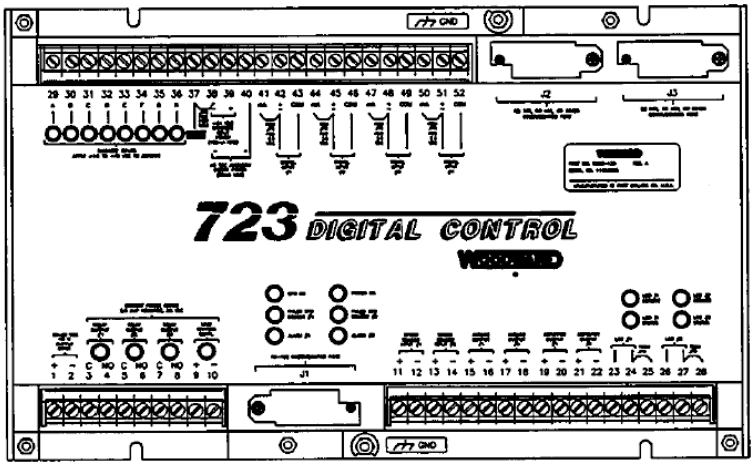
WOODWARD

Product Manual 02785
(Revision A)
Original Instructions



723 Digital Speed Control for Reciprocating Engines—Analog Load Share

9907-035, -036, -037, -038

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 *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

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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 *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, 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 Out-of-date translations are marked with ⚠.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.

Manual 02785

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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

This manual describes the Woodward 723 Digital Speed Control, models 9907-035 (low voltage), 9907-036 (high voltage), 9907-037 (low voltage with torsional filter), and 9907-038 (high voltage with torsional filter).

Declaration of Incorporation

In accordance with the EMC Directive 89/336/EEC and its amendments, this controlling device, manufactured by the Woodward Governor Company, is applied solely as a component to be incorporated into an engine prime mover system. Woodward declares that this controlling device complies with the requirements of EN50081-2 and EN50082-2 when put into service per the installation and operating instructions outlined in the product manual.

NOTICE: This controlling device is intended to be put into service only upon incorporation into an engine prime mover system that itself has met the requirements of the above Directive and bears the CE mark.

Application

The 723 Digital Speed Control controls the speed and load of reciprocating engines in generator set service, including those with flexible couplings (see Figure 1-1). The control includes inputs for two magnetic pickups (MPUs) or proximity switches for monitoring flexible coupling torsionals, an input for a remote speed or load setting, an input for output fuel limiting, an internal speed reference for local control of speed, and an input for a KW load sensor and load sharing connections for load sharing applications.

The two LON channels can be used to support Woodward LonTalk® input/output nodes for monitoring functions.

The two serial channels can interface to a Modbus®* master device such as a PC operator interface to monitor the control and engine parameters. This includes devices on the LON channels.

*—Modbus is a trademark of Schneider Automation Inc.

The 723 control system includes:

- a 723 Digital Speed Control
- an external power source
- one or two speed-sensing devices (as required)
- a proportional actuator to position the fuel rack
- a terminal for adjusting control parameters
- an optional KW load sensing device
- an optional manifold air pressure transducer for fuel limiting

The 723 control (Figure 1-2) consists of a single printed circuit board in a sheet-metal chassis. Connections are via three terminal strips and three 9-pin subminiature D connectors.

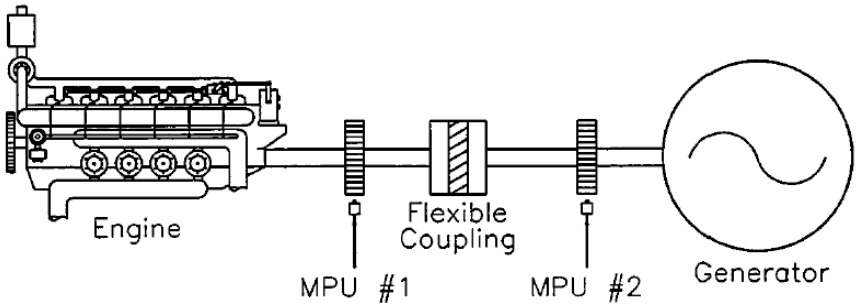

Figure 1-1. Flexible Coupled Generator Set

Control Options

The 723 control requires the following power supply input voltages, with 40 watts as the nominal power consumption at rated voltage:

- low voltage—18–40 Vdc (24 or 32 Vdc nominal)
- high voltage—90–150 Vdc (125 Vdc nominal)

Discrete input voltages provide on/off command signals to the electronic control, such as Raise Speed/Load, Lower Speed/Load, etc. Each discrete input requires 10 milliamps at its 24 Vdc nominal voltage rating (for 24 volt switching logic).

Other control options are:

- proximity switch input for speed signal frequencies below 100 Hz
- tandem actuator outputs

Magnetic pickup versions are limited to operating speeds providing 400 Hz magnetic pickup frequency minimum.

723 Digital Speed Control Accessories

Hand Held Programmer (Figure 1-3) is used for adjusting the 723 control. It plugs into serial port J1 of the control.

SPM-A Synchronizer, for synchronizing the generator phase to that of the power bus. The synchronizer generates a close generator breaker signal to parallel the generator with the power bus.

Real Power Sensor or KW transducer, for load sharing or droop-parallel generator applications.

LonTalk® nodes for additional input/output control capability.

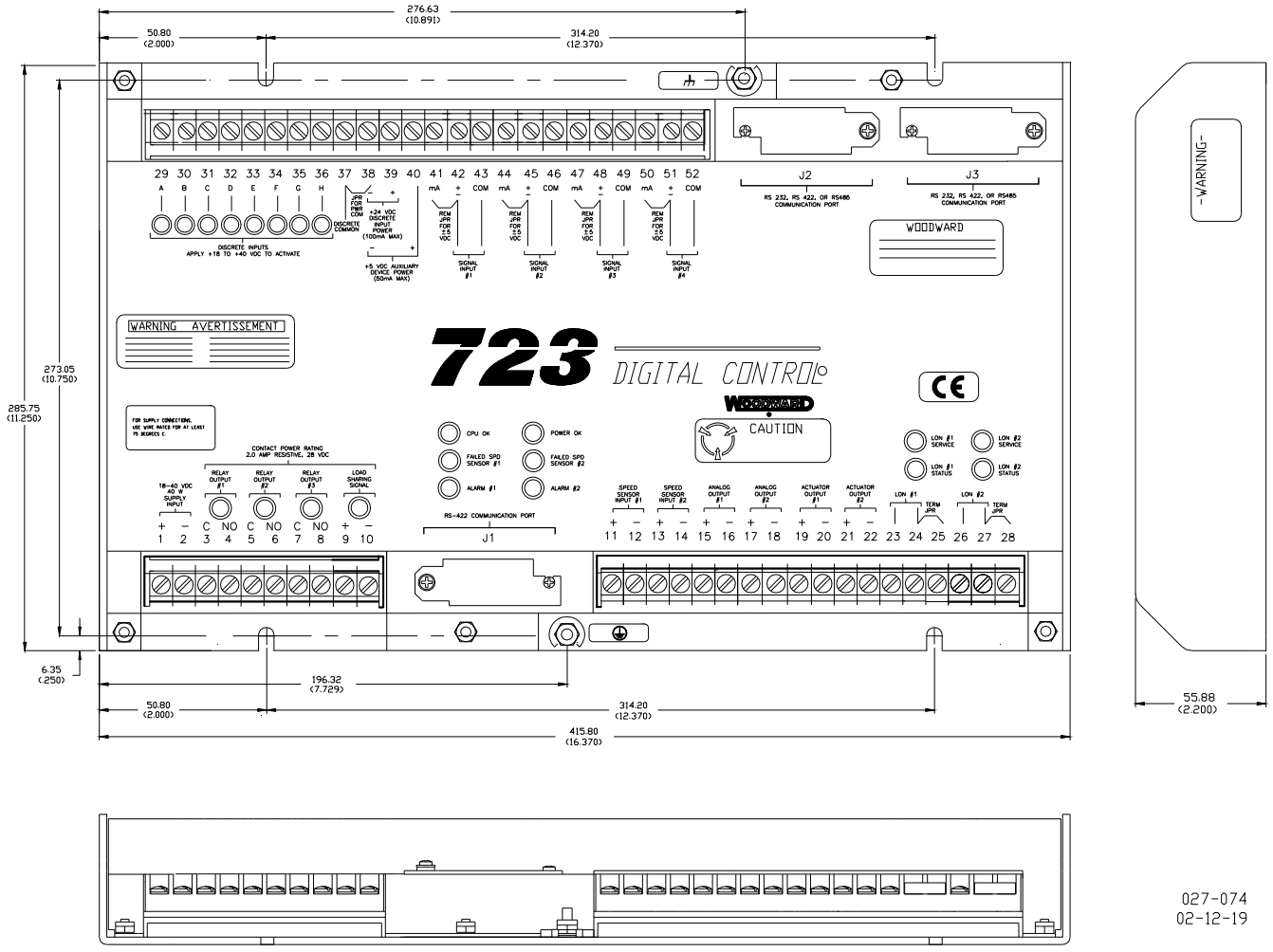

Figure 1-2. 723 Digital Speed Control

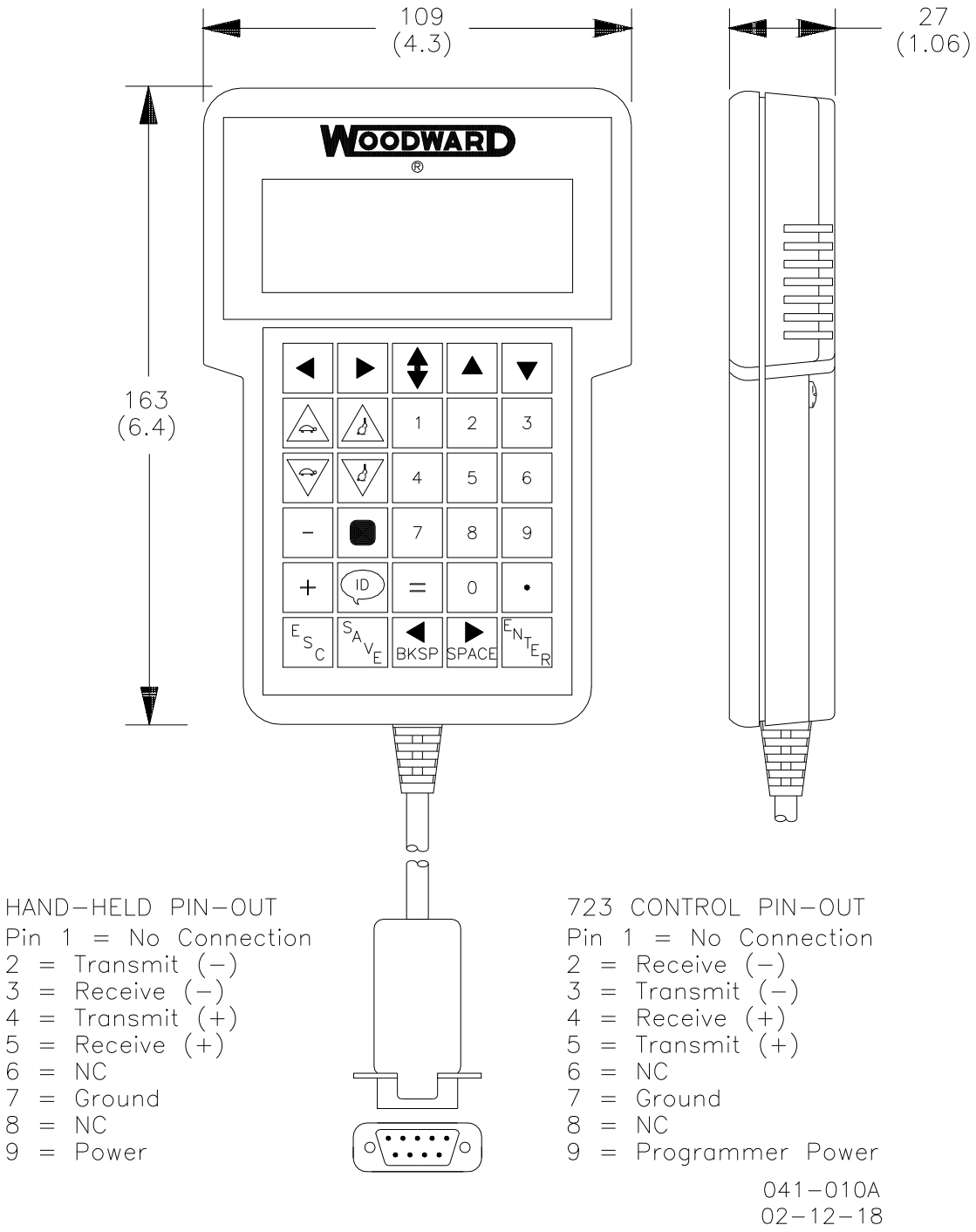

Figure 1-3. Hand Held Programmer

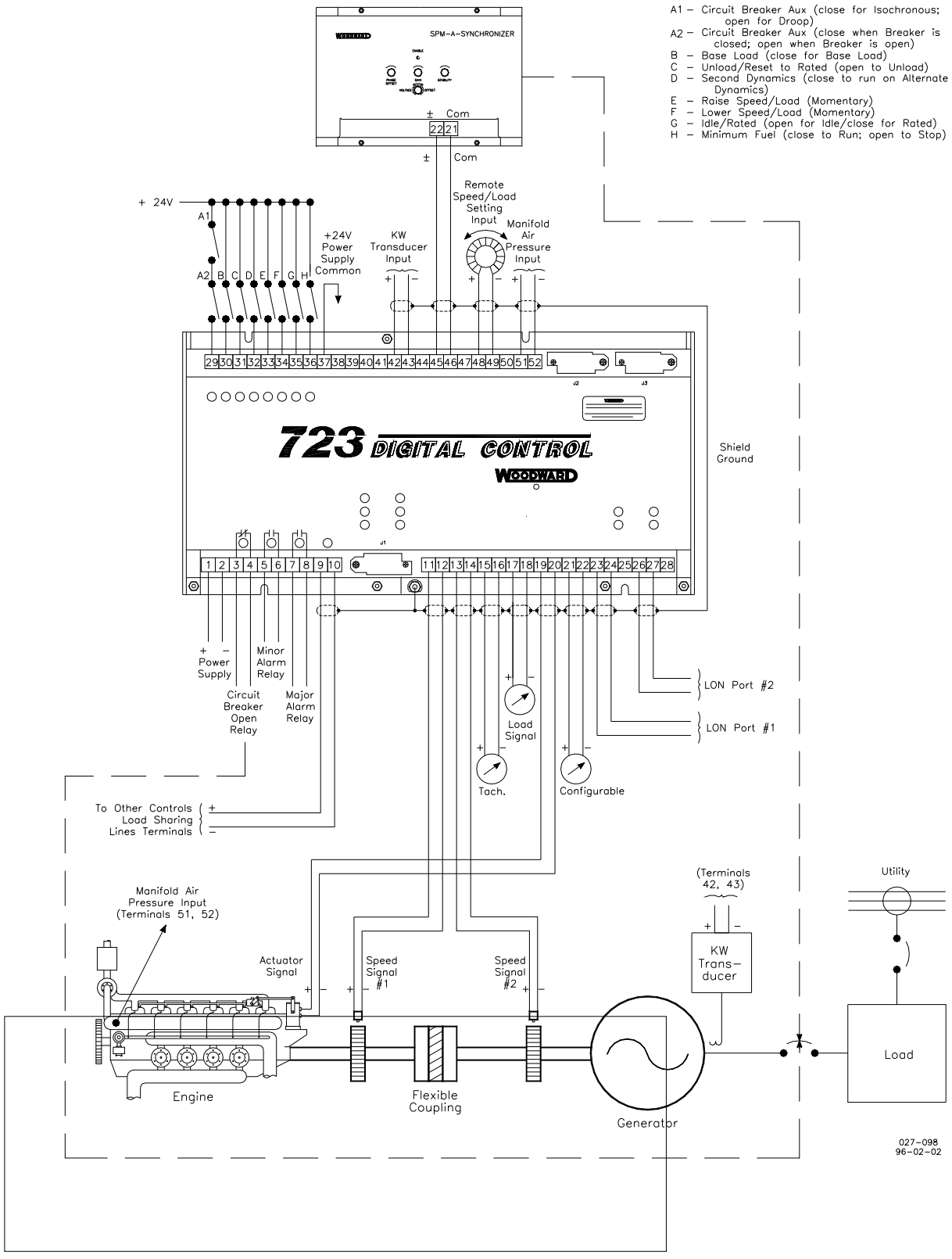

Figure 1-4. Typical 723 Connections

NOTES:

1. SHIELDED WIRES ARE TWISTED PAIRS, WITH SHIELD GROUNDED AT ONE END ONLY. WHEN MOUNTING CONTROL TO BULKHEAD, USE THE GROUNDING STUD AND HARDWARE SUPPLIED WITH THE CHASSIS TO ENSURE PROPER GROUNDING.

2. SHIELDS MUST NOT BE GROUNDED AT ANY EXTERNAL POINT UNLESS OTHERWISE NOTED.

3. ALL SHIELDS MUST BE CARRIED CONTINUOUSLY TROUGH ALL TERMINAL BLOCKS AND MUST NOT BE TIED TO OTHER SHIELDS EXCEPT AT THE COMMON GROUND POINT. TIE ALL SHIELDS TOGETHER AT THE GROUND STUD LOCATED NEAR CONNECTOR J1.

4. REMOVE JUMPER FOR VOLTAGE INPUT.

5. REMOVE JUMPER IF USING EXTERNAL DISCRETE INPUT POWER.

6. DISCRETE INPUTS ARE ISOLATED FROM OTHER CIRCUITS AND INTENDED TO BE POWERED BY TB1-39 (+24 VDC) LEAVING THE JUMPER IN PLACE. INPUT CURRENT IS NOMINALLY 10 MILLIAMPERES PER INPUT INTO 2210 OHM.

7. UNLESS OTHERWISE SPECIFIED:
   - A. RELAYS SHOWN DE-ENERGIZED
   - B. RELAYS ENERGIZE FOR FUNCTION
   - C. RELAY CONTACT RATINGS FOR MINIMUM 100,000 OPERATIONS:

   RESISTIVE- 2.0 AMPERES AT 28 VDC
   0.1 AMPERES AT 115 VAC 50 TO 400 Hz

   INDUCTIVE- 0.75 AMPERES AT 28 VDC 0.2 HENRY
   0.1 AMPERES AT 28 VDC LAMP

8. ANALOG OUTPUT SIGNALS TO OTHER SYSTEMS MUST BE ISOLATED FROM GROUND EITHER BY DESIGN OR EMPLOYMENT OF ISOLATION AMPLIFIERS.

9. ANALOG INPUT SIGNALS FROM OTHER SYSTEMS MUST BE ISOLATED FROM GROUND EITHER BY DESIGN OR EMPLOYMENT OF ISOLATON AMPLIFIERS.

10. FACTORY SET FOR MPU INPUT.

11. FACTORY SET FOR 20-160 mA OUTPUT.

12. FACTORY SET FOR 4-20 mA OUTPUT.

13. INTERNAL POWER SUPPLY PROVIDES DC ISOLATION BETWEEN THE POWER SOURCE AND ALL OTHER INPUTS AND OUTPUTS.

14. COMMUNICATION PORT J1 CAN ONLY BE USED WITH THE WOODWARD ST2000 HAND HELD PROGRAMMER.

15. COMMUNICATION PORT J2 OR J3 CAN BE CONFIGURED AS A RS-232, RS-422 OR RS-485 SERIAL INTERFACE. PORT CONFIGURATION CAN BE DONE IN THE APPLICATION SOFTWARE ONLY. FOR THE PIN ASSIGNMENT OF J2 AND J3 SEE HARDWARE MANUAL 02758.

16. THIS ANALOG OUTPUT MAY CONNECT TO A METERING/CONTROLLING DEVICE. THE SHIELD SHOULD BE CONTINUOUS BETWEEN ALL CONNECTED DEVICES WITH A SINGLE SHIELD TERMINATION POINT TO GROUND.

17. USE TWISTED PAIR SHIELDED WIRES ONLY.

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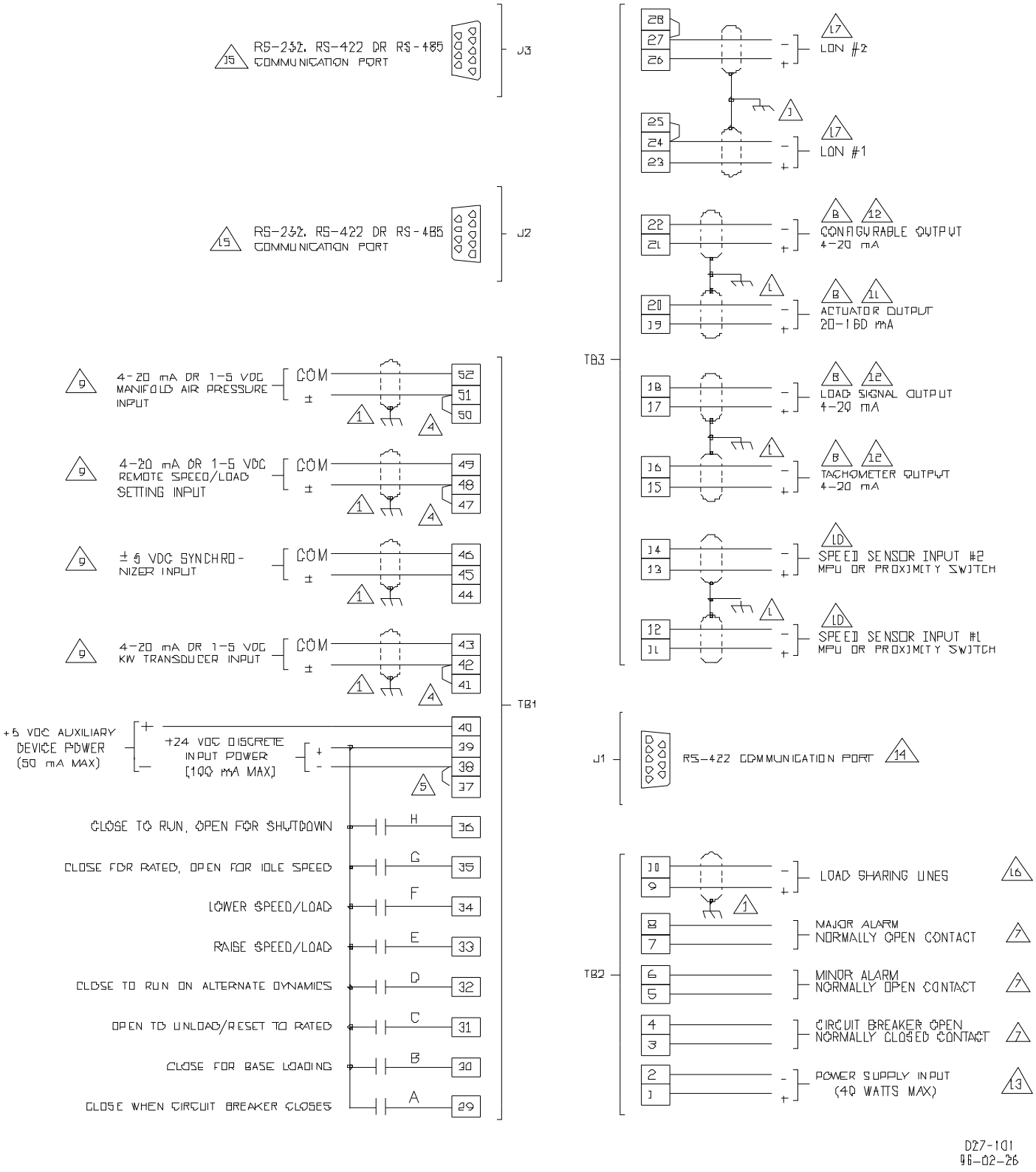


Figure 1-5. Plant Wiring Diagram

Chapter 2. Installation

Introduction

This chapter contains general installation instructions for the 723 control. Power requirements, environmental precautions, and location considerations are included to help you determine the best location for the control. Additional information includes unpacking instructions, electrical connections, and installation checkout procedures.

Unpacking

Before handling the control, read page iii, Electrostatic Discharge Awareness. Be careful when unpacking the electronic control. Check the control for signs of damage such as bent panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.

Power Requirements

The high-voltage versions of the 723 Digital Speed Control require a voltage source of 90 to 150 Vdc. The low-voltage versions require a voltage source of 18 to 40 Vdc.

NOTICE **To prevent damage to the control, do not exceed the input voltage range.**

IMPORTANT **If a battery is used for operating power, an alternator or other battery-charging device is necessary to maintain a stable supply voltage.**

NOTICE **To prevent damage to the control, make sure that the alternator or other battery-charging device is turned off or disconnected before disconnecting the battery from the control.**

Location Considerations

Consider these requirements when selecting the mounting location:

- adequate ventilation for cooling
- space for servicing and repair
- protection from direct exposure to water or to a condensation-prone environment
- protection from high-voltage or high-current devices, or devices which produce electromagnetic interference
- avoidance of vibration
- selection of a location that will provide an operating temperature range of –40 to +70 °C (–40 to +158 °F)

The control must NOT be mounted on the engine.

Internal Jumpers

The 723 control has ten, two-position internal jumpers (JPR1 through JPR20) located on the top of the printed circuit board. If you need to change any jumper to match your control needs, be sure to read page iii, Electrostatic Discharge Awareness, before proceeding.

With the power off, remove the control cover. With your fingers or a small pair of tweezers, carefully remove the appropriate jumper and replace it securely over the proper two connectors (see Figure 2-1).

Only the following jumper options are available for these 723 controls:

*	JPR13 & JPR2	actuator output #1	0–200 mA, single
	JPR14 & JPR2	actuator output #1	0-160 mA, tandem
	JPR5 & JPR17	speed sensor #1	proximity switch
*	JPR6 & JPR18	speed sensor #1	magnetic pickup
	JPR7 & JPR20	speed sensor #2	proximity switch
*	JPR8 & JPR19	speed sensor #2	magnetic pickup

*—default jumper settings

Electrical Connections

External wiring connections and shielding requirements for a typical 723 control installation are shown in Figure 1-4. The plant wiring connections (Figure 1-5) are explained in the rest of this chapter.

Shielded Wiring

All shielded cable must be twisted conductor pairs. Do not attempt to tin the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields to the nearest chassis ground. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor. DO NOT run shielded signal wires along with other wires carrying large currents. See Woodward application note 50532, Interference Control in Electronic Governing Systems for more information.

Where shielded cable is required, cut the cable to the desired length and prepare the cable as instructed below.

1. Strip outer insulation from BOTH ENDS, exposing the braided or spiral wrapped shield. DO NOT CUT THE SHIELD.

2. Using a sharp, pointed tool, carefully spread the strands of the shield.

3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.

4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.

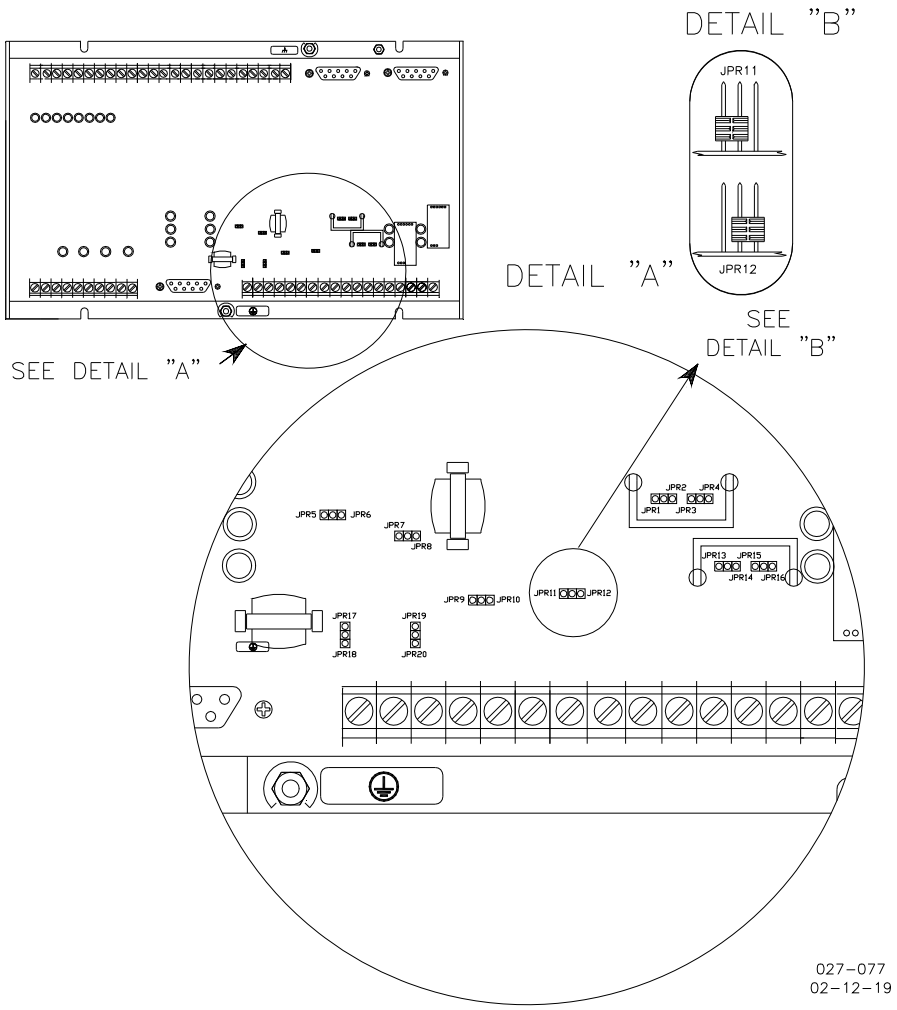


Figure 2-1. 723 Control Internal Jumpers

Installations with severe electromagnetic interference (EMI) may require additional shielding precautions. Contact Woodward for more information.

Power Supply (Terminals 1/2)

Power supply output must be low impedance (for example, directly from batteries). DO NOT power the control from high-voltage sources with resistors and zener diodes in series with the control power input. The 723 control contains a switching power supply which requires a current surge to start properly.

NOTICE

To prevent damage to the control, do not power a low-voltage control from high-voltage sources, and do not power any control from high-voltage sources with resistors and zener diodes in series with the power input.

Run the power leads directly from the power source to the control. DO NOT POWER OTHER DEVICES WITH LEADS COMMON TO THE CONTROL. Avoid long wire lengths. Connect the positive (line) to terminal 1 and negative (common) to terminal 2. If the power source is a battery, be sure the system includes an alternator or other battery-charging device.

If possible, do NOT turn off control power as part of a normal shutdown procedure. Use the Minimum Fuel (Run/Stop) discrete input (terminal 36) for normal shutdown. Leave the control powered except for service of the system and extended periods of disuse.

NOTICE

Do NOT apply power to the control at this time. Applying power may damage the control.

NOTICE

To prevent damage to the engine, apply power to the 723 control at least 25 seconds prior to starting the engine. The control must have time to do its power up diagnostics and become operational. Do not start the engine unless the green POWER OK and CPU OK indicators on the 723 control cover come on, because test failure turns off the output of the control.

Relay Outputs (Terminals 3/4, 5/6, 7/8)

(See plant wiring notes for contact ratings.)

Connect the Circuit Breaker Open relay, if used, to terminals 3/4 (normally closed). The contacts open momentarily to open the generator breaker.

Connect the Minor Alarm relay, if used, to terminal 5/6 (normally open). The contacts close to energize the relay (minor alarm condition).

Connect the Major Alarm relay, if used, to terminals 7/8 (normally open). The contacts close to energize the relay (major alarm condition).

Load Sharing Lines (Terminals 9/10)

Connect the lines of the system load sharing device or another 723's load sharing lines to terminals 9(+) and 10(–). Use shielded twisted-pair wires.

Speed Signal Inputs (Terminals 11/12 and 13/14)

Connect a magnetic pick-up (MPU) or proximity switch to terminals 11 and 12. You may connect a second MPU/proximity switch to terminals 13 and 14. If you have a flexible coupling between the engine and generator set, you must connect the first MPU (terminals 11/12) to detect engine speed, and the second MPU (terminals 13/14) to detect generator set speed. The MPUs must be on shafts rotating at exactly the same speed (not a camshaft, nor on each side of a gearbox, etc). Use shielded wire for all speed sensor connections. Connect the shield to the chassis. Make sure the shield has continuity the entire distance to the speed sensor, and make sure the shield is insulated from all other conducting surfaces.

⚠WARNING

The number of gear teeth is used by the control to convert pulses from the speed sensing device to engine rpm. To prevent possible serious injury from an overspeeding engine, make sure the control is properly programmed to convert the gear-tooth count into engine rpm. Improper conversion could cause engine overspeed.

NOTICE

To prevent possible damage to the control or poor control performance resulting from ground loop problems, we recommend using current-loop isolators if the 723 control's analog inputs and outputs must both be used with non-isolated devices. A number of manufacturers offer 20 mA loop isolators. Consult Woodward for further information.

Tachometer Output (Terminals 15/16)

The tachometer readout wires connect to terminals 15(+) and 16(–). Use shielded twisted-pair wires. For an electrically isolated input device such as a 4 to 20 mA input analog meter, the shield should be grounded at the control end of the cable. For input to other devices, use the recommendation of the device manufacturer.

Generator Load Output (Terminals 17/18)

The generator load output wires connect to terminals 17(+) and 18(–). Use a shielded twisted-pair cable. For an electrically isolated input device such as a 4 to 20 mA input analog meter, the shield should be grounded at the control end of the cable. For input to other devices, use the recommendation of the device manufacturer.

Actuator Output (Terminals 19/20)

The actuator wires connect to terminals 19(+) and 20(–). Use shielded wires with the shield connected to chassis at the control.

Configurable Output (Terminals 21/22)

The configurable output wires connect to terminals 21(+) and 22(–). This output is selectable for indication of either actuator output, torsional level (on versions with torsional filter), remote speed input setting, or remote load input setting. Use shielded twisted-pair wires. For an electrically isolated input device such as a 4 to 20 mA input analog meter, the shield should be grounded at the control end of the cable. For input to other devices, use the recommendation of the device manufacturer.

Discrete Inputs (Terminals 29-36)

Discrete inputs are the switch input commands to the 723 control. In low voltage systems, or other systems where nominal 24 Vdc is available, the discrete inputs should be powered by this external voltage.

If you are using the control-supplied discrete input power, which is recommended only for high voltage systems where 24 Vdc is not available, jumper terminal 37 to terminal 38. This connects the control's common to the discrete input common. Terminal 39 then supplies power to the discrete inputs. Since the discrete input voltage is not isolated from other control circuits, use only isolated contacts for the discrete circuits. DO NOT POWER ANY OTHER DEVICES WITH THE DISCRETE INPUT VOLTAGE SOURCE.

If you are supplying the discrete input voltage (24 Vdc), connect the voltage source negative (–) to terminal 37. Then run the voltage source positive (+) to the appropriate switch or relay contact and then to the corresponding discrete input.

Minimum Fuel (Run/Stop) Contact (Input H; Terminal 36)

The Minimum Fuel (Run/Stop) contact is the preferred means for a normal shutdown of the engine. It connects to terminal 36 (discrete input H) of the control. The control will not operate without voltage applied to terminal 36. When the contact is closed, the voltage applied to terminal 36 allows the control to move the actuator to any position required for operating conditions.

⚠WARNING

The Minimum Fuel (Run/Stop) contact is not intended for use in any emergency stop sequence. To prevent possible serious injury from an overspeeding engine, do NOT use the Minimum Fuel contact as part of any emergency stop sequence.

Idle/Rated Contact (Input G; Terminal 35)

The Idle/Rated contact (open for idle, closed for rated) connects to terminal 35 (discrete input G). When the Idle/Rated contact is closed, the control ramps engine speed to the rated speed set point (or the speed specified by the Remote Speed/Load Setting input). When the Idle/Rated contact is opened, the control ramps engine speed to the idle speed setting.

The idle set point should not be set above the rated set point.

Lower Speed/Load Contact (Input F; Terminal 34)

The Lower Speed/Load contact connects to terminal 34 (discrete input F). When the 723 is in Speed Control Mode (terminal 29 open) and the Lower Speed/Load contact is closed, the control lowers speed at a rate determined by the Lower Speed Rate set point. When the contact is open, speed remains at its current value. Closing the Lower Speed/Load contact with the 723 in Speed Control Mode will cancel the ramps started by the Idle/Rated contact.

When the 723 is in Load Control Mode (terminal 29 closed) and the Lower Speed/Load contact is closed, the control lowers the load at a rate determined by the Lower Load Rate set point. When the contact is open, load remains at its current value. Closing the Lower Speed/Load contact with the 723 in Load Control Mode will cancel the ramps started by the Unload/Reset to Rated and Base Load contacts.

The Lower Speed/Load contact input is disabled when the remote speed/load setting mode is selected by closing both the Lower Speed/Load and Raise Speed/Load contacts.

Raise Speed/Load Contact (Input E; Terminal 33)

The Raise Speed/Load contact connects to terminal 33 (discrete input E). When the 723 is in Speed Control Mode (terminal 29 open) and the Raise Speed/Load contact is closed, the control raises speed at a rate determined by the Raise Speed Rate set point. When the contact is open, speed remains at its current value. Closing the Raise Speed/Load contact with the 723 in Speed Control Mode will cancel the ramps started by the Idle/Rated contact.

When the 723 is in Load Control Mode (terminal 29 closed) and the Raise Speed/Load contact is closed, the control raises the load at a rate determined by the Raise Load Rate set point. When the contact is open, load remains at its current value. Closing the Raise Speed/Load contact with the 723 in Load Control Mode will cancel the ramps started by the Unload/Reset to Rated and Base Load contacts.

The Raise Speed/Load contact input is disabled when the remote speed setting mode is selected by closing both the Lower Speed/Load and Raise Speed/Load contacts.

Second Dynamics (Input D; Terminal 32)

The Second Dynamics contact is connected to terminal 32 (discrete input D). When the contact is open, the control uses the dynamics from the First Dynamics service menu. When the contact is closed, the control uses the dynamics from the Second Dynamics service menu.

Close to Load/Open to Unload/Reset to Rated Contact (Input C; Terminal 31)

The Close to Load/Open to Unload/Reset to Rated contact connects to terminal 31 (discrete input C). When the 723 control is in Load Control Mode (terminal 29 closed) and this contact is opened, the load ramps to the Unload Trip Level at the rate determined by the Unload Ramp Time. When the Unload Trip Level is achieved, the Breaker Open relay will open until the Circuit Breaker Aux contact opens.

