WOODWARD

Product Manual 26240V1
(Revision B)
Original Instructions

505CC-2 Steam Turbine and Compressor Control

Volume 1, Hardware and Installation Manual
INACTIVE Part Number 8701-1114
(current P/N is 8701-1356, in manual 26451)

Manual 26240 consists of 4 volumes (26240V1, 26240V2, 26240V3, & 26240sup).

Hardware and Installation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

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

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Proper Use

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

Translated Publications

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

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 Out-of-date translations are marked with ⚠.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

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

Contents

Contents

Illustrations and Tables

Illustrations and Tables

Warnings and Notices

Important Definitions

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

Chapter 1.
General Information

Introduction

The 505CC-2 is a steam turbine and compressor control designed for use on a single- or two-valve steam turbine driving a one- or two-loop dynamic compressor. This manual, 26240, encompasses three separate volumes:

- Volume 1—Hardware and Installation
- Volume 2—Steam Turbine Control
- Volume 3—Compressor Control

This volume describes the 505CC-2's hardware platform, which is based on the Woodward AtlasPC™ Digital Control. It provides a variety of useful information for the user ranging from simple basic descriptions to detailed information on wiring, specifications, functionality, and initial software configuration.. Included are:

- General information on the AtlasPC platform
- A physical description of the control hardware
- A description of the AtlasPC modules
- A description of available options
- Information on AtlasPC communications interfaces
- Installation and configuration of the 505CC-2 HMI (Human Machine Interface) & Configuration Tool (CCT) software
- Installation and maintenance
- Troubleshooting information

This manual does not contain instructions for the operation of the complete turbine and compressor systems. For turbine, compressor, or plant operating instructions, contact the plant-equipment manufacturer.

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—***be sure to read and understand this manual fully***.

Topic	Location (manual 26240)
Physical Installation / Wiring	Volume 1, Chapters 2 and 3
Software / System Configuration	Volume 1, Chapter 3
Configuration File Management	Volume 1, Chapter 3
Modbus® *	Volume 1, Chapter 3
Security / Log-In Passwords	Volume 1, Appendix A
Turbine Configuration	Volume 2, Chapter 4
Turbine Operation	Volume 2, Chapter 5
Turbine Dynamics (PID) Tuning	Volume 2, Chapters 4 and 5
Compressor Configuration	Volume 3, Chapter 4
Compressor Operation	Volume 3, Chapter 5
Compressor Dynamics (PID) Tuning	Volume 3, Chapters 4 and 5

*—Modbus is a trademark of Schneider Automation Inc.

HMI & Configuration Tool Software

The HMI/CCT software provides full configuration and operation of the 505CC-2 control system through intuitive, menu-driven screens. The software is supplied with the 505CC-2 on a compact disc (CD) for installation on any Microsoft Windows 2000/XP computer. The same software comes pre-loaded on an optional touchscreen HMI. This HMI consists of a compact, industrial computer and 15 inch (381mm) touchscreen LCD monitor (Woodward part number 8928-7037).

AtlasPC Control Description

At the heart of the AtlasPC 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 AtlasPC 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 or DCS system, is accomplished by means of serial Modbus 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 AtlasPC 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 AtlasPC 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). AtlasPC field wiring is accomplished via terminal blocks that plug into the control modules.

Control Versions

The AtlasPC control provides a flexible platform that can be structured into a wide variety of configurations of I/O and communications. The required number of I/O modules and the types of communication modules that are required will depend entirely on the specific application scenario. Table 1-1 shows the modules utilized for the 505CC-2 application.

I/O Modules	Processor & Communication Modules
SmartCore	Pentium CPU
Analog I/O	
Power Supply	

Table 1-1. AtlasPC Modules for the 505CC-2 Control

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 and the main processor. All configurations contain a SmartCore module that spans both the Power Bus Stack and the PC/104 Stack. Figure 1-1 shows the 505CC-2 module configuration.

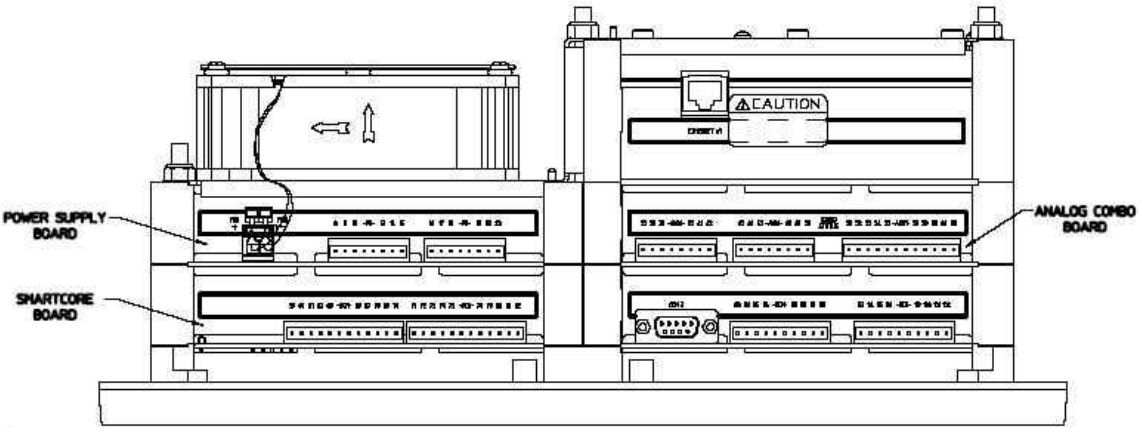


Figure 1-1. AtlasPC / 505CC-2 Module Layout

Control Accessories

The AtlasPC digital control platform is designed to interface with several Woodward service tools and commercial hardware and software products. Available accessories are listed below with a brief description of their functionality:

- **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 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.
- **External Interfaces**—Commercially available HMI (Human Machine Interface) programs, Distributed Control Systems (DCS), and Programmable Logic Controllers (PLC) can interface to the AtlasPC control through serial or Ethernet connections to provide operator access and control of the application machinery.
- **Optional Touchscreen HMI (8928-7037)**—An Ethernet-based HMI package that facilitates full configuration and operation of the control is included on a supplied CD that can be installed to any Microsoft Windows 2000/XP computer. The same HMI application is available in an optional 15-inch Touchscreen HMI as Woodward part number 8928-7037 (see Chapter 9).
- **Optional Relay Output Module (8928-459)**—Because the AtlasPC control requires interposing relays on its discrete output channels, an optional relay output module with cable is available as Woodward part number 8928-459 (see Chapter 8).

Regulatory Compliance

The AtlasPC control is suitable for use in Class I, Division 2, Groups A, B, C, D, per UL for Canada and US or non-hazardous locations only.

The AtlasPC control is suitable for use in European Zone 2, Group IIC environments when installed in an IP-54 minimum rated enclosure per DEMKO certification.

The optional HMI touchscreen and its computer are suitable for use in non-hazardous locations only, intended for installation in a controlled environment such as a control room or motor control center. The touchscreen panel is environmentally rated to NEMA4/IP65.

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

Field wiring must be suitable for at least 75 °C for operating ambient temperatures expected to exceed 50 °C.

A fixed wiring installation is required.

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

Connect ground screw to earth ground (see Figure 1-2).

These listings are limited to those units bearing the UL or DEMKO agency identifications.

⚠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 or Zone 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, Division 2 ou Zone 2.

Regulatory Compliance Specifications (AtlasPC Control Only)

European Compliance for CE Mark

EMC Directive	Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
Low Voltage Directive	Declared to 73/23/EEC COUNCIL DIRECTIVE of 10 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.
ATEX—Potentially Explosive Atmospheres Directive	Declared to 94/9/EEC 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.

Other European Compliance

DEMKO	Certified to EN50021, Zone 2: EEx nL IIC 02 ATEX 0220460U

North American Compliance

UL	UL Listed for Class I, Division 2, Groups A, B, C, & D, T4A at 70 °C ambient. For use in Canada and the United States.

These listings are limited to those units bearing the UL or DEMKO agency identification.

Marine Compliance

American Bureau of Shipping	ABS Rules 2003 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, 2001: Temperature Class B, Humidity Class B, Vibration Class C, and EMC Class A
Lloyd's Register of Shipping	LR Type Approval Test Specification No. 1, 2002 for Environmental Categories ENV1, ENV2, and ENV3

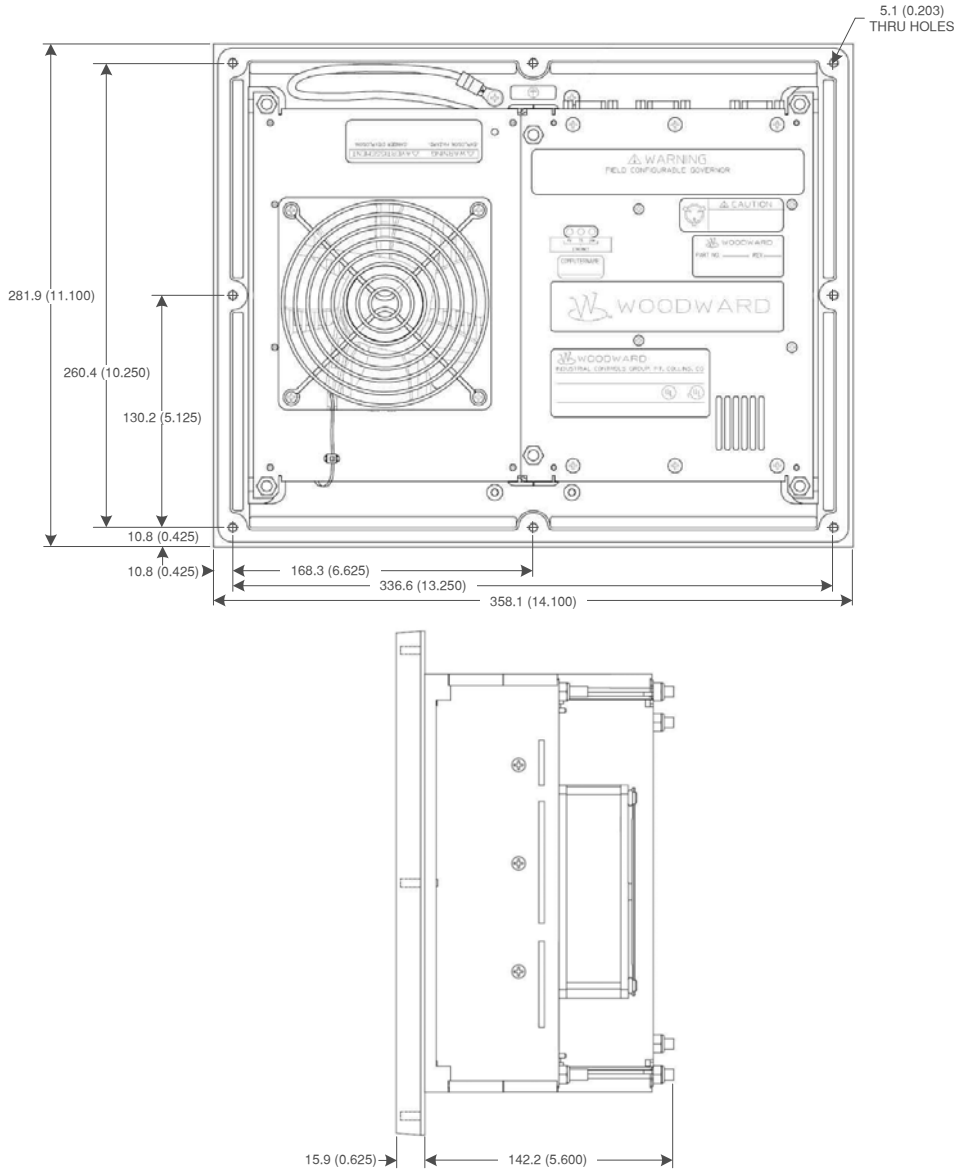


Figure 1-2. Physical Dimensions
(dimensions shown in millimeters (inches))

Chapter 2.
Basic Installation

Introduction

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

General Installation Notes

When selecting a location for mounting the AtlasPC control, consider the following:

- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The operating range of the AtlasPC control is –20 to +70 °C (–4 to +158 °F).
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Do not install near high-voltage or high-current devices.
- 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.

