OP8900 SLSC Boards General Information

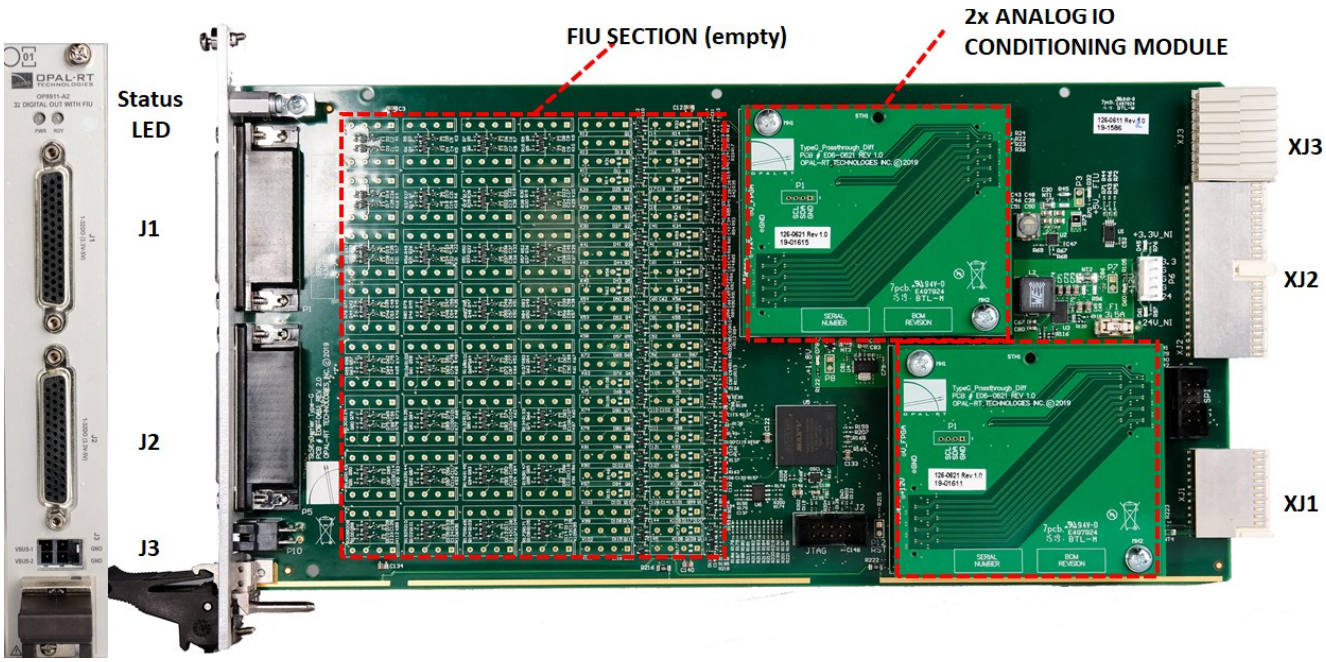
For a description of the OP8900 series FIU (fault insertion unit), see here.

Form Factor

The SLSC boards are 144.32mm tall (4U) by 281.9mm deep. For detailed information refer to OP8940 Configurations.

Board Layout

Analog Board and passthrough (OP893x / OP8940)