When the 723 is in Speed Control Mode (terminal 29 open) and the Close to Load/Open to Unload/Reset to Rated contact is opened momentarily, the speed will ramp to the rated speed set point at the rate determined by the Raise Speed Rate set point or the Lower Speed Rate set point.

Base Load Contact (Input B; Terminal 30)

The Base Load contact connects to terminal 30 (discrete input B). When the Base Load contact is closed (and the Circuit Breaker Aux and Close to Load/Open to Unload/Reset to Rated contacts are also closed), the control ramps the load at the load ramp rate (or unload ramp rate) to the Base Load Reference set point, and holds it there.

Circuit Breaker Aux Contact (Input A; Terminal 29)

The Circuit Breaker Aux contact connects to terminal 29 (discrete input A). This contact changes the control state between speed control and load control.

When the contact is open, the control runs in droop (but note that 0 droop = isochronous), and the load control functions are disabled. When the contact is closed, the control runs isochronously, and enables the load control functions.

See the table below for a complete comparison of the control states based on the status of the Circuit Breaker Aux contact.

Effects of Circuit Breaker Aux Contact Status

	CB Aux contact open	CB Aux contact closed
Load Control Function	disabled	enabled
Speed Reference	N/A	rated set point
Speed Control Mode	droop	isochronous
Remote Reference Input	speed reference	load reference
Raise Speed/Load Contact	raise speed	raise load
Lower Speed/Load Contact	lower speed	lower load
Unload/Reset to Rated Contact (momentary)	reset to rated	unload load
Remote Enabled *	remote speed ref. enabled	rem. load ref. enabled
Idle/Rated Contact	active	still active
Load Sharing Lines	open	closed
Breaker Open Contact	disabled	enabled

* — Raise and Lower contacts both closed

KW Transducer Input (Terminals 42/43)

Connect a 4 to 20 mA kilowatt transducer input to terminals 42(+) and 43(–) for the KW Transducer input. Use a shielded, twisted-pair cable. Make sure a jumper is installed between terminals 41 and 42 for the mA input. This input is not isolated from the other control inputs and outputs (except the power supply input and the discrete inputs). If any other analog input or output is used in a common ground system, an isolator must be installed. A number of manufacturers offer 20 mA loop isolators. Consult Woodward for further information.

SPM Synchronizer Input (Terminals 45/46)

Connect the low-impedance output from an SPM-A synchronizer across terminals 45(+) and 46(–).

Remote Speed/Load Setting Input (Terminals 48/49)

Connect a 4 to 20 mA current transmitter or 1 to 5 Vdc voltage transmitter to terminals 48(+) and 49(–) for the Remote Speed/Load Setting input. Use a shielded, twisted-pair cable. When using a 4 to 20 mA transmitter, you must install a jumper between terminals 47 and 48 to connect a 250 ohm burden resistor in the loop. This input is not isolated from the other control inputs and outputs (except the power supply input and the discrete inputs). If any other analog input or output is used in a common ground system, an isolator must be installed. A number of manufacturers offer 20 mA loop isolators. Consult Woodward for further information.

Manifold Air Pressure Input (Terminals 51/52)

Connect a 4 to 20 mA current transmitter or 1 to 5 Vdc voltage transmitter to terminals 51(+) and 52(–) for the Manifold Air Pressure Input (you can use turbo boost pressure, manifold pressure, or any other source that indicates engine load). Use a shielded, twisted-pair cable. When using a 4 to 20 mA transmitter, you must install a jumper between terminals 50 and 51 to connect a 250 ohm burden resistor in the loop. This input is not isolated from the other control inputs and outputs (except the power supply input and the discrete inputs). If any other analog input or output is used in a common ground system, an isolator must be installed. A number of manufacturers offer 20 mA loop isolators. Consult Woodward for further information.

Installation Checkout Procedure

With the installation complete as described in this chapter, do the following checkout procedure before beginning set point entry (Chapter 4) or initial start-up adjustments (Chapter 5).

1. Visual inspection
   A. Check the linkage between the actuator and fuel metering device for looseness or binding. Refer to the appropriate actuator manual, and Manual 25070, Electric Governor Installation Guide for additional information on linkage.

⚠WARNING **To prevent possible serious injury from an overspeeding engine, the actuator lever or stroke should be near but not at the minimum position when the fuel valve or fuel rack is at the minimum fuel delivery position.**

   B. Check for correct wiring in accordance with the plant wiring diagram, Figure 1-5.

   C. Check for broken terminals and loose terminal screws.

   D. Check the speed sensor(s) for visible damage. If the sensor is a magnetic pickup, check the clearance between the gear and the sensor, and adjust if necessary. Clearance should be between 0.25 and 1.25 mm (0.010 and 0.050 inch) at the closest point. Make sure the gear runout does not exceed the pickup gap.

2. Check for grounds

   Check for grounds by measuring the resistance from all control terminals to chassis. All terminals except terminals 2 and 37 should measure infinite resistance (the resistance of terminals 2 and 37 depends on whether a floating or grounded power source is used). If a resistance less than infinite is obtained, remove the connections from each terminal one at a time until the resistance is infinite. Check the line that was removed last to locate the fault.

Chapter 3.
Entering Control Set Points

Introduction

Because of the variety of installations, plus system and component tolerances, the 723 control must be tuned to each system for optimum performance.

This chapter contains information on how to enter control set points through the control's menu system using the Hand Held Programmer. See the next chapter for prestart-up and start-up settings and adjustments.

WARNING

An improperly calibrated control could cause an engine overspeed or other damage to the engine. To prevent possible serious injury from an overspeeding engine, read this entire procedure before starting the engine.

Hand Held Programmer and Menus

The Hand Held Programmer is a hand-held computer terminal that gets its power from the 723 control. The terminal connects to the RS-422 communication serial port on the control (terminal J1). To connect the terminal, slightly loosen the right-hand screw in the cover over J1 and rotate the cover clockwise to expose the 9-pin connector. Then firmly seat the connector on the terminal into J1.

The programmer does a power-up self-test whenever it is plugged into the control. When the self-test is complete, the screen will display two lines of information pertaining to the application. Press the “ID” key to display the part number and revision level of the software in the control. Refer to this number and revision level in any correspondence with Woodward (write this information in the Programming Checklist, Appendix A).

The programmer screen is a four-line, backlighted LCD display. The display permits you to look at two separate functions or menu items at the same time. Use the “Up/Down Arrow” key to toggle between the two displayed items. The BKSP and SPACE keys will scroll through the display to show the remainder of a prompt if it is longer than the display screen's 18 characters.

The 723 has two sets of menus—the Service menus and the Configure menus. The Service menus allow easy access and tuning while the engine is running. The Configure menus may be entered only if the I/O is shut down (the engine is stopped).

Configure Menus

To access the Configure menus, the engine must be shutdown. Press the . key. The display will show, 'To select configure, press enter'. Press the ENTER key and the display will show, 'To shutdown I/O, press enter'. Press the ENTER key and this will allow you into the Configure menus. Note: If the engine is running during this process, it will be shutdown due to shutting down the I/O of the control. To move between the menus use the “Left Arrow” and “Right Arrow” keys. To move through the set points within a menu, use the “Up Arrow” and “Down Arrow” keys. Once within a menu, to return to the menu header, press the ESC key.

To leave the Configure menus press the ESC key. The set points will be automatically saved when leaving Configure.

Service Menus

To access the Service menus press the “Down Arrow” key. To move between menus, and to move through set points within menus follow the instructions as for the Configure menus. Also to return to return to the menu header, or to leave Service, follow the Configure instructions.

Adjusting Set Points

To adjust a set point, use the “Turtle Up” or the “Rabbit Up” keys to increase the value, and the “Turtle Down” or “Rabbit Down” keys to decrease the value. The “Rabbit Up” and “Rabbit Down” keys will make the rate of change faster than the “Turtle Up” and “Turtle Down” keys. This is useful during initial setup where a value may need to be changed significantly. Where necessary, to select TRUE, use either the “Turtle Up” or the “Rabbit Up” keys, and to select FALSE, use the “Turtle Down” or “Rabbit Down” keys.

To obtain an exact value, press the = key. Key in the required figure and press ENTER.

IMPORTANT

This may only be done if the figure is within 10% of the existing value.

To save set points at any time, use the SAVE key. This will transfer all new set point values into the EEPROM memory. The EEPROM retains all set points when power is removed from the control.

NOTICE

To prevent possible damage to the engine resulting from improper control settings, make sure you save the set points before removing power from the control. Failure to save the set points before removing power from the control causes them to revert to the previously saved settings.

Hand Held Programmer Keys

The programmer keys do the following functions (see Figure 3-1):

(left arrow)	Moves backward through Configure or Service, one menu at a time.
(right arrow)	Advances through Configure or Service, one menu at a time.
(up/down arrow)	Toggles between the two displayed items.
(up arrow)	Moves backward through each menu, one step at a time.
(down arrow)	Advances through each menu, one step at a time. Selects Service from Main Screen.
(turtle up)	Increases the displayed set point value slowly.
(turtle down)	Decreases the displayed set point value slowly.
(rabbit up)	Increases the displayed set point value quickly (about 10 times faster than the turtle keys).
(rabbit down)	Decreases the displayed set point value quickly (about 10 times faster than the turtle keys).
+ (plus)	Increases set point values by one step at a time.
– (minus)	Decreases set point values by one step at a time.
(solid square)	Not used.
ID	Displays the 723 control part number and software revision level.
ESC	To return to menu header or to main screen.
SAVE	Saves entered values (set points).
BKSP	Scrolls left through line of display.
SPACE	Scrolls right through line of display.
ENTER	Used when entering exact values and accessing Configure.
= (equals)	For entering exact values (within 10%).
● (decimal)	To select Configure.

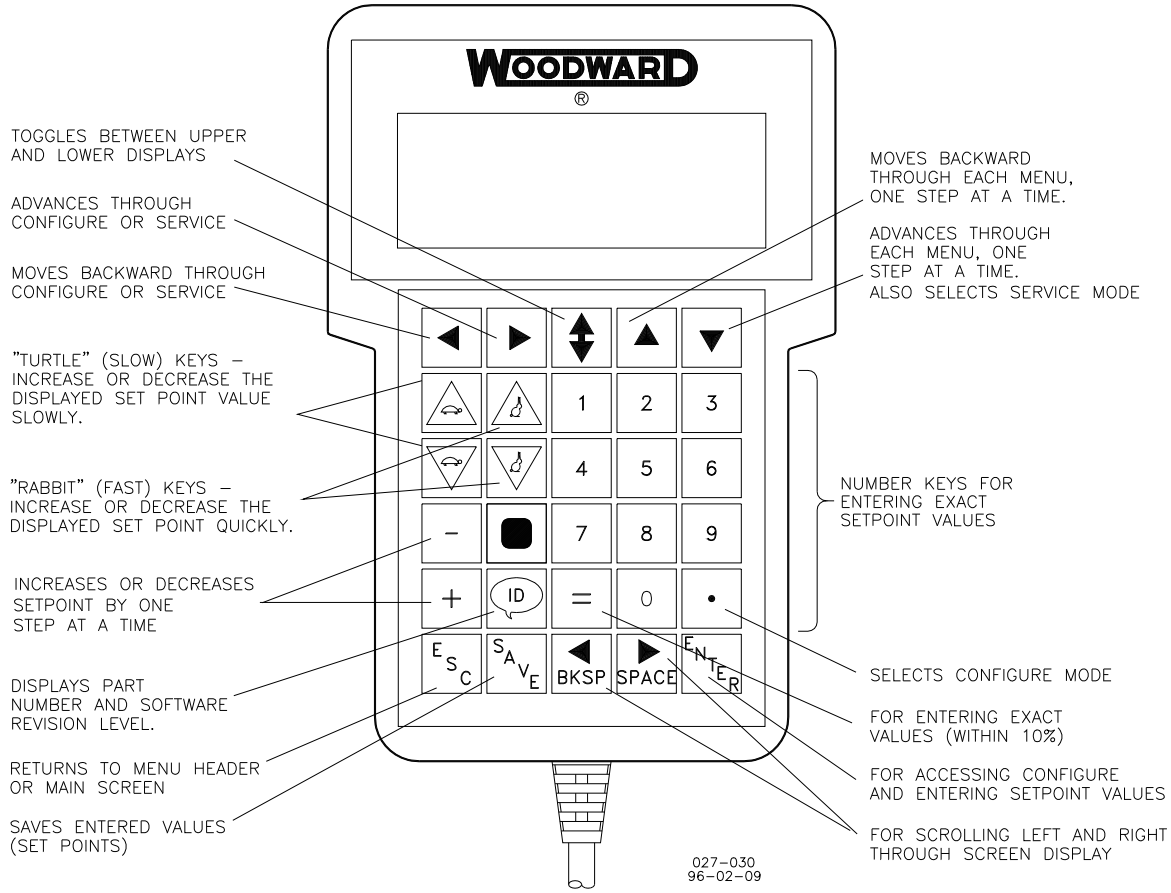


Figure 3-1. Hand Held Programmer Functions

Service Menus

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
1st DYNAMICS					
GAIN 1	10	1000	0.0015		
STABILITY 1	0.35	10	0		sec
COMPENSATION 1	0.2	10	0		sec
GAIN RATIO 1	1	20	1		
WINDOW WIDTH 1	60	2100	0		rpm
GAIN SLOPE BK PNT 1	20	100	0		%
GAIN SLOPE 1	0	50	-50		
SPEED FILTER 1	15	20	0		Hz
ENABLE ACT BUMP	false				
ACT BUMP LEVEL	100	100	0		%
ACT BUMP DURATION	2	30	0		sec
2nd DYNAMICS					
GAIN 2	10	1000	0.0015		
STABILITY 2	0.35	10	0		sec
COMPENSATION 2	0.2	10	0		sec
GAIN RATIO 2	1	20	1		
WINDOW WIDTH 2	60	2100	0		rpm
GAIN SLOPE BK PNT 2	20	100	0		%
GAIN SLOPE 2	0	50	-50		
SPEED FILTER 2	15	20	0		Hz
ENABLE ACT BUMP	false				
ACT BUMP LEVEL	100	100	0		%
ACT BUMP DURATION	2	30	0		sec
SPEED SETTING					
RAISE SPEED LIMIT	1300	2100	0		rpm
LOWER SPEED LIMIT	1100	2100	0		rpm
IDLE SPEED	750	2100	0		rpm
ACCEL RAMP TIME	8	500	0		sec
DECEL RAMP TIME	8	500	0		sec
RAISE SPEED RATE	100	5000	0		rpm/min
LOWER SPEED RATE	100	5000	0		rpm/min
4mA REMOTE REF	1100	2100	0		rpm
20mA REMOTE REF	1300	2100	0		rpm
TACH @ 4mA OUTPUT	400	5000	-500		rpm
TACH @ 20mA OUTPUT	2000	5000	-500		rpm
ENABLE SPEED FILTER	false				
SELECT DIGITAL MPU	false				
TORSIONAL FILTER					
TORSIONAL FILTER	0.5	1	0		
DERATED FUEL LIMIT	100	100	0		%
DERATED TRIP LEVEL	100	100	0		%
DERATED CLEAR LEVEL	0	100	0		%
TOR LIMIT ACTIVE					

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
KW SETTING					
MAXIMUM LOAD	1000	30000	0		kW
LOAD GAIN VOLTAGE	6	7	4		volts
4mA KW LOAD INPUT	-1000	30000	-30000		kW
20mA KW LOAD INPUT	1000	30000	-30000		kW
BASE LOAD REFERENCE	800	30000	0		kW
UNLOAD TRIP LEVEL	50	30000	0		kW
LOADING RATE	1000	30000	0		kW/min
UN-LOADING RATE	1000	30000	0		kW/min
4mA REMOTE REF	0	30000	-30000		kW
20mA REMOTE REF	1000	30000	-30000		kW
LOAD DROOP PERCENT	5	100	0		%
ACT OUT @ NO LOAD	20	100	0		%
ACT OUT @ FULL LOAD	80	100	0		%
LOAD @ 4mA OUTPUT	0	30000	-30000		kW
LOAD @ 20mA OUTPUT	1000	30000	-30000		kW
FUEL LIMITERS					
START FUEL LIMIT	0	100	0		%
START FUEL ACTIVE					
MAX FUEL LIMIT	0	100	0		%
MAX FUEL ACTIVE					
ENABLE MAP LIMIT	false				
MAP ACTIVE					
MAP BREAKPOINT A	6	500	0		eng units
FUEL LIMIT AT BP A	20	100	0		%
MAP BREAKPOINT B	8	500	0		eng units
FUEL LIMIT AT BP B	40	100	0		%
MAP BREAKPOINT C	10	500	0		eng units
FUEL LIMIT AT BP C	60	100	0		%
MAP BREAKPOINT D	15	500	0		eng units
FUEL LIMIT AT BP D	80	100	0		%
MAP BREAKPOINT E	20	500	0		eng units
FUEL LIMIT AT BP E	100	100	0		%
MAP @ 4mA	0	500	0		eng units
MAP @ 20mA	0	500	0		eng units
MISCELLANEOUS					
LON SERVICE PIN	false				
LON RESET	false				
SERVICE RESET	false				
COMM RESET	false				
CFIG OUTPUT @ 4mA	1200	30000	0		
CFIG OUTPUT @ 20mA	2000	30000	0		
SERIAL PORT SETUP					
PORT 2 HW CFIG	2	3	1		
PORT 2 BAUD RATE	6	7	1		
PORT 2 STOP BITS	1	3	1		
PORT 2 PARITY	1	3	1		
PORT 3 HW CFIG	2	3	1		
PORT 3 BAUD RATE	6	7	1		
PORT 3 STOP BITS	1	3	1		
PORT 3 PARITY	1	3	1		

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
DISPLAY MENU 1					
ENGINE SPEED					rpm
SPEED REFERENCE					rpm
BIASED SPEED REF					rpm
BIAS FROM ISOCH LS					rpm
BIAS FROM DROOP					rpm
BIAS FROM SYNC					rpm
GENERATOR OUTPUT					kW
LOAD REFERENCE					kW
ACTUATOR OUTPUT					%
TORSIONAL LEVEL					%
REMOTE SPEED REF					rpm
REMOTE LOAD REF					kW
REMOTE ENABLED					
LS LINE VOLTAGE					volts
LS BRIDGE BIAS					
SYNC INPUT					volts
MAP LIMIT					%
MAP INPUT					eng units
DISPLAY MENU 2					
SPEED INPUT #1					rpm
SPEED INPUT #2					rpm
MIN FUEL					status
IDLE/RATED					status
RAISE SPEED/LOAD					status
LOWER SPEED/LOAD					status
UNLOAD					status
BASELOAD					status
2nd DYNAMICS					status
ISOCH/DROOP					status
LOAD SHARE RELAY					status
CKT BKR RELAY					status
MINOR ALARM OUTPUT					status
MAJOR ALARM OUTPUT					status
MPU1 FAILED					status
MPU2 FAILED					status
MINOR ALARM MENU					
MPU 1 FAIL					status
MPU 2 FAIL					status
MPU 1 AND 2 FAIL					status
KW XDCR FAIL					status
REM SPD/LD XDCR FAIL					status
MAP XDCR FAIL					status
HIGH KW ALM					status
HIGH ACT OUTPUT ALM					status
HIGH TOR LEVEL ALM					status
OVERSPEED ALM					status
FAIL TO XMIT ALM					status
MINOR ALARM OUTPUT					status

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
MAJOR ALARM MENU					
MPU 1 FAIL					status
MPU 2 FAIL					status
MPU 1 AND 2 FAIL					status
KW XDCR FAIL					status
REM SPD/LD XDCR FAIL					status
MAP XDCR FAIL					status
HIGH KW ALM					status
HIGH ACT OUTPUT ALM					status
HIGH TOR LEVEL ALM					status
OVERSPEED ALM					status
FAIL TO XMIT ALM					status
MINOR ALARM OUTPUT					status

Configure Menus

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
CFIG SPEED CONTROL					
RATED SPEED	1200	2100	1		rpm
AMPU #1 TEETH	60	500	4		
AMPU 1 MAX FREQ	1440	17500	10		Hz
AMPU #2 TEETH	60	500	4		
AMPU 2 MAX FREQ	1440	17500	10		Hz
REVERSE ACTING?	false				
ACT2 CFIG VALUE					
DMPU #1 TEETH	60	500	4		
DMPU #2 TEETH	60	500	4		
CFIG MINOR ALARM					
MPU 1 FAIL	false				
MPU 2 FAIL	false				
MPU 1 AND 2 FAIL	false				
KW XDCR FAIL	false				
REM SPD/LD XDCR FAIL	false				
HIGH KW ALM	false				
HIGH KW SET POINT	0	30000	0		kW
HIGH KW DELAY	10	10800	0		sec
HIGH ACT OUTPUT ALM	false				
HIGH ACT SET POINT	10	100	0		%
HIGH ACT DELAY	0	10800	0		sec
HIGH TOR LEVEL ALM	false				
HIGH TOR SET POINT	0	100	0		%
HIGH TOR DELAY	10	10800	0		sec
OVERSPEED ALM	false				
OVERSPEED SET POINT	0	2500	0		rpm
OVERSPEED DELAY	10	10800	0		sec
FAIL TO XMIT ALM	false				

PROMPT	DEFAULT	MAX	MIN	ACTUAL	UNITS
CFIG MAJOR ALARM					
MPU 1 FAIL	false				
MPU 2 FAIL	false				
MPU 1 AND 2 FAIL	false				
KW XDCR FAIL	false				
REM SPD/LD XDCR FAIL	false				
HIGH KW ALM	false				
HIGH KW SET POINT	0	30000	0		kW
HIGH KW DELAY	10	10800	0		sec
HIGH ACT OUTPUT ALM	false				
HIGH ACT SET POINT	0	100	0		%
HIGH ACT DELAY	10	10800	0		sec
HIGH TOR LEVEL ALM	false				
HIGH TOR SET POINT	0	100	0		%
HIGH TOR DELAY	10	10800	0		sec
OVERSPEED ALM	false				
OVERSPEED SET POINT	0	2500	0		rpm
OVERSPEED DELAY	10	10800	0		sec
FAIL TO XMIT ALM	false				
CFIG MODBUS					
PORT 2 ADDRESS	1	247	1		
PORT 3 MODE	2	2	1		
PORT 3 ADDRESS	1	247	1		

Service Menu Descriptions

1st Dynamics Menu/2nd Dynamics Menu

Dynamic adjustments are settings that affect the stability and transient performance of the engine. There are two sets of dynamics provided. The set being used is selected by the 2nd Dynamics contact input. The control uses the 1st dynamics when the 2nd Dynamics contact is open, and it uses the 2nd dynamics when the contact is closed.

The following descriptions of each menu item apply to either set. Also see Figures 3-2, 3-3, and 3-4.

1. Gain determines how fast the control responds to an error in engine speed from the speed-reference setting. The Gain is set to provide stable control of the engine at light or unloaded conditions.

2. Stability compensates for the lag time of the engine. It adjusts the time required for the control to return the speed to zero error after a disturbance. Stability is adjusted to prevent slow hunting and to minimize speed overshoot after a load disturbance.

3. Compensation compensates for the actuator and fuel system time constant.

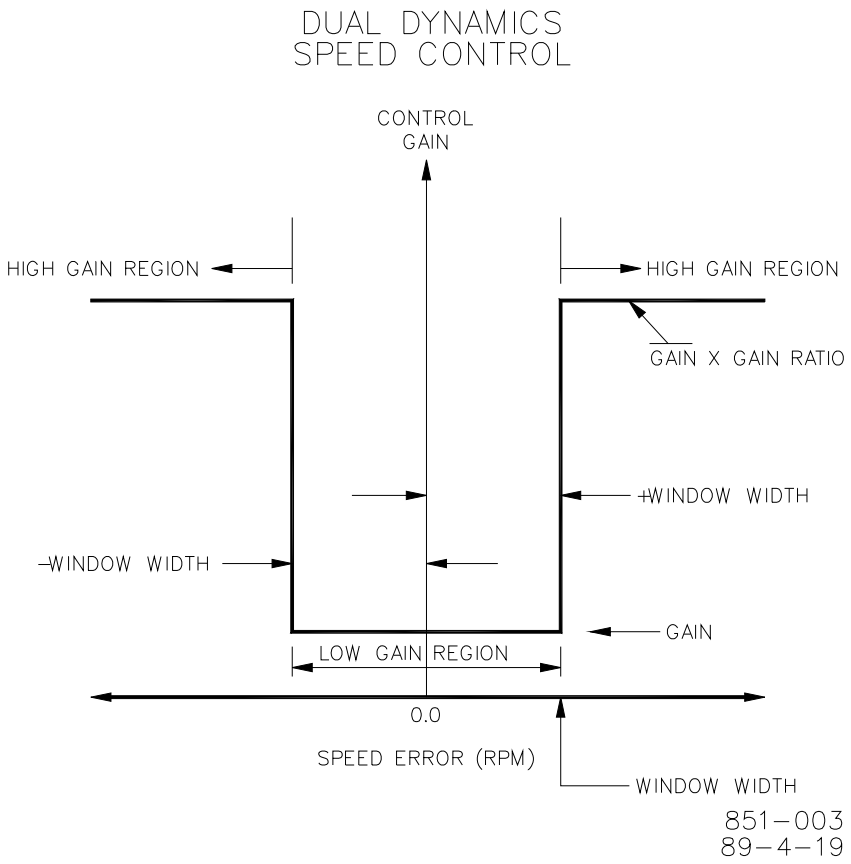


Figure 3-2. Control Gain as a Function of Speed Error

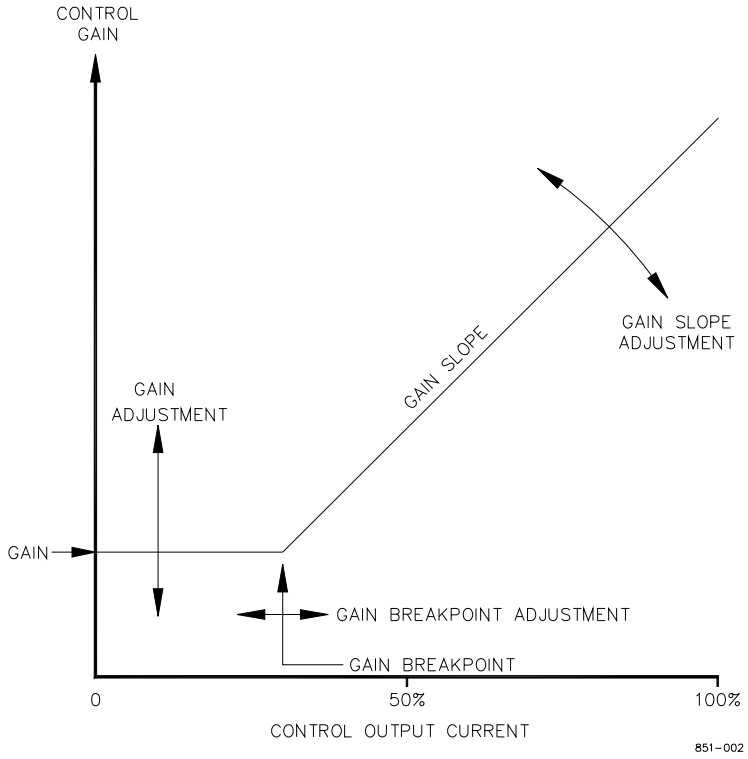


Figure 3-3. Control Gain as a Function of Control Output

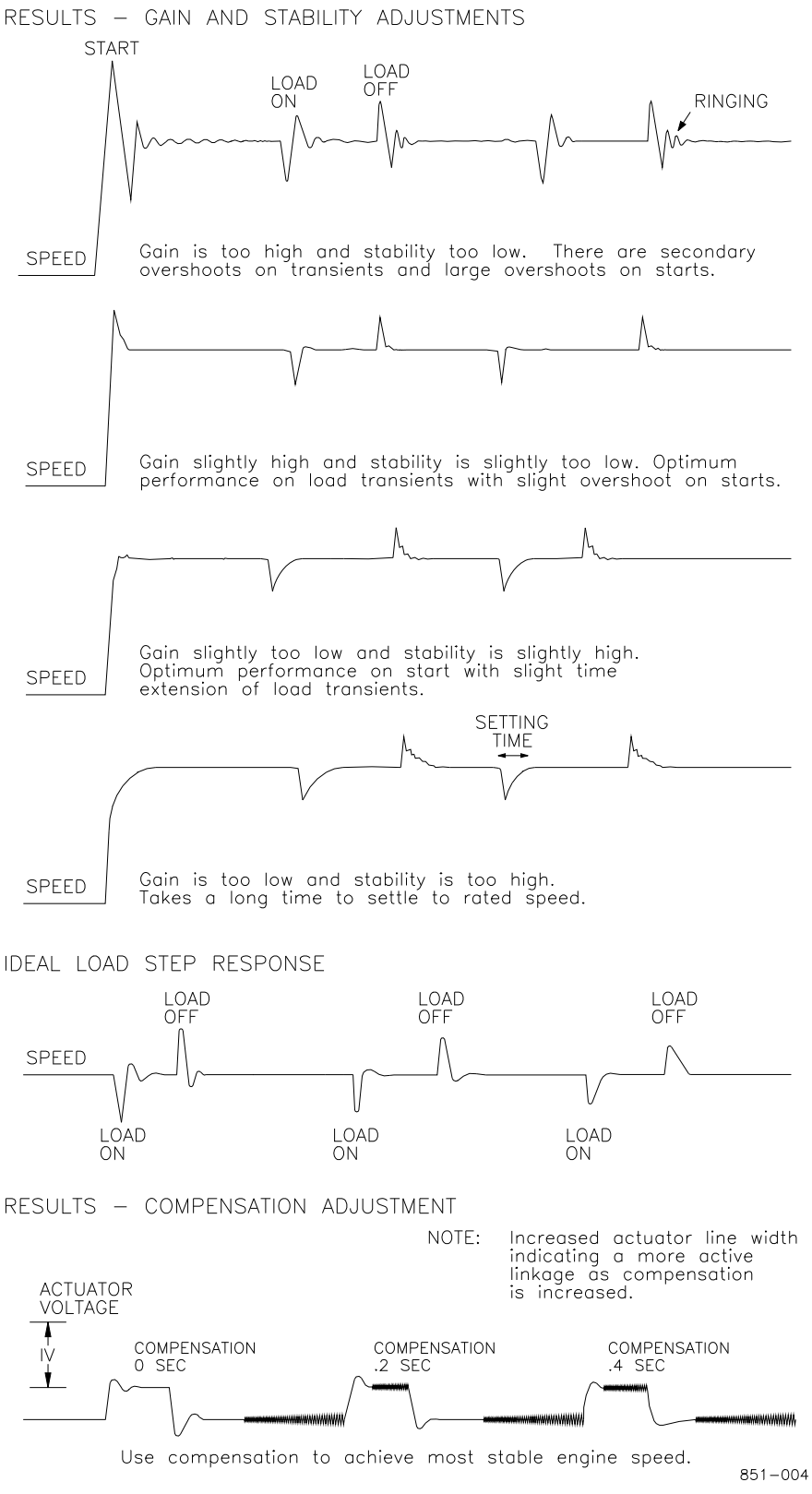


Figure 3-4. Typical Transient Response Curves

4. Gain Ratio is the ratio of the Gain setting at steady state to the Gain setting during transient conditions. The Gain Ratio operates in conjunction with the Window Width and Gain adjustments by multiplying the Gain set point by the Gain Ratio when the speed error is greater than the Window Width. This makes the control dynamics fast enough to minimize engine-speed overshoot on start-up and to reduce the magnitude of speed error when loads are changing. This allows a lower gain at steady state for better stability and reduced steady-state actuator linkage movement.

5. Window Width is the magnitude (in rpm) of a speed error at which the control automatically switches to fast response. The control does not use the absolute value of speed error, but “anticipated” speed error to make this switch. This method provides for quick switching to the high Gain value when an off-speed occurs and early switching to the low Gain value when recovering from the speed transient. This provides smoother switching than if the absolute speed error was used for the window.

6. Gain Slope Breakpoint sets the percent output above which the Gain Slope becomes effective. It should usually be set just above the minimum load output.

7. Gain Slope changes Gain as a function of actuator output. Since actuator output is proportional to engine load, this makes Gain a function of engine load. Gain Slope operates in conjunction with the Gain Slope Breakpoint adjustment to increase (or decrease) Gain when percent Actuator Output is greater than the breakpoint. This compensates for systems having high (or low) gain at low load levels. This allows the Gain setting to be lower at light or no load for engine stability, yet provide good control performance under loaded conditions.

8. Speed Filter adjusts the cutoff frequency of a low pass filter used on the speed sensing input (see Figure 3-5). The filter is used to attenuate engine firing frequencies. To calculate the desired filter cutoff point, use the following formula:

camshaft frequency = (engine rpm)/60 [for 2-cycle engines]
camshaft frequency = (engine rpm)/120 [for 4-cycle engines]

Always try to use the minimum frequency for good steady state response.

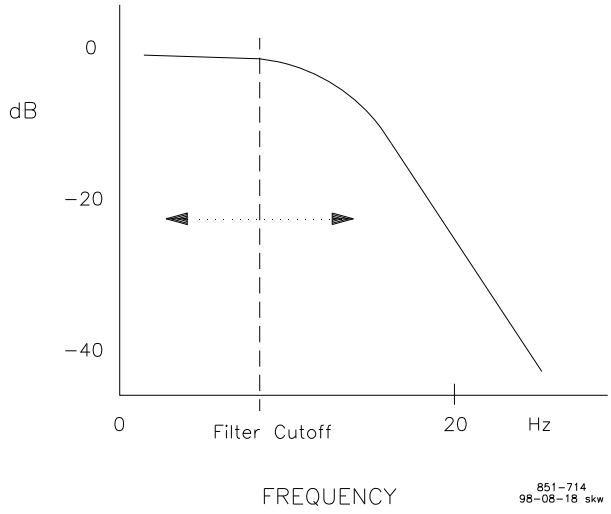


Figure 3-5. Speed Filter

9. Enable Actuator Bump allows you to test your dynamics setting by putting a transient or bump in the system.

10. Actuator Bump Level is what percent of the actuator travel you want to introduce in a transient.

11. Actuator Bump Duration is how many seconds the actuator will be influenced by the bump.

Speed Setting Menu

Speed adjustments are the settings that affect the speed reference.

1. Raise Speed Limit is the maximum speed reference setting. It is used to limit the Raise Speed/Load and Remote Speed/Load Setting inputs to a maximum. It normally is set at the maximum rated engine speed.

2. Lower Speed Limit is the minimum speed reference setting. It is used to limit the Lower Speed/Load and Remote Speed/Load Setting inputs to a minimum. It normally is set at the minimum operating speed of the engine.

3. Idle Speed Reference sets the speed at which the engine is operated at start-up. It sometimes is used during cool down.

4. Accel Ramp Time is the time required for the control to ramp the engine speed from Idle speed to Rated speed. The ramp is started whenever the Idle/Rated contact is closed.

5. Decel Ramp Time is the time required for the control to ramp the engine speed from Rated speed to Idle speed. The ramp is started whenever the Idle/Rated contact is opened.

IMPORTANT

Actual engine deceleration may be slower than set by the Decel Ramp Time set point. This occurs when the Decel Ramp Time set point is faster than system inertias will allow the engine to come down in speed. This condition is indicated by the control actuator output going to the minimum fuel position.

6. Raise Speed Rate is the rate at which the speed reference is ramped when using the Raise command as well as when the Remote Speed/Load Setting input is changed in the increase direction. A step change on the remote input does not cause an immediate change in the reference, which is ramped to the new setting at the Raise Speed Rate.

7. Lower Speed Rate is the rate at which the speed reference is ramped when using the Lower Speed/Load input, as well as when the Remote Speed/Load Setting input is changed in the decrease direction. A step change on the remote input does not cause an immediate change in the reference, which is ramped to the new setting at the Lower Speed Rate.

8. 4 mA Remote Reference is the engine speed desired when 4 mA is applied to the Remote Speed/Load Setting input.

9. 20 mA Remote Reference is the engine speed desired when 20 mA is applied to the Remote Speed/Load Setting input.

10. Tach at 4 mA Output is the engine speed when the Tachometer output is 4 mA.

11. Tach at 20 mA Output is the engine speed when the Tachometer output is 20 mA.

12. Enable Speed Filter allows you to enable or disable the speed filter function.

13. Select Digital MPU is used when you select a digital MPU signal into the control.

Torsional Filter Menu (9907-037/-038 only)

Torsional filter adjustments are the settings that affect the control's ability to react to flexible coupling torsionals.

1. Torsional Filter is the inertia ratio setting between the engine inertia and the system inertia. Set the value equal to engine inertia divided by (engine inertia + generator inertia).

2. Derated Fuel Limit is the percentage of Actuator Output the actuator output will be limited to when the input torsional level exceeds the Derated Trip Level. The Derated Fuel Limit is low signal selected with the Manifold Air Pressure input and the Maximum Fuel Limit.

3. Derated Trip Level is the torsional level at which the Derated Fuel Limit is activated and the alarm state is triggered.

4. Derated Clear Level is the torsional level at which the Derated Fuel Limit is deactivated and the alarm state is cleared.

5. Tor Limit Active is an indication that the actuator output is being limited by the torsional filter.

KW Setting Menu

KW load adjustments are the settings that affect the KW load reference.

1. Maximum Load is the maximum load reference setting. It is used to limit the Raise Load command and Remote Speed/Load Setting input to a maximum. It normally is set at the maximum rated engine KW load.

2. Load Gain Voltage is a voltage representation of the amount of load on the generator. It is used to balance the generator loads when in isochronous parallel operation. It normally is set to 6 volts at the maximum rated generator load.

3. 4 mA KW Load Input is the amount of KW load on the generator when 4 mA is applied to the Remote Speed/Load Setting input.

4. 20 mA KW Load Input is the amount of KW load on the generator when 20 mA is applied to the Remote Speed/Load Setting input.

5. Base Load Reference is the amount of load on the generator which the control will ramp to when the Base Load contact is closed and the Unload/Reset to Rated contact is closed.

6. Unload Trip Level is the amount of load on the generator which opens the Breaker Open relay contact output when generator unload has been selected by opening the Unload/Reset to Rated contact. The 723 will hold this load setting if the circuit breaker is not tripped.

IMPORTANT

Actual generator unloading may be slower than set by the Unloading Rate set point. This occurs when the Unloading Rate set point is faster than system dynamics will allow the engine to reduce load. This condition is indicated by the control actuator output going to the minimum fuel position during unloading.

