



## Kohler® Decision-Maker™ 550 Controller

Software (Code) Version 2.10 or higher

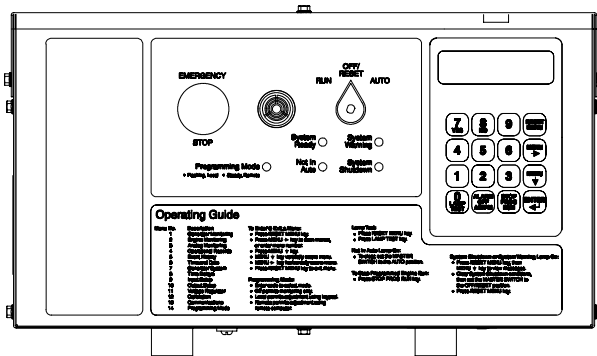
### General Description and Function

The Decision-Maker™ 550 generator set controller provides advanced control, system monitoring, and system diagnostics for optimum performance.

The Decision-Maker™ 550 generator set controller provides complete compatibility with selected engine Electronic Control Module (ECM) and non-ECM equipped generator set engines.

The Decision-Maker™ 550 generator set controller interfaces between the generator set and Kohler switchgear for paralleling applications between generator sets and/or the utility.

**ECM models only:** The Decision-Maker™ 550 controller directly communicates with the ECM to monitor engine parameters and diagnose engine problems. (See Controller Diagnostics for details.)



