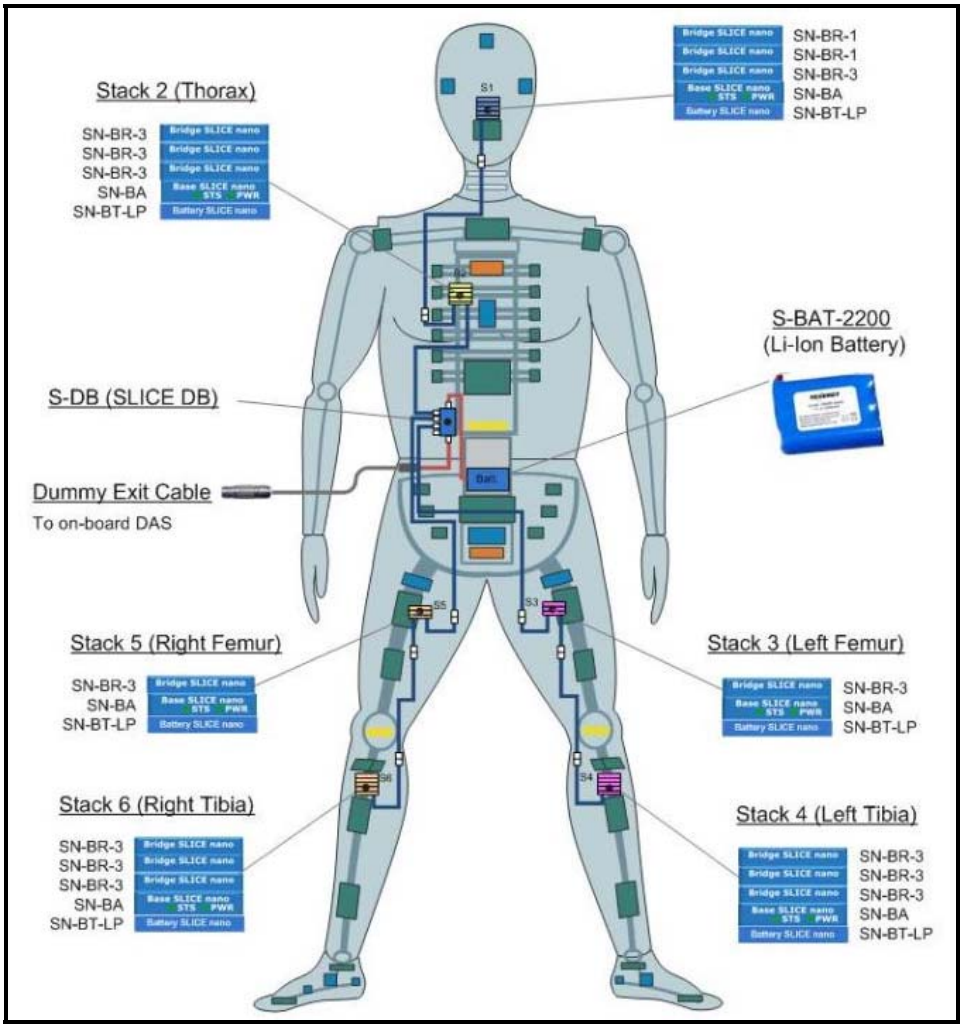
Notes:

- Although this shows a SLICE MICRO, connections with a SLICE NANO are similar.

- The SLICE Ethernet Interface is NOT a shock rated item.
- Voltage input can be with the included power supply a battery, or any voltage source between 9 and 15 VDC. Warning: Do not exceed the 15 VDC input voltage range as damage may result.
- The AUX connector is a standard D-sub HD15. This can be used to hardwire a Start Record or Event switch or monitor the Status line.

3.9. Using the SLICE Distributor

The SLICE Distributor allows for the connection of up to 4 SLICE chains and converts the communications signals from USB to Ethernet. This allows for a longer communications cable between the PC and the SLICE system. The most common application for the SLICE Distributor is for an embedded system with a high channel count as shown for the in-dummy (manikin) configuration below.

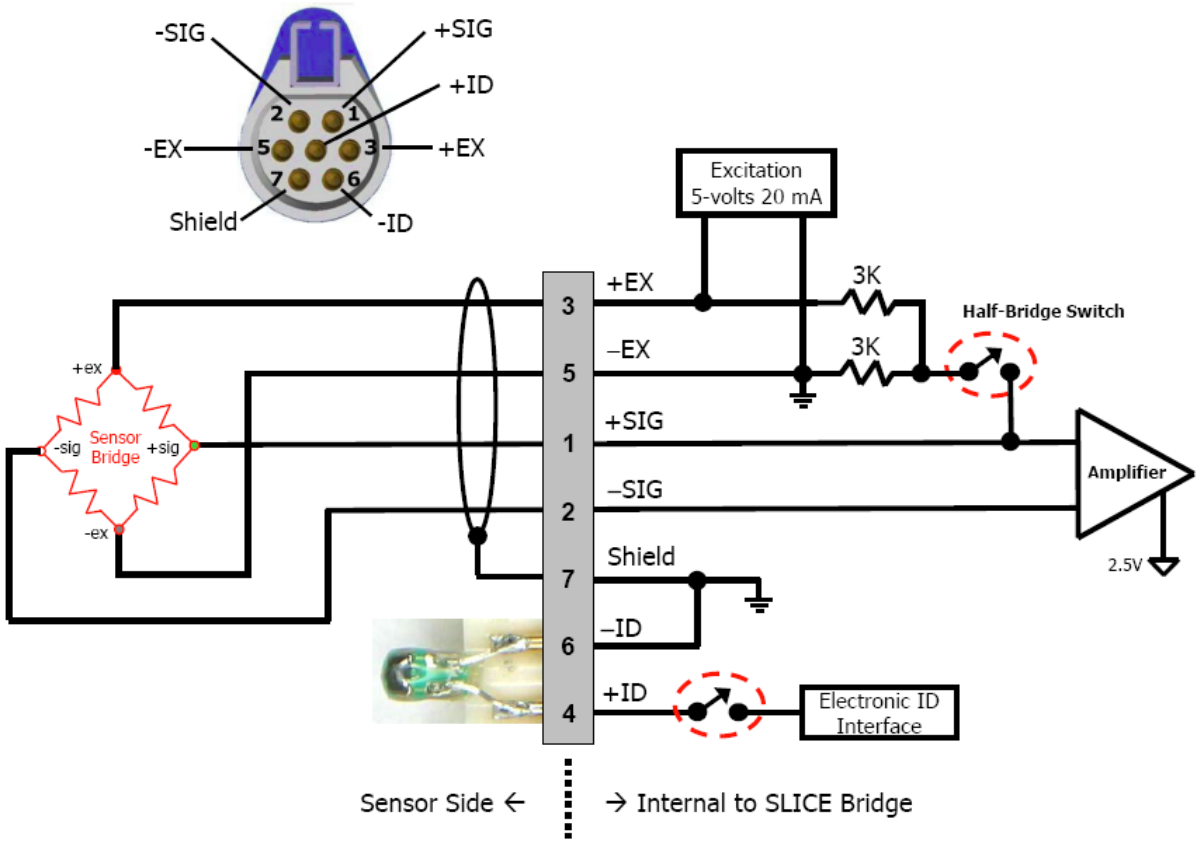


SLICE Application Diagram: 42-channel integrated SLICE NANO for H3-50% Dummy

4. Sensor ID and Supported Sensor Types

This section covers basic information regarding SLICE compatible sensors and sensor ID. *More detailed information regarding sensor connections can be found in Appendix H.*

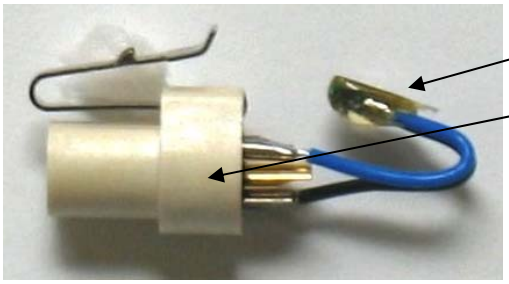
The diagram below shows a common 4-wire bridge sensor connection to a Bridge SLICE input channel.



4.1. Sensor ID

Sensor ID is also referred to as electronic ID (EID). The function of EID is for the SLICE hardware to automatically read and determine what sensor is attached to each sensor input channel.

SLICE uses EID chips from Maxim IC, model DS2401 (see http://www.maxim-ic.com/quick_view2.cfm/qv_pk/2903). To make soldering of the EID easier, DTS provides EID microcards, which have a chip scale packaged DS2401 soldered to a circuit board with wires attached (see below).



4.2. Supported Sensor Types

The Bridge SLICE supplies 5 VDC excitation up to 20 mA and supports many types of accelerometers, load cells, pressure sensors and other sensor types. The following general sensor types are supported:

- Full (4-wire) or half bridge (2- or 3-wire) resistive and piezo-resistive types
- Voltage input: Input range 0.1 to 4.9 V; larger range with voltage expander circuit
- Conditioned sensors with 5 V excitation and 2.5 V centered signal output
- Common piezo-electric sensor types

If you have questions regarding what sensors are supported, please contact support@dtsweb.com and provide the sensor manufacturer and model number if available.

5. Software

This section covers software installation and use. *See Appendices I, J and K for additional information regarding file formats and how to update the Base SLICE firmware.*

5.1. Basic Requirements

SLICEWare is a Windows® based program. Minimum PC specifications are:

- Windows XP, Windows Vista, or Windows 7. 32- and 64-bit versions are available.
- 1 GHz or faster processor
- 2 GB RAM minimum. More RAM is important for longer/higher sample rate data acquisition.
- 100 MB disk space for Software plus storage for test data
- 1024 x 768 minimum screen resolution

5.2. Data Collection Concepts

This section discusses the basics of data collection with SLICE.

5.2.1. Standalone Operation

SLICE is a standalone data logger. This means that once it is armed, the PC can be disconnected if desired. After receiving a Start Record or Trigger signal, the SLICE autonomously collects data, storing it to flash memory with no user interaction. After the test, the user can reconnect the PC to download the data.

There is also a real-time mode in the SLICEWare software application that allows the user to check channel inputs on an oscillograph-looking screen. (This data is not logged.)

5.2.2. Data Collection Modes

SLICE supports two data collection modes: Circular Buffer and Recorder. (Note: SLICEWare cannot simultaneously display the data while the system is recording.)

5.2.2.1. Circular Buffer Mode

In circular buffer mode, the user can program SLICE to record pre-trigger data. For example, the test set-up can specify to record x seconds pre-trigger and x seconds post trigger. Time Zero (T=0) is marked when the trigger signal is received.

5.2.2.2. Recorder Mode

Recorder mode starts when a Start Record signal is received and continues for the time specified in the test set-up. If a trigger signal is received sometime after the Start Record, this marks the T=0 point.

NOTE:

An event or trigger signal applied anywhere in the SLICE chain is distributed throughout the system. This applies to level trigger as well.

5.3. SLICEWare

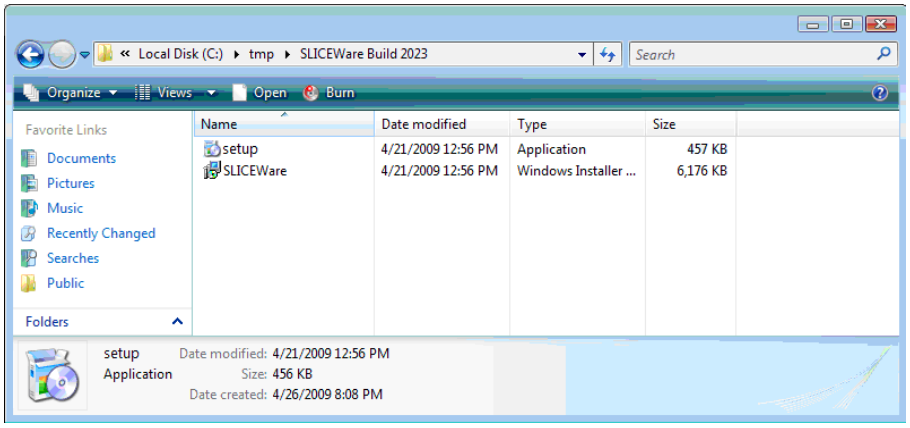
This section discusses the basics of SLICE data collection using the SLICEWare application.

The SLICEWare software application allows for easy:

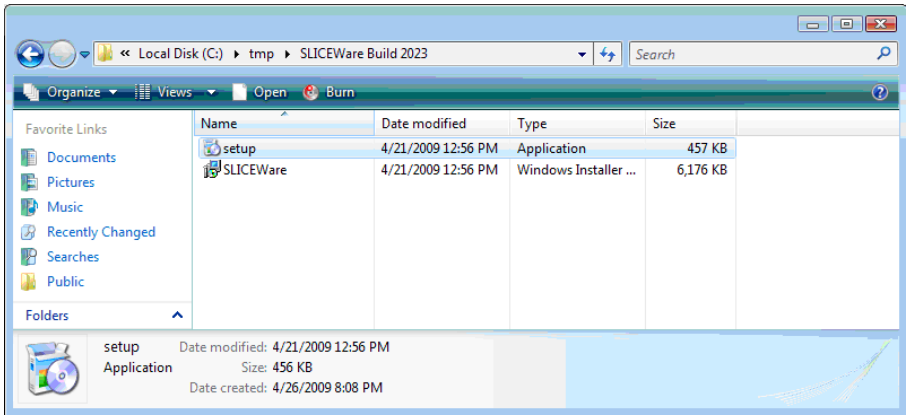
- Test set-up
- Sensor database management
- Real-time sensor check-out
- Test execution
- Data download and viewing
- Data export

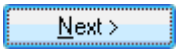
5.3.1. Software Installation

Locate the installation files on the CD or flash drive provided.



Double-click the "set-up.exe" file to begin installation.

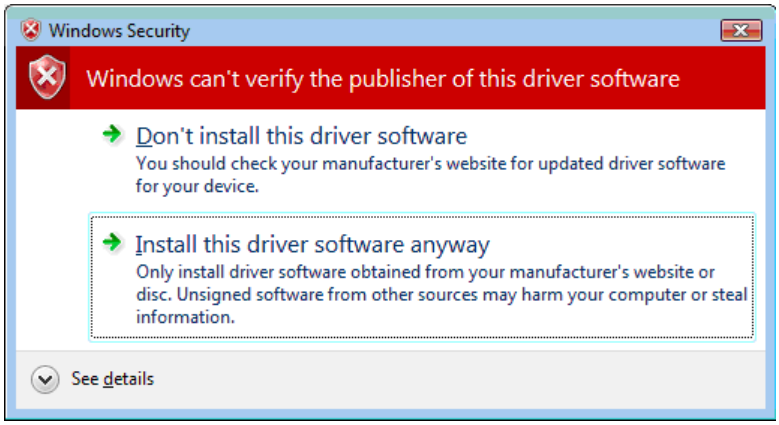


Click 

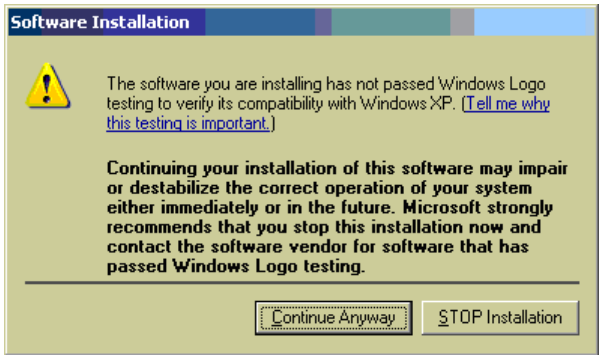
for each of the screens: set-up wizard, driver installation, installation folder and confirming installation.

You must allow the driver to be installed. You may see these screens:

For Windows® Vista, click to "Install this driver software anyway."



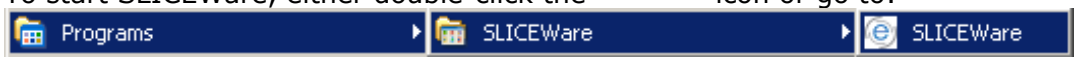
For Windows® XP, click "Continue Anyway."



Note: Windows® will ask you to reinstall the hardware driver each time you connect the SLICE Stack to a different USB port.

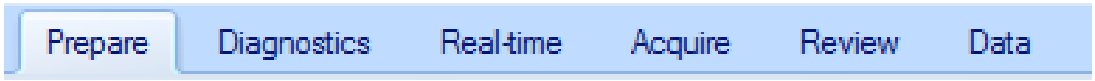
To start SLICEWare, either double-click the 

icon or go to:



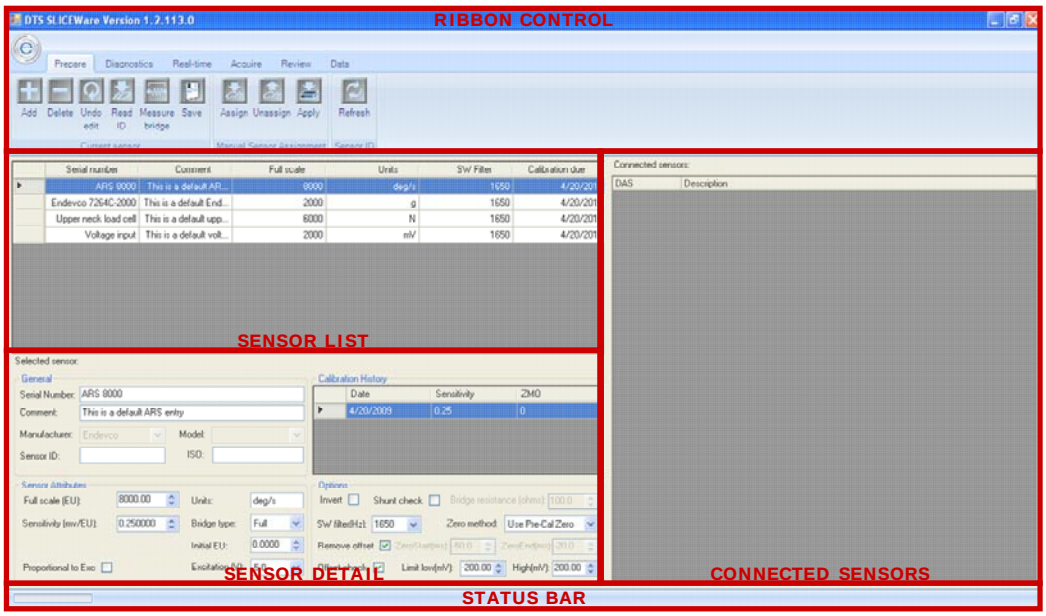
5.3.2. Menu Descriptions

Click Prepare tab …

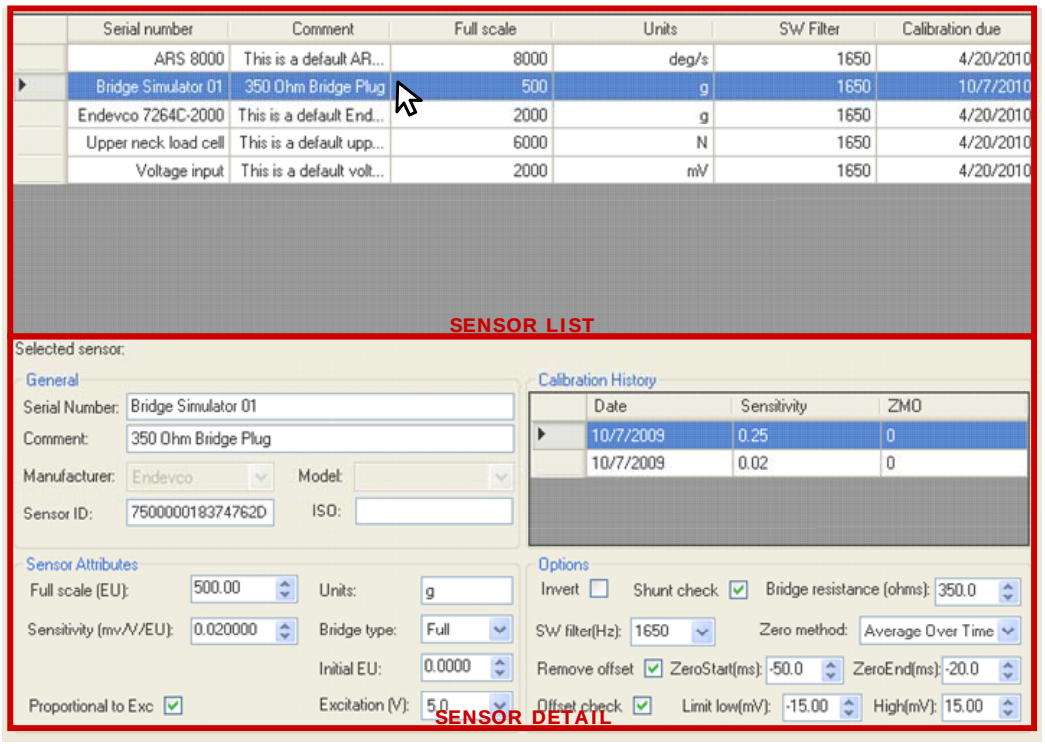


This tab identifies the relationship between available sensors and the attached SLICE units. Sensor information can be added, removed, viewed, edited or assigned to channels on connected data acquisition hardware.

