SLICE User's Manual

Version 1.0j
February 2018

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1. Contacting Technical Support

SLICE systems are designed to be reliable and simple to operate. Should you need assistance, DTS has support engineers worldwide with extensive product knowledge and crash test experience to help via telephone, e-mail or on-site visits.

The best way to contact a DTS support engineer is to submit a request through the DTS Help Center web portal (support.dtsweb.com). You must be registered (support.dtsweb.com/registration) to submit a request (https://support.dtsweb.com/hc/en-us/requests/new). Registration also enables access to additional self-help resources and non-public support information.

2. SLICE Overview

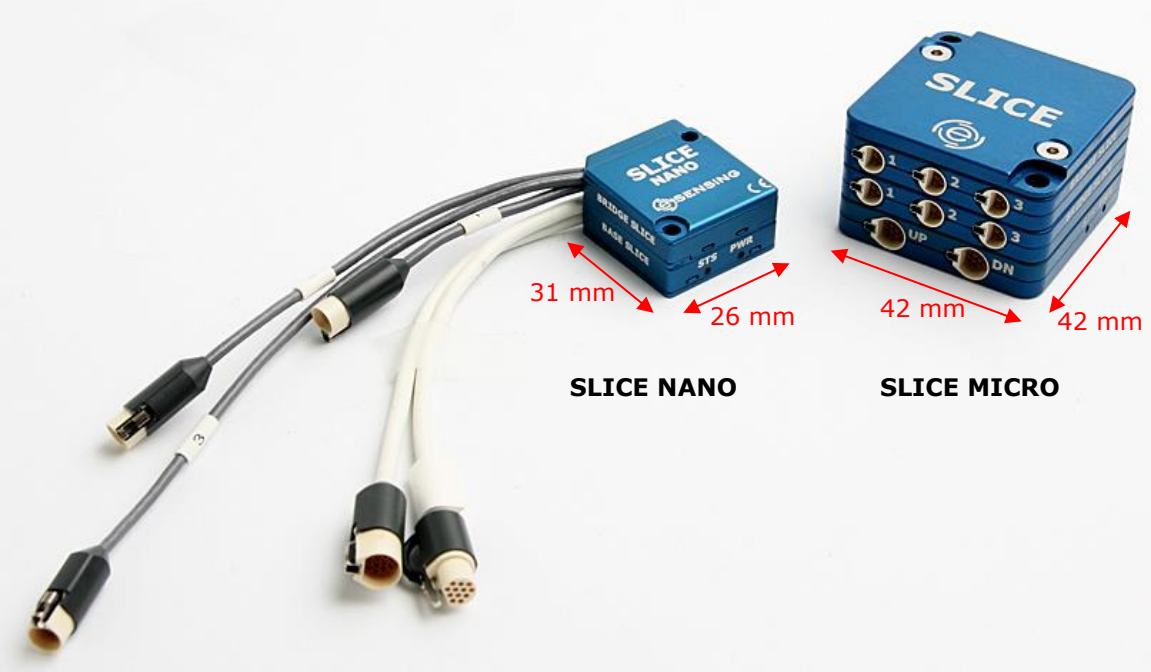
SLICE is an ultra-small, low-power, high-shock-rated data acquisition system. SLICE is a standalone system with microprocessor, memory, sensor excitation and signal conditioning with options for built-in battery and internal sensors. Systems from 3 to hundreds of channels can be built-up in 3 channel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

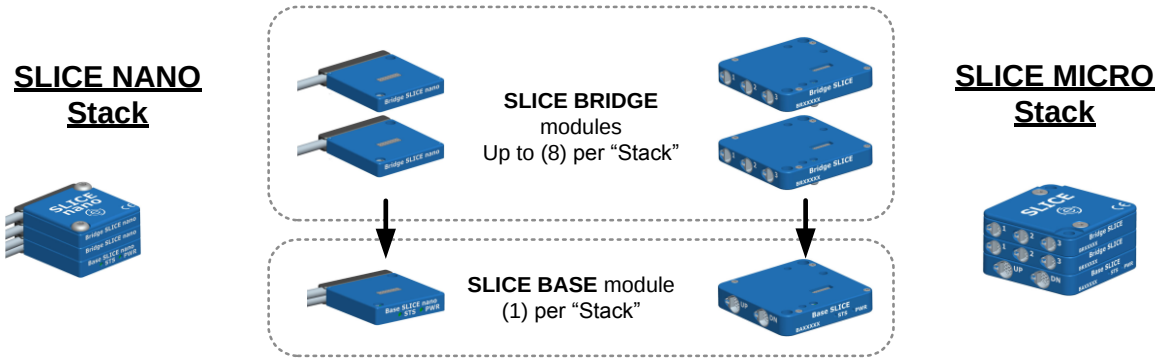
They have the exact same function and circuit boards inside. SLICE MICRO has built-in connectors; SLICE NANO has wires with connectors.



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 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	Yes
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

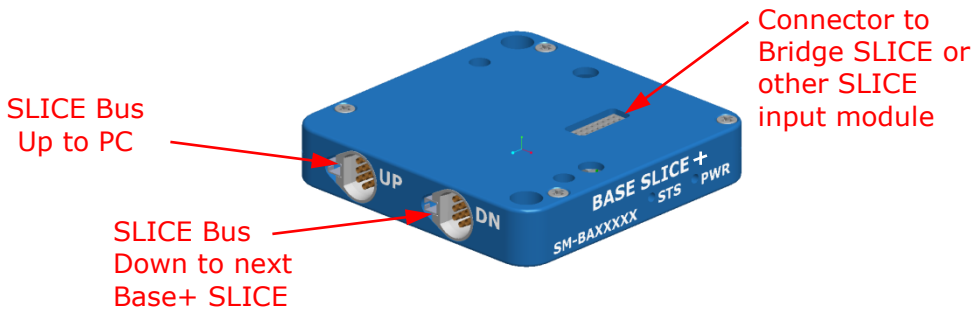
2.3.1. Base+ SLICE

See Appendix A for detailed specifications. See the DTS Support site 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
- 16 GB flash data memory standard (15 GB available for data storage)
- USB hub
- Power conditioning
- Control signals

A Base+ SLICE MICRO is shown below.



Note: For original Base SLICE specifications, see Version 1.0g of this manual.

# of Channels*	Maximum Sampling Rate (per channel)
3	500,000 samples per second (sps)
6	400,000 sps
9	300,000 sps
12	200,000 sps
15	200,000 sps
18	200,000 sps
21	200,000 sps
24	200,000 sps

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

How to Calculate Maximum Storage Times

With 15 GB available for data storage, there are a total of 7.5 G samples available in each Base+ SLICE (1 sample = 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.

$$\frac{7{,}500{,}000{,}000}{\text{Sampling rate (sps)} \quad X \quad \text{\# of channels in Stack}} = \text{\# of seconds}$$

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

$$\frac{7{,}500{,}000{,}000}{10{,}000 \quad X \quad 9} = 83{,}333 \text{ sec (23 hours)}$$

Example 2: 100,000 sps using a 6-channel SLICE Stack

$$\frac{7{,}500{,}000{,}000}{100{,}000 \quad X \quad 6} = 12{,}500 \text{ sec (3.47 hours)}$$

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.

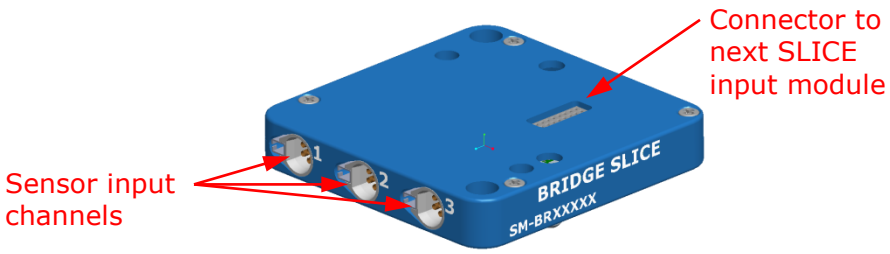
2.3.2. Bridge SLICE

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
- 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:

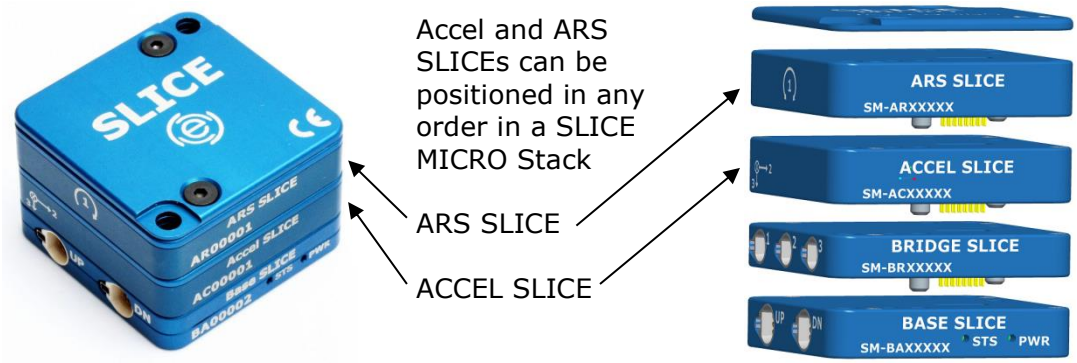
- 3 input channels
- One 2.2 mA constant-current source per channel at up to 24 V
- Software adjustable gain, anti-alias filters and offset
- TEDS sensor ID

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:

- Options from 25 to 500 g
- DC response



2.3.5. ARS PRO SLICE

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

- Uses DTS ARS PRO (see http://dtsweb.com/products/dtsars.php)
- Options from 300 to 8000 deg/sec
- DC response

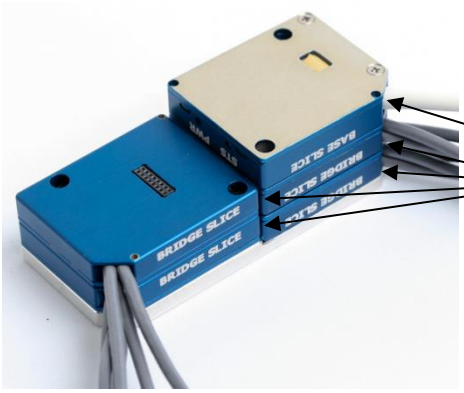
2.3.6. Battery SLICE

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
- 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.

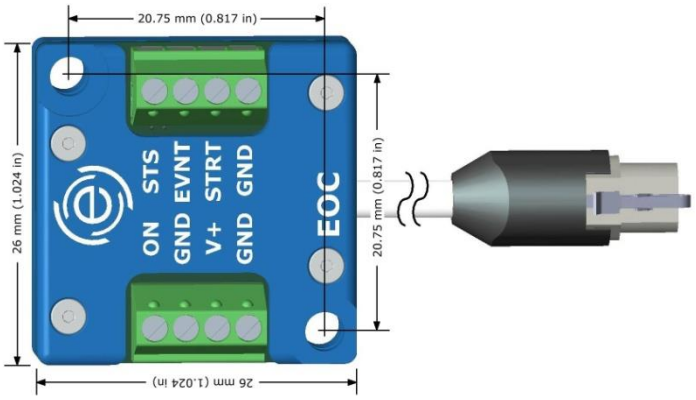


Stack Extender
- Example: 12 channel system
- 1 Base+ SLICE
- 4 Bridge SLICEs

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.



