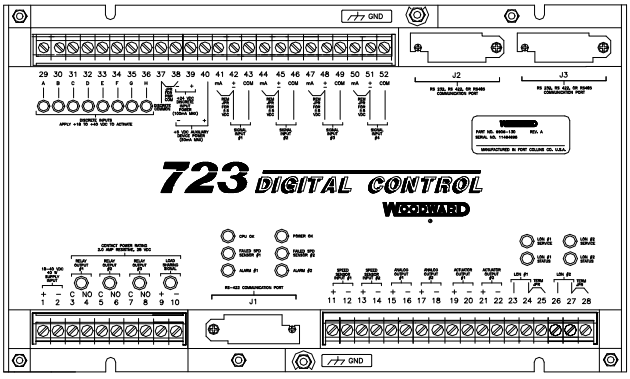
WOODWARD

Product Manual 02784
(Revision A)
Original Instructions



723 Digital Speed Control for Reciprocating Engines—DSLC™ Compatible

9907-031, 9907-032, 9907-033, 9907-034

Installation and Operation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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

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

Proper Use

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

Translated Publications

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

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 Out-of-date translations are marked with ⚠.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

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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 DSLC™ Compatible Digital Speed Control, models 9907-031 (low voltage), 9907-032 (high voltage), 9907-033 (low voltage with torsional filter), and 9907-034 (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

This 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 a speed bias input for the DSLC™ Digital Synchronizer and Load Control.

One LON channel can be used to support Woodward LinkNet input/output nodes for monitoring functions. The other LON channel can be used to tap into the DSLC for monitoring parameters.

The two serial channels can interface to a Modbus® * master device such as a Human/Machine Interface(HMI) to monitor the control and engine parameters.

*—Modbus is a trademark of Schneider Automation Inc.

The 723 control system includes:

- a 723 Digital Speed Control
- a handheld terminal for adjusting control parameters
- one or two proportional actuators to position the fuel metering
- an external power source
- one or two speed-sensing devices (two required for coupling torsional filtering)
- eight optional switch contacts to manage control functions
- a DSLC or other load control device
- Load Pulse or other frequency correction device
- an optional fuel limiting transducer
- three optional analog readout devices for display
- two optional relay-driven alarms
- optional Modbus devices for digital monitoring and control
- optional LinkNet Modules to provide additional I/O paths for the Modbus Devices

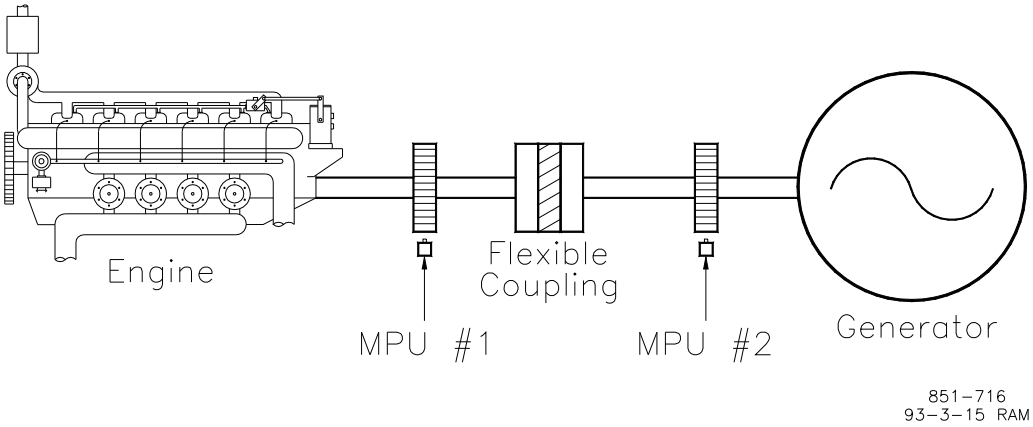


Figure 1-1. Flexible Coupled Generator Set

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.

Control Options

Each 723 control requires 40 W of power. A nominal current in-rush of 7 A is possible. Acceptable input voltage ranges are:

- low voltage—18 to 40 Vdc
- high voltage—90 to 150 Vdc

Discrete input voltages provide on/off command signals to the electronic control, such as Raise Speed, Lower Speed, etc. Each discrete input requires 10 mA at its 24 Vdc nominal voltage rating (2210 Ω load).

Other control options (on-board jumper configurations):

- proximity switch input for speed signal frequencies below 1000 Hz
- tandem actuator outputs
- 0–1 or 4–20 mA analog outputs
- 4–20 or 0–200 mA actuator outputs

Magnetic pickup inputs should only be used when operating speeds provide at least 400 Hz magnetic pickup frequency.

723 Digital Speed Control Accessories

A Hand Held Programmer (part number 9907-205) is used for adjusting software parameters of the 723 control, including the software options. It plugs into communication port J1 of the control. [Hand Held Programmer part number 9905-292 can also be used.]

An analog Load Pulse Unit (part number 8272-615) can be used to increase the performance of the engine generator. Signal Input #1 has been dedicated to this purpose.

A DSLC control (Digital Synchronizer and Load Control) for generator load management and load sharing between multiple generator sets can be used with the 723 control. The 723 controls described in this manual are designed to accept load and synchronizing inputs from the DSLC unit through Signal Input # 2.

The 723 control will also receive the generator parameters through the LON #2 data channel. The generator parameters are used for alarming and output from the 723 control. The generator parameters are also made available to both communication ports, J2 and J3. To extract the DSLC information to the 723, use the LON Binding Kit (part number 9924-863). If the LON hardware is already available, you can order the 723/DSLC/GATEWAY Standard Database (part number 9924-852). Refer to Woodward manual 02817, *723 Software/DSLC Compatible—Network Binding Procedure*, for detailed binding instructions.

Signal Input # 2 will also accept signals from a Woodward Generator Load Sensor (part number 8290-048) or a Woodward Real Power Sensor (part number 8272-695) if a DSLC control is not used.

The two communication ports (J2 and J3) and the LON # 1 data channel allow for digital communications between external Modbus compatible devices and Woodward LinkNet I/O modules. Up to 18 LinkNet modules have been designated for use and can be connected to the LON # 1 channel. The inputs and outputs of these modules can be read and controlled with Modbus compatible devices connected to communication ports J2 and J3. The number and types of LinkNet modules available:

Description	Nodes Available	Total Channels Available	Network Address	Module Part Numbers
J Thermocouple In–Fail High OR J Thermocouple In–Fail Low	4	24	9905-966 1, 2, 3, or 4	9905-967
100 Ω Am RTD Input	3	18	5, 6, or 7	9905-970
4–20 mA Input	2	12	8 or 9	9905-968
Discrete Input	4	64	10, 11, 12, or 13	9905-971
Relay Output	4	32	14, 15, 16, or 17	9905-973
4–20 mA Output	1	6	18	9905-972
TOTAL	**18**	**156**		

Table 1-1. LinkNet Modules (Summary)

Addr.	Description	Channels	Notes
1	J TC–Fail High	6	
2	J TC Input	6	
3	J TC Input	6	
4	J TC Input	6	
5	100 Ω Am RTD Input	6	
6	100 Ω Am RTD Input	6	
7	100 Ω Am RTD Input	6	
8	4–20 mA Input	6	
9	4–20 mA Input	6	
10	Discrete Input	16	
11	Discrete Input	16	
12	Discrete Input	16	
13	Discrete Input	16	
14	Relay Output	8	
15	Relay Output	8	
16	Relay Output	8	
17	Relay Output	8	
18	Analog Output	6	
Total		**156**	

Table 1-2. LinkNet Modules (Address)

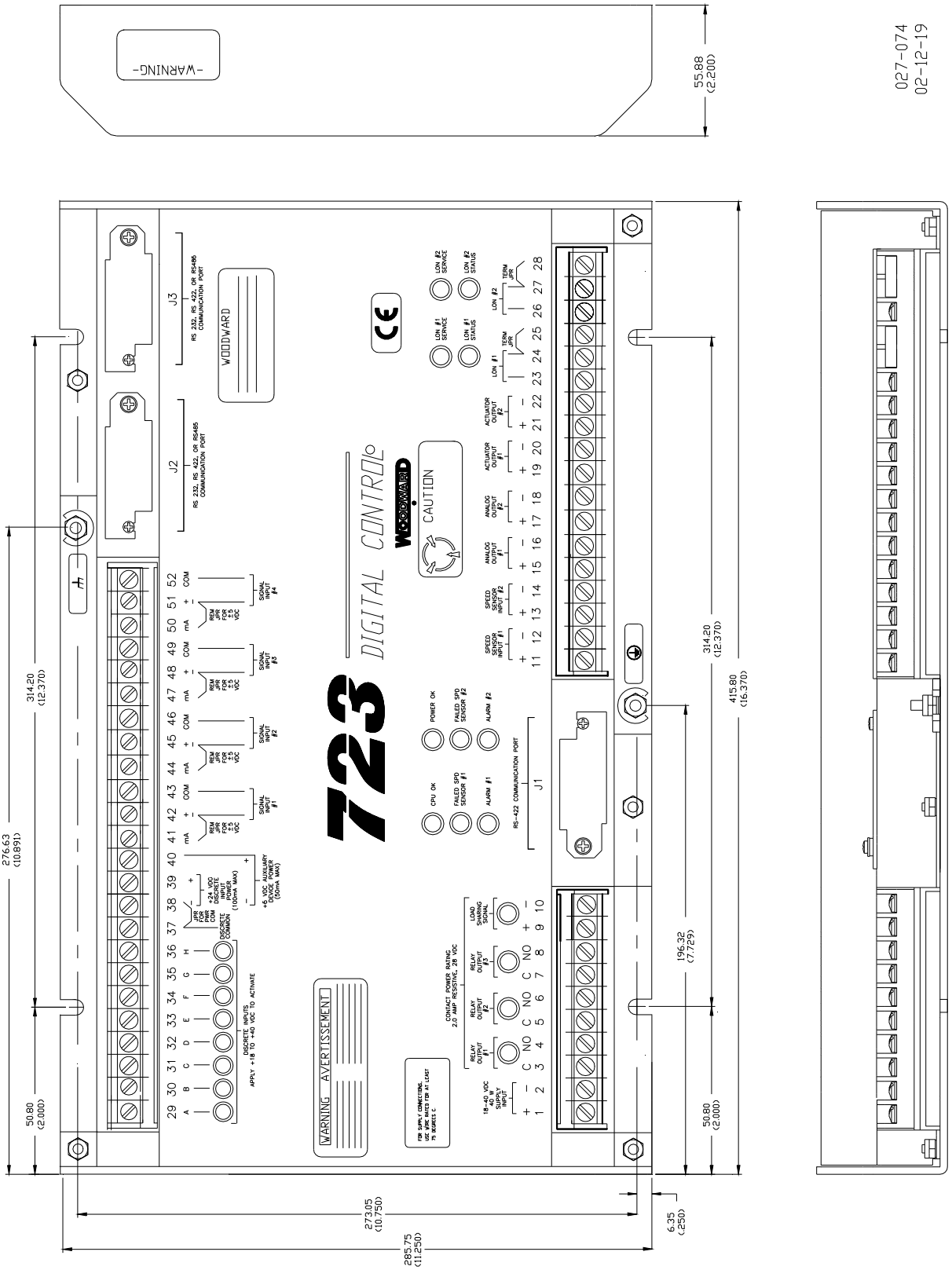
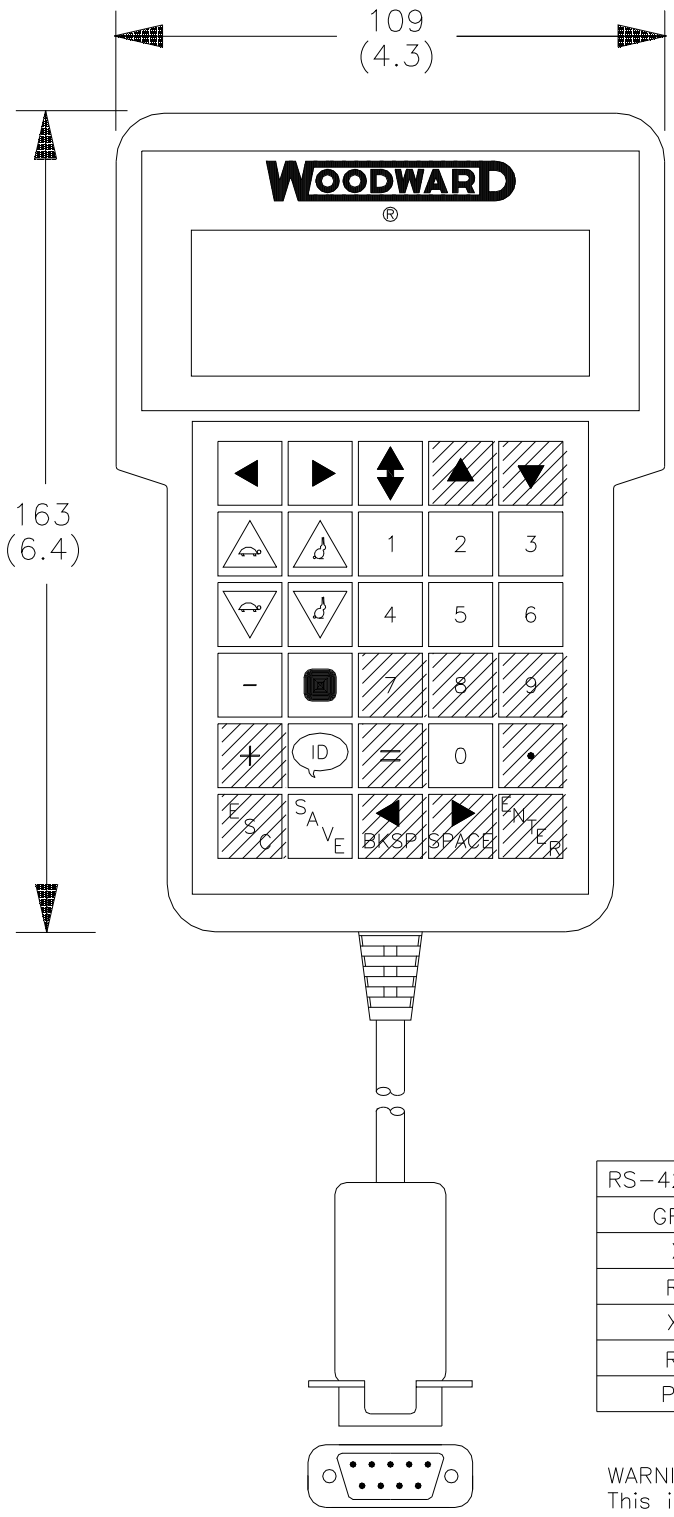


Figure 1-2. 723 Digital Speed Control



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98–02–26 skw

RS–422 SIGNAL	DE–9P PIN ASSIGNMENT
GROUND	7
XMIT–	2
RECV–	3
XMIT+	4
RECV+	5
POWER	9

WARNING
This is a class A product based on testing to EN55022 for ITE hardware. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Figure 1-3. Hand Held Programmer

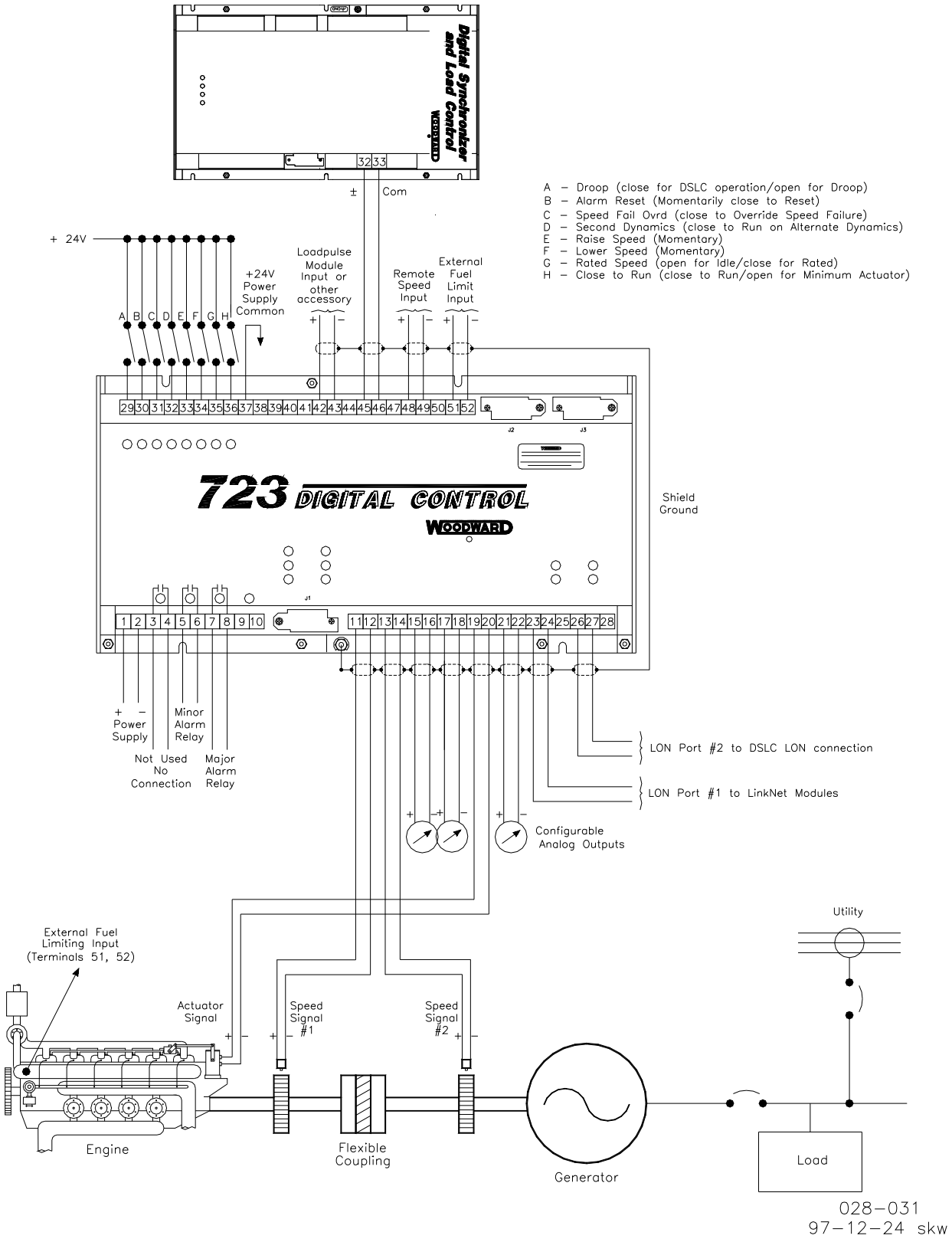

Figure 1-4. Typical 723 Connections

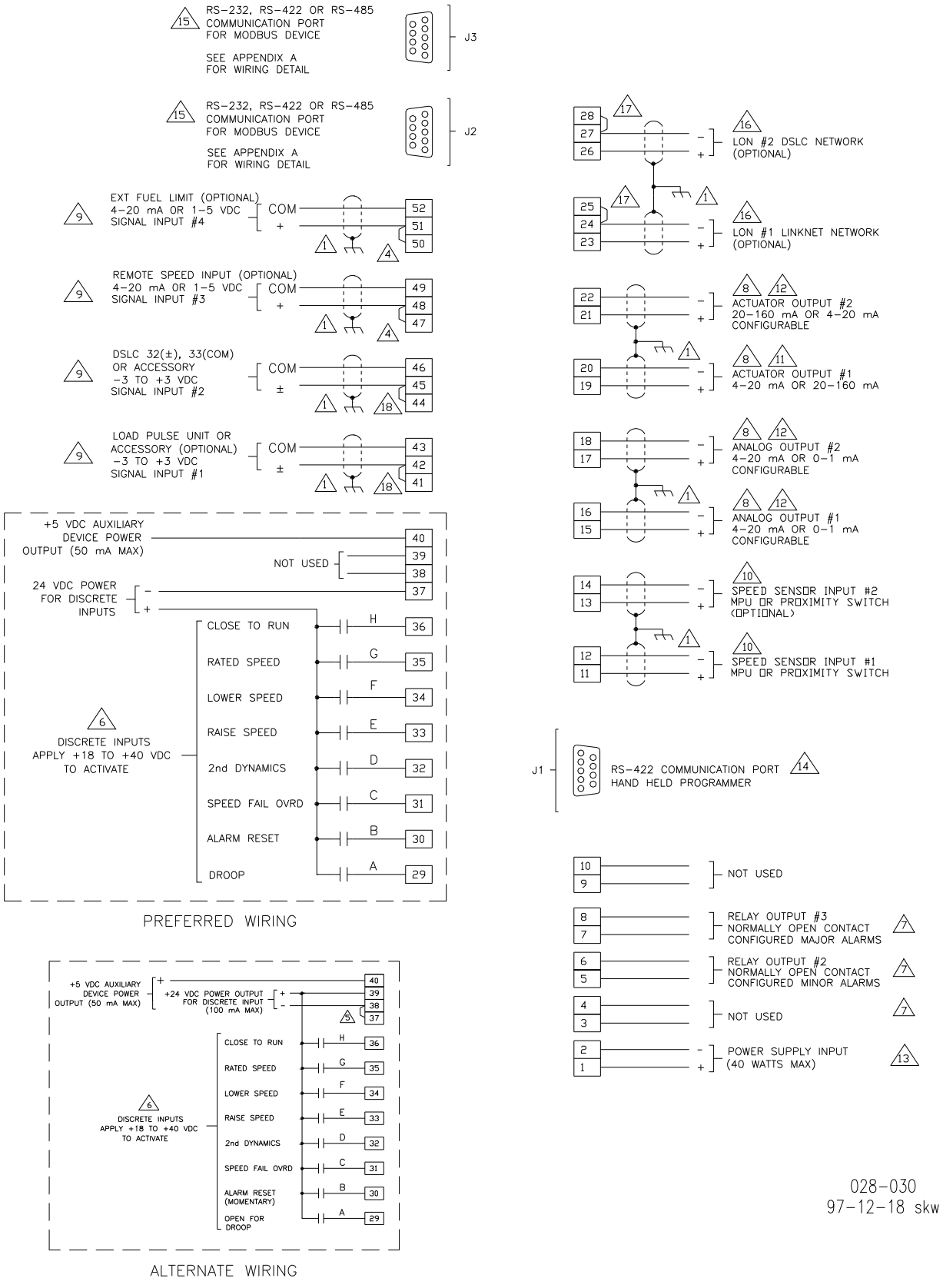

Figure 1-5a. Control Wiring Diagram

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 THROUGH ALL TERMINAL BLOCKS AND MUST NOT BE TIED TO OTHER SHIELDS EXCEPT AT THE COMMON GROUND POINT. THE SHIELDS ARE TIED TOGETHER AT THE GROUND STUD

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 0−200 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 APPENDIX A.

16. THE LON MUST BE CONNECTED USING PROPER CABLE AS DESCRIBED IN APPENDIX B. PORT MUST BE BOUND PER APPLICATION NOTE 02817.

17. BOTH LON NETWORKS NEED TO BE PROPERLY TERMINATED. THIS CAN BE DONE AT THE 723 BY INSTALLING JUMPERS FROM TERMINALS 24 TO 25 FOR LON #1. REFER TO APPENDIX B FOR FURTHER DETAILS.

18. THE DSLC, THE LOAD PULSE MODULE, AND OTHER WOODWARD ACCESSORIES PROVIDE +/− 5 Vdc TO THE 723. REMOVE THE JUMPERS IF USING WOODWARD ACCESSORIES INTO THESE INPUTS.

028−029
97−04−28

Figure 1-5b. Control Wiring Diagram Notes

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 iv, 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 iv, Electrostatic Discharge Awareness, before proceeding.

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

The following jumper options are available for these 723 controls:

	JPR10	analog output #1	0–1 mA
*	JPR9	analog output #1	0–20 mA
	JPR12	analog output #2	0–1 mA
*	JPR11	analog output #2	0–20 mA
*	JPR13 & JPR2	actuator output #1	0–200 mA, single
	JPR13 & JPR1	actuator output #1	0–20 mA, single
&	JPR14 & JPR2	actuator output #1	0–160 mA, tandem
	JPR15 & JPR3	actuator output #2	0–200 mA, single
*	JPR15 & JPR4	actuator output #2	0–20 mA, single
&	JPR16 & JPR3	actuator output #2	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
&—tandem outputs are designed to supply a maximum of 160 mA into two actuators connected in series.

Electrical Connections

External wiring connections and shielding requirements for a typical 723 control installation are shown in Figure 1-4. The control 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 25 mm (1 inch). 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, *EMI Control for Electronic Governing Systems* for more information.

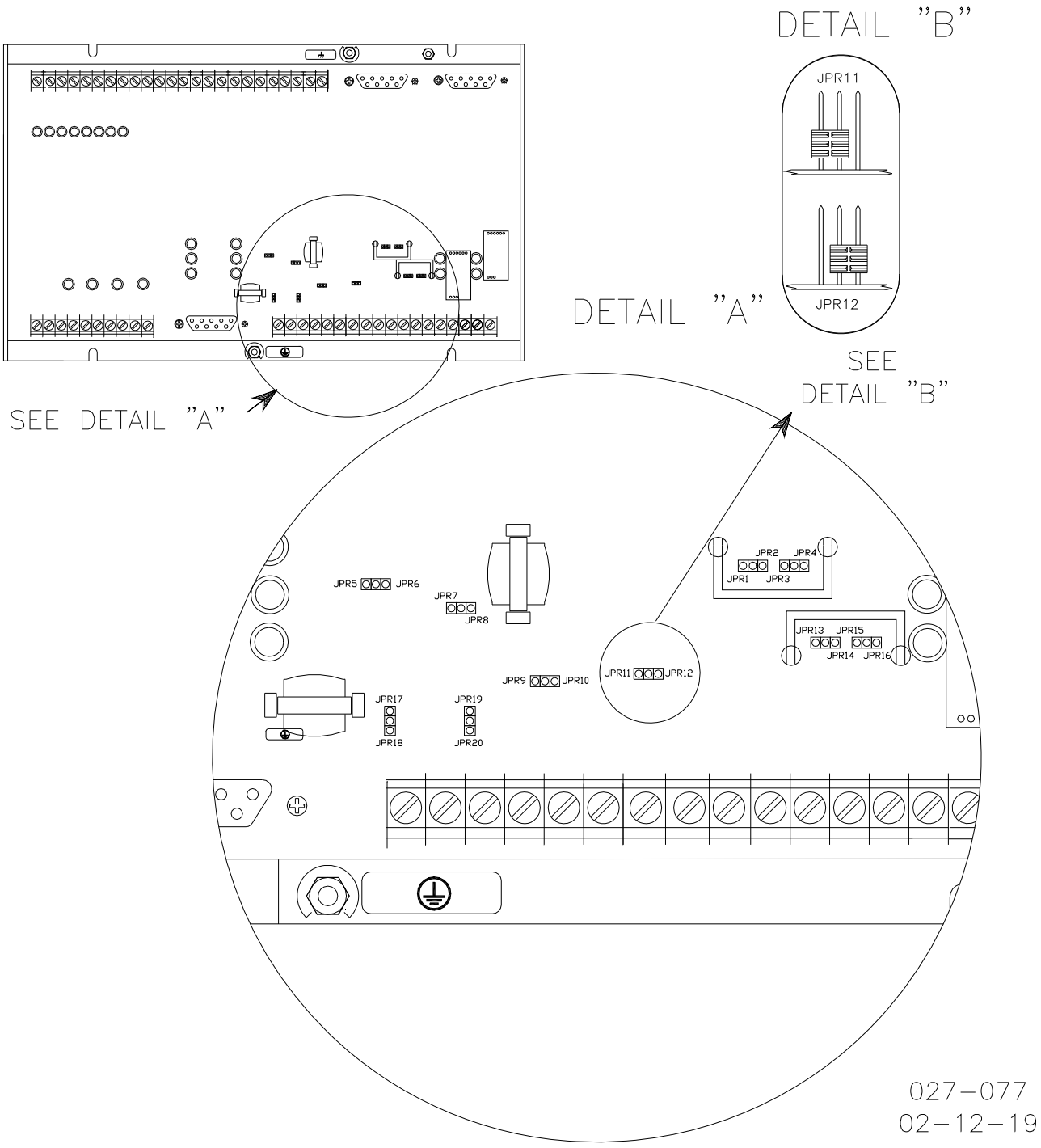

Figure 2-1. 723 Control Internal Jumpers

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 braided 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.

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 (7 A) 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 shutdown procedure. Use the Minimum Fuel (Run/Stop) discrete input (terminal 36) for 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 60 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 control wiring notes for contact ratings.)

The relay contacts on terminals 3/4 are not used and should remain unconnected.

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).

The contact ratings are shown on the control wiring (Figure 1-5). Interposing relays should be used if the application exceeds these ratings.

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. The second speed-sensing device may be used for redundancy and for torsional filtering on models with torsional filters. The second device will provide backup speed sensing in the event of a single speed sensor device failure. If two speed sensor devices are used, they must both sense the exact same speed of rotation. The usual location for both devices is on the upper half of the flywheel housing.

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 speed. The speed sensors 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.

Analog Output #1 and #2 (Terminals 15/16 and 17/18)

The two analog outputs can be configured several different ways depending on the application needs. The output current is hardware configurable for either 0 to 1 mA or 4 to 20 mA. This current signal is supplied to terminals 15(+) and 16(–) for Analog Output #1 and terminals 17(+) and 18(–) for Analog Output #2. Note that the these terminals must be isolated from ground.

Either of the outputs can be software configured to one of several control parameters. These parameters include:

- 1—Fuel Demand
- 2—Remote Speed Set Point
- 3—J3 Modbus Analog Write Address 40001
- 4—Engine Speed
- 5—Real Power (supplied from the DSLC unit connected and bound to LON #2)
- 6—Reactive Power (supplied from the DSLC unit connected and bound to LON #2)
- 7—Biased Speed Reference
- 8—Actuator Position
- 9—Torsional Level (available on certain part numbers only)

Analog Output #1 is factory set for 4 to 20 mA representing the engine speed. Default range is 0 to 1300 rpm. Software settings must be changed if the hardware is configured for 0 to 1 mA.

Analog Output #2 is factory set for 4 to 20 mA representing the real power as determined from the DSLC unit. Software settings must be changed if the hardware is configured for 0 to 1 mA. Note that the DSLC unit must be bound to the 723 for this default signal to work. See Application Note 02817 for information on LON binding parameters.

Use shielded twisted-pair wires. For electrically isolated devices such as 4 to 20 mA analog meters, 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 #1 (Terminals 19/20)

The actuator wires connect to terminals 19(+) and 20(+). Use shielded wires with the shield connected to chassis at the control. The unit may be configured for 4–20 mA. If the hardware jumper is changed, the software settings must also be changed.

Actuator Output #2 (Terminals 21/22)

The Actuator Output #2 can be configured several different ways depending on the application needs. The output current is hardware configurable for either 0 to 200 mA, 0 to 160 mA, or 4 to 20 mA. This actuator output can also be software configured to one of several control parameters similar to Analog Outputs #1 and #2 above. These parameters are identical to the selections for Analog Out #1 & #2.

Actuator Output #2 is factory set for 4 to 20 mA representing the fuel demand.

Actuator Position selection can be used to allow Actuator Output #2 to have an actuator signal identical to Actuator Output #1. Actuator Output #2 can be connected to a second standard Woodward actuator by changing the hardware configuration to 0 to 200 mA. Software settings must be changed if the hardware is configured for 0 to 200 mA.

Use shielded twisted-pair wires. For electrically isolated devices such as 4 to 20 mA input analog meters, the shield should be grounded at the control end of the cable. For input to other devices, use the recommendation of the device manufacturer.

LON #1 and LON #2 (Terminals 23—28)

The 723 control provides two separate LON communication channels for communicating with Echelon® networks.

LON #1 is used to connect up to eighteen Woodward LinkNet® I/O modules. These modules provide values for temperature, 4 to 20 mA inputs, and discrete inputs for availability to the two serial communication ports (J2 and J3). Additionally, the information can be read on the Hand Held Programmer connected to J1. Modules can also be used which will provide 4 to 20 mA outputs and relay outputs. These outputs are driven by the Modbus device connected to Communication Port J3.

LON #2 is typically connected to the DSLC unit which is used to control loading and synchronizing of the generator. This connection needs to be made if the 723 is using the real power value for alarming or for readouts, or if power information is used by the Modbus devices.

IMPORTANT **The connection to LON #2 is not required for the DSLC unit to properly perform load control with the 723.**

If several gensets are connected together with a common LON, the 723 LON #2 channel will connect to this same LON. This connection will require the binding procedure described in Application Note 02817. This connection will allow all parameters described in the DSLC manual 02007C - Chapter 9 to be read by either of the two Modbus devices connected to Ports J2 and J3.

Discrete Inputs (Terminals 29—36)

Discrete inputs are the switch input commands to the 723 control. They interact in such a way as to allow engine control and power management under a variety of conditions.

Voltage is supplied to the discrete input terminal when an input switch or relay contact closes. This will cause the input state for that discrete input to be “TRUE”. The input terminal will be open circuited when the input switch or relay contact opens. This will cause the input state for that discrete input to be “FALSE”. When the input switch or relay contact is closed, the voltage supplying the discrete inputs should be present from the appropriate discrete input (terminal 29, 30, 31, 32, 33, 34, 35, or 36) to terminal 37 (common). Terminal 37 is the common return path for all of the discrete input channels. A lower voltage indicates that the switch contacts have too high a resistance when closed and should be replaced. These terminals must be isolated from ground. The green light above each input terminal will illuminate for a valid “TRUE” state.

In systems which provide an external low voltage source to power the 723 control (or other systems where external low voltage dc power is available), the discrete inputs may be powered by this external low voltage. The voltage source used must be capable of supplying 100 mA at a voltage level of 18 to 40 Vdc. Connect the external low voltage source negative to terminal 37(–). Connect the external low voltage source positive to the appropriate input switch or relay contact and connect the mated switch or relay contact to the corresponding discrete input terminal on the 723 control.

NOTICE

Remove the factory installed jumper between terminal 37 and terminal 38 when using external discrete input power.

