WOODWARD

Product Manual 85565
(Revision E)
Original Instructions

Peak® 150 Digital Control for Steam Turbines

9905-857/858/860/861/863/864/866/867

Installation and Operation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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

www.woodward.com/publications

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

Proper Use

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

Translated Publications

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

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 Out-of-date translations are marked with ⚠.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

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

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Warnings and Notices

Important Definitions

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

Regulatory Compliance

North American Compliance

CSA: CSA Listed for Class I, Division 2, Groups A, B, C, & D, T4 at 60 °C Ambient. For use in Canada and the United States. CSA Certificate Number 2474728

Special Conditions for Safe Use:
Input and output wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

All peripheral equipment must be suitable for the location in which used.

Chapter 1.
General Information

This manual describes the Woodward Peak 150 digital control for steam turbines and the hand-held programmer (9905-292) used to program it. The following topics are covered in the chapter indicated:

- Installation & Hardware (Chapter 2)
- Overview of Turbine System Operation (Chapter 3)
- Peak 150 Inputs & Outputs (Chapter 4)
- Peak 150 Control Functions (Chapter 5)
- Explanation of Operating Procedures (Chapter 6)
- Overview of Hand Held Programmer and Menus (Chapter 7)
- Set up of Configuration menus (Chapter 8)
- Set up of Service menus (Chapter 9)
- Detailed Functional Block Diagram (Chapter 10)
- Modbus Communications (Chapter 11)
- Troubleshooting (Chapter 12)
- Service Options (Chapter 13)
- Program Worksheets (Appendix)

Parameter names are shown in all capital letters and match the syntax as seen on the Hand Held Programmer or the plant wiring diagram.

The Peak 150 control is CSA Listed for the US and Canada (cCSAus) for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.

⚠WARNING

EXPLOSION HAZARD—The Peak 150 control box should not be opened when a hazardous atmosphere is present. Wiring connections which could cause sparks are exposed inside the cabinet.

NOTICE

Do NOT attempt to operate the turbine until the Peak 150 control has been programmed. To do so could cause equipment damage.

The scope of this manual is to provide information on programming, operation and troubleshooting of the Peak 150 control. This manual was written for the program and specifications of the 5-digit display version of the Peak 150 control. This manual can also be used for the 4-digit display version of the Peak 150 control. For the 4-digit version there may be slight differences in the program. However, all aspects of the 4-digit version are covered by this manual.

Chapter 2. Installation

Packaging

Figure 2-1 is an outline drawing of the Peak 150 control. All Peak 150 control components are contained in a single, NEMA 4X enclosure. The enclosure can be mounted indoors or out. Access to internal components is through a right-hand-hinged door which is held closed by six captive screws. The approximate size of the enclosure is 19 x 12 x 4 inches (approximately 483 x 305 x 102 mm).

The enclosure has two openings in the bottom for wiring access. One hole is approximately 25 mm (1 inch) diameter, and the other is approximately 38 mm (1.5 inch) diameter. These holes accept either English or metric standard conduit hubs.

IMPORTANT **If it is necessary to meet NEMA 4X requirements, you must use the appropriate conduit hubs and conduit when installing this control.**

IMPORTANT **When using the stainless steel hubs to meet the NEMA 4X requirements, ensure the ground post on the conduit hubs is positioned down to allow the front door to fully and properly close.**

All internal components are industrial grade. The components include the CPU (central processing unit), its memory, the switching power supply, all relays, all input/output circuitry, and all communications circuitry for the front door display, touch keypad, remote RS-232, RS-422, and RS-485 Modbus communications.

Mounting

The standard Peak 150 control enclosure must be vertically mounted on a wall or 19" (483 mm) rack, allowing sufficient room for lid opening and wiring access. Two welded flanges, one on the right side and one on the left side, permit secure mounting.

Electrical Connections

All electrical connections must be made through the two openings in the bottom of the enclosure to the terminal blocks inside the enclosure. Route all low-current lines through the large wiring port. Route all high-current lines through the small wiring port.

Wiring for each MPU and for each actuator must be separately shielded. We also recommend separate shielding for each mA input. Contact inputs may be bundled together within a single multi-conductor cable with one overall shield. Shields should be connected only at the Peak 150 control. Relay and power supply wiring do not normally require shielding.

Make sure that all inputs and outputs, including all shields, are NOT grounded outside the Peak 150 control box. Terminal block 1 (ground) is the only connection that should be wired to external ground.

See Figure 2-2 for the control wiring diagram and terminal block numbers.

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division or Zone applications.

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, applications Division ou Zone.

IMPORTANT

All peripheral equipment must be suitable for the location in which used.

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 indicated shield terminals. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor. DO NOT run shielded signal wires along side or in the same conduit with other wires carrying large currents. See Woodward publication 50532, *EMI Control for Electronic Governing Systems*, for more information.

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

1. Strip outer insulation from BOTH ENDS, exposing the braided or spiral wrapped shield. DO NOT CUT THE SHIELD.
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.

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

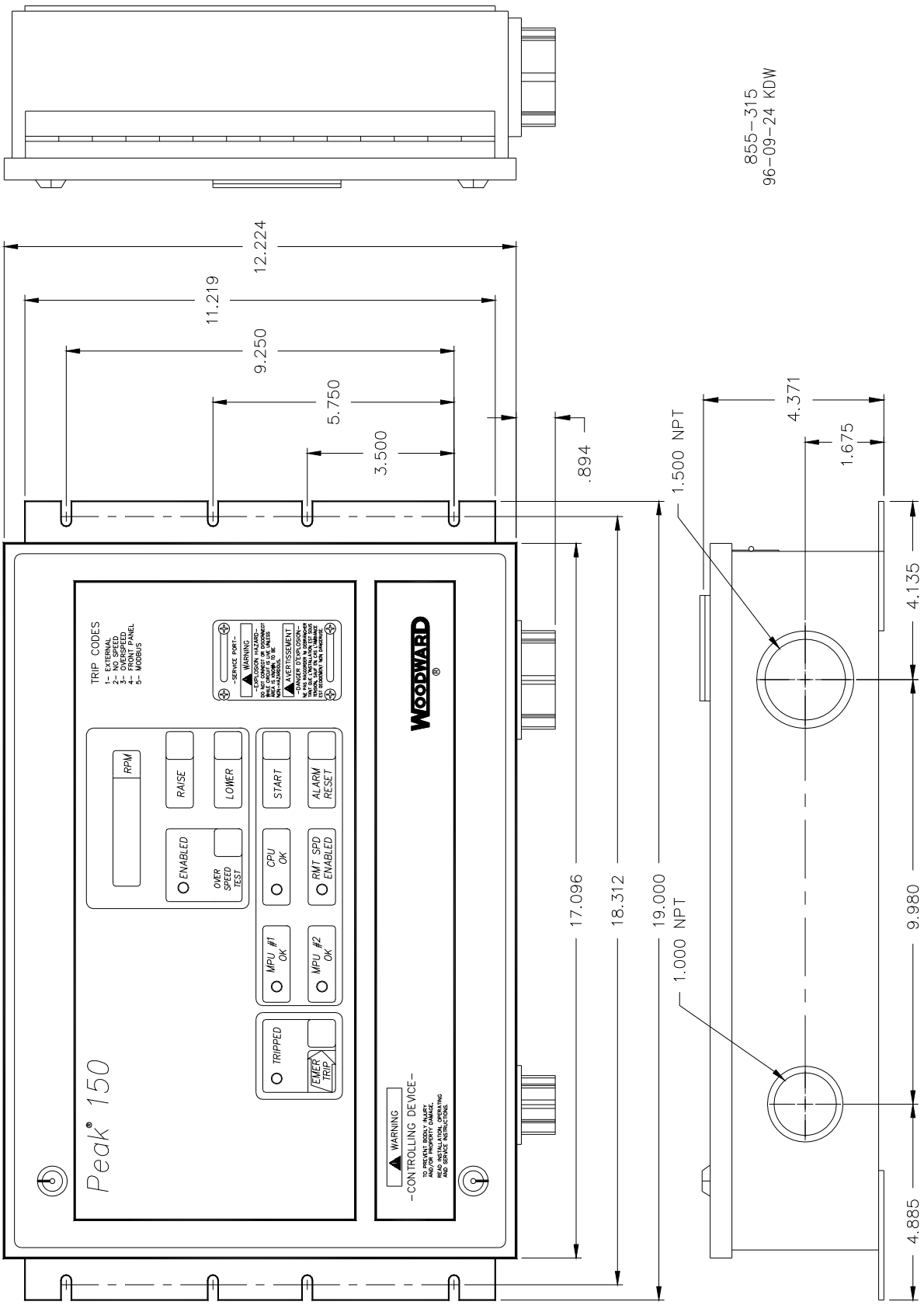


Figure 2-1. Peak 150 Control Outline Drawing

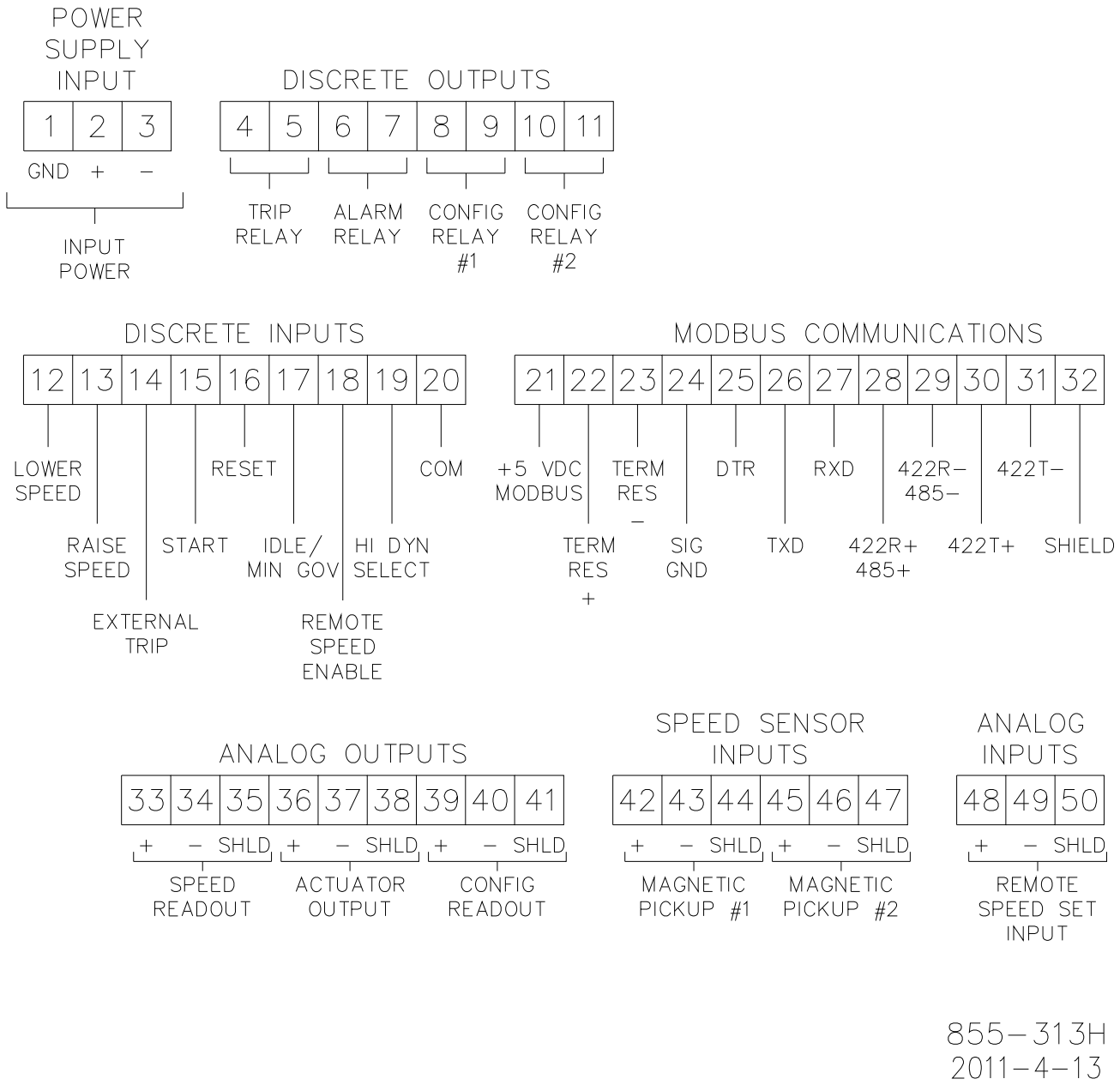


Figure 2-2. Control Wiring Diagram

Power Supply

Run the power leads directly from the power source to the control box. Use 3 mm ² (12 AWG) or larger wire for the power supply. Shield the power supply wires and connect the shield to an external point. DO NOT POWER OTHER DEVICES WITH LEADS COMMON TO THE CONTROL. Avoid long wire lengths. This wiring must be fully enclosed in conduit to meet Class I, Division 2, Group D requirements.

IMPORTANT **Input and output wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.**

Chapter 3.
Turbine Operation

Introduction

Steam Turbine applications include mechanical drive systems such as: pumps, fans, blowers, compressors, etc. The Peak 150 is designed to operate those Steam Turbines with a single-valve or a single-valve rack. The microprocessor-based design of the Peak 150 provides the flexibility for configuring for any of the above applications. This ability to configure the system in the field with a single design reduces both cost and delivery time.

START MODES

Turbine start-up is accomplished by controlling the inlet steam with the turbine's Trip & Throttle valve and/or the Actuator/Valve. The sequence of operation for these two devices determines the start mode which is either: **MANUAL START MODE** and **AUTO START MODE**.

MANUAL START MODE

The MANUAL START MODE is when a turbine operator manually controls the inlet steam by opening the TRIP & THROTTLE VALVE. The operator has control of the turbine speed from zero RPM to the MIN GOVERNOR SPEED. While the operator is starting the turbine, the Peak 150 ramps the speed set point to the MIN GOVERNOR SPEED. It waits for the turbine speed to reach this point and then it automatically takes control of the inlet steam.

The Peak 150 can be configured for MANUAL START by setting MANUAL START MODE = TRUE. Setting MANUAL START MODE = TRUE will set the AUTO START MODE = FALSE.

The Speed Relationship diagram (Figure 7-3) shows how the speed settings in the Peak 150 relate to each other.

AUTO START MODE

AUTO START MODE is defined as controlling the inlet steam with the ACTUATOR / VALVE via the Peak 150 during start up. In the AUTO START MODE, the VALVE RAMP controls the speed from zero to either IDLE SPEED or to the MIN GOVERNOR SPEED depending on how the control is configured. (see Figure 7-3).

If IDLE SPEED is configured, the speed will control at IDLE until the IDLE / MIN GOV input is closed. When closed, the speed will RAMP up to the MIN GOVERNOR SPEED.

This mode of operation starts with the ACTUATOR/ VALVE RAMP closed and the Trip and Throttle fully opened.

The Peak 150 can be configured for AUTO START by setting MANUAL START MODE = FALSE. Setting MANUAL START MODE = FALSE will set the AUTO START MODE = TRUE.

Either start mode begins with the START command from the START button, the START discrete input, or a Modbus START command. (All ALARMS and TRIPS must be cleared and RESET for the Peak 150 to respond to the START command).

OPERATING MODE
(Setting Turbine Speed)

The Peak 150 control has three operating modes for setting the turbine speed:
- MANUAL CONTROL mode
- REMOTE CONTROL mode
  - Function of Analog Input
  - Function of Modbus command
- COMBINATION mode

In all three modes, the set point for the turbine speed is the value of the ACTUAL SPEED SETPT. The ACTUAL SPEED SETPT can be monitored in the SPEED VALUES menu.

MANUAL CONTROL Mode

In the MANUAL CONTROL mode, the turbine operator adjusts the speed by changing the value of the LOCAL SPEED SETPT. This set point is adjusted by:
- The RAISE / LOWER buttons on the front panel.
- The RAISE SPEED / LOWER SPEED discrete inputs.
- The Modbus RAISE SPEED / LOWER SPEED commands.

In the MANUAL CONTROL mode, the ACTUAL SPEED SETPT is equal to the LOCAL SPEED SETPT. The LOCAL SPEED SETPT can be monitored in the SPEED VALUES menu.

The MANUAL CONTROL mode is selected by configuring MANUAL CONTROL ONLY = TRUE.

REMOTE CONTROL Mode

In the REMOTE CONTROL mode, the turbine speed is adjusted between the MIN GOVERNOR SPEED and the MAX GOVERNOR SPEED with the REMOTE SPEED SET input of 1–5 Vdc or 4–20 mA.

Terminology:
1. REMOTE SPEED SET INPUT: This is a 1–5 Vdc or a 4–20 mA input from terminals 48 & 49. This signal can be the output from a Pressure Transducer, a PLC or a Manual Control Station in the Turbine Control Room.
2. REMOTE SPD SET: This is the value of the turbine's REMOTE SPEED SET INPUT converted to RPMs. The REMOTE SPD SET can be monitored in the SPEED VALUES menu.

When the REMOTE CONTROL mode is configured and activated, the ACTUAL SPEED SETPT is equal to the REMOTE SPD SET. In this mode the LOCAL SPEED SETPT tracks the value of the REMOTE SPD SET. If the REMOTE CONTROL mode is disabled, speed control reverts to the MANUAL CONTROL mode at the last value of the LOCAL SPEED SETPT.

The REMOTE CONTROL mode is selected by configuring MANUAL CONTROL ONLY = FALSE, USE REMOTE SPD SET? = TRUE and USE HI-SIG-SELECT? = FALSE.

The REMOTE CONTROL mode is active only when the turbine speed is at or above MIN GOVERNOR SPEED, and there is either a REMOTE SPEED ENABLE discrete input or a Modbus ENABLE REMOTE command.

MODBUS CONTROL Mode

The MODBUS CONTROL mode is a variation of the REMOTE CONTROL mode. When the OPERATING MODE is configured USE MODBUS ANALOG INPUT = TRUE, the REMOTE SPD SET uses the value of the Modbus analog write REMOTE SETTING vs. the value of the Analog Input.

COMBINATION Mode
(High-Signal-Select)

When the OPERATING MODE is configured for USE HIGH-SIGNAL-SELECT, the speed setting is a combination of the MANUAL CONTROL mode and the REMOTE CONTROL mode. The values of the REMOTE SPD SET and the LOCAL SPEED SETPT are adjusted independently. The ACTUAL SPEED SETPT equals the set point, LOCAL or REMOTE, with the highest speed. If the REMOTE CONTROL mode is disabled, control reverts to MANUAL CONTROL mode with the speed set at the LOCAL SPEED SETPT.

Communication

Commands are communicated to the Peak 150 from four sources:
1. From the Front Control Panel
2. From a Hand-Held Programmer
3. From Inputs via the field wiring such as analog inputs and discrete inputs
4. From the Modbus serial port

Chapter 4.
Wiring

Inputs and Outputs

All inputs and outputs to the Peak 150 control are made through terminal blocks inside the Peak 150 control enclosure. Wiring passes through two wiring ports on the bottom of the control.

Inputs and outputs to the control are:

- Power Supply Input
- Analog Input
- Analog Outputs
- Discrete Inputs
- Discrete Outputs
- Speed Sensor (magnetic pickup) Inputs
- Modbus communications (optional)
- A service port for the hand-held programmer

⚠WARNING

EXPLOSION HAZARD—The Peak 150 control box should not be opened when a hazardous atmosphere is present. Wiring connections which could cause sparks are available inside the cabinet.

Power Supply

Figure 4-1 shows the power-supply connections. The following tables show the Input voltages and frequencies for the different versions of the Peak 150 control. Maximum power consumption is 38 W.

cCSAus Version	NEMA 4 Part Number	NEMA 4X Part Number
24 Vdc	9905-857	9905-863
24 Vdc w/Modbus	9905-860	9905-866
ac/dc	9905-858	9905-864
ac/dc/ w/Modbus	9905-861	9905-867

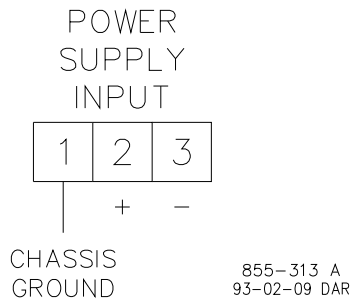


Figure 4-1. Power Supply Input

Version	Input Voltage	Frequency
1 (24 Vdc)	18–32 Vdc	NA
2 (ac/dc)	90–150 Vdc	NA
	88–132 Vac	47–63 Hz

No power switch is provided, the unit operates whenever power is applied. Input over-or under-voltage shutdown is not provided; if the +5 Vdc supply in the unit goes below 4.7 volts, the microprocessor will be reset.

Discrete Outputs

There are four hermetically-sealed relays. Two are dedicated, and two are user-configurable:

- Output #1 = TRIP RELAY (programmed energize or de-energize for trip)
- Output #2 = ALARM RELAY (de-energizes for alarm)
- Output #3 = CONFIG RELAY #1 (energizes for function)
- Output #4 = CONFIG RELAY #2 (energizes for function)

If required the configurable relays can be programmed as an additional Trip (using Option 2) or Alarm (Option 1) function. See Functional Block Diagram (Chapter 10) or Relays section of Configuration Menu (Chapter 8) for options.

Figure 4-2 shows the relay terminals.

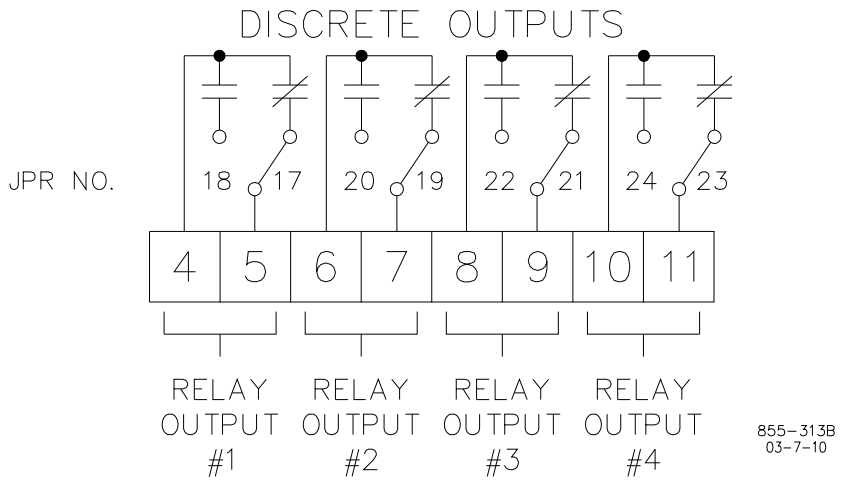


Figure 4-2. Relay Outputs

Internal jumpers provide a choice of normally open or normally closed contacts (see Figure 4-9 for jumper option chart).

Relay Contact Output Ratings

- 2 A Resistive @ 28 Vdc
- 0.3 A Resistive @ 115 Vac

IMPORTANT **An interposing relay is required if more current is needed.**

Discrete Inputs

There are eight discrete inputs (shown in Figure 4-3), powered either by an internal 24 Vdc supply or by an external 5–28 Vdc supply:

- Input #1 = LOWER SPEED
- Input #2 = RAISE SPEED
- Input #3 = EXTERNAL TRIP
- Input #4 = START
- Input #5 = RESET
- Input #6 = IDLE / MIN GOV
- Input #7 = REMOTE SPEED ENABLE
- Input #8 = HI DYN SELECT or (OVERSPEED TEST)

IMPORTANT **A jumper or external shutdown switch must be installed across Input #3.**

As shown in Figure 4-4, internally powered contact inputs (dry contacts) use Jumper 15 and +24 Vdc from analog Outputs Terminal 33 or 39). Externally powered contact inputs use Jumper 16 and an external + 24 Vdc supply.

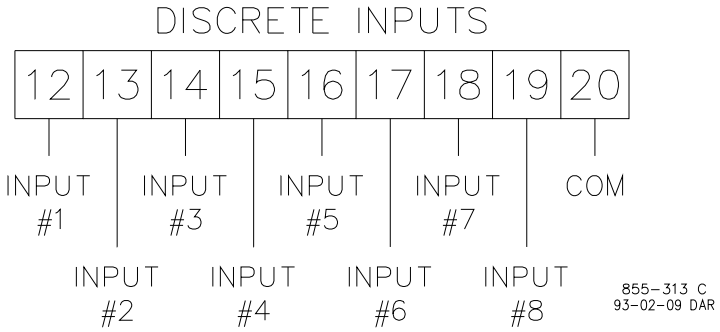


Figure 4-3. Discrete Input Connections

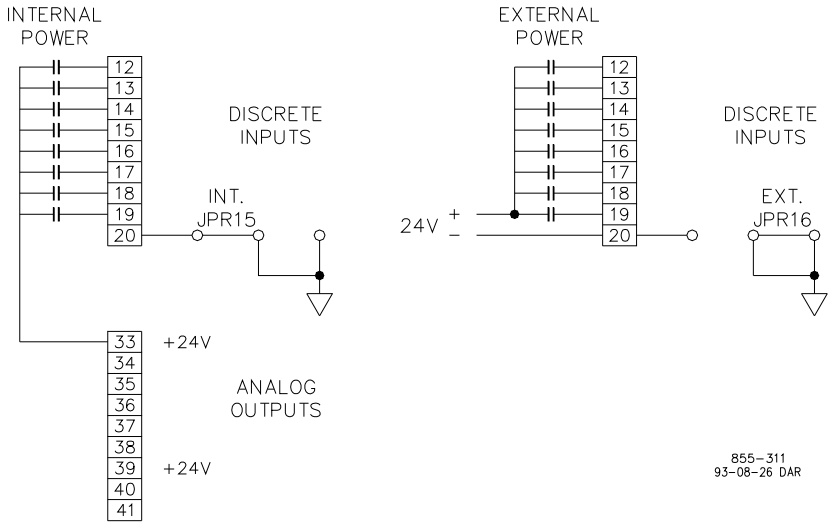


Figure 4-4. Powering Discrete Inputs

Modbus Communications

Figure 4-5 shows the connections for Modbus communications. Refer to Chapter 11 for additional Modbus information.

If terminals 21–34 are not installed, your unit is not capable of Modbus communications.

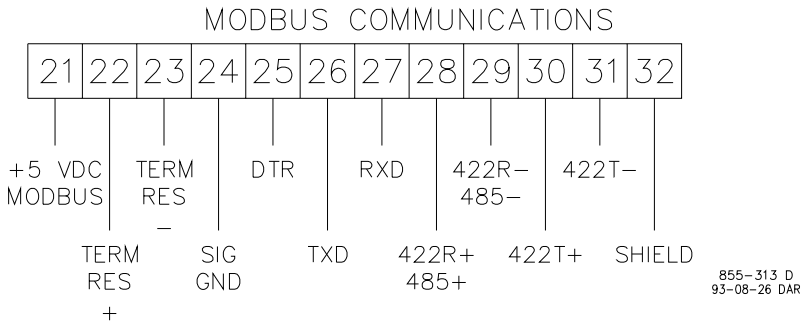


Figure 4-5. Modbus Connections

Analog Outputs

- Analog output #1 = Speed Readout
- Analog output #2 = User Configurable
- Actuator output = Signal to Actuator

Figure 4-6 shows the ANALOG OUTPUT connections. ANALOG OUTPUTs #1 and #2 are 4–20 mA or 0–1 mA, internal jumper selectable (see Figure 4-9 for jumper option chart).

The ACTUATOR OUTPUT (current) can be programmed for 0–200 mA or 0–20 mA. The internal jumpers must be selected to connect the proper current to the actuator driver (see Figure 4-9 for jumper option chart). The maximum load for the 0–200 mA driver is 60 Ω. The maximum load for the 0-20 mA driver is 450 ohms.

The fuel-valve actuator wires will carry a 0–200 mA or 4–20 mA signal and must be fully enclosed in conduit to meet hazardous-environment requirements.

The SPEED READOUT output is included in the control to drive a tachometer either near the turbine or in a control room. The maximum load for the readout circuits is 600 Ω.

The control may be tailored to give accurate readings on the tachometer by making adjustments on the set point programmer (see Configure Menus and Service Menus Chapters).

See Readouts section of Configuration Menus for Configurable Readout options.

Figure 4-6 shows the connections for analog outputs.

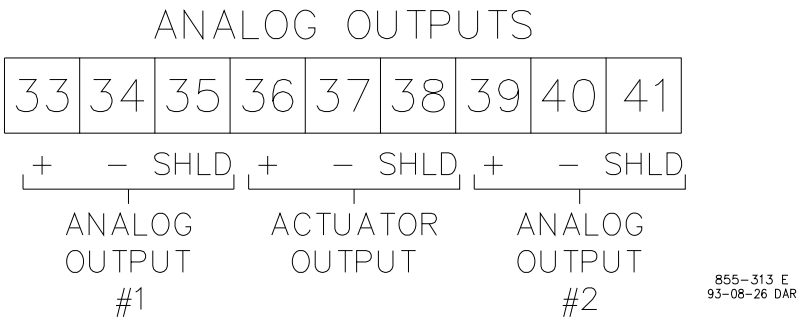


Figure 4-6. Connections for Analog Outputs

Speed Sensor Inputs

Figure 4-7 shows the connections for the two SPEED SENSOR INPUTS. The minimum signal amplitude required for speed sensing is 1 Vrms. The minimum detectable frequency is 200 Hz @ 1 Vrms. The maximum detectable frequency is 15 kHz.

- Input #1 = MAGNETIC PICKUP # 1
- Input #2 = MAGNETIC PICKUP # 2

Maximum control speed = 15 000 rpm.

The MPU cable must have two wires from the MPU plus a shield. The shield is grounded at the control only: it must not be grounded at the MPU. The integrity of the shield must be maintained between the MPU and the control. Polarity of the signal wires from the MPU to the control is not important.

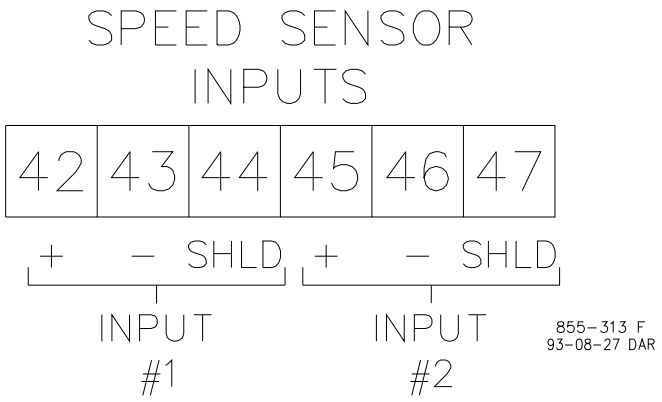


Figure 4-7. Connections for Speed Sensing

Analog Input

There is one analog input: the remote speed setting input. Figure 4-8 shows the connections for the analog input.

There is a jumper option for the Analog Input for either 4–20 mA or 1–5 Vdc. When 4–20 mA is selected, the ANALOG INPUT drives a 250 Ω load (see Figure 4-9 for jumper option chart).

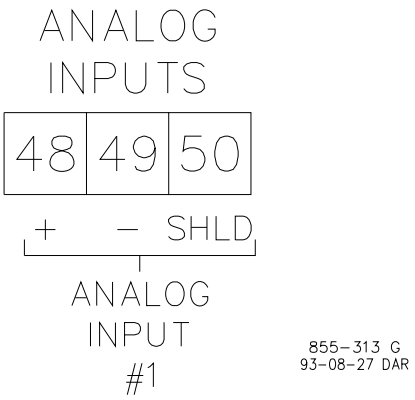


Figure 4-8. Connections for Analog Input

Jumpers and Test Points

Figure 4-9 shows the location and functions of the Peak 150 control's jumpers and test points.

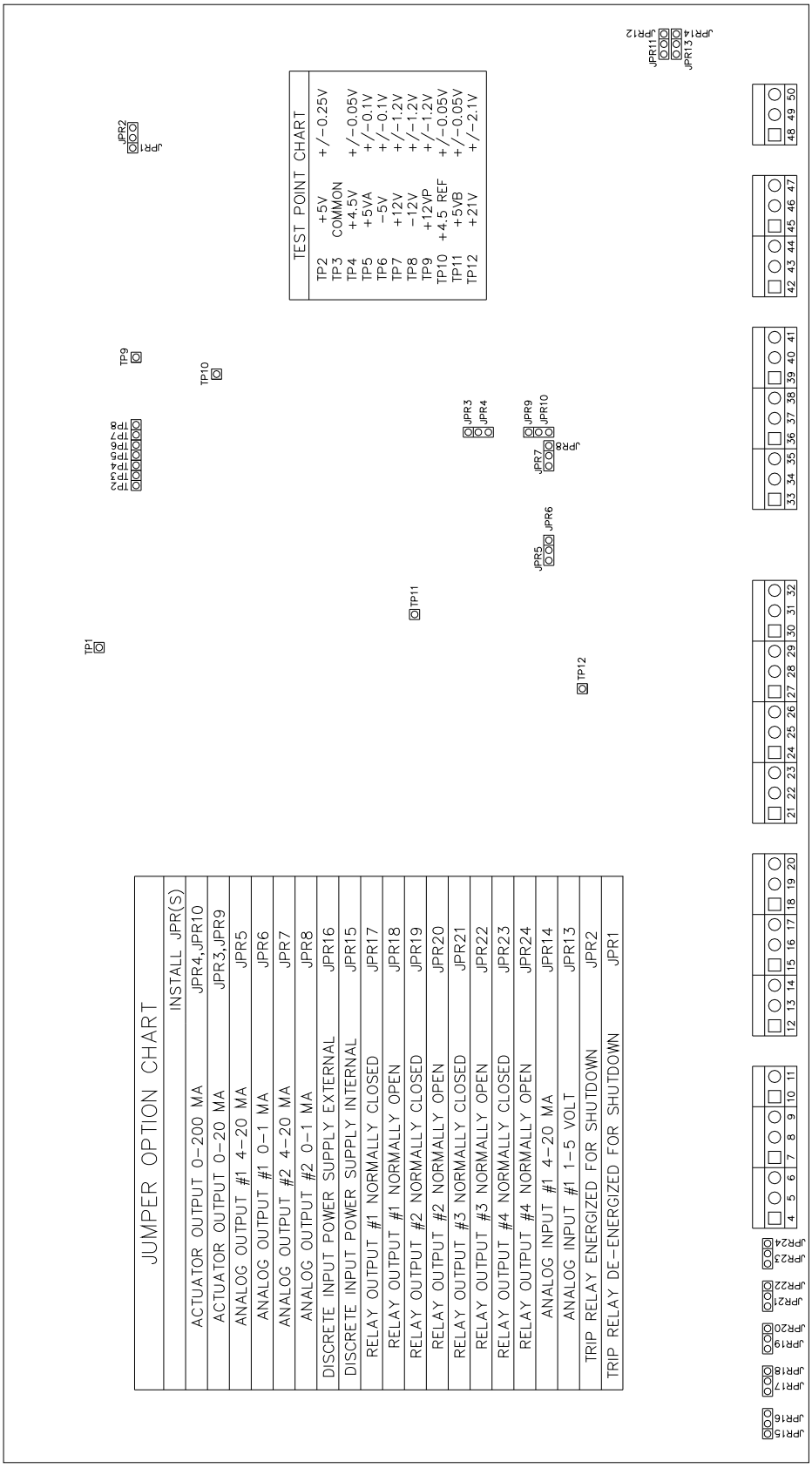


Figure 4-9. Jumper and Test Point Locations and Functions

Chapter 5.
Functional Description

Introduction

A system overview in block form is shown in Figure 5-1. Chapter 10 contains the detailed functional block diagram for the Peak 150 control.

