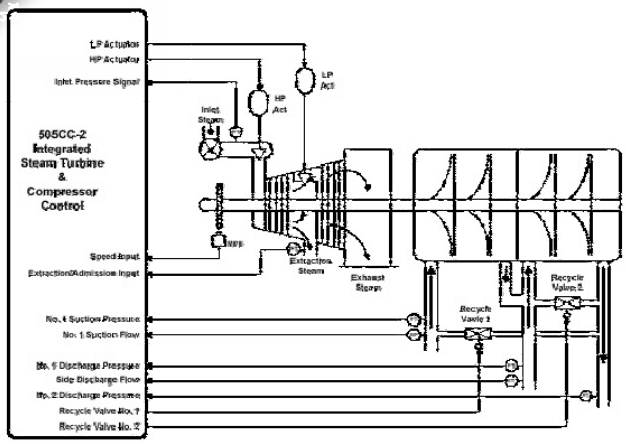
WOODWARD

Product Manual 26542V1
(Revision C, 4/2013)
Original Instructions



505CC-2 Atlas-II™
Steam Turbine and Compressor Control

Hardware and Installation Manual
Part Number 8301-1258

Volume 1

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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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 Out-of-date translations are marked with ⚠.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 26542V1

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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.

Regulatory Compliance

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking.

EMC Directive: Declared to 2004/108/EC COUNCIL DIRECTIVE of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and all applicable amendments.

ATEX—Potentially Explosive Atmospheres Directive: Declared to 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.
Zone 2, Category 3, Group II G, Ex nA IIC T3 X

North American Compliance:
These listings are limited only to those units bearing the UL identification.

UL: UL Listed for Class I, Division 2, Groups A, B, C, & D, T3C at 70°C surrounding air temperature. For use in Canada and the United States.
UL File E156028
The 16-channel relay interface modules are suitable for ordinary or non-hazardous locations only.

Marine Compliance

American Bureau of Shipping ABS Rules 2006 SVR 4-2-1/7.3, 7.5.1, 7.9.3/17, 4-9-4/23, 4-9-7/Table 9

Det Norske Veritas Standard for Certification No. 2.4, 2006: Temperature Class B, Humidity Class B, Vibration Class A, and EMC Class A

Lloyd's Register of Shipping LR Type Approval Test Specification No. 1, 2002 for Environmental Categories ENV1, ENV2, and ENV3

Special Conditions For Safe Use:
This Equipment is Suitable For Use in Class I, Division 2, Groups A, B, C, D or Non-Hazardous Locations Only.

This equipment is suitable for use in European Zone 2, Group IIC environments.

This equipment is intended to be installed in a metal cabinet or enclosure to provide protection against the entry of dust or water and to protect against mechanical impact. For ATEX compliance, a minimum ingress protection rating of IP54 is required for the enclosure.

For ATEX compliance, this equipment must be protected externally against transient disturbances. Provisions shall be made to prevent the power input from being exceeded by transient disturbances of more than 40% of the rated voltage

Wiring must be in accordance with North American Class I, Division 2, or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

A fixed wiring installation is required and a switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach of the operator and that is clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the protective earth conductor.

Do not connect more than one main power supply to any one fuse or circuit breaker.

Protective Earth Grounding is required by the input PE terminal (see Chapter 2, Installation).

Ground leakage current exceeds 3.5 mA.

For Communications wires, use wires with a temperature rating of at least 5 °C above surrounding ambient. All others use wires with a temperature rating of at least 10 °C above surrounding ambient.

The Atlas-II™ A5200 board contains a single cell primary battery. This battery is not to be charged and is not customer replaceable.

Control is suitable for installation in pollution degree 2 environments.

Unmarked inputs are classified as permanently connected IEC measurement Category I. To avoid the danger of electric shock, do not use inputs to make measurements within measurement categories II, III, or IV. See individual inputs for additional information on transient overvoltage input ratings.

⚠WARNING

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

Substitution of components may impair suitability for Class I, Division 2 applications.

⚠AVERTISSEMENT

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

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, applications Division 2.

IMPORTANT

The Atlas-II is designed for installation in a standard metal cabinet. If the cabinet door is open or Atlas-II is not installed in a metal cabinet, some degraded performance can occur on RTD and thermocouple inputs in the presence of radio wave energy. Radio wave energy may be from transmitters such as cell phones or push to talk radios.

This degraded performance is in the form of a slight change in the accuracy of the RTD and thermocouple input measured temperature. It is recommended that operation of such radio wave devices be kept more than 3 m (10 ft) from the Atlas-II control. This will prevent performance degradation. Installation of the Atlas-II control in a metal enclosure, as intended, will also prevent performance degradation.

IMPORTANT

The Atlas-II Actuator and Analog outputs are intended to drive loads that are isolated from protective earth, like actuators and meters.

NOTICE

The Atlas-II is protected from indirect lighting strikes. However, during a lighting strike to protective earth (PE), or similar transient events, if the Actuator or Analog outputs are connected to earth-referenced devices, the device may significantly reduce performance of the Atlas-II.

Protective earth connections separated by a significant distance (>30 m) can see a large voltage difference due to transient surge events. The non-isolated device may cause a ground fault with significant current flow through the analog signal lines, causing signal input measurement errors beyond Analog I/O to occur.

Adding an isolator between the Atlas-II and its analog loads will solve this issue. Alternatively adding clamping circuitry, like Metal Oxide Varistors (MOV) or Transient Voltage Suppression (TVS) diodes, from chassis to signal lines at both ends will also solve this issue. (See the appropriate sections for more details.)

Chapter 1.
General Information

⚠WARNING

IOLOCK. When a CPU or I/O module fails, watchdog logic drives it into an IOLOCK condition where all output circuits and signals are driven to a known de-energized state as described below. The System MUST be designed such that IOLOCK and power OFF states will result in a SAFE condition of the controlled device.

- **CPU and I/O module failures will drive the module into an IOLOCK state.**
- **CPU failure will assert an IOLOCK signal to all modules and drive them into an IOLOCK state.**
- **Discrete outputs / relay drivers will be non-active and de-energized.**
- **Analog and actuator outputs will be non-active and de-energized with zero voltage or zero current.**

The IOLOCK state is asserted under various conditions including:

- **CPU and I/O module watchdog failures**
- **Power Up and Power Down conditions**
- **System reset and hardware/software initialization**
- **Entering configuration mode**

NOTE: Additional watchdog details and any exceptions to these failure states are specified in the related CPU or I/O module section of the manual.

1.1 Introduction

The 505CC-2 is a steam and compressor control designed for use on a single- or two-valve steam turbine driving a one- or two-loop dynamic compressor. This is volume 1 of the 26542 Woodward 505CC-2 Atlas-II™ manual. The manual encompasses three separate volumes:

- **Volume 1**—Provides information on the Commissioning Configuration software Tools (CCT), hardware interface, such as a description of the Atlas-II platform, modules, I/O interfaces used, installation, maintenance, and troubleshooting.
- **Volume 2**—Provides information on steam turbine control, configuration, service, and run mode configuration and settings.
- **Volume 3**—Provides information on compressor control, configuration, service, and run mode configuration and settings.

This volume describes the Woodward 505CC-2 Atlas-II™ Digital Control. It provides a variety of useful information for the user ranging from simple basic descriptions to detailed information on wiring, specifications, and functionality. Included are:

- General information on the Atlas-II platform and available versions
- A physical description of the control hardware
- A description of all Atlas-II modules
- A listing of accessories that may be used with the platform
- Information on Atlas-II communications and distributed I/O interfaces
- Installation and maintenance
- Troubleshooting information
- Modbus communication and list
- Description of service tools supplied with application CD
- Alarm, and shutdown list

1.2 Quick Start Guide

The following links provide shortcuts to pertinent information within this manual required of a typical installation. However, they are not intended to replace comprehensive understanding of the 505CC-2 and its functionality, it is still recommended to read and understand the manual fully.

Topic	Location (manual 26542)
Physical Installation / Wiring	Volume 1, Chapter 2
Software / System Configuration	Volume 1, Chapter 8
Modbus® *	Volume 1, Chapter 7
Security / Login Passwords	Volume 1, Chapter 8
Turbine Configuration Mode	Volume 2, Chapter 4
Turbine Service Mode	Volume 2, Chapter 5
Turbine Run Mode	Volume 2, Chapter 6
Compressor Configuration Mode	Volume 3, Chapter 4
Compressor Service Mode	Volume 3, Chapter 5
Compressor Run Mode	Volume 3, Chapter 6

*—Modbus is a trademark of Schneider Automation Inc.

1.3 Atlas-II Control Description

The Atlas-II digital control platform fits a wide range of prime mover applications. These include small mechanical-drive units with a minimum of complexity on up to large two-shaft gas turbine generator sets that require unit sequencing and load control. The Atlas-II control is programmed to the specific needs of the prime mover and its driven load which resulted in the 505CC-2 Atlas-II that is designed for steam turbine and/or compressor control.

Steam turbine control type possible are no extraction, extraction only, admission only, admission only with direct feed, and both extraction and admission. Compressor control possible is a single or dual single shaft compressor with side stream extraction or admission.

At the heart of the Atlas-II control is a 32-bit microprocessor that runs a powerful Real Time Operating System. This operating system is specifically designed to control the proper timing of all application code so that dynamic performance of the final control system is absolutely guaranteed. Each piece of the application code is “scheduled” under a Rate Group structure that ensures execution of the code at a predetermined time.

Application programming is accomplished via Woodward’s GAP™ Graphical Application Program. GAP is a pictures-to-code system that provides a high-level programming environment for users who have control expertise but do not have specific programming skills. Once the application program has been generated and loaded into the Atlas-II control, the user can view variables and tune the control with a variety of Woodward service tools. Connection to other devices, such as an HMI, is accomplished by means of serial Modbus or Ethernet ports on the control. The desired information flow is programmed into the control via GAP.

The hardware platform is based on the industry-standard PC/104 bus structure. In the Atlas-II control, the backplane is the SmartCore board. The PC/104 modules are “stacked” onto the SmartCore board in order to add I/O or other functionality. Each of the stacked modules has an on-board DIP switch that is positioned to the unique address of that particular module. The Atlas-II control uses a second stack called the Power Bus Stack. This stack is used primarily for power-related I/O. The control runs on low-voltage DC power (18–32 Vdc). Atlas-II field wiring is accomplished via terminal blocks that plug into the control modules.

1.4 Control Version

The Atlas-II control provides a flexible platform that can be structured into a wide variety of configurations of I/O and communications. The number of I/O modules and the types of communication modules that are used for the 505CC-2 are shown below:

- 8273-565 505CC-2 Atlas-II
- Power Supply
- SmartCore CPU A5200
- Analog Combo I/O

Atlas-II Item Number	Operating System	Atlas-II A5200	Power-Sense	Analog Combo	DLE Com	Profibus	Cooling Fan	Description
8273-565	VxWorks	1		1				ATLAS-II, 2 X 2, A5200, LV, 1 COMBO

Table 1-1. VxWorks 505CC-2 Atlas-II Item Number

Figure 1-1 shows diagrammatically the physical arrangement of the modules in the 505CC-2 Atlas-II control hardware. The hardware uses two stacked-bus arrangements to provide the required structure. The Power Bus Stack is used for the power-related I/O as well as the discrete output drivers. The PC/104 Stack is used primarily for the signal I/O, the main processor, and communications modules. The SmartCore CPU A5200 module spans both the Power Bus Stack and the PC/104 Stack.

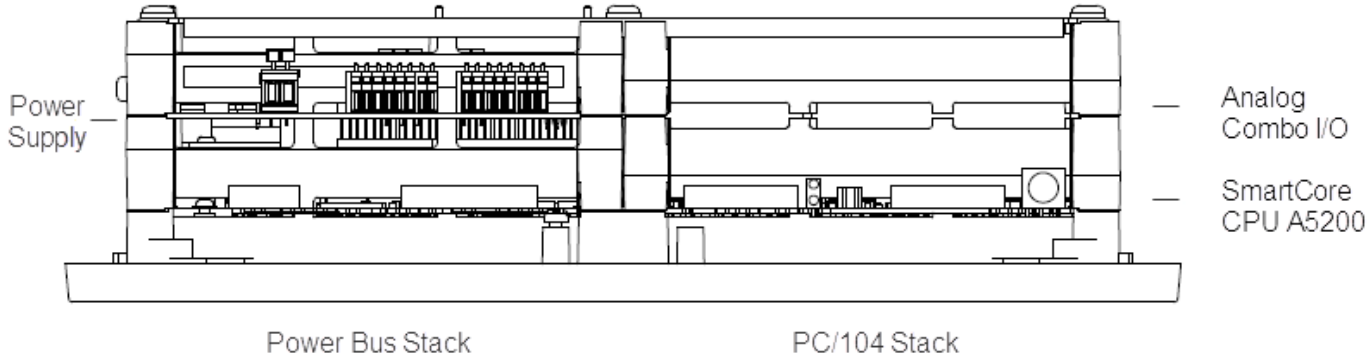


Figure 1-1. Atlas-II, Example Module Layout

The physical dimensions of the Atlas-II are shown in Figure 1-2.

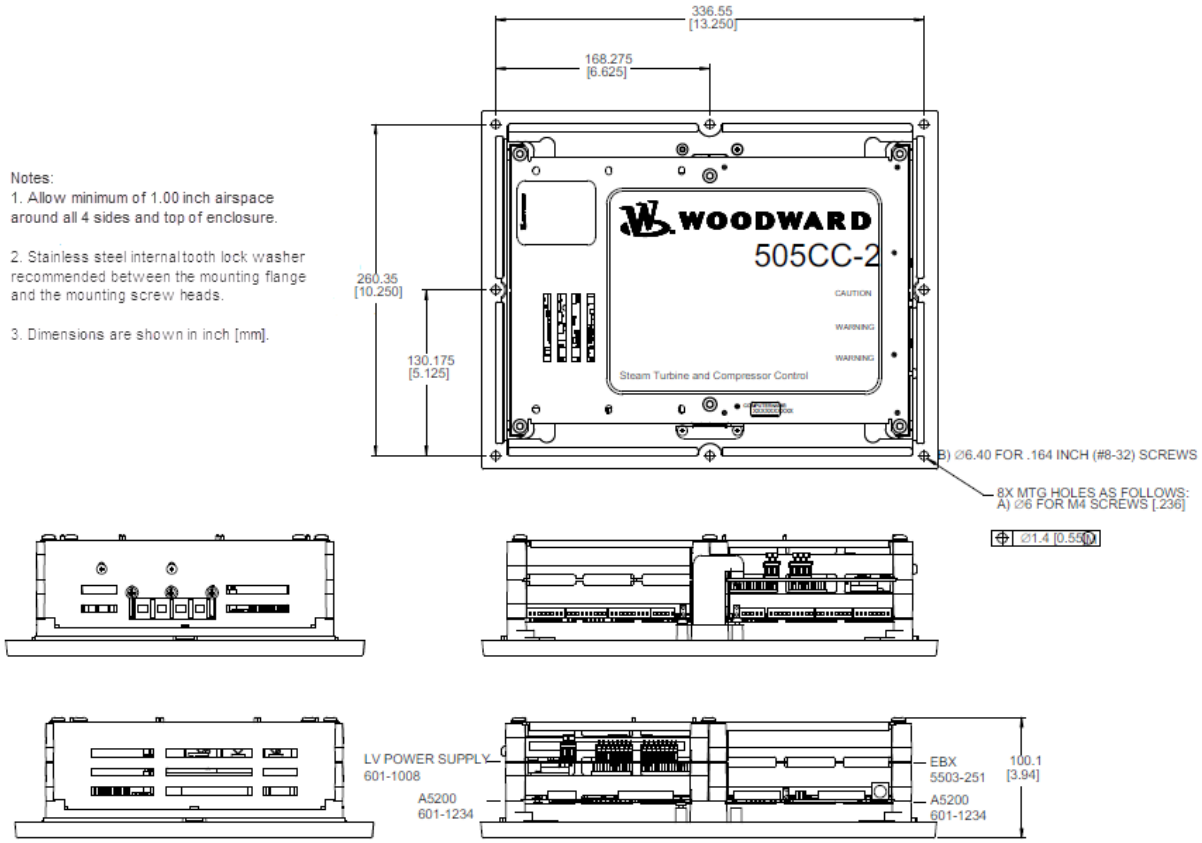


Figure 1-2. Physical Dimensions

1.5 Control Accessories

The Atlas-II digital control platform is designed to interface with several Woodward service tools and commercial software products. Available tools are listed below with a brief description of their functionality, see also Chapter 9 Commissioning and Configuration Tools:

- Monitor GAP
  - An Ethernet connection to the control allows on-line GAP monitoring, debug, and tunable configuration.
- Watch Window
  - Provides an Ethernet or serial connection to the control to allow 1) initial configuration of the unit; 2) monitoring and tuning of system variables; and 3) management of configuration and setpoints.
- Control Assistant
  - Ethernet connection to the control for Tunable Management, viewing of high-speed data captures, and other useful utilities.
- Application Manager
  - Ethernet access to the control for program loading, network configuration and support, and system diagnostics.
- HMI (Human Machine Interface)
  - Commercially available HMI programs interface to the Atlas-II control through Ethernet or serial connections to provide operator access and control of the application machinery.

Chapter 2. Installation

2.1 Introduction

This chapter provides the general information for mounting location selection, installation, and wiring of the 505CC-2 Atlas-II™ control. Hardware dimensions, ratings, and requirements are given for mounting and wiring the control in a specific application.

2.2 General Installation

When selecting a location for mounting the 505CC-2 Atlas-II control, consider the following:

- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The control is designed for installation in a protective metal enclosure such as a standard cabinet with ingress protection rating of IP54.
- A standard “EMC” cabinet is required when installing into a Marine Type Approval applications.
- Provide an ESD strap inside the cabinet for handling the equipment and plugging/unplugging the connectors.
- The operating range of the Atlas-II control is –40 to +70 °C (–40 to +158 °F) except when the Profibus module is used. See the Environmental Specifications for more details.
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Do not install the unit or its connecting wires near inductive, high-voltage, or high-current devices. If this is not possible, shield both the system connecting wires and the interfering devices or wires.
- Allow adequate space around the unit for servicing and wiring.
- Do not install where objects can be dropped on the terminals.
- Ground the chassis for proper safety and shielding.
- When installing on a generator set package, provide vibration isolation.

2.3 Shipping Carton

Before unpacking the control, refer to the inside front cover of this manual for WARNINGS and CAUTIONS. Be careful when unpacking the control. Check for signs of damage such as bent or dented panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.

The Atlas-II control was shipped from the factory in anti-static foam lined carton. This carton should always be used for transport of the control or for storage when the control is not installed.

2.4 Mounting

Figure 1-2 shows the Atlas-II control layout and mounting pattern. The Atlas-II digital control is to be mounted in an appropriate enclosure for the installed environment. This equipment is designed for installation within a control room panel or cabinet.

WARNING

This equipment is intended to be installed in a metal cabinet or enclosure to provide protection against the entry of dust or water and to protect against mechanical impact. For ATEX compliance, a minimum ingress protection rating of IP54 is required for the enclosure.

The 505CC-2 Atlas-II package must be mounted to allow sufficient room for wiring access. Eight front panel mounting holes permit secure mounting. Depending on its configuration, the Atlas-II weighs between 3.4 and 4.5 kg (7.5 and 10 pounds). A minimum of 25 mm (1 inch) of clear space around the outer surfaces of the Atlas-II is adequate for ventilation, however approximately 75 mm (3 inches) of space may be required for wiring, depending on wire size.

2.5 Environmental Specifications

2.5.1 Operating Temperature

The Atlas-II Control Platform operates in a specified ambient temperature of –40 to +70 °C (–4 to +158 °F) with forced convection cooling. When the Atlas-II contains a single Profibus module, the operating temperature is limited to –20 to +60 °C (–4 to +140 °F). When the Atlas-II contains (2) Profibus modules, the operating temperature is limited to –20 to +55 °C (–4 to +131 °F).

NOTICE

Continuous operation with insufficient airflow or higher operating temperatures will lead to reduced reliability and possible damage to the control.

2.5.2 Storage Temperature

The Atlas-II Control Platform is designed to be stored without applied power at the temperature range of –40 to +85 °C (–40 to +185 °F). Any unit with Profibus is limited to –20 to +70 °C (–4 to +158 °F).

Component life is adversely affected by high-temperature, high-humidity environments. Room temperature storage is recommended for long life. If the unit is to be stored for a long period of time, operating power must be applied at least for one hour every 18 to 24 months.

2.5.3 Shock

The Atlas-II Control Platform was designed to meet the shock requirements specified by MIL-STD-810C procedure 516.2, procedure 1 (30g, 11 millisecond half sine pulse). During Shock, relay bounce shall be limited to less than 100 ms.

2.5.4 Vibration (Sinusoidal)

The Atlas-II Control Platform was designed and tested to meet Lloyd's Test Specification No. 1, 2002, Vibration Test 1. The Vibration test profile includes 3–16 Hz, ±1 mm and 16–150 Hz, ±1.0g.

2.5.5 Audible Noise Emission

The Atlas-II Control Platform does not emit an audible noise above 70 dBA as measured 1 meter away, with or without a fan.

2.5.6 Enclosure Protection

In order to meet Zone 2 European Group IIC, the Atlas-II Control must be mounted in an enclosure that meets or exceeds IP 54.

2.5.7 Altitude

The Atlas-II Control Platform is designed to operate up to 3000 m / 9800 feet.

2.6 Electrical Connections

Most of the Atlas-II control's terminal blocks are designed to be removed by hand. The Atlas-II Control uses two different styles of pluggable terminal blocks: Screw Connection (limited to the A5200 SmartCore board) and "CageClamp".

The pluggable terminal blocks on the SmartCore CPU A5200 board all utilize the Screw Connection style terminal blocks (see Figure 2-1 for torque and screwdriver requirements). The Screw Connection terminal blocks accept wires from 0.08–1.5 mm² (28–16 AWG). Two 0.8 mm² (18 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal.

The pluggable terminal blocks on the modules (other than the A5200 SmartCore) are screwless, CageClamp style blocks. The spring clamp can be actuated by using a standard 2.5 mm (3/32 inch) flat bladed screwdriver (see Figure 2-2). These terminal blocks accept wires from 0.08–1.1 mm² (28–18 AWG). Two 0.5 mm² (20 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal.

Most of the Atlas-II control's terminal blocks are designed to be removed by hand. After Atlas-II input power is disconnected, the terminal blocks can be removed one at a time by pulling them straight out. Be careful not to pull the plug out at an angle, as this will fracture the end terminal. Wires for the all the pluggable I/O terminal blocks should be stripped at 8 mm (0.3 inch).

Torque range for screws of Screw Connection Terminal Blocks:

- 0.22–0.25 N·m (1.95–2.21 lb-in).

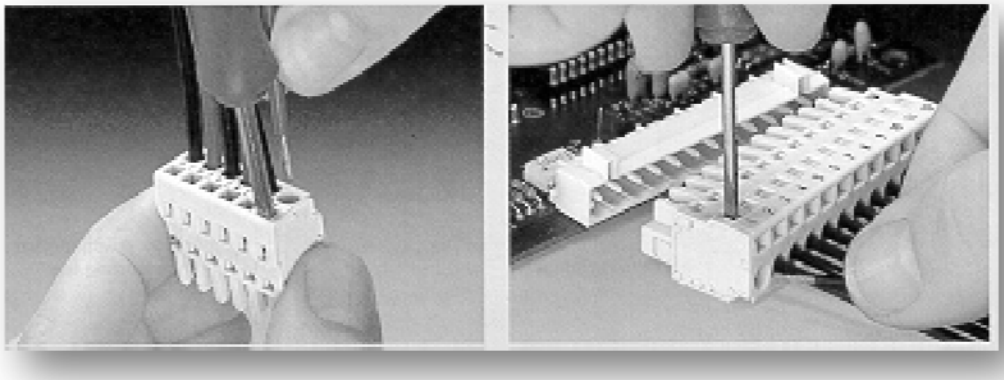
Screwdriver blade:

- 0.4 X 2.5 mm (0.016 X 0.10 inch)

Screwdriver available:

- Woodward PN 8992-005

Figure 2-1. Screw Connection Terminal Block, A5200 SmartCore Board



Method #1
Free Hand (holds spring open)

Method #2
Bench (momentarily opens spring while force is applied)

Figure 2-2. Spring Clamp Terminal Block

The Atlas-II fixed terminal blocks used for the power supply input accept wires from 0.08–1.1 mm² (28–18 AWG). Two 0.5 mm² (20 AWG) wires or three 0.3 mm² (22 AWG) wires can be easily installed in each terminal. Wires for the fixed mounted power terminals should be stripped 5 mm (0.2 inch).

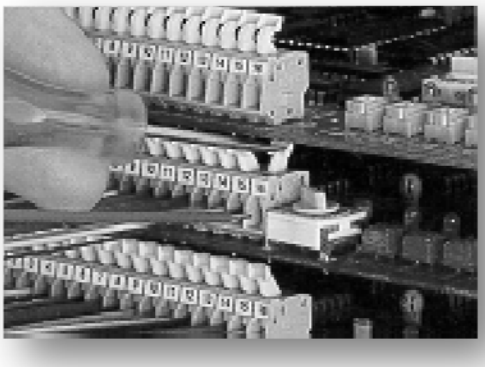


Figure 2-3. Cage Clamp Terminal Block

IMPORTANT

Do not tin (solder) the wires that terminate at the Atlas-II terminal blocks. The spring-loaded CageClamp terminal blocks are designed to flatten stranded wire, and if those strands are tinned together, the connection loses surface area and is degraded.

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live 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.

All AC wiring for voltages and currents is done with fixed screw barrier blocks rather than pluggable terminal blocks. The fixed screw barrier blocks accept wires terminated into terminal lugs for #6 screws.

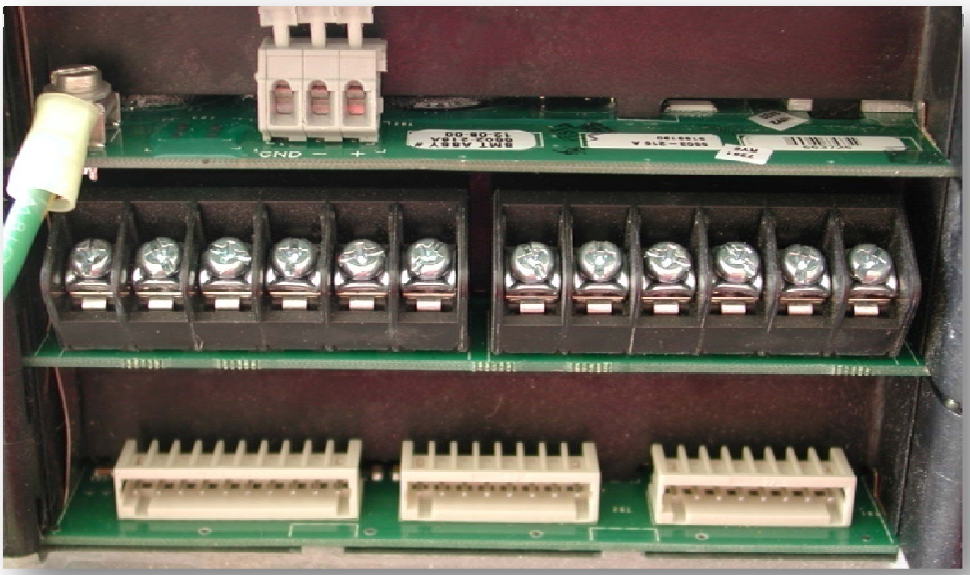


Figure 2-4. Fixed Screw Terminals

2.7 Grounding

Protective Earth (PE) must be connected to the termination point on the backside of the unit next to the label with the ⏚ symbol to reduce the risk of electric shock. This connection will be made using a thread-forming screw (M4 x 6 mm). The conductor providing the connection shall have a properly sized ring lug and wire larger than or equal to 3.3 mm² (12 AWG).

The unit also needs low impedance grounding to earth, e.g. the cabinet or enclosure used. The low impedance ground can be accomplished by one or more of the following:

- A short 15 cm (6 inch) protective earth wire
- A 1.3 cm (0.5 inch) wide flat hollow braid less than 1 m long
- A 1.3 cm (0.5 inch) wide flat tin or lead/tin plated copper strap less than 1 m long
- The use of the eight mounting bolts and paint breaking washers

⚠WARNING **Do not connect chassis ground or PE ground to signal common.**

2.7.1 Safety Ground Wire Installation

Safety wires must be routed against the grounded cabinet structure. Locate safety ground wire 150 mm (6 inches) from unshielded cabling and 75 mm (3 inches) from shielded cabling inside the cabinet, and 150 mm (6 inches) from any I/O cabling exiting the cabinet.

2.7.2 Recommended Grounding Practices

Providing the proper ground for the Atlas-II control is important. Improper connection of the control chassis to the protective earth / building ground plane may lead to stray currents between the reference point for the AC signal sources (current and voltage transformers), and the reference point for the sensing inputs on the Atlas-II control. Differences in potential between these two points results in equalizing current flow which then produces unacceptably high common mode voltages. Common mode voltages may result in improper readings for the sensed AC inputs, or even damage to the Atlas-II control in extreme cases. To minimize this problem, it is necessary to provide a low resistance path between the AC signal reference point, and the chassis of the Atlas-II control. Typically this point is the designated ground for the generator set and related instrument transformers.

2.7.3 Shields and Grounding

All signal lines except PT/CT, relay outputs, contact inputs, and power supply wiring should be shielded to prevent picking up stray signals from adjacent equipment.

IMPORTANT

Shielding of PT/CT, relay outputs, contact inputs, and power supply wires inside the metal enclosure is required for Marine Type Approval installation applications. Relay outputs, contact inputs, and power supply wiring do not normally require shielding for other installations, but may be shielded if desired.

All shielded cable must be twisted conductor pairs. The Atlas-II control is designed with shield terminations to earth ground at the control. An individual shield termination to earth is provided at the terminal block for each of the signals requiring shielding. Do not tin (solder) or attempt to tin the braided shield for connection into the terminal block. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches).

If intervening terminal blocks are used in routing a signal, the shield should be continued through the terminal block. If shield grounding is desired at the terminal block, it should be AC coupled to earth. All shield terminations not at the Atlas-II or entry into its metal enclosure should be AC coupled to earth through a capacitor. (A 1000 pF, 500 V capacitor is typically sufficient. The intent is to provide a low impedance path to earth for the shield at frequencies of 150 kHz and higher.)

Multiple, spread out, direct or high capacitance connections of a shield to earth should be avoided. Multiple connections risks high levels of low frequency ground current, like 50/60 Hz, flowing within the shield.

Shield termination can be a deterministic process. AC shield connections (capacitors) may be dictated at the control, instead of the direct earth connection provided. Typically, shields at signal inputs are connected directly to earth, and shields at signal outputs are AC-coupled to earth or floating. See Woodward application notes 50532, *Interference Control in Electronic Governing Systems*, and 51204, *Grounding and Shield Termination,* for more information.

2.7.4 Shielded Wire Preparation

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

1. Strip outer insulation from both ends, exposing the braided or spiral wrapped shield. Do not cut the shield or nick the wire inside the shield.
2. Using a sharply pointed tool, carefully spread the strands of the braided shield to form a hole.
3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.
5. Connect wiring and shield as shown in plant wiring diagram.
6. If a shield connection is not required or desired, fold back and secure or remove the excess shield as needed.

2.7.5 General Wiring Guidance

For noise suppression reasons, it is recommend that all low-current wires be separated from all high-current wires and high-voltage be separated from low-voltage.

Input power ground terminal, not power return, should also be wired to earth ground.

Installations with severe electromagnetic interference (EMI) may require additional shielding precautions, such as wire run in conduit or double shielding. Contact Woodward for more information.

Shields from the control to its loads or inputs can be directly grounded to earth at both ends, if the cable length is sufficiently short to prevent ground loop current in the shield (e.g. within a single cabinet).

Enclosure Installations: If the control is installed in a metal enclosure, as intended, shielded I/O must be AC or DC terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as at the control shield pins.

Specifics are provided in each individual installation section.

2.8 Enclosure Application Information

NOTICE

This manual details only guidelines specific for the Atlas-II platform supplied, and I/O used, with .the 505CC-2.
Do not use this as a reference for other Atlas-II applications

2.8.1 Cabinet Structural Grounding

- The cabinet needs to be a six-sided metal enclosure;
- Do not use cabinet doors with windows—doors should be solid metal.
- The enclosure floor and/or top panels must provide holes for cable entry.
- Top and bottom cable entry areas must be restricted in size. Cable entry aperture sizes should be minimized to the extent possible, the largest dimension of any aperture (hole) is no greater than 152 mm (6 inches). This is particularly important when RF transmitters, like push to talk radios or cell phones, can be located near the cable access areas.

- An enclosed metal cable area or cable way joining to the cabinet may be thought of as part of the enclosure; If it has no holes larger than 152 mm (6 inches) and no RF transmitters can be present with in it. This allows larger holes in the enclosure cable access plate. The enclosed cableway effectively becomes part of the enclosure.
- The cabinet enclosure frame and device mounting areas must be bonded (grounded) together.
- The frame shall be electrically connected at each structural interface (<2.5 mΩ).Mounting plates shall be electrically connected to structural frame (<2.5 mΩ);
- 4 corners minimum—4 corners + 2 mid-points preferred.
- Doors must be electrically connected to the main structural frame (<2.5 mΩ);
- 1 place minimum, 3 places preferred, use of 25 mm (1 inch) wide bond straps is preferred.
- Optimally install bond straps at the locations that cables cross the door hinge. If no cables cross the hinge point, locate straps to break up the size of gaps or openings in the metal structure to door interface.
- Cover panels shall be electrically connected to structural frame (<10 mΩ);
- 1 place minimum, 2 places preferred (placed at opposite corners).
- Floor and top panels must be electrically connected to structural frame (<2.5 mΩ);
- 1 place minimum, 4 places at the corners is preferred.
- DIN rails must be electrically connected to structural frame (<2.5 mΩ);
- Once every 12”, use a minimum of 2 screws to bond a DIN rail to cabinet frame or mounting panel.
- The cabinet must provide a shield termination point for cables as they enter the enclosure. Shielded I/O must be AC or DC terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as to the Atlas-II shield pins.

IMPORTANT **The grounding section covers how to create shield terminations and when to ground shields: directly to earth or indirectly to earth through a capacitor. There must be one earth ground.**

2.8.2 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 (<2.5 mΩ) or AC grounding of cable shields as specified.
- Route each of the shielded cable types separately, by type. A minimum of 5 cm (2 inches) between types should be maintained.
- Maintain unshielded cables within 0-10 mm (0.0-0.4 inches) of the enclosure metal mounting panels, frame rails, etc, until they get close to the Atlas-II. Approximately 152-203 mm (6-8 inches) near the Atlas-II may be moved away from the enclosure ground by as much as needed to get to the connector.
- The cable shielding of shielded cables performs better if the shielded cables follow the same routing instructions given for unshielded cables, however this is not required.

- Atlas-II cable shields termination pins, except for CAN shield, are designed connected directly to chassis. If this direct connection is used, cables at the cabinet's cable entry point should also be directly connected to the cabinet.
- All signal lines going outside the cabinet must be shielded while inside the cabinet to prevent picking up stray signals.

IMPORTANT

Shielding of PT/CT, relay outputs, contact inputs, and power supply wires inside the metal enclosure is required for Marine Type Approval installation applications. Relay outputs, contact inputs, and power supply wiring do not normally require shielding for other installations, but may be shielded if desired.

IMPORTANT

The grounding section covers how to create shield terminations and when to ground shields: directly to earth or indirectly to earth through a capacitor. There must be one earth ground.

2.8.3 Equipment Zoning (Segregation)

Separate the equipment types inside the enclosure/cabinet, as possible:

- Analog equipment area
- Discrete I/O equipment areas
- Shielded I/O area
- Un-shielded I/O area
- Power
- AC mains PT & CT monitoring area
- Light Industrial EMC compliant equipment area
- Monitor/kybd/pointing device (HMI if applicable)
- Other equipment area
- Maintain a minimum or 6" of separation between equipment type areas

IMPORTANT

Light Industrial equipment is defined as equipment that is designed and tested to comply with European Union (EU) directives (e.g. EN61000-6-1 and EN61000-6-3) for Light Industrial environments. Industrial compliant equipment is designed and tested for the EU directives for Heavy Industrial environments (e.g., EN61000-6-2 and EN61000-6-4).

2.8.4 Third Party Hardware Located Inside the Cabinet

Use only CE Compliant devices

- CE Compliant to Light Industrial Levels;
- Locate cables (to and from Light Industrial) away from all I/O cables that enter or exit the cabinet by 305 mm (12 inches)
- Locate cables (to and from Light Industrial) away from all other cables not going outside the cabinet, separated by greater than 150 mm (6 inches).
- CE Complaint to Industrial Levels
- Locate based on zoning restrictions

2.8.5 Installation of Other Equipment, Fans, Meters, etc.

2.8.5.1 Shield Termination Schemes

Concerning shield termination schemes follow general guidance above and see Application Note 51204 for this information.

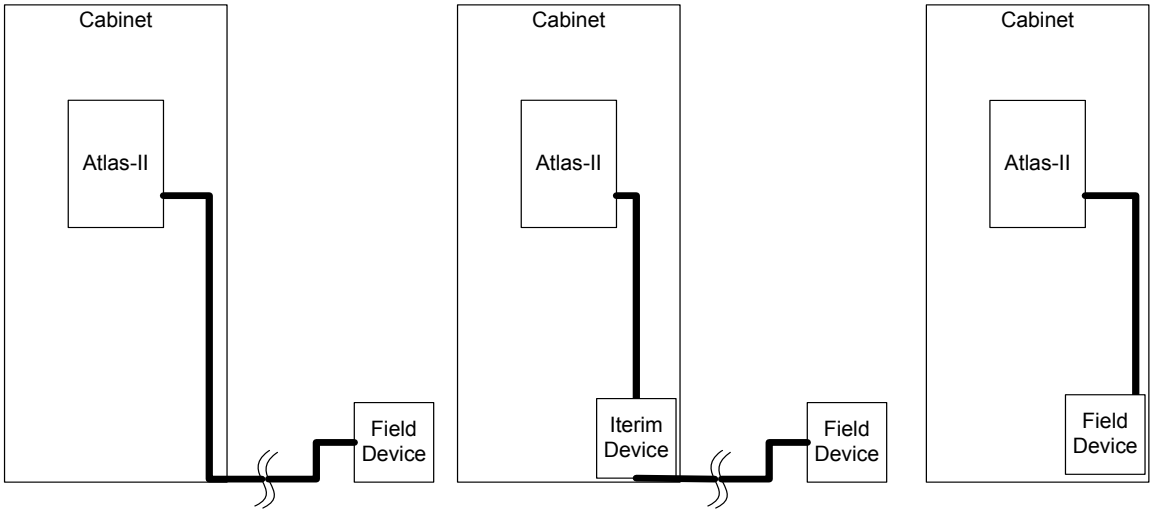
2.8.5.2 Input Power Routing and Filtering

- Input power coming inside the cabinet from outside it or going outside the cabinet from inside it must be routed separately from all other circuits as it enters the cabinet and while inside the cabinet.
- If input power feeding the Atlas-II is ever outside the cabinet, it must be routed separately from all other circuits as it enters the cabinet and while inside the cabinet. Marine Type Approval applications also require input power that leaves the cabinet to be shielded while inside the cabinet. Shield termination at the cabinet entry point and just before the device input.
- Route Atlas-II power coming from outside the cabinet along the left side of middle, at the back of the cabinet. Route it directly against the mounting panel. All other I/O and internal cabling must be kept more than 152 mm (6 inches) away.
- Input power must route directly to controls that are “Industrial” compliant.
- Input power that must route to controls that are “Light Industrial” compliant must be filtered with a minimum of 20 dB filtering.
- Input power that must be routed near other cabling will be filtered prior to the point the cables follow a common path. Filter with a 20 dB filter.

2.8.6 Shielded Cable Routing & Shield Termination

WARNING

Do not connect chassis ground or PE ground to signal common.



Interim Device: Isolator, Relay Box, FTM, etc.
Field Device: Actuator, Valve, Sensor, Meter, Profibus Head, etc.

Figure 2-5. Descriptions of Main Cabinet Cabling Options

2.8.6.1 Field Device not in Cabinet, No Interim Device

- Use shielded cable from Atlas-II to field device (Isolator, FTM, Analog Driver, indicator meter, etc).
- Route the cable from Atlas-II to the cabinet exit point with the cable against cabinet metal structure.
- AC or DC ground the cable shield at entry point to cabinet and at the Atlas-II shield termination pin.
- If the I/O cable is AC grounded or floated at the field device end of the cable, it must be directly ground at the cabinet and Atlas-II shield termination pin.
- If the I/O cable is directly grounded (DC coupled) at the field device end of the cable, it should be ground with a capacitor (AC ground) at the cabinet. AC ground it both at the Atlas-II shield pin and at the cable entry point into the cabinet.
- Two separate I/O cable shields;
- If over braided (two shields), directly ground over braid shield to cabinet and shield pin—directly connect inner braids at field device termination point. The inner braid must have at least one point directly grounded to earth.

2.8.6.2 Field Device not in Cabinet, with Interim Device

- Locate interim device away from unshielded discrete areas > 152 mm (6 inches).
- Use shielded cable from Atlas-II to field device (Isolator, FTM, Analog Driver, indicator meter, etc.)
- Route the cable from Atlas-II to the interim device with the cable against cabinet metal structure.
- The interim device must have one AC shield and one DC shield connection. The following are the shield termination combinations, starting from outside the cabinet and working to the Atlas-II.

Field Device	Cabinet Entry	Interim Device Out	Interim Device In	Atlas-II	Status
DC	AC	AC	DC	DC	Allowed / Preferred
AC	AC	AC	DC	DC	Allowed
AC	AC	AC	DC	AC	Allowed / Not Preferred
AC	DC	DC	AC	DC	Allowed / Not Preferred
AC	DC	DC	AC	AC	Allowed / Not Preferred
DC	AC or DC	DC	AC	AC or DC	Not allowed
DC	DC	DC	AC	AC or DC	Not allowed

Table 2-1. Shield Termination Combinations

- Two separate I/O cable shields;
- If over braided (two shields), directly ground over braid shield to cabinet & shield pin—directly connect inner braids at field device termination point. The inner braid must still have at least one point directly grounded to earth.

