Variable Resistance Module

Product Data Sheet
B&A Document 110050_A

Part No.
200169

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	INTRODUCTION		SAFETY

This document contains technical specifications for the Variable Resistance Module (B&A Part No. 200169). Specifications are shown at 25 °C temperature, unless otherwise noted. The main features of the module are listed below:

- Up to 16 independent isolated channels
- Digitally configurable output resistance
- Output is purely resistive, no digital or analog circuitry
- Internal housekeeping / Health monitoring
- Safe to connect to Flight hardware, FMEA approved
- LabVIEW drivers

The following items must be considered for safety:

- Using the Variable Resistance Module in a manner not described within this document damage the Variable Resistance Module.
- The SLSC-12001 chassis and the SLSC Modules **do not support** hot plug-in. The entire chassis must be powered down when a module is installed.
- Always follow ESD procedures for handling.
- If cleaning is required, wipe with dry and clean towel.
- Installation of the Variable Resistance Module must be performed in accordance with "B&A SLSC Module User Manual" (Document No. 140040).

	INTERFACES		SPECIFICATIONS[1]

Front Output Connector	37 Position Receptacle (Male Pin) D-sub
Backplane Connector	55 Position Compact PCI
Number of Channels	16 (CH0 – CH15)
Power Up State	Disabled, Full Scale Output
Number of on-card Temperature Sensors	4
Properties	See Page 8

Maximum Resistance (Ω)	16383
Least Significant Bit (Ω)	1
Resolution (bit)	14
Maximum Current (mA)	3.5
Register Mapping	See Page 11
Configuration Option	See Page 13

Note:
(1) For further specification details, please contact support@baengineering.com

STANDARD CONFIGURATIONS SPECIFICATIONS

Available Part No.	Number of Channels	Resolution	Resistor Tolerance
200169-00	16	14 bits	L (0.1%)
200169-XX	Customizable based on customer requests. (see last page for ordering instructions)		

| Product Specifications	Min	Max
Absolute Maximum Voltage Per Channel (V)[1]		75
Absolute Maximum Current Per Channel (mA)		4.6
	Min	Max
Maximum Recommended Voltage Per Channel (V)[1]		57
Maximum Recommended Current Per Channel (mA)		3.5
Number of Channels	4	16
Resistance Range (Ω)[2]	1	16383
Resistance Resolution (bit)	10	14
Resistance Least Significant Bit (Ω)	1	
Resistance Error from 0Ω to 100Ω (mΩ)[3]	471	738
Resistance Error from 0Ω to 100Ω (%)[3]	0.318	56.1
Resistance Error from 100Ω to 1kΩ (mΩ)[3]	340	810
Resistance Error from 100Ω to 1kΩ (%)[3]	0.044	0.607
Resistance Error from 1kΩ to 16.3kΩ (Ω)[3]	0.2	2.2
Resistance Error from 1kΩ to 16.3kΩ (%)[3]	0.002	0.082
Short Circuit Resistance (Ω)		1

Note:
(1) Voltage rating is only applicable if current is below maximum rating.
(2) For 14bit card only. The maximum resistance of lower resolution configurations is $2^{(\#bit + LSB - 1)}$ - LSB.
(3) Values obtained through testing. Actual values may vary by an additional 0.1% - 5% due to resistor tolerance.

