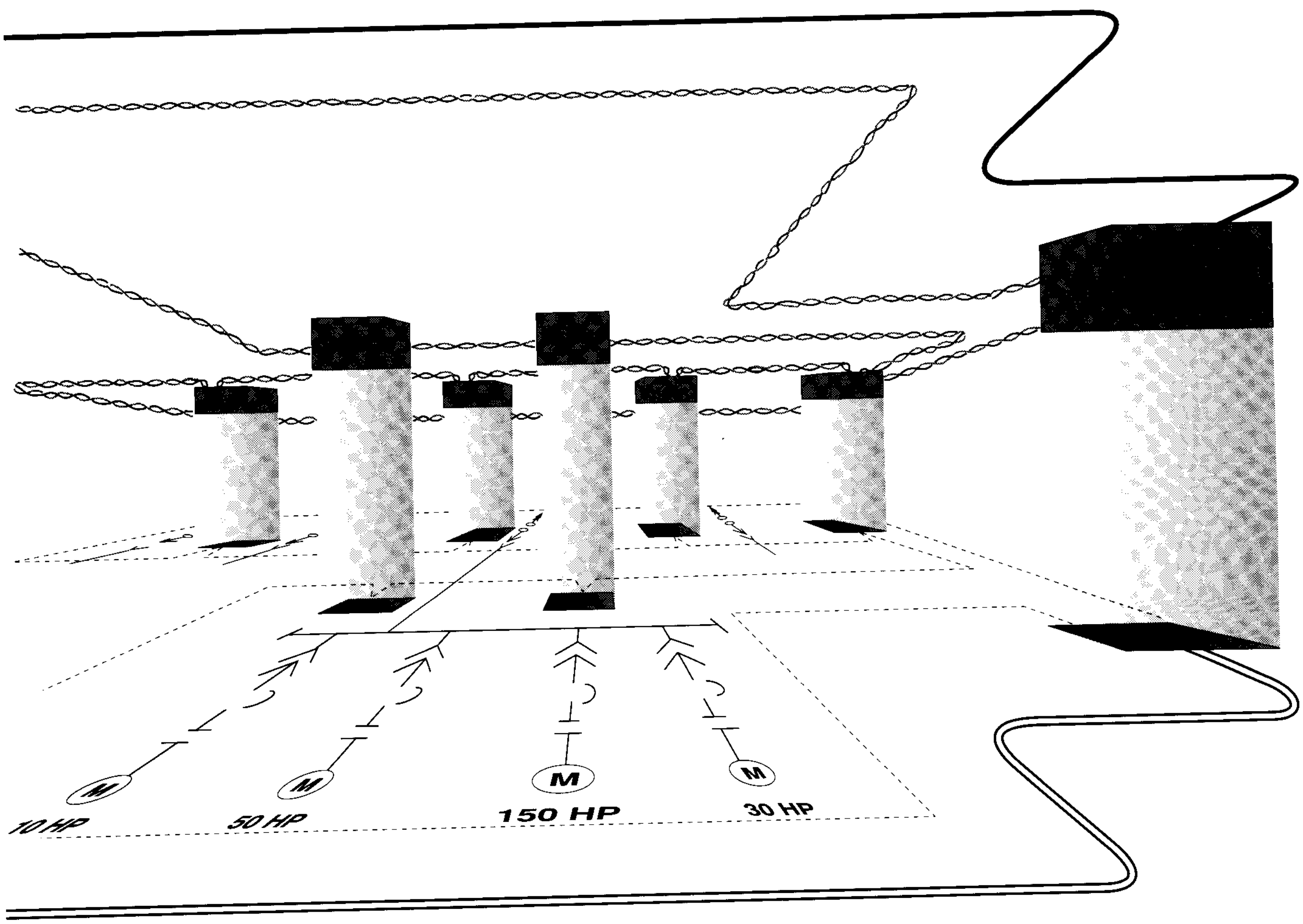
SIEMENS

Installing the ACCESS™ System



Manual No. SG-6028

DANGER

Hazardous voltages are present in the equipment that will cause severe personal injury and equipment damage. Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which can cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

Circuit breaker indicators shown in this booklet are for illustration purposes only. Circuit breakers are to be installed in "Discharged" and "Open" positions only.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence.

NOTE

***Authorized and qualified personnel—**
For the purpose of this manual a qualified person is one who is familiar with the installation, construction or operation of the equipment and the hazards involved. In addition, he has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.

(c) **is trained** in rendering first aid.

SUMMARY

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office, listed on back of this instruction guide.

The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc. The warranty contained in the contract between the parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

Table of Contents

1 Introduction

The ACCESS™ electrical distribution communications system comprises a variety of complex devices. The installation, operation and maintenance of these devices requires a high level of technical instruction. This manual provides general information on installing the ACCESS system. This manual does not replace other Siemens manuals covering detailed information, installation, operation, or maintenance of equipment or software.

1.1 Arrangement of This Manual

Section 2, "Operational Overview," discusses the nature of the communication network and how it operates. A firm understanding of the overview may enable you to enhance your system as your needs develop.

Section 3, "Installing the Network," discusses the arrangement of devices into closed loops and interconnections. This section contains recommended practices and guidelines to assist your planning and installation procedures. Included are installation and setup instructions, such as preparing the cable, grounding the shield, grounding equipment, and terminating the cable in special circumstances. Where possible, follow these procedures to give your system needed redundancy and to help avoid problems, such as ground loops.

Note: As with most engineering installations, there are usually several ways of accomplishing the same objective. If you use several of these methods simultaneously within the same system, problems can occur. Therefore, this manual explains only one installation method, and you should follow these procedures for the best results.

Section 4, "ACCESS Devices," discusses product descriptions and specific interconnections. This section does not replace the instruction manuals available with each Siemens product. Those manuals contain specific operating and setup instructions you need to get the full use of your system. There is some repetition of material across manuals; however, this repetition is intended to reinforce the most important elements of device installation and operation.

Siemens recommends that you have available the user's manuals for each device on your system. The following list identifies each user's manual by name and manual number:

Electronic Trip Unit for SB Encased Systems Breakers (Manual no. 2.20-3A)
Static Trip III (Manual no. SG-3118-01)
SCOR Overcurrent Protective Relay (Manual no. SG-9228-01)
Electronic Metering Package: 4700 Power Meter (Manual no. SG-6018)
Electronic Metering Package: 4300 Power Meter (Manual no. SG-6038)
SAMMS Siemens Advanced Motor Master System (Manual no. CP3290)
Multiplexer Translator (MT) (Manual no. 2.21-1A)
SB Encased Systems Breakers: 400-2000 Ampere Frame Rating (Manual no. 2.20-4A)
I-T-E® Molded Case Circuit Breakers (Manual no. SIB 2.7-8)
Power Monitor™ Display and Monitoring Unit (Manual no. SG-4018-01)
Isolated Multi-Drop™ RS-232 to RS-485 Converter (Manual no. SG-6048)

Section 5, "Startup and Troubleshooting," contains guidelines for powering the system and for identifying and solving basic problems. These guidelines assume that you are starting up and troubleshooting a properly installed network.

Appendix A, "Documenting Your System," contains sample documentation and forms that you need to plan, install, troubleshoot, and monitor the ACCESS system.

Appendix B, "Technical Details of the ACCESS System," contains detailed discussions of information about the ACCESS system. Refer to this section if you need more detail than what is provided in the main sections of this manual. Siemens issues application notes from time to time covering anything from software revisions to field changes. These application notes are summarized in this appendix.

Appendix C, "Ordering Information," includes listings for all peripheral items such as modems, cables, surge protectors, and signal converters. For ordering convenience, this listing also includes manufacturers' part numbers.

1.2 How to Use This Manual

To eliminate installation problems, read and understand section 2, "Operational Overview," and section 3, "Installing the Network," before attempting to install the ACCESS system. These sections contain the recommended installation guidelines. The construction of your equipment dictates how you can best use these guidelines. In section 4, "ACCESS Devices," Figure 4.1 illustrates the correct relationship of all devices in the ACCESS system.

Finally, to properly install the ACCESS system, read and understand the individual installation, instruction, and operation manuals available with each Siemens device. These manuals are listed above in section 1.1.

If You...	...Read this section:
Have never installed ACCESS	2. Operational Overview and continue through the manual before attempting to install ACCESS system
Need an explanation of the communication network	2. Operational Overview
Understand communication networks	3. Installing the Network
Need installation information on a specific ACCESS device	4. ACCESS Devices
Need troubleshooting procedures	5. Startup and Troubleshooting
Need to document device setup and configuration information	Appendix A Documenting Your System
Need more detailed technical information	Appendix B Technical Details of the ACCESS System
Need ordering information	Appendix C Ordering Information

2 Operational Overview

The ACCESS system is described as a network because it is an interconnection of similar-purpose components. This section establishes the guidelines for the interconnection. The layout of the devices in the network is known as the network's topology. Each component supplied by Siemens for the ACCESS system has electrical system data to communicate to the supervisory (master) devices in the network. Some latitude in topology is allowed depending on your application; however, your overall configuration will be similar to that shown in Figure 2.1.

2.1 The Network

The network contains master and slave devices. Master devices initiate commands, and slave devices respond to these commands. These devices can both transmit and receive data on the same serial network.

The Power Monitor™ display and monitoring unit is a master device. Its commands are mostly requests for data. After sending a request, the Power Monitor unit receives feedback sent from a field (slave) device via the serial network. This process, called polling, allows the master and slave devices to exchange information. Serial data communication is explained in more detail in section 2.4.

At the top level of the ACCESS system is the ACCESS Host PC. The ACCESS Host PC is a personal computer that monitors the entire ACCESS system. The Host PC can be connected directly to as many as 40 Power Monitor units via an RS-232 connection. Data exchange and definition is described by the Host PC-to-Power Monitor SEAbus™ protocol. The Power Monitor unit communicates with field devices via an RS-485 communications interface using the field device's SEAbus protocol as illustrated in Figure 2.1.

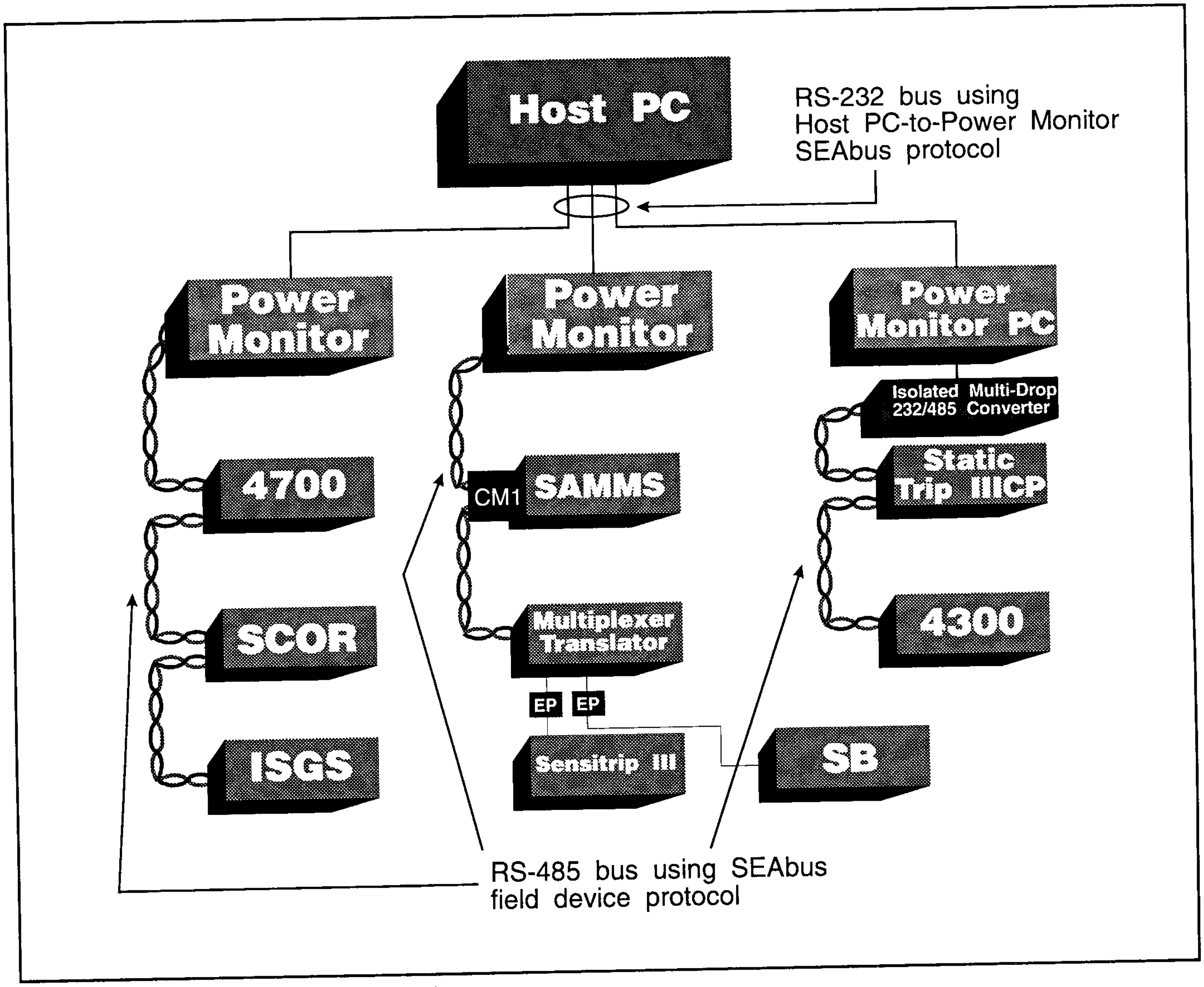


Figure 2.1 Example ACCESS Network Topology

The communications bus standard used for the field-level ACCESS system is the RS-485 standard. This is the Electronics Industries Association (EIA) 485 standard, but it is commonly referred to as RS-485. The SEAbus protocol defines the pattern of bits and bytes within the communications data packets, which contain the specific information to be transferred. The RS-485 standard defines the properties of the electrical signal of the electronic bus interface that handles this communication.

RS-485 is a standard that is commonly used in many industrial environments. It differs from the RS-232 standard found on most personal computers and has advantages that make it better suited for industrial applications. One advantage is that RS-485 offers a balanced transmission scheme that uses differential drivers and receivers. This scheme cancels noise and allows for better data integrity. By contrast, the RS-232 standard uses a single-ended, unbalanced design that can distort data. The RS-485 design can support 32 different drivers and receivers over a maximum distance of 4000 ft., and at data transmission speeds of up to 10 megabits-per-second (Mbps). The RS-232 standard supports only one driver and receiver over 50 ft. of distance, at transmission speeds as high as 20 kilobits-per-second (Kbps). Table 2.1 lists the parameters for both RS-485 and RS-232 standards.

Table 2.1 RS-485 and RS-232 parameters

Parameter	**RS-232**	**RS-485**
Mode of Operation	Single-ended	Differential
Number of drivers and receivers allowed	1 driver 1 receiver	32 drivers 32 receivers
Maximum cable length (ft)	50	4000
Maximum data transmission rate	20 Kbps	10 Mbps

2.2 Connecting Field Devices

Communications-grade, shielded, twisted-pair cable is used to connect the devices within the network. The cable is connected to the RS-485 communications port on each device, linking the devices in an interconnection loop, as illustrated in Figure 2.2. This cable makes up part of the communications "bus," or the hardware that connects the devices together. The ACCESS system uses Siemens SEAbus protocol for data transfer on the bus.

The recommended method for connecting field devices is daisy chaining. Daisy chaining is a method of connecting one device (master) to a second device (slave) and the second device to a third device (another slave) and so on. This process is repeated until the last device is connected to the first device (master), thereby establishing an interconnection loop. In the event of a break in the cable, each device is still connected to the master device.

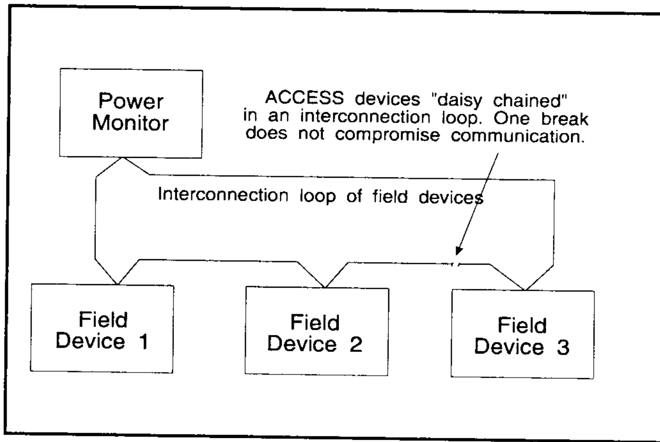


Figure 2.2 ACCESS Field Devices in an Interconnection Loop

2.3 Connecting Host PC to Power Monitor

The Power Monitor unit connects to the Host PC via an RS-232 port. This RS-232 port is located on the eight-port cable that is attached to an ARTIC Portmaster card. The ARTIC Portmaster card is installed inside the Host PC. Only two devices may be connected using the RS-232 standard. The maximum cable length between devices is 50 ft., with a maximum data rate of 20 kilobits-per-second (Kbps). The ACCESS System typically uses short-haul modems to increase this distance to approximately 3.5 miles. Refer to section 4.2 for more information on short-haul modems.

2.4 Serial Communications

Data communicated along the bus is in binary form. The information is broken down into combinations of "1s" and "0s" (these are binary digits or "bits"), whose exact combination and pattern is understood by both devices. For example, in binary-coded decimal (BCD) form, the numbers 5, 2, 8 and 0 are 0101, 0010, 1000, and 0000 respectively. Each number is represented by a combination of four 1s and 0s. Eight bits are commonly called a "byte." A "word" can be made up of two bytes. This is just one example of many ways to encode data. For more information on data communication, consult the *Design Guidelines for the SEAbus and SEAbus Plus Communications Protocols* (Document no. AED 01-003-01).

The value of this system is that a one or a zero can be translated by the electronic circuitry as a higher (1) or lower (0) voltage state, either on or off. This system greatly simplifies the circuit design. To send the above numbers (5,2,8,0) along the bus to another unit, the binary digits representing each number are put onto the bus one bit at a time, in sequence. This system is known as "serial" data communication.

The transmission described in the preceding paragraph over simplifies the issue. In reality, the receiving unit must first be told to receive the data, and it must have a context for the values. For example, when the numbers 5, 2, 8 and 0 are received, the receiving device must understand what they mean. To make sense of this string of 1s and 0s transmitted on the bus, the data must be organized. This organization is unique to each field device and is defined in the device protocol packet definitions.

2.5 SEAbus Communications Protocol

The rules that govern this packet organization for the field level of the ACCESS system are collectively called the SEAbus Protocol, or SEAbus. This protocol is defined in a written document detailing "the rules of the bus." Siemens makes this protocol available to anyone who wants to connect their device to the ACCESS system. This is called an "open protocol."

2.5.1 SEAbus Message Structure

Information in SEAbus data packets is packed in the following sequence called a message:

Sync	Devt	Msgt	Len	Data	LRC

The following definitions briefly describe each of the fields in the above message structure:

Sync — The Sync byte (8 bits) alerts the system that information is coming. There is a master-to-slave sync byte (14h) and a slave-to-master response sync byte (27h).(The "h" indicates a hexadecimal number.)

Devt — The Devt byte is the device's intended address. It can be either a direct address for a specific device or an indirect address for a device type.

Msgt — The Msgt byte tells the receiving device what the message means. One code might mean current or voltage data, a second code might mean device status, and so on.

Len — The Len byte indicates the number of bytes in the data section of the packet.

Data — This is the data, the reason the communication system is in place. With indirect addressing, the first one or two bytes in this field is the device's address.

LRC — This is the checksum byte. This field, Longitudinal Redundancy Check, is put in place as a check on the integrity of the whole packet. It can detect if one or more of the bits was changed during transmission.

For more information on SEAbus message structure, refer to the *Design Guidelines for the SEAbus and SEAbus Plus Communications Protocols* (Document no. AED 01-003-01).

2.5.2 Addressing

Each device is capable of receiving and decoding messages. The key is to have the correct device respond to the message. To accomplish this, you must establish a unique address or location on the bus for each device. This allows the Power Monitor unit to send information to a specific device that responds to that information.

On the communications bus, all connected devices are exposed to the same signals going back and forth. The device address is the data field that alerts the device that the rest of the message is for this device. This address is a unique number assigned to each device.

Addresses are stored in two ways: using solid state data memory and using hardware switches. The first way uses a data memory location that is not lost during a power outage. This memory can be divided into two types: The first type is typically called Electrically Erasable Programmable Read Only Memory (EEPROM). Using the routines for each device described in section 4, "ACCESS Devices," the address is programmed into this memory location, replacing anything that was previously recorded. The second memory type uses a long-life battery to maintain the address and setup information in a standard non-volatile electronic memory.

The second way of storing an address is through the use of hardware switches on the device. Using this method, the address is set manually and can only be changed manually.

The Devt field contains the device address for the Static Trip IIIC trip unit and the SAMMS motor protection and control relay devices only. Indirect addressing is used in all other cases. In the indirect addressing mode, the Devt field contains a code specific to the group of devices addressed. The actual address is contained within the first one or two bytes of the Data field, depending on the device type.

The Siemens Multiplexer Translator (MT) device (see section 4, "ACCESS Devices") has a two-part address scheme. The first Data byte is the address of the MT. The second Data byte is the address of the device connected to the MT. Section 3, "Installing the Network," explains this scheme in more detail.

2.5.3 Error Checking

Occasionally, data errors occur in a data communication system. Whatever the cause, the system is built to tolerate bit errors in any packet transmitted or received. The SEAbus software incorporates a scheme for error checking, called Longitudinal Redundancy Check (LRC). If the LRC byte detects an error, the message is retransmitted.

2.6 Cabling Requirements

The cable connecting the field devices to the Power Monitor unit is a twisted-pair of insulated conductors. The pair is twisted to minimize pickup of random signals between the conductors particularly those signals induced by electromagnetic interference (EMI).

To further protect against external electrical interference, the pair is shielded by a grounded outer covering. The shield conducts radio frequency interference (RFI) to the ground, thus reducing its effect on the twisted pair. Concern over RFI and EMI is important given the high electrical current and electrically noisy environment through which the communication wires are routed.

3 Installing the Network

This section discusses installing the network. Follow the rules explained in this section to properly install the system. Following these rules also prevents possible injury and equipment damage.

To install an ACCESS system properly, you must understand certain concepts of network installation such as establishing topology, grounding ACCESS equipment, connecting field devices in a network, installing the field cable, and connecting to the ACCESS Host PC. The following sections discuss these issues in detail.

3.1 Field Device to Master Topology

A shielded, twisted-pair of wires forms the cable for the SEAbus network. Using this kind of cable offers an inexpensive, easily available method for connecting field devices to the master device. As mentioned in section 2, this pair of wires is twisted and shielded to prevent RFI and EMI from affecting the signal. Refer to section 3.6, "Cable Characteristics," for a complete description of cable characteristics.

Rule 1: Connect all field devices in a loop topology (explained in section 2, "Operational Overview") so that all devices are connected to the master in case of a line break.

One of the objectives of the communication bus design is to provide redundancy so that, if a line is cut, communication is not interrupted. By completing the loop in the RS-485 cable, one break can be made anywhere in the line without compromising communication with the master device. To maintain redundancy, avoid open ended runs of the bus. However, if this is not practical because of physical restrictions such as maintaining maximum distance requirements, the bus can operate open ended.

Rule 2: A maximum of 32 devices may be connected in a single RS-485 bus for a total cable run no longer than 4000 ft.

Figure 3.1 illustrates several complete RS-485 loops connected to a main interconnection loop. From the individual device loops, stub cables are dropped down to each device. The master device (in this case a Power Monitor unit) supervises all the devices connected to the main interconnection loop up to a total of 32 devices.

3.2 Grounding the Cable Shield and the Field Devices

For all devices, ground the cable shield at one end only to prevent induced interference that may result from circulating ground currents. If a cable's shield is grounded at both ends, a ground loop can exist between the components. This ground loop can result in induced interference that causes signal distortion. Figure 3.2 on the next page illustrates the preferred method for connecting cable to field devices.

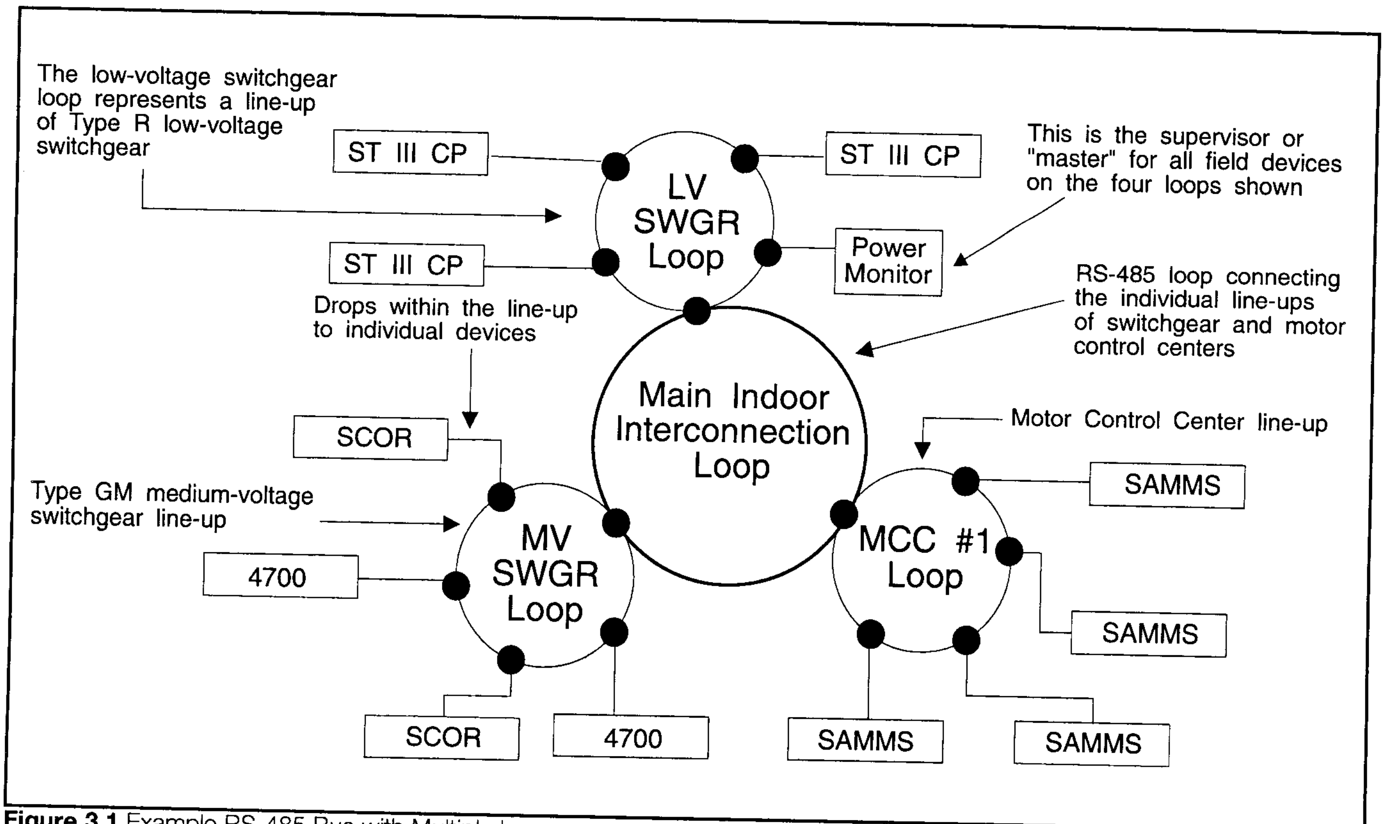


Figure 3.1 Example RS-485 Bus with Multiple Loops

Rule 3: Always ground the shield at only one end of a cable segment.

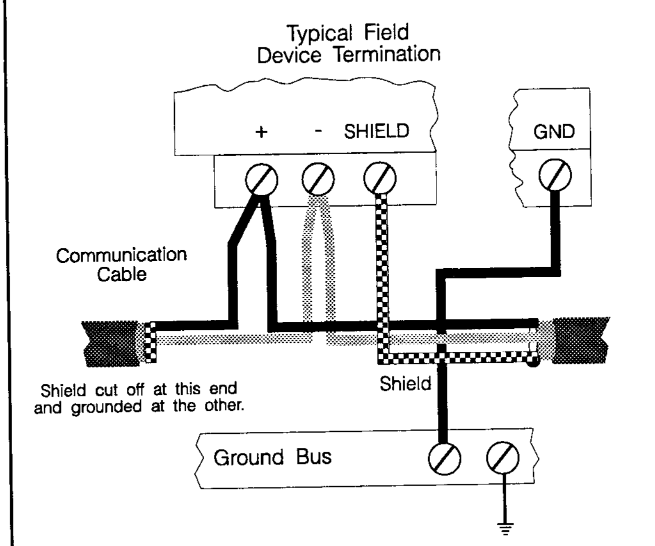


Figure 3.2 RS-485 Field Device Termination

At each field device, connect the shield of the cable to the shield or chassis ground terminal only if the other end of the same segment of the cable shield is not connected to ground.

Rule 4: Always connect the field device's ground terminal directly to the equipment ground bus.

If there are several different grounds in a cubicle or instrument compartment, there is a possibility of elevated voltage levels from one ground to the next. To be certain this situation does not occur, tie the equipment ground terminals of all devices directly to the equipment ground bus. The reasons for this requirement are listed below:

- The RS-485 bus requires equipotential ground reference for all devices on a common bus within the specified +12V/-7V.
- Noise and surge protection circuitry must be ground referenced.
- Measurement references require a good ground connection for proper accuracy.
- Varying voltage levels are a safety hazard.

Rule 5: Run ground connections directly to the equipment ground bus and do not daisy chain them from one component's ground to the next.

3.3 Connecting Field Devices

It is convenient in some switchgear arrangements to run a single RS-485 loop for a line-up, then to connect each field component (for example: a breaker with a Static Trip III C trip unit) with a stub cable. Figure 3.3 shows the suggested cabling at a terminal block at the top of a vertical section of circuit breakers. The loop cable ties together all of the vertical sections of the low-voltage switchgear.

From this loop, stub cables are dropped to the individual low-voltage breakers. Notice in Figure 3.3 the grounding on one of the loop segments and all of the stub cables.

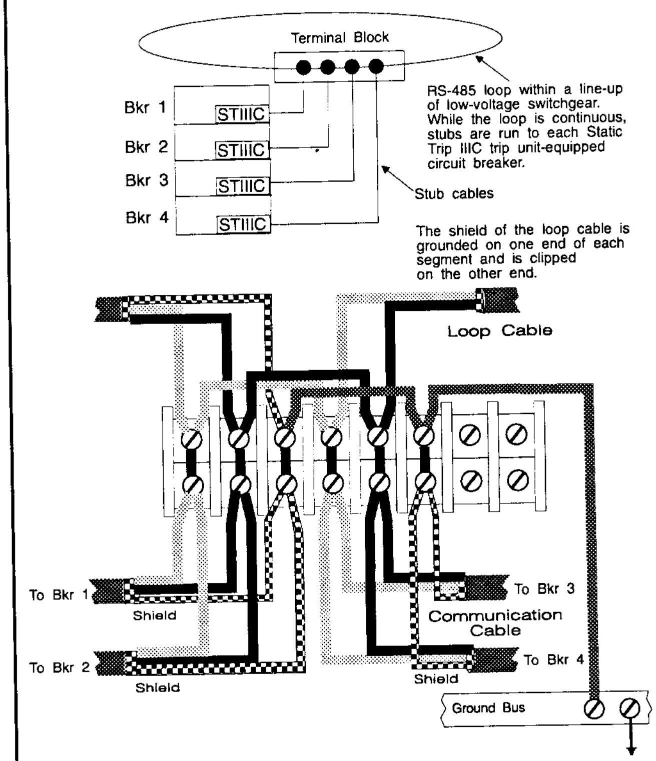


Figure 3.3 Example Cable Connection for Low-Voltage Switchgear

Figure 3.4 illustrates another cabling example. The figure illustrates two components mounted on an instrument door of a medium voltage switchgear frame.

In installations for all panel-mounted devices, the cabling is brought out to a panel hinge terminal block. The two example devices on the door form a series stub. The terminal block is the common point between this stub and the interconnection loop for the switchgear line-up. Figure 3.4 shows the interconnection loop, the series stub, and the physical arrangement of the two components.

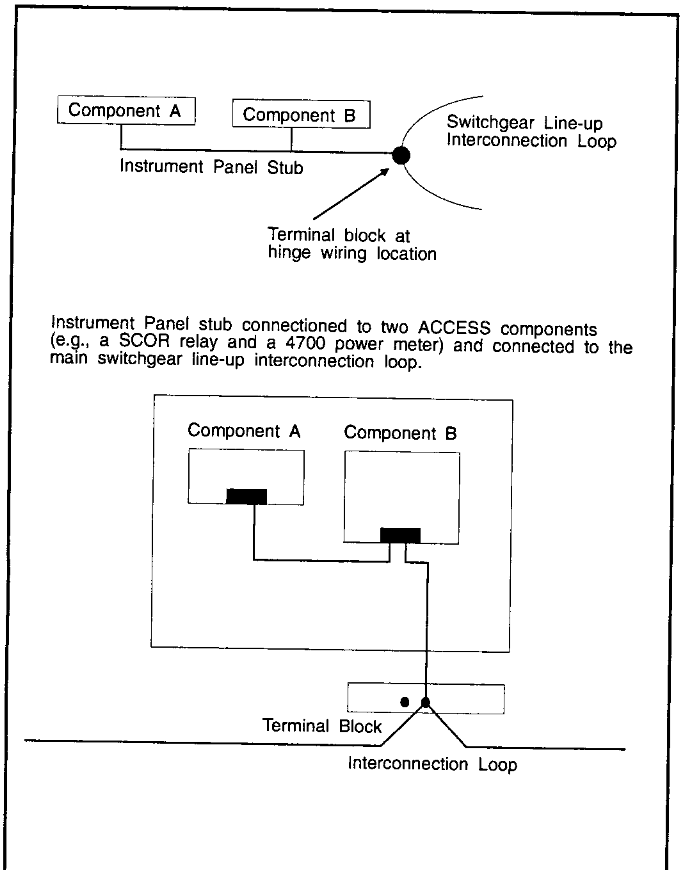


Figure 3.4 Example Cable Connection for Panel Devices

Figure 3.5 illustrates the termination of all cabling on this panel and the terminal block.

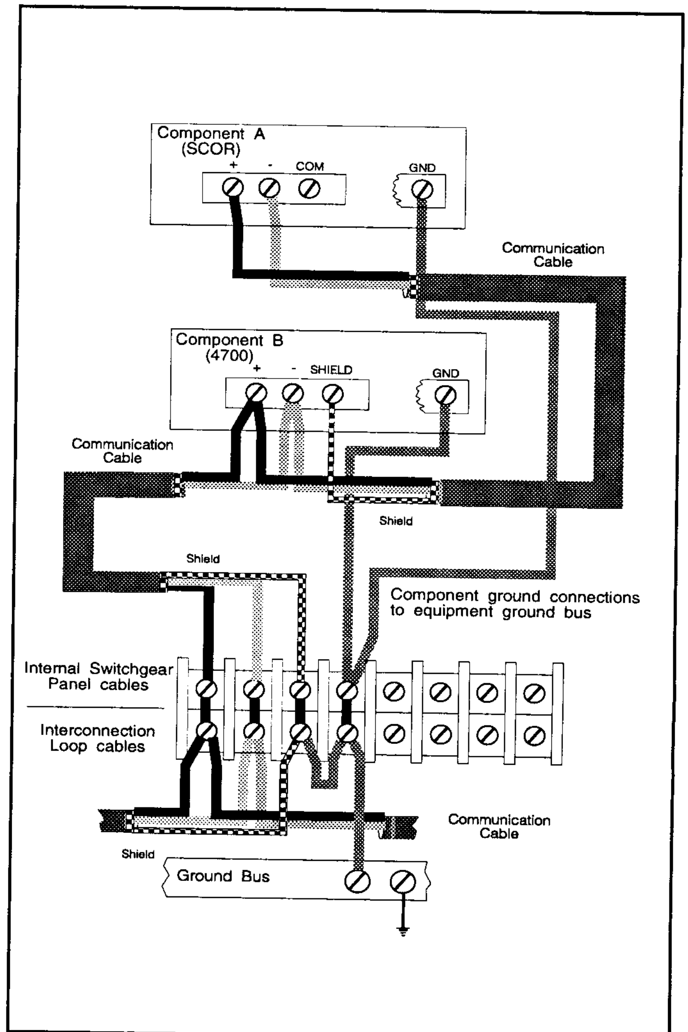


Figure 3.5 Example Terminal Block Connection for Panel Devices

3.4 Installing the Field Cable

Cable installation can consist of either single-ended run or looped topologies. Both methods are discussed in this section; however, Siemens recommends using the looped topology.

To use the single-ended run topology, install the cable so that it is daisy-chained between each device. The Power Monitor unit connects to a field device, which in turn connects to another field device, and so on.

With any communications transmission line, reflections can cause garbled data and failed communications between units. Reflections are caused by mismatched line and load impedances. To prevent reflections on long, single-ended runs, eliminate any impedance discontinuities as explained in the following paragraphs.

The recommended twisted-pair cable for an RS-485 bus has a characteristic impedance of 120 ohms. Any change in the type of cable, or an open-ended length of cable, creates a discontinuity in the impedance and causes a reflection. Placing resistors that match the characteristic impedance of the cable at the open end of a twisted-pair stub eliminates reflection.

For long, single-ended runs (over 1000 ft.), you may need to install a 120 ohm terminating resistor between the data (+) and (-) terminals of the farthest device from the Power Monitor unit or master end. Because of the relatively slow data or baud rate (9600 or less) used by the field devices, adding the terminating resistor is not an absolute requirement, but using it minimizes reflected interference on the communication cable.

In a loop topology, install the cable in a similar manner to the single-ended run approach, but rather than terminating at the farthest device, form a complete loop by bringing the cable back to the Power Monitor unit.

Each installation method has advantages and disadvantages. The loop method requires more cable than does the single-ended run method. This extra cable is needed to run from the last device on the run to the master device. The additional cable adds expense and shortens the total distance the farthest device can be located from the master device. The advantage of the loop method is in the ability to communicate with all devices when there is a break in the loop.

The single-ended run allows larger distances between the master device and the farthest slave device, but it does not allow the master device to communicate with devices on the far side of a break.

3.4.1 Routing the Cable

Even though the communications cable is shielded, the effect is not perfect. It can still pick up random signals and interference from the surrounding environment. This random pickup can cause errors in the data transmission. For this reason, route signal cabling perpendicular to the power conductors as illustrated in Figure 3.6.

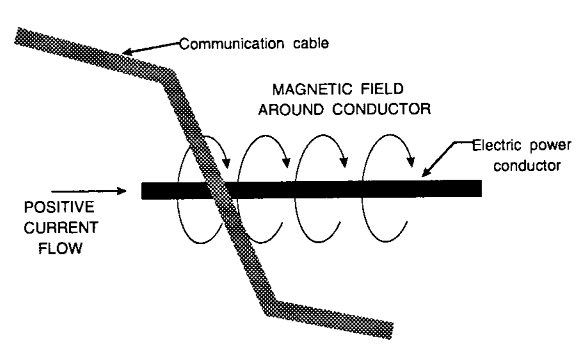


Figure 3.6 Cable Routing

Rule 6: Do not route signal cabling parallel to power conductors. Power conductors are any cables or bus conductors carrying currents greater than 20 amps.

Electrical current flowing through a conductor forms a magnetic field around the wire, as shown in Figure 3.6. Interference is coupled into the wires in the cable through electromagnetic fields. Just as current through a wire causes a magnetic field to form around it, a magnetic field can cause current to flow in a wire. This induction of current is a function of the geometry or orientation of the wires. If the second wire (not the one causing the magnetic field) is at a right angle with the first, it is aligned with the direction of the magnetic field and no current is induced.

Follow these guidelines when you route communications cabling *within* electrical equipment:

- You may install ACCESS SEAbus cable in the cabinet in the same cable duct as unshielded digital and analog signal cables ≤60V.
- Install signal and supply cables in the same cable duct as communications cables only when these signal or supply cables are shielded for voltages up to 230V.
- If you use unshielded signal and supply cables up to 230V, run communications cables at least 4 inches away.
- If you use unshielded signal and supply cables up to 1 Kv, run communications cables in a separate duct at least 4 inches away. Make sure that all communications cables are shielded and that you use grounded metallic cabling ducts or additional shielding plates.

Follow these guidelines when you route communications cable *between* electrical equipment:

- Run communications cables in the same cable raceways (cable routes, cable trays or cable gutters) as unshielded digital and analog signal cables up to 60V.
- Run communications cables in the same cable raceway with shielded signal and supply cables up to 230V.
- Run communications cables 4 inches away from unshielded signal and supply cables of up to 230V.
- Run cables with voltages greater than 230V in separate ducts (routes, conduits).
- ACCESS SEAbus allows safe, reliable data transmission up to a displacement of the earth potentials of +12V/-7V. If lines exceed +12V/-7V, even within a given building, use equipotential bonding conductors of size 6 AWG copper or greater between grounded segments.

For routing cables between buildings, ensure proper grounding and lightning protection by observing the following guidelines:

Potential Isolation

Use galvanically isolated communication drivers when routing cable between buildings because of earth ground potential differences. Use isolated modems or the Isolated Multi-Drop™ Converter for this purpose.

Surge and Lightning Protection

Use integrated supplemental high-energy surge protection on ACCESS digital communication networks within the power switchgear. Install these surge protection devices where inter-building, copper-based communication networks are routed outside the building, via overhead trays or underground conduits. Such cable installations may be exposed to lightning or other electromagnetically induced high energy surges which can potentially damage any attached electronics. Run communications cables in bilaterally grounded metal conduits, or use a lightning conductor/surge protection module (transient eliminator).

Following these guidelines ensures that you will install the ACCESS network correctly. The troubleshooting measures explained later in this manual assume that you have installed the network as directed here.

3.4.2 Terminating the Cable

Use the following guidelines to connect the cable to the bus terminal as illustrated in Figure 3.7:

1. Connect the conductors (black/white for SEAbus RS-485 communications cable) to the terminals (A or B) or (+ or -). White is connected to Data - or B. Black is connected to Data + or A.

2. Connect the cable shield to SHIELD termination. If shield termination is not available, then connect to ground, GND. (Do not ground shield at both ends of a single cable.)

3. Connect equipment ground bus to GND.

Note: The shield terminal is connected to the device's ground terminal on all devices except the SCOR relay and the Multiplexer Translator. These devices have a COM terminal which is not connected to ground. For the SCOR relay and the Multiplexer Translator, ground the shield at the ground terminal.

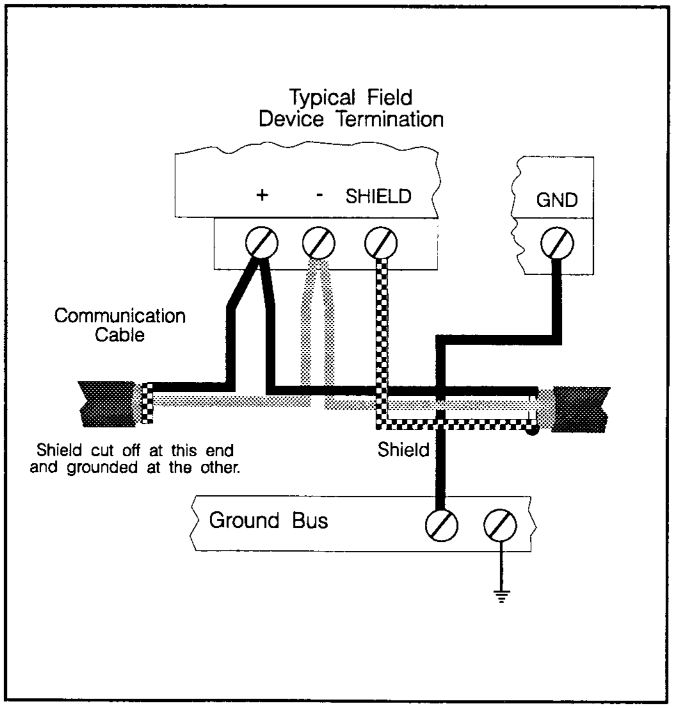


Figure 3.7 Typical SEAbus RS-485 Device Termination

3.4.3 Shielding

Adhering to the following guidelines for cable shielding guarantees the minimum possible noise on the network.

1. Carefully strip the cable's insulation.

2. Where the cable enters the cabinet, connect the cable shields on the shield bar or ground screw terminal referenced to the ground bar.

3. Securely attach the shield to the shield or ground connection via a crimped lug.

4. Connect the shield at either the shield or ground terminals with the shield crimp covering as large an area as possible. Connect the shield at only one end of a cable segment to prevent induced interference that may result from circulating ground currents.

5. To effectively discharge high frequency interference, cable shield segments should be made as short as possible. Terminate all shield reference terminals at the nearest ground bar.

Note: High frequency parasitic currents are discharged over the low-resistance internal bonding of the shield through the shield connection on the terminal block. Terminate the shield securely for effective protection.

3.5 Connecting the ACCESS Host PC

Cabling between the Power Monitor unit and Host PC is typically straight point-to-point. Use short-haul modems to provide ground isolation and to increase the distance between the Power Monitor unit or field master devices and the Host PC.

When using short-haul modems, the transmitter output of each modem is cabled to the receive input of the other. One short-haul modem is connected to one of eight RS-232 ports located on the ARTIC Portmaster 8-port cable. The 8-port cable is connected to the ARTIC Portmaster card installed in the Host PC. The other short-haul modem is connected to the RS-232 port located on the rear panel of the Power Monitor unit. Only one Power Monitor unit can be connected to each Host PC ARTIC Portmaster card's RS-232 channel. Always install surge protection devices on the Host PC-to-Power Monitor unit connection. Refer to section 4.2, ACCESS Host PC, for more detailed installation instructions.

3.6 Cable Characteristics

Twisted-pair cable connects the Power Monitor unit to the other field devices. Table 3.1 provides values for the cable's characteristics necessary for proper electrical performance of the SEAbus RS-485 communications network. Along with the following specifications, use a cable with shielding that provides 100 percent coverage. An explanation of the values follows the table.

Table 3.1 RS-485 Cable Requirements

Characteristic	Value	Maximum/Typical
Impedance	120 ohms	Typical
Capacitance (pF/ft.)	35	Maximum
Cable Size	22 AWG	Typical
DC Resistance	17 ohms/kft	Maximum
Velocity of Propagation	80%	Maximum

Impedance: The maximum transfer of signal energy from a cable to a connected device occurs when the cable's terminating impedance matches the characteristic impedance of the cable. The SEAbus RS-485 cable uses a 120 ohm terminating resistor; therefore, the cable has a characteristic impedance of 120 ohms.

Capacitance: Wire capacitance affects the rise and fall times of a transmitted signal and, as a result, limits the signalling (baud) rate of the data. The higher the capacitance, the lower the maximum baud rate. Additionally, higher capacitance requires higher output current to "drive the line." Since capacitance is proportional to wire length, it can limit the maximum cable length for a given baud rate.

Cable Size: Cable size, along with its capacitance and its DC resistance, determines the cable's suitability for the job and its mounting/terminating hardware. A 22-gauge cable provides a proper balance of capacitance and resistance and is fairly inexpensive and easy to handle.

DC Resistance: DC resistance determines the maximum length of wire in an application. The maximum length is determined by the voltage divider effect (which is caused by the resistance of each twisted-pair) along with the device termination resistance. Use Table 3.2 to find the maximum cable distance based on the number of devices and surge protectors you are using.

Table 3.2 Maximum Cable Length (in Feet) Based on D.C. Resistance

		Number of Surge Devices (15 ohms typical series resistance)						
		0	1	2	3	4	5	6
Number of SEAbus Field Devices	1	4000	4000	4000	4000	4000	4000	4000
	4	4000	4000	4000	4000	4000	4000	3944
	8	4000	4000	4000	4000	4000	4000	3625
	12	4000	4000	4000	4000	4000	4000	3306
	16	4000	4000	4000	4000	4000	3857	2987
	20	4000	4000	4000	4000	4000	3596	2726
	24	4000	4000	4000	4000	4000	3277	2407
	28	4000	4000	4000	4000	3915	3045	2175
	32	4000	4000	4000	4000	3683	2813	1943

Note: The use of transient surge protectors with series resistance subtracts from the allowable loop resistance. For example, the DLP-10 surge protector specified for the SEAbus RS-485 loop has 15 ohms of series resistance per line, for a total of 30 ohms. Since two surge protectors are required (one at each building entry point), the loop resistance increases.

These values consider only the DC resistance of the cable, not other factors such as capacitance, or velocity of propagation. These factors decrease the overall cable length which should be kept under 4000 ft. See Appendix B for more details on cable length.

3.7 Cable Recommendations

Use the following twisted-pair cabling in the ACCESS communications system. Any substitutions must meet the minimum guidelines stated in the section 2, "Operational Overview." For SEAbus RS-485 communications use Alpha cable, part number 5121C. If Plenum rated cable is required, use Alpha 55121.

For Host PC-to-Power Monitor unit installations, use part number 6052 from Alpha or 9406 from Belden. These cables are PVC insulated and jacketed. For Plenum-rated cable, use Alpha part number 58612, Belden 88723 or Aerospace Wire & Cable part number 2262. Refer to Appendix C, "Ordering Information," for more information on cabling.

4 ACCESS Devices

This section contains interconnection information for each ACCESS component. This section does not replace in any form the individual instruction, operation, or installation manuals that are available for each component. Precautions and warnings associated with each component are included here for safety.

4.1 Configuring Devices

Even when interconnected properly, the ACCESS system components do not yet constitute a viable communication system. As discussed in section 2, "Operational Overview," each component must have a unique address on the data bus. Without this unique address, the master devices, such as the Power Monitor unit or Power Monitor PC™ communications and supervisory software, cannot communicate with the slave devices to receive data.

For many of the individual ACCESS components, the operator must set parameters for proper data acquisition and resolution. Once entered, these settings are maintained in the component's non-volatile memory (either EEPROM, battery back-up, or hardware switches). Some of these devices require configuration of many data fields. It is generally easier to enter values into these data fields using the Power Monitor unit for remote configuration. Using the Power Monitor unit gives you a keyboard and menu-driven display screens for entering values. The Power Monitor unit also allows you to program parameters for all devices from one location.

The operator must program the unique address for each device before establishing any operational communications system. Typically, it is more convenient to set up the address and the baud rate at the device (local configuration). Each device has a default address. Programming a new device address from the default address applies when installing a new device into equipment at the factory or in the field.

Note: For factory-built electrical apparatus orders, Siemens programs the unique address of each device.

4.1.1 Local Configuration

Follow these steps to configure a device locally.

1. With control power on the device (the device is turned on), use the step-by-step routines listed in the individual device's section to configure each device. You should also use the device's instruction manual to locally program the address, but not all devices are designed for locally programmed addressing.

2. On some components, such as the Multiplexer Translator, you set the address using a special switch on the circuit board. Follow the instructions in this section to set this switch.

4.1.2 Remote Configuration

To program the device address from the Power Monitor unit, you must first program the system baud rate. This baud rate is common throughout the entire system. Program the SEAbus baud rate by following this sequence:

1. Attach the device, by itself, to the field cable, referring to section 3, "Installing the Network."

2. From the Power Monitor unit, select Global Settings from the Configuration Menu. The Global Settings screen appears.

3. Move the cursor to the Baud rate of SEAbus field. Select the SEAbus baud rate. (This baud rate must match the baud rate set locally on the device.)

4. Press F6 to save the new settings, and press F6 again to return to the Configuration Menu.

The Power Monitor unit can interrogate the device through the default address at which point you can change the address to the permanent address. Refer to the operator's manual for the Power Monitor unit (manual no. SG-4018-01). If ordered individually, field devices are shipped from the factory with the device default address of 222 already set.

If you do not know the new device's address, the Power Monitor unit can request the device address via its Universal Request function or its Find Address function. The Universal Request function commands the device to transmit its address to the Power Monitor unit. The Find Address function commands the Power Monitor unit to search all unassigned addresses for a device that is not communicating. The Find Address function is not restricted to searching for a particular type of device. Use the Find Address function when you want to determine the unknown address of a device that you are adding to the communications bus or if more than one device is connected to the Power Monitor unit.

Note: Do not use the universal request method for initial system addressing because you must disconnect all other ACCESS devices programmed for the default address from the RS-485 bus before setting the address.

To change a device's address, use this procedure.

1. Choose Circuit Configuration from the Configuration Menu.

2. Position the cursor on the circuit that you want to edit.

3. Press F5, Edit Circuit, to edit the circuit.

4. Position the cursor on the device that you want to edit.

5. Press F3, Device Configuration.

6. Press F2, Confirm Settings, to confirm the settings. Either "Test Passed" or "Configuration Discrepancy" appears. If "Device Not Found" appears, ensure that the device is connected to the RS-485 communications bus and the Power Monitor unit's polling feature is "ON." You may use the Find Address function (F) to identify the device address.

7. Move the cursor to the device address field, press A and enter the new address.

8. To program the device with the new address, press F1, Configure to Device. (Ensure that polling is "ON").

9. Press F6, Return/Save, to return to Circuit Configuration menu and save changes.

Once the address and the baud rate are set, the ACCESS system can communicate with the attached devices, and you can continue programming the device.

When ACCESS field devices are installed in equipment for future communications, Siemens recommends that discrete addresses be programmed for the devices during installation; otherwise, depending on their options, the devices may have to be disconnected from the communications bus and reconnected individually to change the default address.

Figure 4.1 is a master diagram of an ACCESS system. For each device on the diagram, a detailed description of the interconnections appears in a later subsection in this section (except the ISGS).

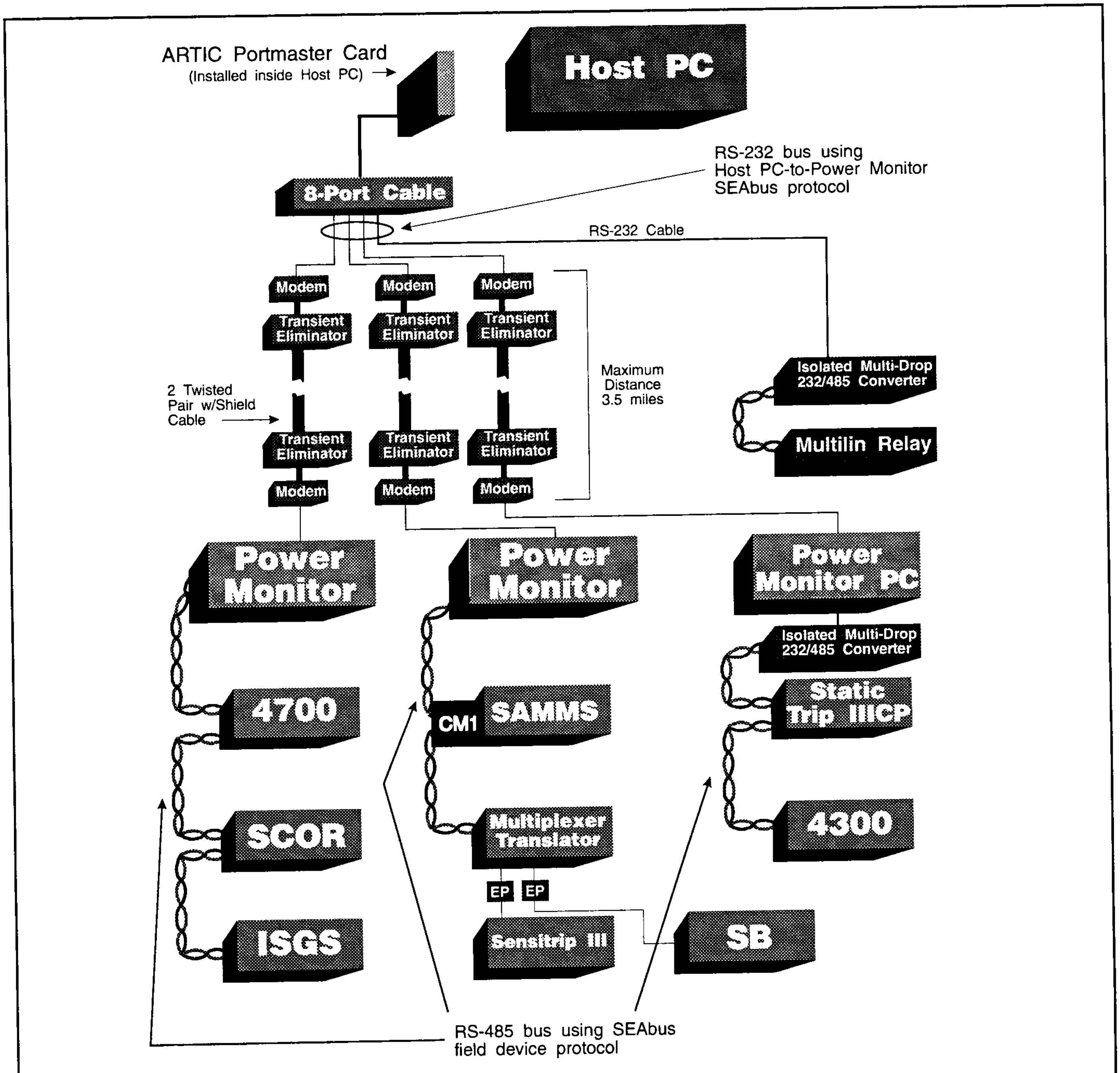


Figure 4.1 Example Master Diagram for an ACCESS System

4.2 ACCESS Host PC

The ACCESS Host PC is a computer based on IBM® Micro-Channel™ Architecture. Depending on the user's requirements, the computer can be set up in several software and hardware configurations. The specific computer models used for host computers include the following:

- the IBM PS/2™ Model 7561, based on the 80386 microprocessor, which supports up to four ARTIC cards.
- the IBM PS/2 Model 7568, based on the 80486 microprocessor, which supports up to five ARTIC cards.
- the IBM PS/2 Model 95, based on the 80486 microprocessor, which supports up to five ARTIC cards.

Note: The Host PC is set up and configured by Siemens Energy and Automation, Inc. Siemens maintains an engineering staff ready to provide the necessary programming and training for this part of the ACCESS system.

4.2.1 ARTIC Portmaster Card

The ARTIC Portmaster card is a printed circuit board assembly installed in the host computer. The ARTIC Portmaster card supports eight RS-232 DB25 ports. It is a communication co-processor that off-loads communications-specific tasks from CPU of the main Host PC. The entire assembly consists of the interface card (installed internally in the Host PC) and the eight-port cable, one end of which is connected directly to the interface card. The other end of the cable provides the eight RS-232 DB25 ports.

A short-haul modem is attached to each RS-232 port, connecting the Host PC with a Power Monitor unit. The Host PC communicates with the Power Monitor unit through this dedicated bus.