OP8900 SLSC Boards FIU Description

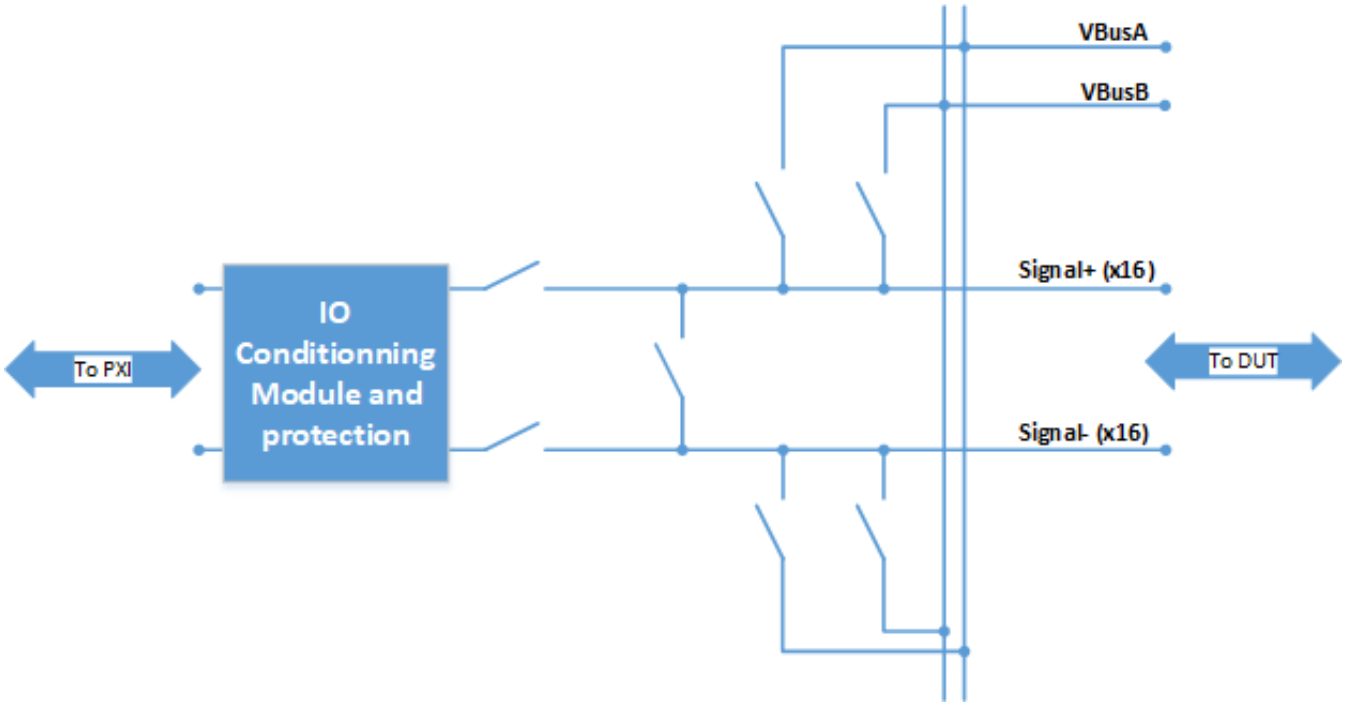
Topology

The Fault Insertion Unit (FIU) section of the OP8900 boards consists of **seven relays per differential pair** of signals, for a total of 112 relays (7 x16).

Each relay can be controlled individually.

For each group of 7 relays, **the possible faults are**

- **Open-circuit** of the pair
- **Short-circuit** of the two signals of the pair
- Two **fault injection**, with two user-supplied voltage references voltages (VBusA and VBusB), for each signal of the pair.



Note: Diagram only shows one channel.

Embedded Protections

The following protections are implemented:

- In the default state, all relays are open
- All channels are updated simultaneously
- VBusA and VBusB cannot be connected on the same channel at the same time: VBusA and VBusB cannot be shorted
- When the Signal + and Signal - are shorted together, only one other fault is allowed for VBusA or VBusB on that channel pair
- Relays on a channel are always open before closing any other

The maximum peak current per relay is 1A. There is no over-current protection

The relay technology used in the FIU allows a higher density and has a fast response time (<0.5ms). However, this technology is very sensitive to peak current, even for a few micro-seconds. It is the customer's responsibility to limit the peak current by adding the resistor on the signal or VBus based on the capacitor and cabling present on the circuit.

Even if the power supply on the VBus is limited to 0.1A, a capacitor is present at the output and the peak current can easily >5A before the internal current limit kick in creating permanent damage to the relay.

