Rear Transition Interface Design Specifications

Version 1.3

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Contents

1 About This Document

This document is intended for use with other documents within the SLSC MDK and is not a standalone document. It includes references to module components defined within the *SLSC Module Design Specifications* without fully re-defining these components.

Conventions and Definitions

In addition to providing descriptions, examples, and rationale for Rear Transition Interface (RTI) requirements, this specification includes formal rules, recommendations, permissions, and observations. The definition for each of these items is as follows:

RULE—Rules SHALL be followed to ensure compatibility. A rule is characterized by the use of the words SHALL and SHALL NOT.

RECOMMENDATION—Recommendations consist of advice to implementers that will affect the usability of the final product. A recommendation is characterized by the use of the words SHOULD and SHOULD NOT.

PERMISSION—Permissions clarify the areas of the specification that are not specifically prohibited. Permissions reassure you that a certain approach is acceptable and will cause no problems. A permission is characterized by the use of the word MAY.

OBSERVATION—Observations spell out implications of rules and bring attention to things that might otherwise be overlooked. They also give the rationale behind certain rules, so the reader understands why the rule must be followed.

MODULE DEVELOPER—Someone designing modules (hardware and software) responsible for meeting requirements as stated in this specification as well as meeting Safety, EMC, and Legal requirements pertinent to the module.

RTI DEVELOPER—Someone designing RTIs who is responsible for meeting requirements as stated in this specification as well as meeting Safety, EMC, and Legal requirements pertinent to the module.

SYSTEM INTEGRATOR—Someone designing a system using SLSC

chassis and SLSC modules responsible for ensuring the system as a whole meets required functionality, Safety, EMC, and Legal requirements pertinent to the system following the specifications published by the product manufacturers.

USER—End user of a system that contains an SLSC chassis and SLSC modules that is responsible for following the product specifications published by the product manufacturers and System Integrator.

FULLY COMPATIBLE REAR I/O—The standard rear I/O configuration that allows cross-compatibility among SLSC modules and RTIs, defined in *SLSC Module Design Specifications*.

Related Documentation

This document is a component of the SLSC RTI Design, which is part of the complete SLSC MDK.

RTI Design Components

- **Rear Transition Interface Design Specifications**—This document. The rules and requirements for designing an RTI compliant to the SLSC architecture.
- **RTI Drawings**—Mechanical drawings giving details of mechanical requirements including tolerances are referenced in *Mechanical*, Chapter 3.
- **RTI Artwork**—Artwork file defining glyph design and placement as well as required and recommended module text size, font, and placement referenced in *Cosmetic Appearance*, Chapter 5.

SLSC MDK Components

- **SLSC Module Design Specifications**—The rules and requirements for designing a module compliant to the SLSC architecture.
- **SLSC Module Drawings**—Mechanical drawings giving details of mechanical requirements including tolerances for an SLSC module.
- **SLSC Module Artwork**—Artwork file defining module front panel glyph design and placement as well as required and recommended module text size, font, and placement for an SLSC module.
- **SLSC Design Guidelines**—A set of recommendations for module and RTI design including parts NI or partners have experience using with the SLSC architecture.
- **SLSC Example Module Files**—Example PCB design files for an SLSC module.

- **SLSC Prototyping Module**—This module contains the circuitry and programming required for SLSC communication with a lattice available for Module Developers to implement their circuitry.
- **SLSC Example Error Detection Block (HDL)**—This is code that provides the minimum required logic to complete the SLSC communication.
- **SLSC Module Capabilities**—JSON files for different module capability examples as well as a tool to validate your JSON format and a Python script to create a binary file from the JSON file.
- **SLSC RTI Design**—A set of documents defining rules and recommendations for RTI module design.

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RTI Overview

RTIs interface with the board-to-board rear I/O connectors of the modules and route those signals to cable connectors and/or to other modules. They may consist of a single large backplane spanning all slots or a combination of smaller segments.

RTIs allow the use of a variety of standard cables to route signals from modules to an NI Measurement System without requiring modules to be designed for specific cable types.

