Kohler Dec III & Dec III +

Microprocessor Controller Operation

The microprocessor controller is available in the standard model and the oversize meterbox version for installation of additional meters and gauges.

The Decision-Maker™ 3+ and Decision-Maker™ 3 microprocessor controllers are similar in appearance and function except as noted.

The microprocessor controller has several annunciator panel lamp versions. The 16-light (level 1) is shown in Figure 2-1. The 7-light (level 2) is shown in Figure 2-2. The 6-light (level 2) is similar to the illustration and features of the 7-light microprocessor controller except as noted. For identification and an explanation of lamp functions see the corresponding illustration and the following descriptions.

The Decision-Maker™ 3+ controller has a prime power mode of operation. The prime power mode allows reduced controller current draw in applications where no battery charger is present to replenish battery drain from controller circuitry. When the generator master switch is moved to the OFF/RESET position all controller functions are inoperative including the LEDs and alarm horn. When the generator master switch is moved to the AUTO position, LEDs and alarm horn features become operational and all controller functions return to normal. See Fuses and Terminal Strip for instructions on how to enable the prime power mode later in this section. See Starting and Stopping for instructions on prime power operation also later in this section.

NOTE

Some installations use the 16-light microprocessor controller with switchgear applications. These nonstandard controllers have remote start and no time delay for engine cooldown circuitry. Consult switchgear literature for configuration and function.

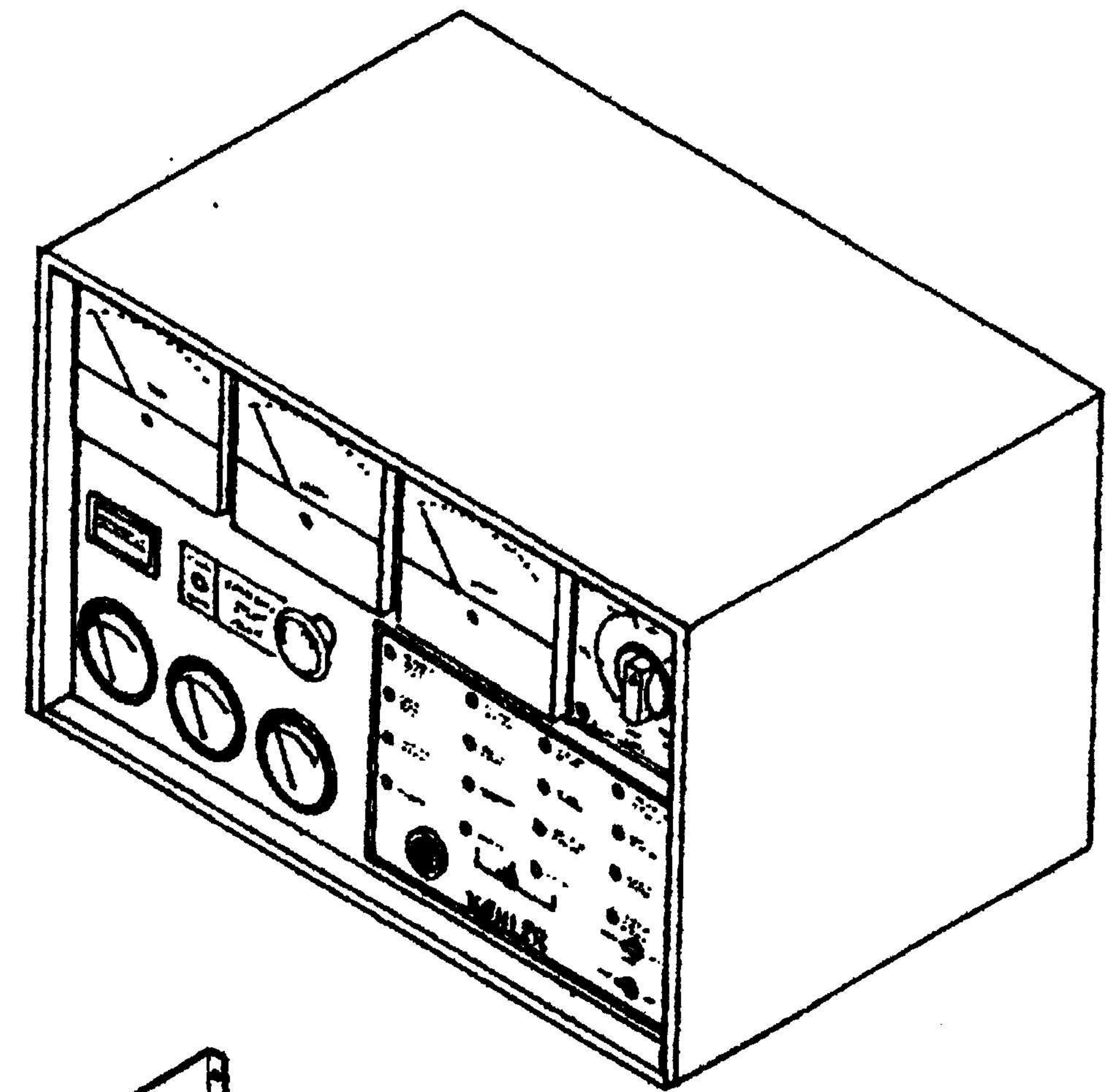
CONTROLLER CABINET

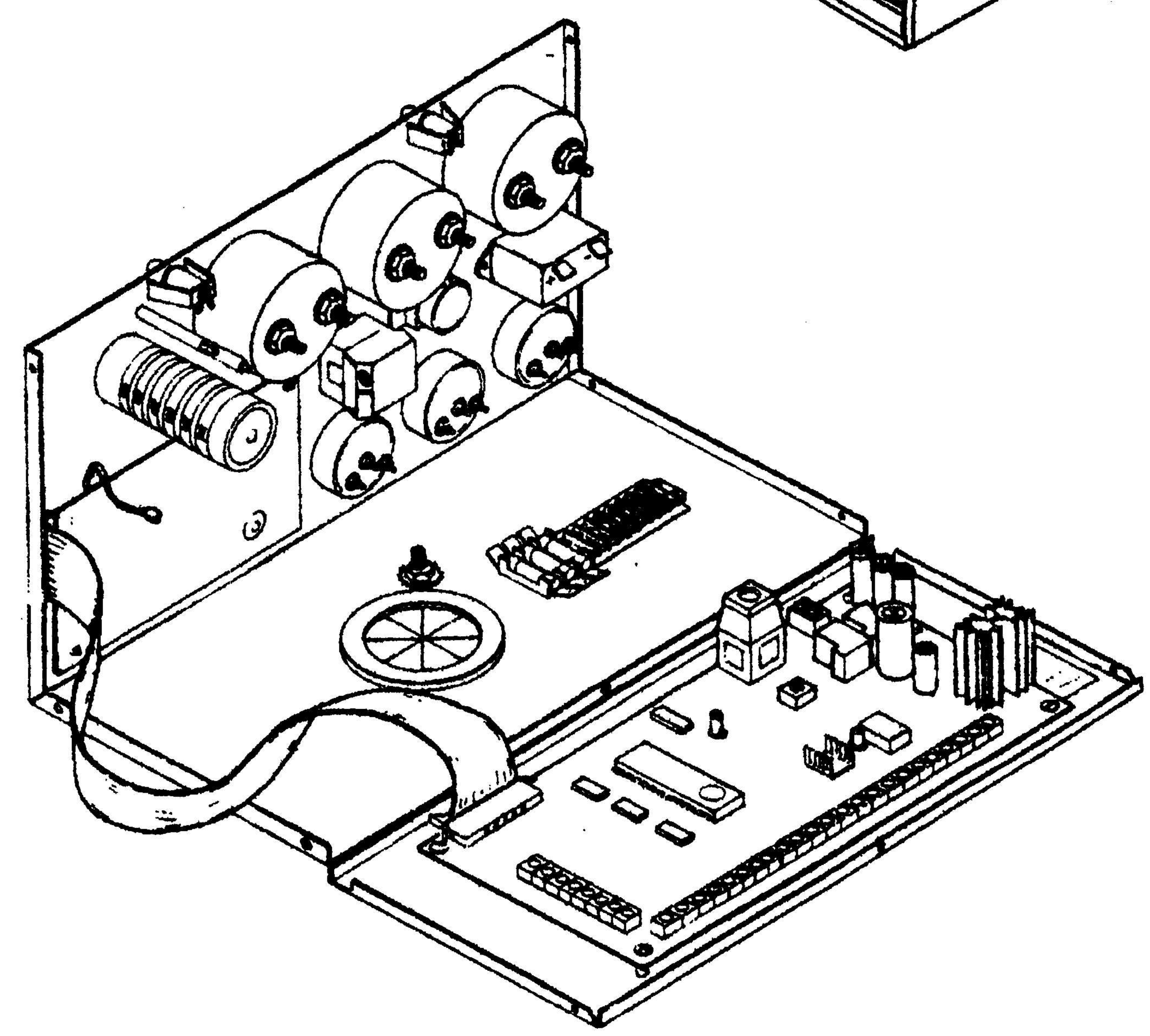
The control cabinet houses the generator set control circuity and connection terminals. The vibration isolators are symmetrically located so the cabinet can be mounted to face the side or rear.

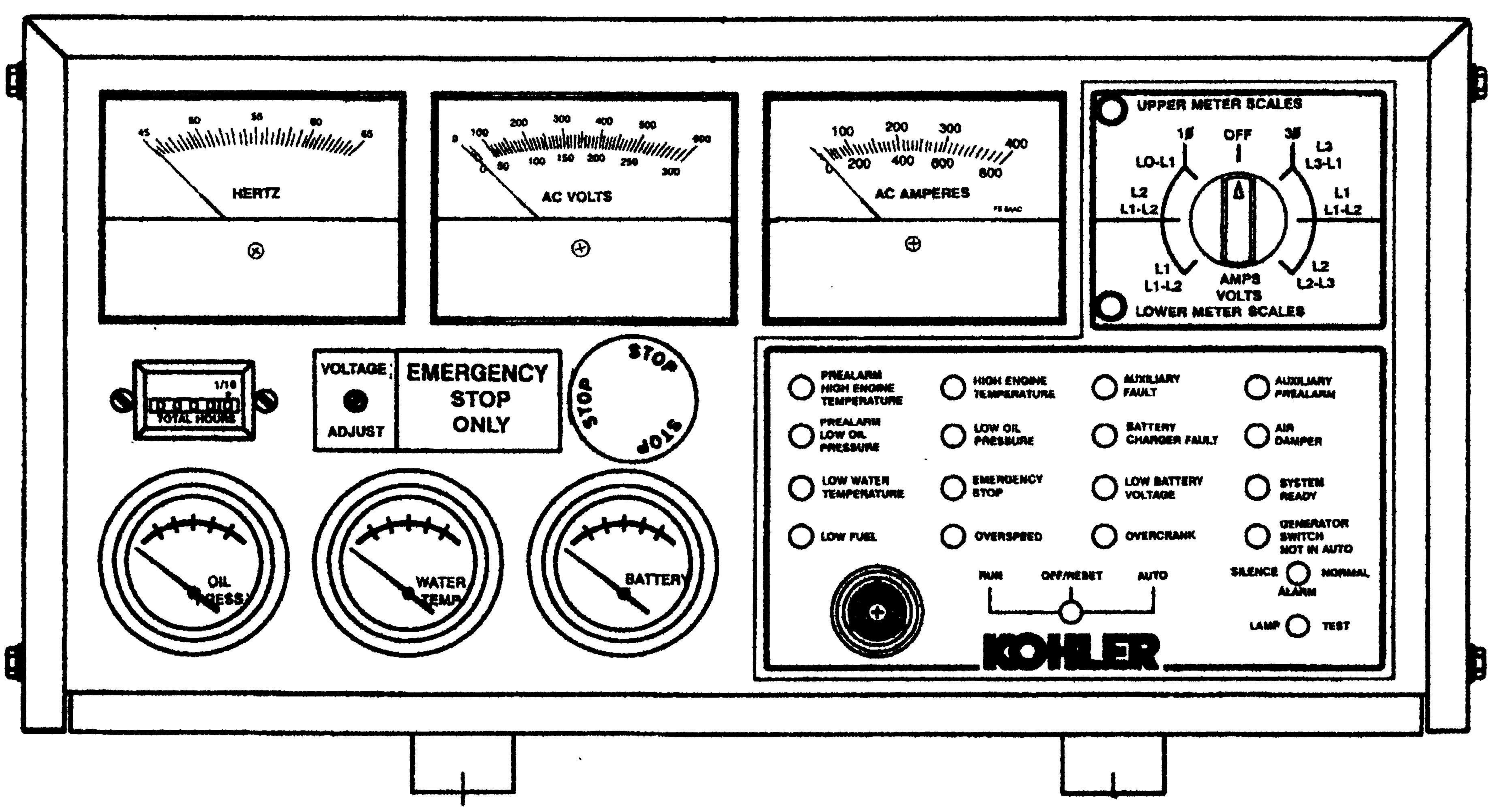
The rear panel is hinged to allow easy access to the microcomputer circuit board and customer connection terminals.

The face of the FR generator set controller cabinet is lit during operation and contains the generator voltage output adjust rheostat, AC metering system, Running time indicator, engine control switches and gauges plus an array of system condition indicators.

Meters, gauges and indicator panel are included in the controller and provided as standard on FR Generator Sets.

