WOODWARD

Product Manual 26361V2
(Revision F, 4/2013)

Original Instructions

505DE Digital Governor for Steam Turbines

Part numbers: 8262-1023, -1024, -1040, -1041

Manual 26361 consists of 2 volumes (26361V1 & 26361V2).

Volume 2—Hardware Installation

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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

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

Proper Use

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

Translated Publications

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

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 Out-of-date translations are marked with ⚠.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

Manual 26361V2

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

Chapter 1.
General Information

Introduction

This Installation Manual describes the installation of the 505DE Double Extraction Steam Turbine Control System hardware, and the installation of the 505DE PCI Tool (PC Interface Tool) software on a PC. It will help you get to the stage where you can configure the 505DE before operation.

To fully understand the information given in this manual, it is necessary to understand the control and operational characteristics of the 505DE. This information can be found in the manuals listed below in Associated Publications.

Woodward has highlighted potential dangers that can be encountered during the installation and operation of the unit, and the instructions must be closely followed and any safety instructions must be fully obeyed. All involved personnel must carefully read and understand these instructions, and also understand and obey all applicable local health and safety regulations.

⚠WARNING

Use of this equipment by untrained or unqualified personnel could result in damage to the control or the installation's equipment and possible loss of life or personal injury. Make sure personnel using or working on this equipment are correctly trained.

This manual covers only equipment manufactured and software programmed by Woodward and does not include operating instructions for the prime mover or the driven devices or processes.

For specific operating information such as start-up, shutdown, and the prime mover's response to signals from the Woodward control, refer to the prime mover manufacturer's manual.

The 505DE can be ordered in a short or long chassis configuration. In either chassis, I/O can be selected to be redundant. All I/O appears twice in the pull down selection boxes found in the 505DE PCI tool. Selecting the first occurrence to one channel and the “red” occurrence to another channel will provide a high-signal select for the two inputs and activate redundant alarming. In the short chassis, multiple valve demand outputs can be selected, but they will not current share. The base 505DE long chassis model ships from the factory with the ability drive current sharing actuator outputs.

The base 505DE Short Chassis model includes an 8-slot chassis, one power supply, one CPU module, two analog modules and one discrete module. Optionally a second (redundant) CPU module, a second discrete module, “integrating” actuator driver modules, and/or a second (redundant) power supply module and can be added and installed in the system as required by the application. Because the redundant CPU, second discrete module, redundant power supply, and integrating actuator modules are optional, they must be ordered separately from the base model.

The base 505DE long chassis model includes a 14-slot chassis, two (redundant) power supplies, two (redundant) CPU modules, three analog modules and two discrete modules. Optionally integrating actuator driver modules can be added as required by the application. Because the integrating actuator modules are optional, they must be ordered separately from the base model.

Part Number	**Power**
8262-1023	Configuration # 1 – Short Chassis with AC/DC Power Supply
8262-1024	Configuration # 2 – Short Chassis with HVAC Power Supply
8262-1040	Configuration # 3 – Short Chassis Redundant CPU, I/O & P/S
8262-1041	Configuration # 4 – Short Chassis Redundant CPU, I/O & P/S

Please see Appendix B at the rear of this manual for kit bill of materials.

505DE Accessories: **Part Number**

DC/DC Power Supply – 5466-1000
- Can be used with both chassis models for Power Supply redundancy
- Can be field-installed in both chassis models
- Can be used as a spare power supply

AC/DC Power Supply – 5466-1001
- Can be used with both chassis models for Power Supply redundancy
- Can be field-installed in both chassis models
- Can be used as a spare power supply

HVAC Power Supply – 5466-1002
- Can be used with both chassis models for Power Supply redundancy
- Can be field-installed in both chassis models
- Can be used as a spare power supply in Short or Long Chassis Models

CPU Module – 5466-1035
- Used in both chassis models to increase CPU redundancy
- Can be field-installed in both chassis models
- Can be used as a spare CPU module

505DE OpView™ / PCI – 8262-1027
- 15” Advantech Touchscreen PC Operator Control Panel
- 505DE PCI Software Loaded and operational
- Can be used as an OCP and or engineering workstation
- Password protected

505DE PCI Software Program – 8262-1047
- Includes: 505DE PCI Software Install CD and software run-time key
- BCD85225 CD Interface Program and hardware documentation
- Can be installed and used on a site computer
- Can be used as an OCP and or engineering workstation
- Password protected

How to Contact Woodward

Contact information is on our website: **www.woodward.com**.

Associated Publications

The following Publications are helpful in understanding various aspects of the 505DE. Most of these manuals are included on the 505DE CD. If they are not on the CD you can download them from the Woodward website at **www.woodward.com**.

Manual 26361V1	505DE Description, Configuration and Operation
Manual 26361V2	505DE Hardware and Installation
App. Note 51204	Grounding and Shield Termination
Manual 82510	Magnetic Pickups & Proximity Switches for Electronic Controls
Manual 82715	Guide for Handling & Protection: Electronic Controls, PCBs, Modules
App. Note 83402	PID Control
Manual 26166V1	MicroNet Simplex/Plus, Installation and Operation volume 1
Manual 26166V2	MicroNet Simplex/Plus, Installation and Operation volume 2

System Compliance

This system complies with the relevant industry specifications and regulations.

General Safety Precautions

Obey the following safety precautions when you install the unit:

- Obey all cautions or warnings given in the procedures.
- Never bypass or override machine safety devices.
- Never jumper or force Input/Output signals while operating the machine.
- Do not change software settings unless completely sure of the consequences of that change.
- Always use sufficiently trained personnel and the right equipment to operate the machine.

Abbreviations Used in This Manual

ASCII	American Standard Code for Information Interchange
AWG	American Wire Gauge
CMRR	Common Mode Rejection
CPU	Central Processing Unit
DCS	Direct Control System or Digital Control System
DIN	Deutsches Institut für Normung (German Standards Institute)
DO	Digital Output
EEPROM	Electrically-Erasable Programmable Read Only Memory
EMC	Electromagnetic Compatibility
ESD	Depends on the context: Emergency Shutdown Electrostatic Discharge
EU	Engineering Units
FTM	Field Terminal Module
GAP™	Graphical Application Programmer (the editor used to write the software)
GND	Ground or earth connection
HMI	Human Machine Interface, the operator interface system
HP	High Pressure
I/O	Input/output, the electrical signals to and from a unit
IP	Depends on the context: Internet Protocol Ingress Protection Intermediate Pressure
LED	Light Emitting Diode
LP	Low Pressure
MPU	Magnetic pickups for speed sensing
NC	Normally Closed
NO	Normally open
OPC	Object Linking and Embedding for Process Control
P2	L P Compressor inlet pressure.
PC	Personal Computer
PCB	Printed Circuit Board
PE	Protective Earth
PID	Proportional Integral Derivative
PS	Power Supply
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read Only Memory
RTU	Real Time Upcall
SP	Setpoint
SPDT	Single-Pole Double-Throw (switch or relay contacts)
SSTP	Double Shielded Twisted Pair
STP	Shielded Twisted Pair
TCP	Depends on the context: Turbine Control Panel Transmission Control Protocol
TM	Torque Motor
UART	Universal Asynchronous Receiver Transmitter
UDP	User Datagram Protocol
USB	Universal Serial Bus
VME	VERSA Module Eurocard (bus standard for connector specification and data transfer)
Vrms	Voltage Root Mean Squared
XVGA	Extended Video Graphics Array (a computer display standard)

Chapter 2.
Hardware Description

Introduction

The 505DE control system is built of hardware from Woodward's proven MicroNet™ digital control system. MicroNet hardware is highly interchangeable and comes together as a whole system based on three interlinked sub-systems.

Chassis

The 505DE utilizes a modular (block) chassis. Each block consists of a molded cage with a fan for cooling and a temperature switch for high temperature detection. The chassis are cooled by forced air, and either a module or a module blank must be installed in every slot to maintain correct air flow. The fans run when power is applied to the system.

The 505DE can be ordered in a 505DE Short or Long chassis configuration. The 505DE Short chassis is comprised of an 8-slot chassis with a motherboard mounted in the back of the assembly to make connections between the fans, switches, power supplies, and control modules (see Figure 2-1). I/O connections are made through cables, each 6 ft long, connected from the front of the I/O modules to field termination modules. Optionally a second (redundant) power supply module and can be added as required by the application.

Figure 2-1. 505DE Short Chassis

Power Supplies

The 505DE control can use either single or redundant power supplies. The 505DE Short Chassis controls can be purchased with either a single power supply or with a second redundant power supply depending on the options.

A motherboard located on the back of the chassis distributes power to the CPU and all I/O modules. When redundant power supplies are running, current sharing circuitry balances the load to reduce heat and improve the reliability of the power supplies. In the event that one supply requires replacement, this feature also ensures hot replacement of the power supplies without disrupting the operation of the control.

Each main power supply has four LEDs to indicate power supply health (OK, Input Fault, Overtemperature, and Power Supply Fault). See Power Supply Troubleshooting for a description of the LED indications. Input power connections are made to the power supply through terminals on the front of the power supply.

For redundant operation, the control can use any combination of power supplies. The power supplies can only be installed in slots PA1 (power supply #1) and PA2 (power supply #2). If redundant power supplies are not required, blanking plates (p/n 3799-301) must be installed in the slots not used. 2.1.3—Redundant Power Supplies

Two load sharing power supplies provide redundant power to the motherboard, CPU and I/O modules. The 505DE power supplies are 2-slots wide each and are located at each end of the chassis in the designated PS1 and PS2 slots.

For 505DE installation instructions, refer to Chapter 3 and to Installation below.

Figure 2-2. Power Supply Module

CPU Module

The 505DE Short Chassis models can be purchased with either a single CPU module located in chassis slot A01 or with a second redundant CPU in chassis slot A08 depending on the option. The 505DE Long Chassis models contain two CPU modules located in chassis slots A01, and A14. The 505DE Central Processor Unit (CPU) module, functions as the brain of the controller, to process the software application program to manage all system modules and ultimately manage all control and sequencing functions. Each CPU utilizes a Motorola 5200 microprocessor to perform its data processing.

Modbus® * communications is available via the CPU's Ethernet or Serial ports. Refer to volume one of this manual for more information on the 505DE's networking environment.

*—Modbus is a trademark of Schneider Automation Inc.

Figure 2-3. CPU Module

MicroNet Discrete I/O Smart-Plus Module (HDDIO)

Module Description

Figure 2-4. Discrete Combo Module (HDDIO)

The HDDIO module is a MicroNet Plus module that will allow the customer to access information about the module during operation via AppManager.

A 48/24 Discrete Combo module contains circuitry for forty-eight optically isolated discrete inputs and twenty-four discrete outputs. These modules require no calibration; a module may be replaced with another module of the same part number without any adjustment.

Two 24/12 Discrete FTMs (DIN rail mounted) are connected to the MicroNet Discrete I/O Smart-Plus module via two High Density Analog/Discrete cables and provide access to the optically-isolated discrete inputs and the discrete output relays. The discrete outputs on the MicroNet Discrete I/O Smart-Plus module are non-isolated; the isolation takes place in the 24/12 Discrete FTM.

Discrete Combo FTM

The 24/12 Discrete Field Termination Module (FTM) is used with 48/24 Discrete Combo Module. The 24/12 Discrete Module has 24 discrete inputs connections and 12 SPDT relay outputs. Two relay modules connect to one 48/24 Discrete Combo Module. Each FTM uses one 505DE High Density Analog/Discrete cable to connect it with the 48/24 Discrete Combo Module. This relay module incorporates an I/O lockout relay that de-energizes all of the relays if de-activated by the I/O lock signal from the Discrete Combo Module. I/O lock is activated when performing configure level operations – such as loading settings. All field connections use removable connectors for ease in replacing a module in the field. All relays are field replaceable.

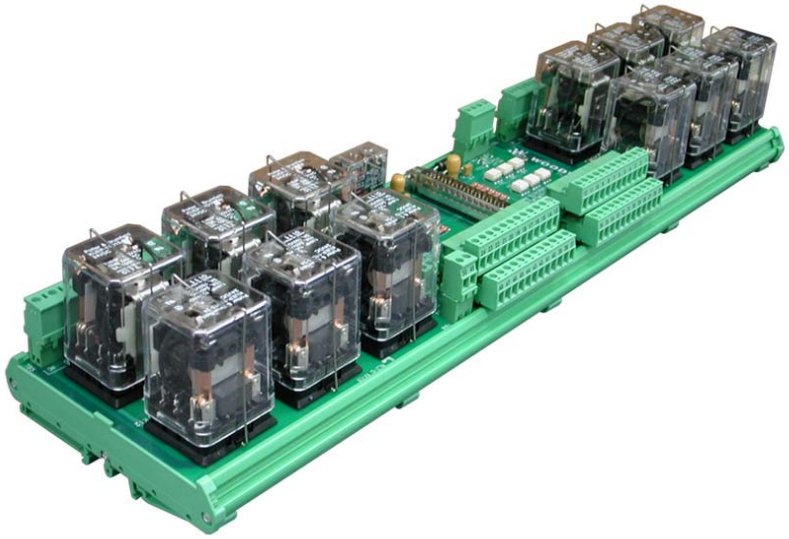


Figure 2-5. Discrete FTM Module

Analog Combo Module

Module Description

Figure 2-6. Analog Combo Module

Each High Density Analog Combo module contains circuitry for four speed-sensor inputs, eight analog inputs, four analog outputs, and two proportional actuator driver outputs. Each speed sensor input can be from a magnetic pick-up or from a proximity probe, and each actuator driver can be configured as 4 – 20 mA or 20 – 160 mA.

Each Analog Combo module is connected through two 10 ft analog cables to one Analog Combo FTM. All of the I/O are accessible on the FTM, and the channels are labeled to correspond to their software locations, e.g. analog input 1 on the FTM will be analog input 1 in the application software.

This module includes no potentiometers and requires no calibration. An Analog Combo module can be replaced with another module of the same part number without any adjustment.

MPU and Analog IO Field Termination Module

The MPU/Analog Field Termination Modules (FTM) mount external to the 505DE chassis on a standard DIN rail. The Analog Field Termination Modules provide screw-type terminals used to connect analog field wiring to the control. Each MPU and Analog I/O chassis module is connected through two analog cables to one FTM. An MPU / Analog FTM houses circuitry to route each input signal to the associated MPU / Analog Module and produce each output signal as determined by the MPU / Analog Module.

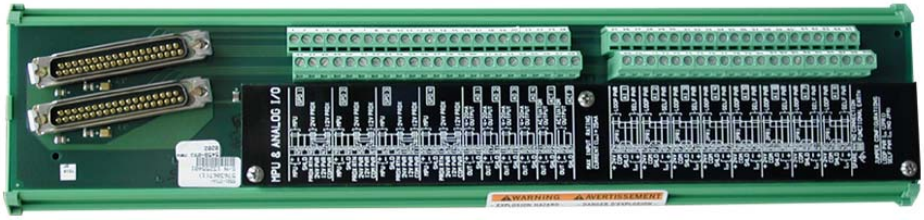


Figure 2-7. Analog Combo Module

Chapter 3.
Mechanical Installation Procedures

Introduction

The 505DE can be ordered in a short or long chassis configuration. Short chassis models utilize an 8-slot chassis with I/O connections made through 6' (183 cm) cables from the front of the I/O modules to field termination modules. Long chassis models utilize a 14-slot chassis with I/O connections also made through 6' (183 cm) cables from the front of the I/O modules to field termination modules. The cable-to-chassis module connections are D-shaped, and keyed so that the cables must run over the top of the chassis. Typically, a chassis is mounted on a mid-depth plane with the cables running over the chassis and down to the FTMs mounted on DIN rail in the back of the cabinet. Any mechanically acceptable cable routing will not affect control operation. Also, optional modules can be added as required by the application.

Pre-Installation Information

Storage

Store 505DE controls and associated parts between –20 and +70 °C (–4 and +158 °F) at a maximum relative humidity of 90% non-condensing. If modules (especially power supplies) are to be stored for a long time, apply operating power to them at least once every 18 months. This is done to re-form the aluminum electrolytic capacitors, and will prevent them from overheating upon initial power up after extended storage.

Unpacking

Unpack each part of the system carefully. Check the units for signs of damage, such as bent or dented panels, scratches, loose or broken parts, and missing parts. If any damage is found, notify the shipper immediately.

Unit Location

Consider the following when selecting a cabinet location for mounting the 505DE:

- Make sure the 505DE unit(s) is mounted in a dry location, protected from water and condensation.
- Make sure the ambient temperature of the system location is not lower than 0 °C (32 °F) or higher than 50 °C (122 °F), and that the relative humidity is not over 90%, non-condensing.
- Provide adequate ventilation for cooling the units. If the units must be mounted near heat-producing devices, shield them from the heat.
- Do not install the units or their connecting wires near high-voltage/high-current devices or inductive devices. If this is not possible, shield both the system connecting wires and the interfering devices or wires.
- If the selected location does not already have a conductor to a good earth ground, provide one.
- This equipment is suitable for Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only. The 24/12 relay modules are for use in ordinary or non-hazardous locations only.

Use the following procedures to install a system in the selected location. Before beginning installation successfully identify all components and read this entire chapter.

Install 505DE Chassis

In a panel or bulkhead:

1. Mark 505DE chassis mounting hole locations (see Figure 3-2), taking care to leave sufficient space between the chassis and walls, objects, etc. for easy access (see Figure 3-1).

2. Drill and tap mounting holes using a # 21 (0.156 – 0.164”) drill bit, and a 10-32 tap.

3. Place chassis in position, insert 10-32 mounting screws into the tapped holes, and tighten them securely. (Socket head screws, with flat washers and locking devices are recommended.)

4. Verify that the chassis is at earth ground potential, and if it is not, connect it to earth ground via a 3 mm² (12 AWG) or larger yellow/green wire or braid.

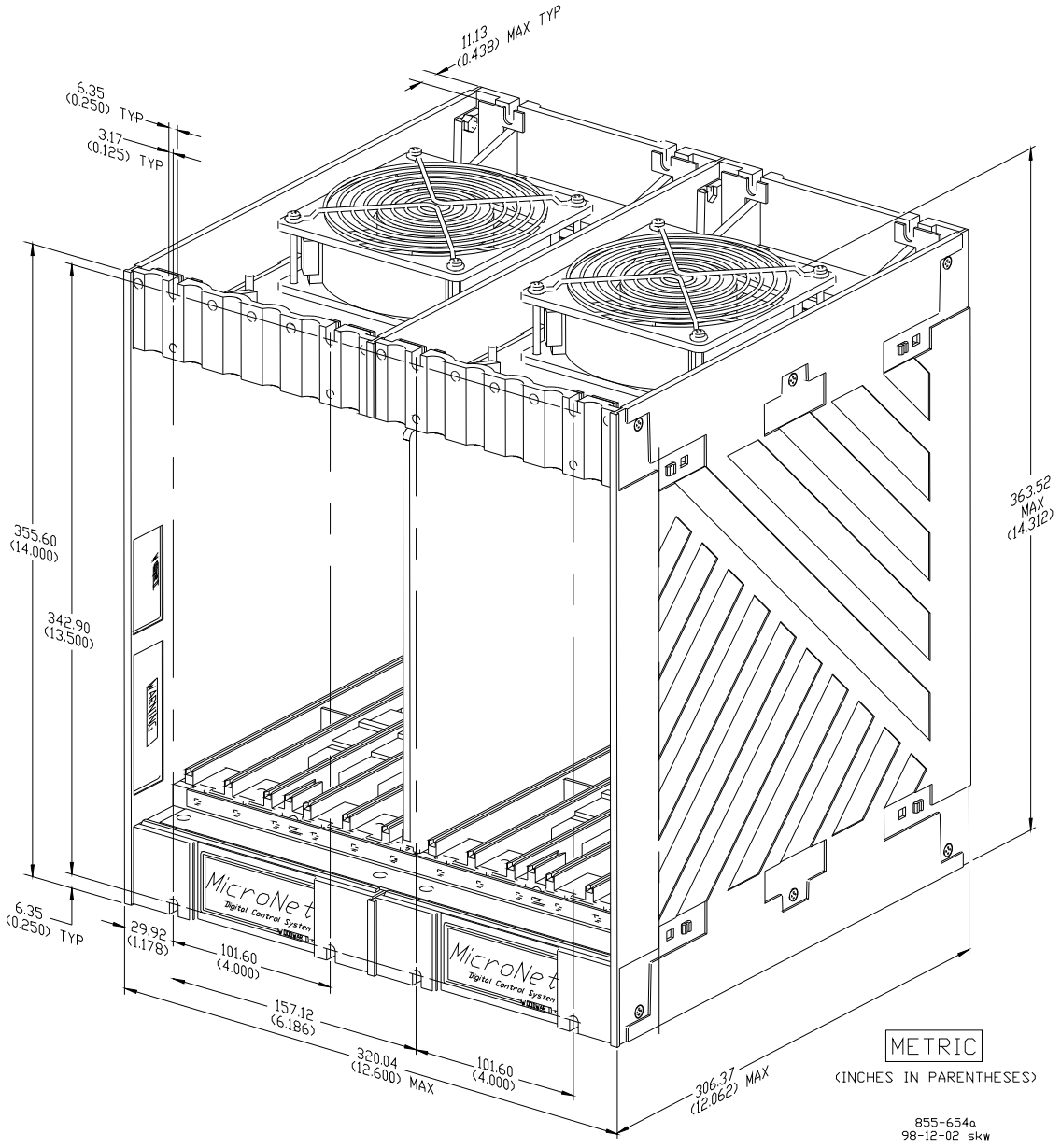


Figure 3-1. Outline Drawing of 505DE Short Chassis

Installation

Figure 3-2 shows the mounting template and fasteners to mount the chassis on a bulkhead. Rack mounting is not recommended.

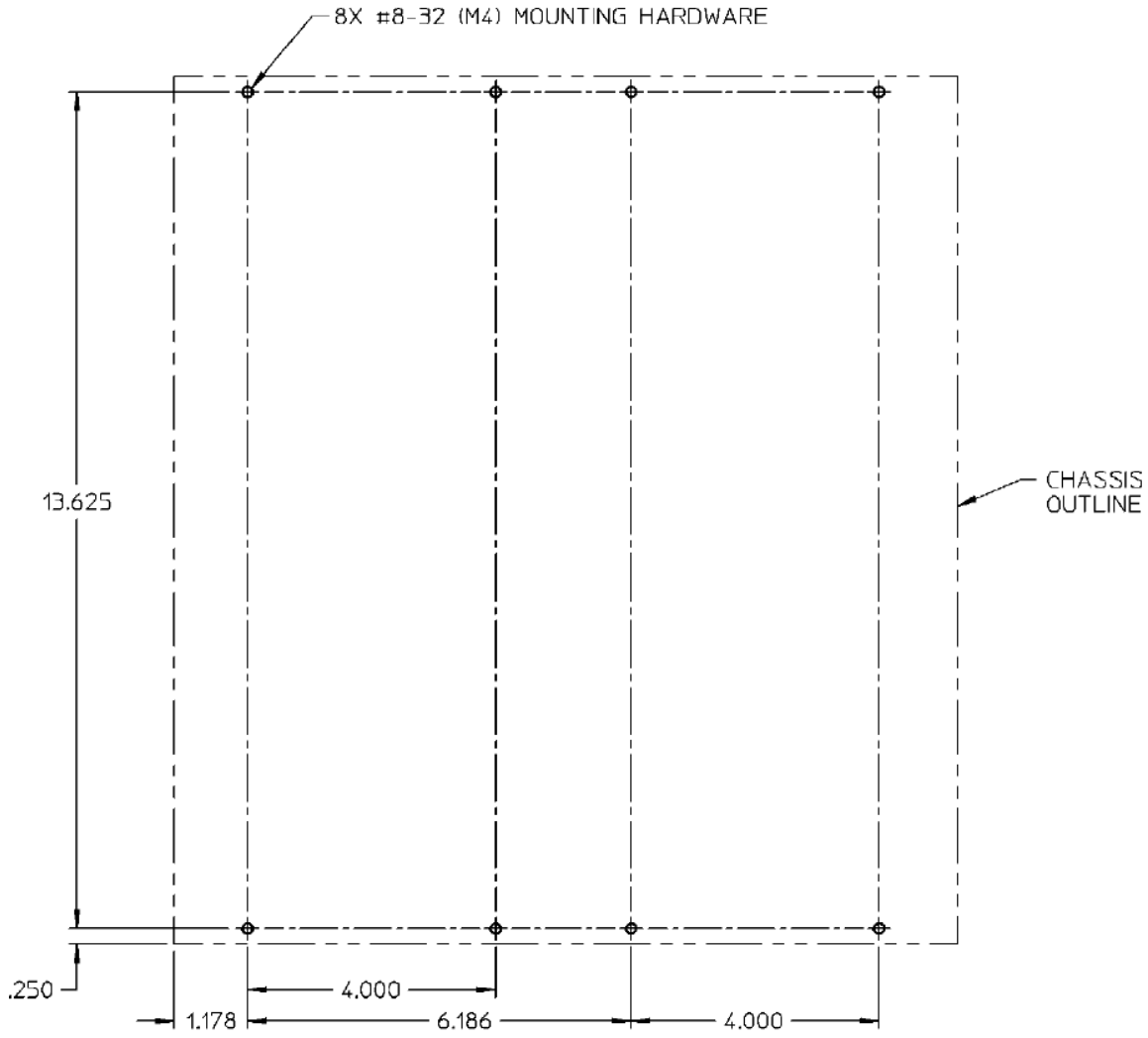


Figure 3-2. Mounting Template for the 505DE Short Chassis (Dimensions in Inches)

Install Modules

The following procedure describes the proper method of initial installation of the 505DE modules.

1. Take care that each module is installed in the correct slot; there are no keys to keep a module from being installed in the wrong slot. Installing a module in the wrong slot will not damage it, but it will not operate. To aid proper module placement, the module slots are labeled with the slot number. The module “Identifier” is shown on the module’s lower handle.

2. Align the circuit board edges in the card guides and push the module into the slot until the connector on the module and the connector on the motherboard make contact. Be sure the module moves freely into the chassis and is aligned vertically. Check to be sure that the screws found at the bottom and top of the module do not become misaligned and catch on the chassis when the module is inserted almost all the way. The screws can be pushed back flush with the mating surface before installation.

3. Some resistance will be met when the module connector meets the Motherboard. With even pressure exerted at the top and bottom of the module, firmly push the module into place.

4. Tighten the two screws that secure the module in place (one at the top and one at the bottom).

Cable Entry Locations

- Cable shield termination hardware must be installed at cable entry points.
- Cable shield terminations must be electrically connected to structural frame, and shall allow direct grounding or ac grounding of cable shields. The connection must have a resistance of less than 2.5 mΩ.

WARNING

Remove the power from power supplies before installing or removing them.

IMPORTANT

If resistance is encountered when installing a module, do not force the module. Remove the module and check the connectors for bent contacts or foreign objects. Also check to ensure that the module screws are fully retracted. Forcing a module into place can break the connector or bend the securing screws.

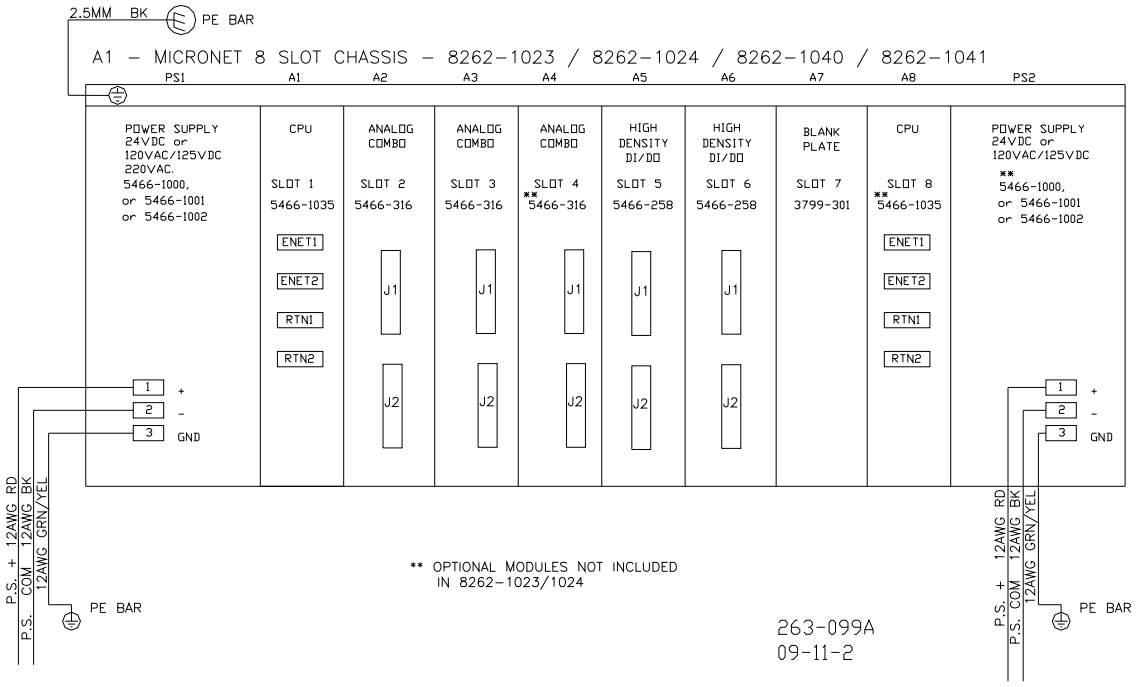


Figure 3-3. 505DE Short Chassis Module Positions
(** This module loaded for part numbers 8262-1040 and 8262-1041.)

Install Field Termination Modules

The 505DE system's FTMs all snap onto a standard DIN rail (not provided). Mount FTMs within the length of the provided cable from the control's main chassis, leaving adequate service loop. Refer to Figures 3-7 through 3-9 for DIN rail and FTM dimensions.

1. Obtain a DIN rail strip. Cut it to the desired length and mount it to a panel. Leave sufficient space between the DIN rail and walls, objects, etc. for easy access.

2. Drill and tap at least two holes per foot (1 hole every 15 cm) and install DIN rail, using the appropriate screws and washers.

3. Verify that the DIN rail is at earth ground potential (connected to a panel that is at earth ground potential). If the DIN rail is not at earth ground potential connect it to earth ground via a 12 AWG (4.0 mm²) or larger green/yellow wire or braid; keeping the wire/braid as short as possible.

4. Snap the FTMs onto the DIN rail.

5. Snap the included ground terminals onto the DIN rail next to the FTMs.

6. Connect a 12 AWG (4.0 mm²) green/yellow wire between each ground terminal and FTM terminal "Chassis Ground". This wire should be kept as short as possible and be no longer than six inches (15 cm) in length.

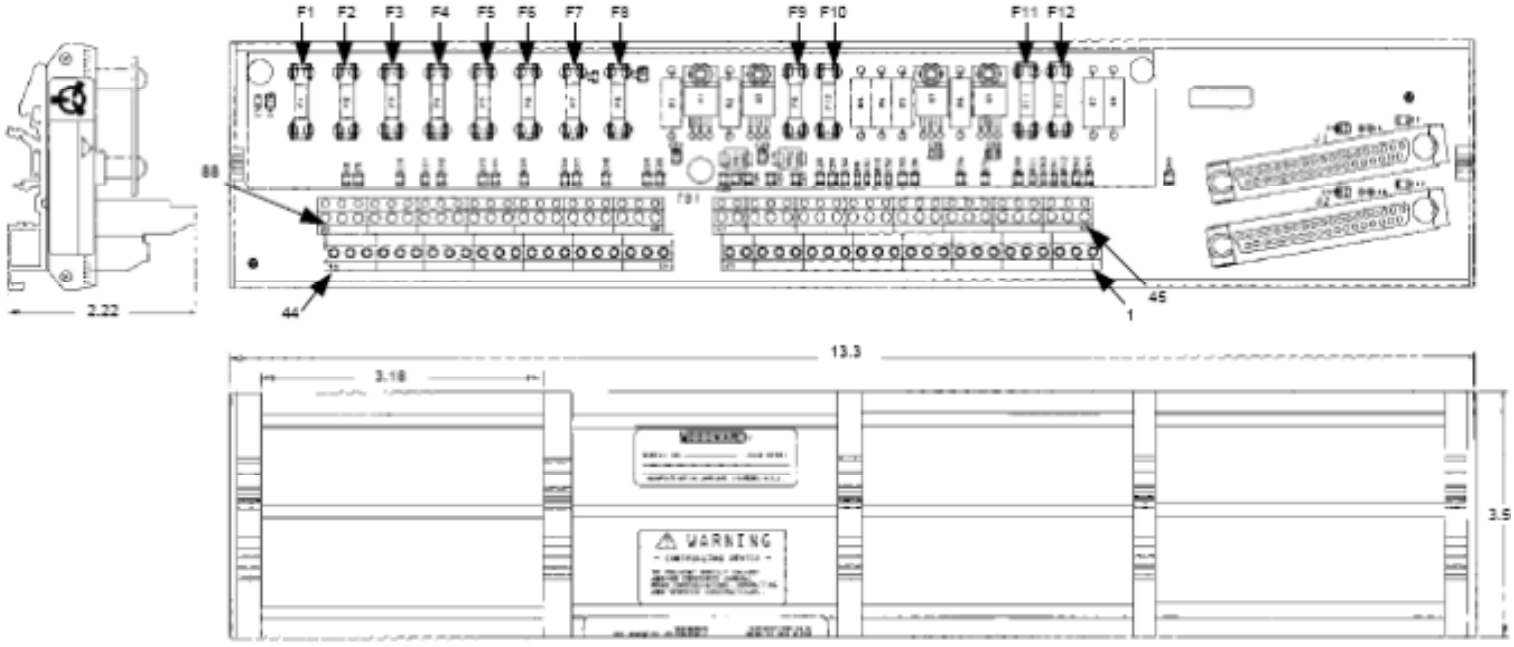


Figure 3-4. MPU / Analog Field Termination Module and DIN Rail Dimensions

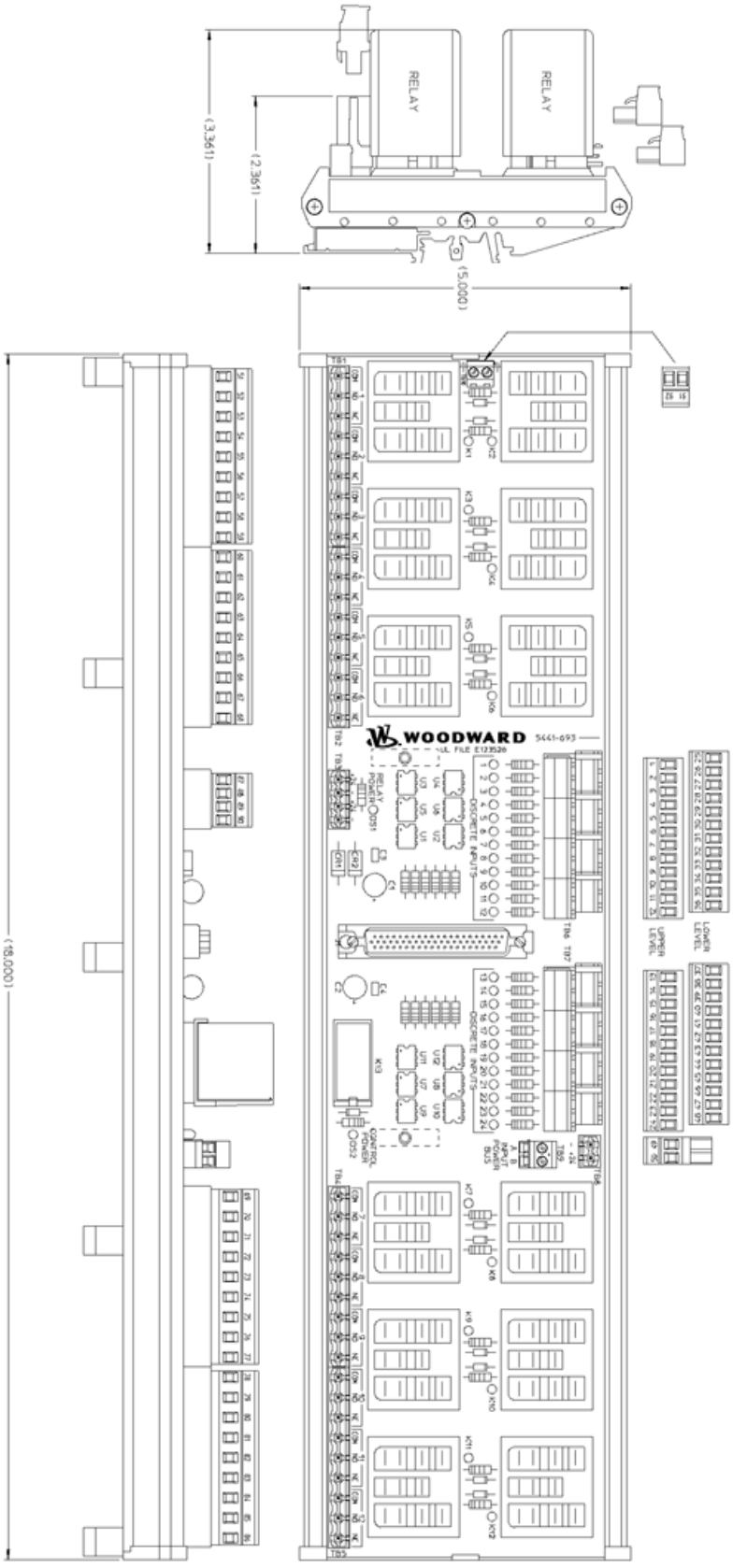


Figure 3-5. Discrete Field Termination Module Dimensions

Chapter 4.
Electrical Installation

Introduction

NOTICE

Before installation read the electrostatic discharge precautions on page iv of this volume.

Electrical ratings, wiring requirements, and options are provided to allow a customer to fully install the 505DE control into a new or existing application. Field wiring must be rated at least 75 °C for operating ambient temperatures expected to exceed 50 °C.

Wiring for Class I, Division 2 installations must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

After the system has been mechanically installed read this chapter thoroughly before proceeding. Perform system electrical installation by stepping through this chapter's instructions in sequence. Start with cabinet installation instructions, step to the system cables instruction, then step to the next set of instructions, etc.

⚠WARNING

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.

Wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

Field Termination Modules (FTMs)

Field Termination Modules (FTM) are used to connect field wiring to the front of the 505DE's I/O Modules. They connect to the subminiature D-type connectors on the front of the I/O modules and provide cage-clamp terminal connection points for field wiring. They also provide shield termination and EMI protection. All FTMs can be mounted on 35 mm DIN Rails and take the place of interposing terminal blocks to field wiring.

The cage-clamp terminals on the FTMs and relay modules accept a maximum of one 4 mm^2 (12 AWG) wire or two 1 mm^2 (18 AWG) wires. To connect the field wiring strip the wire back 8 mm (0.3 in), insert into the cage clamp and tighten the screw.

System Cables

After the 505DE control and power chassis' have been correctly mounted, and with no power connected to the system:

1. Install the interconnect cables between the chassis modules and FTMs. The IO cables are 10' (305 cm) long, standard jacketed cables with 37 or 61-contact subminiature D-type connectors on both ends. MPU / Analog cables have a black outer jacket and 37 pins. Discrete cables have a gray outer jacket and 61 pins. Actuator cables have a gray outer jacket with 37 pins. Do not use black MPU / Analog cables to connect actuator modules and FTMs. When installing cables, check to be sure male connectors have no bent pins and female receptacles are not blocked before carefully aligning the contacts and firmly pushing them together. Secure each connector's slide latch.

Shields and Grounding

If the panel that the control chassis and termination modules are mounted on is not at earth ground potential connect it to earth ground via a 4.0 mm² (12 AWG) or larger, green/yellow wire or braid, keeping the wire/braid as short as possible.

An individual shield termination is provided at the terminal block for each of the speed sensor inputs, actuator outputs, analog inputs and analog outputs. All analog inputs and outputs should be wired using shielded, twisted-pair wiring. The shields should be connected to earth ground at one point, such as at an intermediate terminal block or the analog device, as well as terminated at the designated shield termination point on the FTM. The exposed field wire length, beyond the shield, should be limited to one inch. Relay outputs, contact inputs, and power supply wiring do not normally require shielding, but can be shielded if desired by tying a single point to earth ground (no termination points are provided on the FTM). Figure 4-1 is a diagram showing the 505DE chassis, the standard cable to the FTM, the FTM itself and then the field wiring to the device. Note that the analog shield uses the shield termination point on the FTM and is landed directly to ground at one other point.

For compliance with EMC standards, it is required that all analog and discrete input/output wiring be separated from all power wiring.

Cable Entry Locations

- Cable shield termination hardware must be installed at cable entry points.
- Cable shield terminations must be electrically connected to structural frame, and shall allow direct grounding or ac grounding of cable shields. The connection must have a resistance of less than 2.5 mΩ.

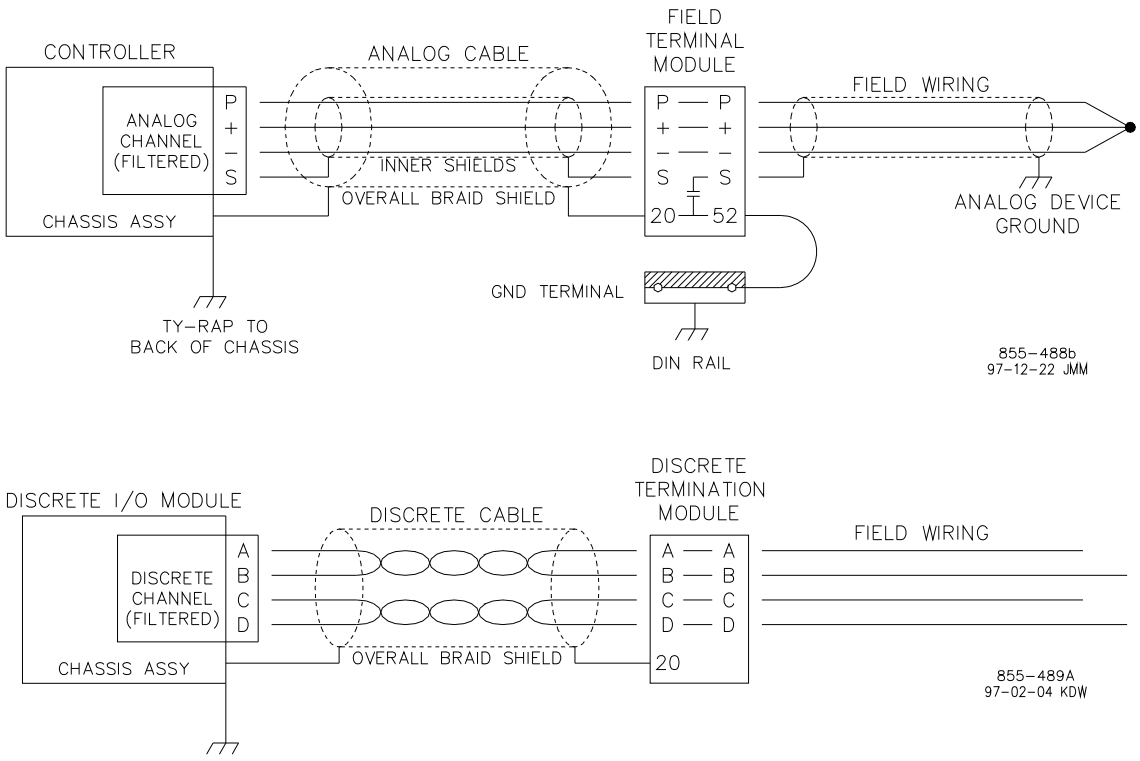


Figure 4-1. Shield Termination Diagram

Input Power

Branch circuit fuses; breakers, and wiring must have applicable safety approval and be selected according to applicable codes and area classifications. The system disconnect MUST be in easy reach of the operator and marked as a disconnect device. Each unit Power Supply must have its own branch circuit rated fuse, or circuit breaker with a rating no more than 250% of the maximum rated current of the power supply (see Table 4-1). Do not connect more than one power supply to any one fuse or circuit breaker. Use only the wire sizes specified in Table 4-1, or equivalent metric sizes that meet local code requirements.

Each 505DE control requires a power source capable of a certain output voltage and current. For AC sources, this power rating is stated in Volt-Amps (VA). The maximum VA of a source can be calculated by taking the rated output voltage times the maximum output current at that voltage. This value should be greater than or equal to the 505DE control VA requirement.

Note that control's main power supplies are not equipped with input power switches. For this reason, some means of switching input power to each main power supply must be provided for installation and servicing. A circuit breaker meeting the above requirements or a separate switch with appropriate ratings may be used for this purpose. An appropriately sized fuse or circuit breaker must be provided for each of the 505DE power supplies. Refer to below power supply specifications for recommended fuse ratings and circuit breaker ratings. Use only time-delay fuses or circuit breakers to avoid nuisance trips. A fixed wiring installation is required. Power supply leakage current exceeds 3.5 mA so a protective earth ground connection is required.

Power Supply Module Specifications

IMPORTANT

- **All Temperature ratings specify the System Ambient Temperature as measured at the front of the 505DE chassis.**
- **The Power Supply operating temperature range is –10 to +65 °C with de-rated 5 Vdc output current above 55 °C. See Power Supply specifications.**
- **For a particular system configuration, use the 505DE Power Program to calculate the output current requirements (24 V, 5 V) as a function of the Chassis, CPUs, and I/O modules used in the system.**

AC/DC Power Supply Ratings (110Vac)

AC input

Operating range:	88 to 132 Vac (47 to 63 Hz)
Nominal input voltage rating:	98 to 120 Vac, as on power supply label
Maximum input current:	13.6 A
Maximum input power:	1250 VA
Input power fuse/breaker rating:	20 A time delay
Maximum output current (24 Vdc):	12.0 A @ 65 °C System Ambient Temp.
Maximum output current (5 Vdc):	28.0 A @ 65 °C, 32A @ 60 °C
Holdup time:	1 cycle @ 120 Vac

DC input

Operating range:	100 to 150 Vdc
Nominal input voltage rating:	111 to 136 Vdc, as on power supply label
Maximum input current:	6 A
Maximum input power:	600 W
Input power fuse/breaker rating:	10 A time delay
Maximum output current (24 Vdc):	12.0 A @ 65 °C System Ambient Temp.
Maximum output current (5 Vdc):	28.0 A @ 65 °C, 32A @ 60 °C
Holdup time:	7 ms @ 120 Vdc

HVAC Power Supply Ratings (220Vac)

High Voltage AC

Operating range:	180 to 264 Vac (47 to 63 Hz)
Nominal input voltage rating:	200 to 240 Vac, as on power supply label
Maximum input current:	6.7 A
Maximum input power:	1250 VA
Input power fuse/breaker rating:	10 A time delay
Maximum output current (24 Vdc):	12.0 A @ 65 °C System Ambient Temp.
Maximum output current (5 Vdc):	22.0 A @ 65 °C, 28A @ 60°C, 32A @ 55 °C
Holdup time:	1 cycle @ 220 Vac

MAXIMUM INPUT VOLTAGE RANGE	MAXIMUM FUSE/ C.B. RATING (Time Delay)	WIRE SIZE ** (AWG/mm²)
18–36 Vdc	50 A	8 / 10 *
100–150 Vdc	10 A	14 / 2.5
88–132 Vac 47–63 Hz	20 A	12 / 4
180–264 Vac 47–63 Hz	10 A	14 / 2.5

* must use wire rated for at least 75 °C for use at 30 °C ambient

** except as noted, wire sizes are rated 60 °C for 30 °C ambient

Table 4-1. 505DE Plus Power Supply Requirements

Input Power Wiring
A ground conductor connected to the chassis is required for safety. The power supply grounding terminal(s) should also be connected to earth to ensure grounding of the power supply printed circuit boards. The grounding conductor must be the same size as the main supply conductors.

IMPORTANT

Note that the control's power supplies are not equipped with input power switches. For this reason, some means of disconnecting input power to each main power supply must be provided for installation and servicing.

A circuit breaker meeting the above requirements or a separate switch with appropriate ratings may be used for this purpose. Label the circuit breaker and locate it in close proximity to the equipment and within easy reach of the operator. To avoid nuisance trips, use only time-delay fuses or circuit breakers.

Significant inrush currents are possible when current is applied to the main power supply. The magnitude of the inrush current depends on the power source impedance, so Woodward cannot specify the maximum inrush current. Time-delay fuses or circuit breakers must be used to avoid nuisance trips during power up.

Input power and PE ground connections are made through terminals on the front of each main power supply. These terminals accept wires from 0.08–2.5 mm² (20–8 AWG) wire. For a good connection the inserted wires should have the insulation stripped back by about 8 mm (1/3"). A green/yellow wire must be used for PE ground connection. Fixed wiring installation is required for power supplies.

⚠WARNING

Remove the input power from the 505DE power supplies before installing or removing them.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.

The 24/12 relay modules are for use in ordinary or non-hazardous locations only.

Wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

CPU Module Wiring Instruction

The CPU5200 Module can operate in both 505DE short and long chassis models. Every 505DE Short Chassis controller contains one CPU module located in the first I/O slot of the chassis. A 505DE Long chassis model will also have a CPU located in the CPU2 location (slot 8 or slot 14 depending on which chassis is used).

This module was designed and rated for –40 to +85 °C operation in the industrial marketplace.

NOTICE

RESET MODULE BEFORE REMOVAL

Live insertion and removal of this module is allowed in a 505DE Plus chassis. This module should be reset immediately before removing it from the chassis. This notifies the module that it will be removed and provides a graceful failover to another healthy CPU module if available.

The CPU module runs the GAP application program. When the power is applied, the CPU module will perform diagnostic tests, before running the application program.

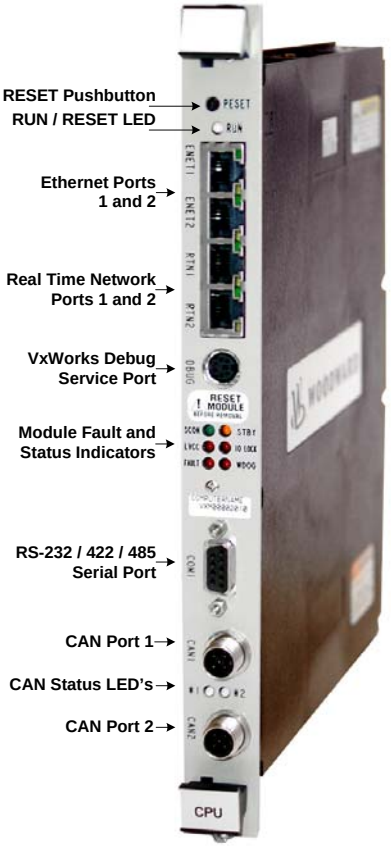
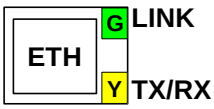
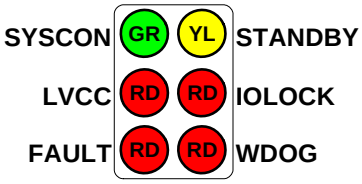


Figure 4-2. CPU Module

Front Panel Indicators (LEDs)

The 505DE CPU module has the following front-panel LEDs.

LED	Name	Description
	RUN	RUN / RESET (GREEN/RED)—Active RED when the user pushes the reset switch. Active GREEN upon release and after the CPU Operating system is loaded and running.
	LINK	LINK ACTIVE (GREEN)—A valid Ethernet connection to another device exists
	TX/RX	TX/RX (YELLOW)—Active YELLOW when data is transmitted or received.
	SYSCON	System Controller (GREEN)—Active when this CPU or RTN module is the VMEbus System Controller.
	STANDBY	Standby Ready (YELLOW)—Active when this CPU or RTN module is in STANDBY mode and ready to take over the System Controller functions in case of any failover event.
	LVCC	Low VCC Power Fault (RED)—A CPU or VME power supply fault has been detected. Local CPU power faults could be 1.2 V, 1.5 V, 1.8 V, 2.5 V, or 3.3 V. VME power faults could be VME_5V, VME_5VPC, or VME_24V.
	IOLOCK	IOLOCK (RED)—This LED indicates that an I/O LOCK condition exists either locally on the CPU itself and/or on the VMEbus. **NOTE:** IOLOCK is a condition driven by the SYSCON where all I/O modules are placed into a failsafe condition and outputs are driven to a known state.
	FAULT	CPU FAULT (RED)—Actively flashes CPU fault codes as necessary.
	WATCHDOG	CPU Watchdog / Health Faults (RED)—The processor watchdog or Health monitor has tripped and the CPU or RTN module is prevented from running. The CPU Watchdog includes a 1 ms failover event and an 18ms timeout event. Health faults include Watchdog events and local SYSCLK and MFT faults.
	CAN #1, #2	CAN #1, #2 (GREEN/RED)—Active GREEN or RED when data is transmitted or received through CAN port #1 or #2.

Module Reset

Front Panel Reset Switch. The CPU module has a pushbutton reset switch on the front panel to reset the module. If a GAP application was successfully running at the time of reset, the same application will be auto-started and re-initialized.

Reset Notes:

- Resetting a CPU module creates a HealthFault that immediately sets the WDOG light RED.
- Any System running with one healthy CPU. Reset detection will also drive IOLOCK and IORESET to place the Control System, its expansion racks, and all output signals into a known failsafe condition.
- Redundant Systems running with two healthy CPU's. Reset detection on the SYSCON (System Controller) causes an immediate "Failover" to the other STANDBY CPU who then becomes the new System Controller. Reset detection on the STANDBY unit causes a HealthFault that removes it from STANDBY mode.
- The front-panel RUN/RESET led will be RED while reset is held and will turn GREEN for a few seconds after releasing reset. After turning OFF, it will again turn GREEN when the operating system starts to boot.

