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Connector Options for the NI 6810 Serial Data Analyzer

Arthur Ryan

Introduction

The NI 6810 Serial Data Analyzer for PCI and PXI/CompactPCI addresses many requirements of device-functional testing in laboratory, manufacturing, and repair center environments. It is especially useful to communicate with customer proprietary serial protocols. Because the NI 6810 can work with many types of serial transmission applications, the ability to easily connect the NI 6810 to other equipment in a test system is extremely important. National Instruments provides several connector products to help you integrate the NI 6810 into your test system. This application note discusses cable and connector options available to you and provides some recommendations to help you build a reliable system. A table at the end of this application summarizes all of the products discussed. The Appendix shows NI 6810 I/O connector pin assignments and descriptions.

Design Considerations

In order to ensure reliable signal transmission, it is important to carefully plan the cabling between the NI 6810 and other test equipment. At low bit rates (below 500 kb/s), cabling design does not have to be especially stringent. However, as bit rates approach the NI 6810 maximum rate of 10 Mb/s, the cable interconnection is especially important. Listed below are the most important design considerations you should account for when planning your test system. Many of these guidelines are appropriate even for cable applications that do not use the NI 6810. In general, a simple and short cable path from the NI 6810 to other devices should satisfy all of the following design guidelines.

Signal Propagation

When operating the NI 6810 near its maximum 10 Mb/s rate, *signals should fully propagate and stabilize within 30 ns.* Ideally, electrical signals propagate at 6 to 8 ns/ft. over properly terminated copper wire. However, if you account for signal reflections, imperfect termination, and impedance mismatches from connectors, the effective propagation time is closer to 1 to 2 ns/ft.

Cross Talk

Groups of signals propagating for long distances will induce cross-talk interference among the signals. Use twisted signal/ground pairs and shielded cable to help reduce cross-talk interference.

Termination and Impedance

You should properly terminate long wires with resistors that match the characteristic impedance of your cable. The NI-6810 general purpose transceivers have an output impedance of 75 Ω. The NI 6810 RS-485 transceivers are not terminated but are designed to accommodate external RS-485 termination of 120 Ω, if the NI 6810 serves as the terminal device.

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Clock and Signal Skew

If your application uses synchronous serial communication (i.e., separate clock and data signals) keep the propagation paths for the clock and data as equal as possible to minimize clock-to-signal skew. This is especially important when speeds approach the 10 Mb/s maximum rate.

Cable Options for the NI 6810

The pin arrangement of the NI 6810 68-pin connector is compatible with the National Instruments SH68-68-D1 cable (Part Number 183432-xx, where xx defines the cable length in meters). The SH68-68-D1 cable is the same one used with the NI 6533 high-speed digital I/O product and the cable provides good signal integrity. The SH68-68-D1 cable is black and should not be confused with the white SH68-68-EP cable for MIO applications. The white MIO cable is incompatible with the NI 6810.

For those applications where the SH68-68-D1 cable may not be appropriate, you can purchase a 68-pin connector and backshell (Part Number 776832-01) from National Instruments for building custom cables that connect seamlessly to the NI 6810.

Connector Block Options for the NI 6810

There are several different products that connect to the NI 6810 via the SH68-68-D1 cable. The connector blocks have unique qualities for different applications and requirements.

BNC-2810 Connector Accessory

Designed specifically for the NI 6810, this product connects signals from the NI 6810 to common test equipment connectors. For example, the general-purpose transceivers route to coaxial BNC connectors, and the RS-232 signals route to 9-pin D-Sub connectors. The BNC-2810 is made of durable extruded aluminum and is well shielded to reduce electromagnetic emissions. The BNC-2810 is especially helpful for prototyping applications due to the common connectors it provides. If you decide to use the BNC-2810 in a test system, the BNC-2810 has four threaded holes on the bottom plate so you can mount the BNC-2810 to cabinets or other fixtures.

SCB-68 Shielded I/O Connector Block

The SCB-68 routes the 68 pins in the NI 6810 connector to individual screw terminals. The connector block is housed in a shielded metal box to help reduce electromagnetic emissions. When you use the SCB-68, make sure you set the switches in the box to disable the thermocouple circuitry in the SCB-68, which is used with DAQ products.