2.8.6.3 Field Device in Cabinet, No Interim Device

- Locate field device away from unshielded discrete areas > 152 mm (6 inches).
- Use shielded cable from Atlas-II to field device (Isolator, FTM, Analog Driver, indicator meter, etc.)
- Locate field device as close to I/O cable entry point as possible.
- Route the I/O cable against cabinet metal wall from entry point to field device.
- Ground the I/O cable shield directly at both ends;
- If over braided (two shields), directly ground over braid shield to cabinet—directly connect inner braids at field device termination point. The inner braid must have at least one point directly grounded to earth.
- If single shield, ground the shield to the cabinet and/or shield pin at both ends.

2.8.7 Unshielded Cable Routing & Termination

2.8.7.1 Field Device not in Cabinet, No Interim Device

- Route the I/O cable against the metal cabinet wall, from cabinet entry point to the Atlas-II.
- Limit the length of unshielded I/O cable inside the cabinet. Lengths over 915 mm (36 inches) are too long.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

2.8.7.2 Field Device not in Cabinet, with Interim Device

- Locate unshielded field devices > 152 mm (6 inches) away from other field devices.
- Locate field device as close to I/O cable entry point as possible.
- Route the I/O cable against the metal cabinet wall, from cabinet entry point to the interim device.
- Route the I/O cable against the metal cabinet wall, from the interim device to the Atlas-II.
- Limit the length of unshielded I/O cable inside the cabinet. Lengths over 915 mm (36 inches) are too long.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

2.8.7.3 Field Device in Cabinet, No Interim Device

- Locate field device as close to I/O cable entry point as possible.
- Route the I/O cable against the metal cabinet wall, from cabinet entry point to the Atlas-II.
- Limit the length of unshielded I/O cable inside the cabinet. Length over 915 mm (36 inches) is too long and may couple.
- If lengths greater than 915 mm (36 inches) are required, special considerations should be used to separate this unshielded wiring from other circuits and minimize electromagnetic minimize electromagnetic coupling into or from the cable.
- Do not let other cables within 305 mm (12 inches) of unshielded cables if they are parallel for greater than 610 mm (24 inches).
- Do not let other cables within 150 mm (6 inches) of unshielded cables if they are parallel for less than 610 mm (24 inches).

2.9 Input Power

The 505CC-2 Atlas-II control requires a nominal voltage source of 18 to 32 Vdc. Input power requirements vary depending on the control version. Table 2-2 contains information for the maximum configuration.

⚠WARNING

Power must be applied to the Atlas-II control at least 60 seconds prior to expected use. The control must have time to do its power up diagnostics to become operational. Failure of the diagnostics will disable control function.

⚠WARNING

The Atlas-II power supply board must have the input power removed before installing or removing.

This Equipment is Suitable For Use in Class I, Division 2, Groups A, B, C, D or Non-Hazardous Locations Only.

This equipment is suitable for use in European Zone 2, Group IIC environments.

Wiring must be in accordance with North American Class I, Division 2, or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Do not connect more than one main power supply to any one fuse or circuit breaker.

For Communication wires, use wires with a temperature rating of at least 5°C above surrounding ambient. All others use wires with a temperature rating of at least 10°C above surrounding ambient.

⚠WARNING

For ATEX compliance, this equipment must be protected externally against transient disturbances. Provisions shall be made to prevent the power input from being exceeded by transient disturbances of more than 40% of the rated voltage.

The power supply output supplying the Atlas-II must be of a low impedance type for proper operation of the control. DO NOT power a control from a high voltage source containing dropping resistors and zener diodes. If batteries are used for operating power, an alternator or other battery-charging device is necessary to maintain a stable supply voltage.

NOTICE

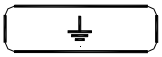
To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

IMPORTANT

If an alternator is used to charge batteries supplying the Atlas-II power, the alternator must be a suppressed/clamped type or have external load dump transient suppression. The Atlas-II does not have sufficient energy handling capability to suppress a full alternator load dump.

Significant inrush currents are possible when current is applied to the Atlas-II control. 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.

2.9.1 Input Power Wiring

Protective earth ground (PE) must be connected to the chassis at the termination point on the unit labeled with  . The power supply grounding terminals 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 or the combined PT wires, whichever is larger.

WARNING

The control's power supplies are not equipped with input power switches. For this reason, a fixed wiring installation is required and a switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach of the operator and that is clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the protective earth conductor.

It is expected that the installation of this equipment will include over current protection between the power source and the Atlas-II control. This over current protection may be accomplished by series connection of properly rated fuses or circuit breakers. Branch circuit protection of no more than 250% of the maximum Atlas-II power supply input current rating must be provided. See Table 2-2 for maximum recommended fuse ratings. This value meets the 250% UL listing requirements. The use of properly sized UL class CC, J, T, G, RK1, or RK5 fuses meet the requirements for branch circuit protection. Do not connect more than one Atlas-II control to any one fuse. Use only the wire size specified in Table 2-2 or equivalent metric size which meets local code requirements. Time delay fuses should be used to prevent nuisance trips.

Table 2-2 provides the power supply holdup time specification; which is the time the supply will continue to operate within specification after its input power is interrupted. This information may be useful in specifying uninterruptible power supply (UPS) systems.

Input Voltage Range	Fuse (Current Rating)	Fuse (I^2t Rating)	Wire Size* **	Holdup Time
18–32 Vdc**	9 A	>800	2/4 mm² 12/14 AWG	8 ms

Table 2-2. Power Supply Requirements

IMPORTANT

*** 4 mm² (12 AWG) is the largest wire gauge size that may be connected to the control power input terminal blocks.**

**** The minimum input voltage allowed is 18 V at the power input of the control. The length, size of wire, and load current will determine the minimum supply output voltage. The minimum supply voltage measured at the source should always be greater than 18 V. Example: two (source and return) 20 foot (6 m) lengths of 14 AWG (2 mm²) wire carrying 1.2 A (maximum rated current) will result in a voltage drop from source output to control power input of approx. 0.16 volts. The resulting supply voltage from the example must be greater than 18.16 volts.**

***** A fuse or circuit breaker shall not interrupt the protective earth conductor.**

2.9.2 Input Power Wiring Diagram

The power supply and ground connections are located on the power supply board (see also Recommended Grounding Practices).

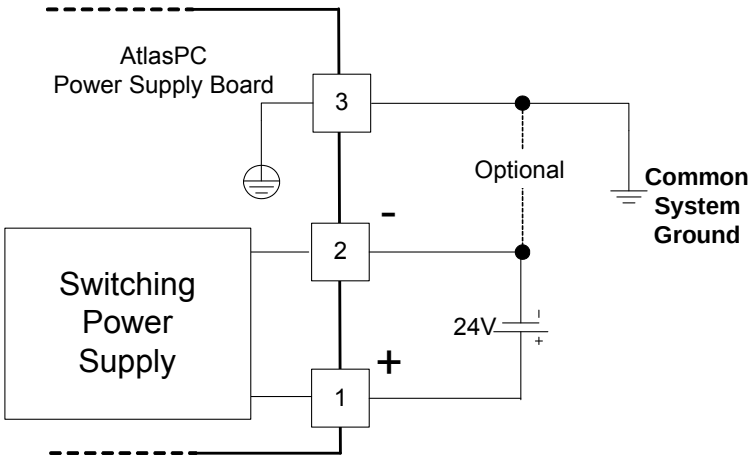


Figure 2-6. Power Supply and Ground Connections

2.10 Maintenance

The only part of the Atlas-II control system that may require user maintenance is the cooling fan (Woodward part number 1886-439). In the event that the fan must be replaced, please use the following procedure to remove a faulty fan from the chassis:

- Use a #2 Phillips screwdriver
- Power down the control to avoid overheating or other hazards.
- Disconnect fan wires from terminal block. Cut the tie-wrap supporting the wires to the cover.
- Remove, the four retaining screws holding the fan and guard to the cover.
- Remove fan and guard from unit.
- Remove guard from faulty fan
- Install new fan of same size and flow rate.
- Reinstall fan (flow arrows should point "OUT")
- Reinstall fan guard with the 4 screws. Torque screws to 0.1 N·m (1 lb-in) max to avoid damage to the flange of fan.
- Trim leads to a reasonable length.

- Connect RED wire to the + fan terminal and BLACK wire to – fan terminal.
- If desired strain relief leads to cover with a new tie-wrap.

2.11 Application Guidelines

The following items are general guidelines intended to educate the system integrator on potential installation and application issues related to the 505CC-2 that might arise when the Atlas-II controller is applied.

NOTICE

This manual details only guidelines specific for the Atlas-II platform supplied, and I/O used, with the 505CC-2.

Do not use this as a reference for other Atlas-II applications.

2.11.1 Analog Inputs

Two of the connectors used for the analog inputs are identical. It is possible for the end user to connect the wrong connector to the wrong input. The terminals are numbered to minimize the chance of this happening however it is possible. The system integrator should take precautions to ensure that it is easy to view the terminal labels or design other methods to allow the user to easily identify the correct cable for each connector.

Analog Input cables are shielded, and shields should be terminated directly at the Atlas-II end and the cabinet entry/exit point.

2.11.2 Actuator Outputs

Analog Output cables are shielded, and shields may be terminated directly (preferred) or via AC coupling at the Atlas-II end and the cabinet entry/exit point.

2.11.3 Discrete Inputs

Two of the connectors used for the discrete input connections are identical. It is possible for the end user to connect the wrong connector to the wrong input. The terminals are numbered to minimize the chance of this happening however it is possible. The system integrator should take precautions to ensure that it is easy to view the terminal labels or design other methods to allow the user to easily identify the correct cable for each connector.

Discrete Input cables are only required to be shielded for Marine Type Approval applications, and shielding may be limited to the cabinet interior. Cable shields should be terminated directly at the Atlas-II end and the cabinet entry/exit point.

2.11.4 Serial Ports

The connectors used for the serial port connections are identical. It is possible for the end user to connect the wrong connector to the wrong input. The terminals are numbered to minimize the chance of this happening however it is possible. The system integrator should take precautions to ensure that it is easy to view the terminal labels or design other methods to allow the user to easily identify the correct cable for each connector.

Serial port cables are shielded and should be terminated directly at the Atlas-II end and the cabinet entry/exit point. Take care with the shield termination at the field device end.

2.11.5 Ethernet Connectors

The Atlas-II has four Ethernet connectors that are arranged in one connector. The physical spacing between connectors is limited. This can create the situation where it is easy to connect the wrong cable to the connector. Another consideration is that the Ethernet cables are located on the side of the controller which was not used for connections on the original AtlasPC™. In certain installations, the space to access these connectors may be limited.

To mitigate the risk the system integrator should implement an Ethernet cable labeling process to allow the user to easily identify which Ethernet cable connects to each Ethernet port. The Atlas-II also has application level checks that the system integrator should be aware of when designing a system.

The following functions are available in the 505CC-2:

- Modbus Communications
- Woodward Service Tools
- Woodward service tools will only work when the laptop is connected to Port1.

Ethernet port cables are shielded. Cable shields are terminated directly at the Atlas-II end and the cabinet entry/exit point. An Ethernet Field Termination Module (FTM), available from Woodward, may be used to break the shield path between the field device and the Atlas-II.

2.11.6 Speed Sensor Ports

Speed Sensor port cables are shielded. Cable shields are terminated directly at the Atlas-II end and the cabinet entry/exit point. Refer to the SmartCore CPU A5200 module for additional information and wiring requirements.

2.11.7 Installation Functional Check Guidelines

In general all I/O points should be functionally tested prior to starting the steam turbine and/or compressor. The I/O points should be checked for ground loops and other possible sources of noise as well as isolation from other power sources that are not related to the specific I/O circuit. These installation guidelines are given as general guidelines only. The system integrator / end user are responsible for understanding the application and defining a field checkout procedure that addresses the requirements of the system being installed.

IMPORTANT

When performing I/O checkout, appropriate safety precautions must be taken to ensure that the devices being tested are properly locked out or that a safety issue is not created.

Analog Inputs

- The field signal should be validated to ensure that the correct field signal is connected to the correct analog input channel. It is recommended that this validation is done by viewing the field signal in the Toolkit application.
- Example: If the analog input comes from a pressure transducer then a pressure tester could be used to vary the analog output that is being input to the Atlas. This signal can then be verified to be correct in the Toolkit application.

Analog Outputs

- Analog output values should be forced from the Atlas-II controller and verified at the receiving device. Outputs should be checked at min and max current values (4–20 mA).
- Example: If the analog output is used to drive an indicator then the output should be forced to several values and the indicator should be monitored to ensure that the indicator is connected to the correct analog output as defined by the Toolkit application.
- Verify that the total loop resistance is less than the specification limit defined in the hardware manual.

Discrete Inputs

- The field contacts should be operated to ensure that the correct field device is connected to the correct discrete input on the Atlas-II.
- Example: If the discrete input tells the Atlas-II a certain switch position then the switch should be operated and the input should be viewed in the Toolkit application to ensure that software “sees” the change of state.
- Verify that only the 24 Vdc wetting voltage is connected to the discrete inputs.
- Check for AC by measuring all inputs from the input terminals to chassis ground.
- Check the discrete input common with respect to other power supply commons to ensure that the discrete inputs are isolated from other power supplies that are not used with the discrete inputs.

Discrete Outputs

- The discrete outputs should be forced and the resulting signal should be confirmed at the field device.
- Example: If the discrete output is input to another PLC then the output should be forced from the Toolkit application and verified in the PLC logic. If the output drives a field device such as a motor starter then the output should be forced and verified at the motor starter. Note: Before forcing outputs to field devices verify that all necessary safety precautions are in place.

Ethernet Connections

- The Ethernet connections should be removed one at a time and expected faults should be verified in the Toolkit application and also in the other device.
- Example: If port 2 is connected to an HMI using the Modbus TCP protocol then removing the Ethernet cable connected to port 2 should cause a Link Error in the Toolkit application and a communication fault in the HMI application.
- Note: Due to the identical design of the Ethernet ports and the potential for similar cables, labeling is important to ensure that the user can easily identify which cable goes to each connector.

Chapter 3.
Power Supply Board

3.1 General Description

The 505CC-2 Atlas-II™ power supply contains the power supply and twelve discrete output driver channels. The discrete outputs are low-side drivers having short circuit and thermal shutdown protection. The discrete output drivers are not isolated from each other, and are powered by an external +12 Vdc or +24 Vdc. They are isolated from the internal power supplies of the Atlas-II Control platform.

Input power connections are made to the power supply through terminals on the front of the power supply.

⚠WARNING

The Atlas-II power supply board must have the input power removed before installing or removing.

This equipment is suitable for use in Class 1, Division 2, Groups A, B, C, and D, Zone 2, Group IIC, or non-hazardous locations only.

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

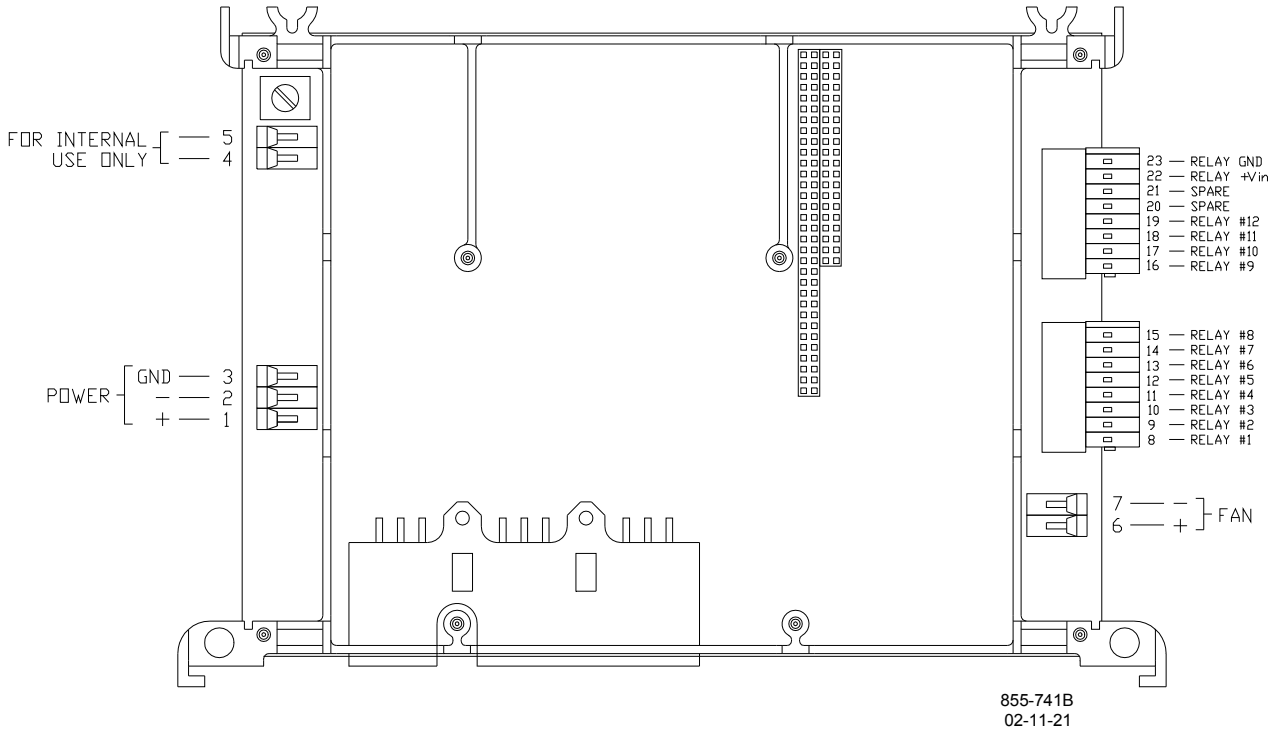


Figure 3-1. Atlas-II Power Supply Board

3.2 Specifications

3.2.1 Power Supply Input (Power Supply Board)

Range	18–32 Vdc
Input Current	2.7 A @ 24 Vdc 3.61 A @ 18 Vdc
Input Power	less than 65 W at 70 °C
Interrupt Time Holdup	8 ms @ >/= 24 V
Efficiency	70% minimum over operating input voltage range
Reverse Polarity Protection	56 V
Input Wiring Constraints	The Atlas-II control platform must be wired such that no other device receives power from the wiring between the Atlas-II Control Platform and the power supply source.

3.2.2 Discrete Output Drivers (Power Supply Board)

Number of channels	12
Type	Low-side driver with short circuit and overvoltage protection
Current drive rating	200 mA
Discrete Output Supply Voltage	9–32 V

3.2.3 Power Supply Monitoring Circuit (Power Supply Board)

LVdc Maximum voltage measured	35 Vdc
Resolution in volts	0.15 Vdc
Maximum Error due to temperature change	1.0 Vdc
Maximum Error due to load change	1.0 Vdc
Total maximum error at 25 °C (over 15 to 35 V range)	1.2 Vdc

3.2.4 Electric Shock

The Atlas-II control platform shall not present an electrical shock hazard to the operator or maintenance personnel when used in a normal manner per the National Electrical Code Handbook, ANSI/NFPA 70 HANDBOOK-1990. Safety is ensured by certification through the safety agencies specified in the “Regulatory Compliance” section of this document.

3.3 Troubleshooting Guide

3.3.1 Power Supply Checks

The following is a troubleshooting guide for checking areas, which may present difficulties. If these checks are made prior to contacting Woodward for technical assistance, system problems can be more quickly and accurately assessed.

- Is the input voltage within the control’s specified input voltage range (measured at control power supply input)?
- Is the input power free of switching noise or transient spikes?
- Is the power circuit dedicated to the Atlas-II control only?

3.3.2 Discrete Output Checks

The Atlas-II power supply contains twelve discrete output driver channels. The discrete outputs are low-side drivers having short circuit and thermal shutdown protection. The discrete output drivers are not isolated from each other, and are powered by an external +12 Vdc or +24 Vdc. They are isolated from the internal power supplies of the Atlas-II Control platform.

- Is the input power within the range of 9–32 V?
- Is the input free of switching noise or transient spikes?
- Is the power circuit dedicated to the control only?
- Are the individual discrete output lines current limited by external series connected components (example: relay coils) to <200 mA?

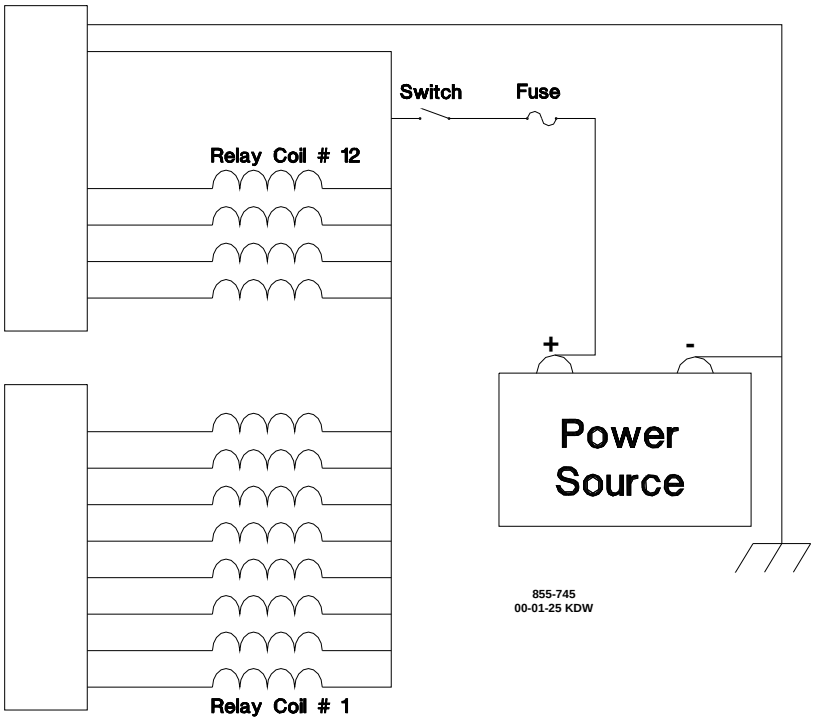


Figure 3-2. Discrete Output Wiring Example

(Discrete Output Interface Wiring to the Power Supply Board)

Configuration Notes

- See volume 2 steam turbine control, and/or volume 3 compressor control for 505CC-2 functionality configuration options.
- Refer to Figure 3-2 for discrete output wiring.
- Discrete outputs are not normally shielded, however may be shielded.
- When shielding cables, shield at least from the Atlas-II to the cabinet entry/exit point. Terminate the shield directly to the cabinet at the entry/exit point and Atlas-II.
- The discrete output commons are tied together, so each power supply board accepts only one voltage source.
- Power for the discrete outputs must be externally supplied, the external supply must be capable of supplying a voltage between 9–32 V while supplying up to 2.5 A. As specified in the Input Power Wiring Section, branch circuit protection of no more than 250% of the maximum rated current of the load (Discrete Output power input current plus 12 times the maximum Discrete Output channel current) shall be provided. Fuse current rating should not exceed 6.25 A (time delay fuses are recommended).

- Chapter 7, 12-Channel Relay Module, describes a Woodward relay module that can be used with these discrete outputs drivers.

IMPORTANT

Relay outputs do not normally require shielding for other installations, but may be shielded if desired.

Chapter 4.
SmartCore CPU A5200 Board

4.1 General Description

The SmartCore CPU A5200 board contains 4 Ethernet communication ports as well as circuitry for 2 speed sensor inputs, 6 analog inputs, 4 analog outputs, 2 proportional actuator drivers, 2 CAN communication ports, 2 isolated serial ports, 1 debug serial port (isolated), and 24 discrete inputs. Each speed sensor input may be either from a magnetic pick-up or a proximity probe. Analog input and output circuits are 4–20 mA. The actuator driver outputs may be configured as either 4–20 mA or 20–160 mA. The user serial ports are configurable as RS-232, RS-422, or RS-485.

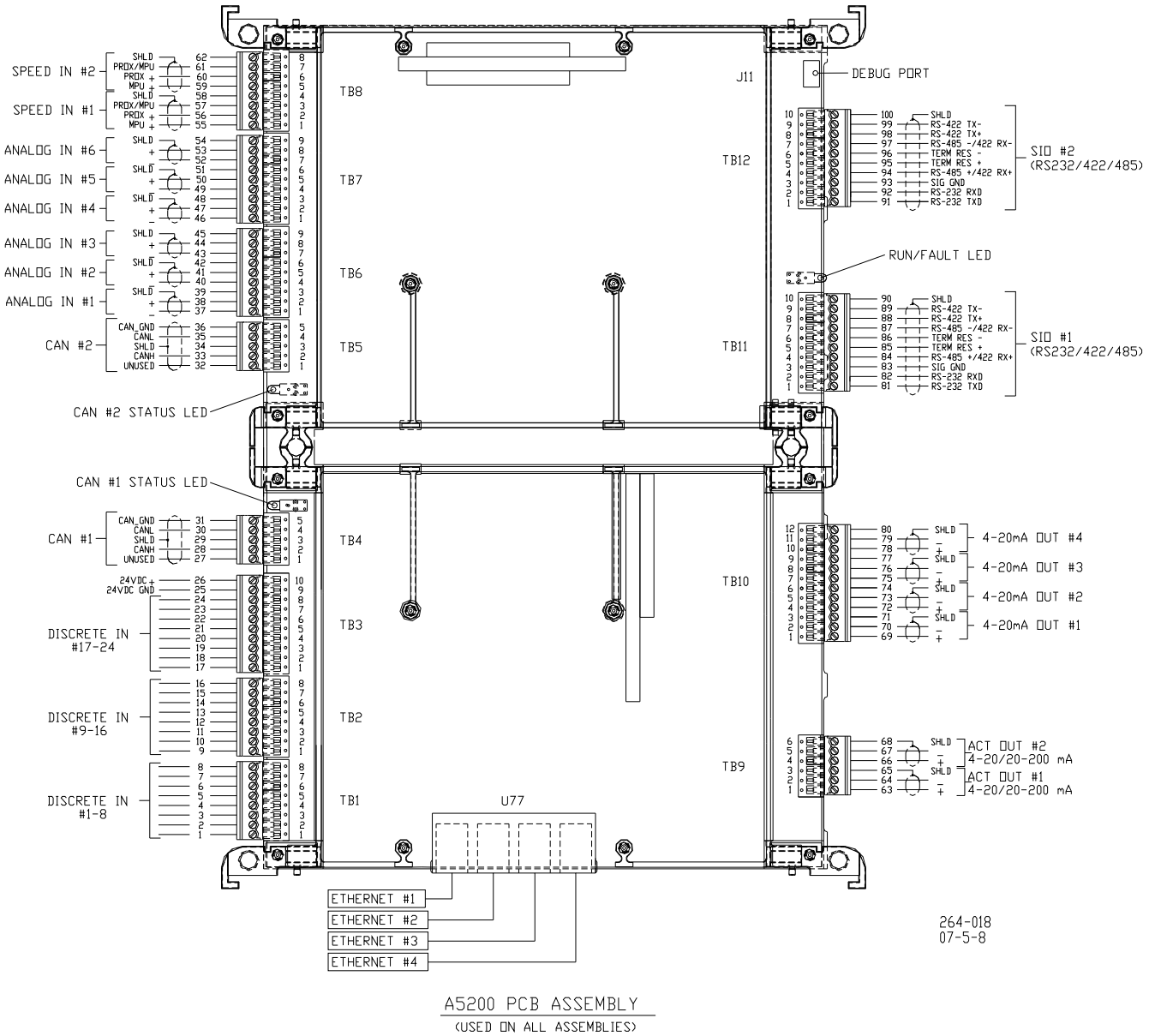


Figure 4-1. SmartCore CPU A5200 board, Connectors

4.1.1 Features

- 5 ms update rate
- On-board processor for automatic calibration of the I/O channels
- PowerPC 5200, low power version
- 64 MB DDR-266 MHz, DRAM
- 8/16 bit PC/104 Interface (ISA bus)

4.1.2 Communications

- (4) RJ45 10/100 Base-TX Ethernet
- (2) isolated CAN ports
- (2) isolated and configurable RS-232 / RS-422 / RS-485 Serial ports, 115.2 kBaud max
- (1) isolated RS-232 Debug Service Port

4.1.3 Hardware I/O

- (24) Discrete inputs
- (2) Speed Sensor Inputs (MPU / Proximity), 16 bit minimum resolution
- (6) Analog inputs have 16 bit resolution
- (4) Analog outputs have 15 bit resolution
- (2) Actuator outputs with 15 bit resolution

4.1.4 Block Diagram

The Atlas-II™ boards connect to each other through either the PC/104 bus connectors or the power bus connectors. All of the boards are held together and to the chassis, by bolts. The SmartCore CPU A5200 board is the size of two analog boards.

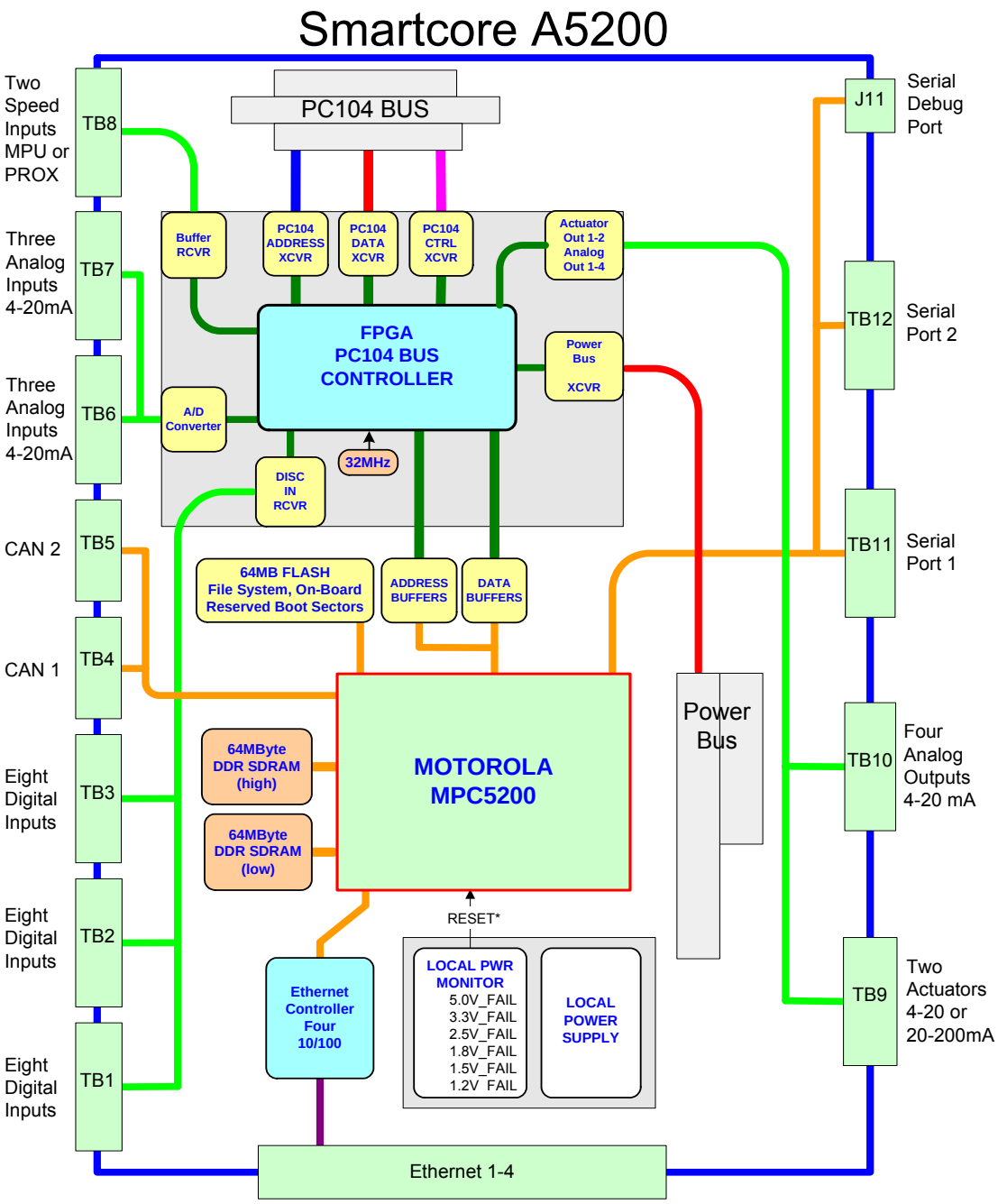


Figure 4-2. Block Diagram— 505CC-2 Atlas-II SmartCore CPU A5200 Board

4.1.5 Module Configuration

Network Configuration

Ethernet port #1 can be re-configured for the customer network as desired. See the on-site Network Administrator to define an appropriate I/P address configuration for port #1. Please note that each Ethernet port is required to be on a separate domain.

IMPORTANT

This module has been factory configured with fixed Ethernet IP addresses of:
Ethernet #1 = 172.16.100.20, Subnet Mask = 255.255.0.0
Ethernet #2 = 192.168.128.20, Subnet Mask = 255.255.255.0
Ethernet #3 = 192.168.129.21, Subnet Mask = 255.255.255.0
Ethernet #4 = 192.168.130.22, Subnet Mask = 255.255.255.0

Network Configuration Utility (AppManager)

Woodward's AppManager software supplied with the 505CC-2 application CD can be used to load 505CC-2 GAP control software, monitor diagnostic faults, and configure network settings. The AppManager utility can be downloaded from **www.woodward.com/software**. A PC to Atlas-II connection must be made using an Ethernet cable and Ethernet port #1:

- Locate the Atlas-II control name on the chassis and highlight it using AppManager.
- To view the IP address configuration, select menu option, Control – Control Information. Look for the Ethernet adapter addresses under the Footprint Description.
- To change the IP address configuration, select menu option, Control – Change Network Settings.

4.1.6 Module Indicators (LEDs)

The SmartCore CPU A5200 module has the following LEDs:

LED	Name	Description
RD FAULT GR RUN	FAULT	CPU FAULT (RED)—Active upon reset and flashes CPU fault codes as necessary.
	RUN	RUN (GREEN)—Active GREEN after the CPU Operating system is loaded and running.
ETH G LINK Y TX/RX	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.
CAN LED's GR RD	CAN #1, #2	CAN #1, #2 (GREEN/RED)—Active GREEN or RED when data is transmitted or received through CAN port #1 or #2.

Table 4-1. SmartCore CPU A5200 LEDs

4.1.7 10/100 BaseT Ethernet Ports

There are four 10/100 BaseT Ethernet Ports (RJ45) available to the application software. These ports are full duplex, auto switching, and do not require the use of an Ethernet shield box.

IMPORTANT

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

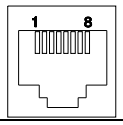
Connector	Signal Mnemonic
RJ45F 	Shielded RJ45 female receptacle
1	RX+
2	RX-
3	TX+
4	--
5	--
6	TX-
7	--
8	--
Shield	Chassis EARTH

Table 4-2. Ethernet Port Pinout

4.1.8 RS-232/422/485 Serial Ports

Two isolated, pluggable RS-232 / 422 / 485 serial ports (SIO1, SIO2) are available for customer use and can be configured by the Toolkit application. The baud rate is selectable from 9600 baud to 57600 baud. 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.

Pin 1—RS-232 Transmit
Pin 2—RS-232 Receive
Pin 3—Signal Ground
Pin 4—RS-485/422 Receive (+)
Pin 5—Termination Resistor (+)
Pin 6—Termination Resistor (–)
Pin 7—RS-485/422 Receive (–)
Pin 8—RS-422 Transmit (+)
Pin 9—RS-422 Transmit (–)
Pin 10—Chassis EARTH

Figure 4-3. SmartCore CPU A5200 Communications Ports (SIO1, SIO2)

4.1.9 RS-232 Service Port

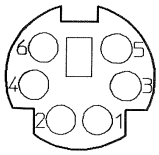
An isolated RS-232 service port is located near one corner of the A5200 CPU module. This port is for VxWorks® * operating system use only. The communication settings are fixed at 38.4 kBaud, 8 data bits, no parity, 1 stop-bit, and no flow control.

*—VxWorks is a trademark of Wind River Systems, Inc.

For debug use, a null-modem cable and 5450-1065 Serial Adapter cable (PS2M to DB9F) is required to attach this port to a PC.

NOTICE **The RS-232 service port is to be used by trained Field Service personnel only!**

Shielded cable is required when connecting to the Service Port. Using shielded cable will help ensure the robustness of the serial communications.



Pin 1—RS-232 Receive
Pin 2—RS-232 Transmit
Pin 3—Signal Ground
Pin 4—Not Used
Pin 5—Signal Ground
Pin 6—Not Used
Connector Shell—Chassis EARTH

Figure 4-4. CPU Service Port (mini-DIN6F)

4.2 Hardware Specifications

4.2.1 Digital Speed Sensor Inputs

Number of channels	2, selectable as MPU or proximity probe, by terminal block wiring and correct software switches
Input frequency	100–25 000 Hz (MPU), 0.5-25 000 Hz (Prox) (25 kHz is the max reading available using the TSS_ATL GAP block)
Input frequency (max)	25 000 Hz
Resolution	Dependent on frequency, 16 bit minimum at maximum speed
Accuracy	Less than ±0.08% full scale from –40 to +85 °C internal temperature

Table 4-3. Digital Speed Sensor Inputs

Shielded cable is required when connecting to the Digital Speed Sensor Inputs.

4.2.2 MPU Inputs

Input magnitude (min)	See Figure 4-5.
Input magnitude (max)	See Figure 4-6.
Input impedance (typ)	See Figure 4-7.
Input impedance (min)	1450 Ohm at 1 Vrms and 100 to 25 000 Hz input
Input impedance (min)	450 Ohm at 14.6 Vrms and 100 to 300 Hz input
Input impedance (min)	1450 Ohm at 14.6 Vrms and 301 to 25 000 Hz input
Isolation voltage	500 Vac minimum, each channel is isolated from all other channels and from the Atlas-II platform

Table 4-4. MPU Inputs

IMPORTANT

When choosing to wire either a MPU or proximity speed input, make sure the unused MPU/PROX(+) terminal block input is shorted to MPU/PROX (–).

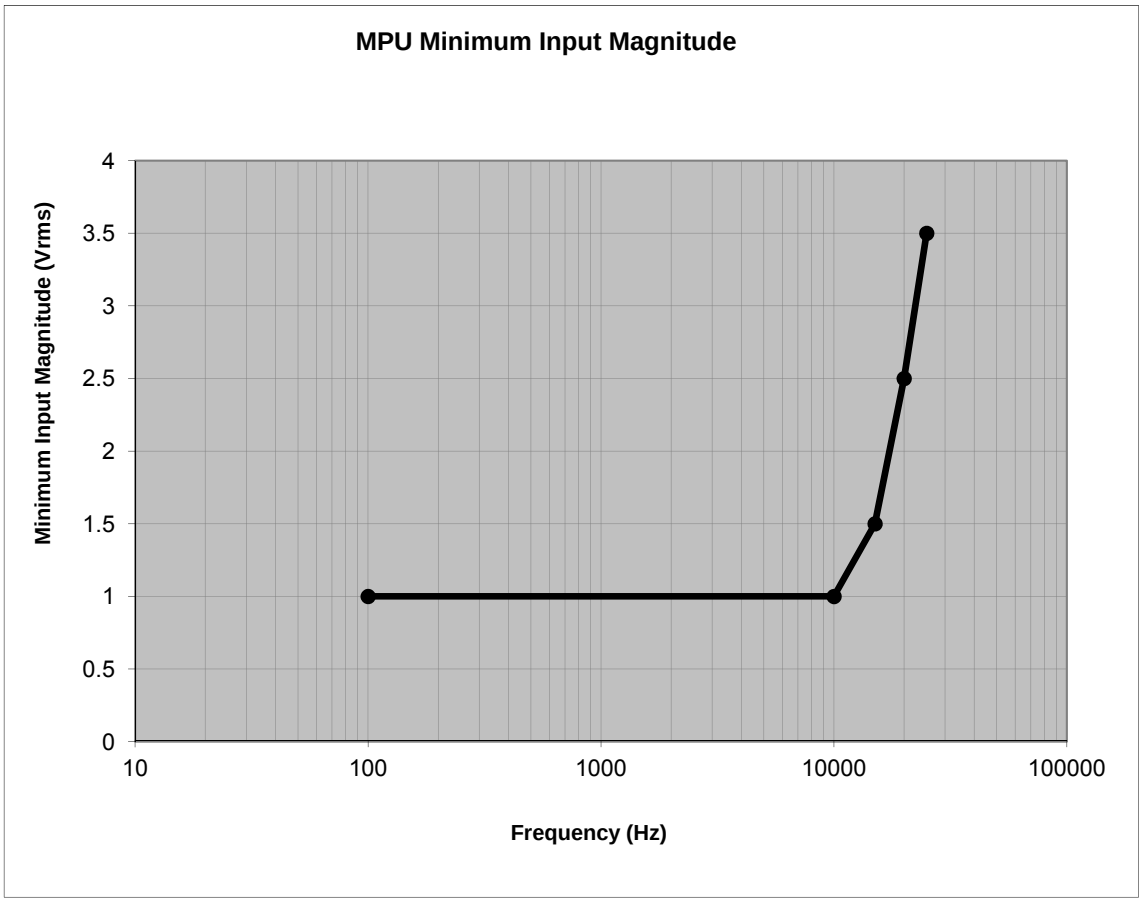


Figure 4-5. MPU Minimum Input Magnitude in Vrms

To convert to V peak to peak, multiply by 2.828.

