GENSET CONTROL MODULE—LEVEL 2

A121E0M

Features:

- One model for both spark ignition and diesel engines.
- 8-alarm light outputs with lamp-test and alarm silence provisions.
- User selectable starting modes: full cycle cranking, or single-cycle crank limiter.
- Loss of speed signal protection for crank motor circuit.
- Special logic to re-establish cranking following a false start.
- Special logic permits re-starting of hot engine.
- Additional relay contact to trip main circuit breaker during fault shutdown.
- Pluggable terminal blocks for ease in installation.

General Description:

The Genset Control Module is a microprocessor based control system which provides complete automatic control of standby generator set engines. Fuel solenoid and/or ignition control, cranking control, main circuit breaker trip, and audible alarm control are via heavy duty industrial type relay contacts. Engine temperature and oil pressure monitoring are obtained from engine mounted sensor contacts. Adjustable overspeed shutdown and crank termination control are provided internally via a frequency monitoring input terminal. This input signal may be obtained from frequency source related to engine speed: distributor ignition pulses, A.C. tachometer generator, alternator tachometer terminal, etc. Four spare inputs and four spare outputs are available for special customer program requirements. Unless otherwise specified, these spare inputs are shipped programmed as additional shutdowns and alarm light outputs.

A121E0M Specifications

Input Voltage: Model A121E0M: 12VDC nominal, 16VDC max; transient and reverse polarity protected. (Typical: Pickup at 10VDC, Dropout at 6VDC.)

Supply Current: 0.4A maximum plus alarm light burden.

Relay Load Contacts: FS, CS, & AX: 10A at 28VDC, inductive.
AR: 2A at 28VDC, resistive.

Alarm Light Load: 150mA maximum each output (incandescent inrush is permitted.)

Shutdown Input Contacts: 3 (See operating instructions for start-up override times.)

Approach Input Contacts: 2 (See operating instructions for start-up override times.)

Frequency Input: 80V RMS max. (See note 1.)
Overspeed trip point is adjustable from;
A121E0M: 40 to 800Hz. (Ignition / Alternator)

Crank Disconnect Frequency: Internally fixed at 30% of the overspeed setting.

Crank Control: Single-cycle crank limiter: continuous 48 sec. crank period (non-adjustable.)
Cycle cranking: 5 cycles of 12 sec. crank and 12 sec. rest (non-adjustable.)

Shielding: Internal EMI shielding provided.

Ambient Temperature: -25° F to +140° F

Finish: PC Board: Protected with moisture/fungus proof varnish.
Chassis: Zinc plated / yellow dichromate.
Cover: ABS plastic.

Terminal Blocks: Industrial vertical plug-in type header for ease in installation.