⚙ FUNCTIONAL BLOCK DIAGRAM

The functional block diagram is shown below:
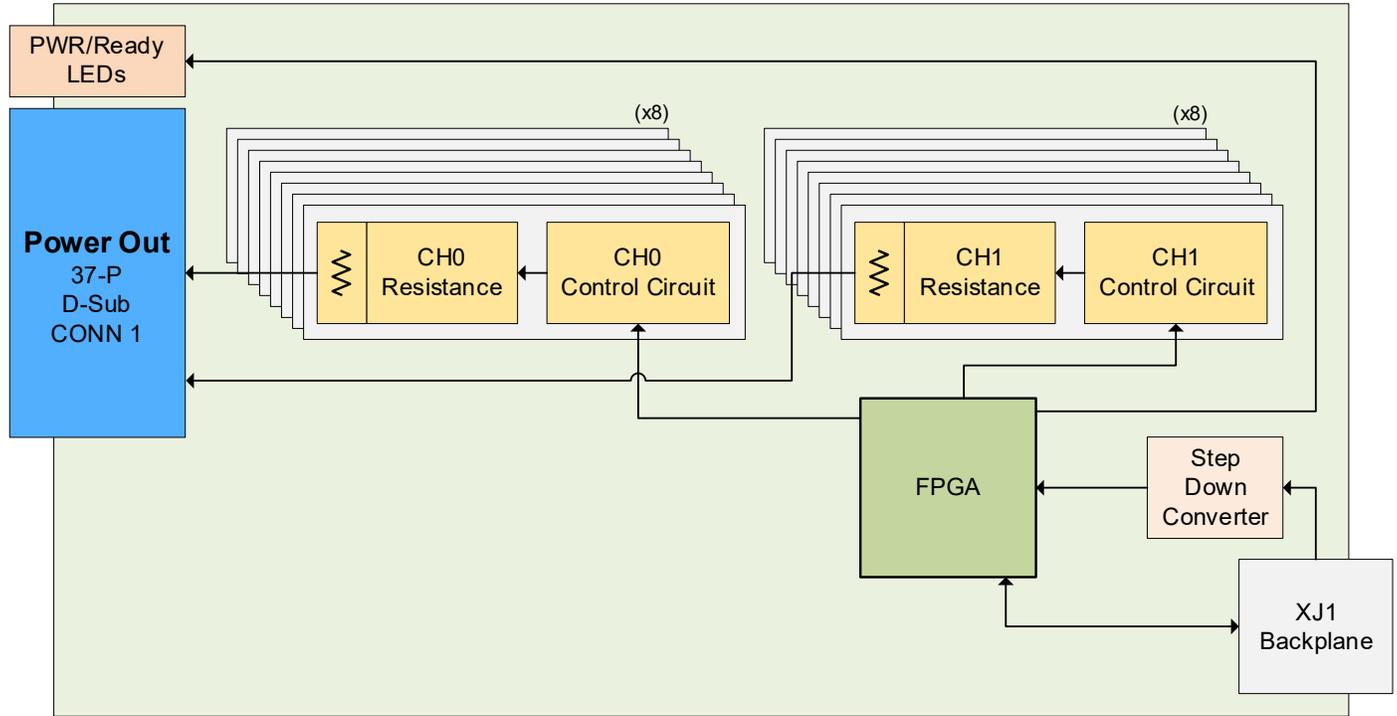
Item	Function/Application
XJ1	Main power source of SLSC module and communication line
LEDs	Power-on and Ready status

OUTPUT ERROR CHARACTERIZATION (For 0.1% Configuration)