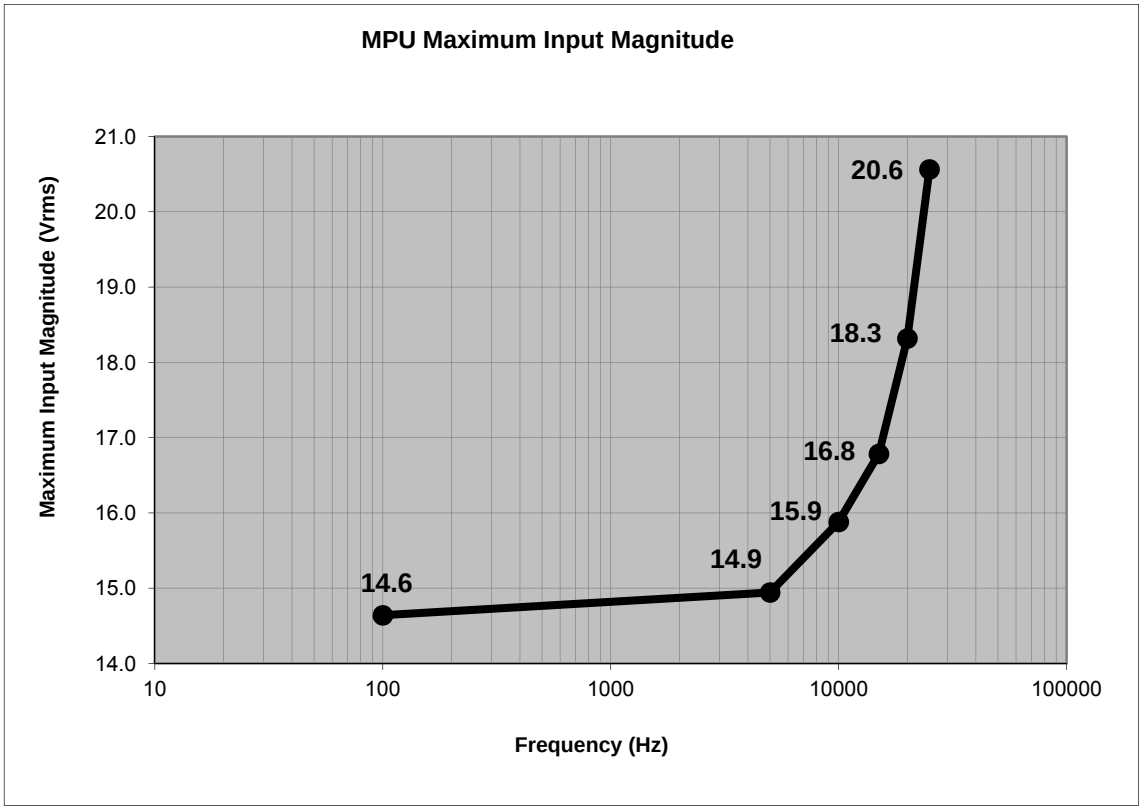


Figure 4-6. MPU Maximum Input Magnitude in Vrms

To convert to V peak to peak, multiply by 2.828.

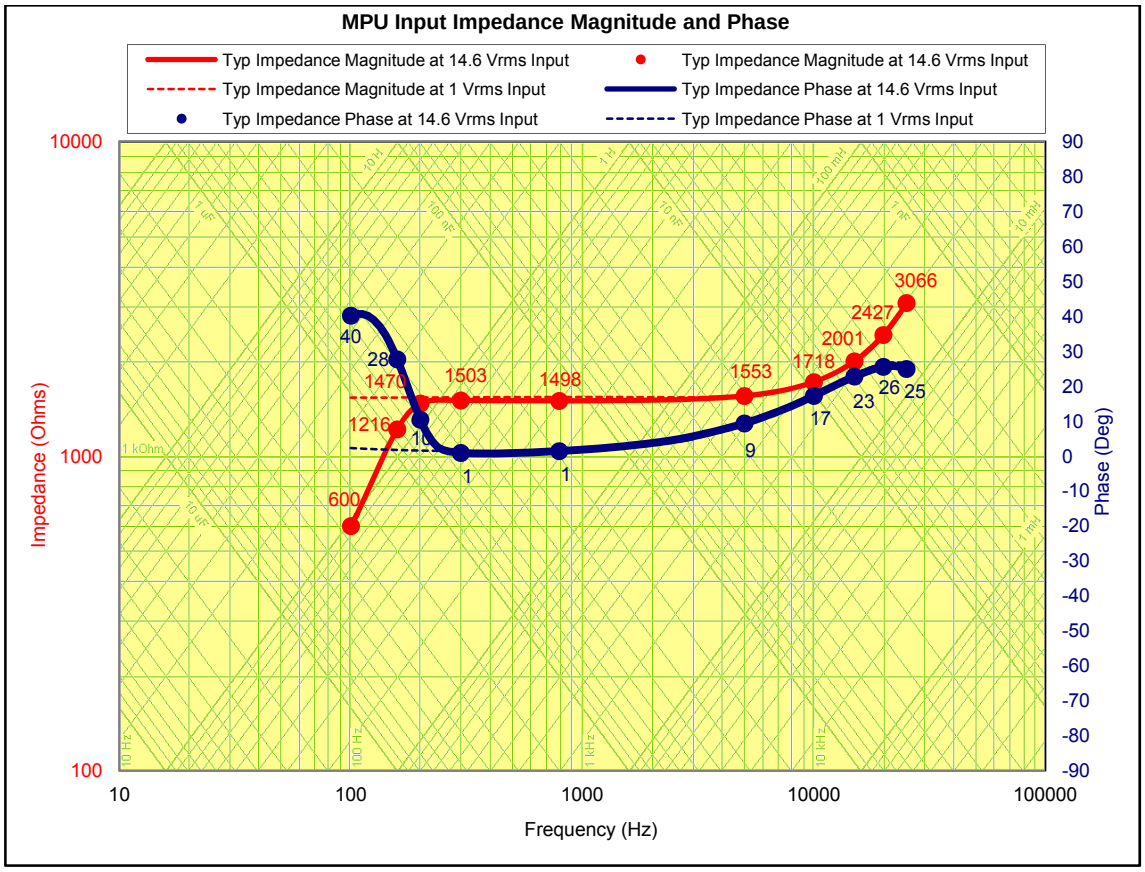


Figure 4-7. MPU Typical Input Impedance Magnitude and Phase

4.2.3 Proximity Probe Inputs

Voltage threshold /duty cycle at 5 kHz	at 16 Vin, duty cycle = 3.5–96.5% at 24 Vin, duty cycle = 3.5–96.5% at 28 Vin, duty cycle = 3.5–96.5%
Voltage threshold /duty cycle at 25 kHz	at 16 Vin, duty cycle = 17.5-82.5% at 24 Vin, duty cycle = 17.5-82.5% at 28 Vin, duty cycle = 17.5-82.5%
Input threshold (V low)	< 8 Vdc
Input threshold (V high)	> 16 Vdc
Input voltage (V high range)	16–28 Vdc
Minimum Input Resistance (Ω) @ 8 V	37730
Minimum Input Resistance (Ω) @ 16 V	7160
Minimum Input Resistance (Ω) @ 28 V	4190
Available power	none
Isolation	500 Vac minimum, each channel is isolated from all other channels and from the Atlas-II platform
Input frequency	0.5–25 000 Hz

Table 4-5. Proximity Probe Inputs

- A derivative output is provided to the application software. Generally, the derivative error increases with frequency input. The typical six-sigma performance with input frequencies < 5000 Hz is better than 8 Hz/s. The typical six-sigma performance with input frequencies > 5000 Hz is better than 24 Hz/s;
- **Note:** Field wiring may introduce additional signal error due to cable length, cable routing, and other sources.

- No proximity probe power is provided.

IMPORTANT **When choosing to wire either a MPU or proximity speed input, make sure the unused MPU/PROX(+) terminal block input is shorted to MPU/PROX (–).**

4.2.4 Analog Inputs

Number of channels	6
Input type	4–20 mA , (full scale = 24 mA)
Max. input current	> 23 mA
Max. input voltage	24 V @ 25 °C
Common mode rejection	80 dB minimum
Input common mode range	±40 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	211 Ω (±1.3%)
Anti-aliasing filter (ch 1-4)	2 poles at 10 ms
Anti-aliasing filter (ch 5-6)	2 poles at 5 ms
Resolution	Greater than 16 bits
Accuracy @ 25 °C	less than ±0.1% of full scale
Temp Drift	171 ppm/°C, maximum (1.1% of full scale, 0.275 mA) 30 ppm/°C, typical (0.20% of full scale, 0.05 mA)
I/O Latency	1 ms

Table 4-6. Analog Inputs

Shielded cable is required when connecting to the Analog Inputs.

- Loop power for the analog inputs is NOT available.
- Only 4–20 mA inputs are supported. This is a change from the previous SmartCore module that allowed both current and voltage inputs.

IMPORTANT **External loop powered transducers must be individually protected with a 100 mA fuse on each channel.**

4.2.5 Analog Outputs

Number of channels	4
Output type	4–20 mA outputs, non-isolated, (full scale = 25 mA)
Common Mode Voltage	15 Vdc ±10%
Max current output	25 mA ±5%
Min. load resistance	0 Ω
Max load resistance	300 Ω at 22 mA
Resolution	15 bits of full scale
Accuracy @ 25 °C	less than ±0.1% of full scale
Readback Accuracy @ 25 °C	±1% of full scale
Temperature Drift	140 PPM/°C, maximum (±0.23 mA) 70 ppm/°C, typical (±0.45% of full scale, 0.1125 mA)

Table 4-7. Analog Outputs

Shielded cable is required when connecting to the Analog Outputs.

4.2.6 Actuator Outputs

Number of channels	2	
Actuator Type	Proportional, non-isolated,	
Output Type	4-20 or 20-200 mA, software selectable (full scale = 31 mA or 233 mA)	
Isolation	None	
Max current output	27 mA +10% 218 mA +10%	(4-20 mA range) (20-200 mA range)
Min. load resistance	10 Ω	
Max load resistance	300 Ω at 22 mA 40 Ω at 200 mA	(4-20 mA range) (20-200 mA range)
Resolution	15 bits of full scale	
Accuracy @ 25 °C	less than ±0.1% of full scale 0.029 mA 0.220 mA	 (4-20 mA range) (20-200 mA range)
Readback Accuracy @ 25 °C	±1.0 % of full scale	
Temperature Drift	140 PPM/°C maximum 0.26 mA maximum 2.00 mA maximum 70 ppm/°C typical 0.13 mA 1.00 mA	 (4-20 mA range) (20-200 mA range) 0.45% of full scale, (4-20 mA range) (20-200 mA range)
Readbacks	Actuator source and return currents	
Dither Current	25 Hz, fixed duty cycle, software variable amplitude	

Table 4-8. Actuator Outputs

Shielded cable is required when connecting to the Actuator Outputs.

4.2.7 Discrete Inputs

Number of channels	24
Input type	Optically isolated discrete input
Input thresholds	< 8 Vdc = “OFF”
	> 16 Vdc = “ON”
Input current	3 mA @ 24 Vdc
Contact voltage	24 Vdc isolated output (100 mA max, internally protected)
Max input voltage	28 Vdc
Isolation voltage	500 Vac, all channels are isolated from the Atlas-II platform

Table 4-9. Discrete Inputs

Shielded cable is not required when connecting to the Discrete Inputs, but can be used.

- For EMC compliance, the on-board, isolated, +24 Vdc supply is recommended for use as power to contacts, 100 mA maximum.
- All channels are common to each other. Isolation is with respect to the Atlas-II platform and other I/O types.

4.2.8 Serial I/O

Number of channels	3 isolated ports, 115.2 K max
Channel configuration	1—RS-232 Debug Port (PS2 style, mini-DIN6F connector) 2—RS-232/RS-485/RS-422 software configurable, terminal block connections
Termination Resistor	Located on the board and are accessible via field wiring. Termination resistors are provided for RS-485 and RS-422 Receive.
Isolation Voltage	500 Vdc

Table 4-10. Serial I/O

Shielded cable is required when connecting to the Serial I/O.

4.3 SmartCore CPU A5200 Board Operation

This board includes no potentiometers and requires no field calibration.

4.3.1 Speed Sensor Inputs

The MPU and proximity probe inputs are read and the speed is provided to the 505CC-2 application program. A derivative output is also provided. The speed sensor inputs are filtered by the SmartCore CPU A5200 board with the filter time constant being selectable in GAP software between 5 and 160 ms. Eight milliseconds should be acceptable for most turbine applications, while 16 milliseconds may be necessary for very slow speed applications. The speed range is configured in the Toolkit application and determines the maximum speed that the board will detect. The control output of the software will detect a minimum speed of one fiftieth of the speed range. This allows detection of failed speed sensors to help prevent overspeed due to slow update times at very low speeds. The monitor output of the GAP block will read down to 0.5 Hz, regardless of the speed range. An application may use any combination of accepted MPU and proximity probes, and any combination of speed ranges.

The SmartCore CPU A5200 board uses speed sensing probes mounted on a gear connected or coupled to the turbine's rotor to sense turbine rotor speed. Either of the A5200 board's speed channels accepts passive magnetic pickup units (MPUs) or proximity probes.

It is not recommended that gears mounted on an auxiliary shaft coupled to the rotor be used to sense speed. Auxiliary shafts tend to turn more slowly than the rotor (reducing speed sensing resolution) and have coupling gear backlash, resulting in less than optimum speed control. For safety purposes, it is also not recommended that the speed sensing device sense speed from a gear coupled to a generator or mechanical drive side of a system's rotor coupling.

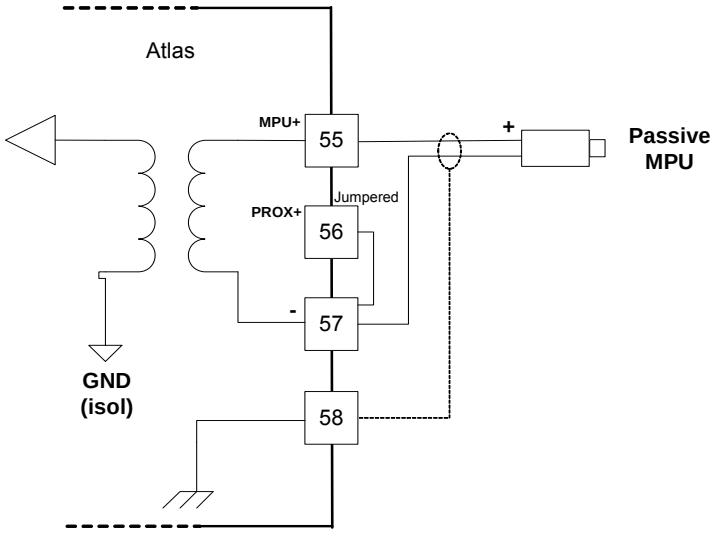


Figure 4-8. Example–MPU Interface, SmartCore Board

A proximity probe may be used to sense very low speeds. With a proximity probe, speed can be sensed down to 0.5 Hz. When interfacing to open collector type proximity probes, a pull-up resistor is required between the supplied proximity probe voltage and the proximity probe input to the SmartCore CPU A5200 board.

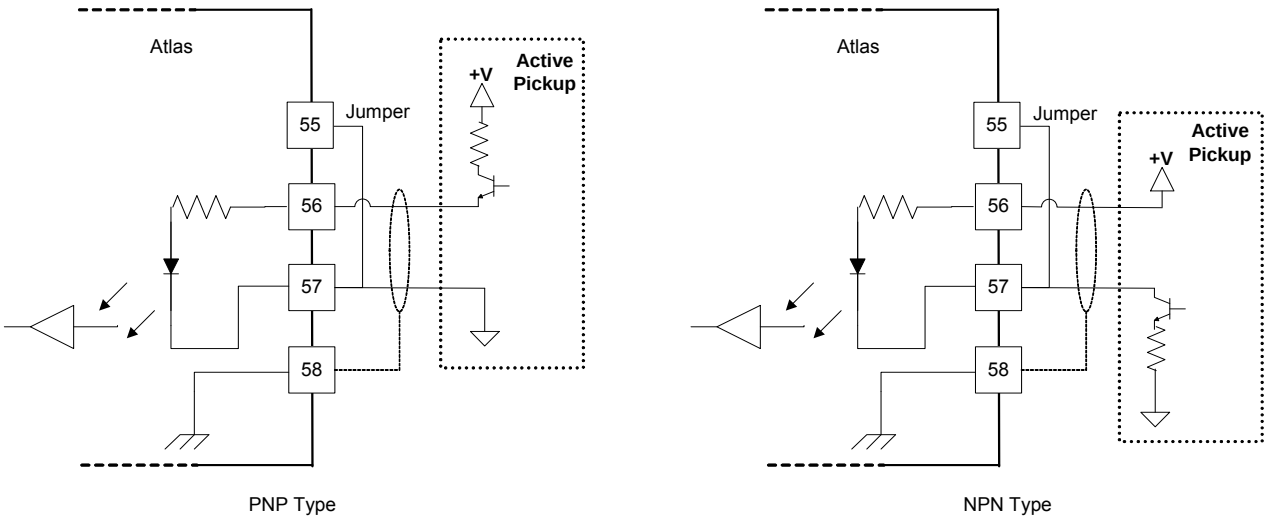


Figure 4-9. Example–Proximity Probe, SmartCore CPU A5200

Configuration Notes

- Refer to Figures 4-8 and 4-9 for speed sensor wiring.
- Each speed input channel can only accept one MPU or one proximity probe.
- Proximity probe power is not provided.
- Proximity probes only—External pull-up resistors are required when interfacing to open collector type proximity probes.
- If the proximity probe inputs are used, the corresponding MPU inputs must be jumpered as shown.

Speed Sensor Input Configuration Limitations

- (T x M x R)/60 must be < 25 000 Hz;
- T = gear teeth
- M = (overspeed test limit setting x 1.2)
- R = gear ratio

4.3.2 Analog Inputs

The analog inputs accepts a 4-20 mA current signal and may be used with two-wire ungrounded (loop powered) transducers or isolated (self-powered) transducers. All Analog inputs have greater than 40 Vdc of common mode rejection. If interfacing to a non-isolated device, which may have the potential of reaching over 40 Vdc with respect to the control's common, the use of a loop isolator is recommended to break any return current paths, which could produce erroneous readings.

For a 4–20 mA input signal, the SmartCore CPU A5200 board uses a 211 Ω resistor across the input.

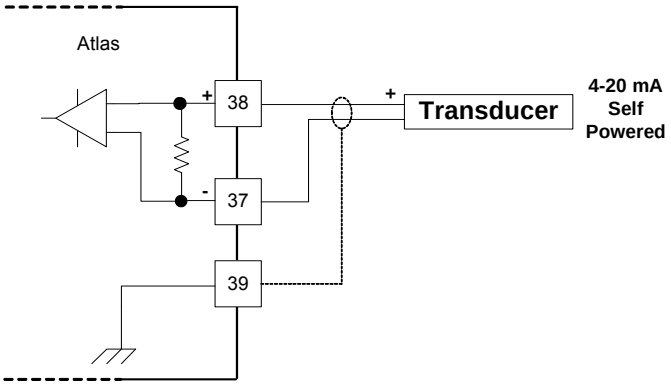


Figure 4-10. Example–4–20 mA Input Interface, SmartCore CPU A5200

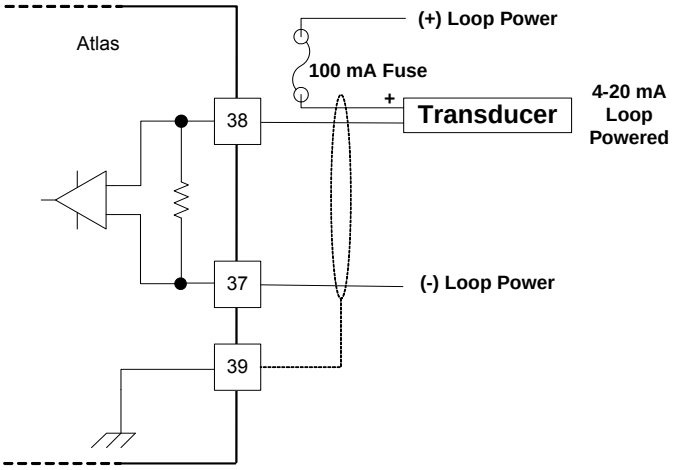


Figure 4-11. Example–4–20 mA Input Interface using External Loop Power

Configuration Notes

- Refer to Figures 5-11 and 5-12 for analog input wiring.
- All 4-20 mA inputs have an input impedance of 211 Ω.
- Loop power is NOT provided by the Atlas control, it must be sourced externally.

IMPORTANT **External loop powered transducers must be individually protected with a 100 mA fuse on each channel.**

4.3.3 Analog Outputs

The analog outputs are 4–20 mA with a full scale range of 0–25 mA. The SmartCore CPU A5200 board has four analog outputs.

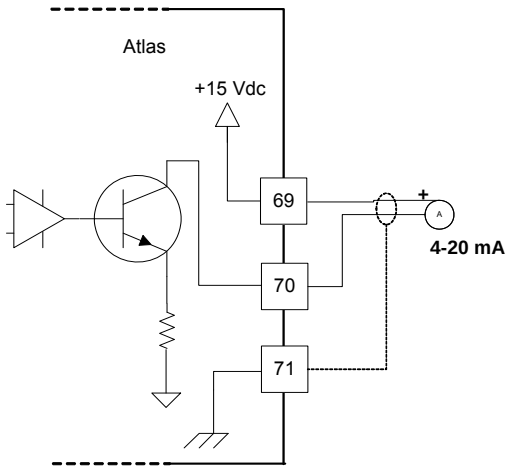


Figure 4-12. Example–Analog Output Interface, SmartCore CPU A5200

Configuration Notes

- Refer to Figure 4-12 for analog output wiring.
- Only 4–20 mA signals are output.
- See the specifications section for the maximum analog output load.
- Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices.
- Each output provides readback capability that can be used to detect field wiring or device faults as needed.
- The analog outputs have a 15 V common mode voltage, with respect to Atlas-II control common.

NOTICE

Avoid misconnection of the Analog Output (+) to the Actuator Output (–). This will damage internal components, making the control inoperable.

NOTICE

Signal Isolators should be used when connecting to non-isolated field devices greater than 30 meters away.

Beware of Analog and Actuator output connections to non-isolated field devices that are located greater than 30 meters away from the Atlas-II Control. Ground potentials between different locations can be severe enough under certain EMC/Surge events to cause control malfunction.

4.3.4 Actuator Outputs

The (2) proportional actuator driver outputs are software configurable as either 4-20 mA or 20-200 mA with a full scale range of 0–31 mA or 0-233 mA. Each driver output provides both current source and return readbacks that can assist in troubleshooting and detection of field wiring or device failures.

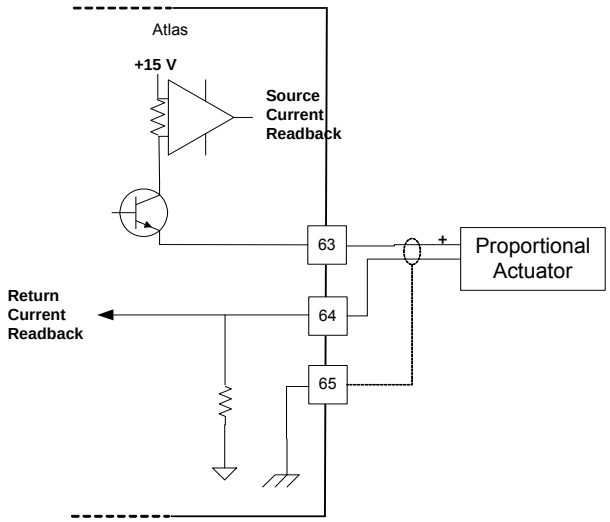


Figure 4-13. Example–Actuator Output, SmartCore CPU A5200 Board

Configuration Notes

- Refer to Figure 4-13 for actuator output wiring.
- 4–20 mA or 20-160 mA signals are output.
- See the specifications section for the maximum actuator output load.
- Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices.
- Application software selects the actuator type, the output range, and the dither amount.
- Each output provides readback capability that can be used to detect field wiring or device faults as needed.

NOTICE

Avoid misconnection of the Analog Output (+) to the Actuator Output (–). This will damage internal components, making the control inoperable.

NOTICE

Signal Isolators should be used when connecting to non-isolated field devices greater than 30 meters away.

Beware of Analog and Actuator output connections to non-isolated field devices that are located greater than 30 meters away from the Atlas-II Control. Ground potentials between different locations can be severe enough under certain EMC/Surge events to cause control malfunction.

4.3.5 Discrete Inputs

The SmartCore CPU A5200 board accepts 24 discrete inputs. Contact wetting voltage may be supplied by the SmartCore CPU A5200 card. Optionally, an external 18–28 Vdc power source can be used to source the circuit wetting voltage.

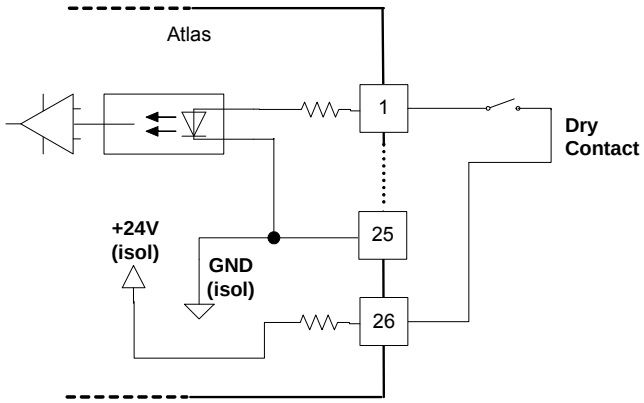


Figure 4-14. Example–Discrete Input Interface, SmartCore CPU A5200

Configuration Notes

- Refer to Figure 4-14 for discrete input wiring.
- The discrete input commons are tied together, so each SmartCore CPU A5200 board accepts only one voltage source, which can be internally or externally supplied.
- All contact inputs accept dry contacts.
- If an external power supply is used, it must be rated to 28 Vdc max from Class 2 type source for North America (SELV type source for applications outside North America). Power supply 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).
- The 24 V isolated contact power is protected by a 0.3 A poly switch that is rated for 0.1 A continuous use. This may not prevent interruption in control operation due to a short in the field wiring, but should protect the control from damage. The poly switch will reset itself when the short condition is resolved.
- If unused (floated) Discrete Inputs have an extended cable length attached for future use, they must be ignored in software. Events such as large transient pulses near the unused cable can cause them to momentarily toggle.

4.3.6 Serial I/O

The SmartCore CPU A5200 accepts (2) user serial I/O connections. Both isolated ports are configurable for RS-232, RS-422, or RS-485. RS-232 is specified to 50 feet (15 m) while RS-485 and RS-422 are specified to 4000 feet (1219 m).

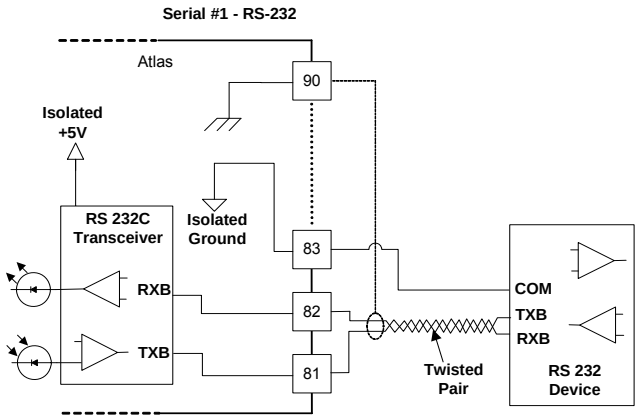


Figure 4-15. Serial #1–RS-232 Pinouts

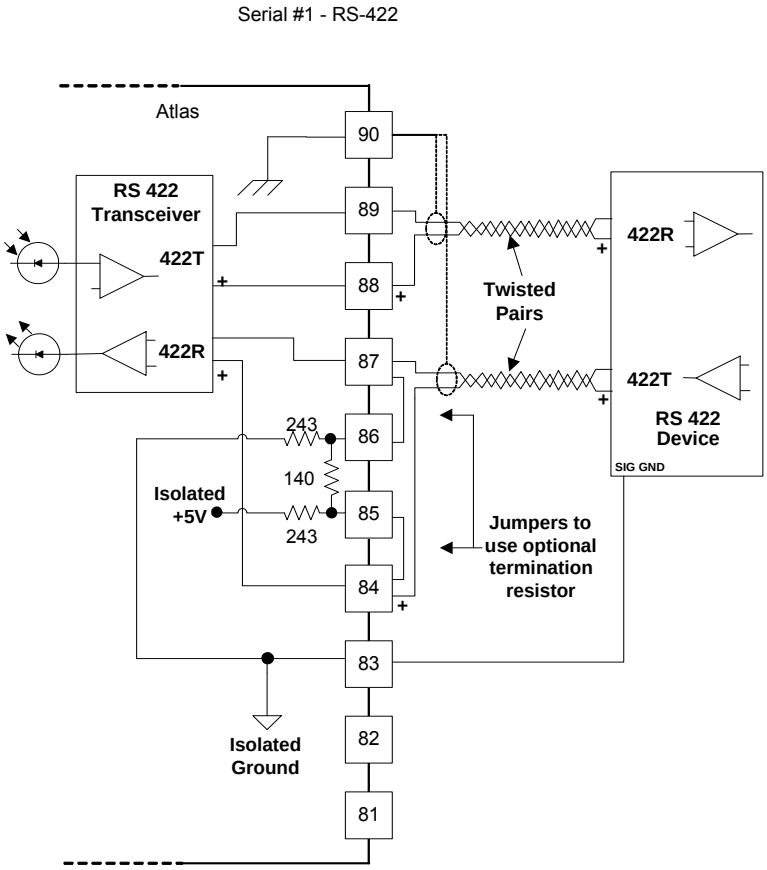


Figure 4-16. Serial #1–RS-422 Pinouts

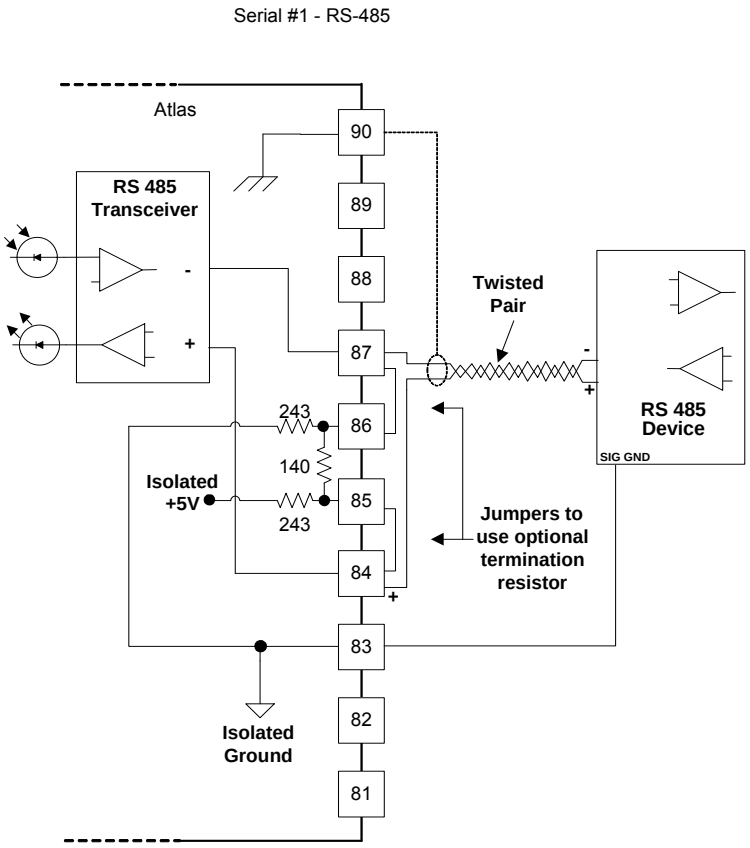


Figure 4-17. Serial #1–RS-485 Pinouts

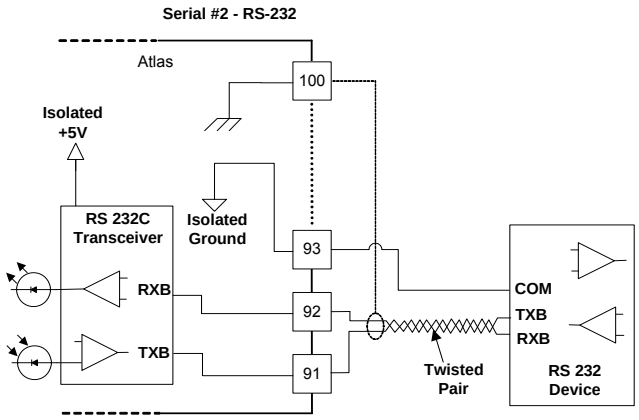


Figure 4-18. Serial #2–RS-232 Pinouts

Serial #2 - RS-422

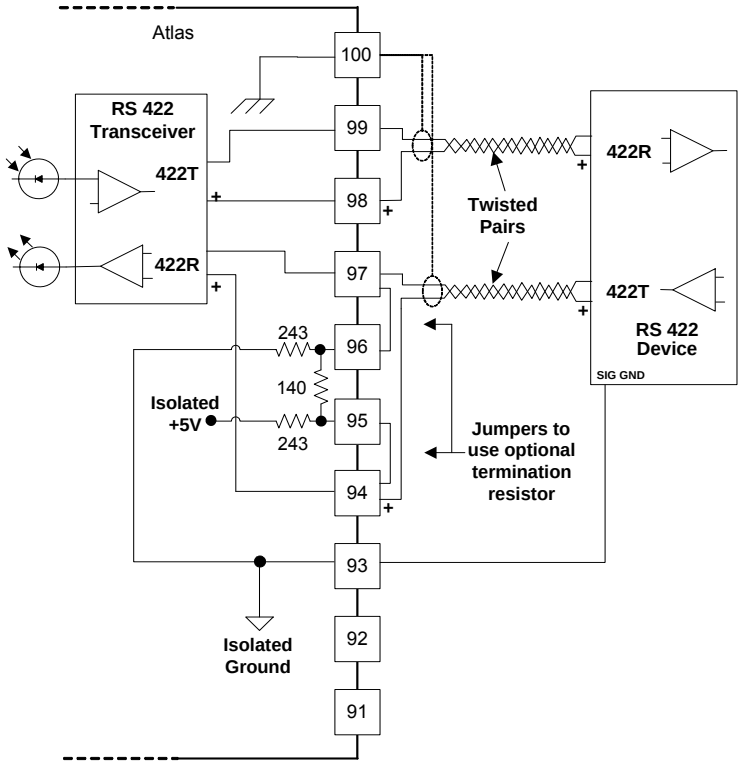


Figure 4-19. Serial #2–RS-422 Pinouts

Serial #2 - RS-485

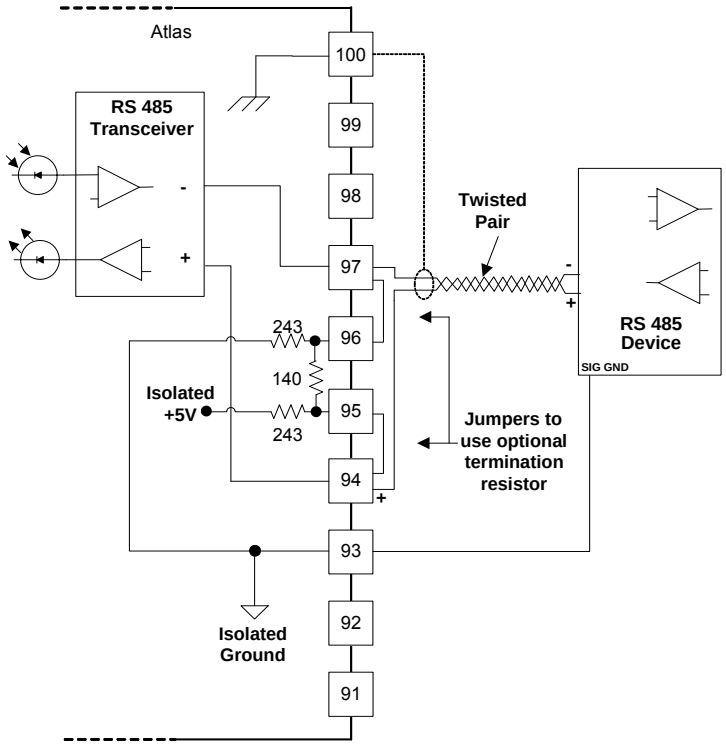


Figure 4-20. Serial #2–RS-485 Pinouts

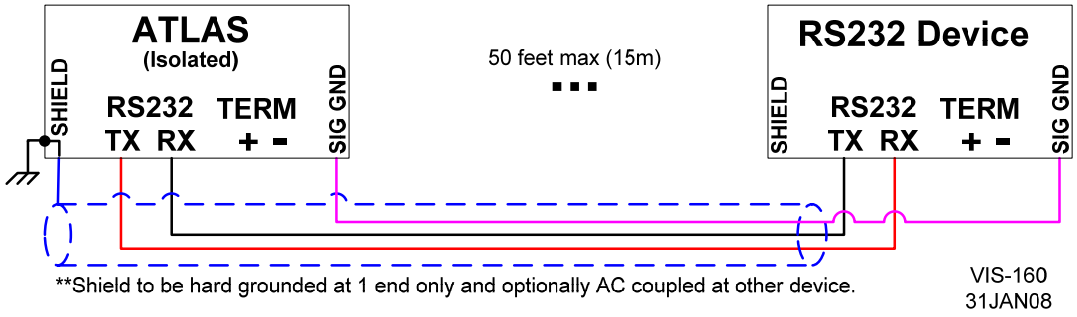


Figure 4-21. Example–RS-232 Interface to the SmartCore CPU A5200

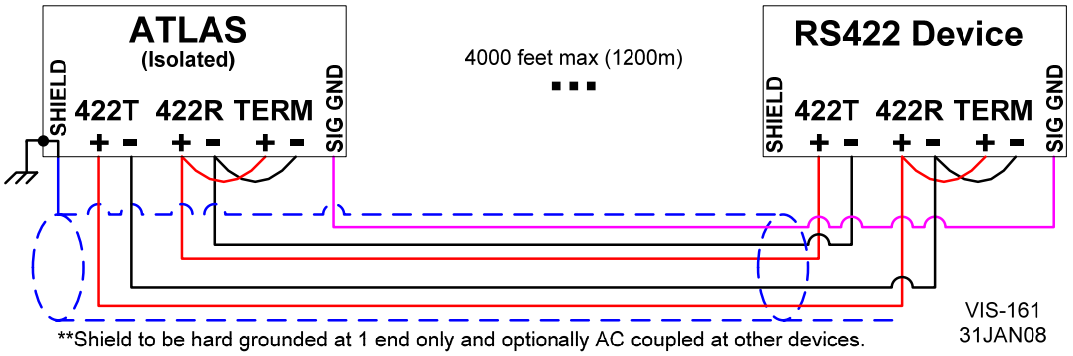


Figure 4-22. Example–RS-422 Interface to the SmartCore CPU A5200

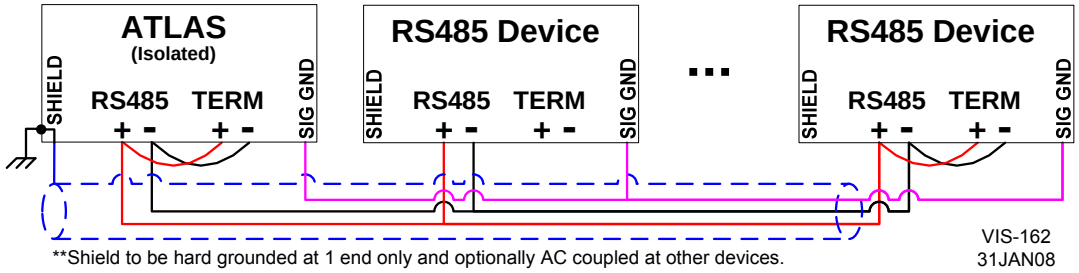


Figure 4-23. Example–RS-485 Interface to the SmartCore CPU A5200

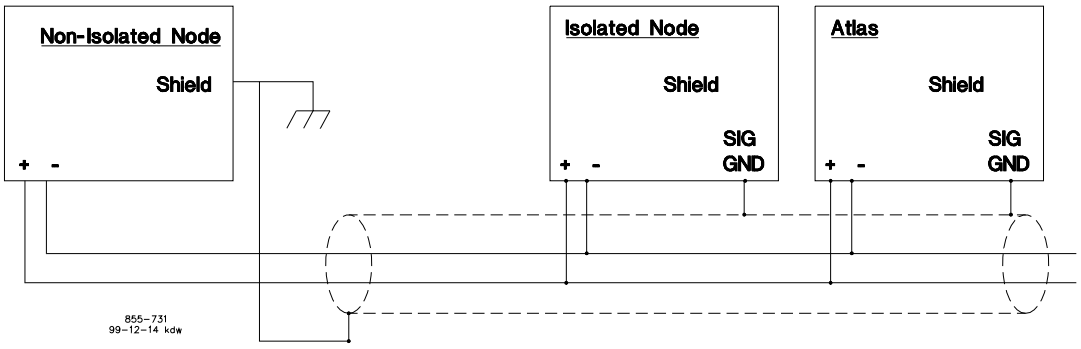


Figure 4-24. Example–Alternate Multipoint Wiring

(Without a separate signal ground wire for the SmartCore CPU A5200 board)

Configuration Notes

- **RS-232.** Refer to Figure 4-21 for RS-232 wiring. The transmit data (TXD), receive data (RXD), and signal ground (SIG GND) must be properly connected as shown. In addition the shield (SHLD) should be connected in at least one location.
- **RS-422.** Refer to Figure 4-22 for RS-422 wiring. The transmit data pairs (422T+ and 422T-), receive data pairs (422R+ and 422R-), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected in at least one location. Only the receiver at each end of the network should be terminated with a resistor.
- **RS-485.** Refer to Figure 4-23 for RS-485 wiring. The data lines (485+ and 485–) and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected in at least one location. The unit at each end of the network should be terminated with a resistor.
- **Termination Resistors.** The Atlas-II has termination resistors (TERM RES) built into the SmartCore CPU A5200 board that can be jumpered-in as required for RS-422 and RS-485 communication networks.
- The serial ports must be properly configured in the application software for the appropriate communication parameters.

