SLICE PRO DIM
User's Manual

March 2018

13000-30770-MAN (Rev. 3)
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DTS Support

TDAS 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.

This manual supports the following products:

13000-30770: SLICE PRO DIM (1B LEMOs) (18 ch)
13000-30771: SLICE PRO DIM (0B LEMOs) (18 ch)
13000-30772: SLICE PRO DIM (terminal blocks) (18 ch)

Introducing the SLICE PRO DIM

The SLICE PRO Digital Input Module (DIM) is an 18-channel digital module capable of recording virtually any on/off condition. Each channel is independently programmable for either contact-closure or voltage event signals. The SLICE PRO DIM integrates with plug-and-play ease into a SLICE PRO system and may be programmed for use as a level-trigger for all modules in that system.

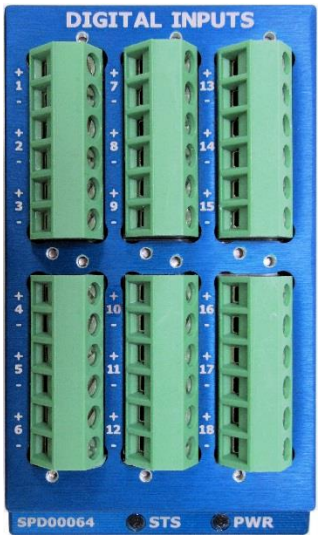
- Shock hardened to 100 g for dynamic testing environments.
- 18 fully-isolated contact-closure or voltage event channels.
- Voltage event input range of 3-20 V.
- Electronic identification (EID) support. (Terminal block version does not support EID.)
- Internal battery with up to 1 hour capacity functions as primary or back-up power.
- LED indicators for power and system status.
- Easy communications via the SLICE PRO USB Controller or SLICE PRO Ethernet Controller.
- Chainable with up to 3 other SLICE PRO modules.

Connector information and pin assignments are included in Appendices A and B. Mechanical specifications are included in Appendix C. Appendix D provides information on how to calculate data storage duration. Please see your packing list for your hardware's specifications.

Connector Panel

The SLICE PRO DIM is available with LEMO 0B, 1B or terminal block input connectors. See Appendix A for connector information and pin assignments.

P/N 13000-30770
(0B LEMOs also available)



P/N 13000-30772

(images not to scale)

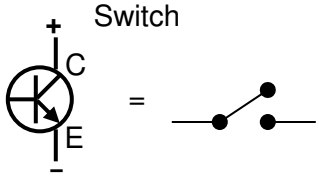
Using the Voltage Input

These inputs are configured as shown below.

	Operational Parameters
Voltage Input	Proper polarity must be observed. >3 V = logic one (3-20 V input range with respect to chassis; logic compatible). Can be configured as normally high (⌐⌐) or normally low (⌐⌐).

Using the Contact-Closure Input

These inputs can be used 2 ways: simple contact closure or via an external semiconductor switch.

Type of Contact Closure	Operational Parameters
Simple Contact Closure (tape switch or other on/off device)	Self powered. No polarity requirement. Can be configured as normally open (⊣ ⊢) or normally closed (⊣/⊢).
External Semiconductor Switch 	Self powered. Proper polarity must be observed. <100 ohms = logic one; >4500 ohms = logic zero; with a current conducting capability of at least 5 mA. Can be configured as normally open (⊣ ⊢) or normally closed (⊣/⊢).

Electronic Identification (EID)

Each input channel supports communication with silicon serial number devices manufactured by Dallas Semiconductor/Maxim Integrated Products. When an ID chip is connected to the proper pins on the sensor connector, the software can read these devices and correlate the serial number to channel set-up information stored in the sensor database. Note: The terminal block version does not support EID. (See Appendix A for connector information and pin assignments.)

Level Trigger

Any channel may be configured as a level-trigger channel via the software. When this channel is triggered, all other modules in the SLICE PRO chain are also triggered. Specifying a level-trigger channel does not prevent the SLICE PRO DIM from responding normally to a hardware trigger.

Sampling Rates

The SLICE PRO DIM has user-selectable sampling rates from 100 sps to 1 Msps. The maximum sampling rate for 9 channels is 1 Msps; the maximum sampling rate for 18 channels is 500 ksps. Only 9 channels (channels 1-9 specifically) are available for any sampling rate >500 ksps. For information on how to calculate data storage duration, please see Appendix D.