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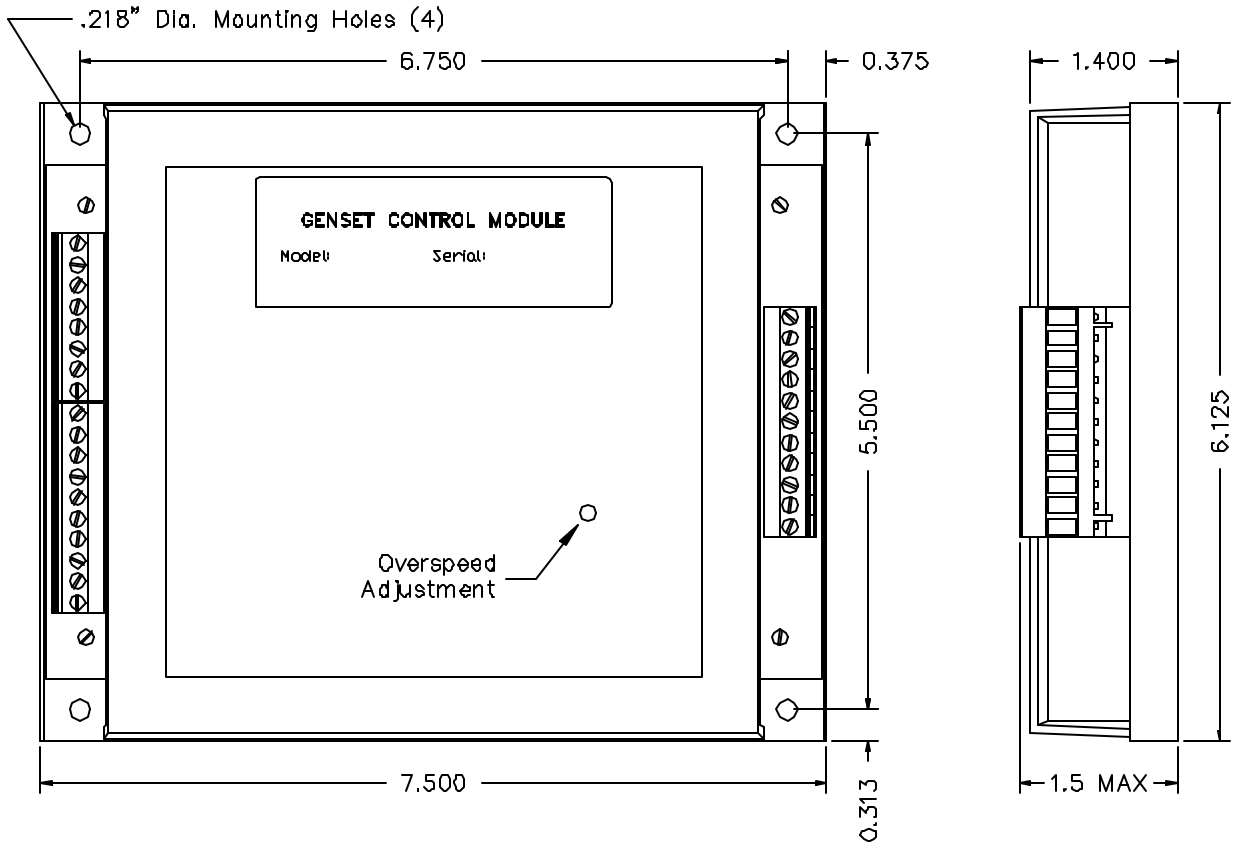
A121E0M Dimensions



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GENSET CONTROL MODULE — LEVEL 1

A121E0M

Control Switch Inputs

The following operator panel controls are wired into the microprocessor through the front-mounted terminal blocks:

1. Run/Stop/Auto Switch.

a. "Run" position causes the engine to start and run immediately.

b. "Auto" position allows the unit to be controlled via any remote single-pole dry-type contact (transfer switch, remote start switch, etc.). Contact closure causes the unit to start and run, while contact opening causes the unit to shut down.

c. "Stop" position de-energizes the control module for immediate shutdown.

2. Lamp Test Push-Button.

Energizes all alarm lights simultaneously. This feature is disabled with the Run/Stop/Auto selector switch in the "Stop" position, and has no other effect on unit operation.

3. Alarm Silence Push-Button.

De-energizes the alarm relay at any time and changes the status of the alarm lights from flashing to continuous 'on'.

Relay Functions

1. Master Control Relay (FS).

Operates the fuel solenoid, etc.

2. Cranking Control Relay (CS).

Controls engine cranking functions.

3. Alarm Relay (AR).

Provides contact (2-amp. maximum) for remote alarm indication, bell, etc. The alarm relay is energized for all engine fault conditions.

4. Shunt Trip Relay (AX).

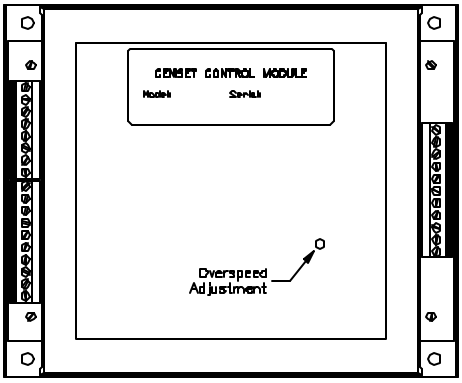
Provides contact (10-amp. maximum) for energizing the main line circuit breaker shunt trip coil if the engine is shutdown for any fault condition. This contact will remain closed until the Run/Stop/Auto switch is placed in the "Stop" position.

Safety Shutdown Inputs

1. Low Oil Pressure (LOP) Shutdown.
Monitoring of oil pressure begins 12-seconds after the unit starts and remains in effect until the unit is shut down *(except as noted in section Microprocessor Program Notes.)* Except as noted, closure of this contact while engine is running results in an engine fault shutdown and alarm with flashing light indication. The LOP signal is derived from an oil pressure sensor switch mounted on the engine.

