## CHAPTER 1—INTRODUCTION

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This document is intended to provide information about components and applications of the POWERLOGIC Power Monitoring and Control System. Use this document as a tool in planning a system or adding to an existing system. Many diagrams are included to enhance understanding of system architecture.

WHAT IS A POWERLOGIC® SYSTEM?

The POWERLOGIC Power Monitoring and Control System, also referred to in this document as the “system,” combines microprocessor-based instrumentation and control with Windows®-based software to provide information from the entire electrical power distribution system. System capabilities such as alarm reporting, automatic control, high-accuracy instrumentation, power quality and disturbance monitoring, and data sharing are just a few benefits of the system.

The system can be applied to virtually any electrical power distribution equipment, resulting in a network of distributed intelligent devices reporting to one or more centralized locations.

A POWERLOGIC system consists of three main parts (Figure 1–1):

- intelligent devices
- data communication interfaces
- power management software

Figure 1–1 The three parts of a POWERLOGIC system
WHAT ARE THE MAIN PRODUCTS OF THE POWERLOGIC SYSTEM?

The main products of the POWERLOGIC system are intelligent power monitoring devices, protective devices, communications components, and System Manager™ Software (SMS).

Supported Devices

The following devices are supported by a POWERLOGIC System:

- Circuit Monitors Series 4000
- Circuit Monitors Series 2000
- Power Meters PM300, PM600, PM620, PM650
- Enercept® Meters
- Low Voltage Circuit Breakers with MICROLOGIC® Electronic Trip Units
- DiGIPACT® interfaces (DC150...)
- SEPAM 1000+, SEPAM 2000 Relays
- many other Schneider Electric products: Modicon PLCs, POWERLINK panels, drives, starters, and more
- nearly any device supporting MODBUS RTU protocol (some custom engineering may be required)

NOTE: Not all devices listed above are available in all countries. Contact your local sales representative for availability and more information about devices.

Communication Components

The POWERLOGIC System uses the most open protocols and interfaces available. This benefits the user in several ways. Two of the biggest benefits include:

- a wide choice of low-cost third-party hardware such as converters, modems, and interfaces.
- greater ease in developing interfaces with other systems such as Building Automation or computer application software.

A typical POWERLOGIC System includes a cost-effective and rugged “field bus” that connects the power monitoring devices in the field. The field bus uses the industry standard RS-485 wiring that has been widely used in rugged industrial control applications for years. The field bus protocol may be either the POWERLOGIC protocol or MODBUS. MODBUS has become the de facto standard and is very widely used. It was originally developed for factory automation by MODICON, a division of Schneider Electric. Most larger POWERLOGIC Systems also include a high-speed backbone that can handle the voluminous data of power monitoring. This backbone is Ethernet.

The POWERLOGIC Ethernet communication components support the POWERLOGIC System family of products. This allows you to leverage all existing Ethernet technology for power monitoring, power quality, and other information over almost any existing communication infrastructure, including the Internet. Ethernet is the most widely supported network in the world. It offers an open architecture, speed, wide range of connectivity products, and practically unlimited flexibility, allowing you to build any size network. These benefits ensure users of their investment in Ethernet as the backbone network of choice for power monitoring and control systems.

POWERLOGIC Ethernet communications components include:

- POWERLOGIC Ethernet Gateway (EGW)
- Ethernet Communication Modules (ECM-RM, ECM-2000)
- Ethernet Communications Card (ECC) for direct Ethernet communication to the Circuit Monitor Series 4000 (CM4000)
Software

The POWERLOGIC System (Figure 1–2) provides a total, integrated system approach to power management. Intelligent devices such as Circuit Monitors, SEPAM Medium Voltage Relays and MICROLOGIC Electronic Trip Unit Systems provide a tremendous amount of data. System Manager Software (SMS) turns that data into powerful, useful power monitoring information, as shown in Figure 1–3 and Figure 1–4.

![Diagram of POWERLOGIC System components](image)

**Figure 1–2** Some core products in a POWERLOGIC system

![SMS display image](image)

**Figure 1–3** A standard SMS display enables instant reporting of gathered information
Most components in the POWERLOGIC system meet IEC, CE, CSA, NOM and UL standards.

There are four basic types of communication systems. Each of these system types is detailed in a separate chapter later in this document, beginning with “Chapter 3—System Type 1: Serial Communications” on page 11.

System Type 1: Serial Communications

An easy-to-install small system (Figure 1–5) may consist of monitoring devices connected to a PC using twisted-pair cabling and open communication protocol. Software on the PC collects data and helps show how your power system is functioning.
System Type 2: Ethernet Local Area Network (LAN)  
Larger systems may use a high-speed backbone to collect information from many devices and to allow the data to be shared by multiple users on different PCs (Figure 1–6). Ethernet is the typical backbone. It may be dedicated to power monitoring or share an existing Ethernet Local Area Network (LAN).

![Figure 1–6 System Type Two: Ethernet LAN](image)

System Type 3: Wide Area Network (WAN)—Company Intranet/Internet  
Using your company’s Wide Area Network (WAN) across the Internet and Intranet allows data to be shared enterprise-wide, even around the globe (Figure 1–7). Companies with many facilities can monitor all of them from one location at high speeds without depending on dial-up lines. Pooling of data can be used to improve electricity purchasing decisions.

![Figure 1–7 System Type 3: Wide Area Network (WAN)—company Intranet/Internet](image)
System Type 4: Custom Solutions

Automatic control can be added to systems via Programmable Logic Controllers (PLC). The controls can be used to implement cost-saving practices from load preservation to peak shaving. The controls can be simple, set-point based operations at a single device or complex, system-wide operations.

System Type 4 requires Engineering Services to design the system, specify the components, and possibly supply custom PLC programming.

Figure 1–8  System Type 4: Integration with other systems
CHAPTER 2—SAFETY PRECAUTIONS

This chapter contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Turn off all power supplying the equipment before working on or inside.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Beware of potential hazards, wear personal protective equipment, and carefully inspect the work area for tools and objects that may have been left inside the equipment.
- Use caution while removing or installing panels so that they do not extend to the energized bus; avoid handling the panels, which could cause personal injury.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

Failure to observe these instructions will result in death or serious injury.
CHAPTER 3—SYSTEM TYPE 1: SERIAL COMMUNICATIONS

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INTRODUCTION

This chapter gives an overview of the Type 1 communication system: serial communications.

In this chapter, we will discuss the different components of POWERLOGIC System Type 1 architecture. These components are illustrated in Figure 3–1.

![Figure 3–1 Main components of System Type 1 architecture](image)

This chapter serves a dual purpose. In addition to discussing Type 1 architecture, we will use this most basic system type to provide an overview of the seven steps necessary from planning and designing a system to getting it up and running. This overview will include information on devices, daisy chain, converters, terminators, and System Manager Software.

THE SEVEN STEPS TO IMPLEMENT A POWERLOGIC SYSTEM TYPE 1

There are seven steps involved in planning a system for your particular needs, from designing the system to implementing it. These steps are:

1. Selecting POWERLOGIC System devices
2. Defining the communications daisy chain
3. Ensuring proper wiring and connections of the daisy chain
4. Terminating the daisy chain
5. Connecting the daisy chain to a personal computer
6. Setting up device communication parameters
7. Installing and setting up System Manager Software

We suggest reading through all the steps before beginning to implement your system. By doing so, you will be aware of top-level system architecture considerations, as well as device-specific application issues.
STEP 1: SELECTING POWERLOGIC SYSTEM DEVICES

The first step in designing your POWERLOGIC System is to select the appropriate devices, depending on your application. Refer to specific device instruction bulletins for information on functions and specifications.

In the following steps, we will assume that your POWERLOGIC System devices have been installed in electrical equipment and we will focus on communication considerations only.

If you need help in selecting POWERLOGIC System devices for your system or installing them in electrical equipment, contact your local sales representative.

