Planning and Installation Guide
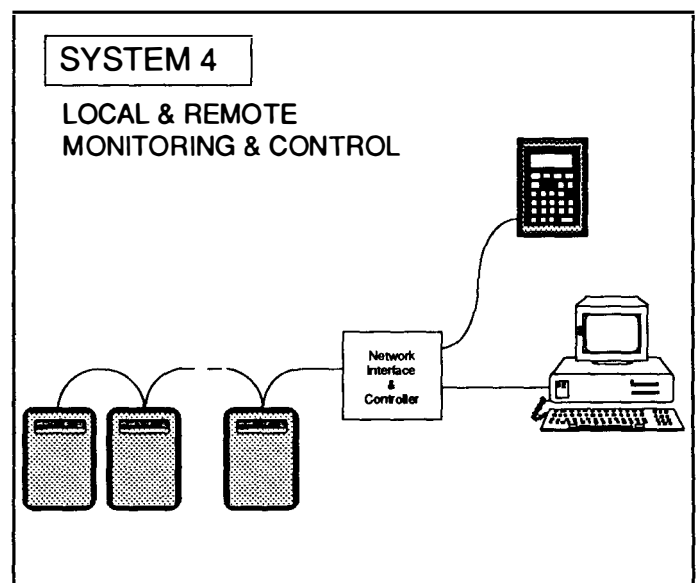
PowerLogic™
Power Monitoring and Control Systems
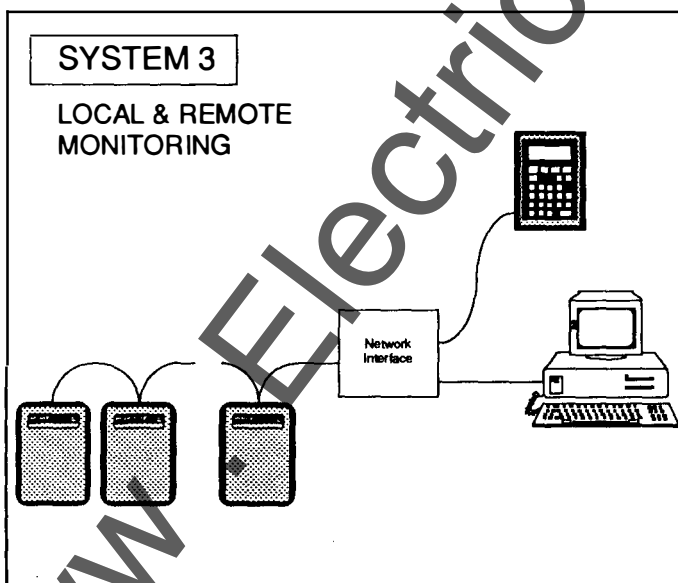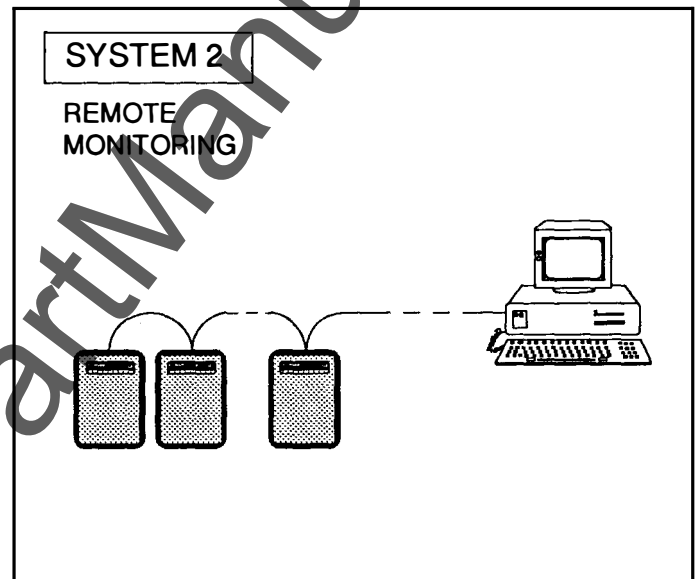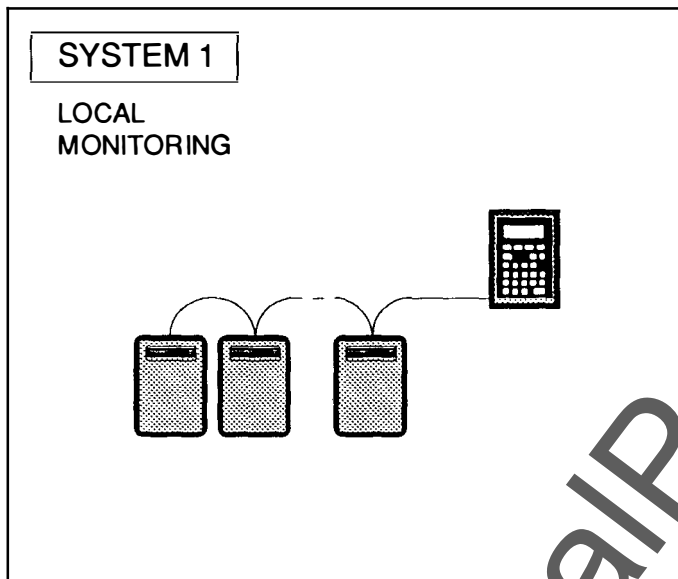
SYSTEM 1

LOCAL MONITORING

SYSTEM 2

REMOTE MONITORING

SYSTEM 3

LOCAL & REMOTE MONITORING

Network Interface

SYSTEM 4

LOCAL & REMOTE MONITORING & CONTROL

Network Interface & Controller

SQUARE D COMPANY

THIS EQUIPMENT COMPLIES WITH THE REQUIREMENTS IN PART 15 OF FCC RULES FOR A CLASS A COMPUTING DEVICE. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA MAY CAUSE UN-ACCEPTABLE INTERFERENCE TO RADIO AND TV RECEPTION REQUIRING THE OPERATOR TO TAKE WHATEVER STEPS ARE NECESSARY TO CORRECT THE INTERFERENCE.

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5.0 APPLICATION CONSIDERATIONS

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1.0 INTRODUCTION

1.1 PowerLogic™ System Capabilities

Square D's PowerLogic™ Power Monitoring and Control System combines microprocessor based instrumentation and control, to provide advanced features for electrical power distribution systems. The PowerLogic™ system represents the latest development in Square D's effort to promote more efficient utilization and improved reliability of power distribution equipment. These benefits are made possible due to system capabilities such as alarm reporting, automatic control, instrumentation and data sharing with various communication choices.

The PowerLogic™ system can be applied to many of the Square D electrical power distribution equipment products, resulting in a network of distributed devices which report to one or more centralized locations. The PowerLogic system does not require connections to breaker trip units or relays. PowerLogic system capabilities include the following:

• Metering Functions
  Instantaneous Readings:
  - Voltage (L-L, L-N)
  - Current
  - Power Factor
  - Frequency
  - Real Power
  - Reactive Power
  - Apparent Power
  - Apparent Current
  - Temperature
  Demand Readings
  - Average Demand, Current
  - Average Demand, Real Power
  - Predicted Demand, Real Power
  - Peak Demand, Real Power
  - Peak Demand, Current
  Energy Readings
  - Accumulated Energy
  - Accumulated Reactive Energy

• Minimum / Maximum and Historical Values

• Monitoring of Status Inputs

• Local / Remote Control of Relay Outputs

• Energy Management Alarms

• PowerLogic Application Software Series

• Personal Computer Interface

• Local System Display

• Network Communications

• Modem Communications

• Waveform Capture Feature
  - Total Harmonic Distortion
  - Most Significant Harmonic Component
  - Magnitude of Most Significant Harmonic

• Custom Automatic Control Functions
  - Data-Logging, Event-Logging
  - Automatic Transfer Schemes
  - Load-Shedding, Sequencing
  - Power Factor Correction

• Connections to Other Compatible Devices
  - Motor Protection Relays
  - Transformer Temperature Monitors

1.2 Summary of Manual Contents

This manual is divided into five sections, including the introduction. Section 2.0 contains a description of the PowerLogic System and options available. Section 3.0 discusses system configuration including component selection. Section 4.0 tells how to configure each component for use with PowerLogic. Section 5.0 discusses application considerations. Appendix A offers a complete list of products used with PowerLogic, Appendix B includes a brief discussion of routing in PowerLogic communications, and Appendix C offers pinouts for communication cables used with PowerLogic.

2.0 SYSTEM DESCRIPTION

2.1   Introduction

PowerLogic's power monitoring and control systems consist of a number of discrete components which work in unison to perform the monitoring and control functions necessary for modern power systems. PowerLogic's modular design offers a wide variety of system configuration options allowing PowerLogic to be tailored to the user's specific needs.

PowerLogic systems are typically classified into one of four groups referred to as Systems 1, 2, 3, and 4. (See Figure 2-1). Each system has standard features and a number of available options. Sections 2.2 through 2.6 are dedicated to describing the systems and options available.

2.2   System 1 - Local Monitoring

PowerLogic System 1 provides for the local monitoring of up to 16 circuits. Circuit Monitors are directly connected to a PowerLogic System Display. Total length of the data communications channel can be up to 10,000 feet, allowing for convenient location of the System Display.

The System Display provides real-time access to all Circuit Monitor instrumentation and historical data. Available information includes instantaneous meter readings, demand history, energy consumption, minimum/maximum historical data, energy management alarm history and present status. All necessary system setup functions are supported, allowing independent operation as a stand-alone system.

System Options include the Monitoring of Status Inputs (e.g. Circuit Breakers "open/closed/tripped"), Customized Screen Displays, and an RS-232 Port for printout of Circuit Monitor data on user command.

2.3   System 2 - Remote Monitoring

With System 2, one or more PowerLogic Circuit Monitors (up to 16) can be directly connected to a personal computer for remote monitoring of circuit parameters. A SY/LINK® PC interface board installed in the Personal Computer performs all communications processing, relieving the PC's processor from these tasks.

A wealth of information is accessible for real-time monitoring and control, with a variety of user functions available, depend-ing on the software option(s) selected. (See Section 2.6).

System options include monitoring of Status Inputs, Remote Control of Relay Outputs, Network Communications Interface for connection of additional groups of (up to 16) Circuit Monitors, Modem Communications Kit for remote access via standard telephone lines, and PowerLogic's Application Software Series.

2.4   System 3 - Local & Remote Monitoring

Local and remote monitoring capabilities are combined in System 3. One or more PowerLogic Circuit Monitors (up to 16) can be connected to a PowerLogic Network Interface Module (PNIM) for connection to the SY/NET® Local Area Network (LAN). A PowerLogic System Display is connected to a second port on the PNIM to provide local monitoring.

The SY/NET® Local Area Network connection is standard, providing connections to one or more PCs with installed SY/LINK® boards and additional groups of Circuit Monitors.

System 3 includes all of the options described for Systems 1 and 2. In addition, the System Display may be upgraded to a SY/VIEW® Color Workstation with 80-column by 25-line CRT screen.

2.5   System 4 - Local & Remote Monitoring and Control

System 4 combines the components and capabilities of System 3 with a SY/MAX® programmable controller to provide automatic control capabilities tailored to individual customer requirements.

System 4 includes all System 1, 2, and 3 options. In addition, automatic control functions are available on a custom basis, including:

- Data-Logging, Event-Logging
- Automatic Transfer Schemes
- Load Shedding, Sequencing
- Power Factor Correction

Connections to other compatible devices including motor protection relays and transformer temperature monitors are also possible.
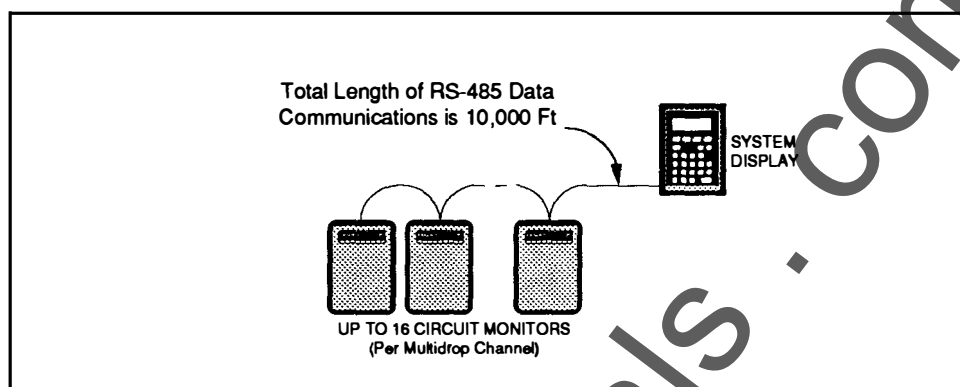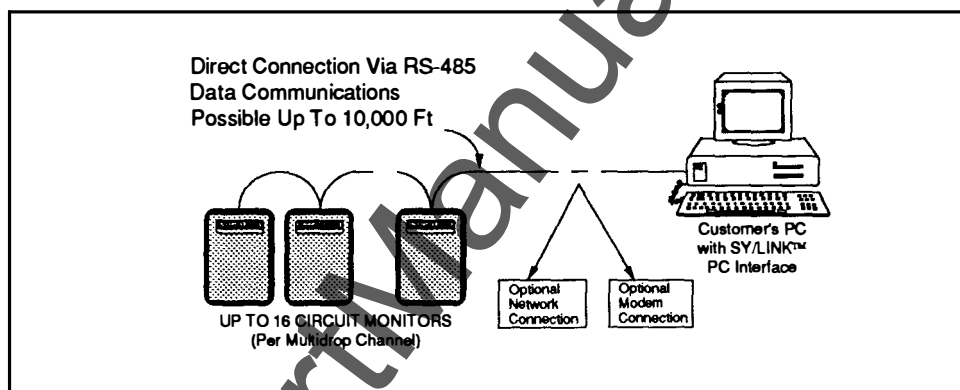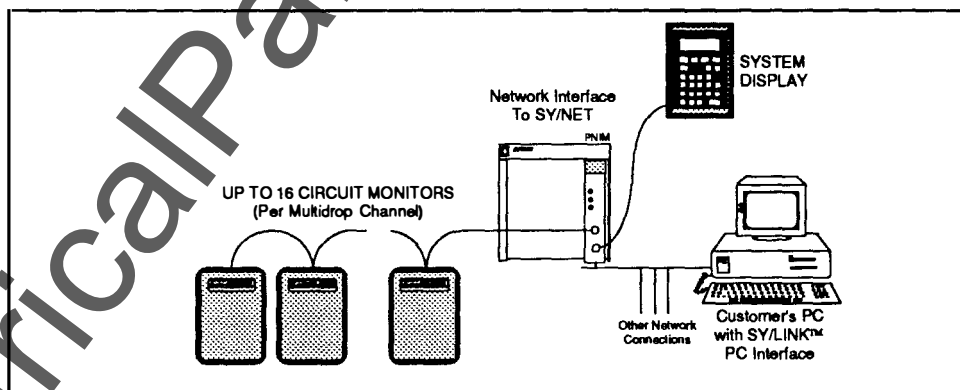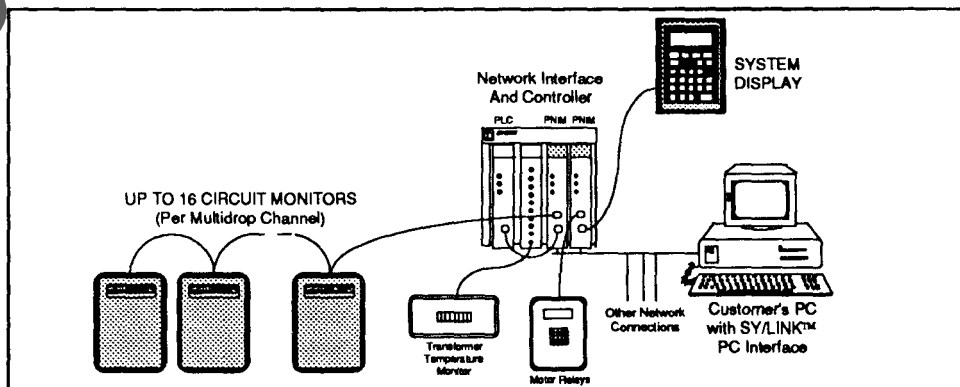
Figure 2-1 - PowerLogic Systems 1, 2, 3, and 4

2.6 PowerLogic Application Software Series

The PowerLogic™ Application Software Series includes a number of software packages offering a variety of ways to display and manipulate power system data. The software packages currently available are:

> System Monitoring Software (SSW-101)
> Product Communications Software (PSW-101)
> System Manager (SMS-700)
> System Manager-Plus (SMS-770)

The System Monitoring Software, used only with PowerLogic System 4's, is for special applications in which a Model 400 processor polls the Circuit Monitors for data. The Product Communications Software is a low-end communications package with the ability to display all of the data from up to 99 Circuit Monitors without the need for a Model 400 processor.

The PowerLogic System Manager is a powerful application which runs under Microsoft Windows. The program offers a number of ways to collect, display and analyze data including data logging, charts, reports, tables and more. The System Manager-Plus includes all of the features of the System Manager and offers the additional ability to customize the program to meet each user's needs.

Additional Software Options

In addition to PowerLogic software, the PowerLogic System supports a number of standard software tools available from Square D to allow customers the flexibility of customizing their own PowerLogic systems, including:

> 234 Link™ Spreadsheet Interface to Lotus 1-2-3™
> Screenware2™ Color Graphics Interface
> Cell Link™ Supervisory Software for Cell Control

3.0 SYSTEM CONFIGURATION

3.1 Introduction

This section describes the components and connections needed to configure a PowerLogic system. Sections 3.2, 3.3, 3.4, and 3.5 describe PowerLogic Systems 1, 2, 3 and 4, respectively. Drawings of common system configurations are also offered. Each drawing indicates the connection of components (including the proper cables to use) and placement of communications terminators and adapters.

In some cases, cables are only available in lengths of ten feet or less. But often an application will require a much longer cable. In this case the user must build a custom cable. Each drawing includes the Belden number for cables which may need to be custom made. The appropriate end connectors are also specified, and a complete set of the cable pinouts is offered in Appendix C.

Section 3.6 discusses component selection. It describes available components and models and offers a catalog number for each. It should be used in conjunction with Appendix A which offers a complete list of PowerLogic components along with a selected list of SY/MAX® components used in PowerLogic.

3.2 System 1

PowerLogic System 1 provides for the connection of up to 16 Circuit Monitors to a System Display. (See Figure 3-1). Total length of the data communications link can be up to 10,000 feet allowing for convenient location of the System Display. The System Display is available in a standard model, and a model equipped with a printer port and additional screen memory. (See Section 3.6). Custom screen displays are available with the ability to display the status of Circuit Monitor input contacts.

When input status is required, all Circuit Monitors on the communications channel must have identical input capability. That is, if one CM has eight status inputs, then all other Circuit Monitors daisy-chained to it must have eight status inputs. Section 3.6 lists available Circuit Monitor models.

The Circuit Monitors' communication terminals are daisy-chained together using Belden 8723 (or equivalent) wire. If the System Display is less than ten feet away from the first Circuit Monitor, a CAB-107 interconnect cable may be used to connect the first CM to the Multi-point Communications Adapter (MCA-485). If greater than ten feet a custom cable must be made using Belden 8723 with one male DB-9 connector. (See Appendix C for CAB-107 pinouts). The MCA-485 is then plugged into the RS-485 communications port on the System Display. A Multi-point Communications Terminator (MCT-485) is required on the last CM on the communications channel. (See Section 3.7).

3.3 System 2

In PowerLogic System 2, one or more Circuit Monitors (up to 16) can be directly connected to a personal computer (equipped with SY/LINK® PC Interface Card) for remote monitoring of circuit parameters. (See Figure 3-2). A network interface is optionally available for connection of additional groups of (up to 16) Circuit Monitors. (See Figure 3-4). Modem communications are also optionally available for remote communications via standard telephone lines. (See Figure 3-3).

Figure 3-2 shows up to 16 Circuit Monitors connected directly to a PC. A Multi-point Communications Adapter (MCA-485) is plugged into the RS-422 port of the SY/LINK card installed in the PC. (Refer to the SY/LINK instruction bulletin for instructions on installing the SY/LINK card). PowerLogic cable CAB-107 may then be used to connect the Circuit Monitors to the Communications Adapter. If the PC is located more than ten feet from the first CM, a custom cable must be made using Belden 8723 (or equivalent) wire and a male DB-9 connector. (See Appendix C for CAB-107 pinouts).

Circuit Monitor communication terminals are daisy-chained together using Belden 8723 (or equivalent) wire. The maximum length of the communications link is 10,000 feet. A Multi-point Communications Terminator (MCT-485) is required on the last CM on the communications channel. (See Section 3.7).

Figure 3-1 - System 1

Belden 8723
or
Equivalent

Connected to
RS-422 Port of
SY/LINK Card

MCT-485

MCA-485

CAB-107 (If < 10')
Else
Belden 8723
With Male DB-9
Connector

Circuit Monitors

Figure 3-2 - System 2 Direct Communication

System 2 with Modem Option

Modem communications allow communication to Circuit Monitors at long distances via standard telephone lines. Figure 3-3 shows a System 2 configuration in which a PC communicates to up to 16 Circuit Monitors via modem.

