WOODWARD

Product Manual 02031
(Revision NEW)
Original Instructions

Load Sharing Interface Module (LSIM)

8239-082

Installation and Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.
General Information

Introduction

The Woodward LSIM (Load Sharing Interface Module) is made for use with Woodward analog load sharing controls and the Woodward DSLC™ (Digital Synchronizer and Load Control) units.

Description

The control is housed in a unitized package, and consists of a single printed circuit board.

The LSIM acts as an interface between one or more DSLC controls and the analog load sharing lines on one or more of the following Woodward controls:

- 721 Digital Speed Control
- 2301A Load Sharing and Speed Control
- Generator Load Sensor
- Load Sharing Module

The end result is effective load sharing between any number of the two different controls. A typical system setup is shown in Figure 1-1.

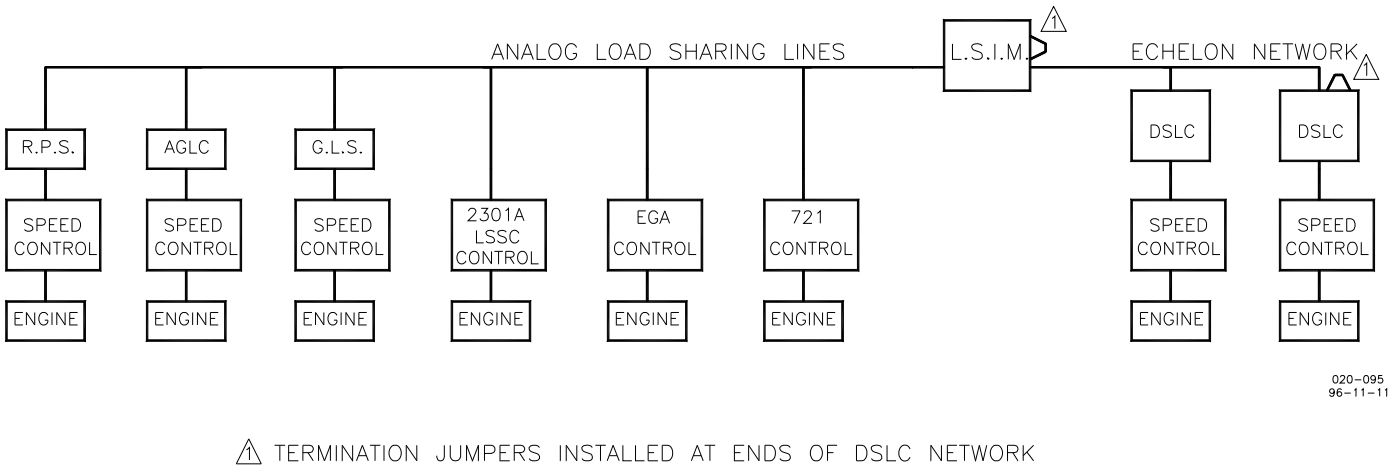


Figure 1-1. Typical LSIM System Setup

See Figure 1-2 for an outline and dimensional drawing of the LSIM.

