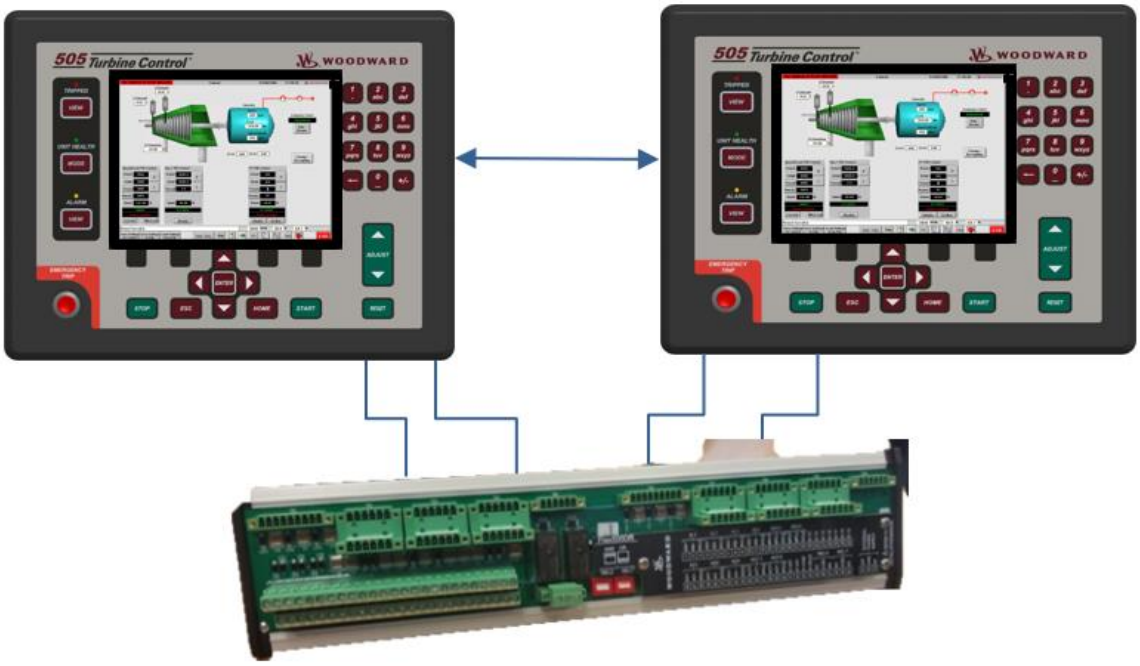
Released

Product Manual 35018V3
(Revision B, 8/2024)
Original Instructions



505XT Digital Control for Steam Turbines (Single Valve, Extraction and/or Admission)

Manual 35018 consists of 3 volumes:
35018V1, 35018V2 & 35018V3

505XT Dual Redundant Manual Volume 3

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

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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.

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

Manual 35018

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Important Definitions

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

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 since 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. After removing the old PCB from the control cabinet, immediately place it in the antistatic protective bag.

Chapter 1.
General Information

Two 505XT controllers can be applied together and configured to function in a redundant manner to increase overall system reliability and availability. In such applications, one 505XT functions as the SYSCON (In-Control) unit and controls all aspects of the turbine system. The second 505XT functions as a BACKUP unit and tracks the SYSCON 505XT's operating parameters to ensure a smooth transfer if the SYSCON 505XT fails.

In a redundant configuration, all 505XT functionality is available so that redundant operation is available for all steam turbines, including:

- Single Valve or split-range actuators turbines
- Controlled Extraction or Admission turbines (2 Control valves)
- Controlled Extraction and Admission turbines (2 Control valves)

The 505XT uses the term Primary to describe the unit with DIP Switch position 0001 and the term Secondary to describe the unit with DIP Switch position 0002 (please refer to Appendix A in the Flex500 hardware manual 26838 for DIP switch configuration instructions). The Primary and Secondary unit designations allow the system to identify each unit specifically. The term SYSCON is used to describe the unit that is currently in-control of the system and the term BACKUP to describe the tracking unit. Either of the Primary or Secondary units can become the SYSCON unit, but in a healthy system, the Primary unit will always boot up as the SYSCON.

The 505XT operating system continuously keeps the BACKUP unit in-sync with the current control state of the SYSCON. On a control transfer, the BACKUP unit becomes the new SYSCON in the exact same state as the previous unit just prior to the transfer. The previous SYSCON will then become the BACKUP unit and begin tracking the SYSCON in the same way. Once the transfer occurs, the new SYSCON begins controlling the system processing its local IO. The system is designed to have identical IO signals between both the Primary and Secondary units such that either unit can become SYSCON with no change in the system control state. In the case of an IO signal discrepancy between the SYSCON and BACKUP units, an alarm is annunciated.

If the system transfers control and an IO signal is not available, the new SYSCON unit will process the signal failure of that function as described in Volume 1 of this manual. For example, if the AUX Input is healthy on the SYSCON but failed on the BACKUP and the SYSCON fails, the control will transfer the SYSCON and the AUX controller will be disabled.

Transfer of control is initiated under the following conditions:

- SYSCON 505XT failure (CPU or internal problem, OS)
- Loss of power to the SYSCON 505XT
- Loss of all speed probes to the SYSCON 505XT
- SYSCON 505XT actuator driver (ACT or AO) output failure detected
- CAN communication fault
- A user "Transfer" command

The 505XT operating system also manages operational commands (Local Panel Commands, RemoteView Commands, or DCS Modbus Commands) and ensures that all operational commands are given to the SYSCON when performed on either unit. This allows the turbine to be operated from either the SYSCON or BACKUP unit. In this way, the BACKUP unit also serves as a redundant interface to operate the turbine. The BACKUP unit will always display the same control states and variables as the SYSCON. All IO as seen from the BACKUP unit on the IO channel pages and operation pages are the signals being processed by the SYSCON. When the SYSCON is transferred, the signals displayed switch to the other unit, as it is now in control of the system. The signals into the BACKUP unit can be monitored from the DR Overview GUI pages.

Unlike commands over communication paths (Local Panel, RemoteView, or DCS Modbus Commands), only the SYSCON processes hardwired Discrete Input signals. Therefore, the system is designed to have Discrete Input signals wired to each 505XT controller so that a command or system signal is seen by both 505XT units simultaneously.

The 505DR Field Termination Module (FTM) provides a convenient method for wiring IO signals and the discrete interconnect signals between the two 505XT units. Please refer to Appendix A in the Flex500 hardware manual 26838 for details on the 505DR FTM and IO signal wiring.

When configured for redundant applications the 505XT can be configured to drive single coil actuators, dual coil actuators, or parallel actuators (Woodward redundant VariStroke I or CPCII skid). See the redundant control configuration section of this manual to understand all redundant application options.

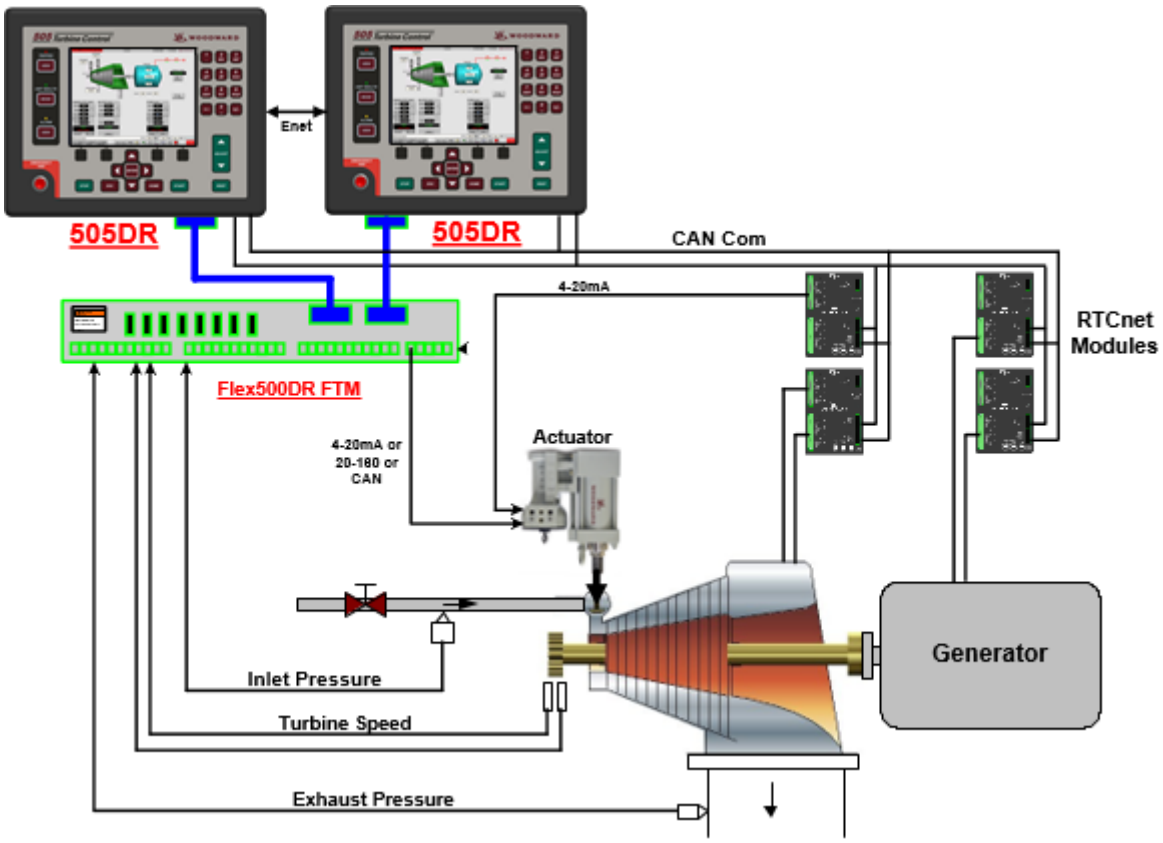

Figure 1-1. Typical Redundant 505XT Application Configuration

Part Number Options

In order to be used as a redundant system, the 505XT must be purchased as a redundant controller using the part numbers below.

IMPORTANT **The simplex 505 and 505XT part numbers listed in Volume 1 of this manual cannot be applied in a redundant application. The 505DR part numbers below must be purchased for redundant applications.**

Part Number	Power
8200-1330	505DR (LVDC 18–36 Vdc Standard Compliance) STEAM TURBINE CONTROL
8200-1331	505DR (AC/DC 88–264 Vac or 90–150 Vdc Standard Compliance) STEAM TURBINE CONTROL
5541-705	FTM AND CABLES, FLEX500 REDUNDANT

Terminology

505	Refers to the overall Woodward Product family / hardware platform
505XT	Refers specifically to the Control/GUI application software features described in this manual – identified on unit p/n label and logo on Home screen
505DR	Refers to a Dual Redundant application of the 505XT.

FTM	Refers to the Field Termination Module (FTM) kit that prewires the field IO and interconnect signals
CrissCross	Refers to the Relay #8 to DI #20 discrete health interconnection between the Primary and Secondary units.

Feature Differences between the 505DR and Previous 505/505XT

The 505DR supports all of the same turbine types and primary control functions of the previous 505 and 505XT simplex models. There are, however, some feature differences to note. The items added were improvements and features that are likely options for redundant systems. A few minor items were eliminated due to low utilizations and pending product changes that could affect the need for this to be a Woodward digital link.

New Features Added

- Enhanced Actuator support - dual coil and redundant actuators on both HP and LP valves and allows configuration of these outputs on 8 AO channels and 4 digital drivers (SPC's)
- Support of SPC Digital Drivers (4) – to provide simplex or redundant drives to a wider variety of actuator/valve assemblies including integrating valves.
- Support of LinkNet RTC nodes – (previous 505XT model supported using LinkNet HT nodes) which allows control process variables and driver outputs to be connected via a real time distributed I/O network
- Added support for redundancy of critical input signals – 7 analog inputs now support duplexed inputs - Remote Speed, Load, Cascade, Auxiliary, Inlet, Extraction, and Exhaust

Features Not Supported in Initial Release

- CAN interface to the VariStroke-II (expected to be added at a future software release)
- CAN interface to the MFR300 product, a power management multi-function protection relay
- Modbus interface to the HighProtec generator protection device

Chapter 2.
Redundant Setup and Configuration

Hardware Setup

Detailed hardware setup information is covered in the Flex500 Manual **26838** Appendix A.

The following is a bullet list of the hardware configuration and control interlocks required to operate the 505DR controllers in a redundant mode.

- Must use the correct 505DR part numbers identified in Chapter 1 of this manual, 35018V3.
- Must set DIP switches on top of controller to configure one as the Primary unit
- Must set DIP switches on top of controller to configure the other one as the Secondary unit
- Must use a CAT5 or 6 Ethernet cable and make a direct connection between ETHERNET port 4 of each controller
- Must wire DI 24vdc power of each controller to the COM terminal of Relay #8 of the other controller and wire the NO terminal of Relay #8 back to DI #20

Woodward Flex500 DR FTM Kit (5541-705)

The FTM Kit includes the following parts:

Table 2-1. Field Termination Module Kit Bill of Materials

Part Number	Description
5541-705	FTM AND CABLES KIT, FLEX500/505/VERTEX REDUNDANT
5404-1484 (2x)	HARNESS KIT, FTM, FLEX500/505/VERTEX REDUNDANT
5501-503	FTM MODULE, FLEX500/505/VERTEX REDUNDANT
KP-50001	CABLE – ENET CAT6A RJ45 Length 2 M

The FTM Kit simplifies the signal splitting of IO signals to each of the 505DR control units and provides a single point of termination for field signals.

Flex500 FTM kit utilizes following input/outputs from 505DR units:

- Two Speed Sensor inputs MPU #1, MPU #2 (MPU inputs).
- Four Analog input 4-20 mA channels AIN #1 – AIN #4 (only in self-powered mode).
- Three Analog output 4-20 mA channels AO #1 – AO #3.
- Two Actuator output channels ACT #1 – ACT #2 (can work in 4-20 mA/20-200 mA current range).
- Seven Discrete input channels DI #13 – DI #19 with Contact Power (DI24V_1, DI24V_2, DI_COM).
- Two Relay outputs RELAY #6, RELAY #7 (form-c).
- Relay output RELAY #8 and Discrete input DI #20 used to control interlock in redundant mode (connection between RELAY#8 from one Flex500 unit to DIN#20 from second Flex500 unit and vice versa).

Detailed information on the FTM Kit is covered in the Flex500 Manual 26838 Appendix A.

Figure 2-1. 505DR with FTM

Input and Output Signals

Please refer to Appendix A in the Flex500 hardware manual 26838 for details on IO signal wiring for each channel type.

The I/O channels are configured the same as described in V1 of this manual. When an IO channel is configured, the configuration applies to both control units. All signal scaling and calibration is applied to both units as the I/O signals are shared between both units for each channel.

The details for each IO channel type below describe how the channels function specifically in the 505XT application and how failure modes are handled.

IMPORTANT

When 505XTs are used in a Dual Redundant configuration, Relay 8 and Discrete Input 20 are used in the health status communication between the units and are not available in the application.

Analog Inputs

Each Analog Input signal should be wired to both 505DR units utilizing the wiring methods described in Appendix A of the Flex500 hardware Manual 26838. By following these wiring schemes:

1. A transducer mA signal is seen identically by both the Primary and Secondary units and minimizes the disturbance of a transfer.
2. The diodes across each unit terminals allow for unit replacement by completing the circuit when the terminal is disconnected from a 505XT unit.

The following table describes the SYSCON and BACKUP behaviors on signal failures:

Table 2-2. Analog Input Fault Table

Channel	SYSCON FAULT	BACKUP FAULT	BACKUP STAT	SYSCON Transfer
Analog Input	FALSE	FALSE	Available	No
Analog Input	TRUE	FALSE	Available	Yes
Analog Input	FALSE	TRUE	Available (default)	No
Analog Input	TRUE	TRUE	Available	Yes

A difference between the SYSCON and BACKUP Analog Input signals will be annunciated as a difference alarm.

MPU Inputs

MPU transducer signals drive both Primary and Secondary Speed Signal Input channels such that the signal is identical between the two units. The following table describes the SYSCON and BACKUP behaviors on signal failures:

Table 2-3. Single Speed Signal Fault Table

1 Speed Signal Configured

Channel	SYSCON FAULT	BACKUP FAULT	BACKUP STAT	SYSCON Transfer
Speed Input	FALSE	FALSE	Available	No
Speed Input	TRUE	FALSE	Available	Yes
Speed Input	FALSE	TRUE	Unavailable	No
Speed Input	TRUE	TRUE	Unavailable	Yes (TRIP)

Table 2-4. 2 Speed Signal Fault Table

2 Speed Signals Configured

Channel	SS1 SYSCON FAULT	SS1 BACKUP FAULT	SS2 SYSCON FAULT	SS2 BACKUP FAULT	BACKUP STAT	SYSCON Transfer	
Speed Input	FALSE	FALSE	FALSE	FALSE	Available	No	
Speed Input	TRUE	TRUE	X	FALSE	Available	No	*1
Speed Input	X	FALSE	TRUE	TRUE	Available	No	*1
Speed Input	X	TRUE	X	TRUE	Unavailable	No	*2
Speed Input	TRUE	FALSE	FALSE	FALSE	Available	No	*3
Speed Input	FALSE	FALSE	TRUE	FALSE	Available	No	*3
Speed Input	TRUE	FALSE	TRUE	FALSE	Available	Yes	*4
Speed Input	TRUE	TRUE	TRUE	TRUE	Unavailable	Yes (TRIP)	*5

*1 – As long as there is a BACKUP signal available, the BACKUP is available.
*2 – Both MPUs faulted on the BACKUP inhibits a transfer
*3 – A single channel fault does not transfer
*4 – A fault on both SYSCON channels causes a transfer
*5 – All probes must be failed to trip on SYSCON and BACKUP

A difference between the SYSCON and BACKUP MPU signals will be annunciated as a difference alarm.

The automatic Open Wire Detection function that is available on the simplex versions of the 505 and 505XT, is not available on the DR version. This is due to the fact that the MPU signals are paralleled between the 2 controls. The open wire detection routine can be used as a manual check prior to starting the unit and is available in the Service menu under the MPU signals screens.

IMPORTANT

To test the MPU, remove the speed signal connector from the backup unit, then initiate the test from the SYSCON unit. When complete, re-attach the speed signal connector to the Backup unit. If the speed signal connector is NOT removed from the Backup unit, the test will always pass.

PROX Inputs

If active probes are used, the 505DR system will require a minimum of 2 probes and will support up to 4 probes. A minimum of 1 speed sensor per control is required and should be wired directly to the control, no wiring of active/proximity probes is supported on the DR-FTM. In the configuration of the 505DR, only select the choice of “Use Speed Input Channel 2” if 4 probes are being used (2 to each controller).

When using just 1 speed input into each controller –

- Both controllers will show the validated speed as the value seen by the SYSCON
- The 505DR will transfer SYSCON control to the other unit if it detects a failed speed input signal as per the above table
- The speed value in each controller can be seen on the Speed Inputs page under the Redundancy Overview page menu
- Adjust the “Speed Difference Tolerance” setting, on this page, to an acceptable level of difference in speed that can be tolerated when switching between the 2 units. When the difference between the SYSCON and the BACKUP exceeds this value, the control will annunciate an alarm and make the BACKUP unit unavailable

Contact Inputs

In a healthy system, the SYSCON and BACKUP contact input signals will be identical. A difference between the SYSCON and BACKUP Contact Input signals will be annunciated as a difference alarm. In the case of a signal difference, the 505XT control will *always* follow the SYSCON signal status.

WARNING

If a DI difference alarm is present, an operator action or event causing a SYSCON transfer may result in unexpected results, including a TRIP.

Relay Outputs

Relay Outputs will follow the SYSCON demand signal. When the SYSCON drives a Relay Output channel to energize, that output is also energized on the BACKUP unit channel. The Appendix A wiring diagrams of manual 26838 illustrate how to wire these as a logical AND or an OR of the two relay outputs to the field device.

Analog Outputs

Analog Output currents are shared between the SYSCON and BACKUP units. The BACKUP unit will output a constant 2mA demand as a circuit health check. The SYSCON will output a 16-18mA signal to modulate the output demand according to the control logic. On detection of a BACKUP fault, the SYSCON will pick up the BACKUP demand and output the full 4-20mA demand. On detection of a SYSCON fault, the SYSCON will transfer and the new SYSCON unit will pick up the full 4-20mA demand.

The following table describes the SYSCON and BACKUP behaviors on signal failures, depending on whether the Analog Output is configured as a Readout or is being used as an Actuator Driver:

Table 2-5. Analog Output Fault Table

Channel	SYSCON FAULT	BACKUP FAULT	BACKUP STAT	SYSCON Transfer
Analog Output (RO)	FALSE	FALSE	Available	No
Analog Output (RO)	TRUE	FALSE	Available	Yes
Analog Output (RO)	FALSE	TRUE	Available	No
Analog Output (RO)	TRUE	TRUE	Available	Yes
Channel	**SYSCON FAULT**	**BACKUP FAULT**	**BACKUP STAT**	**SYSCON Transfer**
Analog Output (Driver)	FALSE	FALSE	Available	No
Analog Output (Driver)	TRUE	FALSE	Available	Yes
Analog Output (Driver)	FALSE	TRUE	Unavailable	No
Analog Output (Driver)	TRUE	TRUE	Unavailable	Yes (TRIP)

Actuator Outputs

Actuator Output currents are shared between the SYSCON and BACKUP units. The BACKUP unit will output a constant current demand, equal to half of the Minimum current setting, as a circuit health check. The SYSCON will output half of the Minimum current plus the full 0-100% current value signal to modulate the output demand according to the control logic. On detection of a BACKUP fault, the SYSCON will pick up the BACKUP demand and output the full current demand. On detection of a SYSCON fault, the SYSCON will transfer and the new SYSCON unit will pick up the full current demand.

WARNING

When the high current range (0-200 mA) is used on the actuator channels, it is possible to damage the readback circuit on the controller if both the following events occur:

1. **A wiring fault (open wire) exists on one of the actuator return wires (this cannot be detected or annunciated by the application).**
2. **Operator commands both units to enter "Run Alone" mode – which directs both controllers to become SYSCON.**

It is critical on these circuits to use the DR-FTM or if not using it to wire correctly as per the hardware manual (using isolation diodes on both the positive and negative signal lines) in order to have correct output current readback signals.

The following table describes the SYSCON and BACKUP behaviors on signal failures:

Table 2-6. Driver Single Coil Fault Table

Single Coil Shared Actuators

Channel	SYSCON FAULT	BACKUP FAULT	BACKUP STAT	SYSCON Transfer
Actuator Driver	FALSE	FALSE	Available	No
Actuator Driver	TRUE	FALSE	Available	Yes
Actuator Driver	FALSE	TRUE	Unavailable	No
Actuator Driver	TRUE	TRUE	Unavailable	Yes (TRIP)

Table 2-7. Driver Dual Coil or Redundant Fault Table

Dual Coil and Redundant Actuators

Channel	HP A SYSCON	HP A BACKUP	HP B SYSCON	HP B BACKUP	BACKUP STAT	SYSCON Transfer	
Actuator Driver	FALSE	FALSE	FALSE	FALSE	Available	No	
Actuator Driver	TRUE	FALSE	X	FALSE	Available	Yes	*1
Actuator Driver	X	FALSE	TRUE	FALSE	Available	Yes	*1
Actuator Driver	FALSE	TRUE	X	X	Unavailable	No	*2
Actuator Driver	X	X	FALSE	TRUE	Unavailable	No	*2
Actuator Driver	TRUE	FALSE	TRUE	FALSE	Available	Yes	*3
Actuator Driver	TRUE	TRUE	TRUE	X	Unavailable	No (TRIP)	*4
Actuator Driver	TRUE	X	TRUE	TRUE	Unavailable	No (TRIP)	*4

*1 – Always transfer on a SYSCON Actuator fault if both BACKUPs are healthy

*2 – A BACKUP fault of either A / B inhibits the transfer

*3 – A fault on both A/B drivers on the SYSCON will transfer to BACKUP if they are both healthy

*4 – A fault on both A/B drivers will cause a TRIP if there is also a fault on one of the BACKUP drivers

Actuator Drivers

The Driver Configuration menu has been updated for new Driver functionality added in the 505DR control. The 505DR supports configurations for 3 types of actuators: Single Coil, Dual Coil, and Redundant Actuators for both the HP and LP valve output demands. In addition, the driver demands can also be routed to Woodward Digital Drivers or a LinkNet RTC node for bumpless SYSCON transfers. For split-range applications, HP2 and LP2 are supported as a Single Coil configuration.

The actuator functions (HP, HP2, LP, and LP2) can be configured on any of the following channels or Digital Drivers:

- Actuator 1 or 2 Outputs
- Analog Outputs 1-6
- SPC Digital Drivers (configurable for up to 4 units)
- RTCNet Node 26 Analog Output 1 or 2

Actuator Types

The sections below detail the actuator types supported by the 505DR.

Single Coil

A Single Coil actuator is a single demand signal to the final drive device. The device may be an actuator coil or digital driver (VariStroke, VariStroke, CPCII etc.). The drive signal is shared between the configured channel of the Primary and Secondary 505DR units. The BACKUP unit outputs the backup demand (trickle) current that should be configured to equal 1/2 of the minimum current, as a health check on the backup unit circuit. The SYSCON outputs the required current (plus half of the Minimum current) to drive the coil from 0 to 100%. For example, the backup demand current for a 4-20 mA output should be set to 2 mA.

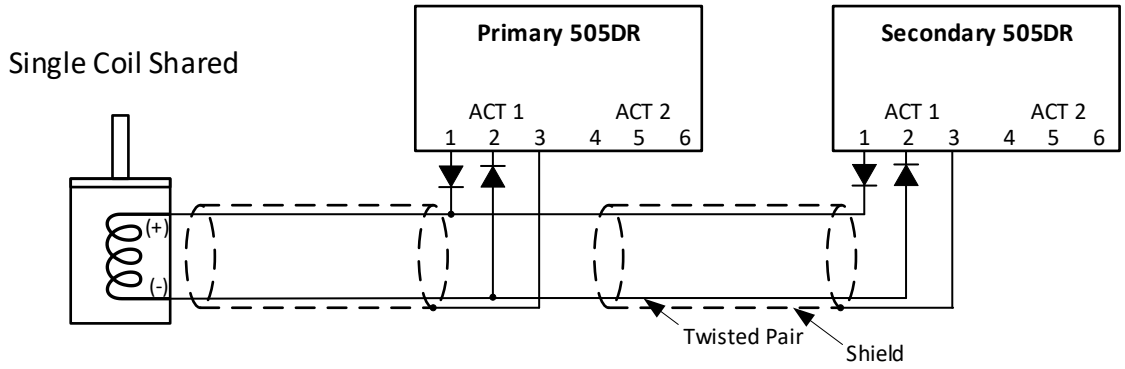

Figure 2-2. Single Coil Shared Driver

IMPORTANT **It is recommended to use the 505DR FTM which builds-in the diode and wire junctions between Actuator Output channels on the Primary and Secondary units.**

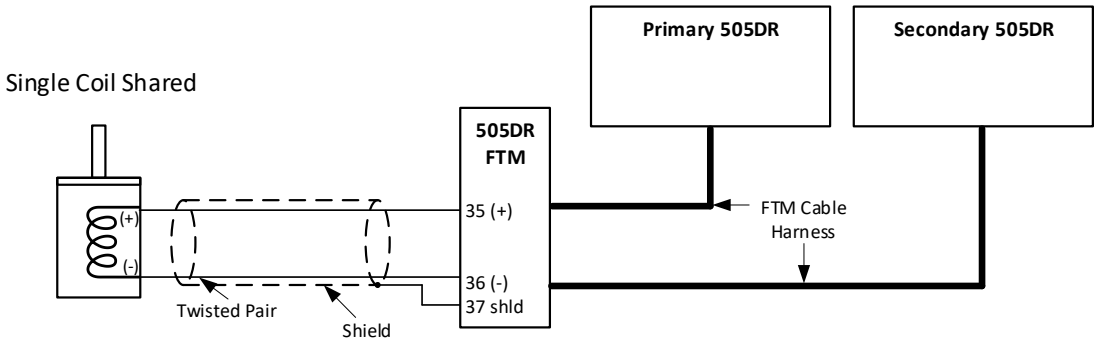

Figure 2-3. Single Coil Shared Driver with 505DR FTM

Dual Coil

A Dual Coil actuator requires two independent output demand signals to the final drive. The position of the actuator is the summed total of the mA current demands from the two demand signals. In this configuration, each drive signal is ½ of the total current demand. Upon failure of one of the demand signals, the healthy demand signal will step up to demand the full drive current.

For example – if the dual coil actuator requires 20-160 mA for full stroke from 0-100%, then the backup demand current for each of the actuator channels should be set to 5 mA. Thus, when both controllers and all actuator circuits are healthy the sum of the current outputs will equal 20 mA at a demand of 0%. The application will automatically account for providing the correct output current required on the healthy channels due to any faults detected.

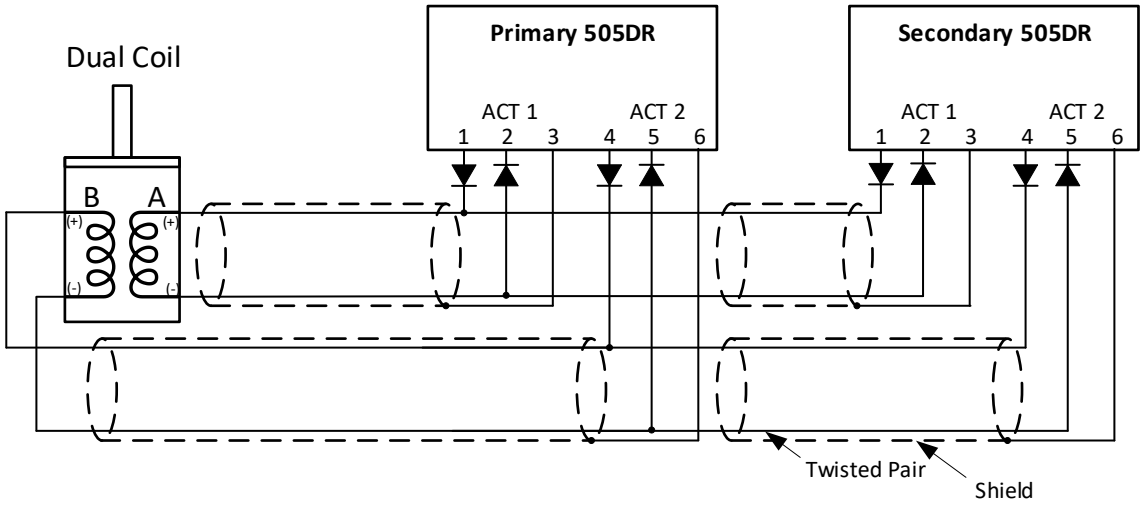

Figure 2-4. Dual Coil Driver

IMPORTANT **It is recommended to use the 505DR FTM which builds-in the diode and wire junctions between Actuator Output channels on the Primary and Secondary units.**

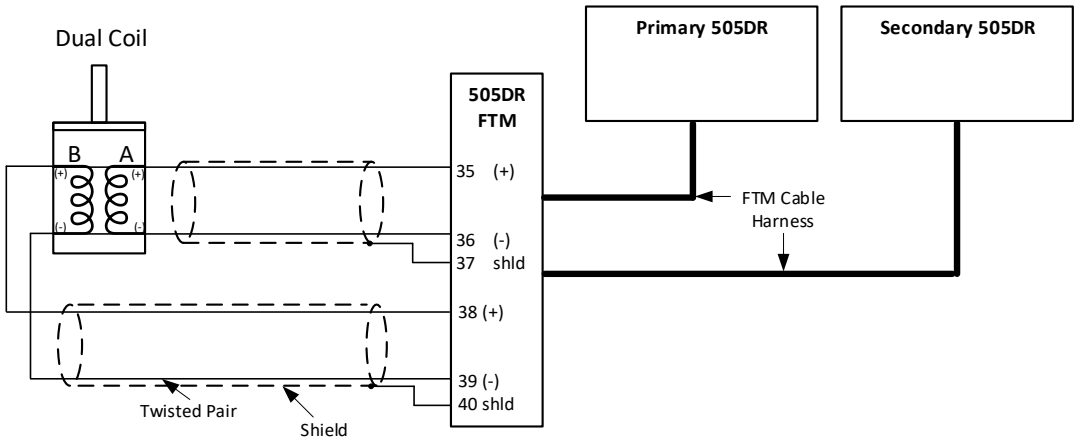

Figure 2-5. Dual Coil Driver with 505DR FTM

Redundant (parallel) Actuators

A Redundant Actuator application requires two independent output demand signals to two separate final drive devices. In this configuration, the 505DR outputs the full demand signal on each output. Typically, the valve position is driven by the high signal select (HSS) of the two servos.

For example – if the redundant actuators require 20-160 mA for full stroke from 0-100%, then the backup demand current for each of the actuator channels should be set to 10 mA. Thus, when both controllers and all actuator circuits are healthy, both of the servos will receive an output current of 20 mA at a demand of 0%. The application will automatically account for providing the correct output current required on the healthy channels due to any faults detected.

The following are examples of redundant actuators available from Woodward that would be configured as redundant actuators in the 505DR.

Table 2-8. Woodward Redundant Actuators

Product Name	Part Number	Description
CPC-DX	8918-116 (10 Bar) 8918-118 (25 Bar)	Current to Pressure Converter Dual Transfer Skid (manual 26758)
VariStrokeDX	8918-165, -167 (Zone 1) 8918-164, -166 (Zone 2)	Varistroke DX Skid (manual 35132)

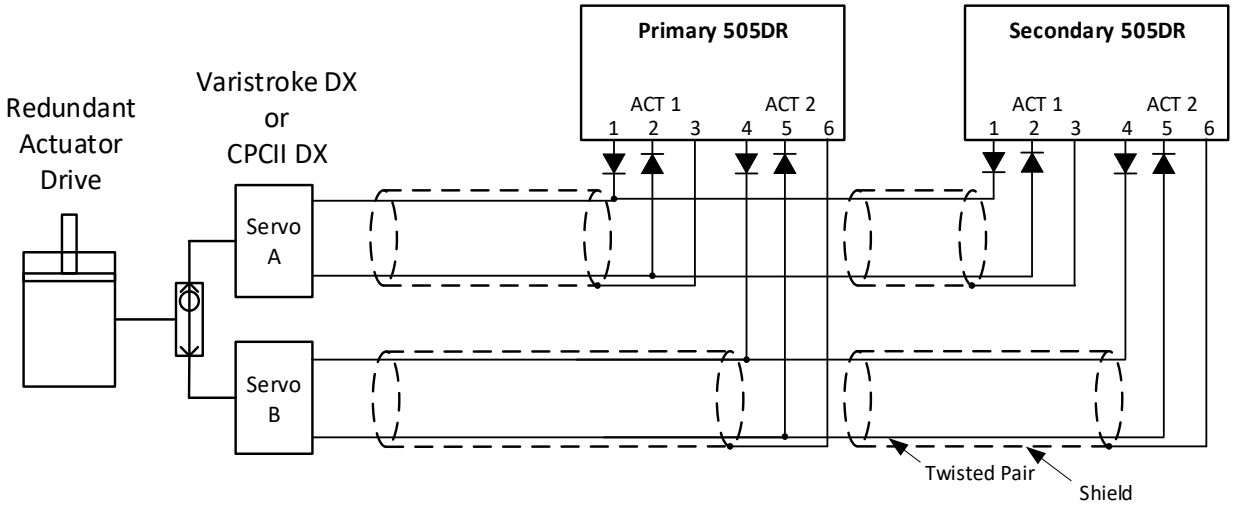

Figure 2-6. Redundant (Parallel) Actuator Driver

IMPORTANT **It is recommended to use the 505DR FTM which builds in the diode and wire junctions between Actuator Output channels on the Primary and Secondary units.**

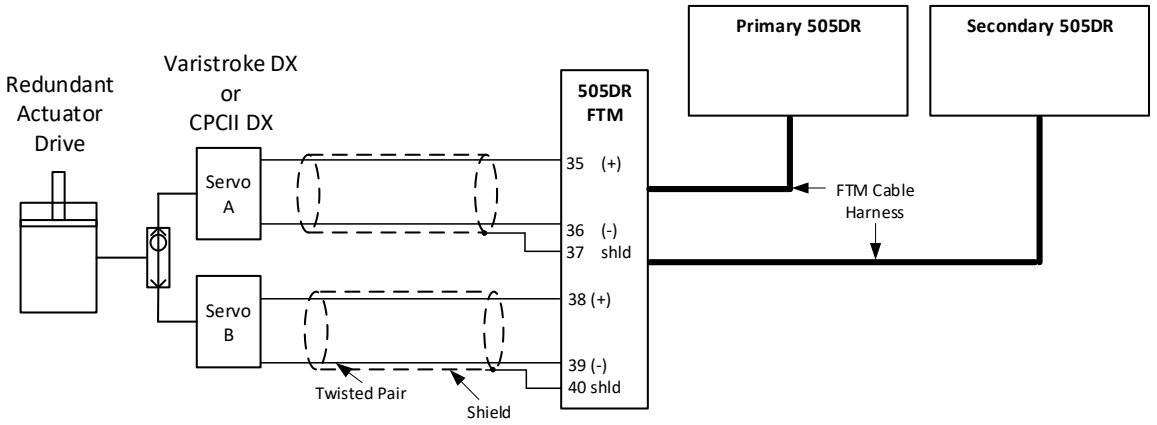

Figure 2-7. Redundant (Parallel) Actuator Driver with 505DR FTM

When a Redundant Actuator is configured, the Boolean Input function lists can be used to provide the health status of each actuator driver back to the 505DR. The Boolean input can be configured for the following options:

Table 2-9. Boolean Input Configuration Options

Menu #	Boolean Input Function
52	Redundant HP A Health Contact
53	Redundant HP B Health Contact
81	Redundant LP A Health Contact
82	Redundant LP B Health Contact

If both A and B drivers indicate a fault to the 505DR, the unit will trip if the HP or LP driver are configured to trip on an actuator fault.

Redundant Actuator drivers can also be used to drive redundant demands to a simplex VariStroke or CPCII unit.

