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The Leader in Automated Test, Data Acquisition, and Control

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Headquarters
68 Nutmeg Road South
South Windsor, CT 06074
Phone: 860-298-9925

Massachusetts
257 Simarano Drive
Marlborough, MA 01752
Phone: 508-281-8288

New Jersey
10 Forest Avenue, Suite 120
Paramus, NJ 07652
Phone: 201-773-9115

SLSC 8-Channel VDT/Resolver Simulation Module

Installation Instructions and Reference Manual

Revision A
May 31, 2022

Revision History

Rev.	Date	Description
A	5/31/22	Modernized terminology for consistency with other modules, updated with SLSC Switch information.

Bloomy Controls, Inc.
68 Nutmeg Road South
South Windsor, CT 06074
860-298-9925

www.bloomy.com

Table of Contents

1.0 Overview

These operating instructions describe how to install and use the Bloomy 1200-00019 SLSC 8-Channel VDT/Resolver Simulation Module into a Bloomy or National Instruments Switch/Load/Signal Conditioning (SLSC) system. For information about installing, configuring, and programming the system, refer to the system's documentation.

Note: The safety guidelines and specifications in this document are specific to this module. The other components in your system may not meet the same ratings and specifications. Refer to the documentation for each component in your system to determine the ratings and specifications for the entire system.

1.1 Regulatory

Refer to the product Declaration of Conformity for additional regulatory compliance information. To obtain product certifications and declarations of conformity for this product, see www.bloomy.com/support.

2.0 Module Description

The Bloomy SLSC VDT/Resolver Simulator Module is designed for use with the National Instruments SLSC family of products. It provides eight channels which may be used for LVDT, RVDT, synchro, or resolver simulation. Each channel can be connected as one four, five or six wire simulation, or two four-wire simulations with common excitation, or two channels with a common excitation may be connected to simulate a synchro. It conforms to the NI SLSC Module Development Kit v1.1, occupies a single slot of a standard SLSC chassis, and requires no external power.

The module uses a standard 44-pin D-sub connector which allows the user to easily use standard or custom cable assemblies to interface with the card.

A block diagram of the module is shown in Figure 1:

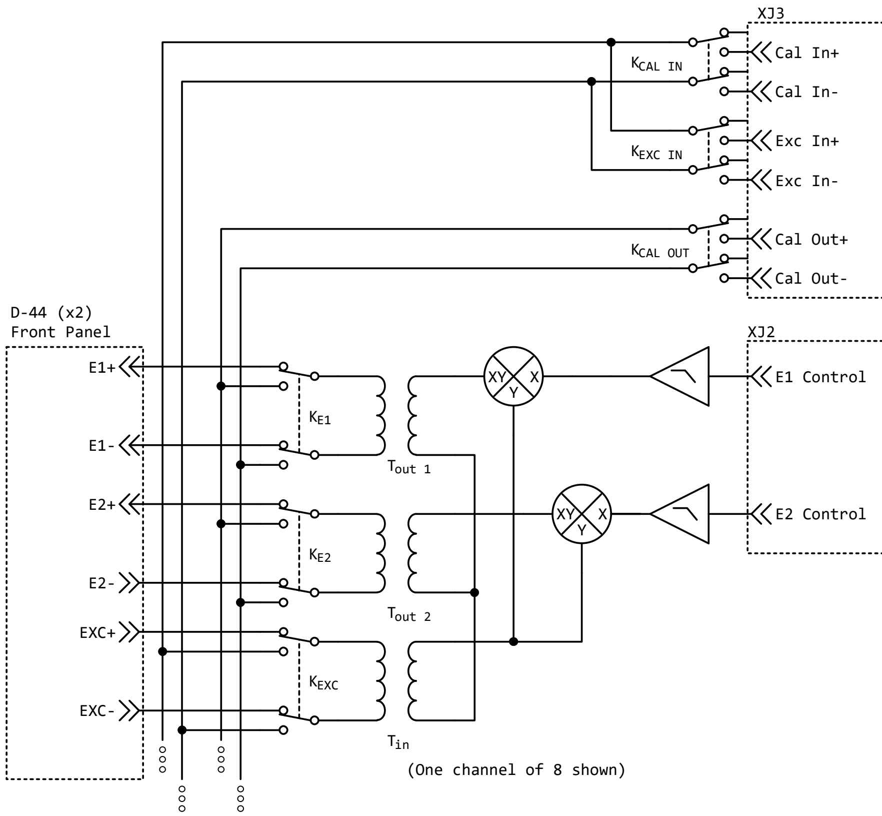


Figure 1 - SLSC 8-Channel VDT/Resolver Module block diagram

2.1 Features

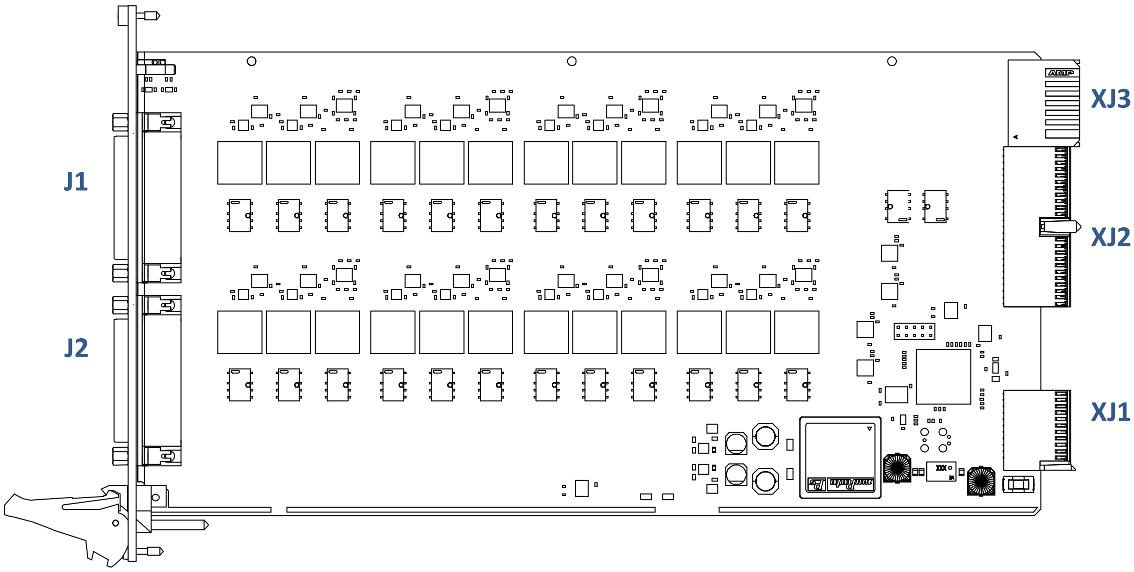
The SLSC VDT/Resolver Simulator Module has the following features:

- Each channel can simulate either an LVDT, an RVDT, or a resolver independently of the other channels.
- Each channel can be wired as an independent 4-wire, 5-wire or 6-wire simulation without affecting the other channels.
- Each channel can simulate two four-wire devices as long as the excitation source is common for both simulations.
- Two channels sharing a common excitation source may be connected to simulate a synchro.
- Independent control of the two returns for each channel allow simulation of both nominal as well as non-nominal devices.
- Excitation for each channel's simulation can be provided through the module's front panel connectors or can be selectively provided from an SLSC-wide system bus for UUTs which do not supply their own excitation.
- Calibration relays on each channel provide both calibration and open-circuit fault/disconnect capability for the channel. The calibration relays connect the channel to the system-wide instrumentation bus allowing system instrumentation resources to calibrate each channel's transfer function.

2.2 Hardware Overview

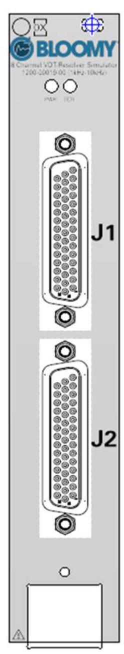
Side and front views of the module are shown below with connector designators. Pinouts for the connectors are shown in Appendix A.

Right Side View:



J1 and J2 are provide connection points for the units under test (UUTs). Connector XJ1 connects to the SLSC backplane, while connectors XJ2 and XJ3 connect to the rear transition interface (RTI) and then to the rest of the system. XJ2 is the low power signal interface, and XJ3 is the system-wide fault/instrumentation bus interface.

Front View:



J1 and J2 are 44-pin high-density female D-shell connectors. Pin assignments are documented in Appendix A. The PWR and RDY indicators show the status of the module according to the table below.

Indicator	Behavior	Status
PWR	Off	The module is not properly powered.
	Solid Green	The module is powered correctly.
	Blinking Red	Module fault.
RDY	Off	Module is not powered or is not ready.
	Solid Green	Module is in default condition and ready for use.
	Blinking Yellow	Module is active, but in a non-default condition.

Table 1 - LED Indicators

2.3 Specifications

Conforms to National Instruments SLSC Module Development Kit v1.1.

Parameter	Value	Notes
Supply power	24VDC	Supplied through SLSC backplane connector XJ1
Supply power	3.3VDC	Supplied through SLSC backplane connector XJ1
$V_{EXC, MAX}$	$11V_{peak}$	1200-00019-00
	$20V_{peak}$	1200-00019-01
	$40V_{peak}$	1200-00019-02
f_{EXC}	1kHz-10kHz	1200-00019-00
	400Hz-1kHz	1200-00019-01
	400Hz-1kHz	1200-00019-02
DCR, input	38Ω±15%	1200-00019-00
	44Ω±15%	1200-00019-01
	40Ω±15%	1200-00019-02
DCR, output	41Ω±15%	1200-00019-00
	52Ω±15%	1200-00019-01
	52Ω±15%	1200-00019-02

Table 2 - Specifications

2.4 Theory of Operation

The module simulates VDTs and resolvers by using an analog four-quadrant multiplier under external control to vary the amplitude and sign of two return outputs for each excitation input. Both the excitation and the returns are transformer coupled for isolation and to provide the unit under test with an inductive load. The external control is provided by an analog signal from a digital to analog converter, such as a National Instruments PXI or Compact RIO module.

2.4.1 Transfer Function

The basic transfer function for each channel of the module is defined by the formulas below:

$$E_1 = V_{EXC} \times T_{in} \times \frac{V_{control,1}}{10} \times T_{out}$$

$$E_2 = V_{EXC} \times T_{in} \times \frac{V_{control,2}}{10} \times T_{out}$$

Note that V_{EXC} is bandwidth-limited and has a -3dB corner frequency of 20kHz.

The transformation ratios (T_{in} and T_{out}) are dependent on the module configuration per the following table:

Part number	T_{in}	T_{out}
1200-00019-00	0.909	1.2
1200-00019-01	0.5	2.1
1200-00019-02	0.25	2.1

Table 3 - Transformer ratios

Custom transformer configurations may also be provided on request.

2.4.1.1 4-Wire VDT Simulation

Because the output E of a four-wire VDT is the sum of the two return coils, E_1 and E_2, the output may be expressed by the following equation:

$$E = V_{EXC} \times S \times d$$

where

V_{EXC} is the RMS, peak or instantaneous voltage,

S is the sensitivity of the VDT in units of $\frac{mV}{V*mm}$ or similar, and

d is the displacement of the VDT from its null position in units of corresponding length or rotation.

Note that because the displacement can be positive or negative that the return voltage can be in phase or inverted relative to the excitation.

Because the module has the capability of providing inverted outputs, each channel can be used to simulate two 4-wire VDTs with a common excitation.

2.4.1.2 5- and 6-wire VDT Simulation

Each channel of the module simulates a 6-wire VDT in its normal configuration. Connecting the channel's returns in series as shown in the following diagram yields a 5-wire configuration.