Error (Ω) 0Ω to 100Ω

Error (%) 0Ω to 100Ω

Error (Ω) 100Ω to 1kΩ

Error (%) 100Ω to 1kΩ

Error (Ω) 1kΩ to 16.3kΩ

Error (%) 1kΩ to 16.3kΩ
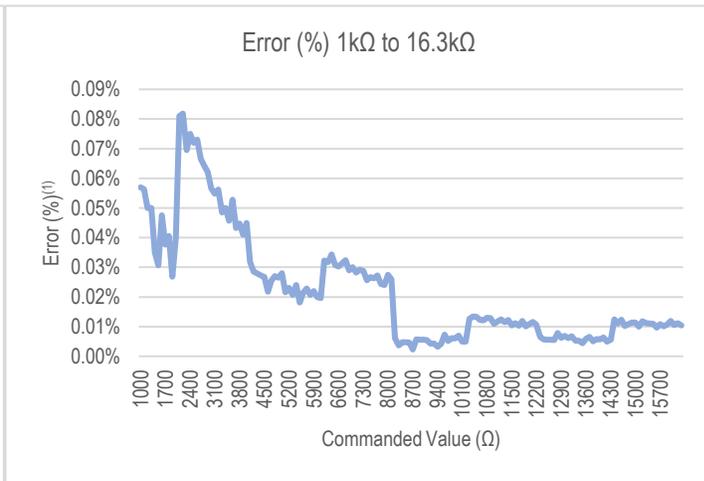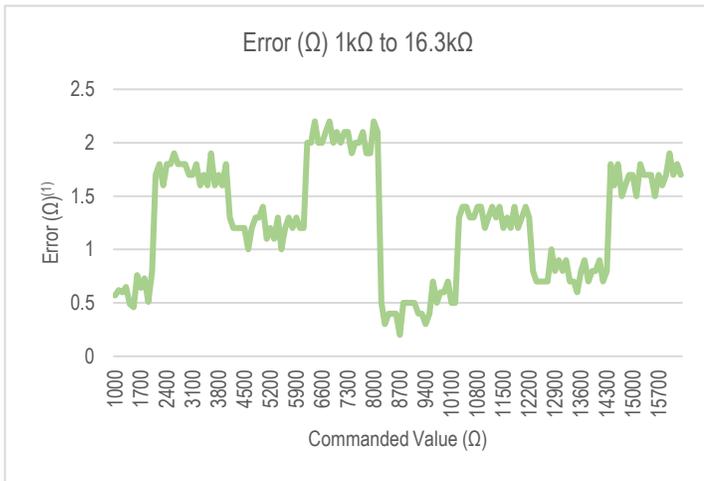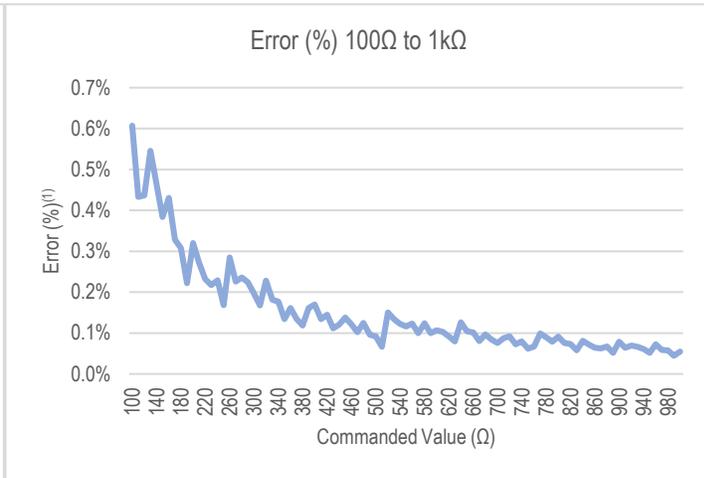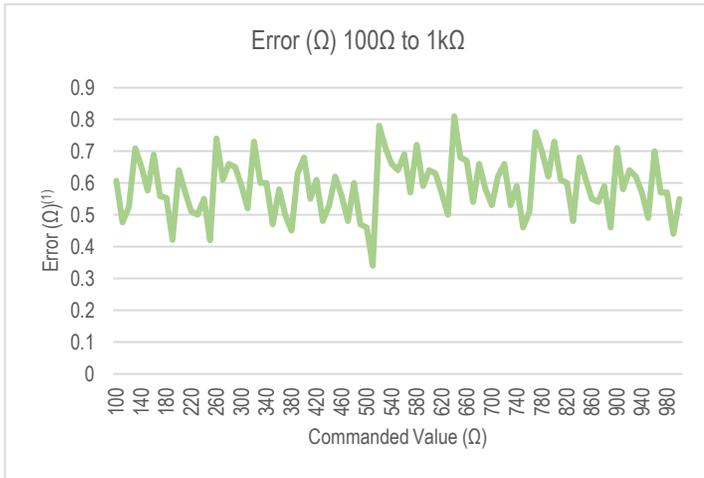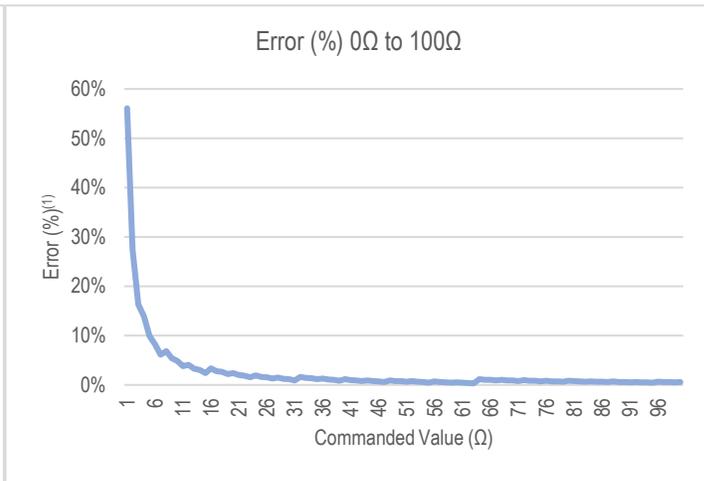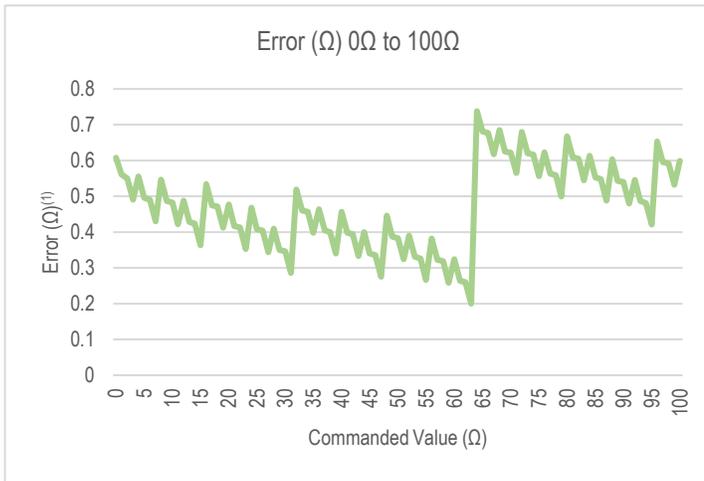
Note:
(1) Values obtained through testing. Actual values may vary by an additional 0.1% due to resistor tolerance.