7. Loading Rate is the rate at which the load reference is ramped when using the Raise Load command as well as when the Remote Speed/Load Setting input is changed in the increase direction. A step change on the remote input does not cause an immediate change in the reference, which is ramped to the new setting at the Raise Load Rate.

8. Unloading Rate is the rate at which the load reference is ramped when using the Lower Load command as well as when the Remote Speed/Load Setting input is changed in the decrease direction. A step change on the remote input does not cause an immediate change in the reference, which is ramped to the new setting at the Lower Load Rate.

9. 4 mA Remote KW Reference is the generator load desired when 4 mA is applied to the Remote Speed/Load Setting input.

10. 20 mA Remote KW Reference is the generator load desired when 20 mA is applied to the Remote Speed/Load Setting input.

11. Load Droop Percent is the percentage of speed droop when the generator load is at maximum.

12. Actuator Output at No Load. Set this to the percent travel that the actuator is open when the engine is operating at full speed no load.

13. Actuator Output at Full Load. Set this to the percent travel that the actuator is open when the engine is operating at full load.

14. Load at 4 mA Output is the generator load when the KW load signal output is 4 mA.

15. Load at 20 mA Output is the generator load when the KW load signal output is 20 mA.

Fuel Limiters Menu

Fuel limiters limit the actuator output current from the control.

1. Start Fuel Limit sets the maximum percent actuator output current when the engine speed is below idle. The limit is usually set at the fuel level required to start the engine. The limiter is removed when speed goes above idle.

2. Start Fuel Active is an indication that the actuator output is being limited by the Start Fuel Limiter.

3. Maximum Fuel Limit sets the maximum percent actuator output current. Maximum (100%) is based on 200 mA. The limit is usually set just above the output at full load.

4. Maximum Fuel Active is an indication that the actuator output is being limited by the Maximum Fuel Limiter.

IMPORTANT **Maximum and Start Fuel Limiters are active in both local and remote modes.**

5. Enable Map Limit enables and disables the fuel limiter, which uses the Manifold Air Pressure input to limit the actuator output. If the fuel limiter is disabled, the fuel limiter breakpoint settings will not be used.

6. Map Active is an indication that the actuator output is being limited by the Manifold Air Pressure Limiter.

7. Map Breakpoint A is the Manifold Air Pressure value where the slope of the fuel limiter output changes (x-axis input in Figure 3-6). Breakpoint A must be set between 2 mA and Breakpoint B.

8. Fuel Limit at Breakpoint A is the percent actuator output current allowed when the Manifold Air Pressure is at or below Breakpoint A (y-axis input in Figure 3-6). The fuel limiter interpolates between Breakpoint A and Breakpoint B when the Manifold Air Pressure is between these two settings.

9. Map Breakpoint B is the Manifold Air Pressure value where the slope of the fuel limiter output changes (x-axis input in Figure 3-6). Breakpoint B must be set between Breakpoint A and Breakpoint C.

10. Fuel Limit at Breakpoint B is the percent actuator output current allowed when the Manifold Air Pressure is at Breakpoint B (y-axis input in Figure 3-6). The fuel limiter interpolates between Breakpoint B and Breakpoint C when the Manifold Air Pressure is between these two settings.

11. Map Breakpoint C is the Manifold Air Pressure value where the slope of the fuel limiter output changes (x-axis input in Figure 3-6). Breakpoint C must be set between Breakpoint B and Breakpoint D.

12. Fuel Limit at Breakpoint C is the percent actuator output current allowed when the Manifold Air Pressure is at Breakpoint C (y-axis input in Figure 3-6). The fuel limiter interpolates between Breakpoint C and Breakpoint D when the Manifold Air Pressure is between these two settings.

13. Map Breakpoint D is the Manifold Air Pressure value where the slope of the fuel limiter output changes (x-axis input in Figure 3-6). Breakpoint D must be set between Breakpoint C and Breakpoint E.

14. Fuel Limit at Breakpoint D is the percent actuator output current allowed when the Manifold Air Pressure is at Breakpoint D (y-axis input in Figure 3-6). The fuel limiter interpolates between Breakpoint D and Breakpoint E when the Manifold Air Pressure is between these two settings.

15. Map Breakpoint E is the Manifold Air Pressure value where the slope of the fuel limiter output changes (x-axis input in Figure 3-6). Breakpoint E must be set between Breakpoint D and 20 mA.

16. Fuel Limit at Breakpoint E is the percent actuator output current allowed when the Manifold Air Pressure is at or above Breakpoint E (y-axis input in Figure 3-6).

17. Map at 4 mA is the Manifold Air Pressure when the transducer is at 4 mA.

18. Map at 20 mA is the Manifold Air Pressure when the transducer is at 20 mA.

Figure 3-6 illustrates these breakpoints and adjustments.

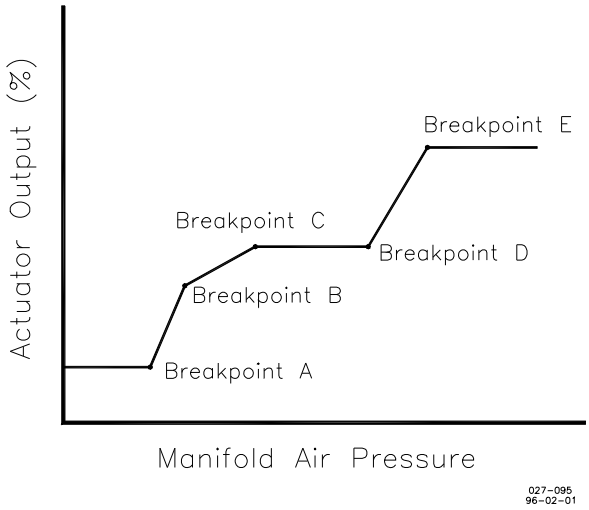


Figure 3-6. Fuel Limit Breakpoints

Miscellaneous Menu

1. LON Service Pin tells the LON Neuron Processor to send out its unique ID over the network. This is used in the LON installation and maintenance procedures.

2. LON Reset sends a reset command to the LON Neuron Processor.

3. Service Reset sends a command to the hardware blocks in the program to reset their faults.

4. Comm Reset sends a command to the Communication blocks in the program to reset their faults.

5. CFIG Output @ 4 mA sets the value that will cause the control to output 4 mA on the Actuator #2 output. The Configurable Menu CFIG SPEED CONTROL is used to select what program value is sent out this output. For example, if the Actuator Output is selected to go to this output, then the Value @ 4 mA should be set to 0 since the Actuator Output is a 0-100% signal.

6. CFIG Output @ 20 mA sets the value that will cause the control to output 20 mA on the Actuator #2 output. For example, if the Actuator Output was selected to go to this output, then the Value @ 20 mA should be set to 100 since the Actuator Output is a 0-100% signal.

Serial Port Setup

The 723 control has two serial ports that are configured to support the Modbus Protocol. The ports are configured in this menu for the type of hardware interface and other parameters. Both ports have monitoring information available that can be retrieved by a Modbus master device such as a PC-based Man Machine Interface (MMI). Port 2 supports Modbus ASCII only, and Port 3 supports either Modbus ASCII or RTU. This is selected in the Configure Menu CFIG MODBUS. Port 3 also allows commands to be sent from the Modbus Master Device to the control. (See the Modbus Register List for the addresses for this).

1. Port 2 HW CFIG determines if the port is set for RS-232 or RS-422, based on:
   1 = RS-232
   2 = RS-422
   If RS-422 mode is selected, then the devices can be in a multi-drop configuration.

2. Port 2 Baud Rate determines the port's baud rate, based on:
   1 = 1200
   2 = 1800
   3 = 2400
   4 = 4800
   5 = 9600
   6 = 19200
   7 = 38400

3. Port 2 Stop Bits determines the Stop Bits, based on:
   1 = 1 stop bit
   2 = 1.5 stop bits
   3 = 2 stop bits

4. Port 2 Parity determines what parity the port uses, based on:
   1 = no parity
   2 = odd parity
   3 = even parity

5. Port 3 HW CFIG determines if the port is set for RS-232 or RS-422, based on:
   1 = RS-232
   2 = RS-422
   If RS-422 mode is selected, then the devices can be in a Multi-drop configuration.

6. Port 3 Baud Rate determines the port's baud rate, based on:
   1 = 1200
   2 = 1800
   3 = 2400
   4 = 4800
   5 = 9600
   6 = 19200
   7 = 38400

7. Port 3 Stop Bits determines the Stop Bits, based on:
   1 = 1 stop bits
   2 = 1.5 stop bits
   3 = 2 stop bits

8. Port 3 Parity determines what parity the port uses, based on:
   1 = no parity
   2 = odd parity
   3 = even parity

IMPORTANT **If ports J2 and J3 are both being used, and both require 19200 or higher baud rates, the baud rates must be set to the same value for each port.**

Display Menu 1

The programmer displays input and output values as each item is selected. The control automatically updates the display.

1. Engine Speed displays the current engine speed in rpm.

2. Speed Reference displays the current speed reference in rpm. Note that this may not be the speed the engine is currently running at due to the effect of droop, fuel limiters, etc.

3. Biased Speed Reference displays the speed reference value in rpm that is being used by the speed control, which includes the bias from load sharing, droop, and the synchronizer.

4. Bias from Isochronous Load Sharing displays the value in rpm that the load sharing lines are biasing the speed reference.

5. Bias from Droop displays the value in rpm that the droop percentage calculation is biasing the speed reference.

6. Bias from Synchronizer displays the value in rpm that the synchronizer is currently biasing the speed reference.

7. Generator Output displays the current generator load in KW.

8. Load Reference displays the current load reference in KW. Note that this may not be the load the generator is currently outputting due to the effect of fuel limiters, etc.

9. Actuator Output displays the current percent of output. Maximum (100%) is 200 mA (0 mA for reverse-acting). This is useful for setup of the control fuel limiters, and Gain Slope Breakpoint settings.

10. Torsional Level displays the current torsional level (the percent of speed that the engine and generator are out of phase) in percent.

11. Remote Speed Reference displays the current remote speed reference signal in rpm.

12. Remote Load Reference displays the current remote load reference signal in kW.

13. Remote Enabled is an indication that the remote reference (speed/load) is being used by the speed control.

14. Load Sharing Line Voltage displays the voltage that the load sharing circuitry is putting on the load sharing lines.

15. Load Sharing Bridge Bias displays the current value of the bias across the load sharing bridge as seen by the control software.

16. Synchronizer Input displays the current voltage that is on the synchronizer input lines.

17. Map Limit displays the current percent actuator output of the fuel limiter.

18. Map Input displays the current value of the Manifold Air Pressure input.

Display Menu 2

The programmer displays input and output values as each item is selected. The control automatically updates the display.

1. Speed Input #1 displays the rpm shown by speed sensor #1 after conversion from a frequency to an analog voltage signal. The control uses the signal to determine the average speed of the engine and for torsional filtering.

2. Speed Input #2 displays the rpm shown by speed sensor #2 after conversion from a frequency to an analog voltage signal. The control uses the signal to determine the average speed of the engine and for torsional filtering.

3. Min Fuel Contact Status shows the status of the Minimum Fuel (Run/Stop) contact (open or closed).

4. Idle/Rated Contact Status shows the status of the contact (open or closed).

5. Raise Speed Contact Status shows the status of the contact (open or closed).

6. Lower Speed Contact Status shows the status of the contact (open or closed).

7. Unload Contact Status shows the status of the contact (open or closed).

8. Base Load Contact Status shows the status of the contact (open or closed).

9. 2nd Dynamics Contact Status shows the status of the contact (open or closed).

10. Isoch/Droop (Circuit Breaker) Contact Status shows the status of the contact (open or closed).

11. Load Share Relay Status shows the status of the contact (open or closed).

12. Breaker Open Relay Status shows the status of the relay (open or closed).

13. Minor Alarm Relay Status shows the status of the relay (open or closed).

14. Major Alarm Relay Status shows the status of the relay (open or closed).

15. MPU #1 LED Status shows the status of the Alarm #1 LED (on or off).

16. MPU #2 LED Status shows the status of the Alarm #2 LED (on or off).

Configuration Menu Descriptions

CFIG Speed Control

1. Rated Speed (synchronous speed) sets the normal operating speed of the engine. It should be set at the speed at which the engine is operated at full load.

2. Gear #1 Teeth (analog speed signal) is the number of teeth or holes in the gear or flywheel that speed sensor #1 is on. If the gear is running at camshaft speed (one-half engine speed) then you must enter one-half the number of teeth on the gear. The control requires the number of teeth per engine revolution. If a flexible coupling is being used, gear #1 must be on the engine side of the coupling.

3. Maximum Frequency (analog speed sensor #1) is used to set the range that the frequency-to-digital converter can sense. It should be set to the maximum running frequency multiplied by 1.2.

4. Gear #2 Teeth (analog speed signal) is the number of teeth or holes in the gear or flywheel that speed sensor #2 is on. If the gear is running at camshaft speed (one-half engine speed) then you must enter one-half the number of teeth on the gear. The control requires the number of teeth per engine revolution. If a flexible coupling is being used, gear #2 must be on the generator side of the coupling.

5. Maximum Frequency (analog speed sensor #2) is used to set the range that the frequency-to-digital converter can sense. It should be set to the maximum running frequency multiplied by 1.2.

IMPORTANT

Best control performance will be obtained when sensing speed from a gear rotating at full engine speed. Slower-speed gears (such as the camshaft) provide a lower sampling rate which impairs control response time.

⚠WARNING

The number of gear teeth is used by the control to convert pulses from the speed-sensing device to engine rpm. To prevent possible serious injury from an overspeeding engine, make sure the control is properly programmed to convert the gear-tooth count into engine rpm. Improper conversion could cause engine overspeed.

6. Actuator Sense sets the direction of the control actuator output to increase fuel. Forward-acting actuators require increased current to increase fuel. Reverse-acting actuators require decreased current to increase fuel (reverse-acting actuators should always incorporate a mechanical ballhead backup governor, such as the Woodward EGB).

7. Actuator 2 Configure Value selects the signal on the Actuator 2 output lines. Choosing "1" selects indication of the actuator output, choosing "2" selects indication of the remote speed input setting, and choosing "3" selects indication of the remote load input setting.

   On versions with torsional filter, choosing "1" selects indication of the actuator output, choosing "2" selects indication of the torsional level, choosing "3" selects indication of the remote speed input setting, and choosing "4" selects indication of the remote load input setting.

8. Gear #1 Teeth (digital speed signal) is the number of teeth or holes in the gear or flywheel that speed sensor #1 is on. If the gear is running at camshaft speed (one-half engine speed) then you must enter one-half the number of teeth on the gear. The control requires the number of teeth per engine revolution. If a flexible coupling is being used, gear #1 must be on the engine side of the coupling.

9. Gear #2 Teeth (digital speed signal) is the number of teeth or holes in the gear or flywheel that speed sensor #2 is on. If the gear is running at camshaft speed (one-half engine speed) then you must enter one-half the number of teeth on the gear. The control requires the number of teeth per engine revolution. If a flexible coupling is being used, gear #2 must be on the generator side of the coupling.

CFIG Minor Alarm/Major Alarm

1. MPU1 Failed Alarm sets the alarm condition which will occur when a loss of the speed sensor #1 input signal has been detected. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

2. MPU2 Failed Alarm sets the alarm condition which will occur when a loss of the speed sensor #2 input signal has been detected. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

3. Both MPUs Failed Alarm sets the alarm condition which will occur when a loss of the speed sensor #1 and #2 input signals has been detected. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

4. Load Sensor Failed Alarm sets the alarm condition which will occur when the KW Transducer input drops below 2 mA. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

5. Remote Input Failed Alarm sets the alarm condition which will occur when the Remote Speed/Load Setting input drops below 2 mA. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

6. High KW Alarm sets the alarm condition which will occur when the KW transducer input goes above the High KW Setpoint. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

7. High KW Setpoint is the KW level at which the High KW Alarm is activated.

8. High KW Delay is the delay time in seconds the KW input is above the KW setpoint before the KW alarm is activated.

9. High Actuator Output Alarm sets the alarm condition which will occur when the actuator output goes above the High Actuator Setpoint. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

10. High Actuator Setpoint is the actuator level at which the High Actuator Output Alarm is activated.

11. High Actuator Delay is the delay time in seconds the actuator output is above the actuator setpoint before the actuator alarm is activated.

12. High Torsional Level Alarm sets the alarm condition which will occur when the High Torsional set point has been exceeded. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

13. High Torsional Setpoint is the torsional level at which the High Torsional Level Alarm is activated.

14. High Torsional Delay is the delay time in seconds that the torsional level is above the Torsional Setpoint before the Torsional Alarm is activated.

15. Overspeed Alarm sets the alarm condition which will occur when the engine speed goes above the Overspeed Setpoint. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

16. Overspeed Setpoint is the speed level at which the Overspeed Alarm is activated.

17. Overspeed Delay is the delay time in seconds that the engine speed is above the Overspeed Setpoint before the Overspeed Alarm is activated.

CFIG Modbus

The 723 control has two serial ports that are configured to support the Modbus Protocol. The ports are configured in this menu to set the slave address that they will use, and for port 3 to set if it uses ASCII or RTU mode. Both ports have monitoring information available that can be retrieved by a Modbus Master device such as a PC-based Man Machine Interface (MMI). Port 2 supports Modbus ASCII only, and Port 3 supports either Modbus ASCII or RTU. Port 3 also allows commands to be sent from the Modbus Master Device to the control. (See the Modbus Register List for the addresses for this).

1. Port 2 ADDRESS determines the port's Modbus address from 1 to 247.

2. Port 3 MODE determines if the port will use the Modbus ASCII or Modbus RTU mode, based on:
   1 = ASCII
   2 = RTU

3. Port 3 ADDRESS determines the port's Modbus address from 1 to 247.

At this time, we recommend saving this setup by pressing the “SAVE” key on the Hand Held Programmer. The programmer will display the message “Saving Changes”. Be sure to select a menu prior to continuing.

NOTICE

To prevent possible damage to the engine resulting from improper control settings, make sure you save the set points before removing power from the control. Failure to save the set points before removing power from the control causes them to revert to the previously saved settings.

Chapter 4.
Initial Adjustments

Introduction

This chapter contains information on control calibration. It includes initial prestart-up and start-up settings and adjustments.

⚠WARNING

An improperly calibrated control could cause an engine overspeed or other damage to the engine. To prevent possible serious injury from an overspeeding engine, read this entire procedure before starting the engine.

Start-up Adjustments

1. Complete the installation checkout procedure in Chapter 3 and the prestart menu settings in Chapter 4.

2. Close the Minimum Fuel (Run/Stop) contact. Be sure the Idle/Rated contact is in idle (open). Apply power to the control. Do NOT proceed unless the green POWER OK and CPU OK indicators on the front of the control are on.

3. Check the speed sensor.

   Minimum voltage required from the speed sensor to operate the control is 1.0 Vrms, measured at cranking speed or the lowest controlling speed. For this test, measure the voltage while cranking, with the speed sensor connected to the control. Before cranking, be sure to prevent the engine from starting. At 5% of rated speed and 1.0 Vrms, the failed speed sensing circuit function is cleared. If the red FAILED SPD SENSOR #1 indicator remains on, shut down the engine.

⚠WARNING

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.

4. Start the engine.

   If there is insufficient fuel to start the engine, increase the Start Fuel Limit (Fuel Limiters Menu). (The control will reduce fuel as required when the speed setting is reached. It requires extra fuel to accelerate the engine to idle speed.) It may take a few starts to determine the final setting of the Start Fuel Limit. If the start time is excessive, increase the Start Fuel Limit. If the start time is too fast or flooding is occurring, decrease the Start Fuel Limit. We recommend trying both hot and cold starts to determine a final setting.

5. Adjust for stable operation.

   If the engine is hunting at a rapid rate, slowly decrease the Gain until performance is stable. If the engine is hunting at a slow rate, increase the Stability time. If increasing the Stability time does not stabilize the engine, it also may be necessary to slowly decrease the Gain OR to slowly decrease the Gain and increase the Compensation.

This completes the start-up adjustments. We recommend saving the settings at this time by pressing the “SAVE” key on the Hand Held Programmer.

Dynamic Adjustments

The objective of the dynamic adjustments is to obtain the optimum, stable engine speed response from minimum speed/load to full speed and load. All adjustments apply to both 1st dynamics (2nd Dynamics contact open) and 2nd dynamics (2nd Dynamics contact closed).

Do the following adjustments first for 1st dynamics (2nd Dynamics contact open). Use the 1st Dynamics Menu to set the 1st dynamics, if changes are needed.

Then repeat the adjustments for 2nd dynamics (2nd Dynamics contact closed). Use the 2nd Dynamics Menu to set the 2nd dynamics, if changes are needed.

1. No-Load Adjustments

   Do this adjustment without load applied.

   Slowly increase the Gain set point until the engine becomes slightly unstable, then reduce the Gain as necessary to stabilize the engine.

   After acceptable performance at no load, record the Actuator Output as read on the Display Menu. Set the Gain Slope Breakpoint (1st Dynamics Menu) to this reading.

   Observe the movement of the actuator. If the activity of the actuator is excessive, reduce the Gain set point slightly to get the actuator movement to an acceptable level.

   If there is a slow periodic cycling of the engine speed above and below the speed setting, there are two possible causes:

   - Gain is too high and Stability is too low. Reduce the Gain by 50% (i.e., if the Gain was 0.02, reduce it to 0.01) and increase Stability slightly. Observe the movement of the actuator. Continue to increase Stability until the movement is acceptable but not excessive. A final value of Stability should be between 1.0 and 2.0 for most large engines. If the Stability value exceeds 2.0, but this procedure continues to improve performance, increase the Compensation set point 50% and repeat the procedure.

   - Gain is too low. If the preceding procedure does not improve the slow periodic cycling of the engine speed, the control may be limiting cycling through the low gain control region set by the Window Width set point. Increase the Gain set point to minimize the cycling. If actuator movement becomes excessive, reduce the Compensation set point until movement is acceptable. In some cases, Compensation may be reduced to zero and only the Gain and Stability adjustments used. This should be done only if necessary to eliminate excessive actuator response to misfiring or other periodic disturbances. Reduce the Window Width set point until the limit cycle amplitude is acceptable without excessive rapid actuator movement.

2. Full Load Adjustment

   Do these adjustments at the speed and load at which the engine is most often operated.

   If operation in this range is satisfactory, no further dynamic adjustments are necessary. If during changes in load, excessive speed errors occur, increase the Gain Slope adjustment until engine performance is satisfactory. If excessive actuator movement again occurs, do procedure 3, then repeat procedure 2. If the settling time after a load change is too long, reduce the Stability set point slightly and increase the Gain slightly. If slow-speed hunting occurs after a load change but decreases or stops in time, increase the Stability set point slightly and reduce the Gain set point. See Figure 3-4.

⚠WARNING

The use of negative Gain Slope should be considered carefully. Low gain at high fuel levels will result in poor load rejection response or possible overspeed. To prevent possible serious injury from an overspeeding engine, the Maximum Fuel Limit must be set near the full load output current demand to prevent excessive integrator windup and a subsequent low gain condition.

3. When load changes occur, the control should switch automatically to high gain to reduce the amplitude of the off-speeds. Reduce (or increase) the Window Width set point to just greater than the magnitude of acceptable speed error. A value of Gain Ratio too high will cause the control to hunt through the low-gain region. This normally will occur only if the Window Width is too low. If necessary to decrease the Window Width to control limit cycling (identified by the engine speed slowly cycling from below to above the speed setting by the amount of Window Width), the Gain Ratio may be reduced for more stable operation.

4. Verify that performance at all speed and load conditions is satisfactory and repeat the above procedures if necessary.

5. While operating at full load, record the Actuator Output on Display Menu 1. Select the Maximum Fuel Limit set point on the Fuel Limiter Menu. Set at approximately 10% over the full load output if desired, otherwise leave at 100%.

We recommend you check the operation from both hot and cold starts to obtain the optimum stability under all conditions.

Speed Adjustments

Adjustment of the idle, rated, raise, and lower references should not require further setting as they are precisely determined. The Remote Speed/Load Setting input and the Tachometer Output, however, involve analog circuits and may require adjustment.

1. 4 to 20 mA Remote Speed/Load Setting Input

   Apply 4 mA to the Remote Speed/Load Setting Input. Be sure remote operation is selected (Raise Speed/Load and Lower Speed/Load contacts both closed). If the engine rpm is lower or higher than desired, increase or decrease the 4 mA Remote Reference set point to obtain the correct speed. There may be a small difference between the set point and actual speed which compensates for the inaccuracies in the analog circuits.

   Now apply 20 mA to the Remote Speed/Load Setting Input. Wait until the ramp stops. Increase or decrease the 20 mA Remote Reference set point to obtain the engine rpm desired.

   Repeat the above steps until the speeds at 4 mA and 20 mA are within your required range.

IMPORTANT

When the Circuit Breaker Aux contact is closed, the Remote Speed/Load Setting Input is an input to the load control portion of the 723. Whenever the CB Aux contact is closed, make sure a proper load signal is provided for the Remote Speed/Load Setting Input.

2. 4 to 20 mA Tachometer Output

   Set engine speed to the speed desired for 4 mA output. If this is not possible, skip this step or use a signal generator into the speed input with the correct frequency corresponding to the desired rpm. Trim the Tach at 4 mA Output rpm set point for 4 mA set point output.

   Set engine speed to the speed desired for 20 mA output. Trim the Tach at 20 mA Output rpm set point for 20 mA set point output.

   Repeat the above steps until the speeds at 4 mA and 20 mA are within your required range.

Automatic Generator Loading Functions

The 723 control's automatic generator loading functions are designed to be used with the speed control functions to automatically control the loading and unloading of the generator. This accomplishes a bumpless transfer when paralleling the generator to a load sharing or infinite bus system, or separating a generator from a system.

Load Control Mode Switching

Load control operation is determined by the status of the contacts to the Circuit Breaker Aux contact input (terminal 29) and the load control mode select contact inputs. The load control mode contacts are Base Load (terminal 30), and Unload (terminal 31). The two mode contacts determine the load control operating mode:

1.	Both open	isochronous load sharing at unload trip level
2.	Base Load only closed	base load at unload trip level
3.	Unload only closed	isochronous load sharing system
4.	Both closed	base load in parallel bus systems

When the CB Aux contact input is open, droop is the only available operating mode. In single unit operation, speed will decrease as load increases. In parallel with a bus, the generator is loaded by increasing the speed reference. The 723 will provide the droop signal required for stability. When the CB Aux contact input is closed when the generator is paralleled to a bus, the load control operating mode contact inputs become effective.

The 723 base load mode is selected by closing both the Base Load contact and the Unload contact. This function can be used in one of two modes: either as a control to load against a utility, or to isolate a single generator set from a load sharing system and load that set to a specific load. The second mode can also be used when a controlled unload is desired without taking the generator set off line.

Automatic Load Control Applications

Soft Loading into a Load Sharing System

Automatic soft loading into a load sharing system is selected by closing the Aux contact. The Unload contact should be closed to allow full load sharing operation. The loading function is activated when the oncoming generator set is properly synchronized and the paralleling generator breaker closes, closing the generator breaker auxiliary contacts to terminal 29.

The activated soft loading function compares the load on the oncoming unit with the load on the load sharing system. The load ramp then linearly increases the load on the unit at the rate set by the loading rate set point. When the loads match, the ramp is shut off and the internal load sharing relay closes.

Soft Unloading from a Load Sharing System

The unload sequence is initiated by opening the Unload contact. The 723 then ramps the load down to the unload trip level at the preset rate. When the load reaches the unload trip level set point, the control momentarily energizes the Circuit Breaker Open relay (terminals 3/4) to initiate the opening of the generator breaker. The 723 will hold the load at that point until the breaker opens.

Base Loading against a Utility and Load Sharing Systems

Close the Load/Unload contact (terminal 31) to enable loading. To enable base loading, the Base Load contact (terminal 30) and the Circuit Breaker Aux contact (terminal 29) must be connected to a set of generator breaker auxiliary contacts.

When the generator breaker is closed, the ramp starts and the unit load is increased to match the base load set point. The base load can be adjusted up or down while in the base load mode with the Raise and Lower Load contact inputs. The load will follow at a rate set by the appropriate load or unload rate set points. The external 4-20 mA load setting input, if used, takes precedence over the internal base load set point when both the Raise and Lower Load contacts are closed.

The Unload input (terminal 31) will initiate the unload sequence. Opening the Unload switch contact commands the ramp to decrease the demand on the generator to the unload trip level. When the trip level is reached, the breaker open command relay is momentarily de-energized to initiate opening of the generator circuit breaker. When the Circuit Breaker Aux contact opens, the 723 will remove the bias signal from the speed control and reset the loading function for when the breaker is again closed.

Conclusion of Setup Procedures

This completes the adjustment chapter. Save the set points by pressing the "SAVE" key on the Hand Held Programmer. Run through all the set points and record them in Appendix A for future reference. This can be useful if a replacement control is necessary or for start-up of another similar unit. Power down the control for about 10 seconds. Restore power and verify that all set points are as recorded.

NOTICE

To prevent possible damage to the engine resulting from improper control settings, make sure you save the set points before removing power from the control. Failure to save the set points before removing power from the control causes them to revert to the previously saved settings.

Disconnect the Hand Held Programmer from the control. Close the cover over J1 and retighten the retaining screw.

Chapter 5.
Description of Operation

General

This chapter provides an overview of the features and operation of the 723 Digital Speed Control. Figures 5-1 and 5-2 show the control block diagram, for reference in the following descriptions.

The 723 Digital Speed Control uses a 32-bit microprocessor for all control functions. All control adjustments are made with a hand-held terminal/display that communicates with the control via a serial port. The terminal/display is disconnected from the control when not in service, to provide security against tampering.

The speed sensors (9906-037 and 9906-038 controls) contain a special tracking filter designed for reciprocating engines, which minimizes the effects of flexible coupling torsionals. This provides exceptionally smooth steady-state control and allows the control dynamics to be matched to the engine rather than detuned to compensate for coupling torsionals. The speed signal itself is usually provided by a magnetic pickup or proximity switch supplying from 1 to 60 Vrms to the control. The control has two red indicators which illuminate if a speed sensor signal is lost.

The control has a switching power supply with excellent spike, ripple, and EMI (electromagnetic interference) rejection. Discrete inputs are optically isolated and capable of rejecting EMI and variable resistance in switch or relay contacts. Analog inputs are differential type with extra filtering for common-mode noise rejection. This protects the control from spurious interference and noise, which can cause speed and load shifts.

An auxiliary analog input is provided to interface with Woodward (or other) Power Sensors to provide isochronous load sharing, base loading, or droop operation.

The control also provides 4 to 20 mA terminals for tachometer output, KW load output, and a configurable output. These outputs may be used for an analog meter or as input to a computer. The offset and span are adjustable for range.

The 723 control provides two separate serial interfaces for RS-232 or RS-422 communications. The ports feature standard ASCII character handling. Baud rates and message protocols are programmable to meet specific user requirements. An industry-standard Modbus is also available for both ASCII and RTU protocols. Devices that may be connected include terminals, printers, data loggers, modems, and any other devices that use serial communications protocol.

The 723 control also communicates using the LonTalk® protocol to other LonTalk-compatible products. These include thermocouple, RTD, analog, and discrete-type I/O modules.

Control Dynamics

The control algorithms used in the 723 control are designed specifically for reciprocating engine applications. Control dynamics are varied automatically as a function of load to provide better performance over the operating range of the engine.

To provide better transient performance, the control can be operated automatically with two gain settings depending on engine speed error (speed error is the difference between the speed setting and the actual engine speed). During steady-state operation with a constant load, the control uses the base gain setting. This gain is adjusted by the user to a value to prevent the control from responding to minor fluctuations in engine speed, a common problem with gas-fueled, spark-ignited engines. This feature eliminates potentially damaging jiggle of the actuator and fuel system. The control automatically increases gain by an adjustable ratio when a speed error exceeding an adjustable window occurs. Operation with base gain is restored once the control senses the return to steady-state speed.

The control can also compensate for nonlinear fuel systems and changes in engine dynamics with load. The control dynamics are mapped as a function of actuator current (actuator current is proportional to engine load). This provides optimal dynamics and smooth steady-state operation for all conditions from no load to full engine load.

The control also provides two complete sets of dynamic adjustments which are selected when the 2nd Dynamics discrete input is activated. The two sets of dynamics are provided for use where engine operating conditions change, such as in systems with electrical power generation where the unit may be operated stand alone or paralleled with an infinite bus.

Fuel Limiters

The 723 Digital Speed Control provides a start fuel limiter to limit overfueling or flooding during start-up. The limiter is set to provide the desired maximum rack position during starts. The control will reduce the fuel when the speed set point is reached as required to control engine speed, but will not exceed the Start Fuel Limit.

A Maximum Fuel Limit set point is provided to limit the maximum control output current to the actuator during normal engine operating conditions. See Figure 5-3.

Speed Reference and Ramps

The 723 control provides local control of the speed reference, with discrete inputs to issue raise and lower speed commands. For remote speed setting, the control provides a 4 to 20 mA/1 to 5 Vdc Remote Speed/Load Setting input which is used for the speed reference. Remote is selected by closing both the Raise Speed/Load contact and the Lower Speed/Load contact.

This section describes the operation of each of the speed reference and ramp functions and their relation to each other. Read this section carefully to be sure your switchgear sequencing provides the proper operating modes.