STEP 2: DEFINING THE COMMUNICATIONS DAISY CHAIN

In this step you will define the type of daisy chain that best fits your application requirements. You will decide whether to use a 2-wire or 4-wire daisy chain. You will also need to check the maximum length of your daisy chain, taking into consideration the number of devices on the daisy chain and the baud rate at which they will communicate.

A daisy chain consists of an RS-485 cable connecting multiple RS-485 based devices. Each daisy chain can support up to 32 devices (Figure 3–2) of different types communicating with POWERLOGIC or MODBUS protocols. Supporting both POWERLOGIC and MODBUS devices on the same daisy chain is called “mixed-mode.”

Figure 3–2 A daisy chain is the multi-drop communications link between devices

NOTES:

- 32 devices on a daisy chain should be considered as a maximum limit. Depending on your system architecture, response time required, device types, and daisy chain length, it may be advisable to limit the number of devices to less than 32.
- JBUS protocol, which can be considered a subset of MODBUS protocol, is fully supported in the POWERLOGIC System. All references to MODBUS in this document can also be applied to JBUS.
4-wire or 2-Wire Daisy Chain?

In planning your system, you will need to decide whether to use a 4-wire or 2-wire daisy chain. This decision will depend mainly on two considerations:

- 4-wire vs. 2-wire device compatibility
- daisy chain maximum lengths

Device Compatibility

Basically, MODBUS protocol can be implemented on either a 2-wire or 4-wire daisy chain, whereas POWERLOGIC protocol requires a 4-wire daisy chain.

Table 3–1 shows which Schneider Electric devices can be used on 4-wire and 2-wire systems.

Table 3–1: 4-Wire and 2-Wire Device Compatibility

<table>
<thead>
<tr>
<th>Device</th>
<th>Compatibility</th>
<th>Protocol Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Monitor Series 4000</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>Circuit Monitor Series 2000</td>
<td>yes</td>
<td>POWERLOGIC</td>
</tr>
<tr>
<td>PM600, 620, 650 Power Meter</td>
<td>yes</td>
<td>MODBUS or POWERLOGIC</td>
</tr>
<tr>
<td>PM300 Power Meter</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>Enercept Meter</td>
<td>yes ²</td>
<td>MODBUS</td>
</tr>
<tr>
<td>MICROLOGIC Electronic Trip Unit System</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>Sepam 2000 Relay</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>Sepam 1000+ Relay ³</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>DC150 Data Concentrator</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
<tr>
<td>PIF3 Interface</td>
<td>yes</td>
<td>POWERLOGIC</td>
</tr>
<tr>
<td>POWERLINK AS Lighting Control Panel</td>
<td>yes</td>
<td>POWERLOGIC</td>
</tr>
<tr>
<td>Vigilohm XLI/XTU Interface</td>
<td>yes</td>
<td>MODBUS</td>
</tr>
</tbody>
</table>

1. Not all devices are available in all countries. Contact your local sales representative for availability.
2. With the ENA-485 adapter or the EDI-32 display.
3. With the ACE 949 (2-wire) or ACE 959 (4-wire) accessory.
Step 3 involves properly selecting cable for the daisy chain and connecting devices to it.

Use shielded twisted pair cable for a POWERLOGIC System daisy chain: one shielded twisted pair for 2-wire daisy chains; two shielded twisted pairs for 4-wire daisy chains.

### Table 3–2: POWERLOGIC/MODBUS Protocols 4-Wire Daisy Chain Maximum Distances

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Maximum Distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>2400</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>4800</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>9600</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>19200</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>38400</td>
<td>5,000 ft. (1,524 m)</td>
</tr>
</tbody>
</table>

1. Device quantities apply to daisy chains consisting of Schneider Electric devices which can be wired for either 4-wire or 2-wire. For a daisy chain containing only true 2-wire devices, refer to the manufacturer's instruction bulletin for daisy chain limits.

### Table 3–3: MODBUS Protocol 2-Wire Daisy Chain Maximum Distances

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Maximum Distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>2400</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>4800</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>9600</td>
<td>10,000 ft. (3,048 m)</td>
</tr>
<tr>
<td>19200</td>
<td>5,000 ft. (1,524 m)</td>
</tr>
<tr>
<td>38400</td>
<td>3,000 ft. (914 m)</td>
</tr>
</tbody>
</table>

1. Device quantities apply to daisy chains consisting of Schneider Electric devices which can be wired for either 4-wire or 2-wire. For a daisy chain containing only true 2-wire devices, refer to the manufacturer's instruction bulletin for daisy chain limits.
The following Belden cables (or equivalent) shown in Table 3–4 are strongly recommended:

**Table 3–4: Recommended Cables**

| Daisy Chain | Cable                          | Reference  
|-------------|-------------------------------|------------
| 4-wire      | Two shielded twisted pairs    | Belden 8723 or Belden 9642 |
| 2-wire      | One shielded twisted pair      | Belden 9841 or Belden 1120A² |

1. Or equivalent.
2. For Enercept Meters.

**How To Connect Devices To The Daisy Chain**

Communication wires are daisy-chained from one device to the next in the following manner: RX+ to RX+, RX– to RX–, TX+ to TX+, TX– to TX–, and Shield to Shield (Figure 3–3). For 4-wire topology, it is important to keep the wires with the two twisted pairs separate. For example, if one twisted pair is used for the RX connections, use the other twisted pair for the TX connections. Do not mix the wires from the two twisted pairs.

Figure 3–3 shows how to connect 4-wire device comms terminals to a 4-wire daisy chain or to a 2-wire daisy chain.

*NOTE: The wire colors shown in Figure 3–3 are for Belden 8723 cable.*

![Diagram of 4-Wire RS-485 Daisy Chain](image1)

**Figure 3–3**  Daisychaining the RS-485 communications terminals

![Diagram of 2-Wire RS-485 Daisy Chain](image2)

*NOTE: Some 4-wire device terminals are labeled with designations other than RX and TX. See Table 3–5 on page 18.*
Figure 3–4 illustrates the correct RS-485 communications daisy chain wiring method.

![Correct RS-485 Communications Wiring](image)

**Correct RS-485 Communications Wiring**

Belden 8723
(or equivalent)

RS-485 comm terminals

RS-485 comm terminals

Device

Device

Important: The communications shield is terminated at each device with a shield terminal. The communications shield should continue throughout the entire daisy chain.

**Figure 3–4**  Correct RS-485 comms wiring

**Tee Connections**

Figure 3–5 shows custom-made tee connections, which should be avoided. These connections will cause unbalanced impedance in the communication lines, resulting in data corruption.

Some Schneider Electric connection accessories use tee connections. However, these accessories have been designed and tested to ensure that the tee connections do not corrupt communications data. Follow the specific wiring instructions included with each accessory.

![Custom-made Tee Connection RS-485 Communications Wiring](image)

**Custom-made Tee Connection RS-485 Communications Wiring**

**Figure 3–5**  Custom-made tee connections should be avoided

**Grounding**

A daisy chain should be grounded in one place only, typically at the last device on the daisy chain.

When the shield terminal of a device is internally connected to the ground, to avoid ground loops we recommend interrupting the shield wire when daisy-chaining these devices.
## Device Terminal Connections

Table 3–5 summarizes how communications terminals on Schneider Electric devices are labeled and which of the comms wires should be attached to each terminal.

For additional information refer to the specific device instruction bulletin.