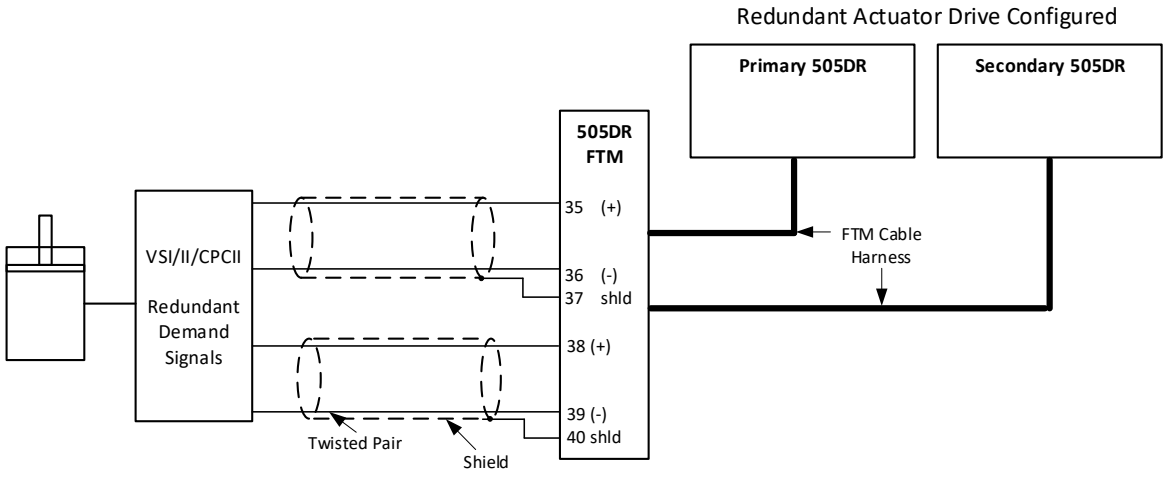

Figure 2-8. Actuator Driver with Redundant Demands

Table 2-10. Driver Fault Current Table

SYSCON Unit OK	BACKUP Unit OK	System Status	Actuator Type	Act Current Output
Yes	Yes	Healthy	Single Coil Shared	SYSCON = Valve Demand + ½ of the Min Act current BACKUP = ½ of the Min Act current
Yes	No	BACKUP Unavailable	Single Coil Shared	SYSCON = Valve Demand + full Min Act current BACKUP = Zero Act current
Yes initially then No	Yes	BACKUP Takes Over as SYSCON	Single Coil Shared	SYSCON = Zero Act current BACKUP = Valve Demand + full Min Act current
No	No	Tripped	Single Coil Shared	SYSCON = Zero Act current BACKUP = Zero Act current
Yes	Yes	Healthy	Dual Coil Actuators	SYSCON = Valve1 = ½ Demand + ½ of the Min Act current Valve2 = ½ Demand + ½ of the Min Act current BACKUP = Valve1 = ½ of the Min Act current Valve2 = ½ of the Min Act current
Yes	No	BACKUP Unavailable	Dual Coil Actuators	SYSCON = Valve1 = ½ + full Min Act current Valve2 = ½ Demand + full Min Act current BACKUP = Valve1 = Zero current Valve2 = Zero current
Yes initially then No	Yes	BACKUP Takes Over as SYSCON	Dual Coil Actuators	SYSCON = Valve1 = Zero current Valve2 = Zero current BACKUP = Valve1 = ½ Demand + full Min Act current Valve2 = ½ Demand + full Min Act current
No	No	Tripped	Dual Coil Actuators	SYSCON = Valve1 = Zero current Valve2 = Zero current BACKUP = Valve1 = Zero current Valve2 = Zero current
Yes	Yes	Healthy	Redundant Actuators	SYSCON = Valve1 =Full Demand + ½ of the Min Act current Valve2 =Full Demand + ½ of the Min Act current BACKUP = Valve1 = ½ of the Min Act current Valve2 = ½ of the Min Act current

Table 2-10. Driver Fault Current Table (cont'd.)

SYSCON Unit OK	BACKUP Unit OK	System Status	Actuator Type	Act Current Output
Yes	No	BACKUP Unavailable	Redundant Actuators	SYSCON = Valve1 = Full Demand + full Min Act current Valve2 = Full Demand + full Min Act current BACKUP = Valve1 = Zero current Valve2 = Zero current
Yes initially then No	Yes	BACKUP Takes Over as SYSCON	Redundant Actuators	SYSCON = Valve1 = Zero current Valve2 = Zero current BACKUP = Valve1 = Full Demand + full Min Act current Valve2 = Full Demand + full Min Act current
No	No	Tripped	Redundant Actuators	SYSCON = Valve1 = Zero current Valve2 = Zero current BACKUP = Valve1 = Zero current Valve2 = Zero current
Yes	Yes	Healthy	Digital Valve	SYSCON = Full Valve Demand BACKUP = Full Valve Demand
Yes	No	BACKUP Unavailable	Digital Valve	SYSCON = Full Valve Demand BACKUP = Zero Valve Demand
Yes initially then No	Yes	BACKUP Takes Over as SYSCON	Digital Valve	SYSCON = Zero Valve Demand BACKUP = Full Valve Demand
No	No	Tripped	Digital Valve	SYSCON = Zero Valve Demand BACKUP = Zero Valve Demand

Control Drivers

The 505DR can send actuator demand signals (HP, HP2, LP, or LP2) from any of the Analog or Actuator output channels on the 505DR platform. The 505DR also supports sending the HP, HP2, LP, or LP2 demand signals from a digital driver via CAN from an RTCNet Node, up to 4 SPCs, or 2 VSII.

Configuration of Actuator Drivers

1. Login to the Configure User Level and then enable Configuration Mode from the Mode Screen
2. Navigate to the Configuration Menu, then select the Drivers page
3. On the Drivers page, the Left and Right Arrow Keys cycle between the Driver Types: HP, HP2, LP, and LP2.
4. Once the Driver Type (HP, HP2, LP, or LP2) has been selected, first select the Actuator Type. There are three Actuator Types supported:
    a. Single Coil
    b. Dual Coil
    c. Redundant Actuators

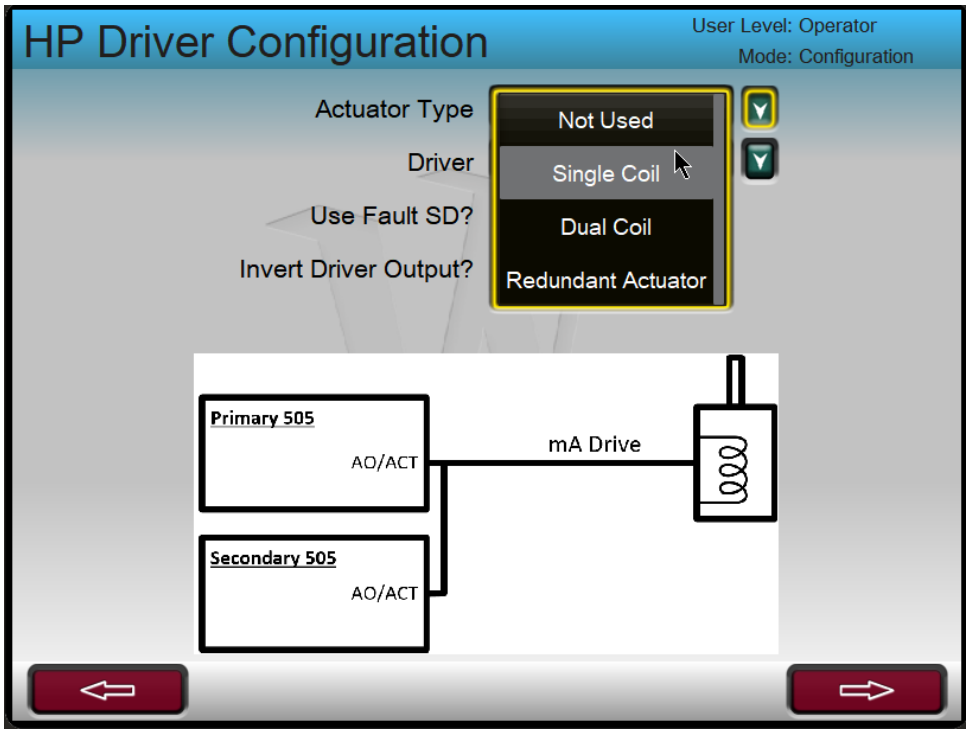

Figure 2-9. Actuator Type Configuration

5. After the Actuator Type is selected, the output channel Driver needs to be set. For the 505DR, the channel is selected from this page in the Driver drop down list. The available channels are:
    a. Actuator Output 1
    b. Actuator Output 2
    c. Analog Output 1
    d. Analog Output 2
    e. Analog Output 3
    f. Analog Output 4
    g. Analog Output 5
    h. Analog Output 6
    i. RTC Node 26 Analog Output 1
    j. RTC Node 26 Analog Output 2
    k. SPC Driver (SPC node number is determined by the function)
        i. HP Driver: SPC11
        ii. HP Coil/Red A Driver: SPC11
        iii. HP Coil/Red B Driver: SPC 13
        iv. HP2 Driver: SPC13
        v. LP Driver: SPC12
        vi. LP Coil/Red A Driver: SPC12
        vii. LP Coil/Red B Driver: SPC 14
        viii. LP2 Driver: SPC14

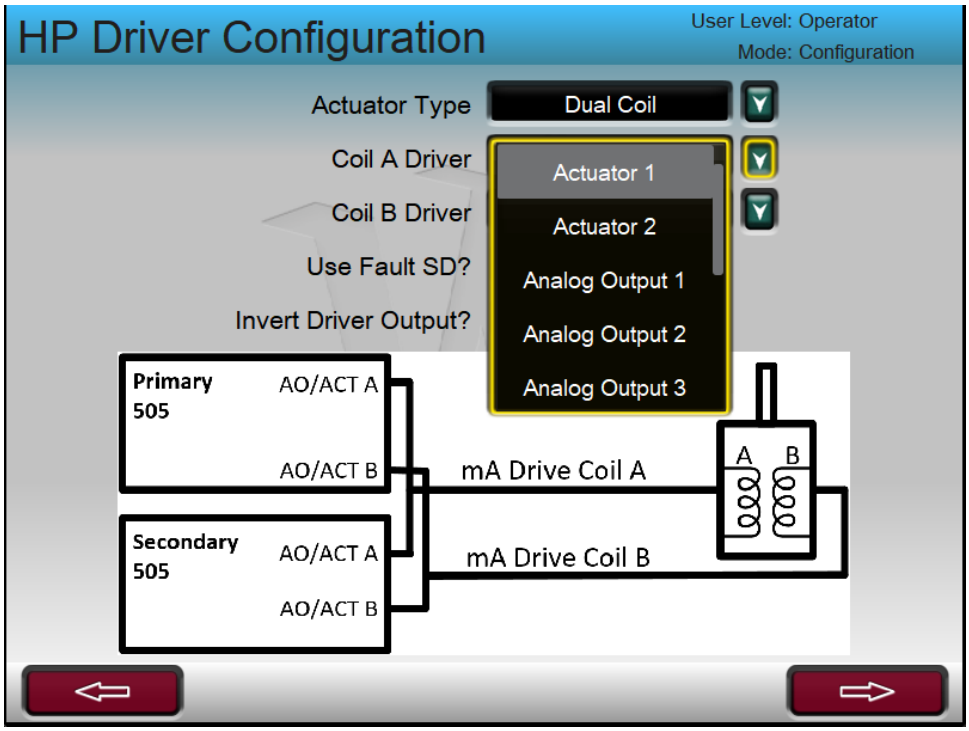

Figure 2-10. Driver Channel Configuration

If an SPC is configured, an option for an Analog Backup driver will be made available. This demand signal can be configured on an Analog Output channel of the 505DR to provide the drive signal in the case of a CAN communication failure. Analog Backup demands can be configured on one of the following channels:

1. Actuator Output 1
2. Actuator Output 2
3. Analog Output 1
4. Analog Output 2
5. Analog Output 3
6. Analog Output 4
7. Analog Output 5
8. Analog Output 6
9. RTC Node 26 Analog Output 1
10. RTC Node 26 Analog Output 2

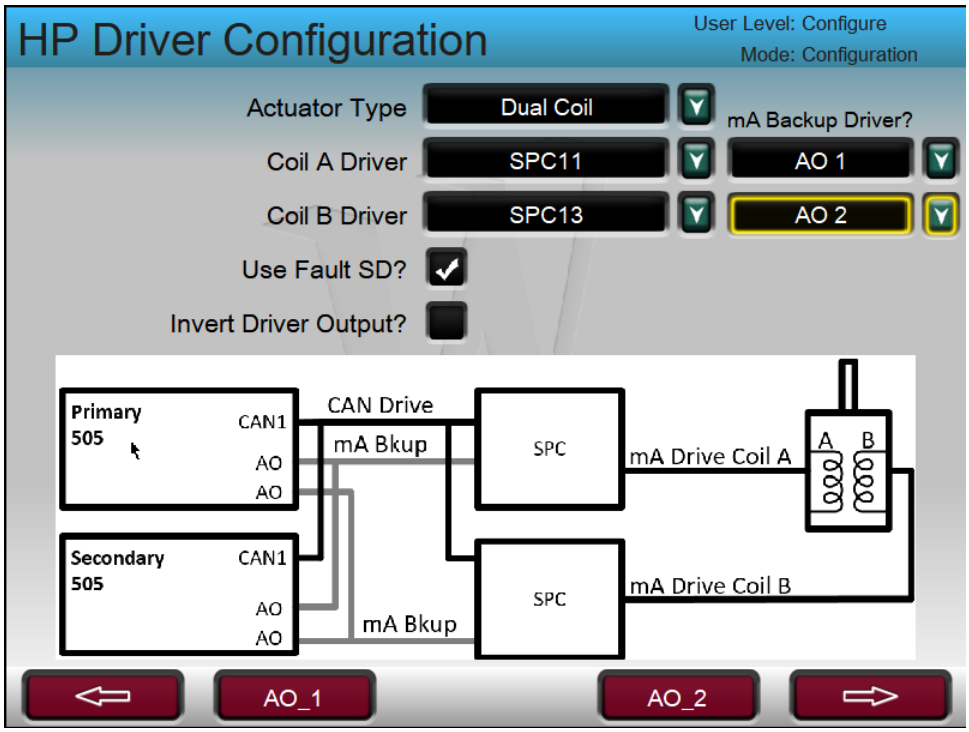

Figure 2-11. mA Backup Channel Configuration

IMPORTANT

If an SPC or RTCNet AO channel is used, the CAN network needs to be enabled in the Woodward Links configuration menu.

IMPORTANT

Once a channel has been selected, the configuration of that channel function is overridden by the control logic.

IMPORTANT

Configuring two different driver signals to the same driver channel will result in a configuration error.

1. If a Dual Coil or Redundant Actuator Type is configured, an option for the A and B demand signals will become available. Each of these signals have the same options as above.
2. Once the Driver channels have been selected, the Driver configuration is complete.
3. Channel specifics can be configured for each driver (Tag, Scaling, and Calibration) can be configured on the channel pages. Links to the channel pages will be provided in the 2 and 3 softkey locations as they are configured.

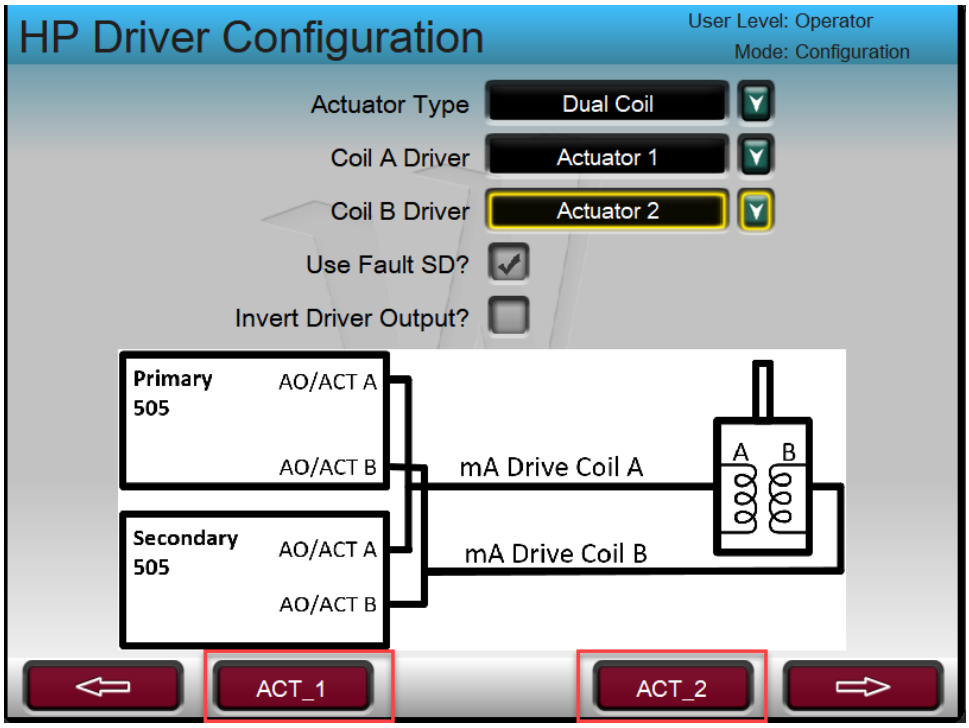

Figure 2-12. Driver Configuration Page Buttons

CAN Devices – Optional I/O and Digital Drivers

Each CAN port used on the Primary and Secondary are paired together such that both units operate as a node on the same network and either unit can communicate with the devices on the network in the case of a SYSCON transfer. In a redundant application, the SYSCON unit sends CAN messages to the devices on the network and the BACKUP unit remains active on the network but does not send messages. On a failover, the new SYSCON resumes sending messages after the failover time.

IMPORTANT

The CAN communication timeout on end devices should be set to 100ms or greater in order to allow the SYSCON transfer time to resume sending messages on the network without timing out.

The CAN communication ports are available for interfacing the control application with other products. The 505XT has programmed these to be used for the following:

CAN #1 Link to digital drivers/actuators (such as the SPC and VariStroke family)
CAN #2 Link to RTCNet distributed I/O nodes
CAN #3 Link to Power management products (such as LS-5, MFR300)
CAN #4 Reserved

Servo Position Controller (SPC)

Four SPC's (p/n 8200-227) are pre-programmed in the control application to have CAN interfaces to this product. These digital drivers (manual 26236) support a variety of actuator interfaces including proportional or integrating valves, single coil drives of up to +/- 250 mA, with single or redundant position feedback. They must be configured and calibrated with the SPC Service Tool from a user PC.

Figure 2-13. Servo Position Controller

The 505DR can be used with an SPC utilizing CAN as the primary driver signal as well as an Analog Backup option. The 505DR has pre-designated the Node ID of SPC devices based on the actuator function. For example, HP Drivers are on SPC ID 11 and LP Drivers are on SPC ID 12.

Table 2-11. Available (programmed) SPC Drivers

Node Device ID	Part Number	Description
HP (A) Driver ID=11	8200-227	Servo Position Controller (manual 26236)
LP Driver ID=12	8200-227	Servo Position Controller (manual 26236)
HP (B) / HP2 Driver ID=13	8200-227	Servo Position Controller (manual 26236)
LP (B) / LP2 Driver ID=14	8200-227	Servo Position Controller (manual 26236)

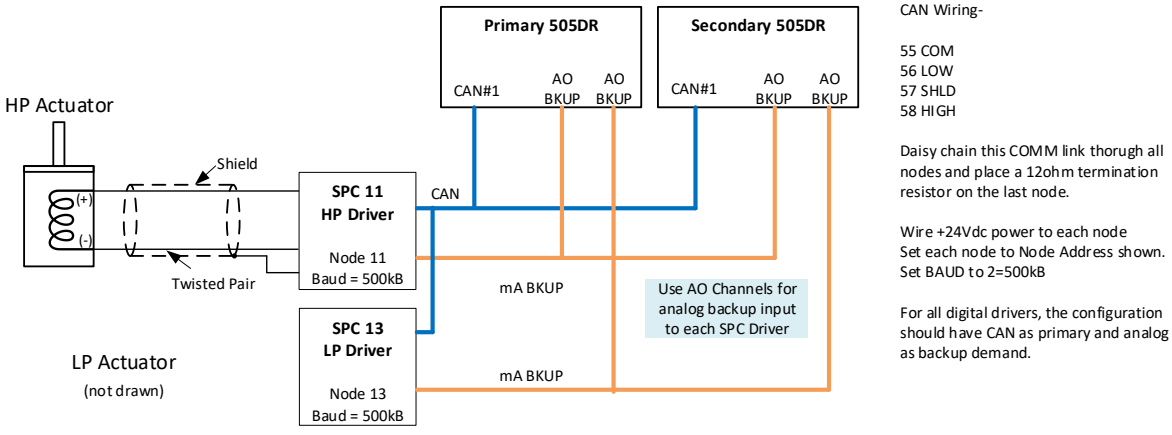

Figure 2-14. SPC Driver CAN Links

On a SYSCON transfer, the actuator demand is constant resulting in a bumpless failover at the actuator. See the Failover Performance section in Chapter 3.

To configure an SPC for use, select the SPC Driver for the HP/HP2/LP/LP2 function from Driver option in the Driver Configuration Menu. This will automatically activate the CAN network to look for an SPC at the associated Node ID. If an Analog Backup is going to be used, select the channel that will drive the Analog Backup from the Driver dropdown menu that appears when an SPC is selected as the driver in the Driver Configuration Menu.

SPC Configurations

If using 2 SPC's for redundant actuators – configure the following parameters

- Set Servo Controller Min & Max Position Currents to the appropriate currents for the proportional actuator being used (below example is a 20-160 mA coil)
- Set the Position Demand source to be either CANOpen Only, if no analog backup input is used, or as CANOpen Primary, if an analog backup input is used and connected to an analog output channel from the 505DR.
- Set the Position Demand Fault Response as a Shutdown
- Configure the CANOpen communication link as show with baud rate of 500 kb/s, a timeout of 60ms and the correct Node ID for the function (For HP Demand 11 & 13, for LP Demand 12 & 14)

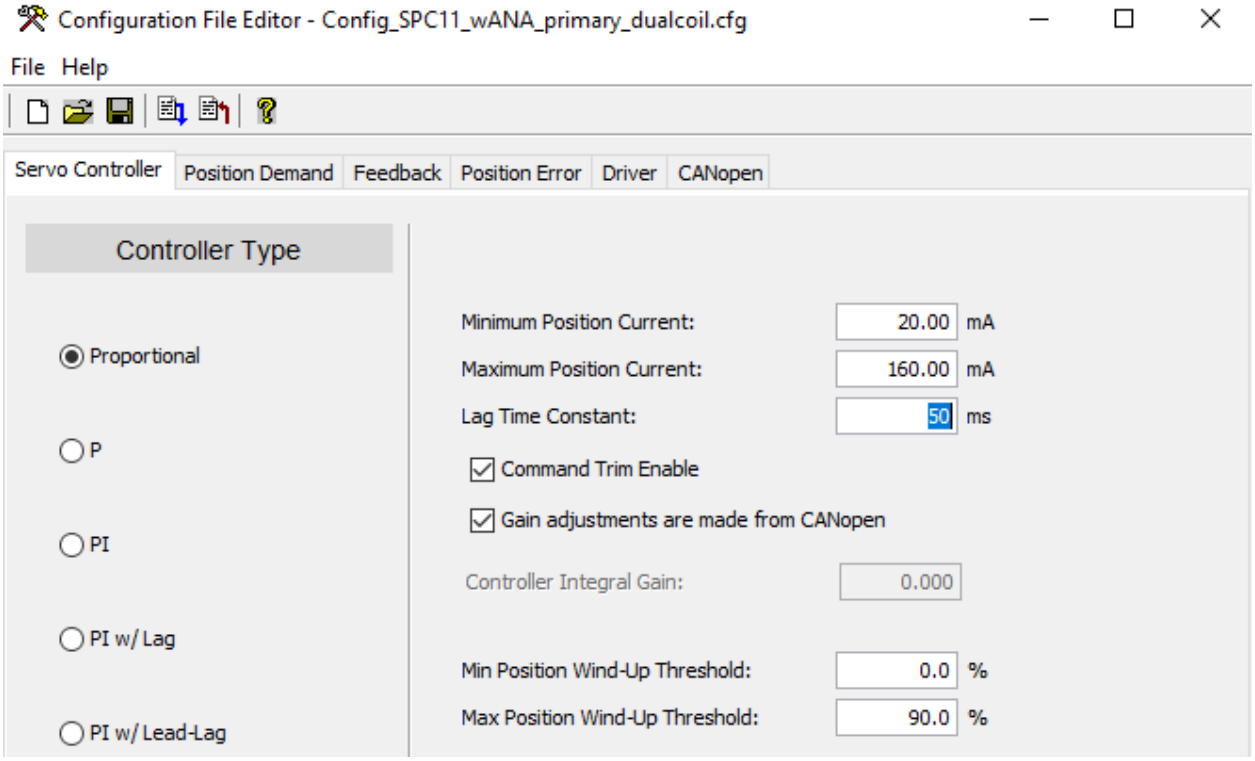

Figure 2-15a. SPC Driver Configuration for Redundant Actuators

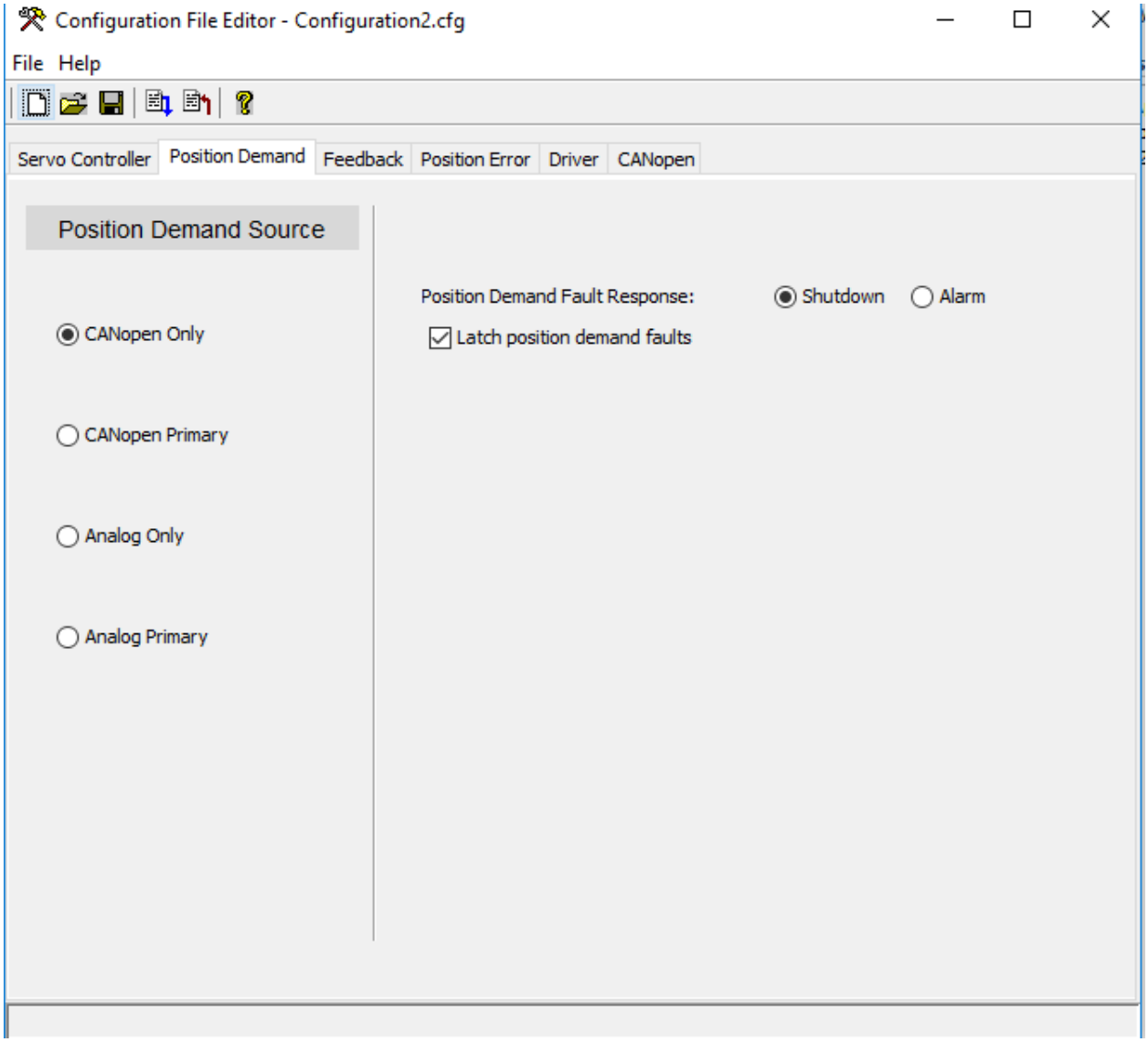

Figure 2-15b. SPC Driver Configuration for Redundant Actuators

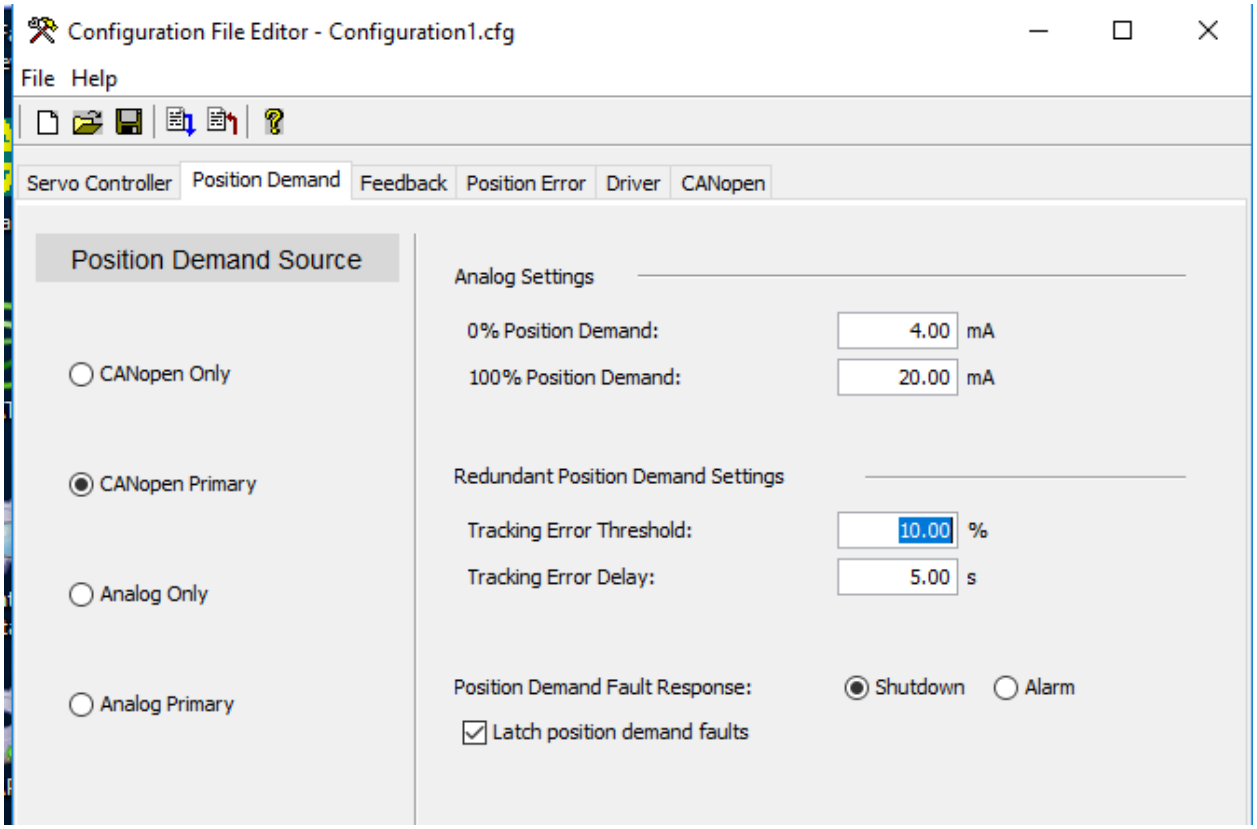

Figure 2-15c. SPC Driver Configuration for Redundant Actuators

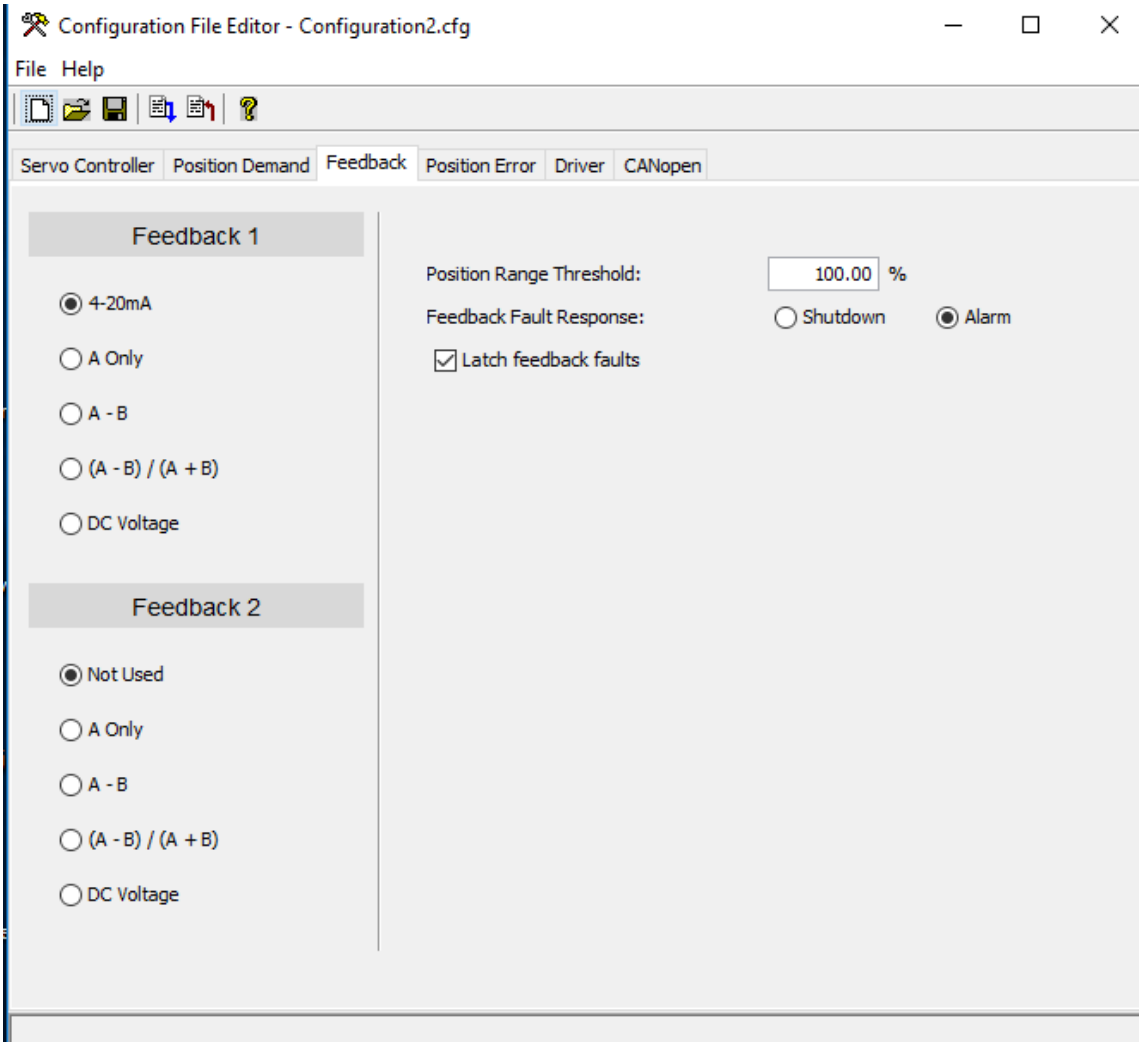

Figure 2-15d. SPC Driver Configuration for Redundant Actuators

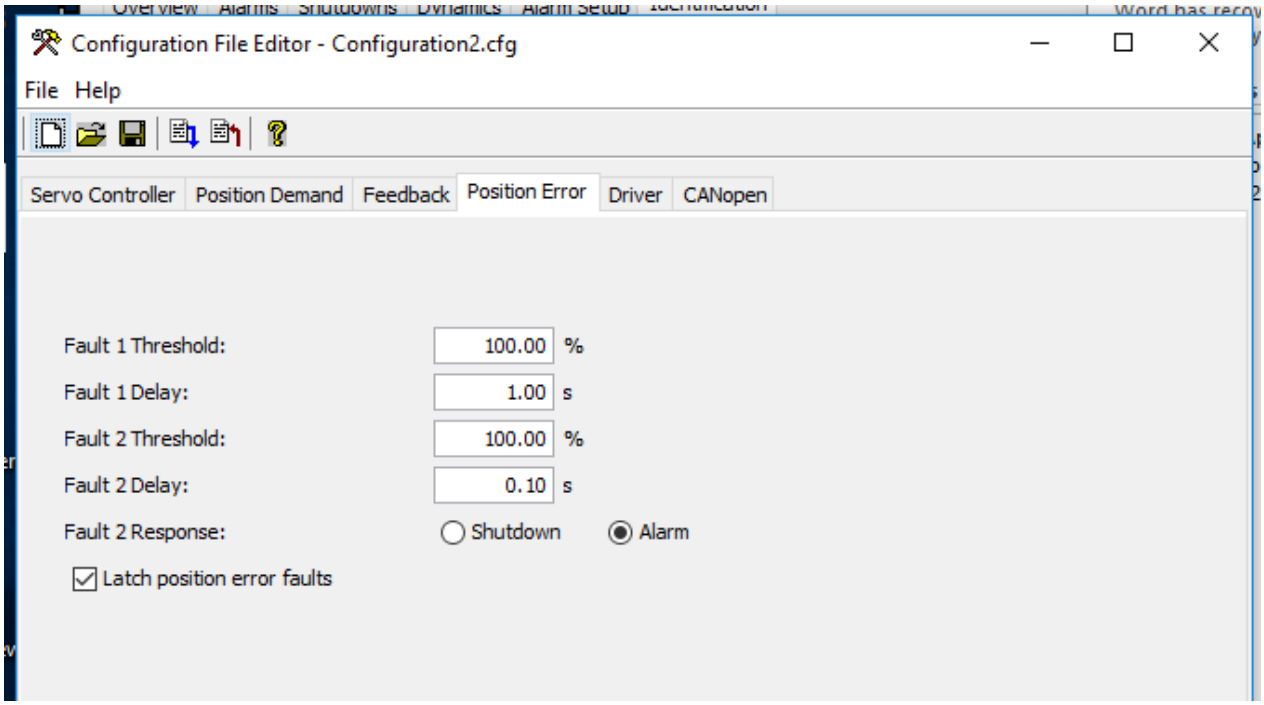

Figure 2-15e. SPC Driver Configuration for Redundant Actuators

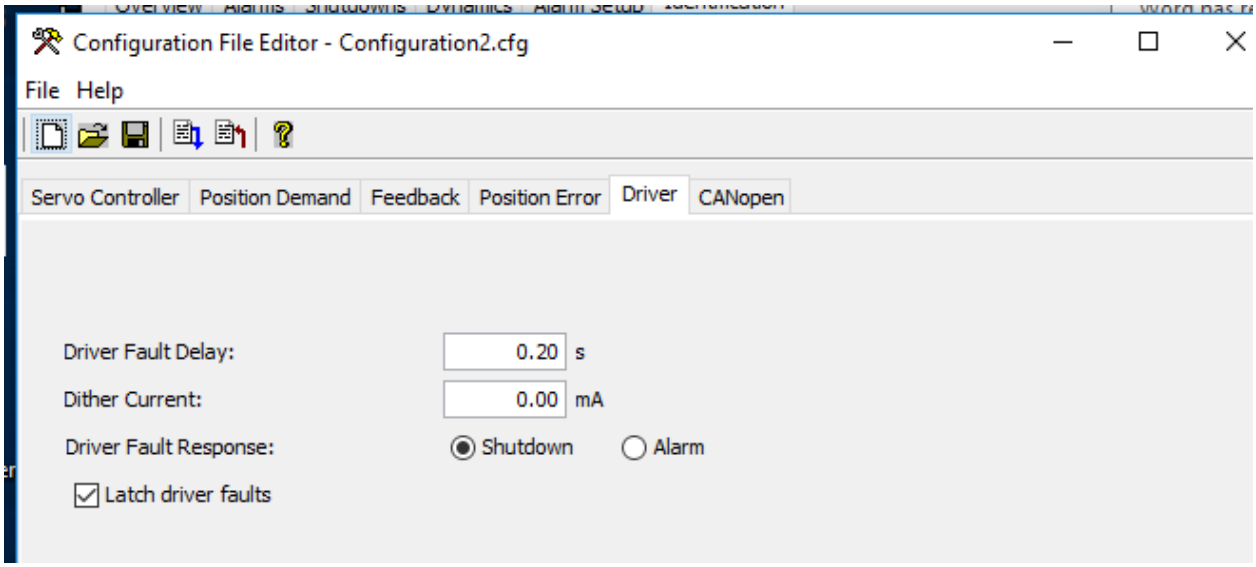

Figure 2-15f. SPC Driver Configuration for Redundant Actuators

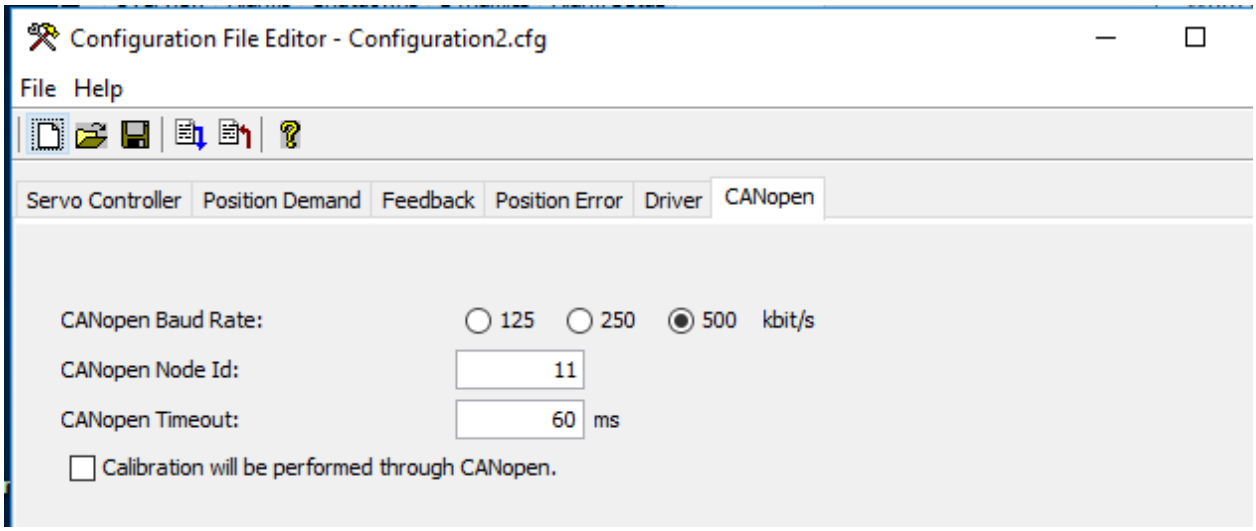

Figure 2-15g. SPC Driver Configuration for Redundant Actuators

If using 2 SPC's for dual coil actuators – configure the following parameters

- Set Servo Controller Min & Max Position Currents to the appropriate currents for the proportional actuator being used (below example is a 20-160 mA coil)
- Set the Position Demand source to be **Analog Only** and set 0% position demand as 4.00 mA and the 100% Position Demand as 20.00 mA with Fault response as Shutdown
- Configure the CANOpen communication link as show with baud rate of 500 kb/s, a timeout of 60ms and the correct Node ID for the function (For HP Demand 11 & 13, for LP Demand 12 & 14)