Reference Grounds

- The serial ports are individually isolated from each other, and from the rest of the Atlas-II control. The RS-422 and RS-485 specifications state that a ground wire is needed if there is no other ground path between units. The preferred method for isolated ports is to include a separate wire in the ground cable that connects the circuit grounds together.
- Non-isolated nodes may not have a signal ground available. If signal ground is not available, use the alternate wiring scheme of connecting all circuit grounds of isolated nodes to the shield, and connecting the shield to earth ground at a non-isolated node.

4.3.7 Troubleshooting and Tuning

The SmartCore CPU A5200 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 upon reset. On-line diagnostics run during normal Control System operation when the GAP application is active. More information on diagnostics tests, subsequent LED flash codes, and serial port messages is contained in the VxWorks manual.

4.3.8 Fault Detection (Board Hardware)

Each SmartCore CPU A5200 board has a red fault LED that is turned on when the system is reset. During initialization of a board, which occurs after every CPU reset, the CPU turns the Fault LED on. The CPU then tests the board using diagnostic routines built into the software. If the diagnostic test is not passed, the LED remains on or blinks. If the test is successful, the LED goes off. If the fault LED on a board is illuminated after the diagnostics and initialization have been completed, the SmartCore CPU A5200 board may be faulty.

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

Table 4-11. SmartCore CPU A5200 Failure Codes

4.3.9 Fault Detection (I/O)

In addition to detecting board hardware faults, the 505CC-2 application program detects I/O faults.

- Analog Input Faults—A high and low latch set point to detect input faults.
- Speed Sensor Input Faults—A high and low latch set point to detect input faults.
- Serial Port Faults—The system monitors the serial communications on the serial ports for various communication errors.
- Microcontroller Faults—The system monitors a software watchdog, a hardware watchdog. All outputs are shutdown, I/O lock, in the event of a microcontroller fault.

4.4 Troubleshooting Guide

4.4.1 Speed Sensor Inputs

4.4.1.1 MPUs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Measure the input voltage on the terminal block. It should be greater than 1 Vrms.
- Verify that the signal waveform is clean and void of double zero crossings.
- Verify that no signal return to ground connections exist and that the 60 Hz signal resulting from ground loops is absent.
- Measure the frequency. Frequency should be in the range of 100 Hz to 25 kHz.
- Check the wiring. Look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.1.2 Proximity Probes

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Measure the input voltage on the terminal block. It should be in the range of 16–28 V peak, and the duty cycle should be within the specified range for the input voltage.
- Verify that the signal waveform is clean and void of double zero crossings.
- Verify that no signal return to ground connections exist and that the 60 Hz signal resulting from ground loops is absent.
- Measure the frequency. Frequency should be in the range of 0.5 Hz to 3 kHz.
- Check the wiring. Look for a loose connection at the terminal blocks and disconnected or misconnected cables. If an open collector probe is used, check to ensure that the pull-up resistor is installed properly.
- Check the software configuration to ensure that the input is configured properly.
- Verify that the corresponding MPU input is jumpered.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.2 Analog Inputs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Measure the input voltage on the terminal block. It should be in the range of 0–5 V.
- Verify that there are no or minimal AC components to the analog input signal. AC components can be caused by improper shielding or grounding.
- Check the wiring. If the inputs are reading 0 or the engineering units that correspond to 0 mA, look for a loose connection at the terminal blocks and disconnected or misconnected cables. If the unit is a 4–20 mA input, check for proper jumper installation on the terminal block.
- If all of the inputs are reading high, check that the power is not connected across the input directly.
- Check the software configuration to ensure that the input is configured properly.
- If the input is loop powered, ensure that power is provided externally, the Atlas control does not provide this power.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.3 Analog Outputs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Check the load resistance, ensure that it is less than the specification limit for the output current.
- Check to ensure that the load wiring is isolated.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.

- 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.
- Check the software configuration to ensure that the output is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.4 Actuator Outputs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Check the load resistance, ensure that it is less than the specification limit for the output current.
- Check to ensure that the load wiring is isolated.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- 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.
- Check the software configuration to ensure that the output is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.5 Discrete Inputs

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

- Measure the input voltage on the terminal block. It should be in the range of 18–28 Vdc.
- If an external wetting voltage source is used, check the voltage source is referenced to the A5200 wetting voltage's common.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

4.4.6 Serial I/O

If a serial port is not functioning properly, verify the following:

- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- Check to be sure that termination resistors are properly installed where needed on the network.
- Check the software configuration to ensure that the input is configured properly.
- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.

After verifying all of the above, the Atlas-II should be returned for service.

Chapter 5.
Analog Combo Board

5.1 General Description

NOTICE

This manual details only guidelines specific for the Atlas-II platform supplied, and I/O used, with .the 505CC-2.
Do not use this as a reference for other Atlas-II applications.

The Analog Combo board used with the 505CC-2 application supports only configuration of 4-20 mA analog inputs and outputs which are described in this chapter. The Analog Combo board does facilitate RTD, T/C, and speed inputs, but these are not utilized in the 505CC-2 configuration. The Analog Combo board has fifteen analog inputs and two analog outputs.

Features:

- 5 ms update rate
- On-board processor for automatic calibration of the I/O channels
- Analog inputs have 15 bit resolution
- Analog outputs have 12 bit resolution

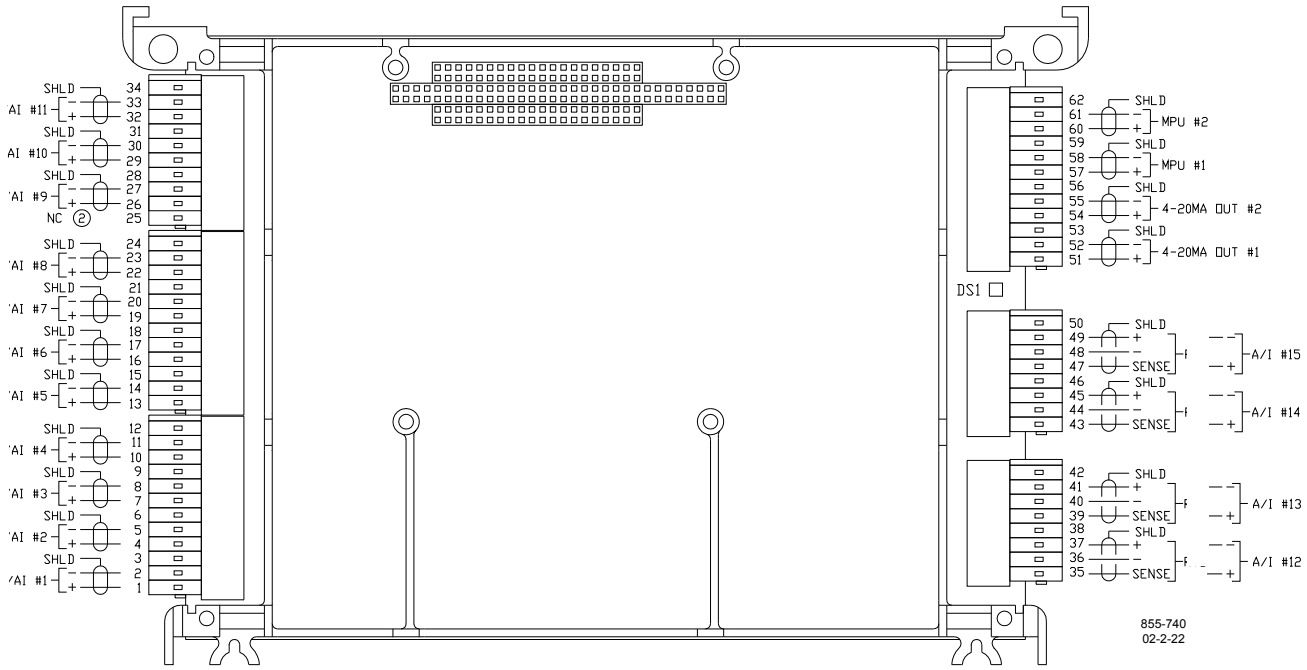


Figure 5-1. Atlas-II Analog Combo Board Connections

The Atlas-II™ Analog Combo board connects to the CPU board through the PC/104 bus. It does not connect to the Atlas-II power bus directly, it requires a SmartCore CPU A5200 board for this purpose.

5.2 Specifications

5.2.1 4–20 mA Analog Inputs

Number of channels	11
Input type	4–20 mA, type
Max. input current	24 mA
Common mode rejection	–80 dB minimum for analog inputs –96 dB typical for analog inputs
Input common mode range	±11 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	103 Ω (±1%) for 4–20 mA inputs
Anti-aliasing filter	2 poles at 10 ms (channel 11 has 2 poles at 5 ms)
Resolution	15 bits
Accuracy	See table below

4–20 mA Input Accuracy @ 25°C (%)		
Input type	**Typ**	**Max**
4–20 mA	0.05	0.10

Temperature Drift See table below

Temperature Drift			
Input Type	**Full Scale**	**Max Drift µa/°C)**	**Max % Error over 25 °C Delta (% of full scale)**
4–20 mA	25 mA	4 µA	0.40

IMPORTANT

Terminal block wiring must use multi-stranded wires to provide best results. Due to the clamping action of the spring-loaded terminal blocks, lower level signals are susceptible to glitches when using single "solid-core" wiring.

IMPORTANT

The 505CC-2 Atlas may experience degraded performance of these 4–20 mA inputs of the Analog Combo cards from 410 MHz to 450 MHz at field strengths greater than 10 V/m. Fields of 10–20 V/m degrade the steady-state performance from a 0.1% tolerance to a 0.36% tolerance. Installation of the Atlas in a metal cabinet will minimize this degradation.

IMPORTANT

For the 4–20 mA inputs, the Max % Error example is calculated for a 25 °C delta using the 25 mA full scale.

- All input channels are isolated from the rest of the Atlas-II platform to 500 Vac, however they are not isolated from each other. The inputs are differential, with high impedance between channels.
- Loop power for the analog inputs must be supplied by an external supply, if needed.
- Maximum wire size, one 16 AWG (1.5 mm²), or two 20 AWG (0.5 mm²) wires. Wires must be shielded.
- Channels 1–10 must be configured in pairs, that is, channels 1 and 2, 3 and 4, etc., must both be configured as 4–20 mA inputs
- Any "unused" channel of a pair, Channels 1–10, must have its input shorted to prevent measurement errors on the "in-use" channel of the pair.

IMPORTANT

External loop powered transducers must be individually protected with a 100 mA fuse on each channel.

5.2.2 Analog Outputs

Number of channels	2
Output type	4–20 mA outputs, non-isolated
Current output	4–20 mA
Max current output	25 mA ±5%
Isolation	0 Vdc
Min. load resistance	0 Ω
Max load resistance	300 Ω at 22 mA
Resolution	12 bits
Accuracy	less than ±0.1% of full scale at 25 °C (after software calibration)
Temperature drift	140 ppm/°C, maximum, =0.23 mA 70 ppm/°C, typical (0.45% of full scale), =0.11375 mA

- 0–1 mA outputs are not supported, without a greater than 4 bit loss of resolution. Resulting resolution would be 7 bits.
- Common mode voltage is 15 Vdc.
- Maximum wire size, one 16 AWG (1.5 mm²), or two 20 AWG (0.5 mm²) wires. Wires must be shielded.
- When interfacing to non-isolated devices, an isolator should be used between the Atlas-II and the device.

5.3 Analog Combo Board Operation

This board includes no potentiometers and requires no field calibration.

5.3.1 Analog Inputs

All 4–20 mA inputs may be used with two-wire ungrounded (loop powered) transducers or isolated (self-powered) transducers. All Analog inputs have 11 Vdc of common mode rejection. If interfacing to a non-isolated device, which may have the potential of reaching over 11 Vdc with respect to the control's common, the use of a loop isolator is recommended to break any return current paths, which could produce erroneous readings.

The first 11 analog inputs are isolated as a group from control common, earth ground, and the other 4 analog inputs. The last 4 analog inputs are also isolated as a group from control common, earth ground, and the first 11 analog inputs. For a 4–20 mA input signal, the Analog Combo board uses a 100 Ω resistor across the input.

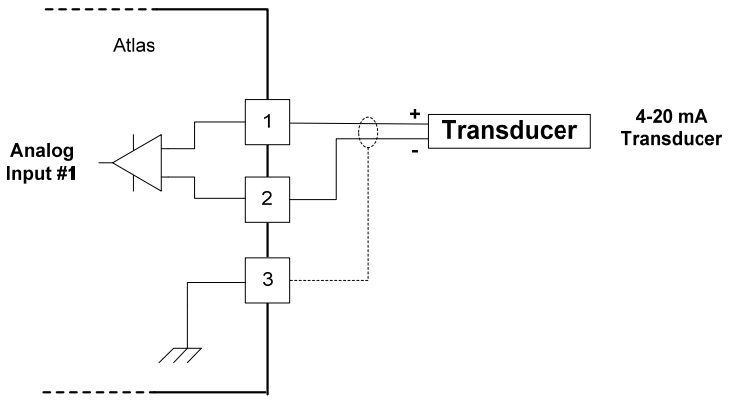


Figure 5-2. Wiring Example–Analog Input Interface

(To the Analog Combo Board for 4–20 mA on inputs 1–11)

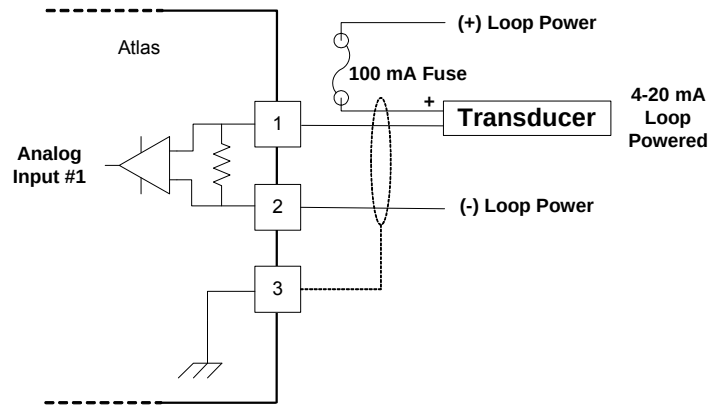


Figure 5-3. Example–Analog Input Interface with External Loop Power

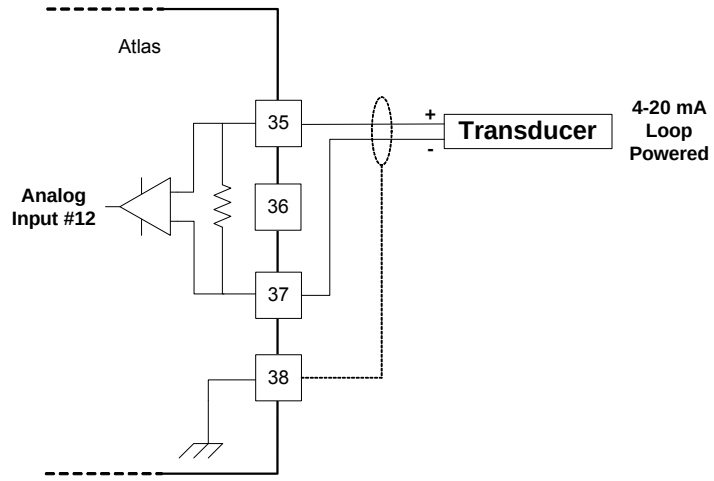


Figure 5-4. Example–4–20 mA Input Interface

(To the Analog Combo Board for inputs 12–15)

Configuration Notes

- Refer to Figures 5-1, 5-2, and 5-3 for analog input wiring.
- 4–20 mA inputs are supported, 0–5 V inputs are not.
- All 4–20 mA inputs have an impedance of 100 Ω.
- No loop power is provided.

IMPORTANT **External loop powered transducers must be individually protected with a 100 mA fuse on each channel.**

5.3.2 Analog Outputs

The Analog outputs are 4–20 mA with a full scale range of 0–24 mA. The Analog Combo board has four Analog outputs.

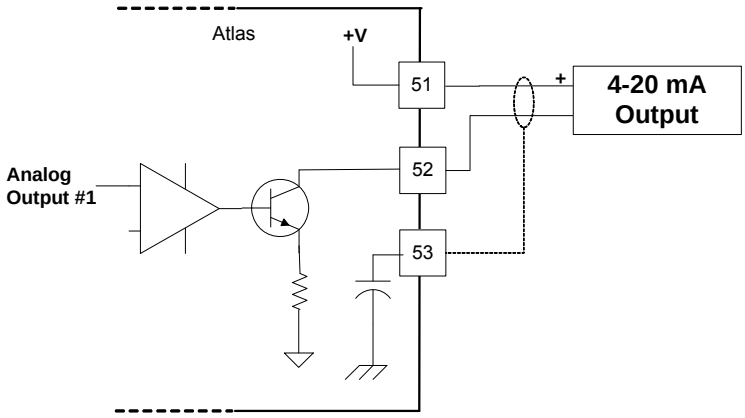


Figure 5-5. Example–Analog Output Interface

(To the Analog Combo Board)

IMPORTANT

On earlier versions of the Analog Combo board, the cable shield termination went directly to earth.

Configuration Notes

- Refer to Figure 5-1 for analog output wiring.
- Only 4–20 mA signals are output.
- See the specifications section for the maximum analog output load.
- Care should be taken to prevent ground loops and other faults when interfacing to non-isolated devices.
- The output does not contain fault detection. If it is necessary to detect failures, then the device that is driven by the Analog output, for example an actuator driver, must contain reference failure detection.
- The Analog outputs have a 15 V common mode voltage, with respect to Atlas-II control common.
- +V is 15 V

NOTICE

Avoid misconnection of the Analog Output (+) to the Actuator Output (–). This will damage internal components, making the control inoperable. This applies only when a SmartCore CPU A5200 board is installed in the control.

5.3.3 Fault Detection (Board Hardware)

Each Analog Combo board has a red fault LED that is turned on when the system is reset. During initialization of a board, which occurs after every CPU reset, the CPU turns the Fault LED on. The CPU then tests the board using diagnostic routines built into the software. If the diagnostic test is not passed, the LED remains on or blinks. If the test is successful, the LED goes off. If the fault LED on a board is illuminated after the diagnostics and initialization have been completed, the Analog Combo board may be faulty or may have the address DIP switches configured incorrectly. The DIP switch setting must match the module address set in the GAP application program.

Number of LED Flashes:	Failure:
1	Microprocessor failure
2	Bus, address, any unexpected exception error
5	Failure during EE test or erasing
7	Kernel software Watchdog count error
12	Failure during CPU Internal RAM test
13	Dual port RAM error

Table 5-1. Analog Combo Failure

5.3.4 Fault Detection (I/O)

In addition to detecting board hardware faults, the 505CC-2 application program may detect I/O faults.

- Analog Input Faults;
- A high and low latch set point to detect input faults is set and configurable in the 505CC-2.
- Microcontroller Faults;
- The system monitors a software watchdog, a hardware watchdog, and a software watchdog on the PC/104 bus communications. All outputs are shutdown in the event of a microcontroller fault.

5.4 Troubleshooting Guide

5.4.1 Analog Inputs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Measure the input voltage on the terminal block. It should be in the range of 0–5 V for 4–20 mA inputs.
- Verify that there are no or minimal AC components to the Analog Input signal. AC components can be caused by improper shielding or grounding.
- Check the wiring. For a 4–20 mA input if the input is reading 0 or the engineering units that correspond to 0 mA, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- If the input is reading high, check that the power is not connected across the input directly.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

5.4.2 Analog Outputs

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

- Check that the cable is shielded and the shield is properly grounded per the shields and grounding section in Chapter 2.
- Check the load resistance, ensure that it is less than the specification limit for the output current.
- Check to ensure that the load wiring is isolated.
- Check the wiring, look for a loose connection at the terminal blocks and disconnected or misconnected cables.
- 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.
- Check the software configuration to ensure that the input is configured properly.

After verifying all of the above, the Atlas-II should be returned for service.

Chapter 6.
12-Channel Relay Module

6.1 General Information

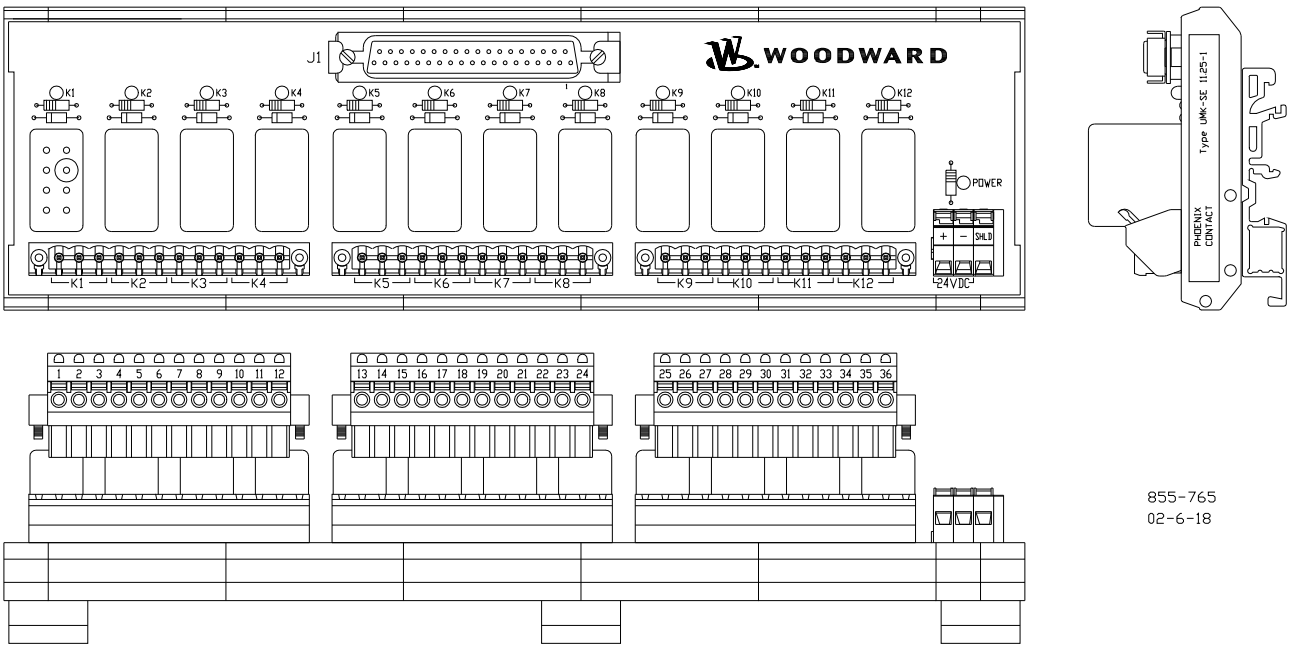


Figure 6-1. Channel Relay Module

The 505CC-2 Atlas system has 12 relay drivers on the power supply board. For customers that do not wish to wire their own discrete relays, Woodward can provide an integrated 12-channel relay module with cable harness that is certified for use in ordinary, hazardous, locations.

The module is DIN rail mounted. Approximate dimensions are 254 mm long, 76 mm wide, and 64 mm tall (10 inches long, 3 inches wide and 2.5 inches tall).

- Relay Module, Item Number 5441-699
- Cable, Item Number 5417-747

This equipment has been evaluated as EEx nC IIC T3 equipment under DEMKO Certificate No. 03 ATEX 0328750 U. Each device is suitable for use in Zone 2 explosive atmospheres. Device must be installed in a minimum IP54 enclosure as defined in IEC60529 and EN60529. This certification applies only to products bearing the DEMKO identification and the following marking:

II 3G.

6.2 Relay Information

Each relay has one set of normally open contacts and one set of normally closed contacts. The relay contact ratings are:

- 5 A at 28 Vdc resistive
- 0.1 A at 125 Vdc resistive
- 3 A at 120 Vac resistive
- 2 A at 120 Vac inductive
- 0.241 hp—120 Vac motor
- 0.112 hp—28 Vdc motor
- 0.5 A at 120 Vac tungsten

6.3 Shielding

There is a terminal on the module labeled “SHLD”. A wire should be connected between this terminal and a good local system ground. Alternatively, a ground wire can be crimped to the bare shield wire at the Atlas end of the cable and then tied to the chassis ground stud of the Atlas. If this shield wire is not used at the Atlas end of the cable, it should be trimmed back to the insulation jacket of the cable.

6.4 Board Status Lights

The module is equipped with twelve yellow LEDs to indicate when each relay has been energized, and one green LED to indicate that there is external power to the module. For proper operation, the green LED must be lit any time the Atlas system is being used.

6.5 Wiring

The relay module requires an external 18 to 32 Vdc power supply and a wiring harness. One end of this cable has been stripped back several inches, and individual wires are labeled with the terminal numbers of the appropriate terminals used on the Atlas power supply board. Refer to the following plant wiring diagram and the power supply chapter of this manual for more details.

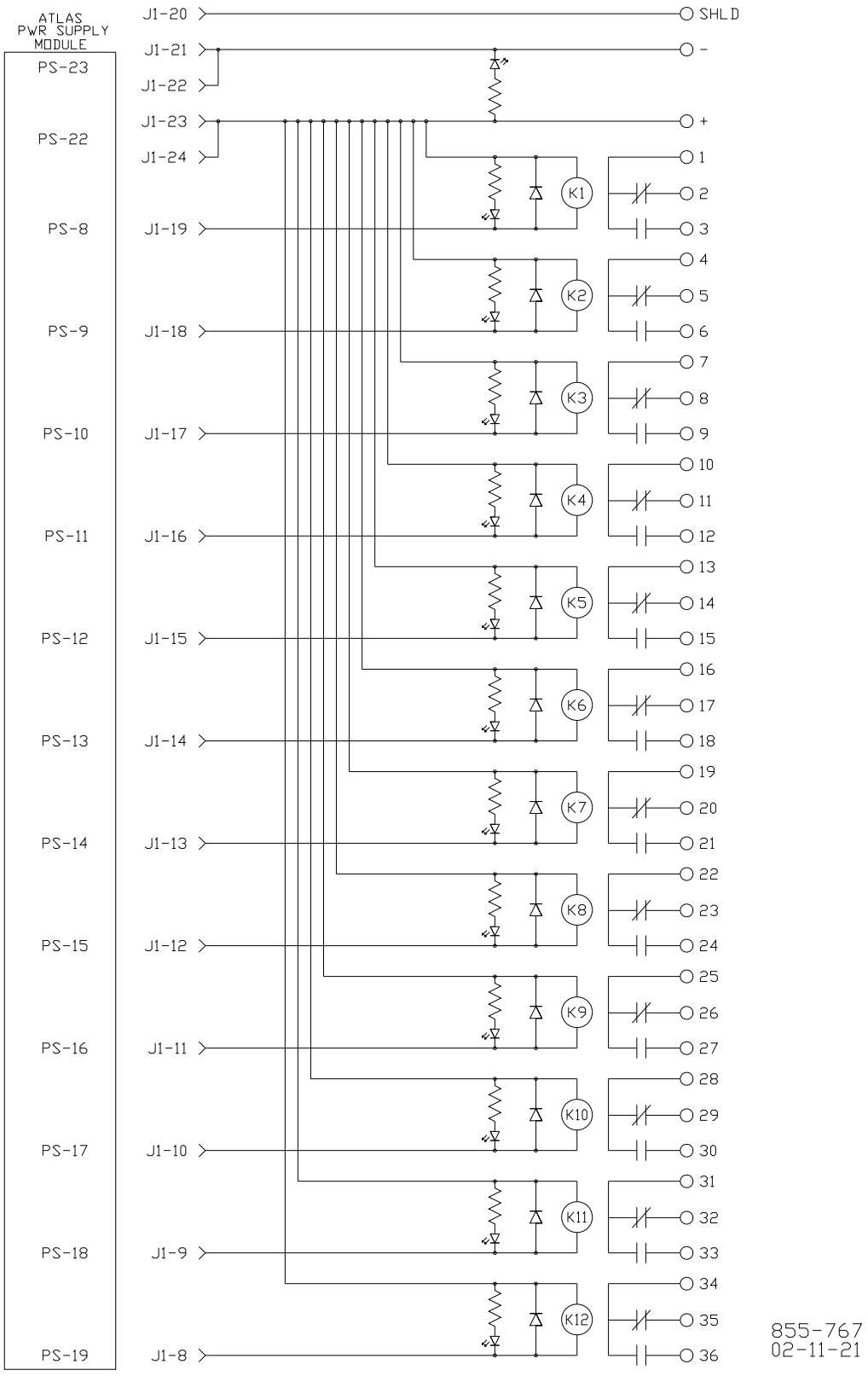


Figure 6-2. 12-Channel Relay Module Wiring Diagram

Chapter 7.
Modbus Communication

7.1 Introduction

This control can communicate with plant distributed control systems and/or CRT based operator control panels through up to two Modbus communication ports. These ports support ASCII or RTU MODBUS transmission protocols. The 505CC-2 supports Ethernet UDP, TCP or serial (RS-232, RS-422, or RS-485) communications. 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. The 505CC-2 control is always the slave device, the DCS or operator interface will act as the master and initiate communication transactions.

7.1.1 Monitor Only

The Modbus communication ports can be configured to communicate with any device that communicates through Modbus and has the same port settings. Alternatively, each port can be configured to only output data and ignore any input commands. This allows the control 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 control parameters, modes, etc. without effecting control of the turbine. To use a Modbus port for monitoring only (Boolean and analog write commands are ignored), configure this as described in Volume 2 and 3, Configuration Mode, Communication.

7.1.2 Monitor and Control

Once a Modbus port is configured for Modbus communications, the control will accept Run mode commands from an external network master device (DCS, HMI, etc.). This allows a Modbus compatible device to monitor and perform all 505CC-2 Run mode parameters and commands. Modbus ports are independent of each other, and can be used simultaneously. The last command given between the ports has priority. To use a 505CC-2 Modbus port to monitor and operate the 505CC-2 Control, configure this as described in Volume 2 and 3, Configuration Mode, Communication.

7.1.3 Modbus Communication

The 505CC-2 Control supports two Modbus transmission modes (ASCII & RTU). 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	8-bit binary
	ASCII printable binary	
	characters: 0-9, A-F)	
Start Bits	1	1
Data Bits per Char	7	8
Parity	even, odd,	even, odd,
	or none	or none
Stop Bits	1, 1.5, or 2	1, 1.5, or 2
Baud Rate	110, 300, 600, 1200,	110,300, 600, 1200,
	1800,2400, 4800, 9600,	1800, 2400, 4800, 9600,
	19200, 38400, or 57600	19200, or 38400
Error Checking	LRC (Longitudinal	CRC (Cyclical
	Redundancy Check)	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 7-1 below).

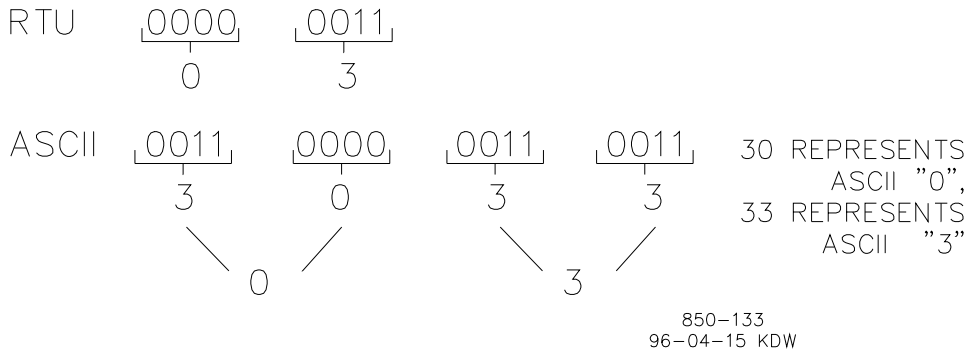


Figure 7-1. ASCII/RTU Representation of 3

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 protocol and Modbus device number are set in the Program Mode and can be adjusted in the Service Mode, if required.

The control's CPU module serial communication ports are defaulted for RS-232 communications. RS-232 communications is limited to a distance of 15 meters (50 feet). The transmit data (TXD), receive data (RXD), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected in at least one location.

In cases where a device which is being interfaced to is located a distance of greater than 15 meters (50 feet) from the control, it is recommended that RS-422 or RS-485 be used. With the use of RS-422 or RS-485 communications, the control can interface with a device through serial communications up to 1200 meters (4000 feet) from the control.

This control functions as a slave unit only. As a slave unit, the control will only respond to a transaction request by a master device. The control can directly communicate with a DCS or other Modbus supporting device on a single communications link. The 505CC-2 currently does not support multi-dropping via RS-422 or RS-485 communications.

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. Table 7-2 lists the function codes supported by this control.

7.1.4 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
5	Write Single Discrete Output (Raise/Lower and Enable/Disable Commands)	0XXXX
6	Write Single Register (Enter Setpt Directly)	4XXXX
8	Loopback Diagnostic Test (supports subfunction 0 only)	N/A
5	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, an error code is sent back to the master and the control issues an alarm message. The error codes are defined in Table 7-3.

If the control has not received a message for the configured time-out period, the control will alarm with an error message, but no message is sent to the master, see Table 7-3.

7.1.5 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 addressee 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

7.2 Port Adjustments

Before the 505CC-2 Control will communicate with the master device, the communication parameters must be verified. These values are set in the full configuration mode and can be adjusted, if required, from the limited configuration mode. The communication paragraph in volume 2 and 3 describes the miscellaneous port adjustments in configuration mode for turbine and/or compressor control.

7.3 Modbus Address List

The Modbus communication ports in the 505CC-2 control are programmed for unique Modbus addresses. A complete listing of these addresses to be used for your application is located in Appendix E. 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 referred to as input registers and holding registers.

All values that can be addressed by Modbus are considered to be discrete and numeric. The discrete are a 1 bit binary, on or off value and the numeric are 16 bit values. Discrete are sometimes referred to as coils or digitals and numeric are referred to as registers or analogs. All read/write registers are interpreted by the 505CC-2 control 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 505CC-2 control. See Tables 8-7 and 8-8 (Analog Reads and Analog Writes) under the MULTIPLIER column for defaulted communication constants and ranges.

The maximum number of discrete 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

7.3.1 Boolean Writes (Holding Coils)

Holding coils are logical signals that are both readable from and writable to the 505CC-2 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 505CC-2 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 E-1 (Modbus List Boolean Writes).

7.3.2 Boolean Reads (Input Coils)

Input coils are logical signals that are readable from, but not writable to, the 505CC-2 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 505CC-2 control supports Modbus function code 2, which involves reading selected input coils. The input coils available are listed in Table E-2 (Modbus List Boolean Reads).

7.3.3 Analog Reads (Input Registers)

Input registers are analog values that are readable from, but not writable to, the 505CC-2 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 505CC-2 control before being sent across the Modbus link. For example, these input registers may be listed as the Modbus value 'x100' 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 505CC-2 control configuration mode, communication, for defaulted communication constants and ranges. The control supports Modbus function code 4, which involves reading selected input registers. The input registers available are listed in Table E-3 (Modbus List Analog Reads).

7.3.4 Analog Writes (Holding Registers)

Holding registers are analog values that are writable to the 505CC-2 control. These values can also be read from 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 values of the holding registers are also stored in the control as numbers representing engineering units (i.e. PSI (kPa) 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 505CC-2 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 E-4 (Modbus List Analog Writes).

7.4 Modbus Scale Factors

Modbus has two limitations:

- Only integers can be sent across.
- The value is limited between -32767 and 32767.

These limitations can be overcome by scaling the value before it is sent across the Modbus. The scale factor is fixed as or can be changed in the configuration or service mode between to the following multipliers:

- X 0.001
- X 0.01
- X 0.1
- X 1
- X 10
- X 100
- X 1000
- X 10000

The scale factors that are adjusted can be identified in the list shown in Appendix E by not showing the constant value, but instead a reference to the control application, for example:

3:0420	AI__.FLOW2_PV.A_NAME	Comp2: Prim flows PV (EU)	MOD_MULT.MLT_FLO2.A_MUX_N_1

Table 7-5. Modbus Scale Factor Adjustable

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. Values that are larger than the limitation of Modbus can be sent across by multiplying the value by a factor of 0.1, then dividing the value by the same scale factor in the Master.

For example:

If the Cascade setpoint of 60000 needs to be sent across the Modbus, the Cascade Scale Factor would automatically be set to 0.1, this will change the value so that it can be sent across the Modbus (60000 * 0.1 = 6000). After the value is sent across the Modbus, it must be rescaled in the Master to the original value (6000 / 0.1 = 60000).

7.5 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 505CC-2 control System 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 and acknowledgement on address 0:0002 has to be given within five seconds for the control to issue an emergency shutdown command.

See for more information in volume 2 and 3 concerning this Modbus trip configuration

7.6 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.

Chapter 8.
Commissioning and Configuration Tools

8.1 Introduction

This chapter applies to all 505CC-2 control systems but may include information that is not used, supplied, or not applicable to your system. The CCT software described cover only the tools on the accompanied 505CC-2 application CD as generated by Woodward and optional other tools.

8.2 Installation Instructions

The 505CC-2 software can be installed in two different ways. The easiest and preferred way to install the software is using the automated software installation. The steps to perform the automated installation can be found in chapter 8.2.1 Installing the software automatically.

8.2.1 Installing the software automatically

To install the software follow the steps below:

1. Insert the CD with P/N BCD85253 into the computer/laptop on which you want to install the 505CC-2 application software.
2. When the Auto-run window appears click Setup.exe

   When no Auto-run window appears follow the next steps:

   a. Browse to you CD drive folder using your file Explorer i.e. Windows Explorer.
   b. Double-click the file Setup.exe
3. Follow the steps given by the installation program.
4. During the install process your computer/laptop will/can restart several times. This is normal as for the installation your computer this is necessary for the process.
5. When the message “Installation finished!” appears, the 505CC-2 software is installed successfully. On your next restart of your computer/laptop the 505CC-2 software will start automatically.

   If for any case during installation an error message occurs you can follow the next steps

   a. Go back to step 2 and follow the instructions.
   b. Install all software separately by following the instructions written in chapter 8.2.2, Installing the software manually.

8.2.2 Installing the software manually

If it is preferred to install the software manually, or when during the automated software install process an error occurred, follow the steps below in exact order:

1. Insert the CD with P/N BCD85253 into the computer/laptop on which you want to install the 505CC-2 application software
2. On your computer/laptop browse to the CD drive and open the folder on the CD called Woodward_apps

   If one of the below software is already installed, skip that step.
3. Install Windows Installer 3.1 by opening the file named **Installer3.1**
   a. Follow the instructions provided by the installer
   b. (The computer will) restart after completing the installation.

4. Install Microsoft .NET 3.5 by opening the file **dotnetfx35**
    a. Follow the instructions provided by the installer
    b. (The computer will) restart after completing the installation
5. Install Microsoft .NET 4.0 by opening the file named **dotnetfx40**
    a. Follow the instructions provided by the installer
    b. (The computer will) restart after completing the installation.
6. Install SOS OPC Server by opening the file named **9927-1223**
    a. Follow the instruction provided by the installer
7. Install Appmanager by opening the file named **9927-785**
    a. Follow the instructions provided by the installer
    b. (The computer will) restart after completing the installation
8. Install Control Assistant by opening the file named **9927-1237**
    a. Follow the instructions provided by the installer
9. Install Woodward Toolkit by opening the file named **9927-1226**
    a. Follow the instruction provided by the installer
10. Open the file called **app_setup.bat**. This batch operation will setup and move all necessary settings and files for the 505CC-2 software to their corresponding settings/locations.
11. All software is installed. Please restart your computer/laptop and all software related to the 505CC-2 will startup automatically.

IMPORTANT **Updates can be found on the website of Woodward. Visit www.woodward.com to download the latest software versions.**

8.2.3 Overview of software

The software and revisions that is located on this CD can be found in below table:

Description	Part Number	Version No.
Windows Installer 3.1	N/A	N/A
Microsoft .NET 3.5	N/A	N/A
Microsoft .NET 4.0	N/A	N/A
Woodward SOS OPC server	9927-1223	4.01
Woodward AppManager	9927-785	3.0
Woodward Control Assistant	9927-1237	4.2
Woodward Toolkit	9927-1226	3.5.3

Table 8-1. Software Overview

8.3 ToolKit

The 505CC-2 Toolkit program is the interface program which will be started and used to configure, service, and operate the 505CC-2 control. The program interface modes are as follows:

8.3.1 Connection

The Toolkit application consists of two files:

- 54183682CF.wtool
    - For full and limited configuration mode.
- 54183682RS.wtool
    - For service and run mode.

Double click on the icons to start the Toolkit application.

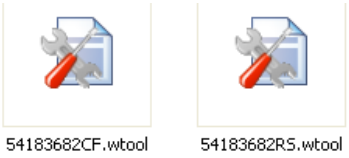


Figure 8-1. ToolKit Icons

The ToolKit application will launch and the following screen should be seen:

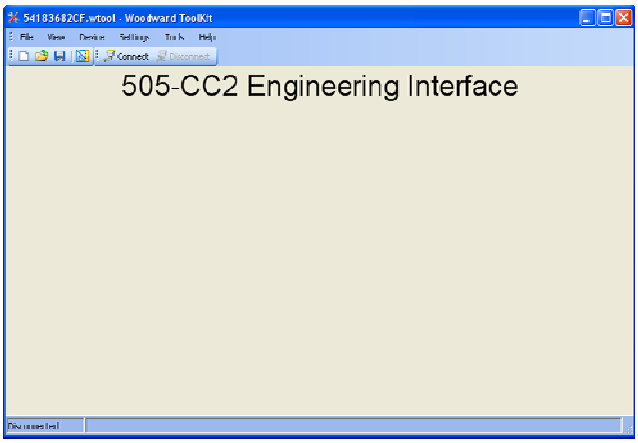


Figure 8-2. Connect to ToolKit

Next click on the connect icon on the center of the Toolbar. It will open a pull-down menu as shown below. Select the 505CC-2 IP address and click on the connect button at the bottom of the menu.

