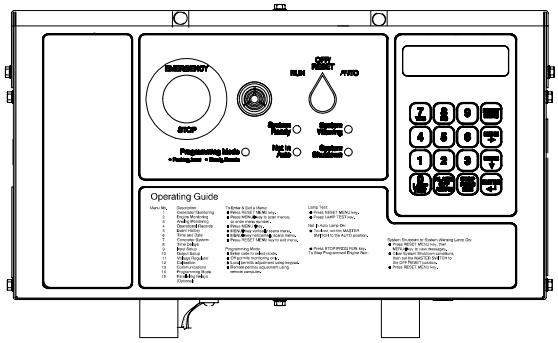
KOHLER POWER SYSTEMS

Decision-Maker™ 550 Communications

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED



Controller Communications

Applicable to all generator sets using the Kohler® Decision-Maker™ 550 Controller.

The Decision-Maker™ 550 controller supports different communication protocols in a variety of ways to enhance power system monitoring and control. Coded messages specific to the communication protocol are transported through hardwire connections.

- KBUS, a Kohler proprietary protocol
  - Provides communication between a Decision-Maker™ 550 controller and a personal computer running Monitor II software.
  - Monitor II software is used to monitor and control Kohler generator sets, transfer switches, and power monitors. Refer to G6-38, Monitor II Software spec sheet.
  - More information about KBUS protocol is available upon request from Kohler Co.
- Modbus®, an industry standard open protocol
  - Modbus® protocol provides communication between the 550 controller and a master device.
  - Master devices may include a personal computer or a third-party controller.
  - A software driver is required by the Modbus® master device. Refer to TP-6113, Modbus® Communications Protocol Operation Manual for the Decision-Maker™ 550 Controller.

Communications Features

- Supports industry-standard Modbus® RTU protocol
- Uses either an RS-232 or RS-485 network port
- Communicates at baud rates up to 19200
- Shares a network with up to 128 devices
- Allows selection of an access code for remote programming
- Remotely monitors system operation including run times, shutdowns, warnings, and input/output activity
- Allows selection of either metric (SI) or English (IP) units
- Provides more than 100 different Modbus® message codes for system monitoring, including System Ready and Generator Running
- Provides remote programming of most system parameters including time delays, trip points, voltage, frequency, and current
- Allows remote engine start/stop and controller reset

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Modbus® is a registered trademark of Schneider Electric.

Monitoring, Diagnostics, Inputs, and Outputs

The following controller information is available through KBUS and/or Modbus® communications. The availability of certain functions depends on specific engine types, engine controls, and paralleling applications.

Monitoring

- Engine monitoring data (metric or English units):
  - Battery voltage
  - Coolant—pressure and level ‡
  - Coolant—temperature
  - Engine start countdown
  - Fuel—pressure, temperature, and fuel rate ‡
  - Fuel—used last run ‡
  - Oil—level and crankcase pressure ‡
  - Oil—pressure
  - Oil—temperature ‡§
  - RPM
  - Temperature—ambient ‡
  - Temperature—intake air §
- Generator monitoring data:
  - Current (L1, L2, L3), ±0.25% accuracy
  - Frequency, ±0.5% accuracy
  - Kilowatts, total per phase (L1, L2, L3), ±0.5% accuracy
  - KVA, total per phase (L1, L2, L3), ±0.5% accuracy
  - KVAR, total absorbing/generating per phase (L1, L2, L3), ±0.5% accuracy
  - Percent alternator duty level (actual load kW/standby kW rating)
  - Power factor per phase, leading/lagging
  - Voltage (line-to-line, line-to-neutral for all phases), ±0.25% accuracy
- Operational records:
  - Event history (stores up to 100 system events)
  - Last run duration, loaded or unloaded
  - Last start date and time
  - Number of starts
  - Number of starts since last maintenance
  - Operating days since last maintenance
  - Operating mode—standby or prime power
  - Run time (total, loaded and unloaded hours, and total kW hours)
  - Run time since maintenance (total, loaded, and unloaded hours and total kW hours)
  - System shutdowns
  - System warnings
  - Time, date, and day of week
- Time delays*—general:
  - Crank cycles for on/pause
  - Crank cycles for overcrank shutdown
  - Engine cooldown
  - Engine start
  - Load shed
  - Voltage, over and under
  - Starting aid
- System parameters:
  - Current, rated
  - ECM serial number ‡
  - Engine model number ‡
  - Engine serial number ‡
  - Frequency*
  - Generator set model number
  - Generator set serial number
  - Generator set spec number
  - kW Rating*
  - Phase, single and three (wye or delta)*
  - Unit number ‡
  - Voltage, AC*
  - Voltage configuration, wye or delta*