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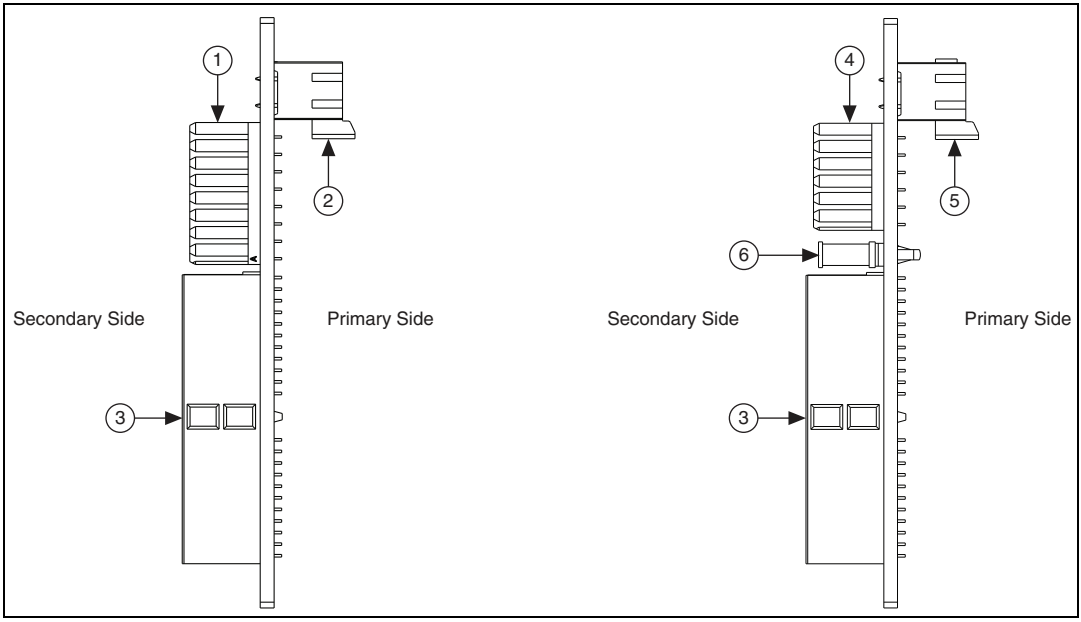
Mechanical

Mechanical Terminology

- **Primary Side**—The side that is visible from outside the SLSC chassis, which contains the connectors for cables to the measurement system.
- **Secondary Side**—The side of the PCB facing the interior of the SLSC chassis, which contains the connectors that mate with the SLSC module.
- **XJ2**—The 110-pin Hard Metric type A connector used on SLSC modules, designed to mate with XP2 on the RTI. Connector type and standard position are defined in **SLSC Module Design Specifications**.
- **XJ3**—The 8-blade right-angle Universal Power Module (UPM) connector used on SLSC modules, designed to mate with XP3 on the RTI. Connector type and standard position are defined in **SLSC Module Design Specifications**.
- **XJ4**—The 6-blade right-angle Universal Power Module (UPM) connector used on high-voltage SLSC modules, designed to mate with XP4 on the RTI. Connector type and standard position are defined in **SLSC Module Design Specifications**.
- **XP#**—A board-to-board connector placed on the secondary side of the RTI.
- **XP2**—A pressfit, hard metric Type A, 110-pin, (plus 44 shield pins), vertical, male connector as defined by IEC 61076-4-101, which mates with XJ2 on the SLSC module.
- **XP3**—A pressfit, female, vertical, 8-position Universal Power Module (UPM) connector rated to at least 10 A per contact, compatible with IEC 61076-4-101, which mates with XJ3 on the SLSC module.
- **XP4**—A pressfit, female, vertical, 6-position Universal Power Module (UPM) connector rated to at least 10 A per contact, compatible with IEC 61076-4-101, which mates with XJ4 on the SLSC module.
- **XP2, XP3, and XP4 Standard Positions**—XP2/XP3/XP4 placement defined on sheet 2 of **SLSC RTI Drawings**. This placement allows mating with XJ2, XJ3, and XJ4 in their standard positions.
- **JR# and JH#**—A cable connector placed on the primary side of the RTI.