Shipping Carton

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

The AtlasPC control was shipped from the factory in an anti-static foam lined carton. This carton should always be used for transport of the control when it is not installed.

Mounting

Figure 1-2 shows the AtlasPC control layout and mounting pattern. The AtlasPC 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. An IP-54 minimum rated enclosure is required for European Zone 2 applications (per EN50021).

The standard AtlasPC package must be mounted to allow sufficient room for wiring access. Eight front panel mounting holes permit secure mounting. Depending on its configuration, the AtlasPC weighs between 3.4 and 4.5 kg (7.5 and 10 lb), and has an operating range of –20 to +70 °C ambient air temperature. A minimum of 25 mm (1 inch) of clear space around the outer surfaces of the AtlasPC is adequate for ventilation, however approximately 75 mm (3 inches) of space may be required for wiring, depending on wire size.

Environmental Specifications

Operating Temperature
The AtlasPC Control Platform operates in a specified ambient temperature of –20 to +70 °C (–4 to +158 °F) with forced convection cooling.

NOTICE

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

Storage Temperature
The AtlasPC Control Platform is designed to be stored without applied power at the temperature range of –40 to +85 °C (–40 to +185 °F).

Shock
The AtlasPC 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.

Vibration (Sinusoidal)
The AtlasPC Control Platform was tested to Lloyd's Test Specification No. 1, 2002, Vibration Test 1 (5–13.2 Hz, ±1 mm; 13.2–100 Hz, ±0.7g).

Audible Noise Emission
The AtlasPC Control Platform does not emit an audible noise above 70 dBA as measured 1 meter away, with or without a fan.

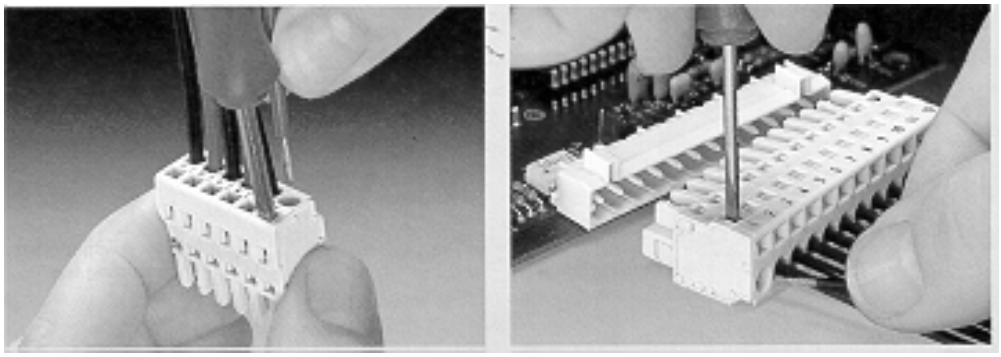
Enclosure Protection
In order to meet Zone 2 European Group IIC, the AtlasPC Control must be mounted in an enclosure that meets or exceeds IP 54.

Electrical Connections

Most inputs and outputs to the AtlasPC control are made through "CageClamp" terminal blocks. For noise suppression, it is recommend that all low-current wires be separated from all high-current wire.

The pluggable terminal blocks on the I/O modules 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 2-1). The AtlasPC pluggable 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. Wires for the pluggable I/O terminals should be stripped 8 mm (0.3 inch).

Most of the AtlasPC control's terminal blocks are designed to be removed by hand. After AtlasPC 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.

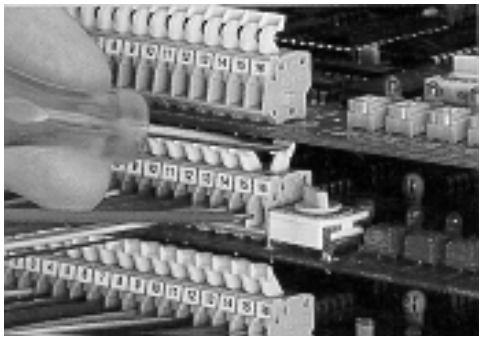


Method #1
Free Hand (holds spring open)

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

Figure 2-1. Spring Clamp

The AtlasPC 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).



Wiring Fixed Terminal

IMPORTANT

<u>Do not</u> tin (solder) the wires that terminate at the AtlasPC 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.

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).

Shields and Grounding

An individual shield termination is provided at the terminal block for each of the signals requiring shielding, which includes all analog sensors, speed inputs, and communications ports. Relay outputs, contact inputs, and power supply wiring do not normally require shielding, but can be shielded if desired. All shielded cable must be twisted conductor pairs. Do not attempt to tin (solder) the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor.

The AtlasPC control is designed for shield termination to earth ground at the control. 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 other shield terminations except at the AtlasPC control should be ac coupled to earth through a capacitor. A 1000 pF, 500 V capacitor is sufficient. The intent is to provide a low impedance path to earth for the shield at frequencies of 150 kHz and up. Multiple direct connections of a shield to earth risk high levels of current to flow within the shield. See Woodward application note 50532, *Interference Control in Electronic Governing Systems*, for more information.

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

1. Strip outer insulation from both ends, exposing the braided or spiral wrapped shield. Do not cut the shield.
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
4. Remove 6 mm (1/4 inch) of insulation from the inner conductors.
5. Connect wiring and shield as shown in plant wiring diagram.

For noise suppression reasons, it is recommend that all low-current wires be separated from all high-current wires. Input power ground terminal 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 can be grounded at both ends (AtlasPC control and load) if the cable length is sufficiently short (within a cabinet) to prevent ground loop current in the shield.

Cabinet Installations: If the AtlasPC control is installed in a cabinet, shielded I/O can be terminated directly to the cabinet (earth ground) at the entry to the cabinet, as well as at the control.

Input Power

The AtlasPC control requires a nominal voltage source of 18 to 32 Vdc. Input power requirements vary depending on the control version. Table 2-1 contains information for the maximum configuration.

NOTICE

Power must be applied to the AtlasPC 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 AtlasPC 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, or non-hazardous locations only.

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

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

Power supply output 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.

Significant inrush currents are possible when current is applied to the AtlasPC 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.

Input Power Wiring

Protective earth ground (PE) must be connected to the chassis at the termination point on the back side 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.

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

It is expected that the installation of this equipment will include over current protection between the power source and the AtlasPC 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 AtlasPC power supply input current rating must be provided. See Table 2-1 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 AtlasPC control to any one fuse. Use only the wire size specified in Table 2-1 or equivalent metric size, which meets local code requirements. Time delay fuses should be used to prevent nuisance trips.

Table 2-1 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 2-1. Power Supply Requirements

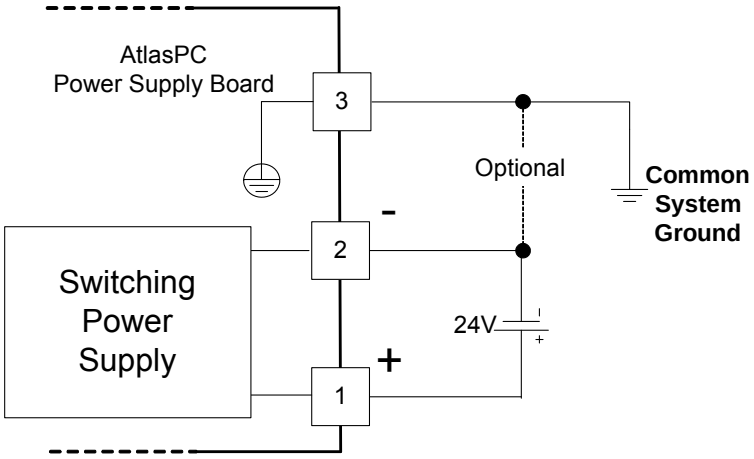
IMPORTANT

*** 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.**

Input Power Wiring Diagram

The power supply and ground connections are located on the power supply board, directly below the cooling fan.



Maintenance

The only part of the AtlasPC control system that may require user maintenance is the cooling fan. 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 and secure with the 4 screws.
- 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.

Chapter 3.
Wiring, Communications, and Setup

General Description

Turbine and compressor I/O are divided among the AtlasPC™ control's SmartCore, Analog Combo, and Power Supply Boards. The SmartCore, which is the bottom, full size board spanning both stacks, is primarily for turbine I/O with some compressor discrete inputs. Above the SmartCore are the Power Supply (left) and Analog Combo (right) Boards. The latter is reserved entirely for compressor I/O, while all discrete outputs for both the turbine and compressor reside on the Power Supply. See Figure 3-1 for the 505CC-2's AtlasPC module layout.

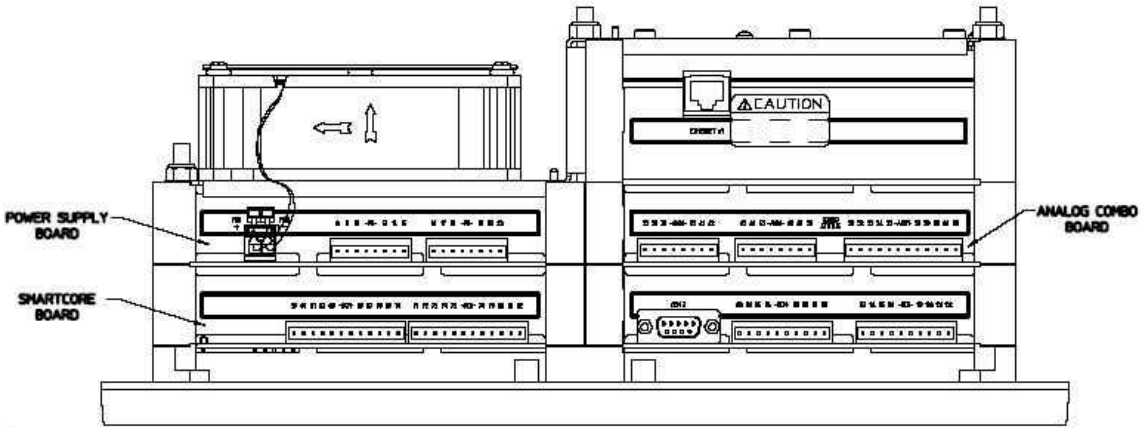


Figure 3-1. AtlasPC Module Layout

See Chapter 9 for a description of the optional touchscreen HMI (Human Machine Interface). For hardware troubleshooting help, see the individual chapters describing each board.