Diagnostics

Shutdowns stop the generator set. Warnings signal an impending problem.

Shutdown Functions

- Engine functions:
  - Air damper fault, if equipped
  - Air/fuel module §
  - Coolant temperature signal loss
  - Detonation shutdown §
  - High coolant temperature
  - High oil temperature
  - Intake air temperature §
  - Knock shutdown §
  - Low coolant level
  - Low fuel pressure (standard on 125RZG) †
  - Low oil pressure
  - No air temperature signal §
  - No oil temperature signal §
  - Oil pressure signal loss
  - Overcrank*
  - Overspeed*
- General functions:
  - Auxiliary—(up to 7 analog inputs each with a high and low programmable shutdown level) *
  - Auxiliary—digital (up to 21 programmable shutdowns) *
  - ECM communications loss (ECM models only)
  - Emergency stop
  - Internal fault
  - Master switch in off/reset position
  - Master switch error
  - Master switch open
  - Serial number mismatch
- Generator functions:
  - Alternator protection against overload and short circuits
  - Critical overvoltage
  - Generator set parameter fault
  - Locked rotor (failed to crank)
  - Overfrequency *
  - Overvoltage, AC output *
  - Underfrequency*
  - Undervoltage, AC output *
- Paralleling functions:
  - Loss of field
  - Overcurrent
  - Overpower
  - Reverse power

Warning Functions

- Engine functions:
  - Detonation warning §
  - High battery voltage
  - High coolant temperature
  - High oil temperature §
  - Intake air temperature §
  - Low battery voltage
  - Low coolant temperature
  - Low fuel (level or pressure) †
  - Low oil pressure
  - Speed sensor fault
  - Weak battery
- General functions:
  - Auxiliary—(up to 7 analog inputs each with a high and low programmable warning level).*
  - Auxiliary—Digital (up to 21 programmable warnings) *
  - Battery charger fault †
  - Emergency power system (EPS) supplying load
  - Load shed kW overload *
  - Load shed underfrequency
  - Master switch not in auto
  - NFPA 110 fault
  - Serial number mismatch
- Generator functions:
  - AC sensing loss
  - Generator set parameter fault
  - Ground fault †
  - Overcurrent*
  - Underfrequency *
- Paralleling functions:
  - Common protective relay output

* User-programmable settings
† Requires optional input sensors on some models
‡ Detroit Diesel DDEC only
§ Waukesha engines only

User-Defined Common Faults and Status

The user defines up to 21 RDOs (relays not included) from the following list of functions:

- Engine functions:
  - Air damper fault, if equipped
  - Air/fuel module engine start delay §
  - Air/fuel module remote start §
  - Coolant temperature signal loss
  - Fuel valve relay §
  - High battery voltage
  - High coolant temperature shutdown
  - High coolant temperature warning
  - High intake air temperature shutdown §
  - High intake air temperature warning §
  - High oil temperature shutdown (ECM models only)
  - High oil temperature warning §
  - Low battery voltage
  - Low coolant level
  - Low coolant temperature warning
  - Low fuel (level or pressure) warning †
  - Low oil pressure shutdown
  - Low oil pressure warning
  - No intake air temperature signal §
  - No oil temperature signal §
  - Oil pressure signal loss
  - Overcrank
  - Overspeed
  - Prelube relay §
  - Speed sensor fault
  - Starting aid
  - Weak battery
- General functions:
  - Battery charger fault †
  - ECM communications loss (ECM models only)
  - EEPROM write failure
  - Emergency stop
  - Engine cooldown delay
  - Engine start delay
  - EPS supplying load
  - Internal fault
  - Load shed kW overload
  - Load shed underfrequency
  - Master switch error
  - Master switch not in auto
  - Master switch open
  - Master switch off
  - NFPA 110 common alarm
  - System ready
- Generator functions:
  - AC sensing loss
  - Alternator protection against overload and short circuits
  - Frequency, over and under
  - Generator running
  - Ground fault
  - Locked rotor (failed to crank)
  - Overcurrent
  - Overvoltage
  - Undervoltage
- Paralleling applications with Kohler switchgear
  - Breaker trip
  - Loss of field shutdown
  - Overcurrent shutdown
  - Overpower shutdown
  - Reverse power shutdown
  - Loss of synchronization

* User-programmable settings
† Requires optional input sensors on some models
‡ Detroit Diesel DDEC only
§ Waukesha engines only

NFPA 110 Alarms

Additional annunciated alarms including NFPA 110 alarms.

- Engine functions:
  - Air damper indicator
  - High battery voltage
  - High coolant temperature shutdown
  - High coolant temperature warning
  - Low battery voltage
  - Low coolant level
  - Low coolant temperature warning
  - Low fuel (level or pressure) †
  - Low oil pressure shutdown
  - Low oil pressure warning
  - Overcrank
  - Overspeed
- General functions:
  - Battery charger fault †
  - EPS supplying load
  - Master switch not in auto

Inputs

- Digital inputs (up to 21 user-defined digital inputs with shutdown or warning levels):
  - Air damper fault, if equipped
  - Air/fuel module shutdown §
  - Battery charger fault †
  - Battleswitch
  - Detonation shutdown §
  - Detonation warning §
  - Field overvoltage
  - Ground fault
  - High oil temperature
  - Idle mode active (ECM models only)
  - Knock shutdown §
  - Low coolant level
  - Low coolant temperature
  - Low fuel warning †
  - Low fuel shutdown (standard on 125RZG) †
  - Shutdown type A
  - Shutdown type B
  - Warning
- Switchgear inputs (to interface with switchgear system):
  - Circuit breaker closed
  - Enable synch
  - Remote reset
  - Remote shutdown
  - VAR/PF mode enable/disable
  - Voltage—raise/lower (or VAR/PF raise/lower in VAR/PF mode.)

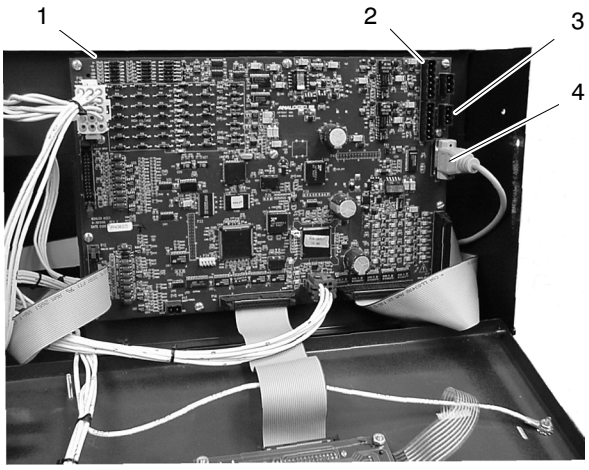
Outputs

See the Diagnostics section for a breakdown of the available shutdown and warning functions.

