



# 4100/4120-6014 NIC and 4100/4120-Series Media Modules Installation Instructions

## Introduction

This publication describes the installation procedure for the 4100/4120-6014 Network Interface Card (NIC) and the following media modules:

- 4100/4120-0144 Modem Media Card (non-4100U/4100ES only)
- 4100-6056 Wired Media Card (4100U/4100ES only)  
4100/4120-0142 Wired Media Card (non-4100U/4100ES only)
- 4100-6057 Fiber Media Card (4100U/4100ES only)  
4100/4120-0143 Fiber Media Card (non-4100U/4100ES only)

## Related Documentation

- *Field Wiring Diagram for 4100 Power Limited (841-731) or,*
- *Field Wiring Diagram for 4100 Non Power Limited (841-995)*
- *4100ES Fire Alarm System Installation Guide (574-848)*

## In this Publication

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## Cautions, Warnings, and Regulatory Information

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**READ AND SAVE THESE INSTRUCTIONS.** Follow the instructions in this installation manual. These instructions must be followed to avoid damage to this product and associated equipment. Product operation and reliability depends upon proper installation.



**DO NOT INSTALL ANY SIMPLEX® PRODUCT THAT APPEARS DAMAGED.** Upon unpacking your Simplex product, inspect the contents of the carton for shipping damage. If damage is apparent, immediately file a claim with the carrier and notify Simplex.



**ELECTRICAL HAZARD** - Disconnect electrical field power when making any internal adjustments or repairs. All repairs should be performed by a representative or an authorized agent of you local Simplex product supplier.



**STATIC HAZARD** - Static electricity can damage components. Therefore, handle as follows:

- Ground yourself before opening or installing components.
- Prior to installation, keep components wrapped in anti-static material at all times.



**EYE SAFETY HAZARD** - Under certain fiber optic application conditions, the optical output of this device may exceed eye safety limits. Do not use magnification (such as a microscope or other focusing equipment) when viewing the output of this device.

**FCC RULES AND REGULATIONS – PART 15** - This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**SYSTEM REACCEPTANCE TEST AFTER SOFTWARE CHANGES** - To ensure proper system operation, this product must be tested in accordance with NFPA72-1996, Chapter 7 after any programming operation or change in site-specific software. Reacceptance testing is required after any change, addition or deletion of system components, or after any modification, repair or adjustment to system hardware or wiring.

All components, circuits, system operations, or software functions known to be affected by a change must be 100% tested. In addition, to ensure that other operations are not inadvertently affected, at least 10% of initiating devices that are not directly affected by the change, up to a maximum of 50 devices, must also be tested and proper system operation verified.

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# Introduction to the 4100 Network Interface Card (NIC)

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## Overview

The Network Interface Card (NIC) is a slave card that uses the standard 4100 serial bus to communicate with the master. The NIC connects FACPs in a network, allowing for communication between each panel via fiber, modem, or twisted shielded pair wire in a Style 7 wiring configuration.

The NIC is designed to be connected in a point-to-point arrangement, so that one wire fault does not cause the entire system to fail. The point-to-point arrangement provides the most secure and fault-tolerant wiring possible.

Two types of media boards can be used with the NIC.

- The Fiber-Optic Media Card can be used for electrically noisy environments or for connecting externally to other buildings.
- *Non-4100U/4100ES only*: the Modem Media Card is typically used when a large transmission distance is required.
- The Wired Media Card is used in all other types of applications.

Up to two media boards can be plugged into each NIC. The same NIC can use a combination of two types of media boards (for example, a NIC may have a wired media card connected to port 1 and a fiber-optic media card connected to port 2).

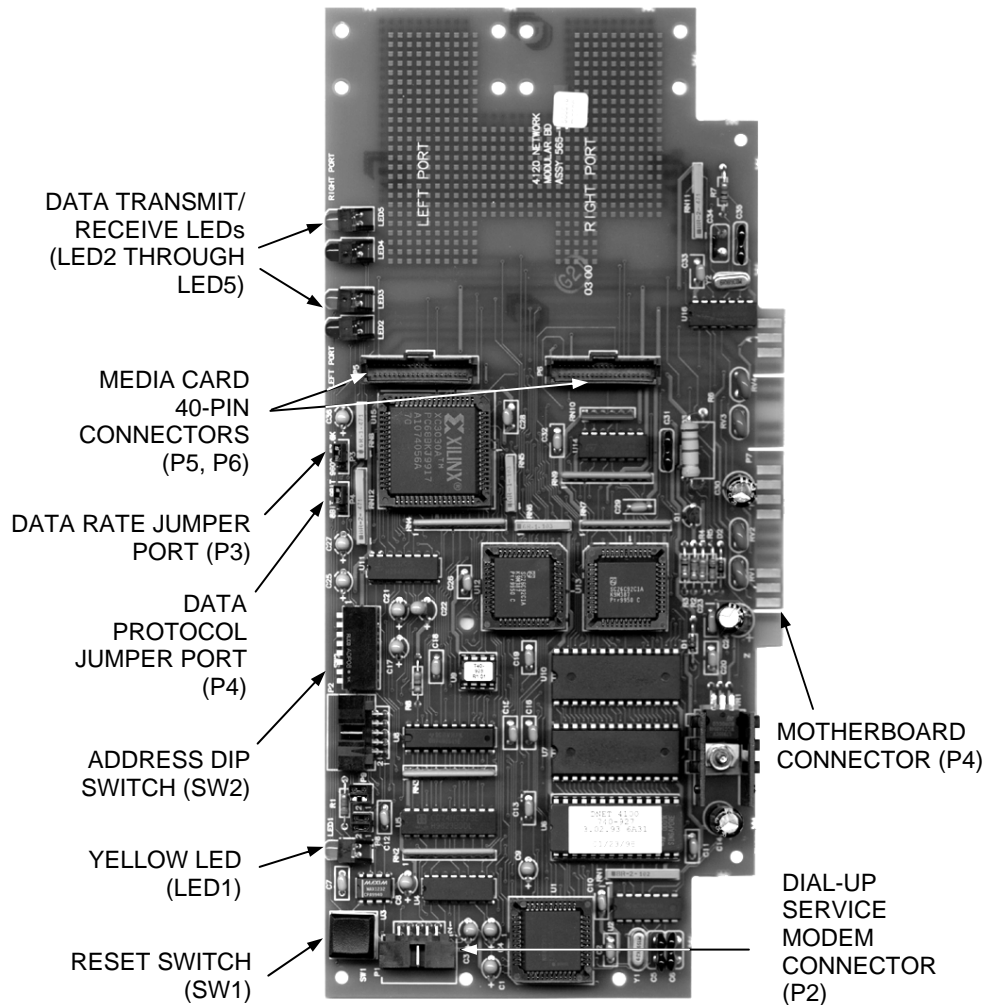
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# Introduction to the 4100 Network Interface Card (NIC), *Continued*

## Illustration

Figure 1 depicts the 4100-6014 Network Interface Card.



**Figure 1. 4100-6014 Network Interface Card**

## NIC Card LED Indications

The 4100-6014 NIC module has the following LEDs:

**LED1 (yellow).** Illuminates when the NIC has not established a communications link with the 4100 master.

**LED2 (red).** Illuminates when a data '0' is received at the right port.

**LED3 (green).** Illuminates when a data '0' is transmitted at the right port.

**LED4 (red).** Illuminates when a data '0' is received at the left port.

**LED5 (green).** Illuminates when a data '0' is transmitted at the left port.

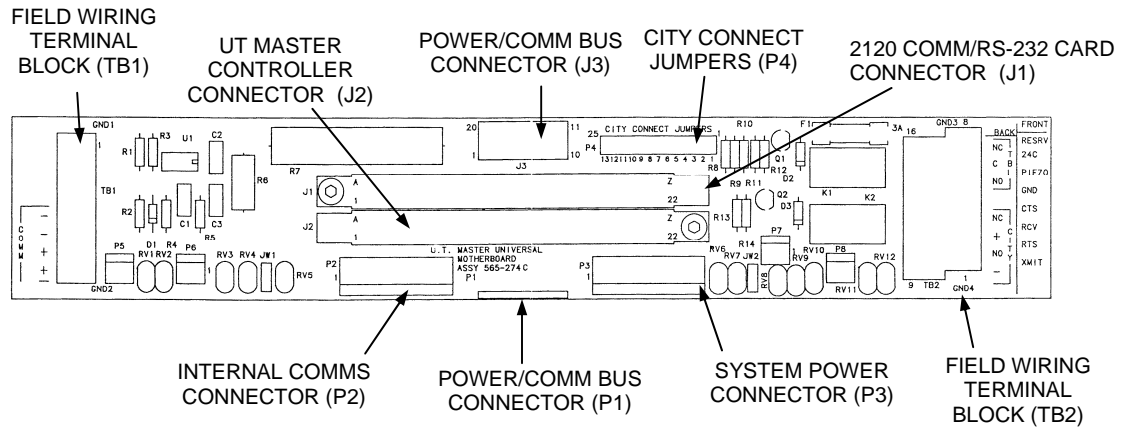
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# Introduction to the 4100 Network Interface Card (NIC), *Continued*

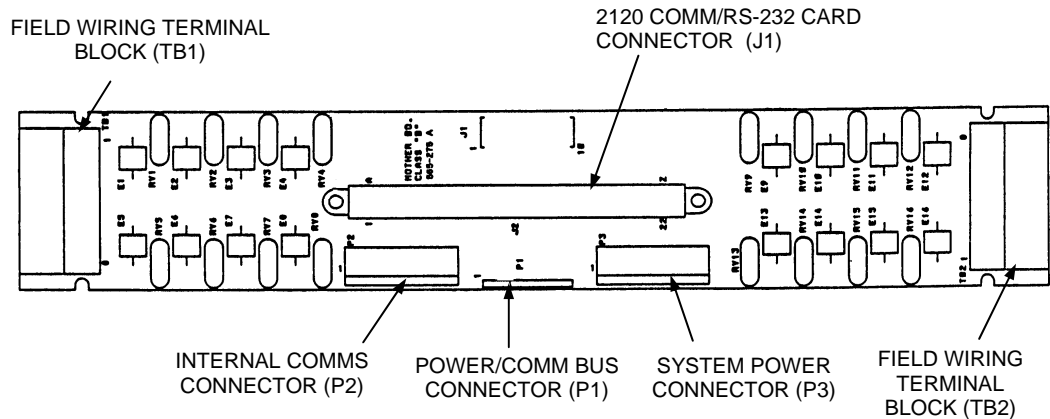
## NIC Card LED Indications

The figures below are illustrations of three motherboards apart from the default CPU motherboard that can be used with the 4100 NIC.

- The 565-274 Master Motherboard holds two daughter cards: the 4100 master controller card and the 4100 NIC.
- The 565-275 Class B Motherboard holds the 4100 NIC by itself.
- The 566-227 4100U/4100ES Master Motherboard holds a CPU card and NIC.