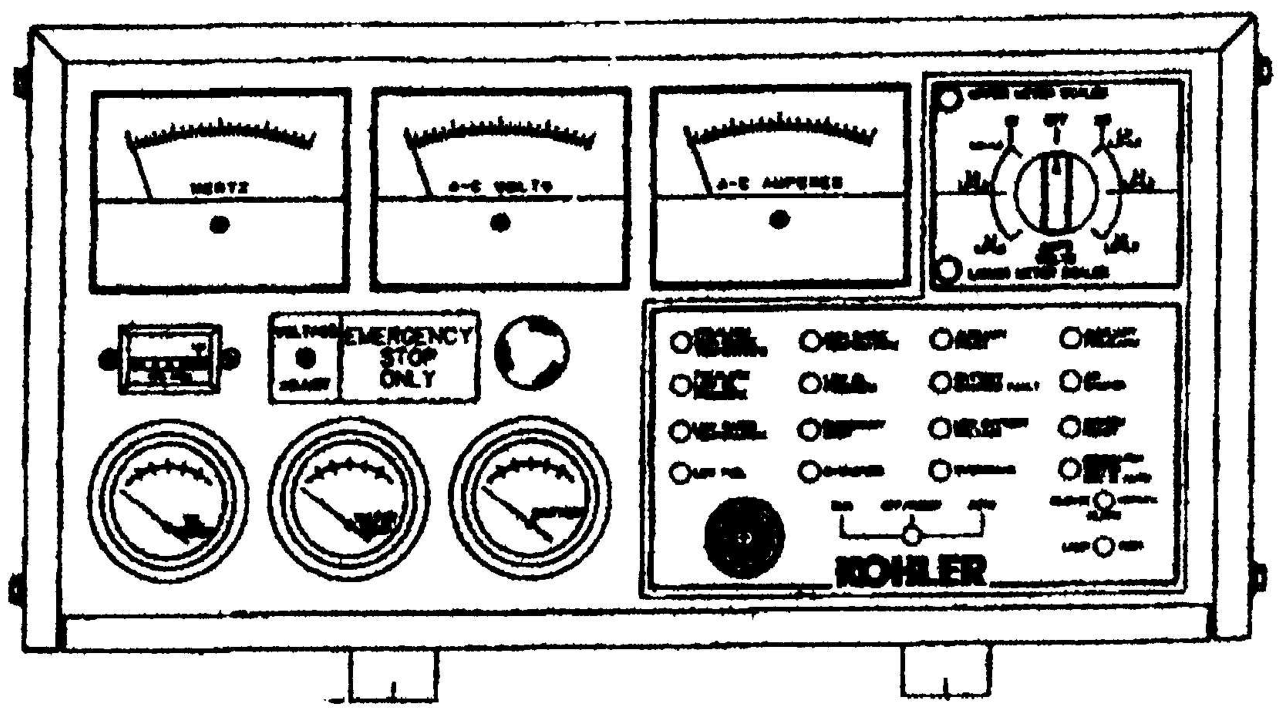




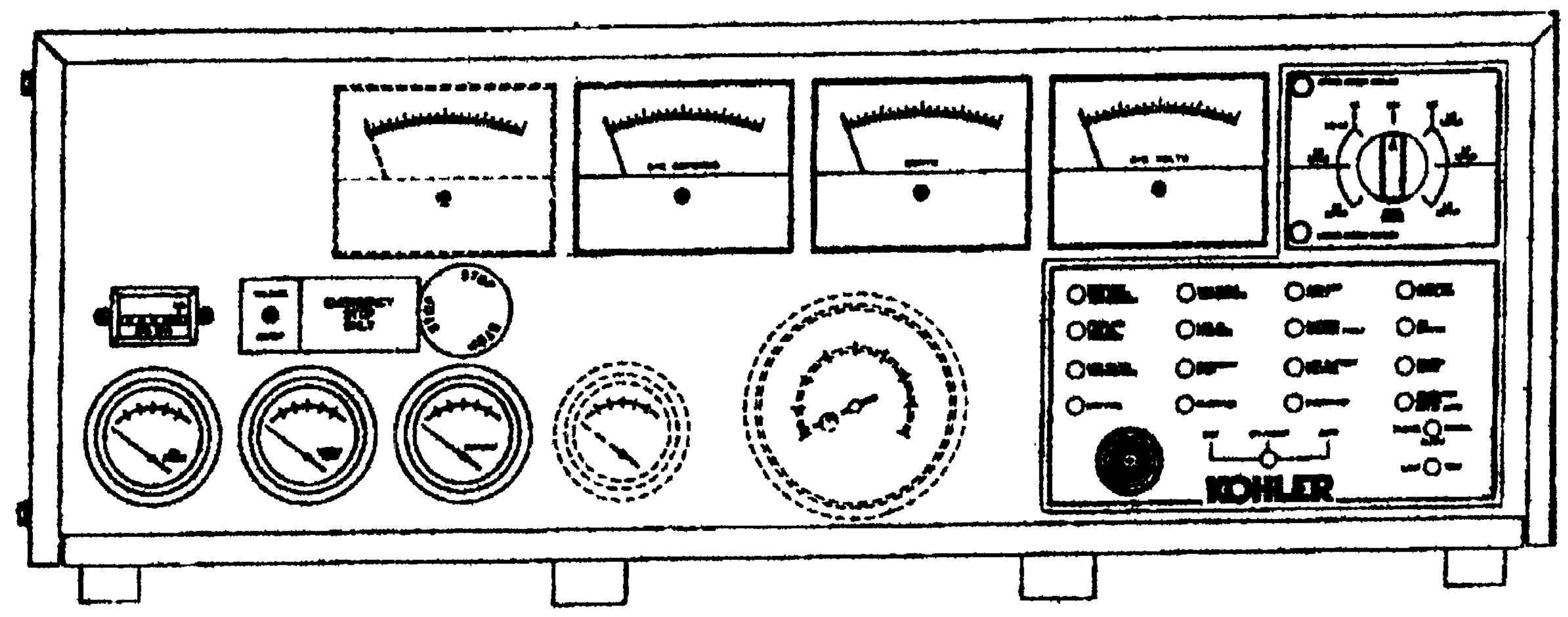


Optional Controllers are available for Fast Response Generator sets to meet customers special needs.

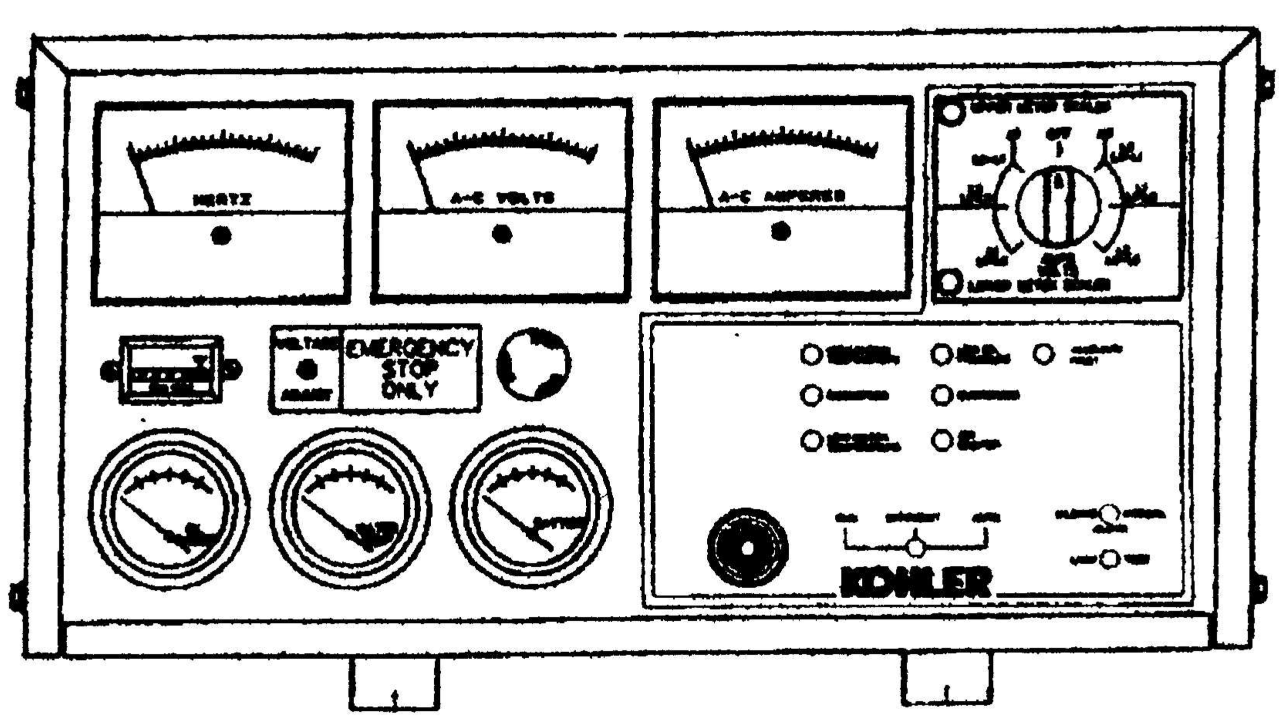
Expanded cabinet boxes are required when optional AC Wattmeter, engine tachometer or oil temperature gauge are supplied.



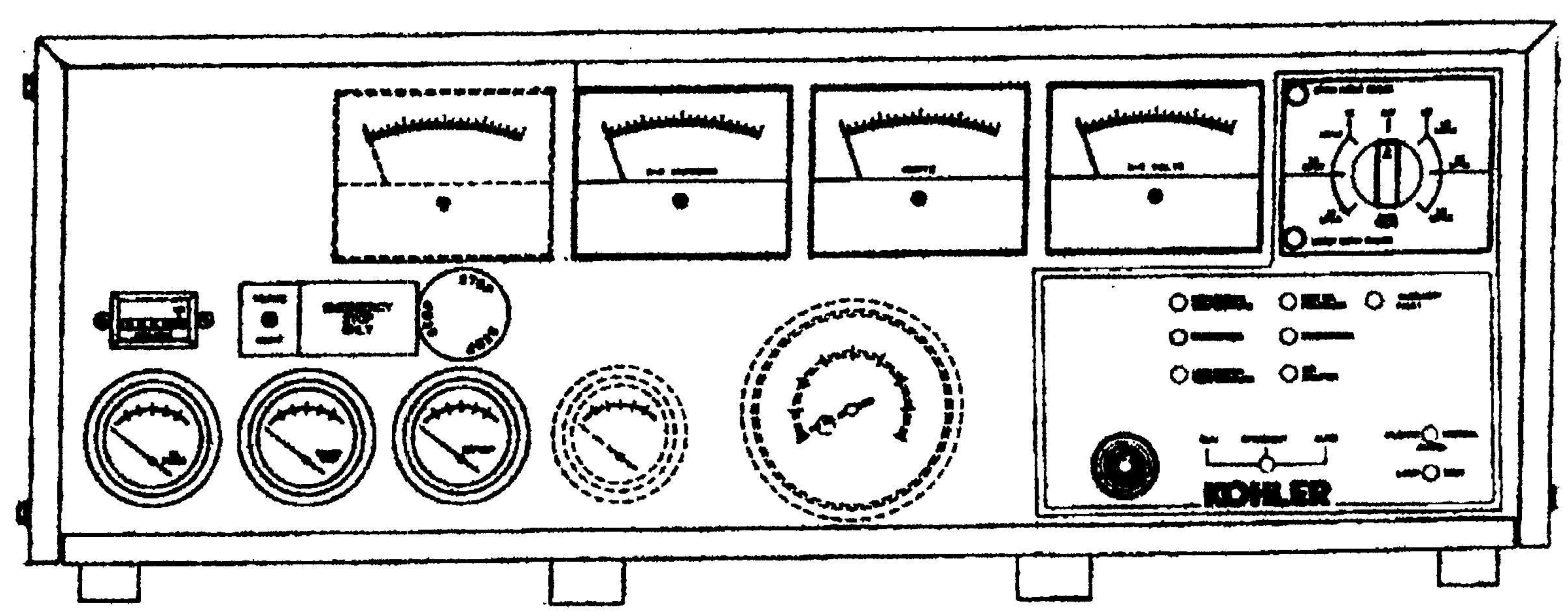
Standard 16 Light Microcomputer Controller. (Level 1) Meets NFPA-99 and 110.



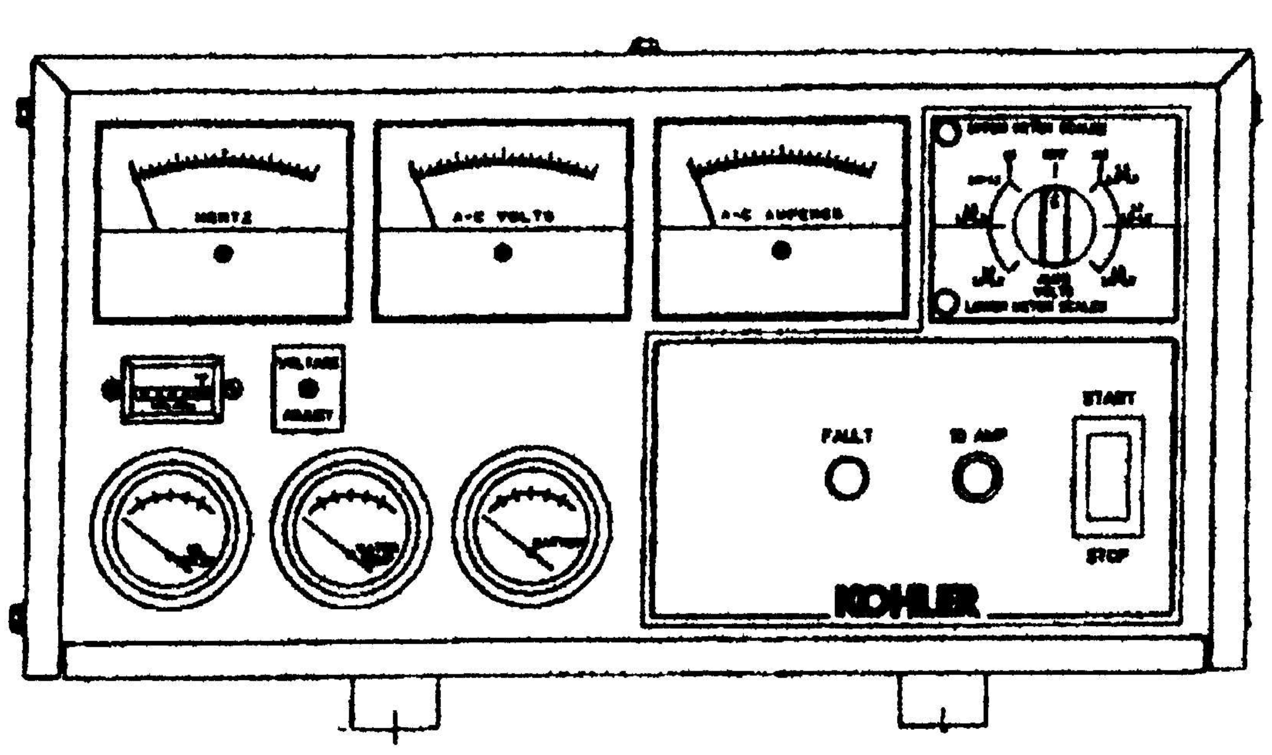
Expanded 16 Light Microcomputer Controller.



