

**INSTALLATION INSTRUCTIONS**

Original Issue Date: 3/98

Model: 20-2000 kW Generator Sets/Transfer Switches/Power Monitor

Market: Industrial/ATS

Subject: KBUS Controller Communication Kits

Kit Number	Kit Description
PA-294864, PA-294864-SD	External modem for PC, 120 V, 60 Hz
PA-294865, PA-294865-SD	External modem for device, 120 V, 60 Hz
PA-294866, PA-294866-SD	RS-485 communication module for ATS controllers
PA-294867, PA-294867-SD	RS-232 communication module forATS controllers
PA-294992, PA-294992-SD	PC connection cable kit
PA-352249, PA-352249-SD	RS-232 to RS-485 converter, external
PA-353073 PA-353073-SD	External modem for PC, 220 V, 50 Hz
PA-353074 PA-353074-SD	External modem for device, 220 V, 50 Hz
PA-353395	RS-232 communication module for the power monitor
PA-353396	RS-485 communication module for the power monitor
PA-353397	RS-232 to RS-485 converter, internal
PA-354197, PA-354197-SD	RS-485 communication module for generator set controllers
PA-354198, PA-354198-SD	RS-232 communication module for generator set controllers

**Figure 1** Communication Kits

**Introduction**

These instructions explain how to install communication kits and connect generator set controllers, automatic transfer switch (ATS) controllers, and power monitors to personal computers for use with KBUS protocol and the remote monitoring and control software.

Figure 1 lists communication kits covered in these instructions. The manufacturer may also provide these instructions with communication kits that are not listed above.

Read the entire installation procedure and compare the kit parts with the corresponding parts list at the end of this publication before beginning installation. Perform the steps in the order shown.

**Safety Precautions**

Observe the following safety precautions during installation.

**⚠ WARNING**



**Accidental starting.  
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

**⚠ WARNING**



**Hazardous voltage.  
Can cause severe injury or death.**

Disconnect all power sources before servicing. Install the barrier after adjustments, maintenance, or servicing.

*(600 volts and under)*

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

**Short circuits. Hazardous voltage/current can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing the equipment.

**Opening the power monitor enclosure. Hazardous voltage can cause severe injury or death.** Only trained and qualified personnel should open the power monitor enclosure.

**Opening the power monitor enclosure. Hazardous voltage can cause severe injury or death.** A transfer switch or generator set connected to the power monitor could automatically energize the power monitor or accessories. Disconnect all power sources before opening the enclosure. Move the generator set master switch on the controller to the OFF position and disconnect the battery negative (-) lead before proceeding.

**Current transformer voltage. Hazardous voltage can cause severe injury or death.** Disconnecting current transformer leads and reenergizing the power source could cause equipment damage and personal injury. If the situation requires reenergizing the power source, reconnect the current transformer leads or short the leads together first.

**Installing accessories to the transformer assembly. Hazardous voltage can cause severe injury or death.** To prevent electrical shock disconnect the harness plug before installing accessories that will be connected to the transformer assembly primary terminals on microprocessor logic models. Terminals are at line voltage.

**NOTICE**

**Electrostatic discharge damage.** Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

**Note:** Install communication conductors in raceways, cables, or conduit separate from AC power conductors.

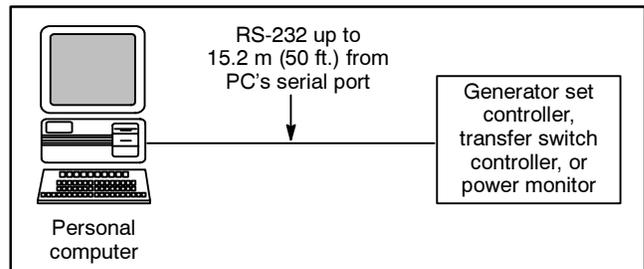
## Connection Types

Before using the remote monitoring and control software, connect the PC to one or more generator set controllers, ATS controllers, or power monitors.

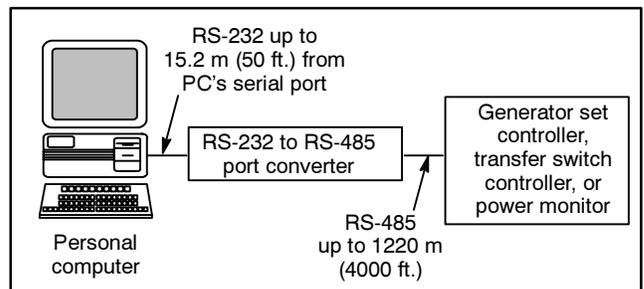
This section describes and illustrates the different types of connections. Figure 11 and Figure 12 list the hardware required to connect the PC to the generator set controller, transfer switch controller, or power monitor.

### Local Single Connection

Use an RS-232 cable to connect a PC to the RS-232 port on a device (such as a generator set controller) that is located within 15 m (50 ft.) of the PC. See Figure 2. For longer connections, use an RS-232 to RS-485 port converter within 15 m (50 ft.) of the PC. Then use an RS-485 cable to connect to an RS-485 port on a device located up to 1220 m (4000 ft.) away from the converter. See Figure 3.



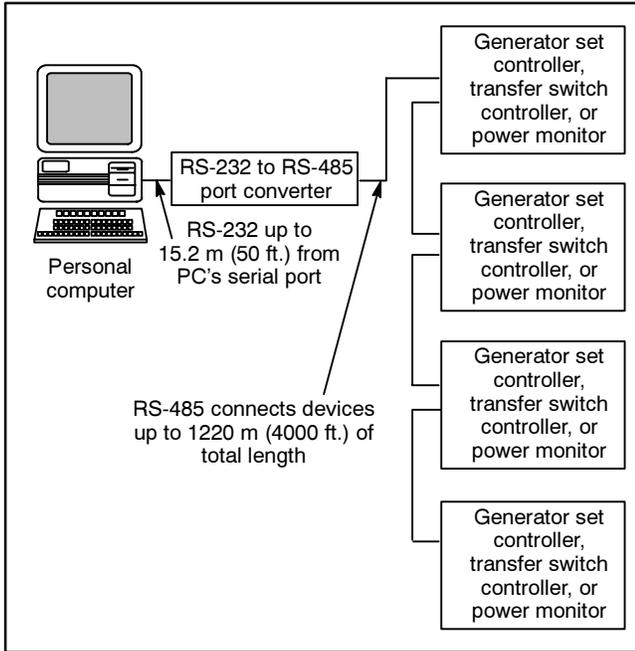
**Figure 2** Local Single Connection, up to 15 m (50 ft.)



**Figure 3** Local Single Connection, up to 1220 m (4000 ft.)

### Local Area Network (LAN)

Use an RS-232 cable, an RS-232 to RS-485 converter, and an RS-485 cable to connect a PC to a local area network (LAN) with as many as 128 devices. See Figure 4.



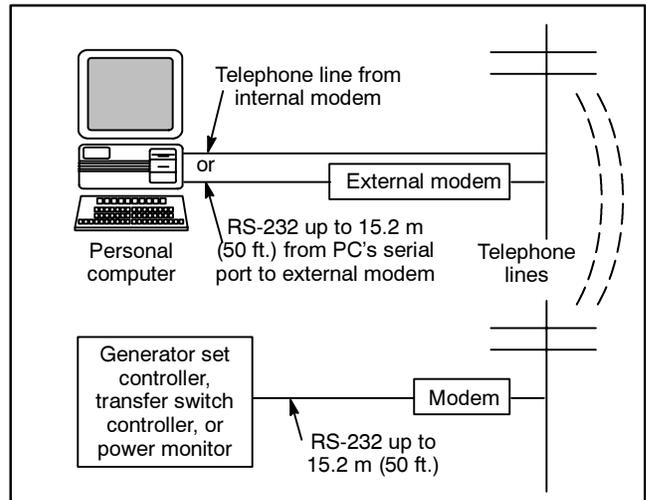
**Figure 4** Local Area Network Connection, up to 128 Devices

### Remote Single Connection

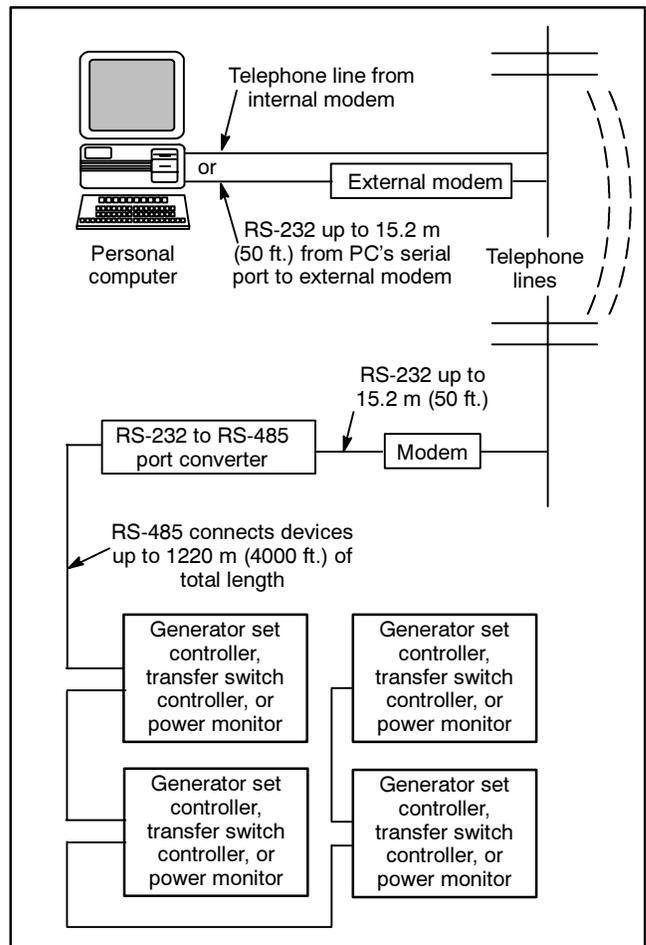
Use an internal or external modem with the PC and another modem with the device that is being monitored or controlled. The PC communicates with the device using the modems and the telephone network. Locate the PC anywhere a telephone line is available. See Figure 5.

### Remote Area Network

Use an internal or external modem with the PC. Use another modem and an RS-232 to RS-485 port converter to connect up to 128 devices to an RS-485 local area network (LAN). The PC communicates with the devices using the modems and the telephone network. Locate the PC anywhere a telephone line is available. See Figure 6.



**Figure 5** Remote Single Connection



**Figure 6** Remote Area Network Connection

# Hardware Requirements

## Personal Computer (PC)

The personal computer (PC) must meet the minimum system requirements for the remote monitoring and control software. See the Generator System Monitoring and Control for Windows specification sheet. Install and configure the software according to the instructions in the Software Operation Manual. The PC must also have either an RS-232 serial port or an internal modem supported by the software, depending on the type of connection.

## Devices

A device in these instructions is defined as a generator set controller, ATS controller, or power monitor that can be monitored and controlled remotely through the Monitor II software. Compatible devices are the 550 generator set controller, the Digital or 340 generator set controller, microprocessor-based automatic transfer switch controllers, and the power monitor.

Refer to Figure 7 to identify the 550 Generator Set Controller, and Figure 8 to identify the Digital or 340 Generator Set Controller. Figure 9 shows typical compatible ATS controllers, and Figure 10 shows the power monitor.