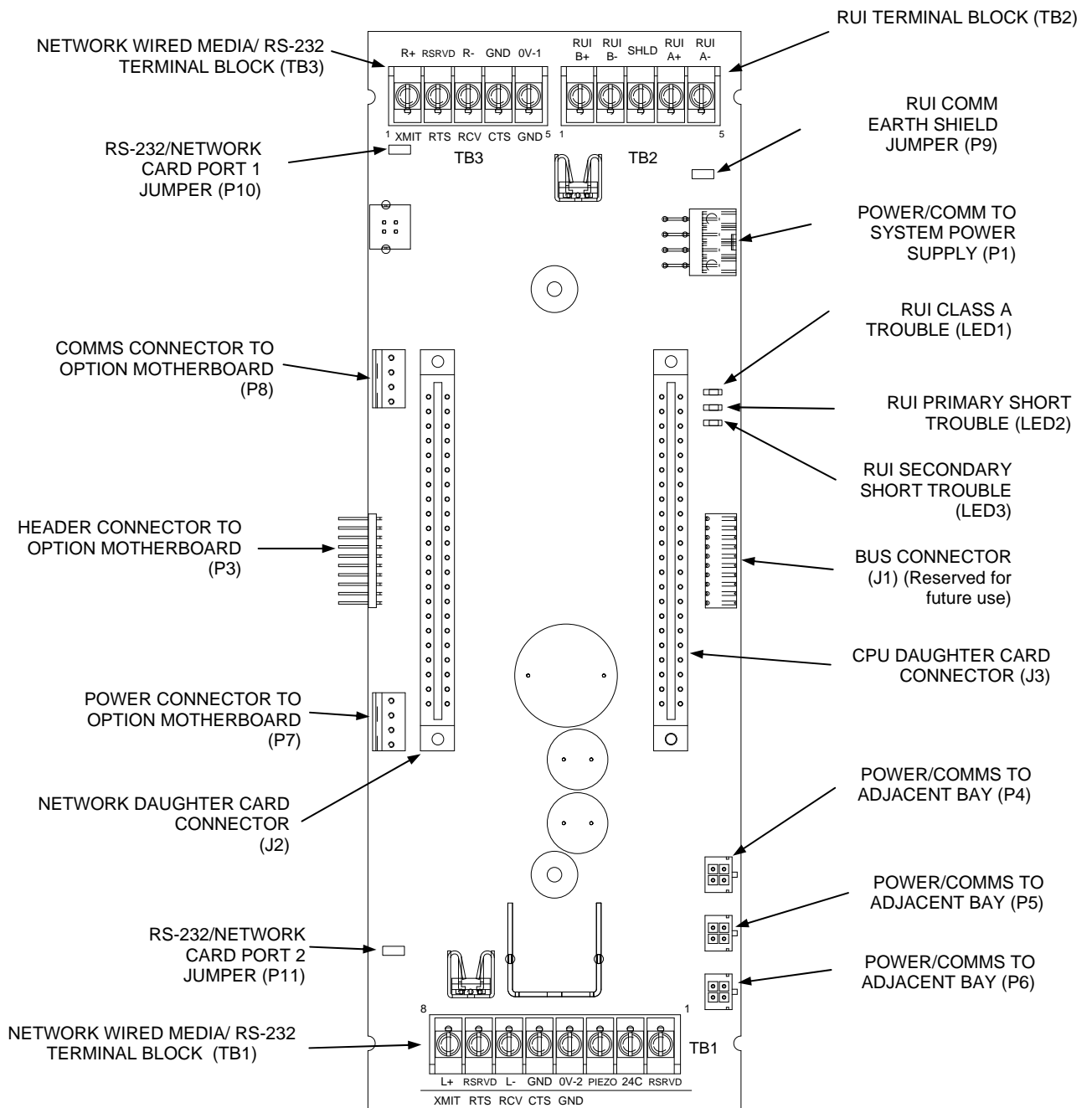
**Figure 2. UT Motherboard with City Connection (565-274)**



**Figure 3. Class B Motherboard (565-275)**

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# Introduction to the 4100 Network Interface Card (NIC), *Continued*



**Figure 4. 4100U/4100ES CPU Master Motherboard**

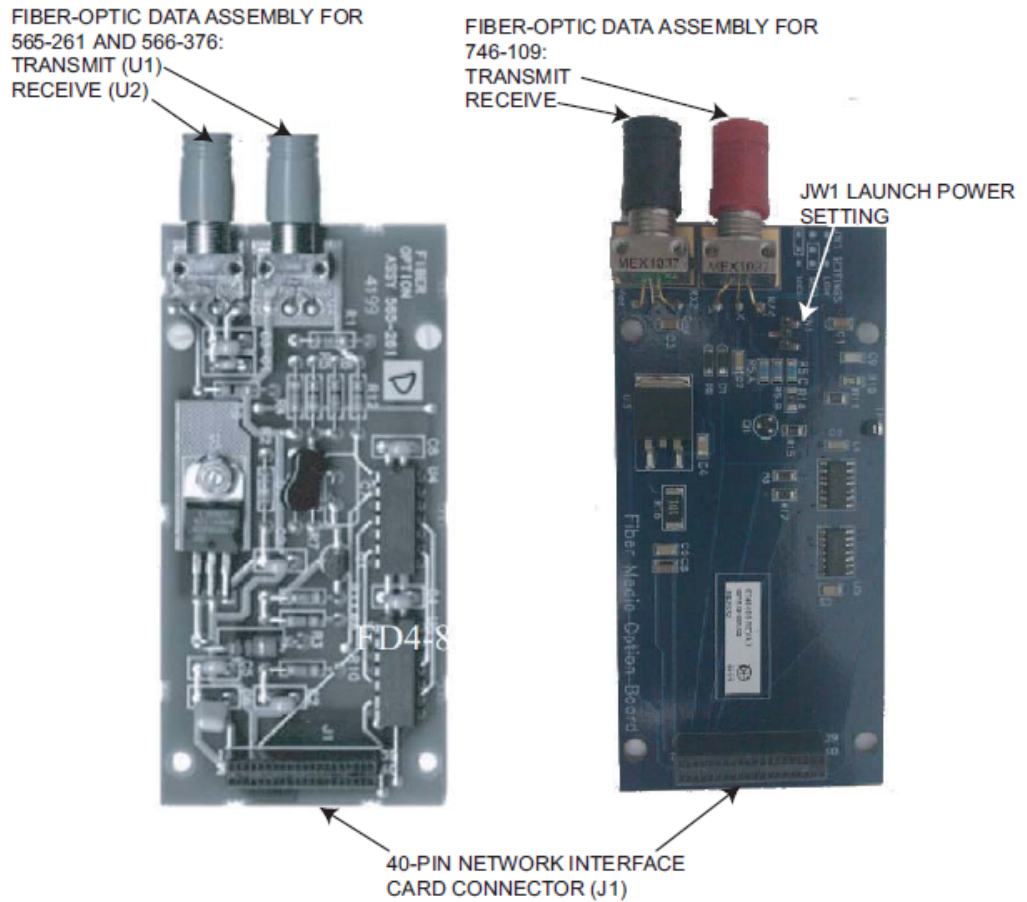
# Introduction to the 4100 Network Interface Card (NIC), *Continued*

## Media Module Illustrations

There are three modules that can be plugged into the 4100-6014 NIC:

- 4100-6057 Fiber-Optic Media Card (565-261, 566-376, or 746-109)
- 4100-6056 Wired Media Card (565-413)
- 4100/4120-0144 Modem Media Card (565-279 or 566-338; non-4100U /4100ES only)

Each module is shown below.

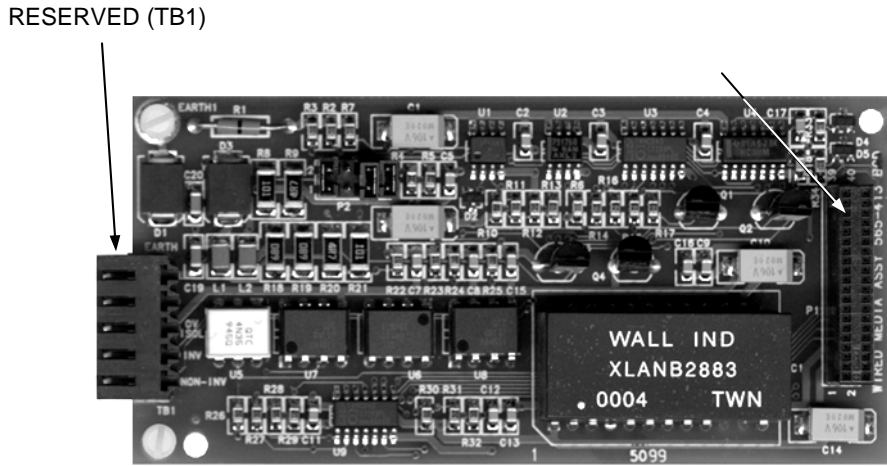


**Figure 5. The 4100-6057 Fiber-Optic Media Card**

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# Introduction to the 4100 Network Interface Card (NIC), *Continued*

## Media Module Illustrations



**Figure 6. The 4100-6056 Wired Media Card**



**Note:** Modem assembly number 565-279 is shown. Modem is also available as 566-338.

**Figure 7. The 4100/4120-0144 Modem Media Card (Non-4100U/4100ES Only)**

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## Introduction to the 4100 Network Interface Card (NIC), *Continued*

### Specifications

Refer to Table 1 for electrical and environmental requirements for the 4100 NIC and media cards.

**Table 1. Electrical and Environmental Specifications**

<b>Electrical Specifications</b>	
Network Interface Card (565-516)	Startup, no media cards: 8 VDC at 110 mA Nominal, no media cards: 20 to 32 VDC at 0 mA
Network Interface Card (566-793)	Nominal, no media cards: 20 to 32 VDC at 46 mA
Modem Media Card	5 VDC at 180 mA max.
Fiber Media Card	Using 24 V power supply: 20 VDC at 140 mA max. Using 5 V power supply (GCC/NPU): 5 VDC at 130 mA max.
Output Voltage	For wired media card: 4.75 V min to 5.25 V max.
<b>Environmental Specifications</b>	
Operating Temperature	32° to 120° F (0° to 49° C)
Humidity	10% to 93% relative humidity at 90° F (32° C)

# Jumper Settings

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## Overview

The NIC card, along with the fiber, modem, and wired media cards, all have jumpers that must be set.

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## Motherboard Jumper Settings

NIC-compatible jumper settings on CPU motherboards depend on which motherboards are used.

### Motherboard 565-274:

- JW1 and JW2 must be installed.
- Jumper plugs P5-P8 must not be installed.