NOTICE

RESET MODULE BEFORE REMOVAL

This module should be reset immediately before removing it from the chassis. This notifies the module that it will be removed and provides a graceful failover to another healthy CPU module if available.

Ethernet Communications

The 505DE's CPU module contains various communication peripherals (RTN, CAN, etc.), however the 505DE controller only uses the module's (2) general use Ethernet ports and (1) serial port. The two Ethernet Ports support 10/100 Base-TX communications and are full duplex and auto switching. One RJ45 connector is provided for each port. Every 505DE control contains one CPU module located in the first I/O slot of the chassis. A redundant configuration will also have a CPU located in slot 14. This module is designed to fully support auto-switching 10/100 Base-TX Ethernet connections.

Wiring Notes:

- Refer to Figure 4-3 for Ethernet port wiring connections.
- For system architecture reasons, it is required that each Ethernet port be connected on a separate network.
- Each port has a defaulted IP address as shipped from the factory, but can be changed with Woodward's AppManager service tool program.

IMPORTANT

This module has been factory configured with fixed Ethernet IP addresses of

- **Ethernet #1 (ENET1) = 172.16.100.1, Subnet Mask = 255.255.0.0**
- **Ethernet #2 (ENET2) = 192.168.128.20, Subnet Mask = 255.255.255.0**

IMPORTANT

To fully realize 100 Base-TX connectivity, downstream devices must be capable of 100 Base-TX. When using an Ethernet hub for multiple connections, either a fixed 100 Base-TX or an auto-switching 10/100 Base-TX hub is required.

IMPORTANT

Max cable length is 30 meters. Double shielded, Cat 5 Ethernet cables (SSTP) are required for customer installations.

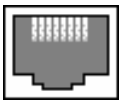
Connector	Signal Mnemonic
RJ45 female 1 8 	Shielded RJ45 female receptacle
1	TX+
2	TX-
3	RX+
4	---
5	---
6	RX-
7	---
8	---
Shield	Chassis GND

Figure 4-3. RJ45 Ethernet Module Pinouts

RTN Ports

The 505DE does not utilize the two Real Time Network ports (RJ45) on the CPU's front panel.

Service Port

The 505DE does not utilize the service port located on the front of each 505DE CPU module.

RS-232/422/485 Serial Port

An isolated, configurable RS-232 / 422 / 485 serial port is located on the front of the 505DE's CPU module and is configured by the GAP software application. The baud rate is selectable from 300 baud to 57.6 Kbaud. Shielded cable is required when connecting to the CPU module's serial port. Using shielded cable will help ensure the robustness of the serial communications.

The serial port's communication parameters are configured using the 505DE PCI Tool. This port is configured for use as a Modbus communications port. It can be used for monitoring and control.

RS-232 communication is limited to a distance of 15 m (50 ft). In cases where a device which is being interfaced to is located a distance of greater than 15 m (50 ft) from the control, it is recommended to use RS-422 or RS-485 utilized. RS-422 and RS-485 communication also support multi-dropping (multiple slaves on a single communication line), RS-232 communication does not.

A standard RS-232 based null-modem cable is required for interfacing between a personal computer and the control.

Pin 1 – RS-422 Transmit (+)
Pin 2 – RS-232 Receive
Pin 3 – RS-232 Transmit
Pin 4 – RS-422 Transmit (-)
Pin 5 – Signal Ground
Pin 6 – Termination Resistor (+)
Pin 7 – RS-485/422 Receive (+)
Pin 8 – RS-485/422 Receive (-)
Pin 9 – Termination Resistor (-)

Figure 4-4. 505DE CPU / SIO Communications Port

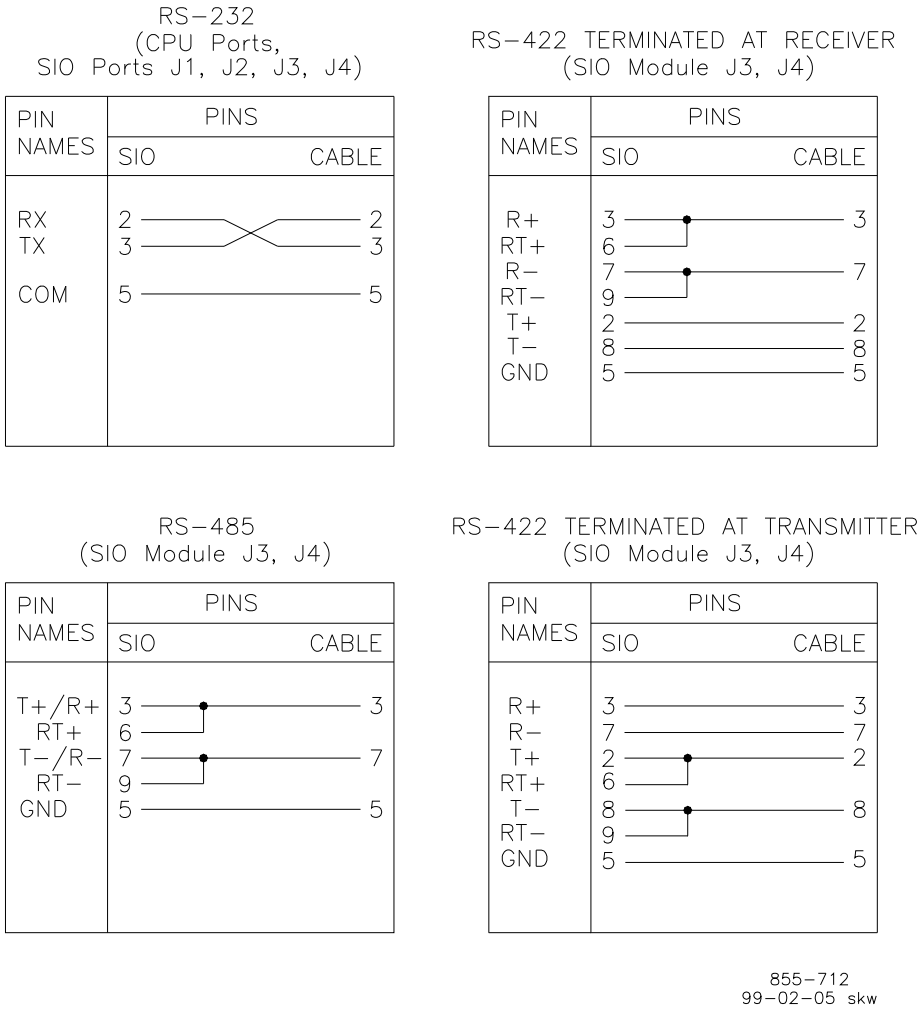


Figure 4-5. Typical Communications Cable Connections

CAN Communication Ports

The 505DE does not utilize the two CAN ports located on the front of each 505DE CPU module.

Speed Sensor Inputs

The 505DE control uses speed-sensing probes mounted off of a gear connected or coupled to the turbine's rotor to sense turbine rotor speed. The 505DE control accepts two types of speed inputs; passive MPU probes for accurate high-speed measurement and active proximity probes for low speed measurement. It is not recommended that gears mounted on an auxiliary shaft coupled to the turbine rotor be used to sense turbine speed. Auxiliary shafts tend to turn more slowly than the turbine rotor (reducing speed sensing resolution) and have coupling gear backlash, which results in less than optimum speed control. For safety purposes it is also not recommend that the speed sensing device sense speed from a gear coupled to a generator or mechanical drive side of a system's rotor coupling.

A passive MPU provides a frequency output signal corresponding to turbine speed by sensing the movement of a gear's teeth past the MPU's pole piece. The closer the MPU's pole piece is to a gear's teeth and the faster the gear turns the higher a passive MPU's output voltage amplitude will be. The 505DE control must sense an MPU voltage of 1 to 25 Vrms for proper operation. With proper MPU, gear size, and MPU-to-gear clearance, speed measurement should be capable down to 100 Hz. Standard MPU clearance is recommended to be 0.25 to 1.02 mm (0.010 to 0.040 inch) from tooth face to pole piece. For information on selecting the correct MPU or gear size, please refer to Woodward manual 82510. See Figure 4-6 for wiring schematic.

A proximity (active) probe may be used to sense very low speeds. With a proximity probe, speed can be sensed down to 0.5 Hz. The 505DE control can be programmed to turn on or off a turbine turning gear using a relay output programmed as a speed switch. See Figure 4-6 for proximity probe wiring schematic.

Because of differences between the sensing circuits required to interface with passive (MPUs) and active (proximity) probes, separate terminals are provided for each type. This allows a simple method of field selecting the type of speed input based on the type of probe used. Short-circuit protected 12 Vdc and 24 Vdc sources, with isolation diodes on the power, common, and output source lines, are provided with each speed input to power system proximity probes.

Each channel's proximity probe input accepts 5–28 Vdc. Alternatively the channel can be used with either 12 Vdc or 24 Vdc open collector probes. When interfacing to open collector type probes a pull-up resistor between the 24-volt supply terminal and the proximity return terminal is required.

The 505DE control's speed sensor inputs are located on the MPU / Analog Field Termination Modules. The termination points are the same for each Field Termination Module, although individual speed inputs are used for different purposes and types depending on 505DE configuration and type selected by the user. Refer to volume three of this manual for speed channel assignments and configuration information.

Wiring Notes:

- Refer to Figure 4-6 for Speed Sensor wiring connections on the MPU / Analog FTM.
- Each Speed input channel can only accept one MPU or one Proximity probe at a time.
- Proximity Probes only—External pull-up resistors are required when interfacing with an open collector type of proximity probe.

- It is recommended that twisted shielded wiring be used between each probe and ATM.
- Shields should be connected to earth ground at one point (analog device or intermediate terminal block), as well as terminated at the shield termination point provided on the MPU / Analog FTM. The exposed wire length, beyond the shield, should be limited to 25 mm (1”).
- MPU / Analog FTM terminals accept wires from 0.08–2.5 mm² (27–12 AWG).

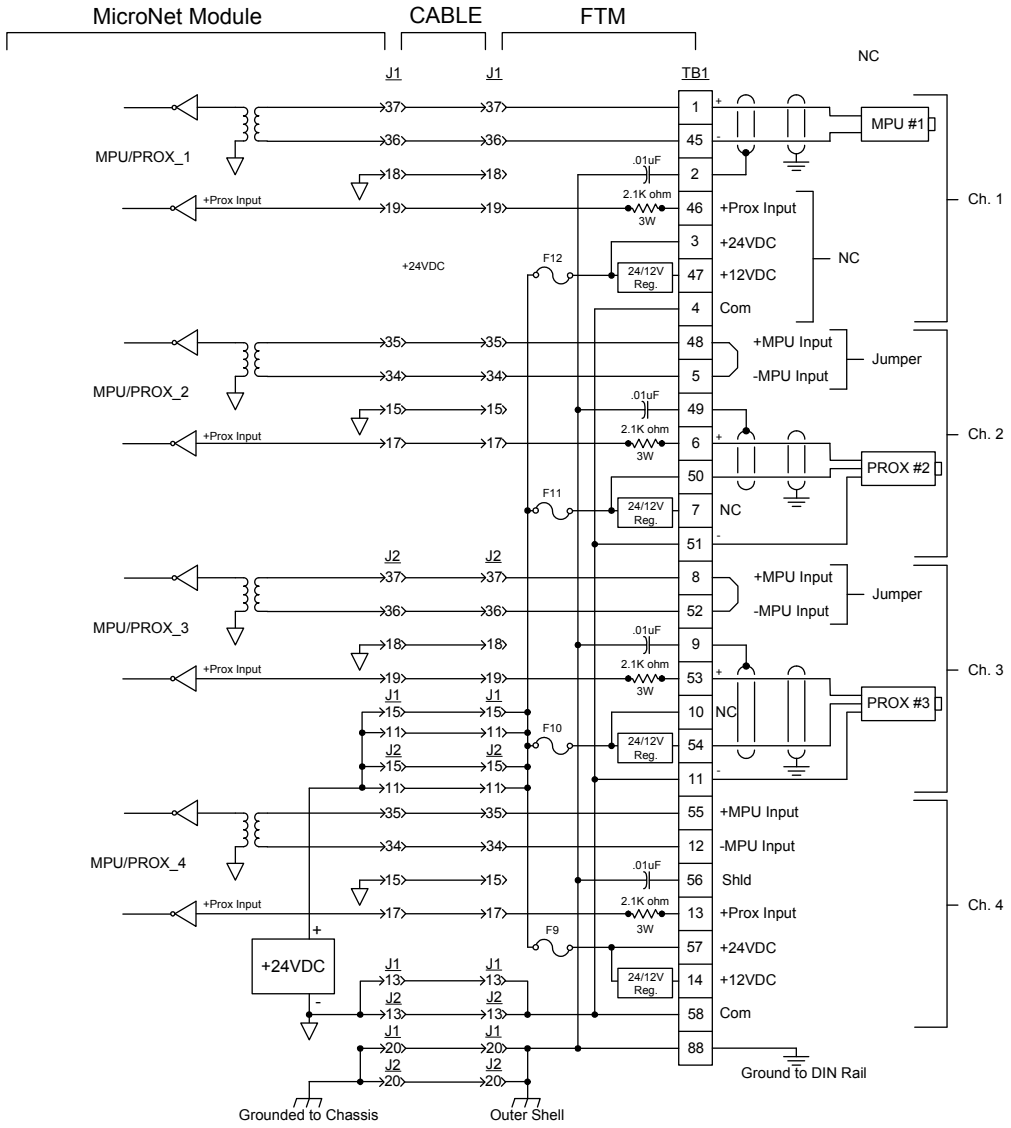


Figure 4-6. Example Speed Probe Circuitry and Wiring Diagram

IMPORTANT

If the MPU device is not providing a voltage greater than 1.5 Vrms, the MPU device should be moved closer to the gear where speed is being monitored. The following graph shows the minimum voltage necessary to detect speed at the various frequencies.

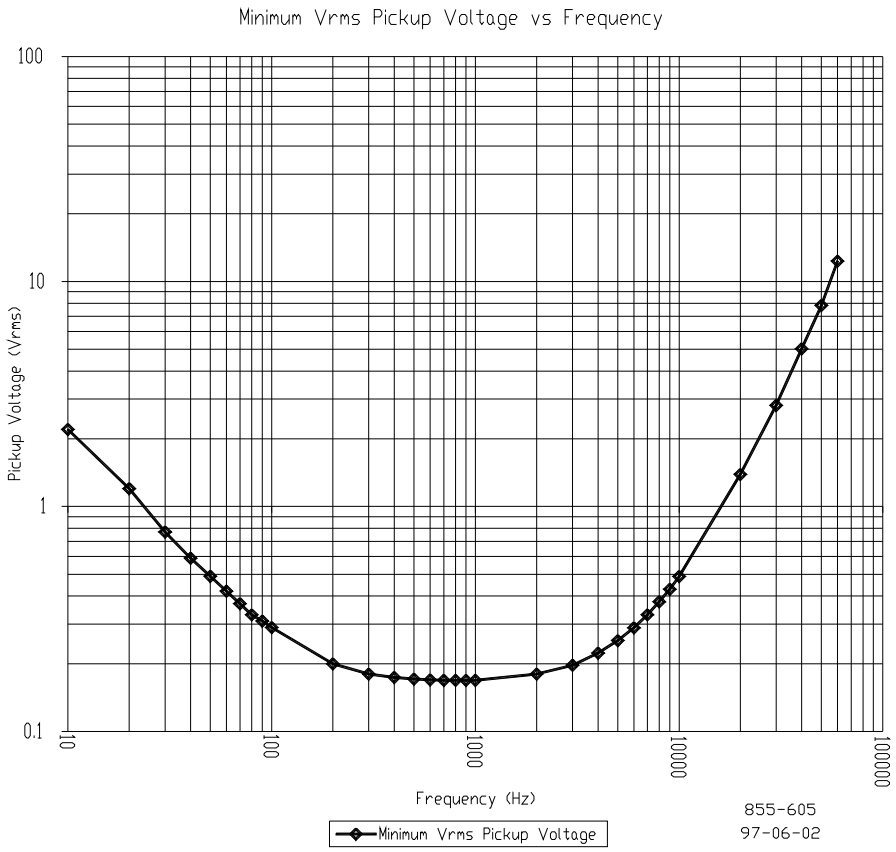


Figure 4-7. MPU Required Vrms at Frequency

Speed Sensor Specifications

Digital Speed Sensor Inputs

Number of channels	4
Update time	5 ms

MPU Input Ratings

Input frequency	100 - 25000 Hz
Input amplitude	1-25 Vrms
Input impedance	2000 Ohms
Isolation voltage	500 Vrms
Resolution	12 bits minimum over chosen frequency range
Accuracy	0.03% full scale, minimum

Proximity Probe Input Ratings

Input frequency	0.5 - 25000 Hz
Input amplitude	3.5 - 32 Vdc input to the module
Available power	12 Vdc or 24 Vdc, 50 mA maximum
Isolation voltage	0 Vrms
Resolution	12 bits minimum over chosen frequency range
Accuracy	Software calibrated to 0.03% full scale
Fuse	24 Vdc 100 mA fuse/channel, 12 Vdc short circuit protected

Analog Inputs

The 505DE accepts multiple 4–20 mA current inputs. All analog inputs may be used with two-wire ungrounded (loop powered) transducers or isolated (self-powered) transducers. Because inputs are not fully isolated, care must be taken in their application and maintenance to avoid “ground-loop” type problems. All analog inputs have 200 Vdc common mode rejection isolation. If interfacing to a non-isolated device that may have the potential of reaching over 200 Vdc with respect to the control’s common, the use of a loop isolator is recommended to break any return current paths, which could result in erroneous readings.

Each current input channel can power its own 4–20 mA transducer. This power is protected with a 100 mA fuse on each channel to prevent an inadvertent short from damaging the module. The 24 Vdc outputs are capable of providing 24 Vdc with ±10% regulation. Power connections can be made through terminals located on the FTMs.

Figure 4-8 shows the eight analog inputs available on one MPU / Analog FTM. The first 6 channels show input wiring examples and the last two channels have the termination points labeled. Channel one gives a wiring example for a single loop powered transmitter connected to a single channel. Channel two shows a single self powered transmitter wired to a single channel. Shields are not shown on the drawing but should be connected to the available shielding termination points as well as grounded at one place on an intermediate terminal strip or at the analog device.

Wiring Notes:

- All analog inputs have an input impedance of 200 Ω – thus use a 200 ohm resistor externally to provide voltage to the input.
- Each 24 Vdc source terminal has an internal 100 mA fuse in series with it (located on the ATM). To meet CENELEC ratings, power for sensors and contacts must be supplied either by the 505DE power supplies, or the external power supply outputs must be rated for 30 Vdc or less and have their outputs fused with appropriate sized fuses.
- It is recommended that 0.75 mm² (20 AWG) or larger twisted/ shielded wire be used between each transducer and ATM.
- Shields should be connected to earth ground at one intermediate point, as well as terminated at the FTM shield termination point. The exposed wire length, beyond the shield, should be limited to 25 mm (1”).
- Do not place shielded wires in the same cable conduit with high-voltage or large-current-carrying cables.
- Cable shields must be electrically continuous from the signal source to the point the signal wire enters the 505DE Analog Termination Module.
- ATM terminals accept wires from 0.08–2.5 mm² (27–12 AWG).

The 505DE control’s analog inputs are located on the MPU / Analog Field Termination Modules. The termination points are the same for each Field Termination Module, although individual analog inputs are used for different purposes and types depending on 505DE configuration and type selected by the user. Refer to volume three of this manual for analog input channel assignments and configuration information.

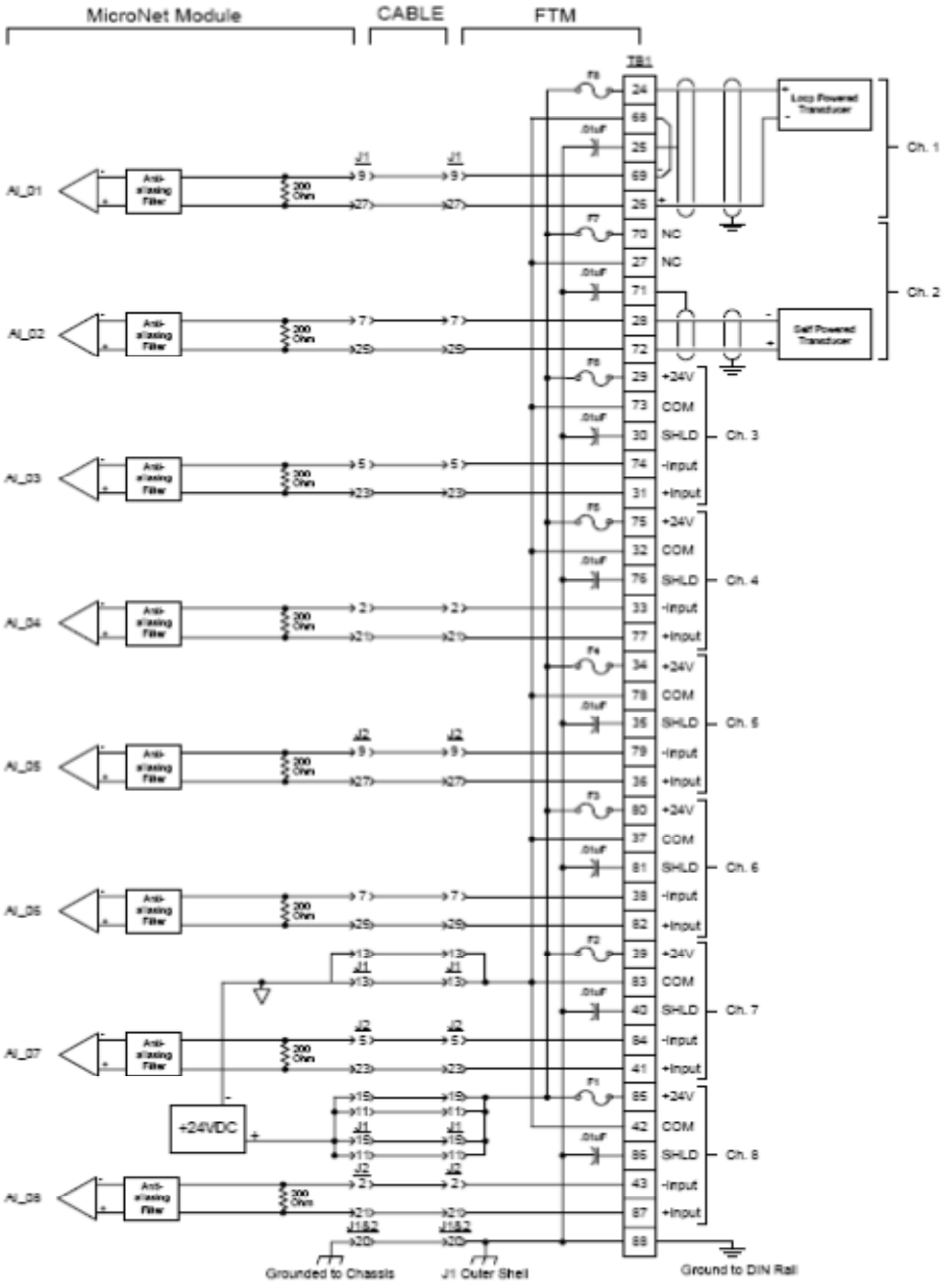


Figure 4-8. Analog Input Circuitry and Wiring Diagram

Analog / Proportional Act Outputs

The 505DE analog outputs are 4–20 mA with a full-scale range of 0–25 mA. Each output monitors the output source current for fault detection. All of the analog outputs may be individually disabled. When a channel fault or a module fault is detected, the application program may annunciate the fault, disable the channel or module, and stop using the data in system calculations or control. Analog outputs that are used redundantly should be wired in parallel to the current input device.

The Analog Combo module has four 4–20 mA current output drivers. These four analog outputs can drive a maximum load of 600 ohms (load + wire resistance). Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices. See Figure 4-9 for an example of 4–20 mA output wiring.

Actuator Outputs (Figure 4-9 as ACT_01 and ACT_02)
The actuator outputs can be configured for 4–20 mA or 20–160 mA. Configuration is done through the application software; no hardware modifications in the forms of jumpers or switches are necessary. For fault detection, each output monitors the output source current and the output return current. All of the actuator outputs can be individually disabled. When a channel fault or a module fault is detected, the application program can annunciate the fault, disable the channel or module, and stop using the data in system calculations or control.

Redundant Act Outputs
Not to be confused with integrating actuator modules, the four (two on each AIO FTM), Act outputs can perform in redundant fashion. If two actuator outputs are configured for the same parameter, then they become redundant current sharing outputs. Only the Act outputs behave this way. Configuring two analog outputs for the same parameter will provide two identical outputs. Redundant outputs should be wired to a single coil in parallel, or to one to each coil of a redundant coil actuator. If one fails, the other will assume the lost current. When repaired and reset (software reset), they will return to current sharing mode.

Dither can be provided in the application software for each output. Dither is a low frequency (25 Hz) signal consisting of a 5 ms pulse modulated onto the dc actuator-drive current to reduce sticking due to friction in linear type actuators. Woodward TM-type actuators typically require dither. Dither amplitude is variable through the application software.

Configuration Notes
- Maximum impedance for a 4 to 20 mA actuator output driver is 360 ohms (actuator impedance + wire resistance).
- Maximum impedance for a 20 to 160 mA actuator output is 45 ohms (actuator impedance + wire resistance).
- Each actuator driver senses its source and return current to allow overcurrent and undercurrent alarms and shutdowns.
- As the return current is measured, attempting to sense the actuator driver current with a grounded or non-floating input causes current feedback errors. Make sure the sensing device is not grounded and has some common mode handling capability.

Wiring Notes:
- Refer to Figure 4-9 for Analog Output wiring connections on the MPU / Analog IO Field Termination Modules.
- Only self-powered 4–20 mA signals are output (does not interface with loop powered inputs on another device).
- All analog outputs can drive into a maximum of 600 Ω.
- It is recommended that 0.75 mm² (20 AWG) or larger twisted/ shielded wire be used between each meter (or DCS input) and ATM.
- Shields should be connected to earth ground at all intermediate terminal blocks, as well as terminated at the control terminal block. The exposed wire length, beyond the shield, should be limited to 25 mm (1”).
- Cable shields must be electrically continuous from the signal source to the point the signal wire enters the 505DE Field Terminal Module.

- MPU / Analog FTM terminals accept wires from 0.08–2.5 mm² (27–12 AWG) wire.
- Analog outputs are not isolated; care should be taken when interfacing to other non-isolated devices to prevent wiring faults. The use of an isolator is recommended.
- Maximum impedance for a 4 to 20 mA actuator output driver is 360 ohms (actuator impedance + wire resistance).

Figure 4-9 shows a circuitry and wiring schematic for the six analog outputs found on an MPU / Analog IO Field termination Module. Refer to Volume #3 of this manual for a complete list of programmable analog output options.

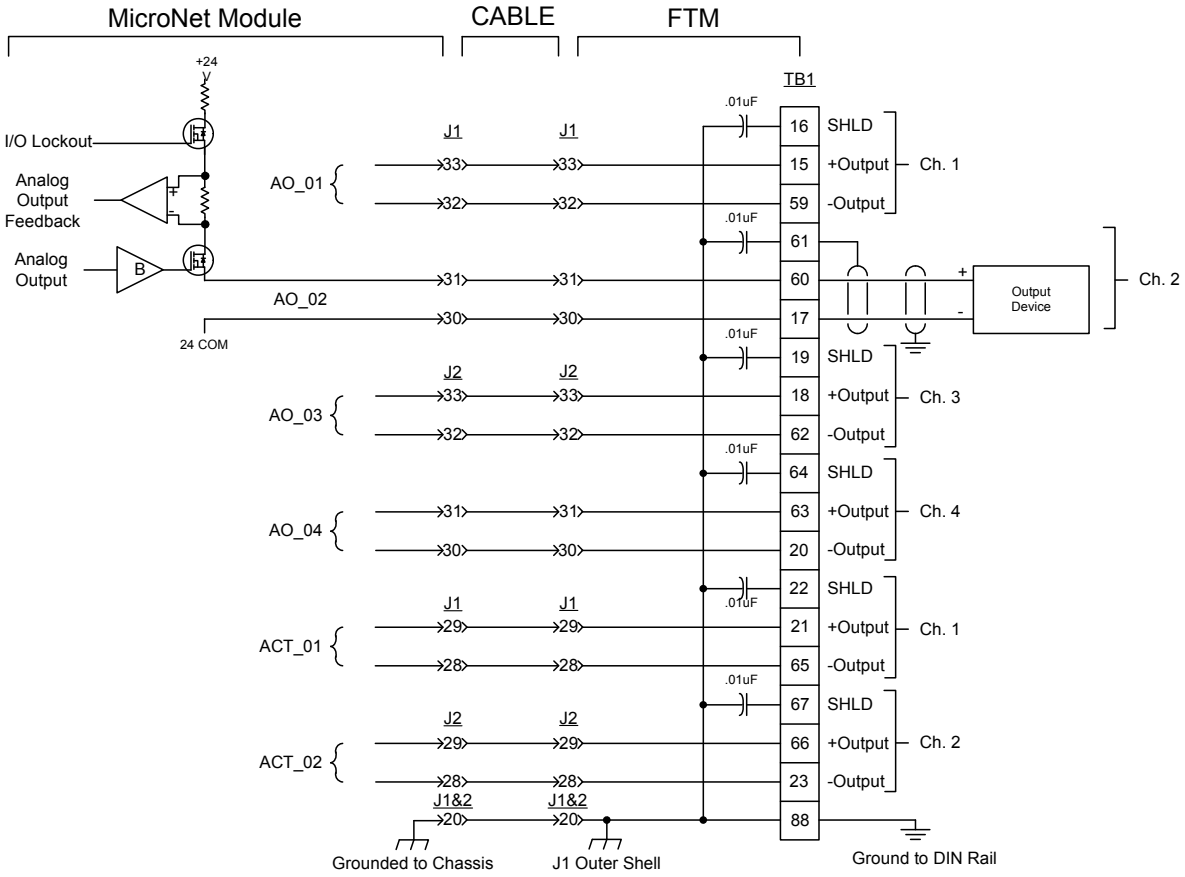


Figure 4-9. Example Analog Output Circuitry and Wiring Diagram

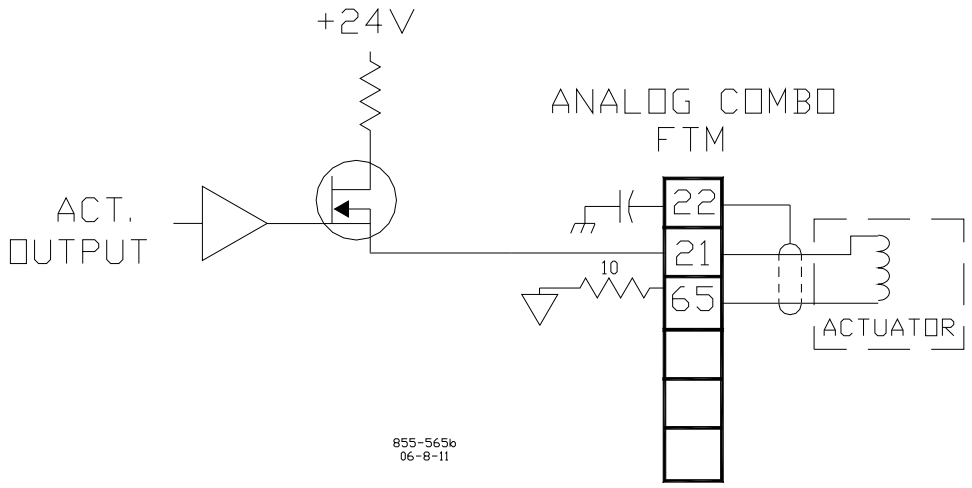


Figure 4-10. Actuator FTM Wiring Diagram – Proportional Actuator

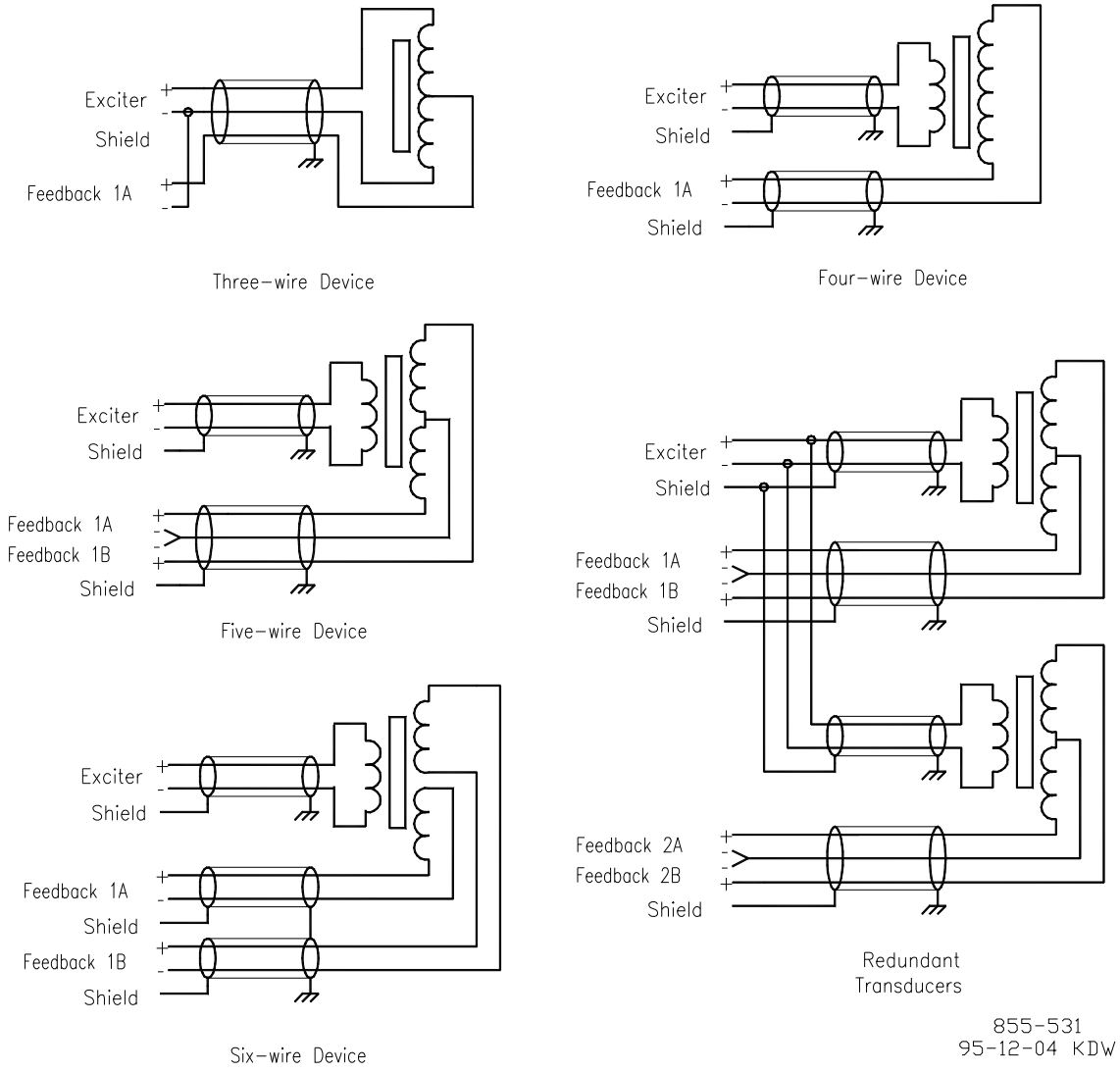


Figure 4-11. 505DE Compatible Position LVDT/RVDT Schematics

Analog Input & Output Specifications

Analog Input Ratings

Number of channels	8
Update time	5 millisecond
Input range	0-25 mA
Isolation	0 Vrms, -60 dB CMRR, 200 Vdc common mode rejection voltage; no galvanic isolation
Input impedance	200 ohms
Anti-aliasing filter	2 poles at 10 ms
Resolution	16 bits
Accuracy	Software calibrated to 0.1%, over 25 mA full scale
Temp drift	275 ppm/C, maximum
Fuse	100 mA fuse per channel

4–20 mA Analog Output Ratings

Number of channels	4
Update time	5 ms
Driver	Pulse Width Modulated (PWM)
PWM frequency	6.14 kHz
Filter	3 poles at 500 ms
Current output	4–20 mA current output range: 0–25 mA
Isolation	0 Vrms
Max load resistance	600 ohms (load + wire resistance)
Current readback	11 bits
Readback isolation	-60 dB CMRR, 200 Vdc common mode
Resolution	11 bits
Accuracy	Software calibrated to 0.2%, over 25 mA full scale
Temperature drift	125 ppm/C, maximum
Readback accuracy	0.2%, over 25 mA full scale
Readback temp drift	400 ppm/C, maximum

Actuator Driver Output Ratings

Number of channels	2
Update time	5 millisecond
Driver	PWM (proportional only), single or dual coil
PWM frequency	6.14 kHz
Filter	3 poles at 500 microseconds
Current output	4–20 mA or 20–160 mA, software selectable
Current output range	0–24 mA or 0–196 mA, depending on the selected range
Isolation	0 Vrms
Max. act resistance	45 ohms on the 20–160 mA output, 360 ohms on the 4–20 mA output
Readback	Actuator source and return currents
Readback isolation	-60 dB CMRR, 200 Vdc common mode
Dither current	25 Hz, fixed duty cycle, software variable amplitude
Resolution	11 bits over 25 or 200 mA range
Accuracy	Software calibrated to 0.2% of 25 or 200 mA range
Temperature drift	125 ppm/C, maximum
Readback accuracy	0.1% of 25 or 200 mA range
Readback temp drift	150 ppm/C, maximum

Discrete Inputs

The 505DE control accepts many contact inputs. Refer to Volume 1 of this manual for a complete list of contact input options.

Each 24/12 Discrete FTM accepts 24 contact inputs. The 24/12 Discrete FTM may supply contact wetting voltage. Optionally, an external 18–32 Vdc power source can be used to source the circuit wetting voltage. If the 24 Vdc internal power source is used for contact wetting, a jumper is required between FTM terminals on TB9. If an external power source is used for contact wetting, the TB9 jumper must be removed and the external source's common must be connected to the FTM's discrete input common, terminal 49.

The 24 contact inputs found on a Discrete FTM are located on terminals TB6, 1 - 12 and TB7, 13 - 24. When internal power is used, wetting voltage is taken from terminals TB6, 25 - 36 and TB7, 37 – 48. See Figure 4-12 for a wiring example.

Wiring Notes:

- Refer to Figure 4-12 for Contact Input wiring connections to the FTM.
- All contact inputs accept dry contacts.
- If the internal 24 Vdc is used, a jumper must be added to tie the internal 24 Vdc to the bussed power terminal blocks (see Figure 4-12).
- If an external 24 Vdc is used, the common for the external 24 Vdc must be tied to the discrete input common (see Figure 4-12). Power for contacts must be supplied by the control's power supplies, or the external power supply outputs must be rated to Class II at 30 Vdc or less and outputs must be fused with appropriately sized fuses (a maximum current rating of 100/V, where V is the supply's rated voltage, or 5 A, whichever is less).
- It is recommended that 0.75 mm² (20 AWG) or larger wire be used between each discrete input and the Discrete FTM.
- Discrete FTM terminals accept wires from 0.08–2.5 mm² (27–12 AWG).

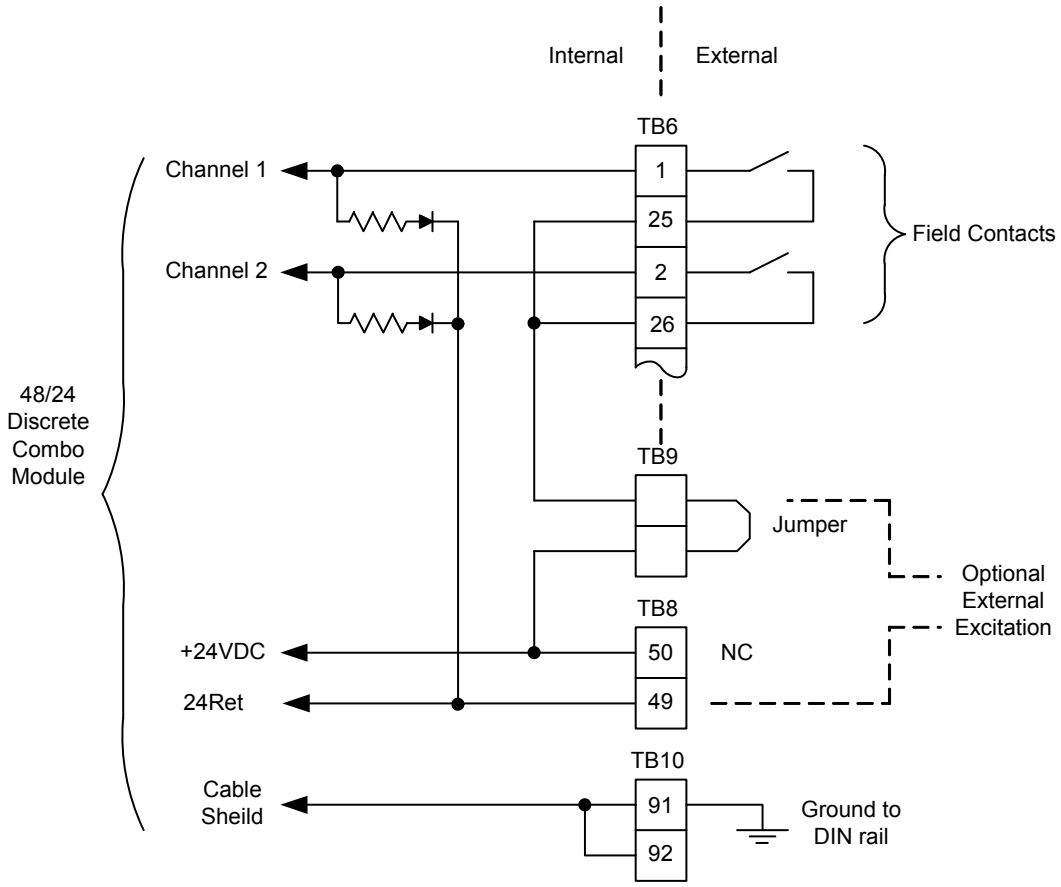


Figure 4-12. Discrete Input Wiring to a 24/12 Discrete FTM

Discrete Input Specifications

Number of channels:	48
Update time:	5 ms
Input type:	Optically isolated discrete input (galvanically isolated)

48/24 Discrete FTM

Input thresholds:	
Low voltage:	8 Vdc at 1.5 mA = “OFF” > 16 Vdc at 3 mA = “ON”
High voltage:	<29 Vdc at 1.8 mA = “OFF” >67 Vdc at 4 mA = “ON”
Input current:	4 mA @ 24 Vdc; 2.6–5 mA @ 125 Vdc
External input voltage:	18–32 Vdc (UL and LVD), or 100–150 Vdc (UL) w/ high Voltage FTM
Isolation voltage:	500 Vdc to earth ground, 1000 Vdc to control common
Isolated 24 Vdc contact supply:	400 mA maximum

Discrete Outputs

The 505DE provides multiple Contact Outputs.

The 505DE control system does not have the capability to provide circuit power to external circuits interfacing with a relay output. All external circuits interfacing with control relay outputs must have circuit power provided externally. All relays are dust-tight, magnetic blowout type relays with Form-C type contacts.

The Discrete FTM incorporates an I/O lockout relay that will de-energize all of the relays if de-activated by the I/O lock signal from the CPUs. All field connections use removable connectors for ease in replacing module in the field. All relays are field replaceable.

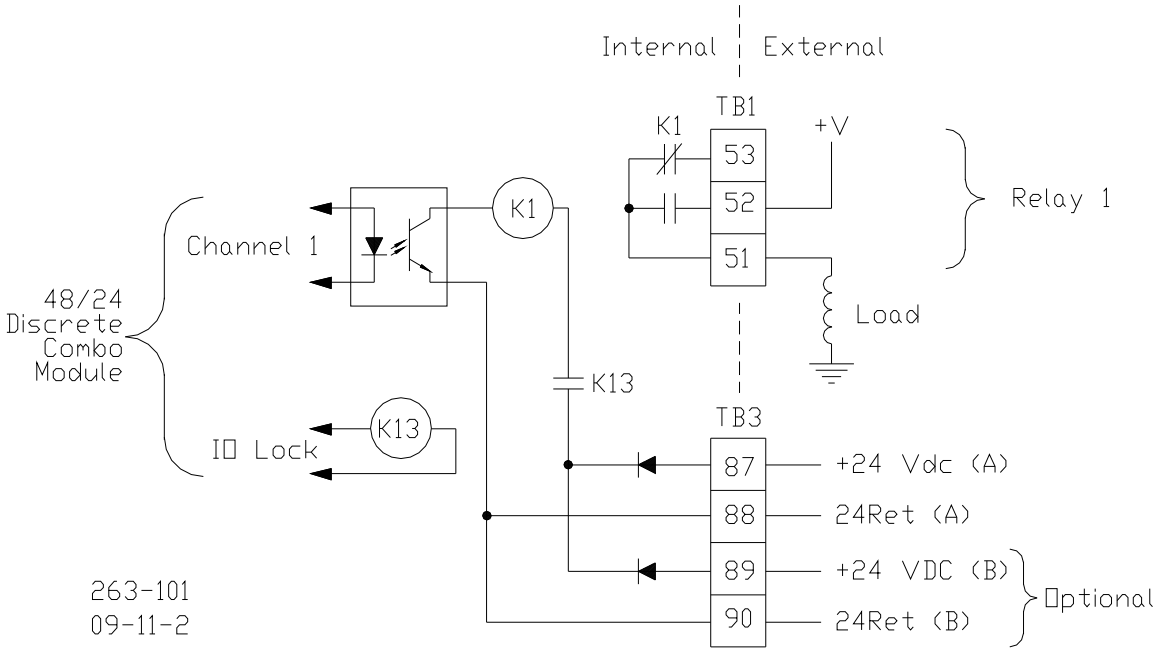


Figure 4-13. Relay Output Wiring on a 24/12 Discrete FTM

The 24/12 Discrete FTM is used with 48/24 Discrete Combo Module. The 24/12 Discrete Module has 24 discrete inputs connections and 12 SPDT relay outputs. Two relay modules connect to one 48/24 Discrete Combo Module. Each FTM uses one 505DE High Density Analog/Discrete cable to connect it with the 48/24 Discrete Combo Module. This relay module incorporates an I/O lockout relay that de-energizes all of the relays if de-activated by the I/O lock signal from the Discrete Combo Module. All field connections use removable connectors for ease in replacing a module in the field. All relays are field replaceable.

Power for the output relays need to be supplied externally. The 12 relays draw 1 A @ 24 Vdc from the external power supply (with all 12 relays energized). It also has redundant power input capability.

Table 4-2. Relay Specifications

Relay type	Dust-tight with magnetic blow-out
Coil rating	80 mA @ 24 Vdc, suppressor located on circuit board
Isolation	1000 Vrms
Relay response time	15 ms (operate and release)
Relay life expectancy	50 000 operations @ rated load
Replaceability	Relays are socket mounted and retained by a wire bail
Status indication	Yellow LED - Relay energized Green LED - Relay power on Green LED - Control power on

The external power source connected to the relay contacts should be limited to 10 A to protect the circuit board.

Table 4-3. Relay Contact Ratings

Current	Load Type
10 A	28 Vdc Resistive
3 A	150 Vdc Resistive
10 A	115 Vac Resistive
10 A	240 Vac Resistive
3 A	28 Vdc Inductive
1.2 A	150 Vdc Inductive
6 A	115 Vac Inductive
3 A	240 Vac Inductive

IMPORTANT

Verify that each set of relay contacts meets the power requirements of the circuit with which it is being used. Interposing relays are required when the interfaced circuit demands relay contacts with a higher power rating.

Verify that the voltage applied to each set of relay contacts meets the regulatory demands related to the isolation voltage provided by the FTM. Interposing relays are required when the interfaced circuit requires a higher isolation voltage to touchable circuits.

If interposing relays or other inductive loads are required, it is recommended that interposing relays with surge (inductive kickback) protection be used. Improper connection could cause serious equipment damage.