- **JR1**—A black keyed, two-row, 8-position Molex Ultra-Fit™ vertical header with 0.38 µm gold plating. This is used to connect cabled signals to and/or from XP3.
- **JH1**—A white/natural resin keyed, two-row, 6-position Molex Ultra-Fit™ vertical header with 0.38 µm gold plating. This is used to connect cabled signals to and/or from XP4.
- **XJ5, XP5, and JH2**—Reserved connectors.
- **Interboard Separation Plane (IBSP)**—The theoretical limit of the assigned space of a module. The distance between these planes is the slot pitch.
- **MH5 (Spacer)**— Essentra Components push spacer. This is used to prevent mating XP4 to XJ3.



1	XP3	2	JR1	3	XP2
4	XP4	5	JH1	6	MH5 (Spacer)

Figure 1-1. SLSC RTI Reference Diagram

Environmental

1. **RULE**: RTIs SHALL meet the following requirements:

   RTI operating temperature..... 0 °C to 40 °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

2. **OBSERVATION**: At full power dissipation, an SLSC chassis internal ambient temperature is expected to reach up to 85 °C when the air at the intake is at the maximum operating temperature allowed by the chassis. For the SLSC-12001 chassis this corresponds to an intake temperature of 40 °C.
3. **RULE**: RTIs SHALL be validated to maintain specified operation under a maximum internal chassis ambient of 85 °C.
4. **OBSERVATION**: The internal chassis ambient tends to be lowest closer to the air intake and highest closer to the exhaust, while measurements close to any hot components may give temperatures higher than aggregate ambient conditions. Testing has shown that slots 8 and 11 of the SLSC-12001 chassis are typically the worst performing thermally. The exact internal ambient temperature locations to monitor to ensure that all components stay within their recommended operating specifications is at the designer's discretion.
5. **RECOMMENDATION**: RTIs SHOULD be tested in accordance with the following specifications:
   - IEC 60068-2-1 and IEC 60068-2-2 (operating and storage temperature)
   - IEC 60068-2-78 (operating and storage humidity)
6. **RULE**: All RTI components SHALL have a minimum 85 °C ambient temperature rating.
7. **RULE**: PCB traces must be designed to limit self-heating temperature rise to 20°C maximum.

Shock and Vibration

1. **RULE**: RTIs SHALL meet the following requirements when mounted inside a chassis:

   Operating shock ..... 30 g, 11 ms

   Operating vibration, random ..... 0.3 g_{rms}, 5 Hz to 500 Hz

   Non-operating shock ..... 50 g, 11 ms

   Non-operating vibration, random ..... 2.4 g_{rms}, 5 Hz to 500 Hz

2. **RECOMMENDATION**: RTIs SHOULD be tested in accordance with the following specifications:
   - IEC 60068-2-27 (shock)
   - IEC 60068-2-64 (vibration)

Safety

1. **RULE**: For consistency across modules, RTI Developers SHALL meet the requirements of the following standards for safety for electrical equipment for measurement, control, and laboratory use:
   - IEC 61010-1 3rd Edition, EN 61010-1 3rd Edition
   - UL 61010-1 3rd Edition, CSA 61010-1 3rd Edition
2. **OBSERVATION**: IEC 61010-1 refers to IEC 61010-2-030 for special requirements regarding testing and measuring circuits.
3. **RULE**: When designing RTIs with hazardous circuits (>30 V RMS, 42.4 V_{pk}, 60 V DC), RTIs SHALL have double or reinforced insulation between hazardous circuits and all other circuits as well as the SLSC chassis. The chassis frame SHALL be considered accessible.
4. **RULE**: Insulation calculations SHALL assume a minimum 500 V RMS or 920 V_{pk} transient for measurement circuits (sometimes referred to as CAT I or CAT O) that are not considered CAT II, CAT III, or CAT IV. A larger transient voltage may be required, depending on the application.
5. **RULE**: Insulation calculations SHALL assume the altitude and pollution degree given in *Environmental*.