Turbine I/O / SmartCore Board

Most turbine I/O are connected to the AtlasPC SmartCore Board, which is the bottom, full size board in the stack. Table 3-1 lists the SmartCore Board I/O assignments.

I/O Type	Channel	Description	SmartCore Terminal Block	SmartCore Terminal Numbers
Discrete Input	DI_01	Discrete Input #1 - Unit Shutdown	SCM-TB1	1
Discrete Input	DI_02	Discrete Input #2 - Unit Reset	SCM-TB1	2
Discrete Input	DI_03	Discrete Input #3 - Turbine Raise Speed Setpoint	SCM-TB1	3
Discrete Input	DI_04	Discrete Input #4 - Turbine Lower Speed Setpoint	SCM-TB1	4
Discrete Input	DI_05	Discrete Input #5 - Turbine Configurable	SCM-TB1	5
Discrete Input	DI_06	Discrete Input #6 - Turbine Configurable	SCM-TB1	6
Discrete Input	DI_07	Discrete Input #7 - Turbine Configurable	SCM-TB1	7
Discrete Input	DI_08	Discrete Input #8 - Turbine Configurable	SCM-TB1	8
Discrete Input	DI_09	Discrete Input #9 - Turbine Configurable	SCM-TB2	9
Discrete Input	DI_10	Discrete Input #10 - Turbine Configurable	SCM-TB2	10
Discrete Input	DI_11	Discrete Input #11 - Turbine Configurable	SCM-TB2	11
Discrete Input	DI_12	Discrete Input #12 - Turbine Configurable	SCM-TB2	12
Discrete Input	DI_13	Discrete Input #13 - Comp 1 Open Anti-Surge Vlv	SCM-TB2	13
Discrete Input	DI_14	Discrete Input #14 - Comp 1 Close Anti-Surge Vlv	SCM-TB2	14
Discrete Input	DI_15	Discrete Input #15 - Comp 2 Open Anti-Surge Vlv	SCM-TB2	15
Discrete Input	DI_16	Discrete Input #16 - Comp 2 Close Anti-Surge Vlv	SCM-TB2	16
Discrete Input	DI_17	Discrete Input #17 - Compressor Configurable	SCM-TB3	17
Discrete Input	DI_18	Discrete Input #18 - Compressor Configurable	SCM-TB3	18
Discrete Input	DI_19	Discrete Input #19 - Compressor Configurable	SCM-TB3	19
Discrete Input	DI_20	Discrete Input #20 - Compressor Configurable	SCM-TB3	20
Discrete Input	DI_21	Discrete Input #21 - Compressor Configurable	SCM-TB3	21
Discrete Input	DI_22	Discrete Input #22 - Compressor Configurable	SCM-TB3	22
Discrete Input	DI_23	Discrete Input #23 - Compressor Configurable	SCM-TB3	23
Discrete Input	DI_24	Discrete Input #24 - Compressor Configurable	SCM-TB3	24
		24 Vdc Wetting Voltage for Discrete Inputs	SCM-TB3	26
Analog Input	AI_01	Analog Input #1 - Turbine Configurable	SCM-TB4	27-30
Analog Input	AI_02	Analog Input #2 - Turbine Configurable	SCM-TB4	31-34
Analog Input	AI_03	Analog Input #3 - Turbine Configurable	SCM-TB4	35-38
Analog Input	AI_04	Analog Input #4 - Turbine Configurable	SCM-TB5	39-42
Analog Input	AI_05	Analog Input #5 - Turbine Configurable	SCM-TB5	43-46
Analog Input	AI_06	Analog Input #6 - Turbine Steam Pressure	SCM-TB5	47-50
Speed Input	SS_01	Speed Input #1 - Unit Speed Input (MPU or Prox)	SCM-TB6	51-54
Speed Input	SS_02	Speed Input #2 – Unit Speed Input (MPU or Prox)	SCM-TB6	55-58
Actuator Output	ACT_01	Actuator Output #1 - Turbine Actuator Output (V1)	SCM-TB7	59-61
Actuator Output	ACT_02	Actuator Output #2 - Turbine Actuator Output (V2)	SCM-TB7	62-64
Analog Output	AO_01	Analog Output #1 - Turbine Configurable	SCM-TB7	65-67
Analog Output	AO_02	Analog Output #2 - Turbine Configurable	SCM-TB7	68-70
Analog Output	AO_03	Analog Output #3 - Turbine Configurable	SCM-TB8	71-73
Analog Output	AO_04	Analog Output #4 - Turbine Configurable	SCM-TB8	74-76
Analog Output	AO_05	Analog Output #5 - Compressor Configurable	SCM-TB8	77-79
Analog Output	AO_06	Analog Output #6 - Compressor Configurable	SCM-TB8	80-82
Serial Port #3	COM #3	RS-232 Serial Port, DB9 Connector	SCM-COM3	
Serial Port #2	SIO #2	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB9	83-92
Serial Port #1	SIO #1	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB10	93-102

Table 3-1. AtlasPC SmartCore Board I/O List

Discrete Inputs

Discrete inputs are optically isolated from the rest of the platform but are common to one another. 24 Vdc is supplied for wetting voltage at Terminal 26.

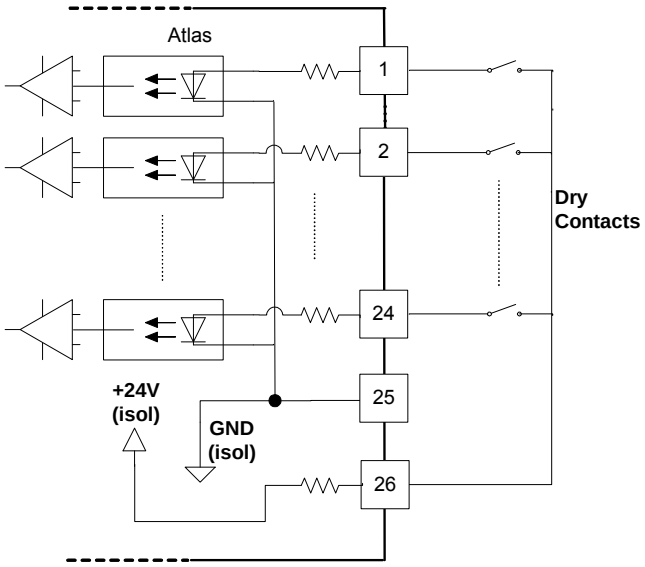


Figure 3-2. SmartCore Discrete Input Connections

Analog Inputs

Analog inputs are 4–20 mA. Jumpers are required, as shown in Figure 3-3.

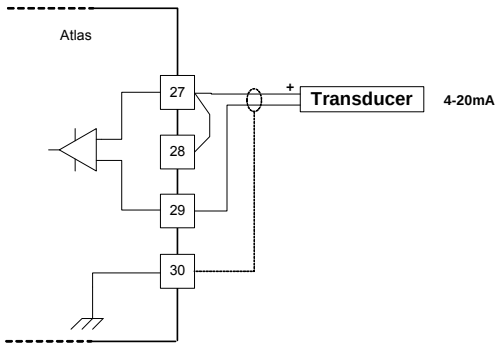


Figure 3-3. SmartCore Analog Input Connection

No loop power is provided. If loop powered (2-wire) transmitters are used, an external power supply must be utilized. In this case, it is recommended that loops be individually protected with 100 mA fuses. See Figure 3-4 for a sample wiring connection.

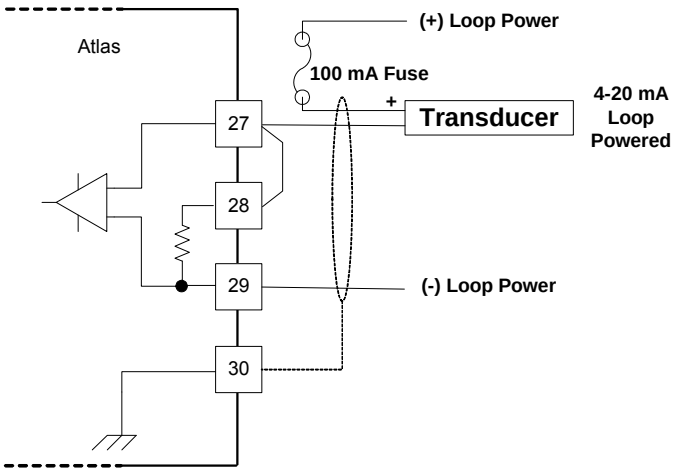


Figure 3-4. Loop Powered, 4–20 mA Transmitter Connection

Speed Inputs

Speed inputs may be passive magnetic pickups (MPUs) or active proximity probes, but no supply voltage is provided for the latter. Selection between the two is by wiring connection. Jumpers are required when connecting proximity probes. See Figure 3-5 for wiring examples for each.

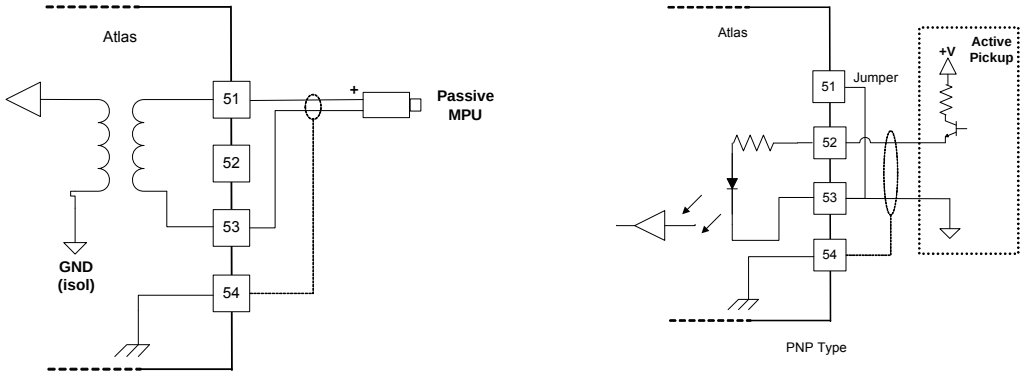


Figure 3-5. SmartCore Speed Input Connections

Analog / Actuator Outputs

Analog outputs are 4–20 mA. 15 Vdc loop power is provided. Actuator outputs are 4–20 mA or scalable 0-190 mA, selectable in software configuration.