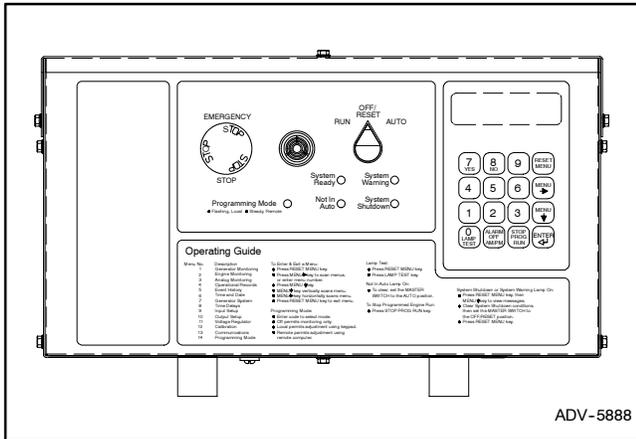


Figure 7 550 Generator Set Controller

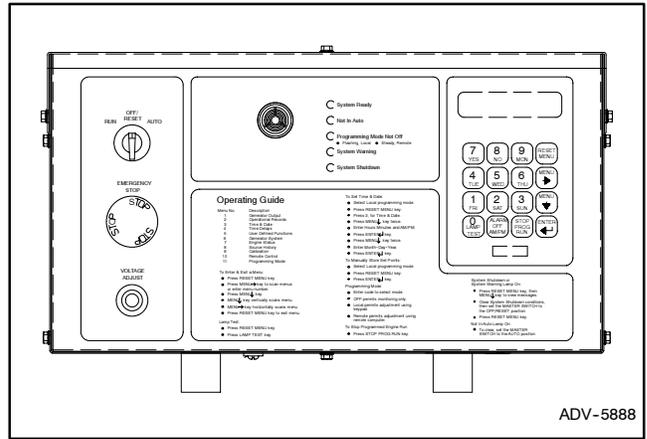
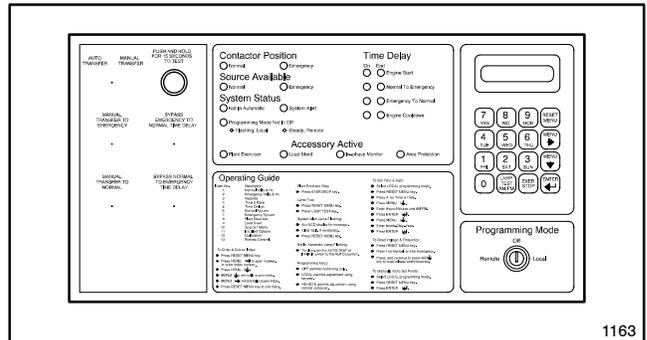
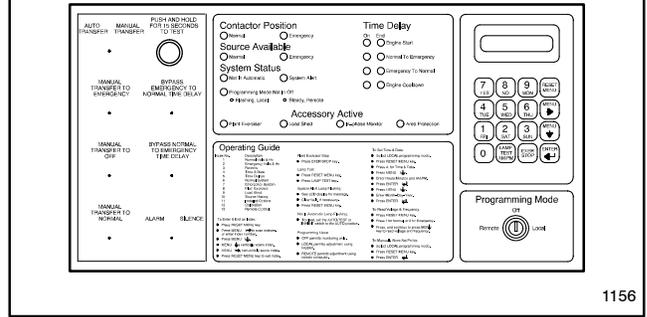


Figure 8 Digital or 340 Generator Set Controller

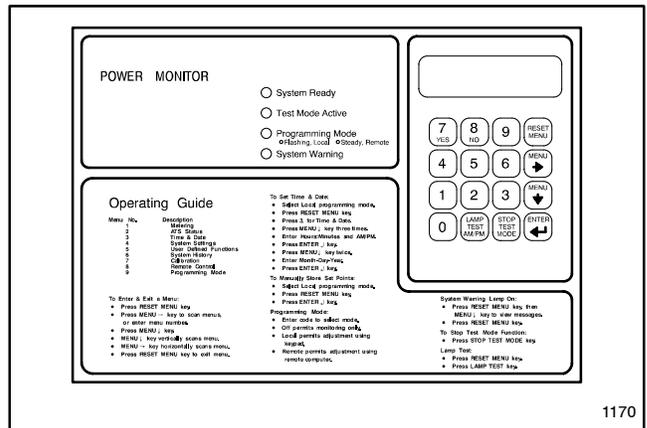


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Figure 9 Compatible ATS Controllers (shown without optional accessories)



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Figure 10 Power Monitor

## Device Ports and Communication Modules

Each device requires one of the following ports in order to communicate with the PC.

- RS-232—used for local single connection, 15.2 m (50 ft.) maximum, and remote single connection using modems
- RS-485—used for local single connection, 1219.2 m (4000 ft.) maximum, and local or remote area network connections

The 550 generator set controller has both of these ports as standard equipment. The other devices, including the Digital or 340 generator set controller, ATS controllers, and the power monitor, require factory- or field-installed communication modules.

## Converters and Modems

Some connections require RS-232 to RS-485 converters and modems.

An RS-232 to RS-485 converter connects between an RS-232 serial line and an RS-485 serial line.

**Note:** The 550 controller can act as a convertor when it is located within 15.2 m (50 ft.) of the PC. See Figure 45.

External modems connect between an RS-232 serial line and a telephone line. Some PCs have internal modems that connect directly to the telephone line.

Refer to the following tables for the specific requirements for each type of connection.

## Hardware Requirements

Connection Type	Device	Required Communication Modules		Port
		Factory-Installed Modules	Loose Kits	
Local single connection up to 15.2 m (50 ft.) See Figure 2	550 generator set controller	N/A (standard)	N/A	RS-232
	Digital or 340 generator set controller	354197, RS-232	PA-354197 or PA-354197-SD	
	ATS controller	DD-51-B or KD-51-B	PA-294867 or PA-294867-SD	
	Power monitor	353395, RS-232	PA-353395	
Local single connection up to 1219.2 m (4000 ft.) See Figure 3	550 generator set controller	N/A (standard)	N/A	RS-485
	Digital or 340 generator set controller	354198, RS-485	PA-354198 or PA-354198-SD	
	ATS controller	DD-51-A or KD-51-A	PA-294866 or PA-294866-SD	
	Power monitor	353396	PA-353396	
Local area network (LAN) See Figure 4	550 generator set controller	N/A (standard)	N/A	RS-485
	Digital or 340 generator set controller	354198, RS-485	PA-354198 or PA-354198-SD	
	ATS controller	DD-51-A or KD-51-A	PA-294866 or PA-294866-SD	
	Power monitor	353396	PA-353396	
Remote single connection See Figure 5	550 generator set controller	N/A (standard)	N/A	RS-232
	Digital or 340 generator set controller	354197	PA-354197 or PA-354197-SD	
	ATS controller	DD-51-B or KD-51-B	PA-294867 or PA-294867-SD	
	Power monitor	353395	PA-353395	
Remote area network See Figure 6	550 generator set controller	N/A (standard)	N/A	RS-485
	Digital or 340 generator set controller	354198	PA-354198 or PA-354198-SD	
	ATS controller	DD-51-A or KD-51-A	PA-294866 or PA-294866-SD	
	Power monitor	353396	PA-353396	
<b>Note:</b> See the connection type figures indicated or the connection diagrams beginning on page 20 to prevent duplication of hardware for sites with multiple devices or networks.				

**Figure 11** Required Communication Hardware Summary, Table 1 of 2

## Hardware Requirements, continued

Connection Type	Device	Port	Required Hardware*		
			RS-232 to RS-485 Converters	Cables	Modems
Local single connection up to 15.2 m (50 ft.) See Figure 2	550 generator set controller	RS-232	N/A	1	N/A
	Digital or 340 generator set controller				
	ATS controller				
	Power monitor				
Local single connection up to 1219.2 m (4000 ft.) See Figure 3	550 generator set controller	RS-485	3 or 4	1 and 2	N/A
	Digital or 340 generator set controller	RS-485			
	ATS controller	RS-485	3 or 4 or 5	1 and 2	N/A
	Power monitor				
Local area network (LAN) See Figure 4	550 generator set controller	RS-485	3 or 4†	1 and 2	N/A
	Digital or 340 generator set controller	RS-485	3 or 4		
	ATS controller	RS-485	3 or 4 or 5	1 and 2	N/A
	Power monitor				
Remote single connection See Figure 5	550 generator set controller	RS-232	N/A	N/A (Cables are included with the modem kits.)	6 or 7 or 8; plus 9 or 10
	Digital or 340 generator set controller				
	ATS controller				
	Power monitor				
Remote area network See Figure 6	550 generator set controller	RS-485	3 or 4†	2	6 or 7 or 8; plus 9 or 10
	Digital or 340 generator set controller	RS-485	3 or 4		
	ATS controller	RS-485	3 or 4 or 5	2	6 or 7 or 8; plus 9 or 10
	Power monitor				

**Hardware Key:**

1. PA-294992 or PA-294992-SD, PC cable connection kit. Includes 3 m (10 ft.) RS-232 cable (294981), null modem cable (GM16657), and connector (294988). Requires customer-supplied RS-232 cable for distances longer than 3 m (10 ft.).
2. Customer-supplied RS-485 cable, Belden #9841 or equivalent
3. PA-352249 or PA-352249-SD, external RS-232 to RS-485 converter, 120 V, 60 Hz
4. GM10683-KP1, external RS-232 to RS-485 converter, 220 V, 50 Hz
5. PA-353397 or PA-353397-SD, internal RS-232 to RS-485 converter (mounts only in the power monitor)
6. Internal modem on PC
7. RS-232 serial port and PA-294864 or PA-294864-SD, modem for PC side, 120 V, 60 Hz
8. RS-232 serial port and PA-353073 or PA-353073-SD, modem for PC side, 220 V, 50 Hz
9. PA-294865 or PA-294865-SD, modem for device side (set to automatically answer calls), 120 V, 60 Hz
10. PA-353074 or PA-353074-SD, modem for device side (set to automatically answer calls), 220 V, 50 Hz

\* See the connection type figures indicated or the connection diagrams beginning on page 20 to prevent duplication of hardware for sites with multiple devices or networks.

† If the PC or modem is less than 15.2 m (50 ft.) away from the 550 controller, an external convertor is not required. See Figure 45.

**Figure 12** Required Communication Hardware Summary, Table 2 of 2

## Circuit Board Handling

Improper removal, installation, transportation, storage, or service can damage sensitive electronic components. Observe the following guidelines to prevent damage when working with circuit boards or electronic components.

### Circuit Board and Electronic Component Handling

- Keep circuit boards or electronic components inside the antistatic, cushioned factory packaging until installation.
- Store circuit boards or electronic components in a clean environment away from moisture, vibration, static electricity, corrosive chemicals, and solvents.
- Disconnect all power sources before removing or installing circuit boards or electronic components.
- Wear an approved, grounded, antistatic wrist strap when handling circuit boards or electronic components.
- Carefully hold the circuit board by its edges and not by any of its components or electrical contacts.
- Do not drop the circuit board or electronic components.
- Do not bend the circuit board, electronic components, or electronic component leads.
- Do not strike the circuit board or electronic components using or against a hard object.
- Clean dusty or dirty circuit boards with a vacuum cleaner or soft, dry brush.
- Never attempt circuit board repairs, adjustments, or modifications other than replacing plug-in service parts or performing manufacturer-approved installation or service procedures.

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## Installation and Connection Procedure

### 1. Determine and obtain the necessary hardware and software.

- 1.1 Check that the PC meets the minimum system requirements. See the remote monitoring and control communication software operation and installation manual.
- 1.2 Determine the type of connection required based on the number of devices installed and the distance from the PC to the device(s). See Connection Types and Hardware Requirements, beginning on page 2. Also see the Connection Diagrams, Figure 42 through Figure 48.
- 1.3 Obtain the communication hardware required by each device(s) and the PC to connect the PC to the device(s). See Figure 11 and Figure 12. Ensure availability of all parts and components needed for the connection before proceeding.

### 2. Disable generator sets and disconnect all power sources.

- 2.1 Place all generator set master switches in the OFF position.
- 2.2 Disconnect the power to all battery chargers, if equipped.
- 2.3 Disconnect all generator set engine starting battery(ies), negative (-) leads first.
- 2.4 Disconnect all power sources to transfer switches or power monitors.
- 2.5 Turn off and disconnect the power to all devices in the system.

### 3. Locate ports and prepare to install communication modules in each device.

- 3.1 Open the device enclosure and find the port location or module installation location for each device.

Use Figure 14 through Figure 35, located immediately after this Installation Procedure, to determine where to install communication modules and/or connect cables.

- 3.2 Remove protective covers to access the port or module mounting location, if required.

#### 4. Install communication modules, if needed.

**Note:** The 550 generator set controllers do not require communication modules. Proceed to step 5 to connect the cables to the 550 generator set controller.

- 4.1 Connect the ribbon cable included in RS-232 or RS-485 communication module kits to the communication module.

**ATS controllers only:** Carefully align the pins on the ribbon cable connector with the mating socket on the communication module. The pins are soft and can bend or break easily and the connector can be installed incorrectly in an offset position. To correct connector installation, carefully pull it out of the socket and reinstall.

**Digital or 340 generator set controller and power monitors only:** Align the pins on the communication module connector with the socket on the mating ribbon cable connector. Push the connectors together. The connectors lock when the connection is made.

- 4.2 Install the spacers included with the kit on the mounting studs on the device or cover.
- 4.3 Carefully place the module onto the mounting studs through the holes provided in the module in the orientation shown in the corresponding figure.
- 4.4 Install a lock washer and a nut on each stud and carefully tighten the nut. Overtightening the nuts can damage the module.
- 4.5 **Power monitor internal RS-232 to RS-485 converter module kit only:** Place the silkscreened cover from the kit over the module so that the two longer studs pass through the holes provided. Place a lock washer and a nut on each of the studs and tighten the nuts to hold the cover on. Overtightening the nuts can damage the cover and/or the module.