Data Memory Size

With 15 GB of flash memory available for data storage, the SLICE PRO DIM can record ~14 minutes of data at the maximum sampling rate (9 channels at 1 Msps or 18 channels at 500 ksps). Since the recording capacity is very large, it is generally best to limit sampling rates and event 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. Use of the Region of Interest (ROI) download can save a great deal of time if implemented properly. For information on how to calculate data storage duration, please see Appendix D.

UP/DOWN Interface Connectors

The UP interface connector allows the user to interface to a SLICE PRO Ethernet Controller, USB Controller or another SLICE PRO module. (The UP connector may appear loose, however do not tighten.) The DOWN interface connector allows the user to interface to another SLICE PRO module (chainable with up to 3 other modules). Please see Appendix B for pin assignments.

LEDs

The SLICE PRO DIM has 2 LED indicators. At system power up, the red-green-blue LED initialization sequence is performed by the status LED followed by the power LED.

LED behavior is summarized below.

Recorder Mode	STS	Circular Buffer Mode
Armed and waiting for Start Record signal to begin data collection		
Start Record signal received and recording data; waiting for Event signal (optional)		Armed and recording data; waiting for Event signal
Event signal received (optional) –or– fault		Event signal received –or– fault
Event signal received + data collection completed (no USB)		Event signal received + data collection completed (no USB)
Fault received + data collection completed (no USB)		Fault received + data collection completed (no USB)
Data collection completed; PC downloading data		Data collection completed; PC downloading data

Condition	STS	PWR
Charging (system off and connected to external power)		
Unit is charging (power OK)		
Unit fully charged		
System on; not armed		
Power up		
Power OK; no USB		
Power OK; USB connected		
Power fault (out of range)		
Communicating with host		

Basic Care and Handling

SLICE PRO systems are precision devices designed to operate reliably in dynamic testing environments. Though resistant to many environmental conditions, care should be taken not to subject the unit to harsh chemicals, submerge it in water, or drop it onto any hard surface.

WARNING:

Electronic equipment dropped from desk height onto a solid floor may experience up to 10,000 g. Under these conditions, damage to the exterior and/or interior of the unit is likely.

The SLICE PRO DIM is supplied with calibration data from the factory. DTS recommends annual recalibration to ensure that the unit is performing within factory specifications. The SLICE PRO DIM is not user-serviceable and should be returned to the factory for service or repair.

When not in use or if shipping is required, we suggest that you always place the unit in the padded carrying case originally provided with your unit.

Shock Rating

The SLICE PRO DIM is rated for 100 g, 12 ms half-sine duration, in all axes.

Mounting Considerations

The unit should be securely bolted to the test article or dynamic testing device to provide the best shock protection. Mounting methods and hardware selection should be carefully calculated to withstand expected shock loading and facilitate proper grounding. Check bolt tightness periodically to ensure that 1) the unit is securely fastened to the baseplate, and 2) the baseplate is securely fastened to the testing platform. (See Appendix C for the unit's mechanical specifications.)

DTS strongly recommends that all equipment be properly grounded to minimize any risk of data noise due to high-current transients. The test vehicle or dynamic testing device should be connected to earth ground. Crashworthy SLICE PRO equipment should be grounded to each other and bolted to the test vehicle. SLICE PRO LAB modules should be bolted to the rack and the rack properly grounded. DTS recommends checking continuity between the enclosures of each unit to confirm resistance readings of <1 ohm.

Thermal Considerations

SLICE PRO systems are low power devices with negligible self-heating and it is unlikely that self-heating will be an issue in real-world testing. Should you have any questions about using SLICE PRO in your environment, please contact DTS.

WARNING:

Due to battery chemistry, do not operate SLICE PRO DAS at temperatures below 0°C (32°F) or in excess of 60°C (140°F).

Power Management

A good power source is of paramount importance. SLICE PRO DIMs should be powered from a SLICE PRO Controller. (One Controller can support up to 4 SLICE PRO modules.) Be sure to consider any power drop due to cable length.

Input Voltage, System OFF/ON	Power Consumption, System OFF*	Power Consumption, System ON**
11.5-15 VDC; 15 VDC nominal	7.5 W; 500 mA per module***	15 W; 1 A per module***

* charging all internal batteries ** fully armed + charging all internal batteries
*** Controllers are considered modules for the purposes of power calculations.