In systems which provide a high voltage source to power the 723 control (or systems where the external low voltage dc power is not appropriate), the discrete inputs may be powered by the internal 24 Vdc Discrete Input Power source at terminal 39. This source is capable of supplying 100 mA at a voltage level of 24 Vdc. Connect the internal 24 Vdc voltage source positive from terminal 39 to the appropriate input switch or relay contact, and connect the mated switch or relay contact to the corresponding discrete input terminal on the 723 control. Assure that a connection exists between terminal 37 and terminal 38 when using the internal Discrete Input Power. Do not power other devices with the internal discrete input power source, and assure that the switch or relay contacts used are isolated from any other circuit or system.

Close for Isochronous (Input A; Terminal 29)

The input switch or relay contact used to de-activate the Droop function connects to terminal 29 (Discrete Input A). This discrete input changes the control state between isochronous and droop control. When the contact is open, the control will operate in droop based on a software-adjusted signal proportional to fuel demand. In this state, the load on the engine will be changed with the RAISE SPEED and LOWER SPEED contacts described below. Refer to Woodward Application Note 01302 for a further discussion of droop. With the contact closed (discrete input in the “TRUE” state), the DSLC bias will cause the fuel demand to vary according to the analog signal from the DSLC unit or other Woodward accessory connected to Signal Input #2. Note that a “FALSE” state on this input must also de-activate the DSLC unit (by opening the CB Aux input). Otherwise the DSLC unit will erroneously affect other DSLC units in the system.

Alarm Reset (Input B; Terminal 30)

The input switch or relay contact used to activate the Alarm Reset command connects to terminal 30 (Discrete Input B). This discrete input will issue a reset command to all parameters which can latch into an alarm state. Only those parameters which are in the normal state when the discrete input first goes “TRUE” will be reset to the no-alarm condition. When the external switch or relay contacts are closed (discrete input in the “TRUE” state), internal software will limit the command so that the reset condition will apply only for a short time within the control even if the external contact remains closed. With the contacts open (discrete input in the “FALSE” state), the control will again be ready to respond to the external contacts closing. The Alarm Reset command works in parallel with the command from Port J2, the command from Port J3, and a software switch from the Hand Held Programmer.

Speed Fail Override (Input C; Terminal 31)

The input switch or relay contact used to activate the Speed Fail Override command connects to terminal 31 (Discrete Input C). This discrete input changes the control operation to allow the fuel demand to increase even though the speed signal is not present. This command is normally used to allow the actuator to open for engine starting when the speed signal is too low to be detected. Note that most starting designs will crank the engine fast enough to allow the speed signal to be detected by the control. For these designs, the override command is not needed, and this input can be left disconnected. When the external switch or relay contacts are closed (discrete input in the “TRUE” state), the control will override the shutdown associated with losing the speed sensor. With the contacts open (discrete input in the “FALSE” state), the control will shut down if both speed sensor signals are lost.

For reverse-acting systems where the fuel demand is allowed to increase to the speed setting of a mechanical governor when the electrical system fails, this discrete input should be set to the “TRUE” state. This can be done by connecting the input directly to the positive Discrete Input Power source. This action will force the fuel demand to increase if the electrical speed signal is lost, and relinquish control to the mechanical governor. Be sure the mechanical governor is properly set up to assume control in the event of an electrical system failure. The mechanical governor must NOT be set up to assume control during normal electrical governor operation. Such interaction produces undesirable instability.

⚠WARNING

To prevent possible serious injury from an overspeeding engine, the Speed Fail Override command must be “FALSE” during normal operating conditions of direct-acting systems. This is accomplished by open circuiting the discrete input at terminal 31. If switch or relay contacts are used to activate this command, the contacts must be designed to open when the engine is running under normal governor control.

2nd Dynamics (Input D; Terminal 32)

The input switch or relay contact used to activate the 2nd Dynamics command connects to terminal 32 (Discrete Input D). This discrete input changes the control operation to allow a second set of dynamic terms to be used. This command is normally used when the closed loop path needs two independent sets of dynamics such as with circuit breaker open/closed or with dual-fuel engines. When the input switch or relay contacts are closed (discrete input in the “TRUE” state), the control will use the 2nd Dynamics set. When the contacts are open (discrete input in the “FALSE” state), the control will use the 1st Dynamics set. No connection needs to be made to this input if only one set of dynamics is used.

Raise Speed Contact (Input E; Terminal 33)

The input switch or relay contact used to activate the Raise Speed command connects to terminal 33 (Discrete Input E). This discrete input changes the control operation by increasing the speed reference ramp. The ramp can increase only to a software adjusted RAISE SPEED limit. The ramp will increase at a software adjusted rate. De-selecting the Rated Speed command (described below) will take command control away from Raise Speed and effectively disable the command. This command is normally used to allow raising the engine speed for manually synchronizing and testing high-speed operations such as overspeed. The Raise Speed command will increase the fuel demand and load when the system is run in droop. If the 723 is being used with a DSLC unit, the Raise Speed command should not be used when the generator breaker is closed. When the external switch or relay contacts are closed (discrete input in the “TRUE” state), the control will raise the speed reference. Raise is limited to the maximum speed limit. With the contacts open (discrete input in the “FALSE” state), the control will stop raising the speed reference.

Lower Speed Contact (Input F; Terminal 34)

The input switch or relay contact used to activate the Lower Speed command connects to terminal 34 (Discrete Input F). This discrete input changes the control operation by decreasing the speed reference ramp. The ramp can decrease only to a software adjusted LOWER SPEED limit. The ramp will decrease at a software adjusted rate. De-selecting the Rated Speed command (described below) will take command control away from Lower Speed and effectively disable the command. This command is normally used to allow lowering the engine speed for manually synchronizing and testing low speed operations such as critical speeds. The Lower Speed command will decrease the fuel demand and load when the system is run in droop. If the 723 is being used with a DSLC unit, the Lower Speed command should not be used when the generator breaker is closed. When the external switch or relay contacts are closed (discrete input in the “TRUE” state), the control will lower the speed reference. Lower is limited to the minimum speed limit. With the contacts open (discrete input in the “FALSE” state), the control will stop lowering the speed reference.

Rated Speed (Input G; Terminal 35)

The external contact used to activate the Rated Speed command connects to terminal 35 (Discrete Input G). This discrete input changes the control operation by increasing the speed reference to **RATED SPEED** and decreasing the speed reference to **IDLE SPEED**. When the switch or relay contacts are closed (discrete input in the “TRUE” state), the speed reference will ramp for a time set by the Accel Time to the rated speed control point. When the switch or relay contacts are open (discrete input in the “FALSE” state), the speed reference will ramp for a time set by the Decel Time to the idle speed control point. If the 723 is being used with a DSLC unit, the Rated Speed input should be left in the “TRUE” state when the generator breaker is closed. If the application does not require an idle speed setting, the Rated Speed input can be left in the “TRUE” state at all times. This can be done by connecting the input directly to the positive Discrete Input Power source.

Close to Run (Input H; Terminal 36)

The external contact used to activate the Close to Run command connects to terminal 36 (Discrete Input H). This discrete input changes the control operation by immediately decreasing the fuel demand to zero. When the switch or relay contacts are closed (discrete input in the “TRUE” state), the control is allowed to control the fuel in an attempt to control the speed/load of the prime mover. When the switch or relay contacts are open (discrete input in the “FALSE” state), the Minimum Fuel Function will immediately pull the fuel demand to zero.

The Close to Run command is the preferred means for a normal shutdown of the engine. The control output to the actuator will be minimum fuel demand when no voltage is applied to terminal 36.

⚠WARNING

The Close to Run discrete input is not intended for use as the sole means of shutdown in any emergency stop sequence. To prevent possible serious injury and engine damage from an overspeeding engine, do NOT use the Close to Run discrete input as the sole means of shutdown in any emergency stop sequence.

Load Pulse Input (Signal Input #1; Terminals 42/43)

Use a shielded twisted-pair cable to connect the low impedance output from a Load Pulse Unit to terminals 42(+) and 43(–). No connection is required to this input if this function is not needed by the application. Also remove the factory installed jumper between terminals 41 and 42. The Load Pulse Unit is described in Product Specification 82388. This auxiliary control is used in applications which require smaller frequency changes when large load transients occur. The Load Pulse Unit is a bi-directional voltage source to the 723 control. During steady state operation, the Load Pulse Unit will send close to zero volts to the control. Decreases in load will result in a temporary negative voltage bias at the Load Pulse Input, and increases in load will result in a temporary positive voltage bias at the Load Pulse Input. This provides a temporary change in speed reference by 3% of Rated speed per volt input to terminals 42 and 43. This input can also be used for other devices that require a zero-based signal. One example of such a device is a satellite time-base correction.

DSLC Input (Signal Input #2; Terminals 45/46)

Use a shielded twisted-pair cable to connect the low-impedance output from DSLC terminals 32(±) and 33(COM) to 723 terminals 45(±) and 46(COM). Also remove the factory installed jumper between terminals 44 and 45. The DSLC unit is described in Product Specification 02006 and Manual 02007. This input allows a change in speed reference by 3% of Rated speed per volt input to terminals 42 and 43.

IMPORTANT

Use only DSLC bias output option ±3.0 Vdc.

Remote Speed Reference (Signal Input #3; Terminals 48/49)

Connect a remote speed reference transmitter to Signal Input #3. The input signal must be an isolated high-quality signal. No connection is required to this input if this function is not needed by the application.

Use a shielded twisted-pair cable to connect a 4 to 20 mA current transmitter or 1 to 5 Vdc voltage transmitter to terminals 48(+) and 49(–). When using a voltage transmitter, remove the jumper between terminals 48 and 47. An input impedance of 250 Ω is present when the jumper is installed. Without the jumper installed, the input impedance will be greater than 10 MΩ. This input is not isolated from the other control inputs and outputs, and an isolation device must be installed if the transmitter output is not isolated. A failure of the input signal is detected for input values less than 2.0 mA (0.5 Vdc). A detected failure will remain until the failure is repaired and an Alarm Reset is issued.

Ext Fuel Limit (Signal Input #4; Terminals 51/52)

Connect an External Fuel Limit transmitter to Signal Input #4. The input signal must be an isolated high-quality signal representing the External Fuel Limit signal. This signal input will allow an external signal to limit the fuel demand. It is typically used to set a maximum fuel demand limit based on a parameter such as manifold air pressure or exhaust temperature. No connection is required to this input if this function is not needed by the application.

Use a shielded twisted-pair cable to connect a 4 to 20 mA External Fuel Limit current transmitter or 1 to 5 Vdc External Fuel Limit voltage transmitter to terminals 51(+) and 52(–). When using a voltage transmitter, remove the jumper between terminals 51 and 50. An input impedance of 250 Ω is present when the jumper is installed. Without the jumper installed, the input impedance will be greater than 10 MΩ. This input is not isolated from the other control inputs and outputs, and an isolation device must be installed if the transmitter output is not isolated. A failure of the input signal is detected for input values less than 2.0 mA (0.5 Vdc). A detected failure will remain until the failure is repaired and an Alarm Reset is issued.

Communication Ports J2 and J3

Communication Ports J2 and J3 are used to connect two separate Modbus devices to the 723 control. These devices are used to read control parameters as well as read inputs from the LinkNet nodes. The Modbus device connected to J3 can additionally drive LinkNet nodes and also drive certain 723 control parameters. The Modbus device can be any master device capable of communicating with Modbus standard protocol. This includes any Modbus compatible PC, any compatible SCADA system, etc.

Communication Ports J2 and J3 can be software configured for a wide variety of serial communications. Either port can be set to standard specifications for RS-232, RS-422, or RS-485. Additionally the BAUD rates can be independently set for 1200, 2400, 4800, 9600, 19200, or 38400. The only restriction is that if one port is set for a BAUD rate of 38400, the other port must be set to the same rate. Stop bits on either port can be set at 1, 1.5, or 2. Parity can be set for OFF, ODD, or EVEN. The data must be formatted as ASCII on Port J2. On Communication Port J3, the data may be formatted as either ASCII or RTU.

Communication Port J2 can read all control parameters as well as all connected LinkNet inputs. The only information which can be sent from Port J2 is an Alarm Reset command. See Appendixes C and D for complete listings of port addresses and description of values for Port J2.

Communication Port J3 can read all control parameters, read all connected LinkNet inputs, send commands and values to all connected LinkNet outputs, and send limited commands and one signal to the 723 control. The one signal which can be sent to the 723 is a value which can be the source for one of the configured analog outputs. The commands which can be sent to the 723 control are Alarm Reset, Raise Speed, and Lower Speed. The Alarm Reset command works in parallel with the command from Port J2, the discrete input Alarm Reset command connected to terminal 30 (B), and a software switch from the Hand Held Programmer. The Raise Speed and Lower Speed commands work in parallel with the discrete inputs Raise Speed (terminal 33,E) and Lower Speed (terminal 34,F) respectively. See Appendixes C and D for complete listings of port addresses and description of values for Port J3.

The DSLC control can provide a variety of generator information to the Modbus devices. This includes real power, imaginary power, phase voltages and currents, load and process set points and parameters, transformer ratios, voltage regulator commands, synchronizer actions, etc. The power factor is multiplied by a factor of 1000 and the generator and bus frequencies are multiplied by a factor of 100 to provide good resolution (that is, a power factor of 0.8 will be seen as 800 and a frequency of 60 Hz will be seen as 6000). Note that information from the DSLC unit will be available only if the DSLC unit is connected to LON #2 and has gone through the process of binding (see Application Note 02817).

LinkNet nodes can provide system parameters which can be sent to and used by the Modbus devices connected to Communication Ports J2 and J3. The LinkNet nodes can provide temperature signals from 24 “J” type thermocouples and 18 RTDs. Nodes can also provide 12 analog inputs in the form of 4 to 20 mA signals and 64 discrete inputs. All signal input values sent to the Modbus device are scaled in milliamps x100 (that is, a 12 mA signal input to a 4–20 input LinkNet node will be read as 1200 on the corresponding address by the Modbus device).

LinkNet nodes can also be used to provide system parameters from a Modbus device to the system. This can only occur with the Modbus device connected to Communication Port J3. The LinkNet nodes can provide up to six 4 to 20 mA outputs and 32 Form C relay outputs (contacts are rated 5 A at 28 Vdc). The 4 to 20 mA outputs must be scaled as milliamps x100 from the Modbus device (that is, to produce 12 mA from a particular output, the Modbus device must send a value 1200). The relay outputs will energize when the state of the correct address is set to “TRUE”. A “FALSE” state will cause the relay output to de-energize.

Modbus Analog Write Address 0001 allows control of any or all three configurable analog outputs. The signed 16-bit integer must be scaled as milliamps x100 for communication (that is, to produce a 12 mA output from the 723 a value of 1200 must be applied to address 40001.)

Installation Checkout Procedure

With the installation complete as described in this chapter, do the following checkout procedure before beginning set point entry (Chapter 3) or initial start-up adjustments (Chapter 4).

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, *Electronic 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 control 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.

IMPORTANT

The smallest practical gap is preferred, typically smaller gaps can be set on smaller gears and larger gaps on larger gears.

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 and repair the ground 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 and configured for each system to obtain 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 E).

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 19 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 “Right Arrow” and “Left 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 be done in CONFIGURE MODE. This may also be done in SERVICE MODE only when 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. Also used for entering negative exact values.
(solid square)	Not used.
ID	Displays the 723 control part number and software revision level (can only be accessed from the TOP main screen).
ESC	To return to menu header or to main screen, or to exit Configure and save set points.
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. Also used for entering decimal exact values.

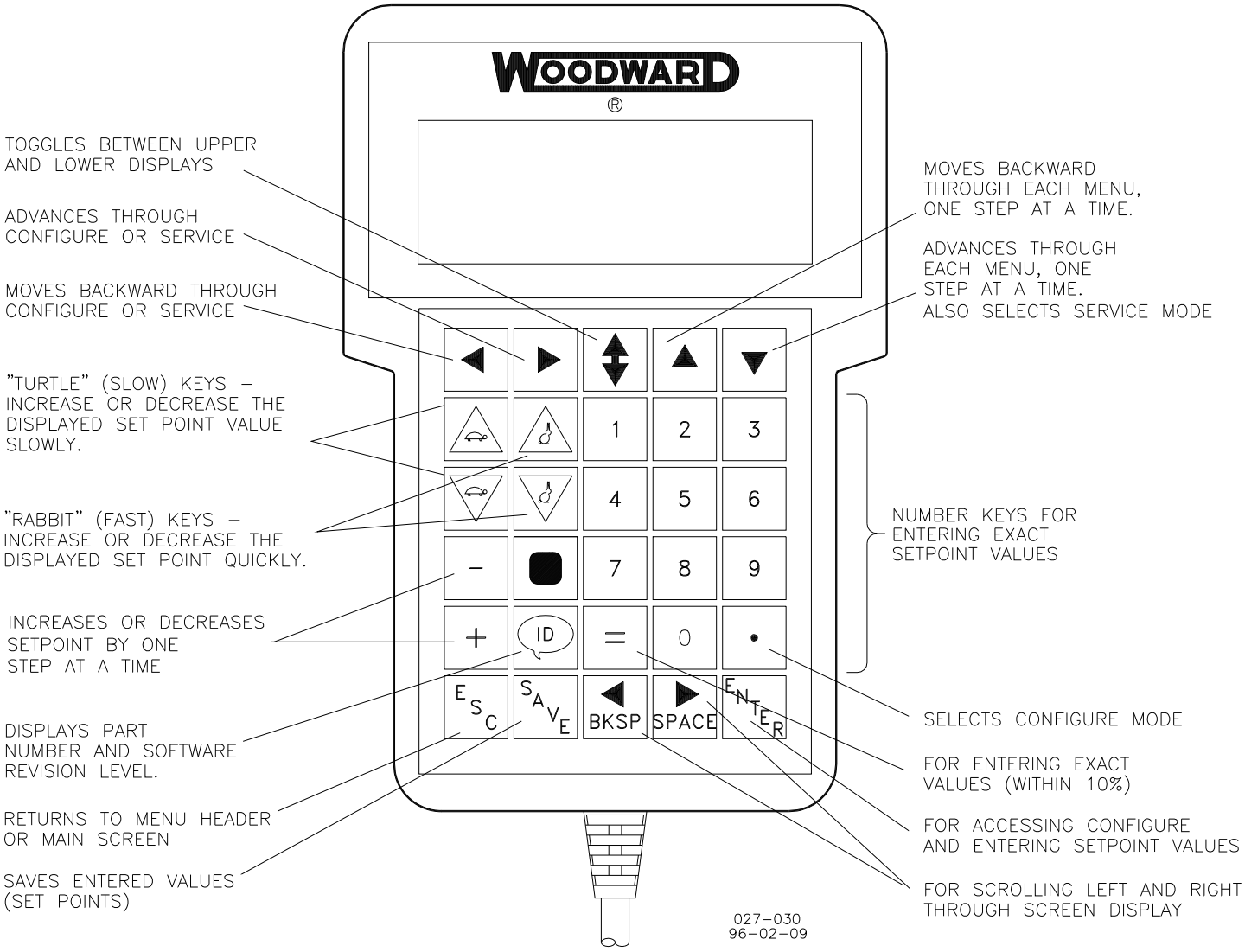

Figure 3-1. Hand Held Programmer Functions

Configuration Menu Descriptions

CFIG Speed Control Menu

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. **AMPU #1 TEETH** 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.

IMPORTANT

Always set AMPU #1 TEETH the same as DMPU #1 TEETH.

3. **AMPU 1 MAX FREQ** 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. To get operating frequency: Hz = Num Teeth * RPM/60

4. **AMPU #2 TEETH** 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 load side of the coupling.

IMPORTANT

Always set AMPU #2 TEETH the same as DMPU #2 TEETH.

5. **AMPU 2 MAX FREQ** 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. To get operating frequency: Hz = Num Teeth * RPM/60

IMPORTANT

Better 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 increases control-loop response time and degrades performance.

⚠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. **REVERSE ACTING ?** should be set to TRUE for reverse acting actuators and FALSE for forward acting actuators (default is FALSE). 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. **DMPU #1 TEETH** 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.

IMPORTANT **Always set DMPU #1 TEETH the same as AMPU #1 TEETH above.**

8. **DMPU #2 TEETH** 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 load side of the coupling.

IMPORTANT **Always set DMPU #2 TEETH the same as AMPU #2 TEETH above.**

9. **ENABLE TORS FILTER** allows the TORSIONAL FILTER menu to appear, permitting the Flexible Coupling Torsional Filter function to operate. [This item is available only with the flexible coupling torsional filter option.]

CFIG Minor Alarm/Major Alarm Menus

1. **MPU 1 FAIL** 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. This condition is disarmed when the Run/Stop discrete input is used to stop the engine.

2. **MPU 2 FAIL** 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. This condition is disarmed when the Run/Stop discrete input is used to stop the engine.

3. **MPU 1 AND 2 FAIL** sets the alarm condition which will occur when a loss of both 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. This condition is disarmed when the Run/Stop discrete input is used to stop the engine.

4. **REM SPD XDCR FAIL** sets the alarm condition which will occur when the Remote Speed 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.

5. **MAP XDCR FAIL** sets the alarm condition which will occur when the MAP 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 ALM** sets the alarm condition which will occur when the DSLC KW input goes above the High KW Set Point. This is supplied from the DSLC unit connected and bound to LON #2. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

7. **HIGH KW SET POINT** 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 set point before the KW alarm is activated.

9. **HIGH ACT OUTPUT ALM** sets the alarm condition which will occur when the fuel demand goes above the High Actuator Set Point. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu.

10. **HIGH ACT SET POINT** is the fuel demand at which the High Actuator Output Alarm is activated.

11. **HIGH ACT DELAY** is the delay time in seconds the fuel demand is above the actuator set point before the actuator alarm is activated.

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

13. **OVERSPEED SET POINT** is the speed level at which the Overspeed Alarm is activated.

14. **OVERSPEED DELAY** is the delay time in seconds that the engine speed is above the Overspeed Set Point before the Overspeed Alarm is activated.

15. **FAIL TO XMIT ALM**—NOT USED

16. **HIGH TORSION ALARM** sets the alarm condition which will occur when the TORSION LEVEL SETPT has been exceeded. This condition may be enabled as a Major Alarm, Minor Alarm, or both by selecting TRUE in the appropriate menu. [This item is available only with the flexible coupling torsional filter option.]

17. **TORSION LEVEL SETPT (%RPM)** is the torsional level at which the HIGH TORSION ALARM is activated. [This item is available only with the flexible coupling torsional filter option.]

18. **TORSIONAL DELAY** is the delay time in seconds that the torsional level is above the TORSION LEVEL SETPT before the HIGH TORSION ALARM is activated. [This item is available only with the flexible coupling torsional filter option.]

CFIG Communication Menu

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 Human Machine Interface (HMI). 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, Appendixes C and D, for the addresses.)

1. **PORT3 Mode** determines if the port J3 will use the Modbus ASCII or Modbus RTU mode:
   1 = ASCII
   2 = RTU

2. **PORT 3 Address** determines the port's Modbus address from 1 to 247.

3. **PORT 2 Address** determines the port's Modbus address from 1 to 247.

CFIG Analog Outputs Menu

This menu allows configuration of the two analog outputs and the two actuator outputs. This configuration will determine which parameters are in control of the outputs. These menu items are also used along with the Hardware Jumper Configuration to determine the output current range.

1. **AOUT 1 SELECTION** determines which parameter controls Analog Output #1. The parameters which can be selected are:
   1–Fuel Demand
   2–Remote Speed Reference
   3–J3 Modbus Address 40001
   4–Engine Speed
   5–Real Power (supplied from DSLC unit connected and bound to LON #2)
   6–Reactive Power (supplied from DSLC unit connected and bound to LON #2)
   7–Biased Speed Reference
   8–Actuator Output
   9–Torsional Level (available on certain part numbers only)

2. **AOUT 1 4–20 mA?** scales the Analog Output #1 for 4 to 20 mA or 0 to 1 mA. A value of TRUE will scale the output for 4 to 20 mA. A value of FALSE will scale the output for 0 to 1 mA. Note that the an internal hardware jumper must be configured if this item is changed.

3. **AOUT 2 SELECTION** determines which parameter controls Analog Output #2. The parameter selections are the same as for AOUT 1 SELECTION above.

4. **AOUT 2 4–20 mA?** scales the Analog Output #2 for 4 to 20 mA or 0 to 1 mA. A value of TRUE will scale the output for 4 to 20 mA. A value of FALSE will scale the output for 0 to 1 mA. Note that an internal hardware jumper must be configured if this item is changed.

5. **ACT OUT 1 0–200 mA?** scales the Actuator Output #1 for 0 to 200 mA or 4 to 20 mA. A value of TRUE will scale the output for 0 to 200 mA. A value of FALSE will scale the output for 4 to 20 mA. Note that an internal hardware jumper must be configured if this item is changed.

6. **ACT OUT 2 SELECTION** determines which parameter controls Actuator Output #2. The parameter selections are the same as for AOUT 1 SELECTION above.

7. **ACT OUT 2 4-20 mA?** This item scales the Actuator Output #2 for 4 to 20 mA or 0 to 1 mA. A value of TRUE will scale the output for 4 to 20 mA. A value of FALSE will scale the output for 0 to 200 mA. Note that an internal hardware jumper must be configured if this item is changed.

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”.

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.

Service Menu Descriptions

1st Dynamics/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. **RESET** 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. Reset 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. Increasing Compensation increases actuator activity and transient performance.

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. (See Figure 3-2.)

5. **WINDOW WIDTH** is the magnitude (in rpm) of a speed error at which the control automatically switches to fast response. The control uses the absolute value of speed error to make this switch. A Window Width too narrow will result in cycling that always factors in the Gain Ratio. (See Figure 3-2.)

6. **GAIN SLOPE BK PNT** sets the percent output above which the Gain Slope becomes effective. It should usually be set just above the minimum load output. (See Figure 3-3.)

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. (See Figure 3-3.)

8. **SPEED FILTER** adjusts the cutoff frequency of a low pass filter used on the speed sensing input (see Figure 3-5). To use this feature set SPEED SETTING MENU - ENABLE SPEED FILTER to TRUE. The filter is used to attenuate engine firing frequencies. To calculate the desired filter cutoff point, use the following formulas:

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

   firing frequency = *camshaft frequency* x number of cylinders

   Initially set the filter frequency to the firing frequency.

   As the filter frequency is reduced, steady state stability improves but transient performance may worsen. As the filter frequency is increased, steady state stability worsens but transient performance may improve.

IMPORTANT **If the calculated firing frequency is greater that 15.9 Hz then disable the filter. SPEED SETTING MENU - ENABLE SPEED FILTER to FALSE.**

9. **BUMP ACT** allows you to test your dynamics settings by temporarily applying a decreased fuel demand transient to stimulate a control response. Both the magnitude (Act Bump Level) and duration (Act Bump Duration) of the transient may be set. See the ACTUATOR BUMP menu. To initiate an actuator bump, toggle Bump Act to TRUE then back to FALSE while the engine is operating in a normal steady state loaded or unloaded condition.

IMPORTANT **Be prepared to change the dynamics settings since the actuator bump transient may stimulate instability.**

IMPORTANT **BUMP ENABLE must be set TRUE to enable the BUMP ACT function. See the ACTUATOR BUMP menu.**

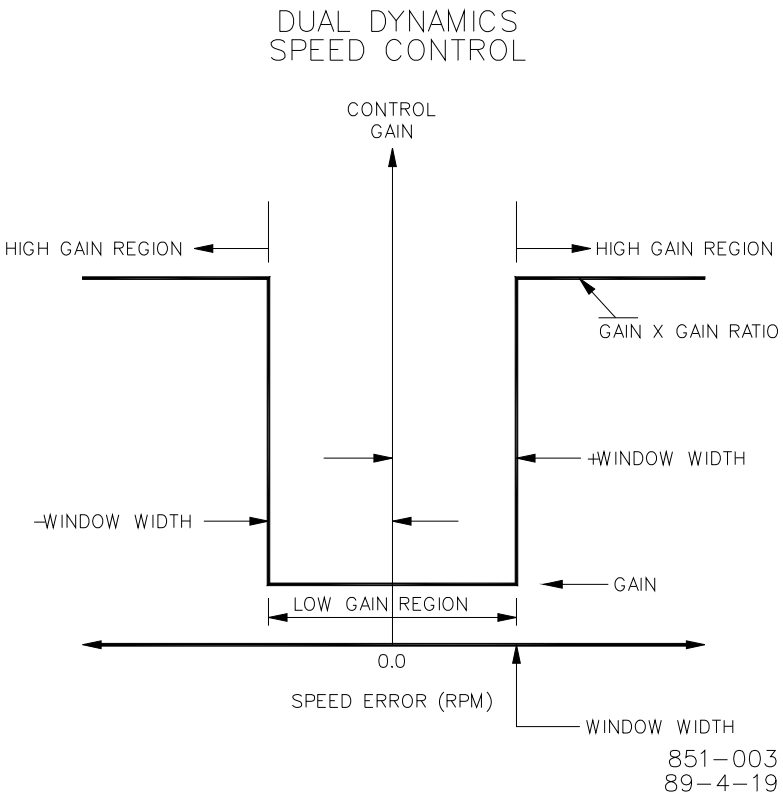

Figure 3-2. Control Gain as a Function of Speed Error

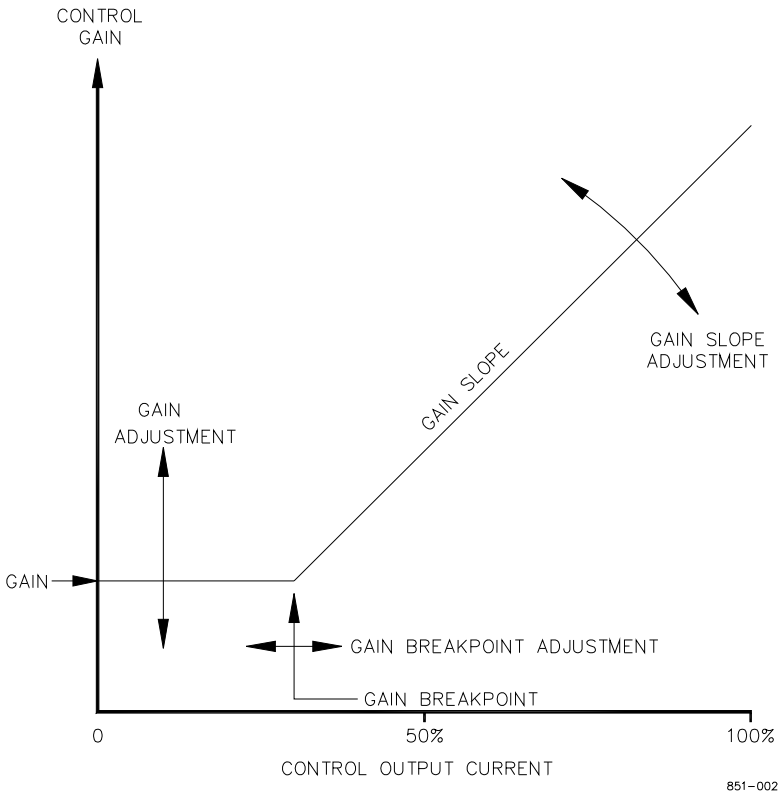

Figure 3-3. Control Gain as a Function of Control Output

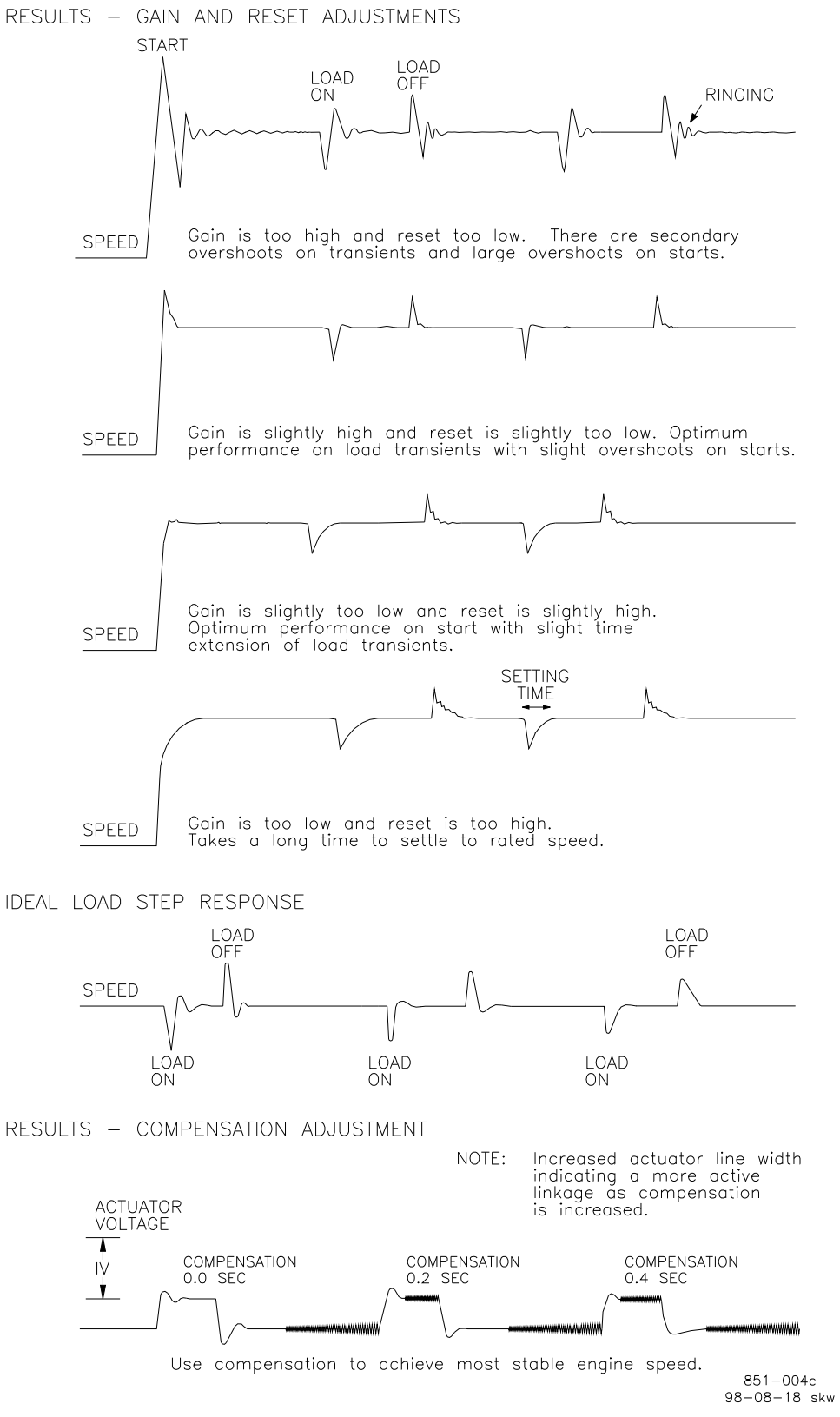

Figure 3-4. Typical Transient Response Curves

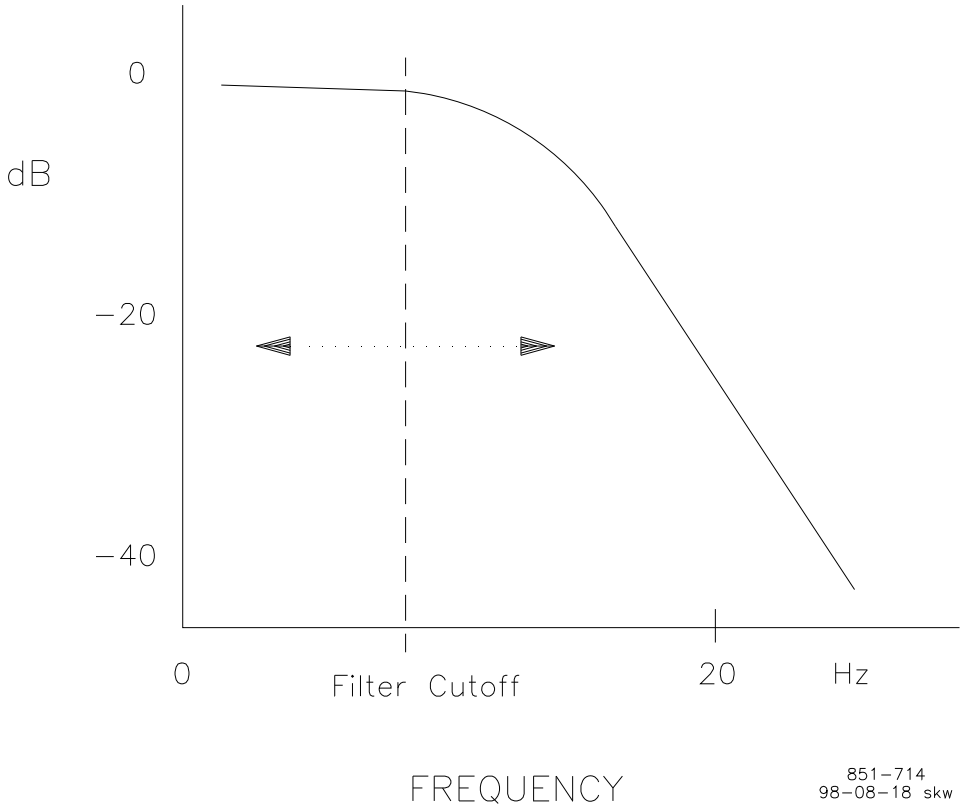

Figure 3-5. Speed Filter

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 and Remote Speed Setting inputs to a maximum. It normally is set at the speed at which the engine operates at full load.