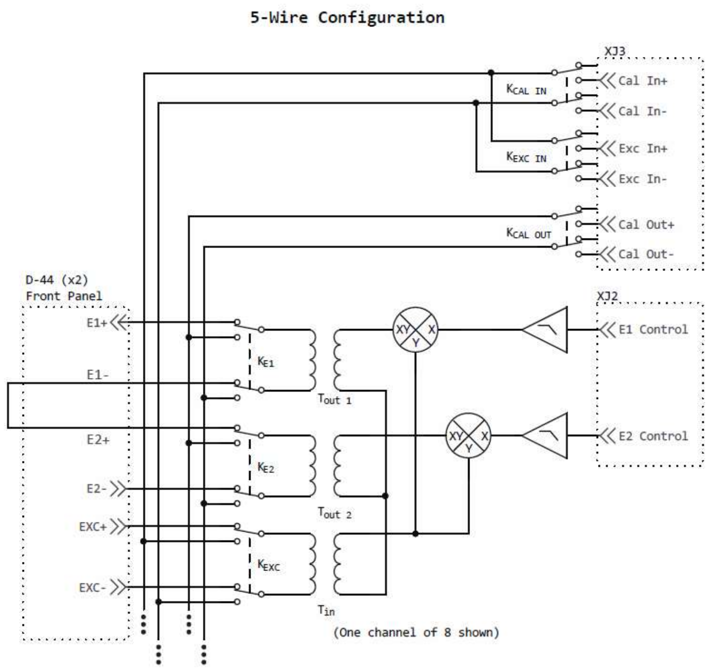


Figure 2 - 5-Wire simulation connections

The normal transfer function of a variable differential transformer can be expressed by the following equations:

$$E_1 = (V_{EXC} \times N) + (V_{EXC} \times S \times d)$$

$$E_2 = (V_{EXC} \times N) - (V_{EXC} \times S \times d)$$

where

> V_{EXC} is the RMS, peak or instantaneous voltage,
>
> S is the sensitivity of each return in units of $\frac{mV}{V*mm}$ or similar,
>
> d is the displacement of the VDT from its null position in units of corresponding length or rotation, and
>
> N is the nominal transformation ratio of the VDT, i.e. the ratio of the VDT when the VDT's displacement is 0.

Notes:

When obtained from a datasheet, sensitivity (S) is typically expressed based on the sensitivity of the VDT (that is, the sensitivity of the difference between E_1 and E_2), and thus must be divided by 2 for use in the equations above. When in doubt, the sensitivity can be derived using the following equation:

$$S = \frac{V_{max} - V_{min}}{V_{EXC} \times D}$$

where

V_{max}, V_{min} are the outputs of one of the returns at opposite ends of the VDT's displacement,

V_{EXC} is the excitation voltage, and

D is the total stroke (end-to-end displacement) of the VDT.

N is rarely available from the VDT data sheet but is necessary for this type of simulation. It may be derived using the following equation:

$$N = \frac{V_{max} + V_{min}}{2 \times V_{EXC}}$$

where

V_{max}, V_{min} are the outputs of one of the returns at opposite ends of the VDT's displacement, and

V_{EXC} is the excitation voltage.

Also note that in a 5- or 6-wire configuration, E_1 and E_2 are never inverted in polarity from the excitation; their difference will be inverted, however, for negative displacements.

2.4.1.3 Resolver Simulation

The resolver simulation works similarly to the 6-wire VDT simulation described above. The normal transfer function of a resolver can be expressed with the following equations:

$$S_{24} = R_{13} \times TR \times \sin(\mathrm{N}\Theta + \Phi)$$

$$S_{13} = R_{13} \times TR \times \cos(\mathrm{N}\Theta + \Phi)$$

where

S_{24} is the sine return, provided by the E1 return of a channel

S_{13} is the cosine return, provided by the E2 return of a channel

R_{13} is the excitation voltage, provided by the V_{EXC} input of a channel

TR is the nominal transformation ratio

N is the number of poles (or "speed") of the device

Θ is the angle of the rotor, and

Φ is the phase shift of the resolver.

The module does not simulate four-wire rotor resolvers.

2.4.1.4 Synchro Simulation

Synchro simulation requires three coils, and therefore the use of two channels sharing a common excitation. The three coils to simulate the synchro must have their returns connected as shown in Figure 3.

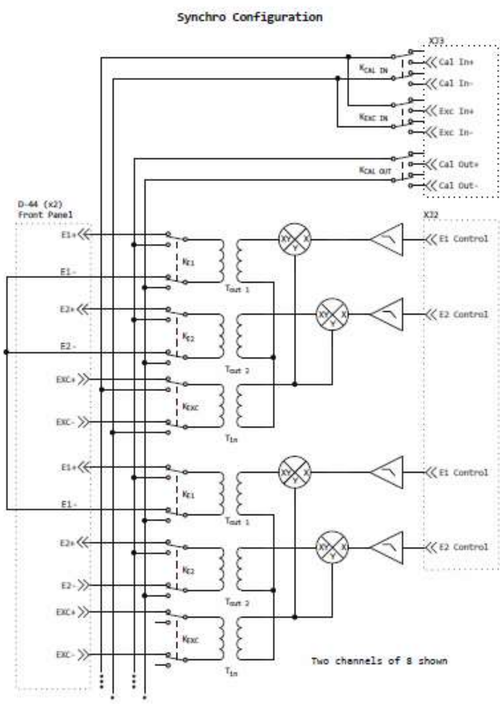


Figure 3 - Synchro simulation connections

The normal transfer function of a synchro can be expressed with the following equations:

$$E_x = V_{ex} \times TR \times \sin(\mathrm{N}\Theta + \Phi)$$

$$E_y = V_{ex} \times TR \times \sin(\mathrm{N}\Theta + \Phi \; + 120°)$$

$$E_z = V_{ex} \times TR \times \sin(\mathrm{N}\Theta + \Phi \; + 240°)$$

where

V_{ex} is the excitation voltage

TR is the nominal transformation ratio

N is the number of poles of the device

Θ is the angle of the rotor, and

Φ is the offset of the rotor.