Power Consumption

Power off: When connected to sufficient external power, the SLICE PRO DIM will draw up to 500 mA for charging the internal battery.

Power on: When the DIM is initially powered, all signal conditioning electronics are in a shutdown state. When the user runs a test set-up, the software automatically energizes these circuits. The current draw per DIM will increase to as much as 1 A when the system is fully armed and energized.

During data collection: Once the system has been armed for data collection, all circuits remain in a full power state until data collection is finished. After the data collection routine has completed, the DIM de-energizes several circuits to minimize power consumption.

Internal Battery

The SLICE PRO DIM contains an internal 7.4 V (nominal) lithium battery that operates as primary power or back-up power should primary power fail. When fully charged, battery capacity is sufficient to provide primary power and sustain full operation for 1 hour. It charges whenever sufficient external power is connected to the module via a SLICE PRO Controller. The maximum charge time is 3-4 hours from complete discharge to full capacity. The module does not need to be ON in order to charge the internal battery.

Charging practices can affect the useful operational life of the battery. In addition to good charging habits, conditioning the battery may be useful—3 deep-discharge/recharge cycles may increase battery performance. The battery's useful capacity is greatly shortened near the end of its service life and should be replaced when it has decreased to 50% of its initial capacity. The battery is not user-serviceable and should be returned to the factory for battery replacement.

WARNING:

Due to battery chemistry, do not operate SLICE PRO DAS at temperatures below 0°C (32°F) or in excess of 60°C (140°F).

Power-up and Power-down Procedures

The SLICE PRO DIM is powered up when the proper signal is connected at the UP interface connector. This is typically accomplished via a SLICE PRO Controller. Power-up of the module takes 10 seconds (USB Controller) or between 1-2 minutes (Ethernet Controller), after which communication is enabled.

To restart a system, turn off the Controller and wait ~30 seconds before reinitializing. (Press and hold the switch firmly for 2 seconds to start or stop the system.) If a system is armed for data collection, it will remain on until it is disarmed or power reserves are exhausted. An incomplete power-down/power-up cycle can result in errors, so be certain to follow proper procedures.

CAUTION:

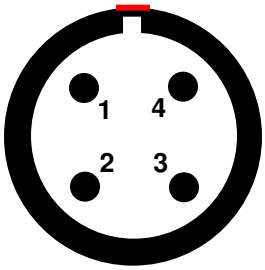
Do not turn off the Controller if the system is armed. You must disarm the system before initiating a system restart.

Communication Features

Communications with the SLICE PRO DIM is accomplished via 1) a SLICE PRO USB Controller and USB comm cable (USB A to USB B) or 2) a SLICE PRO Ethernet Controller and Ethernet (REC) comm cable (P/N 10700-0015x). Please see the SLICE PRO USB Controller or SLICE PRO Ethernet Controller User's Manuals for additional information.

Appendix A: LEMO Connector Information

4-pin front panel connectors
(ECG.xB.304.CLL)



(panel view)

Suggested cable connector P/N:
FGG.xB.304.CLADxx**

Terminal block connector
(Phoenix Contact P/N 1869101)

(panel view)

Pin	Function	Signal
1	(+) Contact closure*/+ voltage (external)	+
2	(-) Contact closure*/- voltage (external)	-
3	+ID	
4	-ID	

* No polarity requirement for simple contact closure (tape switch or other on/off device), however proper polarity must be observed when using an external semiconductor switch.

** xx denotes diameter of cable to be used; e.g., 52 = 5.2 mm. See www.lemo.com for more information.

Suggested Connector Sources

DTS uses LEMO connectors on the SLICE PRO DIM. If you need to purchase connectors, we suggest first going to LEMO directly (www.lemo.com). Their web site and worldwide sales team are very helpful. Should you have difficulty obtaining a specific part number, they can suggest connector variations or alternates and explain options that may be useful for your particular application. Another U.S. source is Alpine Electronics (www.alpine-electronics.com) in San Jose, California. They are a stocking distributor for LEMO and LEMO-compatible connectors.