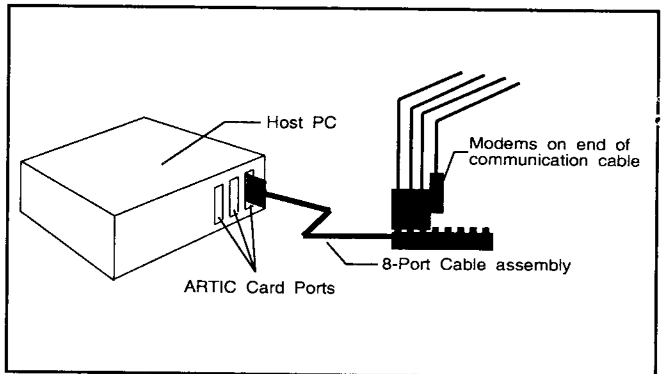


Figure 4.2 ARTIC Portmaster Card

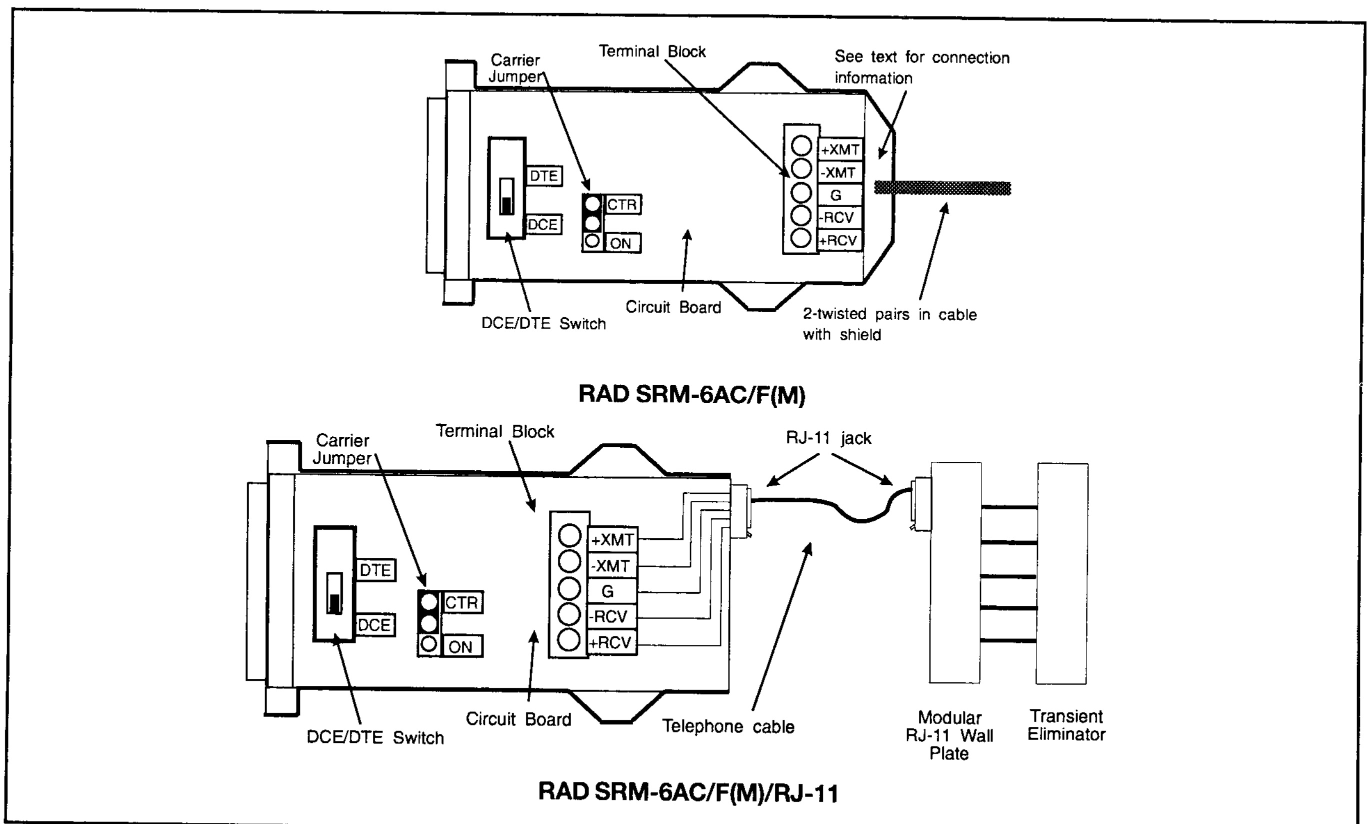


Figure 4.3 Short-haul Modems

4.2.2 Connecting Modems to the Host PC

Modems are electronic assemblies used for sending and receiving communication data over long distances (up to 3.5 miles). The modems used with the ACCESS system are "short-haul modems" and can easily handle a distance of up to several miles. The modems are self-powered, requiring no external power supply. Figure 4.3 on the previous page illustrates two models of self-powered short-haul modems with the covers removed.

"Modem" is a contraction of the terms modulator and demodulator. At the transmitting end, the modem changes the digital signals of the communication bus to a modulated audio signal. At the receiving end, the modem changes the modulated signal back to the original digital form.

Installing modems includes configuring them for their positions in the ACCESS system and attaching the communications cables to them. Each modem has an internal terminal block with five connections: XMT+, XMT-, GND, RCV+, and RCV-. Follow the steps below while referring to Figure 4.4 to install the modems:

1. Separate the two parts of the modem's plastic cover by firmly pressing the marked places on the sides, starting at the cable end.
2. For the RAD SRM-6AC/F(M) modem, connect the communication wire to the terminal pair connected to 'XMT' and receive pair connected to 'RCV' as illustrated in Figure 4.4. Do not connect the shield wire to the modem 'GND' terminal.
3. For the RAD SRM-6AC/F(M)/RJ-11 modem, plug the telephone cable into modem's RJ-11 jack.
4. Make sure both modems are set for DCE.
5. Set the CARRIER jumper to ON (carrier on continuously) for the modem that connects to the Power Monitor unit (RAD SRM-6AC/F) and to CTR (carrier controlled by RTS) for the modem that connects to the Host PC (RAD SRM-6AC/M).
6. Close the modem by pressing the two plastic covers together.
7. Plug the other end of the telephone cable to the RJ-11 jack on the wall plate connected to a transient eliminator. (Refer to section 4.4, Transient Eliminator, for more details on transient eliminators).
8. Connect the modem with the female connector (RAD SRM-6AC/F) to the 25-pin connector on the eight-port cable attached to the ARTIC card, and tighten the screws on each side of the connector.
9. Connect the modem with the male connector (RAD SRM-6AC/M) to the 25-pin connector of the Power Monitor unit, and tighten the screws on each side of the connector.
10. Ground the shield at the transient eliminator (see section 4.4). Do not ground the shield at the modem's ground connection terminal. ACCESS Host PC connections typically use modems and transient eliminators together. (Refer to section 7.3, Surge Protection, for more details on modems and transient eliminators).

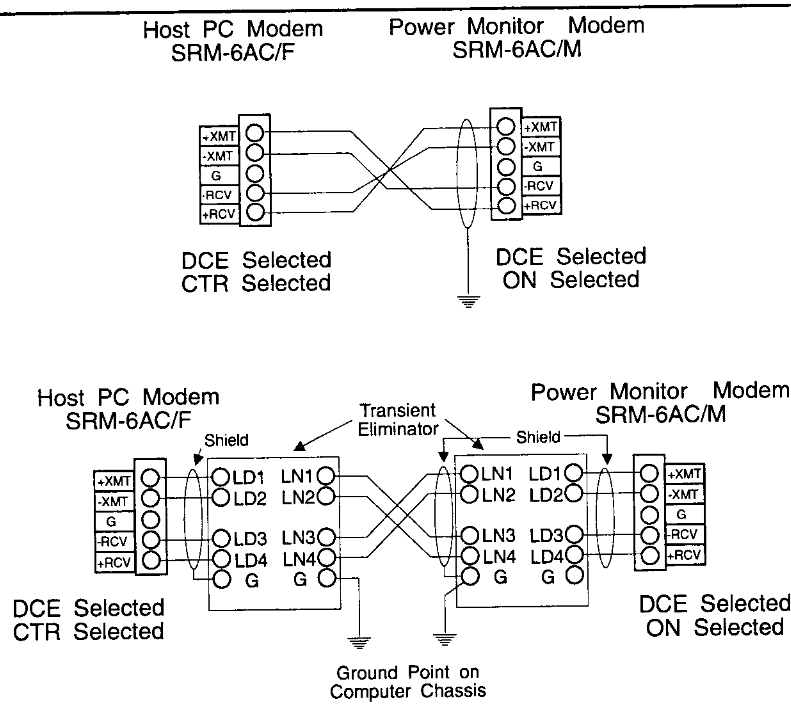


Figure 4.4 Short-haul Modem Connections (above) with Transient Eliminators (below)

4.3 Power Monitor Display and Monitoring Unit

The Power Monitor unit is an embedded, industrial computer that executes a supervisory program to communicate with the many devices it must monitor. The unit's display and sealed-membrane keypad allow you to program it and acquire data from it. The Power Monitor unit provides a variety of information screens and user programmable features, and it maintains a 64-entry event log in its nonvolatile memory. Screens include single-line diagrams of selected parts of the power network. These screens display summary and detailed data, both historical and real-time, including minimum and maximum value tables for each device.

4.3.1 Installing and Configuring the Power Monitor Unit

The Power Monitor user's manual (manual no. SG-4018-01) contains all of the needed setup information and the procedures for using the individual screens and devices. Figure 4.5 illustrates the communications bus's termination area with its proper connection to two RS-485 loops. Also shown are two RS-485 loops with stub cables leading to the Power Monitor unit. Notice the grounding of the shields. The Power Monitor unit connects directly to the Host PC (when Host PC is used) via the remote RS-232 port located on the Power Monitor unit's back panel. The Power Monitor unit is powered from either a 120 VAC or 125 VDC power source via its power connector.

Note: As a Master device, the Power Monitor unit has no SEAbus address.

4.3.2 Power Monitor PC Communications and Supervisory Software

Power Monitor PC (PMPC) software runs on an IBM or IBM-compatible PC, allowing the PC to emulate a Power Monitor unit. PMPC software incorporates a user interface similar to the Power Monitor unit. Using the software requires one RS-232 serial communication port on the PC for communication with the field devices. Connecting the PMPC to a Host PC requires a second RS-232 port. This first communication port typically connects to the RS-232 port on an Isolated Multi-Drop™ converter or other approved RS-232/RS-485 converter (see section 7.4, for ordering information). The Isolated Multi-Drop converter converts the RS-232 signal from the PC to an RS-485 signal used by the field devices on the RS-485 network.

In addition to the Power Monitor PC software, Siemens also provides Dynamic Data Exchange (DDE) Driver Software, called SEAserv, with each ACCESS component. This software runs under Microsoft® Windows™ 3.0 (or later versions) on an IBM PC or compatible computer. This software allows you to collect real-time data from a field device and allows full DDE connectivity with other Windows applications. You must use the Isolated Multi-Drop (refer to section 4.5 for details) or other 232/485 converter to connect the PC to the field device.

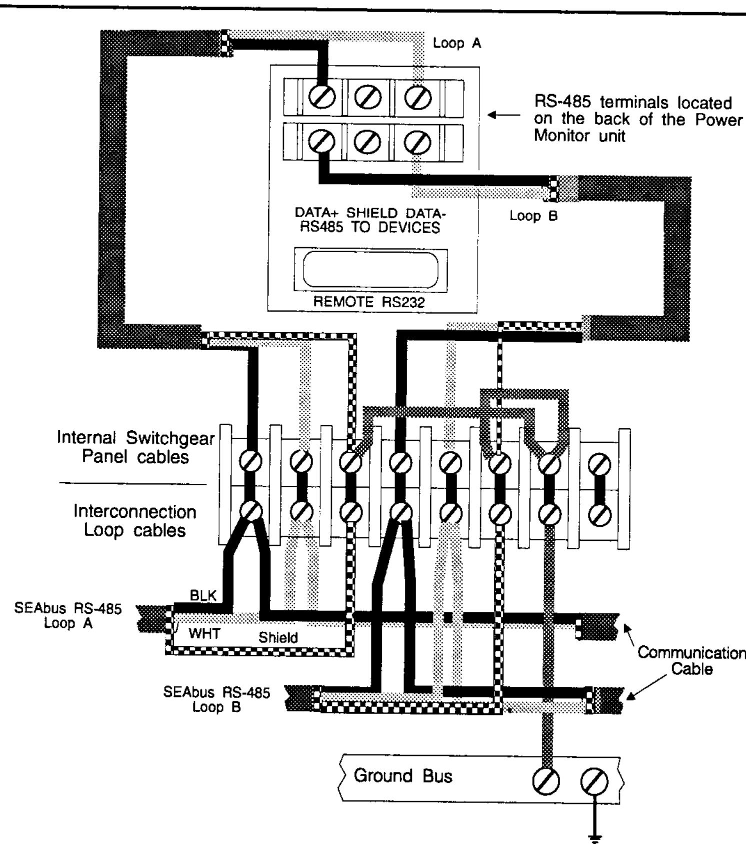


Figure 4.5 Power Monitor Connections

4.4 Transient Eliminator

Lightning and electrical switching transients can cause significant voltage and current surges on a communication cable. These surges can easily damage the electronic circuit components. Transient eliminators provide protection against these spikes and surges.

For surge protection, use a transient eliminator whenever an ACCESS communication line leaves a building, either on an RS-232 connection (using modems) or on an RS-485 loop. Inside a building, for long distances (over 1000 ft.) between devices or in electrically noisy environments, use transient eliminators for additional protection. (Refer to Appendix B for more information on surge protection.)

Siemens recommends two transient eliminators for the ACCESS system. Both transient eliminators are made by MCG Electronics. (Refer to Appendix C for ordering information.) Use the DLP-10-6V15, illustrated in Figure 4.6, for the single twisted-pair cable used in the RS-485 loops. Use the DLP-20-6V15, illustrated in Figure 4.7 for the two twisted-pair cable used between the Power Monitor unit and the Host PC. Figures 4.6 and 4.7 illustrate the proper wiring for the single twisted-pair connection used in the RS-485 network and for the Power Monitor-to-Host PC connection respectively. The CASE GROUND of each transient eliminator is a continuous connection through the device with no isolation between the terminals.

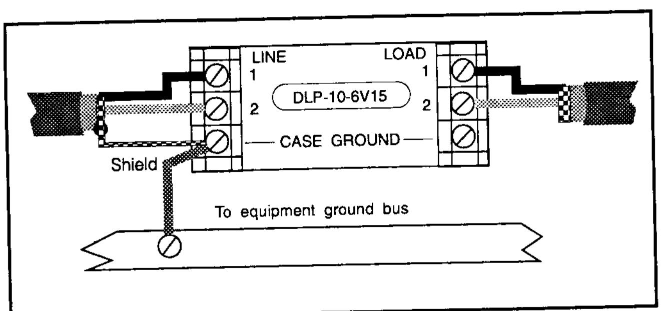


Figure 4.6 Transient Eliminator for Single Twisted-Pair Cable (RS-485 Loops)

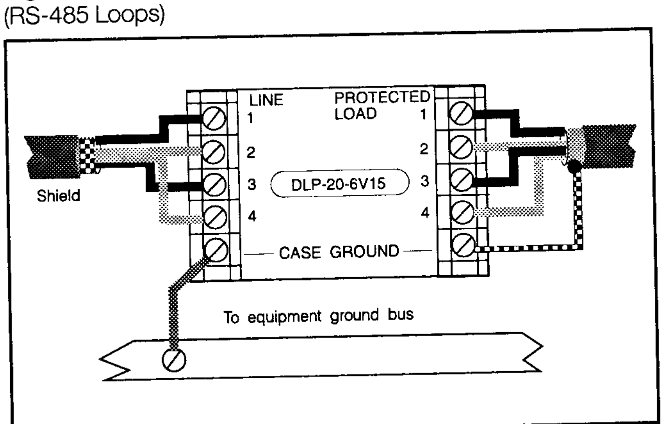


Figure 4.7 Transient Eliminator for Two Twisted-Pair Cable (Power Monitor-to-Host PC)

Use the transient eliminator for single twisted-pair cable in a simple point-to-point connection or at the interface of two RS-485 loops as illustrated in Figure 4.8. In either case, avoid interconnecting the equipment ground buses of two or more remote switchgear line-ups (i.e., shields should be terminated at one end only).

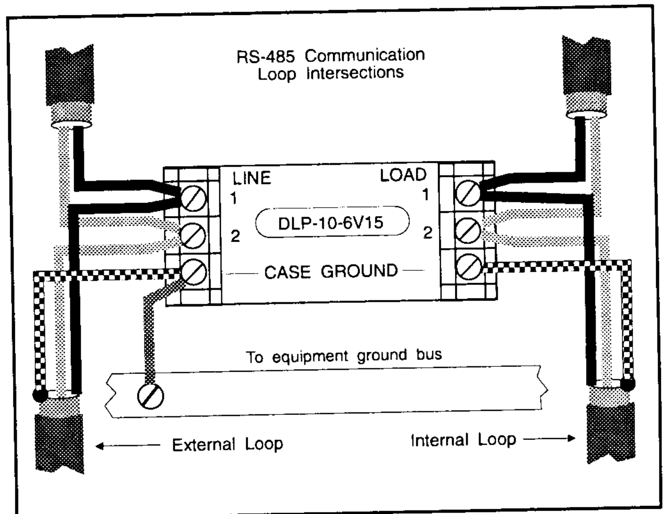


Figure 4.8 Transient Eliminator Between Two RS-485 Loops

Depending on the layout and installation of your facility's electrical equipment, the equipment ground bus potentials (for voltage) may differ substantially between two locations. This difference is especially true of an industrial plant spread across acres of land. A cable shield connected to two different voltages at its ends conducts a current limited only by the impedance of the shield itself. Such a situation can cause equipment damage. To avoid it, ground shields only at one end of cable.

There are no fool-proof rules to prevent grounding of both ends of a shield; however, addressing this issue when developing the communication diagrams, schematic diagrams, and wiring diagrams for a particular system installation can eliminate surge problems.

4.5 Isolated Multi-Drop Converter

The Siemens Isolated Multi-Drop converter provides galvanically isolated RS-232-to-RS-485 conversion for accessing RS-485 compatible devices (such as SEAbus field devices) via a computer equipped with an RS-232 port. The Isolated Multi-Drop is also used to connect other RS-485 based devices such as the Multilin 169+ and 269+ Relays to the Host PC.

Isolation is obtained by using opto-isolators between the RS-232 and RS-485 interfaces of the Isolated Multi-Drop, and by supplying power to the RS-485 interface via a galvanically isolated, internal, DC/DC power supply. In addition to isolating the computer from the field device potential, the Isolated Multi-Drop converter uses various electronic and electrical components to suppress surges. It meets or exceeds ANSI C62.41 (IEEE 587) surge requirements.

4.5.1 Installing the Isolated Multi-Drop Converter

When connected to the computer's serial communications port, the Isolated Multi-Drop converter provides four RS-485 ports as illustrated in Figure 4.9. It thus supports up to 128 (maximum of 32 per port) RS-485 compatible devices.

Input power (120VAC/125VDC) is supplied to the Isolated Multi-Drop converter via a separate power connector incorporating a line filter. Also included are a two-position power switch and a 15 VDC output for use in testing a Static Trip III trip unit or a SAMMS relay.

On the top of the Isolated Multi-Drop converter are the designations for each of the RS-485 channels and two LED indicators: one transmit and one receive (Tx and Rx). These indicators blink during data transmission or reception. Transmission occurs on all four ports simultaneously.

The RS-485 ports are on the front of the unit. The set-up switches, input power connection, RS-232 port and 15 Vdc port are on the rear. Refer to Figure 4.10. RS-485 and 15 Vdc connections to the converter are made with special connectors shipped with the Isolated Multi-Drop converter.

Each device attached to the Isolated Multi-Drop converter must have a unique address to prevent data collisions when more than one device is attached. This rule applies to all the devices, regardless of the particular RS-485 loop to which it is connected. Device addressing is a process independent of the RS-485 loop.

4.5.2 Local Configuration

The Isolated Multi-Drop converter is configured with setup switches rather than software. The switches are located on the rear of the unit in the area labeled TX Control. There are three basic configurations:

1. The Isolated Multi-Drop converter is directly attached to either the Host PC or the PC running the Power Monitor PC software and is not located more than 50 ft., away from the computer. In this configuration, no modems are used. Set the DCD/RTS switch to RTS and the MAN/AUTO switch to MAN.

2. If located more than 50 ft. from the computer, use short-haul modems between the Isolated Multi-Drop converter and the Host PC or the PC running the Power Monitor PC software. In this configuration, set the DCD/RTS switch to DCD and the MAN/AUTO switch to MAN.

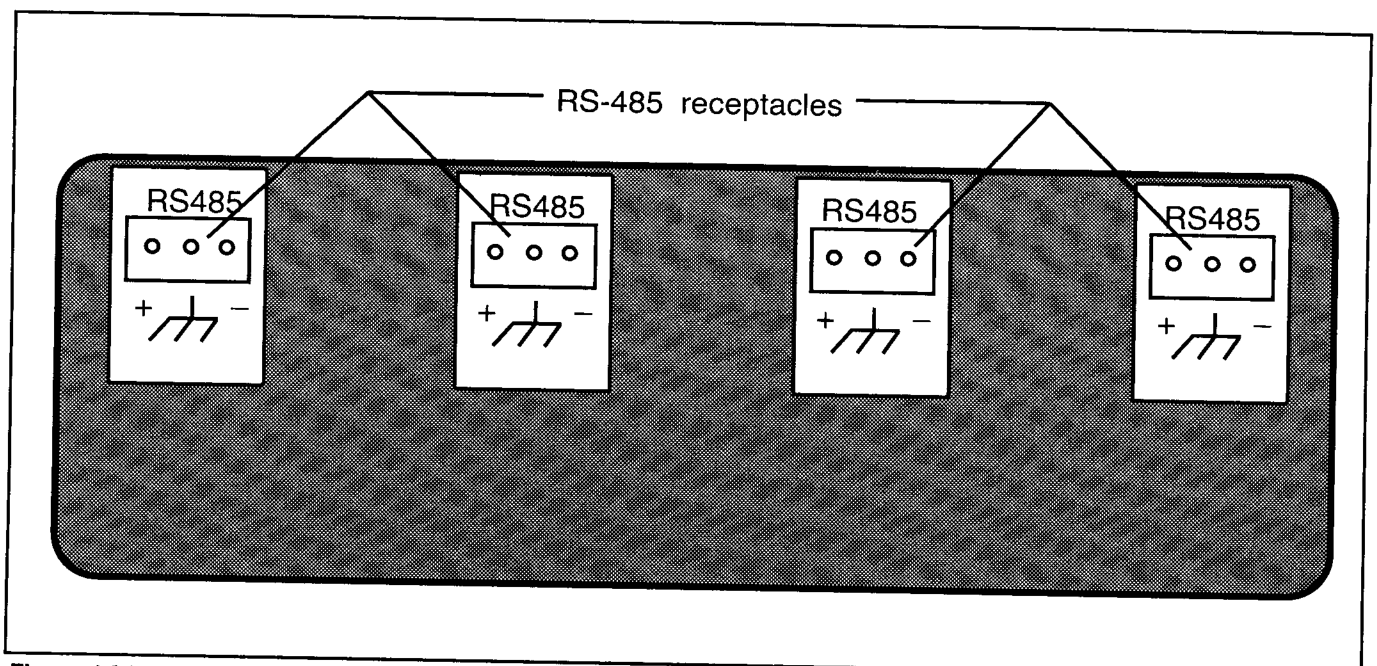


Figure 4.9 Isolated Multi-Drop Converter (Front View)

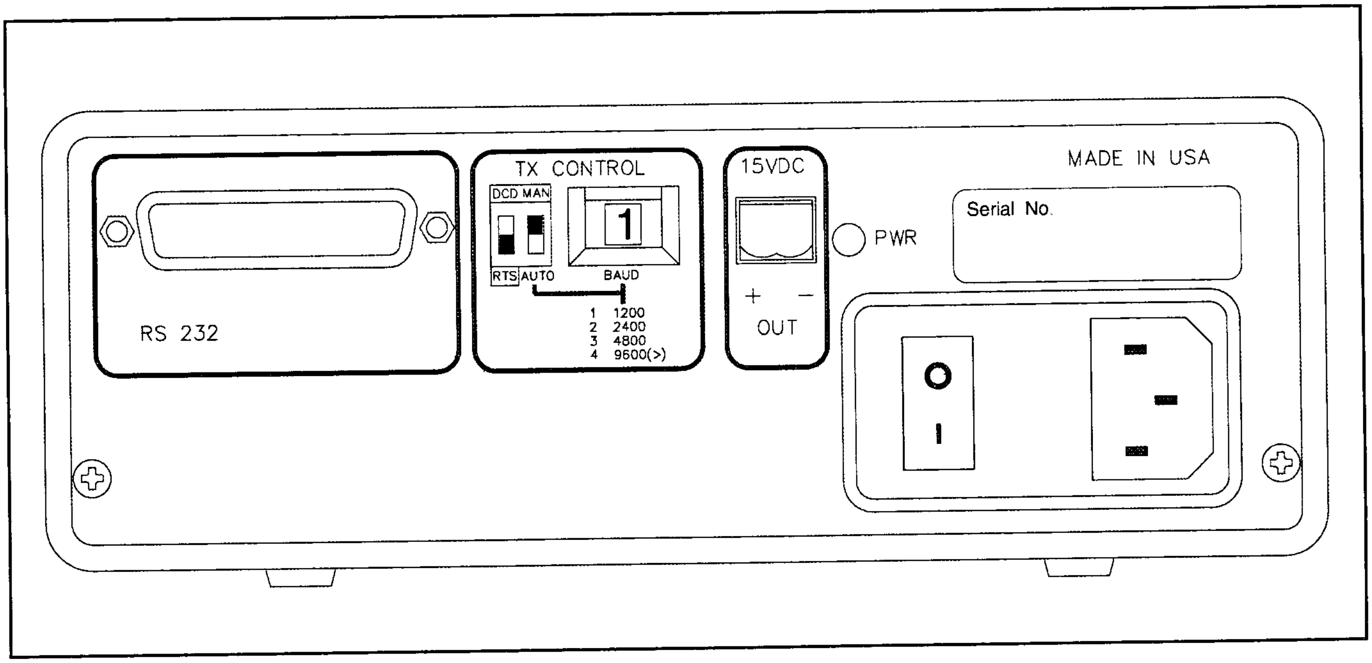


Figure 4.10 Isolated Multi-Drop Converter (Rear View)

3. Dial-up modems can be used between the Isolated Multi-Drop converter and the Host PC or the PC running the Power Monitor PC software. In this configuration, set the AUTO/MAN switch to AUTO. With AUTO enabled, set the baud rate to your ACCESS system's baud rate (1200, 2400, 4800 or 9600) using the BAUD switch. When in the AUTO position, the DCD/RTS switch selection is disabled.

Note: If you are not using Siemens software, refer to the operater's manual for the Isolated Multi-Drop converter (manual no. SG-6048) for further set-up information.

4.5.3 Remote Configuration

The Isolated Multi-Drop converter has no remote configuration procedure.

4.5.4 Preparing Cables and Connectors

The Isolated Multi-Drop converter uses special connectors for the RS-485 communication cable connections. These special connectors, along with a two-conductor connector for the 15VDC power supply, are included with the Isolated Multi-Drop converter when it is shipped. Figure 4.11 illustrates how to wire one of these connectors properly. The shield wire is grounded at only one end of each cable segment.

Note: The Isolated Multi-Drop's 120VAC power receptacle must contain an earth ground connection. The Isolated Multi-Drop converter requires a high-integrity earth ground for proper shield reference and surge protection.

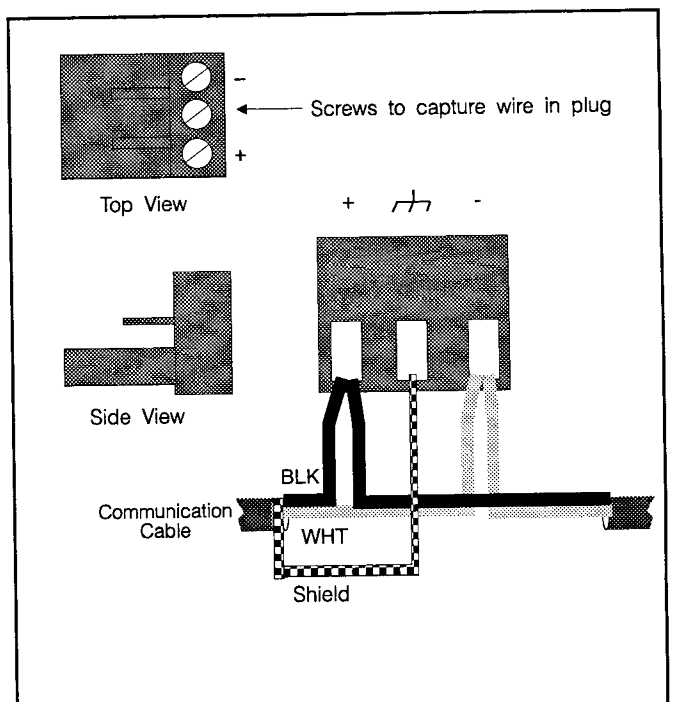


Figure 4.11 Isolated Multi-Drop Converter Connector

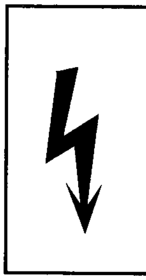
4.6 SCOR Overcurrent Protective Relay

The Siemens Communicating Overcurrent Relay (SCOR) is a microprocessor-based, time/instantaneous relay designed for easy incorporation into a computer-monitored power system. The relay is available in a number of styles to supply two-phase-with-ground, three-phase, and three-phase-with-ground protection for 60 Hz power systems. It also displays amperes and amperes demand.

Note: The SCOR relay need not be connected to an ACCESS system to function as an overcurrent relay.

4.6.1 Installing the SCOR Relay

The SCOR relay must have the optional plug-in communications board called Option 2-C to interface with the Siemens ACCESS system. This board allows remote monitoring of real-time system and circuit breaker information, and it allows the transmission of event and historical data, as well as remote configuration of operating parameters.



DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

The SCOR relay must be powered from an external source. The relay is available in either a 48 VDC or a 120 VAC/125 VDC version. Connect the power supply to terminals 3 and 4 on the back of the relay. Terminal 3 is the positive terminal if DC is used. When cabling the RS-485 system, use only the (+) and (-) labels for proper RS-485 polarity. If required, connect the shield to the GND screw lug. Figure 4.12 illustrates the back panel of the SCOR relay.

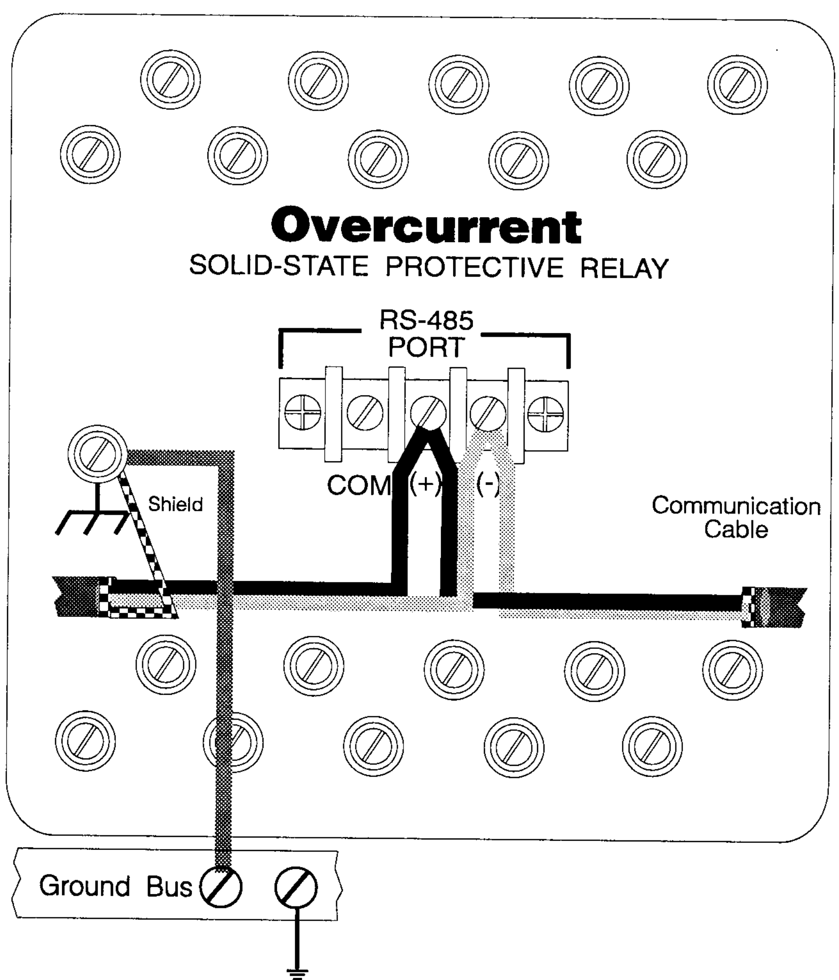


Figure 4.12 SCOR Relay Connections for RS-485 Communications

You must configure the SCOR after you install it. Configure the circuit protection modes, time curves, etc., as well as the communications function. You may configure the SCOR relay either locally or remotely as described in the next two sections.

4.6.2 Local Configuration

Follow the procedure below to configure the SCOR relay locally. Refer to Figure 4.13.

1. Set the Phase Tap selector (and ground if present) to the desired tap on the face of the relay.

2. To enter configuration mode (ConF) from the data collection mode (dAtA), press down on the Mode/Next switch repeatedly until the word dAtA appears on the front panel display.

3. Next, hold the Mode/Next switch up for approximately five seconds, during which time the display first becomes blank, and then ConF appears.

4. After "ConF" appears on the display, release the Mode/Next switch. Releasing the MODE/NEXT switch before ConF appears causes the SCOR relay to return to the dAtA mode.

5. Upon releasing the Mode/Next switch, the STATUS LED lights up and "ConF" appears on the Func/Data display.

6. To advance to the Addr register (parameter that programs the address), press down on the Mode/Next switch once. The word "Addr" appears on the display.

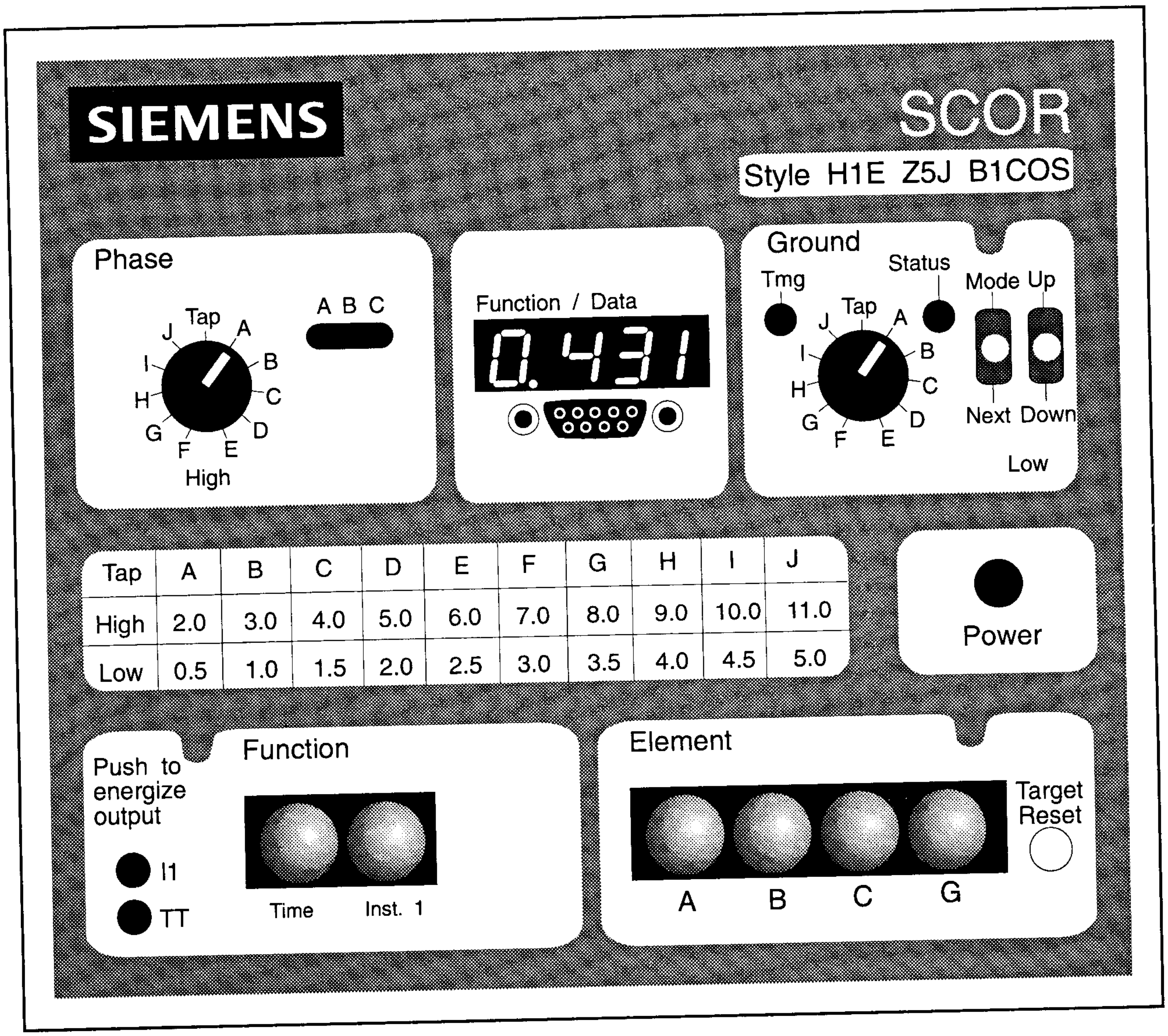


Figure 4.13 SCOR Relay Front Panel

7. Release the switch and the present address appears on the display. If necessary, enter the new address using the Up/Down switch to scroll through the available choices.

Note: Relays initially are configured with the address 222. Unless the device was configured at the factory, you must change the address prior to final system configuration. Use the Up/Down switch to change the address.

8. Advance to the "bAUd" (baud rate) register by pressing down on the Mode/Next switch. Use the Up/Down switch to select the SEAbus baud rate (usually 4800).

Note: Configuring the remaining settings and options is easier using remote configuration from the Power Monitor unit. If you use a Power Monitor unit to configure the SCOR relay, go to Step 8. If not, set the remaining registers by stepping through them using the Mode/Next switch and by setting them using the Up/Down switch. Refer to the operator's manual for the SCOR relay (manual no. SG-9228-01).

9. After configuring the relay, press up on the Mode/Next switch repeatedly until "ConF" appears.

10. Hold the Mode/Next switch up in the Mode position until the message "P EE" appears. This indicates that the data changes made while in the ConF mode have replaced the contents of the configuration information stored in the non-volatile memory. After a brief interval, the display changes again to "dAtA." The relay now returns to its normal operating mode.

4.6.3 Remote Configuration

You can configure the device's address and other parameters via the Power Monitor unit. For details, refer to the operator's manual for the Power Monitor unit (manual no. SG-4018-01). Use the following procedure to configure the address.

Note: On switchgear that includes Power Monitor units, Siemens configures all devices and sets all addresses at the factory.

1. On the Power Monitor unit, proceed to the Circuit Configuration screen, and select Device Setup.

2. Position the cursor on the address field.

3. Press F2 to verify that the SCOR relay is communicating ("Device passed test" or "Configuration discrepancy" appears).

4. To program the SCOR relay to a new address, press A, enter the new address, and press F1.

5. Complete the configuration of other settings and parameters according to the operator's manual for the SCOR relay (manual no. SG-9228).

Once configured, the SCOR relay is ready to be an active part of your ACCESS system. Record the programmed address on the ACCESS Device Log in Appendix A. This SCOR relay retains its address when exchanged with other installed SCOR relays.

4.7 4700 Power Meter

The 4700 power meter is a microprocessor-based instrumentation package for low, medium, or high voltage electrical equipment and substations. It is a state-of-the-art alternative to traditional analog electro-mechanical metering devices. It requires no external transducers. The 4700 power meter replaces up to 12 traditional analog devices.

4.7.1 Installing the 4700 Power Meter

All 4700 power meters support an optional plug-in communications card that allows remote access to the device's data. The card supports both RS-232C and RS-485 communication and provides 120V galvanic isolation. If you order the 4700 power meter without a communications card, you can retrofit the card in the field at a later date.

The standard 4700 power meter can be powered at 0.2 amps by 85 to 132 VAC (47 to 440 Hz) or by 110 to 170 VDC.

For 4700 power meter **Rev A** versions, the ground connection, "G", to the 4700 power meter serves as the measurement reference point and as the chassis ground connection for the meter. Connect this lead directly to the equipment ground bus in the switchgear as shown in Figure 4.14.

For **Rev B** versions, the chassis ground connection is made via one of the mounting studs on the chassis of the meter, using the supplied lug. Connect this lead directly to the equipment ground bus as shown in Figure 4.14.

The communications card allows the 4700 power meter to communicate using either the RS-232C or the RS-485 communication standard. Connections are made to the terminal strip on the communication card as illustrated in Figure 4.14. The shield terminal is internally connected to the device's ground terminal.

The communications card has a jumper labelled J1. This jumper has two positions labelled A and B. Position the jumper in position A for the RS-485 mode. If you are adding the communications card in the field, follow the instructions in the 4700 Power Meter operator's manual (manual no. SG-6018). The card is shipped from the factory to operate in the RS-485 mode.

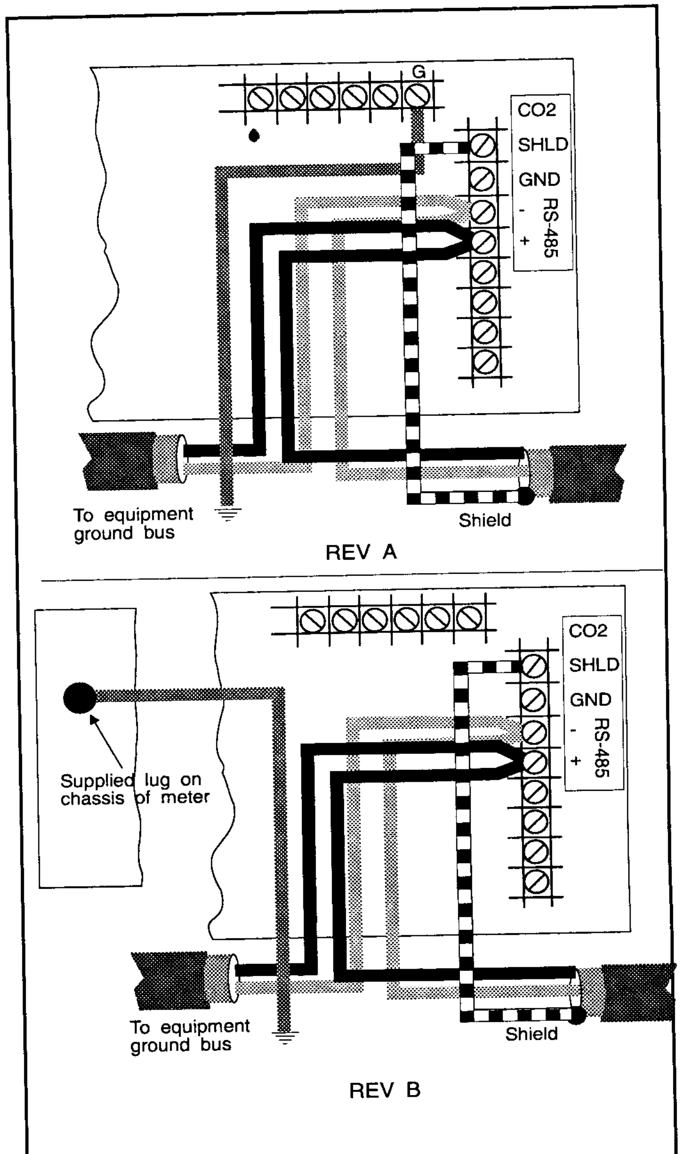


Figure 4.14 Communications Terminals for the 4700 Power Meter

tied together on the circuit board. Attaching the wires as shown maintains the continuity of the RS-485 loop.

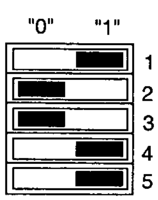
5. Make sure the wires are not touching any other terminal or electronic component. Using wire ties or other means, secure the communications cable so that they cannot become disconnected.

4.9.3 Local Configuration

Set the SEAbus address of a Multiplexer Translator using the five position DIP switch located on the electronic circuit board just below the eight configuration switches on the left side of the device as illustrated in Figure 4.19. An MT can have an address from 1 to 31 (decimal). The address "0" is reserved for troubleshooting software routines.

Use the address switch located on the MT to set the MT's address. Table 4.1 illustrates each switch setting for all addresses (1-31). From the Power Monitor unit, enter the same address (from 1 to 31). These two settings must be identical. Figure 4.20 illustrates the address switch, and Table 4.1 provides the proper address settings.

Refer to section 4.9.4 Remote Configuration for setting the baud rate.



MT Address Switch: The "1" position is to the right. This diagram illustrates the 25 setting. The MT address is 25.

Figure 4.20 MT Address Switch

4.9.4 Remote Configuration

Devices that use the MT to connect to the ACCESS network have MT Address and Device Number fields in their configuration screens on the Power Monitor unit. In the MT Address field, enter the address for the MT that the device is connected to. In the Device Number field, enter the device number (1-8) corresponding to the device number port on the MT that the device is connected to.

Set the baud rate of the Multiplexer Translator using the Power Monitor unit. There is no local configuration procedure for setting the baud rate. Baud rate is the only parameter that is configured remotely.

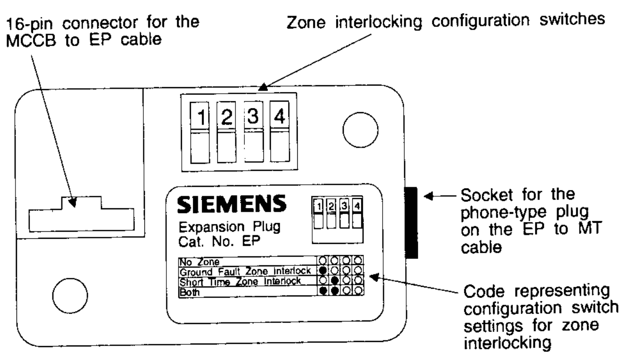
Table 4.1 MT Address Settings

Address	SW 1	SW 2	SW 3	SW 4	SW 5
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	1
28	0	0	1	1	1
29	1	0	1	1	1
30	0	1	1	1	1
31	1	1	1	1	1

4.10 Expansion Plug

Sentron Series Molded Case Circuit Breakers with the Sensitrip solid-state trip system include SEAbus communications capability. These circuit breakers along with the Type SB insulated case circuit breakers connect to the ACCESS system through the Siemens Expansion Plug which connects them to the Multiplexer Translator.

Proper interface techniques on a communications system call for electronic isolation between components. This procedure, called galvanic isolation, minimizes problems from voltage differences between the components in the system. As with the molded case and insulated case circuit breakers, the electronic components that provide this isolation are external to the circuit breakers and are contained in the Expansion Plug.



Expansion Plug showing the location of the interface cable sockets

Figure 4.21 Expansion Plug

Although the Expansion Plug contains electronic circuitry, it requires no separate control power source. It receives power from the MT through the interconnecting cable. You do not need to open the Expansion Plug because there are no internal connections or adjustments.

4.10.1 Zone Interlocking

In addition to its primary function of circuit isolation, the device also provides information related to the position of the circuit breaker in a zone interlocking scheme. Molded case and insulated case circuit breakers use the Multiplexer Translator device to handle the zone interlocking communications.

This zone interlocking information is set using the four-position switch on the front of the Expansion Plug. The setting code is located on the front label.

In a zone interlock network, circuit breakers are grouped into zones. Zone 1 includes the circuit breaker(s) nearest the power source. Zone 2 includes the circuit breaker(s) at the next level away from the power source. Zone 3 includes the circuit breaker(s) in the last level away from the power source. The Multiplexer Translator and the Expansion Plug configure these circuit breakers into their respective zones.

For further information on zone interlocking as it relates to molded case, insulated case and power circuit breakers, refer to the individual product instruction books listed in section 6, Reference.

4.10.2 Input and Output Connections

On the front of the trip unit of a molded case circuit breaker is a 16-pin connector. This connector is standard equipment throughout the Sentron line. In addition to the communications interface, this connector is also used for the Universal Test Set (TS-31) for device testing.

The Expansion Plug has a 16-pin connector on its front as illustrated in Figure 4.21. A factory prepared cable is used to connect the circuit breaker with the Expansion Plug. Table 4.2 lists the different lengths of cable assembly with their Siemens catalog numbers. Simply plug the cable into both devices. The connectors are keyed allowing you to connect the cable with no polarity problems. Make sure that you do not connect the cable backwards. When properly inserted, the ribbon cable should hang below the connector. Route the cable so that it does not interfere with the switches on the front of the circuit breaker.

Use the proper Siemens cable for connecting the Expansion Plug to the MT. Refer to Table 4.2 for the proper cable's catalog number.

Table 4.2 Multiplexer Translator and Expansion Plug Cables

Catalog Number	Description	Length
EPC08	Ribbon cable for connecting MCCB or ICCB to the Expansion Plug	8 inches
EPC12	Ribbon cable for connecting MCCB or ICCB to the Expansion Plug	12 inches
EPC18	Ribbon cable for connecting MCCB or ICCB to the Expansion Plug	18 inches
MTC08	Telephone cable for connecting Expansion Plug to Multiplexer Translator	8 feet
MTC15	Telephone cable for connecting Expansion Plug to Multiplexer Translator	15 feet
MTC25	Telephone cable for connecting Expansion Plug to Multiplexer Translator	25 feet

4.11 Sensitrip III Trip Unit

The Sensitrip III trip unit is the electronic trip unit used in the Sentron Series molded case circuit breakers (MCCB). These small trip units have microprocessor-based trip systems that are programmed to support connection to the ACCESS communications system.

DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

Molded case circuit breakers are usually not equipped with terminals for control circuits and accessories. They are designed to be mounted end-to-end and side-by-side leaving only the front panel for you to make adjustments on the trip unit. Connections are needed for functions such as testing, zone interlocking and communications. On the Sentron Series breakers, these connections are made through the Universal Test Pin port on the front panel of the trip unit.

In addition to the lack of space for control terminals on the molded case breakers, the trip units lack extra room for electronics to support optional functions such as communication and zone interlocking. Accordingly, the extra circuit elements for these features are provided by the Expansion Plug. See section 4.10, Expansion Plug.

Sensitrip III trip units are capable of communication and zone interlocking when they leave the factory. The trip unit and several other Siemens circuit protection components use the Multiplexer Translator to connect to the SEAbus network. See section 4.9 Multiplexer Translator.

4.11.1 Installing the Sensitrip III Trip Unit

Use the Expansion Plug to connect the Sensitrip III trip unit to the ACCESS network. The Expansion Plug is small so that it can be mounted close to the breaker as illustrated in Figure 4.22. Connect the Sensitrip III trip unit to the Expansion Plug using the shielded ribbon cable included with the Expansion Plug.

Both the cable from the circuit breaker to the Expansion Plug and the cable from the Expansion Plug to the Multiplexer Translator are made with the connectors already attached. Once the breaker (including the trip unit), Expansion Plug, and Multiplexer Translator are positioned, plug in the appropriate cables. The connectors are all keyed so there are no rules for establishing polarity.

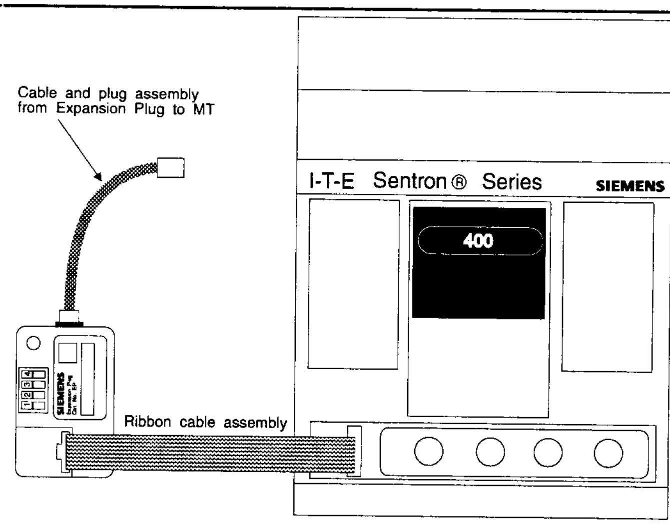
The ribbon cable connector is made at a right angle to the trip unit so that the cable lies flat against the circuit breaker, under the front cover of the switchboard. Run the ribbon cable to the Expansion Plug. Then, run the supplied telephone cable from the Expansion Plug to the Multiplexer Translator, following the general guidelines stated in Section 3, "Installing the Network." Make sure you do not run the cable parallel to a power conductor.

4.11.2 Local Configuration

There is no local ACCESS-specific configuration for the Sensitrip III trip unit. All configuration is done through the Multiplexer Translator using the Power Monitor unit.

4.11.3 Remote Configuration

Refer to subsection 4.9.4 "Remote Configuration" for the Multiplexer Translator for instructions on remote configuration of devices connected to the Multiplexer Translator.



A Sensitrip III (MCCB) trip unit shown with connections for ACCESS system. The Expansion Plug is normally mounted in a wireway close to the breaker.

Figure 4.22 Sensitrip III Trip Unit

4.12 Type SB Insulated Case Circuit Breaker (ICCB)

Insulated case circuit breakers (ICCBs) bridge the performance and feature gap between molded case circuit breakers and low-voltage power circuit breakers such as the Static Trip III trip unit. Type SB insulated case circuit breakers are available only with microprocessor-based trip systems and are compatible with the ACCESS system.

4.12.1 Installing the Type SB ICCB

Type SB circuit breakers are either fixed-mounted (bolted directly to the supporting structure with the cables or bus tied directly to the back of the breaker) or they are drawout-mounted. Drawout-mounting requires a mechanical assembly called a cradle that guides the circuit breaker's mechanical insertion and removal from the circuit's connected position.

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

Both test connections and ACCESS connections are made through the Universal Test Pin Port on the front of the trip unit that comes with the ICCB. From the Type SB circuit breaker, run the multi-conductor ribbon cable to secondary connections within the circuit breaker assembly.

If the Type SB breaker is drawout-mounted, the ACCESS connections are run within the breaker assembly to the lower left side of the secondary disconnect assemblies. There is a matching set of secondary assemblies on the fixed cradle. For the fixed mounted breaker, there are terminal blocks mounted in the same lower left position.

In either circuit breaker mounting arrangement, connect the electronic trip unit installed in the ICCB to the same Siemens Expansion Plug (see section 4.10) used for the Sensitrip III trip units as shown in Figure 4.23. Connect the Expansion Plug to the Multiplexer Translater. Refer the Table 4.2 for proper cables for each connection.

4.12.2 Local Configuration

There is no local ACCESS-specific configuration for the Type SB ICCB. All configuration is done through the Multiplexer Translator.

4.12.3 Remote Configuration

Refer to subsection 4.9.4 "Remote Configuration" for the Multiplexer Translator for instructions on remote configuration of devices connected to the Multiplexer Translator.

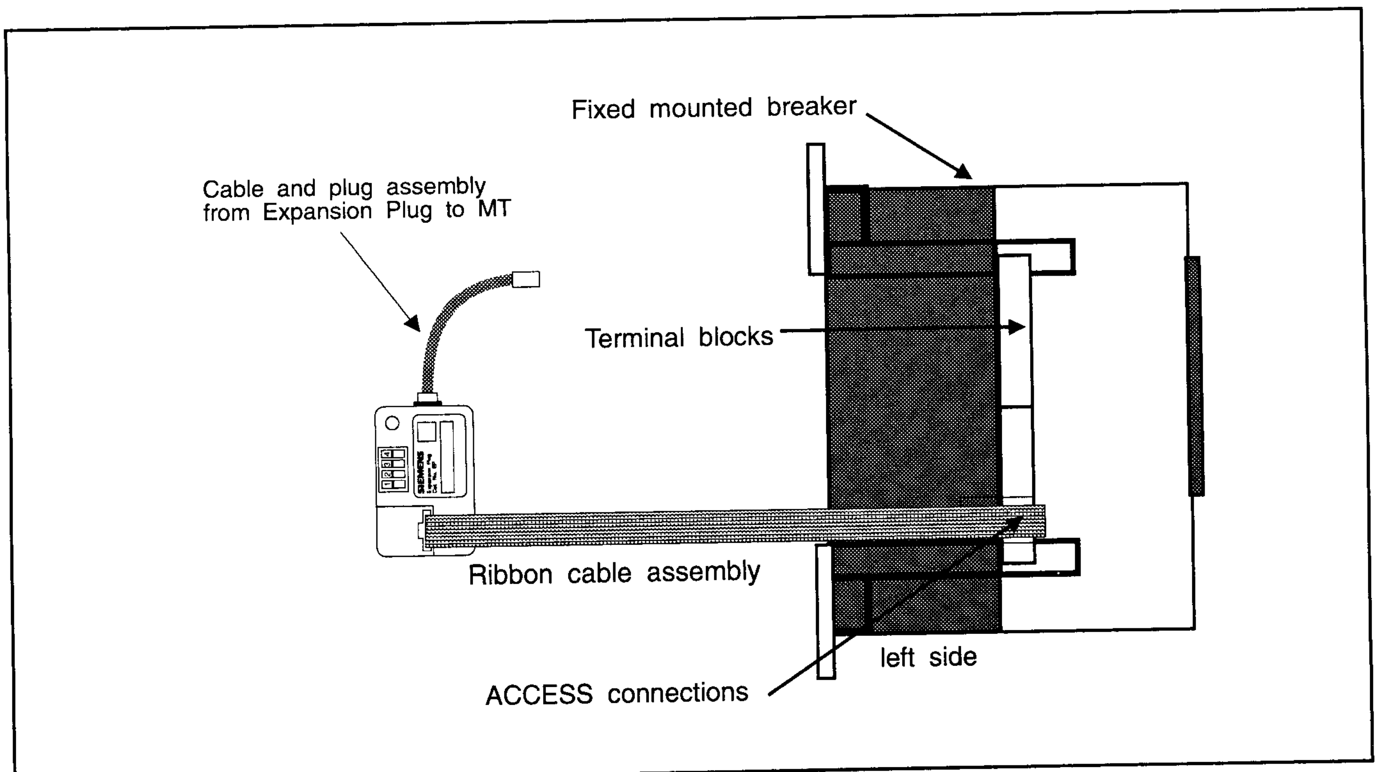


Figure 4.23 Fixed-Mounted Type SB Circuit Breaker with Expansion Plug

4.13 SAMMS Motor Protection and Control Relay

The Siemens Advanced Motor Master System (SAMMS) is a user-programmable motor protection and control relay. Available in three models, the SAMMS device provides reliable, flexible protection for all NEMA/EEMAC-size, low-voltage motors from 0.3 to 540 amps rating.

4.13.1 Installing the SAMMS Relay

A compact system with programmable control logic, the SAMMS device replaces a maze of timers, control relays, push-buttons, selector switches, pilot devices, and associated wiring. The SAMMS device requires a control power transformer to power the microprocessor-based controller and the optional hand-held communicator. The SAMMS device requires a source of 12 VAC power to operate. Siemens motor control equipment includes a 12 VAC connection on the control power transformer to power the SAMMS device.

The SAMMS device connects to SEAbus RS-485 through a SAMMS Communication Module CM-1. This module requires a 12 VDC, 50mA power supply. The connections for the SAMMS device are illustrated in Figure 4.24.

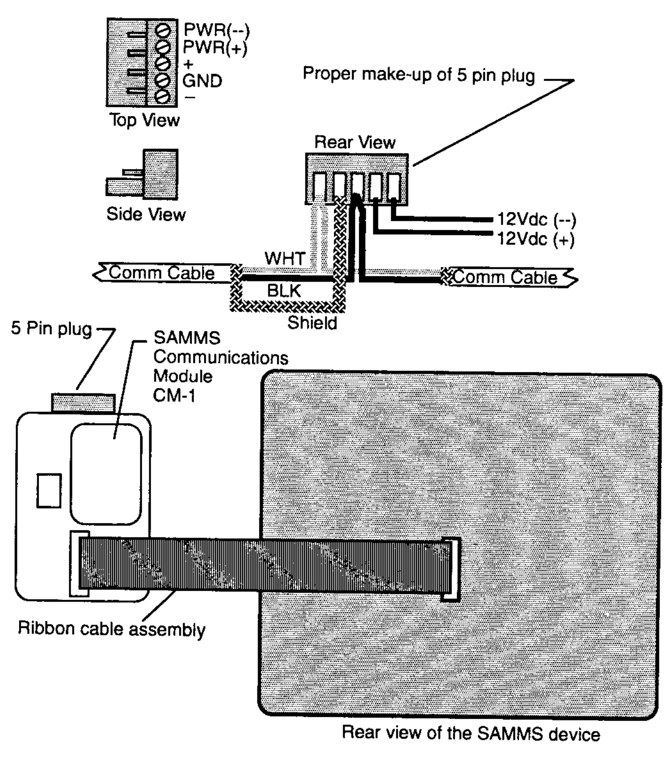


Figure 4.24 Connecting SAMMS Relay to ACCESS Network

4.13.2 Local Configuration

There are no ACCESS-specific parameters to setup locally for the SAMMS device. These parameters are configured remotely through the Power Monitor unit.

4.13.3 Remote Configuration

Use the following procedure to configure the SAMMS device via the Power Monitor unit:

1. On the Power Monitor unit, choose Circuit Configuration from the Main Menu. The Circuit Configuration Menu appears.
2. Using the Arrow keys, position the cursor on the circuit you want to edit. Press F5, Edit Circuit. The Circuit Configuration screen appears.
3. Using the Arrow keys, position the cursor on the circuit device you want to edit. Press F5, Edit Field. The Device Configuration screen appears.
4. Using the left and right arrow keys, position the cursor on the address field.
5. Press F2 to verify that the SAMMS device is communicating ("Device passed test" or "Configuration discrepancy" appears). (If the device is not communicating, refer to section 5, "Startup and Troubleshooting," to find and solve the problem.
4. Press A, enter the new address, and press F1 to program the SAMMS device to the new address.
5. Select Polling "On" so that the Power Monitor unit can poll the SAMMS device.
6. Complete the rest of the configuration according to the operator's manual for the SAMMS device (manual no. CP3290) and the operator's manual for the Power Monitor unit (manual no. SG-4018-01).

4.14 Static Trip IIIC, CP, and CPX Trip Units

The Static Trip IIIC, CP, and CPX microprocessor-based trip units are supplied on type RL Low-Voltage Power Circuit Breakers. In addition to the primary function of protecting circuits, this series of trip units also offers ACCESS communication of current values [C], power metering [P], and power relaying [X]. The Static Trip IIIC, CP and CPX can be supplied with a circuit breaker display unit (BDU). If the trip unit is configured with the communications open or close option, the operator may open or close the breaker from the Power Monitor unit.