2. **LOWER SPEED LIMIT** is the minimum speed reference setting. It is used to limit the Lower Speed and Remote Speed Setting inputs to a minimum. It normally is set at the minimum operating speed of the engine.

3. **IDLE SPEED** is the speed that the speed reference ramp goes to when the Close for Rated Discrete Input is OPEN. It is normally the speed at which the engine is operated at start-up. It is also used during cool down.

⚠WARNING

To prevent possible death or serious injury from an overspeeding engine, Idle speed must be set the same as or lower than Rated speed.

NOTICE

Be sure to avoid critical speeds when setting idle speed.

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 the amount of time that system inertias allow the engine to slow down. 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 Setting input is changed in the increase direction. A step change on the remote input does not cause an immediate change in the reference. Instead, it 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 input, as well as when the Remote Speed Setting input is changed in the decrease direction. A step change on the remote input does not cause an immediate change in the reference. Instead, it is ramped to the new setting at the Lower Speed Rate.

8. **4mA REMOTE REF** is the engine speed desired when 4 mA is applied to the Remote Speed Setting input.

9. **20mA REMOTE REF** is the engine speed desired when 20 mA is applied to the Remote Speed Setting input.

10. **REM REF FAIL LOCK** selects the Remote speed input failure mode. When this value is set to FALSE: In remote mode and the signal is failed then the speed reference will ramp to the LOWER SPEED LIMIT. When this value is set to TRUE: In remote mode and the transducer is failed then the speed reference will stay at the last value before signal failure.

11. **ENABLE SPEED FILTER** allows you to enable or disable the speed filter function.

12. **SELECT DIGITAL MPU** is used to select digital processing of the speed signal into the control. Normally this value is set to TRUE. When using Wärtsilä Engines, set this value to FALSE.

Torsional Filter Menu (9907-033/-034 only)

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

1. **ENABLE TORS FILTER** when set to TRUE enables the Flexible Coupling filtering function. When set to FALSE the function is disabled.

2. **ENG SENSOR WEIGHT** 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).

3. **TORS SCALE (%RATED)** is the percentage of Rated RPM that corresponds to 100% torsional measurement in the 723. Example: TORS SCALE=1%, RATED=1200 rpm, Torsional RPM=6 rpm, therefore torsional measurement = $\frac{6}{1200x.01}x100$ = 50%. This only has an effect on the measurement value and has NO effect on the actual dynamic response of the control. Should be left at default value for normal operation.

4. **TORSNL FUEL LIMIT** is the percentage of Fuel Demand the actuator output will be limited to when the torsional measurement level exceeds the TORSNL LEVEL @LIMIT(%).

5. **TORSNL LEVEL @LIMIT(%)** is the torsional level at which the TORSNL FUEL LIMIT is activated and the alarm state is triggered.

6. **TORSNL LEVEL @CLEAR(%)** is the torsional level at which the TORSNL FUEL LIMIT is deactivated and the alarm state is cleared.

KW Setting Menu

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

1. **LOAD DROOP PERCENT** is the percentage of speed droop when the generator load is at maximum load.

2. **ACT OUT @ NO LOAD** should be set to the percent fuel demand that the engine is operating at rated-speed/no-load. This establishes the 0% internal load measurement for droop.

3. **ACT OUT @ FULL LOAD** should be set to the percent fuel demand when the engine is operating at rated-speed/full-load. This establishes the 100% internal load measurement for droop.

Fuel Limiters Menu

Fuel limiters restrain the fuel demand from the control to the actuator.

1. **START FUEL LIMIT** limits the percent fuel demand when the engine is started. The limit is usually set at the fuel level required to start the engine. The limiter is disabled when the engine speed exceeds 95% of speed reference (see Figure 3-6).

2. **START RAMP %/sec** establishes the start limiter ramping rate at which the fuel demand increases to assist starting in colder ambient conditions.

3. **MAX FUEL LIMIT** sets the maximum percent fuel demand. Maximum (100%) is based on 200 mA. This is an electronic rack stop which is active in all modes of operation.

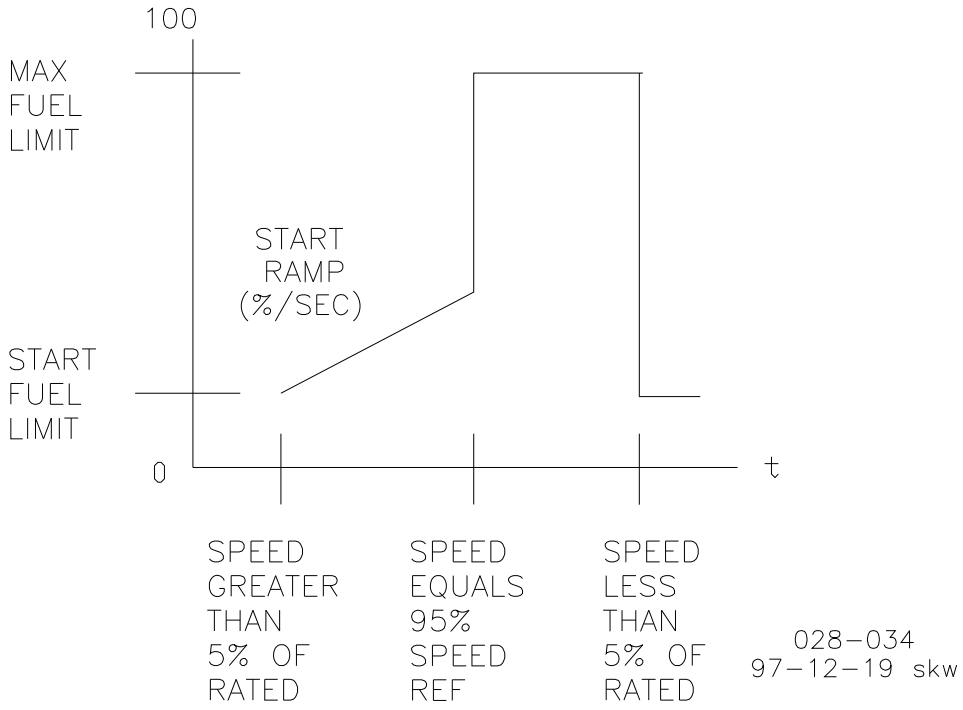

Figure 3-6. Start Limit Function

MAP Limiter Menu

Manifold Air Pressure Limiter limits the fuel demand based on a two-dimensional curve and an external 4-20 mA input. This function is mainly used to limit fuel demand during a sudden load increase to prevent overfueling due to turbocharger lag as sensed by the Manifold Air Pressure. Limiting fuel demand minimizes smoke on diesel engines and prevents load transient detonation on gas and dual-fuel engines. In extreme cases, this limit can also prevent flooding of gas and dual-fuel engines. Normally, the load transient performance is not degraded since the lack of combustion air (not fuel) is the transient performance limiting factor. However, setting the fuel demand limit too low can degrade transient performance.

A five-point curve is constructed using the manufacturer recommended settings for MAP versus Fuel Demand. Refer to Figure 3-7. The ‘X’ values are the Breakpoints and the ‘Y’ values are the Fuel Limit at the Breakpoints. All values between the designated breakpoints are interpolated.

1. **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.

2. **MAP BREAKPOINT X** is the Manifold Air Pressure value that designates that particular breakpoint (x-axis input in Figure 3-7).

3. **FUEL LIMIT AT BP X** is the percent fuel demand allowed when the Manifold Air Pressure is at that respective Breakpoint (y-axis output in Figure 3-7).

4. **MAP @ 4 mA** is the Manifold Air Pressure in engineering units when the transducer is at 4 mA.

5. **MAP @ 20 mA** is the Manifold Air Pressure in engineering units when the transducer is at 20 mA.

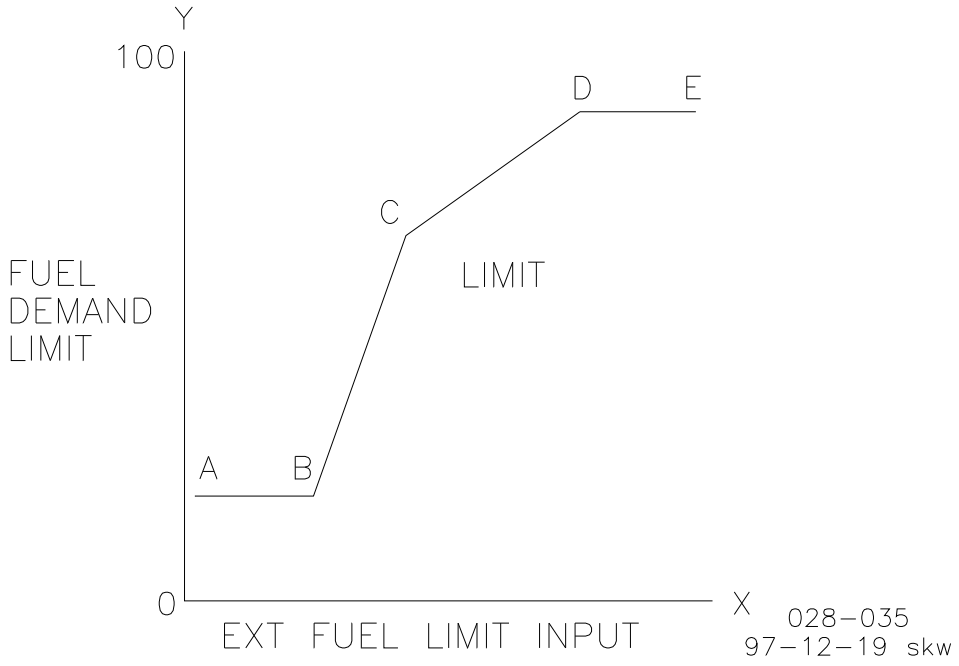

Figure 3-7. Fuel Limit Breakpoints

Miscellaneous Menu

1. **ACKNOWLEDGE ALARMS** allows the user to reset any activated and cleared alarms. Set this value to TRUE and return to FALSE. When this value changes from FALSE to TRUE, a 0.1 second reset pulse is sent throughout the control.

2. **LON SERVICE PIN** tells the LON Neuron Processor to send out its unique ID over the network. This is used in the LON binding installation procedures.

3. **DSLC NODE FAULT** is an indication that there are no faults associated with the DSLC LON messages received on LON Port #2. Once binding has been performed, this fault indicator is activated. If the 723 does not receive a message from the DSLC in five seconds, the fault indication will go TRUE. If the ACKNOWLEDGE ALARMS value is activated the fault will reset to FALSE. If there still is a fault, five seconds later the fault indication will return to TRUE.

IMPORTANT **If the unit is not "bound", the fault will always be FALSE.**

4. **LINKNET ADDR FAULT** field latches at TRUE if, during a scan cycle, two or more messages with the same node addresses are received. This will happen when the hardware switches on two or more nodes have been set to the same position resulting in the same address. To rectify this fault, find the node with the duplicate address and modify it to its proper address. To reset a latched fault, toggle ACKNOWLEDGE ALARMS.

5. **LINKNET TYPE FAULT** latches at TRUE if network messages are received for a node but its type is different from that specified in the application. To reset a latched fault, toggle ACKNOWLEDGE ALARMS.

IMPORTANT **LinkNet Nodes only reset their hardware switch addresses on power-up.**

Serial Port Setup Menu

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 Human Machine Interface (HMI). 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, Appendixes C and D, for the addresses).

1. **PORT 3 HW CFIG** determines if the port is set for RS-232, RS-422, or RS-485 based on:
   1 = RS-232
   2 = RS-422
   3 = RS-485

IMPORTANT **If RS-422 or RS-485 is selected, then the devices can be in a multi-drop configuration.**

2. **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

3. **PORT 3 STOP BITS** determines the Stop Bits, based on:
   1 = 1 stop bit
   2 = 1.5 stop bits
   3 = 2 stop bits

4. **PORT 3 PARITY** determines what parity the port uses, based on:
   1 = no parity
   2 = odd parity
   3 = even parity

5. **PORT 2 HW CFIG** determines if the port is set for RS-232, RS-422, or RS-485 based on:
   1 = RS-232
   2 = RS-422
   3 = RS-485

IMPORTANT **If RS-422 or RS-485 is selected, then the devices can be in a multi-drop configuration.**

6. **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

7. **PORT 2 STOP BITS** determines the Stop Bits, based on:
   1 = 1 stop bit
   2 = 1.5 stop bits
   3 = 2 stop bits

8. **PORT 2 PARITY** determines what parity the port uses, based on:
   1 = no parity
   2 = odd parity
   3 = even parity

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

Tune Analog Outputs Menu

This menu sets the Analog Outputs to allow the proper scaling of each output based on the engineering units of the software configured input and type of hardware configured output. The items below should be entered so that the MIN entry represents the configured value in engineering units at 4 mA (or 0 mA), and the MAX entry represents the configured value in engineering units at 20 mA (or 1 mA).

1. **ANALOG OUTPUT 1 MIN** is adjusted to the engineering units which will output 4 mA (or 0 mA if so configured) at Analog Output #1.

2. **ANALOG OUTPUT 1 MAX** is adjusted to the engineering units which will output 20 mA (or 1 mA if so configured) at Analog Output #1.

3. **ANALOG OUTPUT 2 MIN** is adjusted to the engineering units which will output 4 mA (or 0 mA if so configured) at Analog Output #2.

4. **ANALOG OUTPUT 2 MAX** is adjusted to the engineering units which will output 20 mA (or 1 mA if so configured) at Analog Output #2.

5. **ACTUATOR OUT 1 MIN** is adjusted to set the Actuator Output #1 for minimum position when the fuel demand is at 0 percent. It is factory set for 0 mA output with the fuel demand at 0 percent.

6. **ACTUATOR OUT 1 MAX** is adjusted to set the Actuator Output #1 for maximum position when the fuel demand is at 100 percent. It is factory set for 200 mA output with the fuel demand at 100 percent.

7. **ACTUATOR OUT 2 MIN** is adjusted to the engineering units which will output 4 mA (or 0 mA if so configured) at Actuator Output #2.

8. **ACTUATOR OUT 2 MAX** is adjusted to the engineering units which will output 20 mA (or 200 mA if so configured) at Actuator Output #2.

Actuator Control Menu

This is a monitor menu only and displays the status of the Actuator Low Signal Select Bus (LSS). The Item that is TRUE is the item that is in control of the LSS and the Fuel Demand. This menu is very helpful during setup and troubleshooting to determine what may be limiting the fuel demand in certain circumstances.

1. **ACT ON SPD CONTROL** indicates that the speed control PID is in control of the fuel demand.

2. **ACT ON START LIMIT** indicates that the Start Fuel Limit is in control of the fuel demand.

3. **ACT ON MAX LIMITER** indicates that the Maximum Fuel Limit is in control of the fuel demand.

4. **ACT ON MAP LIMITER** indicates that the Manifold Air Pressure Limiter is in control of the fuel demand.

5. **ACT SHUTDOWN** indicates that the fuel demand is being forced to 0% by the shutdown function. The shutdown function is activated when the Close to Run Contact is opened or the speed fail shutdown is active.

6. **ACT ON TORSIONAL** indicates that the Flexible Coupling Torsional Limiter is in control of the fuel demand. [This item is available only with the flexible coupling torsional filter option.]

Actuator Bump Menu

This menu allows activation and adjustment of the Actuator Bump Function. This function allows you to test your dynamics setting by putting a temporary limiter in the system, causing a speed/load disturbance. To activate the function the BUMP ENABLE must be set to TRUE and DYNAMICS - ACT BUMP must also be set to TRUE.

1. **BUMP ENABLE** enables the Actuator bump function for a period of 30 minutes.

2. **ACT BUMP LEVEL** sets the magnitude of the fuel limitation. A higher value will cutoff the fuel more, causing a larger ‘bump’.

3. **ACT BUMP DURATION** sets the duration of the fuel limitation. A higher value will cutoff the fuel for a longer time, causing a longer ‘bump’.

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 REF** 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 DROOP** displays the value in rpm that the droop percentage calculation is biasing the speed reference.

5. **BIAS FROM DSLC** displays the value in rpm that the DSLC is currently biasing the speed reference.

6. **BIAS FROM LD PULSE** displays the value in rpm that the Load Pulse Input is currently biasing the speed reference.

7. **TORSIONAL LEVEL (%)** displays the current torsional in percent. The scaling is dependent on TORSIONAL FILTER - TORS SCALE (%RATED). [This item is available only with the flexible coupling torsional filter option.]

8. **KW LOAD** displays the current generator load in KW. This is supplied from the DSLC unit connected and bound to LON #2.

9. **FUEL DEMAND** displays the current percentage of maximum fuel. 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. **REMOTE SPEED REF** displays the current remote speed reference signal in rpm.

11. **REMOTE ENABLED** is an indication that the remote speed reference is being used by the speed control.

12. **DSLC INPUT** displays the current voltage that is on the DSLC input lines.

13. **MAP LIMIT** displays the current percent fuel demand output of the fuel limiter.

14. **MAP INPUT** displays the current value of the Manifold Air Pressure input, in engineering units.

15. **LOAD PULSE INPUT** displays the current voltage that is on the Load Pulse input lines.

16. **TORSNL FILTR ACTIVE** indicates if the flexible coupling torsional filtering function is active. [This item is available only with the flexible coupling torsional filter option.]

Display Menu 2

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

1. **SPEED INPUT #1** displays the rpm shown by speed sensor #1. The control uses the signal to determine the speed of the engine and for torsional filtering.

2. **SPEED INPUT #2** displays the rpm shown by speed sensor #2. The control uses the signal to determine the speed of the engine and for torsional filtering.

3. **CLOSE TO RUN** shows the status of the Run/Stop contact (TRUE = CLOSED).

4. **IDLE/RATED** shows the status of the Idle/Rated contact (TRUE = CLOSED).

5. **LOWER SPEED** shows the status of the Lower Speed contact (TRUE = CLOSED).

6. **RAISE SPEED** shows the status of the Raise Speed contact (TRUE = CLOSED).

7. **2ND DYNAMICS** shows the status of the 2nd Dynamics contact (TRUE = CLOSED).

8. **FAIL SAFE OVERRIDE** shows the status of the Failsafe Override contact (TRUE = CLOSED).

9. **EXT ACKNOWLEDGE** shows the status of the External Acknowledge contact (TRUE = CLOSED).

10. **ISOCH/DROOP** shows the status of the Isochronous/Droop contact (TRUE = CLOSED).

11. **MPU1 FAILED** indicates that Speed Sensor #1 is failed. A speed sensor is considered failed if the speed sensed is less than 5% of Rated Speed or the voltage is less than 1.0 Vrms.

12. **MPU2 FAILED** indicates that Speed Sensor #2 is failed. A speed sensor is considered failed if the speed sensed is less than 5% of Rated Speed or the voltage is less than 1.0 Vrms.

Minor Alarm Menu

This menu displays the Minor Alarms that are activated and have been triggered. An alarm may be cleared if the alarm condition is not present and the Acknowledge Alarms is activated (through the external discrete input, Modbus, or MISCELLANEOUS - ACKNOWLEDGE ALARMS)

1. **1-MPU 1 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

2. **2-MPU 2 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

3. **3-MPU 1 AND 2 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

4. **4-REM SPD IN FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

5. **5-MAP XDCR FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

6. **6-HIGH KW ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

7. **7-HI ACT OUTPUT ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

8. **8-OVERSPEED ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

9. **9-FAIL TO XMIT ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu.

10. **10-TORSIONAL ALARM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MINOR ALARMS menu. [This item is available only with the flexible coupling torsional filter option.]

11. **FIRST MINOR ALARM** displays the Minor Alarm that occurred first. The number matches with the number of the alarm in this menu.

Major Alarm Menu

This menu displays the Major Alarms that are activated and have been triggered. An alarm may be cleared if the alarm condition is not present and the Acknowledge Alarms is activated(through the external discrete input, Modbus, or MISCELLANEOUS - ACKNOWLEDGE ALARMS)

1. **1-MPU 1 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

2. **2-MPU 2 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

3. **3-MPU 1 AND 2 FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

4. **4-REM SPD IN FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

5. **5-MAP XDCR FAIL** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

6. **6-HIGH KW ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

7. **7-HI ACT OUTPUT ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

8. **8-OVERSPEED ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

9. **9-FAIL TO XMIT ALM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu.

10. **10-TORSIONAL ALARM** displays the current condition of the latched alarm. This alarm will only indicate if it has been activated in the CONFIG MAJOR ALARMS menu. [This item is available only with the flexible coupling torsional filter option.]

11. **FIRST MAJOR ALARM** displays the Major Alarm that occurred first. The number matches with the number of the alarm in this menu.

TC Module 1 Menu

The programmer displays Thermocouple input values as each item is selected. The control automatically updates the display. This menu is only active when the TC Module 1 is connected and addressed properly.

1. **CH1 - TC DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - TC DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - TC DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - TC DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - TC DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - TC DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

TC Module 2 Menu

The programmer displays Thermocouple input values as each item is selected. The control automatically updates the display. This menu is only active when the TC Module 2 is connected and addressed properly.

1. **CH1 - TC DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - TC DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - TC DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - TC DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - TC DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - TC DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

TC Module 3 Menu

The programmer displays Thermocouple input values as each item is selected. The control automatically updates the display. This menu is only active when the TC Module 3 is connected and addressed properly.

1. **CH1 - TC DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - TC DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - TC DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - TC DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - TC DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - TC DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

TC Module 4 Menu

The programmer displays Thermocouple input values as each item is selected. The control automatically updates the display. This menu is only active when the TC Module 4 is connected and addressed properly.

1. **CH1 - TC DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - TC DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - TC DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - TC DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - TC DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - TC DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

RTD Module 1 Menu

The programmer displays RTD input values as each item is selected. The control automatically updates the display. This menu is only active when the RTD Module 1 is connected and addressed properly.

1. **CH1 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

RTD Module 2 Menu

The programmer displays RTD input values as each item is selected. The control automatically updates the display. This menu is only active when the RTD Module 2 is connected and addressed properly.

1. **CH1 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

RTD Module 3 Menu

The programmer displays RTD input values as each item is selected. The control automatically updates the display. This menu is only active when the RTD Module 3 is connected and addressed properly.

1. **CH1 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #1. This is also the value sent to the Modbus.

2. **CH2 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #2. This is also the value sent to the Modbus.

3. **CH3 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #3. This is also the value sent to the Modbus.

4. **CH4 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #4. This is also the value sent to the Modbus.

5. **CH5 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #5. This is also the value sent to the Modbus.

6. **CH6 - RTD DEGREES F** displays the temperature in Fahrenheit for channel #6. This is also the value sent to the Modbus.

AI Module 1 Menu

The programmer displays Analog Input values as each item is selected. The control automatically updates the display. This menu is only active when the AI Module 1 is connected and addressed properly.

1. **CH1 - mA IN PERCENT** displays the current in x 100 for channel #1. This is also the value sent to the Modbus.

2. **CH2 - mA IN PERCENT** displays the current in x 100 for channel #2. This is also the value sent to the Modbus.

3. **CH3 - mA IN PERCENT** displays the current in x 100 for channel #3. This is also the value sent to the Modbus.

4. **CH4 - mA IN PERCENT** displays the current in x 100 for channel #4. This is also the value sent to the Modbus.

5. **CH5 - mA IN PERCENT** displays the current in x 100 for channel #5. This is also the value sent to the Modbus.

6. **CH6 - mA IN PERCENT** displays the current in x 100 for channel #6. This is also the value sent to the Modbus.

AI Module 2 Menu

The programmer displays Analog Input values as each item is selected. The control automatically updates the display. This menu is only active when the AI Module 2 is connected and addressed properly.

1. **CH1 - mA IN PERCENT** displays the current in x 100 for channel #1. This is also the value sent to the Modbus.

2. **CH2 - mA IN PERCENT** displays the current in x 100 for channel #2. This is also the value sent to the Modbus.

3. **CH3 - mA IN PERCENT** displays the current in x 100 for channel #3. This is also the value sent to the Modbus.

4. **CH4 - mA IN PERCENT** displays the current in x 100 for channel #4. This is also the value sent to the Modbus.

5. **CH5 - mA IN PERCENT** displays the current in x 100 for channel #5. This is also the value sent to the Modbus.

6. **CH6 - mA IN PERCENT** displays the current in x 100 for channel #6. This is also the value sent to the Modbus.

DI Module 1 Menu

The programmer displays discrete input conditions as each item is selected. FALSE = OPEN and TRUE = CLOSED. The control automatically updates the display. This menu is only active when the DI Module 1 is connected and addressed properly.

1. **CH1 CONTACT CLOSED** displays the condition of channel #1. This is also the value sent to the Modbus.

2. **CH2 CONTACT CLOSED** displays the condition of channel #2. This is also the value sent to the Modbus.

3. **CH3 CONTACT CLOSED** displays the condition of channel #3. This is also the value sent to the Modbus.

4. **CH4 CONTACT CLOSED** displays the condition of channel #4. This is also the value sent to the Modbus.

5. **CH5 CONTACT CLOSED** displays the condition of channel #5. This is also the value sent to the Modbus.

6. **CH6 CONTACT CLOSED** displays the condition of channel #6. This is also the value sent to the Modbus.

7. **CH7 CONTACT CLOSED** displays the condition of channel #7. This is also the value sent to the Modbus.

8. **CH8 CONTACT CLOSED** displays the condition of channel #8. This is also the value sent to the Modbus.

9. **CH9 CONTACT CLOSED** displays the condition of channel #9. This is also the value sent to the Modbus.

10. **CH10 CONTACT CLOSED** displays the condition of channel #10. This is also the value sent to the Modbus.

11. **CH11 CONTACT CLOSED** displays the condition of channel #11. This is also the value sent to the Modbus.

12. **CH12 CONTACT CLOSED** displays the condition of channel #12. This is also the value sent to the Modbus.

13. **CH13 CONTACT CLOSED** displays the condition of channel #13. This is also the value sent to the Modbus.

14. **CH14 CONTACT CLOSED** displays the condition of channel #14. This is also the value sent to the Modbus.

15. **CH15 CONTACT CLOSED** displays the condition of channel #15. This is also the value sent to the Modbus.

16. **CH16 CONTACT CLOSED** displays the condition of channel #16. This is also the value sent to the Modbus.

DI Module 2 Menu

The programmer displays discrete input conditions as each item is selected. FALSE = OPEN and TRUE = CLOSED. The control automatically updates the display. This menu is only active when the DI Module 2 is connected and addressed properly.

1. **CH1 CONTACT CLOSED** displays the condition of channel #1. This is also the value sent to the Modbus.

2. **CH2 CONTACT CLOSED** displays the condition of channel #2. This is also the value sent to the Modbus.

3. **CH3 CONTACT CLOSED** displays the condition of channel #3. This is also the value sent to the Modbus.

4. **CH4 CONTACT CLOSED** displays the condition of channel #4. This is also the value sent to the Modbus.

5. **CH5 CONTACT CLOSED** displays the condition of channel #5. This is also the value sent to the Modbus.

6. **CH6 CONTACT CLOSED** displays the condition of channel #6. This is also the value sent to the Modbus.

7. **CH7 CONTACT CLOSED** displays the condition of channel #7. This is also the value sent to the Modbus.

8. **CH8 CONTACT CLOSED** displays the condition of channel #8. This is also the value sent to the Modbus.

9. **CH9 CONTACT CLOSED** displays the condition of channel #9. This is also the value sent to the Modbus.

10. **CH10 CONTACT CLOSED** displays the condition of channel #10. This is also the value sent to the Modbus.

11. **CH11 CONTACT CLOSED** displays the condition of channel #11. This is also the value sent to the Modbus.

12. **CH12 CONTACT CLOSED** displays the condition of channel #12. This is also the value sent to the Modbus.

13. **CH13 CONTACT CLOSED** displays the condition of channel #13. This is also the value sent to the Modbus.

14. **CH14 CONTACT CLOSED** displays the condition of channel #14. This is also the value sent to the Modbus.

15. **CH15 CONTACT CLOSED** displays the condition of channel #15. This is also the value sent to the Modbus.

16. **CH16 CONTACT CLOSED** displays the condition of channel #16. This is also the value sent to the Modbus.

DI Module 3 Menu

The programmer displays discrete input conditions as each item is selected. FALSE = OPEN and TRUE = CLOSED. The control automatically updates the display. This menu is only active when the DI Module 3 is connected and addressed properly.

1. **CH1 CONTACT CLOSED** displays the condition of channel #1. This is also the value sent to the Modbus.
2. **CH2 CONTACT CLOSED** displays the condition of channel #2. This is also the value sent to the Modbus.
3. **CH3 CONTACT CLOSED** displays the condition of channel #3. This is also the value sent to the Modbus.
4. **CH4 CONTACT CLOSED** displays the condition of channel #4. This is also the value sent to the Modbus.
5. **CH5 CONTACT CLOSED** displays the condition of channel #5. This is also the value sent to the Modbus.
6. **CH6 CONTACT CLOSED** displays the condition of channel #6. This is also the value sent to the Modbus.
7. **CH7 CONTACT CLOSED** displays the condition of channel #7. This is also the value sent to the Modbus.
8. **CH8 CONTACT CLOSED** displays the condition of channel #8. This is also the value sent to the Modbus.
9. **CH9 CONTACT CLOSED** displays the condition of channel #9. This is also the value sent to the Modbus.
10. **CH10 CONTACT CLOSED** displays the condition of channel #10. This is also the value sent to the Modbus.
11. **CH11 CONTACT CLOSED** displays the condition of channel #11. This is also the value sent to the Modbus.
12. **CH12 CONTACT CLOSED** displays the condition of channel #12. This is also the value sent to the Modbus.
13. **CH13 CONTACT CLOSED** displays the condition of channel #13. This is also the value sent to the Modbus.
14. **CH14 CONTACT CLOSED** displays the condition of channel #14. This is also the value sent to the Modbus.
15. **CH15 CONTACT CLOSED** displays the condition of channel #15. This is also the value sent to the Modbus.
16. **CH16 CONTACT CLOSED** displays the condition of channel #16. This is also the value sent to the Modbus.

DI Module 4 Menu

The programmer displays discrete input conditions as each item is selected. FALSE = OPEN and TRUE = CLOSED. The control automatically updates the display. This menu is only active when the DI Module 4 is connected and addressed properly.

1. **CH1 CONTACT CLOSED** displays the condition of channel #1. This is also the value sent to the Modbus.

2. **CH2 CONTACT CLOSED** displays the condition of channel #2. This is also the value sent to the Modbus.

3. **CH3 CONTACT CLOSED** displays the condition of channel #3. This is also the value sent to the Modbus.

4. **CH4 CONTACT CLOSED** displays the condition of channel #4. This is also the value sent to the Modbus.

5. **CH5 CONTACT CLOSED** displays the condition of channel #5. This is also the value sent to the Modbus.

6. **CH6 CONTACT CLOSED** displays the condition of channel #6. This is also the value sent to the Modbus.

7. **CH7 CONTACT CLOSED** displays the condition of channel #7. This is also the value sent to the Modbus.

8. **CH8 CONTACT CLOSED** displays the condition of channel #8. This is also the value sent to the Modbus.

9. **CH9 CONTACT CLOSED** displays the condition of channel #9. This is also the value sent to the Modbus.