- 4.6 Carefully connect the loose end of the ribbon cable included in the RS-232 or RS-485 communication kit to the controller circuit board as shown in the corresponding figure.

**ATS controller communication modules only:** Carefully align the pins on the ribbon cable connector with the mating socket on the controller circuit board. The pins are soft and can bend or break easily and the connector can be installed incorrectly in an offset position. To correct

connector installation, carefully pull it out of the socket and reinstall.

**Digital generator set controller and power monitor communication modules only:** Align the pins on the controller circuit board connector with the socket on the mating ribbon cable connector. Push the connectors together. The connectors lock when the connection is made.

#### 5. Connect the cables to each device.

See the instructions and illustrations after this procedure for cable connection details.

#### 6. Replace the covers.

- 6.1 Replace the protective covers removed in step 3.2. and tighten the cover screws.
- 6.2 Close and lock the enclosure doors on all system devices.

#### 7. Make final connections to the PC.

Connect the device(s) to the PC using the required cables and additional hardware products, such as external RS-232 to RS-485 converter modules, modems, and telephone lines for some connection types. See the hardware summary beginning on page 6 and the connection diagrams beginning on page 20. See Figure 13.

#### 8. Enable generator sets and restore power.

- 8.1 Check that the generator set master switches are in the OFF position.
- 8.2 Reconnect power to the battery charger(s), if equipped.
- 8.3 Reconnect the generator set engine starting batteries, negative (-) leads last.

Figure	Description
Figure 42	Local single connection up to 15.2 m (50 ft.)
Figure 43	Local single connection up to 1219 m (4000 ft.)
Figure 44	Local area network (LAN)
Figure 45	Local area network (LAN) with the 550 controller
Figure 46	Remote single connection
Figure 47	Remote area network
Figure 48	Remote area network with the 550 controller

**Figure 13** Connection Diagrams

# Port Locations and Communication Module Installation

## 550 Generator Set Controller Communications Port Locations

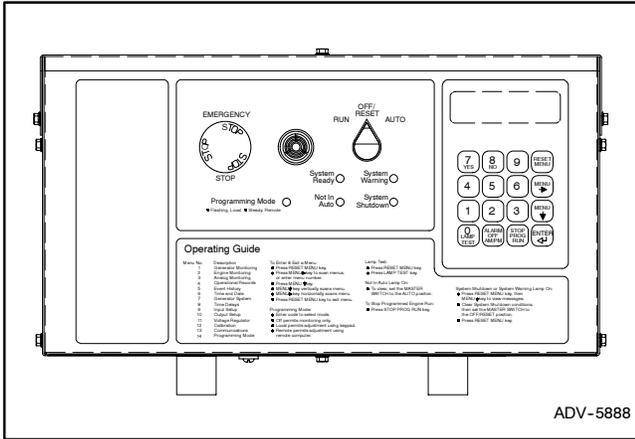


Figure 14 550 Generator Set Controller

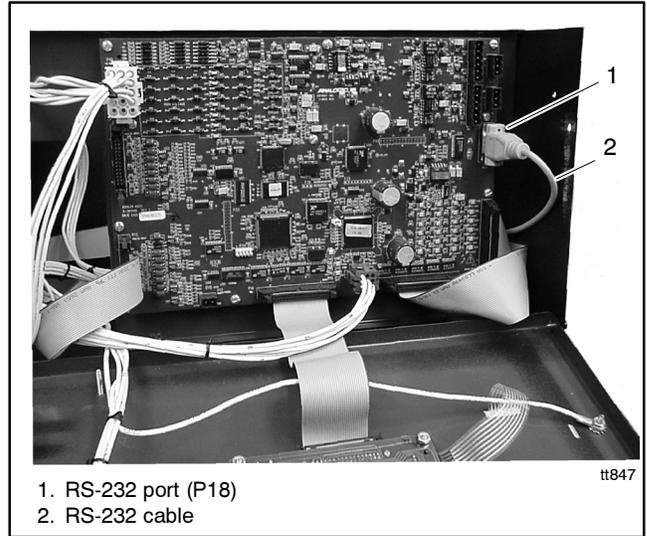


Figure 16 RS-232 Port Location and Connection for the 550 Generator Set Controller

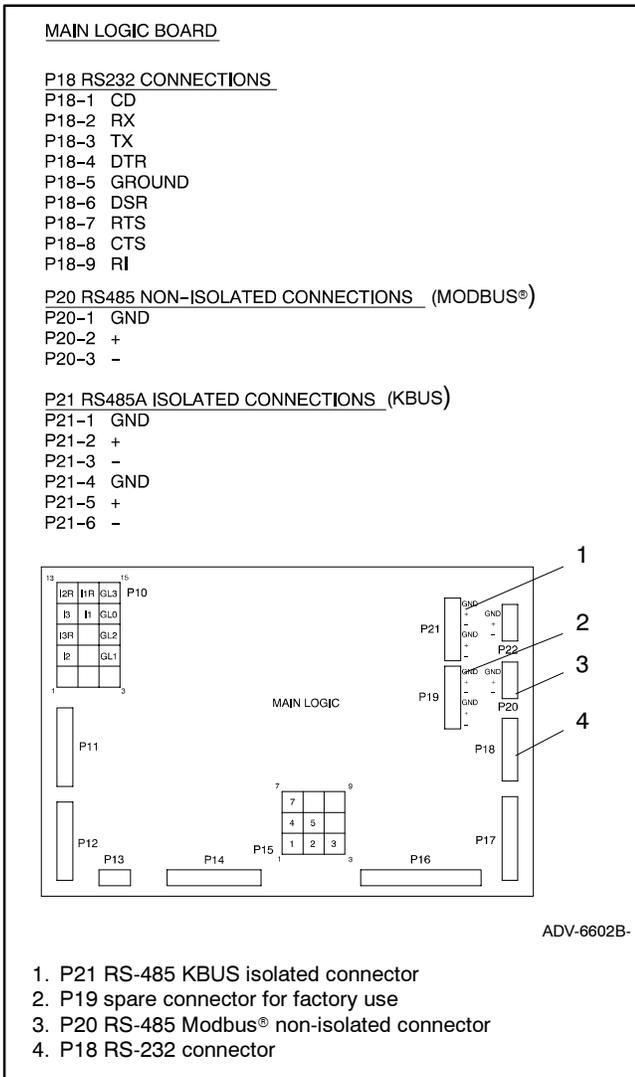


Figure 15 Communications Connectors on the 550 Controller Main Logic Board

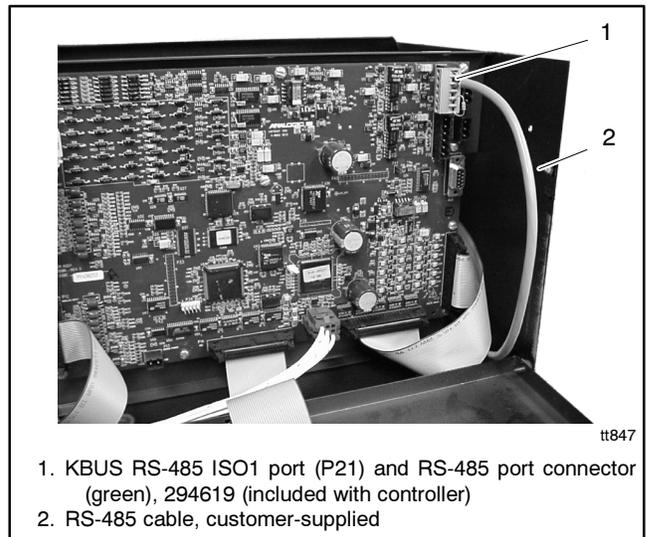
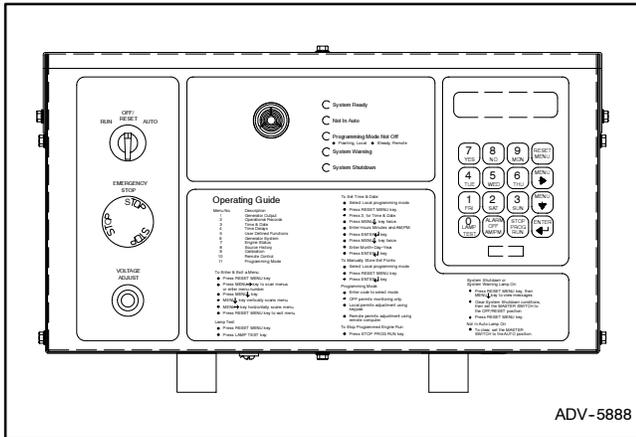


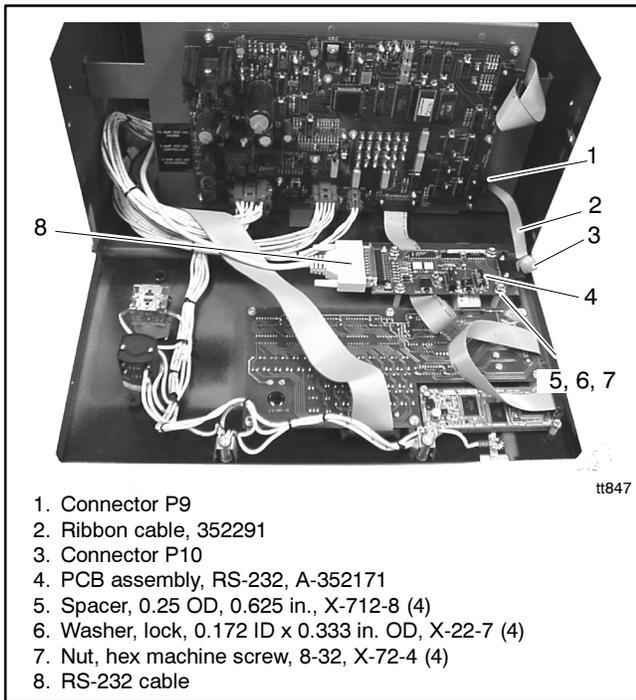
Figure 17 RS-485 KBUS Port Location and Connection for the 550 Generator Set Controller

## Digital or 340 Generator Set Controller Communication Kit Installation



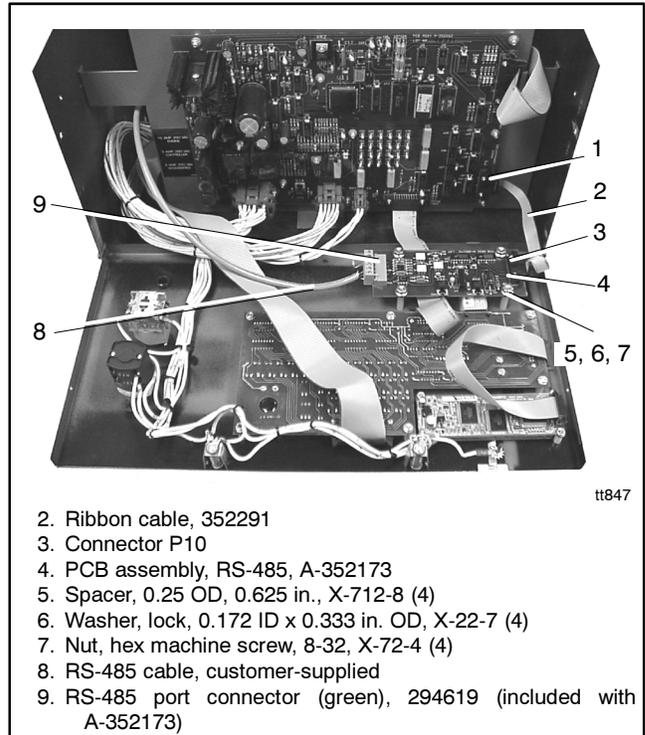
ADV-5888

**Figure 18** Digital or 340 Generator Set Controller



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**Figure 19** RS-232 Communication Module  
PA-354198 or PA-354198-SD Installation  
for the Digital or 340 Generator Set  
Controller