6. **OBSERVATION**: The mounting rail worst-case position references defined in RTI Drawings, Sheet 1, may be considered as the worst-case edge of the chassis mounting rails for insulation calculations.
7. **OBSERVATION**: The documentation for SLSC chassis requires the chassis to be mounted inside a rack or similar enclosure so that the RTI area at the rear of the chassis is inaccessible from the outside rack during normal use and requires a tool to access for maintenance. However, the front of the chassis may be accessible during normal use.
8. **OBSERVATION**: The documentation for SLSC chassis requires the chassis to be mounted inside a rack or similar enclosure that meets the constructional requirements of IEC 61010-1 for an enclosure to contain the spread of fire from the RTIs.
9. **RECOMMENDATION**: To improve safety during installation and maintenance, the exterior surface (primary side) of the RTI SHOULD be considered as an accessible, outer surface for IEC 61010-1 requirements regarding protection against electric shock and surface temperature limits.
10. **RECOMMENDATION**: RTIs with hazardous voltages SHOULD be certified by an independent third party.
11. **RULE**: RTIs implementing XJ4 SHALL be rated Measurement Category O, per IEC 61010-01 and provide reinforced insulation to support a 100 VDC working voltage and 920 Vpk transient.

PCB Dimensions

1. **RULE**: RTI PCB dimensions SHALL comply with the dimensions defined in **RTI Drawings**, Sheet 1.
2. **RECOMMENDATION**: Nominal PCB thickness SHOULD be 2.4 mm (0.094 in.).
3. **PERMISSION**: PCB thickness MAY be greater or less than 2.4 mm (0.094 in.) to comply with connector requirements.

Mounting Requirements

Mounting Hole Placement

1. **RULE**: Mounting hole placement and size SHALL comply with the dimensions defined in **RTI Drawings**, Sheet 1.
2. **RULE**: An exposed copper pad SHALL be placed around the mounting holes on the PCB primary side, with the minimum size defined in **RTI Drawings**, Sheet 1. This pad SHALL tie the RTI to chassis ground via the mounting screws.
3. **RECOMMENDATION**: The copper pads around the mounting holes SHOULD be extended into long strips on the primary and secondary sides as defined in **RTI Drawings**, Sheet 1. These improve the grounding of the RTI and optional strain relief brackets or other similar hardware.

Mounting Screw Requirements

1. **RULE**: Mounting screws SHALL have M2.5x.45 thread and SHALL extend between 7.3 mm (0.287 in.) and 8.8 mm (0.346 in.) beyond the secondary side of PCB when fully seated.
2. **RULE**: RTI documentation SHALL identify compatible mounting screws.
3. **RECOMMENDATION**: RTIs SHOULD be packaged with compatible mounting screws.
4. **OBSERVATION**: 10 mm screws comply with this length requirement on RTI PCBs between 1.2 mm and 2.6 mm thickness.

Placement Restrictions

General Placement Restrictions

1. **RULE**: PCB-mounted components, including connectors, SHALL NOT extend beyond the bounds of the PCB.
2. **PERMISSION**: Cables for primary side connectors MAY extend beyond the PCB edge, as defined in *Cable Overhang*.
3. **OBSERVATION**: Rules in the *Safety* section, may further restrict component, trace, and using placement.

Secondary Side Restrictions

1. **RULE**: Except for connectors designed to mate with the SLSC module such as XP2, XP3, and XP4, all components SHALL comply with the secondary side general height restriction defined in **RTI Drawings**, Sheet 1. This includes leads and other features of primary-side connectors that stick through the PCB.
2. **RULE**: The upper and lower mounting rail keepout areas, as defined in **RTI Drawings**, Sheet 1, SHALL have no components placed therein.
3. **RECOMMENDATION**: Placing traces and vias in the outer PCB layers of these rail keepout areas SHOULD be avoided where possible. This will avoid unnecessary damage while attaching the RTI to the SLSC chassis.
4. **RULE**: If XP3/XP4 is used in standard position, components other than XP3/XP4 SHALL NOT be placed in the keepout marked "PLACE KEEPOUT AROUND XP3/XP4" as defined in **RTI Drawings**, Sheet 1.
5. **RECOMMENDATION**: Even if XP3/XP4 is not used, components SHOULD NOT be placed in the keepout marked "PLACE KEEPOUT AROUND XP3/XP4" as defined in **RTI Drawings**, Sheet 1. This is to avoid damage if a module with XJ3/XJ4 is inserted in a slot with an RTI not designed to mate with it.
6. **RULE**: RTIs that use XP4 SHALL NOT intermate with modules that use XJ3.