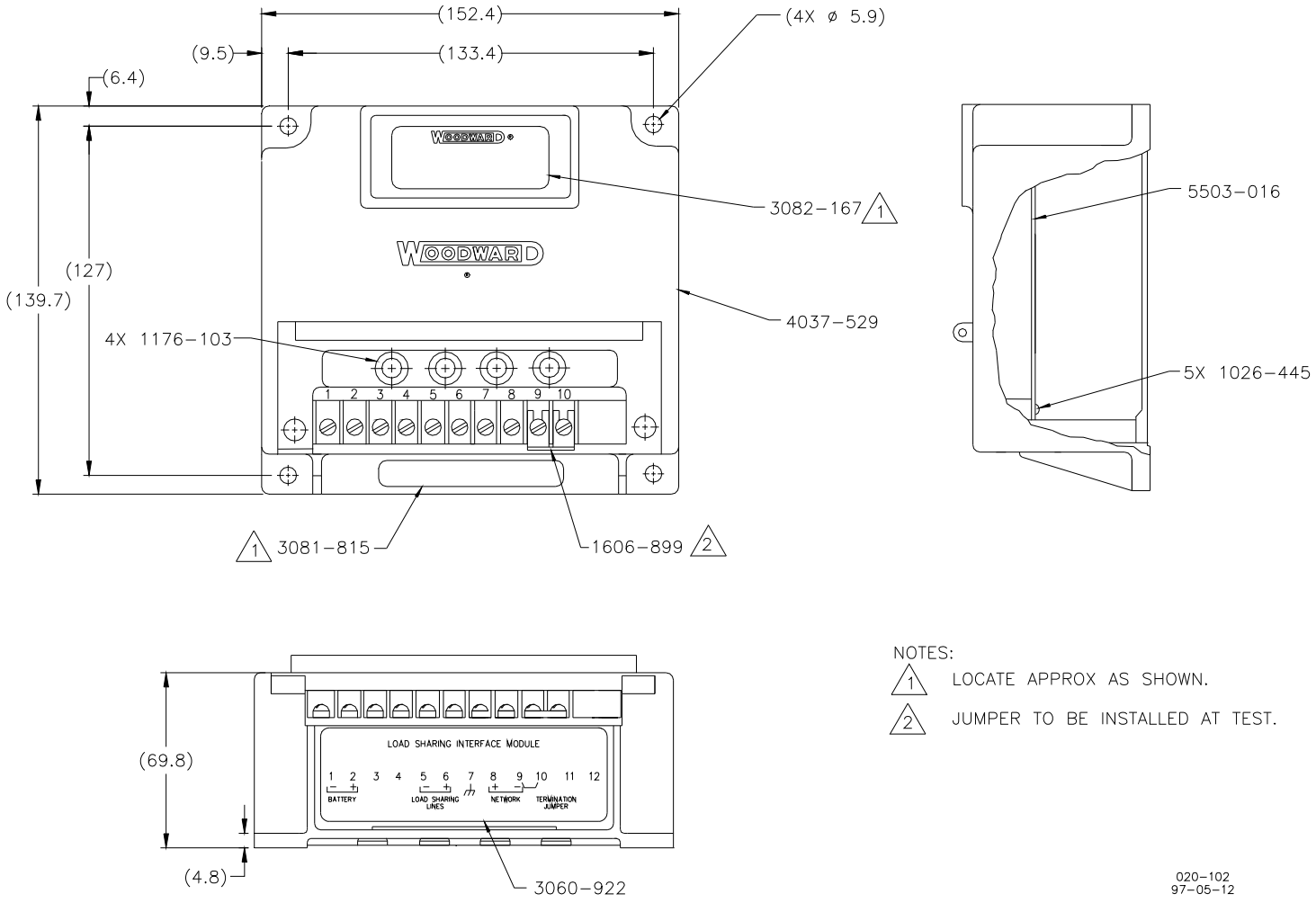


Figure 1-2. Outline Diagram of LSIM

Application

The LSIM is intended for retrofit sites that are updating their current engine controls with DSLC controls over a period of time. During a retrofit period, the LSIM is used to link the analog load sharing controls to the DSLC controls, enabling the two different types of controls to share load.

The LSIM may also be used as a permanent interface between Woodward DSLC controls and Woodward analog load sharing controls. However, reduced functionality of the DSLC control may occur in this type of application. See the “Limitations” section in Chapter 4 for more information.

Chapter 2. Installation

Unpacking

Before handling the control, read page ii, Electrostatic Discharge Awareness. Be careful when unpacking the electronic control. Check the control for signs of damage such as bent or dented panels, scratches, and loose or broken parts. Notify the shipper of any damage.

Power Requirements

The LSIM requires a nominal voltage of 24 Vdc. If batteries are used for operating power, an alternator or other battery charging device is necessary to maintain a stable supply voltage.