2. High Water Temperature (HWT) Shutdown.
The engine coolant temperature sensor monitoring begins immediately with the start signal. However, if the water temperature is excessive prior to start, (i.e., heat soak after shutdown), the unit is permitted to start and the high temperature condition is permitted to exist for up to 60-seconds after the unit is running, before an engine fault shutdown and alarm with light indication occurs. If the high temperature condition is corrected within that time period, the microprocessor circuit reverts to normal monitoring. Except as noted, closure of this contact while engine is running results in an engine fault shutdown and alarm with flashing light indication. The HWT signal is derived from a temperature sensor switch mounted on the engine.

3. Low Fuel Level Shutdown (Optional).
4. Over Voltage Shutdown (Optional).
5. Under Voltage Shutdown (Optional).
6. Under Frequency Shutdown (Optional).
Monitoring of these spare input begins 12-seconds after the unit starts and remains in effect until the until is shut down. Except as noted, closure of any of these contacts while running results in an engine fault shutdown and alarm with flashing light indication. If used, these inputs are derived from sensor switches external to the control module.



Genset Control Module - Face

7. Overspeed (OS) Shutdown / Adjustment.
Overspeed shutdown protection is provided by a frequency sensing network within the control module. The trip point of the frequency network is screwdriver adjustable through the opening in the face of the control module as shown. Clockwise rotation increases the trip frequency and thereby, raises the shutdown speed. Exceeding this speed will result in an engine fault shutdown and alarm with flashing light indication.

Cranking Control

1. Overcrank (OC) Protection.
Two different cranking cycles are programmed into the control modules microprocessor:

a. Single-Cycle Cranking Feature.
This feature provides a single, non-adjustable, crank period of 48-seconds. Failure of the engine to start within that time results in an "overcrank" engine fault shutdown and alarm with flashing light indication.

b. Cycle Cranking Feature.
The control module may be field-converted to the "cycle cranking" feature by grounding the "CCI" terminal on the control. This feature provides a series of five cranking cycles; each containing a 12-second crank period with a 12-second rest period. Failure of the engine to start by the end of the fifth crank period results in an "overcrank" engine fault shutdown and alarm with flashing light indication.

2. Cranking Disconnect.
The cranking termination speed is obtained from the frequency network within the control module. The microprocessor automatically sets the cranking termination speed at 30% of the selected overspeed trip value.

Microprocessor Program Notes

Internal protection against loss of frequency input signal is programmed in after the unit has started normally. In the event the frequency goes to zero (engine runs out of fuel, frequency signal source fails, etc.), the LOP shutdown circuit is bypassed and a 12-second wait period is initiated. If the 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, the cranking cycle will begin in an effort to restart the engine. If the engine has not stopped (loss of input signal, etc.), the unit will display an "overcrank" indication and alarm, and will continue to run ***WITHOUT OVERSPEED PROTECTION*** until stopped in a normal manner. Re-starting at a later time is prevented until the "overcrank" indication has been reset.

Caution: "Overcrank" indication can mean a loss of frequency input signal during the previous run period. Attempting to re-start the engine without any frequency input signal can destroy the starter motor, which can cause serious personal injury. The frequency signal source is a key component in this system and must be checked out thoroughly whenever an "overcrank" shutdown occurs, since the control module only provides an indication of loss of signal during startup.

Resetting A Fault Shutdown

A shutdown with alarm, due to any fault condition, will prevent any subsequent operation of the generator set. The Run/Stop/Auto selector switch on the operator control panel must be momentarily placed in the "Stop" position to reset these functions.

GENSET CONTROL MODULE—LEVEL 1 & 2

Overspeed Selection Formula

The Genset manufacturer must determine the overspeed (OS) trip point based on maximum allowable speeds for both the engine and generator.

The following formula should be used to determine the OS trip frequency for any engine[1]. Select a Genset Control model which OS frequency range includes the desired trip frequency.