<table>
<thead>
<tr>
<th>Device</th>
<th>Green^1 RX+</th>
<th>White^1 RX–</th>
<th>Red^1 TX+</th>
<th>Black^1 TX–</th>
<th>Silver^1 (Bare Wire) SHLD</th>
<th>RS-485 Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Monitor Series 4000</td>
<td>RX+ 20</td>
<td>RX– 21</td>
<td>TX+ 22</td>
<td>TX– 23</td>
<td>SHLD 24</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>Circuit Monitor Series 2000</td>
<td>In– 21</td>
<td>Out+ 22</td>
<td>Out– 23</td>
<td>SHLD 24</td>
<td>Screw Terminals</td>
<td></td>
</tr>
<tr>
<td>PM600, 620, 650 Power Meter</td>
<td>In+ 5</td>
<td>In– 4</td>
<td>Out+ 3</td>
<td>Out– 2</td>
<td>SHLD 1</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>PM300 Power Meter</td>
<td>B’</td>
<td>A’</td>
<td>B</td>
<td>A</td>
<td>SHLD</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>ENA adapter, EDI display^2</td>
<td>In+</td>
<td>In–</td>
<td>Out+</td>
<td>Out–</td>
<td>SHLD</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>MICROLOGIC CCM^3</td>
<td>In+</td>
<td>In–</td>
<td>Out+</td>
<td>Out–</td>
<td>SHLD</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>MICROLOGIC BCM^3</td>
<td>In+ E6</td>
<td>In– E5</td>
<td>Out+ E4</td>
<td>Out– E3</td>
<td>N/A</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>SEPAM 2000 Relay^4</td>
<td>B’ 4</td>
<td>A’ 8</td>
<td>B 5</td>
<td>A 9</td>
<td>SHLD</td>
<td>DB-9 Female</td>
</tr>
<tr>
<td>DC150 Data Concentrator</td>
<td>B’ 4</td>
<td>A’ 8</td>
<td>B 5</td>
<td>A 9</td>
<td>SHLD</td>
<td>DB-9 Female</td>
</tr>
<tr>
<td>PIF3 Interface</td>
<td>In+ 5</td>
<td>In– 4</td>
<td>Out+ 3</td>
<td>Out– 2</td>
<td>SHLD 1</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>POWERLINK AS Lighting Control Panel</td>
<td>In+</td>
<td>In–</td>
<td>Out+</td>
<td>Out–</td>
<td>SHLD</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>Vigilohm XLI/XTU Interface</td>
<td>B’ 4</td>
<td>A’ 8</td>
<td>B 5</td>
<td>A 9</td>
<td>SHLD</td>
<td>DB-9 Female</td>
</tr>
</tbody>
</table>

^1. The wire colors shown are for Belden 8723 cable.

^2. For Enercept Meters 4-wire conversion.

^3. CCM=Cradle Communication Module; BCM=Breaker Communication Module.

^4. For SEPAM 1000+, refer to the SEPAM 1000+ instruction bulletin.
STEP 4: TERMINATING THE DAISY CHAIN

To ensure proper communication, the daisy chain must be terminated. A terminator prevents reflection of transmitted signals.

Only the last device in a communications daisy chain must be terminated (Figure 3–6). For example, if a daisy chain contains only a single device, that device must have a terminator.

Figure 3–6 Terminating a daisy chain
The MCT-485, when combined with a terminal block, can be used on any device (Figure 3–7).

**Figure 3–7** Terminating a CM4000 circuit monitor on a daisy chain with a terminal block and MCT-485
If the last device on the daisy chain is a circuit monitor series CM2000, the MCT-485 terminator can be directly connected to the RS-485 terminals of the CM2000 (Figure 3–8).

**Figure 3–8** MCT-485 terminator connected directly to CM2000 series circuit monitor

The MCTAS-485 terminator can be used with devices having Phoenix-type screw terminals, such as the circuit monitor CM4000 (Figure 3–9), PM600, 620, and 650 power meters, POWERLINK AS panels, PM300 power meters, and the MICROLOGIC Electronic Trip Unit System.

**Figure 3–9** Terminating a CM4000 circuit monitor with an MCTAS-485 terminator

For more information, refer to the device instruction bulletins.
STEP 5: CONNECTING THE DAISY CHAIN TO A PERSONAL COMPUTER

In System Type 1, one or more devices are connected directly to a personal computer for remote monitoring (Figure 3-10). Communications can be performed directly out of a serial communications port (comms port) on the computer. Communicating directly out of the RS-232 comm port requires an RS-232 to RS-485 converter.

![Diagram of direct connection to a personal computer]

Table 3–6 summarizes recommended RS-485/RS-232 converters.

Table 3–6: RS-485/RS-232 Converters For Connecting to a Personal Computer

<table>
<thead>
<tr>
<th>Converter</th>
<th>4-Wire</th>
<th>2-Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCI-101</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ACE 909</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>ACE 909-2¹</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1. When SEPAM 1000+ is the first device on a daisy chain.

NOTES:

- Typically, in North and South America the MCI-101 Converter Kit is used; in Europe an ACE or third-party converter is used.
- Many types of third-party converters are available, depending upon your application needs. When using a third-party converter, make sure it has biasing configurable by the user.

For more information on connecting the daisy chain to a PC, refer to the specific converter instruction bulletin.
STEP 6: SETTING UP DEVICE COMMUNICATION PARAMETERS

This step explains how to set up the baud rate, parity and address communication parameters. These parameters must be set up at the device level.

Baud Rate and Parity

When daisy-chaining devices, all devices on the daisy chain must be set up to communicate at the same baud rate and parity.

Table 3–7 summarizes the baud rate range and parity options available for POWERLOGIC System devices.

<table>
<thead>
<tr>
<th>Device</th>
<th>Baud Rate</th>
<th>Parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Monitor Series 4000</td>
<td>1200 to 38400</td>
<td>None/Even</td>
</tr>
<tr>
<td>Circuit Monitor Series 2000</td>
<td>1200 to 19200</td>
<td>None/Even</td>
</tr>
<tr>
<td>PM600, 620, 650 Power Meter</td>
<td>1200 to 19200</td>
<td>None/Even</td>
</tr>
<tr>
<td>PM300 Power Meter</td>
<td>9600 &amp; 19200</td>
<td>None</td>
</tr>
<tr>
<td>Enercept Meter</td>
<td>9600</td>
<td>None</td>
</tr>
<tr>
<td>MICROLOGIC Electronic Trip Unit System</td>
<td>1200 to 19200</td>
<td>None/Even</td>
</tr>
<tr>
<td>Sepam 2000 Medium Voltage Relay (versions 5 &amp; 6)</td>
<td>300 to 38400</td>
<td>None/Even/Odd</td>
</tr>
<tr>
<td>Sepam 1000+ Medium Voltage Relay</td>
<td>1200 to 19200</td>
<td>Even</td>
</tr>
<tr>
<td>DC150 Data Concentrator</td>
<td>9600 &amp; 19200</td>
<td>None</td>
</tr>
<tr>
<td>PIF3 interface to MICROLOGIC circuit breaker trip unit</td>
<td>1200 to 19200</td>
<td>None/Even/Odd</td>
</tr>
<tr>
<td>POWERLINK AS Lighting Control Panel</td>
<td>1200 to 9600</td>
<td>Even</td>
</tr>
<tr>
<td>Vigilohm XLI/XTU Interface</td>
<td>300 to 19200</td>
<td>None</td>
</tr>
</tbody>
</table>

Device Addresses

Each device on a daisy chain must have a unique address (Figure 3–11). We recommend using the following address ranges:

- MODBUS protocol devices: 1 through 247
- POWERLOGIC protocol devices: 1 through 198

In this example, the address 13 was mistakenly assigned to two devices on the same daisy chain. A different, unique address must be assigned to each device.

Figure 3–11 Each device on the daisy chain must have a unique address
In addition, if your system includes a mixed-mode daisy chain (POWERLOGIC and MODBUS devices on the same daisy chain), follow these requirements:

- Any Circuit Monitor Series 2000 on the daisy chain must have firmware version 17.008 or higher.
- Do not assign address 1 to any POWERLOGIC device on the daisy chain.
- Do not assign address 16 to any MODBUS device on the daisy chain.

For additional information about addressing, refer to the specific device instruction bulletin. This is especially important for information on the following:

- MICROLOGIC Electronic Trip Unit System addresses
- Enercept Meter addresses

STEP 7: INSTALLING AND SETTING UP SYSTEM MANAGER SOFTWARE (SMS)

The final step is installing and setting up System Manager Software. For instructions, refer to the SMS Setup Guide.

