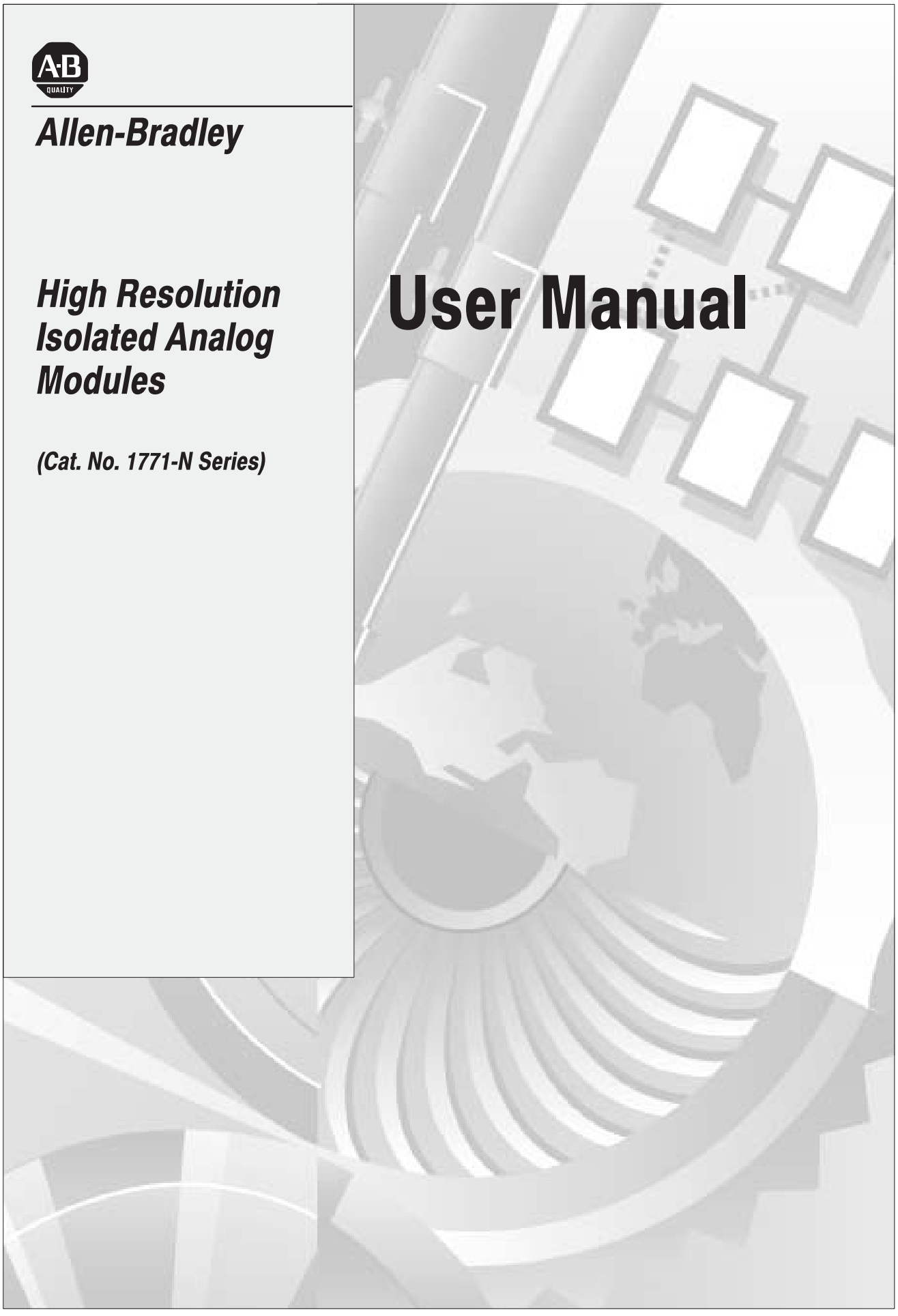


Allen-Bradley

High Resolution Isolated Analog Modules

(Cat. No. 1771-N Series)

User Manual

Overview of the High Resolution Isolated Analog Modules

Chapter Objectives

This chapter gives you information on:

- features of the input/output modules
- how the modules communicate with programmable controllers

Module Description

The high resolution isolated analog modules are intelligent block transfer modules that interface analog signals with Allen-Bradley PLC-3 and PLC-5 family programmable controllers that have block transfer capability. Block transfer programming moves input data words from the module's memory to a designated area in the processor data table in a single scan. It also moves configuration words and output data from the processor data table to module memory.

The N-series family includes modules with both analog inputs and outputs on the same module. The modules use 16-bit analog-to-digital converters and 14-bit digital-to-analog converters for high resolution and accuracy. All of these modules require only a single slot in the I/O chassis, and do not require an external power supply.

Since the N-series modules are combination modules, with input and output capabilities on the same module, block transfer reads from the module are structured differently from dedicated input or output modules. Normally, block transfer read information is contiguous, and is stored in contiguous locations in the data block. N-series modules transmit channel data on an individual basis with status information in between. This results in non-contiguous blocks of data in non-contiguous data locations. Care must be taken when transferring this information. Additional programming may be required.

IMPORTANT Use with PLC-2 family programmable controllers isnot recommended. Refer to chapter 3, page 3-2.