PowerLogic offers a modem communications kit which includes a modem, an RS-232 to RS-485 converter and the appropriate cables. (See Section 3.6). The converter supplied with the kit is a freestanding device called a "Black Box" which translates between the RS-485/422 signal used by PowerLogic and the RS-232 signal used by modems. When modem communications are used in conjunction with a network interface, the freestanding "Black Box" converter at the power equipment end may be replaced with a rack-mounted SY/MAX CRM-601 converter. Figure 3-6 shows the CRM-601 converter in a PowerLogic System 3. The converter is applied in the same manner with System 2.

As shown in Figure 3-3, the Black Box converter at the PC end is connected directly to the RS-422 port of the SY/LINK card using PowerLogic cable CAB-106. The Black Box is in turn connected to the modem using cable CAB-104. The modem should be connected to the phone lines as described in the modem instruction manual.

The Black Box converter at the power equipment end is connected to the Multi-point Communications Adapter (MCA-485) using cable CAB-108. The adapter is then connected to the first CM using cable CAB-107. If the Circuit Monitor is more than ten feet from the adapter, a custom cable will need to be made using Belden 8723 (or equivalent) wire and a male DB-9 connector. (See Appendix C for CAB-107 pinouts).

Circuit Monitor communication terminals are daisy-chained together using Belden 8723 (or equivalent) wire. A Multi-point Communications Terminator (MCT-485) is required on the last CM on the communications channel. (See Section 3.7).

System 2 with Network Option

When more than 16 Circuits need to be monitored, a network interface may be used. Figure 3-4 shows a System 2 configuration in which a PC is communicating to up to 32 CMs via Square D's SY/NET® Local Area Network (LAN).

The PC is connected to the network via the network port of the SY/LINK card. One end of the network connection cable supplied with the SY/LINK card is connected to the network port. The other end is connected to a Network Tee Connector (CCK-212). A Tee connector is also connected to the network port on the bottom of the PowerLogic Network Interface Module as shown. SY/MAX cable CC-210 may be used to connect the Tee connectors if they are less than ten feet apart. If not, custom cable must be made using Belden 9463 (or equivalent) wire and a Network Cable End Kit (CCK-211). Instructions for connecting the network cable ends are supplied with the kit.

Each end of the network must be terminated using a SY/NET Network Terminator (CCK-213). Figure 3-4 illustrates the proper placement of these terminators.

Circuit Monitors are connected to the network via the top RS-422 port (port 0) of PowerLogic Network Interface Modules (CRM-565). Circuit Monitors may not be connected to the bottom port (port 1) of a PNIM. Therefore, each PNIM supports up to 16 Circuit Monitors. PNIMs are connected to each other via the network port on their bottoms using Tee Connectors and a CC-202 network cable as shown. Additional PNIMs may be added as needed, each supporting up to 16 Circuit Monitors.

PNIMs are mounted in a SY/MAX register rack with power supply. For clarity, the rack and power supply are not shown in the drawings. Refer to section 3.6 for a listing of available register racks and power supplies.

A Multi-point Communications Adapter (MCA-485) must be connected to the top port of each PNIM to which Circuit Monitors are connected. The CMs are then connected to the adapter using cable CAB-107, if less than ten feet. A longer cable may be constructed using Belden 8723 (or equivalent) wire and a male DB-9 connector. (See Appendix C for CAB-107 pinouts). A Multi-point Communications Terminator (MCT-485) is required on the last CM on each communications channel. (See Section 3.7).

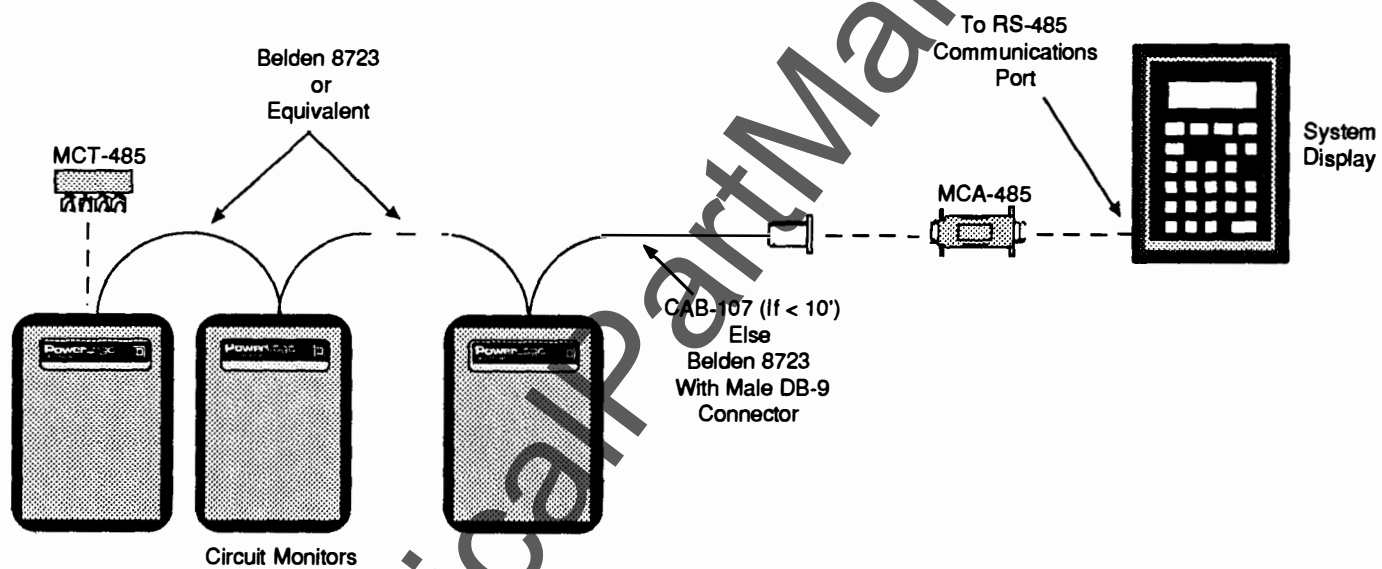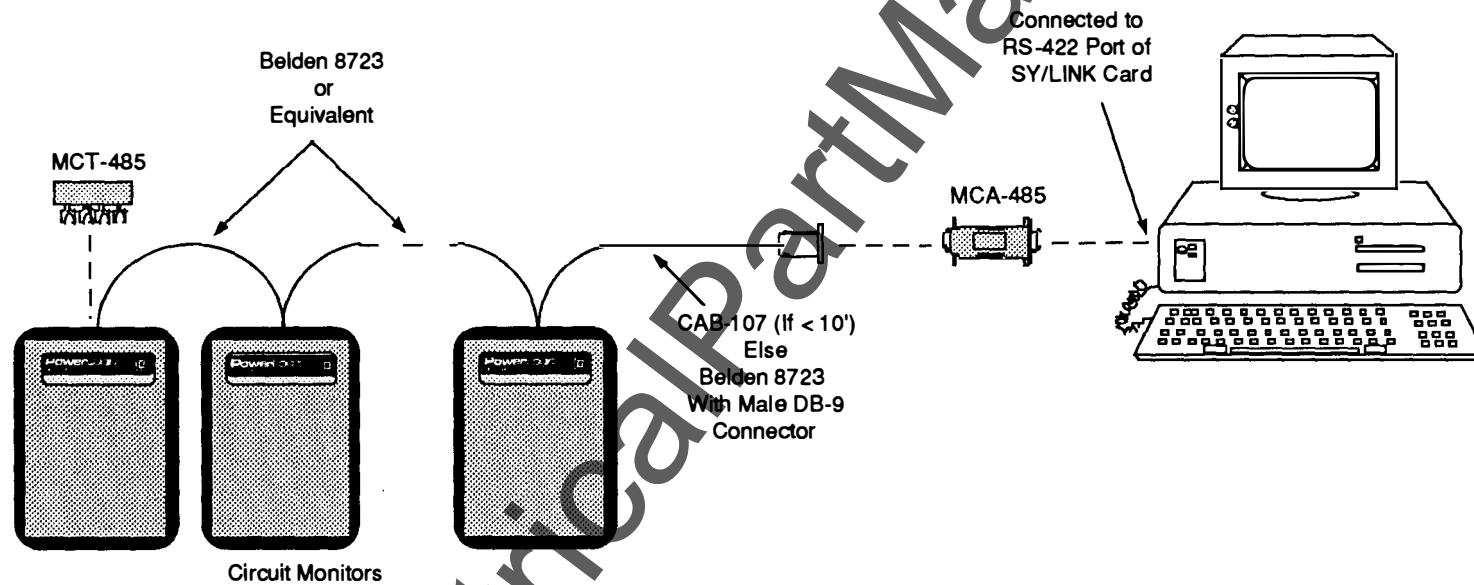**Figure 3-3** - System 2 with Modem Communications
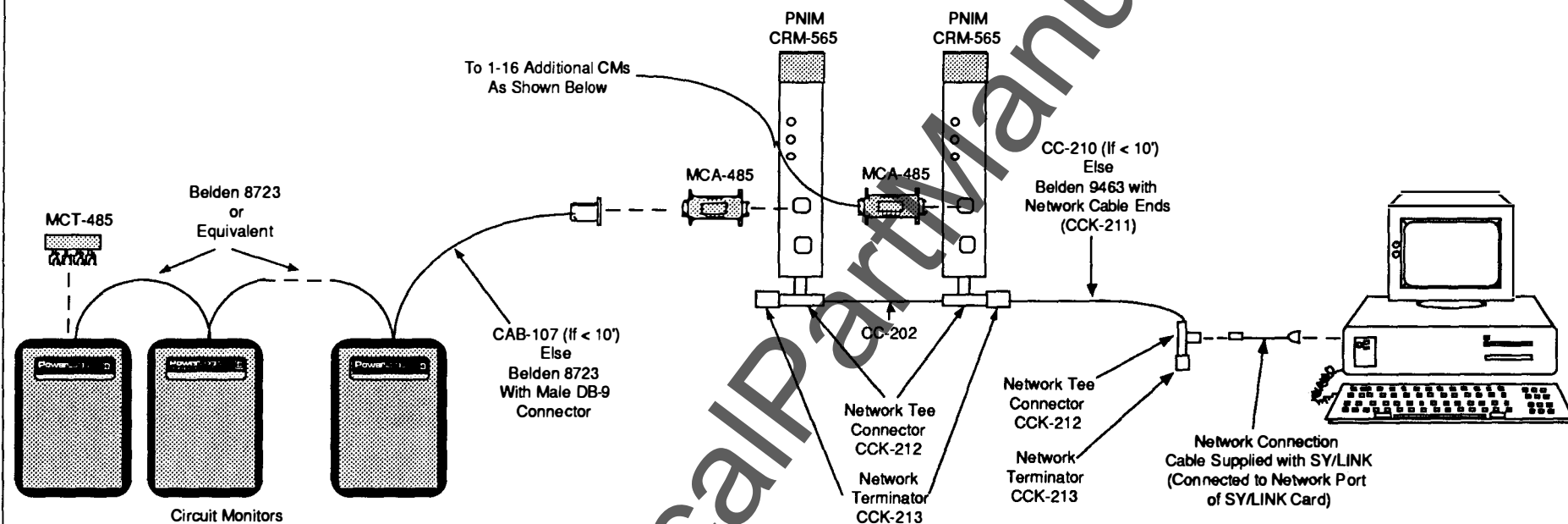
Figure 3-4 - System 2 with Network Communications

3.4 System 3

PowerLogic System 3 provides both local and remote monitoring capabilities. (See Figure 3-5). A PNIM (CRM-565) controls communications from the PC and System Display to prevent data collisions that might occur if both tried to communicate simultaneously.

The PC is connected to the network via the network port of the SY/LINK card. One end of the network connection cable supplied with the SY/LINK card is connected to the network port. The other end is connected to a Network Tee Connector (CCK-212). A Tee connector is also connected to the network port on the bottom of the PowerLogic Network Interface Module as shown. SY/MAX cable CC-210 may be used to connect the Tee connectors if they are less than ten feet apart. If not, custom cable must be made using Belden 9463 (or equivalent) wire and a Network Cable End Kit (CCK-211). Instructions for connecting the network cable ends are supplied with the kit.

Each end of the network must be terminated using a SY/NET Network Terminator (CCK-213). Figure 3-5 illustrates the proper placement of these terminators.

Circuit Monitors are connected to the network via the top RS-422 port (**port 0**) of PowerLogic Network Interface Modules (CRM-565). Circuit Monitors may not be connected to the bottom port (port 1) of a PNIM. Therefore, each PNIM supports up to 16 Circuit Monitors. PNIMs are connected to each other via the network port on their bottoms using Tee Connectors and a CC-202 network cable as shown. Additional PNIMs may be added as needed, each supporting up to 16 Circuit Monitors.

PNIMs are mounted in a SY/MAX register rack with power supply. For clarity, the rack and power supply are not shown in the drawings. Refer to section 3.6 for a listing of available register racks and power supplies.

A Multi-point Communications Adapter (MCA-485) must be connected to the top port of each PNIM to which Circuit Monitors are connected. The CMs are then connected to the adapter using cable CAB-107, if less than ten feet. A longer cable may be constructed using Belden 8723 (or equivalent) wire and a male DB-9 connector. (See Appendix C for CAB-107 pinouts). A Multi-point Communications Terminator (MCT-485) is required on the last CM on each communications channel. (See Section 3.7).

The System Display is connected to the bottom RS-422 port (port 1) of the PNIM. A SY/MAX CC-100 cable may be used to make the connection if the System Display is less than ten feet away. A longer cable may be constructed using Belden 8723 (or equivalent) wire and a male DB-9 connector. (See Appendix C for CC-100 pinouts). A Multi-point Communications Terminator (MCT-485) is required on the last CM on each communications channel. (See Section 3.7).
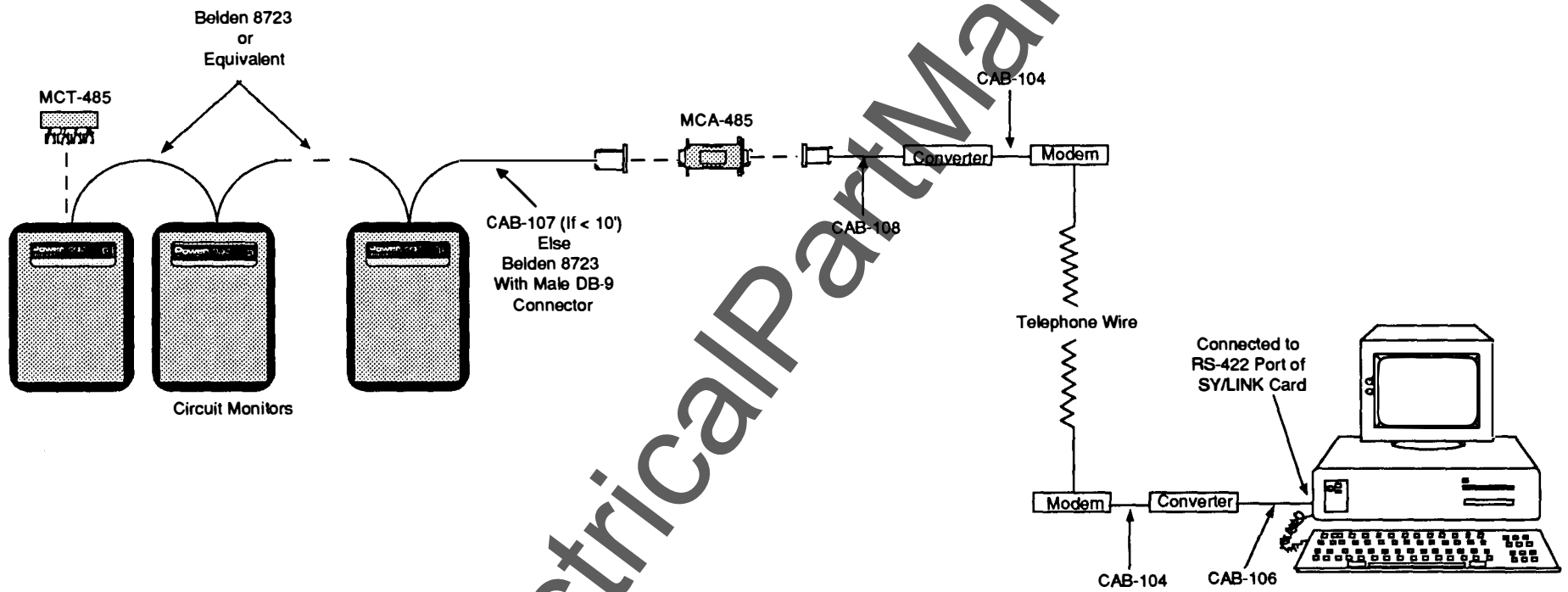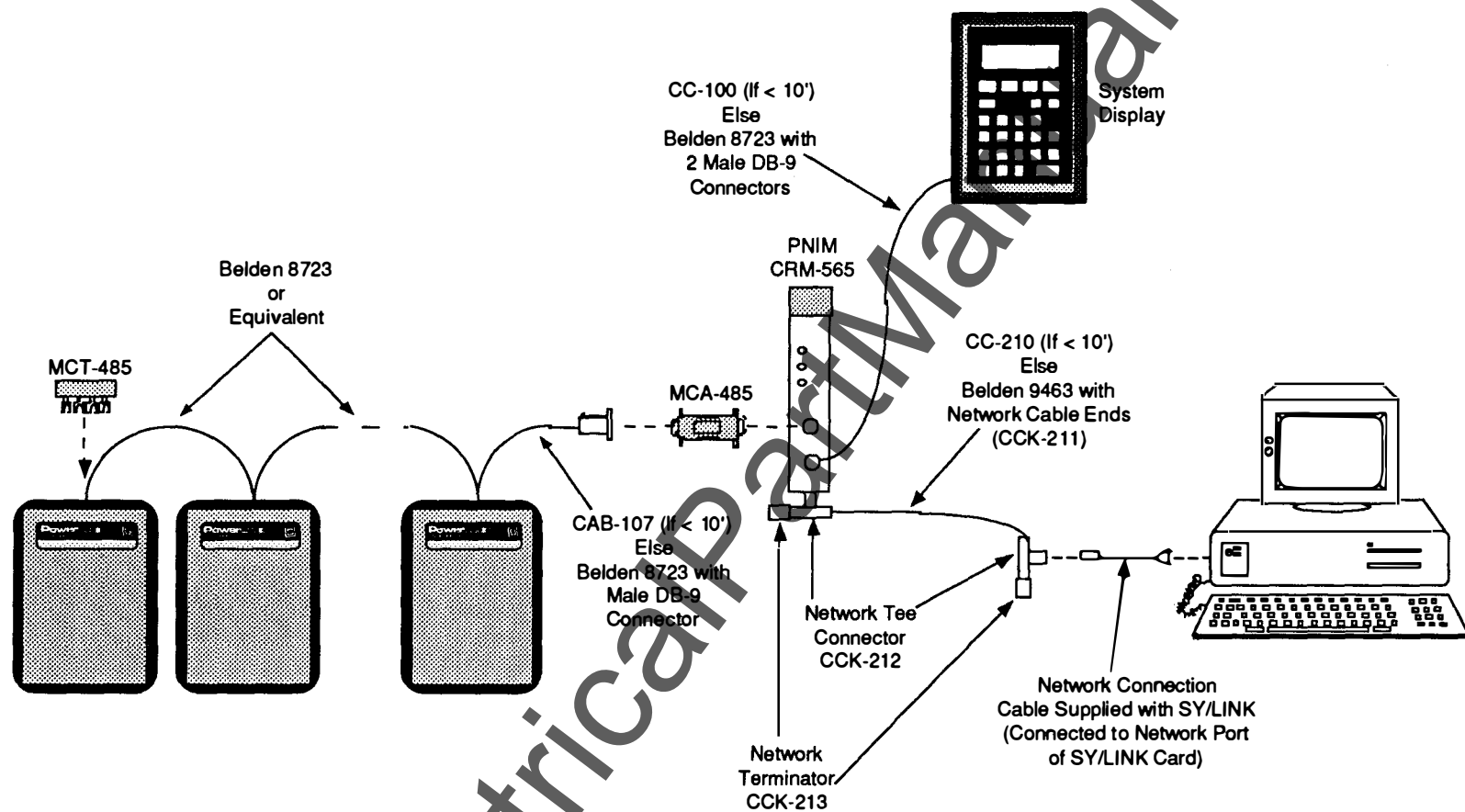
Figure 3-5 - System 3

System 3 with Modem Option

When the remote PC is located more than 10,000 feet from the PNIM, modem communications may be used. Figure 3-6 shows a System 3 configuration with modem communications.

PowerLogic offers a modem communications kit which includes a modem, an RS-232 to RS-485 converter and the appropriate cables. (See Section 3.6). The converter supplied with the kit is a freestanding device called a "Black Box" which translates between the RS-485/422 signal used by PowerLogic and the RS-232 signal used by modems. In a System 3 configuration, since modem communications are used in conjunction with a network interface, the freestanding "Black Box" converter at the power equipment end may be replaced with a rack-mounted SY/MAX CRM-601 converter. Though different in appearance, the CRM-601 and the Black Box converter perform virtually identical functions.

As shown in Figure 3-6, the Black Box converter at the PC end is connected directly to the RS-422 port of the SY/LINK card using PowerLogic cable CAB-106. The Black Box is in turn connected to the modem using cable CAB-104. The modem should be connected to the phone lines as described in the modem instruction manual.

