LSM100 Series
Load Sharing Modules

+1 413 233 1888
www.governors-america.com

1 INTRODUCTION

The Load Sharing Module LSM100 proportionally shares load between two or more generator sets while the system frequency is held constant. The LSM100 measures the true power current, and through a parallel cable interconnection, continuously controls the governing system.

The all electronic power sensing circuits of the LSM100 increase the accuracy of measuring the true power current over conventional methods by differentiating between real and reactive current so the governor responds only to the real portion. The LSM100 continuously adjusts governor speed settings for paralleled generators averaging out the power differences. The generators are locked together through synchronizing torques, and act as though they are tightly connected through a gear drive.

Using various droop and power control connections the LSM100 can parallel and share load with the utility's main bus. In addition to load sharing, a load anticipation circuit is included to maximize performance in single or parallel engine generator operation. The LSM100 provides:

- Isochronous Load Sharing
- Adaptable for Single Phase
- Main Bus Power Management
- Power Control Circuit
- Load Sensitivity Circuit
- Load Anticipation

2 SPECIFICATIONS

PERFORMANCE	
Load Sharing	Adjustable to within +1-2 % between sets
Performance	Isochronous and droop paralleling and power control
Power Output Signal	0 to 7 V DC representing no load to full load All performance specifications are based on 5 A from the current transformer (CT) secondaries at full load
ENVIRONMENTAL	
Temperature Range	-40 to 185 °F [-40 to +85 °C]
Relative Humidity	up to 99 %
All Surface Finishes	Fungus proof and corrosion resistance
COMPLIANCE / STANDARDS	
Agency	CE - RoHS Compliant

POWER INPUT \ OUTPUT	
AC Signal	SW1 ON for 100-240 VAC, SW1 OFF for 240-500 V AC nominaL line to line, 5 A CT's with a minimum 1.25 VA rating (Internal 0.05 Ω burden resistors)
DC Supply	+10 V DC from speed control
Polarity	Negative ground (case isolated)
Power Consumption	20 mA typical
PHYSICAL	
Dimensions	See Section 4, Wiring and Dimensions
Weight	1.2 lbf [0.56 kgf]
Mounting	Any position, vertical preferred
RELIABILITY	
Vibration	5 g, 20 - 500 Hz
Testing	100 % Functional testing before and after potting

3 OVERVIEW

Engine generator sets with isochronous governors maintain a requested speed very precisely. If synchronous generators are electrically paralleled to increase their load capability, they need a system to share the load. Even the finest electric governors will have minor frequency differences between the paralleled units; one generator set will increase the power it produces, while the other sets will decrease the power they produce. This condition eventually leads to the motorizing of one or more of the engines, causing it to overheat.