To DN port on Base+ SLICE MICRO or NANO

Connections:
- Up to 4 SLICE Stacks in chain with a maximum total current draw of 3 A
- 9 to 15 VDC input power
- ON signal
- Status output, start record input and event input signals

2.3.9. SLICE Distributor

See the SLICE Distributor User's Manual for detailed information.

The SLICE Distributor serves as a single interface supporting power, Ethernet communications and status signals for an extended SLICE system. It supports in excess of 200 channels via four SLICE MICRO/NANO chains (3 stacks per chain), and is designed to integrate in-dummy and withstand high shock environments. It supports 9-18 VDC input power and back-up battery input.

2.3.10. SLICE USB Interface

See Appendix C 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.)

2.3.11. SLICE Ethernet Interface

See Appendix D 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:

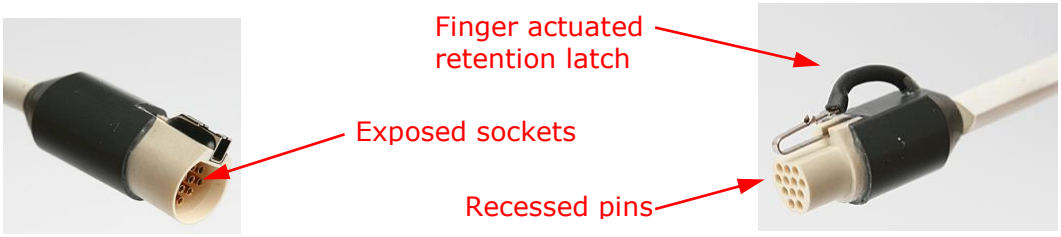
- 2 SLICE Stack chains
- Ethernet communications
- 9 to 15 VDC input power
- ON/OFF switch
- Manual Start/Event
- AUX input (battery, trigger, etc.)

2.3.12. 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

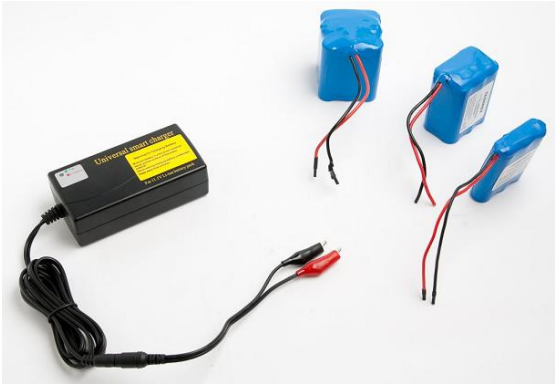
DTS offers some commercial-off-the-shelf batteries for operation of SLICE systems. Batteries must be disconnected from the SLICE system before connecting to a charger.

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 the SLICEWare User's Manual for detailed information. Appendices G and H provide information regarding file formats. See the DTS Support site for information on how to update 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) driver is 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 E.*
- 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.

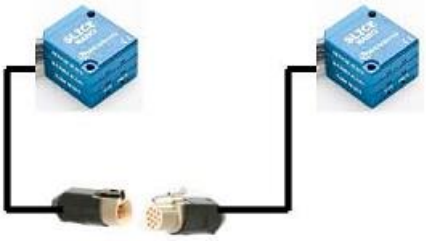
SLICE MICRO Base units can be connected together via a daisy-chain cable. SLICE NANO Base units can be connected to each other directly or via a daisy-chain extension cable.

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

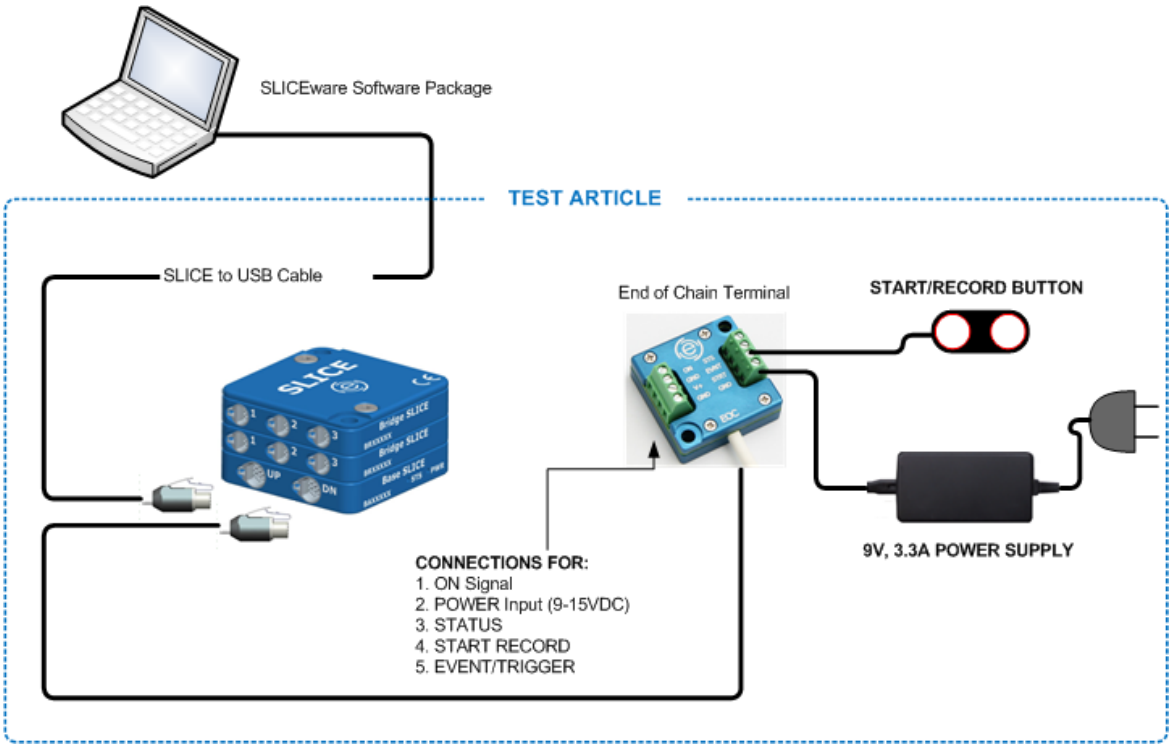
The SLICE system runs on DC power. Acceptable input power can range from 9 V minimum to 15 or 18 V maximum, depending on the accessories used with your system. Do not exceed the maximum input power for the accessory you are using.

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	

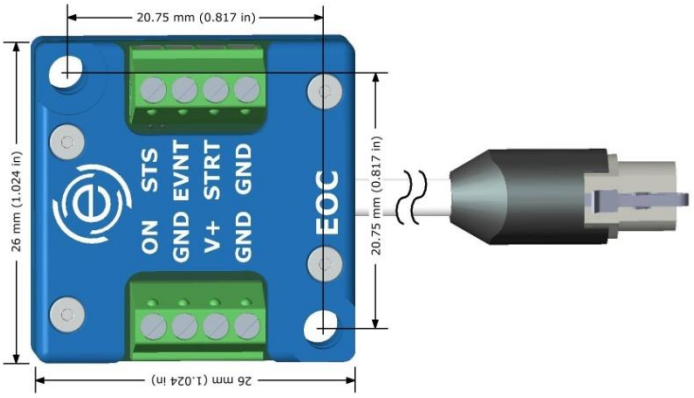
3.5. Using the End-of-Chain (EOC) Terminal

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.

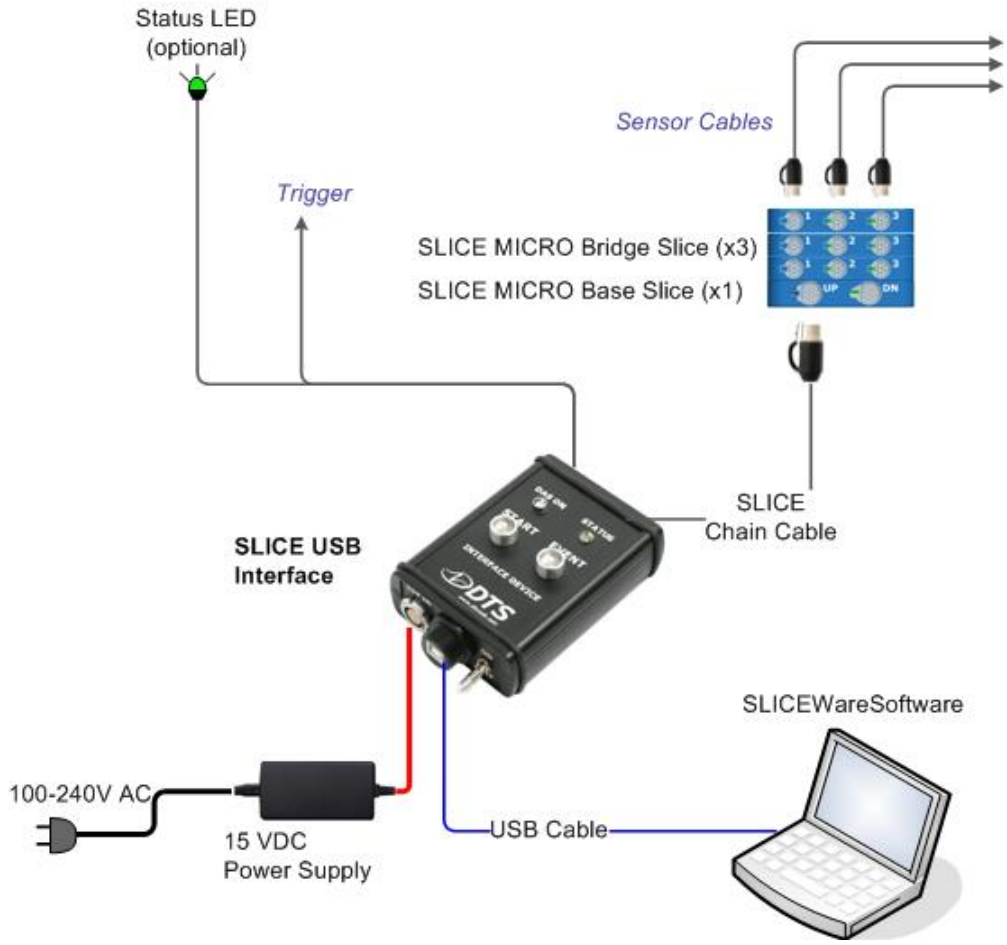


To DN port on the last Base+ SLICE MICRO or NANO in a SLICE

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

3.6. Using the SLICE USB Interface

The SLICE USB Interface is designed for bench-top, non-rugged use. See the example diagram below.