CB-68LP, CB-68LPR I/O Connector Blocks

These connector blocks route the NI 6810 signals to screw terminals and provide a low-cost connector option. The CB-68LP incorporates a vertically mounted 68-pin connector and the CB-68LPR uses a right angle 68-pin connector. You should use the CB-68LPR inside the CA-1000 connector assembly product (see Table 1).

TBX-68 Connector Block with DIN Rail Mounting

This connector block routes the NI 6810 signals to screw terminals and includes mounting hardware to attach it to standard DIN rails.

68-Pin PWB-Mount Connectors

The 68-pin PWB-mount connectors used in the NI-6810 are offered as separate products. National Instruments stocks vertical and right angle mount versions of the connector. With the PWB-mounted connector, you can develop your own custom connector blocks that incorporate any type of external circuitry or connectors. The PWB-mount connectors are especially attractive for high-speed applications because you can design connector assemblies that connect directly to the NI 6810 using the SH68-68-D1 cable.

Custom-Connector Enclosures

National Instruments offers the CA-1000 Configurable Signal Enclosure to help you build your own custom connector boxes for desktop or rack-mount applications. This product consists of an aluminum enclosure with a series of panelettes that you mount on the front of the enclosure. Each panelette incorporates a specific connector type. National Instruments offers a range of different panelettes such as BNC, 9-pin D-sub, and even blank panelettes so you can mount your own type of connector. You need to purchase a CB-68LPR connector block and mount it in the CA-1000 enclosure so you can route signals from a 68-pin cable to the connectors on the panelettes. The CA-1000 is mechanically compatible with the CB-68LPR. You can refer to the catalog or contact National Instruments for the latest offerings for the CA-1000 enclosure.

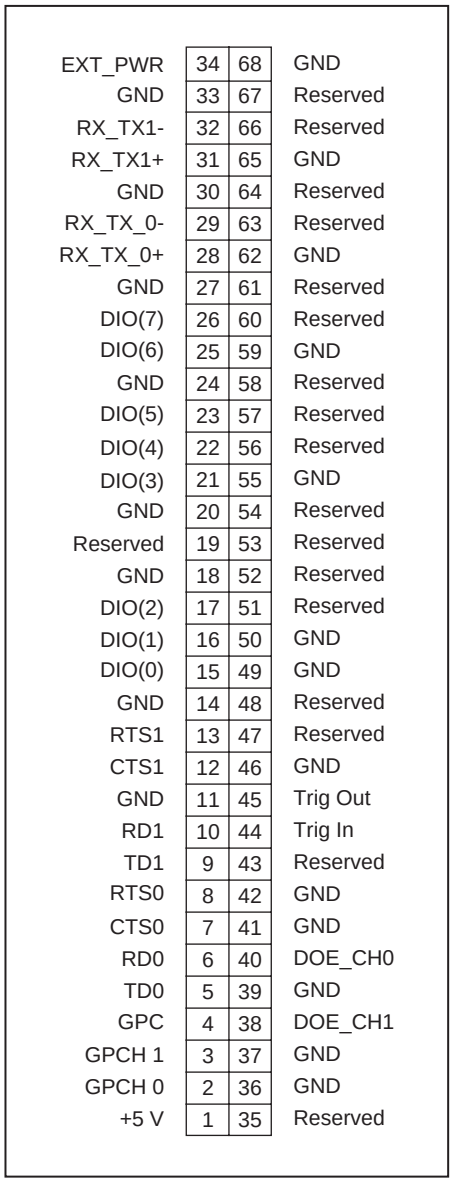
Table 1. Cable and Connector Block Products Compatible with the NI 6810

Product Description	Part Number
SH68-68-D1 Shielded Cable for Digital I/O Devices	183432-xx
68-Pin Custom Cable Connector / Backshell Kit	776832-01
BNC-2810 Connector Assembly	777606-01
SCB-68 Shielded I/O Connector Block	776844-01
CB-68LP I/O Connector Block – Vertical	777145-01
CB-68LPR I/O Connector Block – Right Angle	777145-02
TBX-68 Connector Block with DIN Rail Mounting	777141-01
68-Pin PWB Mount Connector – Right Angle Mounting	777600-01
68-Pin PWB Mounting connector – Vertical Mounting	777601-01
CA-1000 Configurable Signal Enclosure	777664-01