The modem at the power equipment end is connected to the CRM-601 converter using PowerLogic cable CAB-102. The CRM-601 is in turn connected to an RS-422 communication port on a SY/NET Network Interface Module (CRM-510) using cable CC-104 or CC-105. The NIM is connected to the PNIM via their network ports using Tee Connectors (CCK-212) and a CC-202 cable. Network termination is achieved using Network Terminators (CCK-213) as shown.

A SY/NET Network Interface Module (CRM-510) is required since its RS-422 communication ports can be configured for Net-to-Net operation, a requirement for modem communications with a network. The PNIM's ports do not have this capability; therefore, the standard NIM must be used. The RS-422 port of the NIM **and** the RS-422 port of the SY/LINK card must be configured for Net-to-Net operation. Refer to the instruction bulletins for the NIM and SY/LINK for instructions on configuring their ports.

3.5 System 4

PowerLogic System 4 combines the local and remote capabilities of System 3 with the ability to perform automatic control functions. Automatic control is provided with the addition of a SY/MAX Model 400 processor. System connections are virtually identical to those described in PowerLogic System 3 above. The Model 400 processor is typically connected to a PNIM using a SY/MAX CC-100 cable.

Many automatic control functions are available on a custom basis. Consult you Square D sales representative for additional information.
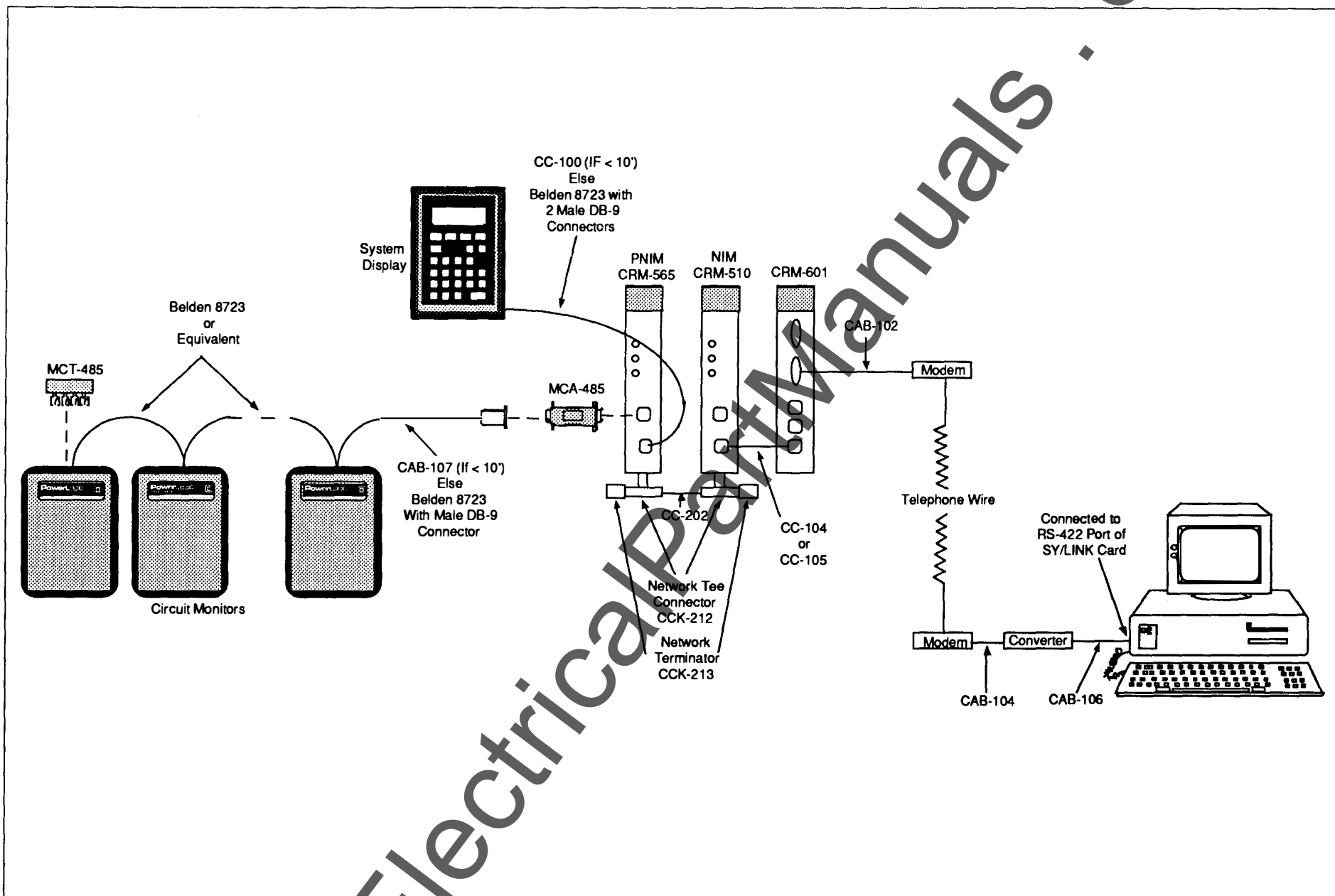
Figure 3-6 - System 3 with Modem Communications

3.6 Component Selection

This section addresses PowerLogic component selection. It should be used in conjunction with Appendix A which offers a complete list of available parts along with the part number for each.

3.6.1 Circuit Monitors

The Circuit Monitor is available in eight functional versions. (See Table 3-1). Full instrumentation and communications are standard with **all** Circuit Monitor models. Status inputs, relay outputs, waveform capture, and an integral display are optionally available.

A Circuit Monitor may be placed on any circuit where power monitoring or harmonic analysis is required. Up to 16 Circuit Monitors may be daisy-chained to a single RS-422/RS-485 communication port.

3.6.2 System Display

The PowerLogic System Display offers a convenient method for displaying data from multiple Circuit Monitors in a single location. Up to 16 Circuit Monitors may be connected to the System Display's RS-485 communications port.

The System Display is available in two functional versions. (See Table 3-2). System Display Model SD-220X1 is equipped with a serial printer port to allow connection to a serial printer for hardcopy output of displayed values. In addition, Model SD-220X1 offers 16K of screen memory for programming custom screen displays. (Consult Square D headquarters if custom screen displays are required).

CLASS	TYPE	DESCRIPTION
3050	SD-200X1	Standard System Display
3050	SD-220X1	System Display with 16K Memory and Serial Printer Port

Table 3-2 - *PowerLogic System Displays*

CLASS	TYPE	DESCRIPTION
3020	CM-100X1	Instrumentation
3020	CM-108X1	Instrumentation, 8 Status Inputs
3020	CM-144X1	Instrumentation, 4 Status Inputs, 4 Relay Outputs
3020	CM-150X1	Instrumentation plus Integral Display
3020	CM-200X1	Instrumentation plus Waveform Capture
3020	CM-208X1	Instrumentation, Waveform Capture, 8 Status Inputs
3020	CM-244X1	Instrumentation, Waveform Capture, 4 Status Inputs, 4 Relay Outputs
3020	CM-250X1	Instrumentation, Waveform Capture, Integral Display
3020	CMX-101	Circuit Monitor Trim Ring

Table 3-1 - *PowerLogic Circuit Monitors*

3.6.3 SY/VIEW® Workstation

The PowerLogic System may be furnished with a SY/VIEW® Color Workstation (**Class 8010 Type SDF-602**) for local display of Circuit Monitor data. The SY/VIEW Workstation is essentially an industrial PC/AT computer system capable of fulfilling a wide variety of applications where both a powerful PC and a durable industrial enclosure are needed. PowerLogic application software can be loaded on the machine for convenient display of data. A SY/LINK® Network Interface Card (Class 8010 Type SFI-510) is also required.

3.6.4 Personal Computer

Users that require remote monitoring capabilities have the option to purchase one or more personal computers for remote monitoring. Personal computers are supplied on a custom basis. Many users already own one or more PCs meeting the minumum requirements, or will opt to purchase them on their own. In this case, they need only purchase a SY/LINK® board for each PC. The minimum PC requirements are:

> IBM AT/386 or 100% Compatible Computer
> 640K RAM Minimum

DOS 2.1 or Later
Floppy Disk Drive
Hard Drive (Optional but recommended)
EGA or VGA Monitor
SY/LINK® Network Interface Board (Class 8010
    Type SFI-510)

The SY/LINK PC Interface Card, installed in the PC, manages data communications, freeing the computers processor from this task. Communications from the PC to Circuit Monitors may be accomplished via a direct RS-485/422 connection, via a high-speed network connection, or via telephone modem communications. Sections 3.3, 3.4, and 3.5 discuss the application of remote PCs in Systems 2, 3, and 4. The components required for network communications and modem communications are discussed below.

Network Communications

Network communication is achieved using Square D's SY/NET® Network. The SY/NET Network is a high-speed data highway over which PowerLogic and SY/MAX® communications are transmitted. PowerLogic Systems 3, 4 and, optionally, System 2 utilize network communications. Figures 3-4, 3-5, and 3-6 show examples of each.
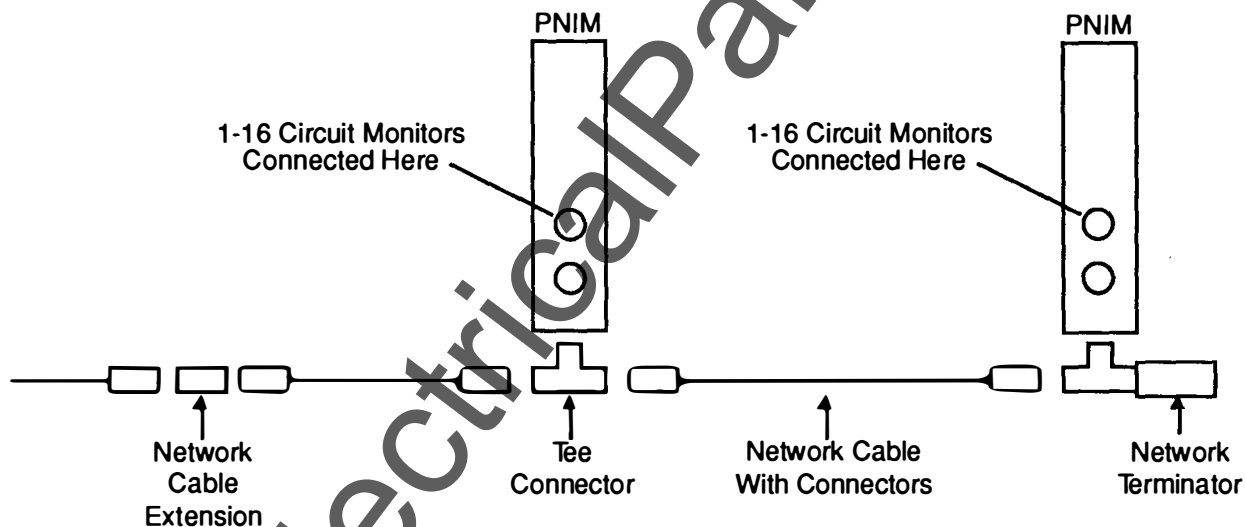
Figure 3-7 - SY/NET Network components and connection hardware

Circuit Monitors are connected to the network via port 0 of the PNIM (the top port). Circuit Monitors should **never** be connected to the lower communications port (port 1). Up to 16 Circuit Monitors may be connected to a single PNIM. If more than 16 Circuit Monitors are required, additional PNIMs may be added, each supporting 16 CMs.

PNIMs are mounted in a SY/MAX® register rack with accompanying power supply. Section 3.6.6 lists available register racks and power supplies.

PNIMs are connected to each other via the SY/NET port on the bottom of each device. A Tee Connector is required at each PNIM and a Network Terminator must be used to terminate the ends of the network. Figure 3-7 illustrates the connection of network components. Table 3-3 lists the SY/NET network components and connecting hardware.

Modem Communications

In applications where a remote PC is located at distances beyond those practical for direct or network communications, telephone modem communications may be used. To communicate to a PowerLogic lineup, a PC must be equipped with a modem and an RS-232/485 converter. The remote PowerLogic lineup must also be equipped with a modem and converter. The RS-232/RS-485 converter converts the RS-232 signal required by the modem, to the RS-485 signal used by PowerLogic and vica versa. Figure 3-3 illustrates a PC communicating to Circuit Monitors via modem communications.

PowerLogic offers a Modem Communications Kit (See Table 3-4). The kit includes a modem, an RS-232/RS-485 "Black Box" converter and the appropriate cables. Since a modem and converter are required at each end, two kits are required for a PC to communicate to a remote PowerLogic lineup.

In a System 3 or 4 configuration, since modem communications are used in conjunction with a network interface and SY/MAX® rack, the freestanding "Black Box" converter at the Power Equipment end may be replaced with a rack-mounted SY/MAX CRM-601 Dual Interface Converter Module. Though different in appearance, the "Black Box" and CRM-601 perform virtually identical functions. Figure 3-6 shows a System 3 using a CRM-601 in modem communications.

CLASS	TYPE	DESCRIPTION
3070	MDK-012	Modem communications kit with RS-232/485 converter & cables
8030	CRM-601	Dual Interface Converter

Table 3-4 -Modem Communications Kit

CLASS	TYPE	DESCRIPTION
8030	CRM-565	PowerLogic Network Interface Module
8030	CRM-510	SY/NET Network Interface Module
8010	SFI-510	SY/LINK Network Interface Board for PCs
8030	CC-201	Network Cable with Connectors - 2 ft (.6m)
8030	CC-202	Network Cable with Connectors - 10 ft (3m)
8030	CCK-211	Network Cable End (for Beldon 9463)
8030	CCK-212	Network Tee Connector
8030	CCK-213	Network Terminator (set of two)
8030	CCK-214	Network Cable Extension (male to male)
Belden 9463 or Equivalent		SY/NET Network Cable

Table 3-3 - SY/NET Network Components and Connection Hardware

3.6.5 Model 400 Processor (System 4)

PowerLogic System 4 incorporates the ability to perform control functions with the addition of a SY/MAX programmable logic controller (PLC). The PLC used with the PowerLogic system is the SY/MAX Model 400 Processor. The Model 400 processor is available in four types. Table 3-5 offers a description of each. For additional information, refer to Instruction Bulletin 30598-503-XX.

3.6.6 Racks, Power Supplies

PowerLogic Systems 3 and 4 (and System 2's equipped with network communications) require the use of a SY/MAX® rack and power supply. SY/MAX offers three register rack assemblies. (See Table 3-6). The rack needed for a specific lineup is dependent upon the total number of SY/MAX modules required. For example, a PowerLogic System 4 utilizing a Model 400 processor, two PowerLogic Network Interface Modules, two Digital Input Modules, and one Digital Output Module, requires a 9 slot rack. If a lineup requires more than 18 modules, Local and Remote Interface Modules may be used to connect multiple racks. (See Section 3.6.8).

Power must be supplied to the rack by a SY/MAX power supply. The number and type of modules in a rack and their total current draw determine the power supply to be used. Table 3-7 lists the available power supplies and cables.

CLASS	TYPE	DESCRIPTION
8030	RRK-100	SY/MAX 5 slot register rack
8030	RRK-200	SY/MAX 9 slot register rack
8030	RRK-300	SY/MAX 18 slot register rack

Table 3-6 - SY/MAX Register Rack Assemblies

3.6.7 Application Software

The PowerLogic Application Software Series offers a variety of programs, to address varying levels of user need. A brief description of each is offered below.

The PowerLogic **Product Communications Software** is a low-cost package with the ability to display all of the data from up to 99 Circuit Monitors. In addition, the package offers the ability to view captured waveforms (from Circuit Monitors equipped with the Waveform Capture feature), log data to printer or disk, read or write Circuit Monitor registers, and more.

CLASS	TYPE	DESCRIPTION
8020	SCP-401	Model 400 4K RAM without Floating Point
8020	SCP-423	Model 400 8K RAM with Floating Point and High Speed Scan
8020	SCP-424	Model 400 16K RAM with Floating Point and High Speed Scan
8020	SCP-444	Model 400 16K RAM/PROM Mix with Floating Pt and High Speed Scan

Table 3-5 - Model 400 Processors

CLASS	TYPE	DESCRIPTION
8030	PS-11	64 I/O Capacity with 120 VAC Incoming Power and Output Current Capacity of 4A
8030	PS-21	128 I/O Capacity with 120 VAC Incoming Power and Output Current Capacity of 12A
8030	PS-31	512 I/O Capacity with 120 VAC Incoming Power and Output Current Capacity of 23/2.2A
8030	PS-41	64 I/O Capacity with 240 VAC Incoming Power and Output Current Capacity of 4A
8030	PS-51	128 I/O Capacity with 240 VAC Incoming Power and Output Current Capacity of 12A
8030	PS-61	512 I/O Capacity with 240 VAC Incoming Power and Output Current Capacity of 23/2.2A
8030	PS-70	128 I/O Capacity with 24 VDC Incoming Power and Output Current Capacity of 10A
8030	PS-74	128 I/O Capacity with 125 VDC Incoming Power and Output Current Capacity of 8A
8030	CC-10	Power Supply Cable for Rack Assembly Containing CPU - 36"
8030	CC-20	Power Supply Cable - 60"
8030	CC-21	Power Supply Cable - 3 Drops - 48", 60", 72"
8030	CC-30	Power Supply Cable - 120"
8030	CC-31	Power Supply Cable - 2 Drops - 96", 120"
8030	CC-40	Power Supply Cable for TTL (+5VDC) voltage - 72"
8030	CC-51	Redundant Power Supply Cable - 6"

Table 3-7 - SY/MAX Power Supplies and Cables

The PowerLogic **System Monitoring Software**, used only with System 4's, is for special applications in which a Model 400 processor polls the Circuit Monitors for data. This is the only program which requires a Model 400 processor.

The PowerLogic **System Manager** is a powerful application which runs under Microsoft Windows™. The program offers a number of ways to collect, display, and analyze data including, data logging, charts, reports, tables and more.

The most powerful package, the **System Manager-Plus**, includes all of the features of the System Manager and offers the additional ability to customize the program as needed. Table 3-8 summarizes the available software.

NOTE: All software is licensed for use on a single personal computer. A separate package must be purchased for each PC.

3.6.8 Local/Remote Interface Modules

If the number of SY/MAX modules needed for a lineup exceeds the number of available slots in the rack, Local and Remote Interface Modules may be used to "connect" multiple racks. The Local Interface Module available for use with the

PowerLogic System is the SY/MAX CRM-210 Local Interface Module. Remote Interface is achieved using the SY/MAX CRM-222 Remote Interface Module. (See Table 3-9).

3.6.9 Digital I/O

Circuit Monitor models CM-108 and CM-208 are each equipped with 8 status inputs which can be used to monitor the status of discrete contacts as needed. Circuit Monitor models CM-144 and CM-244 are equipped with 4 status inputs and 4 relay outputs which can be externally controlled via the communications channel. Additional I/O is available with the use of SY/MAX Class 8030 Digital Input and Output modules. Each Digital Input Module offers 16 optically isolated inputs. Each Digital Output Module offers 16 optically isolated outputs. The I/O modules recommended for use with PowerLogic are shown in Table 3-10.

CLASS	TYPE	DESCRIPTION
8030	RIM-101	Digital Input Module 120VAC/DC
8030	ROM-221	Digital Output Module 120VAC

Table 3-10 - Recommended Digital I/O Modules

CLASS	TYPE	DESCRIPTION
3080	PSW-101	Product Communications Software
3080	SSW-101	System Monitoring Software (Model 400 PLC Required)
3080	SMS-700	System Manager Software (Includes Microsoft Windows 3.0 & Mouse)
3080	SMS-770	System Manager-Plus Software (Includes Microsoft Windows 3.0 & Mouse)

Table 3-8 - PowerLogic Application Software

CLASS	TYPE	DESCRIPTION
8030	CRM-210	Local Interface Module
8030	CRM-222	Remote Interface Module

Table 3-9 - Local/Remote Interface Modules

CLASS	TYPE	DESCRIPTION
3090	CAB-102	Interconnect Cable (CRM-601 Converter to Modem)
3090	CAB-104	Interconnect Cable (Black Box Converter to Modem)
3090	CAB-106	Interconnect Cable (10-ft Flying Lead, Spade Lugs)
3090	CAB-107	Interconnect Cable (10-ft Flying Lead, Spade Lugs)
3090	CAB-108	Interconnect Cable (10-ft Flying Lead, Spade Lugs)
3090	MCA-485	Multipoint Communications Adapter
3090	MCT-485	Multipoint Communications Terminator
3090	ATM-120	Auxiliary 120 VAC Test Module

Table 3-11 - PowerLogic System Accessories

3.7 Termination and Bias of Communication Lines

To ensure accurate communications, steps must be taken to properly terminate and bias the Circuit Monitor communication lines. The following paragraphs detail the necessary steps.

Termination of the communication lines is achieved with the use of the PowerLogic RS-485 Multipoint Communications Terminator (Catalog No. 3090 MCT-485). The terminator has four spade connectors which are connected to the IN+, IN-, OUT+, and OUT- communication terminals on the rear of the Circuit Monitor. (See figure 3-9).

IMPORTANT: *Only the last CM in a communications link must be terminated.* For example, if a link contains only a

NOTE: The communications terminator must only be used on the last CM on a link. It is also required where only one CM is on a link.

Figure 3-9 - *Multipoint Communications Terminator*

single Circuit Monitor, that CM must have a terminator. If multiple CMs are daisy chained together, only the *last* CM in the link should be terminated. Figure 3-9 illustrates the proper placement of the terminator.