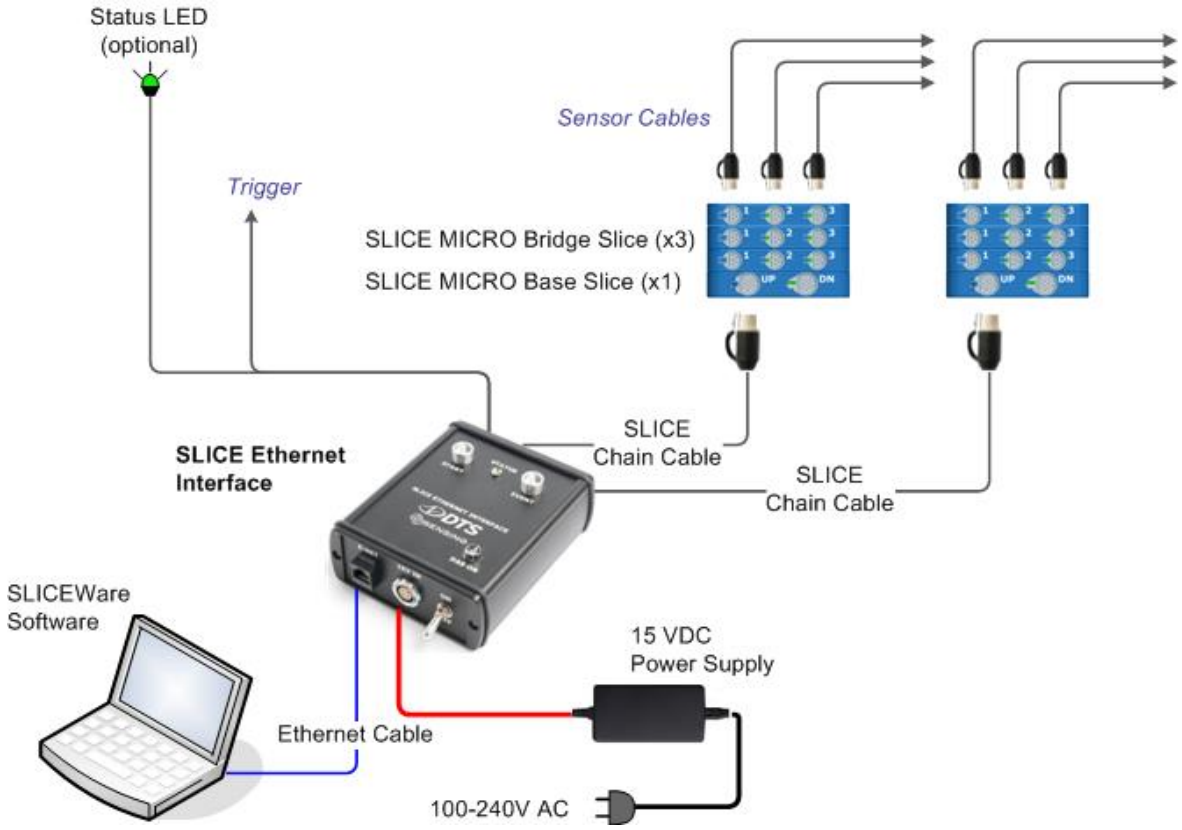


Notes:

- 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.

3.7. 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.



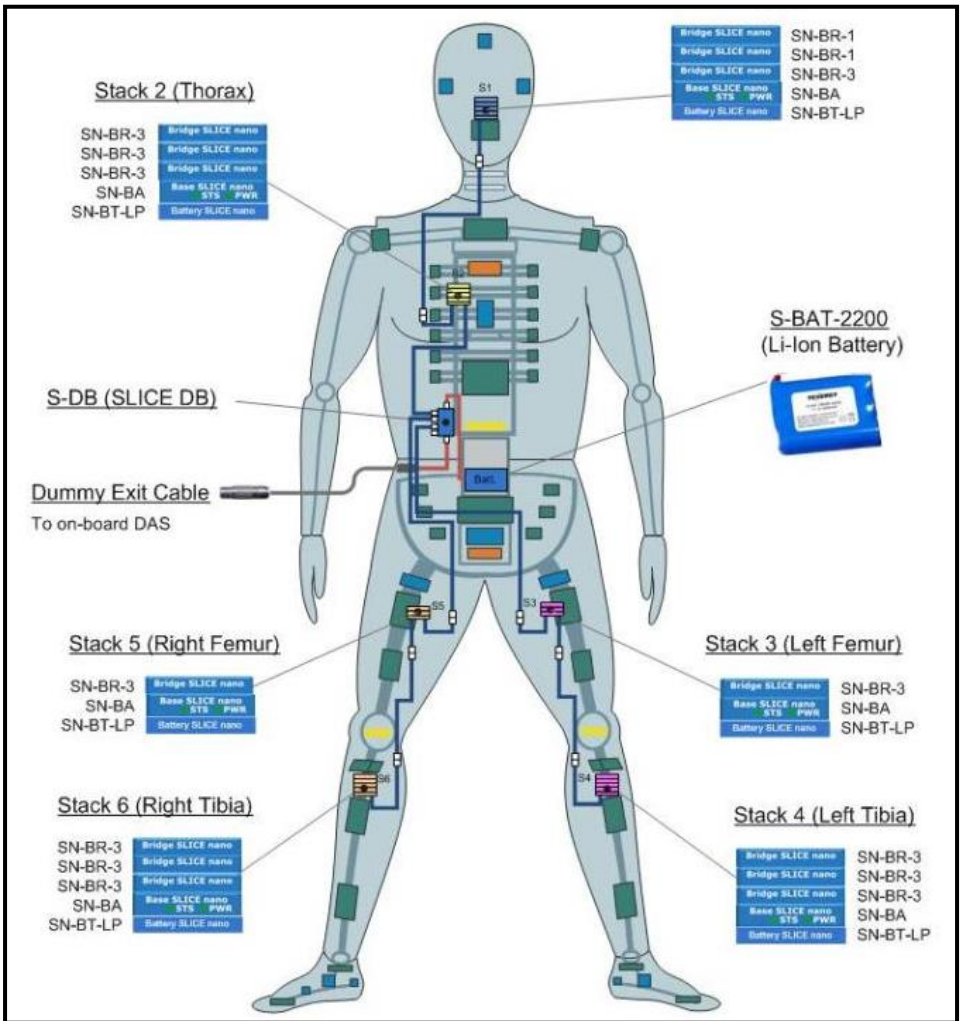
Notes:

- 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.

3.8. 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.

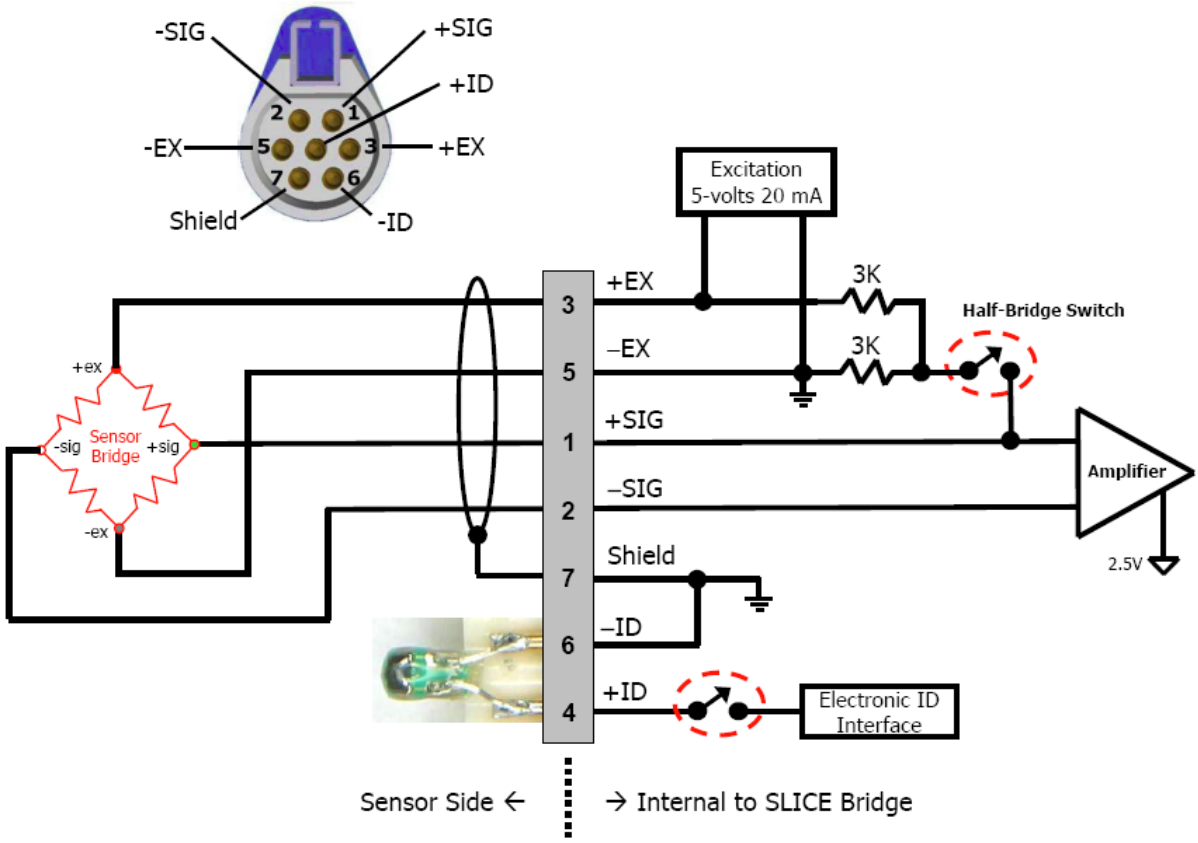


SLICE Application Diagram: 42-channel integrated SLICE NANO for H3-50% Dummy

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 F.*

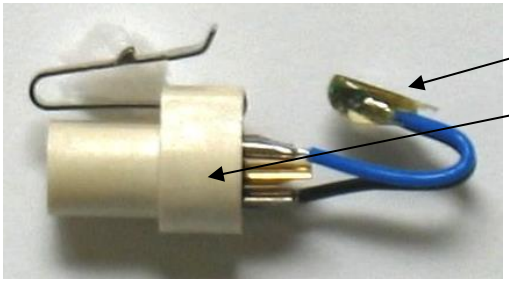
The diagram below shows a common 4-wire bridge sensor connection to a Bridge SLICE input channel.



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

See the SLICEWare User's Manual for detailed information. Appendices G and H provide information regarding file formats. See the DTS Support site for information on how to update firmware.

5.1. Basic Requirements

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

- 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 can be logged.)

5.2.2. Data Collection Modes

SLICE supports four data collection modes: Circular Buffer, Recorder, Hybrid Recorder, and Continuous 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.

5.2.2.3. Hybrid Recorder Mode

Hybrid Recorder mode starts when a Start Record signal is received and continues until the unit receives a trigger signal and then records for the post-trigger time specified by the host software. The trigger signal marks the T=0 point and all data recorded is available for download.

5.2.2.4. Continuous Recorder Mode

Continuous Recorder mode starts when a Start Record signal is received and continues until the Start Record signal is released. The unit will then re-arm for another event. The LEDs on the unit will flash blue slowly then rapidly, and then the STATUS LED will become solid blue, indicating the unit is fully armed. The unit will continue to record new events until it records the number of events specified by the host software. If a trigger signal is received after the unit has re-armed the unit will disarm and no longer attempt to re-arm.

5.2.3. Multiple-Event Modes

All SLICE data collection modes have an equivalent multi-event arming mode. A unit armed in a multiple-event mode will re-arm when an event completes. The unit will stop re-arming when the number of events specified by the host software has been recorded.

5.2.4. Auto-Arm Data Collection

SLICE can be placed in an auto-arm mode that will cause the unit to arm automatically when the power cycled. The unit can be placed into this mode and record with any data collection mode.

NOTE:

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

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.

To initialize SLICE MICRO/NANO systems without power back-up:

1. Apply power to the Base.
2. Connect the SLICE system to the PC via the comm cable.
3. Initialize the software to enable communication.