4.14.1 Installing the Static Trip IIIC, CP, CPX Trip Units

The Static Trip III trip unit mounts onto a slide-type bracket at the lower right side of Type RL circuit breakers. Although the Type RL circuit breaker can be mounted as a fixed device, it is provided almost exclusively as a drawout breaker in low-voltage switchgear or switchboards. The drawout assembly contains primary circuit disconnects, secondary circuit disconnects, and communication circuit disconnects. Matching disconnects are mounted in the equipment cubicle. These disconnects engage automatically when the circuit breaker is racked into the cubicle.

Figure 4.25 represents a typical switchgear assembly and the SEAbus interface point with the breaker cubicle.

Although the circuit-protecting portion is self powered, the communications portion of Static Trip III trip unit requires 15 VDC to terminals 2 and 3 of the communications disconnect. The RS-485 SEAbus connections are made to terminals 4 and 5 of the same disconnect.

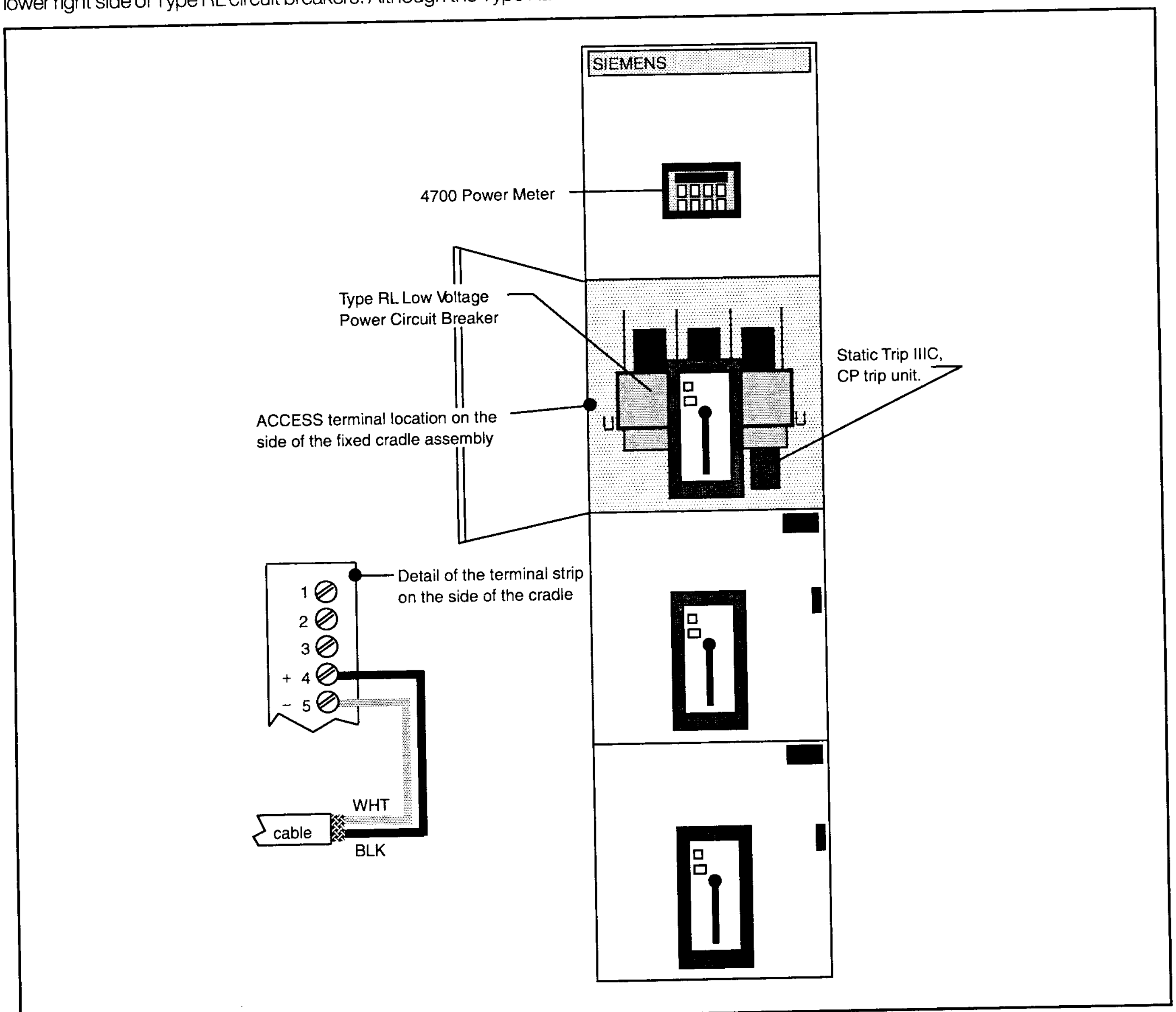


Figure 4.25 Switchgear section

Using the communications close and open feature or the alarm feature requires interposing relays that are mounted in the equipment cubicle and are connected through terminals 8, 9 and 10 of the communications disconnect. The output of these relays is connected to the circuit breaker close and open circuitry or to a remote annunciator.

When furnished, the breaker display unit (BDU), illustrated in Figure 4.26, is mounted on the front plate of the circuit breaker's drawout element and is connected to the Static Trip IIIC trip unit by its cable.

Figure 4.27 on the following page shows the wiring from the cubicle through the circuit breaker to the Static Trip III trip unit.

4.14.2 Local Configuration

Local configuration of the Static Trip IIIC, CP, or CPX trip units requires a breaker display unit; otherwise, configure them remotely as described in section 4.14.3. To configure a Static Trip III trip unit with a breaker display unit follow these steps:

1. Press the Read/Max and the Enter/Min keys simultaneously to enter program mode. The word "PROGRAM" appears in the LED display.

2. Press the ▼ key to display the PASSWORD parameter. You must enter the correct password to change the setup parameters.

3. Enter the password using the ▲ and ▼ keys to count up and down. (Enter the right-most digit first. The cursor then moves to the left to enter the next digit until all four digits are entered.) After entering the password, either "Correct" or "Incorrect" appears on the display.

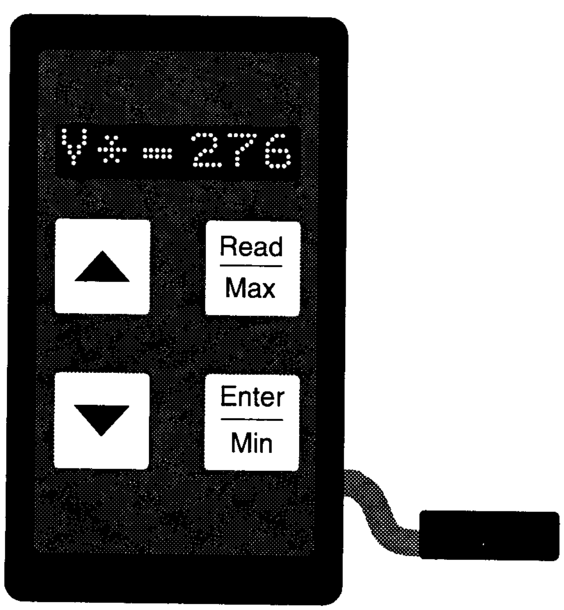


Figure 4.26 Breaker Display Unit (BDU)

4. When you have entered the correct password, press the ▼ key to scroll to "ADDRESS".

5. Press Read to read the address, or press Enter to return to "ADDRESS" in the main scrolling sequence.

6. To change the address while the present address is displayed, use the ▲ and ▼ keys to enter the new address. Press Enter. The word "Enter?" appears.

7. Press Enter to accept the change and return to the main scrolling sequence.

8. Press the ▼ key to scroll to the "BAUD" parameter. Press Read to display the present baud rate.

9. To change the baud rate use the ▲ or ▼ key to display the desired rate, and press Enter. "Enter?" appears.

10. Press Enter again to accept the change and return to the main scrolling sequence.

You may view and modify other set points as described in the *Static Trip III Information and Instruction Guide* (manual no. SG3118). You can also view and modify these set points using the Power Monitor unit.

To return to the DATA mode, press the Read/Max and Enter/Min keys at the same time from any parameter in the main scrolling sequence.

4.14.3 Remote Configuration

To configure the address, the baud rate, and all other parameters of the Static Trip IIIC trip unit on circuit breakers without BDUs, use the Power Monitor unit. If you have a BDU, this method is optional. For remote configuration, refer to the Power Monitor unit operator's manual (manual no. SG-4018-01) and the *Static Trip III Information and Instruction Guide* (manual no. SG3118). From the Power Monitor unit, use the following procedure to remotely configure the Static Trip III trip unit's address.

1. Choose Circuit Configuration from the Main Menu.

2. Position the cursor on the circuit that you want to edit.

3. Press F5, Edit Circuit, to edit the circuit.

4. Position the cursor on the trip unit that you want to edit.

5. Press F3, Device Configuration.

6. Press F2, Confirm Settings, to confirm the settings. Either "Test Passed" or "Configuration Discrepancy" appears. If

"Device Not Found" appears, ensure that the device is connected to the RS-485 communications bus and the Power Monitor unit's polling feature is "ON."

7. Move to the address field, press A and enter the new address.

8. Press F1, Configure to Device, to program the device with the new address.

9. Press F6, Return/Save, to return to the Circuit Configuration menu and save changes.

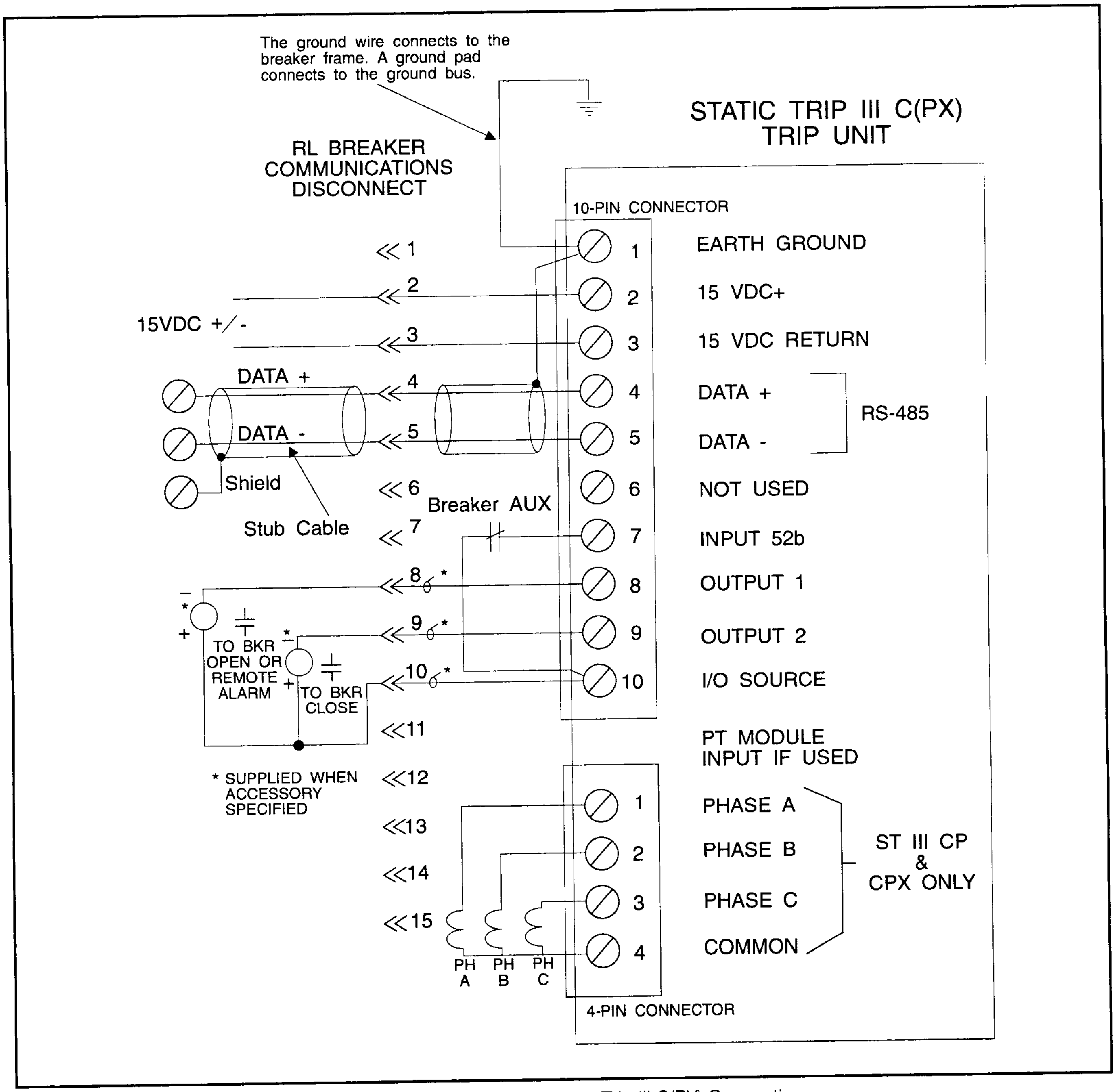


Figure 4.27 Typical Cubicle, RL Drawout Breaker Element and Static Trip III C(PX) Connections

4.15 Multilin 169+ and 269+ Relay

Multilin 169+ and 269+ motor protection relays are used in medium-voltage motor control. (For low-voltage control, refer to section 4.13 about the SAMMS relay.) The Multilin relay, in addition to offering motor protection and control, also supports up to ten resistance temperature detector (RTD) inputs. The Multilin relay connects to the ACCESS Host PC via the Isolated Multi-Drop or 232/485 Converter. It **does not** connect to the Power Monitor unit through the RS-485 SEAbus network.

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

4.15.1 Installing the Multilin 169+ and 269+

There are 83 terminals on the back of the Multilin 169+ relay and 88 terminals on the back of the Multilin 269+ relay. For the 169+ relay, connect the communications cable to terminals 46 (-) and 47 (+), and connect the shield to terminal 42 (G). For the 269+ relay, connect the communications cable to 46(-) and 47(+), and connect the shield to terminal 88 (Shield). Figure 4.28 illustrates the proper connections for a Multilin 169+ relay.

4.15.2 Configuration

To establish ACCESS communication, you must set the address for the Multilin 169+ or 269+ relay. The special-purpose jumper must be installed to store setpoint changes. (Refer to the Multilin Protection Relays documentation for information on installing the special-purpose jumper.) Use the following procedure to set the address while referring to Figure 4.29:

1. Press the SET POINTS key on the front panel of the relay. This key can be pressed at any time, and in any mode, to view and alter relay setpoints.

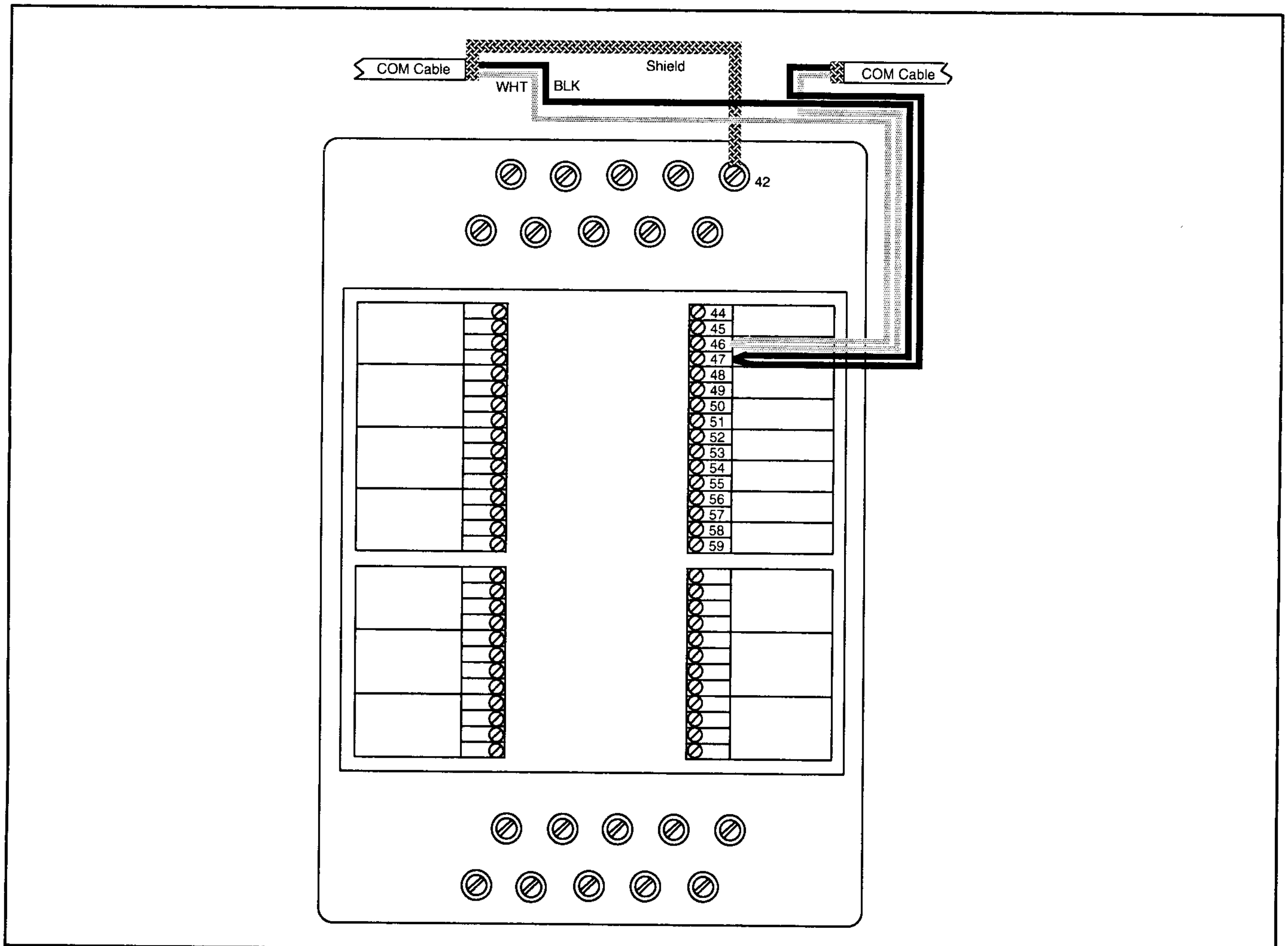


Figure 4.28 Rear View Multilin 169+ Relay

2. There are seven pages of information in the SET POINTS mode. Use the PAGE ▼ key to move the cursor to page 5, System Configuration.

3. Use the LINE ▼ key to move the cursor to the SLAVE ADDRESS field.

4. Indicate the new address using the VALUE ▲ and VALUE ▼ keys. The allowable range is 1-254 or OFF (no address).

5. Press the STORE key to save the new address. The relay responds with "New Setpoint Stored" on the display.

Local configuration is complete. There is no remote configuration for the Multilin relays.

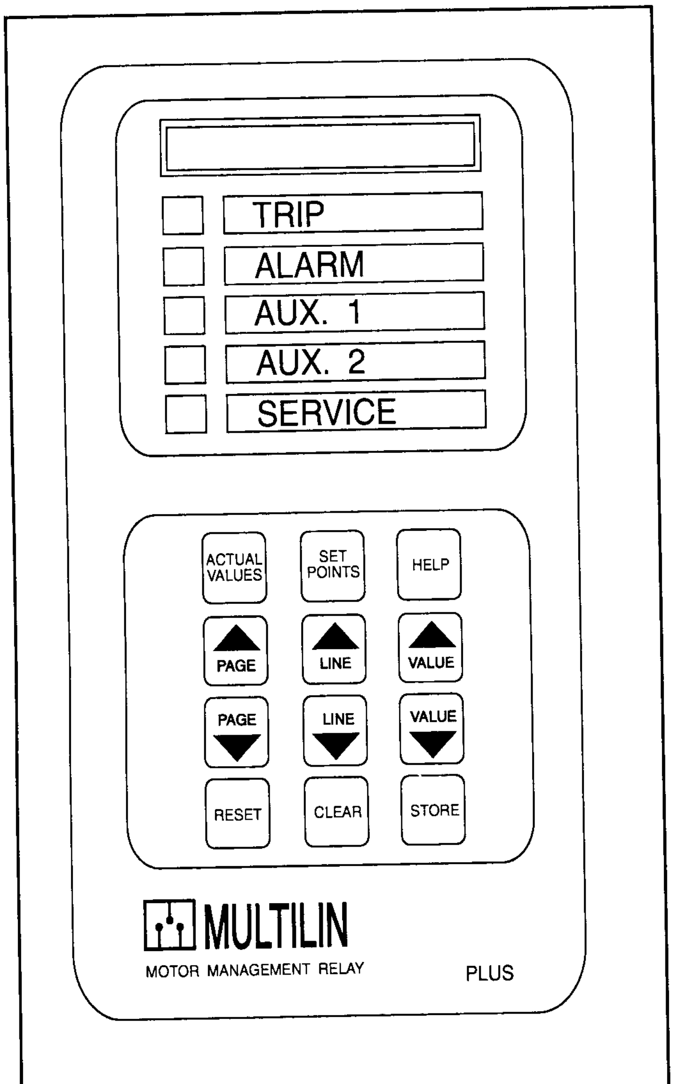


Figure 4.29 Multilin 169+ or 269+ Relay Front Panel

5 Startup and Troubleshooting

This section contains step-by-step guides for starting and troubleshooting the ACCESS communications system as well as a theory of operation subsection and a detailed troubleshooting guidelines subsection. With the exception of the master device on the communication bus (i.e. Power Monitor unit), each of the components in the ACCESS system is meant to function by itself. In other words, each component has a primary function other than ACCESS communications (i.e., over-current protection, metering, extended protection, motor protection, etc.).

Section 5 is intended to help you locate communication problems within the ACCESS system. Help with noncommunications problems can be found in the individual operating instruction manuals for each device. For further help in these areas, contact your local Siemens sales office, which is listed on the back cover of this manual.

5.1 Startup

The first three sections of this manual describe the ACCESS communication system. As discussed earlier, this system consists of master and slave devices and the RS-485 twisted-pair bus between them.

The first step in startup is to check all connections in the system. Before inspecting the wiring, disconnect all power and short Current Transformers if applicable.

DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

Follow all safety precautions when inspecting the wiring for the ACCESS system. Instrument compartments and switchgear structures typically contain many different circuits and some of them may be energized.

1. Check to see if devices that require external power are connected to the appropriate source of voltage and current.
2. Verify correct polarity of positive (Data +) and negative (Data -) communication wires to all devices. (White wires connect to the negative terminal, and black wires connect to the positive terminal.)
3. Verify that all equipment ground terminals are directly connected to the equipment ground bus.
4. Verify that no shield of any twisted-pair cable leading to or from an ACCESS component is connected to ground at both ends. All shields must be terminated to ground at one end only. (Refer to section 3, "Installing the Network" for information on grounding the shield.)
5. Verify that the RS-485 shields are grounded to the equipment ground bus at the interface point with another RS-485 loop. (Refer to section 3, "Installing the Network," for information on grounding the shield between loops.)
6. Verify that there are no shorts between the positive and negative communication wires (white and black leads and shield). One of the common causes of communications failure is nicked signal wire (white and black wires) in the area of the shield. These nicks short the signal.

Note: You should eliminate shorts because measured resistance varies depending on the type and connection of the master device. Master devices always incorporate necessary bus termination and bus reference components required for proper biasing of the RS-485 network. Resistances will normally fall within 60 to 180 ohms when measured between positive and negative (black and white) communications wires.

It is impossible to verify live operation of the ACCESS communications system without using a master device. If the field device you are testing is not connected to a master device, attach one to the RS-485 bus.

Turn on power to all ACCESS components. Wait until the master device goes through its internal set-up routines. Using the master device's selection routine, select each slave device on the bus. Verify that each device is correctly addressed and that it responds to the master's inquiry. If it doesn't, proceed to section 5.2, "Troubleshooting."

Using either real operating conditions or recommended test conditions, verify that all devices on the bus perform properly. If this step does not yield the expected results, proceed to section 5.2.

Ensure that you properly installed the network according to the rules discussed in section 3, Installing the Network. These rules are listed again below:

Rule 1: Connect all devices in a loop topology (explained in section 2, Operational Overview) so that all devices stay connected to the master in case of a line break.

Rule 2: A maximum of 32 devices may be connected in a single RS-485 bus for a total cable run no longer than 4000 ft.

Rule 3: Always ground the shield at only one end of a cable segment.

Rule 4: Always connect the field device's ground terminal directly to the switchgear equipment ground bus.

Rule 5: Run ground connections directly to the equipment ground bus and do not daisy chain them from one component's ground to the next.

Rule 6: Do not route signal cabling parallel to power conductors. Power conductors are any cables or bus conductors carrying currents greater than 20 amps.

5.2 Troubleshooting

The following sets of troubleshooting procedures categorize routine problems and offer a series of possible solutions.

If the Power Monitor unit does not display the Main Menu screen on power up,

1. check that the on-off switch is turned on and that power is available to the Power Monitor unit
2. contact your local Siemens service representative

If the Power Monitor unit displays the proper screens but receives no data from any component,

1. verify that polling is enabled for all devices
2. verify the RS-485 continuity between the Power Monitor unit and the rest of the system (Do this by tracing signals from the master through the system using an oscilloscope as discussed in section 5.5, "Detailed Troubleshooting Procedure.")
3. verify that there are no shorts on the RS-485 network
4. verify correct polarity of the RS-485 connection at the Power Monitor unit
5. verify that there is no nonfunctioning surge suppressor between the Power Monitor unit and the rest of the system
6. verify that the baud rates of the Power Monitor unit and the rest of the system are compatible

If the Power Monitor unit displays data from one loop but not another,

1. check the terminal block at the interconnection of the "lost loop" and the rest of the system and verify correct polarity
2. verify that the RS-485 cable is continuous in both directions from the interconnection of the loops and that there are no shorts on the unresponsive loop
3. verify that the shield grounding at the interconnection point is not in contact with the white or black leads
4. verify that the surge protection device is functioning properly (Do this by looking at input and output signals simultaneously on an oscilloscope.)

If a field device is not sending data,

1. verify that the address of the device is correct (The Power Monitor unit may have the wrong device address, or the device may have an incorrect address.)
2. verify that polling is enabled for the slave device
3. verify that the baud rate of the slave device matches that of the master
4. check the power supply to the noncommunicating device (Make sure the device is turned on, if it has a separate switch.)
5. verify that the device's ground terminal is connected directly to the equipment ground bus
6. verify that the device is connected to the RS-485 bus and the device's polarity is correct
7. verify that the C01 communications card is installed and set for RS-485 for the 4700 power meter
8. verify that the device does not have a duplicate address (Refer to the operator's manual for the Power Monitor unit, manual no. SG-4018-01.)

If data is inaccurate,

1. verify that the correct current and voltage sensor ratings (or scales) are entered into the device
2. follow the instructions for calibration and verification contained in the instruction and operation manual for each device
3. verify that the power system's 3-phase volt mode is properly set for the given wiring (Wye, Delta, etc.)
4. check for proper voltage phase rotation and polarity
5. verify that the ground terminal is connected to the equipment ground bus
6. check current and voltage levels of inputs to the device

If data error messages appear on the Power Monitor unit,

1. check the continuity and polarity of the RS-485 bus.
2. verify that the ACCESS component is functioning normally in its primary role (if not, contact your Siemens representative)
3. verify that the levels for communication signals are correct per the RS-485 requirements (Refer to the following problem.)
4. contact your Siemens representative

If levels for communication signals are not within RS-485 standards,

1. verify that no more than 32 devices are connected to the RS-485 bus
2. verify that the bus length does not exceed 4000 feet (Refer to section 5.5 below for more information about bus length.)
3. contact your Siemens representative

If the Power Monitor unit does not receive data from a circuit breaker through a Multiplexer Translator,

1. verify that the Multiplexer Translator has control power
2. check the configuration switches on the MT

If none of the MT channels transmit data,

1. replace the MT
2. verify continuity with the expansion plug
3. replace the expansion plug
4. call your Siemens representative

If data from one input device is not being transmitted,

1. plug the device into a different channel on the MT
2. verify continuity with the expansion plug
3. replace the expansion plug
4. contact your Siemens representative

Note: The Power Monitor unit receives occasional Alarm messages from the ACCESS components. These messages do not indicate a communication malfunction or error; instead, they indicate a condition from the component's electrical distribution function that requires operator action.

5.3 Understanding the RS-485 Network

The RS-485 network transfers data by applying differential signals to a twisted-pair cable. The phase relationship between the two transmitted signals on the cable is 180 degrees out of phase. This relationship may be viewed clearly in Figure 5.1 in the time period containing no noise.

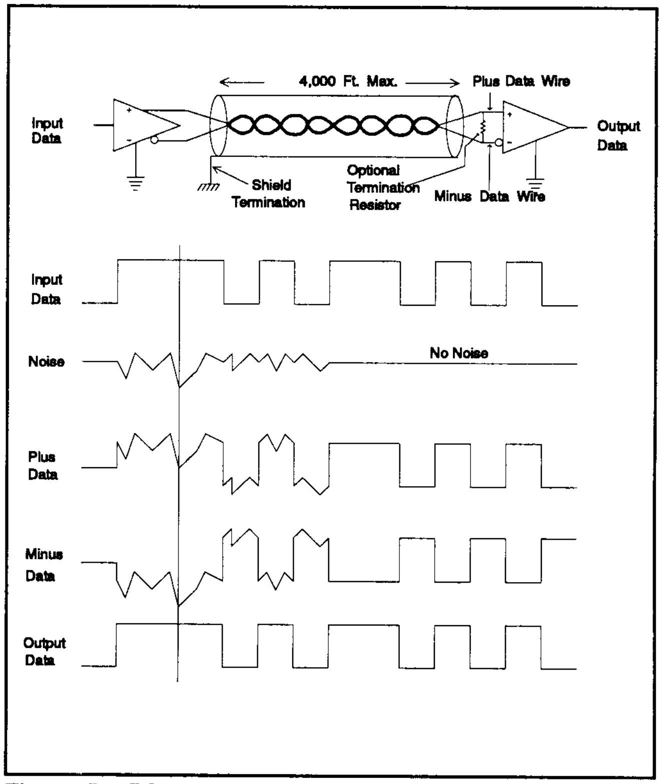


Figure 5.1 RS-485 Waveform Diagram

When noise occurs on the bus, it is induced onto the twisted-pair cable at the same amplitude and time as the data signal, causing the noise signal to be in phase. The resulting waveform then contains both the desired signal plus the noise; as a result, the desired signal is out of phase and the noise is in phase. The relationship between the resulting waveforms on each wire contains the desired signal plus the noise. In this case, the desired signal is out-of-phase and the noise is in-phase.

The receiver circuit of the RS-485 bus differentially combines the waveform of each wire. (Refer to section 2, "Operational Overview," for explanation of drivers and receivers.) This combination produces a signal that represents the difference between the two waveforms and that the in-phase (noise) portion of the waveform cancels out, leaving only the desired signal. The phase relationship between the desired signal (input and output data) and noise may be seen at the vertical line in the diagram.

The environment where ACCESS equipment is located typically has large magnitudes of current flowing through it. Potential problems with communication, associated with high current flow and noise, are to some extent controlled by the RS-485 bus and by the common-mode rejection and differential characteristics of the receivers. However, if the severity of the disturbance forces voltage outside the range of +12/-7 VDC from the receiver's ground reference point, then data can be corrupted. Likewise, the difference in earth ground voltage at devices located across the bus may also pose problems. The RS-485 receivers can correctly decode bus data if the signals they receive are within the range of +12/-7 VDC of the receiver's ground voltage point. Therefore, the transmitter and receiver may have a ground voltage difference of +12 to -7 volts and still function.

5.4 Detailed Troubleshooting Guidelines

Figure 5.2 illustrates an RS-485 waveform captured at a receiver, with channels 1 & 2 adjusted to the same ground reference point at the center of the grid. With the waveforms displayed in this fashion, it is easy to see and compare the relationship between ground reference and the RS-485 lines. The RS-485 plus and minus waveforms form an envelope that must stay between +12 volts (valid high-receive level) and -7 volts (valid low-receive level) for the receiver to decode the data. The position of the resulting differential signal has no significance. The waveform shown in Figure 5.2 is at ideal voltage levels.

Different earth-ground voltages can occur at any receiver on the bus; however, they most likely occur at the receiver located farthest from the transmitter. They can also occur at the Power Monitor unit, since it receives data.

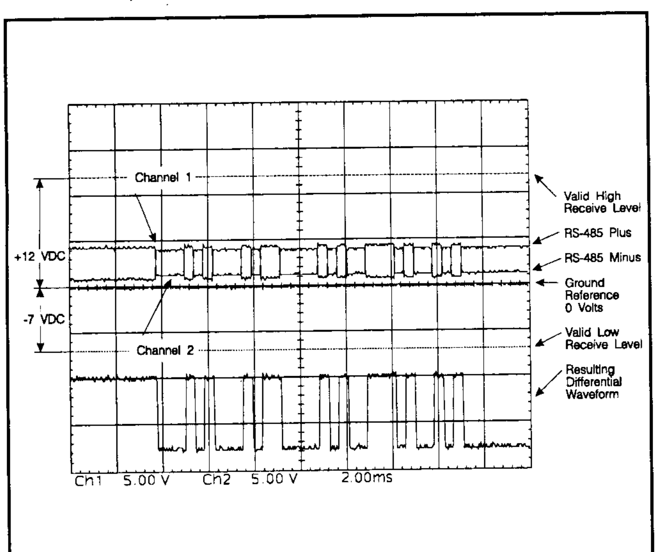


Figure 5.2 RS-485 Waveform

The RS-485 standard specifies that a driver must be capable of presenting a 1.5V signal differentially at its outputs, under the loading of 32 receivers and two 120 ohm termination resistors. (Refer to section 2, "Operational Overview," for an explanation of drivers and receivers.) Each receiver or passive transceiver must provide a minimum input impedance of 12K ohms. The parallel load impedance is 51 ohms, which includes the receiver load, termination resistors, and biasing resistors. Typically, many RS-485 drivers can drive more than 51 ohms or as low as 20 ohms. If typical characteristics are used, a network can consist of more than the 32 devices specified by the RS-485 standard.

5.4.1 Setting Up the Oscilloscope

A differential measurement is the difference between the two points that are contacted by the measurement probes. For example, a voltage meter displays a true differential measurement between its plus and minus probes. An oscilloscope displays a differential waveform.

Before an oscilloscope can make an accurate measurement, you must connect it's frame ground to the circuit being measured. If the oscilloscope is powered by an external AC source, this connection may be through earth ground via the power cord or through the scope's probe ground clip. If the scope is powered by an external AC source, the scope's frame ground is held to the earth ground's voltage potential.

To obtain a differential measurement from an oscilloscope that does not use earth ground as its reference point, use either the dual-probe or single-probe method.

The dual-probe method displays a waveform representing the difference between input channels 1 and 2. This method has two requirements:

- The scope must have at least two (dual) input channels.
- If the oscilloscope is an analog scope, it must be able to add two channels together and invert one of those two channels.

All dual-channel, digital scopes comply with these requirements.

You can use the single-probe method with any oscilloscope. Siemens recommends that you use it with oscilloscopes that have only one input channel or that lack the controls necessary for the dual-probe method.

The single-probe method displays a waveform representing the difference between channel 1 and the scope's frame ground. Connect the probe (channel 1) to the device's plus terminal. The "second reference" associated with the waveform is not as obvious as it is with the voltage meter. This second reference is the probe's ground reference lead. This reference is taken from the scope's frame ground. This voltage reference point (the second probe) is equivalent to the voltage meter's minus probe. The single-probe method establishes this equivalent of the minus probe by disconnecting the external connection between earth ground and the oscilloscope's frame ground. Also, AC line power is coupled to the oscilloscope via an isolation transformer. The scope's AC power lines and frame ground are then isolated, and the scope is "floating". At this point, the oscilloscope's frame ground may be used as a reference probe.

CAUTION: The oscilloscope's frame is not grounded when using the Single-Probe Method. This condition may cause a potential shock hazard if the oscilloscope is not in proper operating condition.

If possible, establish communication on the RS-485 bus prior to performing the oscilloscope set-up procedure.

5.4.2 Using the Dual-Probe Method

Use the dual-probe method for both analog and digital scopes.

1. Set the vertical mode switch for input channels 1 & 2 to BOTH.
2. Set the vertical coupling switch for input channels 1 & 2 to DC.
3. Set the vertical amplitude controls for channels 1 & 2 to 2 volts per division. Verify the probe type (X1 or X10) and compensate accordingly.
4. Set the time-base control to 2 milliseconds per division for an RS-485 bus transfer speed of 4800 baud (4ms for 2400 baud, 1ms for 9600 baud).
5. Set the trigger mode switch to AUTO.
6. Set the trigger source switch to CHANNEL 1.
7. Adjust the vertical sweep POSITION control for channel 1 so that the channel 1 sweep is halfway between the middle and the top of the CRT display.
8. Adjust the vertical sweep POSITION control for channel 2 so that the channel 2 sweep is halfway between the middle and the bottom of the CRT display.
9. Attach the channel 1 probe to the RS-485 plus (black) wire and the channel 2 probe to the RS-485 minus (white) wire. To reduce noise, connect the probe ground clips together, but do not ground them.
10. If a 60Hz signal appears to modulate both displayed waveforms, attach both probe ground clips to earth ground. If a 60Hz signal is still present, use a voltage meter and measure the AC voltage between the RS-485 cable shield (at the channel 1 & 2 probe connection) and the earth ground. If the AC voltage measured is less than 7 volts, connect the scope's probe ground leads to the RS-485 cable shield connection. If the AC voltage is greater than 7 volts or if the 60Hz signal is still present, ensure that the scope is properly grounded before going to the next step.
11. If necessary, adjust the vertical POSITION control for channels 1 & 2 to return the waveforms to their previous positions.

At this point, the procedure may differ between analog and digital scopes. For digital oscilloscopes without INVERT control, go to step 12. For analog and digital oscilloscopes with channel mode ADD and INVERT controls, go to step 15.

12. Digital oscilloscopes differ with respect to math functions controls. At this point either invert channel 2 and then add channels 1 and 2, or subtract channel 1 from channel 2 or channel 2 from channel 1. Refer to the oscilloscope operator's manual for detailed instructions.
13. After you complete the math function, the differential waveform appears on the CRT display.
14. Proceed to Step 18 if you are using a digital oscilloscope without INVERT control.
15. Adjust the vertical mode switch for input channels 1 & 2 to ADD. (A straight line is displayed, representing the algebraic sum of channels 1 & 2. Channels 1 & 2 waveforms may disappear on some oscilloscopes, leaving only the sum.)
16. Place the third (sum) waveform at the center of CRT screen, with channels 1 & 2 vertical position controls.
17. Place the channel 2 invert switch in the active position. (The waveform displays the differential measurement.)
18. Adjust the trigger-level control to synchronize the waveform(s).
19. Adjust the vertical amplitude control if its signal level is too low. Adjust vertical amplitude controls for channels 1 & 2 to the same value.

5.4.3 Using the Single-Probe Method

Use the single-probe method for oscilloscopes that have only one probe. (Refer to section 5.4.1, "Setting Up the Oscilloscope," for more information on the single-probe and dual-probe methods.) If your oscilloscope is powered by batteries (DC) and is not connected to earth ground, begin with step 3. If not, isolate the oscilloscope from the external AC power and earth ground connections using either step 1 or step 2 below. Once completed, proceed to step 3:

1. Use an isolation transformer that isolates not only the AC power line but also the earth ground. Make sure the

isolation transformer has an adequate VA power rating to power the oscilloscope.

2. Use a ground isolation monitor such as the Tektronix A6901. The Tektronix A6901 provides ground isolation for the measurements and protection from shock hazards, but it does not isolate the AC line.

CAUTION: Do not use a grounding or "cheater" plug between the scope's power cord and the power receptacle. Using a cheater plug is dangerous for the operator and may damage the equipment.

3. Set the vertical coupling switch for input channel 1 to DC.
4. Set the vertical amplitude controls for channel 1 to 2 volts per division. Verify the probe type (X1 or X10) and compensate accordingly.
5. For 4800 baud, adjust the time-base control to 2 milliseconds per division (4ms for 2400 baud, 1ms for 9600 baud).
6. Set the trigger mode switch to AUTO.
7. Set the trigger source switch to CHANNEL 1.
8. Adjust the vertical sweep POSITION control for channel 1 to place channel 1 sweep in the middle of the CRT display.
9. Attach the channel 1 probe to the RS-485 plus (black) wire and the ground of the channel 1 probe to the RS-485 minus (white) wire. The oscilloscope should now display the differential measurement. If a 60Hz signal appears to modulate the displayed waveform, ensure that the scope's probe ground is properly connected. If connecting the scope's probe ground causes a voltage change at the point it connects, verify that the scope is indeed floating.
10. Adjust the trigger-level control as necessary to synchronize the waveform.
11. Adjust the vertical amplitude control if the signal level is too low.

Figure 5.3 in the next column shows a captured waveform of a Power Monitor unit's RS-485 bus that is polling slave devices. The baud rate is 4800. Channel 1 is the top waveform, the differential is the middle waveform, and channel 2 is the bottom waveform. If the single-probe method is used, channels 1 and 2 are not displayed. The amplitude of the differential waveform should be about twice that of channels 1 and 2.

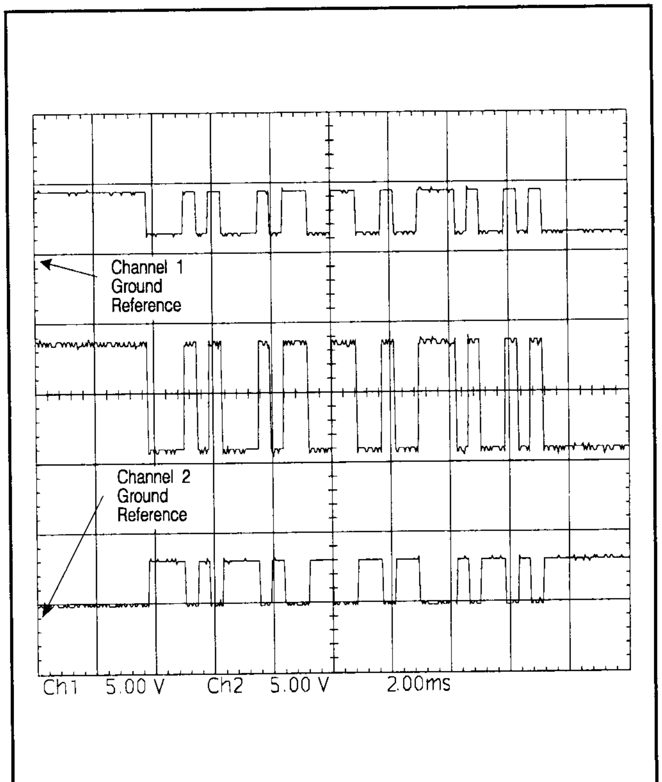


Figure 5.3 Channel 1, Differential, and Channel 2 Waveforms

The waveform in Figure 5.4 on the next page is an RS-485 transmission that has traveled through approximately 4,000 feet of cable. A termination resistor is located at the probe point, and several receivers are attached to the cable as well. Notice the low amplitude (.5 volts per division) of the waveform on channels 1 and 2. The low amplitude occurs because of the resistance of the cable and the termination resistor. Also, the noise common to channels 1 and 2 is cancelled out by the inherent common-mode rejection from the resulting differential waveform (center). The resulting differential waveform is reduced to half amplitude scale.

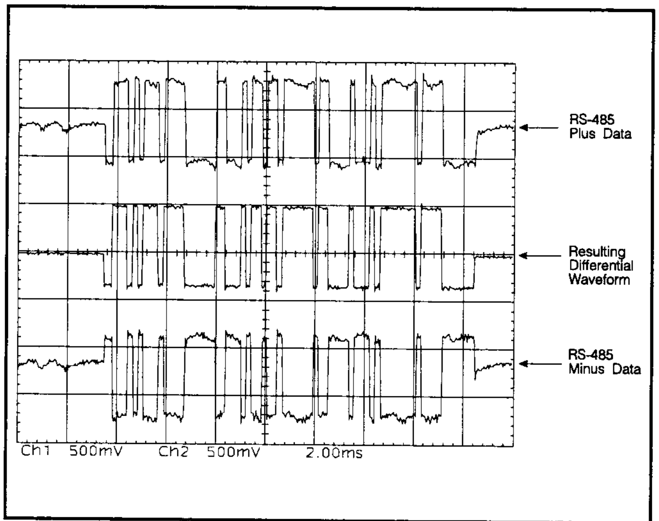


Figure 5.4 Waveform Through 4000 Feet of Cable

5.4.4 Administering the 51 Ohm Test

In Figure 5.5, the waveform is from a Power Monitor unit with its RS-485 cable disconnected. Complete the following steps to set up the Power Monitor unit for the 51 ohm test:

1. Set up your oscilloscope according to the instructions in section 5.4.1 above.

2. Attach a 51-ohm resistor across the Power Monitor unit's RS-485 plus and minus terminals. (While in polling mode, the Power Monitor unit transmits at its maximum load.)

3. Observe the waveforms on the oscilloscope. The top and bottom waveforms (illustrated in Figure 5.5) show the required 1.5 volts swing from each plus and minus driver.

The center differential waveform should have a minimum voltage swing of 3.0 volts to comply with the RS-485 specification. The voltage scale for the waveform is 2 volts per division.

The preceding explanation is a valuable test. It is used to narrow down a problem location to either the transmitter or the RS-485 bus. For example, if the Power Monitor unit (or other bus transmitter) passes the 51 ohm test but fails the same test after connecting the RS-485 cable, the impedance "seen" by that device must be too low. Even though the bus may have fallen within the specified range using an ohmmeter, there still may be problems on the bus with loading. Keep in mind that a simple ohmmeter test does not give the capacitance or inductance value of the bus. Also, it is not always practical to do an ohmmeter test because all devices must be powered down for a correct measurement.

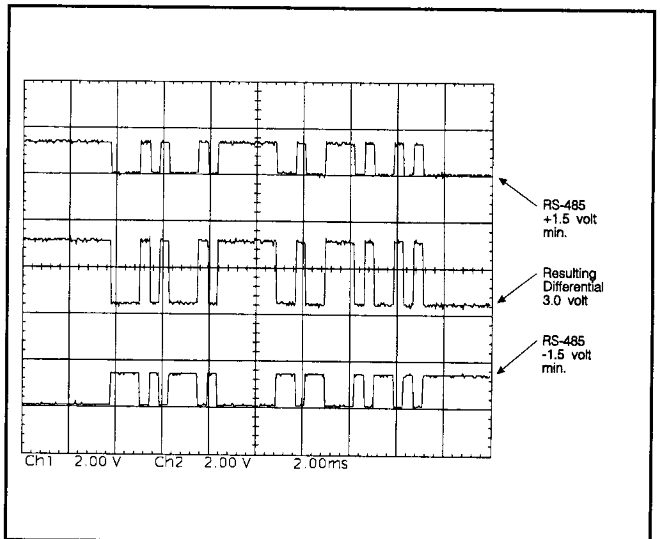


Figure 5.5 51 Ohm Test

A Documenting Your System

This section covers the paper work necessary to properly plan for and assemble an ACCESS communications system. Section 2, "Operational Overview," and section 3, "Installing the Network," describe the method for creating the RS-485 loops that interconnect all of the components. This section tells you how to make a record of those loops. The communication diagram (Figure A.1 on the next page) graphically represents the network. The ACCESS Device Log (Figure A.2) records the device addresses, switch settings, and software revisions.

A.1 The Communication Diagram

The communication diagram, on the next page, illustrates the loops making up your ACCESS system. If the size of the communications system is large enough, there may be a hierarchy of communication diagrams. The highest level might show the Host PC, the modems, Multilin Relays (because they connect directly to the Host PC), and the Power Monitor units. A second-level diagram might show the loops from the level of the Power Monitor units on down. Communication diagram(s) include the following items:

- the designation of each line-up of electrical equipment
- the type of electrical equipment
- the reference drawing numbers
- a list of the ACCESS components within each line-up
- the addresses of each ACCESS component
- the designation and location of each component

The communication diagrams also show which loops are inside a building and which ones are outside a building (if known). The diagrams also show the location of transient suppressors.

A.2 The ACCESS Device Log

Figure A.2 on page 47 is a tabulation of ACCESS component information, an ACCESS Device Log. The log allows you to record information on the components. This information includes:

- device type
- model number
- serial number (cannot be filled in until the component is in your possession)
- software version
- ACCESS device address
- cell location
- device name
- MT setup

One use of this log sheet is to record the addresses for each component. These addresses come from the communication diagram. This log sheet is a good place to check for any duplication of addresses in the system. The log sheet is not used in low-voltage or medium-voltage switchgear.

On some components, configuration switches contain information about addresses and functions. Since this sheet is used by the wiremen and the testers and inspectors on the shop floor, the configuration setting information is added by the applications engineer. Figure A.3 on page 48 illustrates a completed log sheet.

The finished log sheet is an important tool that the testers and inspectors use to set the addresses and switches on the devices. Some devices, such as the Static Trip III CP trip units, can have their addresses preset electronically before they arrive on the assembly floor.

Finally, the tester uses this sheet to verify the settings prior to startup and to troubleshoot the system if something does not work properly the first time.

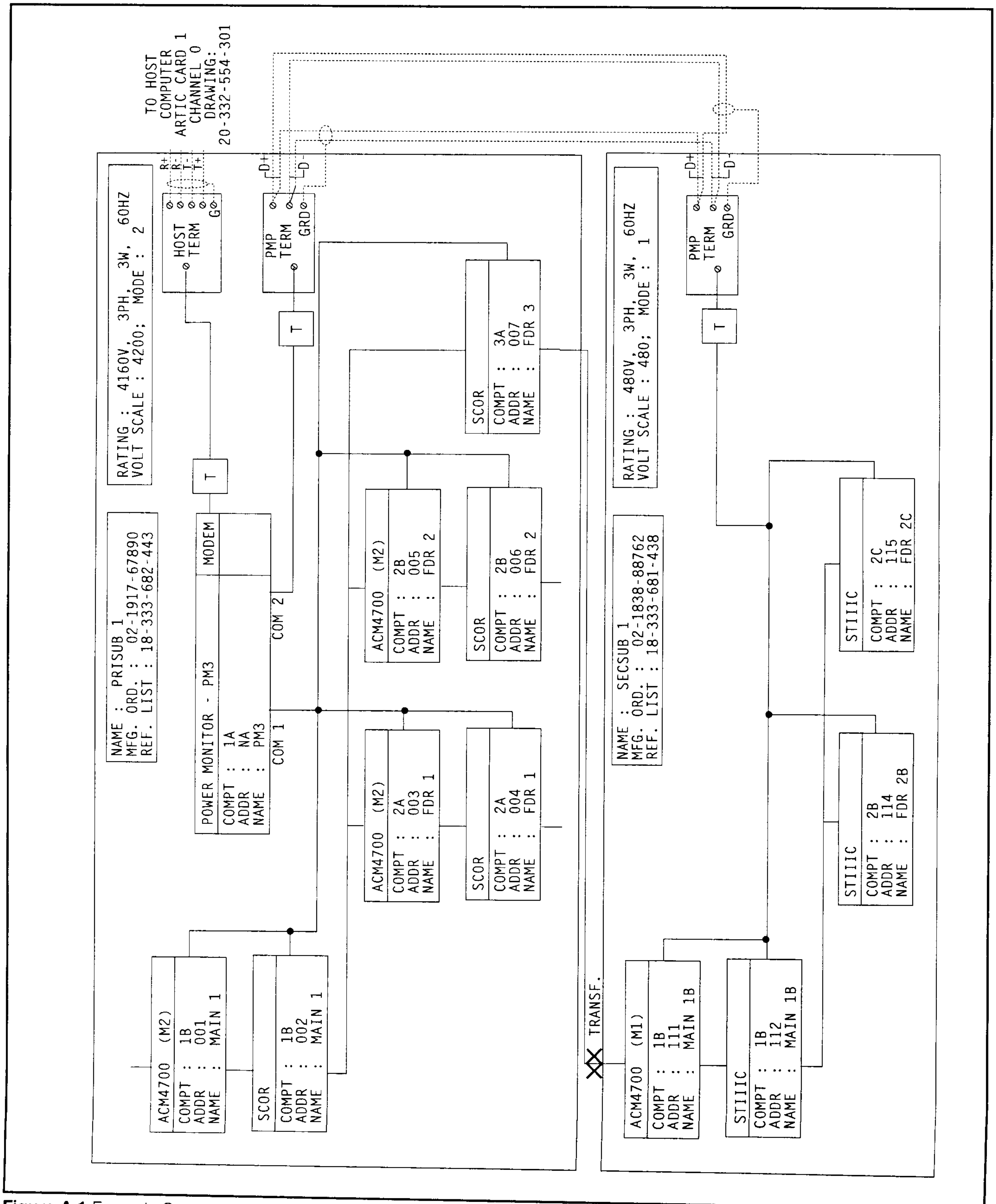


Figure A.1 Example Communications Diagram

SIEMENS						**ACCESS Device Log**								
Customer/Job						Group No.								
S.O. No.			MFG. No.			Date								
Order No.			Equip:			Rev. No.								
								MT Setup *						
Item No.	Device Type	Model No.	Serial Number	Product Revision Level(s)	ACCESS Device Address	Cell Location	ACCESS Circuit Name	MT Device Number	MT Address Switch 5	4	3	2	1	Comments

* MT address switch field is the binary form of the SEAbus address.
The MT address switch settings should show a "1" for ON and a "0" for OFF.
The MT address switch settings are labeled "1" through "5."
MT device number is the MT port.

Figure A.2 ACCESS Device Log

SIEMENS

ACCESS Device Log

Customer/Job RED MILL No. 1 Mine		Group No. Bus 509	
S.O. No. 01-1900-93345	MFG. No. 02-1916-93346	Date Mar. 20, 1992	
Order No. 123	Equip: 4.16 KV Main Swgr	Rev. No. 0	

Item No.	Device Type	Model No.	Serial Number	Product Revision Level(s)	ACCESS Device Address	Cell Location	ACCESS Circuit Name	MT Setup * MT Device Number	MT Address Switch 5	4	3	2	1	Comments
1	PM		199394 - 481	V3.13	---	5A								
2	4700	DC311H	6435	Rev. B V 2.2.0.1	013	3A	FDR1-3A							5KV SUB FEED NO. 1
3	SCOR	G2EZ5JB2C05	488	HW 1.5 SW 3.11	014	3A	SUB FD 1							,,
4	4700	DC311H	6551	Rev. B V 2.2.0.1	017	2A	FDR 2-2A							5KV SUB FEED NO. 2
5	SCOR	H4EZ5JB2C05	493	HW 1.5 SW 3.11	018	2A	SUB FD 2							
6	M/T	MTA	---	1.0	020	6B	MT #1		1	0	1	0	0	LOW VOLTAGE SWBD
7	SEN III	SND69120A	---	---	---	6B	MCCB MAIN	01						MAIN MCCB 1200A.
8	SEN III	SNJD69400	---	---	---	6B	MCCB 1	02						FEEDER MCCB 400A.
9	SEN III	SLD69400	---	---	---	6B	MCCB 2	03						FEEDER MCCB 400A.
10	SAMMS	1L1ALG0001	---	SAMMS 1	100	9A	FAN1-9A							VENT FAN NO. 1 SAMMS
11	SAMMS	1L1ALG0002	---	SAMMS 2	101	10A	FAN2-10A							VENT FAN NO. 2 SAMMS
12	STIII CP	TSI-TZ-CPX		V 2.24	51	1B	SUB #1							
13	STIII CP	TSIG-TZ-CPX		V 2.24	52	1C	FEEDER 4							

* MT address switch field is the binary form of the SEAbus address.
The MT address switch settings should show a "1" for ON and a "0" for OFF.
The MT address switch settings are labeled "1" through "5."
MT device number is the MT port.

Figure A.3 Completed ACCESS Device Log

B Technical Details of the ACCESS System

This appendix contains detailed information about installing the ACCESS system. These topics provide more detailed technical information than the information contained in the body of the manual. Where appropriate, the text in the main sections of the manual refers you to these technical details for more information.

B.1 Maximum Cable Length

As mentioned earlier, one of the physical constraints in a SEAbus system is the length of the cable that can be used to connect the various devices. This limitation is due in part to the total resistance in the loop. Loop resistance is made up of several components as illustrated in Figure B.1 on the following page. The variables used in the illustration are defined as follows:

R_{Surge} = the equivalent series resistance of the surge protectors. Siemens recommended surge protectors have a resistance of 30 ohms.

R_{Cable} = the total DC resistance of the wire in the cable. The recommended cable with 22 gauge wire has a DC resistance of 17Ω/1000 ft. for each wire (34Ω/1000 ft. for the cable).

R_{Loop} = the sum of the series resistance elements:

$$R_{Loop} = R_{Surge} + R_{Cable}$$

R_{Term} = an optimal terminating resistor, typically 120 ohms.

$R_{Receivers}$ = the equivalent resistance of all the receiver input resistances in parallel. For typical input resistance of 12 Kohms, the equivalent resistance for 32 receivers is 375 Ω.

R_{In} = the equivalent input resistance at the far point of the loop. R_{In} is the parallel combination of R_{Term} and $R_{Receivers}$. For the values stated above, $R_{In} \approx 91\Omega$.

V_{Out} = the differential output of a SEAbus driver. The minimum specified output voltage is 1.5 volts.

V_{In} = the minimum allowable input voltage for a SEAbus receiver (typically 0.4 volts).

As a signal travels from the output of the driver to the input of the farthest receiver, it suffers from voltage drops caused by the various series resistance elements.

Applying the potentiometer (voltage divider) rule to the cable yields the following relationship:

$$R_{Loop\ Max} = R_{In}\left(\frac{V_{Out} - V_{In}}{V_{In}}\right).$$

Using the values listed in the variable definitions for the vaiables above:

$$R_{Loop\ Max} = R_{In}\left(\frac{1.5 - 0.4}{0.4}\right)$$

$$\approx 250\ \Omega.$$

If you use four surge protectors in your network:

$$R_{Surge} = 4 \times 30$$

$$= 120\ \Omega,$$

Then:

$$R_{Max\ Cable} = R_{Loop\ Max} - R_{Surge}$$

$$= 250 - 120$$

$$= 130\ \Omega.$$

If you are using cable with 34 ohms/1000 ft., the formula for determining maximum cable length is:

$$L_{Cable\ Max} = \frac{R_{Max\ Cable}}{34} \times 1000$$

$$= 3831\ \text{ft.}$$

If you use four surge protectors in your network:

$$R_{Surge} = 2 \times 30$$

$$= 60\ \Omega,$$

$$R_{Cable\ Max} = 250 - 60$$

$$= 190\ \Omega, \text{ and}$$

$$L_{Cable\ Max} = \frac{190}{34} \times 1000$$

$$= 5588\ \text{ft.}$$

Based on the DC resistance, the maximum cable length is 5588 ft.; however, there are inductive and capacitive effects that limit the cable length to a total of 4000 ft.

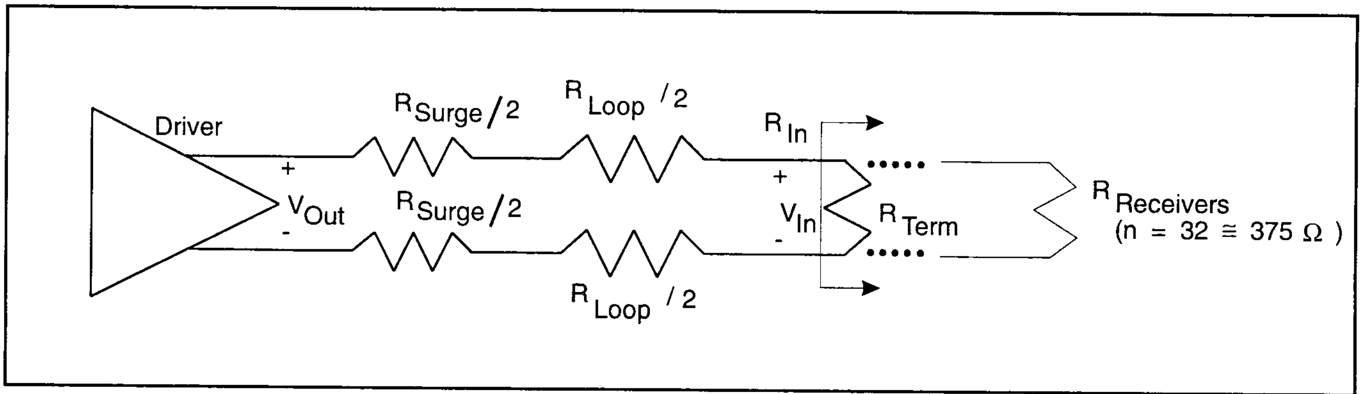


Figure B.1 Resistances for maximum loop length

B.2 Addressing

Address ranges and the addressing method for ACCESS devices vary among devices. Although the addressing method is invisible to the end user of a Power Monitor unit, it is covered here to aid in troubleshooting. There are three methods of addressing SEAbus field devices, and the method you use for each device depends on the device type. These methods are direct, indirect, and extended addressing.

As illustrated in Figure B.2, the second byte (DEVT) in a SEAbus packet is the address field for the direct address method of device communications. There are two direct address devices, the SAMMS relay and the original Static Trip IIIC trip unit. While one byte provides 256 possible addresses, these devices are restricted to addresses in range 1 to 224. Address 0 is reserved for universal access requests, while address 255 is reserved for broadcasting addresses for the devices. A broadcast address allows all devices to simultaneously act upon a request such as time synchronization. The universal access address is used to find and identify a unit with an unknown address. Any device that receives a packet with this address responds to it, so make sure that only one device is attached when this message is sent.

