GOVERNORS AMERICA CORP.

ENGINE GOVERNING SYSTEMS

LSM100 SERIES

LOAD SHARING MODULE

MEMBER EGSA Electrical Generating Systems Association

GOVERNORS AMERICA CORP. • 720 Silver St. • Agawam, MA 01001-2907, USA

INTRODUCTION

The function of a Load Sharing Module is to proportionally share load between two or more generator sets while the system frequency is held constant. As an accessory to the Electronic Governing System, the LSM100 measures the true power current, and through a parallel cable interconnection, continuously controls the governor system. The all electronic power sensing circuits of the LSM100 increase the accuracy of measuring the true power current over conventional methods. This modern method discriminates more closely between real and reactive current so that the governor will respond to the real portion only. By using various droop and power control connections, the Load Sharing Module can parallel and share load with the utility's main bus. In addition to its primary function of load sharing, a load anticipation circuit is included to maximize performance in single or parallel engine generator operation.

DESCRIPTION

Engine generator sets with isochronous governors maintain the requested speed very precisely. If synchronous generators are electrically paralleled to increase their load carrying capability, a system to apportion the load is required. Even the finest electric governors will have minor frequency differences among units to be paralleled. For this reason, one generator set will continuously 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 generator/engines. The load sharing system continuously adjusts the governor speed settings so that no average power difference exists. The generators are locked together through synchronizing torques, and they act as though they are tightly connected through a gear drive.

The Load Sharing Module measures the power that the generator supplies to a common load. Voltage inputs accept a wide range of three phase voltages and cover most applications (See specifications).

The line current measurements are usually taken from CT's existing in the equipment such as those used for ammeters. The load sharing module adds a small additional burden of only 1.25 VA to each transformer. Added cabling may also increase the burden. For example, a 0.1 ohm cable resistance is an additional 2.5 VA.

The all electronic power measurement circuit develops a signal across the parallel cable. The magnitude and sensitivity of the load sharing is adjustable through the 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 VDC represents zero load to full load (5 Amps in CT's) for 3 phase systems. The SENSITIVITY adjustment can control the parallel cable and test point voltages over the same 0 to 7 VDC range.

The load anticipation feature (load pulse) provides a signal that is a derivative function. A 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.

SPECIFICATIONS

PERFORMANCE

Load Sharing .... Adjustable to within ±2% between sets

Performance .... Isochronous and droop paralleling and power control

Power Output Signal .... 0 to 7 Volts DC representing no load to full load

All performance specifications are based on 5 amps from the current transformer (CT) secondaries at full load

POWER INPUT

AC Signal .... SW1 "ON" for 100-240 VAC, SW1 "OFF" for 240-500 VAC nominal line to line, 5 amp CT's with a minimum 1.25 VA rating (Internal 0.05 ohm burden resistors)

DC Supply .... +10 VDC from speed control

Polarity .... Negative ground (case isolated)

Power Consumption .... 20 ma typical

ENVIRONMENTAL

Temperature Range .... −40°F to +185°F (−40°C to +85°C)

Relative Humidity .... up to 100%

All Surface Finishes .... Fungus proof and corrosion resistant

PHYSICAL

Dimensions .... See Diagram 1

Weight .... 1.5 Lbs. (0.68 Kgs)

Mounting .... Any position, vertical preferred

RELIABILITY

Testing .... 100% Functional tested

Vibration .... 5g @ 20 - 100 Hz

INSTALLATION

The unit is typically mounted in the generator set control cabinet with the other dedicated control equipment. Always keep the clear terminal strip cover in place when high voltage is present.

WIRING

Electrical connections are illustrated in Diagram 1. Choice of the proper wire size is dependent on the maximum current expected at specific terminals of the load sharing module. Terminals 4-9 can experience a maximum of 5 amps. All others are less than 50 ma.

Terminal N is connected to the neutral of the generator.

Terminals 1-3 accept the 3 PHASE AC VOLTAGE inputs. See the specifications for the two selectable voltage ranges.

