sbRIO-9687

General Purpose Inverter Controller Universal Interface Board

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* specifications describe the performance met by a majority of models.
- *Nominal* specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

Conditions

Specifications are valid for the range -40 °C to 85 °C unless otherwise noted.

The following specifications refer only to the sbRIO-9687 interface board, which only works when paired with the sbRIO-9683 or sbRIO-9684 General Purpose Inverter Controller. The specifications of a fully assembled system must be derived by accounting for specifications of all stacked boards.

⚠ **Caution** NI makes no product safety, electromagnetic compatibility (EMC), or CE marking compliance claims for the sbRIO-9687. The end-product supplier is responsible for conformity to any and all compliance requirements.

Simultaneous Sampled Analog Input

Number of analog input channels from inverters	14
Number of external input channels	16
Gain settings	x1, x2, x3, x4 (DIP switch configurable)

Input impedance	>100 MΩ
Overvoltage protection	±30 V maximum
Current-sensing resistor footprint	2512, 1206
Current-sensing resistor power	1 W, 0.25 W
Input filter	
Filter type	Second order low pass
Filter bandwidth (-3 dB)	901 Hz typical
Filter resistors	10 kΩ, 0.5%

Table 1. Simultaneous Sampled Analog Input Accuracy

Gain (V/V)	Input Range (V)	Typical Offset Error (mV)	Maximum Offset Error (mV)	Typical Gain Error (% of Reading)	Maximum Gain Error (% of Reading)	-3 dB Bandwidth (kHz)[1]
1	±10	1.16	3.21	0.005	0.005	700
2	±5	1.16	3.21	0.098	0.258	350
3	±3.33	1.16	3.21	0.131	0.344	230
4	±2.5	1.16	3.21	0.147	0.387	175

Scanned Analog Inputs

Number of analog input channels from inverters	7
Number of external input channels	7
Gain setting	0.5
Input range	0 V to 10 V or -5 V to 5 V (DIP switch configurable)
Input impedance	110 kΩ
Overvoltage protection	±30 V maximum

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[1] Low pass filter not populated.

Table 2. Scanned Analog Input Accuracy

Mode	Input Range (V)	Typical Offset Error (mV)	Maximum Offset Error (mV)	Typical Gain Error (% of Reading)	Maximum Gain Error (% of Reading)	-3 dB Bandwidth (kHz)
Unipolar	0–10	1.50	4.99	0.08	0.25	350
Bipolar	±5	4.14	12.40	0.08	0.25	350

Over-Range Comparators

Number of over-range comparators	8
Input gain	0.5
Input impedance	
Differential	101 kΩ
Common mode	50.5 kΩ
Comparator hysteresis	±50 mV
Response time	0.5 μs

Table 3. Over-Range Comparators Accuracy

Set Point Programming	Input Range (V)	Typical Offset Error (mV)	Maximum Offset Error (mV)	Typical Gain Error (% of Set Point)	Maximum Gain Error (% of Set Point)
With GPIC AO	±10	19.13	45.12	0.43	1.25
With 0.5% Resistors	±10	13.0	16.45	4.45	5.62

Analog Outputs

Number of analog output channels at breakout connector	7

The sbRIO-9687 analog outputs are pass-through signals. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Sourcing Digital Inputs

Number of sourcing digital input channels at breakout connector	28
Sourcing voltage for port 0	+24 V
Sourcing voltage for port 1	Externally supplied

The sbRIO-9687 sourcing digital inputs are pass-through signals. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Sinking Digital Outputs

Number of sinking digital output channels at breakout connector	24

The sbRIO-9687 sinking digital outputs are pass-through signals. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Relay Outputs

Number of relay output channels at breakout connector	4

The sbRIO-9687 relay outputs are pass-through signals. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Half Bridge Digital Outputs

Number of half bridge digital output channels at breakout connector	14
Logical level	24 V

The sbRIO-9687 half bridge digital outputs are pass-through signals. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Low-Voltage TTL Digital IO

Number of low-voltage TTL digital IO channels at breakout connector	32

The sbRIO-9687 low-voltage TTL digital IO signals are pass-through. For detailed specifications, refer to the *NI 9683 User Manual and Specifications* or *NI 9684 User Manual and Specifications* as appropriate.

Feedback Inputs

Encoder inputs	
Number of inputs	12
Signal compatibility	RS485
Overvoltage protection	±25 V
Hall sensor inputs	
Number of inputs	6
Pull-up voltage	+5 V
Pull-up resistor	10 kΩ

Thermistor Inputs

Number of thermistor inputs	2
Maximum thermistor voltage	2.5 V
Internal divider resistor	10 kΩ, 0.1%

Relative Humidity Sensor

Sensor type	HDC1080 (Texas Instruments)

Power

Input voltage (+24 V)	
Typical	+24 V
Maximum	+28.8 V
Minimum	+19.2 V

Maximum DC input current	8 A
F4 Fuse	10 A, 250 VAC, Fast Acting, .25 in. × 1.25 in.
Onboard current consumption	0.1 A max
GPIC current consumption	0.75 A max
5 V supply	
Typical	+5 V
+5 V accuracy	±3%
Feedback connector current	0.5 A max
Display current	0.5 A max
Expansion board current	1 A max
3.3 V supply[2]	
Maximum current	0.33 A

Physical Characteristics

Dimensions	381 mm × 280 mm × 39 mm (15 in. × 11 in. × 1.5 in.)
Weight	0.9 kg (2 lbs)

Environmental

Operating temperature[3] (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-78)	5% RH to 95% RH, noncondensing
Pollution degree	2
Maximum altitude	2,000 m

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[2] The 3.3 V supply from the sbRIO-9683 or sbRIO-9684 GPIC is connected directly to the sbRIO-9687.

[3] Measure the local ambient temperature by placing thermocouples on both sides of the PCB, 5 mm (0.2 in.) from the board surface. Users populating the sbRIO-9687 current-sensing resistors should thermally validate that, in the vicinity of the resistors, the local ambient temperature does not exceed 85 °C and the current-sensing resistor case temperatures and local PCB surface temperatures do not exceed 125 °C.

Indoor use only.

> 📋 **Note** The sbRIO device thermal performance is greatly influenced by several factors, including resource utilization, mounting, and adjacent power dissipation. These factors can substantially affect the achievable external ambient temperature at which the maximum local and reported temperatures are reached. NI recommends additional thermal design to remain within the maximum allowed temperature ranges. For information about and examples of environmental and design factors that can affect the thermal performance of sbRIO systems, visit *ni.com/info* and enter the Info Code sbRIOcooling.

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit *ni.com/certification*, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at *ni.com/environment*. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

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> 🗑️ **EU Customers** At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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