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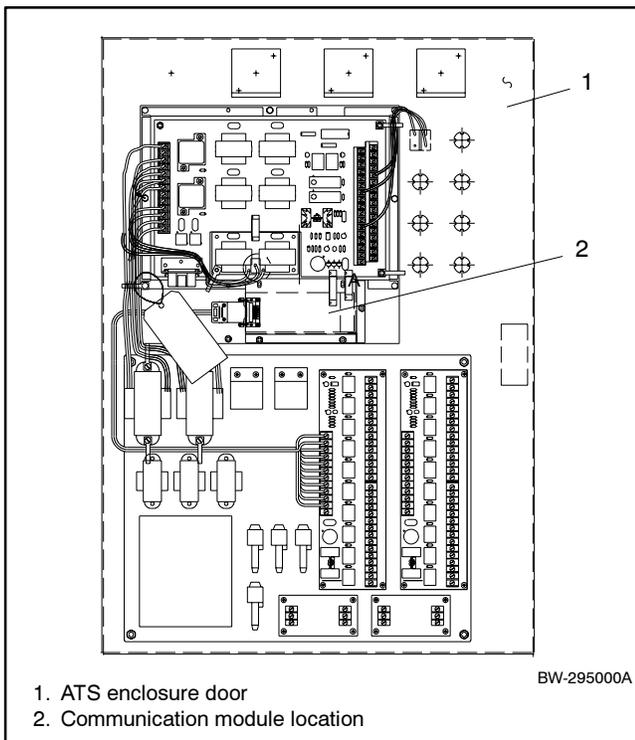
**Figure 20** RS-485 Communication Module  
PA-354197 or PA-354197-SD Installation  
for the Digital or 340 Generator Set  
Controller

## ATS Controller Communication Kit Installation

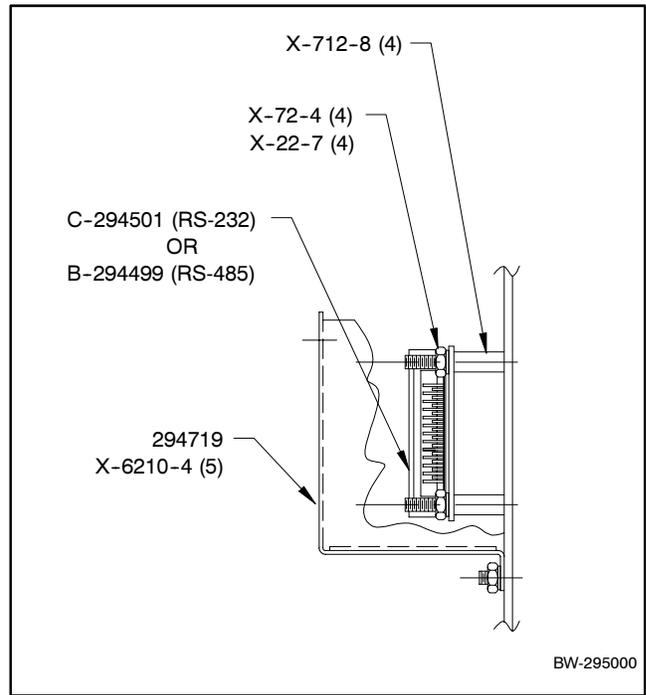
Use the table in Figure 21 to identify the illustrations for your application. Mount ATS controller communication modules on mounting studs located below the main controller housing. If the ATS is equipped with a load shed accessory KD-35N or DD-35N, mount the communication module over it.

Description	Figure	
	RS-232	RS-485
Module Location	Figure 22	
Module Installation	Figure 23	
Without Load Shed Accessory	Figure 23	
With Load Shed Accessory	Figure 24	
Ribbon Cable Connection	Figure 25	
Module Installation Details	Figure 26	Figure 28
Port Location	Figure 27	Figure 29

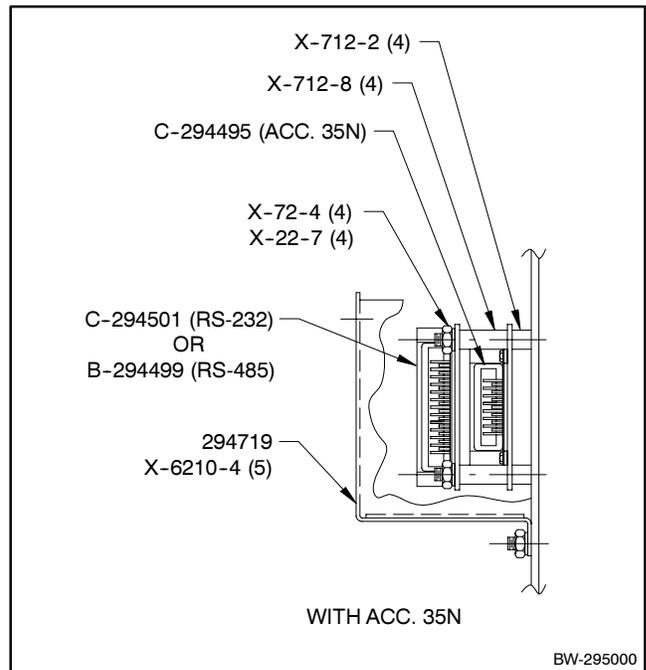
**Figure 21** ATS Controller Communication Module Figures



**Figure 22** Communication Module Location for ATS Controllers

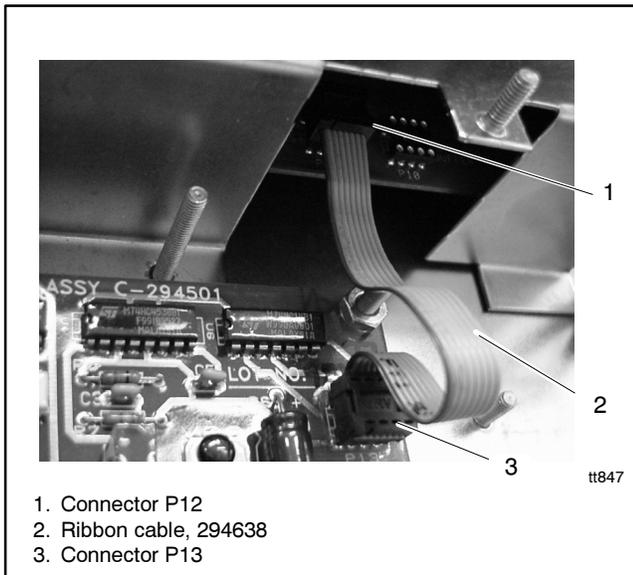


**Figure 23** Communication Module Installation Details for ATS Controllers Without Load Shed Accessory 35N

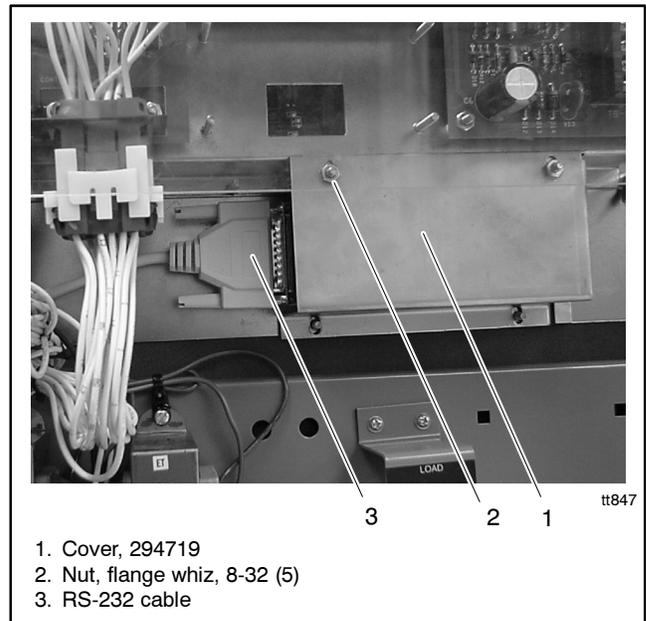


**Figure 24** Communication Module Installation Details for ATS Controllers With Load Shed Accessory 35N

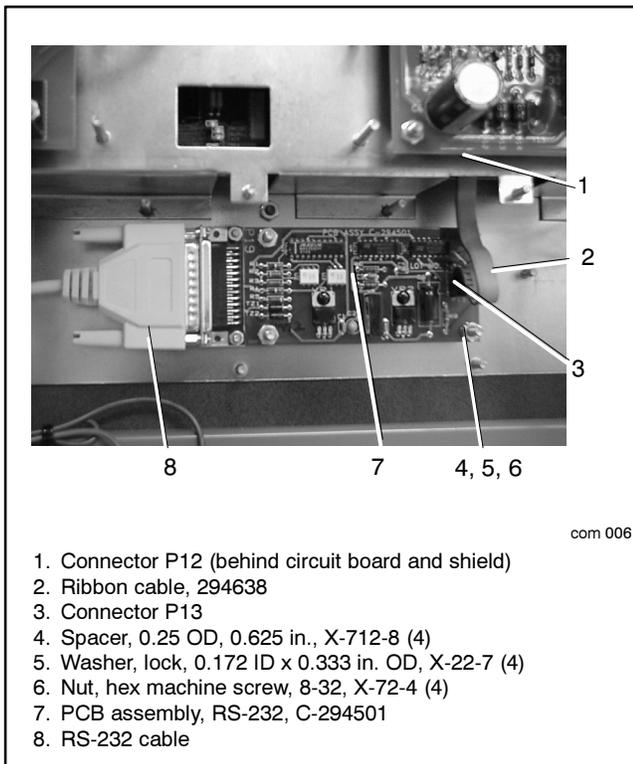
## ATS Controller Communication Kit Installation, continued



**Figure 25** Ribbon Cable Connection Details

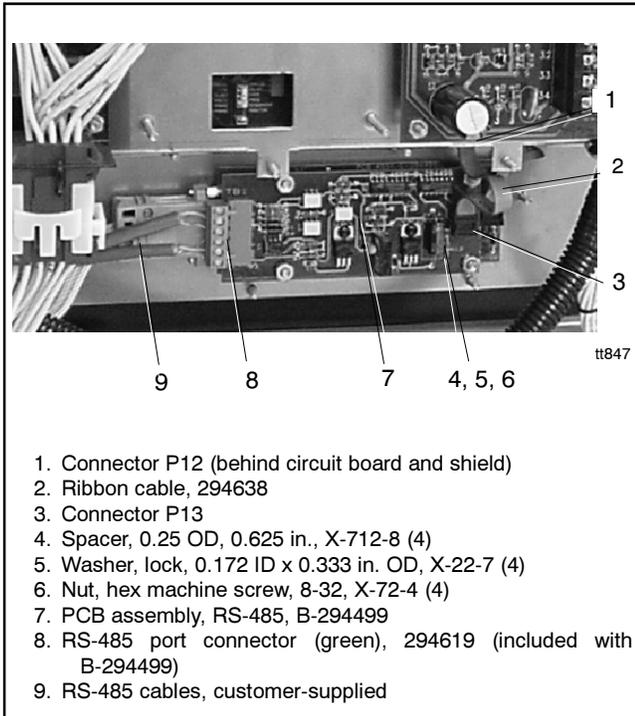


**Figure 27** RS-232 Port Location and Connection on  
ATS Controller

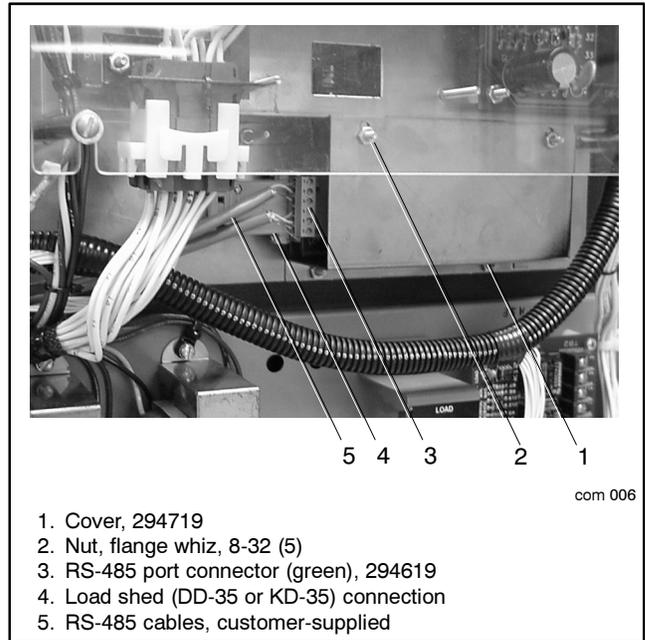


**Figure 26** RS-232 Communication Module  
PA-294867 or PA-294867-SD Installation  
Details for ATS Controllers

## ATS Controller Communication Kit Installation, continued



**Figure 28** RS-485 Communication Module  
PA-294866 or PA-294866-SD Installation  
Details for ATS Controllers



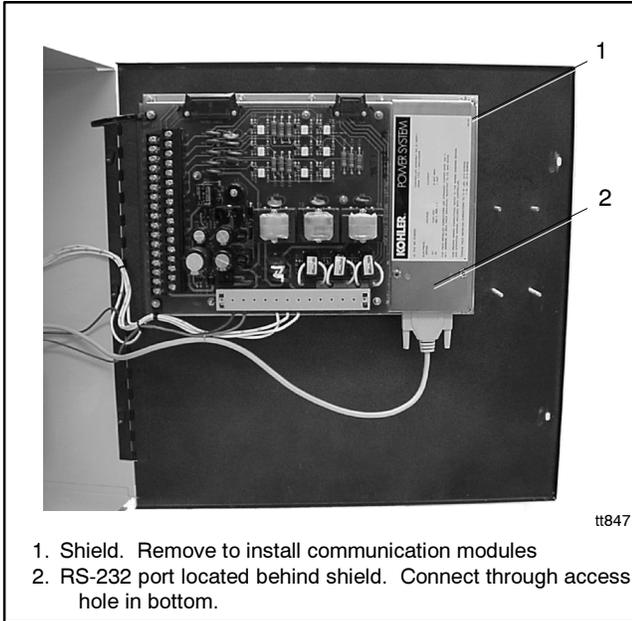
**Figure 29** RS-485 Port location and Connection on  
ATS Controller with Load Shed Accessory  
35N