### Motherboard 566-227:

**P10:** Port 1 settings.

**P11:** Port 2 settings.

- P10/P11 position 1 – 2: Network card (NIC) attached to CPU motherboard (default).
  - P10/P11 position 2 – 3: RS-232/2120 card attached to CPU motherboard.
- 

## NIC Card Address Setting

Use **SW2** to set the NIC card address. Refer to Appendix A for the address table.

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## NIC Card Jumper Settings

There are two shunt jumper ports on the NIC card that need to be set: P3 and P4.

**P3:** Determines the NIC data transmission rate, 57.6 kbits/second or 9600 bits/second.

- Position 1 – 2 (the right two pins) *or* no pins jumpered: 57.6 kbits/second.
- Position 2 – 3 (the left two pins): 9600 bits/second.

**P4:** Determines the data protocol, 8-bit or 9-bit, that the NIC card is using.

- Position 1 – 2 (the right two pins) *or* no pins jumpered: 9-bit.
- Position 2 – 3 (the left two pins): 8-bit.

All settings are labeled on the card.

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## Wired Media Card Jumper Settings

**P2:** Tells the system which wire type is to be used.

- Positions 1 – 2, 5 – 6, and 7 – 8: 18 AWG shielded, twisted pair wiring.
- Remove all jumpers to specify 24 AWG twisted pair telephone cable wiring.

**IMPORTANT:** When using the wired media card, the Earth fault detection is performed on the left port only. Remove R1 (0 Ohm resistor) from the media card on the right port.

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## Modem Media Card Jumper Settings

*Non-4100U/4100ES only.* P4 and P5 on the modem media card tell the system how the card is being used.

**P4:** Sets the card up as a network media card or a standalone modem.

- Position 1 – 2 (required): Sets the card up as a network media card, a service modem, or a physical bridge.
- Position 2 – 3: Sets the card up as a stand-alone modem.

**P5:** Specifies which connector will be used for data transmission.

- Position 1 – 2: For modem media board or stand-alone modem. Specifies that the transmission data comes from the 40-pin connector (J1).
  - Position 2 – 3: For service modem or physical bridge. Specifies that the transmission data comes from the 10-pin RS-232 connector (P1).
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## Jumper Settings, *Continued*

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### **Fiber Media Jumper Settings (746-109 only)**

JW1 is used to adjust the link power budget. If communication problems are encountered, make sure that the fiber connections comply with ANSI/TIA/EIA 568-B-3 industry standards. Once that is done, set the jumper to the next lower power budget setting.

#### **Link Power Budget Settings (62.5um fiber/50 fiber)**

Low 11dB / 6.6 dB

Med 16 dB / 11.6 dB

High 21.4dB / 17 dB (default setting)

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# Setting the NIC Daughter Card Address

## Overview

Switch SW2 on the 4100 NIC is a bank of eight dip switches. From left to right (see Figure 8, below) these switches are designated as SW2-1 through SW2-8. The function of these switches is as follows:

- **SW2-1.** This switch sets the baud rate for the internal 4100 communications line running between the card and the 4100 CPU. Set this switch to ON.
- **SW2-2 through SW2-8.** These switches set the card's address within the 4100 FACP. Refer to Table 2 for a complete list of the switch settings for all of the possible card addresses.

**Note:** You must set these switches to the value assigned to the card by the Programmer.

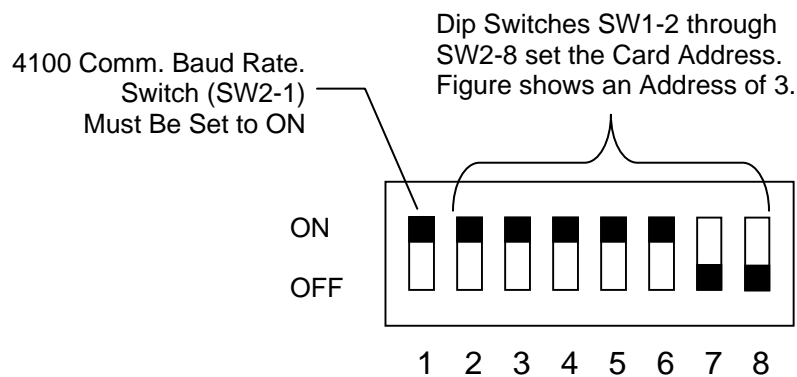


Figure 8. DIP Switch SW2

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# Setting the NIC Daughter Card Address, *Continued*

## Overview

**Table 2. 4100-6014 Module Card Addresses**

Address	SW 2-2	SW 2-3	SW 2-4	SW 2-5	SW 2-6	SW 2-7	SW 2-8	Address	SW 2-2	SW 2-3	SW 2-4	SW 2-5	SW 2-6	SW 2-7	SW 2-8
1	ON	ON	ON	ON	ON	ON	OFF	61	ON	OFF	OFF	OFF	OFF	ON	OFF
2	ON	ON	ON	ON	ON	OFF	ON	62	ON	OFF	OFF	OFF	OFF	OFF	ON
3	ON	ON	ON	ON	ON	OFF	OFF	63	ON	OFF	OFF	OFF	OFF	OFF	OFF
4	ON	ON	ON	ON	OFF	ON	ON	64	OFF	ON	ON	ON	ON	ON	ON
5	ON	ON	ON	ON	OFF	ON	OFF	65	OFF	ON	ON	ON	ON	ON	OFF
6	ON	ON	ON	ON	OFF	OFF	ON	66	OFF	ON	ON	ON	ON	OFF	ON
7	ON	ON	ON	ON	OFF	OFF	OFF	67	OFF	ON	ON	ON	ON	OFF	OFF
8	ON	ON	ON	OFF	ON	ON	ON	68	OFF	ON	ON	ON	OFF	ON	ON
9	ON	ON	ON	OFF	ON	ON	OFF	69	OFF	ON	ON	ON	OFF	ON	OFF
10	ON	ON	ON	OFF	ON	OFF	ON	70	OFF	ON	ON	ON	OFF	OFF	ON
11	ON	ON	ON	OFF	ON	OFF	OFF	71	OFF	ON	ON	ON	OFF	OFF	OFF
12	ON	ON	ON	OFF	OFF	ON	ON	72	OFF	ON	ON	OFF	ON	ON	ON
13	ON	ON	ON	OFF	OFF	ON	OFF	73	OFF	ON	ON	OFF	ON	ON	OFF
14	ON	ON	ON	OFF	OFF	OFF	ON	74	OFF	ON	ON	OFF	ON	OFF	ON
15	ON	ON	ON	OFF	OFF	OFF	OFF	75	OFF	ON	ON	OFF	ON	OFF	OFF
16	ON	ON	OFF	ON	ON	ON	ON	76	OFF	ON	ON	OFF	OFF	ON	ON
17	ON	ON	OFF	ON	ON	ON	OFF	77	OFF	ON	ON	OFF	OFF	ON	OFF
18	ON	ON	OFF	ON	ON	OFF	ON	78	OFF	ON	ON	OFF	OFF	OFF	ON
19	ON	ON	OFF	ON	ON	OFF	OFF	79	OFF	ON	ON	OFF	OFF	OFF	OFF
20	ON	ON	OFF	ON	OFF	ON	ON	80	OFF	ON	OFF	ON	ON	ON	ON
21	ON	ON	OFF	ON	OFF	ON	OFF	81	OFF	ON	OFF	ON	ON	ON	OFF
22	ON	ON	OFF	ON	OFF	OFF	ON	82	OFF	ON	OFF	ON	ON	OFF	ON
23	ON	ON	OFF	ON	OFF	OFF	OFF	83	OFF	ON	OFF	ON	ON	OFF	OFF
24	ON	ON	OFF	OFF	ON	ON	ON	84	OFF	ON	OFF	ON	OFF	ON	ON
25	ON	ON	OFF	OFF	ON	ON	OFF	85	OFF	ON	OFF	ON	OFF	ON	OFF
26	ON	ON	OFF	OFF	ON	OFF	ON	86	OFF	ON	OFF	ON	OFF	OFF	ON
27	ON	ON	OFF	OFF	ON	OFF	OFF	87	OFF	ON	OFF	ON	OFF	OFF	OFF
28	ON	ON	OFF	OFF	OFF	ON	ON	88	OFF	ON	OFF	OFF	ON	ON	ON
29	ON	ON	OFF	OFF	OFF	ON	OFF	89	OFF	ON	OFF	OFF	ON	ON	OFF
30	ON	ON	OFF	OFF	OFF	OFF	ON	90	OFF	ON	OFF	OFF	ON	OFF	ON
31	ON	ON	OFF	OFF	OFF	OFF	OFF	91	OFF	ON	OFF	OFF	ON	OFF	OFF
32	ON	OFF	ON	ON	ON	ON	ON	92	OFF	ON	OFF	OFF	OFF	ON	ON
33	ON	OFF	ON	ON	ON	ON	OFF	93	OFF	ON	OFF	OFF	OFF	ON	OFF
34	ON	OFF	ON	ON	ON	OFF	ON	94	OFF	ON	OFF	OFF	OFF	OFF	ON
35	ON	OFF	ON	ON	ON	OFF	OFF	95	OFF	ON	OFF	OFF	OFF	OFF	OFF
36	ON	OFF	ON	ON	OFF	ON	ON	96	OFF	OFF	ON	ON	ON	ON	ON
37	ON	OFF	ON	ON	OFF	ON	OFF	97	OFF	OFF	ON	ON	ON	ON	OFF
38	ON	OFF	ON	ON	OFF	OFF	ON	98	OFF	OFF	ON	ON	ON	OFF	ON
39	ON	OFF	ON	ON	OFF	OFF	OFF	99	OFF	OFF	ON	ON	ON	OFF	OFF
40	ON	OFF	ON	OFF	ON	ON	ON	100	OFF	OFF	ON	ON	OFF	ON	ON
41	ON	OFF	ON	OFF	ON	ON	OFF	101	OFF	OFF	ON	ON	OFF	ON	OFF
42	ON	OFF	ON	OFF	ON	OFF	ON	102	OFF	OFF	ON	ON	OFF	OFF	ON
43	ON	OFF	ON	OFF	ON	OFF	OFF	103	OFF	OFF	ON	ON	OFF	OFF	OFF
44	ON	OFF	ON	OFF	OFF	ON	ON	104	OFF	OFF	ON	OFF	ON	ON	ON
45	ON	OFF	ON	OFF	OFF	ON	OFF	105	OFF	OFF	ON	OFF	ON	ON	OFF
46	ON	OFF	ON	OFF	OFF	OFF	ON	106	OFF	OFF	ON	OFF	ON	OFF	ON
47	ON	OFF	ON	OFF	OFF	OFF	OFF	107	OFF	OFF	ON	OFF	ON	OFF	OFF
48	ON	OFF	OFF	ON	ON	ON	ON	108	OFF	OFF	ON	OFF	OFF	ON	ON
49	ON	OFF	OFF	ON	ON	ON	OFF	109	OFF	OFF	ON	OFF	OFF	ON	OFF
50	ON	OFF	OFF	ON	ON	OFF	ON	110	OFF	OFF	ON	OFF	OFF	OFF	ON
51	ON	OFF	OFF	ON	ON	OFF	OFF	111	OFF	OFF	ON	OFF	OFF	OFF	OFF
52	ON	OFF	OFF	ON	OFF	ON	ON	112	OFF	OFF	OFF	ON	ON	ON	ON
53	ON	OFF	OFF	ON	OFF	ON	OFF	113	OFF	OFF	OFF	ON	ON	ON	OFF
54	ON	OFF	OFF	ON	OFF	OFF	ON	114	OFF	OFF	OFF	ON	ON	OFF	ON
55	ON	OFF	OFF	ON	OFF	OFF	OFF	115	OFF	OFF	OFF	ON	ON	OFF	OFF
56	ON	OFF	OFF	OFF	ON	ON	ON	116	OFF	OFF	OFF	ON	OFF	ON	ON
57	ON	OFF	OFF	OFF	ON	ON	OFF	117	OFF	OFF	OFF	ON	OFF	ON	OFF
58	ON	OFF	OFF	OFF	ON	OFF	ON	118	OFF	OFF	OFF	ON	OFF	OFF	ON
59	ON	OFF	OFF	OFF	ON	OFF	OFF	119	OFF	OFF	OFF	ON	OFF	OFF	OFF
60	ON	OFF	OFF	OFF	OFF	ON	ON								