- Controller relay driver outputs (RDOs) (relays not included):
  - NFPA 110
  - Thirty-one user-defined RDOs
  - User-defined common fault RDOs

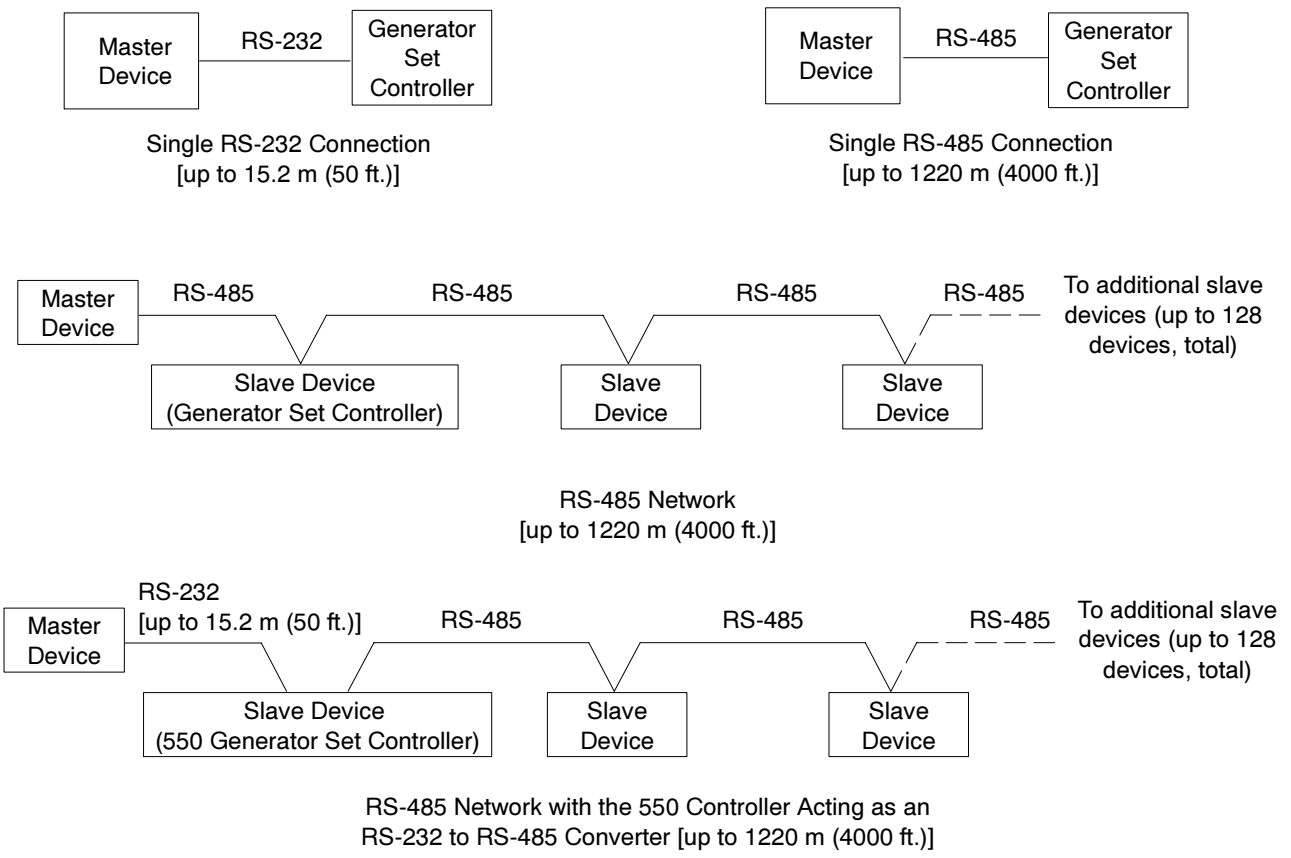
Configurations

In the following diagrams a master device can be either a KBUS master, such as a PC equipped with the Monitor II software, or a Modbus® master, such as a PC equipped with a Modbus® application or a programmable controller (PLC). A slave device is any device operating with the same protocol as the master device. The master device must poll the slave device for data. Up to 128 slave devices, including generator set controllers, transfer switch controllers, and power monitors, can be supported on a single RS-232 or RS-485 network.