DATASHEET

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PHYSICAL DIMENSIONS

11.4"

6.78"

5.70"

1.18"

1.41"

13.00"

Front Panel View

Top View
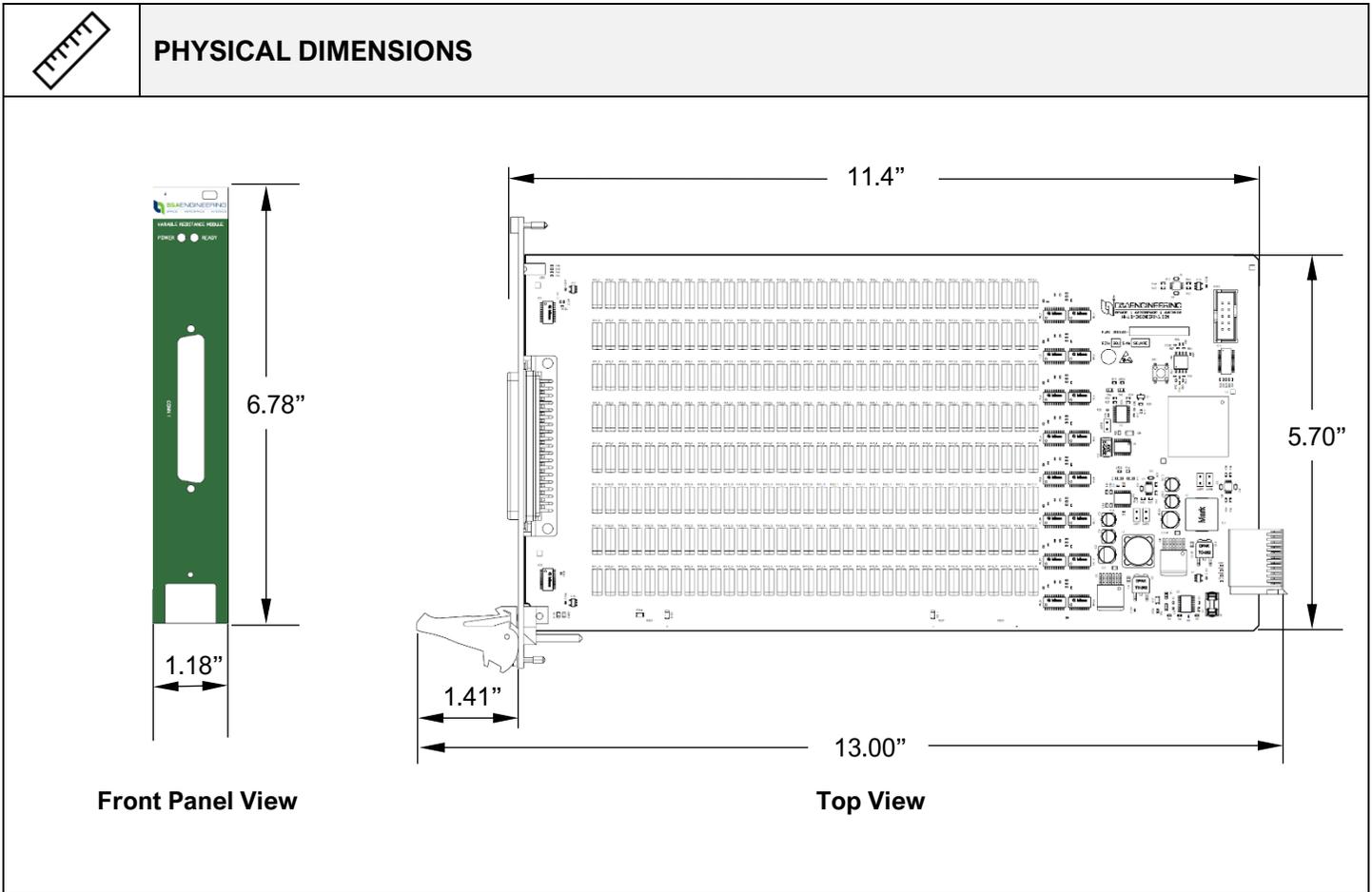
FRONT PANEL CONNECTOR 1 PINOUT

Left Pin	Pin #	Pin #	Signal
		1	CH0_IN
CH0_RTN	20		
		2	CH1_IN
CH1_RTN	21		
		3	CH2_IN
CH2_RTN	22		
		4	CH3_IN
CH3_RTN	23		
		5	CH4_IN
CH4_RTN	24		
		6	CH5_IN
CH5_RTN	25		
		7	CH6_IN
CH6_RTN	26		
		8	CH7_IN
CH7_RTN	27		
		9	CH8_IN
CH8_RTN	28		
		10	CH9_IN
CH9_RTN	29		
		11	CH10_IN
CH10_RTN	30		
		12	CH11_IN
CH11_RTN	31		
		13	CH12_IN
CH12_RTN	32		
		14	CH13_IN
CH13_RTN	33		
		15	CH14_IN
CH14_RTN	34		