System Wiring Diagrams

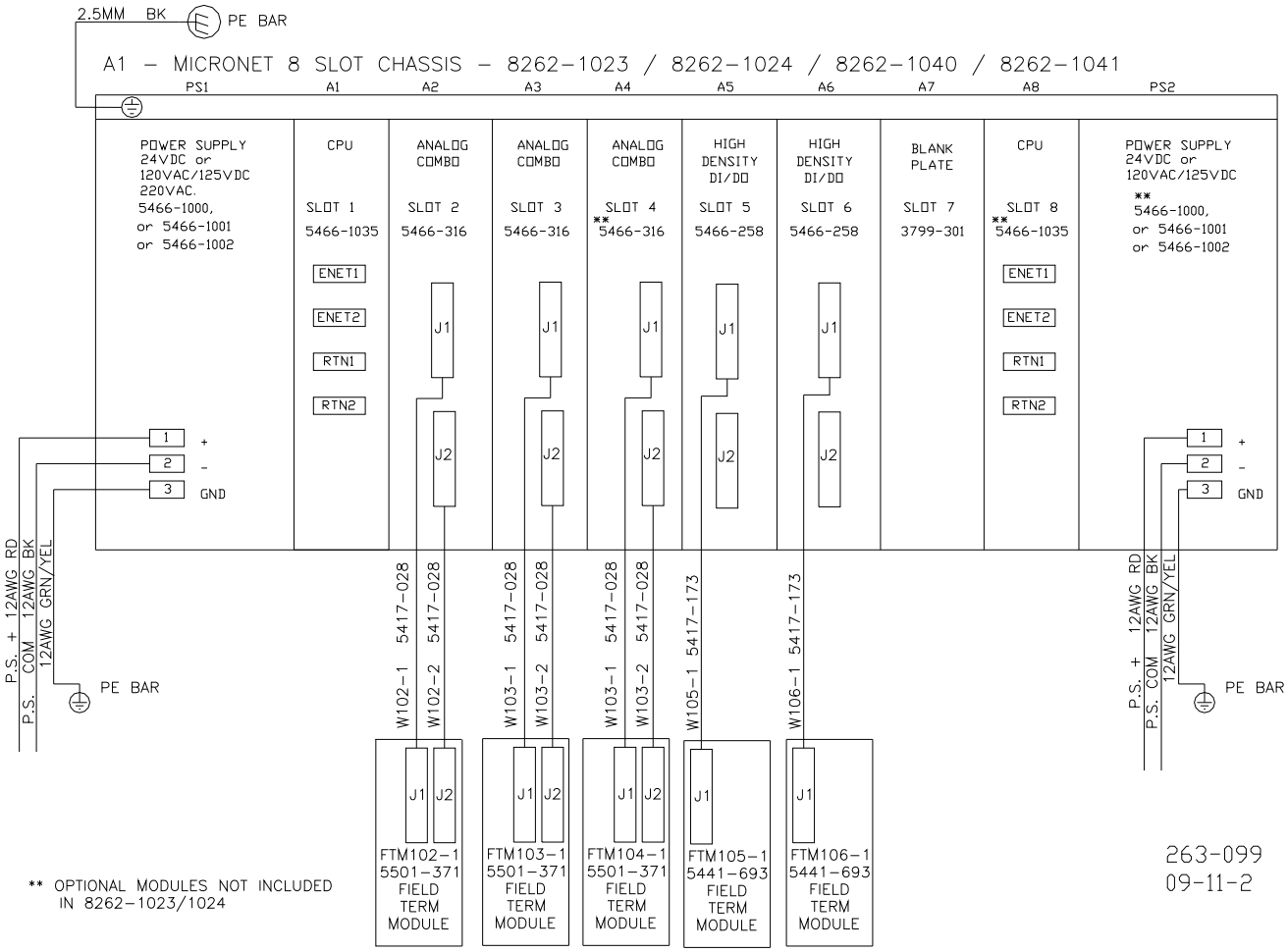


Figure 4-14. 505DE Short Chassis Configuration

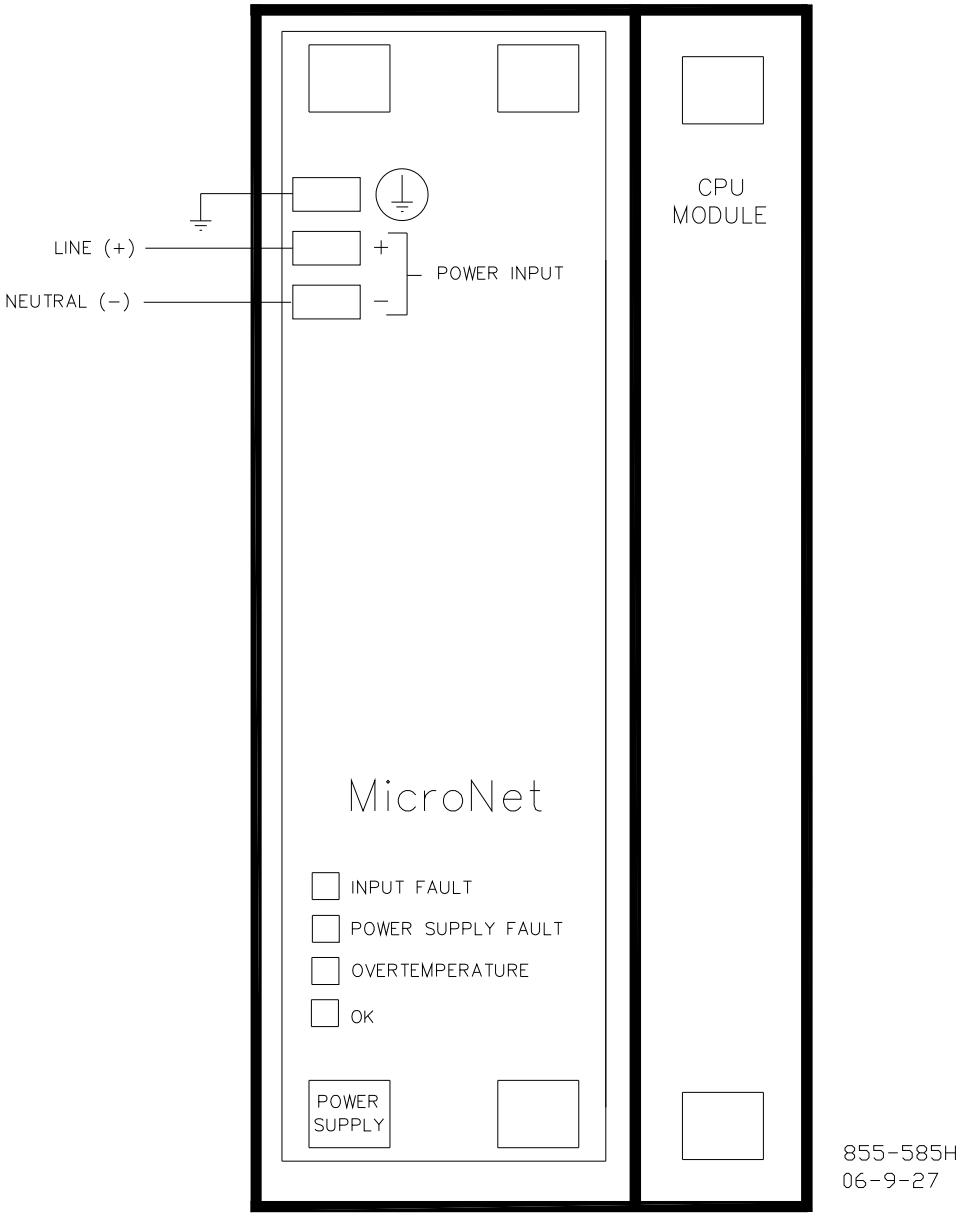


Figure 4-15. Power Supply Wiring

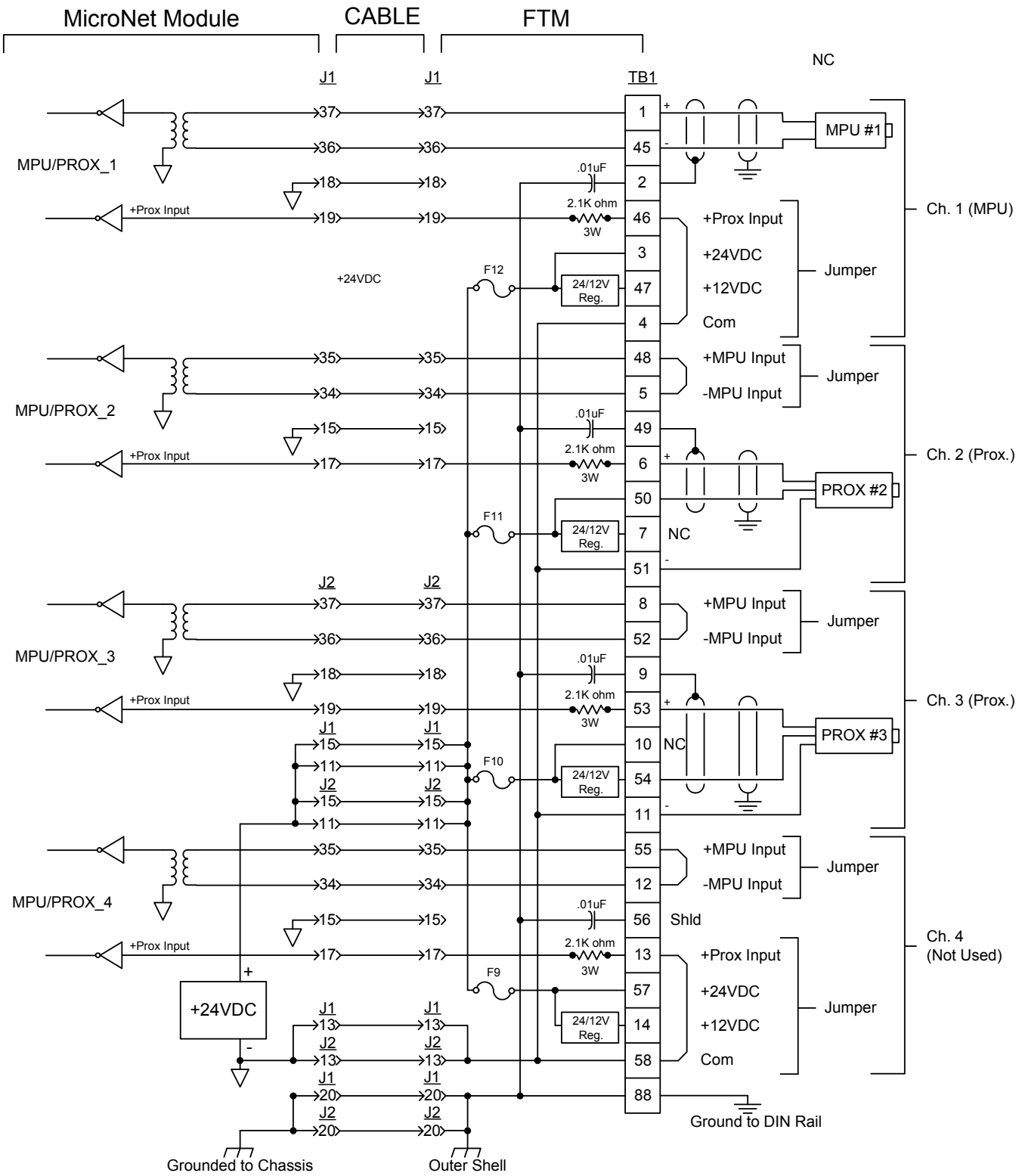


Figure 4-16. Analog Combo #1 Wiring

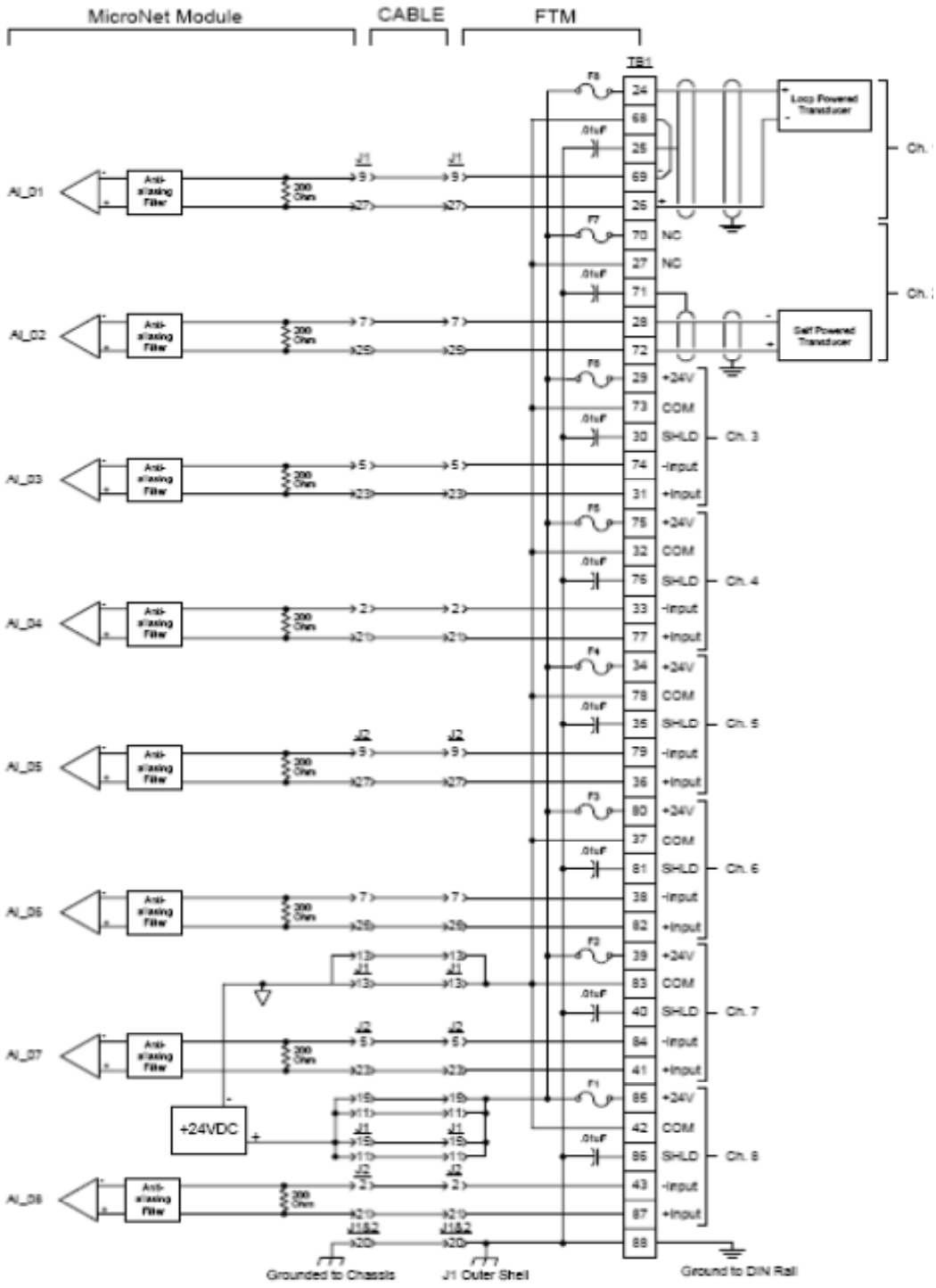


Figure 4-17. Analog Combo #1 Wiring

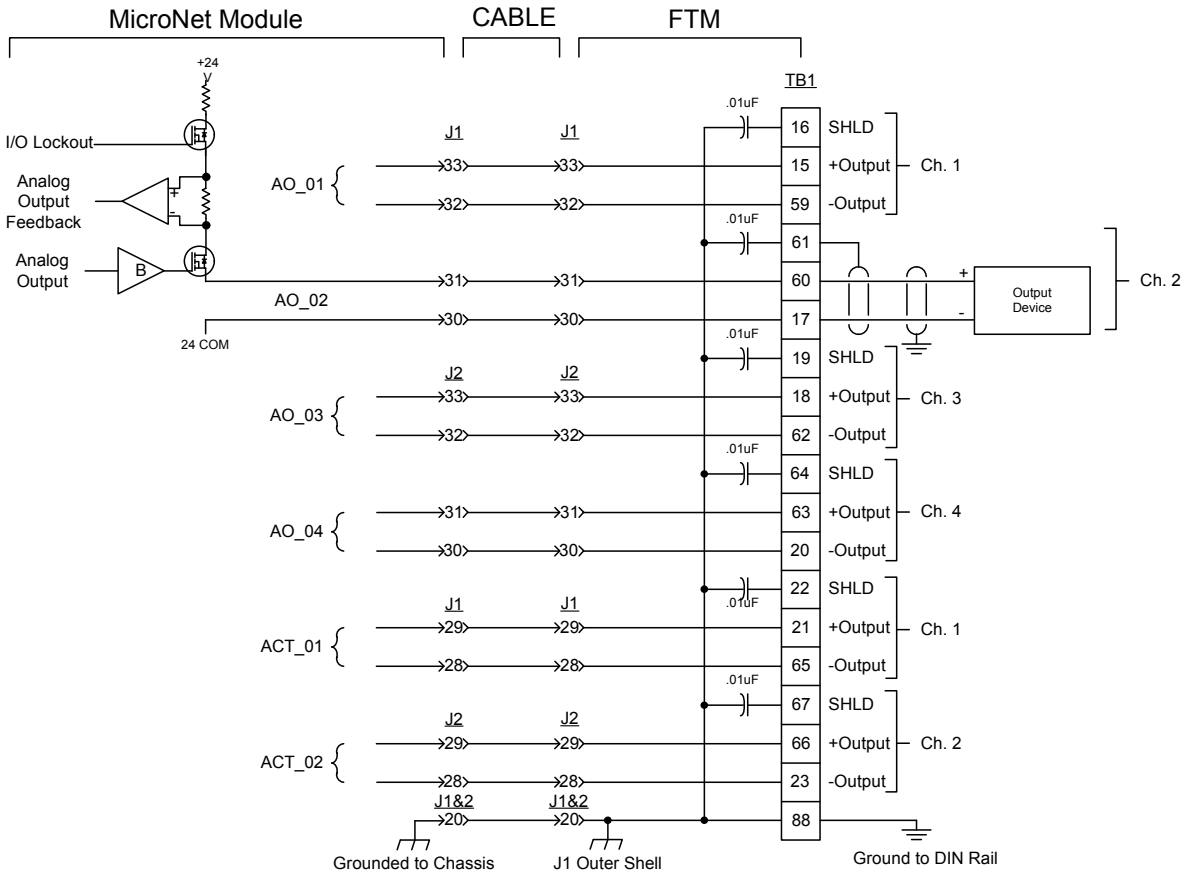


Figure 4-18. Analog Combo #1 Wiring

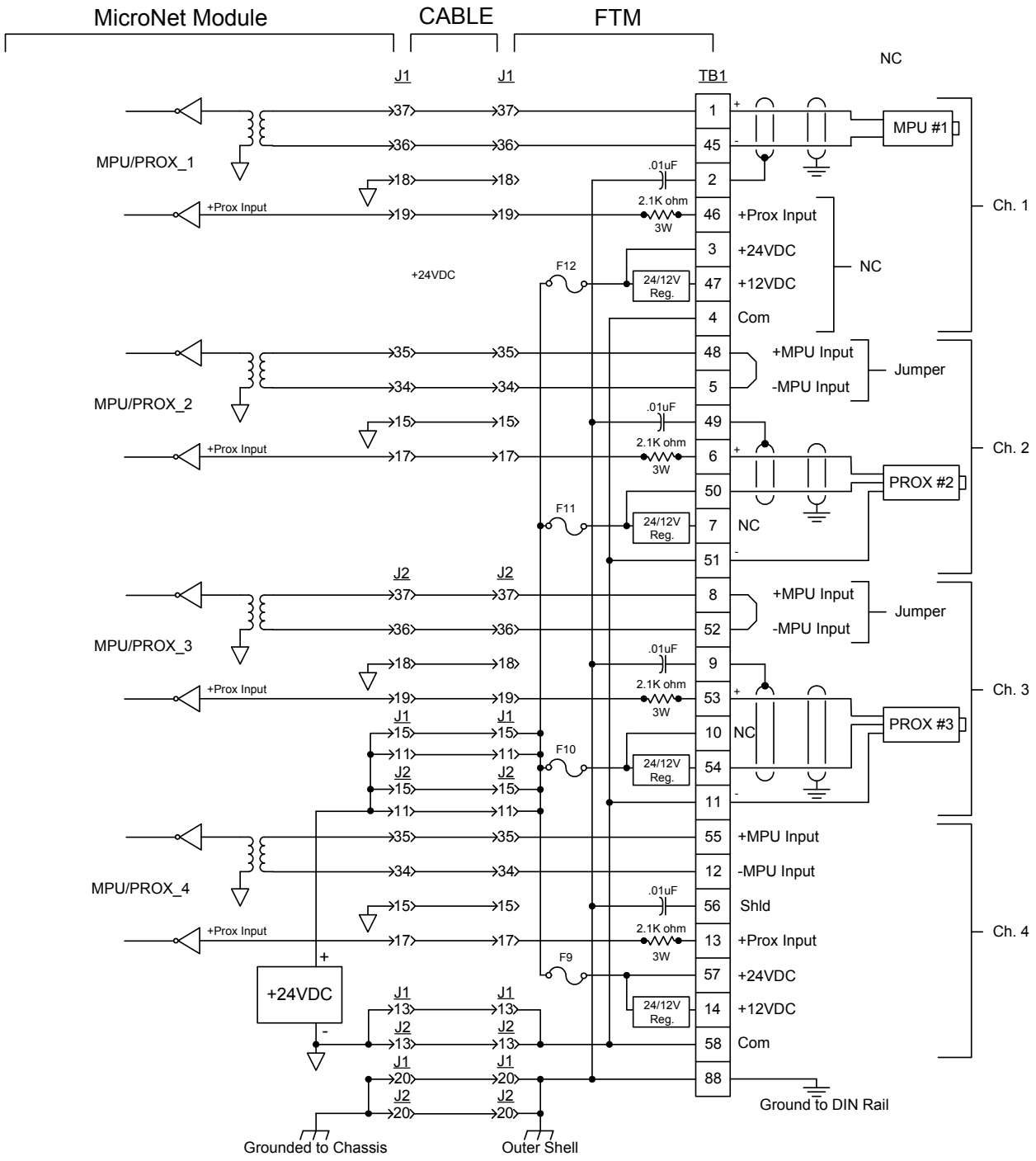


Figure 4-19. Analog Combo #2 Wiring

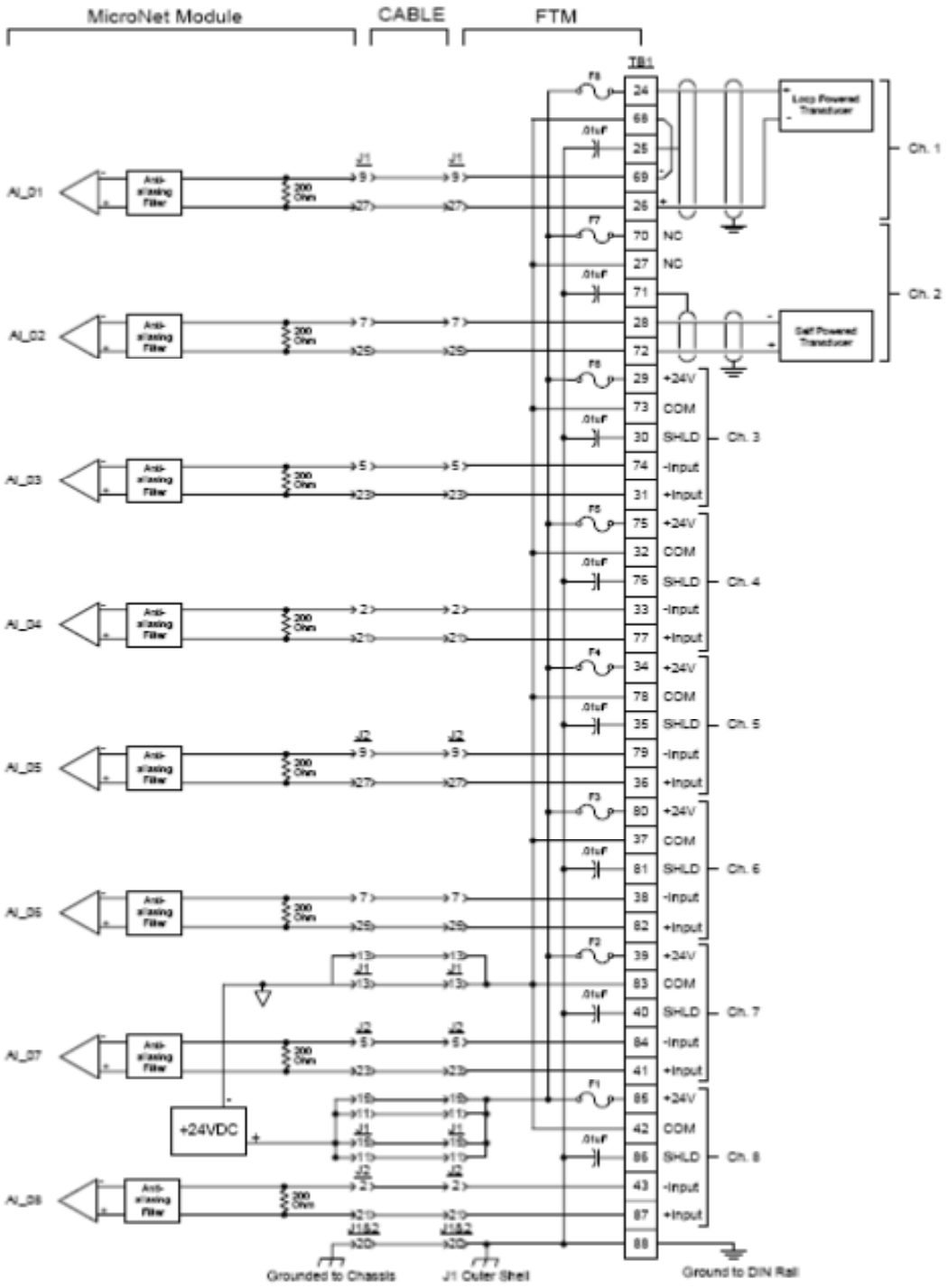


Figure 4-20. Analog Combo #2 Wiring

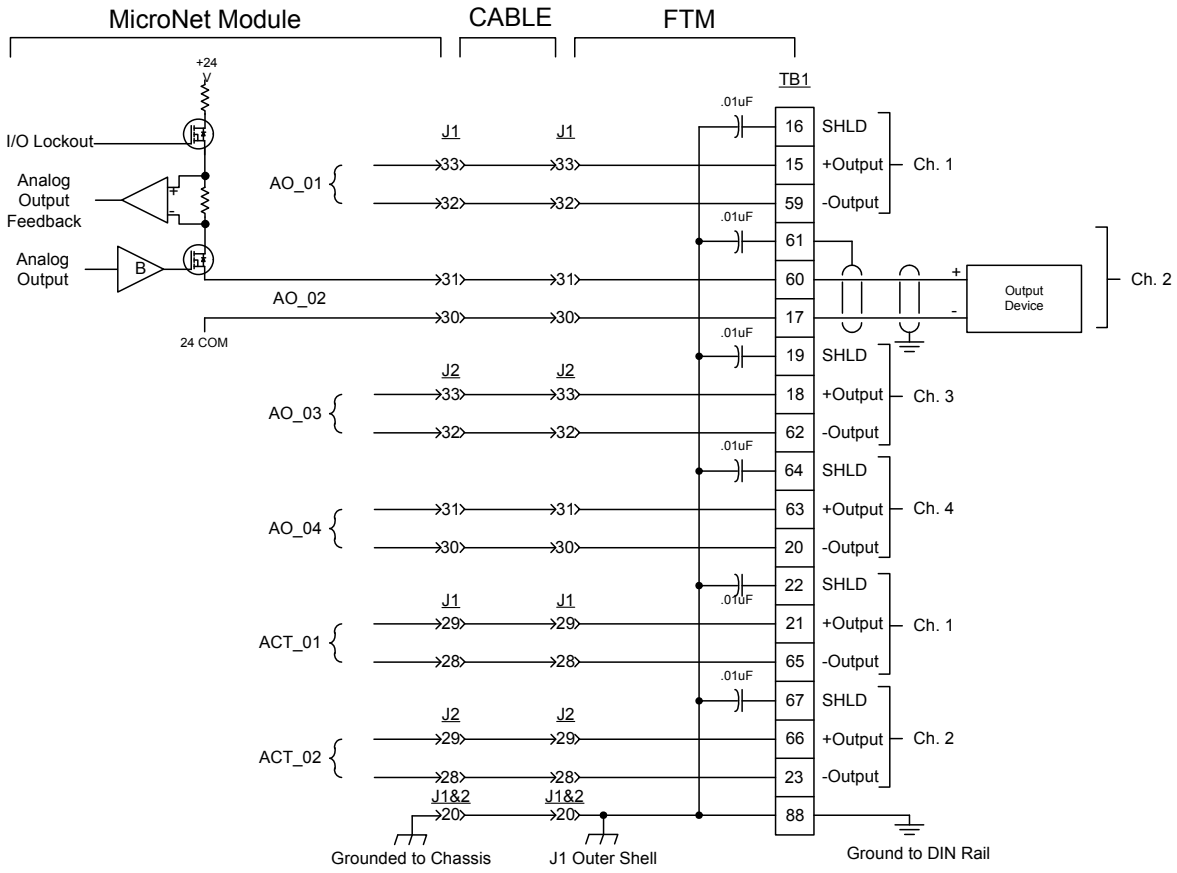


Figure 4-21. Analog Combo #2 Wiring

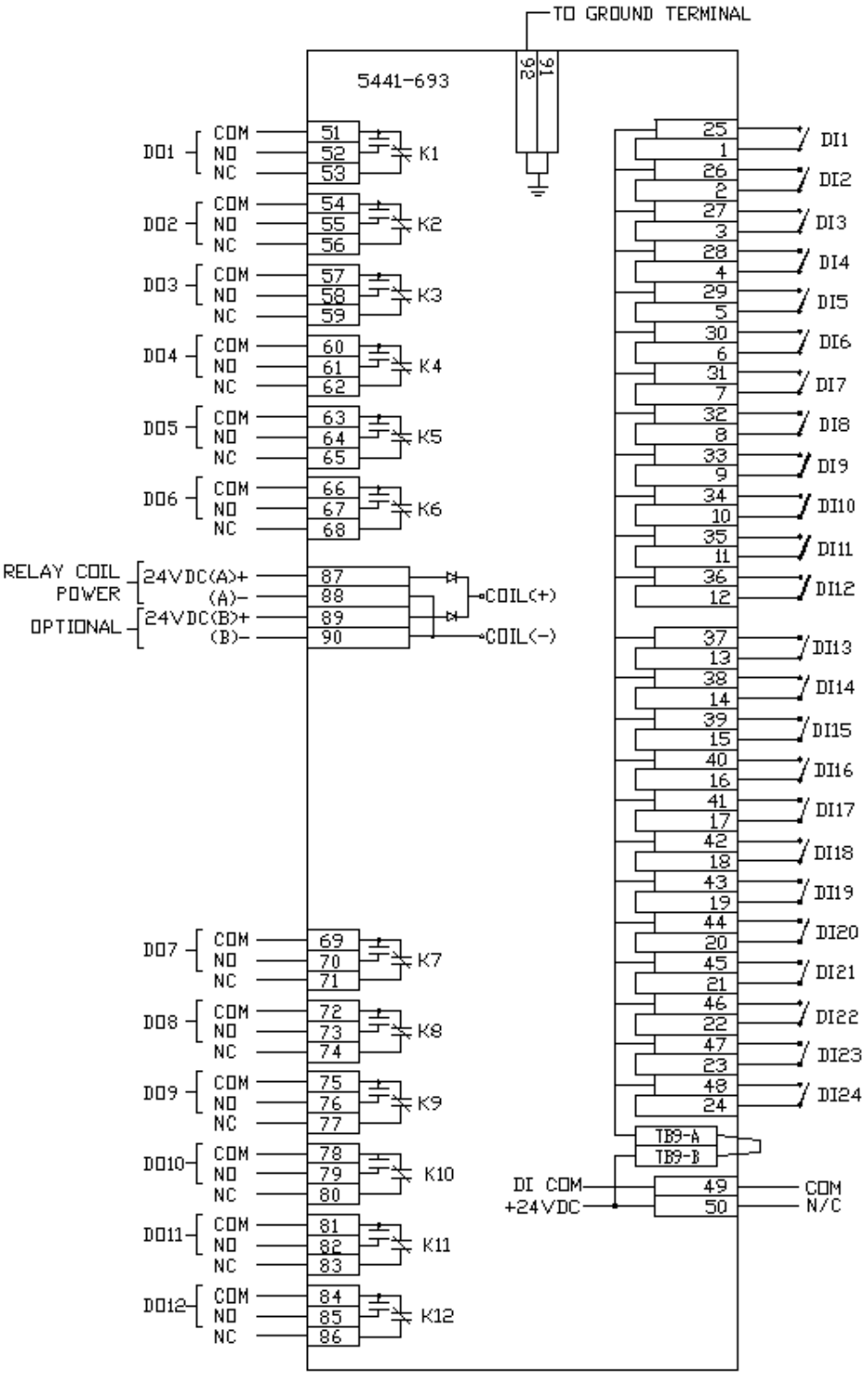


Figure 4-22. Discrete I/O Module #1 Wiring

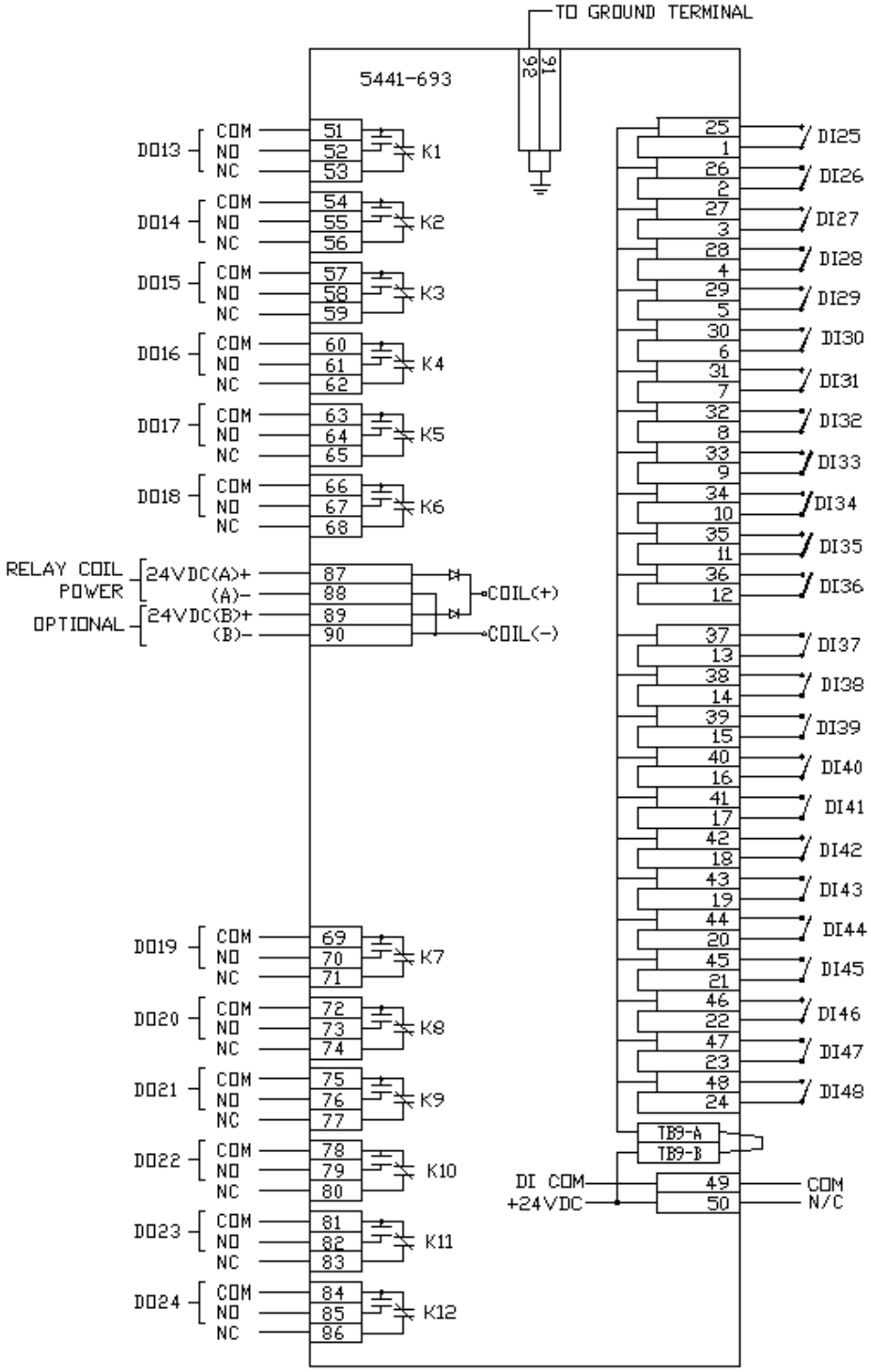


Figure 4-23. Discrete I/O Module #2 Wiring

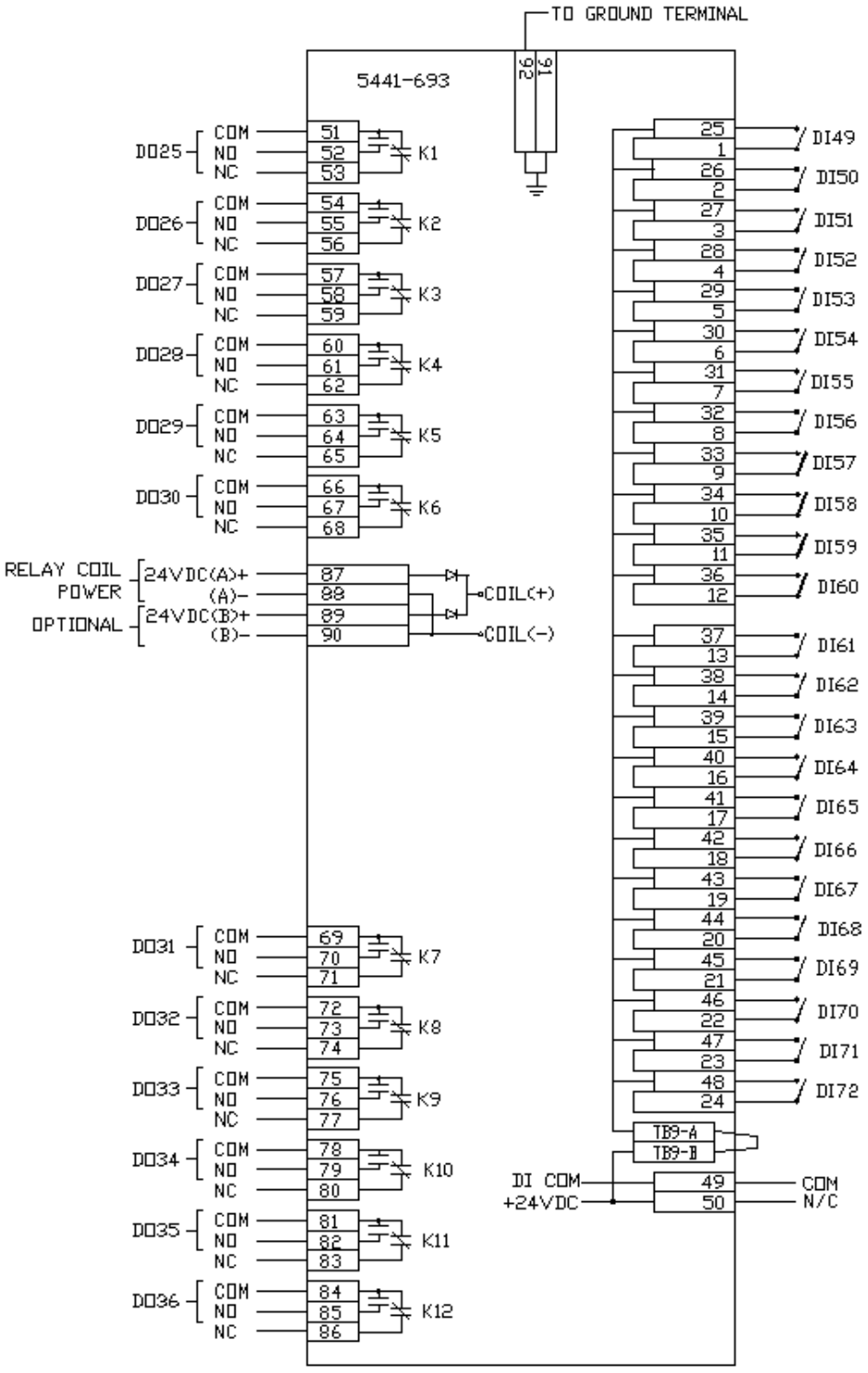


Figure 4-24. Discrete I/O Module #3 Wiring

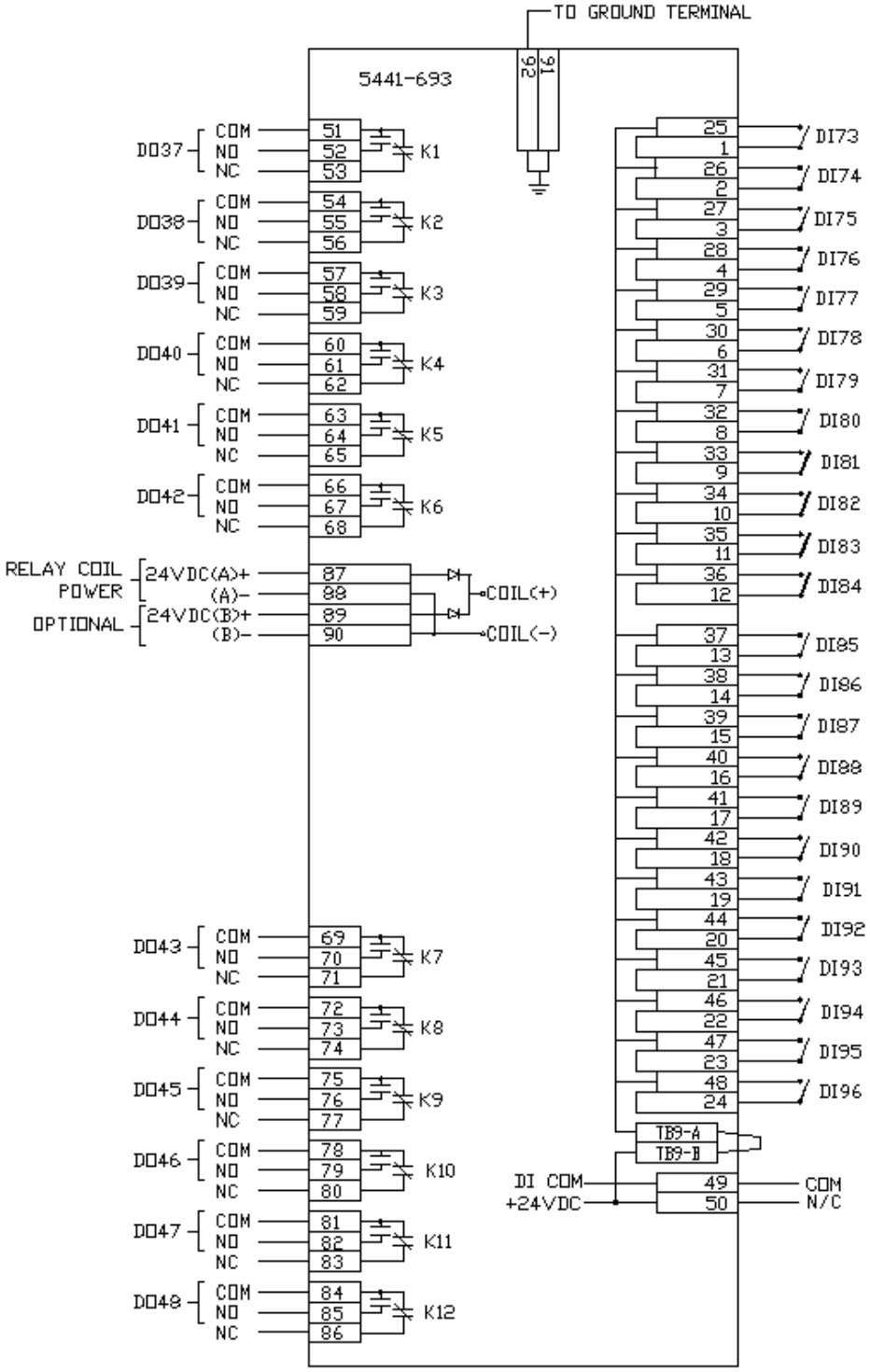


Figure 4-25. Discrete I/O Module #4 Wiring

System Power-Up

If at any time during this procedure the defined or expected result is not achieved, go to Chapter 5 of this volume and begin system troubleshooting.

1. Verify that the entire 505DE control system has been installed.
2. Turn on the power to one power supply and verify that the power supply's green LED is the only power supply LED on.
3. Turn off the power to the first power supply and turn on the power to the second power supply (if a second power supply is present) and verify that the power supply's green LED is the only power supply LED on.
4. The CPU will automatically boot and start running the application.

Chapter 5. Troubleshooting and Module Replacement

Replacing Chassis Fans

1. Loosen, but do not remove, the four retaining screws holding the fan assembly to the chassis. Use a stubby (approximately 9 cm/3.5" long) #2 Phillips screwdriver.
2. Rotate fan to access the power supply wire quick-connections. Disconnect the wires.

NOTICE **Do not let contact quick connect terminals touch any metallic surface.**

3. Remove the four retaining screws and the fan and guard assembly from the chassis.
4. Remove the guard from the fan, noting the location of the captive nuts.

NOTICE **Captive nuts should be rethreaded onto screws between fan mounting flanges to prevent loose hardware contacting live circuits.**

5. Assemble the new fan and guard using the screws and captive nuts.
6. Loosely the fan assembly on the chassis (flow arrows must point "UP").
7. Connect the RED wire to the (+) fan terminal and the BLACK wire to (–) fan terminal.
8. Turn the fan and secure it in the correct position.

Power Supply Troubleshooting

OK LED—This green LED turns on to indicate that the power supply is operating and that no faults are present.

INPUT FAULT LED—This red LED turns on to indicate that the input voltage is either above or below the specified input range. If this LED is on, check the input voltage, and correct the problem. Long-term operation with incorrect input voltages may permanently damage the power supply. Once the input voltage is within the supply's input specifications, this LED will turn off. Refer to the power supply input specifications.

POWER SUPPLY FAULT LED—This red LED turns on when one of the supply's four power converters has shut down. If this LED is on, check for a short circuit on external devices connected to the control's power supply. When the short circuit has been removed, the supply will resume normal operation. If no short circuit is found, reset the supply by removing input power for one minute. If the power supply is still not functioning after input power has been restored, verify that the supply is properly seated to the motherboard connector. If the supply is properly seated but is not working, then replace the supply.

OVERTEMPERATURE LED—This red LED gives an early warning of a thermal shutdown.

1. Disconnect the power to the supply being installed. Verify that all pins in the module connectors are parallel and straight.
2. Install a new power supply by aligning the circuit board edges in the card guides, then pushing the unit into the slots until the connectors on the modules and the connectors on the motherboard make contact.
3. With even pressure exerted at the top and bottom of the supply's front panel, firmly push the unit into place.

CPU Module Troubleshooting

The 505DE CPU module runs off-line and on-line diagnostics that display troubleshooting messages through the debug Service Port and AppManager. Off-line diagnostics run automatically on power-up and when the Reset switch is asserted. On-line diagnostics run during normal Control System operation when the GAP application is active. A table of the CPU fault LED flash codes is shown below:

Failure	Flash Code
RAM Test Failure	1, 4
Real Time Clock Test Failure	2, 2
Floating Point Unit Test Failure	2, 3
Flash Test Failure	2, 4
HD1 Flash Test Failure	2, 5
I2C Bus Test Failure	2, 6
Module Installed in wrong slot	2, 7
Main Chassis CPU switch must be set to 0	3,5
Remote RTN Rate Group 5 Slip	3, 7
Remote RTN Rate Group 10 Slip	3, 8
Remote RTN Rate Group 20 Slip	3, 9
Remote RTN Rate Group 40 Slip	3, 10
Remote RTN Rate Group 80 Slip	3, 11
Remote RTN Rate Group 160 Slip	3, 12
Remote RTN Chassis Switch Invalid	4, 5
Backup Remote RTN Chassis Switch different from Primary Remote RTN	4, 6

Table 5-1. CPU LED flash code indications

Replacement Procedures

Safety Considerations

⚠WARNING

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

Substitution of components can impair suitability for Class I, Division applications.

Do not remove or install power supply while circuit is live unless area is known to be non-hazardous.

Do not remove or install modules while circuit is energized unless area is known to be non-hazardous.

⚠AVERTISSEMENT

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

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

Ne pas enlever ni installer l'alimentation électrique pendant que le circuit est sous tension avant de s'assurer que la zone est non dangereuse.

Ne pas enlever ni installer les cartes pendant que le circuit est sous tension sans s'assurer que la zone non dangereuse.

Replacing a Module

IMPORTANT

For Simplex systems, this procedure will shutdown the control system.

⚠WARNING

If power has not been removed from the control system, power will be active at the module and also at the cable connectors. It is recommended that the cables not be removed until after the module is disconnected from the motherboard. If cables are removed with power applied, care must be used to avoid shorting cable connector pins.

1. If the CPU needs to be exchanged, remove power from the chassis. For all other modules this is not strictly necessary, but recommended anyway. Remember to save your configuration.
2. Remove the cable saddle at the top of the chassis section. The saddle can be lifted off by removing the two screws which hold it in place.
3. Unscrew the module's captive-screw fasteners (one at the top of the module and the other at the bottom), and release the module by simultaneously pressing the top module handle up and the bottom module handle down.
4. Pull the module straight out along the card guide slots until it is approximately 25 mm (1") from the motherboard. Disconnect the I/O cables from the module, and secure the ends to avoid damage or shorting of pins. The I/O cables use a slide latch (to disengage, slide the latch towards the top of the module).

5. Remove the module by pulling it straight out. Immediately put it into a conductive plastic bag.
6. Before installing a replacement module, verify that all connector pins are parallel and straight. Install the replacement module by aligning the circuit board edges inside the card guides and pushing the module straight in until it is approximately 25 mm (1”) from the motherboard.
7. Connect the I/O cables to the module. The I/O cables use a slide latch (to engage, slide the latch towards the bottom of the module). Verify that the I/O cables are connected to the correct cable connector.
8. With even pressure exerted at the top and the bottom of the module, push the module into the motherboard.
9. Tighten the two captive-screw fasteners (one at the top of the module and the other at the bottom).
10. If power was removed, apply power.
11. Reset the CPU.
12. If the CPU was replaced, restore the configuration.
13. Verify that the replacement 505DE module is working correctly.
14. Install the cable saddle.

Replacing a Field Termination Module (FTM)

⚠WARNING

It is not possible to replace an FTM without shutting down the entire control system and the prime mover.

⚠WARNING

If power has not been removed from the control system, power will be active at the module and also at the cable connectors. It is recommended that the cables not be removed until after the module is disconnected from the motherboard. If cables are removed with power applied, care must be used to avoid shorting cable connector pins.

1. Carefully, to avoid shorting cable pins, disconnect all I/O cables from the FTM, and secure cable ends to avoid damage or shorting of pins. The I/O cables use a slide latch (to disengage, slide the latch to the release position).
2. Disconnect all field wiring. Care should be taken to avoid shorting the wires.
3. Remove the FTM by inserting a screwdriver into the mounting foot and lifting each foot away from the DIN rail. Install the replacement FTM.
4. Reconnect all field wiring. Refer to the Wiring Notes for the appropriate module.
5. Connect all I/O cables to the FTM, being careful to avoid shorting cable pins. Lock the connector in position by sliding the latch to the latched position.
6. If power was removed, apply power.
7. Reset the CPU.
8. Verify that the new FTM is working correctly.

Replacing a Fuse on the Field Terminal Module (FTM)

1. Before replacing a fuse, check that the condition that caused the fuse to blow has been corrected.

⚠WARNING

If power has not been removed from the control system, power will be active at the module and also at the FTM. Shorting of protected circuitry could cause a control system shutdown.

2. To remove the FTM cover, pinch the retaining barb and lift the cover. Remove the FTM cover carefully to prevent contact with any FTM circuitry under the cover.
3. Locate and replace the fuse with another fuse of the same size and rating.
4. Replace the FTM cover.

Replacing a Receptacle-Mounted Relay

⚠WARNING

HIGH VOLTAGE—If there is high voltage on the relay CONTACTS, there will be high voltage on the relay itself when it is plugged into the relay module.

1. If possible, remove all power from the control system and the relay module
2. Identify the faulty relay.
3. Move the relay's hold-down spring out of the way, and pull the relay out of its socket.
4. Insert a replacement relay with the same manufacturer's part number into the vacated socket. Engage the hold down spring.
5. Supply all power if previously removed.
6. Verify that the new relay is functioning correctly.

Replacing an I/O Cable

NOTICE

This procedure will shut down the control system.

⚠WARNING

If power has not been removed from the control system, power will be active at the module and also at the cable connectors. It is recommended that the cables not be removed until after the module is disconnected from the motherboard. If cables are removed with power applied, care must be used to avoid shorting cable connector pins.

1. Remove the cable saddle at the top of the chassis section. The saddle can be lifted off by removing the two screws which hold it in place.
2. Unscrew the module's captive-screw fasteners (one at the top of the module and the other at the bottom), and release the module by simultaneously pressing the top module handle up and the bottom module handle down.
3. Disconnect the module from the motherboard by pulling the module straight out along the card guide slots until it is approximately 25 mm (1") from the motherboard.
4. Disconnect the I/O cable from the module, and secure the ends to avoid damage or shorting of pins. The I/O cable uses a slide latch (to disengage, slide the latch towards the top of the module).
5. Disconnect the I/O cable from the FTM or Relay/Discrete Input module.
6. Install the replacement I/O cable and connect it to the FTM or Relay/Discrete Input module, securing the end to avoid shorting or damage to pins.
7. Connect the I/O cable to the module. The I/O cable uses a slide latch (to engage, slide the latch towards the bottom of the module). Verify that the I/O cable is connected to the correct cable connector.
8. With even pressure exerted at the top and the bottom of the module, seat the module into the motherboard.
9. Tighten the two captive-screw fasteners (one at the top of the module and the other at the bottom).
10. If power was removed, apply power.

11. Reset the CPU.
12. Verify that the new 505DE module is working correctly.
13. Install the cable saddle.

Analog I/O Troubleshooting Guide

Fault Detection (Module Hardware)
Each Analog Combo module has a red Fault LED that is on when the system is reset. During initialization of a module, which occurs after every CPU reset, the Fault LED comes on. The CPU then tests the module using diagnostic routines built into the software. If the diagnostic test is not passed, the LED remains on or flashes. If the test is successful, the LED goes off. If the Fault LED on a module is on after the diagnostics and initialization have been completed, the Analog Combo module can be faulty or can be located in the wrong slot.

Table 5-2. AIO LED Indications of Failure

Number of LED Flashes	Failure
1	Hardware watchdog, CPU clock failure, reset fail
2	Micro-controller internal RAM test failure
3	External RAM test failure
4	Unexpected exception error
5	Dual Port RAM test failure
6	EEPROM failure
7	Communications watchdog time out

Fault Detection (I/O)
In addition to detecting module hardware faults, the application program can detect I/O faults:

- Analog Input Faults. The application software can set a high and low latch setpoint to detect input faults.
- Speed Sensor Input Faults. The application software can set a high and low latch setpoint to detect input faults. The low latch setpoint must be greater than one fiftieth of the speed input frequency range.
- Analog Output Driver Faults. The module monitors the source currents and annunciates faults. The application determines the action taken in the event of a fault.
- Actuator Driver Or Load Faults. The module monitors the source and return currents and annunciates faults. The application determines the action taken in the event of a fault.
- Micro-controller Faults. The system monitors a software watchdog, a hardware watchdog, and a software watchdog on the VME bus communications. All outputs are shutdown in the event of a microcontroller fault.

If during normal control operation all of a chassis' Analog Combo modules have Fault LEDs on, check the chassis' CPU module for a failure. If during normal control operation only the Analog Combo module's Fault LED is on or flashing, make sure that it is installed in the correct slot. If it is, replace that Analog Combo module (refer to Chapter 3 "Replacing a VME Module"). When a module fault is detected, its outputs should be disabled or de-energized.

MPU inputs

If a magnetic pickup input is not functioning properly, verify the following:

1. Check that the cable is shielded and the shield is properly grounded in accordance with Chapter 3 “Shields and Grounding”.
2. Measure the input voltage on the terminal block. It should be in the range of 1 - 25 Vrms.
3. Verify that the signal waveform is clean and void of double zero crossings.
4. Verify that no ground connection exists and that the resulting 60 Hz signal is absent.
5. Measure the frequency. It should be in the range of 100 Hz to 25 kHz.
6. Check the wiring. Look for a loose connection at the terminal blocks and disconnected or misconnected cables.
7. Check the software configuration to ensure that the input is properly configured.
8. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).
9. If the readings are incorrect on several channels of the module, corresponding to both cables, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).
10. If replacing the module does not fix the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”). The FTM does not contain any active components on the MPU inputs, so replacing it should be the last option.

Proximity Probes Inputs

If a proximity probe input is not functioning properly, verify the following:

1. Check that the cable is shielded and the shield is properly grounded in accordance with Chapter 3 “Shields and Grounding”.
2. Measure the input voltage on the terminal block. It should be in the range of 3.5 - 32 Vpeak.
3. Verify that the signal waveform is clean and void of double zero crossings.
4. Verify that no ground connection exists and that the resulting 60 Hz signal is absent.
5. Measure the frequency. It should be in the range of 0.5 Hz to 25 kHz.
6. Check the wiring. Look for a loose connection at the terminal blocks, disconnected or misconnected cables, a missing jumper on the terminal block, or a blown fuse on the 24 Vdc on the FTM.
7. Check the software configuration to ensure that the input is configured properly.
8. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).
9. If the readings are incorrect on several channels of the Analog Combo module, corresponding to both cables, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).
10. If replacing the module does not solve the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”). The FTM contains only a wire-wound 3 W resistor and traces, so failure is extremely unlikely and replacing it should be the last option.