2.5 Software Overview

The Bloomy 8-Channel SLSC VDT/Resolver Simulator Module offers a standalone SLSC-BCI-VDT LabVIEW API for LabVIEW applications, as well as a custom device for integration into NI VeriStand systems. The LabVIEW API calculates the control voltage(s) to apply based on the simulation type selected and provides basic control of module relays. The custom device pairs with a DAQ analog output device in a VeriStand system definition to generate control voltages for selected simulation types and provides basic relay control or external switching control through the NI Routing and Faulting custom device. The standalone API and custom device are available for download at www.bloomy.com.

The Bloomy 8-Channel SLSC VDT/Resolver Simulator Module is also accessible to the NI SLSC and NI SLSC Switch APIs. For a full list of properties accessible through the NI SLSC API, see Appendix C. For details of topologies, relays, and channels available through the NI SLSC Switch API, see Appendix D.

3.0 Installation

3.1 System Requirements

This module requires:

- an open slot in a National Instruments SLSC-12001 chassis
- a single-ended analog rear transition interface (RTI) module installed into the open slot
- a National Instruments PXI or Compact RIO D/A converter (two D/As per simulation channel)
- a cable which mates the RTI to the D/A converters
- LabVIEW 2019 or later
- SLSC 20.1 or later

3.2 External Connections

The module is designed to be used with the National Instruments Mil/Aero HIL SLSC standard system of components such as the Bloomy ThroughPoint™ Interface Panel. As such, most connections can be made using the off-the-shelf D-shell cables which are part of this system. When necessary, connections to the module may be made using custom D-shell cables per the pinouts shown in Appendix A.

4.0 Appendix A: Module Pinouts

4.1 J1: Simulation I/O Channels 0-3

Connector type: HD44F
Mates with: HD44M, e.g., AMP/TE Connectivity P/N 1757823-9

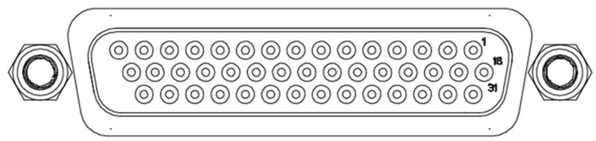


Figure 4 - J1 connector

Pin	Function	Pin	Function
1	Channel 0 E1+/S2	9	Channel 2 E1+/S2
16	Channel 0 E1-/S4	24	Channel 2 E1-/S4
2	Channel 0 E2+/S1	10	Channel 2 E2+/S1
17	Channel 0 E2-/S1	25	Channel 2 E2-/S3
3	NC	11	NC
18	NC	26	NC
32	Channel 0 EXC-/R3	40	Channel 2 EXC-/R3
31	Channel 0 EXC+/R1	39	Channel 2 EXC+/R1
5	Channel 1 E1+/S2	13	Channel 3 E1+/S2
20	Channel 1 E1-/S4	28	Channel 3 E1-/S4
6	Channel 1 E2+/S1	14	Channel 3 E2+/S1
21	Channel 1 E2-/S3	29	Channel 3 E2-/S3
7	NC	15	NC
22	NC	30	NC
36	Channel 1 EXC-/R3	44	Channel 3 EXC-/R3
35	Channel 1 EXC+/R1	43	Channel 3 EXC+/R1

Table 4 - J1 pinout

4.2 J2: Simulation I/O Channels 4-7

Connector type: HD44F
Mates with: HD44M, e.g., AMP/TE Connectivity P/N 1757823-9

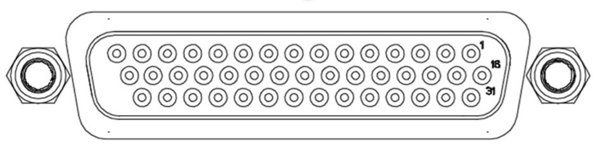


Figure 5 - J2 connector

Pin	Function	Pin	Function
1	Channel 4 E1+/S2	9	Channel 6 E1+/S2
16	Channel 4 E1-/S4	24	Channel 6 E1-/S4
2	Channel 4 E2+/S1	10	Channel 6 E2+/S1
17	Channel 4 E2-/S1	25	Channel 6 E2-/S3
3	NC	11	NC
18	NC	26	NC
32	Channel 4 EXC-/R3	40	Channel 6 EXC-/R3
31	Channel 4 EXC+/R1	39	Channel 6 EXC+/R1
5	Channel 5 E1+/S2	13	Channel 7 E1+/S2
20	Channel 5 E1-/S4	28	Channel 7 E1-/S4
6	Channel 5 E2+/S1	14	Channel 7 E2+/S1
21	Channel 5 E2-/S3	29	Channel 7 E2-/S3
7	NC	15	NC
22	NC	30	NC
36	Channel 5 EXC-/R3	44	Channel 7 EXC-/R3
35	Channel 5 EXC+/R1	43	Channel 7 EXC+/R1

Table 5 - J2 pinout

4.3 XJ1: SLSC Backplane

Reserved for SLSC use.