Sync	Devt	Msgt	Len	Data	LRC

Figure B.2 SEAbus Packet Contents

Addresses 225 through 254 are used to indicate a device type that must use indirect addressing or, in the case of the 3600-S1, extended addressing. All devices, except the SAMMS device, Static Trip IIIC trip unit, and 3600-S1 power meter, use indirect addressing. The indirect addressing mode requires that a particular device first recognize its assigned device type (in the DEVT byte) within the range of 225 to 254, then recognize its unique address, which is sent as the first byte within the data field. The 3600-S1 power meter addressing differs from the indirect method in that its address is contained in the first two bytes of the data field.

Table B.1 presents the values assigned to the DEVT (second) byte in a SEAbus packet. All devices other than the Static Trip IIIC trip unit and SAMMS device use this value as a device-type code and find their addresses in the data packet.

Table B.1 Devt (second) byte value assignments

DEVT Value	Address for: (addressing mode)
000	Universal access
001 ... 224	STIIIC, SAMMS (Direct)
225 ... 245	Reserved for future devices (Indirect)
246	4300 (Indirect)
247	ISGS (Indirect)
248	ST IIICP (Indirect)
249	Multiplexer/Translator (Indirect)
250	SCOR (Indirect)
251	Local Display Unit LAD (Indirect)
252	ARTIC Host (Indirect with no address)
253	3600-S1 (Extended address mode)
254	4700 (Indirect)
255	Global broadcast

Note: The Host PC is an indirectly addressed device. Since there is only one Host PC per Power Monitor unit, it does not require an address byte in the data field of the SEAbus packet.

Table B.2 presents the address ranges for each device. The table does not indicate a device's addressing method, which is independent of the address range. Also, all indirect and extended address devices use address 0 for device-type specific access requests, and 255 (0 in the case of the 3600-S1) for device type specific broadcast messages.

Note: All SEAbus devices are shipped from the factory with 222 as the default address. For ease in adding devices to a system, do not assign address 222 to any system device. This allows you to insert a new device with address 222 and program it with another address.

Table B.2 Addressing Ranges

Device	Address Range
3600-S1	1 ... 9999
ST IIIC	1 ... 224
SAMMS	1 ... 224
SCOR	1 ... 254
4300	1 ... 254
4700	1 ... 254
ST IIICP	1 ... 224
ISGS	1 ... 254
MT	1 ... 31
SEN III	1 ... 254
SB	1 ... 254

Note: The new Static Trip IIIC and Static Trip IIICP trip units, although primarily indirectly addressed devices, are limited to the addressing range of 1 to 224. This maintains compatibility with the Static Trip IIIC trip unit for which it provides SEAbus emulation.

The following guidelines help you set up an ACCESS system where all devices are properly addressed. For further instructions, refer to the instruction manuals for each device.

- Configure a unique address for each device connected to a Power Monitor unit. In a system that contains more than one Power Monitor unit connected to a Host PC, the same address can be used for different devices provided that these devices are connected to different Power Monitor units; however, whenever possible, do not duplicate addresses.

- Do not assigned an address to Power Monitor units.

- The Power Monitor Series 3 unit allows two RS-485 loops, each containing up to 32 devices. Each device connected to it requires a unique address regardless of the loop to which the device is connected.

- Connect the Multilin 169+ and 269+ relays to the Host PC ARTIC Card port via an RS-485 to RS-232 converter module. The converter module can be either the Siemens Isolated Multi-Drop converter or the Power Measurements, Ltd. COM32. Do not connect more than six Multilin 169+ relays on a single RS-485 loop. The maximum number of loops is currently one per available ARTIC port on the Host PC. Multilin 169+ Relays have an address range of 1 to 254; each one must be uniquely addressed.

- The Isolated Multi-Drop converter converts four RS-485 loops to one RS-232 port. The Isolated Multi-Drop converter connects to either the Host PC or the PC running the Power Monitor PC software via an RS-232 port. Currently, the Host PC can not handle more than one RS-485 loop when connected to the Isolated Multi-Drop converter. The PC running the Power Monitor PC software can handle 32 devices per loop for a total of 128 devices with the Isolated Multi-Drop converter. Each device connected to the Isolated Multi-Drop converter must have a unique address regardless of the RS-485 loop to which the device is connected.

Additional information on SEAbus communications can be found in Siemens *Design Guidelines for SEAbus and SEAbus Plus Communications Protocol*, (document no. AED01-003-01-1190).

B.3 Surge Protection

Install surge protection devices on ACCESS communications wiring entering a building from the outside. Install surge protection modules within the electrical equipment to provide necessary protection for the ACCESS communication system. Failure to do so can result in induced system failures.

As a standard practice, install transient surge protection modules at the termination point of any communication wires that may exit the building. This guideline applies to the Power Monitor unit communicating with a remote ACCESS Host PC; however, it may also apply to field device (i.e., Static Trip III trip unit, 4700 power meter, SCOR relay, etc.) protection on the local RS-485 communications bus.

B.3.1 Standards for Surge Protection Devices

There are many devices available today that provide surge protection for power line transients but few that provide surge protection for digital data communications. Standards are emerging for protection of data communications lines; however, in the past, companies applied standards for protection of power lines for use with data communications lines.

Originally, data communications modules were tested against ANSI 37.90A (IEEE 472-1974) and later ANSI/IEEE C62.41 (formerly IEEE 587), which are the standards for surge testing low-voltage power lines. These standards use both a 6.5kV, 100Hz, 500A ringwave waveform (damped sinusoidal) and a 6.5kV, 3kA, 8x20 microsecond waveform to simulate surges on power lines.

Newer standards, such as the IEC 801-5 and UL 497, either provide for testing data communications protection or are specifically designed (UL 497) for testing data communications protection devices. These newer standards are the ones that all surge protection devices for the ACCESS system must meet. As devices begin to meet these newer standards, older, noncomplying devices will be phased out of use.

B.3.2 Guidelines for Selecting Surge Protection Devices

Use the following guidelines to select a surge protection module:

- Select surge protection modules that meet ANSI/IEEE C62.41 voltage and current clamping requirements for both Categories A and B. Ideally, they should meet U.L. 497 as well.
- Properly ground all surge protection modules as illustrated in Figure B.3.
- Install surge protection modules at the point of exit from the electrical equipment where an outside communications cable connection occurs.

Note: This guideline does not apply to interelectrical equipment communication wiring located within the same building or between electrical equipment line-ups. For Multilin relays, the Isolated Multi-Drop converter, used for RS-232-to-RS-485 conversion at the Host PC, also provides the necessary surge protection (at the Host PC), so a separate unit is not required.

- Surge protection modules attached to the SEAbus RS-485 networks require only a 2-wire connection. Ground the communications cable's shield to earth ground at the surge modules.
- Surge modules attached to the RAD short haul modems on the Power Monitor units require a 4-wire connection. The communications cable's shield must be grounded to earth ground at the surge modules and not propagated through the RAD modems.

Note: Do not connect the shield under any circumstances to the RAD Modem.

B.3.3 Recommended Surge Devices

Siemens recommends the following surge devices:

- MCG Electronics' part number DLP-10-6V-15. This is a 2-wire protector for SEAbus RS-485 wiring.

- MCG Electronics' part number DLP-20-6V-15. This is a 4-wire protector for Power Monitor-to-Host PC connection and interconnects via the RAD Modem.

Refer to Appendix C "Ordering Information" for ordering information about surge protectors and other devices.

These modules provide a 6-volt clamp voltage and are therefore suitable for both RS-485 (6-volt) and short-haul modem applications. They also meet ANSI/IEEE C62.41 clamping requirements and are U.L. listed.

Other modules that meet ANSI/IEEE C62.41 may be used in place of the DLP-10 and DLP-20 series, but they may not be U.L. listed and therefore are not suitable for those sites where U.L. listing is required. These modules include L.E.A. Dynatech model TE (4) 7.5V10 and TE (2) 7.5V10 for Host RS-232/modem and RS-485 SEAbus protection, respectively.

The surge modules typically induce on each line a series resistance of 15 ohms, which affects the maximum loop length. Depending on the cable selected, the maximum loop length may drop below the specified maximum of 4000 feet (see section 2, Table 2.2).

Figure B.3 illustrates a typical installation of surge protectors between the Host PC and Power Monitor unit. Note that the cable shield is not attached at either short-haul modem. The surge protectors for SEAbus are similarly installed, but as two-wire devices. (Also the RAD modems are not on the SEAbus loop.)

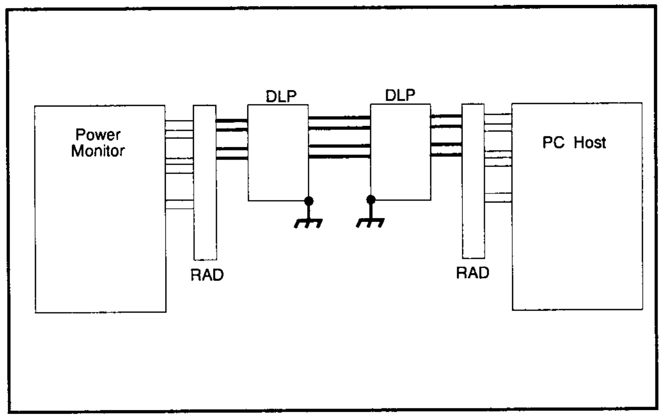


Figure B.3 Typical Host PC Connection

Note: The cable shields are grounded at each surge protector and are not propagated through to the RAD modems.

C Ordering Information

The following tables include several third party components used in the installation of the ACCESS system. Siemens has tested these components and recommends them for use with the ACCESS system.

C.1 Modems

The RAD Data Communications SRM-6AC asynchronous Short Range Modem is used for local data distribution, connecting full or half-duplex asynchronous terminals to computing equipment. To order, contact RAD Data Communications.

Manufacturer	SRM-6AC/F/RJ-11	SRM-6AC/M/RJ-11
RAD Data Communications 151 West Passaic St. Rochelle Park, NJ 07662 Telephone: (201) 587-8822 Telex: 6502403647 MCI Fax: (201) 368-2102	Specify for Host PC connection	Specify for Power Monitor, Power Monitor PC, or Isolated Multi-Drop 232/485 Converter

C.2 Surge Protectors

The transient eliminators discussed in this document are manufactured by MCG Electronics, Inc. These components provide 6-volt clamp voltage and are therefore suitable for both RS-485 (6-volt) and short-haul modem applications. They also meet ANSI/IEEE C62.41 clamping requirements and are U.L. listed.

Manufacturer	DLP-10-6V-15	DLP-20-6V-15
MCG Electronics, Inc. 12 Burt Dr. Deer Park, NY 11729 Telephone: (516) 586-5125	Specify for 2-wire protector	Specify for 4-wire protector

C.3 Cables

For Host PC-to-Power Monitor unit connection and RS-485 network loops use the following cables.

Manufacturer	Host PC-to-PMP		RS-485 Loop	
	PVC	Teflon Insulated	PVC	Teflon Insulated
Alpha Wire Corp. 711 Lidgerwood Ave. P.O. Box 711 Elizabeth, NJ 07207-0711 Telephone: (201) 925-8000 FAX: (201) 925-7938	6052	58612	5121C	55121
Belden Wire and Cable P.O. Box 1980 Richmond, IN 47375 Telephone: (317)983-5200	9406	88723		
Aerospace Wire & Cable 129-09 18th Avenue College Point, NY 11356 Telephone: (718) 358-2348 FAX: (718) 358-2522		2262		

C.4 RS-232-to-RS-485 Converters

The following table includes RS-232-to-RS-485 converters that have been tested and approved by Siemens.

Manufacturer	Product Name	Part Number
Siemens Energy & Automation, Inc. Electrical Apparatus Division P.O. Box 29503 Raleigh, NC 27626 (919) 365-2200	Isolated Multi-Drop 232/485 Converter	18-658-582-537
Power Measurement, Ltd. 6703 Rajpur Place Victoria, BC Canada, V8X 3X1 (604) 652-5118 Fax: (604) 652-0411	RS-232 to RS-485 Converter	COM32

Problem Report for ACCESS Systems and Devices

If you have a problem with Siemens ACCESS systems or devices, please make a copy of this two-page form and fill it out. Then contact your Siemens representative to report the problem. (If you have an emergency, call 1-800-241-4453.)

Customer Information

Job-site contact ______________________

Company's name ______________________

Job site or location where equipment is installed

____

Siemens sales order number ______________________

____

Siemens manufacturing order number (from manufacturing drawing) ______________________

Date problem occurred ______________________

Contact's phone number ______________________

Contact's fax number ______________________

Device Information

If you are experiencing a problem with a specific device, please provide the following information from the device's label(s):

Device type ______________________

Model (or catalog number) number ______________________

Part number ______________________

Serial number ______________________

Hardware version ______________________

Software version ______________________

Device options ______________________

Problem-Specific Information

1. Please provide a brief, general description of any performance problems with the system or any devices. ______________________

____

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2. Does the system have any of the following supervisory and monitoring devices? How many?

- ❑ ACCESS Host PC ______________________
- ❑ Power Monitor unit ______________________
- ❑ Power Monitor PC units ______________________
- ❑ Other (please specify) ______________________

____

____

3. How many of the following ACCESS devices are on the system?

- ❑ 3600 power meter ______________________
- ❑ 4300 power meter ______________________
- ❑ 4700 power meter ______________________
- ❑ Static Trip IIIC trip unit ______________________
- ❑ Static Trip IIICP trip unit ______________________
- ❑ SCOR relay ______________________
- ❑ SB breaker trip unit ______________________
- ❑ Sensitrip III trip unit ______________________
- ❑ SAMMS device ______________________
- ❑ Isolated Multi-Drop converter ______________________
- ❑ Multiplexer Translator ______________________
- ❑ Other (please specify) ______________________

____

4. What type of electrical equipment is the system or device installed on (switchgear, motor control center, switchboard, etc.)? ______________________

____

____

____

5. If the problem is with a specific device, describe its configuration; that is, describe its particular operational settings and parameters. (Attach additional sheet if necessary.) ______________

6. List any error codes, error messages, or targets that have been generated by the system or by individual devices. ______________

7. If the device is installed on an ACCESS system, please provide a summary (or a copy) of any Event Logs and System Diagnostic Logs. ______________

8. Please provide any other information that you think might help Siemens correct the problem (such as information about the wiring, system application, system load, operating environment, or about the physical condition of the system or devices). ______________

To be completed by Siemens personnel

Initial Problem Report completed by ______________

Division or department name ______________

Phone number ______________

Problem report reviewed by ______________

Review date ______________

Sales engineer ______________

Problem referred to ______________

Date problem referred ______________

Problem Report tracking number ______________

Problem classification code ______________

Corrective action taken ______________

Upon completing this form, please forward a copy to:

Siemens Energy & Automation, Inc.
Electrical Apparatus Division
Customer Service Department
P. O. Box 29503
Raleigh, North Carolina 27626-0503

Fax Number 919-365-2598

SIEMENS

Siemens Energy
& Automation, Inc.
Electrical Apparatus
Division
P.O. Box 29503
Raleigh, NC 27626-0503

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Wallingford
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(813) 656-3605
Jacksonville
(904) 363-0087
Miami
(305) 592-4106
Orlando
(407) 894-7771
Tampa
(813) 287-2356
West Palm Beach
(407) 683-5185

Georgia
Atlanta
(404) 458-4353
Macon
(912) 743-8994
Savannah
(912) 354-5092

Hawaii
Honolulu
(808) 533-7135

Idaho
Boise
(208) 342-6852

Illinois
Chicago
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Peoria
(309) 688-8729

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(812) 422-9176
Fort Wayne
(219) 483-6999
Indianapolis
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South Bend
(219) 232-6050

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(319) 359-1357
Des Moines
(515) 280-1614

Kansas
Kansas City
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Kentucky
Louisville
(502) 426-4647

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(318) 424-0720

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Springfield
(413) 562-7994
Worcester
(508) 792-4566

Michigan
Detroit
(313) 597-7400
Grand Rapids
(616) 247-7611

Minnesota
Edina
(612) 942-8888

Mississippi
Jackson
(601) 936-9360

Missouri
Kansas City
(913) 491-3740
St. Louis
(314) 567-3900
Sunrise Beach
(314) 374-2737

Nebraska
Omaha
(402) 397-1940

Nevada
Las Vegas
(702) 739-7900

New Hampshire
Manchester
(603) 626-0701

New Jersey
Union
(908) 687-7672

New Mexico
Albuquerque
(505) 881-1611

New York
Albany
(518) 482-0790
Buffalo
(716) 834-3815
Long Island
(516) 759-2325
New York
(800) 677-1125
Syracuse
(315) 453-3780

North Carolina
Charlotte
(704) 536-1201
Greensboro
(919) 852-1758
Raleigh
(919) 782-3365
Wilmington
(919) 763-1359

North Dakota
Bismarck
(701) 258-9555
Fargo
(701) 293-7709

Ohio
Cincinnati
(513) 891-8717
Cleveland
(216) 642-0701
Columbus
(614) 766-2204
Dayton
(513) 279-0458
Toledo
(419) 893-7197
Wooster
(216) 262-3268

Oklahoma
Oklahoma City
(405) 235-7515
Tulsa
(918) 665-1806

Oregon
Eugene
(503) 683-2111
Portland
(503) 635-6700

Pennsylvania
Philadelphia
(215) 646-3800
Pittsburgh
(412) 788-8060
York
(717) 854-9776

Rhode Island
Providence
(401) 943-6990

South Carolina
Columbia
(803) 254-7095
Greenville
(803) 288-3490

Tennessee
Chattanooga
(615) 267-7412
Johnson City
(615) 282-2718
Knoxville
(615) 690-5172
Memphis
(901) 761-2123
Nashville
(615) 367-9403

Texas
Austin
(512) 892-0278
Dallas
(214) 247-4481
Fort Worth
(817) 838-9770
Houston
(713) 690-3000
McAllen
(512) 687-2072
San Antonio
(512) 377-3292

Utah
Salt Lake City
(801) 266-9612

Virginia
Richmond
(804) 288-8311
Roanoke
(703) 982-2776
Virginia Beach
(804) 486-0174

Washington
Seattle
(206) 828-6600
Spokane
(509) 325-2582

Washington, D.C.
(301) 459-2044

Wisconsin
Green Bay
(414) 336-1144
Milwaukee
(414) 774-9500

Canada
Mississauga,
Ontario
(416) 564-1995
Pointe Claire,
Quebec
(514) 695-7300
Vancouver,
British Columbia
(604) 321-8687

International
TLX: 822024SEA
IBU UF
Fax: (404) 751-2496
Phone: (404) 751-2291

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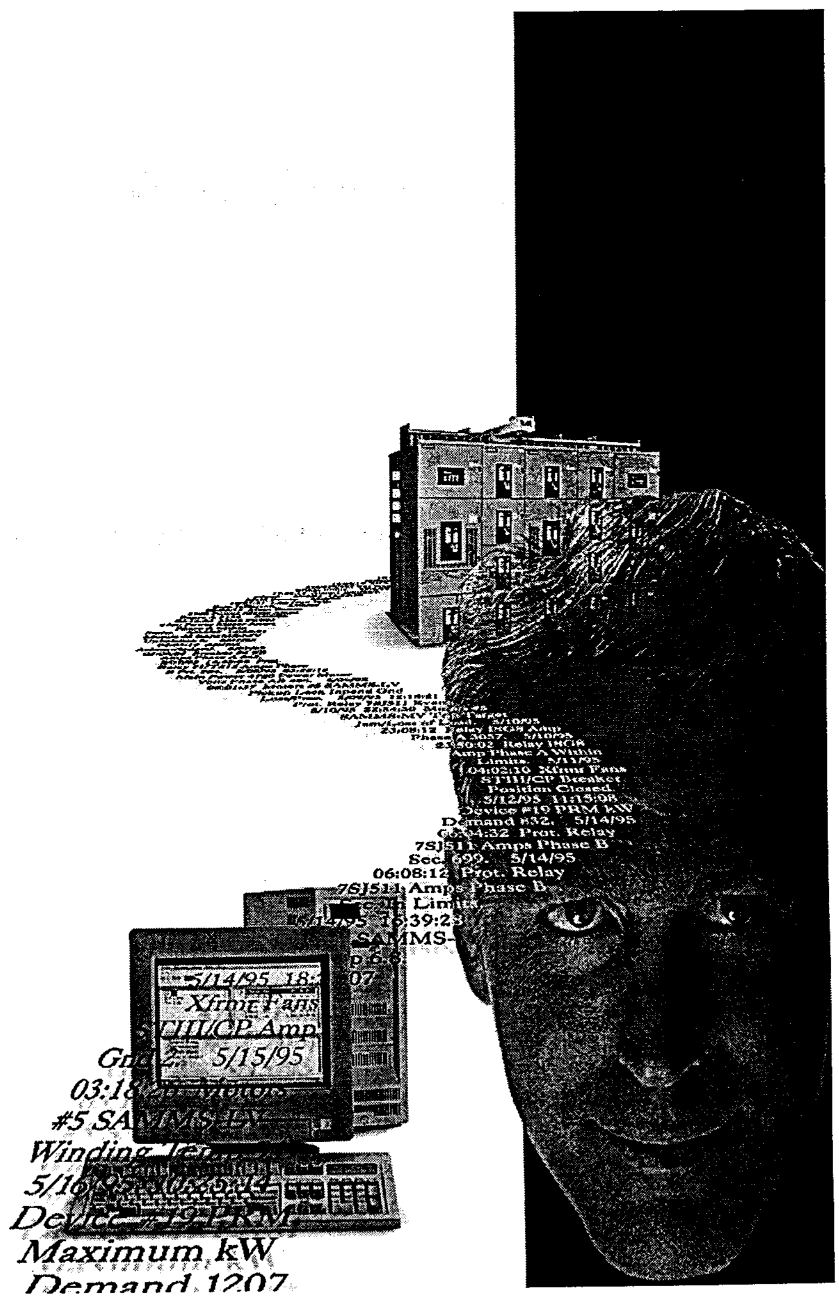
SIEMENS

ACCESS™ Systems

Installation Guide



Manual No. SG6028-01

⚠ DANGER

Hazardous voltages and high-speed moving parts.

Will cause death, serious personal injury, or equipment damage.

Always de-energize and ground equipment before maintenance. Read and understand this instruction manual before using equipment. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions that will cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

QUALIFIED PERSON

For the purposes of this manual, a qualified person is one who is familiar with the installation, construction, or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety procedures.

(c) **is trained** in rendering first aid.

NOTE

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office.

The contents of the instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc. The warranty contained in the contract between parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

Table of Contents

Table of Contents

1 Introduction

The ACCESS™ electrical distribution communications system comprises a variety of complex devices networked together with industry standard communications technology to provide a complete network solution. The installation, operation and maintenance of these devices requires a high level of technical instruction. This manual provides general information on installing the ACCESS system. This guide does not replace other Siemens manuals covering detailed information, installation, operation, or maintenance of equipment or software. As a guide, this document is intended to serve as an introduction and to offer some assistance when installing an ACCESS system. It is not a complete set of instructions. Detailed installation instructions are given in device operator's manuals and other documents.

Siemens ACCESS systems comprise a variety of "smart" devices that control, monitor, and display data from your electrical distribution system. The first level of control is in the field where microprocessor-based trip units, power meters, protective relays, and motor control devices also send and receive information about your system. At a second, higher level are supervisory devices that collect information from these field devices. Supervisory devices display the information and add the capabilities of programming, monitoring alarms, and logging system events. Field and supervisory devices are linked together by an industry-standard EIA/TIA-485 (RS-485) communications bus. Siemens SEAbus™ communications protocol (an open protocol) defines the exchange of information over a shielded, twisted-pair cable that links all devices. Presiding over the system is an ACCESS host personal computer that can monitor an entire electrical system consisting of more than 1000 devices (see **Figure 1.1**).

Adding SEAbus or SEAbus Plus protocol communications to a device provides remote access to the information collected by the device. All configuration and setup procedures that are possible at the supervisory device can also be executed from a remote location over the communications link. Any field device with an operator interface (for example, buttons and a display) that is added to the system must be able to provide all available functions from its interface to the supervisory device through the SEAbus or SEAbus Plus protocol. Any added supervisory device must have the ability to remotely configure, read back, and check the configuration of all field devices. It also must be able to poll real-time and other data from all field devices.

1.1 Contents of This Guide

Chapter 2, Planning the Network, contains recommended practices and guidelines to assist your planning of the network. Documenting the system before making connections will assure a planned network and may raise questions before any implementation begins.

Chapter 3, Connecting the Network, discusses the arrangement of devices into closed loops and interconnections. This section contains recommended practices and guidelines to assist your installation procedures. Included are installation and setup instructions, such as preparing the cable, grounding the shield, grounding equipment, and terminating the cable in special circumstances. Where possible, follow these procedures to give your system needed redundancy and to help avoid problems, such as ground loops.

As with most engineering installations, there are usually several ways of accomplishing the same objective. If you use several of these methods simultaneously within the same system, problems can occur. Therefore, this manual explains the recommended installation method; you should follow these procedures for the best results.

Chapter 4, Installing Field Devices, discusses product descriptions and specific interconnections for devices that may or may not be in your particular system. This section does not replace the operator's manuals available with each Siemens product. Those manuals contain specific operating and setup instructions you need to get the full use of your system. There is some repetition of material across manuals; however, this repetition is intended to reinforce the most important elements of device installation and operation.

Chapter 5, Installing Supervisory Hardware, discusses the products that are common to all systems and includes connections to the highest level in the system, the host computer.

Chapter 6, Installing Supervisory Software, discusses how to configure the supervisory hardware with the communications software needed. This section does not replace the user's manuals available with the software product.

Chapter 7, Verifying the Network, contains guidelines for powering the system and running some preliminary acceptance tests.

Chapter 8, Troubleshooting, contains guidelines for identifying and solving basic problems. These guidelines assume that you have installed every part according to the instructions in the previous chapters.

The appendixes contain detailed technical information for more in-depth explanation of the operation of the system.

1.2 Other Relevant Information

Siemens recommends that you have available the operator's manuals for each device on your system. The following list identifies the operator's manuals, by name and manual number, for Siemens ACCESS system devices:

Electronic Trip Unit for SB Encased Systems Breakers Operator's Manual (Manual No. 2.20-3A)

Static Trip III Trip Unit Operator's Manual (Manual No. SG-3118)

4720 Power Meter Operator's Manual (Manual No. SG6068)

4700 Power Meter Operator's Manual (Manual No. SG6018)

4300 Power Meter Operator's Manual (Manual No. SG-6038)

SAMMS Siemens Advanced Motor Master System Operator's Manual (Manual No. CP3290)

Multiplexer Translator (MT) Operator's Manual (Manual No. 2.21-1A)

SB Encased Systems Breakers: 400-2000 A Frame Rating Operator's Manual (Manual No. 2.20-4A)

I-T-E Molded Case Circuit Breakers Operator's Manual (Manual No. SIB 2.7-8)

SCOR Overcurrent Protective Relay Operator's Manual (Manual No. SG-9228-01)

Isolated Multi-Drop Converter Operator's Manual (Manual No. SG-6048)

Power Monitor Display and Monitoring Unit Operator's Manual (Manual No. SG-4018)

PMPC Software User's Manual (Manual No. SG-4028)

WinPM Software User's Manual (Manual No. SG-6118)

SIEServe Electrical Distribution Communications Software User's Manual (Manual No. SG-6058)

1.3 System Overview

The ACCESS system is described as a network because it is an interconnection of devices that communicate with each other. The layout of the devices in the network is known as the network's topology. Each field device (slave) supplied by Siemens for the ACCESS system has electrical system data to communicate to a supervisory device (master) in the network. Some freedom in the design of the topology is allowed depending on your application; however, your overall configuration will be similar to the generic topology shown in **Figure 1.1**.

At the highest level of the system is WinPM™ software running on a personal computer (PC). The PC may be connected directly to field devices or by way of modem to remote field devices. **Figure 1.1** shows several possible configurations. For information on WinPM software, refer to the *WinPM Software User's Manual* (Manual No. SG-6118).

In general, the network contains supervisory and field devices. Supervisory devices initiate commands, and field devices respond to these commands. These devices can both transmit and receive data on the same serial network. After sending a request, the supervisory device receives feedback sent from a field device over the serial network. This process, called polling, allows the supervisory and field devices to exchange information. The communications bus standard used for ACCESS system at the field device level is the RS-485 standard. The SEAbus protocol defines the pattern of bits and bytes within the communications data packets, which contain the specific information to be transferred. The RS-485 standard defines the properties of the electrical signal of the electronic bus interface that handles this communication. Serial data communications is explained in more detail in **Appendix C**.

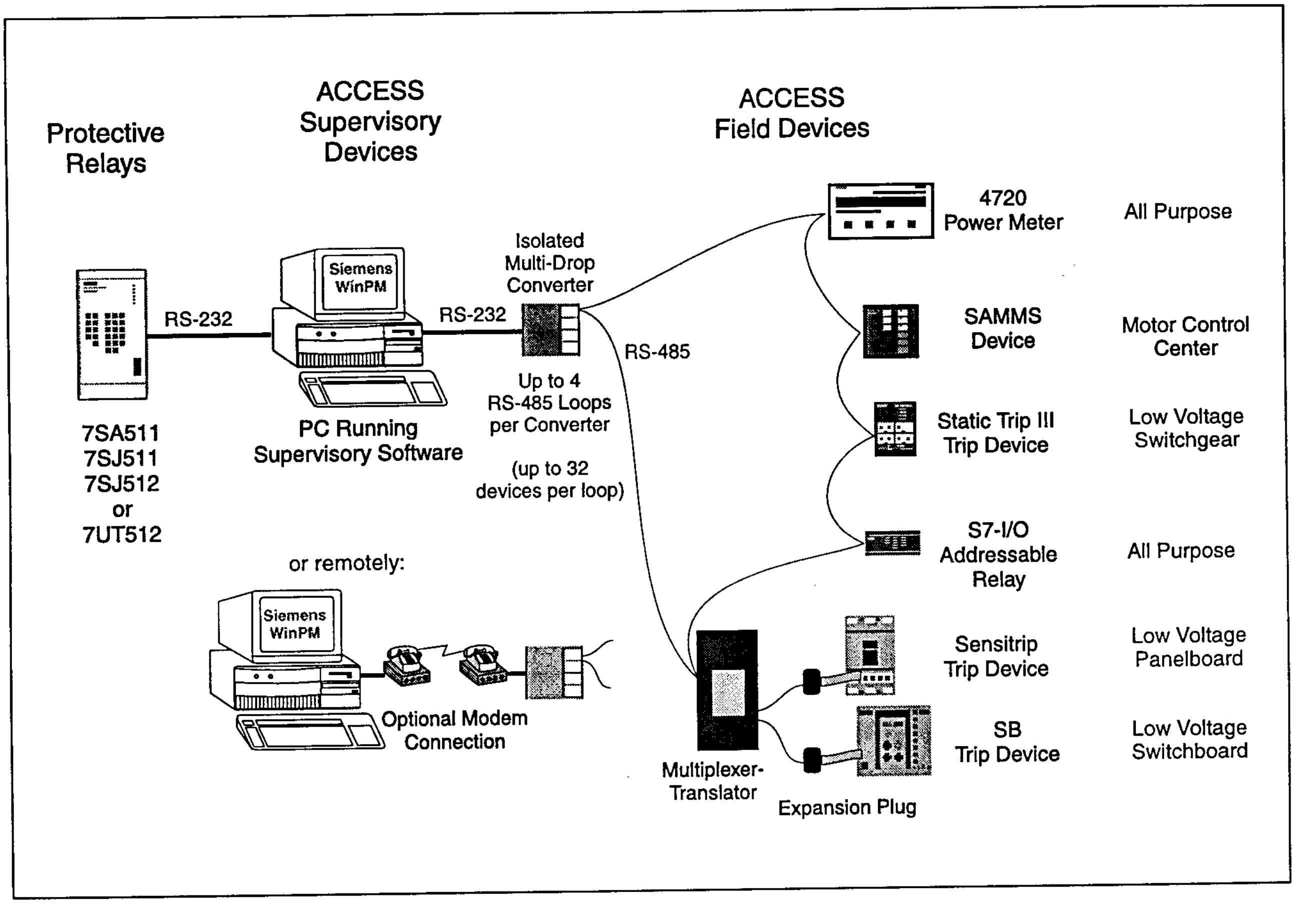


Figure 1.1 Generic ACCESS System Topology

In older systems the Power Monitor™ display and monitoring unit is the supervisory device. Its commands are mostly requests for data. At the top level of this version of the ACCESS system is the ACCESS Host PC. The ACCESS Host PC is a personal computer that monitors the entire ACCESS system. The Host PC is connected directly to as many as 40 Power Monitor units via an EIA/TIA-232 (RS-232) connection. Data exchange and definition is described by the Power Monitor-to-Host PC SEAbus protocol. The Power Monitor unit communicates with field devices via an RS-485 communications interface using the SEAbus protocol for the specific device. For more details on these older systems, refer to the operator's manuals for these devices.

Notes:

2 Planning the Network

This section helps you plan the network before any installation is done. The main idea is to have you document the essential elements of your system. You are encouraged to read the rest of this installation guide before planning your network. For safety, subsequent sections include precautions and warnings associated with each device.

2.1 Documenting Your System

This section shows examples of how to properly plan and assemble an ACCESS communications system. This section also tells you how to make a record of the RS-485 loops that interconnect all of the field devices.

The Connection Diagram (discussed below and shown on the next page) graphically represents the network.

The ACCESS Device Log (discussed below and shown on a subsequent page) is used as a record of the device addresses, switch settings, and software revisions of the field devices on the network.

2.2 Using the ACCESS Connection Diagram

The connection diagram helps you visualize the connections necessary to connect your field devices to a PC running WinPM. The diagram illustrates the loops making up your ACCESS system. If the size of the communications system is large enough, there may be a hierarchy of connection diagrams.

A connection diagram includes the following items:

- Designation (and relative location) of each device
- Actual physical connections of each device
- Addresses of each ACCESS device
- Reference drawing numbers

The connection diagram also shows which loops are inside a building and which ones are outside a building (if known). The diagrams also show the location of transient eliminators and any additional hardware. A sample connection diagram is shown in **Figure 2.1**.

In addition to the converters, multiplexers or other items, you may want to consider connecting your computer, converter, and field devices to an uninterruptible power source, to avoid any interruption in data collection during an outage (when you may need the program the most).

2.3 Using the ACCESS Device Log

The ACCESS Device Log is a tabulation of ACCESS device information. **Figure 2.2** shows an example of a Device Log sheet. The log allows you to record information on the devices. This information includes:

- Device type
- Model number
- Serial number
  (assumes device is in your possession)
- Software version
- ACCESS device address
- Cell location
- Device name
- MT setup (if applicable)

One use of this log sheet is to record the addresses for each device. These addresses come from the communication diagram. This log sheet is a good place to check for any duplication of addresses in the system. The log sheet is not used by low voltage or medium voltage switchgear.

On some devices, configuration switches contain information about addresses and functions. Since this sheet is used by the testers, inspectors, and wiring personnel on the shop floor, the configuration setting information is added by the applications engineer. **Figure 2.2** illustrates a completed log sheet.

The finished log sheet is an important tool that the testers and inspectors use to set the addresses and switches on the devices. Some devices, such as the Static Trip III trip units, can have their addresses preset electronically before they arrive on the assembly floor.

Finally, the tester uses this sheet to verify the settings prior to startup and to troubleshoot the system if something does not work properly the first time.

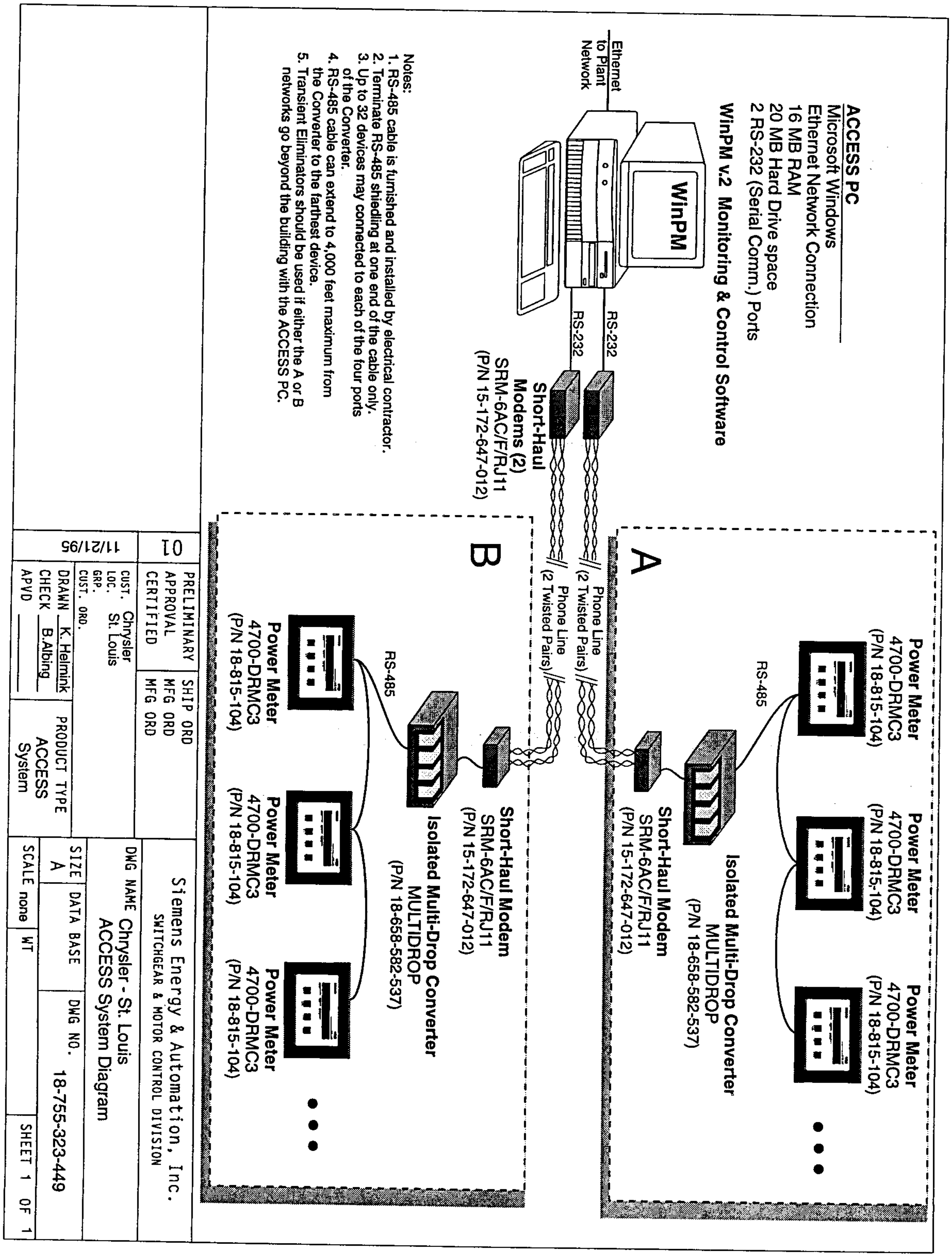


Figure 2.1 Sample Connection Diagram

SIEMENS **ACCESS Device Log**

Customer/Job RED MILL No. 1 Mine		Group No. Bus 509	
S.O. No. 01-1900-93345	MFG. No. 02-1916-93346	Date Mar. 20, 1992	
Order No. 123	Equip: 4.16 KV Main Swgr	Rev. No. 0	

Item No.	Device Type	Model No.	Serial Number	Product Revision Level(s)	ACCESS Device Address	Cell Location	ACCESS Circuit Name	MT Setup * MT Device Number	MT Address Switch 5	4	3	2	1	Comments
1	PM		199394 - 481	V3.13	---	5A								
2	4700	DC311H	6435	Rev. B V 2.2.0.1	013	3A	FDR1-3A							5KV SUB FEED NO. 1
3	SCOR	G2EZ5JB2C0S	488	HW 1.5 SW 3.11	014	3A	SUB FD 1							"
4	4700	DC311H	6551	Rev. B V 2.2.0.1	017	2A	FDR 2-2A							5KV SUB FEED NO. 2
5	SCOR	H4EZ5JB2C0S	493	HW 1.5 SW 3.11	018	2A	SUB FD 2							
6	M/T	MTA	---	1.0	020	6B	MT #1		1	0	1	0	0	LOW VOLTAGE SWBD
7	SEN III	SND69120A	---	---	---	6B	MCCB MAIN	01						MAIN MCCB 1200A.
8	SEN III	SNJD69400	---	---	---	6B	MCCB 1	02						FEEDER MCCB 400A.
9	SEN III	SLD69400	---	---	---	6B	MCCB 2	03						FEEDER MCCB 400A.
10	SAMMS	1L1ALG0001	---	SAMMS 1	100	9A	FAN1-9A							VENT FAN NO. 1 SAMMS
11	SAMMS	1L1ALG0002	---	SAMMS 2	101	10A	FAN2-10A							VENT FAN NO. 2 SAMMS
12	STIII CP	TSI-TZ-CPX		V 2.24	51	1B	SUB #1							
13	STIII CP	TSIG-TZ-CPX		V 2.24	52	1C	FEEDER 4							

* MT address switch field is the binary form of the SEAbus address.
The MT address switch settings should show a "1" for ON and a "0" for OFF.
The MT address switch settings are labeled "1" through "5."
MT device number is the MT port.

Figure 2.2 ACCESS Device Log Example

SIEMENS ACCESS Device Log

Customer/Job		Group No.
S.O. No.	MFG. No.	Date
Order No.	Rev. No.	Equipment

Item No.	Device Type	Model No.	Serial Number	Product Revision Level(s)	ACCESS Device Address	Cell Location	ACCESS Circuit Name	MT Device Number	MT Setup * MT Address Switch					Comments
									5	4	3	2	1	

* MT address switch field is the binary form of the SEAbus address.
The MT address switch setting should show "1" for ON and "0" for OFF.
The MT address switch settings are labeled "1" through "5".
MT device number is the MT port

Figure 2.3 Device Log Template

3 Connecting the Network

To install an ACCESS system properly, you must understand certain concepts of network installation such as connection basics, proper device grounding, terminal block connections, field cable routing, cable termination, and cable characteristics. The following sections discuss these issues in detail. Follow the rules explained in this section to properly install the system. Following these rules will help prevent possible injury and equipment damage.

3.1 Connection Basics

The recommended method for connecting field devices is *daisy chaining*. Daisy chaining is a method of connecting one device (supervisory) to a second device (field device) and the second to a third (another field device) and so on. This process is repeated until the last device is connected to the first device, thereby establishing an interconnection loop. This loop and all the devices make up the network. In the event of a break in the cable, each device is still connected to the master device.

Rule 1:

Connect all field devices in a "daisy-chained" loop topology so that all devices are connected to the supervisory device in case of a line break.

Refer to **Figure 3.1** for a simplified diagram of such a system. One of the objectives of the communication bus design is to provide redundancy so that, if a line is cut, communication is not interrupted. By completing the loop in the RS-485 cable, one break can be made anywhere in the line without compromising communication with the supervisory device. To maintain redundancy, avoid open ended runs of the bus. However, if this is not practical because of physical restrictions such as maintaining maximum distance requirements, the bus can operate open ended.

Rule 2:

A maximum of 32 devices may be connected in a single RS-485 bus for a total cable run no longer than 4000 feet (1219 meters).

Several loops may be created for a given network. **Figure 3.2** shows an example of devices on different types of switchgear connected to individual loops that are interconnected to a main loop. From the individual loops, stub cables are dropped down to each field device. The supervisory device supervises all the field devices connected to the main interconnection loop up to a maximum of 32 devices. To handle more than 32 devices, the supervisory device may be connected to an Isolated Multi-Drop™ converter, which provides four RS-485 ports. Each port can handle up to the maximum of 32 devices.

Rule 3:

Use a good quality shielded twisted-pair cable for each RS-485 bus. It is recommended that 22 AWG (0.6 mm) or larger conductor be used.

Cable installation can consist of either straight line (single-ended run) or looped topologies. Both methods are possible, but Siemens recommends using the looped topology.

3.1.1 Straight-Line Topology

To use the straight-line topology, install the cable so that it is daisy-chained between each device. The supervisory device connects to a field device, which in turn connects to another field device, and so on.

With any communications transmission line, reflections can cause garbled data and failed communications between units. Reflections are caused by mismatched line and load impedances. To prevent reflections on long, single-ended runs, eliminate any impedance discontinuities with a terminating resistor.

The recommended twisted-pair cable for an RS-485 bus has a characteristic impedance of 120 Ω. Any change in the type of cable, or an open-ended length of cable, creates a discontinuity in the impedance and causes a reflection. To eliminate reflection in this circumstance, place resistors that match the characteristic impedance of the cable at the open end of a twisted-pair stub.

For long, single-ended runs (over 1000 feet), you may need to install a 120Ω, ¼W terminating resistor between the Data+ and Data- terminals of the farthest device from the supervisory end. For 22 AWG shielded twisted-pair cable, values between 100 Ω and 300 Ω are typical. Consult the cable manufacturer's documentation for the exact impedance of the cable in your system. Each end point of the straight-line bus should be terminated with such a resistor to reduce signal reflections that may corrupt data on the bus. Because of the relatively slow data rate (9600 or less) used by the field devices, adding the terminating resistor is not an absolute requirement, but using it minimizes reflected interference on the communication cable.

3.1.2 Loop Topology

In a loop topology, install the cable in a similar manner to the single-ended run approach, but rather than terminating at the farthest device, form a complete loop by bringing the cable back to the supervisory device.

Each installation method has advantages and disadvantages. The loop topology requires more cable than does the straight-line topology. This extra cable is needed to run from the last device on the run to the supervisory device. The additional cable adds expense and shortens the total distance the farthest device can be located from the supervisory device. The advantage of the loop is in the ability to communicate with all devices when there is a break in the loop. The straight line allows larger distances between the supervisory device and the farthest slave device, but it does not allow the supervisory device to communicate with devices on the far side of a break.

Rule 4:

Ensure that the polarity is correct when connecting the RS-485 port Plus (+) and Minus (-) terminals of each device.

Devices are connected in a point-to-point configuration with the (+) and - terminals of each device connected to the associated terminals on the next device in the loop.

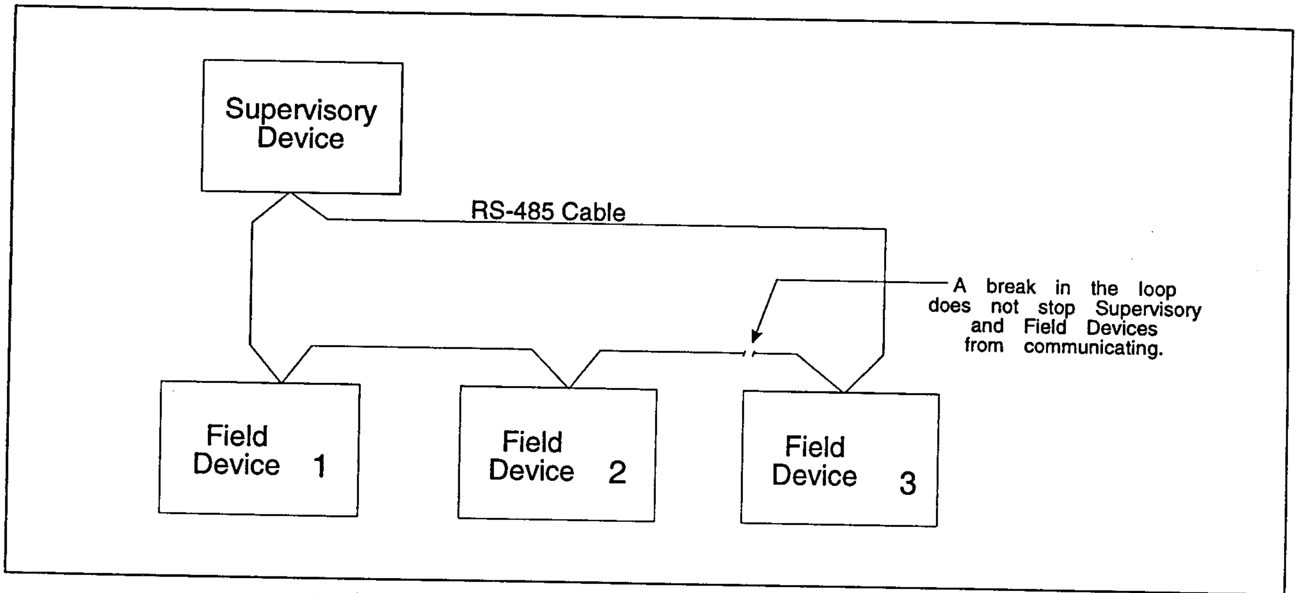


Figure 3.1 Simplified Interconnection Loop

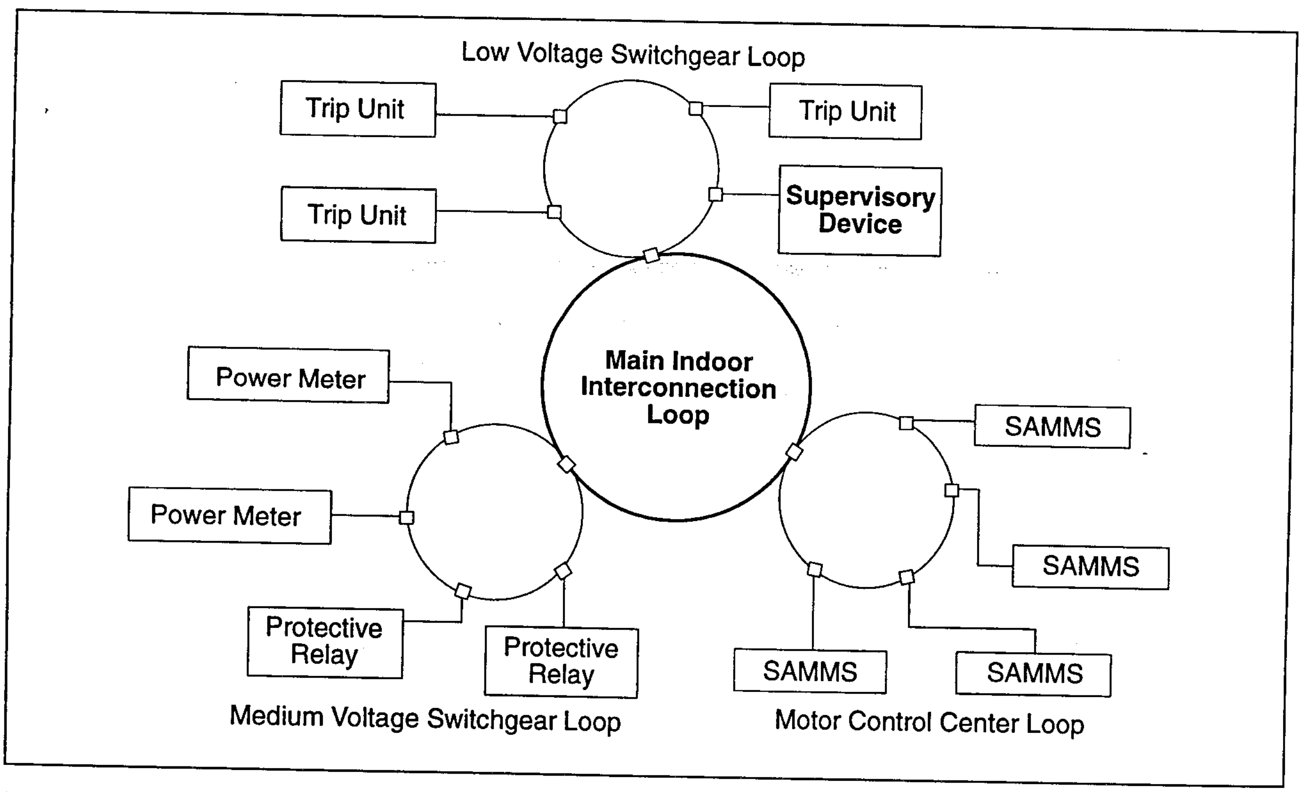


Figure 3.2 Example Interconnection Loop

3.2 Proper Device Grounding

Communications-grade, shielded, twisted-pair cable is used to connect the devices within the network. The cable is connected to the RS-485 communications port on each device, linking the devices in an interconnection loop. These three wires (Data (+), Data (-), and Shield) make up part of the *communications bus*—the hardware that connects the devices together. Using this kind of cable offers an inexpensive, easily available method for connecting field devices to a supervisory device. The pair of data or signal wires is twisted and shielded to prevent radio-frequency interference (RFI) and electromagnetic interference (EMI) from affecting the signal. Refer to **Appendix A** for a complete description of cable characteristics.

Rule 5:
Always ground the shield at only one end of a cable segment.

If the ground potentials at both ends of a signal cable are not the same, a current will flow in the shield wire that may induce noise in the communications wiring. Grounding the cable at only one end (device end recommended) will prevent this. NEVER ground the shield of a communications cable at both ends. Note that a metal conduit is not a good shield. When multiple grounds exist in a system, all of the grounds may not be at the same potential leading to current flow between grounds and ground loops. Ground loops can also cause damage to instruments and are also a hazard to operators.

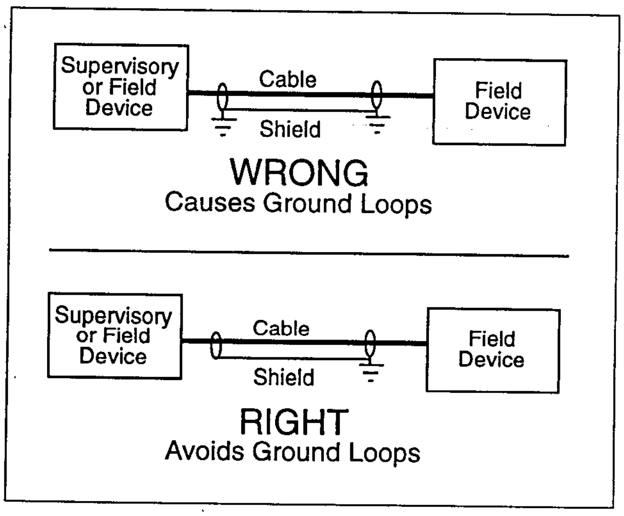


Figure 3.3 Ground Loops

For all devices, ground the cable shield at one end only to prevent induced interference that may result from circulating ground currents. Connecting the shield at both ends of a segment to ground allows ground loop currents to flow in the shield, inducing electrical noise in the communications cable. **Figure 3.4** illustrates the preferred method for connecting cable to field devices.

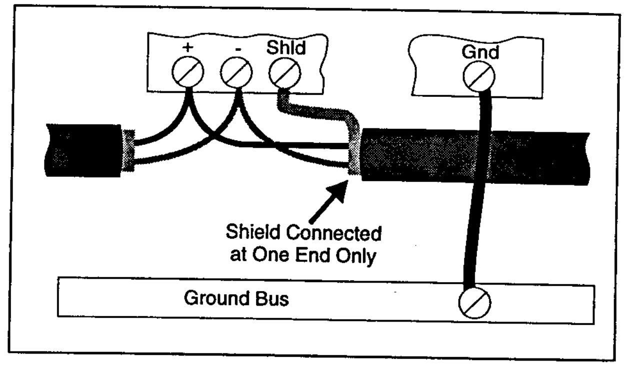


Figure 3.4 RS-485 Field Device Termination

At each field device, connect the shield of the cable to the shield or chassis ground terminal only if the other end of the same segment of the cable shield is not connected to ground.

Rule 6:
Always connect the field device's ground terminal directly to the equipment ground bus.

If there are several different grounds in a cubicle or instrument compartment, there is a possibility of elevated voltage levels from one ground to the next. To be certain this situation does not occur, tie the equipment ground terminals of all devices directly to the equipment ground bus. The reasons for this requirement are listed below:

- The RS-485 bus requires equipotential ground reference for all devices on a common bus within the specified range (-7 V to +12 V)
- Noise and surge protection circuitry must be ground referenced
- Measurement references require a good ground connection for proper accuracy
- Varying voltage levels are a safety hazard

Rule 7:
Run ground connections directly to the equipment ground bus and do not daisy chain them from one device's ground to the next.

3.3 Terminal Block Connections

Give careful consideration to the arrangement of connections to minimize the effort of wiring the devices to the network. There are several types of connections that are possible. Most often, the devices are either connected on stub cables to a terminal block in the loop or devices are daisy chained off a terminal block in the loop. These connections are described below.

It is convenient in some switchgear arrangements to run a single RS-485 loop for a line-up, then to run a stub cable to each of several field devices. **Figure 3.5** shows the connections for such a loop with stubs each connected to a terminal block.

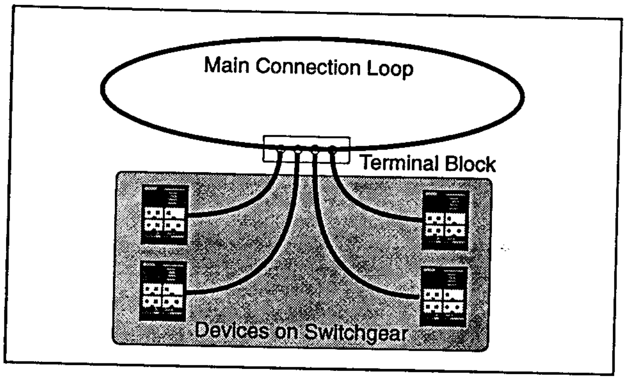


Figure 3.5 Individual Stub Topology for Switchgear

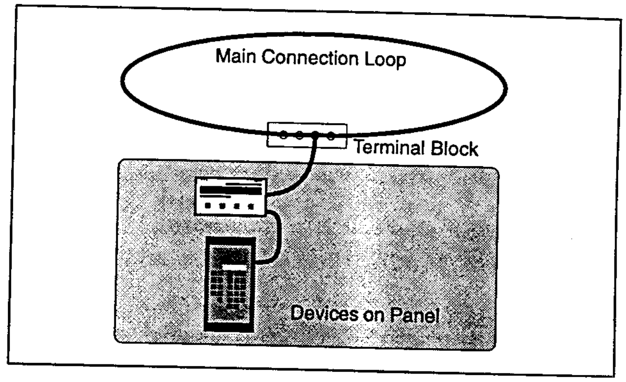


Figure 3.7 Series Stub Topology for Panel Devices

Figure 3.6 shows the suggested cabling at such a terminal block at the top of a vertical section of circuit breakers. The loop cable ties together all of the vertical sections of the low-voltage switchgear. From the terminal block on the loop, stub cables are dropped to the individual low-voltage breakers. Notice the grounding on one of the loop segments and all of the stub cables.

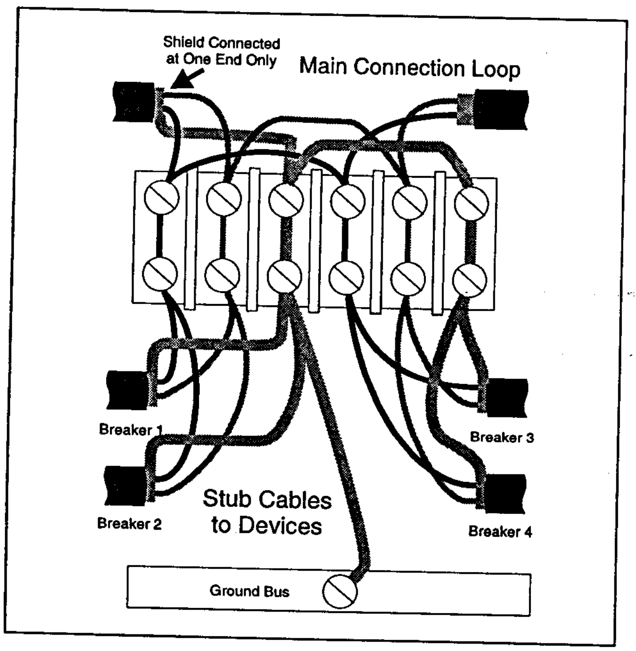


Figure 3.6 Terminal Block for Switchgear Loop

Figure 3.7 illustrates another cabling example. The figure shows two devices mounted on an instrument door of a medium voltage switchgear frame. In installations for panel-mounted devices, the cabling is brought out to a panel hinge terminal block. The two example devices on the door form a series stub. The terminal block is the common point between this stub and the interconnection loop for the switchgear line-up.

Figure 3.8 shows the suggested cabling at such a terminal block for two devices connected in series. From terminal blocks on the loop, cabling is connected first to one device then to another. Notice the grounding on one of the loop segments and all of the devices.