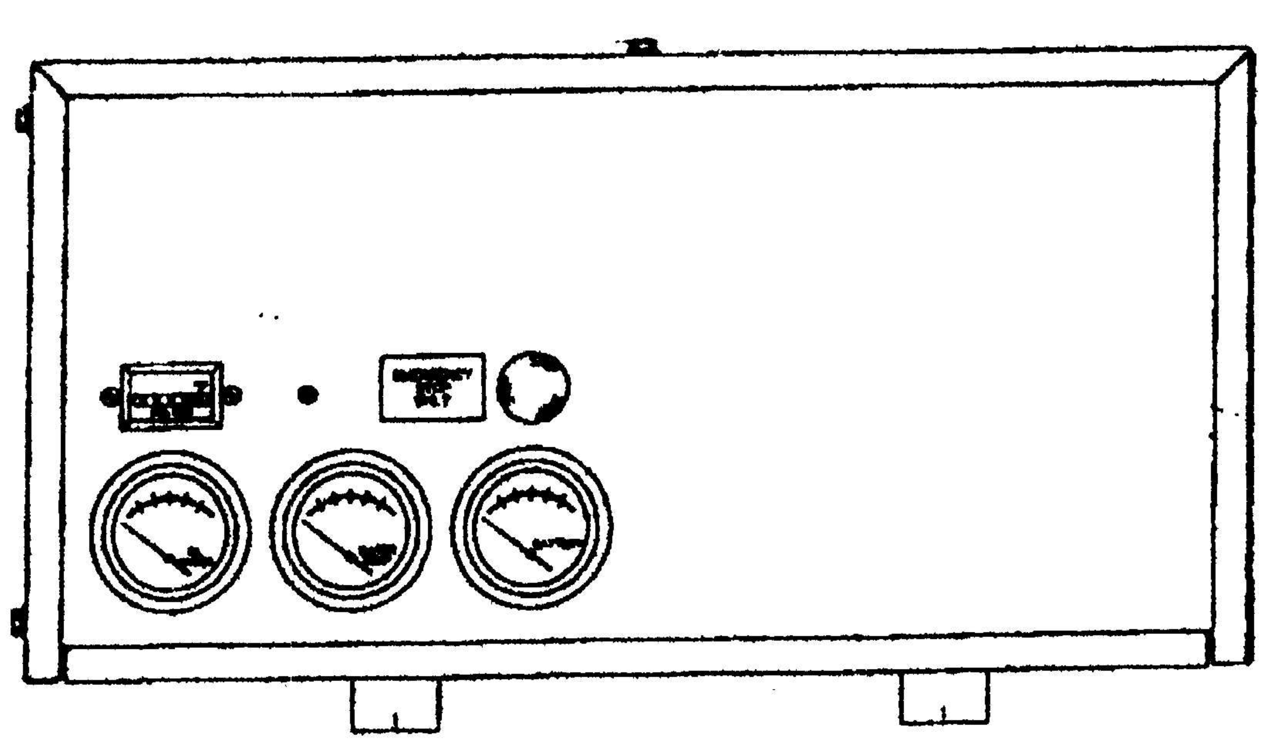
Optional 7 Light Microcomputer Controller. (Level 2)



Expanded 7 Light Microcomputer Controller.



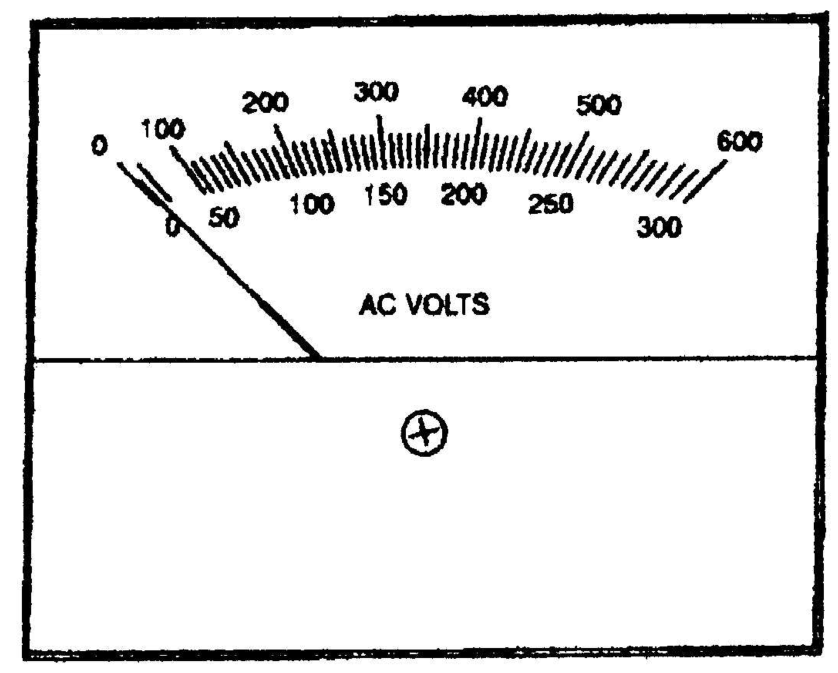
Optional Manual Controller.



Paralleling Engine Gauge Box.

METERS

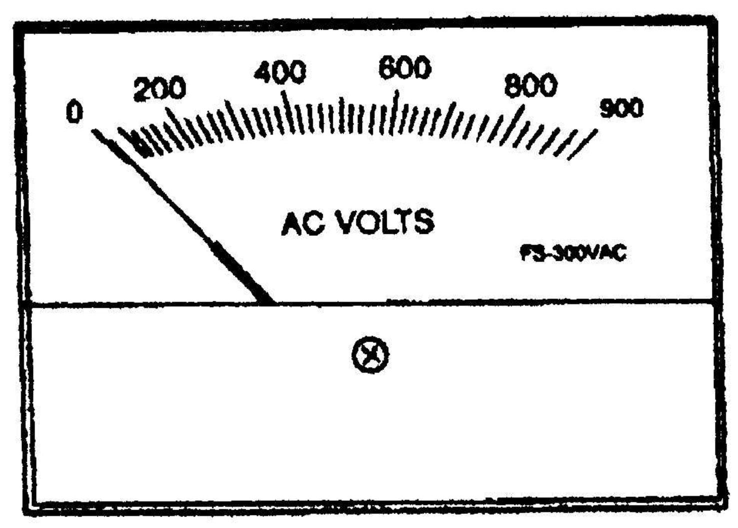
VOLTMETER

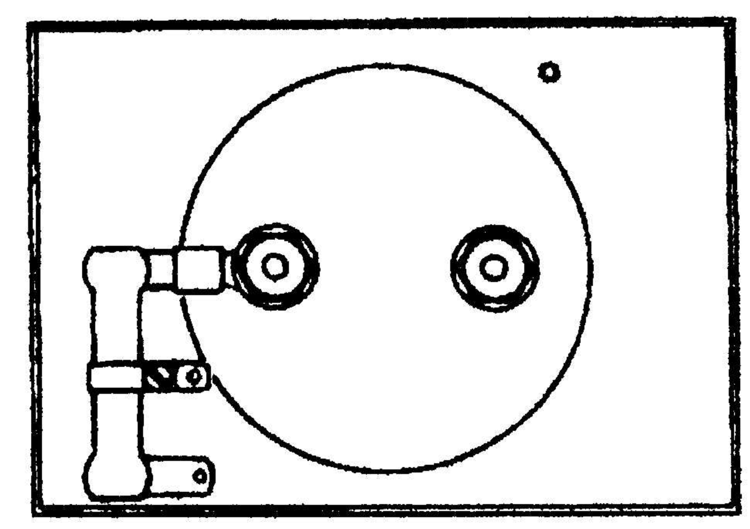


A 3 1/2 " dual scale voltmeter is used as standard for 12 lead generator models.

Upper scale is 0-600 the lower scale is 0-300. lamps on the meter selector switch plate will indicate which scale is to be read and is set at time of generator voltage connection.

The meters are calibrated to read full scale (FS) with 300 volts applied to the terminals and are rated at 2% FS.

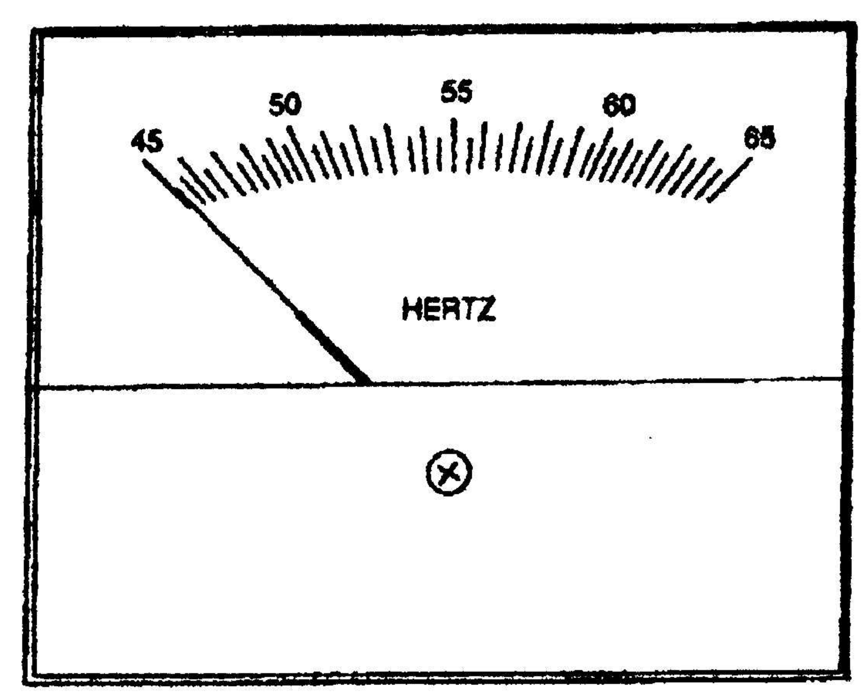




VOLTMETER (600V Models)

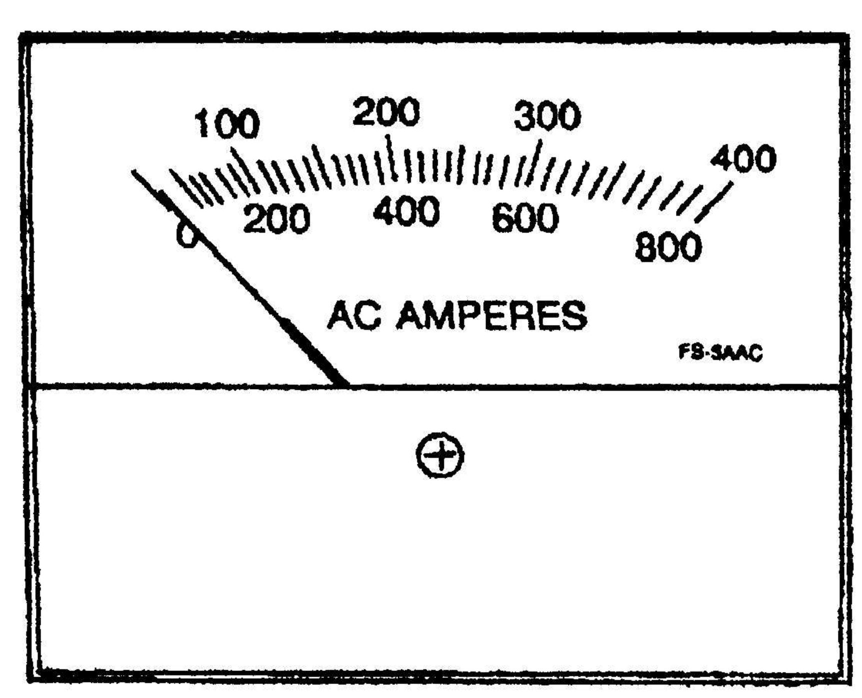
A 0-900 scale voltmeter is supplied on the 600 volt non-reconnectable models. These meters also have a 300 volt full scale movement and sense the V7-V8-V9 stator taps. A 10W, 10K variable resistor is connected in series with a meter terminal and is used for calibration during final plant test.

FREQUENCY METER



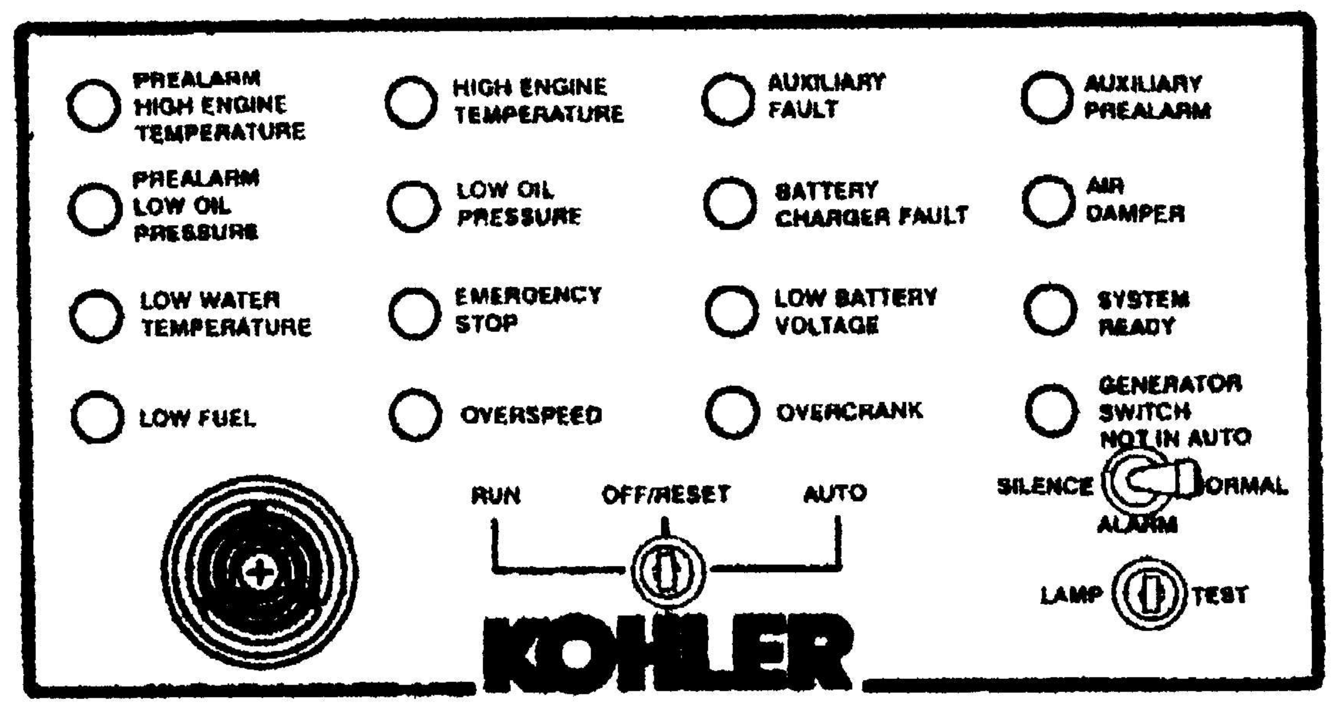
The standard frequency meter used for both 50 and 60 Hertz models as well as 600V models is a 3 1/2" with a scale of 45 to 65 Hz. and a 120 vac .5% movement. The meter is connected to monitor stator leads V7 - V0.