The communication lines are biased with the use of the PowerLogic RS-485 Multipoint Communications Adapter (Catalog No. 3090 MCA-485). The 9-pin, male to female adapter is attached to the host device to which multiple CMs are daisy chained. Possible connection points include: the RS-422 port of a SY/LINK Card, the top RS-422 communications port of a PowerLogic Network Interface Module (PNIM), the communications port of a Model 400 processor, and connection to a "Black Box" converter as described in Section 3.3. Figure 3-8 illustrates the adapter connected to a communications port of a Model 400 processor.

IMPORTANT: Unlike the Communications Terminator, the Communications Adapter need not be used when only one Circuit Monitor is on a link. When a single CM is used, its address switches must be set to 00 which causes the lines to be properly biased. The Communications Adapter must only be used when *multiple* CMs are daisy chained on a communications link.

NOTE: The communications adapter is required when multiple CMs are connected to a processor, NIM, or remote workstation. The adapter should not be used when a single CM is connected to a device.

Figure 3-8 - *Multipoint Communications Adapter*

3.8 Addressing

Each PowerLogic Network Interface Module (PNIM), SY/LINK® Board, and Circuit Monitor must have an address assigned to it. The following sections discuss addressing of these devices. For additional information on setting and using addresses, refer to the instruction bulletin for each device.

3.8.1 PNIM and SY/LINK Addressing

The PNIM has a two digit thumbwheel for setting a network address number between 00 and 99. This address number not only identifies the PNIM (and the devices connected to it) but also sets the communication priority that the PNIM has in relation to other PNIMs on the network.

The PNIM has two RS-422 communication ports to which the programmable controllers or other devices are connected. The two ports are numbered 0 and 1. These port numbers are combined with the PNIM address number to identify the devices for network communication. For example, the device connected to port 1 of PNIM 55 would be identified by the number 155 in the route portion of network communication commands. The device connected to port 0 of the same module would have the number 055. (See Appendix B for a discussion of route instructions).

On the bottom of the PNIM is a high speed, network port to which the network cable is connected. This port is connected directly to a Tee connector on the network cable or to an extension cable which leads to a Tee connector.
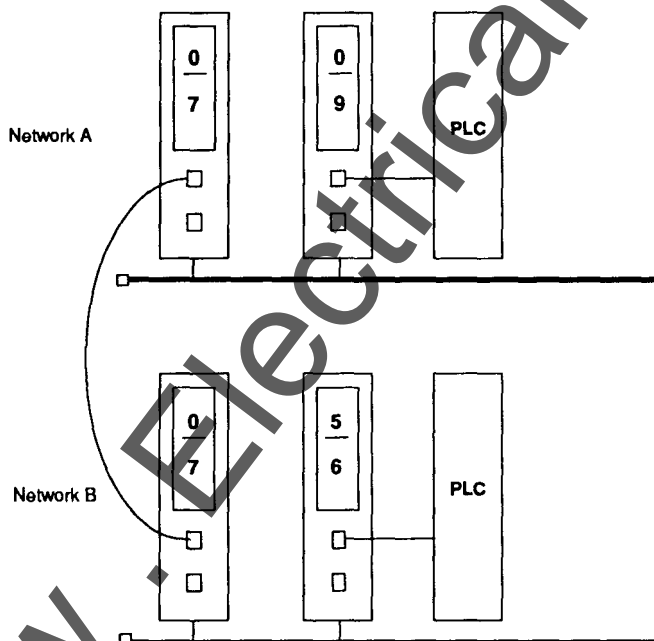
Figure 3-10 - Network-to-Network Configuration

Like the PNIM, the SY/LINK board also allows two devices to be connected to the network. One device is the computer in which the board is mounted, a second device is connected to the RS-422 port on the SY/LINK board.

Like the PNIM, a number between 00 and 99 is assigned to each SY/LINK board as an address and communication priority. The network address of the SY/LINK board is set by the user program. The board's edge connector is considered port 0 and the RS-422 port is considered port 1. Therefore, if the SY/LINK board is given an address of 28, the computer will have the number 028, and the device connected to the RS-422 port will have the number 128.

For network-to-network communication, a COMM port on one network is connected to a COMM port on another network using a CC-100 series differential communication cable. The two COMM ports involved in the net-to-net connection must have the same address number. For example, port 007 on network 1 must be connected to port 007 on network 2. (See Figure 3-10). The two ports must also be set for the same baud rate.

3.8.2 Circuit Monitor Addressing

Each Circuit Monitor in a system must have a unique address assigned to it. (In this context, the term system means one or more Circuit Monitors "daisy chained" to a processor or similar controlling device). Once assigned, a Circuit Monitor's address is used in a manner similar to one's home address; for example, for the host to exchange information with the Circuit Monitor whose address is 12, it sends the information over the communication lines, accompanied by the address of the target Circuit Monitor (number 12). In this way, information can be routed to specific units in a system.

A Circuit Monitor's address is determined by two ten-position rotary switches located behind a door on the rear of the unit. The switches are accessed by loosening the screws which secure the device address door, and sliding the right end of the door toward the top of the Circuit Monitor. The switches allow a total of 100 settings (0 to 99). The Circuit Monitor only recognizes 39 of those settings, 33 of which are reserved for addressing the unit. (Refer to Table 3-12 for a summary of Circuit Monitor switch settings).

Circuit Monitors can be used in either a multipoint or point-to-point configuration. In either case, CM to host communications are virtually the same. A difference arises in the setting of the address switches. The following paragraphs illustrate the difference.

In a system with multiple CMs in a multipoint configuration, the last CM in the daisy chain, i.e. the CM which is located farthest from the processor, should have the address 01. This is necessary to ensure maximum reliability with standard SY/MAX® protocol. SY/MAX devices periodically send out an *inquire* signal to ensure that the communications link has not failed due to poor connections, device failure, etc... The inquire signal is sent to the device addressed as 01. Failure of CM 01 to respond will result in a communication error. Assigning address 01 to the last CM in a chain, allows the connections preceding CM 01 to be checked since the signal must traverse the entire chain to reach the final unit. Subsequent units may then have any address in the range (2..32), excluding the addresses of previously installed units.

In a system utilizing a single CM in a point-to-point configuration, the address switches on the rear of the unit must be set to 00. This informs the CM's internal logic that communications are point-to-point. The communication lines are then biased for proper operation in the point-to-point mode. **Important:** *Though the address switches are physically set to 00, the logical address of the Circuit Monitor will remain 01. Therefore, all communications to the unit should be sent to Circuit Monitor 01, not CM 00.*   ◆

Circuit Monitors are shipped with a default address of 01. Refer to Section 4.1.1 for instructions on setting the Circuit Monitor's address.

4.0 COMPONENT CONFIGURATION

Many of the components discussed in Section 3.0 need to be configured to operate properly in the PowerLogic system. This configuration includes setting jumpers and dip switches to meet the requirements of the PowerLogic system and to allow for user selected options. This section covers the configuration of these components. Refer to the instruction bulletin for each device for additional configuration information.

4.1 Circuit Monitor

Up to 16 Circuit Monitors may be daisy-chained to a single communications port. In order to allow communication to specific Circuit Monitors, each CM must have a unique address. In addition, each Circuit Monitor must be set to operate at the same baud rate as the port to which it is connected. The Circuit Monitor's baud rate and address are set via switches located on the rear of the device. The following sections tell how to set the Circuit Monitor's address and baud rate.

4.1.1 Setting the Circuit Monitor Address

Each Circuit Monitor on a single communications channel must have a unique address assigned to it. (In this context, the term *communications channel means 1 to 16* Circuit Monitors "daisy chained" to a communications port). Once assigned, a Circuit Monitor's address is used in a manner similar to one's home address; for example, for the host to exchange information with the Circuit Monitor whose address is 12, it sends the information over the communication lines, accompanied by the address of the target Circuit Monitor (number 12). In this way, information can be routed to specific CMs in a system.

A Circuit Monitor's address is determined by two ten-position rotary switches located behind a door on the rear of the unit. The switches are accessed by loosening the screws which secure the device address door, and sliding the right end of the door toward the top of the Circuit Monitor. The switches allow a total of 100 settings (0 to 99). The Circuit Monitor only recognizes 39 of those settings, 33 of which are reserved for addressing the unit. Table 4-1 offers a summary of Circuit Monitor switch settings.

Circuit Monitors can be used in either a multipoint configuration (i.e. multiple CMs daisy-chained to a single communication port) or point-to-point configuration (i.e. a single CM). In either case, CM to host communications are virtually the same. A difference arises in the setting of the address switches. The following paragraphs illustrate the difference.

In a system with multiple CMs daisy chained to a single port, the last CM in the chain, i.e. the CM which is located farthest from the port, should have the address 01. This is necessary to ensure maximum reliability with standard SY/MAX protocol. SY/MAX devices periodically send out an *inquire* signal to ensure that the communications link has not failed due to poor connections, device failure, etc... The inquire signal is sent to the device addressed as 01. Failure of CM 01 to respond will result in a communication error. Assigning address 01 to the last CM in a chain, allows the connections preceding CM 01 to be checked since the signal must traverse the entire chain to reach the final unit. Subsequent units may then have any address in the range (2..32), excluding the addresses of previously installed units.

In a system utilizing a single CM in a point-to-point configuration, the address switches on the rear of the unit must be set to 00. This informs the CM's internal logic that communications are point-to-point. The communication lines are then biased for proper operation in the point-to-point mode. **Important:** *Though the address switches are physically set to 00, the logical address of the Circuit Monitor will remain 01. Therefore, all communications to the unit should be sent to Circuit Monitor 01, not CM 00.*

Circuit Monitors are shipped with a default address of 01. To change the address of a Circuit Monitor complete the following steps:

1) Turn the control power to the unit off.
2) Set the address switches to a unique number in the range 1..32. (Set switches to 00 for a single CM system).
3) Return control power to the unit.

Switch Setting	Function
0	Switch Setting for a single CM using point-to-point communications. (Logical device address will be 01).
1-32	Determines the Device Address
33-93	Reserved
94-98	Used to Set the Unit's Baud Rate
99	Reserved

Table 4-1 *- Summary of Circuit Monitor Address Switch Settings*

The Circuit Monitor must be powered down when the address switches are changed. Once changed, the Circuit Monitor will respond to the new address upon return of control power. The Circuit Monitor will retain its address upon loss of control power if the address switches are not changed during the period of power loss.

4.1.2 Setting the Circuit Monitor Baud Rate

The Circuit Monitor is capable of communicating at the following baud rates:

- 19.2 K baud
- 9600 baud
- 4800 baud
- 2400 baud
- 1200 baud

Each Circuit Monitor is shipped with a default setting of 9600 baud, which may be reset as required. The baud rate is set with the use of the device address switches located on the rear of the unit.

To change the baud rate, turn off the control power to the unit, set the device address switch to either 94, 95, 96, 97, or 98, and return control power to the unit. Table 4-2 shows the proper switch settings required for each baud rate.

After the baud rate has been changed, the Circuit Monitor's address must be reset. Section 4.1.1 details the setting of the Circuit Monitor address. The list that follows summarizes the steps required to change a Circuit Monitor's baud rate. Steps 1-3 change the unit's baud rate. Steps 5-7 reset the device address.

1) Turn off control power to the unit.
2) Set the device address switch to the proper baud rate setting (see Table 4-2).
3) Return control power to the unit.
4) Wait 5 seconds.
5) Turn off control power to the unit.
6) Reset the Circuit Monitor's address (see Section 4.1.1).
7) Return control power to the unit. The Circuit Monitor will communicate at the selected rate.

The Circuit Monitor will retain its baud setting upon control power loss.

Address Switch Setting	Baud Rate
94	1200
95	2400
96	4800
97	9600 (default)
98	19.2 K

Table 4-2 - CM Baud Rate Switch Settings

4.2   System Display

The PowerLogic System Display has two groups of DIP switches located on the rear of the unit. (See Figure 4-1). Each switch is located behind a black plastic cover. To remove the cover, insert a small standard screwdriver or other flat object under the edge of the cover and lift.

Each group contains 8 separate switches numbered 1 through 8. Each switch enables or disables a specific function or feature of the System Display. The function of each switch is indicated on a label located to the right of each DIP switch group. Figure 4-2 shows the labels.

Each switch has two positions: OFF (OPEN: switch handle down) and ON (CLOSED: switch handle up). The switch positions required by PowerLogic are described below. For a more detailed description of the switch functions refer to the System Display instruction bulletin (63210-150-01).
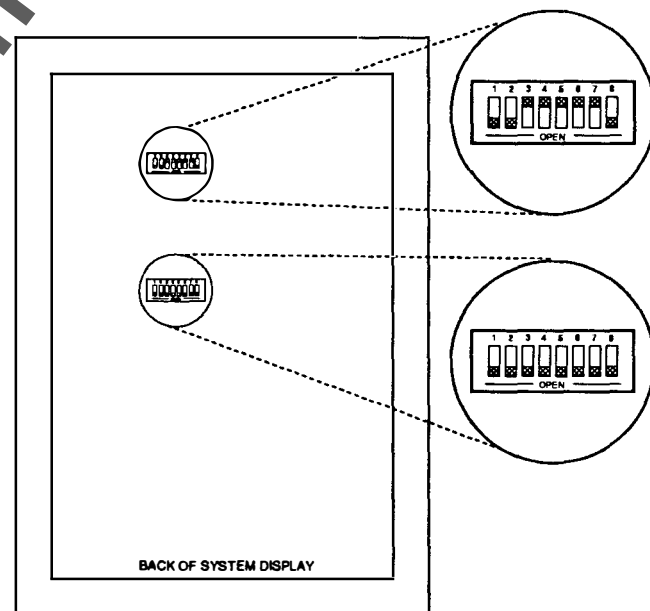

Figure 4-1 - System Display Dip Switches

Switch Group SW1

Switch 1 - This switch must be OFF for normal operation of the System Display. When this switch is ON, the unit will enter the programming mode to allow files to be downloaded from a PC.

Switch 2 - This switch must be OFF to run the display program. When this switch is ON, the unit will simulate all protocol communications.

Switch 3 - When this switch is ON, the user will be able to use the backlight key on the keyboard to change the LED backlighting in four steps (0%, 33%, 66%, and 100%). When this switch is OFF, the backlighting cannot be adjusted and will retain its current setting.

Switch 4 - When this switch is ON, the user will be able to use the contrast key on the keypad to change the LCD contrast in four increments. When this switch is OFF, the contrast cannot be adjusted and will retain its current setting.

Switch 5 - This switch should be ON. When this switch is ON, the System Display may scale data to and from Circuit Monitors as required.

Switch 6 - When this switch is ON, the defined Master Security Code can be used to edit the other security codes, three (3) per security screen. When this switch is OFF, security codes cannot be changed. Section 5.3 offers instructions on setting security codes.

Switch 7 - When this switch is ON, the function key will have no effect when pressed. When this switch is OFF, the function key will operate normally, allowing access to the System Display Setup Menu. (System Display setup is described in Section 5.0).

Switch 8 - This switch must be OFF. When this switch is ON, the System Display will enter its "terminal" mode, displaying any ASCII text that it receives and sending ASCII text when its keys are depressed.

Switch Group SW2 - (Model SD-220 Only)

Switch 1 - When this switch is ON, the printer port is enabled. When this switch is OFF, any attempts to print will be disregarded.

Switch 2 - When this switch is ON, the System Display will send a linefeed with a carriage return each time a print command is executed. When OFF, a linefeed will not be automatically sent. This switch should be ON.

Switch 3 - When this switch is ON, the "Handshaking" for the printer port is enabled. When this switch is OFF, data is transmitted in a "don't care" situation, and if the printer is not ready data is lost. This switch should be OFF.

Switch 4 - NOT USED.

Switch 5 - This switch tells the System Display to transmit in Full or Half Duplex when in terminal mode. Since the System Display protocol is "turned off" in terminal mode, this switch must be OFF.

Switch 6 - This switch enables the linefeed capability when the System Display is in terminal mode. Since the System Display protocol is "turned off" in terminal mode, this switch must be OFF.

Switch 7 - This switch enables the cursor when the System Display is in terminal mode. Since the System Display protocol is "turned off" in Terminal Mode, this switch must be OFF.

Switch 8 - NOT USED.

SW1	ON (ENABLE) / OFF (DISABLE)
1	DOWNLOAD / RUN PROGRAM
2	SIMULATE PROTOCOL ENABLE
3	BACKLIGHT CHANGE ENABLE
4	CONTRAST CHANGE ENABLE
5	SCALING ENABLE
6	MASTER SECURITY ENABLE
7	FUNCTION KEY ENABLE
8	TERMINAL MODE ENABLE
OFF = OPEN	
ON = CLOSED	

SW2	ON (ENABLE) / OFF (DISABLE)
1	PRINTER PORT ENABLE
2	PRINTER LINE FEED ENABLE
3	PRINTER HANDSHAKE ENABLE
4	NOT USED
5	• TERMINAL FULL/HALF DUPLEX
6	• TERMINAL LF ENABLE
7	• TERMINAL CURSOR ENABLE
8	NOT USED
OFF = OPEN	
ON = CLOSED	

Figure 4-2 - System Display Dip Switch Function Tables

4.3   PowerLogic Network Interface Module (PNIM)

On the rear of the PowerLogic Network Interface Module (PNIM) are three groups of DIP switches labeled S3, S4, and S5. (See Figure 4-3). DIP switch group S3 contains four individual switches (numbered 1 to 4) and is used to set the baud rate at which the network port is to operate. DIP switch groups S4 and S5 each contain seven individual switches (numbered 1 to 7) and are used to select the mode of operation, comm port baud rate and other special functions for communication ports 1 and 0, respectively.

Certain switch settings are required for proper communication with Circuit Monitors in a PowerLogic System. The following paragraphs detail the proper switch settings.
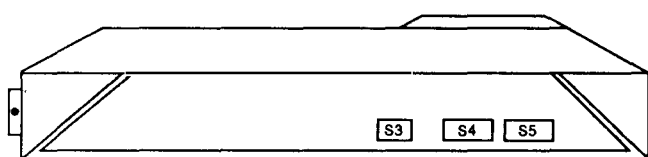
Back of PNIM

Figure 4-3 - *Location of PNIM DIP Switches*

Figure 4-4 - *PNIM DIP Switch S3 Configuration*

Switch Group S3 - Network Baud Rate

Switch group S3 selects the communication baud rate of the network port. PowerLogic does not require a specific network baud rate, but the baud rate should be set the same for all NIMs, PNIMs, and SY/LINK boards connected on the same network cable.

NOTE: As the network baud rate increases, it becomes necessary to limit the maximum overall length of the network cable in order to reduce noise susceptibility. Figure 4-4 shows the DIP switch positions for each baud rate along with the maximum network length for each. Refer to Section 5.5 for more on network length limitations.
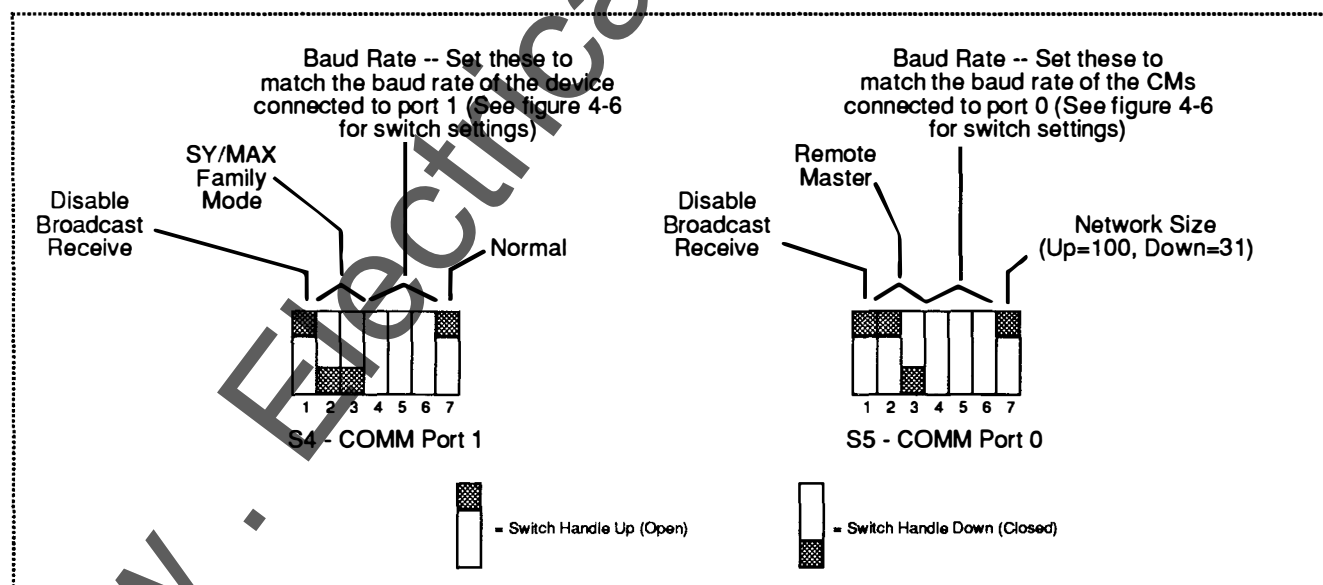

Figure 4-5 - *PNIM DIP Switch S4 and S5 Configuration*

Switch Groups S4 and S5 - COMM Port Parameters

Switches S4 and S5 are used to set communications parameters for COMM Port 1 and COMM Port 0, respectively. The switches select the following values:

- Broadcast Enable / Disable
- Mode of Operation
- Baud Rate
- Self Test
- Network Size (100 / 31)

A description of the switch functions and positions follows. Figure 4-5 summarizes the switch settings.