☞ **Note:** ***The*** xx ***value in the SH68-68-D1 cable denotes the length of the cable in meters. As of June 1998, 0.4 m (-0R4), 1 m (-01), 2 m (-02), and 5 m (-05) lengths are standard offerings. National Instruments may offer more length options in the future.***

Appendix

NI 6810 I/O Connector Pin Assignments



EXT_PWR	34	68	GND
GND	33	67	Reserved
RX_TX1-	32	66	Reserved
RX_TX1+	31	65	GND
GND	30	64	Reserved
RX_TX_0-	29	63	Reserved
RX_TX_0+	28	62	GND
GND	27	61	Reserved
DIO(7)	26	60	Reserved
DIO(6)	25	59	GND
GND	24	58	Reserved
DIO(5)	23	57	Reserved
DIO(4)	22	56	Reserved
DIO(3)	21	55	GND
GND	20	54	Reserved
Reserved	19	53	Reserved
GND	18	52	Reserved
DIO(2)	17	51	Reserved
DIO(1)	16	50	GND
DIO(0)	15	49	GND
GND	14	48	Reserved
RTS1	13	47	Reserved
CTS1	12	46	GND
GND	11	45	Trig Out
RD1	10	44	Trig In
TD1	9	43	Reserved
RTS0	8	42	GND
CTS0	7	41	GND
RD0	6	40	DOE_CH0
TD0	5	39	GND
GPC	4	38	DOE_CH1
GPCH 1	3	37	GND
GPCH 0	2	36	GND
+5 V	1	35	Reserved

NI 6810 Connector Pin Description

Pin	Signal Name	Description
19, 35, 43, 47-48, 51, 54, 56, 57-58, 60-61, 63-64, 66-67	Reserved	Reserved – Pins labeled as reserved are intended for future functionality from National Instruments. Do not connect anything to these signals.
34	EXT_PWR	External Power – Provides power to the GPIO transceivers for low-voltage test applications. Refer to the 6810 specifications for appropriate voltage levels.
11, 14, 18, 20, 24, 27, 30, 33, 36-37, 39, 41-42, 46, 49-50, 55, 59, 62, 65, 68	GND	Ground – These pins are connected to the ground signal.
28, 29	RX_TX_<0+..0–>	An RS-485 Differential Pair – A single channel on the 6810 device can either transmit or receive data on a differential pair.
31, 32	RX_TX_<1+..1–>	An RS-485 Differential Pair – A single channel on the 6810 device can either transmit or receive data on a differential pair.
15-17, 21-23, 25-26	DIO<0..7>	Digital I/O – These eight signals provide static digital input and output. The signals operate at 5 V TTL levels by default, but can support low-voltage operation by drawing power from the EXT_PWR signal.
8, 13	RTS<0..1>	Request to Send – An RS-232 handshaking signal driven by the 6810 device. The 6810 will assert this signal, per the RS-232 specification, whenever it is ready to receive serial data.
7, 12	CTS<0..1>	Clear to Send – An RS-232 handshaking signal received from a remote device. The 6810 device will generate serial data acquisition whenever handshaking is enabled and CTS is asserted, per the RS-232 specifications.
5, 9	TD<0..1>	Transmit Data – The 6810 transmits RS-232 serial data on these signals.
6, 10	RD<0..1>	Receive Data – The 6810 receives RS-232 serial data on these signals.
44, 45	Trig In, Trig Out	5 V TTL Trigger input and 5 V TTL Trigger output
4	GPC	General-Purpose Clock – The 6810 either transmits or receives a clock signal depending on software configuration. The signal levels for the clock are the same as the general-purpose channel signals.
2-3	GPCH<0..1>	General-Purpose Serial Channel – Generates or receives serial data signals between ±10 V depending on whether the appropriate channel on the 6810 is configured for output or input.
38, 40	DOE_CH<0..1>	Drive Output Enable – This 5 V TTL active low signal asserts whenever the 6810 activates the signal drive circuitry data on the corresponding GPCH<1..0> signal. It provides the system integrator a means to control any external hardware that may be connected to the GPCH signals.
1	+5 V	+5 VDC – Power provided by the 6810 device.



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