		16	CH15_IN
CH15_RTN	35		
		17	N/C
N/C	36		
		18	N/C
N/C	37		
		19	CHASSIS_GND

VARIABLE RESISTANCE MODULE

POWER ○ ○ READY

CONN 1
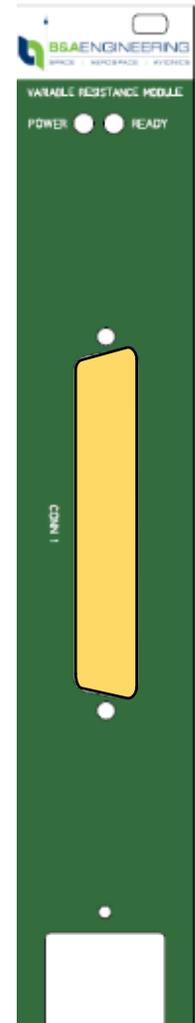
BACKPLANE 55P XJ1 CONNECTOR PINOUT
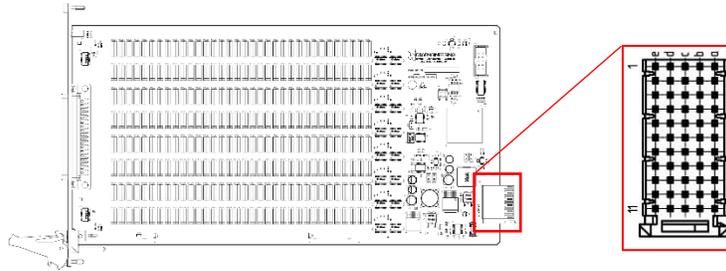
	e	d	c	b	a
1	N/C	N/C	N/C	N/C	N/C
2	N/C	N/C	N/C	N/C	N/C
3	N/C	N/C	N/C	N/C	N/C
4	N/C	N/C	N/C	N/C	N/C
5	N/C	N/C	N/C	N/C	N/C
6	N/C	N/C	N/C	N/C	N/C
7	GSE_GND	N/C	GSE_GND	N/C	GSE_GND
8	SLSC_SpiMosi	GSE_GND	SLSC_SpiCLK	GSE_GND	SLSC_IntIn#
9	GSE_GND	SLSC_Trig_To_Mod	GSE_GND	SLSC_Trig_From_Mod	GSE_GND
10	N/C	GSE_GND	SLSC_SpiMiso	GSE_GND	SLSC_ED_SS#
11	24 V	SLSC_Rdy/Rst#	3.3 V	SLSC_ID_SS#	24 V