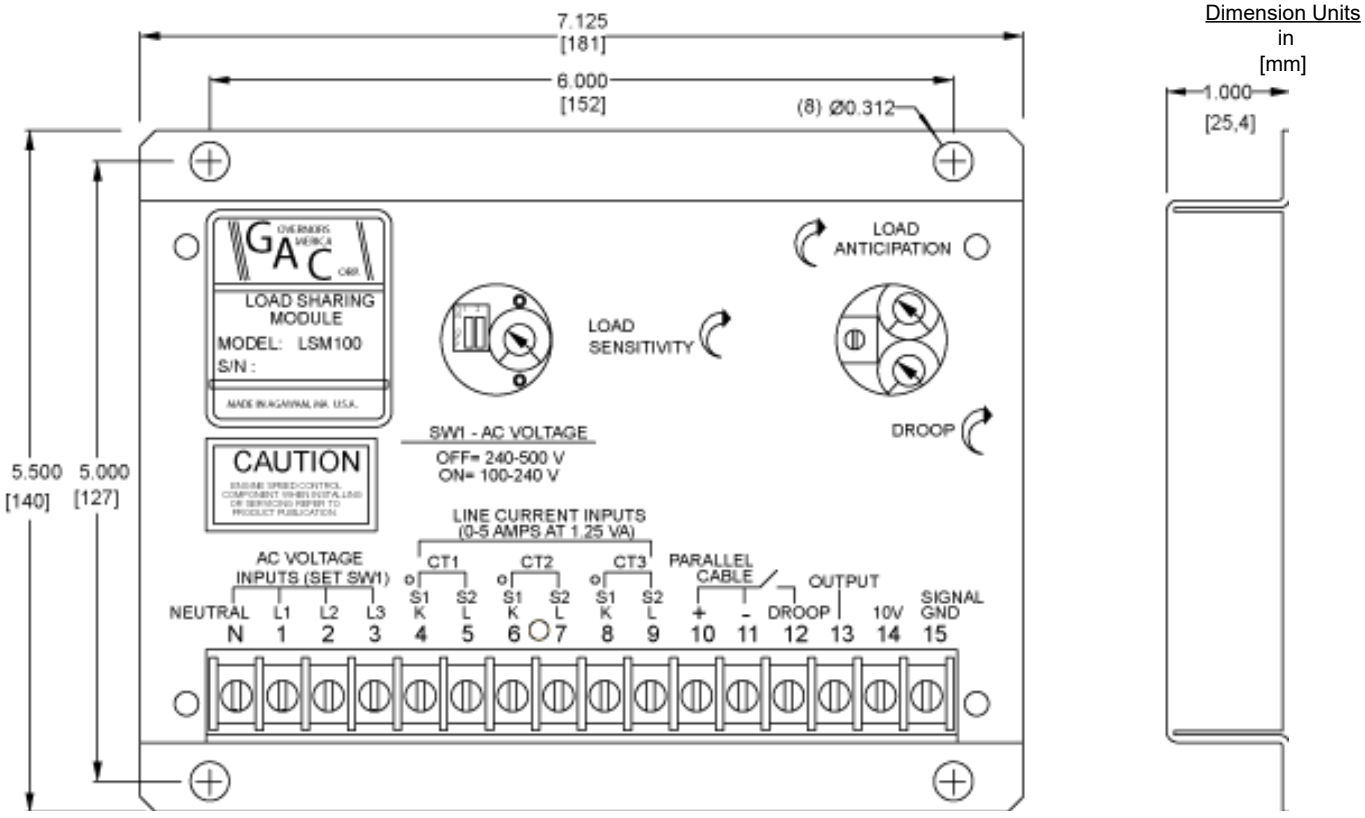
The LSM100 module measures the power the generator supplies to a common load. Voltage inputs accept a wide range of three phase voltages and cover most applications. The line current measurements are usually taken from current transformer (CT) in the equipment such as those used for ammeters. The LSM adds a small additional burden of 1.25 VA to each transformer. LSM cabling may also increase resistance; for example a 0.1 Ω cable adds an additional 2.5 VA.

The LSM all-electronic power measurement circuit develops a signal across the parallel cable. The magnitude and sensitivity of the load sharing is adjustable through the LOAD SENSITIVITY control in the module. Test points adjacent to this control may be used to measure the polarity and magnitude of the signal on the parallel cable. This measurement is very important when initially installing a system and these test points may also be used in troubleshooting the system. A measurement of 0 to 7 V DC represents zero load to full load (5 A in CT's) for 3 phase systems. The LOAD SENSITIVITY adjustment can control the parallel cable and test point voltages over the same 0 to 7 V DC range.

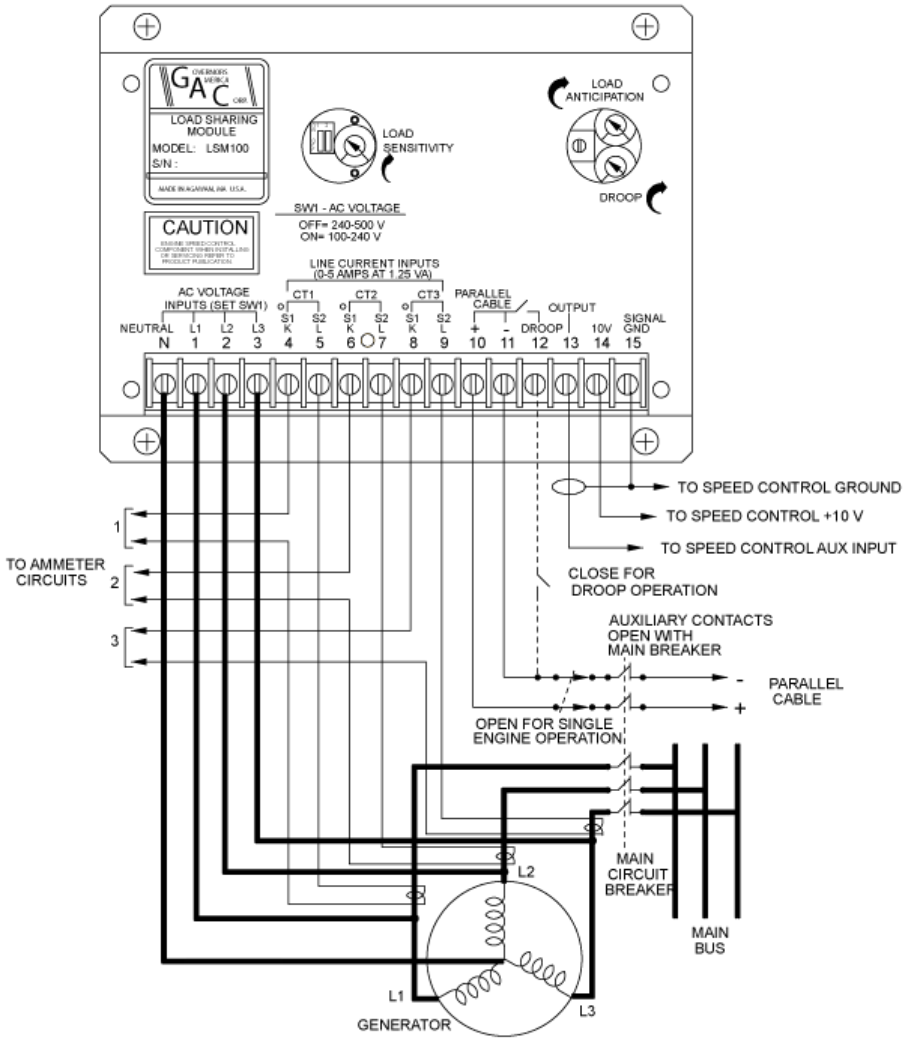
The load anticipation feature (load pulse) provides a signal that is a derivative function. A clock-wise (CW) adjustment of the LOAD ANTICIPATION will make the governor more responsive to transient loads on the generator by quickly moving the fuel rack as load is changed.