# Mounting Media Cards to the NIC

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## Overview

The first step of the installation process is to identify the media cards that have to be connected to the NIC, and connect them properly.

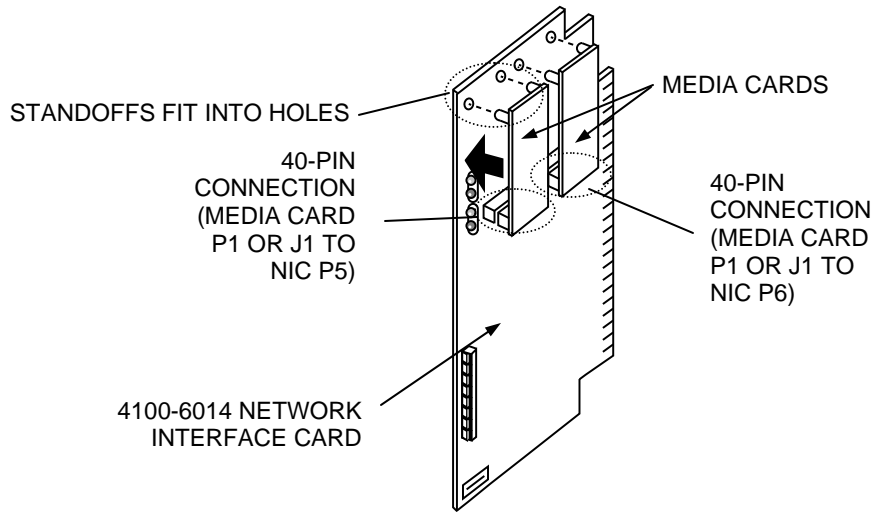
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## Media Board Mounting

Refer to Figure 9 as you read the following instructions.

Connect P1 on the wired media card, *or* J1 on the modem or fiber media cards, to P5 (the left port) on the NIC.

To connect a second media card to the same NIC, connect it as described above, but use P6 (the right port) on the NIC. Note that any two types of media cards can be connected to the same NIC.



**Figure 9. Mounting the Media Card**

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# Installing Motherboards into 2975-91xx Back Boxes (Non-4100U/4100ES)

## Overview

The NIC card can be mounted to either 2975-91xx Master Controller Bays (4100) or, for the 4100U/4100ES, 2975-94xx CPU Bays. This section describes mounting into 4100 Master Controller Bays.

## Installing into a 2975-91xx Master Controller Bay

Use the following guidelines and instruction when installing into a master controller bay.

- If the 565-274 Master Motherboard is used, it must be installed in the leftmost position of this bay. If the 565-274 Master Motherboard is not used, the CPU motherboard must be installed in the leftmost position of the bay.
- The power supply must be installed in the rightmost position of the bay.
- Relay cards must be installed in the slots immediately to the left of the power supply. This is necessary to allow for the proper routing of non-power limited wiring (120 VAC wiring connected to the relay card).
- If used, the Class B motherboard (565-275) must be installed to the left of the relay cards. If a physical bridge is used with the Class B motherboard, it must be to the right of any motherboards using NICs. This allows for earth ground detection via the physical bridge.

Install the motherboard as described below.

1. Orient the motherboard.
  - *565-274 Master Motherboard:* if it is not already installed, orient with the connector labeled J3 on the right and the header labeled P1 on the left.
  - *565-275 Class B Motherboard:* orient with the connector labeled J1 on the right and the header labeled P1 on the left.
2. *565-275 Class B Motherboard only:* Slide the motherboard to the left until the pins are completely inserted in the connector of a previously installed motherboard.
3. Secure the motherboard to the chassis with four torx screws.

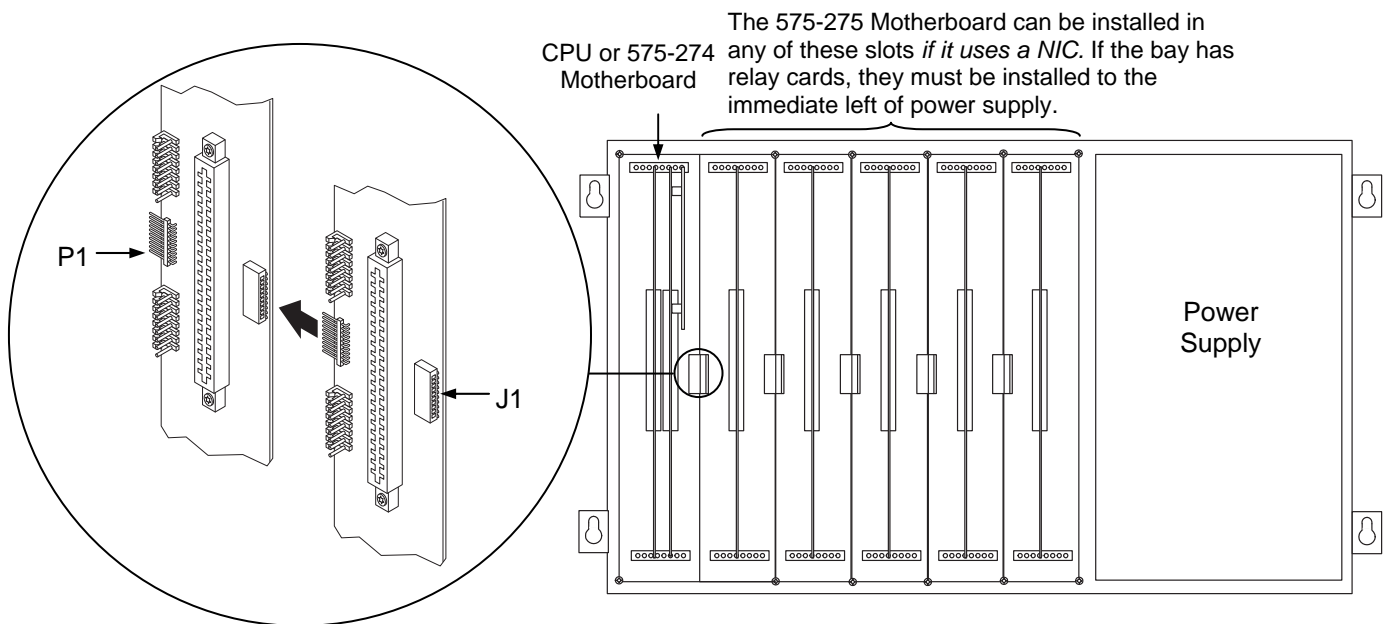


Figure 10. Installing the Motherboard into a 4100 Master Controller Bay

# Installing Motherboards into 2975-94xx Back Boxes (4100U/4100ES)

## Overview

The NIC card can be mounted to either 2975-91xx Master Controller Bays (4100) or, for the 4100U/4100ES, 2975-94xx CPU Bays. This section describes mounting into 4100U or 4100ES CPU Bays.

## Installing into a 2975-94xx CPU Bay

Up to two motherboards may be installed with the system CPU in the CPU bay. **In most cases, the NIC is used with the CPU motherboard.** If this is the case, you can skip this section. If you are installing an additional motherboard that uses the NIC, follow the directions below.

1. Orient the motherboard with the connector labeled J1 on the right and the header labeled P1 on the left.
2. Slide the motherboard to the right until the pins from P1 on the motherboard to the right are completely inserted in the motherboard's J1 connector.
3. Attach four lockwashers and metal standoffs to the chassis, and secure the motherboard to the chassis using four #6 screws.

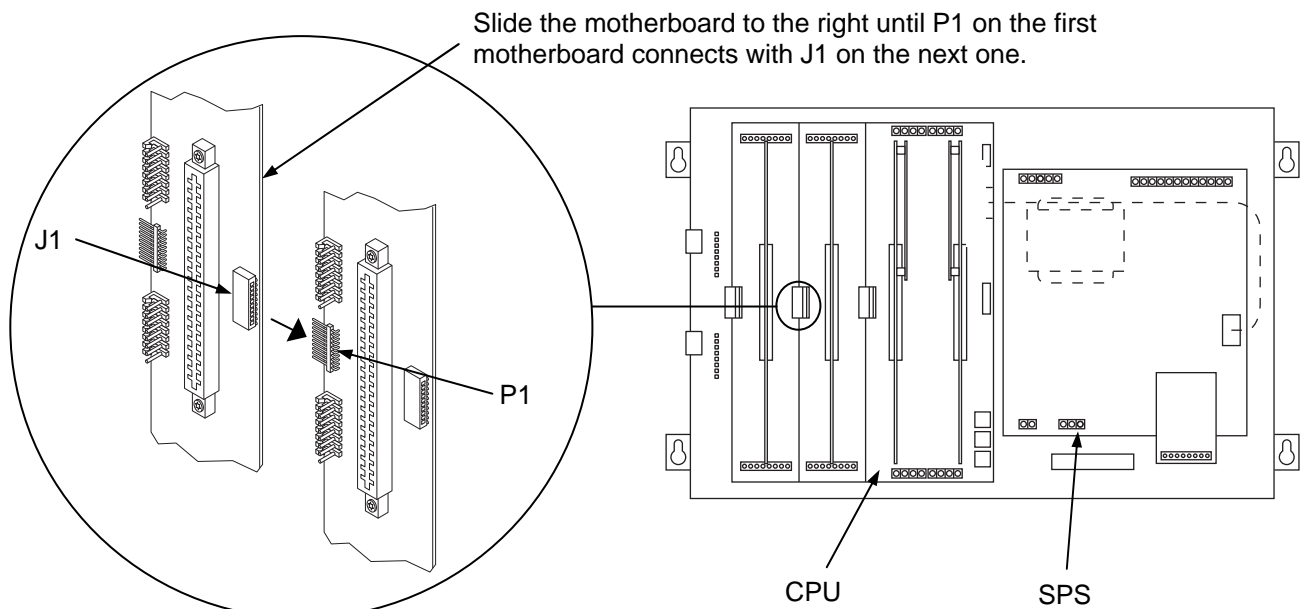


Figure 11. Installing the Motherboard into a 4100U/4100ES CPU Bay



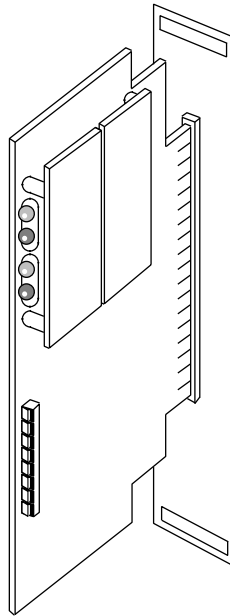
## Installing the Daughter Card

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### Installing into a 2975-94xx CPU Bay

The 4100 NIC daughter card, shown in Figure 12 below, inserts into motherboards as follows:

- If the 565-274 Master Motherboard is being used, the NIC daughter card is inserted into connector J1.
- If the 566-227 or 565-275 CPU Motherboard is used, the NIC daughter card is inserted into connector J2.