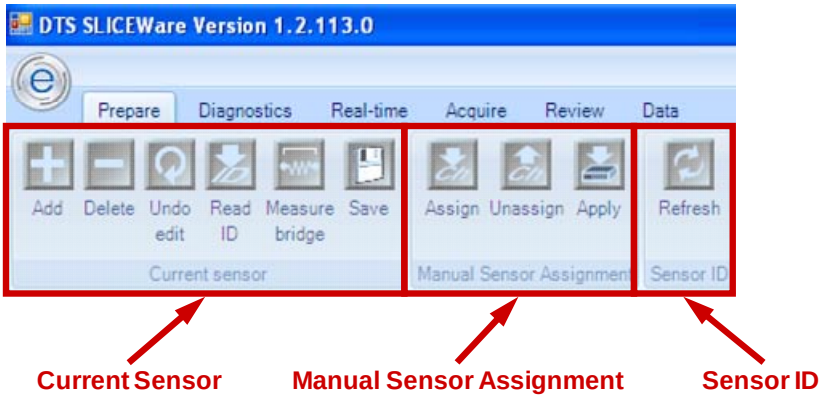
The image below highlights the different screen areas. The red boxes and type are used in this manual only (not visible in actual software).



Click anywhere on a line in the Sensor List to show the Sensor Details for that sensor.



Prepare Tab Groupings



Current Sensor

- Add: Will add a blank Sensor Details field to all for creating a new sensor entry.
- Delete: Deletes the sensor that is highlighted in the sensor list.
- Undo Edit: Reverts all edits made in the sensor details fields.
- Read ID: Reads the EID from the channel selected in the Connected Sensor list. The returned ID value will be populated in the Sensor ID field for the sensor that is highlighted in the sensor list.
- Measure Bridge: Measures a sensors bridge resistance from the channel selected in the Connected Sensor list. The returned bridge resistance will be populated in the Bridge resistance (ohms) field for the sensor that is highlighted in the sensor list.
- Save: Saves edits made in the Sensor Detail area.

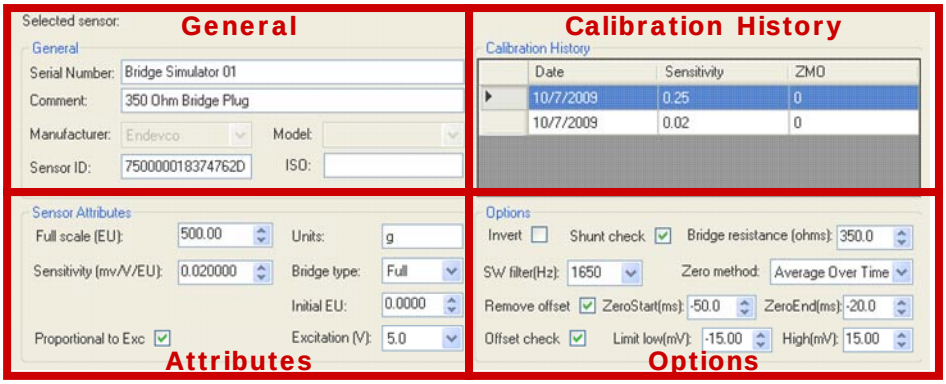
Manual Sensor Assignment

- For sensors connectors without an EID.
- You cannot un-assign or overwrite an auto-assigned channel.
- Assign: After highlighting a sensor in the Sensor List and highlighting an un-assigned channel in the Connected Sensors area, use this to assign the sensor.
- Un-assign: Remove the highlighted channel in the Connected Sensors area.
- Apply: Commits the sensor set-up information to SLICE.
- *Note: A sensor that is manually applied should not have a value in the Sensor ID field and the SLICE should not have an EID installed on the connector. If the Sensor ID field is populated or an EID exists on the channel, the sensor will need to be re-applied after switching away from and then back to the Prepare tab.*

Sensor ID

- Refresh: The sensor IDs are read when the software is started or when a SLICE is rebooted. If sensor connections are switched, choosing refresh will read the connected IDs on the current channels.

Sensor Details



General

- Serial Number: Used to identify the sensor. Can be any unique identifier. The sensor list is sorted by default with the serial number.
- Comment: User field can be any text entry.
- Manufacturer: Not enabled as of 200910.
- Model: Not enabled as of 200910.
- Sensor ID: Enter or "READ ID" to populate.

Attributes

- Full Scale: The maximum expected value the sensor will be subjected to.
- Units: The Engineering Units of the sensor.
- Sensitivity:
  - When Proportional to Excitation is checked: This value is the calibrated sensitivity in mV/V/EU.
  - When Proportional to Excitation is un-checked: This value is the calibrated sensitivity in mV/EU.
- Initial EU: Typically left at 0.00. This entry may be used to insert an engineering value to the starting point of the recorded sensor.
- Excitation: Leave at 5.0. Adjustment is not enabled as of 200910.

Calibration History

- This field is automatically updated whenever a new sensitivity is applied to the sensor attributes. You cannot enter directly into this field.

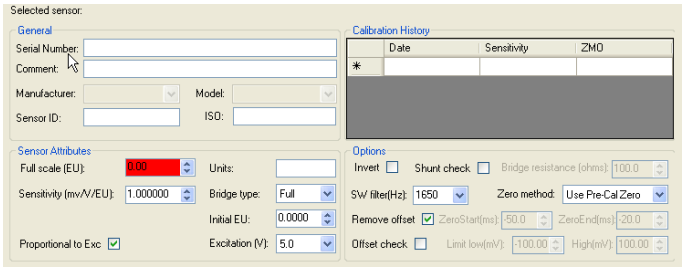
Options

- Invert: When checked, the data will be inverted.
- Shunt Check and Bridge Resistance: When Shunt Check is checked, the sensor will have the bridge resistance measured during diagnostics and compared to the value entered in Bridge resistance.
- SW Filter: Choose the frequency of a software filter to be applied to the data when viewing. This only affects the viewed data as all data stored will be as collected with the hardware anti-alias filter.
- Zero Method (post download software zeroing):
    - o Use Pre-Cal Zero: The Zero Measured Output (ZMO) of the sensor during calibration will be used to set the EU zero of the downloaded data.
    - o Average Over Time: Used in conjunction with ZeroStart and ZeroEnd, the average EU value during the Start and End window will be used to Zero the collected data. The Zero Start/End window must be set to data that will be collected. If using a negative time, then the Acquire tab must include this window.
    - o None: The actual recorded input will not be adjusted or compensated for zero level. This setting can be used to show the actual mV offset. An example may be to record a logic level signal and see the actual on/off state.
    - o Remove Offset (hardware): When checked, this will remove the ZMO during diagnostics. This will "electrically" zero the input.
    - o ZeroStart/End: See Zero Method→Average Over Time.
    - o Offset Check: Used in conjunction with Limit Low/High during diagnostics. When checked, the ZMO is measured and compared the Low/High limits as a pass/fail criteria during diagnostics.

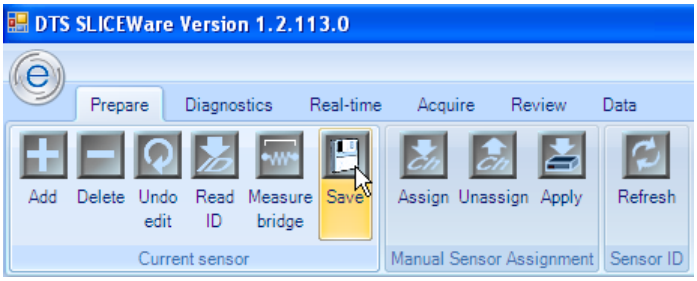
Step-by-Step Procedure to Add a New Sensor

1. On the PREPARE tab, click the "Add" button in the "Current Sensor" button group

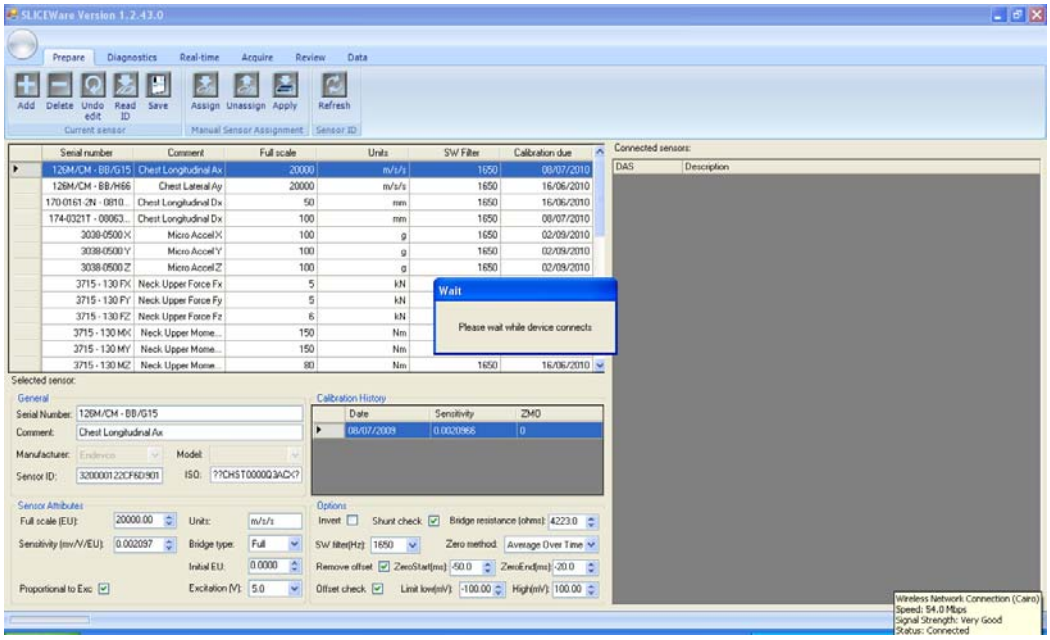
2. Edit the Sensor Details Field



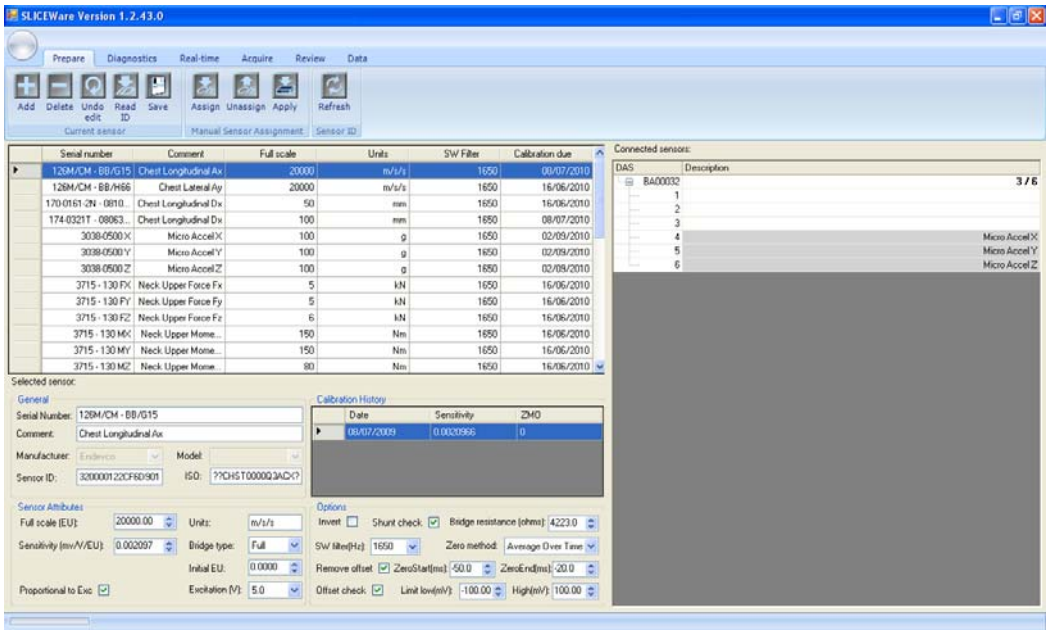
3. Select "Save" in the "Current Sensor" button group



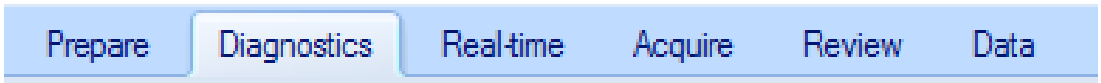
Connect SLICE …
Connect the USB and power up the SLICE system…



SLICE hardware appears on right hand side …

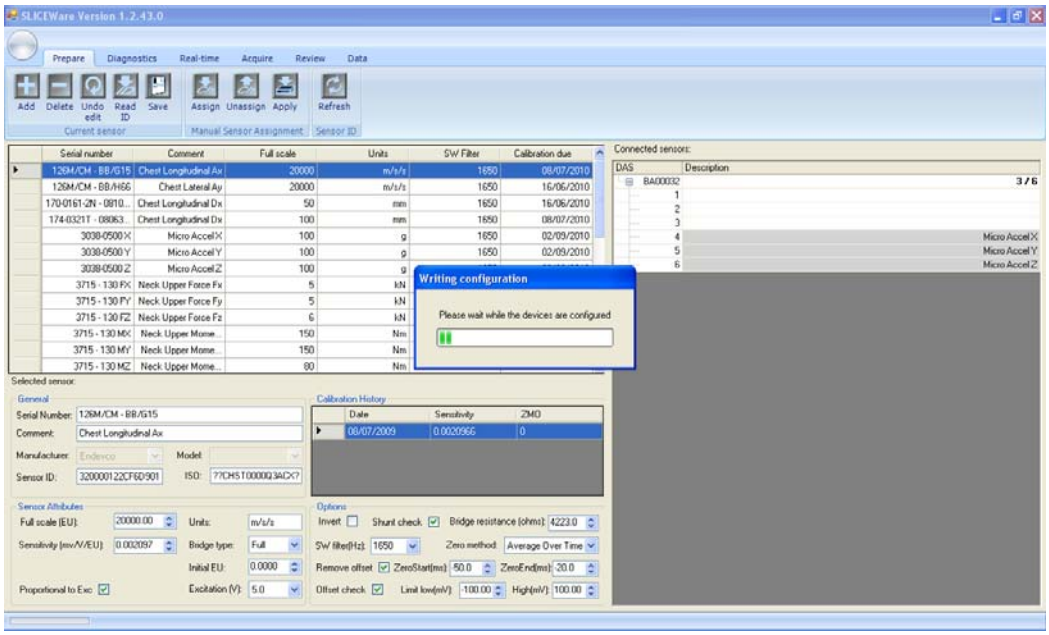


Click Diagnostics tab …

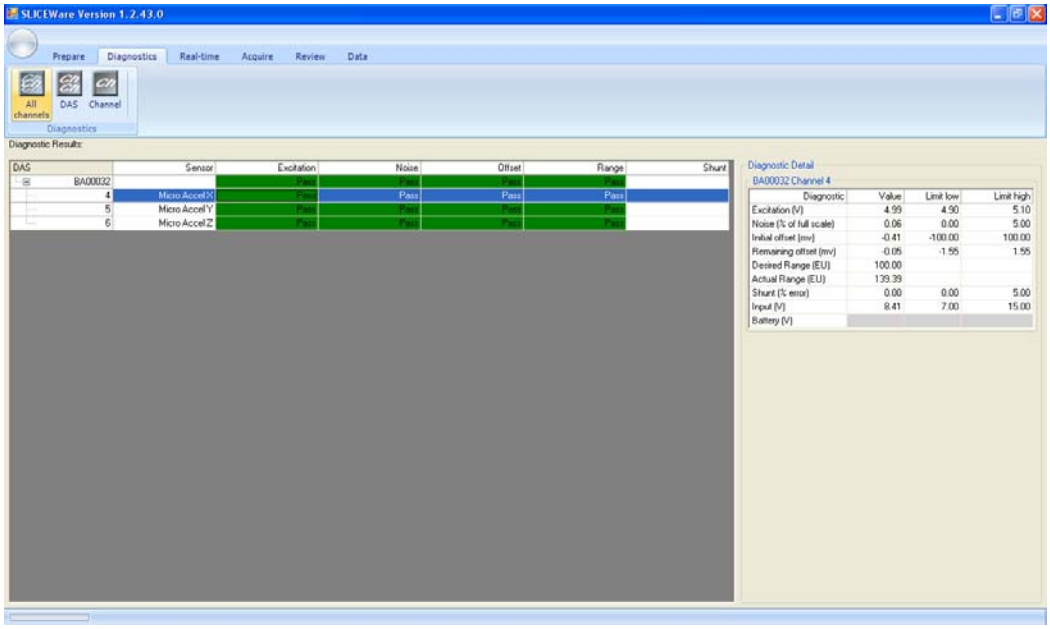


This tab ensures that the connected hardware is operating normally. Hardware diagnostics include checks for battery level, excitation voltage, noise and expected offset.