Primary Side Restrictions

1. **RECOMMENDATION**: The area around mounting holes SHOULD be kept clear of components that could interfere with the insertion and removal of mounting screws.
2. **RULE**: All components, including expected cable over-molds and backshells, SHALL comply with the Adjacent Cabling Overhang Height Restriction as defined in **RTI Drawings**, Sheet 1.

Cable Overhang

Due to the tight physical constraints of the RTI, this specification allows for some cable over-molds and backshells to partially hang over adjacent RTIs.

1. **RULE**: Cable over-molds and backshells SHALL comply with the following:
   - SHALL NOT extend beyond the top, right, and bottom bounds of the RTI PCB as viewed from the primary side.
   - SHALL NOT extend beyond the Cable Overhang Limit defined in **RTI Drawings**, Sheet 1.
   - SHALL NOT extend beyond the left PCB edge toward the Cable Overhang Limit if they do not meet the minimum clearance from the secondary (interior) side of the PCB defined in **RTI Drawings**, Sheet 1.
2. **RULE**: Cabling connectors (primary side) SHALL comply with the component height restriction that allows cable overhang from adjacent RTIs, defined in **RTI Drawings**, Sheet 1.
3. **RECOMMENDATION**: Where possible, connectors SHOULD be placed such that cable over-molds and backshells stay within the RTI's Interboard Separation Planes (IBSP).

I/O Connector Restrictions

1. **RULE**: Molex Ultra-Fit connectors (of any kind) SHALL NOT be used on the RTI, except as defined in *Connector Routing* for Fully Compatible Rear I/O (for example, JR1 and JH1).
2. **OBSERVATION**: The black and natural resin (white) Ultra-Fit connectors have separate keying. However, connectors of different pin count but matching color/keying may be able to accidentally mate, but not latch, which could allow a hazardous connection to non-hazardous cicruitry (for example, the cable for a standard JH1 connection might mate to a non-standard white 8-position Ultra-Fit). To avoid this risk, NI restricts the use of Ultra-Fits on the RTI to only standard pinouts and voltage levels.

Fully Compatible I/O Mating Connector Placement

1. **RULE**: If designing an RTI to mate with XJ2 in standard position, XP2 as defined in *Mechanical Terminology* SHALL be placed as defined in **RTI Drawings**, Sheet 2.
2. **RULE**: If designing an RTI to mate with XJ3 in standard position, XP3 as defined in *Mechanical Terminology* SHALL be placed as defined in **RTI Drawings**, Sheet 2.
3. **RECOMMENDATION**: If designing an RTI to mate with XJ3, JR1 as defined in *Mechanical Terminology* SHOULD be placed as defined in **RTI Drawings**, Sheet 2.
4. **RULE**: If designing an RTI to mate with XJ4 in standard position, XP4 as defined in *Mechanical Terminology* SHALL be placed as defined in **RTI Drawings**, Sheet 2.
5. **RECOMMENDATION**: If designing an RTI to mate with XJ4 in standard position, a MH5 (spacer) as defined in Mechanical Terminology SHALL be placed as defined in **RTI Drawings**, Sheet 2.
6. **RECOMMENDATION**: If designing an RTI to mate with XJ4, JH1 as defined in *Mechanical Terminology* SHALL be placed as defined in **RTI Drawings**, Sheet 2.
7. **RECOMMENDATION**: Recommended positions for common cable connectors defined in **RTI Drawings** SHOULD be used, if applicable.
   a. See Sheet 4 for 37-position DSUB connector placement recommendation.
   b. See Sheet 5 for 68-position VHDCI connector placement recommendation.
   c. See Sheet 6 for 26-position MDR connector placement recommendation.

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Connector Routing

Signals are defined by the module. If the module implements *Fully-Compatible Rear I/O* as defined in *SLSC Module Design Specifications*, these signals come in a standardized format, but the cabling to the DAQ system or among RTIs may vary.

1. **RULE**: If using XP2 in standard position, trace size and routing from XP2 SHALL be designed to accommodate 32 V_{pk} at 0.75 A per pin.
2. **RULE**: If using XP3 in standard position, trace size and routing from XP3 SHALL be designed to accommodate 60 VDC signals up to 8 A per contact.
3. **RULE**: If using XP4 in standard position, trace size and routing from XP4 SHALL be designed to accommodate 100 VDC signals up to 8 A per contact.
4. **RECOMMENDATION**: The RTI Developer SHOULD either design RTI cabling to match exact pinouts of specific measurement modules (C-Series or PXIe) or design them to subdivide signal pins into discrete banks as defined in *Fully-Compatible Rear I/O* section of *SLSC Module Design Specifications*. For example, an RTI may break out 32 channels of analog input into four connectors with each taking a bank of 8 signal channels.