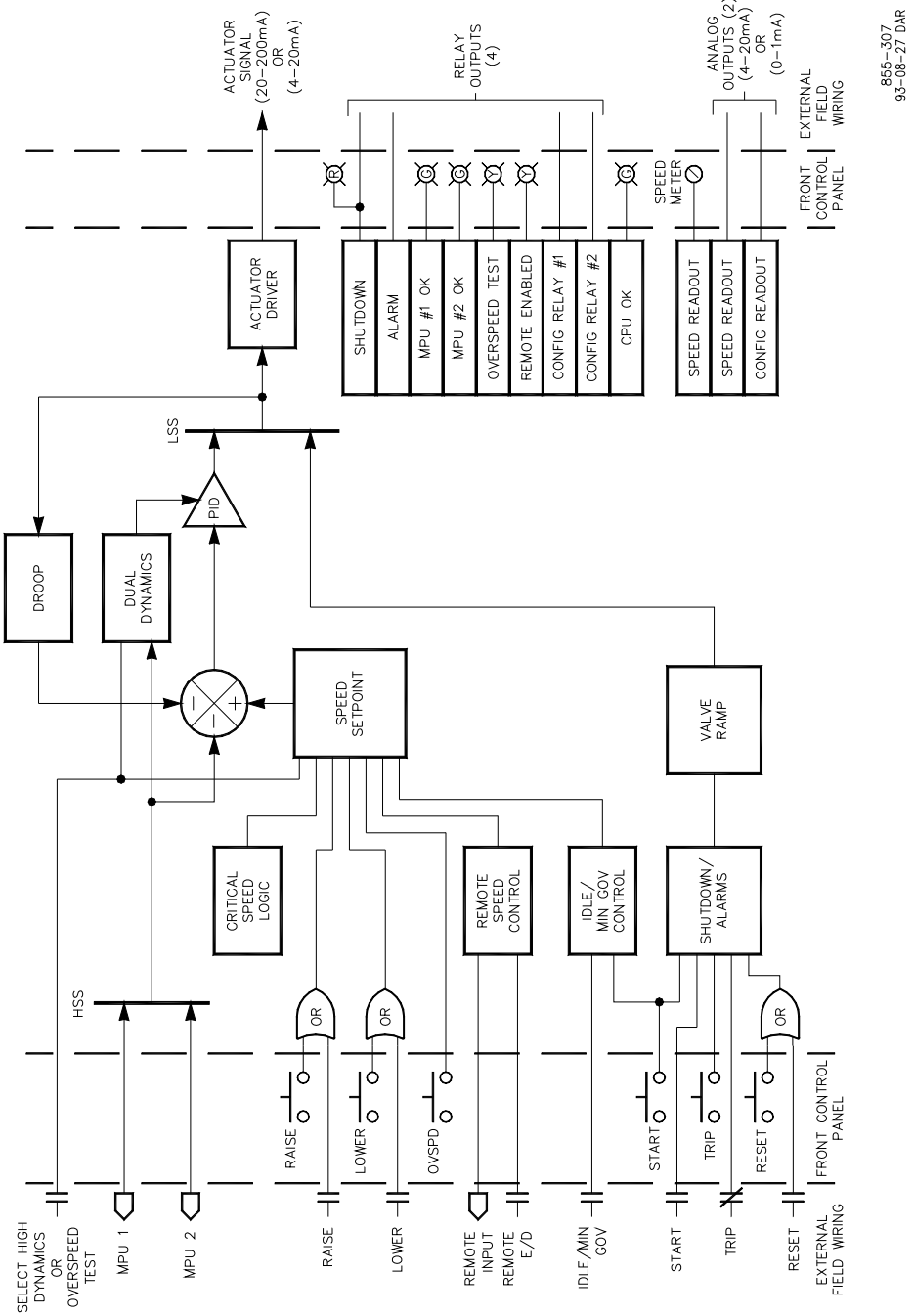


Figure 5-1. System Overview

Magnetic Pickups

The Magnetic Pickups (MPUs) generate a speed signal that is used to provide speed feedback to the Peak 150. The MPUs do this by generating voltage pulses as the gear teeth pass through the MPU's magnetic field. The Peak 150 counts the number of pulses per second from the MPUs (frequency in HZ) and converts this frequency to turbine RPM.

Two MPUs (**MPU 1 and MPU 2**) may be used to provide redundant speed inputs, that is where one can fail and the remaining MPU keeps the turbine operating. The Peak 150 determines which MPU is outputting the highest frequency and uses that frequency as the speed feedback to control the turbine.

When only one MPU is used, the output should be connected in parallel to both MPU inputs to prevent getting an alarm on the unused MPU input.

The Peak 150 converts the MPUs input frequency to RPMs by using the number of teeth programmed in the SPEED CONFIGURATION menu for TEETH SEEN BY MPU = xxxxx (Teeth) in the following formula:

$$RPM = (Hz \times 60) / Teeth$$

When the speed of the main turbine shaft is different from the speed of the MPU gear shaft, the value for MPU GEAR RATIO = x is programmed for the correct ratio. The above equation will be multiplied by the RATIO so that the RPM seen by the Peak 150 will be the turbine RPM and not the MPU gear shaft RPM.

$$RPM = ((Hz \times 60) / Teeth) \times Ratio$$

If the two MPUs are mounted on separate gears, each gear must have the same number of teeth and rotate at the same RPM, so that both MPUs are sensing the same speed.

When the MPU signal is below 1.0 V_{RMS} the Peak 150 activates an ALARM of FAILED MPU.

Analog Input

The ANALOG INPUT, **REMOTE INPUT**, is an isolated current-source which is used for REMOTE SPEED CONTROL. When operating in the REMOTE CONTROL MODE, this input controls the speed set point between the MIN GOV SPEED and the MAX GOV SPEED.

Contact Inputs

The eight discrete inputs are:

- **LOWER**
- **RAISE**
- **TRIP**
- **START**
- **RESET**
- **IDLE / MIN GOV**
- **REMOTE SPEED ENABLE**
- **SELECT HI DYN or OVERSPEED TEST**

These discrete inputs can be selected by connecting them to a 5–28 Vdc supply. See Figure 4-4 for the power supply options.

For an EMERGENCY SHUTDOWN, power is removed from the **TRIP** input. Therefore, before the turbine can be started, the external **TRIP** contact must be closed with a switch, a relay contact or a jumper.

The **IDLE / MIN GOV** input is opened for IDLE speed and closed for MIN GOVERNOR speed.

All other inputs close for the listed function.

Actuator Driver

The normal ACTUATOR OUTPUT currents are:
- 20 to 160 mA for Woodward actuators
- 4 to 20 mA for non-Woodward actuators

The ACTUATOR OUTPUT current is selected in the ACTUATOR CONFIGURATION menu by setting USE 20–160 mA ACTUATOR = TRUE and by installing the appropriate actuator drive current jumpers (see Figure 4-9). If USE 20–160 mA ACTUATOR = FALSE then USE 4–20 mA ACTUATOR is automatically set = TRUE (Status Indication Only).

Analog Outputs

There is a SPEED READOUT and a CONFIG READOUT available. These readouts can be set for either 4–20 mA or 0–1 mA depending on the jumper installed (see Jumper Option Chart figure 4-9). The configurable meter is selected in the Configure Mode from the following five options:
- ACTUAL SPEED (RPM)
- ACTUAL SPEED SETPT (RPM)
- REMOTE SPEED SET INPUT (RPM)
- VALVE POSITION (Actuator Output) (0 to 100%)
- VALVE RAMP POS'N (0 to 100%)

Relays

The Peak 150 has 4 discrete outputs or relays. Two of the relay outputs are dedicated:
- TRIP RELAY (Configurable to either energize or de-energize for trip)
- ALARM RELAY (Normally energized—de-energizes for alarm)

The other two relays are configurable from the following 11 options:
- Alarm
- Trip Output
- Shutdown
- Remote Control
- Speed Control
- Either MPU Failed
- Overspeed Trip
- Overspeed Test
- Remote Status

- Spd Switch or Hand Valve #1
- Spd Switch or Hand Valve #2

Normally-open or normally-closed contact is selectable (see Figure 4-9).

Relay contacts are rated at:
- 2.0 A of resistive load at 28 Vdc
- 0.75 A of inductive load at 28 Vdc
- 0.3 A of resistive load at 115 Vrms, 60–400 Hz
- (The relay contacts are not rated for 125 Vdc)

An interposing relay is required if more current is needed.

Speed Set Point

The SPEED SET POINT is the value (in RPMs) of the ACTUAL SPEED SETPT. This is one of the inputs to the SPEED CONTROL. Depending on the Operating Mode for setting the turbine speed, the ACTUAL SPEED SETPT is equal to the LOCAL SPEED SETPT or the REMOTE SPEED SET point. (For additional information about controlling the ACTUAL SPEED SETPT see the OPERATING MODE section on page 8).

Remote Speed Set (Process Control)

In the REMOTE CONTROL mode the REMOTE SPEED SET input has control of the ACTUAL SPEED SETPT and operates the turbine between the MIN GOV SPEED and the MAX GOV SPEED when the REMOTE SPEED ENABLE is closed. For additional information on this operation see REMOTE CONTROL on page 8.

The REMOTE CONTROL mode can be used as a PROCESS CONTROL for controlling processes such as pump discharge pressure, water drum level, etc. The Process Control is external to the Peak 150 and its output is the input to the REMOTE SETTING. The function of the Process Control is to compare a Process Set Point to a Process Variable and generate a 4–20 mA or 1–5 Vdc output used by the Peak 150.

Idle/Min Start Ramp

In the AUTO START MODE the Peak 150 can be programmed to use an IDLE SPEED. During start up, the LOCAL SPEED SETPT ramps from zero RPM to IDLE SPEED when the control is RESET and gets a START command. (If the IDLE/MIN GOV input is jumped, the ramp will not stop at IDLE SPEED, but will go to the MIN GOVERNOR SPEED).

When IDLE SPEED is used by programming USE IDLE / MIN GOV RAMP = TRUE, closing the IDLE/MIN GOV input will automatically ramp the LOCAL SPEED SETPT to MIN GOVERNOR SPEED. The RAMP to MIN GOVERNOR SPEED can also be started by pushing the START button when the START = RAMP TO MIN GOV is set to TRUE.

- When the IDLE / MIN GOV external contact is closed, the LOCAL SPEED SETPT will increase to the MIN GOVERNOR SPEED at the IDLE/MIN GOV RATE.

- If the IDLE / MIN GOV external contact is opened before the speed reaches MIN GOVERNOR SPEED, the ramp will stop at its current value. When reclosed, the ramp will continue ramping to the MIN GOVERNOR SPEED.
- If there is a RAISE or LOWER command while in the IDLE / MIN GOV START RAMP, the ramp will stop. Once stopped, the RAISE or LOWER commands will increase or decrease the LOCAL SPEED SETPT. Also reselecting the IDLE / MIN GOV input will restart the ramp.

When programmed for USE IDLE / MIN GOV RAMP = FALSE, the IDLE / MIN GOV external contact will not ramp the SPEED SET POINT to RATED SPEED, nor will the START button. When programmed for false, the RAISE and LOWER buttons control the LOCAL SPEED SETPT. The RAISE button can drive the SPEED SET POINT to the MAX GOV SPEED. The LOWER button can drive the SPEED SET POINT to IDLE SPEED if the speed is below the MIN GOV SPEED or it can only drive the SPEED SET POINT to the MIN GOV SPEED if the speed is already above this set point.

Critical Speed Band

The CRITICAL SPEED BAND is used to prevent turbine operation at speeds where there is excessive turbine vibration. The CRITICAL SPEED BAND function does this by switching to a faster RAMP while the ACTUAL SPEED SETPT is in the CRITICAL SPEED BAND. This function also prevents the ACTUAL SPEED SETPT from being stopped while in the CRITICAL SPEED BAND.

The CRITICAL SPEED BAND menu is displayed only in the AUTO START mode.

IMPORTANT **Even though the CRITICAL SPEED BAND menu is not displayed in the MANUAL START MODE, the CRITICAL SPEED function will still operate if enabled.**

This function is enabled by programming USE CRITICAL BAND = TRUE. The speed band is defined by the values assigned to CRITICAL SPEED MIN (RPM) and the CRITICAL SPEED MAX (RPM). The CRITICAL BAND RATE = _____ (RPM / SEC) sets the rate used to pass through this speed range.

The default CRITICAL SPEED BAND is 1500 to 1800 RPM.

Normally the CRITICAL SPEED BAND will be between IDLE SPEED and MIN GOV SPEED. As the ACTUAL SPEED SETPT cannot be stopped inside the CRITICAL SPEED BAND it is NOT recommended to set this band between the MIN GOV SPEED and the MAX GOV SPEED.

It is possible to change the direction of the speed ramp, (increase to decrease or decrease to increase), by giving the control a LOWER, or RAISE command while in the CRITICAL SPEED BAND. When a command is given for the opposite direction, the ACTUAL SPEED SETPT will be driven to the appropriate CRITICAL SPEED BAND limit, MIN or MAX and stop.

Valve Ramp Control

Either the output of the VALVE RAMP or the SPEED CONTROL is used to open and close the steam valve during turbine operation. These outputs are LOW SIGNAL SELECTED by the LSS Bus so that the control function with the lowest demand sets the position of the actuator.

The VALVE RAMP is opened via the START COMMAND during START UP to run its output out of the way of the SPEED CONTROL (100%-Open). When the control gets a TRIP command, the VALVE RAMP over rides the SPEED CONTROL and closes the ACTUATOR (0%-Closed).

The SPEED CONTROL increases or decreases the steam demand signal during normal turbine operation.

In the MANUAL START MODE the Trip & Throttle valve holds the steam valve closed while the outputs of the VALVE RAMP and the SPEED CONTROL are driven quickly to 100% and to the MIN GOVERNOR speed. Start is initiated when the Peak 150 is RESET and receives a START command. Initial speed control is via the Trip & Throttle valve with the operator in control of the turbine speed.

Initially In the AUTO START MODE the VALVE RAMP and SPEED CONTROL hold the ACTUATOR at the closed position. Before a START command is given the Trip & Throttle valve is opened by the operator. When given a START command the VALVE RAMP is opened slowly to apply steam to the turbine. At the same time the LOCAL SPEED SETPT starts ramping from zero to IDLE speed. When the turbine speed exceeds the LOCAL SPEED SETPT, the SPEED CONTROL closes the actuator until it is controlling the turbine speed at the SET POINT.

Speed Control

The SPEED CONTROL compares the turbine SPEED with the ACTUAL SPEED SET POINT. When the two values are equal, the Actuator signal is a constant value between 4 & 20 mA or between 0 & 200 mA. (The actuator output range is selected in the ACTUATOR CONFIGURATION MENU).

The ACTUAL SPEED signal is the output of the MPU HSS (HIGH SIGNAL SELECTOR). The ACTUAL SPEED SETPT is either the LOCAL SPEED SETPT or the REMOTE SPEED SET depending on which CONTROL MODE has been configured.

When needed, the speed control can be configured to use DROOP feedback. Droop is defined as a decrease in speed set point proportional to an increase in load. The DROOP Signal is a function of the VALVE POSITION (ACTUATOR) signal. When DROOP is configured, the SPEED CONTROL compares the ACTUAL SPEED SET POINT to the combination of the SPEED signal plus the DROOP signal.

Dual Dynamics

The SPEED DYNAMICS are used to match the control response time to the natural response time of the turbine. When there is a change in speed (or load), there will be an error between the inputs to the SPEED CONTROL. The PID within the SPEED CONTROL responds to this error by driving the actuator signal to the new required position. The P (Proportional) term determines how fast the signal reaches the new position, while the I (Integral) term determines the dampening when the new position is reached.

The Peak 150 has two sets of SPEED DYNAMICS for adjusting the turbine's response. They are LOW SPEED GAIN & RESET and HIGH SPEED GAIN & RESET. These adjustments, found in the SPEED DYNAMICS MENU, can be accessed in the SERVICE MODE menu with the turbine running. The transfer between the dynamics is selected by the setting of the HIGH SPEED SWITCH POINT or with the contact closure of the HI DYN SELECT input.

Diagnostics

When the control is powered up, the microprocessor begins executing the software and illuminates the front panel CPU OK LED. The LED stays on as long as the microprocessor is running. This LED is controlled in the hardware by a watchdog timer circuit. When the microprocessor stops executing or when the program is not running correctly, the watchdog timer will time out and the CPU OK LED will turn off. When this happens, the I/O LOCKOUT will be activated, and will turn off all DISCRETE and ANALOG OUTPUTS. To restart the control the power must be cycled off and on.

When the control is powered on or when it is rebooting after being configured, the software performs several hardware diagnostic tests. If an error is found during this testing, it is annunciated through the tachometer display on the front of the control. The tachometer will display the message "ERR" followed by an error number. If any of these errors occur, the control must be returned to the factory for repair. Refer to Chapter 12 for an explanation of the diagnostic tests and their corresponding error numbers that are displayed if an error occurs.

- RAM Test Failure "Err0"
- Analog I/O Timer #1 Failure "Err1"
- Analog I/O Timer #2 Failure "Err2"
- I/O Lockout Failure "Err3"
- –12 V Power Supply Failure "Err4"
- +12 V Power Supply Failure "Err5"
- +12 V P Power Supply Failure "Err6"
- +4.5 V Power Supply Failure "Err7"

Shutdown and Alarm Summary

The following is a list of the various occurrences which generate either an ALARM or SHUTDOWN condition. SHUTDOWN conditions are signaled by a relay which is configured by the user to either ENERGIZE or DE-ENERGIZE for shutdown. The front panel display will also indicate the cause of the trip. ALARM conditions are signaled by a relay that de-energizes. Any common alarm or trip condition can be identified using the hand-held programmer. In addition, the cause of the last trip is held in a register and can be identified using the hand-held programmer.

Alarm conditions are:
- MPU #1 Failure
- MPU #2 Failure
- Remote Input Failure
- Shutdown (configurable)
- Communications Failure (if used)

Shutdown conditions are:
- Loss of both magnetic pickup signals
- Electrically-sensed overspeed trip
- Emergency Trip pushbutton is pushed
- Shutdown contact input initiated
- Trip initiated by Modbus device (if used)

Magnetic Pickup Failsafe

The Peak 150 has a MAGNETIC PICKUP FAILSAFE function that trips the turbine when both MPU input signals are lost. During turbine start up, the MAGNETIC PICKUP FAILSAFE function is automatically overridden.

The USE MPU OVERRIDE TIMER limits the time between the START COMMAND and the minimum detected speed (approximately 200 RPM). The turbine trips if the MAX STARTING TIME expires and the Peak 150 is not sensing speed. The override is removed when the turbine speed exceeds the AUTO-OVRD-OFF-SPEED. (This speed is programmed by the user and should be above the minimum detected speed).

Slow Roll Down Failsafe Override

The USE SLOW ROLLDOWN OVRD function differentiates between the gradual loss of the speed signal (or roll down when the Trip & Throttle Valve is closed gradually) and a sudden loss of the speed signal.

When the speed gradually drops below the setting of The AUTO-OVRD-ON-SPEED for the time set by the AUTO-OVRD-ON-DELAY, the MAGNETIC PICKUP FAILSAFE override is switched on. This prevents a LOSS OF BOTH MPUs trip, and drives the Peak 150 governor valve opens fully as turbine speed decreases.

A sudden loss of the MPU inputs trips the turbine and closes the governor valve.

Power Supplies

The Peak 150 control is available with the following power supplies:

Version	Input	Frequency
1 (24 Vdc)	18–32 Vdc	NA
2 (ac/dc)	90–150 Vdc	NA
	88–132 Vac	47–63 Hz

Power is supplied directly to the Peak 150 as no power switches are provided.

The POWER SUPPLY INPUT is protected with two user-replaceable fuses that are sized to eliminate nuisance trips. The following fuses are recommended:

Version 1 (24 Vdc)	3 A, 250 V, Slo-Blo, 3AG
Version 2 (ac/dc)	1 A, 250 V, Slo-Blo, 3AG

When replacement fuses are needed, the control should be tested and repaired.

If power is disconnected the control will continue to operate for at least the following holdup times:

Version 1:	28 milliseconds from 24 Vdc
Version 2:	50 milliseconds from 120 Vdc
	4 cycles from 100 Vac

Input voltage fluctuations within the acceptable range will not affect operation of the Peak 150 control.

⚠WARNING

HIGH VOLTAGE—Before replacing fuses, remove all power from the control; high voltage is present on the fuse clips and elsewhere in the control. Contact with this voltage could cause personnel injury or death.

Communications (Optional)

The Peak 150 control is capable of communicating to a plant computer using Modbus protocol. All pertinent parameters are programmed to be transferred through this link. The following link parameters are configurable: data bits, stop bits, baud rate, and parity.

This option requires additional communication hardware not available unless purchased. Be sure to specify the Modbus option if this is required.

See Chapter 11 for complete details.

Chapter 6.
Operating Procedures

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.

NOTICE

Do NOT attempt to operate the turbine until the Peak 150 control has been programmed. Refer to the program worksheets.

Front Panel Operation

Figure 6-1 shows the front panel of the Peak 150 control.

RPM Meter

The RPM METER (tachometer) displays the SPEED sensed by the Peak 150 control. The minimum speed will depend on when the MPU voltage level goes above 1 Vrms, but can be no lower than 200 rpm.

When the Peak 150 control is tripped, the RPM display flashes a TRIP CODE. The SPEED and TRIP CODE flash alternately. Once the trip is cleared with a RESET command, the display will show only the SPEED. The last TRIP CODE can be found in the Service Mode TRIPS menu using the hand-held programmer (see Service Mode program chapter). The TRIP CODES are as follows:

Code	Cause
1	External Trip (contact input opened)
2	Loss of Both MPU inputs
3	Overspeed Trip indication
4	Front Panel Trip indication
5	Modbus Trip indication

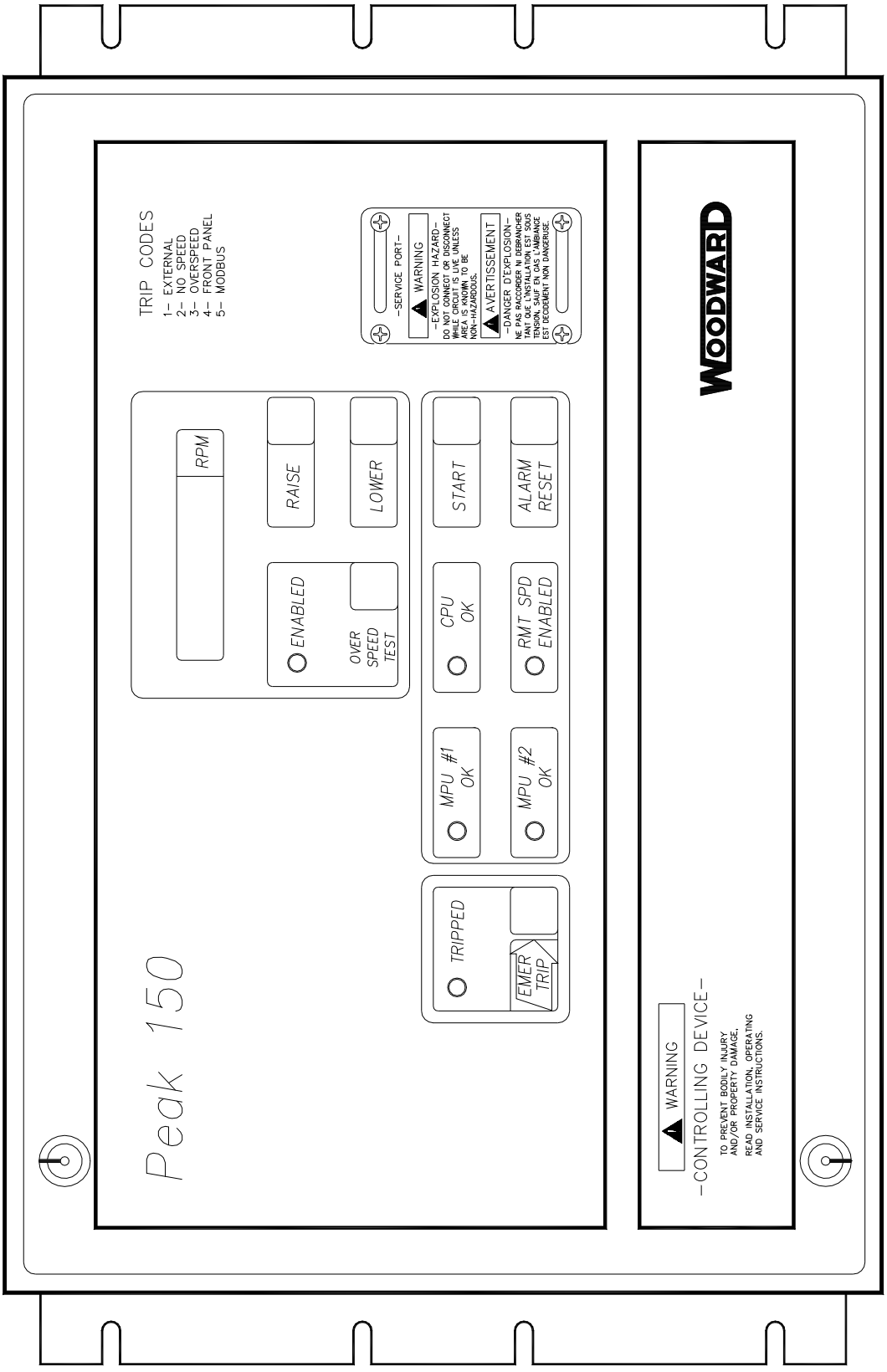


Figure 6-1. Front Panel of Peak 150 Control

LEDs

TRIPPED LED: The TRIPPED LED will be on as a result of pressing the EMER TRIP button, opening the EXTERNAL TRIP input, or as a result of one of the programmed TRIP conditions. In addition to illuminating the TRIPPED LED, the TRIP relay will either energize or de-energize as programmed.

When programmed for RESET CLEARS TRIP, the TRIPPED LED and the TRIP relay can be RESET even if a trip condition still exists. This restores the TRIP RELAY to the RUN state which removes it from the turbine trip string. Resetting the TRIP relay gives the operators the opportunity to prepare for a turbine re-start.

When RESET CLEARS TRIP is active and after the control has been RESET, no other trips can be activated / tested until the turbine has been started.

OVER SPEED TEST ENABLED LED: The OVER SPEED TEST ENABLED LED indicates that the OVER SPEED TEST button on the front panel is pressed or, contact input #8 is configured for OVER SPEED TEST ENABLE and is closed (see OVERSPEED TEST section of OPERATING PROCEDURES chapter 6).

This LED is on while the OVERSPEED TEST is selected. It blinks at a slow rate when the turbine's speed is above the control's trip point, and it blinks at a fast rate when the turbine's speed is above the external trip device's trip point.

CPU OK LED: The CPU OK LED is always on when the control is operating properly. During power-up this LED is out until all power-up diagnostics are completed. If this LED is not on, the CPU is not running and this indicates a hardware problem. If cycling the power does not reset the CPU OK LED, the Peak 150 needs repaired.

MPU #1 OK and MPU #2 OK LEDs— MPU #1 OK and MPU #2 OK LEDs go out if an MPU #1 or MPU #2 failed signal is detected. The LEDs are ON during start-up and as long as the MPU output is within normal frequency range and voltage levels. The LEDs will be ON during a turbine start, indicating the SPEED FAILSAFE is overridden (see MAGNETIC PICKUP FAILSAFE OVERRIDE section in OPERATING PROCEDURES chapter 6).

RMT SPD ENABLED LED—The RMT SPD ENABLED LED is on when the REMOTE SPEED SET input is between 4 and 20 mA, the REMOTE SPEED ENABLE input is closed and the turbine SPEED is equal to or greater than the MIN GOVERNOR SPEED. When this LED is on, the REMOTE SPEED SET input controls the ACTUAL SPEED SETPT / turbine speed. The following conditions affect the operation of the REMOTE SPEED:

- The RMT SPD ENABLED LED blinks at a slow rate if remote control is selected (USE REMOTE SPEED SETTING is configured and the REMOTE SPEED ENABLE input is closed) but remote control is inhibited. Remote control will be inhibited when the LOCAL SPEED SETPT is in control with the turbine operating below the MIN GOV SPEED. Remote control will also be inhibited when MANUAL CONTROL ONLY is selected.

- The RMT SPD ENABLED LED blinks at a fast rate when the USE REMOTE SPEED SETTING is configured but the REMOTE SPEED SET input has failed. This input failure latches and requires a RESET after the input signal has been restored. The REMOTE SPEED ENABLE contact enables the REMOTE FUNCTION when closed and disables the REMOTE FUNCTION when open. When open, the RMT SPD ENABLED LED is off, unless the REMOTE SPEED SET input has failed. When the REMOTE SPEED SET input fails (even if the REMOTE SPEED ENABLE contact is open), the RMT SPD ENABLED LED will blink at a fast rate.

- Failure of the REMOTE SPEED SET input is when it drops below 2 mA (0.5 V) or goes above 22 mA (5.5 V). When the REMOTE SPEED SET input fails, the ACTUAL SPEED SETPT remains at the last remote set point and the RMT SPD ENABLED LED flashes at a fast rate. The ACTUAL SPEED SETPT now follows the LOCAL SPEED SETPT and changes can be made with the RAISE / LOWER buttons or the RAISE SPEED / LOWER SPEED discrete inputs.
- If remote is not configured for use, this LED will not turn on.

RMT SPD ENABLED LED / COMBINATION MODE
When the combination mode is configured (see Configuration and Operating chapters), the ACTUAL SPEED SETPT is equal to the higher value between the LOCAL SPEED SETPT and the REMOTE SPD SET. The RMT SPD ENABLED LED is ON when the REMOTE SPEED SET (point) is in control, is OFF when the REMOTE SPEED ENABLE input is open, blinks slowly when LOCAL SPEED SETPT is in control, and blinks fast when the REMOTE SPEED SET input signal fails.

If the REMOTE SPEED SET input fails or is disabled by opening the REMOTE SPEED ENABLE contact, the REMOTE SPEED SET (point) ramps to MIN GOV SPEED at the SET POINT FAST RATE to allow the LOCAL SPEED SETPT to be the highest setting. Once the input is restored and a RESET command is issued, the ACTUAL REMOTE SPEED SET (point) will ramp towards the REMOTE SPEED SET INPUT value.

Front Panel Buttons (FP/B)

ALARM RESET—The Peak 150 latches when it senses an ALARM or a TRIP condition. After the ALARM or TRIP condition has been cleared, pressing the ALARM RESET button will clear the latch function. Normal start sequence is to push the ALARM RESET button then the START button.

Along with the ALARM RESET button, the Peak 150 can be reset externally with the RESET discrete input, or with the Modbus RESET command.

START—Pressing the START button initiates the Turbine Start Sequence. The START button is inactive until all ALARMS and TRIPS are cleared and RESET.

- In the MANUAL START MODE, pressing the START button opens the VALVE RAMP and ACTUATOR while a turbine operator controls the turbine speed with a trip & throttle valve. Governor speed control begins at the MIN GOVERNOR SPEED.

- In the AUTO START MODE, the trip and throttle valve is opened before the Peak 150 START button is pressed. When the START button is pressed, the Peak 150 controls the speed with the VALVE RAMP and ACTUATOR. Governor speed control begins at either IDLE SPEED or the MIN GOVERNOR SPEED.

- Either START MODE begins operating when the Peak 150 receives a START command from the START button, the START discrete input, or a Modbus START command.

If the external START input is closed, the RESET button will both RESET and START the Peak 150.

- In the MANUAL START MODE the ACTUAL SPEED SETPT will RAMP to the MIN GOVERNOR SPEED.

- In the AUTO START MODE the ACTUAL SPEED SETPT will RAMP to IDLE speed. When the IDLE / MIN GOV input is closed, the ACTUAL SPEED SETPT will ramp to MIN GOVERNOR SPEED.

If START = RAMP TO MIN GOV is configured as part of the AUTO START MODE, pressing the START button after the turbine is running will ramp the ACTUAL SPEED SETPT to MINIMUM GOVERNOR SPEED even if the turbine speed has not reached IDLE SPEED.

EMER TRIP—Pressing the EMER TRIP button will trip the turbine. When pressed it sets the ACTUAL SPEED SETPT to zero, drives the VALVE RAMP (ACTUATOR) to zero (closed position) and changes the state of the TRIP RELAY.

RAISE and LOWER— In the MANUAL MODE and the COMBINATION MODE, these buttons will adjust the LOCAL SPEED SETPT. These buttons are disabled in the REMOTE CONTROL MODE.

The LOCAL SPEED SETPT moves at the SETPT SLOW RATE until the DELAY FOR FAST RATE time has expired. The ramp rate will then switch to the SETPT FAST RATE.

Closing the RAISE or LOWER buttons while ramping from IDLE SPEED to MIN GOVERNOR SPEED will halt the IDLE/ MIN GOVERNOR ramp as long as the set point is not within a CRITICAL SPEED BAND. When the IDLE / MIN GOVERNOR ramp is halted, the RAISE or LOWER buttons can be used to manually adjust the ACTUAL SPEED SETPT. The ramp can be restarted by selecting the START command.

OVERSPEED TEST—With the OVERSPEED TEST button closed, along with the RAISE button, the governor speed can be increased above the MAX GOV SPEED. This enables the testing of the overspeed trip devices, both the OVERSPEED TRIP on the Peak 150 and any external overspeed trip devices.

Once the speed is above the OVERSPEED LEVEL, the ENABLED (OVERSPEED TEST) LED blinks at the slow rate. If the OVERSPEED TEST button is released above this point, the unit will trip. Code "3" will flash on the display, and the TRIPS menu in the SERVICE header will indicate an OVERSPEED TRIP has occurred.

If the speed reaches the EXTERNAL OSPD LEVEL the ENABLED (OVERSPEED TEST) LED will blink at the fast rate. This is an indication that turbine speed is near the trip speed of the external trip device.

If the OVERSPEED TEST button is opened below the OVERSPEED LEVEL, the ACTUAL SPEED SETPT ramps back to MAX GOV SEED. If using COMBINATION mode, the LOCAL SET POINT must be used to perform the test as the speed cannot go above MAX GOV SPEED in the REMOTE mode.

Relays

TRIP RELAY: The TRIP relay is activated as part of a turbine trip as a result of pressing the EMER TRIP button, as a result of losing the EXTERNAL TRIP input on terminal 14, or as a result of one of the internal trip conditions on the Peak 150.

The TRIP relay opens a set of contacts between terminals 4 &5 when tripped. This set of contacts is used in many systems as part of a trip string where any of the safety systems can open the string and trip the turbine. The string usually consists of inputs from the lube oil system, the turbine vibration system, an over speed trip device or one of the trips on the Peak 150.

- If one of the trip conditions de-activates the TRIP relay and opens the trip string, the trip string removes the EXTERNAL TRIP input from terminal 14. To overcome this trip loop, the Peak 150 can be configured so that RESET CLEARS TRIP. When this is configured TRUE and the RESET is closed momentarily, all trips are overridden and the TRIP relay resets. This restores the speed control output in the trip string so the turbine operator can RESET the turbine for the next start.
- When testing the TRIP function on the Peak 150, note that after a TRIP has been RESET, all other TRIPs will be ignored until the turbine is started.

The TRIP relay defaults at DE-ENERGIZE to trip. However the TRIP relay can be configured to ENERGIZE to trip by setting TRIP RELAY ENERGIZES FOR TRIP to TRUE in the program. After configuring the TRIP relay, ensure that the correct jumpers (Jumpers 2 & 17 OR Jumpers 1 & 18) are installed to provide closed contacts and the proper LED display when the turbine is running. See Figure 4-9 for proper jumper selection and location.

ALARM RELAY: The ALARM relay de-energizes when an alarm condition is detected. Even though the turbine continues to operate with an alarm condition, the ALARM condition should be corrected before it develops into a trip condition.

CONFIG RELAY #1 & #2: The CONFIG relays can be configured for one of 11 functions. The CONFIG relays will be energized to indicate the function. The (+) increases the configuration option number and the (–) decreases the configuration option number. (For a list of the relay configuration options, see Chapter 5 under the Relay heading).

Prior To Turbine Start

- Program the Peak 150 for the specific turbine application (see Appendix for program worksheets).
- Stroke the actuator (linkage) to ensure that the turbine can be shut down when calling for 0% actuator position and can reach full load when calling for 100% actuator position (see Stroking Actuator).
- Be prepared to adjust the system dynamics when the Peak 150 takes control of the speed (see Dynamics Adjustments).

IMPORTANT **When starting the turbine, monitor the speed readout to ensure you have a good speed signal from the magnetic speed pickups, especially on initial turbine start.**

IMPORTANT **Refer to turbine manufacturer's operating procedures for complete information on turbine start-up.**

Turbine Start

When starting the turbine, both the actuator and the Peak 150 have minimum start up requirements:

- The Peak 150 needs a 1.0 Vrms MPU signal to sense speed.
- The Actuator, when driven directly from the turbine, requires enough speed to develop the force required to operate the steam valves or servo valve.

The Peak 150 and actuator rely on an alternate means of opening the governor valve or applying bypass steam to roll the turbine for start up. The minimum speed at which the Peak 150 can control turbine speed depends on the minimum speed required to meet these two conditions. (see the actuator specifications).

Idle/Minimum Ramp

If the Peak 150 control is programmed for a MANUAL START, this section can be ignored. When MANUAL START is configured, speed control will begin at MIN GOVERNOR SPEED which is much higher than IDLE speed. All speed control, including avoiding the CRITICAL SPEED BAND, is the responsibility of the operator until the turbine reaches MIN GOVERNOR SPEED.

If the control is programmed for AUTO START, the Peak 150 will begin controlling the turbine speed at IDLE speed. The following apply to the AUTO START mode.

The turbine can be accelerated either manually or automatically from IDLE to MIN GOVERNOR SPEED.