## Power Monitor Communication Kit Installation

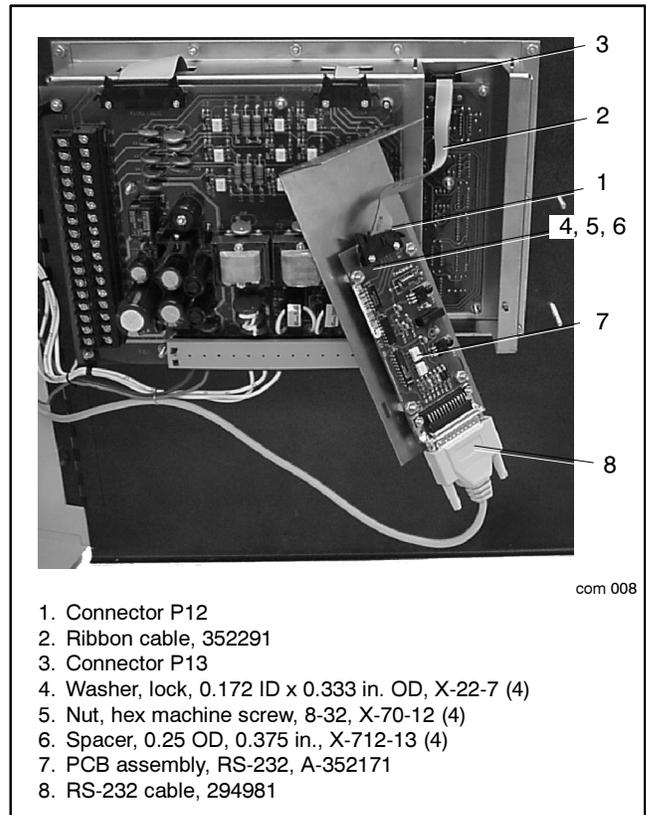
Use the table in Figure 30 to identify the illustrations for your application.

Description	Figure	
	RS-232	RS-485
Communication Port Location	Figure 31	Figure 33
Communication Module Installation	Figure 32	Figure 34
Internal RS-232 to RS-485 Converter Installation	—	Figure 35

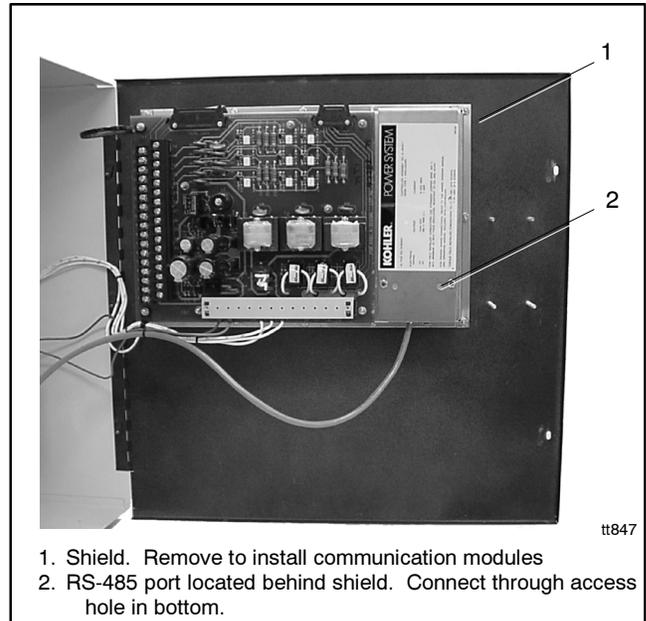
**Figure 30** Power Monitor Figures



**Figure 31** RS-232 Communication Port Location and Connection for the Power Monitor

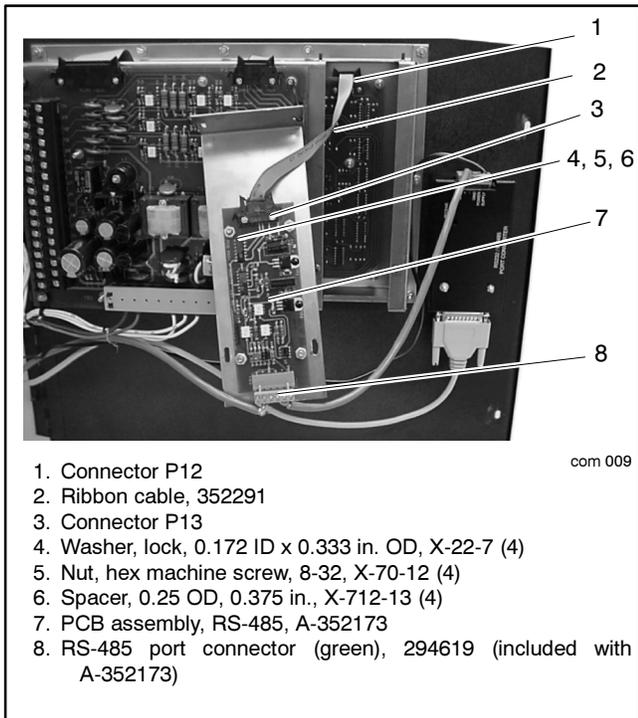


**Figure 32** RS-232 Module PA-353395 Installation Details for the Power Monitor

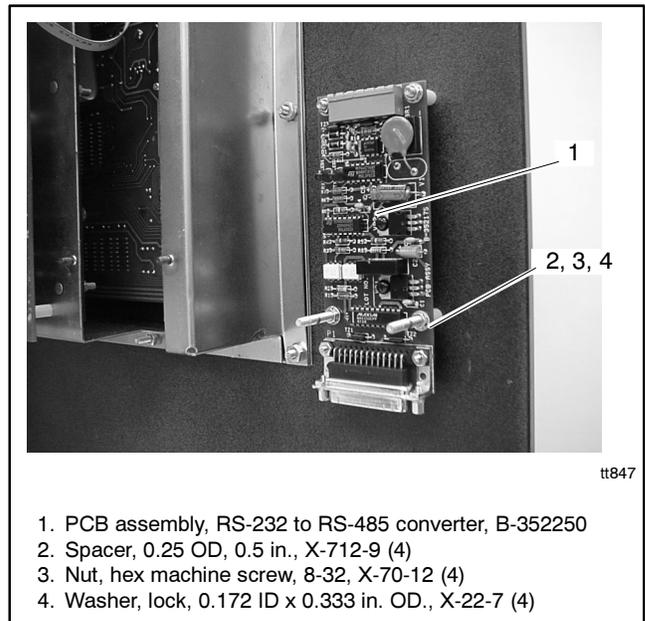


**Figure 33** RS-485 Communication Port Location and Connection for the Power Monitor

## Power Monitor Communication Kit Installation, continued



**Figure 34** RS-485 Module PA-353396 or PA-353396-SD and Internal RS-232 to RS-485 Converter PA-353397 Installation Details for the Power Monitor



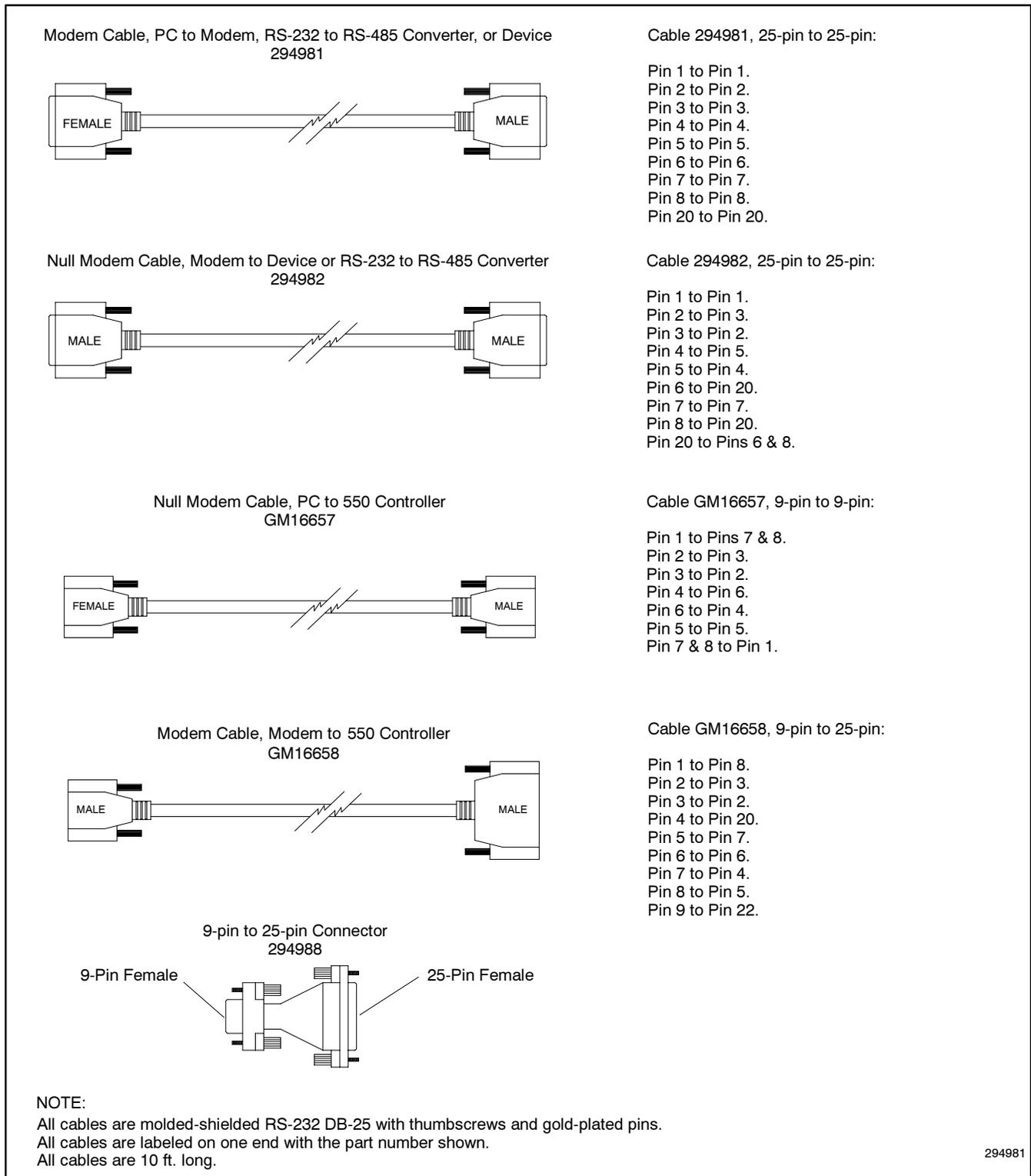
**Figure 35** Internal RS-232 to RS-485 Converter PA-353397 Installation Details for the Power Monitor

# Connection Cable Details

## RS-232 Cables

See Figure 36 for details on RS-232 cables and adapters that connect directly from a PC to a device,

from the PC to a modem, or from a modem to a device. Some PC serial ports have 9-pin connectors. For these PCs, use the 9-pin female to 25-pin male adapter to connect to the cables.