JR1 to XP3 Routing

1. **RULE**: If using JR1 to route signals/power to/from XP3 (XJ3 on module), the pinout mapping SHALL follow the definition in Table 4- 1. Figure 4- 1-1 provides a illustrates the mapping.

Table 4-1. JR1 to XP3 Mapping

JR1 Signal	XP3 Contact	JR1 Pin	Description
V 1+	H	8	Positive voltage for signal 1.
V 1-	G	4	Negative voltage/Return for signal 1.
V 2+	F	7	Positive voltage for signal 2.
V 2-	E	3	Negative voltage/Return for signal 2.
V 3+	D	6	Positive voltage for signal 3.
V 3-	C	2	Negative voltage/Return for signal 3.
V 4+	B	5	Positive voltage for signal 4.
V 4-	A	1	Negative voltage/Return for signal 4.

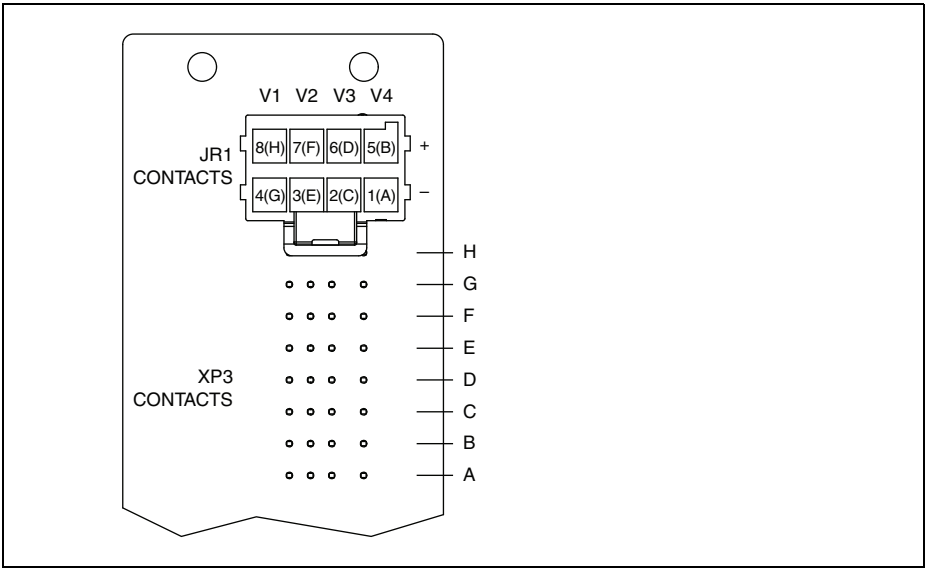

Figure 1-1. JR1 to XP3 Mapping

2. **RECOMMENDATION**: All eight XP3 signals SHOULD be routed to JR1.
3. **RULE**: If any signals are not routed between XP3 and JR1, the corresponding XP3 contacts and JR1 pins SHALL be no-connects.
4. **RECOMMENDATION**: If any signals are not routed from XP3 to JR1, PCB markings SHOULD clearly indicate which JR1 pins are no-connects.
5. **RULE**: If any signals are not routed from XP3 to JR1, RTI documentation SHALL clearly indicate which JR1 pins are no-connects.
6. **RULE**: Signals routed between JR1 and XP3 SHALL NOT be shorted to each other in the RTI.
7. **OBSERVATION**: These signals may be shorted in other parts of the system (such as on SLSC modules or in cabling).

JH1 to XP4 Routing

1. **RULE**: If using JH1 to route signals/power to/from XP4 (XJ4 on module), the pinout mapping SHALL follow the definition in Table 4- 2. Figure 4- 1-2 provides a illustrates the mapping.