- To operate the system manually, use the RAISE or LOWER buttons or inputs. When a button is closed, the turbine speed will change. When the button is opened, the turbine runs at the current speed.
- To operate the system automatically, use one of the following:
  - Close the IDLE / MIN GOV input.
  - Press the START button on the front panel, if START = RAMP TO MIN GOV is set to TRUE.
- This ramp will accelerate the turbine at the IDLE / MIN GOV RATE.

If a CRITICAL SPEED BAND has been defined, the ramp rate of the speed increase (or decrease) in this band will be the CRITICAL BAND RATE. When the speed of the turbine is outside the CRITICAL SPEED BAND the ramp rate will return to the IDLE / MIN GOV RATE.

The IDLE to MIN GOVERNOR SPEED ramp can be stopped at any point between IDLE SPEED and MIN GOVERNOR SPEED, except within the CRITICAL SPEED BAND:

- By pressing the RAISE or LOWER button on the front panel.
- By closing the external RAISE or LOWER contact.
- By opening the IDLE / MIN GOV input if one of the following scenarios has been programmed:
  - The USE RAMP TO IDLE function is set FALSE.
  - The USE RAMP TO IDLE function is set TRUE and START = RAMP TO MIN is set TRUE.

If the speed is below the MIN GOVERNOR SPEED set point, the IDLE to MIN GOVERNOR SPEED ramp can be changed with the RAISE / LOWER buttons, or it can be restarted:

- By toggling the IDLE / MIN GOV input.
- By pressing the START button on the front panel if configured for START = RAMP TO MIN GOV and the IDLE / MIN GOV input is open.

If the speed is below MIN GOVERNOR SPEED and the IDLE / MIN GOV input is opened, the speed set point will move back to IDLE speed at the IDLE / MIN GOV RATE if:

- USE RAMP TO IDLE is set TRUE.
- START = RAMP TO MIN GOV is set FALSE.

When the speed is at or above MIN GOVERNOR SPEED opening the IDLE / MIN GOV input will not lower the turbine speed to IDLE speed.

The IDLE / MIN GOV input can be open or closed during turbine start-up.

- If the IDLE / MIN GOV input is open, when the trips are cleared, pressing the START button will ramp the turbine speed to IDLE.
- If the IDLE / MIN GOV input is closed, when the trips are cleared, pressing the START button will ramp the turbine speed to the MIN GOVERNOR SPEED.

Critical Speed Band

The ACTUAL SPEED SETPT cannot be stopped within the CRITICAL SPEED BAND. The ramp will continue at the CRITICAL BAND RATE until the actual speed is outside the CRITICAL SPEED BAND then stop. Once outside the CRITICAL SPEED BAND, the ACTUAL SPEED SETPT can be adjusted manually with the RAISE / LOWER buttons or contact inputs and will change at the Slow Rate defined under the SPEED VALUES service menu. The ACTUAL SPEED SETPT can also be adjusted automatically by pressing the START button (if configured) or by toggling the IDLE / MIN GOV input.

While operating in the CRITICAL SPEED BAND, if a LOWER command is issued while the ACTUAL SPEED SETPT is increasing, the direction will reverse and return to the CRITICAL SPEED MIN setting. If a RAISE command is issued while the ACTUAL SPEED SETPT is decreasing, the direction will reverse and run the speed to the CRITICAL SPEED MAX setting.

Speed Reference Operating Modes

Using the hand-held programmer, the user can choose one of three operating modes to adjust the speed reference between the MIN and MAX GOV SPEED set points. The span between MIN GOV SPEED and MAX GOV SPEED is the normal operating speed range of the turbine. These limits are programmed by the operator.

IMPORTANT

If the control has been configured for droop, the turbine speed will always be less than the speed set point. The difference will depend on the amount (%) of droop selected during programming.

Manual Speed Set Mode

MANUAL SPEED SET mode is defined as:

- Changing the SPEED REFERENCE with the RAISE and LOWER buttons on the FRONT PANEL.
- Changing the SPEED REFERENCE with the RAISE and LOWER discrete inputs.
- Changing the SPEED REFERENCE with the RAISE SPEED and LOWER SPEED Modbus commands.

The MANUAL SPEED SET mode is selected when MANUAL CONTROL ONLY is configured in the OPERATING MODE menu.

The SPEED REFERENCE will change at the SET POINT SLOW RATE for the DELAY FOR FAST RATE time. After the delay time, it will switch to the SET POINT FAST RATE.

While in this mode, the REMOTE SPEED SET mode cannot be enabled.

Remote Speed Set Mode

The REMOTE SPEED SET mode is when an external 4–20 mA signal sets the SPEED REFERENCE. (This 4–20 mA input, called the REMOTE SPEED SET signal, normally comes from a PLC or manual turbine control station). The REMOTE SPD SETPT is tracked by the ACTUAL SPEED SETPT. The rate which the REMOTE SPEED SETPT can change the ACTUAL SPEED SETPT is set by the REMOTE RATE---MAX ramp.

The control speed defined by 4 mA and 20 mA is programmed in the SPEED VALUES menu by the values assigned to the MIN GOV SPEED and the MAX GOV SPEED respectively.

Before the REMOTE SPEED SET mode can be enabled, the following operating conditions must be met:

- The turbine speed must be above the MIN GOV SPEED.
- The REMOTE SPEED ENABLE input must be closed.
- The REMOTE SPEED SET signal must be between 2 mA and 22 mA.

With the IDLE / MIN GOV input closed, and the turbine speed above MIN GOV SPEED, when the REMOTE SPEED ENABLE input is closed, the ACTUAL SPEED SETPT will ramp from the current speed to the REMOTE SPEED SET input at the REMOTE-NOT-MATCHED RATE.

The RMT SPD ENABLED LED has the following flash codes:

- When the USE REMOTE SPEED SETTING is configured TRUE, the REMOTE SPEED ENABLE contact is closed and the REMOTE SPEED SETPT is below the ACTUAL SPEED SETPT the RMT SPD ENABLED LED will flash at a rate of once per second.
- When the USE REMOTE SPEED SETTING is configured TRUE, the REMOTE SPEED ENABLE contact is closed and the REMOTE SPEED SETPT is equal to the ACTUAL SPEED SETPT, the RMT SPD ENABLED LED will stay on (no longer flashing).

- When USE REMOTE SPEED SETTING is configured and the REMOTE SPEED SET input fails, the RMT SPD ENABLED LED will flash at a fast rate. This will also trigger a general alarm. When the input is restored, the control must be RESET to stop the LED from flashing. It is not necessary to open and reclose the REMOTE SPEED ENABLE contact.
- When the control is configured for MANUAL SPEED SET mode, (USE REMOTE SPEED SETTING is not configured), detection of an out-of-range signal will have no effect on the control and the RMT SPD ENABLED LED will not flash.

The Peak 150 will stay in the REMOTE SPEED SET mode unless one of the following occurs:

- The REMOTE SPEED ENABLE input is opened.
- SPEED is reduced to below MIN GOV SPEED.
- A SHUTDOWN occurs.
- A REMOTE INPUT FAILURE occurs. The ACTUAL SPEED SETPT will be the value of the REMOTE SPEED SETTING input at the time when a REMOTE SPEED SET failure is detected.

Opening the REMOTE SPEED ENABLE contact will disable the REMOTE SPEED SET mode, turn off the front panel RMT SPD ENABLED LED (unless out of range), and revert speed control to the MANUAL SPEED SET mode.

Opening of the IDLE / MIN GOV, and the REMOTE SPEED ENABLE contacts, will disable the REMOTE SPEED SET mode and ramp the SPEED REFERENCE back to IDLE SPEED at the IDLE / MIN GOV RATE as long as START = RAMP TO MIN GOV is false.

Combination Speed Set Mode

The COMBINATION SPEED SET mode uses the HIGH SIGNAL SELECT block to choose the speed set mode with the highest speed demand from either the REMOTE SPEED SET mode or the MANUAL SPEED SET mode. If the REMOTE SPEED SET signal is disabled for any reason, operation defaults to MANUAL MODE at the speed of the LOCAL SPEED SETPT.

If the IDLE / MIN GOV contact is opened, the REMOTE SPEED SET mode will be disabled and the ACTUAL SPEED SETPT will ramp down to IDLE SPEED at the IDLE / MIN GOV RATE.

Overspeed Test

While the OVERSPEED TEST button is pushed or the OVERSPEED TEST contact is closed (if configured), the front panel OVERSPEED TEST ENABLED LED will illuminate. This LED indicates that the ACTUAL SPEED SETPT can be adjusted above the MAX GOV SPEED. The maximum speed that can be reached during the OVERSPEED TEST is the value entered for the OVERSPEED TEST LIMIT. The OVERSPEED LEVEL sets the electronic trip speed of the control, and the EXTERNAL OSPD LEVEL sets the lower limit of the external trip devices.

Closing the OVERSPEED TEST button disables the REMOTE SPEED SET mode without changing the REMOTE SPEED SETPT. As long as the OVERSPEED TEST button is closed, only the OCP RAISE and LOWER buttons or the RAISE and LOWER contacts can be used to raise the ACTUAL SPEED SETPT to the OVERSPEED TEST LIMIT at the SET POINT SLOW RATE.

At any time during the test, when the OVERSPEED TEST button is released:

- If the speed is above the OVERSPEED LEVEL, the turbine will trip. If the speed is manually lowered below the OVERSPEED LEVEL with the LOWER button prior to opening the OVERSPEED TEST button the turbine will not trip.
- If the speed is less than the OVERSPEED LEVEL, the control reverts to the mode of operation that was programmed prior to the test.
  - In the MANUAL SPEED SET mode the ACTUAL SPEED SETPT will instantly ramp to the MAX GOV SPEED. The speed also returns to the MAX GOV SPEED when the RAISE button is released.
  - In the REMOTE SPEED SET mode, the speed will decrease to the MAX GOV SPEED at the SET POINT SLOW RATE, than it will decrease to the REMOTE SPEED SETPT at the REMOTE NOT MATCHED RATE.
  - In the COMBINATION SPEED SET mode, the speed will decrease to the MAX GOV SPEED at the SET POINT SLOW RATE. Control stays in LOCAL SPEED SETPT until the speed is manually decreased below the REMOTE SPEED SETPT.

During the OVERSPEED TEST, at speeds greater than or equal to the OVERSPEED LEVEL and less than the EXTERNAL OSPD LEVEL, the OVERSPEED TEST button will flash at a rate of once per second. At speeds equal to or greater than the EXTERNAL OSPD LEVEL, the OVERSPEED TEST button will flash at a rate of twice per second.

Shutdown and Alarm Function Summary

The following indicates the various conditions which constitute either an alarm or shutdown condition. A shutdown condition is signaled by the TRIP relay which defaults as DE-ENERGIZE on trip. It can be configured to ENERGIZE on trip by setting TRIP RELAY ENERGIZES FOR TRIP = TRUE. Alarm conditions are signaled by the ALARM relay de-energizing.

Alarm conditions are:

- MPU #1 FAILED
- MPU #2 FAILED
- REMOTE INPUT FAILED
- COMM LINK FAILURE
- TURBINE TRIP (When configured USE TRIP AS ALARM = TRUE)

Shutdown conditions are:

- EXTERNAL TRIP (Contact input opened)
- LOSS OF BOTH MPU INPUTS
- OVERSPEED TRIP
- FRONT PANEL EMER TRIP
- MODBUS TRIP

The TRIP and ALARM functions latch. A RESET is required once the condition is corrected to clear the latch. If the governor is TRIPPED, a RESET command will clear the TRIP RELAY output and the front panel EMER TRIP LED if configured for RESET CLEARS TRIP = TRUE. This does not clear the TRIP input on terminal 14 which is part of the turbine trip string. When an operator resets this string, the turbine is ready to start. (If an EXTERNAL TRIP still exists, the control will not initiate a start).

A typical start requires a RESET command and a START command. If these two separate commands are not desired, the START command can be closed with a jumper and only a RESET command is required.

Magnetic Pickup Failure Override

The MAGNETIC PICKUP signal failed shutdown is overridden during start up of the turbine. The override is activated automatically during the start. It is removed when the turbine speed is greater than the speed configured for the AUTO-OVRD-OFF SPEED.

The MAGNETIC PICKUP signal failed shutdown can also be overridden during start up for a set time in addition to using the AUTO-OVRD-OFF SPEED. This function is enabled by configuring USE MPU OVERRIDE TIMER = TRUE, and by setting the MAX STARTING TIME = _____ sec. When the speed is greater than the AUTO-OVRD-OFF SPEED or the when the MAX STARTING TIME expires, the override will be disabled.

When stopping the turbine, the MAGNETIC PICKUP signal failed shutdown will be activated when the turbine speed is too low to produce an MPU signal greater than 1 Vrms. BY configuring USE SLOW ROLLDOWN OVRD = TRUE the Peak 150 can differentiate between the sudden loss of the MPU signal and the loss of the MPU signal due to the roll down during a normal stop. This function is initiated when the turbine speed drops below the AUTO-OVRD-SPEED for the AUTO-OVRD-ON DELAY time. The DELAY time differentiates between the sudden loss of the MPU, which will trip the turbine, and the slow roll down.

On a normal stop, the trip and throttle valve would be closed gradually with the Peak 150 control demanding the governing valve to be fully open as the turbine speed decreases below the IDLE set point. With no fault conditions detected by the Peak 150 control, the throttling valve needs only to be opened to affect a start. If the governor initiated a shutdown, the RESET and START buttons must be pushed before the turbine can be started.

Stroking Actuator

⚠WARNING

STEAM TO THE TURBINE MUST BE SHUT OFF BY OTHER MEANS DURING THIS PROCESS. Overspeed sensing and trip detection are disabled during this process. Overspeeding the turbine will cause damage to the turbine and can cause personnel injury or death to personnel.

The ACTUATOR OUTPUT can be stroked (or calibrated) from the SERVICE MODE. Pressing the down arrow on the hand-held programmer when the display shows WOODWARD GOVERNOR COMPANY will enter the SERVICE MODE. Pressing the ESC key will return to the Woodward heading.

Press the left arrow until the VALVE header appears. Next, press the down arrow to see VALVE menu options. Continue pressing the down arrow until STROKE VLV OUTPUT? appears. Press the turtle or rabbit adjust-up arrow to change the display to TRUE. **The control must be tripped to perform this function.**

Press the down arrow until the VALVE POSITION (%) is on the top line of the display. Next, press the up-down arrow to change to the bottom display line. Go to the VALVE header in the SERVICE MODE. Press the up arrow until MIN/MAX SWITCH is displayed. Toggling this between TRUE and FALSE will change the output current between minimum and maximum.

Another option for stroking the actuator is the STROKE POSITION (%). This allows the actuator to be set manually between 0% and 100% by using the rabbit or turtle adjust up and down keys. The MIN/MAX SWITCH is a shortcut method of accomplishing this.

When the VALVE POSITION (%) = 0%, the actuator should be closing the steam valve. It is important that the actuator has sufficient over travel at the minimum stop to ensure that the actuator can close the steam valve completely. When the VALVE POSITION(%) = 100%, the actuator should be at maximum stop to ensure the system can carry full load. The process of going between minimum and maximum will have to be repeated several times before the initial start to ensure the actuator and linkages are properly set up.

Be sure to set STROKE VLV OUTPUT to FALSE when done.

Dynamics Adjustments

DYNAMIC adjustments are made in the SERVICE MODE. Press the down arrow on the hand-held programmer when it displays WOODWARD GOVERNOR COMPANY to enter the SERVICE MODE. Press the ESC key to display the WOODWARD message.

Press the right arrow until the SPEED DYNAMICS header appears. Next, press the down arrow to see the dynamic menu options. The first two options are LOW SPEED GAIN and LOW SPEED RESET and will be referred to as GAIN and RESET, respectively.

The GAIN and RESET are used to match the response time of the Peak 150 to the natural response time of the turbine. To obtain a faster transient response, slowly increase the GAIN with the turtle-adjust-up key until the ACTUATOR OUTPUT begins to oscillate. (The best way to verify this is by placing an analog voltmeter across the ACTUATOR OUTPUT). When the GAIN is set, adjust the RESET as necessary to stabilize the output. If stability cannot be obtained with the RESET adjustment, reduce the GAIN setting.

A second set of dynamics is available, if necessary. This second set is selected by closing the HI DYN SELECT input (if configured) or with a speed setting. The dynamics switch point is the speed that is configured for the HI SPEED SWITCH PT in the SPEED DYNAMICS menu. If only one set of dynamics is desired or the contact input is used, set the HI SPEED SWITCH PT above the maximum speed setting (i.e., above the OVERSPEED TEST LIMIT setting) to ensure the high dynamics are never selected.

Communications (Optional)

The Peak 150 control is capable of communicating to a plant computer using Modbus protocol. All pertinent parameters are programmed to be transferred through this link. The following link parameters are configurable: data bits, stop bits, baud rate, and parity.

This option requires additional communication hardware that is not available unless purchased. The Modbus option must be specified when ordering the Peak 150.

See Chapter 11 for complete details.

Chapter 7.
Programming

Introduction

The Peak 150 control uses menu-driven software for ease of programming. Programming is divided into two sections: CONFIGURE Mode (see Chapter 8), and SERVICE Mode (see Chapter 9).

Before running the turbine the Peak 150 control must be programmed. The program worksheets (see Appendix) must be filled out and these values entered into the control. Different applications will have different programs because of speed range, relay options, readout options, mode of operation, or other programmable options.

IMPORTANT

Any parameters that do not require an input are listed as "STATUS INDICATION ONLY" in the program worksheets. They are in the program to provide information to the operator or programmer only.

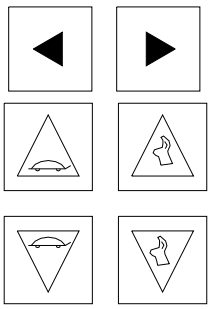
All Programming is done with the hand-held programmer (CE version part number 9907-205) (See Figure 7-1) through the service port on the front of the Peak 150 control. It plugs into the 9-pin connector of the RS-485/422 port inside the service port. The service port is normally sealed by a removable cover. When not being used, the programmer should be disconnected from the control to provide security against tampering.

⚠WARNING

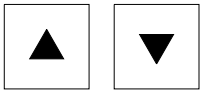
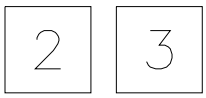
EXPLOSION HAZARD—The programmer should not be connected or disconnected while an explosive gas is present.

Hand-Held Programmer

Key Functions



DISPLAY	A four-line digital display that can show two independent parameters at the same time. The current line is indicated by the @ sign.
LEFT/RIGHT Arrows	These keys are used to scroll through headers and categories.
ADJust Arrows	These keys are used to adjust the value of a parameter either (Rabbit & Turtle) up or down, at either a fast 10% (rabbit) or slow 1% (turtle) rate.

	**– (minus)**	This key is used to enter a negative value.
 	**ADJust Down/Up**	These keys are used to adjust the value of a parameter either up or down at a very slow rate (Integer values change by 1.0; Real values change by 0.01). (+ is up; – is down)
	**ESC**	The Escape key, when pressed once, will return to the top of the category. When pressed twice, it will exit the mode and save all changed tunables.
	**ID**	The ID key identifies the software used in your system.
	**SAVE**	This key saves all changed tunable values.
	**BKSP**	The BACKSPACE key scrolls to the left.
	**SPACE**	The SPACE key scrolls to the right.
	**=**	To enter the exact value of a tunable, press this key, then enter the number, then press ENTER. (must be within 10% of the value on the screen, except when in the configure mode.
	**ENTER**	This key enters the exact value of a tunable (see = above).
	**•**	This key selects the Configure mode or enters a decimal point in a number.
	**Up/Down Arrows**	Down arrow selects the Service mode or scrolls down through blocks. Up arrow scrolls up through blocks.
	**Up & Down Arrow**	This key with a double-ended arrows is used to select screens; the selected screen is identified by the @ sign.
	**Number Keys**	These keys (0 and 1–9) are used to enter the exact value of a tunable (see = and ENTER key descriptions).

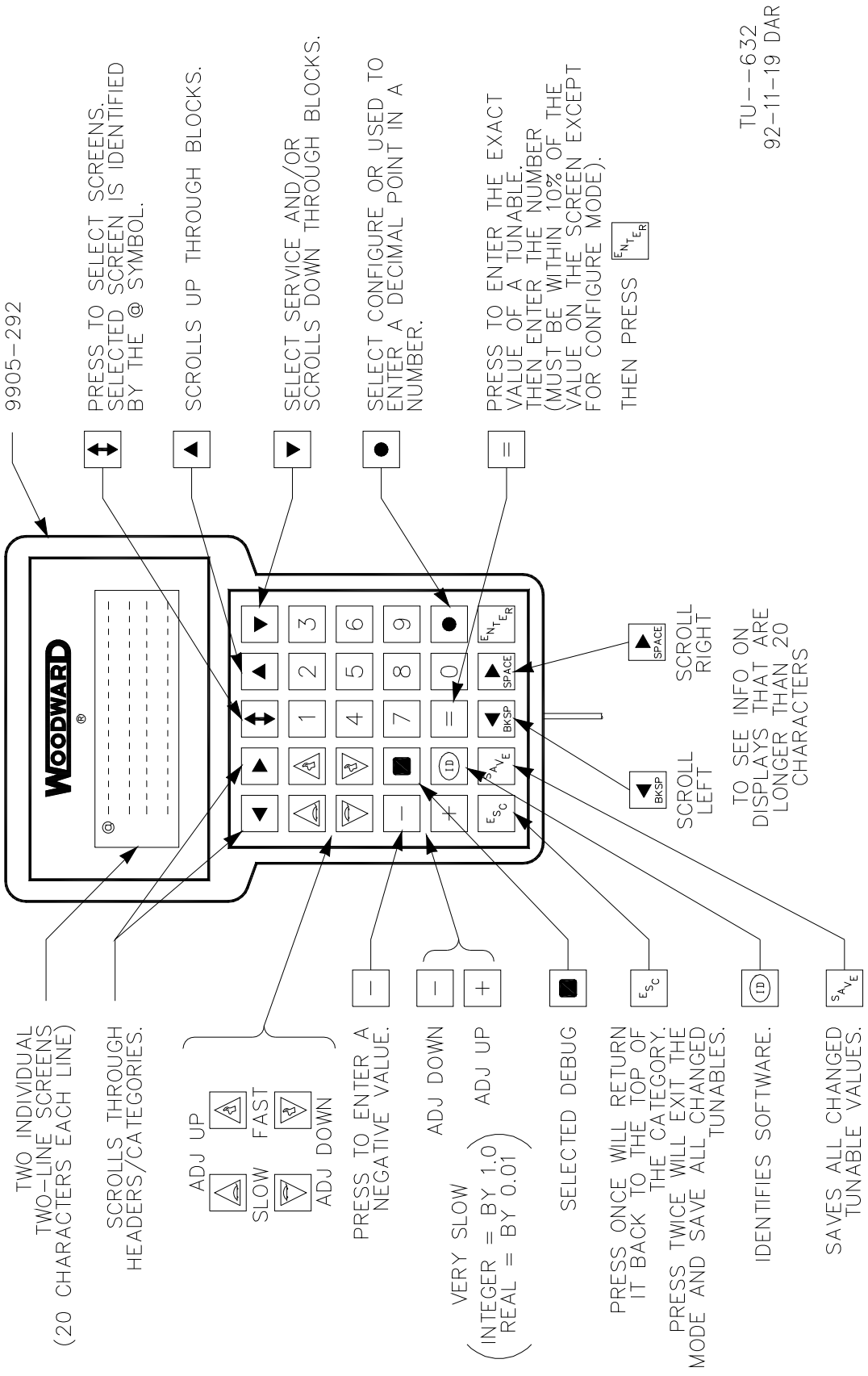


Figure 7-1. Hand-held Programmer

⚠WARNING

Errors in configuration or programming of the Peak 150 control may create dangerous overspeed conditions. The turbine must be equipped with an overspeed device completely separate from the Peak 150 control or actuators attached to the Peak 150 control. The turbine must never be run when this device is not present and is not operating correctly.

Configure Mode

The CONFIGURE mode has parameters that must be adjusted or changed with the turbine shut down. When the CONFIGURE mode is entered, all control outputs are disabled, the relays are de-energized, and the analog-output currents go to minimum.

Configure Mode Menus

There are eight CONFIGURE MODE menus:

SPEED CONFIG	This menu is used to set minimum and maximum speed levels and to enter MPU information.
START MODE	This menu is used to select either MANUAL or AUTO starting mode.
ACTUATOR CONFIG	This menu is used to select either 20–160 mA or 4–20 mA actuator current range.
OPERATING MODE	This menu is used to select the MANUAL, REMOTE, HI SIG SELECT, or MODBUS operating mode.
READOUTS	This menu is used to scale the SPEED RO, to select the configurable readout option, and to scale the readout values.
RELAYS	This menu is used to select the options of the configurable relays and to configure the TRIP relay to ENERGIZE or DE-ENERGIZE on trip.
CONTACT IN #8	This menu is used to set the operation of CONTACT IN #8 as OVERSPEED TEST or HI DYN SELECT.
PORT CONFIG	This menu is used to set the parameters of the port configuration for using MODBUS.

For details on these menus, refer to Chapter 8.

Service Mode

Items in the SERVICE mode are parameters that can be adjusted at any time, including while the turbine is running.

Service Mode Menus

There are 13 SERVICE mode menus, eight of which are always displayed. The remaining five menus appear conditionally. The SERVICE mode menus are:

Always Displayed Menus

ALARMS	This menu displays the status of the ALARMS and is used to select when a TRIP is displayed as an ALARM.
TRIPS	This menu is used to display the code of the last TRIP and to display the status of all the TRIPS.
SPEED DYNAMICS	This menu is used to adjust speed dynamics for turbine response and stability, to set the SPEED where the control switches from LOW dynamics to HI dynamics and displays which dynamics is currently in use.
SPEED VALUES	This menu displays turbine SPEED, and the speed SET POINTS. It is also used to set the RAMP rates, the MIN & MAX GOV SPEEDs, the OVERSPEED set points and DROOP.
FAILED MPU OVRD	This menu is used to set FAILED MPU OVRD conditions and levels.
VALVE	This menu displays the VALVE POSITION, and the VALVE RAMP POS'N. It is used to set the VLV OFFSET, the VALVE GAIN, the RAMP RATE and the DITHER. This menu is also used to stroke the actuator / turbine valves by manually adjusting the VALVE RAMP, or by opening and closing the ACTUATOR / VALVEs.
READOUT ADJUST	This menu is used to scale readout signals.
I/O CHECK	This menu displays the status of most I/O points. This menu is a tool for troubleshooting the control.

Conditionally Displayed Menus

The following menu displays if REMOTE is configured.

REMOTE SETTING	This menu displays remote speed signal, the remote set point, and sets the remote rates.

The following 2 menus display if Automatic Start is configured.

IDLE/MIN RAMP	This menu is used to enable and set IDLE / MIN RAMP and to set MIN GOVERNOR SPEED.
CRITICAL SPEED	This menu is used to enable the CRITICAL SPEED BAND, set the speed limits of the band and the ramp rate through the band.

The following menu displays if speed switch or hand valve is configured.

SPD SW / HAND VLV	This menu is used to set the speed or position for picking up and dropping SPD SW or HAND VLV relays.

The following menu displays if Use Modbus Port is configured.

PORT ADJUST	This menu is used to set the Modbus port communication parameters and displays error information.

Refer to Chapter 9 for information on these Service mode menus.

Basic Program Architecture

Figure 7-2 shows the basic program architecture of the Peak 150 control.

IMPORTANT

Before the turbine can be run, the Peak 150 control must be programmed for the specific turbine application. Programming is divided into two sections: using the Configure mode and the Service mode.

Refer to the Appendix for programming worksheets.

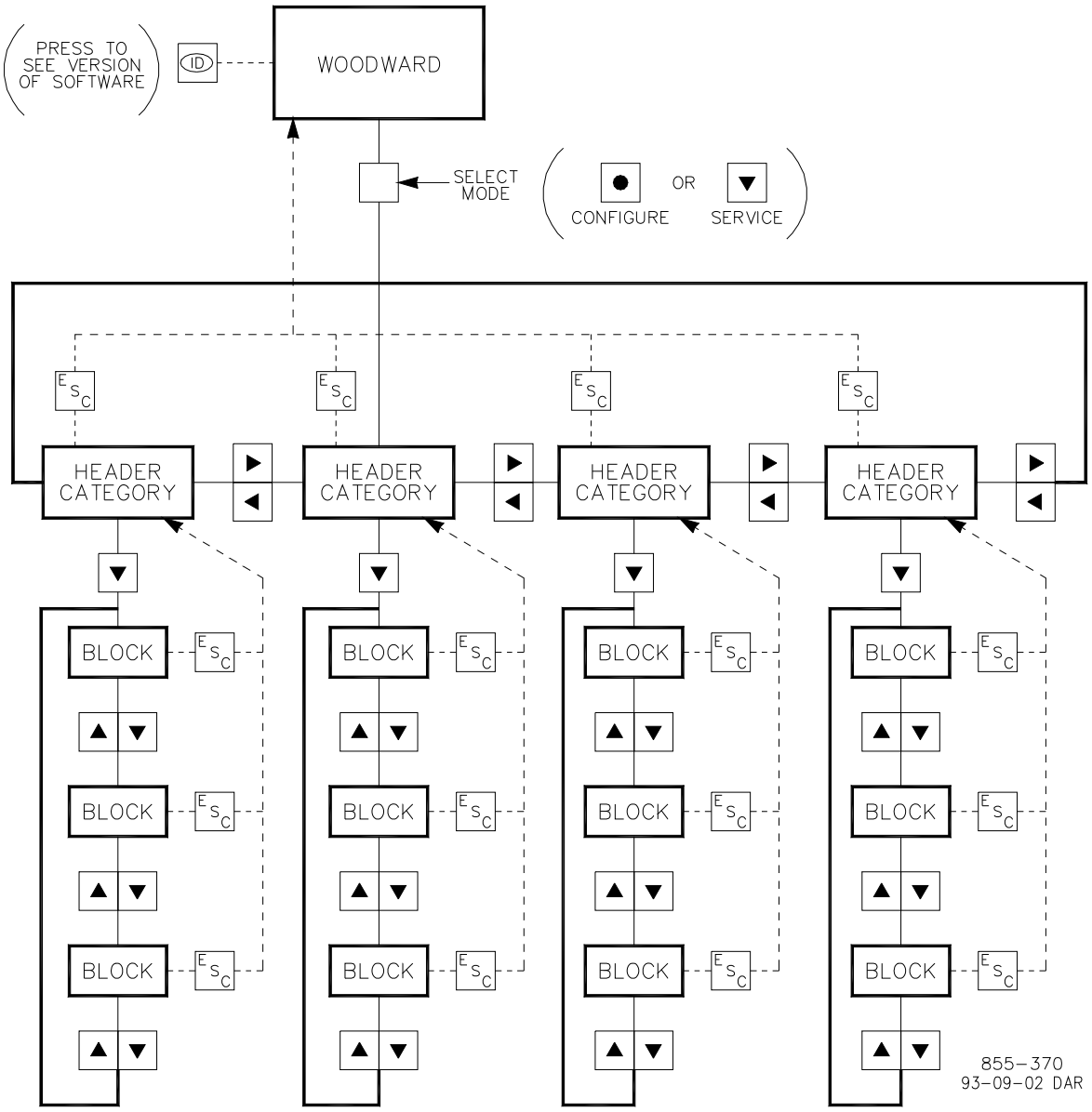


Figure 7-2. Basic Program Architecture

Speed Relationships

Figure 7-3 shows the relationships between the various set points, as well as the mode (Service or Configuration) in which they are adjusted.

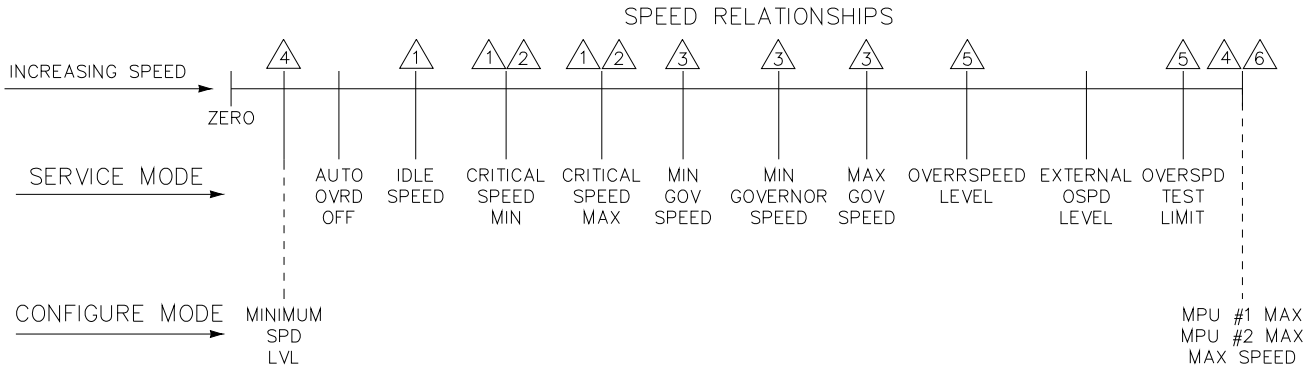


Figure 7-3. Speed/Mode Relationships

Configuration Mode Programming

WARNING

To prevent damage to the turbine 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. Dangerous conditions such as turbine overspeed may result from operating the turbine with incorrect settings, possibly resulting in equipment damage and injury or death of personnel.

WARNING

The turbine must be shut down during configuration. Permitting the turbine to run while the turbine is being configured can cause turbine overspeed.

Using Configure Menus

- RIGHT and LEFT Arrows (top row of keys) moves between MENUS.
- DOWN ARROW (top row of keys) enters the list of items in each MENU.
- UP and DOWN arrows move through items in the MENU.
- ESC key moves back to the menu title.

- ESC key again leaves the menu title and returns to the header. This records in the permanent memory any changes made.
- Control will reboot as it leaves the Configuration mode.

Procedure For Configure Mode

1. Plug the programmer into the service port (on the front panel) and wait until the self-test is complete (about 5 sec.). The back lighting will turn on and the Woodward header will appear. If the Woodward header does not appear, press the ESC key until it does.

2. Press "." to select the CONFIGURATION mode. Press the ENTER key when the programmer displays “TO ENABLE CONFIGURE PRESS *ENTER*, Press the ENTER key again when the programmer displays TO SHUTDOWN I/O PRESS *ENTER*. When the DISCRETE OUTPUTS and the ANALOG OUTPUTS are shutdown, the programmer will enter the first Configuration Menu.

3. To scroll through the CONFIGURATION menus use the LEFT and RIGHT arrows. When the desired menu is displayed, press the DOWN arrow to enter the menu.
   To scroll through the menu items use the UP and DOWN arrows.
   To return to the menu header press the ESC button.

4. Two independent variables can be displayed on the programmer screen. An "@"beside one of the variables indicates that this item can be adjusted. Use the UP/DOWN arrow to toggle the "@" between the top to the bottom row.

5. To leave configuration press ESC until the Woodward header appears in the window.

Making Changes In Configure Mode

To change TRUE / FALSE Values:
- Use the TURTLE UP or RABBIT UP arrows for TRUE.
- Use the TURTLE DOWN or RABBIT DOWN arrows for FALSE.

To adjust Numerical Values:
- Use the RABBIT UP and RABBIT DOWN arrows to change the existing values by 10 percent in the direction indicated.
- Use the TURTLE UP and TURTLE DOWN arrows to change the existing values by 1 percent in the direction indicated.

To Enter Numerical Values Directly:
(The number keys can be used to change the existing value. To make this type of entry.)
- Press the = key.
- Enter the number (plus, minus, and decimal point keys work.)
- Press ENTER key to activate the number on the screen.

IMPORTANT **The change is not limited to 10% in the Configure mode, as it is in the Service mode.**

The screen is limited to 20 characters. When the menu item is longer than 20 characters, scroll to the ends with the BKSP or SPACE keys.

To adjust Integer Values: The ADJ up (+) and the ADJ down (–) keys increment integers up or down by 1.0.

Service Mode Programming

The Service mode can be used while the turbine is running.

Using Service Menus

- The LEFT and RIGHT ARROWS move from one MENU to the next.
- The DOWN ARROW opens the MENU.
- The UP and DOWN ARROWS scroll inside the MENU.
- Pressing the ESC key jumps to the MENU's title.
- Pressing the ESC key a second time jumps from the MENU's title to the WOODWARD header. This also saves the changes in the permanent memory. Another way to permanently store changes is to press the SAVE key.
- The SERVICE MENUs can be changed with the turbine running. Changes are immediately used by the Peak 150 to operate the turbine, but the changes are not saved until the operator returns to the WOODWARD header by pressing either ESC or SAVE key.
- A number of items in the service menus monitor information for the user. These items are shaded, and cannot be changed. However, they will change if the condition being monitored changes.
- On the programmer screen, tunable items are indicated by an asterisk (*) following the number. Numbers which are for monitor only will not have an asterisk (*) following the number.