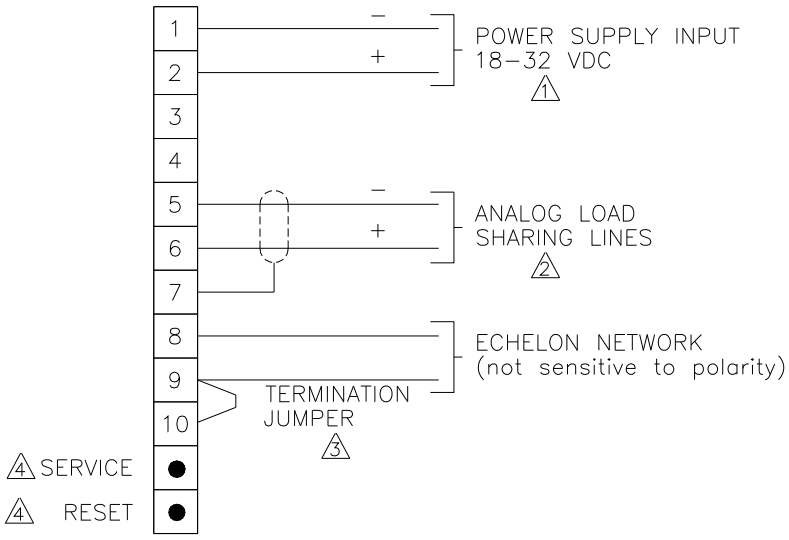
Location Considerations

When selecting a location for mounting the LSIM, consider the following:

- Protect the unit from direct exposure to water or to a condensation-prone environment
- The continuous operating range of the LSIM is –40 to +70 °C (–40 to +158 °F)
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Protection from high-voltage or high-current devices or devices which produce electromagnetic interference
- Protection from excessive vibration
- The control must NOT be mounted on the engine

Electrical Connections

External wiring connection and shielding requirements for a typical control installation are shown in the plant wiring diagram, Figure 2-1.



1 200 mA TYPICAL AT 24 VDC.

2 TERMINATE SHIELD AT ONE END ONLY.

3 INSTALL TERMINATION JUMPERS ON END UNITS IN NETWORK.

4 SERVICE AND RESET BUTTONS ARE USED FOR MANUALLY BINDING TO THE NETWORK. THESE BUTTONS SHOULD NOT BE DEPRESSED AT ANY TIME WHEN USING THE LSIM WITH DSLC CONTROLS.

020–104
97–05–12

Figure 2-1. Plant Wiring Diagram

Chapter 3.
Echelon® LonWorks® Network

Introduction

The communications network used by the DSLC control and the LSIM is Echelon Corporation's technology. In the LSIM, an Echelon Neuron® chip operates as the main control processor. This communication network provides the interconnection between all DSLC controls and the LSIM over which information for dead bus breaker closing permission, and load sharing occurs.

IMPORTANT

The network address of the LSIM is always 15. Make sure that no DSLC controls have this network address (menu 5, item 7) while the LSIM is operating on the same network.

Setup and Calibration

The LSIM is a self configuring, self binding module. No setup or calibration is required to place the unit in operation. Simply attach the load sharing lines and the Echelon network to the LSIM module, apply power, and the unit is ready to operate.

It is important that all analog controls using the load sharing lines to the LSIM have a 6.0 Vdc Load Gain Voltage at full load. Failure to properly set this voltage will result in an imbalance in load sharing between the analog and digital units.

*—LonWorks® and Neuron® are trademarks of Echelon Corporation.