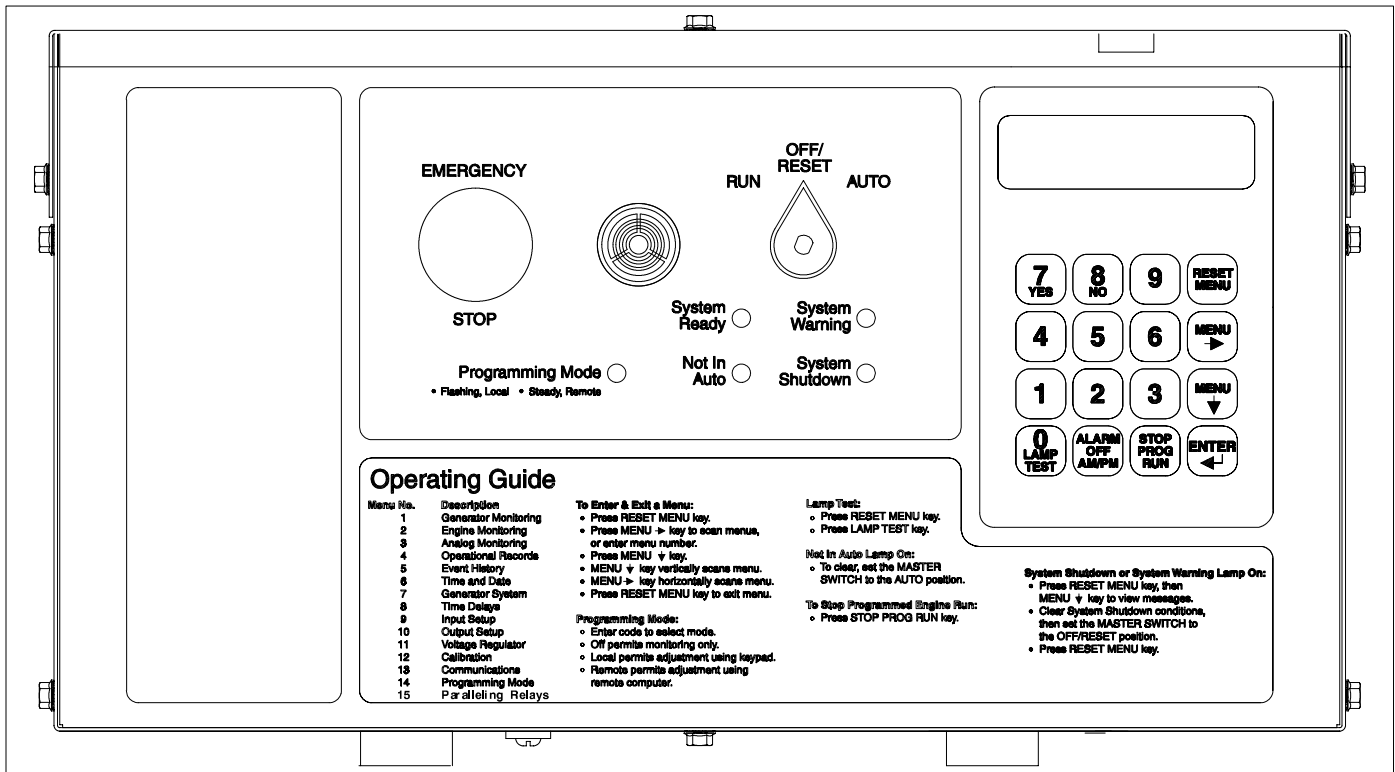
### Standard Features

- The controller meets the National Fire Protection Association requirements of NFPA 99 and NFPA 110, Level 1.
- The controller is listed under Underwriter's Laboratories UL-508.
- A digital display and keypad provide access to data. A two-line vacuum fluorescent display provides complete and understandable information in either English or metric units.
- The controller can communicate directly with a personal computer, via a network, or via a modem configuration. See spec sheets G6-38 Monitor II Software and G6-50 Decision-Maker™ 550 Communications for more information.
- Monitor II an optional menu-driven Windows®-based PC software monitors engine and alternator parameters and also provides control capability.
- The controller supports Modbus® RTU (Remote Terminal Unit)—an industry standard open communication protocol.
- An optional paralleling feature provides user-defined functions and time delays. Menu 15 (Paralleling Relays) is available when ordering Kohler PD-Series switchgear.

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# Decision-Maker™ 550 Controller



## Controller Features

### Specifications

- Power source with circuit protection: 12- or 24-volt DC
- Power drain: 700 milliamps (or 400 milliamps without panel lamps)
- Humidity range: 5% to 95% noncondensing
- Operating temperature range: -40°C to +70°C (-40°F to +158°F)
- Storage temperature range: -40°C to +85°C (-40°F to +185°F)
- The 230-300REOZD generator set models with the Decision-Maker™ 550 controller comply with ISO 8528-5, Class G3, for transient response.
- Standards:
  - NFPA 99
  - NFPA 110, Level 1
  - UL-508

### Hardware Features

- Vacuum fluorescent display
- Environmentally sealed 16-button membrane keypad
- Five LED status indicating lights
- Three-position (run, off/reset, auto) selector switch
- Latch-type emergency stop switch with International Electromechanical Commission (IEC) yellow ring identification
- Alarm horn
- Fuse-protected battery circuits
- Controller mounts locally or remotely up to a distance of 12 m (40 ft.) and viewed from one of four positions
- Dimensions—W x H x D,  
460 x 275 x 291 mm (18.15 x 10.8 x 11.47 in.)

## NFPA Requirements

In order to meet NFPA 110, Level 1 requirements the generator set controller must monitor specific engine/generator functions and faults.

### NFPA 110 Common Alarm

- Engine functions:
    - Overcrank
    - Low coolant temperature warning
    - High coolant temperature warning
    - High coolant temperature shutdown
    - Low oil pressure shutdown
    - Low oil pressure warning
    - Overspeed
    - Low fuel (level or pressure) \*
    - Low coolant level
    - EPS supplying load
    - High battery voltage \*
    - Low battery voltage \*
    - Air damper indicator
  - General functions:
    - Master switch not in auto
    - Battery charger fault \*
    - Lamp test
    - Contacts for local and remote common alarm
    - Audible alarm silence switch
    - Remote emergency stop
- \* Requires optional input sensors on some generator set models

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## Control Functions

The control functions apply to both the ECM and non-ECM equipped models unless noted otherwise.