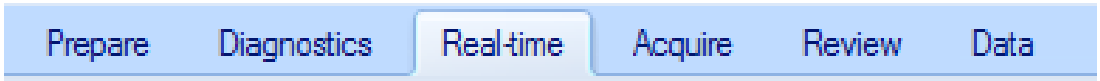
SLICEWare configures any connected channels …



Detailed calibration results for all channels …

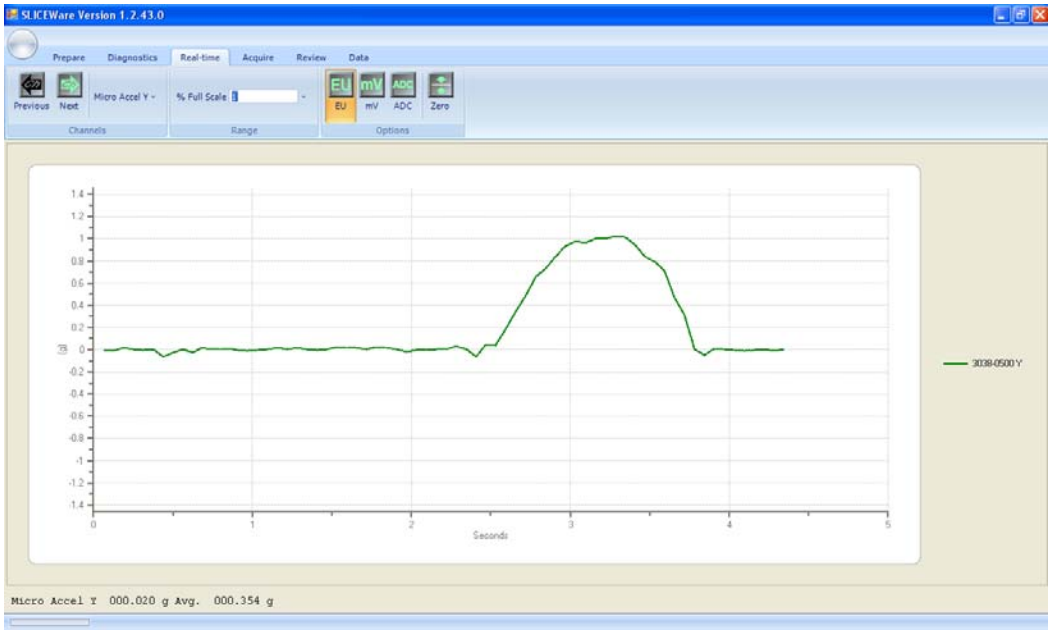


Click Real-time tab …

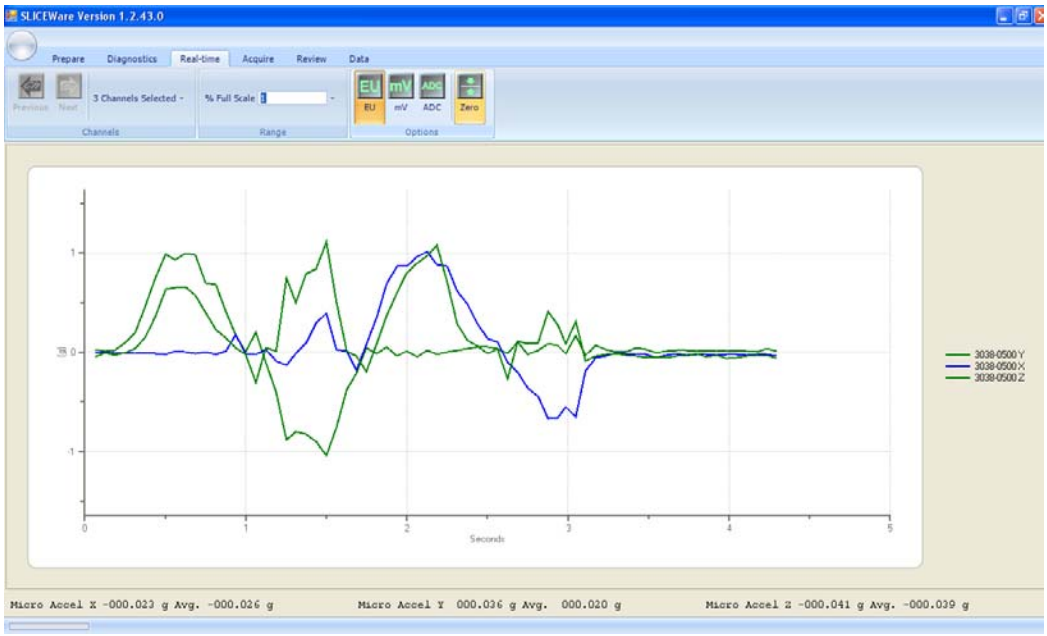


This tab shows data input to the attached SLICE hardware in real-time. It is a useful tool for establishing confidence in the current hardware configuration prior to data collection. (Note: This data is not logged.)

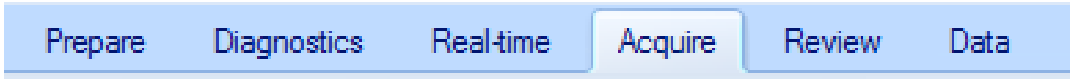
1 g roll tests …



Real-time with X, Y and Z …

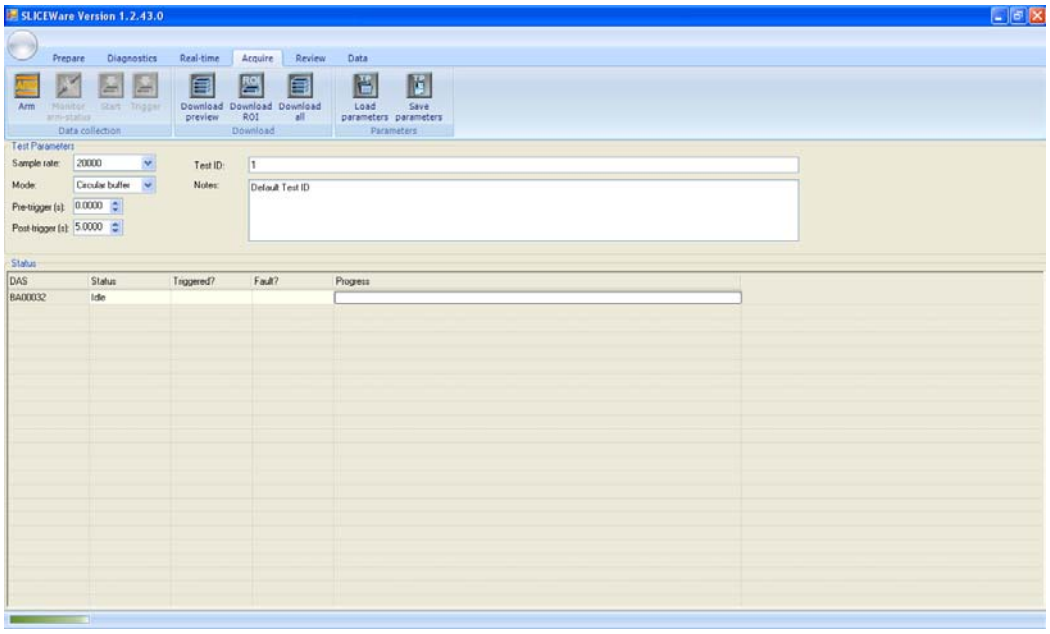


Click Acquire tab …

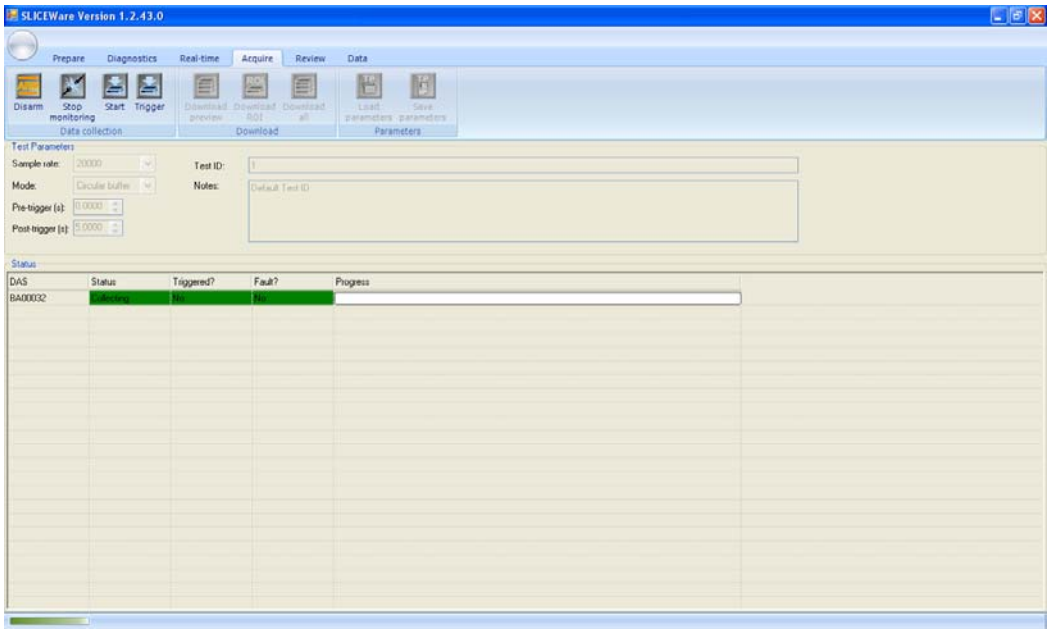


This tab configures and controls the data acquisition process. The user enters the test name, description, sample rate, acquisition mode (circular buffer or recorder mode), pre- and post-trigger times and then prepares the system for data acquisition with the arm command. After the test is completed, the user can use the download command to view the data.

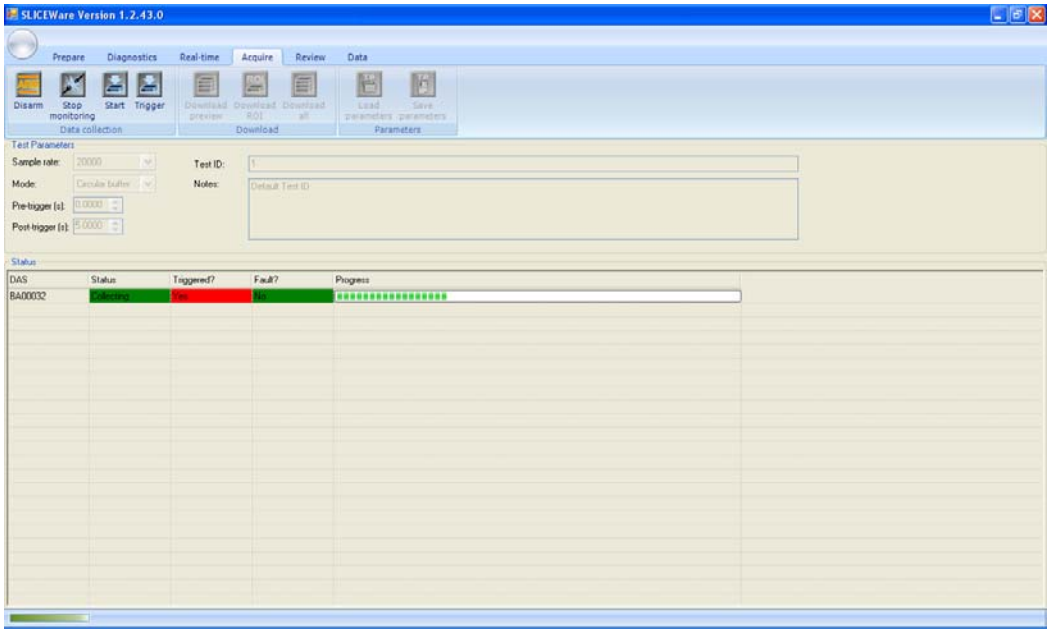
Enter sampling rates and pre-post test times etc …



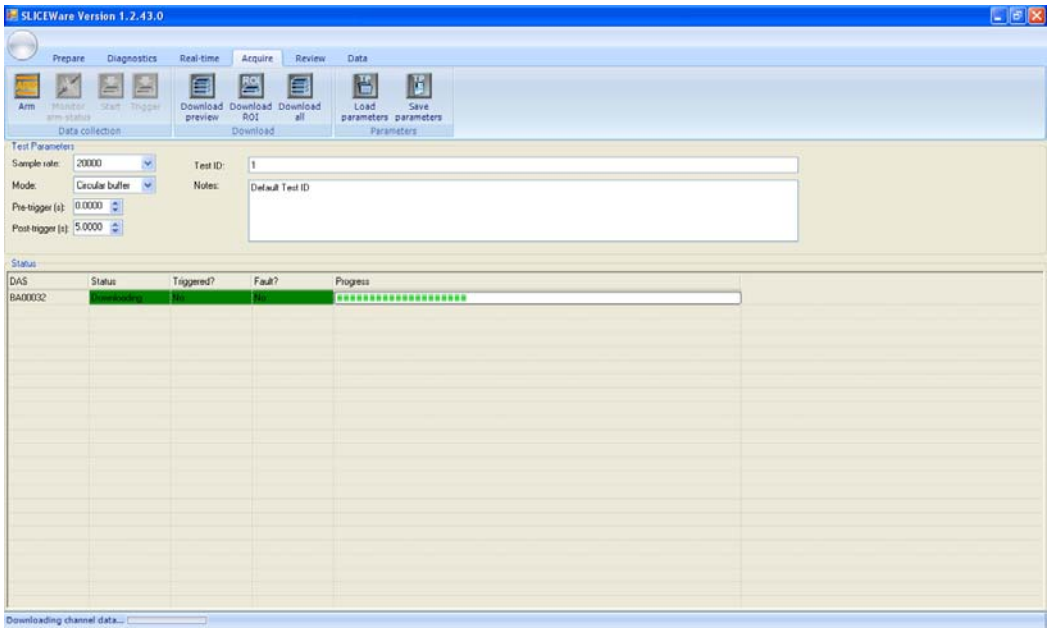
System ARMed …



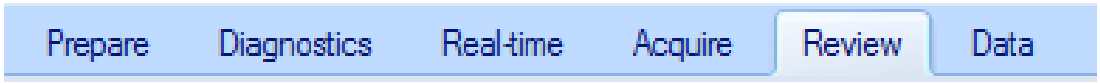
System triggered and acquiring data … (Note: SLICEWare cannot simultaneously display the data while the system is recording.)



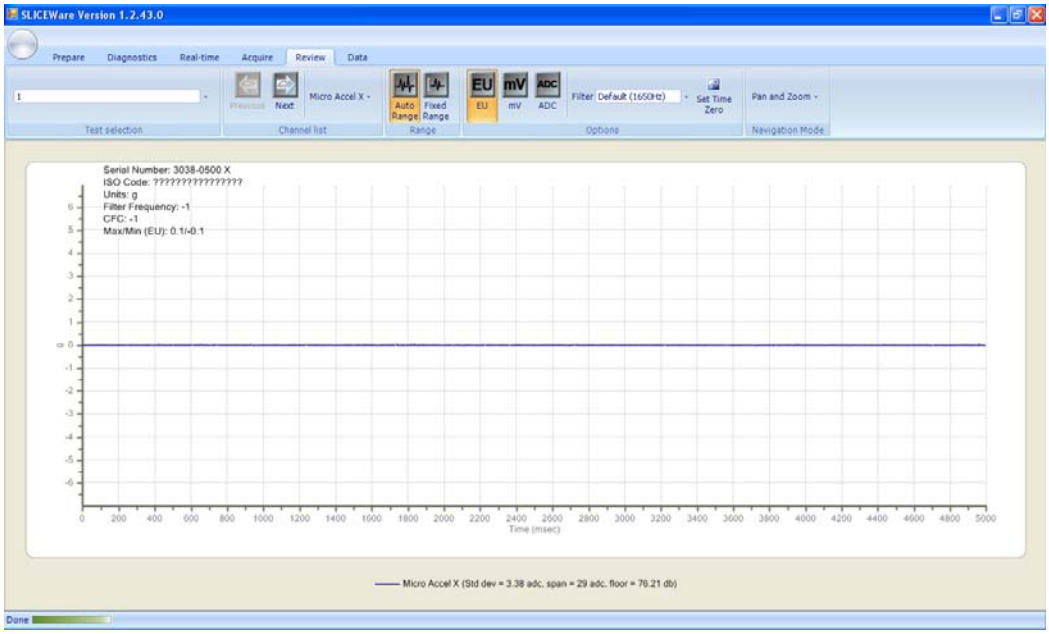
Downloading data …



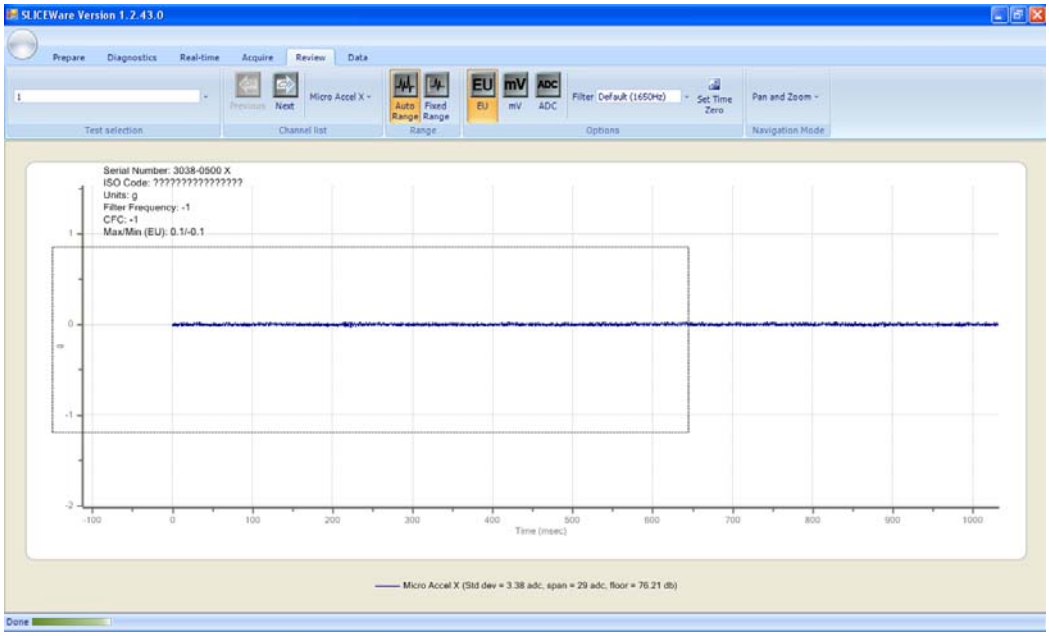
Click Review tab …



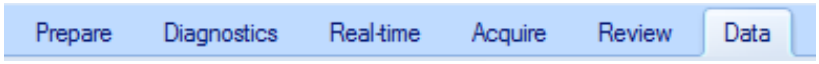
This tab displays collected data. Previously downloaded tests can be viewed and examined on a per-channel basis.



Dynamic "zoom" selection …

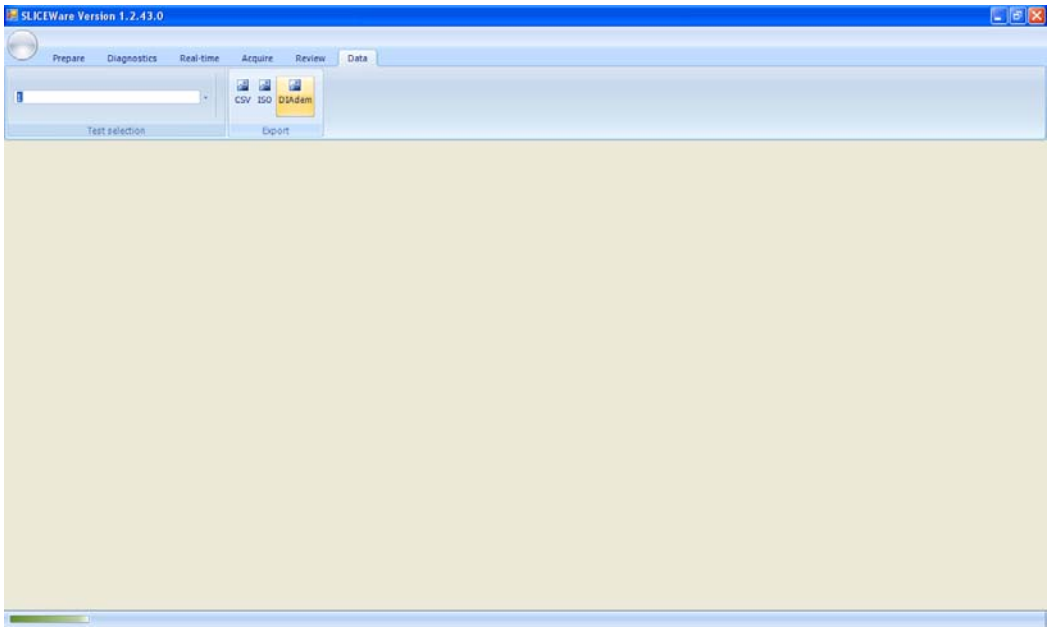


Click Data tab …



This tab provides export options for collected data. Export options include CSV, ISO and DIAdem formats.