Input data is converted to a specified data type in a digital format to be transferred to the processor's data table on request. Output data is converted to analog signals and sent to the appropriate output channels. If real time sampling is selected, block transfer reads will only occur at the time selected. Consequently, the minimum interval between block transfer reads is the same as the total input update time for each analog input module (25ms).

The modules have either four or eight channels, each electrically isolated from each other and from the backplane. Input and output terminations are made through prefabricated cables which connect to remote termination panels (RTP). The modules are compatible with all 1771-A1B, A2B, A3B, A3B1, A4B, and later 1771 universal I/O chassis. In addition, they can be used in 1771-AM1, and -AM2 chassis.

Features of the High Resolution Isolated Analog Series Modules

The analog modules are comprised of modular analog signal conditioning blocks that are plugged into a common circuit board.

These signal conditioning blocks provide the following:

- **4–20mA output range**
- **0–50mA output range**
- **±10V output (scalable ±5V, 0-5V, 0-10V, etc.)**
- **thermocouple input (±100mV)**
- **±5V input (±20mA with resistor RTP)**
- **±10V input (±20mA with resistor RTP)**
- **4–20mA input with sourcing/sinking input**
- **1–650 ohm RTD input**

Your particular module may have a combination of the above conditioning blocks.

The N-Series analog modules feature:

- **scaling of data to engineering units**
- **self-calibration (external reference required)**
- **software configuration**
- **user-selectable high and low alarms with deadband (hysteresis)**
- **self diagnostics**
- **input open circuit detection**
- **programmable ramped outputs**

Specific analog modules have these additional features:

- **Thermocouple input channels**
  - **input channels configurable for thermocouple input ranges — Types B, E, J, K, R, S and T thermocouples (1771-NT2 also includes types C and N)**
  - **cold junction compensation**
  - **scaling to selected temperature range in °C or °F**
  - **temperature resolution —**
    up to 0.03°C/0.06°F (E, J, K, T, N)
    up to 0.1°C/0.2°F (B, R, S)
    up to 0.07°C/0.1°F (C)
  - **millivolt resolution up to 1 microvolt**

- **RTD input channels**
  - **reports °C, °F, or ohms for 100Ω platinum, 120Ω nickel, or 10Ω copper sensors**
  - **reports ohms for other types of sensors**
  - **0.1°C/0.1°F resolution on 100Ω platinum sensor**
  - **resistance resolution to 10mΩ**
- **±5V and ±10V input channels — can be used with remote termination panel resistor to achieve a nonsourcing current input**
- **4-20mA input with internal loop power supply**
- **±10V output channels**
- **0-25mA output channels**
- **0-50mA output channels**

Catalog/Channel Numbers

The following are standard catalog numbers and their respective channel configurations:

Module	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Refer to Appendix
1771-NIS	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	B
1771-NIV	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	B
1771-NIV1	±10V	±10V	±10V	±10V	±10V	±10V	±10V	±10V	B
1771-NIVR	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	RTD	RTD	RTD	RTD	B
1771-NIVT	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	B
1771-NR	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	B
1771-NT1	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	B
1771-NT2	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	–5/+55mV/TC	B
1771-NOC	0–25mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	C
1771-NOV	±10V out	±10V out	±10V out	±10V out	±10V out	±10V out	±10V out	±10V out	C
1771-NB4T	0–25mA out	0–25mA out	±100mV/TC	±100mV/TC					D
1771-NB4S	0–25mA out	0–25mA out	4–20mA	4–20mA					D
1771-NBSC	0–25mA out	0–25mA out	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	4–20mA	E
1771-NBRC	0–25mA out	0–25mA out	RTD	RTD	RTD	RTD	RTD	RTD	E
1771-NBTC	0–25mA out	0–25mA out	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	±100mV/TC	E
1771-NBV1	±10V out	±10V out	±10V in	±10V in	±10V in	±10V in	±10V in	±10V in	E
1771-NBVC	0–25mA out	0–25mA out	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	±5V (±20mA)	E
1771-NX1	0–50mA out	0–25mA out	0–50mA out	0–25mA out	0–25mA out	RTD	RTD	100mV/TC	F
1771-NX2	0–50mA out	0–25mA out	0–50mA out	0–25mA out	RTD	RTD	100mV/TC	100mV/TC	G
1771-NX3	0–50mA out	0–25mA out	0–50mA out	0–25mA out	RTD	RTD	RTD	100mV/TC	G
1771-NX4	0–50mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	0–25mA out	RTD	100mV/TC	H

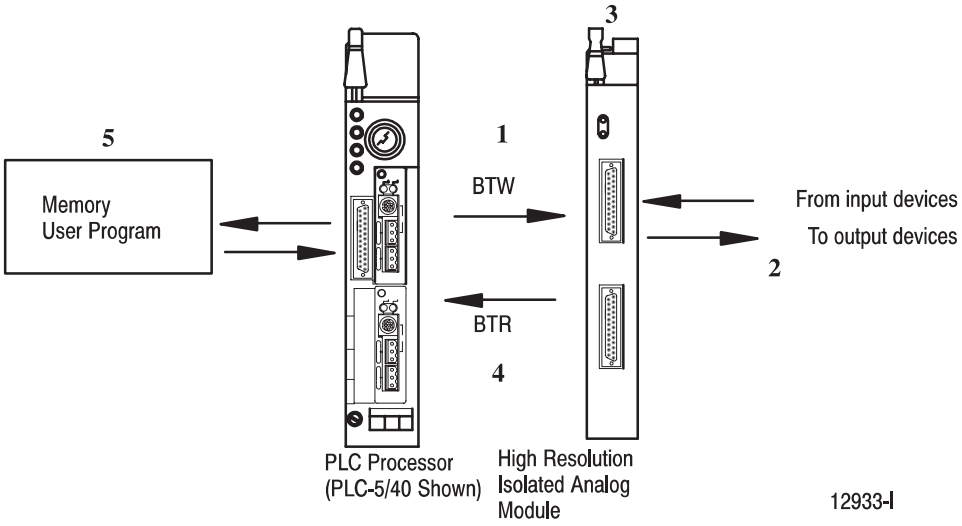
Note: Appendices I thru L cover other variations of the 1771-N series module.

How the High Resolution Isolated Analog Modules Communicate with Processors

The processor transfers data to and from the module using BTW (block transfer write) and BTR (block transfer read) instructions in your ladder diagram program. These instructions let the processor obtain input values and status from the module, and let you establish the module's mode of operation (Figure NO TAG).

1. **The processor transfers your configuration data, output data and calibration values to the module using a block transfer write instruction.**
2. **External input devices generate analog signals that are transmitted to the module. Internal output circuitry generates analog signals that drive field devices.**
3. **The module converts the analog signals into binary or BCD format and stores theses values until the processor requests their transfer.**

Table 1.A
Communication Between the Processor and the Module



4. **When instructed by your ladder program, the processor performs a read block transfer of the values and stores them in a data table.**
5. **The processor and module determine that the transfer was made without error, and that input values are within specified range.**
6. **Your ladder program can use and/or move the data (if valid) before it is written over by the transfer of new data in a subsequent transfer.**

See chapter 4, "Configuring the Module," for more information.

Accuracy

The accuracy of each of the high resolution isolated analog modules is described in Appendix A.

Chapter Summary

In this chapter you read about the functional aspects of the analog modules and how they communicate with programmable controllers.

Installing the Module

Chapter Objectives

This chapter gives you information on:

For information on	See page
Before You Install Your Module	2–1
Determining Power Requirements	2–1
Determining Module Location in the Chassis	2–2
Installing the Module	2–2
Connecting Wiring	2–5
Connecting 4–wire sensors	2–9
Sourcing input Analog Modules	2–10
Making Your Own Cables	2–11
Grounding Field Devices	2–12
Module Indicators	2–13

Before You Install Your Analog Module

Before installing your module in the I/O chassis you must:

Action required:	Refer to:
Calculate power requirements for the I/O chassis.	page 2–1
Determine module location in the I/O Chassis	page 2–2
Connect the cable and make wiring connections to the remote termination panel	page 2–3

Electrostatic Damage

ATTENTION

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- **Touch a grounded object to discharge potential static.**
- **Wear an approved grounding wriststrap.**
- **Do not touch connectors or pins on component boards.**
- **Do not touch circuit components inside the equipment.**
- **If available, use a static–safe workstation.**
- **When not in use, keep modules in appropriate static–safe packaging.**

Calculate Power Requirements for the I/O Chassis

Your module receives its power through the 1771 I/O chassis backplane from the chassis power supply. The maximum current drawn by the module from this supply ranges from 1.5 to 3.3A, dependent upon the particular type of module. Refer to the specifications in appendix A for standard modules.

Add this value to the requirements of all other modules in the I/O chassis to prevent overloading the chassis backplane and/or backplane power supply.

Determine Module Location in the I/O Chassis

Place your module in any slot of the I/O chassis except for the extreme left slot. This slot is reserved for processors or adapter modules.

Group your modules to minimize adverse affects from radiated electrical noise and heat. We recommend the following.

- **Group analog and low voltage dc modules away from ac modules or high voltage dc modules to minimize electrical noise interference.**
- **Do not place this module in the same I/O group with a discrete high-density I/O module when using 2-slot addressing. This module uses a byte in both the input and output image tables for block transfer.**

Install the Analog Module

To install your module in an I/O chassis:

1. **First, turn off power to the I/O chassis:**

ATTENTION

Remove power from the 1771 I/O chassis backplane and disconnect the cable from the module before removing or installing an I/O module.

- **Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.**
- **Failure to remove power from the backplane could cause module damage, degradation of performance, or injury.**

ATTENTION

Observe the following precautions when inserting or removing keys:

- **insert or remove keys with your fingers**
- **make sure that key placement is correct**

Incorrect keying or the use of a tool can result in damage to the backplane connector and possible system faults.

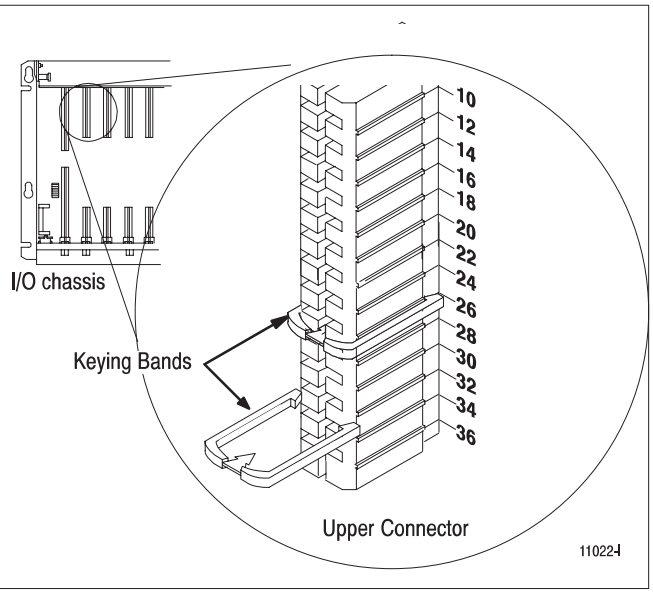
Key the Backplane Connector

Place your module in any slot in the chassis except the leftmost slot which is reserved for processors or adapters.

Position the keying bands in the backplane connectors to correspond to the key slots on the module.

Place the keying bands:
between **26** and **28**
between **32** and **34**

You can change the position of these bands if subsequent system design and rewiring makes insertion of a different type of module necessary.



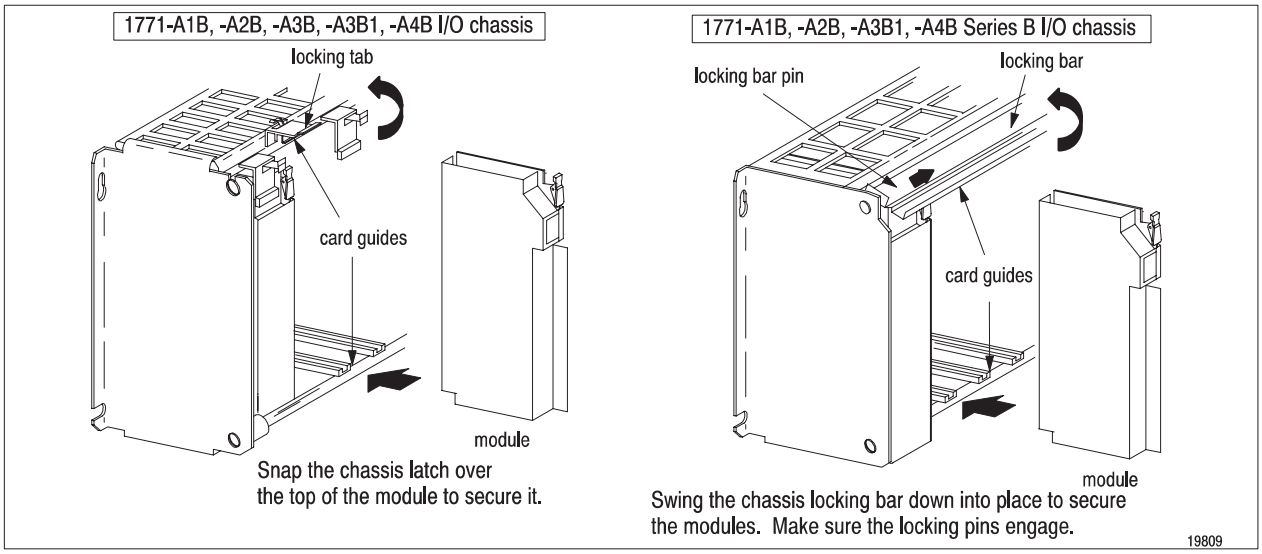
Install the Module in the Chassis and Connect the Cable

ATTENTION

Remove power from the 1771 I/O chassis backplane and field wiring arm before removing or installing an I/O module.

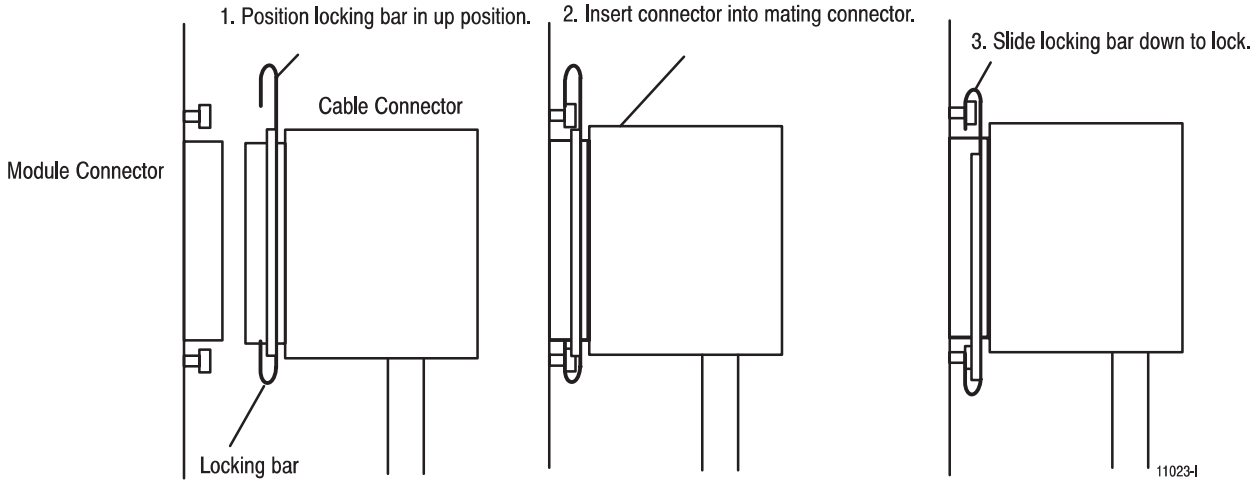
- **Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.**
- **Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.**

1. **Place the module in the plastic tracks on the top and bottom of the slot that guides the module into position.**
2. **Do not force the module into its backplane connector. Apply firm even pressure on the module until it is firmly seated in the chassis. Note: The chassis locking bar will not close if all modules are not seated properly.**



3. **Connect the 1771-NC cable to the module as shown in Figure 2.1.**
   - **A. Slide the locking bar up.**
   - **B. Insert the cable connector into the mating connector on the front of the module.**
   - **C. Slide the locking bar down over the mating pins on the module to lock the connector onto the module.**

Figure 2.1
Connecting the Cable to the Front of the Module



Connecting Wiring

The N-series modules are cable-connected to a remote termination panel using cat. no. 1771-NC6 (6 ft) or -NC15 (15 ft) cables.

Variations of remote termination panels are used, depending on the type of module used. These are:

Catalog Number	Description
1771-RTP1	has cold junction compensation for thermocouples
1771-RTP3	incorporates resistors and fuses; used primarily for 4-20mA inputs when using ±5V inputs (Uses 5mm x 20mm fast acting 1/4A fuses such as Bussmann GMA–1/4, 250V/250mA.)
1771-RTP4	a general-use block with straight-thru wiring that can be used for all applications except thermocouples[1]
1771-RT41	a 4-channel block with cold junction compensation for thermocouples
1771-RT44	a general-use 4-channel block with straight-thru wiring that can be used for all applications except thermocouples[1]

[1] RTP4 and RT44 can be used with thermocouples if a method of cold junction compensation is provided at the interface of thermocouple and copper wires within the system.

The remote termination panels are designed for mounting on standard DIN 1 or DIN 3 mounting rails.

Figure 2.2
Mounting Dimensions for the Remote Termination Panels

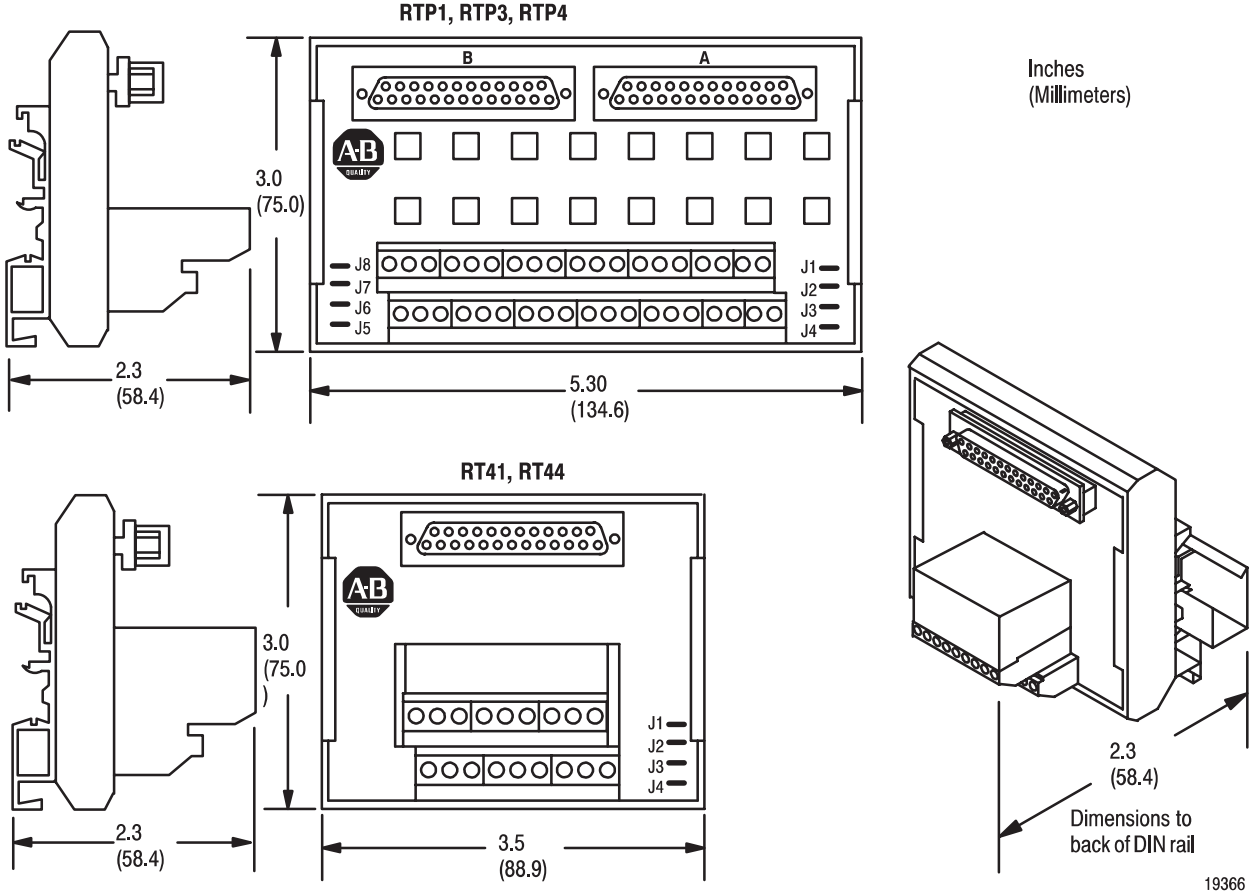
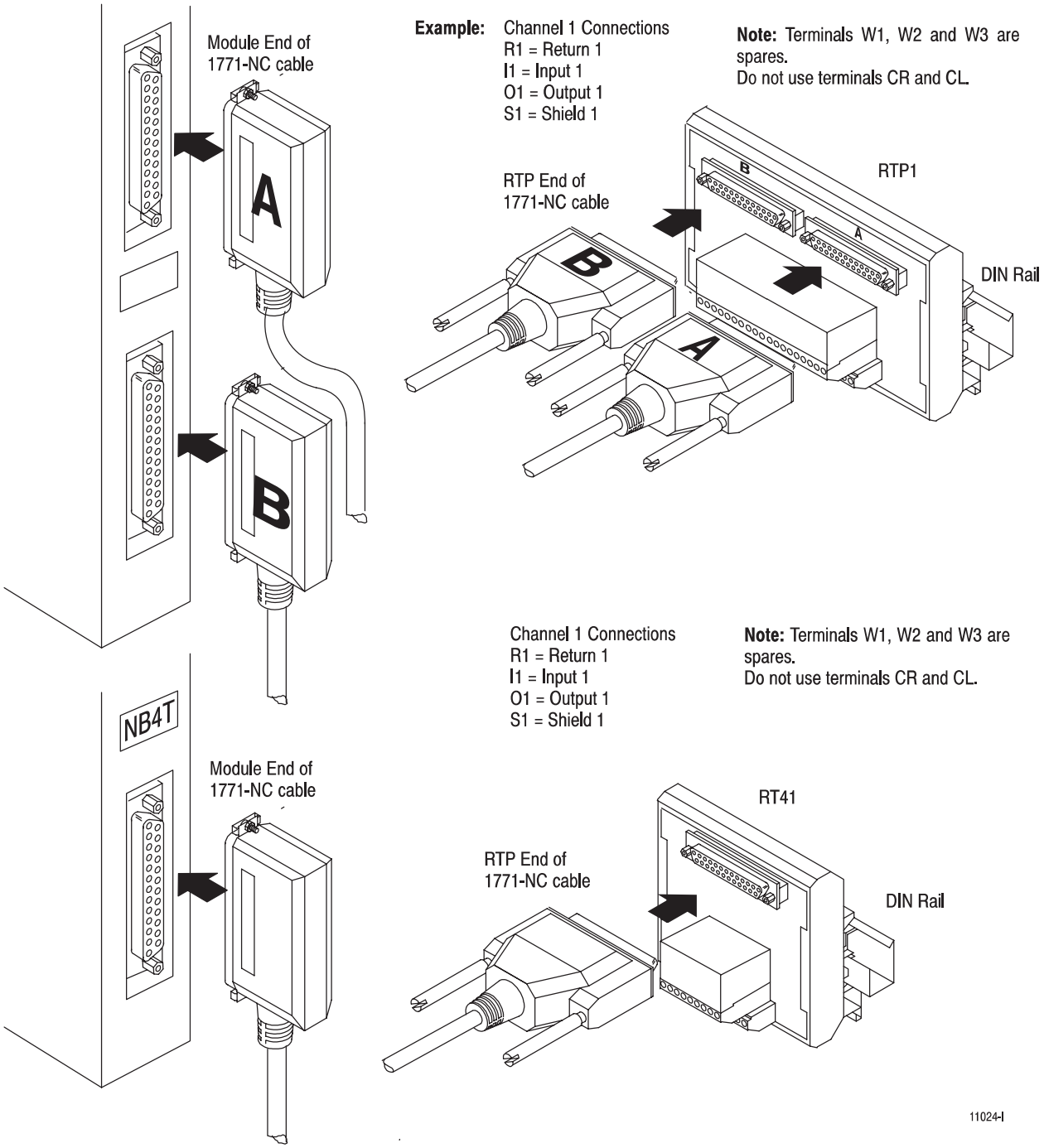


Table 2.A
Remote Termination Panel Connection Points for Field Devices (Channel 1 shown)

Input Type	Connect	To	Input Type	Connect	To	Input Type	Connect	To	Input Type	Connect	To
Voltage	+	I1	Current (with external resistor)	+	I1	Thermocouple	+	I1	Current (Source/ Sink)	+	I1
	-	R1		-	R1		-	R1		- [2]	R1
	Shield	S1		Shield	S1		Shield	S1		Shield	S1
Output Type	**Connect**	**To**	**Output Type**	**Connect**	**To**	**Input Type**	**Connect**	**To**		Loop Power	O1
Voltage	+	O1	Current	+	O1	RTD[1]	Excitation (A)	O1			
	-	R1		-	R1		Lead Compensation (B)	I1			
	Shield	S1		Shield	S1		Common (C)	R1			

[1] When using 4-wire RTD, leave the 4th wire open.
[2] Not used when N-Series module is supplying loop power. Refer to Figure 2.6 in this document.

Figure 2.3
Remote Termination Panel Wiring



Field wiring to the remote termination panel is the same for all remote termination panel variations. Refer to Figure 2.4.

Each channel has 4 connections: R, I, O, and S.