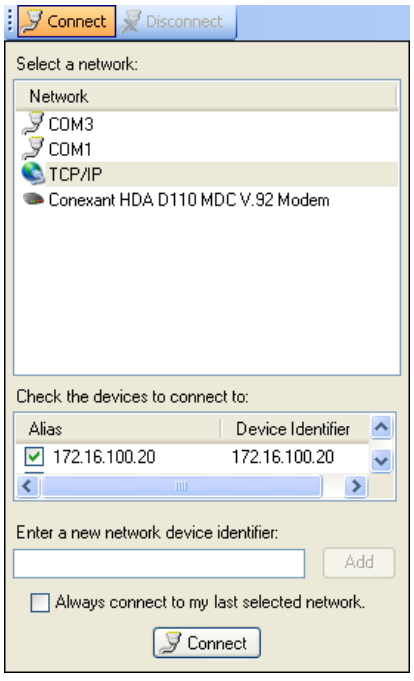


Figure 8-3. Connect to Network

Toolkit will connect to the control and the following dialog box will appear.

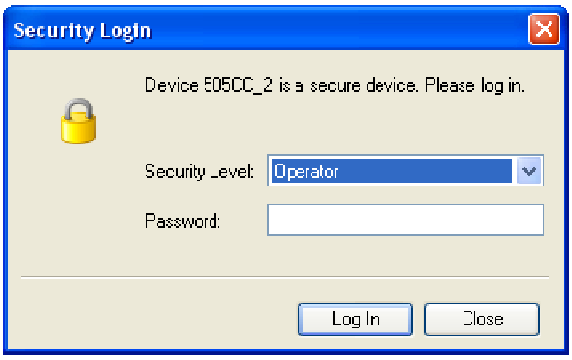


Figure 8-4. Security Login

Subsequent the user can login with the required security level and the home page is displayed from which the user can access the different features explained further in volume 2 and 3.

8.3.2 Security Levels

The 505CC-2 has 3 security levels with the following passwords:

- Operator, 1111
- Service, 1112
- Configuration, 1113

For initial configuration of the unit login using the configuration level security with the 54183682CF file. Once the unit has been configured, commissioned and started up, the service or operator level logins can be used with file 54183682RS to prevent the user from changing critical parameters, or entering a mode that will place the control in an I/O Lock condition.

While connected the user can click on the 'Details' block at the bottom of the window. A details window will pop-up and allow the user to Log Out and one can then return to another user mode via the Log In button.

To hide the details dialog, just re-click on the details button.

8.3.3 Configure Mode

This mode has password based security and is used when the system is shutdown to:

- Configure the control to an application
- Can enter numbers/values directly (not restricted to up/down tune buttons)
- Change control input/output assignments
- Load a control's configuration from a computer file

⚠WARNING

Entering full configuration mode will issue a CPU I/O lock to the hardware interface modules and all outputs from the control will be disabled.

Ensure the turbine and/or compressor is in a shutdown condition and that devices are properly locked out or that a safety issue is not created.

8.3.4 Service (or Limited Configuration) Mode

This mode has password based security and is used when the system is operating on-line to:

- Calibrate control inputs and outputs
- Tune system settings
- Monitor Control Health
- Test Voting Logic
- Test control and system protection logic

8.3.5 Run Mode

This mode can be used as an alternative operator control panel to:

- Start and Stop the turbine
- Enable and Disable all system control modes (Cascade, Auxiliary Control, Extraction/Admission, etc.)

As with any Windows based program, the pages displayed and the navigation between pages will change depending on the input from the user. If certain options of the ToolKit Tool File program are not used, navigation to some pages may disappear and not be shown. For the purpose of this manual, all options and all pages have been displayed in the figures that follow. The folders and screens that you as the user will see on your own unit will be different. Sometimes conflicting options have been shown so that the figure can display all the information necessary to the different types of applications, i.e. Extraction, Admission, and Extraction/Admission navigation buttons cannot all appear at the same time on the PC.

The primary way to select options in the 505CC-2 control is to use the navigation button menus. An option will appear in the appropriate folder with a pull down box shown after it. The selected option will be displayed in the pull-down box. If the user clicks on the box with the mouse or touch screen (placing the mouse cursor over it and clicking the left mouse button) the program will navigate to that page.

For some selections pull-down menus are provided. Clicking on any of the options will place that option in the display area of the pull-down box, and make that option the selected one for the 505CC-2 control. At that time additional options may appear or disappear depending on whether they are valid.

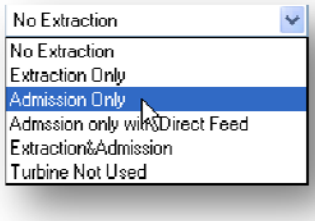


Figure 8-5. Pull Down Menus

The other way to select options in the 505CC-2 control is the check box. An option will appear with a small box in front of the text. The box will show a small check mark inside it if the option or the box is clicked on with the mouse. If the option is clicked on again, the check mark will disappear. The check mark determines the use or non-use of the option.

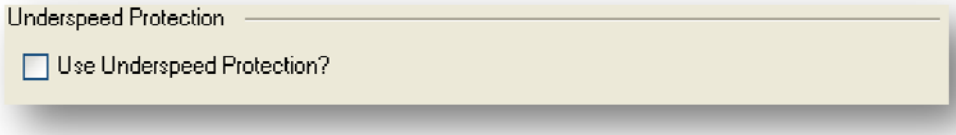


Figure 8-6. Check Box Not Selected

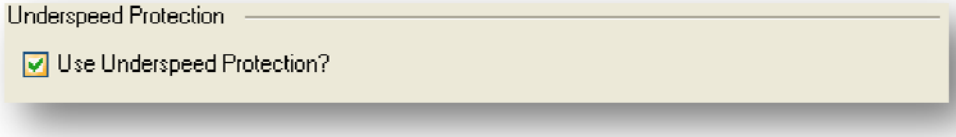


Figure 8-7. Check Box Selected

As options are selected, check mark appears; other options or input values appear on the page and allow the user to further define the 505CC-2 control. For example, if Use Remote Speed Setpoint is selected, the necessary analog input signal must be assigned to one of the available AI channels or else a configuration error will be annunciated. Some options will not be available for a certain configuration, but will remain visible. These options will be shaded to inform the user that they cannot be selected due to a conflicting option selected elsewhere.

8.3.6 Save and load configuration settings

In Toolkit the option is available to save the current configuration settings to a file and store them on a hard disk or other device. Choose “Settings” and “Save from Device to File” to do so.

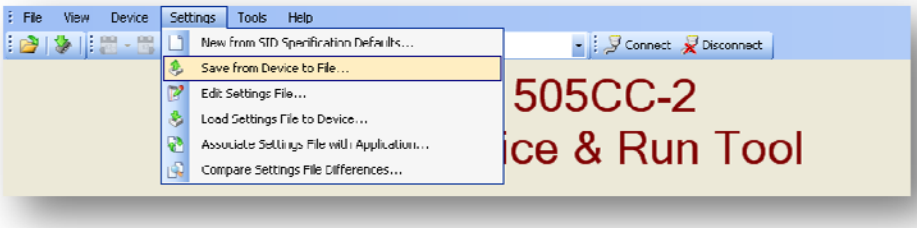


Figure 8-8. Save from Device to File

To load configuration settings from a file to a device choose “Settings” and “Load Settings File to Device”. The control needs to be in I/O lock to successfully load the settings.

8.4 Control Assistant

The Control Assistant program is a troubleshooting and debugging tool that provides a window into the control system. This program is provided with all Woodward 505CC-2 controls to allow internal program calculation and logic monitoring by Woodward technicians and engineers and by other users that are already familiar with this tool. It is anticipated that a typical 505CC-2 control user may never use this program once the unit is configured and commissioned.

Some of the many features are:

- Trending
- Tunable Maintenance (Upload/Download)
- WinPanel viewing
- Datalog Analysis

8.4.1 Trending

A live Trending feature allows user to create or open script files of certain control parameters to assist in typical commissioning procedures like tuning of control loops.

8.4.2 Tunables

The ability to save, compare, upload and download tunables to and from the control. The ToolKit Tool can also handle this operation.

8.4.3 WinPanel

The WinPanel feature presents variables in a tabular format. The user chooses the variables to view at any given time. Multiple pages of variables can be created, each with useful parameters for various trouble shooting or tuning procedures. The user can toggle between screens depending on the work being done.

8.4.4 Datalog Viewing

Control Assistant also has the ability to open datalog files that are captured and stored on the Atlas CPU's. The 505CC-2 application has automated logic, as well as manual user triggers, to capture and create a file from a running buffer of control program data whenever a turbine shutdown occurs.

8.4.5 Licensing

Some Control Assistant functionality may be used without purchasing a software license. Following are the limitations of an unlicensed Control Assistant program:

- Only one WinPanel sheet may be specified
- WinPanel configuration scripts may not be saved
- Only the most recent 100 data samples may be viewed in a log file
- Once 100 data samples have been collected for any OPC value, trending functionality stops

To authorize the license of Control Assistant, select "Authorize" from the License menu and then select the desired licensing option from the license dialog.

The following instructions will help you authorize your software license via the Internet. If you do not have access to the Internet, you must contact the vendor where you purchased this product to authorize the license.

1. The first step to authorizing your software is to purchase a software license. Upon purchasing a license, you will be granted a unique serial number. It is important for you to keep this number in a safe place, as it is your proof that you own a license.
2. Install the software on your computer. It is important that the software is installed on the computer that you intend to run it from. This is because the software license will only work on the computer that the software is installed on.
3. After installing the software, run it for the first time. From the License menu, you may select "Authorize". A dialog will provide you with a number called a site code that identifies your computer as well as this software product.

4. Access the Woodward License web site at: http://www.woodward.com/software/registration/login.cfm?Action=authorization.
5. Upon entering the License Software page you will be prompted for some information required to ensure that you are informed of any product updates that may occur. After submitting this information you will be prompted for the serial number of your license and the site code from the Authorization dialog.
6. The web site will verify that your serial number and site code is valid and provide you with your license key. The license key is a twenty-six-digit identifier that will be used to unlock your software product.
7. Enter your license key from the web page into the Authorization dialog of the software. The software should now operate in accordance with the software license that you purchased.

   NOTE: You may use the cut and paste functionality of Windows to aid in entering the license key.

8.5 AppManager

The application manager tool is mainly used to view and transfer files to and from the CPU's on the control. It is also used to install service packs, configure CPU IP addresses and help debug system problems.

8.5.1 Downloading and Running the Application

The AppManager tool is used to transfer the application to the control. AppManager must first be installed on a PC that is networked to the control. Then, the AppManager's "Transfer Application Files" command is used to move the .OUT file to the control's non-volatile flash memory (flash disk). AppManager makes sure the application files are transferred to the proper area on the control for execution.

NOTE: If the application on the CPU has been changed, Toolkit has lost all configuration settings. These settings should be uploaded again in to Toolkit. Refer to 8.3.6 for the uploading procedure.

8.5.2 Retrieving Log Files

The system logs are used to record events on the CPU. This includes login information and fault status information. If you need the login history (failed or successful) or if you are asked to provide the system logs for a CPU to assist in trouble shooting a problem, use this command.

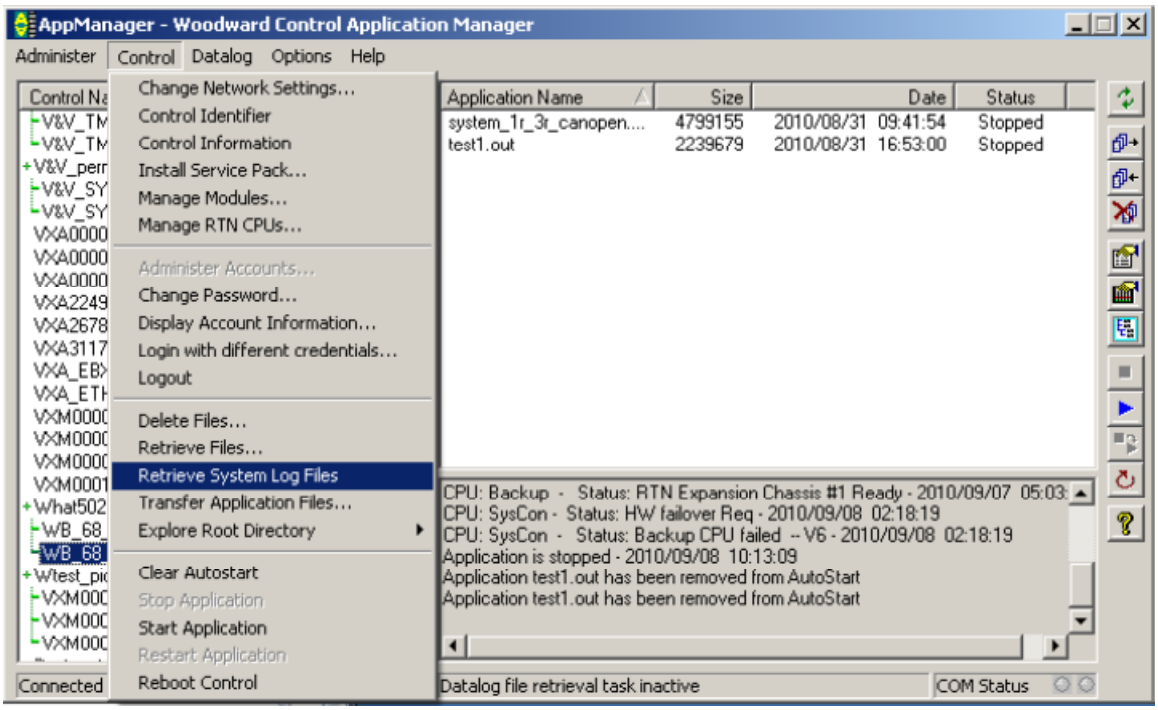


Figure 8-9. Retrieving Log Files

Using AppManager, System Log files can be retrieved per the following:

1. On your PC, open AppManager.
2. You should see the Woodward control's Computer Name in the AppManager window. Select the control's Computer Name. If it didn't show up, check your connections and verify the Link lights are on.
3. Login to the Control with a valid User Name and Password.
4. Click "Control" in the top header of the AppManager window, use the pull down menu, and select "Retrieve System Log Files".
5. All system log files will be copied from the selected CPU to the PC where AppManager is running in the following directory: c:\documents and Settings\All Users\Application Data\Woodward\System Log Files\<Application Name of Main PU>\<Name of Main CPU>*.log.

8.6 OPC Server

The Toolkit software program internally runs a communications program called Servlink. Servlink is an interface program which directs and manages the transfer of data between the tool program and the 505CC-2 control. If the Control Assistant program is launched—an additional Servlink program called SOS (Servlink-to-OPC-Server) will launch to create a link to this tool.

The setup program that installs the Toolkit and Control Assistant programs on your computer will also install the Servlink program. All control communications to these programs are performed through the Servlink program.

8.6.1 Service Interface Definition (.sid) File

The Servlink program uses a network definition file to communicate with the 505CC-2 control's application software. This file acts as an encoded tag-name look up table so that only encoded tag names are used when communicating with the control. This type of encoding logic allows for faster communications speeds. Both ToolKit and SOS will automatically retrieve and save this file, there is no action is required by the user to do anything with these files.

8.7 GAP

GAP (Graphical Application Programmer) is the Woodward software tool used to program the control hardware. It is a pictures-to-code language software tool that allows control programmers to develop the functionality that the control hardware will provide.

Monitoring the live values of the control are a powerful tool to help debug system problems, however GAP is not supplied with the 505CC-2 since it use and understanding of this tool is not required by the user of the 505CC-2.

8.8 Requirements

All Woodward software installed can be installed and run on any compatible PC hardware platform with the following minimum restrictions:

- Pentium 200 MHz
- 512 Meg RAM
- 20 Meg Disk Drive Space
- Windows NT, Windows 2000, Windows XP
- CD-ROM drive

Any PC that has the above list of features will function as a host for the CCT software package. As the speed and memory capabilities of the PC are increased, so will the speed of the CCT software program.

The connection between the user PC and the 505CC-2 control consists of an Ethernet connection to the Ethernet 1 network of the 505CC-2 control.

Chapter 9.
Service Options

9.1 Product Service Options

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

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

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

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

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

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

www.woodward.com/directory

9.2 Woodward Factory Servicing Options

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

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

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

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

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

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

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

9.3 Returning Equipment for Repair

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

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

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

9.3.1 Packing a Control

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

NOTICE

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

9.4 Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

9.5 Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.
- Technical Support
- Product Training
- Field Service

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

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

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

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

9.6 How to Contact Woodward

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

Electrical Power Systems

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

Engine Systems

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

Turbine Systems

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

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

www.woodward.com/directory

9.7 Technical Assistance

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

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

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

Appendix A.
Acronyms and Glossary of Terms

Acronyms

ADC	Analog-to-Digital Converter
AWG	American Wire Gauge (metric equivalent is mm^2)
CE	The CE marking is a European proof of conformity and is also described as "passport" that allows manufacturers and exporters to circulate products freely within the EU. The letters "CE" (French for "Conformité Européenne") indicate that the manufacturer has satisfied all assessment procedures specified by law for its product.
CPU	Central Processing Unit. Executes the GAP application program.
dc	Direct Current
EEPROM	Electrically Erasable and Programmable Read Only Memory
EMC	Electromagnetic Conformity
EMI	Electromagnetic Interference
GAP	Graphical Application Program
I/O	Input/Output
LED	Light Emitting Diode
LON	Local Operating Network
MFT	Minor Frame Timer. Used by the CPU for scheduling execution of the software.
MPU	Magnetic Pick-Up
MTBF	Mean Time Between Failures
PC	Personal Computer
PCB	Printed Circuit Board
PWM	Pulse Width Modulated
RAM	Random Access Memory
RG	Rate Group. Defines how often software is executed.
RXD	Receive Data Line
SRAM	Static Random Access Memory
SSTP	Shielded-Shielded Twisted Pair (or Double Shielded Ethernet Cables)
THD	Total Harmonic Distortion
TXD	Transmit Data Line
V/I	Voltage-to-Current converter

Glossary of Terms

Analog Input—A 4–20 mA or 0–5 V input on the SmartCore CPU A5200 board, and a thermocouple, RTD or 4–20 mA input on the Analog Combo board.

Analog Output—A 4–20 mA output, usually the full range is 0–24 mA.

Atlas-II™ Analog Combo board—An Atlas-II board with an analog format that connects to the Atlas-II SmartCore CPU A5200 board or PowerNet board, through the PC/104 interface. The 505CC-2 is using 15 analog inputs, and 2 Analog outputs.

Atlas-II Chassis—A combination of pieces required to hold the boards together, and may optionally include a keyboard and display.

Atlas-II Platform—The combination of boards, a power supply, and a chassis, that can be combined to compose a variety of controls for a variety of applications. The boards must have either a PC/104 connection, or a proprietary power bus connection, and meet certain packaging constraints.

Atlas-II Power Supply board—An Atlas-II board with primary power supply and 12 discrete outputs.

Atlas-II SmartCore CPU A5200 board—An Atlas-II board with 6 analog inputs, 4 analog outputs, 2 actuator outs, 2 speed sensor inputs, 24 discrete inputs, 4 Ethernet, 2 CAN, and 2 serial communication ports. This board includes both the PC/104 and the power bus connections, allowing it to function as a backplane.

Backplane—A board that ties other boards together electrically. Atlas-II needs either the SmartCore CPU A5200 board, or the PowerNet board, to connect the power bus voltages to the PC/104 bus.

Discrete Input—An input used for switches or other contacts, that registers only two states, open or closed.

Discrete Output—Output drivers used for driving relays that register only two states, high or low.

Serial Port—A connection for RS-232, RS-422, or RS-485.

Speed Sensor Input—An MPU or proximity probe input on the SmartCore CPU A5200 board for the 505CC-2.

Appendix B.
Wiring Diagrams

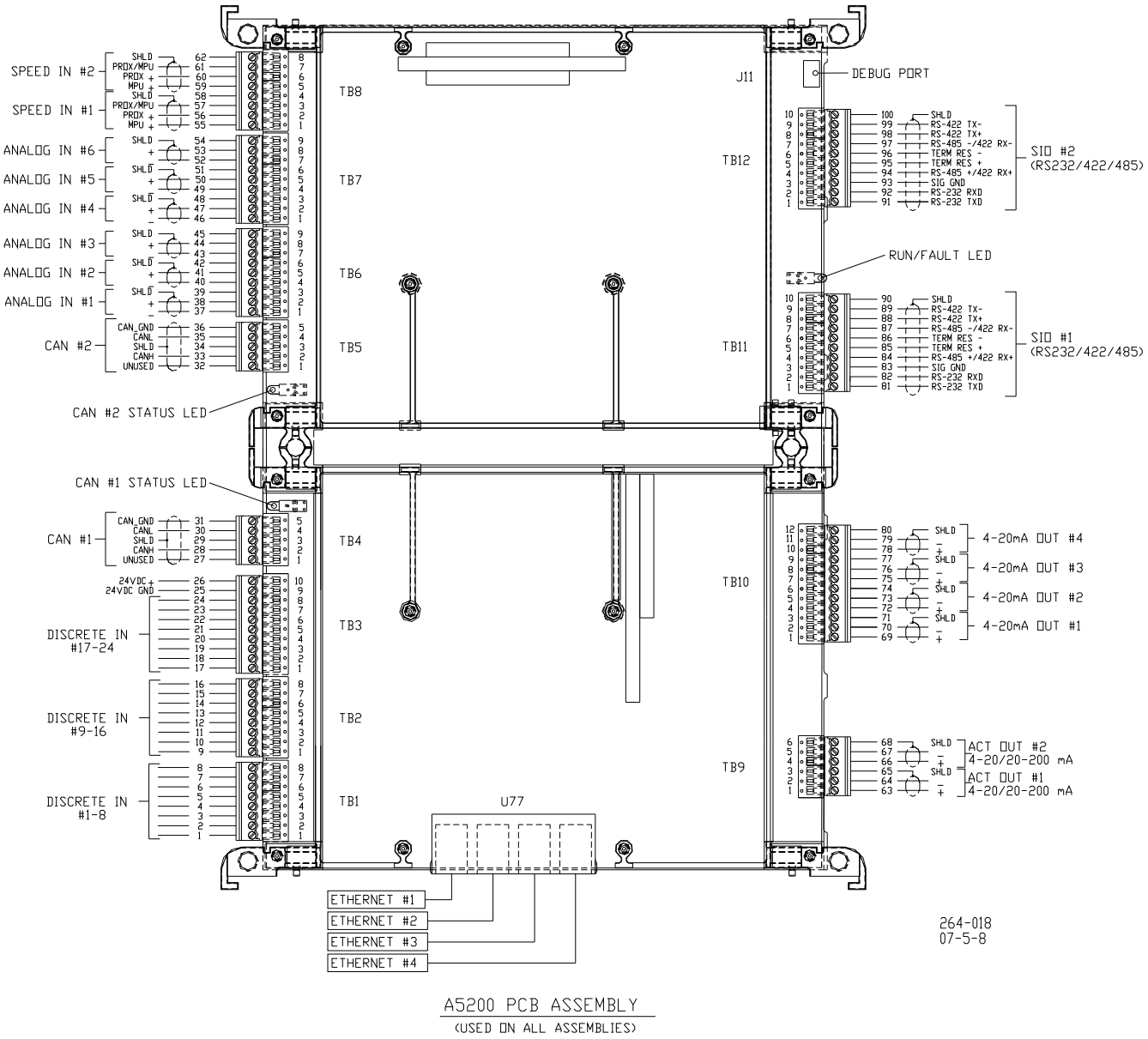


Figure B-1. SmartCore CPU A5200 board Connections

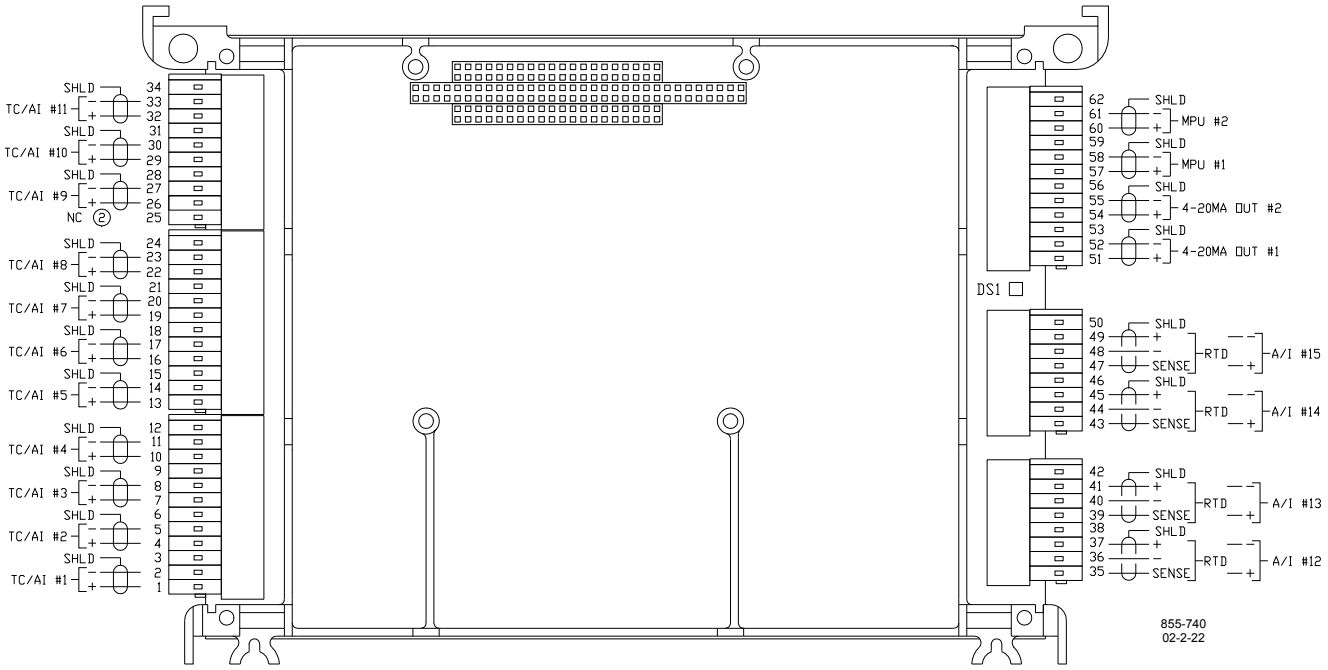


Figure B-2. Analog Combo Board Connections

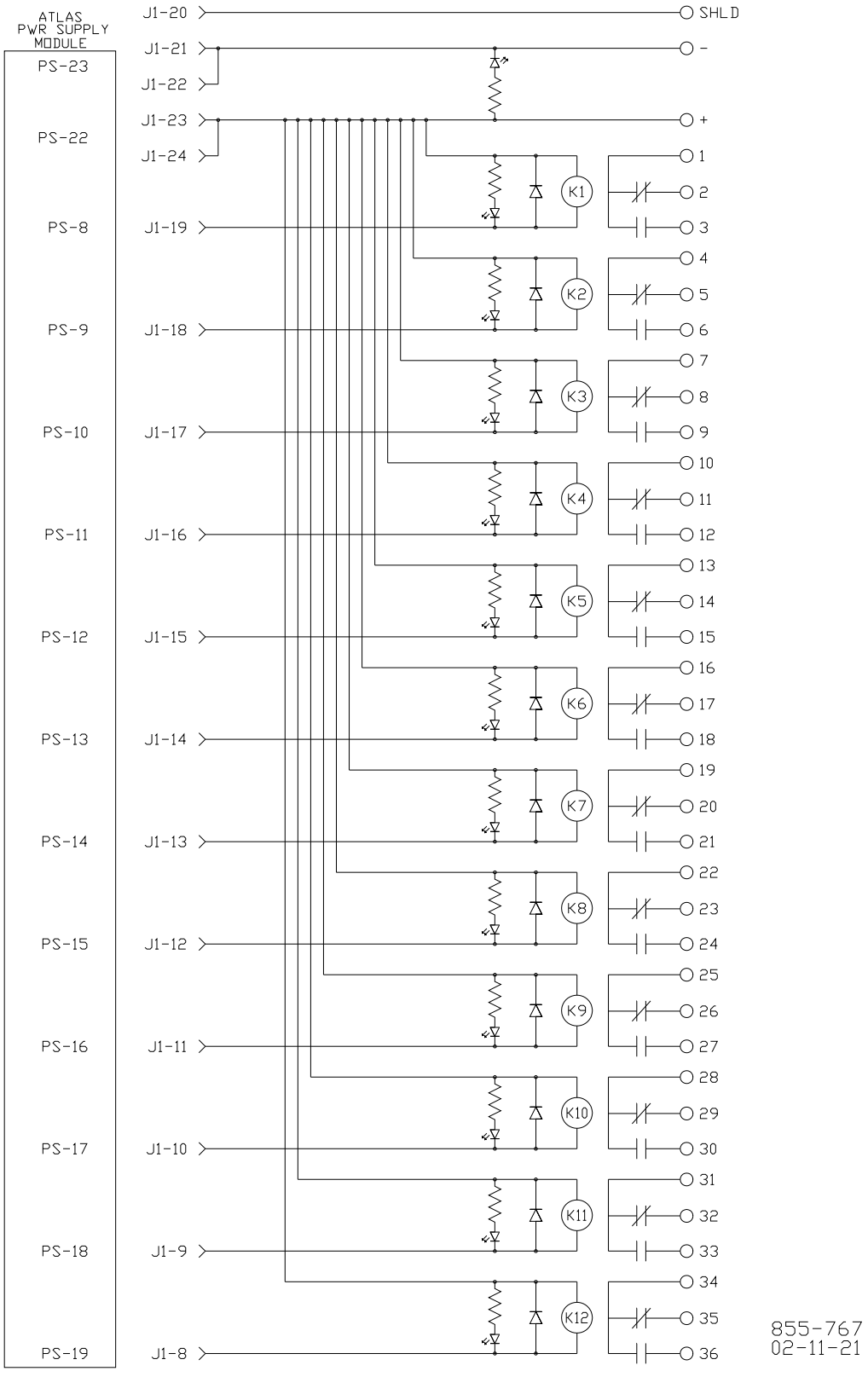


Figure B-2. 12-Channel Relay Module Connections

Appendix C.
Flash Codes

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

Table C-1. SmartCore CPU A5200 Failure Codes

Number of LED Flashes	Failure
1	Microprocessor failure
2	Bus, address, any unexpected exception error
5	Failure during EE test or erasing
7	Kernel software Watchdog count error
12	Failure during CPU Internal RAM test
13	Dual port RAM error

Table C-2. Analog Combo Failure Codes

Number of LED Flashes	Failure
Off	No failure, system OK
Solid	Module in initialization mode
1	Hardware watchdog, CPU clock failure, reset fail
2	Unexpected Exception Error
3	RAM test failure
5	EEPROM failure
7	Kernel Watchdog Timeout
10	System Error
11	Board Identification Error
12	TPU RAM failure
13	Dual Port RAM test failure
14	QSM or ADC Initialization failure
15	Self test status failure
20	Invalid A/D converter selected
21	QSPI timeout
24	ADC auto calibration time-out

Table C-3. PowerSense Failure Codes

LED and Number of Flashes	Failure
H 1	RAM test fail (this test is done only at boot and application start)
H 2	exception error
H 3	dual port test fail (this test is done only at boot and application start)
H 4	watchdog timeout
H 7	kernel watchdog timeout
D 1	RAM test fail (this test is done only at boot and application start)
D 2	exception error
D 3	dual port test fail (this test is done only at boot and application start)
D 3	module watchdog timeout
D 7	kernel watchdog timeout

Table C-4. DLE Failure Codes

Appendix D. 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):	Atlas II
Conformance to Directive(s):	2004/108/EC COUNCIL DIRECTIVE of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and all applicable amendments. 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):	Category 3, Group II G, Ex nA II T3 X
Applicable Standards:	EN 61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments EN 61000-6-4, 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' EN61010-1, 2001: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1:General Requirements

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

MANUFACTURER

Wayne Penfold
Signature

Wayne Penfold
Full Name

Engineering Manager
Position

WGC, Fort Collins, CO, USA
Place

25-JAN-2008
Date

5-09-1183 Rev 11, 24-May-06 00359-04-EU-02-01.doc

This Declaration of Conformity is in accordance with the European Standard EN45014. "General criteria for supplier's declaration of conformity" The basis for the criteria has been found in international documentation, particularly in ISO/IEC Guide 22, 1982, "Informations on manufacturer's declaration of conformity with standards or other technical specifications".

Document No. 020815/1-03

Declaration of Conformity

We **Phoenix Contact Inc.**
(Supplier's Name)

586 Fulling Mill Road
Middletown, PA 17057-2966
(Address)

declare under our sole responsibility that the product

RELAY Module
(Name, type or model, batch or serial number, possibly sources and number of item

WOODWARD 12CH RELAY P/N 5603266

to which this declaration relates is in conformity with the following standard(s)

or other normative document(s).

IEC 60664-1: 2002
EN 60999:1993
BS EN 50178:1998
Additional documentation (i.e. test reports) which were used as the basis for this Declaration of Conformity: WOODWARD Test Report #00104-04-EMC-EMC-03-10
EN50021: 1999
This product has been evaluated to EN50021:1999 under DEMKO Certificate No. 03 ATEX 0328750U. The device is marked EEx nC IIC and is suitable for use in Zone 2 explosive atmospheres.

Title and/or number and date of issue of the standard(s) or other normative document(s)

Following the provisions of Directive(s) (if applicable)

Low Voltage Directive (73/23/EEC)
EMC Directive (89/336/EEC)
ATEX Directive (94/9/EC)

Middletown September 24, 2003
(Place and Date of issue)

(Signature)

(Signature)

James J. Gehenio
(Name or equivalent marking of authorized person)

Kurt B. Boegli
(Name or equivalent marking of authorized person)

Engineering Manager
(Title)

Chief Standards Engineer
(Title)

Appendix E.
Modbus List

Boolean Writes (RPTbw)			
Addr	**Input**	**Description**	
0:0001		Modbus Shutdowns	
0:0002		Modbus Shutdowns Acknowledge	
0:0003		Normal SD	
0:0004		Quit Normal SD	
0:0005		Reset	
0:0006		Start	
0:0007		Raise HP Ramp Limiter	
0:0008		Lower HP Ramp Limiter	
0:0009		Lower Speed	
0:0010		Raise Speed	
0:0011		Go to Rated	
0:0012		Go to Idle	
0:0013		Halt Sequence	
0:0014		Continue Sequence	
0:0015		Remote Speed Enable	
0:0016		Remote Speed Disable	
0:0017		Go to Speed Target	
0:0018		Overspeed Request	
0:0019		Overspeed Quit Request	
0:0020		Internal Overspeed Test	
0:0021		Select Hot Curve	
0:0022		Select Cold Curve	
0:0023		Cascade Enable	
0:0024		Cascade Disable	
0:0025		Cascade Lower SP	
0:0026		Cascade Raise SP	
0:0027		Enable Remote Cascade	
0:0028		Disable Remote Cascade	
0:0029		Go to Cascade Setpoint	
0:0030		spare	
0:0031		Enable Aux Control	
0:0032		Disable Aux Control	
0:0033		Lower Aux Setpoint	
0:0034		Raise Aux Setpoint	
0:0035		Go to Auxiliary Target	
0:0036		Manual Control Demand	
0:0037		Raise Aux Demand	
0:0038		Lower Aux Demand	
0:0039		Enable Remote Aux	

0:0040		Disable Remote Aux	
0:0041		Remote Selected	
0:0042		Local Selected	
0:0043		Enable Extraction	
0:0044		Disable Extraction	
0:0045		Open LP Ramp	
0:0046		Close LP Ramp	
0:0047		Select Manual Extraction	
0:0048		Select Automatic Extraction	
0:0049		Raise Extraction SP	
0:0050		Lower Extraction SP	
0:0051		Go to Extraction SP	
0:0052		Raise Extraction Demand	
0:0053		Lower Extraction Demand	
0:0054		Remote Man Flow request	
0:0055		Remote Man Flow Disable	
0:0056		Remote Extr SP Request	
0:0057		Remote Extr SP Disable	
0:0058		Decoupling Request	
0:0059		Decoupling Quit	
0:0060		Decoupling Manual Request	
0:0061		Decoupling Automatic Request	
0:0062		Raise Decoupling SP	
0:0063		Lower Decoupling SP	
0:0064		Goto Inlet/Exhaust SP Target	
0:0065		Remote Decoupling SP Request	
0:0066		Quit Remote Decoupling SP	
0:0067		Enable Remote Man Decoupling	
0:0068		Disable Remote Man Decoupling	
0:0069		Enable Feed-forward	
0:0070		Disable Feed-forward	
0:0071		spare	
0:0072		spare	
0:0073		spare	
0:0074		spare	
0:0075		spare	
0:0076		spare	
0:0077		spare	
0:0078		spare	
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		spare	
0:0091		spare	
0:0092		spare	
0:0093		spare	
0:0094		spare	
0:0095		spare	
0:0096		spare	
0:0097		spare	
0:0098		spare	
0:0099		spare	
0:0100		spare	
0:0101		spare	
0:0102		spare	
0:0103		spare	
0:0104		spare	
0:0105		spare	
0:0106		spare	
0:0107		spare	
0:0108		spare	
0:0109		spare	
0:0110		spare	
0:0111		spare	
0:0112		spare	
0:0113		spare	
0:0114		spare	
0:0115		spare	
0:0116		spare	
0:0117		Comp1: Lower Surge Margin	
0:0118		Comp1: Raise Surge Margin	
0:0119		Comp1: Aux Detection—Online	
0:0120		Comp1: Aux Detection—Offline	
0:0121		Comp1: Purge Request	
0:0122		Comp1: Quit Purge	
0:0123		Comp1: Reset SMP	
0:0124		Comp1: Reset Surge Counter	
0:0125		spare	
0:0126		spare	
0:0127		Comp1: Auto Mode Selected	
0:0128		Comp1: Manual Mode Selected	
0:0129		Comp1: Full Manual Mode Selected	
0:0130		Comp1: Close Anti-Surge Valve	
0:0131		Comp1: Open Anti-Surge Valve	

0:0132		Comp1: Go to Entered Vlv Position	
0:0133		Comp1: Enable Psuc Override	
0:0134		Comp1: Disable Psuc Override	
0:0135		Comp1: Go to enter Psuc Ovrd SP	
0:0136		Comp1: Enable Pdis Override	
0:0137		Comp1: Disable Pdisch Override	
0:0138		Comp1: Go to enter Pdis Ovrd SP	
0:0139		spare	
0:0140		spare	
0:0141		spare	
0:0142		Comp2: Lower Surge Margin	
0:0143		Comp2: Raise Surge Margin	
0:0144		Comp2: Aux Detection—Online	
0:0145		Comp2: Aux Detection—Offline	
0:0146		Comp2: Purge Request	
0:0147		Comp2: Quit Purge	
0:0148		Comp2: Reset SMP	
0:0149		Comp2: Reset Surge Counter	
0:0150		spare	
0:0151		spare	
0:0152		Comp2: Auto Mode Selected	
0:0153		Comp2: Manual Mode Selected	
0:0154		Comp2: Full Manual Mode Selected	
0:0155		Comp2: Close Anti-Surge Valve	
0:0156		Comp2: Open Anti-Surge Valve	
0:0157		Comp2: Go to Entered Vlv Position	
0:0158		Comp2: Enable Psuc Override	
0:0159		Comp2: Disable Psuc Override	
0:0160		Comp2: Go to Enter Psuc Ovrd SP	
0:0161		Comp2: Enable Pdis Override	
0:0162		Comp2: Disable Pdis Override	
0:0163		Comp2: Go to Enter Pdis Ovrd SP	
0:0164		spare	
0:0165		spare	
0:0166		spare	
0:0167		spare	
0:0168		spare	
0:0169		spare	
0:0170		spare	
0:0171		spare	
0:0172		spare	
0:0173		spare	
0:0174		spare	
0:0175		spare	
0:0176		spare	
0:0177		spare	

0:0178		spare	
0:0179		spare	
0:0180		spare	
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0:0182		spare	
0:0183		spare	
0:0184		spare	
0:0185		spare	
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0:0187		spare	
0:0188		spare	
0:0189		spare	
0:0190		spare	
0:0191		spare	
0:0192		spare	
0:0193		spare	
0:0194		spare	
0:0195		spare	
0:0196		spare	
0:0197		spare	
0:0198		spare	
0:0199		spare	
0:0200		spare	
0:0201		spare	
0:0202		spare	
0:0203		spare	
0:0204		spare	
0:0205		spare	
0:0206		spare	
0:0207		spare	
0:0208		spare	
0:0209		spare	
0:0210		spare	
0:0211		spare	

Table E-1. Modbus List Boolean Writes

Boolean Reads (RPTbr)