4.4 XJ2: Low Power Signal Interface

Connector type: 110-pin hard metric connector, ERNI Electronics P/N 354142

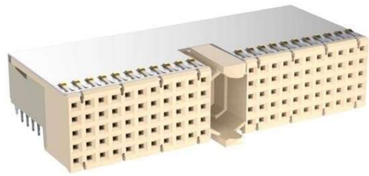


Figure 6 - XJ2 connector

Pin	SLSC Designation	Function	Pin	SLSC Designation	Function
A1	AI 1_0+	CH0 $V_{in,1}$	A15	AI 5_0+	NC
B1	AI 1_0-	CH0 $V_{in,1}$ RTN	B15	AI 5_0-	NC
D1	AI 1_1+	CH0 $V_{in,2}$	D15	AI 5_1+	NC
E1	AI 1_1-	CH0 $V_{in,2}$ RTN	E15	AI 5_1-	NC
A2	AI 1_2+	CH1 $V_{in,1}$	A16	AI 5_2+	NC
B2	AI 1_2-	CH1 $V_{in,1}$ RTN	B16	AI 5_2-	NC
D2	AI 1_3+	CH1 $V_{in,2}$	D16	AI 5_3+	NC
E2	AI 1_3-	CH1 $V_{in,2}$ RTN	E16	AI 5_3-	NC
A4	AI 2_0+	CH2 $V_{in,1}$	A18	AI 6_0+	NC
B4	AI 2_0-	CH2 $V_{in,1}$ RTN	B18	AI 6_0-	NC
D4	AI 2_1+	CH2 $V_{in,2}$	D18	AI 6_1+	NC
E4	AI 2_1-	CH2 $V_{in,2}$ RTN	E18	AI 6_1-	NC
A5	AI 2_2+	CH3 $V_{in,1}$	A19	AI 6_2+	NC
B5	AI 2_2-	CH3 $V_{in,1}$ RTN	B19	AI 6_2-	NC
D5	AI 2_3+	CH3 $V_{in,2}$	D19	AI 6_3+	NC
E5	AI 2_3-	CH3 $V_{in,2}$ RTN	E19	AI 6_3-	NC
A7	AI 3_0+	CH4 $V_{in,1}$	A21	AI 7_0+	NC
B7	AI 3_0-	CH4 $V_{in,1}$ RTN	B21	AI 7_0-	NC
D7	AI 3_1+	CH4 $V_{in,2}$	D21	AI 7_1+	NC
E7	AI 3_1-	CH4 $V_{in,2}$ RTN	E21	AI 7_1-	NC
A8	AI 3_2+	CH5 $V_{in,1}$	A22	AI 7_2+	NC
B8	AI 3_2-	CH5 $V_{in,1}$ RTN	B22	AI 7_2-	NC
D8	AI 3_3+	CH5 $V_{in,2}$	D22	AI 7_3+	NC
E8	AI 3_3-	CH5 $V_{in,2}$ RTN	E22	AI 7_3-	NC
A10	AI 4_0+	CH6 $V_{in,1}$	A24	AI 8_0+	NC

B10	AI 4_0-	CH6 $V_{in,1}$ RTN	B24	AI 8_0-	NC
D10	AI 4_1+	CH6 $V_{in,2}$	D24	AI 8_1+	NC
E10	AI 4_1-	CH6 $V_{in,2}$ RTN	E24	AI 8_1-	NC
A11	AI 4_2+	CH7 $V_{in,1}$	A25	AI 8_2+	NC
B11	AI 4_2-	CH7 $V_{in,1}$ RTN	B25	AI 8_2-	NC
D11	AI 4_3+	CH7 $V_{in,2}$	D25	AI 8_3+	NC
E11	AI 4_3-	CH7 $V_{in,2}$ RTN	E25	AI 8_3-	NC
F1	GND	GND	E3	GND	GND
F2	GND	GND	A6	GND	GND
F3	GND	GND	B6	GND	GND
F4	GND	GND	C6	GND	GND
F5	GND	GND	D6	GND	GND
F6	GND	GND	E6	GND	GND
F7	GND	GND	A9	GND	GND
F8	GND	GND	B9	GND	GND
F9	GND	GND	C9	GND	GND
10	GND	GND	D9	GND	GND
F11	GND	GND	E9	GND	GND
F15	GND	GND	A17	GND	GND
F16	GND	GND	B17	GND	GND
F17	GND	GND	C17	GND	GND
F18	GND	GND	D17	GND	GND
F19	GND	GND	E17	GND	GND
F20	GND	GND	A20	GND	GND
F21	GND	GND	B20	GND	GND
F22	GND	GND	C20	GND	GND
F23	GND	GND	D20	GND	GND
F24	GND	GND	E20	GND	GND
F25	GND	GND	A23	GND	GND
A3	GND	GND	B23	GND	GND
B3	GND	GND	C23	GND	GND
C3	GND	GND	D23	GND	GND
D3	GND	GND	E23	GND	GND

Table 6 - XJ2 pinout

4.5 XJ3: Instrumentation/Fault Bus

Connector: 8-position power connector, TE Connectivity P/N 5646958-2

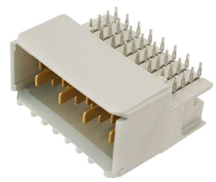


Figure 7 - XJ3 connector

Pin	Function	Pin	Function
A	Inst 0+	E	reserved
B	Inst 0-	F	reserved
C	Inst 1+	G	Exc In+
D	Inst 1-	H	Exc In-