Export options for CSV, ISO and DIAdem formats …



6. Powering Up SLICE

This section covers what to expect when powering up a SLICE system and running a test. The LEDs on the Base SLICE indicate the status of the system.

6.1. Status (STS) LED

Action	Result
Power up	
Communicating with PC	
Recording Data (Recorder Mode) -or- Armed (Circular Buffer)	
Armed in Recorder Mode	
Unit received Event	
Idle	

The status LED is red, green or blue. At system power up, the LED cycles from red to green to blue followed immediately by the power LED boot-up sequence.

The status LED indicates communication and arm status.

- When the unit is not armed, the status LED will blink green when handling a command from the PC.
- For Recorder Mode
  - When the unit is first armed, the LED will go solid blue to indicate that it is waiting for the START RECORD signal but not taking data.
  - When it receives the START RECORD signal, the LED will turn green to indicate that it is actively recording data.
  - The LED will turn off when data collection has completed.
  - If an EVENT signal is received while the unit is recording data, the LED will turn red and then turn off when data collection has completed.
- For Circular Buffer Mode
  - When the unit is armed, the LED will go solid green to indicate that it is collecting data and waiting for the EVENT signal.
  - When an EVENT signal is received the LED will turn red and then turn off when data collection has completed.

6.2. Power (PWR) LED

Action	Result (not armed)
Power up	
Connected to USB power Only	
Connected to external power – power is OK	
Connected to external power – power is low	

The power LED is red, green or blue.

- At power up, the LED cycles from red to green to blue immediately after the status LED has completed its boot-up sequence.
- When USB is connected, the LED will turn blue.
- With OK external power, the LED will turn green.
- With low external power, the LED will turn red.
- These transitions do not happen if the unit is armed.

SERVICES

24/7 Worldwide Tech Support
ISO 17025 (A2LA) Calibration
Onsite Calibration & Training
Application Consulting
Software Integration
OEM/Embedded Applications

TECH CENTERS

Seal Beach, California USA
Novi, Michigan USA
Sydney, Australia
Shanghai, China
Zorge, Germany
Tokyo, Japan

Specifications

BASE SLICE (MICRO & NANO)

Size:	MICRO 42 x 42 x 8 mm (1.65 x 1.65 x 0.32") NANO 26 x 31 x 6.5 mm (1.02 x 1.22 x 0.26")
Weight:	MICRO ~28 g (0.99 oz), NANO ~14.2 g (0.50 oz)
Connectors:	Omnetics, circular locking, 12-pin
Connectors:	MICRO integrated, NANO cable assembly

ENVIRONMENTAL

Operating Temp.:	0 to 60°C (32 to 140°F) Call to discuss extended temperature ranges
Humidity:	95% RH non-condensing
Shock:	500 g, 4 msec half sine 5000 g option (SLICE NANO) 50,000 g option (SLICE HG)

DATA RECORDING

Modes:	Recorder or circular buffer modes available.
Memory:	7 GB non-volatile flash per SLICE stack
Sample Rate:	Up to 120 ksps/channel Individual channel sample rate is determined by number of SLICEs in each stack

TRIGGERING

Hardware Trigger:	Isolated contact closure & logic-level input
Level Trigger:	Software programmable from any channel(s)

POWER

Supply Voltage:	9-15 VDC; >11 VDC when using BATT SLICE
Current (Maximum):	100 mA. Each additional SLICE unit requires additional power (depends significantly on connected sensor load)
Power Control:	Remote power control input for on/off
Protection:	Reverse current, ESD

SOFTWARE

Control:	SLICEWare, API
Operating Systems:	Windows® XP/Vista/7
Communication:	USB; optional Ethernet interface

BRIDGE SLICE (MICRO & NANO)

Size:	MICRO 42 x 42 x 7 mm (1.65 x 1.65 x 0.32") NANO 26 x 31 x 5.5 mm (1.02 x 1.22 x 0.22")
Weight:	MICRO ~25 g (0.88 oz), NANO ~13.8 g (0.49 oz)
Connectors:	Omnetics, circular locking; 3 single-channel 7-pin or 1 three-channel 16-pin

SIGNAL CONDITIONING

Number of Channels:	3 differential, programmable
Input Range:	±2.4 V (2.5 V center)
Bandwidth:	DC to 40 kHz, programmable
Gain Range:	1.0-1280, programmable
Auto Offset Range:	100% of effective input range
Bridge Support:	Software switchable completion
Shunt Check:	Emulation method

ANALOG-TO-DIGITAL CONVERSION

Type:	16-bit SAR, one ADC per channel

EXCITATION

Method:	One 20 mA current-limited source/channel
Voltage:	5.0 V
On/Off Control:	Shut down when not armed or recording Opt. pulsed excitation for low sampling rates

POWER

Voltage:	Supplied via BASE SLICE
Current (Maximum):	110 mA with 350 ohm bridges all channels Power will vary significantly with sensor load

ANTI-ALIAS FILTER

Fixed Low Pass:	4-pole Butterworth, standard knee frequency of 40 kHz
Adjustable Low Pass:	5-pole Butterworth set under software control, 50 Hz to 40 kHz
Overall Response:	Both filters may be used together to achieve 9-pole effective response
SAE J211:	System exceeds SAE J211 response

IEPE SLICE (MICRO Only)

Size:	MICRO 42 x 42 x 7 mm (1.65 x 1.65 x 0.28")
Weight:	~28 g (0.99 oz)
Connectors:	10-32 coaxial (Microdot-compatible)

SIGNAL CONDITIONING

Number of Channels:	3
Input Range:	0.5-23.5 V (12 V center)
Bandwidth:	DC to 40 kHz, programmable
Gain Options:	1 or 10, user programmable
Auto Offset Range:	100% of effective input range at gain of 1

ANALOG-TO-DIGITAL CONVERSION

Type:	16-bit SAR, one ADC per channel

EXCITATION

Method:	One 2.2 mA constant-current source/channel
Voltage:	up to 24 V
On/Off Control:	Shut down when not armed or recording

POWER

Voltage:	Supplied via BASE SLICE
Current (Maximum):	70 mA with sensors connected to all channels

ANTI-ALIAS FILTER

Fixed Low Pass:	4-pole Butterworth, standard knee frequency of 40 kHz
Adjustable Low Pass:	5-pole Butterworth set under software control, 50 Hz to 40 kHz
Overall Response:	Both filters may be used together to achieve 9-pole effective response

ARS SLICE (MICRO Only)

Size:	MICRO 42 x 42 x 9 mm (1.65 x 1.65 x 0.35")
Weight:	~30 g (1.06 oz)
Number of Channels:	3
Range Options:	Triaxial, ±300, 1500, 8k, 12k, 50k deg/sec
Current (Maximum):	75 mA (power supplied via BASE SLICE)

ACCEL SLICE (MICRO Only)

Size:	MICRO 42 x 42 x 9 mm (1.65 x 1.65 x 0.35")
Weight:	~30 g (1.06 oz)
Number of Channels:	3
Range Options:	Triaxial, ±50, 100, 500 g
Current (Maximum):	65 mA (power supplied via BASE SLICE)

BATTERY SLICE (NANO Only)

Size:	NANO 26 x 31 x 4 mm (1.65 x 1.65 x 0.16")
Weight:	~7 g (0.25 oz)
Charge Status:	Backup battery charges when input voltage to BASE SLICE is greater than 11 VDC
Charge Time:	~15 min. from complete discharge to full charge (100 mA at input connector on Base)
Discharge Rate:	~16 seconds at 1 A ~2 minutes at 400 mA

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Phone: +1 562 493 0158
Email: sales@dtsweb.com
www.dtsweb.com

SLICE NANO Base Pin Assignments

support@dtsweb.com

DOWN connector**

(looking into the connector)

Mating connector: DTS P/N 80000-04030

Mating connector + backshell: DTS P/N 13000-30170

Pin	Function
1	$\overline{\text{On}}$ (contact closure input to ground)
2	$\overline{\text{Start}}$ (contact closure input to ground)
3	$\overline{\text{Event}}$ (contact closure input to ground)
4	Status output (5 V via 10K with respect to ground)
5, 6	7–15 VDC
7, 8, 12	Ground
9	USB_PWR
10	USB_DP
11	USB_DM

** Both cables are 10 cm in length

UP* connector**

(looking into the connector)

Mating connector: DTS P/N 80000-04029

Mating connector + backshell: DTS P/N 13000-30180

Pin	Function
1	$\overline{\text{On}}$ (contact closure input to ground)
2	$\overline{\text{Start}}$ (contact closure input to ground)
3	$\overline{\text{Event}}$ (contact closure input to ground)
4	Status output (5 V via 10K with respect to ground)
5, 6	7–15 VDC
7, 8, 12	Ground
9	USB_PWR
10	USB_DP
11	USB_DM

* to PC

SLICE NANO Bridge Pin Assignments

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Channels 1, 2 and 3*

(looking into the connector)

Mating connector: DTS P/N 80000-04019

Mating connector + backshell:
DTS P/N 13000-30310

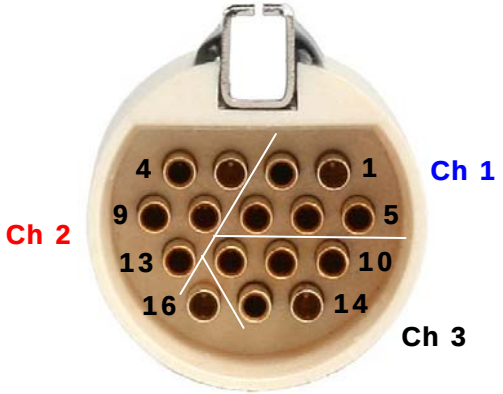
Mating connector + backshell + ID:
DTS P/N 13000-30120

Pin	Function
1	+ Sig
2	- Sig
3	+ Ex
4	+ ID
5**	- Ex
6**	- ID
7**	Shield

* Three connectors; cables 6, 10 and 14 cm in length

** Pins 5, 6 and 7 are common

Channels 1-3***



(looking into the connector)

Mating connector: DTS P/N 80000-14031

Mating connector + backshell: DTS P/N 13000-30320

Mating connector + backshell + 3 IDs: DTS P/N 13000-30140

Pin	Function
1	+ Sig (Ch 1)
2	+ ID (Ch 1)
3	- Sig (Ch 2)
4	+ Sig (Ch 2)
5	- Sig (Ch 1)
6	+ Ex (Ch 1)
7	- Ex (Ch 1)
8	+ Ex (Ch 2)

Pin	Function
9	+ ID (Ch 2)
10	+ Sig (Ch 3)
11	+ Ex (Ch 3)
12	- Ex (Ch 3)
13	- Ex (Ch 2)
14	- Sig (Ch 3)
15	+ ID (Ch 3)
16	- ID (Ch 1, 2, 3)/Shield

*** One connector; cable 10 cm in length

SLICE NANO Mechanical Specifications

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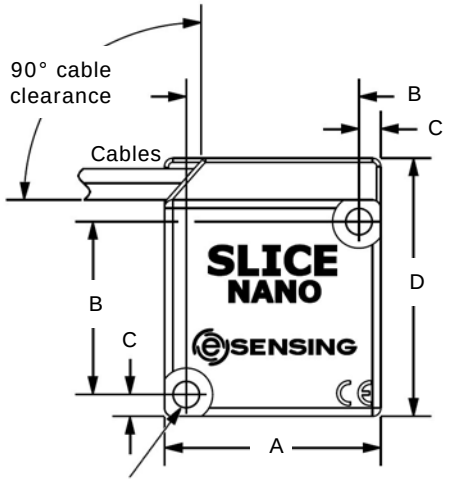
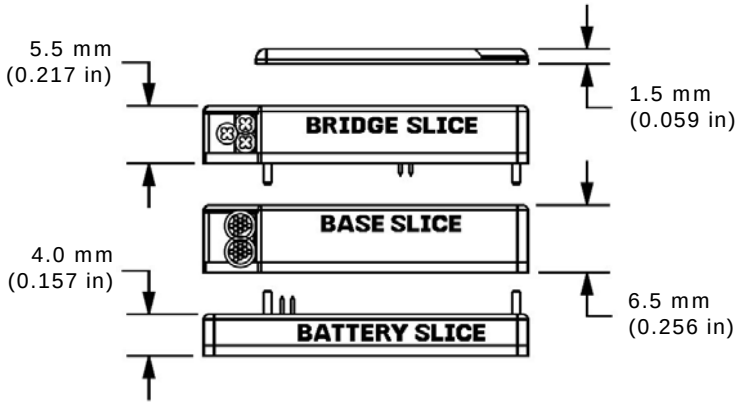


A = 26 mm (1.024 in)
B = 20.75 mm (0.817 in)
C = 2.62 mm (0.103 in)
D = 31 mm (1.220 in)

Ø3.2 mm (0.125 in) mounting thru holes x2
Accepts M2.5 (loose fit); 4-40 (free fit); M3 (tight fit)



	Weight
Lid	~2.6 grams
Bridge (1 conn)	~12.6 grams
Bridge (3 conn)	~13.8 grams
Base	~14.2 grams
Battery	~7 grams

Total Stack Height mm (inch)	Mounting Screw Length (min) BH or SHC	
	M2.5*/M3**	4-40**
13.5 (0.531)	18 mm	3/4"
17.5 (0.689)	22 mm	7/8"
19 (0.748)	25 mm	1"
23 (0.906)	30 mm	1-1/8"
24.5 (0.965)	30 mm	1-1/8"
28.5 (1.122)	35 mm	1-1/4"
30 (1.181)	35 mm	1-3/8"
34 (1.339)	40 mm	1-1/2"
35.5 (1.398)	40 mm	1-3/4"
39.5 (1.555)	45 mm	1-3/4"
41 (1.614)	45 mm	1-3/4"
45 (1.772)	50 mm	2"
46.5 (1.831)	60 mm	2"
50.5 (1.988)	60 mm	2-1/2"
52 (2.047)	60 mm	2-1/2"
56 (2.205)	60 mm	2-1/2"
57.5 (2.264)	70 mm	2-1/2"
61.5 (2.421)	70 mm	3"
63 (2.480)	70 mm	3"
67 (2.638)	70 mm	3"

Specifications may be revised without notice.

Torque specs: * 3.9 in-lb (0.44 Nm); ** 5.2 in-lb (0.59 Nm)

SLICE MICRO Pin Assignments

support@dtsweb.com

DOWN and **UP*** connectors for SLICE MICRO Base

(looking into the connector)

Mating connector: DTS P/N 80000-04030

Mating connector + backshell: DTS P/N 13000-30170

Pin	Function
1	$\overline{\text{On}}$ (contact closure input to ground)
2	$\overline{\text{Start}}$ (contact closure input to ground)
3	$\overline{\text{Event}}$ (contact closure input to ground)
4	Status output (5 V via 10K with respect to ground)
5, 6	7–15 VDC
7, 8, 12	Ground
9	USB_PWR
10	USB_DP
11	USB_DM

* to PC

Channels **1**, **2** and **3** for SLICE MICRO Bridge

(looking into the connector)

Mating connector: DTS P/N 80000-04019

Mating connector + backshell: DTS P/N 13000-30310

Mating connector + backshell + ID: DTS P/N 13000-30120

Pin	Function
1	+ Sig
2	- Sig
3	+ Ex
4	+ ID
5*	- Ex
6*	- ID
7*	Shield

* Pins 5, 6 and 7 are common

SLICE MICRO Mechanical Specifications

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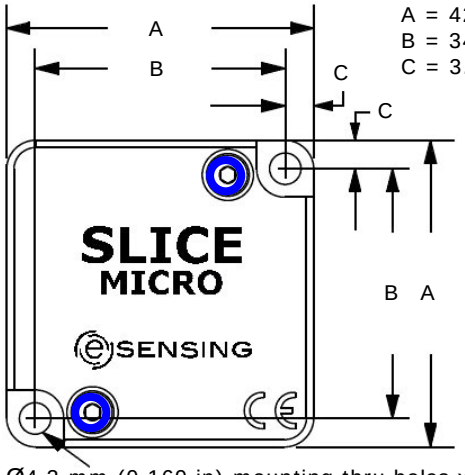


A = 42 mm (1.654 in)
B = 34.2 mm (1.346 in)
C = 3.9 mm (0.154 in)

Ø4.3 mm (0.169 in) mounting thru holes x2
Accepts 6-32 (loose fit); M4 (free fit); 8-32 (tight fit)

	Weight	Height mm (inch)
Lid	~9 grams	2 (0.079)
IEPE	~28 grams	7 (0.276)
Accel	~33 grams	9 (0.354)
ARS	~33 grams	9 (0.354)
Bridge	~25 grams	7 (0.276)
Base	~28 grams	8 (0.314)

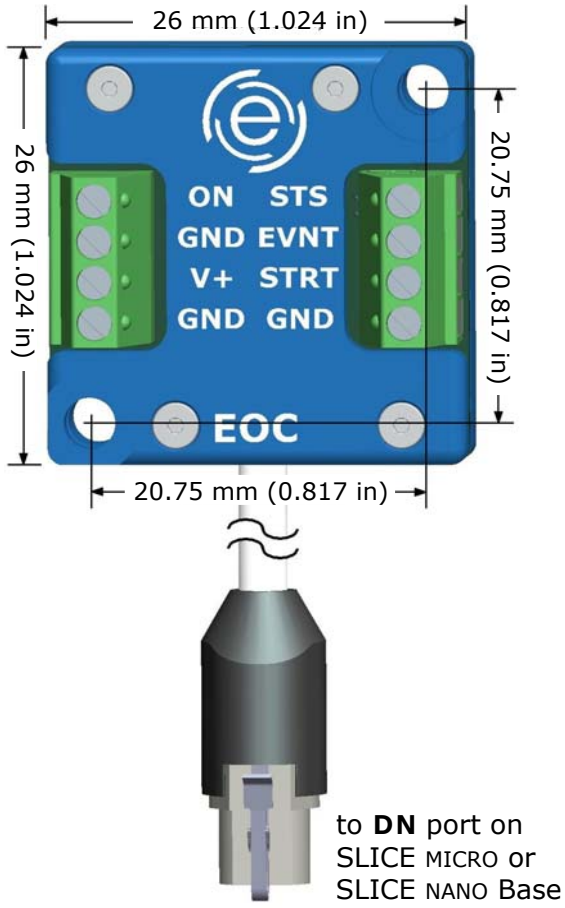
Total Stack Height mm (inch)	Assembly Screw Length (FH)	Mounting Screw Length (min) (BH or SHC)	
	M3*	M4**	6-32***/8-32**
17 (0.67)	16 mm	22 mm	7/8"
24 (0.95)	20 mm	30 mm	1-1/4"
26 (1.02)	25 mm	35 mm	1-1/4"
31 (1.22)	30 mm	35 mm	1-1/2"
33 (1.30)	30 mm	40 mm	1-1/2"
35 (1.38)	35 mm	40 mm	1-5/8"
38 (1.50)	35 mm	45 mm	1-3/4"
40 (1.57)	40 mm	45 mm	1-3/4"
42 (1.65)	40 mm	50 mm	2"
45 (1.77)	45 mm	50 mm	2"
47 (1.85)	45 mm	55 mm	2-1/4"
49 (1.93)	45 mm	55 mm	2-1/4"
52 (2.05)	50 mm	60 mm	2-1/4"
54 (2.13)	50 mm	60 mm	2-1/2"
56 (2.21)	55 mm	70 mm	2-1/2"
59 (2.32)	55 mm	70 mm	2-1/2"
61 (2.40)	60 mm	70 mm	3"
63 (2.48)	60 mm	70 mm	3"
66 (2.60)	65 mm	70 mm	3"
68 (2.68)	65 mm	80 mm	3"
70 (2.76)	70 mm	80 mm	3"
73 (2.87)	70 mm	80 mm	3"
75 (2.95)	75 mm	80 mm	3-1/2”
77 (3.03)	75 mm	90 mm	3-1/2”
80 (3.15)	80 mm	90 mm	3-1/2”
82 (3.23)	80 mm	90 mm	3-1/2”
84 (3.31)	80 mm	90 mm	3-1/2”

Specifications may be revised without notice.