Analog Inputs

If an analog input is not functioning properly, verify the following:

1. Check that the cable is shielded and the shield is properly grounded in accordance with Chapter 3 “Shields and Grounding”.
2. Measure the input voltage on the terminal block. It should be in the range of 0 - 5 V.
3. Verify that there are no or minimal ac components to the Analog Input signal. ac components can be caused by improper shielding.
4. Check the wiring. If the inputs are reading 0 or the engineering units that correspond to 0 mA or volts, look for a loose connection on the terminal blocks, disconnected or misconnected cables, a missing jumper on the terminal block, or a blown fuse on the 24 Vdc on the FTM.
5. If all of the inputs are reading high, check that the 24 Vdc is not connected across the input directly.
6. Check the software configuration to ensure that the input is configured properly.
7. Check the fuse on the FTM. Refer to the instructions and fuse locations below.
8. If the other channels on the Analog Combo module are not working either, check the fuse on the Analog Combo module. This fuse is visible and can be changed through the bottom of the module. If the fuse is blown, fix the wiring problem, then replace the fuse with another fuse of the same type and rating (refer to Chapter 3 “Replacing a Fuse on the Field Termination Module (FTM)”).
9. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the Analog Combo module.
10. If the readings are incorrect on several channels of the module, corresponding to both cables, replace the Analog Combo module.
11. If replacing the module does not fix the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”). The FTM does not contain any active components on the MPU inputs, so replacing it should be the last option.

Analog Outputs

If an analog output is not functioning properly, verify the following:

1. Check that the cable is shielded and the shield is properly grounded in accordance with Chapter 3 “Shields and Grounding”.
2. Check the load resistance to ensure that it is not greater than 600 ohms.
3. Check to ensure that the load wiring is isolated.
4. Check the wiring for a loose connection on the terminal blocks and disconnected or misconnected cables.
5. Disconnect the field wiring and connect a resistor across the output. If the output is correct across the resistor, there is a problem with the field wiring.
6. If the other output channels on the Analog Combo module are also not working, check the fuse on the Analog Combo module. This fuse is visible and can be changed through the bottom of the module. If the fuse is blown, fix the wiring problem and replace the fuse with a fuse of the same type and rating (refer to Chapter 3 “Replacing a Fuse on the Field Termination Module (FTM)”).
7. Check the software configuration to ensure that the output is configured properly.
8. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).

9. If the readings are incorrect on several channels of the module, corresponding to both cables, replace the Analog Combo module (refer to Chapter 3 “Replacing a VME Module”).
10. If replacing the module does not fix the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”). The FTM does not contain any active components on the MPU inputs, so replacing it should be the last option.

Actuator Outputs

If an actuator output is not functioning properly, verify the following:

1. Check that the cable is shielded and the shield is properly grounded in accordance with Chapter 3 “Shields and Grounding”.
2. Check the load resistance to ensure that it is below the specified limit.
3. Check that the actuator wiring is isolated.
4. Check the wiring for a loose connection on the terminal blocks or disconnected or misconnected cables.
5. Disconnect the field wiring and connect a resistor across the output. For example:
   - 359 Ω/1 W for 4 – 20 mA
   - 45 Ω/3 W for 20 – 160 mA
6. If the other output channels on the Analog Combo module are also not working, check the fuse on the Analog Combo module. This fuse is visible and can be changed through the bottom of the module. If the fuse is blown, fix the wiring problem, and replace the fuse with a fuse of the same type and rating (refer to Chapter 3 “Replacing a Fuse on the Field Termination Module (FTM)”).
7. Check the software configuration to ensure that the output is configured properly.
8. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the Analog Combo module replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”).
9. If the readings are incorrect on several channels of the module, corresponding to both cables, replace the Analog Combo module replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”).
10. If replacing the module does not fix the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”). The FTM does not contain any active components on the MPU inputs, so replacing it should be the last option.

Discrete I/O Troubleshooting Guide

Discrete I/O Module Troubleshooting

Each MicroNet Discrete I/O Smart-Plus module has a red Fault LED that is on when the system is reset. During initialization of a MicroNet Discrete I/O Smart-Plus module, which occurs after every CPU reset, the red Fault LED comes on. The CPU then tests each MicroNet Discrete I/O Smart-Plus module using diagnostic routines built into the software. If the diagnostic test is not passed, the red LED remains on or blinks. If the test is successful, the red Fault LED goes off. If the red Fault LED on a MicroNet Discrete I/O Smart-Plus module is on after the diagnostics and initialization have been run, the module can be faulty or can be located in the wrong slot.

Table 5-3. LED Indications of Failure

Number of Fault LED Flashes	Failure
1	Watchdog Failure
2	No Application
3	Flash Memory Failure
4	Exception Failure
5	FPGA Failure
6	Non-Volatile Memory Error
7	Kernel Watchdog Error
8	MFT Failure
9	Software Slip
10	Ram Memory Failure
11	Software Failure

Fault Detection (I/O)
In addition to detecting MicroNet Discrete I/O Smart-Plus module hardware faults, the application software may detect I/O faults.

Discrete Output Faults: The module monitors the FTM control voltage and annunciates faults. The application software determines the course of action in the event of a fault.

Microcontroller Faults: The system monitors a software watchdog, a hardware watchdog, and a software watchdog on the VME bus communications. All outputs are shut down in the event of a microcontroller fault.

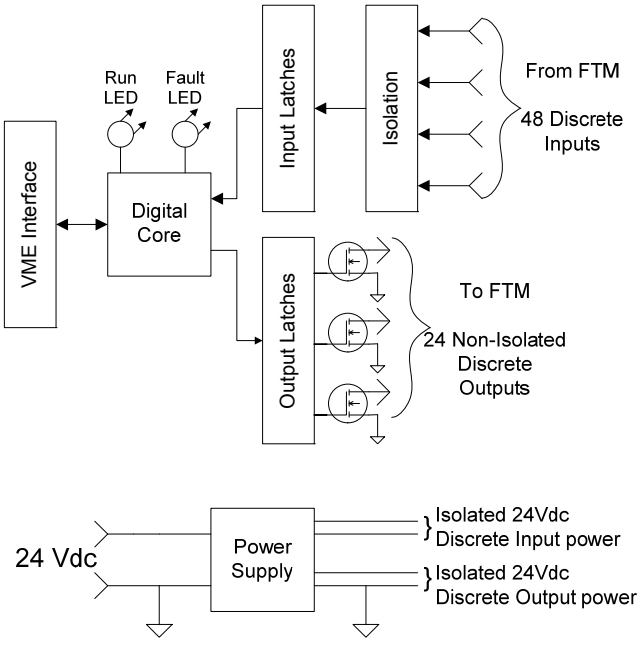


Figure 5-1. 48/24 Discrete Combo Module Block Diagram

If during normal control operation all of a chassis' MicroNet Discrete I/O Smart-Plus modules have Fault LEDs on, check the chassis' CPU module for a failure. If during normal control operation only the microNet Discrete I/O Smart-Plus module's Fault LED is on or flashing, insure that it is installed in the correct slot. If it is, then replace that microNet Discrete I/O Smart-Plus module. When a module fault is detected, its outputs should be disabled or de-energized.

Discrete Inputs
If a discrete input is not functioning properly, verify the following:

1. Measure the input voltage on the terminal block. It should be between 16 and 32 Vdc.
2. Check the wiring. If the inputs are reading open, look for a loose connection on the terminal blocks, disconnected or misconnected cables, or a missing jumper on the terminal block.
3. Check the application software configuration to ensure that the input is configured properly.
4. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, replace the 48/24 Discrete Combo module.
5. If the readings are incorrect on several channels of the 48/24 Discrete Combo module, corresponding to both cables, replace the 48/24 Discrete Combo module.
6. If replacing the module does not fix the problem, replace the FTM (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”).

Discrete Outputs
If a discrete output is not functioning properly, verify the following:

1. Check the wiring for a loose connection on the terminal blocks, or disconnected or misconnected cables.
2. Verify that the current through the relay contacts is not greater than the relay contact rating.

3. Check the software configuration to ensure that the output is configured properly.
4. After verifying all of the above, exchange the J1 and J2 cables. If the problem moves to a different channel, replace the cable. If not, exchange the cables at the FTM, so J1 is driving J2 and vice versa. If the problem moves to a different relay, replace the 48/24 Discrete Combo module. If the fault stays with the same relay, replace the relay or the relay module. Refer to Chapter 3 “Replacing a Receptacle-Mounted Relay” for instructions on replacing the relay modules. If replacing the relay module does not fix the problem, replace the cable between the relay module and the FTM, or replace the FTM itself (refer to Chapter 3 “Replacing a Field Termination Module (FTM)”).

Chapter 6.
Software Installation and Connection

Installation of Indusoft Webstudio

Indusoft Webstudio is a Human Machine Interface (Graphical User Interface) programming environment. It must be installed on the host PC in order to execute the 505DE interface tool application files.

Software is pre-installed for the 505DE HMI option (8262-1027).

If you already have Webstudio installed, skip to the next section.

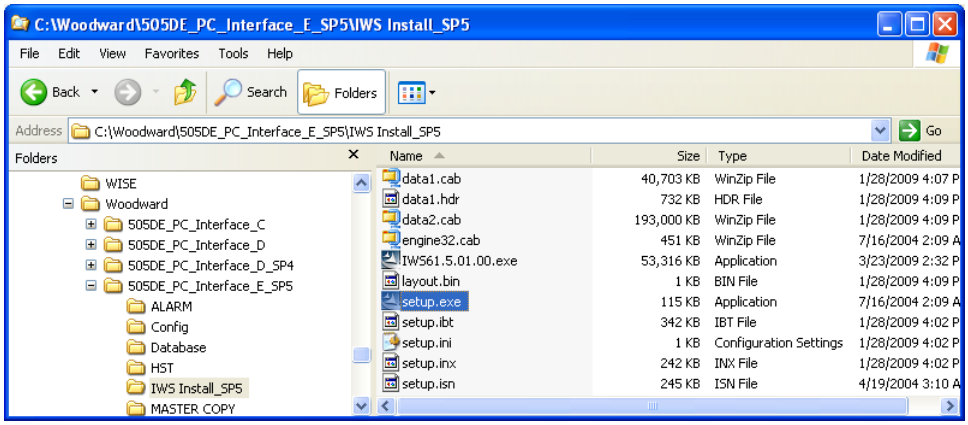


Figure 6-1. Run Indusoft Webstudio Install by double clicking setup.exe

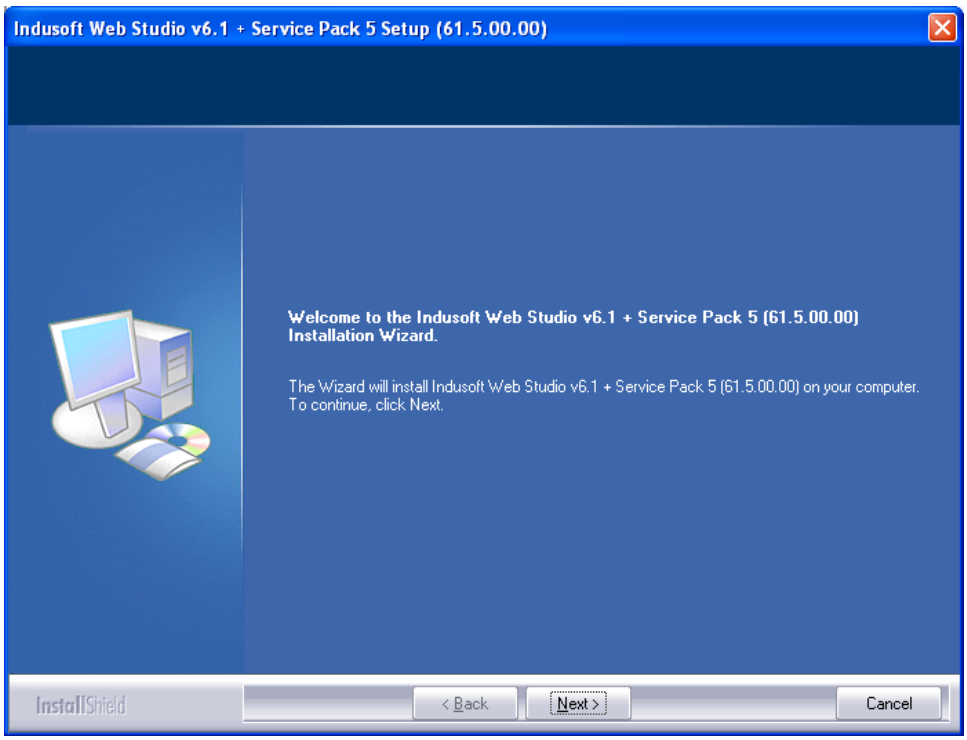


Figure 6-2. Click Next

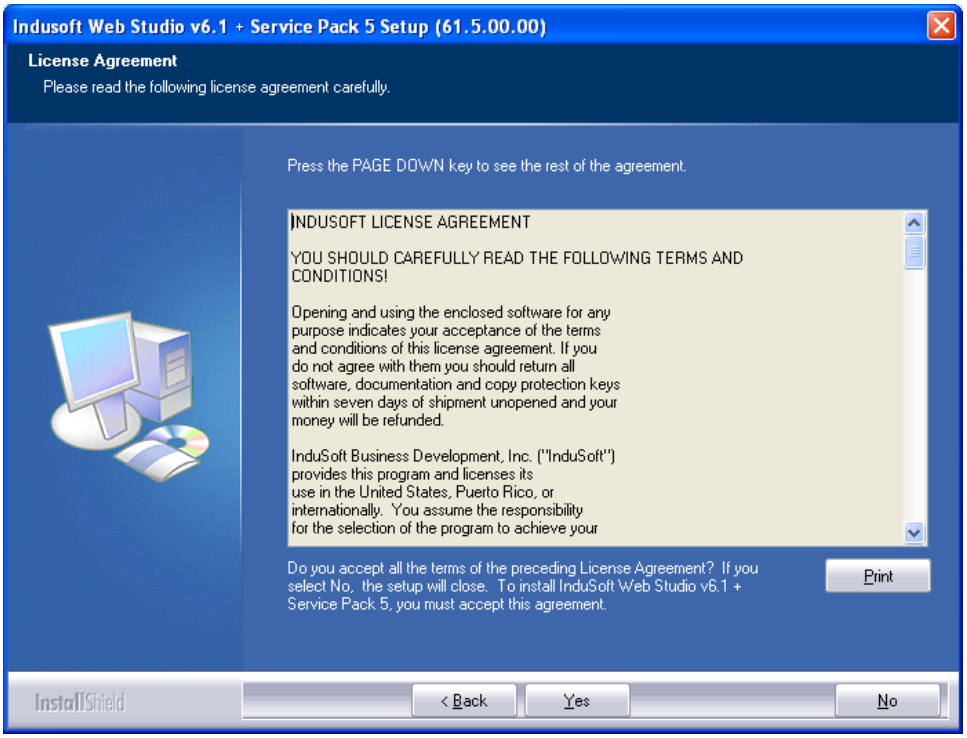


Figure 6-3. Accept the license agreement

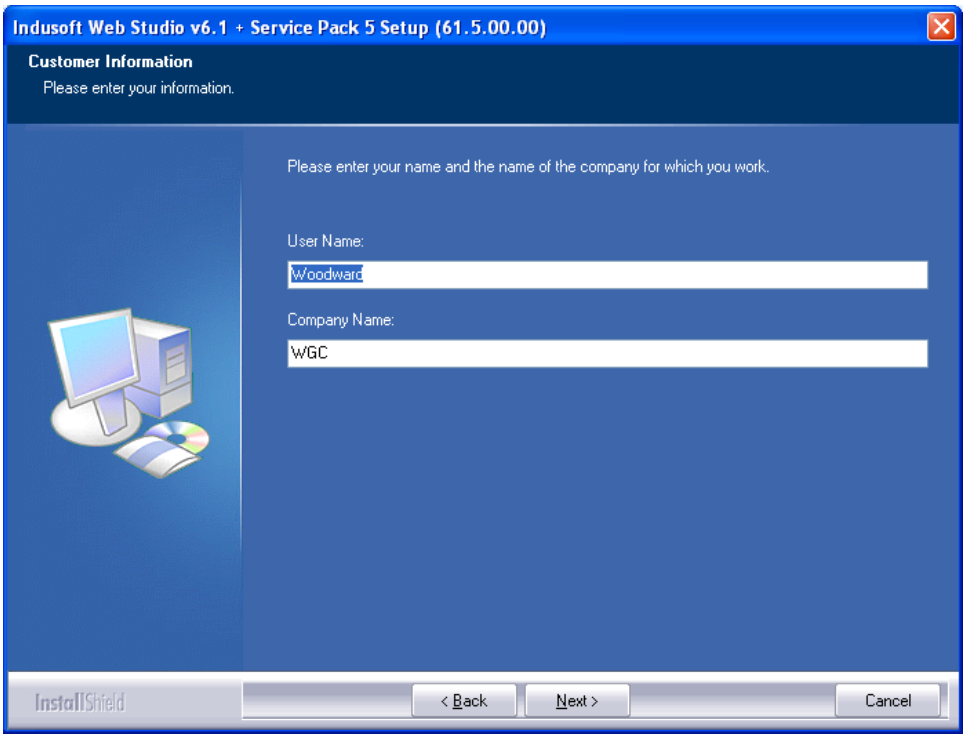


Figure 6-4. Enter Name and Company

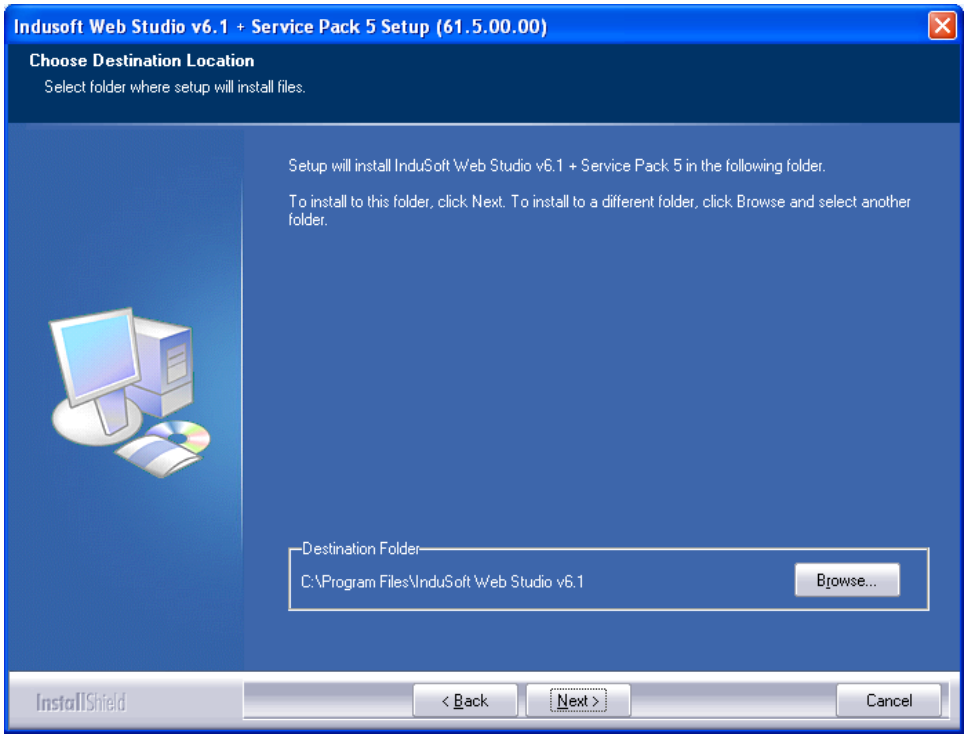


Figure 6-5. Keep the default Program Files Location

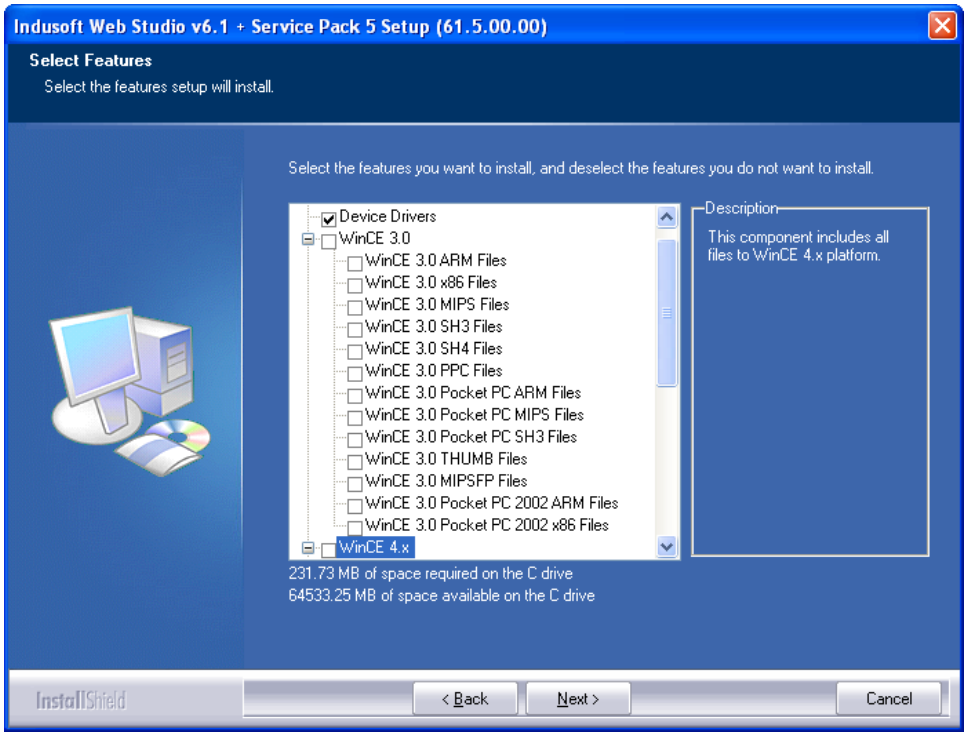


Figure 6-6. Deselect WinCE 3.0 and WinCE 4.x boxes

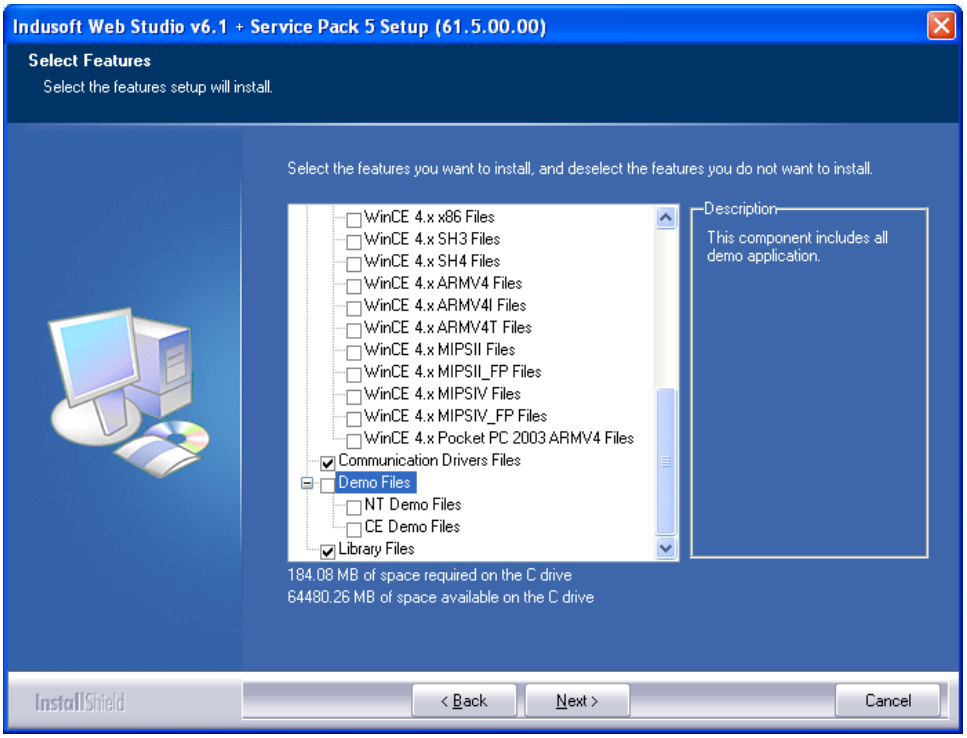


Figure 6-7. Scroll down, deselect Demo Files, click next

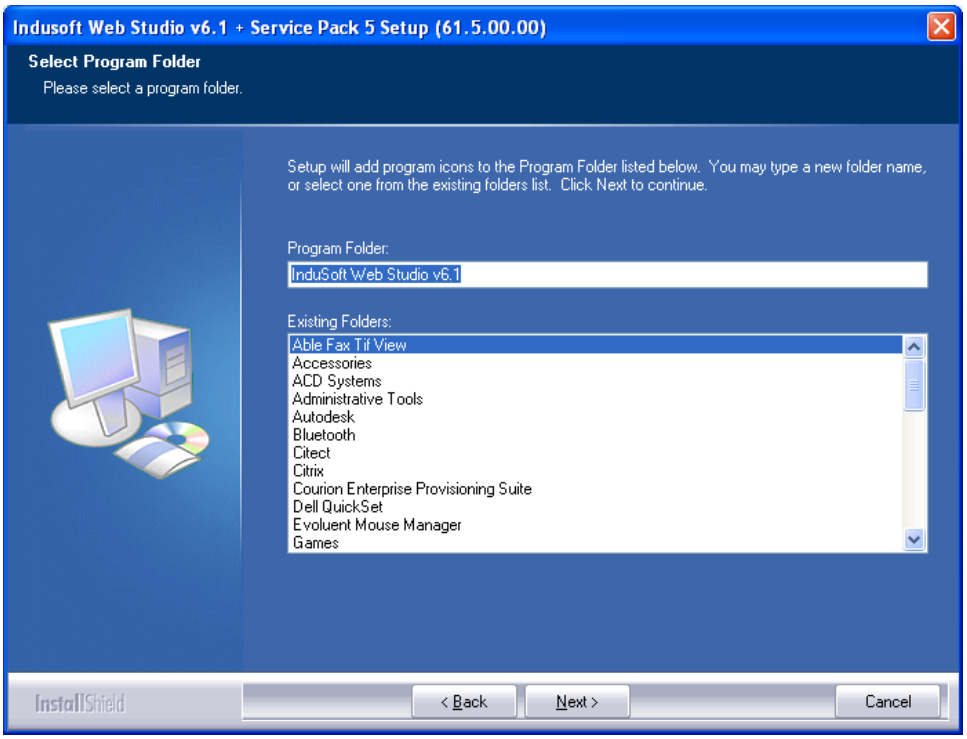


Figure 6-8. Keep the same Program Folder name

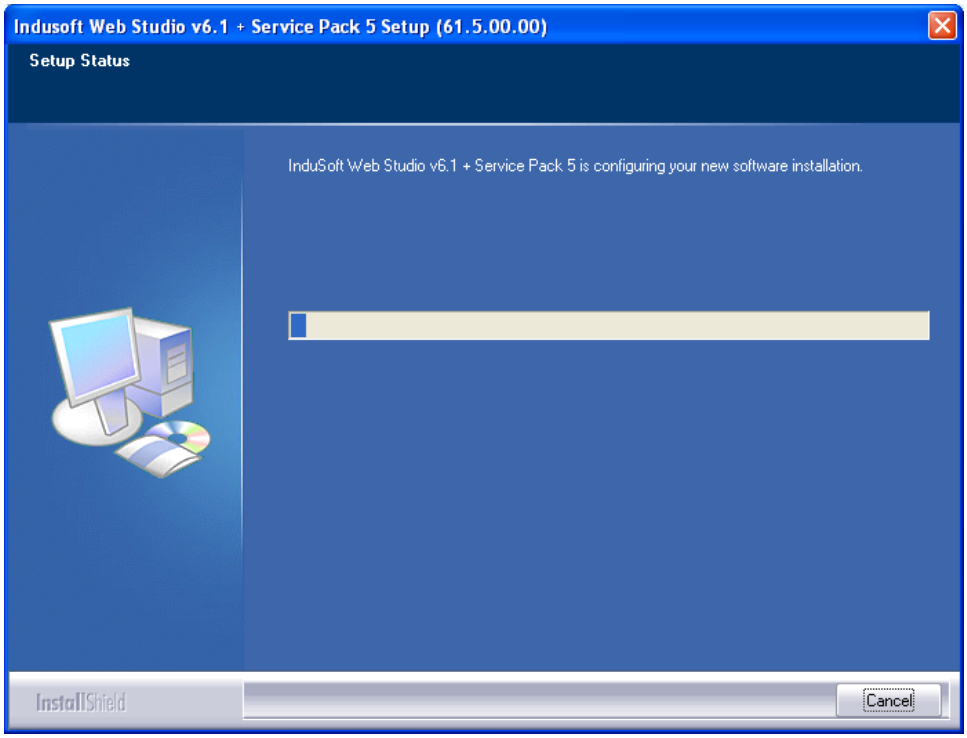


Figure 6-9. Installation Progress

C++ Redistributable will automatically be installed (only a couple MB's for this version).

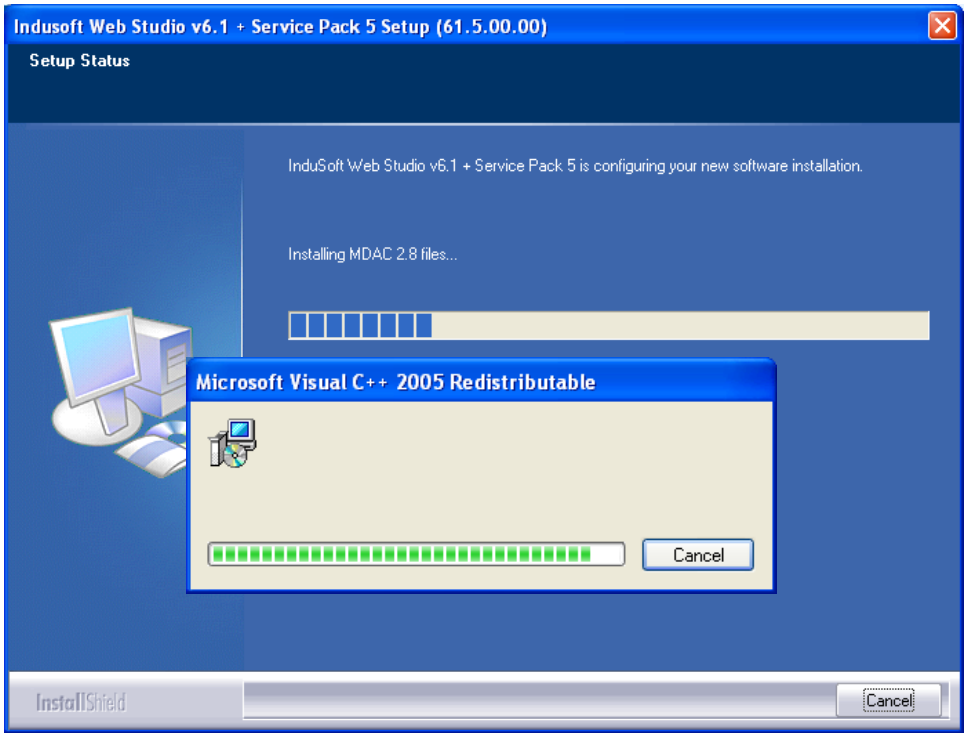


Figure 6-10. C++ Redistributable

You may get a Microsoft Data Access Message, Ignore it and click Cancel to continue Install progress:

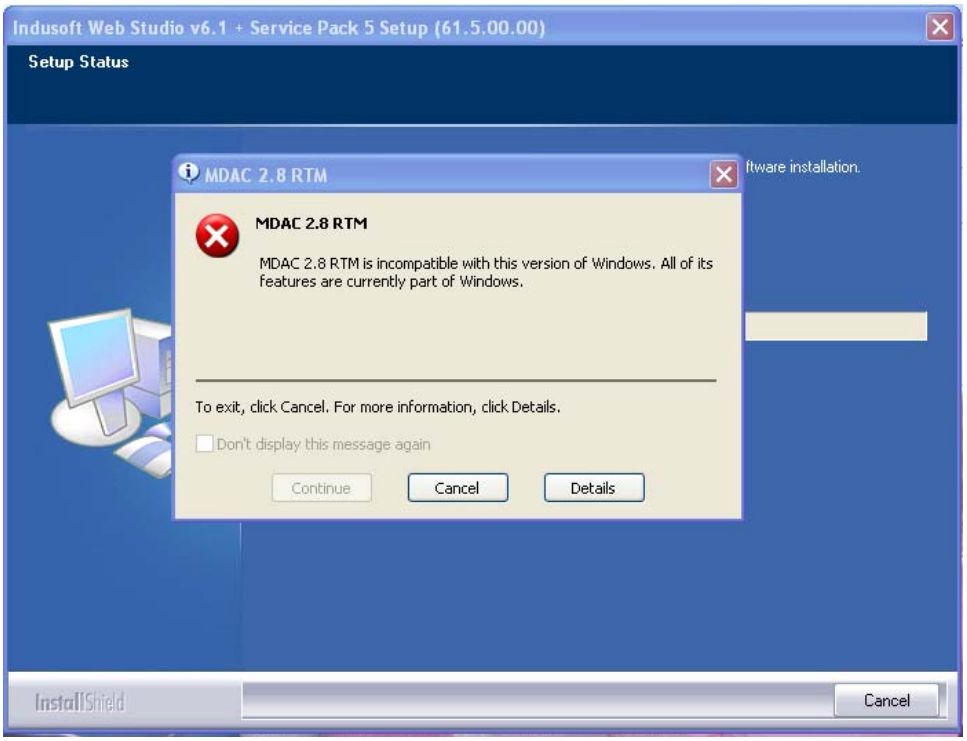


Figure 6-11. MDAC Message

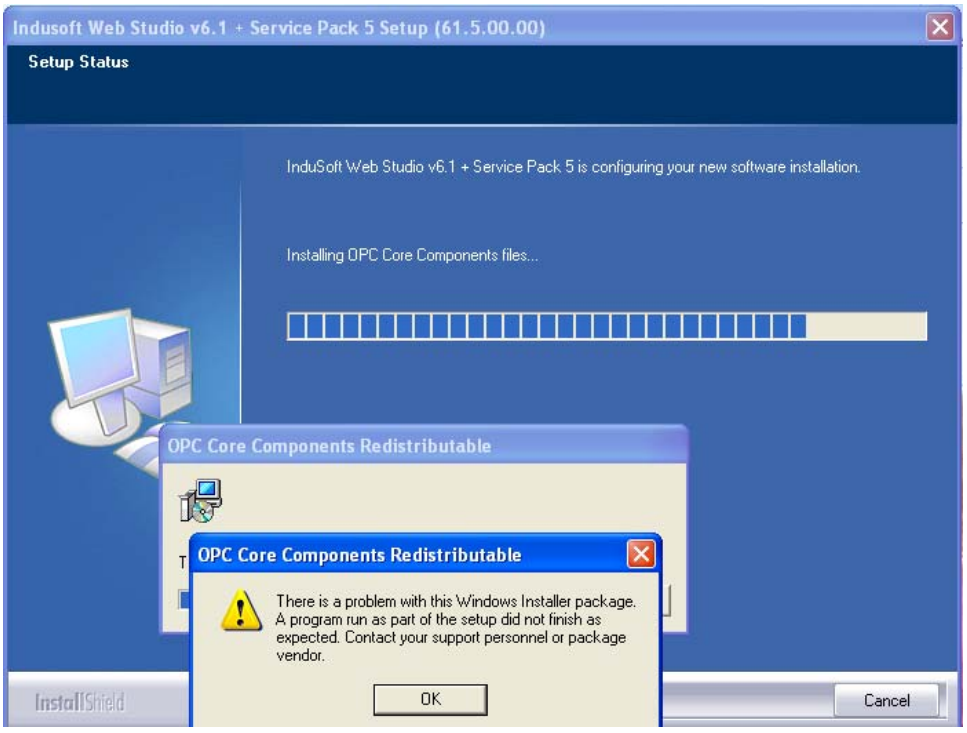


Figure 6-11a. Installation Error

This error may appear if you have prior OPC components installed on your computer. Click OK to continue installation.

If you do not already have .NET Framework 2.0 installed, the Webstudio installer will do it for you. If it is installed the program will jump to the install finished – restart computer? Screen

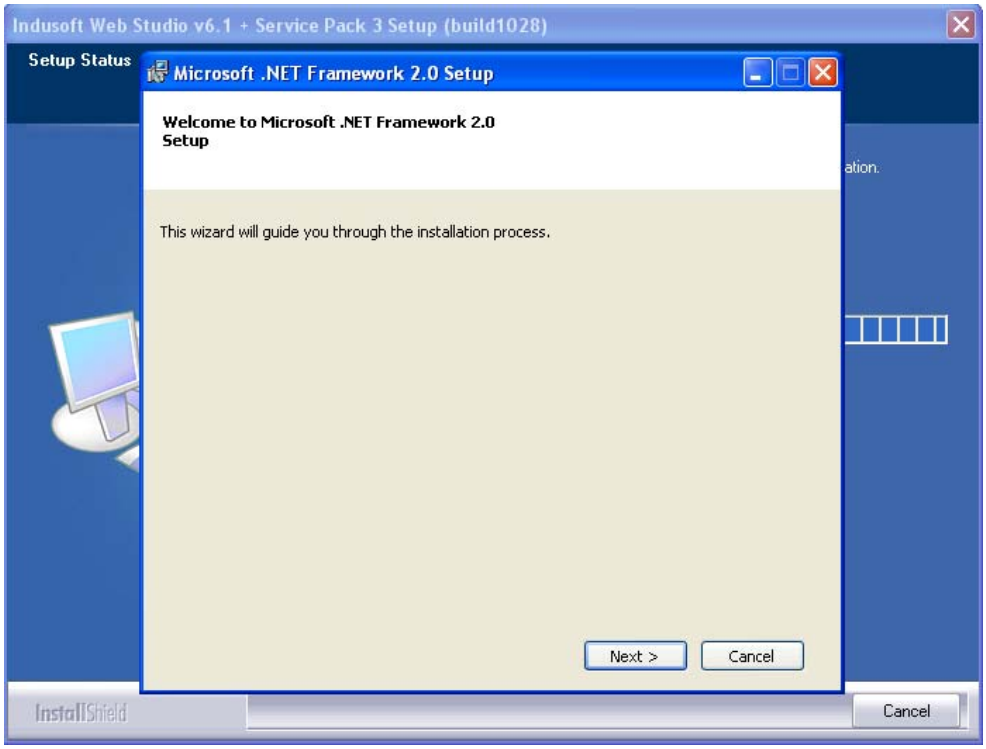


Figure 6-12. Installation of .Net 2.0

Accept the terms and click Next:

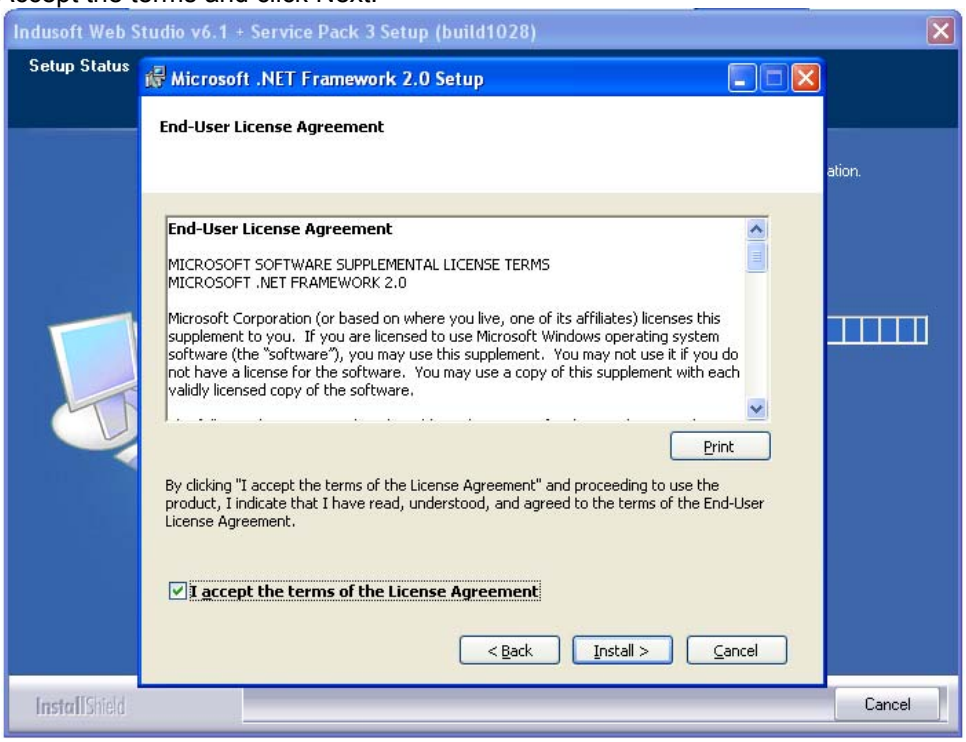


Figure 6-13. Accept Terms

Install Progress – may take several minutes:

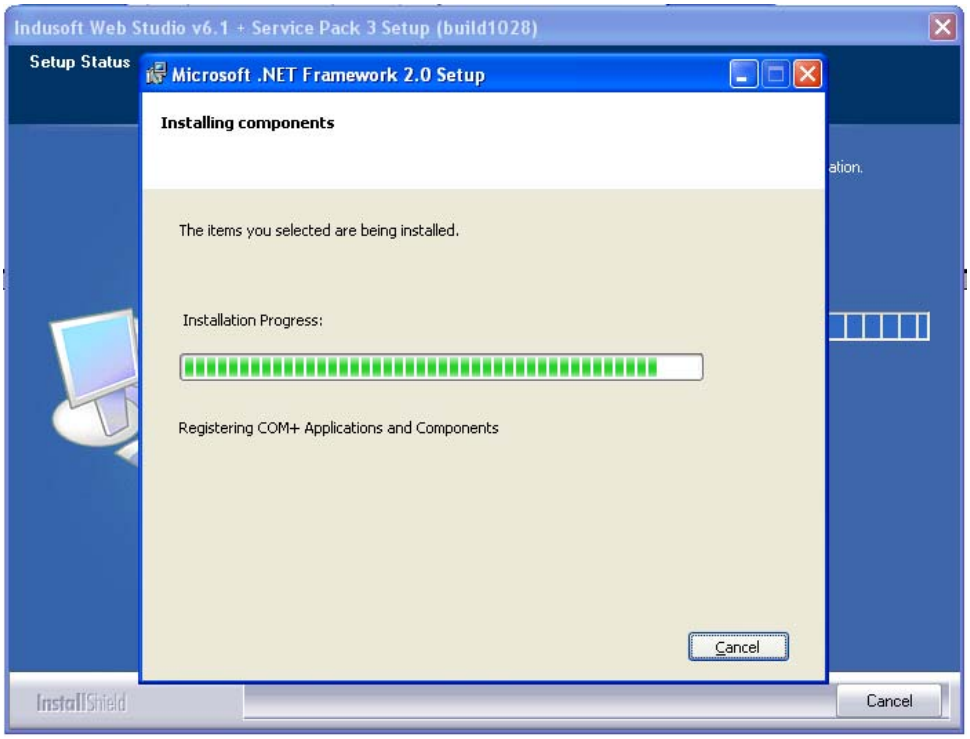


Figure 6-14. Install Progress

.NET Framework 2.0 installation successful, click finish:

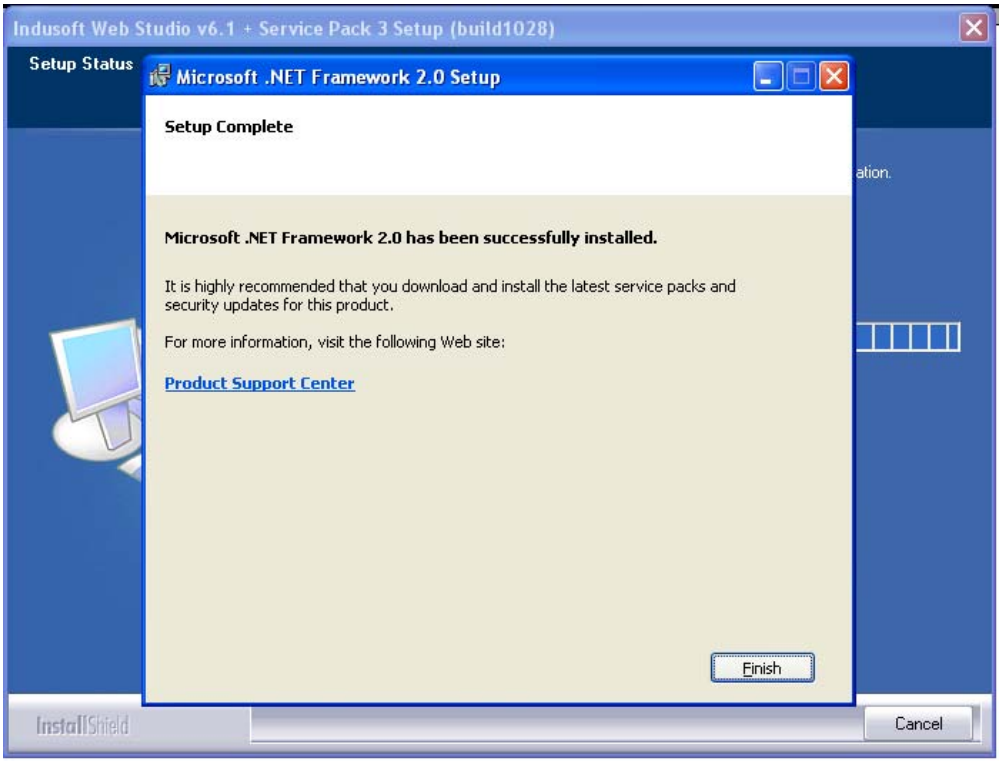


Figure 6-15. .NET 2.0 Finished

After installing the main application, there is a service patch named IWS61.5.01.00.exe that is recommended to be installed at this stage. It is located in the same folder.

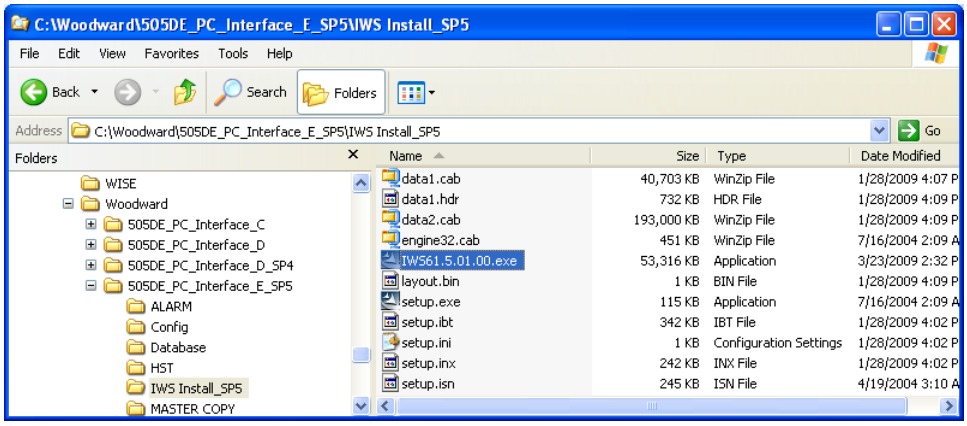


Figure 6-16a. Installing Patch

Prior to restarting the computer, an installation Patch should be installed by clicking on the above icon. It will display this image.

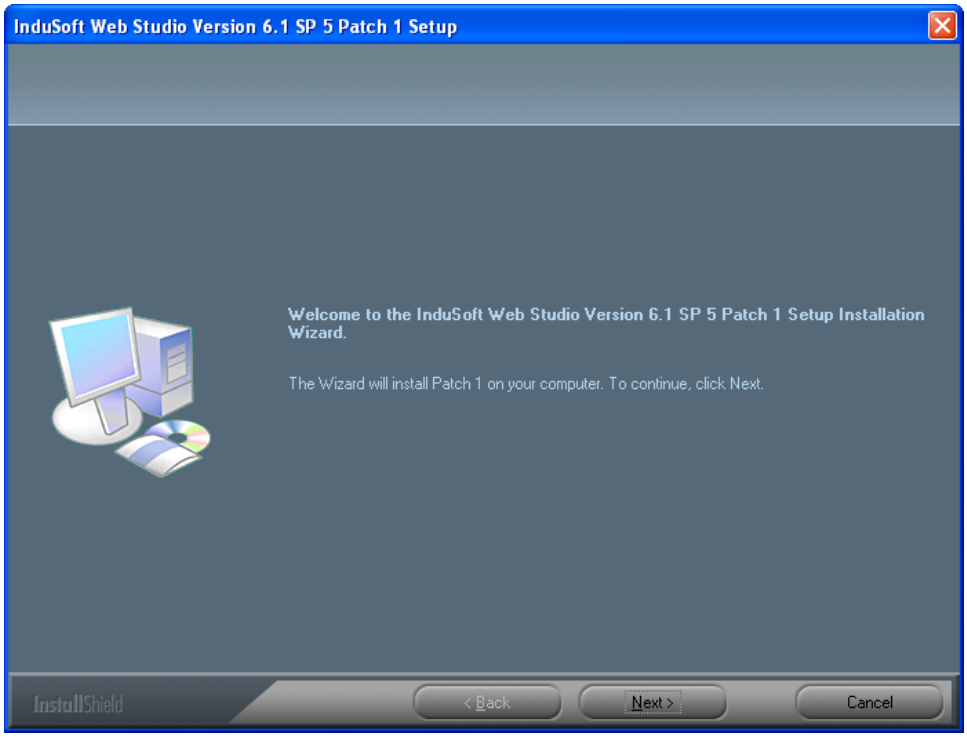


Figure 6-16b. Installing Patch

Install the User Name and Company Name.