AMMETERS



The ammeters are all dual scale meters and selected so one meter will cover all the standard voltage connections in a specific KW model range, except 600v.
All ammeters have a 5 amp. full scale movement and are used in conjunction with current transformers.

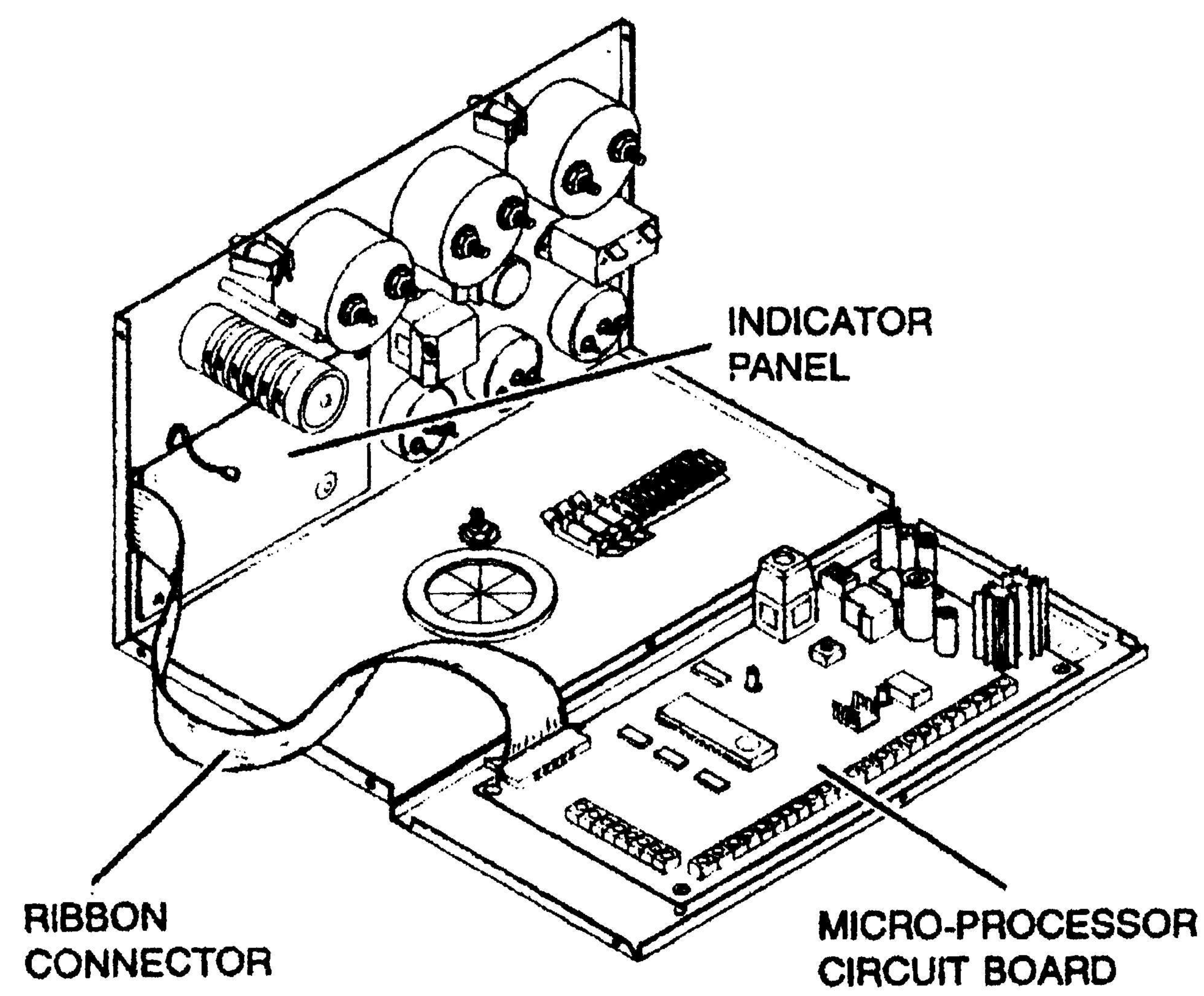
CONTROL/STATUS INDICATOR PANEL



Generator set operational mode selector switch, audible alarm and 16 visual indicators of system condition are contained on the Indicator panel.

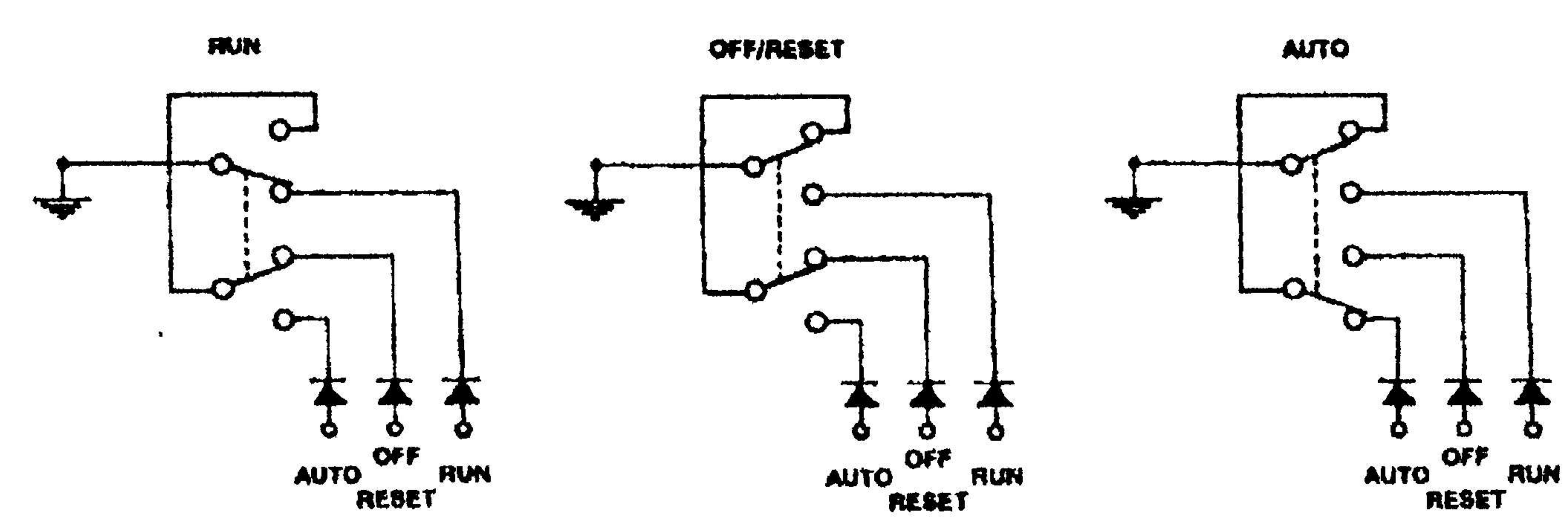
Programmed decisions of starting and stopping as well as monitoring the system conditions and channeling the appropriate actions is performed by the Decision Maker Microprocessor control board.

The Indicator panel is powered by a 12vdc regulated supply from the Processor circuit board. Interconnection between the two circuit boards is by a ribbon connector.

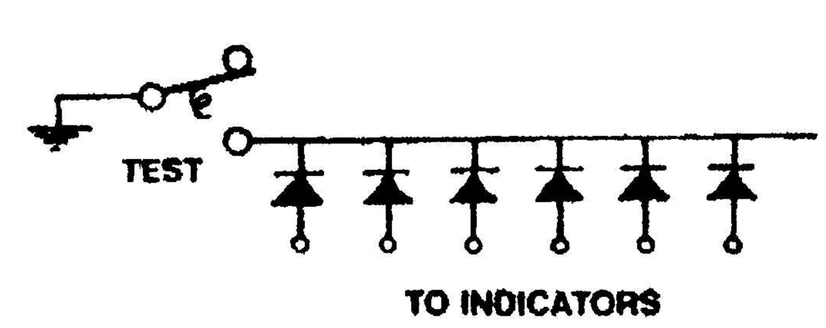


- **RUN-OFF/RESET-AUTO SW.** Selects the mode of Engine operation.

  - **RUN** - Start and run the generator set locally
  - **OFF/RESET** - Stop the generator set locally, and reset the system after a fault shutdown.
  - **AUTO** - Allows Start/Stop commands from a remote location.

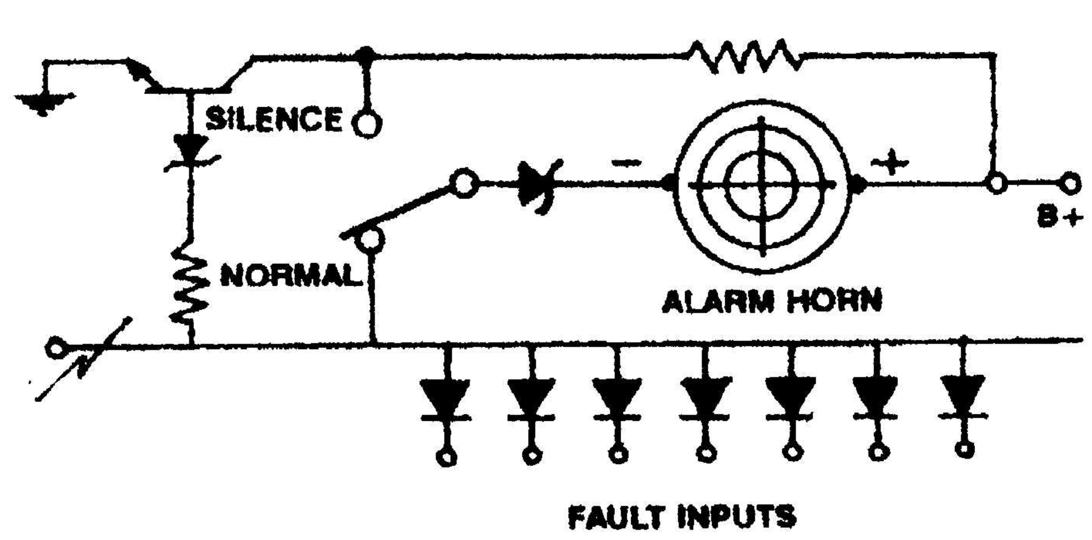


- **LAMP TEST SW.** Provides a ground to all 16 LED indicator input circuits. All indicators should light.



- **ALARM HORN.** Provides an audible signal indicating a fault is or was on the system or the main control switch is not in the "Auto" position.

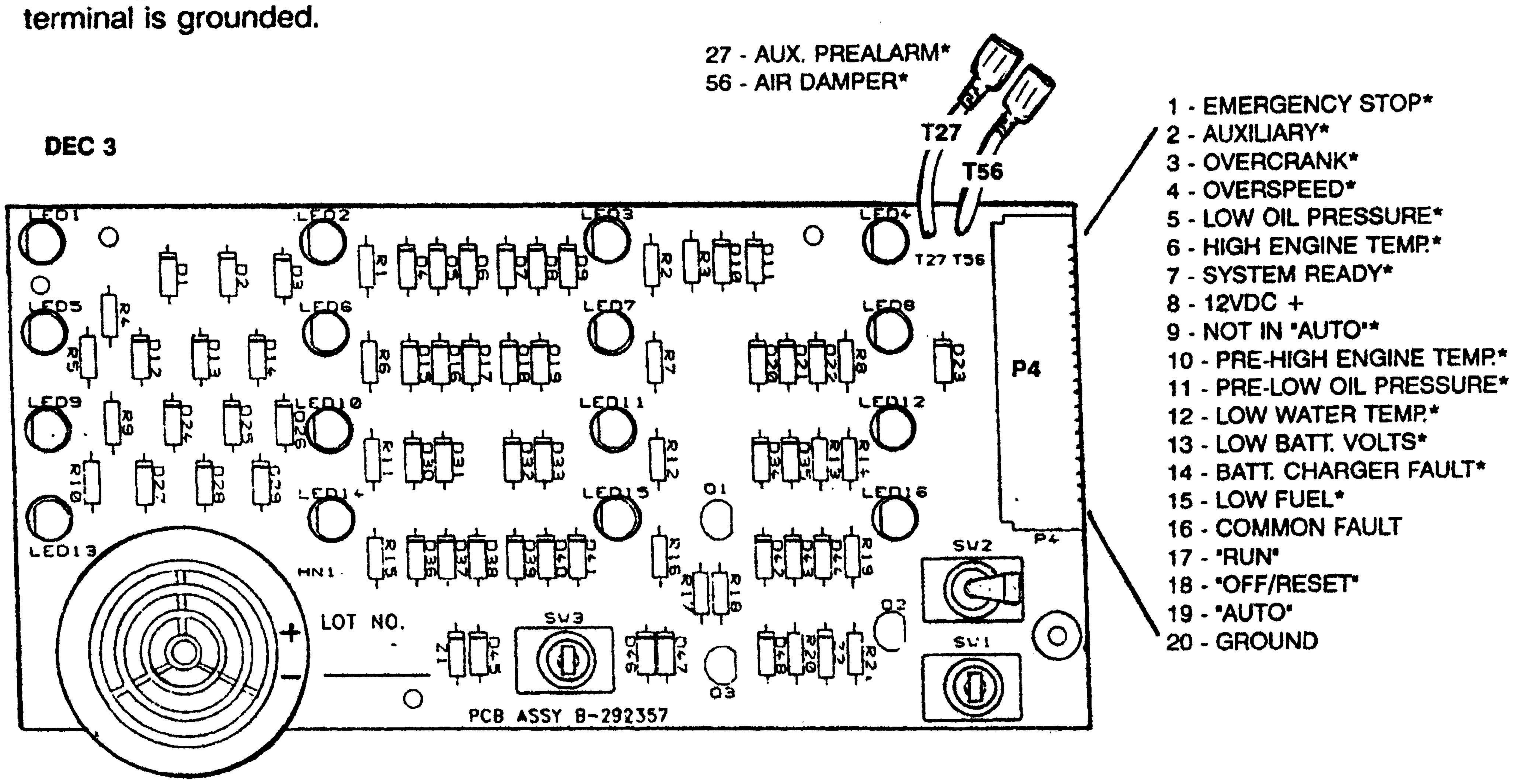
- **ALARM SILENCE SW.** Allows the Horn to be silenced when the Engine control switch is in the "Auto" position. Horn can not be silenced in the "Run" or "Off/Reset" positions