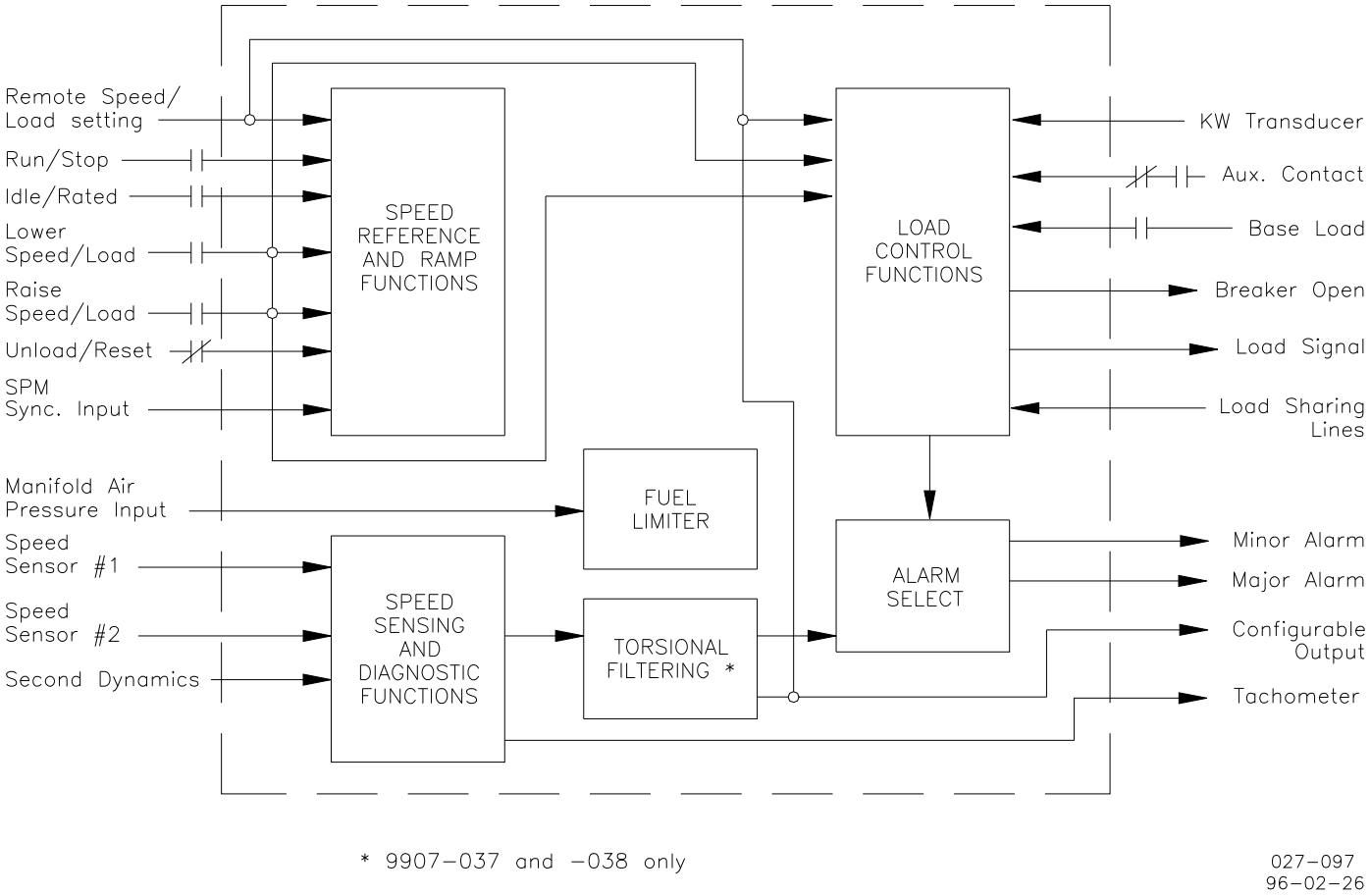
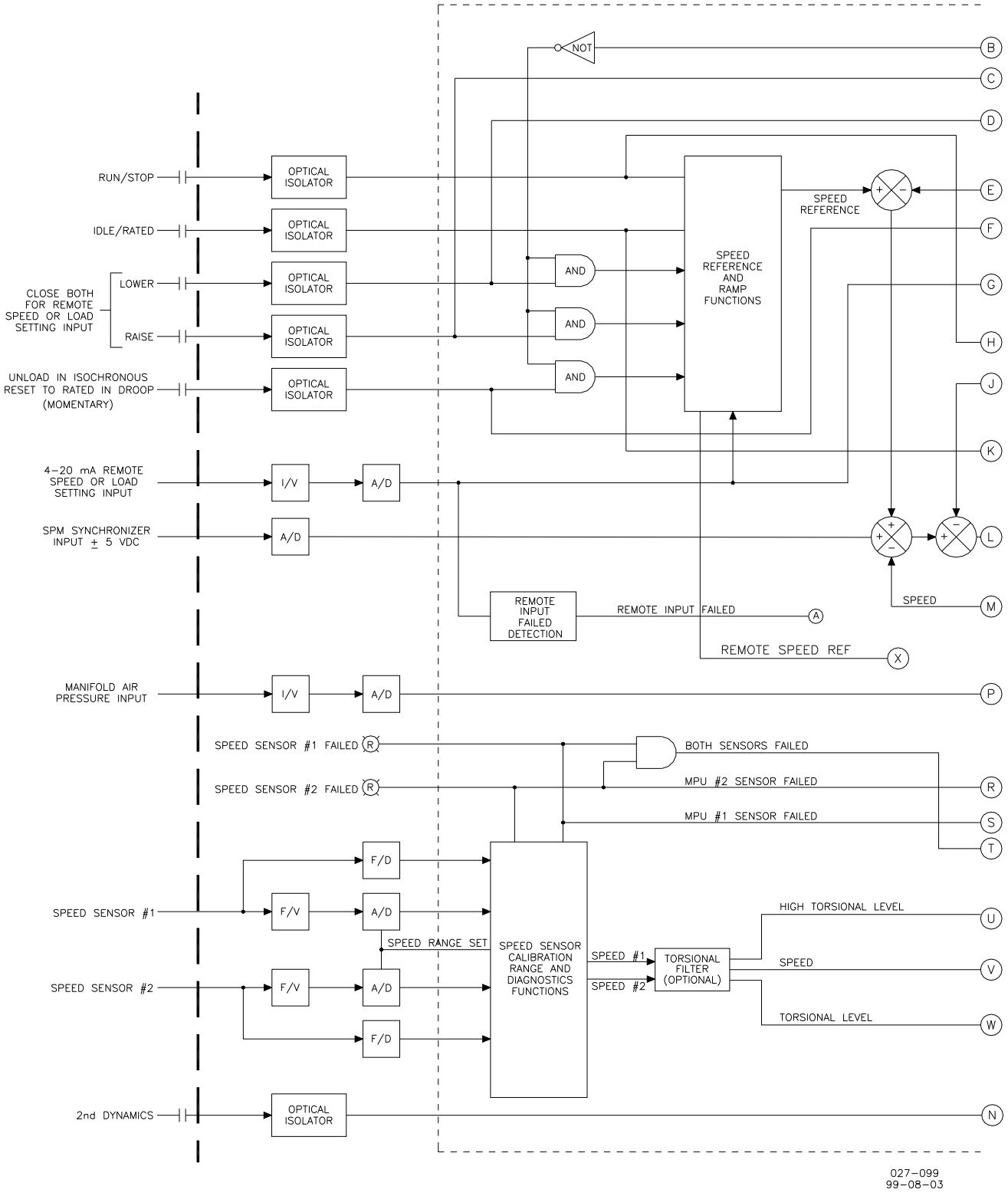


Figure 5-1. Simplified Block Diagram


NOT
B
C
D
RUN/STOP
OPTICAL ISOLATOR
IDLE/RATED
OPTICAL ISOLATOR
CLOSE BOTH FOR REMOTE SPEED OR LOAD SETTING INPUT
LOWER
OPTICAL ISOLATOR
RAISE
OPTICAL ISOLATOR
AND
AND
AND
SPEED REFERENCE AND RAMP FUNCTIONS
SPEED REFERENCE
E
F
G
H
UNLOAD IN ISOCHRONOUS RESET TO RATED IN DROOP (MOMENTARY)
OPTICAL ISOLATOR
J
K
4–20 mA REMOTE SPEED OR LOAD SETTING INPUT
I/V
A/D
SPM SYNCHRONIZER INPUT ± 5 VDC
A/D
L
SPEED
M
REMOTE INPUT FAILED DETECTION
REMOTE INPUT FAILED
A
REMOTE SPEED REF
X
MANIFOLD AIR PRESSURE INPUT
I/V
A/D
P
SPEED SENSOR #1 FAILED
R
SPEED SENSOR #2 FAILED
R
BOTH SENSORS FAILED
MPU #2 SENSOR FAILED
R
MPU #1 SENSOR FAILED
S
T
F/D
SPEED SENSOR #1
F/V
A/D
SPEED RANGE SET
SPEED SENSOR #2
F/V
A/D
F/D
SPEED SENSOR CALIBRATION RANGE AND DIAGNOSTICS FUNCTIONS
SPEED #1
SPEED #2
TORSIONAL FILTER (OPTIONAL)
HIGH TORSIONAL LEVEL
U
SPEED
V
TORSIONAL LEVEL
W
2nd DYNAMICS
OPTICAL ISOLATOR
N
027–099
99–08–03

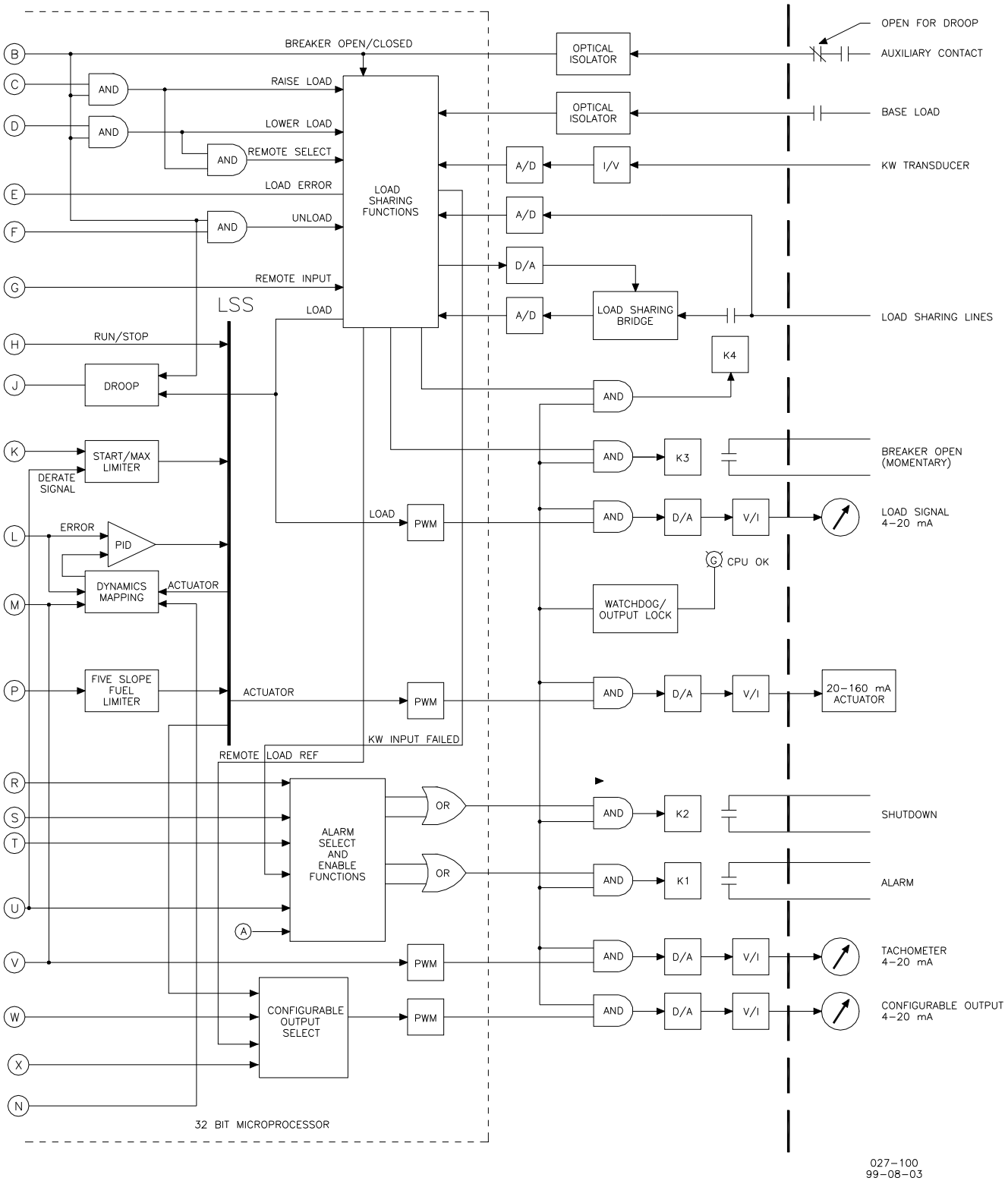


Figure 5-2. Detailed Block Diagram

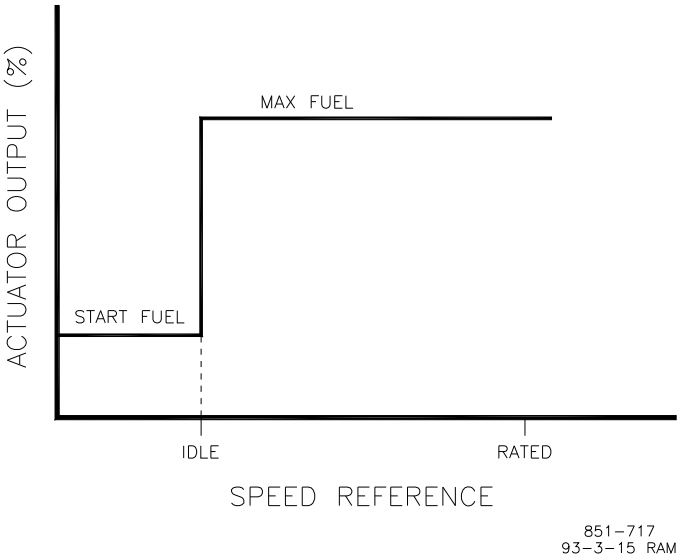


Figure 5-3. Fuel Limiters

The control provides idle, lower limit, rated, and raise limit set points, accel and decel times, and raise and lower rates, for local operation. Accel time determines the time required for the engine to ramp from idle to rated speed. Decel time determines the time required for the engine to ramp from rated speed to idle speed. Raise and lower rates determine how fast speed is increased or decreased by the raise and lower command inputs.

The idle speed set point is provided for engine start-up or cool down speed. Idle speed may be set equal to or less than the rated speed set point. Idle is independent of the lower limit set point and may be set to a lower speed. Idle speed cannot be changed except through adjustment of the idle speed set point.

Closing either the Raise or Lower contacts while ramping from idle to rated results in immediate cancellation of the idle to rated ramp.

After acceleration to rated speed is completed, the raise and lower commands increase and decrease engine speed based on the raise and lower rate set points. The raise and lower limits determine the limits of these commands.

If remote operation is selected after the engine reaches rated speed, the control will ramp speed to the reference value set by the Remote Speed/Load Setting milliamp input based on the raise or lower rate. The Remote Speed/Load Setting operates from 4 to 20 mA (1 to 5 Vdc). The values of the 4 mA and 20 mA remote reference set points must be set between the raise and lower limit set points. The 4 mA Remote Reference set point may be set to a lower or higher speed than the 20 mA set point, providing for either direct or reverse-acting remote speed setting.

If a remote input is present and selected when the Idle/Rated contact is closed or during the idle to rated ramp, the speed reference will ramp to the speed reference value determined by the milliamps on the Remote Speed/Load Setting input, based on the raise rate set point. This may not be the desired mode of operation, so be sure to understand the implications of operating the control in this manner.

Below 2 mA (0.5 Vdc), the remote input is considered failed. Between 4 and 20 mA (1 and 5 Vdc), the control determines the required speed reference based on a straight line between the 4 mA Remote Reference and 20 mA Remote Reference set points. If a difference is detected between the current speed reference and the remote reference computed from the mA input, the current speed reference is raised or lowered at the rate determined by the raise or lower rate to bring the speed reference into agreement with the remote speed reference. The remote reference will not increase speed over the raise limit or lower it below the lower limit.

When in remote mode (Raise and Lower Speed/Load contacts both closed), if the remote input goes below 2 mA (0.5 Vdc), the speed reference remains at the current value.

If the Idle/Rated contact is changed to idle after operating at rated, the control will immediately ramp engine speed to idle based on the decel time set point.

KW Load Reference and Ramps

When the Base Load and Circuit Breaker Aux contacts are closed, the speed reference is locked at its present value, and the raise, lower, and remote inputs control the KW load reference instead of the speed reference. The load reference then biases the speed reference for load control.

The 723 control provides local control of the base load reference with discrete inputs to issue raise and lower load commands. For remote KW load setting, the control provides a 4 to 20 mA/1 to 5 Vdc Remote Speed/Load Setting input which is used for the KW load reference. Remote is selected by closing both the Raise Speed/Load contact and the Lower Speed/Load contact.

The control provides Unload Trip Level, Base Load Reference, and Maximum Load set points, and Raise Load Rate and Lower Load Rate, for local operation. Raise Load and Lower Load Rates determine how fast KW load is increased or decreased by the raise and lower command inputs.

Power-Up Diagnostics

The power-up diagnostics feature is provided to verify the proper operation of the microprocessor and memory components. The diagnostics take about 20 seconds after the control is powered on. A failure of the test will turn off the output of the control. If diagnostic testing is successful, the green CPU OK indicator on the control cover will light.

Power System Management Concepts

This section provides a review of the operation of droop, isochronous, droop/isochronous, isochronous load sharing, and base load. These concepts provide an understanding for power management.

Paralleling

There are two basic methods used for paralleling: droop, where speed decreases with load, and isochronous, where speed remains constant. The paralleling system shown in Figure 5-4 consists of a load matching circuit (1), a load scaling circuit (2), and a KW transducer (3).

An auxiliary contact on the generator circuit breaker connected to terminal 29 is used to select isochronous load sharing operation. A contact in series with the auxiliary contact may be used to select either the droop or isochronous mode of operation.

When the input to the CB Aux contact is open, the control is in droop. When the CB Aux contact is closed, the control is in isochronous load sharing or base load as determined by the base load contact.

With only one unit on line, the generator picks up the available load and remains at isochronous speed. If additional units are on line, the load matching circuit corrects the fuel output to proportion load.

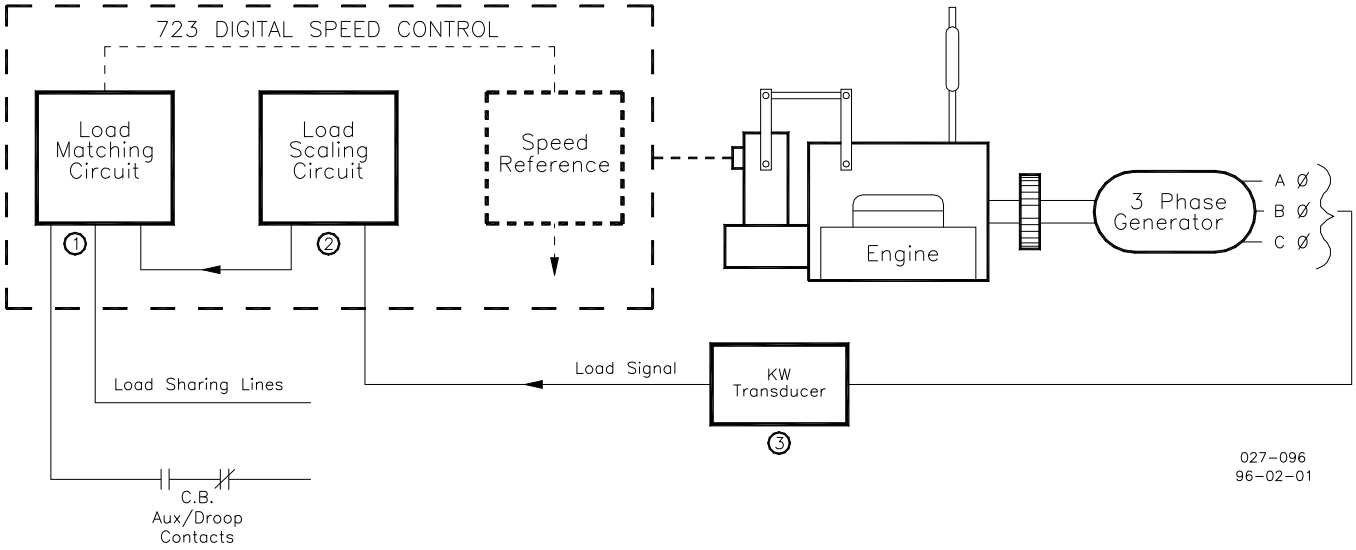


Figure 5-4. Paralleling System

An amplifier in the KW transducer computes the load carried by each phase of the generator. The current load on each phase is multiplied by the cosine of the phase difference between the current and the voltage, and the three phases are added to determine the total load.

The output of the load amplifier is adjusted by the load gain set point. By setting the load gain voltage on each unit to the same level at full load, proportional load sharing is achieved. Regardless of differences in generator set capacities in the system, each generator set is loaded to the same percentage of its capacity. A final adjustment of the individual load gain adjustment will compensate for minor differences in the generator sets.

Droop mode allows operation of a generator on an infinite bus or in parallel with other engine generator units using hydromechanical governors. In droop, speed changes as the load on the generator changes. An increase in load results in a decrease in speed. The amount of speed change or droop is expressed in percent and is set by the load droop set point.

The 723 digital control is powered by a dc-dc isolated power supply, which allows operation over a wide voltage range without generating excessive heat. This isolation protects the system from interference caused by ground loops, particularly through the load sharing lines, and allows load sharing with earlier models of Woodward load sharing controls.

Droop Mode

Droop is a decrease in speed or frequency, proportional to load. That is, as the load increases, the speed or frequency decreases, as illustrated in Figure 5-5. This reduction in speed is accomplished with negative feedback. The feedback increases as the system is loaded.

Droop is expressed as the percentage reduction in speed that occurs when the generator is fully loaded. With a given droop setting, a generator set will always produce the same power output at a particular speed or frequency. Droop sometimes is called the percent speed regulation.

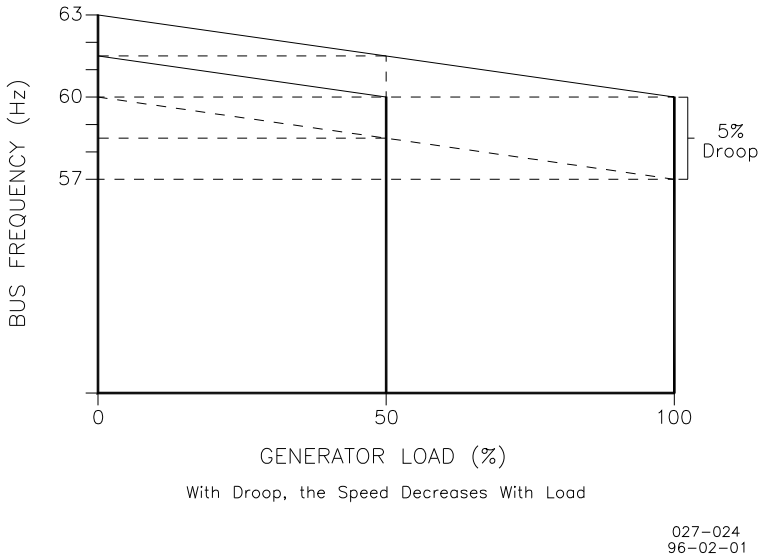


Figure 5-5. Droop Mode

If all generator sets in a droop system have the same droop setting, they will each share load proportionally. The amount of load will depend on their speed settings. If the system load changes, the system frequency will also change. A change in speed setting will then be required to offset the change in feedback and return the system to its original speed or frequency. In order for each generator set in the system to maintain the same proportion of the shared load, each generator will require the same change in speed setting.

Isochronous Mode

Isochronous means repeating at a single rate or having a fixed frequency or period. A generator set operating in the isochronous mode will operate at the same set frequency regardless of the load it is supplying, up to the full load capability of the generator set (see Figure 5-6). This mode can be used on one generator set running by itself in an isolated system.

The isochronous mode can also be used on a generator set connected in parallel with other generator sets. Unless the governors are load sharing and speed controls, however, no more than one of the generator sets operating in parallel can be in the isochronous mode. If two generator sets operating in the isochronous mode without load sharing controls are tied together to the same load, one of the units will try to carry the entire load and the other will shed all of its load. In order to share load with other units, some additional means must be used to keep each generator set from either trying to take all the load or from motoring.

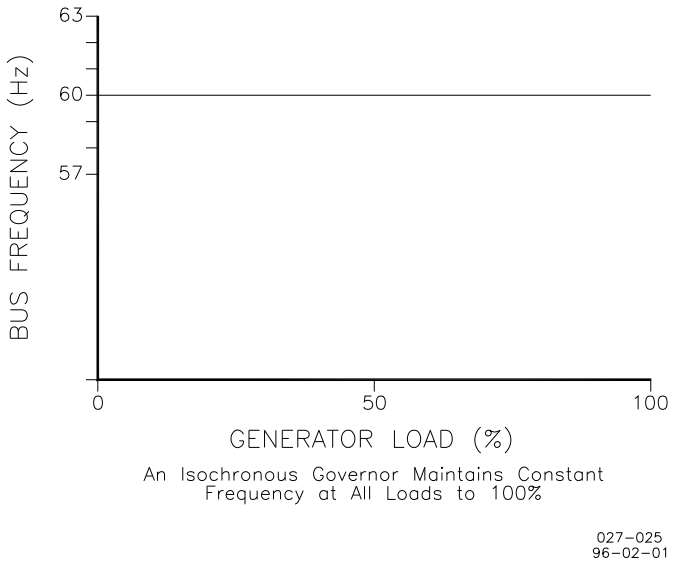


Figure 5-6. Isochronous Mode

Droop/Isochronous Load Sharing on an Isolated Bus

Droop/isochronous load sharing combines the first two modes. All generator sets in the system except one are operated in the droop mode. The one unit not in droop is operated in the isochronous mode. It is known as the swing machine. In this mode, the droop machines will run at the frequency of the isochronous unit. The droop and speed settings of each droop unit are adjusted so that each generates a fixed amount of power (see Figure 5-7). The output power of the swing machine will change to follow changes in the load demand.

Maximum load for this type of system is limited to the combined output of the swing machine and the total set power of the droop machines. The minimum system load cannot be allowed to decrease below the output set for the droop machines. If it does, the system frequency will change, and the swing machine can be motored.

The machine with the highest output capacity should be operated as the swing machine, so that the system will accept the largest load changes within its capacity.

Isochronous Load Sharing on an Isolated Bus

Isochronous load sharing operates all generator sets in a system in the isochronous mode. Load sharing is accomplished by adding a load sensor to each electric isochronous governor. The load sensors are interconnected by the load sharing lines. Any imbalance in load between units will cause a change to the regulating circuit in each governor. While each unit continues to run at isochronous speed, these changes force each machine to supply a proportional share of power to meet the total load demand on the system (see Figure 5-8).

Base Load on an Isolated Bus

Base Load is a method of setting a base or fixed load on a machine operating in parallel with an isolated bus. This is accomplished by using an isochronous load control and providing a reference at which to control the load. The governor will force the generator output to increase or decrease until the output of the load sensor is equal to the reference setting. At this point, the system is in balance.

This method can only be used where other generator sets are producing enough power to meet the changes in load demand. This operating mode is ideal for either soft loading additional units into an isochronous system, or for derating or unloading a machine (see Figure 5-9).

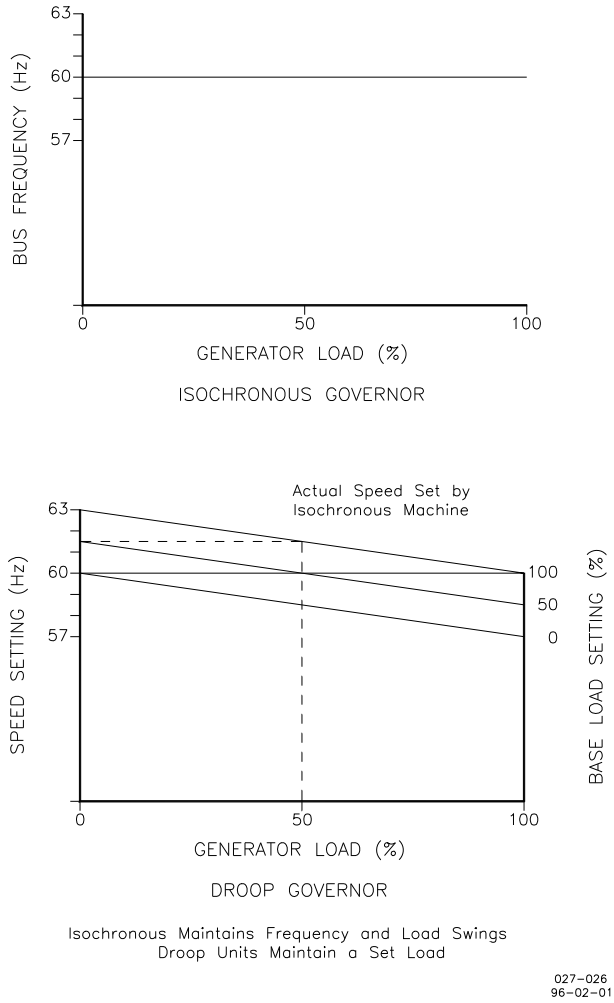


Figure 5-7. Droop/Isochronous Load Sharing

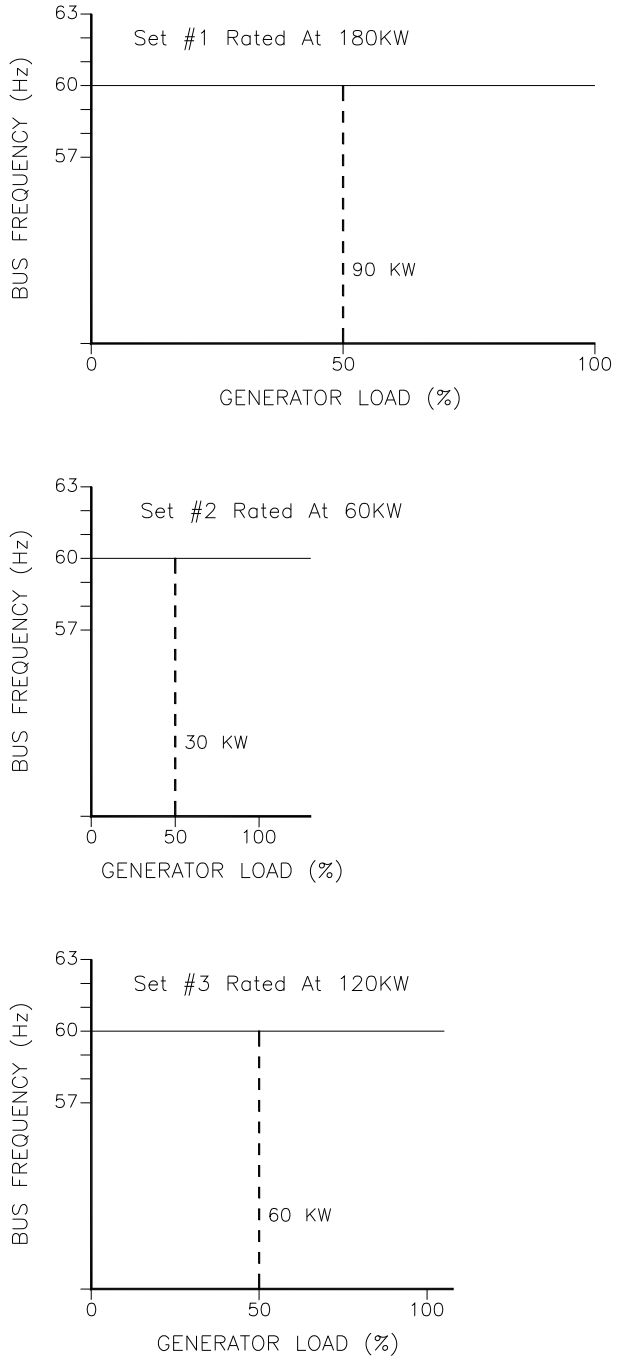


Figure 5-8. Isochronous Load Sharing

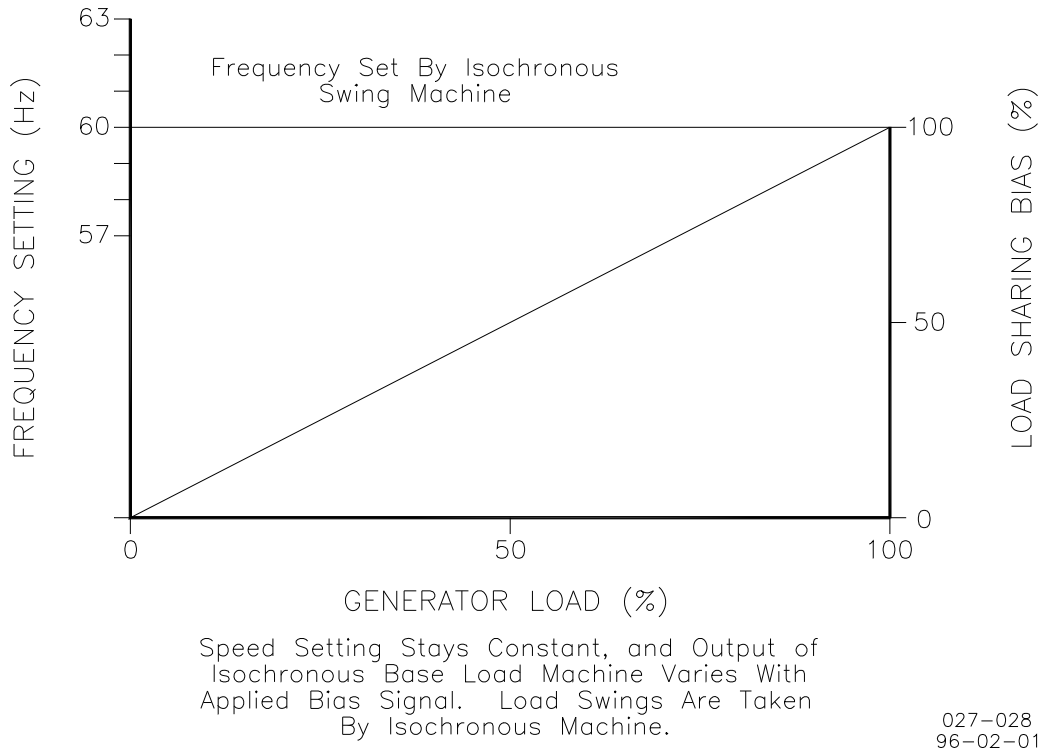


Figure 5-9. Isochronous Base Load on an Isolated Bus

Base Load

Base Load for a system paralleled to an infinite bus or utility is the same as base load in an isolated system. The advantage of base loading over droop is that when separating from a utility, there is no frequency change. Simply removing the bias signal on breaking from the utility returns the system to isochronous.

Chapter 6. Troubleshooting

General

The following troubleshooting guide is an aid in isolating trouble to the control box, actuator, plant wiring, or elsewhere. Troubleshooting beyond this level is recommended ONLY when a complete facility for control testing is available.

NOTICE

The control can be damaged with the wrong voltage. When replacing a control, check the power supply, battery, etc., for the correct voltage.

Troubleshooting Procedure

This chapter is a general guide for isolating system problems. Before using this procedure, make sure that the system wiring, soldering connections, switch and relay contacts, and input and output connections are correct and in good working order. Make the checks in the order indicated. Each system check assumes that the prior checks have been properly done.

Control Test and Calibration

General

Do the following checks on the 723 control. Then verify the functioning of set points and adjustments.

1. Connect the Hand Held Programmer to the control in accordance with the instructions in Chapter 4. Verify that correct voltage and polarity are applied to the control. Verify that the programmer does its power-up tests. Failure to do the power up test indicates either the control or Hand Held Programmer has failed. If so, try this step with another Hand Held Programmer. If the test still fails, replace the 723 control. If the test passes with the second Hand Held Programmer, replace the Hand Held Programmer.

2. Press the “ID” key. The message “723 Gen Set 9924-444” or “723 Gen Set 9924-445” should appear. Failure indicates either the control or Hand Held Programmer has failed. If so, try this step with another Hand Held Programmer. If the test still fails, replace the 723 control. If the test passes with the second Hand Held Programmer, replace the Hand Held Programmer.

3. Select the 1st Dynamics Menu. Verify that all set points are as recorded during installation. Repeat for the other menus. If any differences are found, change the set point(s) to the correct value. Press the “SAVE” key. The message “Saving Changes” should be displayed. Remove power from the control for at least 10 seconds. Verify correct values were retained during power down. Failure indicates the control has failed and should be replaced.

Discrete Inputs

Do the following test to verify the function of the discrete inputs. Do NOT do these tests with the engine running.

1. Close the Minimum Fuel (Run/Stop) contact. Select Min Fuel Contact Status on Display Menu 2. The status should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 36. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

2. Close the Idle/Rated contact. The Idle/Rated Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 35. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

3. Close the Raise Speed/Load contact. The Raise Speed Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 34. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

4. Close the Lower Speed/Load contact. The Lower Speed Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 33. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

5. Close the Unload contact. The Unload Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 32. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

6. Close the Baseload contact. The Baseload Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 31. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

7. Close the 2nd Dynamics contact. The 2nd Dynamics Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 30. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

8. Close the Isoch/Droop contact. The Isoch/Droop Contact Status in Display Menu 2 should be TRUE. If the value does not change from FALSE to TRUE when the contact is closed, verify the LED is illuminated at control terminal 29. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced.

KW Transducer Input

The following tests calibrate and verify the function of the KW Transducer input (Signal Input #1).

1. Connect a 4 to 20 mA source to terminals 42(+) and 43(–). Make sure a jumper is installed across terminals 41 and 42. Connect a mA meter in series with the 4 to 20 mA source.

2. Set the source for 20.0 mA on the meter. Select Display Menu 1 on the Hand Held Programmer. Select Generator Output.

3. The KW value should be equal to the 20mA KW Load Input value set previously in the KW Setting menu.

4. Set the source for 4.0 mA. The Generator Output value should be equal to the 4.0 mA KW Load Input value set previously in the KW Setting menu. If the meter indicates proper currents are present on Signal Input #1, but readings on the Hand Held Programmer are incorrect, the 723 control is defective and should be replaced.

SPM Synchronizer Input

The following tests calibrate and verify the function of the SPM Synchronizer input (Signal Input #2).

1. Connect a 1 to 5 Vdc source to terminals 45(+) and 46(–). Connect a dc voltmeter across terminals 45(+) and 46(–).

2. Set the source for 5.0 Vdc on the meter. Select Display Menu 1 on the Hand Held Programmer. Select Sync Input.

3. Verify that the display reads +5.0 ± 0.1 Vdc.

4. Set the source for -5.0 Vdc. The Synchronizer Input value should be -5.0 ± 0.1 Vdc. If the meter indicates proper voltages are present on Signal Input #2, but readings on the Hand Held Programmer are incorrect, the 723 control is defective and should be replaced.

Remote Speed/Load Xdcr Input

The following tests calibrate and verify the function of the Remote Speed/Load Xdcr input (Signal Input #3).

1. Connect a 4 to 20 mA or 1 to 5 Vdc source to terminals 48(+) and 49(–). If a mA source is used, a jumper must be installed across terminals 47 and 48. Connect a dc voltmeter across terminals 48(+) and 49(–). Optionally, a mA meter may be installed in series with the 4 to 20 mA source.

2. Set the source for 5.0 Vdc (20.0 mA) on the meter. Select Display Menu 1 on the Hand Held Programmer. Select Remote Speed Reference.

3. The rpm value should be equal to the 20mA Remote Reference value set previously in the Speed Setting menu.

4. Set the source for 1.0 Vdc (4.0 mA). The Remote Speed Reference value should be equal to the 4mA Remote Reference value set previously in the Speed Setting menu. If the meter indicates proper voltages (or currents) are present on Signal Input #3, but readings on the Hand Held Programmer are incorrect, the 723 control is defective and should be replaced.

Manifold Air Pressure Xdcr Input

The following tests calibrate and verify the function of the Manifold Air Pressure Xdcr input (Signal Input #4).

1. Connect a 4 to 20 mA or 1 to 5 Vdc source to terminals 51(+) and 52(–). If a mA source is used, a jumper must be installed across terminals 50 and 51. Connect a dc voltmeter across terminals 51(+) and 52(–). Optionally, a mA meter may be installed in series with the 4 to 20 mA source.

2. Set the source for 5.0 Vdc (20.0 mA) on the meter. Select Display Menu 1 on the Hand Held Programmer. Select MAP Input.

3. The MAP Input value should be equal to the MAP @ 20mA value set previously in the Fuel Limiters menu.

4. Set the source for 1.0 Vdc (4.0 mA). The MAP input value should be equal to the MAP @ 4mA value set previously in the Fuel Limiters menu. If the meter indicates proper voltages (or currents) are present on Signal Input #4, but readings on the Hand Held Programmer are incorrect, the 723 control is defective and should be replaced.

Actuator Output

The following tests verify the actuator output of the control.

1. Connect a frequency signal generator to Speed Sensor Input #1 (terminals 11/12). Set the output level above 1.0 Vrms, and the frequency to 400 Hz.

2. Close the Run contact (terminal 36). Connect a milliamp meter across terminals 19(+) and 20(–) if no actuator is connected. Connect the milliamp meter in series with the actuator if one is connected to the control. (Alternately, a dc voltmeter may be connected across the output when an actuator is connected. The correct output currents must be computed using the voltage measured and the input resistance of the actuator.)

3. Select the CFIG Speed Control Menu on the Hand Held Programmer. Set the Actuator Output to Forward Acting.

4. Select the Fuel Limiters Menu. Set Start Fuel Limit to 20%. The output current should be 42 ± 2 mA.

5. Set the Start Fuel Limit to 100%. The output current should be 210 ± 10 mA. If with all connections verified, the output of the control fails to perform as above, replace the control.

Speed Inputs

The following tests verify the operation of the speed inputs.

1. Connect a frequency signal generator to Speed Sensor Input #1 (terminal 11/12). Set the output level above 1.0 Vrms. Record the Gear #1 Teeth set point from the CFIG Speed Control Menu. Temporarily set the Gear #1 Teeth set point to 60 (this causes the rpm values and Hertz values to be the same, to make doing the tests easier).

2. Set the signal generator to 400 Hz. Read Engine Speed value of 400 rpm on Display Menu 1. Increase the signal generator frequency to 2000 Hz (NOTE—the value of the test frequency must not exceed the maximum frequency values set in the CFIG SPEED CONTROL menu). The value read should follow the signal generator frequency.

3. Return the Gear #1 Teeth set point on the CFIG Speed Control Menu to the previously recorded value for your engine.

4. Connect a frequency signal generator to Speed Sensor Input #2 (terminal 13/14). Set the output level above 1.0 Vrms. Record the Gear #2 Teeth set point from the CFIG Speed Control Menu. Temporarily set the Gear #2 Teeth set point to 60.

5. Set the signal generator to 400 Hz. Read Engine Speed value of 400 rpm on Display Menu 1. Increase the signal generator frequency to 2000 Hz (NOTE—the value of the test frequency must not exceed the maximum frequency values set in the CFIG SPEED CONTROL menu). The value read should follow the signal generator frequency.

6. Return the Gear #2 Teeth set point on the CFIG Speed Control Menu to the previously recorded value for your engine.

Conclusion of Test and Calibration Procedures

This completes the test and calibration chapter. Save the set points by pressing the “SAVE” key on the Hand Held Programmer. Power down the control for about 10 seconds. Restore power and verify that all set points are as recorded.