PROPERTIES TABLE
For use with NI SLSC VI package

Signal Name	Description	Documentation	RW
BA.ModuleControllerVersion	Module Controller Version.	The version is the timestamp, in hexadecimal format, of the time the Module Controller was compiled.	R
BA.SLSC_3p3_Voltage	Read SLSC 3.3V Rail Voltage.	Read SLSC 3.3V Rail Voltage.	R
BA.SLSC_24V_Voltage	Read SLSC 24V Rail Voltage.	Read SLSC 24V Rail Voltage.	R
BA.SLSC_24V_Current	Read SLSC 24V Rail Current.	Read SLSC 24V Rail Current.	R
BA.GSE_3p3V_Voltage	Read GSE 3.3V Rail Voltage.	Read GSE 3.3V Rail Voltage.	R
BA.GSE_3p3V_Current	Read GSE 3.3V Rail Current.	Read GSE 3.3V Rail Current.	R
BA.GSE_1p5V_Voltage	Read GSE 1.5V Rail Voltage.	Read GSE 1.5V Rail Voltage.	R
BA.GSE_1p5V_Current	Read GSE 1.5V Rail Current.	Read GSE 1.5V Rail Current.	R
BA.GSE_Temperature_Sensor_1	Read GSE Temperature Sensor 1.	Read GSE Temperature Sensor 1.	R
BA.GSE_Temperature_Sensor_2	Read GSE Temperature Sensor 2.	Read GSE Temperature Sensor 2.	R
BA.GSE_Temperature_Sensor_3	Read GSE Temperature Sensor 3.	Read GSE Temperature Sensor 3.	R
BA.GSE_Temperature_Sensor_4	Read GSE Temperature Sensor 4.	Read GSE Temperature Sensor 4.	R
BA.Switch_Enable_0	Switch Enable for Channel 0.	Switch Enable for Channel 0.	RW
BA.Switch_Enable_1	Switch Enable for Channel 1.	Switch Enable for Channel 1.	RW
BA.Switch_Enable_2	Switch Enable for Channel 2.	Switch Enable for Channel 2.	RW
BA.Switch_Enable_3	Switch Enable for Channel 3.	Switch Enable for Channel 3.	RW
BA.Switch_Enable_4	Switch Enable for Channel 4.	Switch Enable for Channel 4.	RW
BA.Switch_Enable_5	Switch Enable for Channel 5.	Switch Enable for Channel 5.	RW

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Signal Name	Description	Documentation	RW
BA.Switch_Enable_6	Switch Enable for Channel 6.	Switch Enable for Channel 6.	RW
BA.Switch_Enable_7	Switch Enable for Channel 7.	Switch Enable for Channel 7.	RW
BA.Switch_Enable_8	Switch Enable for Channel 8.	Switch Enable for Channel 8.	RW
BA.Switch_Enable_9	Switch Enable for Channel 9.	Switch Enable for Channel 9.	RW
BA.Switch_Enable_10	Switch Enable for Channel 10.	Switch Enable for Channel 10.	RW
BA.Switch_Enable_11	Switch Enable for Channel 11.	Switch Enable for Channel 11.	RW
BA.Switch_Enable_12	Switch Enable for Channel 12.	Switch Enable for Channel 12.	RW
BA.Switch_Enable_13	Switch Enable for Channel 13.	Switch Enable for Channel 13.	RW
BA.Switch_Enable_14	Switch Enable for Channel 14.	Switch Enable for Channel 14.	RW
BA.Switch_Enable_15	Switch Enable for Channel 15.	Switch Enable for Channel 15.	RW
BA.Error_Global_Open_Load	Global Relay Driver Ouput Open Load Error.	Global Relay Driver Ouput Open Load Error.	R
BA.Error_Global_Transmission_Error	Global Relay Driver Transmission Error.	Global Relay Driver Transmission Error.	R
BA.Error_Global_Mode_0	Global Relay Driver Mode 0 Error.	Global Relay Driver Mode 0 Error.	R
BA.Error_Global_Mode_1	Global Relay Driver Mode 1 Error.	Global Relay Driver Mode 1 Error.	R
BA.Error_Global_Relay_Logic_Supply	Global Relay Driver Logic Supply Overvoltage Error.	Global Relay Driver Logic Supply Overvoltage Error.	R
BA.Error_Global_Relay_Driver_Supply	Global Relay Supply Voltage Undervoltage Error.	Global Relay Supply Voltage Undervoltage Error.	R
BA.Channel_Relay_Driver_Supply	Per Channel Relay Supply Voltage Undervoltage Error.	Per Channel Relay Supply Voltage Undervoltage Error.	R
BA.Channel_Relay_Logic_Supply	Per Channel Relay Driver Logic Supply Voltage Range.	Per Channel Relay Driver Logic Supply Voltage Range.	R
BA.Channel_Mode_0	Per Channel Relay Driver Mode 0 Value.	Per Channel Relay Driver Mode 0 Value.	R