If a relay is broken in short mode, an RMA can be issued to repair the card. If the customer has access to a technician with valid IPC-610 certification and experience with a rework of through-hole lead-free and no-clean soldering, OPAL-RT authorizes this technician to replace once a faulty relay.

Here is a short recap of the process:

1. Remove the SLSC card out of the SLSC chassis.
2. With a basic multimeter measure the impedance between pin 1 and 4 of all 112 relays. If <100R, the relay needs to be changed.
3. Unsolder the faulty relay. No-clean flux can be used.
4. Solder a new relay: Comus International 3570-1419-054.

For output signal (analog or digital), always open the load relay (relay in series of the signal) when creating faults to prevent damage on the output circuit.

Even if some protection is built-in on the output circuit to prevent damage, creating a direct fault to VBus with higher voltage can create permanent damage.

OP8940 32-channel Passthrough Board With FIU

Passthrough board with complete FIU capability

OP8940 Configurations

Part Number	Description	Differential Pairs 1 to 16	Differential Pairs 17 to 31	FIU
OP8940-F	32-channel passthrough SLSC Conditioning Board with FIU	Passthrough	Passthrough	16 diff. FIU
OP8940-N	32-channel passthrough SLSC Conditioning Board	Passthrough	Passthrough	N/A

OP8940 Description

The OP8940 is a 32-channel passthrough board with fault insertion, compatible with the NI SLSC-12001 Platform.

Features

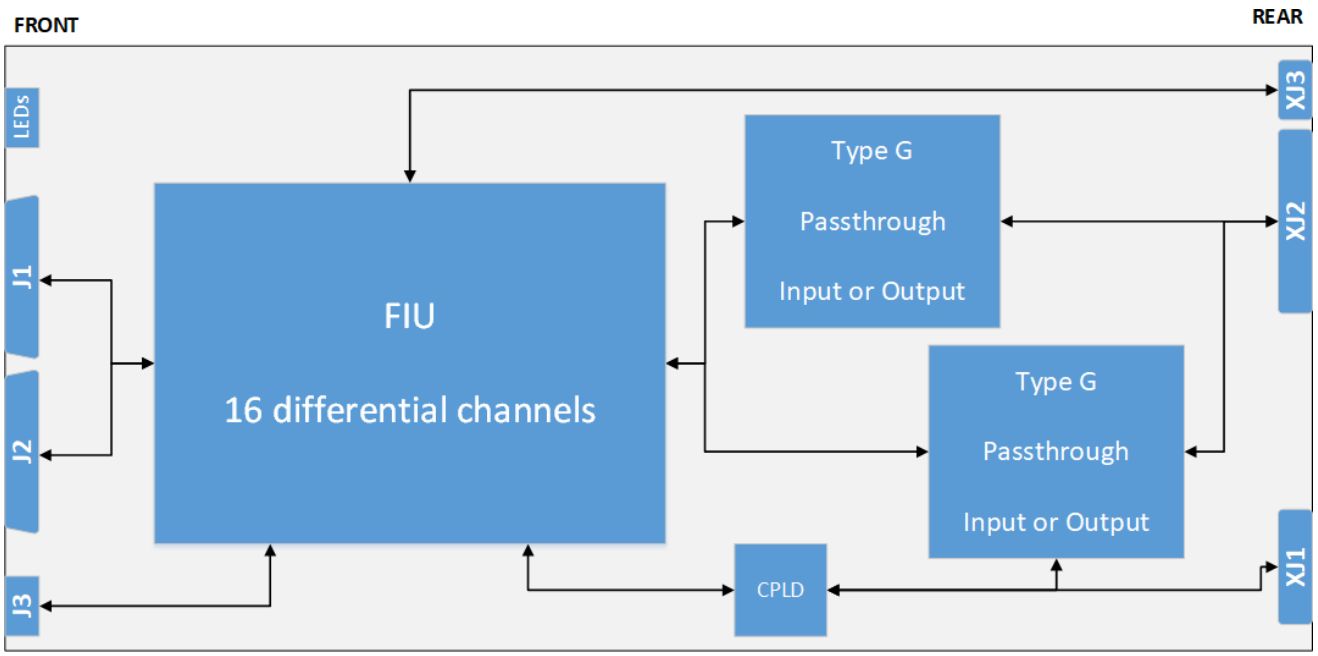
- Passthrough modules for 32 signals total
- 7 individually configurable relays for fault injection for each pair of 2 signals, for a total of 112 relays