Switch S4 - COMM Port 1

Switch 1 - Switch 1 of switch group S4 selects whether broadcast messages on the network port will be received by a COMM port. This switch should be OPEN (handle up) to disable broadcast receive.

Switches 2, 3 - Switches 2 and 3 of switch group S4 select the operating mode of COMM port 1. Port 1 must be set for SY/MAX Family mode. To do this, set both switches to CLOSED (switch handles down).

Switches 4, 5, 6 - Switches 4, 5, and 6 set the baud rate at which the PNIM will communicate to the device connected to Port 1. This should match the baud rate of the device connected to the port. Figure 4-6 illustrates the switch positions for each baud rate.

Switch 7 - Switch 7 of switch group S4 is set UP for normal PNIM operation, or DOWN to enable the self-test mode. This switch should be set to the UP position.

Switch S5 - COMM Port 0

Switch 1 - Switch 1 of switch group S5 selects whether broadcast messages on the network port will be received by a COMM port. This switch should be OPEN (handle up) to disable broadcast receive.
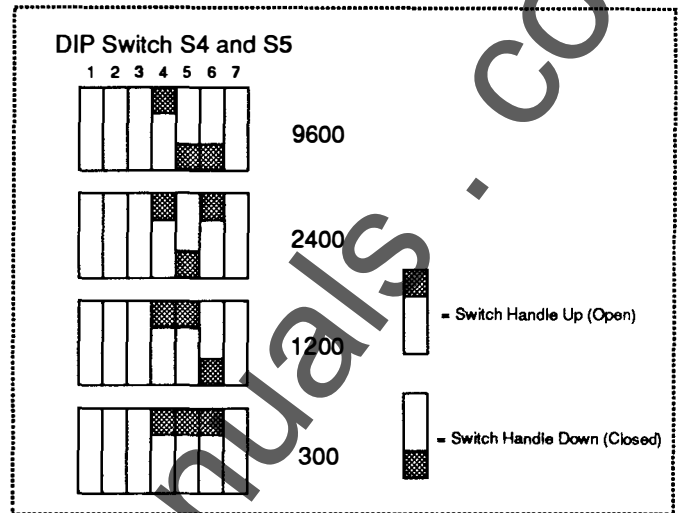
Figure 4-6 - PNIM DIP Switch S4 and S5 Baud Rate Configuration

Switches 2, 3 - Switches 2 and 3 of switch group S5 select the operating mode of COMM port 0. When communicating to Circuit Monitors, port 0 must **always** be set for Remote Master mode. To do this, set switch 2 to Up (OPEN) and switch 3 to Down (CLOSED).

Switches 4, 5, 6 - Switches 4, 5, and 6 set the baud rate at which the PNIM will communicate to the CMs connected to Port 0. This should match the baud rate of the CMs. Figure 4-6 shows the switch positions for each baud rate. Refer to Section 4.1 for instructions on changing the Circuit Monitor baud rate.

Switch 7 - Switch 7 of switch group S5 is set UP for a local network size of 100 network interfaces (00 through 99), or DOWN to limit the network size to 31 interfaces (00 through 31). Limiting the size improves the efficiency of the network. All NIMs, PNIMs and SY/LINK boards on the same network cable must be set for the same network size.

4.4   SY/LINK Board

The only hardware configuration required for the SY/LINK board involves the selection of the memory address range. This memory address range tells the computer which memory addresses to use for SY/LINK board functions and is set using the DIP switch on the SY/LINK board. The PowerLogic Software has a default address range of CA000 to CA3FF. To specify the address range CA000 to CA3FF, set the four switches on the board to the OFF position.

More information on the SY/LINK board can be found in the instruction bulletin for the SY/MAX Class 8010 Type SFI-510, 533, and 534 SY/LINK Network Interface Boards (Bulletin number 30598-277-01).

4.5   Modem

A modem can be installed in the system to provide for communication over phone lines. The modem used by the PowerLogic system is a Universal Data Systems 212A LP modem. Instructions for configuring the modem are offered below.

The SY/MAX components use 8 data bits, 1 start bit, 1 stop bit, and even parity format for communication over serial (COMM) ports. The modem must be set up to recognize this 11 bit word length. Figure 4-7 shows the proper strap position for the 11 bit word length. **Remove the cover from the modem. Place the jumpers in the positions shown in Figure 4-7, and replace the cover.**

In addition to the internal configuration straps, the modem has three external switches which must be properly set in order to establish successful communication. These switches are: the DATA/TALK switch, located on the front of the modem; the High/Low Speed switch, located on the rear of the modem; and the Answer/Originate switch, also on the rear of the modem (See Figure 4-7).

The **High/Low Speed switch** determines the baud rate at which the modem will transmit data. *This switch, on both the modem located in the switchgear compartment and the modem at the remote terminal, should be set to transmit data at 1200 bps.*

The **Answer/Originate switch** sets the modem up to either receive data or transmit data. *The modem located within the switchgear housing should always be in the Answer position. The modem at the remote workstation should always be in the Originate mode.*

The final switch is the **DATA/TALK switch**, a rocker switch located on the front of the modem. When the switch is in the DATA position, the modem is setup to exchange data. *The modem located in the switchgear housing should always be in DATA mode.*

At the remote terminal, when the modem is not in use, the DATA/TALK switch should be in the TALK position. When in TALK position, your modem will not have any effect on normal conversation. The phone may be used as usual. **To "call up" the PowerLogic system,** the switch must first be in the TALK position. Simply dial the number of the modem located in the switchgear housing, and when the responding tone is heard, change the DATA/TALK switch to the DATA position and hang up the telephone handset. Data transmittal will then proceed. More information can be found in the Universal Data Systems 212A LP modem Installation and Operation Manual.
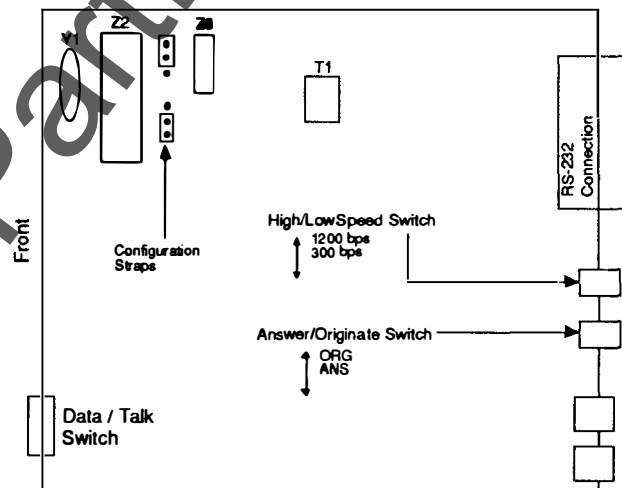

Figure 4-7 - Modem Setup

4.6 RS-232 to RS-485 "Black Box" Converter

The RS-232 to RS-485 converter supplied with the Power-Logic Modem Communications Kit (MDK-012) has five switches/jumpers which must be configured to allow conversion between RS-232 and RS-485 signals. Figure 4-8 shows the location and proper settings for each.

The only external switch, labeled DLB, is located on the front of the Black Box. The switch should always be in the "Normal" or Out position.

To access the internal switches, remove the cover by completely removing the thumb screw located on the bottom of the Black Box. Switch S2, located near the back of the Black Box, also has two positions: Terminated and Unterminated. Set this switch to the Terminated position. A Dip shunt is used to determine whether the Black Box will act as a DTE or DCE device. The Dip Shunt should be in the DTE position.

Also located inside the Black Box are two jumpers labeled

W8 and W9. Jumper W8 has two positions, HALF Duplex and FULL Duplex. Set the jumper to FULL. Jumper W9 has four positions. Set Jumper W9 to the ON position.

4.6.1 Connecting the CAB-106 Cable

The RS-232/RS-485 converter is connected to the SY/LINK Card using a CAB-106 Interconnect Cable. The cable's wires must be connected to the TXA, TXB, RXA, and RXB terminals inside the converter as indicated by Figure 4-9. Table 4-3 summarizes the connections. Note: The shield may be connected to the screw which secures the power cable to the converter housing as shown in Figure 4-9.

Terminal	Wire Color
TXA	RED
TXB	GREEN
RXA	BLACK
RXB	WHITE

Table 4-3 - CAB-106 Connections to Converter

Switch S2 should be in the **TERM.** position.

The dip shunt should be in the **DTE** position.

Jumper **W8** should be set to **Full** Duplex.

This switch should be in the **Normal** ("out") position.

Jumper W9 should be in the **ON** position.

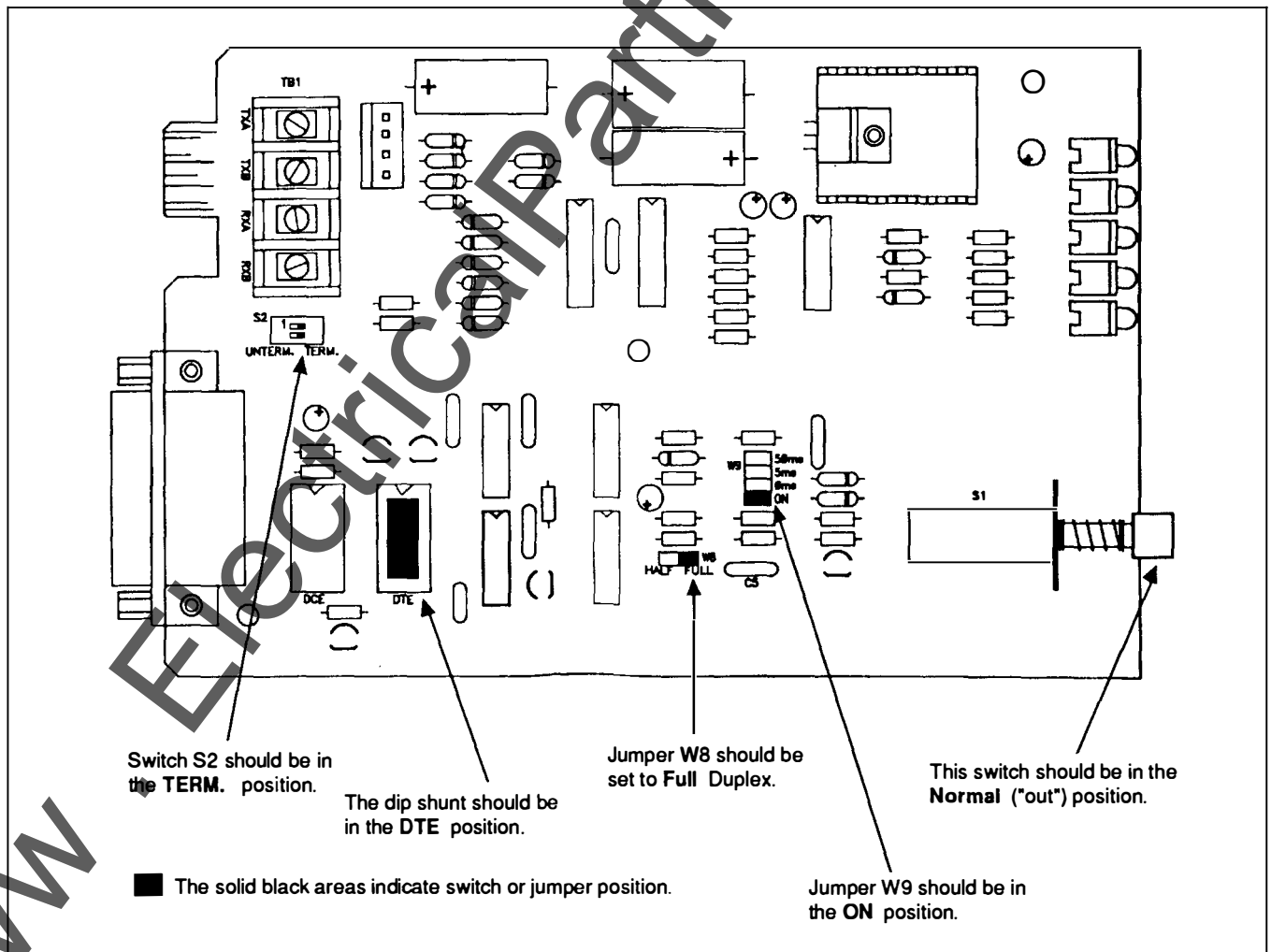■ The solid black areas indicate switch or jumper position.

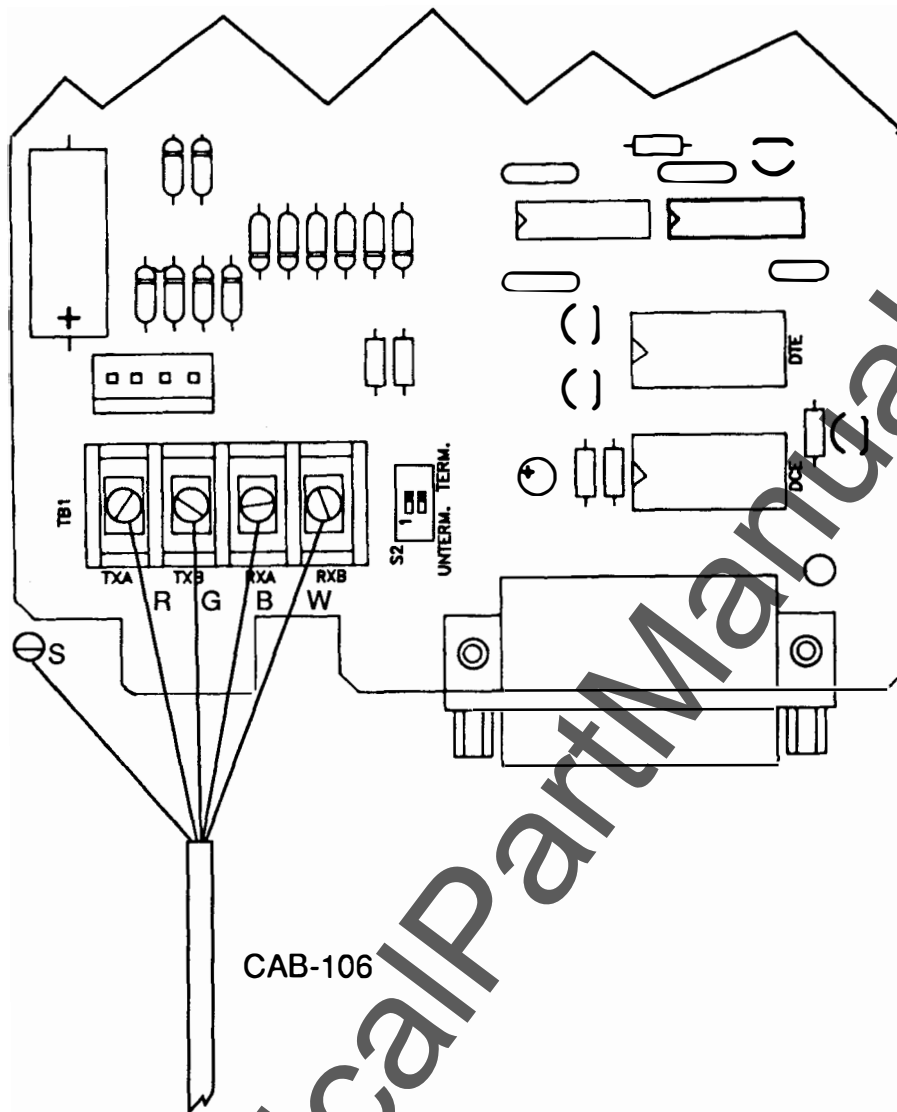**Figure 4-8** - RS-232 / RS-485 Converter Configuration

Figure 4-9 – CAB-106 to Black Box Converter Connections

4.7 Model 400 Processor (System 4)

The SY/MAX Model 400 processor uses an on-board lithium battery to protect the information in RAM should power be lost. This battery is shipped with the processor and needs to be installed. To install the battery, **remove the battery housing cover on the front of the processor, install the battery as shown in the diagram under the cover, and replace the cover.** The date the battery is installed should be marked with tape on the front of the processor.
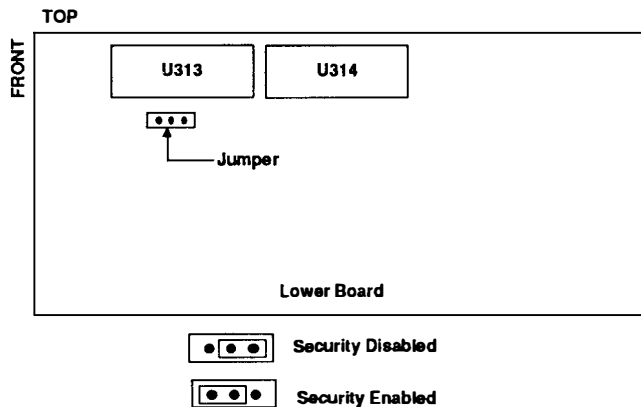

Figure 4-10 - Model 400 Security Jumper

The Model 400 processor has an internal jumper that sets the hardware security level. The jumper is accessed by removing the Model 400's side plate (see Figure 4-10). The internal jumper is located on a three-pin header. If the jumper connects the pin closest to the front of the processor with the center pin, the security is enabled. With the jumper connecting the pin farthest from the front of the processor to the center pin, the security is disabled. **Ensure that the jumper is set to *disable* the security.**

All other user selected features of the Model 400 processor are controlled by software switches. More information on the Model 400 processor can be found in the instruction bulletin for the SY/MAX Class 8020 Types SCP-401, 423, 424, and 444 Model 400 Processor (Bulletin number 30598-503-01).

4.8 Local / Remote Interface Modules (System 4)

The largest SY/MAX register rack has 18 slots available for modules. If a system requires more than 18 SY/MAX modules, or if a double-ended lineup is physically separated by a tie busway or cable, a local / remote interface may be used to connect multiple racks. The local / remote interface consists of two modules: a CRM-210 (local interface with 512 registers), and a CRM-222 (standard size remote interface).

A single local interface (LI) may have up to 8 remote interfaces (RI) connected to it. Each RI must have a drop number, from 1 to 8, assigned to it. A drop number is assigned to an RI by a DIP switch located on the rear of the module near the edge of the circuit board. **If only one RI is required, verify that all handles on the DIP switch are down (on).** This sets the RI module as drop #1 and the last drop on the channel. For more information, refer to the instruction bulletin for the SY/MAX Local/Remote Interface Class 8030 Types CRM-210, 211, 220, 222 (Bulletin number 30598-247-02).

4.9 Dual Interface Converter Module (System 3, 4)

The Dual Interface Converter Module allows for an RS-232 type device such as a modem to communicate with a SY/MAX component such as the Model 400 processor or the Network Interface Module. Configuration of this module involves setting the device type (either DCE or DTE) and matching the signal lines to the requirements of the RS-232 device. Two DIP shunt switches and two jumpers, shown in Figure 4-11, control these settings for the Dual Interface Converter Module.

There are two channels on the Dual Interface Converter Module and either one can be used for RS-232 communication. **Select which channel will be used to communicate with the RS-232 device.** DIP shunt switch S1 and jumper W3 are used to configure channel 1 while DIP shunt switch S2 and jumper W4 are used to configure channel 2. **Ensure that the DIP shunt switch for the selected channel is in the DCE position.** This will allow data to be received on pin 2 of the RS-232 connector on the Dual Interface Converter Module and data to be transmitted on pin 3.

Most modems require a Data Terminal Ready (DTR) signal to be active (high) on pin 20 of the standard RS-232 connector. **Connect positions 5 and 6 of jumper W3 for channel 1 or jumper W4 for channel 2.** This will provide a constant active (+12 volt) signal on the modems DTR line. More information on the Dual Interface Converter Module can be found in the instruction bulletin for the SY/MAX Class 8030 Type CRM-601 Dual Interface Converter Module (Bulletin number 30598-152-01).
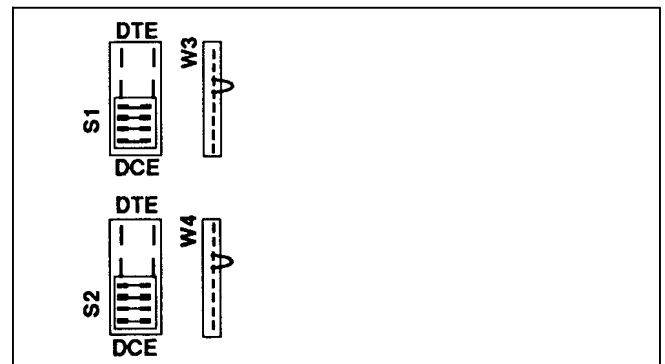

Figure 4-11 - Dual Interface Converter Module Switch and Jumper Configuration

5.0 APPLICATION CONSIDERATIONS

5.1   Wiring CTs and PTs

Figures 5-3, 5-4, and 5-5 offer typical wiring plans for Circuit Monitors in a 3-phase/3-wire system, a 3-phase/4-wire system, and a 3-phase/4-wire system with mixed loads (3-wire and 4-wire loads).

Multiple Circuit Monitors are paralleled allowing CMs to share one set of 3-phase PTs. Figure 5-5 illustrates PTs wired in parallel. (NOTE: This wiring method requires that PT secondaries are grounded in only one location). Unlike the PTs, each Circuit Monitor requires a separate set of CTs, wired as shown by the first Circuit Monitor in Figures 5-3, 5-4, and 5-5. The following list summarizes important wiring considerations.