Recommended PC Requirements

The recommended PC requirements for System Manager Software are:

- Pentium-based PC
- Windows NT for SMS-3000; Windows NT or Windows 98 for SMS-1000, SMS-1500, and SMS-121, PMX-1500
- 128 MB RAM
- 4 GB hard drive
- RS-232 serial port for System Type 1; Network Interface Card for System Type 2 (see “Chapter 4—System Type 2: Ethernet LAN” on page 29)
- Parallel port
Table 3–8 summarizes the minimum SMS version required, depending on devices installed in your system.

<table>
<thead>
<tr>
<th>Device</th>
<th>Minimum SMS Version Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Monitor Series 4000</td>
<td>3.2</td>
</tr>
<tr>
<td>Circuit Monitor Series 2000</td>
<td>3.1</td>
</tr>
<tr>
<td>PM600, 620, 650 Power Meter</td>
<td>3.1</td>
</tr>
<tr>
<td>PM300 Power Meter</td>
<td>3.1</td>
</tr>
<tr>
<td>Enercept Meter</td>
<td>3.1</td>
</tr>
<tr>
<td>MICROLOGIC Electronic Trip Unit System</td>
<td>3.1.1</td>
</tr>
<tr>
<td>Sepam 2000 Medium Voltage Relay (versions 5 &amp; 6)</td>
<td>3.1</td>
</tr>
<tr>
<td>Sepam 1000+ Medium Voltage Relay</td>
<td>3.2</td>
</tr>
<tr>
<td>DC150 Data Concentrator</td>
<td>3.1.1</td>
</tr>
<tr>
<td>PIF3 interface to MICROLOGIC circuit breaker trip unit</td>
<td>3.1</td>
</tr>
<tr>
<td>POWERLINK AS Lighting Control Panel</td>
<td>3.1</td>
</tr>
</tbody>
</table>

1. Listed version or higher is required.
2. Primarily used with Circuit Manager Software (CMS).
TYPICAL APPLICATION DIAGRAMS

This section shows typical System Type 1 4-wire and 2-wire application diagrams.

Figure 3–12 Typical 4-wire application diagram

Figure 3–13 Typical application diagram with 4-to-2 wire ENA 485 converter for Enercept Meters
Figure 3–14 Typical 2-wire application diagram

1. At 19,200 bps (baud rate) for 8 devices maximum.
# CHAPTER 4—SYSTEM TYPE 2: ETHERNET LAN

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<td>SY/MAX System Connection</td>
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</tbody>
</table>
This chapter gives an overview of the System Type 2 communication system: Ethernet Local Area Network (LAN) (Figure 4–1). We will describe POWERLOGIC systems using Ethernet as the high-speed backbone to collect information from various devices and to allow the data to be shared by multiple users on different PCs.

![System Type 2: Ethernet LAN](image)

Figure 4–1  System Type 2: Ethernet LAN

Also in this chapter, we will show you examples of typical POWERLOGIC system architecture that is based on Ethernet. For details on RS-485 daisy-chaining, refer to “Chapter 3—System Type 1: Serial Communications” on page 11.

Because this chapter only briefly describes the basics of Ethernet networks, we recommend the following resources for more detailed information about Ethernet networks:

- MODICON web site [www.modicon.com](http://www.modicon.com), which provides comprehensive information on networking technology, networking devices, and a glossary of terms.
- Communication companies’ web sites, which offer valuable general information about Ethernet technology. These include:
  - [www.cisco.com](http://www.cisco.com)
  - [www.3com.com](http://www.3com.com)
  - [www.blackbox.com](http://www.blackbox.com)

To design a POWERLOGIC System Type 2, basically you will follow the 7 steps described in Chapter 3—System Type 1: Serial Communications.

Only Step 5 is different in that, instead of using an RS-232/RS-485 converter, you will be using POWERLOGIC Ethernet components and Ethernet hardware (hubs, etc.) to connect the daisy chains to the Ethernet LAN. That information is included in this chapter.

**NOTE:** Not all POWERLOGIC System devices or POWERLOGIC Ethernet components are available in all countries. Contact your local sales representative for availability.
ETHERNET LAN TOPOLOGIES

Ethernet is the most popular and widely used network technology, primarily because it strikes a good balance among speed, price, and ease of installation.

An Ethernet network can be configured in a "bus" or "star" topology, depending on the cabling. A "ring" topology is another type, but far less common.

Bus Topology

The bus topology is the Ethernet topology based on a one-cable LAN where all workstations are connected in succession to a single cable (Figure 4–2). Because the devices are linked by the same line, one drawback of this configuration is that the entire segment goes down if the wiring connection is interrupted at any point.

Star Topology

In a star topology, all attached workstations are wired directly to a central hub, which has several separate links to the connected devices (Figure 4–3). If a problem occurs on one of these connections, only that section of the network is affected.
Combination of Bus and Star Topology

A combination of bus and star topologies is frequently used (Figure 4–4).

![Combination Bus and Star Topology](image)

**Figure 4–4 Combination Bus and Star Topology**

**ETHERNET LAN MEDIA CABLE TYPES**

The three types of cabling used to interconnect the communication nodes (computers, gateways, hubs, and so forth) in an Ethernet LAN network are:

- Twisted-pair cables (10BaseT, 100BaseTX)
- Fiber-optic cables (10BaseFL, 100BaseFX)
- Co-axial cables (10Base5, 10Base2)

Bus topologies use co-axial cables (10Base5, 10Base2), while star topologies use twisted-pair cable (10BaseT) or fiber-optic cable (10BaseFL). Fast Ethernet communication (100 Mbps) requires twisted-pair cable (100BaseTX) or fiber-optic cable (100BaseFX). POWERLOGIC Ethernet components support 10BaseT, 10 Mbps as standard. The Ethernet Communication Card (ECC) of the Series 4000 Circuit Monitor supports both 10 Mbps and fast Ethernet 100 Mbps (twisted-pair and fiber optic) communications.

Table 4–1 summarizes specifications concerning the most-commonly used Ethernet LAN cabling.

**Table 4–1: Ethernet LAN Cabling Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>10BaseT 100BaseTX</th>
<th>10BaseFL 100BaseFX</th>
<th>10Base5</th>
<th>10Base2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (Mbps)</td>
<td>10/100</td>
<td>10/100</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Cable Type</td>
<td>UTP (unsheilded twisted-pair,100 Ω, Cat. 5 recommended)</td>
<td>Fiber Optic</td>
<td>Co-axial 50 Ω</td>
<td>Co-axial 50 Ω</td>
</tr>
<tr>
<td>Topology</td>
<td>Star</td>
<td>Star</td>
<td>Bus</td>
<td>Bus</td>
</tr>
<tr>
<td>Max. Length of Cable</td>
<td>328 ft (100 m)</td>
<td>6562 ft (2000 m)</td>
<td>1640 ft (500 m)</td>
<td>607 ft (185 m)</td>
</tr>
<tr>
<td>Connector Type</td>
<td>RJ-45</td>
<td>Fiber Connector</td>
<td>FNC</td>
<td>BNC</td>
</tr>
<tr>
<td>Common Name</td>
<td>Twisted-Pair Ethernet</td>
<td>Fiber Optic Ethernet</td>
<td>ThickNET</td>
<td>ThinNET</td>
</tr>
</tbody>
</table>
This section contains definitions of some basic Ethernet network components referred to in the diagrams that follow. For more detailed information, refer to the manufacturer's literature and digests.

- **Transceivers.** Figure 4–5 illustrates the use of a transceiver/media converter to connect a co-axial cable with a BNC connector to Category 5 UTP wiring with an RJ-45 connector.

![Figure 4–5 Use of a transceiver/media converter](image)

Transceivers are also often used to convert UTP to fiber-optic.