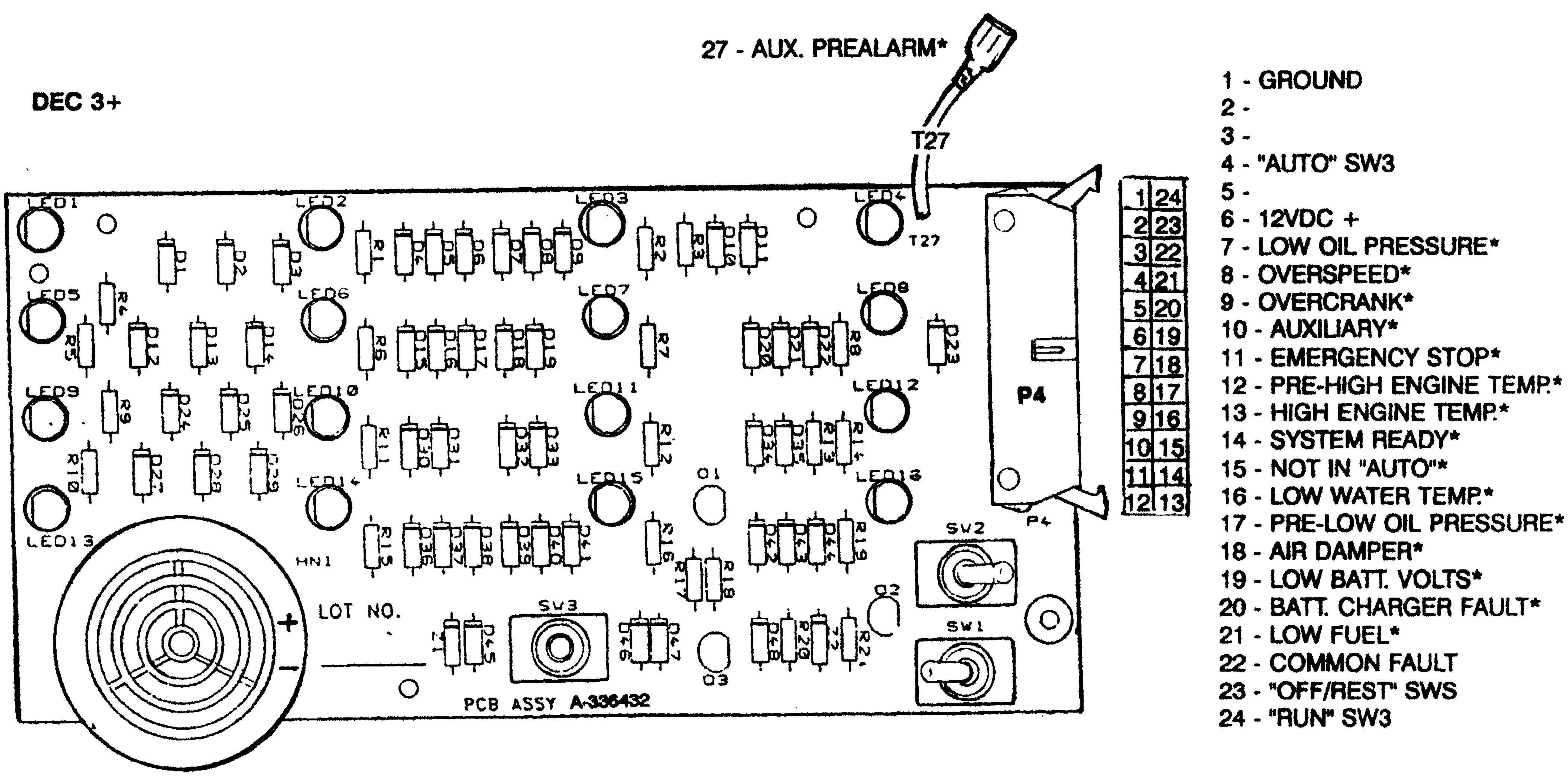
CONTROL/STATUS INDICATOR PANEL
CIRCUIT BOARD

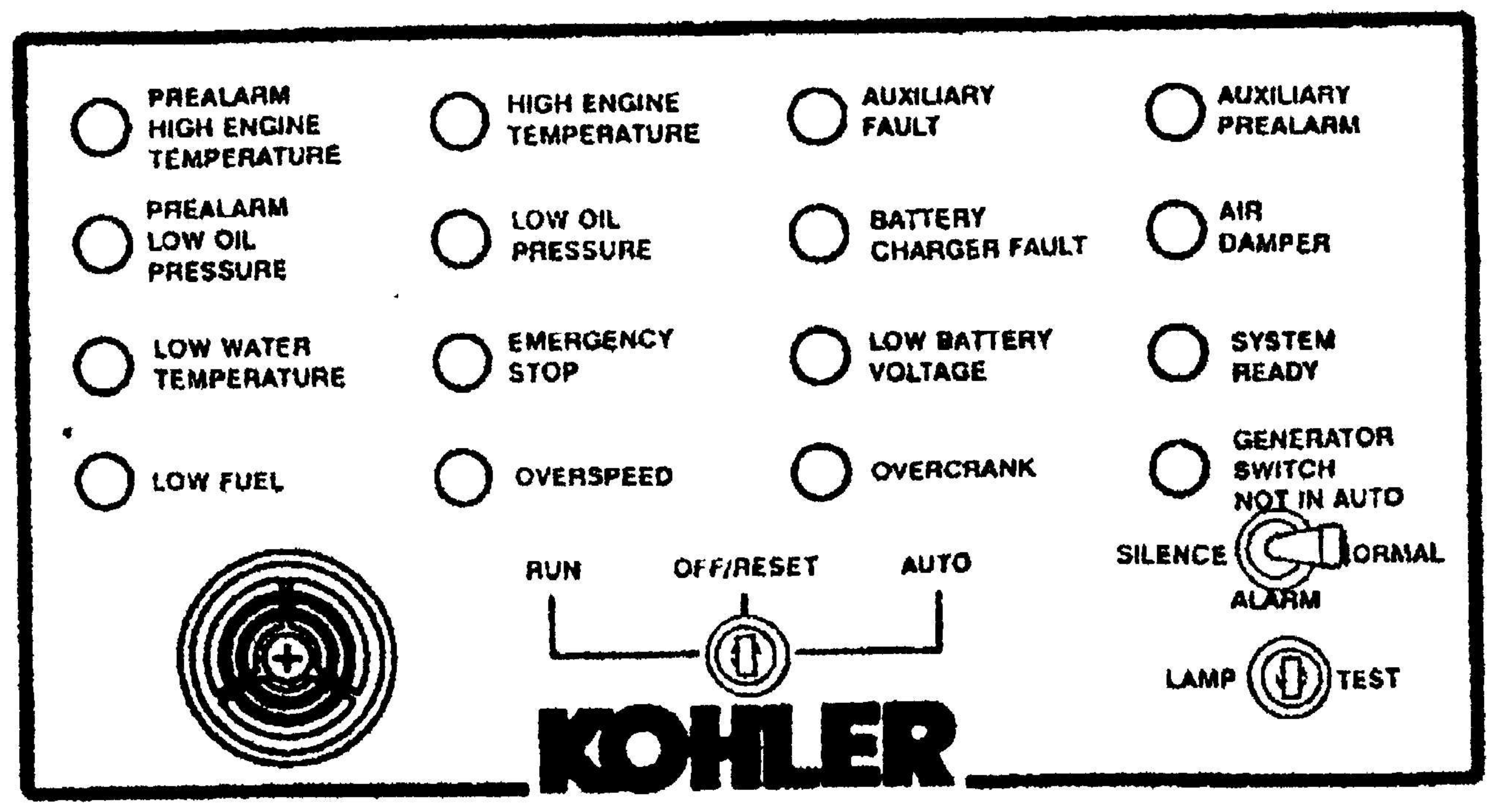
* Will light corresponding indicator when terminal is grounded.

DEC 3



DEC 3+





CONTROL/STATUS INDICATORS

A total of 16 LED indicators are provided, 1 Green (System Ready) 3 Amber (Prealarm) and 12 Red. Not all 16 input senders are standard or factory wired.

FRII STANDARD FEATURES

- SYSTEM READY - SW. NOT IN AUTO
- HIGH ENG. TEMP. - LOW OIL PRESS
- OVERCRANK - OVERSPEED
- LOW COOLANT LEVEL (AUX)
- EMERGENCY STOP (DDC only)

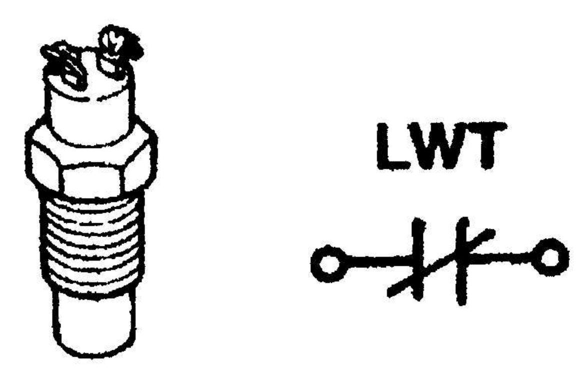
SYSTEM READY. Indicator lights when the Start/Selector switch is in the "AUTO" position and the system senses no faults. The set is ready to start on a remote command.

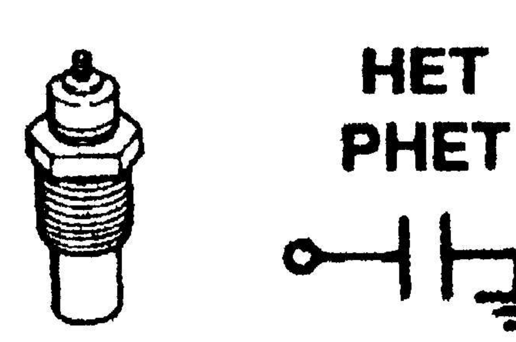
GENERATOR SWITCH NOT IN AUTO. Lamp lights and alarm sounds when Start/Selector switch is in RUN or OFF/RESET position indicating the set cannot be operated automatically from a remote location.

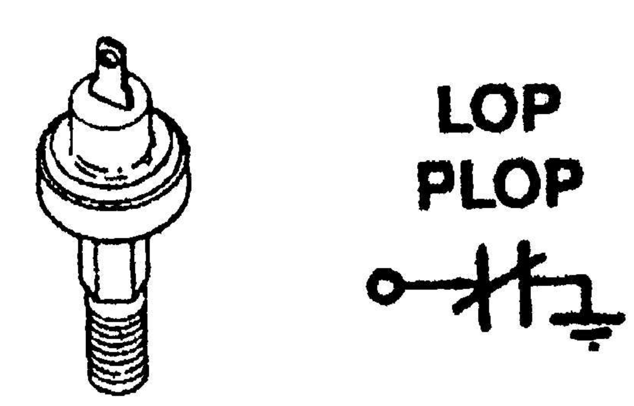
HIGH ENGINE TEMP.
LOW OIL PRESS. - Switches are factory installed and will close when coolant temperature reaches approximately 225°F (107°C) and Oil Pressure drops to approximately 5.5 - 10.5 psi (38-72kPa). After 5 seconds from switch closure the corresponding Indicator will light the horn will sound and engine shutdown will occur.

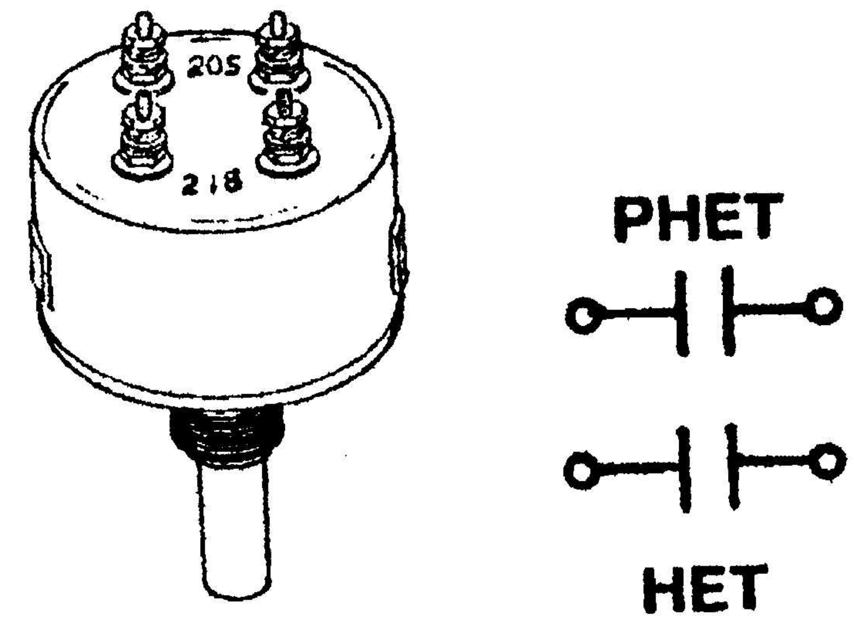
PREALARM HIGH ENG. TEMP.
PREALARM LOW OIL PRESS. - Optional switches are required to be installed in the engine block which will activate the indicators and horn at temperatures slightly below and pressures slightly above the standard cutout switch ratings. No engine shutdown will occur. Wiring is standard and located in the harness. Dual temperature switches may be installed.

LOW WATER TEMPERATURE. - Optional Switch is required to be installed in engine block. Contacts will close to activate indicator and horn at 60°F (16°C) and open at 80°F (27°C). Usually used in conjunction with block heaters and is included with the Prealarm Senders Kit. Wiring is standard and located in the harness.