- Multiple Circuit Monitors may be connected in parallel to a single set of PTs
- Each Circuit Monitor requires its own set of CTs
- PT secondaries are grounded in only one location

5.2   Communication Wiring

The Circuit Monitor requires a communication cable containing two shielded twisted pairs (Belden 8723 or equivalent). Communications wires are **daisy-chained** from one Circuit Monitor to the next, IN+ being wired to IN+, OUT- to OUT- and shield to shield. Figure 5-1 illustrates *correct* communication wiring. Figure 5-2 shows an *incorrect* wiring method. Never wire Circuit Monitor communications in this manner. Doing so will cause unbalanced impedence in the communications lines resulting in corruption of data.
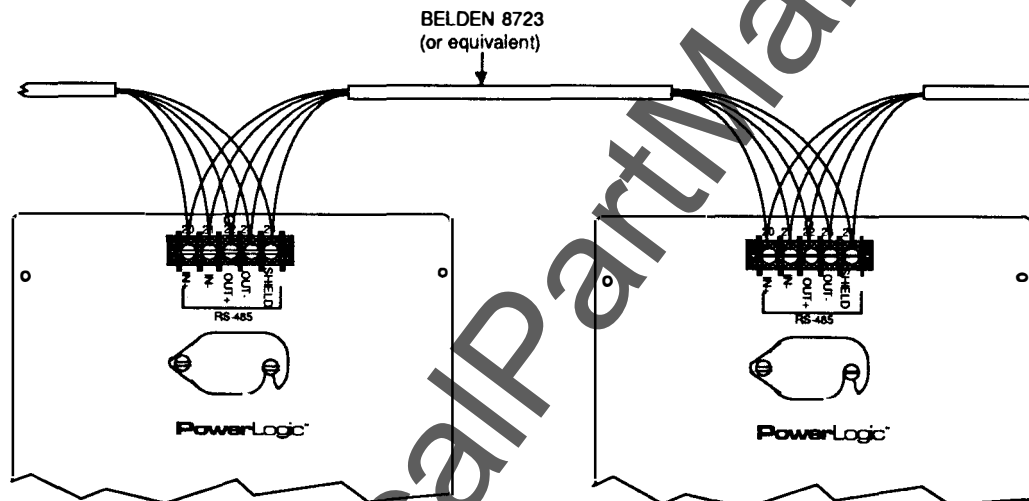
IMPORTANT: The communications shield is terminated at each Circuit Monitor.

Figure 5-1 - CORRECT Circuit Monitor Communication Wiring
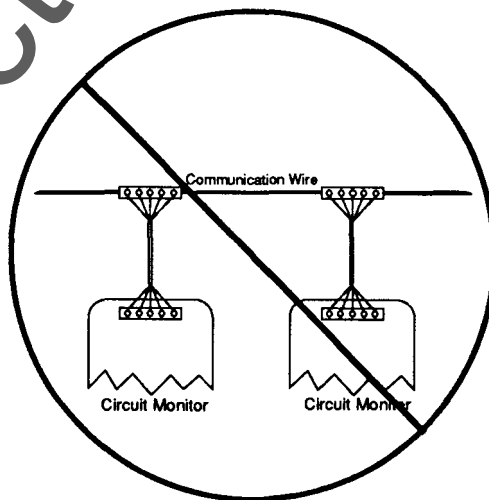
Figure 5-2 - INCORRECT Circuit Monitor Communication Wiring

3 PHASE / 3 WIRE SYSTEM
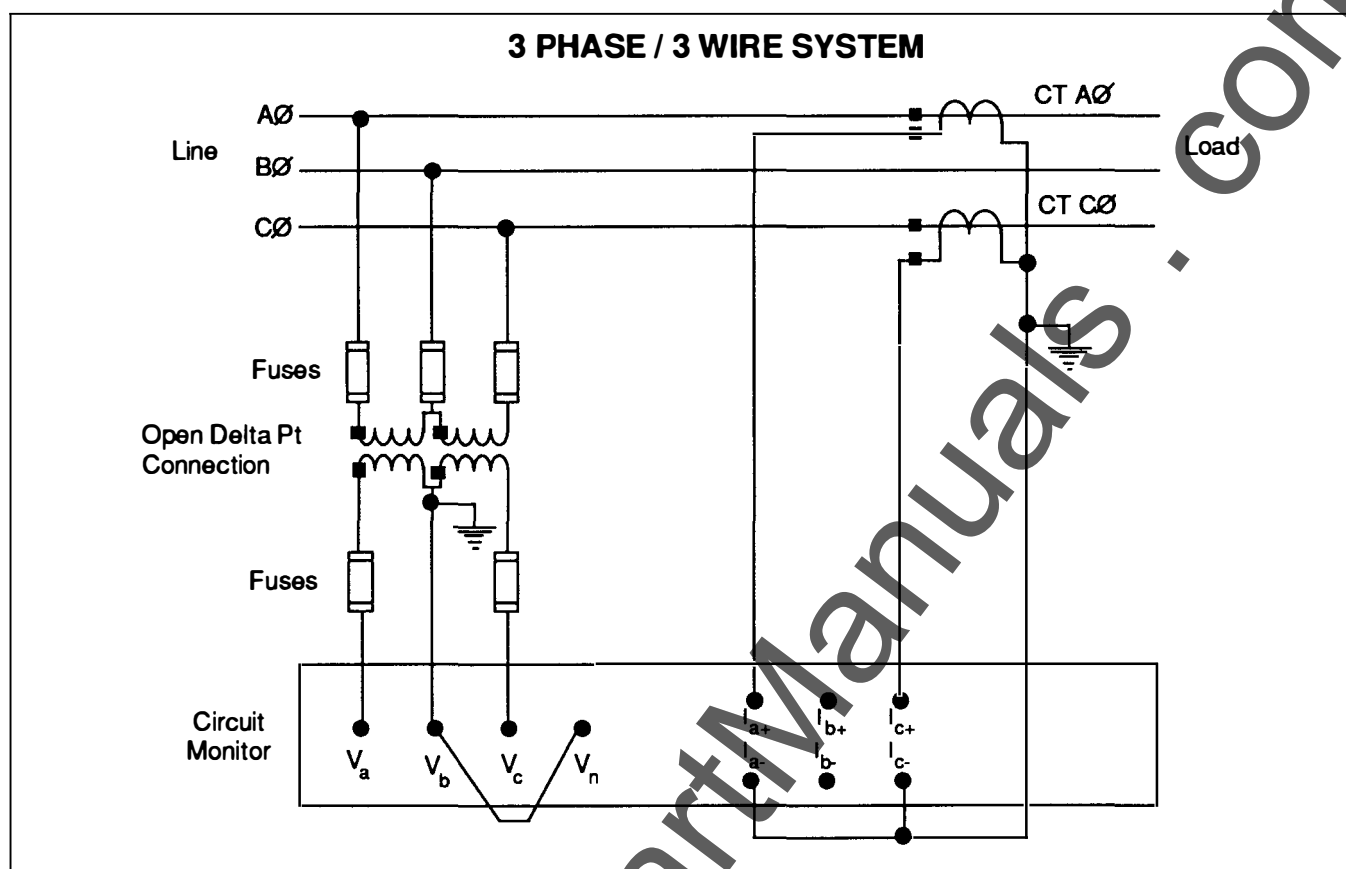
Figure 5-3 - Circuit Monitor Wiring for 3 Phase / 3 Wire system.

3 PHASE / 4 WIRE SYSTEM
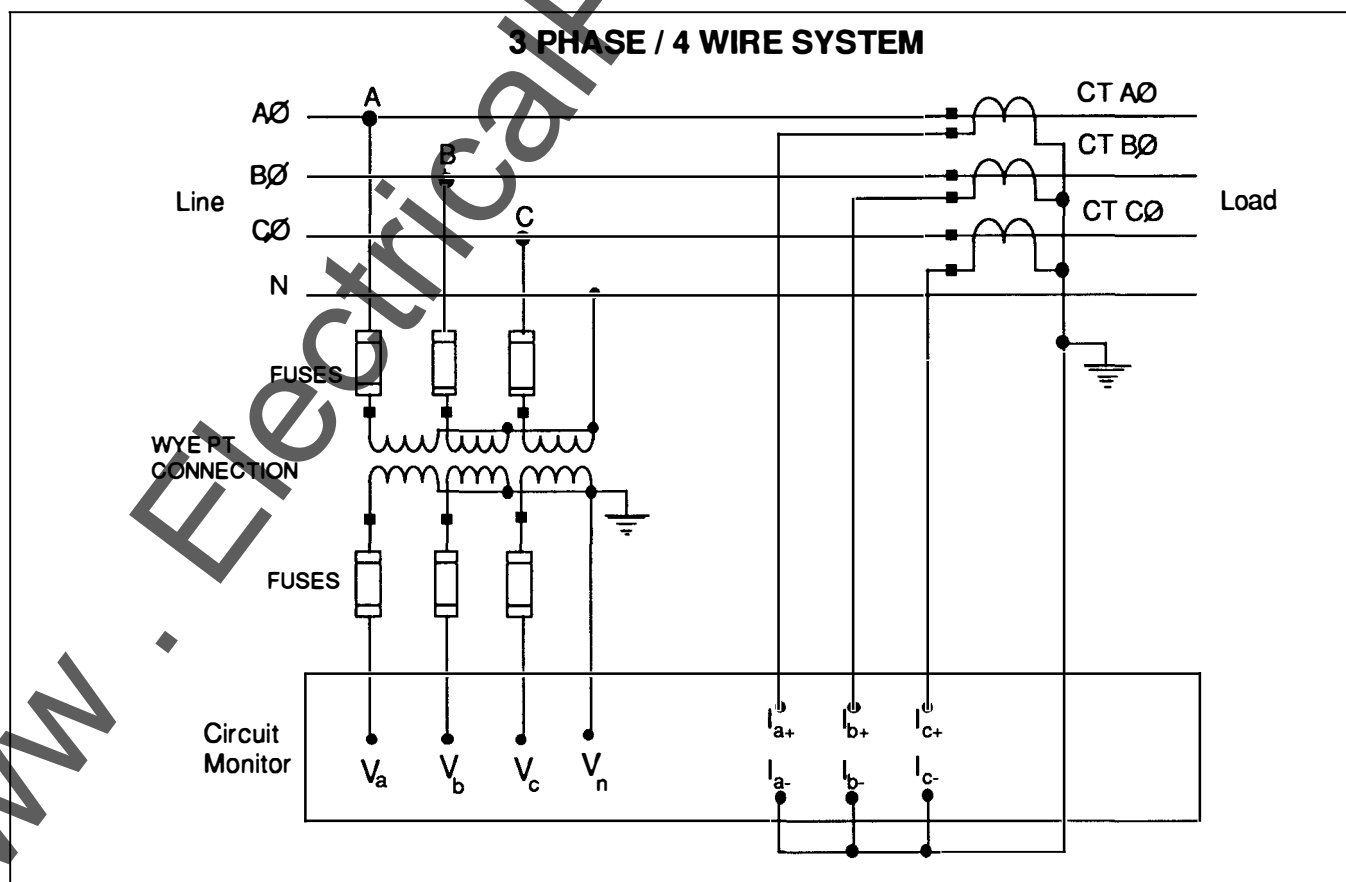
Figure 5-4 - Circuit Monitor Wiring for 3 Phase / 4 Wire system.

3 PHASE / 4 WIRE SYSTEMS - MIXED LOADS
(3 WIRE AND 4 WIRE LOADS)
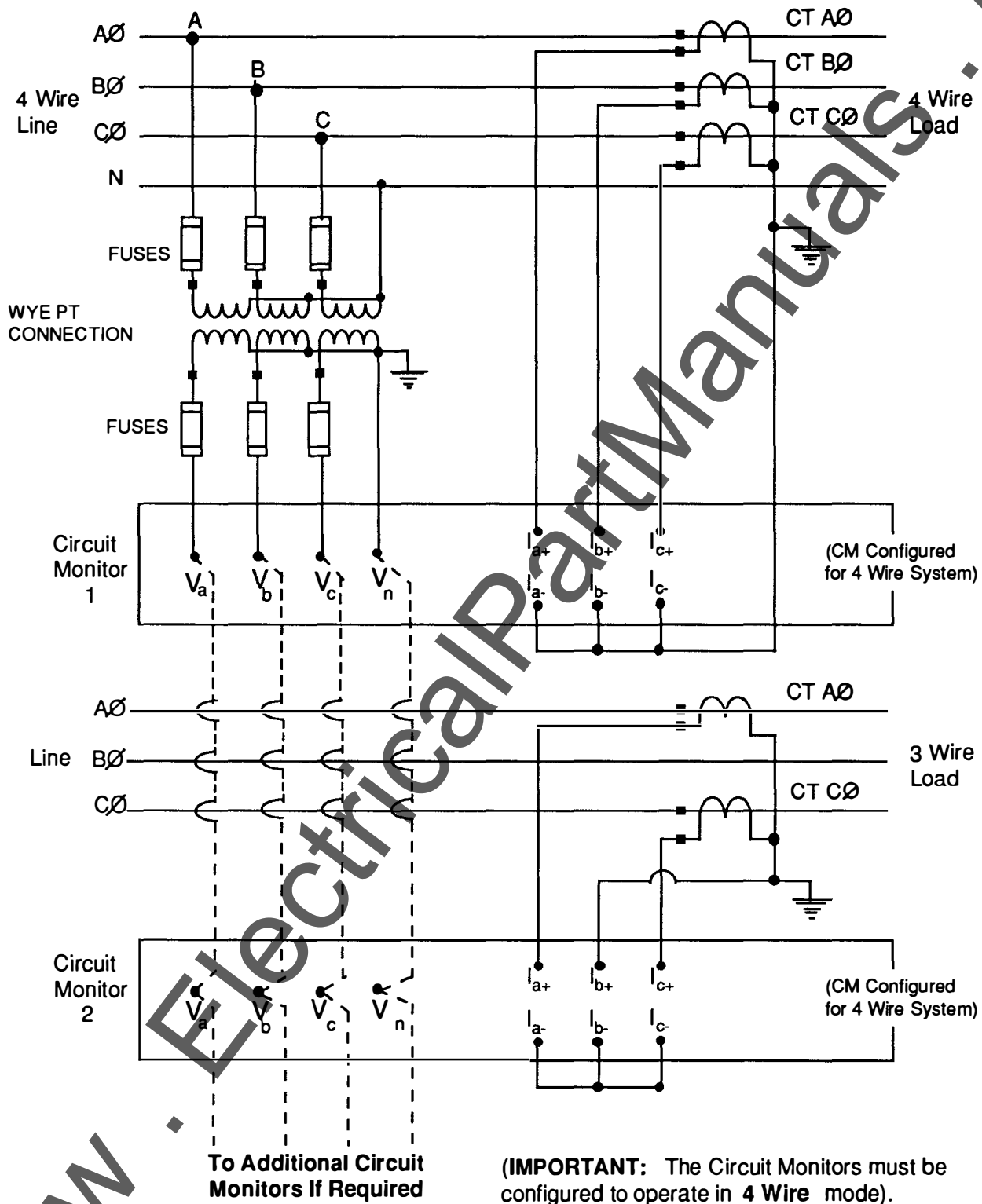
Figure 5-5 - *Circuit Monitor Wiring for 3 Phase / 4 Wire systems with mixed loads.*

5.3   Circuit Monitor Case Grounding

Grounding of the Circuit Monitor case is normally accomplished through the connection of its hardware to a grounded metal enclosure. If additional grounding is deemed necessary, a separate equipment ground wire may be connected to one of the Circuit Monitor's mounting studs.

5.4   Component Spacing

Recommended spacings between programmable controller components or between components and the sides of the enclosure are indicated in Figure 5-6. A six inch (152mm) minimum clearance is required between PLC components and any electro-mechanical or incoming line device such as mag-

netic starters, contactors, relays, etc... Clearances are determined by the space necessary to attach electrical plugs, route cables and wires, meet ventilation requirements for heat dissipation, prevent electrical noise transmission, and provide hand and tool access for maintenance.

SY/MAX® power supplies may be placed directly alongside an I/O rack or above it. Allow a 6 inch clearance when mounting the power supply above the rack. The power supply may be mounted vertically or horizontally.

Locate the power supply within cable distance of the racks it will support. The power supply must also occupy a position that allows unobstructed insertion and removal of the power supply battery pack.

Rack Assembly Mounting Configurations $\frac{INCHES}{MM}$
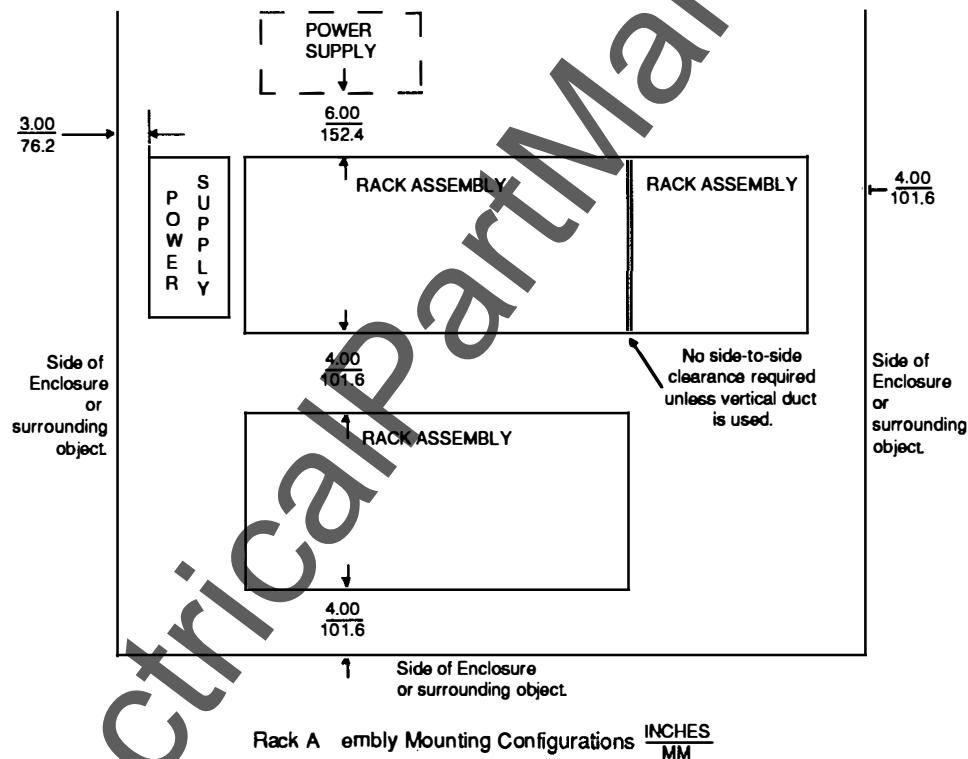
Figure 5-6 - Component Spacing: Type HRK and RRK Racks

5.5 Temperature

Most SY/MAX® Programmable Controller components are rated for an operating temperature range of 0 to 60 degrees Celsius. Storage temperature rating is -40 to 80 degrees Celsius. The Circuit Monitor has an operating temperature range of -25 to 70 degrees Celsius and a storage temperature of -40 to 85 degrees Celsius. The SY/VIEW® workstation is rated for an operating temperature of 0 to 50 degrees Celsius and a non-operating temperature of -40 to 60 degrees Celsius. If an internal floppy disk drive is installed, the operating temperature range becomes 5 to 40 degrees Celsius. Special care should be taken to maintain a temperature within the specified range when using a SY/VIEW workstation as a local display.

The operating range applies to ambient temperatures around the devices (inside the enclosure). If conditions produce temperature "hot spots" inside the enclosure that are higher than the stated range, a fan or air line should be installed to circulate the air and equalize the temperature. Refer to the instruction bulletin for each component for additional environmental specifications.

5.6 Network Cable Length

The maximum network cable length is dependent on the selected speed of the network communication and on the drop lengths used on the network. The drop length is the cable distance between the SY/LINK board or NIM and the Tee Connector. The table 5-1 lists the maximum network cable length based on network baud rate.

Network Baud Rate	Maximum Network Length (Feet/Meters)
62.5 K Baud	15,000 / 4,572
125 K Baud	9,250 / 2,819
250 K Baud	4,250 / 1,295
500 K Baud	2,400 / 732
(drop length = 0 feet/meters)	

Table 5-1 - Maximum Network Cable Length, Drop length = 0

The network cable lengths listed in table 5-1 are based on connecting the network Tee connector directly to the network connection cable from the SY/LINK board, NIM or PNIM (drop length 0 feet). When it is necessary to extend the length of the network drop, table 5-2 can be used in determining the maximum possible network length.

Network Baud Rate	Number of Drops	Drop Length	Maximum Network Length (Feet/Meters)
62.5 K Baud	25	100	15,000 / 4,572
62.5 K Baud	100	100	950 / 290
125 K Baud	100	0	9,250 / 2,819
250 K Baud	100	0	4,250 / 1,295
500 K Baud	100	0	2,400 / 732

Table 5-2 - Max Network Cable Length, Variable Drops

5.7   Deriving Circuit Monitor Control Power From Phase PT Inputs

Whenever possible, Circuit Monitor control power should be obtained from a stable 120 VAC source. If such a source is unavailable, CM control power may be derived from phase PT inputs.