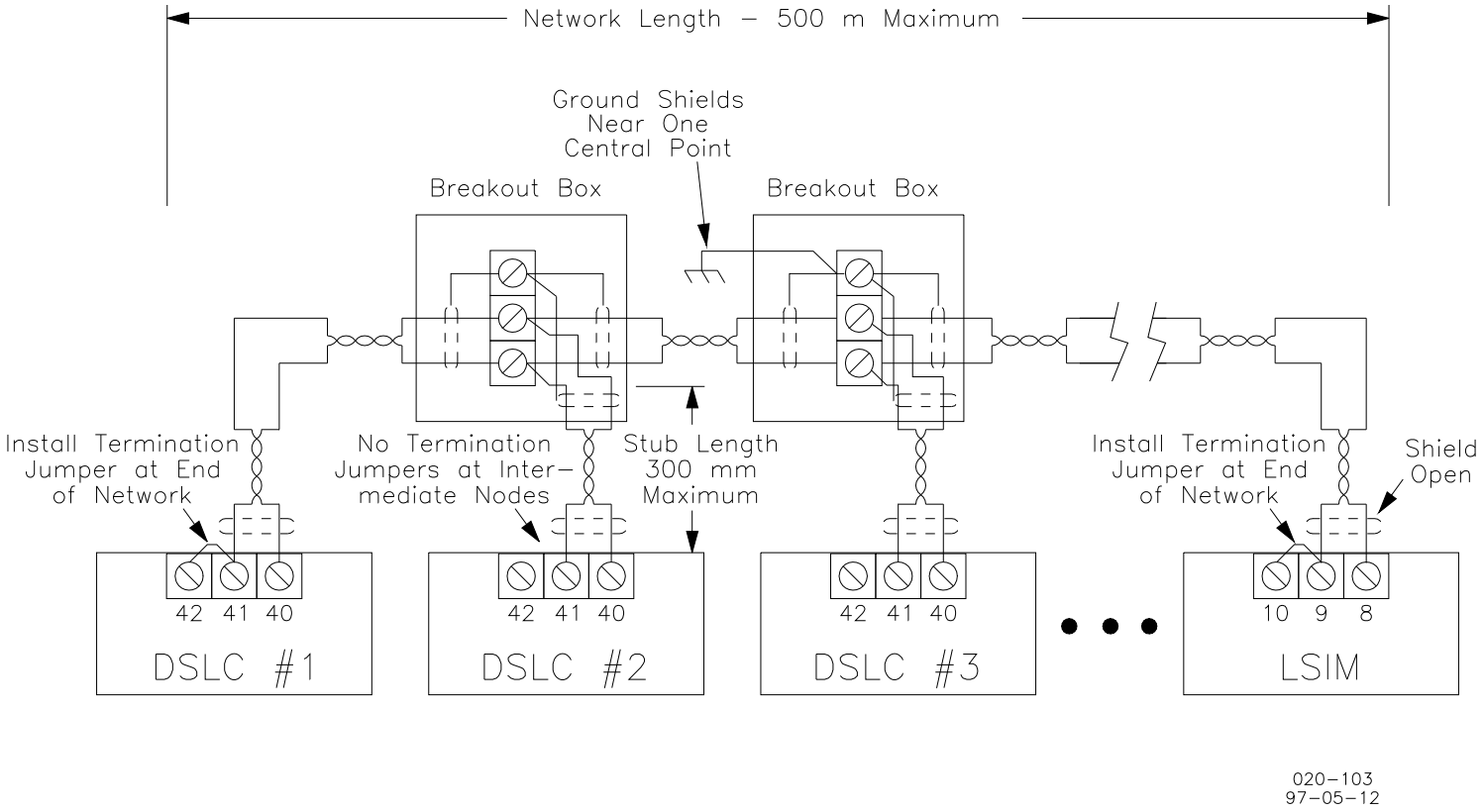


Figure 3-1. Typical LON Setup

Chapter 4.
Theory of Operation

Introduction

The 2301A Load Sharing and Speed Control and other analog load sharing controls use an analog bridge network to load share, while the DSLC controls load share over the digital Echelon network. An analog load sharing bridge network and an Echelon® network are both included in the LSIM. This gives the LSIM the capability of load sharing between DSLC controls and analog load sharing controls.

Function

The LSIM represents all of the generator sets controlled by DSLC controls as one analog control (such as the 2301A LSSC) on the analog load sharing lines. The LSIM also represents all of the analog controlled generator sets as a single DSLC control over the Echelon network.

The LSIM appears to the DSLC controls as a single DSLC unit. This “apparent” DSLC control has the capacity of all the engines operating using the analog load sharing lines (see Figure 4-1).