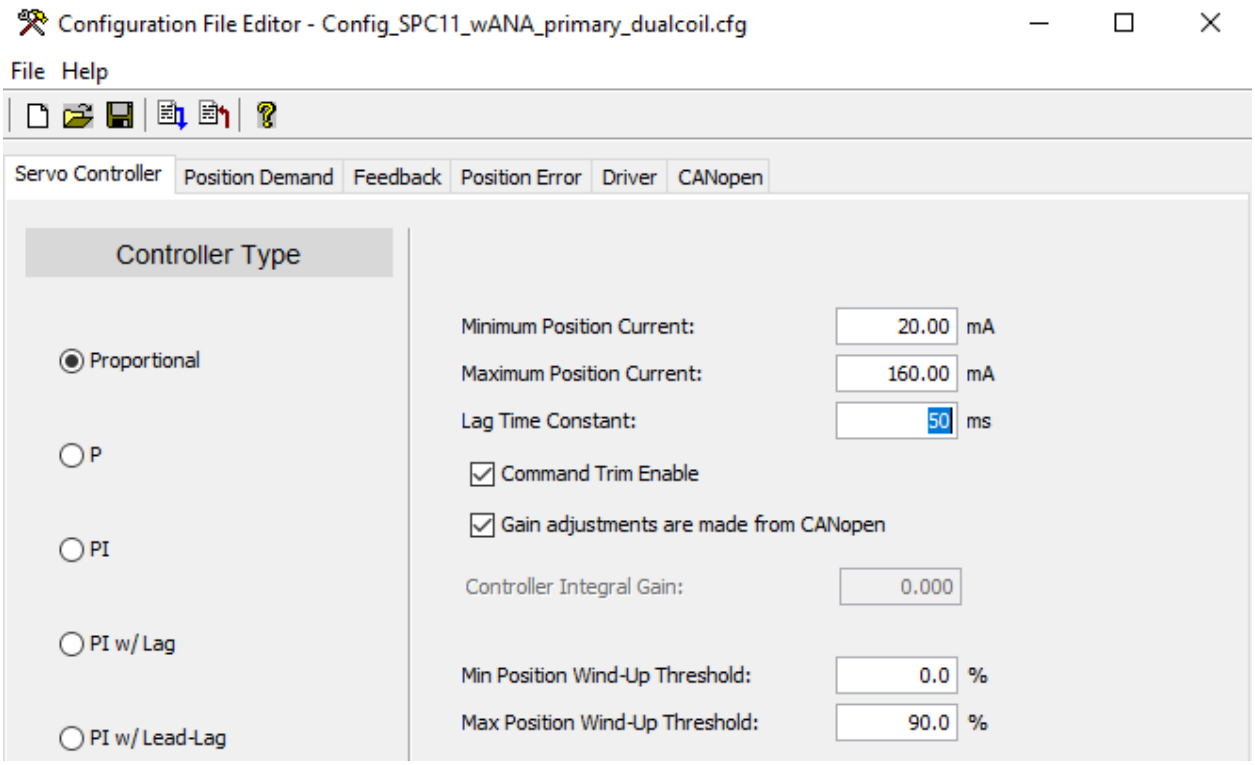

Figure 2-16a. SPC Driver Configuration for Dual Coil Actuators

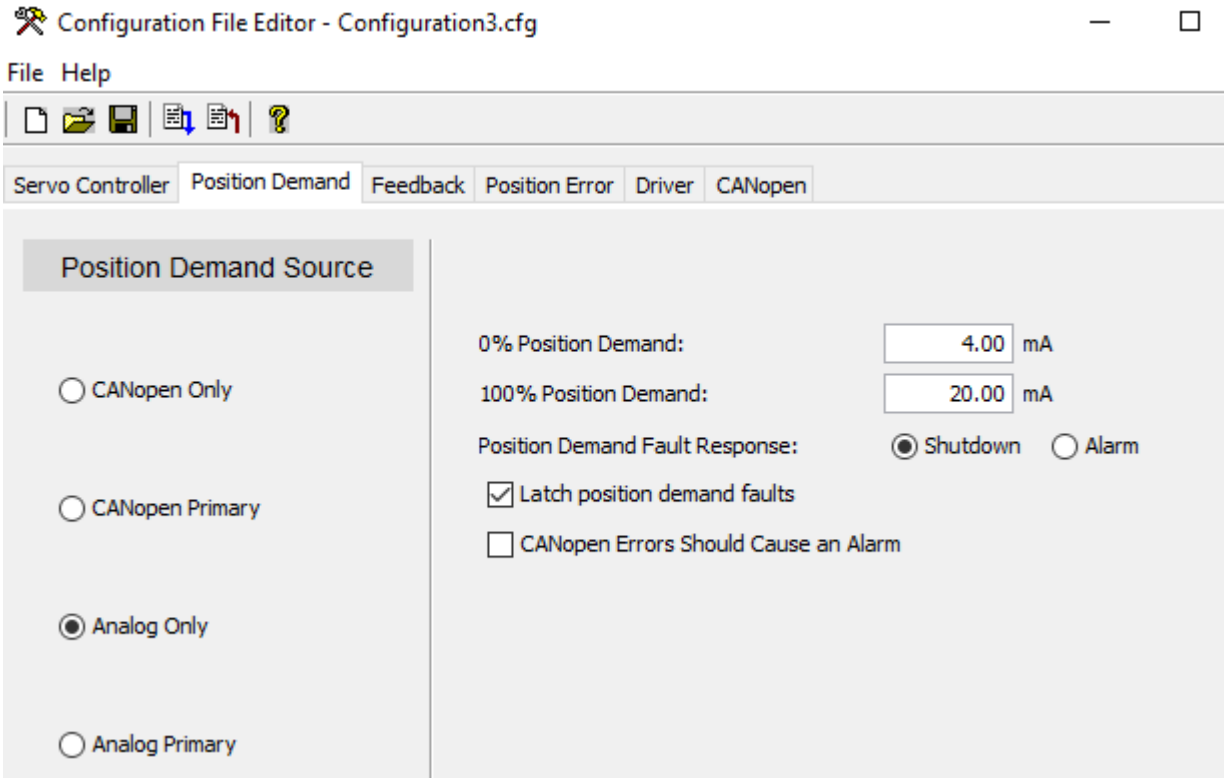

Figure 2-16b. SPC Driver Configuration for Dual Coil Actuators

Optional Distributed I/O

In the 505DR, additional I/O has been pre-programmed using Woodward's RTCNet distributed I/O nodes. These are available via the Configuration Menu (under Woodward Links) and the user is free to select any or all of the nodes listed below. All distributed I/O channels have the same menu of functional choices as the lists above for the 505 hardware I/O.

Table 2-12. Expandable I/O RTCNet Node Part Numbers

Node Device ID	Part Number	Description	I/O Type/Quantity
21	8200-1103*	Analog 4-20 mA I/O	8 AI and 2 AO
22	8200-1103*	Analog 4-20 mA I/O	8 AI and 2 AO
23	8200-1100	RTD Temperature Inputs	8 RTD
24	8200-1104	Discrete Input	16 DI
25	8200-1105	Discrete Output	16 DO
26	8200-1103	Analog 4-20 mA I/O	8 AI and 2 AO

(*) 8200-1103 is the Loop Power Analog Input module. Alternatively, 8200-1102 can be used with Self Powered Analog Inputs.

IMPORTANT

The 505DR replaces the LinkNet HT nodes on CAN#2 with RTCNet nodes. The same functionality as described in Volume 1 is available with RTCNet Nodes.

The RTCNet nodes can be individually purchased (1 or more) and installed based on the needs of the application. In general, the following functionality is available through Expandable I/O:

1. Analog AIO Nodes
    a. Analog Inputs (8x per node)
        i. All available analog input functions can be programmed to an AIO Node. For example: Cascade Input, Auxiliary Input, kW Load, etc.
        ii. Vibration 4-20mA sensors can be programmed to monitor for Alarm and Trip levels
        iii. Generic, monitoring signals (such as system pressures and temperatures) can be added and setup with Alarm and Trip levels.
    b. Analog Outputs (2x per node)
        i. For Nodes 21 and 22, the analog output channels can be configured as any available analog output function but should not be used as HP or LP valve drivers due to the recursion rate of the node.
        ii. For Node 26, the analog output channels can be configured as Valve Drivers to achieve bumpless SYSCON transfers
1. Discrete DI and DO Nodes
    a. Discrete Inputs (16x per node)
    b. All available contact input functions can be programmed to a DI node. For example: External Trip signals, External Alarm Signals, or operation commands (enable/setpoint raise / setpoint lower), etc.
        i. Discrete Outputs (16x per node)
2. All available relay output functions can be programmed to a DO node. For example: Cascade Enabled, Speed PID in Control, Speed Level Switch, etc.
    a. RTD Node (8x per Node)
        i. RTD sensors can be directly wired to the RTD node for temperature monitoring. Each channel can be programmed with Alarm and Trip levels.

IMPORTANT

RTCNet Nodes provide a convenient method to wire field sensors to both Primary and Secondary 505DR units, without the need for splitting signals. The RTCNet node will communicate the signal to both units, providing a single termination point for all field IO. For output signals, there will be no bump or change in the signal on a SYSCON failover.

RTCNet Actuator Driver Node 26

An Analog 4-20 mA I/O module has been pre-programmed to Node 26 in the 10ms rate group to accommodate Actuator Drivers on an RTCNet node. On a SYSCON transfer, the actuator demand is constant resulting in a bumpless failover at the actuator. See the Failover Performance section in Chapter 3.

This node also supports all analog input functions on the AI channels.

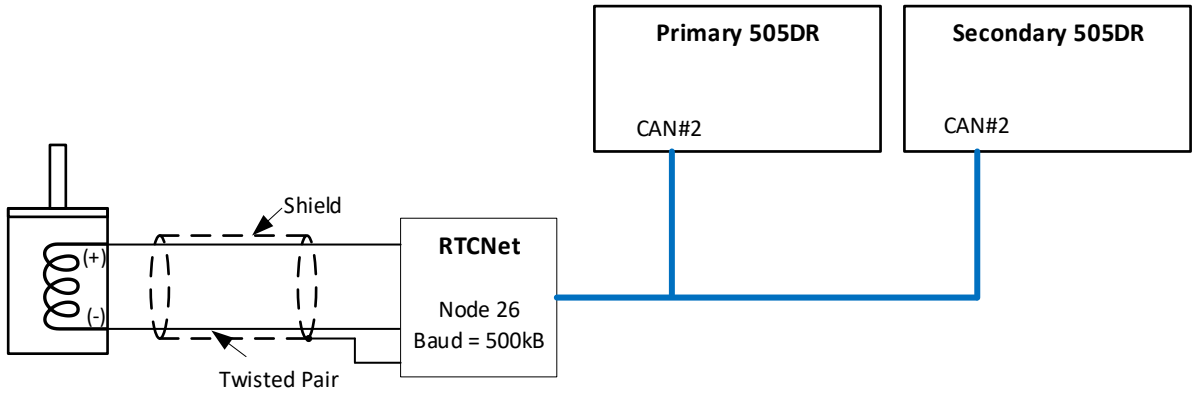

Figure 2-17. Expandable I/O Node 26 Driver (Bumpless SYSCON Transfer)

Communications

Ethernet

Each 505DR unit has 3 Ethernet ports available to interface to the controllers for a total of 6 available ports to be used for Modbus communications or WWD Service Tools. Since the operating system processes all commands to the SYSCON, the turbine can be operated via Modbus from either the SYSCON or BACKUP controllers. The reference network diagrams below show two examples of how to network the Primary and Secondary controls depending on if a single or redundant network is being used.

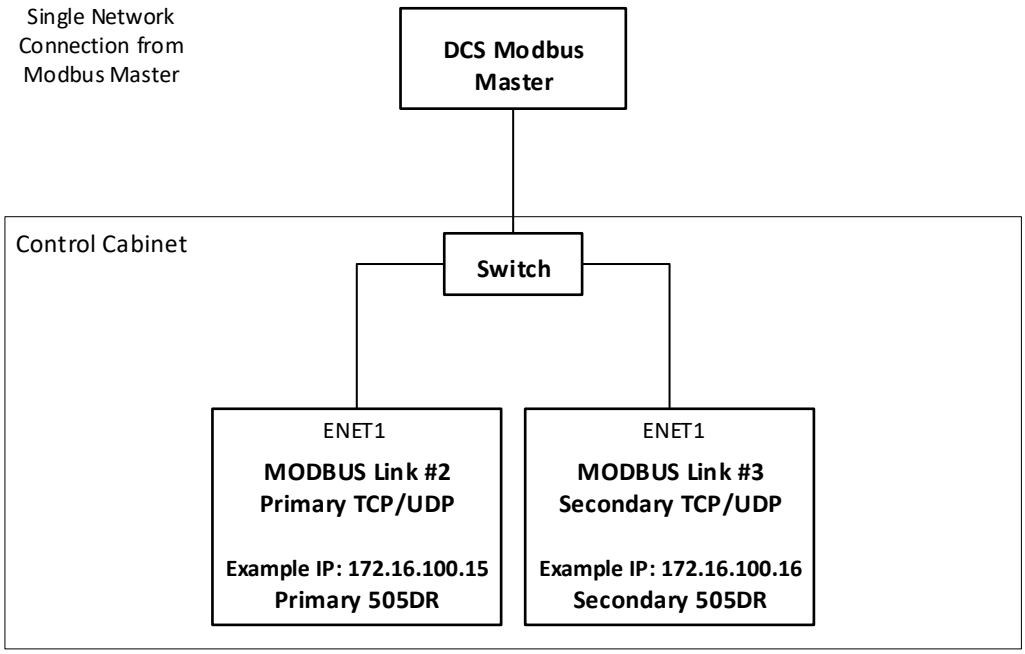

Figure 2-18. Single Network Modbus Architecture

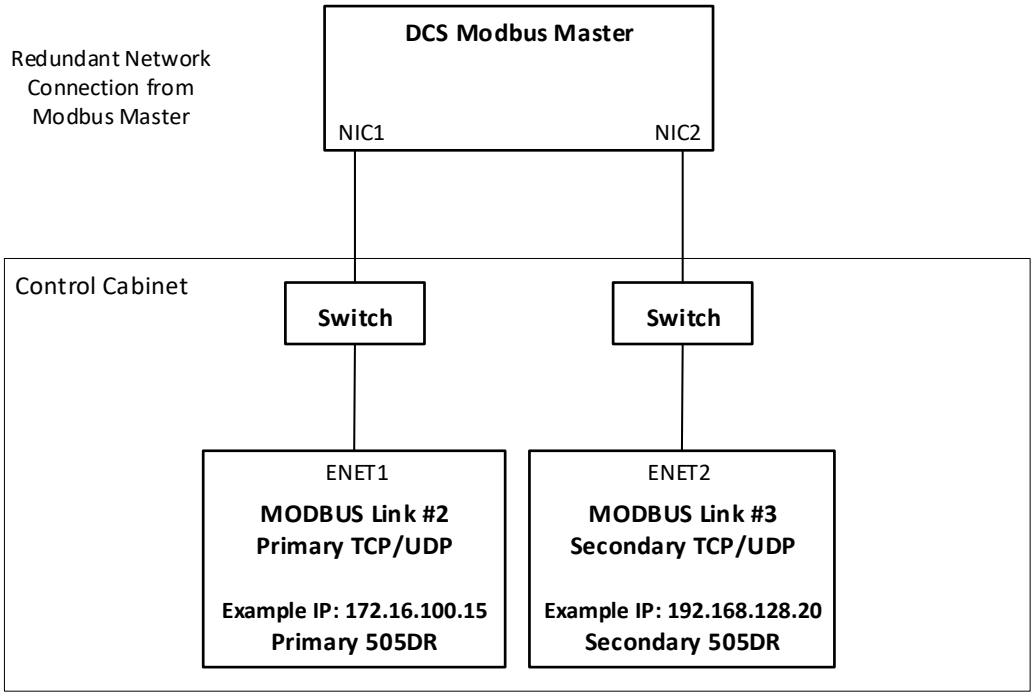

Figure 2-19. Redundant Network Modbus Architecture

Configuration Menu

The 505DR should be configured for the application as described in Volume 1 and Volume 2 of this manual, 35018.

When Configuration, Service, or Runtime settings are adjusted in either the SYSCON or BACKUP the two units will automatically synchronize the settings changes so that both units contain identical settings. When a Save Settings command is issued, both units will save settings to non-volatile memory. It is only necessary to configure or make settings updates in one of the units. The operating system will automatically update both systems to keep them in sync.

For redundancy, the following configuration options are added:

Operating Parameters Menu

Use 505DR FTM? **dflt= NO**

(Yes/No)

Select YES if 505DR FTM will be used. If YES, the Dedicated Trip Input is moved to Boolean Input Channel 13 and Dedicated Trip Relay will be moved to Relay Output 7.

If No, the Dedicated Trip Input remains on Boolean Input Channel 1 and the Dedicated Trip Relay will remain on Relay Output 1.

Driver Configuration Menu

Actuator Type **dflt =Single Coil (Single Coil, Dual Coil, Redundant)**

Select the type of actuator for the valve driver. See the Actuator Drivers section for detailed descriptions on the Actuator Types supported.

Driver **dflt =Actuator 1 (Menu List)**

Select the 505DR channel or digital driver that will drive the actuator. See the Actuator Drivers section for detailed descriptions on the channels and digital drivers supported.

Actuator Driver Menu

Backup Demand Setting (mA) **Monitor Only**

This analog value determines the milliamp current output of the BACKUP channel. This demand provides a continuous health check on the BACKUP driver circuit. If the BACKUP unit detects a fault on the driver circuit, the BACKUP unit will be inhibited.

This value is set to ½ the Minimum current (mA at 0% Demand). If the Actuator range is 4-20mA, it will be set to 2mA. If the Actuator range is 20-160mA, it will be set to 10mA.

The lowest mA value that the BACKUP unit will detect a fault at is 0.6mA for the 4-20mA range and 4.5mA for the 0-200mA range. The Minimum current calibration setting (mA at 0% Demand) should be high enough to keep the BACKUP health check functioning correctly. Since the BACKUP demand setting is calculated to ½ the Minimum current, the Minimum current must be greater or equal to 1.2mA for the 4-20mA range or 9mA for the 0-200mA range. If the Minimum current is lower, the BACKUP circuit health check will not detect BACKUP circuit failures, creating a potential latent fault in the system.

IMPORTANT

For a dual coil actuator, there are four circuits driving the two coils that need to have an active health check current. Therefore, the Minimum current setting (mA at 0% Demand) must be greater than 2.4mA for 4-20mA range and 18mA for 0-200mA range for the BACKUP health check to function correctly.

Communications Menu – Secondary Chassis

IMPORTANT

From the Factory, the Primary and Secondary chassis will have identical IP addresses for each of the ENET ports. The addresses should be set to a unique IP address to avoid IP address conflicts when placed on a network.

The best practice is to place ENET 1 on both the Primary and Secondary chassis to unique IP addresses on the same subnet domain.

ENET 2 should have unique IP addresses on the same subnet domain, but a different subnet domain than ENET 1 and 3.

ENET 3 should have unique IP addresses on the same subnet domain, but a different subnet domain than ENET 1 and 2.

IMPORTANT

Each of the ETHERNET ports is required to be configured for a unique subnet (domain) (view default settings as an example). The IP's can be set by other service tools.
The top of the screen shows the current IP addresses in use on for each port.

Ethernet IP Configuration – Secondary Unit

ENET 1 ADDRESS **dflt= 172.16.100.15 (0, 255)**
Enter the integers corresponding to the network TCP/IP address.
ENET 1 SUBNET MASK **dflt= 255.255.0.0 (0, 255)**
Enter the integer corresponding to the network subnet mask.
SET IP1 **dflt= NO (Yes/No)**
Press this button to trigger resetting the IP of ENET 1 to the entered value
ENET 2 ADDRESS **dflt= 192.168.128.20 (0, 255)**
Enter the integers corresponding to the network TCP/IP address.
ENET 2 SUBNET MASK **dflt= 255.255.255.0 (0, 255)**
Enter the integer corresponding to the network subnet mask.
SET IP2 **dflt= NO (Yes/No)**
Press this button to trigger resetting the IP of ENET 2 to the entered value
ENET 3 ADDRESS **dflt= 192.168.129.20 (0, 255)**

Enter the integers corresponding to the network TCP/IP address.

ENET 3 SUBNET MASK **dflt= 255.255.255.0 (0, 255)**

Enter the integer corresponding to the network subnet mask.

SET IP3 **dflt= NO (Yes/No)**

Press this button to trigger resetting the IP of ENET 3 to the entered value

GATEWAY **dflt= 0.0.0.0 (0, 255)**

Enter the integers corresponding to the network gateway.

Note: the ENET 4 address is not changeable at the front panel. It is always available for service tools and is defaulted to the following:

ENET 4 ADDRESS	192.168.130.20
ENET 4 SUBNET MASK	255.255.255.0

Woodward Links Menu

RTCNet I/O NODES

Enable Using RTCNet I/O Nodes? **dflt= NO (Yes/No)**

Enable Node 21 (AIO) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 21

Enable Node 22 (AIO) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 22

Enable Node 23 (RTD) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 23

Enable Node 24 (BI) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 24

Enable Node 25 (BO) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 25

Enable Node 26 (AIO) **dflt= NO (Yes/No)**

If YES – set the Node Address on this device to 26

CAN 1 Digital Drivers

Using Digital Drivers on CAN1? **dflt= NO (Yes/No)**

SPC Node 11 Used **Monitor Only**

SPC Node 12 Used **Monitor Only**

SPC Node 13 Used **Monitor Only**

SPC Node 14 Used **Monitor Only**

If SPC nodes are used, they are configured for use in the Driver Configuration Menu by selecting the SPC as the channel driver for the actuator function.

Home – Site Information

Control ID **dflt= 505XT_DR (string input)**

The Control ID sets the control name in the SOS Service tool and AppManager. This should be modified when there are multiple 505DR systems to uniquely identify them on the network.

RTCNet Configuration Menu

Trip on Network Link Error?

dflt= NO (Yes/No)

Select YES to issue a Trip when the CAN network is failed on both the SYSCON and BACKUP units. This can be used when the RTCNodes have critical system I/O that will be lost on a CAN network failure.

Analog Inputs Menu

Inhibit BACKUP on Fault? **dflt= NO (Yes/No)**

Select YES to inhibit SYSCON transfers when an Analog Backup signal failure is detected on the BACKUP unit only (if failed on both SYSCON and BACKUP, this option is ignored). This should be used when a SYSCON transfer will result in the failed AI signal to cause a trip. For example, if the AUX Input failure is configured as a Trip condition.

Select NO to allow SYSCON transfers. If the SYSCON transfers and the AI signal is failed, the control logic will follow the behavior for a failed signal for that function described in Volume 1 of this manual.

Redundant Sensor Max Diff. **dflt = 10.0 (0.01, 10000.0)**

This sets the allowable difference window between redundant sensors, in engineering units. If the redundant signals differ by more than this value, an alarm will be annunciated.

This setting is found on the control function runtime screen within the Redundant Sensor softkey menu. For example, if Cascade Input #2 is programmed, then on the Cascade control page from the Home screen, press the redundant sensor softkey to access this setting.

Redundant Sensor 2 Good Equation **dflt = Average (HSS, LSS, Avg)**

When both redundant sensors are healthy this value sets the equation used to calculate the Validated Signal for control. HSS = High Signal Select between the two sensors, LSS = Low Signal Select between the two sensors, AVG = Average of the two sensors.

This setting can only be tuned while the turbine is tripped.

This setting is found on the control function runtime screen within the Redundant Sensor softkey menu. For example, if Cascade Input #2 is programmed, then on the Cascade control page from the Home screen, press the redundant sensor softkey to access this setting.

Table 2-13. Analog Input Function List

Menu #	MSG_
1	--- Not Used ---
2	Remote Speed Setpoint #1
3	Synchronizing Input
4	Sync / Load Share
5	Generator Load Input #1
6	Cascade Input #1
7	Remote Cascade Setpoint
8	Auxiliary Input #1
9	Remote Auxiliary Setpoint
10	Redundant LP A Feedback
11	Redundant LP B Feedback
12	Inlet Pressure Input #1
13	Redundant HP A Feedback
14	Redundant HP B Feedback
15	Speed Feed-Forward
16	Remote Droop
17	Remote Load Setpoint
18	Exhaust Pressure Input #1
19	Spare 19
20	HP Valve Feedback Position
21	HP2 Valve Feedback Position
22	Isolated PID PV
23	Remote SP for Isolated PV
24	Signal Monitoring #1
25	Signal Monitoring #2
26	Signal Monitoring #3
27	Start Temperature 1

Menu #	MSG_
28	Start Temperature 2
29	Extraction/Admission Input #1
30	Remote Extr/Adm Setpoint
31	Remote Manual Extr/Adm (P) Demand
32	Remote Exhaust Pressure Setpoint
33	Remote Inlet Pressure Setpoint
34	LP Valve Position Feedback
35	Remote Speed Setpoint #2
36	Generator Load Input #2
37	Cascade Input #2
38	Auxiliary Input #2
39	Inlet Pressure Input #2
40	Exhaust Pressure Input #2
41	Extraction/Admission Input #2
42	Vibration Signal #1
43	Vibration Signal #2
44	Vibration Signal #3
45	Vibration Signal #4
46	Vibration Signal #5
47	Vibration Signal #6
48	Vibration Signal #7
49	Vibration Signal #8
50	Spare_50

Table 2-14. Analog Output (Readout) Function List

Menu #	MSG_
1	--- Not Used ---
2	Actual Shaft Speed
3	Speed Reference Setpoint
4	Remote Speed Setpoint
5	Load Share Input
6	Synchronizing Input
7	Generator Load
8	Cascade Input Signal
9	Cascade Setpoint
10	Remote Cascade Setpoint
11	Auxiliary Input Signal
12	Auxiliary Setpoint
13	Remote Auxiliary Setpoint
14	Redundant LP A Feedback
15	Redundant LP B Feedback
16	Spare 16
17	Valve Limiter Setpoint
18	LSS Value
19	HP Valve Demand

Menu #	MSG_
20	HP2 Valve Demand
21	Inlet Pressure Input
22	Redundant HP A Feedback
23	Redundant HP B Feedback
24	Isolated PID Dmd Output
25	Isolated PID PV Input Signal
26	Isolated PID Setpoint
27	Remote Isolated PID Setpoint
28	Remote KW Setpoint
29	Exhaust Pressure Input
30	HP Valve Feedback Position
31	HP2 Valve Feedback Position
32	Signal Monitoring #1
33	Signal Monitoring #2
34	Signal Monitoring #3
35	Start Temperature 1
36	Start Temperature 2
37	LP Valve Demand
38	LP Valve Limiter Setpoint
39	Extraction/Admission Input
40	Extraction/Admission Setpoint
41	Exhaust Pressure Setpoint
42	Inlet Pressure Setpoint
43	Speed/Load Demand (S Demand)
44	Extraction/Admission Demand (P Demand)
45	Inlet Pressure Demand (Q Demand)
46	Exhaust Pressure Demand (R Demand)
47	SPC11 AI Backup
48	SPC12 AI Backup
49	SPC13 AI Backup
50	SPC14 AI Backup
51	Spare_51
52	Spare_52
53	Spare_53
54	Spare_54
55	Spare_55

Table 2-15. Boolean Input Function List

Menu #	MSG_
1	---Not Used---
2	Reset Command
3	Speed Raise Command
4	Speed Lower Command
5	Generator Breaker
6	Utility Tie Breaker
7	Overspeed Test
8	External Run
9	Start Permissive 1
10	Idle / Rated Command
11	Halt/Continue Auto Start
12	Override MPU Fault
13	Select On-Line Dynamics
14	Local / Remote
15	Rmt Spd Setpt Enable
16	Sync Enable
17	Freq Control Arm/Disarm
18	Casc Setpt Raise
19	Casc Setpt Lower
20	Casc Control Enable
21	Rmt Casc Setpt Enable
22	Aux Setpt Raise
23	Aux Setpt Lower
24	Aux Control Enable
25	Rmt Aux Setpt Enable
26	DI Health from SPC11 Driver
27	DI Health from SPC12 Driver
28	DI Health from SPC13 Driver
29	DI Health from SPC14 Driver
30	HP Valve Limiter Open
31	HP Valve Limiter Close
32	Controlled Shutdown(STOP)
33	External Trip 2
34	External Trip 3
35	External Trip 4
36	External Trip 5
37	External Trip 6
38	External Trip 7
39	External Trip 8
40	External Trip 9
41	External Trip 10
42	External Alarm 1
43	External Alarm 2
44	External Alarm 3

Menu #	MSG_
45	External Alarm 4
46	External Alarm 5
47	External Alarm 6
48	External Alarm 7
49	External Alarm 8
50	External Alarm 9
51	Spare 51
52	Redundant HP A Health Contact
53	Redundant HP B Health Contact
54	Speed Forward Enable
55	Instant Min Gov/Load Speed
56	Select Hot Start
57	Remote KW Setpoint Enable
58	Clock SYNC Pulse Contact
59	Enable Rem SP for Isolated PID
60	Isolated Controller Raise
61	Isolated Controller Lower
62	LP Valve Limiter Open
63	LP Valve Limiter Close
64	Extr/Adm Setpoint Raise
65	Extr/Adm Setpoint Lower
66	Extr/Adm Control Enable
67	Extr/Adm Remote Setpoint Enable
68	Enable Manual Extr/Adm (P) Demand
69	Inlet Pressure Setpoint Raise
70	Inlet Pressure Setpoint Lower
71	Inlet Pressure Control Enable
72	Inlet Pressure Remote Setpoint Enable
73	Exhaust Pressure Setpoint Raise
74	Exhaust Pressure Setpoint Lower
75	Exhaust Pressure Control Enable
76	Exhaust Pressure Remote SP Enable
77	Select Priority
78	Enable Decoupling
79	Manual P Demand Raise
80	Manual P Demand Lower
81	Redundant LP A Health Contact
82	Redundant LP B Health Contact
83	Spare_83
84	Spare_84
85	Spare_85
86	Spare_86
87	Spare_87
88	Spare_88
89	External Trip 11

Menu #	MSG_
90	External Trip 12
91	External Trip 13
92	External Trip 14
93	External Trip 15
94	External Alarm 10
95	External Alarm 11
96	External Alarm 12
97	External Alarm 13
98	External Alarm 14
99	External Alarm 15
100	External Trip 1

Table 2-16. Relay Output Indication Function List

Boolean Indication

Menu #	MSG_
1	--- Not Used ---
2	Summary Shutdown
3	Summary Shutdown (Trip Relay)
4	Summary Alarm
5	All Alarms Clear
6	Unit is Powered & Booted-up
7	Overspeed Trip
8	Overspeed Test Enabled
9	Speed PID in Control
10	Remote Speed Setpoint Enabled
11	Remote Speed Setpoint Active
12	Underspeed Switch
13	Auto Start Sequence Halted
14	On-Line Speed PID Dynamics Mode
15	Local Interface Mode Selected
16	Frequency Control Armed
17	Frequency Control
18	Sync Input Enabled
19	Sync / Loadshare Input Enabled
20	Loadshare Mode Active
21	Cascade Control Enabled
22	Cascade Control Active
23	Remote Cascade Setpoint Enabled
24	Remote Cascade Setpoint Active
25	Auxiliary Control Enabled
26	Auxiliary Control Active
27	Auxiliary PID in Control
28	Remote Auxiliary Setpoint Enabled
29	Remote Auxiliary Setpoint Active
30	Turbine Started
31	Spare 31

Menu #	MSG_
32	Primary Unit is SYSCON
33	Secondary Unit is SYSCON
34	Healthy Redundant Mode (Backup Ready)
35	HP Valve Limiter in Control
36	Command from Modbus BW addresses
37	Reset Pulse (2 sec)
38	Open GEN Breaker Cmd
39	Feed-Forward Enabled
40	Feed-Forward Active
41	Cascade PID in Control
42	Ready to Start
43	Spare 43
44	Spare 44
45	All Trips Cleared (No SD)
46	Remote KW SP Enabled
47	Remote KW Setpoint Active
48	Manual Relay Control
49	Isolated Controller in Auto
50	LP Valve Limiter in Control
51	Extr/Adm Control Enabled
52	Extr/Adm Control Active
53	Extr/Adm PID In Control
54	Remote Extr/Adm Setpoint Enabled
55	Remote Extr/Adm Setpoint Active
56	Inlet Pressure Control Enabled
57	Inlet Pressure Control Active
58	Inlet Pressure PID In Control
59	Remote Inlet Pressure Setpoint Enabled
60	Remote Inlet Pressure Setpoint Active
61	Exhaust Pressure Control Enabled
62	Exhaust Pressure Control Active
63	Exhaust Pressure PID In Control
64	Remote Exhaust Pressure SP Enabled
65	Remote Exhaust Pressure SP Active
66	Priority Selected
67	Alternate Mode Enabled
68	Controlling on Steam Map Limiter
69	Priority Active
70	Extr/Adm Input Failed
71	Inlet Pressure Input Failed
72	Exhaust Pressure Input Failed
73	Zero Speed Detected
74	Spare_74
75	Spare_75

Menu #	MSG_
76	Spare_76
77	Spare_77
78	Spare_78
79	Spare_79
80	Spare__80

Table 2-17. Relay Output Level Switch Function List

Relay Level Switch Menu

Menu #	MSG_
1	--- Not Used ---
2	Actual Speed
3	Speed Setpoint
4	KW Input
5	Sync/Load Share Input
6	Cascade Input
7	Cascade Setpoint
8	Auxiliary Input
9	Auxiliary Setpoint
10	Spare 10
11	Spare 11
12	HP Valve Limiter
13	LSS Value
14	HP Valve Demand Output
15	HP2 Valve Demand Output
16	Inlet Pressure
17	Exhaust Pressure
18	Customer Defined Monitor Input #1
19	Customer Defined Monitor Input #2
20	Customer Defined Monitor Input #3
21	LP Valve Limiter
22	LP Valve Demand
23	Speed/Load Demand (S Demand)
24	Extr/Adm Input
25	Extr/Adm Setpoint
26	Ext/Adm Demand (P Demand)
27	Inlet Pressure Setpoint
28	Inlet Pressure Demand (Q Demand)
29	Exhaust Pressure Setpoint
30	Exhaust Pressure Demand (R Demand)
31	Spare_31
32	Spare_32
33	Spare_33
34	Spare_34
35	Spare_35

Actuator Driver Function List **Menu List**

See the Actuator Drivers section in this chapter for details on the available channels for the following functions. Actuator functions are configured in the Driver Configuration Menu. The menu does not chose a function based on the channel configuration like the other IO channels. For Drivers, the channel is chosen for the function.

Table 2-18. Actuator Driver Function List

Menu #	MSG_
1	---Not Used---
2	HP Valve Demand
3	HP Dual Coil A Vlv Dmd
4	HP Dual Coil B Vlv Dmd
5	HP Redund Act A Vlv Dmd
6	HP Redund Act B Vlv Dmd
7	LP Valve Demand
8	LP Dual Coil A Vlv Dmd
9	LP Dual Coil B Vlv Dmd
10	LP Redund Act A Vlv Dmd
11	LP Redund Act B Vlv Dmd
12	HP2 Valve Demand
13	LP2 Valve Demand
14	Isolated PID Dmd Output
15	Spare_15

Configuration Error Messages

When using the 505DR, the Configuration Error Message list in Volume 1 of this manual is replaced with the following list.

Table 2-19. Configuration Error Messages

Event ID	Description	Error Meaning
1	Duplicate Contact Input Channel	Two contact inputs were programmed for the same function.
2	Contact Input Error	Should never appear (always FALSE) since Contact Input 01 is hard coded as a trip input.
3	Contact Input 02 Error	The specified contact input was configured for a function that is not configured as used. Either the contact input was mis-configured or the function required is mis-configured. For example, contact input #1 is programmed for Remote Cascade Set Point Enable but Remote Cascade Set Point was not programmed under the Cascade configure menu.
4	Contact Input 03 Error	See "Contact Input 02 Error".
5	Contact Input 04 Error	See "Contact Input 02 Error".
6	Contact Input 05 Error	See "Contact Input 02 Error".
7	Contact Input 06 Error	See "Contact Input 02 Error".
8	Contact Input 07 Error	See "Contact Input 02 Error".
9	Contact Input 08 Error	See "Contact Input 02 Error".
10	Contact Input 09 Error	See "Contact Input 02 Error".
11	Contact Input 10 Error	See "Contact Input 02 Error".