10. **CH10 CONTACT CLOSED** displays the condition of channel #10. This is also the value sent to the Modbus.

11. **CH11 CONTACT CLOSED** displays the condition of channel #11. This is also the value sent to the Modbus.

12. **CH12 CONTACT CLOSED** displays the condition of channel #12. This is also the value sent to the Modbus.

13. **CH13 CONTACT CLOSED** displays the condition of channel #13. This is also the value sent to the Modbus.

14. **CH14 CONTACT CLOSED** displays the condition of channel #14. This is also the value sent to the Modbus.

15. **CH15 CONTACT CLOSED** displays the condition of channel #15. This is also the value sent to the Modbus.

16. **CH16 CONTACT CLOSED** displays the condition of channel #16. This is also the value sent to the Modbus.

DO Module 1 Menu

The programmer displays discrete output conditions as each item is selected. FALSE = DE-ENERGIZED and TRUE = ENERGIZED. The control automatically updates the display. This menu is only active when the DO Module 1 is connected and addressed properly.

1. **CH1 ENERGIZED** displays the condition of channel #1. This is also the value received from the Modbus.

2. **CH2 ENERGIZED** displays the condition of channel #2. This is also the value received from the Modbus.

3. **CH3 ENERGIZED** displays the condition of channel #3. This is also the value received from the Modbus.

4. **CH4 ENERGIZED** displays the condition of channel #4. This is also the value received from the Modbus.

5. **CH5 ENERGIZED** displays the condition of channel #5. This is also the value received from the Modbus.

6. **CH6 ENERGIZED** displays the condition of channel #6. This is also the value received from the Modbus.

7. **CH7 ENERGIZED** displays the condition of channel #7. This is also the value received from the Modbus.

8. **CH8 ENERGIZED** displays the condition of channel #8. This is also the value received from the Modbus.

DO Module 2 Menu

The programmer displays discrete output conditions as each item is selected. FALSE = DE-ENERGIZED and TRUE = ENERGIZED. The control automatically updates the display. This menu is only active when the DO Module 2 is connected and addressed properly.

1. **CH1 ENERGIZED** displays the condition of channel #1. This is also the value received from the Modbus.

2. **CH2 ENERGIZED** displays the condition of channel #2. This is also the value received from the Modbus.

3. **CH3 ENERGIZED** displays the condition of channel #3. This is also the value received from the Modbus.

4. **CH4 ENERGIZED** displays the condition of channel #4. This is also the value received from the Modbus.

5. **CH5 ENERGIZED** displays the condition of channel #5. This is also the value received from the Modbus.

6. **CH6 ENERGIZED** displays the condition of channel #6. This is also the value received from the Modbus.

7. **CH7 ENERGIZED** displays the condition of channel #7. This is also the value received from the Modbus.

8. **CH8 ENERGIZED** displays the condition of channel #8. This is also the value received from the Modbus.

DO Module 3 Menu

The programmer displays discrete output conditions as each item is selected. FALSE = DE-ENERGIZED and TRUE = ENERGIZED. The control automatically updates the display. This menu is only active when the DO Module 3 is connected and addressed properly.

1. **CH1 ENERGIZED** displays the condition of channel #1. This is also the value received from the Modbus.

2. **CH2 ENERGIZED** displays the condition of channel #2. This is also the value received from the Modbus.

3. **CH3 ENERGIZED** displays the condition of channel #3. This is also the value received from the Modbus.

4. **CH4 ENERGIZED** displays the condition of channel #4. This is also the value received from the Modbus.

5. **CH5 ENERGIZED** displays the condition of channel #5. This is also the value received from the Modbus.

6. **CH6 ENERGIZED** displays the condition of channel #6. This is also the value received from the Modbus.

7. **CH7 ENERGIZED** displays the condition of channel #7. This is also the value received from the Modbus.

8. **CH8 ENERGIZED** displays the condition of channel #8. This is also the value received from the Modbus.

DO Module 4 Menu

The programmer displays discrete output conditions as each item is selected. FALSE = DE-ENERGIZED and TRUE = ENERGIZED. The control automatically updates the display. This menu is only active when the DO Module 4 is connected and addressed properly.

1. **CH1 ENERGIZED** displays the condition of channel #1. This is also the value received from the Modbus.

2. **CH2 ENERGIZED** displays the condition of channel #2. This is also the value received from the Modbus.

3. **CH3 ENERGIZED** displays the condition of channel #3. This is also the value received from the Modbus.

4. **CH4 ENERGIZED** displays the condition of channel #4. This is also the value received from the Modbus.

5. **CH5 ENERGIZED** displays the condition of channel #5. This is also the value received from the Modbus.

6. **CH6 ENERGIZED** displays the condition of channel #6. This is also the value received from the Modbus.

7. **CH7 ENERGIZED** displays the condition of channel #7. This is also the value received from the Modbus.

8. **CH8 ENERGIZED** displays the condition of channel #8. This is also the value received from the Modbus.

AO Module 1 Menu

The programmer displays Analog Output values as each item is selected. The control automatically updates the display. This menu is only active when the AO Module 1 is connected and addressed properly.

1. **CH1 - mA IN PERCENT** displays the current out x 100 for channel #1. This is also the value received from the Modbus.

2. **CH2 - mA IN PERCENT** displays the current out x 100 for channel #2. This is also the value received from the Modbus.

3. **CH3 - mA IN PERCENT** displays the current out x 100 for channel #3. This is also the value received from the Modbus.

4. **CH4 - mA IN PERCENT** displays the current out x 100 for channel #4. This is also the value received from the Modbus.

5. **CH5 - mA IN PERCENT** displays the current out x 100 for channel #5. This is also the value received from the Modbus.

6. **CH6 - mA IN PERCENT** displays the current out x 100 for channel #6. This is also the value received from the Modbus.

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 2 and the prestart menu settings in Chapter 3.

2. Close the 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 start attempts to determine the final setting of the Start Fuel Limit. If the start time is excessive (lightoff speed too slow), increase the Start Fuel Limit. If the start time/lightoff speed is too fast or flooding occurs, 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 Reset time. If increasing the Reset 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 actuator output or engine speed 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 achieve an acceptable actuator movement 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 Reset is too low. Reduce the Gain by 50% (i.e., if the Gain was 0.02, reduce it to 0.01) and increase Reset slightly. Observe the movement of the actuator or actuator output. Continue to increase Reset until the movement is active and acceptable but not rapid or excessive. A final value of Reset should be between 1.0 and 2.0 for most large engines. If the Reset 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 Reset 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 or an actuator bump, 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 Reset 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 Reset 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 significant load changes occur, the control should switch automatically to high gain (gain x gain ratio) to reduce the amplitude of the speed error. 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.

IMPORTANT

When paralleled to the utility, speed error is created when corrective bias signals following load changes are applied to the speed reference by the DSLC control, droop, or Load Pulse Control inputs. Speed errors are manifested as load transients instead of speed transients. An actuator bump is recommended to test dynamic settings when operating in parallel with the utility.

4. Verify that performance at all speed and load conditions is satisfactory and repeat the above procedures if necessary. Full load rejection testing is recommended as part of the performance testing.

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 Setting input and the Tachometer Output, however, involve analog circuits and may require adjustment.

1. 4 to 20 mA Remote Speed Setting Input

   Apply 4 mA to the Remote Speed Setting Input. Be sure remote operation is selected (Raise Speed and Lower Speed 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 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.

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.

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 E for future reference. This can be very 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 re-tighten 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 (9906-033 and 9906-034 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.

The control also provides 4 to 20 mA for configurable outputs. These outputs may be used for an analog meter, recorder, or as input to a computer.

The 723 control provides two separate serial interfaces for RS-232, RS-422, or RS-485 communications. An industry-standard Modbus is available for both ASCII and RTU protocols.

The 723 control also communicates using the LonTalk® protocol to the DSLC control.

Additional I/O can be added for monitoring and control, these LinkNet Nodes include J-Type Thermocouple, RTD, Analog Input, Analog Output, Discrete Input, and Discrete Output modules.

Control Dynamics

The control algorithms used in the 723 control are designed specifically for reciprocating engine applications. Control dynamics may be 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. This automatic feature is active when paralleled to a utility grid. Although actual engine speed does not change, the speed reference is changed when corrective bias signals are applied by the DSLC control, droop, or Load Pulse Modules. Large corrective bias signals will produce a large speed error to automatically increase gain.

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 dual-fuel engines or 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 fuel metering device 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 3-7.

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 Setting input which is used for the speed reference. Remote is selected as long as the Raise Speed and Lower Speed contacts are both closed.

This section describes the operation 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.

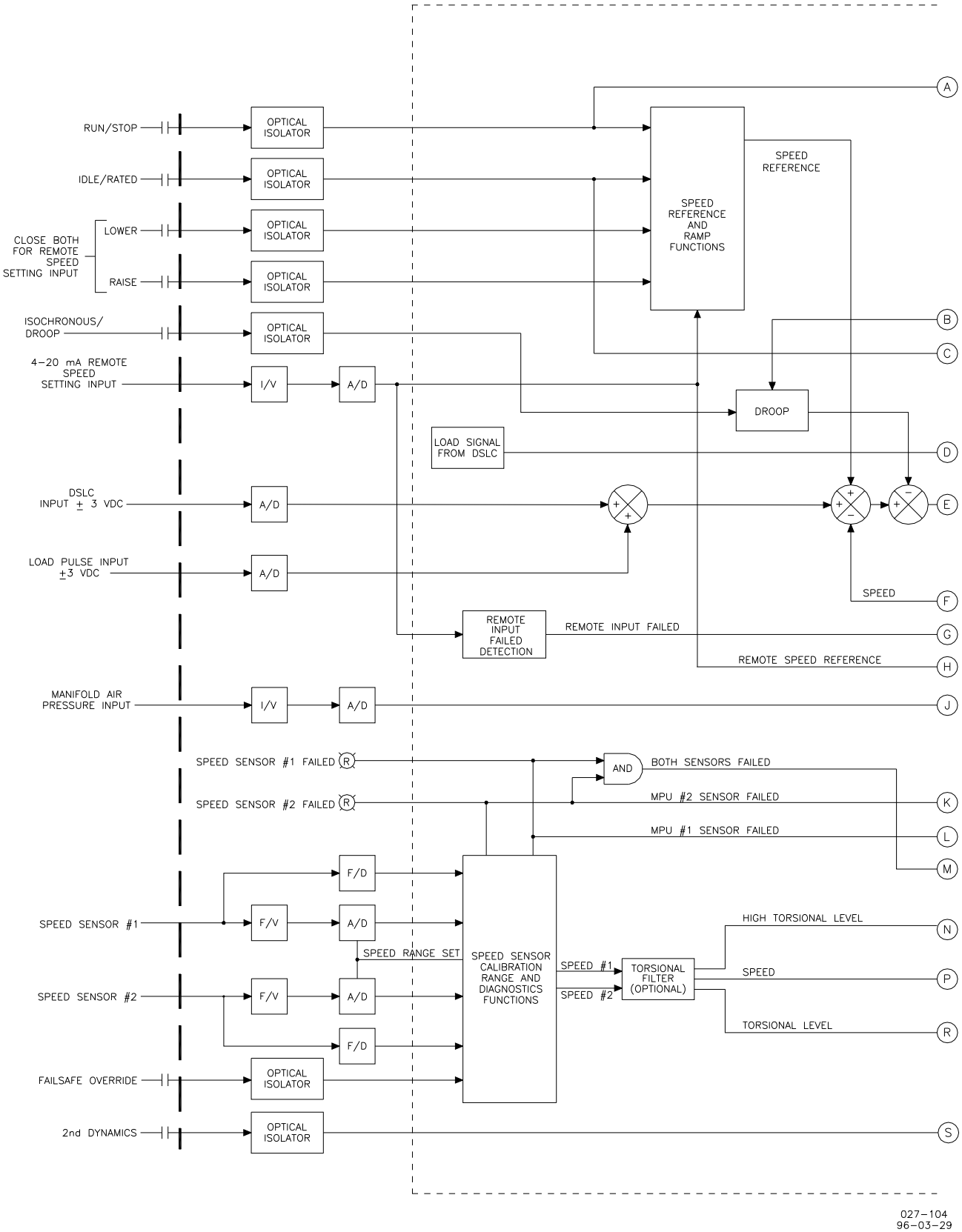

Figure 5-1a. Detailed Block Diagram

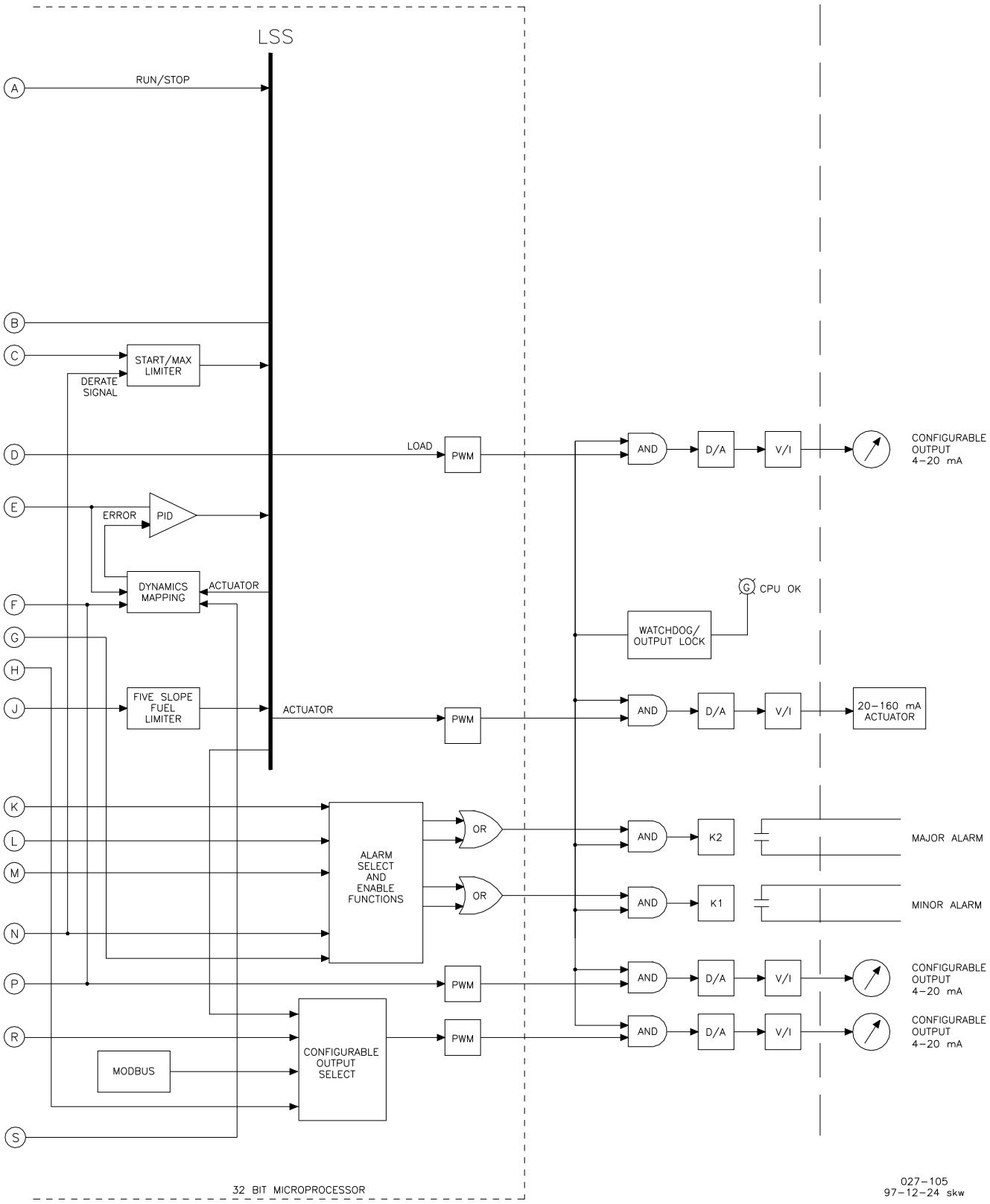

Figure 5-1b. Detailed Block Diagram

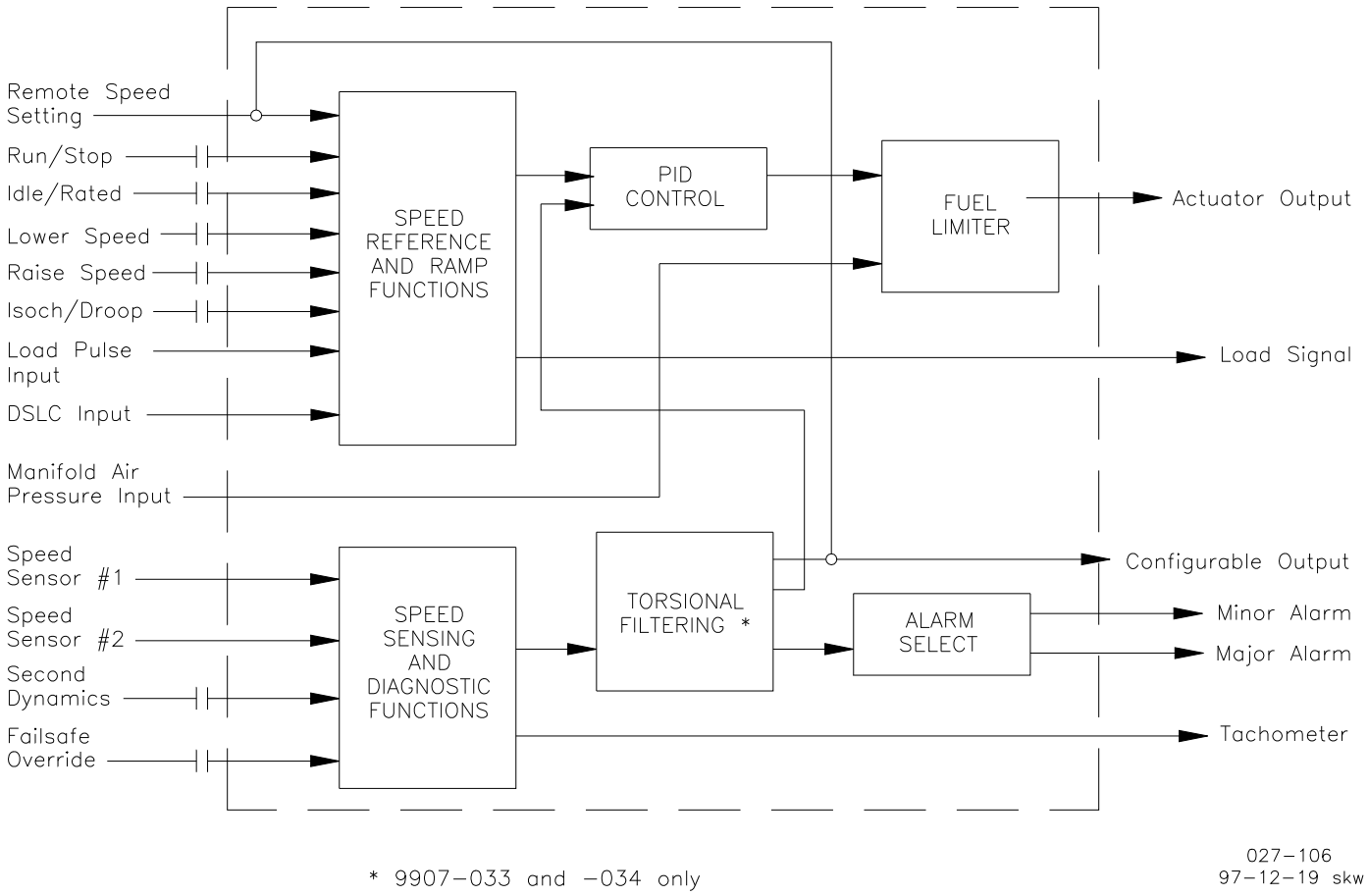

Figure 5-2. Simplified Block Diagram

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 and the remote speed setting.

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 the Rate contact ramps the speed set point from idle to rated.

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 Setting milliamp input based on the raise or lower rate. The Remote Speed 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 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 contacts both closed), if the remote input goes below 2 mA (0.5 Vdc), the speed reference remains at the current value if the lock-in-last option is TRUE.

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.

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 all outputs from the control. If diagnostic testing is successful, the green CPU OK indicator on the control cover will light.

Chapter 6. Troubleshooting

General

The following troubleshooting guide is an aid in isolating trouble to the control box, actuator, control 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.

NOTICE

The engine must be shut down for all system checks.

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 3. 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 “9924-442” or “9924-443” 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 first 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. Repeat this step for all discrete inputs. Close the appropriate input. The 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 the respective control terminal. If the LED is illuminated and correct voltage is verified, the control has failed and should be replaced. If the LED is NOT illuminated and correct voltage is verified at the terminal (common to terminal 37), the control has failed and should be replaced.

DSLC Input

The following tests calibrate and verify the function of the DSLC 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 DSLC Input.

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

4. Set the source for -5.0 Vdc. The DSLC 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 Xdcr Input

The following tests calibrate and verify the function of the Remote Speed 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 a value greater than 5% of rated *frequency* and less than 50% of rated *frequency*.

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 100%. Set Max Fuel Limit to 20%. The output current should be 42 ± 2 mA.

5. Set the Max 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.

6. Return to the CFIG Speed Control menu on the Hand Held Programmer. Set the Actuator Output to the value as recorded during installation.

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 AMPU #1 TEETH and DMPU #1 TEETH set point from the CFIG SPEED CONTROL Menu. Temporarily set both 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. The value read should follow the signal generator frequency.

IMPORTANT

The value of the test frequency must not exceed the maximum frequency values set in the CFIG SPEED CONTROL menu.

3. Return AMPU #1 TEETH and DMPU #1 TEETH on the CFIG Speed Control Menu to the previously recorded values for your engine.

4. Repeat steps 1–3 for Speed Sensor Input #2

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 re-tighten 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.
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.
Serial Communication Port Wiring

The Communication Ports J2 and J3 can be configured for RS-232, RS-422 or RS-485 serial communications. The default settings are for RS-232.

The RS-232 connections are shown in Figure A-1. The maximum distance from the Master Modbus Device to the 723 control is 15 m (50 ft).

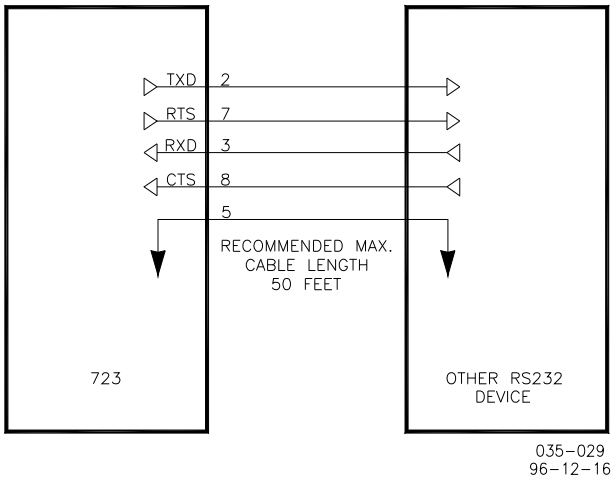

Figure A-1. 723 RS-232 Connections

The RS-422 connections are shown in Figure A-2. The maximum distance from the Master Modbus Device to the 723 control is 1219 m (4000 ft).

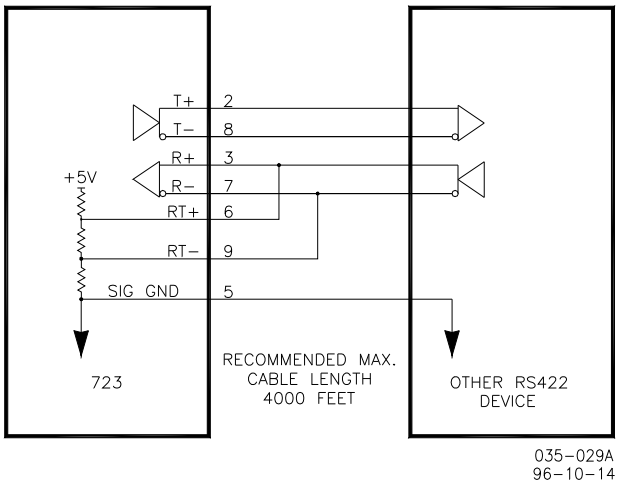

Figure A-2. 723 RS-422 Connections with Optional Termination at Receiver

The RS-485 connections are shown in Figure A-3. The maximum distance from the Master Modbus Device to the 723 control is 1219 m (4000 ft).

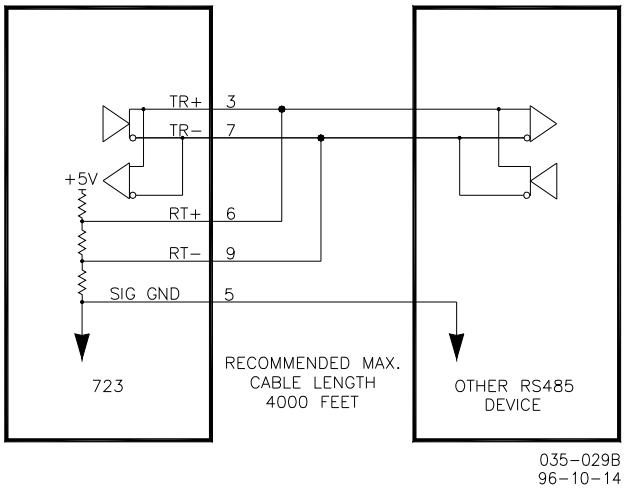

Figure A-3. 723 RS-485 Connections with Optional Termination

RS-422 and RS-485 can use a multi-drop set-up where more than one device is connected to a master device. A termination should be located at the receiver when one or more transmitters are connected to a single receiver. When a single transmitter is connected to one or more receivers, termination should be at the receiver farthest from the transmitter. Figure A-4 is an example.

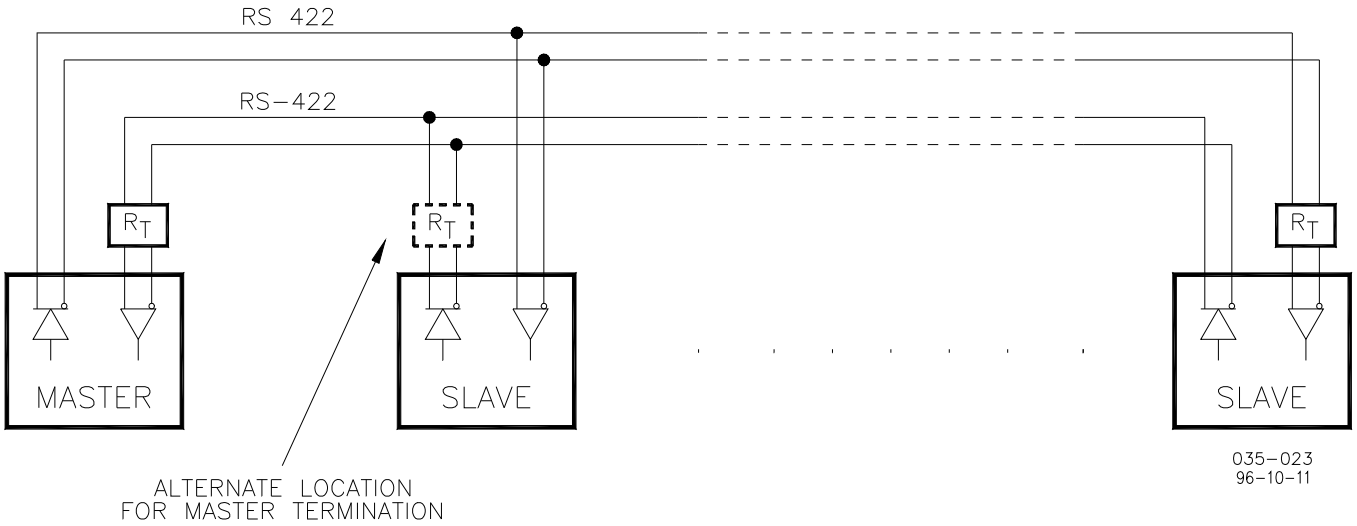

Figure A-4. RS-422 Terminator Locations

Termination is accomplished using a three-resistor voltage divider between a positive voltage and ground. The impedance of the resistor network should be equal to the characteristic impedance of the cable. This is usually about 100 to 120 A. The purpose is to maintain a voltage level between the two differential lines so that the receiver will be in a stable condition. The differential voltage can range between 0.2 and 6 V. The maximum voltage between either receiver input and circuit ground must be less than 10 V. There is one termination resistor network for each port located on the 723 board. Connection to this resistor network is made through the 9-pin connectors on pins 6 and 9.

Grounding and Shielding

The RS-422 specifications state that a ground wire is needed if there is no other ground path between units. The preferred method to do this is to include a separate wire in the cable that connects the circuit grounds together. Connect the shield to earth ground at one point only. The alternate way is to connect all circuit grounds to the shield, and then connect the shield to earth ground at one point only. If the latter method is used, and there are non-isolated nodes on the party line, connect the shield to ground at a non-isolated node, not an isolated node. Figures A-5 and A-6 illustrate these cabling approaches.

IMPORTANT

Non-isolated nodes may not have a signal ground available. If signal ground is not available, use the alternate wiring scheme in Figure A-5 with the signal ground connection removed on those nodes only.

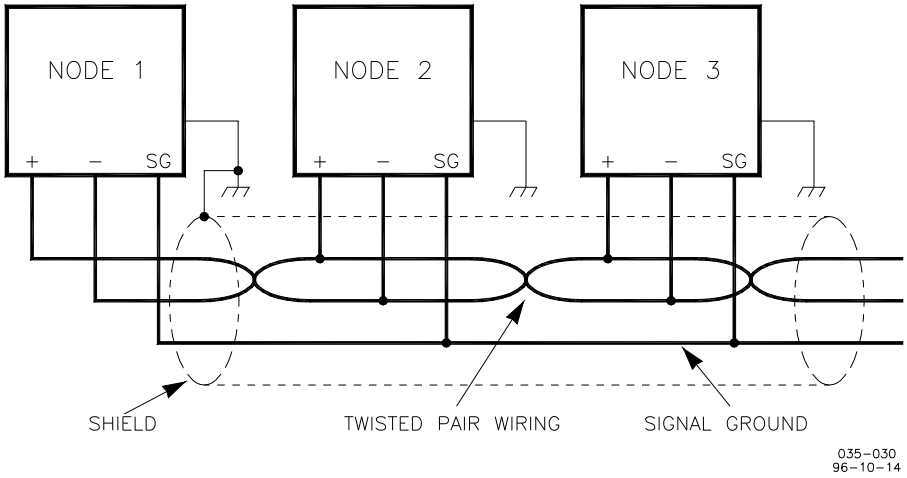

Figure A-5. Preferred Multipoint Wiring Using Shielded Twisted-pair Cable with a Separate Signal Ground Wire

IMPORTANT

The SG (signal ground) connection is not required if signal ground is unavailable.

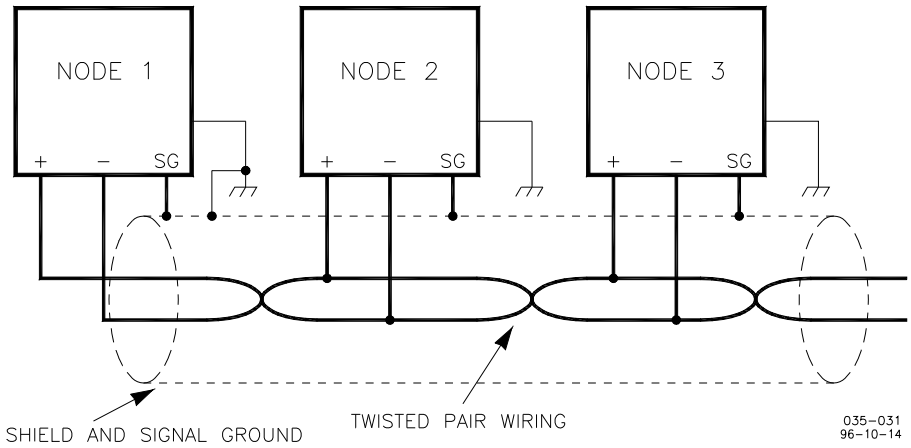

Figure A-6. Alternate Multipoint Wiring Using Shielded Twisted-pair Cable without a Separate Signal Ground Wire

Appendix B.
LinkNet® I/O Network

Introduction

The LinkNet® option provides distributed I/O capabilities for the 723 control system through LON #1. The LinkNet I/O modules, while slower and less powerful than on-board I/O, are well suited for functions which are not time-critical, such as sequencing and monitoring.

Network Architecture

An I/O network consists of the 723 LON #1 channel, which provides independent network trunks of up to 18 I/O modules. The LinkNet I/O modules, or nodes, on each trunk are attached to the 723 via a single twisted-pair wire (see end of this Appendix for correct wiring geometry).

Each LinkNet I/O module has two rotary switches that are used to set its network address. On installation, these switches must be dialed so that the I/O module's network address of 1–18 matches the network address defined for this I/O module in the application program. The I/O modules may be placed in any order on the network, and gaps are allowed in the address sequence.

Hardware

Each network consists of one LinkNet channel of a 723 and many I/O modules. The I/O modules include thermocouple inputs, RTD inputs, 4–20 mA inputs, and discrete inputs as well as 4-20 mA and relay outputs. All of the analog modules consist of six channels per module. The Relay Output module contains eight channels, and the Discrete Input module has 16 channels.

Each I/O module is housed in a plastic, field-termination-module-type package for DIN rail mounting. The LinkNet I/O modules can be mounted in the control cabinet or in any convenient location in the vicinity of the engine that meets the temperature and vibration specifications.