Table 7 - XJ3 pinout

5.0 Appendix B: Module Memory Map

Address	Bitmask	Function
0x000		ID Demux
0x001	0000 0001	LED1_RED
	0000 0010	LED2_RED
	0000 0100	LED1_GREEN
	0000 1000	LED2_GREEN
0x100	0000 0001	CH0_EXC_TO_CAL1
	0000 0010	CH0_OUT1_TO_CAL2
	0000 0100	CH0_OUT2_TO_CAL2
	0001 0000	CH1_EXC_TO_CAL1
	0010 0000	CH1_OUT1_TO_CAL2
	0100 0000	CH1_OUT2_TO_CAL2
0x101	0000 0001	CH2_EXC_TO_CAL1
	0000 0010	CH2_OUT1_TO_CAL2
	0000 0100	CH2_OUT2_TO_CAL2
	0001 0000	CH3_EXC_TO_CAL1
	0010 0000	CH3_OUT1_TO_CAL2
	0100 0000	CH3_OUT2_TO_CAL2
0x102	0000 0001	CH4_EXC_TO_CAL1
	0000 0010	CH4_OUT1_TO_CAL2
	0000 0100	CH4_OUT2_TO_CAL2
	0001 0000	CH5_EXC_TO_CAL1
	0010 0000	CH5_OUT1_TO_CAL2
	0100 0000	CH5_OUT2_TO_CAL2
0x103	0000 0001	CH6_EXC_TO_CAL1
	0000 0010	CH6_OUT1_TO_CAL2
	0000 0100	CH6_OUT2_TO_CAL2
	0001 0000	CH7_EXC_TO_CAL1
	0010 0000	CH7_OUT1_TO_CAL2
	0100 0000	CH7_OUT2_TO_CAL2
0x104	0000 0001	CAL1_ENABLE (Connects CAL1 to XJ3-CD)
	0000 0010	EXCITE_ENABLE
	0000 0100	CAL2_ENABLE (Connects CAL2 to XJ3-AB)
0x200		Temperature #1 (low-order byte)
0x201		Temperature #1 (high-order byte)
0x202		Temperature #2 (low-order byte)
0x203		Temperature #2 (high-order byte)
0x300	0000 0001	DC_DC_ENABLE
0x400		CPLD Version (low-order byte)
0x401		CPLD Version
0x402		CPLD Version
0x403		CPLD Version (high-order byte)

Table 8 - Memory map

6.0 Appendix C: SLSC API Properties

6.1 Device Properties

Property	Type	Access	Description
BCI.ModuleLed1	Enum	Read/Write	Sets the color of LED #1.
BCI.ModuleLed2	Enum	Read/Write	Sets the color of LED #2.
BCI.ModuleLed1Override	Boolean	Read/Write	Enables manual control of LED #1.
BCI.ModuleLed2Override	Boolean	Read/Write	Enables manual control of LED #2.
BCI.TempSensor1	Double	Read Only	Returns the value of onboard temperature sensor #1.
BCI.TempSensor2	Double	Read Only	Returns the value of onboard temperature sensor #2.
BCI.CPLDVersion	U32	Read Only	Returns the current version of the module CPLD firmware.
BCI.DCDCEnable	Boolean	Read/Write	Controls the DC-DC converter used by the module circuitry.
BCI.ModuleID	String	Read Only	Returns the part number of the module.

Table 9 - SLSC device properties

6.2 Physical Channel Properties

Property	Type	Access	Description
CalConnections			
BCI.CalConnections.CalInputEnable	Boolean	Read/Write	Controls the relay that connects the calibration input bus to the rear connector
BCI.CalConnections.ExciteEnable	Boolean	Read/Write	Controls the relay that connects the excitation bus to the rear connector
BCI.CalConnections.CalOutputEnable	Boolean	Read/Write	Controls the relay that connects the calibration output bus to the rear connector
VDTSimCh1			
BCI.VDTSimCh1.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.

BCI.VDTSimCh1.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh1.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh1.Tin	Double	Read Only	Input transformer ratio for Channel 1
BCI.VDTSimCh1.ToutA	Double	Read Only	Output transformer ratio for Channel 1A
BCI.VDTSimCh1.ToutB	Double	Read Only	Output transformer ratio for Channel 1B.
VDTSimCh2			
BCI.VDTSimCh2.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh2.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh2.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh2.Tin	Double	Read Only	Input transformer ratio for Channel 2
BCI.VDTSimCh2.ToutA	Double	Read Only	Output transformer ratio for Channel 2A
BCI.VDTSimCh2.ToutB	Double	Read Only	Output transformer ratio for Channel 2B.

VDTSimCh3			
BCI.VDTSimCh3.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh3.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh3.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh3.Tin	Double	Read Only	Input transformer ratio for Channel 3
BCI.VDTSimCh3.ToutA	Double	Read Only	Output transformer ratio for Channel 3A
BCI.VDTSimCh3.ToutB	Double	Read Only	Output transformer ratio for Channel 3B.
VDTSimCh4			
BCI.VDTSimCh4.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh4.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh4.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output

			bus.
BCI.VDTSimCh4.Tin	Double	Read Only	Input transformer ratio for Channel 4
BCI.VDTSimCh4.ToutA	Double	Read Only	Output transformer ratio for Channel 4A
BCI.VDTSimCh4.ToutB	Double	Read Only	Output transformer ratio for Channel 4B.
VDTSimCh5			
BCI.VDTSimCh5.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh5.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh5.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh5.Tin	Double	Read Only	Input transformer ratio for Channel 5
BCI.VDTSimCh5.ToutA	Double	Read Only	Output transformer ratio for Channel 5A
BCI.VDTSimCh5.ToutB	Double	Read Only	Output transformer ratio for Channel 5B.
VDTSimCh6			
BCI.VDTSimCh6.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh6.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects

			output 1 transformer to calibration output bus.
BCI.VDTSimCh6.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh6.Tin	Double	Read Only	Input transformer ratio for Channel 6
BCI.VDTSimCh6.ToutA	Double	Read Only	Output transformer ratio for Channel 6A
BCI.VDTSimCh6.ToutB	Double	Read Only	Output transformer ratio for Channel 6B.
VDTSimCh7			
BCI.VDTSimCh7.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation calibration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh7.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh7.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh7.Tin	Double	Read Only	Input transformer ratio for Channel 7
BCI.VDTSimCh7.ToutA	Double	Read Only	Output transformer ratio for Channel 7A
BCI.VDTSimCh7.ToutB	Double	Read Only	Output transformer ratio for Channel 7B.
VDTSimCh8			
BCI.VDTSimCh8.ExcCalRelayEnable	Boolean	Read/Write	Determines the state of the excitation cali-

			bration relay. Enabling relay connects excitation transformer to calibration input bus.
BCI.VDTSimCh8.Output1CalRelayEnable	Boolean	Read/Write	Determines the state of the output 1 calibration relay. Enabling relay connects output 1 transformer to calibration output bus.
BCI.VDTSimCh8.Output2CalRelayEnable	Boolean	Read/Write	Determines the state of the output 2 calibration relay. Enabling relay connects output 2 transformer to calibration output bus.
BCI.VDTSimCh8.Tin	Double	Read Only	Input transformer ratio for Channel 8
BCI.VDTSimCh8.ToutA	Double	Read Only	Output transformer ratio for Channel 8A
BCI.VDTSimCh8.ToutB	Double	Read Only	Output transformer ratio for Channel 8B.