NOTICE

To prevent possible damage to the engine resulting from improper control settings, make sure you save the set points before removing power from the control. Failure to save the set points before removing power from the control causes them to revert to the previously saved settings.

Disconnect the Hand Held Programmer from the control. Close the cover over J1 and retighten the retaining screw.

⚠WARNING

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.

Chapter 7.
Echelon® LonWorks® Network

The communications network used by the 723 control is Echelon® Corporation's LonWorks® technology. An Echelon Neuron® chip operates as a slave processor to the 723 control main processor. LonWorks provides the interconnection between all controls over which I/O (input/output) information passes (see Figure 7-1).

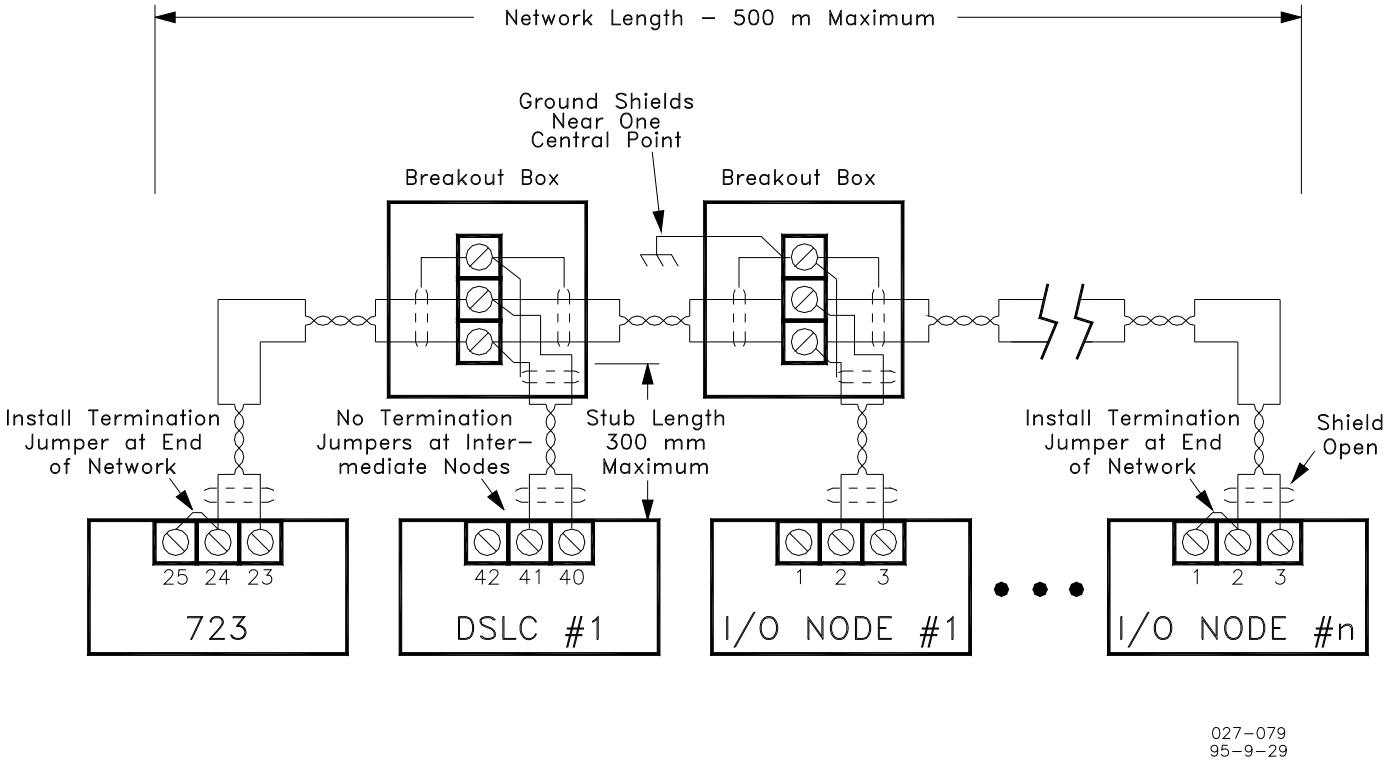


Figure 7-1. Typical LON Setup

The network may also include a Woodward DSLC™ Digital Synchronizer and Load Control. Information on operation with a DSLC control is contained in manual 02007.

Chapter 8.
Product Support and Service Options

Product Support Options

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

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or 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 current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
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

Products Used In 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

Products Used In Industrial Turbomachinery 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

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name

Site Location

Phone Number

Fax Number

Prime Mover Information

Manufacturer

Engine Model Number

Number of Cylinders

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.)

Power Output Rating

Application (power generation, marine, etc.)

Control/Governor Information

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

Symptoms

Description

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.

Appendix A.
Programming Checklist

We recommend you write down the final value of each menu item here so you will have a record if you later need to reprogram or replace the control.

_____ Software Part Number and Revision Letter

Service Menus

1st Dynamics Menu

_____ Gain 1
_____ Stability 1
_____ Compensation 1
_____ Gain Ratio 1
_____ Window Width 1
_____ Gain Slope Bk Pnt 1
_____ Gain Slope 1
_____ Speed Filter 1
_____ Enable Act Bump
_____ Act Bump Level
_____ Act Bump Duration

2nd Dynamics Menu

_____ Gain 2
_____ Stability 2
_____ Compensation 2
_____ Gain Ratio 2
_____ Window Width 2
_____ Gain Slope Bk Pnt 2
_____ Gain Slope 2
_____ Speed Filter 2
_____ Enable Act Bump
_____ Act Bump Level
_____ Act Bump Duration

Speed Setting Menu

_____ Raise Speed Limit
_____ Lower Speed Limit
_____ Idle Speed
_____ Accel Ramp Time
_____ Decel Ramp Time
_____ Raise Speed Rate
_____ Lower Speed Rate
_____ 4mA Remote Ref
_____ 20mA Remote Ref
_____ Tach @ 4mA Output
_____ Tach @ 20mA Output
_____ Enable Speed Filter
_____ Select Digital MPU

Torsional Filter Menu (9907-037/-038 only)

_____ Torsional Filter
_____ Derated Fuel Limit
_____ Derated Trip Level
_____ Derated Clear Level
_____ Tor Limit Active

KW Setting Menu

_____ Maximum Load
_____ Load Gain Voltage
_____ 4mA KW Load Input
_____ 20mA KW Load Input
_____ Base Load Reference
_____ Unload Trip Level
_____ Loading Rate
_____ Un-loading Rate
_____ 4mA Remote Ref
_____ 20mA Remote Ref
_____ Load Droop Percent
_____ Act Out @ No Load
_____ Act Out @ Full Load
_____ Load @ 4mA Output
_____ Load @ 20mA Output

Fuel Limiters Menu

_____ Start Fuel Limit
_____ Start Fuel Active
_____ Max Fuel Limit
_____ Max Fuel Active
_____ Enable MAP Limit
_____ MAP Active
_____ MAP Breakpoint A
_____ Fuel Limit at BP A
_____ MAP Breakpoint B
_____ Fuel Limit at BP B
_____ MAP Breakpoint C
_____ Fuel Limit at BP C
_____ MAP Breakpoint D
_____ Fuel Limit at BP D
_____ MAP Breakpoint E
_____ Fuel Limit at BP E
_____ MAP @ 4mA
_____ MAP @ 20mA

Miscellaneous Menu

_____ LON Service PIN
_____ LON Reset
_____ Service Reset
_____ Comm Reset
_____ CFIG Output @ 4mA
_____ CFIG Output @ 20mA

Serial Port Setup Menu

_____ Port 2 HW CFIG
_____ Port 2 Baud Rate
_____ Port 2 Stop Bits
_____ Port 2 Parity
_____ Port 3 HW CFIG
_____ Port 3 Baud Rate
_____ Port 3 Stop Bits
_____ Port 3 Parity

Display Menu 1

_____ Engine Speed
_____ Speed Reference
_____ Biased Speed Ref
_____ Bias from Isoch LS
_____ Bias from Droop
_____ Bias from Sync
_____ Generator Output
_____ Load Reference
_____ Actuator Output
_____ Torsional Level **(9907-037/-038 only)**
_____ Remote Speed Ref
_____ Remote Load Ref
_____ Remote Enabled
_____ LS Line Voltage
_____ LS Bridge Bias
_____ Sync Input
_____ MAP Limit
_____ MAP Input

Display Menu 2

_____ Speed Input #1
_____ Speed Input #2
_____ Min Fuel
_____ Idle/Rated
_____ Raise Speed/Load
_____ Lower Speed/Load
_____ Unload
_____ Baseload
_____ 2nd Dynamics
_____ Isoch/Droop
_____ Load Share Relay
_____ Ckt Bkr Relay
_____ Minor Alarm Output
_____ Major Alarm Output
_____ MPU1 Failed
_____ MPU2 Failed

Minor Alarm Menu

_____ MPU 1 Fail
_____ MPU 2 Fail
_____ MPU 1 and 2 Fail
_____ KW Xdcr Fail
_____ Rem Spd/Ld Xdcr Fail
_____ MAP Xdcr Fail
_____ High KW Alm
_____ High Act Output Alm
_____ High Tor Level Alm **(9907-037/-038 only)**
_____ Overspeed Alm
_____ Fail to Xmit Alm
_____ Minor Alarm Output

Major Alarm Menu

_____ MPU 1 Fail
_____ MPU 2 Fail
_____ MPU 1 and 2 Fail
_____ KW Xdcr Fail
_____ Rem Spd/Ld Xdcr Fail
_____ MAP Xdcr Fail
_____ High KW Alm
_____ High Act Output Alm
_____ High Tor Level Alm **(9907-037/-038 only)**
_____ Overspeed Alm
_____ Fail to Xmit Alm
_____ Major Alarm Output

Configure Menus

CFIG Speed Control

_____ Rated Speed
_____ AMPU #1 Teeth
_____ AMPU 1 Max Freq
_____ AMPU #2 Teeth
_____ AMPU 2 Max Freq
_____ Reverse Acting?
_____ Act2 CFIG Value
_____ DMPU #1 Teeth
_____ DMPU #2 Teeth

CFIG Minor Alarm

_____ MPU 1 Fail
_____ MPU 2 Fail
_____ MPU 1 and 2 Fail
_____ KW Xdcr Fail
_____ Rem Spd/Ld Xdcr Fail
_____ High KW Alm
_____ High KW Set Point
_____ High KW Delay
_____ High Act Output Alm
_____ High Act Set Point
_____ High Act Delay
_____ High Tor Level Alm **(9907-037/-038 only)**
_____ High Tor Set Point **(9907-037/-038 only)**
_____ High Tor Delay **(9907-037/-038 only)**
_____ Overspeed Alm
_____ Overspeed Set Point
_____ Overspeed Delay
_____ Fail to Xmit Alm

CFIG Major Alarm

_____ MPU 1 Fail
_____ MPU 2 Fail
_____ MPU 1 and 2 Fail
_____ KW Xdcr Fail
_____ Rem Spd/Ld Xdcr Fail
_____ High KW Alm
_____ High KW Set Point
_____ High KW Delay
_____ High Act Output Alm
_____ High Act Set Point
_____ High Act Delay
_____ High Tor Level Alm **(9907-037/-038 only)**
_____ High Tor Set Point **(9907-037/-038 only)**
_____ High Tor Delay **(9907-037/-038 only)**
_____ Overspeed Alm
_____ Overspeed Set Point
_____ Overspeed Delay
_____ Fail to Xmit Alm

CFIG Modbus

_____ Port 2 Address
_____ Port 3 Mode
_____ Port 3 Address

Appendix B.
Modbus Slave Address Information
Models 9907-035/-036 (without torsional filtering)

This appendix contains the Modbus slave address information for the 723 models without torsional filtering. See Appendix C for the address information for 723 models with torsional filtering.

```
MODBUS_S Block Name : COMM.SER_PORT2

Boolean Writes

Addr    Description
0:0001  SPEED RAISE
0:0002  SPEED LOWER
0:0003  CHANNEL 1 DISCRETE OUTPUT MODULE 1
0:0004  CHANNEL 2 DISCRETE OUTPUT MODULE 1
0:0005  CHANNEL 3 DISCRETE OUTPUT MODULE 1
0:0006  CHANNEL 4 DISCRETE OUTPUT MODULE 1
0:0007  CHANNEL 5 DISCRETE OUTPUT MODULE 1
0:0008  CHANNEL 6 DISCRETE OUTPUT MODULE 1
0:0009  CHANNEL 7 DISCRETE OUTPUT MODULE 1
0:0010  CHANNEL 8 DISCRETE OUTPUT MODULE 1
0:0011  CHANNEL 1 DISCRETE OUTPUT MODULE 2
0:0012  CHANNEL 2 DISCRETE OUTPUT MODULE 2
0:0013  CHANNEL 3 DISCRETE OUTPUT MODULE 2
0:0014  CHANNEL 4 DISCRETE OUTPUT MODULE 2
0:0015  CHANNEL 5 DISCRETE OUTPUT MODULE 2
0:0016  CHANNEL 6 DISCRETE OUTPUT MODULE 2
0:0017  CHANNEL 7 DISCRETE OUTPUT MODULE 2
0:0018  CHANNEL 8 DISCRETE OUTPUT MODULE 2
0:0019  CHANNEL 1 DISCRETE OUTPUT MODULE 3
0:0020  CHANNEL 2 DISCRETE OUTPUT MODULE 3
0:0021  CHANNEL 3 DISCRETE OUTPUT MODULE 3
0:0022  CHANNEL 4 DISCRETE OUTPUT MODULE 3
0:0023  CHANNEL 5 DISCRETE OUTPUT MODULE 3
0:0024  CHANNEL 6 DISCRETE OUTPUT MODULE 3
0:0025  CHANNEL 7 DISCRETE OUTPUT MODULE 3
0:0026  CHANNEL 8 DISCRETE OUTPUT MODULE 3
0:0027  CHANNEL 1 DISCRETE OUTPUT MODULE 4
0:0028  CHANNEL 2 DISCRETE OUTPUT MODULE 4
0:0029  CHANNEL 3 DISCRETE OUTPUT MODULE 4
0:0030  CHANNEL 4 DISCRETE OUTPUT MODULE 4
0:0031  CHANNEL 5 DISCRETE OUTPUT MODULE 4
0:0032  CHANNEL 6 DISCRETE OUTPUT MODULE 4
0:0033  CHANNEL 7 DISCRETE OUTPUT MODULE 4
0:0034  CHANNEL 8 DISCRETE OUTPUT MODULE 4
0:0035  SEVICE RESET
0:0036  COMM RESET

Boolean Reads

Addr    Input                                Description
1:0001  SR.REM_SEL_2.AND                       REMOTE SPD ENABLED
1:0002  DI.MIN_FUEL.BI                         MIN FUEL CONTACT
1:0003  DI.RATED.BI                            IDLE/RATED CONTACT
1:0004  DI.RAISE.OR                            RAISE SPEED CONTACT
1:0005  DI.LOWER.OR                            LOWER SPEED CONTACT

1:0006  DI.LOAD.BI                             UNLOAD CONTACT
1:0007  DI.BASE_LD.BI                          BASE LOAD CONTACT
1:0008  DI.DYN_2ND.BI                          2nd DYNAMICS CONTACT
1:0009  DI.CB_AUX.BI                           ISOCH/DROOP CONTACT
1:0010  LS.LS_EN_02.LATCH                      LOAD SHARE RELAY
1:0011  LS.BKR_OPN_01.NOT                      OPEN CIRCUIT BREAKER RELAY
1:0012  SC.SPD_CTRL_5.SEL_2                    START FUEL LIMIT ACTIVE
1:0013  SC.SPD_CTRL_5.SEL_3                    MAX FUEL LIMIT ACTIVE
1:0014  SC.SPD_CTRL_5.SEL_4                    MAP LIMIT ACTIVE
```

```
1:0015
1:0016  MAINIO.MPU_ALM_1.B_SW               MPU 1 FAILED
1:0017  MAINIO.MPU_ALM_2.B_SW               MPU 2 FAILED
1:0018  MINOR_ALM.ALARM.OR                  MINOR ALARM RELAY
1:0019  MINOR_ALM.MPU1.AND                  MPU 1 FAILURE MI/ALM
1:0020  MINOR_ALM.MPU2.AND                  MPU 2 FAILURE MI/ALM
1:0021  MINOR_ALM.MPU12.AND                 MPU 1 AND 2 FAILURE MI/ALM
1:0022  MINOR_ALM.KW_XDCR.AND               KW XDCR FAILURE MI/ALM
1:0023  MINOR_ALM.RM_SPD_LD.AND             REM SPD XDCR FAILURE MI/ALM
1:0024  MINOR_ALM.MAP_XDCR.AND              MAP XDCR FAILURE MI/ALM
1:0025  MINOR_ALM.HIGH_KW_1.LATCH           HIGH KW  OUTPUT MI/ALM
1:0026  MINOR_ALM.HIGH_ACT_1.LATCH          HIGH ACTUATOR OUTPUT MI/ALM
1:0027
1:0028  MINOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MI/ALM
1:0029  MINOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MI/ALM
1:0030  MAJOR_ALM.ALARM.OR                  MAJOR ALARM RELAY
1:0031  MAJOR_ALM.MPU1.AND                  MPU 1 FAILURE MA/ALM
1:0032  MAJOR_ALM.MPU2.AND                  MPU 2 FAILURE MA/ALM
1:0033  MAJOR_ALM.MPU12.AND                 MPU 1 AND 2 FAILURE MA/ALM
1:0034  MAJOR_ALM.KW_XDCR.AND               KW XDCR FAILURE MA/ALM
1:0035  MAJOR_ALM.RM_SPD_LD.AND             REM SPD XDCR FAILURE MA/ALM
1:0036  MAJOR_ALM.MAP_XDCR.AND              MAP XDCR FAILURE MA/ALM
1:0037  MAJOR_ALM.HIGH_KW_1.LATCH           HIGH KW  OUTPUT MA/ALM
1:0038  MAJOR_ALM.HIGH_ACT_1.LATCH          HIGH ACTUATOR OUTPUT MA/ALM
1:0039
1:0040  MAJOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MA/ALM
1:0041  MAJOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MA/ALM
1:0042–1:0098
1:0099  COMM.FAIL_XMIT.OR                   LON BLOCK FAIL TO TRANSMIT
1:0100  DI_MOD_01.CH_01.BI                  DISCRETE IN MOD 1 CHANNEL 1
1:0101  DI_MOD_01.CH_02.BI                  DISCRETE IN MOD 1 CHANNEL 2
1:0102  DI_MOD_01.CH_03.BI                  DISCRETE IN MOD 1 CHANNEL 3
1:0103  DI_MOD_01.CH_04.BI                  DISCRETE IN MOD 1 CHANNEL 4
1:0104  DI_MOD_01.CH_05.BI                  DISCRETE IN MOD 1 CHANNEL 5
1:0105  DI_MOD_01.CH_06.BI                  DISCRETE IN MOD 1 CHANNEL 6
1:0106  DI_MOD_01.CH_07.BI                  DISCRETE IN MOD 1 CHANNEL 7
1:0107  DI_MOD_01.CH_08.BI                  DISCRETE IN MOD 1 CHANNEL 8
1:0108  DI_MOD_01.CH_09.BI                  DISCRETE IN MOD 1 CHANNEL 9
1:0109  DI_MOD_01.CH_10.BI                  DISCRETE IN MOD 1 CHANNEL 10
1:0110  DI_MOD_01.CH_11.BI                  DISCRETE IN MOD 1 CHANNEL 11
1:0111  DI_MOD_01.CH_12.BI                  DISCRETE IN MOD 1 CHANNEL 12
1:0112  DI_MOD_01.CH_13.BI                  DISCRETE IN MOD 1 CHANNEL 13
1:0113  DI_MOD_01.CH_14.BI                  DISCRETE IN MOD 1 CHANNEL 14
1:0114  DI_MOD_01.CH_15.BI                  DISCRETE IN MOD 1 CHANNEL 15
1:0115  DI_MOD_01.CH_16.BI                  DISCRETE IN MOD 1 CHANNEL 16
1:0116  DI_MOD_02.CH_01.BI                  DISCRETE IN MOD 2 CHANNEL 1
1:0117  DI_MOD_02.CH_02.BI                  DISCRETE IN MOD 2 CHANNEL 2
1:0118  DI_MOD_02.CH_03.BI                  DISCRETE IN MOD 2 CHANNEL 3
1:0119  DI_MOD_02.CH_04.BI                  DISCRETE IN MOD 2 CHANNEL 4
1:0120  DI_MOD_02.CH_05.BI                  DISCRETE IN MOD 2 CHANNEL 5
1:0121  DI_MOD_02.CH_06.BI                  DISCRETE IN MOD 2 CHANNEL 6
1:0122  DI_MOD_02.CH_07.BI                  DISCRETE IN MOD 2 CHANNEL 7
1:0123  DI_MOD_02.CH_08.BI                  DISCRETE IN MOD 2 CHANNEL 8
1:0124  DI_MOD_02.CH_09.BI                  DISCRETE IN MOD 2 CHANNEL 9
1:0125  DI_MOD_02.CH_10.BI                  DISCRETE IN MOD 2 CHANNEL 10
1:0126  DI_MOD_02.CH_11.BI                  DISCRETE IN MOD 2 CHANNEL 11
1:0127  DI_MOD_02.CH_12.BI                  DISCRETE IN MOD 2 CHANNEL 12

1:0128  DI_MOD_02.CH_13.BI                  DISCRETE IN MOD 2 CHANNEL 13
1:0129  DI_MOD_02.CH_14.BI                  DISCRETE IN MOD 2 CHANNEL 14
1:0130  DI_MOD_02.CH_15.BI                  DISCRETE IN MOD 2 CHANNEL 15
1:0131  DI_MOD_02.CH_16.BI                  DISCRETE IN MOD 2 CHANNEL 16
1:0132  DI_MOD_03.CH_01.BI                  DISCRETE IN MOD 3 CHANNEL 1
1:0133  DI_MOD_03.CH_02.BI                  DISCRETE IN MOD 3 CHANNEL 2
1:0134  DI_MOD_03.CH_03.BI                  DISCRETE IN MOD 3 CHANNEL 3
1:0135  DI_MOD_03.CH_04.BI                  DISCRETE IN MOD 3 CHANNEL 4
1:0136  DI_MOD_03.CH_05.BI                  DISCRETE IN MOD 3 CHANNEL 5
1:0137  DI_MOD_03.CH_06.BI                  DISCRETE IN MOD 3 CHANNEL 6
1:0138  DI_MOD_03.CH_07.BI                  DISCRETE IN MOD 3 CHANNEL 7
1:0139  DI_MOD_03.CH_08.BI                  DISCRETE IN MOD 3 CHANNEL 8
1:0140  DI_MOD_03.CH_09.BI                  DISCRETE IN MOD 3 CHANNEL 9
1:0141  DI_MOD_03.CH_10.BI                  DISCRETE IN MOD 3 CHANNEL 10
1:0142  DI_MOD_03.CH_11.BI                  DISCRETE IN MOD 3 CHANNEL 11
1:0143  DI_MOD_03.CH_12.BI                  DISCRETE IN MOD 3 CHANNEL 12
1:0144  DI_MOD_03.CH_13.BI                  DISCRETE IN MOD 3 CHANNEL 13
```

1:0145	DI_MOD_03.CH_14.BI	DISCRETE IN MOD 3 CHANNEL 14
1:0146	DI_MOD_03.CH_15.BI	DISCRETE IN MOD 3 CHANNEL 15
1:0147	DI_MOD_03.CH_16.BI	DISCRETE IN MOD 3 CHANNEL 16
1:0148	DI_MOD_04.CH_01.BI	DISCRETE IN MOD 4 CHANNEL 1
1:0149	DI_MOD_04.CH_02.BI	DISCRETE IN MOD 4 CHANNEL 2
1:0150	DI_MOD_04.CH_03.BI	DISCRETE IN MOD 4 CHANNEL 3
1:0151	DI_MOD_04.CH_04.BI	DISCRETE IN MOD 4 CHANNEL 4
1:0152	DI_MOD_04.CH_05.BI	DISCRETE IN MOD 4 CHANNEL 5
1:0153	DI_MOD_04.CH_06.BI	DISCRETE IN MOD 4 CHANNEL 6
1:0154	DI_MOD_04.CH_07.BI	DISCRETE IN MOD 4 CHANNEL 7
1:0155	DI_MOD_04.CH_08.BI	DISCRETE IN MOD 4 CHANNEL 8
1:0156	DI_MOD_04.CH_09.BI	DISCRETE IN MOD 4 CHANNEL 9
1:0157	DI_MOD_04.CH_10.BI	DISCRETE IN MOD 4 CHANNEL 10
1:0158	DI_MOD_04.CH_11.BI	DISCRETE IN MOD 4 CHANNEL 11
1:0159	DI_MOD_04.CH_12.BI	DISCRETE IN MOD 4 CHANNEL 12
1:0160	DI_MOD_04.CH_13.BI	DISCRETE IN MOD 4 CHANNEL 13
1:0161	DI_MOD_04.CH_14.BI	DISCRETE IN MOD 4 CHANNEL 14
1:0162	DI_MOD_04.CH_15.BI	DISCRETE IN MOD 4 CHANNEL 15
1:0163	DI_MOD_04.CH_16.BI	DISCRETE IN MOD 4 CHANNEL 16
1:0164	DI_MOD_05.CH_01.BI	DISCRETE IN MOD 5 CHANNEL 1
1:0165	DI_MOD_05.CH_02.BI	DISCRETE IN MOD 5 CHANNEL 2
1:0166	DI_MOD_05.CH_03.BI	DISCRETE IN MOD 5 CHANNEL 3
1:0167	DI_MOD_05.CH_04.BI	DISCRETE IN MOD 5 CHANNEL 4
1:0168	DI_MOD_05.CH_05.BI	DISCRETE IN MOD 5 CHANNEL 5
1:0169	DI_MOD_05.CH_06.BI	DISCRETE IN MOD 5 CHANNEL 6
1:0170	DI_MOD_05.CH_07.BI	DISCRETE IN MOD 5 CHANNEL 7
1:0171	DI_MOD_05.CH_08.BI	DISCRETE IN MOD 5 CHANNEL 8
1:0172	DI_MOD_05.CH_09.BI	DISCRETE IN MOD 5 CHANNEL 9
1:0173	DI_MOD_05.CH_10.BI	DISCRETE IN MOD 5 CHANNEL 10
1:0174	DI_MOD_05.CH_11.BI	DISCRETE IN MOD 5 CHANNEL 11
1:0175	DI_MOD_05.CH_12.BI	DISCRETE IN MOD 5 CHANNEL 12
1:0176	DI_MOD_05.CH_13.BI	DISCRETE IN MOD 5 CHANNEL 13
1:0177	DI_MOD_05.CH_14.BI	DISCRETE IN MOD 5 CHANNEL 14
1:0178	DI_MOD_05.CH_15.BI	DISCRETE IN MOD 5 CHANNEL 15
1:0179	DI_MOD_05.CH_16.BI	DISCRETE IN MOD 5 CHANNEL 16
1:0180	DI_MOD_06.CH_01.BI	DISCRETE IN MOD 6 CHANNEL 1
1:0181	DI_MOD_06.CH_02.BI	DISCRETE IN MOD 6 CHANNEL 2
1:0182	DI_MOD_06.CH_03.BI	DISCRETE IN MOD 6 CHANNEL 3
1:0183	DI_MOD_06.CH_04.BI	DISCRETE IN MOD 6 CHANNEL 4
1:0184	DI_MOD_06.CH_05.BI	DISCRETE IN MOD 6 CHANNEL 5
1:0185	DI_MOD_06.CH_06.BI	DISCRETE IN MOD 6 CHANNEL 6
1:0186	DI_MOD_06.CH_07.BI	DISCRETE IN MOD 6 CHANNEL 7
1:0187	DI_MOD_06.CH_08.BI	DISCRETE IN MOD 6 CHANNEL 8
1:0188	DI_MOD_06.CH_09.BI	DISCRETE IN MOD 6 CHANNEL 9
1:0189	DI_MOD_06.CH_10.BI	DISCRETE IN MOD 6 CHANNEL 10
1:0190	DI_MOD_06.CH_11.BI	DISCRETE IN MOD 6 CHANNEL 11
1:0191	DI_MOD_06.CH_12.BI	DISCRETE IN MOD 6 CHANNEL 12
1:0192	DI_MOD_06.CH_13.BI	DISCRETE IN MOD 6 CHANNEL 13
1:0193	DI_MOD_06.CH_14.BI	DISCRETE IN MOD 6 CHANNEL 14
1:0194	DI_MOD_06.CH_15.BI	DISCRETE IN MOD 6 CHANNEL 15
1:0195	DI_MOD_06.CH_16.BI	DISCRETE IN MOD 6 CHANNEL 16

Analog Reads

Addr	Input	Description
3:0001	SPD.ENG_SPD_04.HSS_BUS	ENGINE SPEED (rpm)
3:0002	SR.SPD_REF_08.RAMP	SPEED REFERENCE (rpm)
3:0003	SR.SPD_REF_01.ADD	BIASED SPEED RFERENCE (rpm)
3:0004	SC.SPD_CTRL_3.A_SW	ACTUATOR OUTPUT (%)
3:0005	LS.LD_SEN_2.LAG	GENERATOR OUTPUT (kw)
3:0006	SR.REM_SPD_3.CURVE_2D	REMOTE SPEED REF (rpm)
3:0007		
3:0008	MAINIO.SYNC.AI_CURVE	SYNCHRONIZER INPUT (volts)
3:0009	LS.REM_BLD_03.CURVE_2D	REMOTE LOAD REF (kw)
3:0010	LS.B_LD_01.RAMP	BASE LOAD LEVEL
3:0011	LIMIT.MAP_05.CURVE_2D	MAP SENSOR INPUT (eng unit)
3:0012	SPD.ENG_SPD_06.A_SW	SPEED INPUT #1 (rpm)
3:0013	SPD.ENG_SPD_07.A_SW	SPEED INPUT #2 (rpm)
3:0014–3:0030		
3:0031	MAINIO.TC_MOD_01.TE_1	TC MODULUE 1 CHANNEL 1
3:0032	MAINIO.TC_MOD_01.TE_2	TC MODULUE 1 CHANNEL 2
3:0033	MAINIO.TC_MOD_01.TE_3	TC MODULUE 1 CHANNEL 3
3:0034	MAINIO.TC_MOD_01.TE_4	TC MODULUE 1 CHANNEL 4
3:0035	MAINIO.TC_MOD_01.TE_5	TC MODULUE 1 CHANNEL 5

3:0036	MAINIO.TC_MOD_01.TE_6	TC MODULUE 1 CHANNEL 6
3:0037	MAINIO.TC_MOD_01.TE_7	TC MODULUE 1 CHANNEL 7
3:0038	MAINIO.TC_MOD_01.TE_8	TC MODULUE 1 CHANNEL 8
3:0039	MAINIO.TC_MOD_02.TE_1	TC MODULUE 2 CHANNEL 1
3:0040	MAINIO.TC_MOD_02.TE_2	TC MODULUE 2 CHANNEL 2
3:0041	MAINIO.TC_MOD_02.TE_3	TC MODULUE 2 CHANNEL 3
3:0042	MAINIO.TC_MOD_02.TE_4	TC MODULUE 2 CHANNEL 4
3:0043	MAINIO.TC_MOD_02.TE_5	TC MODULUE 2 CHANNEL 5
3:0044	MAINIO.TC_MOD_02.TE_6	TC MODULUE 2 CHANNEL 6
3:0045	MAINIO.TC_MOD_02.TE_7	TC MODULUE 2 CHANNEL 7
3:0046	MAINIO.TC_MOD_02.TE_8	TC MODULUE 2 CHANNEL 8
3:0047	MAINIO.TC_MOD_03.TE_1	TC MODULUE 3 CHANNEL 1
3:0048	MAINIO.TC_MOD_03.TE_2	TC MODULUE 3 CHANNEL 2
3:0049	MAINIO.TC_MOD_03.TE_3	TC MODULUE 3 CHANNEL 3
3:0050	MAINIO.TC_MOD_03.TE_4	TC MODULUE 3 CHANNEL 4
3:0051	MAINIO.TC_MOD_03.TE_5	TC MODULUE 3 CHANNEL 5
3:0052	MAINIO.TC_MOD_03.TE_6	TC MODULUE 3 CHANNEL 6
3:0053	MAINIO.TC_MOD_03.TE_7	TC MODULUE 3 CHANNEL 7
3:0054	MAINIO.TC_MOD_03.TE_8	TC MODULUE 3 CHANNEL 8
3:0055	MAINIO.TC_MOD_04.TE_1	TC MODULUE 4 CHANNEL 1
3:0056	MAINIO.TC_MOD_04.TE_2	TC MODULUE 4 CHANNEL 2
3:0057	MAINIO.TC_MOD_04.TE_3	TC MODULUE 4 CHANNEL 3
3:0058	MAINIO.TC_MOD_04.TE_4	TC MODULUE 4 CHANNEL 4
3:0059	MAINIO.TC_MOD_04.TE_5	TC MODULUE 4 CHANNEL 5
3:0060	MAINIO.TC_MOD_04.TE_6	TC MODULUE 4 CHANNEL 6
3:0061	MAINIO.TC_MOD_04.TE_7	TC MODULUE 4 CHANNEL 7
3:0062	MAINIO.TC_MOD_04.TE_8	TC MODULUE 4 CHANNEL 8
3:0063	MAINIO.TC_MOD_05.TE_1	TC MODULUE 5 CHANNEL 1
3:0064	MAINIO.TC_MOD_05.TE_2	TC MODULUE 5 CHANNEL 2
3:0065	MAINIO.TC_MOD_05.TE_3	TC MODULUE 5 CHANNEL 3
3:0066	MAINIO.TC_MOD_05.TE_4	TC MODULUE 5 CHANNEL 4
3:0067	MAINIO.TC_MOD_05.TE_5	TC MODULUE 5 CHANNEL 5
3:0068	MAINIO.TC_MOD_05.TE_6	TC MODULUE 5 CHANNEL 6
3:0069	MAINIO.TC_MOD_05.TE_7	TC MODULUE 5 CHANNEL 7
3:0070	MAINIO.TC_MOD_05.TE_8	TC MODULUE 5 CHANNEL 8
3:0071	MAINIO.TC_MOD_06.TE_1	TC MODULUE 6 CHANNEL 1
3:0072	MAINIO.TC_MOD_06.TE_2	TC MODULUE 6 CHANNEL 2
3:0073	MAINIO.TC_MOD_06.TE_3	TC MODULUE 6 CHANNEL 3
3:0074	MAINIO.TC_MOD_06.TE_4	TC MODULUE 6 CHANNEL 4
3:0075	MAINIO.TC_MOD_06.TE_5	TC MODULUE 6 CHANNEL 5
3:0076	MAINIO.TC_MOD_06.TE_6	TC MODULUE 6 CHANNEL 6
3:0077	MAINIO.TC_MOD_06.TE_7	TC MODULUE 6 CHANNEL 7
3:0078	MAINIO.TC_MOD_06.TE_8	TC MODULUE 6 CHANNEL 8
3:0079	MAINIO.TC_MOD_07.TE_1	TC MODULUE 7 CHANNEL 1
3:0080	MAINIO.TC_MOD_07.TE_2	TC MODULUE 7 CHANNEL 2
3:0081	MAINIO.TC_MOD_07.TE_3	TC MODULUE 7 CHANNEL 3
3:0082	MAINIO.TC_MOD_07.TE_4	TC MODULUE 7 CHANNEL 4
3:0083	MAINIO.TC_MOD_07.TE_5	TC MODULUE 7 CHANNEL 5
3:0084	MAINIO.TC_MOD_07.TE_6	TC MODULUE 7 CHANNEL 6
3:0085	MAINIO.TC_MOD_07.TE_7	TC MODULUE 7 CHANNEL 7
3:0086	MAINIO.TC_MOD_07.TE_8	TC MODULUE 7 CHANNEL 8
3:0087	MAINIO.TC_MOD_08.TE_1	TC MODULUE 8 CHANNEL 1
3:0088	MAINIO.TC_MOD_08.TE_2	TC MODULUE 8 CHANNEL 2
3:0089	MAINIO.TC_MOD_08.TE_3	TC MODULUE 8 CHANNEL 3
3:0090	MAINIO.TC_MOD_08.TE_4	TC MODULUE 8 CHANNEL 4
3:0091	MAINIO.TC_MOD_08.TE_5	TC MODULUE 8 CHANNEL 5
3:0092	MAINIO.TC_MOD_08.TE_6	TC MODULUE 8 CHANNEL 6
3:0093	MAINIO.TC_MOD_08.TE_7	TC MODULUE 8 CHANNEL 7
3:0094	MAINIO.TC_MOD_08.TE_8	TC MODULUE 8 CHANNEL 8
3:0095	MAINIO.RTD_MOD_01.TE_1	RTD MODULE 1 CHANNEL 1
3:0096	MAINIO.RTD_MOD_01.TE_2	RTD MODULE 1 CHANNEL 2
3:0097	MAINIO.RTD_MOD_01.TE_3	RTD MODULE 1 CHANNEL 3
3:0098	MAINIO.RTD_MOD_01.TE_4	RTD MODULE 1 CHANNEL 4
3:0099	MAINIO.RTD_MOD_01.TE_5	RTD MODULE 1 CHANNEL 5
3:0100	MAINIO.RTD_MOD_01.TE_6	RTD MODULE 1 CHANNEL 6
3:0101	MAINIO.RTD_MOD_01.TE_7	RTD MODULE 1 CHANNEL 7
3:0102	MAINIO.RTD_MOD_01.TE_8	RTD MODULE 1 CHANNEL 8
3:0103	MAINIO.RTD_MOD_02.TE_1	RTD MODULE 2 CHANNEL 1
3:0104	MAINIO.RTD_MOD_02.TE_2	RTD MODULE 2 CHANNEL 2
3:0105	MAINIO.RTD_MOD_02.TE_3	RTD MODULE 2 CHANNEL 3
3:0106	MAINIO.RTD_MOD_02.TE_4	RTD MODULE 2 CHANNEL 4
3:0107	MAINIO.RTD_MOD_02.TE_5	RTD MODULE 2 CHANNEL 5
3:0108	MAINIO.RTD_MOD_02.TE_6	RTD MODULE 2 CHANNEL 6
3:0109	MAINIO.RTD_MOD_02.TE_7	RTD MODULE 2 CHANNEL 7