I/O Module Specifications

Accuracy
1% at 25 °C without field calibration

Power Supply Input
18 to 32 Vdc

Isolation
Network to I/O channel: 277 Vac
Power supply input to network: 277 Vac
I/O channel to I/O channel: 0 V
Power supply input to I/O channel: 500 Vdc except for discrete inputs, discrete input power comes directly from power supply input

Scan Rate

Less than 7 output modules:

(# of I/O modules x 6 + 75) ms typical

(# of I/O modules x 6 + 100) ms max

7 or more output modules:

(# of I/O modules x 6 + # of output modules x 3 + 55) ms typical

(# of I/O modules x 6 + # of output modules x 3 + 80) ms max

Field Wiring

2 mm^2 (14 AWG) maximum wire size

Temperature Range

–40 to +55 °C

UL Listed Component

Class 1, Division 2, Groups A, B, C, and D, when wired in accordance with NEC Class 1 Div. 2 wiring methods

Shock and Vibration

US Mil-Std-810, 30 Gs sine wave at 11 ms

US Mil-Std-167, 18-50 Hz

EMC

Emissions: EN 55011, Class A, Group 1

ESD immunity: IEC 801-2 (1991) 8 kV air and 4 kV contact, HCP and VCP tests

Radiated RF immunity: IEC 801-3, 10 V/m +80% 1 kHz AM, 80–1000 MHz

Fast transient immunity: IEC 801-4 (1988) 2 kV directly coupled onto power lines and 2 kV capacitively coupled onto I/O network lines

Discrete Input Current

13.1 mA per channel when “on” (@ 24 V)

Relay Contacts

Ratings: 5.0 A @ 28 Vdc resistive

0.5 A @ 115 Vac resistive

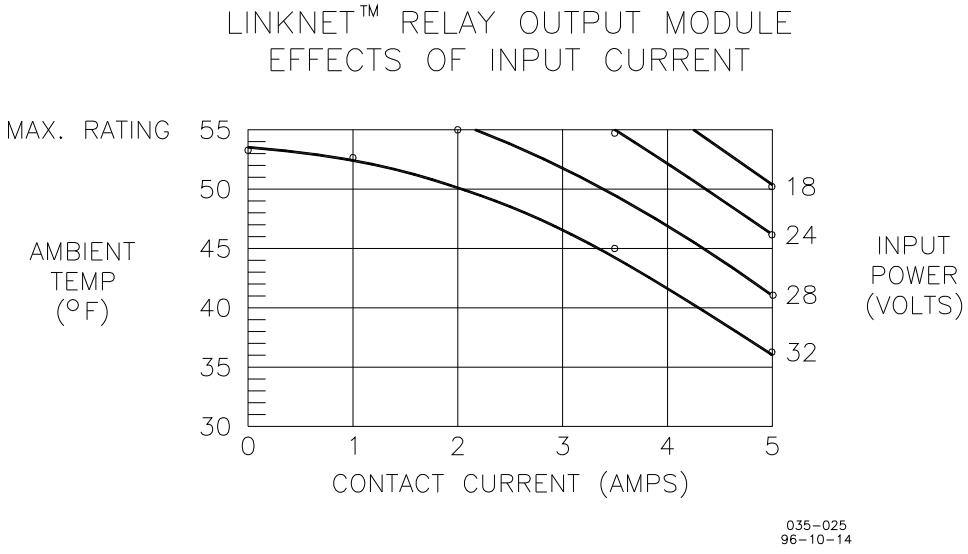

Figure B-1. LinkNet Relay Contacts

Individual I/O Module Specifications

I/O Module Type	Number of Channels	Resolution (bits)	Temp Coefficient (ppm/°C)	Input Impedance	Power Required at 24 V input
Discrete Input	16	N/A	N/A	N/A	6.5 W
Relay Output	8	N/A	N/A	N/A	5.0 W
4-20 mA Input with 24 V	6	12	235	250 A	5.3 W
4-20 mA Input	6	12	235	250 A	2.4 W
4-20 mA Out	6	12	250	N/A	6.0 W
RTD Input	6	12	290	2.2 MA	3.1 W
Thermocouple Input (J or K type +1 AD592)	6 +1 cold junction	12	235	2 MA	2.4 W

LinkNet I/O Module Descriptions

The FAULT LED denotes the status of the module processor, and will be off during normal operation. If the FAULT LED is on or is blinking, and cycling power to the module does not change it, then the I/O module should be replaced.

The module address circuit reads the selected module address from the rotary switches on each node. This address should correspond to the address of the I/O module hardware in the application program. If these rotary switches are set incorrectly, the node will not communicate with the 723, and a “no message” fault will be annunciated through the application program. If two nodes are set to the same address, an “address” fault will be annunciated through the application program, and both nodes will not function. If the node address switches are changed, power to the module must be cycled before it will read the new module address and change its communication accordingly.

A “type” fault is annunciated through the application program when the wrong module type is installed at a given address. For example, installing a thermocouple module in place of an RTD module generates a type fault. If an output node receives data intended for a different module type, it will not update its outputs, and will set them to the “off” state when its watchdog timer times out.

No-message faults, address faults, and type faults can be latching or non-latching (selectable within the 723 control). When these faults occur for an input module, the application program can give default values for each channel.

Output modules contain readback circuits to verify proper operation of each output channel. Analog input modules monitor a reference voltage to verify proper operation of the A/D converter. Appropriate faults are annunciated through the application program.

The LinkNet system accommodates hot-replacement of faulty nodes. When replacing a node, the network cable connections must remain intact. A faulty node can be removed from the network by pulling both terminal blocks out of their headers, and removing the node from the DIN rail. The address switches of the replacement node should be set to match those of the faulty node. The replacement node can then be mounted on the DIN rail, and the terminal blocks pushed into the headers. It may be necessary to reset the node through the application program to reinitiate communications with the 723 and to clear the “no message” fault.

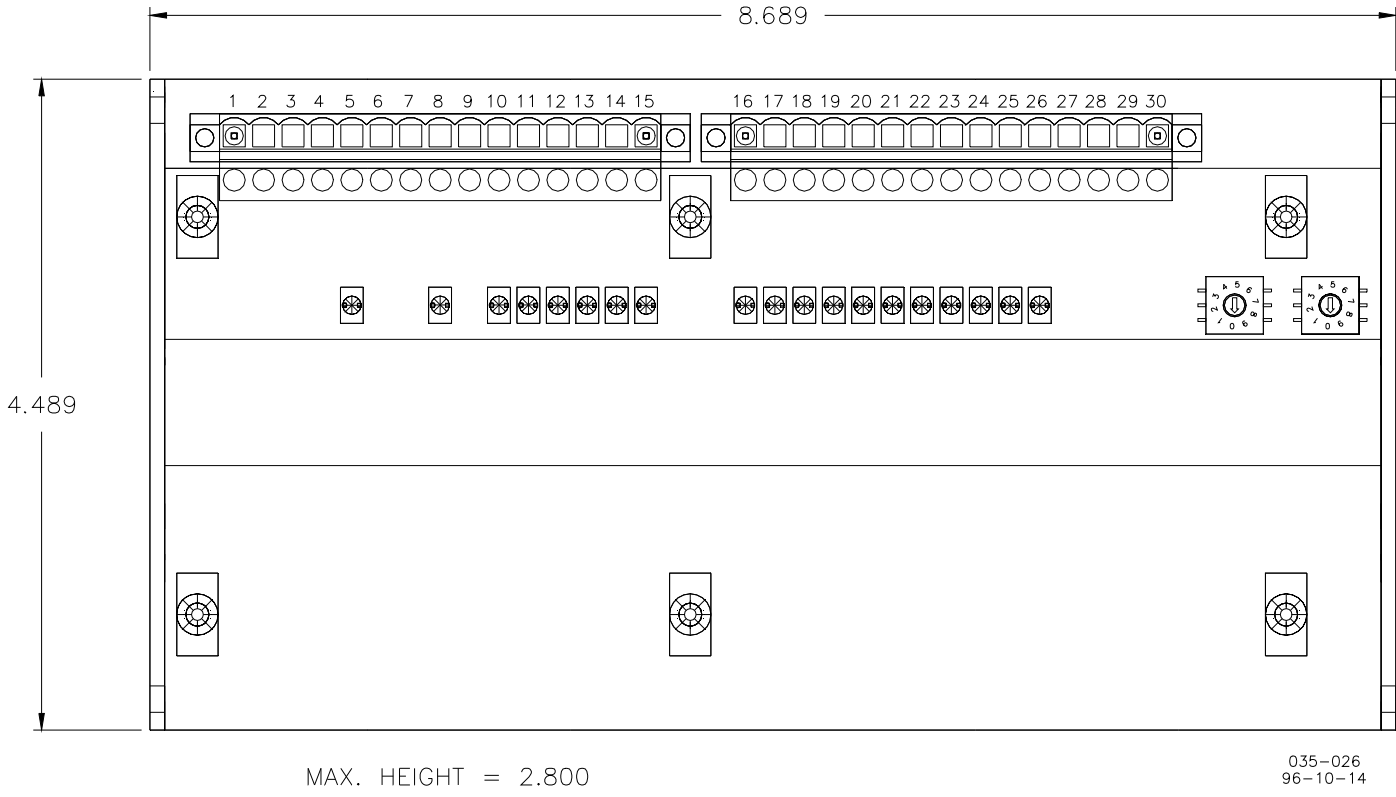

Figure B-2. Outline Drawing of I/O Module

Discrete Input Module

Figure B-3 is a block diagram and Figure B-4 is a wiring diagram of the Discrete Input module. The module receives information from field switches and relays. Power is provided for these contacts, on four terminal blocks, TB-5 through TB-8. The input power on TB-2 may also be used, but does not have the benefit of an internal fuse and some filtering, therefore external fusing should be provided. The state of each discrete input is passed through an optoisolator and an LED to the shift register. In this manner, the LEDs will light when a contact is closed. The module processor receives this information and transmits it through the transceiver to the 723.

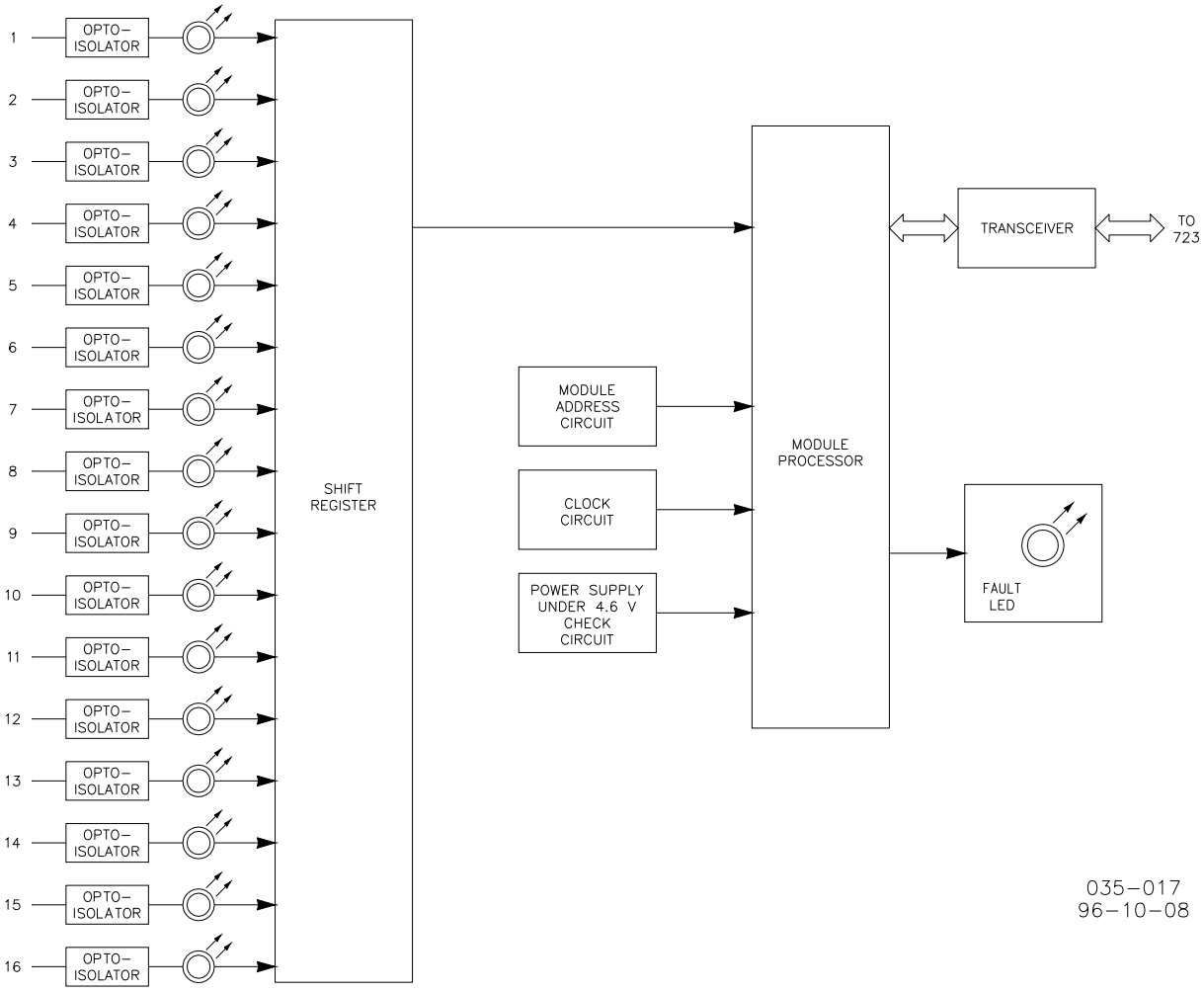

Figure B-3. Discrete Input Module Block Diagram

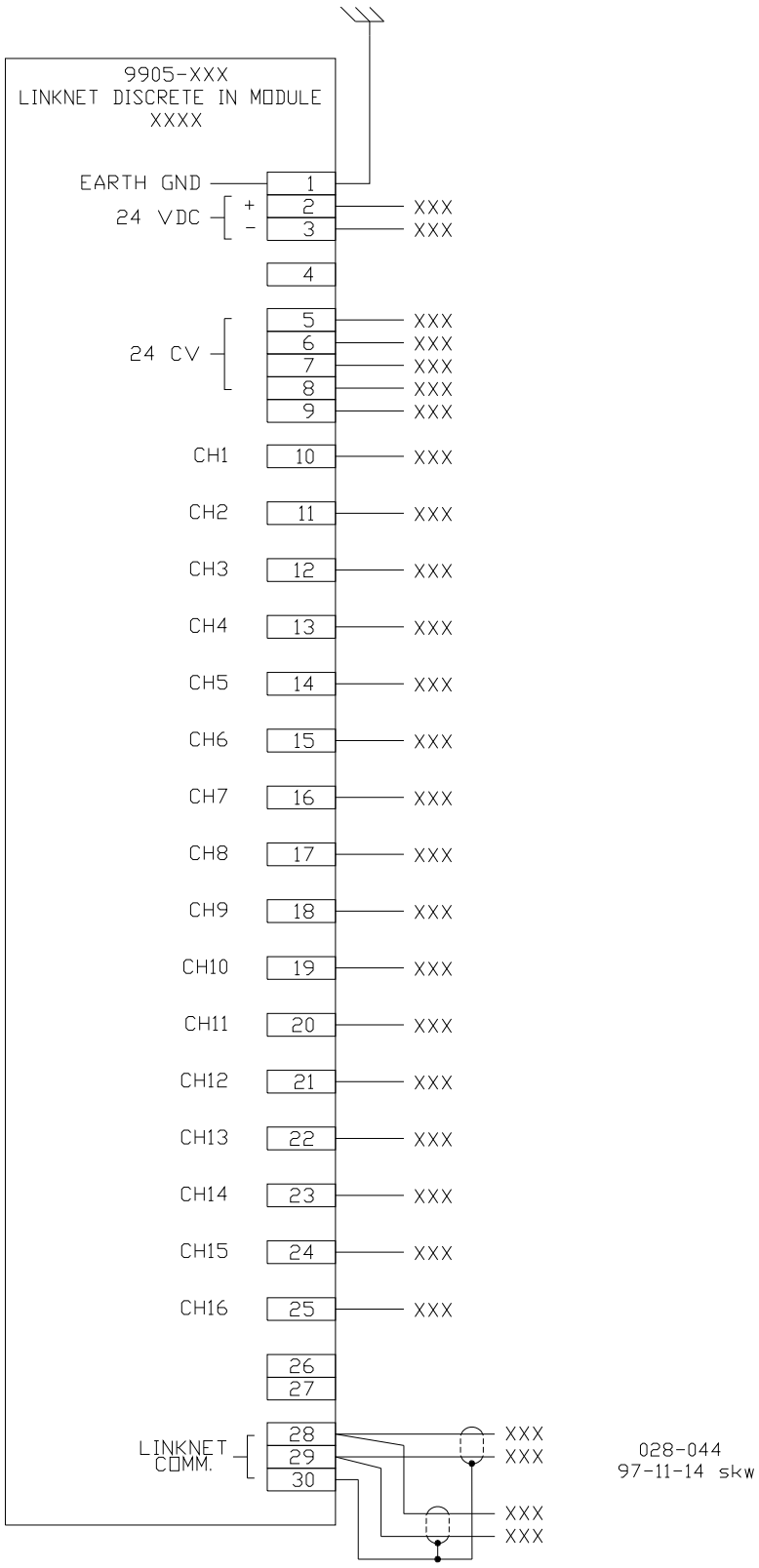

Figure B-4. Discrete Input Module Wiring Diagram

4–20 mA Input Module

Figure B-5 is a block diagram and Figure B-6 is a wiring diagram of the 4–20 mA Input module. The module receives information from 4–20 mA sources, such as transducers. Power is provided for these transducers on one version of the module, but all module inputs must use the power provided. No inputs may use a separate power source, as all of the negatives are tied together and to 24 V common. The advantage of this module version is that it simplifies wiring to devices such as transducers that require external power. Each input is converted to a 0–5 V signal, and then multiplexed to a voltage-to-frequency converter. The module processor reads the period of this signal and converts it to a count, which it transmits through the transceiver to the 723.

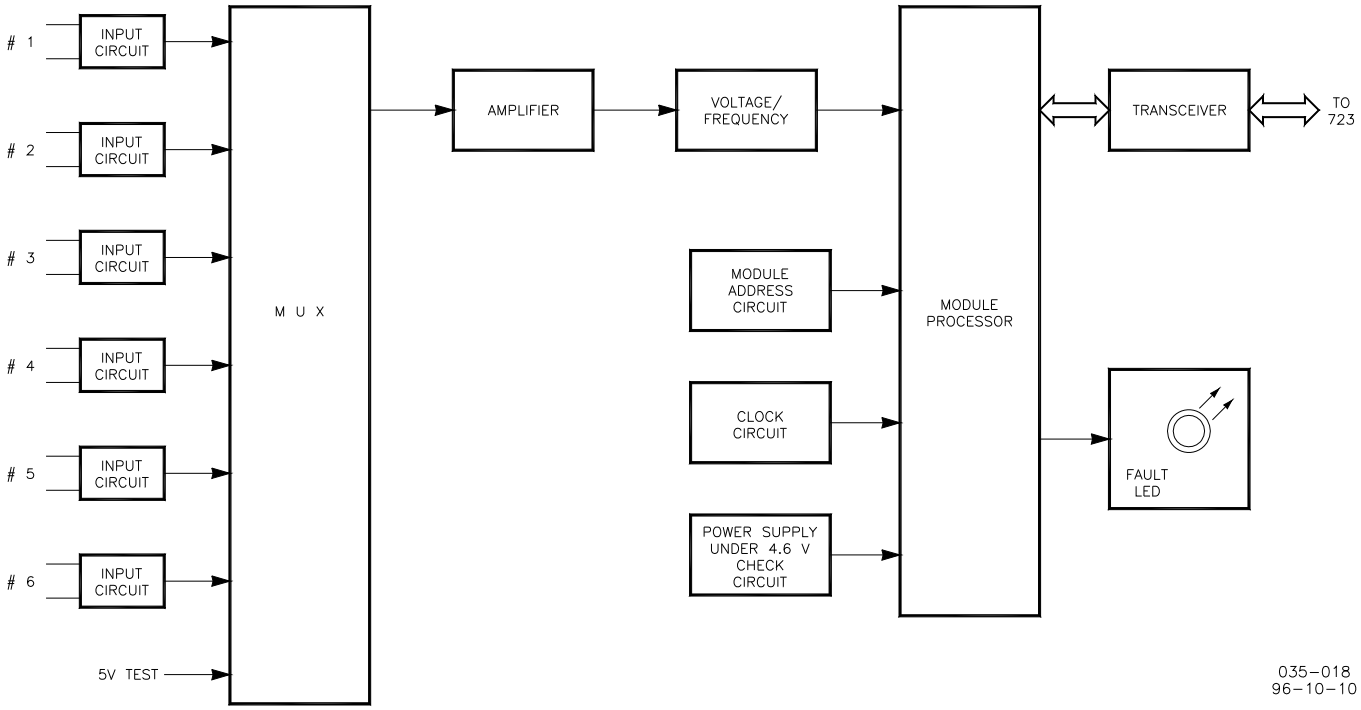

Figure B-5. 4–20 mA Input Module Block Diagram

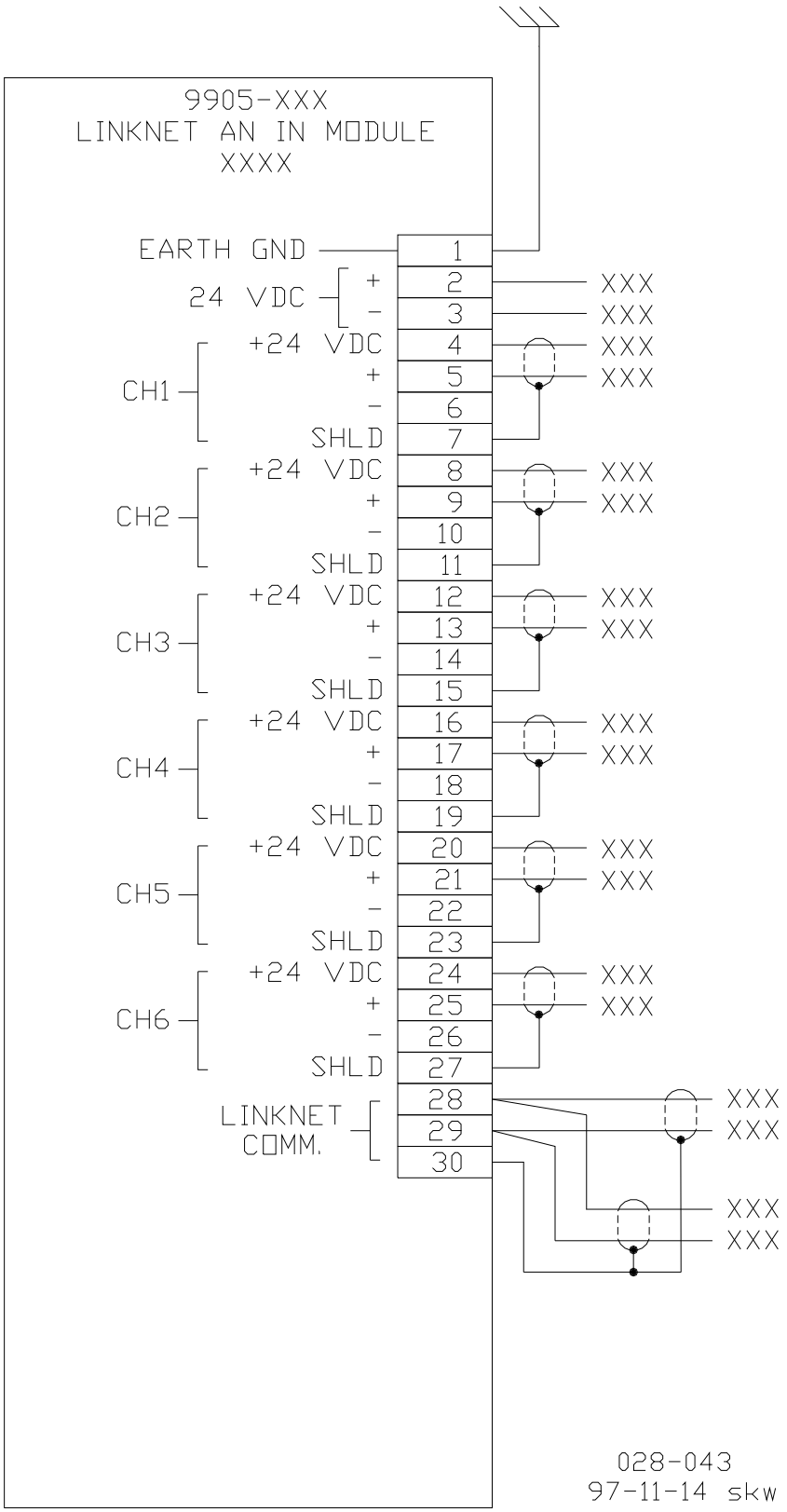

Figure B-6. 4–20 mA Input Module Wiring Diagram

Thermocouple Input Module

Figure B-7 is a block diagram and Figure B-8 is a wiring diagram of the Thermocouple Input module. The module receives information from thermocouples, which can be either J or K type. The type is selected in the application program. It also has an AD592 ambient temperature sensor mounted on the module for cold junction temperature sensing. The cold junction compensation is performed in software. There is a fail high and a fail low version of the module, selected by jumpers on the board, which allow the input channels to be pulled high or low on an open input. Each input is multiplexed to a voltage-to-frequency converter. The module processor reads the period of this signal and converts it to a count, which it transmits through the transceiver to the 723.

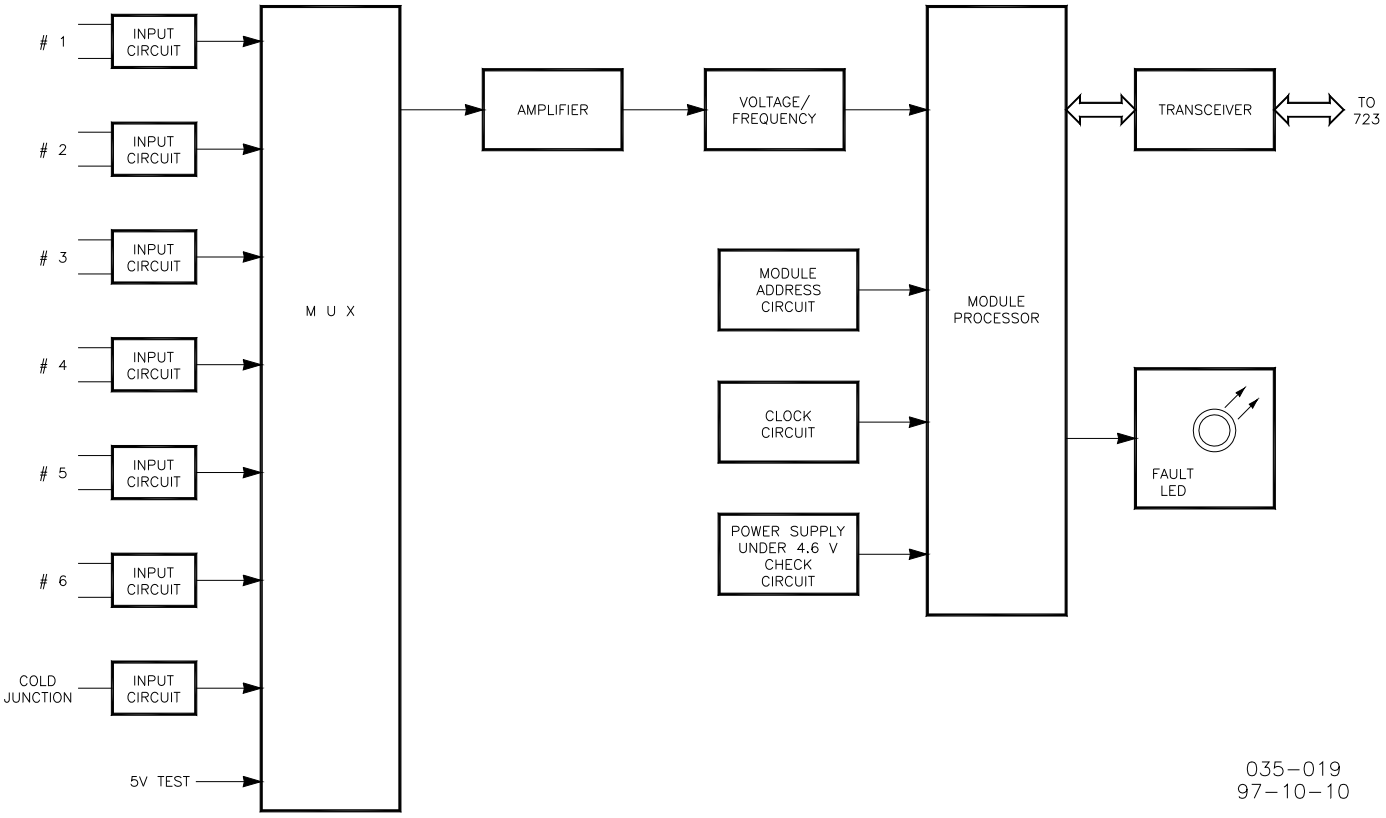

Figure B-7. Thermocouple Input Module Block Diagram

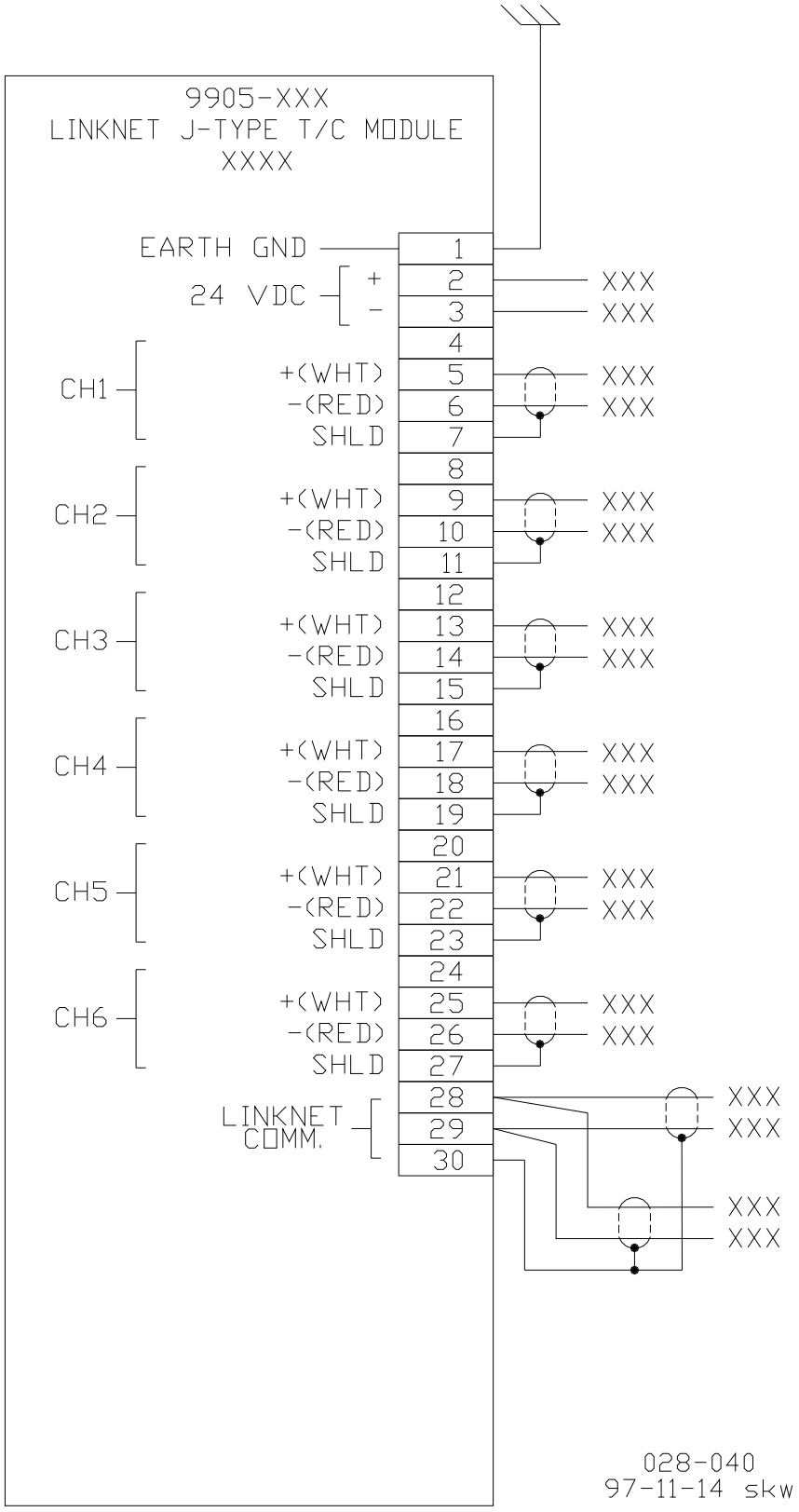

Figure B-8. Thermocouple Input Module Wiring Diagram

RTD Input Module

Figure B-9 is a block diagram and Figure B-10 is a wiring diagram of the RTD Input module. A 1 or 2 mA source is provided for each input. The module receives voltages from six 100 or 200 Ω, 3-wire RTDs. Each voltage is compensated for line resistance, and then is multiplexed to a voltage-to-frequency converter. The module processor reads the period of this signal and converts it to a count, which it transmits through the transceiver to the 723.