Event ID	Description	Error Meaning
12	Contact Input 11 Error	See "Contact Input 02 Error".
13	Contact Input 12 Error	See "Contact Input 02 Error".
14	Contact Input 13 Error	See "Contact Input 02 Error".
15	Contact Input 14 Error	See "Contact Input 02 Error".
16	Contact Input 15 Error	See "Contact Input 02 Error".
17	Contact Input 16 Error	See "Contact Input 02 Error".
18	Contact Input 17 Error	See "Contact Input 02 Error".
19	Contact Input 18 Error	See "Contact Input 02 Error".
20	Contact Input 19 Error	See "Contact Input 02 Error".
21	Contact Input 20 Error	See "Contact Input 02 Error".
22	Duplicate Analog Input Channel	Two analog inputs were programmed for the same function.
23	Analog Input 01 Error	The specified analog input was configured for a function that is not configured as used. Either the analog input was mis-configured or the function required is mis-configured. For example, analog input #1 is programmed for Remote Cascade Set Point but Remote Cascade Set Point was not configured under the Cascade configuration menu.
24	Analog Input 02 Error	See "Analog Input 01 Error".
25	Analog Input 03 Error	See "Analog Input 01 Error".
26	Analog Input 04 Error	See "Analog Input 01 Error".
27	Analog Input 05 Error	See "Analog Input 01 Error".
28	Analog Input 06 Error	See "Analog Input 01 Error".
29	Analog Input 07 Error	See "Analog Input 01 Error".
30	Analog Input 08 Error	See "Analog Input 01 Error".
31	Relay 01 Error	The specified relay was programmed for a function that is not configured as used. Either the relay was mis-configured or the function required is mis-programmed. For example, relay #1 is configured for Remote Cascade Set Point Enabled but Remote Cascade Set Point was not configured under the Cascade configure menu.
32	Relay 02 Error	See "Relay 01 Error".
33	Relay 03 Error	See "Relay 01 Error".
34	Relay 04 Error	See "Relay 01 Error".
35	Relay 05 Error	See "Relay 01 Error".
36	Relay 06 Error	See "Relay 01 Error".
37	Relay 07 Error	See "Relay 01 Error".
38	Relay 08 Error	See "Relay 01 Error".
39	Analog Output 01 Error	The specified readout was configured for a function that is not configured as used. Either the readout was mis-configured or the function required is mis-configured. For example, readout #1 is configured for Cascade Set Point but Cascade Control was not configured under the Cascade configure menu.
40	Analog Output 02 Error	See "Analog Output 01 Error".
41	Analog Output 03 Error	See "Analog Output 01 Error".
42	Analog Output 04 Error	See "Analog Output 01 Error".

Event ID	Description	Error Meaning
43	Analog Output 05 Error	See "Analog Output 01 Error".
44	Analog Output 06 Error	See "Analog Output 01 Error".
45	Duplicate HP Configured	Both actuator channels have been configured for the HP valve functionality. This function is only allowed on one channel.
46	Duplicate HP2 Configured	Both actuator channels have been configured for the HP2 valve functionality. This function is only allowed on one channel.
47	Duplicate LP Configured	There is more than 1 selection for the LP valve demand output
48	Duplicate LP2 Configured	There is more than 1 selection for the LP2 valve demand output
49	HP Driver Selection Error	The Actuator Type (single coil, dual coil, redundant) does not have appropriate driver channels selected.
50	LP Driver Selection Error	The Actuator Type (single coil, dual coil, redundant) does not have appropriate driver channels selected.
51	LP2 Driver Selection Error	The Actuator Type (single coil, dual coil, redundant) does not have appropriate driver channels selected.
52	Two Actuators Config. to One Channel	The same channel (example: Actuator Output 1) has been selected twice for two different functions (HP, LP) on the Driver Configuration Menu
53	Spare 53	
54	Spare 54	
55	Spare 55	
56	Max KW Load > Max KW AI Scale	The KW Max Load setting was programmed at a higher value than the maximum KW input (KW input at 20 mA).
57	Selected KW Source Not Configured	Occurs when a Primary or Secondary kW Signal source has been selected under Operating Parameters but that source is not configured. For example, Primary kW Source is set as 'Analog Input' but no analog input is configured as a kW Input.
58	Auxiliary Configured, No AI	The Auxiliary control function was configured but no Auxiliary analog input was configured.
59	KW AUX Configured, AUX AI Configured	The Auxiliary control function was configured to use the kW analog input but an Auxiliary analog input was configured also. With this configuration, only the kW analog input is used for the Auxiliary controller.
60	Remote AUX Configured, No AI	The Remote Auxiliary set point control function was configured but no Remote Auxiliary set point analog input was configured.
61	Wrong Product Model Detected	The 505DR application is not loaded onto a Production 505DR hardware platform.
62	Alternate Mode Map Error	Steam Performance Map values not entered correctly for Alternate Modes
63	Cascade Configured, No AI	The Cascade control function was programmed but no Cascade analog input was configured.
64	KW CASC Configured,CASC AI Configured	The Cascade control function was configured to use the kW analog input but an Cascade analog input was configured also. With this configuration, only the kW analog input is used for the Cascade controller.
65	Remote Casc Configured, No AI	The Remote Cascade set point control function was configured but no Remote Cascade set point analog input was configured.
66	Inlet Pres CASC Config, CASC AI Config	The Cascade control function was configured to use the Inlet Pressure analog input but an Cascade

Event ID	Description	Error Meaning
		analog input was configured also. With this configuration, only the Inlet Pressure analog input is used for the Cascade controller.
67	Exhst Pres CASC Config, CASC AI Config	The Cascade control function was configured to use the Exhaust Pressure analog input but an Cascade analog input was configured also. With this configuration, only the Exhaust Pressure analog input is used for the Cascade controller.
68	Exhaust Pres CASC Config, No AI	The Cascade control function was configured to use the Exhaust Pressure analog input but no AI is configured to be the Exhaust Pressure input
69	Remote Speed Configured, No AI	The remote speed set point control function was configured but no remote speed set point analog input was configured.
70	Feed Forward Programmed, No AI	The Feed Forward function was configured but no Feed Forward analog input is configured.
71	Sync and Sync/Load Share Configured	Both the synchronizing analog input and the sync/load share or load share analog inputs are configured. If the application needs to perform both synchronizing and load sharing with analog signals, only the sync/load sharing analog input needs to be configured.
72	Load Share and Frequency Arm Cnfg	Both the frequency arm/disarm function and the load share control functions are configured. Only one of these modes can be programmed — either freq arm/disarm OR Load Sharing.
73	Generator Application, No Tie Breaker	The unit is configured for a generator application but no utility tie breaker contact input is configured. This is a requirement.
74	Generator Application, No Gen Breaker	The unit is configured for a generator application but no generator breaker contact input is configured. This is a requirement.
75	Idle 1 in Critical Band	Either the Idle speed set point (when using Idle/Rated) or the Idle 1 set point (when using the Automatic Start sequence) is configured within a critical speed avoidance band.
76	Idle 2 in Critical Band	The Idle 2 speed set point (when using the Automatic Start sequence) is configured within a critical speed avoidance band.
77	Idle 3 in Critrical Band	The Idle 3 speed set point (when using the Automatic Start sequence) is configured within a critical speed avoidance band.
78	Min Control Speed < Failed Speed Level	Either the Idle speed set point (when using Idle/Rated) or the Idle 1 set point (when using the Automatic Start sequence) is configured lower than the Failed Speed Level for speed input 1 or 2.
79	Idle 1 Setpoint > Minimum Governor	The Idle Speed setpoint is configured at a higher speed than the minimum governor speed setpoint.
80	Idle 2 Setpoint > Minimum Governor	The Idle Speed setpoint is configured at a higher speed than the minimum governor speed setpoint.
81	Idle 3 Setpoint > Minimum Governor	The Idle Speed setpoint is configured at a higher speed than the minimum governor speed setpoint.
82	Idle 1 > Idle 2	The Idle 1 speed setpoint is configured at a higher speed than the Idle 2 speed setpoint.
83	Idle 2 > Idle 3	The Idle 2 speed setpoint is configured at a higher speed than the Idle 3 speed setpoint.
84	Rate to Idle 2 Error	The Cold Rate to Idle 2 (rpm/second) is configured at a higher rate than the Hot Rate to Idle 2. Or the Warm Rate to Idle 2 (if used) is configured at a higher rate than the Hot Rate to Idle 2.

Event ID	Description	Error Meaning
85	Rate to Idle 3 Error	The Cold Rate to Idle 3 (rpm/second) is configured at a higher rate than the Hot Rate to Idle 3. Or the Warm Rate to Idle 3 (if used) is configured at a higher rate than the Hot Rate to Idle 3.
86	Rate to Rated Error	The Cold Rate to Rated (rpm/second) is configured at a higher rate than the Hot Rate to Rated. Or the Warm Rate to Rated (if used) is configured at a higher rate than the Hot Rate to Rated.
87	Critical Band Rate < Slow Rate	The acceleration rate (rpm/second) through the critical speed avoidance band must be faster than the normal speed set point rate.
88	Critical Speeds Enabled, No Idle	A critical speed avoidance band is configured but neither idle/rated nor auto start sequence is configured. To use the critical speed avoidance logic one of these functions that uses an idle speed must be programmed.
89	Critical Band Below 1st Idle Setpoint	A critical speed avoidance band is configured below either the Idle speed set point (when using Idle/Rated) or the Idle 1 set point (when using the Automatic Start sequence).
90	Critical Band > Minimum Governor	A critical speed avoidance band is configured higher than the Minimum Governor speed level.
91	Critical Band Min > Max	A critical speed avoidance band minimum limit is configured higher than the maximum limit of that band.
92	Minimum Governor > Maximum Governor	The Minimum Governor speed level is configured higher than the Maximum Governor speed level.
93	Rated Speed SP < Min Gov	The Rated speed set point is configured at a lower speed than the Minimum Governor speed set point.
94	Rated Speed SP > Max Gov	The Rated speed set point is configured at a higher speed than the Maximum Governor speed set point.
95	Max Gov > Overspeed Test Limit	The Maximum Governor speed level is configured greater than the Overspeed Test Limit.
96	Overspeed Trip > Overspeed Test SP	The Overspeed Trip setpoint is greater than the Overspeed Test Limit.
97	Overspeed Test Limit > Maximum Speed	The Overspeed Test Limit is configured greater than the Maximum Speed Level for speed input 1 or 2 (if used).
98	Maximum Speed > Probe 1 Freq Range	The maximum speed input is 35000 hertz. This is a limitation of the 505's hardware/speed sensing circuitry. The frequency input of the speed sensor must be less than this value. The gear the speed sensor is mounted on may need to be changed to one with less teeth, this will decrease the frequency seen by the speed probes. The Maximum Speed Level for Speed Input Channel 1, converted to frequency (Hz), is greater than 35000 Hz.
99	Maximum Speed > Probe 2 Freq Range	The maximum speed input is 35000 hertz. This is a limitation of the 505's hardware/speed sensing circuitry. The frequency input of the speed sensor must be less than this value. The gear the speed sensor is mounted on may need to be changed to one with less teeth, this will decrease the frequency seen by the speed probes. The Maximum Speed Level for Speed Input Channel 2, converted to frequency (Hz), is greater than 35000 Hz.
100	Speed Sensor #1 Failed < Freq Range	The failed speed setting for speed input #1 is below the minimum allowed setting. The minimum allowed setting is calculated as follows: (Maximum Speed Level) * (0.0204).

Event ID	Description	Error Meaning
101	Speed Sensor #2 Failed < Freq Range	The failed speed setting for speed input #2 is below the minimum allowed setting. The minimum allowed setting is calculated as follows: (Maximum Speed Level) * (0.0204).
102	No Start Mode Configured	No start mode is selected in the Configure mode. One of the three start modes must be selected in the Configure mode under the Start menu.
103	Remote KW Setpoint Configured, No AI	The Remote kW Setpoint is configured as used but no analog input is configured as a Remote kW Setpoint.
104	Remote Speed and KW Setpoint	Both Remote Speed Setpoint and Remote kW Setpoints are configured as used. Only one of these inputs may be configured.
105	Hot Start greater than Cold Start	The time configured for a Hot Start is greater than the Cold Start. The time remaining after shutdown for a Hot Start must be less than the time for a Cold Start.
106	Hot Reset Level Error	Hot Reset Timer Level is greater than the Maximum Governor speed level or less than the Minimum Governor speed level. The Hot Reset Timer Level must be between Minimum and Maximum Governor.
107	Temperature 1 or 2 used, no AI	A Start Temperature function is configured but no Analog Input is configured as a temperature input.
108	Cascade Speed Limit Error	The Cascade minimum speed limit is configured less than Minimum Governor, the Cascade maximum speed limit is configured greater than Maximum Governor, or the Cascade minimum speed limit is greater than the Cascade maximum speed limit.
109	KW Signal Source Not Selected	A controller has been configured to use a kW input but no Primary or Secondary Signal source has been selected under Operating Parameters.
110	SYNC Signal Source Not Selected	A controller has been configured to use a Synchronization input but no Primary or Secondary Signal source has been selected under Operating Parameters.
111	SYNC LS Signal Source Not Selected	A controller has been configured to use a Synchronization/Load Sharing input but no Primary or Secondary Signal source has been selected under Operating Parameters.
112	Isolated Process Control Error	An analog input for the process value and/or an analog output for the PID demand have not been configured.
113	Selected SYNC Source Not Configured	Occurs when a Primary or Secondary Synchronization Signal source has been selected under Operating Parameters but that source is not configured. For example, Primary Synchronization Source is set as 'Analog Input' but no analog input is configured as a Synchronization Input.
114	Selected SYNC LS Source Not Configured	Occurs when a Primary or Secondary Synchronization/Load Sharing Signal source has been selected under Operating Parameters but that source is not configured. For example, Primary Synchronization/Load Sharing Source is set as

Event ID	Description	Error Meaning
		'Analog Input' but no analog input is configured as a Synchronization/Load Sharing Input.
115	Duplicate Node IDs on CAN3 Network	Multiple nodes on the CAN3 network have the same Node ID. Node IDs on the same network must be unique.
116	Remote KW SP Selected, Not Genset	The unit is not a generator unit but the Remote kW Setpoint is selected.
117	Generator Load Casc Input. Not Genset.	The unit is not a generator unit but the CASC control is trying to use Generator Load
118	Generator Load Aux Input. Not Genset.	The unit is not a generator unit but the AUX control is trying to use Generator Load
119	Map Entry Values Incorrect	Steam Performance Map values not entered correctly
120	Inlet AI for both CASC and INL Cntrl	The Inlet AI is programmed for both Cascade and Inlet Control
121	Exhaust AI for both CASC and EXH Cntrl	The Exhaust AI is programmed for both Cascade and Exhaust Control
122	Extraction Configured, No AI	Configured to use Extraction control but no Ext/Adm AI is programmed
123	Inlet Configured, No AI	Configured to use Inlet control but no Inlet AI is programmed
124	Exhaust Configured, No AI	Configured to use Exhaust control but no Exhaust AI is programmed
125	Remote Extraction Configured, No AI	Programmed to use a remote Extraction setpoint, but no AI for this function is configured
126	Remote Inlet Configured, No AI	Programmed to use a remote Inlet setpoint, but no AI for this function is configured
127	Remote Exhaust Configured, No AI	Programmed to use a remote Exhaust setpoint, but no AI for this function is configured
128	RTCNet Node 21 Analog Input 01 Error	See "Analog Input 01 Error".
129	RTCNet Node 21 Analog Input 02 Error	See "Analog Input 01 Error".
130	RTCNet Node 21 Analog Input 03 Error	See "Analog Input 01 Error".
131	RTCNet Node 21 Analog Input 04 Error	See "Analog Input 01 Error".
132	RTCNet Node 21 Analog Input 05 Error	See "Analog Input 01 Error".
133	RTCNet Node 21 Analog Input 06 Error	See "Analog Input 01 Error".
134	RTCNet Node 21 Analog Input 07 Error	See "Analog Input 01 Error".
135	RTCNet Node 21 Analog Input 08 Error	See "Analog Input 01 Error".
136	RTCNet Node 22 Analog Input 01 Error	See "Analog Input 01 Error".
137	RTCNet Node 22 Analog Input 02 Error	See "Analog Input 01 Error".
138	RTCNet Node 22 Analog Input 03 Error	See "Analog Input 01 Error".
139	RTCNet Node 22 Analog Input 04 Error	See "Analog Input 01 Error".
140	RTCNet Node 22 Analog Input 05 Error	See "Analog Input 01 Error".
141	RTCNet Node 22 Analog Input 06 Error	See "Analog Input 01 Error".
142	RTCNet Node 22 Analog Input 07 Error	See "Analog Input 01 Error".

Event ID	Description	Error Meaning
143	RTCNet Node 22 Analog Input 08 Error	See "Analog Input 01 Error".
144	RTCNet Node 26 Analog Input 01 Error	See "Analog Input 01 Error".
145	RTCNet Node 26 Analog Input 02 Error	See "Analog Input 01 Error".
146	RTCNet Node 26 Analog Input 03 Error	See "Analog Input 01 Error".
147	RTCNet Node 26 Analog Input 04 Error	See "Analog Input 01 Error".
148	RTCNet Node 26 Analog Input 05 Error	See "Analog Input 01 Error".
149	RTCNet Node 26 Analog Input 06 Error	See "Analog Input 01 Error".
150	RTCNet Node 26 Analog Input 07 Error	See "Analog Input 01 Error".
151	RTCNet Node 26 Analog Input 08 Error	See "Analog Input 01 Error".
152	RTCNet Node 24 Boolean Input 01 Error	See "Contact Input 02 Error".
153	RTCNet Node 24 Boolean Input 02 Error	See "Contact Input 02 Error".
154	RTCNet Node 24 Boolean Input 03 Error	See "Contact Input 02 Error".
155	RTCNet Node 24 Boolean Input 04 Error	See "Contact Input 02 Error".
156	RTCNet Node 24 Boolean Input 05 Error	See "Contact Input 02 Error".
157	RTCNet Node 24 Boolean Input 06 Error	See "Contact Input 02 Error".
158	RTCNet Node 24 Boolean Input 07 Error	See "Contact Input 02 Error".
159	RTCNet Node 24 Boolean Input 08 Error	See "Contact Input 02 Error".
160	RTCNet Node 24 Boolean Input 09 Error	See "Contact Input 02 Error".
161	RTCNet Node 24 Boolean Input 10 Error	See "Contact Input 02 Error".
162	RTCNet Node 24 Boolean Input 11 Error	See "Contact Input 02 Error".
163	RTCNet Node 24 Boolean Input 12 Error	See "Contact Input 02 Error".
164	RTCNet Node 24 Boolean Input 13 Error	See "Contact Input 02 Error".
165	RTCNet Node 24 Boolean Input 14 Error	See "Contact Input 02 Error".
166	RTCNet Node 24 Boolean Input 15 Error	See "Contact Input 02 Error".
167	RTCNet Node 24 Boolean Input 16 Error	See "Contact Input 02 Error".
168	RTCNet Node 25 Relay Error 01	See "Relay 01 Error".
169	RTCNet Node 25 Relay Error 02	See "Relay 01 Error".
170	RTCNet Node 25 Relay Error 03	See "Relay 01 Error".
171	RTCNet Node 25 Relay Error 04	See "Relay 01 Error".
172	RTCNet Node 25 Relay Error 05	See "Relay 01 Error".
173	RTCNet Node 25 Relay Error 06	See "Relay 01 Error".
174	RTCNet Node 25 Relay Error 07	See "Relay 01 Error".

Event ID	Description	Error Meaning
175	RTCNet Node 25 Relay Error 08	See "Relay 01 Error".
176	RTCNet Node 25 Relay Error 09	See "Relay 01 Error".
177	RTCNet Node 25 Relay Error 10	See "Relay 01 Error".
178	RTCNet Node 25 Relay Error 11	See "Relay 01 Error".
179	RTCNet Node 25 Relay Error 12	See "Relay 01 Error".
180	RTCNet Node 25 Relay Error 13	See "Relay 01 Error".
181	RTCNet Node 25 Relay Error 14	See "Relay 01 Error".
182	RTCNet Node 25 Relay Error 15	See "Relay 01 Error".
183	RTCNet Node 25 Relay Error 16	See "Relay 01 Error".
184	RTCNet Node 21 AO 1 Error	See "Analog Output 01 Error".
185	RTCNet Node 21 AO 2 Error	See "Analog Output 01 Error".
186	RTCNet Node 22 AO 1 Error	See "Analog Output 01 Error".
187	RTCNet Node 22 AO 2 Error	See "Analog Output 01 Error".
188	RTCNet Node 26 AO 1 Error	See "Analog Output 01 Error".
189	RTCNet Node 26 AO 2 Error	See "Analog Output 01 Error".
190	RTCNet Node 26 Used Error	CAN#2 Network not enabled, but RTCNode Configured
191	RTCNet Node 21 Used Error	CAN#2 Network not enabled, but RTCNode Configured
192	RTCNet Node 22 Used Error	CAN#2 Network not enabled, but RTCNode Configured
193	Activate CAN1 Digital Drvr Network	Digital Driver Selected but CAN#1 network not enabled.
194	No Drivers on CAN1	CAN#1 Network enabled, but no drivers have been configured.

Service Menu

The 505DR Service Menu should be adjusted for the application as described in Volume 1 and Volume 2 of this manual, 35018. The same Service Menu options of the simplex 505XT apply to the 505DR redundant application as well.

Some Configuration Menu settings within the AutoStart Sequence ramp rates are made available online for adjustment. These settings are contained within the Configuration Menu. The following Rates are available within the Configuration Menu for online adjustment:

- **Rate To Min (rps/s)**
- **Cold/Hot Rates to Idle 1/2/3 (rpm/s)**
- **Cold Rate to Rated (rpm/s)**
- **Hot Rate to Rated (rpm/s)**

For redundancy, the following Service options are added:

Alarms

Use RemoteView Audible Alarms? dflt= NO
(Yes/No)

Select YES to enable RemoteView to send an audible alarm and trip sound through your PC speakers for each new event. This provides an audible sound to alert remote operators of new alarm or trip conditions. Once checked, the Sound option in the RemoteView settings window needs to also be enabled.

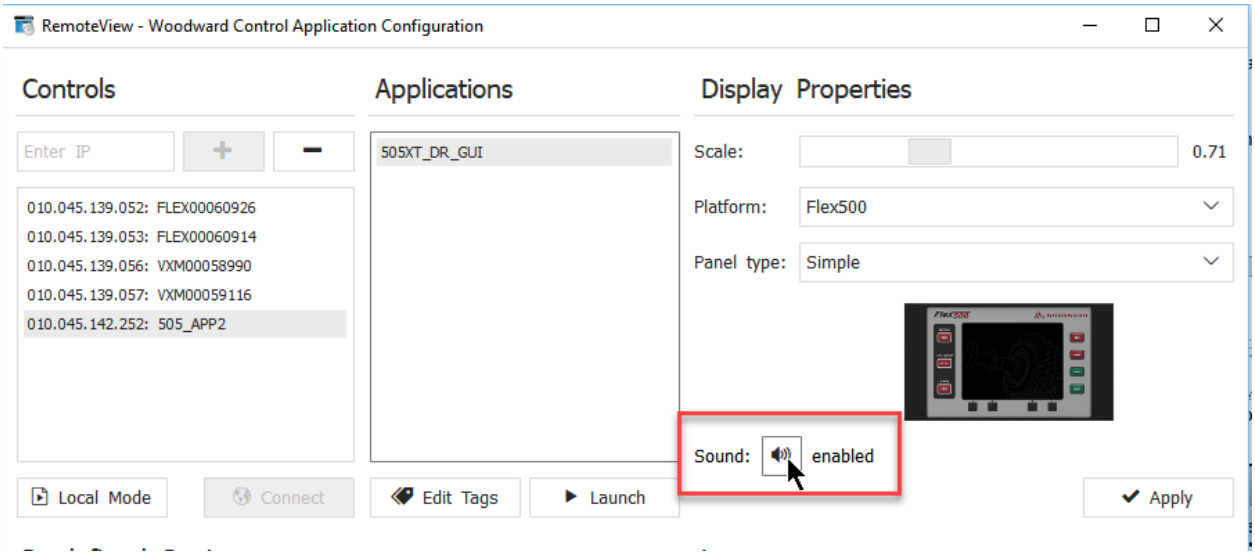

Figure 2-20. Sound Enablement on RemoteView Screen

Calibration

Calibration of the Actuator Outputs, Analog Outputs and Analog Inputs should be done following the instructions in Volume 1 of this manual. The SYSCON and BACKUP units will keep all settings in-sync, such that calibration values are automatically set in both units. The I/O channel functions are identical between the Primary and Secondary units such that the same calibration is used in both units.

The background for all pages will turn orange to indicate that Calibration Mode is enabled.

For Dual Coil actuators, there is a “SD Coil?” checkbox on the channel calibration page. When checked the output current will be driven to 0.00mA. This allows each coil to be stroked independently. For example, to calibrate Coil A, the SD Coil for Coil B should be checked. Once Coil A is calibrated, the SD Coil for Coil A should be checked and removed from Coil B so that it can then be calibrated. The SD Coil option is automatically removed once calibration is exited.

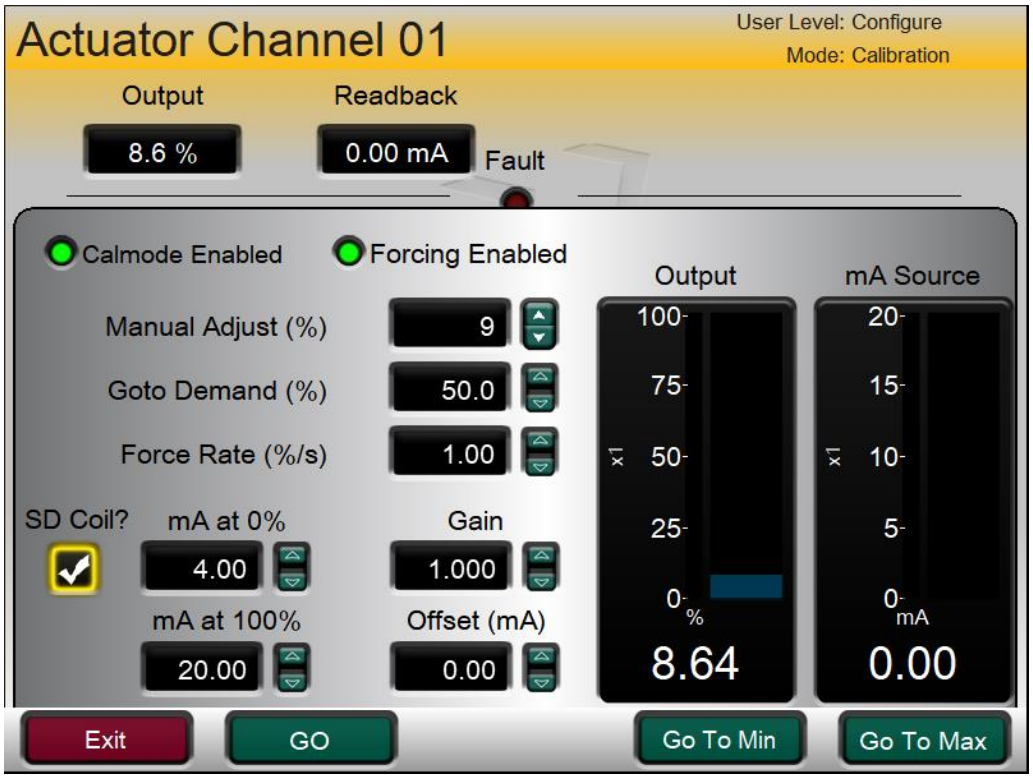

Figure 2-21. Channel Calibration Page

Chapter 3.
Redundant Operation

This chapter will detail how the SYSCON and BACKUP units' function, the failover performance of a SYSCON transfer, and document any lists (Alarm, Trip, Modbus) that have changed in the redundant version of the 505XT control. For details on turbine operation using the 505DR, please refer to Chapter 5 of Volume 1 in this manual, as the turbine operation is identical to the 505XT simplex model.

Initializing a Redundant System

Before powering up the 505DR units for the first time, it is important to verify that the two units are properly setup for redundancy. The following checks should be made:

- Must use the correct 505DR part numbers identified in Chapter 1 of this manual, 35018V3.
- Must set DIP switches on top of controller to configure one as the Primary unit
- Must set DIP switches on top of controller to configure the other one as the Secondary unit
- Must use a CAT5 or 6 Ethernet cable and make a direct connection between ETHERNET port 4 of each controller
- Must wire DI 24vdc power of each controller to the COM terminal of Relay #8 of the other controller and wire the NO terminal of Relay #8 back to DI #20 (if using the FTM, verify all harnesses are properly connected)

The determination of the Primary and Secondary units is arbitrary. The designation allows the system to specify each unit individually. In a healthy system, the Primary will bootup as the SYSCON controller.

When power is first applied, the units will begin their boot sequence. When the Operating System has initialized, the GAP control software will be started, and the units will verify that they can successfully communicate to each other over the Ethernet 4 communication link and discrete CrissCross, about 1 minute after power up. Once the IOLOCK LED is off, the units are synchronized and ready to run the system as a redundant pair.

Booting with Ethernet 4 Link or CrissCross Faults

If the system is booted up with an error in the Ethernet 4 link or Discrete CrissCross the units will not be able to correctly communicate. They will initialize the application but hold the controllers in IOLOCK.

1) Ethernet 4 link NOT connected
   Both the Primary and Secondary units will bootup in the Wait-Run Permissive state. See the "Run Alone" section for more information.

   If the Ethernet 4 link is repaired, once the Primary unit has removed the Wait-Run Permissive, a "Reset Backup" command from the DR Redundancy Overview screen will re-sync the units.

2) Discrete CrissCross NOT connected
   The Primary unit will bootup in the Wait-Run Permissive state and the Secondary unit will become Inactive.

   If the Discrete CrissCross is repaired, once the Primary unit has removed the Wait-Run Permissive, a "Reset Backup" command from the DR Redundancy Overview screen will re-sync the units.

3) Ethernet 4 link and Discrete CrissCross NOT connected
   Both the Primary and Secondary units will bootup in the Wait-Run Permissive state. See the "Run Alone" section for more information.

   If the Ethernet 4 link and Discrete CrissCross are repaired, once the Primary unit has removed the Wait-Run Permissive, a "Reset Backup" command from the DR Redundancy Overview screen will re-sync the units.

Run-Alone Command

When a unit is powered on with a fault on the Ethernet 4 and discrete CrissCross it will initialize into the Wait-Run Perm state and hold IOLOCK. This state will occur for both the Primary and Secondary units. See the System Diagnostics section for details on the Redundancy Overview GUI screen.

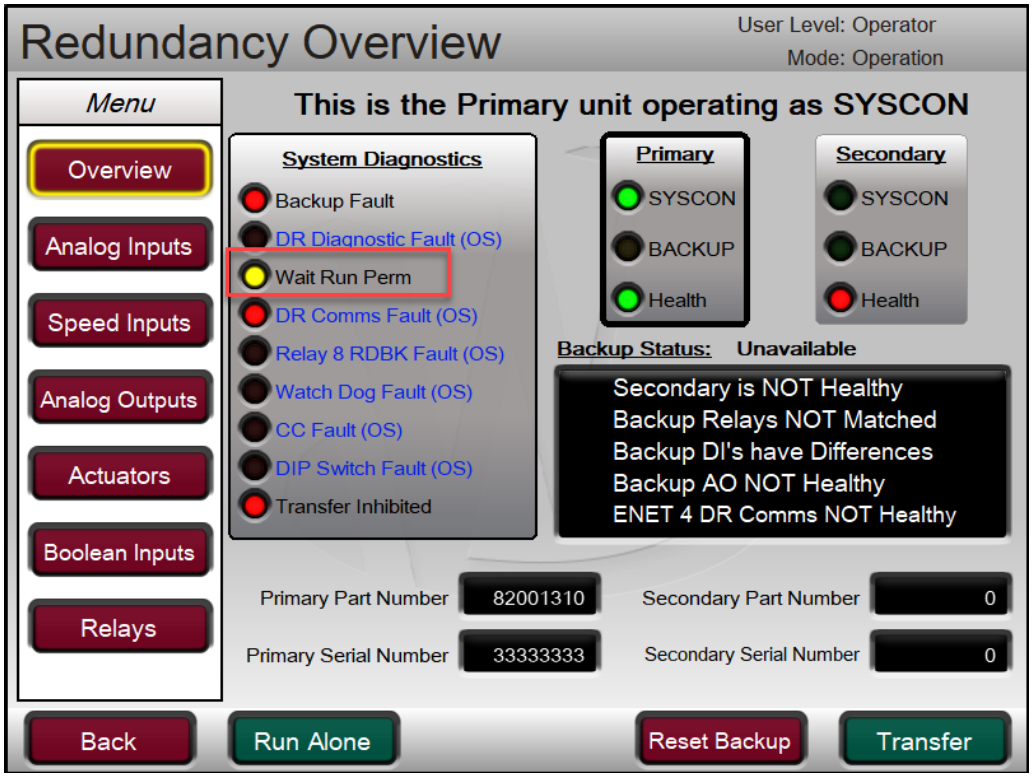

Figure 3-1. Wait Run Permissive Screen

The purpose of the Wait Run Permissive is to prevent a situation in which a unit powers on with the Ethernet 4 or discrete CrissCross communications disconnected and becomes a second SYSCON within the system. By holding IOLOCK and the Wait Run Permissive, the unit waits for the operator to confirm that it is the only controller currently in the system before removing IOLOCK and becoming SYSCON in the system.

The Run Alone command will remove IOLOCK and that unit will become the SYSCON controller. This allows a redundant system to be run from a single controller until the other unit is synced into the running unit, restoring redundancy. See the “Syncing into a Running Unit” section.

The system will have a constant alarm condition and messaging of the failed backup unit and its I/O channels. If the plan is to operate like this for an extended period of time, read the notice below.

NOTICE

Operation with alarm conditions

If the control is to be in operation for an extended period of time with alarms present, it may be helpful to adjust the “Blink upon new Alarm” setting. Checking this box will instruct the control to ‘blink’ (flash 1 second on/off) the alarm indication (both LED and summary relay output) whenever a new alarm occurs. When an alarm reset command is entered the blinking will stop.
This is found in the Service Menu / Alarms screen.

System Diagnostics

The Redundancy Overview page can be reached from the Home screen of a configured unit or the Configuration Menu of a unit at factory defaults.

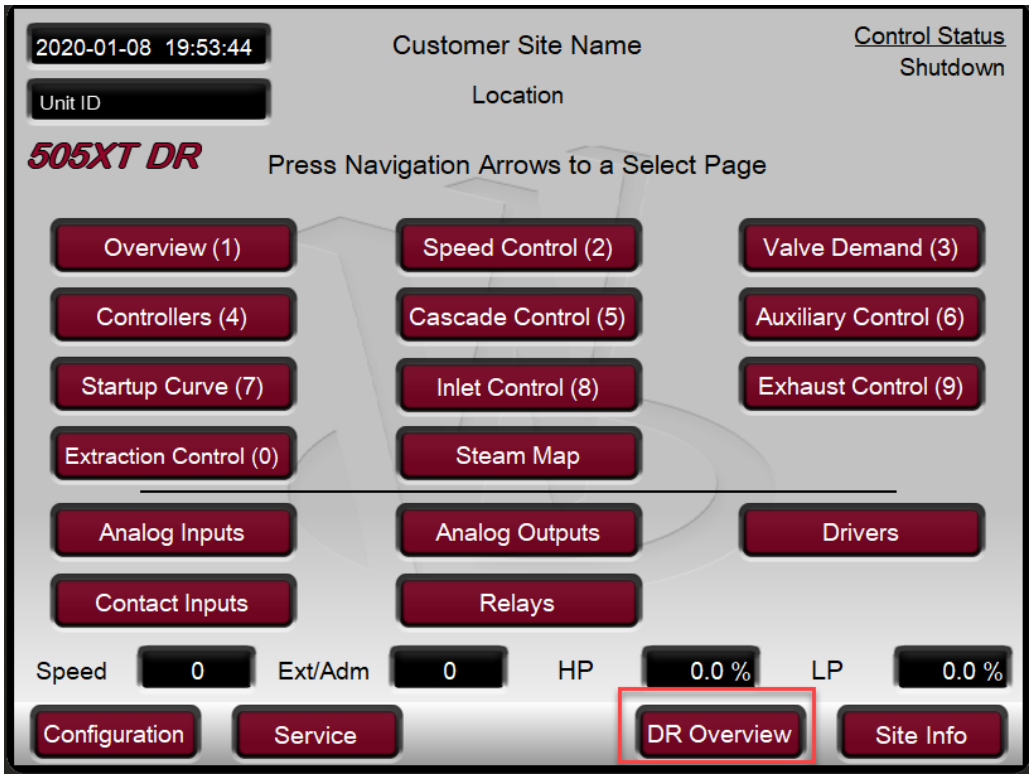

Figure 3-2. Navigating to the DR Overview Screen

The Redundancy Overview page provides system diagnostic indications as well as information about the SYSCON and BACKUP unit statuses. The message at the top of the Redundancy Overview screen indicates if the unit being viewed is the Primary or Secondary unit, and whether or not that unit is currently the SYSCON or BACKUP.

Example: “This is the Primary unit operating as SYSCON”
Or
“This is the Secondary unit operating as BACKUP”
Or
“This is the Primary unit operating as BACKUP”
Or
“This is the Secondary unit operating as SYSCON”

The LEDs next to the diagnostic message will illuminate when a system error is detected.

Table 3-1. System Diagnostic Descriptions

LED	Description
Backup Fault	The health of the backup is bad for any reason.
DR Diagnostic Fault (OS)	An error has been detected during the startup of a Dual-Redundant system. At startup the Primary and Secondary units go through a handshaking process where the Primary unit requests a failover while the Secondary unit waits to become the Syscon. The Secondary unit then requests a failover and the Primary waits to become the Syscon. This process is repeated 3 times. If this test fails for any reason this output is set to TRUE. If this output is TRUE it usually indicates there is a problem with the crisscross connections between the two DR units. Once the output is set TRUE it will remain TRUE until the problem is addressed and the unit's application is restarted.
Wait Run Perm	The DR Diagnostic Fault is TRUE and the unit has not been given a Run Alone command. The I/O lock not allowed to release while in this state. This indicates a DR diagnostic test failed and the unit is waiting for permission to run alone.
DR Comms Fault (OS)	The DR Ethernet communication fails on port 4 between the Primary and Secondary units. This can occur when the Ethernet cable is broken or disconnected, when the DIP switch settings are incorrect (e.g both set as Primary unit), or if the other unit is not running a GAP application. This output is non-latching and always reflects the current status of DR Ethernet communications. This output may go FALSE if the backup unit is re-synced.
Relay 8 RDBK Fault (OS)	An error occurred on the CrissCross Discrete Output #8 (Relay #8) readback circuit. This is only checked at application startup and indicates a hardware failure that is usually caused by an open relay coil. Once detected the output will remain TRUE until the problem is addressed and the unit's application is restarted.
Watch Dog Fault (OS)	This output is TRUE when the microprocessor fails to service the FPGA watchdog within a prescribed time after the MFT (system software tick). This can be caused by unexpected software delays, microprocessor exceptions, or hardware failures. This output will remain set to TRUE until the unit's application is restarted.
CC Fault (OS)	This output is TRUE when a diagnostic test fails that indicates a problem with the crisscross connections. This can happen if the connection between Relay #8 and Discrete Input #20 is miswired, disconnected, or if a hardware failure occurs. This output is non-latching and will only remain TRUE as long as there is a mismatch between both units health status.
Transfer Inhibited	An OS or I/O fault is inhibiting a SYSCON transfer to the BACKUP unit.