Signal Name	Description	Documentation	RW
BA.Channel_Mode_1	Per Channel Relay Driver Mode 1 Value.	Per Channel Relay Driver Mode 1 Value.	R
BA.Channel_Tranmission_Error	Per Channel Relay Driver Transmission Error.	Per Channel Relay Driver Transmission Error.	R
BA.Channel_Output_Open_Load	Per Channel Relay Driver Output Open Load Error.	Per Channel Relay Driver Output Open Load Error.	R
BA.Resistance_Channel_0	Channel 0 Output Resistance.	Channel 0 Output Resistance.	RW
BA.Resistance_Channel_1	Channel 1 Output Resistance.	Channel 1 Output Resistance.	RW
BA.Resistance_Channel_2	Channel 2 Output Resistance.	Channel 2 Output Resistance.	RW
BA.Resistance_Channel_3	Channel 3 Output Resistance.	Channel 3 Output Resistance.	RW
BA.Resistance_Channel_4	Channel 4 Output Resistance.	Channel 4 Output Resistance.	RW
BA.Resistance_Channel_5	Channel 5 Output Resistance.	Channel 5 Output Resistance.	RW
BA.Resistance_Channel_6	Channel 6 Output Resistance.	Channel 6 Output Resistance.	RW
BA.Resistance_Channel_7	Channel 7 Output Resistance.	Channel 7 Output Resistance.	RW
BA.Resistance_Channel_8	Channel 8 Output Resistance.	Channel 8 Output Resistance.	RW
BA.Resistance_Channel_9	Channel 9 Output Resistance.	Channel 9 Output Resistance.	RW
BA.Resistance_Channel_10	Channel 10 Output Resistance.	Channel 10 Output Resistance.	RW
BA.Resistance_Channel_11	Channel 11 Output Resistance.	Channel 11 Output Resistance.	RW
BA.Resistance_Channel_12	Channel 12 Output Resistance.	Channel 12 Output Resistance.	RW
BA.Resistance_Channel_13	Channel 13 Output Resistance.	Channel 13 Output Resistance.	RW
BA.Resistance_Channel_14	Channel 14 Output Resistance.	Channel 14 Output Resistance.	RW
BA.Resistance_Channel_15	Channel 15 Output Resistance.	Channel 15 Output Resistance.	RW

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REGISTER MAPPING TABLE
For developing custom SLSC drivers