Torque specs: * 5.2 in-lb (0.59 Nm); ** 19.8 in-lb (2.24 Nm); *** 9.6 in-lb (1.1 Nm)

support@dtsweb.com

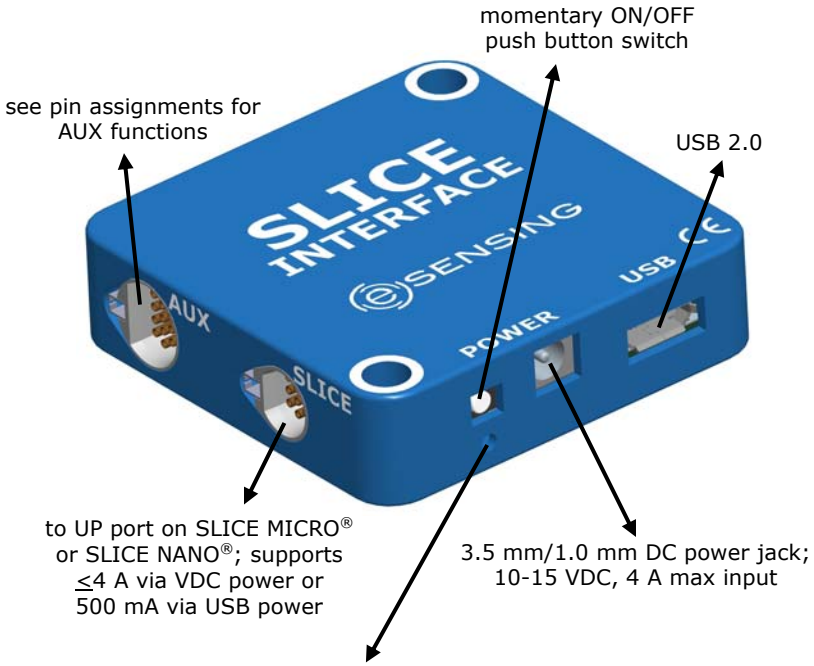
SLICE End-of-Chain Terminal



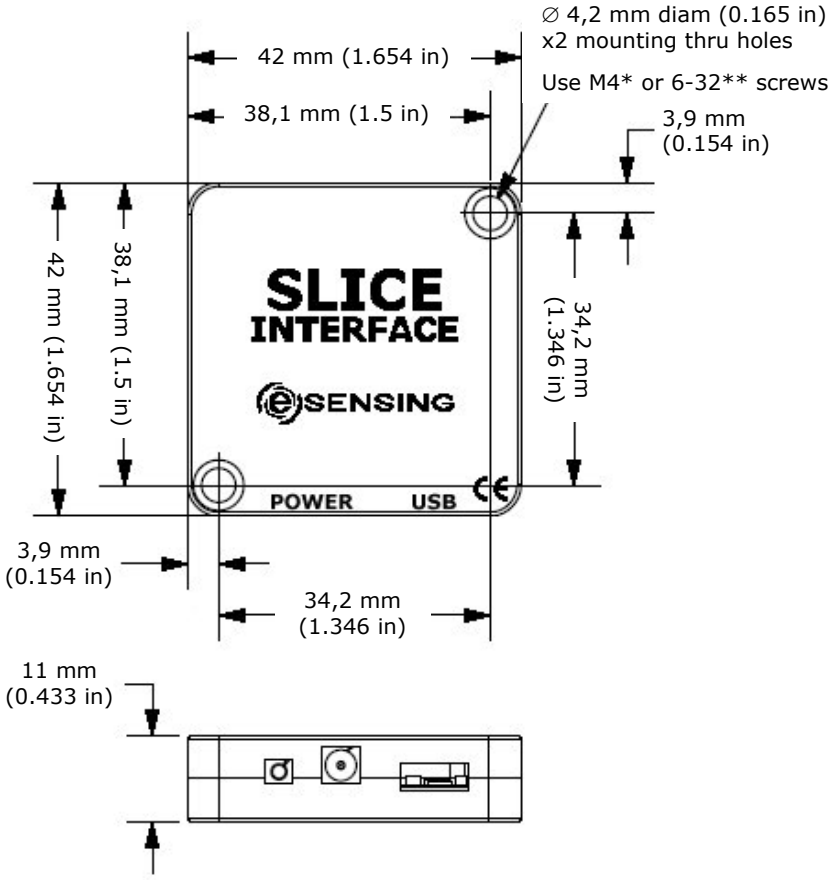
to **DN** port on SLICE MICRO or SLICE NANO Base

	Function	Connections
ON	Turns on SLICE	Contact closure = ON to GND (continuous) If ON signal is removed and the system is not armed, the system will turn off If ON signal is removed and the system is armed, the system will remain on and collect data (sufficient input power permitting)
V+	Power input	+V = input voltage (red) -V = GND (black)
STS	Status output	5 V logic-level output = STS to GND Conditioned status output; LED direct drive (≥20 mA) LED is on only when SLICE is collecting data
EVNT	Event input	Contact closure = EVNT to GND (momentary) An EVNT signal can initiate data collection (circular buffer mode) or mark an event within the data collection window (recorder mode)
STRT	Start record input	Contact closure = STRT to GND (momentary) A STRT signal initiates data collection (recorder mode)

Weight: 12 grams (without cabling)
20-30 AWG terminals.
All GND terminations are common.
Reverse polarity and overvoltage protection.



Status LED	Action
●	No input power
●	Power input detected; system OFF
●	Power input detected; system ON
●	Collecting data



Torque specs: * 19.8 in-lb (2.24 Nm); ** 9.6 in-lb (1.1 Nm)

Specifications may be revised without notice.

SLICE Interface Pin Assignments

support@dtsweb.com

AUX connector

(looking into the connector)

Mating connector: DTS P/N 13000-30160

Pin	Function
1	$\overline{\text{ON}}$; contact closure input to ground
2	$\overline{\text{START}}$; contact closure input to ground
3	$\overline{\text{EVENT}}$; contact closure input to ground
4	STATUS LED output; 4-5 V, 10 mA max, relative to ground
5	CHARGE output; 10-18 VDC, 2 A out
6	Ground
7	No connection
8	Ground

Pin	Function
9	START input; 1.5-14 VDC, relative to ground
10	+EPWR input; 10-18 VDC, 4 A*
11	Ground
12	Ground
13	EVENT input; 1.5-14 VDC, relative to ground
14	+EPWR input; 10-18 VDC, 4 A*
15	+BAT input; 10-18 VDC, 4 A
16	+BAT input; 10-18 VDC, 4 A

* ≥13 V required for charging SLICE chain/stack battery

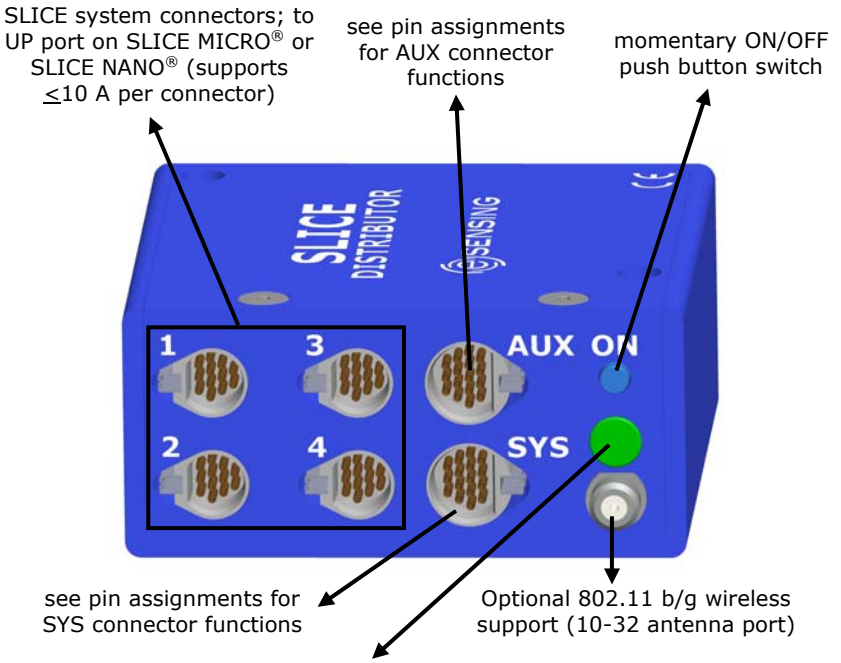
SLICE Interface Pin Assignments (cont.)

SENSING
support@dtsweb.com

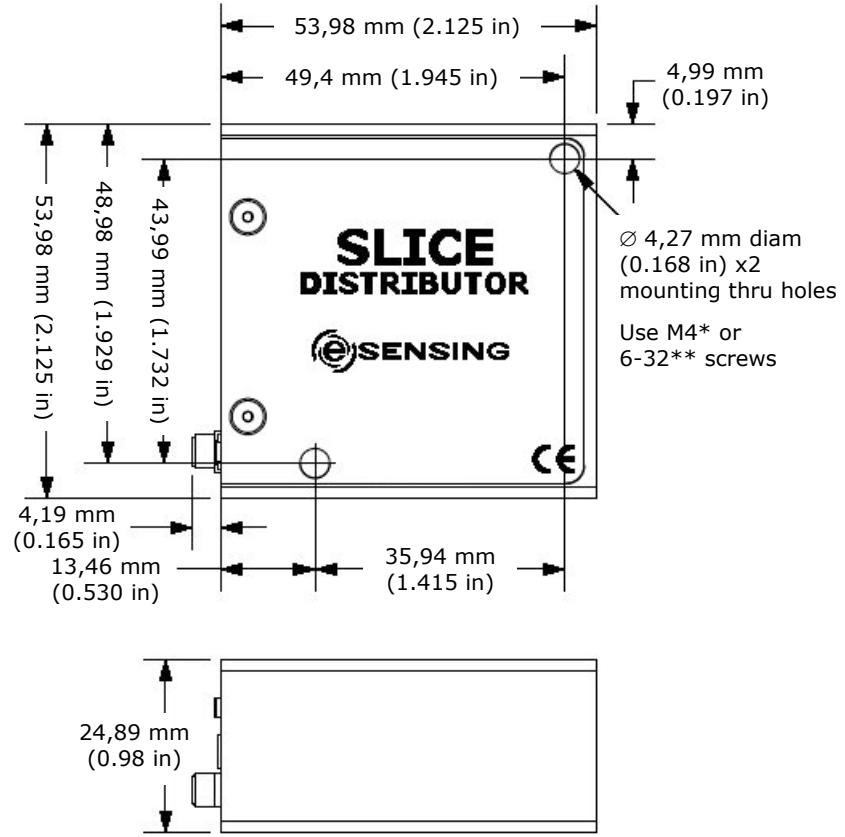
SLICE connector

(looking into the connector)
Mating connector: DTS P/N 13000-30170

Pin	Function
1	$\overline{\text{On}}$ (contact closure input to ground)
2	$\overline{\text{Start}}$ (contact closure input to ground)
3	$\overline{\text{Event}}$ (contact closure input to ground)
4	Status output (5 V via 10K with respect to ground)
5	7–15 VDC
6	7–15 VDC
7	Ground
8	Ground
9	USB_PWR
10	USB_DP
11	USB_DM
12	Ground



Status LED	Action
●	No input power
●	Power input detected; system OFF
●	Power input detected; system ON
✹	Armed in recorder mode; not collecting data
●	Collecting data



Torque specs: * 19.8 in-lb (2.24 Nm); ** 9.6 in-lb (1.1 Nm)

Specifications may be revised without notice.

SLICE Distributor Pin Assignments

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AUX connector

(looking into the connector)

Mating connector: DTS P/N S-MCP-16-SDA

Pin	Function
1	/PWR_ON
2	- Event
3	+ Event
4	RECORD_STATUS
5	CHARGE
6	Ground
7	Ground
8	

Pin	Function
9	START_RECORD
10	+ BAT
11	Ground
12	No connection
13	CHARGE_STATUS
14	+ BAT
15	EN_BAT_PWR
16	Start (contact closure input to ground)

9-20 VDC in; 10 A max

SLICE Distributor Pin Assignments (cont.)

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SYS connector

(looking into the connector)

Mating connector: DTS P/N S-MCP-16-SDX

Pin	Function
1	/PWR_ON
2	- Event
3	+ Event
4	RECORD_STATUS
5	ON_STATUS
6	Ground
7	Ground
8	No connection

Pin	Function
9	START_RECORD
10	+ V1
11	Ground
12	Tx+
13	Rx+
14	+ V1
15	Tx-
16	Rx-

SLICE Distributor Pin Assignments (cont.)

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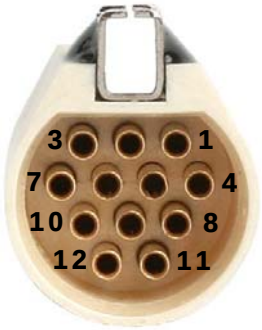
SLICE system connectors (1, 2, 3 and 4)



(looking into the connector)

Mating connector: DTS P/N S-MCP-12

Pin	Function
1	$\overline{\text{On}}$ (contact closure input to ground)
2	$\overline{\text{Start}}$ (contact closure input to ground)
3	$\overline{\text{Event}}$ (contact closure input to ground)
4	Status output (5 V via 10K with respect to ground)
5	9–15 VDC
6	9–15 VDC
7	Ground
8	Ground
9	USB_PWR
10	USB_DP
11	USB_DM
12	Ground

APPENDIX E
SLICE USB Interface (UI)

The SLICE USB Interface connects 1 SLICE system to a PC via USB.

	 *	 *
	Correct input power applied	
		SLICE system is on
		
		SLICE system is recording data

* You must *pull out* on the switch before moving—*do not force*.

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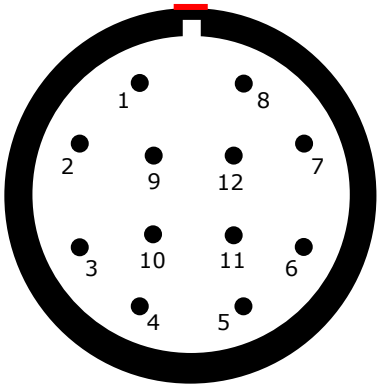
+1 562 493 0158

SLICE
(ECG.2B.312.CLL)

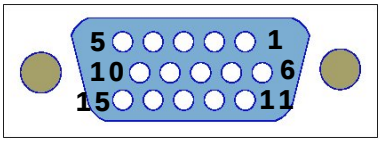


(panel view)

Pin	Function
1	/ON
2	/START
3	/EVENT
4	STATUS
5	12.6 VDC out
6	12.6 VDC out
7	Ground
8	Ground
9	USB power
10	USB_DP
11	USB_DM
12	Ground

This is a standard USB ("B") interface. A commercial, off-the-shelf USB cable is acceptable.

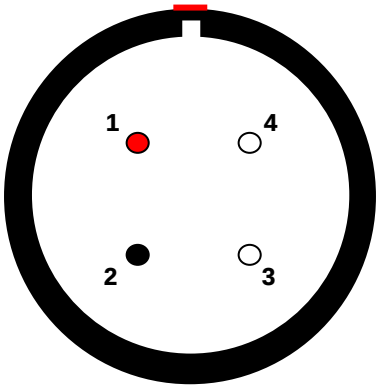
AUX
DB15F (high density)



(panel view)

Pin	Function
1	/START, CC to ground
2	+Status out
3	/EVENT, CC to ground
6	Ground
7	-Status out
8	Ground

15V IN
(ECG.2B.304.CLL)



(panel view)

Pin	Function
1	+Power (15 VDC)
2	-Power/Ground
3, 4	Ground

APPENDIX F
SLICE Ethernet Interface (EI)

The SLICE Ethernet Interface connects 1 or 2 SLICE systems to a PC via Ethernet.

	 *	 *
●	Input power is over voltage	
●	Correct input power applied	
✸		System boot-up
●		System on
		
●		All SLICE systems are recording data
●		

* You must *pull out* on the switch before moving—*do not force*.

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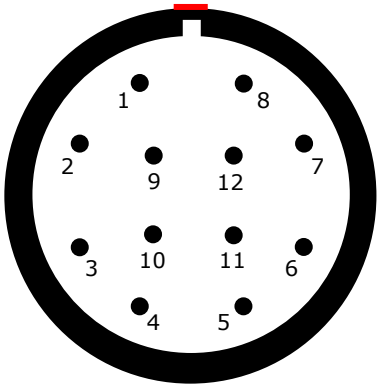
+1 562 493 0158

SLICE 1 / SLICE 2
(ECG.2B.312.CLL)

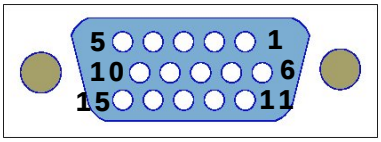


(panel view)

Pin	Function
1	/ON
2	/START
3	/EVENT
4	STATUS
5	6.5-15 VDC out
6	6.5-15 VDC out
7	Ground
8	Ground
9	USB power
10	USB_DP
11	USB_DM
12	Ground

This is a standard Ethernet (RJ45) interface. A commercial, off-the-shelf patch cable is acceptable.

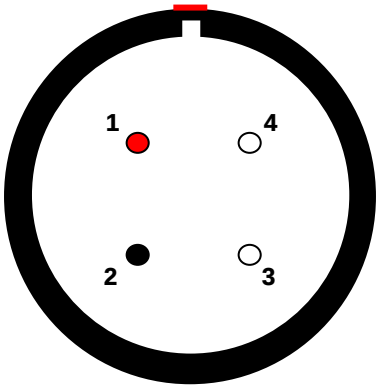
AUX
DB15F (high density)



(panel view)

Pin	Function
1	/START, CC to ground
2	+Status out
3	/EVENT, CC to ground
6	Ground
7	-Status out
8	Ground

15V IN
(ECG.2B.304.CLL)



(panel view)

Pin	Function
1	+Power (9-15 VDC range)
2	-Power/Ground
3, 4	Ground

APPENDIX G

SLICE Grounding Recommendations

SLICE Grounding and Shielding Overview

Electromagnetic Interference (EMI), Radio Frequency Interference (RFI) and Electrostatic Discharge (ESD) can seriously degrade the performance of electronic equipment if not addressed. DTS SLICE systems contain protection for EMI/RFI/ESD, however, many dynamic testing environments (pyrotechnics, blast) are particularly noisy and require the utmost attention to grounding and shielding practices. The following recommendations are intended to maximize protection and keep systems functioning properly in the harshest environments.