Addr	Input	Description	
1:0001	ALARM.SD_ALL.LATCH_AE	Shutdown Exist	
1:0002	ALARM.ALARM.LATCH_AE	Alarm Exist	
1:0003	INHIBITS.INH_START.LATCH_AE	Start Inhibit Exist	
1:0004	INHIBIT.READY.B_ACTION	Ready to Start	
1:0005	T1__SPDC.AUTO_SEL.B_NAME	Continue or Rated Start Selected	
1:0006	T1__SPDC.STARTING.B_NAME	Engine Started (running)	
1:0007	T1__SPDC.SRT_ENBL.B_NAME	Speed Response Test Enabled	
1:0008	T1__SPDC.SRT_ACTV.B_NAME	Speed Response Test Active	
1:0009	X2C_CASC.USE_REM_SP.B_NAME	Remote Speed: Used	
1:0010	T1__CASC.RSPD_ENBLD.B_NAME	Remote Speed: Enabled	
1:0011	T1__CASC.RSPD_ACTV.B_NAME	Remote Speed: Active	
1:0012	AI_ERR.CP_CASC.GT	Cascade: Used	
1:0013	T2C_DCPL.IS_CASC.B_NAME	Cascade is inlet/Exhaust	
1:0014	T1__CASC.CRT_ENBL.B_NAME	Cascade: Response Test Enabled	
1:0015	T1__CASC.CRT_ACT.B_NAME	Cascade: Response test Active	
1:0016	T2__CASC.PROCESS_FL.B_NAME	Cascade: PV Fault	
1:0017	T1__CASC.CAS_ENBLD.B_NAME	Cascade: Enabled	
1:0018	T1__CASC.TRACK.B_NAME	Cascade: Active	
1:0019	T1__CASC.CASC_ACTV.B_NAME	Cascade: SP is Tracking	
1:0020	T2C_CASC.USE_RCASC.B_NAME	Cascade: Use Rem Setpoint	
1:0021	T1__CASC.CASC_RSPEN.B_NAME	Cascade: Rem SP Enabled	
1:0022	T1__CASC.CASC_RSPAC.B_NAME	Cascade: Rem SP Active	
1:0023	T1__CASC.LDSH_ENBLD.B_NAME	Cascade: Load Share Enabled	
1:0024	T1__CASC.CASC_OVLSS.B_NAME	Cascade: LSS Ovrd Active	
1:0025	T1__CASC.CASC_OVHSS.B_NAME	Cascade: HSS Ovrd Active	
1:0026	T1__CASC.CASC_EMER.B_NAME	Cascade: Emerg Activated	
1:0027	T1__CASC.B03_ST.B_NAME	Cascade: Sequence/ Load Sharing	
1:0028	T1__CASC.B02_ST.B_NAME	Cascade: Sequence Swing	
1:0029	T1__CASC.B01_ST.B_NAME	Cascade: Sequence Droop Mode	
1:0030	T1__CASC.EMRG_CTRL.B_NAME	Cascade: Sequence Emerg in Ctrl	
1:0031	T1__EXTC.EXTC_NOCON.B_NAME	Extraction NOT Configured	
1:0032	MODBUS.EXTR_TYPE.OUT_2	Extraxtion: Configured for Only Auto	
1:0033	MODBUS.EXTR_TYPE.OUT_3	Extraction: Conf for Only in Manual	
1:0034	MODBUS.EXTR_TYPE.OUT_4	Extraction: Conf for Never Used	
1:0035	T1__EXTC.ERT_ENBLD.B_NAME	Extraction: Response Test Enabled	
1:0036	T1__EXTC.ERT_ACT.B_NAME	Extraction: Response test Active	
1:0037	T2__EXTC.EXTR_FLT.B_NAME	Extraction: Fault	
1:0038	T1__EXTC.EXTC_ENABL.B_NAME	Extraction: Enabled	
1:0039	T1__EXTC.EXTC_ACTIV.B_NAME	Extraction: Active	
1:0040	T1__EXTC.TRACK_ST.B_NAME	Extraction: Setpoint is Tracking	
1:0041	T2C_EXTC.REXTR_US.B_NAME	Extraction: Use Remote SP	
1:0042	T1__EXTC.REXTC_ENAB.B_NAME	Extraction: Rem SP Enabled	
1:0043	T1__EXTC.A04_ST.B_NAME	Extraction: Rem SP Active	

1:0044	T2C_EXTC.USE_RMEXTC.B_NAME	Extraction: Use Remote Manual	
1:0045	T1__EXTC.A02R_ST.B_NAME	Extraction: Remote Man Enabled	
1:0046	T1__EXTC.A02R_ST.B_NAME	Extraction: Rem Manual Flow Active	
1:0047	T1__EXTC.Z00_ST.B_NAME	Extraction: Sequence/SD Condition	
1:0048	T1__EXTC.Z01_ST.B_NAME	Extraction: Sequence/ Ramp LP	
1:0049	T1__EXTC.A00_ST.B_NAME	Extraction: Sequence/ Disabled	
1:0050	T1__EXTC.A00EST.B_NAME	Extraction: Sequence / Enabled	
1:0051	T1__EXTC.A01_ST.B_NAME	Extraction: Sequence/ Manual Enabling	
1:0052	T1__EXTC.A0A_ST.B_NAME	Extraction: Sequence/ Auto Enabling	
1:0053	T1__EXTC.A02_ST.B_NAME	Extraction: In Manual Extraction	
1:0054	T1__EXTC.A03_ST.B_NAME	Extraction: In Automatic Extraction	
1:0055	T1__EXTC.A05_ST.B_NAME	Extraction: Disabling	
1:0056	MODBUS.USE_DCPL.B_MUX_N_1	Inlet/Exhaust: Used	
1:0057	MODBUS.DCPL_MTYPE.OUT_2	Inlet/Exhaust: Conf for Auto Only	
1:0058	MODBUS.DCPL_MTYPE.OUT_3	Inlet/Exhaust: Conf for Man Only	
1:0059	T1__DCPL.DRT_ENBLD.B_NAME	inlet/Exhaust: Response Test Enabled	
1:0060	T1__DCPL.DRT_ACT.B_NAME	inlet/Exhaust: Response Test Active	
1:0061	T2__DCPL.DCPL_FLT.B_NAME	Inlet/Exhaust: PV Fault	
1:0062	T1__MAP_.DECOUP_IND.B_NAME	Inlet/Exhaust: Inhibited	
1:0063	T1__MAP_.DECOUP_ACT.B_NAME	Inlet/Exhaust: Ctrl Active	
1:0064	T1__DCPL.TRACK_ST.B_NAME	Inlet/Exhaust: Setpoint Tracking	
1:0065	T1__EXTC.B02_ST.B_NAME	Inlet/Exhaust: Sequence / in Man mode	
1:0066	T2C_DCPL.USE_RMDCPL.B_NAME	Inlet/Exhaust: Used Remote Man	
1:0067	T1__EXTC.B02R_ST.B_NAME	Inlet/Exhaust: Sequence/ Rem Man Enbld	
1:0068	T1__EXTC.B02R_ST.B_NAME	Inlet/Exhaust: Sequence/ Rem Man Activ	
1:0069	T1__EXTC.B03_ST.B_NAME	Inlet/Exhaust: Sequence/ in Auto	
1:0070	T2C_DCPL.USE_RDCP.B_NAME	Inlet/Exhaust: Use Remote SP	
1:0071	T1__EXTC.RDCPL_ENAB.B_NAME	Inlet/Exhaust: Rem SP Enabled	
1:0072	T1__EXTC.B04_ST.B_NAME	Inlet/Exhaust: Sequence/ Rem SP Active	
1:0073	MODBUS.USE_AUX1.B_MUX_N_1	Aux1: Used	
1:0074	T2__AUX1.SENSOR_FLT.B_NAME	Aux1: Fault Detected	
1:0075	T1__AUX1.ART_ENBLD.B_NAME	Aux1: Response Test Enabled	
1:0076	T1__AUX1.ART_ACT.B_NAME	Aux1: Response Test Active	
1:0077	T1__AUX1.Z00_ST.B_NAME	Aux1: Disabled	
1:0078	T1__AUX1.A00_ST.B_NAME	Aux1: In Control	
1:0079	T1__AUX1.A02_ST.B_NAME	Aux1: In Manual	
1:0080	T1__AUX1.A01_ST.B_NAME	Aux1: Limiting	
1:0081	FALSE	spare	
1:0082	FALSE	spare	
1:0083	FALSE	spare	
1:0084	FALSE	spare	
1:0085	FALSE	spare	
1:0086	FALSE	spare	
1:0087	FALSE	spare	
1:0088	FALSE	spare	
1:0089	FALSE	spare	

1:0090	FALSE	spare	
1:0091	FALSE	spare	
1:0092	FALSE	spare	
1:0093	FALSE	spare	
1:0094	FALSE	spare	
1:0095	T2C_FW__.FWRD_CF.B_MUX_N_1	Feed-forward: Used	
1:0096	T1__FW__.FW_ENABLED.B_NAME	Feed-forward: Enabled	
1:0097	T1__FW__.FW_ACTIVE.B_NAME	Feed-forward: Active	
1:0098	T1__MAP_.MAP_LIMITD.B_NAME	Steam Map Limit Active	
1:0099	T1__MAP_.HPMAX_LMT.B_NAME	HP Max Limited	
1:0100	T1__MAP_.HPMIN_LMT.B_NAME	HP Min Limited	
1:0101	T1__MAP_.LPMAX_LMT.B_NAME	LP Max Limited	
1:0102	T1__MAP_.LPMIN_LMT.B_NAME	LP Min Limited	
1:0103	T1__MAP_.MAX_S_LMT.B_NAME	Max S Limited	
1:0104	T1__MAP_.MIN_P_LMT.B_NAME	Min P limited	
1:0105	T1__MAP_.K_ILLEGAL.B_NAME	Error K-Values	
1:0106	T1__MAP_.MN_FLW_LMT.B_NAME	MIn Flow Limited	
1:0107	T1__MAP_.RECOUP_IND.B_NAME	Recoupling Inhibited	
1:0108	T1__MAP_.MAX_P_LMT.B_NAME	Max P Limited	
1:0109	T1__SPDC.CAN_OSPD.B_NAME	Ovrd Speed Test Permissive	
1:0110	T1__SPDC.SRTE_ACT.B_NAME	Spare	
1:0111	T1__SPDC.SPDC_HOT.B_NAME	Hot Curve Selected	
1:0112	T1__SPDC.PID_ONLINE.B_NAME	PID Online Used	
1:0113	T1__SPDC.OVERRIDE.B_NAME	Ovrd Speed Fault	
1:0114	T1__SPDC.NOT_COMPLT.B_NAME	Startup Not Completed	
1:0115	T1__SPDC.Z00_ST.B_NAME	Speed Seq: Shutdown Step	
1:0116	T1__SPDC.Z01_ST.B_NAME	Speed Seq: Nornal SD Step	
1:0117	T1__SPDC.A00_ST.B_NAME	Speed Seq: Reset Step	
1:0118	T1__SPDC.A00AST.B_NAME	Speed Seq: Restart Step	
1:0119	T1__SPDC.A02AST.B_NAME	Speed Seq in Manual Mode	
1:0120	T1__SPDC.A01_ST.B_NAME	Speed Seq: Startup to Level 1 Step	
1:0121	T1__SPDC.A02_ST.B_NAME	Speed Seq: At Idle 1 Step	
1:0122	T1__SPDC.A03_ST.B_NAME	Speed Seq: Startup to Auto Level 2	
1:0123	T1__SPDC.A04_ST.B_NAME	Speed Seq: At Auto Level 2	
1:0124	T1__SPDC.A05_ST.B_NAME	Speed Seq: To Auto Level 3	
1:0125	T1__SPDC.A06_ST.B_NAME	Speed Seq: At Auto Level 3	
1:0126	T1__SPDC.A07_ST.B_NAME	Speed Seq: Startup to Rated Step	
1:0127	T1__SPDC.A08_ST.B_NAME	Startup Completed	
1:0128	T1__SPDC.A09_ST.B_NAME	Speed Seq: Test Overspeed Step	
1:0129	T1__SPDC.A10_ST.B_NAME	Speed Seq: Abort Overspeed Step	
1:0130	T1__SPDC.NSDCPLTE.B_NAME	Speed Seq: Normal SD Completed	
1:0131	T1__SPDC.WARN_SCHED.B_NAME	Speed Seq: Warning/Off Schedule	
1:0132	T1__SPDC.START_ACT.B_NAME	Turbine Started	
1:0133	T1__VLV_.HPSTRTVLEN.B_NAME	Startup Valve Enabled	
1:0134	T1__VLV_.HPSTR_ACT.B_NAME	Startup Valve Opened	
1:0135	T1__VLV_.HP_BST_OPR.B_NAME	HP2 Boost Valve Operating	

1:0136	T2__CASC.CASC_DIS.B_NAME	Cascade Mode is Disabled	
1:0137	T2__CASC.CASC_IH.B_NAME	Cascade Inhibited	
1:0138	T2__CASC.OTHER_SD.B_NAME	Other Unit SD	
1:0139	T2__CASC.OTHER_SW.B_NAME	Other Unit Swing or LDSH	
1:0140	T2__CASC.REM_DIS.B_NAME	Remote Speed Disabled Forced	
1:0141	T2__CASC.SWING_DIS.B_NAME	Swing Mode Disable	
1:0142	T2__CE__.EXT_CF_ERR.B_NAME	External Configuration Error	
1:0143	T2__CE__.GOTO_IH.B_NAME	Go to Commands Inhibited	
1:0144	T2__CE__.CONFIG_SEL.B_NAME	In Configure Mode	
1:0145	T2__DCPL.EXTRDCRI.B_NAME	Remote Decoupling Disabled	
1:0146	T2__EXTC.INHIBITED.B_NAME	Extraction Inhibit	
1:0147	T2__EXTC.DISABLE.B_NAME	Extraction Disable	
1:0148	T2__EXTC.DIS_AUTO.B_NAME	Extraction Auto Disable BUS	
1:0149	T2__EXTC.DIS_RMAN.B_NAME	Extraction Disable Rem E/A Man Force	
1:0150	T2__EXTC.REM_DIS.B_NAME	Extraction Remote SP Disable Forced	
1:0151	ALARM.ALM_MAIN.SEL_1	Alarm: Fault Remote Speed Setpoint	
1:0152	ALARM.ALM_MAIN.SEL_2	Alarm: Fault Cascade PV	
1:0153	ALARM.ALM_MAIN.SEL_3	Alarm: Fault Remote Cascade PV	
1:0154	ALARM.ALM_MAIN.SEL_4	Alarm: Fault Auxiliary PV	
1:0155	ALARM.ALM_MAIN.SEL_5	Alarm: Fault Remote Auxiliary	
1:0156	ALARM.ALM_MAIN.SEL_6	Alarm: Fault Extraction PV	
1:0157	ALARM.ALM_MAIN.SEL_7	Alarm: Fault Remote Extr/Adm PV	
1:0158	ALARM.ALM_MAIN.SEL_8	Alarm: Fault Rem Manual Extr/Adm PV	
1:0159	ALARM.ALM_MAIN.SEL_9	Alarm: Fault Inlet/Exhaust Press PV	
1:0160	ALARM.ALM_MAIN.SEL_10	Alarm: Fault Remote Inlet/Exh SP	
1:0161	ALARM.ALM_MAIN.SEL_11	Alarm: Fault Rem Man inlet/Exhaust PV	
1:0162	ALARM.ALM_MAIN.SEL_12	Alarm: Fault Feed-forward PV	
1:0163	ALARM.ALM_MAIN.SEL_13	Alarm: Fault Housing Temperature	
1:0164	ALARM.ALM_MAIN.SEL_14	Alarm: Fault Monitor Input #1	
1:0165	ALARM.ALM_MAIN.SEL_15	Alarm: Fault Monitor Input #2	
1:0166	ALARM.ALM_MAIN.SEL_16	Alarm: Fault Monitor Input #3	
1:0167	ALARM.ALM_MAIN.SEL_17	Alarm: Fault Monitor Input #4	
1:0168	ALARM.ALM_MAIN.SEL_18	Alarm: Monitor Input#5 Fault	
1:0169	ALARM.ALM_MAIN.SEL_19	Alarm: Monitor Input#6 Fault	
1:0170	ALARM.ALM_MAIN.SEL_20	Alarm: Monitor Input#7 Fault	
1:0171	ALARM.ALM_MAIN.SEL_21	Alarm: Monitor Input#8 Fault	
1:0172	ALARM.ALM_MAIN.SEL_22	Alarm: Speed Deviation Failure	
1:0173	ALARM.ALM_MAIN.SEL_23	Alarm: Speed Sensor #1 Lost	
1:0174	ALARM.ALM_MAIN.SEL_24	Alarm: Speed Sensor#2 Lost	
1:0175	ALARM.ALM_MAIN.SEL_25	Alarm: Speed Sensor#3 Lost	
1:0176	ALARM.ALM_MAIN.SEL_26	Alarm: Fault Analog Readout#1	
1:0177	ALARM.ALM_MAIN.SEL_27	Alarm: Fault Analog Readout#2	
1:0178	ALARM.ALM_MAIN.SEL_28	Alarm: Fault Analog Readout#3	
1:0179	ALARM.ALM_MAIN.SEL_29	Alarm: Fault Analog Readout#4	
1:0180	ALARM.ALM_MAIN.SEL_30	Alarm: Communication #1 Fault	
1:0181	ALARM.ALM_MAIN.SEL_31	Alarm: Communication #2 Fault	

1:0182	ALARM.ALM_MAIN.SEL_32	Alarm: Actuator#1 Fault	
1:0183	ALARM.ALM_MAIN.SEL_33	Alarm: Actuator#2 Fault	
1:0184	ALARM.ALM_MAIN.SEL_34	Alarm: Any Analog Output Forced	
1:0185	ALARM.ALM_MAIN.SEL_35	Alarm: External alarm #1	
1:0186	ALARM.ALM_MAIN.SEL_36	Alarm: External alarm #2	
1:0187	ALARM.ALM_MAIN.SEL_37	Alarm: External alarm #3	
1:0188	ALARM.ALM_MAIN.SEL_38	Alarm: External alarm #4	
1:0189	ALARM.ALM_MAIN.SEL_39	Alarm: External alarm #5	
1:0190	ALARM.ALM_MAIN.SEL_40	Alarm: External alarm #6	
1:0191	ALARM.ALM_MAIN.SEL_41	Alarm: External alarm #7	
1:0192	ALARM.ALM_MAIN.SEL_42	Alarm: External alarm #8	
1:0193	ALARM.ALM_MAIN.SEL_43	Alarm: External alarm #9	
1:0194	ALARM.ALM_MAIN.SEL_44	Alarm: External alarm #10	
1:0195	ALARM.ALM_MAIN.SEL_45	Alarm: Internal level switch #1	
1:0196	ALARM.ALM_MAIN.SEL_46	Alarm: Internal level switch #2	
1:0197	ALARM.ALM_MAIN.SEL_47	Alarm: Internal level switch #3	
1:0198	ALARM.ALM_MAIN.SEL_48	Alarm: Internal level switch #4	
1:0199	ALARM.ALM_MAIN.SEL_49	Alarm: Internal level switch #5	
1:0200	ALARM.ALM_MAIN.SEL_50	Alarm: Internal level switch #6	
1:0201	ALARM.ALM_MAIN.SEL_51	Alarm: Internal level switch #7	
1:0202	ALARM.ALM_MAIN.SEL_52	Alarm: Internal level switch #8	
1:0203	ALARM.ALM_MAIN.SEL_53	Alarm:Binary Ouputs Forced	
1:0204	ALARM.ALM_MAIN.SEL_54	Alarm: spare	
1:0205	ALARM.ALM_MAIN.SEL_55	Alarm: spare	
1:0206	ALARM.ALM_MAIN.SEL_56	Alarm: spare	
1:0207	ALARM.ALM_MAIN.SEL_57	Alarm: spare	
1:0208	ALARM.ALM_MAIN.SEL_58	Alarm: spare	
1:0209	ALARM.ALM_MAIN.SEL_59	Alarm: spare	
1:0210	ALARM.ALM_MAIN.SEL_60	Alarm: spare	
1:0211	ALARM.ALM_CORE.SEL_1	Alarm: Underspeed	
1:0212	ALARM.ALM_CORE.SEL_2	Alarm: Speed Control Lost	
1:0213	ALARM.ALM_CORE.SEL_3	Alarm: Stuck in Critical	
1:0214	ALARM.ALM_CORE.SEL_4	Alarm: Rotor is Sticky	
1:0215	ALARM.ALM_CORE.SEL_5	Alarm: Configuration Error	
1:0216	ALARM.ALM_CORE.SEL_6	Alarm: Cascade Ovrd Active	
1:0217	ALARM.ALM_CORE.SEL_7	Alarm: Emergency Cascade Activated	
1:0218	ALARM.ALM_CORE.SEL_8	Alarm: Auxiliary Limiter Active	
1:0219	ALARM.ALM_CORE.SEL_9	Alarm: Aux in Ctrl/No Speed Raise	
1:0220	ALARM.ALM_CORE.SEL_10	Alarm: spare	
1:0221	ALARM.ALM_CORE.SEL_11	Alarm: spare	
1:0222	ALARM.ALM_CORE.SEL_12	Alarm: spare	
1:0223	ALARM.ALM_CORE.SEL_13	Alarm: spare	
1:0224	ALARM.ALM_CORE.SEL_14	Alarm: spare	
1:0225	ALARM.ALM_CORE.SEL_15	Alarm: spare	
1:0226	ALARM.ALM_CORE.SEL_16	Alarm: spare	
1:0227	ALARM.STG1_ALM.SEL_1	Alarm: #1 Surge Detected on Flow Deriv	

1:0228	ALARM.STG1_ALM.SEL_2	Alarm: #1 Surge Detected on P1 Deriv	
1:0229	ALARM.STG1_ALM.SEL_3	Alarm: #1 Surge Detected on P2 Deriv	
1:0230	ALARM.STG1_ALM.SEL_4	Alarm: #1 Surge Detected on Spd Deriv	
1:0231	ALARM.STG1_ALM.SEL_5	Alarm: #1 Surge Detected on Min flow	
1:0232	ALARM.STG1_ALM.SEL_6	Alarm: #1 Surge Detected on Cross Line	
1:0233	ALARM.STG1_ALM.SEL_8	Alarm: Comp#1 Flow Difference	
1:0234	ALARM.STG1_ALM.SEL_9	Alarm: Comp#1 Prim Flow Sensor Flt	
1:0235	ALARM.STG1_ALM.SEL_10	Alarm: Comp#1 Second Flow Sensor Flt	
1:0236	ALARM.STG1_ALM.SEL_11	Alarm: Comp#1 All Flow Sensor Fault	
1:0237	ALARM.STG1_ALM.SEL_12	Alarm: Comp#1 Suction Press Diff	
1:0238	ALARM.STG1_ALM.SEL_13	Alarm: Comp#1 Prim Suction Press Flt	
1:0239	ALARM.STG1_ALM.SEL_14	Alarm: Comp#1 Sec Suction Press Flt	
1:0240	ALARM.STG1_ALM.SEL_15	Alarm: Comp#1 All Suction Press Flt	
1:0241	ALARM.STG1_ALM.SEL_16	Alarm: Comp#1 Disch Press Difference	
1:0242	ALARM.STG1_ALM.SEL_17	Alarm: Comp#1 Primary Disch Press Flt	
1:0243	ALARM.STG1_ALM.SEL_18	Alarm: Comp#1 Second Disch Press Flt	
1:0244	ALARM.STG1_ALM.SEL_19	Alarm: Comp#1 All Disch Press Fault	
1:0245	ALARM.STG1_ALM.SEL_20	Alarm: Comp#1 Pressure at Flow Fault	
1:0246	ALARM.STG1_ALM.SEL_21	Alarm: Comp#1 Suction Temp Fault	
1:0247	ALARM.STG1_ALM.SEL_22	Alarm: Comp#1 Disch Temp Fault	
1:0248	ALARM.STG1_ALM.SEL_23	Alarm: Comp#1 Temp at Flow Fault	
1:0249	ALARM.STG1_ALM.SEL_24	Alarm: Comp#1 HSS#1 Fault	
1:0250	ALARM.STG1_ALM.SEL_25	Alarm: Comp#1 HSS#2 Fault	
1:0251	ALARM.STG1_ALM.SEL_26	Alarm: Comp#1 Decoupling#1 Fault	
1:0252	ALARM.STG1_ALM.SEL_27	Alarm: Comp#1 Decoupling#2 Fault	
1:0253	ALARM.STG1_ALM.SEL_28	Alarm: Comp#1 Remote Man Vlv Fault	
1:0254	ALARM.STG1_ALM.SEL_29	Alarm: Comp#1 Upstr Valve Press Flt	
1:0255	ALARM.STG1_ALM.SEL_30	Alarm: Comp#1 Downstr Valve Press Flt	
1:0256	ALARM.STG1_ALM.SEL_31	Alarm: Comp#1 Temp at Valve Fault	
1:0257	ALARM.STG1_ALM.SEL_32	Alarm: Comp#1 Alternate P1 Overrd Flt	
1:0258	ALARM.STG1_ALM.SEL_33	Alarm: Comp#1 Alternate P2 Overrd Flt	
1:0259	ALARM.STG1_ALM.SEL_34	Alarm: Comp#1 Consecutive Surge	
1:0260	ALARM.STG1_ALM.SEL_35	Alarm: Fault Export gas 1 sensor	
1:0261	ALARM.STG1_ALM.SEL_36	Alarm: Fault Export gas 2 sensor	
1:0262	ALARM.STG1_ALM.SEL_37	Alarm: Spare	
1:0263	ALARM.STG1_ALM.SEL_38	Alarm: Spare	
1:0264	ALARM.STG1_ALM.SEL_39	Alarm: Spare	
1:0265	ALARM.STG1_ALM.SEL_40	Alarm: Spare	
1:0266	FALSE	spare	
1:0267	ALARM.STG2_ALM.SEL_1	Alarm: #2 Surge Detected on Flow Deriv	
1:0268	ALARM.STG2_ALM.SEL_2	Alarm: #2 Surge Detected on P1 Deriv	
1:0269	ALARM.STG2_ALM.SEL_3	Alarm: #2 Surge Detected on P2 Deriv	
1:0270	ALARM.STG2_ALM.SEL_4	Alarm: #2 Surge Detected On Spd Deriv	
1:0271	ALARM.STG2_ALM.SEL_5	Alarm: #2 Surge Detected on Min Flow	
1:0272	ALARM.STG2_ALM.SEL_6	Alarm: #2 Surge Detected on Cross Line	
1:0273	ALARM.STG2_ALM.SEL_7	Alarm: Comp#2 Configuration Error	

1:0274	ALARM.STG2_ALM.SEL_8	Alarm: Comp#2 Flow Difference	
1:0275	ALARM.STG2_ALM.SEL_9	Alarm: Comp#2 Primary Flow Sensor Flt	
1:0276	ALARM.STG2_ALM.SEL_10	Alarm: Comp#2 Second Flow Sensor Flt	
1:0277	ALARM.STG2_ALM.SEL_11	Alarm: Comp#2 All Flow Sensor Fault	
1:0278	ALARM.STG2_ALM.SEL_12	Alarm: Comp#2 Suction Press Diff	
1:0279	ALARM.STG2_ALM.SEL_13	Alarm: Comp#2 Prim Suction Press Flt	
1:0280	ALARM.STG2_ALM.SEL_14	Alarm: Comp#2 Sec Suction Press Flt	
1:0281	ALARM.STG2_ALM.SEL_15	Alarm: Comp#2 All Suction Press Flt	
1:0282	ALARM.STG2_ALM.SEL_16	Alarm: Comp#2 Disch Press Diff	
1:0283	ALARM.STG2_ALM.SEL_17	Alarm: Comp#2 Primary Disch Press Flt	
1:0284	ALARM.STG2_ALM.SEL_18	Alarm: Comp#2 Second Disch Press Flt	
1:0285	ALARM.STG2_ALM.SEL_19	Alarm: Comp# 2 All Disch Press Flt	
1:0286	ALARM.STG2_ALM.SEL_20	Alarm: Comp#2 Pressure at flow Fault	
1:0287	ALARM.STG2_ALM.SEL_21	Alarm: Comp#2 Suction Temp Fault	
1:0288	ALARM.STG2_ALM.SEL_22	Alarm: Comp#2 Disch Temp Fault	
1:0289	ALARM.STG2_ALM.SEL_23	Alarm: Comp#2 Temp at flow Fault	
1:0290	ALARM.STG2_ALM.SEL_24	Alarm: Comp#2 HSS#1 Fault	
1:0291	ALARM.STG2_ALM.SEL_25	Alarm: Comp#2 HSS#2 Fault	
1:0292	ALARM.STG2_ALM.SEL_26	Alarm: Comp#2 Decoupling#1 Fault	
1:0293	ALARM.STG2_ALM.SEL_27	Alarm: Comp#2 Decoupling#2 Fault	
1:0294	ALARM.STG2_ALM.SEL_28	Alarm: Comp#2 Remote Man Vlv Fault	
1:0295	ALARM.STG2_ALM.SEL_29	Alarm: Comp#2 Upstr Valve Press Flt	
1:0296	ALARM.STG2_ALM.SEL_30	Alarm: Comp#2 Downstr Valve Press Flt	
1:0297	ALARM.STG2_ALM.SEL_31	Alarm: Comp#2 Temp at Valve Fault	
1:0298	ALARM.STG2_ALM.SEL_32	Alarm: Comp#2 Alternate P1 Overrd Flt	
1:0299	ALARM.STG2_ALM.SEL_33	Alarm: Comp#2 Alternate P2 Overrd Flt	
1:0300	ALARM.STG2_ALM.SEL_34	Alarm: Side Stream Flow Difference	
1:0301	ALARM.STG2_ALM.SEL_35	Alarm: Primary Side Stream Flow Fault	
1:0302	ALARM.STG2_ALM.SEL_36	Alarm: Secondary Side Stream Flow Faul	
1:0303	ALARM.STG2_ALM.SEL_37	Alarm: All Side Stream Flow Fault	
1:0304	ALARM.STG2_ALM.SEL_38	Alarm: Side Stream Pressure Difference	
1:0305	ALARM.STG2_ALM.SEL_39	Alarm: Primary Side Stream Press Fault	
1:0306	ALARM.STG2_ALM.SEL_40	Alarm: Second Side stream Press Fault	
1:0307	ALARM.STG2_ALM.SEL_41	Alarm: All Side Stream Pressure Fault	
1:0308	ALARM.STG2_ALM.SEL_42	Alarm: Side Stream Temperature	
1:0309	ALARM.STG2_ALM.SEL_43	Alarm: Comp#2 Consecutive Surge	
1:0310	ALARM.STG2_ALM.SEL_44	Alarm: spare	
1:0311	ALARM.STG2_ALM.SEL_45	Alarm: spare	
1:0312	ALARM.STG2_ALM.SEL_46	Alarm: spare	
1:0313	ALARM.STG2_ALM.SEL_47	Alarm: spare	
1:0314	ALARM.STG2_ALM.SEL_48	Alarm: spare	
1:0315	ALARM.STG2_ALM.SEL_49	Alarm: spare	
1:0316	ALARM.STG2_ALM.SEL_50	Alarm: spare	
1:0317	FALSE	Alarm: spare	
1:0318	FALSE	Alarm: spare	
1:0319	FALSE	Alarm: spare	

1:0320	FALSE	Alarm: spare	
1:0321	FALSE	Alarm: spare	
1:0322	FALSE	Alarm: spare	
1:0323	FALSE	Alarm: spare	
1:0324	FALSE	Alarm: spare	
1:0325	FALSE	Alarm: spare	
1:0326	ALARM.AL_HORN.B_NAME	Alarm not Acknowledged	
1:0327	ALARM.SD_MAIN.SEL_1	Shutdown: Trip from Modbus#1	
1:0328	ALARM.SD_MAIN.SEL_2	Shutdown: Trip from Modbus#2	
1:0329	ALARM.SD_MAIN.SEL_3	Shutdown: Trip from Engineer Station	
1:0330	ALARM.SD_MAIN.SEL_4	Shutdown: IO Lock Activated	
1:0331	ALARM.SD_MAIN.SEL_5	Shutdown: All Speed Channel Lost	
1:0332	ALARM.SD_MAIN.SEL_6	Shutdown: Actuator#1 Fault	
1:0333	ALARM.SD_MAIN.SEL_7	Shutdown: Actuator#2 Fault	
1:0334	ALARM.SD_MAIN.SEL_8	Shutdown: Contact SD#1 Activated	
1:0335	ALARM.SD_MAIN.SEL_9	Shutdown: External #1	
1:0336	ALARM.SD_MAIN.SEL_10	Shutdown: External #2	
1:0337	ALARM.SD_MAIN.SEL_11	Shutdown: External #3	
1:0338	ALARM.SD_MAIN.SEL_12	Shutdown: External #4	
1:0339	ALARM.SD_MAIN.SEL_13	Shutdown: External #5	
1:0340	ALARM.SD_MAIN.SEL_14	Shutdown: External #6	
1:0341	ALARM.SD_MAIN.SEL_15	Shutdown: External #7	
1:0342	ALARM.SD_MAIN.SEL_16	Shutdown: External #8	
1:0343	ALARM.SD_MAIN.SEL_17	Shutdown: External #9	
1:0344	ALARM.SD_MAIN.SEL_18	Shutdown: External #10	
1:0345	ALARM.SD_MAIN.SEL_19	Shutdown: Internal level #1 Shutdown	
1:0346	ALARM.SD_MAIN.SEL_20	Shutdown: Internal level #2 Shutdown	
1:0347	ALARM.SD_MAIN.SEL_21	Shutdown: Internal level #3 Shutdown	
1:0348	ALARM.SD_MAIN.SEL_22	Shutdown: Internal level #4 Shutdown	
1:0349	ALARM.SD_MAIN.SEL_23	Shutdown: Internal level #5 Shutdown	
1:0350	ALARM.SD_MAIN.SEL_24	Shutdown: Internal level #6 Shutdown	
1:0351	ALARM.SD_MAIN.SEL_25	Shutdown: Internal level #7 Shutdown	
1:0352	ALARM.SD_MAIN.SEL_26	Shutdown: Internal level #8 Shutdown	
1:0353	ALARM.SD_MAIN.SEL_27	Shutdown: Comp#1 Consecutive Surge	
1:0354	ALARM.SD_MAIN.SEL_28	Shutdown: Comp#2 Consecutive Surge	
1:0355	ALARM.SD_MAIN.SEL_29	Shutdown: spare	
1:0356	ALARM.SD_MAIN.SEL_30	Shutdown: spare	
1:0357	ALARM.SD_MAIN.SEL_31	Shutdown: spare	
1:0358	ALARM.SD_MAIN.SEL_32	Shutdown: spare	
1:0359	ALARM.SD_MAIN.SEL_33	Shutdown: spare	
1:0360	ALARM.SD_CORE.SEL_1	Shutdown: Overspeed Trip	
1:0361	ALARM.SD_CORE.SEL_2	Shutdown: Max Overspeed Reached	
1:0362	ALARM.SD_CORE.SEL_3	Shutdown: Predictive Overspeed Trip	
1:0363	ALARM.SD_CORE.SEL_4	Shutdown: Normal SD Completed	
1:0364	ALARM.SD_CORE.SEL_5	Shutdown: Underspeed Trip	
1:0365	ALARM.SD_CORE.SEL_6	Shutdown: Speed Control Lost	

1:0366	ALARM.SD_CORE.SEL_7	Shutdown: Stuck in Critical	
1:0367	ALARM.SD_CORE.SEL_8	Shutdown: SD for Sticky Rotor	
1:0368	ALARM.SD_CORE.SEL_9	Shutdown: Speed Control Fail to Start	
1:0369	ALARM.SD_CORE.SEL_10	Shutdown: Boot-Up Trip	
1:0370	ALARM.SD_CORE.SEL_11	Shutdown: Configuration Error	
1:0371	ALARM.SD_CORE.SEL_12	Shutdown: Extraction Sensor Fault	
1:0372	ALARM.SD_CORE.SEL_13	Shutdown: spare	
1:0373	ALARM.SD_CORE.SEL_14	Shutdown: spare	
1:0374	ALARM.SD_CORE.SEL_15	Shutdown: spare	
1:0375	FALSE	Shutdown: spare	
1:0376	FALSE	Shutdown: spare	
1:0377	FALSE	Shutdown: spare	
1:0378	FALSE	Shutdown: spare	
1:0379	ALARM.SD_HORN.B_NAME	Trip Not Acknowledged	
1:0380	INHIBITS.INH_START.SEL_1	External Start Inhibit #1	
1:0381	INHIBITS.INH_START.SEL_2	External Start Inhibit #2	
1:0382	INHIBITS.INH_START.SEL_3	External Start Inhibit #3	
1:0383	INHIBITS.INH_START.SEL_4	External Start Inhibit #4	
1:0384	INHIBITS.INH_START.SEL_5	External Start Inhibit #5	
1:0385	INHIBITS.INH_START.SEL_6	External Start Inhibit #6	
1:0386	INHIBITS.INH_START.SEL_7	External Start Inhibit #7	
1:0387	INHIBITS.INH_START.SEL_8	External Start Inhibit #8	
1:0388	INHIBITS.INH_START.SEL_9	External Start Inhibit #9	
1:0389	INHIBITS.INH_START.SEL_10	External Start Inhibit #10	
1:0390	INHIBITS.INH_START.SEL_11	Internal level #1 Start Inhibit	
1:0391	INHIBITS.INH_START.SEL_12	Internal level #2 Start Inhibit	
1:0392	INHIBITS.INH_START.SEL_13	Internal level #3 Start Inhibit	
1:0393	INHIBITS.INH_START.SEL_14	Internal level #4 Start Inhibit	
1:0394	INHIBITS.INH_START.SEL_15	Internal level #5 Start Inhibit	
1:0395	INHIBITS.INH_START.SEL_16	Internal level #6 Start Inhibit	
1:0396	INHIBITS.INH_START.SEL_17	Internal level #7 Start Inhibit	
1:0397	INHIBITS.INH_START.SEL_18	Internal level #8 Start Inhibit	
1:0398	INHIBITS.INH_START.SEL_19	spare	
1:0399	INHIBITS.INH_START.SEL_20	spare	
1:0400	INHIBITS.INH_START.SEL_21	spare	
1:0401	INHIBITS.INH_START.SEL_22	spare	
1:0402	INHIBITS.INH_START.SEL_23	spare	
1:0403	INHIBITS.INH_START.SEL_24	spare	
1:0404	INHIBITS.INH_START.SEL_25	spare	
1:0405	T2__SPDC.FRC_LOWER.B_NAME	Lower Speed Forced	
1:0406	T2__VLV_.IH_HP2.B_NAME	Inhibit HP2 Usage	
1:0407	T2C_CE__.NON_LATCH.B_NAME	Use none latching alarm reset?	
1:0408	T2C_DCPL.CONFDCLI.B_NAME	Decoupled Mode is Limiter (reserve)	
1:0409	T2C_DCPL.SEMIDPRIOR.B_NAME	Semi-Automatic First at Enable	
1:0410	T2C_SPDC.USE_ACC_ON.B_NAME	Use Acceleration Protection Online?	
1:0411	T2C_SPDC.USE_ACC_OF.B_NAME	Use Acceleration Protection Offline?	