Procedure for Service Mode

To enter the SERVICE MODE, press the DOWN ARROW when the WOODWARD header is displayed. To display the WOODWARD header, press the ESC key twice.

1. To enter a MENU press the DOWN ARROW.

2. To scroll between the menus, use the LEFT ARROW and RIGHT ARROW. To return to a menu header, press ESC.

   Values changed will become active immediately, but will not become part of the permanent memory until the ESC button is pressed again and the WOODWARD header reappears or the SAVE button is pressed. Either method will save ALL changed parameters in permanent non-volatile memory.

Two menu items can appear on the screen at the same time. Changes can be made only to the item preceded by the @ sign. To make changes to the other item, toggle the @ sign with the UP/DOWN key.

Making Changes In Service Mode

To change TRUE / FALSE Values:
- Use the TURTLE UP or RABBIT UP arrows for TRUE.
- Use the TURTLE DOWN or RABBIT DOWN arrows for FALSE.

To adjust Numerical Values:
- Use the RABBIT UP and RABBIT DOWN arrows to change the existing values by 10 percent in the direction indicated.
- Use the TURTLE UP and TURTLE DOWN arrows to change the existing values by 1 percent in the direction indicated.

To Enter Numerical Values Directly:
The number keys can be used to change the existing value by as much as ±10% of its current value. To make this type of entry:
- Press the = key.
- Enter the number (plus, minus, and decimal point keys work).
- Press ENTER key to activate the number on the screen.

If the number you enter is more than 10% greater or less than the existing value, the entry will be refused and an error message will appear on the screen. The error message will remain on the screen for about 5 seconds, and the previous value will be displayed.

The screen is limited to 20 characters. When the menu item is longer than 20 characters, scroll to the ends with the BKSP or SPACE keys.

TO adjust Integer Values: The ADJ up (+) and the ADJ down (–) keys increment integers up or down by 1.0.

Chapter 8.
Configuration Menus

Introduction

Before the turbine can be run, the Peak 150 control must be programmed (see Program Mode Worksheets in the Appendix). The configure mode parameters can only be changed while the turbine is shut down.

Speed Configuration Menu

This menu is used to set the parameters for the MPU inputs and for scaling the minimum and maximum signal of the MPUs.

To control the speed of a turbine, an MPU senses the speed in Hz (cycles per second). In the Peak 150, the MPU speed signal is converted from Hz to RPM. The values of the turbine's operating speeds are set in RPM.

On many turbines (as in **Case 1**), the MPU gear is mounted on the main turbine shaft so that the speed of the MPU gear is the same as the speed of the turbine. On other turbines (as in **Case 2**), the MPU gear is mounted on an auxiliary shaft so that the speed of MPU gear is different than the speed of the turbine. In Case 2, the RPM displayed and controlled by the Peak 150 is a function of the number of teeth, the speed of the shaft and the ratio between the main turbine shaft and the MPU gear shaft.

⚠WARNING **Before running the turbine, ensure that the correct RATIO between the turbine speed and the MPU gear speed is entered correctly. Failure to set the correct RATIO could result in personal injury, loss of life, or property damage.**

CASE1: Turbine speed and MPU gear speed are same:

Equation 1:

$$\text{MPU (Hz)} = \frac{\text{RPM} * \text{Teeth}}{60}$$

For example: with RPM = 3600 RPM
Teeth = 120:

$$\text{MPU (Hz)} = \frac{3600 * 120}{60} = 7200 \text{ Hz}$$

or

Equation 2:

$$\text{RPM} = \frac{\text{MPU (HZ)} * 60}{\text{Teeth}}$$

For example: With MPU (Hz) = 3600 Hz
Teeth = 60

$$\text{RPM} = \frac{3600 * 60}{60} = 3600 \text{ RPM}$$

Case 2: Turbine speed and MPU gear speed are different:

The MPU gear ratio is the number of revolutions of the turbine divided by the number of revolutions made by the magnetic pickup gear. For example, if the turbine revolves twice for every revolution of the MPU gear, enter 2 for the “MPU GEAR RATIO 1”. The following is the equation for calculating the MPU Gear Ratio 1:

Equation 3:

$$\text{"MPU GEAR RATIO 1"} = \frac{\text{Turbine RPM}}{\text{MPU gear RPM}} = \text{X}$$

For example: With Turbine speed = 4500 RPM
MPU Gear = 3000 RPM

$$\text{"MPU GEAR RATIO 1"} = \frac{4500\ \text{RPM}}{3000\ \text{RPM}} = 1.5$$

The equation for calculating turbine RPM is:

Equation 4:

$$\text{RPM} = \frac{\text{MPU (HZ)} * 60}{\text{Teeth}} * \text{“MPU GEAR RATIO 1”}$$

For example: With: MPU (Hz) = 3600 Hz
Teeth = 60.
MPU Gear Ratio 1 = 1.5.

$$\text{RPM} = \frac{3600 * 60}{60} * 1.5 = 5400\ \text{RPM}$$

The equation for calculating MPU HZ is:

Equation 5:

$$\text{MPU (Hz)} = \frac{\text{Turbine RPM} * \text{Teeth}}{60*(\text{MPU Gear Ratio 1})}$$

For example: With Turbine RPM = 3600 RPM
Teeth = 72
MPU Gear Ratio 1 = 2

$$\text{MPU (Hz)} = \frac{3600 * 72}{60*2} = 2160\ \text{Hz}$$

(See Figure 7-3 for the relationships between the Speed Values and the mode in which the values are set.)

The following parameters are set in the Speed Configuration Menu:

- TEETH SEEN BY MPU _____
  (Enter the number of gear teeth on the MAGNETIC PICKUP gear.)
  (Tunable Range: 1 to 200.)

- MPU GEAR RATIO 1 _____
  (Enter the ratio between the speed of the turbine shaft and the MPU gear shaft).
  (Tunable Range: 0 to 200.)

The speed range of the Peak 150 needs to be scaled to optimize the resolution of the speed sensing function. Use the following steps for calculating the preferred values:

Determine the Overspeed Test Limit for the turbine in RPM.

Using Equation 5, convert the Overspeed Test Limit to Hz.

Set the MPU #1 – MAX HERTZ equal to 1.02 * (Hz value of the Overspeed Test Limit).

With: Overspeed Test Limit = 4000 RPM
Teeth = 60
MPU Gear Ratio 1 = 1

$$\text{MPU (Hz)} = \frac{\text{Turbine RPM} * \text{Teeth}}{60*(\text{MPU Gear Ratio 1})}$$

$$\text{MPU (Hz)} = \frac{4000 * 60}{60*1} = 4000 \text{ Hz}$$

$$\text{MPU \#1 - Max Hertz} = 1.02 * \text{Overspeed Test Limit (Hz)}$$

= 1.02 * 4000 Hz = 4080 Hz

- MPU #1 – MAX HERTZ (HZ) _____
(Enter the maximum speed/frequency in Hertz that will be seen by MPU #1.)

  (Tunable Range: 0 to 15000.)

- MPU #2 – MAX HERTZ (HZ) _____
  (Enter the maximum speed/frequency in Hertz that will be seen by MPU #2.)
  (Same as MPU #1 – MAX HERTZ)
  (Tunable Range: 0 to 15000).

- MAX SPEED LEVEL (HZ) _____
  (Enter the maximum speed/frequency in Hertz that will be seen by the control).
  (Same as MPU #1 – MAX HERTZ)
  (Tunable Range: 0 to 15000).

IMPORTANT

MPU #1—MAX Hz, MPU #2—MAX Hz, and Max Speed Level will normally all three be the same value. This setting must be greater than the Overspeed test Limit Speed (see Service Mode).

- MINIMUM SPD LVL (HZ) _____
(Enter the minimum detectable speed/frequency in Hertz that will be seen by the control. Below this speed, the MPU detects a failed signal and issues an alarm. The MPU signal must be at least 1.0 Vrms at the MINIMUM SPD LVL.)
(Tunable Range: 0 to 2000).

⚠WARNING

Do not set any set points greater than the value set for MPU #1—Max, MPU #2—Max, and Max Speed Level. If the speed set point exceeds the maximum frequency set by these set points, the turbine will overspeed, resulting in possible equipment damage and personnel injury or death.

IMPORTANT

Pressing the "ESC" (escape) key will return the display to the heading, which would be Speed Configuration in this case. Using the right (or left) arrow key at the header will advance the display to the next header.

Start Mode Menu

This menu shows the starting modes.

- MANUAL START MODE? (TRUE/FALSE) _____
  (Set to TRUE to choose MANUAL START MODE

- AUTO START MODE? ***(status indication only)***
  (This indicates the status of the AUTO START MODE. This mode will be TRUE when the MANUAL START MODE is set FALSE. No Configuration required).

IMPORTANT

In Manual Start Mode, governor speed control starts at minimum governor speed. In Auto Start Mode, speed control starts at idle speed which is much lower than minimum governor speed (see Start Modes in Operating Procedures chapter).

Actuator Configuration Menu

This menu shows the actuator configurations.

- USE 20–160 MA ACTUATOR? (TRUE/FALSE) _____
  (When this value is set TRUE, the 20–160 MA ACTUATOR DRIVER is configured. Most Woodward actuators use 20–160 mA current. If not a Woodward ACTUATOR, check with vendor for proper drive current.)

- USE 4–20 MA ACTUATOR? ***(status indication only)***
  (When TRUE, this status indicates the 4–20 mA driver is programmed. This value will be TRUE when 20–160 mA is set to FALSE. No configuration required.)

IMPORTANT

Check that the correct drive current jumpers are installed. For a 0–200 mA drive-current range, Jumpers 4 and 10 should be installed. For a 0–20 mA drive-current range, Jumpers 3 and 9 should be installed.

Operating Mode Menu

This menu shows the operating modes, MANUAL, REMOTE, HSS, and MODBUS.

IMPORTANT

For a description of operating modes, see Chapter 3.

- MANUAL CONTROL ONLY? (TRUE/FALSE) _____
  (When set to TRUE, MANUAL MODE ONLY will be selected. All speed control adjustments must be done with the RAISE and LOWER front panel buttons or with the discrete inputs.)

- USE REMOTE SPEED SET? (TRUE/FALSE) _____
(This mode selects the REMOTE SPEED SET input, 4–20 mA or 1–5 V, for setting the speed. This mode can be selected only when MANUAL CONTROL ONLY = FALSE.)

IMPORTANT **Select the corresponding jumper for the input of 4–20 mA or 1–5 V.**

- USE HI-SIG-SELECT? (TRUE/FALSE) _____
(When set to TRUE, this mode High-Signal-Selects the greater speed demand between the LOCAL SPEED SETPT and the REMOTE SPEED SET. This mode can be selected only if MANUAL CONTROL ONLY = FALSE and USE REMOTE SPD SET = TRUE)

- USE MODBUS ANALOG INPUT? (TRUE/FALSE) _____
(When set to TRUE, this mode uses the REMOTE SPD SET mode where the REMOTE SIGNAL comes from the MODBUS link rather than from the analog 4–20 mA input. This mode can be selected only if MANUAL CONTROL ONLY = FALSE and USE REMOTE SPD SET = TRUE. The Peak 150 must be purchased with the Modbus option.)

Readouts Menu

This menu shows the READOUT options and VALUES at 4 mA and 20 mA.

- SPEED RO 4 MA VALUE (RPM) _____
(This sets the RPM value for the readout at 4 mA.)
(Tunable Range: 0 to 10000).

- SPEED RO 20 MA VALUE (RPM) _____
(This sets the RPM value for readout at 20 mA.)
(Tunable Range: 0 to 15000).

- READOUT #2 OPTION? (OPTION #) _____
(The option number can be increased with the (+) key and decreased with the (-) key.)

  Readout #2 Options:
  1. ACTUAL SPEED
  2. ACTUAL SPEED SETPT
  3. VALVE POSITION (Actuator Output)
  4. REMOTE SPEED SET INPUT
  5. VALVE RAMP POS'N
  6. Not Used

IMPORTANT **Use the "+" and "–" keys to adjust the desired option number up or down respectively.**

- READOUT #2— 4 MA VALUE (RPM or %) _____
(This sets the value for READOUT # 2 at 4 mA.)
(Tunable Range: 0 to 10000).

- READOUT #2—20 MA VALUE (RPM or %) _____
(This sets the value for READOUT #2 at 20 mA.)
(Tunable Range: 0 to 15000).

Relays Menu

This menu shows the relay options, use speed switch, hand valve, and trip relay.

- RELAY #3 OPTION? (OPTION #) _____
  (Select the relay function by entering the option number from the configurable relay option list. The option number can be increased with the (+) key and decreased with the (-) key.)

- RELAY #4 OPTION? (OPTION #) _____
  (Select the relay function by entering the option number from the configurable relay option list. The option number can be increased with the (+) key and decreased with the (-) key.)

  Configurable Relay Options:
  1. Alarm
  2. Trip Output
  3. Shutdown
  4. Remote Control
  5. Speed Control
  6. Either MPU Failed
  7. Overspeed Trip
  8. Overspeed Test
  9. Remote Signal OK
  10. Speed Switch #1 or Hand Valve #1
  11. Speed Switch #2 or Hand Valve #2

IMPORTANT **Use the "+" and "–" keys to adjust the desired option number up or down respectively.**

- USE SPEED SWITCHES? (TRUE/FALSE) _____
  (Set this value TRUE to use CONFIG RELAYs as SPEED SWITCHES. Set the SWITCH point levels in the service mode.)

- SWITCH #2 UNDERSPD? (TRUE/FALSE) _____
  (Set this value TRUE to enable using CONFIG RELAY #2 as an under speed indication.)

- USE HAND VALVE(S)? (TRUE/FALSE) _____
  (Set this value TRUE to use CONFIG RELAYs to control HAND VALVES. Set the SWITCH levels in the service mode.)

IMPORTANT **A combination of both a hand valve and a speed switch is not possible. If both "Use Hand Valve" and "Use Speed Switch" are set to TRUE, hand valves will be selected (if Option 10 or 11 is selected above in the relay options).**

- TRIP RELAY ENERGIZES? (TRUE/FALSE) _____
  (If set TRUE the trip relay will energize on shutdown; if set FALSE, it will de-energize.)

IMPORTANT **If the trip relay is programmed to energize for a shutdown, Jumper 2 and Jumper 17 must both be installed to properly display the unit's "Tripped" status on the front-panel LED and to provide the proper contacts between terminals 4 and 5. If the trip relay is programmed to de-energize for a shutdown, Jumper 1 and Jumper 18 must both be installed.**

- RESET CLRS TRIP RLY (TRUE/FALSE) _____
  (Setting RESET CLRS TRIP RLY = TRUE enables the resetting of the TRIP relay with the RESET command even though the EXTERNAL TRIP input is still in the TRIP state, open. If set FALSE all TRIP conditions including the EXTERNAL TRIP INPUT must be cleared before a RESET command will RESET the TRIP RELAY.)

Contact In #8

This menu is used to select the function of contact input #8.

- IN #8 IS OSPD TEST (TRUE/FALSE) _____
  (When TRUE is selected, the function of DI #8 is OVERSPEED TEST ENABLE. If FALSE is selected, the function of DI #8 is HI DYN SELECT.)

Port Configuration

This menu is used to enable the Modbus option and set some communication parameters.

- USE MODBUS PORT? (TRUE/FALSE) _____
  (If set TRUE the MODBUS PORT is enabled.)

- HARDWARE CONFIG (OPTION #) _____
  (This adjustment sets the hardware link used for the Modbus Communication. The options in the following list correspond to the 3 types of hardware configurations. The option number can be increased with the (+) key and decreased with the (-) key.)

  1 = RS-232 Communication
  2 = RS-422 Communication
  3 = RS-485 Communication

- TRANSMISSION MODE (OPTION #) _____
  (This value selects the protocol of the character transmission mode used by Modbus.
  (Enter the option number from the list below.)

  Modbus Port Transmission Mode Configuration Options:
  (The option number can be increased with the (+) key and decreased with the (-) key.)

  1 = ASCII
  2 = RTU

- NETWORK ADDRESS _____
  (This value assigns a Network address to the Peak 150 in a multi drop configuration.)
  (Normally set to 01).

IMPORTANT **When configuration is complete, press the ESC key until the display reads "Rebooting Control."**

Configure Mode Flow Diagram

Refer to Figure 8-1 for a flow diagram of the configure mode headers.

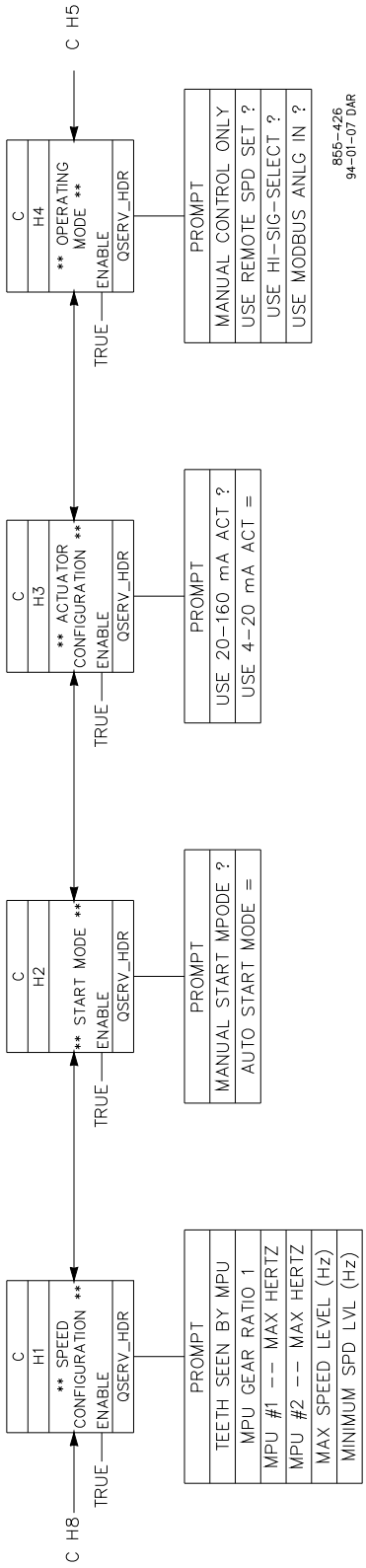
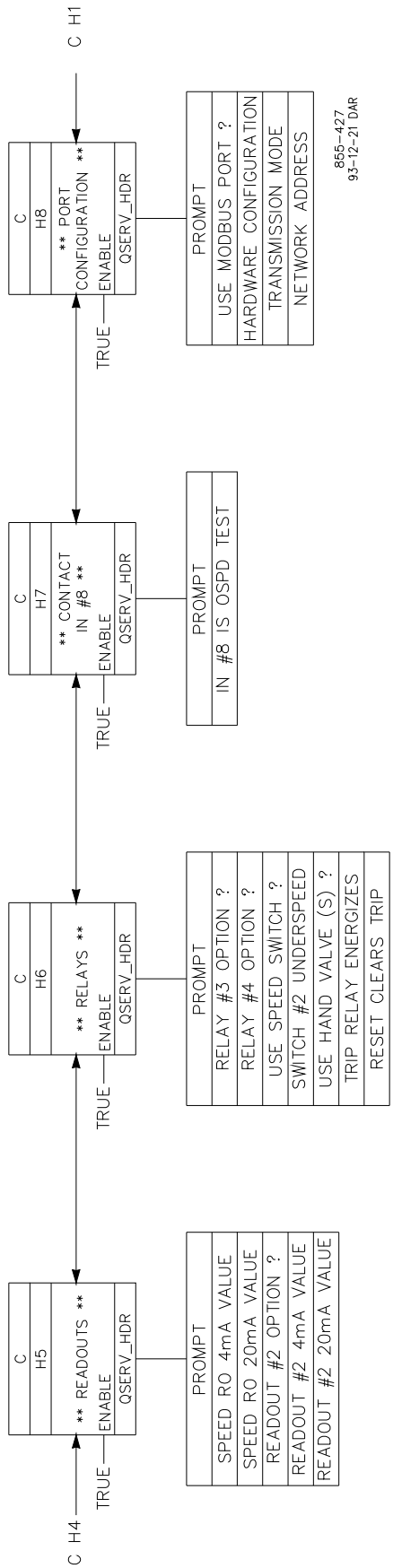


Figure 8-1. Configure Mode Flow Diagram
(2 pages)


C H1
C
H8
** PORT CONFIGURATION **
ENABLE
QSERV_HDR
TRUE
PROMPT
USE MODBUS PORT ?
HARDWARE CONFIGURATION
TRANSMISSION MODE
NETWORK ADDRESS
855-427
93-12-21 DAR
C
H7
** CONTACT IN #8 **
ENABLE
QSERV_HDR
TRUE
PROMPT
IN #8 IS OSPD TEST
C
H6
** RELAYS **
ENABLE
QSERV_HDR
TRUE
PROMPT
RELAY #3 OPTION ?
RELAY #4 OPTION ?
USE SPEED SWITCH ?
SWITCH #2 UNDERSPEED
USE HAND VALVE (S) ?
TRIP RELAY ENERGIZES
RESET CLEARS TRIP
C
H5
** READOUTS **
ENABLE
QSERV_HDR
TRUE
PROMPT
SPEED RO 4mA VALUE
SPEED RO 20mA VALUE
READOUT #2 OPTION ?
READOUT #2 4mA VALUE
READOUT #2 20mA VALUE
C H4

Chapter 9.
Service Menus

Introduction

Before the turbine can be run the Peak 150 control must be programmed (see Program Mode Worksheets in the Appendix). The Peak 150 control uses easily programmable menu driven software. Programming is divided into two sections: SERVICE MODE and CONFIGURE MODE (see Chapter 7). The CONFIGURE MODE parameters can only be changed while the turbine is shutdown. After the initial programming is complete, the SERVICE MODE parameters can be viewed and adjusted while the turbine is running.

Alarms Menu

The Alarms menu shows the alarms that have occurred.

- MPU #1 FAILED (***status indication only***)
  (TRUE when MPU #1 input has failed).
- MPU #2 FAILED (***status indication only***)
  (TRUE when MPU #2 input has failed).
- REMOTE INPUT FAILED (***status indication only***)
  (TRUE when the REMOTE SPEED SET input has failed).
- COMM LINK FAILURE (***status indication only***)
  (TRUE when the Modbus communication link has failed).
- TURBINE TRIP (***status indication only***)
  (TRUE when the turbine has tripped).
- USE TRIP AS ALARM? (TRUE/FALSE) _____
  (When set to TRUE, a turbine TRIP indicates an ALARM in addition to tripping the turbine).

Trips Menu

The Trips menu shows the trip conditions that have occurred.

- LAST TRIP CODE = (CODE#) (***status indication only***)
  (Will display the TRIP CODE of the last trip from the list below. The TRIP CODE also flashes on the front panel RPM display).

Code	Cause
1	EXTERNAL TRIP
2	LOSS OF BOTH MPUs
3	OVERSPEED TRIP
4	FRONT PANEL TRIP
5	MODBUS TRIP

- EXTERNAL TRIP (***status indication only***)
  (TRUE when the EXTERNAL TRIP input is opened/tripped. (Input to terminal 14 is open.)

- OVERSPEED TRIP (***status indication only***)
  (TRUE when the turbine speed exceeds the OVERSPEED LEVEL set point).

- LOSS OF BOTH MPUs (***status indication only***)
  (TRUE when both MPU signals are lost).

- FRONT PANEL TRIP (***status indication only***)
  (TRUE when the EMER TRIP button has been pushed).

- MODBUS TRIP (***status indication only***)
  (TRUE when the MODBUS TRIP command is received).

Speed Dynamics Menu

This menu is used to set the dynamic values. These values can be adjusted with the Hand Held Programmer while the turbine is running if preceded by an "*".

- LOW SPEED GAIN _____
  (This value is used to set the LOW SPEED (proportional) GAIN).

- LOW SPEED RESET _____
  (This value is used to set the LOW SPEED (integral gain) RESET).

- HI SPEED SWITCH PT (RPM) _____
  (The value entered for the HI SPEED SWITCH PT sets the speed where control is switched from LOW SPEED DYNAMICS to HI SPEED DYNAMICS).

- HI SPEED GAIN _____
  (This value is used to set the HIGH SPEED (proportional) GAIN).

- HI SPEED RESET _____
  (This value is used to set the HIGH SPEED (integral gain) RESET).

- HI SPEED SELECTED (***status indication only***)
  (TRUE when the turbine speed exceeds the HI SPEED SWITCH PT and the HI SPEED DYNAMICS are selected).

Adjusting Gain And Reset

See Dynamics Adjustments under Operating Procedures, Chapter 6.

Speed Values Menu

This menu shows speeds, speed rates, overspeed levels, and droop. These values can be seen without any other conditions occurring and can be adjusted if preceded by an "*" on the hand-held programmer. See Figure 7-3 for the relationships between all speed values and the mode in which the value is set.

- ACTUAL SPEED = (RPM) (***status indication only***)
  (This displays the turbine speed.)

- LOCAL SPEED SETPT = (RPM) (***status indication only***)
  (This displays the LOCAL SPEED SETPT. In the LOCAL mode this speed is controlled by the RAISE/LOWER buttons or inputs. This is the speed set point in the COMBINATION mode.)

- ACTUAL SPEED SETPT = (RPM) (***status indication only***)
  (This displays the ACTUAL SPEED SETPT. This is a function of the LOCAL SPEED SETPT or the REMOTE SPD SET depending on what OPERATING mode is configured.)

IMPORTANT **Normally LOCAL and ACTUAL SPEED SETPTs will be the same. They may be different in the REMOTE mode and in the HIGH-SIGNAL SELECT mode.**

- REMOTE SPD SET = (RPM) (***status indication only***)
  (This displays the REMOTE SPEED SET.)

- START RAMP RATE (RPM/SEC) _____
  (This sets the rate of speed change from START to IDLE SPEED or to MIN GOVERNOR SPEED depending on what START MODE is configured.)
  (Tunable Range: 1-1000.)

- SETPT SLOW RATE (RPM/SEC) _____
  (This sets the initial rate of speed change when operating in the MANUAL CONTROL mode and using the RAISE / LOWER commands.)
  (Tunable Range: 0 to 100).

- DELAY FOR FAST RATE (SEC) _____
  (When operating in the MANUAL CONTROL mode and using the RAISE / LOWER commands, this sets the delay time before switching from the SLOW rate to the FAST rate.)
  (Tunable Range: 0 to 100).

- SETPT FAST RATE (RPM/SEC) _____
  (This sets the rate of speed change when operating in the MANUAL CONTROL mode and using the RAISE / LOWER commands after the DELAY FOR FAST RATE has expired.)
  (Tunable Range: 0 to 200).

- MIN GOV SPEED (RPM) _____
  (This sets the minimum speed of the turbines normal operating range. Once the turbine speed is above the MIN GOV SPEED, the speed reference cannot be adjusted below this point. This value also sets the minimum setting (4 mA value) for the REMOTE SPEED SET input,)
  (Tunable Range: 0 to 15000.)

- MAX GOV SPEED (RPM) _____
  (This sets the maximum speed of the turbines normal operating range. This value also sets the maximum setting (20 mA value) for the REMOTE SPEED SET input, The only time the turbine can be operated above this speed is during an OVERSPEED TRIP TEST.)
  (Tunable Range: 0 to 15000).

- OVERSPEED LEVEL (RPM) _____
  (This sets the TRIP point of the governor OVERSPEED switch. Unless the OVERSPEED TEST button is held closed, the turbine will trip when it reaches this speed.)
  (This must NOT be the system's primary OVERSPEED TRIP.)
  (Tunable Range: 0 to 15000).

- EXTERNAL OSPD LEVEL (RPM) _____
  (This sets the speed where external OVERSPEED trip devices are expected to operate. When this speed point is reached, the function of this setting is to flash the OVERSPEED TEST ENABLED LED on the front panel. This value is typically set at the lower end of the external trip device's speed range to let the operator know that the turbine should trip soon.)
  (Tunable Range: 0 to 15000).

- OVERSPEED TEST LIMIT (RPM) _____
  (This sets the maximum speed that the turbine can reach when performing the OVERSPEED TRIP TEST. This limit is set above the OVERSPEED LEVEL and the EXTERNAL OSPD LEVEL.)

- DROOP (%) *0.0 (%) _____
  (This sets the percent of speed droop. When set to 0.0, droop is disabled.)
  (Tunable Range: 0 to 10).

- USE SET POINT SET-BACK (TRUE/FALSE) _____
  (When USE SET POINT SET-BACK = TRUE, opening the RAISE or LOWER button will instantly reset the ACTUAL SPEED SETPT to the ACTUAL SPEED.)

Remote Setting Menu

This menu shows the remote settings and appears only if REMOTE mode is configured.

- ACTUAL REMOTE SETPT = (RPM) (***status indication only***)
  (This is the value of the REMOTE SPEED set point.)

- REMOTE SET INPUT = (RPM) (***status indication only***)
  (This is the value of the REMOTE SET INPUT.)

- RMT-NOT-MATCHED RATE (RPM/SEC) _____
  (This is the ramp rate used after REMOTE CONTROL is enabled while the LOCAL SPEED SETPT matches the REMOTE SPEED SET.)

- REMOTE RATE—MAX (RPM/SEC) _____
  (This sets the rate that the ACTUAL SPEED SETPT can change as a function of changes to the REMOTE SPEED SET input. This limits the rate so that the Process Controller does not fight the SPEED CONTROL causing oscillation.)
  (Tunable Range: 0 to 100)

- MODBUS REMOTE USED = (***status indication only***)
  (When TRUE, the MODBUS communication link sets the REMOTE SPEED SETPT.).

Failed MPU Override Menu

This menu shows the values for MPU overrides. These values can be seen without any other conditions occurring and can be adjusted if preceded by an "*".

- AUTO-OVRD-OFF SPEED (Hz) _____
  (This is the speed where the FAILED MPU OVERRIDE is automatically removed. This speed must be high enough so that the MPU signal is at least 1.0 Vrms.)
  (If the speed drops below the MINIMUM SPD LVL (see CONFIGURE mode) after the FAILED MPU OVERRIDE is removed, the turbine will trip on loss of speed (Code 2). If only one MPU drops below the MINIMUM SPD LVL after the FAILED MPU OVERRIDE is removed, that MPU OK LED will go out and an alarm will be issued.)
  (Tunable Range: 0 to 2000)

- USE MPU OVRD TIMER? (TRUE/FALSE) _____
  (When USE MPU OVRD TIMER? = TRUE, there are two ways of removing the FAILED MPU OVERRIDE. Normally the override is automatically removed when the AUTO OVRD-OFF SPEED is reached. If this speed is not reached and the TIMER expires the override will be removed. In this scenario, the turbine will trip on MPUs failed to prevent a turbine OVERSPEED.)

- MAX STARTING TIME= (SEC) _____
  (This sets the time that the MPU OVRD TIMER holds on the FAILED MPU OVERRIDE while waiting for the turbine speed to reach the AUTO OVRD-OFF SPEED. If the turbine has not reached the Minimum Speed level before this time expires, the turbine will trip on MPUs failed to prevent turbine OVERSPEED.)
  (Tunable Range: 0 to 3000).

- USE ROLLDOWN OVRD? (TRUE/FALSE) _____
  (When USE ROLLDOWN OVRD = TRUE, the MPU FAILED OVERRIDE is turned on when the speed drops below the AUTO-OVRD-ON SPEED for the AUTO-OVRD-DELAY time as it is being slowly reduced by closing the trip and throttle or stop valve.. Using this option allows the operator to resume operation at the last set point on the next startup rather than at minimum set point.)

- AUTO-OVRD-ON SPEED (HZ) _____
  (This sets the speed for turning on the MPU FAILED OVERRIDE after the AUTO_OVRD_ON DELAY time.)
  (Tunable Range: 0 to 2000).

- AUTO-OVRD-ON DELAY (SEC) _____
  (This sets the time delay for turning on the ROLLDOWN OVRD. If the turbine speed drops below the MINIMUM SPD LVL before this time expires, the unit will trip on LOSS OF MPUs and reset the speed set point to minimum.)
  (Tunable Range: 0 to 100).

- OVRD ON STATUS (***status indication only***)
  (This displays the status of the MPU OVERRIDE.)

Idle/Min Ramp Menu

This menu shows the IDLE SPEED and MIN GOVERNOR SPEED.
(This menu is displayed only if AUTOMATIC START mode is configured.)

- IDLE SPEED (RPM) _____
  (This sets the IDLE SPEED. This is the initial speed control point in the AUTO START MODE and is normally used for turbine warm up.)
  (Tunable Range: 0 to 5000).

- USE IDLE/MIN RAMP? (TRUE/FALSE) _____
  (When USE IDLE / MIN RAMP = TRUE, closing the IDLE / MIN GOV contact automatically ramps the turbine speed from the IDLE SPEED to the MIN GOVERNOR SPEED).

- MIN GOVERNOR SPEED (RPM) _____
  (This sets the MIN GOVERNOR SPEED that is the target of the IDLE / MIN RAMP. This is the speed where the turbine normally operates.)
  (Tunable Range: 0 to 15000).

- IDLE/MIN GOV RATE = (RPM/SEC) _____
  (This sets the rate the IDLE / MIN GOVERNOR ramp can change the speed when ramping up to MIN GOVERNOR SPEED or down to IDLE SPEED.)
  (Tunable rage: 0 to 1000).

- USE RAMP TO IDLE? (TRUE/FALSE) _____
  (When USE RAMP TO IDLE = TRUE, opening the IDLE / MIN GOV contact will ramp the ACTUAL SPEED SETPT to IDLE speed. This function is disabled if START = RAMP TO MIN is set to TRUE.)

- START = RAMP TO MIN (TRUE/FALSE) _____
  (When START = RAMP TO MIN is set TRUE, closing the front panel START button will ramp the ACTUAL SPEED SETPT to the MIN GOVERNOR SPEED in place of closing the IDLE / MIN GOV input. Closing the START button after the unit is running will restart the ramp to MIN GOVERNOR SPEED. When this function is used, the USE RAMP TO IDLE function is disabled)

- RAMPING TO MIN (***status indication only***)
  (This indicates the ramp is moving towards Minimum Governor.)

- RAMPING TO IDLE (***status indication only***)
  (This indicates the ramp is moving towards Idle.)

Critical Speed Menu

This menu shows the critical speed band and rate—displayed only if Automatic Start Mode is configured.

- USE CRITICAL BAND? (TRUE/FALSE) _____
  (When set to TRUE the CRITICAL SPEED BAND can be set up and used. The CRITICAL SPEED BAND is used to prevent operation at turbine speeds where there are high vibrations in the system.)

- CRITICAL SPEED MIN (RPM) _____
  (This value sets the lower limit of the CRITICAL SPEED BAND.)
  (Tunable Range: 0 to 10000).

- CRITICAL SPEED MAX (RPM) _____
  (This value sets the upper limit of the CRITICAL SPEED BAND.)
  (Tunable Range: 0 to 10000).

- CRITICAL BAND RATE (RPM/SEC) _____
  (This value sets the rate that the speed reference changes while transiting through the critical band.)
  (Tunable Range: 0 to 1000).

- IN CRITICAL BAND (***status indication only***)
  (This indicates the speed is within the CRITICAL SPEED BAND.)

Speed Switch / Hand Valve Menu

This menu is displayed only if configured for SPD SW / HAND VLV.

- RLY #1 ON (RPM or %) _____
  (This is the SPEED or VALVE POSITION where CONFIG RELAY #1 is energized. This function must be enabled In the Configuration mode by setting USE SPEED SWITCH = TRUE or USE HAND VALVE = TRUE, and also by setting RELAY #3 OPTION = 10.)
  (Tunable Range: 0 to 15000).

- RLY #1 OFF (RPM or %) _____
  (This is the SPEED or VALVE POSITION where CONFIG RELAY #1 de-energizes.)
  (Tunable Range: 0 to 15000).

- RLY #2 ON (RPM or %) _____
  (This is the SPEED or VALVE POSITION where CONFIG RELAY #2 is energized. This function must be enabled In the Configuration mode by setting USE SPEED SWITCH = TRUE or USE HAND VALVE = TRUE, and also by setting RELAY #4 OPTION = 11.)
  (Tunable Range: 0 to 15000).

- RLY #2 OFF (RPM or %) _____
  (This is the SPEED or VALVE POSITION where CONFIG RELAY #2 is de-energized.)
  (Tunable Range: 0 to 15000)

IMPORTANT

A combination of both a hand valve and a speed switch is not possible. If both "Use Hand Valve" and "Use Speed Switch" are set to TRUE, hand valves will be selected (if Option 10 or 11 is selected in the relay options—see Configuration).