1. Main logic board
2. RS-485 KBUS isolated connection (P21)
3. RS-485 Modbus® port (P20)
4. RS-232-C port (P18), connects with standard DB-9 RS-232 cable

Communication Port Locations for the Decision-Maker 550 Generator Set Controller



Communication Configurations

PC Communication

A personal computer (PC) can communicate with the generator set controller using local or remote, single or network connections. See TT-847, Controller Communication Kits, for more detailed connection information.

Local Single Connection

A PC connects directly to the controller's communication port with an RS-232 cable for applications where the PC is within 15 m (50 ft.) from the device or with an RS-485 cable for applications where the PC is up to 1220 m (4000 ft.) from the device.

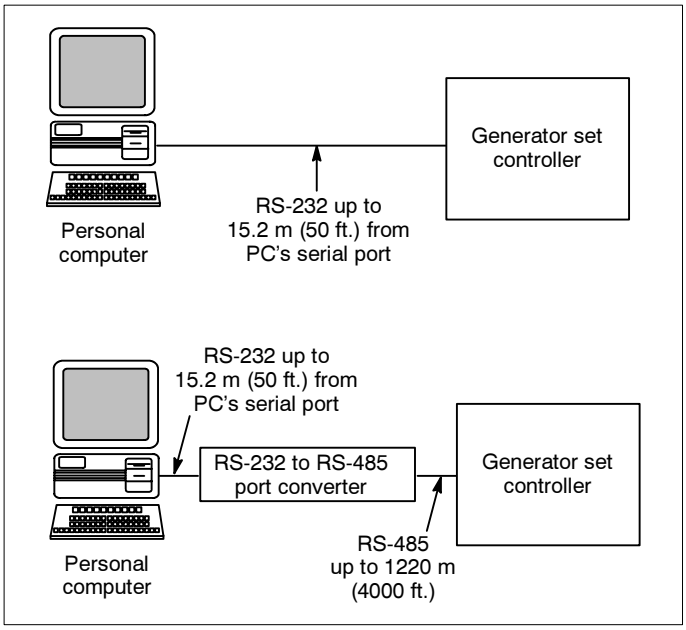


Figure 9 Local Single Connection

Local Area Network (LAN)

A PC connects directly to the controller's local area network (LAN). A LAN is a system that connects more than one device to a single PC.

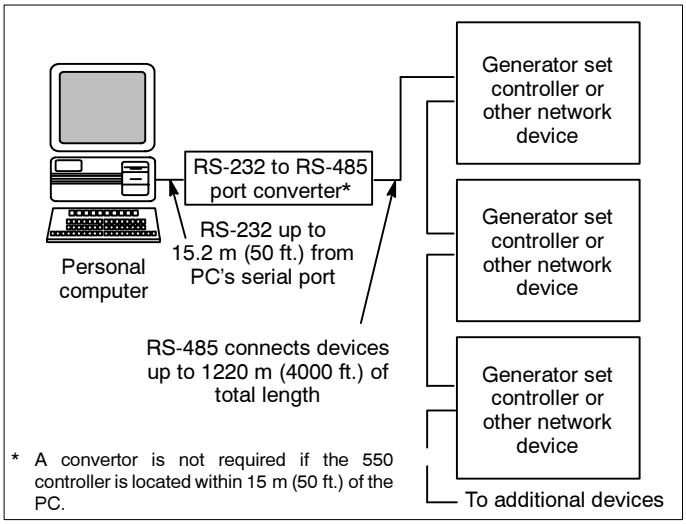


Figure 10 Local Area Network

Remote Single Connection

The PC and controller are connected by modems. The PC communicates with the controller through telephone lines, and the PC can be located anywhere a telephone line can be accessed.