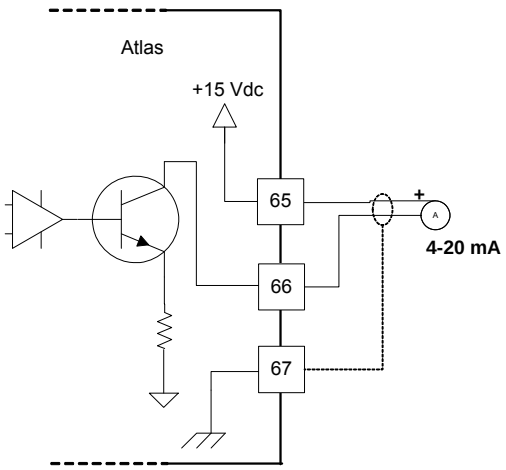


Figure 3-6. SmartCore Analog Output Connection

NOTICE

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

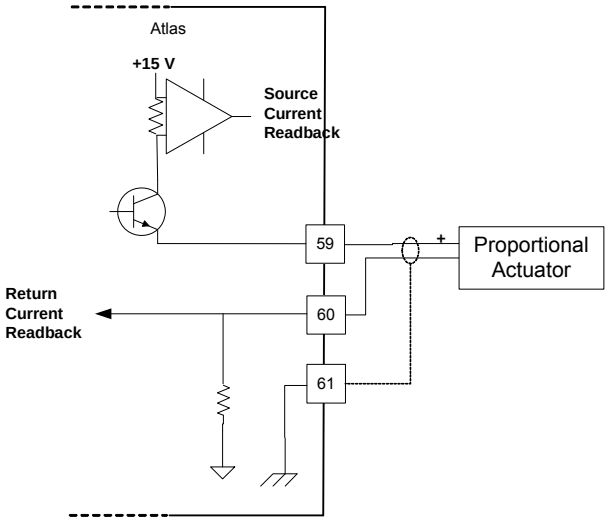


Figure 3-7. SmartCore Actuator Output Connection

Figure 3-8 provides an overall, sample wiring diagram for the turbine I/O on the SmartCore Board. Turbine configurations vary, so this is provided as an example only. The speed input connections shown are for MPUs.

Serial I/O Ports

Three SIO Ports are provided on the SmartCore Board for troubleshooting with special software tools and for connection to external control devices via serial Modbus. COM #3 provides a DB-9 connection and is dedicated as RS-232 for use with Woodward software tools. SIO #1 and SIO #2 provide Modbus interfaces to third-party devices and are software configurable for RS-232, RS-422, or RS-485. The SmartCore Board includes the required termination resistors in the event the AtlasPC is the final element on an RS-422 or RS-485 network--See the section on Serial I/O in Chapter 6 for appropriate wiring terminations for each protocol. See Chapter 3 for a complete Modbus list.

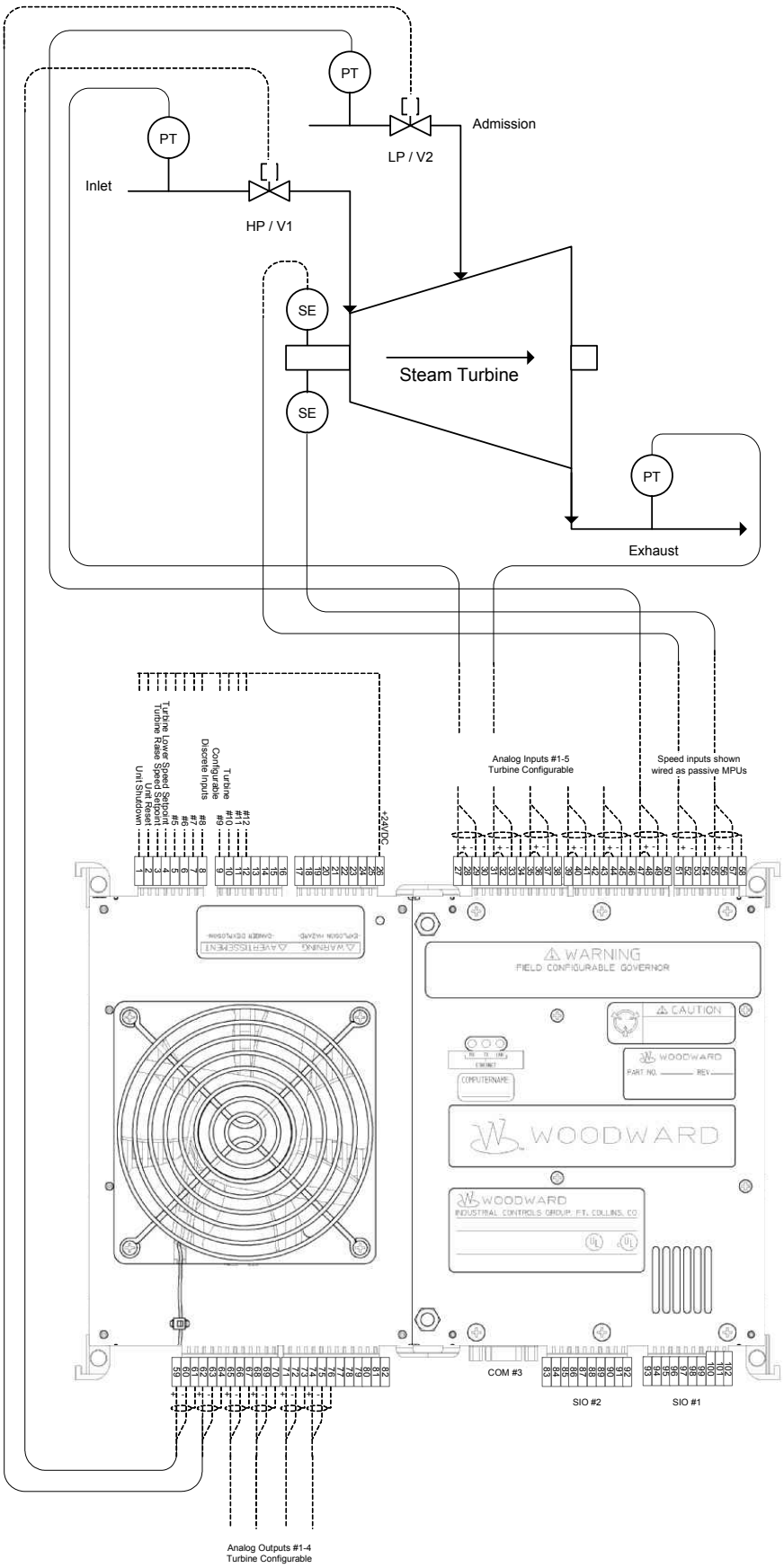


Figure 3-8. Turbine I/O / SmartCore Connections

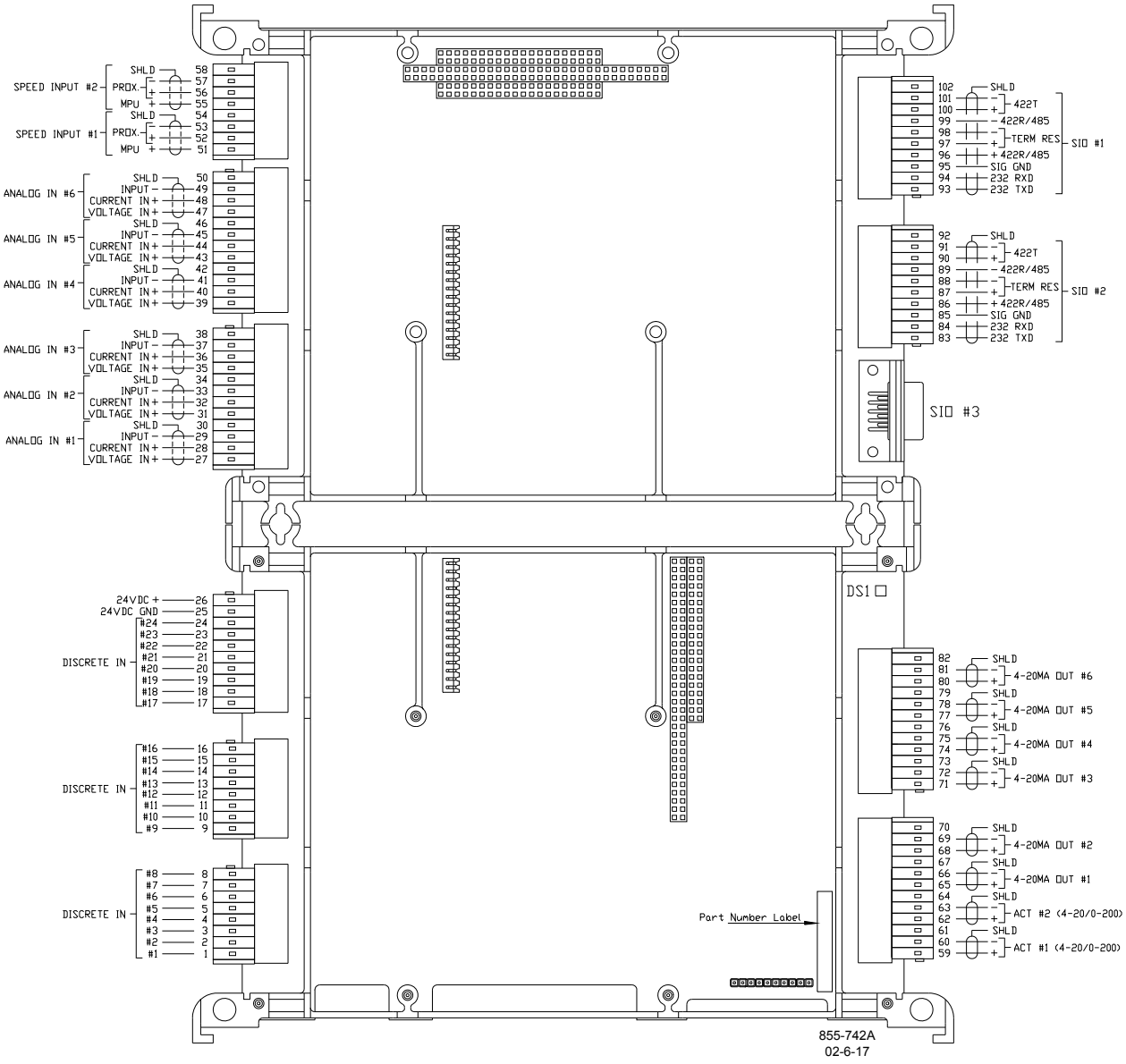


Figure 3-9. SmartCore Board with Actuators Connections

Compressor I/O / Analog Combo Board

Compressor I/O are split among the SmartCore Board, which handles discrete inputs and configurable analog outputs, and the Analog Combo Board, which hosts analog inputs and 4–20 mA actuator outputs. The Analog Combo Board is the middle, half-size board in the PC/104 stack on the right side of the control (between the CPU and the SmartCore Board). Tables 3-2 and 3-3 list the SmartCore and Analog Combo Board I/O assignments for the compressor.