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3:0110  MAINIO.RTD_MOD_02.TE_8              RTD MODULE 2 CHANNEL 8
3:0111  MAINIO.RTD_MOD_03.TE_1              RTD MODULE 3 CHANNEL 1
3:0112  MAINIO.RTD_MOD_03.TE_2              RTD MODULE 3 CHANNEL 2
3:0113  MAINIO.RTD_MOD_03.TE_3              RTD MODULE 3 CHANNEL 3
3:0114  MAINIO.RTD_MOD_03.TE_4              RTD MODULE 3 CHANNEL 4
3:0115  MAINIO.RTD_MOD_03.TE_5              RTD MODULE 3 CHANNEL 5
3:0116  MAINIO.RTD_MOD_03.TE_6              RTD MODULE 3 CHANNEL 6
3:0117  MAINIO.RTD_MOD_03.TE_7              RTD MODULE 3 CHANNEL 7
3:0118  MAINIO.RTD_MOD_03.TE_8              RTD MODULE 3 CHANNEL 8
3:0119  MAINIO.RTD_MOD_04.TE_1              RTD MODULE 4 CHANNEL 1
3:0120  MAINIO.RTD_MOD_04.TE_2              RTD MODULE 4 CHANNEL 2
3:0121  MAINIO.RTD_MOD_04.TE_3              RTD MODULE 4 CHANNEL 3
3:0122  MAINIO.RTD_MOD_04.TE_4              RTD MODULE 4 CHANNEL 4
3:0123  MAINIO.RTD_MOD_04.TE_5              RTD MODULE 4 CHANNEL 5
3:0124  MAINIO.RTD_MOD_04.TE_6              RTD MODULE 4 CHANNEL 6
3:0125  MAINIO.RTD_MOD_04.TE_7              RTD MODULE 4 CHANNEL 7
3:0126  MAINIO.RTD_MOD_04.TE_8              RTD MODULE 4 CHANNEL 8
3:0127  MAINIO.AI_MOD_01.AE_1               ANALOG IN MODULE 1 CHANNEL 1
3:0128  MAINIO.AI_MOD_01.AE_2               ANALOG IN MODULE 1 CHANNEL 2
3:0129  MAINIO.AI_MOD_01.AE_3               ANALOG IN MODULE 1 CHANNEL 3
3:0130  MAINIO.AI_MOD_01.AE_4               ANALOG IN MODULE 1 CHANNEL 4
3:0131  MAINIO.AI_MOD_01.AE_5               ANALOG IN MODULE 1 CHANNEL 5
3:0132  MAINIO.AI_MOD_01.AE_6               ANALOG IN MODULE 1 CHANNEL 6
3:0133  MAINIO.AI_MOD_01.AE_7               ANALOG IN MODULE 1 CHANNEL 7
3:0134  MAINIO.AI_MOD_01.AE_8               ANALOG IN MODULE 1 CHANNEL 8
3:0135  MAINIO.AI_MOD_02.AE_1               ANALOG IN MODULE 2 CHANNEL 1
3:0136  MAINIO.AI_MOD_02.AE_2               ANALOG IN MODULE 2 CHANNEL 2
3:0137  MAINIO.AI_MOD_02.AE_3               ANALOG IN MODULE 2 CHANNEL 3
3:0138  MAINIO.AI_MOD_02.AE_4               ANALOG IN MODULE 2 CHANNEL 4
3:0139  MAINIO.AI_MOD_02.AE_5               ANALOG IN MODULE 2 CHANNEL 5
3:0140  MAINIO.AI_MOD_02.AE_6               ANALOG IN MODULE 2 CHANNEL 6
3:0141  MAINIO.AI_MOD_02.AE_7               ANALOG IN MODULE 2 CHANNEL 7
3:0142  MAINIO.AI_MOD_02.AE_8               ANALOG IN MODULE 2 CHANNEL 8

3:0143  MAINIO.AI_MOD_03.AE_1               ANALOG IN MODULE 3 CHANNEL 1
3:0144  MAINIO.AI_MOD_03.AE_2               ANALOG IN MODULE 3 CHANNEL 2
3:0145  MAINIO.AI_MOD_03.AE_3               ANALOG IN MODULE 3 CHANNEL 3
3:0146  MAINIO.AI_MOD_03.AE_4               ANALOG IN MODULE 3 CHANNEL 4
3:0147  MAINIO.AI_MOD_03.AE_5               ANALOG IN MODULE 3 CHANNEL 5
3:0148  MAINIO.AI_MOD_03.AE_6               ANALOG IN MODULE 3 CHANNEL 6
3:0149  MAINIO.AI_MOD_03.AE_7               ANALOG IN MODULE 3 CHANNEL 7
3:0150  MAINIO.AI_MOD_03.AE_8               ANALOG IN MODULE 3 CHANNEL 8
3:0151  MAINIO.AI_MOD_04.AE_1               ANALOG IN MODULE 4 CHANNEL 1
3:0152  MAINIO.AI_MOD_04.AE_2               ANALOG IN MODULE 4 CHANNEL 2
3:0153  MAINIO.AI_MOD_04.AE_3               ANALOG IN MODULE 4 CHANNEL 3
3:0154  MAINIO.AI_MOD_04.AE_4               ANALOG IN MODULE 4 CHANNEL 4
3:0155  MAINIO.AI_MOD_04.AE_5               ANALOG IN MODULE 4 CHANNEL 5
3:0156  MAINIO.AI_MOD_04.AE_6               ANALOG IN MODULE 4 CHANNEL 6
3:0157  MAINIO.AI_MOD_04.AE_7               ANALOG IN MODULE 4 CHANNEL 7
3:0158  MAINIO.AI_MOD_04.AE_8               ANALOG IN MODULE 4 CHANNEL 8
3:0159  MAINIO.AI_MOD_05.AE_1               ANALOG IN MODULE 5 CHANNEL 1
3:0160  MAINIO.AI_MOD_05.AE_2               ANALOG IN MODULE 5 CHANNEL 2
3:0161  MAINIO.AI_MOD_05.AE_3               ANALOG IN MODULE 5 CHANNEL 3
3:0162  MAINIO.AI_MOD_05.AE_4               ANALOG IN MODULE 5 CHANNEL 4
3:0163  MAINIO.AI_MOD_05.AE_5               ANALOG IN MODULE 5 CHANNEL 5
3:0164  MAINIO.AI_MOD_05.AE_6               ANALOG IN MODULE 5 CHANNEL 6
3:0165  MAINIO.AI_MOD_05.AE_7               ANALOG IN MODULE 5 CHANNEL 7
3:0166  MAINIO.AI_MOD_05.AE_8               ANALOG IN MODULE 5 CHANNEL 8

Analog Writes

Addr    Description
4:0001

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MODBUS_S Block Name : COMM.SER_PORT3

Boolean Writes

Addr    Description
0:0001  SPEED RAISE
0:0002  SPEED LOWER
0:0003  CHANNEL 1 DISCRETE OUTPUT MODULE 1
0:0004  CHANNEL 2 DISCRETE OUTPUT MODULE 1
0:0005  CHANNEL 3 DISCRETE OUTPUT MODULE 1
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0:0006  CHANNEL 4 DISCRETE OUTPUT MODULE 1
0:0007  CHANNEL 5 DISCRETE OUTPUT MODULE 1
0:0008  CHANNEL 6 DISCRETE OUTPUT MODULE 1
0:0009  CHANNEL 7 DISCRETE OUTPUT MODULE 1
0:0010  CHANNEL 8 DISCRETE OUTPUT MODULE 1
0:0011  CHANNEL 1 DISCRETE OUTPUT MODULE 2
0:0012  CHANNEL 2 DISCRETE OUTPUT MODULE 2
0:0013  CHANNEL 3 DISCRETE OUTPUT MODULE 2
0:0014  CHANNEL 4 DISCRETE OUTPUT MODULE 2
0:0015  CHANNEL 5 DISCRETE OUTPUT MODULE 2
0:0016  CHANNEL 6 DISCRETE OUTPUT MODULE 2
0:0017  CHANNEL 7 DISCRETE OUTPUT MODULE 2
0:0018  CHANNEL 8 DISCRETE OUTPUT MODULE 2
0:0019  CHANNEL 1 DISCRETE OUTPUT MODULE 3
0:0020  CHANNEL 2 DISCRETE OUTPUT MODULE 3
0:0021  CHANNEL 3 DISCRETE OUTPUT MODULE 3
0:0022  CHANNEL 4 DISCRETE OUTPUT MODULE 3
0:0023  CHANNEL 5 DISCRETE OUTPUT MODULE 3
0:0024  CHANNEL 6 DISCRETE OUTPUT MODULE 3
0:0025  CHANNEL 7 DISCRETE OUTPUT MODULE 3
0:0026  CHANNEL 8 DISCRETE OUTPUT MODULE 3
0:0027  CHANNEL 1 DISCRETE OUTPUT MODULE 4
0:0028  CHANNEL 2 DISCRETE OUTPUT MODULE 4
0:0029  CHANNEL 3 DISCRETE OUTPUT MODULE 4
0:0030  CHANNEL 4 DISCRETE OUTPUT MODULE 4

0:0031  CHANNEL 5 DISCRETE OUTPUT MODULE 4
0:0032  CHANNEL 6 DISCRETE OUTPUT MODULE 4
0:0033  CHANNEL 7 DISCRETE OUTPUT MODULE 4
0:0034  CHANNEL 8 DISCRETE OUTPUT MODULE 4
0:0035  SERVICE RESET
0:0036  COMM RESET

Boolean Reads

Addr    Input                              Description
1:0001  SR.REM_SEL_2.AND                     REMOTE SPD ENABLED
1:0002  DI.MIN_FUEL.BI                       MIN FUEL CONTACT
1:0003  DI.RATED.BI                          IDLE/RATED CONTACT
1:0004  DI.RAISE.OR                          RAISE SPEED CONTACT
1:0005  DI.LOWER.OR                          LOWER SPEED CONTACT
1:0006  DI.LOAD.BI                           UNLOAD CONTACT
1:0007  DI.BASE_LD.BI                        BASE LOAD CONTACT
1:0008  DI.DYN_2ND.BI                        2nd DYNAMICS CONTACT
1:0009  DI.CB_AUX.BI                         ISOCH/DROOP CONTACT
1:0010  LS.LS_EN_02.LATCH                    LOAD SHARE RELAY
1:0011  LS.BKR_OPN_01.NOT                    OPEN CIRCUIT BREAKER RELAY
1:0012  SC.SPD_CTRL_5.SEL_2                  START FUEL LIMIT ACTIVE
1:0013  SC.SPD_CTRL_5.SEL_3                  MAX FUEL LIMIT ACTIVE
1:0014  SC.SPD_CTRL_5.SEL_4                  MAP LIMIT ACTIVE
1:0015
1:0016  MAINIO.MPU_ALM_1.B_SW                MPU 1 FAILED
1:0017  MAINIO.MPU_ALM_2.B_SW                MPU 2 FAILED
1:0018  MINOR_ALM.ALARM.OR                   MINOR ALARM RELAY
1:0019  MINOR_ALM.MPU1.AND                   MPU 1 FAILURE MI/ALM
1:0020  MINOR_ALM.MPU2.AND                   MPU 2 FAILURE MI/ALM
1:0021  MINOR_ALM.MPU12.AND                  MPU 1 AND 2 FAILURE MI/ALM
1:0022  MINOR_ALM.KW_XDCR.AND                KW XDCR FAILURE MI/ALM
1:0023  MINOR_ALM.RM_SPD_LD.AND              REM SPD XDCR FAILURE MI/ALM
1:0024  MINOR_ALM.MAP_XDCR.AND               MAP XDCR FAILURE MI/ALM
1:0025  MINOR_ALM.HIGH_KW_1.LATCH            HIGH KW  OUTPUT MI/ALM
1:0026  MINOR_ALM.HIGH_ACT_1.LATCH           HIGH ACTUATOR OUTPUT MI/ALM
1:0027
1:0028  MINOR_ALM.HIGH_SPD_1.LATCH           OVERSPEED MI/ALM
1:0029  MINOR_ALM.LON_ALM_02.LATCH           LON FAIL TO TRANSMIT MI/ALM
1:0030  MAJOR_ALM.ALARM.OR                   MAJOR ALARM RELAY
1:0031  MAJOR_ALM.MPU1.AND                   MPU 1 FAILURE MA/ALM
1:0032  MAJOR_ALM.MPU2.AND                   MPU 2 FAILURE MA/ALM
1:0033  MAJOR_ALM.MPU12.AND                  MPU 1 AND 2 FAILURE MA/ALM
1:0034  MAJOR_ALM.KW_XDCR.AND                KW XDCR FAILURE MA/ALM
1:0035  MAJOR_ALM.RM_SPD_LD.AND              REM SPD XDCR FAILURE MA/ALM
1:0036  MAJOR_ALM.MAP_XDCR.AND               MAP XDCR FAILURE MA/ALM
1:0037  MAJOR_ALM.HIGH_KW_1.LATCH            HIGH KW  OUTPUT MA/ALM
1:0038  MAJOR_ALM.HIGH_ACT_1.LATCH           HIGH ACTUATOR OUTPUT MA/ALM
1:0039
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1:0040  MAJOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MA/ALM
1:0041  MAJOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MA/ALM
1:0042–1:0098
1:0099  COMM.FAIL_XMIT.OR                   LON BLOCK FAIL TO TRANSMIT
1:0100  DI_MOD_01.CH_01.BI                  DISCRETE IN MOD 1 CHANNEL 1
1:0101  DI_MOD_01.CH_02.BI                  DISCRETE IN MOD 1 CHANNEL 2
1:0102  DI_MOD_01.CH_03.BI                  DISCRETE IN MOD 1 CHANNEL 3
1:0103  DI_MOD_01.CH_04.BI                  DISCRETE IN MOD 1 CHANNEL 4
1:0104  DI_MOD_01.CH_05.BI                  DISCRETE IN MOD 1 CHANNEL 5
1:0105  DI_MOD_01.CH_06.BI                  DISCRETE IN MOD 1 CHANNEL 6
1:0106  DI_MOD_01.CH_07.BI                  DISCRETE IN MOD 1 CHANNEL 7
1:0107  DI_MOD_01.CH_08.BI                  DISCRETE IN MOD 1 CHANNEL 8
1:0108  DI_MOD_01.CH_09.BI                  DISCRETE IN MOD 1 CHANNEL 9
1:0109  DI_MOD_01.CH_10.BI                  DISCRETE IN MOD 1 CHANNEL 10
1:0110  DI_MOD_01.CH_11.BI                  DISCRETE IN MOD 1 CHANNEL 11
1:0111  DI_MOD_01.CH_12.BI                  DISCRETE IN MOD 1 CHANNEL 12
1:0112  DI_MOD_01.CH_13.BI                  DISCRETE IN MOD 1 CHANNEL 13

1:0113  DI_MOD_01.CH_14.BI                  DISCRETE IN MOD 1 CHANNEL 14
1:0114  DI_MOD_01.CH_15.BI                  DISCRETE IN MOD 1 CHANNEL 15
1:0115  DI_MOD_01.CH_16.BI                  DISCRETE IN MOD 1 CHANNEL 16
1:0116  DI_MOD_02.CH_01.BI                  DISCRETE IN MOD 2 CHANNEL 1
1:0117  DI_MOD_02.CH_02.BI                  DISCRETE IN MOD 2 CHANNEL 2
1:0118  DI_MOD_02.CH_03.BI                  DISCRETE IN MOD 2 CHANNEL 3
1:0119  DI_MOD_02.CH_04.BI                  DISCRETE IN MOD 2 CHANNEL 4
1:0120  DI_MOD_02.CH_05.BI                  DISCRETE IN MOD 2 CHANNEL 5
1:0121  DI_MOD_02.CH_06.BI                  DISCRETE IN MOD 2 CHANNEL 6
1:0122  DI_MOD_02.CH_07.BI                  DISCRETE IN MOD 2 CHANNEL 7
1:0123  DI_MOD_02.CH_08.BI                  DISCRETE IN MOD 2 CHANNEL 8
1:0124  DI_MOD_02.CH_09.BI                  DISCRETE IN MOD 2 CHANNEL 9
1:0125  DI_MOD_02.CH_10.BI                  DISCRETE IN MOD 2 CHANNEL 10
1:0126  DI_MOD_02.CH_11.BI                  DISCRETE IN MOD 2 CHANNEL 11
1:0127  DI_MOD_02.CH_12.BI                  DISCRETE IN MOD 2 CHANNEL 12
1:0128  DI_MOD_02.CH_13.BI                  DISCRETE IN MOD 2 CHANNEL 13
1:0129  DI_MOD_02.CH_14.BI                  DISCRETE IN MOD 2 CHANNEL 14
1:0130  DI_MOD_02.CH_15.BI                  DISCRETE IN MOD 2 CHANNEL 15
1:0131  DI_MOD_02.CH_16.BI                  DISCRETE IN MOD 2 CHANNEL 16
1:0132  DI_MOD_03.CH_01.BI                  DISCRETE IN MOD 3 CHANNEL 1
1:0133  DI_MOD_03.CH_02.BI                  DISCRETE IN MOD 3 CHANNEL 2
1:0134  DI_MOD_03.CH_03.BI                  DISCRETE IN MOD 3 CHANNEL 3
1:0135  DI_MOD_03.CH_04.BI                  DISCRETE IN MOD 3 CHANNEL 4
1:0136  DI_MOD_03.CH_05.BI                  DISCRETE IN MOD 3 CHANNEL 5
1:0137  DI_MOD_03.CH_06.BI                  DISCRETE IN MOD 3 CHANNEL 6
1:0138  DI_MOD_03.CH_07.BI                  DISCRETE IN MOD 3 CHANNEL 7
1:0139  DI_MOD_03.CH_08.BI                  DISCRETE IN MOD 3 CHANNEL 8
1:0140  DI_MOD_03.CH_09.BI                  DISCRETE IN MOD 3 CHANNEL 9
1:0141  DI_MOD_03.CH_10.BI                  DISCRETE IN MOD 3 CHANNEL 10
1:0142  DI_MOD_03.CH_11.BI                  DISCRETE IN MOD 3 CHANNEL 11
1:0143  DI_MOD_03.CH_12.BI                  DISCRETE IN MOD 3 CHANNEL 12
1:0144  DI_MOD_03.CH_13.BI                  DISCRETE IN MOD 3 CHANNEL 13
1:0145  DI_MOD_03.CH_14.BI                  DISCRETE IN MOD 3 CHANNEL 14
1:0146  DI_MOD_03.CH_15.BI                  DISCRETE IN MOD 3 CHANNEL 15
1:0147  DI_MOD_03.CH_16.BI                  DISCRETE IN MOD 3 CHANNEL 16
1:0148  DI_MOD_04.CH_01.BI                  DISCRETE IN MOD 4 CHANNEL 1
1:0149  DI_MOD_04.CH_02.BI                  DISCRETE IN MOD 4 CHANNEL 2
1:0150  DI_MOD_04.CH_03.BI                  DISCRETE IN MOD 4 CHANNEL 3
1:0151  DI_MOD_04.CH_04.BI                  DISCRETE IN MOD 4 CHANNEL 4
1:0152  DI_MOD_04.CH_05.BI                  DISCRETE IN MOD 4 CHANNEL 5
1:0153  DI_MOD_04.CH_06.BI                  DISCRETE IN MOD 4 CHANNEL 6
1:0154  DI_MOD_04.CH_07.BI                  DISCRETE IN MOD 4 CHANNEL 7
1:0155  DI_MOD_04.CH_08.BI                  DISCRETE IN MOD 4 CHANNEL 8
1:0156  DI_MOD_04.CH_09.BI                  DISCRETE IN MOD 4 CHANNEL 9
1:0157  DI_MOD_04.CH_10.BI                  DISCRETE IN MOD 4 CHANNEL 10
1:0158  DI_MOD_04.CH_11.BI                  DISCRETE IN MOD 4 CHANNEL 11
1:0159  DI_MOD_04.CH_12.BI                  DISCRETE IN MOD 4 CHANNEL 12
1:0160  DI_MOD_04.CH_13.BI                  DISCRETE IN MOD 4 CHANNEL 13
1:0161  DI_MOD_04.CH_14.BI                  DISCRETE IN MOD 4 CHANNEL 14
1:0162  DI_MOD_04.CH_15.BI                  DISCRETE IN MOD 4 CHANNEL 15
1:0163  DI_MOD_04.CH_16.BI                  DISCRETE IN MOD 4 CHANNEL 16
1:0164  DI_MOD_05.CH_01.BI                  DISCRETE IN MOD 5 CHANNEL 1
1:0165  DI_MOD_05.CH_02.BI                  DISCRETE IN MOD 5 CHANNEL 2
1:0166  DI_MOD_05.CH_03.BI                  DISCRETE IN MOD 5 CHANNEL 3
1:0167  DI_MOD_05.CH_04.BI                  DISCRETE IN MOD 5 CHANNEL 4
1:0168  DI_MOD_05.CH_05.BI                  DISCRETE IN MOD 5 CHANNEL 5
1:0169  DI_MOD_05.CH_06.BI                  DISCRETE IN MOD 5 CHANNEL 6
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1:0170	DI_MOD_05.CH_07.BI	DISCRETE IN MOD 5 CHANNEL 7
1:0171	DI_MOD_05.CH_08.BI	DISCRETE IN MOD 5 CHANNEL 8
1:0172	DI_MOD_05.CH_09.BI	DISCRETE IN MOD 5 CHANNEL 9
1:0173	DI_MOD_05.CH_10.BI	DISCRETE IN MOD 5 CHANNEL 10
1:0174	DI_MOD_05.CH_11.BI	DISCRETE IN MOD 5 CHANNEL 11
1:0175	DI_MOD_05.CH_12.BI	DISCRETE IN MOD 5 CHANNEL 12
1:0176	DI_MOD_05.CH_13.BI	DISCRETE IN MOD 5 CHANNEL 13
1:0177	DI_MOD_05.CH_14.BI	DISCRETE IN MOD 5 CHANNEL 14
1:0178	DI_MOD_05.CH_15.BI	DISCRETE IN MOD 5 CHANNEL 15
1:0179	DI_MOD_05.CH_16.BI	DISCRETE IN MOD 5 CHANNEL 16
1:0180	DI_MOD_06.CH_01.BI	DISCRETE IN MOD 6 CHANNEL 1
1:0181	DI_MOD_06.CH_02.BI	DISCRETE IN MOD 6 CHANNEL 2
1:0182	DI_MOD_06.CH_03.BI	DISCRETE IN MOD 6 CHANNEL 3
1:0183	DI_MOD_06.CH_04.BI	DISCRETE IN MOD 6 CHANNEL 4
1:0184	DI_MOD_06.CH_05.BI	DISCRETE IN MOD 6 CHANNEL 5
1:0185	DI_MOD_06.CH_06.BI	DISCRETE IN MOD 6 CHANNEL 6
1:0186	DI_MOD_06.CH_07.BI	DISCRETE IN MOD 6 CHANNEL 7
1:0187	DI_MOD_06.CH_08.BI	DISCRETE IN MOD 6 CHANNEL 8
1:0188	DI_MOD_06.CH_09.BI	DISCRETE IN MOD 6 CHANNEL 9
1:0189	DI_MOD_06.CH_10.BI	DISCRETE IN MOD 6 CHANNEL 10
1:0190	DI_MOD_06.CH_11.BI	DISCRETE IN MOD 6 CHANNEL 11
1:0191	DI_MOD_06.CH_12.BI	DISCRETE IN MOD 6 CHANNEL 12
1:0192	DI_MOD_06.CH_13.BI	DISCRETE IN MOD 6 CHANNEL 13
1:0193	DI_MOD_06.CH_14.BI	DISCRETE IN MOD 6 CHANNEL 14
1:0194	DI_MOD_06.CH_15.BI	DISCRETE IN MOD 6 CHANNEL 15
1:0195	DI_MOD_06.CH_16.BI	DISCRETE IN MOD 6 CHANNEL 16

Analog Reads

Addr	Input	Description
3:0001	SPD.ENG_SPD_04.HSS_BUS	ENGINE SPEED (rpm)
3:0002	SR.SPD_REF_08.RAMP	SPEED REFERENCE (rpm)
3:0003	SR.SPD_REF_01.ADD	BIASED SPEED RFERENCE (rpm)
3:0004	SC.SPD_CTRL_3.A_SW	ACTUATOR OUTPUT (%)
3:0005	LS.LD_SEN_2.LAG	GENERATOR OUTPUT (kw)
3:0006	SR.REM_SPD_3.CURVE_2D	REMOTE SPEED REF (rpm)
3:0007		
3:0008	MAINIO.SYNC.AI_CURVE	SYNCHRONIZER INPUT (volts)
3:0009	LS.REM_BLD_03.CURVE_2D	REMOTE LOAD REF (kw)
3:0010	LS.B_LD_01.RAMP	BASE LOAD LEVEL
3:0011	LIMIT.MAP_05.CURVE_2D	MAP SENSOR INPUT (eng unit)
3:0012	SPD.ENG_SPD_06.A_SW	SPEED INPUT #1 (rpm)
3:0013	SPD.ENG_SPD_07.A_SW	SPEED INPUT #2 (rpm)
3:0014–3:0030		
3:0031	MAINIO.TC_MOD_01.TE_1	TC MODULUE 1 CHANNEL 1
3:0032	MAINIO.TC_MOD_01.TE_2	TC MODULUE 1 CHANNEL 2
3:0033	MAINIO.TC_MOD_01.TE_3	TC MODULUE 1 CHANNEL 3
3:0034	MAINIO.TC_MOD_01.TE_4	TC MODULUE 1 CHANNEL 4
3:0035	MAINIO.TC_MOD_01.TE_5	TC MODULUE 1 CHANNEL 5
3:0036	MAINIO.TC_MOD_01.TE_6	TC MODULUE 1 CHANNEL 6
3:0037	MAINIO.TC_MOD_01.TE_7	TC MODULUE 1 CHANNEL 7
3:0038	MAINIO.TC_MOD_01.TE_8	TC MODULUE 1 CHANNEL 8
3:0039	MAINIO.TC_MOD_02.TE_1	TC MODULUE 2 CHANNEL 1
3:0040	MAINIO.TC_MOD_02.TE_2	TC MODULUE 2 CHANNEL 2
3:0041	MAINIO.TC_MOD_02.TE_3	TC MODULUE 2 CHANNEL 3
3:0042	MAINIO.TC_MOD_02.TE_4	TC MODULUE 2 CHANNEL 4
3:0043	MAINIO.TC_MOD_02.TE_5	TC MODULUE 2 CHANNEL 5
3:0044	MAINIO.TC_MOD_02.TE_6	TC MODULUE 2 CHANNEL 6
3:0045	MAINIO.TC_MOD_02.TE_7	TC MODULUE 2 CHANNEL 7
3:0046	MAINIO.TC_MOD_02.TE_8	TC MODULUE 2 CHANNEL 8
3:0047	MAINIO.TC_MOD_03.TE_1	TC MODULUE 3 CHANNEL 1
3:0048	MAINIO.TC_MOD_03.TE_2	TC MODULUE 3 CHANNEL 2
3:0049	MAINIO.TC_MOD_03.TE_3	TC MODULUE 3 CHANNEL 3
3:0050	MAINIO.TC_MOD_03.TE_4	TC MODULUE 3 CHANNEL 4
3:0051	MAINIO.TC_MOD_03.TE_5	TC MODULUE 3 CHANNEL 5
3:0052	MAINIO.TC_MOD_03.TE_6	TC MODULUE 3 CHANNEL 6
3:0053	MAINIO.TC_MOD_03.TE_7	TC MODULUE 3 CHANNEL 7
3:0054	MAINIO.TC_MOD_03.TE_8	TC MODULUE 3 CHANNEL 8
3:0055	MAINIO.TC_MOD_04.TE_1	TC MODULUE 4 CHANNEL 1
3:0056	MAINIO.TC_MOD_04.TE_2	TC MODULUE 4 CHANNEL 2
3:0057	MAINIO.TC_MOD_04.TE_3	TC MODULUE 4 CHANNEL 3
3:0058	MAINIO.TC_MOD_04.TE_4	TC MODULUE 4 CHANNEL 4
3:0059	MAINIO.TC_MOD_04.TE_5	TC MODULUE 4 CHANNEL 5
3:0060	MAINIO.TC_MOD_04.TE_6	TC MODULUE 4 CHANNEL 6

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3:0061  MAINIO.TC_MOD_04.TE_7               TC MODULUE 4 CHANNEL 7

3:0062  MAINIO.TC_MOD_04.TE_8               TC MODULUE 4 CHANNEL 8
3:0063  MAINIO.TC_MOD_05.TE_1               TC MODULUE 5 CHANNEL 1
3:0064  MAINIO.TC_MOD_05.TE_2               TC MODULUE 5 CHANNEL 2
3:0065  MAINIO.TC_MOD_05.TE_3               TC MODULUE 5 CHANNEL 3
3:0066  MAINIO.TC_MOD_05.TE_4               TC MODULUE 5 CHANNEL 4
3:0067  MAINIO.TC_MOD_05.TE_5               TC MODULUE 5 CHANNEL 5
3:0068  MAINIO.TC_MOD_05.TE_6               TC MODULUE 5 CHANNEL 6
3:0069  MAINIO.TC_MOD_05.TE_7               TC MODULUE 5 CHANNEL 7
3:0070  MAINIO.TC_MOD_05.TE_8               TC MODULUE 5 CHANNEL 8
3:0071  MAINIO.TC_MOD_06.TE_1               TC MODULUE 6 CHANNEL 1
3:0072  MAINIO.TC_MOD_06.TE_2               TC MODULUE 6 CHANNEL 2
3:0073  MAINIO.TC_MOD_06.TE_3               TC MODULUE 6 CHANNEL 3
3:0074  MAINIO.TC_MOD_06.TE_4               TC MODULUE 6 CHANNEL 4
3:0075  MAINIO.TC_MOD_06.TE_5               TC MODULUE 6 CHANNEL 5
3:0076  MAINIO.TC_MOD_06.TE_6               TC MODULUE 6 CHANNEL 6
3:0077  MAINIO.TC_MOD_06.TE_7               TC MODULUE 6 CHANNEL 7
3:0078  MAINIO.TC_MOD_06.TE_8               TC MODULUE 6 CHANNEL 8
3:0079  MAINIO.TC_MOD_07.TE_1               TC MODULUE 7 CHANNEL 1
3:0080  MAINIO.TC_MOD_07.TE_2               TC MODULUE 7 CHANNEL 2
3:0081  MAINIO.TC_MOD_07.TE_3               TC MODULUE 7 CHANNEL 3
3:0082  MAINIO.TC_MOD_07.TE_4               TC MODULUE 7 CHANNEL 4
3:0083  MAINIO.TC_MOD_07.TE_5               TC MODULUE 7 CHANNEL 5
3:0084  MAINIO.TC_MOD_07.TE_6               TC MODULUE 7 CHANNEL 6
3:0085  MAINIO.TC_MOD_07.TE_7               TC MODULUE 7 CHANNEL 7
3:0086  MAINIO.TC_MOD_07.TE_8               TC MODULUE 7 CHANNEL 8
3:0087  MAINIO.TC_MOD_08.TE_1               TC MODULUE 8 CHANNEL 1
3:0088  MAINIO.TC_MOD_08.TE_2               TC MODULUE 8 CHANNEL 2
3:0089  MAINIO.TC_MOD_08.TE_3               TC MODULUE 8 CHANNEL 3
3:0090  MAINIO.TC_MOD_08.TE_4               TC MODULUE 8 CHANNEL 4
3:0091  MAINIO.TC_MOD_08.TE_5               TC MODULUE 8 CHANNEL 5
3:0092  MAINIO.TC_MOD_08.TE_6               TC MODULUE 8 CHANNEL 6
3:0093  MAINIO.TC_MOD_08.TE_7               TC MODULUE 8 CHANNEL 7
3:0094  MAINIO.TC_MOD_08.TE_8               TC MODULUE 8 CHANNEL 8
3:0095  MAINIO.RTD_MOD_01.TE_1              RTD MODULE 1 CHANNEL 1
3:0096  MAINIO.RTD_MOD_01.TE_2              RTD MODULE 1 CHANNEL 2
3:0097  MAINIO.RTD_MOD_01.TE_3              RTD MODULE 1 CHANNEL 3
3:0098  MAINIO.RTD_MOD_01.TE_4              RTD MODULE 1 CHANNEL 4
3:0099  MAINIO.RTD_MOD_01.TE_5              RTD MODULE 1 CHANNEL 5
3:0100  MAINIO.RTD_MOD_01.TE_6              RTD MODULE 1 CHANNEL 6
3:0101  MAINIO.RTD_MOD_01.TE_7              RTD MODULE 1 CHANNEL 7
3:0102  MAINIO.RTD_MOD_01.TE_8              RTD MODULE 1 CHANNEL 8
3:0103  MAINIO.RTD_MOD_02.TE_1              RTD MODULE 2 CHANNEL 1
3:0104  MAINIO.RTD_MOD_02.TE_2              RTD MODULE 2 CHANNEL 2
3:0105  MAINIO.RTD_MOD_02.TE_3              RTD MODULE 2 CHANNEL 3
3:0106  MAINIO.RTD_MOD_02.TE_4              RTD MODULE 2 CHANNEL 4
3:0107  MAINIO.RTD_MOD_02.TE_5              RTD MODULE 2 CHANNEL 5
3:0108  MAINIO.RTD_MOD_02.TE_6              RTD MODULE 2 CHANNEL 6
3:0109  MAINIO.RTD_MOD_02.TE_7              RTD MODULE 2 CHANNEL 7
3:0110  MAINIO.RTD_MOD_02.TE_8              RTD MODULE 2 CHANNEL 8
3:0111  MAINIO.RTD_MOD_03.TE_1              RTD MODULE 3 CHANNEL 1
3:0112  MAINIO.RTD_MOD_03.TE_2              RTD MODULE 3 CHANNEL 2
3:0113  MAINIO.RTD_MOD_03.TE_3              RTD MODULE 3 CHANNEL 3
3:0114  MAINIO.RTD_MOD_03.TE_4              RTD MODULE 3 CHANNEL 4
3:0115  MAINIO.RTD_MOD_03.TE_5              RTD MODULE 3 CHANNEL 5
3:0116  MAINIO.RTD_MOD_03.TE_6              RTD MODULE 3 CHANNEL 6
3:0117  MAINIO.RTD_MOD_03.TE_7              RTD MODULE 3 CHANNEL 7
3:0118  MAINIO.RTD_MOD_03.TE_8              RTD MODULE 3 CHANNEL 8
3:0119  MAINIO.RTD_MOD_04.TE_1              RTD MODULE 4 CHANNEL 1
3:0120  MAINIO.RTD_MOD_04.TE_2              RTD MODULE 4 CHANNEL 2
3:0121  MAINIO.RTD_MOD_04.TE_3              RTD MODULE 4 CHANNEL 3
3:0122  MAINIO.RTD_MOD_04.TE_4              RTD MODULE 4 CHANNEL 4
3:0123  MAINIO.RTD_MOD_04.TE_5              RTD MODULE 4 CHANNEL 5
3:0124  MAINIO.RTD_MOD_04.TE_6              RTD MODULE 4 CHANNEL 6
3:0125  MAINIO.RTD_MOD_04.TE_7              RTD MODULE 4 CHANNEL 7
3:0126  MAINIO.RTD_MOD_04.TE_8              RTD MODULE 4 CHANNEL 8
3:0127  MAINIO.AI_MOD_01.AE_1               ANALOG IN MODULE 1 CHANNEL 1

3:0128  MAINIO.AI_MOD_01.AE_2               ANALOG IN MODULE 1 CHANNEL 2
3:0129  MAINIO.AI_MOD_01.AE_3               ANALOG IN MODULE 1 CHANNEL 3
3:0130  MAINIO.AI_MOD_01.AE_4               ANALOG IN MODULE 1 CHANNEL 4
3:0131  MAINIO.AI_MOD_01.AE_5               ANALOG IN MODULE 1 CHANNEL 5
3:0132  MAINIO.AI_MOD_01.AE_6               ANALOG IN MODULE 1 CHANNEL 6
3:0133  MAINIO.AI_MOD_01.AE_7               ANALOG IN MODULE 1 CHANNEL 7
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3:0134	MAINIO.AI_MOD_01.AE_8	ANALOG IN MODULE 1 CHANNEL 8
3:0135	MAINIO.AI_MOD_02.AE_1	ANALOG IN MODULE 2 CHANNEL 1
3:0136	MAINIO.AI_MOD_02.AE_2	ANALOG IN MODULE 2 CHANNEL 2
3:0137	MAINIO.AI_MOD_02.AE_3	ANALOG IN MODULE 2 CHANNEL 3
3:0138	MAINIO.AI_MOD_02.AE_4	ANALOG IN MODULE 2 CHANNEL 4
3:0139	MAINIO.AI_MOD_02.AE_5	ANALOG IN MODULE 2 CHANNEL 5
3:0140	MAINIO.AI_MOD_02.AE_6	ANALOG IN MODULE 2 CHANNEL 6
3:0141	MAINIO.AI_MOD_02.AE_7	ANALOG IN MODULE 2 CHANNEL 7
3:0142	MAINIO.AI_MOD_02.AE_8	ANALOG IN MODULE 2 CHANNEL 8
3:0143	MAINIO.AI_MOD_03.AE_1	ANALOG IN MODULE 3 CHANNEL 1
3:0144	MAINIO.AI_MOD_03.AE_2	ANALOG IN MODULE 3 CHANNEL 2
3:0145	MAINIO.AI_MOD_03.AE_3	ANALOG IN MODULE 3 CHANNEL 3
3:0146	MAINIO.AI_MOD_03.AE_4	ANALOG IN MODULE 3 CHANNEL 4
3:0147	MAINIO.AI_MOD_03.AE_5	ANALOG IN MODULE 3 CHANNEL 5
3:0148	MAINIO.AI_MOD_03.AE_6	ANALOG IN MODULE 3 CHANNEL 6
3:0149	MAINIO.AI_MOD_03.AE_7	ANALOG IN MODULE 3 CHANNEL 7
3:0150	MAINIO.AI_MOD_03.AE_8	ANALOG IN MODULE 3 CHANNEL 8
3:0151	MAINIO.AI_MOD_04.AE_1	ANALOG IN MODULE 4 CHANNEL 1
3:0152	MAINIO.AI_MOD_04.AE_2	ANALOG IN MODULE 4 CHANNEL 2
3:0153	MAINIO.AI_MOD_04.AE_3	ANALOG IN MODULE 4 CHANNEL 3
3:0154	MAINIO.AI_MOD_04.AE_4	ANALOG IN MODULE 4 CHANNEL 4
3:0155	MAINIO.AI_MOD_04.AE_5	ANALOG IN MODULE 4 CHANNEL 5
3:0156	MAINIO.AI_MOD_04.AE_6	ANALOG IN MODULE 4 CHANNEL 6
3:0157	MAINIO.AI_MOD_04.AE_7	ANALOG IN MODULE 4 CHANNEL 7
3:0158	MAINIO.AI_MOD_04.AE_8	ANALOG IN MODULE 4 CHANNEL 8
3:0159	MAINIO.AI_MOD_05.AE_1	ANALOG IN MODULE 5 CHANNEL 1
3:0160	MAINIO.AI_MOD_05.AE_2	ANALOG IN MODULE 5 CHANNEL 2
3:0161	MAINIO.AI_MOD_05.AE_3	ANALOG IN MODULE 5 CHANNEL 3
3:0162	MAINIO.AI_MOD_05.AE_4	ANALOG IN MODULE 5 CHANNEL 4
3:0163	MAINIO.AI_MOD_05.AE_5	ANALOG IN MODULE 5 CHANNEL 5
3:0164	MAINIO.AI_MOD_05.AE_6	ANALOG IN MODULE 5 CHANNEL 6
3:0165	MAINIO.AI_MOD_05.AE_7	ANALOG IN MODULE 5 CHANNEL 7
3:0166	MAINIO.AI_MOD_05.AE_8	ANALOG IN MODULE 5 CHANNEL 8

Appendix C.
Modbus Slave Address Information
Models 9907-037/-038 (with torsional filtering)

This appendix contains the Modbus slave address information for the 723 models with torsional filtering. See Appendix B for the address information for 723 models without torsional filtering.