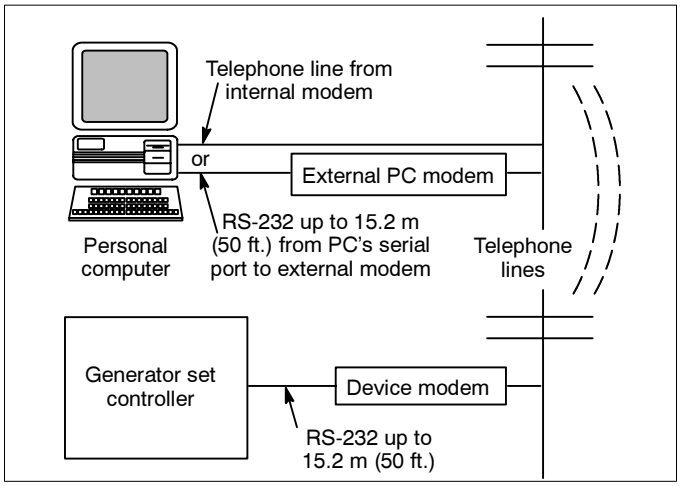


Figure 11 Remote Single Connection

Remote Area Network

A PC is connected to a PC modem. The controller and other devices are connected as a LAN network. The PC communicates with the devices through telephone lines that connect to the LAN network through a device modem. The PC can be located anywhere a telephone line can be accessed.

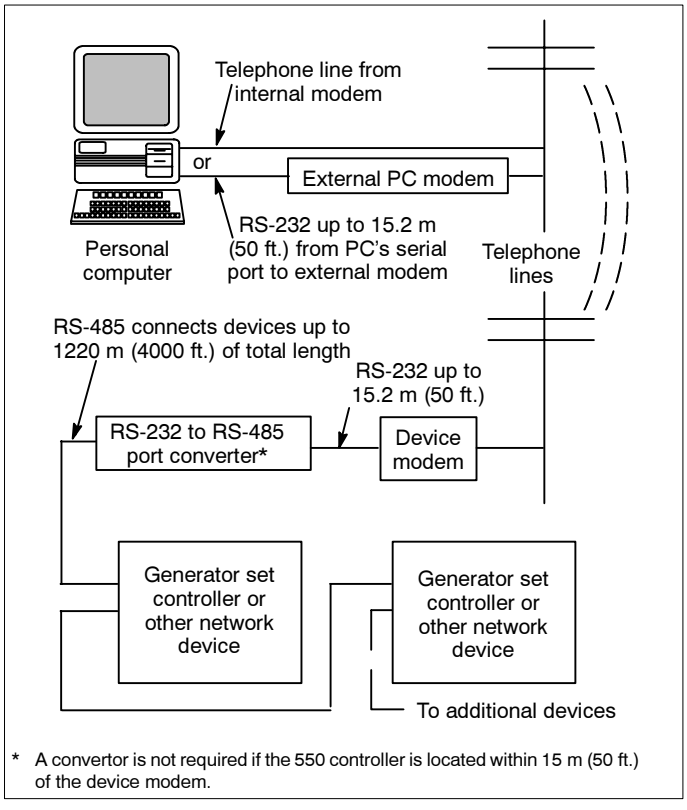


Figure 12 Remote Area Network

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-565-3381, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KohlerPowerSystems.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65)264-6422, Fax (65)264-6455