I/O Type	Channel	Description	SmartCore Terminal Block	SmartCore Terminal Numbers
Discrete Input	DI_01	Discrete Input #1 - Unit Shutdown	SCM-TB1	1
Discrete Input	DI_02	Discrete Input #2 - Unit Reset	SCM-TB1	2
Discrete Input	DI_03	Discrete Input #3 - Turbine Raise Speed Setpoint	SCM-TB1	3
Discrete Input	DI_04	Discrete Input #4 - Turbine Lower Speed Setpoint	SCM-TB1	4
Discrete Input	DI_05	Discrete Input #5 - Turbine Configurable	SCM-TB1	5
Discrete Input	DI_06	Discrete Input #6 - Turbine Configurable	SCM-TB1	6
Discrete Input	DI_07	Discrete Input #7 - Turbine Configurable	SCM-TB1	7
Discrete Input	DI_08	Discrete Input #8 - Turbine Configurable	SCM-TB1	8
Discrete Input	DI_09	Discrete Input #9 - Turbine Configurable	SCM-TB2	9
Discrete Input	DI_10	Discrete Input #10 - Turbine Configurable	SCM-TB2	10
Discrete Input	DI_11	Discrete Input #11 - Turbine Configurable	SCM-TB2	11
Discrete Input	DI_12	Discrete Input #12 - Turbine Configurable	SCM-TB2	12
Discrete Input	DI_13	Discrete Input #13 - Comp 1 Open Anti-Surge Vlv	SCM-TB2	13
Discrete Input	DI_14	Discrete Input #14 - Comp 1 Close Anti-Surge Vlv	SCM-TB2	14
Discrete Input	DI_15	Discrete Input #15 - Comp 2 Open Anti-Surge Vlv	SCM-TB2	15
Discrete Input	DI_16	Discrete Input #16 - Comp 2 Close Anti-Surge Vlv	SCM-TB2	16
Discrete Input	DI_17	Discrete Input #17 - Compressor Configurable	SCM-TB3	17
Discrete Input	DI_18	Discrete Input #18 - Compressor Configurable	SCM-TB3	18
Discrete Input	DI_19	Discrete Input #19 - Compressor Configurable	SCM-TB3	19
Discrete Input	DI_20	Discrete Input #20 - Compressor Configurable	SCM-TB3	20
Discrete Input	DI_21	Discrete Input #21 - Compressor Configurable	SCM-TB3	21
Discrete Input	DI_22	Discrete Input #22 - Compressor Configurable	SCM-TB3	22
Discrete Input	DI_23	Discrete Input #23 - Compressor Configurable	SCM-TB3	23
Discrete Input	DI_24	Discrete Input #24 - Compressor Configurable	SCM-TB3	24
		24 Vdc Wetting Voltage for Discrete Inputs	SCM-TB3	26
Analog Input	AI_01	Analog Input #1 - Turbine Configurable	SCM-TB4	27-30
Analog Input	AI_02	Analog Input #2 - Turbine Configurable	SCM-TB4	31-34
Analog Input	AI_03	Analog Input #3 - Turbine Configurable	SCM-TB4	35-38
Analog Input	AI_04	Analog Input #4 - Turbine Configurable	SCM-TB5	39-42
Analog Input	AI_05	Analog Input #5 - Turbine Configurable	SCM-TB5	43-46
Analog Input	AI_06	Analog Input #6 - Turbine Steam Pressure	SCM-TB5	47-50
Speed Input	SS_01	Speed Input #1 - Unit Speed Input (MPU or Prox)	SCM-TB6	51-54
Speed Input	SS_02	Speed Input #2 - Unit Speed Input (MPU or Prox)	SCM-TB6	55-58
Actuator Output	ACT_01	Actuator Output #1 - Turbine (HP/V1) Actuator	SCM-TB7	59-61
Actuator Output	ACT_02	Actuator Output #2 - Turbine (LP/V2) Actuator	SCM-TB7	62-64
Analog Output	AO_01	Analog Output #1 - Turbine Configurable	SCM-TB7	65-67
Analog Output	AO_02	Analog Output #2 - Turbine Configurable	SCM-TB7	68-70
Analog Output	AO_03	Analog Output #3 - Turbine Configurable	SCM-TB8	71-73
Analog Output	AO_04	Analog Output #4 - Turbine Configurable	SCM-TB8	74-76
Analog Output	AO_05	Analog Output #5 - Compressor Configurable	SCM-TB8	77-79
Analog Output	AO_06	Analog Output #6 - Compressor Configurable	SCM-TB8	80-82
Serial Port #3	COM #3	RS-232 Serial Port, DB9 Connector	SCM-COM#	
Serial Port #2	SIO #2	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB9	83-92
Serial Port #1	SIO #1	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB10	93-102

Table 3-2. AtlasPC SmartCore Board I/O List

I/O Type	Channel	Description	Analog Combo Terminal Block	Analog Combo Terminal Numbers
Analog Input	AI_01	Analog Input #7 - Comp 1 Flow	ANA1-TB1	1-3
Analog Input	AI_02	Analog Input #8 - Comp 1 Suction Pressure	ANA1-TB1	4-6
Analog Input	AI_03	Analog Input #9 - Comp 1 Discharge Pressure	ANA1-TB1	7-9
Analog Input	AI_04	Analog Input #10 - Comp 1 Suction Temp	ANA1-TB1	10-12
Analog Input	AI_05	Analog Input #11 - Comp 1 Discharge Temp	ANA1-TB2	13-15
Analog Input	AI_06	Analog Input #12 - Comp 2 Flow	ANA1-TB2	16-18
Analog Input	AI_07	Analog Input #13 - Comp 2 Suction Pressure	ANA1-TB2	19-21
Analog Input	AI_08	Analog Input #14 - Comp 2 Discharge Pressure	ANA1-TB2	22-24
Analog Input	AI_09	Analog Input #15 - Comp 2 Suction Temp	ANA1-TB3	26-28
Analog Input	AI_10	Analog Input #16 - Comp 2 Discharge Temp	ANA1-TB3	29-31
Analog Input	AI_11	Analog Input #17 - Compressor Configurable	ANA1-TB3	32-34
Analog Input	AI_12	Analog Input #18 - Compressor Configurable	ANA1-TB4	35-38
Analog Input	AI_13	Analog Input #19 - Compressor Configurable	ANA1-TB4	39-42
Analog Input	AI_14	Analog Input #20 - Compressor Configurable	ANA1-TB5	43-46
Analog Input	AI_15	Analog Input #21 - Compressor Configurable	ANA1-TB5	47-50
Analog Output	AO_01	Analog Output #7 – Comp 1 Anti-Surge Vlv Output	ANA1-TB6	51-53
Analog Output	AO_02	Analog Output #8 - Comp 2 Anti-Surge Vlv Output	ANA1-TB6	54-56
Speed Input	SS_01	Not Used	ANA1-TB6	57-59
Speed Input	SS_02	Not Used	ANA1-TB6	60-62

Table 3-3. AtlasPC Analog Combo Board I/O List

Discrete Inputs

Discrete inputs are optically isolated from the rest of the platform but are common to one another. 24 Vdc is supplied for wetting voltage at Terminal 26. See Figure 3-2 for discrete input connections.

Analog Inputs

Analog inputs are 4–20 mA. Inputs 1-11 on the top side of the board are 3-terminal connections (±SHLD). However, inputs 12-15 on the bottom left of the board are 4-terminal connections—The second terminal for each input is not used. No loop power is provided. If loop powered (2-wire) transmitters are used, an external power supply must be utilized. In this case, it is recommended that loops be individually protected with 100 mA fuses. See Figure 3-10 for example terminations.

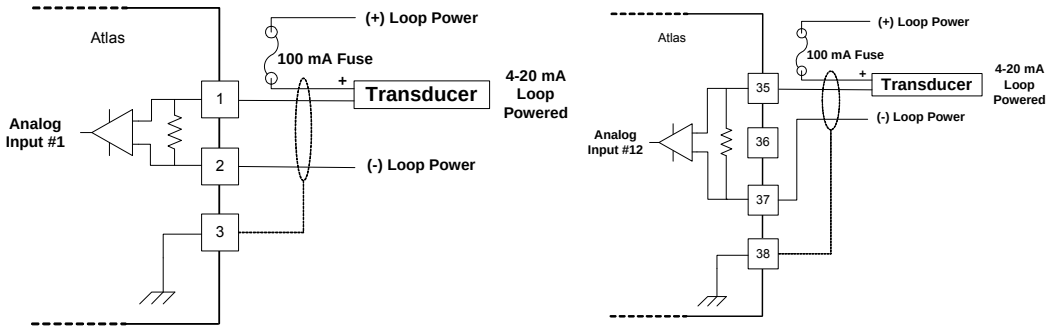


Figure 3-10. Analog Combo Analog Input Connections (Inputs 1-11 and 12-15)

Analog Outputs

Actuator outputs are typical 4–20 mA analog outputs. 15 Vdc loop power is provided. See Figure 3-11 for an example termination.

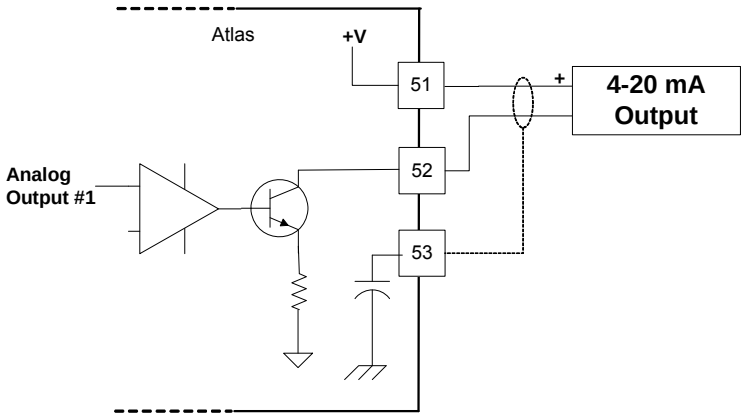


Figure 3-11. Analog Combo Analog Output Connections

Configurable analog outputs are provided on the SmartCore Board. See Figure 3-6 for a wiring example.

Figure 3-12 provides an overall, sample wiring diagram for the compressor I/O on the SmartCore and Analog Combo Boards. Compressor configurations vary, so this is provided as an example only.