MODBUS_S Block Name : COMM.SER_PORT2

Boolean Writes

Addr	Description
0:0001	SPEED RAISE
0:0002	SPEED LOWER
0:0003	CHANNEL 1 DISCRETE OUTPUT MODULE 1
0:0004	CHANNEL 2 DISCRETE OUTPUT MODULE 1
0:0005	CHANNEL 3 DISCRETE OUTPUT MODULE 1
0:0006	CHANNEL 4 DISCRETE OUTPUT MODULE 1
0:0007	CHANNEL 5 DISCRETE OUTPUT MODULE 1
0:0008	CHANNEL 6 DISCRETE OUTPUT MODULE 1
0:0009	CHANNEL 7 DISCRETE OUTPUT MODULE 1
0:0010	CHANNEL 8 DISCRETE OUTPUT MODULE 1
0:0011	CHANNEL 1 DISCRETE OUTPUT MODULE 2
0:0012	CHANNEL 2 DISCRETE OUTPUT MODULE 2
0:0013	CHANNEL 3 DISCRETE OUTPUT MODULE 2
0:0014	CHANNEL 4 DISCRETE OUTPUT MODULE 2
0:0015	CHANNEL 5 DISCRETE OUTPUT MODULE 2
0:0016	CHANNEL 6 DISCRETE OUTPUT MODULE 2
0:0017	CHANNEL 7 DISCRETE OUTPUT MODULE 2
0:0018	CHANNEL 8 DISCRETE OUTPUT MODULE 2
0:0019	CHANNEL 1 DISCRETE OUTPUT MODULE 3
0:0020	CHANNEL 2 DISCRETE OUTPUT MODULE 3
0:0021	CHANNEL 3 DISCRETE OUTPUT MODULE 3
0:0022	CHANNEL 4 DISCRETE OUTPUT MODULE 3
0:0023	CHANNEL 5 DISCRETE OUTPUT MODULE 3
0:0024	CHANNEL 6 DISCRETE OUTPUT MODULE 3
0:0025	CHANNEL 7 DISCRETE OUTPUT MODULE 3
0:0026	CHANNEL 8 DISCRETE OUTPUT MODULE 3
0:0027	CHANNEL 1 DISCRETE OUTPUT MODULE 4
0:0028	CHANNEL 2 DISCRETE OUTPUT MODULE 4
0:0029	CHANNEL 3 DISCRETE OUTPUT MODULE 4
0:0030	CHANNEL 4 DISCRETE OUTPUT MODULE 4
0:0031	CHANNEL 5 DISCRETE OUTPUT MODULE 4
0:0032	CHANNEL 6 DISCRETE OUTPUT MODULE 4
0:0033	CHANNEL 7 DISCRETE OUTPUT MODULE 4
0:0034	CHANNEL 8 DISCRETE OUTPUT MODULE 4
0:0035	SERVICE RESET
0:0036	COMM RESET

Boolean Reads

Addr	Input	Description
1:0001	SR.REM_SEL_2.AND	REMOTE SPD ENABLED
1:0002	DI.MIN_FUEL.BI	MIN FUEL CONTACT
1:0003	DI.RATED.BI	IDLE/RATED CONTACT
1:0004	DI.RAISE.OR	RAISE SPEED CONTACT
1:0005	DI.LOWER.OR	LOWER SPEED CONTACT
1:0006	DI.LOAD.BI	UNLOAD CONTACT
1:0007	DI.BASE_LD.BI	BASE LOAD CONTACT
1:0008	DI.DYN_2ND.BI	2nd DYNAMICS CONTACT
1:0009	DI.CB_AUX.BI	ISOCH/DROOP CONTACT
1:0010	LS.LS_EN_02.LATCH	LOAD SHARE RELAY
1:0011	LS.BKR_OPN_01.NOT	OPEN CIRCUIT BREAKER RELAY
1:0012	SC.SPD_CTRL_5.SEL_2	START FUEL LIMIT ACTIVE
1:0013	SC.SPD_CTRL_5.SEL_3	MAX FUEL LIMIT ACTIVE

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1:0014  SC.SPD_CTRL_5.SEL_4                 MAP LIMIT ACTIVE
1:0015  SC.SPD_CTRL_5.SEL_5                 TORSIONAL LIMIT ACTIVE
1:0016  MAINIO.MPU_ALM_1.B_SW               MPU 1 FAILED
1:0017  MAINIO.MPU_ALM_2.B_SW               MPU 2 FAILED
1:0018  MINOR_ALM.ALARM.OR                  MINOR ALARM RELAY
1:0019  MINOR_ALM.MPU1.AND                  MPU 1 FAILURE MI/ALM
1:0020  MINOR_ALM.MPU2.AND                  MPU 2 FAILURE MI/ALM
1:0021  MINOR_ALM.MPU12.AND                 MPU 1 AND 2 FAILURE MI/ALM
1:0022  MINOR_ALM.KW_XDCR.AND               KW XDCR FAILURE MI/ALM
1:0023  MINOR_ALM.RM_SPD_LD.AND             REM SPD XDCR FAILURE MI/ALM
1:0024  MINOR_ALM.MAP_XDCR.AND              MAP XDCR FAILURE MI/ALM
1:0025  MINOR_ALM.HIGH_KW_1.LATCH           HIGH KW  OUTPUT MI/ALM
1:0026  MINOR_ALM.HIGH_ACT_1.LATCH          HIGH ACTUATOR OUTPUT MI/ALM
1:0027  MINOR_ALM.HIGH_TOR_1.LATCH          HIGH TORTIONAL LEVEL MI/ALM
1:0028  MINOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MI/ALM
1:0029  MINOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MI/ALM
1:0030  MAJOR_ALM.ALARM.OR                  MAJOR ALARM RELAY
1:0031  MAJOR_ALM.MPU1.AND                  MPU 1 FAILURE MA/ALM
1:0032  MAJOR_ALM.MPU2.AND                  MPU 2 FAILURE MA/ALM
1:0033  MAJOR_ALM.MPU12.AND                 MPU 1 AND 2 FAILURE MA/ALM
1:0034  MAJOR_ALM.KW_XDCR.AND               KW XDCR FAILURE MA/ALM
1:0035  MAJOR_ALM.RM_SPD_LD.AND             REM SPD XDCR FAILURE MA/ALM
1:0036  MAJOR_ALM.MAP_XDCR.AND              MAP XDCR FAILURE MA/ALM
1:0037  MAJOR_ALM.HIGH_KW_1.LATCH           HIGH KW  OUTPUT MA/ALM
1:0038  MAJOR_ALM.HIGH_ACT_1.LATCH          HIGH ACTUATOR OUTPUT MA/ALM
1:0039  MAJOR_ALM.HIGH_TOR_1.LATCH          HIGH TORTIONAL LEVEL MA/ALM
1:0040  MAJOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MA/ALM
1:0041  MAJOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MA/ALM
1:0042–1:0098
1:0099  COMM.FAIL_XMIT.OR                   LON BLOCK FAIL TO TRANSMIT
1:0100  DI_MOD_01.CH_01.BI                  DISCRETE IN MOD 1 CHANNEL 1
1:0101  DI_MOD_01.CH_02.BI                  DISCRETE IN MOD 1 CHANNEL 2
1:0102  DI_MOD_01.CH_03.BI                  DISCRETE IN MOD 1 CHANNEL 3
1:0103  DI_MOD_01.CH_04.BI                  DISCRETE IN MOD 1 CHANNEL 4
1:0104  DI_MOD_01.CH_05.BI                  DISCRETE IN MOD 1 CHANNEL 5
1:0105  DI_MOD_01.CH_06.BI                  DISCRETE IN MOD 1 CHANNEL 6
1:0106  DI_MOD_01.CH_07.BI                  DISCRETE IN MOD 1 CHANNEL 7
1:0107  DI_MOD_01.CH_08.BI                  DISCRETE IN MOD 1 CHANNEL 8
1:0108  DI_MOD_01.CH_09.BI                  DISCRETE IN MOD 1 CHANNEL 9
1:0109  DI_MOD_01.CH_10.BI                  DISCRETE IN MOD 1 CHANNEL 10
1:0110  DI_MOD_01.CH_11.BI                  DISCRETE IN MOD 1 CHANNEL 11
1:0111  DI_MOD_01.CH_12.BI                  DISCRETE IN MOD 1 CHANNEL 12
1:0112  DI_MOD_01.CH_13.BI                  DISCRETE IN MOD 1 CHANNEL 13
1:0113  DI_MOD_01.CH_14.BI                  DISCRETE IN MOD 1 CHANNEL 14
1:0114  DI_MOD_01.CH_15.BI                  DISCRETE IN MOD 1 CHANNEL 15
1:0115  DI_MOD_01.CH_16.BI                  DISCRETE IN MOD 1 CHANNEL 16
1:0116  DI_MOD_02.CH_01.BI                  DISCRETE IN MOD 2 CHANNEL 1
1:0117  DI_MOD_02.CH_02.BI                  DISCRETE IN MOD 2 CHANNEL 2
1:0118  DI_MOD_02.CH_03.BI                  DISCRETE IN MOD 2 CHANNEL 3
1:0119  DI_MOD_02.CH_04.BI                  DISCRETE IN MOD 2 CHANNEL 4
1:0120  DI_MOD_02.CH_05.BI                  DISCRETE IN MOD 2 CHANNEL 5
1:0121  DI_MOD_02.CH_06.BI                  DISCRETE IN MOD 2 CHANNEL 6
1:0122  DI_MOD_02.CH_07.BI                  DISCRETE IN MOD 2 CHANNEL 7
1:0123  DI_MOD_02.CH_08.BI                  DISCRETE IN MOD 2 CHANNEL 8
1:0124  DI_MOD_02.CH_09.BI                  DISCRETE IN MOD 2 CHANNEL 9
1:0125  DI_MOD_02.CH_10.BI                  DISCRETE IN MOD 2 CHANNEL 10
1:0126  DI_MOD_02.CH_11.BI                  DISCRETE IN MOD 2 CHANNEL 11
1:0127  DI_MOD_02.CH_12.BI                  DISCRETE IN MOD 2 CHANNEL 12

1:0128  DI_MOD_02.CH_13.BI                  DISCRETE IN MOD 2 CHANNEL 13
1:0129  DI_MOD_02.CH_14.BI                  DISCRETE IN MOD 2 CHANNEL 14
1:0130  DI_MOD_02.CH_15.BI                  DISCRETE IN MOD 2 CHANNEL 15
1:0131  DI_MOD_02.CH_16.BI                  DISCRETE IN MOD 2 CHANNEL 16
1:0132  DI_MOD_03.CH_01.BI                  DISCRETE IN MOD 3 CHANNEL 1
1:0133  DI_MOD_03.CH_02.BI                  DISCRETE IN MOD 3 CHANNEL 2
1:0134  DI_MOD_03.CH_03.BI                  DISCRETE IN MOD 3 CHANNEL 3
1:0135  DI_MOD_03.CH_04.BI                  DISCRETE IN MOD 3 CHANNEL 4
1:0136  DI_MOD_03.CH_05.BI                  DISCRETE IN MOD 3 CHANNEL 5
1:0137  DI_MOD_03.CH_06.BI                  DISCRETE IN MOD 3 CHANNEL 6
1:0138  DI_MOD_03.CH_07.BI                  DISCRETE IN MOD 3 CHANNEL 7
1:0139  DI_MOD_03.CH_08.BI                  DISCRETE IN MOD 3 CHANNEL 8
1:0140  DI_MOD_03.CH_09.BI                  DISCRETE IN MOD 3 CHANNEL 9
1:0141  DI_MOD_03.CH_10.BI                  DISCRETE IN MOD 3 CHANNEL 10
1:0142  DI_MOD_03.CH_11.BI                  DISCRETE IN MOD 3 CHANNEL 11
1:0143  DI_MOD_03.CH_12.BI                  DISCRETE IN MOD 3 CHANNEL 12
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1:0144	DI_MOD_03.CH_13.BI	DISCRETE IN MOD 3 CHANNEL 13
1:0145	DI_MOD_03.CH_14.BI	DISCRETE IN MOD 3 CHANNEL 14
1:0146	DI_MOD_03.CH_15.BI	DISCRETE IN MOD 3 CHANNEL 15
1:0147	DI_MOD_03.CH_16.BI	DISCRETE IN MOD 3 CHANNEL 16
1:0148	DI_MOD_04.CH_01.BI	DISCRETE IN MOD 4 CHANNEL 1
1:0149	DI_MOD_04.CH_02.BI	DISCRETE IN MOD 4 CHANNEL 2
1:0150	DI_MOD_04.CH_03.BI	DISCRETE IN MOD 4 CHANNEL 3
1:0151	DI_MOD_04.CH_04.BI	DISCRETE IN MOD 4 CHANNEL 4
1:0152	DI_MOD_04.CH_05.BI	DISCRETE IN MOD 4 CHANNEL 5
1:0153	DI_MOD_04.CH_06.BI	DISCRETE IN MOD 4 CHANNEL 6
1:0154	DI_MOD_04.CH_07.BI	DISCRETE IN MOD 4 CHANNEL 7
1:0155	DI_MOD_04.CH_08.BI	DISCRETE IN MOD 4 CHANNEL 8
1:0156	DI_MOD_04.CH_09.BI	DISCRETE IN MOD 4 CHANNEL 9
1:0157	DI_MOD_04.CH_10.BI	DISCRETE IN MOD 4 CHANNEL 10
1:0158	DI_MOD_04.CH_11.BI	DISCRETE IN MOD 4 CHANNEL 11
1:0159	DI_MOD_04.CH_12.BI	DISCRETE IN MOD 4 CHANNEL 12
1:0160	DI_MOD_04.CH_13.BI	DISCRETE IN MOD 4 CHANNEL 13
1:0161	DI_MOD_04.CH_14.BI	DISCRETE IN MOD 4 CHANNEL 14
1:0162	DI_MOD_04.CH_15.BI	DISCRETE IN MOD 4 CHANNEL 15
1:0163	DI_MOD_04.CH_16.BI	DISCRETE IN MOD 4 CHANNEL 16
1:0164	DI_MOD_05.CH_01.BI	DISCRETE IN MOD 5 CHANNEL 1
1:0165	DI_MOD_05.CH_02.BI	DISCRETE IN MOD 5 CHANNEL 2
1:0166	DI_MOD_05.CH_03.BI	DISCRETE IN MOD 5 CHANNEL 3
1:0167	DI_MOD_05.CH_04.BI	DISCRETE IN MOD 5 CHANNEL 4
1:0168	DI_MOD_05.CH_05.BI	DISCRETE IN MOD 5 CHANNEL 5
1:0169	DI_MOD_05.CH_06.BI	DISCRETE IN MOD 5 CHANNEL 6
1:0170	DI_MOD_05.CH_07.BI	DISCRETE IN MOD 5 CHANNEL 7
1:0171	DI_MOD_05.CH_08.BI	DISCRETE IN MOD 5 CHANNEL 8
1:0172	DI_MOD_05.CH_09.BI	DISCRETE IN MOD 5 CHANNEL 9
1:0173	DI_MOD_05.CH_10.BI	DISCRETE IN MOD 5 CHANNEL 10
1:0174	DI_MOD_05.CH_11.BI	DISCRETE IN MOD 5 CHANNEL 11
1:0175	DI_MOD_05.CH_12.BI	DISCRETE IN MOD 5 CHANNEL 12
1:0176	DI_MOD_05.CH_13.BI	DISCRETE IN MOD 5 CHANNEL 13
1:0177	DI_MOD_05.CH_14.BI	DISCRETE IN MOD 5 CHANNEL 14
1:0178	DI_MOD_05.CH_15.BI	DISCRETE IN MOD 5 CHANNEL 15
1:0179	DI_MOD_05.CH_16.BI	DISCRETE IN MOD 5 CHANNEL 16
1:0180	DI_MOD_06.CH_01.BI	DISCRETE IN MOD 6 CHANNEL 1
1:0181	DI_MOD_06.CH_02.BI	DISCRETE IN MOD 6 CHANNEL 2
1:0182	DI_MOD_06.CH_03.BI	DISCRETE IN MOD 6 CHANNEL 3
1:0183	DI_MOD_06.CH_04.BI	DISCRETE IN MOD 6 CHANNEL 4
1:0184	DI_MOD_06.CH_05.BI	DISCRETE IN MOD 6 CHANNEL 5
1:0185	DI_MOD_06.CH_06.BI	DISCRETE IN MOD 6 CHANNEL 6
1:0186	DI_MOD_06.CH_07.BI	DISCRETE IN MOD 6 CHANNEL 7
1:0187	DI_MOD_06.CH_08.BI	DISCRETE IN MOD 6 CHANNEL 8
1:0188	DI_MOD_06.CH_09.BI	DISCRETE IN MOD 6 CHANNEL 9
1:0189	DI_MOD_06.CH_10.BI	DISCRETE IN MOD 6 CHANNEL 10
1:0190	DI_MOD_06.CH_11.BI	DISCRETE IN MOD 6 CHANNEL 11
1:0191	DI_MOD_06.CH_12.BI	DISCRETE IN MOD 6 CHANNEL 12
1:0192	DI_MOD_06.CH_13.BI	DISCRETE IN MOD 6 CHANNEL 13
1:0193	DI_MOD_06.CH_14.BI	DISCRETE IN MOD 6 CHANNEL 14
1:0194	DI_MOD_06.CH_15.BI	DISCRETE IN MOD 6 CHANNEL 15
1:0195	DI_MOD_06.CH_16.BI	DISCRETE IN MOD 6 CHANNEL 16

Analog Reads

Addr	Input	Description
3:0001	SPD.ENG_SPD_04.HSS_BUS	ENGINE SPEED (rpm)
3:0002	SR.SPD_REF_08.RAMP	SPEED REFERENCE (rpm)
3:0003	SR.SPD_REF_01.ADD	BIASED SPEED RFERENCE (rpm)
3:0004	SC.SPD_CTRL_3.A_SW	ACTUATOR OUTPUT (%)
3:0005	LS.LD_SEN_2.LAG	GENERATOR OUTPUT (kw)
3:0006	SR.REM_SPD_3.CURVE_2D	REMOTE SPEED REF (rpm)
3:0007	TL.TOR_LVL_01.MULTIPLY	TORTIONAL LEVEL
3:0008	MAINIO.SYNC.AI_CURVE	SYNCHRONIZER INPUT (volts)
3:0009	LS.REM_BLD_03.CURVE_2D	REMOTE LOAD REF (kw)
3:0010	LS.B_LD_01.RAMP	BASE LOAD LEVEL
3:0011	LIMIT.MAP_05.CURVE_2D	MAP SENSOR INPUT (eng unit)
3:0012	SPD.ENG_SPD_06.A_SW	SPEED INPUT #1 (rpm)
3:0013	SPD.ENG_SPD_07.A_SW	SPEED INPUT #2 (rpm)
3:0014—3:0030		
3:0031	MAINIO.TC_MOD_01.TE_1	TC MODULUE 1 CHANNEL 1
3:0032	MAINIO.TC_MOD_01.TE_2	TC MODULUE 1 CHANNEL 2
3:0033	MAINIO.TC_MOD_01.TE_3	TC MODULUE 1 CHANNEL 3
3:0034	MAINIO.TC_MOD_01.TE_4	TC MODULUE 1 CHANNEL 4

3:0035	MAINIO.TC_MOD_01.TE_5	TC MODULUE 1 CHANNEL 5
3:0036	MAINIO.TC_MOD_01.TE_6	TC MODULUE 1 CHANNEL 6
3:0037	MAINIO.TC_MOD_01.TE_7	TC MODULUE 1 CHANNEL 7
3:0038	MAINIO.TC_MOD_01.TE_8	TC MODULUE 1 CHANNEL 8
3:0039	MAINIO.TC_MOD_02.TE_1	TC MODULUE 2 CHANNEL 1
3:0040	MAINIO.TC_MOD_02.TE_2	TC MODULUE 2 CHANNEL 2
3:0041	MAINIO.TC_MOD_02.TE_3	TC MODULUE 2 CHANNEL 3
3:0042	MAINIO.TC_MOD_02.TE_4	TC MODULUE 2 CHANNEL 4
3:0043	MAINIO.TC_MOD_02.TE_5	TC MODULUE 2 CHANNEL 5
3:0044	MAINIO.TC_MOD_02.TE_6	TC MODULUE 2 CHANNEL 6
3:0045	MAINIO.TC_MOD_02.TE_7	TC MODULUE 2 CHANNEL 7
3:0046	MAINIO.TC_MOD_02.TE_8	TC MODULUE 2 CHANNEL 8
3:0047	MAINIO.TC_MOD_03.TE_1	TC MODULUE 3 CHANNEL 1
3:0048	MAINIO.TC_MOD_03.TE_2	TC MODULUE 3 CHANNEL 2
3:0049	MAINIO.TC_MOD_03.TE_3	TC MODULUE 3 CHANNEL 3
3:0050	MAINIO.TC_MOD_03.TE_4	TC MODULUE 3 CHANNEL 4
3:0051	MAINIO.TC_MOD_03.TE_5	TC MODULUE 3 CHANNEL 5
3:0052	MAINIO.TC_MOD_03.TE_6	TC MODULUE 3 CHANNEL 6
3:0053	MAINIO.TC_MOD_03.TE_7	TC MODULUE 3 CHANNEL 7
3:0054	MAINIO.TC_MOD_03.TE_8	TC MODULUE 3 CHANNEL 8
3:0055	MAINIO.TC_MOD_04.TE_1	TC MODULUE 4 CHANNEL 1
3:0056	MAINIO.TC_MOD_04.TE_2	TC MODULUE 4 CHANNEL 2
3:0057	MAINIO.TC_MOD_04.TE_3	TC MODULUE 4 CHANNEL 3
3:0058	MAINIO.TC_MOD_04.TE_4	TC MODULUE 4 CHANNEL 4
3:0059	MAINIO.TC_MOD_04.TE_5	TC MODULUE 4 CHANNEL 5
3:0060	MAINIO.TC_MOD_04.TE_6	TC MODULUE 4 CHANNEL 6
3:0061	MAINIO.TC_MOD_04.TE_7	TC MODULUE 4 CHANNEL 7
3:0062	MAINIO.TC_MOD_04.TE_8	TC MODULUE 4 CHANNEL 8
3:0063	MAINIO.TC_MOD_05.TE_1	TC MODULUE 5 CHANNEL 1
3:0064	MAINIO.TC_MOD_05.TE_2	TC MODULUE 5 CHANNEL 2
3:0065	MAINIO.TC_MOD_05.TE_3	TC MODULUE 5 CHANNEL 3
3:0066	MAINIO.TC_MOD_05.TE_4	TC MODULUE 5 CHANNEL 4
3:0067	MAINIO.TC_MOD_05.TE_5	TC MODULUE 5 CHANNEL 5
3:0068	MAINIO.TC_MOD_05.TE_6	TC MODULUE 5 CHANNEL 6
3:0069	MAINIO.TC_MOD_05.TE_7	TC MODULUE 5 CHANNEL 7
3:0070	MAINIO.TC_MOD_05.TE_8	TC MODULUE 5 CHANNEL 8
3:0071	MAINIO.TC_MOD_06.TE_1	TC MODULUE 6 CHANNEL 1
3:0072	MAINIO.TC_MOD_06.TE_2	TC MODULUE 6 CHANNEL 2
3:0073	MAINIO.TC_MOD_06.TE_3	TC MODULUE 6 CHANNEL 3
3:0074	MAINIO.TC_MOD_06.TE_4	TC MODULUE 6 CHANNEL 4
3:0075	MAINIO.TC_MOD_06.TE_5	TC MODULUE 6 CHANNEL 5
3:0076	MAINIO.TC_MOD_06.TE_6	TC MODULUE 6 CHANNEL 6
3:0077	MAINIO.TC_MOD_06.TE_7	TC MODULUE 6 CHANNEL 7
3:0078	MAINIO.TC_MOD_06.TE_8	TC MODULUE 6 CHANNEL 8
3:0079	MAINIO.TC_MOD_07.TE_1	TC MODULUE 7 CHANNEL 1
3:0080	MAINIO.TC_MOD_07.TE_2	TC MODULUE 7 CHANNEL 2
3:0081	MAINIO.TC_MOD_07.TE_3	TC MODULUE 7 CHANNEL 3
3:0082	MAINIO.TC_MOD_07.TE_4	TC MODULUE 7 CHANNEL 4
3:0083	MAINIO.TC_MOD_07.TE_5	TC MODULUE 7 CHANNEL 5
3:0084	MAINIO.TC_MOD_07.TE_6	TC MODULUE 7 CHANNEL 6
3:0085	MAINIO.TC_MOD_07.TE_7	TC MODULUE 7 CHANNEL 7
3:0086	MAINIO.TC_MOD_07.TE_8	TC MODULUE 7 CHANNEL 8
3:0087	MAINIO.TC_MOD_08.TE_1	TC MODULUE 8 CHANNEL 1
3:0088	MAINIO.TC_MOD_08.TE_2	TC MODULUE 8 CHANNEL 2
3:0089	MAINIO.TC_MOD_08.TE_3	TC MODULUE 8 CHANNEL 3
3:0090	MAINIO.TC_MOD_08.TE_4	TC MODULUE 8 CHANNEL 4
3:0091	MAINIO.TC_MOD_08.TE_5	TC MODULUE 8 CHANNEL 5
3:0092	MAINIO.TC_MOD_08.TE_6	TC MODULUE 8 CHANNEL 6
3:0093	MAINIO.TC_MOD_08.TE_7	TC MODULUE 8 CHANNEL 7
3:0094	MAINIO.TC_MOD_08.TE_8	TC MODULUE 8 CHANNEL 8
3:0095	MAINIO.RTD_MOD_01.TE_1	RTD MODULE 1 CHANNEL 1
3:0096	MAINIO.RTD_MOD_01.TE_2	RTD MODULE 1 CHANNEL 2
3:0097	MAINIO.RTD_MOD_01.TE_3	RTD MODULE 1 CHANNEL 3
3:0098	MAINIO.RTD_MOD_01.TE_4	RTD MODULE 1 CHANNEL 4
3:0099	MAINIO.RTD_MOD_01.TE_5	RTD MODULE 1 CHANNEL 5
3:0100	MAINIO.RTD_MOD_01.TE_6	RTD MODULE 1 CHANNEL 6
3:0101	MAINIO.RTD_MOD_01.TE_7	RTD MODULE 1 CHANNEL 7
3:0102	MAINIO.RTD_MOD_01.TE_8	RTD MODULE 1 CHANNEL 8
3:0103	MAINIO.RTD_MOD_02.TE_1	RTD MODULE 2 CHANNEL 1
3:0104	MAINIO.RTD_MOD_02.TE_2	RTD MODULE 2 CHANNEL 2
3:0105	MAINIO.RTD_MOD_02.TE_3	RTD MODULE 2 CHANNEL 3
3:0106	MAINIO.RTD_MOD_02.TE_4	RTD MODULE 2 CHANNEL 4
3:0107	MAINIO.RTD_MOD_02.TE_5	RTD MODULE 2 CHANNEL 5
3:0108	MAINIO.RTD_MOD_02.TE_6	RTD MODULE 2 CHANNEL 6

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3:0109  MAINIO.RTD_MOD_02.TE_7              RTD MODULE 2 CHANNEL 7
3:0110  MAINIO.RTD_MOD_02.TE_8              RTD MODULE 2 CHANNEL 8
3:0111  MAINIO.RTD_MOD_03.TE_1              RTD MODULE 3 CHANNEL 1
3:0112  MAINIO.RTD_MOD_03.TE_2              RTD MODULE 3 CHANNEL 2
3:0113  MAINIO.RTD_MOD_03.TE_3              RTD MODULE 3 CHANNEL 3
3:0114  MAINIO.RTD_MOD_03.TE_4              RTD MODULE 3 CHANNEL 4
3:0115  MAINIO.RTD_MOD_03.TE_5              RTD MODULE 3 CHANNEL 5
3:0116  MAINIO.RTD_MOD_03.TE_6              RTD MODULE 3 CHANNEL 6
3:0117  MAINIO.RTD_MOD_03.TE_7              RTD MODULE 3 CHANNEL 7
3:0118  MAINIO.RTD_MOD_03.TE_8              RTD MODULE 3 CHANNEL 8
3:0119  MAINIO.RTD_MOD_04.TE_1              RTD MODULE 4 CHANNEL 1
3:0120  MAINIO.RTD_MOD_04.TE_2              RTD MODULE 4 CHANNEL 2
3:0121  MAINIO.RTD_MOD_04.TE_3              RTD MODULE 4 CHANNEL 3
3:0122  MAINIO.RTD_MOD_04.TE_4              RTD MODULE 4 CHANNEL 4
3:0123  MAINIO.RTD_MOD_04.TE_5              RTD MODULE 4 CHANNEL 5
3:0124  MAINIO.RTD_MOD_04.TE_6              RTD MODULE 4 CHANNEL 6
3:0125  MAINIO.RTD_MOD_04.TE_7              RTD MODULE 4 CHANNEL 7
3:0126  MAINIO.RTD_MOD_04.TE_8              RTD MODULE 4 CHANNEL 8
3:0127  MAINIO.AI_MOD_01.AE_1               ANALOG IN MODULE 1 CHANNEL 1
3:0128  MAINIO.AI_MOD_01.AE_2               ANALOG IN MODULE 1 CHANNEL 2
3:0129  MAINIO.AI_MOD_01.AE_3               ANALOG IN MODULE 1 CHANNEL 3
3:0130  MAINIO.AI_MOD_01.AE_4               ANALOG IN MODULE 1 CHANNEL 4
3:0131  MAINIO.AI_MOD_01.AE_5               ANALOG IN MODULE 1 CHANNEL 5
3:0132  MAINIO.AI_MOD_01.AE_6               ANALOG IN MODULE 1 CHANNEL 6
3:0133  MAINIO.AI_MOD_01.AE_7               ANALOG IN MODULE 1 CHANNEL 7
3:0134  MAINIO.AI_MOD_01.AE_8               ANALOG IN MODULE 1 CHANNEL 8
3:0135  MAINIO.AI_MOD_02.AE_1               ANALOG IN MODULE 2 CHANNEL 1
3:0136  MAINIO.AI_MOD_02.AE_2               ANALOG IN MODULE 2 CHANNEL 2
3:0137  MAINIO.AI_MOD_02.AE_3               ANALOG IN MODULE 2 CHANNEL 3
3:0138  MAINIO.AI_MOD_02.AE_4               ANALOG IN MODULE 2 CHANNEL 4
3:0139  MAINIO.AI_MOD_02.AE_5               ANALOG IN MODULE 2 CHANNEL 5
3:0140  MAINIO.AI_MOD_02.AE_6               ANALOG IN MODULE 2 CHANNEL 6
3:0141  MAINIO.AI_MOD_02.AE_7               ANALOG IN MODULE 2 CHANNEL 7
3:0142  MAINIO.AI_MOD_02.AE_8               ANALOG IN MODULE 2 CHANNEL 8

3:0143  MAINIO.AI_MOD_03.AE_1               ANALOG IN MODULE 3 CHANNEL 1
3:0144  MAINIO.AI_MOD_03.AE_2               ANALOG IN MODULE 3 CHANNEL 2
3:0145  MAINIO.AI_MOD_03.AE_3               ANALOG IN MODULE 3 CHANNEL 3
3:0146  MAINIO.AI_MOD_03.AE_4               ANALOG IN MODULE 3 CHANNEL 4
3:0147  MAINIO.AI_MOD_03.AE_5               ANALOG IN MODULE 3 CHANNEL 5
3:0148  MAINIO.AI_MOD_03.AE_6               ANALOG IN MODULE 3 CHANNEL 6
3:0149  MAINIO.AI_MOD_03.AE_7               ANALOG IN MODULE 3 CHANNEL 7
3:0150  MAINIO.AI_MOD_03.AE_8               ANALOG IN MODULE 3 CHANNEL 8
3:0151  MAINIO.AI_MOD_04.AE_1               ANALOG IN MODULE 4 CHANNEL 1
3:0152  MAINIO.AI_MOD_04.AE_2               ANALOG IN MODULE 4 CHANNEL 2
3:0153  MAINIO.AI_MOD_04.AE_3               ANALOG IN MODULE 4 CHANNEL 3
3:0154  MAINIO.AI_MOD_04.AE_4               ANALOG IN MODULE 4 CHANNEL 4
3:0155  MAINIO.AI_MOD_04.AE_5               ANALOG IN MODULE 4 CHANNEL 5
3:0156  MAINIO.AI_MOD_04.AE_6               ANALOG IN MODULE 4 CHANNEL 6
3:0157  MAINIO.AI_MOD_04.AE_7               ANALOG IN MODULE 4 CHANNEL 7
3:0158  MAINIO.AI_MOD_04.AE_8               ANALOG IN MODULE 4 CHANNEL 8
3:0159  MAINIO.AI_MOD_05.AE_1               ANALOG IN MODULE 5 CHANNEL 1
3:0160  MAINIO.AI_MOD_05.AE_2               ANALOG IN MODULE 5 CHANNEL 2
3:0161  MAINIO.AI_MOD_05.AE_3               ANALOG IN MODULE 5 CHANNEL 3
3:0162  MAINIO.AI_MOD_05.AE_4               ANALOG IN MODULE 5 CHANNEL 4
3:0163  MAINIO.AI_MOD_05.AE_5               ANALOG IN MODULE 5 CHANNEL 5
3:0164  MAINIO.AI_MOD_05.AE_6               ANALOG IN MODULE 5 CHANNEL 6
3:0165  MAINIO.AI_MOD_05.AE_7               ANALOG IN MODULE 5 CHANNEL 7
3:0166  MAINIO.AI_MOD_05.AE_8               ANALOG IN MODULE 5 CHANNEL 8

Analog Writes

Addr    Description
4:0001

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MODBUS_S Block Name : COMM.SER_PORT3

Boolean Writes

Addr    Description
0:0001  SPEED RAISE
0:0002  SPEED LOWER
0:0003  CHANNEL 1 DISCRETE OUTPUT MODULE 1
0:0004  CHANNEL 2 DISCRETE OUTPUT MODULE 1
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0:0005  CHANNEL 3 DISCRETE OUTPUT MODULE 1
0:0006  CHANNEL 4 DISCRETE OUTPUT MODULE 1
0:0007  CHANNEL 5 DISCRETE OUTPUT MODULE 1
0:0008  CHANNEL 6 DISCRETE OUTPUT MODULE 1
0:0009  CHANNEL 7 DISCRETE OUTPUT MODULE 1
0:0010  CHANNEL 8 DISCRETE OUTPUT MODULE 1
0:0011  CHANNEL 1 DISCRETE OUTPUT MODULE 2
0:0012  CHANNEL 2 DISCRETE OUTPUT MODULE 2
0:0013  CHANNEL 3 DISCRETE OUTPUT MODULE 2
0:0014  CHANNEL 4 DISCRETE OUTPUT MODULE 2
0:0015  CHANNEL 5 DISCRETE OUTPUT MODULE 2
0:0016  CHANNEL 6 DISCRETE OUTPUT MODULE 2
0:0017  CHANNEL 7 DISCRETE OUTPUT MODULE 2
0:0018  CHANNEL 8 DISCRETE OUTPUT MODULE 2
0:0019  CHANNEL 1 DISCRETE OUTPUT MODULE 3
0:0020  CHANNEL 2 DISCRETE OUTPUT MODULE 3
0:0021  CHANNEL 3 DISCRETE OUTPUT MODULE 3
0:0022  CHANNEL 4 DISCRETE OUTPUT MODULE 3
0:0023  CHANNEL 5 DISCRETE OUTPUT MODULE 3
0:0024  CHANNEL 6 DISCRETE OUTPUT MODULE 3
0:0025  CHANNEL 7 DISCRETE OUTPUT MODULE 3
0:0026  CHANNEL 8 DISCRETE OUTPUT MODULE 3
0:0027  CHANNEL 1 DISCRETE OUTPUT MODULE 4
0:0028  CHANNEL 2 DISCRETE OUTPUT MODULE 4
0:0029  CHANNEL 3 DISCRETE OUTPUT MODULE 4
0:0030  CHANNEL 4 DISCRETE OUTPUT MODULE 4

0:0031  CHANNEL 5 DISCRETE OUTPUT MODULE 4
0:0032  CHANNEL 6 DISCRETE OUTPUT MODULE 4
0:0033  CHANNEL 7 DISCRETE OUTPUT MODULE 4
0:0034  CHANNEL 8 DISCRETE OUTPUT MODULE 4
0:0035  SERVICE RESET
0:0036  COMM RESET