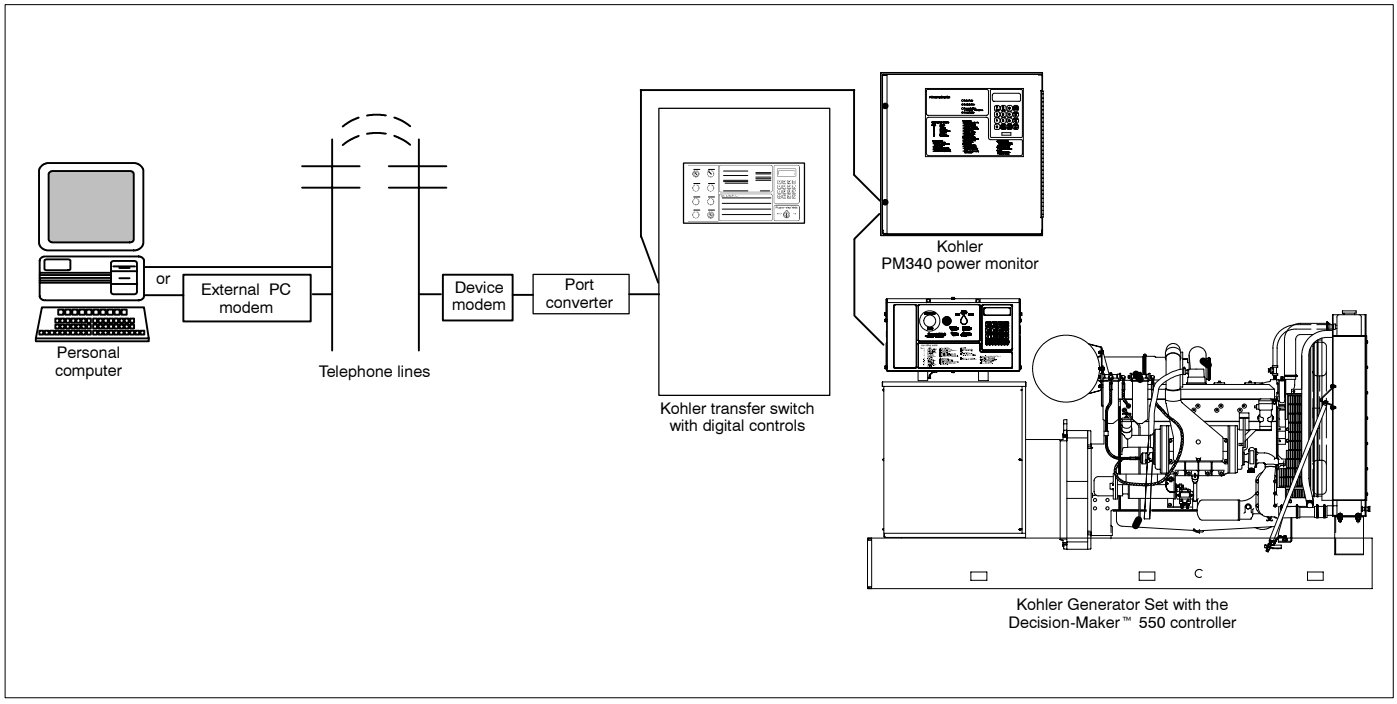


Figure 13 Power System Communication Network Configuration Using Telephone Lines

Communication Products and Accessories

- ❑ Monitor II Software for monitoring and control (PA-361725)
- ❑ External device modem for the controller; includes a 3 m (10 ft.) RS-232 cable
  - ❑ 120 V, 60 Hz device modem (PA-294865)
  - ❑ 240 V, 50 Hz device modem (PA-353074)
- ❑ External modem for a PC; includes a 3 m (10 ft.) RS-232 cable and adapter
  - ❑ 120 V, 60 Hz PC modem (PA-294864)
  - ❑ 240 V, 50 Hz PC modem (PA-353073)
- ❑ RS-232 cable kit for direct connection to a PC or a Modbus® master (PA-294992)
- ❑ RS-232 to RS-485 external port converter (PA-352249). (Add cable kit PA-294992 for RS-232 connection. Use customer-supplied cable for RS-485 connections; Belden #9841 or equivalent is recommended.)
- ❑ Modbus® Protocol Operation Manual for the Decision-Maker™ 550 generator set controller (TP-6113)

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