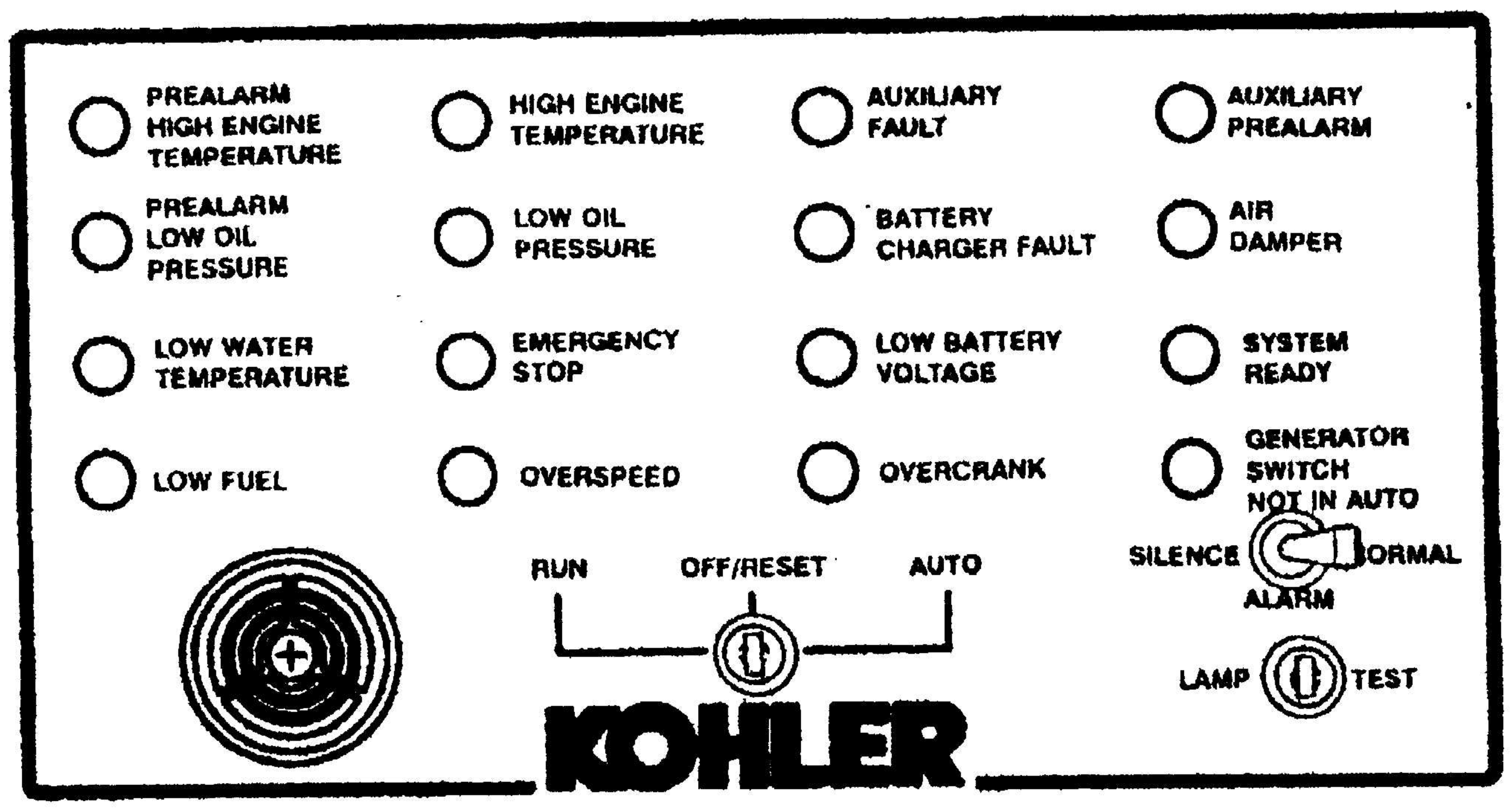






CONTROLLER

CONTROL/STATUS INDICATOR PANEL



LOW FUEL. - Requires customer wiring and tank mounted switch to close at desired fuel level. Will activate indicator and horn.

EMERGENCY STOP. - Requires switch in control panel or optional N.C. remote switches. Contact opening provides Lamp indication, Horn alarm and an immediate engine shutdown.

BATTERY CHARGER FAULT. - Relay in charger required to provide contact closure on charger malfunction. Ground Signal will light indicator if charger malfunctions. (optional)

LOW BATTERY VOLTAGE. - Indicator will light if battery voltage drops below a preset level. Requires ground signal from battery charger relay contact closure. (optional)

OVERCRANK.- Cranking stops and indicator will light if engine does not start after 45 seconds of continuous cranking, 75 seconds of cyclic cranking or 15 seconds of locked rotor.
- OVERCRANK LAMP WILL FLASH IF: Speed sensor signal to microprocessor is absent longer than one second.

OVERSPEED. - Indicator will light, horn will sound and engine will shut down if governed frequency exceeds 70 Hz. The signal is provided to the microprocessor by the Speed Sensor pickup.

AIR DAMPER. Lamp lights after emergency stop, overspeed or overvoltage fault. Indicator signifies the engine air damper is closed. Lamp remains lit until air damper is manually reset. (activated by closure of microswitch contacts, lead T56 to ground.)

AUXILIARY PREALARM. Flashing Amber indicator. Activated by customer provided sensing devices. Pre-low fuel, Generator overload etc. (lead T27 to ground will activate.)

AUXILIARY FAULT. - This lamp provides numerous indications:

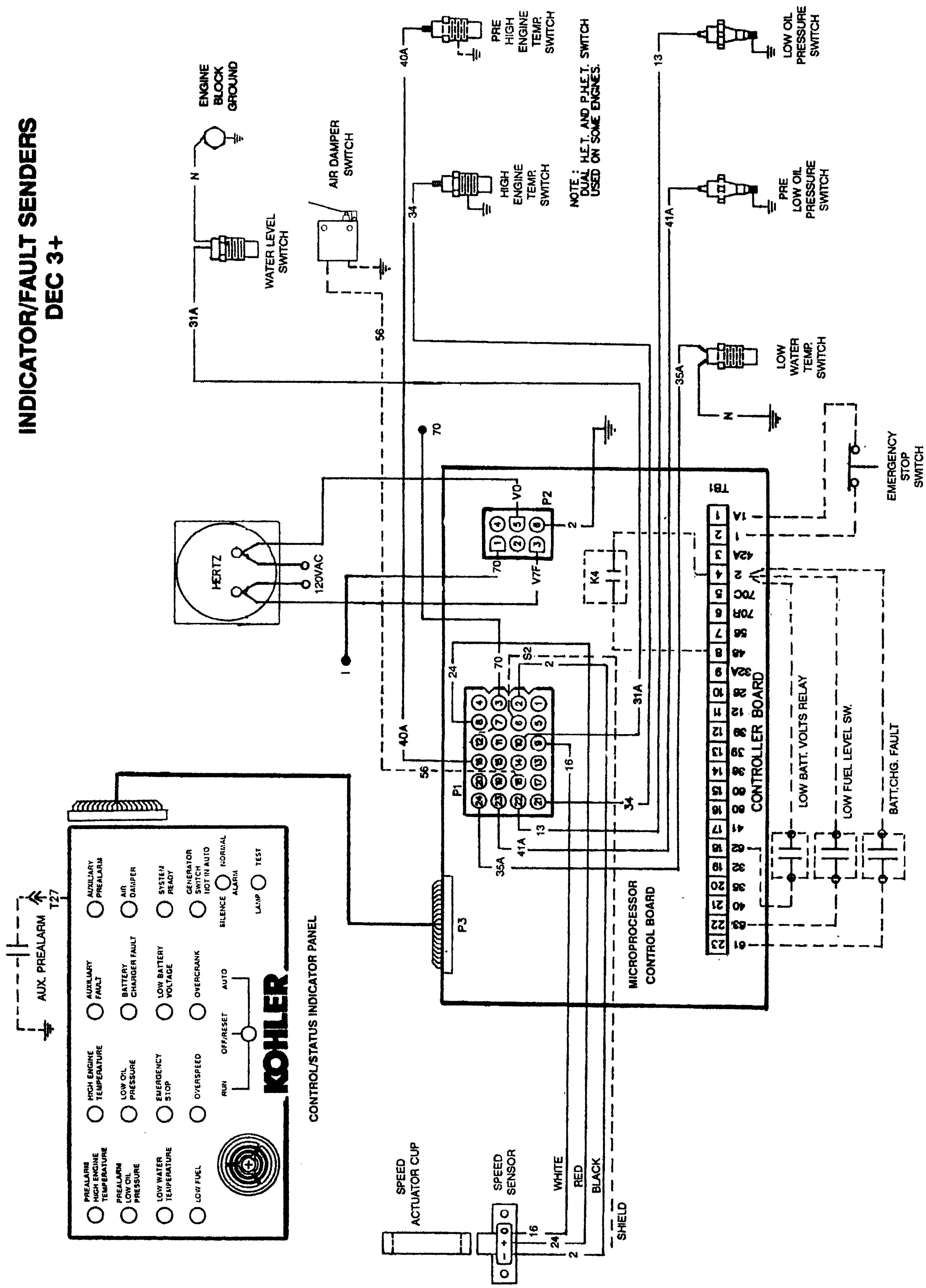
- LAMP WILL LIGHT, HORN WILL SOUND AND ENGINE WILL SHUT DOWN IF:
- **Overvoltage condition occurs.**
Activated by optional Overvoltage circuit board (lead 30). on Dec 3 controllers

- LAMP WILL LIGHT, HORN WILL SOUND AND ENGINE WILL SHUT DOWN 5 SECONDS AFTER:
- **Low Coolant level** (standard).
- **High oil temperature** (optional).
Feature is inhibited during first 30 seconds after startup.

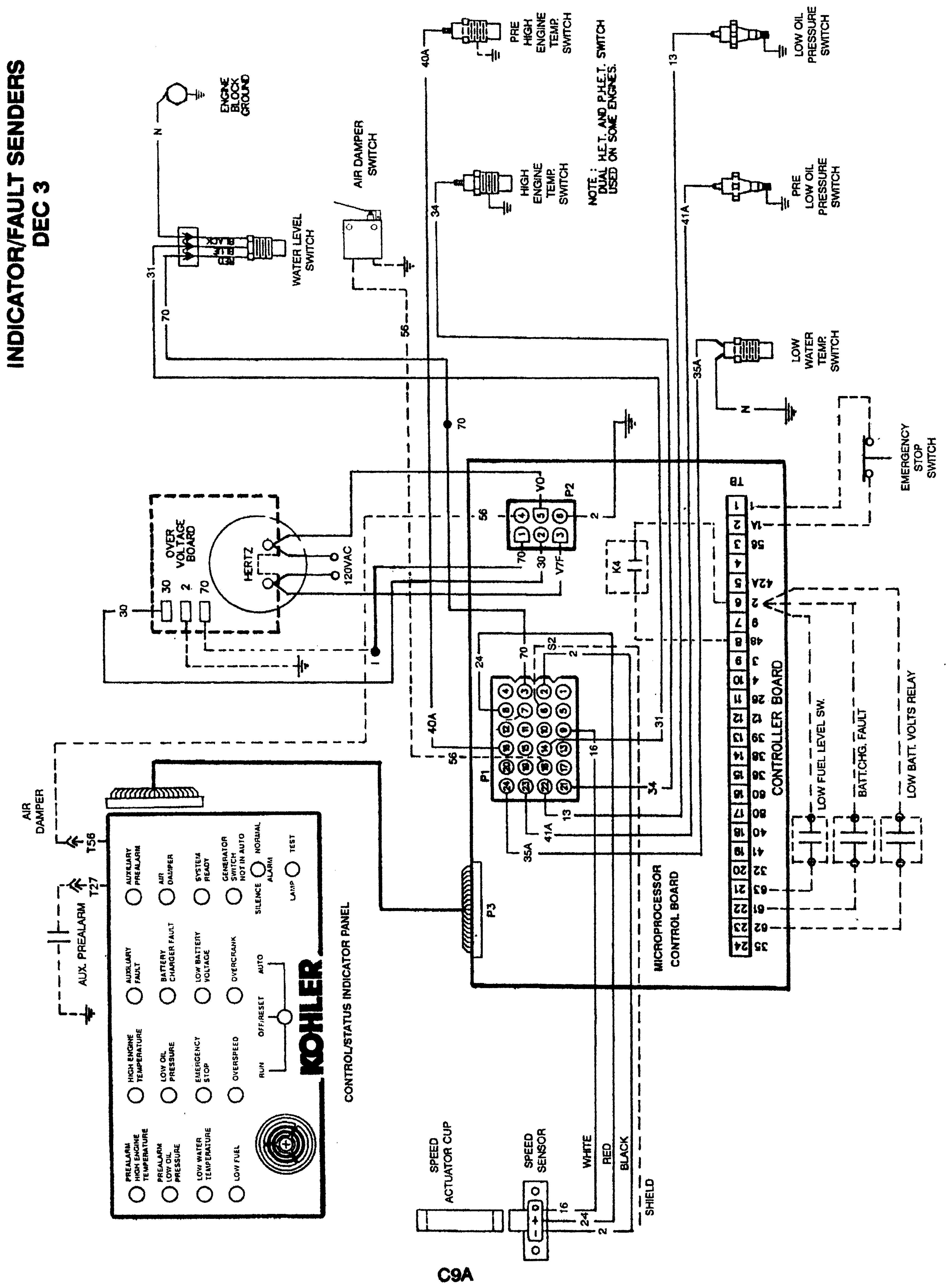
- LAMP WILL <u>LIGHT</u> AND HORN WILL SOUND IF:
- **Optional Emergency Stop switch is reset with the Engine Start selector switch in the AUTO or RUN position.**

- LAMP WILL <u>FLASH</u> AND HORN WILL SOUND IF:
- **No AC output is available** (after 10 seconds of start-up).
- **Battery is connected with the Engine Start selector switch in the RUN or AUTO position.**
- **Low battery voltage** or hardware reset of the Microprocessor occurs.