For a full description of the OP8900 series' FIU (fault insertion unit), see here.

Board Architecture

The board features two groups of 8 differential channels (or 16 single-ended) and a set of relays adding fault insertion capability for each signal.

The general layout of the board is as follows, with the Front Interface connectors on the left and the SLSC backplane connectors on the right:

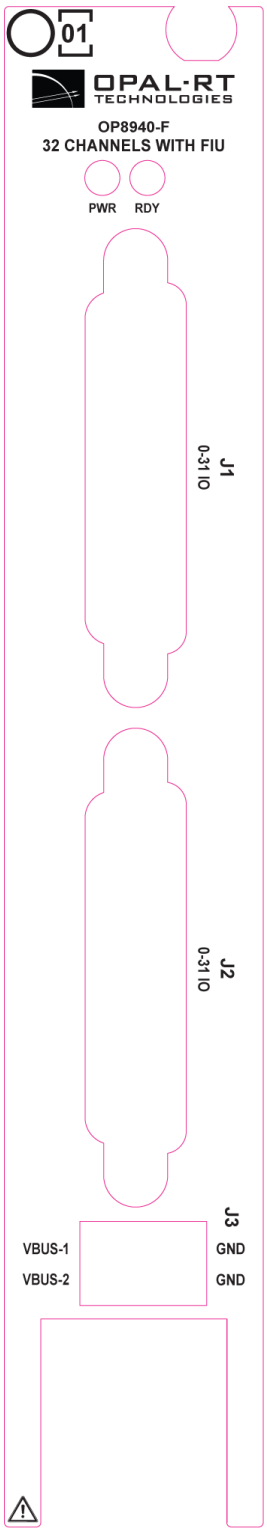


Two OP8G00 (P/N 126-0621) passthrough modules are used to route the signals from the FIU to the back connectors

OP8940 Hardware Interface

Face plate

The face plate provides two HDB44 connectors (J1, J2), one 4-pin Molex connector (J3) and two LEDs:



J1, J2 Connectors

The 32 signals are routed to both J1 and J2 connectors. This allows, for example, splitting the input and output signals into two different cables.

If the harnessing uses only one connector, it is recommended to use J2 (bottom one).

The connectors' pin assignment is detailed in OP8940 Pin assignment

J1-J2 Recommended mating connector

Manufacturer	Part number	Description
Norcomp	180-044-173L000	D-SUB Housings
Norcomp	180-001-170L001	Crimps for 24 to 26 wire gauge
Norcomp	979-025-030R121	

J3 Connector

J3 is used to connect the two external reference voltages for fault insertion.

J3 Mating connector with crimps

Manufacturer	Part number	Description
Molex	538-172258-1004	Headers and Wire Housings
Molex	538-172253-3023-LP	Crimps for 16 to 18 wire gauge

LEDs definition

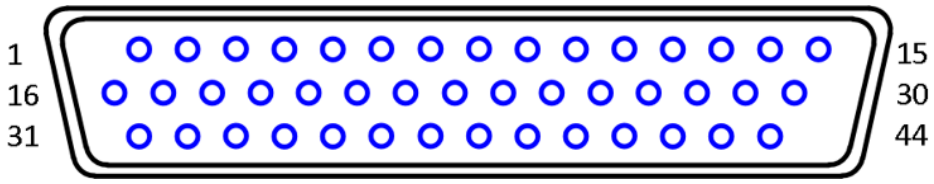
LED Name	LED Behavior	Definition of Behavior
Power	Off	No power present on module (from SLSC Interface nor external power)
	Solid Green	Power Good State
	Blinking Red	Module Fault State
Ready	Off	Module is not powered or in Rdy/Rst# is driven low by the chassis.
	Solid Green	Module in default configuration, recognized by the chassis and ready to configure (The Rdy/Rst# signal has been pulled high by the chassis.)
	Blinking Amber	Module is active (in a non-default configuration and/or communicating with the chassis).