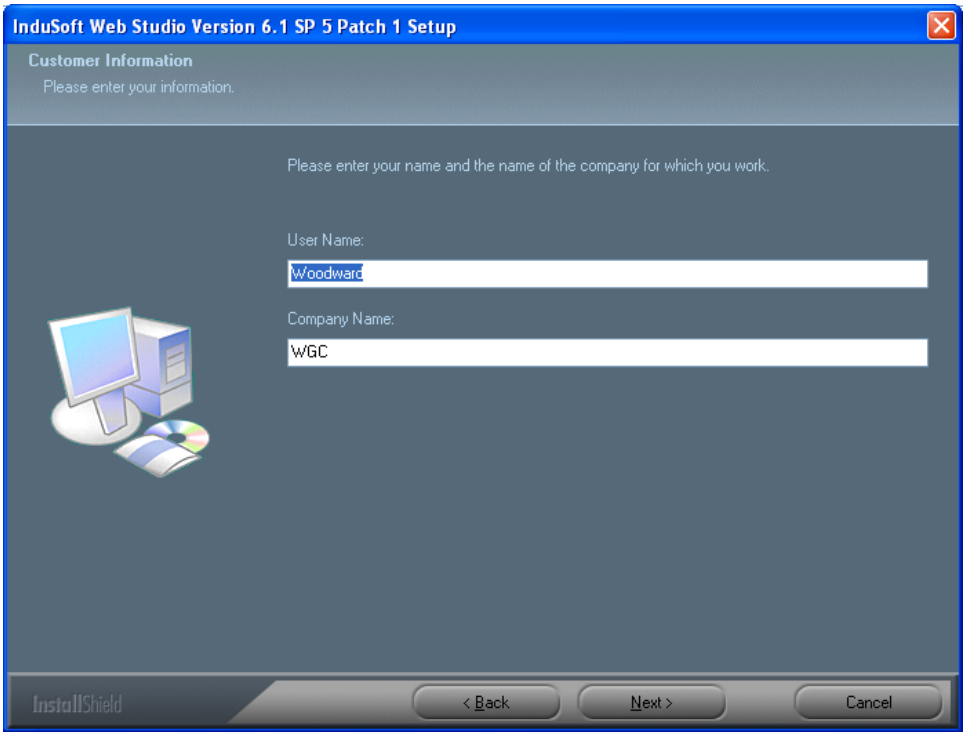


Figure 6-16c. Installing Patch

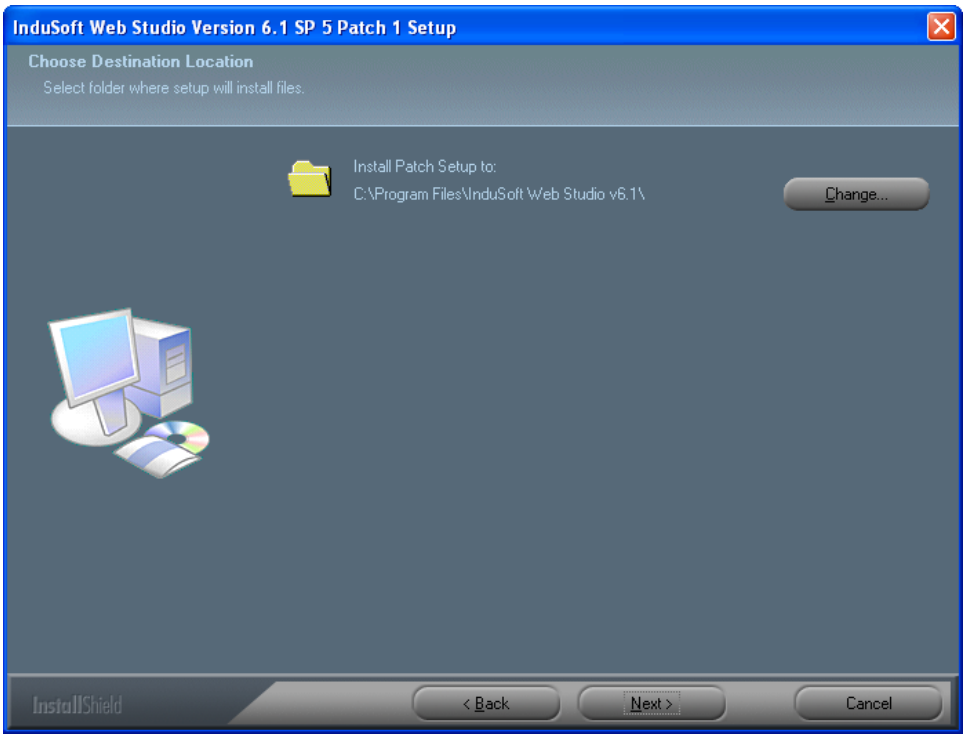


Figure 6-16d. Installing Patch

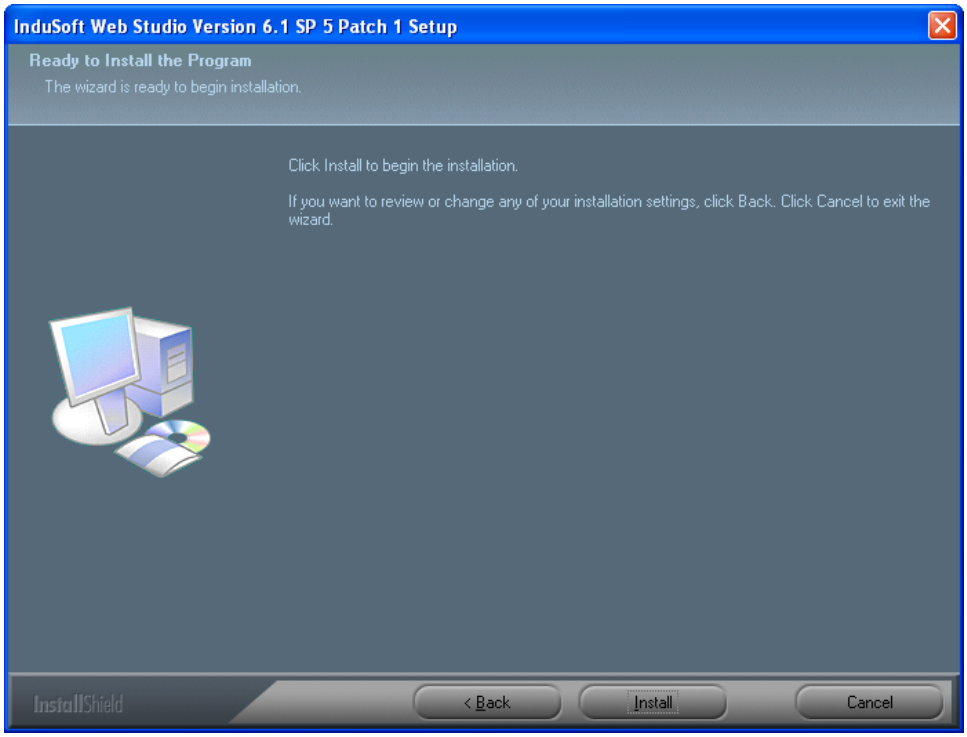


Figure 6-16e. Installing Patch

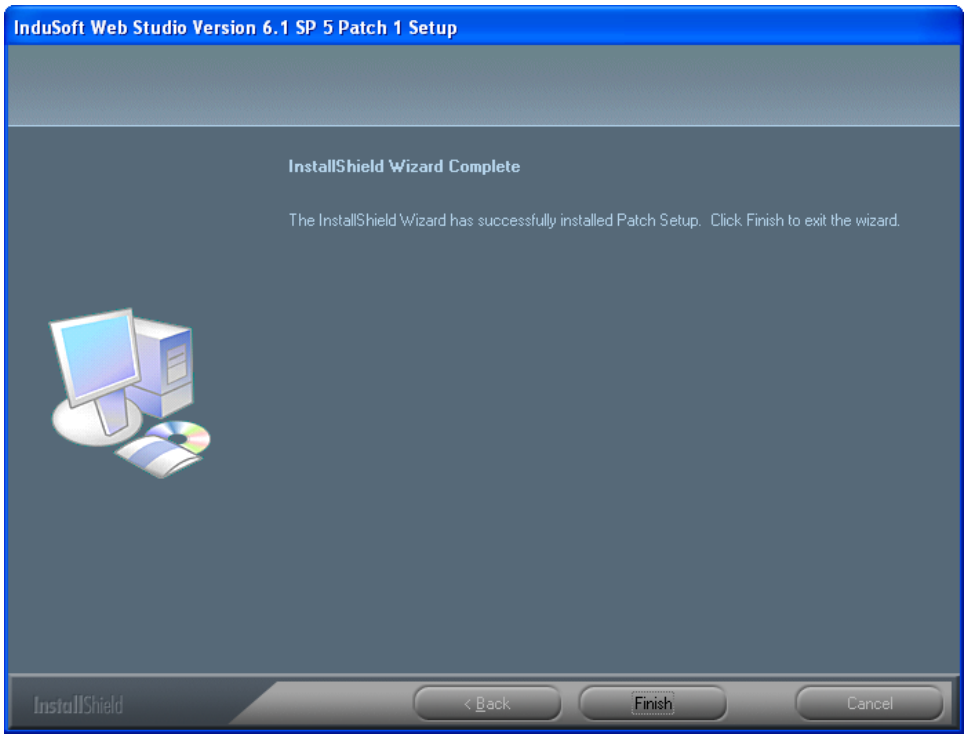


Figure 6-16f. Installing Patch

After several moments, the install finished will appear. Restart your computer before running the 505DE HMI program:

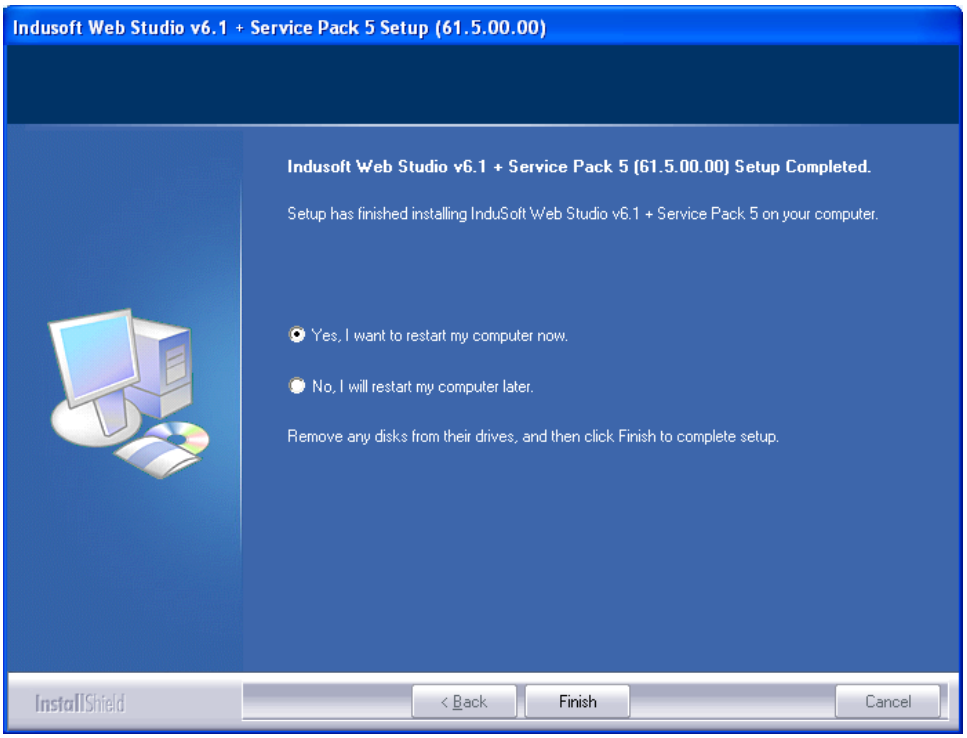


Figure 6-17. Restart the PC

To set the Indusoft Webstudio execution path to the desired directory, the target file must be opened just once. Open the 505DE_Demo Folder, then the cntrl folder. Double click on the 505DE.APP icon:

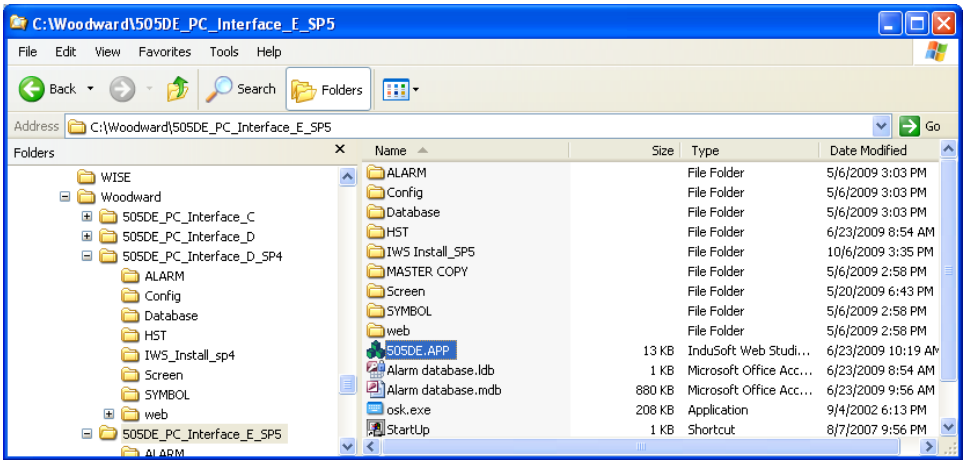


Figure 6-18. Set the runtime path for the interface tool

This will open the editor and most importantly will set the project path for the Web Studio program. There will be no editing permissions; the purpose of opening this is just to set the runtime path. Once this screen comes up, close it, as the runtime path will now be set to this location.

No installation is necessary for the 505DE Application files. The 505DE folder just needs to be copied to the host PC and the above step carried out.

Make a Connection to the 505DE

The first step to programming a 505DE, after all hardware has been installed and is powered up, is to make an Ethernet connection to the 505DE CPU from a Windows XP PC.

Make sure that the physical connection is made with a crossover cable if direct from PC to the 505DE CPU, or through an Ethernet hub that has been confirmed to be working. Making connections over plant networks may require a check with the network administrator to be sure no communications will be blocked between the communicating PC and the 505DE addresses. Some settings on some desktop firewalls can also block TCP/IP messages. The 505DE can be connected to over a wireless connection, as long as a connection can be made with no errors.

The 505DE CPU has two onboard Ethernet adapters each with an Ethernet port located on the front of the CPU. 505DE communications utilize port #1 – and hence Ethernet adapter #1. The default IP addresses (factory set) are shown below.

IMPORTANT

This module has been factory configured with fixed Ethernet IP addresses of:

- **Ethernet #1 (ENET1) = 172.16.100.1 Subnet Mast = 255.255.0.0**
- **Ethernet #2 (ENET2) = 192.168.128.20 Subnet Mast = 255.255.255.0**

If connecting with the 505DE HMI option (8262-1027), its default address is 172.16.100.45, which is compatible with the 505DE default address (172.16.100.1), so no configuration is necessary. The touchscreen will connect when a working connection is made. Once connected, software can be loaded on the 505DE from the touchscreen. If being connected over a managed network, or if a different IP Address is required, the 505DE HMI touchscreen's network settings can be configured using the following procedure that applies to any Windows XP PC.

To setup a connection, first configure the IP address of the PC that will be connecting to the 505DE (Client PC) within the same subnet as the 5200 CPU. Most subnets apply a restriction that the left two (255.255.0.0) or three digits (255.255.255.0) must be the same for computers to communicate. Normally, just choose an IP Address with a right hand digit that is different from any other address on the network. Example: If keeping the Ethernet #1 default address of 172.16.100.1, then any address (as long as it is different from any other addresses on the network) from 172.16.100.2 – 172.16.100.247 will work.

To begin, choose network connections from the windows control panel.

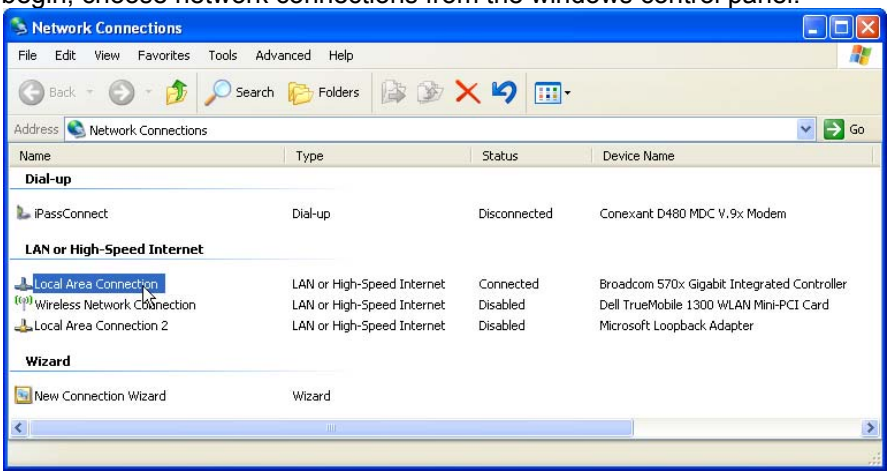


Figure 6-19. Client PC Network Connections

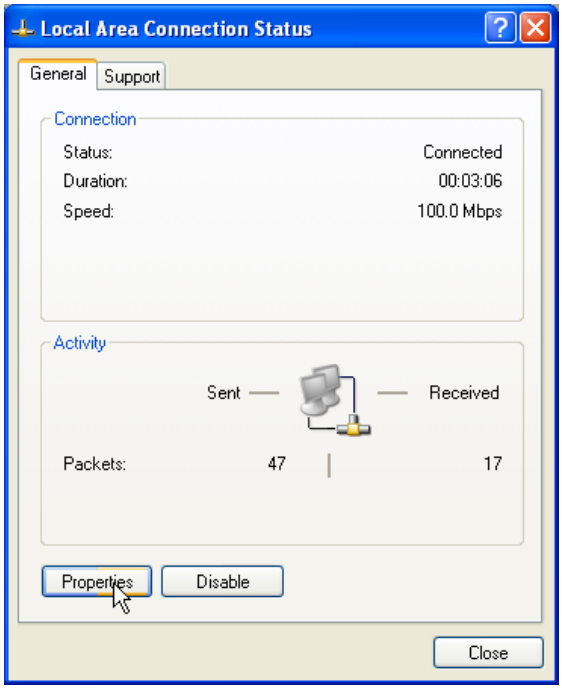


Figure 6-20. Client PC LAN Status

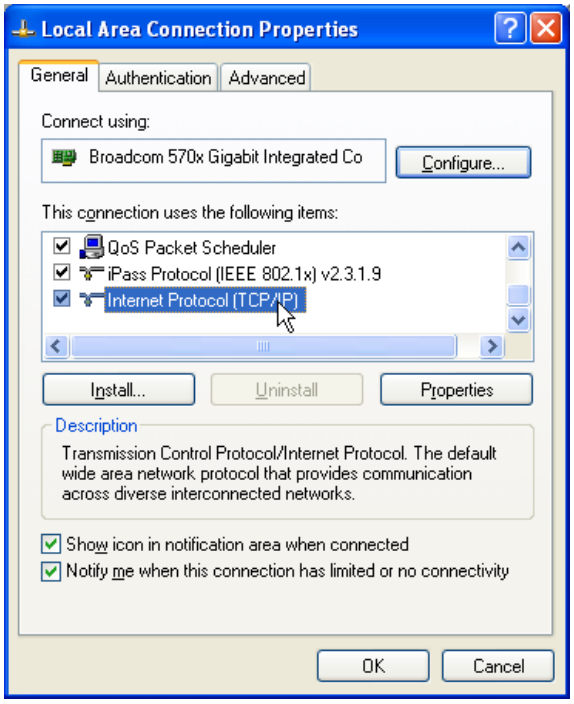


Figure 6-21. Client PC LAN Properties

Choose Internet Protocol (TCP/IP) from the LAN Properties dialog box.

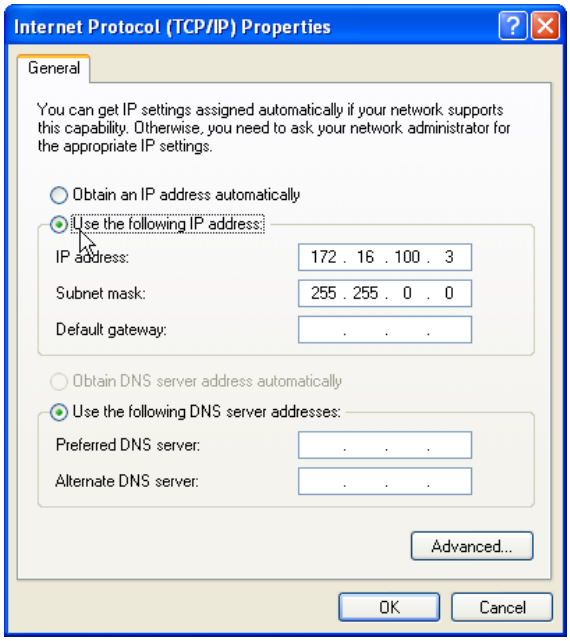


Figure 6-22. TCP/IP Properties

For a direct connection via crossover cable or local Ethernet hub, choose ‘Use the following IP Address’ to set a static IP Address; then enter a compatible address. If connecting over a network using a DHCP server, ‘Obtain an IP address automatically’ can be used. When checked, this means the Client PC will register on the network and receive an address compatible with the network. This also means that the 505DE CPU must either have a static IP Address that has been designated on the managed network for use, or it too must be configured to get an IP Address from a DHCP server on the network.

Try connecting directly if difficulties result from attempting a DHCP connection (‘Obtain IP Address automatically’).

To confirm that the client PC is configured correctly, open a command prompt (Start->Run then type in cmd), and use the command ‘ipconfig’ to verify local settings. Note in the example screen shot that the wireless connection is turned off, so has no IP Address.

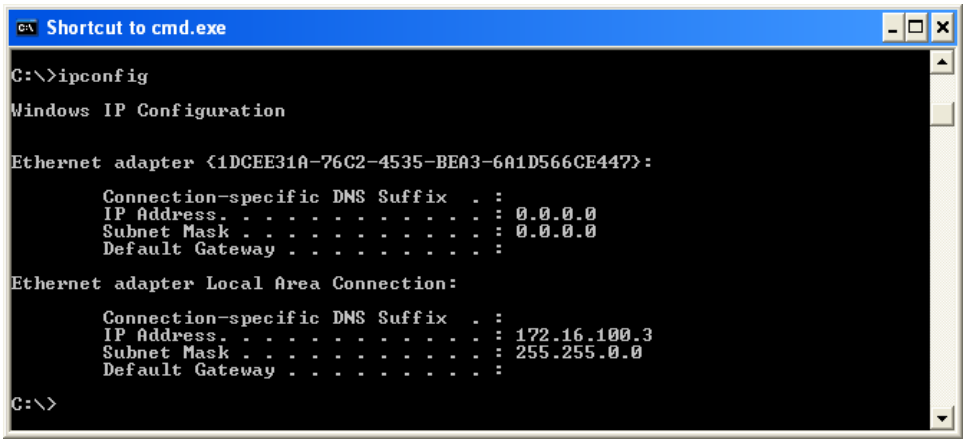


Figure 6-23. ‘ipconfig’ command

To confirm that the 505DE is connected on the same network as the client PC, the ‘ping’ command can be used. This is a good troubleshooting tool if other windows applications, including AppManager and the 505DE HMI are having trouble connecting, because it checks only the low level network card connection. If a ‘ping’ is unsuccessful, then other applications will also fail to connect, and the physical connection or managed network restrictions should be checked.

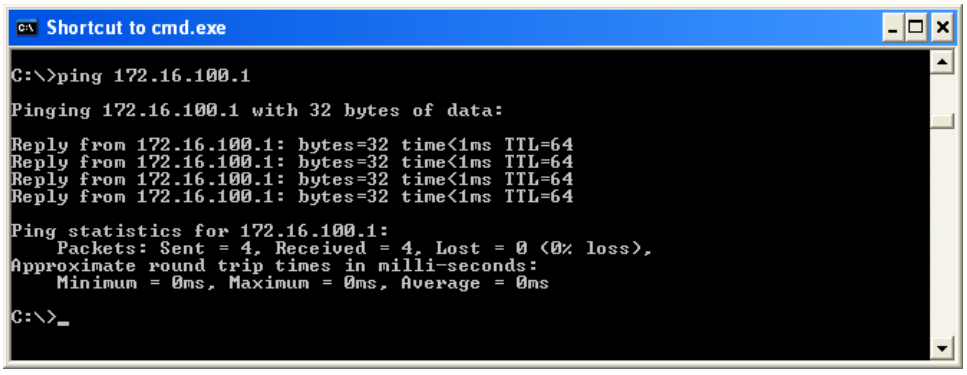


Figure 6-24. Ping the 505DE to confirm connection

Once a good connection is made, on a new 505DE CPU, software must be loaded and executed. Woodward's application manager is used to install software, set the 505DE IP Address, and activate its SNTP time synchronization client if required. AppManager is included with the 505DE software package and can also be obtained from **www.woodward.com**.

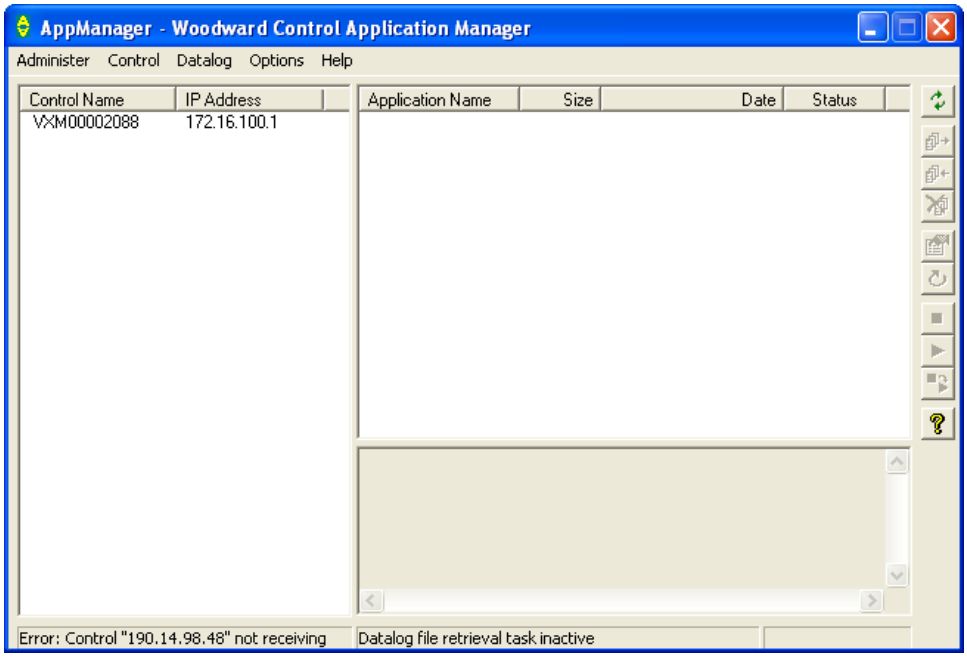


Figure 6-25. Woodward Application Manager (AppManager)

When AppManager is opened, the 505DE CPU will appear as a Control Name and IP Address. The control name is not relevant to 505DE operation, as connections are established based on the IP Address. If redundant CPU's are used or multiple 505DE (or MicroNet in general) CPU's are on the same network, they will also appear in the left pane

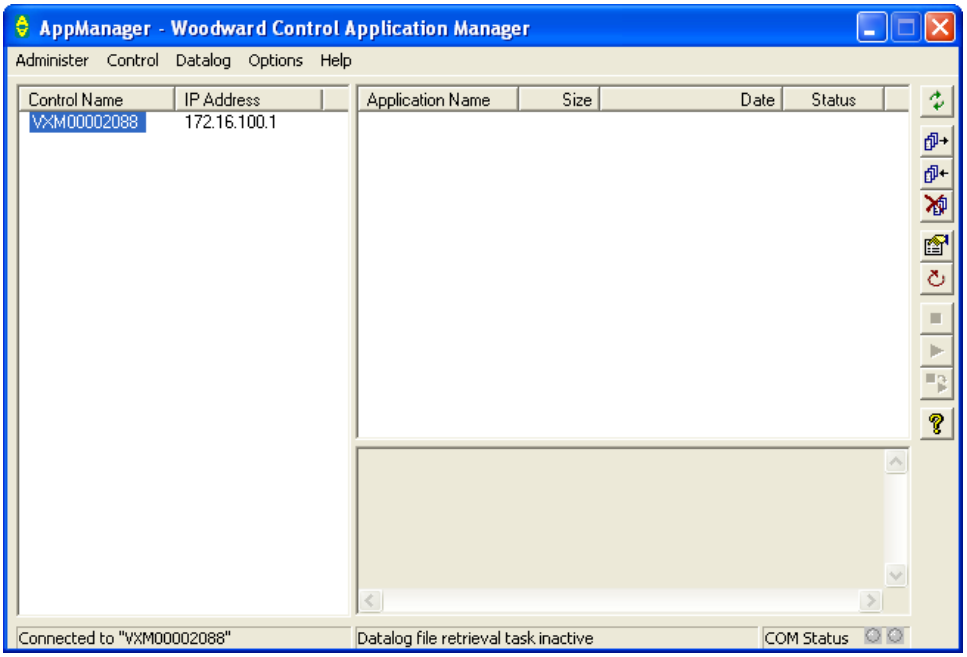


Figure 6-26. Highlight the CPU Name

When a control name is selected, the right pane will be blank on a new CPU, and will contain the name of the application software running for an operating CPU. To load the application software, select the transfer icon (right arrow at top). A password prompt will appear. The username and password are in the back of this manual in the Appendix A.

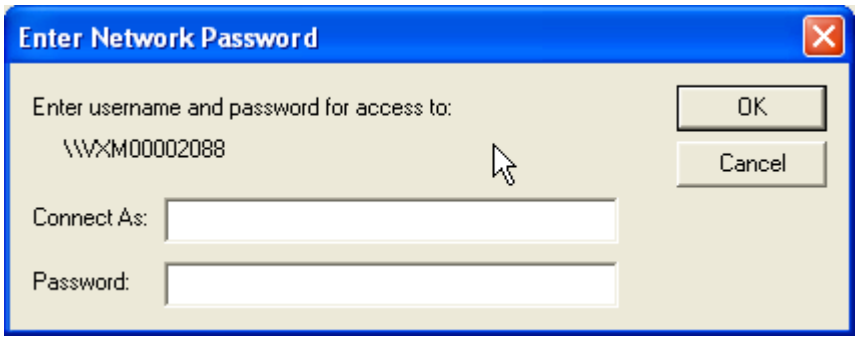


Figure 6-27. AppManager Password Prompt

When the correct username and password have been entered, the transfer files browser will open. In the directory chosen during 505DE software package installation, select the correct part number per the application table at the beginning of this manual, and choose transfer. On the 505DE HMI touchscreen, the application files are in C:\505DE.

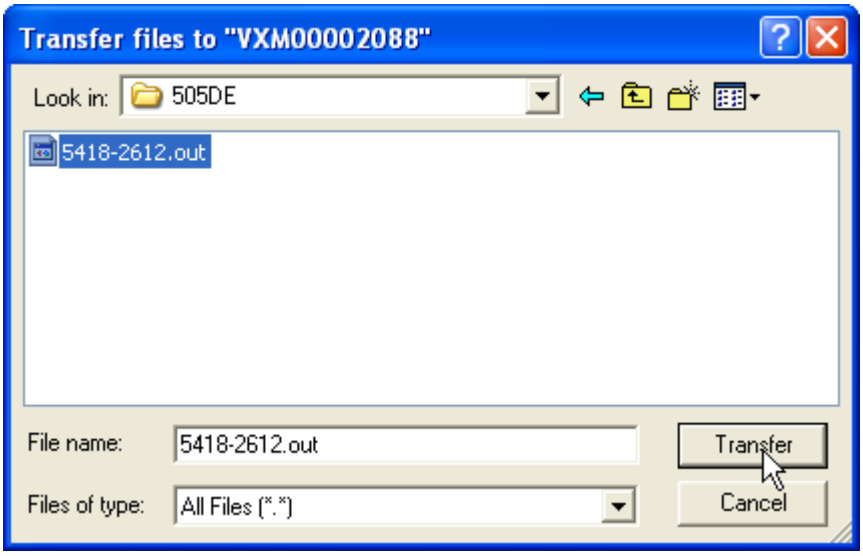


Figure 6-28. AppManager Transfer File Browser

The file will take a few seconds to transfer at which point it just needs to be highlighted and executed via the 'Start the currently selected application' icon (play button).

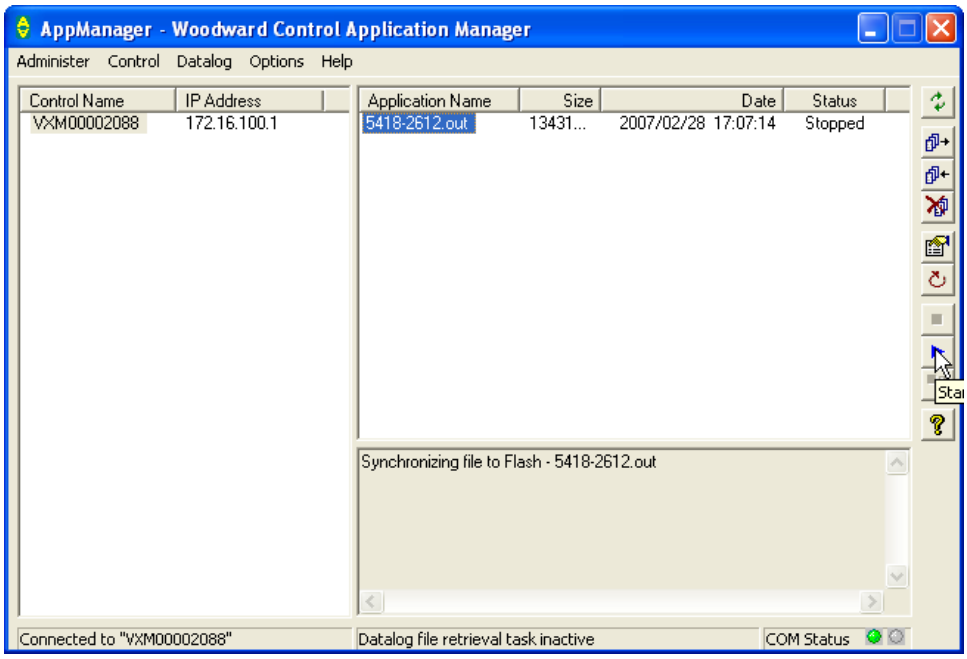


Figure 6-29. Start the application

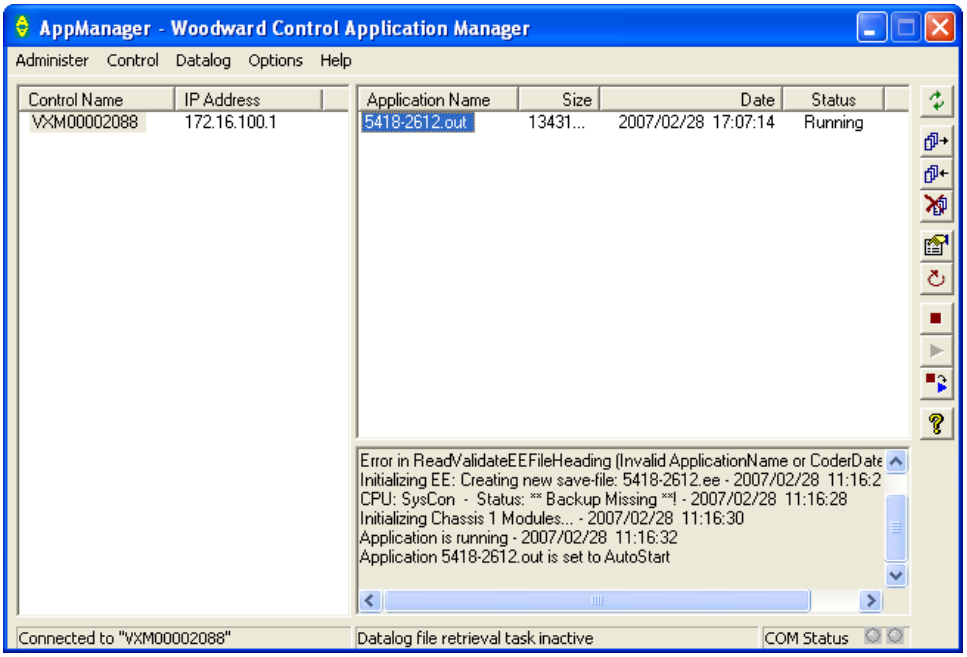


Figure 6-30. Application is running and 505DE is ready for operation

Changing the 505DE IP Address

As a safety measure, the 505DE IP Address can be only be changed with an application stopped or not loaded. Protections also prevent the application from being stopped until the 505DE control software (the turbine) is in a shutdown state. Choose the stop icon and confirm stopping the application.

In AppManager, with the correct control highlighted, choose the Control Menu and then Change Network Settings…

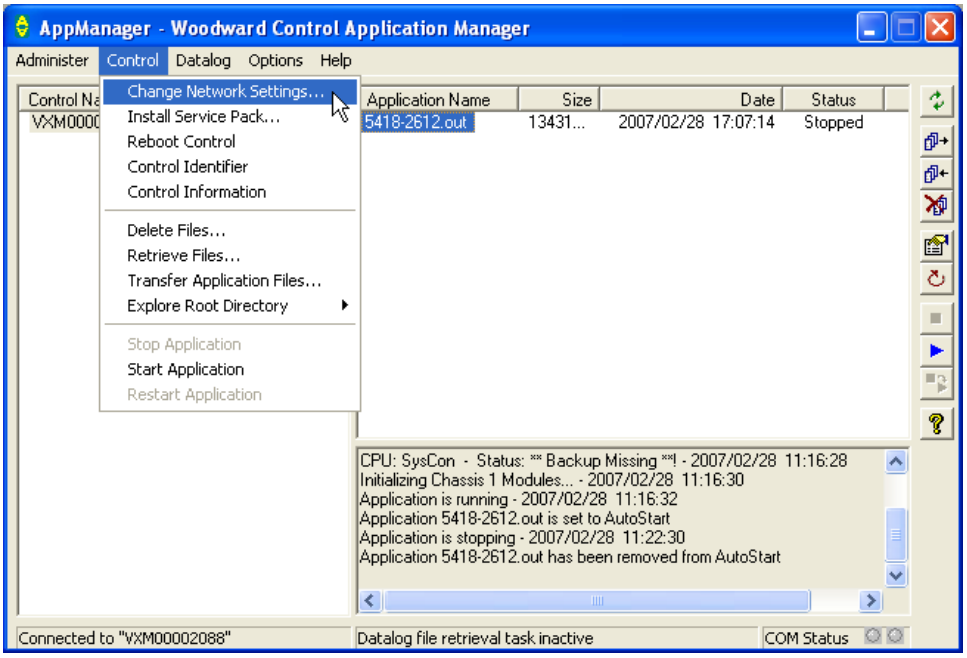


Figure 6-31. Open Change Network Settings

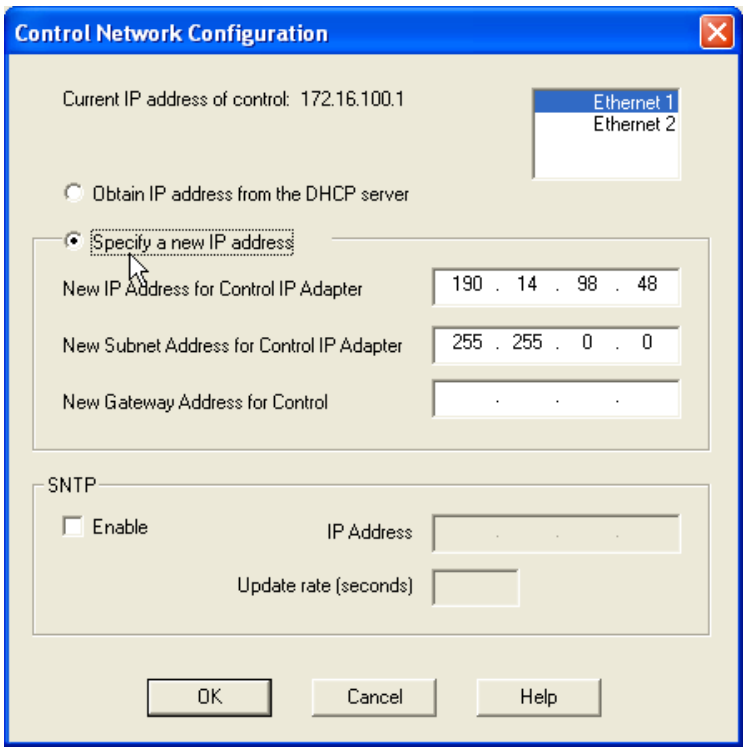


Figure 6-32. Change Network Settings

The Control Network Configuration dialog allows the configuration of the 505DE CPU's network cards, and also specification of an SNTP time synchronizing server address. Choose the type of network connection (static or DHCP) and enter an IP address if using a static IP Address. Choose OK.

A dialog appears to confirm that it is desired to change the IP Address. A second dialog appears to confirm that it is OK to re-boot the control.

Re-boot should take about 30-60 seconds, after which the control name will reappear in AppManager with the new IP Address. To reconnect, shutdown AppManager and change the client PC IP Address to be compatible. Upon reopening AppManager, the control will appear again with its new IP Address. In the example screenshot, another control on the network also appears. Start the application to begin configuring the 505DE.

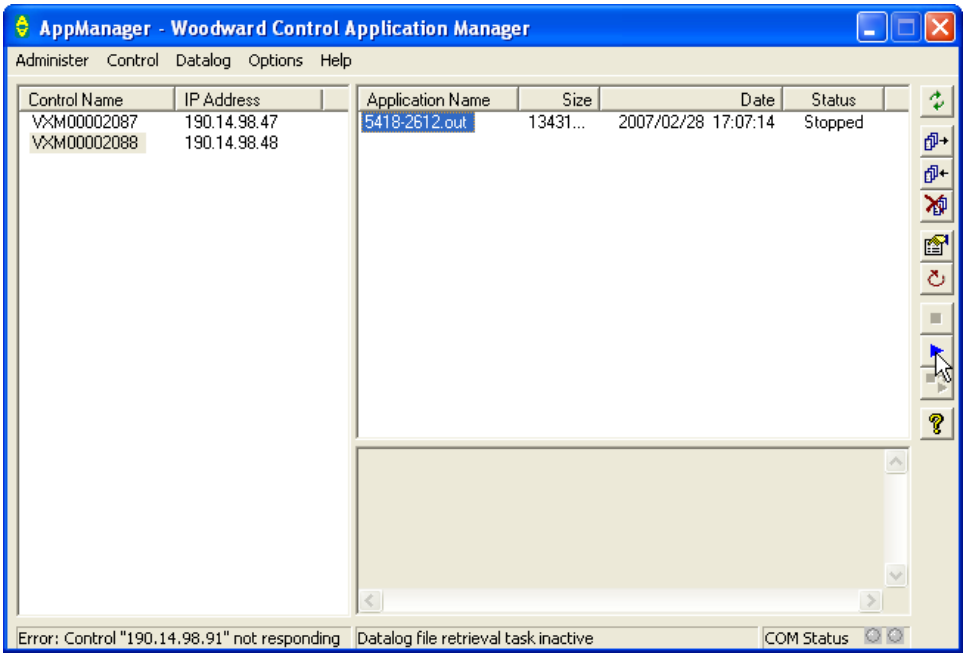


Figure 6-33. Multiple controls on the same network

SNTP Server Connection

To make an SNTP (Simple Network Time Protocol) Server connection, an SNTP server must first be available on the same Ethernet network that the 505DE is connected to. In AppManager open the Control Network Configuration dialog (the same as is used to change IP Address). Set the Server IP Address and specify an update rate. Depending on how accurate the update is required to be, the update rate may be from a few seconds to a few minutes.

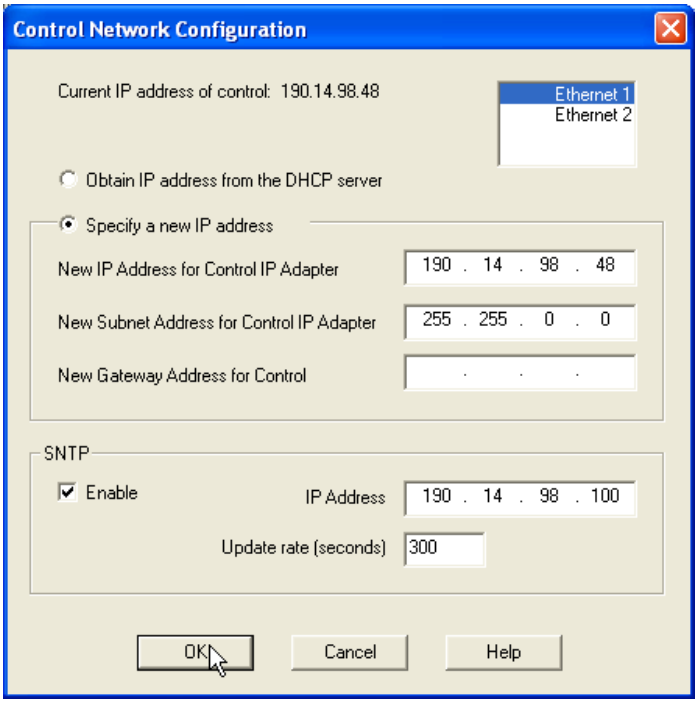


Figure 6-34. Specifying a SNTP server address

Chapter 7. Communications

Modbus Communication

The 505DE control can communicate with plant distributed control systems (DCS) and/or CRT based operator control panels through several Modbus communication ports. The DB-9 serial port located on a 505DE CPU (MicroNet 5200 CPU) supports RS-232, RS-422, or RS-485 communications using ASCII or RTU MODBUS transmission protocols. In addition UDP and TCP Modbus servers are provided over Ethernet. See the 'Application Settings' section of volume 1. Modbus utilizes a master/slave protocol. This protocol determines how a communication network's master and slave devices establish and break contact, how a sender is identified, how messages are exchanged, and how errors are detected.

Use the information in this chapter with the configuration instructions in volume 1 'Application Settings'.

Monitor Only

All Modbus communication ports, as defaulted from the factory, are not configured to accept "write" commands. Although these ports are not configured, they continue to update all information to all registers. This allows the 505DE to be monitored but not controlled from an external device. By simply connecting a monitoring device, configured to communicate through Modbus, this device can be used to monitor all the 505DE's controlling parameters, modes, etc. without effecting control of the turbine. By selecting "Use Modbus X", the user enables alarming for that port. By selecting "Enable Modbus X Commands", the user configures the 505DE to accept write commands.

See the communication configuration section of volume 1 (application settings).

Monitor and Control

Once a Modbus port is configured within the 505DE's Program Mode, the 505DE will accept RUN mode commands from an external network master device (DCS, etc.). This allows a Modbus compatible device to monitor and perform all 505DE RUN mode parameters and commands except for the Overspeed Test enable, On-Line/Off-Line Dynamics select, and Override Failed Speed Signal commands.

Both Modbus ports are independent of each other, and can be used simultaneously. The last command given between the two ports has priority or is the mode or function selected.

See volume 1 for configuration instructions.

Modbus Communication

The 505DE is defaulted, and designed, for RTU transmission mode, however it also supports the ASCII transmission mode, which can be set through a debug interface by qualified personnel (see volume 1 ‘Application Settings’). A mode defines the individual units of information within a message and the numbering system used to transmit the data. Only one mode per Modbus network is allowed. The supported modes are ASCII (American Standard Code for Information Interchange), and RTU (Remote Terminal Unit). These modes are defined in the following table.

CHARACTERISTIC	ASCII	RTU
Coding System	hexadecimal (uses ASCII printable binary characters: 0-9, A-F)	8-bit binary
Start Bits	1	1
Data Bits per Char	7	8
Parity	even, odd, or none	even, odd, or none
Stop Bits	1, 1.5, or 2	1, 1.5, or 2
Baud Rate	110, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, or 57600	110, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, or 57600
Error Checking	LRC (Longitudinal Redundancy Check)	CRC (Cyclical Redundancy Check)

Table 7-1. ASCII vs RTU Modbus

In the RTU mode, data is sent in 8-bit binary characters and transmitted in a continuous stream. In the ASCII mode, each binary character is divided into two 4-bit parts (high order and low order), changed to be represented by a hexadecimal equivalent, then transmitted, with breaks of up to 1 second possible. Because of these differences, data transmission with the ASCII mode is typically slower (see Figure 6-1 below).

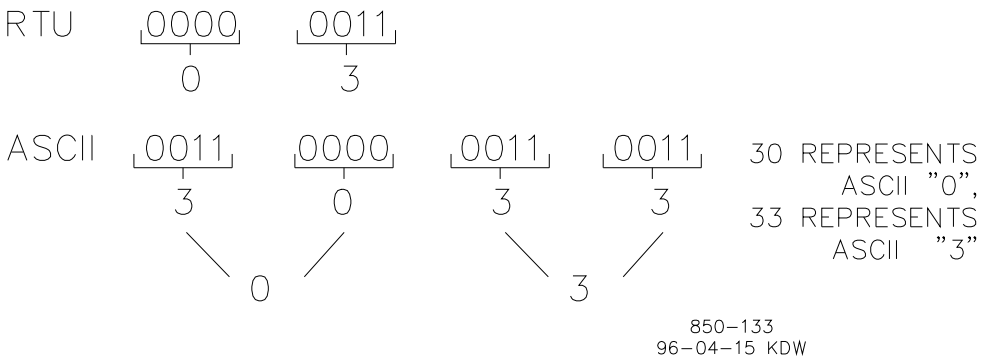


Figure 7-1. ASCII/RTU Representation of 3

The Modbus protocol allows one master and up to 247 slaves on a common network. Each slave is assigned a fixed, unique device address in the range of 1 to 247. With the Modbus protocol, only the network master can initiate a transaction. A transaction consists of a request from the master to a slave unit and the slave’s response.

The 505DE control is programmed to function as a slave unit only. As a slave unit, the 505DE will only respond to a transaction request by a master device. The 505DE can directly communicate with a DCS or other Modbus supporting device on a single communications link, or through a multi-dropped network. If multi-dropping is used, up to 246 devices (505DEs or other customer devices) can be connected to one Master device on a single network. The device numbers are defaulted to 1 and 2 respectively for Modbus slaves 1, 2. They can be changed in debug mode (Volume 1 'Application Settings').

Each message to or from a master has a defined structure called the message "frame". A frame consists of the slave device address, a code defining the requested data, and error checking information. See Figure 7-2.

	BEGINNING OF FRAME	SLAVE ADDRESS	FUNCTION CODE	DATA	ERROR CHECK CODE	END OF FRAME
ASCII	:	2 CHARS 8 BITS	2 CHARS 8 BITS	4 BITS DATA PER CHAR	2 CHAR 8 BITS	CR LF
RTU	3–CHAR DEAD TIME	1 CHAR 8 BITS	1 CHAR 8 BITS	8 BITS DATA PER CHAR	2 CHAR 16 BITS	3 CHAR DEAD TIME

855–382
93–09–27 DAR

Figure 7-2. Modbus Frame Definition

The Modbus function code tells the addressed slaves what function to perform. The following table lists the function codes supported by this control.

Modbus Function Codes

CODE	DEFINITION	REFERENCE ADDRESS
01	Read Digital Outputs (Raise/Lower and Enable/Disable Commands)	0XXXX
02	Read Digital Inputs (Status Indications / Alarms and Trips)	1XXXX
03	Read Analog Outputs	4XXXX
04	Read Analog Inputs (Speed, Setpt, etc)	3XXXX
05	Write Single Discrete Output (Raise/Lower and Enable/Disable Commands)	0XXXX
06	Write Single Register (Enter Setpt Directly)	4XXXX
08	Loopback Diagnostic Test (supports sub-function 0 only)	N/A
15	Write Digital Outputs	0XXXX
16	Write Analog Outputs	4XXXX

Table 7-2. Modbus Function Codes

When a Modbus message is received, it is checked for any errors or invalid data. If there is invalid data in the message, the slave records an error code and the 505DE control issues a link error alarm message. Normally, the link error alarm is the only useful information, however error codes are available through a debug interface (see volume 1 – 'Application Settings') and are defined in the following table.

If the control has not received a message for the configured time-out period, the control will announce the link error alarm. This time-out is defaulted to 2 seconds but can also be adjusted in debug if required.

Modbus Slave Exception Error Codes

CODE	ERROR MESSAGE	TO MASTER	DESCRIPTION
0	No Error	0	No Error.
1	Bad Modbus function	1	The specified function is not supported for this control.
2	Bad Modbus data address	2	The Modbus value address is not valid for this control.
3	Bad Modbus data value	3	Too many values requested or the on/off indicator in function code 5 is invalid.
9	Bad Modbus checksum	None	Message checksum did not match.
10	Bad Modbus message	None	Message could not be decoded.
n/a	Lost Modbus link	None	No messages received for the configured time-out period.

Table 7-3. Modbus Error Codes

Port Adjustments

Before the 505DE will communicate with the master device, the communication parameters must be verified. These values are set on the Application Settings Configuration Page and are accessible in Service Mode (see Application Settings in Volume 1).

505DE Control Modbus Addresses

The Modbus communication ports in the 505DE control are programmed for unique Modbus addresses. A complete listing of these addresses for your application is located at the end of this section. The Modbus address listing consists of Boolean Writes, Boolean Reads, Analog Reads, and Analog Writes. The Boolean reads and writes are also referred to as input and holding coils. The analog reads and writes are also referred to as input registers and holding registers.

All values that can be addressed by Modbus are considered to be discrete and numeric. The discretes are a 1 bit binary, on or off value and the numerics are 16 bit values. Discretes are sometimes referred to as coils or digitals and numerics are referred to as registers or analogs. All read/write registers are interpreted by the 505DE as signed 16 bit integer values. Since Modbus can only handle integers, values that require a decimal point in the Modbus Master Device are multiplied by a scaling constant before being sent by the 505DE. See Tables 7-7 & 7-8 for defaulted communication constants and ranges. Also see 'Application Settings' in volume 1 for scaling configuration instructions.

The maximum number of discretes and registers that can be transmitted in one packet is dependent on each implementation of Modbus. The following table defines these limits.

MODE OF TRANSMISSION	MAX DISCRETES	MAX REGISTERS
ASCII	944	59
RTU	1188	118

Table 7-4. Maximum Modbus Discrete and Analog Values

Boolean Writes (Holding Coils)

Holding coils are logical signals that are both readable from and writable to the 505DE control. An example of a Boolean write value would be raise or lower commands. A logical true denoted by the value 1 will cause the command listed in the description to be executed. For example, if a 1 is written to address 0:0010 and this corresponded to a speed raise command, the speed setpoint will increase until a 0 is written to address 0:0010. The 505DE control supports function codes 1, 5, and 15. These correspond to reading selected holding coils, writing to a single holding coil, and writing to multiple holding coils, respectively. The holding coils available are listed in Table 6-5.

Boolean Reads (Input Coils)

Input coils are logical signals that are readable from, but not writable to, the 505DE control. An example of a Boolean read value would be a turbine trip status indication. The input coil will have the value 1 if the statement in the description column is true and a 0 if false. The ‘1:’ term in the address identifies an input coil. The 505DE control supports Modbus function code 2, which involves reading selected input coils. The input coils available are listed in Table 6-6.

Analog Reads (Input Registers)

Input registers are analog values that are readable from, but not writable to, the 505DE control. An example of an analog read value would be turbine speed. The values of the input registers are stored internal to the control as floating point numbers representing engineering units (i.e. kPa or rpm). The values that are transmitted are integer values ranging from -32767 to +32767. Since Modbus can only handle integers, values that require a decimal point must be multiplied by a scaling constant in the 505DE before being sent across the Modbus link. For example, these input registers may be listed as the Modbus value ‘x100’ or ‘cascade scale factor’ under the description heading to denote the value is multiplied by a scaling constant (refer to Modbus Scale Factors later in this section). This will allow transmission of decimal parts of a unit if this is necessary for better resolution.

See the 505DE Service mode for defaulted communication constants and ranges. The 505DE control supports Modbus function code 4, which involves reading selected input registers. The input registers available are listed in Table 7-7.