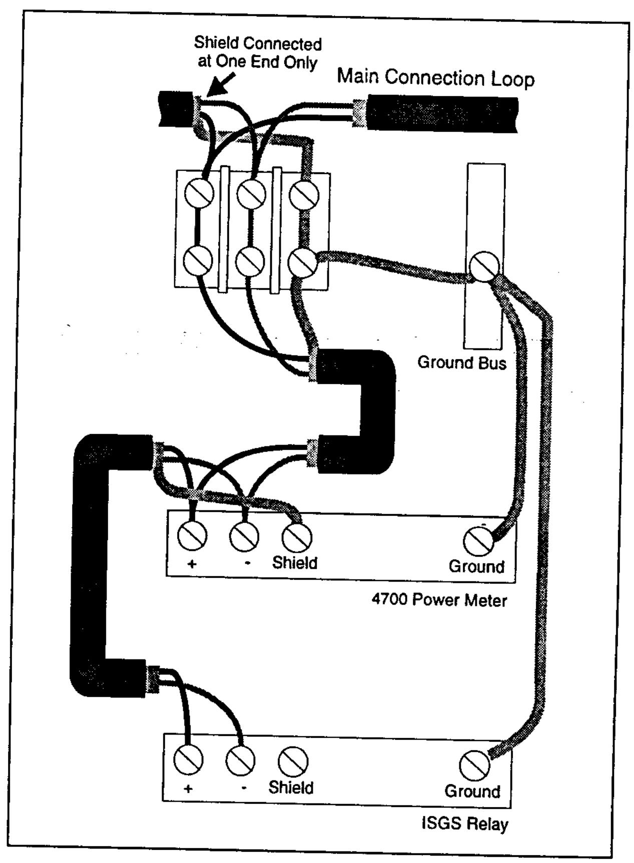


Figure 3.8 Terminal Block Connection for Panel Devices

When connecting more than one terminal block, be sure to connect the shields to ground. The rule for connecting only one end of a communication loop shielding to ground still applies.

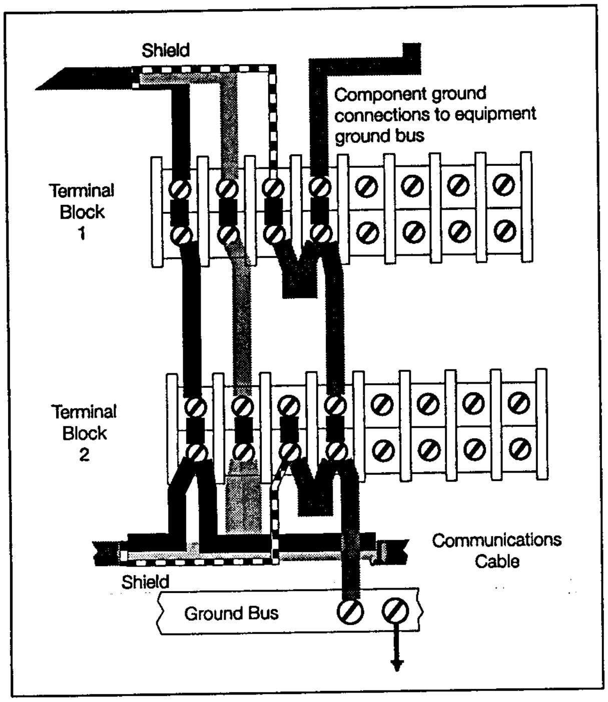


Figure 3.9 Two-Terminal Block Connection

3.4 Cable Termination

3.4.1 Connecting Cable Wires

Use the following guidelines, connect the cable to the bus terminal as illustrated in **Figure 3.4**:

1. Connect the conductors (black and white for SEAbus RS-485 communications cable) to the data terminals marked (+) and (-) or marked A and B.
   - Black is connected to Data (+) or A.
   - White is connected to Data (-) or B.
2. Connect the cable shield to SHIELD termination. If shield termination is not available, then connect to ground, GND. (Do not ground shield at both ends of a single leg of a cable.)
3. Connect equipment ground bus to GND.

Note: The shield terminal is connected to the device's ground terminal on all devices except the Siemens Communicating Overcurrent Relay ((SCOR)™ relay and the Multiplexer Translator™. These devices have a COM terminal which is not connected to ground. For the SCOR relay and the Multiplexer Translator, ground the shield at the ground terminal.

3.4.2 Using the Shielding Properly

Adhering to the following guidelines for cable shielding guarantees the minimum possible noise on the network.

- Carefully strip the cable's insulation.
- Where the cable enters the cabinet, connect the cable shields on the shield bar or ground screw terminal referenced to the ground bar.
- Securely attach the shield to the shield or ground connection via a crimped lug.
- Connect the shield at either the shield or ground terminals with the shield crimp covering as large an area as possible. Connect the shield at only one end of a cable segment to prevent induced interference that may result from circulating ground currents.
- To effectively discharge high frequency interference, cable shield segments should be made as short as possible. Terminate all shield reference terminals at the nearest ground bar.

Note: High frequency parasitic currents are discharged over the low-resistance internal bonding of the shield through the shield connection on the terminal block. Terminate the shield securely for effective protection.

3.5 Field Cable Routing

Even though the communications cable is shielded, the effect is not perfect. It can still pick up random signals and interference from the surrounding environment. This random pickup can cause errors in the data transmission. For this reason, route signal cabling perpendicular to the power conductors as illustrated in **Figure 3.10**.

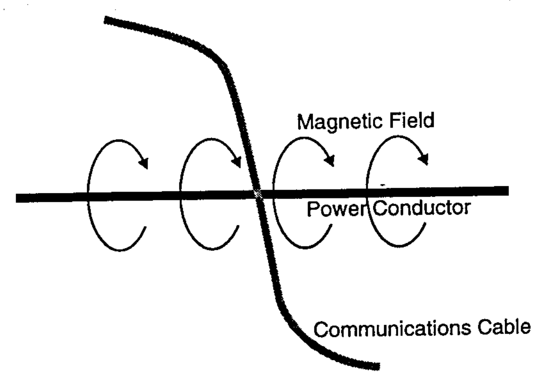


Figure 3.10 Cable Routing

Rule 8:
Do not route signal cabling parallel to power conductors. Power conductors are any cables or bus conductors carrying currents greater than 20 A.

Electrical current flowing through a conductor forms a magnetic field around the wire, as shown in **Figure 3.10**. Interference is coupled into the wires in the cable through electromagnetic fields. Just as current through a wire causes a magnetic field to form around it, a magnetic field can cause current to flow in a wire. This induction of current is a function of the geometry or orientation of the wires. If the second wire (not the one causing the magnetic field) is at a right angle with the first, it is aligned with the direction of the magnetic field and no current is induced.

Rule 9:

Cables should be isolated as much as possible from sources of electrical noise.

Avoid putting communications cabling near sources of electrical noise that may distort the communications signal. If the cable must be near such sources, be sure to insulate the cable sufficiently.

Follow these guidelines when you route communications cabling *within* electrical equipment:

- You may install SEAbus cable in the cabinet in the same cable duct as unshielded digital and analog signal cables ≤60 V.
- Install signal and supply cables in the same cable duct as communications cables only when these signal or supply cables are shielded for voltages up to 230 V.
- If you use unshielded signal and supply cables up to 230 V, run communications cables at least 4 inches away.
- If you use unshielded signal and supply cables up to 1 kV, run communications cables in a separate duct at least 4 inches away. Make sure that all communications cables are shielded and that you use grounded metallic cabling ducts or additional shielding plates.

Follow these guidelines when you route communications cable *between* electrical equipment:

- Run communications cables in the same cable raceways (cable routes, cable trays or cable gutters) as unshielded digital and analog signal cables up to 60 V.
- Run communications cables in the same cable raceway with shielded signal and supply cables up to 230 V.
- Run communications cables 4 inches away from unshielded signal and supply cables of up to 230 V.
- Run cables with voltages greater than 230 V in separate ducts (routes, conduits).
- ACCESS SEAbus allows safe, reliable data transmission up to a displacement of the earth potentials of +12V/-7V. If lines exceed +12V/-7V, even within a given building, use equipotential bonding conductors of size 6 AWG copper or greater between grounded segments.

For routing cables between buildings, ensure proper grounding and lightning protection by observing the following guidelines:

- Use electrically isolated communication drivers when routing cable between buildings because of earth ground potential differences. Use isolated modems or the Isolated Multi-Drop converter for this purpose.
- Use integrated supplemental high-energy surge protection on ACCESS digital communication networks within the power switchgear. Install these surge protection devices where inter-building, copper-based communication networks are routed outside the building, through overhead trays or underground conduits. Such cable installations may be exposed to lightning or other electromagnetically induced high energy surges which can potentially damage any attached electronics. Run communications cables in bilaterally grounded metal conduits, or use a lightning conductor/surge protection module (transient eliminator).

3.6 Minimizing the Effects of EMI

The device is designed to operate in an industrial environment where a high level of electromagnetic interference (EMI) can be expected. Usually, good installation practices will ensure safe and troublefree operation. However, if problems are encountered, the following guidelines may prove useful. In particular, grounding the device, as described next, may prove effective:

1. Ensure that all equipment in the cubicle is well grounded using short, thick grounding cable connected to a common star point or bus. It is particularly important, that any control equipment connected to the device (such as a PLC) is connected to the same earth or star point as the device via a short, thick link. Flat conductors (for example, metal brackets) are preferred because they have lower impedance at high frequencies.
2. Use saw-tooth washers when mounting the device and ensure that a good electrical connection is made between connections.
3. Wherever possible, use shielded leads for connections to the control circuitry. Terminate the ends of the cable neatly, ensuring that long strands of unshielded wire are not left visible.
4. Separate the control cables from the power connections as much as possible, using separate trunking, etc. If control and power cables cross, arrange the cables so that they cross at 90° if possible.
5. Ensure that contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or "flywheel" diodes for DC contactors, **fitted to the coils.** Varistor suppressors are also effective. This is particularly important if the contactors are controlled from the relays on the device.
6. Use shielded or armored cables for the power connections and ground the shield at both ends.
7. Select the lowest switch frequency possible. This will reduce the amount of EMI generated by the inverter.

Note: On no account must safety regulations be compromised when installing devices.

4 Installing Field Devices

This section contains interconnection and configuration information for each field device that may be installed on an ACCESS system. This section does not replace the relevant information in the individual operator's manuals for each device. When installing and configuring field devices, follow all precautions and warnings for safety.

4.1 General Wiring

Each ACCESS device must have communications wiring installed. Instructions for the connection of communications wiring is typically given in the operator's manual of the device. Refer to these manuals for specific instructions.

4.2 General Configuration

For many of the individual ACCESS devices, the operator must set parameters for proper data acquisition and resolution. Once entered, these settings are maintained in the device's nonvolatile memory (either EEPROM, battery backup, or hardware switches). Some of these devices require configuration of many data fields. It is generally easier to enter values into these data fields remotely using the Power Monitor unit or supervisory software such as WinPM. These interfaces give you a keyboard and menu-driven display screens for entering values. The other advantage of remote configuration from a supervisory device is that you can program parameters for all devices from one location.

Even when interconnected properly, the ACCESS devices do not yet constitute a viable communication system. Each device must have a unique address on the data bus. Without this unique address the supervisory devices cannot communicate with the slave devices to receive data.

The operator must program a unique address for each device before establishing any operational ACCESS system. Each device has a default address. Programming a new address from the default address applies when installing a device into equipment at the factory or in the field.

> **Note:** For a factory-built electrical apparatus order, a unique address is programmed at the factory for each device.

4.2.1 Local Configuration

Many of the devices in the ACCESS system can be programmed directly from the front panel of the device. This is referred to as local configuration. Follow these steps to configure a device locally.

1. With control power on the device (the device is turned on), use the step-by-step routines listed in the individual device's section to configure each device. You should also use the device's instruction manual to locally program the address, but not all devices are designed for locally programmed addressing.
2. On some devices, such as the Multiplexer Translator (MT), you set the address using a special switch on the circuit board. Follow the instructions in this chapter to set this switch.

4.2.2 Remote Configuration

Many devices may be programmed from a supervisory device (or remote monitoring system) as well as from the front panel of the device. Some devices can be programmed from the Power Monitor unit. Most devices can be programmed using supervisory software running on a PC, such as WinPM.

The open communications protocol, SEAbus, also allows free access to all programming parameters of many of the devices on the ACCESS system using any compatible third-party system.

To program the device address from a monitoring system, you must first program the system data rate. This data rate is common throughout the entire system. If ordered individually, field devices are shipped from the factory with the device default address of 222 already set. If you do not know the address of the new device, the supervisory device can request the device address.

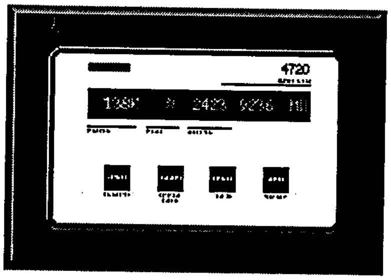
> **Note:** Do not use the universal request method for initial system addressing because you must disconnect all other ACCESS devices programmed for the default address from the RS-485 bus before setting the address.

For remote configuration with supervisory software, refer to the user manual for that software. Typically, there is an appendix section that discusses configuration of each device.

Once the address and the data rate are set, the ACCESS system can communicate with the attached devices, and you can continue programming the device.

When ACCESS devices are installed in equipment for future communications, Siemens recommends that discrete addresses be programmed for the devices during installation; otherwise, depending on their options, the devices may have to be disconnected from the communications bus and reconnected individually to change the default address.

4.3 4720 Power Meter



4.3.1 Overview

The 4720 power meter is a three-phase, rms-sensing microprocessor-based digital power meter that can report waveform and harmonic analysis data to a monitoring system. The 4720 power meter is equipped with a communications card that is field configurable. This card allows the 4720 to communicate over RS-485 lines and provides full isolation between the communication lines and the metering equipment.

The 4720 power meter offers over 300 high-accuracy measurements, on-board harmonic analysis, high-speed waveform capture, digital waveform recording and a high-response setpoint control system. The communications module includes SIEServe software that allows collection and displaying of metered data through a modem or hardwired communications bus. It is fully compatible with supervisory software such as WinPM.

4.3.2 Communications Wiring

For a complete set of instructions for installing and wiring the 4720 power meter, refer to the chapter *Communications Wiring* of the *4720 Power Meter Operator's Manual* (Manual No. SG6068). That chapter explains how to connect the wiring to the terminal blocks and how to change the jumper, if needed. Refer to **Figure 4.1** of this section for an illustration of the connections needed.

The standard 4720 power meter can be powered at 0.2 A by 85 to 132 VAC (47 to 440 Hz) or by 110 to 170 VDC.

The chassis ground connection is made via one of the mounting studs on the chassis of the meter, using the supplied lug. Connect this lead directly to the equipment ground. The shield terminal is internally connected to the device's ground terminal. The function of the terminal strip connections are:

Ground	GND	Chassis ground
RS-485	SHLD	RS-485 shield
	-	RS-485 data minus
	+	RS-485 data plus

Two LED indicators, TXD and RXD, show activity on the RS-485 lines and can be used to verify correct communications (see **Figure 4.1**). The TXD indicator flashes when data is being sent by the device. The RXD indicator flashes when data is being received by the device.

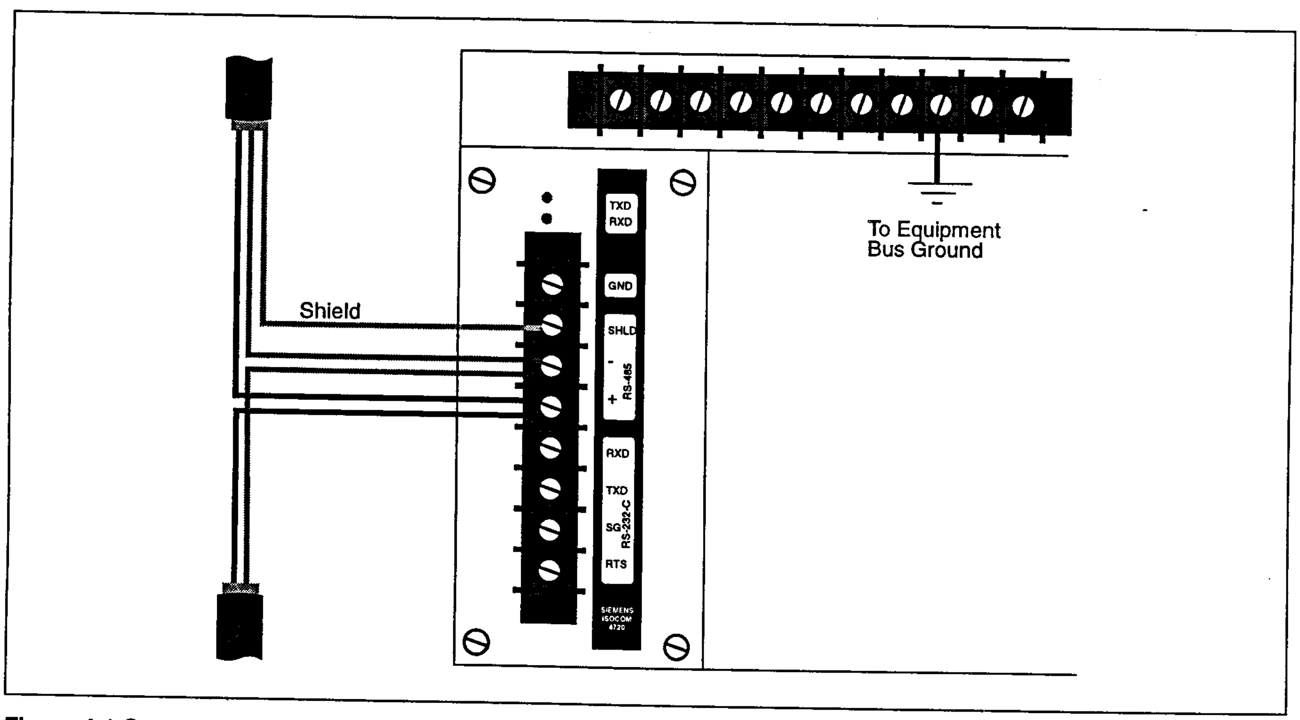


Figure 4.1 Communications Wiring for 4720 Power Meter

4.3.3 RS-485 Connections

RS-485 is used when multiple devices are installed at a remote site. RS-485 communications can be used to concurrently connect up to thirty-two remote devices on a single communications loop. Each device is given a unique unit ID (identification number). In this way, each remote device may be monitored and controlled from one location by a single supervisory device.

The total distance limitation on a single RS-485 communications network is 4000 feet (1219 meters) using 22 AWG twisted-pair shielded cable. **Figure 4.2** provides a wiring diagram for RS-485 network connection.

Communication methods between the remote RS-485 site and the supervisory device can include a direct RS-485 connection, telephone lines with modems, fiber-optic and/or radio links. An RS-232 to RS-485 converter, such as the Isolated Multi-Drop converter, is required between the RS-232 port of the computer or modem and the RS-485 network as illustrated in **Figure 4.3**.

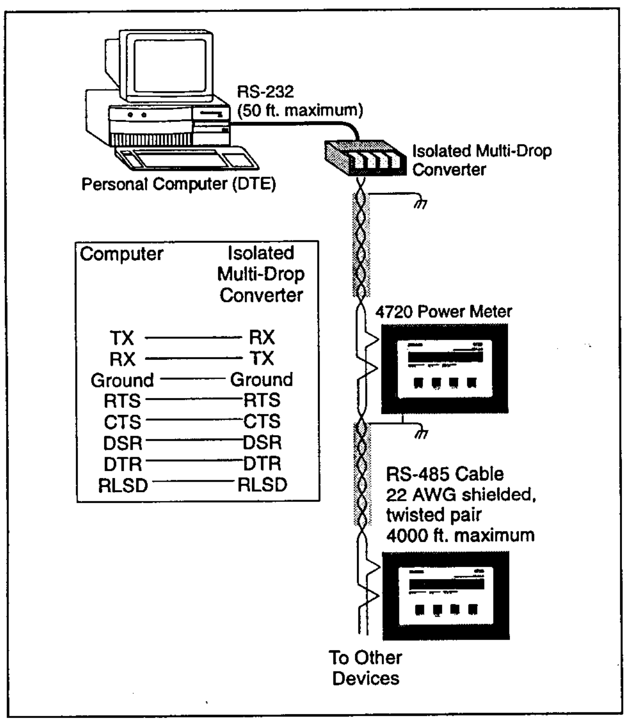


Figure 4.2 RS-485 Communications Connections for the 4720 Power Meter

4.3.4 Local Programming

The following procedure is a step-by-step approach for local programming.

1. To change the power meter operating mode from display mode to programming mode, press the **Function** and **Minimum** keys at the same time. "PROGRAMMING MODE" appears on the display.

   Note: When the power meter is operating in programming mode, the keys on the front panel take on new programming functions. The label below each key indicates its programming mode function (for example, the **Maximum** key now functions as **Parameter Select**).

2. The **Parameter Select** key selects which parameter is displayed. The **Cursor** and **Increment** keys change the value of the displayed parameter. More specifically, pressing the **Cursor** key moves the cursor left one digit (it wraps around the number), and the **Increment** key increases by one the digit under the cursor. Parameters such as BAUD RATE have a number of set values and pressing **Increment** scrolls through them.

3. Scroll up to display "PROGRAMMING MODE." Press and hold the **Minimum** key, then press the **Function** key at the same time to return the power meter to display mode.

4. The first parameter displayed in programming mode is PASSWORD. The power meter is shipped with the password set at zero (0). You must enter the password to change any parameter values. If the password is not entered, you can view, but you cannot change any of the parameters. To change the password, follow the instructions in the *4720 Power Meter Operator's Manual* (Manual No. SG6068). Siemens can issue a backup password if necessary.

5. Select the UNIT ID (address) parameter. Set the address of the power meter, using a number from 1 to 254. Use 222 for storing spare units only.

6. Select the BAUD RATE parameter and set it to the proper rate for your ACCESS system.

Basic device programming can be performed quickly and easily from the front panel or via the communications port using a portable or remotely located computer. Basic setup parameters include scaling factors for the voltage and current inputs, voltage mode (wye, delta, and so on), and communications settings.

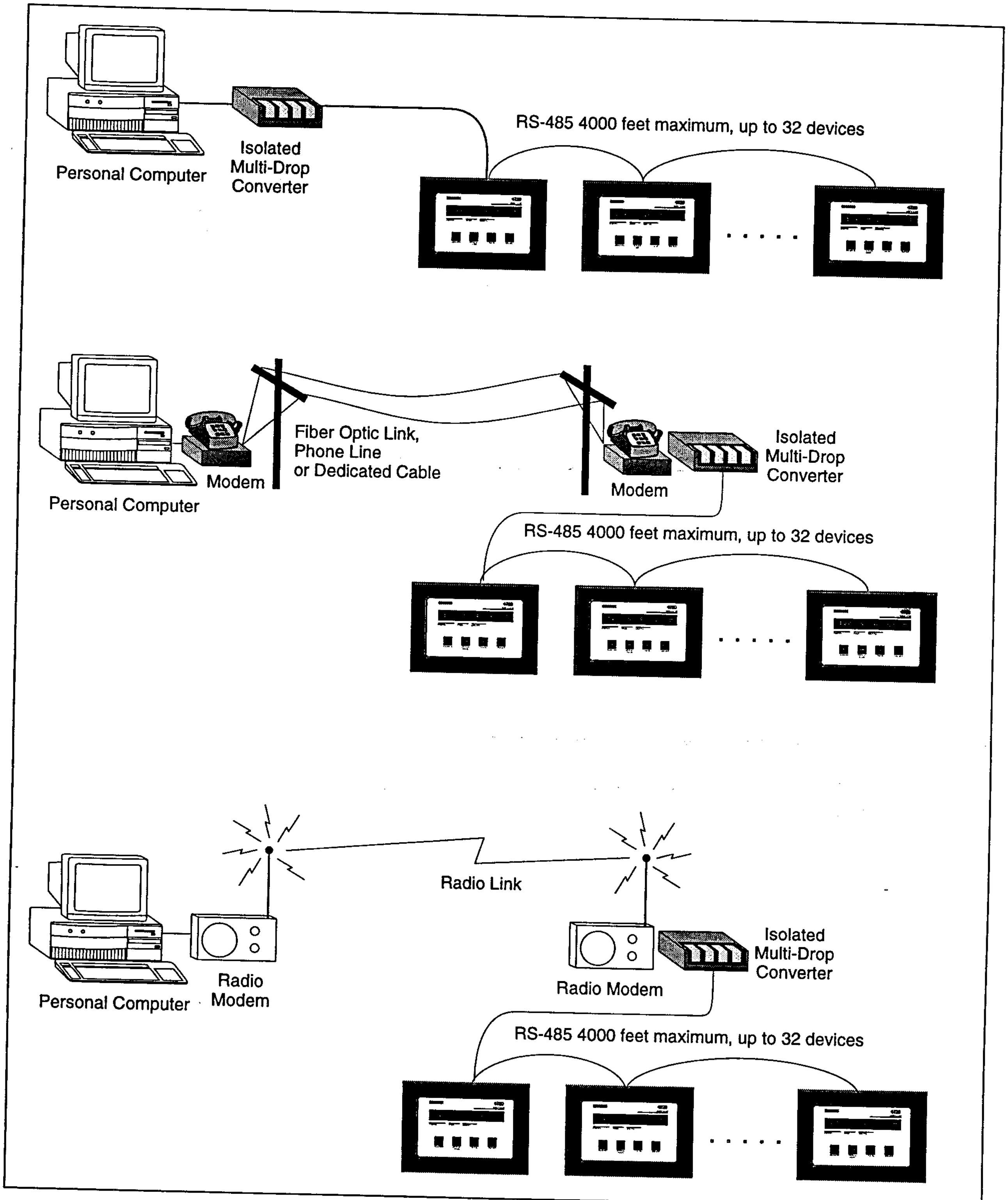
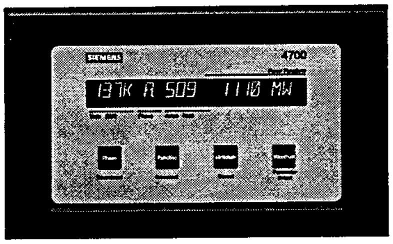


Figure 4.3 Remote Communications Methods

4.4 4700 Power Meter



4.4.1 Overview

The 4700 power meter is a microprocessor-based instrumentation package for low, medium, or high voltage electrical equipment and substations. It is a state-of-the-art alternative to traditional analog electromechanical metering devices. It requires no external transducers. The 4700 power meter replaces up to 12 traditional analog devices.

The 4700 power meter is optionally equipped with a communication card that is field configurable. This card allows the 4700 to communicate over RS-485 lines and provides full isolation between the communication lines and the metering equipment. If you order the 4700 power meter without a communications card, you can retrofit the card in the field at a later date.

The communications module includes SIEServe™ software that allows collection and displaying of metered data through a modem or hard-wired communications bus. It is fully compatible with supervisory software such as WinPM.

The communications card allows the 4700 power meter to communicate using either the RS-232 or the RS-485 communication standard. The shield terminal is internally connected to the device's ground terminal. If you are adding the communications card in the field, follow the instructions in the *4700 Power Meter Operator's Manual* (Manual No. SG6018). If you are using WinPM, refer to the *WinPM Software User's Manual* (SG-6118-02). The card is shipped from the factory to operate in the RS-485 mode.

4.4.2 Communications Wiring

For a complete set of instructions for installing and wiring the 4700 power meter, refer to the *4700 Power Meter Operator's Manual* (Manual No. SG6018). The section in that manual entitled *Communications Wiring* explains how to connect the wiring to the terminal blocks and how to change the jumper, if needed. Refer to **Figure 4.4** for an illustration of the connections needed.

The standard 4700 power meter can be powered at 0.2 A by 85 to 132 VAC (47 to 440 Hz) or by 110 to 170 VDC.

For 4700 power meter **Rev A** versions, the ground connection, "G", to the 4700 power meter serves as the measurement reference point and as the chassis ground connection for the meter. Connect this lead directly to the equipment ground bus in the switchgear as shown in **Figure 4.4.**

For **Rev B** versions, the chassis ground connection is made via one of the mounting studs on the chassis of the meter, using the supplied lug. Connect this lead directly to the equipment ground bus as shown in **Figure 4.4**.

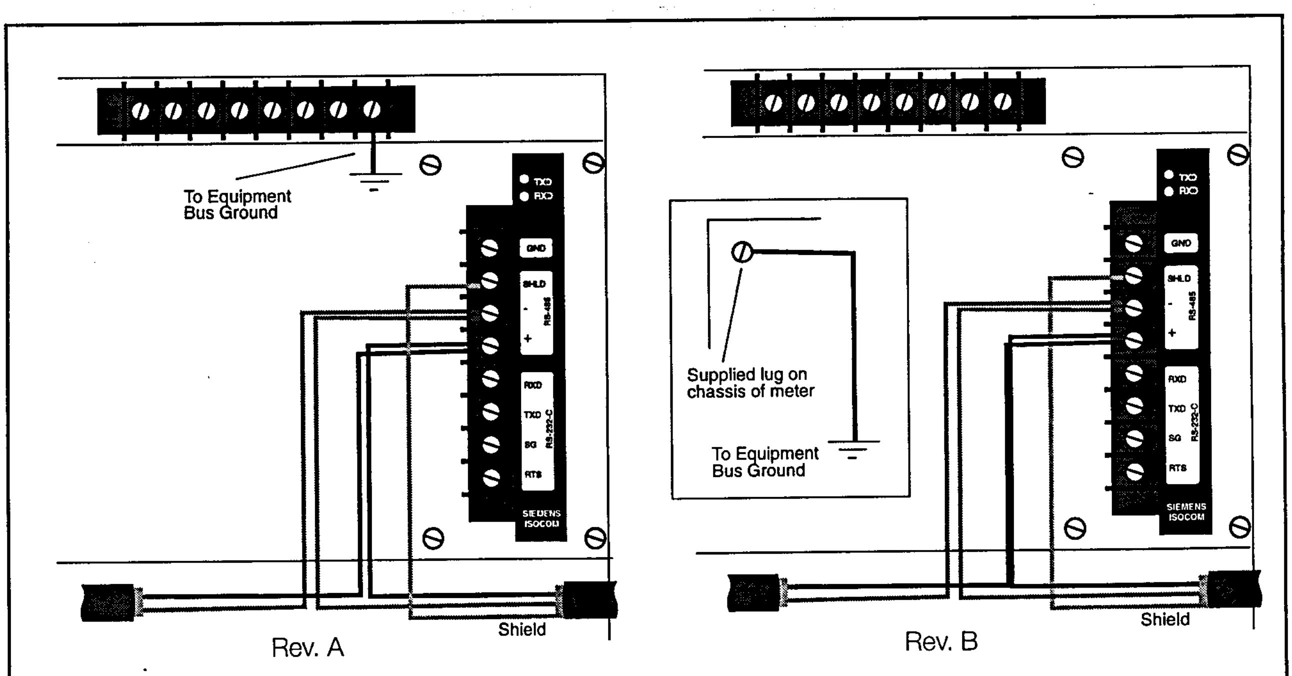


Figure 4.4 Communications Wiring for 4700 Power Meter

4.4.3 RS-485 Connections

RS-485 is used when multiple devices are installed at a remote site. RS-485 communications can be used to concurrently connect up to thirty-two remote devices on a single communications loop. Each device is given a unique unit ID (identification number). In this way, each remote device may be monitored and controlled from one location by a single supervisory device.

The total distance limitation on a single RS-485 communications network is 4000 feet (1200 meters) using 22 AWG twisted-pair shielded cable. **Figure 4.5** provides a wiring diagram for RS-485 network connection.

Communication methods between the remote RS-485 site and the supervisory device can include a direct RS-485 connection, telephone lines with modems, fiber-optic and/or radio links. An RS-232 to RS-485 converter, such as the Isolated Multi-Drop converter, is required between the RS-232 port of the computer or modem and the RS-485 network as illustrated in **Figure 4.3.**

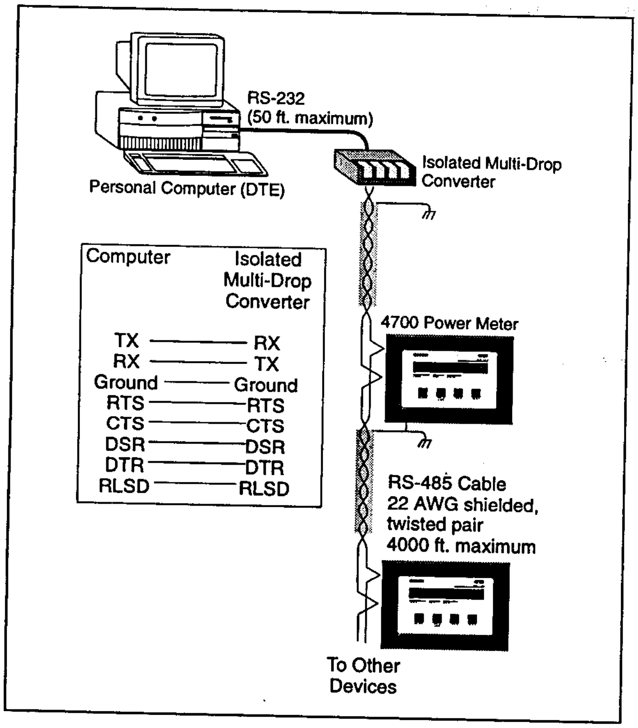


Figure 4.5 RS-485 Communications Connections for the 4700 Power Meter

4.4.4 Local Programming

The following procedure is a step-by-step approach for local programming using the front panel of the meter.

1. To change the operating mode of the power meter from display mode to programming mode, press the Function/Increment and Minimum/Cursor keys at the same time. "PROGRAMMING MODE" appears on the display.

   Note: When the power meter is operating in programming mode, the three right hand keys of the front panel take on new programming functions. The label below each key indicates its programming mode function (for example, the Maximum key now functions as Parameter Select).

2. The Parameter Select key selects which parameter is displayed. The Cursor and Increment keys change the value of the displayed parameter. More specifically, pressing the Cursor key moves the cursor left one digit (it wraps around the number), and the Increment key increases by one the digit under the cursor. Parameters such as BAUD RATE have a number of set values and pressing Increment scrolls through them.

3. The first parameter displayed in programming mode is PASSWORD. The power meter is shipped with the password set at zero (0). You must enter the password to change any parameter values. If the password is not entered, you can view, but you cannot change any of the parameters. To change the password, follow the instructions in the *4700 Power Meter Operator's Manual* (Manual No. SG6018). Siemens can issue a backup password if necessary.

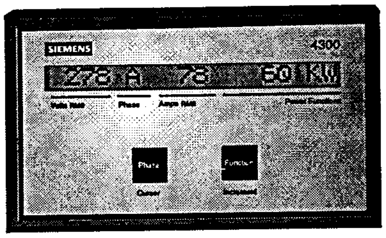
4. Select the UNIT ID (address) parameter. Set the address of the 4700 power meter, using a number from 1 to 254. Use 222 for storing spare units only.

5. Select the BAUD RATE parameter and set it to the proper rate for your ACCESS system.

6. Scroll up to display "PROGRAMMING MODE." Press and hold the **Minimum** key, then press the **Function** key at the same time to return the 4700 power meter to display mode.

Basic device programming can be performed quickly and easily from the front panel or via the communications port using a portable or remotely located computer. Basic setup parameters include scaling factors for the voltage and current inputs, voltage mode (wye, delta, and so on), and communications settings.

4.5 4300 Power Meter



4.5.1 Overview

The 4300 power meter is a 16-bit, microprocessor-based 3-phase power meter. The 4300 power meter directly replaces up to four standard analog meters and selector switches. Its two-module design consisting of a display module and a base module with a display cable simplifies wiring and reduces installation time.

The display module of the 4300 power meter can be panel-mounted for easy access and viewing. The power meter can be powered by 85 to 132 VAC (47 to 440 Hz), or 110 to 170 VDC, at 0.2 A. The meter's display module is typically mounted on the switchgear cabinets door. Cut four holes for mounting the display module on the door. Cut one cutout to connect the display cable.

4.5.2 Communications Wiring

Connect the communications cable to the RS-485 terminals on the base module, which is usually mounted inside the switchgear. Connect the shield to the meter's "G" terminal as shown in **Figure 4.6**.

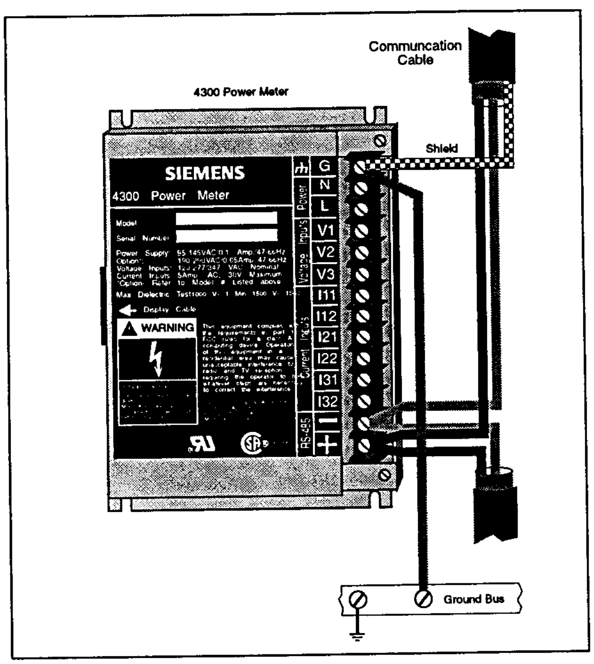


Figure 4.6 Communications Wiring for 4300 Power Meter

4.5.3 RS-485 Connections

RS-485 is used when multiple devices are installed at a remote site. RS-485 communications can be used to concurrently connect up to thirty-two remote devices on a single communications loop. Each device is given a unique unit ID (identification number). In this way, each remote device may be monitored and controlled from one location by a single supervisory device.

The total distance limitation on a single RS-485 communications network is 4000 feet (1200 meters) using 22 AWG twisted-pair shielded cable. **Figure 4.7** provides a wiring diagram for RS-485 network connection.

Communication methods between the remote RS-485 site and the supervisory device can include a direct RS-485 connection, telephone lines with modems, fiber-optic and/or radio links. An RS-232 to RS-485 converter, such as the Isolated Multi-Drop converter, is required between the RS-232 port of the computer or modem and the RS-485 network as illustrated in **Figure 4.3**.

4.5.4 Local Programming

The following procedure is a step-by-step approach for local programming using the front panel of the meter.

1. To change the operating mode of the power meter from display mode to programming mode, press the **Function** and **Phase** keys at the same time. "PROGRAMMING MODE" appears on the display.

   Note: When the power meter is operating in programming mode, the keys of the front panel take on new programming functions. The label below each key indicates its programming mode function (for example, the **Phase** key now functions as **Cursor**).

2. The **Cursor** key moves the cursor left one digit. The cursor wraps around to the right of the number if advanced past the left-most digit. The **Increment** key advances the digit under the cursor. Certain parameters have Yes or No values. Pressing the **Increment** key toggles between the Yes and No values. Other parameters, such as BAUD RATE, have a number of possible values, and pressing the **Increment** key scrolls through them.

3. Advance through each setup parameter by pressing and quickly releasing the **Cursor** and **Increment** keys at the same time. Do not hold down the keys longer than two seconds, since this action returns the power meter to display mode.

4. The first parameter displayed in programming mode is PASSWORD. The power meter is shipped with the password set at zero (0). You must enter the password to change any parameter values. If the password is not entered, you can view, but you cannot change any of the parameters. To change the password, follow the instructions in the *4300 Power Meter Operator's Manual* (Manual No. SG6038). Siemens can issue a backup password if necessary.

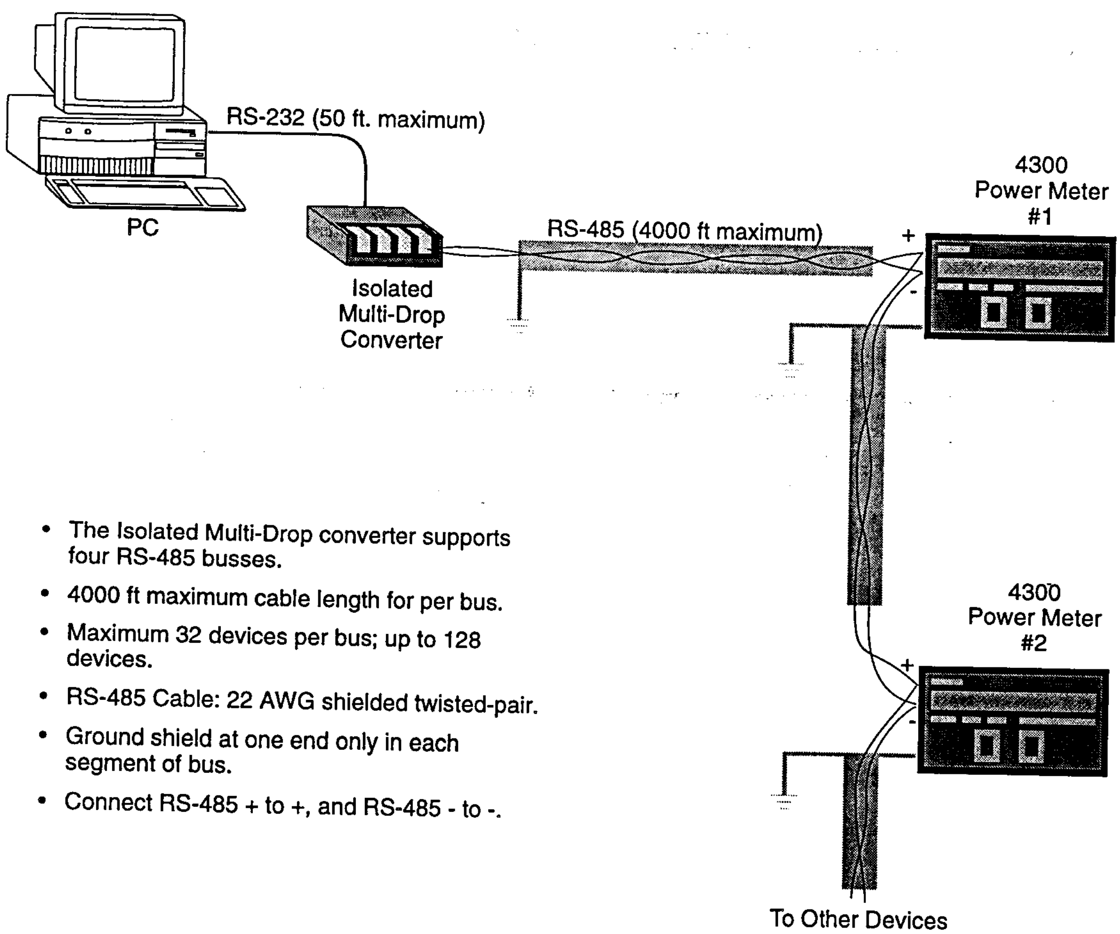
5. Advance to the UNIT ID (address) parameter by pressing the **Cursor** and **Increment** keys simultaneously and releasing quickly. Set the address of the 4300 power meter, using a number from 1 to 254. Use 222 for storing spare units only.

6. Advance to the COM MODE parameter, which selects the function of the RS-485 port. Select RS-485 for SEAbus communications or KWH PULSE to use the port to measure kWh pulse.

7. Advance to the BAUD RATE parameter and set it to the proper rate for your ACCESS system.

8. After setting the parameters to the desired values, press and hold down the **Cursor** and **Increment** keys at the same time to return the 4300 power meter to the display mode.

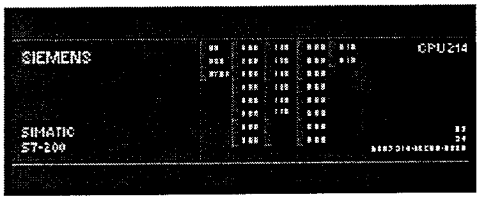
Basic device programming can be performed quickly and easily from the front panel or via the communications port using a portable or remotely located computer. Basic setup parameters include scaling factors for the voltage and current inputs, voltage mode (wye, delta, and so on), and communications settings.



- The Isolated Multi-Drop converter supports four RS-485 busses.
- 4000 ft maximum cable length for per bus.
- Maximum 32 devices per bus; up to 128 devices.
- RS-485 Cable: 22 AWG shielded twisted-pair.
- Ground shield at one end only in each segment of bus.
- Connect RS-485 + to +, and RS-485 - to -.

Figure 4.7 RS-485 Communications Connections for the 4300 Power Meter

4.6 S7-I/O Device



4.6.1 Overview

The S7-I/O™ device is an addressable modular input/output (I/O) device that links power system components to the ACCESS system. The device can monitor or control components which are not specifically designed for digital communication. The SEAbus communications protocol allows the S7-I/O device to communicate with supervisory computers running supervisory software.

The S7-I/O device operates as a field device on the ACCESS communications system. It has a digital address and is polled on a regular schedule by a supervisory computer. Speed of response depends on the number of field devices connected to the loop. The supervisory equipment can either be a host computer, a PLC, a PC or other compatible supervisory device.

Status of the input and output states, counter data, and event log data is exchanged on an RS-485 serial link. Connection to the ACCESS system is self-contained. In addition, the S7-I/O device allows manual control of all outputs.

In combination with a Siemens power meter, the S7-I/O device can be used to provide an economical system for remote monitoring and operation of circuit breakers. Protective and control relay output can also be monitored with controlling functions added through the S7-I/O device.

Remote monitoring of any device equipped with an auxiliary contact (for example, a molded case circuit breaker) is possible with the S7-I/O device. It can even be used to count and communicate the pulsed output from a kilowatt-hour meter.

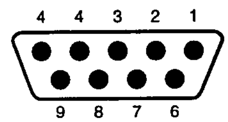
Inputs such as transformer temperature relays and circuit breaker status (open or closed) are typical applications. The outputs can be used to close contactors, trip circuit breakers, provide remote indication, various degrees of alarming, and so on.

For applications in which it is necessary to monitor or control power system elements that are not specifically designed for digital communications, the S7-I/O addressable relay provides that capability. The basic S7-I/O device allows up to 14 digital inputs and 10 outputs in a small, easy to connect package. I/O capacity can be increased in blocks of 8 channels up to a maximum of 64.

4.6.2 Communications Wiring

The S7-I/O device should be connected to the ACCESS system using a SEAbus RS-485 connection, which is a shielded twisted-pair connection that uses the communications port at the bottom of the S7-I/O main unit. The preferred method to connect ACCESS devices is a loop, so that a break in the cable will not prevent communications.

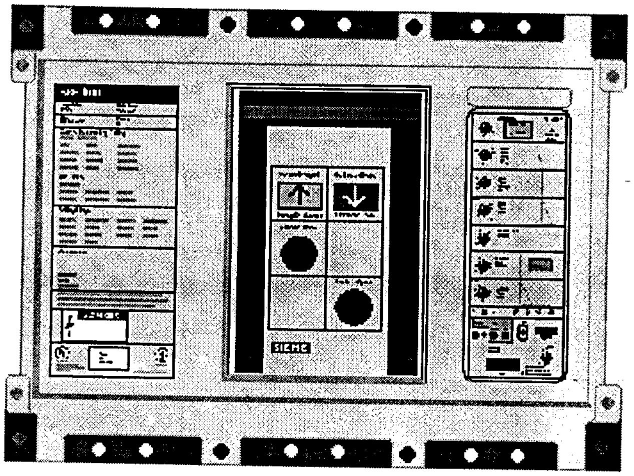
The RS-485 connections are made with a pair of data wires and a shield. The data wires are labeled "Transmit/Receive (+) and "Transmit/Receive (-)," and are wired in parallel. A shield is also used. Connect the shield at one end of the communications link only. The connector used on the S7-I/O unit is a socket (female) 9-pin D-shell connector. See **Figure 4.8** for RS-485 pin assignments.



Pin	Function
1	Logic Ground
3	Tx/Rx +
5	Logic Ground
8	Tx/Rx -

Figure 4.8 S7-I/O Communication Port Pinout

4.7 SB Trip Unit



4.7.1 General Considerations

The insulated case circuit breakers (ICCBs) bridge the performance and feature gap between molded case circuit breakers and low-voltage power circuit breakers such as the Static Trip III™ trip unit. The SB circuit breakers are available with microprocessor-based trip systems and are compatible with the ACCESS system.

The SB circuit breakers are either fixed-mounted (bolted directly to the supporting structure with the cables or bus tied directly to the back of the breaker) or they are drawout-mounted. Drawout-mounting requires a mechanical assembly called a cradle that guides the circuit breaker's mechanical insertion and removal from the circuit's connected position.

Both test connections and ACCESS connections are made through the Universal Test Pin Port on the front of the trip unit that comes with the ICCB. From the SB circuit breaker, run the multiconductor ribbon cable to secondary connections within the circuit breaker assembly.

If the SB circuit breaker is drawout-mounted, the ACCESS connections are run within the breaker assembly to the lower left side of the secondary disconnect assemblies. There is a matching set of secondary assemblies on the fixed cradle. For the fixed mounted breaker, there are terminal blocks mounted in the same lower left position.

In either circuit breaker mounting arrangement, connect the electronic trip unit installed in the ICCB to the same Expansion Plug used for the Sensitrip trip units as shown in **Figure 4.14** (see also **Appendix G**). Connect the Expansion Plug to the Multiplexer Translator.

There is no local ACCESS-specific configuration for the correct breaker. All configuration is done through the Multiplexer Translator.

4.7.2 Using the Multiplexer Translator

The Multiplexer Translator (MT) is a microprocessor-based device designed to accept up to eight independent communication inputs, to temporarily store data, and to send data to an ACCESS supervisory device on request. The MT also assigns circuit breakers within a zone interlock network and defines the fault protection: ground, short time, or both.

The MT accepts data and zone interlocking input from the SB circuit breaker and the Sensitrip trip unit. The MT accepts only zone interlocking input from the Static Trip III trip unit.

The MT appears to the ACCESS system as a single RS-485 field device with a single address. The eight individual devices connected to its inputs are called MT device numbers by the supervisory device. These MT device numbers are automatically assigned as a function of the input connection that is chosen.

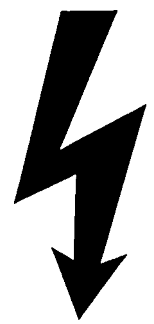
Input connections are made using four-pin telephone-grade plugs and jacks. Use the proper Siemens cable for the interconnections (see **Appendix A**). For SB circuit breakers, connect the devices to the MT using an isolation module called an Expansion Plug described in **Section 4.7.3**. The MT is powered by 120 VAC.

⚠ CAUTION

Do not use standard telephone cable with the MT. Will cause damage to devices.

Use proper Siemens cable only.

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

There are no accessible controls or adjustments on the outside of the MT. All connections and settings are located beneath the steel cover. Follow these steps to install the MT.

1. Disconnect power to the MT.
2. Remove the four machine screws securing the cover to the frame of the MT.
3. Insert the RS-485 cables through one of the holes at the bottom of the frame.
4. Connect both the white and the black wires. The MT has separate terminals for the incoming and outgoing communications leads. These connections are tied together on the circuit board. Attaching the wires as shown maintains the continuity of the RS-485 loop.
5. Make sure the wires are not touching any other terminal or electronic device. Using wire ties or other means, secure the communications cable so that they cannot become disconnected.

For local configuration, set the SEAbus address of a Multiplexer Translator using the five position DIP switch located on the electronic circuit board just below the eight configuration switches on the left side of the device as illustrated in **Figure 4.9**. An MT can have an address from 1 to 31 (decimal). The address "0" is reserved for troubleshooting software routines.

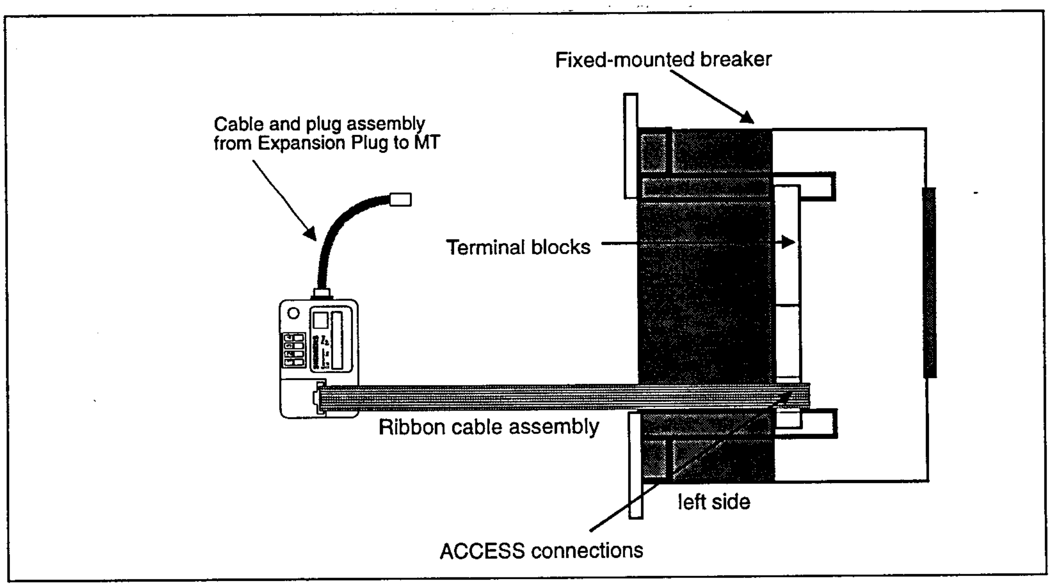


Figure 4.9 Fixed-Mounted SB Trip Unit with Expansion Plug

Use the address switch located on the MT to set the MT address (from 1 to 31), and enter the same address using the supervisory software. These two settings must be identical. **Figure 4.10** illustrates the address switch on the MT, and **Table 4.1** provides the proper address settings.

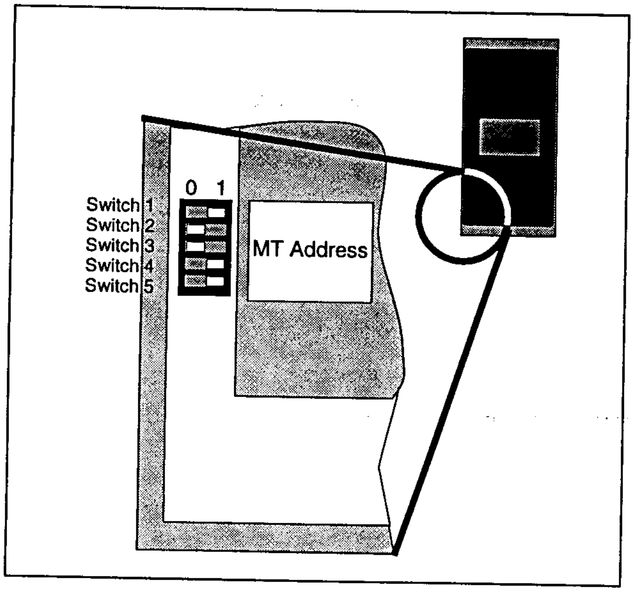


Figure 4.10 MT Address Switch

Devices that use the MT to connect to the ACCESS network have MT Address and Device Number fields in their configuration screens on the Power Monitor unit. In the MT Address field, enter the address for the MT that the device is connected to. In the Device Number field, enter the device number (1 to 8) corresponding to the device number port on the MT that the device is connected to.

Set the data rate of the MT using the supervisory software. There is no local configuration procedure for setting the data rate. BAUD RATE is the only parameter that is configured remotely.

Table 4.1 MT Address Switch Settings

Address	SW1	SW2	SW3	SW4	SW5
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	0
28	0	0	1	0	0
29	1	0	1	1	0
30	0	1	1	1	1
31	1	1	1	1	1

4.7.3 Using the Expansion Plug

The SB insulated case circuit breakers connect to the ACCESS system through the Expansion Plug that connects them to the MT. Refer to **Figure 4.11**. Proper interface techniques on the ACCESS system require electronic isolation between devices. This minimizes problems from voltage differences between the devices in the system. The Expansion Plug provides this isolation.

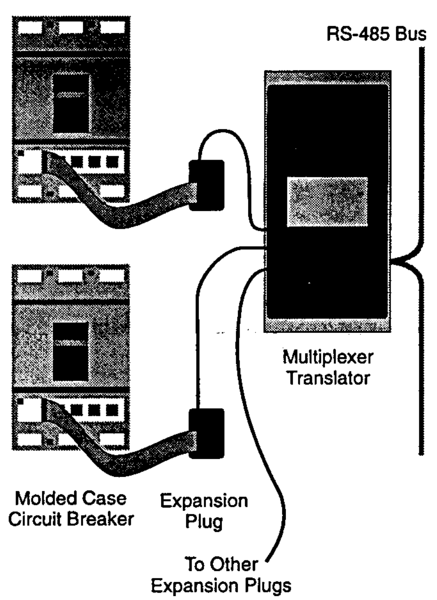


Figure 4.11 Molded Case Circuit Breaker, Expansion Plug and Multiplexer Translator

Although the Expansion Plug contains electronic circuitry, it requires no separate control power source. It receives power from the MT through the interconnecting cable. You do not need to open the Expansion Plug because there are no internal connections or adjustments.

Refer to **Figure 4.12** and to **Appendix G** for details on the connections to the Expansion Plug.

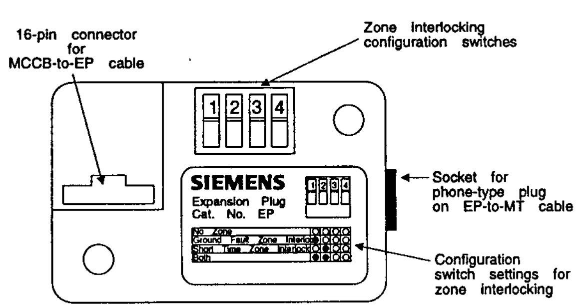


Figure 4.12 Expansion Plug Interface Cable Locations

Both the cable from the circuit breaker to the EP and the cable from the EP to the MT are made with the connectors already attached. Once the breaker (including the trip unit), the EP, and the MT are positioned, plug in the appropriate cables. The connectors are all keyed so there are no rules for establishing polarity.

The ribbon cable connector is made at a right angle to the trip unit so that the cable lies flat against the circuit breaker, under the front cover of the switchboard. First run the ribbon cable to the EP, then run the supplied telephone cable from the EP to the MT.

> **Note:** Make sure you do not run the cable parallel to a power conductor.

There is no local ACCESS-specific configuration for the circuit breaker. All configuration is done through the MT to a supervisory device.

4.8 Sensitrip Trip Unit

4.8.1 General Considerations

The Sensitrip trip unit is the electronic trip unit used in the Sentron Series molded case circuit breakers (MCCB). These small trip units have microprocessor-based trip systems that are programmed to support connection to the ACCESS system.

Molded case circuit breakers are usually not equipped with terminals for control circuits and accessories. They are designed to be mounted end-to-end and side-by-side leaving only the front panel for you to make adjustments on the trip unit. Connections are needed for functions such as testing, zone interlocking and communications. On the Sentron Series breakers, these connections are made through the Universal Test Pin port on the front panel of the trip unit.

In addition to the lack of space for control terminals on the molded case breakers, the trip units lack extra room for electronics to support optional functions such as communication and zone interlocking. Accordingly, the extra circuit elements for these features are provided by the Expansion Plug.

4.8.2 Using the Multiplexer Translator

Sensitrip trip units are capable of communication and zone interlocking when they leave the factory. The trip unit and several other circuit protection devices use the Multiplexer Translator (MT) to connect to the ACCESS system.

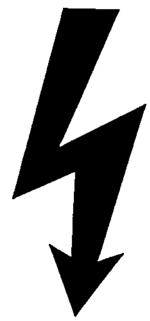
The Multiplexer Translator is a microprocessor-based device designed to accept up to eight independent communication inputs, to temporarily store data, and to send data to an ACCESS supervisory device on request. The MT also assigns circuit breakers within a zone interlock network and defines the fault protection: ground, short time, or both.

The MT accepts data and zone interlocking input from the Sensitrip trip unit. The MT accepts zone interlocking input only from the Static Trip III trip unit.

The MT appears to the ACCESS system as a single RS-485 field device with a single address. The eight individual devices connected to its inputs are called MT device numbers by the supervisory device. These MT device numbers are automatically assigned as a function of the input connection that is chosen.

Input connections are made using four-pin telephone-grade plugs and jacks. Use the proper Siemens cable for the interconnections (see **Appendix A**). For Sensitrip trip units, connect the devices to the MT using an isolation module called an Expansion Plug described **Section 4.8.3**. The MT is powered by 120 VAC.

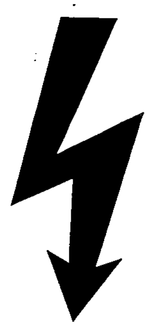
⚠ CAUTION



Do not use standard telephone cable with the MT. Will cause damage to devices.

Use proper Siemens cable only.

⚠ DANGER



Hazardous voltage. Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

There are no accessible controls or adjustments on the outside of the MT. All connections and settings are located beneath the steel cover. Follow these steps to install the MT.

1. Disconnect power to the MT.
2. Remove the four machine screws securing the cover to the frame of the MT.
3. Insert the RS-485 cables through one of the holes at the bottom of the frame.
4. Connect both the white and the black wires. The MT has separate terminals for the incoming and outgoing communications leads. These connections are tied together on the circuit board. Attaching the wires as shown maintains the continuity of the RS-485 loop.
5. Make sure the wires are not touching any other terminal or electronic device. Using wire ties or other means, secure the communications cable so that they cannot become disconnected.

Use the address switch located on the MT to set the MT address (from 1 to 31), and enter the same address using the supervisory software. These two settings must be identical. **Figure 4.13** illustrates the address switch on the MT, and **Table 4.1** provides the proper address settings.