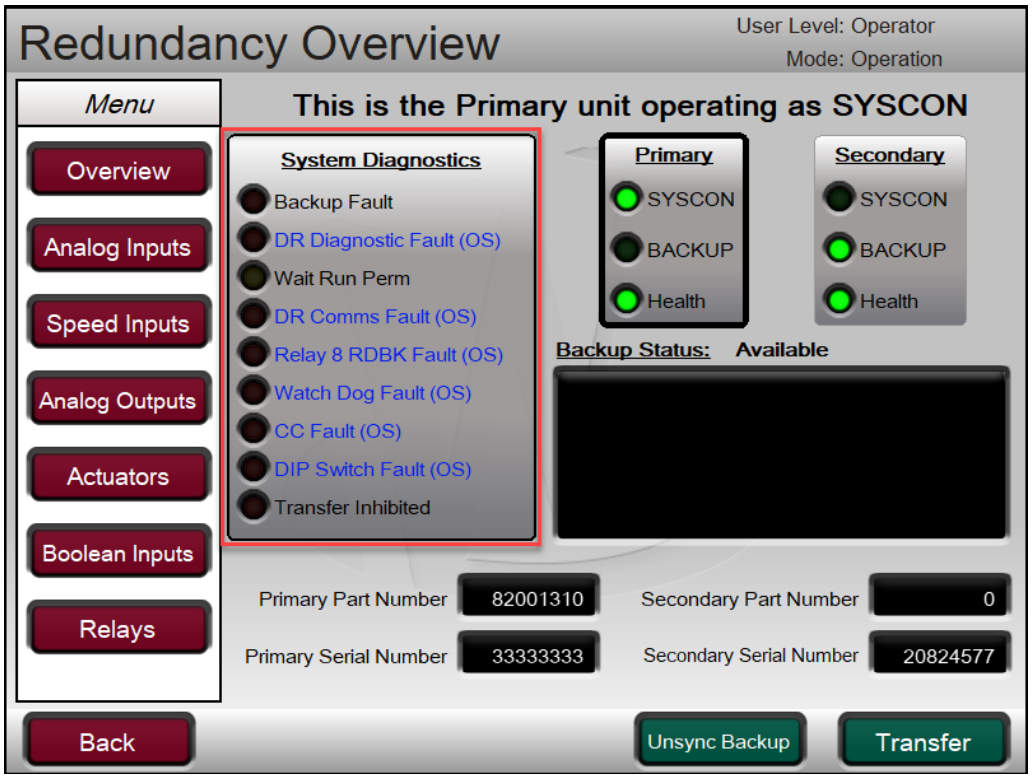

Figure 3-3. System Diagnostics Screen

The SYSCON Unit

The SYSCON unit is the system controller. It controls all aspects of the turbine control processing its own local I/O. All control states of the SYSCON are communicated to the BACKUP unit over the Ethernet 4 communication link such that the SYSCON keeps the BACKUP unit completely in sync. On a SYSCON transfer, the BACKUP unit becomes the new SYSCON in the exact same state of the previous SYSCON so that control can resume with no disturbance to the system or control state.

The Redundancy Overview screen shows which unit, Primary or Secondary, is currently the SYSCON as well as the state and availability of the BACKUP unit to become SYSCON.

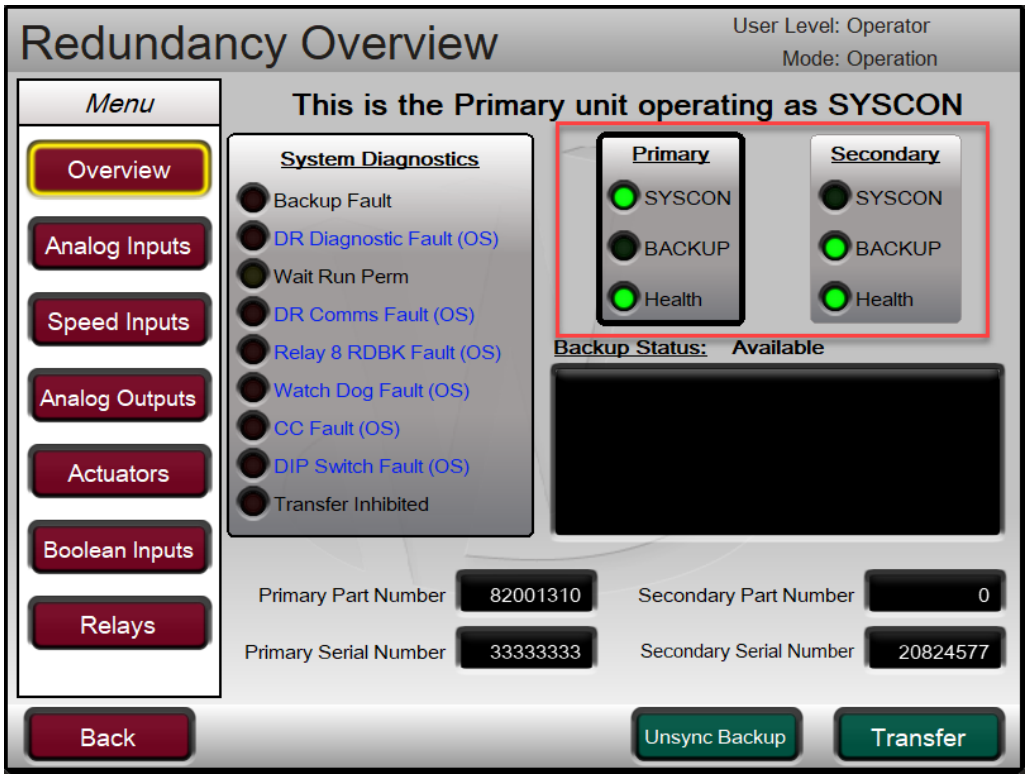

Figure 3-4. Primary/Secondary SYSCON/BACKUP Indications

The bold border of the Primary and Secondary status boxes indicates which unit is currently being viewed. The LEDs have the following colors and meanings.

Table 3-2. Primary/Secondary SYSCON/BACKUP Status Descriptions

Label	Color	Description
SYSCON	Green	The unit is currently operating as the SYSCON
	Off	The unit is NOT currently operating as the SYSCON
BACKUP	Green	The unit is currently the BACKUP
	Amber	The unit is currently the BACKUP but is inhibited from becoming the SYSCON
	Off	The unit is NOT currently operating as the BACKUP
Health	Green	The health of the unit is good.
	Red	The control application of the unit is stopped or cannot be communicated with.

On the front panel of the 505DR units, the CPU LED is used to identify the current SYSCON and BACKUP units.

Table 3-3. Front Panel CPU LED SYCON/BACKUP Descriptions

LED	Color	Description
CPU 	Solid Green	The unit is the SYSCON
	Flashing Green	The unit is the BACKUP and is available for a SYSCON transfer
	Flashing Amber	The unit is the BACKUP and is unavailable (inhibited) for a SYSCON transfer

If at any time this CPU LED seems to not be following the above table – there is an LED reset momentary button on the Screen/Key Options page under the Service menu.

Figure 3-5. Front Panel CPU LED SYCON/BACKUP Indication

Ethernet 4 or CrissCross Faults in a Healthy System

When the system is running in a healthy state and a unit-to-unit communication fault occurs, the system will behave as follows:

1. Ethernet 4 link disconnected
   Upon detection of an Ethernet 4 communication link fault, the SYSCON will continue to operate as the SYSCON and the BACKUP unit will go to an inactive state.

   Upon repair of the Ethernet 4 link, a Reset Backup command will resync the units.

2. CrissCross disconnected
   Upon loss of contact input #20 on the SYSCON or the BACKUP, indicating an issue with the CrissCross link, the SYSCON unit will remain the SYSCON and the BACKUP unit will go to an inactive state.

   Upon repair of the CrissCross, a Reset Backup command will resync the units.

SYSCON Transfer Conditions

The SYSCON transfer is automatically initiated on internal unit faults (OS Transfers) or on local I/O faults (Application transfers). Critical transfers are those that would trip a system if the transfer to the BACKUP unit did not occur. The following critical conditions will initiate a SYSCON transfer:

- SYSCON 505XT failure (CPU or internal problem) (OS transfer)
- Loss of power to the SYSCON 505(OS transfer)
- Loss of all speed probes to the SYSCON 505 (Application transfer)
- SYSCON 505XT actuator output failure detected (Application transfer)
- CAN Communication fault (Application transfer)

The first two transfers listed are OS transfers. An OS transfer will always attempt to fail-over to the BACKUP unit as long as the Backup Fault system diagnostic indication is FALSE, even if the BACKUP unit is inhibited by I/O faults. Application transfer events will only fail-over to the BACKUP when the BACKUP is not inhibited by an OS or Application inhibit condition (see The BACKUP Unit section).

Non-critical faults will also initiate a SYSCON transfer. Non-critical faults are those that wouldn't cause the 505DR to trip but will lead to reduced operability if left on the current unit. Non-critical faults do not inhibit the BACKUP unit from becoming the SYSCON in the case of a critical fault condition. Non-critical conditions include:

- Analog Input signal failure on the SYSCON (Application transfer)
- Readout Analog Output failure on the SYSCON (Application transfer)
- A manual user command (Application transfer)

If the SYSCON transfers on any fault, and that same fault is also present on the new SYSCON unit, the system will process the fault as described in Volume 1 and Volume 2 of this manual. Because the SYSCON transfers for the fault conditions above, most I/O faults will be annunciated as a fault on the BACKUP unit (after the transfer). This allows the signal to be repaired on the BACKUP unit while the unit is online. The operating system has a 12 second delay after a SYSCON transfer before it will accept any other application or user transfer request.

A user command to transfer SYSCON is also available from the Redundancy Overview screen. This is the only user handle to transfer the SYSCON unit.

SYSCON transfers can occur at any point in operation with no change to the current control state. For example, if a SYSCON transfer occurs during the Automatic Start Sequence, the start sequence logic will continue from the new SYSCON with no interruption to the sequence or control.

SYSCON I/O Signal Monitoring

The SYSCON I/O signals are available on the main 505XT Hardware screens.

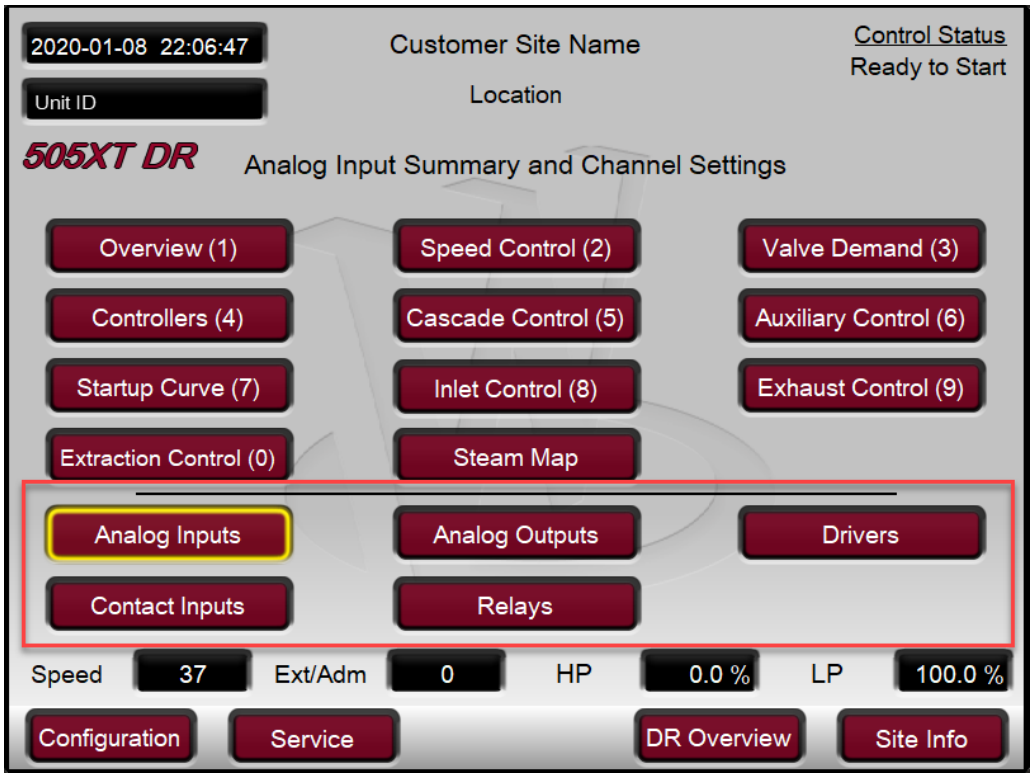

Figure 3-6. SYSCON I/O Monitoring Pages

The signals within the main Hardware screens display the signals that are currently being read and driven from the SYSCON unit. These are the signals that are actively used in turbine control.

The BACKUP Unit

The BACKUP unit is standing by for a SYSCON transfer. The BACKUP unit is continuously kept in-sync with the SYSCON unit such that it can take control of the system on a SYSCON failure with no change in the operating conditions of the controller. The BACKUP unit will be available for transfer if there are no operating system or I/O faults that would inhibit the BACKUP unit.

The BACKUP unit has two categories of conditions that will inhibit it from becoming the SYSCON controller.

1. The operating system has detected a Backup Fault (OS inhibit)
   a. BACKUP application is not running
   b. Ethernet 4 link disconnected
   c. CrissCross disconnected
   d. Primary/Secondary DIP switch settings wrong
2. I/O conditions are inhibiting a transfer (Application inhibit)
   a. Failed Speed probes on BACKUP
   b. Failed Actuator driver on BACKUP
   c. Failed Analog Input on BACKUP that has been programmed to inhibit the BACKUP on a failure
   d. Analog Input signal values on the SYSCON and BACKUP are different
   e. Relay Output readbacks from SYSCON and BACKUP are different
   f. Discrete Input signals from SYSCON and BACKUP are different
   g. CAN Communication link not healthy on BACKUP
   h. User Inhibited the BACKUP

If the Backup Fault system diagnostic is TRUE, the BACKUP unit cannot become the SYSCON even on an OS triggered transfer (see The SYSCON Unit section of this manual). If the Backup Fault system diagnostic is FALSE, an OS triggered transfer from the SYSCON will always attempt to make the BACKUP unit the new SYSCON, even if the BACKUP has an I/O condition, or Application inhibit, preventing a transfer.

The Redundancy Overview screen displays the current status of the BACKUP unit and provides a list of the current inhibit conditions if the BACKUP is unavailable.

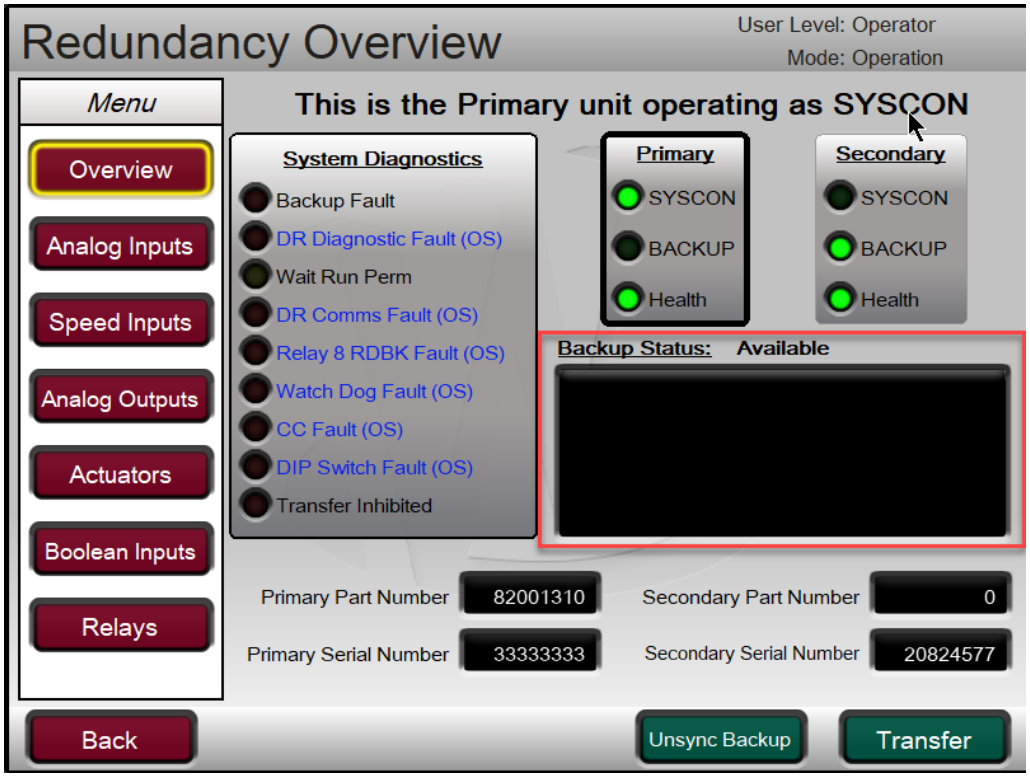

Figure 3-7. BACKUP Unit Available Screen

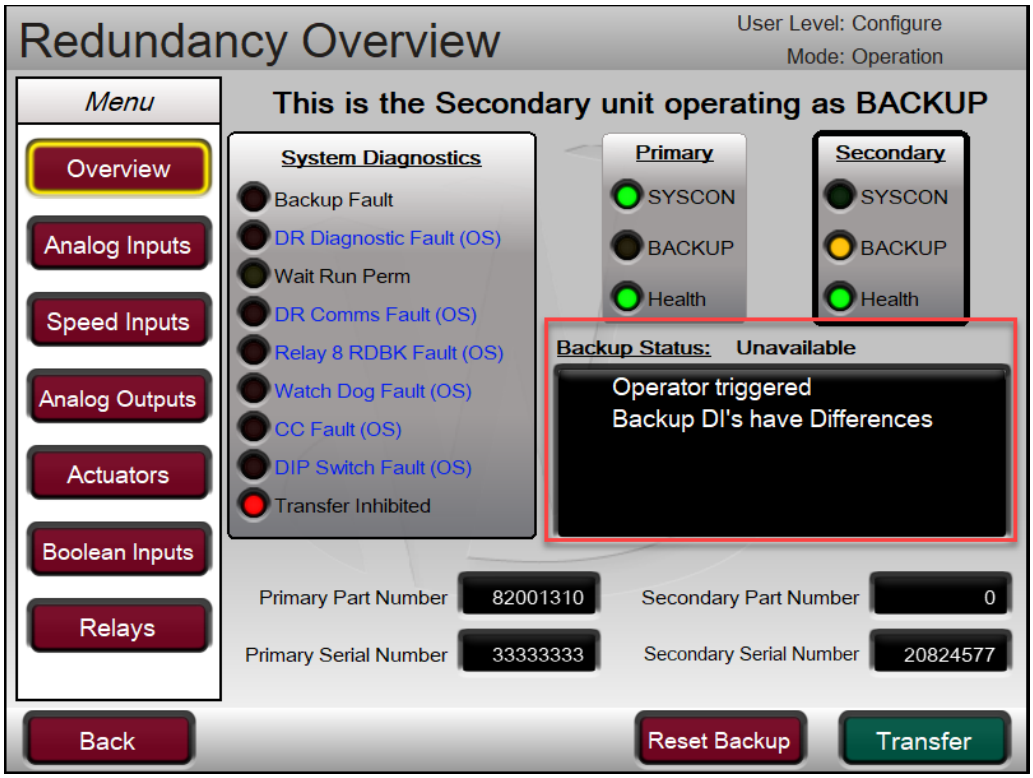

Figure 3-8. BACKUP Unit Inhibited Screen

After an Application inhibit condition is repaired, an alarm Reset command will clear the inhibit condition and the BACKUP will indicate that it is available for a transfer.

BACKUP I/O Signal Monitoring

The BACKUP unit I/O signals can be monitored from the Redundancy Overview screen using the navigation Menu on the right hand side of the screen.

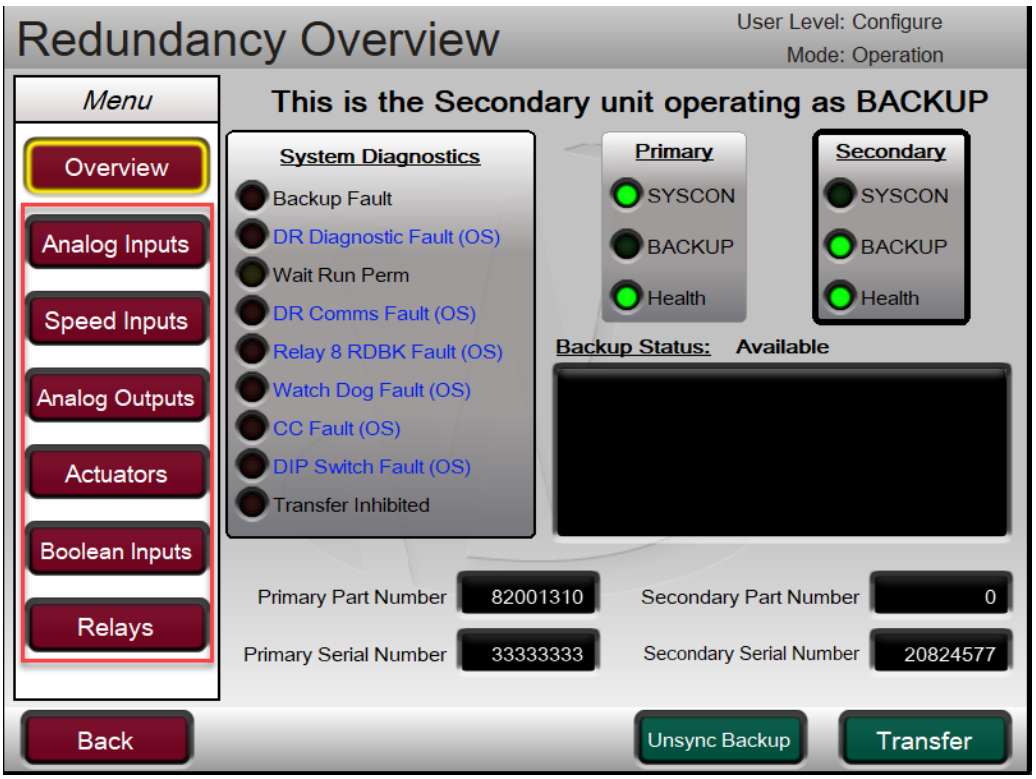

Figure 3-9. BACKUP I/O Monitoring Menu

The Analog Input screen from this menu shows the raw mA signals being read from both the SYSCON and BACKUP units. A fault indication is given for both the SYSCON and BACKUP values if the mA signal is <2mA or >22mA. If there is a difference (2mA window) between the SYSCON and BACKUP mA signal on a channel, an alarm will be annunciated and the BACKUP will be inhibited. This screen also has a toggle button that can be used to control if a transfer of SYSCON will be triggered upon an AI fault (XFER on FLT) or if a fault on an AI signal will NOT initiate a transfer of SYSCON (Inhibit XFER)

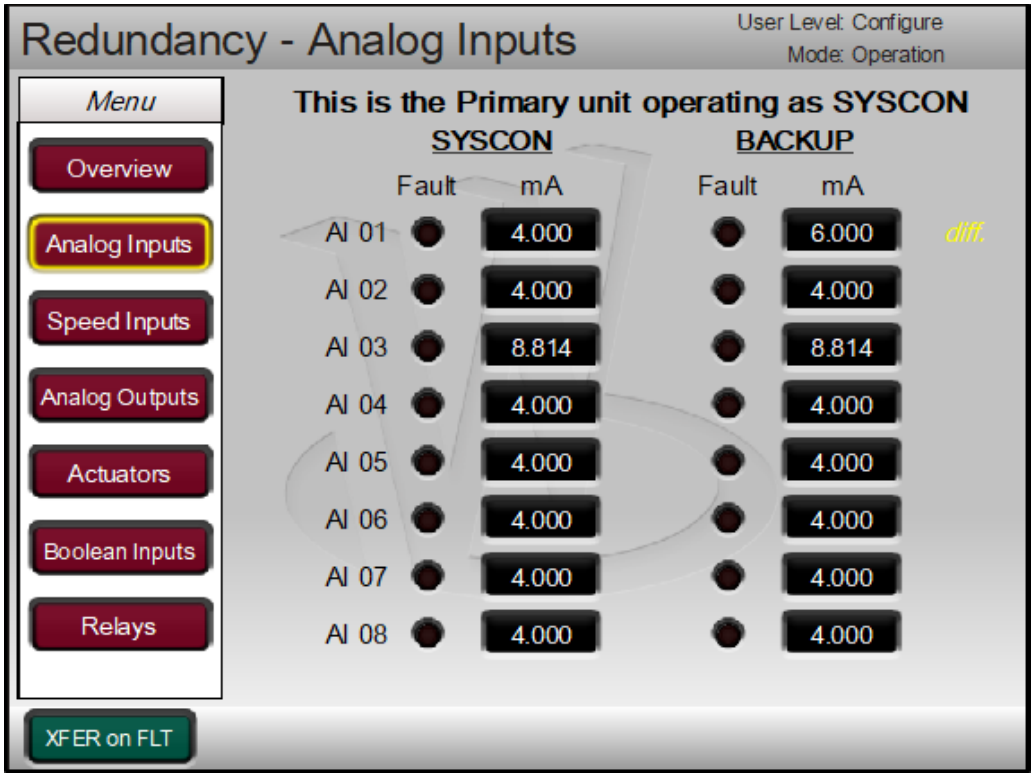

Figure 3-10. BACKUP Analog Inputs Screen

The Speed Inputs screen shows the RPM signals being read from Both the SYSCON and BACKUP units. A fault indication is given for both the SYSCON and BACKUP. If there is a difference (default of 1.0% of the current speed) between the SYSCON and BACKUP signals on a channel, an alarm will be annunciated. If only 1 speed signal is programmed, then this alarm will also make the BACKUP unit unavailable.

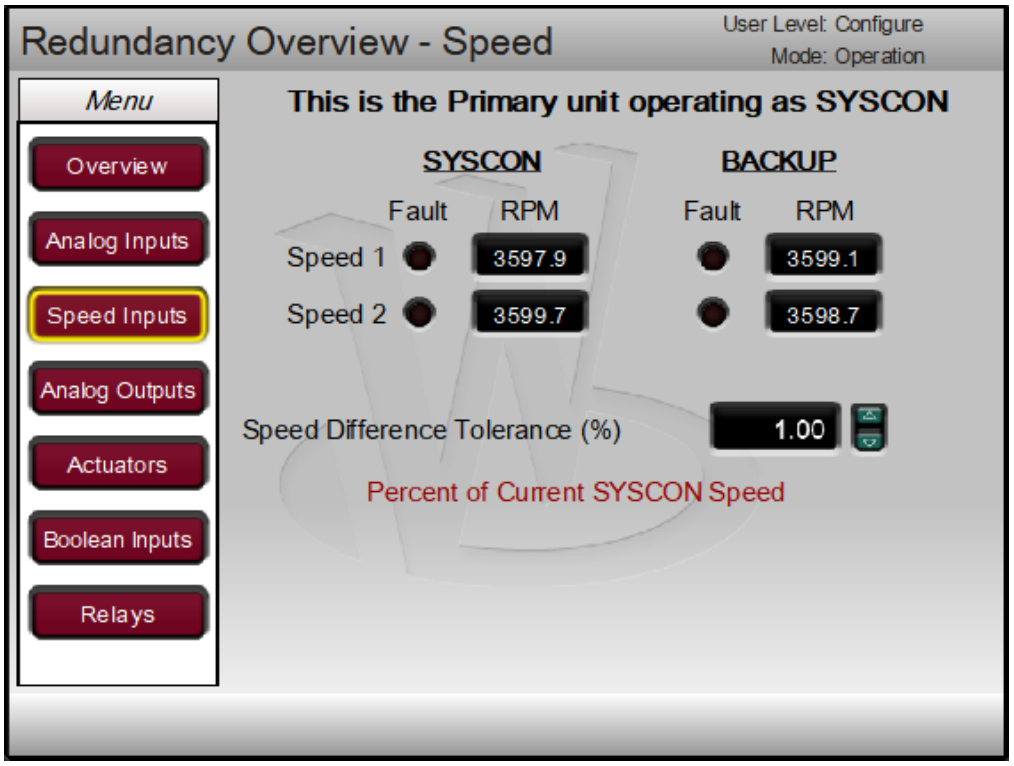

Figure 3-11. BACKUP Speed Inputs Screen

The Analog Output screen shows the raw mA output signals from the SYSCON and BACKUP, as well as the total mA being sent per channel. For each unit, the mA demand (requested amount) and the mA readback (at the negative terminal) are shown. A fault indication is given for both the SYSCON and BACKUP circuits.

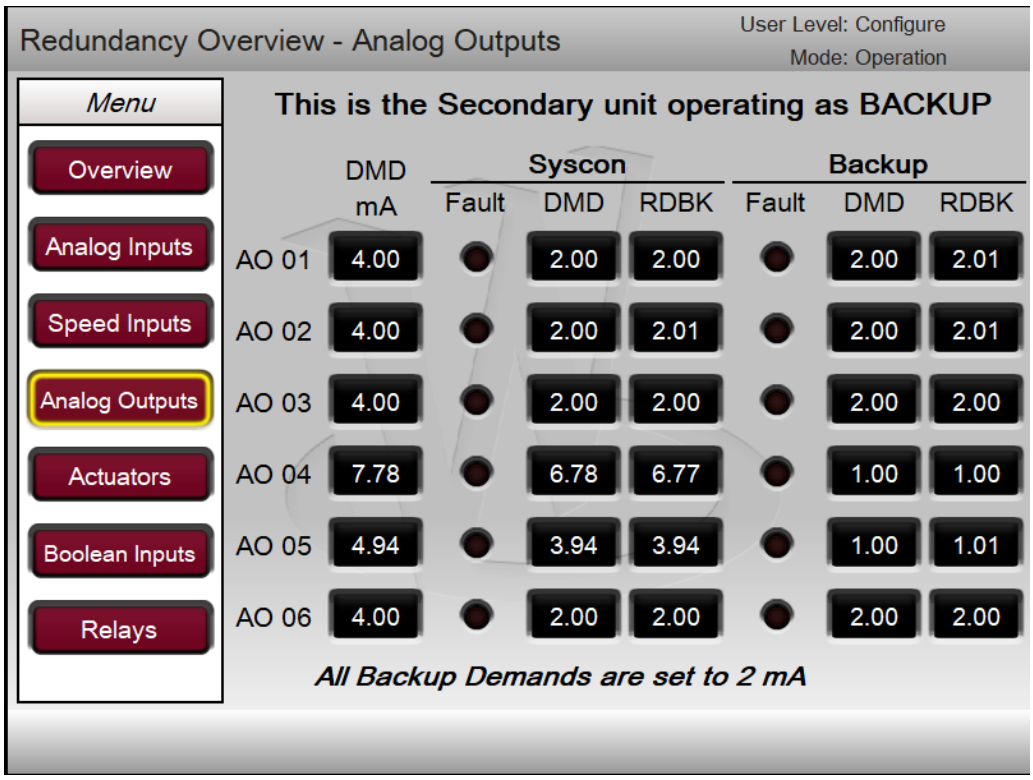

Figure 3-12. BACKUP Analog Outputs Screen

The Actuator Output screen shows the raw mA output signals from the SYSCON and BACKUP, as well as the total mA being sent per channel. For each unit, the mA demand (requested amount) and the mA source (at the positive terminal) are shown. A fault indication is given for both the SYSCON and BACKUP circuits.

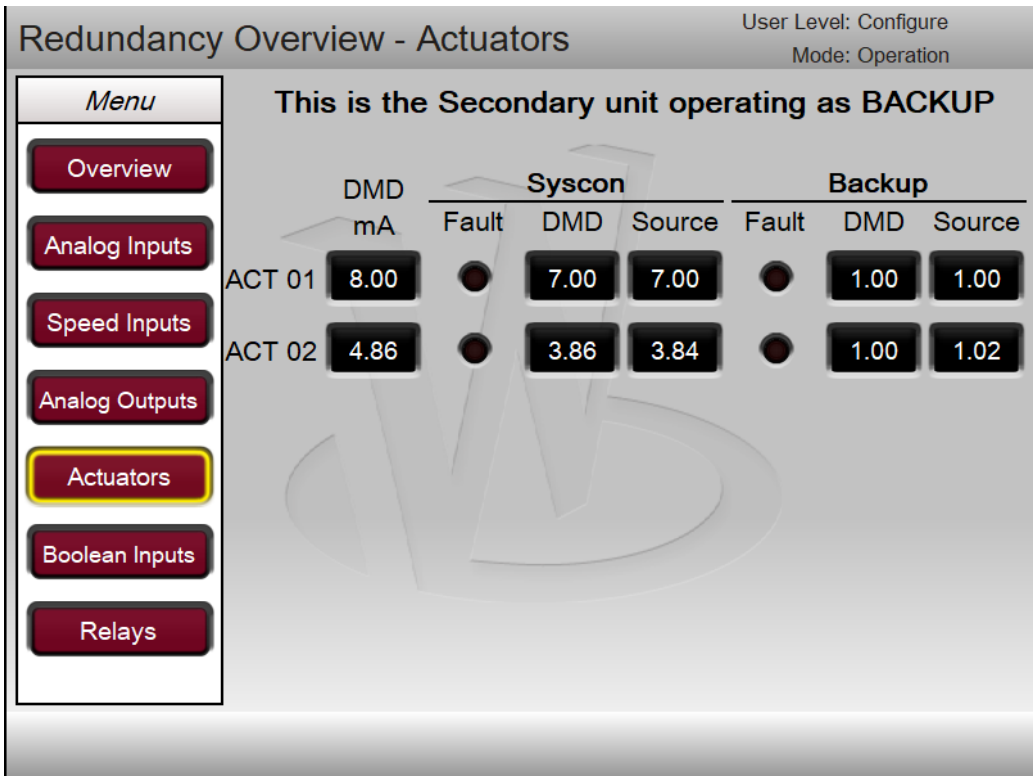

Figure 3-13. BACKUP Actuator Outputs Screen

The Boolean Inputs screen shows the input states for all channels on the SYSCON and BACKUP units. If a difference between the SYSCON and BACKUP channel exists, the control will always follow what the SYSCON signal level indication is indicating. If a difference exists, an alarm will be annunciated and the BACKUP will be inhibited. In rare scenarios, it might be necessary to temporarily override the transfer inhibit on a difference, which can be done using the softkey Toggle Button “OVRD XFR INH”, allowing the SYSCON to transfer units.

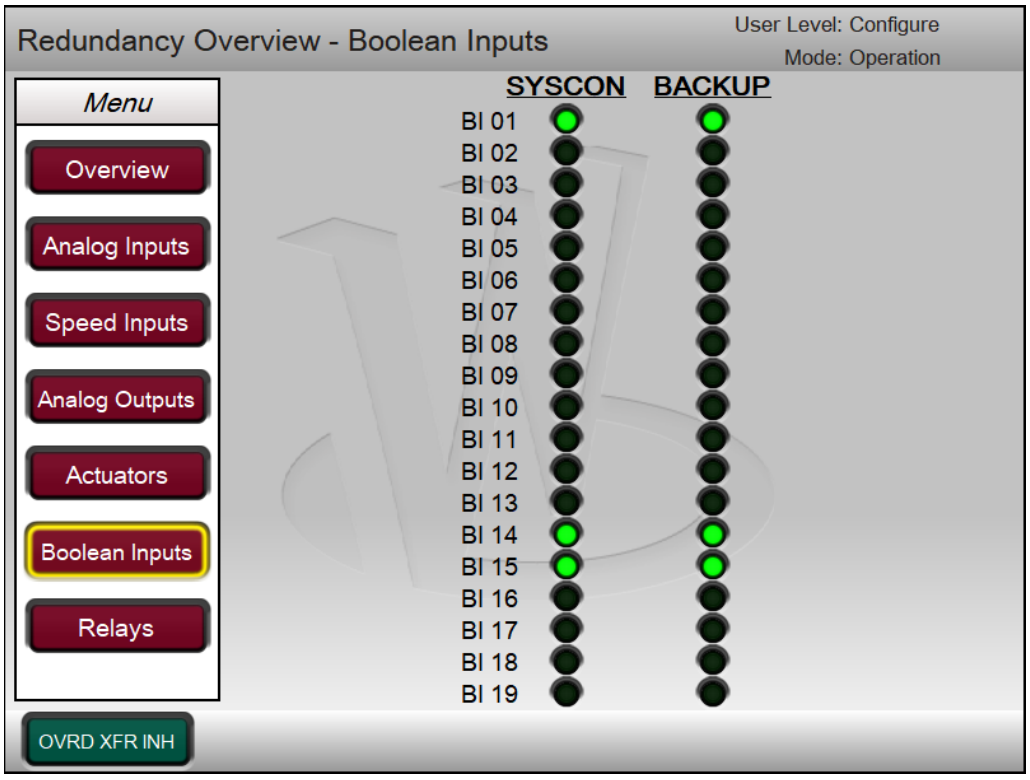

Figure 3-14. BACKUP Boolean Inputs Screen

The Relay Output screen shows the output states for all channels on the SYSCON and BACKUP units. If the internal 505DR readback state of the relay is different between a SYSCON and BACKUP channel, an alarm will be annunciated and the BACKUP will be inhibited.

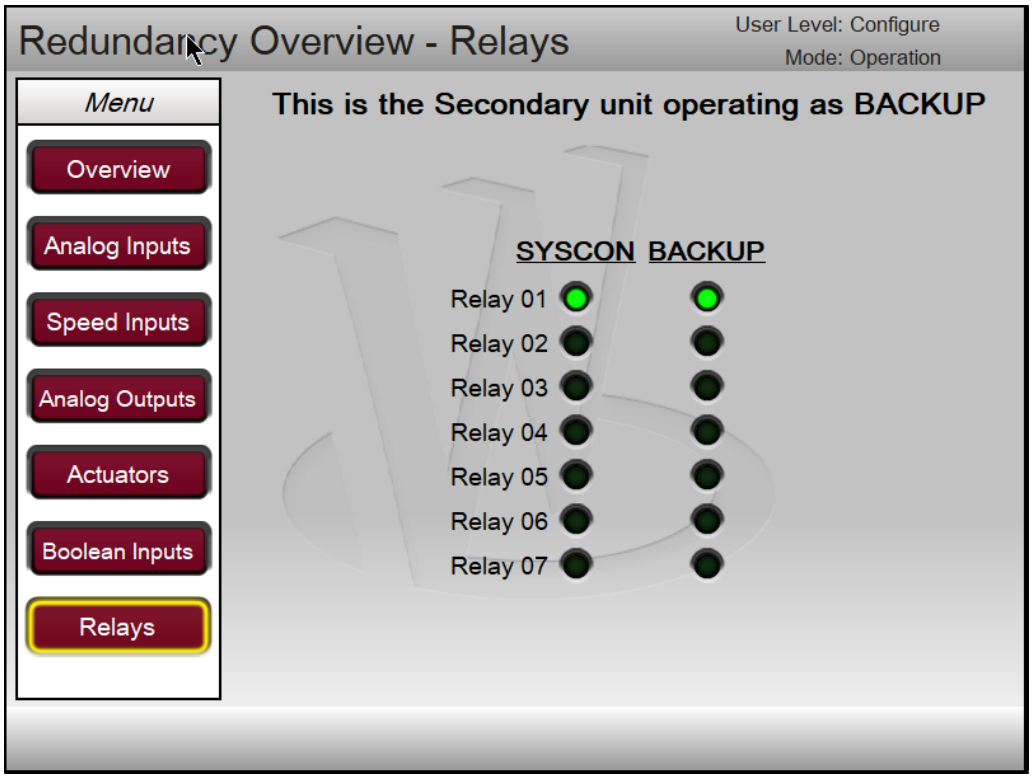

Figure 3-15. BACKUP Relay Outputs Screen

Reset Backup Command

The “Reset Backup” command becomes available from the Redundancy Overview screen when the BACKUP unit is inhibited. This command has two functions:

1. When the BACKUP is Inactive, this command will restart the BACKUP unit’s control application, and resync the BACKUP unit.

   For example, in a healthy system, if the Ethernet 4 link gets disconnected, the BACKUP unit will become Inactive. The SYSCON can then reset the BACKUP unit application once the Ethernet 4 link is repaired to sync the BACKUP unit back in.

2. When the BACKUP is online, this command will stop the BACKUP application for 20s, then restart the application and re-sync the BACKUP unit back in.

   This provides a method for shutting down and disconnecting the BACKUP unit for maintenance reasons. For example, if the BACKUP unit needed to be replaced, the Reset Backup command would take the BACKUP unit offline for 20s, allowing a technician to power the unit off, and take it out of service. See the Online Unit Repairs section of this manual.