To do this, connect the Circuit Monitor's phase A voltage terminal, V_a (terminal 8 on the rear of the CM), to the Line terminal on the CM's control power strip (terminal 34). Also, connect the neutral voltage terminal, V_n (terminal 7), to the neutral terminal on the Circuit Monitor's control power terminal strip (terminal 35). Figure 5-7 illustrates the proper connections.
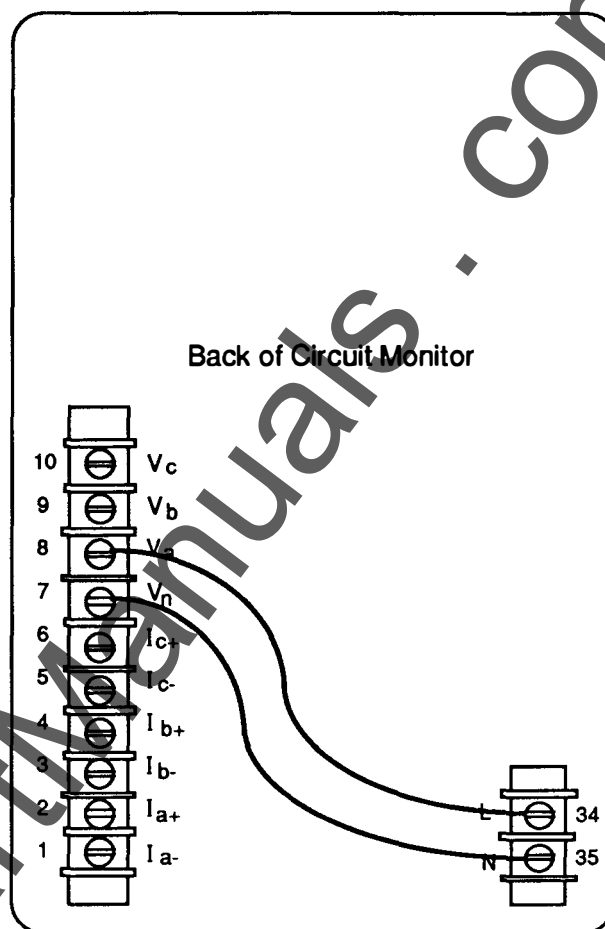
Figure 5-7 - Circuit Monitor Deriving Control Power from PT Inputs

Appendix A - Listing of PowerLogic Components and System-Compatible Products

	PowerLogic Products	
Class	**Catalog No.**	**Description**
		PowerLogic Circuit Monitors
3020	CM-100X1	Circuit Monitor, Model 100 (120VAC)
3020	CM-108X1	Circuit Monitor, Model 108 (120VAC)
3020	CM-144X1	Circuit Monitor, Model 144 (120VAC)
3020	CM-150X1	Circuit Monitor, Model 150 (120VAC)
3020	CM-200X1	Circuit Monitor, Model 200 (120VAC)
3020	CM-208X1	Circuit Monitor, Model 208 (120VAC)
3020	CM-244X1	Circuit Monitor, Model 244 (120VAC)
3020	CM-250X1	Circuit Monitor, Model 250 (120VAC)
3020	CMX-101	Circuit Monitor Trim Ring Kit
		System Components
3050	SD-200X1	System Display, Model 200 (120VAC)
3050	SD-220X1	System Display, Model 220 (120VAC)
		Packaged Systems
3070	QSK-200	Quick-Start Kit (With Circuit Monitor CM-200)
3070	MDK-012	Modem Communications Kit (with converter & cables)
		PowerLogic Application Software Series
3080	PSW-101	Product Communications Software (3.5" and 5.25" Disk)
3080	SSW-101	System Monitoring Software (3.5" and 5.25" Disk)
3080	SMS-700	System Manager Software (w/ Windows 3.0 & mouse)
3080	SMS-770	System Manager-Plus Software (w/ Windows 3.0 & mouse)
		PowerLogic System Accessories
3090	CAB-102	Interconnect Cable (CRM-601 to Modem)
3090	CAB-104	Interconnect Cable (RS-232/RS-485 Converter to Modem)
3090	CAB-106	Interconnect Cable (10-Ft Flying Lead, Spade Lugs)
3090	CAB-107	Interconnect Cable (10 Ft Flying Lead, Spade Lugs)
3090	CAB-108	Interconnect Cable (10 Ft Flying Lead, Spade Lugs)
3090	MCA-485	RS-485 Multipoint Communications Adapter
3090	MCT-485	RS-485 Multipoint Communications Terminator
3090	ATM-120	Auxiliary 120 VAC Test Module
		PowerLogic Instruction Bulletins
	63210-200-xx	System Planning and Installation Guide
	63074-140-xx	Circuit Monitor Instruction Bulletin
	63210-150-xx	System Display Instruction Bulletin

Selected Listing of SY/MAX Products Used In PowerLogic		
Class	**Catalog No.**	**Description**
		SY/MAX Processors
8020	SCP-401	Model 400 4K RAM without Floating Point
8020	SCP-423	Model 400 8K RAM, Floating Pt, High Speed Scan
8020	SCP-424	Model 400 16K RAM, Floating Pt, High Speed Scan
8020	SCP-444	Model 400 16K RAM/PROM, Fltg Pt, High Speed Scan
		SY/MAX Register Racks
8030	RRK-100	Register Rack, 5-Slot
8030	RRK-200	Register Rack, 9-Slot
8030	RRK-300	Register Rack, 18-Slot
8030	CBP-106	Register Slot Cover Plate
		SY/MAX Power Supplies
8030	PS-11	Power Supply, 64 I/O Capacity (120 VAC)
8030	PS-21	Power Supply, 128 I/O Capacity (120 VAC)
8030	PS-31	Power Supply, 512 I/O Capacity (120 VAC)
8030	PS-41	Power Supply, 64 I/O Capacity (240 VAC)
8030	PS-51	Power Supply, 128 I/O Capacity (240 VAC)
8030	PS-61	Power Supply, 512 I/O Capacity (240 VAC)
8030	PS-70	Power Supply, 128 I/O Capacity (24 VDC)
8030	PS-74	Power Supply, 128 I/O Capacity (125 VDC)
8030	CC-xx	Power Supply Cable
		SY/MAX Digital I/O Modules
8030	RIM-101	16-Point Digital Input Module
8030	ROM-221	16-Point Digital Output Module
		SY/MAX Data Communications
8030	CRM-210	Local Interface Module with 512 Registers
8030	CRM-211	Local Interface Module with 4096 Registers
8030	CRM-222	Remote Interface Module, Digital I/O Rack, 8-Point
8030	CRM-601	RS-422/232 Dual Interface Converter Module
8030	CRM-510	SY/NET Network Interface Module
8030	CRM-565	PowerLogic Network Interface Module
8030	CCK-212	SY/NET Network Tee Connector
8030	CCK-213	SY/NET Network Terminator (Set of 2)
8010	CC-102	9-Pin Differential Cable, 2 Ft.
8010	CC-106	9-Pin Flying Lead Differential Cable
8010	SFI-510	SY/LINK PC Interface Board
		SY/MAX Operator Interface
8010	SDF-602	SY/VIEW Color Workstation
8054	SFI-470	Internal Hard Disk Card for SY/VIEW
8054	DSK-100	Internal 3.5" Disk Drive for SY/VIEW
8054	SFW-700	MS-DOS Version 3.2 Operating System
8010	PP-102	Printer with RS-232 Interface
8010	PP-104	Printer with RS-422 Interface
		SY/MATE Software Support
8010	SFW-234	234LINK Spreadsheet Interface Software
8010	SFW-601	Screenware2 Color Graphics Interface

Applicable SY/MAX Instruction Manuals
30598-605	SM-605 Complete 3-Volume Set
30598-175-01	SY/MAX PC Planning and Installation Guide
30598-503-01	Model 400 Processor
30598-265-01	Register Racks
30598-156-02	Power Supplies
30598-282-01	16-Point Digital Input Module
30598-283-01	16-Point Digital Output Module
30598-247-02	Local / Remote Interface
30598-253-01	Local Interface Errata Sheet
30598-152-01	RS-422/232 Dual Interface Converter Module
30598-756-01	PowerLogic Network Interface Module
30598-257-01	SY/NET Network Interface Module
30598-277-01	SY/LINK Network Interface Card for PCs
30598-510-01	SY/VIEW Color Workstation

Appendix B - Routing in PowerLogic Communications

B.1 General

The PowerLogic™ system requires the use of network *route statements* for data communications over the SY/NET® local area network. The purpose of this appendix is to provide the basic information needed to utilize route statements in communicating to PowerLogic and related SY/MAX® devices via the SY/NET® network. Additional information on the use of routing can be found in the instruction bulletin for the SY/NET Network Interface Module (30598-257-01).

B.2 What is Routing?

In many electrical distribution systems, data communications to and from multiple devices are carried over the same set of communication cables. This "cable sharing" greatly reduces the number of cables needed; however, this introduces a new problem: How to direct communications to a specific device in the system. This problem is solved by assigning each device on a network a unique device number (or address). A message may then be sent along a defined path (or Route) until it reaches the device with the desired address.

Routing, then, is the successive listing of these addresses as they are encountered in a communication path. In other words, to talk to one device that is several devices away, each device encountered along the communication path must be included in a route statement.

The remainder of this appendix, discusses the use of routing in PowerLogic Systems 1, 2, 3, and 4 and offers examples of route statements for each.

B.3 System 1 Routing Example

The most basic system involves the connection of up to 16 Circuit Monitors (CMs) to a PowerLogic System Display as shown in Figure B-1. The System Display may be mounted at the equipment location, or in a more accessible remote location. The mounting location of the System Display does not change the routes in the system.

The System Display does not have a device address. Therefore, the route statement from the System Display to a Circuit Monitor only requires the address of the target Circuit Monitor, as shown in the example in Figure B-1.

Total Length of RS-485 Data Communications is 10,000 Ft

SYSTEM DISPLAY

CM 01 CM 02 CM 16

UP TO 16 CIRCUIT MONITORS
(Per Multidrop Channel)

Route from System Display to CM #02:   002

System Display Address (none)
CM Address
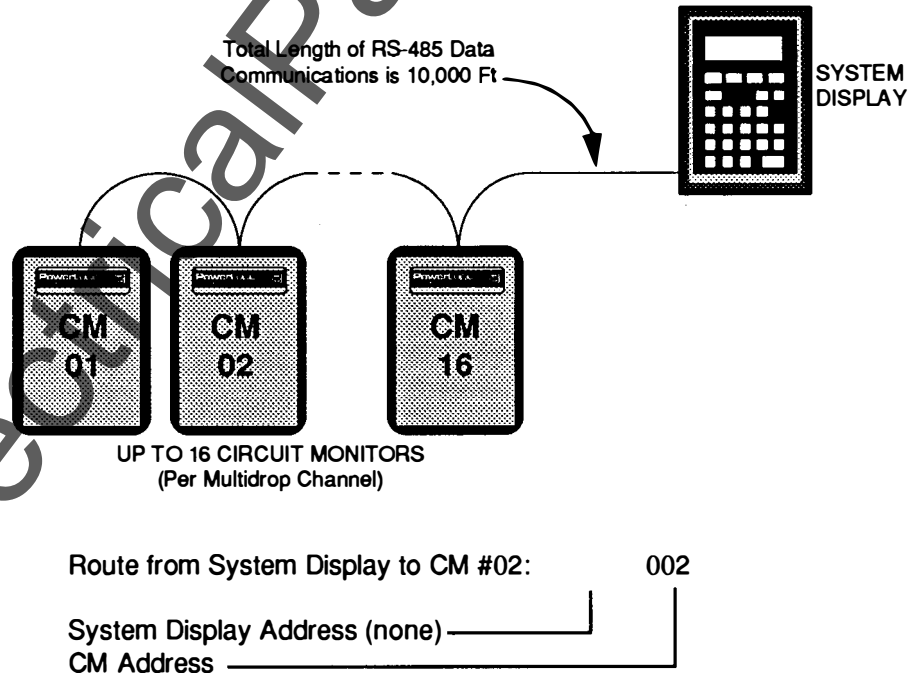
Figure B-1 - *System 1 configuration - System Display and Circuit Monitors.*

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NOTE: When multiple CMs are daisy-chained together, only the address of the target CM need be included in the route statement.

NOTE: The address switches on the back of the last CM daisy-chained to a communications port must be set to 01. In the special case where only one CM is connected to a communications port, the CM address switches are set to 00; however, the CM's logical address is still 01. Therefore, even though the address switches are physically set to 00, communications are routed to logical address 01. Figure B-2 illustrates this point. See section 4.1 for further explanation and instructions on setting the Circuit Monitor's address switches.
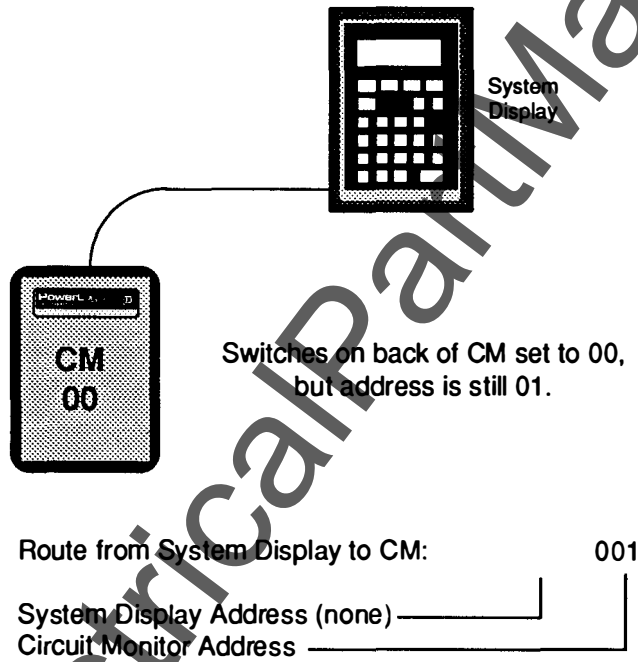

Figure B-2 - System 1 configuration - System Display and Single Circuit Monitor.

B.4 System 2 Routing Example

In System 2 a personal computer is used for remote communications to Circuit Monitors. (See Figure B-4). The personal computer (PC) must contain a SY/LINK® Network Interface Card and supporting software to enable remote monitoring of the CM's. Unlike the System Display, the SY/LINK card is assigned a device address (from 1 to 99) which must always be the first route in the route statement, preceded by a 0. For example, if the SY/LINK card has been assigned the address 28, the first route in the route statement should be 028.

The SY/LINK card has two (2) nine-pin communication ports. (See Figure B-3). The top port (female connector) is an RS-422 port (called port 1) and the bottom port (male connector) is a network port for connection to the SY/NET® network. In the system shown in Figure B-4, the CMs are attached to the RS-422 port (port 1) of the SY/LINK card.

All messages sent from the SY/LINK card default to the network port unless otherwise specified in the software. Software redirection of communications from the network port to
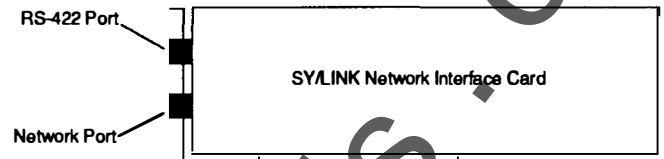
Figure B-3 -SY/LINK Card RS-422 and Network ports.

the RS-422 port is accomplished through the addition of a route in the second position of the route statement. This route consists of the SY/LINK card's address preceded by a '1'. The '1' informs the SY/LINK card to direct communications out the RS-422 port (port 1). Figure B-4 shows sample route statements from the RS-422 port of a SY/LINK card to Circuit Monitors.

Route from SY/LINK to CM #01:   028,   128,   001
Route from SY/LINK to CM #16:   028,   128,   016

SY/LINK Network Address
SY/LINK RS-422 Port
Circuit Monitor Address

Figure B-4 - Routing for System 2 configuration from a PC equipped with a SY/LINK card to CMs.

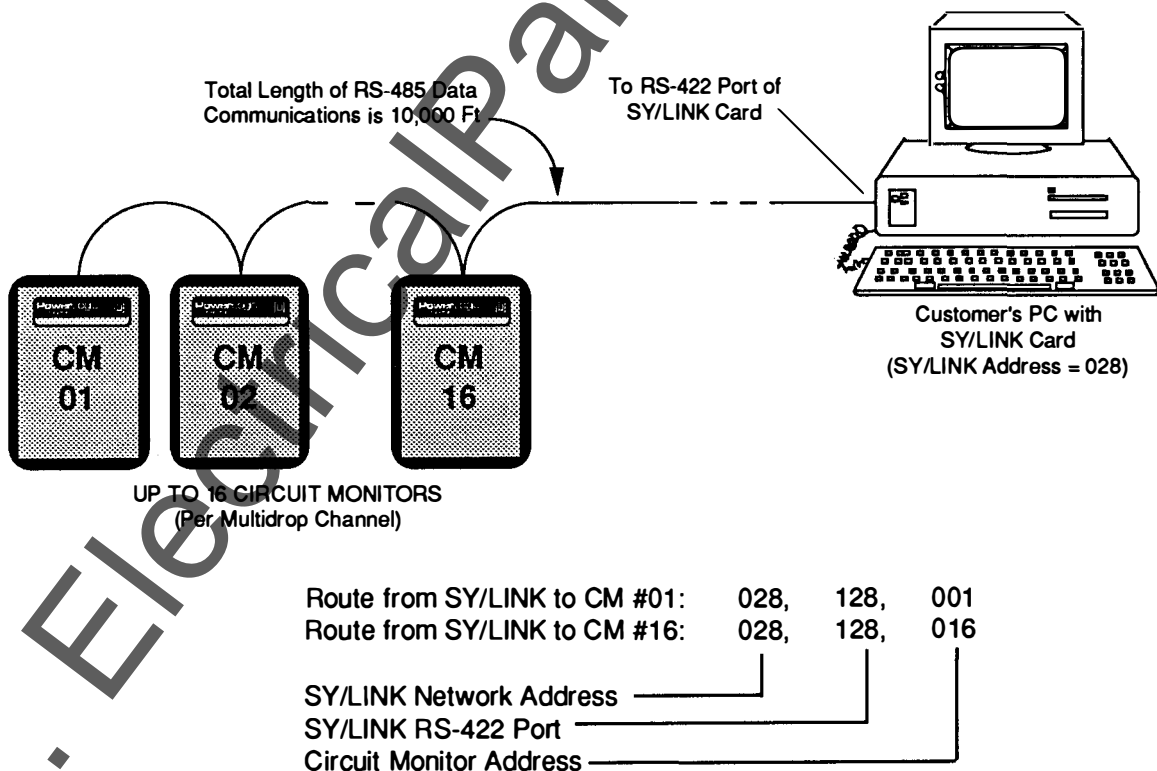## B.5 System 3 Routing Example

To incorporate both the System Display and personal computer options, a PowerLogic™ Network Interface Module (PNIM) must be used. (See Figure B-5). This device controls data communications from the System Display and the PC to avoid collisions that could occur if both devices attempted to communicate to CM's at the same instant.

The PNIM, like the SY/LINK Card, must be assigned a unique address (from 1 to 99) which is used in route statements. Also, the PNIM has two (2) nine-pin communication ports. The top port is referred to as port '0' and the bottom as port '1'. The top port is the only port to which CM's may be connected,

therefore the System Display must be connected to port '1'.