1:0412	T2C_SPDC.USE_PRED_O.B_NAME	Use Predictive Overspeed Protection?	
1:0413	T2C_SPDC.LEVEL2E.B_NAME	Startup Level 2 Used	
1:0414	T2C_SPDC.LEVEL3E.B_NAME	Startup Level 3 Used	
1:0415	T2C_SPDC.CRIT1E.B_NAME	Critical Range 1 Used	
1:0416	T2C_SPDC.CRIT2E.B_NAME	Critical Range 2 Used	
1:0417	T2C_SPDC.CRIT3E.B_NAME	Critical Range 3 Used	
1:0418	A01_CPU.BI_01.BI_ATL	ESD Binary Closed	
1:0419	A01_CPU.BI_02.BI_ATL	Binary #2 Closed	
1:0420	A01_CPU.BI_03.BI_ATL	Binary #3 Closed	
1:0421	A01_CPU.BI_04.BI_ATL	Binary #4 Closed	
1:0422	A01_CPU.BI_05.BI_ATL	Binary #5 Closed	
1:0423	A01_CPU.BI_06.BI_ATL	Binary #6 Closed	
1:0424	A01_CPU.BI_07.BI_ATL	Binary #7 Closed	
1:0425	A01_CPU.BI_08.BI_ATL	Binary #8 Closed	
1:0426	A01_CPU.BI_09.BI_ATL	Binary #9 Closed	
1:0427	A01_CPU.BI_10.BI_ATL	Binary #10 Closed	
1:0428	A01_CPU.BI_11.BI_ATL	Binary #11 Closed	
1:0429	A01_CPU.BI_12.BI_ATL	Binary #12 Closed	
1:0430	A01_CPU.BI_13.BI_ATL	Binary #13 Closed	
1:0431	A01_CPU.BI_14.BI_ATL	Binary #14 Closed	
1:0432	A01_CPU.BI_15.BI_ATL	Binary #15 Closed	
1:0433	A01_CPU.BI_16.BI_ATL	Binary #16 Closed	
1:0434	A01_CPU.BI_17.BI_ATL	Binary #17 Closed	
1:0435	A01_CPU.BI_18.BI_ATL	Binary #18 Closed	
1:0436	A01_CPU.BI_19.BI_ATL	Binary #19 Closed	
1:0437	A01_CPU.BI_20.BI_ATL	Binary #20 Closed	
1:0438	A01_CPU.BI_21.BI_ATL	Binary #21 Closed	
1:0439	A01_CPU.BI_22.BI_ATL	Binary #22 Closed	
1:0440	A01_CPU.BI_23.BI_ATL	Binary #23 Closed	
1:0441	A01_CPU.BI_24.BI_ATL	Binary #24 Closed	
1:0442	A01_PB_MO1.BO01.DISPLAY	Binary Output#1 Closed (no trip)	
1:0443	A01_PB_MO1.BO02.DISPLAY	Binary Output#2 Energized	
1:0444	A01_PB_MO1.BO03.DISPLAY	Binary Output#3 Energized	
1:0445	A01_PB_MO1.BO04.DISPLAY	Binary Output#4 Energized	
1:0446	A01_PB_MO1.BO05.DISPLAY	Binary Output#5 Energized	
1:0447	A01_PB_MO1.BO06.DISPLAY	Binary Output#6 Energized	
1:0448	A01_PB_MO1.BO07.DISPLAY	Binary Output#7 Energized	
1:0449	A01_PB_MO1.BO08.DISPLAY	Binary Output#8 Energized	
1:0450	A01_PB_MO1.BO09.DISPLAY	Binary Output#9 Energized	
1:0451	A01_PB_MO1.BO10.DISPLAY	Binary Output#10 Energized	
1:0452	A01_PB_MO1.BO11.DISPLAY	Binary Output#11 Energized	
1:0453	A01_PB_MO1.BO12.DISPLAY	Binary Output#12 Energized	
1:0454	ALARM.LSW01_USED.B_NAME	Level 1 Switch Used	
1:0455	ALARM.LSW02_USED.B_NAME	Level 2 Switch Used	
1:0456	ALARM.LSW03_USED.B_NAME	Level 3 Switch Used	
1:0457	ALARM.LSW04_USED.B_NAME	Level 4 Switch Used	

1:0458	ALARM.LSW05_USED.B_NAME	Level 5 Switch Used	
1:0459	ALARM.LSW06_USED.B_NAME	Level 6 Switch Used	
1:0460	ALARM.LSW07_USED.B_NAME	Level 7 Switch Used	
1:0461	ALARM.LSW08_USED.B_NAME	Level 8 Switch Used	
1:0462	ALARM.LSW01LL.B_NAME	Level 1 Switch on Falling Value	
1:0463	ALARM.LSW02LL.B_NAME	Level 2 Switch on Falling Value	
1:0464	ALARM.LSW03LL.B_NAME	Level 3 Switch on Falling Value	
1:0465	ALARM.LSW04LL.B_NAME	Level 4 Switch on Falling Value	
1:0466	ALARM.LSW05LL.B_NAME	Level 5 Switch on Falling Value	
1:0467	ALARM.LSW06LL.B_NAME	Level 6 Switch on Falling Value	
1:0468	ALARM.LSW07LL.B_NAME	Level 7 Switch on Falling Value	
1:0469	ALARM.LSW08LL.B_NAME	Level 8 Switch on Falling Value	
1:0470	ALARM.LSW01_ALM.OR	Level 1 Switch Activated	
1:0471	ALARM.LSW02_ALM.OR	Level 2 Switch Activated	
1:0472	ALARM.LSW03_ALM.OR	Level 3 Switch Activated	
1:0473	ALARM.LSW04_ALM.OR	Level 4 Switch Activated	
1:0474	ALARM.LSW05_ALM.OR	Level 5 Switch Activated	
1:0475	ALARM.LSW06_ALM.OR	Level 6 Switch Activated	
1:0476	ALARM.LSW07_ALM.OR	Level 7 Switch Activated	
1:0477	ALARM.LSW08_ALM.OR	Level 8 Switch Activated	
1:0478	MASTER.CPU_OK.B_NAME	CPU is OK	
1:0479	MMI_.M2MOD1CMD.B_NAME	Modbus #1 CMD Enabled	
1:0480	MMI_.M2MOD2CMD.B_NAME	Modbus #2 CMD Enabled	
1:0481	T1__CTRL.CS_ONLINE.B_NAME	Comp #1: On-Line—Ctrl Sd	
1:0482	T1__CTRL.CTRL_AS.B_NAME	Comp #1: In Control—Anti-Surge PID	
1:0483	T1__CTRL.CTRL_AUX_1.B_NAME	Comp #1: In Control—Aux input #1	
1:0484	T1__CTRL.CTRL_AUX_2.B_NAME	Comp #1: In Control—Aux input #2	
1:0485	T1__CTRL.CTRL_AUX_3.B_NAME	Comp #1: In Control—Aux input #3	
1:0486	T1__CTRL.CTRL_BST.B_NAME	Comp #1: In Control—BOOST	
1:0487	T1__CTRL.CTRL_DEACT.B_NAME	Comp #1: In Control—Deactivation	
1:0488	T1__CTRL.SQ_CS.B_NAME	Comp #1: Off-Line—Ctrl SD	
1:0489	T1__CTRL.CTRL_OV_P1.B_NAME	Comp #1: In Control—P1 Override	
1:0490	T1__CTRL.RATE_ACTV.B_NAME	Comp #1:I—Rate Ctr Active	
1:0491	T1__CTRL.CTRL_RATE.B_NAME	Comp #1: In Control—Rate Controller	
1:0492	T1__CTRL.CTRL_SQ.B_NAME	Comp #1: In Control—Sequence Pos	
1:0493	T1__CTRL.CTRL_SR.B_NAME	Comp #1: In Control—Surge Recovery	
1:0494	T1__CTRL.IN_CONTROL.B_NAME	Comp #1: On-Line—Online or Ctrl SD	
1:0495	T1__CTRL.AUTO_ON.B_NAME	Comp #1: Automatic Mode Active	
1:0496	T1__CTRL.MANF_ON.B_NAME	Comp #1: Full Manual Mode Active	
1:0497	T1__CTRL.MAN_ON.B_NAME	Comp #1: Manual Mode Active	
1:0498	T1__CTRL.ON_LINE.B_NAME	Comp #1: On-Line	
1:0499	T1__CTRL.OV_P1ENBLD.B_NAME	Comp #1: P1 Ovrd Enabled	
1:0500	T1__CTRL.OV_P1_ACTV.B_NAME	Comp #1: P1 Ovrd Active	
1:0501	T1__CTRL.OV_P2ENBLD.B_NAME	Comp #1: P2 Ovrd Enabled	
1:0502	T1__CTRL.CTRL_MAN.B_NAME	Comp #1: In Control—Man with Backup	
1:0503	T1__CTRL.OV_P2_ACTV.B_NAME	Comp #1: P2 Ovrd Active	

1:0504	T1__CTRL.SMP_ACT.B_NAME	Comp #1: SMP is Active	
1:0505	T1_BCTRL.CTRL_OV_P2.B_NAME	Comp #2: In Control—P2 Override	
1:0506	T1_BCTRL.BST_ACTV.B_NAME	Comp #2: Boost Active	
1:0507	T1_BCTRL.CS_OFFLINE.B_NAME	Comp #2: Off-Line—Ctrl SD	
1:0508	T1_BCTRL.CTRL_AS.B_NAME	Comp #2: In Control—Anti-Surge PID	
1:0509	T1_BCTRL.CTRL_AUX_2.B_NAME	Comp #2: In Control—Aux Input #2	
1:0510	T1_BCTRL.CTRL_AUX_3.B_NAME	Comp #2: In Control—Aux Input #3	
1:0511	T1_BCTRL.CTRL_BST.B_NAME	Comp #2: In Control—Boost	
1:0512	T1_BCTRL.CTRL_DEACT.B_NAME	Comp #2: In Control—Deactivation	
1:0513	T1_BCTRL.RATE_ACTV.B_NAME	Comp #2: Rate Control—Rate Active	
1:0514	T1_BCTRL.CTRL_OV_P1.B_NAME	Comp #2: In Control—P1 Override	
1:0515	T1_BCTRL.CTRL_RATE.B_NAME	Comp #2: In Control—Rate Controller	
1:0516	T1_BCTRL.CTRL_SQ.B_NAME	Comp #2: In Control—Seq Positioning	
1:0517	T1_BCTRL.CTRL_SR.B_NAME	Comp #2: In Control—Surge Recovery	
1:0518	T1_BCTRL.IN_CONTROL.B_NAME	Comp #2: On-Line—Online or Ctrl SD	
1:0519	T1_BCTRL.AUTO_ON.B_NAME	Comp #2: Automatic Mode Active	
1:0520	T1_BCTRL.MANF_ON.B_NAME	Comp #2: Full Manual Mode Active	
1:0521	T1_BCTRL.MAN_ON.B_NAME	Comp #2: Manual Mode Active	
1:0522	T1_BCTRL.ON_LINE.B_NAME	Comp #2: On-Line	
1:0523	T1_BCTRL.OV_P1ENBLD.B_NAME	Comp #2: P1 Ovrd Enabled	
1:0524	T1_BCTRL.OV_P1_ACTV.B_NAME	Comp #2: P1 Ovrd Active	
1:0525	T1_BCTRL.OV_P2ENBLD.B_NAME	Comp #2: P2 Ovrd Enabled	
1:0526	T1_BCTRL.OV_P2_ACTV.B_NAME	Comp #2: P2 Ovrd Active	
1:0527	T1_BCTRL.CTRL_MAN.B_NAME	Comp #2: In Control—Manual w/Backup	
1:0528	T1_BCTRL.CTRL_AUX_1.B_NAME	Comp #2: In Control—Aux input #1	
1:0529	T1_BCTRL.CS_ONLINE.B_NAME	Comp #2: On-Line—Ctrl SD	
1:0530	T1_BCTRL.SQ_START.B_NAME	Comp #2: Off-Line—Start	
1:0531	T1_BCTRL.SMP_ACT.B_NAME	Comp #2: SMP is Active	
1:0532	T1_BCTRL.SR_ACTV.B_NAME	Comp #2: Surge Recovery—Active	
1:0533	T1_BCTRL.SQ_PURGE.B_NAME	Comp #2: Off-Line—Purge	
1:0534	T1_BCTRL.SQ_CS.B_NAME	Comp #2: Off-Line—Ctrl SD	
1:0535	T1_BCTRL.SQ_SD.B_NAME	Comp #2: Off-Line—ESD	
1:0536	TOOLKIT.SIM_ACTIVE.B_NAME	Control Offline	
1:0537	AI__.EXP1_ACTV.B_NAME	exported flowmeter 1 active	
1:0538	AI__.EXP2_ACTV.B_NAME	exported flowmeter 2 active	
1:0539	AI__.EXP_DP_FLT.B_NAME	all exported flowmeter fault	

Table E-2. Modbus List Boolean Reads

Analog Reads (RPTar)

Addr	Input	Description	Multiplier
3:0001	SS__.SPEED_RM.VALUE_1	Speed Sensor #1	1.0
3:0002	SS__.SPEED_RM.VALUE_2	Speed Sensor #2	1.0
3:0003	SS__.SPEED_RM.VALUE_3	Speed Sensor #3 (spare)	1.0
3:0004	A02_COMBO.DSS_02.TSS_ATL	Speed Sensor #4 (spare)	1.0
3:0005	T2__SPDC.SPEED.A_NAME	Actual Speed PV (rpm)	1.0
3:0006	MODBUS.SPD_PERC.MULTIPLY	Actual Speed PV (X100-%)	100.0
3:0007	T1__SPDC.SPDC_SP.A_NAME	Speed Reference (rpm)	1.0
3:0008	T1__VLV_.HP_DEMAND.A_NAME	HP Demand Linear (X100 %)	100.0
3:0009	A01_CPU.SW_R_ACT1.A_SW	Actuator#1 Demand (X100 %)	100.0
3:0010	A01_CPU.ACT_01.RDBK_SRC	Actuator#1 Current Demand (X100 mA)	100.0
3:0011	A01_CPU.SW_R_ACT2.A_SW	Actuator#2 Demand (X100 %)	100.0
3:0012	A01_CPU.ACT_02.RDBK_SRC	Actuator#2 Current Demand (X100 mA)	100.0
3:0013	T1__VLV_.HP2_DEMAND.A_NAME	HP2 Demand (linear)(X100 %)	100.0
3:0014	T1__VLV_.HP_RAMP.A_NAME	HP RAMP Demand(X100 %)	100.0
3:0015	T2__CASC.REMOTE_SPD.A_NAME	Remote Speed Setpoint (rpm)	1.0
3:0016	T1__SPDC.SPDC_SP2.A_NAME	Speed Ref with Bias (rpm)	1.0
3:0017	T1__SPDC.SPDC_VP.A_NAME	Speed PID Demand (%)	100.0
3:0018	T1__CASC.CASC_PV.A_NAME	Cascade PV (X100 %)	100.0
3:0019	T1__CASC.CASC_PV2.A_NAME	Cascade PV in EU	MOD_MULT.MLT_CASC.A_MUX_N_1
3:0020	T1__CASC.CASC_SP.A_NAME	Cascade Setpoint (X100 %)	100.0
3:0021	T1__CASC.CASC_SP2.A_NAME	Cascade Setpoint in EU	MOD_MULT.MLT_CASC.A_MUX_N_1
3:0022	T2__CASC.REMOTE_SP.A_NAME	Remote Cascade Setpoint	MOD_MULT.MLT_CASC.A_MUX_N_1
3:0023	T1__CASC.CASC_SP3.A_NAME	Casc Setpoint with Droop in EU	MOD_MULT.MLT_CASC.A_MUX_N_1
3:0024	T2__CASC.BIAS.A_NAME	SP Bias Demand on Cascade	MOD_MULT.MLT_CASC.A_MUX_N_1
3:0025	T1__CASC.SPD_DMD.A_NAME	Cascade Speed Demand in %	100.0
3:0026	T1__CASC.SPD_DMD2.A_NAME	Cascade Speed Demand (rpm)	1.0
3:0027	T1__VLV_.LP__DMD.A_NAME	LP Valve Demand (linear)(X100 %)	100.0
3:0028	T1__VLV_.LP_RAMP.A_NAME	LP Ramp Demand(X100 %)	100.0
3:0029	T1__EXTC.PV_PERC.A_NAME	Extraction PV in %	100.0
3:0030	T1__EXTC.PV_UNIT.A_NAME	Extraction PV in EU	MOD_MULT.MLT_EXTR.A_MUX_N_1
3:0031	T1__EXTC.SETP_PERC.A_NAME	Extraction Setpoint in %	100.0
3:0032	T1__EXTC.SETPOINT.A_NAME	Extraction Setpoint in EU	MOD_MULT.MLT_EXTR.A_MUX_N_1
3:0033	T1__EXTC.REM_SP_EU.A_NAME	Extraction Remote SP EU	MOD_MULT.MLT_EXTR.A_MUX_N_1
3:0034	T1__EXTC.REM_SP_PER.A_NAME	Extraction Remote SP %	100.0
3:0035	T1__EXTC.REM_MAN_PR.A_NAME	Extraction Remote manual Demand %	100.0
3:0036	T1__EXTC.DMD_PERC.A_NAME	Extraction Demand %	100.0
3:0037	T1__EXTC.P_LIMITED.A_NAME	Extraction P limited Demand %	100.0
3:0038	T1__DCPL.DMD_PERC.A_NAME	Inlet/Exh Ctlr Demand %	100.0
3:0039	T1__DCPL.PV_PERC.A_NAME	Inlet/Exh Ctlr PV in %	100.0
3:0040	T1__DCPL.PV_UNIT.A_NAME	Inlet/Exh ctlr PV in EU	MOD_MULT.MLT_DCPL.A_MUX_N_1
3:0041	T1__DCPL.SETP_PERC.A_NAME	Inlet/Exh Ctlr Setpoint in %	100.0
3:0042	T1__DCPL.SETPOINT.A_NAME	Inlet/Exh Ctlr Setpoint in EU	MOD_MULT.MLT_DCPL.A_MUX_N_1
3:0043	T1__DCPL.REM_MAN_PR.A_NAME	Inlet/Exh Ctlr Rem Man Dmd %	100.0

3:0044	T1__DCPL.REM_SP_EU.A_NAME	Inlet/Exh Ctlr Remote SP in EU	MOD_MULT.MLT_DCPL.A_MUX_N_1
3:0045	T1__DCPL.REM_SP_PER.A_NAME	Inlet/Exh Ctlr Rem SP in %	100.0
3:0046	T1__AUX1.DMD_EU.A_NAME	AUX1 Dmd in RPM (On Spd Ref)	1.0
3:0047	T1__AUX1.DMD_PERC.A_NAME	AUX1 Demand in %	100.0
3:0048	T1__AUX1.PV_PERC.A_NAME	AUX1 Process Value in %	100.0
3:0049	T1__AUX1.PV_UNIT.A_NAME	AUX1 Process Value in EU	MOD_MULT.MLT_AUX.A_MUX_N_1
3:0050	T1__AUX1.SETP_PERC.A_NAME	AUX1 Setpoint in %	100.0
3:0051	T1__AUX1.SETPOINT.A_NAME	AUX1 Setpoint in EU	MOD_MULT.MLT_AUX.A_MUX_N_1
3:0052	AI__.MON1_PV.A_NAME	Monitor 1 PV	MOD_MULT.MLT_MON1.A_MUX_N_1
3:0053	AI__.MON2_PV.A_NAME	Monitor 2 PV	MOD_MULT.MLT_MON2.A_MUX_N_1
3:0054	AI__.MON3_PV.A_NAME	Monitor 3 PV	MOD_MULT.MLT_MON3.A_MUX_N_1
3:0055	AI__.MON4_PV.A_NAME	Monitor 4 PV	MOD_MULT.MLT_MON4.A_MUX_N_1
3:0056	AI__.MON5_PV.A_NAME	Monitor 5 PV	MOD_MULT.MLT_MON5.A_MUX_N_1
3:0057	AI__.MON6_PV.A_NAME	Monitor 6 PV	MOD_MULT.MLT_MON6.A_MUX_N_1
3:0058	AI__.MON7_PV.A_NAME	Monitor 7 PV	MOD_MULT.MLT_MON7.A_MUX_N_1
3:0059	AI__.MON8_PV.A_NAME	Monitor 8 PV	MOD_MULT.MLT_MON8.A_MUX_N_1
3:0060	T2__SPDC.RTIM_PV.A_NAME	Customer Defined Hot/Cold PV	MOD_MULT.MLT_HOUSG.A_MUX_N_1
3:0061	T2CX_FW.SELFW___PV.A_MUX_N_1	Feed Forward PV (100X%)	100.0
3:0062	T1__FW__.FW_DMD.A_NAME	Feed Forward Demand (rpm)	1.0
3:0063	ALARM.LAST_SD.A_NAME	Cause of Last SD	1.0
3:0064	ALARM.FIRST_SD.A_NAME	Cause of First SD	1.0
3:0065	ALARM.LAST_AL.A_NAME	Cause of Last Alarm	1.0
3:0066	ALARM.FIRST_AL.A_NAME	Cause of First Alarm	1.0
3:0067	T1_EXTC.CV_AN_STEP.OUT_1	Line 1 Extraction Messages	1.0
3:0068	T1_EXTC.CV_AN_ST2.OUT_1	Line 2 Extraction Messages	1.0
3:0069	T2__MAP.MESS_NB.OUT_1	Steam Map Status	1.0
3:0070	T2C_VLV_.HP_MX_RAMP.A_NAME	Max HP ramp (%)	100.0
3:0071	T1__SPDC.SPDC_VP.A_NAME	Steam Map: Op Pt % (load X-axis)	100.0
3:0072	T1__VLV_.HP_DEMAND.A_NAME	Steam Map: Op Pt % (Flow Y-axis)	100.0
3:0073	T1__MAP_.SA_NORM.A_NAME	Steam Map: Pt A (X100 %)	100.0
3:0074	T1__MAP_.HA_NORM.A_NAME	Steam Map:Flow Pt A (X100 %)	100.0
3:0075	T1__MAP_.SB_NORM.A_NAME	Steam Map:S Pt B Norm (X100 %)	100.0
3:0076	T1__MAP_.HB_NORM.A_NAME	Steam Map:Flow Pt B (X100 %)	100.0
3:0077	T1__MAP_.SC_NORM.A_NAME	Steam Map:S Pt C (X100 %)	100.0
3:0078	T1__MAP_.HC_NORM.A_NAME	Steam Map:Flow Pt C (X100 %)	100.0
3:0079	T1__MAP_.LD0_NORM.A_NAME	Steam Map:Min Load at Zero (X100 %)	100.0
3:0080	T1__MAP_.LD100_NORM.A_NAME	Steam Map:Min Load at HP 100% (X100 %)	100.0
3:0081	T1__MAP_.MNFL_NORM.A_NAME	Steam Map:Min Ext Flow Comp (X100 %)	100.0
3:0082	T2C_MAP_.MNLP_CONF.A_NAME	Steam MapLP Minimum lift	100.0
3:0083	T2C_MAP_.MXEXT_CONF.A_NAME	Steam Map Max LP flow (Ext/Adm only)	1.0
3:0084	T2C_MAP_.MXFL_CONF.A_NAME	Steam Map Max HP Flow for Unit	1.0
3:0085	T2C_MAP_.MXLD_CONF.A_NAME	Steam Map Max Power for Unit	1.0
3:0086	T2C_MAP_.MXLP__CONF.A_NAME	Steam Map LP Maximum Lift	100.0
3:0087	T2C_SPDC.LEVEL0.A_NAME	Min Speed Detectable (rpm)	1.0
3:0088	MODBUS.START_MODE.OUT_1	Start Mode Used (Idle/Auto)	1.0
3:0089	T2C_SPDC.MIN_GOV.A_NAME	Minimum Governor Speed (rpm)	1.0

3:0090	T2C_SPDC.MAX_GOV.A_NAME	Max Governor Speed (rpm)	1.0
3:0091	T1__SPDC.MAX_SPDDET.A_NAME	Max Speed Detected (rpm)	1.0
3:0092	T1__SPDC.MAX_ACCDET.A_NAME	Max Acceleration Detected (rpm/s)	10.0
3:0093	T2C_SPDC.CRIT1_H.A_NAME	Protection: H Critical Range 1	1.0
3:0094	T2C_SPDC.CRIT1_L.A_NAME	Protection: L Critical Range 1	1.0
3:0095	T2C_SPDC.CRIT1_RTE.A_NAME	Protection: Critical 1 Rate	10.0
3:0096	T2C_SPDC.CRIT2_H.A_NAME	Protection: H Critical Range 2	1.0
3:0097	T2C_SPDC.CRIT2_L.A_NAME	Protection: L Critical Range 2	1.0
3:0098	T2C_SPDC.CRIT2_RTE.A_NAME	Protection:Critical 2 Rate	10.0
3:0099	T2C_SPDC.CRIT3_H.A_NAME	Protection: H Critical Range 3	1.0
3:0100	T2C_SPDC.CRIT3_L.A_NAME	Protection: L Critical Range 3	1.0
3:0101	T2C_SPDC.CRIT3_RTE.A_NAME	Protection: Ciritcal 3 Rate	10.0
3:0102	T2C_SPDC.ACC_OFFACT.A_NAME	Protection: Off Line Max Accel	10.0
3:0103	T2C_SPDC.ACC_DELTA.A_NAME	Protection: Offline Accel Delta Speed	1.0
3:0104	T2C_SPDC.ACC_ON_RTE.A_NAME	Protection: On-Line Max Accel	10.0
3:0105	T2C_SPDC.EMRG_RTE.A_NAME	Protection: Emerg min gov Rate	10.0
3:0106	T2C_SPDC.LOSS_DELTA.A_NAME	Protection:Max delta spd authorized	1.0
3:0107	T2C_SPDC.OSPD_H2.A_NAME	Protection: Overspeed level	1.0
3:0108	T2C_SPDC.OSPD_RATE.A_NAME	ProtectionOverspeed test rate	10.0
3:0109	T2C_SPDC.OVERR_TIME.A_NAME	Protection: Spd override max time (s)	1.0
3:0110	T2C_SPDC.PRED_ACC.A_NAME	Protection Acceleration at Pred level	10.0
3:0111	T2C_SPDC.PRED_SPDC.A_NAME	Protection: Predictive speed Level	1.0
3:0112	T2C_SPDC.MAX_REF.A_NAME	Protection: Maximum speed reference	1.0
3:0113	T2__SPDC.SPD_TARGET.A_NAME	Speed Target (if send)	1.0
3:0114	T1__SPDC.CONFRTE1.A_NAME	Idle/Rated Rate to Low Idle (rpm/s)	10.0
3:0115	T2C_SPDC.LEVEL1.A_NAME	Idle/Rated Idle Speed (rpm)	1.0
3:0116	T1__SPDC.CONFRTE4.A_NAME	Idle/Rated Rate to Rated (rpm/s)	10.0
3:0117	T2C_SPDC.RATED.A_NAME	Idle/Rated Rated Speed (rpm)	10.0
3:0118	T1__SPDC.CONFRTE5.A_NAME	Idle/Rated Loading Rate (10X rpm/s)	10.0
3:0119	T2C_SPDC.COLD_TIME.A_NAME	Auto Seq: Cold Timer (hr)	1.0
3:0120	T2C_SPDC.HOT_TIME.A_NAME	Auto Seq: Hot Time (hr)	1.0
3:0121	T1__SPDC.CONFRTE1.A_NAME	Auto Seq: Rate to Low Idle (X10 rpm/s)	10.0
3:0122	T2C_SPDC.LEVEL1.A_NAME	Auto Seq: Low Idle Speed	1.0
3:0123	T1__SPDC.CONF_T1.A_NAME	Auto Seq: Time at Low Idle (X10 min)	10.0
3:0124	T1__SPDC.A02_RTMM.A_NAME	Auto Seq: Low Idle Remain (X10 min)	10.0
3:0125	T1__SPDC.CONFRTE2.A_NAME	Auto Seq: Rate to H Idle (rpm/s)	10.0
3:0126	T2C_SPDC.LEVEL2.A_NAME	Auto Seq: H Idle Speed (rpm)	1.0
3:0127	T1__SPDC.CONF_T2.A_NAME	Auto Seq: Time at H Idle (X10 min)	10.0
3:0128	T1__SPDC.A04_RTMM.A_NAME	Auto Seq: H Idle Remain T(X10 min)	10.0
3:0129	T1__SPDC.CONFRTE3.A_NAME	Rate To HH Idle (10Xrpm/s)	10.0
3:0130	T2C_SPDC.LEVEL3.A_NAME	Auto Seq: HH Idle Speed (rpm)	1.0
3:0131	T1__SPDC.CONF_T3.A_NAME	Auto Seq: Time at HH Idle (X10 min)	10.0
3:0132	T1__SPDC.A06_RTMM.A_NAME	Auto Seq: HH Remain T(X10 min)	10.0
3:0133	T1__SPDC.CONFRTE4.A_NAME	Auto Seq: Rate to Rated (10x rpm/s)	10.0
3:0134	T2C_SPDC.RATED.A_NAME	Auto Seq: Rated Speed (rpm)	1.0
3:0135	T1__SPDC.CONFRTE5.A_NAME	Loading Rate (rpm/s)	10.0

3:0136	T2C_SPDC.HOT_RESET.A_NAME	Auto Seq/Time to Detect Hot (x10 min)	10.0
3:0137	T2C_SPDC.MIN_RESET.A_NAME	Auto Seq/Min Speed to Reset (rpm)	1.0
3:0138	T1__SPDC.ACTUAL_OF.A_NAME	Auto Seq/Actual Sched Time (X10 min)	10.0
3:0139	T1__SPDC.REMAIN_T.A_NAME	Auto Seq/Act Remaining Time (X10 min)	10.0
3:0140	T2__SPDC.RTIM_PV.A_NAME	Auto Seq/ Housing Temp PV	MOD_MULT.MLT_HOUSG.A_MUX_N_1
3:0141	MOD_MULT.MLT_TURB.OUT_5	Housing Temp Mult Factor(see tables)	1.0
3:0142	MOD_MULT.UNITS.OUT_1	Housing Temp Unit(see tables)	1.0
3:0143	T1__SPDC.SEQ1_MSG.A_NAME	Message 1 for Speed	1.0
3:0144	T1__SPDC.SEQ2_MGS.A_NAME	Message 2 for Speed	1.0
3:0145	MOD_MULT.MLT_TURB.OUT_6	Monitor 1 Mult Factor (see tables)	1.0
3:0146	MOD_MULT.UNITS.OUT_2	Monitor 1 Unit (see tables)	1.0
3:0147	MOD_MULT.MLT_TURB.OUT_7	Monitor 2 Mult Factor (see tables)	1.0
3:0148	MOD_MULT.UNITS.OUT_3	Monitor 2 Unit (see tables)	1.0
3:0149	MOD_MULT.MLT_TURB.OUT_8	Monitor 3 Mult Factor (see tables)	1.0
3:0150	MOD_MULT.UNITS.OUT_4	Monitor 3 Unit (see tables)	1.0
3:0151	MOD_MULT.MLT_TURB.OUT_9	Monitor 4 Mult Factor (see tables)	1.0
3:0152	MOD_MULT.UNITS.OUT_5	Monitor 4 Unit (see tables)	1.0
3:0153	MOD_MULT.MLT_TURB.OUT_10	Monitor 5 Mult Factor (see tables)	1.0
3:0154	MOD_MULT.UNITS.OUT_6	Monitor 5 Unit (see tables)	1.0
3:0155	MOD_MULT.MLT_TURB.OUT_11	Monitor 6 Mult Factor (see tables)	1.0
3:0156	MOD_MULT.UNITS.OUT_7	Monitor 6 Unit(see tables)	1.0
3:0157	MOD_MULT.MLT_TURB.OUT_12	Monitor 7 Mult Factor (see tables)	1.0
3:0158	MOD_MULT.UNITS.OUT_8	Monitor7 Unit (see tables)	1.0
3:0159	MOD_MULT.MLT_TURB.OUT_13	Monitor 8 Mult Factor (see tables)	1.0
3:0160	MOD_MULT.UNITS.OUT_9	Monitor 8 Unit (see tables)	1.0
3:0161	ALARM.PSD_MAIN1.OUT_1	Pack16bit-LSB- SD Causes (1-16)	1.0
3:0162	ALARM.PSD_MAIN2.OUT_1	Pack16bit-LSB- SD Causes (17-32)	1.0
3:0163	ALARM.PSD_MAIN3.OUT_1	Pack16bit-LSB- SD Causes (33-48)	1.0
3:0164	ALARM.PSD_MAIN4.OUT_1	spare Pack16bit	1.0
3:0165	ALARM.PAL_MAIN1.OUT_1	Pack16bit-LSB- Alm Causes (1-16)	1.0
3:0166	ALARM.PAL_MAIN2.OUT_1	Pack16bit-LSB- Alm Causes (17-32)	1.0
3:0167	ALARM.PAL_MAIN3.OUT_1	Pack16bit-LSB- Alm Causes (33-48)	1.0
3:0168	ALARM.PAL_MAIN4.OUT_1	Pack16bit-LSB- Alm Causes (49-64)	1.0
3:0169	ALARM.PAL_MAIN5.OUT_1	Pack16bit-LSB- Alm Causes (65-80)	1.0
3:0170	ALARM.PAL_MAIN6.OUT_1	Pack16bit-LSB- Alm Causes (81-96)	1.0
3:0171	ALARM.PAL_MAIN7.OUT_1	Pack16bit-LSB- Alm Causes (97-112)	1.0
3:0172	ALARM.PAL_MAIN8.OUT_1	Pack16bit-LSB- Alm Causes (113-128)	1.0
3:0173	ALARM.PAL_MAIN9.OUT_1	Pack16bit-LSB- Alm Causes (129-144)	1.0
3:0174	ALARM.PAL_MAIN10.OUT_1	Pack16bit-LSB- Alm Causes (145-160)	1.0
3:0175	ALARM.PAL_MAIN11.OUT_1	Pack16bit-LSB- Alm Causes (161-166)	1.0
3:0176	SS__.FCT_SS.OUT_1	Turb Speed#2 : Usage (1=used)	1.0
3:0177	SS__.FCT_SS.OUT_2	Turb Speed#3: Usage(1=used, 2= zspd)	1.0
3:0178	SS__.FCT_SS.OUT_3	Turb Speed#4: Zero Spd (1=used)	1.0
3:0179	AI__.FCT_AI.OUT_1	Turb Analog Inputs: Config Nb #1	1.0
3:0180	AI__.FCT_AI.OUT_2	Turb Analog Inputs: Config Nb #2	1.0
3:0181	AI__.FCT_AI.OUT_3	Turb Analog Inputs: Config Nb #3	1.0

3:0182	AI__.FCT_AI.OUT_4	Turb Analog Inputs: Config Nb #4	1.0
3:0183	AI__.FCT_AI.OUT_5	Turb Analog Inputs: Config Nb #5	1.0
3:0184	AI__.FCT_AI.OUT_6	Turb Analog Inputs: Config Nb #6	1.0
3:0185	AO__.FCT_AO.OUT_1	Turb Analog Outputs: Config Nb #1	1.0
3:0186	AO__.FCT_AO.OUT_2	Turb Analog Outputs: Config Nb #2	1.0
3:0187	AO__.FCT_AO.OUT_3	Turb Analog Outputs: Config Nb #3	1.0
3:0188	AO__.FCT_AO.OUT_4	Turb Analog Outputs: Config Nb #4	1.0
3:0189	AO__.FCT_AO.OUT_5	Turb Analog Outputs: Config Nb #5	1.0
3:0190	AO__.FCT_AO.OUT_6	Turb Analog Outputs: Config Nb #6	1.0
3:0191	BI__.FCT_BI.OUT_1	Turb Binary Inputs: Config Nb #2	1.0
3:0192	BI__.FCT_BI.OUT_2	Turb Binary Inputs: Config Nb #3	1.0
3:0193	BI__.FCT_BI.OUT_3	Turb Binary Inputs: Config Nb #4	1.0
3:0194	BI__.FCT_BI.OUT_4	Turb Binary Inputs: Config Nb #5	1.0
3:0195	BI__.FCT_BI.OUT_5	Turb Binary Inputs: Config Nb #6	1.0
3:0196	BI__.FCT_BI.OUT_6	Turb Binary Inputs: Config Nb #7	1.0
3:0197	BI__.FCT_BI.OUT_7	Turb Binary Inputs: Config Nb #8	1.0
3:0198	BI__.FCT_BI.OUT_8	Turb Binary Inputs: Config Nb #9	1.0
3:0199	BI__.FCT_BI.OUT_9	Turb Binary Inputs: Config Nb #10	1.0
3:0200	BI__.FCT_BI.OUT_10	Turb Binary Inputs: Config Nb #11	1.0
3:0201	BI__.FCT_BI.OUT_11	Turb Binary Inputs: Config Nb #12	1.0
3:0202	BI__.FCT_BI.OUT_12	Turb Binary Inputs: Config Nb #13	1.0
3:0203	BI__.FCT_BI.OUT_13	Turb Binary Inputs: Config Nb #14	1.0
3:0204	BI__.FCT_BI.OUT_14	Turb Binary Inputs: Config Nb #15	1.0
3:0205	BI__.FCT_BI.OUT_15	Turb Binary Inputs: Config Nb #16	1.0
3:0206	BI__.FCT_BI.OUT_16	Turb Binary Inputs: Config Nb #17	1.0
3:0207	BI__.FCT_BI.OUT_17	Turb Binary Inputs: Config Nb #18	1.0
3:0208	BI__.FCT_BI.OUT_18	Turb Binary Inputs: Config Nb #19	1.0
3:0209	BI__.FCT_BI.OUT_19	Turb Binary Inputs: Config Nb #20	1.0
3:0210	BI__.FCT_BI.OUT_20	Turb Binary Inputs: Config Nb #21	1.0
3:0211	BI__.FCT_BI.OUT_21	Turb Binary Inputs: Config Nb #22	1.0
3:0212	BI__.FCT_BI.OUT_22	Turb Binary Inputs: Config Nb #23	1.0
3:0213	BI__.FCT_BI.OUT_23	Turb Binary Inputs: Config Nb #24	1.0
3:0214	BO__.FCT_BO.OUT_1	Turb Binary Output Conf Type #2	1.0
3:0215	BO__.FCT_BO.OUT_2	Turb Binary Output Conf Type #3	1.0
3:0216	BO__.FCT_BO.OUT_3	Turb Binary Output Conf Type #4	1.0
3:0217	BO__.FCT_BO.OUT_4	Turb Binary Output Conf Type #5	1.0
3:0218	BO__.FCT_BO.OUT_5	Turb Binary Output Conf Type #6	1.0
3:0219	BO__.FCT_BO.OUT_6	Turb Binary Output Conf Type #7	1.0
3:0220	BO__.FCT_BO.OUT_7	Turb Binary Output Conf Type #8	1.0
3:0221	BO__.FCT_BO.OUT_8	Turb Binary Output Conf Type #9	1.0
3:0222	BO__.FCT_BO.OUT_9	Turb Binary Output Conf Type #10	1.0
3:0223	BO__.FCT_BO.OUT_10	Turb Binary Output Conf Type #11	1.0
3:0224	BO__.FCT_BO.OUT_11	Turb Binary Output Conf Type #12	1.0
3:0225	MODBUS.USAGE.OUT_1	Cascade Usage (1 Used,2 Not Used)	1.0
3:0226	T1CX_CASC.SEL_CASCPV.OUT_1	Cascade Type of PV (see table)	1.0
3:0227	T1C__CASC.UNIT.OUT_1	Cascade Unit Selected(see tables)	1.0

3:0228	T2__CASC.DROOP_ALON.A_NAME	Cascade Droop Value Alone (X100 %)	100.0
3:0229	MOD_MULT.MLT_TURB.OUT_1	Cascade Mult Factor (for Modbus)	1.0
3:0230	T1C__EXTR.UNIT.OUT_1	Extr Unit Selected (see tables)	1.0
3:0231	MOD_MULT.MLT_TURB.OUT_2	Extr Mult Factor (see Modbus tables)	1.0
3:0232	MODBUS.USAGE.OUT_2	Extr Type of Turbine	1.0
3:0233	T1C__DCPL.UNIT.OUT_1	Inlet/Exh Ctlr Unit (see tables)	1.0
3:0234	MOD_MULT.MLT_TURB.OUT_3	Inlet/Exh Ctlr Mult Factor (modbus)	1.0
3:0235	MODBUS.USAGE.OUT_3	Inlet/Exh Ctlr Type (1 not used,2 I,3	1.0
3:0236	T1CX_AUX1.SEL_AUX1PV.OUT_1	AUX1 PV Selected (see table)	1.0
3:0237	T1C__AUX1.UNIT.OUT_1	AUX1 Unit Selected	1.0
3:0238	MOD_MULT.MLT_TURB.OUT_4	AUX1 Mult Factor (see Modbus tables)	1.0
3:0239	MODBUS.USAGE.OUT_4	Aux1 Type (see table)	1.0
3:0240	T1CX_FW__.SEL_FWPV.OUT_1	Feed-forward PV Selected (see table)	1.0
3:0241	MODBUS.USAGE.OUT_5	HP Valve Usage (see table)	1.0
3:0242	0.0	spare	1.0
3:0243	0.0	spare	1.0
3:0244	0.0	spare	1.0
3:0245	0.0	spare	1.0
3:0246	0.0	spare	1.0
3:0247	0.0	spare	1.0
3:0248	0.0	spare	1.0
3:0249	0.0	spare	1.0
3:0250	0.0	spare	1.0
3:0251	0.0	spare	1.0
3:0252	0.0	spare	1.0
3:0253	0.0	spare	1.0
3:0254	0.0	spare	1.0
3:0255	0.0	spare	1.0
3:0256	0.0	spare	1.0
3:0257	0.0	spare	1.0
3:0258	0.0	spare	1.0
3:0259	0.0	spare	1.0
3:0260	0.0	spare	1.0
3:0261	0.0	spare	1.0
3:0262	0.0	spare	1.0
3:0263	0.0	spare	1.0
3:0264	0.0	spare	1.0
3:0265	MOD_CPCF.CONFIG.OUT_1	Comp All: Type of Compres (see tab)	1.0
3:0266	MOD_CPCF.CONFIG.OUT_2	Comp All: Unit, 1 is Metric, 2 is Imperial	1.0
3:0267	MOD_CPCF.CONFIG.OUT_3	Comp All: Temp Unit metric (see Tab)	1.0
3:0268	MOD_CPCF.CONFIG.OUT_4	Comp All: Temp Unit Imperial (Tab)	1.0
3:0269	MOD_CPCF.CONFIG.OUT_5	Comp All: Press Unit Metric (Tab)	1.0
3:0270	MOD_CPCF.CONFIG.OUT_6	Comp All: Press Unit Imperial (Tab)	1.0
3:0271	MOD_CPCF.CONFIG.OUT_7	Comp All: Actual Flow Unit Metric	1.0
3:0272	MOD_CPCF.CONFIG.OUT_8	Comp All: Actual Flow Unit Imperial	1.0
3:0273	MOD_CPCF.CONFIG.OUT_9	Comp All Number Cooler Stg 1	1.0

3:0274	MOD_CPCF.CONFIG.OUT_10	Comp All Number Cooler Stg 2	1.0
3:0275	MOD_CPCF.CONFIG.OUT_11	Comp All: Air Case (2= air case)	1.0
3:0276	MOD_CPCF.CONFIG.OUT_12	Comp All: Flow1 Pos(single, chk tab)	1.0
3:0277	MOD_CPCF.CONFIG.OUT_13	Comp All: Flow2 Pos (single, chk tab)	1.0
3:0278	MOD_CPCF.CONFIG.OUT_14	Comp All: Flow Pos (dual only, chk tab)	1.0
3:0279	MOD_CPCF.CONFIG.OUT_15	Comp All: Flow Pos (E/A, only chk tab)	1.0
3:0280	MOD_CPCF.CONFIG.OUT_16	Comp All: Comp1 Temp Pos(chk tab)	1.0
3:0281	MOD_CPCF.CONFIG.OUT_17	Comp All: Comp2 Temp Pos(chk tab)	1.0
3:0282	MOD_CPCF.CONFIG.OUT_18	Comp All: Temp Pos (E/A only chk tab)	1.0
3:0283	MOD_CPCF.CONFIG.OUT_19	Comp All: Valve Postion (chk Tab)	1.0
3:0284	0.0	spare	1.0
3:0285	0.0	spare	1.0
3:0286	0.0	spare	1.0
3:0287	0.0	spare	1.0
3:0288	0.0	spare	1.0
3:0289	0.0	spare	1.0
3:0290	MOD_GOTO.P1O1_RTE.RATE_LIMIT	Comp1: Suction Pressure Override SP	MOD_MULT.MLT_PSUC1.A_MUX_N_1
3:0291	MOD_GOTO.P2O1_RTE.RATE_LIMIT	Comp1: Discharge Pressure Override SP	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0292	T1__CTRL.WSPV.A_NAME	Comp1: Operating Point (S_PV)	100.0
3:0293	T1__CTRL.VLV_HSS.A_NAME	Comp1: HSS Ctrl Dmd (x100%)	100.0
3:0294	T1__CTRL.MIN_HSS.A_NAME	Comp1: Min HSS Ctrl-SMP (x100%)	100.0
3:0295	T1__CTRL.MAX_HSS.A_NAME	Comp1: Max HSS Ctrl (x100%)	100.0
3:0296	T1__CTRL.AS_PID_OUT.A_NAME	Comp1: AS PID Output(X100%)	100.0
3:0297	T1__CTRL.SR_OUT.A_NAME	Comp1: Surge Recovery Dmd (X100%)	100.0
3:0298	T1__CTRL.BST_OUT.A_NAME	Comp1: Boost Dmd (X100%)	100.0
3:0299	T1__CTRL.MAN_OUT.A_NAME	Comp1: Man Dmd (X100%)	100.0
3:0300	T1__CTRL.OV_P1_OUT.A_NAME	Comp1: P1 Override PID (X100%)	100.0
3:0301	T1__CTRL.OV_P2_OUT.A_NAME	Comp1: P2 Override PID (X100%)	100.0
3:0302	T1__CTRL.RATE_OUT.A_NAME	Comp1: Rate PID Output(X100%)	100.0
3:0303	T1__CTRL.SQ_POS_OUT.A_NAME	Comp1: Seq Demand (X100%)	100.0
3:0304	T1__CTRL.AUX1_DMD.A_NAME	Comp1: Ext HSS1 Demand (X100%)	100.0
3:0305	T1__CTRL.AUX2_DMD.A_NAME	Comp1:Ext HSS2 Demand (X100%)	100.0
3:0306	T1__CTRL.D1_OUT.A_NAME	Comp1: Decoupling 1 Dmd (X100%)	100.0
3:0307	T1__CTRL.D2_OUT.A_NAME	Comp1: Decoupling 2 Dmd (X100%)	100.0
3:0308	T1__CTRL.D2_OUT.A_NAME	Comp1: Other Stg Decp Dmd (X100%)	100.0
3:0309	T1__CTRL.SPD_OUT.A_NAME	Comp1: Speed Decp Dmd (X100%)	100.0
3:0310	T1__CTRL.D_OUT.A_NAME	Comp1: Final Decp Demand (X100%)	100.0
3:0311	T1__VLV.VLV_DSP.A_NAME	Comp1: Final Valve Demand (X100%)	100.0
3:0312	T1__GAS.ACT_FL_DSP.A_NAME	Comp1: Actual Flow (EU)	1.0
3:0313	T1__GAS.STD_FL_DSP.A_NAME	Comp1: Mass/Normal Flow (EU)	1.0
3:0314	T1__GAS.ST_S_F_DSP.A_NAME	Comp1: St Flow at Flow Meter (EU)	1.0
3:0315	T1__GAS.C_FL_DSP.A_NAME	Comp1: Corrected Flow (EU)	1.0
3:0316	T2C_COMM.FLO1_MULT.OUT_1	Comp1: Mult Flow (see table)	1.0
3:0317	MOD_MULT.FLO1_TY_EU.OUT_1	Comp1: Type Flow MKSA (see table)	1.0
3:0318	MOD_MULT.FLO1_TY_US.OUT_1	Comp1: Type Flow Imperial (see tab)	1.0
3:0319	T1__GAS.PRATIO.A_NAME	Comp1: Actual Press Ratio (X10)	10.0