Ground all DAS equipment, power supplies and sensor mounting fixtures whenever possible. This is an extremely important step toward ensuring the best performance from your SLICE system.

- Always connect a cable from a good Earth ground to the test article, test fixture or instrumented vehicle. Not only does this help divert potentially disruptive electrical energy, it is also good safety practice. For remote testing applications, a metal ground rod driven 3 ft into the soil can be an effective Earthing device.
- Ground all SLICE enclosures to the test article or vehicle
  - Install ground cables between all SLICE Stacks and the test article or vehicle.
  - Install ground cables between electrically isolated test article/sensor mounting surfaces and the SLICE Stacks.

SLICE Grounding and Shielding Overview

Shield sensor cables

- Use shielded sensor cables. The shield provides a path for EMI/RFI energy to flow to the DAS ground and enclosure, thus reducing effects on sensor signals.
- Connect the sensor cable shield on the DAS side only to the “Shield” or ground pin on the SLICE.
- Do not connect the shield at both ends. Connecting the sensor cable shield at both ends will cause large ground-loop currents that can increase noise or cause damage.

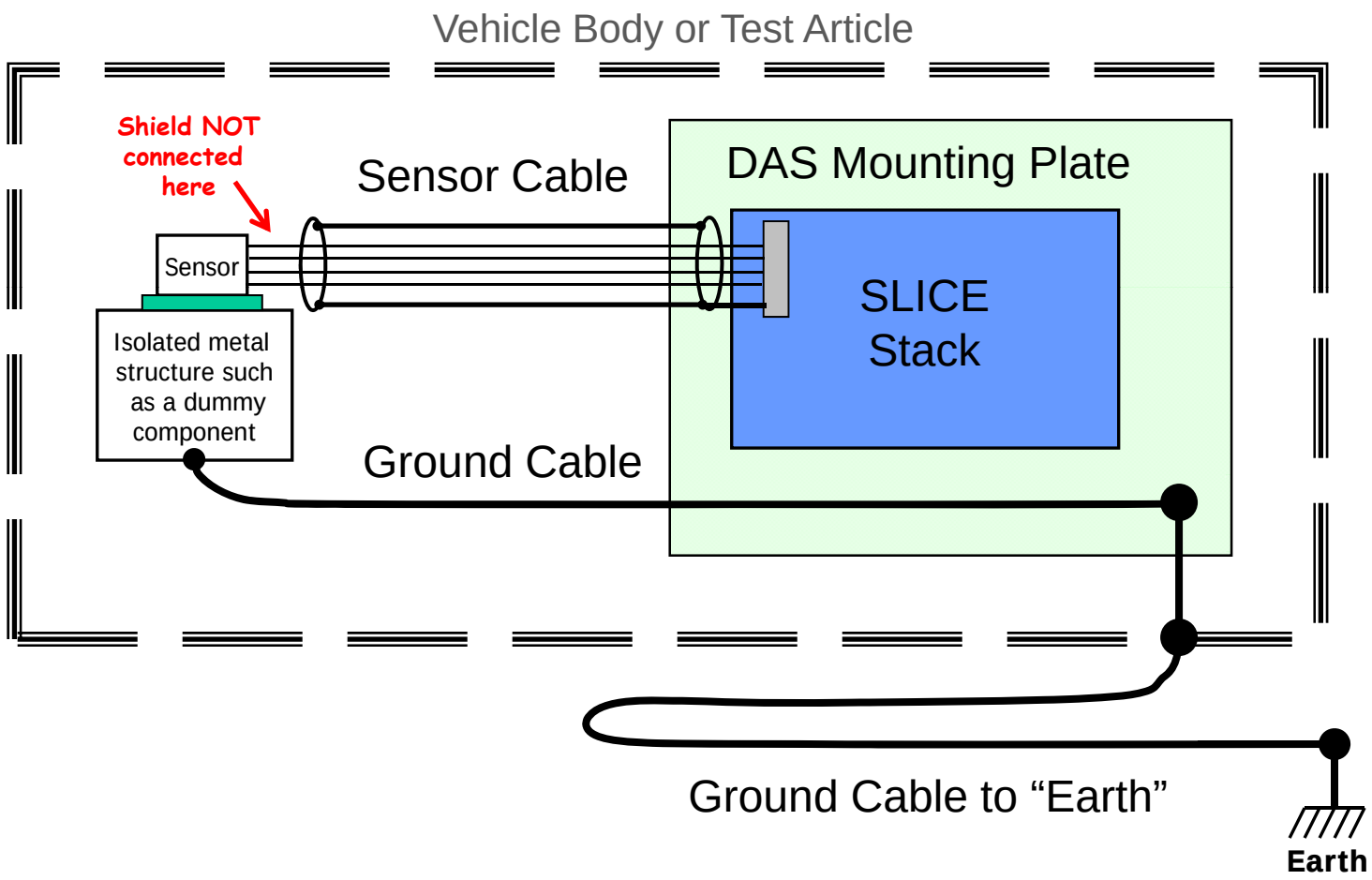
• PC Grounding?

- This is more important than you might think.
- If the Laptop used to communicate with SLICE is powered from a source that has a significantly different ground potential than the SLICE system, communication with the SLICE can be impaired. In severe cases damage to the laptop or SLICE can occur.
- Either run the laptop on battery power or use a voltmeter to make sure the AC outlet ground is not at a significantly different potential than the ground connected to the test article or vehicle.

• Carefully consider routing and cable design for any high current signals to air bags, cameras, lights, etc.

- Route these cables away from sensor wiring.
- Cross sensor wiring at 90° angles if the cables must cross.

Recommended Grounding Architecture



Cable Installation Recommendations

- Flat braided ground cable has lower impedance than typical round wires and hence makes a better ground connection.
- Never assume that connections are good until you check them with an ohmmeter. Should be <1Ω for short runs or <5Ω for long runs.
- Ground cables inside test dummies should be braided type with a 12-gage equivalent size.
- Ground cables from a test article or vehicle to the SLICE Stack should be braided strap type with a 15-gage equivalent size.
- The cable from a test article or vehicle to the Earth connection should be large enough to create an a low impedance connection given the distance between Earth connection and test vehicle. 8 to 12 gage equivalent is common.
- If braided cable is not available, any ground wire is better than none!

Braided Cable

- Alpha wire company makes suitable flat braided ground cable in 100 ft lengths. Similar cables from other companies are OK.

- Alpha part number: 1230 SV005
  - 3/16” wide, 15-gage equivalent
  - Good for SLICE Stack grounding
  - Available from www.Digi-key.com: part # A1230SV-100-ND

- Alpha part number: 1232 SV005
  - 3/8” wide, 12-gage equivalent
  - Good for test article grounding
  - Available from www.Digi-key.com: part # A1232SV-100-ND

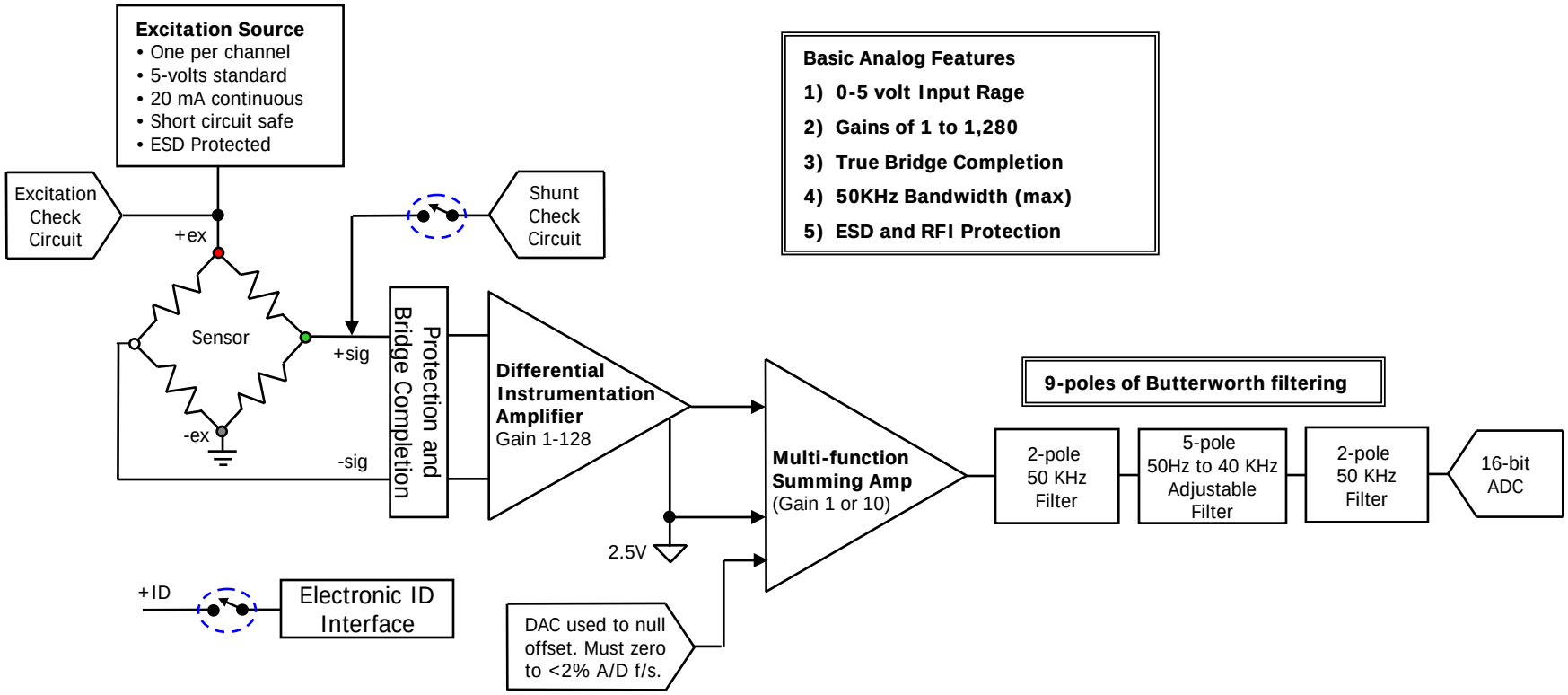
APPENDIX H
SLICE Bridge Sensor Connections

9 August 2011

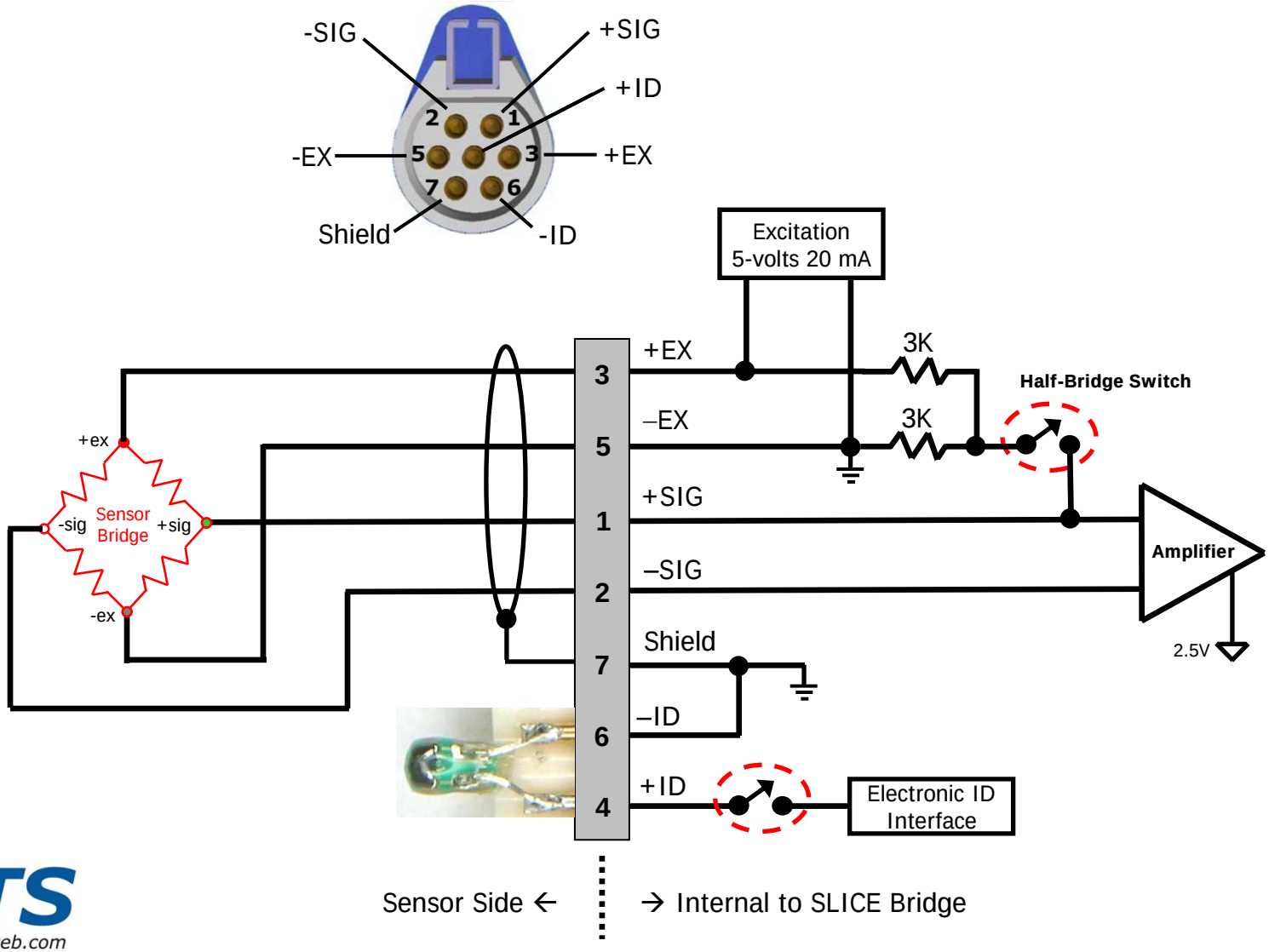
Mike.Beckage@dtsweb.com

562-682-5874

SLICE Bridge – Sensor Interface



Standard 4-wire Bridge Connection



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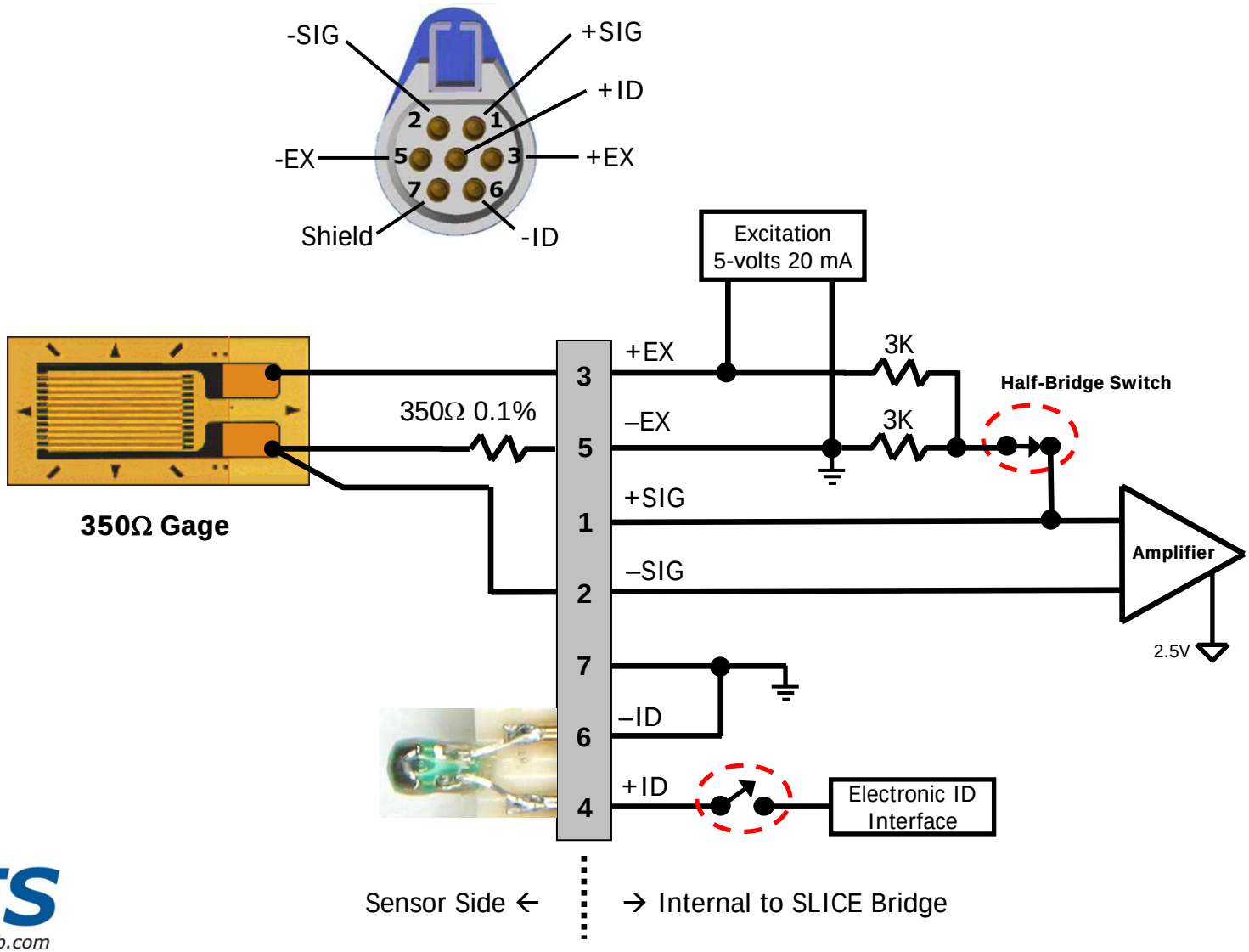
Strain Gage 3-wire Connection