Analog Writes (Holding Registers)

Holding registers are analog values that are writable to the 505DE control. These values can also be read from by a device performing error checking. An example of an analog write value would be a direct speed setpoint value as opposed to raise and lower setpoint commands. The value of the holding registers are also stored in the control as numbers representing engineering units (psi or rpm). Once again, if decimal points are required, a scaling factor must be used (refer to Modbus Scale Factors later in this section). The 505DE control supports Modbus function codes 3, 6, and 16. These correspond to reading selected holding registers, writing to a single holding register, and writing to multiple holding registers, respectively. The holding registers available are listed in Table 7-8.

The following tables give the address and description of all Boolean and analog, reads and writes:

Modbus Boolean Writes

Addr	Description
0:0001	Local Trip Only
0:0002	Trip Acknowledge
0:0003	Enable Controlled SD
0:0004	Abort Controlled SD
0:0005	System Reset
0:0006	Start Command
0:0007	Raise V1 Limiter
0:0008	Lower V1 Limiter
0:0009	Lower Speed Setpoint
0:0010	Raise Speed Setpoint
0:0011	Go To Rated (idl/rtd)
0:0012	Go To Idle (idl/rtd)
0:0013	Halt Auto Start Sequence
0:0014	Continue Auto Start Sequence
0:0015	Remote Speed Enable
0:0016	Remote Speed Disable
0:0017	Go To Mod Speed Setpoint
0:0018	Spare
0:0019	Frequency Control Arm
0:0020	Frequency Control DisArm
0:0021	Sync Enable
0:0022	Sync Disable
0:0023	Cascade Enable
0:0024	Cascade Disable
0:0025	Lower Cascade Setpoint
0:0026	Raise Cascade Setpoint
0:0027	Remote Cascade Enable
0:0028	Remote Cascade Disable
0:0029	Go To Casc Mod Setpoint
0:0030	Spare
0:0031	Aux1 Enable
0:0032	Aux1 Disable
0:0033	Aux1 Setpoint Lower
0:0034	Aux1 Setpoint Raise
0:0035	Remote Aux1 Enable
0:0036	Remote Aux1 Disable
0:0037	Go To Mod Aux1 Setpoint
0:0038	Spare
0:0039	Select Remote
0:0040	Select Local
0:0041	Spare
0:0042	Alarm Horn Acknowledge
0:0043	Spare
0:0044	Aux2 Enable
0:0045	Aux2 Disable
0:0046	Aux2 Setpoint Lower
0:0047	Aux2 Setpoint Raise
0:0048	Remote Aux2 Enable
0:0049	Remote Aux2 Disable
0:0050	Go To Mod Aux2 Setpoint

0:0051	Spare
0:0052	Lower Min Load Setting
0:0053	Raise Min Load Setting
0:0054	Spare
0:0055	Spare
0:0056	Spare
0:0057	Enable P1
0:0058	Disable P1
0:0059	Lower P1 Setpoint
0:0060	Raise P1 Setpoint
0:0061	Remote P1 Setpoint Enable
0:0062	Remote P1 Setpoint Disable
0:0063	Go To P1 Mod Setpoint
0:0064	Raise V2 Limiter
0:0065	Lower V2 Limiter
0:0066	Select Primary Priority Mode
0:0067	Select Secondary Priority Mode
0:0068	Spare
0:0069	Spare0:0070 Enable P2
0:0071	Disable P2
0:0072	Lower P2 Setpoint
0:0073	Raise P2 Setpoint
0:0074	Enable P2 Remote Setpoint
0:0075	Disable P2 Remote Setpoint
0:0076	Go To P2 Mod Setpoint
0:0077	Raise V3 Limiter
0:0078	Lower V3 Limiter
0:0079	Spare
0:0080	Spare
0:0081	Spare
0:0082	Spare
0:0083	Spare
0:0084	Spare
0:0085	Spare
0:0086	Spare
0:0087	Spare
0:0088	Spare
0:0089	Spare
0:0090	Enable P1 Manual Control
0:0091	Disable P1 Manual Control
0:0092	Enable P2 Manual Control
0:0093	Disable P2 Manual Control
0:0094	Enable Flow Demand Remote Input
0:0095	Disable Flow Demand Remote Input
0:0096	Go to Mod P1 Manual Setpoint
0:0097	Go to Mod P2 Manual Setpoint
0:0098	Spare
0:0099	Spare

Table 7-5a. Boolean Write Addresses

Modbus Boolean Reads

Addr	Description	OPC	
1:0001	001: Speed Input #1 Failed	ALARMS.ANY.SEL_1	AR[351]->B0
1:0002	002: Speed Input #2 Failed	ALARMS.ANY.SEL_2	AR[351]->B1
1:0003	003: Speed Input #3 Failed	ALARMS.ANY.SEL_3	AR[351]->B2
1:0004	004: Speed Input #4 Failed	ALARMS.ANY.SEL_4	AR[351]->B3
1:0005	005: KW Input Failed	ALARMS.ANY.SEL_5	AR[351]->B4
1:0006	006: Remote Spd Setpt Input Failed	ALARMS.ANY.SEL_6	AR[351]->B5
1:0007	007: Cascade Input Failed	ALARMS.ANY.SEL_7	AR[351]->B6
1:0008	008: Remote Casc Setpt Input Failed	ALARMS.ANY.SEL_8	AR[351]->B7
1:0009	009: Aux 1 Input Failed	ALARMS.ANY.SEL_9	AR[351]->B8
1:0010	010: Aux 1 Remote Setpt Input Failed	ALARMS.ANY.SEL_10	AR[351]->B9
1:0011	011: Aux 2 Input Failed	ALARMS.ANY.SEL_11	AR[351]->B10
1:0012	012: Aux 2 Remote Setpt Input Failed	ALARMS.ANY.SEL_12	AR[351]->B11
1:0013	013: Sync Input Failed	ALARMS.ANY.SEL_13	AR[351]->B12
1:0014	014: Sync / Loadshare Input Failed	ALARMS.ANY.SEL_14	AR[351]->B13
1:0015	015: Loadshare Input Failed	ALARMS.ANY.SEL_15	AR[351]->B14
1:0016	016: Heat Soak Input Failed	ALARMS.ANY.SEL_16	AR[351]->B15
1:0017	017: First Stage Pressure Input Failed	ALARMS.ANY.SEL_17	AR[352]->B0
1:0018	018: SG PID Input Failed	ALARMS.ANY.SEL_18	AR[352]->B1
1:0019	019: SG PID Setpoint Input Failed	ALARMS.ANY.SEL_19	AR[352]->B2
1:0020	020: P1 Input Failed	ALARMS.ANY.SEL_20	AR[352]->B3
1:0021	021: P1 Setpoint Input Failed	ALARMS.ANY.SEL_21	AR[352]->B4
1:0022	022: Pressure Comp Input Failed	ALARMS.ANY.SEL_22	AR[352]->B5
1:0023	023: Inlet Pres Input Failed	ALARMS.ANY.SEL_23	AR[352]->B6
1:0024	024: Inlet Pres Setpt Input Failed	ALARMS.ANY.SEL_24	AR[352]->B7
1:0025	025: Exhaust Pres Input Failed	ALARMS.ANY.SEL_25	AR[352]->B8
1:0026	026: Exhaust Pres Setpt Input Failed	ALARMS.ANY.SEL_26	AR[352]->B9
1:0027	027: P2 Input Failed	ALARMS.ANY.SEL_27	AR[352]->B10
1:0028	028: P2 Setpoint Input Failed	ALARMS.ANY.SEL_28	AR[352]->B11
1:0029	029: KW Input F	ALARMS.ANY.SEL_29	AR[352]->B12
1:0030	030: Remote Speed Setpt Input F	ALARMS.ANY.SEL_30	AR[352]->B13
1:0031	031: Cascade Input F	ALARMS.ANY.SEL_31	AR[352]->B14
1:0032	032: Remote Cascade Setpt Input F	ALARMS.ANY.SEL_32	AR[352]->B15
1:0033	033: Aux 1 Input F	ALARMS.ANY.SEL_33	AR[353]->B0
1:0034	034: Aux 1 Remote Setpt Input F	ALARMS.ANY.SEL_34	AR[353]->B1
1:0035	035: Aux 2 Input F	ALARMS.ANY.SEL_35	AR[353]->B2
1:0036	036: Aux 2 Remote Setpt Input F	ALARMS.ANY.SEL_36	AR[353]->B3
1:0037	037: Sync Input F	ALARMS.ANY.SEL_37	AR[353]->B4
1:0038	038: Sync / Loadshare Input F	ALARMS.ANY.SEL_38	AR[353]->B5
1:0039	039: Loadshare Input F	ALARMS.ANY.SEL_39	AR[353]->B6
1:0040	040: Heat Soak Input F	ALARMS.ANY.SEL_40	AR[353]->B7
1:0041	041: First Stage Pressure Input F	ALARMS.ANY.SEL_41	AR[353]->B8
1:0042	042: SG PID Input F	ALARMS.ANY.SEL_42	AR[353]->B9
1:0043	043: SG PID Setpt Input F	ALARMS.ANY.SEL_43	AR[353]->B10
1:0044	044: P1 Input F	ALARMS.ANY.SEL_44	AR[353]->B11
1:0045	045: P1 Setpt Input F	ALARMS.ANY.SEL_45	AR[353]->B12
1:0046	046: Pressure Comp Input F	ALARMS.ANY.SEL_46	AR[353]->B13
1:0047	047: Inlet Pressure Input F	ALARMS.ANY.SEL_47	AR[353]->B14
1:0048	048: Inlet Pressure Setpt Input F	ALARMS.ANY.SEL_48	AR[353]->B15
1:0049	049: Exhaust Pressure Input F	ALARMS.ANY.SEL_49	AR[354]->B0
1:0050	050: Exhaust Pressure Setpt Input F	ALARMS.ANY.SEL_50	AR[354]->B1

1:0051	051: P2 Input F	ALARMS.ANY.SEL_51	AR[354]->B2
1:0052	052: P2 Setpt Input F	ALARMS.ANY.SEL_52	AR[354]->B3
1:0053	053: Slot 2 AIO Module Failed	ALARMS.ANY.SEL_53	AR[354]->B4
1:0054	054: Slot 3 AIO Module Failed	ALARMS.ANY.SEL_54	AR[354]->B5
1:0055	055: External Trip F	ALARMS.ANY.SEL_55	AR[354]->B6
1:0056	056: Reset F	ALARMS.ANY.SEL_56	AR[354]->B7
1:0057	057: Speed Raise F	ALARMS.ANY.SEL_57	AR[354]->B8
1:0058	058: Speed Lower F	ALARMS.ANY.SEL_58	AR[354]->B9
1:0059	059: Generator Brkr Closed F	ALARMS.ANY.SEL_59	AR[354]->B10
1:0060	060: Utility Brkr Closed F	ALARMS.ANY.SEL_60	AR[354]->B11
1:0061	061: Enable Overspeed Test F	ALARMS.ANY.SEL_61	AR[354]->B12
1:0062	062: External Run (Start) F	ALARMS.ANY.SEL_62	AR[354]->B13
1:0063	063: Start Permissive F	ALARMS.ANY.SEL_63	AR[354]->B14
1:0064	064: Idle/Rated F	ALARMS.ANY.SEL_64	AR[354]->B15
1:0065	065: Enable Synchronization F	ALARMS.ANY.SEL_65	AR[355]->B0
1:0066	066: Controlled Shutdown F	ALARMS.ANY.SEL_66	AR[355]->B1
1:0067	067: Halt/Continue Auto Seq F	ALARMS.ANY.SEL_67	AR[355]->B2
1:0068	068: Override MPU Fault F	ALARMS.ANY.SEL_68	AR[355]->B3
1:0069	069: Select Online PID Dynamics F	ALARMS.ANY.SEL_69	AR[355]->B4
1:0070	070: Local/Remote F	ALARMS.ANY.SEL_70	AR[355]->B5
1:0071	071: E/D Remote Speed Setpt F	ALARMS.ANY.SEL_71	AR[355]->B6
1:0072	072: Arm/Disarm Frequency Control F	ALARMS.ANY.SEL_72	AR[355]->B7
1:0073	073: Raise P1 Extraction Setpt F	ALARMS.ANY.SEL_73	AR[355]->B8
1:0074	074: Lower P1 Extraction Setpt F	ALARMS.ANY.SEL_74	AR[355]->B9
1:0075	075: E/D P1 Control F	ALARMS.ANY.SEL_75	AR[355]->B10
1:0076	076: E/D P1 Remote Setpt F	ALARMS.ANY.SEL_76	AR[355]->B11
1:0077	077: Raise P2 Extraction Setpt F	ALARMS.ANY.SEL_77	AR[355]->B12
1:0078	078: Lower P2 Extraction Setpt F	ALARMS.ANY.SEL_78	AR[355]->B13
1:0079	079: E/D P2 Extraction Control F	ALARMS.ANY.SEL_79	AR[355]->B14
1:0080	080: E/D P2 Extr. Remote Setpt F	ALARMS.ANY.SEL_80	AR[355]->B15
1:0081	081: Select Priority Mode F	ALARMS.ANY.SEL_81	AR[356]->B0
1:0082	082: Raise Cascade Setpt F	ALARMS.ANY.SEL_82	AR[356]->B1
1:0083	083: Lower Cascade Setpt F	ALARMS.ANY.SEL_83	AR[356]->B2
1:0084	084: E/D Cascade Control F	ALARMS.ANY.SEL_84	AR[356]->B3
1:0085	085: E/D Cascade Remote Setpt F	ALARMS.ANY.SEL_85	AR[356]->B4
1:0086	086: Raise Aux-1 Setpt F	ALARMS.ANY.SEL_86	AR[356]->B5
1:0087	087: Lower Aux-1 Setpt F	ALARMS.ANY.SEL_87	AR[356]->B6
1:0088	088: E/D Aux-1 Control F	ALARMS.ANY.SEL_88	AR[356]->B7
1:0089	089: E/D Aux-1 Remote Setpt F	ALARMS.ANY.SEL_89	AR[356]->B8
1:0090	090: Raise Aux-2 Setpt F	ALARMS.ANY.SEL_90	AR[356]->B9
1:0091	091: Lower Aux-2 Setpt F	ALARMS.ANY.SEL_91	AR[356]->B10
1:0092	092: E/D Aux-2 Control F	ALARMS.ANY.SEL_92	AR[356]->B11
1:0093	093: E/D Aux-2 Remote Setpt F	ALARMS.ANY.SEL_93	AR[356]->B12
1:0094	094: Open HP/V1 Valve Limiter F	ALARMS.ANY.SEL_94	AR[356]->B13
1:0095	095: Close HP/V1 Valve Limiter F	ALARMS.ANY.SEL_95	AR[356]->B14
1:0096	096: Open IP/V2 Valve Limiter F	ALARMS.ANY.SEL_96	AR[356]->B15
1:0097	097: Close IP/V2 Valve Limiter F	ALARMS.ANY.SEL_97	AR[357]->B0
1:0098	098: Open LP/V3 Valve Limiter F	ALARMS.ANY.SEL_98	AR[357]->B1
1:0099	099: Close LP/V3 Valve Limiter F	ALARMS.ANY.SEL_99	AR[357]->B2
1:0100	100: Raise P1 Extraction Demand F	ALARMS.ANY.SEL_100	AR[357]->B3
1:0101	101: Lower P1 Extraction Demand F	ALARMS.ANY.SEL_101	AR[357]->B4
1:0102	102: Enbl/Dsbl P1 Extraction Demand F	ALARMS.ANY.SEL_102	AR[357]->B5
1:0103	103: Enbl/Dsbl P1 Remote Demand F	ALARMS.ANY.SEL_103	AR[357]->B6

1:0104	104: Raise P2 Extraction Demand F	ALARMS.ANY.SEL_104	AR[357]->B7
1:0105	105: Lower P2 Extraction Demand F	ALARMS.ANY.SEL_105	AR[357]->B8
1:0106	106: Enbl/Dsbl P2 Extraction Demand F	ALARMS.ANY.SEL_106	AR[357]->B9
1:0107	107: Enbl/Dsbl P2 Remote Demand F	ALARMS.ANY.SEL_107	AR[357]->B10
1:0108	108: External Trip 1 F	ALARMS.ANY.SEL_108	AR[357]->B11
1:0109	109: External Trip 2 F	ALARMS.ANY.SEL_109	AR[357]->B12
1:0110	110: External Trip 3 F	ALARMS.ANY.SEL_110	AR[357]->B13
1:0111	111: External Trip 4 F	ALARMS.ANY.SEL_111	AR[357]->B14
1:0112	112: External Trip 5 F	ALARMS.ANY.SEL_112	AR[357]->B15
1:0113	113: External Trip 6 F	ALARMS.ANY.SEL_113	AR[358]->B0
1:0114	114: External Trip 7 F	ALARMS.ANY.SEL_114	AR[358]->B1
1:0115	115: External Trip 8 F	ALARMS.ANY.SEL_115	AR[358]->B2
1:0116	116: External Trip 9 F	ALARMS.ANY.SEL_116	AR[358]->B3
1:0117	117: External Trip 10 F	ALARMS.ANY.SEL_117	AR[358]->B4
1:0118	118: Spare	ALARMS.ANY.SEL_118	AR[358]->B5
1:0119	119: Spare	ALARMS.ANY.SEL_119	AR[358]->B6
1:0120	120: Spare	ALARMS.ANY.SEL_120	AR[358]->B7
1:0121	121: Spare	ALARMS.ANY.SEL_121	AR[358]->B8
1:0122	122: Spare	ALARMS.ANY.SEL_122	AR[358]->B9
1:0123	123: Spare	ALARMS.ANY.SEL_123	AR[358]->B10
1:0124	124: Spare	ALARMS.ANY.SEL_124	AR[358]->B11
1:0125	125: Spare	ALARMS.ANY.SEL_125	AR[358]->B12
1:0126	126: Spare	ALARMS.ANY.SEL_126	AR[358]->B13
1:0127	127: Spare	ALARMS.ANY.SEL_127	AR[358]->B14
1:0128	128: Spare	ALARMS.ANY.SEL_128	AR[358]->B15
1:0129	129: Spare	ALARMS.ANY.SEL_129	AR[359]->B0
1:0130	130: Auto-Sync Real-Time Clock F	ALARMS.ANY.SEL_130	AR[359]->B1
1:0131	131: External Alarm 1 F	ALARMS.ANY.SEL_131	AR[359]->B2
1:0132	132: External Alarm 2 F	ALARMS.ANY.SEL_132	AR[359]->B3
1:0133	133: External Alarm 3 F	ALARMS.ANY.SEL_133	AR[359]->B4
1:0134	134: External Alarm 4 F	ALARMS.ANY.SEL_134	AR[359]->B5
1:0135	135: External Alarm 5 F	ALARMS.ANY.SEL_135	AR[359]->B6
1:0136	136: External Alarm 6 F	ALARMS.ANY.SEL_136	AR[359]->B7
1:0137	137: External Alarm 7 F	ALARMS.ANY.SEL_137	AR[359]->B8
1:0138	138: External Alarm 8 F	ALARMS.ANY.SEL_138	AR[359]->B9
1:0139	139: External Alarm 9 F	ALARMS.ANY.SEL_139	AR[359]->B10
1:0140	140: External Alarm 10 F	ALARMS.ANY.SEL_140	AR[359]->B11
1:0141	141: Slot 5 DIO Module Failed	ALARMS.ANY.SEL_141	AR[359]->B12
1:0142	142: Slot 6 DIO Module Failed	ALARMS.ANY.SEL_142	AR[359]->B13
1:0143	143: AO 01 Analog Output Fault	ALARMS.ANY.SEL_143	AR[359]->B14
1:0144	144: AO 02 Analog Output Fault	ALARMS.ANY.SEL_144	AR[359]->B15
1:0145	145: AO 03 Analog Output Fault	ALARMS.ANY.SEL_145	AR[360]->B0
1:0146	146: AO 04 Analog Output Fault	ALARMS.ANY.SEL_146	AR[360]->B1
1:0147	147: AO 05 Analog Output Fault	ALARMS.ANY.SEL_147	AR[360]->B2
1:0148	148: AO 06 Analog Output Fault	ALARMS.ANY.SEL_148	AR[360]->B3
1:0149	149: AO 07 Analog Output Fault	ALARMS.ANY.SEL_149	AR[360]->B4
1:0150	150: AO 08 Analog Output Fault	ALARMS.ANY.SEL_150	AR[360]->B5
1:0151	151: Act 01 Output Fault	ALARMS.ANY.SEL_151	AR[360]->B6
1:0152	152: Act 02 Output Fault	ALARMS.ANY.SEL_152	AR[360]->B7
1:0153	153: Act 03 Output Fault	ALARMS.ANY.SEL_153	AR[360]->B8
1:0154	154: Act 04 Output Fault	ALARMS.ANY.SEL_154	AR[360]->B9
1:0155	155: Act 05 Output Fault	ALARMS.ANY.SEL_155	AR[360]->B10
1:0156	156: Act 06 Output Fault	ALARMS.ANY.SEL_156	AR[360]->B11

1:0157	157: Spare	ALARMS.ANY.SEL_157	AR[360]->B12
1:0158	158: Turbine Trip	ALARMS.ANY.SEL_158	AR[360]->B13
1:0159	159: Overspeed Alarm	ALARMS.ANY.SEL_159	AR[360]->B14
1:0160	160: Speed Stuck in Critical	ALARMS.ANY.SEL_160	AR[360]->B15
1:0161	161: Rmt Spd Setpt Stuck in Critical	ALARMS.ANY.SEL_161	AR[361]->B0
1:0162	162: Tie Breaker Opened	ALARMS.ANY.SEL_162	AR[361]->B1
1:0163	163: Gen Breaker Opened	ALARMS.ANY.SEL_163	AR[361]->B2
1:0164	164: External Alarm #1	ALARMS.ANY.SEL_164	AR[361]->B3
1:0165	165: External Alarm #2	ALARMS.ANY.SEL_165	AR[361]->B4
1:0166	166: External Alarm #3	ALARMS.ANY.SEL_166	AR[361]->B5
1:0167	167: External Alarm #4	ALARMS.ANY.SEL_167	AR[361]->B6
1:0168	168: External Alarm #5	ALARMS.ANY.SEL_168	AR[361]->B7
1:0169	169: External Alarm #6	ALARMS.ANY.SEL_169	AR[361]->B8
1:0170	170: External Alarm #7	ALARMS.ANY.SEL_170	AR[361]->B9
1:0171	171: External Alarm #8	ALARMS.ANY.SEL_171	AR[361]->B10
1:0172	172: External Alarm #9	ALARMS.ANY.SEL_172	AR[361]->B11
1:0173	173: External Alarm #10	ALARMS.ANY.SEL_173	AR[361]->B12
1:0174	174: Power Supply #1 Fault	ALARMS.ANY.SEL_174	AR[361]->B13
1:0175	175: Power Supply #2 Fault	ALARMS.ANY.SEL_175	AR[361]->B14
1:0176	176: Chassis Temperature Alarm	ALARMS.ANY.SEL_176	AR[361]->B15
1:0177	177: Chassis Fan Fault	ALARMS.ANY.SEL_177	AR[362]->B0
1:0178	178: Left CPU Fault	ALARMS.ANY.SEL_178	AR[362]->B1
1:0179	179: Right CPU Fault	ALARMS.ANY.SEL_179	AR[362]->B2
1:0180	180: Modbus #1 Link Error	ALARMS.ANY.SEL_180	AR[362]->B3
1:0181	181: Modbus #2 Link Error	ALARMS.ANY.SEL_181	AR[362]->B4
1:0182	182: Modbus #3 Link Error	ALARMS.ANY.SEL_182	AR[362]->B5
1:0183	Spare	ALARMS.ANY.SEL_183	AR[362]->B6
1:0184	Spare	ALARMS.ANY.SEL_184	AR[362]->B7
1:0185	Spare	ALARMS.ANY.SEL_185	AR[362]->B8
1:0186	Spare	ALARMS.ANY.SEL_186	AR[362]->B9
1:0187	Spare	ALARMS.ANY.SEL_187	AR[362]->B10
1:0188	Spare	ALARMS.ANY.SEL_188	AR[362]->B11
1:0189	Spare	ALARMS.ANY.SEL_189	AR[362]->B12
1:0190	Spare	ALARMS.ANY.SEL_190	AR[362]->B13
1:0191	Spare	ALARMS.ANY.SEL_191	AR[362]->B14
1:0192	Spare	ALARMS.ANY.SEL_192	AR[362]->B15
1:0193	Spare	ALARMS.ANY.SEL_193	AR[363]->B0
1:0194	Spare	ALARMS.ANY.SEL_194	AR[363]->B1
1:0195	Spare	ALARMS.ANY.SEL_195	AR[363]->B2
1:0196	Spare	ALARMS.ANY.SEL_196	AR[363]->B3
1:0197	Spare	ALARMS.ANY.SEL_197	AR[363]->B4
1:0198	Spare	ALARMS.ANY.SEL_198	AR[363]->B5
1:0199	Spare	ALARMS.ANY.SEL_199	AR[363]->B6
1:0200	Spare	ALARMS.ANY.SEL_200	AR[363]->B7
1:0201	001: External Trip Input	SHUTDOWNS.ANY.SEL_1	AR[363]->B8
1:0202	002: External Trip 1	SHUTDOWNS.ANY.SEL_2	AR[363]->B9
1:0203	003: External Trip 2	SHUTDOWNS.ANY.SEL_3	AR[363]->B10
1:0204	004: External Trip 3	SHUTDOWNS.ANY.SEL_4	AR[363]->B11
1:0205	005: External Trip 4	SHUTDOWNS.ANY.SEL_5	AR[363]->B12
1:0206	006: External Trip 5	SHUTDOWNS.ANY.SEL_6	AR[363]->B13
1:0207	007: External Trip 6	SHUTDOWNS.ANY.SEL_7	AR[363]->B14
1:0208	008: External Trip 7	SHUTDOWNS.ANY.SEL_8	AR[363]->B15
1:0209	009: External Trip 8	SHUTDOWNS.ANY.SEL_9	AR[364]->B0

1:0210	010: External Trip 9	SHUTDOWNS.ANY.SEL_10	AR[364]->B1
1:0211	011: External Trip 10	SHUTDOWNS.ANY.SEL_11	AR[364]->B2
1:0212	012: Overspeed Trip	SHUTDOWNS.ANY.SEL_12	AR[364]->B3
1:0213	013: Loss of Speed Signals	SHUTDOWNS.ANY.SEL_13	AR[364]->B4
1:0214	014: Act 01 Output Fault	SHUTDOWNS.ANY.SEL_14	AR[364]->B5
1:0215	015: Act 02 Output Fault	SHUTDOWNS.ANY.SEL_15	AR[364]->B6
1:0216	016: Act 03 Output Fault	SHUTDOWNS.ANY.SEL_16	AR[364]->B7
1:0217	017: Act 04 Output Fault	SHUTDOWNS.ANY.SEL_17	AR[364]->B8
1:0218	018: Act 05 Output Fault	SHUTDOWNS.ANY.SEL_18	AR[364]->B9
1:0219	019: Act 06 Output Fault	SHUTDOWNS.ANY.SEL_19	AR[364]->B10
1:0220	020: Spare	SHUTDOWNS.ANY.SEL_20	AR[364]->B11
1:0221	021: Aux 1 Input Failed	SHUTDOWNS.ANY.SEL_21	AR[364]->B12
1:0222	022: Aux 2 Input Failed	SHUTDOWNS.ANY.SEL_22	AR[364]->B13
1:0223	023: P1 Input Failed	SHUTDOWNS.ANY.SEL_23	AR[364]->B14
1:0224	024: P2 Input Failed	SHUTDOWNS.ANY.SEL_24	AR[364]->B15
1:0225	025: Speed in Critical Band Too Long	SHUTDOWNS.ANY.SEL_25	AR[365]->B0
1:0226	026: Gen Breaker Open Trip	SHUTDOWNS.ANY.SEL_26	AR[365]->B1
1:0227	027: Tie Breaker Open Trip	SHUTDOWNS.ANY.SEL_27	AR[365]->B2
1:0228	028: Power Up Trip	SHUTDOWNS.ANY.SEL_28	AR[365]->B3
1:0229	029: Controlled Shutdown Complete	SHUTDOWNS.ANY.SEL_29	AR[365]->B4
1:0230	030: Configure Active Shutdown	SHUTDOWNS.ANY.SEL_30	AR[365]->B5
1:0231	031: Configure Error Shutdown	SHUTDOWNS.ANY.SEL_31	AR[365]->B6
1:0232	032: Modbus Link #1 Trip	SHUTDOWNS.ANY.SEL_32	AR[365]->B7
1:0233	033: Modbus Link #2 Trip	SHUTDOWNS.ANY.SEL_33	AR[365]->B8
1:0234	034: Modbus Link #3 Trip	SHUTDOWNS.ANY.SEL_34	AR[365]->B9
1:0235	Spare	FALSE	AR[365]->B10
1:0236	Spare	FALSE	AR[365]->B11
1:0237	Spare	FALSE	AR[365]->B12
1:0238	Spare	FALSE	AR[365]->B13
1:0239	Spare	FALSE	AR[365]->B14
1:0240	Spare	FALSE	AR[365]->B15
1:0241	Spare	FALSE	AR[366]->B0
1:0242	Spare	FALSE	AR[366]->B1
1:0243	Spare	FALSE	AR[366]->B2
1:0244	Spare	FALSE	AR[366]->B3
1:0245	Spare	FALSE	AR[366]->B4
1:0246	Spare	FALSE	AR[366]->B5
1:0247	A shutdown is active (before latch)	SHUTDOWNS.ANY_ACTIVE.B_NAME	AR[366]->B6
1:0248	Spare	FALSE	AR[366]->B7
1:0249	Left CPU is Syscon	CHASSIS.L_SYSCON.B_NAME	AR[366]->B8
1:0250	Right CPU is Syscon	CHASSIS.R_SYSCON.B_NAME	AR[366]->B9
1:0251	Alarm Not Acknowledged	ALARMS.UNACK_ALM.B_NAME	AR[366]->B10
1:0252	Alarm Acknowledged	ALARMS.ACK_ALM.B_NAME	AR[366]->B11
1:0253	Alarm Exists (Common Alarm Indication)	ALARMS.ALM_ACTIVE.B_NAME	AR[366]->B12
1:0254	Shutdown Exists (Trip Indication)	SHUTDOWNS.SD.B_NAME	AR[366]->B13
1:0255	ESD Acknowledge Enabled	MOD1.MOD_OS.ONE_SHOT	AR[366]->B14
1:0256	Moving to Min Setpoint (no auto start)	START.GO_TO_MIN.B_NAME	AR[366]->B15
1:0257	Ramping to Idl (idl/rtd)/ LoIdl (Aseq)	START.GO_TO_LO.B_NAME	AR[367]->B0
1:0258	Idle / Rated at Idle	START.AT_LO.B_NAME	AR[367]->B1
1:0259	Ramping to Rated (Idle / Rated)	START.GO_TO_RTD.B_NAME	AR[367]->B2
1:0260	Idle / Rated At Rated	START.NORMAL.B_NAME	AR[367]->B3
1:0261	Auto Seq - Setpt at Lo Idle	START.AT_LO.B_NAME	AR[367]->B4
1:0262	Auto Seq - Ramping to Mid Idle	START.GO_TO_MID.B_NAME	AR[367]->B5

1:0263	Auto Seq - Setpt at Mid Idle	START.AT_MID.B_NAME	AR[367]->B6
1:0264	Auto Seq - Ramping to High Idle	START.GO_TO_HI.B_NAME	AR[367]->B7
1:0265	Auto Seq - Setpt at High Idle	START.AT_HI.B_NAME	AR[367]->B8
1:0266	Auto Seq - Ramping to Rated	START.GO_TO_RTD.B_NAME	AR[367]->B9
1:0267	Auto Seq - At Rated	START.NORMAL.B_NAME	AR[367]->B10
1:0268	Auto Seq - Halted	START.HALT.B_NAME	AR[367]->B11
1:0269	Speed PID In Control of LSS (not aux)	SPD_CTRL.SPD_IN_CTL.B_NAME	AR[367]->B12
1:0270	Speed Sensors Failed Overide ON	SPD_CTRL.OVERIDE1.B_NAME	AR[367]->B13
1:0271	Spare	FALSE	AR[367]->B14
1:0272	Spare	FALSE	AR[367]->B15
1:0273	Spare	FALSE	AR[368]->B0
1:0274	This Modbus Active	CNFG_UNT.MOD1_ENABL.B_NAME	AR[368]->B1
1:0275	This Modbus ESD Active	MOD1.ESD_ON.OR	AR[368]->B2
1:0276	Overspeed Test Permissive	IFACE_TURB.OSPD_PERM.NOT	AR[368]->B3
1:0277	Internal Overspeed Test Enabled	IFACE_TURB.LATCH_OSPD.LATCH_R	AR[368]->B4
1:0278	External Overspeed Test Enabled	IFACE_TURB.LATCH_EXT.LATCH_R	AR[368]->B5
1:0279	Speed At or Above Min Gov	SPD_CTRL.GT_MINGOV.B_NAME	AR[368]->B6
1:0280	Speed In Critical Speed Band	SEQ.SP_IN_CRIT.B_NAME	AR[368]->B7
1:0281	Remote/Local Remote Selected	CNFG_UNT.IN_REMOTE.B_NAME	AR[368]->B8
1:0282	Online Speed Dynamics Selected	SPD_CTRL.SW_DYN.B_SW	AR[368]->B9
1:0283	Start Permissive	START.PERM_MET.B_NAME	AR[368]->B10
1:0284	Zero Speed Detected	SPD_CTRL.ZERO_SPD.B_NAME	AR[368]->B11
1:0285	Speed Above Internal Overspeed	SPD_CTRL.ABVE_TEST.B_NAME	AR[368]->B12
1:0286	Remote Speed Setpt Is Enabled	IFACE_SPD.REM.LATCH_R	AR[368]->B13
1:0287	Remote Speed Setpt Is Active	IFACE_SPD.ACTIVE.B_ACTION	AR[368]->B14
1:0288	Remote Speed Setpt Is In Control	TURB_MESS.SPD_IN_CTR.AND	AR[368]->B15
1:0289	Remote Speed Setpt Is Inhibited	TURB_MESS.IH_REMSP.AND	AR[369]->B0
1:0290	Speed PID In Control (not limited)	SPD_CTRL.SPD_NO_LIM.B_NAME	AR[369]->B1
1:0291	Speed Setpoint Entry Inhibited	IFACE_SPD.SPD_DISABL.OR	AR[369]->B2
1:0292	Spare	FALSE	AR[369]->B3
1:0293	Generator Breaker Closed	IFACE_TURB.GEN_BRKR.B_NAME	AR[369]->B4
1:0294	Utility Tie Breaker Closed	IFACE_TURB.UTIL_BRKR.B_NAME	AR[369]->B5
1:0295	Synchronizing Rate Selected	SPD_SETPT.SYNCH_RATE.OR	AR[369]->B6
1:0296	Synchronizing Is Enabled	SYNC_SEL.SYNC.T_FLIPFLOP	AR[369]->B7
1:0297	Sync / Load Share In Control	LOAD_SHARE.LS_CTRL.AND	AR[369]->B8
1:0298	Sync / Load Share Inhibitied	SYNC_SEL.INHIBITED.OR	AR[369]->B9
1:0299	Frequency Control Armed	FREQ.FREQ_ARMD.B_SW	AR[369]->B10
1:0300	Frequency Control Active	FREQ.ISOCH.AND	AR[369]->B11
1:0301	Spare	FALSE	AR[369]->B12
1:0302	Spare	FALSE	AR[369]->B13
1:0303	Cascade Is Enabled	T_SPDCAS.CAS_ENBLD.B_NAME	AR[369]->B14
1:0304	Cascade Is Active	T_SPDCAS.CASC_ACTV.B_NAME	AR[369]->B15
1:0305	Cascade Is In Control	TURB_MESS.AND_CTRL.AND	AR[370]->B0
1:0306	Cascade Is Inhibited	T_SPDCAS.INHIBITED.B_NAME	AR[370]->B1
1:0307	Remote Cascade Is Enabled	IFACE_CAS.REM.LATCH_R	AR[370]->B2
1:0308	Remote Cascade Is Active	IFACE_CAS.ACTIVE.B_ACTION	AR[370]->B3
1:0309	Remote Cascade Is In Control	TURB_MESS.CAS_IN_CTR.AND	AR[370]->B4
1:0310	Remote Cascade Is Inhibited	TURB_MESS.IH_REMCAS.AND	AR[370]->B5
1:0311	Spare	FALSE	AR[370]->B6
1:0312	Spare	FALSE	AR[370]->B7
1:0313	Auxiliary 1 Is Enabled	AUX1_ENBL.AUX_EN.B_SW	AR[370]->B8
1:0314	Auxiliary 1 Is Active	AUX1_ACTIV.USE_AUX.AND	AR[370]->B9
1:0315	Auxiliary 1 Is In Control	AUX1_STAT.AUX_INCTRL.AND	AR[370]->B10

1:0316	Aux 1 Active / Not Limiting	AUX1_STAT.IN_CTL_LMT.NC	AR[370]->B11
1:0317	Aux 1 Active / Not In Control	AUX1_STAT.IN_CTL_LMT.NO	AR[370]->B12
1:0318	Auxiliary 1 Is Inhibited	AUX1_ENBL.INHIB.B_SW	AR[370]->B13
1:0319	Remote Aux 1 Is Enabled	RMT_AUX1.RMT_AUX.T_FLIPFLOP	AR[370]->B14
1:0320	Remote Aux 1 Is Active	RMT_AUX1.REM_SEL.AND	AR[370]->B15
1:0321	Remote Aux 1 Is In Control	AUX1_STAT.RMT_AUXCTL.AND	AR[371]->B0
1:0322	Remote Aux 1 Is Inhibited	RMT_AUX1.INHIBITED.OR	AR[371]->B1
1:0323	Spare	FALSE	AR[371]->B2
1:0324	Spare	FALSE	AR[371]->B3
1:0325	Auxiliary 2 Is Enabled	AUX2_ENBL.AUX_EN.B_SW	AR[371]->B4
1:0326	Auxiliary 2 Is Active	AUX2_ACTIV.USE_AUX.AND	AR[371]->B5
1:0327	Auxiliary 2 Is In Control	AUX2_STAT.AUX_INCTRL.AND	AR[371]->B6
1:0328	Aux 2 Active / Not Limiting	AUX2_STAT.IN_CTL_LMT.NC	AR[371]->B7
1:0329	Aux 2 Active / Not In Control	AUX2_STAT.IN_CTL_LMT.NO	AR[371]->B8
1:0330	Auxiliary 2 Is Inhibited	AUX2_ENBL.INHIB.B_SW	AR[371]->B9
1:0331	Remote Aux 2 Is Enabled	RMT_AUX2.RMT_AUX.T_FLIPFLOP	AR[371]->B10
1:0332	Remote Aux 2 Is Active	RMT_AUX2.REM_SEL.AND	AR[371]->B11
1:0333	Remote Aux 2 Is In Control	AUX2_STAT.RMT_AUXCTL.AND	AR[371]->B12
1:0334	Remote Aux 2 Is Inhibited	RMT_AUX2.INHIBITED.OR	AR[371]->B13
1:0335	Spare	FALSE	AR[371]->B14
1:0336	Spare	FALSE	AR[371]->B15
1:0337	P1 Extraction Is Enabled	P1.EXTR_ENBL.B_NAME	AR[372]->B0
1:0338	P1 Extraction Is Active	P1.ACTIVE.B_NAME	AR[372]->B1
1:0339	P1 Extr. Is In Control (not limited)	V2.V2_MAP_C.B_NAME	AR[372]->B2
1:0340	P1 Extraction Is Inhibited	P1.NO_EXT_PER.B_NAME	AR[372]->B3
1:0341	Remote P1 Extr Is Enabled	IFACE_P1.REM.LATCH_R	AR[372]->B4
1:0342	Remote P1 Extr Is Active	IFACE_P1.ACTIVE.B_ACTION	AR[372]->B5
1:0343	Remote P1 Extr Is In Control	IFACE_P1.ENABLE_RMT.LATCH_R	AR[372]->B6
1:0344	Remote P1 Extr Is Inhibited	IFACE_P1.INHIBITREM.OR	AR[372]->B7
1:0345	P1 Setpoint Entry Inhibited	IFACE_P1.P1_DISABL.OR	AR[372]->B8
1:0346	Spare	FALSE	AR[372]->B9
1:0347	Spare	FALSE	AR[372]->B10
1:0348	Spare	FALSE	AR[372]->B11
1:0349	Spare	FALSE	AR[372]->B12
1:0350	Spare	FALSE	AR[372]->B13
1:0351	Spare	FALSE	AR[372]->B14
1:0352	Spare	FALSE	AR[372]->B15
1:0353	Spare	FALSE	AR[373]->B0
1:0354	Spare	FALSE	AR[373]->B1
1:0355	Spare	FALSE	AR[373]->B2
1:0356	Spare	FALSE	AR[373]->B3
1:0357	P2 Extraction Is Enabled	P2.EXTR_ENBL.B_NAME	AR[373]->B4
1:0358	P2 Extraction Is Active	P2.ACTIVE.B_NAME	AR[373]->B5
1:0359	P2 Extr. Is In Control (not limited)	V3.V3_MAP_C.B_NAME	AR[373]->B6
1:0360	P2 Extraction Is Inhibited	P2.NO_EXT_PER.B_NAME	AR[373]->B7
1:0361	Remote P2 Extr Is Enabled	IFACE_P2.REM.LATCH_R	AR[373]->B8
1:0362	Remote P2 Extr Is Active	IFACE_P2.ACTIVE.B_ACTION	AR[373]->B9
1:0363	Remote P2 Extr Is In Control	IFACE_P2.ENABLE_RMT.LATCH_R	AR[373]->B10
1:0364	Remote P2 Extr Is Inhibited	IFACE_P2.INHIBITREM.OR	AR[373]->B11
1:0365	P2 Setpoint Entry Inhibited	IFACE_P2.P2_DISABL.OR	AR[373]->B12
1:0366	Spare	FALSE	AR[373]->B13
1:0367	P2 Manual is Enabled	P2_FLOW.OR_MANEXT.LATCH	AR[373]->B14
1:0368	Spare	FALSE	AR[373]->B15

1:0369	Spare	FALSE	AR[374]->B0
1:0370	Spare	FALSE	AR[374]->B1
1:0371	Spare	FALSE	AR[374]->B2
1:0372	Spare	FALSE	AR[374]->B3
1:0373	Spare	FALSE	AR[374]->B4
1:0374	Spare	FALSE	AR[374]->B5
1:0375	Spare	FALSE	AR[374]->B6
1:0376	Spare	FALSE	AR[374]->B7
1:0377	Spare	FALSE	AR[374]->B8
1:0378	Spare	FALSE	AR[374]->B9
1:0379	Spare	FALSE	AR[374]->B10
1:0380	Spare	FALSE	AR[374]->B11
1:0381	Spare	FALSE	AR[374]->B12
1:0382	Spare	FALSE	AR[374]->B13
1:0383	Extra PID Control Is Enabled	FALSE	AR[374]->B14
1:0384	Extra PID Control Is Active	FALSE	AR[374]->B15
1:0385	Extra PID Steam Is In Control	FALSE	AR[375]->B0
1:0386	Extra PID Control is Inhibited	FALSE	AR[375]->B1
1:0387	Extra PID Remote Setpoint Is Enabled	FALSE	AR[375]->B2
1:0388	Extra PID Remote Setpoint Is Active	FALSE	AR[375]->B3
1:0389	Extra PID Remote Setpoint Is In Contro	FALSE	AR[375]->B4
1:0390	Extra PID Remote Setpoint Is Inhibited	FALSE	AR[375]->B5
1:0391	Spare	FALSE	AR[375]->B6
1:0392	Spare	FALSE	AR[375]->B7
1:0393	not used	FALSE	AR[375]->B8
1:0394	not used	FALSE	AR[375]->B9
1:0395	not used	FALSE	AR[375]->B10
1:0396	not used	FALSE	AR[375]->B11
1:0397	not used	FALSE	AR[375]->B12
1:0398	not used	FALSE	AR[375]->B13
1:0399	not used	FALSE	AR[375]->B14
1:0400	not used	FALSE	AR[375]->B15
1:0401	not used	FALSE	AR[376]->B0
1:0402	not used	FALSE	AR[376]->B1
1:0403	not used	FALSE	AR[376]->B2
1:0404	not used	FALSE	AR[376]->B3
1:0405	not used	FALSE	AR[376]->B4
1:0406	not used	FALSE	AR[376]->B5
1:0407	not used	FALSE	AR[376]->B6
1:0408	not used	FALSE	AR[376]->B7
1:0409	not used	FALSE	AR[376]->B8
1:0410	not used	FALSE	AR[376]->B9
1:0411	not used	FALSE	AR[376]->B10
1:0412	not used	FALSE	AR[376]->B11
1:0413	not used	FALSE	AR[376]->B12
1:0414	not used	FALSE	AR[376]->B13
1:0415	not used	FALSE	AR[376]->B14
1:0416	not used	FALSE	AR[376]->B15
1:0417	not used	FALSE	AR[377]->B0
1:0418	not used	FALSE	AR[377]->B1
1:0419	not used	FALSE	AR[377]->B2
1:0420	not used	FALSE	AR[377]->B3
1:0421	not used	FALSE	AR[377]->B4

1:0422	not used	FALSE	AR[377]->B5
1:0423	not used	FALSE	AR[377]->B6
1:0424	not used	FALSE	AR[377]->B7
1:0425	not used	FALSE	AR[377]->B8
1:0426	not used	FALSE	AR[377]->B9
1:0427	not used	FALSE	AR[377]->B10
1:0428	not used	FALSE	AR[377]->B11
1:0429	not used	FALSE	AR[377]->B12
1:0430	not used	FALSE	AR[377]->B13
1:0431	not used	FALSE	AR[377]->B14
1:0432	not used	FALSE	AR[377]->B15
1:0433	not used	FALSE	AR[378]->B0
1:0434	not used	FALSE	AR[378]->B1
1:0435	not used	FALSE	AR[378]->B2
1:0436	not used	FALSE	AR[378]->B3
1:0437	not used	FALSE	AR[378]->B4
1:0438	not used	FALSE	AR[378]->B5
1:0439	not used	FALSE	AR[378]->B6
1:0440	not used	FALSE	AR[378]->B7
1:0441	not used	FALSE	AR[378]->B8
1:0442	not used	FALSE	AR[378]->B9
1:0443	not used	FALSE	AR[378]->B10
1:0444	not used	FALSE	AR[378]->B11
1:0445	not used	FALSE	AR[378]->B12
1:0446	not used	FALSE	AR[378]->B13
1:0447	not used	FALSE	AR[378]->B14
1:0448	not used	FALSE	AR[378]->B15
1:0449	not used	FALSE	AR[379]->B0
1:0450	not used	FALSE	AR[379]->B1
1:0451	not used	FALSE	AR[379]->B2
1:0452	not used	FALSE	AR[379]->B3
1:0453	not used	FALSE	AR[379]->B4
1:0454	not used	FALSE	AR[379]->B5
1:0455	not used	FALSE	AR[379]->B6
1:0456	not used	FALSE	AR[379]->B7
1:0457	not used	FALSE	AR[379]->B8
1:0458	not used	FALSE	AR[379]->B9
1:0459	not used	FALSE	AR[379]->B10
1:0460	not used	FALSE	AR[379]->B11
1:0461	not used	FALSE	AR[379]->B12
1:0462	not used	FALSE	AR[379]->B13
1:0463	not used	FALSE	AR[379]->B14
1:0464	not used	FALSE	AR[379]->B15
1:0465	not used	FALSE	AR[380]->B0
1:0466	not used	FALSE	AR[380]->B1
1:0467	not used	FALSE	AR[380]->B2
1:0468	not used	FALSE	AR[380]->B3
1:0469	not used	FALSE	AR[380]->B4
1:0470	not used	FALSE	AR[380]->B5
1:0471	not used	FALSE	AR[380]->B6
1:0472	not used	FALSE	AR[380]->B7
1:0473	not used	FALSE	AR[380]->B8
1:0474	not used	FALSE	AR[380]->B9

1:0475	not used	FALSE	AR[380]->B10
1:0476	not used	FALSE	AR[380]->B11
1:0477	not used	FALSE	AR[380]->B12
1:0478	not used	FALSE	AR[380]->B13
1:0479	not used	FALSE	AR[380]->B14
1:0480	not used	FALSE	AR[380]->B15
1:0481	not used	FALSE	AR[381]->B0
1:0482	not used	FALSE	AR[381]->B1
1:0483	not used	FALSE	AR[381]->B2
1:0484	not used	FALSE	AR[381]->B3
1:0485	not used	FALSE	AR[381]->B4
1:0486	not used	FALSE	AR[381]->B5
1:0487	not used	FALSE	AR[381]->B6
1:0488	not used	FALSE	AR[381]->B7
1:0489	not used	FALSE	AR[381]->B8
1:0490	not used	FALSE	AR[381]->B9
1:0491	not used	FALSE	AR[381]->B10
1:0492	not used	FALSE	AR[381]->B11
1:0493	not used	FALSE	AR[381]->B12
1:0494	not used	FALSE	AR[381]->B13
1:0495	not used	FALSE	AR[381]->B14
1:0496	not used	FALSE	AR[381]->B15
1:0497	not used	FALSE	AR[382]->B0
1:0498	not used	FALSE	AR[382]->B1
1:0499	not used	FALSE	AR[382]->B2
1:0500	not used	FALSE	AR[382]->B3
1:0501	not used	FALSE	AR[382]->B4
1:0502	not used	FALSE	AR[382]->B5
1:0503	not used	FALSE	AR[382]->B6
1:0504	not used	FALSE	AR[382]->B7
1:0505	not used	FALSE	AR[382]->B8
1:0506	not used	FALSE	AR[382]->B9
1:0507	not used	FALSE	AR[382]->B10
1:0508	not used	FALSE	AR[382]->B11
1:0509	not used	FALSE	AR[382]->B12
1:0510	not used	FALSE	AR[382]->B13
1:0511	not used	FALSE	AR[382]->B14
1:0512	not used	FALSE	AR[382]->B15
1:0513	spare	FALSE	AR[383]->B0
1:0514	spare	FALSE	AR[383]->B1
1:0515	Priority Mode 1 Enabled (Speed-P1-P2)	PRIORITY.PRIOR_1.EQ	AR[383]->B2
1:0516	Priority Mode 1 Active (Speed-P1-P2)	PRIORITY.PRI_1.EQ	AR[383]->B3
1:0517	Priority Mode 2 Enabled (Speed-P2-P1)	PRIORITY.PRIOR_2.EQ	AR[383]->B4
1:0518	Priority Mode 2 Active (Speed-P2-P1)	PRIORITY.PRI_2.EQ	AR[383]->B5
1:0519	Priority Mode 3 Enabled (P1-Speed-P2)	PRIORITY.PRIOR_3.EQ	AR[383]->B6
1:0520	Priority Mode 3 Active (P1-Speed-P2)	PRIORITY.PRI_3.EQ	AR[383]->B7
1:0521	Priority Mode 4 Enabled (P1-P2-Speed)	PRIORITY.PRIOR_4.EQ	AR[383]->B8
1:0522	Priority Mode 4 Active (P1-P2-Speed)	PRIORITY.PRI_4.EQ	AR[383]->B9
1:0523	Priority Mode 5 Enabled (P2-Speed-P1)	PRIORITY.PRIOR_5.EQ	AR[383]->B10
1:0524	Priority Mode 5 Active (P2-Speed-P1)	PRIORITY.PRI_5.EQ	AR[383]->B11
1:0525	Priority Mode 6 Enabled (P2-P1-Speed)	PRIORITY.PRIOR_6.EQ	AR[383]->B12
1:0526	Priority Mode 6 Active (P2-P1-Speed)	PRIORITY.PRI_6.EQ	AR[383]->B13
1:0527	Priority Transfer Permissive	PRIORITY.PERM.AND	AR[383]->B14