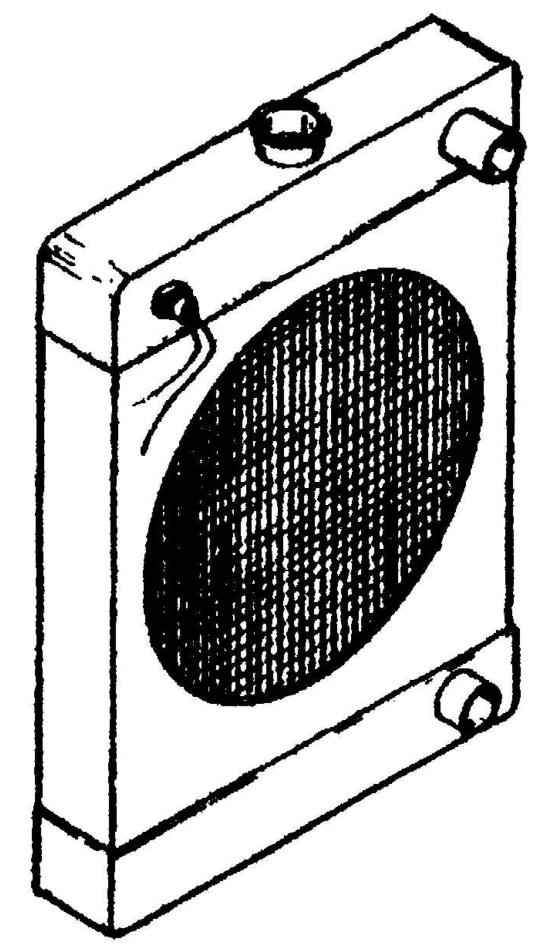
INDICATOR/FAULT SENDERS DEC 3+



INDICATOR/FAULT SENDERS DEC 3



COOLANT LEVEL DETECTOR (LWL)



The Liquid sensor is located in the upper radiator tank and detects the presence and absence of liquid at the probe tip.

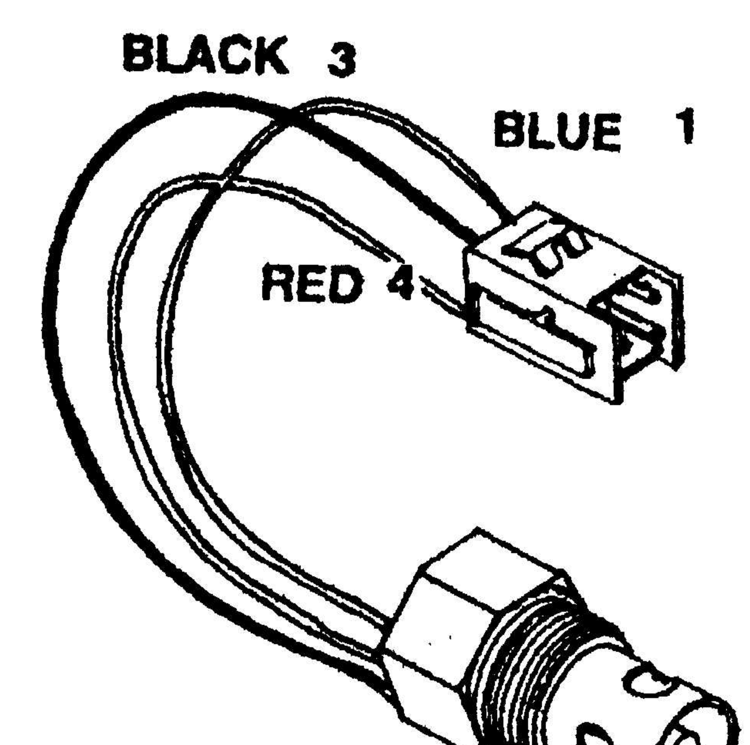
The device will provide a (-) signal via lead 31 to the microprocessor board to initiate an engine shut-down, sound the alarm and light the AUXILIARY lamp. The shut-down is delayed for 5 seconds and the circuit is inhibited for 30 seconds on engine start-up.

TYPE A (DEC 3)

Both 12 and 24v senders are available. The voltage rating is stamped in the hex housing and must match the system voltage.
A bias voltage must be available for the 3 wire device to operate.

During operation with liquid present at the probe an open circuit exists between the Blue (output) and Black (ground) leads.

When liquid is absent from the probe the output terminal will go to ground potential.



A

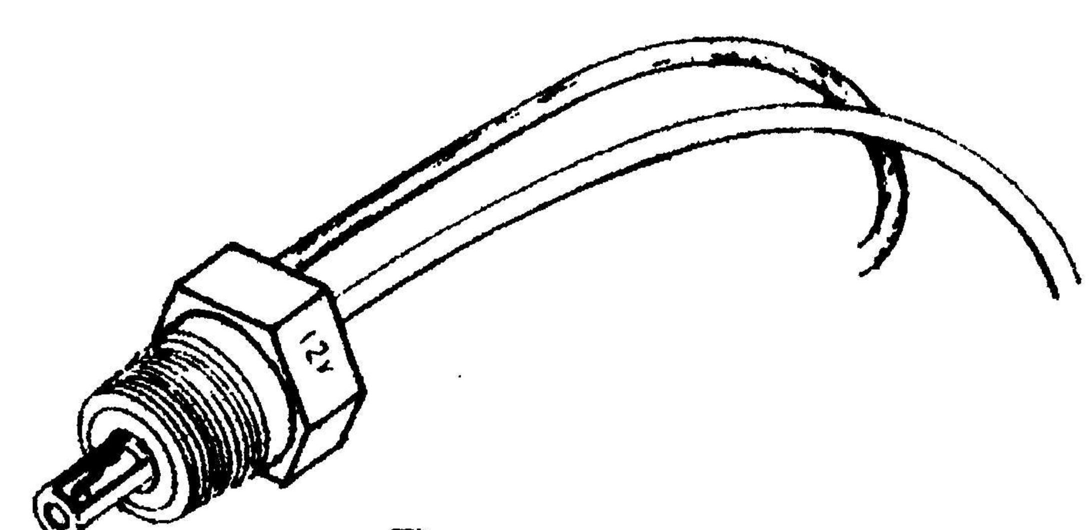
RED = + BLACK = ⏚ BLUE = OUTPUT ⏚

TYPE B (DEC 3+)

The sensor used for both 12 & 24 volt systems with DEC 3+ controls is a 2 wire 12v device.

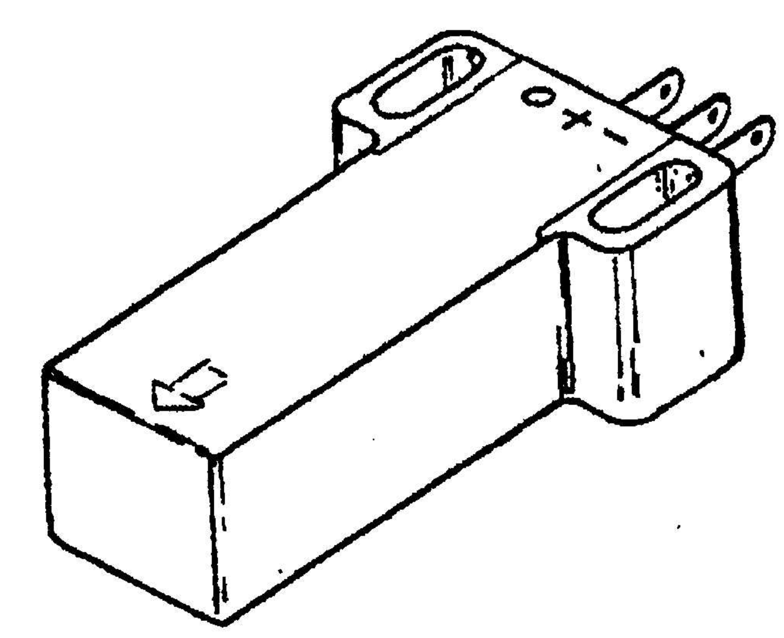
Voltage at the sensor terminals during normal operating conditions when emersed in coolant is 12.5 vdc.

The resistance value of the device will decrease when coolant is removed from the probe. The decrease in resistance will cause the voltage to drop to approximately 7 volts initiating an engine shut-down.



B

SPEED SENSOR (Proximity Sensor)

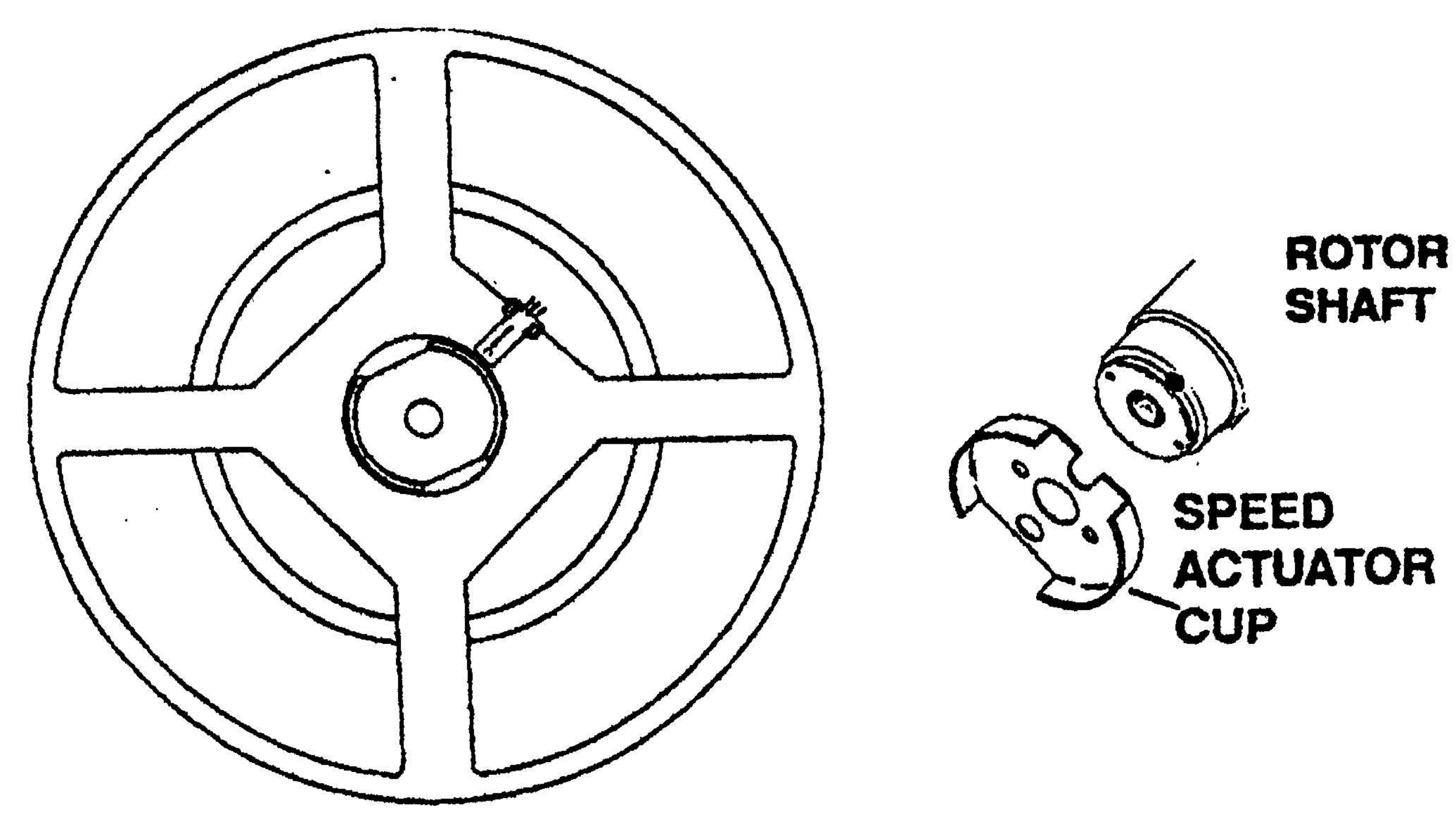


The Speed Sensor provides the Microcomputer circuit board with digital information on the rotating status of the generator set.

The device when energized will provide an output signal when a ferrous metal comes in proximity to its sensing surface.

Input voltage to the sensor is approximately 9.5vdc. During engine cranking and running an average of approximately 7vdc will appear at the output.

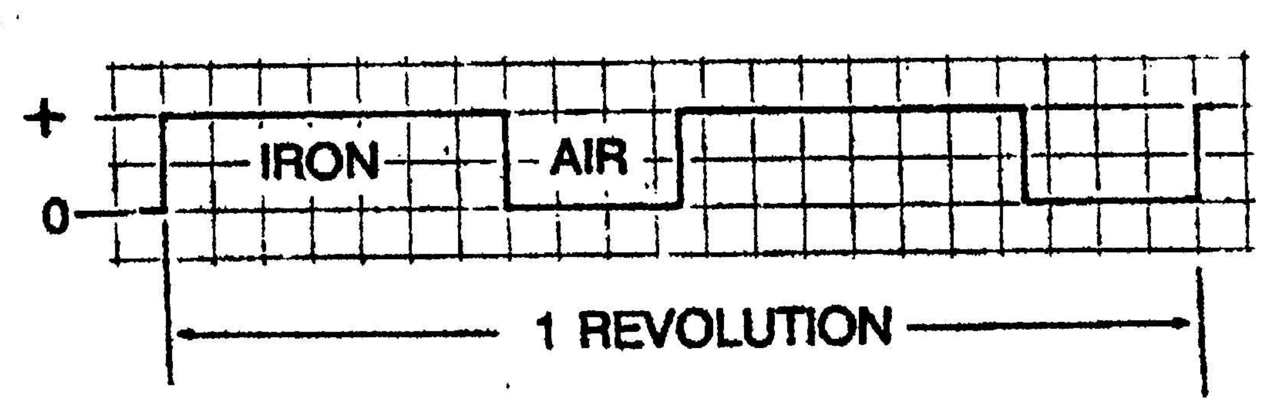
The Sensor is located on the end bracket and mounted so an air gap of .020" is between the sensor and actuator. Two signals are provided per revolution of the rotor shaft.