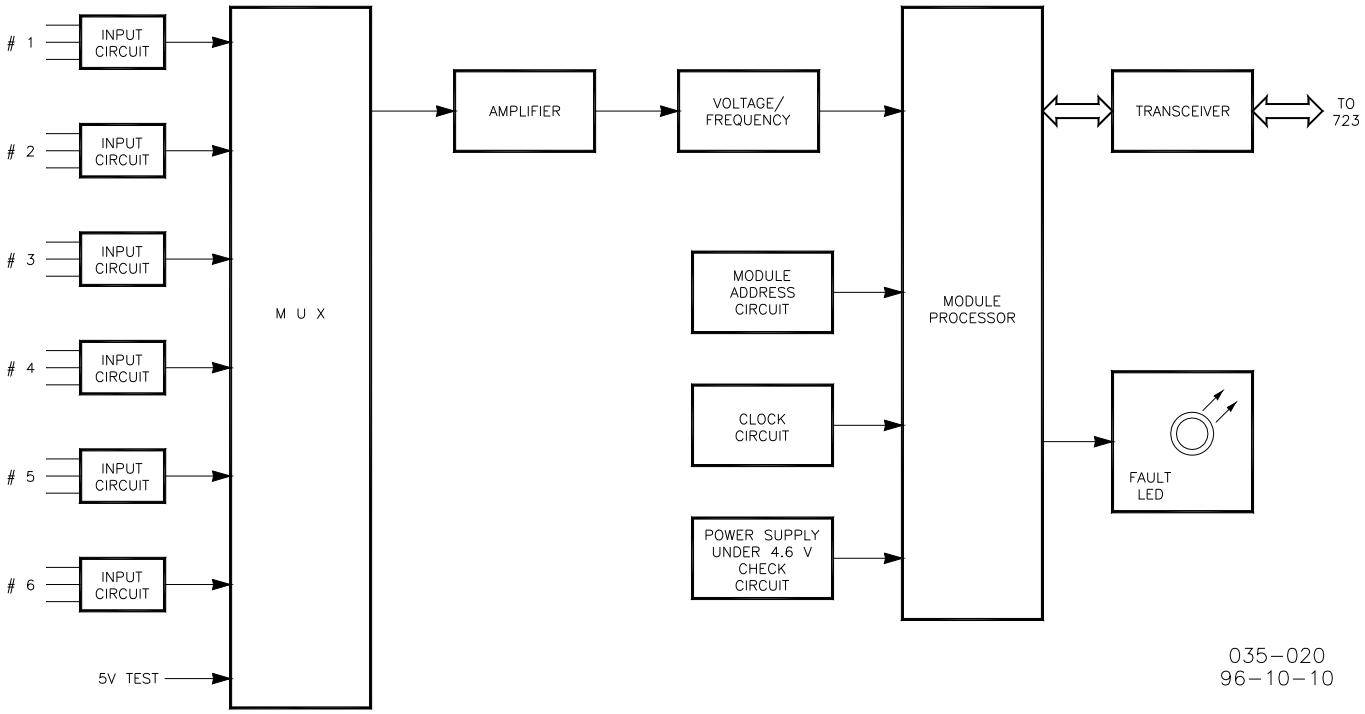

Figure B-9. RTD Input Module Block Diagram

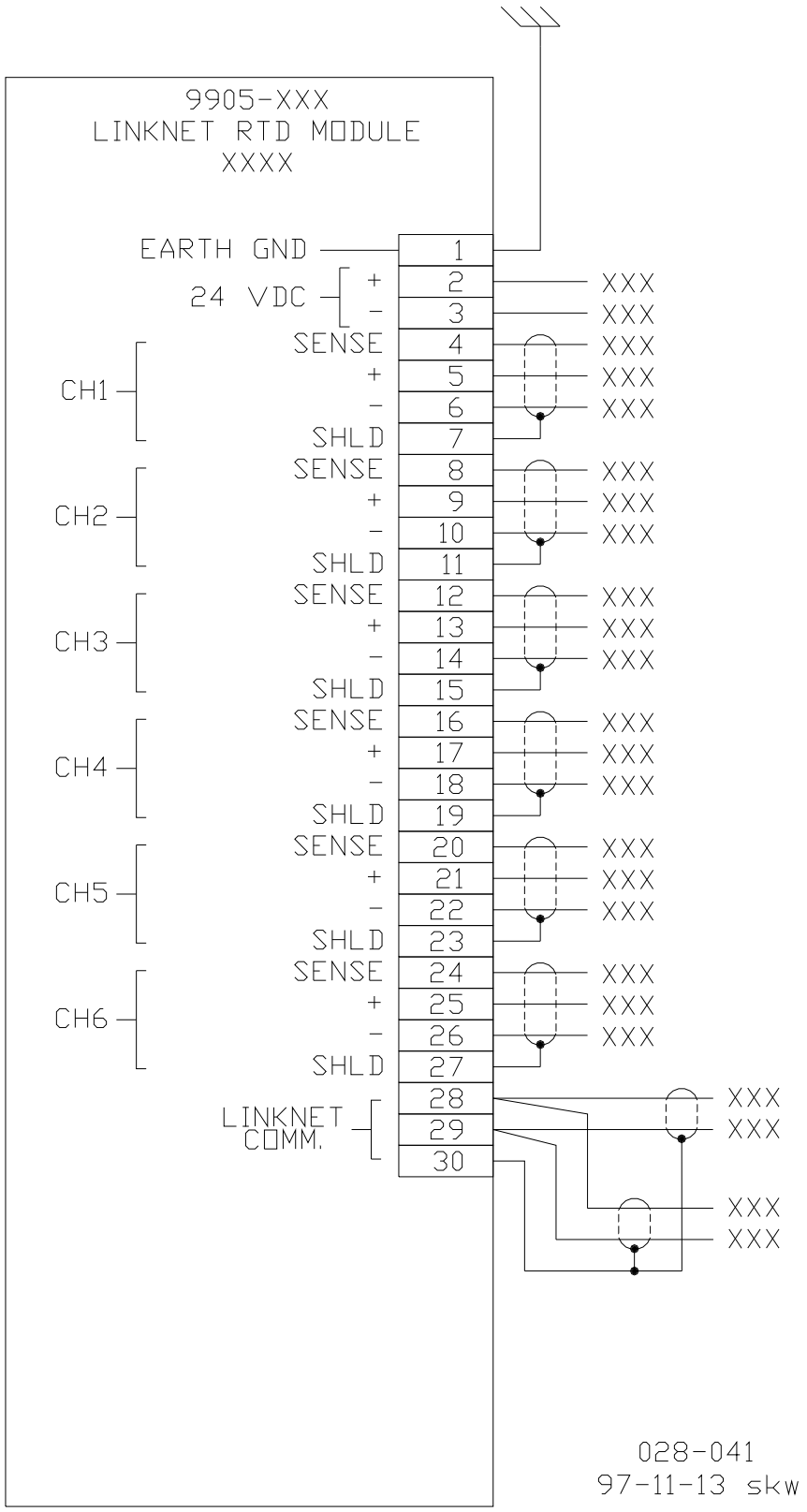

Figure B-10. RTD Input Module Wiring Diagram

Relay Output Module

Figure B-11 is a block diagram and Figure B-12 is a wiring diagram of the Relay Output module. The module outputs information through eight 5 A form C relays. The relay output module processor receives information through the transceiver, from the 723. The node then updates the status of the shift register which updates the relays and a status LED. The second set of relay contacts is input back into the module processor through a shift register, for readback status. The readbacks are compared with the desired outputs, and a status annunciated for each relay in the application program. The relay output module has a watchdog that monitors the communications from the module processor to the shift register, and disables the relay drivers upon a loss of communications of more than 1.2 seconds. The node will not function after a watchdog timeout, until its power is cycled or until the 723 is reset.

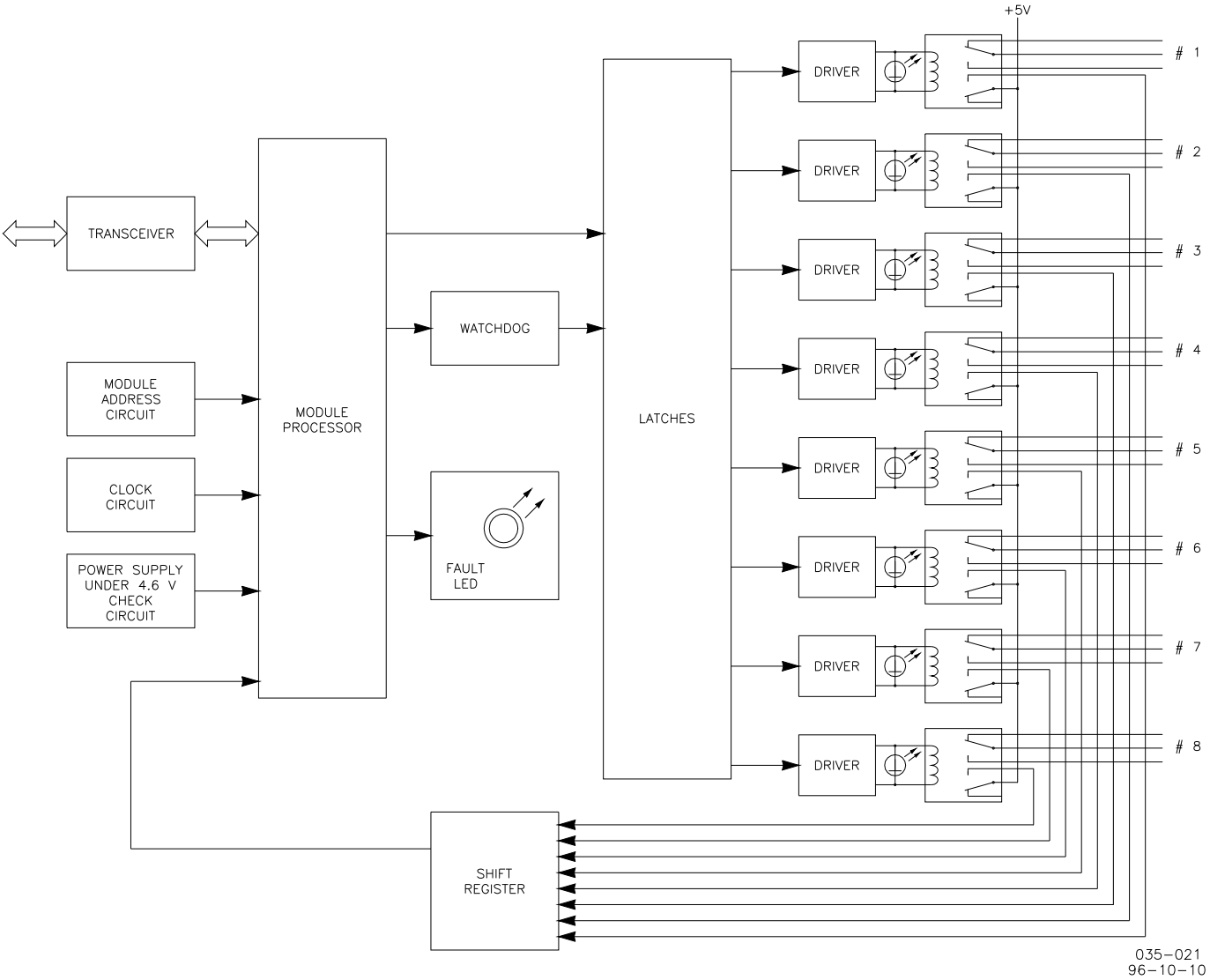

Figure B-11. Relay Output Module Block Diagram

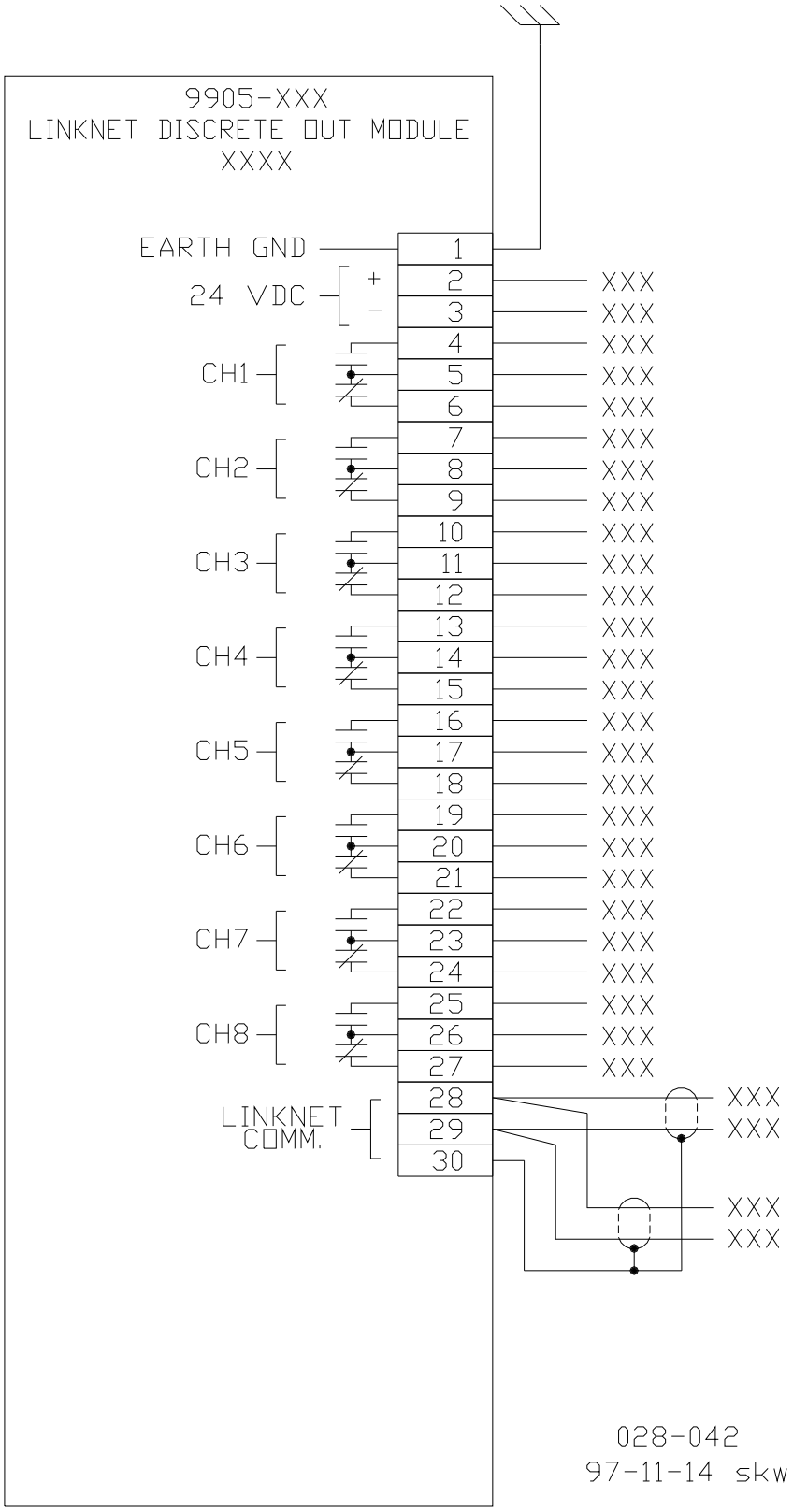

Figure B-12. Relay Output Module Wiring Diagram

4–20 mA Output Module

Figure B-13 is a block diagram and Figure B-14 is a wiring diagram of the 4–20 mA Output module. The 4–20 mA output module processor receives information through the transceiver, from the 723. The 4–20 mA output module then updates the status of the D/A converter which outputs voltages to the current drivers. The output current is monitored by the module processor through an A/D converter. The readback value and status are available through the application program. The 4–20 mA output module has a watchdog that monitors the communications from the module processor to the D/A converter, and disables the current drivers upon a loss of communications of more than 1.2 seconds. The module will not function after a watchdog timeout until its power is cycled or the 723 is reset.

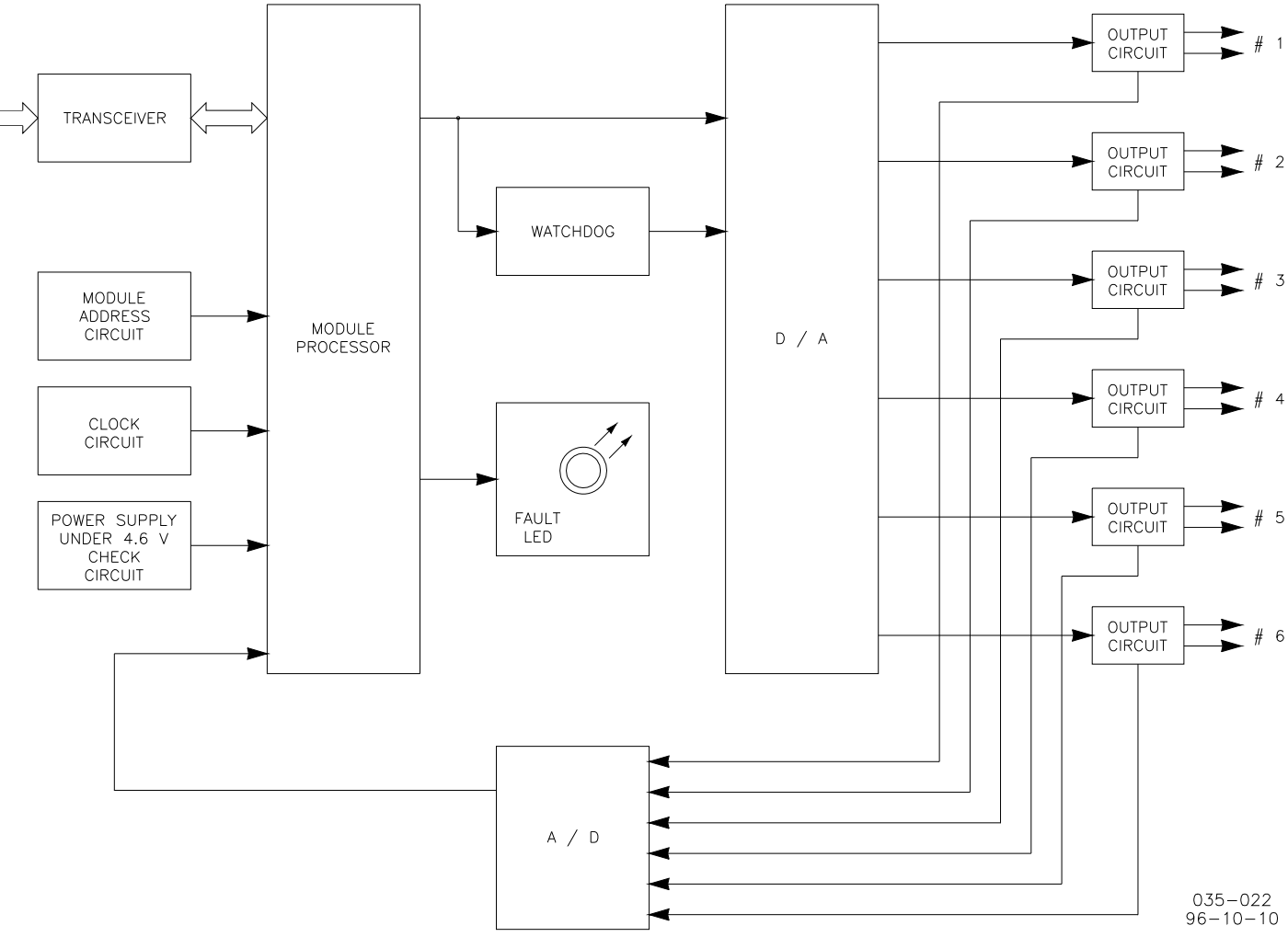

Figure B-13. 4–20 mA Output Module Block Diagram

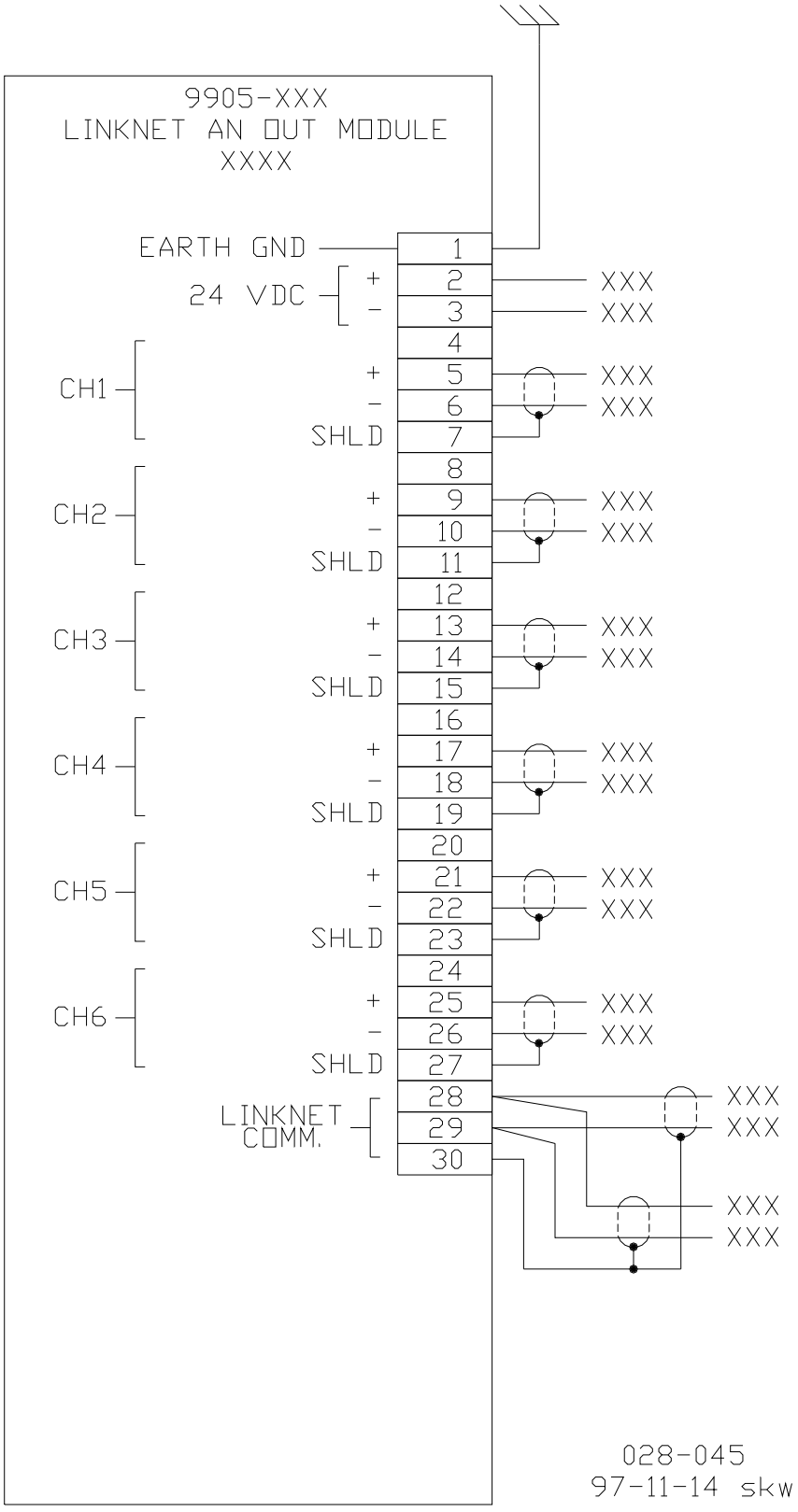

Figure B-14. 4–20 mA Output Module Wiring Diagram

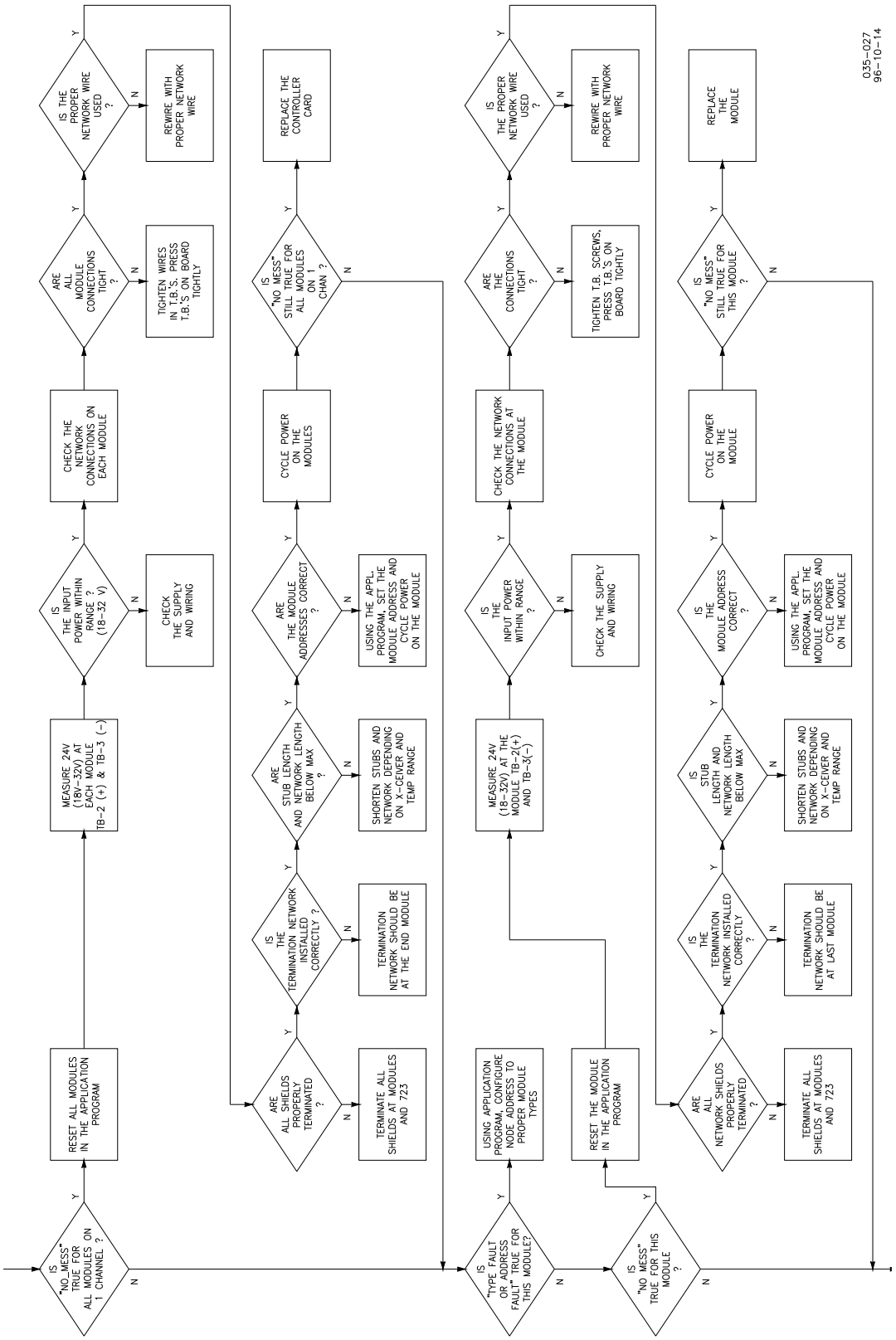

Figure B-15a. Troubleshooting Flowchart (1 of 2)

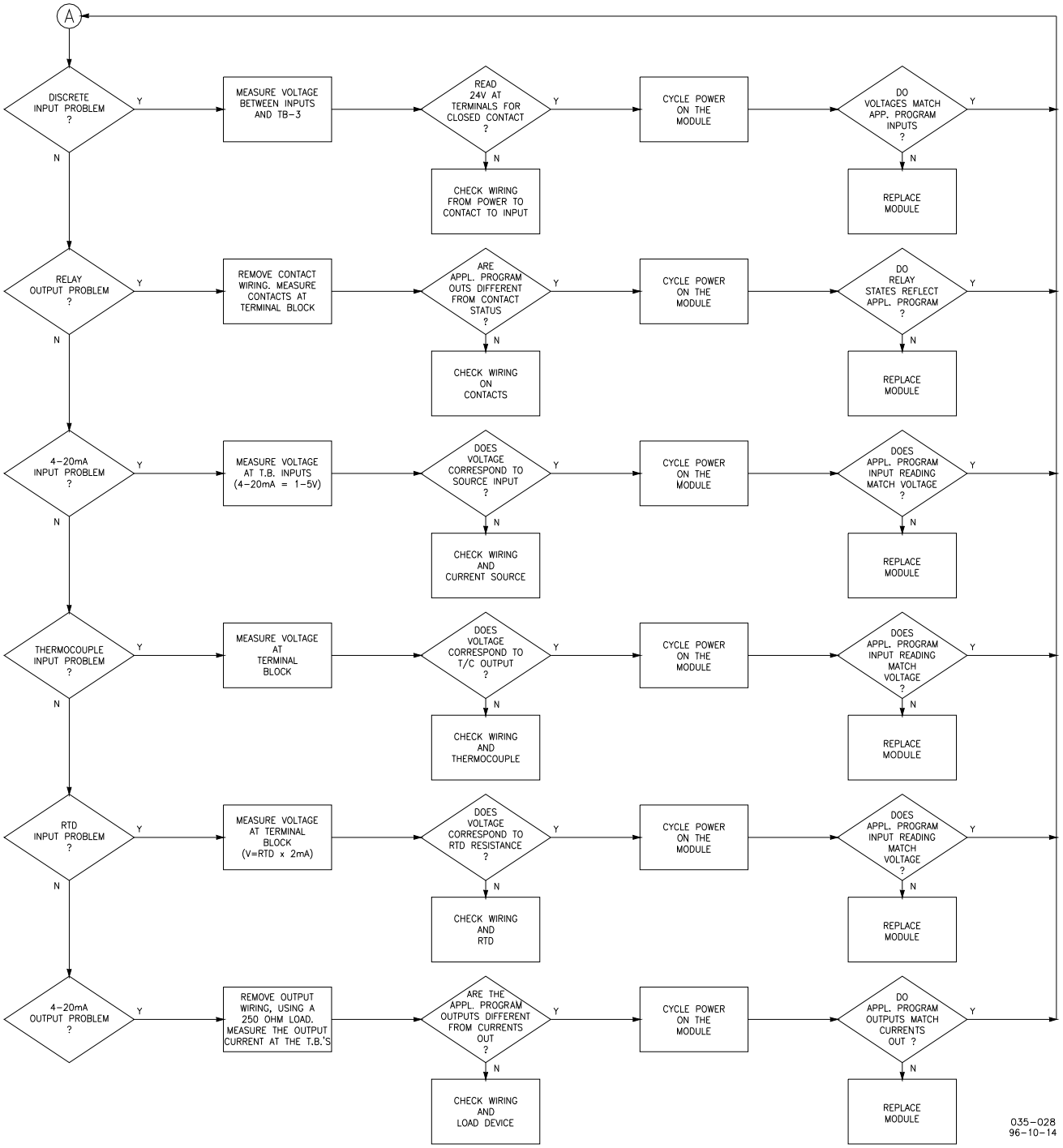

Figure B-15b. Troubleshooting Flowchart (2 of 2)

Troubleshooting Flowchart

If a problem occurs with the LinkNet network, use Figure B-15 (Troubleshooting Flowchart) as a guide to find and repair the problem.

Follow the flowchart down from the title block to the next block. This block may be a rectangular suggestion block, or a diamond shaped decision block. When a suggestion block is entered, do the check suggested. A suggestion block may refer you to the control wiring diagram, the application program, or the module field wiring.

If this check does no find the problem, continue down the flowchart.

When a decision block is entered, the question asked inside it must be answered. This answer then determines the proper exit from that block. The exit taken will lead you to another point on the flowchart.

By following the flowchart in this manner, you should be able to determine a course of action for most problems.

Wiring and Proper Cable

All LinkNet I/O modules communicate with the 723 through shielded twisted pair wiring. The specifications for the LinkNet system require that listed level V type cable be used. The network may be wired directly from I/O module to I/O module, as shown in Figure B-16, or the I/O modules may be connected to the network via stubs as in Figure B-17. A termination network must be installed at the last LinkNet I/O module on the network. There is no polarity associated with the network wiring. For optimum EMC performance, the network cable shield should be landed at each I/O module, and the exposed wire length limited to 25 mm (1 inch). At the 723, the outer insulation should be stripped and the bare shield landed to the chassis.

All field wiring should be shielded. The shield should be landed in the terminal block provided, and the exposed wiring, after the shield is separated, should be limited to one inch.

IMPORTANT

The LinkNet modules should always be mounted in a cabinet, or be otherwise operator inaccessible. The modules should be accessed only for maintenance purposes, in which case, the ESD procedures on page iv should be followed.

Correct cable is available from Woodward, Belden, or other suppliers providing an equivalent cable.

Woodward part number 2008-349

Belden
PO Box 1980
Richmond IN 47375
telephone (317) 983-5200

Belden Part Number	Description
9207	PVC 20 AWG shielded. NEC Type CL2, CSA Cert. PCC FT 1.
89207	Teflon 20 AWG shielded, Plenum version. NEC Type CMP, CSA Cert. FT 4.
YR28867	PVC 22 AWG shielded.
YQ28863	Plenum 22 AWG shielded.