If your system includes a battery (SLICE NANO Stack Battery or SLICE HG system), it is important that the internal capacitors be allowed to charge briefly before system initialization. An ON hardware signal is used to initialize the SLICE system; be sure to disable the ON signal prior to applying power.

To initialize SLICE NANO/HG systems that include power back-up:

1. Remove the hardware ON signal from your system.
2. Apply power to the Base.
3. Wait ~15 seconds to allow the internal capacitors to charge briefly.
4. Enable the hardware ON signal and connect the SLICE system to the PC via the comm cable. (The LEDs will complete the power up sequence as soon as the ON signal is applied.)
5. Initialize the software to enable communication.

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.

Specifications

Number of SLICEs Per Stack*	Total Channel Count	Maximum Sampling Rate SPS/Channel
1	3 ch	500000
2	6 ch	400000
3	9 ch	300000
4	12 ch	200000
5	15 ch	200000
6	18 ch	200000
7	21 ch	200000
8	24 ch	200000

*Not including the one required BASE+ SLICE per stack

BASE+ SLICE (NANO & MICRO)

One (1) required per stack – system microprocessor & memory

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")
Mass:	MICRO 28 g (0.99 oz), NANO 14.2 g (0.50 oz)
Connectors:	Omnetics, circular locking, 12-pin MICRO integrated, NANO cable assembly
Compatibility:	BASE+ works will all legacy NANO & MICRO

DATA RECORDING

Modes:	Recorder, circular buffer, multiple event, arm on power-up, and other modes available
Memory:	16 GB non-volatile flash per SLICE stack
Sample Rate:	Minimum 10 sps per channel
<See Chart for Max:	Up to 200k sps on ≤24 channels per stack Up to 500k sps on ≤3 channels per stack

TRIGGERING

Hardware Trigger:	Contact closure & TTL logic-level (active low)
Level Trigger:	Positive and/or negative level on any active sensor channel (first level crossing of any programmed sensor triggers system)

POWER

Supply Voltage:	9-15 VDC; >11 VDC when using Battery SLICE (NANO)
Current (Maximum):	70 mA @ 12 V plus sensor input SLICEs
Power Control:	Remote power control input for on/off
Protection:	Reverse current, ESD

SOFTWARE

Control:	SLICEWare, DataPRO, API
Operating Systems:	Windows® 7/8/10 (32- and 64-bit)
Communication:	USB; Ethernet available via SLICE Distributor

BRIDGE SLICE (NANO & MICRO)

Three (3) inputs for external sensors

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")
Mass:	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 35 kHz, programmable
Gain Range:	1.0-1280, programmable
Auto Offset Range:	100% of effective input range
Bridge Support:	Software controlled half-bridge completion
Shunt Check:	Emulation method, automatically calculated
Sensor ID:	Maxim Integrated (Dallas) silicon serial number
Linearity (typical):	≤0.2% (gain 1 to 320), ≤0.5% (gain >320)
Accuracy:	0.5% including reference uncertainty

ANALOG-TO-DIGITAL CONVERSION

Type:	16-bit SAR (Successive Approximation Register) ADC, one per channel, simultaneous sample of all channels.

EXCITATION

Method:	Independent regulator for each channel
Voltage:	5.0 V, up to 20 mA, short circuit safe
Power Management:	Shutdown when not armed or recording

POWER

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

ANTI-ALIAS FILTER

Fixed Low Pass:	4-pole Butterworth, standard knee frequency at 40 kHz
Adjustable Low Pass:	5-pole Butterworth set by software from 1 Hz to 35 kHz
Response:	Meets SAE J211/ISO6487 response corridors

ENVIRONMENTAL

Military Standard:	MIL-STD-810G
Operating Temp:	-40° to 60°C (-40° to 140°F) (Method 501,502)
Altitude:	-40°C @ 15240 m (50000 ft) (Method 500)
Vibration (Random):	Exceeds 810-G vibration (Method 514)
Humidity:	95% RH non-condensing
Shock:	500 g, 4 msec half sine 5000 g option (SLICE NANO only)

IEPE SLICE (NANO & MICRO)

Three (3) inputs for external sensors

Size:	MICRO 42 x 42 x 7 mm (1.65 x 1.65 x 0.28") NANO 26 x 46 x 7 mm (1.02 x 1.81 x 0.28")
Mass:	MICRO 28 g (0.99 oz), NANO 23 g (0.81 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 35 kHz, programmable
Gain Options:	1 or 10, user programmable
Auto Offset Range:	100% of effective input range at gain of 1
Sensor ID:	Works with EID or "TEDS" equipped sensors

ANALOG-TO-DIGITAL CONVERSION

Type:	16-bit SAR (Successive Approximation Register) ADC, one per channel, simultaneous sample of all channels.

EXCITATION

Current/Voltage:	2.2 mA constant current with 25 V source. Contact DTS for other options if needed.
On/Off Control:	Shutdown when not armed or recording

POWER

Voltage:	Supplied via BASE SLICE
Current (Maximum):	85 mA with sensors connected to all channels

ANTI-ALIAS FILTER

Fixed Low Pass:	4-pole Butterworth, standard knee frequency at 40 kHz
Adjustable Low Pass:	5-pole Butterworth set by software from 1 Hz to 35 kHz
Response:	Meets SAE J211/ISO6487 response corridors

ARS SLICE (MICRO only)

Built-in triaxial angular rate sensor

Size:	MICRO 42 x 42 x 9 mm (1.65 x 1.65 x 0.35")
Mass:	30 g (1.06 oz)
Number of Channels:	3 orthogonal axes
Range Options:	±300, ±1500, ±8k deg/sec
Bandwidth:	0–2,000 Hz
Current (Maximum):	75 mA (power supplied via BASE SLICE)

ACCEL SLICE (MICRO only)

Built-in triaxial accelerometer

Size:	MICRO 42 x 42 x 9 mm (1.65 x 1.65 x 0.35")
Mass:	30 g (1.06 oz)
Number of Channels:	3 orthogonal axes
Range Options:	±25, ±100, ±500 g
Bandwidth:	0–400 Hz (±25, ±100 g), 0–5,000 Hz (±500 g)
Current (Maximum):	65 mA (power supplied via BASE SLICE)

BATTERY SLICE (NANO only)

Optional back-up battery

Size:	NANO 26 x 31 x 4 mm (1.65 x 1.65 x 0.16")
Mass:	7 g (0.25 oz)
Charge Status:	Backup battery charges when input voltage to BASE SLICE is >11 VDC
Charge Time:	~15 min. from complete discharge to full charge (100 mA at input connector on Base)
Discharge Rate:	~5 seconds with 18 channels (1 Base + 6 Bridges)

CALIBRATION

Calibration Supplied:	NIST traceable
ISO 17025:	ISO 17025 (A2LA Accredited)
Service Options:	Standard, On-site & Service Contracts available

ACCESSORIES

See website for full line of SLICE NANO & SLICE MICRO accessories

SERVICES

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

WORLDWIDE SUPPORT

HELP CENTER (24/7/365 Access)
DTS Technical Centers
Global Sales Partners

HEADQUARTERS

Seal Beach, California USA

CONTACT US

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

DTS
www.dtsweb.com

Specifications subject to change without notice.
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SLICE NANO Base Pin Assignments

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

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SLICE NANO Bridge Pin Assignments

Channels 1, 2 and 3*

(looking into the connector)

Mating connector: DTS P/N 80000-04019

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

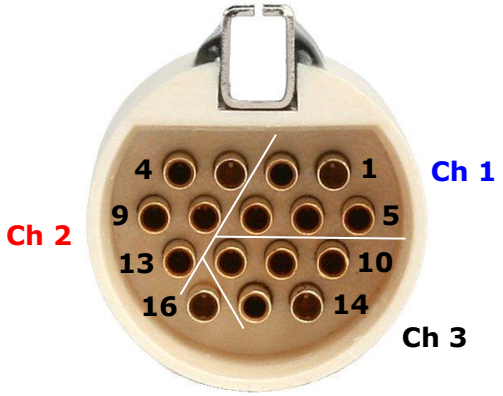
Mating connector + backshell + ID:
DTS P/N 13000-30120

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)

*** One connector; cable 10 cm in length

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

-Ex/-ID/Shield are common

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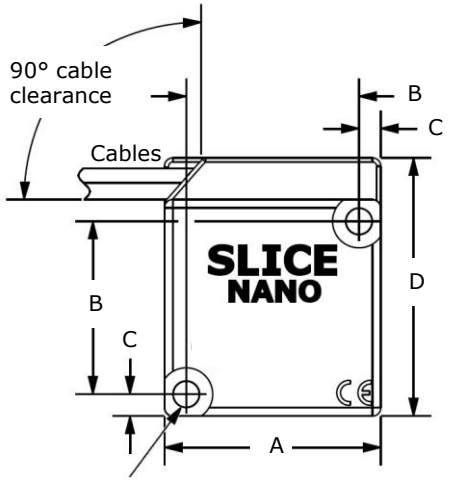
SLICE NANO Mechanical Specifications



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)
D = 46 mm (1.811 in)*

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

	Weight (±5 g)	Height
Lid	2.6 g	1.5 mm (0.059 in)
IEPE*	23 g	7 mm (0.276 in)
Bridge (1 conn)**	12.6 g	5.5 mm (0.217 in)
Bridge (3 conn)**	13.8 g	5.5 mm (0.217 in)
Base**	14.2 g	6.5 mm (0.256 in)
Battery	7 g (±1 g)	4 mm (0.157 in)
Extended Capacity Battery	20 g	16 mm (0.630 in)

** Includes cable assemblies
See the DTS Support site for future updates.

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)

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SLICE MICRO Pin Assignments

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

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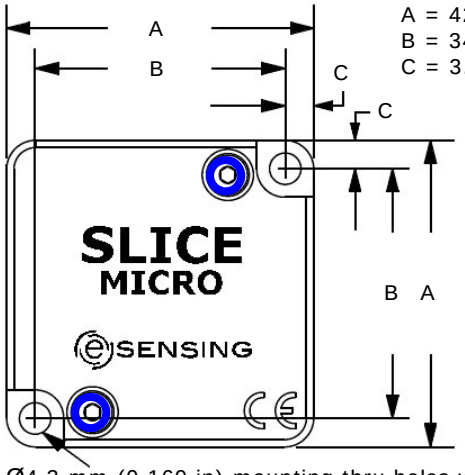
SLICE MICRO Mechanical Specifications



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)

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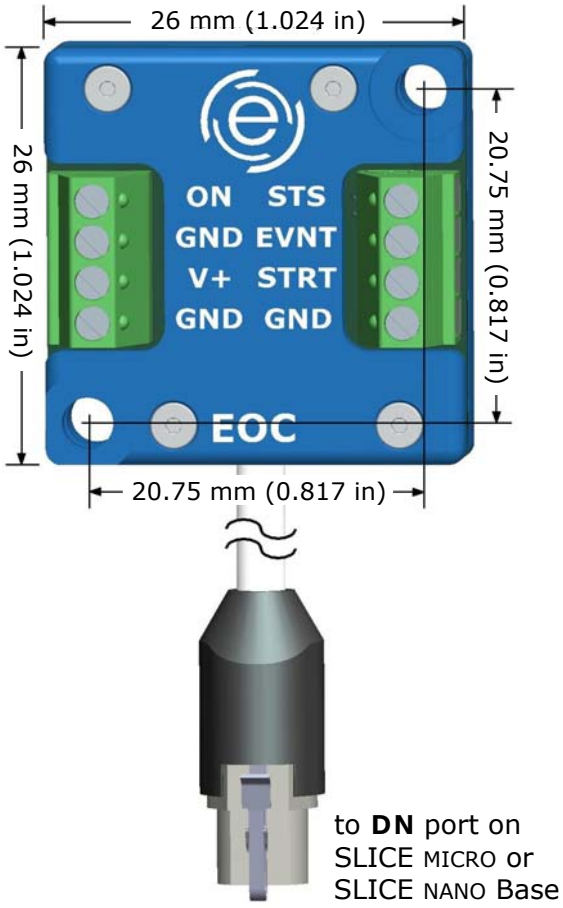
APPENDIX B – SLICE End-of-Chain Terminal

SLICE End-of-Chain Terminal



	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.