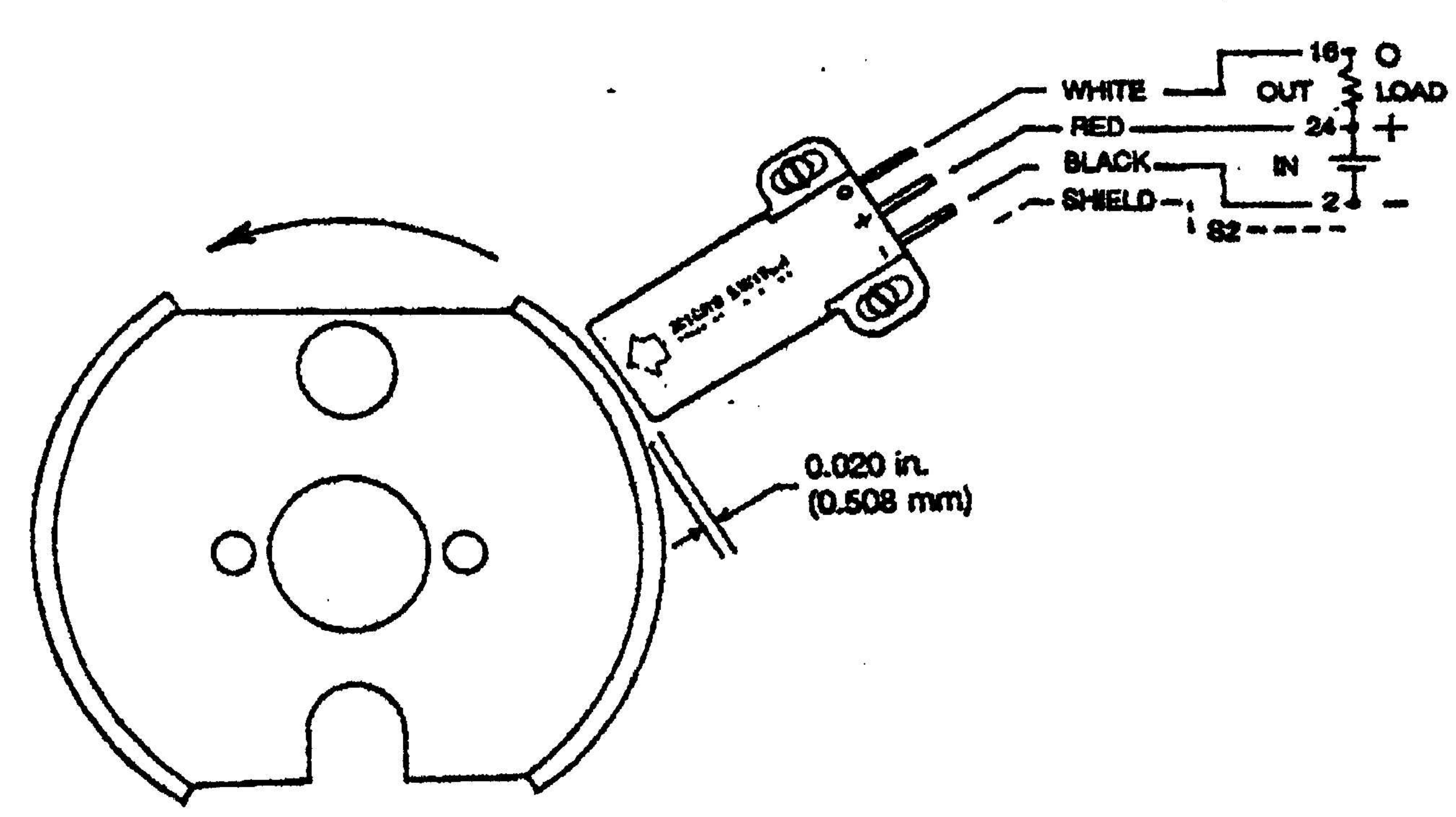
The microcomputer will monitor and respond to the sensors output signals.

- The signal pattern produced at an engine speed of 750 RPM (25Hz) will be interpreted as engine run speed and the cranking cycle will be terminated.

- If the engine run signal provided at 750RPM is not available after a cyclic engine crank totaling 75 seconds or after 45 seconds of continuous cranking, the start attempt will be aborted and the Overcrank indicator will light.



- If no signal is received after 5 seconds of cranking the controller will assume the engine is not rotating and a locked rotor condition exists. After a 5 second rest another 5 second start attempt will be made. If no signal is received within this 15 second interval the cranking cycle will terminate and the Overcrank indicator will light.



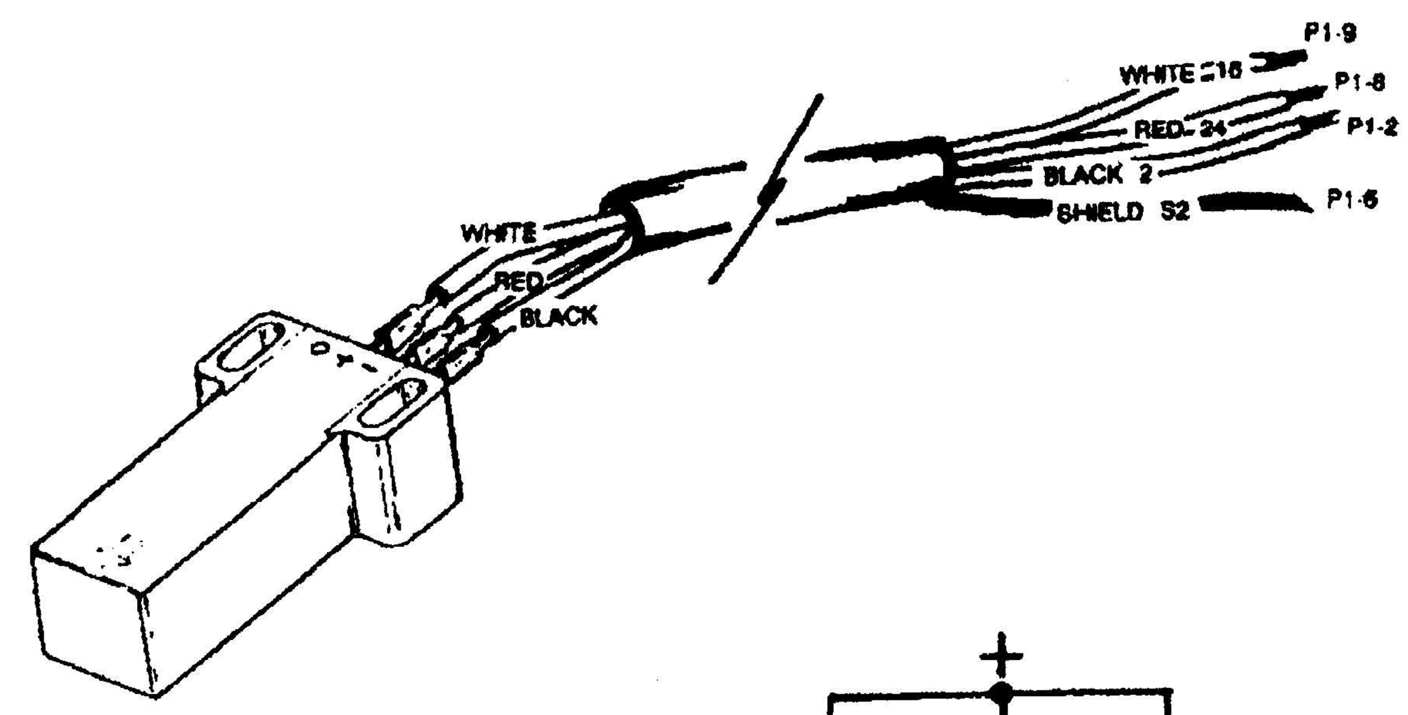
- The signal produced at 2100 RPM (70Hz) and above will initiate an Overspeed shutdown.

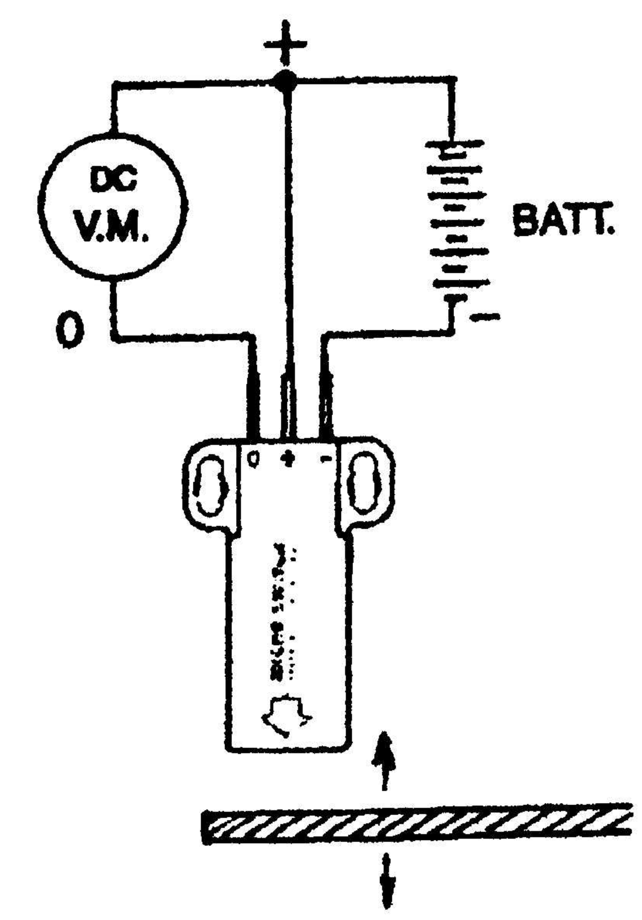
- If during operation a signal is absent for longer than 1 second and AC generated voltage is available the generator set will continue to run, however the Overcrank indicator will flash indicating a fault has occurred in the sensor circuit and service is required prior to the next start-up.

SPEED SENSOR (Proximity Sensor)

The sensor requires a shielded interconnection cable to the micro-processor circuit board. The shield (S2) is grounded through terminal 6 of the P1 connector.

The device can be bench checked by applying 12VDC to the input and observing a DC output when the circuit is triggered by placing a flat piece of iron or steel at the sensing surface.





DEC 3 MICROPROCESSOR CIRCUIT BOARD

The main control circuit board is designed around a self contained, single-chip digital microcomputer that has memory, logic, data bus, control bus and I/O ports in one 40-pin integrated circuit.

The control algorithm is provided in ROM (Read-Only-Memory), which maintains data storage without a power supply, ensuring that programmed information is never lost.

Hardware and software filters protect the board from electrical noises common to generator set applications.

Operating range is from - 40 to 185° F. (- 40 to 85° C)

The G-292806 Board illustrated will control both 12 and 24 volt engine starting systems.

Input and output signals are provided at the three P connectors (P1, P2, P3) and TB1 terminal strip.

The P3 connector provides the interconnection for the 20 conductor ribbon harness and the Control/Status Indicator panel.

The TB1 barrier strip allows interconnection of options such as: remote operation, annunciators, emergency stop switches, and dry contact kits.

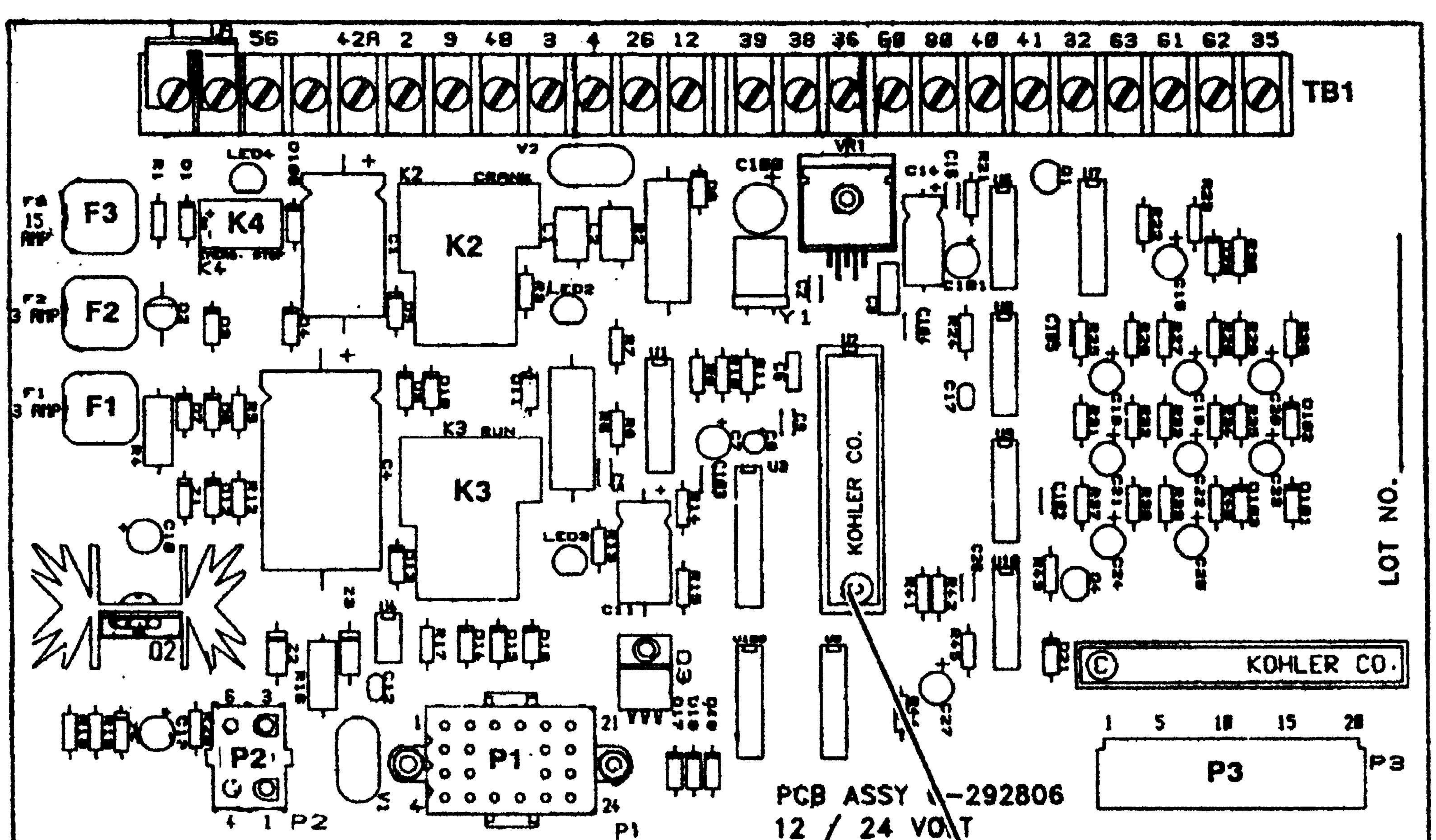
The P1 and P2 connectors provide input and output connections between the engine, generator and controller.

Three sealed relays K2, K3, and K4 provide the engine starting , running and stopping control. LED's are connected across the relay coils to indicate voltage has been directed to energize the relay.

The K2 relay controls the battery supply to the starter solenoid on an engine crank command. The output circuit is protected by the F3 fuse.

The K3 relay provides battery voltage to the engine run circuit, (Fuel pump/solenoid, Ignition etc.) the meter cabinet components and voltage regulator. The contact circuit is also protected by the F3 Fuse.

The K4 relay supplies the control logic circuits with a 12vdc regulated supply. It also functions as the emergency stop relay.



MICROCOMPUTER