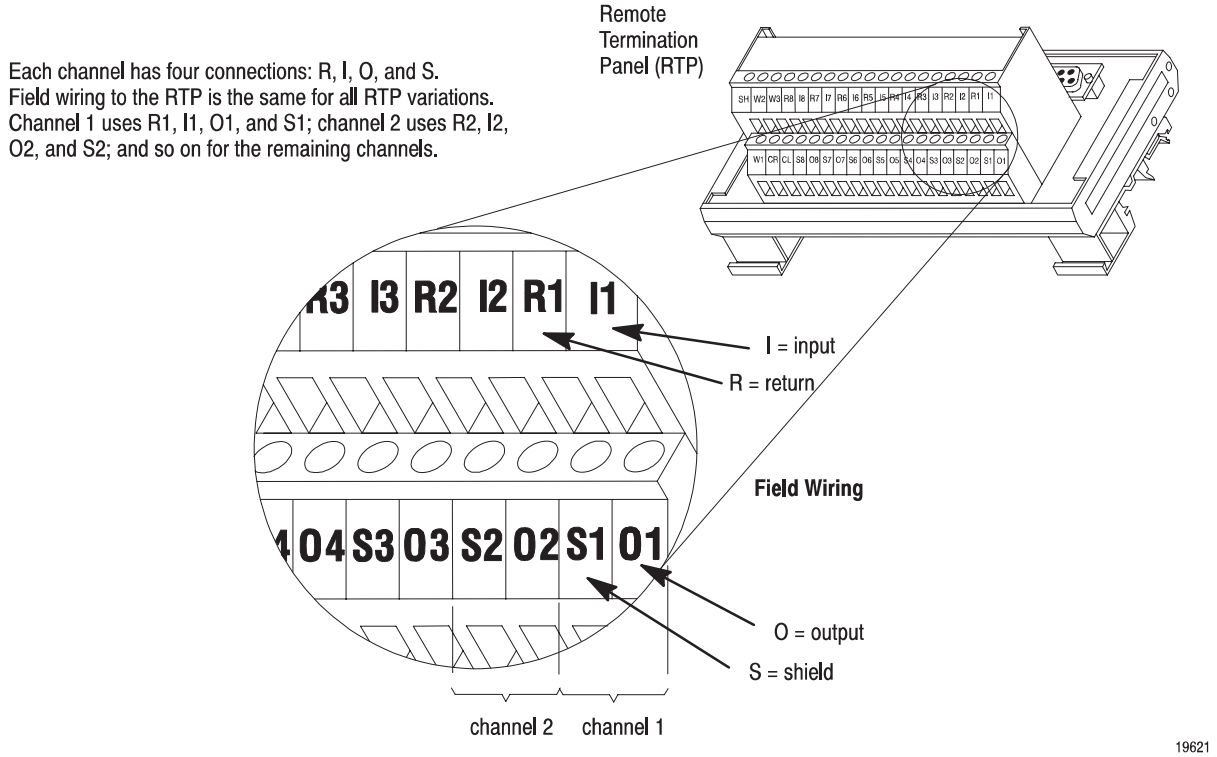
- **R = return**
- **I = input**
- **O = output**
- **S = shield**

Channel 1 would use R1, I1, O1, and S1; channel 2 would use R2, I2, O2, and S2; and so on for the remaining channels.

To connect field wiring to the remote termination panel:

1. **Strip 3/8 inch (9.25 mm) of insulation from the 22-12 AWG wire.**
2. **Insert the wire into the open connector slot.**
3. **Tighten the screw to 4.4–5.2 lb–in. (0.5–0.6Nm) to clamp the wire.**

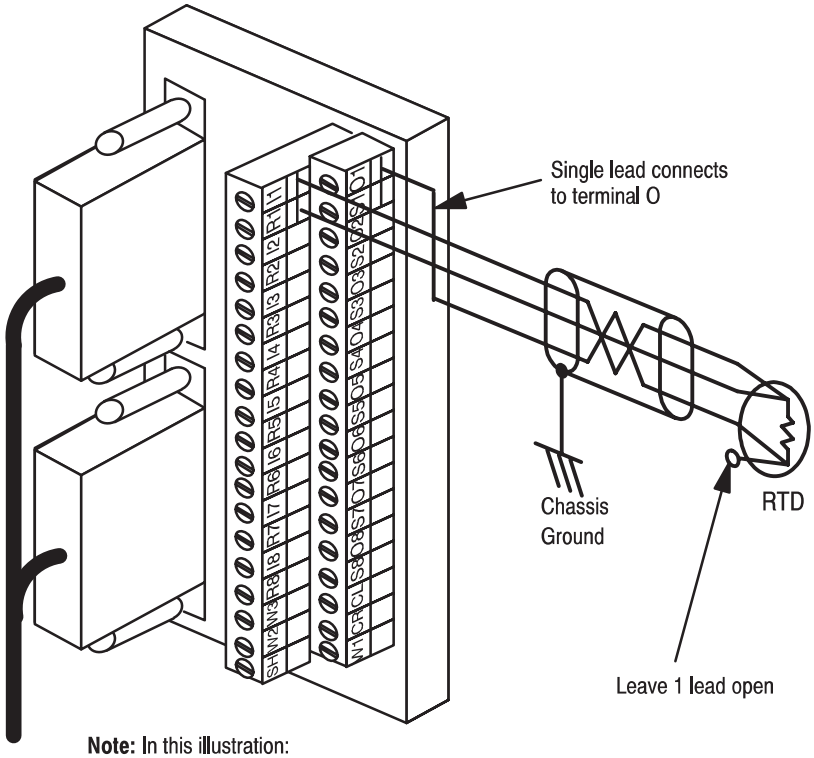
Figure 2.4
Connecting Wire to the Remote Termination Panel