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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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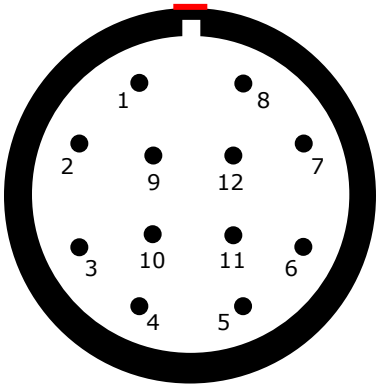
SLICE
(ECG.2B.312.CLL)

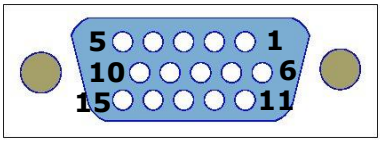


(panel view)

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.

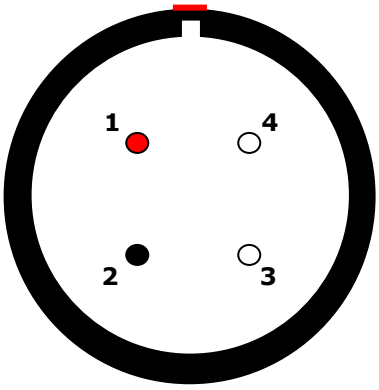
AUX
DB15F (high density)



(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

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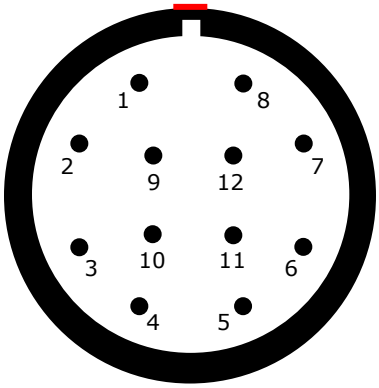
SLICE 1 / SLICE 2
(ECG.2B.312.CLL)

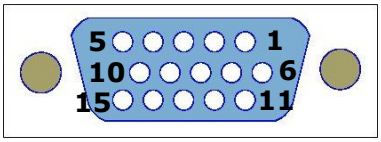


(panel view)

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.

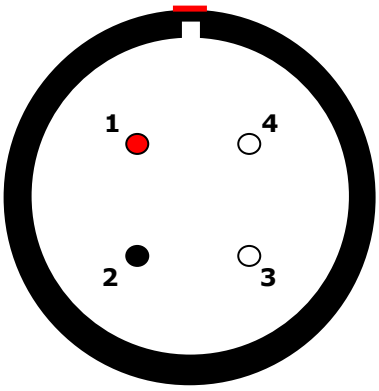
AUX
DB15F (high density)



(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

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APPENDIX E

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.

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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.

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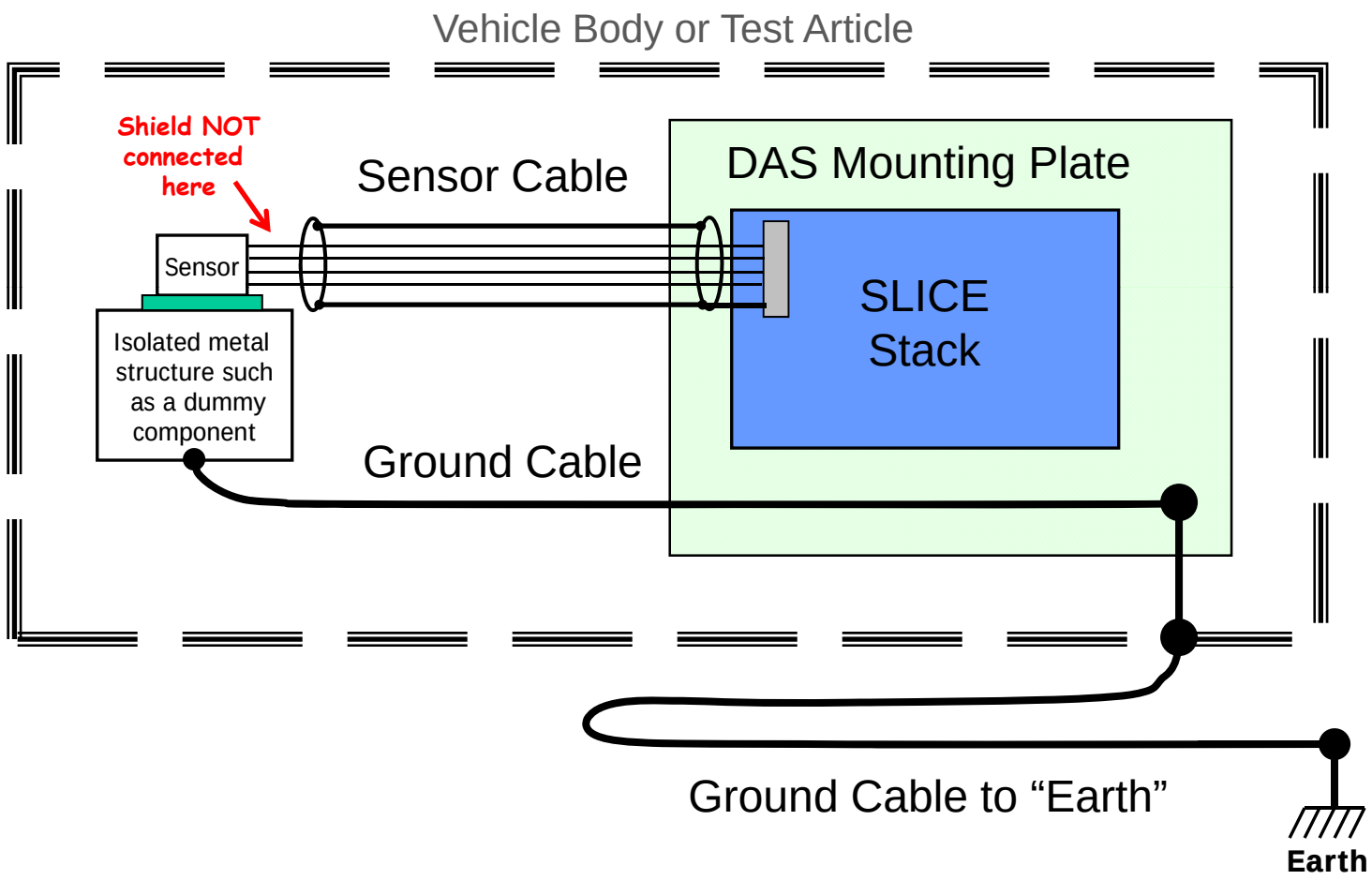
Recommended Grounding Architecture



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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!

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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

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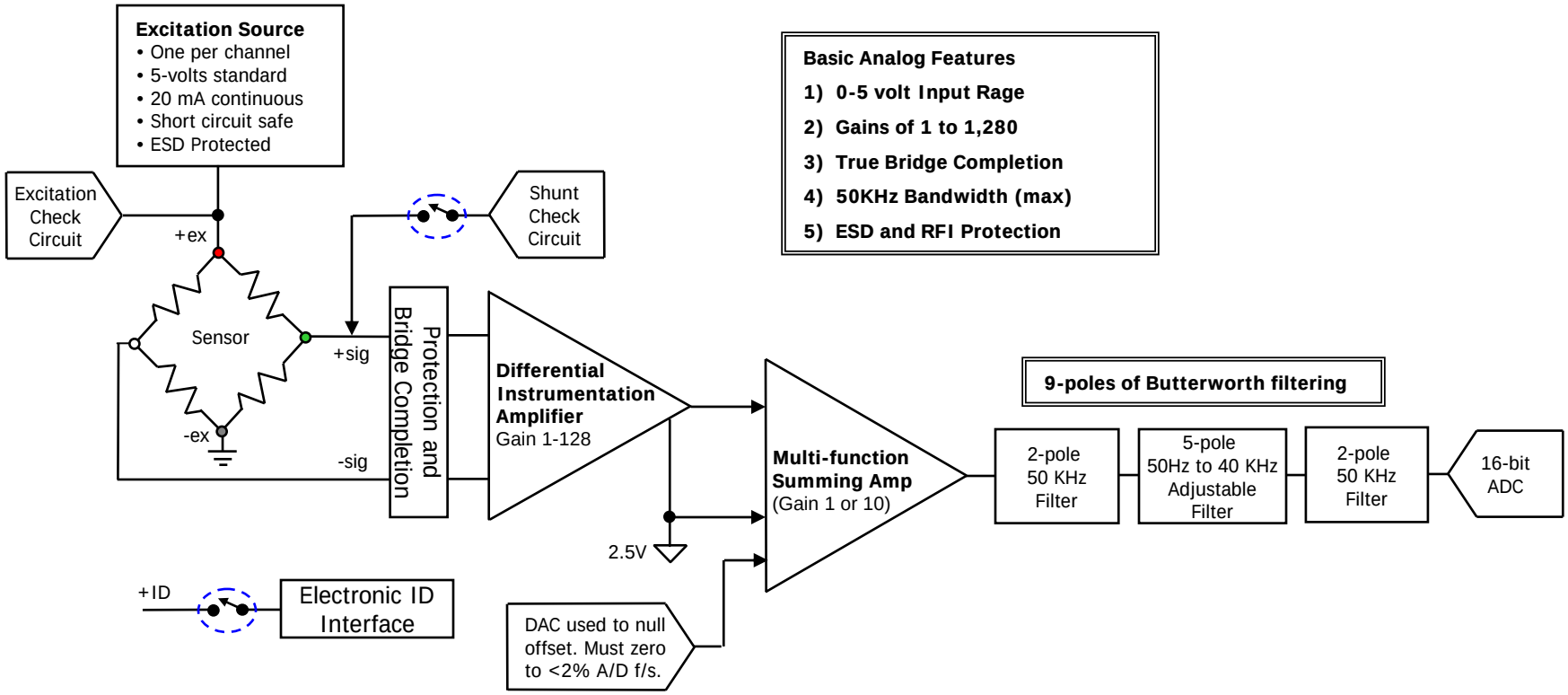
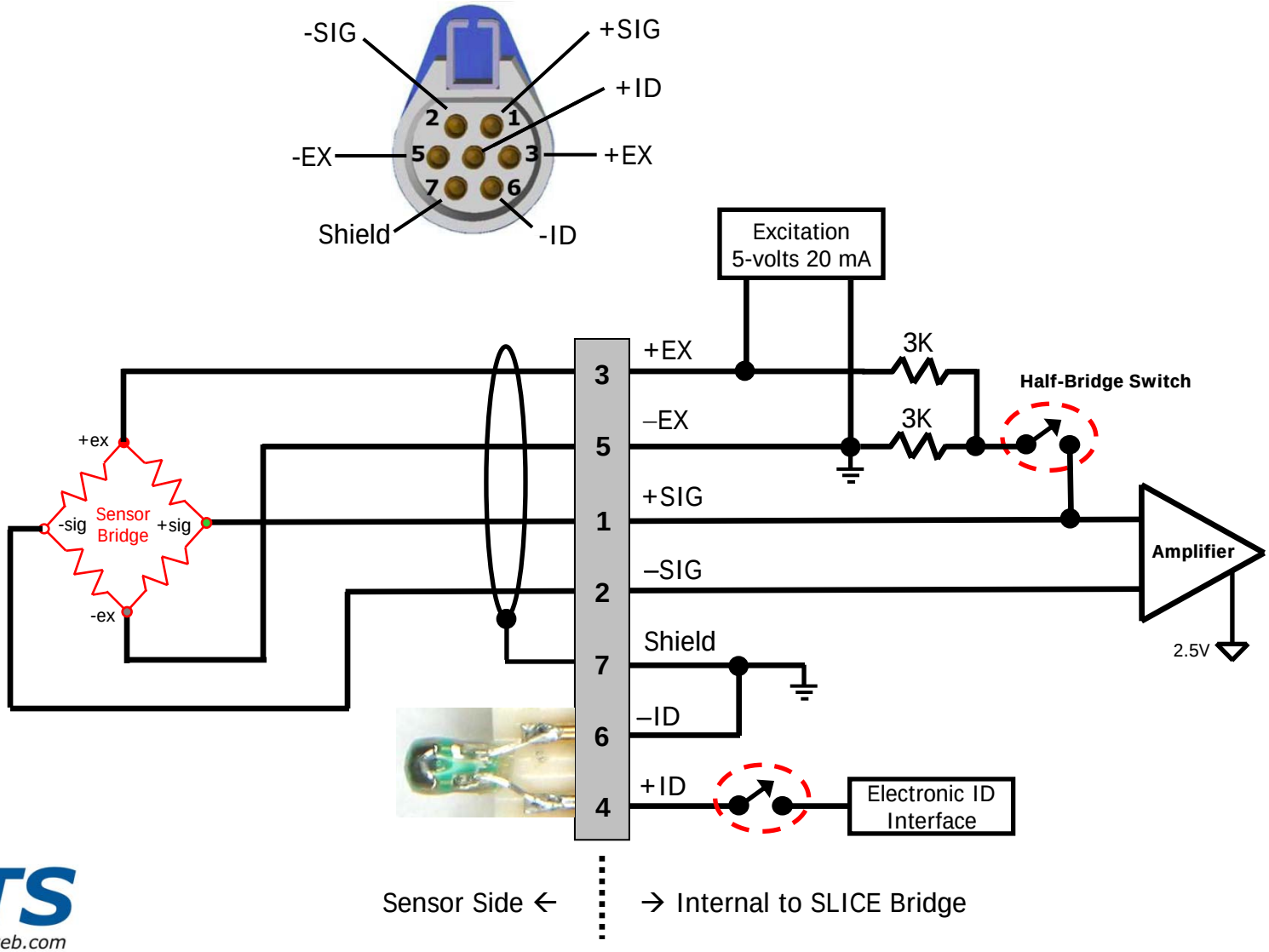
APPENDIX F
SLICE Bridge Sensor Connections