Name	Addr (x16)	RW	Length	Reset Value	Bits							
Version	0000	R	32	x"00040002"	31	30	29	…	…	2	1	0
					Version							
Miscellaneous	0004	RW	8	x"02"	7	6	5	4	3	2	1	0
					X	X	X	X	X	X	aldHold	aldWp
SLSC 24V Voltage	0005	R	32		31	30	29	…	…	2	1	0
					SLSC Backplane 24V Sense							
SLSC 3.3V Voltage	0007	R	32		31	30	29	…	…	2	1	0
					SLSC Backplane 3.3V Sense							
GSE 3.3V Voltage	0009	R	32		31	30	29	…	…	2	1	0
					Regulator GSE_3.3V Sense							
GSE 1.5V Voltage	000B	R	32		31	30	29	…	…	2	1	0
					Regulator GSE_1.5V Sense							
SLSC 24V Current	000D	R	32		31	30	29	…	…	2	1	0
					SLSC Backplane 24V Current Sense							
GSE 3.3V Current	000E	R	32		31	30	29	…	…	2	1	0
					Regulator GSE_3.3V Current Sense							
GSE 1.5V Current	000F	R	32		31	30	29	…	…	2	1	0
					Regulator GSE_1.5V Current Sense							
GSE Temperature Sensor 1	0011	R	32		31	30	29	…	…	2	1	0
					TEMP #1							
GSE Temperature Sensor 2	0012	R	32		31	30	29	…	…	2	1	0
					TEMP #2							
GSE Temperature Sensor 3	0013	R	32		31	30	29	…	…	2	1	0
					TEMP #3							
GSE Temperature Sensor 4	0014	R	32		31	30	29	…	…	2	1	0
					TEMP #4							
General Register	0015	RW	16	x"0000"	15	14	…	n+1	n	…	1	0
					EN_15	EN_14	…	EN_n+1	EN_n	…	EN_1	EN_0
Global Diagnostics	0016	R	8		7	6	5	4	3	2	1	0
					X	X	UVRVS	OPVDD	MODE_1	MODE_0	TER	OLOFF
UVRVS	0017	R	32		15	14	…	n+1	n	…	1	0
					UVRVS_15	UVRVS_14	…	UVRVS_n+1	UVRVS_n	…	UVRVS_1	UVRVS_0
OPVDD	0018	R	32		15	14	…	n+1	n	…	1	0
					OPVDD_15	OPVDD_14	…	OPVDD_n+1	OPVDD_n	…	OPVDD_1	OPVDD_0
MODE_0	0019	R	32		15	14	…	n+1	n	…	1	0
					MODE0_15	MODE0_14	…	MODE0_n+1	MODE0_n	…	MODE0_1	MODE0_0

Name	Addr (x16)	RW	Length	Reset Value	Bits							
MODE_1	001A	R	32		15	14	…	$n+1$	n	…	1	0
					MODE1_15	MOED1_14	…	MODE1_$n+1$	MODE1_n	…	MODE1_1	MODE1_0
TER	001B	R	32		15	14	…	$n+1$	n	…	1	0
					TER_15	TER_14	…	TER_$n+1$	TER_n	…	TER_1	TER_0
OLOFF	001C	R	32		15	14	…	$n+1$	n	…	1	0
					OLOFF_15	OLOFF_14	…	OLOFF_$n+1$	OLOFF_n	…	OLOFF_1	OLOFF_0
Channel 0 Resistance	001D	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 1 Resistance	001E	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 2 Resistance	001F	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 3 Resistance	0020	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 4 Resistance	0021	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 5 Resistance	0022	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 6 Resistance	0023	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 7 Resistance	0024	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 8 Resistance	0025	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 9 Resistance	0026	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 10 Resistance	0027	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 11 Resistance	0028	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 12 Resistance	0029	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 13 Resistance	002A	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 14 Resistance	002B	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					
Channel 15 Resistance	002C	RW	16	x"FFFF"	16	15	14	13	…	…	1	0
					X	X	Resistance					

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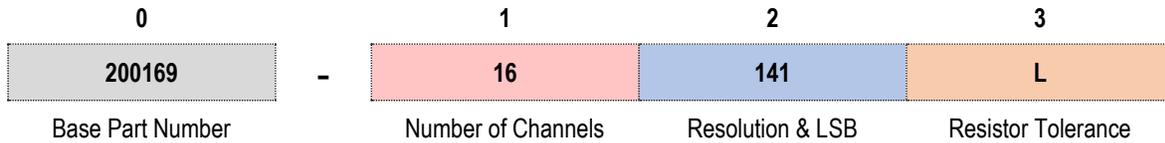Phone: (949) 335-9707
baengineering.com

VARIABLE RESISTANCE MODULE

HOW TO ORDER

For ordering the Variable Resistance Module, please provide the part number by utilizing the information below. Example is shown for part number: 200169-16141L

Custom Part Number

0		1	2	3
200169	**–**	16	141	L
Base Part Number		Number of Channels	Resolution & LSB	Resistor Tolerance

1. Number of Channels		
16	=	16 Channels
08	=	8 Channels
04	=	4 Channels

3. Resistor Tolerance		
H	=	5%
M	=	1%
L	=	0.1%

2. Resolution & LSB		
141	=	14-bit, 1Ω LSB
132	=	13-bit, 2Ω LSB
131	=	13-bit, 1Ω LSB
121	=	12-bit, 1Ω LSB
111	=	11-bit, 1Ω LSB

Notes: