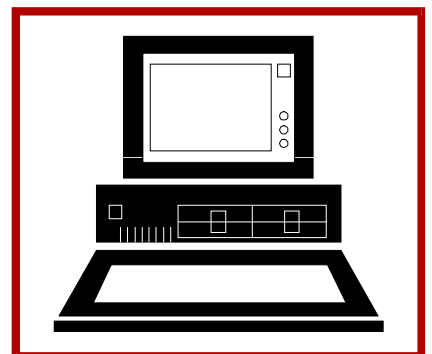
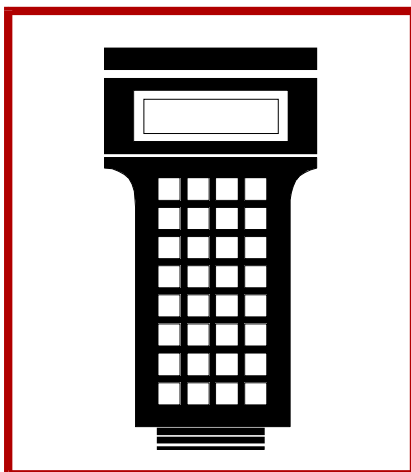
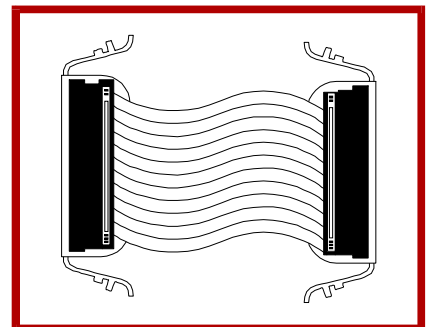
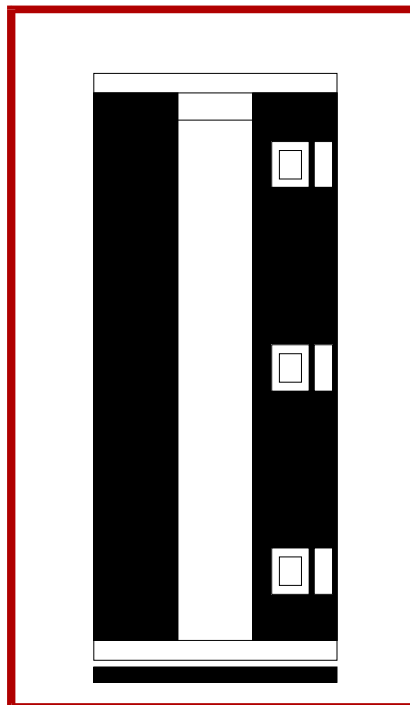
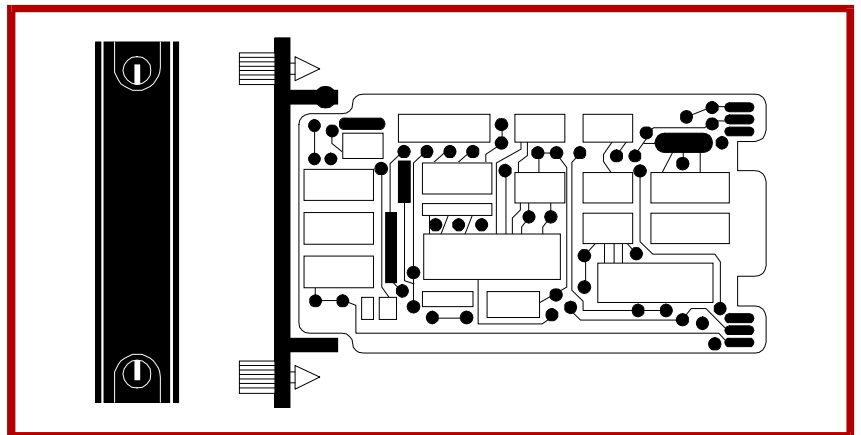
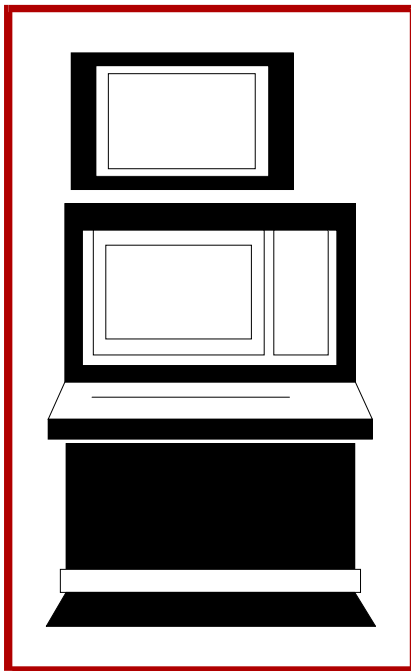


E96-317

Bailey®
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Instruction

Remote I/O Slave Module (IMRIO02)



WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices that could result in property damage.

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN, OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING, AND FOLLOWING THE PROPER **Elsag Bailey** INSTRUCTIONS AND MANUALS; OTHERWISE, INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS

MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

MANUELS D'OPÉRATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER L'ÉQUIPEMENT SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS RÉGLEMENTAIRES DE **Elsag Bailey**. TOUTE NÉGLIGENCE À CET ÉGARD POURRAIT ÊTRE UNE CAUSE D'ACCIDENT OU DE DÉFAILLANCE DU MATÉRIEL.

PERTURBATIONS PAR FRÉQUENCE RADIO

LA PLUPART DES ÉQUIPEMENTS ÉLECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS PAR FRÉQUENCE RADIO. DES PRÉCAUTIONS DEVRONT ÊTRE PRISES LORS DE L'UTILISATION DU MATÉRIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRÉCAUTIONS À PRENDRE DANS CE CAS SOIENT SIGNALÉES AUX ENDROITS VOULUS DANS VOTRE USINE.

PERTURBATIONS DU PROCÉDÉ

L'ENTRETIEN DOIT ÊTRE ASSURÉ PAR UNE PERSONNE QUALIFIÉE EN CONSIDÉRANT L'ASPECT SÉCURITAIRE DES ÉQUIPEMENTS CONTRÔLÉS PAR CE PRODUIT. L'AJUSTEMENT ET/OU L'EXTRACTION DE CE PRODUIT PEUT OCCASIONNER DES À-COUPS AU PROCÉDÉ CONTRÔLE LORSQU'IL EST INSÉRÉ DANS UNE SYSTÈME ACTIF. CES À-COUPS PEUVENT ÉGALEMENT OCCASIONNER DES BLESSURES OU DES DOMMAGES MATÉRIELS.

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Preface

This document provides the users with instructions for configuration, installation, operation, and troubleshooting of the IMRIO02 Remote Input/Output Module.

General information concerning the module, its circuitry, and related equipment is presented here.

List of Effective Pages

Total number of pages in this instruction is 40, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through xxiv	Original
1-1 through 1-6	Original
2-1 through 2-4	Original
3-1 through 3-5	Original
4-1 through 4-2	Original
5-1 through 5-2	Original
6-1	Original
7-1 through 7-2	Original
8-1	Original
A-1 through A-4	Original
B-1 through B-4	Original
C-1 through C-2	Original

When an update is received, insert the latest changed pages and dispose of the superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear beside the page number.

Safety Summary

**GENERAL
WARNINGS****Equipment Environment**

All components, whether in transportation, operation or storage, must be in a noncorrosive environment.

Electrical Shock Hazard During Maintenance

Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.

Special Handling

This module uses Electrostatic Sensitive Devices (ESD).

**SPECIFIC
WARNINGS**

Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock. (p. 3-5)

The RIO module **MUST** be stopped before removal. The output status of slaves may incorrectly change if an active RIO is removed before being properly stopped. (p. 3-5, 7-1)

Sommaire de Sécurité

AVERTISSEMENTS D'ORDRE GÉNÉRAL

Environnement de l'équipement

Ne pas soumettre les composants à une atmosphère corrosive lors du transport, de l'entreposage ou l'utilisation.

Possibilité de chocs électriques durant l'entretien

Débrancher l'alimentation ou prendre les précautions pour éviter tout contact avec des composants sous tension durant l'entretien.

Precautions de Manutention

Ce module contient des composantes sensibles aux decharges electro-statiques.

AVERTISSEMENTS D'ORDRE SPÉCIFIQUE

Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire moretiles. (p. 3-5)

Le module RIO doit place en mode arret avant d'etre retire du chassis. L'etatdes sorties des modules asservis pourrait changer de facon erronee si un module RIO actif est retire avant d'etre place en mode arret. (p. 3-5, 7-1)

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SECTION 1 - INTRODUCTION

OVERVIEW

The Remote I/O Module (IMRIO02) operates with the Bailey Multi-Function Processor (IMMFP01/02/03) to provide powerful control capabilities on a plant wide scale. The Remote I/O module is designed for communication between an MFP and remotely located slave modules.

INTENDED USER

System engineers and technicians should carefully read and understand this manual before installing and placing the RIO Module into service. Once familiar with the operation of the RIO, the tables and illustrations in this manual provide a concise reference of information.

MODULE DESCRIPTION

The RIO occupies one slot in the Module Mounting Unit (MMU). Dipswitches on the RIO configure user options and module addresses. LEDs on the front panel provide operating status. Two captive screws on the module faceplate secure it to the MMU. The user connects the communication cabling to the termination unit/module which is connected to the RIO.

FEATURES

The Remote Input/Output Module (RIO02) provides communication between the Multi-Function Processor and remote slave modules at a rate of one Megabit per second. A RIO on each end of the link supports communication up to 10,000 feet (3,000 meters) to the farthest remote drop. The remote link can be coaxial, twinaxial or fiber optic cable. The RIO also has internal diagnostics which ensure module and communication link integrity. The RIO hardware provides the capability to add redundant modules and communication hardware.

MODULE APPLICATION

The Remote I/O Module (IMRIO02) provides the multi-function processors with remote process control capability. The RIO allows central control of slave modules up to 10,000 feet (3,000 meters) from the MFP (see Figures 1-1 and 1-2). Limitations on this maximum distance depend on the cable type of the system (refer to [Section 3](#)). The Remote I/O Module also supplies additional links between the MFP and Digital Indicator Stations.

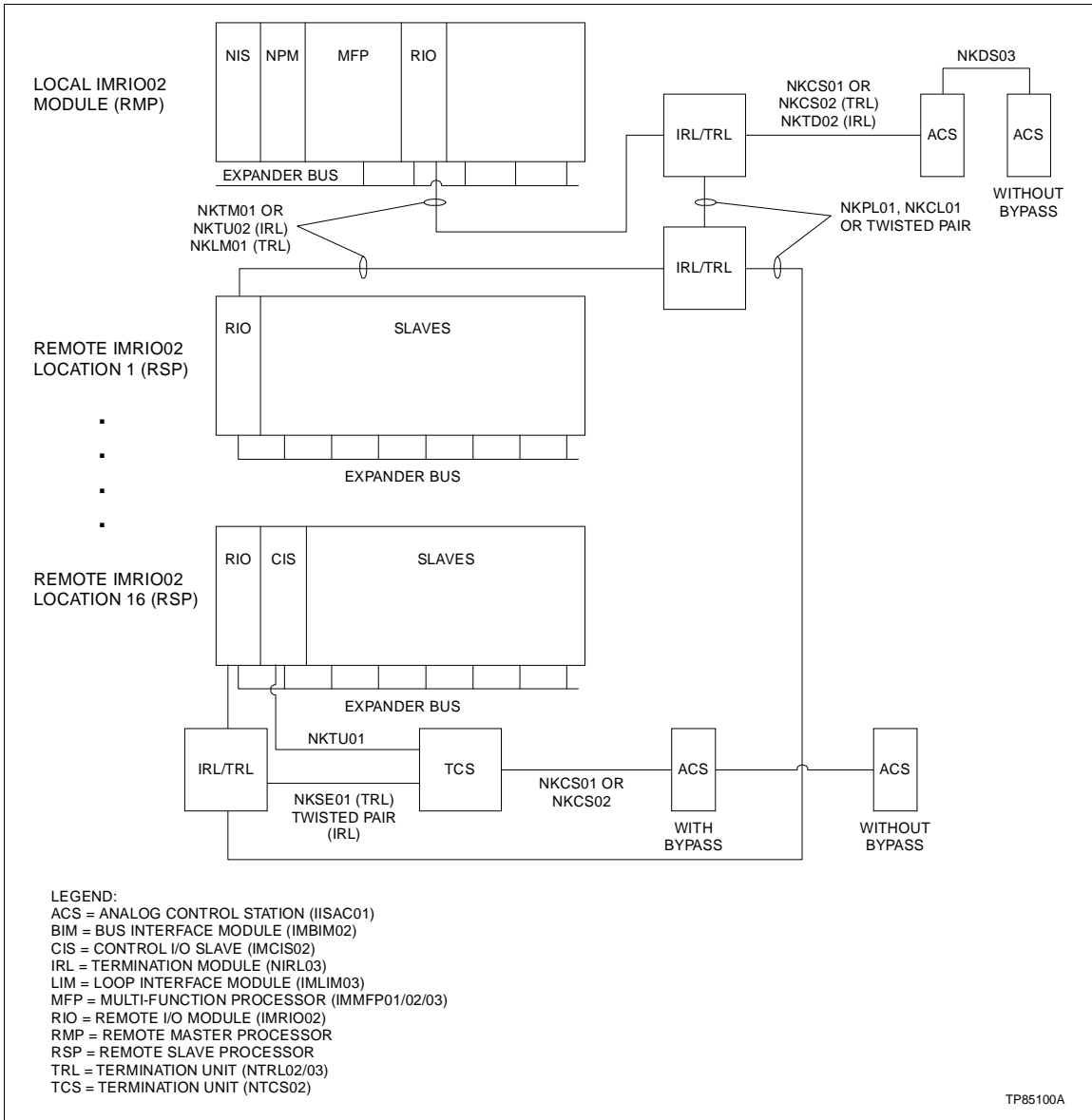


Figure 1-1. Communications Scheme for Remote I/O Modules

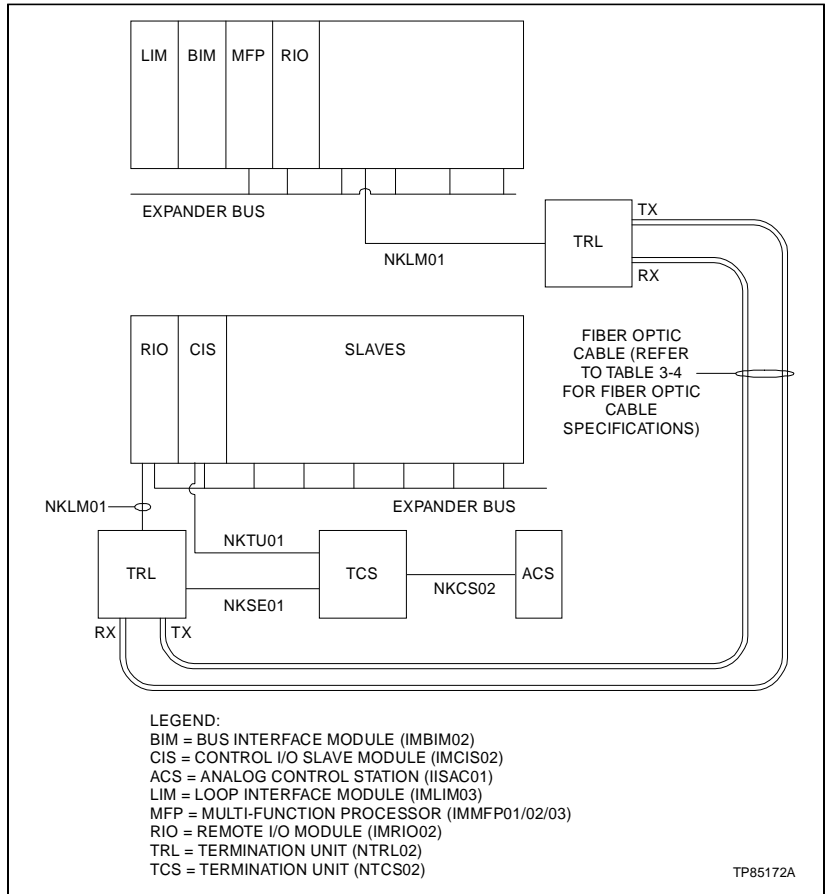


Figure 1-2. Remote I/O Modules Using Fiber Optic Cable

INSTRUCTION CONTENT

This manual is organized in the following manner: **INTRODUCTION** contains general information, technical specifications, and a glossary of terms; **OPERATION AND DESCRIPTION** gives a detailed look at how the module works; **INSTALLATION** is a guide through all the steps that prepare the module for operation; **OPERATING PROCEDURES** provides information on day-to-day operation, what the LED codes mean, and what to look for in the event of an error; and **TROUBLESHOOTING** includes corrective actions to possible error situations. In the **MAINTENANCE** section a maintenance schedule is provided. The **REPAIR/REPLACEMENT** section lists instruction on removal and replacement of the module. **SUPPORT SERVICES** provides replacement part ordering information.

HOW TO USE THIS MANUAL

Read the introductory material first. Then proceed to **Section 2** for a fundamental understanding of how the module works. Next, read **Section 3**. Read this section thoroughly, and perform all preparatory steps, before putting the module into operation. After installing the module, read **Section 4** for normal and abnormal operating modes. Refer to **Section 5** if any abnormal situations occur after putting the module into operation.

REFERENCE DOCUMENTS

Document Number	Document
I-E93-900-20	Function Code Application Manual
I-E96-201	Multi-Function Processor (IMMFP01)
I-E96-202	Multi-Function Processor (IMMFP02)
I-E93-911	Termination Units Manual
Includes:	
NTRL02	Fiber Optic Remote Link-Termination unit
NIRL03	Remote Link Termination Module
NTRL03	Remote Link Termination Unit
IEMMU01/02	Module Mounting unit
NTMU01	Termination Mounting Unit

NOMENCLATURE

The RIO operates with the following Bailey hardware:

Nomenclature	Hardware
NIRL03	Termination Module Remote Link
NTCS02	Termination Unit, Controller Station
NTRL02	Termination Unit, Fiber Optic Remote Link
NTRL03	Termination Unit, Remote Link

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
Buffer	A storage device used to compensate for a difference in rate of flow of information, or time between events, when information is transmitted from one computer to another.
Controlway	A redundant peer-to-peer communication path for point data transfer between intelligent modules within a process control unit.
CPU	Central Processing Unit; the hardware and circuitry necessary to interpret and execute control commands.
ACS	Analog Control Station (IISAC03).
Default Latch	A buffer that stores the default values required for fail-safe operation of the system.
Dipshunt	A dual in-line package with shorting bars.
Dipswitch	Dual in-line package with single-pole switches.
Expander Bus	Parallel bus between the master module and the slave, located on the backplane of the MMU.
Latch	A temporary storage buffer that latches onto a piece of data until instructed to move it elsewhere.
Master Module	One of a series of controller modules designed to direct field processes through output modules. The MFP is a master module; in the remote I/O case, the remote RIO is also a master module.
MFP	Multi-Function Processor module (IMMFP01/02/03).
MMU	Module Mounting Unit (IEMMU01/02); provides electrical and communication support to the modules.
Node	Device(s) on the INFI 90/Network 90 Plant Loop, Superloop or INFI-NET (maximum of 63 on Plant Loop, 250 on Superloop/INFI-NET). A node can be a Operator Interface Station (OIS), a Process Control Unit (PCU) or Network Interface Unit (NIU) in any combination.
PCU	Process Control Unit; rack type industrial cabinet that contains master, slave and communication modules, and their communication paths.
Plant Loop	Network 90 data communication highway with 63 node capacity.
Infi-Net	Advanced data communication highway with 250 node capacity.
Register	The computer hardware for storing one machine word.
RIO	Remote I/O Module (IMRIO02).
RMP	Remote Master Processor; RIO Module that is a master on the RIO serial communication link (slave to MFP).
RSP	Remote Slave Processor; RIO Module that is a slave on the RIO serial communication link (master on Expander Bus).
TMU	Termination Mounting Unit (NTMU01); provides support to the termination modules.

SPECIFICATIONS

Power Requirements	
Operating	+ 5 VDC, 1.45 amps typ., 1.80 amps max. + 15 VDC, 17.5 mA typ., 20 mA max. - 15 VDC, 80.0 mA typ., 90 mA max.
Consumption:	+ 5 VDC, 7.25 watts typ., 9.0 watts max. + 15 VDC, 0.26 watts typ., 0.30 watts max. - 15 VDC, 1.20 watts typ., 1.35 watts max.
Data Rates	
Serial Link:	1 Mbit/sec
Memory Capacity	
Static RAM	8 kbytes
Static RAM	8 kbytes (shared with MFP)
ROM	32 kbytes
Mounting	Uses one slot in Infi 90 Module Mounting Unit.
Environmental	
Ambient Temperature	0° to 70° C (32° to 158° F)
Relative Humidity	5% to 90% RH (± 5%) up to 55° C (131° F) non-condensing 5% to 40% (± 5%) at 70° C (158° F) non-condensing
Atmospheric Pressure	Sea level to 3 km (1.86 miles)
Air Quality	Noncorrosive
Certification	CSA certified for ordinary (nonhazardous) locations.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section describes the functional operation and physical operation of the IMRIO02 module. **FUNCTIONAL OPERATION** describes the purpose of the RIO module. Details covered under **PHYSICAL OPERATION** are the RIO security provisions and the redundancy feature. **RIO CIRCUITRY** lists and explains the various types of circuits used.

FUNCTIONAL OPERATION

The primary function of the RIO is to allow the MFP to interface with remote slave modules. Its secondary function is to provide the MFP with additional Digital Indicator Station (DIS) links. The RIO also supports Analog Control Station (ACS) links. The MFP communicates with the Remote Master Processor (RMP) over the Expander Bus. The RMP communicates with Remote Slave Processors (RSPs) over a serial link at a rate of 1 Mbit/second and uses Cyclic Redundancy Check (CRC) error checking. IMRIO02 also supports Network 90 Multi-Function Controllers (MFC).

PHYSICAL OPERATION

Upon start-up, the Multi-Function Processor downloads the control configuration to the shared memory of the local RMP. The RMP allocates its shared memory accordingly and sends a copy of the configuration to the RSPs. The RSPs are master modules on their remote Expander Buses, reading and writing data to their slave modules. They receive data from the RMP and transmit data back upon request. When the communication link is established, the MFP reads and writes data directly to the shared memory of the RMP. The age of data is proportional to the number of expander bus slaves on the link, and the number of RSPs.

Security

Module security is provided by a Machine Fault Timer (MFT) and a Bus Fault Timer (BFT). The MFT is reset regularly by the microprocessor under normal operation. If the MFT expires, all critical parts of the module will be reset. The BFT is usually reset by the bus clock and has 2 modes of operation.

1. **Remote Master Processor.** When the RIO is used at the local end, it is a slave to the MFP. The BFT will expire if the bus clock stops for more than 10 milliseconds. The RSPs are informed and in turn put their slaves in a "Fail Safe Mode". In this mode, the modules hold their current configurations until

the bus clock is restarted. Since the link has been shut down, the RMP has to be reconfigured by the MFP in order to restart.

2. **Remote Slave Processor.** At the remote end, the BFT is used only for redundancy. If the active RSP module fails (no bus clock), the BFT of the backup RSP expires after 1 millisecond. This causes the backup RSP to become active and restart the clock, preventing the slaves from shutting down.

Redundancy

Two completely independent RIO module sets, termination units and serial links are used for redundancy. The MFP determines the primary (active) link. The primary link is started first and then the backup link is downloaded. The backup link remains in standby until the MFP commands it to take control. A red LED, visible through the RIO front plate, is used to indicate the active link. The RMP and all RSPs on the active link will have their red LEDs turned on. The red LEDs of all RIO modules on the standby link will be turned off.

A failover occurs when a RMP or RSP error is detected on the primary link and no errors exist on the backup link. The two RMPs must have unique expander bus addresses for the MFP to manage both links independently. Each RSP pair must be configured with the same serial link node address.

RIO CIRCUITRY

The RIO Module circuitry is comprised of the following seven blocks (see Figure 2-1):

1. Expander Bus Slave Interface
2. Expander Bus Master Interface
3. Shared RAM
4. Memory
5. CPU Support
6. Serial - CPU Interface
7. Serial Link Interface

An explanation of these blocks follows.

Expander Bus Slave Interface

This interface contains the circuitry necessary to provide communication between the MFP and the RIO. A custom integrated circuit enables the interface to recognize messages sent from the MFP to the RIO across the Expander Bus.

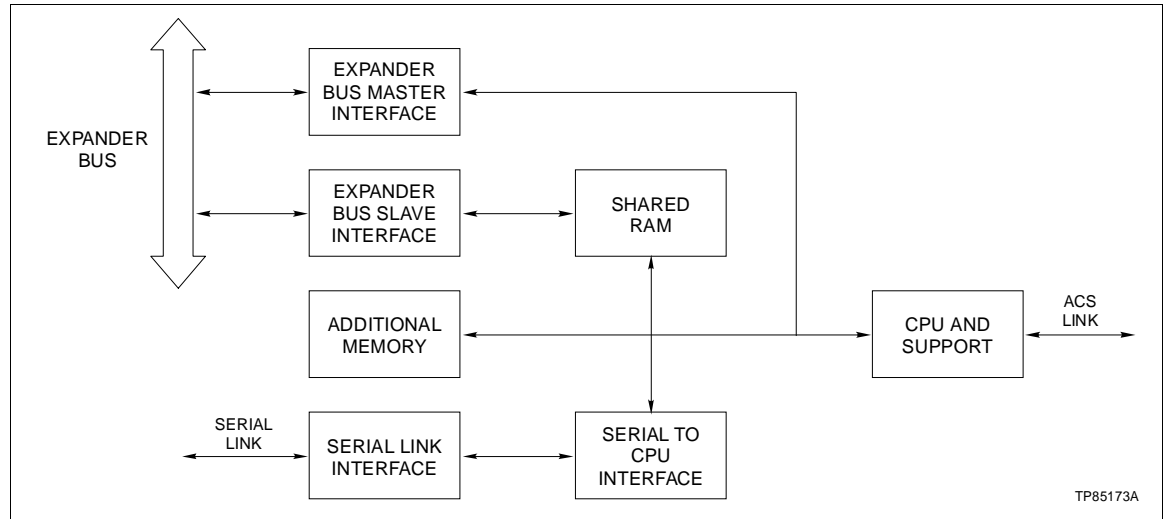


Figure 2-1. Functional Block Diagram

Expander Bus Master Interface

This interface enables the RIO to act as a master module on a remote Expander Bus.

Shared RAM

This block contains 8 kbytes of RAM and the necessary logic to allow the MFP and CPU to access it. The shared RAM is a buffer that stores slave information until the MFP can access it. It also enables the MFP to write data to the slave modules.

Additional Memory

The RIO Module also contains the following general purpose memory:

- 8 Kbytes of static RAM.
- 32 Kbytes of ROM.

CPU Support

The RIO contains two custom integrated circuits that provide support for the CPU. The integrated circuits provide clocks, address decoding, timer functions, and support to the processor and memory system.

Machine Fault Timer (MFT)

The MFT circuit is periodically retriggered by the CPU under normal conditions. If any of the following conditions are detected by the CPU, it does not retrigger the MFT:

- Failure of ROM checksum (an error-detecting procedure).
- Failure of diagnostics at reset/power up time.
- Failure of diagnostics in diagnostic mode with HALT ON ERROR enabled.

When the MFT expires, the CPU is halted and the red/green LED becomes red.

Serial to CPU Interface

This block contains circuitry for the serial communications link, along with FIFO (First In, First Out) buffers. The CPU receives and transmits messages through the FIFO buffers. The CPU transmits a message and waits for a reply. The CPU can read the Serial Link Information Buffer for information about interrupt sources and the current status of the link.

Serial Link Interface

This block contains the driver and receiver circuits for the serial link interface. The receiver circuits condition and amplify the input waveform, and a custom integrated circuit converts this signal back to digital data. This digital data is then stored in the Receive FIFO buffer.

SECTION 3 - INSTALLATION

INTRODUCTION

This section provides information on handling, packing, setup and installation of the modules. Tables are also included that list address dipswitch settings and jumper settings.

SPECIAL HANDLING

NOTE: Always use Bailey's Field Static Kit (P/N 1948385A2 - consists of wrist strap, ground cord assembly, alligator clip) when working with modules. The kit is designed to connect a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

The IMRIO02 uses Electrostatic Sensitive (ESD) devices. Follow these handling procedures:

1. Keep the module in the special antistatic bag until you are ready to install it in the system. Save the bag for future use.
2. Ground the antistatic bag before opening.
3. Verify that all devices connected to the module are properly grounded before using them.
4. Avoid touching the circuitry when handling the modules.

NOTE: Grounding straps (field static kits) must be used when installing or removing modules to configure or change switch settings.

UNPACKING AND INSPECTION

1. Examine the module immediately to verify that no damage has occurred in transit.
2. Notify the nearest Bailey Controls Sales/Service Office of any damage.
3. File a claim for any damage with the transportation company that handled the shipment.
4. Use the original packing material and/or container to store the module.
5. Store the module in an environment of good air quality, and free from temperature and moisture extremes.

SETUP AND INSTALLATION

Prior to inserting the modules into the Module Mounting Unit (MMU), there are four dipswitches that must be set (see Figure 3-1 for switch locations). Switch S1 has two functions depending on the use of the RIO.

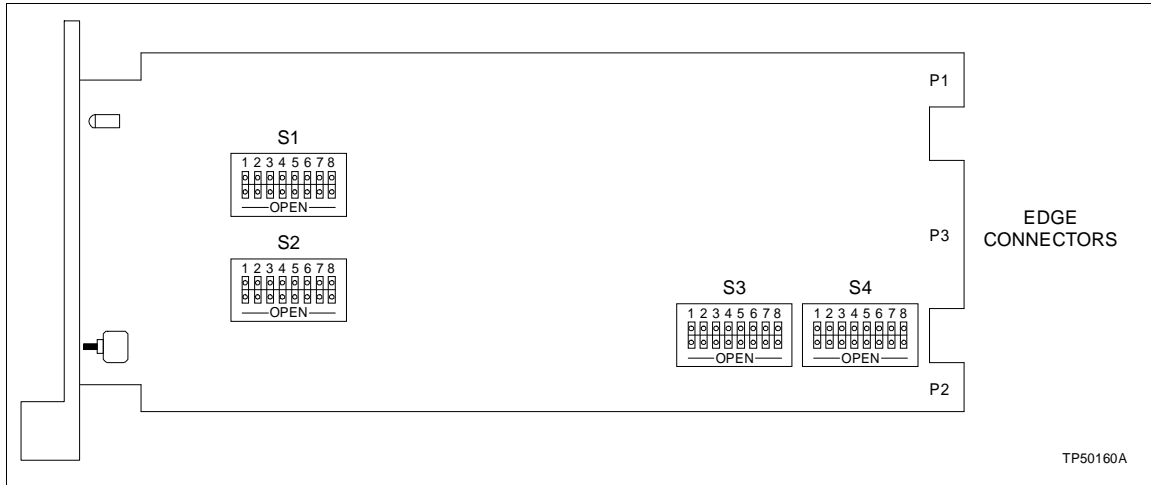


Figure 3-1. IMRIO02 Switch and Connector Locations

S1 Mode Options

LOCAL MODE RMP (Remote Master Processor).

In local mode, S1 sets the slave address on the Expander Bus. Valid addresses range between 0 and 63 (refer to Table 3-1). The slave address must be unique for redundant RIOs on the MFP Expander Bus.

REMOTE MODE RSP (Remote Slave Processor).

In remote mode, S1 sets the node address. Valid addresses range between 0 and 63 (refer to Table 3-1). The node address must be identical for redundant RIOs in the same remote node. The maximum number of slaves on the Expander Bus is 64 and the maximum number of drops on the serial link is 16.

Address Switch Settings

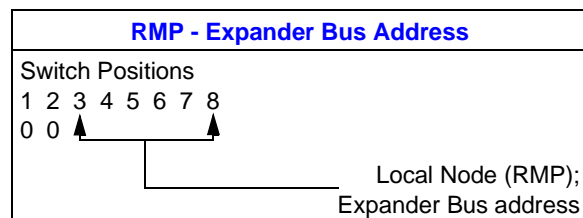
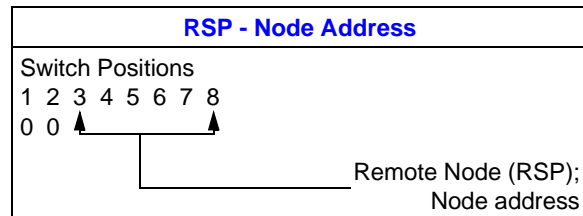
Table 3-1 gives the switch settings that select module or node addresses. The maximum expander bus and node address permitted is 63. A switch position of 1 represents an open switch; a switch position of 0 represents a closed switch.

Table 3-1. Address Switch Settings

Address	Switch Numbers	Address	Switch Numbers	Address	Switch Numbers
	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8
0	00000000	22	00010110	44	00101100
1	00000001	23	00010111	45	00101101
2	00000010	24	00011000	46	00101110
3	00000011	25	00011001	47	00101111
4	00000100	26	00011010	48	00110000
5	00000101	27	00011011	49	00110001
6	00000110	28	00011100	50	00110010
7	00000111	29	00011101	51	00110011
8	00001000	30	00011110	52	00110100
9	00001001	31	00011111	53	00110101
10	00001010	32	00100000	54	00110110
11	00001011	33	00100001	55	00110111
12	00001100	34	00100010	56	00111000
13	00001101	35	00100011	57	00111001
14	00001110	36	00100100	58	00111010
15	00001111	37	00100101	59	00111011
16	00010000	38	00100110	60	00111100
17	00010001	39	00100111	61	00111101
18	00010010	40	00101000	62	00111110
19	00010011	41	00101001	63	00111111
20	00010100	42	00101010		
21	00010101	43	00101011		

Dipswitch S1

Switch 1 and 2 for RSP and RMP switch positions should both be set to 0.



Dipswitch S2

Switch S2 is used for diagnostic purposes. It provides no user options and must be set as follows:

RSP	RMP
Switch Positions 1 2 3 4 5 6 7 8	Switch Positions 1 2 3 4 5 6 7 8
0 0 0 0 0 0 0 0	0 1 0 0 0 0 0 0

NOTES:
 0 represents a closed switch (on).
 1 represents an open switch (off).

Dipswitches S3 and S4

When used at the local end, dipswitches S3 and S4 disconnect the Expander Bus signals that go to the driver section. Position 4 of S3 must be set to match the cable type in your system. The choices are either electrical (standard INFI 90 cable) or fiber optic cable. The switches are set as follows:

RSP	
S3 ¹ 1 2 3 4 5 6 7 8	S4 1 2 3 4 5 6 7 8
x x x ² 1 0 0 0	0 1 0 0 0 0 0 0

RMP	
S3 ¹ 1 2 3 4 5 6 7 8	S4 1 2 3 4 5 6 7 8
x x x ² 0 1 1 1	1 1 1 1 1 1 1 1

NOTES:
 1. X = Switch positions may be open or closed.
 2. For electrical cables, this switch should be 0 (closed). For fiber optic cables, this switch should be 1 (open).

PHYSICAL INSTALLATION

After setting the switches, the RIO is ready to be placed in the MMU. The MMU provides slots for up to twelve modules. The RIO occupies one slot in the Module Mounting Unit. The module front plate has two captive screws that secure the module to the MMU. The RIO may be mounted in any slot provided connection to the Expander Bus. Twelve position dipshunts insert in the 24 pin sockets at the interior bottom of the MMU backplane between adjacent modules. This provides Expander Bus communication between Master Modules and their slaves.

To insert the RIO:

1. Verify the slot assignment of the module.

WARNING	Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock.
AVERTISSEMENT	Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire mortelles.

2. Connect the NKTMO1 or NKTOU2 cable from the NIRLO3 Termination Module, or the NKLM01 cable from the NTRL02/03 Termination Unit, to the rear of the MMU backplane.

3. Slide the RIO into the slot; push until the rear edge connector (P3) is firmly seated in the cable plug, and the module latch snaps into place on the bottom frame of the MMU.

NOTE: RIO Modules can be inserted while the INFI 90 System is operating. When the RMP is inserted, the MFP reads, initializes, and brings the RMP on-line without loss of system performance. Similarly, an RSP begins normal start-up routines upon insertion, and waits for the RMP to bring it on-line. To halt the RIO Module, press the Stop switch on the faceplate. Wait until the red/green Status LED becomes red. The stop is now complete, and the module may be removed. Once stopped, the RIO Module must be removed and reinserted to restart.

WARNING	The RIO module MUST be stopped before removal. The output status of slaves may incorrectly change if an active RIO is removed before being properly stopped.
AVERTISSEMENT	Le module RIO doit être placé en mode arrêt avant d'être retiré du châssis. L'état des sorties des modules asservis pourrait changer de façon erronée si un module RIO actif est retiré avant d'être placé en mode arrêt.

To halt the RIO Module, press the stop switch on the faceplate. Wait until the red/green Status LED becomes red. The stop is now complete, and the module may be removed. Once stopped, the RIO Module must be removed and reinserted to restart.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section provides information for day-to-day operation of the RIO Module. Observe the front panel LED indicator to verify that the module is operating properly.

INITIALIZATION/START-UP PROCEDURES

RIO Module start-up is fully automatic. The following operations are performed before the RIO comes on line:

1. The MFP downloads the configuration into the shared memory of the RIO.
2. The green LED blinks during configuration and turns solid green when the configuration is complete.

If the module fails to operate properly, refer to Table 5-1 in Section 5 for corrective action.

Status LED

The front panel has a red/green LED that indicates the states shown in Table 4-1 (see Figure 4-1).

Table 4-1. Status LED Display

LED Status	Comments
Off	No power or no communication with MFP.
Blinking Green	Any error or non-executing state except as above.
Solid Green	Normal execute mode.
Solid Red	Machine Fault Timer has timed out.

Redundancy LED

The front panel also has a red LED which, when lit, indicates the active module of a redundant pair (see Figure 4-1).

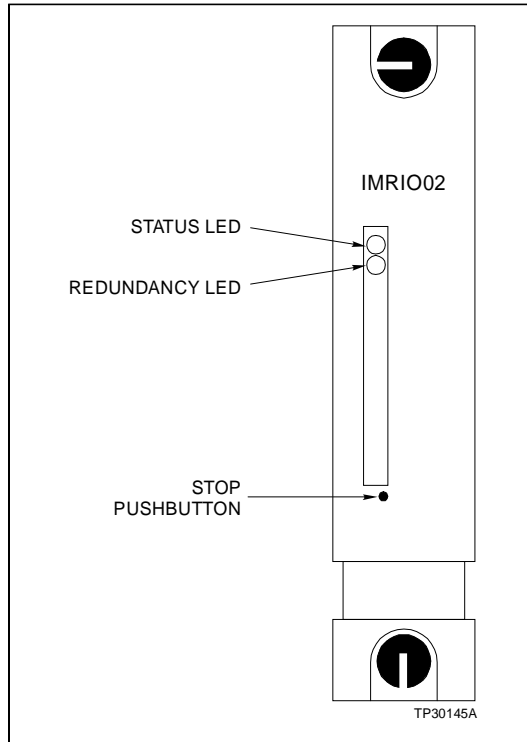


Figure 4-1. IMRIO02 LED and Switch Locations

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

While RIO modules are dependable, error situations can occur. Table 5-1 provides a troubleshooting guide with step-by-step procedures to follow should an error situation arise. Tables 5-2, 5-3, and 5-4 list the pin connections for P1, P2, and P3.

ERROR INDICATIONS

Table 5-1 shows the condition status LED can have and what action to take.

Table 5-1. Troubleshooting the RIO

Problem	Suggested Action
Status LED remains off after start-up.	<p>Local RIO:</p> <ol style="list-style-type: none"> 1. Check the MFP configuration to verify the RIO address assignment. 2. Check the RIO address switch. It must match the address configured in the MFP. 3. Check the status of other slaves n the local Expander Bus. If their status is okay, then a probable defect exists in the RIO, or its connection to the local Expander Bus. 4. Check S2 dipswitch to ensure it is set for local operation. <p>Remote RIO:</p> <ol style="list-style-type: none"> 1. Check the local RIO to verify it is operating. 2. Check the local RIO to verify the RIO address assignment. 3. Check the RIO address switch. It must match the address configured in the MFP. 4. Check S2 dipswitch to ensure it is set for remote operation. 5. Check cable connections between local and remote node.
Status LED remains red after start-up.	<ol style="list-style-type: none"> 1. Replace the RIO.

Table 5-2. RIO P1 Pin Connections

Pin No.	Signal	Pin No.	Signal
1	+ 5 VDC	7	+ 15 VDC
2	+ 5 VDC	8	- 15 VDC
3	N/C	9	PFI
4	N/C	10	PFI
5	Ground	11	Module Bus
6	Ground	12	Module Bus

N/C = Not Connected
PFI = Power Fail Interrupt

Table 5-3. RIO P2 Pin Connections

Pin No.	Signal	Pin No.	Signal
1	D1	7	D7
2	D0	8	D6
3	D3	9	Sync
4	D2	10	N/C
5	D5	11	N/C
6	D4		

Table 5-4. RIO P3 Pin Connections

Pin No.	Signal	Pin No.	Signal
1	Out (+)	A	Ground
2	Out (-)	B	N/C
3	Ground	C	N/C
4	CH1 (+)	D	N/C
5	CH1 (-)	E	N/C
6	FO_In	F	N/C
7	VCC_T_R	H	24V Out
8	Ground	J	N/C
9	DCS_LP	K	FO_Out
10	DCS_LN	L	Ground
11	Ground	M	Ground_T
12	N/C	N	N/C
13	24V_In	P	XD_In
14	Ground	R	XD_OUT
15	N/C	S	Ground

N/C = Not Connected

SECTION 6 - MAINTENANCE

INTRODUCTION

The Remote Input/Output module requires limited maintenance. This section contains a maintenance schedule.

MAINTENANCE SCHEDULE

Perform the tasks in Table 6-1 at the specified intervals.

Table 6-1. Maintenance Schedule

Task	Interval
Clean and tighten all power and ground connection.	Every 6 months or during plant shutdown, whichever occurs first.
Use a static safe vacuum cleaner to remove dust from: Modules Module Mounting Unit Fan Assembly Power Entry Panel	Every 6 months or during plant shutdown, whichever occurs first.

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for the RIO module. There are no special tools required to replace the module.

MODULE REPAIR/REPLACEMENT

If you determine that the module is faulty, replace the faulty module with a new one. **DO NOT** try to repair the module; replacing components may affect the module performance. You can remove the module while system power is supplied. To remove and replace a module:

WARNING

The RIO module **MUST** be stopped before removal. The output status of slaves may incorrectly change if an active RIO is removed before being properly stopped.

AVERTISSEMENT

Le module RIO doit être placé en mode arrêt avant d'être retiré du châssis. L'état des sorties des modules asservis pourrait changer de façon erronée si un module RIO actif est retiré avant d'être placé en mode arrêt.

1. Push and turn the two front panel captive retaining screws one half turn to unlatch the module. It is unlatched when the slots on the screws are vertical and the open end of the slots face away from the module.
2. Gently slide the module out of the MMU. One of the following situations occurs when the RIO is removed from the MMU:
 - a. When the RIO is located on the local expander bus, all remote modules go to a default setting.OR
 - b. When the RIO is located on a remote expander bus, the remote node is marked off-line. All associated remote slave modules go to the default setting.
3. Configure the replacement module switch and jumper settings. Ensure they are set the same as the original module.
4. In the same slot assignment as the original module, align the replacement module with the guide rails in the MMU; gently slide it in until the front panel is flush with the top and bottom of the MMU frame.

5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module.
6. Return to normal operation.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls is ready to help in the use, application and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

When making repairs at your facility, order replacement parts from a Bailey sales office. Provide this information:

1. Part description, part number and quantity.
2. Model and serial numbers (if applicable).
3. Bailey instruction manual number, page number and reference figure that identifies the part.

TRAINING

Bailey Controls has a modern training facility that provides service and repair instruction. This facility is available for in-plant training of your personnel. Contact a Bailey Controls sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

You can obtain additional copies of this manual from the nearest Bailey sales office at a reasonable charge.

APPENDIX A - REMOTE LINK (NTRL03) TERMINATION UNIT CONFIGURATION

INTRODUCTION

This Termination Unit is a seven square inch circuit board which mounts to a Field Termination Panel. An NKLM01 cable connects the RIO to the NTRL03.

CABLE TERMINATION

Due to transmission line effects, the cables must be terminated at each end with the characteristic impedance. The J3 jumper setting on the NTRL03 must match the node position (see Figure A-1) and the system cable type (Refer to Tables A-2 and A-3). Table A-1 illustrates the necessary jumper settings. Figure A-2 shows cable connections for the NTRL03.

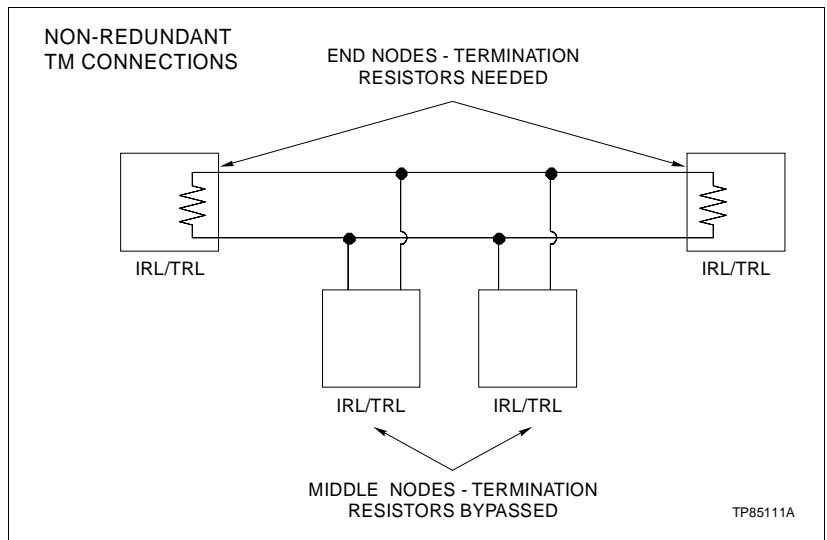


Figure A-1. Node Positions for Non-Redundant TU Connections

Table A-1. J3 jumper Settings

Application	Jumper Position
Coax cable (end nodes only)	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Coax cable (middle nodes only)	<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Twinax cable (end nodes only)	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

NOTE: Jumper positions for twisted wire pairs are the same as those for Twinax cable.

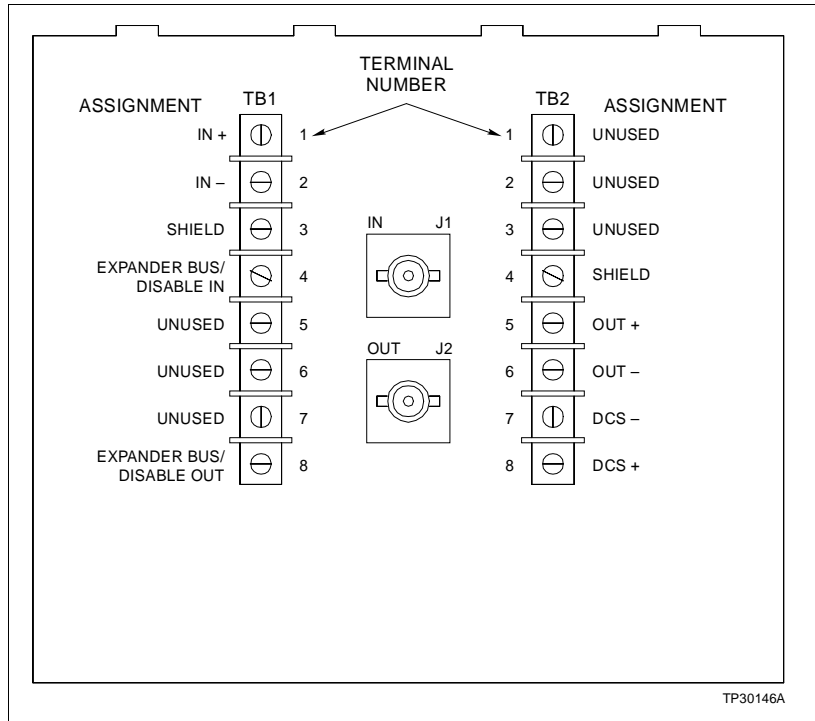


Figure A-2. NTRL03 Termination Unit and Terminal Assignments

Table A-2. Remote I/O Application Guide

Type	Nomenclature	Maximum Length Between RIOs
Coax	NKCL01/NKTL01	10,000 feet (3000 m)
Twinax	NKPL01	4,500 feet (1371 m)
Twisted Pair	---	1500 feet (457 m)

NOTE: The twisted pair is 22 AWG with 36 AWG shield drain wire. Each wire of the twisted pair is 7 strands of 30 AWG wire.

Table A-3. Termination Unit Cable Application Guide

Type	Nomenclature	Maximum Length Between RIOs and TMs/TUs
Flat Cable	NKTM01	20 feet
Twisted Pairs	NKTU02	20 feet
Twisted Pair	NKLM01	45 feet

REMOTE LINK (NTRL03) TERMINATION UNIT CONFIGURATION

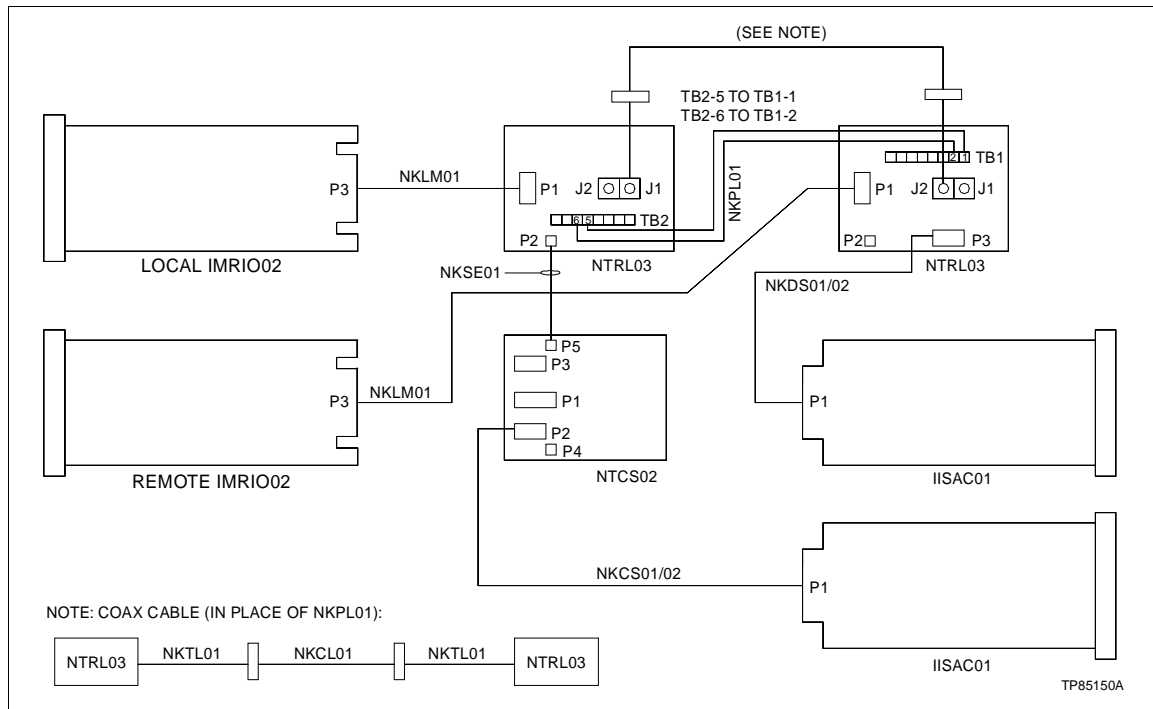


Figure A-3. Cable Connections for the NTRL03

REDUNDANCY

The termination units/modules require additional connections when used with redundant RIO serial links (see Figure A-4). If Analog Control Stations (ACS) are used, then the ACS links must be connected between TUs at each location (local/remote) that has them.