**Figure 12. Installing the Daughter Card**

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# Wiring

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## Overview

The type of wiring used depends on the type of media cards being used in the system. The only time the motherboard terminals are used is when wired media cards are plugged into the daughter card. Otherwise, modem and fiber connections are made straight to and from the media cards.

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## General Guidelines

Make sure these guidelines are accounted for before wiring:

- All wires must be 18 AWG, or as the local code dictates.
  - Conductors must test free of all grounds.
  - All wiring must be done using copper conductors only, unless noted otherwise.
  - If shielded wire is used,
    - the metallic continuity of the shield must be maintained throughout the entire cable length.
    - the entire length of the cable must have a resistance greater than 1 Megohm to earth ground.
  - Underground wiring must be free of all water.
  - In areas of high lightning activity, or in areas that have large power surges, the 2081-9027 Transient Suppressor should be used on monitor points.
  - Wires must not be run through elevator shafts.
  - Wires that run in plenum must be in conduit.
  - Splicing is permitted. All spliced connections must either be soldered (resin-core solder), crimped in metal sleeves, or encapsulated with an epoxy resin. When soldering or crimped metal sleeves are used, the junction must be insulated with a high-grade electrical tape that is as sound as the original insulating jacket. Shield continuity must be maintained throughout.
  - A system ground must be provided for earth detection and lightning protection devices. This connection must comply with approved earth detection per NFPA780.
  - Only system wiring can be run together in the same conduit.
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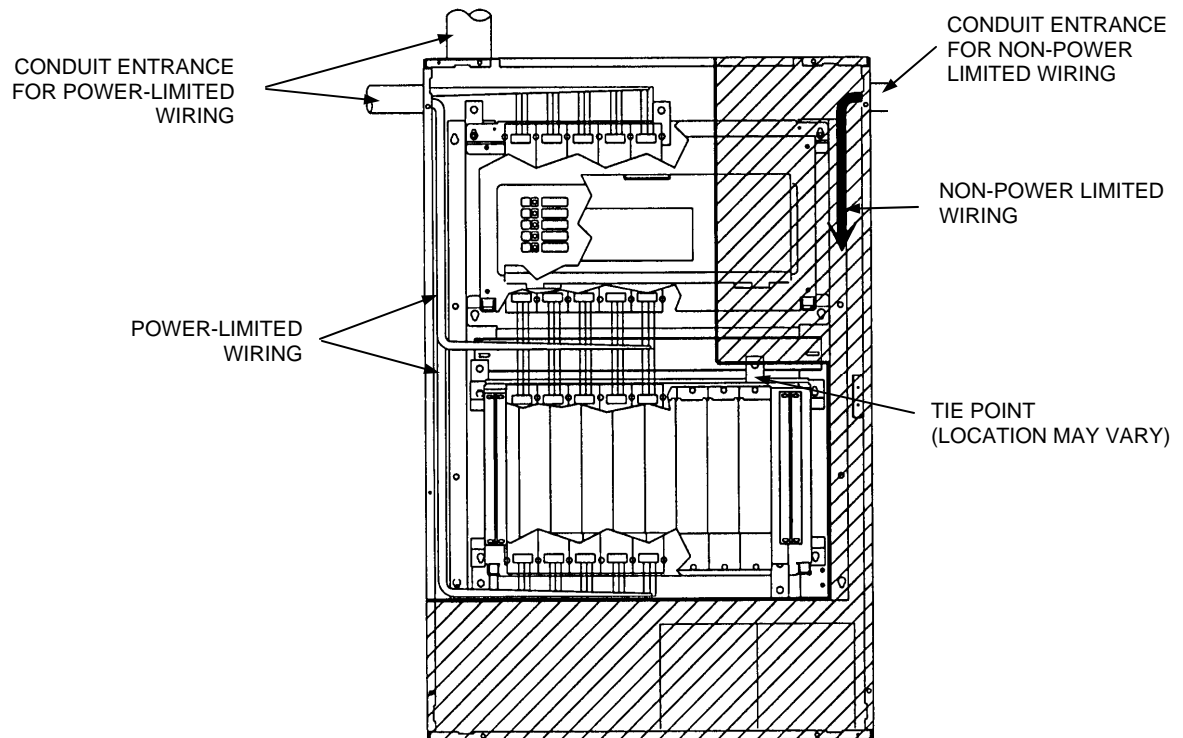
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## Wiring, Continued

### Power-Limited Guidelines

Make sure these guidelines are accounted for before wiring for power-limited systems:

- Non-power limited field wiring (AC power, batteries, City connection) must be installed and routed in the shaded areas shown in Figure 13.
- Power-limited field wiring must be installed and routed in the non-shaded areas shown in Figure 13, with the exception of City wiring.
- Excess slack should be kept to a minimum inside the back box enclosure. The wiring should be neatly dressed and bundled together using the wire ties provided with the equipment. Anchor power-limited wiring to tie points, as shown in Figure 13.



**Figure 13. Power-Limited Wiring**

- Tie the wiring located between bays to the internal wiring troughs, if applicable.
- When powering remote units or switching power through relay contacts, power for these circuits must be provided by a power-limited power supply that listed for fire-protective signaling use. An EOL relay must be used to supervise the auxiliary power circuit.

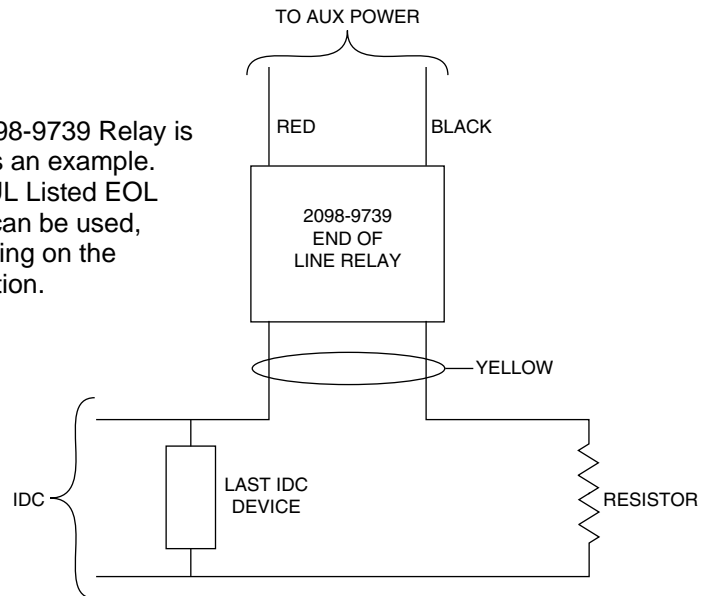
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## Wiring, Continued

### Power-Limited Guidelines

- *Auxiliary power only:* Supervision must be provided if the auxiliary power circuit is to be wired as a power-limited circuit. In order to connect a circuit using power-limited wiring, the devices being powered must all be addressable, or a UL Listed EOL relay must be used to supervise the circuit. Refer to the figure below for wiring directions for the EOL relay.

**Note:** The 2098-9739 Relay is used as an example. Other UL Listed EOL relays can be used, depending on the application.



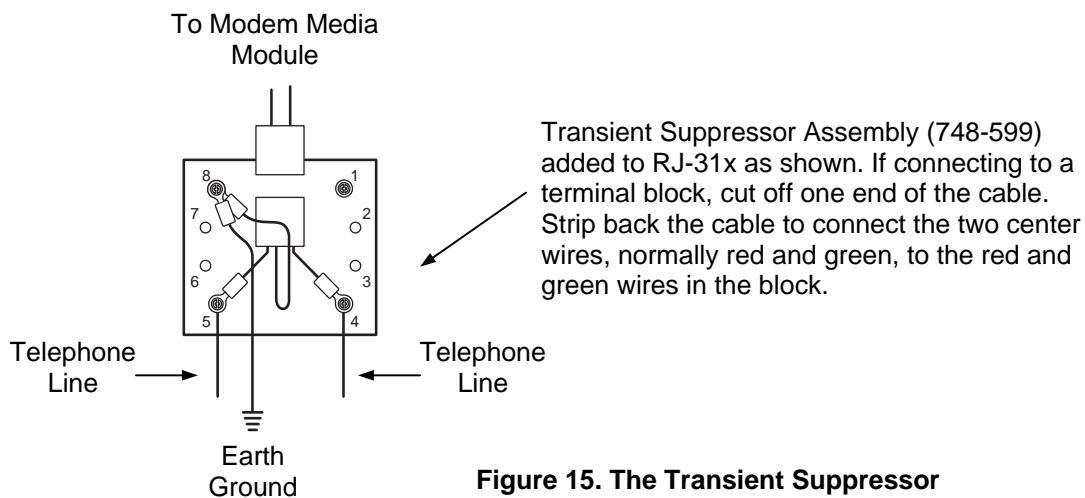
**Figure 14. The EOL Relay**

*Continued on next page*

## Wiring, Continued

### NIC Wiring Guidelines

- Network nodes must be wired right to left port, regardless of the media type selected.
- Style 7 protection is achieved by wiring the nodes in a loop fashion. A single fault (except an Earth fault) will cause the network to reconfigure for degraded Style 7 (Style 4) operation. A second fault (except an Earth fault) will result in the network dividing into two separate networks.
- Style 4 is achieved by wiring the nodes in a linear fashion. Style 4 networks are not fault-tolerant and a single fault (except an Earth fault) will result in the network dividing into two separate networks.
- Earth fault detection is performed on the left port only. When a network Earth fault occurs, the trouble is only reported on the node whose left port is connected to the span.
- All 18 AWG wiring used with 4100-6056 Wired Media Cards must be twisted shielded pair. All 24 AWG (telephone cable) used with 4100-6056 must be twisted pair. When shielded cable is used, the shield must be terminated to chassis Earth on the left port only.
- It is permissible to use mixed media in a network. For example, some spans may be “wired media” while others are optical fiber or telephone modem.
- Each NIC has a jumper for selecting between network data rates of 57.6 kbps and 9.6 kbps. All cards in the network must be set for the same rate. (When modem media or physical bridging is used, the data rate must be set for 9.6 kbps).
- Each NIC has a jumper for selecting between 8- and 9-bit network protocols. All cards in the network must be set for the same network protocol. (When modem media or physical bridging is used, the protocol must be set for 8-bit).
- All network wiring except the shield is supervised.
- When wiring leaves the building, 2081-9044 Overvoltage Protectors are required. One overvoltage protector is installed where wiring leaves the building; another is installed where wiring enters the next building.
- Transient Suppressor 748-599 is required for each modem-to-telephone line connection.