- **Network Adapter Cards.** A network adapter card (also called Network Interface Card, or NIC) is the most basic item needed. Some newer computers have cards built into the system. If your computer does not, you can add one of these small PC boards to your computer in a matter of minutes. The card installs into a slot on your motherboard, just like a sound card or modem card. Several types are available, so make sure you get the one made for your computer model.

  A network interface card provides the necessary link between your computer and your network. It converts your data into a format that an Ethernet network can accept and read. These small cards contain the connectors needed to link your computer to either a hub or another computer. Software comes with the adapter that enables your computer to work with the network.

  Network interface cards are available in 10 Mbps and 100 Mbps configurations. Dual function 10/100 Mbps boards are also available and are the most cost effective if you are currently connecting to a 10 Mbps network but plan on moving to a Fast Ethernet 100 Mbps network in the near future.

- **Hubs.** Hubs (also called a wiring hub, or concentrator) are the central connectivity point in a star configuration. A hub (Figure 4–6) allows each node to communicate with all other connected nodes. Connected nodes provide their own power, and the hub has its own power supply. The hub’s status lights allow for monitoring of the network. Most hubs are “plug and play”; no software is necessary to install. Two or more hubs can be connected to enable network expansion easily and inexpensively.

![Figure 4–6 Ethernet Hub](image)
Within Ethernet standards, there is a limit on the number of hubs that can populate a network. Hubs are available for both 10 and 100Mbps networking.

- **Switches.** A switch is a key component for expanding networks or dividing a large network into smaller segments. Adding a switch often improves the speed of a network that has become bogged down and over used, and a switch helps eliminate network errors. A switch also enables a network transmission to be directed to a specific node on the network instead of being transmitted to all users, like on a hub. A switch can monitor the network activity, send the data, and test it to ensure a complete transmission. This is called “store and forward.”

- **Routers.** Routers filter network traffic and connect different protocols to ensure that the file is routed to the correct location. Unlike direct hubs and switches, routers can offer network-management services, such as zone configuration and control.
POWERLOGIC ETHERNET INTERFACES

The POWERLOGIC system includes network communications interfaces that perform protocol conversion between standard Ethernet network protocols (TCP/IP) and MODBUS and POWERLOGIC-compatible devices.

These interfaces are:

- The POWERLOGIC Ethernet Gateway (EGW)
- The Ethernet Communication Card (ECC) of the Circuit Monitors Series 4000
- The POWERLOGIC Ethernet Communication Module (ECM-2000 and ECM-RM)

*NOTE: While the EGW and ECC are global products, the ECM is available for the UL and CSA markets only.*

Table 4–2 lists some of the features of these interface devices.

<table>
<thead>
<tr>
<th>Feature</th>
<th>EGW</th>
<th>ECC</th>
<th>ECM-RM</th>
<th>ECM-2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Speed (Mbps)</td>
<td>10</td>
<td>10/100</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Ethernet Cabling</td>
<td>10BaseT UTP</td>
<td>10BaseT/ 100BaseTX UTP</td>
<td>10BaseT UTP</td>
<td>10BaseT UTP</td>
</tr>
<tr>
<td>Ethernet Connector</td>
<td>RJ-45 AUI</td>
<td>RJ-45 LC Fiber Optic Connector</td>
<td>RJ-45</td>
<td>RJ-45</td>
</tr>
<tr>
<td>Ethernet Protocol</td>
<td>MMS/TCP</td>
<td>MODBUS/TCP</td>
<td>MODBUS/TCP</td>
<td>MODBUS/TCP</td>
</tr>
<tr>
<td>Number of RS-485 Serial Ports</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>RS-485 Connector</td>
<td>Female DB-9 Screw Terminals</td>
<td>Screw Terminals</td>
<td>Screw Terminals</td>
<td>Screw Terminals</td>
</tr>
<tr>
<td>2- and 4-wire Direct Connection</td>
<td>Yes</td>
<td>Yes</td>
<td>4-wire Only</td>
<td>4-wire Only</td>
</tr>
<tr>
<td>Power Supply</td>
<td>120/240 Vac/ 125 Vdc</td>
<td>Provided by Circuit Monitor Series 4000</td>
<td>120/240 Vac</td>
<td>Provided by Circuit Monitor Series 2000</td>
</tr>
<tr>
<td>Installation/ Mounting</td>
<td>Independent</td>
<td>Inserts into the Circuit Monitor Series 4000</td>
<td>Independent</td>
<td>On the back of Circuit Monitor Series 2000</td>
</tr>
<tr>
<td>Markings</td>
<td>CE, UL, CSA</td>
<td>CE, UL, CSA</td>
<td>UL, CSA</td>
<td>UL, CSA</td>
</tr>
</tbody>
</table>

1. The AUI port is a standard DB-15 attachment unit interface for connecting transceivers for various Ethernet media (for example, fiber-optic, coaxial, etc.)
2. The fiber-optic port of the CM4000 Ethernet Communications Card uses a duplex LC connector receptacle. The transceiver itself is capable of signal integrity up to 6562 ft (2000 m) of multimode fiber. The LC duplex connector fits into the RJ-45 standard cutout. For fiber optic cable, Belden Beloptix Laser Certified Fiber (LCF) or the equivalent is recommended. If an equivalent is used, it should meet these specifications:
   - multimode
   - 50 to 62.5 µm core diameter
   - 125 µm clad diameter
   - 1300 nm wavelength
3. MODBUS addresses are limited to 1–32.
Guidelines for Using POWERLOGIC Ethernet Interfaces

When using POWERLOGIC system Ethernet interfaces, follow these guidelines:

- **RS-485 Device Support.** The EGW and the ECC support all POWERLOGIC system devices on the daisy chain.

- **Static IP Address.** The setup of the system requires assigning a static IP address (Internet Protocol Address) to the interfaces (EGW, ECC, ECM-2000, ECM-RM). A unique IP address is also assigned to the PC that is functioning as the SMS server.

---

**Figure 4–7** POWERLOGIC Ethernet Gateway

- **MICROLOGIC Electronic Trip Unit System.** If the system has MICROLOGIC Electronic Trip Units daisy-chained to the port of a POWERLOGIC Ethernet Gateway, the gateway must use firmware version 2.5.0 or higher. The ECM-RM or ECM-2000 do not support MICROLOGIC Electronic Trip Units as illustrated in Figure 4–8.

---

**Figure 4–8** ECM-2000 and ECM-RM Ethernet Communication Modules
• **Other Interfaces.** Other Schneider Electric or third-party Ethernet communication interfaces can be used as the interface between POWERLOGIC devices and the system, such as a MODICON Ethernet MODBUS bridge. However, to design an architecture with these interfaces, we recommend that you consult your local representative to ensure that the architecture is feasible.

**SYSTEM ARCHITECTURE DIAGRAMS**

This section contains various diagrams of the Ethernet connections including:

- 10BaseT twisted-pair Ethernet in star topologies
- 10Base5 ThickNET
- 10Base2 ThinNET
- Fiber-optic Ethernet and high-speed networking (100 Mbps)
- SY/MAX system connection to Ethernet LAN

**10BaseT Star Topologies**

10BaseT is configured in a star topology and links nodes to a central hub with unshielded twisted pair (UTP) cable that is terminated at each end with RJ-45 connectors. The following provisions apply:

- Segments from the hub to the node should not exceed 328 ft. (100 meters).
- We strongly recommend using Category 5 UTP for POWERLOGIC system installation since it supports 100BaseTX (fast Ethernet) and is backward-compatible with existing category 3 or 4 installations.
- Twisted pair is the most economical cable type and it is the easiest to work with. However, in case of industrial environments with extreme levels of Electromagnetic Interference (EMI) or Radio Frequency Interference (RFI), shielded twisted pair (STP) or fiber-optic cable is preferred. When using STP, use STP 100 Ω (never use IBM STP 150 Ω).