OP8940 Pin Assignment

HDB44 Connector Pinout

As explained in OP8940 Hardware Interface, both HDB44 connectors J1 and J2 share the same pin-out

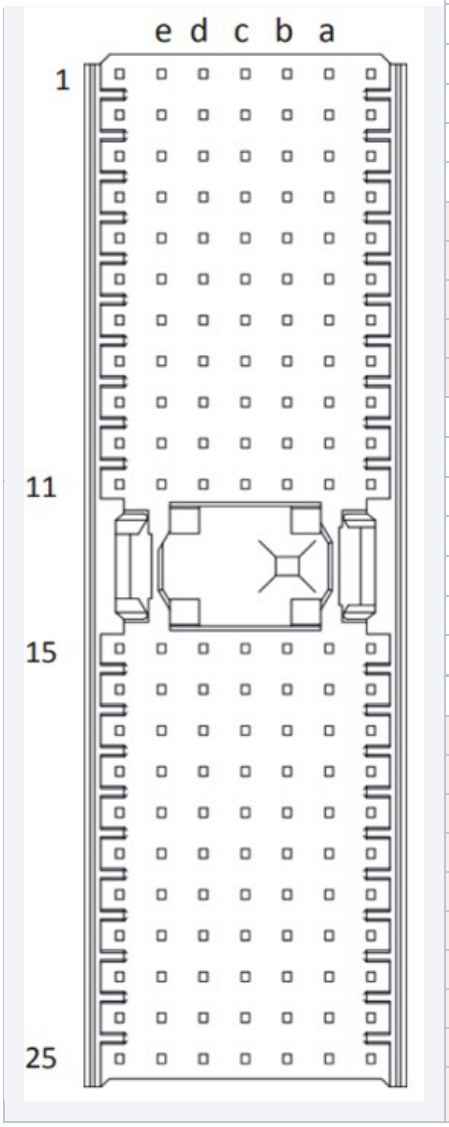
8940 Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal Name	CH0	CH2	CH4	GND	CH8	CH10	CH12	GND	CH16	CH18	CH20	GND	CH24	CH26	CH28



Pin	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Signal Name	CH1	CH3	CH5	GND	CH9	CH11	CH13	GND	CH17	CH19	CH21	GND	CH25	CH27	CH29

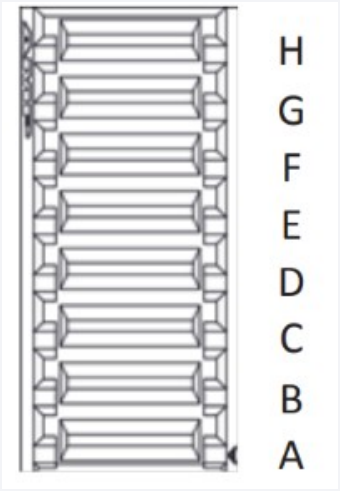
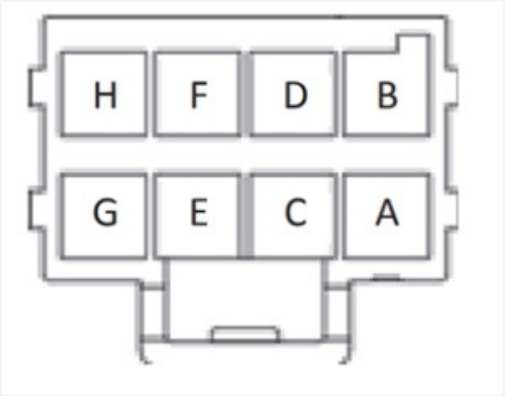
Pin	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
Signal Name	CH7	CH6	GND	GND	CH15	CH14	GND	GND	CH23	CH22	GND	GND	CH31	CH30	