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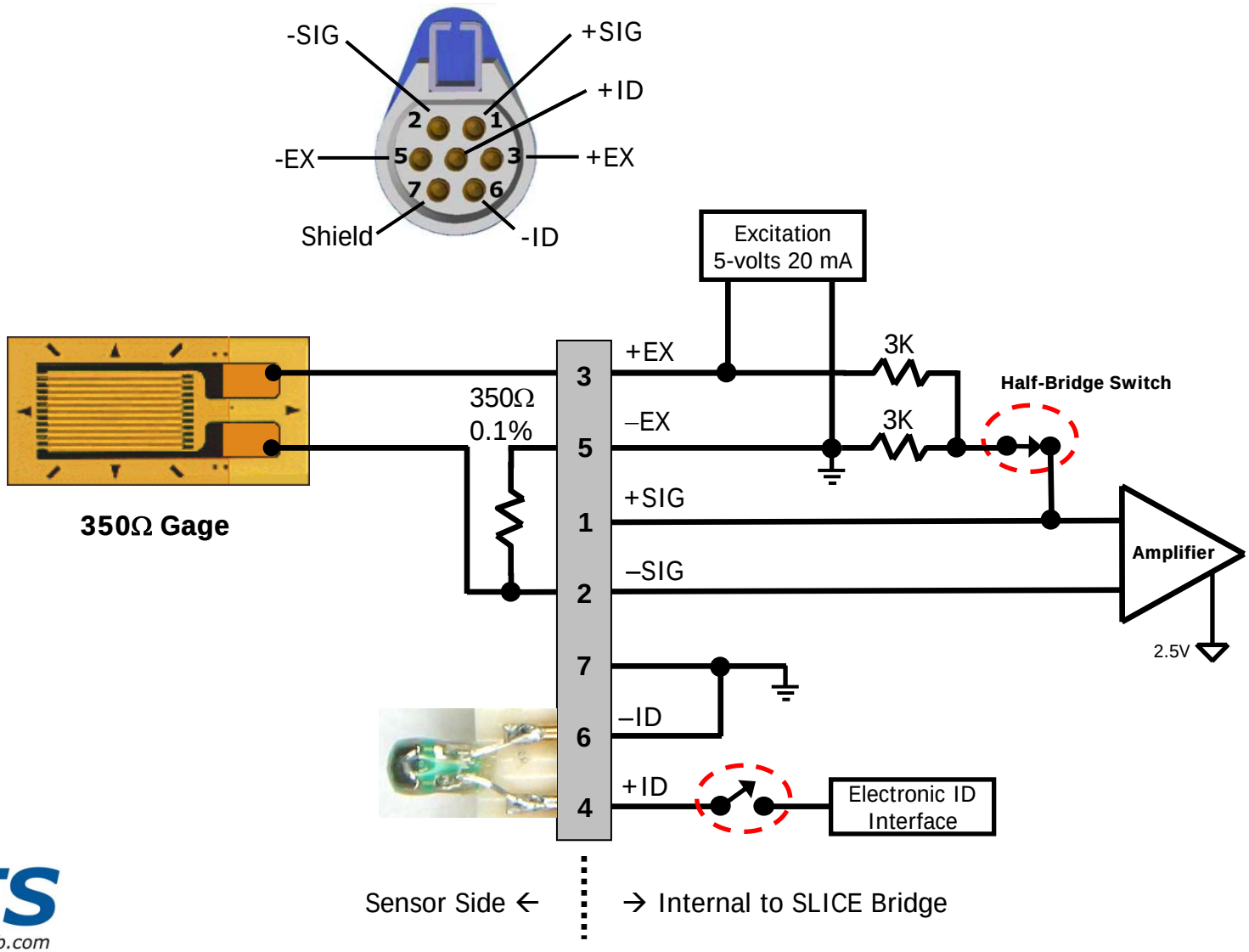
Strain Gage 2-wire Connection



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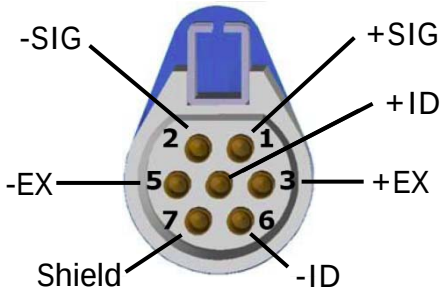
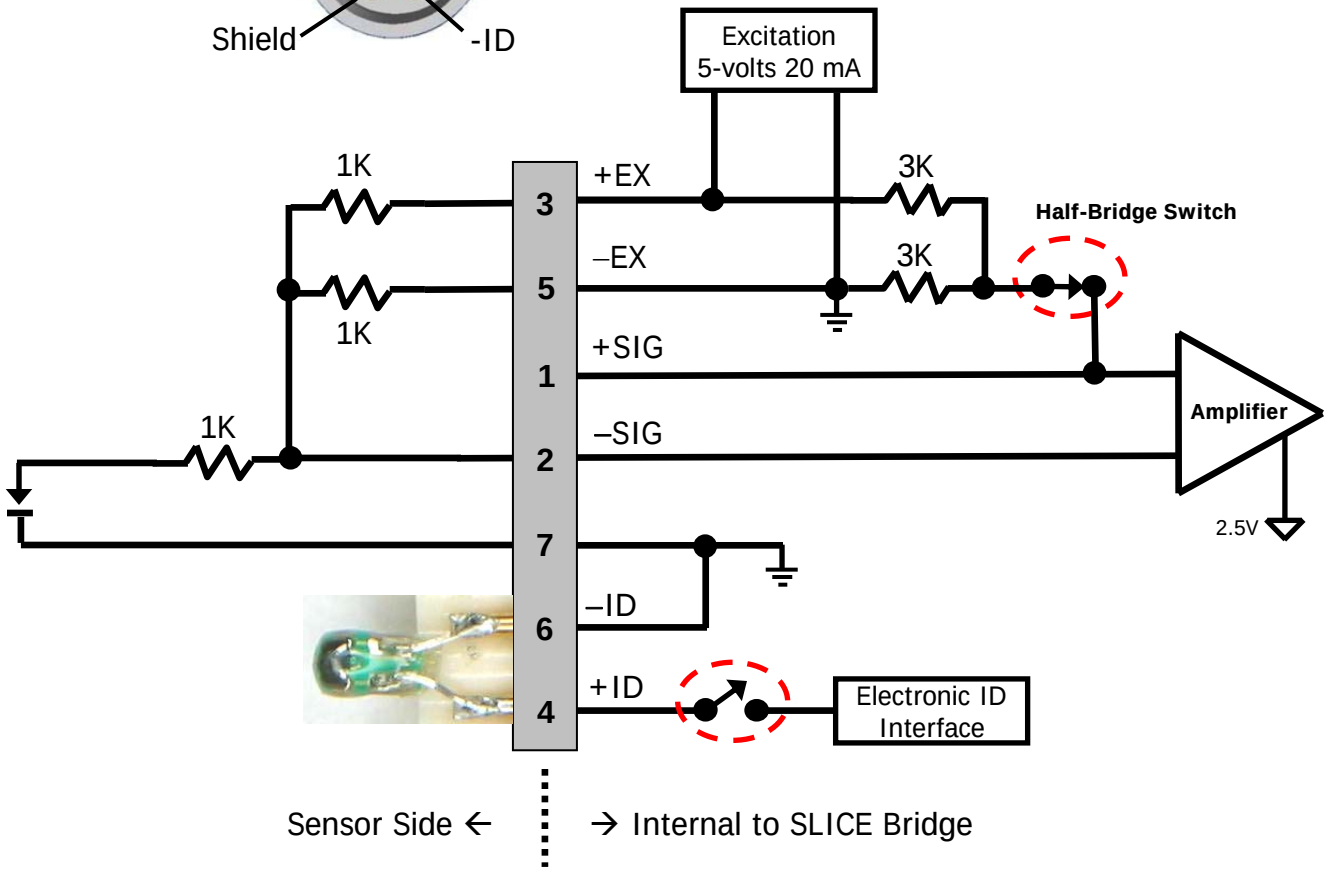
Switch Closure



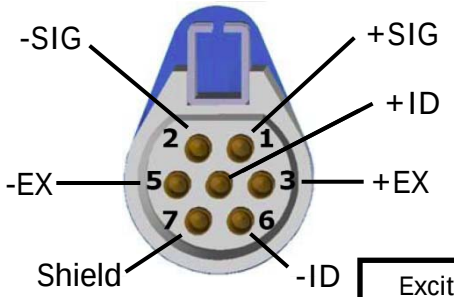
Example Sensor Settings
- Half-Bridge Mode
- Proportional to Excitation = No
- Sensitivity = 1.000 mV/EU will scale data in mV at input. Switch closure as shown gives 833 mV deflection.

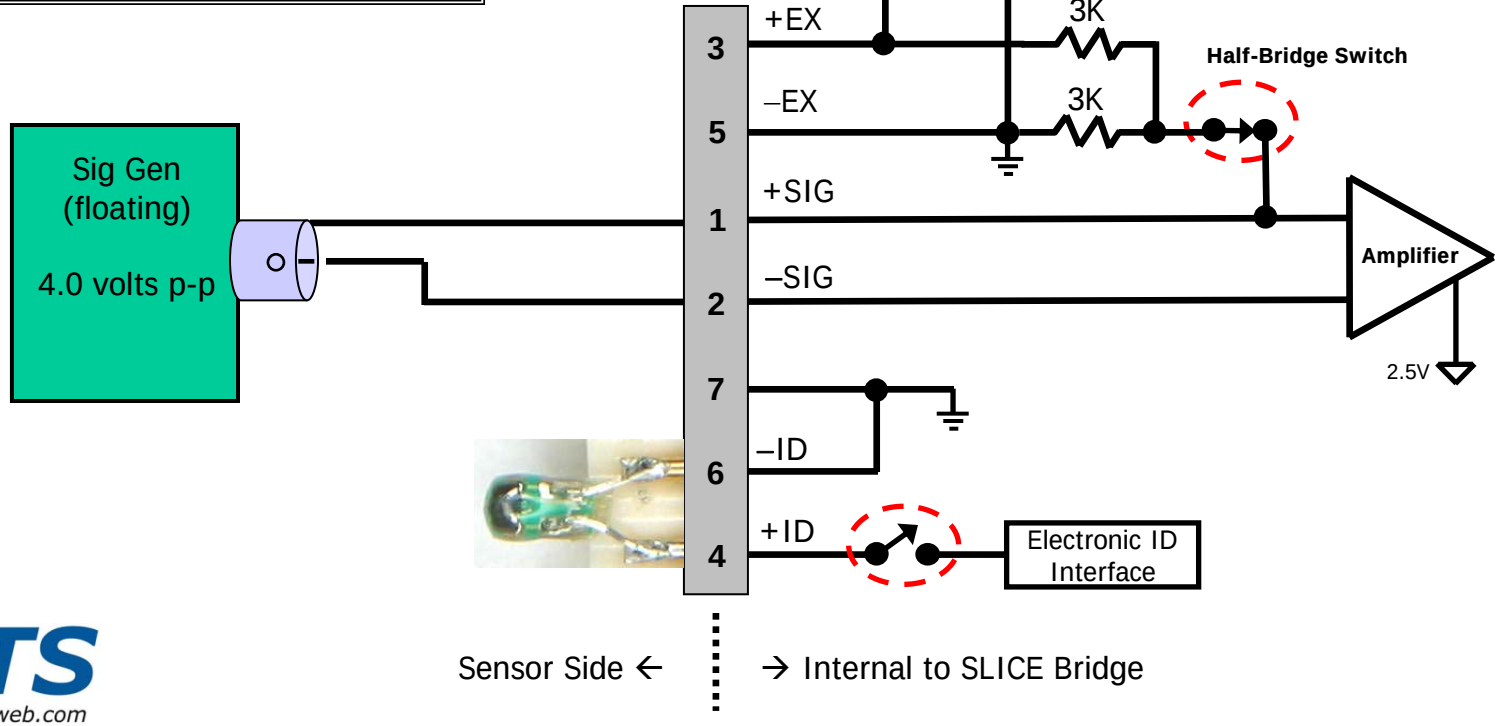


Signal Generator w/floating output

Notes:
- SLICE input range is 0-5 volts WRT SLICE power ground and –Excitation.
- Both sides of input amplifier must be connected either externally or +Signal via ½ bridge mode.
- Signal generator must float WRT ground or alternate connection method must be used.
- Input range does not quite extend to 0 & 5 volts. Best to use signals under 4.5-volts p-p.

Sample Sensor Settings
- Desired Range = 2000
- Sensitivity = 1.000 mV/EU
- Units = mV
- Sensor Type = Half-Bridge
- Proportional to Excitation = No
- Zero Type = None
- Remove Offset = No





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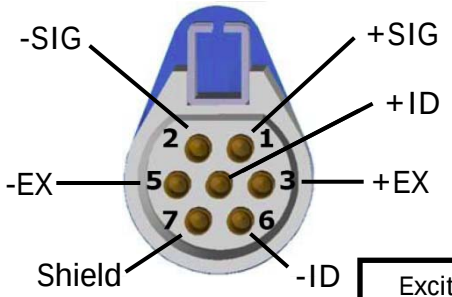
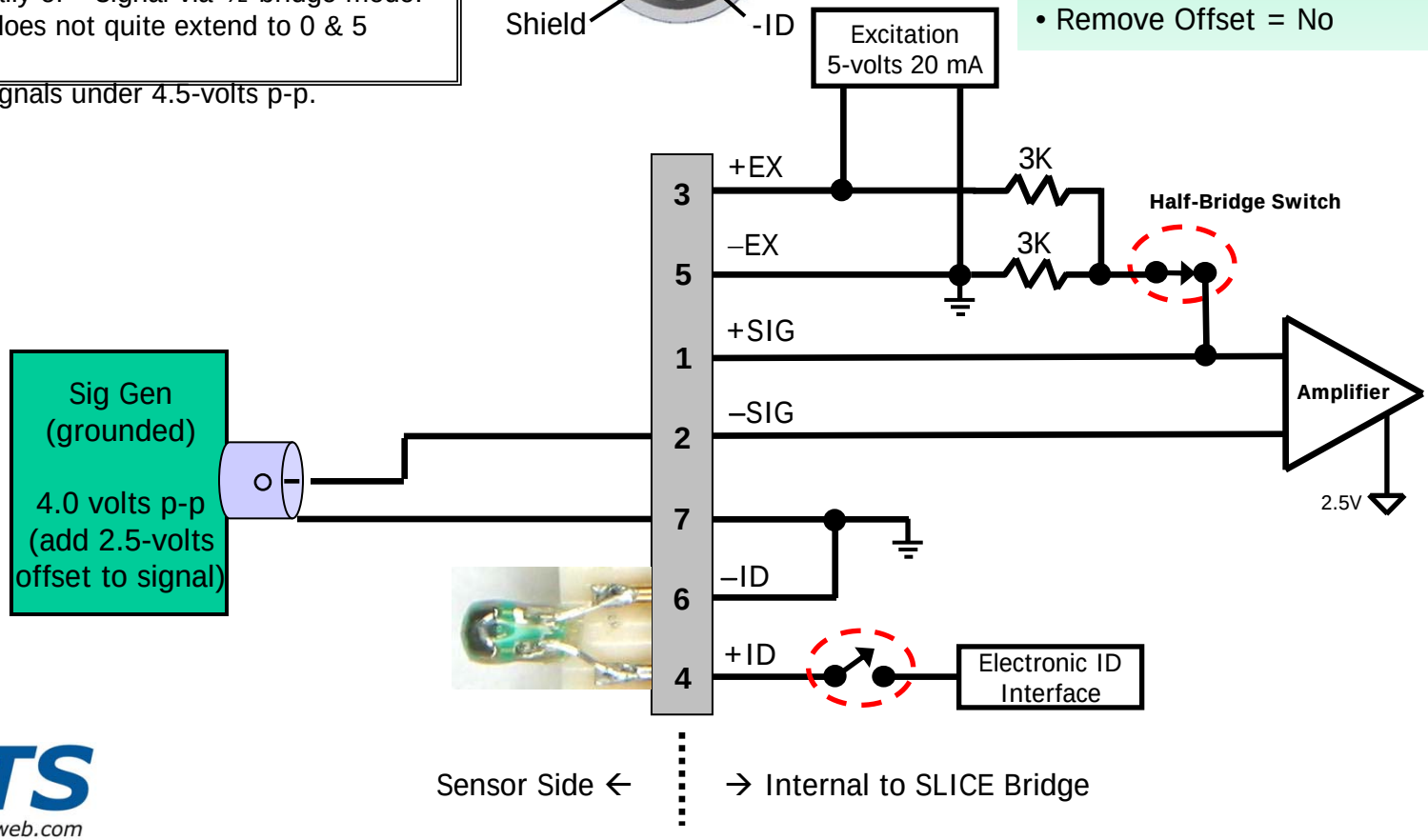
Signal Generator w/grounded output

Notes:
- SLICE input range is 0-5 volts WRT SLICE power ground and –Excitation.
- Both sides of input amplifier must be connected either externally or +Signal via ½ bridge mode.
- Input range does not quite extend to 0 & 5 volts.
  Best to use signals under 4.5-volts p-p.



Sample Sensor Settings
- Desired Range = 2000
- Sensitivity = 1.000 mV/EU
- Units = mV
- Sensor Type = Half-Bridge
- Proportional to Excitation = No
- Zero Type = None
- Remove Offset = No



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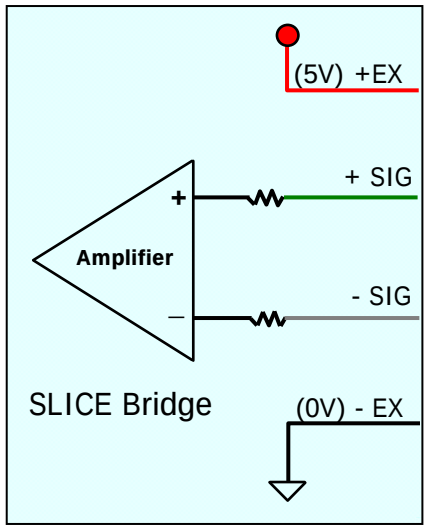
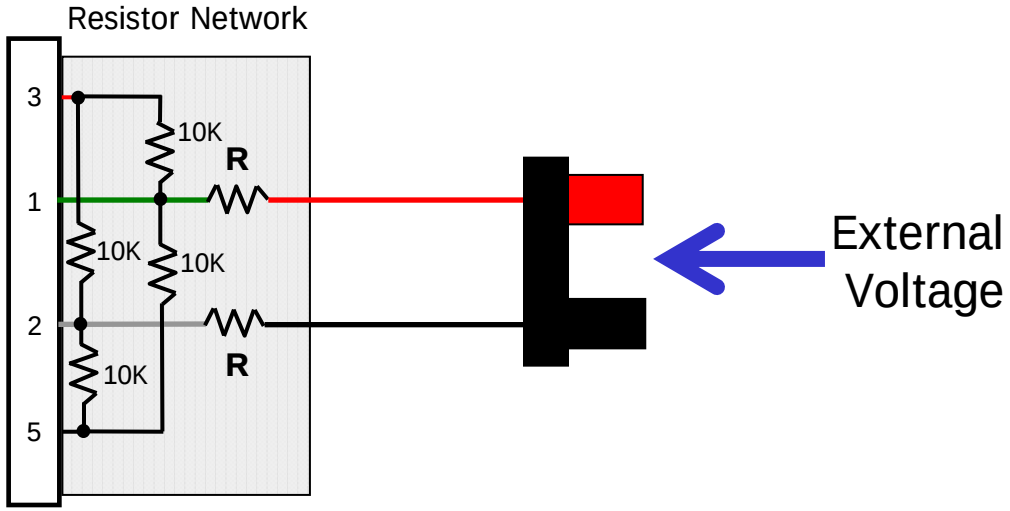
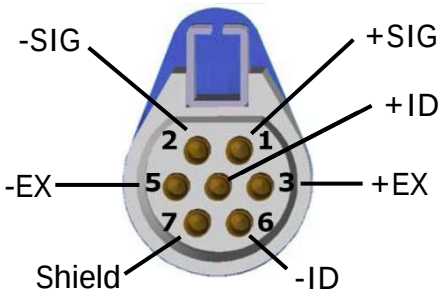
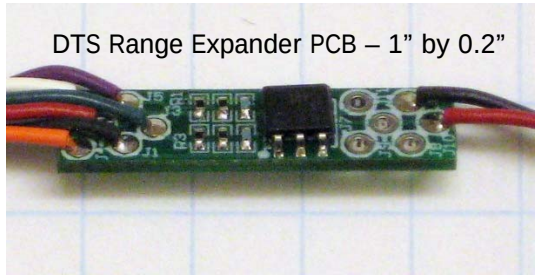
Measuring Large Differential Voltages









Approx MAX External Voltage **Vmax**	Resistance **R**	* Sensitivity mV/V
+/-20V	49.9K	91.07
+/-40V	95.3K	49.85
+/-60V	150K	32.26

* Sensitivity calculation….

$$\left(\frac{5}{(5 + R)}\right) \text{ X } 1000$$

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Appendix I: SLICEWare XML File Format

Overview

The .DTS file is an XML based file that contains information about the overall test and the individual channels. Some of the information may be redundant with information stored in the binary channel header.