The Reset Backup command is communicated over the Ethernet 4 link. The Reset Backup command can be issued from either the SYSCON or BACKUP unit when both units are online. If the BACKUP is offline, the SYSCON must issue the Reset Backup command with a healthy Ethernet 4 link in order to resync the BACKUP unit.

Configuring for Simplex Operation

To run for an extended period of time as a ‘Simplex Control’, the following option is available in the 505DR configuration (in the Revision C release of the application software). In simplex mode, the control will not monitor for a backup unit and all alarms related to the backup unit will be inhibited. To add a redundant unit later, the control will need to be shutdown and placed in IOLOCK to re-configure the control for redundant operation.

To Configure a 505DR Control as a Simplex Unit

1. Install the control unit - set DIP switches for primary.
2. Disconnect the interlink Ethernet cable on Ethernet Port 4 (okay to wire to the DR-FTM if that is desired).
3. Enter CONFIG mode and on first screen under Operating Parameters. 'Check' the box for Run as Simplex unit (see screen below).
4. Exit CONFIG mode (unit will reset and IOLOCK LED should clear).
5. DR Overview screen indicates this is Primary unit configured as Simplex.

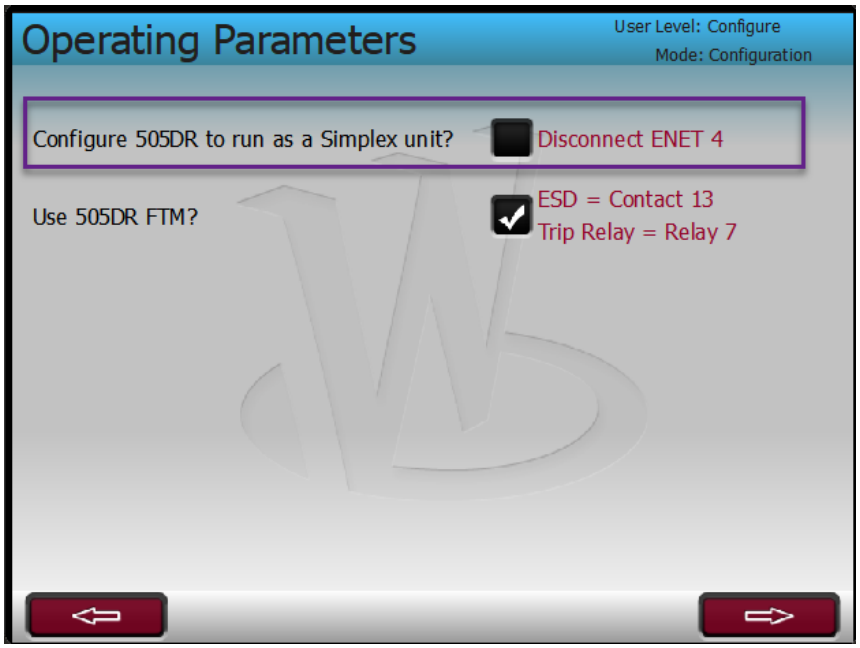

Figure 3-16. Configuration — Operating Parameters Screen

To place the 505DR into redundant mode with a second unit installed, perform the following steps.

To Re-configure Unit for Redundant Operation

1. Enter CONFIG mode from Primary unit and 'uncheck' Run as Simplex.
2. Exit CONFIG mode (unit will reset but remain in IOLOCK).
3. Go to the DR Overview screen and select "Run Alone".
4. IOLOCK will clear and the unit will begin monitoring for the backup unit.
5. Install secondary unit - set DIP switches for secondary.
6. Connect the required ENET 4 and DI-DO interlock signal connections.
7. Powerup the secondary unit.
8. The SYSCON/primary unit will send tunable settings and synchronize with the backup unit.
9. Secondary IOLOCK should clear, CPU LED slow pulse in amber color.
10. Issue Reset command to complete and CPU LED should switch to slow pulse green.

Operational Commands and Settings

Operational Commands

All commands via communication links (front panel GUI, RemoteView, or Modbus) can be issued to either the SYSCON unit or the BACKUP unit. The operating system will ensure that the commands are processed by the SYSCON unit and that the control state is passed to the BACKUP unit to keep it in sync and available for transfer. The system can be operated from either the SYSCON or BACKUP unit in a healthy system.

Discrete Input commands and system signals (breaker signals etc) are only processed by the SYSCON unit. Therefore, the system design requires that all discrete inputs are wired to both the Primary and Secondary units so that the commands are seen by both units simultaneously. If a difference between a SYSCON and BACKUP discrete input channel will be annunciated as an alarm and the BACKUP unit will be inhibited until the signals are matched.

All command functions are described in Volume 1 and 2 of this manual.

Settings Adjustments

When Configuration, Service, or Runtime settings are adjusted in either the SYSCON or BACKUP the two units will automatically synchronize the settings changes so that both units contain identical settings. When a Save Settings command is issued, both units will save settings to non-volatile memory. It is only necessary to configure or make settings updates in one of the units. The operating system will automatically update both systems to keep them in sync.

Settings files (*.tc files) can be loaded to either the SYSCON or BACKUP unit and the settings will be automatically synchronized to both units.

Emergency Stop Button

When the EMERGENCY STOP button on the front panel is pressed from either the SYSCON or BACKUP, both units will trip.

Online Unit Repairs

When used in a redundant configuration, the 505DR is designed such that I/O signals can be disconnected from the BACKUP unit while the healthy 505XT continues to control and operate the turbine on-online. The system is designed so that either unit can be removed and replaced while the other healthy 505XT continues to control and operate the turbine on-line.

Repairs to I/O Signals

When an Analog Input, Analog Output or Actuator Output signal fails, the system is designed to transfer the SYSCON in order to continue to run on a healthy signal, if it is available on the BACKUP unit. The signal can then be repaired on the BACKUP unit allowing the new SYSCON to control and operate the turbine. Once the failure is repaired, a Reset command will restore the fault and make the BACKUP unit available for transfer.

When a signal fails in the field, it is faulted on both the SYSCON and BACKUP. The signal should be repaired in the field and a Reset command will restore the signal to both control units.

When making repairs to IO signals, it is important to not disturb the SYSCON unit IO. The BACKUP unit can be manually inhibited to prevent transfers to that unit while repairs are being made.

Unit Replacement Procedure

1. Transfer turbine control to desired unit.

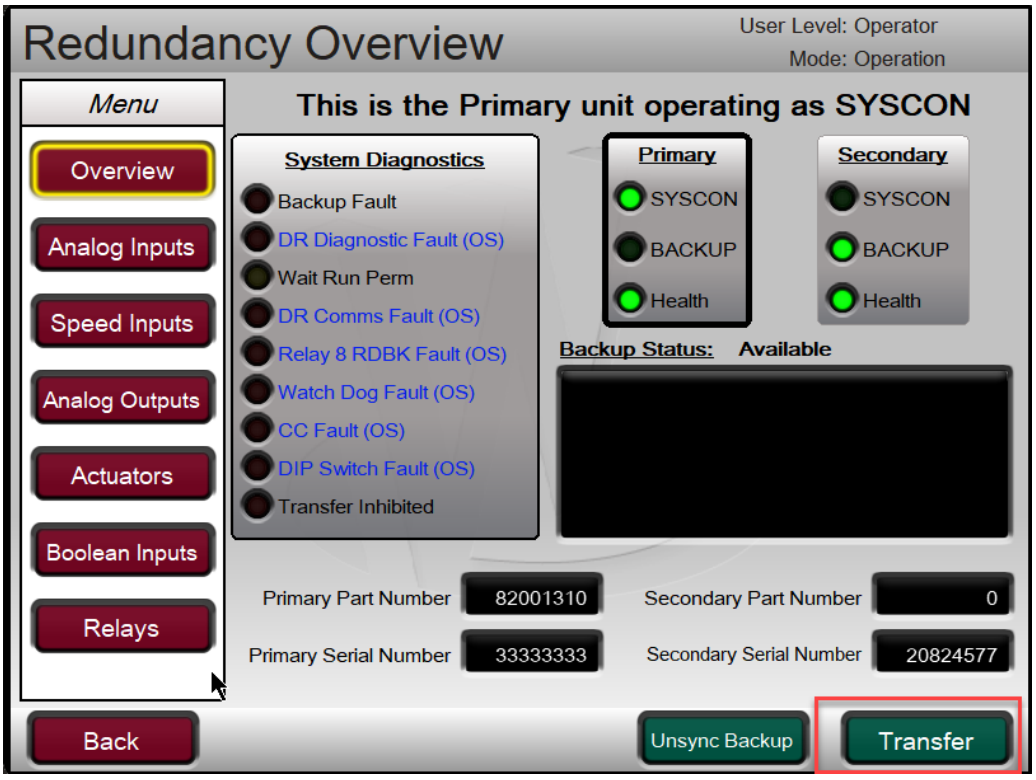

Figure 3-17. User SYSCON Transfer Command

2. Unsync the BACKUP unit from the Redundancy Overview page

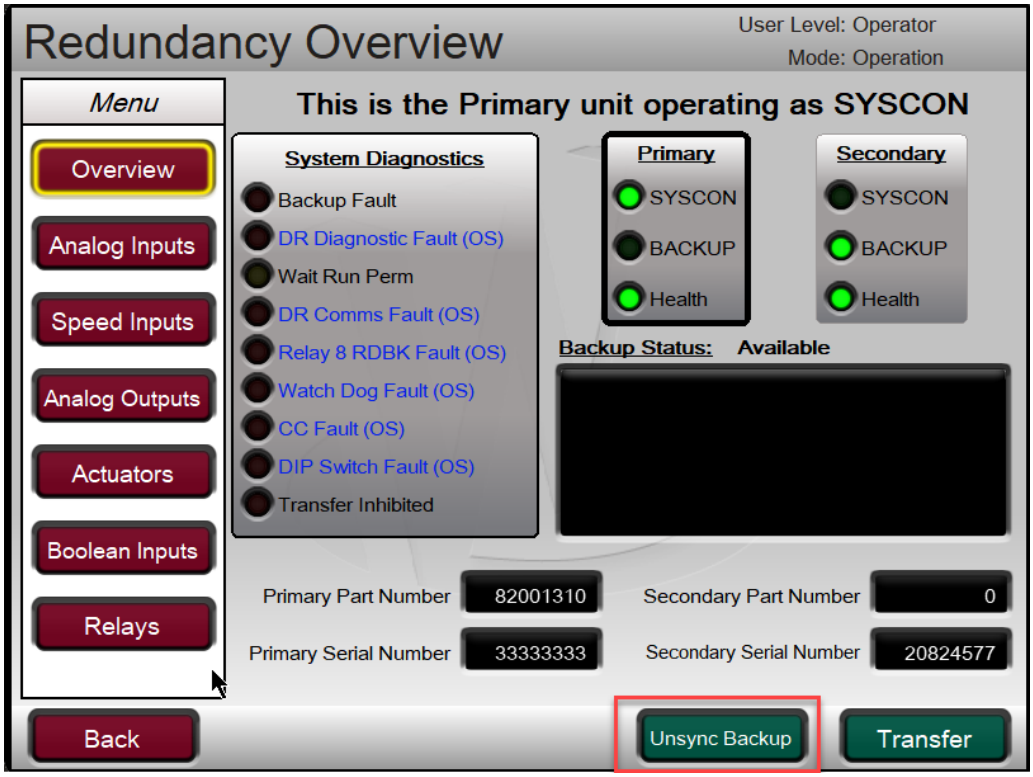

Figure 3-18. User Unsync Backup Command

3. Issue a Reset Backup command. This will take the BACKUP unit offline for 20 seconds.

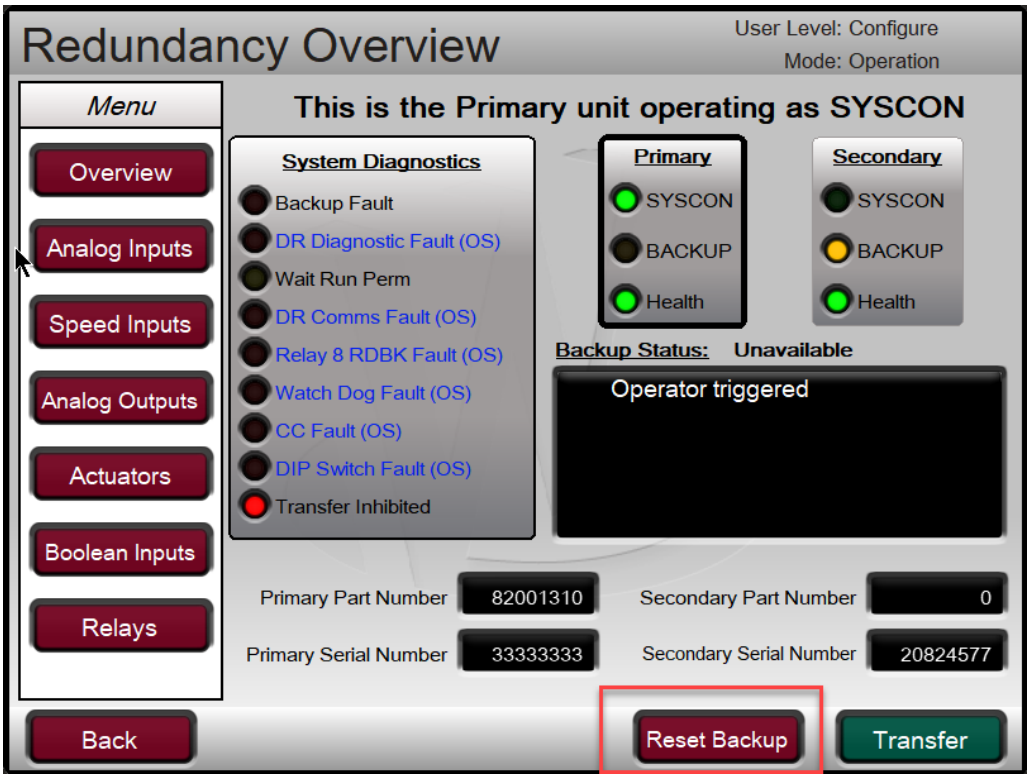

Figure 3-19. User Reset Backup Command

4. Remove power to unit being replaced.
5. Carefully remove all plug-in terminal blocks and Ethernet connections from 505.
6. Replace respective 505DR with another unit, making sure that it has the same DIP switch setting as the previous unit.

IMPORTANT **The replacement 505DR unit must have the same GAP Part Number and revision and same Footprint Part Number as the running unit in order to sync in.**

Note: When the BACKUP unit is synchronized, it receives all of its settings from the SYSCON unit as part of the synchronization process, and the settings are automatically stored in non-volatile memory on the BACKUP unit. It is not necessary to program an offline unit prior to bringing it online with the SYSCON. Any settings in the offline unit will be replaced with those of the SYSCON unit.

7. Carefully connect all plug-in terminal blocks and Ethernet connections to the new 505DR
8. Apply power to the new unit.
9. Allow the new unit to synchronize with the SYSCON unit. Verify that all System Diagnostic faults are cleared (except for the Transfer Inhibited LED)

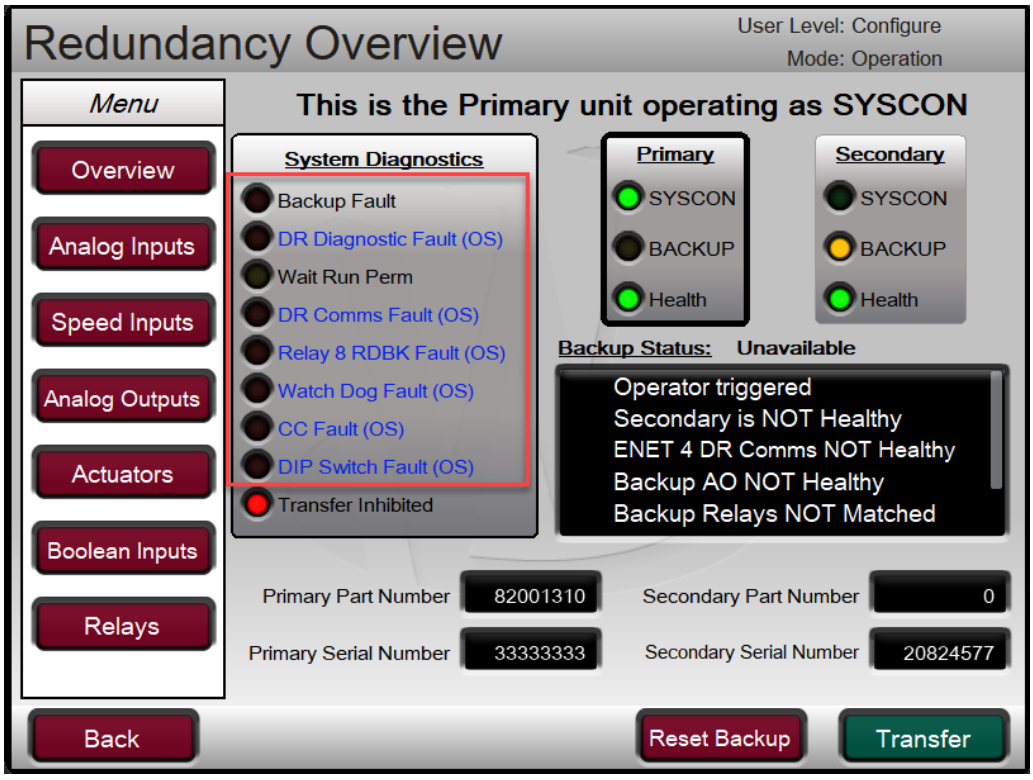

Figure 3-20. System Diagnostic Faults Cleared

10. Issue a 'Reset' command. At this point the new 505DR will reset related faults or alarms and if they clear, will enter BACKUP available mode and output a trickle current (equal to half of the minimum actuator current) to verify actuator circuit continuity.

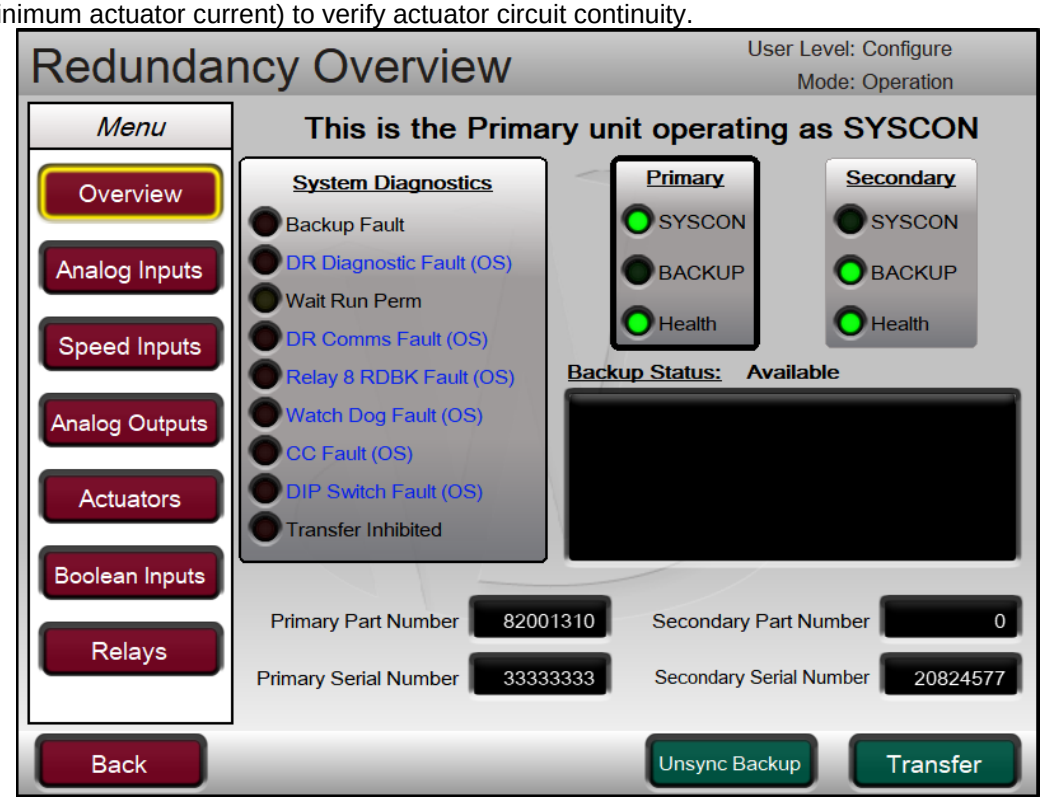

Figure 3-21. BACKUP Available

11. Transfer control to new unit if desired.

Synchronizing an Offline Unit to the SYSCON

When a unit is running as SYSCON and the BACKUP unit is offline, the following steps will sync in the offline unit.

1. Verify that the Ethernet 4 and discrete CrissCross are connected between the running unit and offline unit
2. Verify that all IO signals are properly connected to the offline unit
3. Power on offline unit
4. When the offline unit is initializing, it will look for the SYSCON unit on the communication links and receive the current operating state of the system from the SYSCON, and be brought online as the BACKUP unit.
5. Issue a RESET command and verify that all BACKUP faults are cleared and that the BACKUP unit is Available from the Redundancy Overview page.

IMPORTANT **The replacement 505DR unit must have the same GAP Part Number and revision and same Footprint Part Number as the running unit in order to sync in.**

When the BACKUP unit is synchronized, it receives all of its settings from the SYSCON unit as part of the synchronization process, and the settings are automatically stored in non-volatile memory on the BACKUP unit. It is not necessary to program an offline unit prior to bringing it online with the SYSCON. Any settings in the offline unit will be replaced with those of the SYSCON unit.

RemoteView Connections

The installation file is included on the system documentation CD. The name of the installation file will include the revision and be similar to 9927-2344_F_RemoteView.exe. The file name may vary slightly as future revisions are released. Execute this file to begin the installation process. For Rev F and later, RemoteView will support Redundant connections to the 505DR.
For installation, configuration, and usage instructions, please see the RemoteView Appendix in Volume 2 of this manual.

The Connection dialog box has been updated to support redundant connections. This dialog will appear and give the user an option to modify the IP for the active connection, enter the control IP and if a redundant connection is desired, click the Enable Failover checkbox and add a redundant IP to use. In the case of the 505DR, use one IP address from the Primary unit and one IP address from the Secondary unit, then click apply.

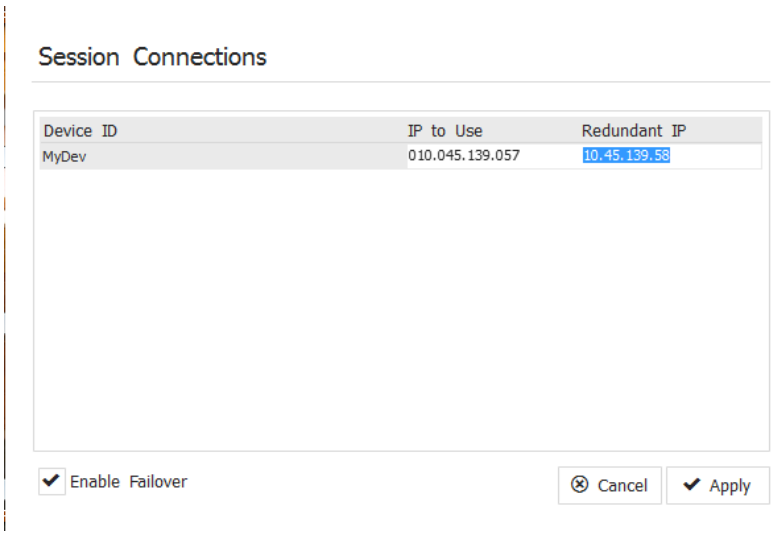

Figure 3-22. Session Connections Dialog Box

This dialog will appear and give the user an option to modify the IP for the active connection, enter the control IP and if a redundant connection is desired, click the Enable Failover checkbox and add a redundant IP to use.

Failover Performance

When a SYSCON failover occurs, Actuator and Analog output currents will experience a small bump as the new SYSCON increases its output to match the last demand level. A transfer of SYSCON at 20mA output will dip around 6mA and recover back to full current within 80ms, as seen at the final driver.

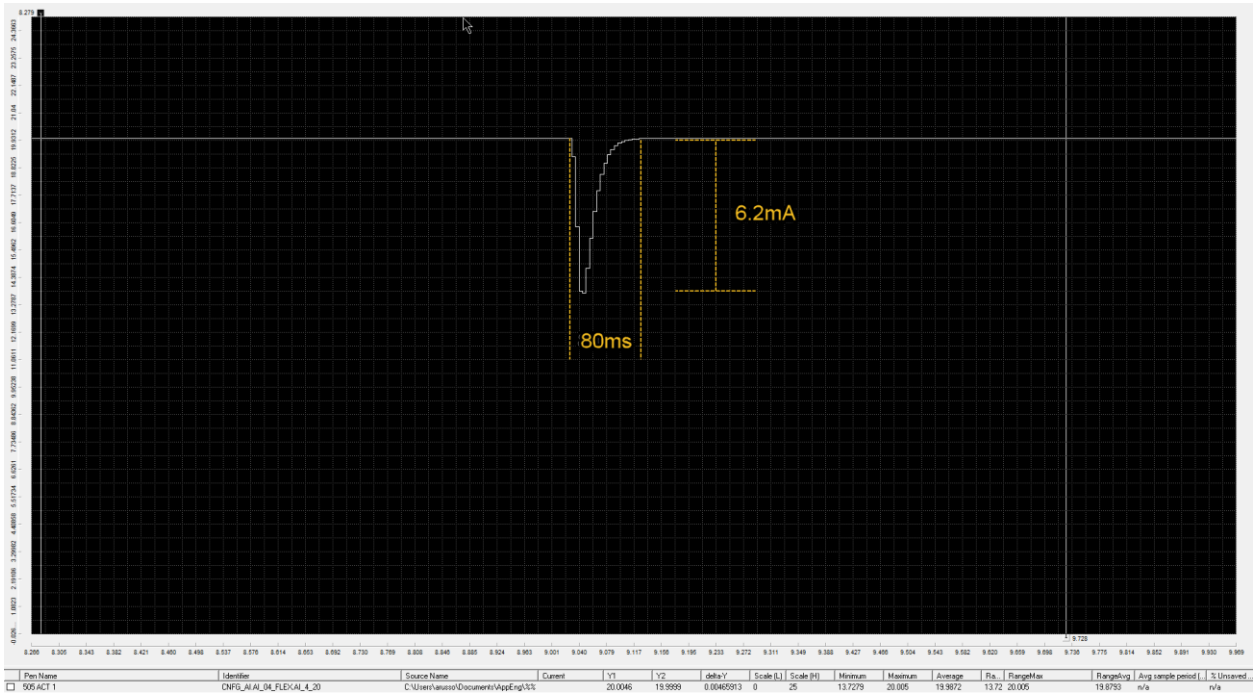

Figure 3-23. Actuator Output Failover Performance

When a Digital Driver (CAN RTCNet Node 26 or SPC) is used, the SYSCON transfer is bumpless as seen by the final driver.

1 2 3 4 (Numbered events below)

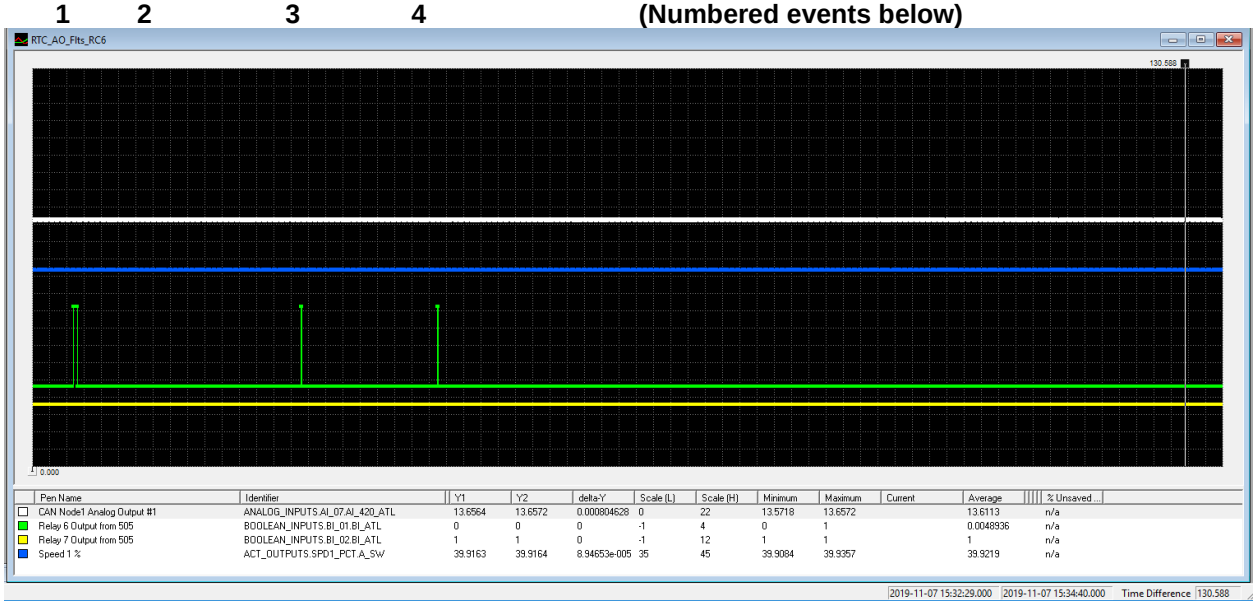

Figure 3-24. RTCNet Node 26 Analog Output Performance

In above trend graph following events occurred –

1 User XFER
2 Fail CAN2 on Backup (no XFER) then Reset
3 Fail CAN2 on Syscon (XFER) then Reset

4 Fail Power on Syscon (XFER) – reset after Reboot

Constant output of 13.65 mA to valve – constant speed of 3992 through each of these 4 events.

1 2 3 4 (Numbered events below)

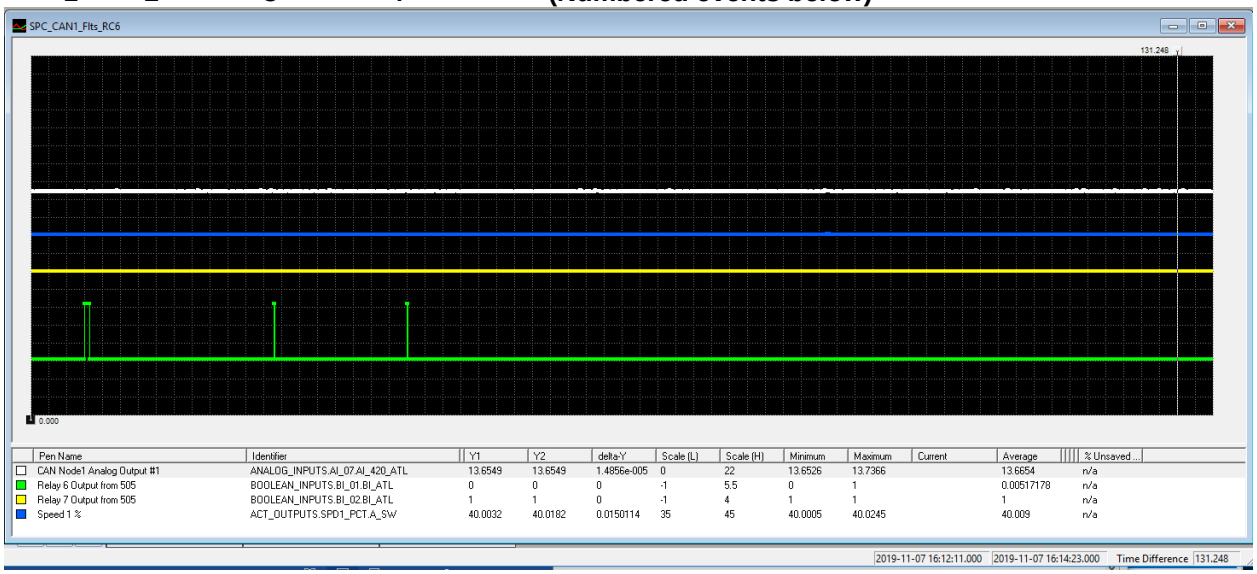

Figure 3-25. SPC Analog Output Performance

In above trend graph following events occurred –

1 User XFER

2 Fail CAN1 on Backup (no XFER) then Reset

3 Fail CAN1 on Syscon (XFER) then Reset

4 Fail Power on Syscon (XFER) – reset after Reboot

Constant output of 13.65 mA to valve – constant speed of 4000 through each of these 4 events.

Alarms

When using the 505DR, the alarm list in Volume 1 of this manual (Table 5-1), is replaced with the following table.

Table 3-4. Alarm Messages

ALARM Number	Description
ALM_001	Speed Probe #1 Failed
ALM_002	Speed Probe #2 Failed
ALM_003	Remote Spd Disabled PV Failed
ALM_004	Sync Input Failed
ALM_005	Load Share Input Failed
ALM_006	KW Load Droop Disabled PV Failed
ALM_007	Cascade Control Disabled PV Failed
ALM_008	Remote Casc Input Failed
ALM_009	AUX Control Disabled PV Failed
ALM_010	Remote AUX Input Failed
ALM_011	Redundant LP A FDBK Failed
ALM_012	Redundant LP B FDBK Failed
ALM_013	Inlet Control Disabled PV Failed
ALM_014	Redundant HP A FDBK Failed
ALM_015	Redundant HP B FDBK Failed
ALM_016	Feed-forward input failed
ALM_017	Remote Droop Fault
ALM_018	Remote KW Setpoint Failed
ALM_019	Exhaust Control Disabled PV Failed
ALM_020	Temp for Hot/Cold Starts Failed
ALM_021	HP Valve Feedback Failed
ALM_022	HP2 Valve Feedback Failed
ALM_023	Isolated PID PV Failed
ALM_024	Rem SP Isolated PID Failed
ALM_025	Customer Input #1 Failed
ALM_026	Customer Input #2 Failed
ALM_027	Customer Input #3 Failed
ALM_028	Start Temperature 1 Failed
ALM_029	Start Temperature 2 Failed
ALM_030	Ext/Adm Control Disabled PV Failed
ALM_031	Remote Extr/Adm SP Input Failed
ALM_032	External alarm # 1
ALM_033	External alarm # 2
ALM_034	External alarm # 3
ALM_035	External alarm # 4
ALM_036	External alarm # 5
ALM_037	External alarm # 6
ALM_038	External alarm # 7
ALM_039	External alarm # 8
ALM_040	External alarm # 9

ALARM Number	Description
ALM_041	Redundant HP A Failed from BI
ALM_042	Redundant HP B Failed from BI
ALM_043	HP Actuator Fault
ALM_044	HP2 Actuator Fault
ALM_045	Start Perm Not Closed
ALM_046	Mod Comm Link #1 Failed
ALM_047	Mod Comm Link #2 Failed
ALM_048	Mod Comm Link #3 Failed
ALM_049	AO_01 Readback Fault
ALM_050	AO_02 Readback Fault
ALM_051	AO_03 Readback Fault
ALM_052	AO_04 Readback Fault
ALM_053	AO_05 Readback Fault
ALM_054	AO_06 Readback Fault
ALM_055	Chassis Summary Alarm
ALM_056	Turbine Tripped
ALM_057	Overspeed
ALM_058	Overspeed Test Enabled
ALM_059	TIE Breaker Opened
ALM_060	GEN Breaker Opened
ALM_061	Tie Open / No Auxiliary
ALM_062	Gen Open / No Auxiliary
ALM_063	Tie Open / No Cascade
ALM_064	Gen Open / No Cascade
ALM_065	Tie Open / No Remote
ALM_066	Gen Open / No Remote
ALM_067	Stuck In Critical Band
ALM_068	505 Display Comm Fault
ALM_069	HP Valve Pos Fdbk Diff ALM
ALM_070	HP2 Valve Pos Fdbk Diff ALM
ALM_071	Limiter in Control
ALM_072	Inlet Steam Pressure Lvl1 ALM
ALM_073	Inlet Steam Pressure Lvl2 ALM
ALM_074	Exh Steam Pressure Lvl1 ALM
ALM_075	Exh Steam Pressure Lvl2 ALM
ALM_076	Selected PV 1 Level 1 ALM
ALM_077	Selected PV 1 Level 2 ALM
ALM_078	Selected PV 2 Level 1 ALM
ALM_079	Selected PV 2 Level 2 ALM
ALM_080	Selected PV 3 Level 1 ALM
ALM_081	Selected PV 3 Level 2 ALM
ALM_082	Tunable Alarm
ALM_083	Tie Open / No Inlet
ALM_084	Gen Open / No Inlet
ALM_085	Actuator 1 Readout Fault

ALARM Number	Description
ALM_086	Actuator 2 Readout Fault
ALM_087	CAN1_DVP1 Summary ALM
ALM_088	CAN1_DVP2 Summary ALM
ALM_089	ALM_089
ALM_090	HP2 Actuator Fault (DVP1 or 2)
ALM_091	Comm Link to DSLC2 Failed
ALM_092	KW Load AI Failed
ALM_093	Turbine Maintenance Interval Alm
ALM_094	Start Temperature #1 Override Active
ALM_095	Start Temperature #2 Override Active
ALM_096	Comm Link to EasyGen Failed
ALM_097	Comm Link to LS-5 Failed
ALM_098	Comm Link to MFR300 Failed
ALM_099	Comm Link to HiProtec Failed
ALM_100	MPU1 Failed Open Wire Test
ALM_101	MPU2 Failed Open Wire Test
ALM_102	Internal HW Simulation Enabled
ALM_103	Pressure Compensation Curve Error
ALM_104	Actuator Linearization Curve Error
ALM_105	Remote Manual P Demand Input Failed
ALM_106	Remote Exhaust SP Input Failed
ALM_107	Remote Inlet Pressure SP Input Failed
ALM_108	LP Position Feedback Input Failed
ALM_109	Reverse Rotation Detected
ALM_110	LinkNet Summary Alarm
ALM_111	Tie Open / No Extraction
ALM_112	Gen Open / No Extraction
ALM_113	Tie Open / No Exhuast
ALM_114	Gen Open / No Exhaust
ALM_115	LP Actuator Fault
ALM_116	LP Actuator Fault ALM (DVP1 or 2)
ALM_117	Speed Below Min - No Extraction
ALM_118	LP Lmtr->No Spd Cntl->Ratio Lmtr Dsbl
ALM_119	External alarm # 10
ALM_120	External alarm # 11
ALM_121	External alarm # 12
ALM_122	External alarm # 13
ALM_123	External alarm # 14
ALM_124	External alarm # 15
ALM_125	Alternate Mode Map Error
ALM_126	LP Valve Pos Fdbk Diff ALM
ALM_127	LP Linearization Alarm
ALM_128	Redundant LP A Failed from BI
ALM_129	Redundant LP B Failed from BI
ALM_130	LP2 Actuator Fault

ALARM Number	Description
ALM_131	spare_131
ALM_132	spare_132
ALM_133	spare_133
ALM_134	spare_134
ALM_135	spare_135
ALM_136	spare_136
ALM_137	Backup Unavailable
ALM_138	Seconday Chassis Fault
ALM_139	Backup Speed 1 Fault
ALM_140	Backup Speed 2 Fault
ALM_141	Backup AI 1 Fault
ALM_142	Backup AI 2 Fault
ALM_143	Backup AI 3 Fault
ALM_144	Backup AI 4 Fault
ALM_145	Backup AI 5 Fault
ALM_146	Backup AI 6 Fault
ALM_147	Backup AI 7 Fault
ALM_148	Backup AI 8 Fault
ALM_149	spare_149
ALM_150	spare_150
ALM_151	spare_151
ALM_152	spare_152
ALM_153	spare_153
ALM_154	spare_154
ALM_155	spare_155
ALM_156	spare_156
ALM_157	Diff Alarm Redun Speed SP
ALM_158	Diff Alarm Redun Gen Load Input
ALM_159	Diff Alarm Redun Casc Inputs
ALM_160	Diff Alarm Redun AUX Inputs
ALM_161	Diff Alarm Redun Inlet Inputs
ALM_162	Diff Alarm Redun Exhaust Inputs
ALM_163	Diff Alarm Redun Ext/Adm Inputs
ALM_164	Remote Speed SP Signal #1 Fault
ALM_165	Remote Speed SP Signal #2 Fault
ALM_166	Generator Load Signal #1 Fault
ALM_167	Generator Load Signal #2 Fault
ALM_168	Cascade Input Signal #1 Fault
ALM_169	Cascade Input Signal #2 Fault
ALM_170	Auxliary Input Signal #1 Fault
ALM_171	Auxiliary Input Signal #2 Fault
ALM_172	Inlet Input Signal #1 Fault
ALM_173	Inlet Input Signal #2 Fault
ALM_174	Exhaust Input Signal #1 Fault
ALM_175	Exhaust Input Signal #2 Fault

ALARM Number	Description
ALM_176	Ext/Adm Input Signal #1 Fault
ALM_177	Ext/Adm Input Signal #2 Fault
ALM_178	Analog Output 01 Backup Fault
ALM_179	Analog Output 02 Backup Fault
ALM_180	Analog Output 03 Backup Fault
ALM_181	Analog Output 04 Backup Fault
ALM_182	Analog Output 05 Backup Fault
ALM_183	Analog Output 06 Backup Fault
ALM_184	Actuator Output 01 Backup Fault
ALM_185	Actuator Output 02 Backup Fault
ALM_186	SPC 11 Driver Summary Fault
ALM_187	SPC 12 Driver Summary Fault
ALM_188	SPC 13 Driver Summary Fault
ALM_189	SPC 14 Driver Summary Fault
ALM_190	DVP 15 Driver Summary Fault
ALM_191	DVP 16 Driver Summary Fault
ALM_192	HP Driver Fault
ALM_193	HP Coil A Fault
ALM_194	HP Coil B Fault
ALM_195	HP Actuator A Fault
ALM_196	HP Actuator B Fault
ALM_197	LP Driver Fault
ALM_198	LP Coil A Fault
ALM_199	LP Coil B Fault
ALM_200	LP Actuator A Fault
ALM_201	LP Actuator B Fault
ALM_202	Speed 1 and Speed 2 Deviation
ALM_203	Backup Unit CAN1 Fault
ALM_204	CAN1 Digital Driver Network Fault
ALM_205	Spare 205
ALM_206	Spare 206
ALM_207	Spare 207
ALM_208	Spare 208
ALM_209	Spare 209
ALM_210	Spare 210
ALM_211	Spare 211
ALM_212	Spare 212
ALM_213	Spare 213
ALM_214	Spare 214
ALM_215	Spare 215
ALM_216	Spare 216
ALM_217	Spare 217
ALM_218	Spare 218
ALM_219	Spare 219
ALM_220	Spare 220

ALARM Number	Description
ALM_221	Spare 221
ALM_222	Spare 222
ALM_223	Spare 223
ALM_224	Spare 224

When using the 505DR, if RTCnet nodes (distributed I/O) are used then this alarm list will apply. It details the summary of alarm events that come from the CAN2 network.