4 INSTALLATION

The LSM100 is typically mounted in the generator set control cabinet with other dedicated control equipment. Keep the clear terminal strip cover in place when high voltage is present. The LSM100 module must be installed by qualified personnel only. This document should be reviewed before starting the installation.



5 WIRING



HIGH VOLTAGE PRESENT. Follow all local safety rules.

Terminal Strip Cover Must Be In Place When In Operation

TERMINAL	DEFINITION	NOTES
N	Neutral of Generator	Active when closed
1-3	Voltage	High Voltage Present at Terminals 1-3. Terminal Strip Cover Must Be In Place When In Operation.
4-9	Phase Current	Input from 5 A current transformers. 3 PHASE CURRENT input from 5 A current transformers. Either Terminals 4, 6, and 8 or Terminals 5, 7 and 9 can be connected together and then connected to battery ground of the speed control unit, not SIGNAL GND of the LSM100.
10-11	Parallel	Terminals 10 and 11 are the PARALLEL CABLE connections which link all load sharing modules together. Proper polarity must be observed. If these cables are longer than 10 ft (3 m), they must be shielded with the shield grounded at Terminal 15.
13	Output	Terminal 13 is the load sharing OUTPUT TERMINAL to the governor system speed control unit. If this cable connection is longer than 2 ft (0.6 m), it must be shielded. Ground the shield at Terminal 15.
14	Interface	Terminal 14 is connected to the +10 V DC supply from the speed control or an EAM interface module.
15	GND	Terminal 15 is connected to the ground reference terminal of the speed control unit.