3:0320	T1__GAS.HEAD_DSP.A_NAME	Comp1: Polytropic Head	1.0
3:0321	MOD_MULT.COMP1_MULT.OUT_8	Comp1: Polytropic Head Mlf Fact	1.0
3:0322	T1__GAS.RED_HEAD.A_NAME	Comp1: Reduced Head	100.0
3:0323	AI_RM.S1_FLOW.A_NAME	Comp1: Delta P Flow PV (EU)	MOD_MULT.MLT_FLO1.A_MUX_N_1
3:0324	AI__.FLOW1_PV.A_NAME	Comp1: Prim Flows PV (EU)	MOD_MULT.MLT_FLO1.A_MUX_N_1
3:0325	AI__.FLOW1R_PV.A_NAME	Comp1: Second Flow PV(EU)	MOD_MULT.MLT_FLO1.A_MUX_N_1
3:0326	MOD_MULT.COMP1_MULT.OUT_1	Comp1: DP Flow Mult (see table)	1.0
3:0327	0.0	Comp1: Delta P Unit EU (spare)	1.0
3:0328	0.0	Comp1: Delta P Unit US (spare)	1.0
3:0329	AI_RM.S1_P1.A_NAME	Comp1: Suction Press Used (EU)	MOD_MULT.MLT_PSUC1.A_MUX_N_1
3:0330	AI__.PSUC1_PV.A_NAME	Comp1: Prim Suction Press PV (EU)	MOD_MULT.MLT_PSUC1.A_MUX_N_1
3:0331	AI__.PSUC1R_PV.A_NAME	Comp1: Second Suction Press PV(EU)	MOD_MULT.MLT_PSUC1.A_MUX_N_1
3:0332	MOD_MULT.COMP1_MULT.OUT_2	Comp1: Suction Press Mult (see table)	1.0
3:0333	AI_RM.S1_P2.A_NAME	Comp1: Disch Press PV Used (EU)	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0334	AI__.PDIS1_PV.A_NAME	Comp1: Prim Disch Press PV (EU)	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0335	AI__.PDIS1R_PV.A_NAME	Comp1: Second Disch Press PV(EU)	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0336	MOD_MULT.COMP1_MULT.OUT_3	Comp1: Disch Press Mult (see table)	1.0
3:0337	AI__.PFLO1_PV.A_NAME	Comp1: Press at Flow (see table)	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0338	AI__.TSUC1_PV.A_NAME	Comp1: Suction T PV Used (EU)	MOD_MULT.MLT_TSUC1.A_MUX_N_1
3:0339	T1__GAS.TSUC_BACK.A_NAME	Comp1: Suct T Used/Back Used (EU)	MOD_MULT.MLT_TSUC1.A_MUX_N_1
3:0340	MOD_MULT.COMP1_MULT.OUT_4	Comp1: Suction T Mult (see table)	1.0
3:0341	AI__.TDIS1_PV.A_NAME	Comp1: Disch T PV (EU)	MOD_MULT.MLT_TDIS1.A_MUX_N_1
3:0342	X1__GAS.TDIS_BACK.A_NAME	Comp1: Disch T Used/Send Back (EU)	MOD_MULT.MLT_TDIS1.A_MUX_N_1
3:0343	MOD_MULT.COMP1_MULT.OUT_5	Comp1: Disch T Mult (see table)	1.0
3:0344	AI__.TFLO1_PV.A_NAME	Comp1: Temperature at Flow (Sensor)	MOD_MULT.COMP1_MULT.OUT_4
3:0345	AI__.P1OV1_PV.A_NAME	Comp1: Alternate P1 Override PV (EU)	MOD_MULT.MLT_PSUC1.A_MUX_N_1
3:0346	AI__.P2OV1_PV.A_NAME	Comp1: Alternate P2 Override PV (EU)	MOD_MULT.MLT_PDIS1.A_MUX_N_1
3:0347	AI__.RMVLV1_PV.A_NAME	Comp1: Remote Vlv Demand (X100%)	100.0
3:0348	AI__.VLV1UP_PV.A_NAME	Comp1: Vlv Upstream Press (EU)	MOD_MULT.MLT_VLV1UP.A_MUX_N_1
3:0349	MOD_MULT.COMP1_MULT.OUT_6	Comp1: Vlv Upstream Mlt (see tab)	1.0
3:0350	AI__.VLV1DW_PV.A_NAME	Comp1: Vlv Downstr Press (EU)	MOD_MULT.MLT_VLV1DW.A_MUX_N_1
3:0351	MOD_MULT.COMP1_MULT.OUT_7	Comp1: Vlv Downstr Mlt (see tab)	1.0
3:0352	AI__.VLV1T_PV.A_NAME	Comp1: Vlv Temperature (X10 EU)	10.0
3:0353	MODBUS.MAP_DISPL.OUT_1	Display Surge Map 1: Map (see tab)	1.0
3:0354	T1__CPMAP.OP_X.A_NAME	Display Surge Map 1: Op ptX (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0355	T1__CPMAP.OP_Y.A_NAME	Display Surge Map 1: Op ptY (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0356	T1__CPMAP.X01_DSP.A_NAME	Display Surge Map 1: Point X1(EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0357	T1__CPMAP.Y01_DSP.A_NAME	Display Surge Map 1: Point Y1 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0358	T1__CPMAP.X02_DSP.A_NAME	Display Surge Map 1: Point X2 (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0359	T1__CPMAP.Y02_DSP.A_NAME	Display Surge Map 1: Point Y2 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0360	T1__CPMAP.X03_DSP.A_NAME	Display Surge Map 1: Point X3 (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0361	T1__CPMAP.Y03_DSP.A_NAME	Display Surge Map 1: Point Y3 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0362	T1__CPMAP.X04_DSP.A_NAME	Display Surge Map 1: Point X4 (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0363	T1__CPMAP.Y04_DSP.A_NAME	Display Surge Map 1: Point Y4 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0364	T1__CPMAP.X05_DSP.A_NAME	Display Surge Map 1: Point X5 (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0365	T1__CPMAP.Y05_DSP.A_NAME	Display Surge Map 1: Point Y5 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1

3:0366	T1__CPMAP.X06_DSP.A_NAME	Display Surge Map 1: Point X6 (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0367	T1__CPMAP.Y06_DSP.A_NAME	Display Surge Map 1: Point Y6 (EU)	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0368	T1__CPMAP.X_MAX.A_NAME	Display Surge Map 1:Max X (EU)	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0369	MODBUS.X_EXPOSANT.OUT_1	Display Surge Map 1: Max X Exponent	1.0
3:0370	T1__CPMAP.Y_MAX.A_NAME	Display Surge Map 1: Max Y (EU))	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0371	MODBUS.Y_EXPOSANT.OUT_1	Display Surge Map 1: Max Y Exponent	1.0
3:0372	T1__CPMAP.ACTUAL_MRG.A_NAME	Display Surge Map 1: Surge Margin (%)	100.0
3:0373	T1__CPMAP.BOOST_MARG.A_NAME	Display Surge Map 1: Boost margin (%)	100.0
3:0374	T1__CTRL.MSG1_NB.OUT_1	Message1 Compressor 1	1.0
3:0375	T1__CTRL.MSG2_NB.OUT_1	Message2 Compressor 1	1.0
3:0376	T1__CALM.S_TOTAL.A_NAME	Comp1: Total NB of Surges	1.0
3:0377	T1__CALM.S_COUNTER.A_NAME	Comp1: Consecutive NB of Surges	1.0
3:0378	MOD_MULT.MAP1_XMLT.A_MUX_N_1	Map1 Multiply Factor OpX (X100)	100.0
3:0379	MOD_MULT.MAP1_YMLT.A_MUX_N_1	Map1 Multiply Factor Opy (X100)	100.0
3:0380	MOD_MULT.MAP1_MNX.MULTIPLY	Minimum Map X Displayed	MOD_MULT.MAP1_XMLT.A_MUX_N_1
3:0381	MOD_MULT.MAP1_MNY.MULTIPLY	Minimum Map Y Displayed	MOD_MULT.MAP1_YMLT.A_MUX_N_1
3:0382	0.0	spare	1.0
3:0383	0.0	spare	1.0
3:0384	0.0	spare	1.0
3:0385	0.0	spare	1.0
3:0386	MOD_GOTO.P1O2_RTE.RATE_LIMIT	Comp2: Suction Pressure Override SP	MOD_MULT.MLT_PSUC2.A_MUX_N_1
3:0387	MOD_GOTO.P2O2_RTE.RATE_LIMIT	Comp2: Discharge Pressure Override SP	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0388	T1_BCTRL.WSPV.A_NAME	Comp2: Operating Point (S_PV)	100.0
3:0389	T1_BCTRL.VLV_HSS.A_NAME	Comp2: HSS Ctrl Dmd (x100%)	100.0
3:0390	T1_BCTRL.MIN_HSS.A_NAME	Comp2: Min HSS Ctrl-SMP (x100%)	100.0
3:0391	T1_BCTRL.MAX_HSS.A_NAME	Comp2: Max HSS Ctrl (x100%)	100.0
3:0392	T1_BCTRL.AS_PID_OUT.A_NAME	Comp2: AS PID Output(X100%)	100.0
3:0393	T1_BCTRL.SR_OUT.A_NAME	Comp2: Surge Recov Dmd (X100%)	100.0
3:0394	T1_BCTRL.BST_OUT.A_NAME	Comp2: Boost Dmd (X100%)	100.0
3:0395	T1_BCTRL.MAN_OUT.A_NAME	Comp2: Man Dmd (X100%)	100.0
3:0396	T1_BCTRL.OV_P1_OUT.A_NAME	Comp2: P1 Override PID (X100%)	100.0
3:0397	T1_BCTRL.OV_P2_OUT.A_NAME	Comp2: P2 Override PID (X100%)	100.0
3:0398	T1_BCTRL.RATE_OUT.A_NAME	Comp2: Rate PID Output (X100%)	100.0
3:0399	T1_BCTRL.SQ_POS_OUT.A_NAME	Comp2: Seq Demand (X100%)	100.0
3:0400	T1_BCTRL.AUX1_DMD.A_NAME	Comp2:Ext HSS1 Demand (X100%)	100.0
3:0401	T1_BCTRL.AUX2_DMD.A_NAME	Comp2:Ext HSS2 Demand (X100%)	100.0
3:0402	T1_BCTRL.D1_OUT.A_NAME	Comp2: Decoupling 1 Dmd (X100%)	100.0
3:0403	T1_BCTRL.D2_OUT.A_NAME	Comp2: Decoupling 2 Dmd (X100%)	100.0
3:0404	T1_BCTRL.D2_OUT.A_NAME	Comp2: Other Stg Decp Dmd (X100%)	100.0
3:0405	T1_BCTRL.SPD_OUT.A_NAME	Comp2: Speed Decp Dmd (X100%)	100.0
3:0406	T1_BCTRL.D_OUT.A_NAME	Comp2: Final Decp Demand (X100%)	100.0
3:0407	T1_BVLV.VLV_DSP.A_NAME	Comp2: Final Valve Demand (X100%)	100.0
3:0408	T1_BGAS.ACT_FL_DSP.A_NAME	Comp2: Actual Flow (EU)	1.0
3:0409	T1_BGAS.STD_FL_DSP.A_NAME	Comp2: Mass/Normal Flow (EU)	1.0
3:0410	T1_BGAS.ST_S_F_DSP.A_NAME	Comp2: St Flow at Flow Meter (EU)	1.0
3:0411	T1_BGAS.C_FL_DSP.A_NAME	Comp2: Corrected Flow (EU)	1.0

3:0412	T2C_COMM.FLO2_MULT.OUT_1	Comp2: Mult Flow (see table)	1.0
3:0413	MOD_MULT.FLO2_TY_EU.OUT_1	Comp2: Type Flow MKSA (see table)	1.0
3:0414	MOD_MULT.FLO2_TY_US.OUT_1	Comp2: Type Flow Imperial (see tab)	1.0
3:0415	T1_BGAS.PRATIO.A_NAME	Comp2: Actual Press Ratio (X10)	10.0
3:0416	T1_BGAS.HEAD_DSP.A_NAME	Comp2: Polytropic Head	1.0
3:0417	MOD_MULT.COMP2_MULT.OUT_8	Comp2: Polytropic Head Mlf Fact	1.0
3:0418	T1_BGAS.RED_HEAD.A_NAME	Comp2: Reduced Head	100.0
3:0419	AI_RM.S2_FLOW.A_NAME	Comp2: Delta P Flow PV (EU)	MOD_MULT.MLT_FLO2.A_MUX_N_1
3:0420	AI__.FLOW2_PV.A_NAME	Comp2: Prim Flows PV (EU)	MOD_MULT.MLT_FLO2.A_MUX_N_1
3:0421	AI__.FLOW2R_PV.A_NAME	Comp2: Second Flow PV(EU)	MOD_MULT.MLT_FLO2.A_MUX_N_1
3:0422	MOD_MULT.COMP2_MULT.OUT_1	Comp2: DP Flow Mult (see table)	1.0
3:0423	0.0	Comp2: Delta P Unit EU (spare)	1.0
3:0424	0.0	Comp2: Delta P Unit US (spare)	1.0
3:0425	AI_RM.S2_P1.A_NAME	Comp2: Suction Press Used (EU)	MOD_MULT.MLT_PSUC2.A_MUX_N_1
3:0426	AI__.PSUC2_PV.A_NAME	Comp2: Prim Suction Press PV (EU)	MOD_MULT.MLT_PSUC2.A_MUX_N_1
3:0427	AI__.PSUC2R_PV.A_NAME	Comp2: Second Suction Press PV(EU)	MOD_MULT.MLT_PSUC2.A_MUX_N_1
3:0428	MOD_MULT.COMP2_MULT.OUT_2	Comp2: Suction Press Mult (see table)	1.0
3:0429	AI_RM.S2_P2.A_NAME	Comp2: Disch Press PV Used (EU)	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0430	AI__.PDIS2_PV.A_NAME	Comp2: Prim Disch Press PV (EU)	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0431	AI__.PDIS2R_PV.A_NAME	Comp2: Second Disch Press PV(EU)	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0432	MOD_MULT.COMP2_MULT.OUT_3	Comp2: Disch Press Mult (see table)	1.0
3:0433	AI__.PFLO2_PV.A_NAME	Comp2: Press at Flow (see table)	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0434	AI__.TSUC2_PV.A_NAME	Comp2: Suction T PV Used (EU)	MOD_MULT.MLT_TSUC2.A_MUX_N_1
3:0435	T1_BGAS.TSUC_BACK.A_NAME	Comp2: Suct T Used/Back Used (EU)	MOD_MULT.MLT_TSUC2.A_MUX_N_1
3:0436	MOD_MULT.COMP2_MULT.OUT_4	Comp2: Suction T Mult (see table)	1.0
3:0437	AI__.TDIS2_PV.A_NAME	Comp2: Disch T PV (EU)	MOD_MULT.MLT_TDIS2.A_MUX_N_1
3:0438	X1_BGAS.TDIS_BACK.A_NAME	Comp2: Disch T Used/Send Back (EU)	MOD_MULT.MLT_TDIS2.A_MUX_N_1
3:0439	MOD_MULT.COMP2_MULT.OUT_5	Comp2: Disch T Mult (see table)	1.0
3:0440	AI__.TFLO2_PV.A_NAME	Comp2: Temperature at Flow (sensor)	MOD_MULT.COMP2_MULT.OUT_4
3:0441	AI__.P1OV2_PV.A_NAME	Comp2: Alternate P1 Override PV (EU)	MOD_MULT.MLT_PSUC2.A_MUX_N_1
3:0442	AI__.P2OV2_PV.A_NAME	Comp2: Alternate P2 Override PV (EU)	MOD_MULT.MLT_PDIS2.A_MUX_N_1
3:0443	AI__.RMVLV2_PV.A_NAME	Comp2: Remote Vlv Demand (X100%)	100.0
3:0444	AI__.VLV2UP_PV.A_NAME	Comp2: Vlv Upstream Press (EU)	MOD_MULT.MLT_VLV2UP.A_MUX_N_1
3:0445	MOD_MULT.COMP2_MULT.OUT_6	Comp2: Vlv Upstream Mlt (see tab)	1.0
3:0446	AI__.VLV2DW_PV.A_NAME	Comp2: Vlv Downstr Press (EU)	MOD_MULT.MLT_VLV2DW.A_MUX_N_1
3:0447	MOD_MULT.COMP2_MULT.OUT_7	Comp2: Vlv Downstr Mlt (see tab)	1.0
3:0448	AI__.VLV2T_PV.A_NAME	Comp2: Vlv Temperature (X10 EU)	10.0
3:0449	AI_RM.SSTRFLOW.A_NAME	Side Stream: Flow PV Used	MOD_MULT.MLT_SSFL.A_MUX_N_1
3:0450	AI__.SSTR_PV.A_NAME	Side Stream: Prim Flow Element PV	MOD_MULT.MLT_SSFL.A_MUX_N_1
3:0451	AI__.SSTRR_PV.A_NAME	Side Stream: Second Flow Element PV	MOD_MULT.MLT_SSFL.A_MUX_N_1
3:0452	MOD_MULT.COMP2_MULT.OUT_9	side Stream: Flow Element Mlt Factor	1.0
3:0453	AI_RM.SSPRFLOW.A_NAME	Side Stream: Pressure PV Used	MOD_MULT.MLT_SSP_.A_MUX_N_1
3:0454	AI__.SSP__PV.A_NAME	Side Stream: Prim Pressure PV	MOD_MULT.MLT_SSP_.A_MUX_N_1
3:0455	AI__.SSPR_PV.A_NAME	Side Stream: Second Pressure PV	MOD_MULT.MLT_SSP_.A_MUX_N_1
3:0456	MOD_MULT.COMP2_MULT.OUT_10	Side Stream: Pressure Mlt Factor	1.0
3:0457	AI__.SSTE_PV.A_NAME	Side Stream: Temperature PV	MOD_MULT.MLT_SST_.A_MUX_N_1

3:0458	MOD_MULT.COMP2_MULT.OUT_11	Side Stream: Temp Mlt Factor	1.0
3:0459	MODBUS2.MAP_DISPL.OUT_1	Display Surge Map 2: Map (see tab)	1.0
3:0460	T1_BCPMAP.OP_X.A_NAME	Display Surge Map 2: Op ptX (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0461	T1_BCPMAP.OP_Y.A_NAME	Display Surge Map 2: Op ptY (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0462	T1_BCPMAP.X01_DSP.A_NAME	Display Surge Map 2: Point X1 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0463	T1_BCPMAP.Y01_DSP.A_NAME	Display Surge Map 2: Point Y1 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0464	T1_BCPMAP.X02_DSP.A_NAME	Display Surge Map 2: Point X2 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0465	T1_BCPMAP.Y02_DSP.A_NAME	Display Surge Map 2: Point Y2 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0466	T1_BCPMAP.X03_DSP.A_NAME	Display Surge Map 2: Point X3 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0467	T1_BCPMAP.Y03_DSP.A_NAME	Display Surge Map 2: Point Y3 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0468	T1_BCPMAP.X04_DSP.A_NAME	Display Surge Map 2: Point X4 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0469	T1_BCPMAP.Y04_DSP.A_NAME	Display Surge Map 2: Point Y4 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0470	T1_BCPMAP.X05_DSP.A_NAME	Display Surge Map 2: Point X5 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0471	T1_BCPMAP.Y05_DSP.A_NAME	Display Surge Map 2: Point Y5 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0472	T1_BCPMAP.X06_DSP.A_NAME	Display Surge Map 2: Point X6 (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0473	T1_BCPMAP.Y06_DSP.A_NAME	Display Surge Map 2: Point Y6 (EU)	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0474	T1_BCPMAP.X_MAX.A_NAME	Display Surge Map 2: Max X (EU)	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0475	MODBUS2.X_EXPOSANT.OUT_1	Display Surge Map 2: Max X Exponent	1.0
3:0476	T1_BCPMAP.Y_MAX.A_NAME	Display Surge Map 2: Max Y (EU*10))	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0477	MODBUS2.Y_EXPOSANT.OUT_1	Display Surge Map 2: Max Y Exponent	1.0
3:0478	T1_BCPMAP.ACTUAL_MRG.A_NAME	Display Surge Map 2: Surge Margin (%)	100.0
3:0479	T1_BCPMAP.BOOST_MARG.A_NAME	Display Surge Map 2: Boost Margin (%)	100.0
3:0480	T1_BCTRL.MSG1_NB.OUT_1	Message 1 Compressor 2	1.0
3:0481	T1_BCTRL.MSG2_NB.OUT_1	Message 2 Compressor 2	1.0
3:0482	T1_BCALM.S_TOTAL.A_NAME	Comp2: Total NB of Surges	1.0
3:0483	T1_BCALM.S_COUNTER.A_NAME	Comp2: Consecutive Surge	1.0
3:0484	MOD_MULT.MAP2_XMLT.A_MUX_N_1	Map2 Multiply OpX (X100)	100.0
3:0485	MOD_MULT.MAP2_YMLT.A_MUX_N_1	Map2 Multiply OpY (X100)	100.0
3:0486	MOD_MULT.MAP2_MNX.MULTIPLY	Minimum Map2 X Displayed	MOD_MULT.MAP2_XMLT.A_MUX_N_1
3:0487	MOD_MULT.MAP2_MNY.MULTIPLY	Minimum Map2 y Displayed	MOD_MULT.MAP2_YMLT.A_MUX_N_1
3:0488	T2C_CAI.SEL_FCT_AI.OUT_1	Comp Analog Inputs: Config Nb #7	1.0
3:0489	T2C_CAI.SEL_FCT_AI.OUT_2	Comp Analog Inputs: Config Nb #8	1.0
3:0490	T2C_CAI.SEL_FCT_AI.OUT_3	Comp Analog Inputs: Config Nb #9	1.0
3:0491	T2C_CAI.SEL_FCT_AI.OUT_4	Comp Analog Inputs: Config Nb #10	1.0
3:0492	T2C_CAI.SEL_FCT_AI.OUT_5	Comp Analog Inputs: Config Nb #11	1.0
3:0493	T2C_CAI.SEL_FCT_AI.OUT_6	Comp Analog Inputs: Config Nb #12	1.0
3:0494	T2C_CAI.SEL_FCT_AI.OUT_7	Comp Analog Inputs: Config Nb #13	1.0
3:0495	T2C_CAI.SEL_FCT_AI.OUT_8	Comp Analog Inputs: Config Nb #14	1.0
3:0496	T2C_CAI.SEL_FCT_AI.OUT_9	Comp Analog Inputs: Config Nb #15	1.0
3:0497	T2C_CAI.SEL_FCT_AI.OUT_10	Comp Analog Inputs: Config Nb #16	1.0
3:0498	T2C_CAI.SEL_FCT_AI.OUT_11	Comp Analog Inputs: Config Nb #17	1.0
3:0499	T2C_CAI.SEL_FCT_AI.OUT_12	Comp Analog Inputs: Config Nb #18	1.0
3:0500	T2C_CAI.SEL_FCT_AI.OUT_13	Comp Analog Inputs: Config Nb #19	1.0
3:0501	T2C_CAI.SEL_FCT_AI.OUT_14	Comp Analog Inputs: Config Nb #20	1.0
3:0502	T2C_CAI.SEL_FCT_AI.OUT_15	Comp Analog Inputs: Config Nb #21	1.0
3:0503	T2C_CAO.SEL_FCT_AO.OUT_1	Comp Analog Output: Config Nb #2	1.0

3:0504	T2C_CAO.SEL_FCT_AO.OUT_2	Comp Analog Output: Config Nb #3	1.0
3:0505	T2C_CAO.SEL_FCT_AO.OUT_3	Comp Analog Output: Config Nb #4	1.0
3:0506	T2C_CAO.SEL_FCT_AO.OUT_4	Comp Analog Output: Config Nb #5	1.0
3:0507	T2C_CAO.SEL_FCT_AO.OUT_5	Comp Analog Output: Config Nb #6	1.0
3:0508	T2C_CBI.SEL_FCT_BI.OUT_1	Comp Binary Inputs: Config Nb #2	1.0
3:0509	T2C_CBI.SEL_FCT_BI.OUT_2	Comp Binary Inputs: Config Nb #3	1.0
3:0510	T2C_CBI.SEL_FCT_BI.OUT_3	Comp Binary Inputs: Config Nb #4	1.0
3:0511	T2C_CBI.SEL_FCT_BI.OUT_4	Comp Binary Inputs: Config Nb #5	1.0
3:0512	T2C_CBI.SEL_FCT_BI.OUT_5	Comp Binary Inputs: Config Nb #6	1.0
3:0513	T2C_CBI.SEL_FCT_BI.OUT_6	Comp Binary Inputs: Config Nb #7	1.0
3:0514	T2C_CBI.SEL_FCT_BI.OUT_7	Comp Binary Inputs: Config Nb #8	1.0
3:0515	T2C_CBI.SEL_FCT_BI.OUT_8	Comp Binary Inputs: Config Nb #9	1.0
3:0516	T2C_CBI.SEL_FCT_BI.OUT_9	Comp Binary Inputs: Config Nb #10	1.0
3:0517	T2C_CBI.SEL_FCT_BI.OUT_10	Comp Binary Inputs: Config Nb #11	1.0
3:0518	T2C_CBI.SEL_FCT_BI.OUT_11	Comp Binary Inputs: Config Nb #12	1.0
3:0519	T2C_CBI.SEL_FCT_BI.OUT_12	Comp Binary Inputs: Config Nb #13	1.0
3:0520	T2C_CBI.SEL_FCT_BI.OUT_13	Comp Binary Inputs: Config Nb #14	1.0
3:0521	T2C_CBI.SEL_FCT_BI.OUT_14	Comp Binary Inputs: Config Nb #15	1.0
3:0522	T2C_CBI.SEL_FCT_BI.OUT_15	Comp Binary Inputs: Config Nb #16	1.0
3:0523	T2C_CBI.SEL_FCT_BI.OUT_16	Comp Binary Inputs: Config Nb #17	1.0
3:0524	T2C_CBI.SEL_FCT_BI.OUT_17	Comp Binary Inputs: Config Nb #18	1.0
3:0525	T2C_CBI.SEL_FCT_BI.OUT_18	Comp Binary Inputs: Config Nb #19	1.0
3:0526	T2C_CBI.SEL_FCT_BI.OUT_19	Comp Binary Inputs: Config Nb #20	1.0
3:0527	T2C_CBI.SEL_FCT_BI.OUT_20	Comp Binary Inputs: Config Nb #21	1.0
3:0528	T2C_CBI.SEL_FCT_BI.OUT_21	Comp Binary Inputs: Config Nb #22	1.0
3:0529	T2C_CBI.SEL_FCT_BI.OUT_22	Comp Binary Inputs: Config Nb #23	1.0
3:0530	T2C_CBI.SEL_FCT_BI.OUT_23	Comp Binary Inputs: Config Nb #24	1.0
3:0531	T2C_CBO.SEL_FCT_BO.OUT_1	Comp Binary Output Conf Type #2	1.0
3:0532	T2C_CBO.SEL_FCT_BO.OUT_2	Comp Binary Output Conf Type #3	1.0
3:0533	T2C_CBO.SEL_FCT_BO.OUT_3	Comp Binary Output Conf Type #4	1.0
3:0534	T2C_CBO.SEL_FCT_BO.OUT_4	Comp Binary Output Conf Type #5	1.0
3:0535	T2C_CBO.SEL_FCT_BO.OUT_5	Comp Binary Output Conf Type #6	1.0
3:0536	T2C_CBO.SEL_FCT_BO.OUT_6	Comp Binary Output Conf Type #7	1.0
3:0537	T2C_CBO.SEL_FCT_BO.OUT_7	Comp Binary Output Conf Type #8	1.0
3:0538	T2C_CBO.SEL_FCT_BO.OUT_8	Comp Binary Output Conf Type #9	1.0
3:0539	T2C_CBO.SEL_FCT_BO.OUT_9	Comp Binary Output Conf Type #10	1.0
3:0540	T2C_CBO.SEL_FCT_BO.OUT_10	Comp Binary Output Conf Type #11	1.0
3:0541	T2C_CBO.SEL_FCT_BO.OUT_11	Comp Binary Output Conf Type #12	1.0
3:0542	A01_CPU.AI_01.AI_420_ATL	Raw Value AI#01	10.0
3:0543	A01_CPU.AI_02.AI_420_ATL	Raw Value AI#02	10.0
3:0544	A01_CPU.AI_03.AI_420_ATL	Raw Value AI#03	10.0
3:0545	A01_CPU.AI_04.AI_420_ATL	Raw Value AI#04	10.0
3:0546	A01_CPU.AI_05.AI_420_ATL	Raw Value AI#05	10.0
3:0547	A01_CPU.AI_06.AI_420_ATL	Raw Value AI#06	10.0
3:0548	A02_COMBO.AI_01.AI_420_ATL	Raw Value AI#07	10.0
3:0549	A02_COMBO.AI_02.AI_420_ATL	Raw Value AI#08	10.0

3:0550	A02_COMBO.AI_03.AI_420_ATL	Raw Value AI#09	10.0
3:0551	A02_COMBO.AI_04.AI_420_ATL	Raw Value AI#10	10.0
3:0552	A02_COMBO.AI_05.AI_420_ATL	Raw Value AI#11	10.0
3:0553	A02_COMBO.AI_06.AI_420_ATL	Raw Value AI#12	10.0
3:0554	A02_COMBO.AI_07.AI_420_ATL	Raw Value AI#13	10.0
3:0555	A02_COMBO.AI_08.AI_420_ATL	Raw Value AI#14	10.0
3:0556	A02_COMBO.AI_09.AI_420_ATL	Raw Value AI#15	10.0
3:0557	A02_COMBO.AI_10.AI_420_ATL	Raw Value AI#16	10.0
3:0558	A02_COMBO.AI_11.AI_420_ATL	Raw Value AI#17	10.0
3:0559	A02_COMBO.AI_12.AI_420_ATL	Raw Value AI#18	10.0
3:0560	A02_COMBO.AI_13.AI_420_ATL	Raw Value AI#19	10.0
3:0561	A02_COMBO.AI_14.AI_420_ATL	Raw Value AI#20	10.0
3:0562	A02_COMBO.AI_15.AI_420_ATL	Raw Value AI#21	10.0
3:0563	A01_CPU.AO_01.DISPLAY	Raw Value AO#01	10.0
3:0564	A01_CPU.AO_02.DISPLAY	Raw Value AO#02	10.0
3:0565	A01_CPU.AO_03.DISPLAY	Raw Value AO#03	10.0
3:0566	A01_CPU.AO_04.DISPLAY	Raw Value AO#04	10.0
3:0567	A02_COMBO.AO_01.DISPLAY	Raw Value AO#05	10.0
3:0568	A02_COMBO.AO_02.DISPLAY	Raw Value AO#06	10.0
3:0569	AI__.EXP_TO_MOD.MULTIPLY	Exported Flow PV (EU)	*1.0 (0.000001, 10000)
3:0570	AI__.LAG_EXP1.LAG_2	Raw value from small-range sensor	*100.0 (1.0, 100.0)
3:0571	AI__.LAG_EXP2.LAG_2	Raw value from large-scale sensor	*100.0 (1.0, 100.0)
3:0572	AI__.DP.A_NAME	DP export flow PV (EU)	*100.0 (1.0, 100.0)

Table E-3. Modbus List Analog Reads

Analog Writes (RPTaw)			
Addr		**Description**	**Multiplier**
4:0001		Speed Target	1.0
4:0002		Cascade SP Target	MODBUS.AW_CASC_SP.DIVIDE
4:0003		Auxiliary SP Target	MODBUS.AW_AUX_SP.DIVIDE
4:0004		Extraction Setpoint Target	MODBUS.AW_EXTR_SP.DIVIDE
4:0005		Inlet/Exhaust Setpoint Target	MODBUS.AW_DCPL_SP.DIVIDE
4:0006		spare	
4:0007		spare	
4:0008		spare	
4:0009		Compressor 1 Valve Target	0.01
4:0010		Compressor 1 Psuc SP Target	MODBUS.AW_PSUC1.DIVIDE
4:0011		Compressor 1 Pdisc SP Target	MODBUS.AW_PDIS1.DIVIDE
4:0012		Compressor 2 valve Target	0.01
4:0013		Compressor 2 Psuc SP Target	MODBUS.AW_PSUC2.DIVIDE
4:0014		Compressor 1 Pdisc SP Target	MODBUS.AW_PDIS2.DIVIDE

Table E-4. Modbus List Analog Writes

Appendix F.
Alarm List

Number	Description
1	Fault Remote Speed Setpoint PV
2	Fault Cascade PV
3	Fault Remote Cascade PV
4	Fault Auxiliary PV
5	Fault Remote Auxiliary
6	Fault Extr/Adm PV
7	Fault Remote Extr/Adm PV
8	Fault Rem Manual Extr/Adm PV
9	Fault Inlet/Exhaust Press PV
10	Fault Remote Inlet/Exh SP
11	Fault Rem Man inlet/Exhaust PV
12	Fault Feed-forward PV
13	Fault Remote Hot/Cold PV
14	Fault Customer Defined Input #1
15	Fault Customer Defined Input #2
16	Fault Customer Defined Input #3
17	Fault Customer Defined Input #4
18	Fault Customer Defined Input #5
19	Fault Customer Defined Input #6
20	Fault Customer Defined Input #7
21	Fault Customer Defined Input #8
22	Speed Deviation Failure
23	Speed Sensor #1 Lost
24	Speed Sensor #2 Lost
25	Speed Sensor #3 Lost
26	Fault Analog Output #1
27	Fault Analog Output #2
28	Fault Analog Output #3
29	Fault Analog Output #4
30	Communication Modbus #1 Fault
31	Communication Modbus #2 Fault
32	Actuator #1 Fault
33	Actuator #2 Fault
34	Any Analog Output Forced
35	External Alarm #1
36	External Alarm #2
37	External Alarm #3
38	External Alarm #4
39	External Alarm #5
40	External Alarm #6
41	External Alarm #7

42	External Alarm #8
43	External Alarm #9
44	External Alarm #10
45	Alarm Internal Level Switch #1
46	Alarm Internal Level Switch #2
47	Alarm Internal Level Switch #3
48	Alarm Internal Level Switch #4
49	Alarm Internal Level Switch #5
50	Alarm Internal Level Switch #6
51	Alarm Internal Level Switch #7
52	Alarm Internal Level Switch #8
53	Any Binary Output Forced
54	Zero Speed (ch3) Fault
55	Zero Speed (ch4) Fault
56	All Zero Speed Fault
57	Speed Detected while Stroking Valve
58	Any Analog Input 1-6 Forced Disabled
59	Any Analog Input 7-21 Forced Disabled
60	Not Used
61	Underspeed Detected
62	Speed Control Lost
63	Stuck in Critical
64	Rotor is Sticky
65	Configuration Error
66	Cascade Override Active
67	Emergency Cascade Activated
68	Auxiliary Limiter Active
69	Auxiliary in Control/No Speed Raise
70	Internal Overspeed Reached
71	Steam Map Limit Reached
72	Not Used
73	Not Used
74	Not Used
75	Not Used
76	Not Used
77	Comp#1: Surge on Flow Deriv
78	Comp#1: Surge on P1 Deriv
79	Comp#1: Surge on P2 Deriv
80	Comp#1: Surge on Speed Deriv
81	Comp#1: Surge on Min Flow
82	Comp#1: Surge on Cross Line
83	Comp#1: Configuration Error
84	Comp#1: Flow Difference Detected
85	Comp#1: Primary Flow Sensor Fault
86	Comp#1: Second Flow Sensor Fault
87	Comp#1: All Flow Sensor Fault

88	Comp#1: Suction Press Difference
89	Comp#1: Primary Suction Press Fault
90	Comp#1: Second Suction Press Fault
91	Comp#1: All Suction Press Fault
92	Comp#1: Disch Press Difference
93	Comp#1: Primary Disch Press Fault
94	Comp#1: Second Disch Press Fault
95	Comp#1: All Disch Press Fault
96	Comp#1: Pressure at Flow Fault
97	Comp#1: Suction Temp Fault
98	Comp#1: Disch Temp Fault
99	Comp#1: Temp at Flow Fault
100	Comp#1: HSS#1 Fault
101	Comp#1: HSS#2 Fault
102	Comp#1: Decoupling#1 Fault
103	Comp#1: Decoupling#2 Fault
104	Comp#1: Remote Man Vlv Fault
105	Comp#1: Upstream Valve Press Flt
106	Comp#1: Downstream Valve Press Flt
107	Comp#1: Temp at Valve Fault
108	Comp#1: Alternate P1 Overrd Fault
109	Comp#1: Alternate P2 Overrd Fault
110	Comp#1: Consecutive Surges
112	Fault export gas 1 sensor
113	Fault export gas 2 sensor
114	Not Used
115	Not Used
116	Not Used
117	Comp#2: Surge on Flow Deriv
118	Comp#2: Surge on P1 Deriv
119	Comp#2: Surge on P2 Deriv
120	Comp#2: Surge on Speed Deriv
121	Comp#2: Surge on Min flow
122	Comp#2: Surge on Cross Line
123	Comp#2: Configuration Error
124	Comp#2: Flow Difference Detected
125	Comp#2: Primary Flow Sensor Fault
126	Comp#2: Second Flow Sensor Fault
127	Comp#2: All Flow Sensor Fault
128	Comp#2: Suction Press Difference
129	Comp#2: Primary Suction Press Fault
130	Comp#2: Second Suction Press Fault
131	Comp#2: All Suction Press Fault
132	Comp#2: Disch Press Difference
133	Comp#2: Primary Disch Press Fault
134	Comp#2: Second Disch Press Fault

135	Comp#2: All Disch Press Fault
136	Comp#2: Pressure at Flow Fault
137	Comp#2: Suction Temp Fault
138	Comp#2: Disch Temp Fault
139	Comp#2: Temp at Flow Fault
140	Comp#2: HSS#1 Fault
141	Comp#2: HSS#2 Fault
142	Comp#2: Decoupling#1 Fault
143	Comp#2: Decoupling#2 Fault
144	Comp#2: Remote Man Vlv Fault
145	Comp#2: Upstream Valve Press Flt
146	Comp#2: Downstream Valve Press Flt
147	Comp#2: Temp at Valve Fault
148	Comp#2: Alternate P1 Overrd Fault
149	Comp#2: Alternate P2 Overrd Fault
150	Side Stream Flow Difference
151	Primary Side Stream Flow Fault
152	Secondary Side Stream Flow Fault
153	All Side Stream Flow Fault
154	Side Stream Pressure Difference
155	Primary Side Stream Pressure Fault
156	Second Side Stream Pressure Fault
157	All Side Stream Pressure Fault
158	Side Stream Temperature Fault
159	Comp#2: Consecutive Surges
160	Not Used
161	Not Used
162	Not Used
163	Not Used
164	Not Used
165	Not Used
166	Not Used

Table F-1. Alarm List

Appendix G.
Shutdown List

Number	Description
1	Trip from Modbus#1
2	Trip from Modbus#2
3	Trip from Engineering Station
4	IO Lock Selected
5	All Speed Channel Fault
6	Actuator #1 Fault
7	Actuator #2 Fault
8	Main BI Shutdown (Contact #1)
9	External Shutdown #1
10	External Shutdown #2
11	External Shutdown #3
12	External Shutdown #4
13	External Shutdown #5
14	External Shutdown #6
15	External Shutdown #7
16	External Shutdown #8
17	External Shutdown #9
18	External Shutdown #10
19	Internal Level #1 Shutdown
20	Internal Level #2 Shutdown
21	Internal Level #3 Shutdown
22	Internal Level #4 Shutdown
23	Internal Level #5 Shutdown
24	Internal Level #6 Shutdown
25	Internal Level #7 Shutdown
26	Internal Level #8 Shutdown
27	Comp 1: Shutdown Consecutive Surges
28	Comp 2: Shutdown Consecutive Surges
29	Not Used
30	Not Used
31	Not Used
32	Not Used
33	Not Used
34	Overspeed Trip
35	Max Overspeed Reached
36	Predictive Overspeed Trip
37	Normal SD Completed
38	Underspeed Trip
39	Speed Control Lost
40	Stuck in Critical
41	SD for Sticky rotor

42	Speed Lost or Fail to Start
43	Boot Up trip
44	Configuration Error
45	Extr/Adm Sensor Lost
46	Not Used
47	Not Used
48	Not Used

Table G-1. Shutdown List

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26542V1C.

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