1:0528	Alternate Priority Enabled	PRIORITY.ENBL_2.T_FLIPFLOP	AR[383]->B15
1:0529	Spare	FALSE	AR[384]->B0
1:0530	Controlled Stop In Progress	START.CNTRL_SD.B_NAME	AR[384]->B1
1:0531	HP/V1 Valve Limiter Is Open	V1.LMTR_MAX.B_NAME	AR[384]->B2
1:0532	HP/V1 Valve Limiter Is Closed	V1.LMTR_MIN.B_NAME	AR[384]->B3
1:0533	HP/V1 Valve Limiter In Control	V1.V1_RMP_CTL.B_NAME	AR[384]->B4
1:0534	IP/V2 Valve Limiter Is Open	V2.LMTR_MAX.B_NAME	AR[384]->B5
1:0535	IP/V2 Valve Limiter Is Closed	V2.LMTR_MIN.B_NAME	AR[384]->B6
1:0536	IP/V2 Valve Limiter In Control	V2.V2_RMP_C.B_NAME	AR[384]->B7
1:0537	LP/V3 Valve Limiter Is Open	V3.LMTR_MAX.B_NAME	AR[384]->B8
1:0538	LP/V3 Valve Limiter Is Closed	V3.LMTR_MIN.B_NAME	AR[384]->B9
1:0539	LP/V3 Valve Limiter In Control	V3.V3_RMP_C.B_NAME	AR[384]->B10
1:0540	Spare	FALSE	AR[384]->B11
1:0541	Spare	FALSE	AR[384]->B12
1:0542	At Steam Map Limit	LIMITS.ANY.OR	AR[384]->B13
1:0543	Min P1 Limit	LIMITS.P1_MIN.A_COMPARE	AR[384]->B14
1:0544	Min P2 Limit	LIMITS.P2_MIN.A_COMPARE	AR[384]->B15
1:0545	S V1=1 Limit	LIMITS.S_1.B_MUX_N_1	AR[385]->B0
1:0546	S V1=2 Limit	LIMITS.S_2.B_MUX_N_1	AR[385]->B1
1:0547	S V3=1	LIMITS.S_3.B_MUX_N_1	AR[385]->B2
1:0548	S V2=0 Limit	LIMITS.S_5.B_MUX_N_1	AR[385]->B3
1:0549	S V3=0 Limit	LIMITS.S_6.B_MUX_N_1	AR[385]->B4
1:0550	P1 V1=1 Limit	LIMITS.P1_1.B_MUX_N_1	AR[385]->B5
1:0551	P1 V2=0 Limit	LIMITS.P1_2.B_MUX_N_1	AR[385]->B6
1:0552	P1 V3=0 Limit	LIMITS.P1_3.B_MUX_N_1	AR[385]->B7
1:0553	P1 V2=1 Limit	LIMITS.P1_5.B_MUX_N_1	AR[385]->B8
1:0554	P1 V3=1 Limit	LIMITS.P1_6.B_MUX_N_1	AR[385]->B9
1:0555	P2 V1=1 Limit	LIMITS.P2_1.B_MUX_N_1	AR[385]->B10
1:0556	P2 V2=1 Limit	LIMITS.P2_2.B_MUX_N_1	AR[385]->B11
1:0557	P2 V3=0 Limit	LIMITS.P2_3.B_MUX_N_1	AR[385]->B12
1:0558	P2 V2=0 Limit	LIMITS.P2_5.B_MUX_N_1	AR[385]->B13
1:0559	P2 V3=1 Limit	LIMITS.P2_6.B_MUX_N_1	AR[385]->B14
1:0560	Spare	FALSE	AR[385]->B15
1:0561	Spare	FALSE	AR[386]->B0
1:0562	Spare	FALSE	AR[386]->B1
1:0563	Shutdown Output Energized (K104.1)	A1_A05_BO1.DO_01.DISPLAY	AR[386]->B2
1:0564	Alarm Output Energized (K104.2)	A1_A05_BO1.DO_02.DISPLAY	AR[386]->B3
1:0565	Digital Output 3 Energized (K104.3)	A1_A05_BO1.DO_03.DISPLAY	AR[386]->B4
1:0566	Digital Output 4 Energized (K104.4)	A1_A05_BO1.DO_04.DISPLAY	AR[386]->B5
1:0567	Digital Output 5 Energized (K104.5)	A1_A05_BO1.DO_05.DISPLAY	AR[386]->B6
1:0568	Digital Output 6 Energized (K104.6)	A1_A05_BO1.DO_06.DISPLAY	AR[386]->B7
1:0569	Digital Output 7 Energized (K104.7)	A1_A05_BO1.DO_07.DISPLAY	AR[386]->B8
1:0570	Digital Output 8 Energized (K104.8)	A1_A05_BO1.DO_08.DISPLAY	AR[386]->B9
1:0571	Digital Output 9 Energized (K104.9)	A1_A05_BO1.DO_09.DISPLAY	AR[386]->B10
1:0572	Digital Output 10 Energized (K104.10)	A1_A05_BO1.DO_10.DISPLAY	AR[386]->B11
1:0573	Digital Output 11 Energized (K104.11)	A1_A05_BO1.DO_11.DISPLAY	AR[386]->B12
1:0574	Digital Output 12 Energized (K104.12)	A1_A05_BO1.DO_12.DISPLAY	AR[386]->B13
1:0575	Digital Output 13 Energized (K104.13)	A1_A06_BO1.DO_01.DISPLAY	AR[386]->B14
1:0576	Digital Output 14 Energized (K104.14)	A1_A06_BO1.DO_02.DISPLAY	AR[386]->B15
1:0577	Digital Output 15 Energized (K104.15)	A1_A06_BO1.DO_03.DISPLAY	AR[387]->B0
1:0578	Digital Output 16 Energized (K104.16)	A1_A06_BO1.DO_04.DISPLAY	AR[387]->B1
1:0579	Digital Output 17 Energized (K104.17)	A1_A06_BO1.DO_05.DISPLAY	AR[387]->B2
1:0580	Digital Output 18 Energized (K104.18)	A1_A06_BO1.DO_06.DISPLAY	AR[387]->B3

1:0581	Digital Output 19 Energized (K104.19)	A1_A06_BO1.DO_07.DISPLAY	AR[387]->B4
1:0582	Digital Output 20 Energized (K104.20)	A1_A06_BO1.DO_08.DISPLAY	AR[387]->B5
1:0583	Digital Output 21 Energized (K104.21)	A1_A06_BO1.DO_09.DISPLAY	AR[387]->B6
1:0584	Digital Output 22 Energized (K104.22)	A1_A06_BO1.DO_10.DISPLAY	AR[387]->B7
1:0585	Digital Output 23 Energized (K104.23)	A1_A06_BO1.DO_11.DISPLAY	AR[387]->B8
1:0586	Digital Output 24 Energized (K104.24)	A1_A06_BO1.DO_12.DISPLAY	AR[387]->B9
1:0587	Spare	FALSE	AR[387]->B10
1:0588	ESD Digital Input Closed (DI1)	A1_A05_BI1.DI_01.BIO_BI	AR[387]->B11
1:0589	Reset Digital Input Closed (DI2)	A1_A05_BI1.DI_02.BIO_BI	AR[387]->B12
1:0590	Raise Speed Digital Input Closed (DI3)	A1_A05_BI1.DI_03.BIO_BI	AR[387]->B13
1:0591	Lower Speed Digital Input Closed (DI4)	A1_A05_BI1.DI_04.BIO_BI	AR[387]->B14
1:0592	Digital Input 5 Closed (DI5)	A1_A05_BI1.DI_05.BIO_BI	AR[387]->B15
1:0593	Digital Input 6 Closed (DI6)	A1_A05_BI1.DI_06.BIO_BI	AR[388]->B0
1:0594	Digital Input 7 Closed (DI7)	A1_A05_BI1.DI_07.BIO_BI	AR[388]->B1
1:0595	Digital Input 8 Closed (DI8)	A1_A05_BI1.DI_08.BIO_BI	AR[388]->B2
1:0596	Digital Input 9 Closed (DI9)	A1_A05_BI1.DI_09.BIO_BI	AR[388]->B3
1:0597	Digital Input 10 Closed (DI10)	A1_A05_BI1.DI_10.BIO_BI	AR[388]->B4
1:0598	Digital Input 11 Closed (DI11)	A1_A05_BI1.DI_11.BIO_BI	AR[388]->B5
1:0599	Digital Input 12 Closed (DI12)	A1_A05_BI1.DI_12.BIO_BI	AR[388]->B6
1:0600	Digital Input 13 Closed (DI13)	A1_A05_BI1.DI_13.BIO_BI	AR[388]->B7
1:0601	Digital Input 14 Closed (DI14)	A1_A05_BI1.DI_14.BIO_BI	AR[388]->B8
1:0602	Digital Input 15 Closed (DI15)	A1_A05_BI1.DI_15.BIO_BI	AR[388]->B9
1:0603	Digital Input 16 Closed (DI16)	A1_A05_BI1.DI_16.BIO_BI	AR[388]->B10
1:0604	Digital Input 17 Closed (DI17)	A1_A05_BI2.DI_17.BIO_BI	AR[388]->B11
1:0605	Digital Input 18 Closed (DI18)	A1_A05_BI2.DI_18.BIO_BI	AR[388]->B12
1:0606	Digital Input 19 Closed (DI19)	A1_A05_BI2.DI_19.BIO_BI	AR[388]->B13
1:0607	Digital Input 20 Closed (DI20)	A1_A05_BI2.DI_20.BIO_BI	AR[388]->B14
1:0608	Digital Input 21 Closed (DI21)	A1_A05_BI2.DI_21.BIO_BI	AR[388]->B15
1:0609	Digital Input 22 Closed (DI22)	A1_A05_BI2.DI_22.BIO_BI	AR[389]->B0
1:0610	Digital Input 23 Closed (DI23)	A1_A05_BI2.DI_23.BIO_BI	AR[389]->B1
1:0611	Digital Input 24 Closed (DI24)	A1_A05_BI2.DI_24.BIO_BI	AR[389]->B2
1:0612	Digital Input 25 Closed (DI25)	A1_A06_BI1.DI_01.BIO_BI	AR[389]->B3
1:0613	Digital Input 26 Closed (DI26)	A1_A06_BI1.DI_02.BIO_BI	AR[389]->B4
1:0614	Digital Input 27 Closed (DI27)	A1_A06_BI1.DI_03.BIO_BI	AR[389]->B5
1:0615	Digital Input 28 Closed (DI28)	A1_A06_BI1.DI_04.BIO_BI	AR[389]->B6
1:0616	Digital Input 29 Closed (DI29)	A1_A06_BI1.DI_05.BIO_BI	AR[389]->B7
1:0617	Digital Input 30 Closed (DI30)	A1_A06_BI1.DI_06.BIO_BI	AR[389]->B8
1:0618	Digital Input 31 Closed (DI31)	A1_A06_BI1.DI_07.BIO_BI	AR[389]->B9
1:0619	Digital Input 32 Closed (DI32)	A1_A06_BI1.DI_08.BIO_BI	AR[389]->B10
1:0620	Digital Input 33 Closed (DI33)	A1_A06_BI1.DI_09.BIO_BI	AR[389]->B11
1:0621	Digital Input 34 Closed (DI34)	A1_A06_BI1.DI_10.BIO_BI	AR[389]->B12
1:0622	Digital Input 35 Closed (DI35)	A1_A06_BI1.DI_11.BIO_BI	AR[389]->B13
1:0623	Digital Input 36 Closed (DI36)	A1_A06_BI1.DI_12.BIO_BI	AR[389]->B14
1:0624	Digital Input 37 Closed (DI37)	A1_A06_BI1.DI_13.BIO_BI	AR[389]->B15
1:0625	Digital Input 38 Closed (DI38)	A1_A06_BI1.DI_14.BIO_BI	AR[390]->B0
1:0626	Digital Input 39 Closed (DI39)	A1_A06_BI1.DI_15.BIO_BI	AR[390]->B1
1:0627	Digital Input 40 Closed (DI40)	A1_A06_BI1.DI_16.BIO_BI	AR[390]->B2
1:0628	Digital Input 41 Closed (DI41)	A1_A06_BI2.DI_17.BIO_BI	AR[390]->B3
1:0629	Digital Input 42 Closed (DI42)	A1_A06_BI2.DI_18.BIO_BI	AR[390]->B4
1:0630	Digital Input 43 Closed (DI43)	A1_A06_BI2.DI_19.BIO_BI	AR[390]->B5
1:0631	Digital Input 44 Closed (DI44)	A1_A06_BI2.DI_20.BIO_BI	AR[390]->B6
1:0632	Digital Input 45 Closed (DI45)	A1_A06_BI2.DI_21.BIO_BI	AR[390]->B7
1:0633	Digital Input 46 Closed (DI46)	A1_A06_BI2.DI_22.BIO_BI	AR[390]->B8

1:0634	Digital Input 47 Closed (DI47)	A1_A06_BI2.DI_23.BIO_BI	AR[390]->B9
1:0635	Digital Input 48 Closed (DI48)	A1_A06_BI2.DI_24.BIO_BI	AR[390]->B10
1:0636	Spare	FALSE	AR[390]->B11
1:0637	ALL Output Forcing Enabled	I_FORCE.FRC_ALLOW.NOT	AR[390]->B12
1:0638	Shutdown Output Forced (K104.1)	DO.FRC_DO_01.B_NAME	AR[390]->B13
1:0639	Alarm Output Forced (K104.2)	DO.FRC_DO_02.B_NAME	AR[390]->B14
1:0640	Digital Output 3 Forced (K104.3)	DO.FRC_DO_03.B_NAME	AR[390]->B15
1:0641	Digital Output 4 Forced (K104.4)	DO.FRC_DO_04.B_NAME	AR[391]->B0
1:0642	Digital Output 5 Forced (K104.5)	DO.FRC_DO_05.B_NAME	AR[391]->B1
1:0643	Digital Output 6 Forced (K104.6)	DO.FRC_DO_06.B_NAME	AR[391]->B2
1:0644	Digital Output 7 Forced (K104.7)	DO.FRC_DO_07.B_NAME	AR[391]->B3
1:0645	Digital Output 8 Forced (K104.8)	DO.FRC_DO_08.B_NAME	AR[391]->B4
1:0646	Digital Output 9 Forced (K104.9)	DO.FRC_DO_09.B_NAME	AR[391]->B5
1:0647	Digital Output 10 Forced (K104.10)	DO.FRC_DO_10.B_NAME	AR[391]->B6
1:0648	Digital Output 11 Forced (K104.11)	DO.FRC_DO_11.B_NAME	AR[391]->B7
1:0649	Digital Output 12 Forced (K104.12)	DO.FRC_DO_12.B_NAME	AR[391]->B8
1:0650	Digital Output 13 Forced (K104.13)	DO.FRC_DO_13.B_NAME	AR[391]->B9
1:0651	Digital Output 14 Forced (K104.14)	DO.FRC_DO_14.B_NAME	AR[391]->B10
1:0652	Digital Output 15 Forced (K104.15)	DO.FRC_DO_15.B_NAME	AR[391]->B11
1:0653	Digital Output 16 Forced (K104.16)	DO.FRC_DO_16.B_NAME	AR[391]->B12
1:0654	Digital Output 17 Forced (K104.17)	DO.FRC_DO_17.B_NAME	AR[391]->B13
1:0655	Digital Output 18 Forced (K104.18)	DO.FRC_DO_18.B_NAME	AR[391]->B14
1:0656	Digital Output 19 Forced (K104.19)	DO.FRC_DO_19.B_NAME	AR[391]->B15
1:0657	Digital Output 20 Forced (K104.20)	DO.FRC_DO_20.B_NAME	AR[392]->B0
1:0658	Digital Output 21 Forced (K104.21)	DO.FRC_DO_21.B_NAME	AR[392]->B1
1:0659	Digital Output 22 Forced (K104.22)	DO.FRC_DO_22.B_NAME	AR[392]->B2
1:0660	Digital Output 23 Forced (K104.23)	DO.FRC_DO_23.B_NAME	AR[392]->B3
1:0661	Digital Output 24 Forced (K104.24)	DO.FRC_DO_24.B_NAME	AR[392]->B4
1:0662	At least one output forced	I_FORCE.ANY.OR	AR[392]->B5
1:0663	Simulate Mode Enabled	SIM.SIMULATE.B_NAME	AR[392]->B6
1:0664	Netsim Mode Enabled	I_CTRL.NETSIM.B_NAME	AR[392]->B7
1:0665	Single-Valve Turbine Configured	ST_RATLIM.CONDENSING.B_NAME	AR[392]->B8
1:0666	Two-Valve Extraction-only Configured	ST_RATLIM.EXTRACTION.B_NAME	AR[392]->B9
1:0667	Two-Valve Admission-only Configured	ST_RATLIM.ADMISSION.B_NAME	AR[392]->B10
1:0668	Two-Valve Extr/Adm Configured	ST_RATLIM.EXTR_ADMIS.B_NAME	AR[392]->B11
1:0669	Three-Valve Double-Extr. Configured	I_APP.DE.EQ	AR[392]->B12
1:0670	Gen Set Configured	I_OPERATE.GENERATOR.B_NAME	AR[392]->B13
1:0671	Save Settings Successful (Pulse)	I_CTRL.EE_DONE.B_NAME	AR[392]->B14
1:0672	IO Lock Active	I_CTRL.IO_LOCK.B_NAME	AR[392]->B15
1:0673	IO Lock Not Active (Running)	I_CTRL.IO_RUNNING.B_NAME	AR[393]->B0
1:0674	IO Lock Permissive	I_CTRL.IOLCK_PERM.B_NAME	AR[393]->B1
1:0675	Loading Settings (Pulse)	I_CTRL.LDSETTINGS.B_NAME	AR[393]->B2
1:0676	Spare	FALSE	AR[393]->B3
1:0677	Manual Start Configured	I_START.MAN_START.B_NAME	AR[393]->B4
1:0678	Auto Start Configured	I_START.AUTO_STRT.B_NAME	AR[393]->B5
1:0679	Semi-Auto Start Configured	I_START.SEMI_STRT.B_NAME	AR[393]->B6
1:0680	Idle/Rated Start Configured	I_START.IDLE_RTD.B_NAME	AR[393]->B7
1:0681	Auto Start Sequence Configured	I_START.USE_AUTO_S.B_NAME	AR[393]->B8
1:0682	MPU 2 (B) Configured	I_SPEED.SS_02.B_NAME	AR[393]->B9
1:0683	MPU 3 (C) Configured	I_SPEED.SS_03.B_NAME	AR[393]->B10
1:0684	MPU 4 (D) Configured	I_SPEED.SS_04.B_NAME	AR[393]->B11
1:0685	Right CPU Configured	I_APP.RED_CPU.B_NAME	AR[393]->B12
1:0686	Remote Speed Setpoint Configured	I_SPEED.USE_RMTSPD.B_NAME	AR[393]->B13

1:0687	Cascade Control Configured	I_CASC.USE_CASC.B_NAME	AR[393]->B14
1:0688	Remote Cascade Setpoint Configured	I_CASC.USE_RMTCAS.B_NAME	AR[393]->B15
1:0689	Aux 1 Control Configured	I_AUX1.USE_AUX1.B_NAME	AR[394]->B0
1:0690	Remote Aux 1 Setpoint Configured	I_AUX1.RMTAUX1.B_NAME	AR[394]->B1
1:0691	Aux 2 Control Configured	I_AUX2.USE_AUX2.B_NAME	AR[394]->B2
1:0692	Remote Aux 2 Setpoint Configured	I_AUX2.RMTAUX2.B_NAME	AR[394]->B3
1:0693	Inlet Pressure Input Configured	AI.AN19_USED.B_NAME	AR[394]->B4
1:0694	Exhaust Pressure Input Configured	AI.AN21_USED.B_NAME	AR[394]->B5
1:0695	P1 Extr. Remote Setpoint Configured	AI.AN17_USED.B_NAME	AR[394]->B6
1:0696	Spare	FALSE	AR[394]->B7
1:0697	P2 Extr. Remote Setpoint Configured	AI.AN24_USED.B_NAME	AR[394]->B8
1:0698	Spare	FALSE	AR[394]->B9
1:0699	Simulate Mode Configured	I_APP.SIM.B_NAME	AR[394]->B10
1:0700	2nd DIO Used	I_APP.RED_DIO.B_NAME	AR[394]->B11
1:0701	3rd AIO Used	I_APP.RED_AIO.B_NAME	AR[394]->B12
1:0702	HP Steam Pressure Compensation Cfgd.	AI.AN18_USED.B_NAME	AR[394]->B13
1:0703	1st Stage Pressure Configured	AI.AN13_USED.B_NAME	AR[394]->B14
1:0704	Heat Soak Input Configured	AI.AN12_USED.B_NAME	AR[394]->B15
1:0705	Loadsharing Configured	SYNC_SEL.SYNC_OR_LS.OR	AR[395]->B0
1:0706	Sync Function Configured	SYNC_SEL.SYNC_USED.OR	AR[395]->B1
1:0707	Frequency Arm/Disarm Configured	FREQ.GEN_AND_AD.AND	AR[395]->B2
1:0708	kW Input Configured	AI.AN01_USED.B_NAME	AR[395]->B3
1:0709	Aux1 Enable Configured	I_AUX1.ENABLE.B_NAME	AR[395]->B4
1:0710	Aux2 Enable Configured	I_AUX2.ENABLE.B_NAME	AR[395]->B5
1:0711	Priority Selection Configured	I_PERFORM.SECOND.GT	AR[395]->B6
1:0712	Decoupling Selection Configured	I_PERFORM.DECOUPLE.GT	AR[395]->B7
1:0713	Start Permissive Configured	DI.I_USE_DI09.B_NAME	AR[395]->B8
1:0714	Local/Remote Configured	I_COMM.USE_LR.B_NAME	AR[395]->B9
1:0715	Modbus ESD (Trip) Configured	MOD1.MOD_SD.B_NAME	AR[395]->B10
1:0716	Casc Setpt Tracking Configured	I_CASC.USECAS_TRK.B_NAME	AR[395]->B11
1:0717	P1 Enable/Disable Configured	I_P1.AUTO_EN.B_NAME	AR[395]->B12
1:0718	P2 Enable/Disable Configured	I_P2.AUTO_EN.B_NAME	AR[395]->B13
1:0719	P1 Setpt Tracking Configured	I_P1.USEP1_TRK.B_NAME	AR[395]->B14
1:0720	P2 Setpt Tracking Configured	I_P2.USEP2_TRK.B_NAME	AR[395]->B15
1:0721	AO1 Forced	AO_01.FRC_ACTIVE.B_NAME	AR[396]->B0
1:0722	AO2 Forced	AO_02.FRC_ACTIVE.B_NAME	AR[396]->B1
1:0723	AO3 Forced	AO_03.FRC_ACTIVE.B_NAME	AR[396]->B2
1:0724	AO4 Forced	AO_04.FRC_ACTIVE.B_NAME	AR[396]->B3
1:0725	Act 1 Forced	ACT_01.FRC_ACTIVE.B_NAME	AR[396]->B4
1:0726	Act 2 Forced	ACT_02.FRC_ACTIVE.B_NAME	AR[396]->B5
1:0727	AO5 Forced	AO_05.FRC_ACTIVE.B_NAME	AR[396]->B6
1:0728	AO6 Forced	AO_06.FRC_ACTIVE.B_NAME	AR[396]->B7
1:0729	AO7 Forced	AO_07.FRC_ACTIVE.B_NAME	AR[396]->B8
1:0730	AO8 Forced	AO_08.FRC_ACTIVE.B_NAME	AR[396]->B9
1:0731	Act 3 Forced	ACT_03.FRC_ACTIVE.B_NAME	AR[396]->B10
1:0732	Act 4 Forced	ACT_04.FRC_ACTIVE.B_NAME	AR[396]->B11
1:0733	Act 5 Forced	ACT_05.FRC_ACTIVE.B_NAME	AR[396]->B12
1:0734	Act 6 Forced	ACT_06.FRC_ACTIVE.B_NAME	AR[396]->B13
1:0735	Configuration Error Exists	C_ERR.C_ERROR.LATCH1	AR[396]->B14
1:0736	001: Speed Setpoints Not in Order	C_ERR.C_ERROR.SEL_1	AR[396]->B15
1:0737	002: Max Speed GT 20000 hz	C_ERR.C_ERROR.SEL_2	AR[397]->B0
1:0738	003: Critical Spd Rate < Slow Spd Rate	C_ERR.C_ERROR.SEL_3	AR[397]->B1
1:0739	004: Low Idle In Critical Speed Band	C_ERR.C_ERROR.SEL_4	AR[397]->B2

1:0740	005: Mid Idle In Critical Speed Band	C_ERR.C_ERROR.SEL_5	AR[397]->B3
1:0741	006: High Idle In Critical Speed Band	C_ERR.C_ERROR.SEL_6	AR[397]->B4
1:0742	007: Low Critical Set Below Idle	C_ERR.C_ERROR.SEL_7	AR[397]->B5
1:0743	008: Highest Idle GT Min Gov	C_ERR.C_ERROR.SEL_8	AR[397]->B6
1:0744	009: KW Max is GT KW Input	C_ERR.C_ERROR.SEL_9	AR[397]->B7
1:0745	010: Generator - No Gen Brkr Cfg'd	C_ERR.C_ERROR.SEL_10	AR[397]->B8
1:0746	011: Generator - No Tie Brkr Cfg'd	C_ERR.C_ERROR.SEL_11	AR[397]->B9
1:0747	012: Freq A/D Cfg'd / No Control In	C_ERR.C_ERROR.SEL_12	AR[397]->B10
1:0748	013: Load Share and Freq A/D Cfg'd	C_ERR.C_ERROR.SEL_13	AR[397]->B11
1:0749	014: Sync / Load Share Configure Error	C_ERR.C_ERROR.SEL_14	AR[397]->B12
1:0750	015: Steam Map Configuration Error	C_ERR.C_ERROR.SEL_15	AR[397]->B13
1:0751	016: Two AI's The Same Error	C_ERR.C_ERROR.SEL_16	AR[397]->B14
1:0752	017: Two DI's The Same Error	C_ERR.C_ERROR.SEL_17	AR[397]->B15
1:0753	018: Slot 5 DIO Used - No Red DIO	C_ERR.C_ERROR.SEL_18	AR[398]->B0
1:0754	019: CSD in Crit or Above Rated	C_ERR.C_ERROR.SEL_19	AR[398]->B1
1:0755	020: Two Ports go to one Modbus	C_ERR.C_ERROR.SEL_20	AR[398]->B2
1:0756	021: AI01 Configuration Error	C_ERR.C_ERROR.SEL_21	AR[398]->B3
1:0757	022: AI02 Configuration Error	C_ERR.C_ERROR.SEL_22	AR[398]->B4
1:0758	023: AI03 Configuration Error	C_ERR.C_ERROR.SEL_23	AR[398]->B5
1:0759	024: AI04 Configuration Error	C_ERR.C_ERROR.SEL_24	AR[398]->B6
1:0760	025: AI05 Configuration Error	C_ERR.C_ERROR.SEL_25	AR[398]->B7
1:0761	026: AI06 Configuration Error	C_ERR.C_ERROR.SEL_26	AR[398]->B8
1:0762	027: AI07 Configuration Error	C_ERR.C_ERROR.SEL_27	AR[398]->B9
1:0763	028: AI08 Configuration Error	C_ERR.C_ERROR.SEL_28	AR[398]->B10
1:0764	029: AI09 Configuration Error	C_ERR.C_ERROR.SEL_29	AR[398]->B11
1:0765	030: AI10 Configuration Error	C_ERR.C_ERROR.SEL_30	AR[398]->B12
1:0766	031: AI11 Configuration Error	C_ERR.C_ERROR.SEL_31	AR[398]->B13
1:0767	032: AI12 Configuration Error	C_ERR.C_ERROR.SEL_32	AR[398]->B14
1:0768	033: AI13 Configuration Error	C_ERR.C_ERROR.SEL_33	AR[398]->B15
1:0769	034: AI14 Configuration Error	C_ERR.C_ERROR.SEL_34	AR[399]->B0
1:0770	035: AI15 Configuration Error	C_ERR.C_ERROR.SEL_35	AR[399]->B1
1:0771	036: AI16 Configuration Error	C_ERR.C_ERROR.SEL_36	AR[399]->B2
1:0772	037: No Rmt Speed Input Prgm	C_ERR.C_ERROR.SEL_37	AR[399]->B3
1:0773	038: No KW Analog Input	C_ERR.C_ERROR.SEL_38	AR[399]->B4
1:0774	039: No Sync/loadshare Analog Input	C_ERR.C_ERROR.SEL_39	AR[399]->B5
1:0775	040: No Cascade Analog Input	C_ERR.C_ERROR.SEL_40	AR[399]->B6
1:0776	041: No Rmt Casc Input Prgm	C_ERR.C_ERROR.SEL_41	AR[399]->B7
1:0777	042: No Aux #1 Analog Input	C_ERR.C_ERROR.SEL_42	AR[399]->B8
1:0778	043: No Rmt Aux #1 Input Prgm	C_ERR.C_ERROR.SEL_43	AR[399]->B9
1:0779	044: No Aux #2 Analog Input	C_ERR.C_ERROR.SEL_44	AR[399]->B10
1:0780	045: No Rmt Aux #2 Input Prgm	C_ERR.C_ERROR.SEL_45	AR[399]->B11
1:0781	046: KW & Aux Config for Aux	C_ERR.C_ERROR.SEL_46	AR[399]->B12
1:0782	047: No P1/P2 Input	C_ERR.C_ERROR.SEL_47	AR[399]->B13
1:0783	048: No Rmt P1 Input	C_ERR.C_ERROR.SEL_48	AR[399]->B14
1:0784	049: No Rmt P2 Input	C_ERR.C_ERROR.SEL_49	AR[399]->B15
1:0785	Spare	FALSE	AR[400]->B0
1:0786	Spare	FALSE	AR[400]->B1
1:0787	Spare	FALSE	AR[400]->B2
1:0788	Spare	FALSE	AR[400]->B3
1:0789	Spare	FALSE	AR[400]->B4
1:0790	Spare	FALSE	AR[400]->B5
1:0791	Spare	FALSE	AR[400]->B6
1:0792	Spare	FALSE	AR[400]->B7

1:0793	Spare	FALSE	AR[400]->B8
1:0794	Spare	FALSE	AR[400]->B9
1:0795	Spare	FALSE	AR[400]->B10
1:0796	Spare	FALSE	AR[400]->B11
1:0797	Spare	FALSE	AR[400]->B12
1:0798	Spare	FALSE	AR[400]->B13
1:0799	Spare	FALSE	AR[400]->B14
1:0800	Spare	FALSE	AR[400]->B15

Table 7-5b. Boolean Read Addresses

Modbus Analog Reads

Addr	Description	Mult	OPC
3:0001	First Trip	1	SHUTDOWNS.FIRST_TRIP.A_NAME
3:0002	First Alarm	1	ALARMS.FIRST_ALM.A_NAME
3:0003	Run Time Hours	1	SEQ.RUN_HOURS.A_NAME
3:0004	Hours Since Trip	1	SEQ.TRIP_HOURS.A_NAME
3:0005	Hot Percent	100	START.I_HOT_PCT.A_NAME
3:0006	Spare	1	0
3:0007	Speed Sensor #1 (A) Input (RPM)	1	A1_A02_AIO.SS_01.MONITOR
3:0008	Speed Sensor #2 (B) Input (RPM)	1	A1_A02_AIO.SS_02.MONITOR
3:0009	Speed Sensor #3 (C) Input (RPM)	1	A1_A03_AIO.SS_01.MONITOR
3:0010	Speed Sensor #4 (D) Input (RPM)	1	A1_A03_AIO.SS_02.MONITOR
3:0011	Speed Sensor #5 (Extra) Input (RPM)	1	A1_A02_AIO.SS_03.MONITOR
3:0012	Speed Sensor #6 (Extra) Input (RPM)	1	A1_A03_AIO.SS_03.MONITOR
3:0013	Speed Sensor #7 (Not Used)	1	A1_A02_AIO.SS_04.MONITOR
3:0014	Speed Sensor #8 (Not Used)	1	A1_A03_AIO.SS_04.MONITOR
3:0015	Actual Turbine Speed (RPM)	1	SPD_CTRL.DISPLAYSPD.A_NAME
3:0016	Actual Speed (% Of Max Governor)	100	SPD_CTRL.PERCENTSPD.A_NAME
3:0017	Speed Setpoint (%)	100	SPD_CTRL.SETPT_PRCT.MULTIPLY
3:0018	Speed Setpoint (RPM)	1	SPD_CTRL.SPD_SETPT.A_NAME
3:0019	Speed Droop Setpoint (%)	100	SPD_CTRL.DROOPED_SP.SUBTRACT
3:0020	Load Speed Droop (%)	100	DROOP.SEL_DROOP.A_SW
3:0021	Speed PID Output (%)	100	SPD_CTRL.S_PID.A_NAME
3:0022	Highest Speed Reached (RPM)	1	SPD_CTRL.PK_SPEED.A_NAME
3:0023	Speed Status Integer	1	TURB_MESS.SPEED_STAT.A_NAME
3:0024	Remote Speed Status Integer	1	TURB_MESS.RMSPD_STAT.A_NAME
3:0025	Min Governor Speed Setpoint (RPM)	1	I_SPEED.MIN_GOV_SP.A_NAME
3:0026	Critical Speed Rate (RPM/SEC)	1	I_SPEED.CRIT_RATE.A_NAME
3:0027	Rate To Min (RPM/SEC)	1	I_START.RT_TO_MIN.A_NAME
3:0028	Low Idle (Idle) Setpt (RPM)	1	I_START.LOW_IDLE.A_NAME
3:0029	AutoSeq-Low Idle Delay (SEC)	1	START.LO_TM.A_NAME
3:0030	AutoSeq-Left At Low Idle (SEC)	1	START.TM_LEFT_LO.A_NAME
3:0031	AutoSeq-Mid Idle Rate (RPM/SEC)	1	START.MI_RT.A_NAME
3:0032	AutoSeq-Mid Idle Speed Setpt (RPM)	1	I_START.MID_IDLE.A_NAME
3:0033	AutoSeq-Mid Idle Delay (SEC)	1	START.MI_TM.A_NAME
3:0034	AutoSeq-Left At Mid Idle (SEC)	1	START.TM_LEFT_MI.A_NAME
3:0035	AutoSeq-High Idle Rate (RPM/SEC)	1	START.HI_RT.A_NAME
3:0036	AutoSeq-High Idle Speed Setpt (RPM)	1	I_START.HI_IDLE.A_NAME
3:0037	AutoSeq-High Idle Delay (SEC)	1	START.HI_TM.A_NAME
3:0038	AutoSeq-Left At High Idle (SEC)	1	START.TM_LEFT_HI.A_NAME
3:0039	AutoSeq(Idl/Rtd)-Rated Rate (RPM/SEC)	1	START.RTD_RT.A_NAME

3:0040	Rated Speed Setpt (RPM)	1	I_START.RATED.A_NAME
3:0041	CSD-Rate to CSD Speed (RPM/SEC)	1	SPD_CTRL.CSD_SW.A_SW
3:0042	CSD-CSD Speed (RPM)	1	I_START.CSD_SPEED.A_NAME
3:0043	CSD-CSD Speed Delay (SEC)	1	START.COOL_SEC.MULTIPLY
3:0044	CSD-Left at CSD Speed (SEC)	1	START.TM_LEFT_CS.A_NAME
3:0045	Sequence Status Integer (All Starts) *	1	TURB_MESS.START_STAT.A_NAME
3:0046	Cascade Setpoint (Scaled)	1	COMM.CASREF_DIV.DIVIDE
3:0047	Cascade PID Output (%)	100	T_SPDCAS.CASC_PID.A_NAME
3:0048	Cascade Input (%)	100	T_SPDCAS.CAS_IN_PCT.A_NAME
3:0049	Cascade Setpoint (%)	100	T_SPDCAS.CAS_SP_PCT.A_NAME
3:0050	Cascade Scale Factor (CSCSF)	100	COMM.CAS_MULT.A_NAME
3:0051	Cascade Input (Scaled)	1	COMM.CASIN_DIV.DIVIDE
3:0052	Remote Cascade Setpoint (Scaled)	1	COMM.CASRMT_DIV.DIVIDE
3:0053	Remote Cascade Setpoint (%)	100	IFACE_CAS.RMT_PCT.A_NAME
3:0054	Cascade Status Integer	1	TURB_MESS.CASC_STAT.A_NAME
3:0055	Remote Cascade Status Integer	1	TURB_MESS.RMCAS_STAT.A_NAME
3:0056	Spare	1	0
3:0057	Aux 1 Setpoint (Scaled)	1	COMM.AUX1REF.DIVIDE
3:0058	Aux 1 PID Output (%)	100	AUX1_PID.PID_PCT.A_NAME
3:0059	Aux 1 Input (%)	100	AUX1_SETPT.AUX_IN_PCT.MULTIPLY
3:0060	Aux 1 Setpoint (%)	100	AUX1_SETPT.AUX_SP_PCT.MULTIPLY
3:0061	Aux 1 Scale Factor (AX1SF)	100	COMM.AUX1_MULT.A_NAME
3:0062	Aux 1 Input (Scaled)	1	COMM.AUX1IN.DIVIDE
3:0063	Remote Aux 1 Setpoint (Scaled)	1	COMM.AUX1RMT.DIVIDE
3:0064	Spare	1	0
3:0065	Aux 1 Status Integer	1	AUX1_STAT.AUX1_STAT.A_NAME
3:0066	Remote Aux 1 Status Integer	1	AUX1_STAT.AUX1R_STAT.A_NAME
3:0067	Spare	1	0
3:0068	Aux 2 Setpoint (Scaled)	1	COMM.AUX2REF.DIVIDE
3:0069	Aux 2 PID Output (%)	100	AUX2_PID.PID_PCT.A_NAME
3:0070	Aux 2 Input (%)	100	AUX2_SETPT.AUX_IN_PCT.MULTIPLY
3:0071	Aux 2 Setpoint (%)	100	AUX2_SETPT.AUX_SP_PCT.MULTIPLY
3:0072	Aux 2 Scale Factor (AX2SF)	100	COMM.AUX2_MULT.A_NAME
3:0073	Aux 2 Input (Scaled)	1	COMM.AUX2IN.DIVIDE
3:0074	Remote Aux 2 Setpoint (Scaled)	1	COMM.AUX2RMT.DIVIDE
3:0075	Spare	1	0
3:0076	Aux 2 Status Integer	1	AUX2_STAT.AUX2_STAT.A_NAME
3:0077	Remote Aux 2 Status Integer	1	AUX2_STAT.AUX2R_STAT.A_NAME
3:0078	Spare	1	0
3:0079	Remote Speed Setpoint (RPM)	1	IFACE_SPD.REMOTE_VAL.A_NAME
3:0080	Remote Speed Setpoint (%)	100	IFACE_SPD.RMT_PCT.A_NAME
3:0081	FSP Scale Factor (FSPSF)	100	COMM.FSP_MULT.A_NAME
3:0082	FSP Input (Scaled)	1	COMM.FSPIN_DIV.DIVIDE
3:0083	Sync / Loadshare Scale Factor (SLSSF)	100	COMM.LS_MULT.A_NAME
3:0084	Sync / Loadshare Input (Scaled)	1	COMM.LSIN_DIV.DIVIDE
3:0085	KW Scale Factor (KWXSF)	100	COMM.KW_MULT.A_NAME
3:0086	KW Input (rpm Scaled)	1	COMM.KWIN_DIV.DIVIDE
3:0087	Inlet Pressure Scale Factor	100	COMM.IP_MULT.A_NAME
3:0088	Inlet Pressure Input (Scaled)	1	COMM.IPIN_DIV.DIVIDE
3:0089	Exhaust Pressure Scale Factor	100	COMM.EP_MULT.A_NAME
3:0090	Exhaust Pressure Input (Scaled)	1	COMM.EPIN_DIV.DIVIDE
3:0091	Spare	1	0
3:0092	Spare	1	0

3:0093	Spare	1	0
3:0094	Spare	1	0
3:0095	V1 Valve Limiter Output (%)	100	V1.V1_RAMP.A_NAME
3:0096	V2 Valve Limiter Output (%)	100	V2.V2_RAMP.A_NAME
3:0097	V3 Valve Limiter Output (%)	100	V3.V3_RAMP.A_NAME
3:0098	V1 Demand To Curve (%)	100	V1.V1_DEMAND.A_NAME
3:0099	V2 Demand To Curve(%)	100	V2.V2_DEMAND.A_NAME
3:0100	V3 Demand To Curve (%)	100	V3.V3_DEMAND.A_NAME
3:0101	V1 Demand To Act (%)	100	V1.V_LIN_OUT.A_NAME
3:0102	V2 Demand To Act (%)	100	V2.V_LIN_OUT.A_NAME
3:0103	V3 Demand To Act (%)	100	V3.V_LIN_OUT.A_NAME
3:0104	Spare	1	0
3:0105	Spare	1	0
3:0106	Min Load at Gen Brkr Closure (%)	100	DROOP.ZERO_S_VAL.SAMP_TUNE
3:0107	P1 Extraction Setpoint (Scaled)	1	COMM.P1REF_DIV.DIVIDE
3:0108	P1 Extraction PID Output (%)	100	P1.PID.PID_2
3:0109	P1 Extraction Input (%)	100	P1.INPUT_PCT.A_NAME
3:0110	P1 Extraction Setpoint (%)	100	P1.SP_PCT.A_NAME
3:0111	P1 Extraction Scale Factor (P1XSF)	100	COMM.P1_MULT.A_NAME
3:0112	P1 Extraction Input (Scaled)	1	COMM.P1IN_DIV.DIVIDE
3:0113	P1 Extraction Remote Setpoint (Scaled)	1	COMM.P1RMT_DIV.DIVIDE
3:0114	P1 Extraction Remote Setpoint (%)	100	IFACE_P1.RMT_PCT.A_NAME
3:0115	P1 Extraction Manual Demand (%)	100	P1_FLOW.FLOW_DMND.A_NAME
3:0116	P1 Extraction Remote Manual Demand (%)	100	P1_FLOW.RMT_FLOW.A_NAME
3:0117	P1 Extraction Status Integer	1	P1_MESSAGE.P1_STAT.A_NAME
3:0118	P1 Extraction Remote Status Integer	1	P1_MESSAGE.P1RMT_STAT.A_NAME
3:0119	P1 Manual Status Integer	1	P1_MESSAGE.P1MAN_STAT.A_NAME
3:0120	Spare	1	0
3:0121	P2 Extraction Setpoint (Scaled)	1	COMM.P2REF_DIV.DIVIDE
3:0122	P2 Extraction PID Output (%)	100	P2.PID.PID_2
3:0123	P2 Extraction Input (%)	100	P2.INPUT_PCT.A_NAME
3:0124	P2 Extraction Setpoint (%)	100	P2.SP_PCT.A_NAME
3:0125	P2 Extraction Scale Factor (P2XSF)	100	COMM.P2_MULT.A_NAME
3:0126	P2 Extraction Input (Scaled)	1	COMM.P2IN_DIV.DIVIDE
3:0127	P2 Extraction Remote Setpoint (Scaled)	1	COMM.P2RMT_DIV.DIVIDE
3:0128	P2 Extraction Remote Setpoint (%)	100	IFACE_P2.RMT_PCT.A_NAME
3:0129	P2 Extraction Manual Demand (%)	100	P2_FLOW.FLOW_DMND.A_NAME
3:0130	P2 Extraction Remote Manual Demand (%)	100	P2_FLOW.RMT_FLOW.A_NAME
3:0131	P2 Extraction Status Integer	1	P2_MESSAGE.P2_STAT.A_NAME
3:0132	P2 Extraction Remote Status Integer	1	P2_MESSAGE.P2RMT_STAT.A_NAME
3:0133	P2 Manual Status Integer	1	P2_MESSAGE.P2MAN_STAT.A_NAME
3:0134	Spare	1	0
3:0135	Spare	1	0
3:0136	Spare	100	0
3:0137	Spare	100	0
3:0138	Spare	100	0
3:0139	Spare	100	0
3:0140	Spare	111	0
3:0141	Spare	111	0
3:0142	Spare	100	0
3:0143	Spare	100	0
3:0144	Spare	100	0
3:0145	Spare	1	0

3:0146	Spare	1	0
3:0147	Spare	111	0
3:0148	Spare	100	0
3:0149	Spare	100	0
3:0150	Spare	100	0
3:0151	Spare	100	0
3:0152	Spare	111	0
3:0153	Spare	111	0
3:0154	Spare	100	0
3:0155	Spare	100	0
3:0156	Spare	100	0
3:0157	Spare	1	0
3:0158	Spare	1	0
3:0159	Spare	1	0
3:0160	Spare	1	0
3:0161	Spare	111	0
3:0162	Spare	111	0
3:0163	Spare	111	0
3:0164	Spare	111	0
3:0165	Spare	100	0
3:0166	Spare	111	0
3:0167	Spare	100	0
3:0168	Spare	111	0
3:0169	Spare	100	0
3:0170	Spare	111	0
3:0171	Spare	100	0
3:0172	Spare	1	0
3:0173	Spare	1	0
3:0174	S-demand Limited (from ratio/lmtr)	100	SPD_CTRL.FDBK_SW.A_SW
3:0175	P1-demand Limited (from ratio/lmtr)	100	P1.FDBK_SW.A_SW
3:0176	P2-demand Limited (from ratio/lmtr)	100	P2.P_CPL_FBK.A_NAME
3:0177	V1 Map Demand (from ratio/lmtr)	100	C_DMD.V1.A_NAME
3:0178	V2 Map Demand (from ratio/lmtr)	100	C_DMD.V2.A_NAME
3:0179	V3 Map Demand (from ratio/lmtr)	100	C_DMD.V3.A_NAME
3:0180	S-term (from LSS to ratio/lmtr)	100	SPD_CTRL.LSS.LSS_BUS
3:0181	P1-term (from PID to ratio/lmtr)	100	P1.E_PID.A_NAME
3:0182	P2-term (from PID to ratio/lmtr)	100	P2.E_PID.A_NAME
3:0183	Spare	1	0
3:0184	Spare	1	0
3:0185	Spare	1	0
3:0186	Spare	1	0
3:0187	Spare	1	0
3:0188	Spare	1	0
3:0189	Spare	1	0
3:0190	Spare	1	0
3:0191	Spare	1	0
3:0192	Spare	1	0
3:0193	Spare	1	0
3:0194	Spare	1	0
3:0195	Spare	1	0
3:0196	S Max @V1=1	1000	LIMITS.S_V1_1.RAMP
3:0197	S Max @V2=1	1000	LIMITS.S_V2_1.RAMP
3:0198	S Max @V3=1	1000	LIMITS.S_V3_1.RAMP

3:0199	S Min @V2=0	1000	LIMITS.S_V2_0.RAMP
3:0200	S Min @V3=0	1000	LIMITS.S_V3_0.RAMP
3:0201	P1 Max @V1=1	1000	LIMITS.P1_V1_1.RAMP
3:0202	P1 Max @V2=0	1000	LIMITS.P1_V2_0.RAMP
3:0203	P1 Max @V3=0	1000	LIMITS.P1_V3_0.RAMP
3:0204	P1 Min @V2=1	1000	LIMITS.P1_V2_1.RAMP
3:0205	P1 Min @V3=1	1000	LIMITS.P1_V3_1.RAMP
3:0206	P2 Max @V1=1	1000	LIMITS.P2_V1_1.RAMP
3:0207	P2 Max @V2=1	1000	LIMITS.P2_V2_1.RAMP
3:0208	P2 Max @V3=0	1000	LIMITS.P2_V3_0.RAMP
3:0209	P2 Min @V2=0	1000	LIMITS.P2_V2_0.RAMP
3:0210	P2 Min @V3=1	1000	LIMITS.P2_V3_1.RAMP
3:0211	Active Priority	1	PRIORITY.PRIORITY.A_NAME
3:0212	Spare	1	0
3:0213	Analog Input #1 (%)	100	CNFG_AI01.AIN_PCT.A_NAME
3:0214	Analog Input #2 (%)	100	CNFG_AI02.AIN_PCT.A_NAME
3:0215	Analog Input #3 (%)	100	CNFG_AI03.AIN_PCT.A_NAME
3:0216	Analog Input #4 (%)	100	CNFG_AI04.AIN_PCT.A_NAME
3:0217	Analog Input #5 (%)	100	CNFG_AI05.AIN_PCT.A_NAME
3:0218	Analog Input #6 (%)	100	CNFG_AI06.AIN_PCT.A_NAME
3:0219	Analog Input #7 (%)	100	CNFG_AI07.AIN_PCT.A_NAME
3:0220	Analog Input #8 (%)	100	CNFG_AI08.AIN_PCT.A_NAME
3:0221	Analog Input #9 (%)	100	CNFG_AI09.AIN_PCT.A_NAME
3:0222	Analog Input #10 (%)	100	CNFG_AI10.AIN_PCT.A_NAME
3:0223	Analog Input #11 (%)	100	CNFG_AI11.AIN_PCT.A_NAME
3:0224	Analog Input #12 (%)	100	CNFG_AI12.AIN_PCT.A_NAME
3:0225	Analog Input #13 (%)	100	CNFG_AI13.AIN_PCT.A_NAME
3:0226	Analog Input #14 (%)	100	CNFG_AI14.AIN_PCT.A_NAME
3:0227	Analog Input #15 (%)	100	CNFG_AI15.AIN_PCT.A_NAME
3:0228	Analog Input #16 (%)	100	CNFG_AI16.AIN_PCT.A_NAME
3:0229	Analog Output #1 (%)	100	AO_01.AO.A_NAME
3:0230	Analog Output #2 (%)	100	AO_02.AO.A_NAME
3:0231	Analog Output #3 (%)	100	AO_03.AO.A_NAME
3:0232	Analog Output #4 (%)	100	AO_04.AO.A_NAME
3:0233	Analog Output #5 (%)	100	AO_05.AO.A_NAME
3:0234	Analog Output #6 (%)	100	AO_06.AO.A_NAME
3:0235	Analog Output #7 (%)	100	AO_07.AO.A_NAME
3:0236	Analog Output #8 (%)	100	AO_08.AO.A_NAME
3:0237	Actuator #1 (%)	100	ACT_01.ACT.A_NAME
3:0238	Actuator #2 (%)	100	ACT_02.ACT.A_NAME
3:0239	Actuator #3 (%)	100	ACT_03.ACT.A_NAME
3:0240	Actuator #4 (%)	100	ACT_04.ACT.A_NAME
3:0241	Analog Output #1 (mA)	100	A1_A02_AIO.AO_01.READBACK
3:0242	Analog Output #2 (mA)	100	A1_A02_AIO.AO_02.READBACK
3:0243	Analog Output #3 (mA)	100	A1_A02_AIO.AO_03.READBACK
3:0244	Analog Output #4 (mA)	100	A1_A02_AIO.AO_04.READBACK
3:0245	Analog Output #5 (mA)	100	A1_A03_AIO.AO_01.READBACK
3:0246	Analog Output #6 (mA)	100	A1_A03_AIO.AO_02.READBACK
3:0247	Analog Output #7 (mA)	100	A1_A03_AIO.AO_03.READBACK
3:0248	Analog Output #8 (mA)	100	A1_A03_AIO.AO_04.READBACK
3:0249	Actuator #1 (mA)	100	A1_A02_AIO.ACT_01.RDBK_SRC
3:0250	Actuator #2 (mA)	100	A1_A02_AIO.ACT_02.RDBK_SRC
3:0251	Actuator #3 (mA)	100	A1_A03_AIO.ACT_01.RDBK_SRC

3:0252	Actuator #4 (mA)	100	A1_A03_AIO.ACT_02.RDBK_SRC
3:0253	Actuator #5 (mA)	100	A1_A04_AIO.ACT_01.RDBK_SRC
3:0254	Actuator #6 (mA)	100	A1_A04_AIO.ACT_02.RDBK_SRC
3:0255	Spare	1	0
3:0256	Spare	1	0
3:0257	Spare	1	0
3:0258	Spare	1	0
3:0259	Spare	1	0
3:0260	Spare	1	0
3:0261	Spare	1	0
3:0262	Spare	1	0
3:0263	Spare	1	0
3:0264	Spare	1	0
3:0265	Spare	1	0
3:0266	Spare	1	0
3:0267	Spare	1	0
3:0268	Spare	1	0
3:0269	Spare	1	0
3:0270	Spare	1	0
3:0271	Spare	1	0
3:0272	Spare	1	0
3:0273	Spare	1	0
3:0274	Spare	1	0
3:0275	Spare	1	0
3:0276	Spare	1	0
3:0277	Spare	1	0
3:0278	Spare	1	0
3:0279	Spare	1	0
3:0280	Spare	1	0
3:0281	Spare	1	0
3:0282	Spare	1	0
3:0283	Spare	1	0
3:0284	Spare	1	0
3:0285	Spare	1	0
3:0286	Spare	1	0
3:0287	Spare	1	0
3:0288	Spare	1	0
3:0289	Spare	1	0
3:0290	Spare	1	0
3:0291	Spare	1	0
3:0292	Spare	1	0
3:0293	Spare	1	0
3:0294	Spare	1	0
3:0295	Spare	1	0
3:0296	Spare	1	0
3:0297	Spare	1	0
3:0298	Spare	1	0
3:0299	Spare	1	0
3:0300	Spare	1	0
3:0301	D Load (% Max Load)	100	MAP_POINTS.I_EA01.A_NAME
3:0302	D Flow (% Max Inlet Flow)	100	MAP_POINTS.I_EA02.A_NAME
3:0303	E Load %	100	MAP_POINTS.I_EA03.A_NAME
3:0304	E Flow %	100	MAP_POINTS.I_EA04.A_NAME