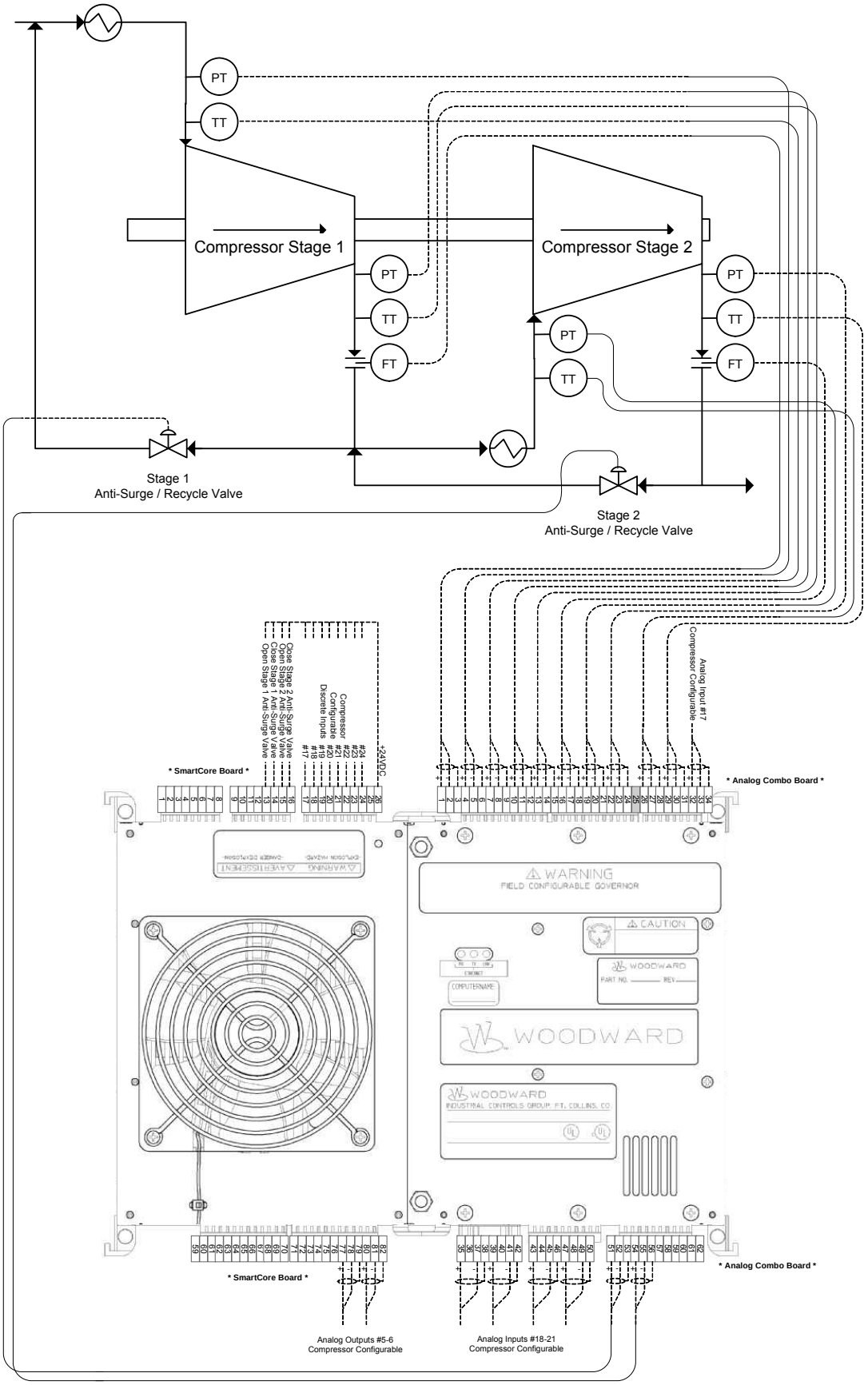


Figure 3-12. Compressor I/O / SmartCore / Analog Combo Connections

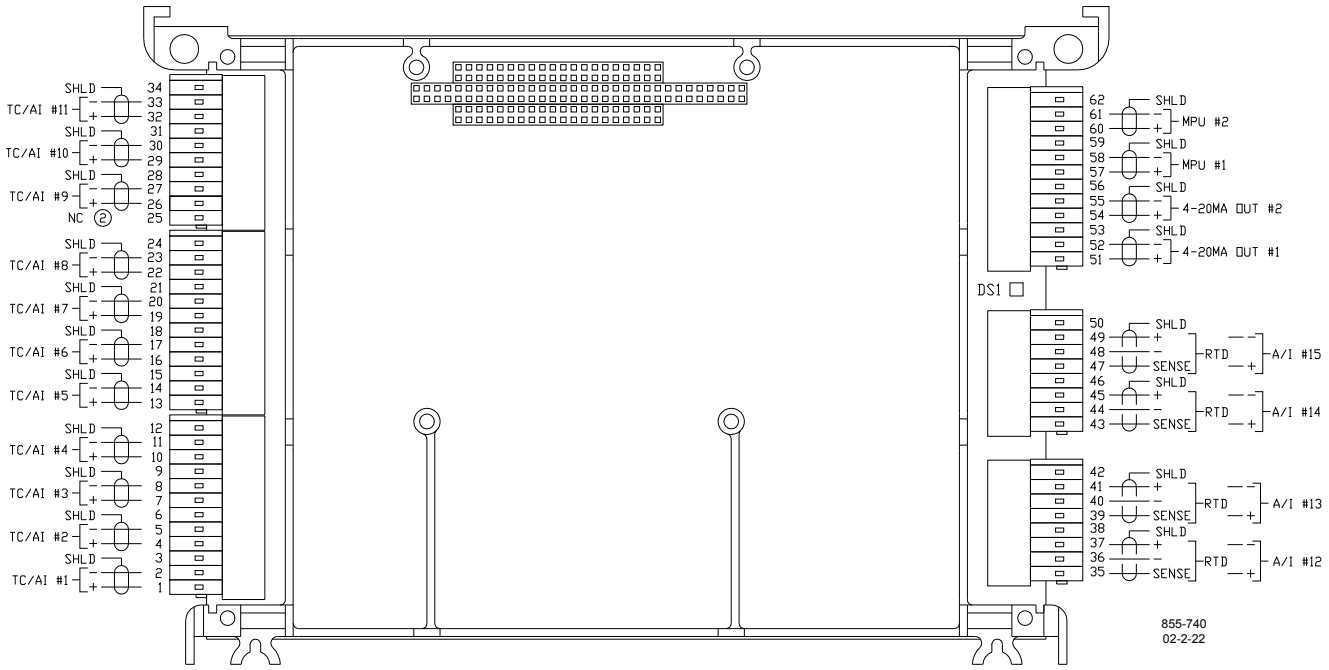


Figure 3-13. Analog Combo Board Connections

Discrete Outputs / Power Supply Board

All discrete outputs for both turbine and compressor are located on the Power Supply Board, the uppermost board in the Power Bus stack, directly beneath the cooling fan. The discrete outputs are not dry contacts. They are low-side relay drivers capable of up to 200 milliamps. As such, external interposing relays are usually required. Table 3-4 lists the Power Supply Board connections.

I/O Type	Channel	Description	Power Supply Terminal Block	Power Supply Terminal Numbers
Input Power		18-32 Vdc (65 W) Supply Power	PS-TB2	1-3
Fan Power		Internal Power to Cooling Fan	PS-TB4	6-7
Discrete Output	DO_01	Discrete Output #1 - Unit Shutdown	PS-TB5	8
Discrete Output	DO_02	Discrete Output #2 - Unit Alarm	PS-TB5	9
Discrete Output	DO_03	Discrete Output #3 - Turbine Configurable	PS-TB5	10
Discrete Output	DO_04	Discrete Output #4 - Turbine Configurable	PS-TB5	11
Discrete Output	DO_05	Discrete Output #5 - Turbine Configurable	PS-TB5	12
Discrete Output	DO_06	Discrete Output #6 - Turbine Configurable	PS-TB5	13
Discrete Output	DO_07	Discrete Output #7 - Compressor Configurable	PS-TB5	14
Discrete Output	DO_08	Discrete Output #8 - Compressor Configurable	PS-TB5	15
Discrete Output	DO_09	Discrete Output #9 - Compressor Configurable	PS-TB6	16
Discrete Output	DO_10	Discrete Output #10 - Compressor Configurable	PS-TB6	17
Discrete Output	DO_11	Discrete Output #11 - Compressor Configurable	PS-TB6	18
Discrete Output	DO_12	Discrete Output #12 - Compressor Configurable	PS-TB6	19
		Not Used	PS-TB6	20-21
Relay Power		18-32 Vdc External Relay Power	PS-TB6	22-23

Table 3-4. AtlasPC Power Supply Board I/O List

See Figure 3-14 for sample relay wiring using external relays or an optional Woodward 12-Channel Relay Module. See Chapter 8 for more information on the Woodward Relay Module.