- UNDERSPD LEVEL (RPM) _____
  (This is the SPEED setting where an under speed condition can be sensed when the turbine speed is decreasing. This function is overridden during start up until MIN GOVERNOR SPEED Is reached. CONFIG RELAY#2 is configured for UNDERSPEED from the relay options list.)

Valve Menu

This menu shows the valve position, offset, gain, stroke position, and valve ramp position.

- VALVE POSITION (%) (***status indication only***)
  (This is the displayed value of VALVE position. This is the signal to the actuator demand or valve position.)

- VLV – OFFSET ADJUST _____*0.0_____
  (This value sets the OFFSET ADJUSTMENT for the VALVE RAMP.)
  (Tunable Range: -10000 to 10000).

- VLV -- GAIN ADJUST _____*1.0_____
  (This value sets the GAIN ADJUSTMENT for the valve RAMP.)
  (Tunable Range: -2 to 2).

- VALVE RAMP POS'N = (***status indication only***)
  (This is the displayed value of the RAMP POSITION. When the turbine is tripped, this value will be 0.0%. As the turbine is starting, the VALVE RAMP will open to 100%.
  The VALVE RAMP is low-signal-selected with the speed control's PID to determine the demand position.
  While running, the VALVE RAMP can be manually raised or lowered by setting either MANUALLY RSE RAMP or MANUALLY LWR RAMP = TRUE. When both are set to FALSE, the VALVE RAMP will stop.
  During shutdown the VALVE RAMP lowers the actuator output to zero by overriding the SPEED PID output.)

- MANUALLY RSE RAMP? ____*false_____
  (When this is set to TRUE the VALVE RAMP will open. When set to FALSE the VALVE RAMP will stop at the last position. By using the MANUALLY RSE RAMP and the MANUALLY LWR RAMP the actuator can be used for stroking the valves from limit to limit when the system is shut down.)
  (This is used as a troubleshooting tool. No configuration is required. To allow the actuator to have full travel during normal operation, make sure the valve ramp is returned to 100% after troubleshooting.)

- MANUALLY LWR RAMP? ____*false_____
  (When this is set to TRUE the VALVE RAMP will close. When set to FALSE the VALVE RAMP will stop at the last position. This can be used for testing the turbine by manually overriding the PID to electrically block the valve. Also this can be used as a VALVE LIMITER to limit the maximum lift of the valve.)
  (This is used as a troubleshooting tool. No configuration is required. To allow the actuator to have full travel during normal operation, make sure the valve ramp is returned to 100% after troubleshooting.)

- RAMP RATE (%/SEC) _____
  (This value sets the rate at which the valve ramp will open during turbine START UP. This is the same rate at which the valve ramp can be adjusted with the MANUALLY RSE RAMP or MANUALLY LWR RAMP commands above.)
  (Tunable Range: 0 to 100).

- DITHER ADJUST _____

(DITHER is used to keep the VALVE OUTPUT active without affecting the turbine speed. The DITHER ADJUST does this by adding a low magnitude, high frequency movement to the ACTUATOR. DITHER is normally set to 0.0 when not needed or to a higher value for those systems that need it.)
(Tunable Range: 0 to 30).

NOTICE **The turbine must be shut down to perform the following functions.**

- STROKE VALVE OUTPUT? (TRUE/FALSE) _____
(Setting STROKE VLV OUTPUT = TRUE enables stroking the valves. When STROKE VLV OUTPUT = TRUE, either the STROKE POSITION (%) or the MIN / MAX SWITCH can be used for opening and closing the ACTUATOR / VALVE.)

- STROKE POSITION (%) _____
(Increasing on decreasing the % of the STROKE POSITION will move the ACTUATOR / VALVE. It can be adjusted between 0% and 100% for stroking the valve as long as the STROKE VLV OUTPUT is set TRUE and the MIN / MAX SWITCH is set to false.)
(Tunable Range: 0 to 100).

- MIN / MAX SWITCH (TRUE/FALSE) _____
(Setting the MIN / MAX SWITCH = TRUE will open the ACTUATOR / VALVE. Setting it = FALSE will close the ACTUATOR / VALVE. By switching between FALSE and TRUE, the actuator can be stroked between 0 and 100%. The STROKE VLV OUTPUT must be set TRUE.)

When the VALVE / ACTUATOR has been stroked, set the STROKE VALVE OUTPUT? = FALSE.

Readout Adjustments Menu

This menu shows the adjustments for readouts #1 and #2.

- RO #1-OFFSET ADJUST: _____
This value sets the RO#1 (SPEED READOUT) offset adjustment.
(Tunable Range: -2000 to 2000).

- RO #1-GAIN ADJUST: _____
This value sets the RO#1 (SPEED READOUT) gain adjustment.
(Tunable Range: 0 to 4).

- RO #2-OFFSET ADJUST: _____
This value sets the RO#2 (SPEED READOUT) offset adjustment.
(Tunable Range: -2000 to 2000).

- RO #2-GAIN ADJUST: _____
This value sets the RO#2 (SPEED READOUT) gain adjustment.
(Tunable Range: 0 to 4).

IMPORTANT **The 4–20 mA readouts are factory calibrated. The adjustments are provided as compensation for external meters, etc. If the 0–1 mA readout option is required (see jumper option chart), the offset and gains will have to be adjusted for full range output calibration.**

- RO #2 VALUE (***status indication only***)
  (This is the value of the parameter configured as the output of readout #2.)

Port Adjustments Menu

This menu shows the adjustments for the MODBUS Communication Port and is displayed only if "Use MODBUS Port" is configured (see Configuration).

- HARDWARE CONFIGURATION _____
  (This code # selects the hardware used for MODBUS Communications. The option number can be increased with the (+) key and decreased with the (-) key.)
  Select the hardware configuration from the following list:
  1 = RS-232 Communication
  2 = RS-422 Communication
  3 = RS-485 Communication

- BAUD RATE _____
  (This code # sets the BAUD RATE for the MODBUS communications. The option number can be increased with the (+) key and decreased with the (-) key.)
  Select the BAUD RATE from the following list:
  1 = 1200 Baud
  2 = 1800 Baud
  3 = 2400 Baud
  4 = 4800 Baud
  5 = 9600 Baud
  6 = 19200 Baud

- STOP BITS _____
  (This code # selects the correct STOP BITS for the transmitted data. The option number can be increased with the (+) key and decreased with the (-) key.)
  Select the STOP BITS from the following list:
  1 = 1 STOP BIT
  2 = 1.5 STOP BITS
  3 = 2 STOP BITS

- PARITY _____
  (This code # sets the correct PARITY to be used during transmission The option number can be increased with the (+) key and decreased with the (-) key.)
  Select the PARITY from the following list:
  1 = Off
  2 = Odd
  3 = Even

- LINK ERROR (***status indication only***)
  (When this indicates TRUE the MODBUS communication link has been lost.)

- EXCEPTION ERROR (***status indication only***)
  (When this indicates TRUE an exception error has been found in the transmitted data.)

- ERROR NUMBER (***status indication only***)
  (This code indicates the cause of the exception error. See the following list for the meaning of the error codes.)

  1 = ILLEGAL FUNCTION (The message function is not an allowable action.)
  2 = ILLEGAL DATA ADDRESS (The message start address is not an allowable address.)
  9 = CHECKSUM ERROR (The received message had an incorrect error check code.)
  10 = GARBLED MESSAGE (The received message could not be decoded.)

- ERROR PERCENT (%) (***status indication only***)
  (This indicates the amount of time that an error has been detected in the data being transmitted [displayed as a percent].)

I/O Check

This menu shows the status of the key input and output points of the control. This menu can be used for troubleshooting of I/O hardware and wiring. It can also be used to determine if an LED is bad.

- MPU #1 (RPM) (***status indication only***)
  (This is the speed sensed by MPU #1.)

- MPU #2 (RPM) (***status indication only***)
  (This is the speed sensed by MPU #2.)

- ANALOG INPUT (%) (***status indication only***)
  (This is the REMOTE SPEED SET input. 0% = MIN GOV SPEED and 100% = MAX GOV SPEED.)

The following I/Os are status indications only and will be TRUE or FALSE.

- DI #1 (***status indication only***)
  (When DI #1 is TRUE (Input Closed) the turbine operator is applying the **SPEED REFERENCE LOWER command**.)

- DI #2 (***status indication only***)
  (When DI #2 is TRUE (Input Closed) the turbine operator is applying the **SPEED REFERENCE RAISE command**.)

- DI #3 (***status indication only***)
  (When DI #3 is **TRUE** (Input Closed) there are no **EXTERNAL TRIPS**. When DI #3 turns **FALSE** (Input Opens) one of the devices in the TRIP STRING has opened the **EXTERNAL TRIP** contact to trip the turbine.)

- DI #4 (status indication only)
  (When DI #4 turns TRUE (Input Closes) the Peak 150 is receiving a **START** command.)

- DI #5 (***status indication only***)
  (When DI #5 turns TRUE (Input Closes) the Peak 150 is getting a **RESET** command for clearing all ALARMS and TRIPS. This is a momentary contact closure.)

- DI #6 (***status indication only***)
  (When DI #6 turns TRUE, closing the **IDLE / MIN GOV** contact, the Peak 150 will ramp from the IDLE SPEED to the MIN GOVERNOR SPEED.)

- DI #7 (***status indication only***)
  (When DI #7 is TRUE (Input Closed) the **REMOTE SPEED ENABLE** function is selected to control the speed as a function of the REMOTE SPEED SET input.)

- DI #8 (***status indication only***)
  (When DI #8 is TRUE (Input Closed) either the **HI DYN SELECT** or the **OSPD TEST** function has been selected. The configuration is done in the CONTACT IN #8 menu.)

- TRIP P/B (***status indication only***)
  (When the front panel TRIP button is pressed, the **TRIP P/B** will indicate TRUE. When the TRIP BUTTON is opened, the **TRIP P/B** will indicate FALSE. However, the Peak 150 will latch in the TRIP state until the trip condition is cleared and a RESET command is received. If the control is configured for RESET CLEARS TRIP = TRUE, then the RESET command will clear the latch even though the TRIP condition has not been cleared.)

- OSPD TEST P/B (***status indication only***)
  (When the front panel OVER SPEED TEST button is pressed, the **OSPD TEST P/B** will indicate TRUE. With the OVER SPEED TEST button closed, the RAISE button will run the turbine speed higher than the MAX GOV SPEED for testing OVER SPEED TRIP devices.)

- RAISE P/B (***status indication only***)
  (When the front panel RAISE button is pressed, the **RAISE P/B** will indicate TRUE. When closed, the RAISE button ramps up the SPEED REFERENCE to increase the turbine speed.)

- LOWER P/B (***status indication only***)
  (When the front panel LOWER button is pressed, the **LOWER P/B** will indicate TRUE. When closed, the LOWER button ramps down the SPEED REFERENCE to decrease the turbine speed.)

- START P/B (***status indication only***)
  (When the front panel START button is pressed, the **START P/B** will indicate TRUE. When closed momentarily, the START button initiates a turbine start, either AUTO or MANUAL depending on the control configuration.)

- RESET P/B (***status indication only***)
  (When the front panel ALARM RESET button is pressed, the **RESET P/B** will indicate TRUE. When closed momentarily, the RESET button clears the latch circuits for all ALARMS and TRIPS.)

- TRIPPED LED (***status indication only***)
  (By default, the TRIP RELAY is configured to be energized to run, and de-energized to trip. When the turbine is operating, the TRIP RELAY is energized (terminals 4 & 5 closed), the TRIPPED LED in the I/O CHECK service menu is TRUE, and the TRIPPED LED on the Front Panel is not illuminated. When the turbine trips, the TRIP RELAY de-energizes (terminals 4 & 5 open), the TRIPPED LED in the I/O CHECK service menu is FALSE, and the TRIPPED LED on the Front Panel is illuminated.)

  The TRIP RELAY can also be configured to energize to trip, and de-energize to run. When the turbine is operating, the TRIP RELAY is de-energized (terminals 4 & 5 closed), the TRIPPED LED in the I/O CHECK service menu is FALSE, and the TRIPPED LED on the Front Panel is not illuminated. When the turbine trips, the TRIP RELAY energizes (terminals 4 & 5 open), the TRIPPED LED on the I/O service menu is TRUE, and the TRIPPED LED on the Front Panel is illuminated.)

IMPORTANT

If the trip relay is programmed to energize for a shutdown, Jumper 2 and Jumper 17 must both be installed to properly display the unit's "Tripped" status on the front-panel LED and to provide the proper contacts between terminals 4 and 5. If the trip relay is programmed to de-energize for a shutdown, Jumper 1 and Jumper 18 must both be installed.

- MPU #1 OK LED (***status indication only***)
  (This indicates the status of MPU #1. When MPU #1 is sensing a speed signal, the **MPU #1 OK LED** status is TRUE and the MPU #1 OK LED is illuminated. When the speed signal is lost, the indication goes FALSE and the LED is no longer illuminated.)

- MPU #2 OK LED (***status indication only***)
  (This indicates the status of MPU #2. When MPU #2 is sensing a speed signal, the **MPU #2 OK LED** status is TRUE and the MPU #2 OK LED is illuminated. When the speed signal is lost, the indication goes FALSE and the LED is no longer illuminated.)

- OSPD ENABLED LED (***status indication only***)
  (The **OSPD ENABLED LED** = TRUE indicates that the front panel OVER SPEED TEST button is being pressed or DI #8 is configured for OVERSPEED TEST and is closed. The front panel ENABLED LED will also be illuminated.)

- RMT SPD LED (***status indication only***)
  (The **RMT SPD LED** = TRUE indicates that REMOTE SPEED CONTROL has been configured and selected by closing the input to DI #7 (REMOTE SPEED ENABLE). The front panel RMT SPD ENABLED LED will also be illuminated.)

- TRIP RELAY ON (***status indication only***)
  (The **TRIP RELAY ON** = TRUE when the TRIP RELAY is energized and the contacts between terminal 4 & 5 are closed.)
  (The default configuration for the TRIP relay is the TRIP RELAY de-energizes for TRIP, which opens the contacts between 4 & 5. The TRIP will also shut down the turbine and illuminate the front panel TRIPPED LED.)
  (The TRIP relay can also be configured for TRIP RELAY energized for TRIP, so that terminal 4 & 5 close on trip. The TRIP will also shut down the turbine and illuminate the front panel TRIPPED LED. In this configuration, Jumper 1 must be removed and Jumper 2 installed.)

- ALARM RELAY ON (***status indication only***)
  (When the **ALARM RELAY ON** = TRUE there are no system ALARMS. This also indicates that the ALARM RELAY is energized. When there is a system ALARM, **ALARM RELAY ON =** FALSE and the ALARM RELAY is de-energized. To RESET the ALARM RELAY, the fault must be cleared and the ALARM RESET input or button must be closed momentarily.)

- CONF RLY #1 ON (***status indication only***)
  (When **CONF RLY #1 ON =** TRUE, CONFIG RELAY #1 is energized. This indicates that the status of the configuration option for RELAY #3 is TRUE.)

- CONF RLY #2 ON (***status indication only***)
  (When **CONF RLY #2 ON =** TRUE, CONFIG RELAY #2 is energized. This indicates that the status of the configuration option for RELAY #4 is TRUE.)

Service Mode Flow Diagram

Refer to Figure 9-1 for a flow diagram of the service mode headers.

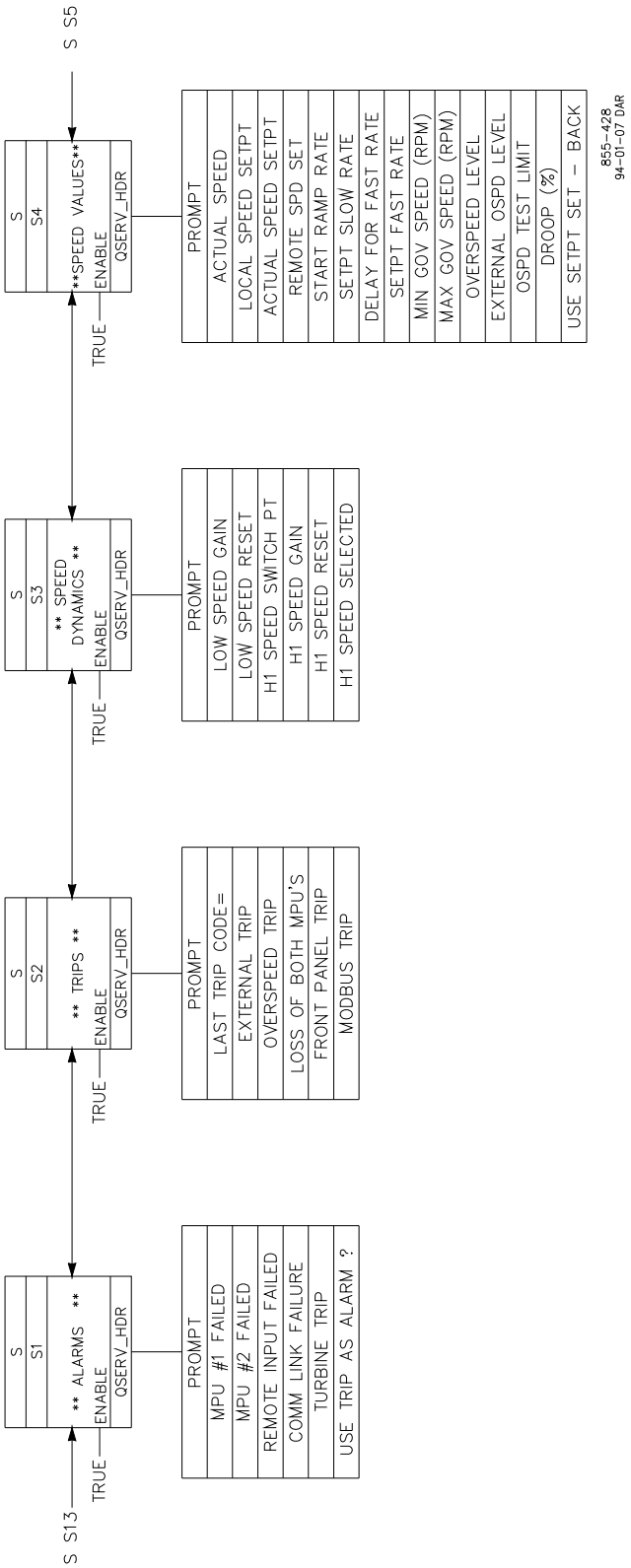
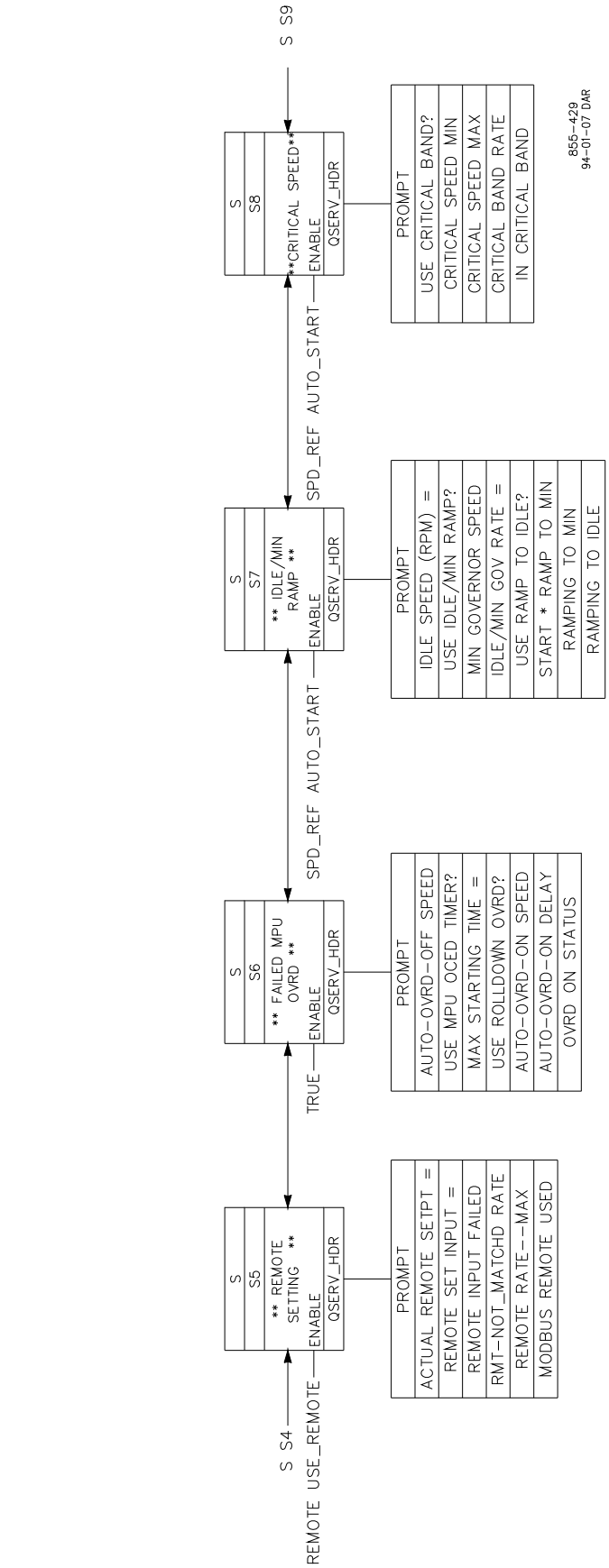
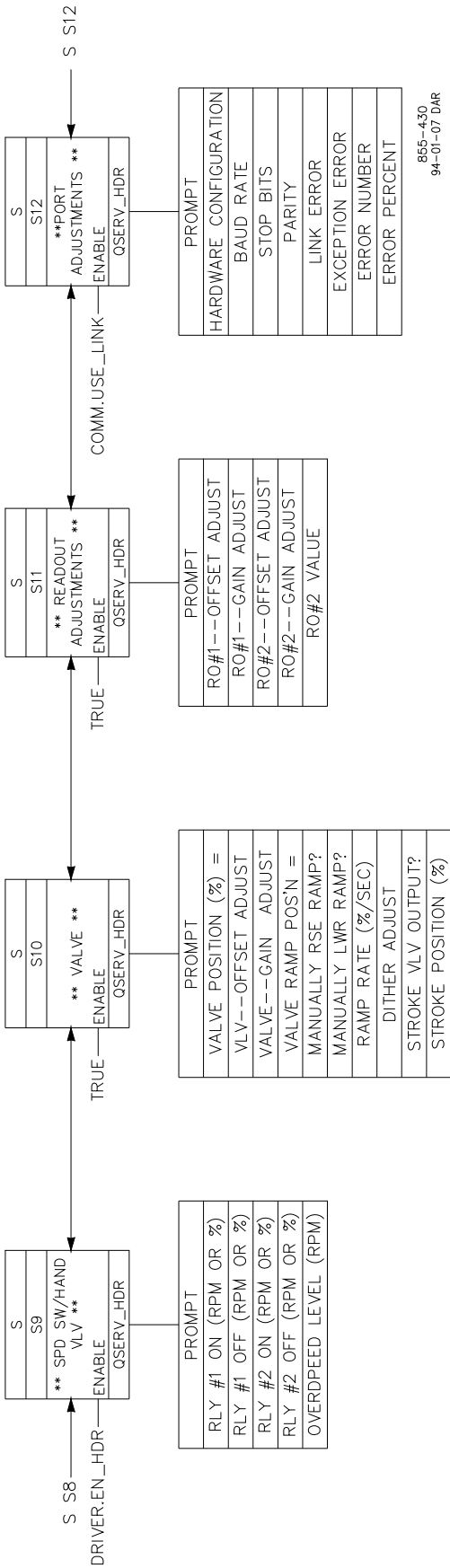
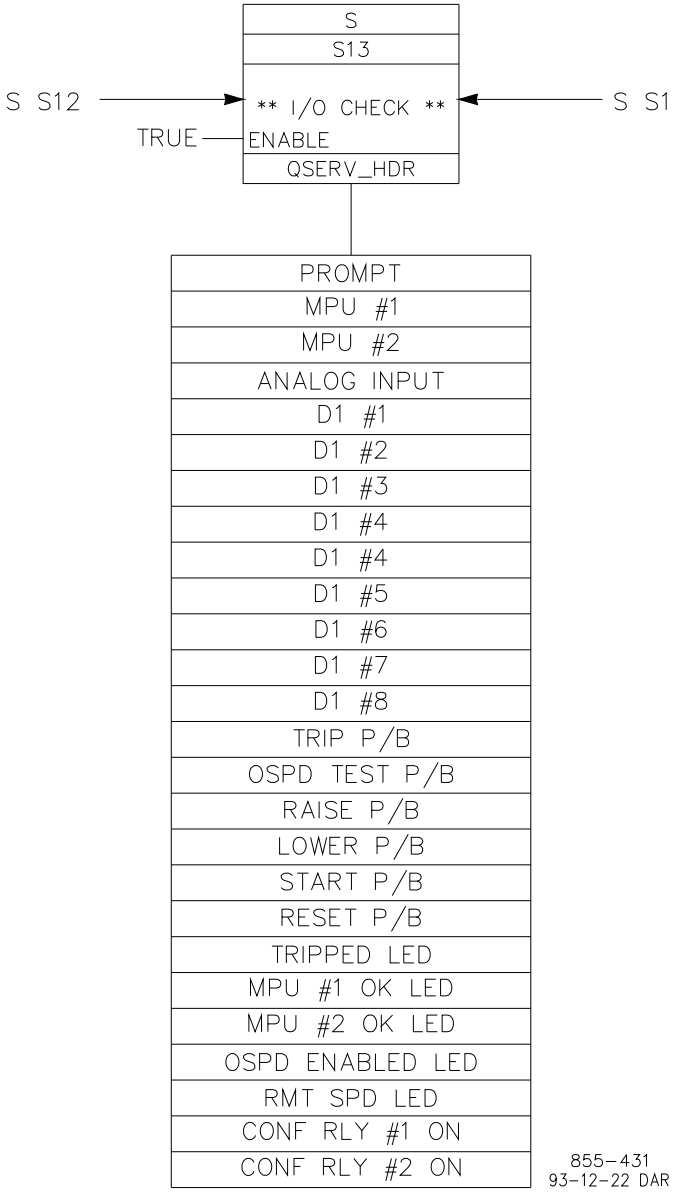


Figure 9-1. Service Mode Flow Diagram
(4 pages)


S S9
S
S8
CRITICAL SPEED
ENABLE
QSERV_HDR
PROMPT
USE CRITICAL BAND?
CRITICAL SPEED MIN
CRITICAL SPEED MAX
CRITICAL BAND RATE
IN CRITICAL BAND
855-429
94-01-07 DAR
SPD_REF AUTO_START
S
S7
** IDLE/MIN RAMP **
ENABLE
QSERV_HDR
PROMPT
IDLE SPEED (RPM) =
USE IDLE/MIN RAMP?
MIN GOVERNOR SPEED
IDLE/MIN GOV RATE =
USE RAMP TO IDLE?
START * RAMP TO MIN
RAMPING TO MIN
RAMPING TO IDLE
SPD_REF AUTO_START
S
S6
** FAILED MPU OVRD **
ENABLE
QSERV_HDR
PROMPT
AUTO-OVRD-OFF SPEED
USE MPU OCED TIMER?
MAX STARTING TIME =
USE ROLLDOWN OVRD?
AUTO-OVRD-ON SPEED
AUTO-OVRD-ON DELAY
OVRD ON STATUS
TRUE
S
S5
** REMOTE SETTING **
ENABLE
QSERV_HDR
PROMPT
ACTUAL REMOTE SETPT =
REMOTE SET INPUT =
REMOTE INPUT FAILED
RMT-NOT_MATCHD RATE
REMOTE RATE--MAX
MODBUS REMOTE USED
S S4
REMOTE USE_REMOTE


S S12
S
S12
**PORT
ADJUSTMENTS **
ENABLE
QSERV_HDR
PROMPT
HARDWARE CONFIGURATION
BAUD RATE
STOP BITS
PARITY
LINK ERROR
EXCEPTION ERROR
ERROR NUMBER
ERROR PERCENT
COMM.USE_LINK
S
S11
** READOUT
ADJUSTMENTS **
ENABLE
QSERV_HDR
PROMPT
RO#1--OFFSET ADJUST
RO#1--GAIN ADJUST
RO#2--OFFSET ADJUST
RO#2--GAIN ADJUST
RO#2 VALUE
TRUE
S
S10
** VALVE **
ENABLE
QSERV_HDR
PROMPT
VALVE POSITION (%) =
VLV--OFFSET ADJUST
VALVE--GAIN ADJUST
VALVE RAMP POS'N =
MANUALLY RSE RAMP?
MANUALLY LWR RAMP?
RAMP RATE (%/SEC)
DITHER ADJUST
STROKE VLV OUTPUT?
STROKE POSITION (%)
MIN/MAX SWITCH
TRUE
S
S9
** SPD SW/HAND
VLV **
ENABLE
QSERV_HDR
PROMPT
RLY #1 ON (RPM OR %)
RLY #1 OFF (RPM OR %)
RLY #2 ON (RPM OR %)
RLY #2 OFF (RPM OR %)
OVERDPEED LEVEL (RPM)
S S8
DRIVER.EN_HDR
855-430
94-01-07 DAR


S
S13
S S12
** I/O CHECK **
S S1
TRUE
ENABLE
QSERV_HDR
PROMPT
MPU #1
MPU #2
ANALOG INPUT
D1 #1
D1 #2
D1 #3
D1 #4
D1 #4
D1 #5
D1 #6
D1 #7
D1 #8
TRIP P/B
OSPD TEST P/B
RAISE P/B
LOWER P/B
START P/B
RESET P/B
TRIPPED LED
MPU #1 OK LED
MPU #2 OK LED
OSPD ENABLED LED
RMT SPD LED
CONF RLY #1 ON
CONF RLY #2 ON
855-431
93-12-22 DAR

Chapter 10.
Functional Block Diagram

Explanation of Functional Block Diagram

The Functional Block Diagram explains how the Peak 150 control operates in logic diagram form. Sheet one of the block diagram covers general and specific block diagram notes. Refer to this sheet for explanation of the information contained on the additional sheets. Sheet two of the diagram shows an overview of the system and identifies the following sheets on which detailed information can be located.

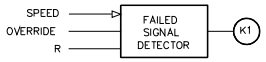
The additional sheets show the simplified block diagram of the control. These blocks represent the functional operational blocks of the control, the functions of which are performed by the computer in the control. The general block diagram notes cover the following topics:

- Signal flow
- Customer input/output (I/O)
- Interconnect code
- Operator control panels
- Switch contact inputs
- Function connectors
- Buses
- Function symbols
- Adjustable Parameter Codes

SIGNAL FLOW

SIGNAL FLOW IS FROM LEFT TO RIGHT. ALL INPUTS ENTER FROM THE LEFT. ALL OUTPUTS EXIT TO THE RIGHT. EXCEPTIONS ARE NOTED. SIGNAL VALUES ARE SHOWN WITH AN ARROW. LOGIC SIGNALS ARE SHOWN WITHOUT AN ARROW.

EXAMPLE:



CUSTOMER INPUT/OUTPUT (I/O)

INPUTS ORIGINATE ON THE LEFT SIDE OF THE DRAWING. OUTPUTS TERMINATE ON THE RIGHT SIDE OF THE DRAWING, WITH THE EXCEPTION OF RELAYS, WHICH ARE SHOWN NEAR THEIR ASSOCIATED FUNCTION BLOCK. VERTICAL DASHED LINES SEPARATE SIGNAL FLOW BETWEEN WOODWARD GOVERNOR AND CUSTOMER EQUIPMENT.

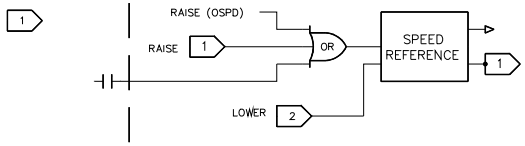
INTERCONNECT CODE

THE ⬠ SYMBOL INDICATES INTERCONNECTING SIGNAL FLOW BY CABLES WITH CONNECTORS ON BOTH ENDS. NO CUSTOMER WIRING REQUIRED. EACH CABLE IS DISTINGUISHED WITHIN THE BLOCK DIAGRAM NUMERICALLY AND GENERALLY EACH RACK WILL BE SHOWN ON SEPARATE SHEETS.

⬠ 1 INDICATES TO/FROM RS-232 DIVICE. THE NUMBER INSIDE THE SYMBOL CORRESPONDS TO THE MODBUS ADDRESS IDETIFIER.

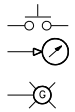
IDENTIFIER (CATEGORY) SYMBOL INDICATES INTERCONNECTION WITHIN THE SOFTWARE. THE INTERCONNECTION IS DESCRIBED BY THE IDENTIFIER IS FOLLOWED BY THE CATEGORY. THE CATEGORY AND ASSOCIATED SHEET NUMBER MATRIX CAN BE FOUND ON SHEET 1 OF THIS DOCUMENT.

EXAMPLE:



OPERATOR CONTROL PANELS

THE FOLLOWING SYMBOLS ARE USED TO DISPLAY OPERATOR CONTROL PANEL FUNCTIONS.



PUSHBUTTON SWITCH

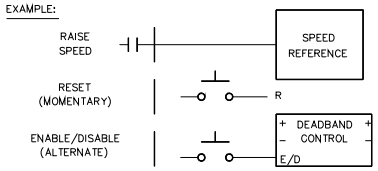
METER

INDICATOR; LED, LAMP OR BACKLIGHTED PUSHBUTTON SWITCH. COLOR SHOWN IN CIRCLE: G = GREEN, R = RED, W = WHITE, Y = YELLOW.

SWITCH CONTACT INPUTS

UNLESS OTHERWISE NOTED, ALL SWITCH CONTACTS CLOSE TO MAKE THE INPUT DESCRIPTION TRUE AND OPEN TO MAKE IT FALSE. SOME INPUTS ONLY REQUIRE A MOMENTARY CONTACT CLOSURE TO MAKE THE INPUT DESCRIPTION TRUE. THEY ARE LABELED AS MOMENTARY. SOME INPUTS REQUIRE AN ALTERNATE ACTION SWITCH CONTACT TO MAKE THE FIRST DESCRIPTION TRUE WHEN THE CONTACT IS CLOSED AND THE SECOND TRUE WHEN CONTACT IS OPENED. THEY ARE LABELED AS ALTERNATE.

EXAMPLE:



FUNCTION CONNECTORS

TO REDUCE THE NUMBER OF LINES ON THE DRAWING, SOME FUNCTIONS ARE CONNECTED TOGETHER BY USING LIKE CHARACTERS, WORDS, OR TIEPOINT SYMBOLS.

R – RESET
A SINGLE INPUT, RESET IS DISTRIBUTED TO ALL OF THE LATCHING FUNCTIONS. AFTER THE INPUT SIGNAL RETURNS TO NORMAL. A RESET IS REQUIRED TO RESTORE THE OUTPUT TO A NORMAL STATE.

S – SHUTDOWN
MULTIPLE INPUTS CAN INITIATE A SHUTDOWN. THE SHUTDOWN FUNCTION BLOCK IS USUALLY LOCATED PHYSICALLY ON THE DRAWING NEAR THE FINAL DRIVER.

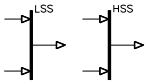
A – ALARM
MULTIPLE INPUTS CAN INITIATE AN ALARM. THE ALARM FUNCTION BLOCK IS USUALLY LOCATED ON THE DRAWING NEAR THE FINAL DRIVER.

⬡ – TIEPOINT SYMBOLS

BUSES

SIGNAL BUSES ARE SHOWN AS HEAVY LINES

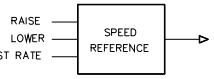
EXAMPLE:



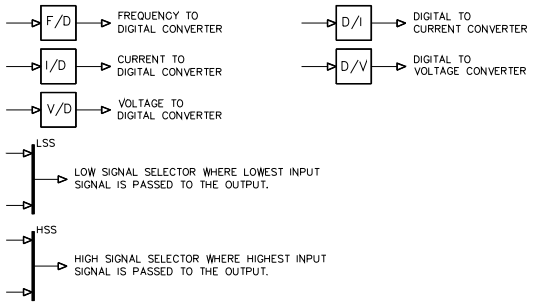
FUNCTION SYMBOLS

COMMON GOVERNOR FUNCTIONS ARE REPRESENTED BY RECTANGULAR BLOCKS. A DESCRIPTION OF THE FUNCTION IS SHOWN INSIDE THE BLOCK.