CAUTION
HIGH VOLTAGE
PRESENT
AT TERMINALS 1-3

TERMINAL STRIP COVER MUST
BE IN PLACE WHEN IN OPERATION

Terminals 4-9 accept the 3 PHASE CURRENT input from 5 amp 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. Series connections can be made from instrument panel CT's. The CT burden of the load sharing module is 1.25 VA for each phase. This will add to the burden rate of the panel instruments and wiring on the CT's.

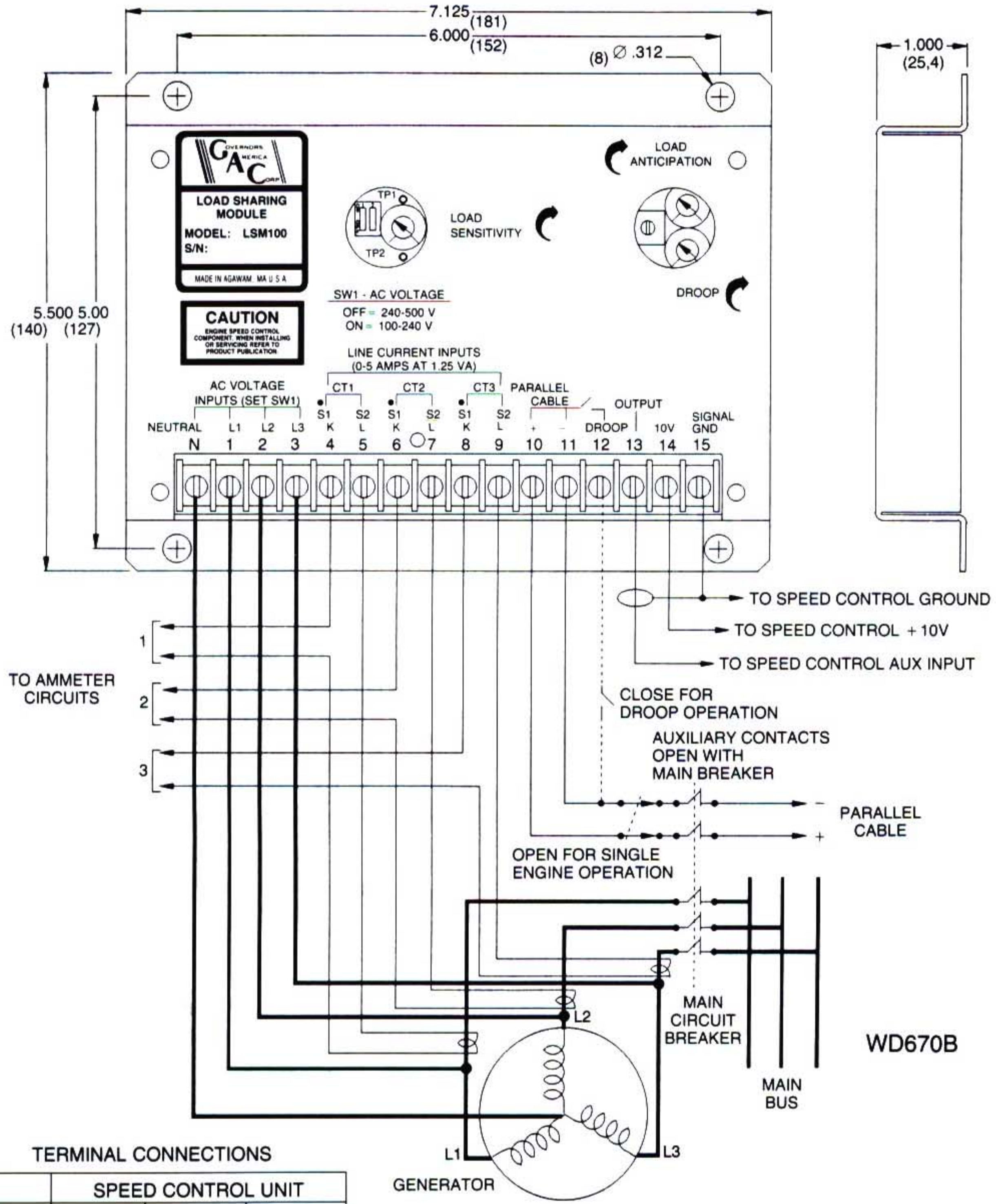
Terminals 10 and 11 are the PARALLEL CABLE connections which link all load sharing modules together. Proper polarity must be observed. If these cables are longer than 10 ft (3m), they must be shielded with the shield grounded at Terminal 15.