Boolean Reads

Addr    Input                              Description
1:0001  SR.REM_SEL_2.AND                     REMOTE SPD ENABLED
1:0002  DI.MIN_FUEL.BI                       MIN FUEL CONTACT
1:0003  DI.RATED.BI                          IDLE/RATED CONTACT
1:0004  DI.RAISE.OR                          RAISE SPEED CONTACT
1:0005  DI.LOWER.OR                          LOWER SPEED CONTACT
1:0006  DI.LOAD.BI                           UNLOAD CONTACT
1:0007  DI.BASE_LD.BI                        BASE LOAD CONTACT
1:0008  DI.DYN_2ND.BI                        2nd DYNAMICS CONTACT
1:0009  DI.CB_AUX.BI                         ISOCH/DROOP CONTACT
1:0010  LS.LS_EN_02.LATCH                    LOAD SHARE RELAY
1:0011  LS.BKR_OPN_01.NOT                    OPEN CIRCUIT BREAKER RELAY
1:0012  SC.SPD_CTRL_5.SEL_2                  START FUEL LIMIT ACTIVE
1:0013  SC.SPD_CTRL_5.SEL_3                  MAX FUEL LIMIT ACTIVE
1:0014  SC.SPD_CTRL_5.SEL_4                  MAP LIMIT ACTIVE
1:0015  SC.SPD_CTRL_5.SEL_5                  TORSIONAL LLIMIT ACTIVE
1:0016  MAINIO.MPU_ALM_1.B_SW                MPU 1 FAILED
1:0017  MAINIO.MPU_ALM_2.B_SW                MPU 2 FAILED
1:0018  MINOR_ALM.ALARM.OR                   MINOR ALARM RELAY
1:0019  MINOR_ALM.MPU1.AND                   MPU 1 FAILURE MI/ALM
1:0020  MINOR_ALM.MPU2.AND                   MPU 2 FAILURE MI/ALM
1:0021  MINOR_ALM.MPU12.AND                  MPU 1 AND 2 FAILURE MI/ALM
1:0022  MINOR_ALM.KW_XDCR.AND                KW XDCR FAILURE MI/ALM
1:0023  MINOR_ALM.RM_SPD_LD.AND              REM SPD XDCR FAILURE MI/ALM
1:0024  MINOR_ALM.MAP_XDCR.AND               MAP XDCR FAILURE MI/ALM
1:0025  MINOR_ALM.HIGH_KW_1.LATCH            HIGH KW  OUTPUT MI/ALM
1:0026  MINOR_ALM.HIGH_ACT_1.LATCH           HIGH ACTUATOR OUTPUT MI/ALM
1:0027  MINOR_ALM.HIGH_TOR_1.LATCH           HIGH TORTIONAL LEVEL MI/ALM
1:0028  MINOR_ALM.HIGH_SPD_1.LATCH           OVERSPEED MI/ALM
1:0029  MINOR_ALM.LON_ALM_02.LATCH           LON FAIL TO TRANSMIT MI/ALM
1:0030  MAJOR_ALM.ALARM.OR                   MAJOR ALARM RELAY
1:0031  MAJOR_ALM.MPU1.AND                   MPU 1 FAILURE MA/ALM
1:0032  MAJOR_ALM.MPU2.AND                   MPU 2 FAILURE MA/ALM
1:0033  MAJOR_ALM.MPU12.AND                  MPU 1 AND 2 FAILURE MA/ALM
1:0034  MAJOR_ALM.KW_XDCR.AND                KW XDCR FAILURE MA/ALM
1:0035  MAJOR_ALM.RM_SPD_LD.AND              REM SPD XDCR FAILURE MA/ALM
1:0036  MAJOR_ALM.MAP_XDCR.AND               MAP XDCR FAILURE MA/ALM
1:0037  MAJOR_ALM.HIGH_KW_1.LATCH            HIGH KW  OUTPUT MA/ALM
1:0038  MAJOR_ALM.HIGH_ACT_1.LATCH           HIGH ACTUATOR OUTPUT MA/ALM
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1:0039  MAJOR_ALM.HIGH_TOR_1.LATCH          HIGH TORTIONAL LEVEL MA/ALM
1:0040  MAJOR_ALM.HIGH_SPD_1.LATCH          OVERSPEED MA/ALM
1:0041  MAJOR_ALM.LON_ALM_02.LATCH          LON FAIL TO TRANSMIT MA/ALM
1:0042–1:0098
1:0099  COMM.FAIL_XMIT.OR                   LON BLOCK FAIL TO TRANSMIT
1:0100  DI_MOD_01.CH_01.BI                  DISCRETE IN MOD 1 CHANNEL 1
1:0101  DI_MOD_01.CH_02.BI                  DISCRETE IN MOD 1 CHANNEL 2
1:0102  DI_MOD_01.CH_03.BI                  DISCRETE IN MOD 1 CHANNEL 3
1:0103  DI_MOD_01.CH_04.BI                  DISCRETE IN MOD 1 CHANNEL 4
1:0104  DI_MOD_01.CH_05.BI                  DISCRETE IN MOD 1 CHANNEL 5
1:0105  DI_MOD_01.CH_06.BI                  DISCRETE IN MOD 1 CHANNEL 6
1:0106  DI_MOD_01.CH_07.BI                  DISCRETE IN MOD 1 CHANNEL 7
1:0107  DI_MOD_01.CH_08.BI                  DISCRETE IN MOD 1 CHANNEL 8
1:0108  DI_MOD_01.CH_09.BI                  DISCRETE IN MOD 1 CHANNEL 9
1:0109  DI_MOD_01.CH_10.BI                  DISCRETE IN MOD 1 CHANNEL 10
1:0110  DI_MOD_01.CH_11.BI                  DISCRETE IN MOD 1 CHANNEL 11
1:0111  DI_MOD_01.CH_12.BI                  DISCRETE IN MOD 1 CHANNEL 12
1:0112  DI_MOD_01.CH_13.BI                  DISCRETE IN MOD 1 CHANNEL 13

1:0113  DI_MOD_01.CH_14.BI                  DISCRETE IN MOD 1 CHANNEL 14
1:0114  DI_MOD_01.CH_15.BI                  DISCRETE IN MOD 1 CHANNEL 15
1:0115  DI_MOD_01.CH_16.BI                  DISCRETE IN MOD 1 CHANNEL 16
1:0116  DI_MOD_02.CH_01.BI                  DISCRETE IN MOD 2 CHANNEL 1
1:0117  DI_MOD_02.CH_02.BI                  DISCRETE IN MOD 2 CHANNEL 2
1:0118  DI_MOD_02.CH_03.BI                  DISCRETE IN MOD 2 CHANNEL 3
1:0119  DI_MOD_02.CH_04.BI                  DISCRETE IN MOD 2 CHANNEL 4
1:0120  DI_MOD_02.CH_05.BI                  DISCRETE IN MOD 2 CHANNEL 5
1:0121  DI_MOD_02.CH_06.BI                  DISCRETE IN MOD 2 CHANNEL 6
1:0122  DI_MOD_02.CH_07.BI                  DISCRETE IN MOD 2 CHANNEL 7
1:0123  DI_MOD_02.CH_08.BI                  DISCRETE IN MOD 2 CHANNEL 8
1:0124  DI_MOD_02.CH_09.BI                  DISCRETE IN MOD 2 CHANNEL 9
1:0125  DI_MOD_02.CH_10.BI                  DISCRETE IN MOD 2 CHANNEL 10
1:0126  DI_MOD_02.CH_11.BI                  DISCRETE IN MOD 2 CHANNEL 11
1:0127  DI_MOD_02.CH_12.BI                  DISCRETE IN MOD 2 CHANNEL 12
1:0128  DI_MOD_02.CH_13.BI                  DISCRETE IN MOD 2 CHANNEL 13
1:0129  DI_MOD_02.CH_14.BI                  DISCRETE IN MOD 2 CHANNEL 14
1:0130  DI_MOD_02.CH_15.BI                  DISCRETE IN MOD 2 CHANNEL 15
1:0131  DI_MOD_02.CH_16.BI                  DISCRETE IN MOD 2 CHANNEL 16
1:0132  DI_MOD_03.CH_01.BI                  DISCRETE IN MOD 3 CHANNEL 1
1:0133  DI_MOD_03.CH_02.BI                  DISCRETE IN MOD 3 CHANNEL 2
1:0134  DI_MOD_03.CH_03.BI                  DISCRETE IN MOD 3 CHANNEL 3
1:0135  DI_MOD_03.CH_04.BI                  DISCRETE IN MOD 3 CHANNEL 4
1:0136  DI_MOD_03.CH_05.BI                  DISCRETE IN MOD 3 CHANNEL 5
1:0137  DI_MOD_03.CH_06.BI                  DISCRETE IN MOD 3 CHANNEL 6
1:0138  DI_MOD_03.CH_07.BI                  DISCRETE IN MOD 3 CHANNEL 7
1:0139  DI_MOD_03.CH_08.BI                  DISCRETE IN MOD 3 CHANNEL 8
1:0140  DI_MOD_03.CH_09.BI                  DISCRETE IN MOD 3 CHANNEL 9
1:0141  DI_MOD_03.CH_10.BI                  DISCRETE IN MOD 3 CHANNEL 10
1:0142  DI_MOD_03.CH_11.BI                  DISCRETE IN MOD 3 CHANNEL 11
1:0143  DI_MOD_03.CH_12.BI                  DISCRETE IN MOD 3 CHANNEL 12
1:0144  DI_MOD_03.CH_13.BI                  DISCRETE IN MOD 3 CHANNEL 13
1:0145  DI_MOD_03.CH_14.BI                  DISCRETE IN MOD 3 CHANNEL 14
1:0146  DI_MOD_03.CH_15.BI                  DISCRETE IN MOD 3 CHANNEL 15
1:0147  DI_MOD_03.CH_16.BI                  DISCRETE IN MOD 3 CHANNEL 16
1:0148  DI_MOD_04.CH_01.BI                  DISCRETE IN MOD 4 CHANNEL 1
1:0149  DI_MOD_04.CH_02.BI                  DISCRETE IN MOD 4 CHANNEL 2
1:0150  DI_MOD_04.CH_03.BI                  DISCRETE IN MOD 4 CHANNEL 3
1:0151  DI_MOD_04.CH_04.BI                  DISCRETE IN MOD 4 CHANNEL 4
1:0152  DI_MOD_04.CH_05.BI                  DISCRETE IN MOD 4 CHANNEL 5
1:0153  DI_MOD_04.CH_06.BI                  DISCRETE IN MOD 4 CHANNEL 6
1:0154  DI_MOD_04.CH_07.BI                  DISCRETE IN MOD 4 CHANNEL 7
1:0155  DI_MOD_04.CH_08.BI                  DISCRETE IN MOD 4 CHANNEL 8
1:0156  DI_MOD_04.CH_09.BI                  DISCRETE IN MOD 4 CHANNEL 9
1:0157  DI_MOD_04.CH_10.BI                  DISCRETE IN MOD 4 CHANNEL 10
1:0158  DI_MOD_04.CH_11.BI                  DISCRETE IN MOD 4 CHANNEL 11
1:0159  DI_MOD_04.CH_12.BI                  DISCRETE IN MOD 4 CHANNEL 12
1:0160  DI_MOD_04.CH_13.BI                  DISCRETE IN MOD 4 CHANNEL 13
1:0161  DI_MOD_04.CH_14.BI                  DISCRETE IN MOD 4 CHANNEL 14
1:0162  DI_MOD_04.CH_15.BI                  DISCRETE IN MOD 4 CHANNEL 15
1:0163  DI_MOD_04.CH_16.BI                  DISCRETE IN MOD 4 CHANNEL 16
1:0164  DI_MOD_05.CH_01.BI                  DISCRETE IN MOD 5 CHANNEL 1
1:0165  DI_MOD_05.CH_02.BI                  DISCRETE IN MOD 5 CHANNEL 2
1:0166  DI_MOD_05.CH_03.BI                  DISCRETE IN MOD 5 CHANNEL 3
1:0167  DI_MOD_05.CH_04.BI                  DISCRETE IN MOD 5 CHANNEL 4
1:0168  DI_MOD_05.CH_05.BI                  DISCRETE IN MOD 5 CHANNEL 5
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1:0169	DI_MOD_05.CH_06.BI	DISCRETE IN MOD 5 CHANNEL 6
1:0170	DI_MOD_05.CH_07.BI	DISCRETE IN MOD 5 CHANNEL 7
1:0171	DI_MOD_05.CH_08.BI	DISCRETE IN MOD 5 CHANNEL 8
1:0172	DI_MOD_05.CH_09.BI	DISCRETE IN MOD 5 CHANNEL 9
1:0173	DI_MOD_05.CH_10.BI	DISCRETE IN MOD 5 CHANNEL 10
1:0174	DI_MOD_05.CH_11.BI	DISCRETE IN MOD 5 CHANNEL 11
1:0175	DI_MOD_05.CH_12.BI	DISCRETE IN MOD 5 CHANNEL 12
1:0176	DI_MOD_05.CH_13.BI	DISCRETE IN MOD 5 CHANNEL 13
1:0177	DI_MOD_05.CH_14.BI	DISCRETE IN MOD 5 CHANNEL 14
1:0178	DI_MOD_05.CH_15.BI	DISCRETE IN MOD 5 CHANNEL 15
1:0179	DI_MOD_05.CH_16.BI	DISCRETE IN MOD 5 CHANNEL 16
1:0180	DI_MOD_06.CH_01.BI	DISCRETE IN MOD 6 CHANNEL 1
1:0181	DI_MOD_06.CH_02.BI	DISCRETE IN MOD 6 CHANNEL 2
1:0182	DI_MOD_06.CH_03.BI	DISCRETE IN MOD 6 CHANNEL 3
1:0183	DI_MOD_06.CH_04.BI	DISCRETE IN MOD 6 CHANNEL 4
1:0184	DI_MOD_06.CH_05.BI	DISCRETE IN MOD 6 CHANNEL 5
1:0185	DI_MOD_06.CH_06.BI	DISCRETE IN MOD 6 CHANNEL 6
1:0186	DI_MOD_06.CH_07.BI	DISCRETE IN MOD 6 CHANNEL 7
1:0187	DI_MOD_06.CH_08.BI	DISCRETE IN MOD 6 CHANNEL 8
1:0188	DI_MOD_06.CH_09.BI	DISCRETE IN MOD 6 CHANNEL 9
1:0189	DI_MOD_06.CH_10.BI	DISCRETE IN MOD 6 CHANNEL 10
1:0190	DI_MOD_06.CH_11.BI	DISCRETE IN MOD 6 CHANNEL 11
1:0191	DI_MOD_06.CH_12.BI	DISCRETE IN MOD 6 CHANNEL 12
1:0192	DI_MOD_06.CH_13.BI	DISCRETE IN MOD 6 CHANNEL 13
1:0193	DI_MOD_06.CH_14.BI	DISCRETE IN MOD 6 CHANNEL 14
1:0194	DI_MOD_06.CH_15.BI	DISCRETE IN MOD 6 CHANNEL 15
1:0195	DI_MOD_06.CH_16.BI	DISCRETE IN MOD 6 CHANNEL 16

Analog Reads

Addr	Input	Description
3:0001	SPD.ENG_SPD_04.HSS_BUS	ENGINE SPEED (rpm)
3:0002	SR.SPD_REF_08.RAMP	SPEED REFERENCE (rpm)
3:0003	SR.SPD_REF_01.ADD	BIASED SPEED RFERENCE (rpm)
3:0004	SC.SPD_CTRL_3.A_SW	ACTUATOR OUTPUT (%)
3:0005	LS.LD_SEN_2.LAG	GENERATOR OUTPUT (kw)
3:0006	SR.REM_SPD_3.CURVE_2D	REMOTE SPEED REF (rpm)
3:0007	TL.TOR_LVL_01.MULTIPLY	TORTIONAL LEVEL
3:0008	MAINIO.SYNC.AI_CURVE	SYNCHRONIZER INPUT (volts)
3:0009	LS.REM_BLD_03.CURVE_2D	REMOTE LOAD REF (kw)
3:0010	LS.B_LD_01.RAMP	BASE LOAD LEVEL
3:0011	LIMIT.MAP_05.CURVE_2D	MAP SENSOR INPUT (eng unit)
3:0012	SPD.ENG_SPD_06.A_SW	SPEED INPUT #1 (rpm)
3:0013	SPD.ENG_SPD_07.A_SW	SPEED INPUT #2 (rpm)
3:0014—3:0030		
3:0031	MAINIO.TC_MOD_01.TE_1	TC MODULUE 1 CHANNEL 1
3:0032	MAINIO.TC_MOD_01.TE_2	TC MODULUE 1 CHANNEL 2
3:0033	MAINIO.TC_MOD_01.TE_3	TC MODULUE 1 CHANNEL 3
3:0034	MAINIO.TC_MOD_01.TE_4	TC MODULUE 1 CHANNEL 4
3:0035	MAINIO.TC_MOD_01.TE_5	TC MODULUE 1 CHANNEL 5
3:0036	MAINIO.TC_MOD_01.TE_6	TC MODULUE 1 CHANNEL 6
3:0037	MAINIO.TC_MOD_01.TE_7	TC MODULUE 1 CHANNEL 7
3:0038	MAINIO.TC_MOD_01.TE_8	TC MODULUE 1 CHANNEL 8
3:0039	MAINIO.TC_MOD_02.TE_1	TC MODULUE 2 CHANNEL 1
3:0040	MAINIO.TC_MOD_02.TE_2	TC MODULUE 2 CHANNEL 2
3:0041	MAINIO.TC_MOD_02.TE_3	TC MODULUE 2 CHANNEL 3
3:0042	MAINIO.TC_MOD_02.TE_4	TC MODULUE 2 CHANNEL 4
3:0043	MAINIO.TC_MOD_02.TE_5	TC MODULUE 2 CHANNEL 5
3:0044	MAINIO.TC_MOD_02.TE_6	TC MODULUE 2 CHANNEL 6
3:0045	MAINIO.TC_MOD_02.TE_7	TC MODULUE 2 CHANNEL 7
3:0046	MAINIO.TC_MOD_02.TE_8	TC MODULUE 2 CHANNEL 8
3:0047	MAINIO.TC_MOD_03.TE_1	TC MODULUE 3 CHANNEL 1
3:0048	MAINIO.TC_MOD_03.TE_2	TC MODULUE 3 CHANNEL 2
3:0049	MAINIO.TC_MOD_03.TE_3	TC MODULUE 3 CHANNEL 3
3:0050	MAINIO.TC_MOD_03.TE_4	TC MODULUE 3 CHANNEL 4
3:0051	MAINIO.TC_MOD_03.TE_5	TC MODULUE 3 CHANNEL 5
3:0052	MAINIO.TC_MOD_03.TE_6	TC MODULUE 3 CHANNEL 6
3:0053	MAINIO.TC_MOD_03.TE_7	TC MODULUE 3 CHANNEL 7
3:0054	MAINIO.TC_MOD_03.TE_8	TC MODULUE 3 CHANNEL 8
3:0055	MAINIO.TC_MOD_04.TE_1	TC MODULUE 4 CHANNEL 1
3:0056	MAINIO.TC_MOD_04.TE_2	TC MODULUE 4 CHANNEL 2
3:0057	MAINIO.TC_MOD_04.TE_3	TC MODULUE 4 CHANNEL 3
3:0058	MAINIO.TC_MOD_04.TE_4	TC MODULUE 4 CHANNEL 4
3:0059	MAINIO.TC_MOD_04.TE_5	TC MODULUE 4 CHANNEL 5

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3:0060  MAINIO.TC_MOD_04.TE_6               TC MODULUE 4 CHANNEL 6
3:0061  MAINIO.TC_MOD_04.TE_7               TC MODULUE 4 CHANNEL 7

3:0062  MAINIO.TC_MOD_04.TE_8               TC MODULUE 4 CHANNEL 8
3:0063  MAINIO.TC_MOD_05.TE_1               TC MODULUE 5 CHANNEL 1
3:0064  MAINIO.TC_MOD_05.TE_2               TC MODULUE 5 CHANNEL 2
3:0065  MAINIO.TC_MOD_05.TE_3               TC MODULUE 5 CHANNEL 3
3:0066  MAINIO.TC_MOD_05.TE_4               TC MODULUE 5 CHANNEL 4
3:0067  MAINIO.TC_MOD_05.TE_5               TC MODULUE 5 CHANNEL 5
3:0068  MAINIO.TC_MOD_05.TE_6               TC MODULUE 5 CHANNEL 6
3:0069  MAINIO.TC_MOD_05.TE_7               TC MODULUE 5 CHANNEL 7
3:0070  MAINIO.TC_MOD_05.TE_8               TC MODULUE 5 CHANNEL 8
3:0071  MAINIO.TC_MOD_06.TE_1               TC MODULUE 6 CHANNEL 1
3:0072  MAINIO.TC_MOD_06.TE_2               TC MODULUE 6 CHANNEL 2
3:0073  MAINIO.TC_MOD_06.TE_3               TC MODULUE 6 CHANNEL 3
3:0074  MAINIO.TC_MOD_06.TE_4               TC MODULUE 6 CHANNEL 4
3:0075  MAINIO.TC_MOD_06.TE_5               TC MODULUE 6 CHANNEL 5
3:0076  MAINIO.TC_MOD_06.TE_6               TC MODULUE 6 CHANNEL 6
3:0077  MAINIO.TC_MOD_06.TE_7               TC MODULUE 6 CHANNEL 7
3:0078  MAINIO.TC_MOD_06.TE_8               TC MODULUE 6 CHANNEL 8
3:0079  MAINIO.TC_MOD_07.TE_1               TC MODULUE 7 CHANNEL 1
3:0080  MAINIO.TC_MOD_07.TE_2               TC MODULUE 7 CHANNEL 2
3:0081  MAINIO.TC_MOD_07.TE_3               TC MODULUE 7 CHANNEL 3
3:0082  MAINIO.TC_MOD_07.TE_4               TC MODULUE 7 CHANNEL 4
3:0083  MAINIO.TC_MOD_07.TE_5               TC MODULUE 7 CHANNEL 5
3:0084  MAINIO.TC_MOD_07.TE_6               TC MODULUE 7 CHANNEL 6
3:0085  MAINIO.TC_MOD_07.TE_7               TC MODULUE 7 CHANNEL 7
3:0086  MAINIO.TC_MOD_07.TE_8               TC MODULUE 7 CHANNEL 8
3:0087  MAINIO.TC_MOD_08.TE_1               TC MODULUE 8 CHANNEL 1
3:0088  MAINIO.TC_MOD_08.TE_2               TC MODULUE 8 CHANNEL 2
3:0089  MAINIO.TC_MOD_08.TE_3               TC MODULUE 8 CHANNEL 3
3:0090  MAINIO.TC_MOD_08.TE_4               TC MODULUE 8 CHANNEL 4
3:0091  MAINIO.TC_MOD_08.TE_5               TC MODULUE 8 CHANNEL 5
3:0092  MAINIO.TC_MOD_08.TE_6               TC MODULUE 8 CHANNEL 6
3:0093  MAINIO.TC_MOD_08.TE_7               TC MODULUE 8 CHANNEL 7
3:0094  MAINIO.TC_MOD_08.TE_8               TC MODULUE 8 CHANNEL 8
3:0095  MAINIO.RTD_MOD_01.TE_1             RTD MODULE 1 CHANNEL 1
3:0096  MAINIO.RTD_MOD_01.TE_2             RTD MODULE 1 CHANNEL 2
3:0097  MAINIO.RTD_MOD_01.TE_3             RTD MODULE 1 CHANNEL 3
3:0098  MAINIO.RTD_MOD_01.TE_4             RTD MODULE 1 CHANNEL 4
3:0099  MAINIO.RTD_MOD_01.TE_5             RTD MODULE 1 CHANNEL 5
3:0100  MAINIO.RTD_MOD_01.TE_6             RTD MODULE 1 CHANNEL 6
3:0101  MAINIO.RTD_MOD_01.TE_7             RTD MODULE 1 CHANNEL 7
3:0102  MAINIO.RTD_MOD_01.TE_8             RTD MODULE 1 CHANNEL 8
3:0103  MAINIO.RTD_MOD_02.TE_1             RTD MODULE 2 CHANNEL 1
3:0104  MAINIO.RTD_MOD_02.TE_2             RTD MODULE 2 CHANNEL 2
3:0105  MAINIO.RTD_MOD_02.TE_3             RTD MODULE 2 CHANNEL 3
3:0106  MAINIO.RTD_MOD_02.TE_4             RTD MODULE 2 CHANNEL 4
3:0107  MAINIO.RTD_MOD_02.TE_5             RTD MODULE 2 CHANNEL 5
3:0108  MAINIO.RTD_MOD_02.TE_6             RTD MODULE 2 CHANNEL 6
3:0109  MAINIO.RTD_MOD_02.TE_7             RTD MODULE 2 CHANNEL 7
3:0110  MAINIO.RTD_MOD_02.TE_8             RTD MODULE 2 CHANNEL 8
3:0111  MAINIO.RTD_MOD_03.TE_1             RTD MODULE 3 CHANNEL 1
3:0112  MAINIO.RTD_MOD_03.TE_2             RTD MODULE 3 CHANNEL 2
3:0113  MAINIO.RTD_MOD_03.TE_3             RTD MODULE 3 CHANNEL 3
3:0114  MAINIO.RTD_MOD_03.TE_4             RTD MODULE 3 CHANNEL 4
3:0115  MAINIO.RTD_MOD_03.TE_5             RTD MODULE 3 CHANNEL 5
3:0116  MAINIO.RTD_MOD_03.TE_6             RTD MODULE 3 CHANNEL 6
3:0117  MAINIO.RTD_MOD_03.TE_7             RTD MODULE 3 CHANNEL 7
3:0118  MAINIO.RTD_MOD_03.TE_8             RTD MODULE 3 CHANNEL 8
3:0119  MAINIO.RTD_MOD_04.TE_1             RTD MODULE 4 CHANNEL 1
3:0120  MAINIO.RTD_MOD_04.TE_2             RTD MODULE 4 CHANNEL 2
3:0121  MAINIO.RTD_MOD_04.TE_3             RTD MODULE 4 CHANNEL 3
3:0122  MAINIO.RTD_MOD_04.TE_4             RTD MODULE 4 CHANNEL 4
3:0123  MAINIO.RTD_MOD_04.TE_5             RTD MODULE 4 CHANNEL 5
3:0124  MAINIO.RTD_MOD_04.TE_6             RTD MODULE 4 CHANNEL 6
3:0125  MAINIO.RTD_MOD_04.TE_7             RTD MODULE 4 CHANNEL 7
3:0126  MAINIO.RTD_MOD_04.TE_8             RTD MODULE 4 CHANNEL 8
3:0127  MAINIO.AI_MOD_01.AE_1              ANALOG IN MODULE 1 CHANNEL 1

3:0128  MAINIO.AI_MOD_01.AE_2              ANALOG IN MODULE 1 CHANNEL 2
3:0129  MAINIO.AI_MOD_01.AE_3              ANALOG IN MODULE 1 CHANNEL 3
3:0130  MAINIO.AI_MOD_01.AE_4              ANALOG IN MODULE 1 CHANNEL 4
3:0131  MAINIO.AI_MOD_01.AE_5              ANALOG IN MODULE 1 CHANNEL 5
3:0132  MAINIO.AI_MOD_01.AE_6              ANALOG IN MODULE 1 CHANNEL 6
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3:0133	MAINIO.AI_MOD_01.AE_7	ANALOG IN MODULE 1 CHANNEL 7
3:0134	MAINIO.AI_MOD_01.AE_8	ANALOG IN MODULE 1 CHANNEL 8
3:0135	MAINIO.AI_MOD_02.AE_1	ANALOG IN MODULE 2 CHANNEL 1
3:0136	MAINIO.AI_MOD_02.AE_2	ANALOG IN MODULE 2 CHANNEL 2
3:0137	MAINIO.AI_MOD_02.AE_3	ANALOG IN MODULE 2 CHANNEL 3
3:0138	MAINIO.AI_MOD_02.AE_4	ANALOG IN MODULE 2 CHANNEL 4
3:0139	MAINIO.AI_MOD_02.AE_5	ANALOG IN MODULE 2 CHANNEL 5
3:0140	MAINIO.AI_MOD_02.AE_6	ANALOG IN MODULE 2 CHANNEL 6
3:0141	MAINIO.AI_MOD_02.AE_7	ANALOG IN MODULE 2 CHANNEL 7
3:0142	MAINIO.AI_MOD_02.AE_8	ANALOG IN MODULE 2 CHANNEL 8
3:0143	MAINIO.AI_MOD_03.AE_1	ANALOG IN MODULE 3 CHANNEL 1
3:0144	MAINIO.AI_MOD_03.AE_2	ANALOG IN MODULE 3 CHANNEL 2
3:0145	MAINIO.AI_MOD_03.AE_3	ANALOG IN MODULE 3 CHANNEL 3
3:0146	MAINIO.AI_MOD_03.AE_4	ANALOG IN MODULE 3 CHANNEL 4
3:0147	MAINIO.AI_MOD_03.AE_5	ANALOG IN MODULE 3 CHANNEL 5
3:0148	MAINIO.AI_MOD_03.AE_6	ANALOG IN MODULE 3 CHANNEL 6
3:0149	MAINIO.AI_MOD_03.AE_7	ANALOG IN MODULE 3 CHANNEL 7
3:0150	MAINIO.AI_MOD_03.AE_8	ANALOG IN MODULE 3 CHANNEL 8
3:0151	MAINIO.AI_MOD_04.AE_1	ANALOG IN MODULE 4 CHANNEL 1
3:0152	MAINIO.AI_MOD_04.AE_2	ANALOG IN MODULE 4 CHANNEL 2
3:0153	MAINIO.AI_MOD_04.AE_3	ANALOG IN MODULE 4 CHANNEL 3
3:0154	MAINIO.AI_MOD_04.AE_4	ANALOG IN MODULE 4 CHANNEL 4
3:0155	MAINIO.AI_MOD_04.AE_5	ANALOG IN MODULE 4 CHANNEL 5
3:0156	MAINIO.AI_MOD_04.AE_6	ANALOG IN MODULE 4 CHANNEL 6
3:0157	MAINIO.AI_MOD_04.AE_7	ANALOG IN MODULE 4 CHANNEL 7
3:0158	MAINIO.AI_MOD_04.AE_8	ANALOG IN MODULE 4 CHANNEL 8
3:0159	MAINIO.AI_MOD_05.AE_1	ANALOG IN MODULE 5 CHANNEL 1
3:0160	MAINIO.AI_MOD_05.AE_2	ANALOG IN MODULE 5 CHANNEL 2
3:0161	MAINIO.AI_MOD_05.AE_3	ANALOG IN MODULE 5 CHANNEL 3
3:0162	MAINIO.AI_MOD_05.AE_4	ANALOG IN MODULE 5 CHANNEL 4
3:0163	MAINIO.AI_MOD_05.AE_5	ANALOG IN MODULE 5 CHANNEL 5
3:0164	MAINIO.AI_MOD_05.AE_6	ANALOG IN MODULE 5 CHANNEL 6
3:0165	MAINIO.AI_MOD_05.AE_7	ANALOG IN MODULE 5 CHANNEL 7
3:0166	MAINIO.AI_MOD_05.AE_8	ANALOG IN MODULE 5 CHANNEL 8

Appendix D.
723 Menu Summary

Service Menus

1—1st Dynamics
1. Gain 1
2. Stability 1
3. Compensation 1
4. Gain Ratio 1
5. Window Width 1
6. Gain Slope BK PNT 1
7. Gain Slope 1
8. Speed Filter 1
9. Enable Act Bump
10. Act Bump Level
11. Act Bump Duration

2—2nd Dynamics
1. Gain 2
2. Stability 2
3. Compensation 2
4. Gain Ratio 2
5. Window Width 2
6. Gain Slope BK PNT 2
7. Gain Slope 2
8. Speed Filter 2
9. Enable Act Bump
10. Act Bump Level
11. Act Bump Duration

3—Speed Setting
1. Raise Speed Limit
2. Lower Speed Limit
3. Idle Speed
4. Accel Ramp Time
5. Decel Ramp Time
6. Raise Speed Rate
7. Lower Speed Rate
8. 4mA Remote Reference
9. 20mA Remote Reference
10. Tach @ 4mA Output
11. Tach @ 20mA Output
12. Enable Speed Filter
13. Select Digital MPU

4—Torsional Filter
1. Torsional Filter
2. Derated Fuel Limit
3. Derated Trip Level
4. Derated Clear Level
5. Tor Limit Active

5—KW Setting
1. Maximum Load
2. Load Gain Voltage
3. 4mA KW Load Input
4. 20mA KW Load Input
5. Base Load Reference
6. Unload Trip Level
7. Loading Rate
8. Un-Loading Rate
9. 4mA Remote Ref
10. 20mA Remote Ref
11. Load Droop Percent
12. Act Out @ No Load
13. Act Out @ Full Load
14. Load @ 4mA Output
15. Load @ 20mA Output

6—Fuel Limiters
1. Start Fuel Limit
2. Start Fuel Active
3. Max Fuel Limit
4. Max Fuel Active
5. Enable MAP Limit
6. MAP Active
7. MAP Breakpoint A
8. Fuel Limit at BP A
9. MAP Breakpoint B
10. Fuel Limit at BP B
11. MAP Breakpoint C
12. Fuel Limit at BP C
13. MAP Breakpoint D
14. Fuel Limit at BP D
15. MAP Breakpoint E
16. Fuel Limit at BP E
17. MAP @ 4mA
18. MAP @ 20mA

7—Miscellaneous
1. LON Service PIN
2. LON Reset
3. Service Reset
4. Comm Reset
5. CFIG Output @ 4mA
6. CFIG Output @ 20mA

8—Serial Port Setup
1. Port 2 HW CFIG
2. Port 2 Baud Rate
3. Port 2 Stop Bits
4. Port 2 Parity
5. Port 3 HW CFIG
6. Port 3 Baud Rate
7. Port 3 Stop Bits
8. Port 3 Parity

9—Display Menu 1
1. Engine Speed
2. Speed Reference
3. Biased Speed Ref
4. Bias from Isoch LS
5. Bias from Droop
6. Bias from Sync
7. Generator Output
8. Load Reference
9. Actuator Output
10. Torsional Level
11. Remote Speed Ref
12. Remote Load Ref
13. Remote Enabled
14. LS Line Voltage
15. LS Bridge Bias
16. Sync Input
17. MAP Limit
18. MAP Input

10—Display Menu 2
1. Speed Input #1
2. Speed Input #2
3. Min Fuel
4. Idle/Rated
5. Raise Speed/Load
6. Lower Speed/Load
7. Unload
8. Baseload
9. 2nd Dynamics
10. Isoch/Droop
11. Load Share Relay
12. Ckt Bkr Relay
13. Minor Alarm Output
14. Major Alarm Output
15. MPU 1 Failed
16. MPU 2 Failed

Service Menus (cont.)

11—Minor Alarm Menu

1. MPU 1 Fail
2. MPU 2 Fail
3. MPU 1 and 2 Fail
4. KW Xdcr Fail
5. Rem Spd/Ld Xdcr Fail
6. MAP Xdcr Fail
7. High KW Alm
8. High Act Output Alm
9. High Tor Level Alm
10. Overspeed Alm
11. Fail to Xmit Alm
12. Minor Alarm Output

12—Major Alarm Menu

1. MPU 1 Fail
2. MPU 2 Fail
3. MPU 1 and 2 Fail
4. KW Xdcr Fail
5. Rem Spd/Ld Xdcr Fail
6. MAP Xdcr Fail
7. High KW Alm
8. High Act Output Alm
9. High Tor Level Alm
10. Overspeed Alm
11. Fail to Xmit Alm
12. Major Alarm Output

Configure Menus

1—CFIG Speed Control

1. Rated Speed
2. AMPU #1 Teeth
3. AMPU 1 Max Freq
4. AMPU #2 Teeth
5. AMPU Max Freq
6. Reverse Acting?
7. Act2 CFIG Value
8. DMPU #1 Teeth
9. DMPU #2 Teeth

2—CFIG Minor Alarm

1. MPU 1 Fail
2. MPU 2 Fail
3. MPU 1 and 2 Fail
4. KW Xdcr Fail
5. Rem Spd/Ld Xdcr Fail
6. High KW Alm
7. High KW Set Point
8. High KW Delay
9. High Act Output Alm
10. High Act Set Point
11. High Act Delay
12. High Tor Level Alm
13. High Tor Set Point
14. High Tor Delay
15. Overspeed Alm
16. Overspeed Set Point
17. Overspeed Delay
18. Fail to Xmit Alm

3—CFIG Major Alarm

1. MPU 1 Fail
2. MPU 2 Fail
3. MPU 1 and 2 Fail
4. KW Xdcr Fail
5. Rem Spd/Ld Xdcr Fail
6. High KW Alm
7. High KW Set Point
8. High KW Delay
9. High Act Output Alm
10. High Act Set Point
11. High Act Delay
12. High Tor Level Alm
13. High Tor Set Point
14. High Tor Delay
15. Overspeed Alm
16. Overspeed Set Point
17. Overspeed Delay
18. Fail to Xmit Alm

4—CFIG Modbus

1. Port 2 Address
2. Port 3 Mode
3. Port 3 Address

723 Control Specifications

Woodward Part Numbers:	
9907-035	723 with low-voltage power supply
9907-036	723 with high-voltage power supply
9907-037	723 with torsional filter and low-voltage power supply
9907-038	723 with torsional filter and high-voltage power supply
9905-292	Hand Held Programmer
Power Supply Rating	18–40 Vdc (24 or 32 Vdc nominal) 90–150 Vdc (125 Vdc nominal)
Power Consumption	40 W nominal
Steady State Speed Band	Magnetic pickup: 400–15 000 Hz (8–2100 rpm) Proximity switch: 7.5–1000 Hz (8–2100 rpm)
Discrete Inputs (8)	10 mA at 24 Vdc
Remote Speed/Load Setting Input	4–20 mA or 1–5 Vdc
Manifold Air Pressure Input	4–20 mA or 1–5 Vdc
KW Transducer Input	4–20 mA or 1–5 Vdc
SPM Synchronizer Input	±5 Vdc from SPM-A synchronizer
Actuator Output	20–160 mA
Tachometer Output	4–20 mA to meter or computer
Configurable Output	4–20 mA to meter or computer
Load Signal Output	4–20 mA to meter or computer
Relay Outputs	Breaker Open, Major Alarm, Minor Alarm
Programmer Serial Port (J1)	RS-422, 9-pin D connector, 1200 baud, full duplex
Communication Ports (J2, J3)	RS-232, RS-422, 9-pin connector, 1200 to 38400 baud, full duplex
Ambient Operating Temperature	–40 to +70 °C (–40 to +158 °F)
Storage Temperature	–55 to +105 °C (–67 to +221 °F)
Humidity	95% at 38 °C
EMI/RFI Susceptibility	EN50081-2 and EN50082-2
Humidity	US MIL-STD 810D, Method 507.2, Procedure III
Mechanical Vibration	24—2000 Hz swept sine, 2.5 Gs constant acceleration, resonant dwells — 1 million cycles, total time — 6 hours/axis
Mechanical Shock	US MIL-STD 810C, Method 516.2, Procedure I (basic design test), Procedure II (transit drop test, packaged), Procedure V (bench handling)
Salt Spray	ASTM B 117-73

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Please reference publication 02785A.

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