Since the PNIM has two RS-422 communication ports (0 and 1), the route statement must specify which port the target Circuit Monitor is connected to. This is done by including a route consisting of the address of the PNIM preceded by a 0 (since the CM is connected to port 0). Also, since the System Display is connected to port 1 of the PNIM, its route statement must indicate this by including a route consisting of the address of the PNIM preceded by a 1 (since the System Display is connected to port 1). Figure B-5 shows sample route statements to CMs through a PNIM.
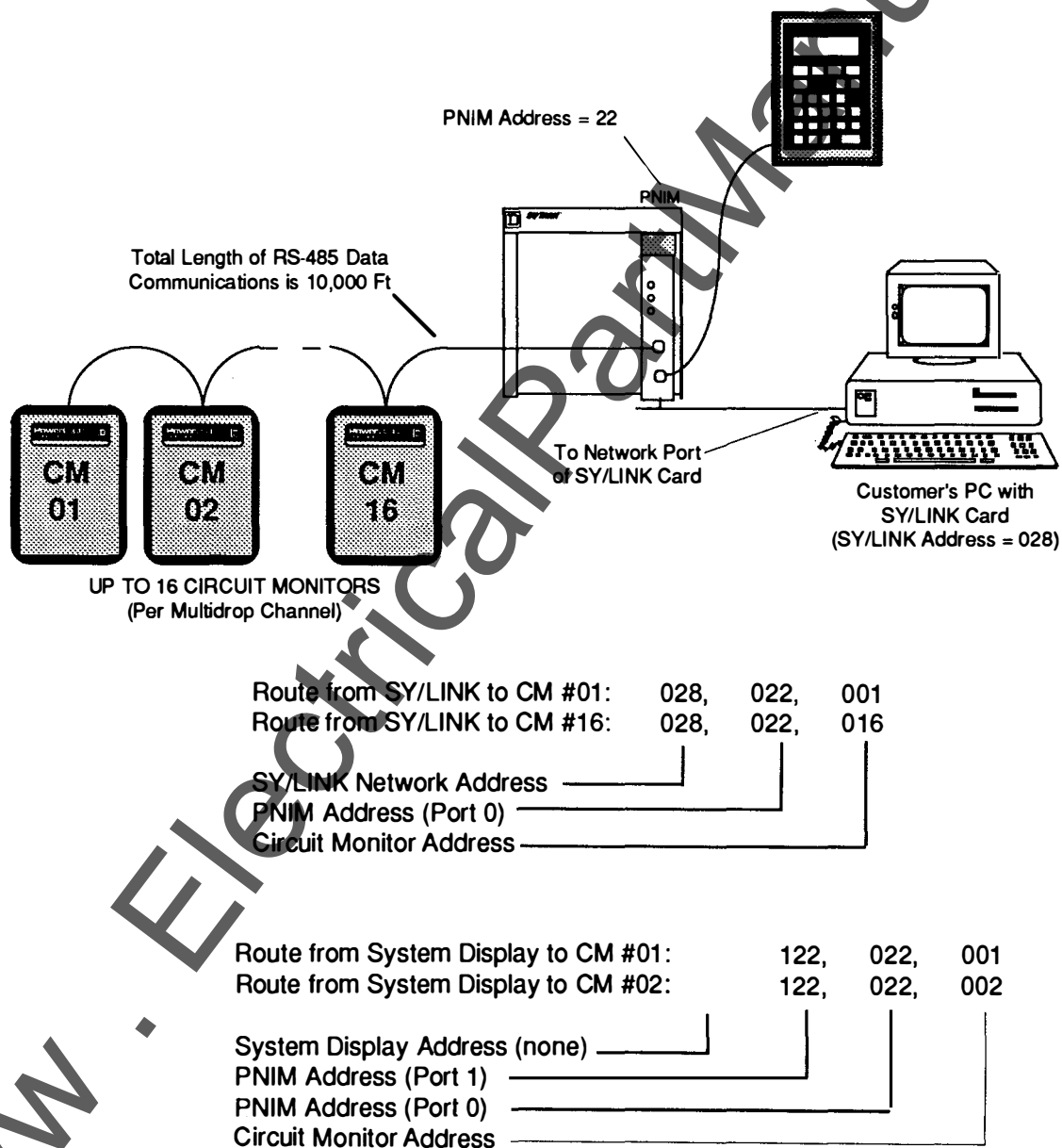
PNIM Address = 22

Total Length of RS-485 Data Communications is 10,000 Ft

CM 01   CM 02   CM 16

UP TO 16 CIRCUIT MONITORS
(Per Multidrop Channel)

To Network Port of SY/LINK Card

Customer's PC with SY/LINK Card
(SY/LINK Address = 028)

Route from SY/LINK to CM #01:   028,   022,   001
Route from SY/LINK to CM #16:   028,   022,   016

SY/LINK Network Address
PNIM Address (Port 0)
Circuit Monitor Address

Route from System Display to CM #01:   122,   022,   001
Route from System Display to CM #02:   122,   022,   002

System Display Address (none)
PNIM Address (Port 1)
PNIM Address (Port 0)
Circuit Monitor Address

Figure B-5 - Routing for System 3 configuration from PC and System Display to CMs.

B.6 System 4 Routing Example

A SY/MAX® programmable logic controller (PLC) may be
added to a PowerLogic System 3 to create a System 4. The
addition of a PLC to the system enhances the control capability
of the power monitoring system. The PLC does not effect the
system routing, and it does not require any additional addresses
in the route statements. (The System Monitoring Software
(SSW-101) is an exception. Refer to the SSW-101 instruction
bulletin for more information). Figure B-6 shows sample route
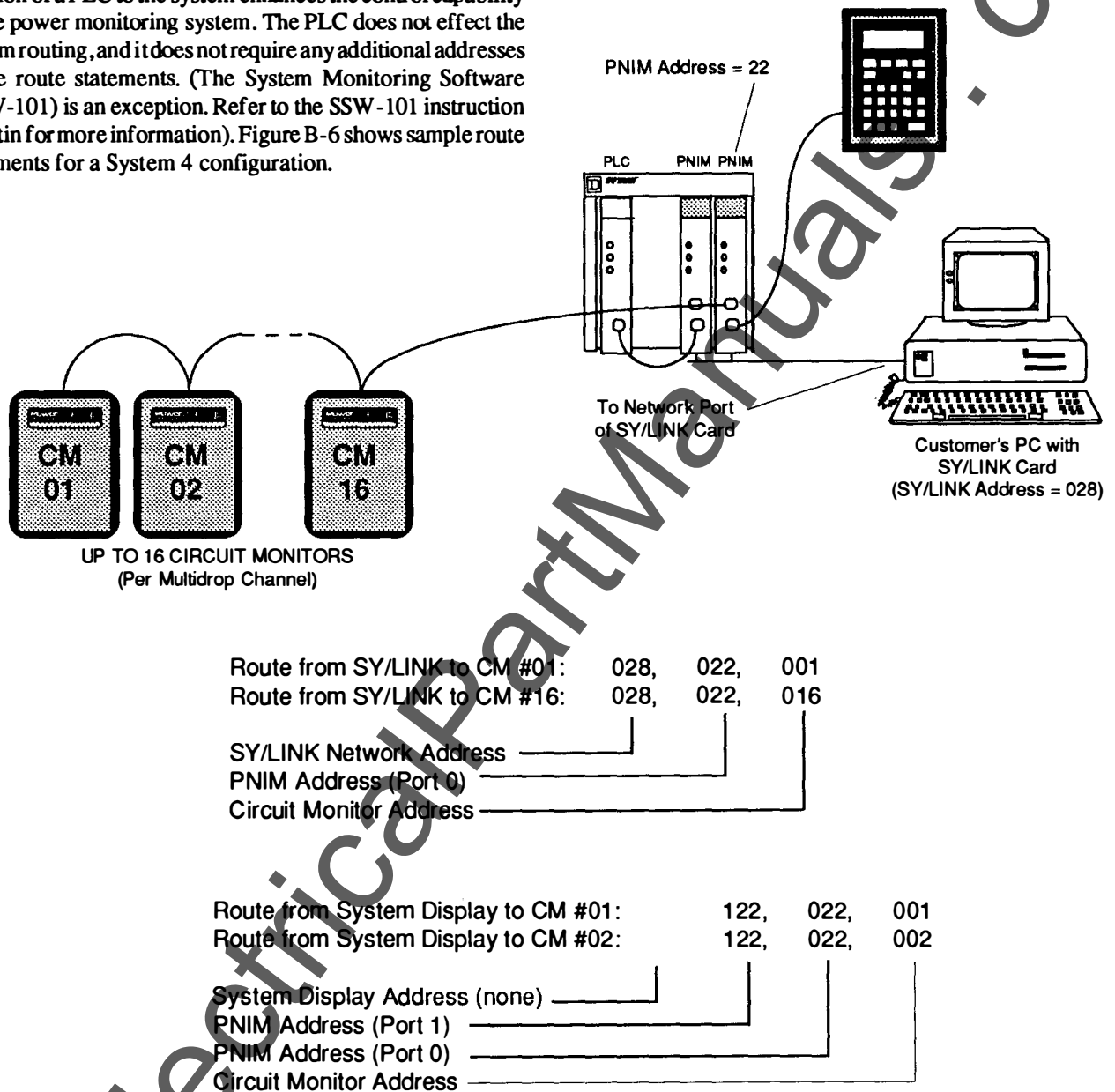statements for a System 4 configuration.

PNIM Address = 22

PLC   PNIM PNIM

To Network Port
of SY/LINK Card

Customer's PC with
SY/LINK Card
(SY/LINK Address = 028)

UP TO 16 CIRCUIT MONITORS
(Per Multidrop Channel)

```
Route from SY/LINK to CM #01:      028,    022,    001
Route from SY/LINK to CM #16:      028,    022,    016

SY/LINK Network Address
PNIM Address (Port 0)
Circuit Monitor Address


Route from System Display to CM #01:     122,    022,    001
Route from System Display to CM #02:     122,    022,    002

System Display Address (none)
PNIM Address (Port 1)
PNIM Address (Port 0)
Circuit Monitor Address
```

Figure B-6 - Routing for System 4 configuration.

B.7   Additional Routing Examples

Multiple PNIMs

When more than 16 Circuits need to be monitored, additional
PNIMs may be added. Each PNIM may have up to 16 CMs
daisy-chained to its top port (port 0). Figure B-7 shows sample
route statements for a system utilizing two PNIMs.
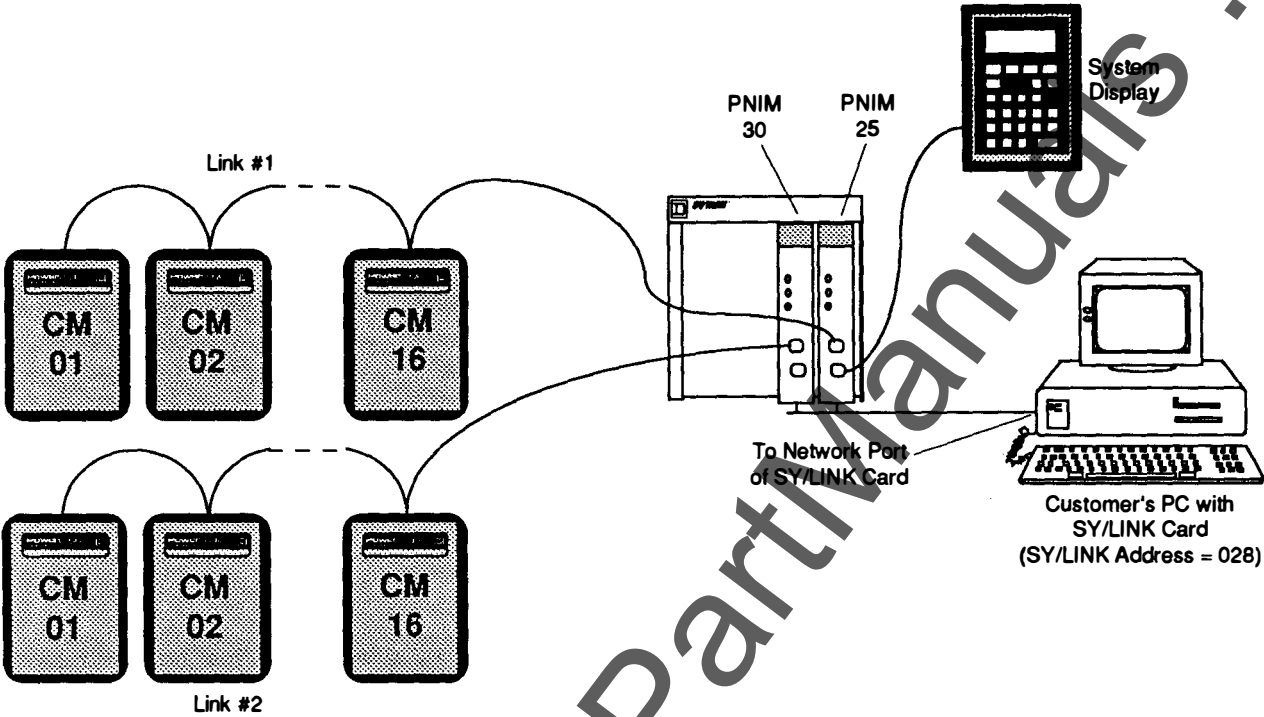
| Route from SY/LINK to CM #01 on Link #1: | 028, | 025, | 001 |
| Route from SY/LINK to CM #16 on Link #2: | 028, | 030, | 016 |

| Route from System Display to CM #01 on Link #1: | 125, | 025, | 001 |
| Route from System Display to CM #02 on Link #2: | 125, | 030, | 002 |

Figure B-7 - *System 3 with two PNIMs.*

Modem Communications

Modem Communications require the use of two modems and two signal conveters. The converters translate between the RS-232 signal required by the modems and the RS-485/422 signal used by PowerLogic and SY/MAX®. There are two types of converters: a freestanding RS-232/485 converter called the "Black Box", and a rack-mounted SY/MAX converter, the CRM-601 (See Figure B-9). Though different in appearance, the converters perform virtually identical functions.

The converters and modems are not addressable and do not require routes in the route statement. Figure B-8 shows a remote PC communicating to 16 Circuit Monitors via modem communications.

Figure B-9 shows a remote PC communicating to 32 Circuit Monitors via modem communications. The system includes two PowerLogic Network Interface Modules (PNIMs) each supporting 16 CMs. The rack-mounted CRM-601 converter is used in place of the free-standing "Black Box" converter.

A standard SY/MAX Network Interface Module (CRM-510) is required to complete communications. The NIM must be set up to communicate to the SY/LINK card in Net-to-Net mode. This involves configuring Port 1 of the NIM and Port 1 (the RS-422 port) of the SY/LINK card for Net-to-Net operation. Also, the NIM and the SY/LINK card must have the same network address. Figure B-9 shows sample route statements for this configuration.
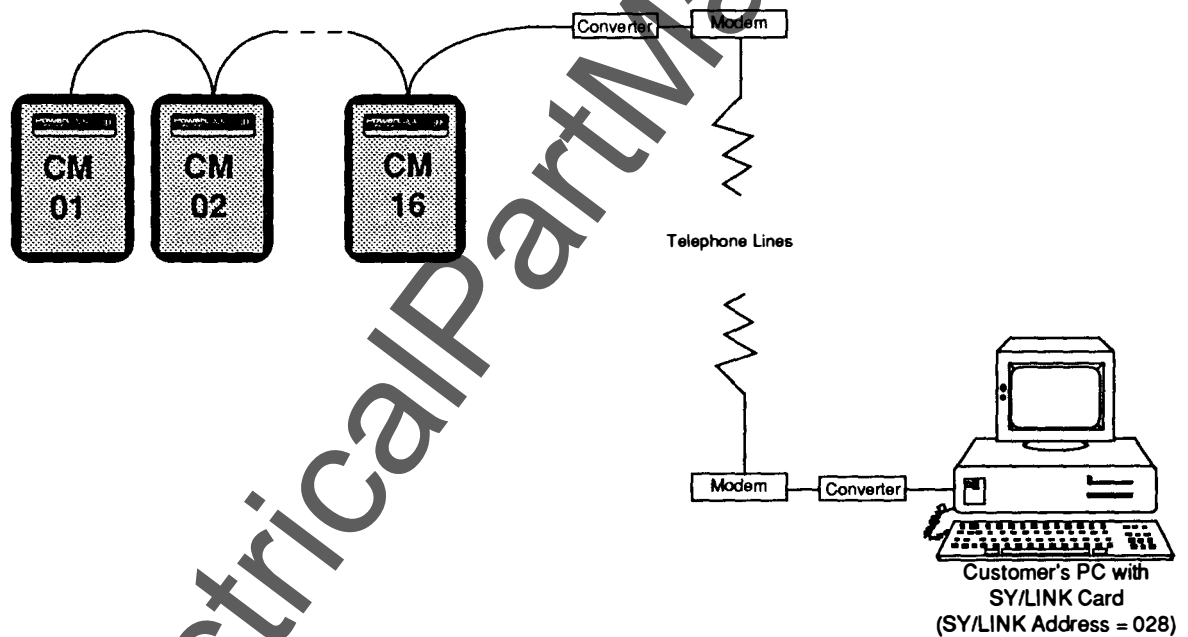

```
Route from SY/LINK to CM #01:    028,    128,    001
Route from SY/LINK to CM #16:    028,    128,    016
```
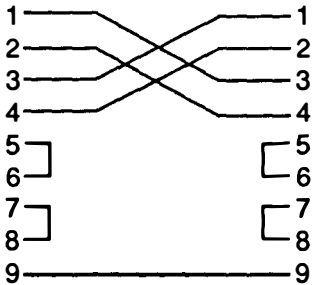
Figure B-8 - System 2 with Modem Communications.
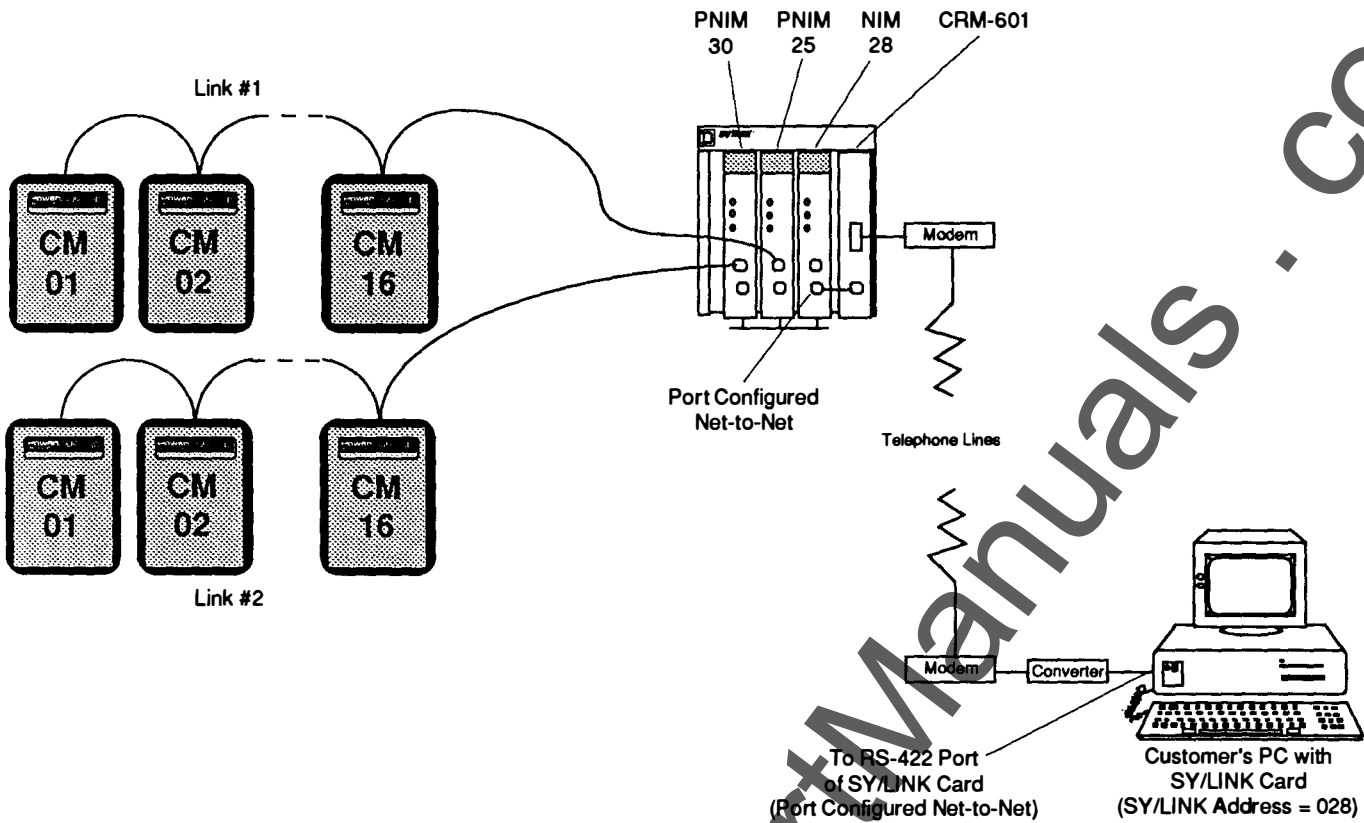
Route from SY/LINK to CM #01 on Link #1:   028,   128,   025,   001
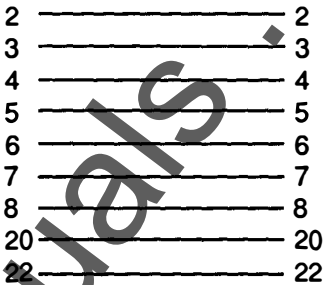Route from SY/LINK to CM #16 on Link #2:   028,   128,   030,   016

Figure B-9 - *System 2 with Network and Modem Communications*
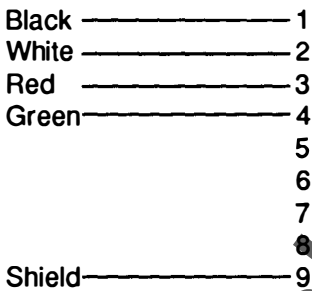
Appendix C - Communication Cable Pinouts

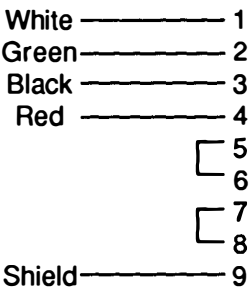### CC-100

```
1 ———\ /——— 1
2 ——\ X /—— 2
3 ——/ X \—— 3
4 ———/ \——— 4
5 ⌐          ⌐ 5
6 ⌐          ⌐ 6
7 ⌐          ⌐ 7
8 ⌐          ⌐ 8
9 ———————————— 9
```

CAB-102, CAB-104

```
2 ———————————— 2
3 ————————•——— 3
4 ———————————— 4
5 ———————————— 5
6 ———————————— 6
7 ———————————— 7
8 ———————————— 8
20 ——————————— 20
22 ——————————— 22
```

CAB-106, CAB-108

```
Black ————————— 1
White ————————— 2
Red   ————————— 3
Green ————————— 4
                5
                6
                7
                8
Shield ———————— 9
```

Circuit Monitor Terminal #

```
(21)
(20)
(23)
(22)



(24)
```

CAB-107

```
White ————————— 1
Green ————————— 2
Black ————————— 3
Red   ————————— 4
             ⌐ 5
             ⌐ 6
             ⌐ 7
             ⌐ 8
Shield ———————— 9
```