Table 3-5. Distributed I/O Alarm Messages

ALARM Number	Description
ALM_001	RTCNet Node 21 Comm Fault
ALM_002	RTCNet Node 22 Comm Fault
ALM_003	RTCNet Node 23 Comm Fault
ALM_004	RTCNet Node 24 Comm Fault
ALM_005	RTCNet Node 25 Comm Fault
ALM_006	RTCNet Node 26 Comm Fault
ALM_007	RTCNet Node 21 Failed
ALM_008	RTCNet Node 22 Failed
ALM_009	RTCNet Node 23 Failed
ALM_010	RTCNet Node 24 Failed
ALM_011	RTCNet Node 25 Failed
ALM_012	RTCNet Node 26 Failed
ALM_013	Node 21 AI_1 Fault
ALM_014	Node 21 AI_2 Fault
ALM_015	Node 21 AI_3 Fault
ALM_016	Node 21 AI_4 Fault
ALM_017	Node 21 AI_5 Fault
ALM_018	Node 21 AI_6 Fault
ALM_019	Node 21 AI_7 Fault
ALM_020	Node 21 AI_8 Fault
ALM_021	Node 21 AO_1 Fault
ALM_022	Node 21 AO_2 Fault
ALM_023	Node 22 AI_1 Fault
ALM_024	Node 22 AI_2 Fault
ALM_025	Node 22 AI_3 Fault
ALM_026	Node 22 AI_4 Fault
ALM_027	Node 22 AI_5 Fault
ALM_028	Node 22 AI_6 Fault
ALM_029	Node 22 AI_7 Fault
ALM_030	Node 22 AI_8 Fault
ALM_031	Node 22 AO_1 Fault
ALM_032	Node 22 AO_2 Fault
ALM_033	Node 23 RTD_1 Fault
ALM_034	Node 23 RTD_2 Fault
ALM_035	Node 23 RTD_3 Fault

ALARM Number	Description
ALM_036	Node 23 RTD_4 Fault
ALM_037	Node 23 RTD_5 Fault
ALM_038	Node 23 RTD_6 Fault
ALM_039	Node 23 RTD_7 Fault
ALM_040	Node 23 RTD_8 Fault
ALM_041	Node 21 AI 1 Alarm Level 1
ALM_042	Node 21 AI 1 Alarm Level 2
ALM_043	Node 21 AI 2 Alarm Level 1
ALM_044	Node 21 AI 2 Alarm Level 2
ALM_045	Node 21 AI 3 Alarm Level 1
ALM_046	Node 21 AI 3 Alarm Level 2
ALM_047	Node 21 AI 4 Alarm Level 1
ALM_048	Node 21 AI 4 Alarm Level 2
ALM_049	Node 21 AI 5 Alarm Level 1
ALM_050	Node 21 AI 5 Alarm Level 2
ALM_051	Node 21 AI 6 Alarm Level 1
ALM_052	Node 21 AI 6 Alarm Level 2
ALM_053	Node 21 AI 7 Alarm Level 1
ALM_054	Node 21 AI 7 Alarm Level 2
ALM_055	Node 21 AI 8 Alarm Level 1
ALM_056	Node 21 AI 8 Alarm Level 2
ALM_057	Node 22 AI 1 Alarm Level 1
ALM_058	Node 22 AI 1 Alarm Level 2
ALM_059	Node 22 AI 2 Alarm Level 1
ALM_060	Node 22 AI 2 Alarm Level 2
ALM_061	Node 22 AI 3 Alarm Level 1
ALM_062	Node 22 AI 3 Alarm Level 2
ALM_063	Node 22 AI 4 Alarm Level 1
ALM_064	Node 22 AI 4 Alarm Level 2
ALM_065	Node 22 AI 5 Alarm Level 1
ALM_066	Node 22 AI 5 Alarm Level 2
ALM_067	Node 22 AI 6 Alarm Level 1
ALM_068	Node 22 AI 6 Alarm Level 2
ALM_069	Node 22 AI 7 Alarm Level 1
ALM_070	Node 22 AI 7 Alarm Level 2
ALM_071	Node 22 AI 8 Alarm Level 1
ALM_072	Node 22 AI 8 Alarm Level 2
ALM_073	Node 23 RTD 1 Alarm Level 1
ALM_074	Node 23 RTD 1 Alarm Level 2
ALM_075	Node 23 RTD 2 Alarm Level 1
ALM_076	Node 23 RTD 2 Alarm Level 2
ALM_077	Node 23 RTD 3 Alarm Level 1
ALM_078	Node 23 RTD 3 Alarm Level 2
ALM_079	Node 23 RTD 4 Alarm Level 1
ALM_080	Node 23 RTD 4 Alarm Level 2

ALARM Number	Description
ALM_081	Node 23 RTD 5 Alarm Level 1
ALM_082	Node 23 RTD 5 Alarm Level 2
ALM_083	Node 23 RTD 6 Alarm Level 1
ALM_084	Node 23 RTD 6 Alarm Level 2
ALM_085	Node 23 RTD 7 Alarm Level 1
ALM_086	Node 23 RTD 7 Alarm Level 2
ALM_087	Node 23 RTD 8 Alarm Level 1
ALM_088	Node 23 RTD 8 Alarm Level 2
ALM_089	Node 26 AI_1 Fault
ALM_090	Node 26 AI_2 Fault
ALM_091	Node 26 AI_3 Fault
ALM_092	Node 26 AI_4 Fault
ALM_093	Node 26 AI_5 Fault
ALM_094	Node 26 AI_6 Fault
ALM_095	Node 26 AI_7 Fault
ALM_096	Node 26 AI_8 Fault
ALM_097	Node 26 AO_1 Fault
ALM_098	Node 26 AO_2 Fault
ALM_099	Node 26 AI 1 Alarm Level 1
ALM_100	Node 26 AI 1 Alarm Level 2
ALM_101	Node 26 AI 2 Alarm Level 1
ALM_102	Node 26 AI 2 Alarm Level 2
ALM_103	Node 26 AI 3 Alarm Level 1
ALM_104	Node 26 AI 3 Alarm Level 2
ALM_105	Node 26 AI 4 Alarm Level 1
ALM_106	Node 26 AI 4 Alarm Level 2
ALM_107	Node 26 AI 5 Alarm Level 1
ALM_108	Node 26 AI 5 Alarm Level 2
ALM_109	Node 26 AI 6 Alarm Level 1
ALM_110	Node 26 AI 6 Alarm Level 2
ALM_111	Node 26 AI 7 Alarm Level 1
ALM_112	Node 26 AI 7 Alarm Level 2
ALM_113	Node 26 AI 8 Alarm Level 1
ALM_114	Node 26 AI 8 Alarm Level 2
ALM_115	All CAN2 Network Links Failed
ALM_116	CAN2 Syscon Link Error - XFER
ALM_117	CAN2 Backup Link Error
ALM_118	SPARE_118

Trips

When using the 505DR, the Trip List in Volume 1 of this manual is replaced with the following list.

Table 3-6. Trip Messages

TRIP Number	Description
SD_01	External Trip Input 1
SD_02	Emergency Stop Button
SD_03	Overspeed
SD_04	All Speed Probes Failed
SD_05	HP Actuator Fault
SD_06	HP2 Actuator Fault
SD_07	Aux Input Failed
SD_08	Power Up Trip
SD_09	Normal Shutdown Complete
SD_10	Trip Command from Modbus
SD_11	Unit in Calibration Mode
SD_12	Configuration Error
SD_13	Tie Breaker Opened
SD_14	GEN Breaker Opened
SD_15	External Trip 2
SD_16	External Trip 3
SD_17	External Trip 4
SD_18	External Trip 5
SD_19	External Trip 6
SD_20	External Trip 7
SD_21	External Trip 8
SD_22	External Trip 9
SD_23	External Trip 10
SD_24	HP Ramp at Max/No Speed
SD_25	Actuator Scaling Min > Max
SD_26	Inlet Input Signal Failed
SD_27	Ext/Adm Input Signal Failed
SD_28	Exhaust Input Signal Failed
SD_29	Inlet Stm Pressure Level2 TRIP
SD_30	EXH Stm Pressure Level2 TRIP
SD_31	Selected PV 1 Level 2 TRIP
SD_32	Selected PV 2 Level 2 TRIP
SD_33	Selected PV 3 Level 2 TRIP
SD_34	Tunable Trip
SD_35	Configuration Mode (IO Lock)
SD_36	RTCnet Summary Trip
SD_37	Open Wire on MPUs
SD_38	LP Actuator Fault
SD_39	Overspeed Test Limit Reached
SD_40	CAN1 Digital Driver Network Fault
SD_41	External Trip 11

TRIP Number	Description
SD_42	External Trip 12
SD_43	External Trip 13
SD_44	External Trip 14
SD_45	External Trip 15
SD_46	Trip cmd from Display/RemoteView
SD_47	LP2 Actuator Fault
SD_48	Started but no SYCON Speed
SD_49	Wait Run Permissive Active
SD_50	spare_50
SD_51	spare_51
SD_52	spare_52
SD_53	spare_53
SD_54	spare_54
SD_55	spare_55

When using the 505DR, if RTCnet nodes (distributed I/O) are used then this alarm list will apply. It details the summary of alarm events that come from the CAN2 network.

Table 3-7. Distributed I/O Trip Messages

TRIP Number	Description
SD_01	Loss of VIB Signals -Trip
SD_02	Node 1 AI_1 Level 2 Trip
SD_03	Node 1 AI_2 Level 2 Trip
SD_04	Node 1 AI_3 Level 2 Trip
SD_05	Node 1 AI_4 Level 2 Trip
SD_06	Node 1 AI_5 Level 2 Trip
SD_07	Node 1 AI_6 Level 2 Trip
SD_08	Node 1 AI_7 Level 2 Trip
SD_09	Node 1 AI_8 Level 2 Trip
SD_10	Node 2 AI_1 Level 2 Trip
SD_11	Node 2 AI_2 Level 2 Trip
SD_12	Node 2 AI_3 Level 2 Trip
SD_13	Node 2 AI_4 Level 2 Trip
SD_14	Node 2 AI_5 Level 2 Trip
SD_15	Node 2 AI_6 Level 2 Trip
SD_16	Node 2 AI_7 Level 2 Trip
SD_17	Node 2 AI_8 Level 2 Trip
SD_18	Node 3 RTD_1 Level 2 Trip
SD_19	Node 3 RTD_2 Level 2 Trip
SD_20	Node 3 RTD_3 Level 2 Trip
SD_21	Node 3 RTD_4 Level 2 Trip
SD_22	Node 3 RTD_5 Level 2 Trip
SD_23	Node 3 RTD_6 Level 2 Trip
SD_24	Node 3 RTD_7 Level 2 Trip
SD_25	Node 3 RTD_8 Level 2 Trip
SD_26	Spare26

TRIP Number	Description
SD_27	Spare27
SD_28	Spare28
SD_29	Spare29
SD_30	Spare30
SD_31	Spare31
SD_32	Spare32
SD_33	Spare33
SD_34	Spare34
SD_35	Spare35

Modbus Addressing

The 505DR Modbus lists are given below. The Modbus lists are very similar to the lists given in Volume 1 but are unique to the 505DR so addresses should be verified if updating systems from Simplex to Redundant.

Table 3-8. Modbus Lists

Addr	Description
0:0001	Emergency Shutdown
0:0002	Emergency Shutdown Acknowledge
0:0003	Controlled Shutdown
0:0004	Abort Controlled Shutdown
0:0005	System Reset
0:0006	Start / Run
0:0007	Manual Open VLV Limiter
0:0008	Manual Close VLV Limiter
0:0009	Lower Speed Setpoint
0:0010	Raise Speed Setpoint
0:0011	Go To Rated (Idle / Rated)
0:0012	Go To Idle (Idle / Rated)
0:0013	Halt Auto Start Seq
0:0014	Continue Auto Start Seq
0:0015	Enable Remote Speed Setpoint Control
0:0016	Disable Remote Speed Setpoint Control
0:0017	Go To Modbus Entered Speed Setpt
0:0018	Comm Heartbeat to BR_89
0:0019	Arm Frequency Control
0:0020	Disarm Frequency Control
0:0021	Sync Enable
0:0022	Sync Disable
0:0023	Enable Cascade Control
0:0024	Disable Cascade Control
0:0025	Lower Cascade Setpoint
0:0026	Raise Cascade Setpoint
0:0027	Enable Remote Cascade Setpoint Control

0:0028	Disable Remote Cascade Setpoint Contro
0:0029	Go To Modbus Entered Cascade Setpt
0:0030	Spare
0:0031	Enable Aux Control
0:0032	Disable Aux Control
0:0033	Lower Aux Setpoint
0:0034	Raise Aux Setpoint
0:0035	Enable Remote Aux Setpoint Control
0:0036	Disable Remote Aux Setpoint Control
0:0037	Go To Modbus Entered Auxiliary Setpt
0:0038	Spare
0:0039	Select Remote Ctrl (Remote/Local)
0:0040	Select Local Ctrl (Remote/Local)
0:0041	Spare
0:0042	Modbus Shutdown Acknowledge
0:0043	Energize Relay 2
0:0044	De-Energize Relay 2
0:0045	Energize Relay 3
0:0046	De-Energize Relay 3
0:0047	Energize Relay 4
0:0048	De-Energize Relay 4
0:0049	Energize Relay 5
0:0050	De-Energize Relay 5
0:0051	Energize Relay 6
0:0052	De-Energize Relay 6
0:0053	Energize Relay 7
0:0054	De-Energize Relay 7
0:0055	Spare
0:0056	Spare
0:0057	Enable Extraction Control
0:0058	Disable Extraction Control
0:0059	Lower Extraction Setpoint
0:0060	Raise Extraction Setpoint
0:0061	Enable Remote Extr Setpoint Control
0:0062	Disable Remote Extr Setpoint Control
0:0063	Go To Modbus Entered Extraction Setpt
0:0064	Open LP Valve Limiter
0:0065	Close LP Valve Limiter
0:0066	Decrease Extr/Adm Demand
0:0067	Increase Extr/Adm Demand
0:0068	Enable Extr/Adm Priority
0:0069	Disable Extr/Adm Priority
0:0070	* Enable Droop Setpoint change
0:0071	* Disable Droop Setpoint change

0:0072	* Enable Speed Forwarding
0:0073	* Disable Speed Forwarding
0:0074	0
0:0075	Momentarily Energize Relay 2
0:0076	Momentarily Energize Relay 3
0:0077	Momentarily Energize Relay 4
0:0078	Momentarily Energize Relay 5
0:0079	Momentarily Energize Relay 6
0:0080	Momentarily Energize Relay 7
0:0081	Enable Inlet Control
0:0082	Disable Inlet Control
0:0083	Lower Inlet Setpoint
0:0084	Raise Inlet Setpoint
0:0085	Enable Remote Inlet Setpoint Control
0:0086	Disable Remote Inlet Setpoint Control
0:0087	Go To Modbus Entered Inlet Setpt
0:0088	Enable Remote KW Setpoint Control
0:0089	Disable Remote KW Setpoint Control
0:0090	Isolated Controller SP Raise
0:0091	Isolated Controller SP Lower
0:0092	Select Hot Start
0:0093	Select Cold Start
0:0094	Energize Relay 8
0:0095	De-Energize Relay 8
0:0096	Momentarily Energize Relay 8
0:0097	Enable Exhaust Control
0:0098	Disable Exhaust Control
0:0099	Lower Exhaust Setpoint
0:0100	Raise Exhaust Setpoint
0:0101	Enable Remote Exhaust Setpoint Control
0:0102	Disable Remote Exhaust Setpoint Control
0:0103	Go To Modbus Entered Exhaust Setpt
0:0104	Request Alternate Mode Transfer
0:0105	Mode 0 Request
0:0106	Enable Manual P Demand
0:0107	Enable Manual P Control
0:0108	Spare 108
0:0109	Lower Manual P Setpoint
0:0110	Raise Manual P Setpoint
0:0111	Enable Remote Manual P Setpoint Control
0:0112	Disable Remote Manual P Setpoint Control
0:0113	Go To Modbus Entered Manual P Setpt
0:0114	Enable Pre-Start Warmup
0:0115	Disable Pre-Start Warmup

0:0116	Open TTV Command
0:0117	Close TTV Command
0:0118	Select Full Arc Start
0:0119	Select Partial Arc Start
0:0120	Enable GEN Load Limiter PID
0:0121	Disable GEN Load Limiter PID

Boolean Read Addresses

Table 3-9. Boolean Read Addresses

Addr	Description
1:0001	Alarm - MPU #1 Failed
1:0002	Alarm - MPU #2 Failed
1:0003	Alarm - Cascade Input Failed
1:0004	Alarm - Aux Input Failed
1:0005	Alarm - KW Input Failed
1:0006	Alarm - Sync Input Failed
1:0007	Alarm - Inlet Press Input Failed
1:0008	Alarm - Remote Speed Input Failed
1:0009	Alarm - Remote Cascade Input Failed
1:0010	Alarm - Remote Aux Input Failed
1:0011	Alarm - Loadshare Input Failed
1:0012	Alarm - HP Actuator Failed
1:0013	Alarm - HP2 Actuator Failed
1:0014	Alarm - Start Permissive Not Met
1:0015	Alarm - Communication Link #1 Failed
1:0016	Alarm - Communication Link #2 Failed
1:0017	Alarm - Generator Breaker Open
1:0018	Alarm - Turbine Trip
1:0019	Alarm - Tie Breaker Open
1:0020	Alarm - Overspeed Alarm
1:0021	Alarm - Tie Breaker Open / No Aux
1:0022	Alarm - Gen Breaker Open / No Aux
1:0023	Alarm - Tie Breaker Open / No Casc
1:0024	Alarm - Gen Breaker Open / No Casc
1:0025	Alarm - Tie Breaker Open / No Remote
1:0026	Alarm - Gen Breaker Open / No Remote
1:0027	Alarm - Stuck in Critical Alarm
1:0028	Alarm - Tie Breaker Open / No Extr
1:0029	Alarm - Gen Breaker Open / No Extr
1:0030	Alarm - Extr Input Failed
1:0031	Alarm - Remote Extr Input Failed
1:0032	Alarm - External Alarm 1
1:0033	Alarm - External Alarm 2

1:0034	Alarm - External Alarm 3
1:0035	Alarm - External Alarm 4
1:0036	Alarm - External Alarm 5
1:0037	Alarm - External Alarm 6
1:0038	CTC Alarm latch
1:0039	Modbus Alarm Acknowledge
1:0040	Alarm Exists (Common Alarm Indication)
1:0041	Trip - External Trip
1:0042	Trip - ESD Button
1:0043	Trip - Overspeed Trip
1:0044	Trip - Loss of Speed Signals
1:0045	Trip - HP Actuator Fault
1:0046	Trip - HP2 Actuator Fault
1:0047	Trip - Aux Input Failed
1:0048	Trip - External Trip 2
1:0049	Trip - External Trip 3
1:0050	Trip - Modbus Link #1 Trip
1:0051	SPARE
1:0052	SPARE
1:0053	Trip - Tie Breaker Open
1:0054	Trip - Gen Breaker Open
1:0055	Trip - Power up
1:0056	Trip - Manual Stop
1:0057	Trip - External Trip 4
1:0058	Trip - External Trip 5
1:0059	Trip - Extraction Input Failed
1:0060	Trip - External Trip 6
1:0061	Trip - External Trip 7
1:0062	Trip - External Trip 8
1:0063	Trip - External Trip 9
1:0064	Shutdown Exists (Trip Indication)
1:0065	Modbus ESD Acknowledge Enable
1:0066	Moving to Min Setpoint
1:0067	Ramping to Idle (Idle / Rated)
1:0068	Idle / Rated at Idle
1:0069	Ramping to Rated (Idle / Rated)
1:0070	At Rated
1:0071	Auto Seq - Setpt at Idle 1
1:0072	Auto Seq - Ramp to Idle 2
1:0073	Auto Seq - Setpt at Idle 2
1:0074	Auto Seq - Ramp to rated
1:0075	Auto Seq - At Rated
1:0076	Speed PID In Control
1:0077	Speed Sensor 1 Failed Override ON

1:0078	Speed Sensor 2 Failed Override ON
1:0079	Overspeed Test Permissive
1:0080	Overspeed Test In progress
1:0081	Speed At or above Min Gov
1:0082	Turbine In Critical Speed Band
1:0083	Remote Speed Setpt Is Enabled
1:0084	Remote Speed Setpt Is Active
1:0085	Remote Speed Setpt Is In Control
1:0086	Remote Speed Setpt Is Inhibited
1:0087	Speed PID In Control (not being lmted)
1:0088	Auto Seq - at idle 3
1:0089	Comm Heartbeat from BW_18
1:0090	Generator Breaker Closed
1:0091	Utility Tie Breaker Closed
1:0092	Synchronizing Rate Selected
1:0093	Synchronizing Is Enabled
1:0094	Sync or Load Share Is In Control
1:0095	Sync / Load Share Is Inhibited
1:0096	Spare
1:0097	Frequency Control Armed
1:0098	Frequency Control
1:0099	Reset
1:0100	Cascade Is Enabled
1:0101	Cascade Is Active
1:0102	Cascade Is In Control
1:0103	Cascade Is Inhibited
1:0104	Rmt Cascade Is Enabled
1:0105	Rmt Cascade Is Active
1:0106	Rmt Cascade Is In Control
1:0107	Rmt Cascade Is Inhibited
1:0108	IH Configured
1:0109	Auxiliary Is Enabled
1:0110	Auxiliary Is Active
1:0111	Auxiliary Is In Control
1:0112	Aux Active / Not Limiting
1:0113	Aux Active / Not In Control
1:0114	Auxiliary is Inhibited
1:0115	Remote Aux Is Enabled
1:0116	Remote Aux Is Active
1:0117	Rmt Aux Is In Control
1:0118	Rmt Aux Is Inhibited
1:0119	Startup Complete
1:0120	Extraction Is Enabled
1:0121	Extraction Is Active

1:0122	Extraction Is In Control
1:0123	Extraction is Inhibited
1:0124	Remote Extraction Is Enabled
1:0125	Remote Extraction Is Active
1:0126	Rmt Extraction Is In Control
1:0127	Rmt Extraction Is Inhibited
1:0128	Pressure Priority Enabled
1:0129	Pressure Priority Active
1:0130	Speed Priority Active
1:0131	Priority Transfer Permissible
1:0132	* Auto seq:ramp to Idle3
1:0133	Controlled Stop In Progress
1:0134	LP Valve Limiter Is Open
1:0135	LP Valve Limiter Is Closed
1:0136	LP Valve Limiter In Control
1:0137	HP Valve Limiter Is Open
1:0138	HP Valve Limiter Is Closed
1:0139	HP Valve Limiter In Control
1:0140	Remote/Local Remote Selected
1:0141	MODBUS Active
1:0142	Start Permissive
1:0143	At Steam Map Limit
1:0144	At Min Press Limit
1:0145	At HP MAX Limit
1:0146	At HP MIN Limit
1:0147	At LP MAX Limit
1:0148	At LP MIN Limit
1:0149	At Max Power Limit
1:0150	At Max Press Limit
1:0151	Shutdown Relay Energized(Relay 1)
1:0152	Alarm Relay Driver
1:0153	Relay 3 Energized
1:0154	Relay 4 Energized
1:0155	Relay 5 Energized
1:0156	Relay 6 Energized
1:0157	Relay 7 Energized
1:0158	Relay 8 Energized
1:0159	ESD Contact Input Closed
1:0160	Contact In 2 Closed
1:0161	Contact In 3 Closed
1:0162	Contact In 4 Closed
1:0163	Contact In 5 Closed
1:0164	Contact In 6 Closed
1:0165	Contact In 7 Closed

1:0166	Contact In 8 Closed
1:0167	Contact In 9 Closed
1:0168	Contact In 10 Closed
1:0169	Contact In 11 Closed
1:0170	Contact In 12 Closed
1:0171	Contact In 13 Closed
1:0172	Contact In 14 Closed
1:0173	Contact In 15 Closed
1:0174	Contact In 16 Closed
1:0175	Aux Controller Configured
1:0176	Sync Function Configured
1:0177	Modbus- ESD Control Configured
1:0178	Manual Start Configured
1:0179	Auto Start Configured
1:0180	Semi-Auto Start Configured
1:0181	Idle/Rated Start Configured
1:0182	Auto Start Sequence Configured
1:0183	Inlet Pressure Configured
1:0184	Remote Control Configured
1:0185	Loadsharing Configured
1:0186	HP2 Configured
1:0187	Gen Set Configured
1:0188	Cascade Control Configured
1:0189	Remote Cascade Configured
1:0190	Aux Control Configured
1:0191	Remote Aux Configured
1:0192	Enables Mod Port1 In Local
1:0193	Start Permissive Configured
1:0194	Frequency Arm/Disarm Configured
1:0195	Frequency Control Configured
1:0196	MPU 2 Configured
1:0197	Local/Remote Configured
1:0198	Local Trip Enabled
1:0199	Casc Tracking Configured
1:0200	KW Signal OK
1:0201	Extr/Adm Configured
1:0202	Admission-only Configured
1:0203	Extr Enable/Disable Configured
1:0204	Priority Selection Configured
1:0205	Remote Extr/Adm Setpt Configured
1:0206	E/A Setpt Tracking Config'd
1:0207	* TRUE = NEW 505 R
1:0208	FALSE = 505D, TRUE = 505XT
1:0209	Alarm - External Alarm 7

1:0210	Alarm - External Alarm 8
1:0211	Alarm - External Alarm 9
1:0212	Alarm - IH-act1 Failed from BI
1:0213	Alarm - IH-act2 Failed from BI
1:0214	Spare
1:0215	Alarm - IH-A Pressure Input Failed
1:0216	Alarm - AI FW Fault
1:0217	Alarm - Remote Droop fault
1:0218	Alarm - Hwr com1 fault
1:0219	Alarm - Temp for Hot/Cold Starts Failed
1:0220	Alarm - Start Temperature 1 Failed
1:0221	Alarm - Start Temperature 2 Failed
1:0222	Trip - External Trip 10
1:0223	Trip - HP Ramp at Max/No Speed
1:0224	SPARE
1:0225	Control Heartbeat (2 sec on/off)
1:0226	Unit Ready to Start
1:0227	GEN Load Limiter PID in Control
1:0228	GEN Load Limiter Enabled
1:0229	SPARE
1:0230	SPARE
1:0231	SPARE
1:0232	SPARE
1:0233	Controlled Stop In Progress
1:0234	SPARE
1:0235	SPARE
1:0236	SPARE
1:0237	SPARE
1:0238	SPARE
1:0239	SPARE
1:0240	* Spare
1:0241	* IH-B Pressure Input Failed
1:0242	Alarm - Spare 011
1:0243	Alarm - Spare 012
1:0244	Alarm - Remote KW Setpoint Failed
1:0245	Alarm - Exhaust Press Input Failed
1:0246	Alarm - Overspeed Test Enabled
1:0247	Alarm - HP Valve Feedback Failed
1:0248	Alarm - HP2 Valve Feedback Failed
1:0249	Alarm - Isolated PID PV Failed
1:0250	Alarm - Rem SP Isolated PID Failed
1:0251	Alarm - Customer Input #1 Failed
1:0252	Alarm - Customer Input #2 Failed
1:0253	Alarm - Customer Input #3 Failed

1:0254	Alarm - Mod Comm Link #3 Failed
1:0255	Alarm - AO_01 Readback Fault
1:0256	Alarm - AO_02 Readback Fault
1:0257	Alarm - AO_03 Readback Fault
1:0258	Alarm - AO_04 Readback Fault
1:0259	Alarm - AO_05 Readback Fault
1:0260	Alarm - AO_06 Readback Fault
1:0261	Alarm - Chassis Temp
1:0262	Alarm - HP Valve Pos Fdbk Diff
1:0263	Alarm - HP2 Valve Pos Fdbk Diff
1:0264	Alarm - Limiter in Control
1:0265	Alarm - Inlet Steam Pressure Lvl1
1:0266	Alarm - Inlet Steam Pressure Lvl2
1:0267	Alarm - Exh Steam Pressure Lvl1
1:0268	Alarm - Exh Steam Pressure Lvl2
1:0269	Alarm - Selected PV 1 Level 1
1:0270	Alarm - Selected PV 1 Level 2
1:0271	Alarm - Selected PV 2 Level 1
1:0272	Alarm - Selected PV 2 Level 2
1:0273	Alarm - Selected PV 3 Level 1
1:0274	Alarm - Selected PV 3 Level 2
1:0275	Alarm - Tunable Alarm
1:0276	Alarm - Tie Open / No Inlet
1:0277	Alarm - Gen Open / No Inlet
1:0278	Alarm - Actuator 1 Readout Fault
1:0279	Alarm - Actuator 2 Readout Fault
1:0280	Alarm - CAN1_DVP1 Summary ALM
1:0281	Alarm - CAN1_DVP2 Summary ALM
1:0282	Alarm - HP Actuator Fault (DVP1 or 2)
1:0283	Alarm - HP2 Actuator Fault (DVP1 or 2)
1:0284	Alarm - Comm Link to DSLC2 Failed
1:0285	Alarm - KW Load AI Failed
1:0286	Alarm - Turbine Maintenance Interval Alm
1:0287	Alarm - Start Temperature #1 Override Active
1:0288	Alarm - Start Temperature #2 Override Active
1:0289	Alarm - Comm Link to EasyGen Failed
1:0290	Alarm - Comm Link to LS-5 Failed
1:0291	Alarm - Comm Link to MFR300 Failed
1:0292	Alarm - Comm Link to HiProtec Failed
1:0293	Alarm - MPU1 Failed Open Wire Test
1:0294	Alarm - MPU2 Failed Open Wire Test
1:0295	Alarm - Internal HW Simulation Enabled
1:0296	Alarm - Pressure Compensation Curve Error
1:0297	Alarm - Actuator Linearization Curve Error

1:0298	Alarm - Remote Manual P Demand Input Failed
1:0299	Alarm - Remote Exhaust SP Input Failed
1:0300	Alarm - Remote Inlet Pressure SP Input Failed
1:0301	Alarm - LP Position Feedback Input Failed
1:0302	Alarm - Reverse Rotation Detected
1:0303	Alarm - LinkNet Summary Alarm
1:0304	Spare
1:0305	Spare
1:0306	Alarm - Tie Breaker Open / No Exhaust
1:0307	Alarm - Gen Breaker Open / No Exhaust
1:0308	Alarm - LP Actuator Fault (Act1 or 2)
1:0309	Alarm - LP Actuator Fault ALM (DVP1 or 2)
1:0310	Alarm - Speed Below Min - No Extraction
1:0311	Alarm - LP Lmtr->No Spd Cntl->Ratio Lmtr Dsbl
1:0312	Alarm - External alarm # 10
1:0313	Alarm - External alarm # 11
1:0314	Trip - Unit in Calibration Mode
1:0315	Trip - Configuration Error
1:0316	Trip - Inlet Stm Pressure Level2
1:0317	Trip - EXH Stm Pressure Level2
1:0318	Trip - Selected PV 1 Level 2
1:0319	Trip - Selected PV 2 Level 2
1:0320	Trip - Selected PV 3 Level 2
1:0321	Trip - Tunable Trip
1:0322	Trip - Configuration Mode (IO Lock)
1:0323	Trip - Linknet Summary Trip
1:0324	Trip - Open Wire on MPUs
1:0325	Trip - LP Actuator Failed
1:0326	Trip - Overspeed Test Limit Reached
1:0327	Trip - spare_40
1:0328	Contact In 17 Closed
1:0329	Contact In 18 Closed
1:0330	Contact In 19 Closed
1:0331	Contact In 20 Closed
1:0332	Relay 2 Energized
1:0333	Inlet Is Enabled
1:0334	Inlet Is Active
1:0335	Inlet Is In Control
1:0336	Inlet Active / Not Limiting
1:0337	Inlet Active / Not In Control
1:0338	Inlet is Inhibited
1:0339	Remote Inlet Is Enabled
1:0340	Remote Inlet Is Active

1:0341	Rmt Inlet Is In Control
1:0342	Rmt Inlet Is Inhibited
1:0343	Inlet Limiter Configured
1:0344	Inlet Control Configured
1:0345	Remote Inlet Configured
1:0346	Remote KW Setpt Is Enabled
1:0347	Remote KW Setpt Is Active
1:0348	Remote KW Setpt Is In Control
1:0349	Remote KW Setpt Is Inhibited
1:0350	Remote KW Control Configured
1:0351	* IHB Configured
1:0352	Enables Mod Port2 In Local
1:0353	Enables Mod Port3 In Local
1:0354	Relay 2 is Level Switch
1:0355	Relay 3 is Level Switch
1:0356	Relay 4 is Level Switch
1:0357	Relay 5 is Level Switch
1:0358	Relay 6 is Level Switch
1:0359	Relay 7 is Level Switch
1:0360	Relay 8 is Level Switch
1:0361	Extraction Active / Not Limiting
1:0362	Extraction Active / Not In Control
1:0363	Extraction Limiter Configured
1:0364	Extraction Control Configured
1:0365	Remote Extraction Configured
1:0366	Exhaust Is Enabled
1:0367	Exhaust Is Active
1:0368	Exhaust Is In Control
1:0369	Exhaust Active / Not Limiting
1:0370	Exhaust Active / Not In Control
1:0371	Exhaust is Inhibited
1:0372	Remote Exhaust Is Enabled
1:0373	Remote Exhaust Is Active
1:0374	Rmt Exhaust Is In Control
1:0375	Rmt Exhaust Is Inhibited
1:0376	Exhaust Limiter Configured
1:0377	Exhaust Control Configured
1:0378	Remote Exhaust Configured
1:0379	At MIN Flow Limit
1:0380	Mode Transfer Inhibited
1:0381	Alternate Mode Active
1:0382	spare
1:0383	Illegal Steam Map
1:0384	Ratio Limiter Active

1:0385	RTD Units: True = F, False = C
1:0386	LinkNet Node 4: BI 01
1:0387	LinkNet Node 4: BI 02
1:0388	LinkNet Node 4: BI 03
1:0389	LinkNet Node 4: BI 04
1:0390	LinkNet Node 4: BI 05
1:0391	LinkNet Node 4: BI 06
1:0392	LinkNet Node 4: BI 07
1:0393	LinkNet Node 4: BI 08
1:0394	LinkNet Node 4: BI 09
1:0395	LinkNet Node 4: BI 10
1:0396	LinkNet Node 4: BI 11
1:0397	LinkNet Node 4: BI 12
1:0398	LinkNet Node 4: BI 13
1:0399	LinkNet Node 4: BI 14
1:0400	LinkNet Node 4: BI 15
1:0401	LinkNet Node 4: BI 16
1:0402	LinkNet Node 5: BO 01
1:0403	LinkNet Node 5: BO 02
1:0404	LinkNet Node 5: BO 03
1:0405	LinkNet Node 5: BO 04
1:0406	LinkNet Node 5: BO 05
1:0407	LinkNet Node 5: BO 06
1:0408	LinkNet Node 5: BO 07
1:0409	LinkNet Node 5: BO 08
1:0410	LinkNet Node 5: BO 09
1:0411	LinkNet Node 5: BO 10
1:0412	LinkNet Node 5: BO 11
1:0413	LinkNet Node 5: BO 12
1:0414	LinkNet Node 5: BO 13
1:0415	LinkNet Node 5: BO 14
1:0416	LinkNet Node 5: BO 15
1:0417	LinkNet Node 5: BO 16
1:0418	LinkNet Node 1 Comm Fault
1:0419	LinkNet Node 2 Comm Fault
1:0420	LinkNet Node 3 Comm Fault
1:0421	LinkNet Node 4 Comm Fault
1:0422	LinkNet Node 5 Comm Fault
1:0423	LinkNet Node 1 Failed
1:0424	LinkNet Node 2 Failed
1:0425	LinkNet Node 3 Failed
1:0426	LinkNet Node 4 Failed
1:0427	LinkNet Node 5 Failed
1:0428	LinkNet Node 1 AI_1 Fault