**Figure 15. The Transient Suppressor**

*Continued on next page*

## Wiring, Continued

### Fiber-Optic Wiring

Connectors U1 (transmitter) and U2 (receiver) on the Fiber-Optic Media Card are used to connect 4100-6014 NICs across parts of a network.

The maximum distance between nodes when using fiber cable is dependent on the size of the cable. Table 3 lists the maximum cable lengths.

**Note:** ST connectors with long strain relief boots are to be used with the fiber optic cable.

Figure 16 shows how two network nodes are connected via fiber-optic cable.

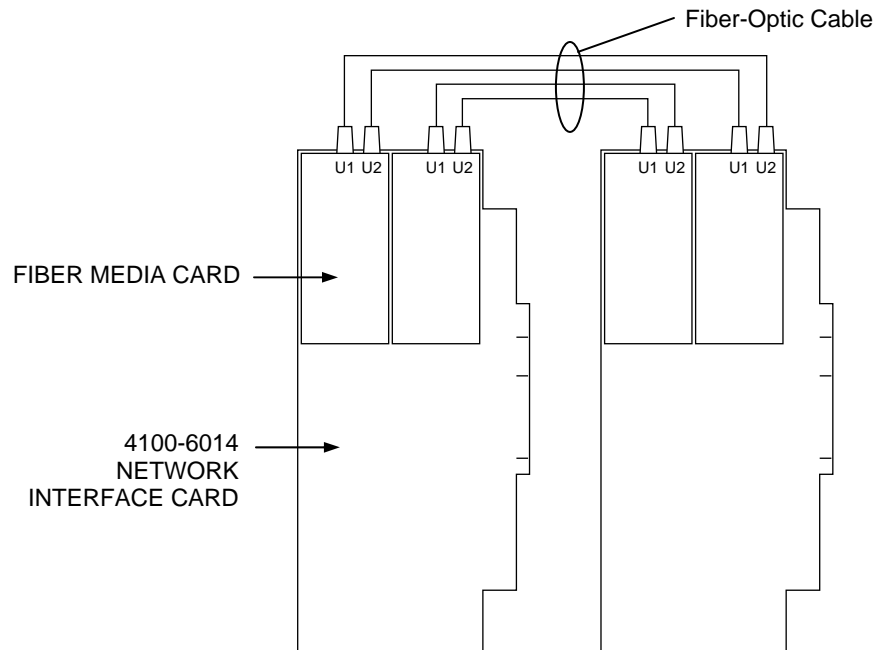


Figure 16. Fiber Wiring

### Fiber Optic Connection Types

**Dual Fiber Optic Cable Connections.** The standard fiber optic that connections between the 4120 Network nodes uses two fiber optic cables: one for transmit, and the other for receive. This connection allows for optimum communications distance.

The available communications distance is determined by the properties of the specific fiber cable used. Distances can be determined using the information and examples shown below in Table 3.

**Single Fiber Optic Cable Connections.** For applications where a single fiber cable is available, or where use of a single cable is desired, using a model 4190-9010 Bi-Directional Coupler at each node combines the separate transmit and receive signals into a single path (refer to the requirements list).

This connection allows use of a single fiber cable, but it does reduce communications distance as indicated in the information and examples shown below in Table 4.

*Continued on next page*

## Wiring, Continued

### 4190-9010 Coupler Requirements

The 4190-9010 Coupler (271-012) is used with the 565-261 Fiber Optic Media Board, revision “C” or higher, the 566-376, or the 746-109. Two 4190-9010 Bi-Directional Couplers are required per connection, one at each node.

The 4190-9010 is equipped with type ST connectors. To make type ST to type ST connections, an ST to ST coupler, by others, is required. ST to ST Couplers are available from:

Black Box, part # FO200  
 Fiber Instrument Sales, part # F1-8101  
 Newark Electronics, part # 95F2097  
 (or equivalent)

**Table 3. Dual Fiber Optic Cable Communications Distance Examples**

Fiber Type <sup>1*</sup>	MIFL <sup>2</sup>	Power Margin	Distance <sup>3</sup>	Budget <sup>3</sup>
50/125 numerical aperture = 0.2	4 dB/km	4 dB	10,000 ft (3.05 km)	17 dB
	3 dB/km	3 dB	15,000 ft (4.57 km)	
62.5/125 numerical aperture = 0.275	4 dB/km	4 dB	13,000 ft (3.96 km)	21.4 dB
	3.75 dB/km	3 dB	15,000 ft (4.57 km)	

\*See notes at bottom of page.

**Table 4. Single Fiber Optic Cable Communications Distance Examples Using 4190-9010 Bi-Directional Couplers**

Fiber Type <sup>1</sup>	MIFL <sup>2</sup>	Power Margin	Distance <sup>3</sup>	Budget <sup>3</sup>	4190-9010 Coupler Loss	ST to ST Coupler Loss
50/125 numerical aperture = 0.2	3 dB/km	2 dB	7,650 ft (2.33 km)	21.4 dB	9.4 dB	3 dB
62.5/125 numerical aperture = 0.275	3.2 dB/km		8,200 ft (2.5 km)			2 dB

**Notes for Table 3 and 4:**

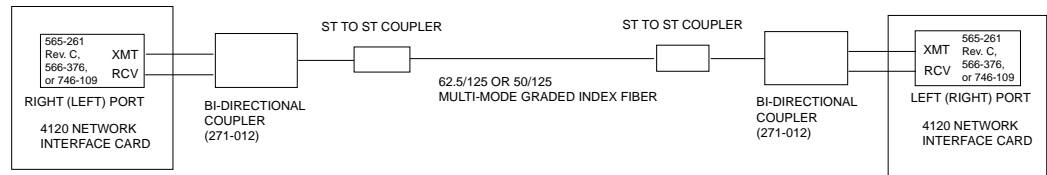
1. Cable specifications are for 50 or 62.5 micron core with 125 micron cladding, multi-mode graded index fiber. Wavelength = 850 nm.
2. MIFL = Maximum Individual Fiber Loss. Numbers shown are for example reference only, refer to specific cable for exact specification.
3. Maximum cable length is determined by distance listed or by reaching budget value, whichever is shorter. Maximum distances listed for dual fiber cable are shorter than would be calculated. Budget using 4190-9010 Bi-Directional Coupler is the same with either size cable because the coupler input cables are 62.5/125 fiber allowing launch power to be the same.

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## Wiring, *Continued*

### 4190-9010 Coupler Requirements

The illustration below shows coupler wiring.



**Figure 17. Coupler Wiring**

### Wiring with the Wired Media Card

Refer to the guidelines and figures in this topic to use wired media cards.

**IMPORTANT:** TB1 on the wired media card must not be used when it is connected to the 4100-6014 NIC.

- When the 565-413 Interface Card is used with 566-793, 565-516, -407, or -409 Network Card, TB1 on the 565-413 Interface Card **cannot** be used. Connection to the motherboard is required as shown.
- The shield should only be connected at one end of the line. The shield is connected to the left port.
- When wiring leaves the building, 2081-9044 Overvoltage Protectors are required. One overvoltage protector is installed where wiring leaves the building; another is installed where wiring enters the next building.

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## Wiring, *Continued*

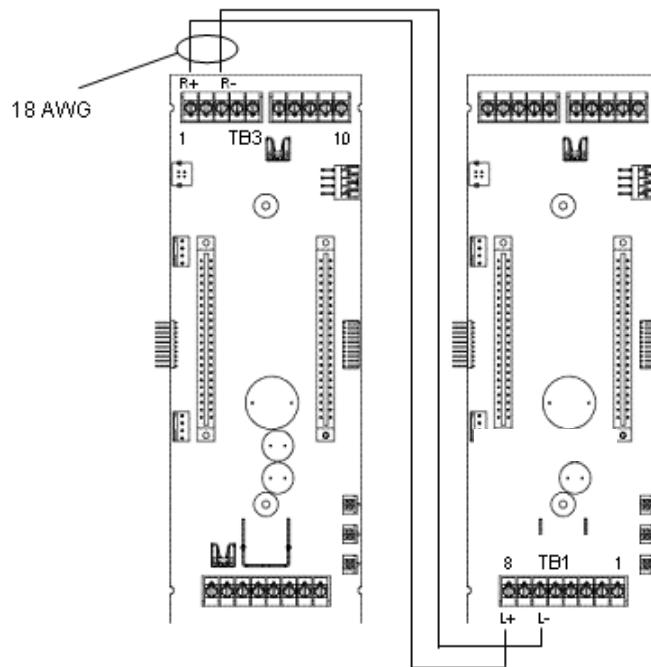
### Wiring with the Wired Media Card

Table 5, below, lists the 4100U/4100ES CPU motherboard connections for the wired media card.

**Table 5. 566-227 CPU Motherboard Wired Media Connections**

Motherboard Port for Media Card Connected to P5	Wired Media Card Connection (Left Port)
TB1-4	0 V
TB1-5	Earth ground
TB1-6	L- (INV (-))
TB1-7	None
TB1-8	L+ (NONINV (+))
Motherboard Port for Media Card Connected to P6	Wired Media Card Connection (Right Port)
TB3-1	R+ (NONINV (+))
TB3-2	Reserved
TB3-3	R- (INV (-))
TB3-4	Earth ground
TB3-5	0 V

Figure 18, below, shows how two CPU motherboards with wired media network cards connect to each other in the 4100U/4100ES.