3:0305	A Load %	100	MAP_POINTS.I_EA05.A_NAME
3:0306	A Flow %	100	MAP_POINTS.I_EA06.A_NAME
3:0307	B Load %	100	MAP_POINTS.I_EA07.A_NAME
3:0308	B Flow %	100	MAP_POINTS.I_EA08.A_NAME
3:0309	C Load %	100	MAP_POINTS.I_EA09.A_NAME
3:0310	C Flow %	100	MAP_POINTS.I_EA10.A_NAME
3:0311	D2 Load % (shifted for P1)	100	MAP_POINTS.I_EA11.A_NAME
3:0312	D2 Flow % (shifted for P1)	100	MAP_POINTS.I_EA12.A_NAME
3:0313	E2 Load % (shifted for P1)	100	MAP_POINTS.I_EA13.A_NAME
3:0314	E2 Flow % (shifted for P1)	100	MAP_POINTS.I_EA14.A_NAME
3:0315	A2 Load % (shifted for P1)	100	MAP_POINTS.I_EA15.A_NAME
3:0316	A2 Flow % (shifted for P1)	100	MAP_POINTS.I_EA16.A_NAME
3:0317	B2 Load % (shifted for P1)	100	MAP_POINTS.I_EA17.A_NAME
3:0318	B2 Flow % (shifted for P1)	100	MAP_POINTS.I_EA18.A_NAME
3:0319	C2 Load % (shifted for P1)	100	MAP_POINTS.I_EA19.A_NAME
3:0320	C2 Flow % (shifted for P1)	100	MAP_POINTS.I_EA20.A_NAME
3:0321	Workline Y1 %	100	WORKLINE.Y1.A_NAME
3:0322	Workline X2 %	100	WORKLINE.X2.A_NAME
3:0323	Workline Y2 %	100	WORKLINE.Y2.A_NAME
3:0324	Workline Y3 %	100	WORKLINE.Y3.A_NAME
3:0325	Workline X4 %	100	WORKLINE.X4.A_NAME
3:0326	Max Inlet Flow (Scaled to FLXSF)	1	COMM.FLIN_DIV.DIVIDE
3:0327	Max P1 Flow (Scaled to FLXSF)	1	COMM.P1MAX_DIV.DIVIDE
3:0328	Max P2 Flow (Scaled to FLXSF)	1	COMM.P2MAX_DIV.DIVIDE
3:0329	Max Load (Scaled to KWXSF)	1	COMM.KWMAX_DIV.DIVIDE
3:0330	Flow Scale Factor (FLXSF)	1	COMM.FL_MULT.A_NAME
3:0331	Sim T&T Percentage	100	I_SIM.TT_PCT.A_NAME
3:0332	Sim P1 Downstream (P1XSF)	1	COMM.P1SIM.DIVIDE
3:0333	Sim P2 Downstream (P2XSF)	1	COMM.P2SIM.DIVIDE
3:0334	Sim P3 Downstream (EXXSF)	1	COMM.P3SIM.DIVIDE
3:0335	Sim P0 (Inlet) Turbine (P0SF)	1	COMM.P0_SIM.DIVIDE
3:0336	Sim P.5 (FSP) Turbine (P.5SF)	1	COMM.FSP_SIM.DIVIDE
3:0337	Sim P1 Turbine (P1SF)	1	COMM.P1_SIM.DIVIDE
3:0338	Sim P2 Turbine (P2SF)	1	COMM.P2_SIM.DIVIDE
3:0339	Sim P3 Turbine (P3SF)	1	COMM.P3_SIM.DIVIDE
3:0340	Sim P0 Supply Flow (% Max Inlet Flow)	100	I_SIM.P0IN_FLOW.A_NAME
3:0341	Sim P1 Supply Flow (% Max Inlet Flow)	100	I_SIM.P1IN_FLOW.A_NAME
3:0342	Sim P2 Supply Flow (% Max Inlet Flow)	100	I_SIM.P2IN_FLOW.A_NAME
3:0343	Sim P3 Supply Flow (% Max Inlet Flow)	100	I_SIM.P3IN_FLOW.A_NAME
3:0344	Sim V1A	100	I_SIM.HRD_SFTV1A.A_SW
3:0345	Sim V1B	100	I_SIM.HRD_SFTV1B.A_SW
3:0346	Sim V2	100	I_SIM.HRD_SFTV2.A_SW
3:0347	Sim V3	100	I_SIM.HRD_SFTV3.A_SW
3:0348	Spare	1	0
3:0349	Spare	1	0
3:0350	Spare	1	0
3:0351	Bitpack	1	COMM.BITPACK_3.OUT_1
3:0352	Bitpack	1	COMM.BITPACK_3.OUT_2
3:0353	Bitpack	1	COMM.BITPACK_3.OUT_3
3:0354	Bitpack	1	COMM.BITPACK_3.OUT_4
3:0355	Bitpack	1	COMM.BITPACK_3.OUT_5
3:0356	Bitpack	1	COMM.BITPACK_3.OUT_6
3:0357	Bitpack	1	COMM.BITPACK_3.OUT_7

3:0358	Bitpack	1	COMM.BITPACK_3.OUT_8
3:0359	Bitpack	1	COMM.BITPACK_3.OUT_9
3:0360	Bitpack	1	COMM.BITPACK_3.OUT_10
3:0361	Bitpack	1	COMM.BITPACK_3.OUT_11
3:0362	Bitpack	1	COMM.BITPACK_3.OUT_12
3:0363	Bitpack	1	COMM.BITPACK_3.OUT_13
3:0364	Bitpack	1	COMM.BITPACK_3.OUT_14
3:0365	Bitpack	1	COMM.BITPACK_3.OUT_15
3:0366	Bitpack	1	COMM.BITPACK_3.OUT_16
3:0367	Bitpack	1	COMM.BITPACK_3.OUT_17
3:0368	Bitpack	1	COMM.BITPACK_3.OUT_18
3:0369	Bitpack	1	COMM.BITPACK_3.OUT_19
3:0370	Bitpack	1	COMM.BITPACK_3.OUT_20
3:0371	Bitpack	1	COMM.BITPACK_3.OUT_21
3:0372	Bitpack	1	COMM.BITPACK_3.OUT_22
3:0373	Bitpack	1	COMM.BITPACK_3.OUT_23
3:0374	Bitpack	1	COMM.BITPACK_3.OUT_24
3:0375	Bitpack	1	COMM.BITPACK_3.OUT_25
3:0376	Bitpack	1	COMM.BITPACK_3.OUT_26
3:0377	Bitpack	1	COMM.BITPACK_3.OUT_27
3:0378	Bitpack	1	COMM.BITPACK_3.OUT_28
3:0379	Bitpack	1	COMM.BITPACK_3.OUT_29
3:0380	Bitpack	1	COMM.BITPACK_3.OUT_30
3:0381	Bitpack	1	COMM.BITPACK_3.OUT_31
3:0382	Bitpack	1	COMM.BITPACK_3.OUT_32
3:0383	Bitpack	1	COMM.BITPACK_3.OUT_33
3:0384	Bitpack	1	COMM.BITPACK_3.OUT_34
3:0385	Bitpack	1	COMM.BITPACK_3.OUT_35
3:0386	Bitpack	1	COMM.BITPACK_3.OUT_36
3:0387	Bitpack	1	COMM.BITPACK_3.OUT_37
3:0388	Bitpack	1	COMM.BITPACK_3.OUT_38
3:0389	Bitpack	1	COMM.BITPACK_3.OUT_39
3:0390	Bitpack	1	COMM.BITPACK_3.OUT_40
3:0391	Bitpack	1	COMM.BITPACK_3.OUT_41
3:0392	Bitpack	1	COMM.BITPACK_3.OUT_42
3:0393	Bitpack	1	COMM.BITPACK_3.OUT_43
3:0394	Bitpack	1	COMM.BITPACK_3.OUT_44
3:0395	Bitpack	1	COMM.BITPACK_3.OUT_45
3:0396	Bitpack	1	COMM.BITPACK_3.OUT_46
3:0397	Bitpack	1	COMM.BITPACK_3.OUT_47
3:0398	Bitpack	1	COMM.BITPACK_3.OUT_48
3:0399	Bitpack	1	COMM.BITPACK_3.OUT_49
3:0400	Bitpack	1	COMM.BITPACK_3.OUT_50
3:0401	Spare	1	0
3:0402	Spare	1	0
3:0403	Spare	1	0
3:0404	Spare	1	0
3:0405	Spare	1	0
3:0406	Spare	1	0
3:0407	Spare	1	0
3:0408	Spare	1	0
3:0409	Spare	1	0
3:0410	Spare	1	0

3:0411	Spare	1	0
3:0412	Spare	1	0
3:0413	Spare	1	0
3:0414	Spare	1	0
3:0415	Spare	1	0
3:0416	Spare	1	0
3:0417	Spare	1	0
3:0418	Spare	1	0
3:0419	Spare	1	0
3:0420	Spare	1	0
3:0421	Spare	1	0
3:0422	Spare	1	0
3:0423	Spare	1	0
3:0424	Spare	1	0
3:0425	Spare	1	0
3:0426	Spare	1	0
3:0427	Spare	1	0
3:0428	Spare	1	0
3:0429	Spare	1	0
3:0430	Spare	1	0
3:0431	Spare	1	0
3:0432	Spare	1	0
3:0433	Spare	1	0
3:0434	Spare	1	0
3:0435	Spare	1	0
3:0436	Spare	1	0
3:0437	Spare	1	0
3:0438	Spare	1	0
3:0439	Spare	1	0
3:0440	Spare	1	0
3:0441	Spare	1	0
3:0442	Spare	1	0
3:0443	Spare	1	0
3:0444	Spare	1	0
3:0445	Spare	1	0
3:0446	Spare	1	0
3:0447	Spare	1	0
3:0448	Spare	1	0
3:0449	Spare	1	0
3:0450	Spare	1	0
3:0451	Spare	1	0
3:0452	Spare	1	0
3:0453	Spare	1	0
3:0454	Spare	1	0
3:0455	Spare	1	0
3:0456	Spare	1	0
3:0457	Spare	1	0
3:0458	Spare	1	0
3:0459	Spare	1	0
3:0460	Spare	1	0
3:0461	Spare	1	0
3:0462	Spare	1	0
3:0463	Spare	1	0

3:0464	Spare	1	0
3:0465	Spare	1	0
3:0466	Spare	1	0
3:0467	Spare	1	0
3:0468	Spare	1	0
3:0469	Spare	1	0
3:0470	Spare	1	0
3:0471	Spare	1	0
3:0472	Spare	1	0
3:0473	Spare	1	0
3:0474	Spare	1	0
3:0475	Spare	1	0
3:0476	Spare	1	0
3:0477	Spare	1	0
3:0478	Spare	1	0
3:0479	Spare	1	0
3:0480	Spare	1	0
3:0481	Spare	1	0
3:0482	Spare	1	0
3:0483	Spare	1	0
3:0484	Spare	1	0
3:0485	Spare	1	0
3:0486	Spare	1	0
3:0487	Spare	1	0
3:0488	Spare	1	0
3:0489	Spare	1	0
3:0490	Spare	1	0
3:0491	Spare	1	0
3:0492	Spare	1	0
3:0493	Spare	1	0
3:0494	Spare	1	0
3:0495	Spare	1	0
3:0496	Spare	1	0
3:0497	Spare	1	0
3:0498	Spare	1	0
3:0499	Spare	1	0
3:0500	Spare	1	0
3:0501	Analog Input #1 Configuration	1	COMM.I_AN.OUT_1
3:0502	Analog Input #2 Configuration	1	COMM.I_AN.OUT_2
3:0503	Analog Input #3 Configuration	1	COMM.I_AN.OUT_3
3:0504	Analog Input #4 Configuration	1	COMM.I_AN.OUT_4
3:0505	Analog Input #5 Configuration	1	COMM.I_AN.OUT_5
3:0506	Analog Input #6 Configuration	1	COMM.I_AN.OUT_6
3:0507	Analog Input #7 Configuration	1	COMM.I_AN.OUT_7
3:0508	Analog Input #8 Configuration	1	COMM.I_AN.OUT_8
3:0509	Analog Input #9 Configuration	1	COMM.I_AN.OUT_9
3:0510	Analog Input #10 Configuration	1	COMM.I_AN.OUT_10
3:0511	Analog Input #11 Configuration	1	COMM.I_AN.OUT_11
3:0512	Analog Input #12 Configuration	1	COMM.I_AN.OUT_12
3:0513	Analog Input #13 Configuration	1	COMM.I_AN.OUT_13
3:0514	Analog Input #14 Configuration	1	COMM.I_AN.OUT_14
3:0515	Analog Input #15 Configuration	1	COMM.I_AN.OUT_15
3:0516	Analog Input #16 Configuration	1	COMM.I_AN.OUT_16

3:0517	Spare	1	COMM.I_AN.OUT_17
3:0518	Spare	1	COMM.I_AN.OUT_18
3:0519	Spare	1	COMM.I_AN.OUT_19
3:0520	Spare	1	COMM.I_AN.OUT_20
3:0521	Spare	1	COMM.I_AN.OUT_21
3:0522	Spare	1	COMM.I_AN.OUT_22
3:0523	Spare	1	COMM.I_AN.OUT_23
3:0524	Spare	1	COMM.I_AN.OUT_24
3:0525	Analog Output #1 Configuration	1	COMM.I_AN.OUT_25
3:0526	Analog Output #2 Configuration	1	COMM.I_AN.OUT_26
3:0527	Analog Output #3 Configuration	1	COMM.I_AN.OUT_27
3:0528	Analog Output #4 Configuration	1	COMM.I_AN.OUT_28
3:0529	Analog Output #5 Configuration	1	COMM.I_AN.OUT_29
3:0530	Analog Output #6 Configuration	1	COMM.I_AN.OUT_30
3:0531	Analog Output #7 Configuration	1	COMM.I_AN.OUT_31
3:0532	Analog Output #8 Configuration	1	COMM.I_AN.OUT_32
3:0533	Actuator Output #1 Configuration	1	COMM.I_AN.OUT_33
3:0534	Actuator Output #2 Configuration	1	COMM.I_AN.OUT_34
3:0535	Actuator Output #3 Configuration	1	COMM.I_AN.OUT_35
3:0536	Actuator Output #4 Configuration	1	COMM.I_AN.OUT_36
3:0537	Actuator Output #5 Configuration	1	COMM.I_AN.OUT_37
3:0538	Actuator Output #6 Configuration	1	COMM.I_AN.OUT_38
3:0539	Spare	1	COMM.I_AN.OUT_39
3:0540	Spare	1	COMM.I_AN.OUT_40
3:0541	Spare	1	COMM.I_AN.OUT_41
3:0542	Spare	1	COMM.I_AN.OUT_42
3:0543	ESD Digital Input Config (DI1)	1	COMM.I_AN.OUT_43
3:0544	Reset Digital Input Config (DI2)	1	COMM.I_AN.OUT_44
3:0545	Raise Speed Digital Input Config (DI3)	1	COMM.I_AN.OUT_45
3:0546	Lower Speed Digital Input Config (DI4)	1	COMM.I_AN.OUT_46
3:0547	Digital Input 5 Config (DI5)	1	COMM.I_AN.OUT_47
3:0548	Digital Input 6 Config (DI6)	1	COMM.I_AN.OUT_48
3:0549	Digital Input 7 Config (DI7)	1	COMM.I_AN.OUT_49
3:0550	Digital Input 8 Config (DI8)	1	COMM.I_AN.OUT_50
3:0551	Digital Input 9 Config (DI9)	1	COMM.I_AN.OUT_51
3:0552	Digital Input 10 Config (DI10)	1	COMM.I_AN.OUT_52
3:0553	Digital Input 11 Config (DI11)	1	COMM.I_AN.OUT_53
3:0554	Digital Input 12 Config (DI12)	1	COMM.I_AN.OUT_54
3:0555	Digital Input 13 Config (DI13)	1	COMM.I_AN.OUT_55
3:0556	Digital Input 14 Config (DI14)	1	COMM.I_AN.OUT_56
3:0557	Digital Input 15 Config (DI15)	1	COMM.I_AN.OUT_57
3:0558	Digital Input 16 Config (DI16)	1	COMM.I_AN.OUT_58
3:0559	Digital Input 17 Config (DI17)	1	COMM.I_AN.OUT_59
3:0560	Digital Input 18 Config (DI18)	1	COMM.I_AN.OUT_60
3:0561	Digital Input 19 Config (DI19)	1	COMM.I_AN.OUT_61
3:0562	Digital Input 20 Config (DI20)	1	COMM.I_AN.OUT_62
3:0563	Digital Input 21 Config (DI21)	1	COMM.I_AN.OUT_63
3:0564	Digital Input 22 Config (DI22)	1	COMM.I_AN.OUT_64
3:0565	Digital Input 23 Config (DI23)	1	COMM.I_AN.OUT_65
3:0566	Digital Input 24 Config (DI24)	1	COMM.I_AN.OUT_66
3:0567	Digital Input 25 Config (DI25)	1	COMM.I_AN.OUT_67
3:0568	Digital Input 26 Config (DI26)	1	COMM.I_AN.OUT_68
3:0569	Digital Input 27 Config (DI27)	1	COMM.I_AN.OUT_69

3:0570	Digital Input 28 Config (DI28)	1	COMM.I_AN.OUT_70
3:0571	Digital Input 29 Config (DI29)	1	COMM.I_AN.OUT_71
3:0572	Digital Input 30 Config (DI30)	1	COMM.I_AN.OUT_72
3:0573	Digital Input 31 Config (DI31)	1	COMM.I_AN.OUT_73
3:0574	Digital Input 32 Config (DI32)	1	COMM.I_AN.OUT_74
3:0575	Digital Input 33 Config (DI33)	1	COMM.I_AN.OUT_75
3:0576	Digital Input 34 Config (DI34)	1	COMM.I_AN.OUT_76
3:0577	Digital Input 35 Config (DI35)	1	COMM.I_AN.OUT_77
3:0578	Digital Input 36 Config (DI36)	1	COMM.I_AN.OUT_78
3:0579	Digital Input 37 Config (DI37)	1	COMM.I_AN.OUT_79
3:0580	Digital Input 38 Config (DI38)	1	COMM.I_AN.OUT_80
3:0581	Digital Input 39 Config (DI39)	1	COMM.I_AN.OUT_81
3:0582	Digital Input 40 Config (DI40)	1	COMM.I_AN.OUT_82
3:0583	Digital Input 41 Config (DI41)	1	COMM.I_AN.OUT_83
3:0584	Digital Input 42 Config (DI42)	1	COMM.I_AN.OUT_84
3:0585	Digital Input 43 Config (DI43)	1	COMM.I_AN.OUT_85
3:0586	Digital Input 44 Config (DI44)	1	COMM.I_AN.OUT_86
3:0587	Digital Input 45 Config (DI45)	1	COMM.I_AN.OUT_87
3:0588	Digital Input 46 Config (DI46)	1	COMM.I_AN.OUT_88
3:0589	Digital Input 47 Config (DI47)	1	COMM.I_AN.OUT_89
3:0590	Digital Input 48 Config (DI48)	1	COMM.I_AN.OUT_90
3:0591	Shutdown Output Config (K104.1)	1	COMM.I_AN.OUT_91
3:0592	Alarm Output Config (K104.2)	1	COMM.I_AN.OUT_92
3:0593	Digital Output 3 Config (K104.3)	1	COMM.I_AN.OUT_93
3:0594	Digital Output 4 Config (K104.4)	1	COMM.I_AN.OUT_94
3:0595	Digital Output 5 Config (K104.5)	1	COMM.I_AN.OUT_95
3:0596	Digital Output 6 Config (K104.6)	1	COMM.I_AN.OUT_96
3:0597	Digital Output 7 Config (K104.7)	1	COMM.I_AN.OUT_97
3:0598	Digital Output 8 Config (K104.8)	1	COMM.I_AN.OUT_98
3:0599	Digital Output 9 Config (K104.9)	1	COMM.I_AN.OUT_99
3:0600	Digital Output 10 Config (K104.10)	1	COMM.I_AN.OUT_100
3:0601	Digital Output 11 Config (K104.11)	1	COMM.I_AN.OUT_101
3:0602	Digital Output 12 Config (K104.12)	1	COMM.I_AN.OUT_102
3:0603	Digital Output 13 Config (K104.13)	1	COMM.I_AN.OUT_103
3:0604	Digital Output 14 Config (K104.14)	1	COMM.I_AN.OUT_104
3:0605	Digital Output 15 Config (K104.15)	1	COMM.I_AN.OUT_105
3:0606	Digital Output 16 Config (K104.16)	1	COMM.I_AN.OUT_106
3:0607	Digital Output 17 Config (K104.17)	1	COMM.I_AN.OUT_107
3:0608	Digital Output 18 Config (K104.18)	1	COMM.I_AN.OUT_108
3:0609	Digital Output 19 Config (K104.19)	1	COMM.I_AN.OUT_109
3:0610	Digital Output 20 Config (K104.20)	1	COMM.I_AN.OUT_110
3:0611	Digital Output 21 Config (K104.21)	1	COMM.I_AN.OUT_111
3:0612	Digital Output 22 Config (K104.22)	1	COMM.I_AN.OUT_112
3:0613	Digital Output 23 Config (K104.23)	1	COMM.I_AN.OUT_113
3:0614	Digital Output 24 Config (K104.24)	1	COMM.I_AN.OUT_114

Table 7-5c. Analog Read Addresses

Modbus Analog Writes

Addr	Description	OPC
4:0001	Speed Setpoint	COMM.MOD3.AW_V_1
4:0002	Cascade Setpoint	COMM.MOD3.AW_V_2
4:0003	Aux-1 Setpoint	COMM.MOD3.AW_V_3
4:0004	Aux-2 Setpoint	COMM.MOD3.AW_V_4
4:0005	Spare	COMM.MOD3.AW_V_5
4:0006	P1 Setpoint	COMM.MOD3.AW_V_6
4:0007	P1 Manual Setpoint	COMM.MOD3.AW_V_7
4:0008	P2 Setpoint	COMM.MOD3.AW_V_8
4:0009	P2 Manual Setpoint	COMM.MOD3.AW_V_9
4:0010	Spare	COMM.MOD3.AW_V_10

Table 7-5d. Analog Write Addresses

Last Turbine Trip Cause

The cause of the last turbine trip (address 3:0001) is an integer that represents the following cause:

Value	Description
1.	External ESD Trip Input
2.	External Trip 1
3.	External Trip 2
4.	External Trip 3
5.	External Trip 4
6.	External Trip 5
7.	External Trip 6
8.	External Trip 7
9.	External Trip 8
10.	External Trip 9
11.	External Trip 10
12.	Loss of Speed Signals
13.	Overspeed Trip
14.	ACT 01 Output Fault
15.	ACT 02 Output Fault
16.	ACT 03 Output Fault
17.	ACT 04 Output Fault
18.	Modbus Link #1 Trip Requested
19.	Modbus Link #2 Trip Requested
20.	Modbus Link #3 Trip Requested
21.	Aux 1 Input Failed
22.	Aux 2 Input Failed
23.	P1 Input Failed
24.	P2 Input Failed
25.	Speed in Critical Band Too Long
26.	Gen Breaker Open Trip
27.	Tie Breaker Open Trip
28.	Power Up Trip
29.	Controlled Shutdown Complete
30.	Configure Active Shutdown
31.	Configuration Error Shutdown

Table 7-6. Turbine Trip

505DE Controlling Parameters

The controlling parameter status of the 505DE uses Analog Read registers to identify the parameters that are in control of the 505DE. The variables give the current status of the control and are defined in the following tables:

CONTROL STATUS - AR[45]

VALUE	DESCRIPTION
1.	Shutdown: Waiting for Reset
2.	Reset: Waiting for Permissive
3.	Reset: Ready to Start
4.	Start: Opening Extraction Valves
5.	Start: Moving to Min
6.	Idl/Rtd: Moving to Idle
7.	Idl/Rtd: At Idle
8.	Idl/Rtd: Moving to Rated
9.	AutoSeq: Moving to Low Idle
10.	AutoSeq: At Low Idle
11.	AutoSeq: Moving to Mid Idle
12.	AutoSeq: At Mid Idle
13.	AutoSeq: Moving to High Idle
14.	AutoSeq: At High Idle
15.	AutoSeq: Moving to Rated
16.	AutoSeq: Halted
17.	Normal Operation
18.	CSD: Moving to CSD Speed
19.	CSD: At CSD Speed
20.	Spare
21.	Moving Through Critical At:

Table 7-7a. Control Status

SPEED CONTROL STATUS - AR[23]

VALUE	DESCRIPTION
0.	In Control
1.	In Critical Band
2.	Limited
3.	Cascade Active

Table 7-7b. Speed Control Status

REMOTE SPEED CONTROL STATUS - AR[24]

VALUE	DESCRIPTION
1.	Remote Inhibited
2.	Remote In Control
3.	Remote Active
4.	Remote Enabled
5.	Remote Disabled

Table 7-7c. Remote Speed Control Status

CASCADE CONTROL STATUS - AR[54]

VALUE	DESCRIPTION
0.	
1.	Cascade Inhibited
2.	Cascade In Control
3.	Cascade Active
4.	Cascade Enabled
5.	Cascade Disabled

Table 7-7d. Cascade Control Status

REMOTE CASCADE CONTROL STATUS - AR[55]

VALUE	DESCRIPTION
1.	Remote Inhibited
2.	Remote In Control
3.	Remote Active
4.	Remote Enabled
5.	Remote Disabled

Table 7-7e. Remote Cascade Control Status

P1 CONTROL STATUS - AR[117]

VALUE	DESCRIPTION
1.	Inhibited
2.	Limited
3.	Tracking
4.	Manual
5.	Active
6.	In Control
7.	Enabling
8.	Disabling
9.	Enabled
10.	Disabled

Table 7-7f. P1 Control Status

P1 REMOTE CONTROL STATUS - AR[118]

VALUE	DESCRIPTION
1.	Remote Inhibited
2.	Remote In Control
3.	Remote Active
4.	Remote Enabled
5.	Remote Disabled

Table 7-7g. P1 Remote Control Status

P1 MANUAL CONTROL STATUS - AR[119]

VALUE	DESCRIPTION
1.	Manual Inhibited
2.	Manual Tracking
3.	Manual In Control
4.	Manual Active
5.	Manual Enabled
6.	Manual Disabled

Table 7-7h. P1 Manual Control Status

P2 CONTROL STATUS - AR[131]

VALUE	DESCRIPTION
1.	Inhibited
2.	Limited
3.	Tracking
4.	Manual
5.	Active
6.	In Control
7.	Enabling
8.	Disabling
9.	Enabled
10.	Disabled

Table 7-7i. P2 Control Status

P2 REMOTE CONTROL STATUS - AR[132]

VALUE	DESCRIPTION
1.	Remote Inhibited
2.	Remote In Control
3.	Remote Active
4.	Remote Enabled
5.	Remote Disabled

Table 7-7j. P2 Remote Control Status

P2 MANUAL CONTROL STATUS - AR[133]

VALUE	DESCRIPTION
1.	Manual Inhibited
2.	Manual Tracking
3.	Manual In Control
4.	Manual Active
5.	Manual Enabled
6.	Manual Disabled

Table 7-7k. P2 Manual Control Status

Analog Read addresses 3:0401-0416 give the configuration value of the analog inputs, 1 to 16, in order. The configuration for the analog inputs is defined in the table below.

ANALOG INPUT CONFIGURATION

VALUE	DESCRIPTION
0.	Not Configured
1.	KW Input
2.	Remote Speed Setpoint
3.	Cascade
4.	Remote Cascade Setpoint
5.	Aux 1
6.	Aux 1 Remote Setpoint
7.	Aux 2
8.	Aux 2 Remote Setpoint
9.	Sync Input
10.	Sync/Loadshare Input
11.	Loadshare Input
12.	Heat Soak Input
13.	First Stage Pressure
14.	SG PID
15.	SG PID Setpoint
16.	P1
17.	P1 Setpoint
18.	Pressure Compensation
19.	Inlet Pressure
20.	Inlet Pressure Setpoint
21.	Exhaust Pressure
22.	Exhaust Pressure Setpoint
23.	P2
24.	P2 Setpoint
25.	Spare
26.	Red. KW Input
27.	Red. Remote Speed Setpoint
28.	Red. Cascade
29.	Red. Remote Cascade Setpoint
30.	Red. Aux 1
31.	Red. Aux 1 Remote Setpoint
32.	Red. Aux 2
33.	Red. Aux 2 Remote Setpoint
34.	Red. Sync Input
35.	Red. Sync/Loadshare Input
36.	Red. Loadshare Input
37.	Red. Heat Soak Input
38.	Red. First Stage Pressure
39.	Red. SG PID
40.	Red. SG PID Setpoint
41.	Red. P1
42.	Red. P1 Setpoint
43.	Red. Pressure Compensation
44.	Red. Inlet Pressure
45.	Red. Inlet Pressure Setpoint
46.	Red. Exhaust Pressure
47.	Red. Exhaust Pressure Setpoint
48.	Red. P2
49.	Red. P2 Setpoint
50.	Sim V1A Input
51.	Sim V1B Input
52.	Sim V2 Input
53.	Sim V3 Input

Table 7-8. Analog Input Configuration

Analog Read addresses 3:XXXX—XXXX give the configuration value of the analog outputs, 1 to 8, in order. The configuration for the analog outputs is defined in the table below.

ANALOG OUTPUT CONFIGURATION

VALUE	DESCRIPTION
0	Not Configured
1	Turbine Speed
2	Turbine Speed Setpoint
3	Turbine Load
4	Cascade Input
5	Cascade Setpoint
6	Cascade PID Demand
7	SG PID Setpoint
8	SG PID Input
9	SG PID Demand
10	Heat Soak Percentage
11	Sync/Ldshare Speed Bias
12	First Stage Pressure
13	Aux 1 Setpoint
14	Aux 1 Input
15	Aux 2 Setpoint
16	Aux 2 Input
17	V1 Demand
18	V1B Demand
19	V2 Demand
20	V3 Demand
21	V1 Limiter Position
22	V2 Limiter Position
23	V3 Limiter Position
24	P1 Setpoint
25	P1
26	P2 Setpoint
27	P2
28	Inlet Pressure
29	Exhaust Pressure
30	Spare
31	Spare
32	Spare
33	Spare
34	Spare
35	Spare
36	Spare
37	Spare
38	Spare
39	Spare
40	Spare
41	Spare
42	Spare
43	Spare
44	Spare
45	Spare
46	Spare
47	Spare
48	Spare
49	Spare
50	Spare

Table 7-9. Analog Output Configuration

Analog Read addresses 3:XXXX—XXXX give the configuration value of the relays, 1 to 48, in order. The configuration for the relays is defined in the table below.

RELAY CONFIGURATION

VALUE	DESCRIPTION
0.	Not Configured
1.	Shutdown Condition
2.	Trip Relay
3.	Alarm Condition
4.	Control Status OK (Under Power)
5.	Overspeed Trip
6.	Overspeed Test Enabled
7.	Speed PID in Control
8.	Remote Speed Setpoint Enabled
9.	Remote Speed Setpoint Active
10.	Underspeed Switch
11.	Auto Start Sequence Halted
12.	On-Line Speed PID Dynamics Mode
13.	Local Control Mode
14.	Frequency Control Armed
15.	Frequency Control Active
16.	Synchronization Enabled
17.	Sync/Loadshare Active
18.	Loadsharing Control
19.	Open Generator Breaker
20.	Generator Breaker Status
21.	Utility Breaker Status
22.	P1 Extr. Control Enabled
23.	P1 Extr. Control Active
24.	P1 Extr. PID In Control
25.	Remote P1 Extr. Setpoint Enabled
26.	Remote P1 Extr. Setpoint Active
27.	P1 Extr. Manual Demand Active
28.	P2 Extr. Control Enabled
29.	P2 Extr. Control Active
30.	P2 Extr. PID in Control
31.	Remote P2 Extr. Setpoint Enabled
32.	Remote P2 Extr. Setpoint Active
33.	P2 Extr. Manual Demand Active
34.	Secondary Priority Selected
35.	Secondary Priority Active
36.	Steam Map Limiter in Control
37.	Modbus Command Selected
38.	Cascade Control Enabled
39.	Cascade Control Active
40.	Remote Cascade Setpoint Enabled
41.	Remote Cascade Setpoint Active
42.	Aux 1 Control Enabled
43.	Aux 1 Control Active
44.	Remote Aux 1 Setpoint Enabled
45.	Remote Aux 1 Setpoint Active
46.	Aux 2 Control Enabled
47.	Aux 2 Control Active
48.	Remote Aux 2 Setpoint Enabled
49.	Remote Aux 2 Setpoint Active
50.	Decoupling Control Enabled
51.	Decoupling Control Active
52.	Decoupling PID in Control
53.	Remote Decoupling Setpoint Enabled
54.	Remote Decoupling Setpoint Active
55.	Decoupling Manual Demand Active
56.	Extra PID Enabled
57.	Extra PID Active

58. ..... Extra PID in Control
59. ..... Remote Extra PID Setpoint Enabled
60. ..... Remote Extra PID Setpoint Active
61. ..... Extra PID Manual Demand Active
62. ..... HP/V1 Valve Limiter In Control
63. ..... IP/V2 Valve Limiter In Control
64. ..... LP/V3 Valve Limiter In Control
65. ..... Level Switch 1
66. ..... Level Switch 2
67. ..... Level Switch 3
68. ..... Level Switch 4
69. ..... Level Switch 5

Table 7-10. Relay Configuration

Analog Read addresses 3:XXXX—XXXX give the configuration value of the contact inputs, 1 to 96, in order. The configuration for the contact inputs is defined in the table below.

CONTACT INPUT CONFIGURATION
VALUE..... DESCRIPTION
0 ..... Not Configured
1. ..... Not Used
2. ..... Not Used
3. ..... Not Used
4. ..... Not Used
5. ..... Generator Breaker Closed
6. ..... Utility Breaker Closed
7. ..... Enable Overspeed Test
8. ..... External Run (Start)
9. ..... Start Permissive
10. ..... Idle/Rated
11. ..... Enable Synchronization
12. ..... Controlled Shutdown
13. ..... Halt/Continue Auto Start Sequence
14. ..... Override MPU Fault
15. ..... Select Online PID Dynamics
16. ..... Local/Remote
17. ..... Enbl/Dsbl Remote Speed Setpoint
18. ..... Arm/Disarm Frequency Control
19. ..... Raise P1 Extraction Setpoint
20. ..... Lower P1 Extraction Setpoint
21. ..... Enbl/Dsbl P1 Extraction Control
22. ..... Enbl/Dsbl P1 Extr. Remote Setpoint
23. ..... Raise P2 Extraction Setpoint
24. ..... Lower P2 Extraction Setpoint
25. ..... Enbl/Dsbl P2 Extraction Control
26. ..... Enbl/Dsbl P2 Extr. Remote Setpoint
27. ..... Select Priority Mode
28. ..... Raise Cascade Setpoint
29. ..... Lower Cascade Setpoint
30. ..... Enbl/Dsbl Cascade Control
31 ..... Enbl/Dsbl Cascade Remote Setpoint
32. ..... Raise Aux 1 Setpoint
33. ..... Lower Aux 1 Setpoint
34. ..... Enbl/Dsbl Aux 1 Control
35. ..... Enbl/Dsbl Aux 1 Remote Setpoint
36. ..... Raise Aux 2 Setpoint
37. ..... Lower Aux 2 Setpoint
38. ..... Enbl/Dsbl Aux 2 Control
39. ..... Enbl/Dsbl Aux 2 Remote Setpoint
40. ..... Open V1 Valve Limiter
41. ..... Close V1 Valve Limiter
42. ..... Open V2 Valve Limiter

43. .....Close V2 Valve Limiter
44. .....Open V3 Valve Limiter
45. .....Close V3 Valve Limiter
46. .....Raise P1 Extraction Demand
47. .....Lower P1 Extraction Demand
48. .....Enbl/Dsbl P1 Extraction Demand
49. .....Enbl/Dsbl P1 Remote Demand
50. .....Raise P2 Extraction Demand
51. .....Lower P2 Extraction Demand
52. .....Enbl/Dsbl P2 Extraction Demand
53. .....Enbl/Dsbl P2 Remote Demand
54. .....External Trip 1
55. .....External Trip 2
56. .....External Trip 3
57. .....External Trip 4
58. .....External Trip 5
59. .....External Trip 6
60. .....External Trip 7
61. .....External Trip 8
62. .....External Trip 9
63. .....External Trip 10
64. .....Raise Inlet Decoupling Setpoint
65. .....Lower Inlet Decoupling Setpoint
66. .....Enbl/Dsbl Inlet Decoupling Control
67. .....Enbl/Dsbl Inlet Dcpl. Remote Setpoint
68. .....Raise Exhaust Decoupling Setpoint
69. .....Lower Exhaust Decoupling Setpoint
70. .....Enbl/Dsbl Exhaust Decoupling Control
71. .....Enbl/Dsbl Exhaust Dcpl. Rmt. Stpnt.
72. .....Raise Decoupling Manual Demand
73. .....Lower Decoupling Manual Demand
74. .....Enbl/Dsbl Decoupling Manual Dmnd.
75. .....Enbl/Dsbl Decoupling Remote Dmnd.
76. .....Auto-Synchronize Real-Time Clock
77. .....External Alarm 1
78. .....External Alarm 2
79. .....External Alarm 3
80. .....External Alarm 4
81. .....External Alarm 5
82. .....External Alarm 6
83. .....External Alarm 7
84. .....External Alarm 8
85. .....External Alarm 9
86. .....External Alarm 10
87. .....Red. Emergency Shutdown
88. .....Red. System Reset
89. .....Red. Raise Speed Setpoint
90. .....Red. Lower Speed Setpoint
91. .....Red. Generator Breaker Closed
92. .....Red. Utility Breaker Closed
93. .....Red. Enable Overspeed Test
94. .....Red. External Run (Start)
95. .....Red. Start Permissive
96. .....Red. Idle/Rated
97. .....Red. Enable Synchronization
98. .....Red. Controlled Shutdown
99. .....Red. Halt/Continue Auto Start Seq.
100. .....Red. Override MPU Fault
101. .....Red. Select Online PID Dynamics
102. .....Red. Local / Remote
103. .....Red. Enbl/Dsbl Rmt. Speed Setpoint
104. .....Red. Arm/Disarm Frequency Control
105. .....Red. Raise P1 Extraction Setpoint
106. .....Red. Lower P1 Extraction Setpoint
107. .....Red. Enbl/Dsbl P1 Extraction Control
108. .....Red. Enbl/Dsbl P1 Extr. Rmt. Stpnt.

109. ..... Red. Raise P2 Extraction Setpoint
110. ..... Red. Lower P2 Extraction Setpoint
111. ..... Red. Enbl/Dsbl P2 Extraction Control
112. ..... Red. Enbl/Dsbl P2 Extr. Rmt. Stpnt.
113. ..... Red. Select Priority Mode
114. ..... Red. Raise Cascade Setpoint
115. ..... Red. Lower Cascade Setpoint
116. ..... Red. Enbl/Dsbl Cascade Control
117. ..... Red. Enbl/Dsbl Cascade Rmt. Stpnt.
118. ..... Red. Raise Aux-1 Setpoint
119. ..... Red. Lower Aux-1 Setpoint
120. ..... Red. Enbl/Dsbl Aux-1 Control
121. ..... Red. Enbl/Dsbl Aux-1 Rmt. Setpoint
122. ..... Red. Raise Aux-2 Setpoint
123. ..... Red. Lower Aux-2 Setpoint
124. ..... Red. Enbl/Dsbl Aux-2 Control
125. ..... Red. Enbl/Dsbl Aux-2 Rmt. Setpoint
126. ..... Red. Open V1 Valve Limiter
127. ..... Red. Close V1 Valve Limiter
128. ..... Red. Open V2 Valve Limiter
129. ..... Red. Close V2 Valve Limiter
130. ..... Red. Open V3 Valve Limiter
131. ..... Red. Close V3 Valve Limiter
132. ..... Red. Raise P1 Extr. Demand
133. ..... Red. Lower P1 Extr. Demand
134. ..... Red. Enbl/Dsbl P1 Extr. Demand
135. ..... Red. Enbl/Dsbl P1 Remote Demand
136. ..... Red. Raise P2 Extr. Demand
137. ..... Red. Lower P2 Extr. Demand
138. ..... Red. Enbl/Dsbl P2 Extr. Demand
139. ..... Red. Enbl/Dsbl P2 Remote Demand
140. ..... Red. External Trip 1
141. ..... Red. External Trip 2
142. ..... Red. External Trip 3
143. ..... Red. External Trip 4
144. ..... Red. External Trip 5
145. ..... Red. External Trip 6
146. ..... Red. External Trip 7
147. ..... Red. External Trip 8
148. ..... Red. External Trip 9
149. ..... Red. External Trip 10
150. ..... Red. Raise Inlet Dcpl. Setpoint
151. ..... Red. Lower Inlet Dcpl. Setpoint
152. ..... Red. Enbl/Dsbl Inlet Dcpl. Control
153. ..... Red. Enbl/Dsbl Inlet Dcpl. Rmt. Stpnt.
154. ..... Red. Raise Exhaust Dcpl. Setpoint
155. ..... Red. Lower Exhaust Dcpl. Setpoint
156. ..... Red. Enbl/Dsbl Exhaust Dcpl. Control
157. ..... Red. Enbl/Dsbl Exh. Dcpl. Rmt. Stpnt.
158. ..... Red. Raise Dcpl. Manual Demand
159. ..... Red. Lower Dcpl. Manual Demand
160. ..... Red. Enbl/Dsbl Dcpl. Manual Demand
161. ..... Red. Enbl/Dsbl Dcpl. Remote Demand
162. ..... Red. Auto-Sync. Real-Time Clock
163. ..... Red. External Alarm 1
164. ..... Red. External Alarm 2
165. ..... Red. External Alarm 3
166. ..... Red. External Alarm 4
167. ..... Red. External Alarm 5
168. ..... Red. External Alarm 6
169. ..... Red. External Alarm 7
170. ..... Red. External Alarm 8
171. ..... Red. External Alarm 9
172. ..... Red. External Alarm 10

Table 7-11. Contact Input Configurations

Analog Read addresses 3:XXXX-XXXX give the configuration value of the Aux units and the Cascade units, in order. The configuration for the units are defined in the table below

UNITS CONFIGURATION

VALUE	DESCRIPTION
1.	psi
2.	kPa
3.	MW
4.	KW
5.	degF
6.	degC
7.	t/h
8.	k#/hr
9.	#/hr
10.	kg/cm²
11.	bar
12.	atm
13.	(none)

Table 7-12. Units Configuration

Analog Read addresses 3:XXXX-XXXX give the configuration value of the Extraction / Admission units, in order. The configuration for the units is defined in the table below.

UNITS CONFIGURATION

VALUE	DESCRIPTION
1.	psi
2.	kPa
3.	kg/cm²
4.	t/h
5.	k#/hr
6.	#/hr
7.	kg/hr
8.	bar
9.	atm
10.	(none)

Table 7-13. Units Configuration

Specific Address Information

Entering Setpoint from the Modbus

The setpoints for the Speed, Extraction, Cascade and Auxiliary can be entered through the Modbus link. When the setpoint is entered for any of these functions the setpoint will not move instantly, but the setpoint will move towards the entered setpoint at the ‘entered rate’ defined for the function in the program mode (see Direct Setpoint Entry information in Chapters 3 and 5). The direct setpoint entry from Modbus functions the same as entering the setpoint from the front panel of the control.

There is feedback provided to let the operator know what value was entered. This value will not change until a new value is entered from the Modbus. The addresses, 4:0001-4:0010, are for Speed, Cascade, Aux 1, Aux 2, SG (Extra) PID, P1, P1 Manual, P2, P2 Manual, and the Decoupling Setpoint respectively. When a new value is entered from the Modbus, the setpoint will move to the new value. If the entered setpoint is the same as the feedback, the operator can use a 'Go To Modbus Entered' setpoint command instead of entering the setpoint again. This command needs to be used when the setpoint to be entered is the same as the feedback. The addresses are as follows:

0:0017 - Go to Modbus Speed Setpoint
0:0029 - Go to Modbus Cascade Setpoint
0:0037 - Go to Modbus Aux 1 Setpoint
0:0050 - Go to Modbus Aux 2 Setpoint
0:0063 - Go to Modbus P1 Setpoint
0:0096 - Go to Modbus P1 Manual Setpoint
0:0072 - Go to Modbus P2 Setpoint
0:0097 - Go to Modbus P2 Manual Setpoint

Modbus Scale Factors

Modbus has two limitations:

only integers can be sent across;
the value is limited between -32768 and 32767.

These limitations can be overcome by scaling the value before it is sent across the Modbus. The default scale factor for the analog values is 1. The scale factor can be changed in the Service Mode between 1 and 100. The following input and setpoint values that are sent across the Modbus have independent scale factors: Casc (xxxxx), Aux (xxxxx), FSP (xxxxx), KW (xxxxx), Sync/Load Share (xxxxx), and Extr/Adm (xxxxx). These scaled parameters and their scale factor are available through the Modbus.

Values that require a decimal point must be multiplied by the scale factor (10, 100) prior to being sent across the Modbus. The value sent must then be divided by the scale factor in the Master.

The Scale Factor adjusts all associated analog reads and writes accordingly. For example, the Cascade Scale Factor adjusts the cascade input and setpoint analog read values as well as the Entered Setpt analog write value.

For example, if the Cascade setpoint of 60.15 needs to be sent across the Modbus and have two decimal places, the Cascade Scale Factor would be set to 100 in the Service Mode. This will change the value so that the decimal places can be sent across the Modbus communications link (60.15 * 100 = 6015). After the value is sent across the Modbus, it must be rescaled in the Master to the original value (6015 / 100 = 60.15). A Directly Entered Cascade Setpoint (4:0002) of 61.5 would be sent across the link as 6150 and the 505E automatically divides the value by the Casc Scale Factor and uses the value of 61.5 as the setpoint desired.

Modbus Percentage

Some of the analog read addresses have percentages sent across. The formula used in the percentage calculation is ((actual/maximum) * 100). The percentage is multiplied by 100 before being sent across the Modbus to provide up to 2 decimal places, if desired.

Modbus Emergency Shutdown

Two different types of shutdown commands (emergency and controlled) can be issued through Modbus. The Emergency Shutdown command instantly takes the speed setpoint to zero and the HP & LP actuator currents to zero. Optionally the 505DE can be configured to ignore this Emergency Shutdown command if it is desired to not allow the unit to be tripped through Modbus.

To avoid an inadvertent trip, the emergency shutdown command from Modbus can be configured to require a two step process before a shutdown command is issued. When the shutdown is a two step process Boolean write address 0:0001 starts the shutdown process. An “ESD ACK ENABLE” feedback (1:0255) is given and an acknowledge on address 0:0002 has to be given within five seconds for the control to issue a shutdown command.

For More Modbus Information

Detailed information on the Modbus protocol is presented in “Reference Guide PI- MBUS-300” published by AEC Corp./Modicon Inc., formerly Gould Inc. To implement your own source code, you must register with Modicon. Registration includes purchasing document PI-MBUS-303 and signing a non-disclosure agreement. You can register to use Modbus at your nearest Modicon field office. To find the office nearest you, contact Modicon Technical Support at 1-800-468-5342.

Appendix A. Passwords

Introduction

The 505 Series control system requires a password to be entered before access can be given to Service or Configure mode. Configure mode can be used to configure the 505DE for the desired operation. Service mode can be used to adjust a limited set of settings while the system is running. These passwords are intended to help prevent unauthorized or untrained personnel from accessing these modes and possibly make changes that could cause damage to the turbine or associated process. If only certain people are to know these passwords, remove this appendix and keep it in a separate place, apart from the manual.

Service Mode Password

To log in to Service mode the default password is “1111”.

Configure Mode Password

To log in to Configure mode the default password is “1113”.

AppManager can be used to access the control and manage the files and software that is running on the control. It can also be used to change the IP address of the control if needed. The following are the default user name and password to access the control via AppManager:

User Name: “ServiceUser” Password: “ServiceUser”

Appendix B.
505DE Short Chassis Material Lists

8262- 1023

Part Number	Description	Quantity	Slot(s)
5453-829	8 Slot Chassis	1	
5466-1001	Power Supply Module (110VAC/125VDC)	1	PS1
5466-1035	CPU Module	1	A1
5466-316	Analog Combo Module	2	A2, A3
5501-371	FTM for Analog Combo	2	
5417-028	Cable - Analog Combo Module to FTM (2 per module)	4	
5466-1158	48/24 HDDIO-2 Smart-Plus Module	2	A5, A6
5441-693	FTM for Discrete I/O	2	
5417-173	Cable - Discrete I/O Module to FTM	2	
3799-301	Blank Face Plate	5	A4, A7, A8, PS2(2)
B26361V1	Manual Volume 1 (Paper)	1	
B26361V2	Manual Volume 2 (Paper)	1	
BCD85225	CD with Manuals and PCI Install Program	1	
1796-3031	Run-Time Software Key	1	

8262- 1024

Part Number	Description	Quantity	Slot(s)
5453-829	8 Slot Chassis	1	
5466-1002	Power Supply Module (220VAC)	1	PS1
5466-1035	CPU Module	1	A1
5466-316	Analog Combo Module	2	A2, A3
5501-371	FTM for Analog Combo	2	
5417-028	Cable - Analog Combo Module to FTM (2 per module)	4	
5466-1158	48/24 HDDIO-2 Smart-Plus Module	2	A5, A6
5441-693	FTM for Discrete I/O	2	
5417-173	Cable - Discrete I/O Module to FTM	2	
3799-301	Blank Face Plate	5	A4, A7, A8, PS2(2)
B26361V1	Manual Volume 1 (Paper)	1	
B26361V2	Manual Volume 2 (Paper)	1	
BCD85225	CD with Manuals and PCI Install Program	1	
1796-3031	Run-Time Software Key	1	

8262- 1040

Part Number	Description	Quantity	Slot(s)
5453-829	8 Slot Chassis	1	
5466-1001	Power Supply Module (110VAC/125VDC)	1	PS1, PS2
5466-1035	CPU Module	2	A1, A8
5466-316	Analog Combo Module	3	A2, A3, A4
5501-371	FTM for Analog Combo	3	
5417-028	Cable - Analog Combo Module to FTM (2 per module)	6	
5466-1158	48/24 HDDIO-2 Smart-Plus Module	2	A5, A6
5441-693	FTM for Discrete I/O	2	
5417-173	Cable - Discrete I/O Module to FTM	2	
3799-301	Blank Face Plate	1	A7
B26361V1	Manual Volume 1 (Paper)	1	
B26361V2	Manual Volume 2 (Paper)	1	
BCD85225	CD with Manuals and PCI Install Program	1	
1796-3031	Run-Time Software Key	1	

8262- 1041

Part Number	Description	Quantity	Slot(s)
5453-829	8 Slot Chassis	1	
5466-1002	Power Supply Module (220VAC)	2	PS1, PS2
5466-1035	CPU Module	2	A1, A8
5466-316	Analog Combo Module	3	A2, A3, A4
5501-371	FTM for Analog Combo	3	
5417-028	Cable - Analog Combo Module to FTM (2 per module)	6	
5466-1158	48/24 HDDIO-2 Smart-Plus Module	2	A5, A6
5441-693	FTM for Discrete I/O	2	
5417-173	Cable - Discrete I/O Module to FTM	2	
3799-301	Blank Face Plate	1	A7
B26361V1	Manual Volume 1 (Paper)	1	
B26361V2	Manual Volume 2 (Paper)	1	
BCD85225	CD with Manuals and PCI Install Program	1	
1796-3031	Run-Time Software Key	1	

Revision History

Changes in Revision F—

- Removed outdate GOST R certificate
- Major technical updates throughout

Changes in Revision E—

- Added additional reference manuals (page 3)
- Replaced 48/24 Discrete I/O Module with Discrete I/O Smart-Plus Module (page 9)
- Updated Discrete I/O Troubleshooting Guide (pages 70-72)
- Replaced PN 5466-258 with new PN 5466-1158 in Appendix B

Declarations

DECLARATION OF CONFORMITY

Manufacturer's Name:	WOODWARD GOVERNOR COMPANY (WGC) Industrial Controls Group
Manufacturer's Address:	1000 E. Drake Rd. Fort Collins, CO, USA, 80525
Model Name(s)/Number(s):	MicroNet™ Simplex, MicroNet™ Plus Digital Control Systems when installed in a non-EMI cabinet, 18-36 VDC.
Conformance to Directive(s):	Declared to 2004/108/EC COUNCIL DIRECTIVE of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility. 94/9/EC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.
Marking(s):	Ex Category 3 Group II G, Ex nA [nL] IIC T3 X
Applicable Standards:	EN61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments EN61000-6-4, 2007: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN60079-15, 2005: Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n' EN60079-0, 2004: Electrical apparatus for explosive gas atmospheres – Part 0: General requirements

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Suhail Horan
Signature

Suhail Horan
Full Name

Quality Manager
Position

Fort Collins, CO, USA
Place

11/17/2009
Date

5-09-1183 Rev 15, 22-Jan-2009 00372-04-EU-02-01

DECLARATION OF CONFORMITY

Manufacturer's Name:	WOODWARD GOVERNOR COMPANY (WGC) Industrial Controls Group
Manufacturer's Address:	1000 E. Drake Rd. Fort Collins, CO, USA, 80525
Model Name(s)/Number(s):	MicroNet™ Simplex, MicroNet™ Plus Digital Control Systems, when installed in a non-EMI cabinet, 88-264 VAC, and 100-300VDC.
Conformance to Directive(s):	Declared to 2004/108/EC COUNCIL DIRECTIVE of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility. Declared to 2006/95/EC COUNCIL DIRECTIVE of 12 December 2006 on the harmonized laws of Member States relating to electrical equipment designed for use within certain voltage limits. 94/9/EC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.
Marking(s):	Ⓔx Category 3 Group II G, Ex nA [nL] IIC T3 X
Applicable Standards:	EN61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments EN61000-6-4, 2007: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN61010-1, 2001: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1:General Requirements EN60079-15, 2005: Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n' EN60079-0, 2004: Electrical apparatus for explosive gas atmospheres – Part 0: General requirements

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Suhail Horan
Signature

Suhail Horan
Full Name

Quality Manager
Position

Fort Collins, CO, USA
Place

11/17/2009
Date

5-09-1183 Rev 15, 22-Jan-2009 00372-04-EU-02-02

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26361V2F.

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PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

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