Appendix B: UP/DOWN Connector Information

UP interface connector*
(Omnetics A99077-015;
MMDS-015-N06-SS)

(panel view)

DOWN interface connector
(Omnetics A98000-015;
MMDP-015-N00-SS)

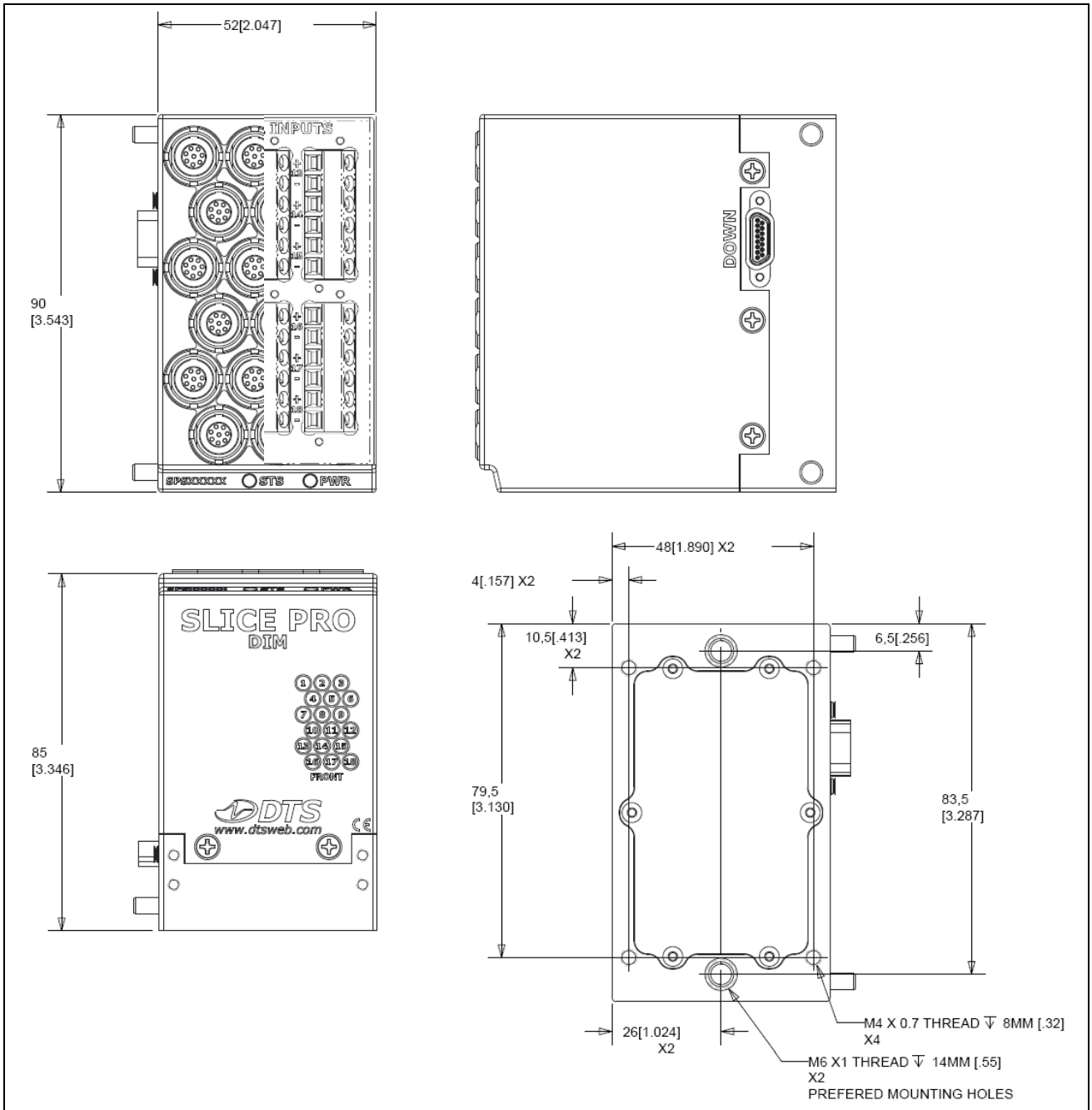
(panel view)

Pin	Function
1	VDC in (UP)/out (DOWN)
2	VDC in (UP)/out (DOWN)
3	Ground
4	Ground
5	/ON (contact closure input to ground)
6	/EVENT (contact closure input to ground)
7	/START (contact closure input to ground)
8	Status input (UP)/output (DOWN) (5 V via 10k with respect to ground)
9	VDC in (UP)/out (DOWN)
10	VDC in (UP)/out (DOWN)
11	Ground
12	Ground
13	USB_DP
14	USB_DM
15	USB power

* The UP connector may appear loose. Do not tighten.