The LSIM appears to the analog load sharing controls as a load sharing unit with the capacity of all the engines operating using DSLC controls (see Figure 4-2).

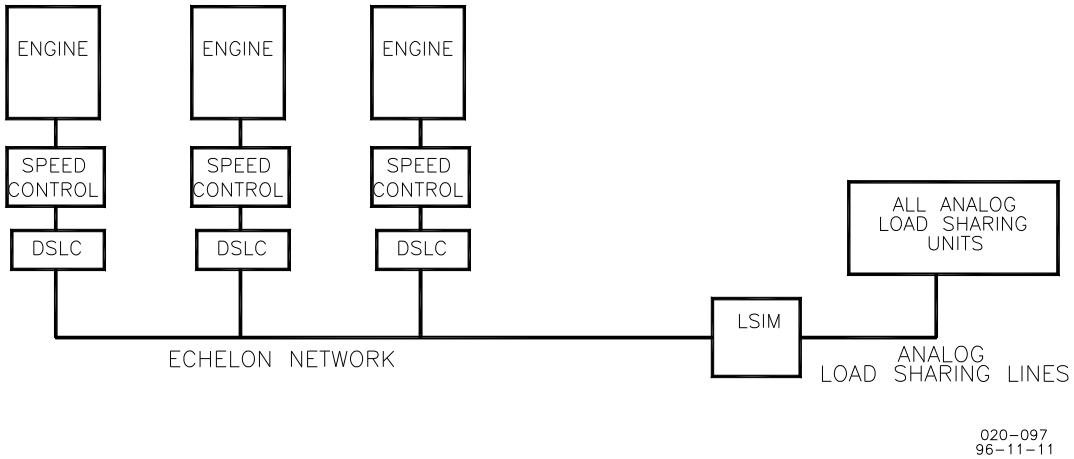


Figure 4-1. How the DSLC Controls See the LSIM
(all of the analog load sharing units appear as a single DSLC unit)

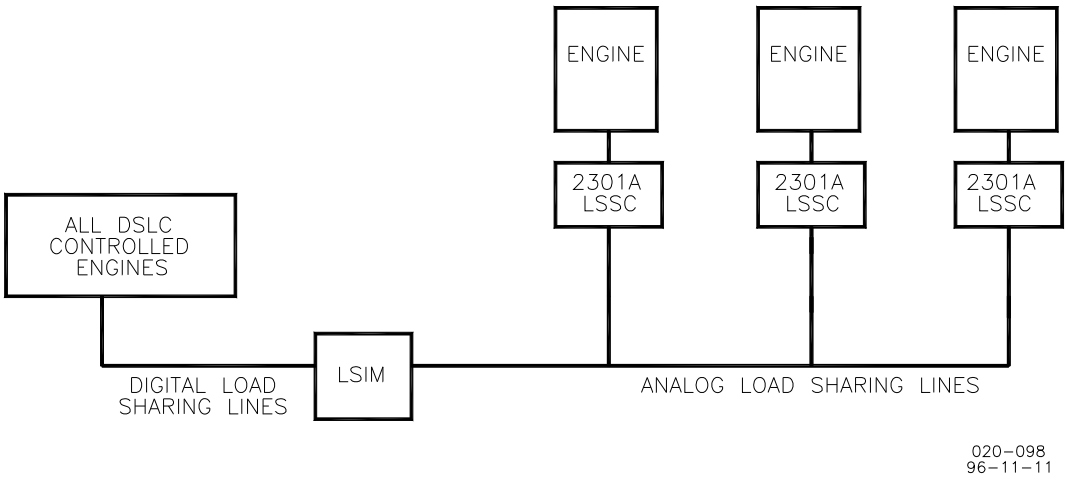


Figure 4-2. How the Analog Controls See the LSIM
(all of the DSLC-controlled engines appear as a single load sharing unit)

The LSIM emulates the DSLC system load as a single analog load sharing bridge, while emulating the analog system load as a single DSLC control (see Figure 4-1). The LSIM senses the load from the analog load sharing lines, and sends that load value out over the Echelon network to be averaged into the DSLC system load. The DSLC system load is averaged into the analog load sharing lines of the bridge network (see Figure 4-3).

