ENGINE CONTROL MODULE (ECM) OPERATION

A. GENERAL

The engine control module (E.C.M.) is a microprocessor based module that monitors the control and safety inputs and provides all the required START and STOP functions automatically.

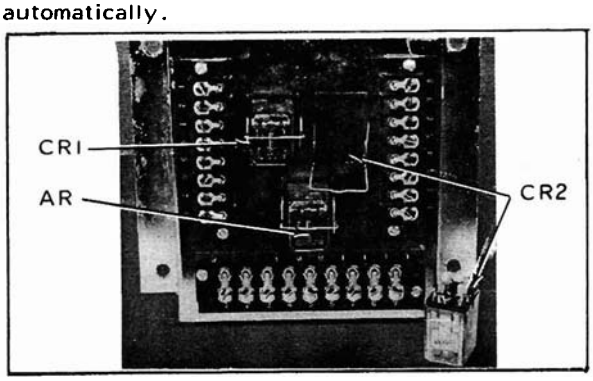

Figure 1. E.C.M.

B. CONTROL SWITCH INPUTS:

The following front panel controls and instruments are wired into the microprocessor through the E.C.M. terminal blocks.

1. Run-Off-Auto Switch

   a. "Run" - run position causes the generator set to start and run immediately.

   b. "Off" - off position prevents unit operation regardless of status of remote control signal status.

   c. "Auto" - auto position allows unit to be controlled via any remote single-pole "dry" contact (transfer switch, start and run, while contact opening causes unit to shut down.

2. Lamp Test

   Push button energizes all four alarm light simultaneously. This feature is disabled with the run-stop-auto switch in the "stop" position, and has no other effect on unit operation.

C. RELAY FUNCTIONS - (See Figure 1.)

1. Master control relay - (CR-1) - operates fuel solenoid, elapsed time meter, etc.

2. Cranking control relay - (CR-2) - controls engine cranking.

3. Alarm relay - (AR) - provides isolated contact (10-amp maximum) for remote alarm indication, bell, etc.

D. SAFETY INPUTS

1. Low Oil Pressure Shutdown - (LOP)

   Monitoring of oil pressure begins 12-seconds after unit starts and remains in effect until unit is shut down (except as noted in "loss of frequency input" below). The LOP signal is derived from an oil pressure switch mounted on the engine.

2. High Water Temperature Shutdown - (HWT)

   The engine coolant sensor temperature monitoring begins immediately with the start signal. If water temperature is excessive at time of start, (i.e., heat soak after shutdown), the HWT red light only goes on (no alarm), and the unit is permitted to start. The HWT condition is permitted to exist for up to 60 seconds after the unit is running before shutdown with alarm occurs. If the excessive water temperature condition is corrected within that time period, the red light is extinguished, and the HWT circuit begins normal monitoring. The HWT signal is derived from an electric temperature sensor switch mounted on the engine.

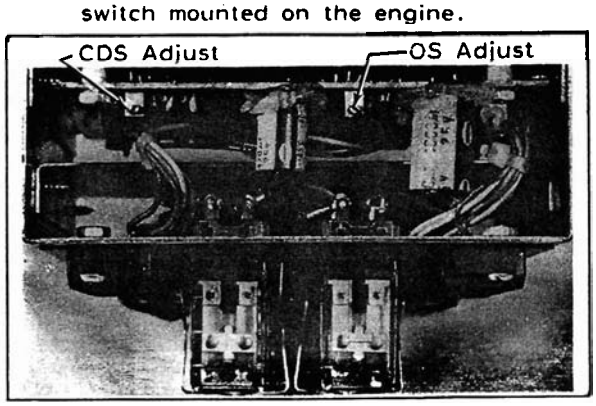

Figure 2. E.C.M. Adjustment

3. Overspeed Adjustment - (OS)

   Overspeed protection is provided by a frequency sensing network within the controller. The trip point of the frequency network is adjustable via a rheostat located on the top of the controller at the right hand side. (See Figure 2). Clockwise (CW) rotation increases the trip frequency and, thereby, raises the shutdown speed.

E. CRANKING CONTROL

1. Overcrank Protection -(OC). Two different cranking cycles are programmed into the controller.

a. Fixed single cycle - the controller is factory supplied with the "cranking limiter" feature which provides a single, non-adjustable, crank period of 48 seconds. Failure of the engine to start within that time results in an "overcrank" shutdown and alarm.

b. Cycle cranking feature - the controller may be field-converted to the "cycle cranking" feature by cutting the jumper wire located through the access hole nearest the middle of the back of the controller. (See Figure 3). This feature provides a series of five cranking cycles, each 12 seconds long with a 12-second rest period between each. Failure of the engine to start by the end of the fifth crank period results in an "overcrank" shutdown and alarm indication.

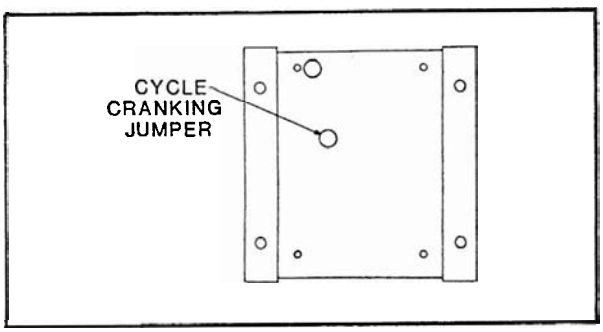

Figure 3. E.C.M. Backside

2. Cranking Disconnect Adjustment - (CDS Adjustment)

The cranking disconnect signal is obtained by a frequency network within the controller. The trip point of the frequency network is adjustable via a rheostat located on the top of the controller at the left hand side. (See Figure 2). CW rotation increases the trip frequency and, thereby, raises the starter motor drop-out speed. The frequency input is usually obtained from the engine battery charging alternator.

F. E.C.M - PROGRAM NOTES

Loss of frequency input.

Internal protection against loss of frequency input to the cranking disconnect circuit is programmed in after the unit has started normally. In the event the frequency goes to zero (engine runs out of fuel, alternator fails, etc.), the LOP shutdown circuit is bypassed and a 12-second wait period is initiated. If frequency returns within this time period, LOP monitoring resumes and operation continues normally. If frequency has not returned at the end of this time period, the engine oil pressure status is observed to determine whether the engine is actually running or stopped. If the engine has stopped (i.e., air in fuel, etc), the unit is shut down with an "overcrank" indication and alarm.

WARNING: "Overcrank" indication can mean a loss of crank-disconnect signal during the previous run period i.e., alternator belt broken. Attempting to restart the engine with no-crank disconnect signal can destroy the starter motor, which can cause serious personal injury.

This is of particular note since the tendency is to pursue only cranking and start related faults. The cranking disconnect signal source (battery charging alternator) is a key component in this system and must be checked out thoroughly whenever an "overcrank" shutdown occurs.

NOTE: The controller does not provide protection against loss of signal during startup. A shutdown with alarm, due to any of the above conditions, will prevent any subsequent operation of the generator set. The run-stop-auto selector switch on the control panel must be momentarily placed in the "stop" position to reset these functions.