- **AC Output Voltage Adjustment**

The voltage adjustment provides keypad adjustment in 0.1 volt increments of the average line-to-line AC output voltage with a maximum adjustment of  $\pm 10\%$  of the system voltage.
- **Alternator Protection**

The controller firmware provides generator set overload and short circuit protection matched to each alternator for the particular voltage/phase configuration.
- **Automatic Restart**

The controller automatic restart feature initiates the start routine and re crank when the generator set slows to less than 390 rpm after a failed start attempt.
- **Battleswitch (Fault Shutdown Override Switch)**

The *battleswitch* input provides the ability to override the fault shutdowns except emergency stop and overspeed shutdown in emergency situations and during generator set troubleshooting.
- **Clock and Calendar**

Real-time clock and calendar functions time stamp shutdowns for local display and remote monitor. Also, use these functions to determine the generator start date and days of operation.
- **Cooldown Temperature Override**

This feature provides the ability to bypass (override) the cooldown temperature shutdown and force the generator set to run for the full engine cooldown time delay. Also see Time Delay Engine Cooldown (TDEC).
- **Cyclic Cranking**

The controller has programmable cyclic cranking. The customer selects the number of crank cycles (1-6) and the crank time from (1-60) seconds. The crank disconnect depends upon the speed sensor input information or the generator frequency information. The default cyclic crank setting is 15 seconds on, 15 seconds off for three cycles.
- **Digital Voltage Regulator**

The digital voltage regulator provides  $\pm 0.25\%$  no-load to full-load regulation.
- **Display Power Shutdown**

To conserve battery power, the display turns off after 5 minutes of inactivity. Pressing any keypad button activates the display.
- **ECM Communication**

The controller monitors ECM communication links and provides fault detection for oil pressure signal loss, coolant temperature signal loss, and ECM communication loss. Each of these faults provides local display, alarm horn ON, and relay driver output (RDO) on ECM models only. See Controller Diagnostics following for additional information.
- **Idle Speed Function**

Idle speed function provides the ability to start and run the engine at idle speed for a selectable time period. The engine will go to normal speed should the temperature reach warm-up before the time delay is complete.
- **Lamp Test**

Keypad switch verifies functionality of the indicator LEDs, alarm horn, and digital display.
- **Load Shed**

The load shed function provides a load control output (RDO) with user selectable load shed level.
- **Master Switch Fault**

The generator set master switch position or failure provides fault detection at four levels: 1) master switch to off, 2) master switch open, 3) master switch error, and 4) master switch not in auto. Each of these faults/warnings provides local display, alarm horn on, and activates a relay driver output (RDO). By placing the master switch to the OFF/RESET position all generator set faults are reset.
- **Modbus® Interface**

The Modbus® interface provides industry standard open protocol for communication between the generator set controller and other devices or for network communications.
- **Number of Starts**

Total number of generator successful starts is recorded and displayed on the local display and remote PC monitor. This information is a resettable and total record.
- **Programming Access**

The setup access and programming information is password protected. When locally accessing programming information, the PM (programming mode) LED flashes. When remotely accessing programming information, the PM LED is steady.
- **Programmed Run**

The programmed run function provides user-selectable time for exercising the generator set.
- **Remote Reset**

The remote reset function resets faults and allows restarting of the generator without going to the master switch off/reset position. The remote reset function is initiated via the remote reset digital input.
- **Running Time Hourmeter**

The running time hourmeter function is available on the local display and remote monitor. The information displayed uses real time loaded and unloaded run time as an actual and resettable record.
- **Self-Test**

The controller has memory protection and microprocessor self-test.
- **Starting Aid**

The starting aid feature provides control for an ether injection system. This setup has adjustable *on* time before engine crank from 0-10 seconds. This feature is also part of the remote communication option.
- **Time Delay Engine Cooldown (TDEC)**

The TDEC provides a user selectable time delay before the generator set shuts down.  
If the engine is *above* the preset temperature and the unit is signalled to shut down, the unit will continue to run for the duration of the TDEC.  
If the engine is *at or below* the preset temperature and the unit is signalled to shut down or the TDEC is running, the unit will shut down without waiting for the time delay to expire.  
Also see Cooldown Temperature Override.
- **Time Delay Engine Start (TDES)**

The TDES provides a user selectable time delay before the generator set starts.

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## Controller Diagnostics

The controller features warnings and shutdowns as text messages on the vacuum fluorescent display. See the table below.