Cable Length and Number of LinkNet I/O Modules

Specification	0 to 55 °C	–20 to +55 °C	–40 to +55 °C
Maximum network cable length	150 m	150 m	50 m
Maximum number of I/O modules	60	32	20
Maximum stub length	300 mm	300 mm	300 mm

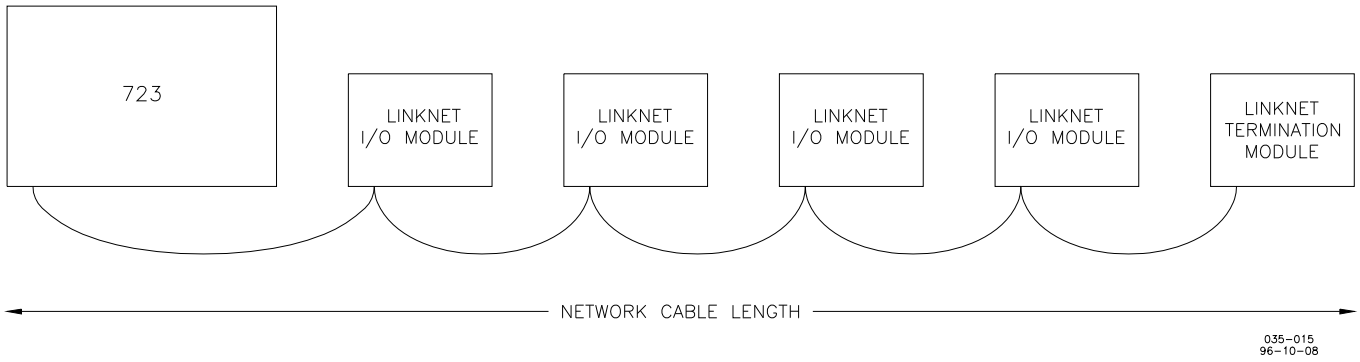

Figure B-16. Direct Wired Network

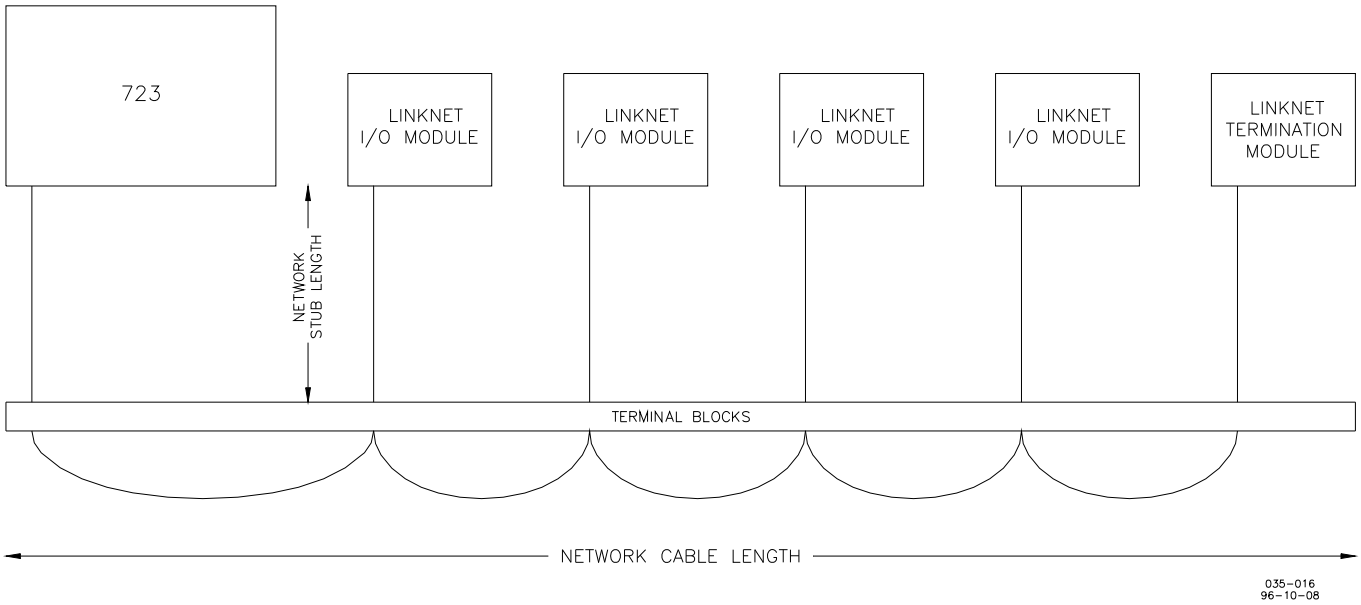

Figure B-17. Network Wired Via Stubs

Appendix C.
Modbus Slave Address Information

Part Numbers 9907-031/-032
(without torsional filtering)

This appendix contains the Modbus slave address information for the 723 part numbers without torsional filtering. See Appendix D for the address information for 723 part numbers with torsional filtering.

NOTE:
This listing is for Modbus port J3
Modbus port J2 is identical with the only
“WRITE” command being ACKNOWLEDGE ALARMS

Boolean Writes

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

Boolean Reads

Addr Description
1:0001 REMOTE SPD ENABLED
1:0002 MIN FUEL CONTACT
1:0003 IDLE/RATED CONTACT
1:0004 RAISE SPEED CONTACT
1:0005 LOWER SPEED CONTACT
1:0006 FAIL SAFE OVERRIDE
1:0007 EXT ACKNOWLEDGE
1:0008 2nd DYNAMICS CONTACT
1:0009 ISOCH/DROOP CONTACT
1:0010
1:0011

1:0012
1:0013 MPU 1 FAILED
1:0014 MPU 2 FAILED
1:0015 MINOR ALARM RELAY
1:0016 MPU 1 FAILURE MI/ALM
1:0017 MPU 2 FAILURE MI/ALM
1:0018 MPU 1 AND 2 FAILURE MI/ALM
1:0019
1:0020 REM SPD XDCR FAILURE MI/ALM
1:0021 MAP XDCR FAILURE MI/ALM
1:0022 HIGH KW OUTPUT MI/ALM
1:0023 HIGH ACTUATOR OUTPUT MI/ALM
1:0024
1:0025 OVERSPEED MI/ALM
1:0026 LON FAIL TO TRANSMIT MI/ALM
1:0027 MAJOR ALARM RELAY
1:0028 MPU 1 FAILURE MA/ALM
1:0029 MPU 2 FAILURE MA/ALM
1:0030 MPU 1 AND 2 FAILURE MA/ALM
1:0031
1:0032 REM SPD XDCR FAILURE MA/ALM
1:0033 MAP XDCR FAILURE MA/ALM
1:0034 HIGH KW OUTPUT MA/ALM
1:0035 HIGH ACTUATOR OUTPUT MA/ALM
1:0036
1:0037 OVERSPEED MA/ALM
1:0038 LON FAIL TO TRANSMIT MA/ALM
1:0039 ACT ON SPD CONTROL
1:0040 ACT ON START LIMIT
1:0041 ACT ON MAX LIMITER
1:0042 ACT ON MAP LIMITER
1:0043 ACT SHUTDOWN
1:0044 ALARM RELAY
1:0045 LOW LIMIT RELAY
1:0046 HIGH LIMIT RELAY
1:0047 LOAD SWITCH RELAY
1:0048 VOLTAGE LOWER RELAY
1:0049 VOLTAGE RAISE RELAY
1:0050 BREAKER OPEN RELAY
1:0051 BREAKER CLOSE RELAY
1:0052 DELTA VS WYE
1:0053 SYNCHRONIZER TIMEOUT ALARM
1:0054 SYNCHRONIZER RECLOSE ALARM
1:0055 LOAD AT HIGH LIMIT ALARM
1:0056 LOAD AT LOW LIMIT ALARM
1:0057 PROCESS AT HIGH LIMIT ALARM
1:0058 PROCESS AT LOW LIMIT ALARM
1:0059 VOLTAGE RANGE ALARM
1:0060 VOLTAGE AT LOW LIMIT ALARM
1:0061 VOLTAGE AT HIGH LIMIT ALARM
1:0062 SYNCHRONIZER IN OFF MODE
1:0063 SYNCHRONIZER IN CHECK MODE
1:0064 SYNCHRONIZER IN PERMISSIVE MODE
1:0065 SYNCHRONIZER IN RUN MODE
1:0066 RECLOSE TIMER TIMING
1:0067 SYNC MAINTAINED FOR BKR DELAY
1:0068 CB AUX CLOSED (MOMENTARY)
1:0069 SYNCHRONIZER IN AUTO OFF MODE
1:0070 LCS DROOP MODE
1:0071 LCS UNLOAD BASELOAD MODE
1:0072 LCS BASE LOAD RAMP MODE
1:0073 LCS BASE LOAD MODE
1:0074 LCS BASE LOAD LOWER MODE
1:0075 LCS BASE LOAD RAISE MODE
1:0076 LCS REMOTE RAMP MODE
1:0077 LCS REMOTE MODE
1:0078 LCS UNLOAD PARALLEL MODE
1:0079 LCS PARALLEL RAMP MODE
1:0080 PARALLEL MODE
1:0081 LCS UNLOAD RAMP MODE
1:0082 LCS PROCESS RAMP MODE
1:0083 LCS PROCESS LOCAL MODE
1:0084 LCS PROCESS LOWER MODE
1:0085 LCS PROCESS RAISE MODE

1:0086 LCS PROCESS REMOTE MODE
1:0087 CHECK INPUT CLOSED
1:0088 PERMISSIVE INPUT CLOSED
1:0089 RUN INPUT CLOSED
1:0090 CB AUX INPUT CLOSED
1:0091 VOLTAGE RAISE INPUT CLOSED
1:0092 VOLTAGE LOWER INPUT CLOSED
1:0093 BASE LOAD INPUT CLOSED
1:0094 LOAD/UNLOAD INPUT CLOSED
1:0095 RAMP PAUSE INPUT CLOSED
1:0096 LOAD RAISE INPUT CLOSED
1:0097 LOAD LOWER INPUT CLOSED
1:0098 PROCESS ENABLE INPUT CLOSED
1:0099 VOLTAGE REGULATOR FAILURE
1:0100 DSLC WATCHDOG TIMER
1:0101 DSLC LON FAIL TO TRANSMIT
1:0102 DISCRETE IN MOD 1 CHANNEL 1
1:0103 DISCRETE IN MOD 1 CHANNEL 2
1:0104 DISCRETE IN MOD 1 CHANNEL 3
1:0105 DISCRETE IN MOD 1 CHANNEL 4
1:0106 DISCRETE IN MOD 1 CHANNEL 5
1:0107 DISCRETE IN MOD 1 CHANNEL 6
1:0108 DISCRETE IN MOD 1 CHANNEL 7
1:0109 DISCRETE IN MOD 1 CHANNEL 8
1:0110 DISCRETE IN MOD 1 CHANNEL 9
1:0111 DISCRETE IN MOD 1 CHANNEL 10
1:0112 DISCRETE IN MOD 1 CHANNEL 11
1:0113 DISCRETE IN MOD 1 CHANNEL 12
1:0114 DISCRETE IN MOD 1 CHANNEL 13
1:0115 DISCRETE IN MOD 1 CHANNEL 14
1:0116 DISCRETE IN MOD 1 CHANNEL 15
1:0117 DISCRETE IN MOD 1 CHANNEL 16
1:0118 DISCRETE IN MOD 2 CHANNEL 1
1:0119 DISCRETE IN MOD 2 CHANNEL 2
1:0120 DISCRETE IN MOD 2 CHANNEL 3
1:0121 DISCRETE IN MOD 2 CHANNEL 4
1:0122 DISCRETE IN MOD 2 CHANNEL 5
1:0123 DISCRETE IN MOD 2 CHANNEL 6
1:0124 DISCRETE IN MOD 2 CHANNEL 7
1:0125 DISCRETE IN MOD 2 CHANNEL 8
1:0126 DISCRETE IN MOD 2 CHANNEL 9
1:0127 DISCRETE IN MOD 2 CHANNEL 10
1:0128 DISCRETE IN MOD 2 CHANNEL 11
1:0129 DISCRETE IN MOD 2 CHANNEL 12
1:0130 DISCRETE IN MOD 2 CHANNEL 13
1:0131 DISCRETE IN MOD 2 CHANNEL 14
1:0132 DISCRETE IN MOD 2 CHANNEL 15
1:0133 DISCRETE IN MOD 2 CHANNEL 16
1:0134 DISCRETE IN MOD 3 CHANNEL 1
1:0135 DISCRETE IN MOD 3 CHANNEL 2
1:0136 DISCRETE IN MOD 3 CHANNEL 3
1:0137 DISCRETE IN MOD 3 CHANNEL 4
1:0138 DISCRETE IN MOD 3 CHANNEL 5
1:0139 DISCRETE IN MOD 3 CHANNEL 6
1:0140 DISCRETE IN MOD 3 CHANNEL 7
1:0141 DISCRETE IN MOD 3 CHANNEL 8
1:0142 DISCRETE IN MOD 3 CHANNEL 9
1:0143 DISCRETE IN MOD 3 CHANNEL 10
1:0144 DISCRETE IN MOD 3 CHANNEL 11
1:0145 DISCRETE IN MOD 3 CHANNEL 12
1:0146 DISCRETE IN MOD 3 CHANNEL 13
1:0147 DISCRETE IN MOD 3 CHANNEL 14
1:0148 DISCRETE IN MOD 3 CHANNEL 15
1:0149 DISCRETE IN MOD 3 CHANNEL 16
1:0150 DISCRETE IN MOD 4 CHANNEL 1
1:0151 DISCRETE IN MOD 4 CHANNEL 2
1:0152 DISCRETE IN MOD 4 CHANNEL 3
1:0153 DISCRETE IN MOD 4 CHANNEL 4
1:0154 DISCRETE IN MOD 4 CHANNEL 5
1:0155 DISCRETE IN MOD 4 CHANNEL 6
1:0156 DISCRETE IN MOD 4 CHANNEL 7
1:0157 DISCRETE IN MOD 4 CHANNEL 8
1:0158 DISCRETE IN MOD 4 CHANNEL 9
1:0159 DISCRETE IN MOD 4 CHANNEL 10

1:0160 DISCRETE IN MOD 4 CHANNEL 11
1:0161 DISCRETE IN MOD 4 CHANNEL 12
1:0162 DISCRETE IN MOD 4 CHANNEL 13
1:0163 DISCRETE IN MOD 4 CHANNEL 14
1:0164 DISCRETE IN MOD 4 CHANNEL 15
1:0165 DISCRETE IN MOD 4 CHANNEL 16
1:0166 LINKNET ADDRESS FAULT
1:0167 LINKNET TYPE FAULT

Analog Reads

Addr Description
3:0001 ENGINE SPEED (rpm)
3:0002 SPEED REFERENCE (rpm)
3:0003 BIASED SPEED REFERENCE (rpm)
3:0004 ACTUATOR OUTPUT (%)
3:0005 GENERATOR OUTPUT (kW)
3:0006 REMOTE SPEED REF (rpm)
3:0007
3:0008 DSLC INPUT (volts)
3:0009 LOAD PULSE INPUT(volts)
3:0010
3:0011 MAP SENSOR INPUT (eng unit)
3:0012 SPEED INPUT #1 (rpm)
3:0013 SPEED INPUT #2 (rpm)
3:0014 FIRST OUT MINOR ALARM
3:0015 FIRST OUT MAJOR ALARM
3:0016 A PHASE VOLTAGE
3:0017 B PHASE VOLTAGE
3:0018 C PHASE VOLTAGE
3:0019 BUS VOLTAGE
3:0020 GENERATOR POWER FACTOR
3:0021 POTENTIAL TRANSFORMER RATIO
3:0022 A PHASE CURRENT
3:0023 B PHASE CURRENT
3:0024 C PHASE CURRENT
3:0025 LOAD REFERENCE
3:0026 PROCESS REFERENCE
3:0027 CURRENT TRANSFORMER RATIO
3:0028 GEN ACTIVE POWER OUTPUT
3:0029 GEN REACTIVE POWER OUTPUT
3:0030 GEN APPARENT POWER OUTPUT
3:0031 GEN FREQUENCY
3:0032 BUS FREQUENCY
3:0033 TC MODULE 1 CHANNEL 1
3:0034 TC MODULE 1 CHANNEL 2
3:0035 TC MODULE 1 CHANNEL 3
3:0036 TC MODULE 1 CHANNEL 4
3:0037 TC MODULE 1 CHANNEL 5
3:0038 TC MODULE 1 CHANNEL 6
3:0039 TC MODULE 2 CHANNEL 1
3:0040 TC MODULE 2 CHANNEL 2
3:0041 TC MODULE 2 CHANNEL 3
3:0042 TC MODULE 2 CHANNEL 4
3:0043 TC MODULE 2 CHANNEL 5
3:0044 TC MODULE 2 CHANNEL 6
3:0045 TC MODULE 3 CHANNEL 1
3:0046 TC MODULE 3 CHANNEL 2
3:0047 TC MODULE 3 CHANNEL 3
3:0048 TC MODULE 3 CHANNEL 4
3:0049 TC MODULE 3 CHANNEL 5
3:0050 TC MODULE 3 CHANNEL 6
3:0051 TC MODULE 4 CHANNEL 1
3:0052 TC MODULE 4 CHANNEL 2
3:0053 TC MODULE 4 CHANNEL 3
3:0054 TC MODULE 4 CHANNEL 4
3:0055 TC MODULE 4 CHANNEL 5
3:0056 TC MODULE 4 CHANNEL 6
3:0057 RTD MODULE 1 CHANNEL 1
3:0058 RTD MODULE 1 CHANNEL 2
3:0059 RTD MODULE 1 CHANNEL 3
3:0060 RTD MODULE 1 CHANNEL 4
3:0061 RTD MODULE 1 CHANNEL 5
3:0062 RTD MODULE 1 CHANNEL 6

3:0063 RTD MODULE 2 CHANNEL 1
3:0064 RTD MODULE 2 CHANNEL 2
3:0065 RTD MODULE 2 CHANNEL 3
3:0066 RTD MODULE 2 CHANNEL 4
3:0067 RTD MODULE 2 CHANNEL 5
3:0068 RTD MODULE 2 CHANNEL 6
3:0069 RTD MODULE 3 CHANNEL 1
3:0070 RTD MODULE 3 CHANNEL 2
3:0071 RTD MODULE 3 CHANNEL 3
3:0072 RTD MODULE 3 CHANNEL 4
3:0073 RTD MODULE 3 CHANNEL 5
3:0074 RTD MODULE 3 CHANNEL 6
3:0075 ANALOG IN MODULE 1 CHANNEL 1
3:0076 ANALOG IN MODULE 1 CHANNEL 2
3:0077 ANALOG IN MODULE 1 CHANNEL 3
3:0078 ANALOG IN MODULE 1 CHANNEL 4
3:0079 ANALOG IN MODULE 1 CHANNEL 5
3:0080 ANALOG IN MODULE 1 CHANNEL 6
3:0081 ANALOG IN MODULE 2 CHANNEL 1
3:0082 ANALOG IN MODULE 2 CHANNEL 2
3:0083 ANALOG IN MODULE 2 CHANNEL 3
3:0084 ANALOG IN MODULE 2 CHANNEL 4
3:0085 ANALOG IN MODULE 2 CHANNEL 5
3:0086 ANALOG IN MODULE 2 CHANNEL 6

Analog Writes

Addr Description
4:0001 SPARE ANALOG OUTPUT
4:0002 ANALOG OUT CHANNEL 1
4:0003 ANALOG OUT CHANNEL 2
4:0004 ANALOG OUT CHANNEL 3
4:0005 ANALOG OUT CHANNEL 4
4:0006 ANALOG OUT CHANNEL 5
4:0007 ANALOG OUT CHANNEL 6

Appendix D.
Modbus Slave Address Information

Part Numbers 9907-033/-034
(with torsional filtering)

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

NOTE:
This listing is for Modbus port J3
Modbus port J2 is identical with the only
“WRITE” command being ACKNOWLEDGE ALARMS

Boolean Writes

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

Boolean Reads

Addr Description
1:0001 REMOTE SPD ENABLED
1:0002 MIN FUEL CONTACT
1:0003 IDLE/RATED CONTACT
1:0004 RAISE SPEED CONTACT
1:0005 LOWER SPEED CONTACT
1:0006 FAIL SAFE OVERRIDE
1:0007 EXT ACKNOWLEDGE
1:0008 2nd DYNAMICS CONTACT
1:0009 ISOCH/DROOP CONTACT
1:0010 TORSIONAL FILTER ENABLED
1:0011 ACT ON TORSIONAL FILTER

1:0012
1:0013 MPU 1 FAILED
1:0014 MPU 2 FAILED
1:0015 MINOR ALARM RELAY
1:0016 MPU 1 FAILURE MI/ALM
1:0017 MPU 2 FAILURE MI/ALM
1:0018 MPU 1 AND 2 FAILURE MI/ALM
1:0019 TORSIONAL LEVEL MI/ALM
1:0020 REM SPD XDCR FAILURE MI/ALM
1:0021 MAP XDCR FAILURE MI/ALM
1:0022 HIGH KW OUTPUT MI/ALM
1:0023 HIGH ACTUATOR OUTPUT MI/ALM
1:0024
1:0025 OVERSPEED MI/ALM
1:0026 LON FAIL TO TRANSMIT MI/ALM
1:0027 MAJOR ALARM RELAY
1:0028 MPU 1 FAILURE MA/ALM
1:0029 MPU 2 FAILURE MA/ALM
1:0030 MPU 1 AND 2 FAILURE MA/ALM
1:0031 TORSIONAL LEVEL MA/ALM
1:0032 REM SPD XDCR FAILURE MA/ALM
1:0033 MAP XDCR FAILURE MA/ALM
1:0034 HIGH KW OUTPUT MA/ALM
1:0035 HIGH ACTUATOR OUTPUT MA/ALM
1:0036
1:0037 OVERSPEED MA/ALM
1:0038 LON FAIL TO TRANSMIT MA/ALM
1:0039 ACT ON SPD CONTROL
1:0040 ACT ON START LIMIT
1:0041 ACT ON MAX LIMITER
1:0042 ACT ON MAP LIMITER
1:0043 ACT SHUTDOWN
1:0044 ALARM RELAY
1:0045 LOW LIMIT RELAY
1:0046 HIGH LIMIT RELAY
1:0047 LOAD SWITCH RELAY
1:0048 VOLTAGE LOWER RELAY
1:0049 VOLTAGE RAISE RELAY
1:0050 BREAKER OPEN RELAY
1:0051 BREAKER CLOSE RELAY
1:0052 DELTA VS WYE
1:0053 SYNCHRONIZER TIMEOUT ALARM
1:0054 SYNCHRONIZER RECLOSE ALARM
1:0055 LOAD AT HIGH LIMIT ALARM
1:0056 LOAD AT LOW LIMIT ALARM
1:0057 PROCESS AT HIGH LIMIT ALARM
1:0058 PROCESS AT LOW LIMIT ALARM
1:0059 VOLTAGE RANGE ALARM
1:0060 VOLTAGE AT LOW LIMIT ALARM
1:0061 VOLTAGE AT HIGH LIMIT ALARM
1:0062 SYNCHRONIZER IN OFF MODE
1:0063 SYNCHRONIZER IN CHECK MODE
1:0064 SYNCHRONIZER IN PERMISSIVE MODE
1:0065 SYNCHRONIZER IN RUN MODE
1:0066 RECLOSE TIMER TIMING
1:0067 SYNC MAINTAINED FOR BKR DELAY
1:0068 CB AUX CLOSED (MOMENTARY)
1:0069 SYNCHRONIZER IN AUTO OFF MODE
1:0070 LCS DROOP MODE
1:0071 LCS UNLOAD BASELOAD MODE
1:0072 LCS BASE LOAD RAMP MODE
1:0073 LCS BASE LOAD MODE
1:0074 LCS BASE LOAD LOWER MODE
1:0075 LCS BASE LOAD RAISE MODE
1:0076 LCS REMOTE RAMP MODE
1:0077 LCS REMOTE MODE
1:0078 LCS UNLOAD PARALLEL MODE
1:0079 LCS PARALLEL RAMP MODE
1:0080 PARALLEL MODE
1:0081 LCS UNLOAD RAMP MODE
1:0082 LCS PROCESS RAMP MODE
1:0083 LCS PROCESS LOCAL MODE
1:0084 LCS PROCESS LOWER MODE
1:0085 LCS PROCESS RAISE MODE

1:0086	LCS PROCESS REMOTE MODE
1:0087	CHECK INPUT CLOSED
1:0088	PERMISSIVE INPUT CLOSED
1:0089	RUN INPUT CLOSED
1:0090	CB AUX INPUT CLOSED
1:0091	VOLTAGE RAISE INPUT CLOSED
1:0092	VOLTAGE LOWER INPUT CLOSED
1:0093	BASE LOAD INPUT CLOSED
1:0094	LOAD/UNLOAD INPUT CLOSED
1:0095	RAMP PAUSE INPUT CLOSED
1:0096	LOAD RAISE INPUT CLOSED
1:0097	LOAD LOWER INPUT CLOSED
1:0098	PROCESS ENABLE INPUT CLOSED
1:0099	VOLTAGE REGULATOR FAILURE
1:0100	DSLC WATCHDOG TIMER
1:0101	DSLC LON FAIL TO TRANSMIT
1:0102	DISCRETE IN MOD 1 CHANNEL 1
1:0103	DISCRETE IN MOD 1 CHANNEL 2
1:0104	DISCRETE IN MOD 1 CHANNEL 3
1:0105	DISCRETE IN MOD 1 CHANNEL 4
1:0106	DISCRETE IN MOD 1 CHANNEL 5
1:0107	DISCRETE IN MOD 1 CHANNEL 6
1:0108	DISCRETE IN MOD 1 CHANNEL 7
1:0109	DISCRETE IN MOD 1 CHANNEL 8
1:0110	DISCRETE IN MOD 1 CHANNEL 9
1:0111	DISCRETE IN MOD 1 CHANNEL 10
1:0112	DISCRETE IN MOD 1 CHANNEL 11
1:0113	DISCRETE IN MOD 1 CHANNEL 12
1:0114	DISCRETE IN MOD 1 CHANNEL 13
1:0115	DISCRETE IN MOD 1 CHANNEL 14
1:0116	DISCRETE IN MOD 1 CHANNEL 15
1:0117	DISCRETE IN MOD 1 CHANNEL 16
1:0118	DISCRETE IN MOD 2 CHANNEL 1
1:0119	DISCRETE IN MOD 2 CHANNEL 2
1:0120	DISCRETE IN MOD 2 CHANNEL 3
1:0121	DISCRETE IN MOD 2 CHANNEL 4
1:0122	DISCRETE IN MOD 2 CHANNEL 5
1:0123	DISCRETE IN MOD 2 CHANNEL 6
1:0124	DISCRETE IN MOD 2 CHANNEL 7
1:0125	DISCRETE IN MOD 2 CHANNEL 8
1:0126	DISCRETE IN MOD 2 CHANNEL 9
1:0127	DISCRETE IN MOD 2 CHANNEL 10
1:0128	DISCRETE IN MOD 2 CHANNEL 11
1:0129	DISCRETE IN MOD 2 CHANNEL 12
1:0130	DISCRETE IN MOD 2 CHANNEL 13
1:0131	DISCRETE IN MOD 2 CHANNEL 14
1:0132	DISCRETE IN MOD 2 CHANNEL 15
1:0133	DISCRETE IN MOD 2 CHANNEL 16
1:0134	DISCRETE IN MOD 3 CHANNEL 1
1:0135	DISCRETE IN MOD 3 CHANNEL 2
1:0136	DISCRETE IN MOD 3 CHANNEL 3
1:0137	DISCRETE IN MOD 3 CHANNEL 4
1:0138	DISCRETE IN MOD 3 CHANNEL 5
1:0139	DISCRETE IN MOD 3 CHANNEL 6
1:0140	DISCRETE IN MOD 3 CHANNEL 7
1:0141	DISCRETE IN MOD 3 CHANNEL 8
1:0142	DISCRETE IN MOD 3 CHANNEL 9
1:0143	DISCRETE IN MOD 3 CHANNEL 10
1:0144	DISCRETE IN MOD 3 CHANNEL 11
1:0145	DISCRETE IN MOD 3 CHANNEL 12
1:0146	DISCRETE IN MOD 3 CHANNEL 13
1:0147	DISCRETE IN MOD 3 CHANNEL 14
1:0148	DISCRETE IN MOD 3 CHANNEL 15
1:0149	DISCRETE IN MOD 3 CHANNEL 16
1:0150	DISCRETE IN MOD 4 CHANNEL 1
1:0151	DISCRETE IN MOD 4 CHANNEL 2
1:0152	DISCRETE IN MOD 4 CHANNEL 3
1:0153	DISCRETE IN MOD 4 CHANNEL 4
1:0154	DISCRETE IN MOD 4 CHANNEL 5
1:0155	DISCRETE IN MOD 4 CHANNEL 6
1:0156	DISCRETE IN MOD 4 CHANNEL 7
1:0157	DISCRETE IN MOD 4 CHANNEL 8
1:0158	DISCRETE IN MOD 4 CHANNEL 9
1:0159	DISCRETE IN MOD 4 CHANNEL 10

1:0160	DISCRETE IN MOD 4 CHANNEL 11
1:0161	DISCRETE IN MOD 4 CHANNEL 12
1:0162	DISCRETE IN MOD 4 CHANNEL 13
1:0163	DISCRETE IN MOD 4 CHANNEL 14
1:0164	DISCRETE IN MOD 4 CHANNEL 15
1:0165	DISCRETE IN MOD 4 CHANNEL 16
1:0166	LINKNET ADDRESS FAULT
1:0167	LINKNET TYPE FAULT

Analog Reads

Addr	Description
3:0001	ENGINE SPEED (rpm)
3:0002	SPEED REFERENCE (rpm)
3:0003	BIASED SPEED REFERENCE (rpm)
3:0004	ACTUATOR OUTPUT (%)
3:0005	GENERATOR OUTPUT (kW)
3:0006	REMOTE SPEED REF (rpm)
3:0007	
3:0008	DSLC INPUT (volts)
3:0009	LOAD PULSE INPUT(volts)
3:0010	TORSIONAL LEVEL(%)
3:0011	MAP SENSOR INPUT (eng unit)
3:0012	SPEED INPUT #1 (rpm)
3:0013	SPEED INPUT #2 (rpm)
3:0014	FIRST OUT MINOR ALARM
3:0015	FIRST OUT MAJOR ALARM
3:0016	A PHASE VOLTAGE
3:0017	B PHASE VOLTAGE
3:0018	C PHASE VOLTAGE
3:0019	BUS VOLTAGE
3:0020	GENERATOR POWER FACTOR
3:0021	POTENTIAL TRANSFORMER RATIO
3:0022	A PHASE CURRENT
3:0023	B PHASE CURRENT
3:0024	C PHASE CURRENT
3:0025	LOAD REFERENCE
3:0026	PROCESS REFERENCE
3:0027	CURRENT TRANSFORMER RATIO
3:0028	GEN ACTIVE POWER OUTPUT
3:0029	GEN REACTIVE POWER OUTPUT
3:0030	GEN APPARENT POWER OUTPUT
3:0031	GEN FREQUENCY
3:0032	BUS FREQUENCY
3:0033	TC MODULE 1 CHANNEL 1
3:0034	TC MODULE 1 CHANNEL 2
3:0035	TC MODULE 1 CHANNEL 3
3:0036	TC MODULE 1 CHANNEL 4
3:0037	TC MODULE 1 CHANNEL 5
3:0038	TC MODULE 1 CHANNEL 6
3:0039	TC MODULE 2 CHANNEL 1
3:0040	TC MODULE 2 CHANNEL 2
3:0041	TC MODULE 2 CHANNEL 3
3:0042	TC MODULE 2 CHANNEL 4
3:0043	TC MODULE 2 CHANNEL 5
3:0044	TC MODULE 2 CHANNEL 6
3:0045	TC MODULE 3 CHANNEL 1
3:0046	TC MODULE 3 CHANNEL 2
3:0047	TC MODULE 3 CHANNEL 3
3:0048	TC MODULE 3 CHANNEL 4
3:0049	TC MODULE 3 CHANNEL 5
3:0050	TC MODULE 3 CHANNEL 6
3:0051	TC MODULE 4 CHANNEL 1
3:0052	TC MODULE 4 CHANNEL 2
3:0053	TC MODULE 4 CHANNEL 3
3:0054	TC MODULE 4 CHANNEL 4
3:0055	TC MODULE 4 CHANNEL 5
3:0056	TC MODULE 4 CHANNEL 6
3:0057	RTD MODULE 1 CHANNEL 1
3:0058	RTD MODULE 1 CHANNEL 2
3:0059	RTD MODULE 1 CHANNEL 3
3:0060	RTD MODULE 1 CHANNEL 4
3:0061	RTD MODULE 1 CHANNEL 5
3:0062	RTD MODULE 1 CHANNEL 6

3:0063	RTD MODULE 2 CHANNEL 1
3:0064	RTD MODULE 2 CHANNEL 2
3:0065	RTD MODULE 2 CHANNEL 3
3:0066	RTD MODULE 2 CHANNEL 4
3:0067	RTD MODULE 2 CHANNEL 5
3:0068	RTD MODULE 2 CHANNEL 6
3:0069	RTD MODULE 3 CHANNEL 1
3:0070	RTD MODULE 3 CHANNEL 2
3:0071	RTD MODULE 3 CHANNEL 3
3:0072	RTD MODULE 3 CHANNEL 4
3:0073	RTD MODULE 3 CHANNEL 5
3:0074	RTD MODULE 3 CHANNEL 6
3:0075	ANALOG IN MODULE 1 CHANNEL 1
3:0076	ANALOG IN MODULE 1 CHANNEL 2
3:0077	ANALOG IN MODULE 1 CHANNEL 3
3:0078	ANALOG IN MODULE 1 CHANNEL 4
3:0079	ANALOG IN MODULE 1 CHANNEL 5
3:0080	ANALOG IN MODULE 1 CHANNEL 6
3:0081	ANALOG IN MODULE 2 CHANNEL 1
3:0082	ANALOG IN MODULE 2 CHANNEL 2
3:0083	ANALOG IN MODULE 2 CHANNEL 3
3:0084	ANALOG IN MODULE 2 CHANNEL 4
3:0085	ANALOG IN MODULE 2 CHANNEL 5
3:0086	ANALOG IN MODULE 2 CHANNEL 6

Analog Writes

Addr	Description
4:0001	SPARE ANALOG OUTPUT
4:0002	ANALOG OUT CHANNEL 1
4:0003	ANALOG OUT CHANNEL 2
4:0004	ANALOG OUT CHANNEL 3
4:0005	ANALOG OUT CHANNEL 4
4:0006	ANALOG OUT CHANNEL 5
4:0007	ANALOG OUT CHANNEL 6

Appendix E.
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.

From the Main Menu Header press 'ID' to get the Software Part Number and revision level.