1) All engines with magnetic pick-up sensing (*recommended*):

OS Frequency = 30 × D × (number of teeth on ring gear)

2) All engines with belt-driven alternator sensing:

$$\text{OS Frequency} = 15 \times D \times (\text{number of alt. poles}) \times \frac{(\text{drive pulley diameter})}{(\text{alt. pulley diameter})}$$

3) All engines with flywheel-type alternator sensing:

OS Frequency = 15 × D × (number of alternator poles)

4) Gasoline engines only, with distributor ignition sensing:

OS Frequency = 15 × D × number of cylinders

D = Speed Multiplier

i.e. If OS is set at @ 72Hz (on 60Hz generator), then D = 1.2 (1.2 × 60Hz = 72Hz)

[1]These formulae are for nominal 1800 RPM engines; for 3600 RPM engines, the calculated OS frequency should be doubled.

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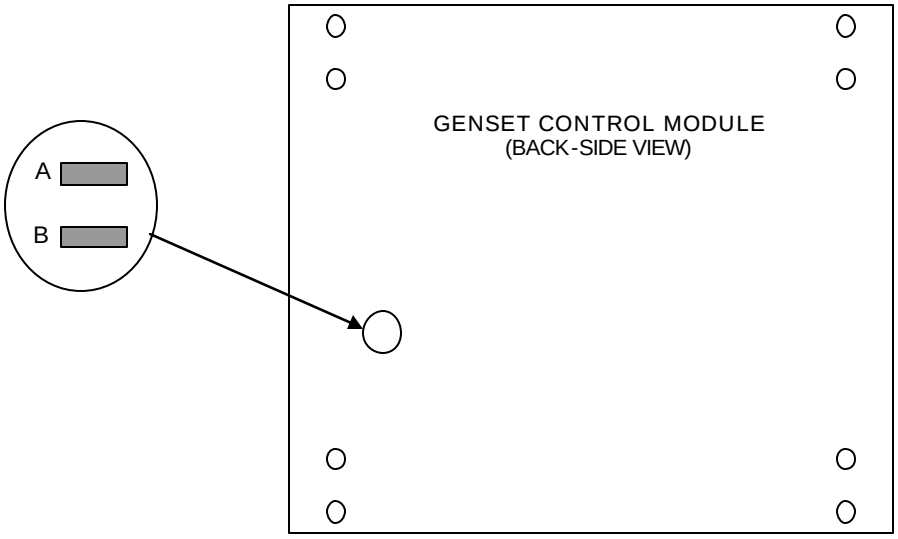
GENSET CONTROL MODULE—A121_ / A122_

Overspeed Set-Up Instructions

STOP

Before installing the Genset Control Module, the proper input frequency range needs to be selected as described below.

Through a hole in the back of each control (as shown in diagram below), jumper wire(s) are used to select the input frequency range. Locate your model number on the following charts for the correct range settings.



Caution: *When cutting jumper wires, do not allow ends of jumper wire to come in contact with other components or the chassis. Completely remove the jumper wire, or cut in the middle and separate ends about 1/8".*

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Important Notice

OVERSPEED MODEL SELECTION—A121_ / A122_

Available Models
A121AM1 A121BM1 A121CB1
A121CM1 A121M1 A121S1
A241AM1 A241BM1 A241CM1

Typical Frequency Input Sources
Magnetic Pick-up
Alternator tachometer terminal
Tachometer generator

At engine overspeed, the Input Frequency is between:	Cut these Jumper Wires
430 - 1350 Hz	None
2380 - 6800 Hz	“A” Only

Available Models
A121AM1 A121BM2 A121CB2
A121CM2 A121M2 A121S2
A241AM A241BM A241CM

Typical Frequency Input Sources
Magnetic Pick-up
Alternator tachometer terminal
Tachometer generator

At engine overspeed, the Input Frequency is between:	Cut these Jumper Wires
350 - 1100 Hz	None
1750 - 5000 Hz	“A” Only

Available Models
A121AL A121AM A121AX A121BM A121CB
A121CD A121CL A121CLM A121CM A121CX
A121E0M A121M A122E0M

Typical Frequency Input Sources
Alternator tachometer terminal
Distributor low-voltage input terminal

At engine overspeed, the Input Frequency is between:	Cut these Jumper Wires
28 - 90 Hz	None
78 - 240 Hz	“A” Only
200 - 600 Hz	“B” Only
250 - 800 Hz	“A” and “B”