EXAMPLE:

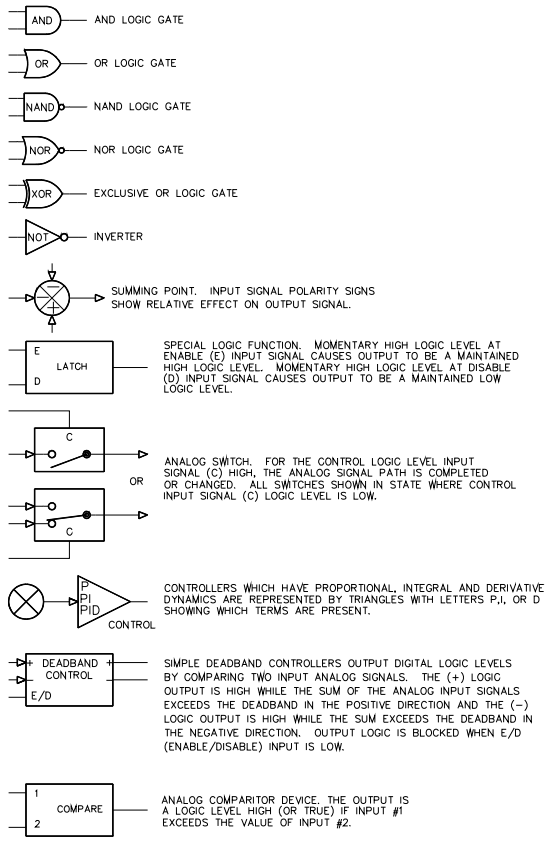


COMMONLY USED ABBREVIATED FUNCTIONS ARE:



FUNCTIONAL BLOCK DIAGRAM NOTES

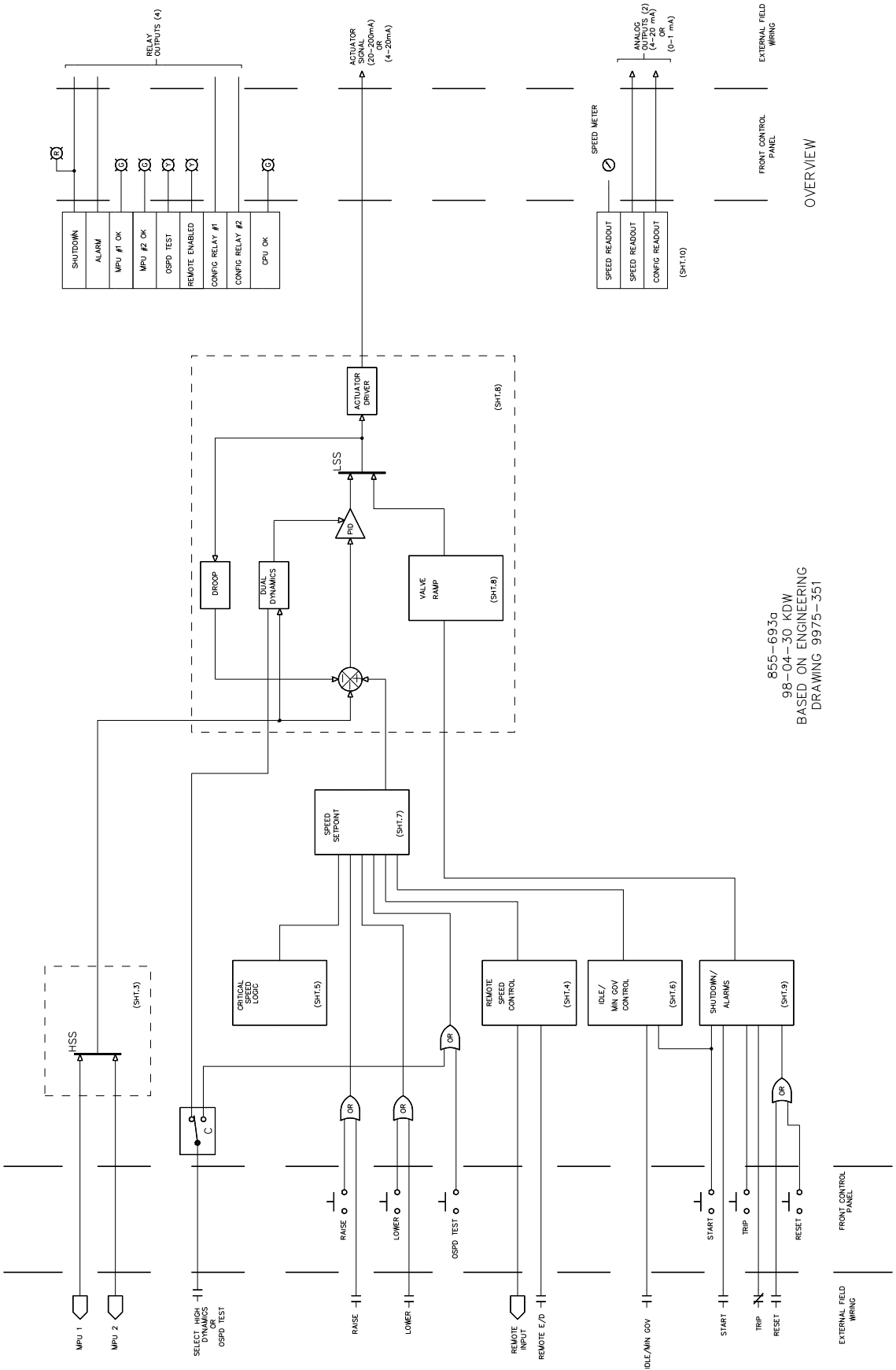
COMMONLY USED ABBREVIATED FUNCTIONS ARE: (CONT)

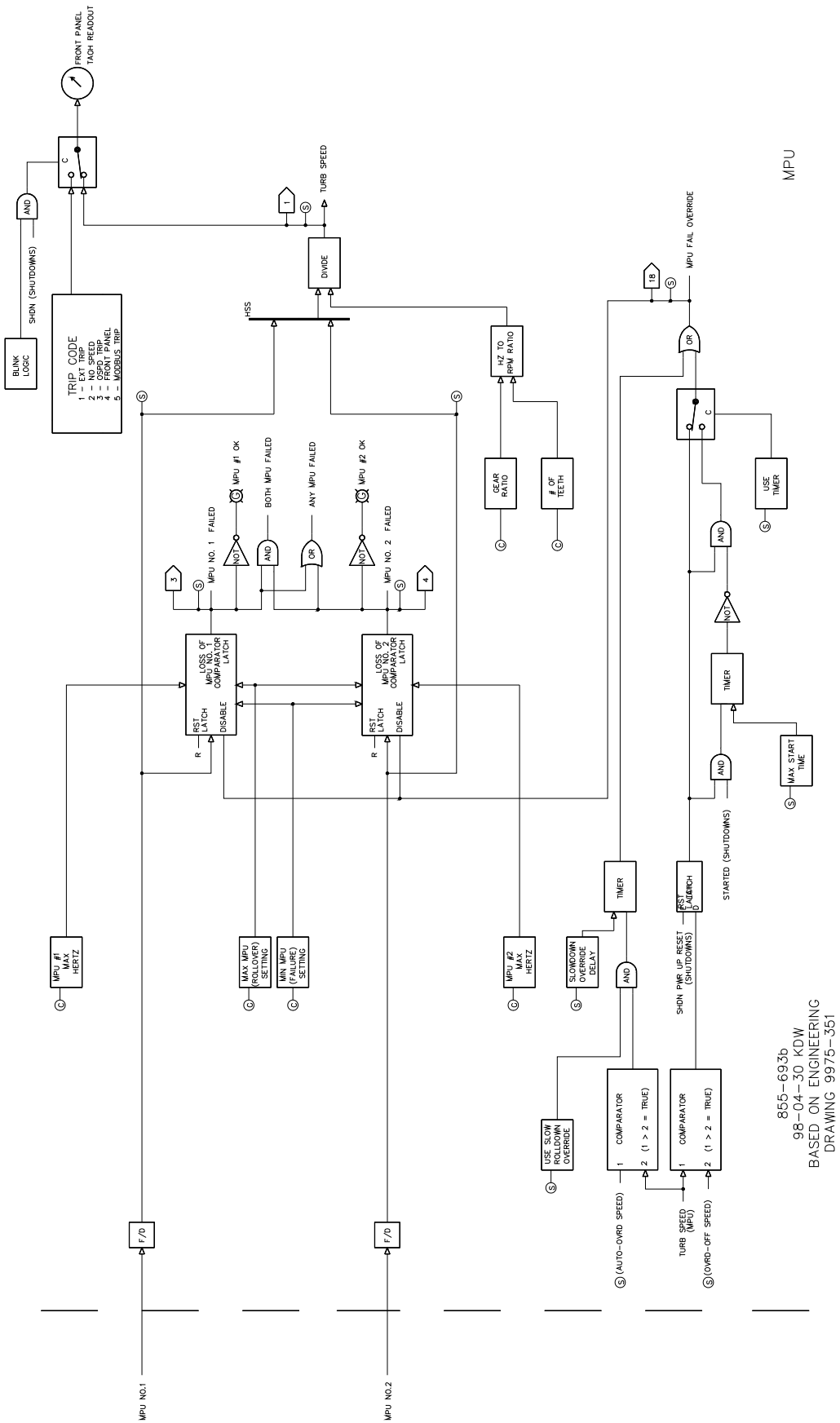


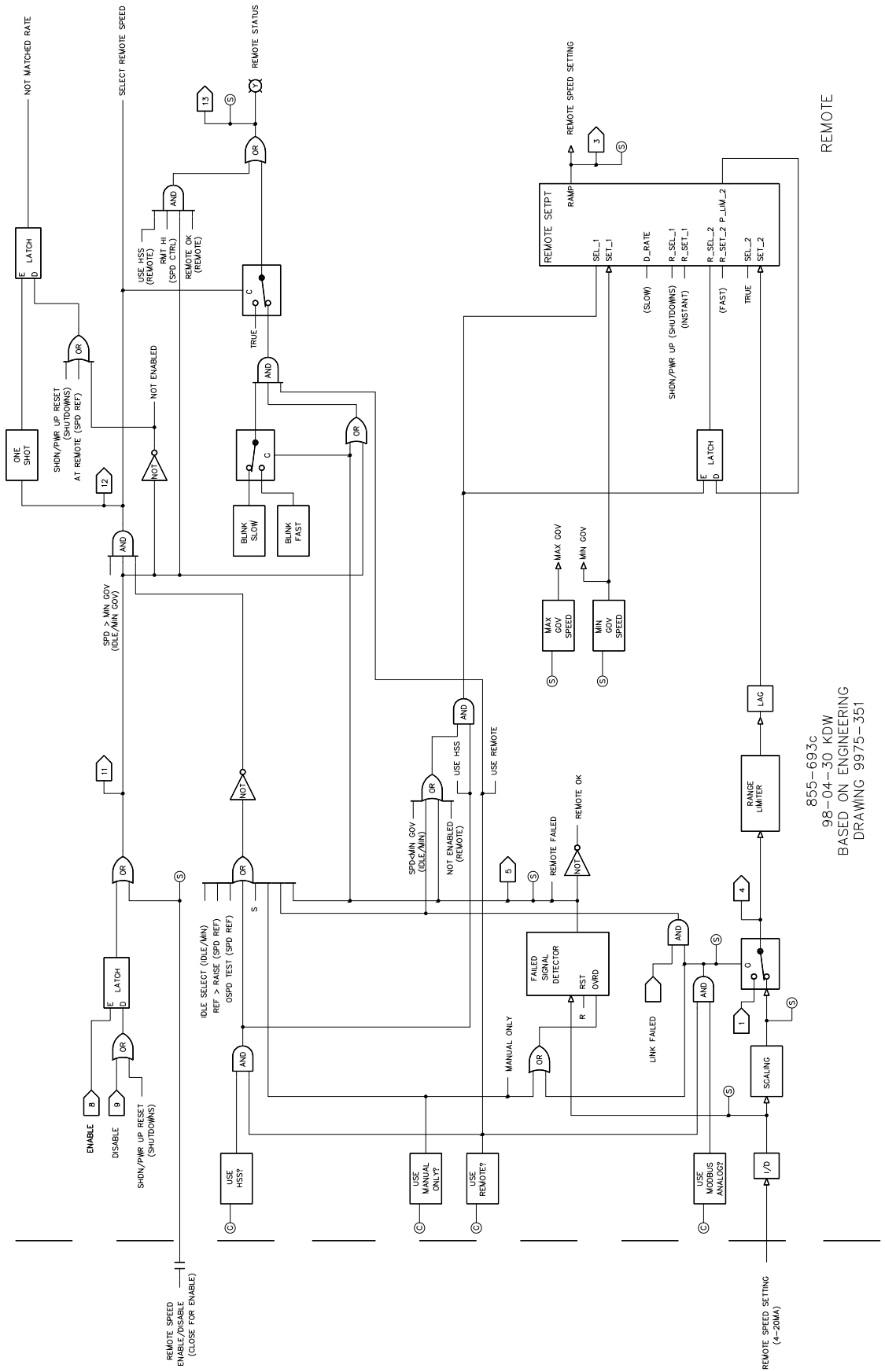
ADJUSTABLE PARAMETER CODES (TUNABLES):

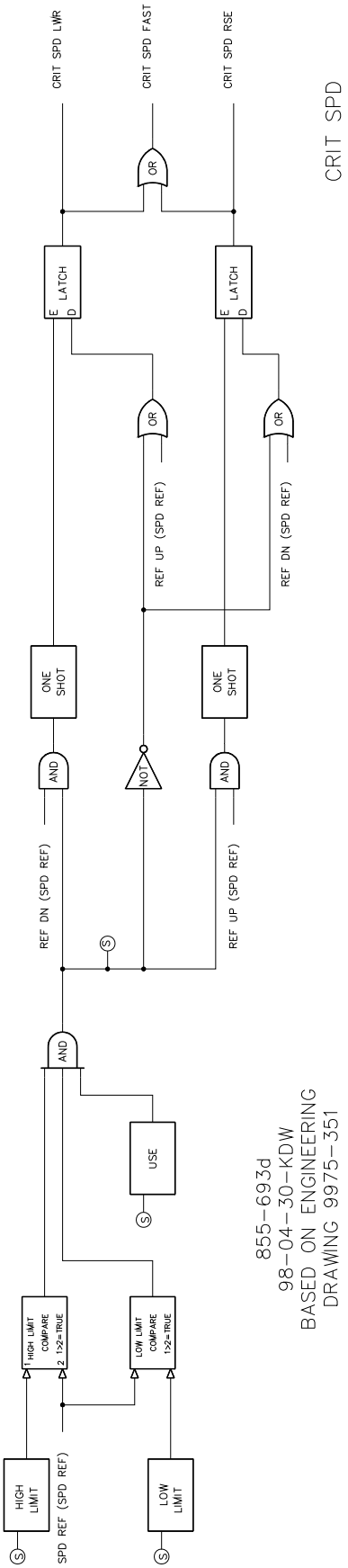
THE SYMBOL Ⓢ INDICATES A PARAMETER THAT IS ADJUSTABLE IN TYHE SERVICE MODE. THE SYMBOL Ⓓ INDICATES A PARAMETER THAT IS ADJUSTABLE IN THE DEBUG MODE BY TRAINED SERVICE PERSONNEL. BOTH SERVICE Ⓢ AND DEBUG Ⓓ MODE PARAMETERS ARE ADJUSTABLE WHILE THE TURBINE IS RUNNING. THE SYMBOL Ⓒ INDICATES A CONFIGURE MODE PARAMETER THAT IS ADJUSTABLE ONLY WHEN THE TURBINE IS SHUT DOWN.

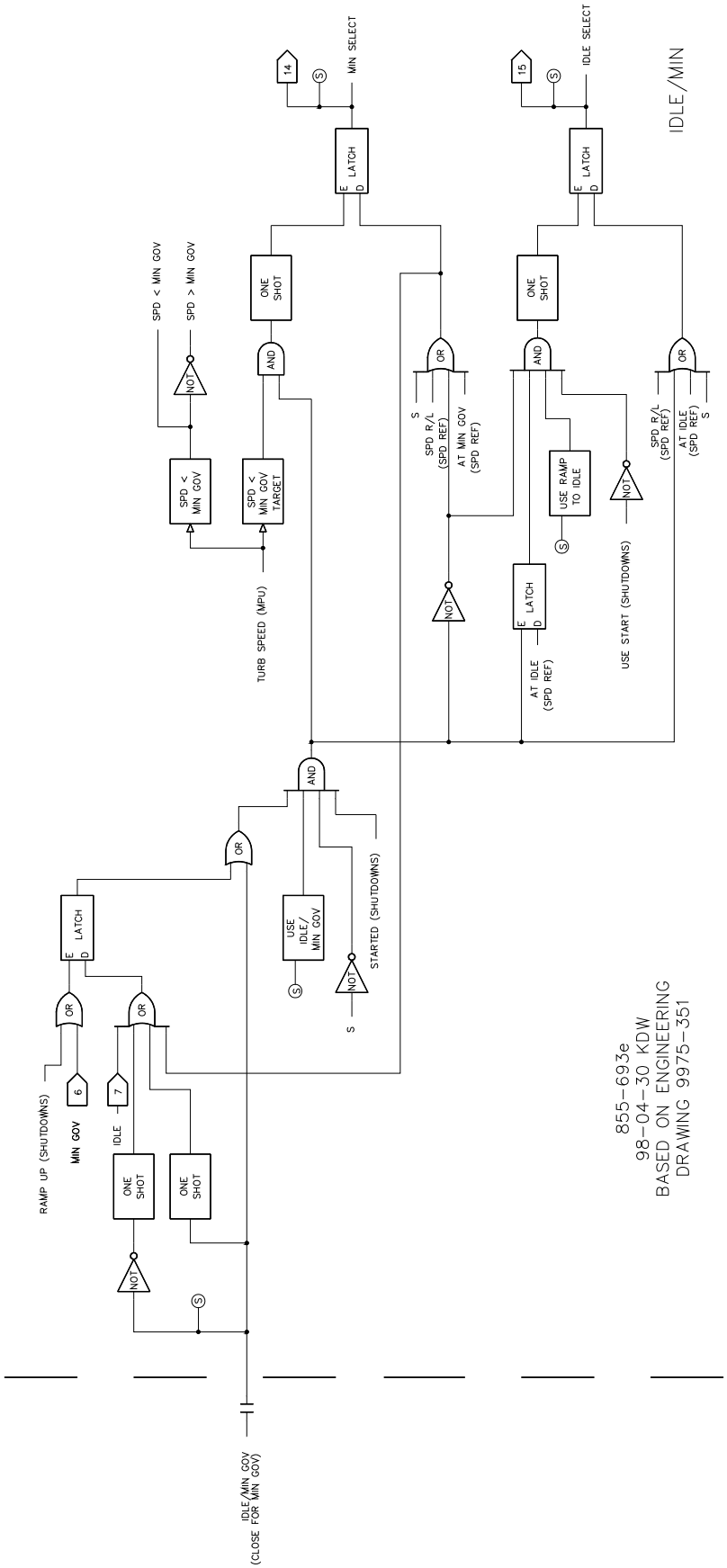
855-693
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351

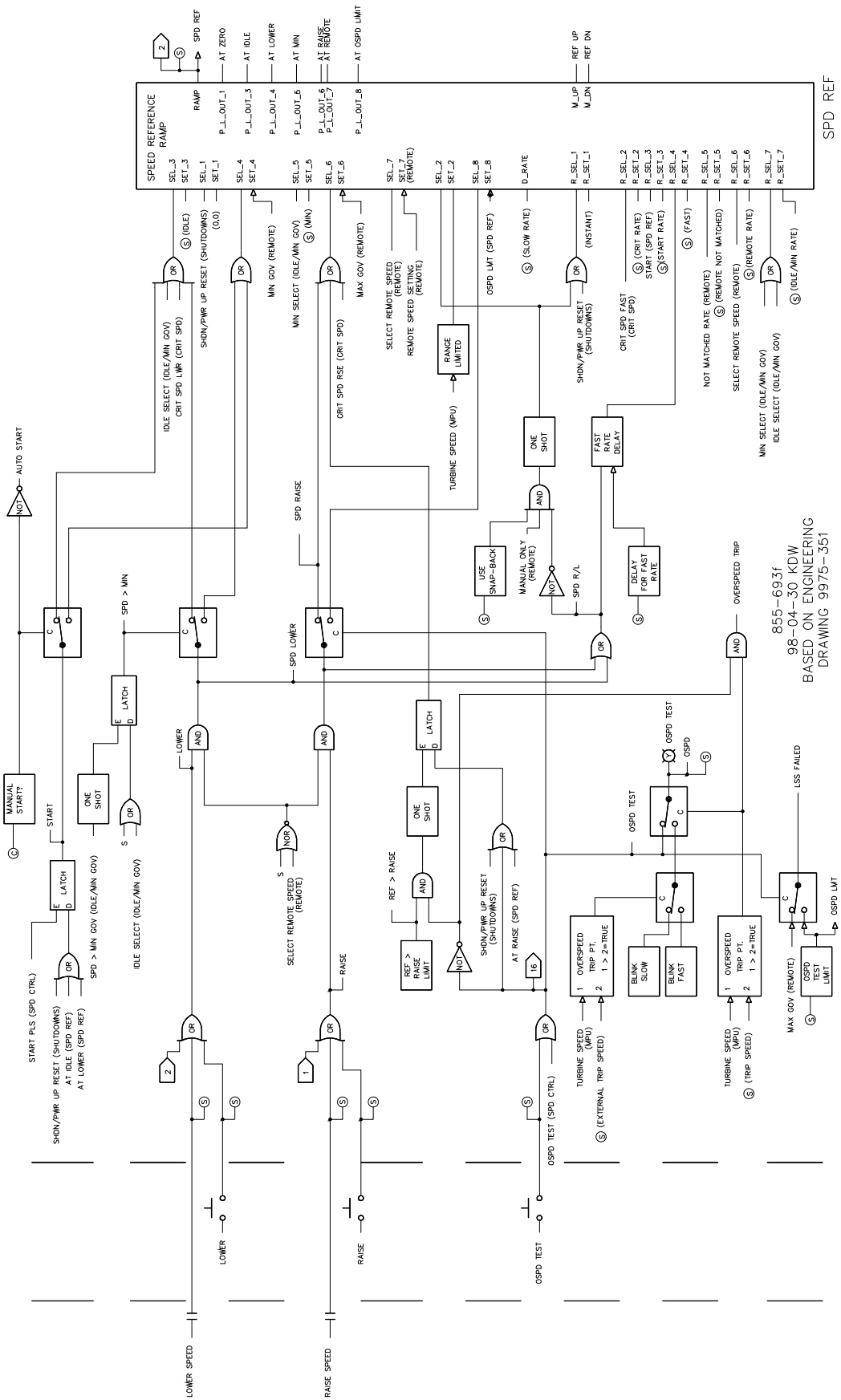

OVERVIEW
855-693a
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351
RELAY OUTPUTS (4)
ACTUATOR SIGNAL (20-200mA) OR (4-20mA)
ANALOG OUTPUTS (2) (4-20 mA) OR (0-1 mA)
EXTERNAL FIELD WIRING
FRONT CONTROL PANEL
SHUTDOWN
ALARM
MPU #1 OK
MPU #2 OK
OSPD TEST
REMOTE ENABLED
CONFIG RELAY #1
CONFIG RELAY #2
CPU OK
SPEED METER
SPEED READOUT
SPEED READOUT
CONFIG READOUT
(SHT.10)
ACTUATOR DRIVER
(SHT.8)
LSS
PID
DROOP
DUAL DYNAMICS
VALVE RAMP
(SHT.8)
SPEED SETPOINT
(SHT.7)
CRITICAL SPEED LOGIC
(SHT.5)
REMOTE SPEED CONTROL
(SHT.4)
IDLE/ MIN GOV CONTROL
(SHT.6)
SHUTDOWN/ ALARMS
(SHT.9)
HSS
(SHT.3)
OR
C
RAISE
LOWER
OSPD TEST
START
TRIP
RESET
MPU 1
MPU 2
SELECT HIGH DYNAMICS OR OSPD TEST
REMOTE INPUT
REMOTE E/D
IDLE/MIN GOV

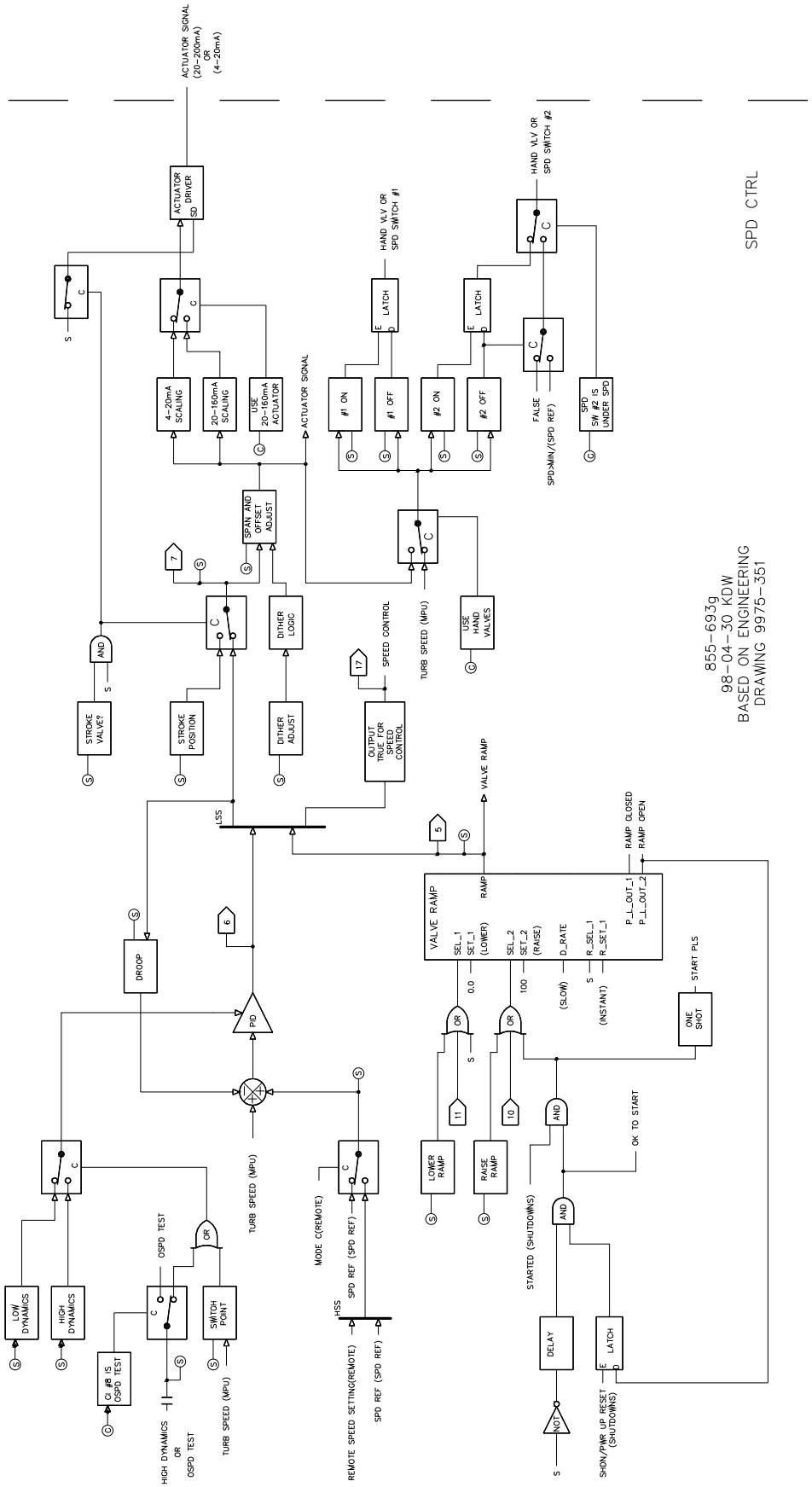

MPU
FRONT PANEL TACH READOUT
AND
SHDN (SHUTDOWNS)
BLINK LOGIC
TRIP CODE
1 – EXT TRIP
2 – LO SPEED
3 – OVERSPEED
4 – FRONT PANEL
5 – MODBUS TRIP
TURB SPEED
DIVIDE
HSS
HZ TO RPM RATIO
GEAR RATIO
OF TEETH
MPU FAIL OVERRIDE
OR
USE TIMER
MPU #1 OK
MPU NO. 1 FAILED
BOTH MPU FAILED
ANY MPU FAILED
MPU #2 OK
MPU NO. 2 FAILED
LOSS OF MPU NO. 1 COMPARATOR LATCH
LOSS OF MPU NO. 2 COMPARATOR LATCH
RST LATCH
DISABLE
TIMER
MAX START TIME
STARTED (SHUTDOWNS)
MPU #1 MAX HERTZ
MAX MPU (ROLLOVER) SETTING
MIN MPU (FAILURE) SETTING
MPU #2 MAX HERTZ
SLOWDOWN OVERRIDE DELAY
SHDN PWR UP RESET (SHUTDOWNS)
USE SLOW ROLLDOWN OVERRIDE
COMPARATOR
(1 > 2 = TRUE)
(AUTO-OVRD SPEED)
TURB SPEED (MPU)
(OVRD-OFF SPEED)
F/D
MPU NO.1
MPU NO.2
855-693b
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351

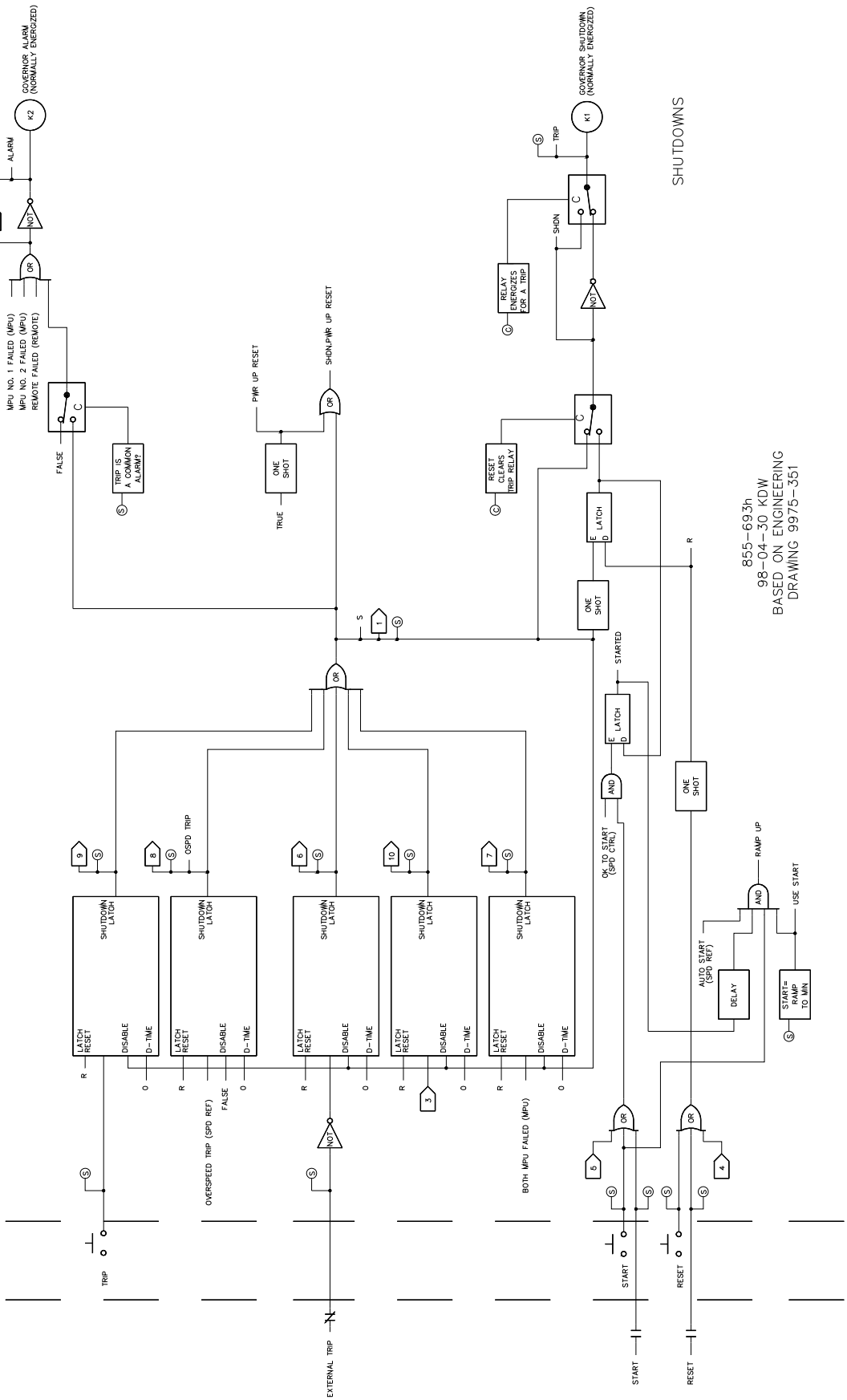

REMOTE
NOT MATCHED RATE
SELECT REMOTE SPEED
REMOTE STATUS
REMOTE SPEED SETTING
LATCH
ONE SHOT
SHDN/PWR UP RESET (SHUTDOWNS)
AT REMOTE (SPD REF)
USE HSS (REMOTE)
RMT HI (SPD CTRL)
REMOTE OK (REMOTE)
NOT ENABLED
TRUE
BLINK SLOW
BLINK FAST
REMOTE SETPT
RAMP
SEL_1
SET_1
D_RATE
R_SEL_1
R_SET_1
R_SEL_2
R_SET_2
P_LIM_2
SEL_2
SET_2
(SLOW)
SHDN/PWR UP (SHUTDOWNS)
(INSTANT)
(FAST)
TRUE
MAX GOV
MIN GOV
MAX GOV SPEED
MIN GOV SPEED
SPD > MIN GOV (IDLE/MIN GOV)
USE HSS
USE REMOTE
SPD<MIN GOV (IDLE/MIN)
NOT ENABLED (REMOTE)
REMOTE FAILED
REMOTE OK
LAG
RANGE LIMITER
IDLE SELECT (IDLE/MIN)
REF > RAISE (SPD REF)
OSPD TEST (SPD REF)
FAILED SIGNAL DETECTOR
RST
OVRD
MANUAL ONLY
LINK FAILED
SCALING
ENABLE
DISABLE
SHDN/PWR UP RESET (SHUTDOWNS)
USE HSS?
USE MANUAL ONLY?
USE REMOTE?
USE MODBUS ANALOG?
I/D
REMOTE SPEED ENABLE/DISABLE (CLOSE FOR ENABLE)
REMOTE SPEED SETTING (4-20MA)
855-693c
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351

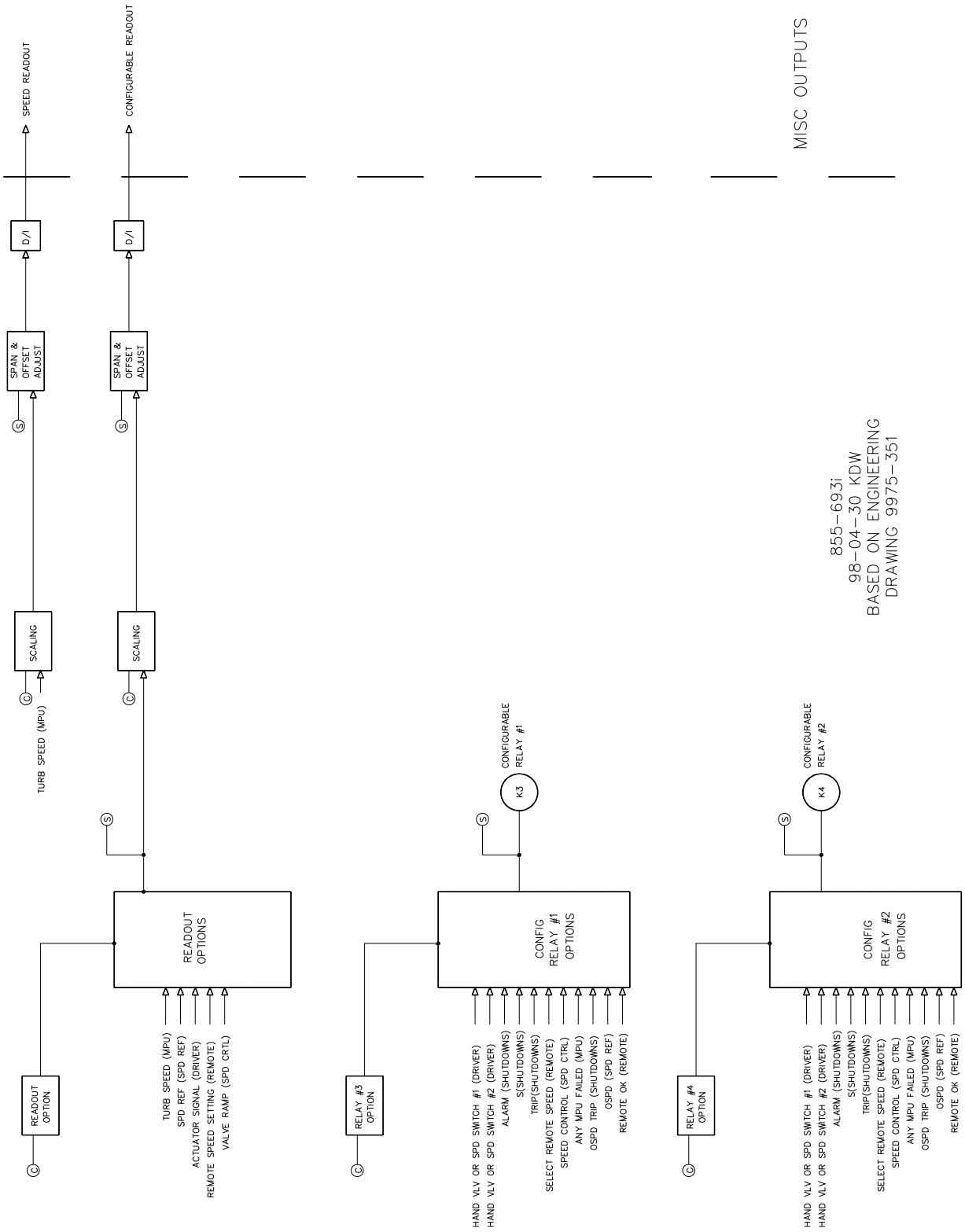

CRIT SPD
CRIT SPD LWR
CRIT SPD FAST
CRIT SPD RSE
OR
LATCH
OR
OR
REF UP (SPD REF)
REF DN (SPD REF)
ONE SHOT
ONE SHOT
AND
NOT
AND
REF DN (SPD REF)
REF UP (SPD REF)
AND
USE
HIGH LIMIT COMPARE 1>2=TRUE
LOW LIMIT COMPARE 1>2=TRUE
HIGH LIMIT
LOW LIMIT
SPD REF (SPD REF)
855-693d
98-04-30-KDW
BASED ON ENGINEERING
DRAWING 9975-351