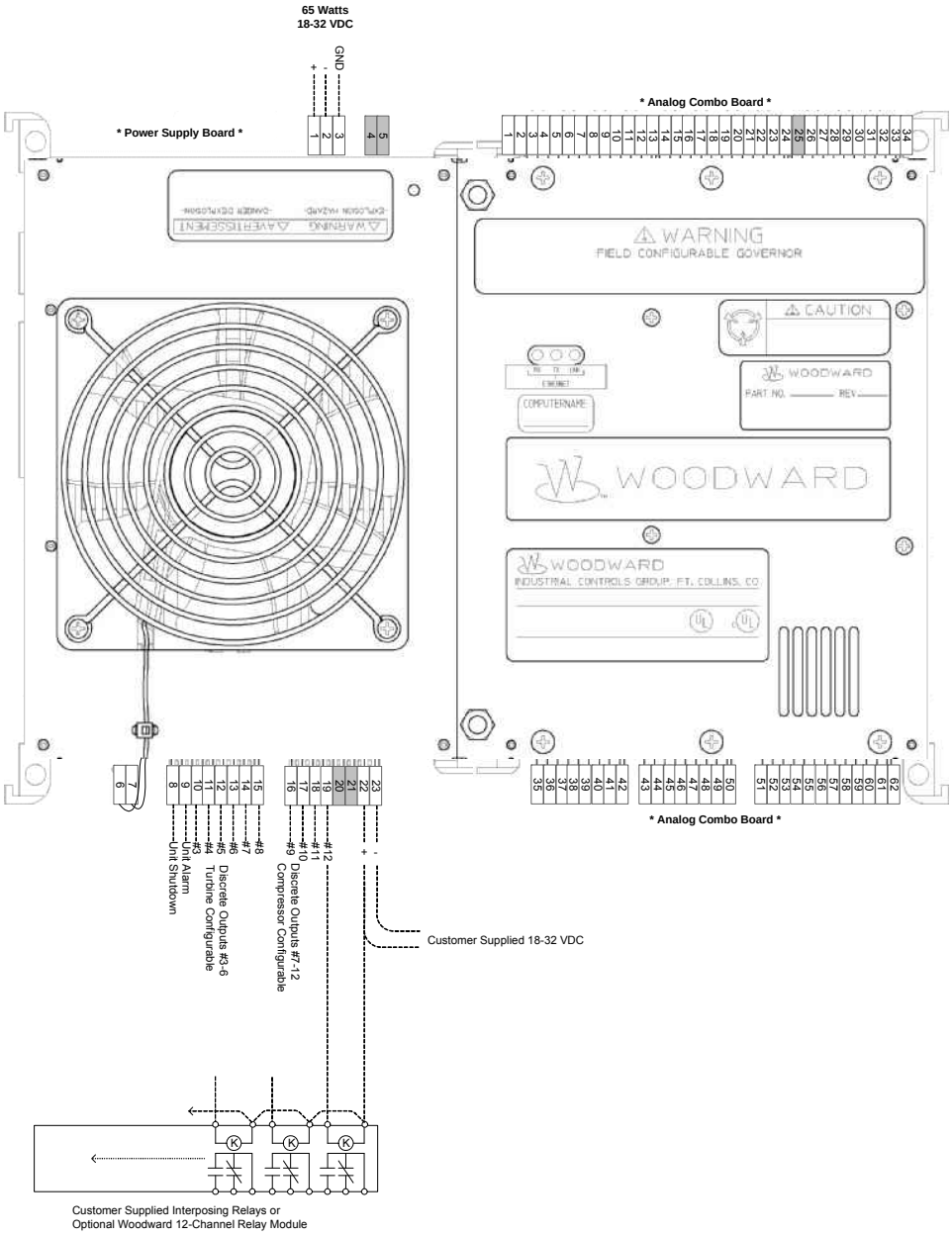


Figure 3-14. AtlasPC Power Supply Board Connections

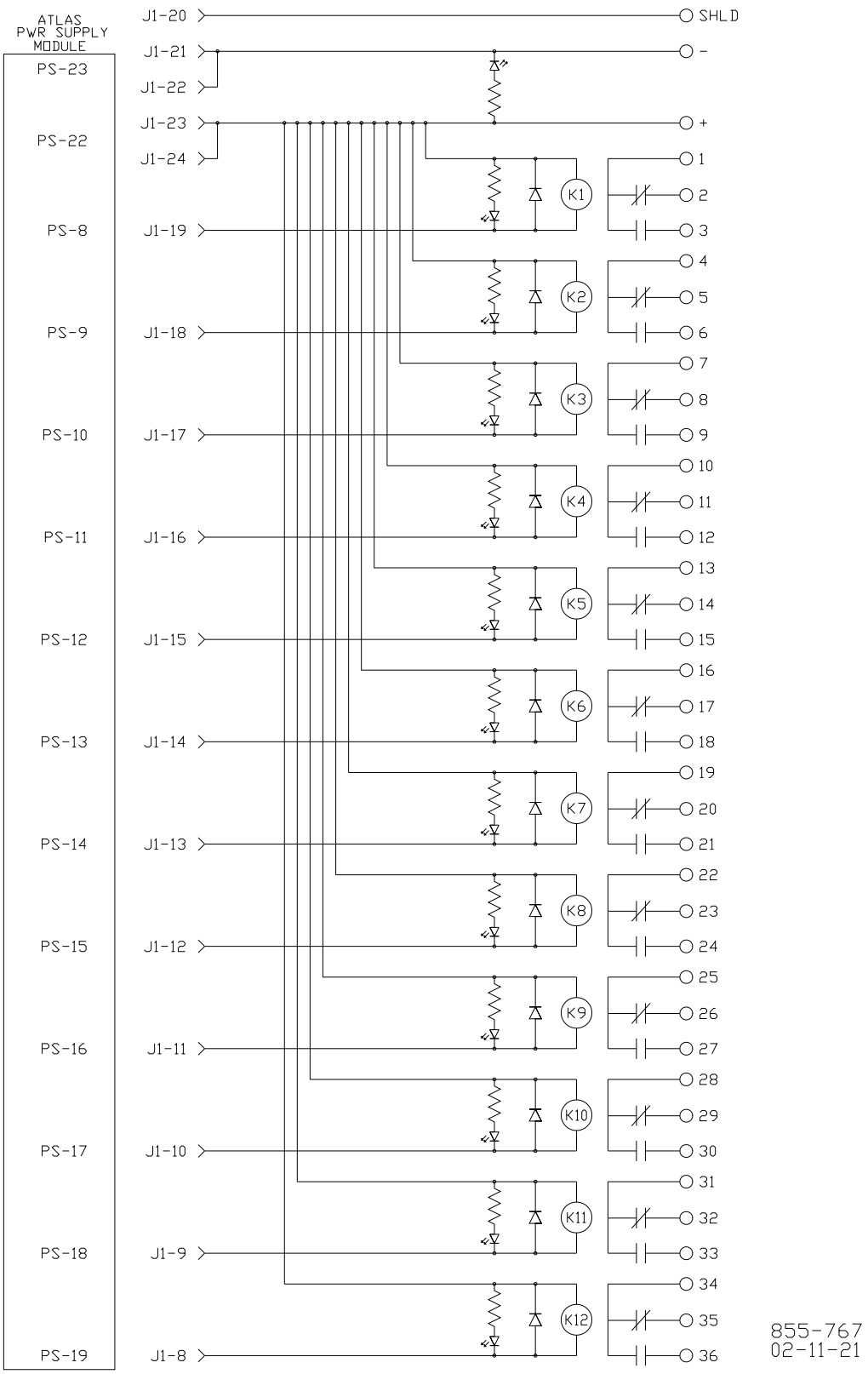


Figure 3-15. Optional 12-Channel Relay Module Connections

CPU

The CPU is the uppermost board on the right side of the control. It includes an RJ-45 10/100Base-T Ethernet jack as well as two DB9 RS-232 serial ports. These two serial ports should not be used for customer connections--Additional serial communications ports are provided for customer use on the SmartCore Board.

NOTICE

The two RS-232 ports on the CPU should not be used without isolators—It is recommended that the serial ports on the SmartCore board be used for serial communications.

There are no required field connections to the CPU, unless the control is installed on an Ethernet network or connected directly to a PC or the optional touchscreen HMI, in which cases the RJ-45 jack is used. If installed on a local area network (LAN) through an Ethernet hub or switch, a regular, straight cable is used (Figure 3-16). If the control is connected directly to a PC or the optional touchscreen HMI, a null, or crossover, cable is required (Figure 3-17). In either case, use port 1, or LAN1, on the HMI computer—LAN2 is a spare port.

To ensure signal integrity and robust operation of Ethernet devices, double shielded Ethernet cables (SSTP) are required for customer installations. Their primary function is to provide EMI shielding and proper shield termination of the Ethernet cable.

IMPORTANT

To fully realize 100 Base-TX connectivity, downstream devices must be 100 Base-TX capable. As such, when using an Ethernet hub for multiple connections, either a fixed 100 Base-TX or an auto-switching 10/100 Base-TX hub would be necessary.

NOTICE

Use shielded Ethernet cable only! Use of non-shielded cable may result in permanent system damage.

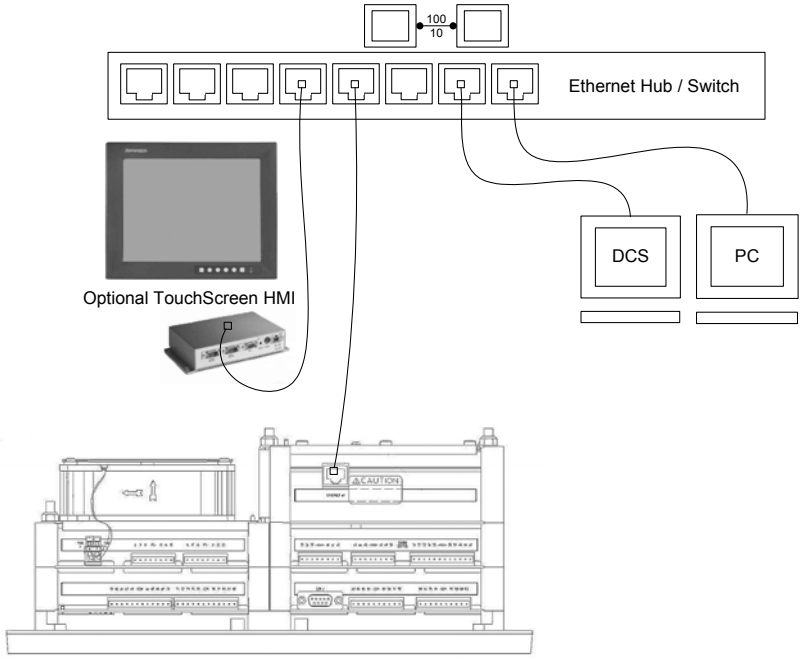


Figure 3-16. Connection to an Ethernet LAN

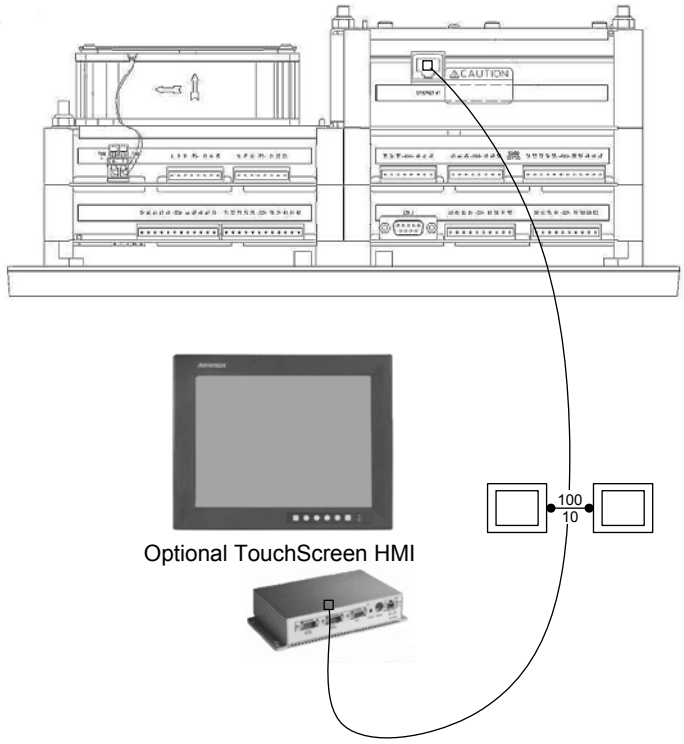


Figure 3-17. Peer-to-peer Ethernet Connection with Crossover Cable

HMI/CCT Software Installation

Full configuration and operation of the 505CC-2 Steam Turbine and Compressor Control is accomplished with the supplied HMI & Configuration Tool (CCT) software or the optional touchscreen HMI.

The HMI/CCT application was developed with Advantech's Studio automation software. The supplied CD will not only install the 505CC-2's HMI/CCT application, but also a fully functional version of Advantech's Studio software. The supplied license key will facilitate runtime operation of the 505CC-2 HMI/CCT. A development key is also available from Advantech that would permit customization of the 505CC-2 HMI & Configuration Tool, or use of AStudio for development of any other automation project.

To install the HMI/CCT onto a Microsoft Windows 2000/XP computer, load the supplied compact disc (CD) into the computer's CD drive. The installation program should start automatically—If not, browse to the CD drive and run the file *setup.exe*.

The first part of the installation will launch the separate AStudio install. It is strongly recommended that you retain all default selections, paths, and program groups suggested by the installer. During this install, you are given the opportunity to select which AStudio components will be copied. If desired, deselect *Demo Files*, *WinCE 3.0*, *WinCE 4.x*, and *Web Tunneling Gateway* as shown in Figure 3-18—These are not used by the 505CC-2 HMI/CCT. However, leaving them selected will not cause any problems.