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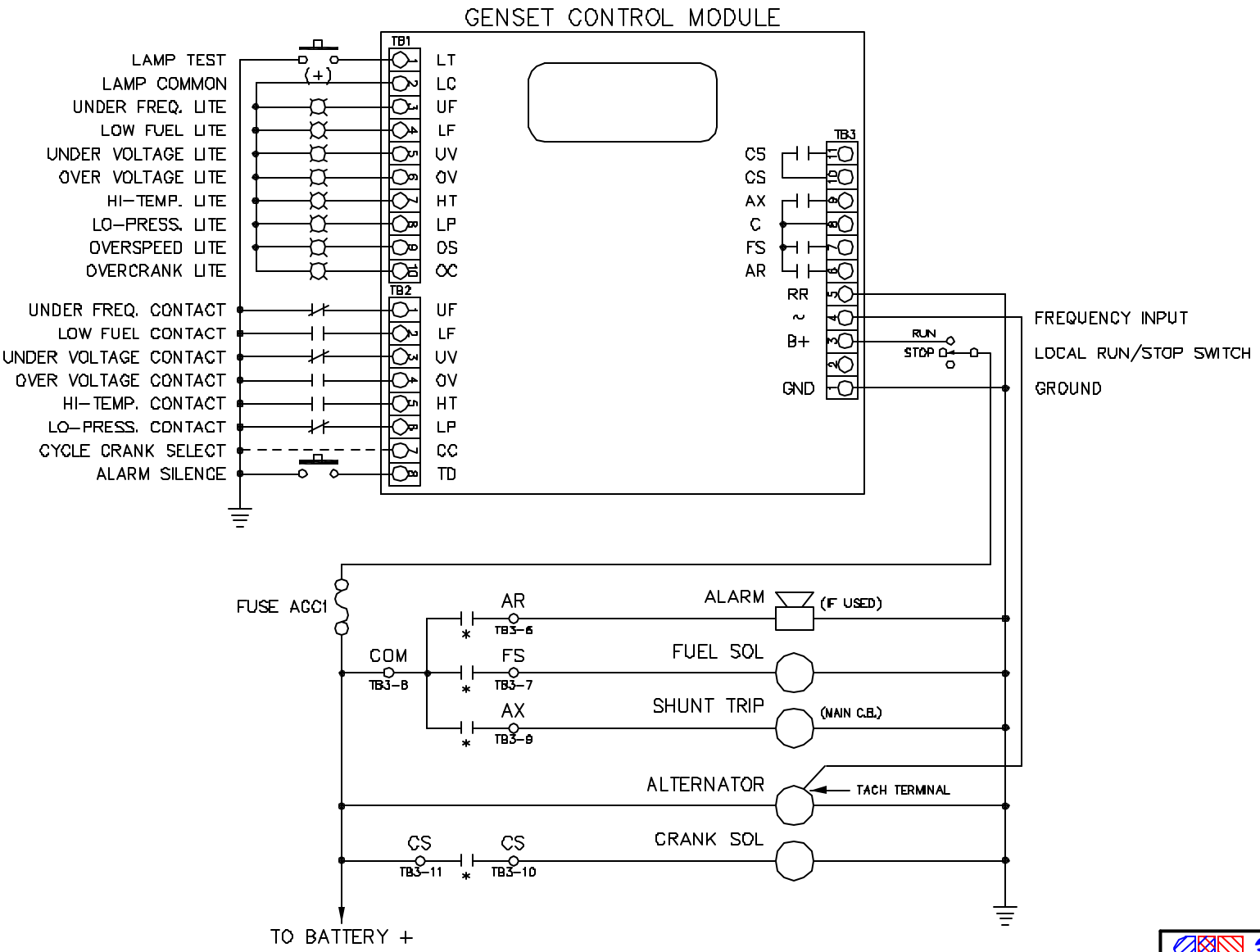

* RELAYS FS, CS, AR, & AX ARE INSIDE THE GENSET CONTROL.

FREQUENCY SENSING FROM ALTERNATOR TACH. TERMINAL

Bouchette Electronics, Inc.
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TITLE: CONNECTION DIAGRAM
A121EOM/A241EOM CONTROL

DATE	DWN BY	CHK	SCALE
08/13/93	DSB	TJB	NONE

P/N	CAD REF	DWG NO
	PCB101	E154-10