**Warnings** show yellow LED and signal an impending problem.

**Shutdowns** show red LED and stop the generator set.

**User-Defined Common Fault and Status.** The user customizes outputs through a menu of warnings, shutdowns, and status conditions. User defines up to 31 Relay Driver Outputs (**RDOs**) (relays not included).

**Note:** The available user inputs are dependent on factory reserved inputs for specific engine types, engine controls, and paralleling applications.

**Note:** Menu 15 features are available by purchasing the paralleling switchgear option.

Standard Controller (available on all models)				
	Warning Function	Shutdown Function	User-Defined	User RDOs
<b>Engine Functions</b>				
Air damper control, if equipped			X	X
Air damper indicator, if equipped		X	X	X
Coolant temp. signal loss		X	X	X
High battery voltage	X		X	X
High coolant temperature	X	X	X	X
High oil temp. shutdown		X	X	X
Low battery voltage	X		X	X
Low coolant level		X	X	X
Low coolant temperature	X		X	X
Low fuel (level or pressure)*	X		X	X
Low oil pressure	X	X	X	X
Oil pressure signal loss		X	X	X
Overcrank		X	X	X
Overspeed		X	X	X
Speed sensor fault	X		X	X
Starting aid			X	X
Weak battery	X		X	X
<b>General Functions</b>				
Auxiliary inputs 0-5 VDC—up to 7 analog	X	X	X	X
Auxiliary inputs—up to 21 digital	X	X	X	X
Battery charger fault*	X		X	X
Defined common fault†			X	X
EEPROM write failure		X	X	X
Emergency stop		X	X	X
Engine cooldown delay			X	X
Engine start delay			X	X
EPS supplying load	X		X	X
Internal fault		X	X	X
Load shed kW overload	X		X	X
Load shed underfrequency	X		X	X
Master switch error		X	X	X
Master switch not in auto	X		X	X
Master switch open		X	X	X
Master switch to off		X	X	X
NFPA 110 common alarm			X	X
SCRDO's 1-4 (software controlled RDOs)			X	X
System ready (status)			X	X
<b>Generator Functions</b>				
AC sensing loss	X	X	X	X
Alternator protection		X	X	X
Critical overvoltage		X	X	X
Generator running			X	X
Ground fault*	X		X	X
Locked rotor		X	X	X

Standard Controller				
	Warning Function	Shutdown Function	User-Defined	User RDOs
Overcurrent	X		X	X
Overfrequency		X	X	X
Overvoltage		X	X	X
Underfrequency		X	X	X
Undervoltage		X	X	X
<b>Menu 15 Enabled Enhancements</b>				
Breaker trip			‡	X
Common protective relay output			X	X
Loss of field		X	X	X
Overcurrent		X	X	X
Overpower		X	X	X
Reverse power		X	X	X
In synchronization			‡	X
<b>Waukesha-Powered Engine Enhancements</b>				
Air/fuel module shutdown		X	‡	X
Air/fuel module engine start delay			X	X
Air/fuel module remote start			X	X
Detonation fault	X	X	‡	
Fuel valve relay			X	X
High oil temp. warning	X		X	X
Intake air temperature	X	X	X	X
Knock fault		X	‡	X
No intake air temp. signal		X	X	X
No oil temp. signal		X	X	X
Prelube relay			X	X
<b>DDC/MTU-Powered Engine and MDEC Enhancements</b>				
Block heater control §			X	X
ECM communications loss		X	X	X
High oil temp. warning	X		X	X
Intake air temperature	X	X	X	X
Load shed overtemperature			X	X
Low coolant temperature	X	X	X	X
MDEC red alarm		X	X	X
MDEC yellow alarm	X		X	X
<b>275-400REOV Engine Enhancements</b>				
ECM communications loss		X	X	X
<b>125 kW with 8.1 L GM Engine Enhancements</b>				
Low fuel pressure		X	‡	X

\* Requires optional input sensors on some models.

† Factory default settings for the defined common fault are emergency stop, high coolant temperature shutdown, low oil pressure shutdown, overcrank, and overspeed.