Terminal 13 is the load sharing OUTPUT TERMINAL to the governor system speed control unit. If this cable connection is longer than 2 ft (0.6m), it must be shielded. Ground the shield at Terminal 15.

Terminal 14 is connected to the +10 VDC supply from the speed control or an EAM interface module.

Terminal 15 is connected to the ground reference terminal of the speed control unit.

DIAGRAM 1 LSM 100 WIRING - OUTLINE



TERMINAL CONNECTIONS

	SPEED CONTROL UNIT		
LSM100	ESC	ESD5100 ESD5200	ESD5300
13	R	N	M
14	K	P	L
15	H	G	G

PRE-PARALLELING CHECKS

1. Select the proper AC voltage range: SW1 "ON" for 100-240V, SW1 "OFF" for 240-500V.
2. LOAD SENSITIVITY adjustment - ¾ turn from full CCW (75).
3. LOAD ANTICIPATION - set to (10).
4. Governor Speed Setpoint - trim to speed setting.
5. CT Phasing - measure across the test posts TP1 and TP2 observing instrument polarity. TP1, the upper post, is (+). This voltage is directly proportional to load. A voltage of 0 to 7 VDC can be expected, depending on load, LOAD SENSITIVITY adjustment, and CT ratios.

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. Each time a CT is independently shorted, the voltage reading will be reduced by about ⅓, If the voltage change is not ⅓, this indicates improper CT or voltage phasing. Corrections to CT phasing must be performed while the generator set is not running.

CAUTION
DO NOT OPEN CIRCUIT CT CONNECTIONS WHILE GENERATOR SET IS RUNNING,
HIGH VOLTAGE WILL BE PRESENT

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 wattmeter. Reactive current should be trimmed out with 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 proportionately. 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. See the Power Control Bulletins for applications that use droop in mains power control.

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 Volts is measured between test posts TP1 and TP2.

Bias Adjustment (left of Droop)

The common mode voltage on the parallel cable, the voltage from Terminals 10 and 11 to Terminal 15, is factory set to 5.0 ±0.1 Volts. 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 Volts.

TROUBLESHOOTING

Engine Instability

If instability is present when the generator sets are in parallel, equally reduce the load sensitivity adjustment of each load sharing module. Rotate the adjustments in small increments counterclockwise on all of the load sharing modules in the system until stability is restored. If the load sensitivity adjustment is reduced to less than 25%, poor load sharing may result.

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. If the system is not stable, check the generator voltage regulator stability.

SPECIAL APPLICATIONS

In addition to load sharing, the LSM100 is capable of power control and main bus power management. Request the application publication.

PTI4002 Generator Power Control

An LSM100 may be used to control the generation of power from engines tied to a main bus. A simple manual adjustment sets all engines to deliver constant power to a main bus.

PTI 4003 Utility Incoming Power Control

The LSM100 can monitor a utility bus and signal the generators to adjust their contribution to the system load to hold constant or limit the mains power.

PTI 4040 Power Ramp Control

The PRC100A Power Ramp Control from GAC can be used to ramp the generator load. Import and/or Export control, or individual control can be achieved with the PRC100A to smoothly ramp the generator onto the line.

ELECTRONIC - HYDRAULIC - SYSTEMS
HUEGLI TECH AG 4900 LANGENTHAL SWITZERLAND
TEL. + 41 62 916 50 30 FAX. + 41 62 916 50 35
E-Mail : sales@huegli-tech.com www.huegli-tech.com