Appendix C: Mechanical Specifications

Weight: ~726 g (26 oz)



Units in mm (inches)

Torque spec: 84 in-lb (M6)

Accessories/Support Equipment

13000-30603: SLICE PRO USB Controller (micro D)
13000-30610: SLICE PRO Ethernet Controller
13000-30990: Cable, SLICE PRO DIM (1B LEMOs) input to pigtail term (6 m)
13000-40332: SLICE PRO USB Controller (micro D) and Cable Kit (Gen2.5)
13000-40340: SLICE PRO Baseplate Kit for USB Controller + 4 SIMs
13000-40350: SLICE PRO Baseplate Kit for USB Controller + 2 SIMs
13000-40360: SLICE PRO Baseplate Kit for Ethernet Controller + 4 SIMs
13000-40370: SLICE PRO Baseplate Kit for Ethernet Controller + 2 SIMs
13000-40380: SLICE PRO Baseplate Kit for USB Controller + 1 SIM
80000-02067: LEMO plug; 0B, 4-pin, solder, 3.5 mm collet (FGG.0B.304.CLAD35)
80000-02068: LEMO plug; 0B, 4-pin, solder, 5.6 mm collet (FGG.0B.304.CLAD56)
80000-02075: LEMO plug; 1B, 4-pin, solder, 4.2 mm collet (FGG.1B.304.CLAD42)

Appendix D: How to Calculate Data Storage Duration

The SLICE PRO DIM has user-selectable sampling rates from 100 sps to 1 Msps. The maximum sampling rate for 9 channels is 1 Msps; the maximum sampling rate for 18 channels is 500 ksps. Only 9 channels (channels 1-9 specifically) are available for any sampling rate >500 ksps.

Sampling Rate	9-channel SLICE PRO DIM	18-channel SLICE PRO DIM
100-500,000 sps	9 channels available*	18 channels available*
>500,000-1 Msps		9 channels available*

* All channels are recorded even if they are not needed for your test.

With 15 GB available for data storage, there are 7,500 M samples available in each SLICE PRO DIM (1 sample = 2 bytes). To determine the recording time possible given the number of channels and sampling rate, use the equation below:

$$\frac{7{,}500{,}000{,}000}{\text{Sampling rate (sps)} \times \text{\# of channels (9 or 18)}} = \text{\# of seconds}$$

Example 1: 100,000 sps using 9 channels

$$\frac{7{,}500{,}000{,}000}{100{,}000 \times 9} = 8{,}333 \text{ sec (2.32 hours)}$$

Example 2: 25,000 sps using 18 channels

$$\frac{7{,}500{,}000{,}000}{25{,}000 \times 18} = 16{,}667 \text{ sec (4.63 hours)}$$

Circular Buffer Limitations

Due to the nature of flash memory, the system cannot be armed in *Circular Buffer* mode indefinitely. To determine the maximum time available in *Circular Buffer* mode, use the equation below:

$$0.8 * \text{recording time} = \text{maximum time available in } \textit{Circular Buffer} \text{ mode}$$

Example:

$$0.8 * 8{,}333 \text{ sec} = 6{,}666 \text{ sec (111 minutes)}$$

In this example, the test must occur within 111 minutes, after which time the unit stops recording data.

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DECLARATION OF CE CONFORMITY

Description	Model
Data Acquisition Module	SLICE PRO Sensor Input Module
Data Acquisition Module	SLICE PRO Timed Output Module
Data Acquisition Module	SLICE PRO Digital Input Module
Data Acquisition Module	SLICE PRO Trigger Distributor
Data Acquisition Module	SLICE PRO Ethernet Controller
Data Acquisition Module	SLICE PRO USB Controller
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.

February 10, 2015
Date

Revision History

Rev	Date	By	Description
3	14 Mar 2018	EK	Updated to include terminal block version.
2	10 Aug 2016	EK	Updated for 0B LEMO version. Added grounding info and operational temp range. Changed upper limit input voltage to 15 VDC. Added CE Declaration.
1	10 Nov 2015	EK	Changed high end of voltage input range (was 15 V; now 20 V).
0	31 Mar 2015	EK	Initial release.