‡ Factory set inputs that are fixed and not user changeable.

§ For future applications

## Controller Monitoring Standard Equipment and Features

- Alarm horn
- Indicators:
  - Not in auto (yellow)
  - Program mode (yellow)
  - System ready (green)
  - System shutdown (red)
  - System warning (yellow)
- Switches and standard features:
  - Keypad, 16-button multi-function membrane environmentally sealed
  - Lamp test
  - Switch, auto, off/reset, run (engine start)
  - Switch, emergency stop (normally closed contacts)
- Vacuum fluorescent display with two lines of 20 characters

### Displays

Some engine displays are dependent upon enhanced electronic engine control availability.

- Engine monitoring data (metric or English units):
  - Battery voltage
  - Coolant—level †
  - Coolant—pressure †
  - Coolant—temperature
  - Engine start countdown
  - Fuel—pressure and temperature
  - Fuel rate expressed as L/hr. (gal./hr.) †
  - Fuel—used last run expressed as L (gal.) is the accumulated fuel qty. used since last reset by the DDC engine DDEC reader †
  - Oil—level and crankcase pressure †
  - Oil—pressure
  - Oil—temperature †‡§
  - Rpm
  - Temperature—ambient †
  - Temperature—intake air ‡§
- Engine setpoints
  - Coolant—high temperature shutdown and warning setpoints
  - Oil—low pressure shutdown and warning setpoints
  - Temperature—engine cooled down setpoint
  - Temperature—engine warmed up setpoint
- 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 start date
  - 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
- Time Delays—paralleling relays (PR) for optional switchgear applications:
  - Current—over (PR)
  - Current—over shutdown
  - Frequency—over- and under- (PR and shutdown)
  - Loss of field (PR and shutdown)
  - Loss of field shutdown (PR)
  - Power—over (PR)
  - Power—over shutdown
  - Reverse power (PR)
  - Reverse power shutdown
  - Synch matching—frequency, phase, voltage
  - Voltage—over- and under- (PR and shutdown)
- System parameters:
  - Alternator number
  - Current, rated (based on kW, voltage, connection settings)
  - 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

### Inputs

- Customer and remote inputs:
  - Analog inputs 0-5 VDC (up to 7 user-defined analog inputs with multiple shutdown and warning levels)
  - Digital contact inputs (up to 21 user-defined digital inputs with shutdown or warning levels)
  - Ground fault detector \*
  - Remote emergency stop
  - Remote reset
  - Remote 2-wire start
- Digital inputs (standard):
  - Air damper fault, if equipped
  - Air/fuel module shutdown §
  - Battery charger fault \*
  - Battleswitch
  - Detonation shutdown §
  - Detonation warning §
  - Emergency stop
  - Field overvoltage (350 kW and higher)
  - 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) \*
- Switchgear inputs in Menu 15 (to interface with switchgear system):
  - Circuit breaker closed
  - Enable synch
  - Lockout shutdown
  - Remote reset
  - Remote shutdown
  - VAR/PF mode selection
  - Voltage—raise/lower (or VAR/PF raise/lower in VAR/PF mode.)

### Outputs

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

- Thirty-one user-defined relay driver outputs (relays not included)
  - Fifteen NFPA 110 faults
  - Defined common faults

### Communication

- RS-485 connector for Modbus® RTU communication port
- RS-232 connector for a PC or modem (optional software required)
- SAE J1939 connector for the engine ECM (engine control module)