Table 4-2. JH1 to XP4 Mapping

JH1 Signal	XP4 Contact	JH1 Pin	Description
V 1+	F	6	Positive voltage for signal 1.
V 1-	E	3	Negative voltage/Return for signal 1.
V 2+	D	5	Positive voltage for signal 2.
V 2-	C	2	Negative voltage/Return for signal 2.
V 3+	B	4	Positive voltage for signal 3.
V 3-	A	1	Negative voltage/Return for signal 3.

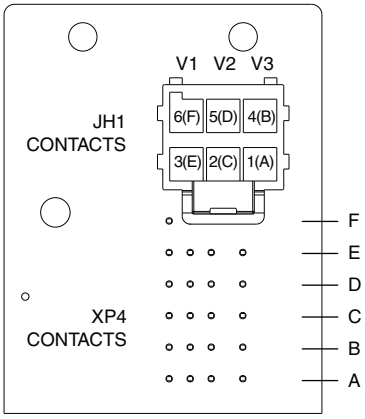

Figure 1-2. JH1 to XP4 Mapping

2. **RECOMMENDATION**: All six XP4 signals SHOULD be routed to JH1.
3. **RULE**: If any signals are not routed between XP4 and JH1, the corresponding XP4 contacts and JH1 pins SHALL be no-connects.
4. **RECOMMENDATION**: If any signals are not routed from XP4 to JH1, PCB markings SHOULD clearly indicate which JH1 pins are no-connects.
5. **RULE**: If any signals are not routed from XP4 to JH1, RTI documentation SHALL clearly indicate which JH1 pins are no-connects.
6. **RULE**: Signals routed between JH1 and XP4 SHALL NOT be shorted to each other in the RTI.
7. **OBSERVATION**: These signals may be shorted in other parts of the system (such as on SLSC modules or in cabling).

XP2 Ground Connections

XP2 has an additional column of pins (z) that does not directly correspond to XJ2.

1. **RECOMMENDATION**: The pins on column z of XP2 SHOULD be connected to the corresponding ground on XJ2. Connect z1 to z11. This grounds pins within rows 1 to 11 and z15 to z25 to the ground pins within rows 15 to 25.
2. **RULE**: If the RTI is designed to mate with Fully Compatible Rear I/O, signals on rows 1 to 11 of XP2 SHALL use GNDA as reference plane and signals on rows 15 to 25 of XP2 SHALL use GNDB as reference plane.

Column f of XP2 will mate with the shield of XJ2. All the pins will be connected together when the module is inserted. The shield will be connected to one of the grounds on the SLSC module.

3. **RULE**: The XP2 column f pins SHALL NOT be connected to any signal on the RTI.
4. **RECOMMENDATION**: The XP2 column f pins SHOULD be connected together.

Recommended Generic Fully Compatible Rear I/O Implementations

Fully Compatible Rear I/O allows for easy creation of generic RTIs that can work across a wide range of SLSC module types. XJ2/XP2 signals are divided into 8 banks with signal pins being AI, AO or DIO depending on the module. These signals may easily be cabled out from the RTI as individual banks, regardless of signal type, to be routed by the system integrator as needed.

1. **RECOMMENDATION**: Up to four 2-row, 10-pin vertical Nano-Fit™ connectors, keyed black, SHOULD be used when cabling out individual signal banks from *Fully Compatible Rear I/O* XP2.
2. **RECOMMENDATION**: Following naming recommendations in *Cosmetic Appearance* of Chapter 5, these Nano-Fit connectors SHOULD be named JR2, JR3, JR4, and JR5, incrementing from the top of the RTI to the bottom.
3. **RECOMMENDATION**: The routing between Nano-Fit™ connectors, JR2-JR5, and signal banks on XP2 connector SHOULD be as described in the *Fully Compatible Rear I/O* pinout as defined in *SLSC Module Design Specifications*.
4. **RULE**: The connection for one bank of XP2 signals and the 10 pin Nano-Fit™ connector SHALL be routed as defined in Table 4- 3.

Table 4-3. Nano-Fit Connector Signal Mapping

JR[2-5] Pin #	XP2 Signals
1	Bank#_7
2	Bank#_5
3	
4	Bank#_3
5	Bank#_1
6	Bank#_6
7	Bank#_4
8	
9	Bank#_2
10	Bank#_0

The signals on the RTI could be analog or digital, depending on the functionality of the SLSC module. For maximum RTI flexibility across different types of SLSC modules, follow these design rules and recommendations.