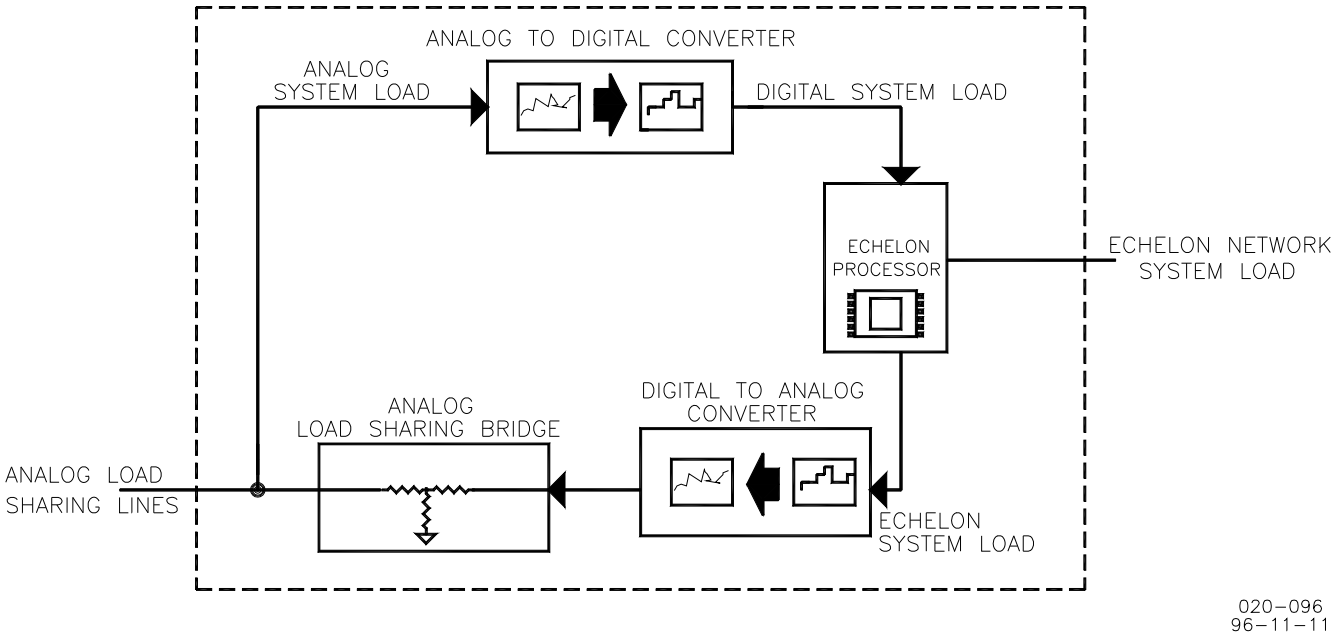


Figure 4-3. Block Diagram of the LSIM

The LSIM will not put negative voltage on the load sharing bridge if the DSLC system load is negative. The LSIM's voltage on the load sharing bridge will go as low as zero volts, but no lower. Likewise, the LSIM will not sense voltages on the load sharing lines lower than zero volts.

If the deadbus closure option of the DSLC control is used, it should be the ONLY dead bus closing logic in the system. The LSIM will check to make sure that the voltage on the load sharing lines is less than 30 mV before granting the DSLC controls deadbus closing permission. If the DSLC controls have trouble with deadbus closure, then there may be more than 30 mV on the load sharing line input to the LSIM.