\* Requires optional input sensors on some models

† Standard on some DDC engines with DDEC

‡ Standard on DDC/MTU engines with MDEC

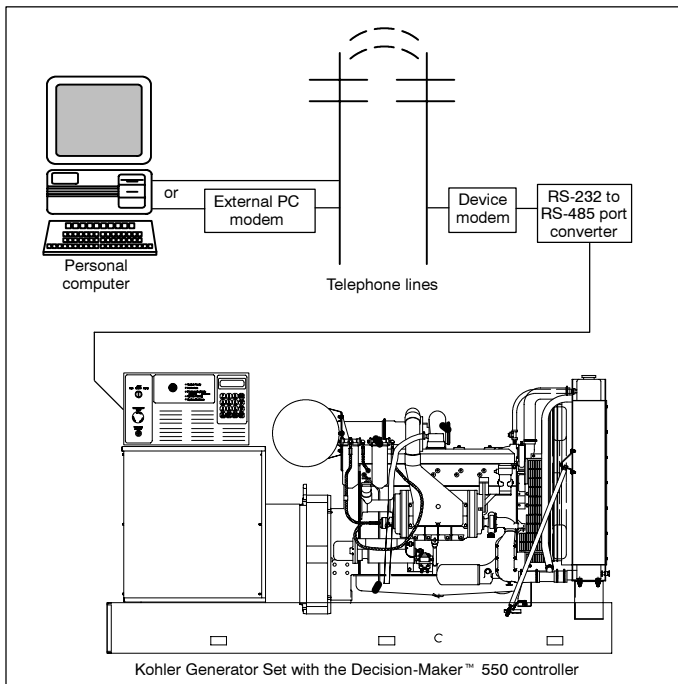
§ Standard on Waukesha engines

## Decision-Maker™ 550 Accessories

### Communication and PC Software Accessories

Refer to spec sheets G6-38 and G6-50 for additional communication and PC software information including Modbus® communication.

- Local Single Connection.** A PC is connected directly to the device communication module with an RS-232 cable for applications where the PC is within 15 m (50 ft.) of the device or RS-485 cable for applications where the PC is up to 1220 m (4000 ft.) from the device.
- Local Area Network (LAN).** A PC is connected directly to the device's local area network. A LAN is a system of connecting more than one device to a single PC.
- Remote Connection.** The PC and device are connected by modems. The PC communicates with the device via a telephone network and the PC can be located anywhere a telephone line can be accessed.
- Remote Network.** A PC is connected to a modem. The devices are connected as a LAN network. The PC communicates with the devices via a telephone network that interfaces to the LAN network. The PC can be located anywhere a telephone line can be accessed.
- Windows® Monitor II Software for Monitoring and Control**
- RS-232 to RS-485 Port Converters**
- Cable for direct connection to a PC**
- External Modems**



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### Other Accessories

- Common Failure Relay** remotely signals auxiliary fault, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed via one single-pole, double-throw relay with 10 amp contacts at 120 VAC or 28 VDC maximum.
- Controller Cable** enables remote mounting of the controller with distances of up to 12 m (40 ft.) from the generator set.
- Controller Connection Kit** provides a cable connecting the controller output terminals to a terminal strip in the junction box.
- Dry Contact Kit** interfaces between the controller signals and customer-supplied accessories providing contact closure to activate warning devices such as lamps or horns. Kits are available with either one or ten single-pole, double-throw relays with 10 amp contacts at 120 VAC or 28 VDC maximum.
- Float/Equalize Battery Charger with Alarm Feature** signals controller of battery charger fault.
- Key-Controlled, Master Switch** with three positions for run, off/reset, and auto functions.
- Paralleling Relay (Menu 15)** functions and switchgear communications via Modbus®. Order with Kohler PD-Series equipment.
- Pre-Alarm Kit for NFPA 110 (Gas Fuel Models only)** warns the operator of low fuel pressure. Select the kit based on LP vapor or natural gas, combination dual fuel, or LP liquid withdrawal.
- Prime Power Switch** prevents battery drain during generator set non-operation periods and when the generator set battery cannot be maintained by an AC battery charger.
- Remote Annunciator Panel** enables the operator to monitor the status of the generator from a remote location. May be required for NFPA 99 and NFPA 110 installations. Includes dry contact box for connection between controller and remote annunciator panel. Remote annunciator panel has surface or flush mounting capability.
- Remote Audio/Visual (A/V) Alarm Panel** warns the operator of fault shutdowns and warning conditions. Kit includes common fault lamp and horn with silence switch.
- Remote Emergency Stop Panel** immediately shuts the generator set down from a remote station.
- Run Relay** provides a three-pole, double-throw relay with 10 amp contacts at 120 VAC or 28 VDC maximum for indicating that the generator set is running.

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