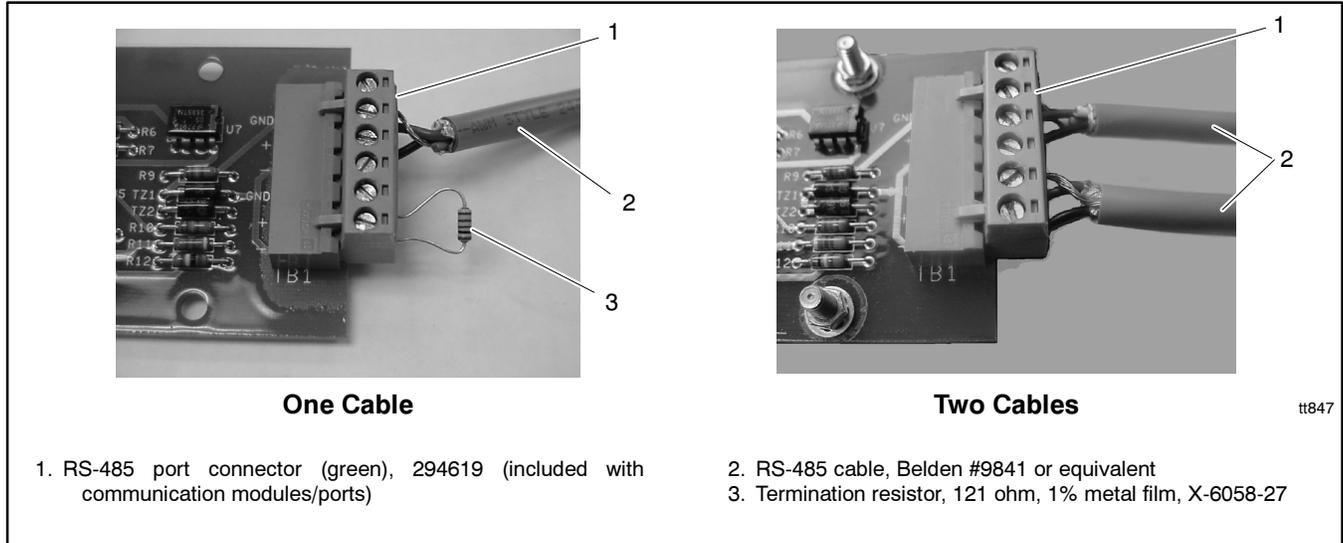
294981

Figure 36 RS-232 Cables

## RS-485 Cables

All RS-485 cables are customer-supplied. Use Belden #9841 or equivalent cable for the RS-485 cables. Connect one or two RS-485 cables to the detachable green RS-485 port connector 294619 on the 550 controller or the communication modules as shown in Figure 37. The terminals are identified on the module

circuit board and are the same for all modules. Connect the 121-ohm termination resistor across the + and - terminals of the unused port on the last device for reliable communication in all installations. Connect the RS-485 cable to a port converter as shown in the next section, RS-232 to RS-485 Port Converters.



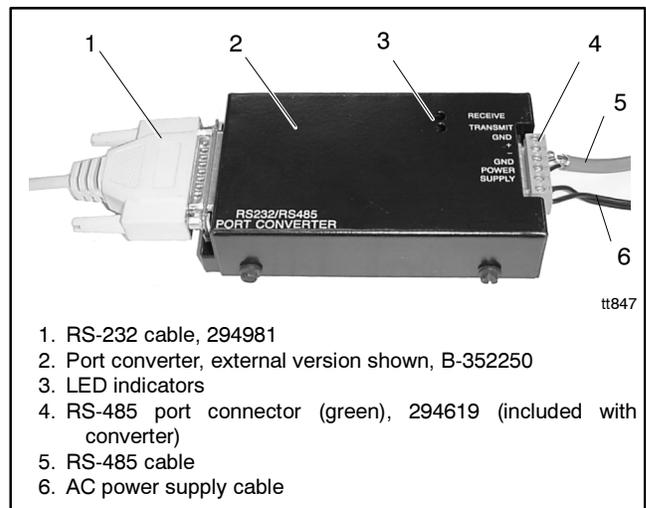
**Figure 37** RS-485 Cable Connection Details

## RS-232 to RS-485 Port Converters

An RS-232 to RS-485 port converter converts communication signals between the devices or PCs using different electrical standards. The kit includes a wall-mounted AC power supply. LEDs on the front of the converter indicate receive or transmit communication activity and can be used as a diagnostic aid.

Locate the external RS-232 to RS-485 converter module in an interior area in the building or with equivalent protection from environmental conditions. If the ATS or power monitor enclosure contains a standard wall outlet, the converter can be placed at the bottom of the enclosure.

Connect the RS-485 cable to the positive (+), negative (-), and ground (GND) terminals as shown in Figure 38. Connect the 2-wire AC power supply cable across the terminals labeled POWER SUPPLY as shown. Do not use a terminating resistor.



**Figure 38** RS-232 to RS-485 Port Converter, PA-352249 or PA-352249-SD (External) or PA-353397 (Internal for Power Monitor Only)

## External Modems

An external modem connects an RS-232 line to a telephone line. Figure 41 shows a typical external modem.

When all connections are made and power is available, place the power switch on front of the modem in the ON position. The modem's front panel LEDs should light as shown in Figure 39 when there is no communication activity. Adjust the volume control located on the side of the modem if desired.

The manufacturer configures and programs the modems. Further adjustment or programming should not be necessary. In the case of operation problems or for identification of the modem, check the DIP switch settings in Figure 40. Adjust the DIP switch settings if needed, disconnect the RS-232 line and telephone lines, and turn the power off and then on again. If the LED indicators do not match the LED status shown in Figure 39, replace the modem.

Device modems 294987 and 353071 are the same as PC modems 294986 and 353072, respectively, except the device modems are set up to automatically answer calls.

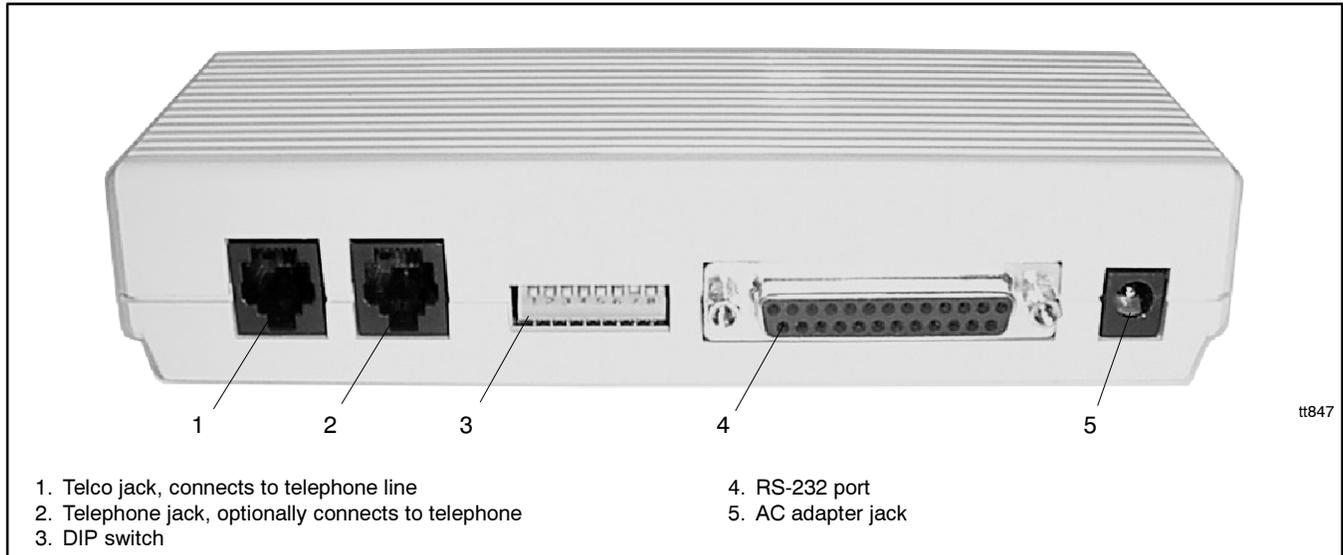
Locate external modems in an interior area in the building or with equivalent protection from environmental conditions. If a standard wall outlet is provided within an ATS or power monitor, it can be placed at the bottom of the enclosure.

Modem	Front Panel LED						
	AA	CD	RD	SD	TR	CS	ARQ/ FAX
PC Modem (294986 or 353072)	off	on	off	off	on	on	off
Device Modem (294987 or 353071)	on	on	off	off	on	on	off

**Figure 39** Idle LED Status

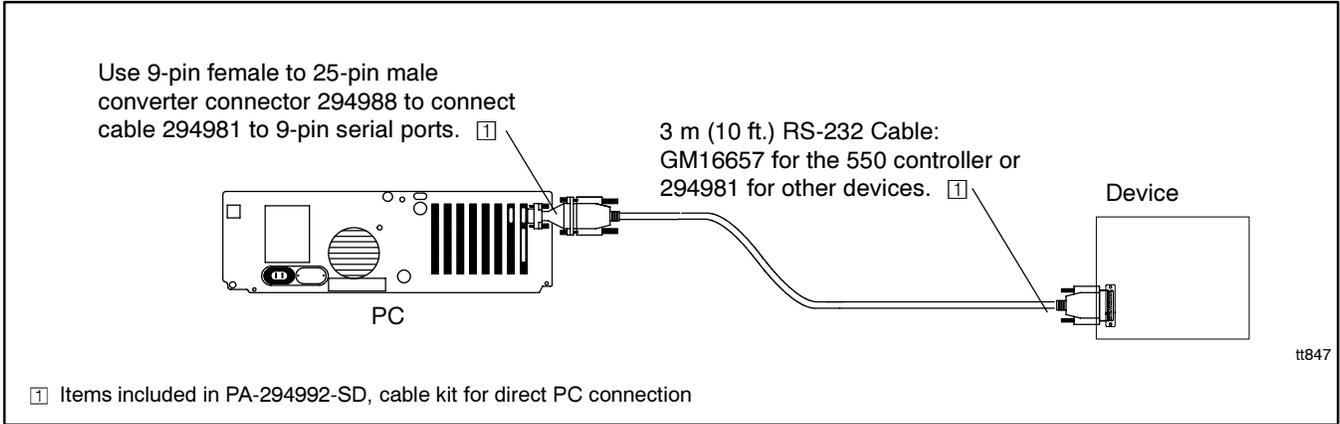
Modem	Switch Position							
	1	2	3	4	5	6	7	8
PC Modem (294986 or 353072)	↓	↓	↓	↓	↓	↓	↑	↓
Device Modem (294987 or 353071)	↓	↓	↓	↓	↑	↓	↑	↓