**Figure 18. Wired Media Interconnections Between 4100U/4100ES CPU Motherboards**

*Continued on next page*

## Wiring, Continued

### Modem Guidelines

- Modem media wiring for NICs applies to **non-4100U/4100ES systems only**.
- Phone Line Classification consists of the following:
  - Private leased line for analog data communications
  - No dialtone
  - Full duplex operation
  - No conditioning required
  - No signaling required
  - Two-wire line interface
  - RJ-11 modular jack
- If a four-wire circuit is required, the line must include a data station termination (DST) device to provide the two-wire interface required by the 4120 network modem. The DST device should be located as close to the FACP as possible to minimize dry line signal losses.
- The modem is capable of full duplex V.32bis analog data communications. The transmit signal level is 10 dbm.
- Telecommunications device: Xecom Model XE1414 *or* XE1414C V.32bis Two-Wire Analog Modem
- Modem FCC Registration Number: DWEUSA-75322-FA-E (565-279); DWEUSA-35610-M5-E (566-338)

### Modem Wiring

**IMPORTANT:** Modem media wiring for NICs applies to **non-4100U/4100ES systems only**.

The Modem Media Card uses RJ-11 connectors to connect 4100-6014 NIC Assemblies across parts of a network.

Use the RJ-11 connector (P2) to connect nodes that use the modem media card. Do not use connector P1 (P1 is reserved for when the daughter card is used as a physical bridge). Leased lines must be analog, full-duplex, private line (no dial tone), with a two-wire RJ-11 interface. Style 4 requires one circuit; Style 7 requires two circuits.

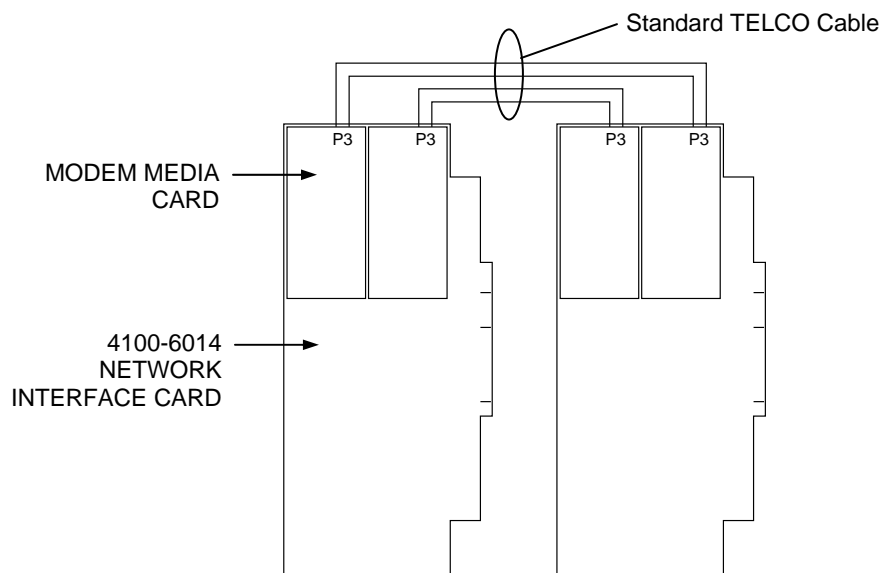


Figure 19. Modem Wiring

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## Wiring, Continued

### Wiring Illustrations

The figures below show how to wire the NIC. The illustrations use the 565-274 and 565-275 motherboards only. If you are using the 4100U/4100ES motherboard, refer to Figure 15, 17, or 18 along with the figures below.

### Wired Media, Style 7 Wiring

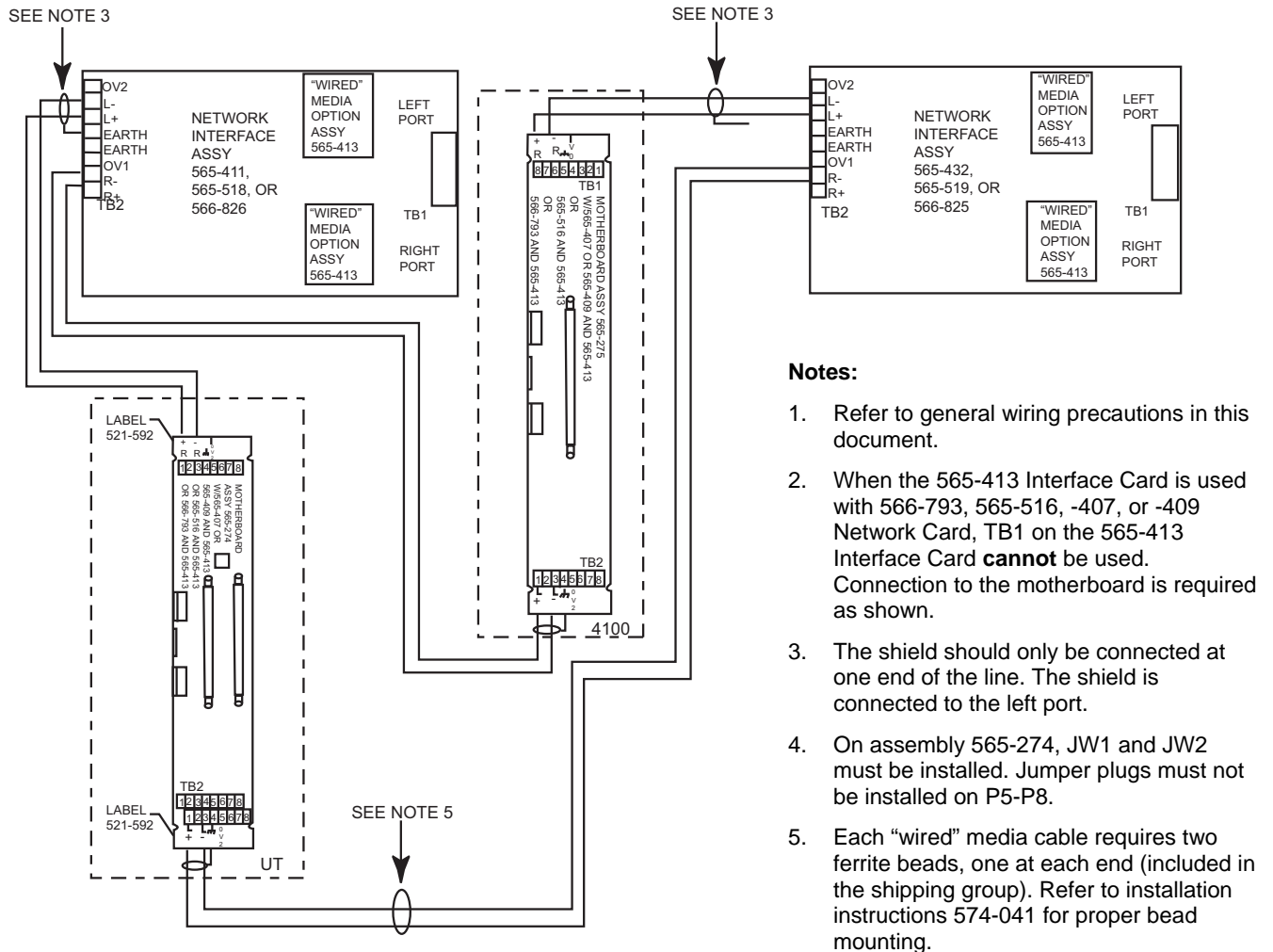
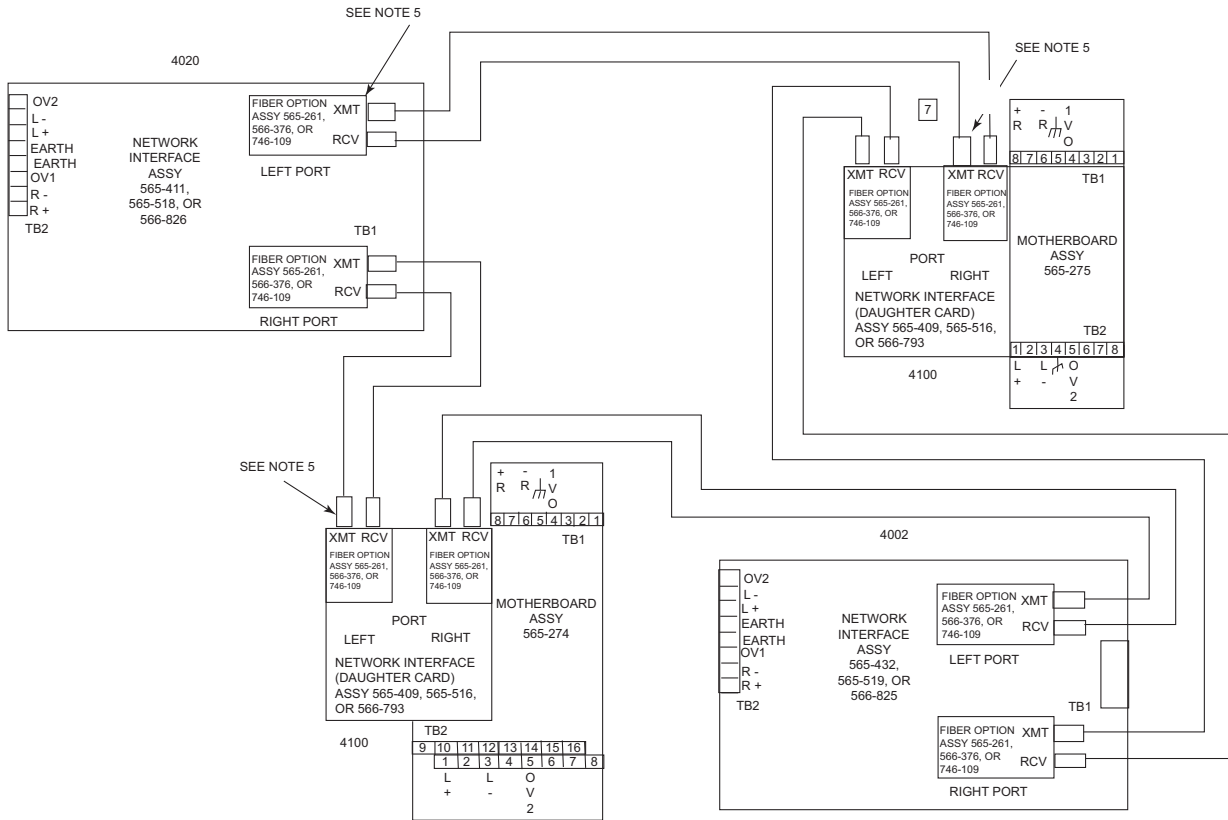