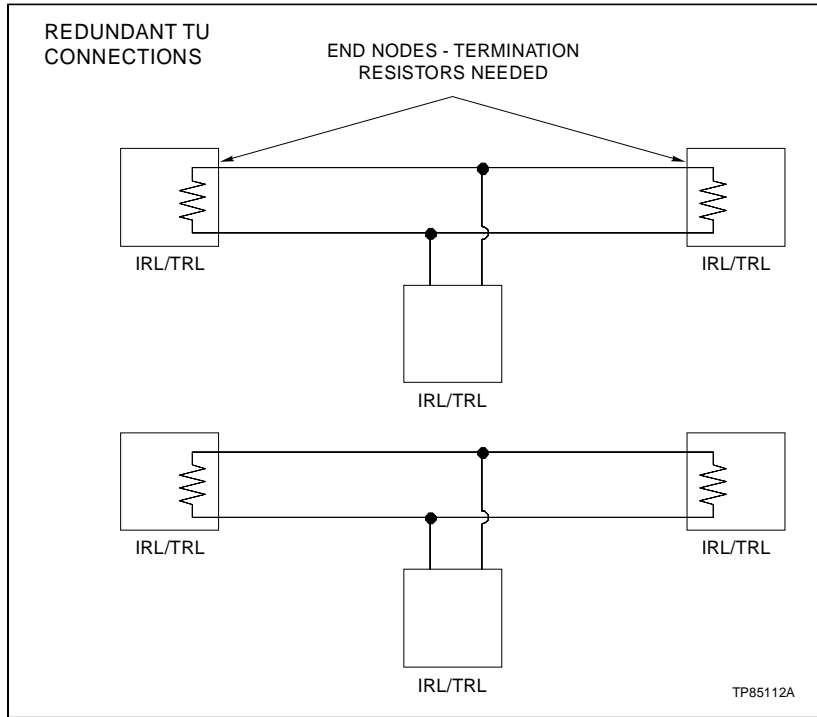


Figure A-4. Node Positions for Redundant TU Connections

APPENDIX B - REMOTE LINK (NIRL03) TERMINATION MODULE CONFIGURATION

INTRODUCTION

The NIRL03 is a module version of the NTRL03 and occupies one slot in the Termination Panel. An NKTU02 or NKTM01 cable connects the RIO to the NIRL03.

CABLE TERMINATION

Due to transmission line effects, the cables must be terminated at each end with the characteristic impedance. The J3 jumper setting on the NIRL03 must match the node position (see Figure B-1). Table B-1 illustrates the necessary jumper settings. Refer to Tables B-2 and B-3 for system cable type and Table B-4 for terminal assignments. Figure B-2 shows cable connections for the NTRL03 and Figure B-3 shows node positions for redundant TM connections.

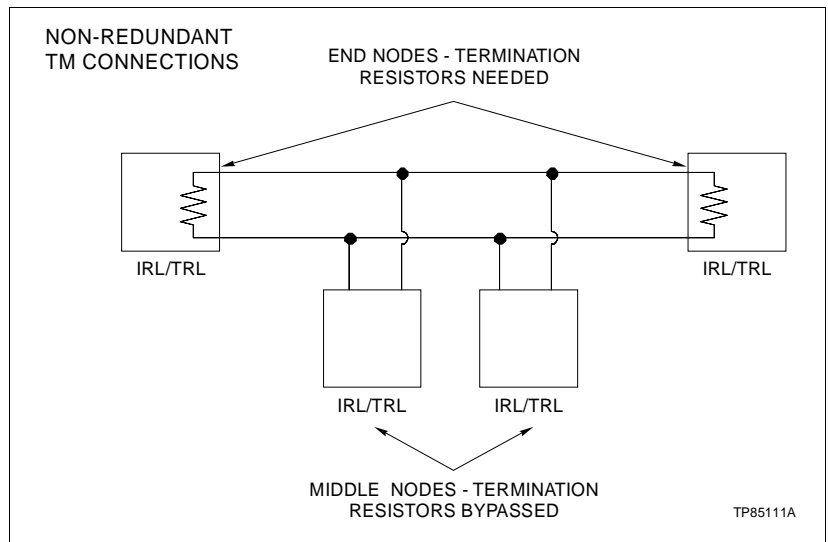


Figure B-1. Node Positions for Non-Redundant TM Connections

Table B-1. J3 jumper Settings

Application	Jumper Position
Coax cable (end nodes only)	
Coax or Twinax cable (middle nodes only)	
Twinax cable (end nodes only)	

NOTE: Jumper positions for twisted wire pairs are the same as those for Twinax cable.

Table B-2. Remote I/O Application Guide

Type	Nomenclature	Maximum Length Between RIOs
Coax	NKCL01/NKTL01	10,000 feet (3000 m)
Twinax	NKPL01	4,500 feet (1371 m)
Twisted Pair ¹	---	1500 feet (457 m)

1. The twisted pair is 22 AWG with 36 AWG shield drain wire. Each wire of the twisted pair is 7 strands of 30 AWG wire.

Table B-3. Termination Unit Cable Application Guide

Type	Nomenclature	Maximum Length Between RIOs and TMs
Flat Cable	NKTM01	20 feet
Twisted Pairs	NKTU02	20 feet
Twisted Pair	NKLM01	45 feet

REMOTE LINK (NIRL03) TERMINATION MODULE CONFIGURATION

Table B-4. NIRL03 Terminal Assignments

TB1 Terminal	Assignment	TB2 Terminal	Assignment	TB3 Terminal	Assignment
1	Ground	4	DCS (+)	25	In (-)
2	Common	5	DCS (-)	26	In (+)
3	+ 24 VDC	6	Expander Bus Disable Out	27	Shield
		7	Expander Bus Disable In		
		8	Out (-)		
		9	Out (+)		
		10	Shield		

NOTE: There are three Terminal Blocks (TB) on the NIRL03. TB1, located at the bottom of the board, is numbered 1 through 3. TB2, located just above TB1, is numbered 4 through 11 (11 not used). TB3, located above TB2, is numbered 25 through 32 (28 through 32 not used).

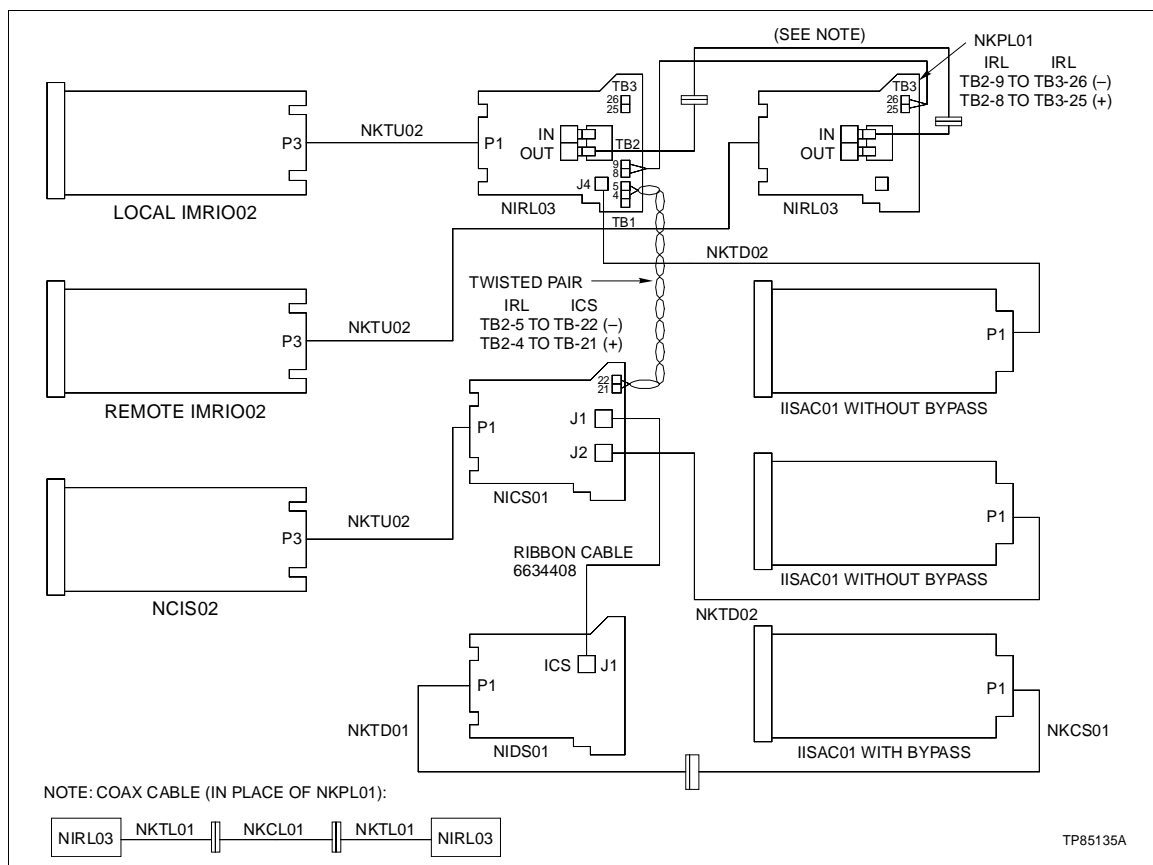


Figure B-2. Cable Connections for the NIRL03

REDUNDANCY

The termination modules require additional connections when used with redundant RIO serial links (see Figure B-3). If Analog Control Stations (ACS) are used, then the ACS links must be connected between TMs at each location (local/remote) that has them.