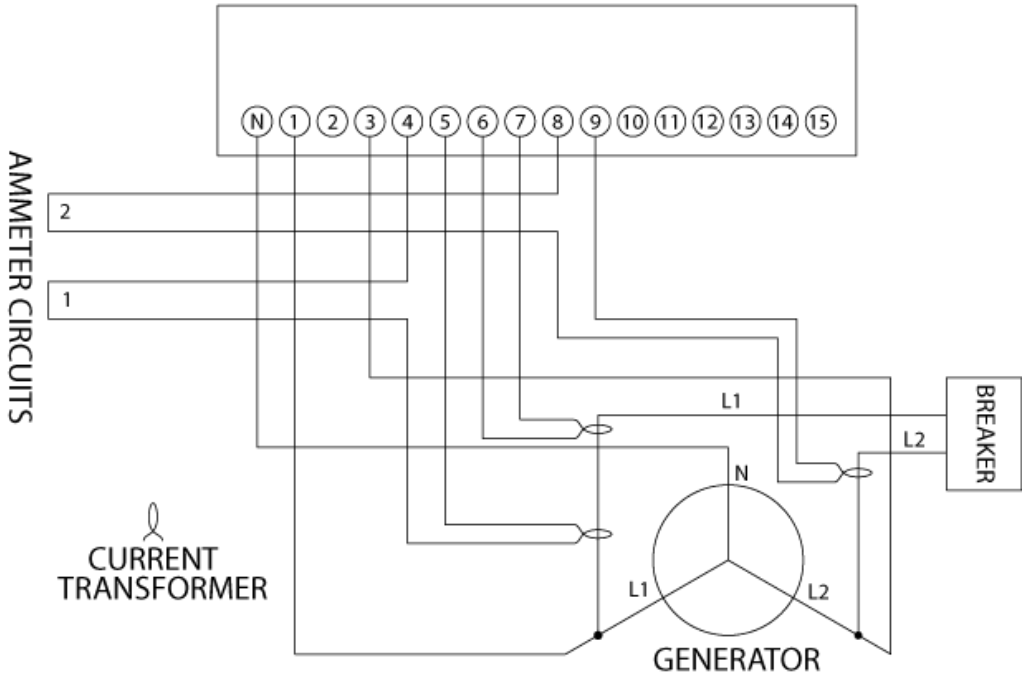
RECOMMENDATIONS

1. Shielded cable should be used for all external connections to the ESD control.
2. One end of each shield, including the speed sensor shield, should be grounded to a single point on the ESD case.
3. Terminals 4-9 can experience a maximum of 5 amps. All others are less than 50 mA.

5 WIRING (CONTINUED)

SINGLE PHASE LSM100

Diagram for reference only.



6 PRE-PARALLELING CHECKS

Do Not Open Circuit Current Transformer Connections While Generator Set Is Running, High Voltage Will Be Present!

Before starting the engine, preset at minimum the following adjustments.

1. Select the AC voltage range:
   - SW1 “ON” for 100- 240 V
   - SW1 “OFF” for 240-500 V

   Failure to set these dip switches may cause startup engine trouble. See Section 10, System Troubleshooting, SW2 SWITCH SETTINGS FOR INSTABILITY table for additional information.

2. Adjust LOAD SENSITIVITY by making ¾ turn from full CCW (75).
3. Adjust LOAD ANTICIPATION to (10).
4. On the governor speed controller match setpoint to speed setting.
5. Check CT Phasing by measuring across the test posts TP1 and TP2 observing instrument polarity.
   - TP1, the upper post, is (+).
   - This voltage is directly proportional to load.
6. A voltage of 0 to 7 V DC can be expected, depending on the load, LOAD SENSITIVITY adjustment, and CT ratios.
7. With the individual generator set under isolated load, momentarily jumper across each CT, one at a time, with a short insulated lead at Terminals 4-5, 6-7, and 8-9.
8. Each time a CT is independently shorted, the voltage reading will be reduced by about 1/3. If the voltage is not 1/3 less, this indicates improper CT or voltage phasing. Corrections to CT phasing must be performed while the generator set is not running. See your generator’s manuals for more information.

7 ADJUSTMENTS

With the system paralleled and at no load, adjust each generators’ speed using the governor speed trim control for zero real power as indicated on each generator set’s wattmeter.

Ensure each engine is at the same current. Reactive current should be trimmed out using the generator set’s voltage regulators. Electrical load can now be applied to the main generator.

LOAD SHARING

All generator sets in the system should share the system load nearly proportionally. The generator set carrying less than its share of the load should be adjusted to accept more of the system load. Move the LOAD SENSITIVITY adjustment counterclockwise to increase it’s load.

LOAD ANTICIPATION

LOAD ANTICIPATION adjustment is factory set at zero sensitivity (full counterclockwise). To improve transient response, gradually advance the adjustment clockwise while the engine generator sets are in parallel. The transient response improvement can be observed when engine load changes. Instability may result if the adjustment is advanced too far clockwise.

DROOP

Adjustable droop of about 5 % can be obtained by placing a jumper between Terminals 11 and 12. Turn the DROOP adjustment clockwise to increase droop. Droop speed control allows synchronous generators to run in parallel, sharing loads among generators with the same droop curve in proportion to their power rating.

OFFSET (ABOVE LOAD SENSITIVITY)

The OFFSET adjustment is factory set to null out any slight error in the load sensing system. This adjustment may be checked by applying both DC and AC voltages, but maintaining zero CT current. Adjust the offset so that a voltage of less than ±0.002 V is measured between test posts TP1 and TP2.

BIAS ADJUSTMENT (LEFT OF DROOP)

The common mode voltage on the parallel cable, the voltage from the Terminals 10 and 11 to Terminals 15, is factory set to 5.0 ±0.1 V DC. To check and adjust this setting, apply both DC and AC voltages but maintain zero CT current. Adjust the BIAS until the voltage measured between Terminals 10 and 15 is 5.0 ± 0.1 V DC.

8 SYSTEM TROUBLESHOOTING

Engine Instability

1. If engine instability is present when the generator sets are in parallel, equally reduce the load sensitivity adjustment of each load sharing module:
   a. Rotate the adjustments in small increments counterclockwise on all of the load sharing modules in the system until stability is restored.
   b. If the load sensitivity adjustment is reduced to less than 25%, poor load sharing may result.
3. If the instability still persists, disconnect all parallel cables and add a jumper across Terminals 11 and 12 of each unit. Droop will be present, but the system should be stable in parallel operation.
4. If the system is not stable, check the generator voltage regulator stability.