SLICE Bridge – Sensor Interface



Standard 4-wire Bridge Connection



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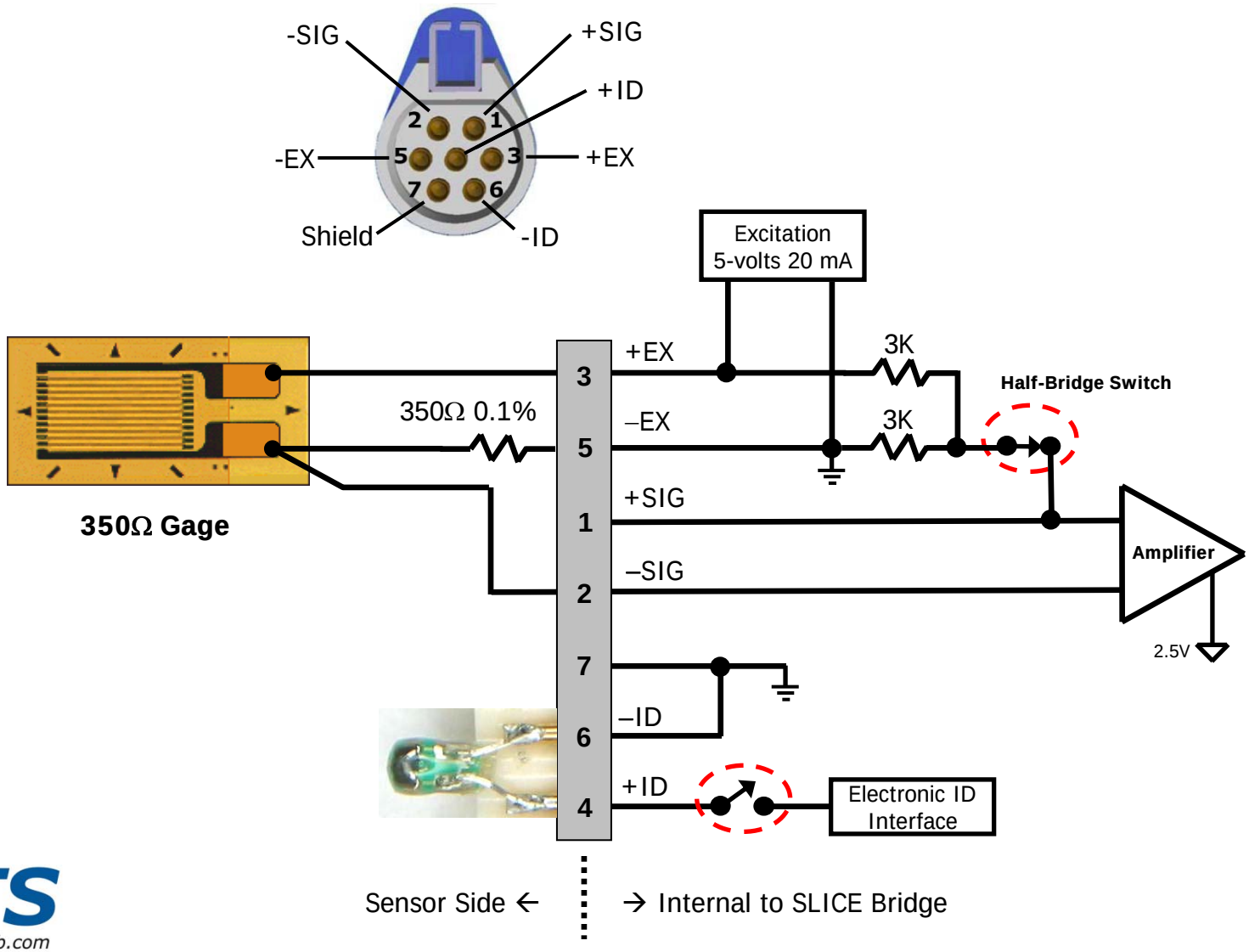
Strain Gage 3-wire Connection



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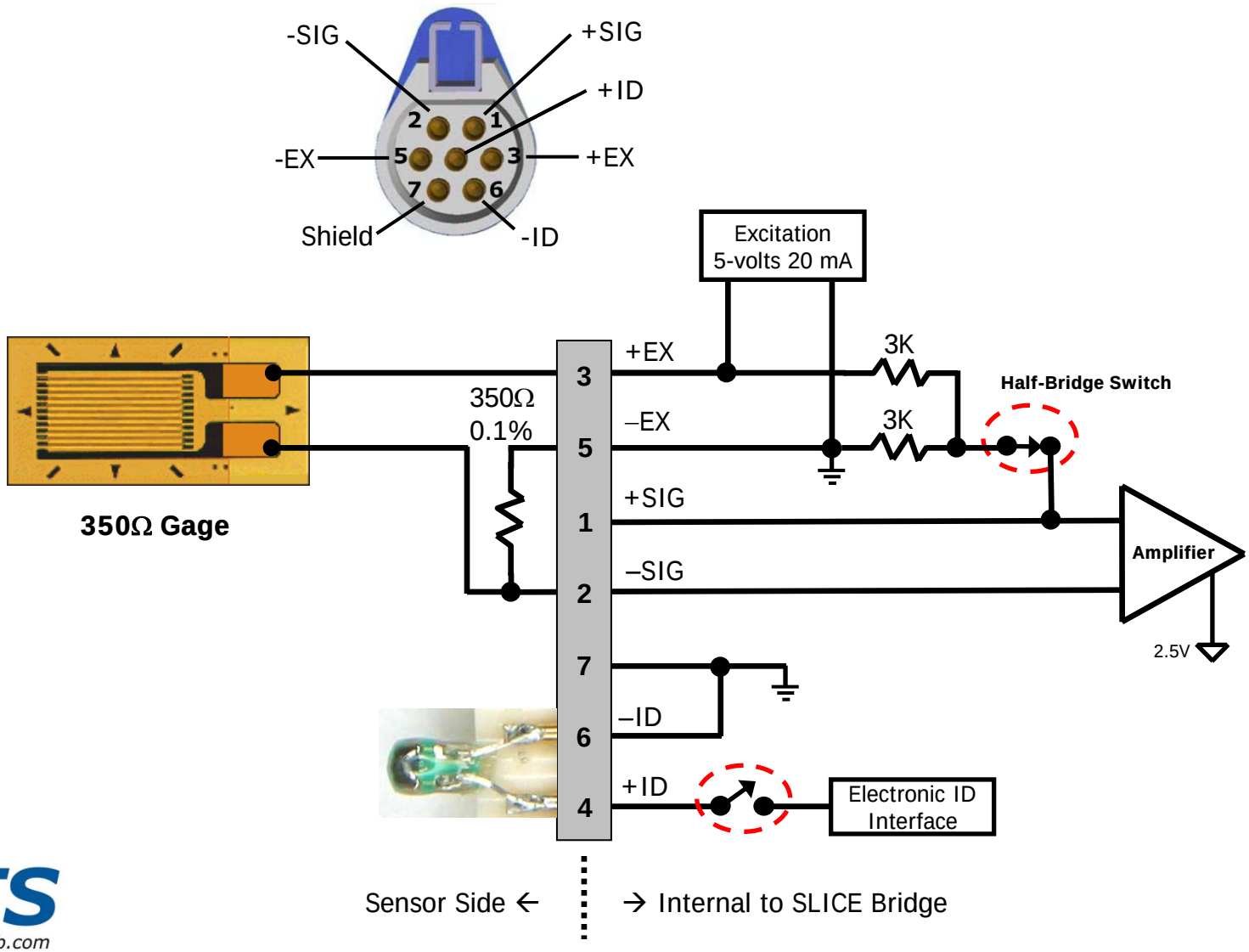
Strain Gage 2-wire Connection