XJ2 Connector Pinout

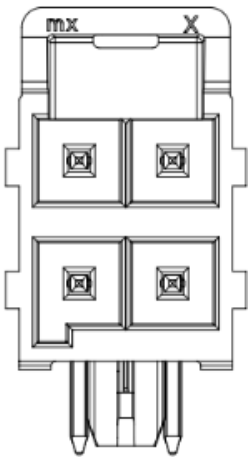


XJ2 Signal	OP8940	XJ2 Pin	XJ2 Signal	OP8940	XJ2 Pin
P0.0	**CH0**	a1	P2.0	**CH16**	a7
P0.1	**CH1**	b1	P2.1	**CH17**	b7
P0.2	**CH2**	d1	P2.2	**CH18**	d7
P0.3	**CH3**	e1	P2.3	**CH19**	e7
P0.4	**CH4**	a2	P2.4	**CH20**	a8
P0.5	**CH5**	b2	P2.5	**CH21**	b8
P0.6	**CH6**	d2	P2.6	**CH22**	d8
P0.7	**CH7**	e2	P2.7	**CH23**	e8
GND	GND	a3	GND	GND	a9
GND	GND	b3	GND	GND	b9
GND	GND	c3	GND	GND	c9
GND	GND	d3	GND	GND	d9
GND	GND	e3	GND	GND	e9
P1.0	**CH8**	a4	P3.0	**CH24**	a10
P1.1	**CH9**	b4	P3.1	**CH25**	b10
P1.2	**CH10**	d4	P3.2	**CH26**	d10
P1.3	**CH11**	e4	P3.3	**CH27**	e10
P1.4	**CH12**	a5	P3.4	**CH28**	a11
P1.5	**CH13**	b5	P3.5	**CH29**	b11
P1.6	**CH14**	d5	P3.6	**CH30**	d11
P1.7	**CH15**	e5	P3.7	**CH31**	e11
GND	GND	a6	GND	GND	a20
GND	GND	b6	GND	GND	b20
GND	GND	c6	GND	GND	c20
GND	GND	d6	GND	GND	d20
GND	GND	e6	GND	GND	e20
GND	GND	a17	GND	GND	a23
GND	GND	b17	GND	GND	b23
GND	GND	c17	GND	GND	c23
GND	GND	d17	GND	GND	d23
GND	GND	e17	GND	GND	e23

XJ3 connector pinout

XJ3 connector	Molex connector (on standard RTI)	XJ3 pin	OP8910
		**H**	VBus_A
		G	GND
		F	VBus_B
		E	GND
		D	VUser_1
		C	GND
		B	VUser_2
		A	GND

J3



GND	**GND**
VBus_A	**VBus_B**

OP8940 Specification

General

Product Name	**OP8940**
Part Numbers	see OP8940 configurations options
Board Type	Analog input/output conditioning
Form Factor	SLSC
SLSC Module Design Specifications	Version 1.2.1
SLSC Compliance Level	1
Rear I/O Compatibility	[01] (Digital/Analog I/O up to 32 channels single-ended or 16 channels differentials)
Hot-Plug support	No

Characteristics

Number of channels	32 passthrough channels
Max peak current with FIU	1A, see OP8900 SLSC Boards - FIU Description

Environmental

The OP8940 is designed for **indoor use only.**

Module operating temperature	0 °C to 85 °C
Storage temperature	-40 °C to 85 °C
Operating humidity	10% to 90% non-condensing
Storage humidity	5% to 95% non-condensing
Pollution Degree	2
Maximum altitude	2,000 m
Power requirement	6W