**Figure 40** Default Modem DIP Switch Settings

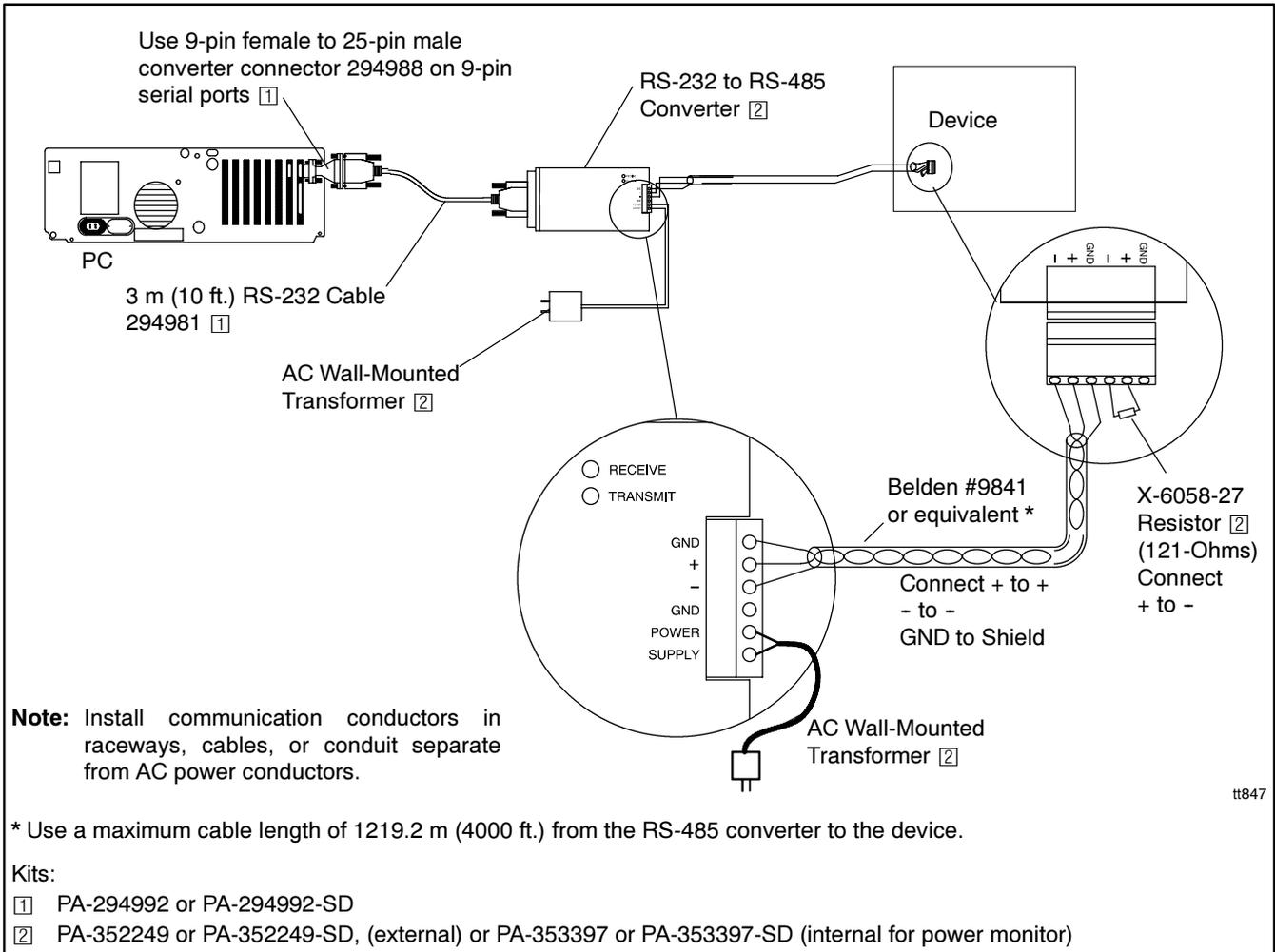


**Figure 41** External Modem (typical), Rear View

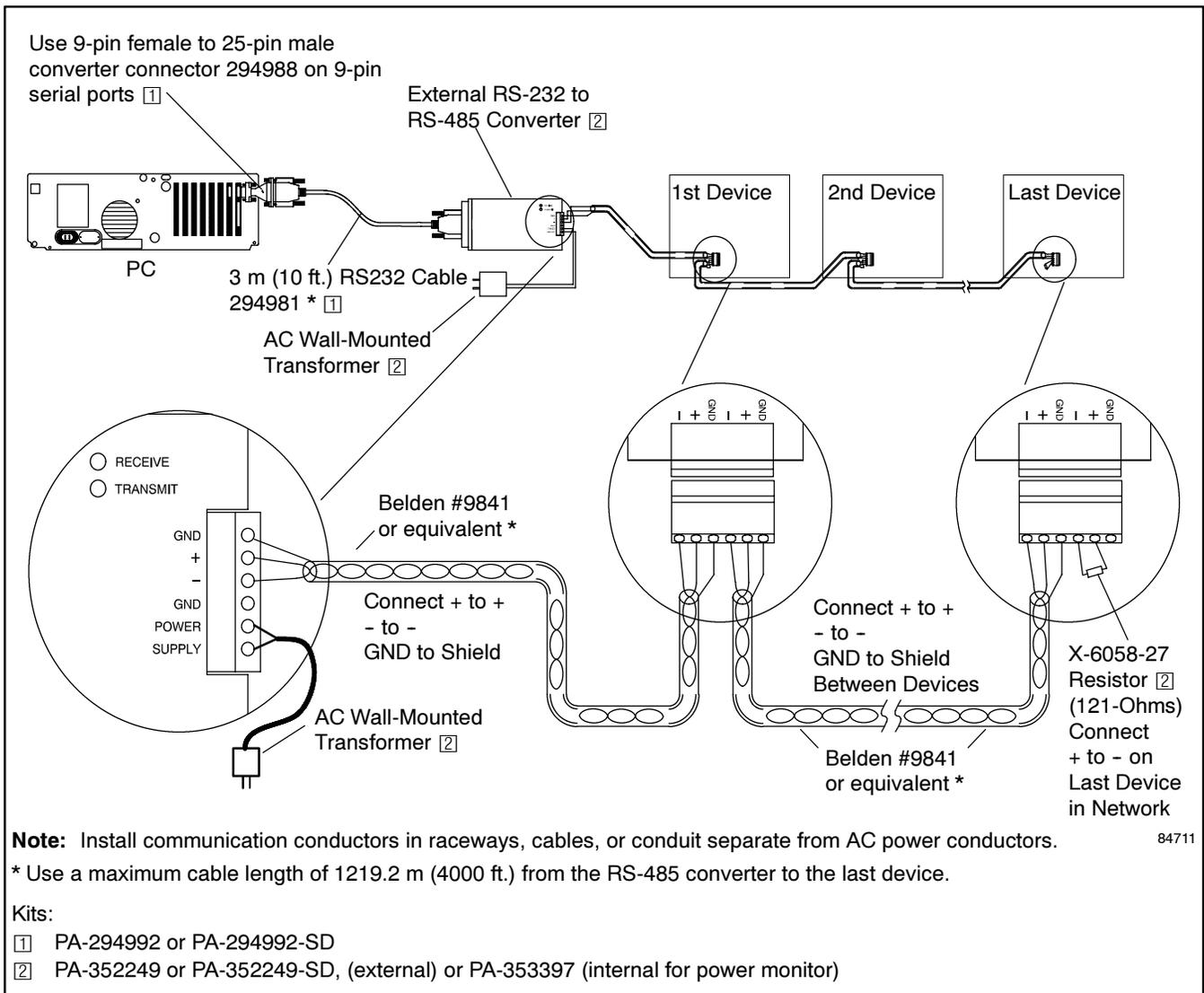
# Connection Diagrams



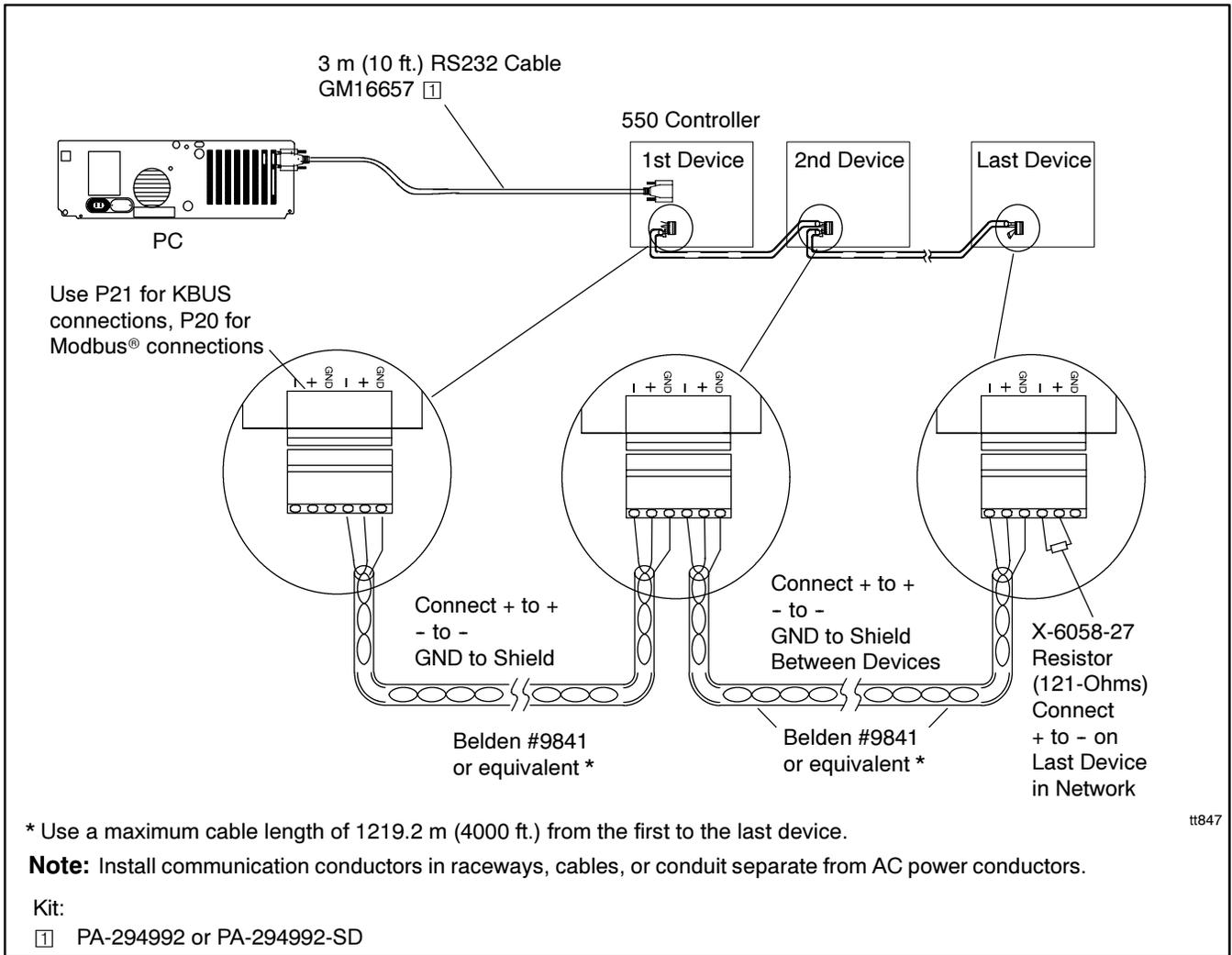
**Figure 42** Local Single Connection Up to 15.2 m (50 ft.)



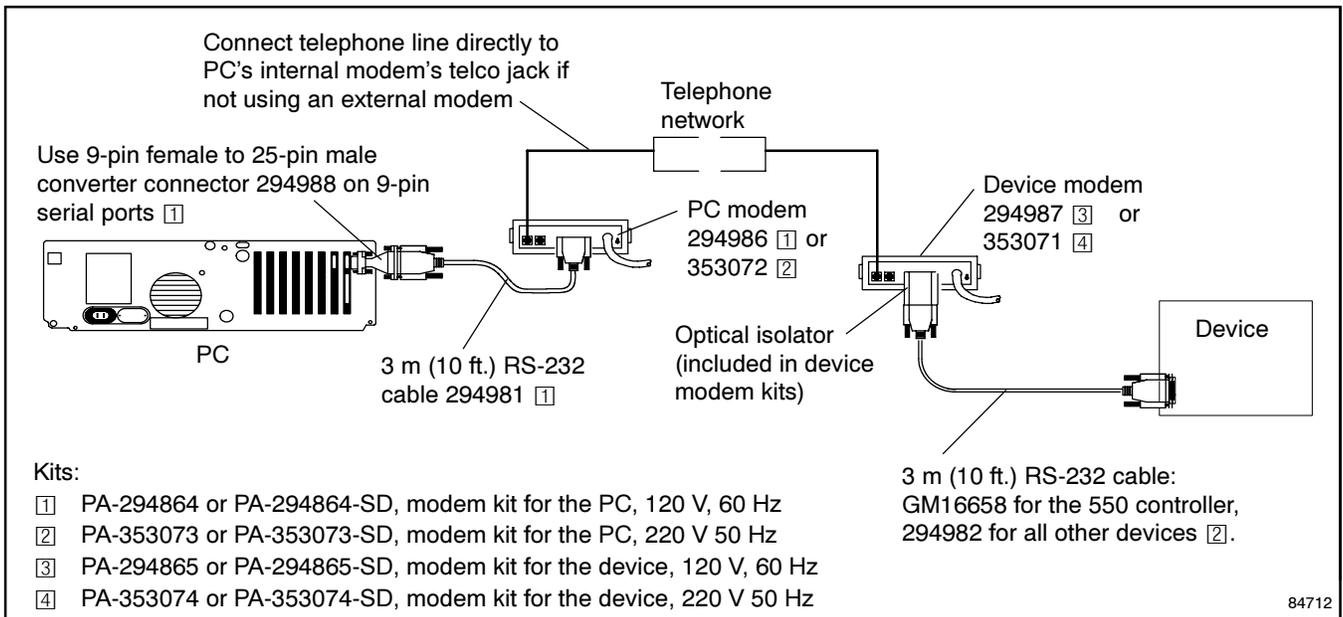
**Figure 43** Local Single Connection Up to 1219.2 m (4000 ft.)