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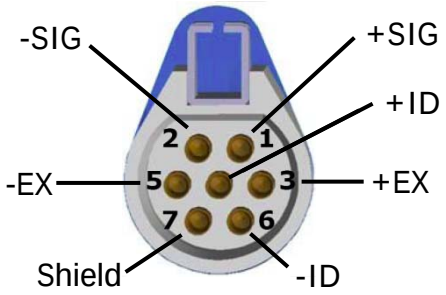
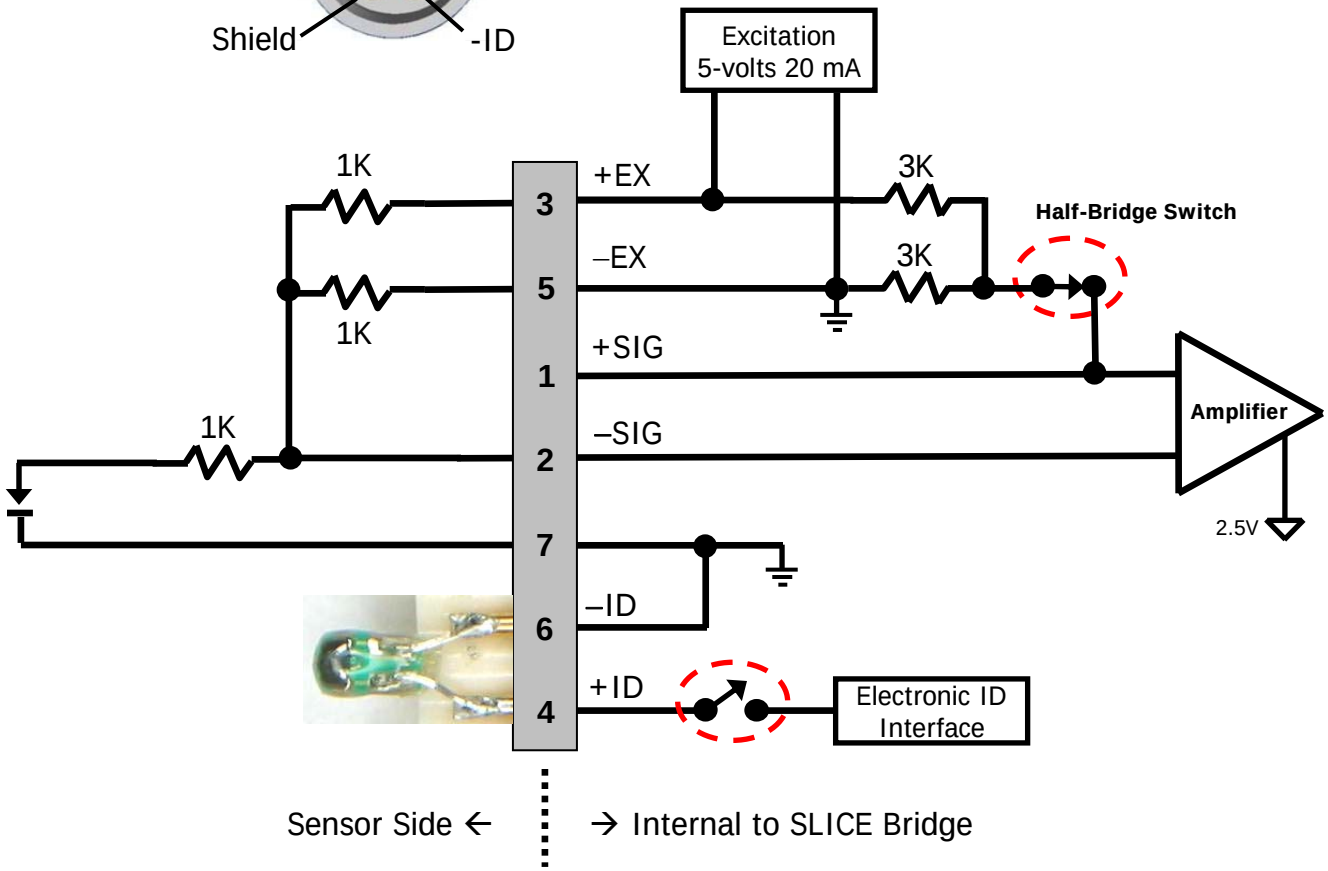
Switch Closure

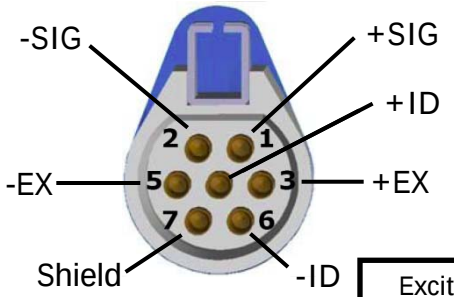


Example Sensor Settings
- Half-Bridge Mode
- Proportional to Excitation = No
- Sensitivity = 1.000 mV/EU will scale data in mV at input. Switch closure as shown gives 833 mV deflection.

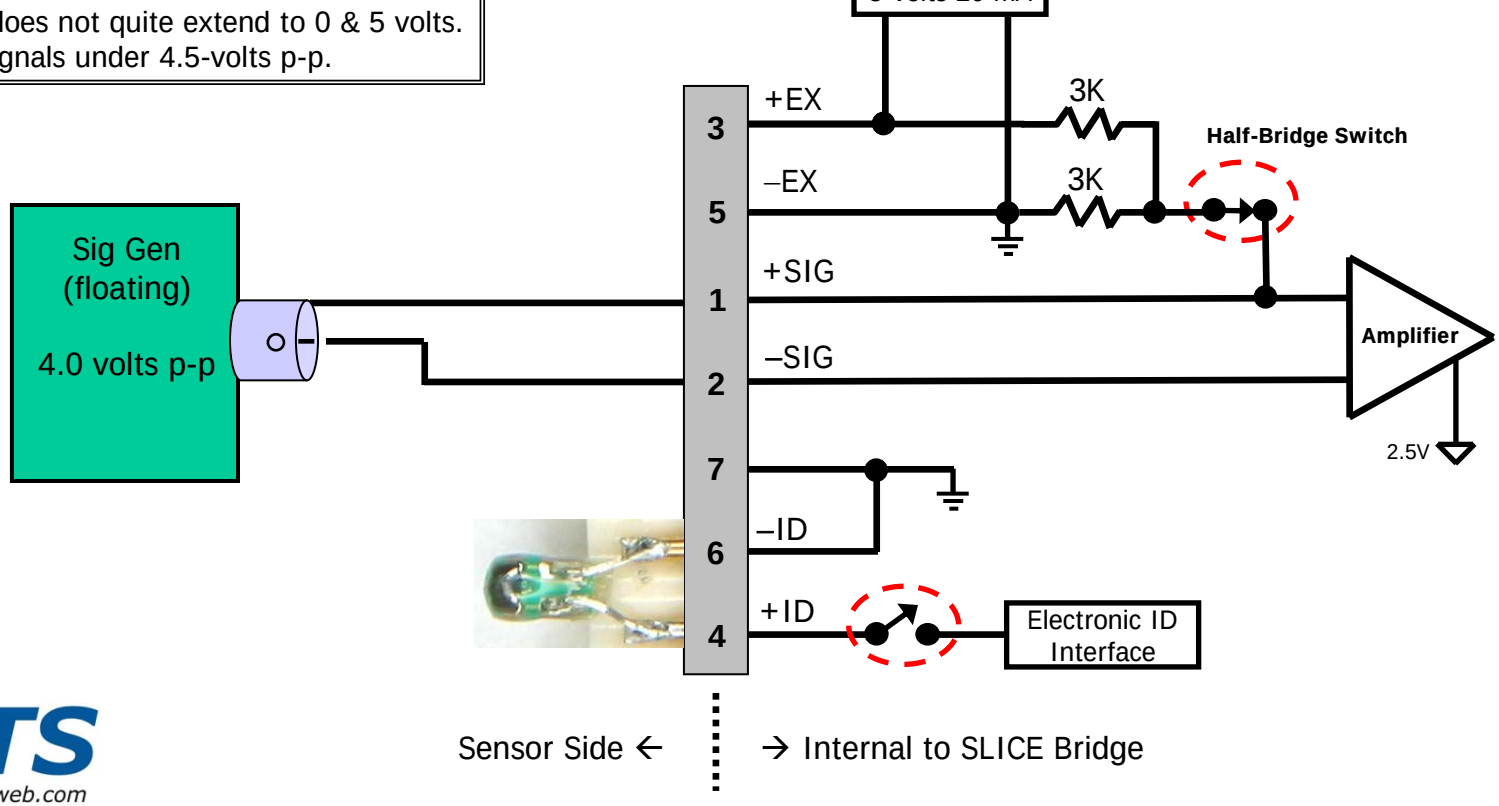


Signal Generator w/floating output

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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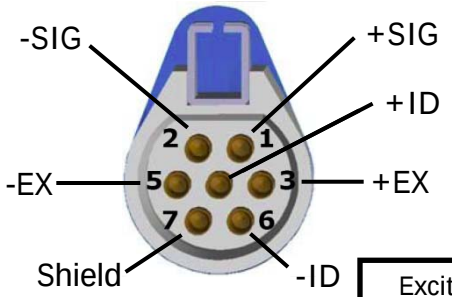
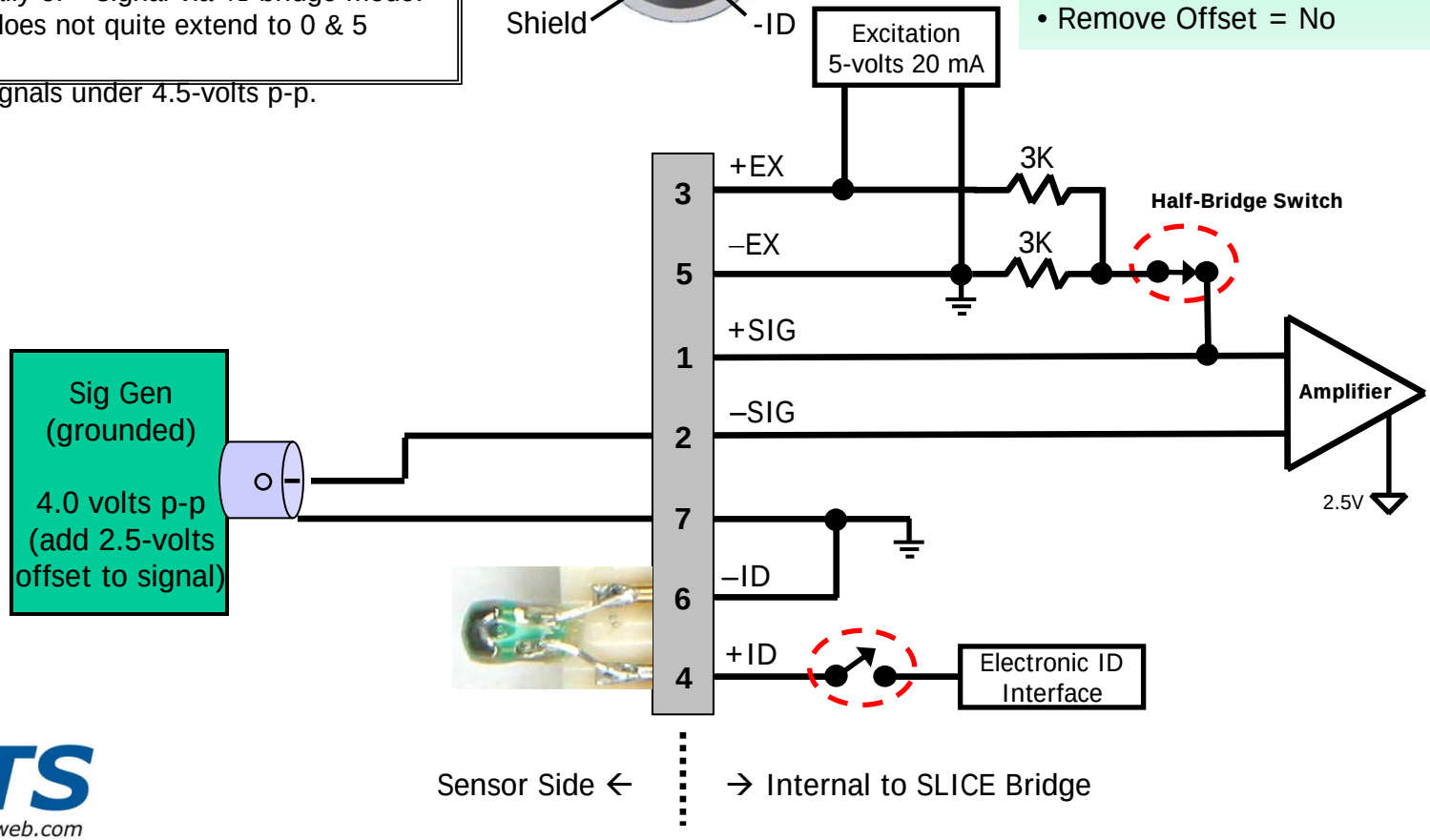
Signal Generator w/grounded output