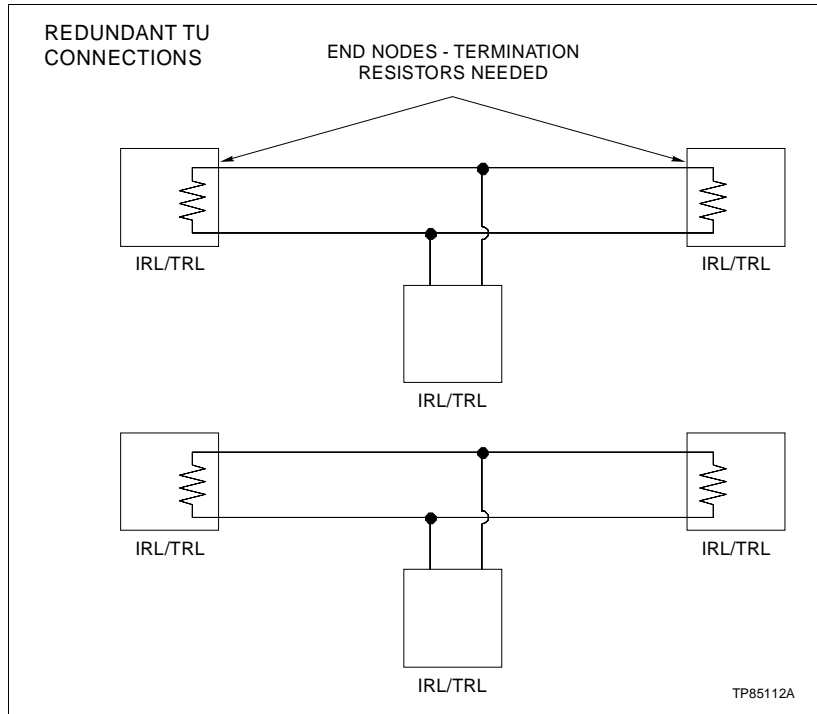


Figure B-3. Node Positions for Redundant TM Connections

APPENDIX C - FIBER OPTIC (NTRL02) TERMINATION UNIT

INTRODUCTION

The NTRL02 allows for fiber optic cable connection to a second NTRL02. The NKLM01 cable connects the RIO to the NTRL02. Figure C-1 shows cable connection for the NTRL02. Figure C-2 shows cable connections for NTRL02 using the Repeater Mode.

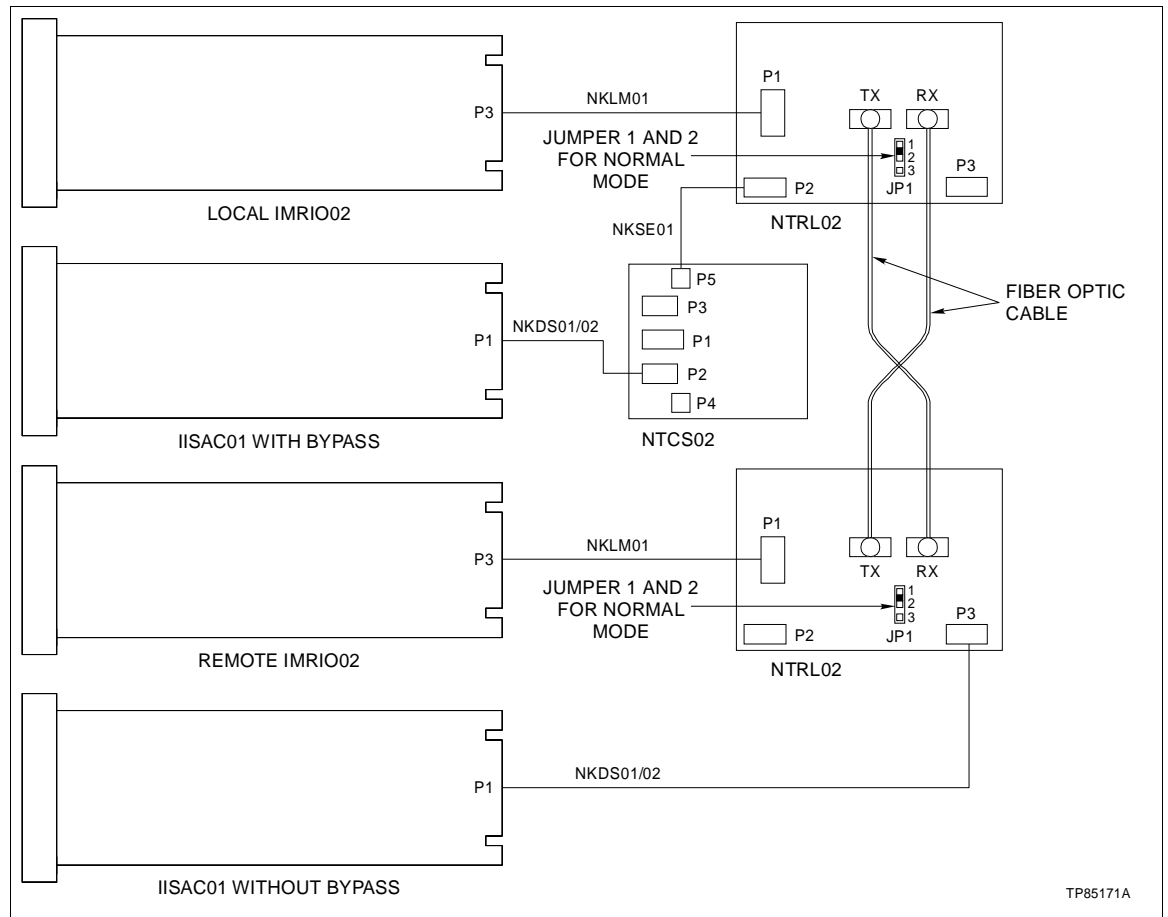


Figure C-1. Cable Connections for NTRL02

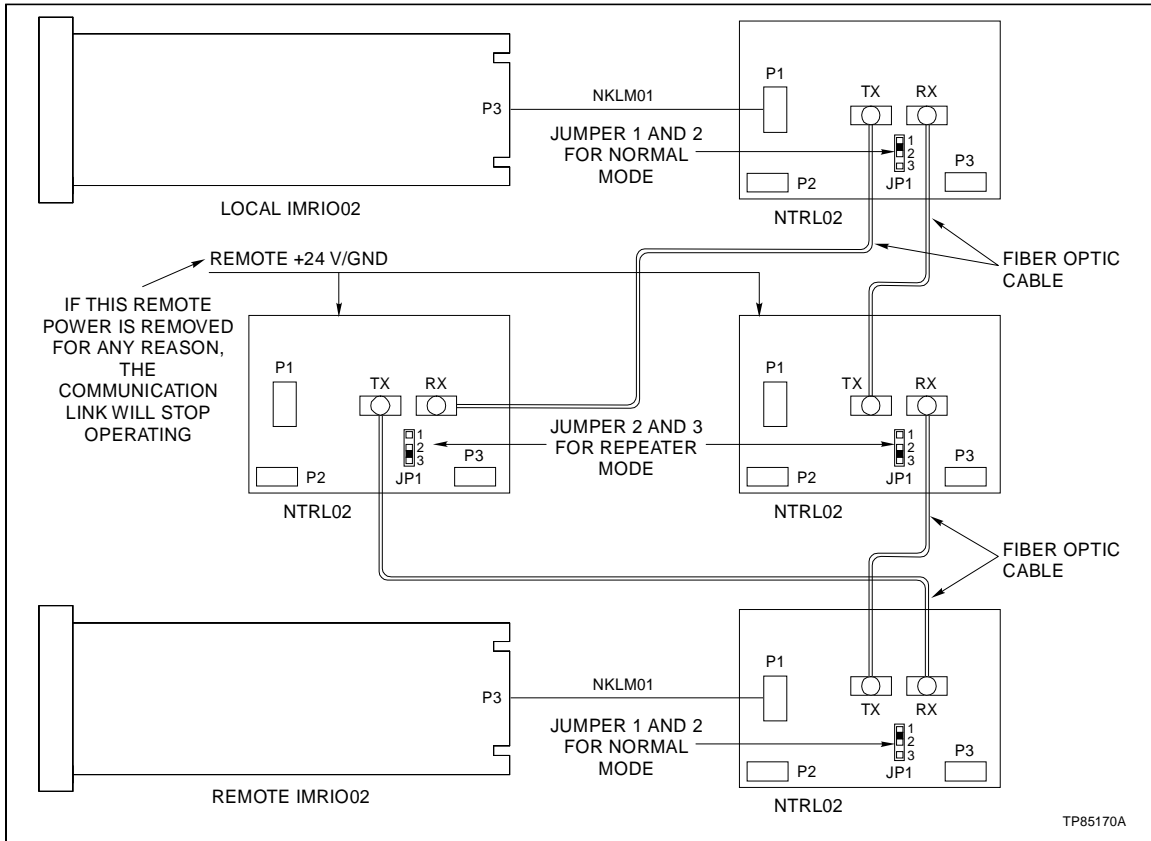


Figure C-2. Cable Connections for NTRL02 - Repeater Mode

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