Figures 4–9, 4–10, 4–11, 4–12, and 4–13 show typical Ethernet-based POWERLOGIC systems using the Ethernet gateway, the Ethernet Communication Card with the CM4000, the Ethernet Communication Module, Ethernet hubs, and 10BaseT wiring in a star topology.

*NOTE: Devices shown in illustrations are examples. Other devices can be substituted if they are compatible with the wiring (2-wire or 4-wire) shown. Refer to Table 3–1 on page 14 for device compatibility.*
Figure 4–9  POWERLOGIC Ethernet Gateway (EGW) in a 10BaseT Star Topology

1. At 19,200 bps for 16 devices maximum.
2. At 9,600 bps for 16 devices maximum.
Figure 4–10  10BaseT Star Topology with Ethernet Communications Card (ECC) installed in Circuit Monitors Series 4000

Figure 4–11  10BaseT Star Topology with Ethernet Communication Modules (ECM-2000 and ECM-RM)
10Base5 ThickNET

10Base5 is configured in a bus topology. It’s often called standard Ethernet or ThickNET because it uses a thick co-axial cable. Devices connect to the backbone via transceivers (Figure 4–12). 10Base5 supports only 10 Mbps segments. Because it is comparatively thick and harder to handle than other cabling, it is difficult to install and use in any situation other than as a backbone cable.

![Figure 4–12 Principle of POWERLOGIC System with 10Base5 ThickNET Ethernet](image)

10Base2 ThinNET

10Base2 is configured in a bus topology and uses a thin co-axial cable. 10Base2 supports only 10 Mbps segments. However, it is less expensive and easier to install than thick co-axial cable, making it sufficient for networks that only need to accommodate a small number of users (Figure 4–13).

![Figure 4–13 Principle of POWERLOGIC System with 10Base2 ThinNET Ethernet](image)
Fiber Optic Ethernet

Fiber-optic Ethernet is configured in a star topology. Fiber-optic cable provides the best signal quality and the greatest point-to-point distances (6,562 ft, 2000 m for multimode fibers). It transmits data as light pulses rather than electric charges, enabling it to be free of Electromagnetic Interference (EMI), Radio Frequency Interference (RFI), and other electrical cable problems. Figure 4–14 illustrates this configuration.

High-Speed Networking (100 Mbps)

High-speed networking, also called switched Ethernet, is a cost-effective technique for increasing the overall network throughput and reducing congestion on a 10 Mbps network.

POWERLOGIC Ethernet Communications Card (ECC) for the Circuit Monitor Series 4000 supports high-speed networking standards:

- 100BaseTX that is based on unshielded twisted pair Category 5 UTP or shielded twisted pair Type 1 STP cable
- 100BaseFX that allows fiber optic links via duplex, multimode fiber cable. (The fiber should be multimode, 62.5 µm core diameter, optimized for 1300 nm wavelength).

Figure 4–14 POWERLOGIC System in an Ethernet LAN with Fiber Optic and High-speed Networking
Wireless Ethernet

Wireless Ethernet extends an Ethernet network so that you can monitor power from a remote facility. Wireless Ethernet offers a solution when cables are cost-prohibitive or impractical to run, or when you want to back up a fiber-optic connection. Wireless Ethernet can use these media:

- spread-spectrum technology (6 miles, up to 10 Mbps)
- infrared laser technology (1000 ft, up to 155 Mbps)
- digital microwave radio links (7 miles, high speed)

NOTE: If your system requires using these technologies, we recommend consulting your local sales representative for additional information.

SY/MAX System Connection

Figure 4–15 illustrates the principle of connecting existing SY/NET-based systems to an Ethernet LAN. For a more detailed description of SY/NET networks used in conjunction with a POWERLOGIC system, refer to the POWERLOGIC Power Monitoring and Control System Planning Guide (3000CT9601).

Figure 4–15 Principle of SY/MAX System Connection to Ethernet LAN
Combinations of incompatible devices between SY/NET systems and the Circuit Monitor Series 4000 are illustrated in Figures 4–16 and 4–17.

Figure 4–16  Do not use a MODBUS-only device on a SY/NET daisy chain

Figure 4–17  Do not connect a Circuit Monitor Series 4000 with an ECC to a PNIM
CHAPTER 5—SYSTEM TYPE 3: WIDE AREA NETWORK (WAN)

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This chapter gives an overview of the System Type 3 communication system: Ethernet Wide Area Network (WAN) (Figure 5–1). Using the WAN allows data to be shared enterprise-wide, even around the globe. Companies with many users can monitor multiple facilities from one location, using high-speed connections that do not depend on dial-up lines.

Because the POWERLOGIC System uses standard TCP/IP protocol, transparent access to data across the company Intranet and the Internet is easy with the use of an Ethernet router. Connecting a LAN to a WAN, an Ethernet router filters and directs network traffic (Figure 5–2).
Figure 5–3 illustrates an example of POWERLOGIC System architecture in a WAN Intranet topology.
ENTERPRISE ENERGY WEB SERVER

The POWERLOGIC System Enterprise Energy Web Server is a Power Management engineered solution that enables you to use your standard web browser to view real-time metered data, historical trends, and reports on the web from actual connected loads. Important information is readily available to help you manage energy costs throughout the entire enterprise. This architecture is available through Schneider Electric Power Management Engineering Services. Contact your local representative for more information about these services.

Figure 5–4 Principle of the Enterprise Energy Web Server
CHAPTER 6—SYSTEM TYPE 4: CUSTOM SOLUTIONS

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  Integrating Third-Party Systems ...................... 53
This chapter introduces you to customized solutions that require Engineering Services to design the system, specify components, supply custom PLC programming, and provide other services.

This includes custom communication interfaces to other systems (Figure 6–1), such as the Building Automation System (BAS) or process control. When required, PLCs are included to perform more sophisticated automation control functions.
SYSTEM ARCHITECTURE DIAGRAMS

This section contains various diagrams of custom systems connections including:

- monitoring water, air, gas, electricity, and steam (WAGES)
- using an automatic transfer scheme
- integrating a POWERLOGIC system with a third-party system and with third-party products

NOTE: Not all third-party products are available in all countries. Contact your local sales representative for availability.

Monitoring WAGES

Figure 6–2 illustrates a POWERLOGIC system that uses MODICON PLCs to enable monitoring of water, air, gas, electricity, and steam (WAGES).

Figure 6–2  Monitoring WAGES with a POWERLOGIC System and MODICON PLCs

1. For example: water, air, steam, gas...
Integrating an Automatic Transfer Scheme

Figure 6–3 illustrates an automatic transfer scheme with redundancy (two QUANTUM PLCs). The PLCs receive data from I/Os (inputs and outputs such as overvoltage relays) and from POWERLOGIC power monitoring devices that work together to monitor and perform controls such as load shedding sequences. (See Figure 6–2 on page 51 for an example.)
Integrating Third-Party Products

Figure 6–4 illustrates POWERLOGIC System Manager Software (SMS) monitoring third-party devices such as protective relays, meters, and so forth.

Integrating Third-Party Systems

Figure 6–5 illustrates how a third-party interface can be used to integrate a POWERLOGIC System to a third-party system such as Johnson Controls, Andover Controls, or Landis & Staefa.
Figure 6–6 illustrates a third-party system interface with a POWERLOGIC System using MODBUS/TCP protocol.

![POWERLOGIC System Interface Diagram](image)

**Figure 6–6** Interfacing a POWERLOGIC System with a third-party system using MODBUS/TCP protocol
APPENDIX A—FREQUENTLY ASKED QUESTIONS

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**ENERCEPT METERS**

What type of cable do I use for my ENERCEPT Meter communications?

Use a Belden 1120A cable or equivalent when daisy-chaining the ENERCEPT Meters.

**ETHERNET-RELATED TOPICS**

Can I connect directly from a PC Network Interface Card (NIC) to an Ethernet Gateway (EGW)?

You can directly connect the PC Ethernet card to the EGW UTP port using a crossover Ethernet network cable.

Can the two ports on the Ethernet Gateway use different baud rates?