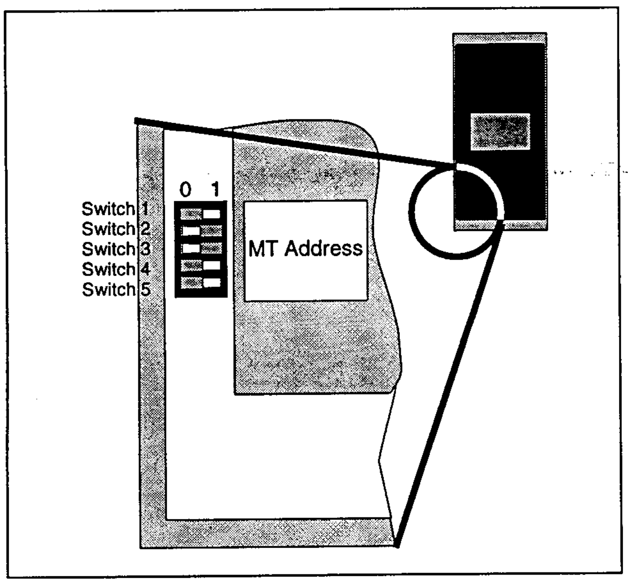


Figure 4.13 MT Address Switch

Devices that use the MT to connect to the ACCESS network have MT Address and Device Number fields in their configuration screens on the Power Monitor unit. In the MT Address field, enter the address for the MT that the device is connected to. In the Device Number field, enter the device number (1 to 8) corresponding to the device number port on the MT that the device is connected to.

Set the data rate of the MT using the supervisory software. There is no local configuration procedure for setting the data rate. BAUD RATE is the only parameter that is configured remotely.

Table 4.2 MT Address Switch Settings

Address	SW1	SW2	SW3	SW4	SW5
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	0
28	0	0	1	0	0
29	1	0	1	1	0
30	0	1	1	1	1
31	1	1	1	1	1

4.8.3 Using the Expansion Plug

The Sensitrip trip unit connects to the ACCESS system through the Expansion Plug that connects them to the MT. Proper interface techniques on the ACCESS system require electronic isolation between devices. This minimizes problems from voltage differences between the devices in the system. The Expansion Plug provides this isolation.

Although the Expansion Plug contains electronic circuitry, it requires no separate control power source. It receives power from the MT through the interconnecting cable. You do not need to open the Expansion Plug because there are no internal connections or adjustments.

Refer to **Figure 4.14** and to **Appendix G** for details on the connections to the Expansion Plug.

Both the cable from the trip unit to the EP and the cable from the EP to the MT are made with the connectors already attached. Once the trip unit, the EP, and the MT are positioned, plug in the appropriate cables. The connectors are all keyed so there are no rules for establishing polarity.

The ribbon cable connector is made at a right angle to the trip unit so that the cable lies flat against the trip unit, under the front cover of the switchboard. First run the ribbon cable to the EP, then run the supplied telephone cable from the EP to the MT.

Note: Make sure you do not run the cable parallel to a power conductor.

There is no local ACCESS-specific configuration for the circuit breaker. All configuration is done through the MT to a supervisory device. For more information, refer to the *Multiplexer Translator (MT) Information and Instruction Guide*, (Bulletin 2.21-1A).

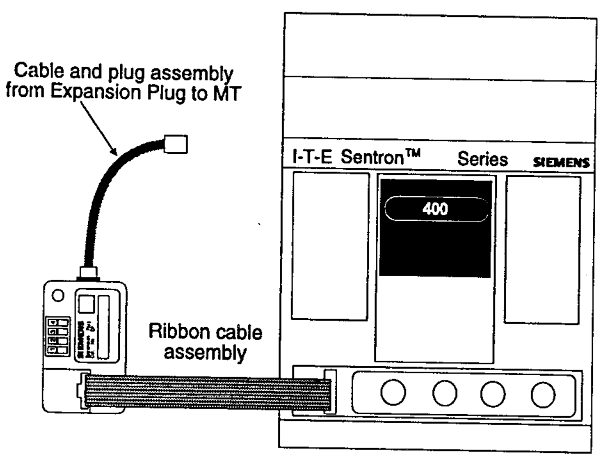


Figure 4.14 Sensitrip Trip Unit with Expansion Plug

4.8.4 Zone Interlocking

In addition to its primary function of circuit isolation, the device also provides information related to the position of the circuit breaker in a zone interlocking scheme. Molded case and insulated case circuit breakers use the MT to handle the zone interlocking communications.

This zone interlocking information is set using the four-position switch on the front of the Expansion Plug. The setting code is located on the front label.

In a zone interlock network, circuit breakers are grouped into zones. Zone 1 includes the circuit breaker(s) nearest the power source. Zone 2 includes the circuit breaker(s) at the next level away from the power source. Zone 3 includes the circuit breaker(s) in the last level away from the power source. The MT and the Expansion Plug configure these circuit breakers into their respective zones.

For further information on zone interlocking, refer to **Appendix G**; and for zone interlocking as it relates to molded case, insulated case, and power circuit breakers, refer to the individual product instruction books.

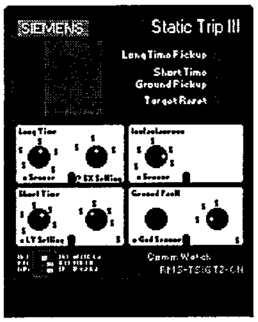
4.8.5 Input and Output Connections

On the front of the trip unit of a molded case circuit breaker is a 16-pin connector. This connector is standard equipment throughout the Sentron line. In addition to the communications interface, this connector is also used for the Universal Test Set (TS-31) for device testing.

The Expansion Plug has a 16-pin connector on its front as illustrated in **Figure 4.12**. A factory-prepared cable is used to connect the circuit breaker with the Expansion Plug. Simply plug the cable into both devices. The connectors are keyed allowing you to connect the cable with no polarity problems. Make sure that you do not connect the cable backwards. When properly inserted, the ribbon cable should hang below the connector. Route the cable so that it does not interfere with the switches on the front of the circuit breaker.

Use the proper Siemens cable for connecting the Expansion Plug to the MT. Refer to **Appendix G** for the proper cable catalog number and length of the cable assembly.

4.9 Static Trip III Trip Unit



The Static Trip III microprocessor-based trip units are supplied on Siemens RL low-voltage power circuit Breakers. In addition to the primary function of protecting circuits, this series of trip units also offers ACCESS communication of current values, power metering, and power relaying. The Static Trip III trip unit can be supplied with a circuit breaker display unit (BDU). If the trip unit is configured with the communications Open or Close option, the operator may open or close the breaker from the supervisory device. Zone interlocking capability is provided as standard on trip units with short time or ground fault protection.

The Static Trip III trip unit mounts onto a slide-type bracket at the lower right side of RL circuit breakers. Although the RL circuit breaker can be mounted as a fixed device, it is provided almost exclusively as a drawout breaker in low-voltage switchgear or switchboards. The drawout assembly contains primary circuit disconnects, secondary circuit disconnects, and communication circuit disconnects. Matching disconnects are mounted in the equipment cubicle. These disconnects engage automatically when the circuit breaker is racked into the cubicle.

Figure 4.15 shows the wiring at the terminals on the side of the fixed cradle assembly for the SEAbus interface point with the breaker cubicle. **Figure 4.16** shows a typical switchgear assembly.

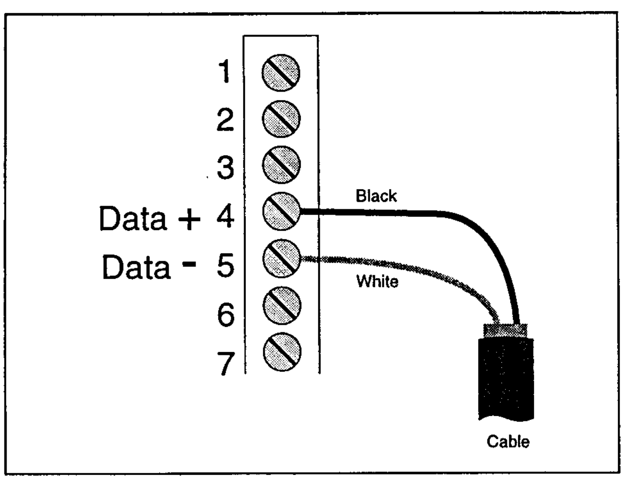


Figure 4.15 Detail of Terminal Strip on Side of Cradle

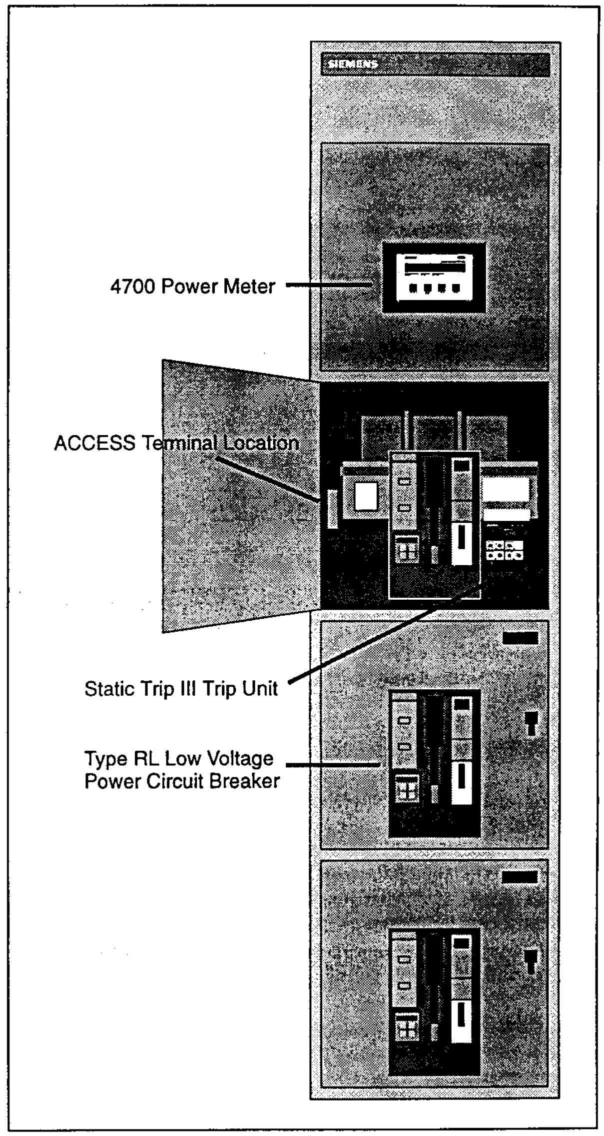


Figure 4.16 Placement in Typical Switchgear Section

Although the circuit-protecting portion is self powered, the communications portion of Static Trip III trip unit requires 15 VDC to terminals 2 and 3 of the communications disconnect. The RS-485 SEAbus connections are made to terminals 4 and 5 of the same disconnect.

Using the communications close and open feature or the alarm feature requires interposing relays that are mounted in the equipment cubicle and are connected through terminals 8, 9, and 10 of the communications disconnect. The output of these relays is connected to the circuit breaker close and open circuitry or to a remote annunciator.

When furnished, the breaker display unit (BDU) is mounted on the front plate of the circuit breaker's drawout element and is connected to the Static Trip III trip unit by its cable.

4.9.1 Local Configuration

Local configuration of the Static Trip III trip unit requires a breaker display unit (BDU); otherwise, configure them remotely as described in **Section 4.9.2**. The BDU is shown in **Figure 4.17**.

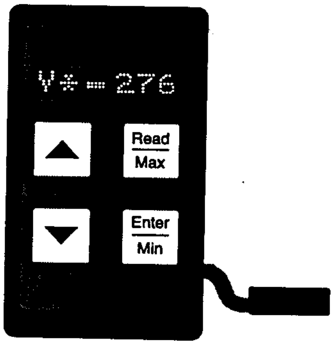


Figure 4.17 Breaker Display Unit (BDU)

To configure a Static Trip III trip unit with a BDU, follow these steps:

1. Press the Read/Max and the **Enter/Min** keys simultaneously to enter program mode. The word "PROGRAM" appears in the LED display.
2. Press the ▼ key to display the PASSWORD parameter. You must enter the correct password to change the setup parameters.
3. Enter the password using the ▲ and ▼ keys to count up and down. (Enter the right-most digit first. The cursor then moves to the left to enter the next digit until all four digits are entered.) After entering the password, either "Correct" or "Incorrect" appears on the display.
4. When you have entered the correct password, press the ▼ key to scroll to "ADDRESS".
5. Press **Read** to read the address, or press **Enter** to return to "ADDRESS" in the main scrolling sequence.
6. To change the address while the present address is displayed, use the ▲ and ▼ keys to enter the new address. Press **Enter.** The word "Enter?" appears.
7. Press **Enter** to accept the change and return to the main scrolling sequence.
8. Press the ▼ key to scroll to the "BAUD" parameter. Press **Read** to display the present data rate.
9. To change the data rate use the ▲ or ▼ key to display the desired rate, and press **Enter.** "Enter?" appears.
10. Press **Enter** again to accept the change and return to the main scrolling sequence.

You may view and modify other set points as described in the *Static Trip III Information and Instruction Guide* (Manual No. SG3118).

To return to the DATA mode, press the **Read/Max** and the **Enter/Min** keys at the same time from any parameter in the main scrolling sequence.

4.9.2 Remote Configuration

To configure the address, the data rate, and all other parameters of the Static Trip III trip unit on circuit breakers without BDUs, use the supervisory device. If you have a BDU, this method is optional. For remote configuration using WinPM software, refer to the *WinPM User's Manual* (SG-6118-02). If you are using the Power Monitor unit, refer to the *Power Monitor Unit Operator's Manual* (Manual No. SG-4018-01) and the *Static Trip III Information and Instruction Guide* (Manual No. SG3118).

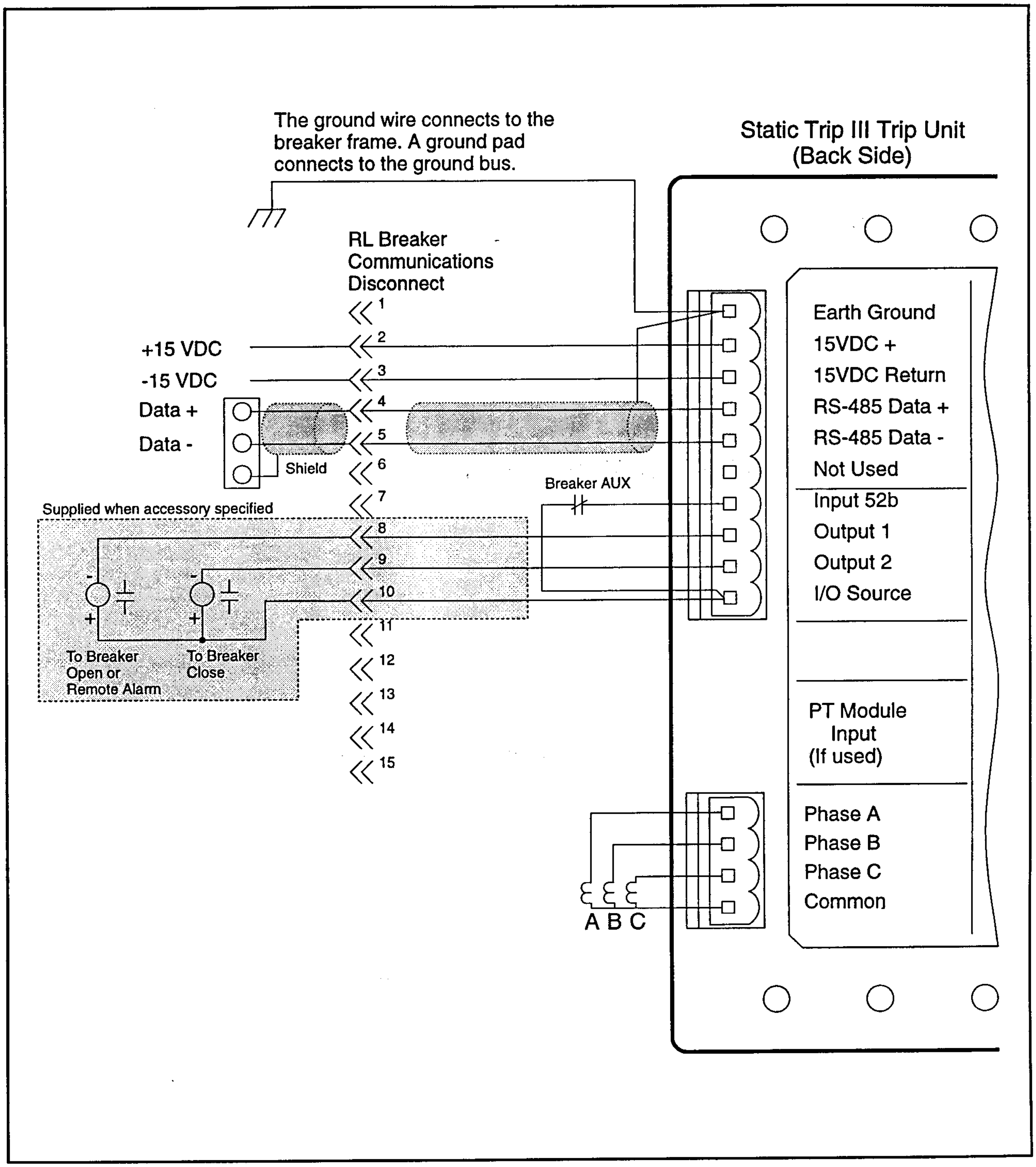
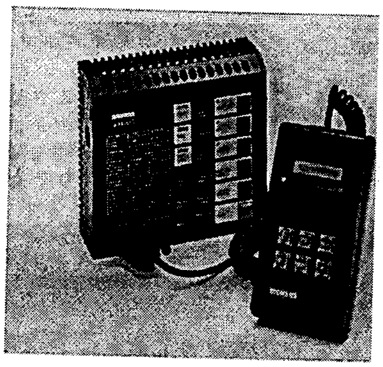


Figure 4.18 Wiring Diagram for RL Drawout Breaker Element and Static Trip III Trip Unit in Typical Cubicle

4.10 SAMMS Motor Protection and Control Relay

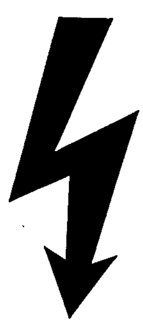


4.10.1 General Considerations

The Siemens Advanced Motor Master System (SAMMS) is a user-programmable motor protection and control relay. Available in three models, the SAMMS device provides reliable, flexible protection for all NEMA/EEMAC-size, low-voltage motors from 0.3 to 540 A rating.

As a compact system with programmable control logic, the SAMMS device replaces a collection of timers, control relays, push-buttons, selector switches, pilot devices, and associated wiring. The SAMMS device requires a control power transformer to power the microprocessor-based controller and the optional hand-held communicator. The SAMMS device requires a source of 12 VAC power to operate. Siemens motor control equipment includes a 12 VAC connection on the control power transformer to power the SAMMS device.

⚠ CAUTION



The control, power supply, and motor leads must be laid separately.

They must not be fed through the same conduit or trunking.

4.10.2 Device Connection

The SAMMS device connects to SEAbus RS-485 through a SAMMS Communication Module CM-1. This module requires a 12 VDC, 50 mA power supply. The connections for the SAMMS device are illustrated in **Figure 4.19**.

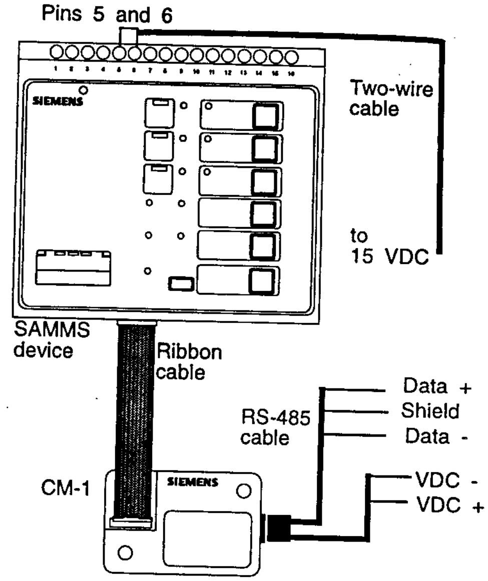


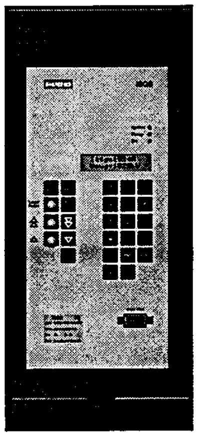
Figure 4.19 Connections for SAMMS Relay

4.10.3 Configuration

There are no ACCESS-specific parameters to setup locally for the SAMMS device. These parameters are configured remotely through the supervisory device. If you are using WinPM software on a PC to configure a SAMMS relay, refer to the *WinPM User's Manual* (SG-6118-02).

If you are using a Power Monitor to configure a SAMMS relay, refer to a previous edition of this manual.

4.11 Intelligent SwitchGear System (ISGS) Relay



The Intelligent SwitchGear System (ISGS™) is a high-speed, numerical, microprocessor-based protective relay designed to be easily incorporated into a computer-monitored medium voltage power system. The relay is designed and manufactured in accordance with the latest provisions of the applicable IEEE, ANSI, and NEMA standards.

The ISGS relay is typically installed in a switchgear unit or relay panel.

Communications connections made to terminals 48 to 50 require shielded twisted pair wire.

CT connections should be made with the polarity end of the CT connected to current terminal marked with an asterisk (*).

The ISGS relay must be connected to a host computer in order for it to communicate with other devices. The relay supports both RS-232 and RS-485 (optional) data interfaces. The use of either of these data interfaces will allow the same level of access to the system as the front panel keypad.

4.11.1 PC Communications RS-232

The RS-232 interface (front port) is intended only for short-term connections to a portable computer. Use this interface to perform initial setup or to read the ISGS relay data logs or waveform buffers using an appropriate software program. To connect your PC to the front port, follow these instructions:

1. Remove the relay case front cover.
2. Locate the RS-232 connector on the front panel of the cradle assembly.
3. Connect the PC to the front panel RS-232 port using a standard DB-9 serial port connection cable DB-9 male to DB-9 female or DB-25 female depending on the type of port). This connection does not require the use of special adapters or a null-modem cable.

4.11.2 Network Communications (RS-485)

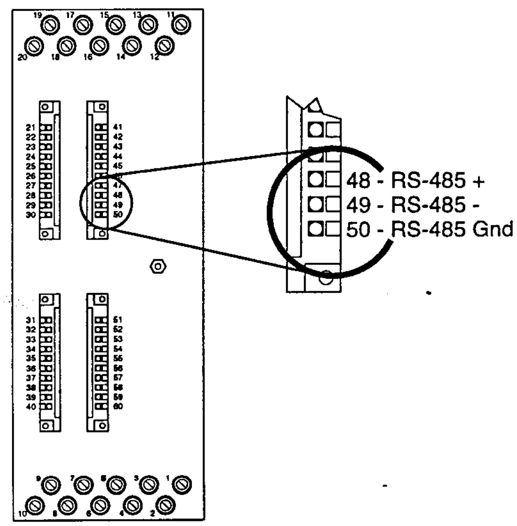
The optional RS-485 interface (rear port) allows remote communication over a shielded twisted pair wire at distances of up to 4000 feet. Use this interface together with an appropriate software program for remote monitoring and control of the ISGS relay.

To connect the ISGS relay to your electrical distribution system, follow these instructions:

1. Locate the RS-485 connector on the rear of the M1 case.
2. Use shielded twisted pair wire to connect pins 48, 49, and 50 to your electrical distribution system.

To connect the ISGS relay to your PC via the rear port

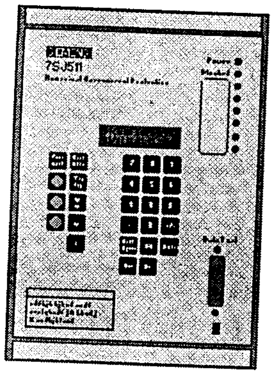
- *directly*, use an RS232 to RS-485 converter.
- *via modem*, use an RS-232 to RS-485 converter and a null modem.



ISGS Relay - Rear View

Figure 4.20 ISGS Communications Connections

4.12 Protective Relays



Protective relays from Siemens AG (model numbers beginning with 7)

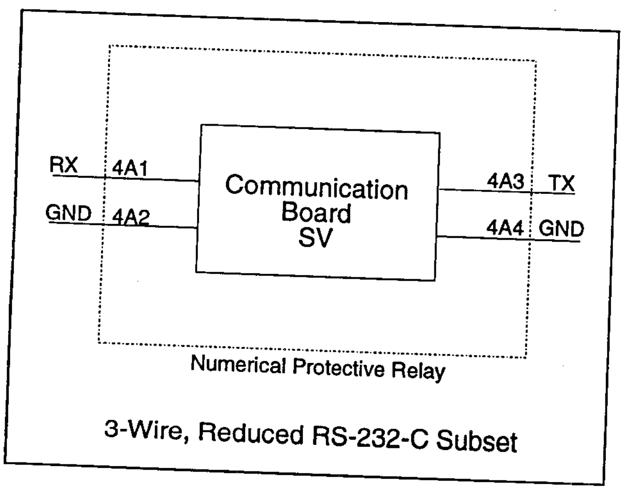


Figure 4.21 3-Wire, Reduced RS-232 Subset

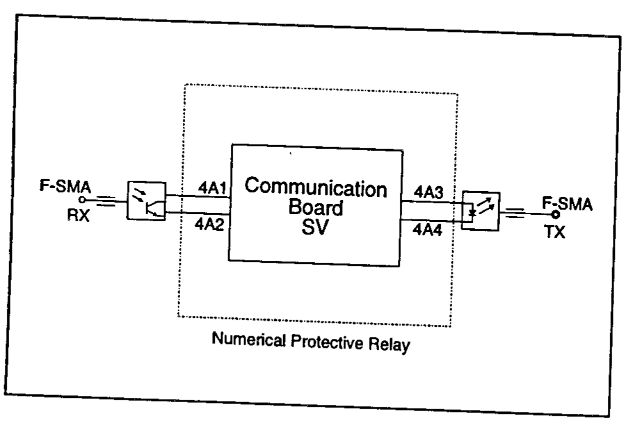
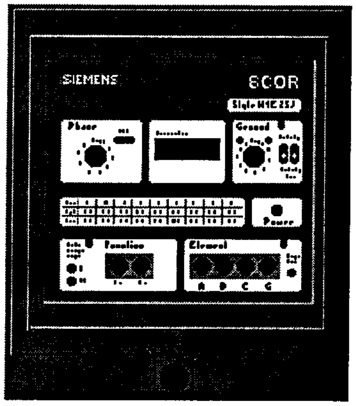


Figure 4.22 Numerical Protective Relay

4.13 SCOR Unit



4.13.1 Overview

The Siemens Communicating Overcurrent Relay (SCOR) is a microprocessor-based, time-instantaneous relay designed for easy incorporation into a computer-monitored power system. The relay is available in a number of styles to supply two-phase-with-ground, three-phase, and three-phase-with-ground protection for 60 Hz power systems. It also displays amperes and amperes demand.

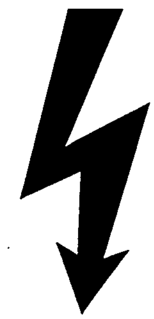
Note: The SCOR unit does not need to be connected to an ACCESS system to function as an overcurrent relay.

The SCOR unit must have the optional plug-in communications board called Option 2-C to interface with the ACCESS system. This board allows remote monitoring of real-time system and circuit breaker information, and it allows the transmission of event and historical data, as well as remote configuration of operating parameters.

The SCOR unit must be powered from an external source. The relay is available in either a 48 VDC or a 120 VAC/125 VDC version. Connect the power supply to terminals 3 and 4 on the back of the relay. Terminal 3 is the positive terminal if DC is used. When cabling the RS-485 system, use only the (+) and (-) labels for proper RS-485 polarity. If required, connect the shield to the GND screw lug. **Figure 4.23** illustrates the back panel of the SCOR unit.

You must configure the SCOR unit after you install it. Configure the circuit protection modes, time curves, and so on, as well as the communications function. You may configure the SCOR unit either locally or remotely.

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

4.13.2 Local Configuration

Follow the procedure below to configure the SCOR unit locally. Refer to the *SCOR Operator's Manual* (Manual No. SG-9228) for more information about the front panel.

1. Set the Phase Tap selector (and ground if present) to the desired tap on the face of the relay.
2. To enter configuration mode (ConF) from the data collection mode (dAtA), press down on the **Mode/Next** switch repeatedly until dAtA appears on the front panel display.
3. Next, hold the **Mode/Next** switch up for approximately five seconds, during which time the display first becomes blank, and then ConF appears.
4. After ConF appears on the display, release the **Mode/Next** switch. Releasing the **Mode/Next** switch before ConF appears causes the SCOR unit to return to the dAtA mode.
5. Upon releasing the **Mode/Next** switch, the Status LED lights up and ConF appears on the Func/Data display.
6. To advance to the Addr register (parameter that programs the address), press down on the **Mode/Next** switch once; Addr appears on the display.
7. Release the switch and the present address appears on the display. If necessary, enter the new address using the **Up/Down** switch to scroll through the available choices.

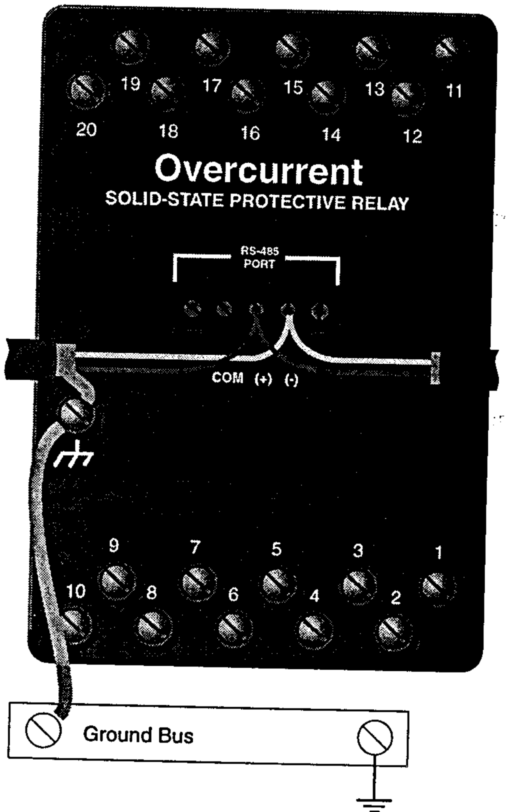


Figure 4.23 SCOR Communications Connections

Note: Relays initially are configured with the address 222. Change this address prior to final system configuration. Use the **Up/Down** switch to change the address.

8. Advance to the bAUd (baud rate) register by pressing down on the **Mode/Next** switch. Use the **Up/Down** switch to select the SEAbus data rate (usually 4800).

Note: Configuring the remaining settings and options is easier using remote configuration from a supervisory device. To configure the SCOR unit with the Power Monitor, go to Step 9. If not, set the remaining registers by stepping through them using the **Mode/Next** switch and by setting them using the **Up/Down** switch. Refer to the *SCOR Operator's Manual* (Manual No. SG-9228).

9. After configuring the relay, press up on the **Mode/Next** switch repeatedly until ConF appears.

10. Hold the **Mode/Next** switch up in the Mode position until the message P EE appears. This indicates that the data changes made while in configuration mode have replaced the contents of the configuration information stored in the nonvolatile memory. After a brief interval, the display changes again to dAtA. The relay now returns to its normal operating mode.

4.13.3 Remote Configuration

You can configure the address of the device and other parameters from the supervisory device.

For details, refer to the operator's manual for the supervisory software.

Once configured, the SCOR unit is ready to be an active part of your ACCESS system. Record the programmed address on the ACCESS Device Log, see **Chapter 2**. This SCOR unit retains its address when exchanged with other installed SCOR units.

5 Installing Supervisory Hardware

Supervisory hardware refers to electronic devices that are used in the polling, monitoring, and controlling of field devices within an electrical distribution system. Supervisory hardware includes stand-alone devices capable of running supervisory software, such as a PC or industrial computer running WinPM software; or complementary devices that allow or protect communication flow between supervisory and field devices, such as a modem, a transient eliminator, a converter, or a bridge.

5.1 Installing a PC or Industrial Computer

There are several configurations possible for supervisory hardware in an ACCESS system. The configurations require one of these options:

- A PC running WinPM software communicating with devices
- Several industrial computers or Host PCs communicating with devices
- Several industrial computers or Host PCs reporting to a PC running WinPM that can also communicate with devices

5.2 Connecting Modems

Modems are electronic devices used for sending and receiving communication data over long distances (up to 3.5 miles). The modems used with the ACCESS system are "short-haul modems" and can easily handle a distance of up to several miles. The modems are self-powered, requiring no external power supply.

"Modem" is a contraction of the terms *modulator* and *demodulator.* At the transmitting end, the modem changes the digital signals of the communication bus to a modulated audio signal that can be sent over a variety of media. At the receiving end, the modem changes the modulated signal back to the original digital form. Modems can convert digital signals of a computer to an analog form for sending over ordinary phone lines.

Installing modems includes configuring them for their positions in the ACCESS system and attaching the communications cables to them. Each modem has an internal terminal block with five connections: XMT+, XMT-, GND, RCV+, and RCV-. Follow these steps to install the modems.

1. Separate the two parts of the modem's plastic cover by firmly pressing the marked places on the sides, starting at the cable end.
2. For the RAD SRM-6AC/F(M) modem, connect the communication wire to the terminal pair connected to XMT and receive pair connected to RCV. Do not connect the shield wire to the modem GND terminal.
3. For the RAD SRM-6AC/F(M)/RJ-11 modem, plug the telephone cable into modem's RJ-11 jack.
4. Make sure both modems are set for DCE.
5. Set the CARRIER jumper to ON (carrier on continuously) for the modem that connects to the Power Monitor unit (RAD SRM-6AC/F) and to CTR (carrier controlled by RTS) for the modem that connects to the Host PC (RAD SRM-6AC/M).
6. Close the modem by pressing the two plastic covers together.
7. Plug the other end of the telephone cable to the RJ-11 jack on the wall plate connected to a transient eliminator. (Refer to **Appendix B** for more details on transient eliminators.)
8. Connect the modem with the socket (female) connector (RAD SRM-6AC/F) to the 25-pin connector on the eight-port cable attached to the ARTIC card, and tighten the screws on each side of the connector.
9. Connect the modem with the plug (male) connector (RAD SRM-6AC/M) to the 25-pin connector of the Power Monitor unit, and tighten the screws on each side of the connector.
10. Ground the shield at the Transient Eliminator. Do not ground the shield at the modem's ground connection terminal. ACCESS Host PC connections typically use modems and transient eliminators together. (Refer to **Appendix B** for more details on transient eliminators.)

Cabling between the PC and field devices is typically straight point-to-point. Use short-haul modems to provide ground isolation and to increase the distance between the PC and field devices.

When using short-haul modems, the transmitter output of each modem is cabled to the receive input of the other. One short-haul modem is connected to one of eight RS-232 ports.

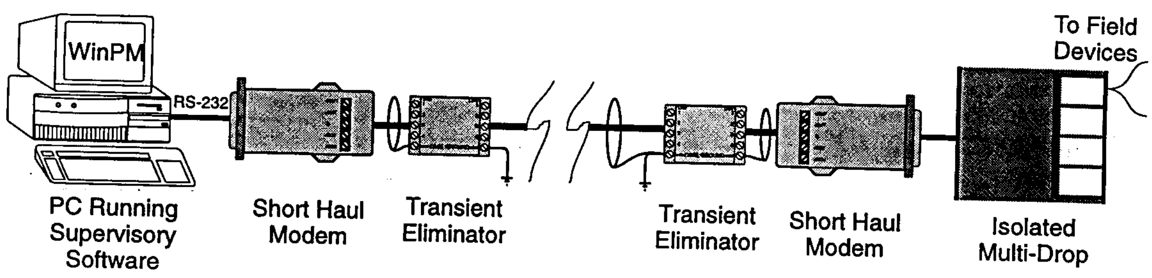


Figure 5.1 Interface to a Short-Haul Modem

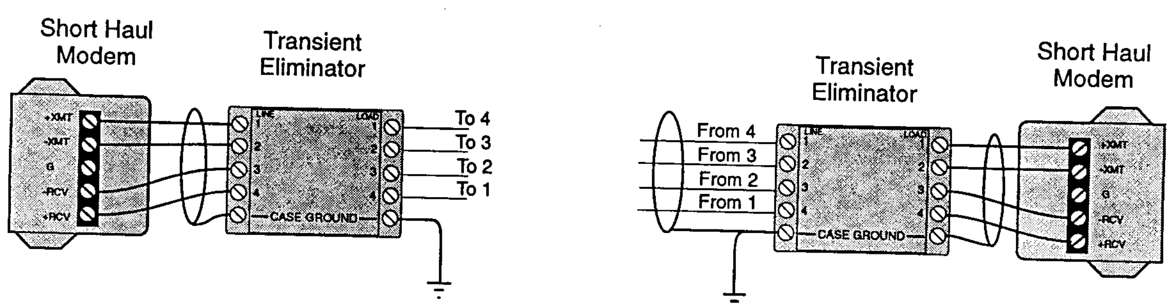


Figure 5.2 Short-Haul Modem Wiring Detail

Table 5.1 Modem Signal Connections

Short Haul Modem Signal Connections (May be Wired at Modems or at Transient Eliminators)	
Supervisory End Modem Terminal	**Field Device End Modem Terminal**
+XMT	+RCV
-XMT	-RCV
+RCV	+XMT
-RCV	-XMT

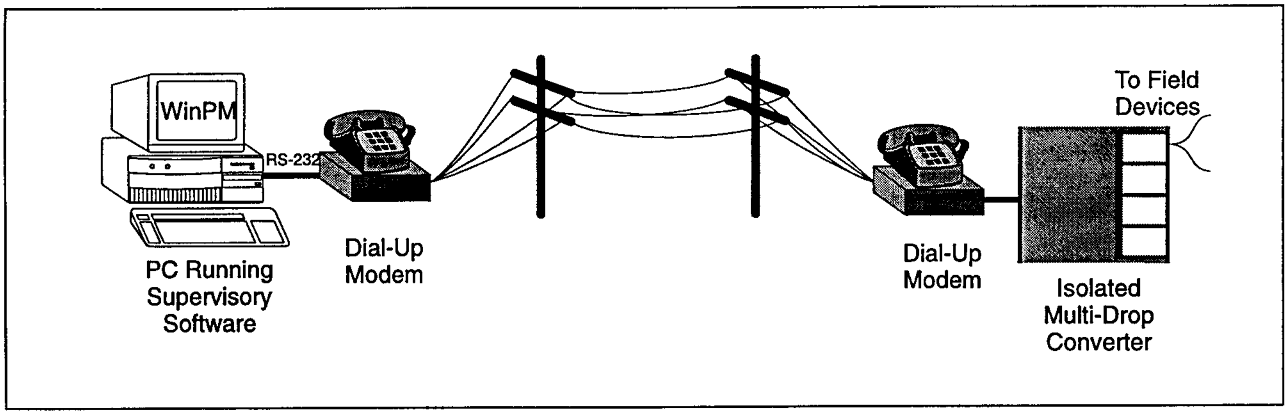


Figure 5.3 Dial-Up Modem To Remote Devices

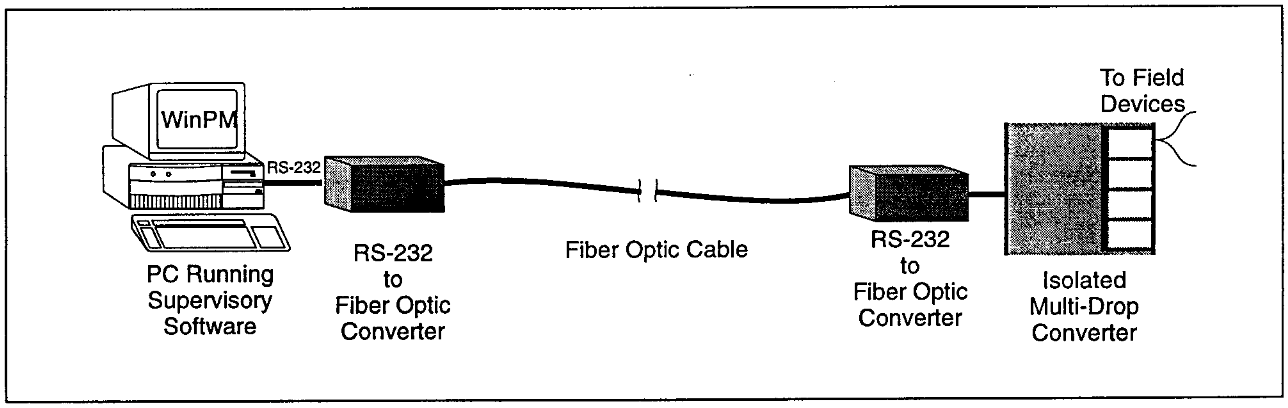


Figure 5.4 Fiber Optic Modem to Remote Devices

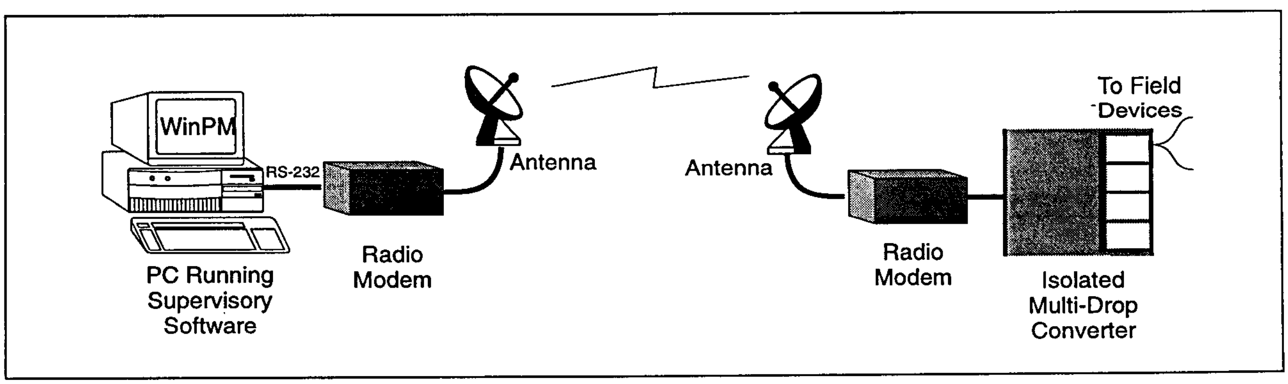


Figure 5.5 Radio Modem to Remote Devices

5.3 Connecting Transient Eliminator

Lightning and electrical switching transients can cause significant voltage and current surges on a communication cable. These surges can easily damage the electronic circuit components. Transient eliminators provide protection against these spikes and surges.

For surge protection, use a transient eliminator whenever an ACCESS communication line leaves a building, either on an RS-232 connection (using modems) or on an RS-485 loop. Inside a building, for long distances (over 1000 feet) between devices or in electrically noisy environments, use transient eliminators for additional protection. (Refer to **Appendix B** for more details on transient eliminators.)

Siemens recommends two transient eliminators for the ACCESS system. Both transient eliminators are made by MCG Electronics. Use the DLP-10-6V15, illustrated in **Figure 5.6**, for the single twisted-pair cable used in the RS-485 loops. Use the DLP-20-6V15, illustrated in **Figure 5.7** for the two twisted-pair cable used between the Power Monitor unit and the Host PC. **Figure 5.6** and **Figure 5.7** illustrate the proper wiring for the single twisted-pair connection used in the RS-485 network and for the Power Monitor-to-Host PC connection, respectively. The CASE GROUND of each transient eliminator is a continuous connection through the device with no isolation between the terminals.

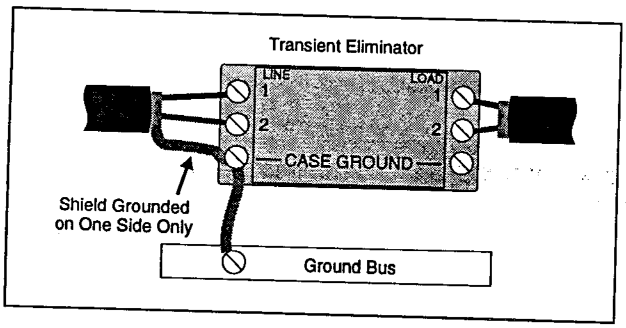


Figure 5.6 Transient Eliminator Connections for Single Twisted-Pair Cable (RS-485 Loop)

Use the transient eliminator for single twisted-pair cable in a simple point-to-point connection or at the interface of two RS-485 loops as illustrated in **Figure 5.7**. In either case, avoid interconnecting the equipment ground buses of two or more remote switchgear line-ups (that is, shields should be terminated at one end only).

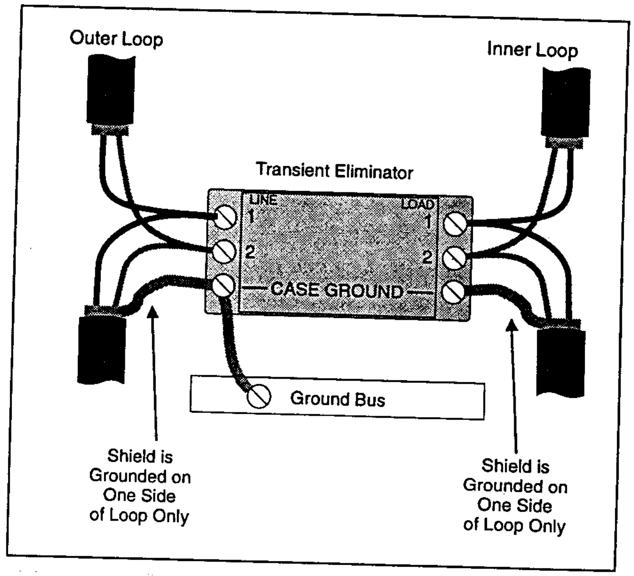


Figure 5.7 Transient Eliminator Connections Between Two RS-485 Loops

Depending on the layout and installation of your facility's electrical equipment, the equipment ground bus potentials (for voltage) may differ substantially between two locations. This difference is especially true of an industrial plant spread across acres of land. A cable shield connected to two different voltages at its ends conducts a current limited only by the impedance of the shield itself. Such a situation can cause equipment damage. To avoid it, ground shields only at one end of cable.

There are no foolproof rules to prevent grounding of both ends of a shield; however, addressing this issue when developing the communication diagrams, schematic diagrams, and wiring diagrams for a particular system installation can eliminate surge problems.

5.4 Connecting Isolated Multi-Drop Converter

The Isolated Multi-Drop converter is an electronic device that lets you connect your DOS-based PC to the SEAbus communications network for ACCESS devices on your power distribution system. This converter converts the RS-232 signal from the PC to an RS-485 signal.

The Isolated Multi-Drop converter has four RS-485 ports that can support 32 field devices on each, for a total of 128 devices on each PC serial ports.

The Isolated Multi-Drop converter also protects the PC from electrical potentials from the field devices by providing opto-isolators between the RS-232 and RS-485 interfaces. To isolate the PC further, the converter is equipped with high-energy surge suppression that meets or exceeds ANSI C62.41 (IEEE 587) standards. The converter also incorporates isolated DC/DC converters that provide electrical isolation between the PC and the RS-485 loop.

Refer to the *Isolated Multi-Drop Converter Operator's Manual* (Manual No. SG-6048) for a complete description of its operation.

5.4.1 Installing the Converter

When connected to the computer's serial communications port, the Isolated Multi-Drop converter provides four RS-485 ports as illustrated in **Figure 5.8**. It thus supports up to 128 (maximum of 32 per port) RS-485 compatible devices.

Input power (either 120 VAC or 125 VDC) is supplied to the Isolated Multi-Drop converter via a separate power connector incorporating a line filter. Also included are a two-position power switch and a 15 VDC output for use in testing a Static Trip III trip unit or a SAMMS relay.

On the top of the Isolated Multi-Drop converter are the designations for each of the RS-485 channels and two LED indicators: one transmit and one receive (Tx and Rx). These indicators blink during data transmission or reception. Transmission occurs on all four ports simultaneously.

The RS-485 ports are on the front of the unit and are label on the top as Ports 1, 2, 3 and 4. The set-up switches, input power connection, RS-232 port, and 15 VDC port are on the rear. RS-485 and 15 VDC connections are made with special connectors shipped with the converter.

Each device attached to the Isolated Multi-Drop converter must have a unique address to prevent data collisions when more than one device is attached. This rule applies to all the devices, regardless of the particular RS-485 loop to which it is connected. Device addressing is a process independent of the RS-485 loop.

5.4.2 Configuring the Converter

The Isolated Multi-Drop converter is configured with setup switches rather than software. The switches are located on the rear of the unit in the area labeled TX Control. There are three basic configurations:

1. The Isolated Multi-Drop converter is directly attached to either the PC running the supervisory software and is not located more than 50 feet away from the computer. In this configuration, no modems are used. Set the DCD/RTS switch to RTS and the MAN/AUTO switch to MAN.
2. If located more than 50 feet from the computer, use short-haul modems between the Isolated Multi-Drop converter and the PC running the supervisory software. In this configuration, set the DCD/RTS switch to DCD and the MAN/AUTO switch to MAN.
3. Dial-up modems can be used between the Isolated Multi-Drop converter and the PC running the supervisory software. In this configuration, set the AUTO/MAN switch to AUTO. With AUTO enabled, set the baud rate to your ACCESS system data rate (1200, 2400, 4800 or 9600) using the BAUD switch. When in the AUTO position, the DCD/RTS switch selection is disabled.

Note: If you are not using Siemens software, refer to the *Isolated Multi-Drop Converter Operator's Manual* (Manual No. SG-6048) for further set-up information.

5.4.3 Preparing Cables and Connectors

The Isolated Multi-Drop converter uses special connectors for the RS-485 communication cable connections. These special connectors, along with a two-conductor connector for the 15 VDC power supply, are included with the Isolated Multi-Drop converter when it is shipped. **Figure 5.8** illustrates how to wire one of these connectors properly. The shield wire is grounded at only one end of each cable segment.

Note: The Isolated Multi-Drop converter 120 VAC power receptacle must contain an earth ground connection. The converter requires a high-integrity earth ground for proper shield reference and surge protection.

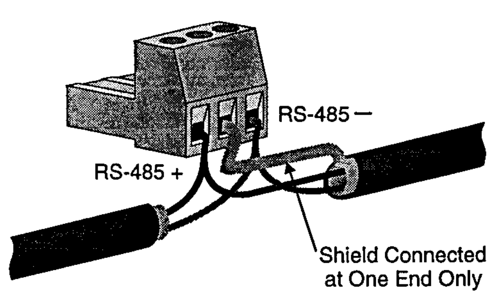


Figure 5.8 Isolated Multi-Drop Converter Connector

5.5 Connecting RS232 Bridge

The RS232 Bridge is an electronic device that allows communication between a single host computer, terminal, or modem and a maximum of 16 field devices. The RS232 Bridge is used in applications where data exchange between host computer and field devices is not modified by the interface.

The host computer sends addresses and commands over a duplex RS-232 cable to the RS232 Bridge. The RS232 Bridge buffers supervisory data to all the relays over individual duplex RS-232 cables.

A single host RS-232 channel is connected to the RS232 Bridge via a DB-9S connector. RS-232 serial data enters the RS232 Bridge, is amplified and sent to the 16 channels. These channels are connected to external relays. When a relay sees its address, it sends an answer to the RS232 Bridge. The RS232 Bridge sends the response to the RS-232 supervisory device.

5.6 Connecting Fiber Optic Bridge

The Fiber Optic Bridge (F.O.B.) allows the communication of a single host computer, terminal, or modem to a maximum of 30 relays by using fiber optic cables. The host computer sends addresses and commands over a duplex RS-232 cable to the F.O.B. The F.O.B. communicates to the relays over individual duplex fiber optic cables.

The F.O.B. allows communication between an RS-232 device and a fiber optic device. A single RS-232 channel is connected to the F.O.B. via a DB9S connector. RS-232 serial data enters the F.O.B., is converted to fiber optic levels, and sent to multiple channels. These channels are connected to external relays. When a relay sees its address, it sends an answer to the F.O.B. The F.O.B. converts the relay's response to RS-232-D levels and sends it to the RS-232 device.

6 Installing Supervisory Software

This section provides a brief overview of the process of installing and configuring the supervisory software that you can run from a personal computer (PC). WinPM software offers the most complete solution to communications and data collection and display for an ACCESS system. For more specific installation details, refer to the user's manual for the specific program.

Follow all safety precautions when inspecting the wiring for the ACCESS system. Instrument compartments and switchgear structures typically contain many different circuits and some of them may be energized.

6.1 Installing WinPM Software

6.1.1 Overview

WinPM electrical distribution communication software operates in the Microsoft® Windows® 3.1 operating environment on a personal computer (PC). Through communications drivers, WinPM software collects and displays real-time data from ACCESS field devices, Siemens protective relays, and other field devices. WinPM displays information and adds the capabilities of programming, monitoring alarms, and logging system events. WinPM also monitors and displays historical data, minimum and maximum data, and waveform data. In addition, WinPM can deliver its data to other compatible Windows applications, in real-time through dynamic data exchange (DDE), a method of sharing information that is supported by Windows applications.

To run WinPM, you need the following hardware, software, and disk storage space:

- WinPM program diskette
- A PC running Microsoft Windows 3.1
- At least 4Mbytes of RAM
- Disk storage space of at least 3 Mbytes
- 3.5", high-density, floppy diskette drive
- A mouse supported by Windows
- RS-232 serial communications port or a modem
- RS-232 to RS-485 converter (Siemens Isolated Multi-Drop converter)

In addition to the preceding items, you may want to consider connecting your computer, converter, and field devices to an uninterruptible power source to avoid any interruption in data collection during an outage (when you may need the program the most).

6.1.2 ACCESS System Connection

Before you can use WinPM to communicate with the ACCESS field devices on your electrical distribution system, you must physically connect your computer to the communications loop that links those devices. WinPM software allows you several options for connecting your computer to field devices. Most often, an Isolated Multi-Drop converter will connect a serial port on your computer to the SEAbus communications bus.

Your computer running WinPM can be connected to intelligent field devices directly, or through a modem to the ACCESS system's SEAbus communications bus.

Check all connections in the system. Before inspecting the wiring, disconnect all power and short current transformers if applicable.

6.1.3 Installation Program

The WinPM product consists of three diskettes. The first diskette, the Registration diskette, should be returned to Siemens to ensure for proper support. The two WinPM program diskettes contain everything you need to install WinPM on your PC. The WinPM installation program creates a directory called "WINPM," copies all files into the directory, and creates a Windows program group with WinPM icons.

To install WinPM, follow these steps:

1. Start Windows.
2. Insert the first WinPM program diskette into your diskette drive.
3. From the **File** menu of Windows Program Manager, select **Run...**, and the Run dialog box appears.
4. In the Command Line box, type the designation of the diskette drive where you inserted the WinPM diskette, followed by a colon and backslash (either **a:** or **b:**).
5. Type **setup.exe** in the Command Line and then click **OK**.
6. Follow the instructions on the screen to configure WinPM to run on your system.

After installing WinPM, you are ready to run the WinPM program. Even if your computer is not yet physically connected to your ACCESS system, you can still see the functionality of WinPM. To run WinPM from the Program Manager, double-click on the WinPM icon.

With WinPM installed, you can configure WinPM to collect and display data from your ACCESS system. Setting up WinPM involves defining user IDs and passwords and configuring ports, devices, diagrams, snapshots, and alarms. Additionally, all of the information that you establish using WinPM must be saved and stored in various system configuration files.

6.2 Installing SIEServe Software

6.2.1 Introducing SIEServe

SIEServe software is a program that operates in the Microsoft Windows operating environment on a personal computer. It offers a means of collecting and displaying real-time data from devices comprised by the ACCESS system. Although SIEServe software does not offer the same monitoring and control capability as the Power Monitor display and monitoring unit or WinPM software, it does enable you to collect and display some of the same real-time data as these other products. In addition, SIEServe software is capable of delivering its data to other compatible Windows applications, also in real time. It does this through dynamic data exchange (called DDE), a method of sharing information that is supported by a growing number of Windows applications. SIEServe software allows you to connect the ACCESS devices on your distribution system, either directly or through a modem, to the ACCESS system's SEAbus communications bus.

Because SIEServe software is a Windows program, you need to be somewhat familiar with the Windows operating environment. If you have not used Windows before, refer to your Windows documentation to learn the basics. You may also need to refer to the Windows documentation as you use SIEServe software if you have difficulty with any of the Windows tasks or terminology you encounter along the way.

Although SIEServe software operates as an independent application, its primary function is to collect information from one source (the ACCESS devices on your electrical distribution system) and then make it available for display or for other applications (such as Microsoft Excel® or Word for Windows). Because SIEServe software operates in conjunction with so many other devices and applications, you will need to refer to their documentation as well, to help you make the most of the information that SIEServe software provides.

To run SIEServe software on your personal computer, you need the following hardware, software, and minimum capability:

- SIEServe program diskette
- Personal computer running Microsoft Windows 3.1
- Disk storage space of at least 3 megabytes
- 3.5", high-density, floppy diskette drive
- A mouse supported by Windows
- RS-232 serial communications port or a modem
- RS-232 to RS-485 converter

Before you can use SIEServe software to communicate with the ACCESS field devices on your electrical distribution system, you must physically connect your computer to the SEAbus communications loop that links those devices. SIEServe software allows you the two options described.

6.2.2 Installing SIEServe

The SIEServe program diskette contains everything you need to install SIEServe software on your PC. All you need to do is run the installation program on the diskette. It creates a SIEServe program directory, copies all files into the directory, and creates a Windows program group and SIEServe icons.

To install SIEServe software on your PC, start Windows and follow these steps:

1. Insert the SIEServe program diskette into your diskette drive.
2. From the **File** menu of Windows Program Manager, select **Run...**, and the Run dialog box appears.
3. In the Command Line box, type the designation of the diskette drive where you inserted the SIEServe diskette, followed by a colon and backslash (either **a:** or **b:**).
4. Type **setup.exe** in the Command Line and then click **OK**.

SIEServe software's installation program creates a default directory (C:\SIESERVE) on your computer and a Windows program group called "Siemens ACCESS", in which it installs program icons for the SIEServe program, the SIEServe Demo, and the Windows Write file for this manual.

The next step is to configure your ACCESS system with SIEServe software. This involves:

- Establishing communications
- Adding a new device to a system configuration
- Saving a system configuration
- Changing an existing device on a system
- Deleting a device from a system

One of the greatest values of SIEServe software is its support of dynamic data exchange (DDE) with other applications that also support DDE. You can use any application that does support DDE to establish direct links to SIEServe data, so that the client application constantly receives real-time data from the SIEServe program. To show you how this works, SIEServe software comes with files from several popular applications. These files already have links established to the SIEServe Demo configuration. All you need to do is to start the SIEServe Demo program and open any of these other files to see simulated real-time data as it is updated in the application.

The SIEServe program disk comes with sample files from commonly used applications. Each spreadsheet contains a sample trend chart, single-line diagram, bar chart, and table of historical data. The word processing document contains a typical report of kilowatt-hours, kilowatt demand, and power factor.

6.3 Installing SIEModem Utility

SIEModem is a modem configuration add-on utility for - SIEServe. This Windows application optimizes a modem's configuration for use with Siemens SIEServe DDE server software. For customers that have difficulty with their "Hayes compatible" modems and SIEServe, this application makes these modems "more Hayes compatible" in a sense by temporarily changing the modems configuration to an optimum setting for SIEServe. In addition to allowing temporary changes, SIEModem has an option to change the configuration and save this configuration as the power-up configuration. An option also exists to restore the factory configuration, storing this as the power-up setting. Another option allows for designating whether the target modem is to be an originating (dialing-out) modem, or a receiving (answering) modem. The default setting is as an originating modem. Most users will not need to use this utility very often, but if problems occur with SIEServe, this utility will help.

When trying to communicate to supervisory devices, dial-up modems need to be configured exactly to allow communications to occur error-free. Problems can arise when the modem local to the device is reading the real time data from that device as potential AT commands to respond to, and is never actually able to connect with other modems. The only solution to date has been to disconnect the RS-232 line from the modem during connection, and then reconnect it after the call initialization is complete. Another problem occurs when the modem's Xon\Xoff local flow control is enabled.

After running SIEModem to configure the local modem's software either a DIP switch or a jumper (depending on whether the modem is an Ultima or an Optima) must be changed to configure the modem's hardware.

Follow these steps:

1. Connect the Hayes modem to your computer.
2. Run Windows, and run SIEModem.
3. In the SIEModem window, select "Optimize for SIEServe and store as power-up configuration".
4. Select the button corresponding to which COM port you are using.
5. From the Options menu, select "Additional Configuration Changes". From that menu, select "Disable character echo" and click **OK**.
6. From the Additional Configuration Changes menu, select "Disable Local Flow Control" and click **OK**.
7. Click the long **Ok** bar on the main window. A window will pop up containing the string of AT commands corresponding to your entries.
8. Click the pop up window's **Ok** box. The RD light (LED) on the front of the modem should flash briefly. Another pop up window comes up and tells you that the configuration changed.
9. Click its **Ok** button and the **Exit** bar on the main window.

The software part of the configuration process is done. Disconnect the modem from your computer.