Table 10 – SLSC physical channel properties

7.0 Appendix D: NI SLSC Switch Topologies

Caution! *Improper use of the relays could lead to damage to the module, system or unit under test.*

The Bloomy 8-Channel VDT/Resolver Simulator Module is compatible with the NI SLSC Switch API and contains a single topology, **BCI_VDT**.

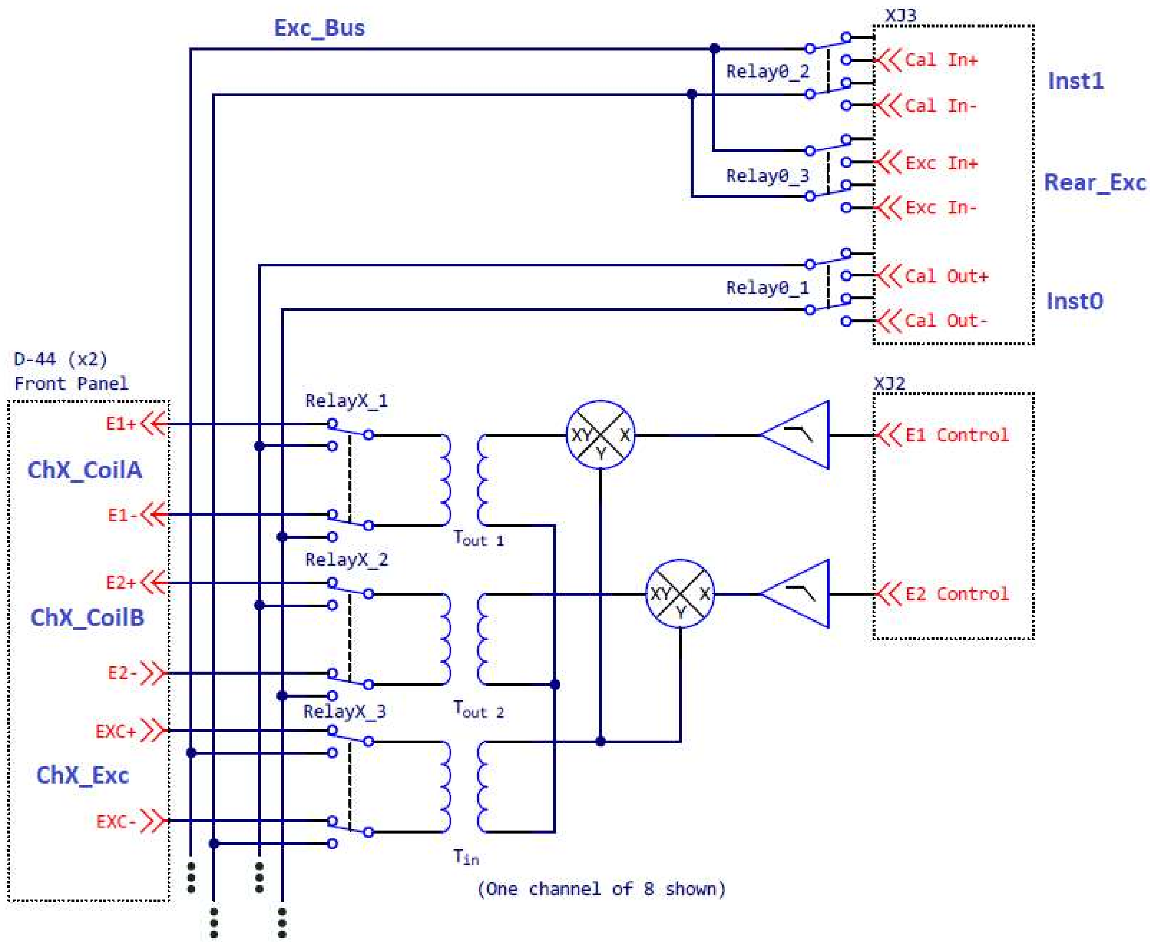


Figure 8 - Channel endpoints and relays for BCI_VDT topology

Figure 8 shows a single channel of the VDT module. Channel endpoints are shown in blue and relay names are shown next to each relay. The module contains a single relay, Relay0_1, which connects the internal calibration bus to an external instrument bus through the XJ3 connector. It also contains two relays, Relay0_2 and Relay0_3[1], which connect the internal excitation bus to external busses for calibration or common excitation through the XJ3 connector. The other relays, RelayX_1, RelayX_2, and RelayX_3, are per-channel and connect simulation coils to either the internal buses or the front panel connector. A complete list of relays available to the NI SLSC Switch API under the BCI_VDT topology is shown in Table 11.

[1] Relay0_3 is not present in modules manufactured prior to 2017.