IDLE/MIN
14
MIN SELECT
15
IDLE SELECT
LATCH
ONE SHOT
AND
OR
NOT
SPD < MIN GOV
SPD > MIN GOV
SPD < MIN GOV
SPD < MIN GOV TARGET
TURB SPEED (MPU)
S
SPD R/L (SPD REF)
AT MIN GOV (SPD REF)
USE RAMP TO IDLE
AT IDLE (SPD REF)
USE START (SHUTDOWNS)
SPD R/L (SPD REF)
AT IDLE (SPD REF)
USE IDLE/ MIN GOV
STARTED (SHUTDOWNS)
RAMP UP (SHUTDOWNS)
6
MIN GOV
7
IDLE
IDLE/MIN GOV (CLOSE FOR MIN GOV)
855-693e
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351


SPD REF
SPEED REFERENCE RAMP
RAMP
SPD REF
AT ZERO
AT IDLE
AT LOWER
AT MIN
AT RAISE
AT REMOTE
AT OSPD LIMT
REF UP
REF DN
SEL_3
SET_3
SEL_1
SET_1
SEL_4
SET_4
SEL_5
SET_5
SEL_6
SET_6
SEL_7
SET_7
SEL_2
SET_2
SEL_8
SET_8
D_RATE
R_SEL_1
R_SET_1
R_SEL_2
R_SET_2
R_SEL_3
R_SET_3
R_SEL_4
R_SET_4
R_SEL_5
R_SET_5
R_SEL_6
R_SET_6
R_SEL_7
R_SET_7
P_1_OUT_1
P_1_OUT_3
P_1_OUT_4
P_1_OUT_5
P_1_OUT_6
P_1_OUT_7
P_1_OUT_8
(IDLE)
(0.0)
MIN GOV (REMOTE)
(MIN)
MAX GOV (REMOTE)
SELECT REMOTE SPEED (REMOTE)
REMOTE SPEED SETTING (REMOTE)
OSPD LMT (SPD REF)
(SLOW RATE)
(INSTANT)
(CRIT RATE)
START (SPD REF)
(START RATE)
(FAST)
(REMOTE NOT MATCHED)
(REMOTE RATE)
(IDLE/MIN RATE)
IDLE SELECT (IDLE/MIN GOV)
CRIT SPD LWR (CRIT SPD)
SHDN/PWR UP RESET (SHUTDOWNS)
MIN SELECT (IDLE/MIN GOV)
CRIT SPD RSE (CRIT SPD)
RANGE LIMITED
TURBINE SPEED (MPU)
CRIT SPD FAST (CRIT SPD)
NOT MATCHED RATE (REMOTE)
SELECT REMOTE SPEED (REMOTE)
MIN SELECT (IDLE/MIN GOV)
IDLE SELECT (IDLE/MIN GOV)
AUTO START
NOT
MANUAL START?
START
START PLS (SPD CTRL)
SHDN/PWR UP RESET (SHUTDOWNS)
AT IDLE (SPD REF)
AT LOWER (SPD REF)
SPD > MIN GOV (IDLE/MIN GOV)
IDLE SELECT (IDLE/MIN GOV)
SPD > MIN
SPD RAISE
SPD LOWER
LOWER
RAISE
SELECT REMOTE SPEED (REMOTE)
REF > RAISE
REF > RAISE LIMIT
SHDN/PWR UP RESET (SHUTDOWNS)
AT RAISE (SPD REF)
OSPD TEST (SPD CTRL)
USE SNAP-BACK
MANUAL ONLY (REMOTE)
SPD R/L
DELAY FOR FAST RATE
OVERSPEED TRIP
OSPD TEST
OSPD
LSS FAILED
OVERSPEED TRIP PT. 1 > 2=TRUE
TURBINE SPEED (MPU)
(EXTERNAL TRIP SPEED)
BLINK SLOW
BLINK FAST
(TRIP SPEED)
OSPD TEST LIMIT
OSPD LMT
MAX GOV (REMOTE)
LOWER SPEED
RAISE SPEED
855-693f
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351


SPD CTRL
855-693g
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351
ACTUATOR SIGNAL
(20-20mA)
OR
(4-20mA)
ACTUATOR SD DRIVER
HAND VLV OR SPD SWITCH #1
HAND VLV OR SPD SWITCH #2
LATCH
4-20mA SCALING
20-160mA SCALING
USE 20-160mA ACTUATOR
#1 ON
#1 OFF
#2 ON
#2 OFF
FALSE
SPD SW #2 IS UNDER SPD
SPD>MIN/(SPD REF)
SPAN AND OFFSET ADJUST
DITHER LOGIC
USE HAND VALVES
TURB SPEED (MPU)
SPEED CONTROL
AND
STROKE VALVE*
STROKE POSITION
DITHER ADJUST
OUTPUT TRUE FOR SPEED CONTROL
LSS
VALVE RAMP
RAMP CLOSED
RAMP OPEN
VALVE RAMP
SEL_1
SET_1
(LOWER)
SEL_2
SET_2
(RAISE)
D_RATE
R_SEL_1
R_SET_1
P_⊥_OUT_1
P_⊥_OUT_2
RAMP
0.0
100
(SLOW)
(INSTANT)
START PLS
ONE SHOT
OR
DROOP
PID
LOWER RAMP
RAISE RAMP
STARTED (SHUTDOWNS)
OK TO START
DELAY
NOT
SHDN/PWR UP RESET (SHUTDOWNS)
LOW DYNAMICS
HIGH DYNAMICS
OSPD TEST
SWITCH POINT
CI #8 IS OSPD TEST
HIGH DYNAMICS OR OSPD TEST
MODE C(REMOTE)
SPD REF (SPD REF)
HSS
REMOTE SPEED SETTING(REMOTE)
SPD REF (SPD REF)


SHUTDOWNS
855-693h
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351
GOVERNOR ALARM
(NORMALLY ENERGIZED)
GOVERNOR SHUTDOWN
(NORMALLY ENERGIZED)
K2
K1
ALARM
TRIP
SHDN
MPU NO. 1 FAILED (MPU)
MPU NO. 2 FAILED (MPU)
REMOTE FAILED (REMOTE)
FALSE
TRIP IS A COMMON ALARM?
PWR UP RESET
SHDN,PWR UP RESET
ONE SHOT
TRUE
RELAY ENERGIZES FOR A TRIP
RESET CLEARS TRIP RELAY
E LATCH D
STARTED
OK TO START (SPD CTRL)
AND
RAMP UP
USE START
AUTO START (SPD REF)
DELAY
START= RAMP TO MIN
SHUTDOWN LATCH
LATCH RESET
DISABLE
D-TIME
OSPD TRIP
OVERSPEED TRIP (SPD REF)
BOTH MPU FAILED (MPU)
EXTERNAL TRIP
START
RESET
OR
NOT


MISC OUTPUTS
SPEED READOUT
CONFIGURABLE READOUT
D/I
D/I
SPAN & OFFSET ADJUST
SPAN & OFFSET ADJUST
SCALING
SCALING
TURB SPEED (MPU)
READOUT OPTION
READOUT OPTIONS
TURB SPEED (MPU)
SPD REF (SPD REF)
ACTUATOR SIGNAL (DRIVER)
REMOTE SPEED SETTING (REMOTE)
VALVE RAMP (SPD CRTL)
CONFIGURABLE RELAY #1
K3
RELAY #3 OPTION
CONFIG RELAY #1 OPTIONS
HAND VLV OR SPD SWITCH #1 (DRIVER)
HAND VLV OR SPD SWITCH #2 (DRIVER)
ALARM (SHUTDOWNS)
S(SHUTDOWNS)
TRIP(SHUTDOWNS)
SELECT REMOTE SPEED (REMOTE)
SPEED CONTROL (SPD CTRL)
ANY MPU FAILED (MPU)
OSPD TRIP (SHUTDOWNS)
OSPD (SPD REF)
REMOTE OK (REMOTE)
CONFIGURABLE RELAY #2
K4
RELAY #4 OPTION
CONFIG RELAY #2 OPTIONS
HAND VLV OR SPD SWITCH #1 (DRIVER)
HAND VLV OR SPD SWITCH #2 (DRIVER)
ALARM (SHUTDOWNS)
S(SHUTDOWNS)
TRIP(SHUTDOWNS)
SELECT REMOTE SPEED (REMOTE)
SPEED CONTROL (SPD CTRL)
ANY MPU FAILED (MPU)
OSPD TRIP (SHUTDOWNS)
OSPD (SPD REF)
REMOTE OK (REMOTE)
855-693i
98-04-30 KDW
BASED ON ENGINEERING
DRAWING 9975-351

Chapter 11.
Modbus Communications

Introduction

The Peak 150 control with Modbus option can communicate to one device via RS-232, RS-422 or RS-485 using an ASCII or RTU MODBUS transmission protocol. The pertinent serial port communications parameters are all adjustable in the service mode through the hand-held programmer of the Peak 150 control. The loss of the communications link is annunciated as a common alarm indication if the Modbus port is configured for use.

The transmission mode (ASCII or RTU), hardware configuration (RS-232, RS-422, or RS-485), and network address (if multidropping) are all defined in the Configure mode of the Peak 150 control (see Chapter 8). In addition, the baud rate, stop bits, parity, and hardware configuration are all set up in the Service mode (see Chapter 9).

All pertinent control parameters are programmed to be displayed on a CRT or plant DCS computer. In addition, all relevant control functions (i.e., raise/lower or enable) can be executed through this link. The functional block diagram (see Chapter 10) shows all Modbus parameters and their address. See Figure 11-1 for an example showing the Modbus communications connections. The example shows that Boolean write registers 1 and 2 are for raising and lowering the speed set point, respectively. It also shows that analog read register 2 contains the speed set point value.

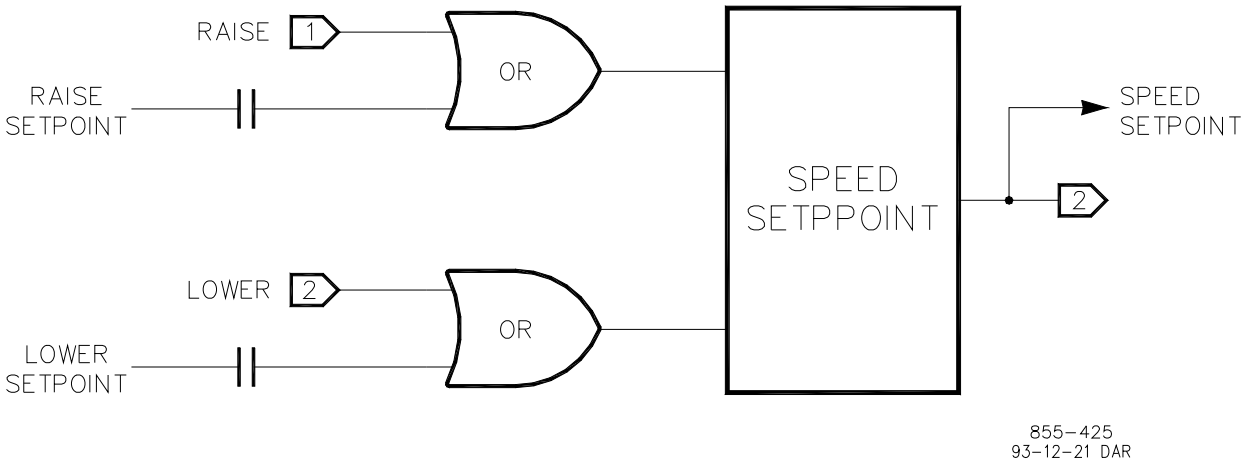


Figure 11-1. Modbus Communication Connections

Modbus Wiring

The Peak 150 control with Modbus option can communicate to one device via RS- 232, RS-422 or RS-485 using an ASCII or RTU MODBUS transmission protocol. The communications port is brought out to terminal blocks for wiring. Each communications mode is wired to different terminals. The following section identifies the terminal landings required for each mode.

RS-232 Wiring

An RS-232 link is limited to a distance of 15 m (50 feet). The Peak 150 control utilizes terminal blocks 22, 25, 26, and 27 for RS-232 connections. Figure 11-2 shows typical RS-232 communications connection. The transmit data (TXD), receive data (RXD), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected at one end only. The data terminal ready (DTR) signal is a constant +12 Volt (+9 V typical) RS-232 signal that is usually left unconnected but is available if required.

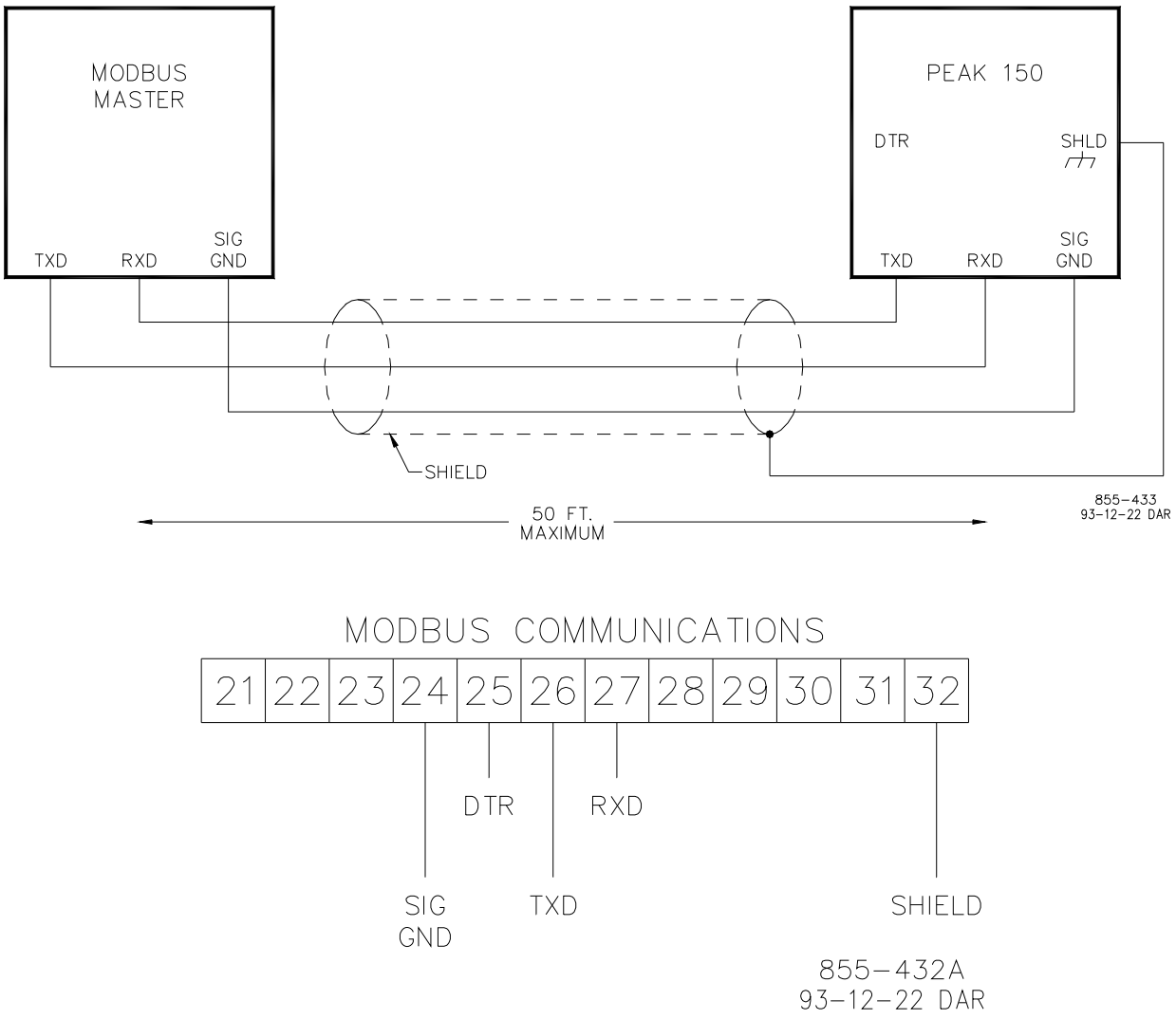


Figure 11-2. Typical RS-232 Communications

RS-422 Wiring

An advantage of RS-422 is that it uses a differential voltage and can accommodate much longer transmission distances. An RS-422 link can communicate up to a distance of 1200 m (4000 feet). The Peak 150 control utilizes terminal blocks 22, 23, 24, 28, 29, 30, 31, and 32 for RS-422 connections. Figure 11-3 shows a typical RS- 422 communications connection. The transmit data (422T+ and 422T–), receive data (422R+ and 422R–), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected at one end only. The last unit in the Modbus network chain should have it's receiver terminated with a resistor. The Peak 150 control has termination resistors built-in and available at the terminal block (TERM RES + and TERM RES –). The RS- 422 receiver should also be properly terminated at the Modbus master. Use the alternate wiring if no signal ground is available at the Modbus master.

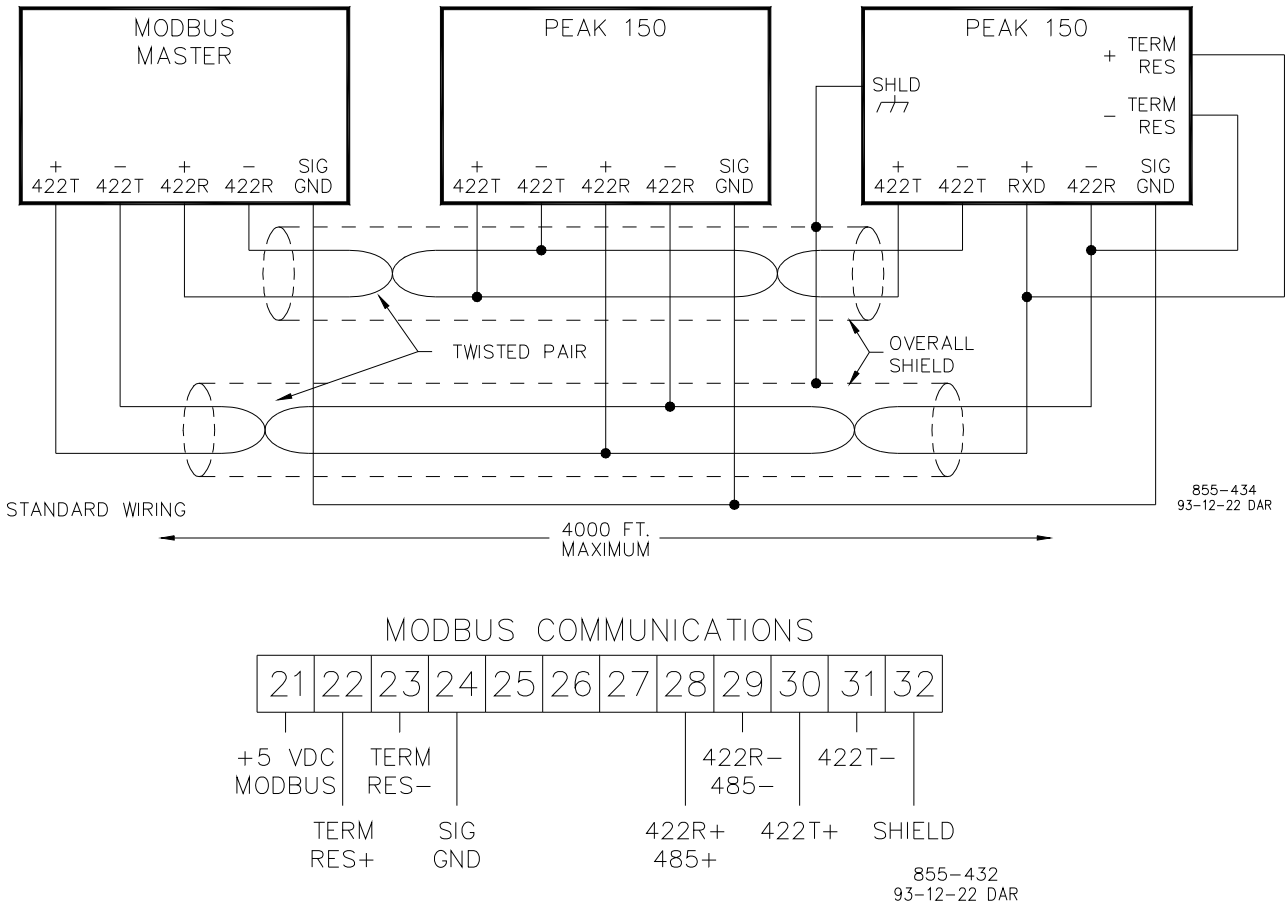


Figure 11-3. Typical RS-422 communications

RS-485 Wiring

RS-485 can also accommodate transmission distances up to 1200 m (4000 feet). The Peak 150 control utilizes terminal blocks 22, 23, 24, 28, 29, and 32 for RS-485 connections. Figure 11-4 shows a typical RS-485 communications connection. The data lines (422R+/485+ and 422R–/485–), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected at one end only. The last unit in the Modbus network chain should have it's receiver terminated with a resistor. The Peak 150 control has termination resistors built-in and available at the terminal block (TERM RES + and TERM RES -). The RS-485 cable should also be properly terminated at the Modbus master. Use the alternate wiring if no signal ground is available at the Modbus master.

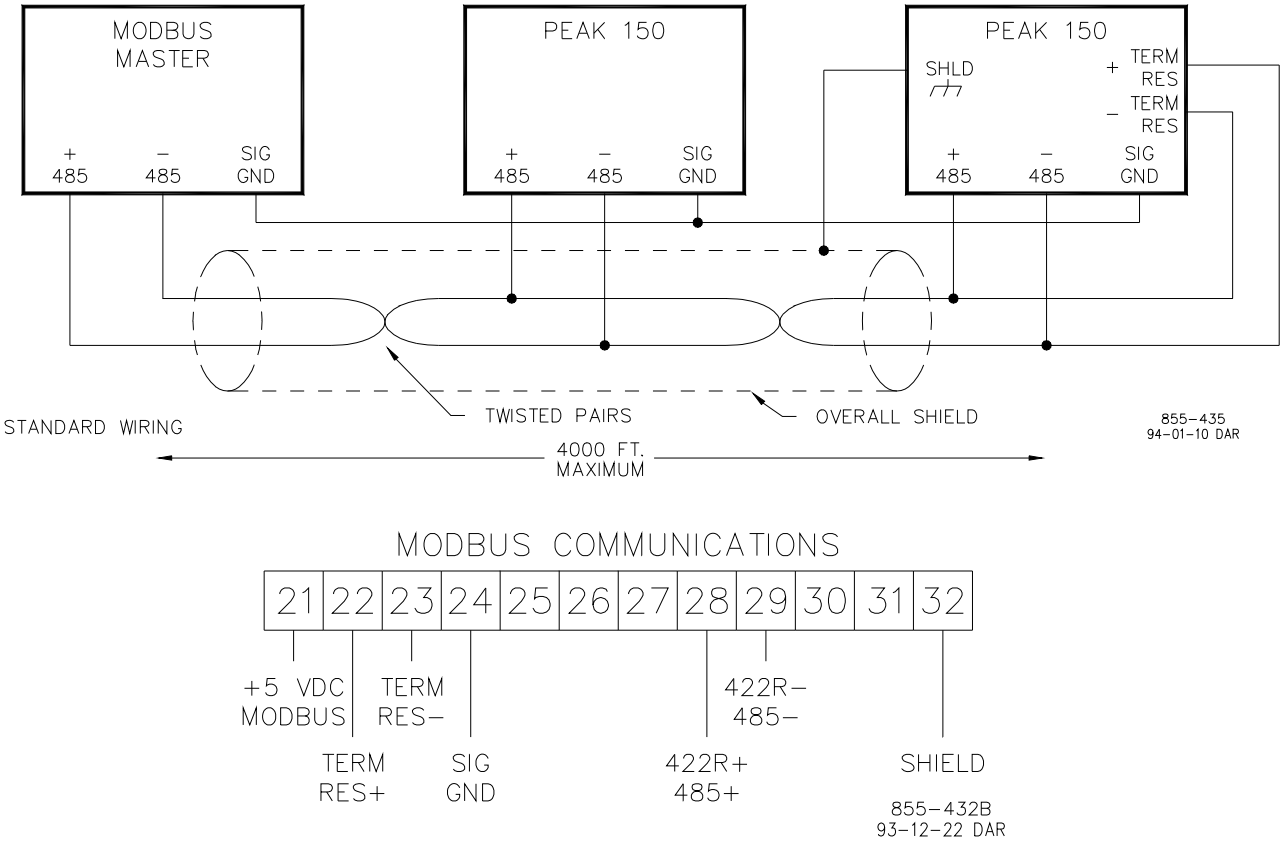


Figure 11-4. Typical RS-485 Communications

Basic Modbus Overview

The Peak 150 control utilizes Modicon Inc.'s Modbus protocol (see Figure 11-5 for Basic Modbus Overview). There are two transmission modes available for use with the Modbus protocol, ASCII and RTU (see Figure 11-6). The Peak 150 control can only act as a slave unit, it responds only after being asked for a set of parameters. Typically the Peak 150 control will communicate with a Modbus Master device with a separate link to each device (i.e., point to point wiring). However, if RS-422 or RS-485 is used, several Peak 150 controls can be connected to one Master device on a single link (i.e., multidropping). The data is passed between the Master and the Peak 150 control in the form of message frames (see figure 11-7). The default slave address for the Peak 150 control is 01, however, this address is adjustable in the configure mode (see Port Configuration in Chapter 8). On any single link, each slave address must be unique.

Modbus Points Of Interest

- Master, Slave network protocol.
- One master and up to 32 slaves on a common line.
- Only the master initiates a transaction.
- A transaction comprises a single query and a single response.
- Data is passed between master and slave in the form of message frames.
- Use 9600 baud or slower when using multidropping.

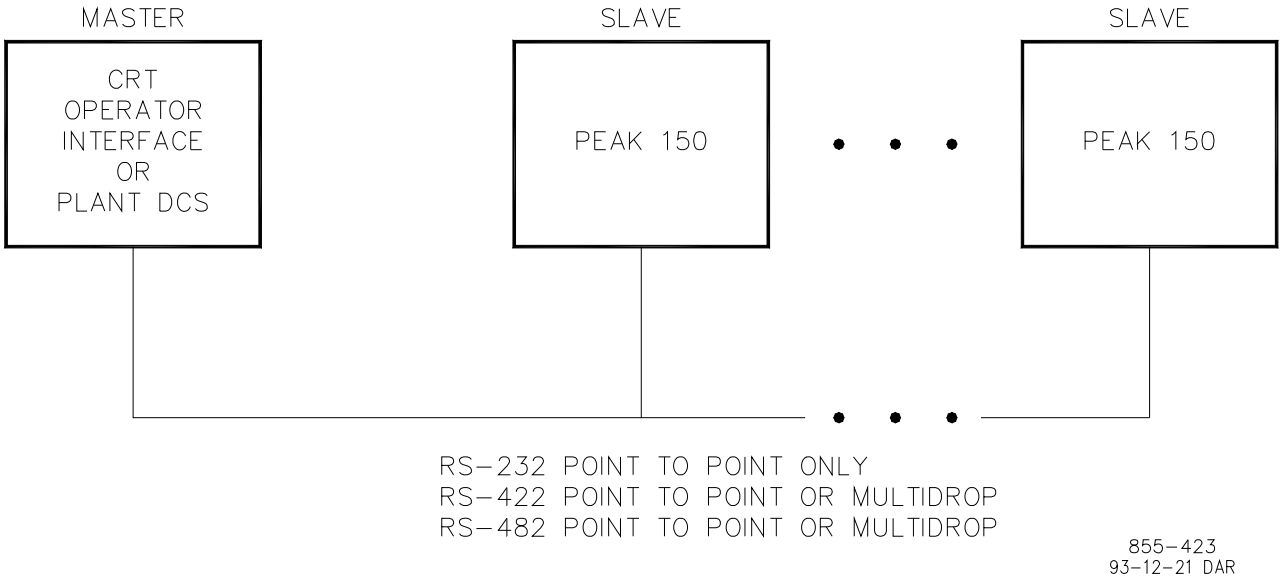


Figure 11-5. Basic Modbus Overview

Modes of Transmission

- ASCII and RTU are the two modes allowed.
- Mixing of modes is not allowed.
- ASCII mode requires twice as many characters as RTU mode to transmit the same amount of data.
- RTU mode has more elaborate error checking.

Characteristics of ASCII and RTU modes.

Characteristic	ASCII	RTU
Coding System	Hexadecimal	8 Bit Binary
Bits per Character	7	8
Parity	Even, Odd, None	Even, Odd, None
Stop Bits	1 or 2	1 or 2
Transmitted Data Per Character	4 bits	8 Bits
Error Checking	LRC (Longitude Redundancy Check)	CRC (Cyclical Redundancy Check)

Figure 11-6. Modbus Transmission Modes

Frame Definition

- Each slave must have a unique address.
- The function code tells the addressed slave what function to perform.
- The high order bit of the function code is used to indicate an exception response.
- The data field contains information needed by the slave or collected by a slave to perform a specific function.
- The error checking assures that the slave or master does not react to messages that have changed during transmission.

ASCII and RTU frame definition.

Function	ASCII	RTU
Beginning of Frame	:	3 Characters Dead Time
Slave Address	2 Characters, 8 Bits	1 Character, 8 Bits
Function code	2 Characters, 8 Bits	1 Character, 8 Bits
Data	4 Bits Data per Character	8 Bits Data per Character
Error Check Code	2 Characters, 8 Bits	2 Characters, 16 Bits
End of Frame	CR LF	3 Characters Dead Time

Figure 11-7. Modbus Frame Definition

The data is passed between the Master and the Peak 150 control in the form of message frames. The function code portion of the frame tells the addressed slave what function to perform (see Figure 11-8).

Function Code Definition

Code	Description
1	Read Digital Outputs
2	Read Digital Inputs
3	Read Analog Outputs
4	Read Analog Inputs
5	Write Single Digital Output
6	Write Single Analog Output
7	Loopback Test - Returns the Query Message
8	Write Digital Outputs
9	Write analog Outputs

Figure 11-8. Modbus Function Codes

Figure 11-9 shows typical Modbus frames for the various function codes. If a slave detects an error in a message, it will not act on or respond to that message. For any requested data that is undefined, the slave will respond with a value of zero. The slave will respond with an exception response if it detects illegal data in a message. The following table lists the exception errors displayed by the Peak 150 control. If the Peak 150 control has an exception error, it will be annunciated under the Port Adjustments heading in the Service mode (see Chapter 8).

Code	Name	Meaning
1	Illegal Function	The message function is not an allowable action
2	Illegal Data Address	The message start address is not an allowable address
9	Checksum Error	The received message had an incorrect error check code
10	Garbled Message	The received message could not be decoded

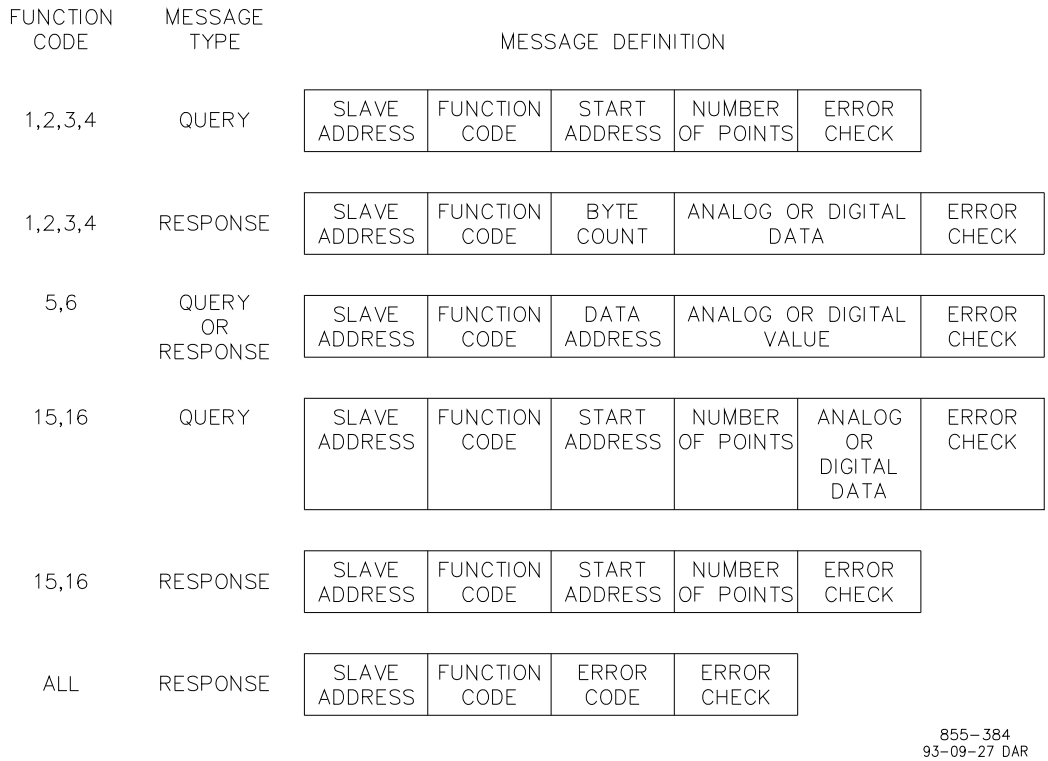


Figure 11-9. Modbus Messages

Port Adjustments

Following is listed the parameters that can be set in the SERVICE Mode under the PORT ADJUSTMENTS heading (see Chapter 9).

- Hardware Configuration: This adjustment sets the physical link to be used by the Modbus Communication. Following is a list of the codes and the corresponding hardware configuration associated with them.
  1 = RS-232 Communication
  2 = RS-422 Communication
  3 = RS-485 Communication

- Baud Rate: This adjustment sets the baud rate or speed of communication. The following list indicates the codes and the corresponding baud rates.
  1 = 1200 Baud
  2 = 1800 Baud
  3 = 2400 Baud
  4 = 4800 Baud
  5 = 9600 Baud
  6 = 19200 Baud

- Stop Bits: This adjustment sets the number of stop bits to be included in the data being transmitted. The following list shows the code and the corresponding number of stop bits to be used.
  1 = 1 stop bits
  2 = 1.5 stop bits
  3 = 2 stop bits

- Parity: This adjustment selects the parity to be used during transmission. The following list shows the code and the corresponding parity to be used.
  1 = Off
  2 = Odd
  3 = Even

- Link Error: This will indicate TRUE if the Modbus communication link has been lost.

- Exception Error: This will indicate TRUE if an exception error is found in the transmitted data.

- Error Number: This indicates the cause of the exception error. The following list shows the error codes and their meanings.
  1 = Illegal Function: The message function is not an allowable action.
  2 = Illegal Data Address: The message start address is not an allowable address.
  9 = Checksum Error: The received message had an incorrect error check code.
  10 = Garbled Message: The received message could not be decoded.