Power off the modem and remove the front plate to expose either the DIP switches or a jumper. The Ultra has a row of DIP switches and the Optima has a jumper. Set DIP switch 1 down, or set the jumper on the two leftmost pins. Connect the modem to the supervisory device by way of an RS-232 cable and connect the modem to a phone line. Power up the modem.

The modem is in "Dumb Mode" which means it will not pay any attention to any data coming from the attached device. The modem will simply pass everything along to the supervisory device that has dialed up to it.

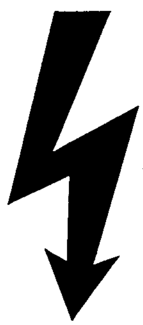
Notes:

7 Verifying the Network

This section contains step-by-step guides for starting the ACCESS system and verifying that it works in its entirety.

Be aware that each of the devices in the ACCESS system is meant to function by itself. In other words, each device has a primary function other than ACCESS communications (for example, overcurrent protection, metering, extended protection, or motor protection).

⚠ CAUTION



Hazardous voltages.
Will cause severe injury or death.

Turn off power and lock out supplying device before working on this equipment.

Follow all safety precautions when inspecting the wiring for the ACCESS system. Instrument compartments and switchgear structures typically contain many different circuits and some of them may be energized.

7.1 Rules Review

Ensure that you properly installed the network according to the rules discussed earlier. These rules are listed again below:

Rule 1:
Connect all devices in a "daisy-chain" loop topology (explained in **Chapter 3, Connecting the Network**) so that all devices are connected to the supervisory device in case of a line break.

Rule 2:
A maximum of 32 devices may be connected in a single RS-485 bus for a total cable run no longer than 4000 feet (1219 meters).

Rule 3:
Use a good quality shielded twisted pair cable for each RS-485 bus. It is recommended that 22 AWG (0.6 mm) or larger conductor be used.

Rule 4:
Ensure that the polarity is correct when connecting the RS-485 port Plus (+) and Minus (-) terminals of each device.

Note: Devices are connected in a point-to-point configuration with the (+) and (-) terminals of each device connected to the associated terminals on the next device in the loop.

Rule 5:
Always ground the shield at only one end of a cable segment.

Note: Connecting the shield at both ends of a segment to ground allows ground loop currents to flow in the shield, inducing electrical noise in the communications cable.

Rule 6:
Always connect the field device's ground terminal directly to the switchgear equipment ground bus.

Rule 7:
Run ground connections directly to the equipment ground bus and do not daisy chain them from one device's ground to the next.

Rule 8:
Do not route signal cabling parallel to power conductors. Power conductors are any cables or bus conductors carrying currents greater than 20 A.

Rule 9:
Cables should be isolated as much as possible from sources of electrical noise.

7.2 Verification (with Power Off)

1. Check all connections in the system. Before inspecting the wiring, disconnect all power and short current transformers if applicable.

2. Check to see if devices that require external power are connected to the appropriate source of voltage and current.

3. Verify correct polarity of positive (Data +) and negative (Data -) communication wires to all devices. (White wires connect to the negative terminal, and black wires connect to the positive terminal.)

4. Verify that all equipment ground terminals are directly connected to the equipment ground bus.

5. Verify that no shield of any twisted-pair cable leading to or from an ACCESS device is connected to ground at both ends. All shields must be terminated to ground at one end only. (Refer to **Chapter 3, Connecting the Network,** for information on grounding the shield.)

6. Verify that the RS-485 shields are grounded to the equipment ground bus at the interface point with another RS-485 loop. (Refer to **Chapter 3, Connecting the Network,** for information on grounding the shield between loops.)

7. Verify that there are no shorts between the positive and negative communication wires (white and black leads and shield). One of the common causes of communications failure is nicked signal wire (white and black wires) in the area of the shield. These nicks short the signal.

   Note: You should eliminate shorts because measured resistance varies depending on the type and connection of the supervisory device. Supervisory devices always incorporate necessary bus termination and bus reference devices required for proper biasing of the RS-485 network. Resistances will normally fall within 60 Ω to 180 Ω when measured between positive and negative (black and white) communications wires.

It is impossible to verify live operation of the ACCESS communications system without using a supervisory device. If the field device you are testing is not connected to a supervisory device, attach one to the RS-485 bus.

7.3 Verification (with Power On)

Turn on power to all ACCESS devices. Wait until the supervisory device goes through its internal setup routines. Using the supervisory device's selection routine, select each slave device on the bus. Verify that each device is correctly addressed and that it responds to the supervisory's inquiry. If it does not, refer to **Chapter 8, Troubleshooting**.

Using either real operating conditions or recommended test conditions, verify that all devices on the bus perform properly. If this step does not yield the expected results, refer to **Chapter 8, Troubleshooting**.

8 Troubleshooting

8.1 Overview

This section contains step-by-step guides for troubleshooting the ACCESS communications system as well as a theory of operation subsection and a detailed troubleshooting guidelines subsection.

This is intended to help you locate communication problems within the ACCESS system. Help with problems not related to communications can be found in the individual operator's manual for each device. For further help, contact your local Siemens service representative.

The following sets of troubleshooting procedures categorize routine problems and offer a series of possible solutions.

8.2 No Power Monitor Main Menu

If the Power Monitor unit does not display the Main Menu screen on power up:

1. Check that the On-Off switch is turned on and that power is available to the Power Monitor unit.
2. Contact your local Siemens service representative.

8.3 No Data Received

If the supervisory device displays the proper screens but receives no data from any device:

1. Verify that polling is enabled for all devices.
2. Verify the RS-485 continuity between the supervisory device and the rest of the system, (Do this by tracing signals from the supervisory device through the system using an oscilloscope as discussed in **Appendix F**.)
3. Verify that there are no shorts on the RS-485 network.
4. Verify correct polarity of the RS-485 connection at the supervisory device.
5. Verify that the transient eliminator or surge suppressor between the supervisory device and the rest of the system is operating properly.
6. Verify that the baud rates of the supervisory device and the rest of the system are compatible.

8.4 Lost Loop

If the Power Monitor unit displays data from one loop but not another:

1. Check the terminal block at the interconnection of the "lost loop" and the rest of the system and verify correct polarity.
2. Verify that the RS-485 cable is continuous in both directions from the interconnection of the loops and that there are no shorts on the unresponsive loop.
3. Verify that the shield grounding at the interconnection point is not in contact with the white or black leads.
4. Verify that the transient eliminator or surge suppressor is functioning properly. (Do this by looking at input and output signals simultaneously on an oscilloscope.)

8.5 Field Device Not Sending Data

If a field device is not sending data:

1. Verify that the address of the device is correct. (The Power Monitor unit may have the wrong device address, or the device may have an incorrect address.)
2. Verify that polling is enabled for the field device.
3. Verify that the baud rate of the field device matches that of the supervisory device.
4. Check the power supply to the noncommunicating device. (Make sure the device is turned on, if it has a separate switch.)
5. Verify that the device's ground terminal is connected directly to the equipment ground bus.
6. Verify that the device is connected to the RS-485 bus and the device's polarity is correct.
7. Verify that the communications card is installed and set for RS-485 for the 4700 power meter.
8. Verify that the device does not have a duplicate address. (Refer to the *Power Monitor Operator's Manual*, Manual No. SG-4018-01.)

8.6 Inaccurate Data

If data is inaccurate:

1. Verify that the correct current and voltage sensor ratings (or scales) are entered into the device.
2. Follow the instructions for calibration and verification contained in the instruction and operation manual for each device.
3. Verify that the power system's three-phase volt mode is properly set for the given wiring (wye, delta, and so on).
4. Check for proper voltage phase rotation and polarity,
5. Verify that the ground terminal is connected to the equipment ground bus.
6. Check current and voltage levels of inputs to the device.

8.7 Error Messages

If data error messages appear on the Power Monitor unit:

1. Check the continuity and polarity of the RS-485 bus.
2. Verify that the ACCESS device is functioning normally in its primary role (and if not, contact your Siemens representative).
3. Verify that the levels for communication signals are correct per the RS-485 requirements.
4. Contact your Siemens representative.

8.8 Signal Levels Not to RS-485

If levels for communication signals are not within RS-485 standards:

1. Verify that no more than 32 devices are connected to the RS-485 bus.
2. Verify that the bus length does not exceed 4000 feet.
3. Contact your Siemens representative.

8.9 Circuit Breaker Not Sending Data

If the supervisory device does not receive data from a circuit breaker through a Multiplexer Translator (MT):

1. Verify that the MT has control power.
2. Check the configuration switches on the MT.

8.10 No Data from MT Channels

If none of the Multiplexer Translator (MT) channels transmit data:

1. Replace the MT.
2. Verify continuity with the Expansion Plug (EP).
3. Replace the EP.
4. Contact your Siemens representative.

8.11 No Data from a Device on the MT

If data from one input device is not being transmitted from the Multiplexer Translator (MT):

1. Plug the device into a different channel on the MT.
2. Verify continuity with the Expansion Plug (EP).
3. Replace the EP.
4. Contact your Siemens representative.

Note: The Power Monitor unit receives occasional alarm messages from the ACCESS devices. These messages do not indicate a communication malfunction or error; instead, they indicate a condition from the device's electrical distribution function that requires operator action.

8.12 Problem with Modem

Use the SIEModem utility to set the modem to a certain configuration. If you are still having problems communicating, chances are the problem is not with the local modem connected to the device, but with the modem you are dialing with.

If this still does not solve the problem make sure that all of the baud rates are the same the device's baud rate, the device's modem's baud rate, your dialing software's baud rate, and your dialing modem's baud rate. SIEModem has a feature for forcing a modem to connect at a certain baud rate. To use this feature in SIEModem, simply select "Set Maximum Baud Rate to Baud Rate" (where Baud Rate is equal to the baud rate setting of the supervisory device's RS-232 output port) from the "Additional Configuration Changes" menu.

If you have configured the modems properly, and you are sure that all of the devices in this communications link are speaking at the same baud rate, and you still can not get it to work properly, try using a Hayes brand modem as your dialing modem. The dialing modem does not have to be a Hayes Ultra or Optima, but using a Hayes product will help.

A Communications Cables

The system being installed determines the type or types of cable required, the cables being a function of system performance criteria.

This chapter provides an overview of multiconductor and fiber optic cable characteristics, cable length considerations, and cable connections. In addition, this chapter lists selected cables and supplier information of communications cables that Siemens recommends using with its devices and the ACCESS system.

For control circuits, a multiconductor configuration is generally employed. Today the movement is to an overall shielded design to mitigate spurious signals which may couple erroneous signals into the circuits which can result in the false operation of controlled devices.

A.1 Cable Recommendations

A.1.1 RS-232

Manufacturer: Alpha Wire Corporation	In US: 1-800-52 ALPHA In CAN: 1-800-533-ALPHA			In UK: 01932-772422 Outside UK: +44-01932-772422			
	Model No.	**No. of Pairs**	**AWG**	**Jacket Insulation**	**Shield**	**Coverage**	**Capacitance betw. Conductors pf/ft (pf/m)**
RS-232 Standard	6222C	2	24	Cellular Polypropylene	Aluminum/Polyester	>65%	12.5 (41,0)
	6413	2	24	PVC Polyethylene	Aluminum/Polyester	>90%	12.8 (42,0)
RS-232 Plenum	58902	2	24	PVC FEP	Aluminum/Polyester		12.5 (41,0)
	58612	2	22	PVC FEP	Aluminum/Polyester		28.6 (93.8)
Manufacturer: Belden Wire and Cable	**In US: 1-800-BELDEN-1**			**In CAN: 416-372-8713**		**In UK: 0 483-728511/726818**	
	Model No.	**No. of Pairs**	**AWG**	**Jacket Insulation**	**Shield**	**Coverage**	**Capacitance betw. Conductors pf/ft (pf/m)**
RS-232 Standard	9842	2	24	Polyethylene	Aluminum/Polyester	100%	12.8 (42,0)
RS-232 Plenum	88723	2	22	Teflon	Aluminum/Polyester	100%	35 (115)

A.1.2 RS-485

Manufacturer: Alpha Wire Corporation	In US: 1-800-52 ALPHA In CAN: 1-800-533-ALPHA			In UK: 01932-772422 Outside UK: +44-01932-772422			
	Model No.	**No. of Pairs**	**AWG**	**Jacket Insulation**	**Shield**	**Coverage**	**Capacitance betw. Conductors pf/ft (pf/m)**
RS-485 Standard	6412	1	24	PVC Polyethylene	Aluminum/Polyester	>90%	12.8 (42,0)
RS-485 Plenum							
Manufacturer: Belden Wire and Cable	**In US: 1-800-BELDEN-1**			**In CAN: 416-372-8713**		**In UK: 0 483-728511/726818**	
	Model No.	**No. of Pairs**	**AWG**	**Jacket Insulation**	**Shield**	**Coverage**	**Capacitance betw. Conductors pf/ft (pf/m)**
RS-485 Standard	9841	1	24	Polyethylene	Aluminum/Polyester	100%	12.8 (42,0)
RS-485 Plenum	89182	1	22	Teflon	Aluminum/Polyester	100%	8.8 (28,9)

A.1.3 Fiber Optic

The recommended cable is 62.5/125 mm diameter fiber optic cable with a maximum attenuation of 5dB/km at a wavelength of 820-850 nm. If this is not available use 50/125 mm diameter glass cable, but only for cable lengths less than 1500 feet. A 100/140 mm diameter cable can also be used for cable lengths less than 1500 feet.

Plastic cable is not recommended due to the coupling efficiency of the cable, which at short lengths will overload the optical receiver. In addition, the large cable attenuation normally associated with plastic cable limits the useful link lengths to a fraction of that achievable with glass cable.

Table A.1 Fiber Optic Cables

Manufacturer: Alpha Wire Corporation	**In US: 1-800-52 ALPHA** **In CAN: 1-800-533-ALPHA**				**In UK: 01932-772422** **Outside UK: +44-01932-772422**		
	Model No.	**Fiber Count**	**Cable Diameter in**	**mm**	**Bend Radius in**	**cm**	**Outer Jacket**
Fiber Optic Std. Simplex	FSIMPO1	1	0.113	2.87	2	5	PVC
Fiber Optic Plenum	FSIMPO1F	1	0.113	2.87	2	5	PVC
Manufacturer: Belden Wire and Cable	**In US: 1-800-BELDEN-1**		**In CAN: 416-372-8713**		**In UK: 0 483-728511/726818**		
	Model No.	**Fiber Count**	**Cable Diameter in**	**mm**	**Bend Radius in**	**cm**	**Outer Jacket**
Fiber Optic Standard	225181	1					PVC
Fiber Optic Plenum	225811	1					PVC
All fiber optic cables are 160/500 dB/km, 850 nm dia.							

A.1.4 Cables for MT and EP

Use the proper Siemens cable for connecting the Expansion Plug (EP) to the trip units or to the Multiplexer Translator (MT). **Table A.2** summarizes the cables and how to order the correct length. These cables apply to the Sentron (a molded-case circuit breaker) and the SB (an insulated-case circuit breaker) trip units.

Table A.2 MT and EP Cables

Connecting	Cable Type	Length	Catalog Number
Trip unit to Expansion Plug	Ribbon cable	8 inches	EPC08
Trip unit to Expansion Plug	Ribbon cable	12 inches	EPC12
Trip unit to Expansion Plug	Ribbon cable	18 inches	EPC18
Expansion Plug to Multiplexer Translator	Telephone cable	8 feet	MTC08
Expansion Plug to Multiplexer Translator	Telephone cable	15 feet	MTC15
Expansion Plug to Multiplexer Translator	Telephone cable	25 feet	MTC25

A.1.5 Maximum Length

One of the physical constraints in a communications system is the length of the cable connecting the various devices. This limitation is due in part to the total resistance in the loop.

As a signal travels from the output of the driver to the input of the farthest receiver, it suffers from voltage drops caused by the various series resistance elements. The variables are defined as follows:

R_{Surge} = The equivalent series resistance of the surge protectors. Siemens recommended surge protectors have a resistance of 30 Ω.

R_{Cable} = The total DC resistance of the wire in the cable. The recommended cable with 22 AWG wire has a DC resistance of 17W/1000 feet for each wire (34W/1000 feet for the cable).

R_{Loop} = The sum of the series resistance elements:

R_{Loop} = $R_{Surge} + R_{Cable}$

R_{Term} = An optimal terminating resistor, typically 120 Ω.

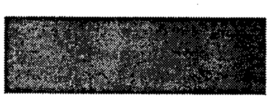
$R_{Receivers}$ = The equivalent resistance of all the receiver input resistances in parallel. For typical input resistance of 12 kΩ, the equivalent resistance for 32 receivers is 375 W.

R_{In} = The equivalent input resistance at the far point of the loop. R_{In} is the parallel combination of R_{Term} and $R_{Receivers}$. For the values stated above, R_{In}=91W.

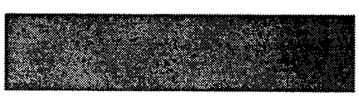
V_{Out} = The differential output of a SEAbus driver. The minimum specified output voltage is 1.5 V.

V_{In} = The minimum allowable input voltage for a SEAbus receiver (typically 0.4 volts).

Applying the potentiometer (voltage divider) rule to the cable yields the following relationship:



Using the recommended values listed in the variable definitions for the variables above:



If you use four surge protectors in you network:

R_{Surge} = 4 x 30 = 120 Ω

Then:

$R_{Max\ Cable}$ = $R_{LoopMax}$ - R_{Surge}

= 250 - 120

= 130 Ω

If you use cable with 34Ω/1000 feet, the maximum cable length is:

$L_{CableMax}$ = ($R_{MaxCable}$ /34) x 1000

= 3831 ft.

If you use two surge protectors in you network:

R_{Surge} = 2 x 30 = 60 Ω

Then:

$R_{Max\ Cable}$ = $R_{LoopMax}$ - R_{Surge}

= 250 - 60

= 190 Ω

and

$L_{CableMax}$ = (190/34) x 1000

= 5588 ft.

Based on the DC resistance, the maximum cable length is 5588 feet; however, there are inductive and capacitive effects that limit the cable length to a total of 4000 feet.

A.1.6 RS-485 Cable Grounding

Ground the cable shield for all devices on the network. Ground the cable shield at only one end to prevent induced interference that may result from circulating ground currents. If a cable shield is grounded at both ends a ground loop can exist between the components. This ground loop can cause induced interference which results in signal distortion. If there is a ground potential rise between the connected devices, connect the Signal Return (RTN) between the devices. **Figure A.1** illustrates the preferred field device connection method.

A.1.7 RS-232 Connections

The following section describes the connection requirements for RS-232 cable. Five of the standard RS-232 wires are used for this application:

- Signal Return (RTN)
- RXD
- TXD
- CTS
- RTS

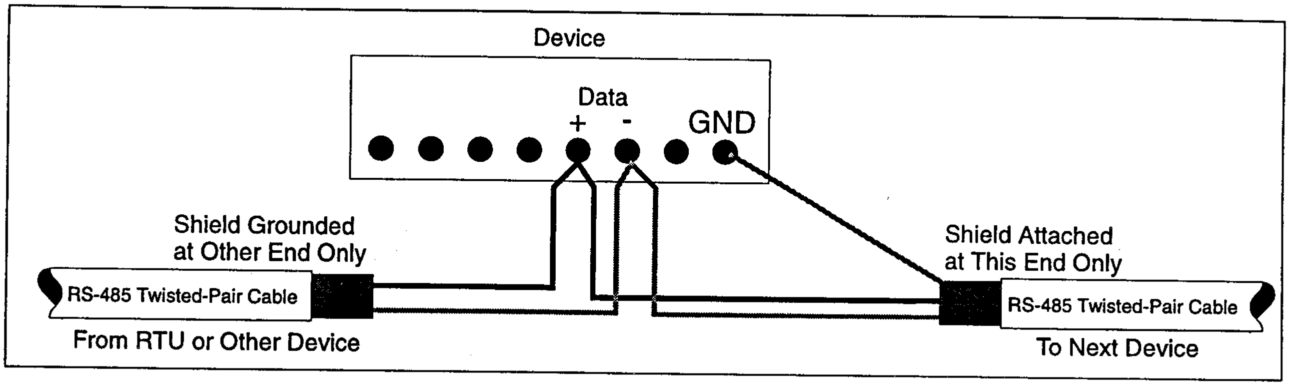


Figure A.1 RS-485 Connection

Listed in **Table A.5** are the connections that must be made to connect the device to a personal computer, RTU, or other supervisory device. Most devices default to *no handshaking required* mode.

Table A.3 RS-232 Intelligent Electronic Device Wiring

Device	PC, Supervisory Device, or Other Network Device
RTN	Signal Ground
RXD	TXD
TXD	RXD

"RXD" is an input for Data Terminal Equipment (DTE) and an output for Data Communications Equipment (DCE). "TXD" is an output for the DTE and an input for the DCE. Personal computer serial ports are configured as DTE and the modems are configured as DCE. The communications module RS-232 connections implement DTE.

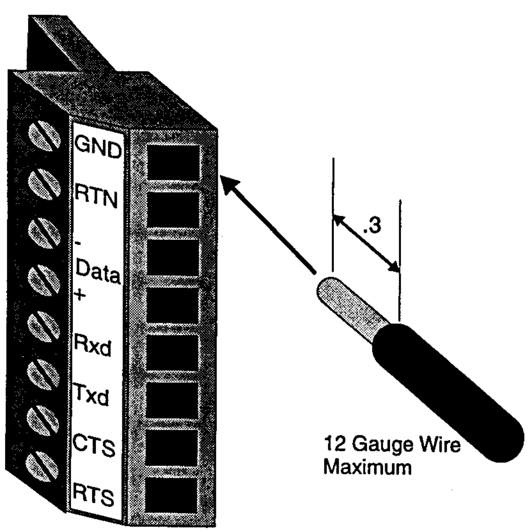


Figure A.2 Typical Screw Terminal Block Connector

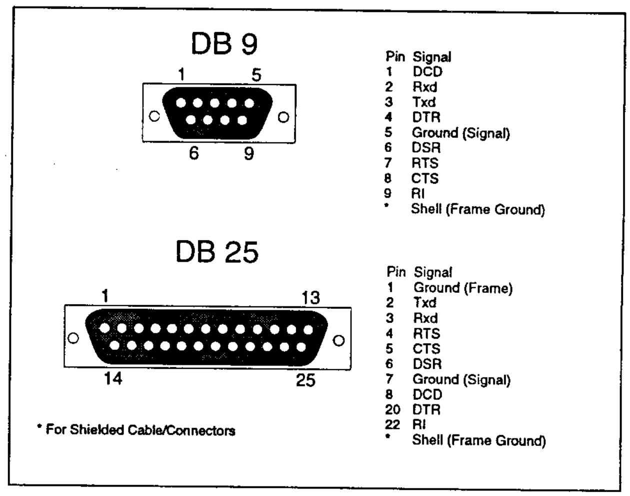


Figure A.3 RS-232 Connector Pinout

Multidrop configurations require that the respective pins of the DTE devices be connected in parallel, **Figure A.4**. The standard pin assignments for RS-232 connectors are shown in **Figure A.3**.

Note: For **Figure A.4**, the RTU port is wired as "DTE". When networking devices together, make sure the RTU "data out" connects to the communications module RXd, and the RTU "data in" connects to the communications module TXd.

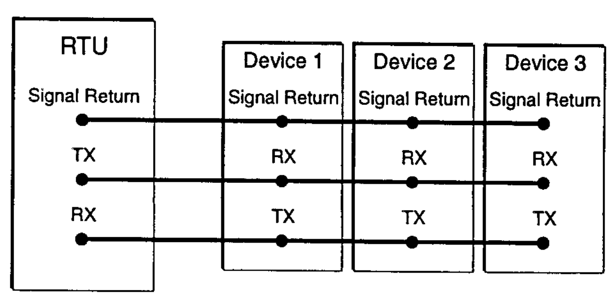


Figure A.4 RS-232 Multidrop Configuration

A.2 Multiconductor Cable Considerations

Performance criteria dictate wire, gauge size, and whether single or paired cables are required. When a particular installation is prone to EMI/RFI/ESI interference from either internal or external sources, some form of cable shielding will be required. It is apparent, therefore, that system engineers should become very familiar with cable shielding techniques, as well as other factors which will influence the behavior of the fully installed system.

Paired cables allow balanced signal transmission which results in lower crosstalk through common mode rejection. Due to the improved noise immunity of twisted pairs, they generally permit higher data speeds than multiconductor cables.

A.2.1 Noise

There are basically four types of noise which will affect the wiring or cabling of an instrument or control circuit: static, magnetic, common mode, and crosstalk noise.

Static Noise

Static noise refers to signal distortion due to the electrical field radiated by a voltage source, which has coupled into the signal-bearing circuit. Simple shielding of the full circuit is a typical means of mitigating this electrostatic type of interference. Foil shields, which offer 100% shielding efficiency, have proven most effective against this type of interference. It is critical that the shield be continued to, and completely encompass, the transmitting and receiving ends of the circuit if high levels of noise reduction are required. Effective grounding of the shield is also required; "floating" or non-grounded shields only partially reduce the effects of noise.

Magnetic Noise

Magnetic fields, radiated by power wiring found in large AC motors, transformers, and knife switches, can set up current flows in opposition to the instrument circuit field. The result is *magnetic* noise, the superimposing of a noise current on the signal current. The simplest and best means of mitigating the effects of such magnetic interference is by simple twisting of the cable elements.

Common Mode Noise

Common mode interference is the result of currents flowing between different potential grounds located at various points within a system. Receivers with very high common mode rejection ratios minimize this type of interference.

Crosstalk

This refers to the superimposing of either pulsed DC or standard AC signals carried on one wire pair to another wire pair in close proximity. Although pair twist tends to reduce crosstalk levels, the most effective means of mitigation is individual cable pair shielding coupled to pair twist.

Noise Levels

Once it has been determined that noise currents are going to pose a system problem, it becomes necessary to determine if the noise is of a low, medium, or high level. The following table gives general guidelines as to the areas which are subject to these generalized noise levels:

Table A.4 Noise Level Chart

Noise Level	Noise Source	Typical Locations
High	Electrolytic processes, heavy motors, generators, transformers, induction heating, relay controls, power lines and control wire in close proximity.	Heavy processing plants such as steel mills and foundries.
Medium	Wiring near medium-sized motors, control relays.	Average manufacturing plants.
Low	Wiring located far from power lines, motors; motors <5 hp; no induction heating, arcs, control or power relays nearby.	Storage areas, labs, offices, and light assembly operations.

A.2.2 Multiconductors

For the RS-485 ACCESS communications network, use cables with characteristics listed in **Table A.5** to provide proper electrical performance. Always use cables with a shield that provides 100 percent RFI/EMI coverage. Characteristic and value definitions follow the table.

Table A.5 RS-485 Cable Requirements

Characteristic	Value	Maximum/Typical
Impedance	120 Ω	Typical
Capacitance	35 pf/ft.	Maximum
Cable Size	22 AWG	Typical
DC Resistance	17 Ω/kft	Maximum
Impedance	120 Ω	Typical
Velocity of Propagation	80%	Maximum

Impedance:

The maximum transfer of signal energy from a cable to a connected device occurs when the cable's terminating impedance matches the characteristic impedance of the cable. The SEAbus RS-485 cable uses a 120 Ω terminating resistor; therefore, the cable has a characteristic impedance of 120 Ω.

Capacitance:

Wire capacitance affects the rise and fall times of a transmitted signal and, as a result, limits the signalling (baud) rate of the data. The higher the capacitance, the lower the maximum baud rate. Additionally, higher capacitance requires higher output current to "drive the line." Since capacitance is proportional to wire length, it can limit the maximum cable length for a given baud rate.

Cable Size:

Cable size, along with its capacitance and its DC resistance, determines the cable's suitability for the job and its mounting/terminating hardware. A 22 AWG cable provides a proper balance of capacitance and resistance and is fairly inexpensive and easy to handle.

DC Resistance:
DC resistance determines the maximum length of wire in an application. The maximum length is determined by the voltage divider effect (which is caused by the resistance of each twisted-pair) along with the device termination resistance. Use **Table A.6** to find the maximum cable distance based on the number of field devices and surge protectors.

Table A.6 Maximum Cable Length Based on DC Resistance

	Maximum Cable Length (in Feet)						
No. of Field Devices	No. of Surge Devices (15 ohms typical series resistance)						
	0	1	2	3	4	5	6
1	4000	4000	4000	4000	4000	4000	4000
4	4000	4000	4000	4000	4000	4000	3944
8	4000	4000	4000	4000	4000	4000	3625
12	4000	4000	4000	4000	4000	4000	3306
16	4000	4000	4000	4000	4000	3857	2987
20	4000	4000	4000	4000	4000	3596	2726
24	4000	4000	4000	4000	4000	3277	2407
28	4000	4000	4000	4000	3915	3045	2175
32	4000	4000	4000	4000	3683	2813	1943

Note: The use of transient surge protectors with series resistance subtracts from the allowable loop resistance. For example, the DLP-10 surge protector specified for the SEAbus RS-485 loop has 15 Ω of series resistance per line, for a total of 30 Ω. Since two surge protectors are required (one at each building entry point), the loop resistance increases.

These values consider only the DC resistance of the cable, not other factors such as capacitance, or velocity of propagation. These factors decrease the overall cable length which should be kept under 4000 feet. See **Section A.1.5** for more details on cable length.

Insulation:
Use a cable with insulation that is appropriate for your application. For conduit runs, use PVC insulated and jacketed cable. For runs in air ducts, use plenum-rated (or Teflon) cables. Typical insulation and jacket compounds are:

Polyethylene
Polyethylene insulation is lightweight, water-resistant, chemically inert, and easy to strip. Its low dielectric constant allows for low capacitance and low electrical loss.

Polyvinyl Chloride (PVC)
Polyvinyl chloride resists flames, oil, ozone, sunlight, and most solvents. It has higher dielectric constant than polyethylene.

Teflon®
Teflon insulated plenum cables are necessary for some applications. Plenum cables offer significant cost savings since they eliminate the need for conduit and reduce installation time.

Coverage:
The shielding of electronic interconnect cables can play a critical role in overall system performance. System configuration, type of signals transmitted, and proximity to noise generating sources all must be considered. These factors plus the type of interference, whether electromagnetic (EMI), electrostatic (ESI) or radio frequency (RFI), will determine the necessity and type of shielding required. Refer to Chapter 3 about cable routing.

The effectiveness of a braided shield depends upon the percent coverage afforded by the shield. Leakage in a braided shield is due to air spaces which exist between the weave. The percent coverage of a braided shield is determined by the diameter under shield (inches) and the percent coverage.

Use a cable with shielding that provides 100% coverage (and 25% overlap).

A.3 Fiber Optic Cables

Fiber is a transmission medium made of glass (and sometimes plastic) consisting of an inner core of doped silica (glass) material. This core is surrounded by a cladding of pure silica (glass) which keeps the light signal within the core. Together the layers form the light tunnel. A coating is applied over the cladding providing protection and allowing fiber to be handled without damage.

A.3.1 How Does Fiber Optics Work?

A transmitter (light source), such as a laser or light emitting diode (LED) at one end of the fiber initiates on/off light pulses. A receiver (light detector) at the other end converts the light pulses back into electrical signals, representing the "bits" of information. At least two fibers are needed to transmit and receive data. Transmission occurs only in the core of the fiber.

Fiber optic transmission works due to the basic principal of total internal reflection. Light is reflected down the length of the fiber and detected at the far end. Reflection occurs because the cladding glass has a lower reflection index than the core, causing the light to stay within the core.

Fiber supports very high data rates, in excess of 100 Mbps in the office environments. Since cables are all-dielectric, transmission is immune to EMI/RFI, crosstalk and does not require grounding.

A.3.2 Types

There are two types of optical fiber, multi-mode and single-mode. Multi-mode fiber is most often used for local area networking (LAN) applications. Single-mode is generally used far long distance telephone communications.

With 62.5/125 micron size fiber, the 62.5 refers to the core diameter, and 125 to the core plus cladding diameter. Alpha offers this most common size. Other sizes include 50/125 and 100/140 micron multi-mode types.

A.3.3 Length

Calculate cable length by determining the output power of the transmitter and the input receive level (Peak Input Power Logic Level Low Receiver Sensitivity). The difference between the two numbers is the optical power budget. For example, transmitter output power is -16 dBm and the input receive level is -24 dBm, the optical power budget is then 8 dBm. Subtract from this value the fixed losses (i.e. connector losses, splice losses). Divide the result by the cables attenuation in dB/km to arrive at the maximum cable length. Note that the transmitter output power data given in the specifications already includes connector loss when using precision ceramic ST connectors.

A.3.4 Jacket

As with conventional wire cables, the jacket ultimately protects the core from the external environment. With optical fibers, however, the selection of materials is influenced by the fact that the thermal coefficient of glass is significantly lower than the metal or plastic used in the cable structure. In addition, the various plastics used as jackets exhibit different characteristics when exposed to the physical and chemical effects of the operating environment.

A.3.5 Optical Characteristics

In all types of cable structures, individual optical fibers are the signal transmission media acting much the same as individual optical wave guides. The fibers have an all dielectric structure consisting of a central circular transparent core region which propagates the optical radiation and an outer cladding layer that completes the guiding structure. To achieve high signal bandwidth capabilities, the core region has a varying or graded refractive index. The four major fiber parameters used in selecting the proper cable for an application are: bandwidth, attenuation, numerical aperture (NA), and core diameter.

Bandwidth

The bandwidth at a specified optical radiation wavelength represents the highest sinusoidal light modulation frequency which can be transmitted through a length of fiber with an optical signal power loss equal to 50 percent (-3 dB) of the zero modulation frequency component. The bandwidth is expressed in megahertz (MHz) over a kilometer (MHz-km).

Attenuation

Fiber loss or optical attenuation denotes the amount of optical power loss due to absorption and scattering of optical radiation at a specified wavelength in a length of fiber. It is expressed in dB/km (decibels) which is equivalent to the amount of light lost over 1 km (3280 feet).

The attenuation is determined by launching a narrow spectral band of light into the full length of fiber and measuring the transmitted intensity. This measurement is then repeated for the first 1.5 to 2.5 meters of the same fiber without disturbing the input end of the fiber. The attenuation is then calculated and normalized to 1 km.

Table A.7 Alpha Multi-Mode Characteristics

Alpha's Multi-Mode	Attenuation (dB/km) Maximum		Bandwidth (MHz - km) Minimum	
62.5 µm Series	850 nm	1300 nm	850 nm	1300 nm
dB/km	3.75	1.5	160	500

Numerical Aperture (NA)

The numerical aperture is a measure of the angular light acceptance for a fiber. It is the sine of the largest meridional ray angle that can be accepted by the fiber and, as such, is a dimensionless number. 100 percent of the output optical power is contained within this angle.

Core Diameter

The fiber core is the central region of an optical fiber whose refractive index is higher than that of the fiber cladding. Various core diameters (from 50 microns to 100 microns) are available in our standard product line to permit the most efficient coupling of light from commercially available light sources, such as LEDs or laser diodes.

Optical Collection Factor

All of these optical fiber parameters interact to offer numerous options for various applications. **Table A.8** illustrates the effect of core diameter and numerical aperture upon the light gathering capability of various commercial fibers. The optical collection factor can be considered a measure of the fiber's collection efficiency for optical radiation.

Table A.8 Optical Collection Factor

Fiber Core Dia. Microns	Numerical Aperture	Collection Factor*	
		Relative	dB Ratio
100.0	0.290	1.00	+0.0
62.5	0.275	0.35	-4.6
50.0	0.200	0.12	-9.2

*Values normalized to short length of 100 micron core fiber.

Optical Spectrum

850 and 1300 nm are the primary transmission wavelengths. 850 has a higher loss, but is more economical for shorter distance.

Fiber operates optimally at specific points on the spectrum called wavelengths. Wavelength are measured in nanometers (nm).

Each 62.5/125 micron fiber has a 160/500 MHz-km bandwidth at 850 nm and 1300 nm.

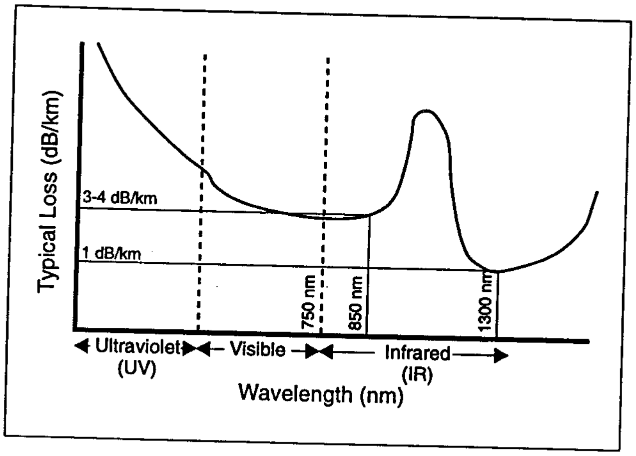


Figure A.5 Optical Spectrum

Installation

Normal cable loads sustained during installation or environmental movements first stress the strength members without transferring the stress to the optical fibers. If the load is increased, the fiber may ultimately be placed in a tensile stress state. This level of stress may cause microbending losses which can result in attenuation increase and fatigue effects. To prevent irreversible changes, cables should be loaded during installation only for short periods. All Belden cables are rated for both short-term installation and long-term application loads.

Belden's fiber optic cables are available with numerous combinations of jacket materials suitable for installation in aerial, direct burial, plenum or cable raceways, as well as underground ducts. Selected cables meet the specifications of NEC Article 770-6 which include General Purpose or Tray (OFN), Riser (OFNR), and Plenum (OFNP).

To Convert From:	To:	Multiply By:
To Convert To:	From:	Divide By:
microns	mills	0.3937
mm	in.	0.3937
cm	in.	0.39370
m	ft.	3.2808
km	ft.	3280.8
km	mi.	0.62137
kg	lbs	2.2046
kg/km	lbs/1000 ft.	0.67197
N	lbs	0.2248
N-m	ft.-lbs	0.73757
N/cm	lbs/in.	0.5710
kPa	PSI	0.14511
°F = 9/5 (°C) + 32	°C = 5/9 (°F- 32)	

A.3.6 Fiber Optic Connector

The fiber optic cables (or "patch cords") must be terminated with ST style connectors and have a numerical aperture of 0.275 ± 0.015. Pre-terminated cables with ST connectors and a 90° strain relief boot attached at one end (for the communications module connection) are recommended. These cables are available from various cable suppliers. Contact the cable supplier for details, including the length specification. **Figure A.6** shows an ST style connector with a 90° strain relief boot. (If pre-terminated cables are not used, follow the instructions supplied by the manufacturer to attach the connector to the fiber cable using the cable type recommended in **Section A.1.3.**)

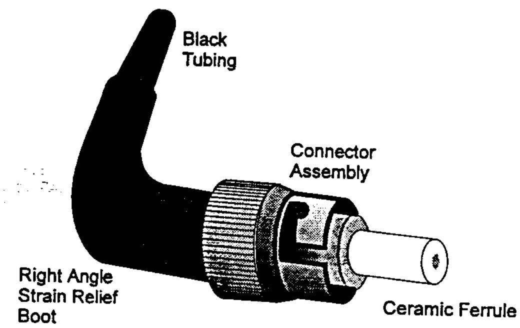


Figure A.6 ST Connector With Right Angle Strain Relief Boot

A.3.7 Fiber Optic Connections

When making connections to the transmitter and receiver inputs/outputs, ensure that the transmit output from one device is connected to the receive input of the next device. **Figure A.7** shows how to insert the connector. The tip of the cable on the ST connector must be clean and free of dust. Dust on the tip of the cable will cause signal attenuation.

Caution: Use extreme care when handling the fiber optic connector, especially the exposed ceramic ferrule.

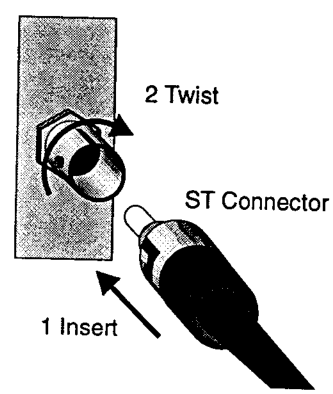


Figure A.7 Fiber Optic Connections

B Transient Eliminator

Install Transient Eliminators on ACCESS communications wiring entering a building from the outside to protect the lines from electrical surges that could destroy data and affect equipment. Install Transient Eliminators within the electrical equipment to provide necessary protection for the ACCESS communication system. Failure to do so can result in induced system failures.

As a standard practice, install Transient Eliminators at the termination point of any communication wires that may exit the building. This guideline applies to the supervisory devices communicating with a remote system; however, it may also apply to field devices (that is, Static Trip III trip unit, 4700 power meter, SCOR relay, and so on) protection on the local RS-485 communications bus.

B.1 Standards

There are many devices available today that provide surge protection for power line transients but few that provide surge protection for digital data communications. Standards are emerging for protection of data communications lines; however, in the past, companies applied standards for protection of power lines for use with data communications lines.

Originally, data communications modules were tested against ANSI 37.90A (IEEE 472-1974) and later ANSI/IEEE C62.41 (formerly IEEE 587), which are the standards for surge testing low- voltage power lines. These standards use both a 6.5 kV, 100 Hz, 500 A ringwave waveform (damped sinusoidal) and a 6.5 kV, 3 kA, 8 x 20 microsecond waveform to simulate surges on power lines.

Newer standards, such as the IEC 801-5 and UL 497, either provide for testing data communications protection or are specifically designed (UL 497) for testing data communications protection devices. These newer standards are the ones that all surge protection devices for the ACCESS system must meet. As devices begin to meet these newer standards, older, noncomplying devices will be phased out of use.

Select devices that meet ANSI/IEEE C62.41 voltage and current clamping requirements for both Categories A and B. Ideally, they should meet UL 497 as well.

B.2 Installing the Transient Eliminator

Refer to **section 5.3, Connecting Transient Eliminator.** Follow these guidelines:

- Properly ground all such devices.
- Install such devices at the point of exit from the electrical equipment where an outside communications cable connection occurs.

  Note: This guideline does not apply to interelectrical equipment communication wiring located within the same building or between electrical equipment line-ups.

  For Multilin relays, the Isolated Multi-Drop converter, used for RS-232-to-RS-485 conversion at the Host PC, also provides the necessary surge protection (at the Host PC), so a separate unit is not required.
- Transient Eliminators attached to the SEAbus RS-485 networks require only a two-wire connection. Ground the communications cable's shield to earth ground at one end only.
- Transient Eliminators attached to the short-haul modems on require a four-wire connection. The communications cable shield must be grounded to earth ground at the Transient Eliminator and not propagated through the modems.

  Note: Do not connect the shield under any circumstances to the modem.

B.3 Recommended Devices

Siemens recommends the following surge devices:

MCG Electronics: Part Number DLP-10-6V-15
This is a two-wire protector for SEAbus RS-485 wiring.

MCG Electronics: Part number DLP-20-6V-15
This is a four-wire protector for Power Monitor-to-Host PC connection and interconnects via the RAD Modem.

These modules provide a 6 V clamp voltage and are therefore suitable for both RS-485 (6 V) and short-haul modem applications. They also meet ANSI/IEEE C62.41 clamping requirements and are UL listed.

Other modules that meet ANSI/IEEE C62.41 may be used in place of these recommended devices, but if they are not UL listed, they are not suitable for those sites where UL listing is required. These devices include L.E.A. Dynatech model TE (4) 7.5V10 and TE (2) 7.5V10 for RS-232 and RS-485 SEAbus protection respectively.

The transient eliminators typically induce on each line a series resistance of 15 Ω, which affects the maximum loop length. Depending on the cable selected, the maximum loop length may drop below the specified maximum of 4000 feet. Refer to **Appendix A**.

C Serial Communications

C.1 RS-232 Overview

The RS-232 interface is the most popular way for PCs to communicate with other devices, usually called *peripherals*. For the ACCESS system, each field device connected to the system is in a sense a peripheral.

The RS-232 interface has become an industry standard by its popularity. It is over 25 years old. Originally, the EIA (Electronic Industries Association) proposed it as a recommended standard (RS). Today, even though it is an accepted standard, EIA/TIA-232-x—where *x* is the revision letter—is still referred to as simply RS-232.

The RS-232 interface is a serial communications standard, as opposed to a parallel communications standard. In serial communications, data is sent one bit (binary digit) at a time; in parallel communications, several bits of data are sent at the same time, each over different wires.

The RS-232 interface was updated in 1986 to include a mechanical (that is, connector) specification as well as the addition of a few new signals and a slight change in some of the terminology. This is called EIA-232-D-1986.

The RS-232 interface is a single-ended or unbalanced interface. Each line consists of a single wire that is referenced to a common ground line. All of the lines share that ground line as the current return path. Because of its susceptibility to noise (unwanted signals), the specification restricts the transmission distance to 50 feet (about 15 meters) and transmission speed to 20 kilobits per second (Kbps, or 20,000 bits per second).

Before the recent addition of the mechanical specification that specified the connector interface, the RS-232 interface came in both 9-pin and 25-pin versions. Today the 25-pin "D" (for its shape) connector is standard.

Five types of interchange circuits exist in RS-232: grounding, data, control signal, timing, and secondary channel. *Grounding* circuits are two types, signal and protective. Signal ground establishes a common reference for all interchange circuits. Protective ground is isolated from signal ground and is electrically bonded to the equipment frame. *Data* circuits (that is, primary channel circuits) handle data transmission and reception. *Control signal* circuits enable and disable data transmission and reception. They also indicate the operational status of the DTE or DCE. A control signal is ON when its voltage is positive (+5 to +25 V). A control signal is OFF when its voltage is negative (-5 to -25 V). *Timing* circuits are used in synchronous communication only, and handle clocking functions for data and control signals. *Secondary channel* circuits are used in systems that require low speed subchannels and high-speed (primary) channels for data. Normally, primary and secondary channels flow in different directions.

The RS-422 interface, introduced in 1978, is an improvement on the 232 standard. Developed years later and providing a differential or balanced form of communications, the RS-422 allows for more dependable communications over larger distances. The RS-422 supports 90 kbps communications with an allowable cable distance of up to 4000 feet (1200 meters) and even faster rates for shorter distances, up to 2 Mbps. A companion mechanical (connector) specification is RS-449.

C.2 RS-485 Overview

The RS-232: and RS-422 are good for point-to-point communications, when only two machines or systems are communicating with each other. For those systems that require more of a party-line communication, RS-485 is used. The RS-485 scheme supports multipoint (or multidrop) operation. It allows up to 32 devices to communicate over a common pair of wires. Introduced in April, 1983, it supports up to 10 megabits per second (Mbps) at up to 4000 feet. The party-line capability is accomplished by having tri-state outputs. The outputs can be sending a one (logic level high) or a zero (logic level low) or be in a high-impedance mode effectively removing it from the line.

With a multipoint communications system, only one device can be transmitting or receiving at a time (half-duplex) as opposed to the point-to-point communications which can transmit and receive simultaneously (full-duplex). Two common approaches of handling this is multiple master approach and master/slave approach. With the multiple master approach, the device that wants to send data must determine first if the line is being used by another device before acquiring control. With master/slave, only one master device resides on the line. All the other devices, the slaves, are receivers of data and communicate their data to the master only when the master device requests it.

Data in half-duplex communication is generally transferred in *packets* in multipoint applications. A packet consists of a header, the body, and a footer. The header may include one or more "sync" characters (indicating the start of a new packet), a node address and an indication of the length of the body of the packet. The body contains the data being transmitted. The footer usually contains some kind of checksum or CRC (cyclic redundancy check) code to verify the integrity of the transmission.

While RS-485 may be either asynchronous or synchronous, most plant applications use the simple, though slower, asynchronous communications. Synchronous communication require special clocking either in the form of dedicated clock lines or specially encoded data. Optical isolation of RS-485 ports is very desirable as it eliminates problems that result from ground potential differences. To limit noise, a shielded, twisted-pair cabling is essential.

RS-485 is a standard that is commonly used in many industrial environments because it has advantages that make it better suited for industrial applications. One advantage is that RS-485 offers a balanced transmission scheme that uses differential drivers and receivers. This scheme cancels noise and allows for better data integrity. By contrast, the RS-232: standard uses a single-ended, unbalanced design that can distort data. The RS-485 design can support 32 different drivers and receivers over a maximum distance of 4000 feet, and at data transmission speeds of up to 10 Mbps. The RS-232: standard supports only one driver and receiver over 50 feet of distance, at transmission speeds as high as 20 Kbps. **Table C.1** lists the parameters for both RS-485 and RS-232 standards.

Table C.1 RS-232 Interface Standard

RS-232 Description	EIA RS-232	CCITT V.24	25-PinDB-25	IBM DB-9	From DCE	To DCE
Protective Ground	AA	101	1	5	-	-
Transmitted Data	BA	103	2	3		X
Received Data	BB	104	3	2	X	
Request to Send	CA	105	4	7		X
Clear to Send	CB	106	5	8	X	
Data Set Ready	CC	107	6	6	X	
Signal Ground	AB	102	7	5	-	-
Carrier Detect	CF	109	8	1	X	
+ Voltage (Reserved for Data Test Setting)			9			X
- Voltage (Reserved for Data Test Setting)			10			X
Secondary Carrier Detect	SCF	122	12		X	
Secondary Carrier to Send	SBC	121	13		X	
Secondary Transmit Data	SBA	118	14		X	
Transmit Clock	DB	114	15		X	
Secondary Receive Data	SBB	119	16			X
Receive Clock	DD	115	17		X	
Secondary Request to Send	SCA	120	19			X
Data Terminal Ready	CD	108.2	20	4		X
Signal Quality Detector	CG	110	21		X	
Ring Indicator	CE	125	22	9	X	
Data Signal Rate Detector	CH/CI	111/112	23		X	X
DTE Transmit Clock	DA	113	24			X

The RS-485 network transfers data by applying differential signals to a twisted-pair cable. The phase relationship between the two transmitted signals on the cable is 180 degrees out of phase. This relationship may be viewed clearly in **Figure C.2** in the time period containing no noise.

When noise occurs on the bus, it is induced onto the twisted-pair cable at the same amplitude and time as the data signal, causing the noise signal to be in phase. The resulting waveform then contains both the desired signal plus the noise; as a result, the desired signal is out of phase and the noise is in phase. The relationship between the resulting waveforms on each wire contains the desired signal plus the noise. In this case, the desired signal is out-of-phase and the noise is in-phase.

The receiver circuit of the RS-485 bus differentially combines the waveform of each wire. This combination produces a signal that represents the difference between the two waveforms and that the in-phase (noise) portion of the waveform cancels out, leaving only the desired signal. The phase relationship between the desired signal (input and output data) and noise may be seen at the vertical line in the diagram.

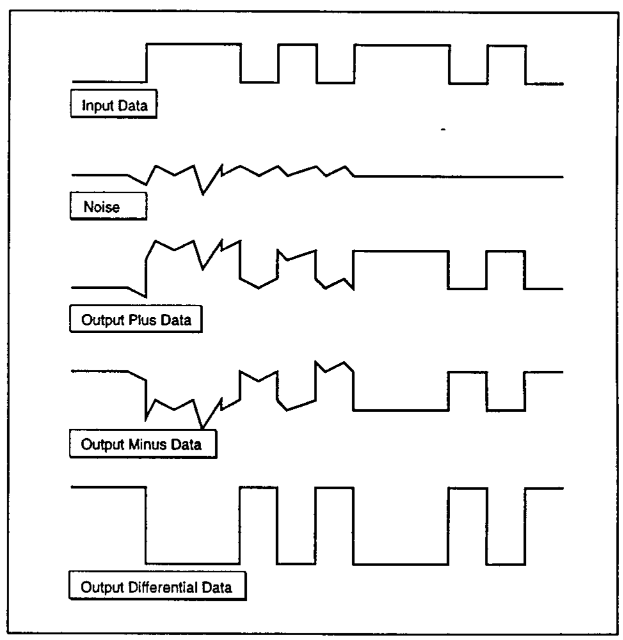


Figure C.2 RS-485 Waveform Diagram

C.3 Data Transmission

Data communicated along the bus is in binary form. The information is broken down into combinations of "1s" and "0s" (these are binary digits or "bits"), whose exact combination and pattern is understood by both devices. For example, in binary-coded decimal (BCD) form, the numbers 5, 2, 8 and 0 are 0101, 0010, 1000, and 0000 respectively. Each number is represented by a combination of four 1s and 0s. Eight bits are commonly called a "byte." A "word" can be made up of two bytes. This is just one example of many ways to encode data.

The value of this form of communication is that a one or a zero can be translated by the electronic circuitry as a higher (1) or lower (0) voltage state, either on or off. This system greatly simplifies the circuit design. To send the above numbers (5,2,8,0) along the bus to another unit, the binary digits representing each number are put onto the bus one bit at a time, in sequence. This system is known as "serial" data communication.

The transmission described in the preceding paragraph over simplifies the issue. In reality, the receiving unit must first be told to receive the data, and it must have a context for the values. For example, when the numbers 5, 2, 8, and 0 are received, the receiving device must understand what they mean. To make sense of this string of 1s and 0s transmitted on the bus, the data must be organized. This organization is unique to each field device and is defined in the device protocol packet definitions.

D Communications Protocol

The rules that govern this packet organization for the field level of the ACCESS system are collectively called the *SEAbus protocol*, or simply SEAbus. This protocol is defined in a written document detailing "the rules of the bus." Siemens makes this protocol available to anyone who wants to connect their device to the ACCESS system, so it is an open protocol. For more information on data communication, consult the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00).

The SEAbus protocol is a software communications protocol that was originally developed for communicating between the Siemens Static Trip III trip unit and the Power Monitor display and monitoring unit. Since then, it has been enhanced to provide increased performance and to allow for other types of field devices, supervisory devices, and software.

The SEAbus Plus protocol is the next generation of the SEAbus protocol. The SEAbus Plus protocol offers significant improvements to error detection and security of control messages. These enhancements were required as the ACCESS system became increasingly integrated into control systems.

Both protocols are used for communication between supervisory and field devices. The protocols generally operate on a serial, two-wire RS-485 network consisting of a single-bus supervisory device and up to 32 field devices. They are also used on RS-232 networks or on multiple parallel RS-485 loops simultaneously (allowing for up to 128 field devices per supervisory device). Their packets have the same header information and do not conflict with each other. As a result, SEAbus and SEAbus Plus devices can coexist on the same communications loop.

D.1 SEAbus Packets

The protocols are essentially byte count oriented protocols (BCOP). All information is contained in data bytes in a base serial format that is standard asynchronous with eight data bits, no parity, and one stop bit. The data bytes are grouped in short packets containing from 5 to 260 characters in the SEAbus protocol and from 8 to 260 characters in the SEAbus Plus protocol. These packets are sent and received at speeds ranging from 2400 to 38400 bits per second (bps).

Packets for both protocols are defined by framing characters contained in their headers. These characters are the Synchronization (Sync) byte, the Address (Devt) byte, the Message Type (Msgt) byte, and the Length (Len) byte. The four-byte header is followed by up to 255 Data bytes and the Longitudinal Redundancy Check (LRC) byte. The primary difference between the two protocols lies in the Data bytes of the packet; in the SEAbus Plus protocol, the last three Data bytes of each packet always define the cyclical redundancy check (CRC), an additional error detection method for SEAbus Plus devices.

A supervisory device (for example, the Power Monitor display and monitoring unit or PC) running an ACCESS host PC software (for example, WinPM) initiates all communication by sending a packet addressed to a field device. The field device either responds with a packet or declines to respond if no response is required. Only one packet is sent at a time. A field device never initiates communication, and any data that does not meet the timing or structural requirements defined in this manual is ignored by all devices.

D.2 SEAbus Message Structure

Information in SEAbus data packets is packed in the following sequence called a message:

Sync	Devt	Msgt	Len	Data	LRC

The following definitions briefly describe each of the fields in the above message structure:

Sync The Sync byte (8 bits) alerts the system that information is coming. There is a supervisory devce-to-field device Sync byte (14h) and a field device-to-supervisory device response Sync byte (27h). (The "h" indicates a hexadecimal number.)

Devt The Devt byte is the device's intended address. It can be either a direct address for a specific device or an indirect address for a device type.

Msgt The Msgt byte tells the receiving device what the message means. One code might mean current or voltage data, a second code might mean device status, and so on.

Len The Len byte indicates the number of bytes in the data section of the packet.

Data This is the data, the reason the communication system is in place. With indirect addressing, the first one or two bytes in this field is the device's address.

LRC This is the checksum byte. This field, Longitudinal Redundancy Check, is put in place as a check on the integrity of the whole packet. It can detect if one or more of the bits was changed during transmission.

For more information on SEAbus message structure, refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual SG-6213).

D.3 Addressing

Each device is capable of receiving and decoding messages. The key is to have the correct device respond to the message. To accomplish this, you must establish a unique address or location on the bus for each device. This allows the Power Monitor unit to send information to a specific device that responds to that information.

On the communications bus, all connected devices are exposed to the same signals going back and forth. Each device has a unique address. The device address in the first byte of the data field alerts the respective device to the arriving message.

Addresses are stored in two ways: using solid state data memory and using hardware switches. The first way uses a data memory location that is not lost during a power outage. This memory can be divided into two types: The first type is typically called Electrically Erasable Programmable Read Only Memory (EEPROM). Using the routines for each device (described in **Chapter 4, Installing Field Devices**, or in their respective operator's manual), the address is programmed into this memory location, replacing anything that was previously recorded. The second memory type uses a long-life battery to maintain the address and setup information in a standard nonvolatile electronic memory.

The second way of storing an address is through the use of hardware switches on the device. Using this method, the address is set manually and can only be changed manually.

The Devt field contains the device address for the Static Trip III trip unit and the SAMMS devices only. Indirect addressing is used in all other cases. In the indirect addressing mode, the Devt field contains a code specific to the device type addressed. The actual device address is contained within the first one or two bytes of the Data field, depending on the device type.

The Multiplexer Translator (MT) (refer to **Section 4.7.2**) has a two-part address scheme. The first Data byte is the address of the MT. The second Data byte is the address of the device connected to the MT. **Chapter 3, Connecting the Network**, and the operator's manual for the MT explain this scheme in more detail.

D.4 Error Checking

Occasionally, data errors occur in a data communication system. Whatever the cause, the system is built to tolerate bit errors in any packet transmitted or received. The SEAbus software incorporates a scheme for error checking, called longitudinal redundancy check (LRC). If the LRC byte detects an error, the message is retransmitted.

E Device Addressing Methods

Address ranges and the addressing method for ACCESS devices vary among devices. Although the addressing method is invisible to the end user of a supervisory device, it is covered here to aid in troubleshooting. There are three methods of addressing SEAbus field devices, and the method you use for each device depends on the device type. These methods are direct, indirect, and extended addressing.

SEAbus and SEAbus Plus field devices can be addressed either directly or indirectly. The value of the second byte ("Device Type" or Devt byte) determines which mode is used. Addresses 1 to 224 (01h to E0h) are reserved for direct addresses, and addresses 225 to 254 (E1h to FEh) are reserved for indirect addresses. For universal requests and broadcast messages, the special addresses 0 (00h) and 255 (FFh) are reserved, respectively.

E.1 Direct Addressing

As illustrated in **Figure E.1**, the second byte (Devt) in a SEAbus packet is the address field for the direct address method of device communications. There are two direct address devices, the SAMMS device and the Static Trip III (Pre '91) trip unit. While one byte provides 256 possible addresses, these devices are restricted to addresses in range 1 to 224. Address 0 is reserved for universal access requests, while address 255 is reserved for broadcasting addresses for the devices. A broadcast address allows all devices to simultaneously act upon a request such as time synchronization. The universal access address is used to find and identify a unit with an unknown address. Any device that receives a packet with this address responds to it, so make sure that only one device is attached when this message is sent.

Sync	Devt	Msgt	Len	Data	LRC

Figure E.1 SEAbus Packet Contents

E.2 Indirect Addressing

Addresses 225 through 254 are used to indicate a device type that must use indirect addressing or, in the case of the 3600-S1 power meter, extended addressing. All devices, except the SAMMS device, the Static Trip III (Pre '91) trip unit, and the 3600-S1 power meter, use indirect addressing. The indirect addressing mode requires that a particular device first recognizes its assigned device type (in the DEVT byte) within the range of 225 to 254, then recognize its unique address, which is sent as the first byte within the data field. The 3600-S1 power meter addressing differs from the indirect method in that its address is contained in the first two bytes of the data field.

Table E.1 presents the values assigned to the DEVT (second) byte in a SEAbus packet. All devices other than the Static Trip III (Pre '91) trip unit and the SAMMS device use this value as a device-type code and find their addresses in the data field of the packet.

Note: The Host PC is an indirectly addressed device. Since there is only one Host PC per Power Monitor unit, it does not require an address byte in the data field of the SEAbus packet.

Table E.2 Device Type Address Code for Devt Byte

Value		Description (1)
Hexa-decimal	Decimal	
00h	0	Universal Access address code (2)
01h...E0h	1...224	Static Trip III trip units and SAMMS devices direct address codes
E1h...F1h	225...241	Indirect address codes reserved (3)
F2h	242	SB trip unit address code
F3h	243	S7-I/O unit address code
F4h	244	PRM E-20 Pulse reading meter address code
F5h	245	4720 power meter address code
F6h	246	4300 power meter address code
F7h	247	ISGS relay address code
F8h	248	Static Trip III trip unit address code
F9h	249	Multiplexer Translator address code
FAh	250	SCOR unit address code
FBh	251	Not used
FCh	252	ACCESS Host PC address code
FDh	253	3600-S1 power meter address code
FEh	254	4700 power meter address code
FFh	255	Global Broadcast address code (4)

1: The Devt byte is only necessary in packets transmitted from supervisory devices to field devices. For consistency, however, and to aid the debugging effort, it is also included in packets transmitted from field devices to supervisory devices.