Connecting 4-Wire Sensors

Figure 2.5 shows how to connect 4-wire sensors to the remote termination panel. A 4-wire sensor has two pairs of leads; one pair for each resistor junction. One wire of the four is not used (it does not matter which one). This leaves three wires – one pair and one single wire. You must connect the single wire to the terminal marked "O_". You connect the remaining pair of wires to terminals "I_" and "R_". It doesn't matter which wire of the pair connects to terminal "I_" and which wire connects to terminal "R_" so long as all three wires are the same AWG gauge.

Figure 2.5
Connecting a 4-Wire Sensor to the Remote Termination Panel



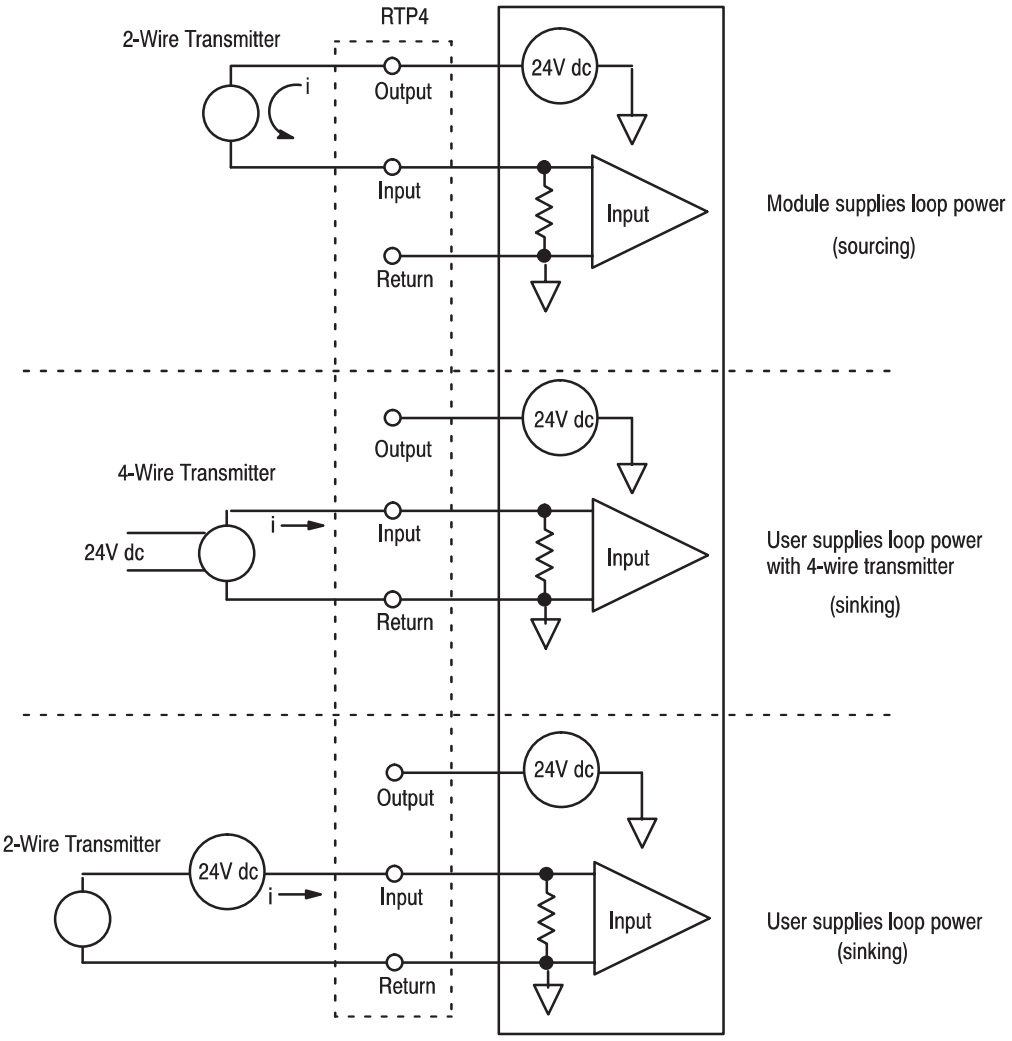
Note: In this illustration:
Terminal O is the 1mA excitation (A) sourcing current
Terminal I is the lead compensation (B) sense input
Terminal R is common (C)

12935–I

Sourcing Input Analog Modules

The 1771-NIS, 1771-NBSC and 1771-NB4S modules are sourcing/sinking input modules. These modules can supply the necessary loop power for 2-wire transmitters connected to the input. All loop power functionality is contained within the analog module. Examples of typical configurations are shown in Figure 2.6. No external resistors are required.

Figure 2.6
Examples of Sourcing/Sinking Input Modules



Inputs can be configured as sourcing or sinking inputs. For sourcing inputs, the N-series module supplies the loop power. For sinking inputs, you supply the loop power.

When the loop power is supplied externally, the 16-bit resolution provides 65535 counts over the 0–20mA current range. This provides about twice the resolution of voltage inputs with external resistors.