Yes, although all the devices on a single port need to use the same baud rate.

Can the Ethernet Gateway “talk” 100baseTX?

No, the EGW uses 10BaseT, but you could use a switch to make the EGW compatible with a 100BaseTX system.

Do I have to install the Ethernet Gateway Driver to communicate to SMS?

For SMS-3000 to communicate with the Ethernet Gateway, you must have the POWERLOGIC TCPMMS driver for SMS installed. The standard driver, however, is MODBUS TCP.

How Do I Find the Mac Address for the Ethernet Gateway?

The Mac Address refers to a special address that identifies every device that is connected to the Ethernet network. The EGW has an address that starts with the first 6 digits of 08.00.17. To find the Mac address of each gateway you will need to do the following:

1. Make sure the EGW is on the same segment as the PC.
2. Ping the IP address, then type “ARP -a” and that will display the Mac address of the Ethernet gateway that you just pinged.

How long will the Ethernet Gateway (EGW) retain its settings after its powered off?

Indefinitely. The system setup data is written to flash RAM.

What Ethernet protocols does the Ethernet Gateway use?

The Ethernet Gateway uses standard TCP/IP and OSI as its transport protocols.

Does the Ethernet Gateway support SNMP?

Yes. To find out more about implementing this contact your local representative.

What are the Internet Protocol (IP) address requirements for the Ethernet Gateway (EGW)?

Each Ethernet Gateway requires one static (fixed) IP address, regardless of the number of serial communication devices attached to it. For example, if five Ethernet Gateways are being used, then five unique static IP addresses are required.

**NOTE:** The SMS Server PC (SMS-3000/1500) requires a static IP address. The SMS clients do not need a static IP address (SMS-1000).

What type of security is implemented by the Ethernet Gateway?

The Ethernet Gateway has two types of security over Ethernet. One is the inherent encrypted security contained in the MMS (Manufacturing Message Specification) application protocol. The MMS protocol contains a specific algorithm that encrypts the messages containing data. The other is a user definable security in the Ethernet Gateway which must be set to match in each SMS server.
How many logical Ethernet connections are possible per port with the Ethernet Gateway?
Logical connections are defined as the number of master Ethernet connections possible between devices. The Ethernet Gateway can support up to eight logical connections per serial port. For example, consider a POWERLOGIC system that contains eight SMS-3000 servers, an unidentified number of SMS clients, and an Ethernet Gateway. If all servers maintained a logical connection to both ports of the EGW, this would be the maximum connections that the Ethernet Gateway could support.

NOTE: The ECM can support up to eight logical connections; the ECC up to ten.

What is the network loading affect of an SMS server communicating with an Ethernet Gateway?
The network loading of the communication between an SMS server and an EGW is about 2/10ths of a percent per port on the EGW. This is based on an EGW baud rate of 19200 and continuous sampling, including waveform captures and uploading log files. If the EGWs baud rate is 9600 then the loading would be lower, because the rate of data coming to the EGW from the device would be slower.

What TCP port does the EGW use?
The EGW uses TCP/MMS port #102.

Why do I need a Null Modem Cable (3050 EGWNMC) when I order an EGW?
The Null Modem Cable is needed to access the setup utility in the Ethernet Gateway. This is done by connecting a null modem cable between the PC's RS-232 port and the gateway's RS-232 port, and by using a terminal program to communicate with the setup utility in the Ethernet Gateway.

Does the Ethernet Gateway support subnet initiated communications?
The EGW supports SYMAX but not MODBUS subnet-initiated communications through RS-485 ports.

MICROLOGIC ELECTRONIC TRIP UNIT SYSTEM

Do I need an external power supply for MICROLOGIC Electronic Trip Units?
The basic LSIG protection functions in the Type A and P trip units are self-powered by the current flowing through the breaker. The display, metering, and communications functions of the Type A can be either self-powered or powered by an external 24-Vdc power supply. If self-powered, the current must be at least 20% of the sensor rating.

The display, metering, communications, and advanced protection functions of the Type P can be powered three ways: from an internal voltage pick-up connected to the bottom terminals of the breaker, from an external voltage pick-up, or by an external 24-Vdc power supply. The external 24-Vdc power supply is recommended to ensure that metering and communication continue, even if the circuit breaker is opened or tripped.

Other components in a MICROLOGIC Electronic Trip Unit System, such as the BCM (breaker communication module), CCM (cradle communication module), MC2 (two-alarm contact module), and M6C (six-alarm contact module) also require an external 24-Vdc power supply.

NOTE: The BCM and CCM may share the same power supply, but it must be separate from the power supply feeding the trip unit. The trip unit and M2C/M6C contact modules may share a common power supply. The M2C/M6C contact modules are electrically connected to the trip unit and therefore must not share a power supply with the communication modules (BCM and CCM).
**MODEMS**

*Does SMS support 10-bit word and 11-bit word modem data transfer?*

SMS-3000 series software supports 10-bit modems. If you are trying to communicate with a 10-bit modem, the POWERLOGIC device being communicated to must also be configured to 10 bit.

- For the Circuit Monitor CM2000 series follow these steps: using the command interface, write 2325 to register 7700 to make 8 bits, even parity (default) or 2326 to register 7700 to make 8 bits, no parity (10 bit).
- For the Power Meter PM-6xx: Register number 2081 must have bit 6 set to 0 for even parity (default) or 1 for none (10 bit).

*Do RS-485 radio modems work with POWERLOGIC systems?*

Use an RS-232 radio modem with a converter instead of the RS-485 model.

*How can I keep my modem from hanging up?*

The modem will hang up when no activity is detected on the line. To avoid hang up, keep a device table on the screen with at least a 5-second update.

*Why does the modem sometimes lose communications at 19200 baud rate to the circuit monitor?*

If you are using one MultiTech MT 1932ZDX, the V.32 turbo mode that the modem uses to speak 19200 is only compatible with V.32 turbo. Therefore, you must use a MultiTech MT 1932ZDX at both ends to communicate at 19200 baud rate.

*My modem dials each meter individually, but the phone number is the same. Shouldn’t it only need to dial one time?*

Yes. The phone number is probably entered differently for some of the devices. Make sure all phone numbers are entered in the same format. For example, if one phone number is entered in as 9,615 287 3404, the rest should be entered in the same way.

**POWER METER PM600, 620, 650**

*When a power meter is on the end of the daisy chain, how do you terminate it?*

Terminate the power meter using one of the following methods:

- MCTAS-485. This terminator plugs directly into the power meter communications port (RS-485 terminals).
- MCT-485. In this method, communication wires route from the last power meter on a daisy chain to a 5-position terminal block. The terminator attaches to the terminal block.

*Do I need a Power Meter Display?*

The display for the power meter is optional. At least one should be purchased for programming the address, baud rate, system type, CT ratio, and PT ratio.

*Does the power meter RS-485 communication connection have an isolated ground or is it tied to the power supply ground?*

The RS-485 communication connection on the power meter is not connected to the power supply ground. The communication connection does not have an isolated ground.

**POWERLINK AS PANELS**

*Can circuit monitors and POWERLINK AS Panels be on the same daisy chain?*

Circuit monitors can be on the same communication daisy chain with POWERLINK AS systems. POWERLINK AS panels use the same communications as Circuit Monitors Series 2000.
**Is there a communication terminator for POWERLINK AS Panels?**
Yes, the part number for the terminator that should be used for POWERLINK AS communication is an MCTAS-485.

**How do I establish communications between a PC and POWERLINK AS Panel?**
To establish communications between a PC and a POWERLINK AS panel, the control module must be attached to the interface module.

**How do I network POWERLINK AS Panels?**
To network POWERLINK AS Panels, each panel must have a network interface module (for example, NEHB442ASP-N) along with a control module plugged into each Interface Module.

---

**SERIAL COMMUNICATION—DAISY CHAIN**

**Can I use Belden 8723 Communication Cable underground?**
For underground burial of Belden cable, Belden recommends Belden 88723.