2: Used to find and identify a device with an unknown address. Any device that receives a packet with this address must respond as though the packet were explicitly addressed to it. When such a request is transmitted from the supervisory device, you can have only one device communicating with the supervisory device.

3: To avoid duplication of device type addresses, these address codes are only assigned by Siemens.

4: The global broadcast address code, which is acted upon by all devices. This address can be used for common packets only.

Table E.2 presents the address ranges for each device. The table does not indicate a device's addressing method, which is independent of the address range. Also, all indirect and extended address devices use address 0 for device-type specific access requests, and 255 (0 in the case of the 3600-S1 power meter) for device type specific broadcast messages.

Note: All SEAbus devices are shipped from the factory with 222 as the default address. For ease in adding devices to a system, do not assign address 222 to any system device. This allows you to insert a new device with address 222 and program it with another address.

Table E.1 Addressing Ranges

Device	Address Range
3600-S1 power meter	1 to 9999
4300 power meter	1 to 254
4700 power meter	1 to 254
4720 power meter	1 to 254
Static Trip III trip unit	1 to 224
SAMMS unit	1 to 224
SCOR device	1 to 254
ISGS relay	1 to 254
Multiplexer Translator	1 to 31
S7-I/O device	1 to 254
Sensitrip trip unit	1 to 254
SB breaker unit	1 to 254

Note: The Static Trip III trip units, although primarily indirectly addressed devices, are limited to the addressing range of 1 to 224. This maintains compatibility with the Static Trip III (Pre '91) trip unit for which it provides SEAbus emulation.

E.3 Indirect Addressing with Multiplexers

Indirect addressing is appropriate for multiplexing devices that connect several non-SEAbus field devices to the SEAbus communications loops. An example of a multiplexing device is the Siemens Multiplexer Translator.

E.4 Global Broadcast Packets

Use Global Broadcast packets to send the same information to all devices simultaneously. The Devt byte is defined as 255 (FFh), the address code reserved for global broadcasts.

E.5 Device Type Broadcast Packets

Each device using indirect addressing must support a broadcast packet that sends the same message to all devices of only one particular type. To send a device type broadcast, first use the indirect addressing scheme to indicate the address code for the particular type of device. Then, instead of the local device address as the first byte in the Data field, substitute a value of 255 (FFh) to indicate that the packet contains a broadcast message.

Note: Under no circumstances must a field device attempt to respond to a Broadcast packet.

E.6 Guidelines

The following guidelines help you set up an ACCESS system where all devices are properly addressed. For further instructions, refer to the instruction manuals for each device.

- Configure a unique address for each device connected to a supervisory device. In a system that contains more than one supervisory device connected to a host PC, the same address can be used for different devices provided that these devices are connected to different supervisory devices. But wherever possible, do not duplicate addresses.
- Do not assign an address to Power Monitor units.
- The Power Monitor Series 3 unit allows two RS-485 loops, each containing up to 32 devices. Each device connected to it requires a unique address regardless of the loop to which the device is connected.
- The Isolated Multi-Drop converter converts four RS-485 loops to one RS-232 port. The Isolated Multi-Drop converter connects to a PC (running supervisory software) via an RS-232 port. The PC running the Power Monitor PC software can handle 32 devices per loop for a total of 128 devices with the Isolated Multi-Drop converter. Each device connected to the Isolated Multi-Drop converter must have a unique address regardless of the RS-485 loop to which the device is connected.

Additional information on SEAbus communications can be found in *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213).

F RS-485 Waveform Analysis

The environment where ACCESS equipment is located typically has large magnitudes of current flowing through it. Potential problems with communication, associated with high current flow and noise, are to some extent controlled by the RS-485 bus and by the common-mode rejection and differential characteristics of the receivers. However, if the severity of the disturbance forces voltage outside the range of +12/-7 VDC from the receiver's ground reference point, then data may be corrupted. Likewise, the difference in earth ground voltage at devices located across the bus may also pose problems. The RS-485 receivers can correctly decode bus data if the signals they receive are within the range of +12/-7 VDC of the receiver's ground voltage point. Therefore, the transmitter and receiver may have a ground voltage difference of between +12 and -7 V and still function.

Figure F.1 illustrates an RS-485 waveform captured at a receiver, with channels 1 and 2 adjusted to the same ground reference point at the center of the grid. With the waveforms displayed in this fashion, it is easy to see and compare the relationship between ground reference and the RS-485 lines. The RS-485 plus and minus waveforms form an envelope that must stay between +12 V (valid high-receive level) and -7 V (valid low-receive level) for the receiver to decode the data. The position of the resulting differential signal has no significance. The waveform shown in **Figure F.2** is at ideal voltage levels.

Different earth-ground voltages may occur at any receiver on the bus; however, they most likely occur at the receiver located farthest from the transmitter. They may also occur at the Power Monitor unit, since it receives data.

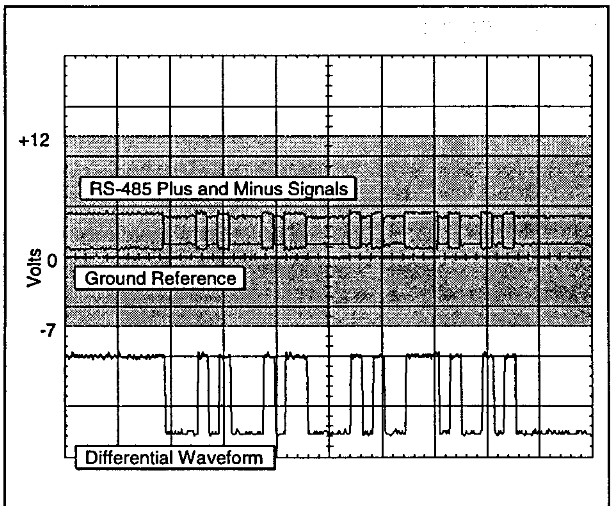


Figure F.1 RS-485 Waveform

The RS-485 standard specifies that a driver must be capable of presenting a 1.5 V signal differentially at its outputs, under the loading of 32 receivers and two 120 Ω termination resistors. Each receiver or passive transceiver must provide a minimum input impedance of 12 KΩ. The parallel load impedance is 51Ω, which includes the receiver load, termination resistors, and biasing resistors. Typically, many RS-485 drivers can drive more than 51Ω or as low as 20 Ω. If typical characteristics are used, a network may consist of more than the 32 devices specified by the RS-485 standard.

F.1 Setting Up the Oscilloscope

A differential measurement is the difference between the two points that are contacted by the measurement probes. For example, a voltage meter displays a true differential measurement between its plus and minus probes. An oscilloscope displays a differential waveform.

Before an oscilloscope can make an accurate measurement, you must connect it's frame ground to the circuit being measured. If the oscilloscope is powered by an external AC source, this connection may be through earth ground via the power cord or through the scope's probe ground clip. If the scope is powered by an external AC source, the scope's frame ground is held to the earth ground's voltage potential.

To obtain a differential measurement from an oscilloscope that does not use earth ground as its reference point, use either the Dual-Probe or Single-Probe method.

The Dual-Probe method displays a waveform representing the difference between input channels 1 and 2. This method has two requirements:

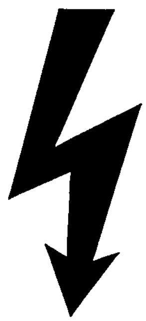
1. The scope must have at least two (dual) input channels.
2. If the oscilloscope is an analog scope, it must be able to add two channels together and invert one of those two channels.

All dual-channel, digital scopes comply with these requirements.

You may use the Single-Probe method with any oscilloscope. Siemens recommends that you use it with oscilloscopes that have only one input channel or that lack the controls necessary for the Dual-Probe method.

The Single-Probe method displays a waveform representing the difference between channel 1 and the scope's frame ground. Connect the probe (channel 1) to the device's plus terminal. The "second reference" associated with the waveform is not as obvious as it is with the voltage meter. This second reference is the probe's ground reference lead. This reference is taken from the scope's frame ground. This voltage reference point (the second probe) is equivalent to the voltage meter's minus probe. The Single-Probe method establishes this equivalent of the minus probe by disconnecting the external connection between earth ground and the oscilloscope's frame ground. Also, AC line power is coupled to the oscilloscope via an isolation transformer. The scope's AC power lines and frame ground are then isolated, and the scope is "floating." At this point, the oscilloscope's frame ground may be used as a reference probe.

⚠ CAUTION



Hazardous voltage.
May cause electrical shock.

The oscilloscope frame is not grounded for the Single-Probe Method. Make sure that the oscilloscpe is operated properly.

If possible, establish communication on the RS-485 bus prior to performing the oscilloscope set-up procedure.

F.2 Using the Dual-Probe Method

Use the Dual-Probe method for both analog and digital scopes.

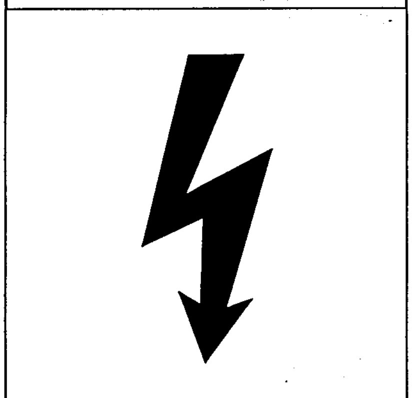
1. Set the vertical mode switch for input channels 1 & 2 to BOTH.
2. Set the vertical coupling switch for input channels 1 & 2 to DC.
3. Set the vertical amplitude controls for channels 1 & 2 to 2 volts per division. Verify the probe type (X1 or X10) and compensate accordingly.
4. Set the time-base control to 2 milliseconds per division for an RS-485 bus transfer speed of 4800 baud (4 ms for 2400 baud, 1 ms for 9600 baud).
5. Set the trigger mode switch to AUTO.
6. Set the trigger source switch to CHANNEL 1.
7. Adjust the vertical sweep POSITION control for channel 1 so that the channel 1 sweep is halfway between the middle and the top of the CRT display.
8. Adjust the vertical sweep POSITION control for channel 2 so that the channel 2 sweep is halfway between the middle and the bottom of the CRT display.
9. Attach the channel 1 probe to the RS-485 plus (black) wire and the channel 2 probe to the RS-485 minus (white) wire. To reduce noise, connect the probe ground clips together, but do not ground them.
10. If a 60 Hz signal appears to modulate both displayed waveforms, attach both probe ground clips to earth ground. If a 60 Hz signal is still present, use a voltage meter and measure the AC voltage between the RS-485 cable shield (at the channel 1 & 2 probe connection) and the earth ground. If the AC voltage measured is less than 7 volts, connect the scope's probe ground leads to the RS-485 cable shield connection. If the AC voltage is greater than 7 volts or if the 60 Hz signal is still present, ensure that the scope is properly grounded before going to the next step.
11. If necessary, adjust the vertical POSITION control for channels 1 & 2 to return the waveforms to their previous positions.
    a. At this point, the procedure may differ between analog and digital scopes. For digital oscilloscopes without INVERT control, go to step 12. For analog and digital oscilloscopes with channel mode ADD and INVERT controls, go to step 15.
12. Digital oscilloscopes differ with respect to math functions controls. At this point either invert channel 2 and then add channels 1 and 2, or subtract channel 1 from channel 2 or channel 2 from channel 1. Refer to the oscilloscope operator's manual for detailed instructions.
13. After you complete the math function, the differential waveform appears on the CRT display.
14. Proceed to Step 18 if you are using a digital oscilloscope without INVERT control.
15. Adjust the vertical mode switch for input channels 1 & 2 to ADD. (A straight line is displayed, representing the algebraic sum of channels 1 & 2. Channels 1 & 2 waveforms may disappear on some oscilloscopes, leaving only the sum.)
16. Place the third (sum) waveform at the center of CRT screen, with channels 1 & 2 vertical position controls.
17. Place the channel 2 invert switch in the active position. (The waveform displays the differential measurement.)
18. Adjust the trigger-level control to synchronize the waveform(s).
19. Adjust the vertical amplitude control if its signal level is too low. Adjust the vertical amplitude controls for channels 1 & 2 to the same value.

F.3 Using the Single-Probe Method

Use the Single-Probe method for oscilloscopes that have only one probe. If your oscilloscope is powered by batteries (DC) and is not connected to earth ground, begin with step 3. If not, isolate the oscilloscope from the external AC power and earth ground connections using either step 1 or step 2 below. Once completed, proceed to step 3:

1. Use an isolation transformer that isolates not only the AC power line but also the earth ground. Make sure the isolation transformer has an adequate VA power rating to power the oscilloscope.
2. Use a ground isolation monitor such as the Tektronix A6901. The Tektronix A6901 provides ground isolation for the measurements and protection from shock hazards, but it does not isolate the AC line.

⚠ CAUTION



Hazardous voltage.
Will cause electrical shock.

Do NOT use a grounding or "cheater" plug between the scope's power cord and the power receptacle.
Using a cheater plug is dangerous for the operator and may damage the equipment.

3. Set the vertical coupling switch for input channel 1 to DC.
4. Set the vertical amplitude controls for channel 1 to 2 volts per division. Verify the probe type (X1 or X10) and compensate accordingly.
5. For 4800 baud, adjust the time-base control to 2 ms per division (4 ms for 2400 baud, 1 ms for 9600 baud).
6. Set the trigger mode switch to AUTO.
7. Set the trigger source switch to CHANNEL 1.
8. Adjust the vertical sweep POSITION control for channel 1 to place channel 1 sweep in the middle of the CRT display.
9. Attach the channel 1 probe to the RS-485 plus (black) wire and the ground of the channel 1 probe to the RS-485 minus (white) wire. The oscilloscope should now display the differential measurement. If a 60 Hz signal appears to modulate the displayed waveform, ensure that the scope's probe ground is properly connected. If connecting the scope's probe ground causes a voltage change at the point it connects, verify that the scope is indeed floating.
10. Adjust the trigger-level control as necessary to synchronize the waveform.
11. Adjust the vertical amplitude control if the signal level is too low.

Figure F.2 shows a captured waveform of a Power Monitor unit's RS-485 bus that is polling slave devices. The baud rate is 4800. Channel 1 is the top waveform, the differential is the middle waveform, and channel 2 is the bottom waveform. If the Single-Probe method is used, channels 1 and 2 are not displayed.

The amplitude of the differential waveform should be about twice that of channels 1 and 2.

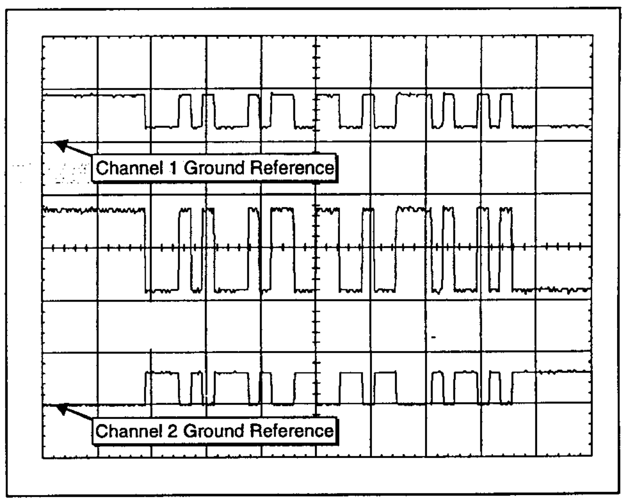


Figure F.2 Channel 1, Differential, and Channel 2 Waveforms

The waveform in **Figure F.3** on the next page is an RS-485 transmission that has traveled through approximately 4,000 feet of cable. A termination resistor is located at the probe point, and several receivers are attached to the cable as well. Notice the low amplitude (0.5 volts per division) of the waveform on channels 1 and 2. The low amplitude occurs because of the resistance of the cable and the termination resistor. Also, the noise common to channels 1 and 2 is cancelled out by the inherent common-mode rejection from the resulting differential waveform (center). The resulting differential waveform is reduced to half amplitude scale.

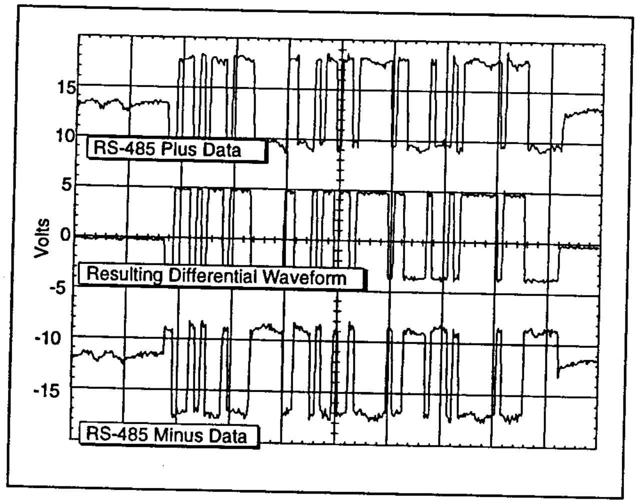


Figure F.3 Waveform Through 4000 Feet of Cable

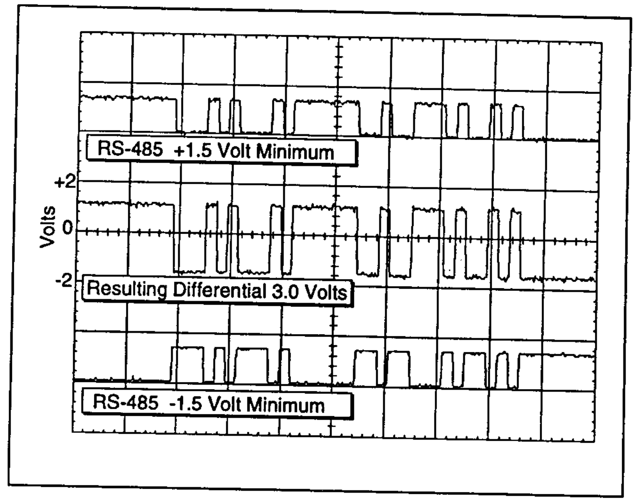


Figure F.4 Waveforms of the 51Ω Test

F.4 Administering the 51 Ω Test

Figure F.3 shows the waveform from a Power Monitor unit with its RS-485 cable disconnected. Complete the following steps to set up the Power Monitor unit for the 51Ω test:

1. Set up your oscilloscope according to the instructions in above.
2. Attach a 51Ω resistor across the Power Monitor unit's RS-485 plus and minus terminals. (While in polling mode, the Power Monitor unit transmits at its maximum load.)
3. Observe the waveforms on the oscilloscope. The top and bottom waveforms (illustrated in **Figure F.4**) show the required 1.5 V swing from each plus and minus driver. The center differential waveform should have a minimum voltage swing of 3.0 V to comply with the RS-485 specification. The voltage scale for the waveform is 2 V per division

The preceding explanation is a valuable test. It is used to narrow down a problem location to either the transmitter or the RS-485 bus. For example, if the Power Monitor unit (or other bus transmitter) passes the 51Ω test but fails the same test after connecting the RS-485 cable, the impedance "seen" by that device must be too low. Even though the bus may have fallen within the specified range using an ohmmeter, there still may be problems on the bus with loading. Keep in mind that a simple ohmmeter test does not give the capacitance or inductance value of the bus. Also, it is not always practical to do an ohmmeter test because all devices must be powered down for a correct measurement.

G Zone Interlocking

Zone interlocking allows the blocking of high-speed overcurrent protection on the supply feeder to a bus if any of the load (downstream) feeder overcurrent devices is in pickup. If a fault is not present on any of the associated load feeders, the supply feeder's high-speed overcurrent protection is not blocked, providing reliable protection for bus faults.

G.1 Zone Interlock Network

In a power distribution network such as one with an ACCESS system, coordinated bus protection can be provided by creating a functioning zone interlock network with field devices that communicate.

Zone selective interlocking of series connected circuit breakers provides for a closer coordination of short time and ground fault protection. When a zone interlock type fault current is detected, the trip units send a blocking signal notifying the upstream circuit breakers that the fault is being cleared at a lower level. If a circuit breaker experiencing the fault receives a blocking signal, it executes the fault protection function based on the programmed short time or ground fault time delay band. If the circuit breaker does not receive a blocking signal, it executes the fault protection function based on the minimum delay band. This coordinated procedure provides for a high level of fault protection to the bus structure between the zones. If, for some reason, the fault current is not cleared by the tripping of the lowest level circuit breaker experiencing the fault, the higher level circuit breakers' trip units continue their pre-programmed tripping functions at their set time delays.

G.2 Zone Interlock Capable Devices

Zone interlocking capability is standard on trip units with short time or ground fault protection, but additional components and wiring are required to connect trip units together into a functioning zone interlock network. Devices that can be integrated into a zone interlock network include the following:

Sensitrip trip units	medium voltage switchgear
SB trip units	medium voltage switchgear
Energy-Comm trip unit	medium voltage switchgear
Static Trip III trip units	low voltage switchgear
SAMMS devices	low voltage and medium voltage motor control centers

The Static Trip III, SAMMS, and Energy-Comm devices can be connected directly to an ACCESS system. The Sensitrip and SB trip units require an Expansion plug that connects to a Multiplexer/Translator (MT) for communications.

The MT and zone interlock expanders and couplers are used to connect all these devices in a zone interlock system.

G.3 Zone Interlock Components

G.3.1 Multiplexer Translator

The Multiplexer Translator (MT) is a microprocessor controlled device for configuring and controlling a zone interlock network and for allowing Sensitrip or SB trip units to communicate on the ACCESS system. The MT can receive data from as many as eight field devices. Multiple MTs can be connected together by expanding with one MT at a time and up to 31 MTs. The MT appears to the ACCESS system hardware as a single device with a single address. (1 to 31).

Note: Never set the address of a Multiplexer Translator to 0 (zero). This address is used for testing purposes only.

The eight individual components connected to the MT's inputs are each assigned a port address ranging from 1 to 8 as a subordinate to the MT's address. For each connected device, an 8-switch dip switch must be set. These settings are described in **Section G.6.**

G.3.2 Expansion Plug

The expansion plug (EP) is an electronic interface and isolation module necessary to integrate a breaker into the ACCESS system. The Expansion Plug performs the parallel-to-serial conversion required between the 16-lead parallel interface test ports of the trip units and the 4-lead serial interface of the MT. With the exception of circuit breakers using Static Trip III trip units, one EP is required for each circuit breaker in the system.

G.3.3 Zone Interlock Coupler

The zone interlock coupler is used to connect individual trip units into a zone interlock system. It includes a cable for direct connection to the trip unit's sub "D" connector. The coupler also has one optically-isolated input and one output channel. The input channel may be used to connect to another coupler associated with a downstream trip unit. The output channel may be used to drive up to two upstream coupler or expander input channels connected in parallel. No external power supply is required.

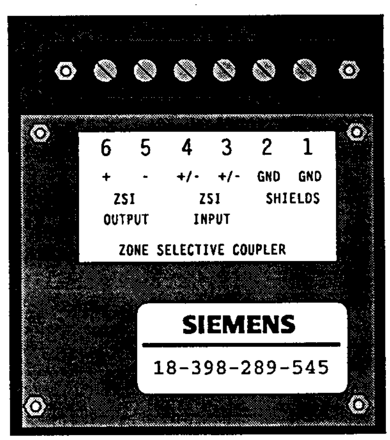


Figure G.1 Zone Interlock Coupler

G.3.4 Zone Interlock Expander

Two zone interlock expander models are available for use with Static Trip III trip units to connect a single upstream circuit breaker to multiple downstream circuit breakers. One model includes a cable for direct connection to the upstream trip unit's sub "D" connector; a second version provides for additional inputs from downstream trip units. Each expander has 6 optically isolated input channels for connection to downstream trip units. Each expander also includes a set of parallel output terminals for connecting the zone interlock signal to an expander farther upstream. No external power supply is required.

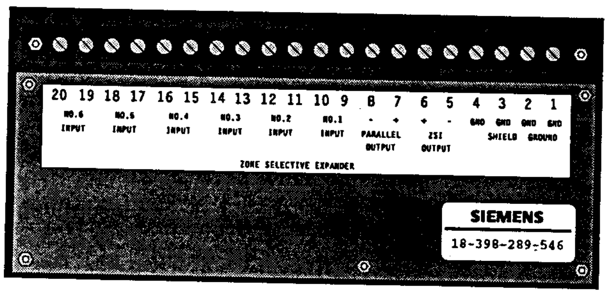


Figure G.2 Zone Interlock Expander

G.4 Making the Connections

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out supplying device before working on this equipment.

G.4.1 Static Trip III Trip Unit to MT

For zone interlocking, Static Trip III trip units are cabled directly to the MT. A separate cable that bypasses the MT is used for the communication function with circuit breakers using Static Trip III trip units. The cable used to connect an MT is a standard flat 4-wire telephone cable with a male RJ11 connector at one end and a special purpose connector at the other end.

Note: Do not use ordinary telephone cable to connect these devices.

1. Plug the special purpose connector into the receptacle on the front of the trip unit.
2. Run the other end of the cable through the cable access hole on the right side at the bottom of the MT.
3. Plug the cable into any one of the receptacle numbered 1 through 8 on the right side of the MT.
4. Record the "Device Number" used for the circuit breaker. This number and the MT address (see **Section G.6.1**) define the electrical installation location of the circuit breaker in the network.
5. Continue the process until all Static Trip III trip units have been connected to the MT. If the network contains more than eight circuit breakers, multiple MTs are required. Refer to **Section G.5**

G.4.2 Installing the Expansion Plug

Physically attach the EP to any flat surface and very close to the circuit breaker. The maximum length of the cable that connects the EP to the circuit breaker is 18 inches. Two holes in the EP for #8 screws secure the EP to the mounting surface.

1. Locate a position on the mounting surface for the screws.
2. Prepare the surface to accept the screws.
3. Place the EP on the mounting surface in position.
4. Tighten the screws securely (do not overtighten)

G.4.3 Circuit Breaker to Expansion Plug

The cable to connect an EP to a circuit breaker is a 16-wire ribbon cable with identical connectors on each end.

1. Connect the EP to one of the trip unit's test port with the ribbon cable.

G.4.4 Expansion Plug to Multiplexer Translator

The cable to connect an EP to an MT is a standard flat 4-wire telephone cable with a male RJ11 connector at each end.

1. Connect one end of the cable to the EP.
2. Run the other end of the cable through the cable access hole on the right side at the bottom of the MT.
3. Plug the cable into any one of the receptacle numbered 1 through 8 on the right side of the MT.
4. Record the "Device Number" used for the circuit breaker. This number and the MT address (see **Section G.6.1**) define the electrical installation location of the circuit breaker in the network.
5. Continue the process until all EPs have been connected to the MT. If the network contains more than eight circuit breakers, multiple MTs are required. Refer to **Section G.5**.

Note: Make sure you do not run the cable parallel to a power conductor.

G.5 Multiple Multiplexer Translators

When more than one MT is used in a zone interlock network, the MTs must be connected to each other. The cables used to connect the MTs are standard flat 4-wire telephone cable with a male RJ11 connector at each end.

1. Connect one end of a cable to the Zone Interlock "In" plug of the first MT. The designation of which MT is first or second is arbitrary.
2. Run the cable from the first MT to the second MT and connect the cable to the Zone Interlock "Out" plug.
3. If there are more than two MTs in the network, connect the Zone Interlock "In" plug of the second MT to the Zone Interlock "Out" plug of the third MT.
4. Continue this process—third "In", fourth "Out"-fourth "In", fifth "Out", etc.—until all MTs are integrated into the network

G.5.1 Multiplexer Translator to SEAbus

The cable used to connect an MT (Model MTA only) to the SEAbus communications bus is a shielded twisted pair wire with a third lead being the common or shield.

1. From one end of the cable, connect one conductor to the SEAbus "Out A" terminal.
2. Connect the other conductor to the SEAbus "Out B" terminal.
3. Connect the common or shield to "Com" terminal.
4. At the other end of the cable, connect the conductors and shield to the corresponding SEAbus "In" terminals of the upstream device in the ACCESS system.
5. To connect two or more MTs to the SEAbus communications loop, connect one end of the cable to the SEAbus "In" terminals of the MT connected to the upstream device.
6. Run the cable to the second MT and connect it to its SEAbus "Out" terminals.
7. Continue this process—second MT SEAbus "In" terminal to third MT SEAbus "Out" terminal, etc.—until all MTs are integrated into the network.

G.5.2 Power to Multiplexer/Translator

Connect 120 VAC source power cables to the power terminals of the MTs. Note the polarities indicated on the label above the power terminal: GND L1 N.

Although the setting of the network switches can be made with power applied to the MTs, a safe procedure is to complete all cabling and switch settings before applying power.

G.6 Zone Interlock Network Setup

G.6.1 MT Configuration Switches

Dip switches in the MT are used to instruct the MT's microprocessor how to configure the zone interlock network and to identify the devices within the network. Each dip switch in the MT has either five or eight individual switches. To set an individual switch to the "On" position, depress or slide the numbered side of the switch with a small screwdriver or similar device. Depressing the other side of the switch will set the switch to the "Off" position.

The eight numbered dip switches on the left side of an MT are used to configure the zone interlocking of the circuit breakers connected to the MT. There is a one-to-one correspondence between the dip switch numbers (1 through 8) and the device numbers. For example, dip switch 1 is used to configure device 1, etc. Each dip switch has eight individual switches with which to set the Ground Fault Zone, Short Time Zone, and the device type connected.

Ground Fault Zone Selection

Switches 1 and 2 of a numbered dip switch are used to select the Ground Fault Zone of the correspondingly numbered device. The required "On/OFF" positions for the two switches to select NO ZONE, ZONE 1, ZONE 2, or ZONE 3 are illustrated on the label.

1. Set switches 1 and 2 of dip switch 1 to the desired Ground Fault Zone configuration of device 1.
2. Repeat the process until the desired Ground Fault Zone configuration has been set for all devices.

Short Time Zone Selection

Switches 3 and 4 of a numbered dip switch are used to select the Short Time Zone of the correspondingly numbered device. The required "On/OFF" positions for the two switches to select NO ZONE, ZONE 1, ZONE 2, or ZONE 3 are illustrated on the label.

1. Set switches 1 and 2 of dip switch 1 to the desired Short Time Zone configuration of device 1.
2. Repeat the process until the desired Short Time Zone configuration has been set for all devices.

Device Type Identification

Switches 5 through 8 of a numbered dip switch are used to identify the device type of the correspondingly numbered device. The required "On/OFF" positions for the four switches to select the device type are illustrated on the label.

1. Set switches 5 through 8 of dip switch 1 to the device type applying to device 1.
2. Repeat the process until the device type of all connected devices has been set.

Multiplexer Translator Address

The address for the MT is set with a dip switch on the left side of the unit and is labeled "M/T Address".

The address dip switch has 5 individual switches to set the MT address to any number from 1 to 31. Each MT must have a unique address. Network communication will not function properly if two or more MTs or any other device on the communications loop have the same address. **Table G.1** shows the settings for all MT addresses.

> **Note:** Never set the address of a Multiplexer/Translator to 0 (zero). This address is used for testing purposes only.

Table G.1 MT Address Switch Settings

Address	SW1	SW2	SW3	SW4	SW5
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	0
28	0	0	1	0	0
29	1	0	1	1	0
30	0	1	1	1	1
31	1	1	1	1	1

G.6.2 Expansion Plug Switches

The dip switch located on the EP is used to configure the zone interlocking of the circuit breaker connected to the EP. The dip switch has four individual switches with which to set No Zone, Ground Fault Zone, Short Time Zone, or both, Ground Fault Zone and Short Time Zone.

The required "On/OFF" positions for these four switches are illustrated on the EP label. Depressing the numbered sides of the switches sets them to "On".

Appendix G: Zone Interlocking

Notes:

4300 power meter A 16-bit, microprocessor-based three-phase Siemens power meter consisting of a display module and a base module. The power meter can directly replace up to four standard analog meters and selector switches and can be powered by 85 to 132 VAC (47 to 440 Hz), or 110 to 170 VDC, at 0.2 A. It provides high accuracy, high reliability, high transient surge, and hipot-withstand capabilities. Voltage and current measurements are true rms, including harmonics. The 4300 power meter is ideal for retrofit applications.

4700 power meter A microprocessor-based instrumentation package for low, medium, or high voltage electrical equipment and substations. It is a state-of-the-art alternative to traditional analog electro-mechanical metering devices. It requires no external transducers. The 4700 power meter replaces up to 12 traditional analog devices. It is optionally equipped with a communication card for communication over RS-485 lines with full isolation between the communication lines and the metering equipment. The communications module includes SIEServe software that allows collection and displaying of metered data through a modem or hard-wired communications bus. It is fully compatible with supervisory software such as WinPM.

4720 power meter A three-phase, rms-sensing microprocessor-based digital power meter that offers over 300 high-accuracy measurements, on-board harmonic analysis, high-speed waveform capture, digital waveform recording and a high-response setpoint control system. The 4720 power meter is equipped with a communications card for communication over RS-485 lines with full isolation between the communication lines and the metering equipment. The card is field configurable. The communications module includes SIEServe software that allows collection and displaying of metered data through a modem or hard-wired communications bus. It is fully compatible with supervisory software such as WinPM.

A

ACCESS device log A tabulation of ACCESS device information that allows the recording of device type, model number, serial number (assumes device is in your possession), software version, ACCESS device address, cell location, device name, and MT setup (if applicable).

ACCESS Host PC A personal computer that monitors the entire ACCESS system.

ACCESS system An electrical distribution communications system comprised of a variety of complex devices networked together with industry standard communications technology to provide a complete network solution.

aerial cable A cable suspended in the air on poles or other overhead structures.

ambient temperature The temperature of a medium surrounding an object.

ambient Conditions existing at a test or operating location prior to energizing equipment (e.g. ambient temperature).

ambient temperature The temperature of a medium surrounding an object.

American Wire Gauge (AWG) A standard system for designating wire diameter. Primarily used in the United States.

amplitude The maximum value of a varying waveform.

ANSI Abbreviation for American National Standards Institute.

ASCII Abbreviation for American Standard Code for Information Interchange.

AWG Abbreviation for American Wire Gauge.

attenuation **(1)** The amount of optical power loss due to absorption and scattering of optical radiation at a specified wavelength in a length of fiber. It is expressed in dB/km (decibels) which is equivalent to the amount of light lost over 1 km (3280 feet). **(2)** Power loss in an electrical system. In cables, generally expressed in dB per unit length.

B

backbone wiring Physical/electrical interconnections betwen telecommunications closets and equipment rooms. Cross-connect hardware and cabling in the main and intermediate cross-connects are considered part of the backbone wiring.

balanced circuit A cable having two identical conductors with the same electromagnetic characteristics in relation to other conductors and to ground.

balanced line A circuit so arranged that the impressed voltages on each conductor of the pair are equal in magnitude but opposite in polarity with respect to ground.

Balun A device for matching an unbalanced coaxial transmission line to a balanced two-wire system. Can also provide impedance transformation, as 300 ohm balanced to 75 ohm unbalanced.

bandwidth **(1)** The difference between the upper and lower limits of a given band of frequencies. Expressed in hertz (Hz). **(2)** In fiber optics, a specified optical radiation wavelength represents the highest sinusoidal light modulation frequency which can be transmitted through a length of fiber with an optical signal power loss equal to 50 percent (-3 dB) of the zero modulation frequency component. The bandwidth is expressed in megahertz (MHz) over a kilometer (MHz-km).

baud Unit of data transmission speed representing bits per second. 9600 baud = 9600 bits per second (bps).

BDU Abbreviation for Breaker Display Unit. *See also* circuit breaker display unit.

bend loss The amount of optical power lost due to outside forces strong enough to allow the light to radiate out through the bend, stated in dB.

bend radius The radius of a curvature that a wire or cable can bend without causing any damaging effects.

braid A fibrous or metallic group of filaments interwoven in cylindrical form to form a covering over one or more wires.

breakout The point at which a conductor or group of conductors is separated from a multiconductor cable to complete circuits at various points along the main cable.

broadcast address Addresses all devices on a loop simultaneously to act upon a request such as time synchronization.

buffer A protective coating over an optical fiber.

C

cabling The method by which a group of insulated conductors is mechanically assembled or twisted together.

capacitance Storage of electrically separated charges between two plates having different potentials. The value depends largely on the surface area of the plates and the distance between them. Capacitance affects the rise and fall times of a transmitted signal and, as a result, limits the signalling (baud) rate of the data. The higher the capacitance, the lower the maximum baud rate. Additionally, higher capacitance requires higher output current to "drive the line." Since capacitance is proportional to wire length, it can limit the maximum cable length for a given baud rate.

cladding A low refractive index material surrounding the core of an optical fiber causing the transmitted light to travel down the core and protects against surface contaminants.

coaxial cable A cylindrical transmission line comprised of a conductor centered inside a metallic tube or shield, separated by a dieletric material, and usually covered by an insulating jacket.

common mode noise Interference that is the result of currents flowing between different potential grounds located at various points within a system. Receivers with very high common mode rejection ratios and grounding at either end rather than both ends (usually grounded at source), reduce this interference.

communications bus The hardware that connects devices together as a communications loop.

conductivity The ability of a material to allow electrons to flow, measured by the current per unit of voltage applied. It is the reciprocal of resistivity.

conductor **(1)** A material that offers little resistance to the flow of electrical current. **(2)** An insulated wire suitable for carrying elecrical current.

conduit A tube or trough in which insulated wires and cables are passed.

connector insertion loss (attenuation) The loss of optical power in a mated pair of connectors, two male connectors and an adapter, stated in dB.

connectors (fiber optic) A device used on the end of fiber optic cable that allows attachment/interconnection to a transmitter, receiver or another fiber optic cable. Examples of most popular styles are ST, SC, SMA, FDDI, and Bionic styles.

core The light-conducting central portion of an optical fiber where the majority of the modes travel. The core has a refractive index higher than that of the cladding. Types of cores include multi-mode 50, 62.5, 100, and 200 µm and single mode 8.5 and 10 µm. Both the core and the cladding are the essential components of an optical fiber.

coupling The transfer of enery between two or more cables or components of a circuit.

coverage *see* shield coverage.

critical angle The angle above which total internal reflection happens. At angles lower than the critical angle, the light is refracted through the cladding.

crosstalk A type of interference caused by either pulsed DC or standard AC signals carried on one wire pair to another wire pair in close proximity. Although pair twist tends to reduce crosstalk levels, the most effective means of mitigation is individual cable pair shielding coupled to pair twist.

C.S.A. Abbreviation for Canadian Standards Association, a non-profit, independent organization which operates a certification service for electrical and electronic materials and equipment.

D

daisy chaining A method of connecting one device (supervisory) to a second device (field device) and the second to a third (another field device) and so on. This process is repeated until the last device is connected to the first device, thereby establishing an interconnection loop. This loop and all the devices make up the network. In the event of a break in the cable, each device is still connected to the master device.

data packet Information consisting of data bytes in a base serial format that is standard asynchronous with eight data bits, no parity, and one stop bit grouped in a specific sequence called message.

dB decibel

decibel (dB) A unit that expresses differences of power level. The unit is one-tenth of a bel and is equal to 10 times the logarithm of the power ratio, 20 times the log of the voltage ratio, or 20 times the log of the current ratio. One decibel is the amount by which the pressure of a pure sine wave of sound must be varied in order for the change to be detected by the average human ear. The decibel can express an actual level only when comparing with some definite reference level that is assumed to be zero dB.

device address A unique identification number assigned to each device on the bus used to send and receive information between supervisory and field devices.

dial-up modem A modem using a dial or pushbutton telephone to initiate station-to station communication.

dielectric Any insulating (nonconducting) material between two conductors, which permits electrostatic attraction and repulsion to take place across it.

differential measurement The difference between two points that are contacted by measurement probes.

direct addressing Method of device communications that addresses only SAMMS devices and original Static Trip III trip units (manufactured before 1991) by placing the device address in the Devt byte of a communications packet. Direct addresses are user definable and may range from 1 to 224.

dispersion The cause of bandwidth limitation in a fiber. Dispersion causes a broadening of input pulses along the length of the fiber. Two major types are: mode dispersion caused by dirrential optical path lengths in a multi-mode fiber, and material disperison caused by a differential delay fo various wavelengths of light in a wave guide material.

Dual-Probe method A method to display a waveform representing the difference between input channels 1 and 2 when using an oscilloscope. This method requires the scope to have at least two (dual) input channels, or, if it is an analog scope, to add two channels together and invert one of those two channels.

dumb mode A mode in which a modem will not pay any attention to data coming from an attached device. The modem will simply pass all data along to the supervisory device that has dialed up to it.

dynamic data exchange (DDE) An information sharing method supported by an increasing number of Windows applications.

E

earth British term for zero-reference ground.

EIA Abbreviation for Electronic Industries Association.

electromagnetic coupling Transfer of energy by means of varying electrostatic field. Capacitive coupling.

electromagnetic interference (EMI) pertaining to the combined electric and magnetic fields associated with movements of electrons through conductors.

EMI Abbreviation for electromagnetic interference.

Expansion Plug An interface that connects SB circuit breakers and Sensitrip III trip units to a Multiplexer/Translator (MT). The Expansion Plug provides isolation between the devices and is powered by the MT.

extended addressing Method of device communications using indirect addressing but requiring the first two data bytes fpr communicating the local address.

F

fiber A transmission medium made of glass (and sometimes plastic) consisting of an inner core of doped silica (glass) material. This core is surrounded by a cladding of pure silica (glass) which keeps the light signal within the core. Together the layers form the light tunnel. A coating is applied over the cladding providing protection and allowing fiber to be handled without damage.

fiber core central circular transparent core region consisting of doped silica (glass) materia which propagates the optical radiation.

Fiber Optic Bridge (F.O.B.) Allows the communication of a single host computer, terminal, or modem to a maximum of 30 relays by using fiber optic cables. The host computer sends addresses and commands over a duplex RS-232 cable to the F.O.B. The F.O.B. communicates to the relays over individual duplex fiber optic cables.

fiber optics Light transmission through optical fibers for communication, including voice, video, and data.

field device A microprocessor-based device in the field (such as trip units, power meters, protective relays, and motor control devices) that send and receive information about your system. Field devices make up the lowest level of an ACCESS system.

floating shield non-grounded shield

G

GND Abbreviation for ground

gauge A term used to denote the physical size of a wire.

ground The connection between an electrical circuit and the earth or other large conducting body to serve as an earth thus making a complete electrical circuit.

ground loop A completed circuit between shielded pairs of a multiple pair created by random contact between shields. An undesirable circuit condition in which interference is created by ground currents when grounds are connected at more than one point.

H

Hi-Pot A test designed to determine the highest voltage that can be applied to a conductor without eletrically breaking down the insulation.

I

ICCB Abbreviation for insulated case circuit breakers

impedance The total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency. It is a combination of resistance R and reactance X, measured in ohms.

index of refraction The ratio of the velocity of light in free space to the velocity of light in a given material.

indirect addressing Method of device communications that addresses devices first by their device type and then by their local device address. The device type code is placed in the Devt byte and the local address as the first data byte of a communications packet. Device type codes are assigned by Siemens while the local addres is user definable and may range from 1 to 254.

individual stub topology Stub cables running to each of several field devices are connected to a single RS-485 loop through a terminal block.

insulation A material having good dielectric properties which is used to separate close electrical components, such as cable conductors and circuit components.

Intelligent SwitchGear System A Siemens high-speed, numerical, microprocessor-based protective relay designed to be easily incorporated into a computer-monitored medium voltage power system. The relay is designed and manufactured in accordance with the latest provisions of the applicable IEEE, ANSI, and NEMA standards. must be connected to a host computer in order for it to communicate with other devices. The relay supports both RS-232 and RS-485 (optional) data interfaces.

interface A region where two systems or a major and a minor system meet and interact with each other.

interference Disturbances of an electrical or electromagnetic nature that introduce undesirable responses into other electronic equipment.

ISGS Abbreviation for Intelligent SwitchGear System.

Isolated Multi-Drop converter An RS-232 to RS-485 converter that allows connection between an IBM compatible personal computer and the SEAbus communications network to link various Siemens software to ACCESS devices. In addition to the RS-232 port, the converter features four RS-485 ports that each support 32 devices, making it a total of 128 devices on each of the computer's serial ports.

J-K

jacket An outer covering, usualy non-metallic, mainly used for protection against the environment.

L

leakage current The undesirable flow of current through or over the surface of an insulation.

light-emitting diode (LED source) A semiconductor device that emits incoherent light formed by the P-N junction. Light intensity is roughly proportional to electrical current flow.

local programming Manually configuring a device using its front panel control and display features such as keypad, buttons, or liquid crystal display.

longitudinal redundancy check (LRC) Error-checking method used by the SEAbus Plus protocol to detect bit errors during data transmission.

looped topology The communications bus connecting the supervisory device and field devices forms a complete loop by bringing the cable back to the supervisory device. Devices are connected in a point-to-point configuration with the + and - terminals of each device connected to the associated terminals on the next device in the loop. Loops allow communication between devices when there is a break in the loop.

loop resistance The total resistance of two conductors measured round trip from one end.

M

magnetic noise Magnetic fields, radiated by power wiring found in large AC motors, transformers, and knife switches, can set up current flows in opposition to the instrument circuit field. The result is the superimposing of a noise current on the signal current. The simplest and best means of mitigating the effects of such magnetic interference is by simple twisting of the cable elements.

message Information contained in a SEAbus data packet following a particular sequence called.

mode permitted field pattern within waveguide fiber.

modem An electronic device used for sending and receiving communication data over long distances. Modem is a contraction of the terms *modulator* and *demodulator*. It converts signals in one form to another form compatible with another kind of equipment.

MT Abbreviation for Multiplexer/Translator

multi-mode fiber An optical waveguide which allows more than one mode to propagate. The fiber is used most often for local area networking (LAN) applications.

Multiplexer Translator (MT) A microprocessor-based device designed to accept up to eight independent communication inputs, to temporarily store data, and to send data to an ACCESS supervisory device on request. The MT also assigns circuit breakers within a zone interlock network and defines the fault protection: ground, short time, or both.

multiplexing Simultaneous transmission of two or more messages over the same medium.

multiplexing device Connects several non-SEAbus field devices to the SEAbus communications loops. An example of a multiplexing device is the Siemens Multiplexer/Translator.

N

NEMA Abbreviation for National Electrical Manufacturers Association.

noise signal distortion caused by EMI/RFI/ESI interference from either internal or external sources affecting wiring and cabling of an instrument or control circuit.

numerical aperture A measure of the angular light acceptance for a fiber. It is the sine of the largest meridional ray angle that can be accepted by the fiber and, as such, is a dimensionless number. 100 percent of the output optical power is contained within this angle.

O

optical collection factor A measure of the fiber's collection efficiency for optical radiation.

P-Q

patchcord A flexible piece of cable terminated at both ends with plugs. Used for interconnecting circuits on a patchboard.

peripheral A device communicating with a PC; here each field device connected to the ACCESS system.

photodetector (receiver) Transforms light into electricity. For relatively fast speeds and moderate sensitivity in the 7.5 µm to 0.95 µm area wavelength, the silicone photodiode is most commonly used.

plenum The air return path of a central air handling system, either ductwork or open space over a dropped ceiling.

plenum cable Cable listed by Underwriters Laboratories for installation in plenums withou the need for conduit.

point-to-point configuration A form of circuit wiring consisting of individual hookup wire links, soldered among various points in a circuit. The beginning and ending points of each wire usually consist of terminals.

polyethylene A family of insulations derived from the polymerization of ethylene gas and characterized by outstanding electrical properties, including high I.R., low dielectric constant, and low dielectric loss across the frequency spectrum. Mechanically rugged, the insulation is lightweight, water-resistant, chemically inert, and easy to strip, making it a choice for audio and radio frequency applications.

polyvinyl chloride (PVC) Insulation that resists flames, oil, ozone, sunlight, and most solvents. Since it has higher dielectric constant than polyethylene, PVC insulation is best suited to audio frequency transmission.

Power Factor The ratio of resistance to impedance. The ratio of an actual power of an alternating current to apparent power. Mathematically, the cosine of the angle between the voltage applied and the current resulting.

Power Monitor The Power Monitor display and monitoring unit is a supervisory device used in older ACCESS systems. Its commands are mostly requests for data.

PVC Abbreviation for polyvinyl chloride.

R

raceway Any channel designed expressly and used solely for conductors (for example, cable routes, cable trays, or cable gutters).

radio-frequency interference (RFI) A common form of electromagnetic interference. Electromagnetic fields from nearby radio broadcast stations, or other transmitting stations, are intercepted by dynamic pickups or wireleads and are rectified by the amplifier circuits.

reflection The change in direction (or return) of waves striking a surface. For example, electromagnetic enery reflections can occur at an impedance mismatch in a transmission line, causing stranding waves.

refractive index Ratio of light velocity in a vacuum to its velocity in the transmitting medium.

RFI Abbreviation for Radio Frequency Interference.

ribbon cable A flat cable of individually insulated conductors lying parallel and held together by means of adhesive film laminate.

root mean square (rms) The effective value of an alternating current or voltage.

RS232 Bridge Electronic device that allows communication between a single host computer, terminal, or modem and a maximum of 16 field devices. The RS232 Bridge is used in applications where data exchange between host computer and field devices is not modified by the interface.

RS-232 An industry standard serial communications interface through which data is sent one bit (binary digit) at a time. The interface is single-ended or unbalanced. Each line consists of a single wire that is referenced to a common ground line. All of the lines share that ground line as the current return path. Because of its susceptibility to noise (unwanted signals), the specification restricts the transmission distance to 50 feet (about 15 meters) and transmission speed to 20 kilobits per second (Kbps, or 20,000 bits per second).

RS-485 Communications bus used for network (remote) communication.

RTU Abbreviation for remote terminal unit acting as a supervisory device.

RXD An input for Data Terminal Equipment (DTE) and an output for Data Communications Equipment (DCE).

S

S7-I/O device An addressable modular input/output (I/O) device that links power system components to the ACCESS system. The device can monitor or control components which are not specifically designed for digital communication. The SEAbus communications protocol allows the S7-I/O device to communicate with supervisory computers running supervisory software.

SAMMS Abbreviation for Siemens Advanced Motor Master System.

SB circuit breaker A microprocessor-based trip system compatible with the ACCESS system.

SCOR Abbreviation for Siemens Communicating Overcurrent Relay.

Sensitrip III trip unit An electronic trip unit used in the Sentron Series molded case circuit breakers (MCCB). These small trip units have microprocessor-based trip systems that are programmed to support connection to the ACCESS system.

series stub topology Used for panel devices where devices mounted on an instrument door use a stub cable that is brought out to a panel hinge terminal block. The terminal block is the common point between the stub and the interconnection loop.

shield In cables, a metallic layer placed around a conductor or a group of conductors to prevent electrostatic interference between the enclosed wires and external fields.

shield coverage The physical area of a cable that is actually covered by the shielding material, expressed in percent.

shield effectiveness The relative ability of a shield to screen out undesirable signals.

short-haul modem ??electronic devices used for sending and receiving communication data over long distances (up to 3.5 miles). can easily handle a distance of up to several miles provide ground isolationWhen using short-haul modems, the transmitter output of each modem is cabled to the receive input of the other. One short-haul modem is connected to one of eight RS-232 ports

Siemens Advanced Motor Master System (SAMMS) A user-programmable motor protection and control relay. Available in three models, the SAMMS device provides reliable, flexible protection for all NEMA/EEMAC-size, low-voltage motors from 0.3 to 540 A rating. With programmable control logic, it replaces a collection of timers, control relays, push-buttons, selector switches, pilot devices, and associated wiring.

Siemens Communicating Overcurrent Relay (SCOR) A microprocessor-based, time-instantaneous relay designed for easy incorporation into a computer-monitored power system. The relay is available in a number of styles to supply two-phase-with-ground, three-phase, and three-phase-with-ground protection for 60 Hz power systems. It also displays amperes and amperes demand.

Siemens protective relays A protective relays series from Siemens AG indicated by a model number beginning with the number 7, for example, 7SJ511.

SIEServe Microsoft Windows-based electrical distribution and communications software designed for PCs. The software links devices connected to an ACCESS system to the SEAbus communications bus directly or through a modem. SIEServe can collect and display real-time data from these devices and deliver their data to other compatible Windows applications through dynamic data exchange (DDE).

single-mode fiber An optical waveguide which allows only one mode to propagate. The fiber has a very small core diameter of approximately 8µm. It permits signal transmission at extremely high bandwidths and is generally used with laser diodes and for long distance telephone communications.

Single-Probe method A method to display a waveform representing the difference between input channel 1 and the frame ground when using an oscilloscope.

SIEModem A modem configuration add-on utility for SIEServe software developed by Siemens. This Windows application optimizes a modem's configuration for use with Siemens SIEServe DDE server software.

skin effect The phenomenon in which the depth of penetration of electric currents into a conductor decreases as the frequency increases.

source The means (usually LED or laser) used to convert an electrical information-carrying signal into a corresponding optical signal for transmission by an optical waveguide.

static noise Signal distortion due to the electrical field radiated by a voltage source, which has coupled into the signal-bearing circuit. Simple shielding of the full circuit is a typical means of mitigating this electrostatic type of interference. Foil shields, which offer 100% shielding efficiency, have proven most effective against this type of interference. It is critical that the shield be continued to, and completely encompass, the transmitting and receiving ends of the circuit if high levels of noise reduction are required. Effective grounding of the shield is also required; "flloating" or non-grounded shields only partially reduce the effects of noise.

Static Trip IIIC Microprocessor-based trip units supplied on Siemens RL low-voltage power circuit breakers. In addition to the primary function of protecting circuits, this series of trip units also offers ACCESS communication of current values, power metering, and power relaying. Each model can be supplied with a circuit breaker display unit (BDU). If the trip unit is configured with the communications Open or Close option, the operator may open or close the breaker from the supervisory device.

straight line topology Communications bus that is daisy-chained between each device, connecting the supervisory device to a field device, which in turn connects to another field device, and so on.

stub Section of transmission line, usually either a half-wave or a quarter-wave section, connected in parallel or in series with the feed system of an antenna. Stubs can be used as impedance matching transformers, as notch filters, or as band-pass filters.

supervisory device A device that can remotely configure, read back, and check the configuration of and poll real-time data from field devices. Supervisory devices display the information and add the capabilities of programming, monitoring alarms, and logging system events.

supervisory hardware ??PC running supervisory software, industrial computer, modems, transient eliminator, converters.

supervisory software Software that can be run from a personal computer to communicate with devices and collect and display data for an ACCESS system.

surge A temporary, large increase in the voltage or current in an electric circuit or cable.

T

Teflon DuPont Company trademark for polytetrafluoroethylene. Teflon insulated Plenum and High-Temperature Cables are ideal for data communications, instrumentation/control, and other commercial and industrial applications. Plenum cables offer significant cost savings since they eliminate the need for conduit and reduce installation time.

terminal block An insulating base equipped with terminals for connecting a secondary and control wiring.

total internal reflection The total reflection tht occurs when light strikes an interface at angles of incidence (with respect to the normal) greater than the critical angle.

transient eliminator A lightning conductor/surge protection module.

tray A cable tray system is a unit or assembly of units or sections, and associated fittings, made of non-combustible materials forming a rigid structural system used to support cables. Cable tray systems (previously termed continuous rigid cable supports) include ladders, troughs, channels, solid bottom trays, and similar structures.

TXD An output for the DTE and an input for the DCE.

U

UL Abbreviation for Underwriters Laboratories, a non-profit independent organization, which operates a listing service for eleltrical and electronic materials and equipment.

unit ID A unique identification number assigned to each device on the bus used to send and receive information between supervisory and field devices. Unit ID is also refered to as device address.

universal request An address code (0) used to request the unknown address of a device on a communications bus. Since the code addresses all devices on the bus, creating data collision during the response, only one device may be connected to the bus while the universal request code is used.

V

velocity of propagation The speed of an electrical signal down a length of cable compared to speed in free space, expressed as a percent. It is the reciprocal of the square root of the dielectric constant of the cable insulation.

W-Y

WinPM Microsoft Windows-based electrical distribution and communications software designed for PCs. Through communications drivers, WinPM software collects and displays real-time data from ACCESS field devices, Siemens protective relays, and other field devices. WinPM displays information and adds the capabilities of programming, monitoring alarms, and logging system events. WinPM also monitors and displays historical data, minimum and maximum data, and waveform data. In addition, WinPM can deliver its data to other compatible Windows applications, in real-time through dynamic data exchange (DDE).

Z

zone interlock coupler Used to connect individual trip units into a zone interlock system. It includes a cable for direct connection to the trip unit's sub "D" connector. The coupler also has one optically-isolated input and one output channel. The input channel may be used to connect to another coupler associated with a downstream trip unit. The output channel may be used to drive up to two upstream coupler or expander input channels connected in parallel. No external power supply is required.

zone interlock expander Two zone interlock expander models are available for use with Static Trip III trip units to connect a single upstream circuit breaker to multiple downstream circuit breakers. One model includes a cable for direct connection to the upstream trip unit's sub "D" connector; a second version provides for additional inputs from downstream trip units. Each expander has 6 optically isolated input channels for connection to downstream trip units. Each expander also includes a set of parallel output terminals for connecting the zone interlock signal to an expander farther upstream. No external power supply is required.

zone interlocking Allows the blocking of high-speed overcurrent protection on the supply feeder to a bus if any of the load (downstream) feeder overcurrent devices is in pickup. If a fault is not present on any of the associated load feeders, the supply feeder's high-speed overcurrent protection is not blocked, providing reliable protection for bus faults.

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Notes:

SIEMENS

Siemens Energy
& Automation, Inc.
Switchgear and Motor Control
Business
Customer Service
P.O. Box 29503
Raleigh, NC 27626

ACCESS Systems Service Request Form

To report problems with Siemens ACCESS systems and devices, make a copy of this form, complete it with as much information as you can, and contact your Siemens representative. You can also fax this form to Siemens Customer Service at 919-365-2830.
For emergency service call 1-800-347-6659.

Customer Information

Job site location and contact: ______________________________

____

____

Phone and fax number: ______________________________

Siemens sales order number: ______________________________

Siemens manufacturing order number (from drawing): ______________________________

System Information

Describe the number and type of devices on your ACCESS system.

Field Devices

Quantity	Device Type	Quantity	Device Type
	4300 power meter		SCOR relay
	4700 power meter		ISGS relay
	4720 power meter		7SA, 7SJ, or 7UT relay
	Static Trip IIIC trip unit		Multiplexer Translator
	Static Trip IIICP trip unit		Isolated Multi-Drop converter
	Sensitrip III trip unit		S7-I/O device
	SB breaker trip unit		PRM pulse reading meter
	SAMMS-LV device		Other:
	SAMMS-MV device		Other:

Supervisory Devices and Software

Quantity	Product	Quantity	Product
	WinPM software		Power Monitor Panel (PMP)
	Host PC software		PC32F power monitor
	Power Monitor PC software		Siemens PLC
	SIEServe software		Other hardware:
	Other software:		Other hardware:

Problem Description

Provide the following information on the affected device(s):

Device type: ______________________________

Model or catalog number: ______________________________

Part number: ______________ Serial number: ______________

Hardware version: ______________ Software version: ______________

Installed options: ______________________________

Configuration information, including operational settings, parameters, wiring, type of system:

____

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____

____

On what type of electrical equipment are the devices installed? (switchgear, motor control center, switchboard, and so on): ______________________________

____

____

Provide a brief description of the problem: ______________________________

____

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____

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Indicate what error messages, if any, are generated by the device or supervisory software. Include messages listed in the event log: ______________________________

____

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____

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To be completed by Siemens

Received by: ______________ Date received: ______________

Reviewed by: ______________ Date reviewed: ______________

Sales engineer: ______________

Problem report tracking number: ______________________________

Problem classification code: ______________________________

Corrective action: ______________________________

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SIEMENS

Warranty

Company warrants that on the date of shipment to Purchaser the goods will be of the kind and quality described herein, merchantable, and free of defects in workmanship and material.

If within one year from date of initial operation, but not more than eighteen months from date of shipment by Company, of any item of the goods, Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such defect by, at Company's option, adjustment, repair or replacement of the item and any affected part of the goods. Purchaser shall assume all responsibility and expense for removal, reinstallation and freight in connection with the foregoing remedy. The same obligations and conditions shall extend to replacement items furnished by Company hereunder. Company shall have the right of disposal of items replaced by it. Purchaser shall grant Company access to the goods at all reasonable times in order for Company to determine any defect in the goods. In the event that adjustment, repair or replacement does not remedy the defect, the Company and Purchaser shall negotiate in good faith an equitable adjustment in the contract price.

The Company's responsibility does not extend to any item of the goods which has not been manufactured and sold by Company. Such item shall be covered only by the express warranty, if any, of the manufacturer thereof. The Company and its suppliers shall also have no responsibility if the goods have been improperly stored, handled, or installed; if the goods have not been operated or maintained according to their ratings or according to instructions in Company or supplier furnished manuals; or if unauthorized repairs or modifications have been made to the goods.

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The foregoing states Purchaser's exclusive remedy against Company and its suppliers for any defect in the goods or for failure of the goods to be as warranted, whether Purchaser's remedy is based on contract, warranty, failure of such remedy to achieve its essential purpose, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installation or defects from any cause.

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