Limitations

Normally when DSLC controls are used, an MSLC can be used to synchronize all of the DSLC-controlled engines to a parallel or utility bus. When the LSIM is included in a system with both DSLC controls and analog load sharing controls, an MSLC cannot be used. MSLC synchronization is not possible because the LSIM has no functional way of making the analog load sharing controls synchronize their generators to a parallel bus. For those locations which require synchronization to a parallel or utility bus, the previous synchronization method (before the retrofitting process) should be used. For example, if the DSLC controls were replacing 2301A LSSC controls, then the DSLC control would use the 2301A as the engine speed control. Some other synchronizing controls (like the Woodward SPM-A) would still be used via the 2301As on all engines (see Figure 4-4). When all of the controls have been replaced with DSLC controls, an MSLC can then be used to synchronize the system to a parallel or utility bus.

Also, in systems using the LSIM and a mixture of analog controls and DSLC controls, the voltage drop, cross-current compensation, and VAR/PF control must be implemented by controls other than the DSLC control. The DSLC system requires that all units in the system communicate PF information over the LON for proper power factor sharing. In a system with DSLC controls and analog controls using the LSIM, this cannot occur. Disable the VAR/PF control mode in menu 4, item 1 of the DSLC set points until the entire system is converted to DSLC/MSLC controls.