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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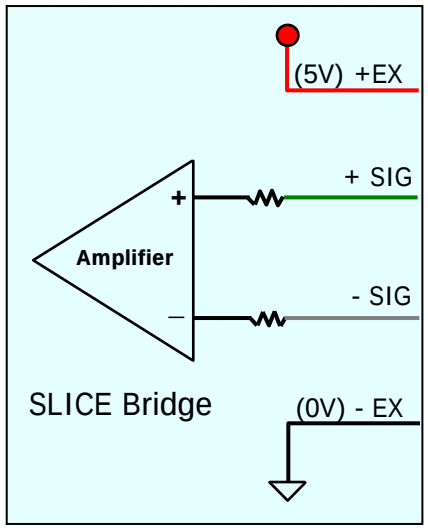
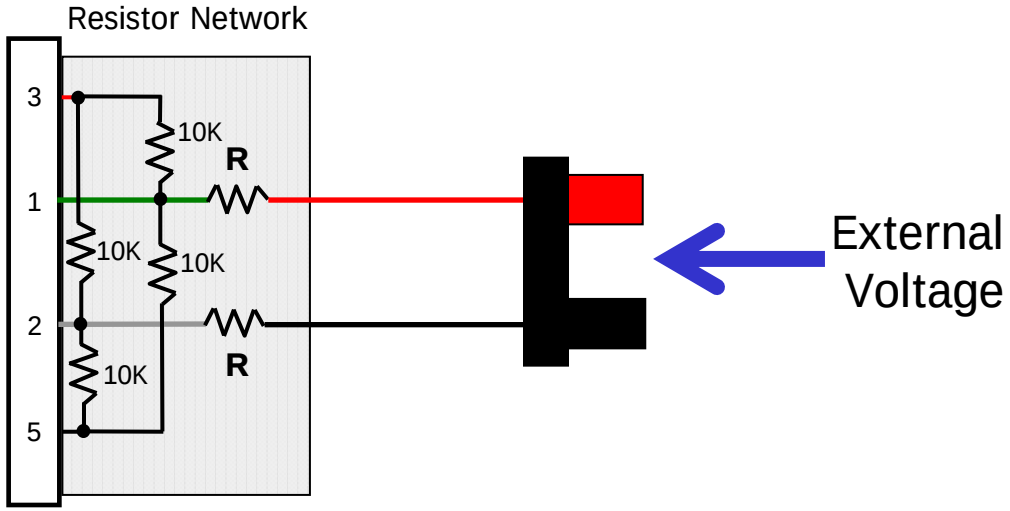
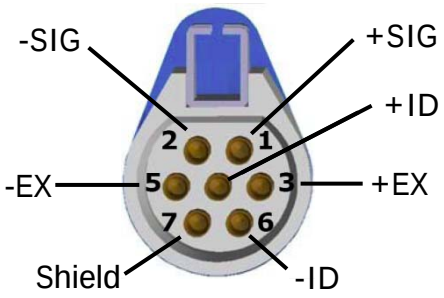
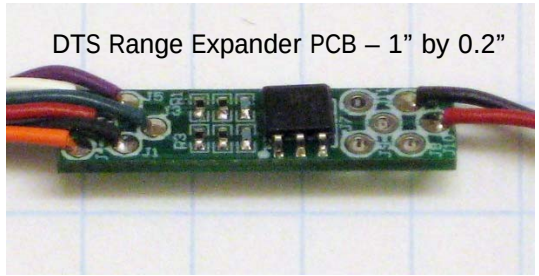
Measuring Large Differential Voltages









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 G: 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.
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

Name	Data Type	Description
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.
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

Name	Data Type	Description
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
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

Name	Data Type	Description
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

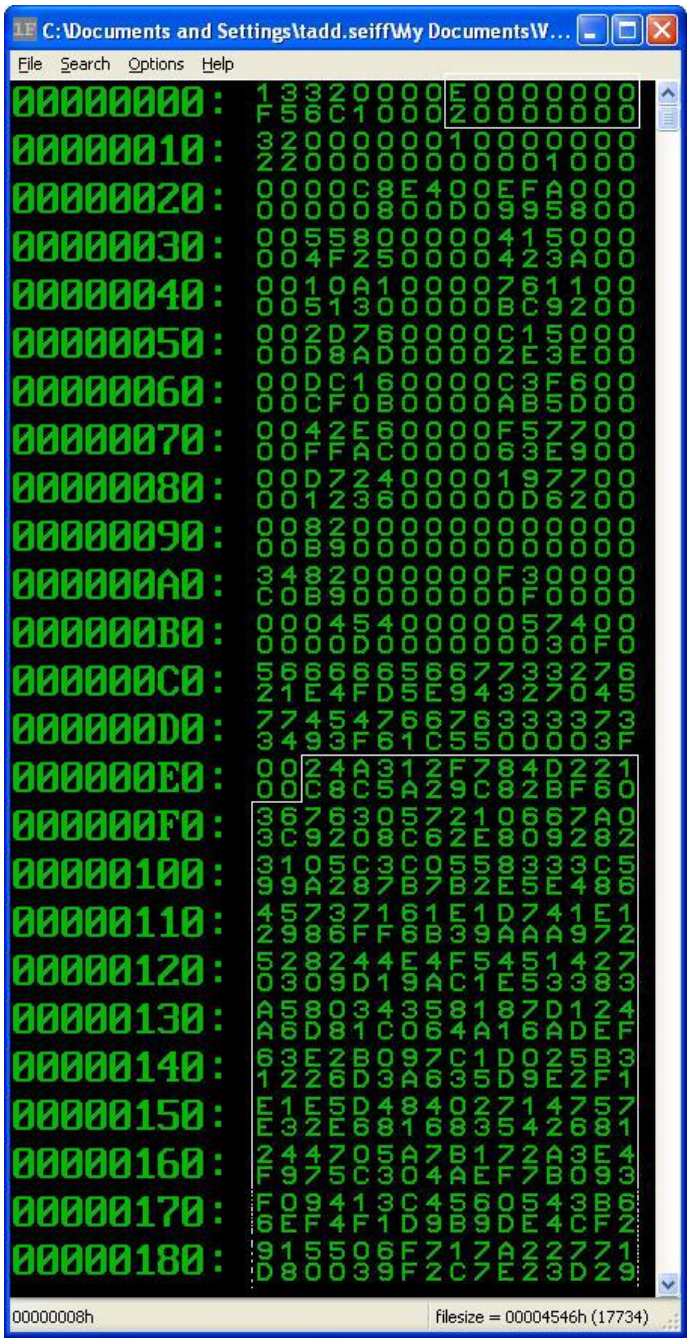
Appendix H: SLICEWare Binary File Format

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 mV/EU (non-proportional); mV/V/EU (proportional)
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.

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DECLARATION OF CE CONFORMITY

Description	Model
Data Acquisition Module	SLICE MICRO Base/Base+
Data Acquisition Module	SLICE NANO Base/Base+
Data Acquisition Module	SLICE IP68 Base+
Data Acquisition Module	SLICE MICRO Bridge
Data Acquisition Module	SLICE NANO Bridge
Data Acquisition Module	SLICE IP68 Bridge
Data Acquisition Module	SLICE MICRO Triax Accel
Data Acquisition Module	SLICE IP68 Triax Accel
Data Acquisition Module	SLICE MICRO Triax ARS/ARS PRO
Data Acquisition Module	SLICE IP68 Triax ARS PRO
Data Acquisition Module	SLICE MICRO IEPE
Data Acquisition Module	SLICE NANO IEPE
Data Acquisition Module	SLICE IP68 IEPE
Back-up Battery	SLICE NANO Stack Battery
Back-up Battery	SLICE IP68 Power Pack
Back-up Battery	SLICE Supercap/Supercap+
Distribution Unit	SLICE Distributor
Distribution Unit	SLICE System Interface
Distribution Unit	SLICE End-of-Chain Terminal
Distribution Unit	SLICE System Interface Auxiliary Terminal
Distribution Unit	SLICE Mini Distributor

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.

November 10, 2017
Date

SLICE User's Manual
Revision History

Date	By	Description
15 Feb 2018	EK	Added max current and revised number of stacks supported for End-of-Chain (section 2.3.8). Corrected number of stacks SLICE Distributor supported (was 4; now 3) (section 2.3.9). Removed references to SLICE Interface Device (page 6). (Version 1.0j)
31 July 2017	EK	Added power up procedures. Updated NANO mechanical specs and added common signals for 16-pin Bridge. Removed reference to LABView driver. Updated datasheet with the latest version. Updated overlooked firmware references. (Version 1.0i)
30 Nov 2015	EK	Updated to support Base+. Removed Appendix I (firmware update procedure) and linked to Support site for latest info. Removed battery spec and added NANO IEPE. (Version 1.0h)
30 Oct 2014	EK	Updated Tech Sppt section. Updated SLICE Distributor section, also removing Appendix D. Removed SLICE System Interface and Appendix C. Removed Software sections 5.3 to end. Updated ARS and Accel. Other minor changes. (Version 1.0g)
29 Nov 2012	EK	Added sections 5.2.2.3, 5.2.2.4, 5.2.3, 5.2.4. Updated LED table in Appendix D (SLICE Distributor). Changed Scale factor EU (table) in Appendix J. Removed e-sensing logo. (Version 1.0f)
25 Aug 2011	EK	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	EK	Modified sections 2.3.11 and 2.3.13. (Version 1.0d)
7 Feb 2011	EK	Added PDF bookmark for CE conformity page. (Version 1.0c)
6 Dec 2010	EK	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	EK	Added Declaration of CE Conformity. (Version 1.0a)
10 May 2010	EK	Initial release. (Version 1.0)