Record Here _____

	CONFIGURE	
Menu Item	**Default (Low, High)**	**As Left**
CFIG SPEED CONTROL		
RATED SPEED	#1200 (1, 2100)	
AMPU #1 TEETH	#60 (4, 500)	
AMPU 1 MAX FREQ	#1440 (10, 17500)	
AMPU #2 TEETH	#60 (4, 500)	
AMPU 2 MAX FREQ	#1440 (10, 17500)	
REVERSE ACTING ?	#FALSE	
DMPU #1 TEETH	#60 (4, 500)	
DMPU #2 TEETH	#60 (4, 500)	
ENABLE TORS FILTER	#FALSE	
CFIG MINOR ALARM		
MPU 1 FAIL	#FALSE	
MPU 2 FAIL	#FALSE	
MPU 1 AND 2 FAIL	#FALSE	
REM SPD XDCR FAIL	#FALSE	
MAP XDCR FAIL	#FALSE	
HIGH KW ALM	#FALSE	
HIGH KW SET POINT	#0.0 (0.0, 30000.0)	
HIGH KW DELAY	#10.0 (0.0, 10800.0)	
HI ACT OUTPUT ALM	#FALSE	
HIGH ACT SET POINT	*0.0 (0.0, 100.0)	
HIGH ACT DELAY	#10.0 (0.0, 10800.0)	
OVERSPEED ALM	#FALSE	
OVERSPEED SET POINT	#0.0 (0.0, 2500.0)	
OVERSPEED DELAY	#10.0 (0.0, 10800.0)	
FAIL TO XMIT ALM	#FALSE	
HIGH TORSION ALARM	#FALSE	
TORSION LEVEL SETPT(%RPM)	*0.0 (0.0, 100.0)	
TORSIONAL DELAY	#10.0 (0.0, 10800.0)	
CFIG MAJOR ALARM		
MPU 1 FAIL	#FALSE	
MPU 2 FAIL	#FALSE	
MPU 1 AND 2 FAIL	#FALSE	
REM SPD XDCR FAIL	#FALSE	
MAP XDCR FAIL	#FALSE	
HIGH KW ALM	#FALSE	
HIGH KW SET POINT	#0.0 (0.0, 30000.0)	
HIGH KW DELAY	#10.0 (0.0, 10800.0)	
HI ACT OUTPUT ALM	#FALSE	
HIGH ACT SET POINT	*0.0 (0.0, 100.0)	
HIGH ACT DELAY	#10.0 (0.0, 10800.0)	
OVERSPEED ALM	#FALSE	
OVERSPEED SET POINT	#0.0 (0.0, 2500.0)	
OVERSPEED DELAY	#10.0 (0.0, 10800.0)	
FAIL TO XMIT ALM	#FALSE	
HIGH TORSION ALARM	#FALSE	
TORSION LEVEL SETPT(%RPM)	*0.0 (0.0, 100.0)	
TORSIONAL DELAY	#10.0 (0.0, 10800.0)	

CFIG COMMUNICATION		
PORT3 Mode	#2 (1, 2)	
PORT 3 Address	#1 (1, 247)	
PORT 2 Address	#1 (1, 247)	
CFIG ANALOG OUTPUTS		
AOUT 1 SELECTION	*4 (1, 8)	
AOUT 1 4-20 mA?	*TRUE	
AOUT 2 SELECTION	*5 (1, 8)	
AOUT 2 4-20 mA?	*TRUE	
ACT OUT 1 0-200mA?	*TRUE	
ACT OUT 2 SELECTION	*1 (1, 8)	
ACT OUT 2 4-20 mA?	*TRUE	

	SERVICE	
Menu Item	**Default (Low, High)**	**As Left**
1st DYNAMICS		
GAIN 1	*10.0 (0.0015, 1000.0)	
RESET 1	*0.35 (0.0, 10.0)	
COMPENSATION 1	*0.2 (0.0, 10.0)	
GAIN RATIO 1	*1.0 (1.0, 20.0)	
WINDOW WIDTH 1	*60.0 (0.0, 2100.0)	
GAIN SLOPE BK PNT 1	*20.0 (0.0, 100.0)	
GAIN SLOPE 1	*0.0 (-50.0, 50.0)	
SPEED FILTER 1	*15.0 (0.0, 20.0)	
BUMP ACT	*FALSE	
2nd DYNAMICS		
GAIN 2	*10.0 (0.0015, 1000.0)	
RESET 2	*0.35 (0.0, 10.0)	
COMPENSATION 2	*0.2 (0.0, 10.0)	
GAIN RATIO 2	*1.0 (1.0, 20.0)	
WINDOW WIDTH 2	*60.0 (0.0, 2100.0)	
GAIN SLOPE BK PNT 2	*20.0 (0.0, 100.0)	
GAIN SLOPE 2	*0.0 (-50.0, 50.0)	
SPEED FILTER 2	*15.0 (0.0, 20.0)	
BUMP ACT	*FALSE	
SPEED SETTING		
RAISE SPEED LIMIT	*1300 (1, 2100)	
LOWER SPEED LIMIT	*1100 (1, 2100)	
IDLE SPEED	*750 (1, 2100)	
ACCEL RAMP TIME	*8.0 (0.0, 500.0)	
DECEL RAMP TIME	*8.0 (0.0, 500.0)	
RAISE SPEED RATE	*100.0 (0.0, 5000.0)	
LOWER SPEED RATE	*100.0 (0.0, 5000.0)	
4mA REMOTE REF	*1100.0 (0.0, 2100.0)	
20mA REMOTE REF	*1300.0 (0.0, 2100.0)	
REM REF FAIL LOCK	*TRUE	
ENABLE SPEED FILTER	*FALSE	
SELECT DIGITAL MPU	*FALSE	
TORSIONAL FILTER		
ENABLE TORS FILTER	*FALSE	
ENG SENSOR WEIGHT	*0.5(0.0,1.0)	
TORS SCALE (%RATED)	*1.0(0.0,100.0)	
TORSNL FUEL LIMIT (%FD)	*100.0(0.0,100.0)	
TORSNL LEVEL @LIMIT(%)	*100.0(0.001,100.0)	
TORSNL LEVEL @CLEAR(%)	*0.001(0.001,100.0)	
KW SETTING		
LOAD DROOP PERCENT	*5.0 (0.0, 100.0)	
ACT OUT @ NO LOAD	*20.0 (0.0, 100.0)	
ACT OUT @ FULL LOAD	*80.0 (0.0, 100.0)	
FUEL LIMITERS		
START FUEL LIMIT	*100.0 (0.0, 100.0)	
START RAMP %/sec	*0.0 (0.0, 20.0)	
MAX FUEL LIMIT	*100.0 (0.0, 100.0)	

MAP LIMITER		
ENABLE MAP LIMIT	*FALSE	
MAP BREAKPOINT A	*6.0 (0.0, 500.0)	
FUEL LIMIT AT BP A	*20.0 (0.0, 100.0)	
MAP BREAKPOINT B	*8.0 (0.0, 500.0)	
FUEL LIMIT AT BP B	*40.0 (0.0, 100.0)	
MAP BREAKPOINT C	*10.0 (0.0, 500.0)	
FUEL LIMIT AT BP C	*60.0 (0.0, 100.0)	
MAP BREAKPOINT D	*15.0 (0.0, 500.0)	
FUEL LIMIT AT BP D	*80.0 (0.0, 100.0)	
MAP BREAKPOINT E	*20.0 (0.0, 500.0)	
FUEL LIMIT AT BP E	*100.0 (0.0, 100.0)	
MAP @ 4mA	*0.0 (0.0, 500.0)	
MAP @ 20mA	*0.0 (0.0, 500.0)	
MISCELLANEOUS		
ACKNOWLEDGE ALARMS	*FALSE	
LON SERVICE PIN	*FALSE	
DSLC NODE FAULT	DISPLAY ONLY	
LINKNET ADDR FAULT	DISPLAY ONLY	
LINKNET TYPE FAULT	DISPLAY ONLY	
SERIAL PORT SETUP		
PORT3 HARDWARE CFIG	*1 (1, 3)	
PORT 3 BAUD RATE	*7 (1, 7)	
PORT 3 STOP BITS	*1 (1, 3)	
PORT 3 PARITY	*1 (1, 3)	
PORT2 HARDWARE CFIG	*1 (1, 3)	
PORT 2 BAUD RATE	*7 (1, 7)	
PORT 2 STOP BITS	*1 (1, 3)	
PORT 2 PARITY	*1 (1, 3)	
TUNE ANALOG OUTPUTS		
ANALOG OUTPUT 1 MIN	*0.0 (-30000.0, 30000.0)	
ANALOG OUTPUT 1 MAX	*1800.0 (-30000.0, 30000.0)	
ANALOG OUTPUT 2 MIN	*0.0 (-30000.0, 30000.0)	
ANALOG OUTPUT 2 MAX	*100.0 (-30000.0, 30000.0)	
ACTUATOR OUT 1 MIN	*0.0 (-20.0, 135.0)	
ACTUATOR OUT 1 MAX	*100.0 (-20.0, 135.0)	
ACTUATOR OUT 2 MIN	*0.0 (-30000.0, 30000.0)	
ACTUATOR OUT 2 MAX	*100.0 (-30000.0, 30000.0)	
ACTUATOR CONTROL		
ACT ON SPD CONTROL	DISPLAY ONLY	
ACT ON START LIMIT	DISPLAY ONLY	
ACT ON MAX LIMITER	DISPLAY ONLY	
ACT ON MAP LIMITER	DISPLAY ONLY	
ACT SHUTDOWN	DISPLAY ONLY	
ACTUATOR BUMP		
BUMP ENABLE	*FALSE	
ACT BUMP LEVEL	*1.0 (0.0, 100.0)	
ACT BUMP DURATION	*0.1 (0.10, 2.0)	
DISPLAY MENU 1		
ENGINE SPEED	DISPLAY ONLY	
SPEED REFERENCE	DISPLAY ONLY	
BIASED SPEED REF	DISPLAY ONLY	
BIAS FROM DROOP	DISPLAY ONLY	
BIAS FROM DSLC	DISPLAY ONLY	
BIAS FROM LD PULSE	DISPLAY ONLY	
TORSIONAL LEVEL(%)	DISPLAY ONLY	
KW LOAD	DISPLAY ONLY	
FUEL DEMAND	DISPLAY ONLY	
REMOTE SPEED REF	DISPLAY ONLY	
REMOTE ENABLED	DISPLAY ONLY	
DSLC INPUT	DISPLAY ONLY	
MAP LIMIT	DISPLAY ONLY	
MAP INPUT	DISPLAY ONLY	
LOAD PULSE INPUT	DISPLAY ONLY	
TORSNL FILTR ACTIVE	DISPLAY ONLY	

DISPLAY MENU 2		
SPEED INPUT #1	DISPLAY ONLY	
SPEED INPUT #2	DISPLAY ONLY	
CLOSE TO RUN	DISPLAY ONLY	
IDLE/RATED	DISPLAY ONLY	
LOWER SPEED	DISPLAY ONLY	
RAISE SPEED	DISPLAY ONLY	
2nd DYNAMICS	DISPLAY ONLY	
FAIL SAFE OVERRIDE	DISPLAY ONLY	
EXT ACKNOWLEDGE	DISPLAY ONLY	
ISOCH/DROOP	DISPLAY ONLY	
MPU1 FAILED	DISPLAY ONLY	
MPU2 FAILED	DISPLAY ONLY	
MINOR ALARM MENU		
1-MPU 1 FAIL	DISPLAY ONLY	
2-MPU 2 FAIL	DISPLAY ONLY	
3-MPU 1 AND 2 FAIL	DISPLAY ONLY	
4-REM SPD IN FAIL	DISPLAY ONLY	
5-MAP XDCR FAIL	DISPLAY ONLY	
6-HIGH KW ALM	DISPLAY ONLY	
7-HI ACT OUTPUT ALM	DISPLAY ONLY	
8-OVERSPEED ALM	DISPLAY ONLY	
9-FAIL TO XMIT ALM	DISPLAY ONLY	
10-TORSIONAL ALM	DISPLAY ONLY	
FIRST MINOR ALARM	DISPLAY ONLY	
MAJOR ALARM MENU		
1-MPU 1 FAIL	DISPLAY ONLY	
2-MPU 2 FAIL	DISPLAY ONLY	
3-MPU 1 AND 2 FAIL	DISPLAY ONLY	
4-REM SPD IN FAIL	DISPLAY ONLY	
5-MAP XDCR FAIL	DISPLAY ONLY	
6-HIGH KW ALM	DISPLAY ONLY	
7-HI ACT OUTPUT ALM	DISPLAY ONLY	
8-OVERSPEED ALM	DISPLAY ONLY	
9-FAIL TO XMIT ALM	DISPLAY ONLY	
10-TORSIONAL ALM	DISPLAY ONLY	
FIRST MAJOR ALARM	DISPLAY ONLY	
TC MODULE 1		
CH1 - TC DEGREES F	DISPLAY ONLY	
CH2 - TC DEGREES F	DISPLAY ONLY	
CH3 - TC DEGREES F	DISPLAY ONLY	
CH4 - TC DEGREES F	DISPLAY ONLY	
CH5 - TC DEGREES F	DISPLAY ONLY	
CH6 - TC DEGREES F	DISPLAY ONLY	
TC MODULE 2		
CH1 - TC DEGREES F	DISPLAY ONLY	
CH2 - TC DEGREES F	DISPLAY ONLY	
CH3 - TC DEGREES F	DISPLAY ONLY	
CH4 - TC DEGREES F	DISPLAY ONLY	
CH5 - TC DEGREES F	DISPLAY ONLY	
CH6 - TC DEGREES F	DISPLAY ONLY	
TC MODULE 3		
CH1 - TC DEGREES F	DISPLAY ONLY	
CH2 - TC DEGREES F	DISPLAY ONLY	
CH3 - TC DEGREES F	DISPLAY ONLY	
CH4 - TC DEGREES F	DISPLAY ONLY	
CH5 - TC DEGREES F	DISPLAY ONLY	
CH6 - TC DEGREES F	DISPLAY ONLY	
TC MODULE 4		
CH1 - TC DEGREES F	DISPLAY ONLY	
CH2 - TC DEGREES F	DISPLAY ONLY	
CH3 - TC DEGREES F	DISPLAY ONLY	
CH4 - TC DEGREES F	DISPLAY ONLY	
CH5 - TC DEGREES F	DISPLAY ONLY	
CH6 - TC DEGREES F	DISPLAY ONLY	

RTD MODULE 1		
CH1 - RTD DEGREES F	DISPLAY ONLY	
CH2 - RTD DEGREES F	DISPLAY ONLY	
CH3 - RTD DEGREES F	DISPLAY ONLY	
CH4 - RTD DEGREES F	DISPLAY ONLY	
CH5 - RTD DEGREES F	DISPLAY ONLY	
CH6 - RTD DEGREES F	DISPLAY ONLY	
RTD MODULE 2		
CH1 - RTD DEGREES F	DISPLAY ONLY	
CH2 - RTD DEGREES F	DISPLAY ONLY	
CH3 - RTD DEGREES F	DISPLAY ONLY	
CH4 - RTD DEGREES F	DISPLAY ONLY	
CH5 - RTD DEGREES F	DISPLAY ONLY	
CH6 - RTD DEGREES F	DISPLAY ONLY	
RTD MODULE 3		
CH1 - RTD DEGREES F	DISPLAY ONLY	
CH2 - RTD DEGREES F	DISPLAY ONLY	
CH3 - RTD DEGREES F	DISPLAY ONLY	
CH4 - RTD DEGREES F	DISPLAY ONLY	
CH5 - RTD DEGREES F	DISPLAY ONLY	
CH6 - RTD DEGREES F	DISPLAY ONLY	
AI MODULE 1		
CH1 - mA IN PERCENT	DISPLAY ONLY	
CH2 - mA IN PERCENT	DISPLAY ONLY	
CH3 - mA IN PERCENT	DISPLAY ONLY	
CH4 - mA IN PERCENT	DISPLAY ONLY	
CH5 - mA IN PERCENT	DISPLAY ONLY	
CH6 - mA IN PERCENT	DISPLAY ONLY	
AI MODULE 2		
CH1 - mA IN PERCENT	DISPLAY ONLY	
CH2 - mA IN PERCENT	DISPLAY ONLY	
CH3 - mA IN PERCENT	DISPLAY ONLY	
CH4 - mA IN PERCENT	DISPLAY ONLY	
CH5 - mA IN PERCENT	DISPLAY ONLY	
CH6 - mA IN PERCENT	DISPLAY ONLY	
DI MODULE 1		
CH1 CONTACT CLOSED	DISPLAY ONLY	
CH2 CONTACT CLOSED	DISPLAY ONLY	
CH3 CONTACT CLOSED	DISPLAY ONLY	
CH4 CONTACT CLOSED	DISPLAY ONLY	
CH5 CONTACT CLOSED	DISPLAY ONLY	
CH6 CONTACT CLOSED	DISPLAY ONLY	
CH7 CONTACT CLOSED	DISPLAY ONLY	
CH8 CONTACT CLOSED	DISPLAY ONLY	
CH9 CONTACT CLOSED	DISPLAY ONLY	
CH10 CONTACT CLOSED	DISPLAY ONLY	
CH11 CONTACT CLOSED	DISPLAY ONLY	
CH12 CONTACT CLOSED	DISPLAY ONLY	
CH13 CONTACT CLOSED	DISPLAY ONLY	
CH14 CONTACT CLOSED	DISPLAY ONLY	
CH15 CONTACT CLOSED	DISPLAY ONLY	
CH16 CONTACT CLOSED	DISPLAY ONLY	

DI MODULE 2		
CH1 CONTACT CLOSED	DISPLAY ONLY	
CH2 CONTACT CLOSED	DISPLAY ONLY	
CH3 CONTACT CLOSED	DISPLAY ONLY	
CH4 CONTACT CLOSED	DISPLAY ONLY	
CH5 CONTACT CLOSED	DISPLAY ONLY	
CH6 CONTACT CLOSED	DISPLAY ONLY	
CH7 CONTACT CLOSED	DISPLAY ONLY	
CH8 CONTACT CLOSED	DISPLAY ONLY	
CH9 CONTACT CLOSED	DISPLAY ONLY	
CH10 CONTACT CLOSED	DISPLAY ONLY	
CH11 CONTACT CLOSED	DISPLAY ONLY	
CH12 CONTACT CLOSED	DISPLAY ONLY	
CH13 CONTACT CLOSED	DISPLAY ONLY	
CH14 CONTACT CLOSED	DISPLAY ONLY	
CH15 CONTACT CLOSED	DISPLAY ONLY	
CH16 CONTACT CLOSED	DISPLAY ONLY	
DI MODULE 3		
CH1 CONTACT CLOSED	DISPLAY ONLY	
CH2 CONTACT CLOSED	DISPLAY ONLY	
CH3 CONTACT CLOSED	DISPLAY ONLY	
CH4 CONTACT CLOSED	DISPLAY ONLY	
CH5 CONTACT CLOSED	DISPLAY ONLY	
CH6 CONTACT CLOSED	DISPLAY ONLY	
CH7 CONTACT CLOSED	DISPLAY ONLY	
CH8 CONTACT CLOSED	DISPLAY ONLY	
CH9 CONTACT CLOSED	DISPLAY ONLY	
CH10 CONTACT CLOSED	DISPLAY ONLY	
CH11 CONTACT CLOSED	DISPLAY ONLY	
CH12 CONTACT CLOSED	DISPLAY ONLY	
CH13 CONTACT CLOSED	DISPLAY ONLY	
CH14 CONTACT CLOSED	DISPLAY ONLY	
CH15 CONTACT CLOSED	DISPLAY ONLY	
CH16 CONTACT CLOSED	DISPLAY ONLY	
DI MODULE 4		
CH1 CONTACT CLOSED	DISPLAY ONLY	
CH2 CONTACT CLOSED	DISPLAY ONLY	
CH3 CONTACT CLOSED	DISPLAY ONLY	
CH4 CONTACT CLOSED	DISPLAY ONLY	
CH5 CONTACT CLOSED	DISPLAY ONLY	
CH6 CONTACT CLOSED	DISPLAY ONLY	
CH7 CONTACT CLOSED	DISPLAY ONLY	
CH8 CONTACT CLOSED	DISPLAY ONLY	
CH9 CONTACT CLOSED	DISPLAY ONLY	
CH10 CONTACT CLOSED	DISPLAY ONLY	
CH11 CONTACT CLOSED	DISPLAY ONLY	
CH12 CONTACT CLOSED	DISPLAY ONLY	
CH13 CONTACT CLOSED	DISPLAY ONLY	
CH14 CONTACT CLOSED	DISPLAY ONLY	
CH15 CONTACT CLOSED	DISPLAY ONLY	
CH16 CONTACT CLOSED	DISPLAY ONLY	
DO MODULE 1		
CH1 ENERGIZED	DISPLAY ONLY	
CH2 ENERGIZED	DISPLAY ONLY	
CH3 ENERGIZED	DISPLAY ONLY	
CH4 ENERGIZED	DISPLAY ONLY	
CH5 ENERGIZED	DISPLAY ONLY	
CH6 ENERGIZED	DISPLAY ONLY	
CH7 ENERGIZED	DISPLAY ONLY	
CH8 ENERGIZED	DISPLAY ONLY	

DO MODULE 2		
CH1 ENERGIZED	DISPLAY ONLY	
CH2 ENERGIZED	DISPLAY ONLY	
CH3 ENERGIZED	DISPLAY ONLY	
CH4 ENERGIZED	DISPLAY ONLY	
CH5 ENERGIZED	DISPLAY ONLY	
CH6 ENERGIZED	DISPLAY ONLY	
CH7 ENERGIZED	DISPLAY ONLY	
CH8 ENERGIZED	DISPLAY ONLY	
DO MODULE 3		
CH1 ENERGIZED	DISPLAY ONLY	
CH2 ENERGIZED	DISPLAY ONLY	
CH3 ENERGIZED	DISPLAY ONLY	
CH4 ENERGIZED	DISPLAY ONLY	
CH5 ENERGIZED	DISPLAY ONLY	
CH6 ENERGIZED	DISPLAY ONLY	
CH7 ENERGIZED	DISPLAY ONLY	
CH8 ENERGIZED	DISPLAY ONLY	
DO MODULE 4		
CH1 ENERGIZED	DISPLAY ONLY	
CH2 ENERGIZED	DISPLAY ONLY	
CH3 ENERGIZED	DISPLAY ONLY	
CH4 ENERGIZED	DISPLAY ONLY	
CH5 ENERGIZED	DISPLAY ONLY	
CH6 ENERGIZED	DISPLAY ONLY	
CH7 ENERGIZED	DISPLAY ONLY	
CH8 ENERGIZED	DISPLAY ONLY	
AO MODULE 1		
CH1 mA OUT PERCENT	DISPLAY ONLY	
CH2 mA OUT PERCENT	DISPLAY ONLY	
CH3 mA OUT PERCENT	DISPLAY ONLY	
CH4 mA OUT PERCENT	DISPLAY ONLY	
CH5 mA OUT PERCENT	DISPLAY ONLY	
CH6 mA OUT PERCENT	DISPLAY ONLY	

Appendix F.
Menu Summary

Configure Menus

CFIG SPEED CONTROL
RATED SPEED
AMPU #1 TEETH
AMPU 1 MAX FREQ
AMPU #2 TEETH
AMPU 2 MAX FREQ
REVERSE ACTING ?
DMPU #1 TEETH
DMPU #2 TEETH
ENABLE TORS FILTER

CFIG MINOR ALARM
MPU 1 FAIL
MPU 2 FAIL
MPU 1 AND 2 FAIL
REM SPD XDCR FAIL
MAP XDCR FAIL
HIGH KW ALM
HIGH KW SET POINT
HIGH KW DELAY
HI ACT OUTPUT ALM
HIGH ACT SET POINT
HIGH ACT DELAY
OVERSPEED ALM
OVERSPEED SET POINT
OVERSPEED DELAY
FAIL TO XMIT ALM
HIGH TORSION ALARM
TORSION LEVEL
SETPT(%RPM)
TORSIONAL DELAY

CFIG MAJOR ALARM
MPU 1 FAIL
MPU 2 FAIL
MPU 1 AND 2 FAIL
REM SPD XDCR FAIL
MAP XDCR FAIL
HIGH KW ALM
HIGH KW SET POINT
HIGH KW DELAY
HI ACT OUTPUT ALM
HIGH ACT SET POINT
HIGH ACT DELAY
OVERSPEED ALM
OVERSPEED SET POINT
OVERSPEED DELAY
FAIL TO XMIT ALM
HIGH TORSION ALARM
TORSION LEVEL
SETPT(%RPM)
TORSIONAL DELAY

CFIG COMMUNICATION
PORT3 Mode
PORT 3 Address
PORT 2 Address

CFIG ANALOG OUTPUTS
AOUT 1 SELECTION
AOUT 1 4-20 mA?
AOUT 2 SELECTION
AOUT 2 4-20 mA?
ACT OUT 1 0-200mA?
ACT OUT 2 SELECTION
ACT OUT 2 4-20 mA?

Service Menus

1st DYNAMICS
GAIN 1
RESET 1
COMPENSATION 1
GAIN RATIO 1
WINDOW WIDTH 1
GAIN SLOPE BK PNT 1
GAIN SLOPE 1
SPEED FILTER 1
BUMP ACT

2nd DYNAMICS
GAIN 2
RESET 2
COMPENSATION 2
GAIN RATIO 2
WINDOW WIDTH 2
GAIN SLOPE BK PNT 2
GAIN SLOPE 2
SPEED FILTER 2
BUMP ACT

SPEED SETTING
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
REM REF FAIL LOCK
ENABLE SPEED FILTER
SELECT DIGITAL MPU

TORSIONAL FILTER
ENABLE TORS FILTER
ENG SENSOR WEIGHT
TORS SCALE (%RATED)
TORSNL FUEL LIMIT (%FD)
TORSNL LEVEL @LIMIT(%)
TORSNL LEVEL @CLEAR(%)

KW SETTING
LOAD DROOP PERCENT
ACT OUT @ NO LOAD
ACT OUT @ FULL LOAD

FUEL LIMITERS
START FUEL LIMIT
START RAMP %/sec
MAX FUEL LIMIT

MAP LIMITER
ENABLE MAP LIMIT
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
ACKNOWLEDGE ALARMS
LON SERVICE PIN
DSLC NODE FAULT
LINKNET ADDR FAULT
LINKNET TYPE FAULT

SERIAL PORT SETUP
PORT3 HARDWARE CFIG
PORT 3 BAUD RATE
PORT 3 STOP BITS
PORT 3 PARITY
PORT2 HARDWARE CFIG
PORT 2 BAUD RATE
PORT 2 STOP BITS
PORT 2 PARITY

TUNE ANALOG OUTPUTS
ANALOG OUTPUT 1 MIN
ANALOG OUTPUT 1 MAX
ANALOG OUTPUT 2 MIN
ANALOG OUTPUT 2 MAX
ACTUATOR OUT 1 MIN
ACTUATOR OUT 1 MAX
ACTUATOR OUT 2 MIN
ACTUATOR OUT 2 MAX

ACTUATOR CONTROL
ACT ON SPD CONTROL
ACT ON START LIMIT
ACT ON MAX LIMITER
ACT ON MAP LIMITER
ACT SHUTDOWN

ACTUATOR BUMP
BUMP ENABLE
ACT BUMP LEVEL
ACT BUMP DURATION

DISPLAY MENU 1
ENGINE SPEED
SPEED REFERENCE
BIASED SPEED REF
BIAS FROM DROOP
BIAS FROM DSLC
BIAS FROM LD PULSE
TORSIONAL LEVEL(%)
KW LOAD
FUEL DEMAND
REMOTE SPEED REF
REMOTE ENABLED
DSLC INPUT
MAP LIMIT
MAP INPUT
LOAD PULSE INPUT
TORSNL FILTR ACTIVE

DISPLAY MENU 2
SPEED INPUT #1
SPEED INPUT #2
CLOSE TO RUN
IDLE/RATED
LOWER SPEED
RAISE SPEED
2nd DYNAMICS
FAIL SAFE OVERRIDE
EXT ACKNOWLEDGE
ISOCH/DROOP
MPU1 FAILED
MPU2 FAILED

MINOR ALARM MENU
1-MPU 1 FAIL
2-MPU 2 FAIL
3-MPU 1 AND 2 FAIL
4-REM SPD IN FAIL
5-MAP XDCR FAIL
6-HIGH KW ALM
7-HI ACT OUTPUT ALM
8-OVERSPEED ALM
9-FAIL TO XMIT ALM
10-TORSIONAL ALM
FIRST MINOR ALARM

MAJOR ALARM MENU
1-MPU 1 FAIL
2-MPU 2 FAIL
3-MPU 1 AND 2 FAIL
4-REM SPD IN FAIL
5-MAP XDCR FAIL
6-HIGH KW ALM
7-HI ACT OUTPUT ALM
8-OVERSPEED ALM
9-FAIL TO XMIT ALM
10-TORSIONAL ALM
FIRST MAJOR ALARM

TC MODULE 1
CH1 - TC DEGREES F
CH2 - TC DEGREES F
CH3 - TC DEGREES F
CH4 - TC DEGREES F
CH5 - TC DEGREES F
CH6 - TC DEGREES F

TC MODULE 2
CH1 - TC DEGREES F
CH2 - TC DEGREES F
CH3 - TC DEGREES F
CH4 - TC DEGREES F
CH5 - TC DEGREES F
CH6 - TC DEGREES F

TC MODULE 3
CH1 - TC DEGREES F
CH2 - TC DEGREES F
CH3 - TC DEGREES F
CH4 - TC DEGREES F
CH5 - TC DEGREES F
CH6 - TC DEGREES F

TC MODULE 4
CH1 - TC DEGREES F
CH2 - TC DEGREES F
CH3 - TC DEGREES F
CH4 - TC DEGREES F
CH5 - TC DEGREES F
CH6 - TC DEGREES F

RTD MODULE 1
CH1 - RTD DEGREES F
CH2 - RTD DEGREES F
CH3 - RTD DEGREES F
CH4 - RTD DEGREES F
CH5 - RTD DEGREES F
CH6 - RTD DEGREES F

RTD MODULE 2
CH1 - RTD DEGREES F
CH2 - RTD DEGREES F
CH3 - RTD DEGREES F
CH4 - RTD DEGREES F
CH5 - RTD DEGREES F
CH6 - RTD DEGREES F

RTD MODULE 3
CH1 - RTD DEGREES F
CH2 - RTD DEGREES F
CH3 - RTD DEGREES F
CH4 - RTD DEGREES F
CH5 - RTD DEGREES F
CH6 - RTD DEGREES F

AI MODULE 1
CH1 - mA IN PERCENT
CH2 - mA IN PERCENT
CH3 - mA IN PERCENT
CH4 - mA IN PERCENT
CH5 - mA IN PERCENT
CH6 - mA IN PERCENT

AI MODULE 2
CH1 - mA IN PERCENT
CH2 - mA IN PERCENT
CH3 - mA IN PERCENT
CH4 - mA IN PERCENT
CH5 - mA IN PERCENT
CH6 - mA IN PERCENT

DI MODULE 1
CH1 CONTACT CLOSED
CH2 CONTACT CLOSED
CH3 CONTACT CLOSED
CH4 CONTACT CLOSED
CH5 CONTACT CLOSED
CH6 CONTACT CLOSED
CH7 CONTACT CLOSED
CH8 CONTACT CLOSED
CH9 CONTACT CLOSED
CH10 CONTACT CLOSED
CH11 CONTACT CLOSED
CH12 CONTACT CLOSED
CH13 CONTACT CLOSED
CH14 CONTACT CLOSED
CH15 CONTACT CLOSED
CH16 CONTACT CLOSED

DI MODULE 2
CH1 CONTACT CLOSED
CH2 CONTACT CLOSED
CH3 CONTACT CLOSED
CH4 CONTACT CLOSED
CH5 CONTACT CLOSED
CH6 CONTACT CLOSED
CH7 CONTACT CLOSED
CH8 CONTACT CLOSED
CH9 CONTACT CLOSED
CH10 CONTACT CLOSED
CH11 CONTACT CLOSED
CH12 CONTACT CLOSED
CH13 CONTACT CLOSED
CH14 CONTACT CLOSED
CH15 CONTACT CLOSED
CH16 CONTACT CLOSED

DI MODULE 3
CH1 CONTACT CLOSED
CH2 CONTACT CLOSED
CH3 CONTACT CLOSED
CH4 CONTACT CLOSED
CH5 CONTACT CLOSED
CH6 CONTACT CLOSED
CH7 CONTACT CLOSED
CH8 CONTACT CLOSED
CH9 CONTACT CLOSED
CH10 CONTACT CLOSED
CH11 CONTACT CLOSED
CH12 CONTACT CLOSED
CH13 CONTACT CLOSED
CH14 CONTACT CLOSED
CH15 CONTACT CLOSED
CH16 CONTACT CLOSED

DI MODULE 4
CH1 CONTACT CLOSED
CH2 CONTACT CLOSED
CH3 CONTACT CLOSED
CH4 CONTACT CLOSED
CH5 CONTACT CLOSED
CH6 CONTACT CLOSED
CH7 CONTACT CLOSED
CH8 CONTACT CLOSED
CH9 CONTACT CLOSED
CH10 CONTACT CLOSED
CH11 CONTACT CLOSED
CH12 CONTACT CLOSED
CH13 CONTACT CLOSED
CH14 CONTACT CLOSED
CH15 CONTACT CLOSED
CH16 CONTACT CLOSED

DO MODULE 1
CH1 ENERGIZED
CH2 ENERGIZED
CH3 ENERGIZED
CH4 ENERGIZED
CH5 ENERGIZED
CH6 ENERGIZED
CH7 ENERGIZED
CH8 ENERGIZED

DO MODULE 2
CH1 ENERGIZED
CH2 ENERGIZED
CH3 ENERGIZED
CH4 ENERGIZED
CH5 ENERGIZED
CH6 ENERGIZED
CH7 ENERGIZED
CH8 ENERGIZED

DO MODULE 3
CH1 ENERGIZED
CH2 ENERGIZED
CH3 ENERGIZED
CH4 ENERGIZED
CH5 ENERGIZED
CH6 ENERGIZED
CH7 ENERGIZED
CH8 ENERGIZED

DO MODULE 4
CH1 ENERGIZED
CH2 ENERGIZED
CH3 ENERGIZED
CH4 ENERGIZED
CH5 ENERGIZED
CH6 ENERGIZED
CH7 ENERGIZED
CH8 ENERGIZED

AO MODULE 1
CH1 mA OUT PERCENT
CH2 mA OUT PERCENT
CH3 mA OUT PERCENT
CH4 mA OUT PERCENT
CH5 mA OUT PERCENT
CH6 mA OUT PERCENT

723 Control Specifications

Woodward Part Numbers:	
9907-031	723 with low-voltage power supply
9907-032	723 with high-voltage power supply
9907-033	723 with torsional filter and low-voltage power supply
9907-034	723 with torsional filter and high-voltage power supply
9907-205	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, 7 A inrush current
Steady State Speed Band	±0.25% of rated speed
Magnetic Pickup	90–15 000 Hz (200–2100 rpm)
Proximity Switch	90–1000 Hz (200–2100 rpm)
Discrete Inputs (8)	10 mA at 24 Vdc
Remote Load Setting Input	4–20 mA or 1–5 Vdc
Manifold Pressure Limiting Input	4–20 mA or 1–5 Vdc
DSLC Input	±5 Vdc from SPM-A synchronizer
Auxiliary Input	±5 Vdc from SPM-A synchronizer
Actuator Output	0–200 mA
Configurable Actuator Output	4–20 or 0–200 mA to meter, computer, or actuator
Configurable Analog Outputs (2)	4–20 or 0–1 mA to meter or computer
Relay Outputs	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, RS-485, 9-pin connector, 1200 to 38 400 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

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

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