- Error Percent: This indicates the amount of time that an error has been detected in the data being transmitted (displayed as a percent).

Modbus Addresses

The Modbus communication port has address locations for the analog and Boolean reads and writes. The Boolean reads and writes are also referred to as input and holding coils. The analog reads are also referred to as input registers. Following is a list of these register values along with a brief description of the parameter.

Boolean Writes (holding coils)—Holding coils are logical signals that are both readable from and writable to the Peak 150 control. The holding coils available are listed below. A logical true denoted by the value 1 will cause the command listed in the description to be executed. For example, if a 1 is written to address 0:0001, the manual speed set point will increase until a 0 is written to address 0:0001. The Peak 150 control supports function codes 1, 5, and 15. These correspond to reading selected holding coils, writing to a single holding coil, and writing to multiple holding coils, respectively.

Address	Description
0:0001	Raise Speed
0:0002	Lower Speed
0:0003	Trip
0:0004	Reset
0:0005	Start
0:0006	Minimum Governor Select
0:0007	Idle Select
0:0008	Enable Remote
0:0009	Disable Remote
0:0010	Raise Valve Ramp
0:0011	Lower Valve Ramp

IMPORTANT

The functional block diagram (Chapter 10) shows all Modbus communications inputs and outputs to the Peak 150 control's software. It shows both the functional location of the parameter as well as the Modbus address. This information is shown with the symbol xx where xx is the Modbus address.

Boolean Reads (input coils)—Input coils are logical signals that are readable from but not writable to the Peak 150 control. The input coils available are listed below. The input coil will have the value 1 if the statement in the description column is true and a 0 if false. The "1:" term in the address identifies an input coil. The Peak 150 control supports MODBUS function code 2, which involves reading selected input coils.

Address	Description
1:0001	Trip Status
1:0002	Alarm Status
1:0003	MPU #1 Failed
1:0004	MPU #2 Failed
1:0005	Remote Failed
1:0006	External Trip
1:0007	No Speed Trip
1:0008	Overspeed Trip
1:0009	Front Panel Trip
1:0010	Modbus Trip
1:0011	Remote Selected
1:0012	Remote Enabled
1:0013	HSS/LSS Remote Ctrl
1:0014	Ramping To Minimum Governor
1:0015	Ramping To Idle
1:0016	Overspeed Test Enabled
1:0017	Speed Control
1:0018	MPU Override On

Analog Reads (input registers)—Input registers are analog values that are readable from but not writable to the Peak 150 control. The input registers available are listed below. The value of the input registers are stored internal to the control as floating point numbers representing engineering units (i.e., rpm). The values that are transmitted are integer values ranging from -32767 to +32767. The Peak 150 control supports MODBUS function code 4, which involves reading selected input registers.

Address	Description	Units
3:0001	Actual Speed	(RPM)
3:0002	Speed Set Point	(RPM)
3:0003	Remote Set Point	(RPM)
3:0004	Remote Input	(RPM)
3:0005	Valve Ramp Position	(0 to 100%)
3:0006	Speed Demand	(0 to 100%)
3:0007	Valve Position Demanded	(0 to 100%)

Analog Writes (holding registers)—Holding registers are analog values that are readable from and writable to the Peak 150 control. The holding registers available are listed below. The values transmitted are integer values ranging from -32767 to + 32767. The Peak 150 control supports Modbus function codes 3, 6, and 16. These correspond to read analog output, write single analog output, and write analog outputs respectively.

Address	Description	Units
4:0001	Remote Setting	(RPM)

Additional Information

Detailed information on the Modbus protocol is presented in "Reference Guide PI-MBUS-300" published by AEC Corp./Modicon Inc., formerly Gould Inc. To implement your own source code, you must register with Modicon. Registration includes purchasing document PI-MBUS-300 and signing a non-disclosure agreement. You can register to use Modbus at your nearest Modicon field office. To find the office nearest you, contact Modicon Technical Support at 1-800-468- 5342.

Chapter 12. Troubleshooting

General

Most problems you will encounter are covered in the manual. Use the index to locate the sections of the manual that may describe your problem. This troubleshooting section contains a description of the diagnostic programs as well as a few troubleshooting guidelines that our field service technicians and engineers have suggested.

Diagnostics

When the control is powered on or when it is rebooting after being configured, the software performs several hardware diagnostic tests. If an error is found, it is annunciated through the tachometer display on the front panel. The tachometer will display the string "Err" followed by an error number. If any of these diagnostic errors occur the control must be returned to the factory for repair.

The following is a list of the diagnostic tests and the corresponding error numbers that are displayed if an error occurs.

RAM Test Failure	"Err0"
Analog I/O Timer #1 Failure	"Err1"
Analog I/O Timer #2 Failure	"Err2"
I/O Lockout Failure	"Err3"
-12 V Power Supply Failure	"Err4"
+12 V Power Supply Failure	"Err5"
+12 VP Power Supply Failure	"Err6"
+4.5 V Power Supply Failure	"Err7"

Troubleshooting

When the control is powered on the microprocessor will begin executing the software and will turn on the CPU OK LED on the front panel. This LED remains on as long as the microprocessor is running. This LED is controlled in hardware by a watchdog timer circuit and under normal operating conditions, should never turn off. If for any reason, the microprocessor stops executing or if the program is not running correctly, the watchdog timer will time out and the CPU OK LED will turn off. If this happens the I/O Lockout will be activated, which will turn off all discrete outputs and all analog outputs. The only way to restart the control is to turn off the power and then turn the power back on.

The software in this control is user configurable. Before running the control, make sure that the software is configured properly for your application. See Chapter 7, Programming.

Troubleshooting Chart

Symptom:
- CPU OK LED is off, EMER TRIP arrow light is off, and tachometer display is blank.

Possible Causes:
- Ribbon cable from operator control panel module to the main control module is unplugged.
- Power supply input wiring is incorrect.
- Power supply input voltage is not present.
- Power supply fuse is blown.
- +5 Volt power supply is bad.

Solutions:
- Check the possible causes listed above. The +5 V power supply voltage can be measured at the test points shown in Figure 4-9. If the +5 V is incorrect, replace the power supply module.

Symptom:
- CPU OK LED is off and EMER TRIP arrow light is on.

Possible Causes:
- Application PROMs are missing or installed incorrectly.
- +5 Volt power supply is bad.
- The microprocessor has stopped because of a hardware failure.

Solutions:
- Check the application PROMs (U11 and U12) for proper installation. They are located underneath the power supply module.
- Measure the +5 V power supply at the terminals shown in Figure 4-9. If the +5 V is out of tolerance replace the power supply module.
- Cycle the input power off for several seconds and then back on. If the CPU OK LED does not come on after approximately ten seconds, the hardware has failed and must be returned to the factory.

Symptom:
- Discrete outputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The CPU OK LED is off activating the I/O Lock mechanism.
- The Normally Open/Normally Closed jumper options are not properly selected.
- +21 Volt power supply is shorted or bad.
- The software is not configured properly.

Solutions:
- Remove the wiring and use an ohmmeter to check for proper contact closure. If the meter indicates the output is working properly, then there is a problem with the wiring.
- Check the CPU OK LED on the front door. If it is off, cycle the input power. This will reset the I/O Lock mechanism.
- Check the jumper options in Figure 4-9 to make sure the correct jumpers are in.

- Check the +21 V power supply voltages at the test points shown in Figure 4-9. If the +21 V power supply is shorted, the voltage measured at the test points will be low.
- Check the wiring at the (+) terminals of the analog outputs TB33, TB36, and TB39. The +21 V power supply is connected to these terminals. Remove the wiring from these terminals and check the +21 V power. If it is correct the wiring is shorting it out. If it is still incorrect replace the power supply module.
- Check the software to see what it is telling the outputs to do. To do this enter the "Service" mode on the hand-held programmer. Find the I/O Check category then check the fields listed below and see what its output is. "True" should energize the associated relay and "False" will de-energize it.

Trip Relay ON	RELAY OUTPUT #1
Alarm Relay ON	RELAY OUTPUT #2
Conf Rly #1 ON	RELAY OUTPUT #3
Conf Rly #2 ON	RELAY OUTPUT #4

Symptom:

- Discrete inputs are not operating correctly.

Possible Causes:

- Incorrect wiring.
- The external/internal power supply jumper options are not properly selected.
- The internal +21 Volt power supply is shorted or bad.
- The external power supply is bad or is wired incorrectly.

Solutions:

- Make sure that the wiring is correct. Refer to Figures 4-3 and 4-4 to see how the contacts and power supplies should be wired.
- Check that the correct jumper option is being used for the external/ internal power supply as shown in Figure 4-4.
- If the internal +21 V power supply is used, check the voltage at the test points shown in Figure 4-9. If the +21 V power supply is shorted, the voltage measured at the test points will be low. Check the wiring at the (+) terminals of the analog outputs, TB33, TB36, and TB39. The +21 V power supply is connected to these terminals. Remove the wiring from these terminals and check the +21 V power. If it is correct, the wiring is shorting it out. If it is still incorrect, replace the power supply module.
- If an external power supply is used, check it to make sure the voltage is correct. Refer to Figures 4-3 and 4-4 to see how the contacts and power supplies should be wired.
- Check the software to see what it senses at the inputs. To do this, enter the "Service" mode on the hand-held programmer. Find the I/O Check category then check the fields listed below and see what its input is. As a contact is closed, the associated variable should be "True" and when it is opened it should be "False". If this is not the case, make sure that the wiring is correct and that the correct jumper option is being used for the External/Internal power supply as shown in Figure 4-4.

DI #1	INPUT #1
DI #2	INPUT #2
DI #3	INPUT #3
DI #4	INPUT #4
DI #5	INPUT #5
DI #6	INPUT #6
DI #7	INPUT #7
DI #8	INPUT #8

Symptom:
- Analog outputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- +21 Volt power supply is shorted or bad.
- The CPU OK LED is off, activating the I/O Lock mechanism.
- The 4–20 mA/0–1 mA jumper options are not properly selected.
- +5 V power supply is bad.
- The software is not configured properly.

Solutions:
- Make sure that the wiring is correct. Refer to Figure 4-6 to see how the analog outputs should be wired.
- Check the +21 V power supply voltages at the test points shown in Figure 4-9. If the +21 V power supply is shorted, the voltage measured at the test points will be low. Check the wiring at the (+) terminals of the analog outputs, TB33, TB36, and TB39. The +21 V power supply is connected to these terminals. Remove the wiring from these terminals and check the +21 V power. If it is correct, the wiring is shorting it out. If it is still incorrect, replace the power supply module.
- Check the front door CPU OK LED. If off, cycle the input power. This will reset the I/O Lock mechanism.
- Check the jumper options (see Figure 4-9) to make sure the correct jumpers are in.
- Check the +5 V power supply voltage at the test points shown in Figure 4- 9). If it is incorrect the unit must be sent back to the factory for repair.
- Check what the software is telling the outputs to do. To do this, enter the "Service" mode on the hand-held programmer. Find the category and the fields listed below and observe its output. The output value will be in engineering units. How this value relates to current depends on how the control was configured.

Speed Values	Actual Speed	Output #1
Readout Adjustments	RO#2 Value	Output #2

Symptom:
- Actuator output is not operating correctly.

Possible Causes:
- Incorrect wiring.
- +21 Volt power supply is shorted or bad.
- The CPU OK LED is off, activating the I/O Lock.
- The 0–200 mA/0–20 mA jumper option is not properly selected.
- +5 V power supply is bad.
- The software is not configured properly.

Solutions:
- Make sure that the wiring is correct. Refer to Figure 4-6 to see how the actuator output should be wired.
- Check the +21 V power supply voltages at the test points shown in Figure 4-9. If the +21 V power supply is shorted, the voltage measured at the test points will be low. Check the wiring at the (+) terminals of the analog outputs, TB33, TB36, and TB39. The +21 V power supply is connected to these terminals. Remove the wiring from these terminals and check the +21 V power. If it is correct the wiring is shorting it out. If it is still incorrect replace the power supply module.

- Check the CPU OK LED on the front door. If it is off, cycle the input power. This will reset the I/O Lock mechanism.
- Check the jumper options (Shown in Figure 4-9) to make sure the correct jumpers are in.
- Check the +5 V power supply voltage at the test points shown in Figure 4- 9. If it is incorrect, the unit must be sent back to the factory for repair.
- Check the software to see what it is telling the output to do. To do this, enter the "Service" mode on the hand-held programmer. Find the category and field listed below and see what its output is. The output value will be in actuator position (0% - 100%). How this value relates to current depends on how the control was configured.
  Valve Valve Position (%)Actuator Output

Symptom:
- Speed sensor inputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The magnetic pickup is not functioning properly.
- +12 V or -12 V power supply is bad.
- +4.5 V Ref, +4.5 V, +5 V, or -5 V power supply is bad.

Solutions:
- Make sure that the wiring is correct. Refer to Figure 10 to see how the speed sensor inputs should be wired.
- Check the magnetic pickup. It must provide at least a 200 Hz, 1 Vrms signal.
- Check the +12 V and -12 V power supply voltages at the test points shown in Figure 4-9. If either is incorrect, replace the power supply module.
- Check the +4.5 V REF, +4.5 V, +5 V and -5 V power supply voltages at the test points shown in Figure 4-9. If any of them are incorrect, the unit must be sent back to the factory for repair.
- Check the software to see what it senses at the inputs. To do this, enter the "Service" mode on the hand-held programmer. Find the I/O Check category and the field listed below and see what its input is. The input value will be in Hz.
  MPU #1 SPEED SENSOR INPUT #1
  MPU #2 SPEED SENSOR INPUT #2

Symptom:
- Analog input is not operating correctly.

Possible Causes:
- Incorrect wiring.
- The 4–20 mA/1–5 V jumper option is not properly selected.
- +12 V or -12 V power supply is bad.
- +4.5 V REF, +5 V, or -5 V power supply is bad.

Solutions:
- Make sure that the wiring is correct. Refer to Figure 11 to see how the analog inputs should be wired.
- Check the jumper options (See Figure 4-9) to make sure the correct jumper is in.
- Check the +12 V and -12 V power supply voltages at the test points shown in Figure 4-9. If either is incorrect replace the power supply module.

- Check the +4.5 V REF, +5 V and -5 V power supply voltages at the test points shown in Figure 4-9. If any of them are incorrect, the unit must be sent back to the factory for repair.
- Check the software to see what it senses at the input. To do this, enter the "Service" mode on the hand-held programmer. Find the I/O Check category and the field listed below and observe its input. The input value will be 0–100, 0 represents 4 mA and 100 represents 20 mA.
  Analog Input Analog Input #1 Remote Speed Input

Symptom:
- Operator Control Panel not operating correctly.

Possible Causes:
- Ribbon cable from operator control panel module to the main control module is unplugged.

Solutions:
- Check the ribbon cable to make sure it is properly connected. If the ribbon cable is properly connected and there still seems to be a problem, check the hardware with the hand-held programmer. To check the operator control panel switches, enter the "Service" mode on the hand-held programmer. Find the I/O Check category and the field listed below and see what its input is. The input value should be "True" when the associated switch is pressed, and should be "False" when the switch is released.

INPUT	**I/O MENU**
EMER TRIP	Trip FP/B
OVERSPEED TEST	Ospd Test FP/B
RAISE	Raise FP/B
LOWER	Lower FP/B
START	Start FP/B
ALARM RESET	Reset FP/B

- To check the operator control panel LEDs enter the "Service" mode on the hand-held terminal. Find the I/O Check category and field listed below and see what its output is. The LED should be on when the associated output value is "True" and off when the output value is "False". The only exception to this is if the TRIPPED LED jumper option is set for trip relay de-energized for shutdown. (See Figure 4-9). If this is the case then the TRIPPED LED will be on when the output is "False" and off when the output is "True".

LED	**I/O MENU**
TRIPPED	Tripped LED
MPU #1 OK	MPU #1 OK LED
MPU #2 OK	MPU #2 OK LED
OVERSPEED TEST ENABLED	Ospd Enabled LED
RMT SPD ENABLED	Rmt Spd LED

IMPORTANT **The CPU OK LED should always be on. If it is not, see the "CPU OK LED is off": Symptom above.**

Symptom:
- The TRIPPED LED is on for normal operation and off when the turbine is tripped or is always off.

Cause:
- The trip relay energized/de-energized for shutdown jumper is in the wrong position or is not installed.

Solution:
- Install the jumper according to Figure 4-9.

Symptom:
- The hand-held programmer is not working.

Cause:
- +12 VP power supply is bad.

Solution:
- Check the +12 VP power supply at the test points shown in Figure 4-9. If incorrect, replace the power supply module. If correct, the hand-held terminal should beep and go through a self-test when plugged in.

Debug Mode Tunables

There are 15 tunables (16 for the 4-digit model) available in the debug mode that may be used for troubleshooting. These tunables are not intended for general use. They have been factory calibrated and should only be adjusted if necessary. The block and field names are listed and a brief description of that tunable's function follows. The "black square" key is used to enter the debug mode.

COMM.CRT.RST	Clears Modbus exception errors generated by the Peak 150 control. (Range = True to False, Default = False)
COMM.CRT.INIT_MOD	Re-initializes the Peak 150 control Modbus outputs to their default values. (Range = True to False, Default = False)
COMM.CRT.TIME_OUT	The dead time allowed on the Modbus comm link before a link error is generated. (Range = 0.00 to 100.00, Default = 3.000)
IO.INPUT1.OFFSET	Offset adjustment for the remote speed analog input calibration. An input of 4 mA is equal to 0%. (Range = -20.00 to 20.00, Default = 0.000)
IO.INPUT1.GAIN	Gain adjustment for the remote speed analog input calibration. An input of 20 mA is equal to 100%. (Range = 0.00 to 2.00, Default = 1.000)
OSPD.HOLD_TRIP.DLY_TIME	Trip code sampling hold delay time. Do not adjust. (Range = 0.00 to 1.00, Default = 0.100)
OSPD.SPD_LAG.LAG_TAU	Front panel display speed filter. (Range = 0.00 to 10.00, Default = 1.000)
OSPD.XXDISPLAY.NC	Front panel display update time. Do not adjust below 0.250. (Range = 0.01 to 2.00, Default = 1.000)
REMOTE.RMT_IN.LAG_TAU	Noise filter for the remote speed analog input. (Range = 0.00 to 10.00, Default = 0.000)
SHUTDOWN.TRIP_OUT.CTRL	This tunable is in debug mode for the 4-digit version only. The 5-digit version has this function in the configure mode. See the Configure mode, Relays heading, Reset Clears Trip Relay field for a description of this function. (Default = True for the 4-digit version)
SPD_CTRL.DROOP_LAG.LAG_TAU	Speed Droop delay. Typically set to 10/I when droop is used. (Range = 0.00 to 10.00, Default = 0.200)

SPD_CTRL.I_SCALED.IN_1	Normalizing value for the Integral constant. Factory set, do not adjust. (Range = 0.01 to 100.00, Default = 0.100)
SPD_CTRL.P_SCALED.IN_1	Normalizing value for the Proportional constant. Factory set, do not adjust. (Range = 1.00 to 100.00, Default = 100.000)
SPD_CTRL.SPD_PID.S_D_R	The PID speed derivative ratio. This affects the derivative portion of the speed PID. Typically set to 100 for mechanical drive applications. (Range = 0.01 to 100.00, Default = 100.000)
SPD_CTRL.VLV_RAMP.P_SP_2	The maximum valve position limit in %. (Range = 0.00 to 100.00, Default = 100.000)
SPD_REF.SETBACK.DLY_TIME	The set point setback pulse time. Factory set, do not adjust. (Range = 0.00 to 1.00, Default = 0.100)

Alarms / Shutdowns

If the control shuts down due to a CPU fault or watchdog timer failure, indicated by the CPU OK LED being off, you must turn off control power then turn the power back on. Until you do, you cannot step through any functions in the hand-held programmer.

After any shutdown, the Shutdown relay contacts should be reset to ensure proper start-up.

Wiring / Component Problems

Most Peak 150 control problems are caused by wiring problems. Carefully and thoroughly check all wiring connections at both ends. Be very careful when installing wires into the Peak 150 control terminal blocks. Check all shields for proper grounding at the control end only.

You can measure all inputs and outputs directly at the terminal strips. The hand-held display will show what the Peak 150 control measures. This comparison will tell you if the Peak 150 control is interpreting the input signal correctly.

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division or Zone applications.

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, applications Division ou Zone.

Actuators / Control Adjustments

If the actuator output is unsteady or hunts, try blocking the steam valve by closing the valve ramp. If you block the steam valve in this manner and the actuator output is steady but the turbine still hunts, then the problem is outside the governor. If an actuator hunts, it may need dither (especially TM type).

If the Peak 150 control is not able to fully close or open the actuator, check to make sure that the actuator is calibrated correctly. If the Peak 150 control is not able to control speed above or below a certain speed, the steam valve may not be adjusted correctly. An indication of this is if the control is calling for minimum actuator but the speed is still climbing or staying the same, or if the control is calling for maximum actuator but the speed will not increase. Shut down the control and verify that the actuator is closed. If it is, then partially open the T&T valve and verify that the turbine does not turn.

If the T&T valve allows the turbine to turn, then the steam valve is not seated.

Other Operating Problems

If actual speed is less than the speed called for by the speed reference, check for speed droop. Droop causes the actual speed to be less than the speed reference.

If the Remote Speed input values are reading incorrectly, check that the input wire shielding is properly grounded at the Peak 150 control end only.

Chapter 13.
Service Options

Product Service Options

NOTICE

Do not attempt to service internal electronic components nor attempt to remove any of the circuit boards. If the control requires repair, contact Woodward or your nearest Woodward authorized service facility.

The field-configured portion of the program will be zeroed out after factory repair. To prevent damage to your equipment, you must reconfigure the Program Mode before the unit is put back into service.

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

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

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

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

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

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

www.woodward.com/directory

Woodward Factory Servicing Options

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

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

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

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

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

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

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

Returning Equipment for Repair

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

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

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

Packing a Control

Use the following materials when returning a complete control:

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

NOTICE

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

Replacement Parts

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

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

Engineering Services

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

- Technical Support
- Product Training
- Field Service

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

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

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

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

How to Contact Woodward

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

Electrical Power Systems

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

Engine Systems

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

Turbine Systems

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

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

www.woodward.com/directory

Technical Assistance

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

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

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

Appendix.
Program Mode Worksheets

Introduction

The program mode worksheets provide a quick reference for programming the Peak 150 control. You may copy or print the worksheets for your use.

The Peak 150 requires a hand-held programmer to set the following menus. (See Chapter 7, Programming for information on the use of this unit.)

⚠WARNING

EXPLOSION HAZARD—The Peak 150 control box should not be opened when a hazardous atmosphere is present. Wiring connections which could cause sparks are exposed inside the cabinet.

⚠WARNING

Errors in configuration or programming of the Peak 150 control may create dangerous overspeed conditions. The turbine must be equipped with an overspeed device completely separate from the Peak 150 control or actuators attached to the Peak 150 control. The turbine must never be run when this device is not present or not operating correctly.

⚠WARNING

To prevent damage to the turbine resulting from improper control settings, make sure you save the set points before removing power. Failure to save the set points before removing power causes them to revert to the previously saved settings. Dangerous conditions such as turbine overspeed may result from operating the turbine with incorrect settings, possibly resulting in equipment damage and injury or death of personnel.

NOTICE

Do NOT attempt to operate the turbine until the Peak 150 control has been programmed. To do so could cause equipment damage; the turbine will start, come up to idle speed, trip and shutdown.

Governor Serial Number _____

Application _____

Configure Mode Program

(The turbine must be shut down to enter this mode.)

Enter the configure mode by pressing the "." key when the screen displays the "Woodward Governor Company" message. The "Woodward Governor Company" heading can be displayed by pressing the "ESC" (escape) key.

Speed Config

TEETH SEEN BY MPU _____

MPU GEAR RATIO 1 _____

MPU #1 – MAX HERTZ (Hz) _____

MPU #2 – MAX HERTZ (Hz) _____

MAX SPD LEVEL (Hz) _____

MINIMUM SPD LVL (HZ) _____

Start Mode

MANUAL START MODE? (TRUE/FALSE) _____

AUTO START MODE (***status indication only***)

Actuator Config

USE 20–160 MA ACTUATOR? (TRUE/FALSE) _____

USE 4–20 MA ACTUATOR (***status indication only***)

Operating Mode

MANUAL CONTROL ONLY? (TRUE/FALSE) _____

USE REMOTE SPD SET? (TRUE/FALSE) _____

USE HI-SIG-SELECT? (TRUE/FALSE) _____

USE MODBUS ANLG IN? (TRUE/FALSE) _____

Readouts

SPEED RO 4 MA VALUE (RPM) _____

SPEED RO 20 MA Value (RPM) _____

READOUT #2 OPTION? (OPTION #) _____

Readout #2 Options:
1. ACTUAL SPEED
2. ACTUAL SPEED SETPT
3. VALVE POSITION (Actuator Output)
4. REMOTE SPEED SET INPUT
5. VALVE RAMP POS'N
6. Not Used

READOUT #2— 4 MA VALUE (RPM or %) _____

READOUT #2—20 MA VALUE (RPM or %) _____

Relays

RELAY #3 OPTION? (OPTION #) _____

RELAY #4 OPTION? (OPTION #) _____

Configurable Relay Options:
1. Alarm (normally energized)
2. Trip Output (same as trip relay output)
3. Shutdown (energizes on trip condition)
4. Remote Control
5. Speed Control
6. Either MPU Failed
7. Overspeed Trip
8. Overspeed Test
9. Remote Status
10. Spd Switch or Hand Valve #1
11. Spd Switch or Hand Valve #2

USE SPEED SWITCHES? (TRUE/FALSE) _____

SWITCH #2 UNDERSPD? (TRUE/FALSE) _____

USE HAND VALVE(S)? (TRUE/FALSE) _____

TRIP RELAY ENERGIZES? (TRUE/FALSE) _____

RESET CLRS TRIP RLY? (TRUE/FALSE) _____

Contact In #8

IN #8 = OSPD TEST? (TRUE/FALSE) _____

Port Config

USE MODBUS PORT? (TRUE/FALSE) _____

HARDWARE CONFIG? (OPTION #) _____

MODBUS PORT HARDWARE Configuration Options:
1 = RS-232
2 = RS-422
3 = RS-485

TRANSMISSION MODE? (OPTION #) _____

MODBUS PORT TRANSMISSION MODE Configuration Options:
1 = ASCII
2 = RTU

NETWORK ADDRESS? _____

Service Mode Program

Enter the service mode by pressing the down arrow key when the screen displays the "Woodward Governor Company" message.

Alarms

MPU #1 FAILED (***status indication only***)

MPU #2 FAILED (***status indication only***)

REMOTE INPUT FAILED (***status indication only***)

COMM LINK FAILURE (***status indication only***)

TURBINE TRIP (***status indication only***)

USE TRIP AS ALARM? (TRUE/FALSE) _____

Trips

LAST TRIP CODE = (***status indication only***)

1) EXTERNAL TRIP
2) LOSS OF BOTH MPUs inputs
3) OVERSPEED TRIP
4) FRONT PANEL TRIP
5) MODBUS TRIP

EXTERNAL TRIP (***status indication only***)

OVERSPEED TRIP (***status indication only***)

LOSS OF BOTH MPUs (***status indication only***)

FRONT PANEL TRIP (***status indication only***)

MODBUS TRIP (***status indication only***)

Speed Dynamics

LOW SPEED GAIN _____*0.8_____

LOW SPEED RESET _____*5.0_____

HI SPEED SWITCH PT (RPM) _____

HI SPEED GAIN _____*0.8_____

HI SPEED RESET _____*5.0_____

HI SPEED SELECTED (***status indication only***)

Speed Values

ACTUAL SPEED (RPM) (***status indication only***)

LOCAL SPEED SETPT (RPM) (***status indication only***)

ACTUAL SPEED SETPT (RPM) (***status indication only***)

REMOTE SPD SET (RPM) (***status indication only***)

START RAMP RATE (RPM/SEC) _____

SETPT SLOW RATE RPM/SEC) _____

DELAY FOR FAST RATE (SEC) _____

SETPT FAST RATE (RPM/SEC) _____

MIN GOV SPEED (RPM) _____

MAX GOV SPEED (RPM) _____

OVERSPEED LEVEL (RPM) _____

EXTERNAL OSPD LEVEL (RPM) _____

OVERSPEED TEST LIMIT (RPM) _____

DROOP (%) _____*0.0_____

USE SET POINT SET-BACK (TRUE/FALSE) _____

Remote Setting

(This menu is displayed when REMOTE CONTROL is configured.)

ACTUAL REMOTE SETPT (***status indication only***)

REMOTE SET INPUT (***status indication only***)

RMT-NOT-MATCHED RATE (RPM/SEC) _____

REMOTE RATE—MAX (RPM/SEC) _____

MODBUS REMOTE USED (***status indication only***)

Failed MPU Ovrd

AUTO-OVRD-OFF SPEED (HZ) _____

USE MPU OVRD TIMER? (TRUE/FALSE) _____

MAX STARTING TIME = (SEC) _____

USE ROLLDOWN OVRD? (TRUE/FALSE) _____

AUTO-OVRD-ON SPEED (HZ) _____

AUTO-OVRD-ON DELAY (SEC) _____

OVRD ON STATUS (***status indication only***)

Idle/Min Ramp

(This menu is displayed only if configured for Auto Start.)

IDLE SPEED = (RPM) _____

USE IDLE / MIN RAMP? (TRUE/FALSE) _____

MIN GOVERNOR SPEED (RPM) _____

IDLE/MIN GOV RATE = (RPM/SEC) _____

USE RAMP TO IDLE? (TRUE/FALSE) _____

START = RAMP TO MIN (TRUE/FALSE) _____

RAMPING TO MIN (***status indication only***)

RAMPING TO IDLE (***status indication only***)

Critical Speed Band

(This menu is displayed only if configured for AUTO START.)

USE CRITICAL BAND? (TRUE/FALSE) _____

CRITICAL SPEED MIN (RPM) _____

CRITICAL SPEED MAX (RPM) _____

CRITICAL BAND RATE (RPM/SEC) _____

IN CRITICAL BAND (***status indication only***)

SPD SW/Hand VLV

(This menu is displayed only if configured for SPD SW / HAND VLV.)

RLY #1 ON (RPM or %) _____

RLY #1 OFF (RPM or %) _____

RLY #2 ON (RPM or %) _____

RLY #2 OFF (RPM or %) _____

UNDERSPEED LEVEL (RPM) _____

Valve Output

VALVE POSITION (% TRAVEL) (***status indication only***)

VLV – OFFSET ADJUST _____*0.0_____

VALVE - GAIN ADJUST _____*1.0_____

VALVE RAMP POS'N (% TRAVEL) (status indication only)

MANUALLY RSE RAMP? (TRUE/FALSE) ____*false_____

MANUALLY LWR RAMP? (TRUE/FALSE) ____*false_____

RAMP RATE (%/SEC) _____

DITHER ADJUST _____*0.0_____

STROKE VLV OUTPUT? (TRUE/FALSE) _____*false_____

STROKE POSITION (% TRAVEL) _____*0.0_____

MIN / MAX SWITCH (TRUE/FALSE) _____*false_____

Readout Adjust

RO #1 -- OFFSET ADJUST (SPEED READOUT) _____*0.0_____

RO #1 – GAIN ADJUST (SPEED READOUT) _____*1.0_____

RO #2 – OFFSET ADJUST (CONFIG READOUT) _____*0.0_____

RO #2 -- GAIN ADJUST (CONFIG READOUT) _____*1.0_____

RO #2 VALUE (***status indication only***)

Port Adjust

HARDWARE CONFIG (OPTION #) _____

Modbus Port Hardware Configuration Options:
1 = RS-232
2 = RS-422
3 = RS-485

BAUD RATE (OPTION #) _____

Modbus Port Baud Rate Configuration Options:
1 = 1200 Baud
2 = 1800 Baud
3 = 2400 Baud
4 = 4800 Baud
5 = 9600 Baud
6 = 19200 Baud

STOP BITS (OPTION #) _____

Modbus Port Stop Bit Configuration Options:
1 = 1 Stop Bit
2 = 1.5 Stop Bits
3 = 2 Stop Bits

PARITY (OPTION #) _____

Modbus Port Parity Configuration Options:
1 = Off Parity
2 = Odd Parity
3 = Even Parity

LINK ERROR (***status indication only***)

EXCEPTION ERROR (***status indication only***)

ERROR NUMBER (***status indication only***)

ERROR PERCENT (***status indication only***)

I/O Check (Status Indications Only)

MPU #1 (RPM)

MPU #2 (RPM)

ANALOG INPUT (%)

DI #1 (LOWER SPEED) (TRUE/FALSE)

DI #2 (RAISE SPEED) (TRUE/FALSE)

DI #3 (EXTERNAL TRIP) (TRUE/FALSE)

DI #4 (START) (TRUE/FALSE)

DI #5 (RESET) (TRUE/FALSE)

DI #6 (IDLE / MIN GOV) (TRUE/FALSE)

DI #7 (REMOTE SPEED ENABLE) (TRUE/FALSE)

DI #8 (OSPD TEST/HI DYN SELECT) (TRUE/FALSE)

TRIP P/B (OCP EMER TRIP) (TRUE/FALSE)

OSPD TEST P/B (OCP OVER SPEED TEST) (TRUE/FALSE)

RAISE P/B (OCP RAISE [Speed]) (TRUE/FALSE)

LOWER P/B (OCP LOWER [Speed]) (TRUE/FALSE)

START P/B (OCP START) (TRUE/FALSE)

RESET P/B (OCP ALARM RESET)	(TRUE/FALSE)
TRIPPED LED	(TRUE/FALSE)
MPU #1 OK LED	(TRUE/FALSE)
MPU #2 OK LED	(TRUE/FALSE)
OSPD ENABLED LED	(TRUE/FALSE)
RMT SPD LED	(TRUE/FALSE)
TRIP RELAY ON	(TRUE/FALSE)
ALARM RELAY ON	(TRUE/FALSE)
CONF RLY #1 ON	(TRUE/FALSE)
CONF RLY #2 ON	(TRUE/FALSE)

Peak 150 Control Specifications

Inputs	
Magnetic Pickup Inputs (2)	Two identical inputs, high-signal-selected Minimum input voltage 1 Vrms, minimum frequency 200 Hz, maximum frequency 15 kHz
Analog Input (1)	Remote Speed Setting signal (4–20 mA or 1–5 Vdc, internal jumper selectable)
Discrete Inputs (8)	Remote (isolated, 5–28 Vdc)
Options	Raise speed Lower speed Emergency stop Alarm reset Remote speed set enable Start Idle/minimum governor Select high dynamics or overspeed test
Outputs	
Analog Outputs (2)	Actual speed output (scalable, 4–20/0–1 mA) Configurable readout (scalable, 4–20/0–1 mA)
Options	Actual speed Speed setpoint Actuator output Remote speed setpoint Valve ramp value
Actuator Output (1)	4–20 or 0–200 mA (internal jumper selectable)
Relay Outputs (4)	Internal jumpers provide choice of normally-open or normally-closed contacts
Contact ratings are	2 A resistive @ 28 Vdc 0.3 A resistive @ 115 Vac
	Shutdown (de-energizes or energizes for shutdown) Alarm (de-energizes for alarm) Configurable Relay #1 Configurable Relay #2
Options	Alarm Trip output Shutdown Remote control Speed control MPU failure Overspeed trip Overspeed test Remote signal OK Speed switch #1 Speed switch #2 Hand valve #1 Hand valve #2
Operator Control Panel	
Keypad Switches (6)	
Options	Raise speed Lower speed Emergency trip Start Overspeed test Alarm reset
LED Indicators (6)	Remote speed setting signal status Shutdown status MPU #1 status MPU #2 status CPU status Overspeed test status
Digital Display	Five-digit LED speed display

Power	
Input	Models are available with these input power requirements: 24 Vdc 90–150 Vdc or 88–132 Vac, 47–63 Hz
Maximum power consumption, all models:	38 W
Environmental Specifications	
Operating Ambient Temperature	–25 to +60 °C (–13 to +140 °F)
Storage Ambient Temperature	–40 to +85 °C (–40 to +185 °F)
Humidity	Designed to meet US MIL-STD-810D, Method 507.2, Procedure II, induced, non-hazardous, cycle 5 (fifteen 24-hour cycles, varying 19–75% humidity, over 33–63 °C)
Vibration	US MIL-STD-167, Type 1
Shock	US MIL-STD-810C, Method 516.2, Procedure 1
Dimensions	
Width	483 mm (19 inches)
Height	310 mm (12.2 inches)
Depth	105 mm (4.1 inches)

Revision History

Changes in Revision E—

- Updated compliance to show CSA listing
- Changed maximum operating ambient temperature to 60 °C

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 85565E.

B85565:E

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Email and Website—www.woodward.com

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