1:0429	LinkNet Node 1 AI_2 Fault
1:0430	LinkNet Node 1 AI_3 Fault
1:0431	LinkNet Node 1 AI_4 Fault
1:0432	LinkNet Node 1 AI_5 Fault
1:0433	LinkNet Node 1 AI_6 Fault
1:0434	LinkNet Node 1 AI_7 Fault
1:0435	LinkNet Node 1 AI_8 Fault
1:0436	LinkNet Node 1 AO_1 Fault
1:0437	LinkNet Node 1 AO_2 Fault
1:0438	LinkNet Node 2 AI_1 Fault
1:0439	LinkNet Node 2 AI_2 Fault
1:0440	LinkNet Node 2 AI_3 Fault
1:0441	LinkNet Node 2 AI_4 Fault
1:0442	LinkNet Node 2 AI_5 Fault
1:0443	LinkNet Node 2 AI_6 Fault
1:0444	LinkNet Node 2 AI_7 Fault
1:0445	LinkNet Node 2 AI_8 Fault
1:0446	LinkNet Node 2 AO_1 Fault
1:0447	LinkNet Node 2 AO_2 Fault
1:0448	LinkNet Node 3 RTD_1 Fault
1:0449	LinkNet Node 3 RTD_2 Fault
1:0450	LinkNet Node 3 RTD_3 Fault
1:0451	LinkNet Node 3 RTD_4 Fault
1:0452	LinkNet Node 3 RTD_5 Fault
1:0453	LinkNet Node 3 RTD_6 Fault
1:0454	LinkNet Node 3 RTD_7 Fault
1:0455	LinkNet Node 3 RTD_8 Fault
1:0456	LinkNet Node 1 AI 1 Alarm Level 1
1:0457	LinkNet Node 1 AI 1 Alarm Level 2
1:0458	LinkNet Node 1 AI 2 Alarm Level 1
1:0459	LinkNet Node 1 AI 2 Alarm Level 2
1:0460	LinkNet Node 1 AI 3 Alarm Level 1
1:0461	LinkNet Node 1 AI 3 Alarm Level 2
1:0462	LinkNet Node 1 AI 4 Alarm Level 1
1:0463	LinkNet Node 1 AI 4 Alarm Level 2
1:0464	LinkNet Node 1 AI 5 Alarm Level 1
1:0465	LinkNet Node 1 AI 5 Alarm Level 2
1:0466	LinkNet Node 1 AI 6 Alarm Level 1
1:0467	LinkNet Node 1 AI 6 Alarm Level 2
1:0468	LinkNet Node 1 AI 7 Alarm Level 1
1:0469	LinkNet Node 1 AI 7 Alarm Level 2
1:0470	LinkNet Node 1 AI 8 Alarm Level 1
1:0471	LinkNet Node 1 AI 8 Alarm Level 2
1:0472	LinkNet Node 2 AI 1 Alarm Level 1

1:0473	LinkNet Node 2 AI 1 Alarm Level 2
1:0474	LinkNet Node 2 AI 2 Alarm Level 1
1:0475	LinkNet Node 2 AI 2 Alarm Level 2
1:0476	LinkNet Node 2 AI 3 Alarm Level 1
1:0477	LinkNet Node 2 AI 3 Alarm Level 2
1:0478	LinkNet Node 2 AI 4 Alarm Level 1
1:0479	LinkNet Node 2 AI 4 Alarm Level 2
1:0480	LinkNet Node 2 AI 5 Alarm Level 1
1:0481	LinkNet Node 2 AI 5 Alarm Level 2
1:0482	LinkNet Node 2 AI 6 Alarm Level 1
1:0483	LinkNet Node 2 AI 6 Alarm Level 2
1:0484	LinkNet Node 2 AI 7 Alarm Level 1
1:0485	LinkNet Node 2 AI 7 Alarm Level 2
1:0486	LinkNet Node 2 AI 8 Alarm Level 1
1:0487	LinkNet Node 2 AI 8 Alarm Level 2
1:0488	LinkNet Node 3 RTD 1 Alarm Level 1
1:0489	LinkNet Node 3 RTD 1 Alarm Level 2
1:0490	LinkNet Node 3 RTD 2 Alarm Level 1
1:0491	LinkNet Node 3 RTD 2 Alarm Level 2
1:0492	LinkNet Node 3 RTD 3 Alarm Level 1
1:0493	LinkNet Node 3 RTD 3 Alarm Level 2
1:0494	LinkNet Node 3 RTD 4 Alarm Level 1
1:0495	LinkNet Node 3 RTD 4 Alarm Level 2
1:0496	LinkNet Node 3 RTD 5 Alarm Level 1
1:0497	LinkNet Node 3 RTD 5 Alarm Level 2
1:0498	LinkNet Node 3 RTD 6 Alarm Level 1
1:0499	LinkNet Node 3 RTD 6 Alarm Level 2
1:0500	LinkNet Node 3 RTD 7 Alarm Level 1
1:0501	LinkNet Node 3 RTD 7 Alarm Level 2
1:0502	LinkNet Node 3 RTD 8 Alarm Level 1
1:0503	LinkNet Node 3 RTD 8 Alarm Level 2
1:0504	LinkNet CAN2 Link Error
1:0505	LinkNet Errors on TX/RX msg
1:0506	LinkNet Errors on RT TX/RX msg
1:0507	SPARE_90
1:0508	Trip - Actuator Scaling Min > Max
1:0509	Trip - Inlet Input Signal Failed
1:0510	Trip - Exhaust Input Signal Failed
1:0511	Trip - External Trip 11
1:0512	Trip - External Trip 12
1:0513	Trip - External Trip 13
1:0514	Trip - External Trip 14
1:0515	Trip - External Trip 15
1:0516	Trip - spare_46

1:0517	Trip - spare_47
1:0518	Trip - spare_48
1:0519	Trip - spare_49
1:0520	Trip - spare_50
1:0521	Trip - spare_51
1:0522	Trip - spare_52
1:0523	Trip - spare_53
1:0524	Trip - spare_54
1:0525	Trip - spare_55
1:0526	Alarm - External alarm # 12
1:0527	Alarm - External alarm # 13
1:0528	Alarm - External alarm # 14
1:0529	Alarm - External alarm # 15
1:0530	Alarm - Alternate Mode Map Error
1:0531	Alarm - LP Valve Pos Fdbk Diff ALM
1:0532	Alarm - spare_127
1:0533	Alarm - spare_128
1:0534	Alarm - spare_129
1:0535	Alarm - spare_130
1:0536	Alarm - spare_131
1:0537	Alarm - spare_132
1:0538	Alarm - spare_133
1:0539	Alarm - spare_134
1:0540	Alarm - spare_135
1:0541	Alarm - spare_136
1:0542	0
1:0543	0
1:0544	**Start of DR added Parameters**
1:0545	Primary Unit Healthy
1:0546	Primary Unit is SYSCON
1:0547	Secondary Unit Healthy
1:0548	Secondary Unit is SYSCON
1:0549	Backup Unit Faulted
1:0550	Backup Unit Unavailable
1:0551	Backup Contact In 1 Closed
1:0552	Backup Contact In 2 Closed
1:0553	Backup Contact In 3 Closed
1:0554	Backup Contact In 4 Closed
1:0555	Backup Contact In 5 Closed
1:0556	Backup Contact In 6 Closed
1:0557	Backup Contact In 7 Closed
1:0558	Backup Contact In 8 Closed
1:0559	Backup Contact In 9 Closed
1:0560	Backup Contact In 10 Closed

1:0561	Backup Contact In 11 Closed
1:0562	Backup Contact In 12 Closed
1:0563	Backup Contact In 13 Closed
1:0564	Backup Contact In 14 Closed
1:0565	Backup Contact In 15 Closed
1:0566	Backup Contact In 16 Closed
1:0567	Backup Contact In 17 Closed
1:0568	Backup Contact In 18 Closed
1:0569	Backup Contact In 19 Closed
1:0570	Backup Contact In 20 Closed
1:0571	Backup Relay 1 Energized
1:0572	Backup Relay 2 Energized
1:0573	Backup Relay 3 Energized
1:0574	Backup Relay 4 Energized
1:0575	Backup Relay 5 Energized
1:0576	Backup Relay 6 Energized
1:0577	Backup Relay 7 Energized
1:0578	Backup Relay 8 Energized
1:0579	SPC 11 is used in system
1:0580	SPC 12 is used in system
1:0581	SPC 13 is used in system
1:0582	SPC 14 is used in system
1:0583	Spare
1:0584	Spare
1:0585	SPC 11 is Faulted
1:0586	SPC 12 is Faulted
1:0587	SPC 13 is Faulted
1:0588	SPC 14 is Faulted
1:0589	Spare
1:0590	Spare
1:0591	Alarm - Backup Unit Unavailable
1:0592	ALM138
1:0593	ALM139
1:0594	ALM140
1:0595	ALM141
1:0596	ALM142
1:0597	ALM143
1:0598	ALM144
1:0599	ALM145
1:0600	ALM146
1:0601	ALM147
1:0602	ALM148
1:0603	ALM149
1:0604	ALM150

1:0605	ALM151
1:0606	ALM152
1:0607	ALM153
1:0608	ALM154
1:0609	ALM155
1:0610	ALM156
1:0611	ALM157
1:0612	ALM158
1:0613	ALM159
1:0614	ALM160
1:0615	ALM161
1:0616	ALM162
1:0617	ALM163
1:0618	ALM164
1:0619	ALM165
1:0620	ALM166
1:0621	ALM167
1:0622	ALM168
1:0623	ALM169
1:0624	ALM170
1:0625	ALM171
1:0626	ALM172
1:0627	ALM173
1:0628	ALM174
1:0629	ALM175
1:0630	ALM176
1:0631	ALM177
1:0632	ALM178
1:0633	ALM179
1:0634	ALM180
1:0635	ALM181
1:0636	ALM182
1:0637	ALM183
1:0638	ALM184
1:0639	ALM185
1:0640	ALM186
1:0641	ALM187
1:0642	ALM188
1:0643	ALM189
1:0644	ALM190
1:0645	ALM191
1:0646	ALM192
1:0647	ALM193
1:0648	ALM194

1:0649	ALM195
1:0650	ALM196
1:0651	ALM197
1:0652	ALM198
1:0653	ALM199
1:0654	ALM200
1:0655	ALM201
1:0656	ALM202 - spare
1:0657	ALM203 - spare
1:0658	ALM204 - spare
1:0659	ALM205 - spare
1:0660	ALM206 - spare
1:0661	ALM207 - spare
1:0662	ALM208 - spare
1:0663	ALM209 - spare
1:0664	ALM210 - spare
1:0665	ALM211 - spare
1:0666	ALM212 - spare
1:0667	ALM213 - spare
1:0668	ALM214 - spare
1:0669	ALM215 - spare
1:0670	ALM216 - spare
1:0671	ALM217 - spare
1:0672	ALM218 - spare
1:0673	ALM219 - spare
1:0674	ALM220 - spare
1:0675	ALM221 - spare
1:0676	ALM222 - spare
1:0677	ALM223 - spare
1:0678	ALM224 - spare
1:0679	Shutdown Warmup Enabled

Analog Read Addresses

Table 3-10. Analog Read Addresses

Addr	Description	Units	Multiplier
3:0001	Control Parameter	-	1
3:0002	Speed Sensor #1 Input (RPM)	rpm	1
3:0003	Speed Sensor #2 Input (RPM)	rpm	1
3:0004	Actual Turbine Speed (RPM)	rpm	1
3:0005	Actual Speed (%) x 100	%	100
3:0006	Speed Setpoint (%) x 100	%	100
3:0007	Speed Setpoint (RPM)	rpm	1
3:0008	Speed Droop Setpoint (RPM)	rpm	1

Addr	Description	Units	Multiplier
3:0009	Speed Droop (%) x 100	%	100
3:0010	Speed PID Output (%)	%	100
3:0011	Min Governor Speed Setpoint (RPM)	rpm	1
3:0012	Highest Speed reached	rpm	1
3:0013	Idle / Rated - Idle Speed (RPM)	rpm	1
3:0014	Idle / Rated - Rated Speed (RPM)	rpm	1
3:0015	Auto Seq - Idle 1 Speed Setpt (RPM)	rpm	1
3:0016	Auto Seq- Idle 1 Dly Time (MIN) X 100	min	100
3:0017	Auto Seq-Time Left Idle 1 (MIN) X 100	min	100
3:0018	Auto Seq- Idle1 to Idle2 Rate RPM/SEC	rpm/s	1
3:0019	Auto Seq - Idle 2 Speed Setpt (RPM)	rpm	1
3:0020	Auto Seq- Idle 2 Dly Time (MIN) X 100	min	100
3:0021	Auto Seq-Time Left Idle 2(MIN) X 100	min	100
3:0022	Auto Seq-Time ramp to Rated (RPM/S)	rpm/s	1
3:0023	Auto Seq- Rated speed stpt (RPM)	rpm	1
3:0024	Auto Seq - Run Time Hours	hrs	1
3:0025	Auto Seq-Hours Since trip	hrs	1
3:0026	Cascade Setpoint (Scaled)	Casc units	AI_SCALE
3:0027	Cascade PID Output (%) x 100	%	100
3:0028	Cascade Input (%)	%	100
3:0029	Cascade Setpoint (%)	%	100
3:0030	Cascade Scale Factor	-	1
3:0031	Cascade Input (Scaled)	Casc units	AI_SCALE
3:0032	Remote Cascade Input (Scaled)	Casc units	AI_SCALE
3:0033	Aux Setpoint (Scaled)	aux units	AI_SCALE
3:0034	Aux PID Output (%) x 100	%	100
3:0035	Aux Input (%)	%	100
3:0036	Aux Setpoint (%)	%	100
3:0037	Aux Scale Factor	-	1
3:0038	Aux Input (Scaled)	aux units	AI_SCALE
3:0039	Remote Aux Input (Scaled)	aux units	AI_SCALE
3:0040	Remote Speed Setpoint Input	rpm	1
3:0041	Inlet Pressure Scale Factor	-	1
3:0042	Inlet Pressure Input (Scaled)	IP units	AI_SCALE
3:0043	Loadshare Scale Factor	-	1
3:0044	Sync / Loadshare Input (Scaled)	rpm	AI_SCALE
3:0045	KW Scale Factor	-	1
3:0046	KW Input (Scaled)	kW units	AI_SCALE
3:0047	HP VLV Limiter Output x 100	%	100
3:0048	LSS Demand (%) x100	%	100
3:0049	HP Actuator Demand (%) x100	%	100
3:0050	HP2 Actuator Demand (%) x100	%	100
3:0051	Extr/Adm Manual Demand x 100	%	100

Addr	Description	Units	Multiplier
3:0052	Extraction Setpoint (Scaled)	ext units	AI_SCALE
3:0053	Extraction PID Output (%) x 100	%	100
3:0054	Extraction Input (%)	%	100
3:0055	Extraction Setpoint (%)	%	100
3:0056	Extraction Scale Factor	-	1
3:0057	Extraction Input (Scaled)	ext units	AI_SCALE
3:0058	Remote Extr Input (Scaled)	ext units	AI_SCALE
3:0059	Spare	-	0
3:0060	Modbus Entered Speed Setpoint (fdbk)	rpm	1
3:0061	Modbus Entered Cascade Setpoint (fdbk)	Casc units	AI_SCALE
3:0062	Modbus Entered Aux Setpoint (fdbk)	Aux units	AI_SCALE
3:0063	Modbus Entered Extr Setpoint (fdbk)	Ext	AI_SCALE
3:0064	S-demand Limited (from ratio/lmtr)	%	100
3:0065	P-demand Limited (from ratio/lmtr)	%	100
3:0066	HP Map Demand (from ratio/lmtr)	%	100
3:0067	LP Map Demand (from ratio/lmtr)	%	100
3:0068	S-term (from LSS to ratio/lmtr)	%	100
3:0069	P-term (from E/A dmd to ratio/lmtr)	%	100
3:0070	Controlling Parameter 1 (505E)	-	0
3:0071	Controlling Parameter 2 (505E)	-	0
3:0072	Analog Input 1 (percent x 100)	%	100
3:0073	Analog Input 2 (percent x 100)	%	100
3:0074	Analog Input 3 (percent x 100)	%	100
3:0075	Analog Input 4 (percent x 100)	%	100
3:0076	Analog Input 5 (percent x 100)	%	100
3:0077	Analog Input 6 (percent x 100)	%	100
3:0078	Analog Output 1 (mA x 100)	mA	100
3:0079	Analog Output 2 (mA x 100)	mA	100
3:0080	Analog Output 3 (mA x 100)	mA	100
3:0081	Analog Output 4 (mA x 100)	mA	100
3:0082	Analog Output 5 (mA x 100)	mA	100
3:0083	Analog Output 6 (mA x 100)	mA	100
3:0084	Actuator #1 Output (mA x 100)	mA	100
3:0085	Actuator #2 Output (mA x 100)	mA	100
3:0086	Last Trip	-	1
3:0087	KW Units (3=MW 4=KW)	-	1
3:0088	Analog Input 1 Configuration	-	1
3:0089	Analog Input 2 Configuration	-	1
3:0090	Analog Input 3 Configuration	-	1
3:0091	Analog Input 4 Configuration	-	1
3:0092	Analog Input 5 Configuration	-	1
3:0093	Analog Input 6 Configuration	-	1
3:0094	Analog Output 1 Configuration	-	1

Addr	Description	Units	Multiplier
3:0095	Analog Output 2 Configuration	-	1
3:0096	Analog Output 3 Configuration	-	1
3:0097	Analog Output 4 Configuration	-	1
3:0098	Analog Output 5 Configuration	-	1
3:0099	Analog Output 6 Configuration	-	1
3:0100	Relay 1 Configuration	-	1
3:0101	Relay 2 Configuration	-	1
3:0102	Relay 3 Configuration	-	1
3:0103	Relay 4 Configuration	-	1
3:0104	Relay 5 Configuration	-	1
3:0105	Relay 6 Configuration	-	1
3:0106	Contact 2 Configuration	-	1
3:0107	Contact 3 Configuration	-	1
3:0108	Contact 4 Configuration	-	1
3:0109	Contact 5 Configuration	-	1
3:0110	Contact 6 Configuration	-	1
3:0111	Contact 7 Configuration	-	1
3:0112	Contact 8 Configuration	-	1
3:0113	Contact 9 Configuration	-	1
3:0114	Contact 10 Configuration	-	1
3:0115	Contact 11 Configuration	-	1
3:0116	Contact 12 Configuration	-	1
3:0117	Contact 13 Configuration	-	1
3:0118	SPARE	-	1
3:0119	SPARE	-	1
3:0120	* Spare E	-	1
3:0121	* S/W PN54186768	-	1
3:0122	*S/W Revision	-	1
3:0123	* Auto Seq-Time ramp to idle 3(RPM/S)	rpm/s	1
3:0124	* Auto Seq Idle 3 speed RPM	rpm	1
3:0125	* Auto Seq-HH Idle Dly Time (MIN)X 100	min	100
3:0126	* Auto Seq-Time Left Idle 3(MIN) X100	min	100
3:0127	* Max Governor Speed	rpm	1
3:0128	SPARE	-	1
3:0129	SPARE	-	1
3:0130	SPARE	-	1
3:0131	SPARE	-	1
3:0132	SPARE	-	1
3:0133	SPARE	-	1
3:0134	* Feed Forward Bias	-	1
3:0135	SPARE	-	1
3:0136	* Droop Setting	-	100
3:0137	* Autostart seq rate to Idle 1	rpm/s	1

Addr	Description	Units	Multiplier
3:0138	* Autostart seq CF Cold rte to Idle 2	rpm/s	1
3:0139	* Autostart seq CF Hot rate to Idle 2	rpm/s	1
3:0140	* Autostart seq CF Cold rte to Idle 3	rpm/s	1
3:0141	* Autostart seq CF Hot rate to Idle 3	rpm/s	1
3:0142	* Autostart seq CF Cold rate to rated	rpm/s	1
3:0143	* Autostart seq CF Hot rate to rated	rpm/s	1
3:0144	Speed Derivative signal	rpm/s	1
3:0145	Speed Accel Rate	%/s	1
3:0146	Analog Input 7 (percent x 100)	%	100
3:0147	Analog Input 8 (percent x 100)	%	100
3:0148	Analog Input 7 Configuration	-	1
3:0149	Analog Input 8 Configuration	-	1
3:0150	Relay 7 Configuration	-	1
3:0151	Relay 8 Configuration	-	1
3:0152	Contact 14 Configuration	-	1
3:0153	Contact 15 Configuration	-	1
3:0154	Contact 16 Configuration	-	1
3:0155	Contact 17 Configuration	-	1
3:0156	Contact 18 Configuration	-	1
3:0157	Contact 19 Configuration	-	1
3:0158	Contact 20 Configuration	-	1
3:0159	Inlet Setpoint (Scaled)	INL units	AI_SCALE
3:0160	Inlet PID Output (%) x 100	%	100
3:0161	Inlet Input (%)	%	100
3:0162	Inlet Setpoint (%)	%	100
3:0163	Inlet Scale Factor	-	1
3:0164	Inlet Input (Scaled)	INL units	AI_SCALE
3:0165	Remote Inlet Input (Scaled)	INL units	AI_SCALE
3:0166	Modbus Entered Inlet Setpoint (fdbk)	INL units	AI_SCALE
3:0167	SPARE	-	1
3:0168	SPARE	-	1
3:0169	SPARE	-	1
3:0170	SPARE	-	1
3:0171	* Autostart seq CF Warm rte to Idle 2	rpm/s	1
3:0172	* Autostart seq CF Warm rte to Idle 3	rpm/s	1
3:0173	* Autostart seq CF Warm rate to rated	rpm/s	1
3:0174	Idle / Rated Cold Rate	rpm/s	1
3:0175	Idle / Rated Warm Rate	rpm/s	1
3:0176	Idle / Rated Hot Rate	rpm/s	1
3:0177	Remote KW Setpoint Scale Factor	-	1
3:0178	Remote KW Setpoint Input	-	AI_SCALE
3:0179	Spare 179	-	0
3:0180	Spare 180	-	0

Addr	Description	Units	Multiplier
3:0181	HP Valve FDBK Position Scale Factor	-	1
3:0182	HP Valve FDBK Position Input	-	AI_SCALE
3:0183	HP2 Valve FDBK Position Scale Factor	-	1
3:0184	HP2 Valve FDBK Position Input	-	AI_SCALE
3:0185	Signal Monitoring #1 Scale Factor	-	1
3:0186	Signal Monitoring #1 Input	-	AI_SCALE
3:0187	Signal Monitoring #2 Scale Factor	-	1
3:0188	Signal Monitoring #2 Input	-	AI_SCALE
3:0189	Signal Monitoring #3 Scale Factor	-	1
3:0190	Signal Monitoring #3 Input	-	AI_SCALE
3:0191	Start Temperature 1 Scale Factor	-	1
3:0192	Start Temperature 1 Input	-	AI_SCALE
3:0193	Start Temperature 2 Scale Factor	-	1
3:0194	Start Temperature 2 Input	-	AI_SCALE
3:0195	Exhaust Setpoint (Scaled)	EXH units	AI_SCALE
3:0196	Exhaust PID Output (%) x 100	%	100
3:0197	Exhaust Input (%)	%	100
3:0198	Exhaust Setpoint (%)	%	100
3:0199	Exhaust Scale Factor	-	1
3:0200	Exhaust Input (Scaled)	EXH units	AI_SCALE
3:0201	Remote Exhaust Input (Scaled)	EXH units	AI_SCALE
3:0202	Modbus Entered Exhaust Setpoint (fdbk)	EXH units	AI_SCALE
3:0203	Exhaust-demand Limited (from ratio/lmtr)	%	100
3:0204	LinkNet Node 1: AI 01 Value	-	AI_SCALE
3:0205	LinkNet Node 1: AI 02 Value	-	AI_SCALE
3:0206	LinkNet Node 1: AI 03 Value	-	AI_SCALE
3:0207	LinkNet Node 1: AI 04 Value	-	AI_SCALE
3:0208	LinkNet Node 1: AI 05 Value	-	AI_SCALE
3:0209	LinkNet Node 1: AI 06 Value	-	AI_SCALE
3:0210	LinkNet Node 1: AI 07 Value	-	AI_SCALE
3:0211	LinkNet Node 1: AI 08 Value	-	AI_SCALE
3:0212	LinkNet Node 2: AI 01 Value	-	AI_SCALE
3:0213	LinkNet Node 2: AI 02 Value	-	AI_SCALE
3:0214	LinkNet Node 2: AI 03 Value	-	AI_SCALE
3:0215	LinkNet Node 2: AI 04 Value	-	AI_SCALE
3:0216	LinkNet Node 2: AI 05 Value	-	AI_SCALE
3:0217	LinkNet Node 2: AI 06 Value	-	AI_SCALE
3:0218	LinkNet Node 2: AI 07 Value	-	AI_SCALE
3:0219	LinkNet Node 2: AI 08 Value	-	AI_SCALE
3:0220	LinkNet Node 3: RTD 01 Value	-	RTD_SCALE
3:0221	LinkNet Node 3: RTD 02 Value	-	RTD_SCALE
3:0222	LinkNet Node 3: RTD 03 Value	-	RTD_SCALE
3:0223	LinkNet Node 3: RTD 04 Value	-	RTD_SCALE

Addr	Description	Units	Multiplier
3:0224	LinkNet Node 3: RTD 05 Value	-	RTD_SCALE
3:0225	LinkNet Node 3: RTD 06 Value	-	RTD_SCALE
3:0226	LinkNet Node 3: RTD 07 Value	-	RTD_SCALE
3:0227	LinkNet Node 3: RTD 08 Value	-	RTD_SCALE
3:0228	Active Speed Setpoint Rate	rpm	1
3:0229	Active Cascade Setpoint Rate	Casc units	1
3:0230	Active AUX Setpoint Rate	aux units	1
3:0231	Active Extraction/Admission Setpoint Rate	ext/adm units	1
3:0232	Active Inlet Setpoint Rate	inlet units	1
3:0233	Active Exhaust Setpoint Rate	EXH units	1
3:0234	505XT Control Parameter	-	1
3:0235	505XT Ratio Limiter Control Parameter	-	1
3:0236	505XT Map Limit Parameter	-	1
3:0237	LP Actuator Demand (%) x100	%	100
3:0238	Turbine Starts Counter	-	1
3:0239	HOT Turbine Starts Counter	-	1
3:0240	Total Trips Counter	-	1
3:0241	Trips with Load >25% Counter	-	1
3:0242	Trips with Load >75% Counter	-	1
3:0243	Total Run Time Hours Counter	hrs	1
3:0244	Run Time Hours with Load >25% Counter	hrs	1
3:0245	Run Time Hours with Load >75% Counter	hrs	1
3:0246	Peak Speed Reached	rpm	1
3:0247	Maximum Acceleration Reached	rpm	1
3:0248	Number of Overspeed Trips	-	1
3:0249	LP Valve Limiter x100	%	1
3:0250	spare	-	1
3:0251	**Start of DR added Parameters**	-	1
3:0252	Backup Speed Sensor #1 Input (RPM)	RPM	1
3:0253	Backup Speed Sensor #2 Input (RPM)	RPM	1
3:0254	Backup Analog Input 1 (mA x 100)	mA	100
3:0255	Backup Analog Input 2 (mA x 100)	mA	100
3:0256	Backup Analog Input 3 (mA x 100)	mA	100
3:0257	Backup Analog Input 4 (mA x 100)	mA	100
3:0258	Backup Analog Input 5 (mA x 100)	mA	100
3:0259	Backup Analog Input 6 (mA x 100)	mA	100
3:0260	Backup Analog Input 7 (mA x 100)	mA	100
3:0261	Backup Analog Input 8 (mA x 100)	mA	100
3:0262	Backup Analog Output 1 (mA x 100)	mA	100
3:0263	Backup Analog Output 2 (mA x 100)	mA	100
3:0264	Backup Analog Output 3 (mA x 100)	mA	100
3:0265	Backup Analog Output 4 (mA x 100)	mA	100
3:0266	Backup Analog Output 5 (mA x 100)	mA	100

Addr	Description	Units	Multiplier
3:0267	Backup Analog Output 6 (mA x 100)	mA	100
3:0268	Backup Actuator #1 Output (mA x 100)	mA	100
3:0269	Backup Actuator #2 Output (mA x 100)	mA	100
3:0270	HP Demand (Single Coil or Redund Act)	%	100
3:0271	HP Coil A Demand	%	100
3:0272	HP Coil B Demand	%	100
3:0273	LP Demand (Single Coil or Redund Act)	%	100
3:0274	LP Coil A Demand	%	100
3:0275	LP Coil B Demand	%	100
3:0276	LP2 Demand	%	100
3:0277	CAN Demand to SPC11 (%) x100	%	100
3:0278	CAN Demand to SPC12 (%) x100	%	100
3:0279	CAN Demand to SPC13 (%) x100	%	100
3:0280	CAN Demand to SPC14 (%) x100	%	100
3:0281	Position FDBK from SPC11 (%) x100	%	100
3:0282	Position FDBK from SPC12 (%) x100	%	100
3:0283	Position FDBK from SPC13 (%) x100	%	100
3:0284	Position FDBK from SPC14 (%) x100	%	100

Analog Write Addresses

Table 3-11. Analog Write Addresses

Addr	Description	Units	Multiplier
4:0001	Modbus Entered Speed Setpoint	rpm	none
4:0002	Modbus Entered Casc Setpoint	Casc units	Casc scale factor
4:0003	Modbus Entered Aux Setpoint	Aux units	Aux scale factor
4:0004	Modbus Entered Extraction Setpoint	Ext/Adm units	Ext/Adm scale factor
4:0005	Modbus Droop demand	%	x0.01
4:0006	Modbus Entered Inlet Setpoint	Inlet Units	Inlet scale factor
4:0007	Modbus Entered Exhaust Setpoint	Exhaust Units	Exhaust scale factor
4:0008	Spare		
4:0009	Modbus Entered Manual P Setpoint	%	x0.01

Chapter 4. Troubleshooting

This chapter contains solutions to some common issues customers experience when initially setting up 505-DR units.

Issue #1

User powers up a 505DR unit without setting the DIP switches.

This results in the following states:

- TRIPPED LED is Red
- CPU LED is Green
- IOLOCK LED is Red
- Display is black (no Splashscreen or GUI will be running)
- No GAP application is running
- if RemoteView is used – no data will show

Figure 4-1. RemoteView

In AppManager the GAP application 5418-7833GAP_x.out will be at status INACTIVE.
The System Message: To run Flex DR the hardware must be configured for Redundant.

What is happening?

From the factory the DIP switches are all set to OFF. This means that the H/W has DIP switch settings (all = OFF) which is the settings to run a simplex application.

At power-up the control launches the 505DR GAP executable (5418-7833GAP_x.out) which is a redundant application, thus the application goes to status INACTIVE and the Qt RTP which handles the GUI execution never boots up either.

Solution

User must adjust the DIP switches to set this H/W unit to be either the Primary or Secondary control unit. See Figure 4-2.

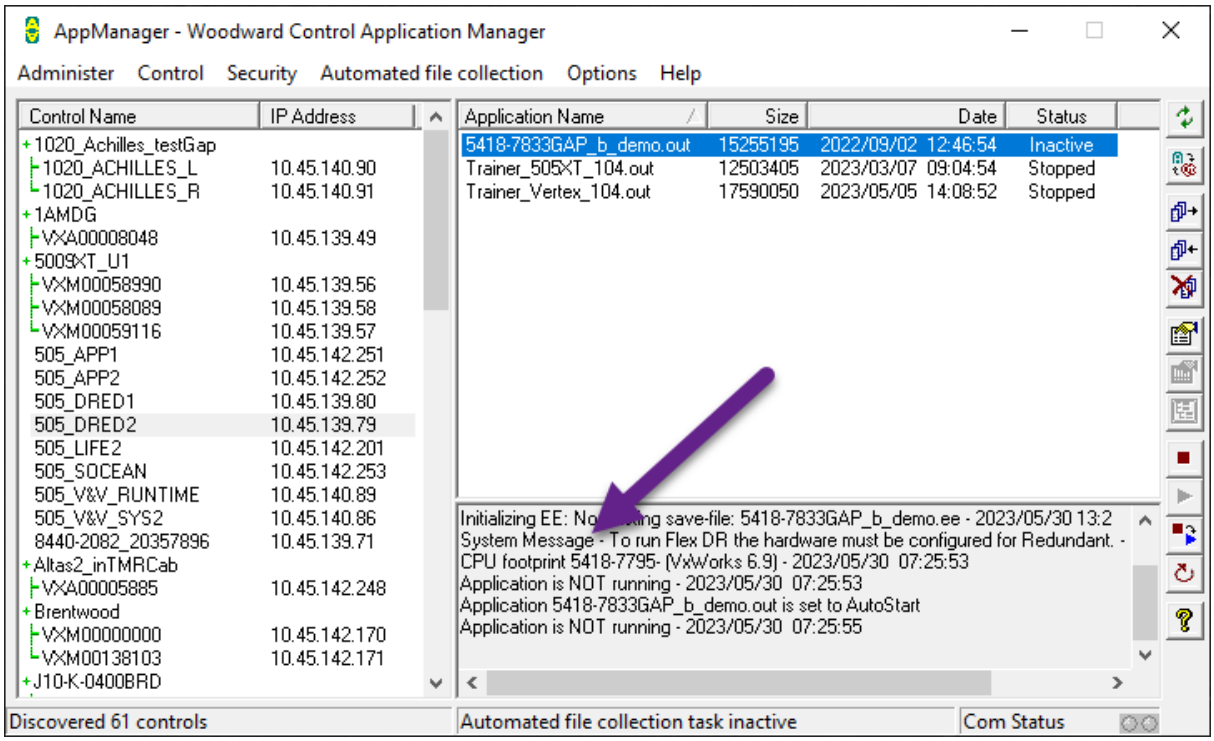

Figure 4-2. AppManager Status – DIP Switches Wrong

Issue #2

User powers up a 505DR unit with the DIP switches correct, but no ENET4 or DI-to-DO Criss-cross interlock wiring between the 2 controls.

This results in the following

- TRIPPED LED is Red (and ALARM LED is amber)
- CPU LED is Green
- IOLOCK LED is Red
- GAP is executing/healthy
- Display is active/healthy
- Unit will connect to AppManager and SOS

User does not have either of the required interlocks between Primary and Secondary -
AppManager status window will list these errors as:

** DR units are not communicating! **
Health status mismatch, check DR crisscross connections!

See Figure 4-3.

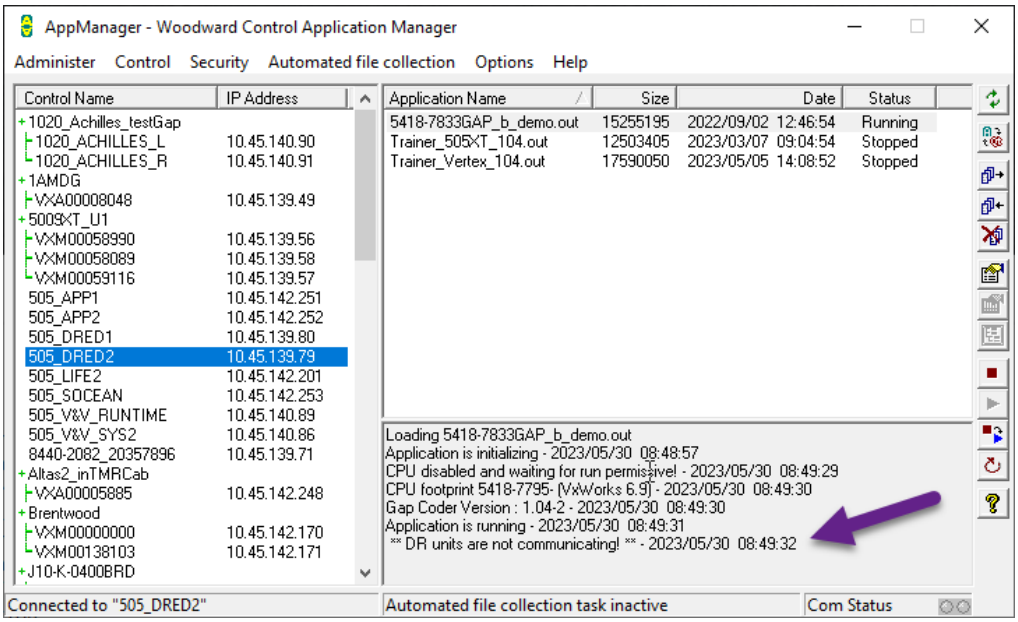

Figure 4-3. AppManager Status – No Interlock Wiring

NOTICE

Users familiar with other Woodward controls will expect that the IOLOCK LED clears after bootup. That is NOT the case with the 505DR. If the desire is to power up a single 505DR with no wiring (only power) and perform the initial configuration, then follow the first option below to place the unit in Run Alone Mode

What is happening?

If a 505DR unit powers up without being able to communicate and synchronize to the other unit it will be held in IOLOCK, in a mode we call the Wait Run Permissive state.

Solution

Go to the DR Overview screen for information.

Two options, depending on how this unit is expected to act:

1. Place the unit in Run Alone Mode (it will become the SYSCON)
   If this is the initial power-up and configuration of the unit (Factory default settings) and no wiring has yet been connected:
   - Go to the MODE screen and log in at User level “Service” or higher
   - From HOME screen go to Configuration Menu, then open DR Overview
   - Launch the Run Alone popup dialog box and select “Run Alone”
   - This will confirm to the system that this unit is the SYSCON controller and IOLOCK will clear.

2. Connect this unit to the SYSCON unit (it will be the Backup)
   To bring this unit online as a Backup control, make the required interfaces by connecting the ENET port 4 of these units together and connect the wiring for the DI-to-DO interlock between the 2 units (if DR-FTM is used, this connection will automatically be made thru the wiring harnesses). Once this is done:
   - Go to the HOME screen on the SYSCON unit and open the DR Overview screen
   - Launch the Reset Backup popup dialog box and select “Reset Backup”
   - The SYSCON will send an operating system reset command to backup unit
   - The Backup unit will receive all current tunable settings from the SYSCON unit
   - The Backup unit will then re-initialize itself and synchronize to the SYSCON unit
   - This unit will clear IOLOCK and the CPU LED should slowly blink Green
   - If the Backup unit fails to synchronize, re-verify the required interfaces and power cycle it

Issue #3

Units are configured and wired correctly but powered-up at different times.

This results in the following for both units:

- TRIPPED LED is Red (and ALARM LED is amber)
- CPU LED is Green
- IOLOCK LED is Red
- GAP is executing/healthy
- Display is active/healthy

If units are configured and wired correctly together and are powered-up at the same time (same time meaning within 30 seconds) – the primary unit will come up as the SYSCON and the secondary unit will automatically synchronize and become the backup unit.

If the time between powering up the units is more than 30 seconds, then the first unit to power up will be the SYSCON but will be held in IOLOCK until it is placed in “Run Alone” mode. Once in this mode it will clear the IOLOCK. When the second unit is powered up, it will automatically synchronize with the SYSCON unit.

Figure 4-4. First Unit Powered – in Wait Run Permissive State

What is happening?

If the first unit is not placed in “Run Alone” mode, then it will remain in IOLOCK. The second unit cannot synchronize to the first unit since relay channel 8 (used for the DI-to-DO crisscross) will not be energized as both controls are in IOLOCK. In this scenario the first unit will be in run mode with the display GUI screen healthy/active. The second unit will be stuck in GAP initialization mode and the display GUI screen will be black (even though the GUI status will show as Running).

In AppManager status window the first unit will list these errors:

** DR units are not communicating! **
Resync not allowed when in STANDBY mode

Solution

Always place the first powered-up unit into Run Alone mode or power the units up together.

Chapter 5.
Product Support and Service Options

Product Support Options

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

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

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

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

A current list of Woodward Business Partners is available at: **www.woodward.com/find-a-local-partner.**

Product Service 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 (Woodward North American Terms and Conditions of Sale 5-09-0690) 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 North American Terms and Conditions of Sale 5-09-0690).

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 North American Terms and Conditions of Sale 5-09-0690) 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 North American Terms and Conditions of Sale 5-09-0690). 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 one of the Full-Service Distributors listed at **www.woodward.com/find-a-local-partner.**

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **www.woodward.com/support**, which also contains the most current product support and contact information.

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

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (32) 422-5551
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
The Netherlands	+31 (23) 5661111
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

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

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Symptoms

Description _____

_____

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

Revision History

Changes in Revision B—

- Added addresses to Table 3-8
- Revised and added addresses to Table 3-9
- Added addresses to Table 3-10
- Added new section in Chapter 3: Configuring for Simplex Operation

Changes in Revision A—

- Renumbered chapters to begin with Chapter 1 instead of Chapter 16
- Added Chapter 4: Troubleshooting

Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 35018V3.

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