Figure 20. Wired Media, Style 7 Wiring

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# Wiring, Continued

## Fiber Optic, Style 7 Wiring



**Notes:**

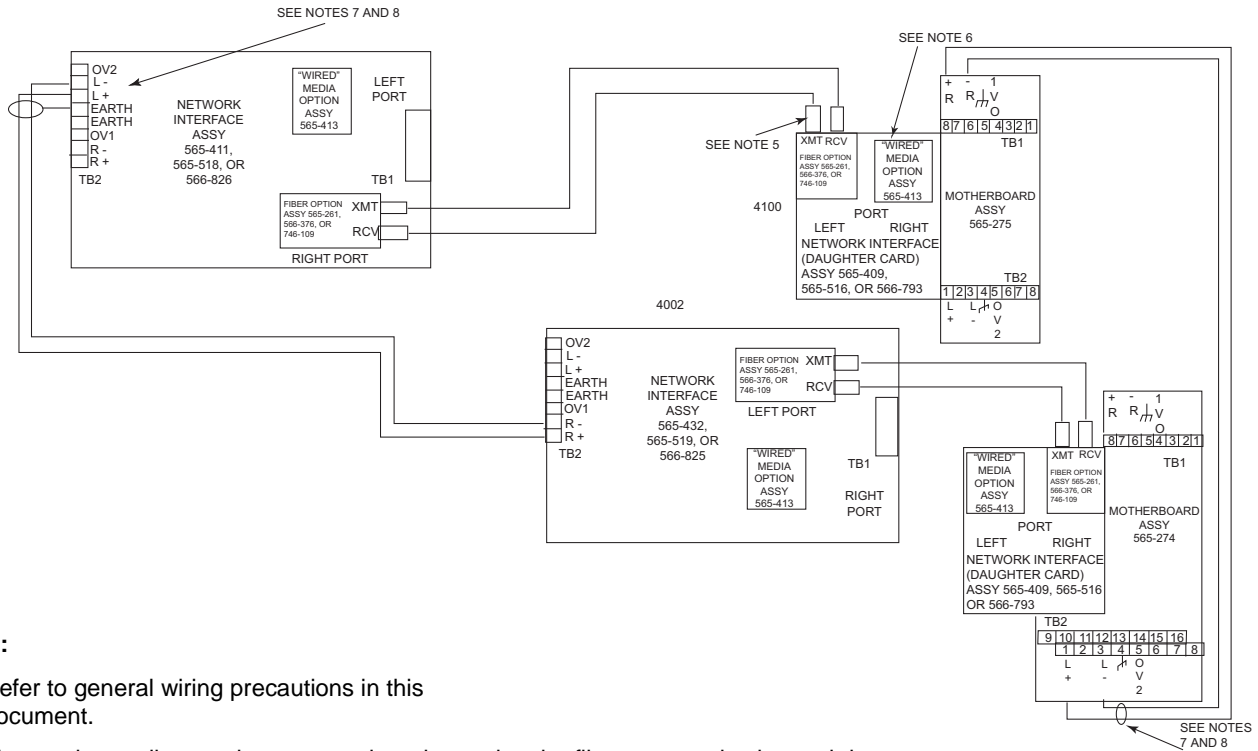
1. Refer to general wiring precautions in this document. For specific information about fiber optic wiring, refer to the 900-143 Fiber Tutorial.
2. The maximum distance between nodes when using the fiber communication path is dependent upon the fiber's multimode graded index: 10,000 feet (3 km) for 50/125 fiber; 15,000 feet (4.5 km) for 62.5/125 fiber. The maximum cable O.D. is 0.118 (3 mm). Reference document 900-143 for other fiber sizes.
3. ST connectors with long strain relief boots are to be used with the fiber optic cable.
4. On assembly 565-274, JW1 and JW2 must be installed. Jumper plugs must not be installed on P5-P8.
5. Cable clamps supplied with 748-531 are used to secure the fiber cable.

**Figure 21. Fiber Optic, Style 7 Wiring**

*Continued on next page*

# Wiring, Continued

## Wired Media and Fiber Optic, Style 7 Wiring



### Notes:

1. Refer to general wiring precautions in this document.
2. The maximum distance between nodes when using the fiber communication path is dependent upon the fiber's multimode graded index: 10,000 feet (3 km) for 50/125 fiber; 15,000 feet (4.5 km) for 62.5/125 fiber. The maximum cable O.D. is 0.118 (3 mm). Reference document 900-143 for other fiber sizes.
3. ST connectors with long strain relief boots are to be used with the fiber optic cable.
4. On assembly 565-274, JW1 and JW2 must be installed. Jumper plugs must not be installed on P5-P8.
5. Cable clamps supplied with 748-531 are used to secure the fiber cable.
6. When the 565-413 Interface Card is used with 566-793, 565-516, -407, or -409 Network Card, TB1 on the 565-413 Interface Card **cannot** be used. Connection to the motherboard is required as shown.
7. The shield should only be connected at one end of the line. The shield is connected to the left port.
8. Each "wired" media cable requires two ferrite beads, one at each end (included in the shipping group). Refer to installation instructions 574-041 for proper bead mounting.
9. When wiring leaves the building, 2081-9044 Overvoltage Protectors are required. One overvoltage protector is installed where wiring leaves the building; another is installed where wiring enters the next building.

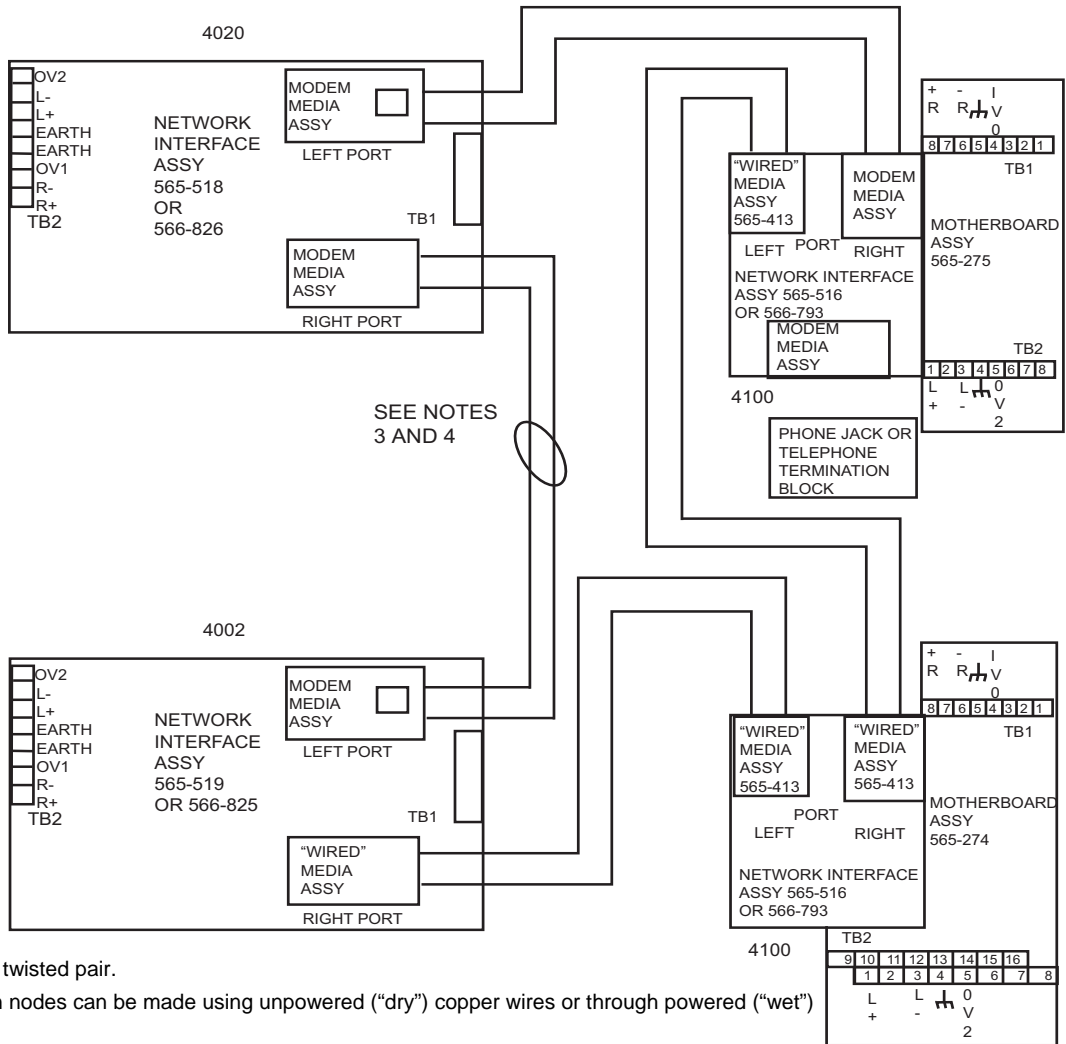
**Figure 22. Wired Media and Fiber Optic, Style 7 Wiring**

*Continued on next page*

# Wiring, Continued

## Modem Media Wiring (Non-4100U/4100ES Only)

**IMPORTANT:** Figure 23 applies only to non-4100U/4100ES systems.



### Notes:

1. All wiring is 24 AWG, twisted pair.
2. Connections between nodes can be made using unpowered ("dry") copper wires or through powered ("wet") leased lines.
3. Maximum cable distance between nodes when using short haul 24 AWG twisted pair is 15,000 feet.
4. Long haul telephone circuits must be private leased lines for analog data, point-to-point, full duplex, two-wire line interface with RJ-11 termination (where no line conditioning or signaling are required).
5. Modem media board power (565-279/566-338): 180 mA. Maximum at 5 +/- 0.25 VDC.
6. Modem media boards operate only at 9600 bps, with an 8-bit protocol.
7. Refer to general wiring precautions in this document, as well as Field Wiring Specifications: document 900-082 for 4100; 900-242 for 4100U/4100ES. Refer to Test Specification 576-241 for instructions on how to communicate with the modem.
8. When using a service modem, connect to the 565-516 or the 566-793 board using Cable 733-808 in shipping group 740-850. Use Cable 171-095 to connect the modem to a phone jack and/or a telephone termination block. Cut off one end of Cable 171-095 if connecting to a telephone termination block. Strip back the cable to connect the two center wires to the red and green wires in the block. Refer to Test Specification 576-241 for instructions on how to communicate with the modem. Place jumpers across 1-2 of P4 and 2-3 of P5.
9. When wiring leaves the building, 2081-9044 Overvoltage Protectors are required. One overvoltage protector is installed where wiring leaves the building; another is installed where wiring enters the next building.
10. Modem media assemblies have part number 565-279 or 566-338.
11. A network can support up to 98 physical bridge nodes. Only four modems are permitted per network.

**Figure 23. Modem Media Wiring (Non-4100U/4100ES Only)**

# Checkout Procedure

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## Checkout Procedure

When the 4100 NIC installation is completed, verify its operation using the Network Programmer's Reports. In addition, do the following:

- Test point status changes
- Test common annunciation
- Interrogate the network about point information
- Test common trouble point status reports and responses

Use Version 7.03 (or later) of the 4100 Programming Unit to make any corrections to the network CFG chips. (Refer to Publication NET-41-003 for programming information.)

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