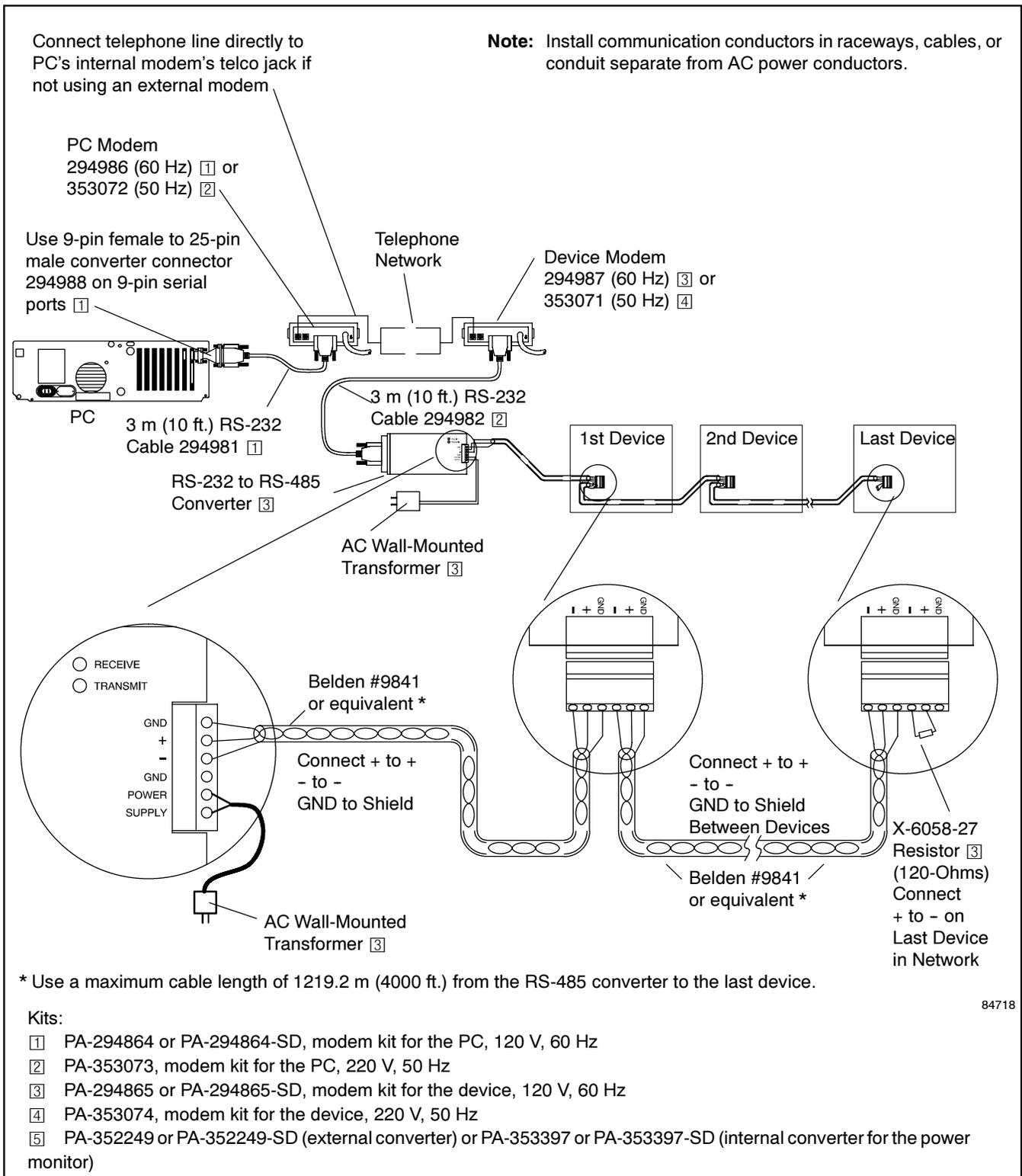
**Figure 44** Local Area Network



**Figure 45** Local Area Network Using the 550 Generator Set Controller as an RS-232 to RS-485 Converter [maximum 15.2 m (50 ft.) from the PC to the controller]

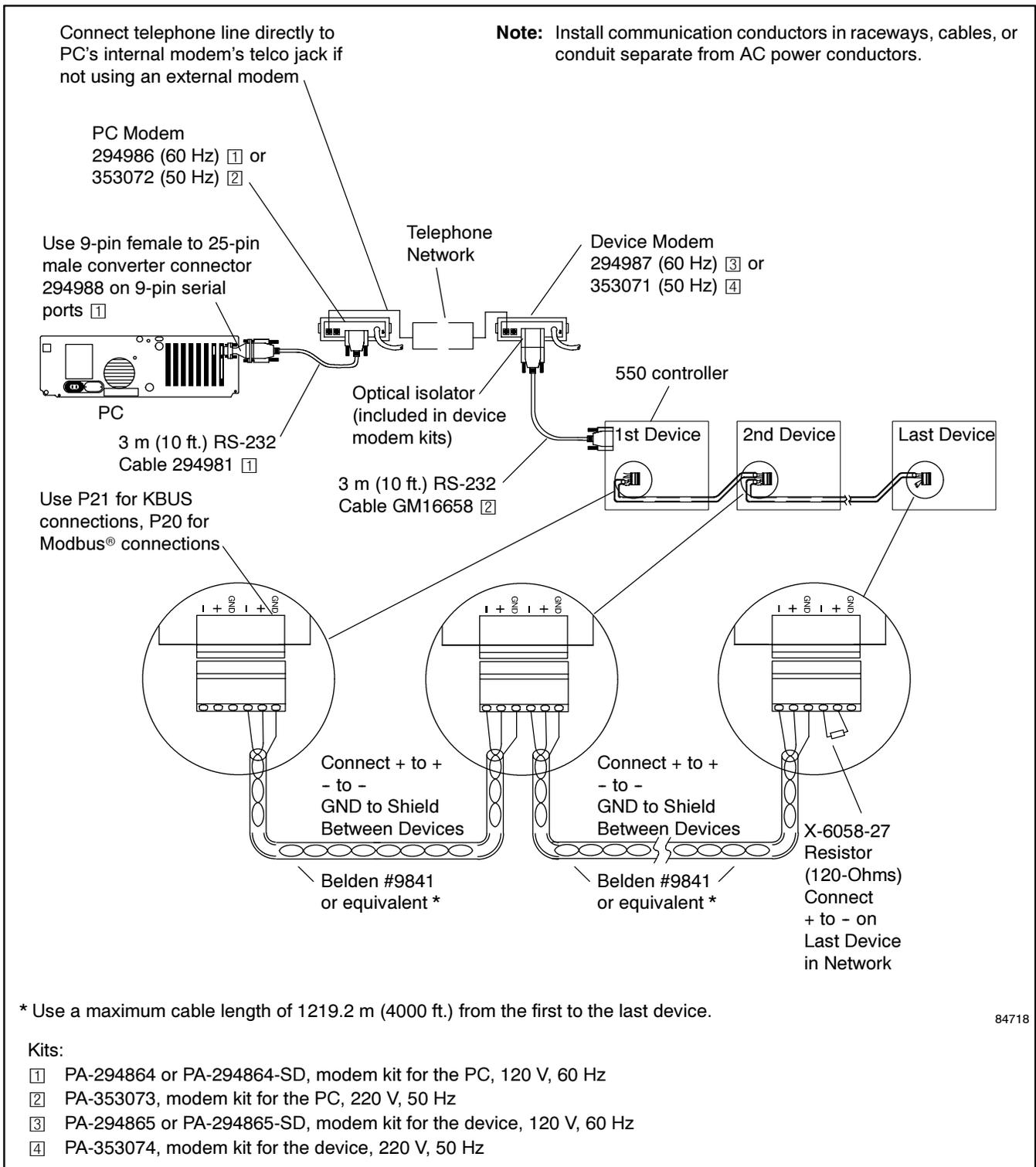


**Figure 46** Remote Single Connection



84718

**Figure 47** Remote Area Network



**Figure 48** Remote Area Network Using the 550 Generator Set Controller as an RS-232 to RS-485 Converter [maximum 15.2 m (50 ft.) from the device modem to the 550 Controller]

## Parts Lists

### Communication Modules

#### Generator Set Controller RS-232 Comm Module

Kit: PA-354197, PA-354197-SD		
Qty.	Description	Part Number
1	PCB assembly, I/O-RS232	A-352171
10	Washer, lock, 172 ID x .333 in. OD	X-22-7
4	Spacer, .25 OD, .937 in.	X-712-14
4	Nut, hex machine screw, 8-32	X-72-4
1	Multiconductor cable, ribbon	352291

#### Generator Set Controller RS-485 Comm Module

Kit: PA-354198, PA-354198-SD		
Qty.	Description	Part Number
1	PCB assembly, I/O-RS485	A-352173
10	Washer, lock, 172 ID x .333 in. OD	X-22-7
4	Spacer, .25 OD, .937 in.	X-712-14
4	Nut, hex machine screw, 8-32	X-72-4
1	Multiconductor cable, ribbon	352291

#### ATS Controller RS-232 Comm Module

Kit: PA-294867, PA-294867-SD		
Qty.	Description	Part Number
1	PCB assembly, ATS controller, RS232	C-294501
10	Washer, lock, 172 ID x .333 in. OD	X-22-7
5	Nut, flange whiz, 8-32	X-6210-4
4	Spacer, .25 OD, .625 in.	X-712-8
4	Nut, hex machine screw, 8-32	X-72-4
1	Multiconductor cable, ribbon	294638
1	Diagram, wiring	294675-S
1	Box, cover	294719

#### ATS Controller RS-485 Comm Module

Kit: PA-294866, PA-294866-SD		
Qty.	Description	Part Number
1	PCB assembly, ATS controller, RS485	B-294499
10	Washer, lock, 172 ID x .333 in. OD	X-22-7
5	Nut, flange whiz, 8-32	X-6210-4
4	Spacer, .25 OD, .625 in.	X-712-8
4	Nut, hex machine screw, 8-32	X-72-4
1	Multiconductor cable, ribbon	294638
1	Diagram, wiring	294675-S
1	Box, cover	294719

#### Power Monitor RS-232 Comm Module

Kit: PA-353395		
Qty.	Description	Part Number
1	PCB assembly, I/O-RS232	A-352171
4	Washer, lock, 172 ID x .333 in. OD	X-22-7
4	Nut, hex machine screw, 8-32	X-70-12
4	Spacer, .25 OD, .375 in.	X-712-13
1	Multiconductor cable, ribbon	352291

#### Power Monitor RS-485 Comm Module

Kit: PA-353396		
Qty.	Description	Part Number
1	PCB assembly, I/O-RS485	A-352173
4	Washer, lock, 172 ID x .333 in. OD	X-22-7
4	Nut, hex machine screw, 8-32	X-70-12
4	Spacer, .25 OD, .375 in.	X-712-13
1	Multiconductor cable, ribbon	352291

### Cables and Modems

#### PC Connection Cable Kit

Kit: PA-294992, PA-294992-SD		
Qty.	Description	Part Number
1	Multiconductor cable	294981
1	Cable, DB9M/DB9F, null modem	GM16657
1	Connector	294988

#### External Modem for PC, 120 V, 60 Hz.

Kit: PA-294864, PA-294864-SD		
Qty.	Description	Part Number
1	Multiconductor cable	294981
1	Modem, external, PC, 120 V, 60 Hz.	294986
1	Connector	294988

#### External Modem for PC, 220 V, 50 Hz.

Kit: PA-353073, PA-353073-SD		
Qty.	Description	Part Number
1	Multiconductor cable	294981
1	Connector	294988
1	Modem, external, PC, 220 V, 50 Hz.	353072

#### External Modem for Device, 120 V, 60 Hz.

Kit: PA-294865, PA-294865-SD		
Qty.	Description	Part Number
1	Multiconductor cable	294982
1	Cable, DB9M/DB25M, AT Modem	GM16658
1	Modem, external, device, 120 V, 60 Hz.	294987
1	Optical isolator	GM17837

#### External Modem for Device, 220 V, 50 Hz.

Kit: PA-353074, PA-353074-SD		
Qty.	Description	Part Number
1	Multiconductor cable	294982
1	Cable, DB9M/DB25M, AT Modem	GM16658
1	Modem, external, device, 220 V, 50 Hz.	353071
1	Optical isolator	GM17837

## Parts Lists, continued

### RS-232 to RS-485 Converters

RS-232 to RS-485 Converter, External, 120 V,  
60 Hz.

Kit: PA-352249 or PA-352249-SD		
Qty.	Description	Part Number
1	Converter assembly	B-352250
1	Resistor, 121 ohm, 1/4 W	X-6058-27

RS-232 to RS-485 Converter, External, 230 V,  
50 Hz.

Kit: GM10683-KP1		
Qty.	Description	Part Number
1	Converter assembly	GM10682
1	Resistor, 121 ohm, 1/4 W	X-6058-27

RS-232 to RS-485 Converter, Internal for Power  
Monitor

Kit: PA-353397		
Qty.	Description	Part Number
1	PCB assembly, RS232/RS485 converter	B-352175
6	Washer, lock, 172 ID x .333 in. OD	X-22-7
1	Resistor, 121 ohm, 1/4 W	X-6058-27
6	Nut, hex machine screw, 8-32	X-70-12
4	Spacer, .25 OD, .5 in.	X-712-9
1	Cover, silkscreen	353325