Relay	Function
Relay0_1	Connects module internal calibration bus to Inst0 external bus.
Relay0_2	Connects module internal excitation bus to Inst1 external bus.
Relay0_3	Connects module internal exciation bus to external excitation bus.
Relay1_1	Connects the Ch0 E1 coil either to the front panel or to the internal calibration bus.
Relay1_2	Connects the Ch0 E2 coil either to the front panel or to the internal calibration bus.
Relay1_3	Connects the Ch0 input coil either to the front panel or to the internal excitation bus.
Relay2_1	Connects the Ch1 E1 coil either to the front panel or to the internal calibration bus.
Relay2_2	Connects the Ch1 E2 coil either to the front panel or to the internal calibration bus.
Relay2_3	Connects the Ch1 input coil either to the front panel or to the internal excitation bus.
Relay3_1	Connects the Ch2 E1 coil either to the front panel or to the internal calibration bus.
Relay3_2	Connects the Ch2 E2 coil either to the front panel or to the internal calibration bus.
Relay3_3	Connects the Ch2 input coil either to the front panel or to the internal excitation bus.
Relay4_1	Connects the Ch3 E1 coil either to the front panel or to the internal calibration bus.
Relay4_2	Connects the Ch3 E2 coil either to the front panel or to the internal calibration bus.
Relay4_3	Connects the Ch3 input coil either to the front panel or to the internal excitation bus.
Relay5_1	Connects the Ch4 E1 coil either to the front panel or to the internal calibration bus.
Relay5_2	Connects the Ch4 E2 coil either to the front panel or to the internal calibration bus.
Relay5_3	Connects the Ch4 input coil either to the front panel or to the internal excitation bus.
Relay6_1	Connects the Ch5 E1 coil either to the front panel or to the internal calibration bus.
Relay6_2	Connects the Ch5 E2 coil either to the front panel or to the internal calibra-

	tion bus.
Relay6_3	Connects the Ch5 input coil either to the front panel or to the internal excitation bus.
Relay7_1	Connects the Ch6 E1 coil either to the front panel or to the internal calibration bus.
Relay7_2	Connects the Ch6 E2 coil either to the front panel or to the internal calibration bus.
Relay7_3	Connects the Ch6 input coil either to the front panel or to the internal excitation bus.
Relay8_1	Connects the Ch7 E1 coil either to the front panel or to the internal calibration bus.
Relay8_2	Connects the Ch7 E2 coil either to the front panel or to the internal calibration bus.
Relay8_3	Connects the Ch7 input coil either to the front panel or to the internal excitation bus.

Table 11 - BCI_VDT relays

Channel connections accessible to the NI SLSC Switch API under the BCI_VDT topology are show below in Table 12.

Endpoint 1	Endpoint 2	Description
Exc_Bus	Rear_Exc	Connects the internal excitation bus to the external excitation bus.
Exc_Bus	Inst1	Connects the internal excitation bus to the external Inst1 bus.
Ch0_Exc	Exc_Bus	Connects the Channel 0 excitation to the internal excitation bus.
Ch0_CoilA	Inst0	Connects the Channel 0 E1 coil to the external Inst0 bus.
Ch0_CoilA	Open	Connects the Channel 0 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch0_CoilB	Inst0	Connects the Channel 0 E2 coil to the external Inst0 bus.
Ch0_CoilB	Open	Connects the Channel 0 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch1_Exc	Exc_Bus	Connects the Channel 1 excitation to the internal excitation bus.
Ch1_CoilA	Inst0	Connects the Channel 1 E1 coil to the external Inst0 bus.
Ch1_CoilA	Open	Connects the Channel 1 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch1_CoilB	Inst0	Connects the Channel 1 E2 coil to the external Inst0 bus.
Ch1_CoilB	Open	Connects the Channel 1 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch2_Exc	Exc_Bus	Connects the Channel 2 excitation to the internal excitation bus.
Ch2_CoilA	Inst0	Connects the Channel 2 E1 coil to the external Inst0 bus.
Ch2_CoilA	Open	Connects the Channel 2 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch2_CoilB	Inst0	Connects the Channel 2 E2 coil to the external Inst0 bus.
Ch2_CoilB	Open	Connects the Channel 2 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch3_Exc	Exc_Bus	Connects the Channel 3 excitation to the internal excitation bus.
Ch3_CoilA	Inst0	Connects the Channel 3 E1 coil to the external Inst0 bus.
Ch3_CoilA	Open	Connects the Channel 3 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch3_CoilB	Inst0	Connects the Channel 3 E2 coil to the external Inst0 bus.
Ch3_CoilB	Open	Connects the Channel 3 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch4_Exc	Exc_Bus	Connects the Channel 4 excitation to the internal excitation bus.
Ch4_CoilA	Inst0	Connects the Channel 4 E1 coil to the external Inst0 bus.
Ch4_CoilA	Open	Connects the Channel 4 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.

Ch4_CoilB	Inst0	Connects the Channel 4 E2 coil to the external Inst0 bus.
Ch4_CoilB	Open	Connects the Channel 4 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch5_Exc	Exc_Bus	Connects the Channel 5 excitation to the internal excitation bus.
Ch5_CoilA	Inst0	Connects the Channel 5 E1 coil to the external Inst0 bus.
Ch5_CoilA	Open	Connects the Channel 5 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch5_CoilB	Inst0	Connects the Channel 5 E2 coil to the external Inst0 bus.
Ch5_CoilB	Open	Connects the Channel 5 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch6_Exc	Exc_Bus	Connects the Channel 6 excitation to the internal excitation bus.
Ch6_CoilA	Inst0	Connects the Channel 6 E1 coil to the external Inst0 bus.
Ch6_CoilA	Open	Connects the Channel 6 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch6_CoilB	Inst0	Connects the Channel 6 E2 coil to the external Inst0 bus.
Ch6_CoilB	Open	Connects the Channel 6 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch7_Exc	Exc_Bus	Connects the Channel 7 excitation to the internal excitation bus.
Ch7_CoilA	Inst0	Connects the Channel 7 E1 coil to the external Inst0 bus.
Ch7_CoilA	Open	Connects the Channel 7 E1 coil to the internal calibration bus without connecting the calibration bus to external buses.
Ch7_CoilB	Inst0	Connects the Channel 7 E2 coil to the external Inst0 bus.
Ch7_CoilB	Open	Connects the Channel 7 E2 coil to the internal calibration bus without connecting the calibration bus to external buses.

Table 12 - BCI_VDT channel connections