**Does the pushbutton on the front of the MCI-101 Converter Kit need to be out (Normal) or pushed in (DLB)?**
The push button should be in the out (Normal) position. DLB is a loop back test switch for diagnostics. Don't use it with POWERLOGIC software.

---

**SOFTWARE-RELATED TOPICS**

**Do I need to install the Ethernet Gateway driver on my server and my remote clients?**
The computer running the SMS server needs the EGW driver installed on it. Remote clients do not need the EGW driver installed.

**Do you need the Ethernet Gateway TCP/MMS driver to use the Ethernet Communications Module (ECM-2000) OR ECC?**
No, you just need SMS-3000/1500 v3.1 or higher.
APPENDIX B—EXTENDING A DAISY CHAIN

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EXTENDING A DAISY CHAIN

Until now, we have described standard architecture and parameters, such as the maximum number of devices and the maximum length of an RS-485 daisy chain. In this appendix, we will describe communication options that can be used to exceed these limits if necessary.

However, we will only describe here the principles of communication options that can be used. We recommend that you consult your local representative for more specific detailed information. You can also find more detailed information in the documentation of communication manufacturers such as CISCO, Black Box, and others.

Repeater

A repeater permits you to go beyond the 32 device limit and/or extend the maximum length of a daisy chain (Figure B–1).

Phone Modem

In some situations, the best communication option consists of using a phone line and modems (Figure B–2). To communicate with devices via modem, connect the remote daisy chain with an RS-232/RS-485 converter and a modem. Connect another modem to the RS-232 port of the PC, according to the diagram below.
When communicating with modems, all devices in the daisy chain must have the same character format (data transfer format). With serial communications, we recommend modems supporting 11-bit character format, which is a format supported by all POWERLOGIC-compatible devices.

However, a 10-bit character format modem can be used instead, provided you set up all devices for 10-bit character format. The character formats are shown in Table B–1.

**Table B–1: Character Formats**

<table>
<thead>
<tr>
<th>Character Format</th>
<th>Start Bits</th>
<th>Data Bits</th>
<th>Parity</th>
<th>Stop Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-bit</td>
<td>1</td>
<td>8</td>
<td>Even</td>
<td>1</td>
</tr>
<tr>
<td>10-bit</td>
<td>1</td>
<td>8</td>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>

In addition, some specific setup has to be performed in SMS. Consult the *SMS Setup Guide* for more information.

**Dedicated Phone Line**

In cases where installing RS-485 cable may be impossible or impractical, the best data communications option may be to use existing dedicated phone lines for data transfer (Figure B–3).

![Diagram of Dedicated Phone Line](image)
Table B–2 below shows maximum distances for typical baud rates when using a line driver via 26 AWG twisted pair.

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Max. Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,200</td>
<td>4.0 miles (6.5 km)</td>
</tr>
<tr>
<td>2,400</td>
<td>3.0 miles (4.8 km)</td>
</tr>
<tr>
<td>4,800</td>
<td>2.3 miles (3.7 km)</td>
</tr>
<tr>
<td>9,600</td>
<td>1.7 miles (2.7 km)</td>
</tr>
<tr>
<td>19,200</td>
<td>1.2 miles (1.9 km)</td>
</tr>
<tr>
<td>38,400</td>
<td>0.9 miles (1.5 km)</td>
</tr>
<tr>
<td>64,000</td>
<td>0.75 miles (1.2 km)</td>
</tr>
</tbody>
</table>

1. Speed and distance are dependent on actual operating conditions.

Fiber Optics

In facilities where communication signals may be exposed to excessive "noise," a fiber-optic communication cable may be the best solution. Figure B–4 below shows a typical application of fiber-optic technology.

Figure B–4  Extending a daisy chain with fiber-optic communication cable
Figure C–1 shows cable pinouts for CAB-107 and CAB-108 cables.

### CAB-107 (10 ft. [3 m])
- **RX–**: White (1)
- **RX+**: Green (2)
- **TX–**: Black (3)
- **TX+**: Red (4)
- **Shield**: Shield (9)

### CAB-108 (2-ft [.6 m])
- **TXA–**: White (1)
- **TXB–**: Green (2)
- **RXA–**: Black (3)
- **RXB–**: Red (4)
- **Shield–Shield**: Shield (9)

![CAB-107 and CAB-108 cable pinouts](image_url)
GLOSSARY

access—allowed availability to information on a network.

address—reference number assigned to an interfaced device.

baud rate—the rate of speed at which information is transmitted over communications lines; expressed in bits per second.

bits—a contraction of binary digits, the smallest unit of information in binary notation. A bit has the value of a zero (0) or a one (1). For example, the binary number 0110 consists of four bits.

circuit monitor—a multifunction metering device that can perform real-time metering of voltage and current, perform calculation of the data, and control relays to replace a variety of meters, relays, transducers, and other components.

CM4000—see POWERLOGIC Circuit Monitor Series 4000.

coaixial cable—a cable consisting of an outer conductor concentric to an inner conductor, separated from each other by insulating material.

daisy chain—the physical method of cabling devices in series.

EIA (Electronic Industries Association)—a standards organization specializing in the electrical and functional characteristics of interface equipment.

Ethernet address—a unique number that identifies the device in the Ethernet network and is always written as a combination of eleven numbers such as 199.186.195.23.

Ethernet—a specification for local communication networks that employs cable as a passive communication medium to interconnect different kinds of computers, information processing products, and office equipment at a local site.

fiber optics—a medium that uses light conducted through glass or plastic fibers for data transmission.

firmware—operating system and/or program within a device.

gateway—in local area networks (LANs), a computer system and its associated software that permit two networks using different protocols to communicate with each other. A gateway translates all protocol levels from physical layer up through applications layer, and can be used to interconnect networks that differ in every detail.


interface—a device that allows communication between systems or ports of systems.

IP address—Internet protocol address. See also Ethernet address and address.

MICROLOGIC Trip Unit—MICROLOGIC Type A and Type P Electronic Trip Unit.

mixed-mode—supporting both POWERLOGIC and MODBUS devices on the same communication daisy chain.

multipoint communications—a method of communication in which a single device can communicate to multiple devices.

NEMA Standards—property characteristics adopted as standard by the National Electrical Manufacturers Association.

network—a group of computing devices that are connected to each other by communications lines to share information and resources.

non-volatile memory—memory which retains its contents upon loss of power.

PLC—see programmable logic controller.

POWERLOGIC Circuit Monitor Series 4000—The most powerful circuit monitor in the family of circuit monitors offered by POWERLOGIC. See also circuit monitor.

programmable logic controller (PLC)—a solid-state control system that has a user-programmable memory for storage instruction to implement specific functions such as I/O control logic, timing, counting, arithmetic, and data manipulation.

protocol—a standardized procedure for establishing a communications link between devices and that is based on such elements as word structure or word length.
router—a device that connects multiple networks together, providing path selection and alternate routing based on network destination addresses and the status of the connected networks.

RS-232—an EIA interface standard between DTE (Data Terminal Equipment such as a PC) and DCE (Data Communication Equipment such as a modem). This is the industry’s most common interface standard that employs serial binary data interchange.

RS-485 interface—a type of electrical interface that offers a standard of communication for electronic devices and provides multipoint communications.

RS-485—an EIA interface for multidrop applications.

SMS—see System Manager Software.

System Manager Software (SMS)—software designed by Schneider Electric for use in evaluating power monitoring and control data.

system—a collection of units (such as devices, and interfaces) combined to work as a larger integrated unit having the capabilities of all the separate units.

terminator—an electrical load employed on the end of a transmission line or cable that is used to balance the impedance.

throughput—maximum system output, measured in tasks per unit of time.
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POWERLOGIC® System
Architecture and Application Guide
NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

---

**DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

---

**WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

---

**CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

---

**CAUTION**

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

---

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. This document is not intended as an instruction manual for untrained persons. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this manual.

---

Class A FCC Statement

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