5. **RULE**: The connection for two banks of XP2 signals to a 26-position MDR connector SHALL be routed as defined in Table 4- 4. Exposed copper pads SHALL connect the connector shell to chassis ground.

Table 4-4. MDR Connector Signal Mapping

JR[2-3] Pin #	XP2 Signals	JR[2-3] Pin #	XP2 Signals
1		14	
2	Bank X_0	15	Bank X_2
3	Bank X_1	16	Bank X_3
4		17	
5	Bank X_4	18	Bank X_6
6	Bank X_5	19	Bank X_7
7		20	
8	Bank Y_0	21	Bank Y_2
9	Bank Y_1	22	Bank Y_3
10		23	
11	Bank Y_4	24	Bank Y_6
12	Bank Y_5	25	Bank Y_7
13		26	

6. **RULE**: The signal traces on RTI SHALL have 50 Ω characteristic impedance.
7. **RECOMMENDATION**: For signal integrity considerations, the signal lines SHOULD have a solid ground reference plane. The signals SHOULD NOT cross reference planes.

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Cosmetic Appearance

1. **RULE**: If using XP2 in standard position, place the SLSC Rear I/O Compatibility Glyph on the primary side as defined in **RTI Artwork**. Compatibility glyph selection is defined in the *SLSC Module Design Specifications*.
2. **RULE**: If using XP2 in standard position, the SLSC Rear I/O Compatibility Glyph SHALL be placed on the secondary side in addition to the marking on the primary side. The exact location is dependent on connector selection.
3. **PERMISSION**: The Rear I/O compatibility glyph MAY be scaled to comply with PCB manufacturing limitations.
4. **RULE**: If you are not using XP2 in standard position, the Rear I/O compatibility glyph SHALL NOT be used.
5. **RECOMMENDATION**: Safety or warning text SHOULD NOT be placed within the exposed copper areas at the top and bottom of the RTI recommended in *Mounting Hole Placement* of Chapter 3, *Mechanical*. Markings placed here may be covered by optional strain relief brackets or other similar hardware.
6. **RECOMMENDATION**: The module name and manufacturer name SHOULD be placed to the right of XP2 on the primary side as defined in **RTI Artwork**.
7. **RULE**: The model name SHALL NOT begin with *RTI*, except by specific arrangement with National Instruments.
8. **RULE**: The label *JR1* SHALL only be used for JR1 as defined in *Mechanical Terminology* of Chapter 3, *Mechanical*.
9. **RULE**: The label *JH1* SHALL only be used for JH1 as defined in *Mechanical Terminology* of Chapter 3, *Mechanical*.

10. **RECOMMENDATION**: The rear-I/O-side connectors SHOULD be labeled *JR2*, *JR3*,…*JR#*, along with any applicable descriptive labeling, which is incremented from top to bottom.
11. **OBSERVATION** All silkscreen text items defined in **RTI Artwork**, other than the SLSC Rear I/O Compatibility Glyph text, are only recommendations and examples, not requirements.

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Additional Documentation Requirements

This section contains requirements and recommendations relating to documentation. Items here are in addition to the requirements and recommendations defined in other sections.

1. **RULE**: RTI documentation SHALL clearly show the version number of the *Rear Transition Interface Design Specifications* for which the RTI was designed.
2. **RULE**: Module documentation SHALL clearly show the rear I/O compatibility category, as defined in *SLSC Module Design Specifications*.
   - If the RTI uses XP2 in standard position but is not designed for Fully Compatible Rear I/O, the appropriate customer-defined glyph (matching that of the module for which it is compatible) and an explanation of its signals SHALL be shown.
   - If the RTI does not use XP2 in standard position, then custom or similar phrasing SHALL be used.
3. **OBSERVATION**: For example, this documentation could be formatted as follows for an RTI using custom pinout on XP2 in standard position:
   - SLSC Module Design Specifications Version:1.2
   - Rear I/O Compatibility Category: [A5] (3 channels DIO, 3 channels AI)
4. **RECOMMENDATION**: RTI documentation SHOULD include technical specifications and a user guide, either as separate documents or as a single document.