The attributes and relationships of each XML node are described below.

XML Structure

<Test>

The Test tag is the outer most tag. It contains the following attributes and describes details common to the entire test.

Name	Data Type	Description
Id	String	The name of the test, typically the same as the .DTS file name
Description	String	The description of the test provided by the user
InlineSerializedData	Boolean	
Guid	Windows UUID string	A unique identifier assigned to each event

<Modules>

Within the Test node will be a list of modules contained within a <Modules></Modules> tag. A module corresponds to a data acquisition system—for example, an entire Stack. Each module will have its own <Module> tag with the following attributes:

Name	Data Type	Description
AaFilterRateHz	Integer	The name cut off frequency of the hardware anti-alias filter used during the test
Number	Integer	A sequential number assigned to each module within the test
SerialNumber	String	The factory assigned serial number of the Base
NumberOfSamples	Integer	The number of samples stored in each channel file. This will be fewer than the number of samples originally requested by the user if the data has been subsampled or if only a portion of the data was downloaded.

Name	Data Type	Description
UnsubsampledNumberOfSamples	Integer	The total number of samples collected during data acquisition
PostTriggerSeconds	Double	The number of seconds of recorded data that the user requested after t=0
PreTriggerSeconds	Double	The number of seconds of recorded data that the user requested before t=0
RecordingMode	String	Either the value RecorderMode or CircularBuffer. Other values will be added in the future.
SampleRateHz	Integer	The rate at which sampling occurred during data collection
StartRecordSampleNumber	Integer	The sample number at which the start signal was first detected. The value will always be 0 when RecordingMode=CircularBuffer.
NumberOfChannels	Integer	The number of user configured channels within the module
InlineSerializedData	Boolean	

<TriggerSampleNumbers>

This is a list (possibly 0 length) of trigger sample numbers. In the circular buffer case, there will be one trigger sample number. In recorder mode, the trigger is optional. In the case of multiple event mode, there may be more than one trigger sample number.

<Channels>

The Channels tag contains a list of channel elements. It should have the same number of entries as NumberOfChannels in the Module tag. The type of the child elements will depend on the type of signal conditioning SLICE used.

<AnalogInputChanel>

The AnalogInputChanel tag corresponds to a Bridge SLICE channel. (Note: There is a typo in the tag name and "Chanel" is misspelled. It has been retained for backward compatibility.) Many of the attributes indicate how the channel was configured during the test. The AnalogInputChanel element has the following properties:

Name	Data Type	Description
ChannelType	String	This identifies the representation of the data contained in the .BIN file. Currently this value is always expected to be DTS.Serialization.Test+Module+AnalogInputChannel.
Number	Integer	The channel number within the signal conditioning unit. In a Bridge SLICE, channels are numbered 0–2.

Name	Data Type	Description
Start	Date	Currently unused
Bridge	String	Either FullBridge or HalfBridge
BridgeResistanceOhms	Integer	The specified bridge resistance used during the shunt check
ChannelDescriptionString	String	The user provided description for the channel
Description	String	The user provided description for the sensor; currently the same as ChannelDescriptionString
DesiredRange	Integer	The user requested full scale
Sensitivity	Double	The sensitivity of the sensor in either mv/V/EU or mv/EU depending on ProportionalToExcitation
SoftwareFilter	String	The requested filtering to apply to this channel. Stored data is unfiltered, and this value must be used to apply proper filtering. Typical values are "1650hz" for CFC1000.
ProportionalToExcitation	Boolean	Indicates if the output of this sensor is proportional to excitation. Used in conjunction with Sensitivity.
IsInverted	Boolean	*(Optional)* Indicates if the data should be inverted before presenting to the user. If missing, this attribute is considered 'false'.
IsSubsampled	Boolean	*(Optional)* Indicates if the data stored on disk is at a lower sample rate than the original data collection. If missing, this attribute is considered 'false'.
Eu	String	The user provided Engineering Units (EU) (e.g., mm, g, or msec2)
SerialNumber	String	The serial number of the sensor used with this channel
CalSignalEnabled	Boolean	Applies to IEPE SLICE only.
ShuntEnabled	Boolean	For Bridge SLICE only. Indicates if the user requested the channel be shunted during diagnostics.
RemoveOffset	Boolean	Indicates if the user requested hardware offset compensation be used during diagnostics
ZeroMethod	String	Identifies the type of software offset compensation that should be used. If the value is "UsePreCalZero," then the Pre Calibration zero value stored in the channel file should be used. If the value is "AverageOverTime," then an average value computed from the channel data should be used.
ZeroAverageWindowBegin	Double	If ZeroMethod=AverageOverTime, this is the beginning of the window to be used for computing the average

Name	Data Type	Description
ZeroAverageWindowEnd	Double	If ZeroMethod=AverageOverTime, this is the end of the window to be used for computing the average
InitialEu	Double	A value provided by the user that should be subtracted from all scaled data in addition to the selected ZeroMethod
UnsubsampledSampleRateHz	Integer	The sampling rate used during data collection. Valid only if IsSubsampled=true.
MeasuredShuntDeflectionMv	Double	*(Optional)* If a shunt test was performed, the actual deflection of the shunt
TargetShuntDeflectionMv	Double	*(Optional)* If a shunt test was performed, the expected shunt deflection
MeasuredExcitationVoltage	Double	*(Optional)* The measured excitation voltage, if available. Used by SLICEWare for scaling proportional-to-excitation sensor data if "factory" excitation voltage is not available.
FactoryExcitationVoltage	Double	*(Optional)* The factory excitation voltage, if available. Used by SLICEWare for scaling proportional-to-excitation sensor data.
TimeOfFirstSample	Double	The time relative to t=0 of the first sample

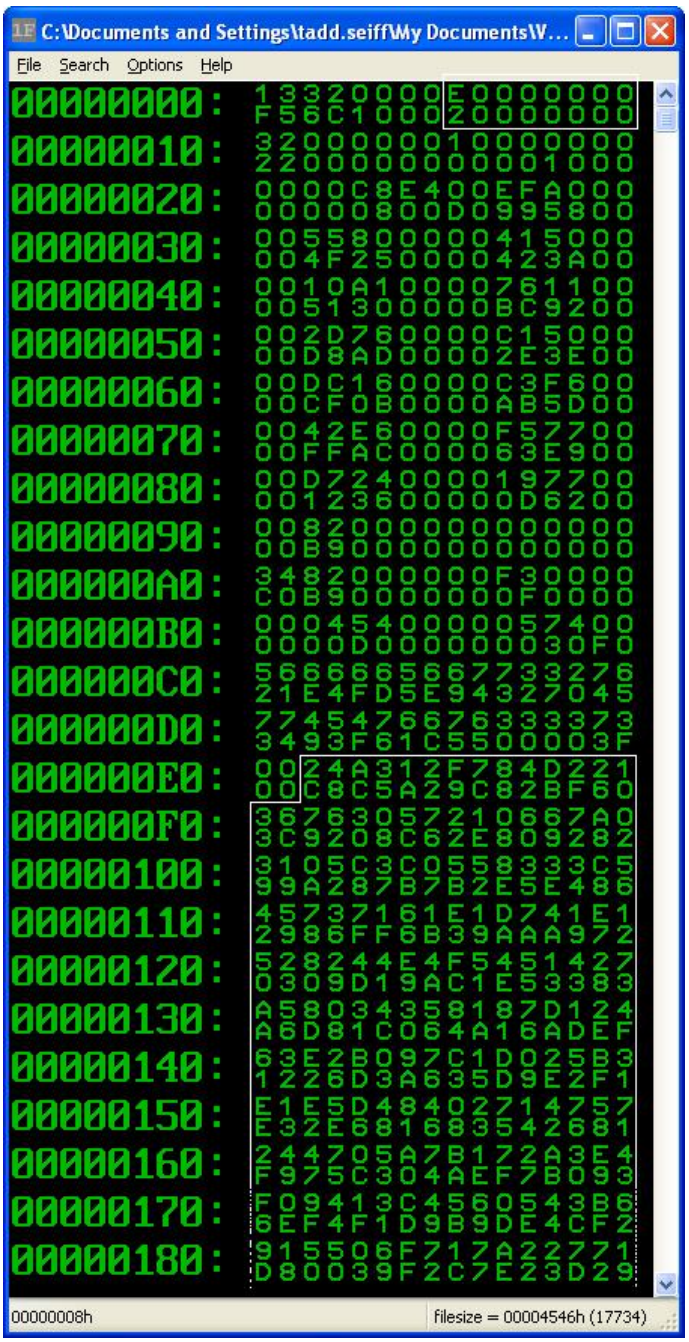
Appendix J: SLICEWare Binary File Format

Bin File Header

Offset	# of bytes	Data Type	Description
0	4	UInt32	Magic key to identify file: 0x2C36351F
4	4	UInt32	Version number of this file header (currently 1)
8	8	UInt64	Offset (in bytes) from start of file to where data samples begin
16	8	UInt64	Number of samples in this file
24	4	UInt32	Number of bits per sample
28	4	UInt32	0 = Unsigned samples, 1 = signed samples
32	8	Double	Sample rate
40	2	UInt16	Number of triggers. May be 0.
42	N = Number of triggers * 8	UInt64	Trigger sample number
N + 42	4	Int32	Pre Test zero level (in counts)
N + 46	4	Int32	Pre Test Cal level (in counts)
N + 50	8	Double	Pre test noise as a percent of FS
N + 58	4	Int32	Post test zero level (in counts)
N + 62	4	Int32	Post test cal level (in counts)
N + 66	4	Int32	Data-Zero level (in counts)
N + 70	8	Double	Scale factor MV (mV/Count)
N + 78	8	Double	Scale factor EU (eng-units/Count)
N + 86	2	UInt16	Number of bytes in engineering unit field + 1
N + 88	X = Length of EU field	Array/string	Engineering unit (without NULL termination)
N + X + 88	16	Char	16 character ISO code
N + X + 104	4	UInt32	CRC32 for entire file
N + X + 108 64bit (ulong) offset found in 3rd file field	Size of Sample Data	16-, 24-, or 32-bit depending on "Number of bits per sample"	DATA SAMPLES START HERE

Example File

Shown below is an example view of a .CHN file in HEXADECIMAL notation. The byte numbers are along the left side of the viewer. Boxed in white is first the DATA start offset and it can be seen that starting at the byte specified in this offset is the actual sample data. Note that it is prefaced by trailing "00" from the previous value and from then on, all sample data is consistently non-zero.



Additional Info

Note that the file is 'little-endian'—that is the values are serialized into the file LSB first. This is not important but should be considered if changes are to be made to the serialization procedure. It must only be consistent between read and write operations. The .NET serialization utilities currently used in SLICEWare have defaulted to this because the x86 processor architecture is 'little-endian'.

Take the data offset for example. The 8 bytes read E2 00 00 00 00 00 00 00, but this does not mean the data starts at byte #1.62850163 × 10e19. E2 is the LSB, so the offset is 00 00 00 00 00 00 00 E2, or byte #226d.

SLICE Base Firmware Update Procedure

To update the SLICE MICRO™ or SLICE NANO™ Base firmware, you need:

1. ***Hardware:*** SLICE USB cable or SLICE SSI Cable Kit.

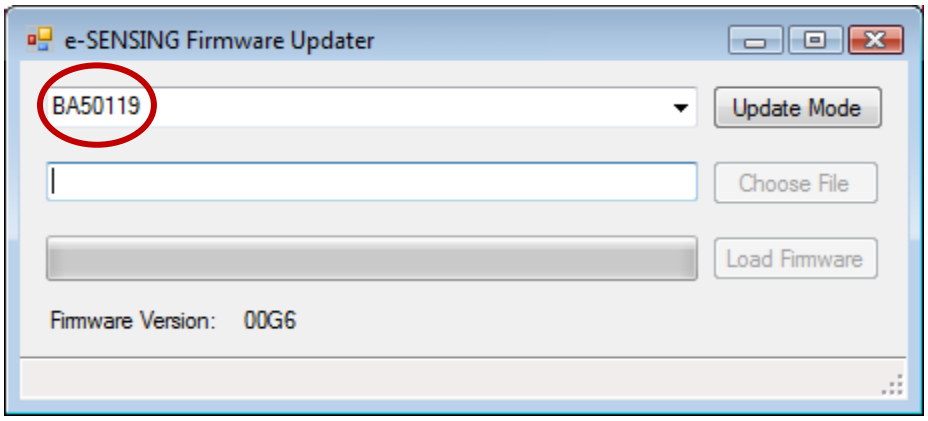
2. ***Software:*** ZIP file extracted on your PC. (This is typically provided by Technical Support via an attachment or web link.) The ZIP file contains the SLICE Firmware Updater program (eSENSING_FirmwareUpdater.exe) and required support files.

3. ***Firmware:*** Firmware version (*.sfw) you want to install.

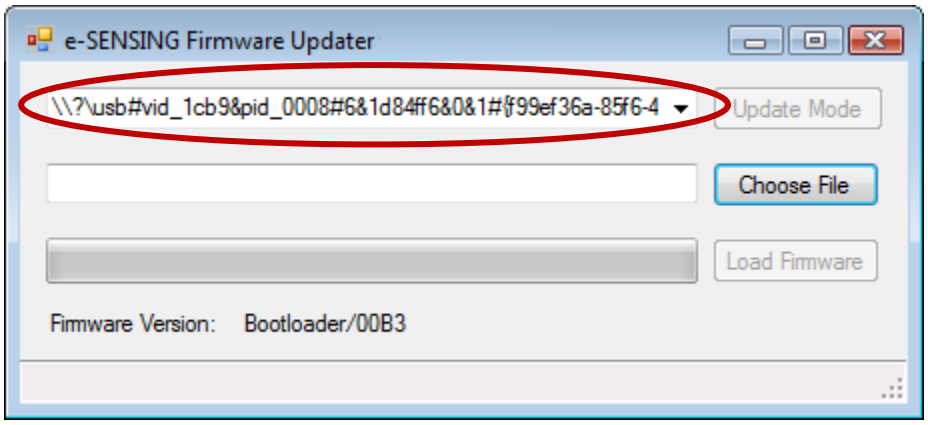
4. ***Procedure:***

   1. With PC on, connect the SLICE Base to the PC via USB. Power-up the SLICE Base.

   2. Start the SLICE Firmware Updater (eSENSING_FirmwareUpdater.exe). The screen will show the serial number of the connected Base:



3. Press Update Mode. The SLICE LEDs will flash. SLICE will disconnect, then reconnect. The internal ID of the SLICE Base will be shown:

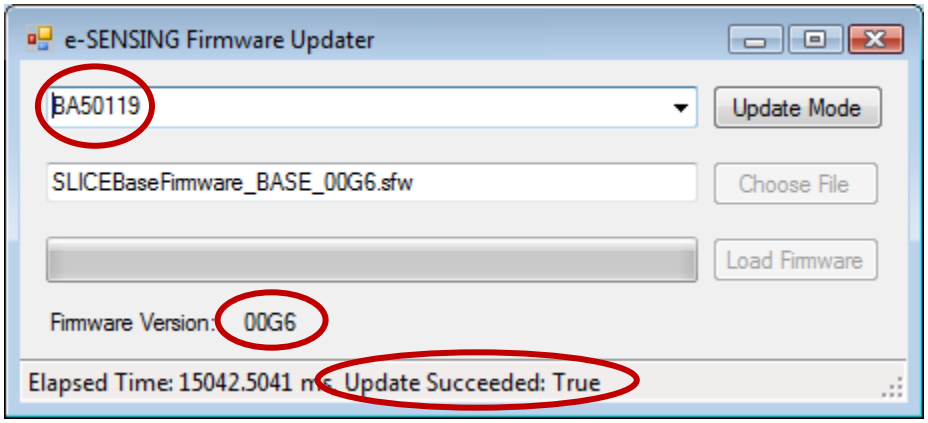


If this does not happen after 30 seconds, close then reopen the Firmware Updater program.

4. Press Choose File. Select the file (*.sfw) you want to use for update.

5. Press Load Firmware. The progress bar will show the progress of the firmware update. When the update is complete, the SLICE Base will reboot.

6. After reboot, the serial number and new firmware version will be shown. The status bar will indicate that the firmware update was successful.



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DECLARATION OF CE CONFORMITY

Description	Model
Data Acquisition Module	**SLICE MICRO Base**
Data Acquisition Module	**SLICE NANO Base**
Data Acquisition Module	**SLICE MICRO Bridge**
Data Acquisition Module	**SLICE NANO Bridge**
Data Acquisition Module	**SLICE MICRO Accel**
Data Acquisition Module	**SLICE MICRO ARS**
Back-up Battery	**SLICE NANO Stack Battery**
Back-up Battery	**SLICE Supercap**
Distribution Unit	**SLICE Distributor**
Distribution Unit	**SLICE System Interface**
Distribution Unit	**SLICE End-of-Chain Terminal**
Distribution Unit	**SLICE System Interface Auxiliary Terminal**

The undersigned hereby declares that the products listed above, manufactured by DTS, Inc., Seal Beach, California, USA, conform to the following directive and standards:

Applicable Council Directive: **89/336/EEC - Electromagnetic Compatibility**

Applicable Harmonized Standards: **EN 55022:1998, EN 55024:1998**

Stephen Pruitt, President
DTS, Inc.

July 30, 2010
Date

SLICE User's Manual
Revision History

Date	By	Description
25 Aug 2011	EKK	Updated sections 2.3, 2.3.1, 2.3.3, 3.1, 3.2, 3.3.2, 3.4, 5.1, 5.2.1 and 5.2.2. Removed section 2.3.4 (Digital SLICE) and any references. Updated options for Accel SLICE (now section 2.3.4, was section 2.3.5). Replaced illustration in Section 4 with one from July 2011 appendix. Removed SLICE Buyer's Guide (was Appendix A) and any references. Revised Appendix B (now Appendix A). Updated Appendix J (now Appendix I) and broke out "SLICE Base Firmware Update Procedure" into separate appendix. Added new appendix for "SLICE Control Binary File Format." Updated Appendix I (now Appendix H). Other minor changes were made that were not technically significant. (Version 1.0e)
24 Feb 2011	EKK	Modified sections 2.3.11 and 2.3.13. (Version 1.0d)
7 Feb 2011	EKK	Added PDF bookmark for CE conformity page. (Version 1.0c)
6 Dec 2010	EKK	Updated Appendix D (SLICE System Interface (SSI). AUX connector pin assignments completely revised (pg 2). Added SLICE mating connector P/N and removed content on right half of page (pg 3). (Version 1.0b)
9 Aug 2010	EKK	Added Declaration of CE Conformity. (Version 1.0a)
10 May 2010	EKK	Initial release. (Version 1.0)