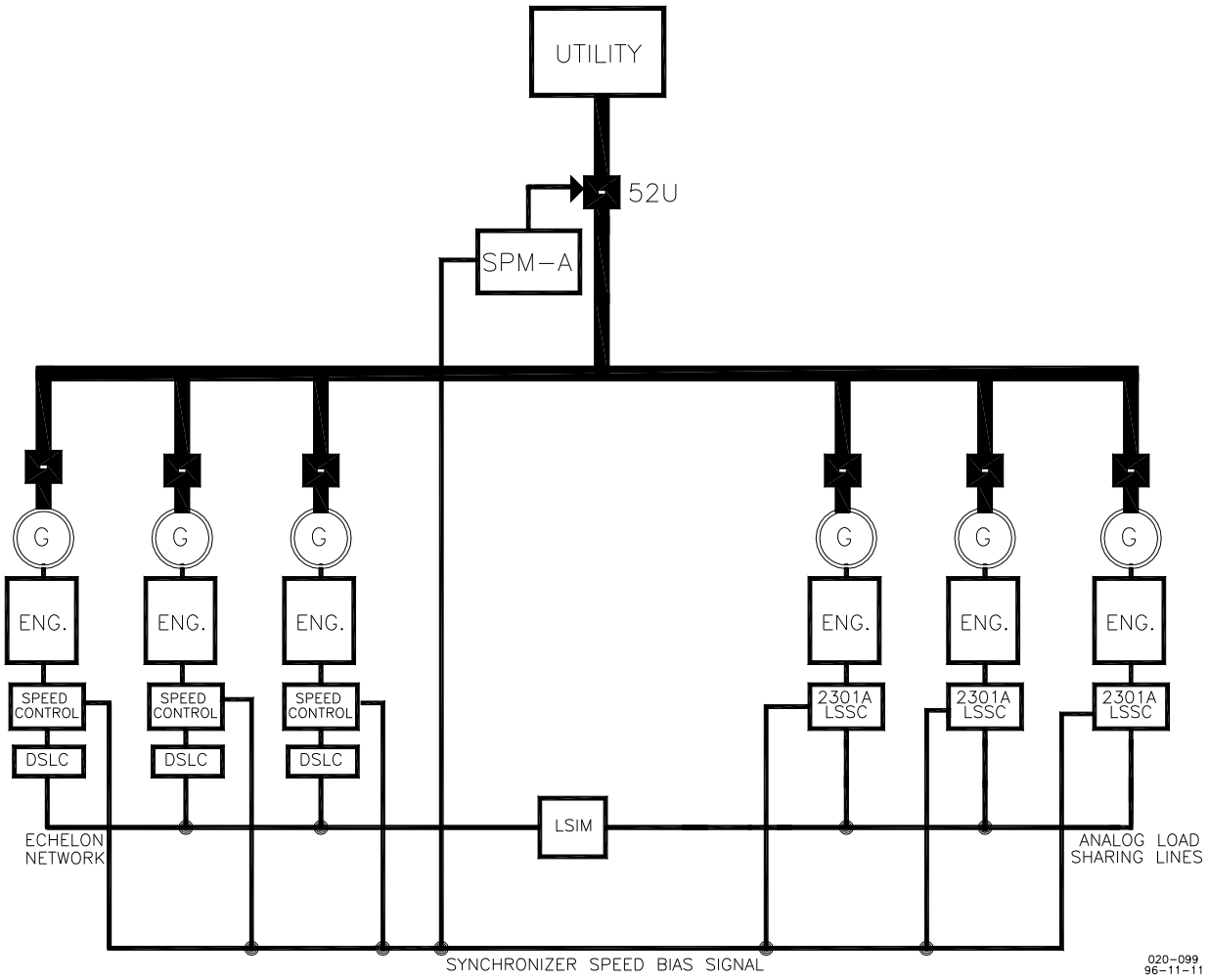


Figure 4-4. Example of Possible Existing Synchronization Method Using the SPM Inputs to the 2301A LSSCs

Chapter 5.
Troubleshooting

Symptom	Possible Cause	Solution
No load sharing between LSIM units	Power supply	Measure voltage on terminals 1(–) and 2(+) of the LSIM. Should be 18–32 Vdc.
	Unit address	On any DSLC control in the system, check menu 0, item 3 “Active DSLCs”: This number should be one greater than the actual number of DSLC controls in the system. This indicates the LSIM is being recognized by the DSLC controls. If this number is NOT equal to the number of DSLC controls +1, check the “Network Address” in menu 5 of each DSLC control. Make sure each DSLC “Network Address” is a unique value, and not set for 15 which is the value the LSIM uses as its address on the network.

Symptom	Possible Cause	Solution
DSLC-equipped units drop frequency as load is increased and analog load sharing units are off line (gen breakers open)	Resistance across analog load sharing lines causing droop effect in DSLC controls	With the LSIM load sharing lines (terminals 5 and 6) disconnected, and analog load sharing units off line, measure the resistance across the load sharing lines to the analog controls. If this resistance is less than 100 kΩ, a droop type effect will be seen on the DSLC controls as they increase load. Locate the source of the resistance on the analog load sharing lines by disconnecting the load sharing lines at each unit, one at a time, until the resistance rises above 100 kΩ. In some cases, such as those using older load sharing controls like the EGA and 2301 modular controls, an isolation relay must be installed on the load sharing lines. This relay is wired normally open, and energizes (closes) whenever that generator breaker closes. 2301A LSSCs, and Generator Load Sensors do not require this isolation relay (this relay is located on board the 2301A and Generator Load Sensor and is activated by the CB Aux input).
	DSLC controls not receiving proper bus PT input	If the DSLC controls in the system are not sensing the true bus condition through the bus PT input on terminals 3 or 4 and 5, they may be communicating dead bus information to the LSIM rather than load sharing information. This problem will occur if the bus is “live”, but sensed as “dead” by the DSLC control(s) due to improper wiring or a failed PT. Measure the voltage of the bus PT input to the DSLC control at terminals 3 or 4 and 5, and check menu 7, “Bus Voltage” to confirm proper bus PT sensing input voltage and calibration at the DSLC control(s).
There is an imbalance in load sharing between analog and digital load sharing units	Improper load gain adjustment on analog load sharing units	Set Load Gain voltage for 6.0 Vdc full load on each analog load sharing unit before connecting to the load sharing system with the LSIM.

Chapter 6.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
Control/Governor #1	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #2	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #3	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

LSIM Control Specifications

Woodward Part Number	8239-082
Operating Temperature Range	–40 to +70 °C (–40 to +158 °F)
Power Supply	18–32 Vdc
Power Consumption	5 W typical at 25 °C
Weight	approximately 1 kg (2 lb)

Controls up to eight Woodward analog load sharing controls (0–6 Vdc full-load span)

Controls up to 14 Woodward Digital Synchronizer and Load Controls (DSLC) on Echelon® network

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 02031.

WOODWARD

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Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

2012/11/Colorado