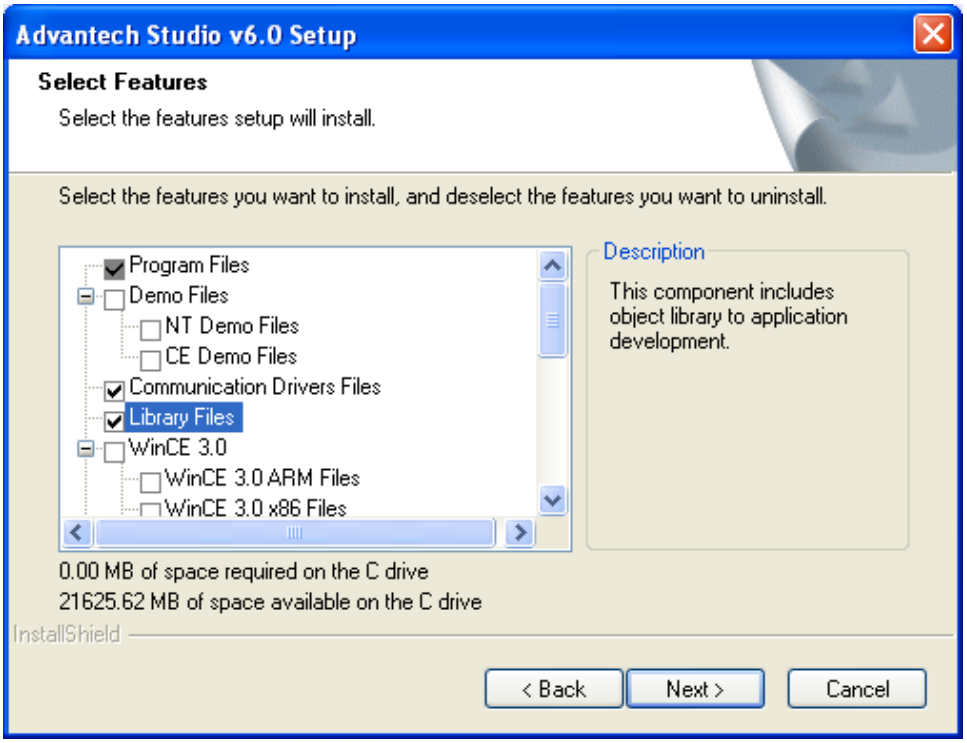


Figure 3-18. AStudio Installation Components

Depending upon the Windows components currently installed on the computer, you may receive warnings or error messages during the AStudio installation. For example, a common message relates to existing Microsoft Data Access Components--Simply acknowledge this or other messages by selecting OK or CANCEL as necessary.

Also, at the end of the AStudio installation, you will be prompted to reboot the computer. Select NO to REBOOT LATER. You will be prompted again at the end of the complete installation, at which time the computer should be rebooted.

The communications interface between the HMI/CCT and the control is a combination of Modbus and a specialized OPC connection managed by Woodward's ServLink OPC Server (SOS). The installer will launch another separate install of this OPC server software and automatically configure the server to connect to the default 505CC-2 IP address. Similar to the AStudio installation mentioned above, it is strongly recommended that you retain all default selections, paths, and program groups suggested by the SOS installer.

The third piece of software to be installed is Woodward's Application Manager (AppManager). In addition to providing control over the 505CC-2's application software, AppManager is the most reliable method for verifying the control's name and IP address. It also facilitates IP address changes and can assist in copying datalogs from the control to the HMI/CCT computer. Similar to the installations mentioned above, it is strongly recommended that you retain all default selections, paths, and program groups suggested by the AppManager installer.

The installer will continue to copy the necessary files, configure settings, and register ActiveX controls necessary for the HMI/CCT's proper operation. At the end of the complete installation, select the option to reboot the computer.

ServLink OPC Server (SOS)

Most of the configuration data and operating commands from the HMI/CCT to the 505CC-2 control are handled via Modbus. However, a small number of configuration values, application file data, and system level commands can only be accessed through Woodward's proprietary ServLink protocol. The SOS Server acts as a protocol converter between ServLink and OPC, and as a typical OPC server facilitating a normal OPC connection by the HMI/CCT application (OPC client) to the control. See Figure 3-19 for a functional diagram of communications between the 505CC-2 and the HMI/CCT software.

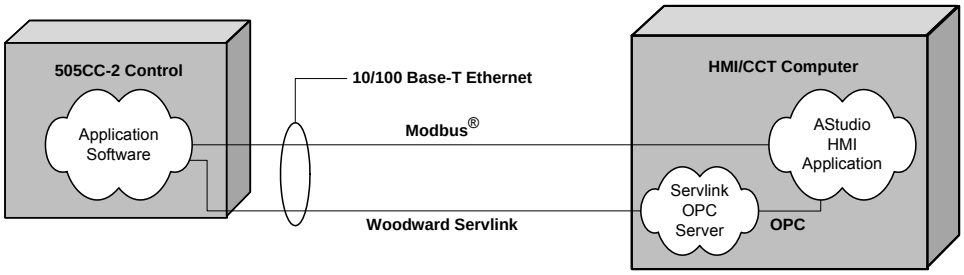


Figure 3-19. 505CC-2--HMI/CCT Communications

As noted previously, the OPC server will be configured during installation to connect to the default 505CC-2 IP address of 190.14.99.220. If the control's IP address is actually different or is changed for installation on a network, for example, the OPC server configuration must be modified. The simplest way to verify the address is by connecting to the control with Woodward's AppManager software (available on the HMI/CCT installation CD). See the IP Addresses section later in this chapter for more information.

IMPORTANT

The following instructions for modifying the default SOS configuration presume that the HMI/CCT computer and 505CC-2 have a good Ethernet connection.

The SOS Server is launched automatically by the HMI/CCT software. It loads to the Windows system tray in the lower right corner of the screen. To open the SOS window, double click on its icon in the system tray.

Figure 3-20 shows a failed SOS connection to a 505CC-2 control. In this example, the SOS Server is attempting to connect to the default IP address of 190.14.99.220. But, the 505CC-2 IP has been changed to 190.14.98.91.

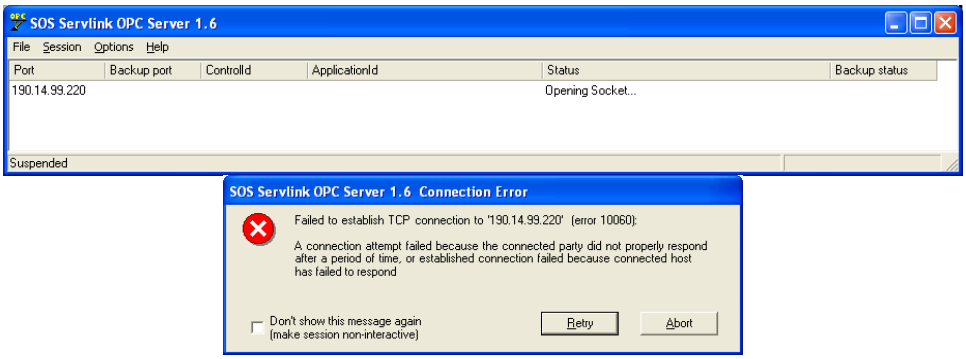
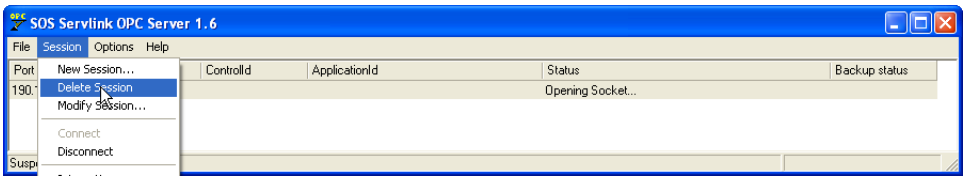
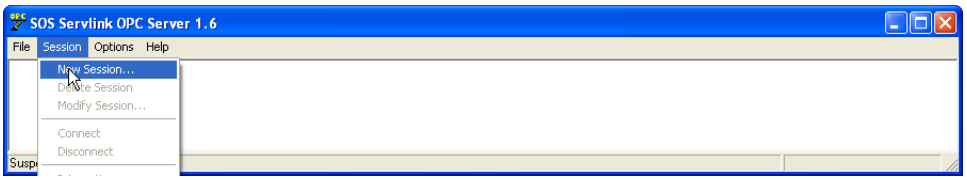


Figure 3-20. Failed ServLink Connection

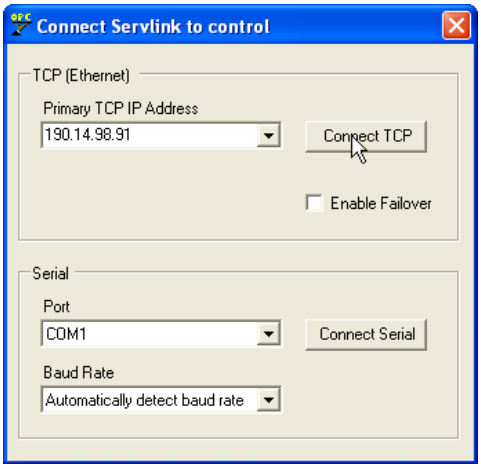
To make the desired connection to 190.14.98.91, the existing SOS session must be deleted and a new session opened. To delete the session with 190.14.99.220, select it in the SOS window. Then select *Delete Session* under the *Session* menu and acknowledge the warning.



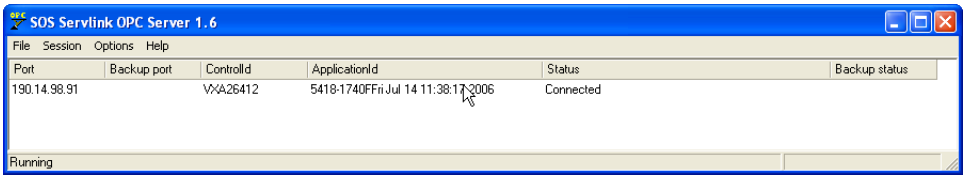
Now, select *New Session* under the same menu.



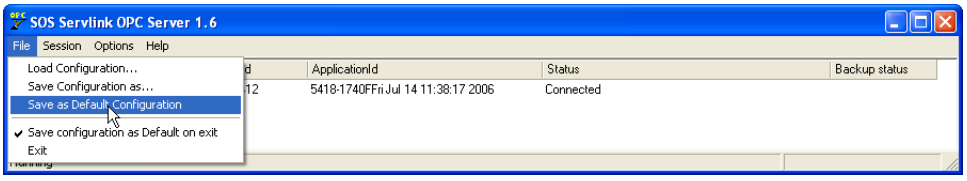
A pop-up will prompt for the new IP address. Enter the correct address and select *Connect TCP*.



After connecting to the 505CC-2 and polling its OPC tags, the SOS server will indicate a successful connection.



Under the *File* menu, select *Save as Default Configuration* to save the new IP address as SOS's default.



The SOS Server is now connected to the 505CC-2, but the HMI/CCT application must also be properly configured to utilize this connection. Refer to the System Configuration screen detail later in this chapter for information on setting the HMI/CCT's Control ID and IP Address.

The SOS Server application is intended to operate as transparently as possible. Under routine conditions, launching the HMI/CCT automatically launches SOS. Similarly, SOS is automatically closed when the HMI/CCT is closed. However, computers and networks are not immune from communications problems or operational errors. The SOS Server runs minimized in the Windows system tray in the lower right corner of the screen. It is also shown in the Windows Task Manager as a Process, not an Application.

To manually shutdown an SOS session, select *Exit* under the *File* menu—Simply closing the window with the X in the upper right corner returns the application to the system tray. Occasionally, an SOS session remains open in Windows even though its icon does not appear in the system tray. To manually shutdown such a session, open the Windows Task Manager (*Ctrl-Alt-Del*), select the *Processes* tab, and find and end SOS.exe (see Figure 3-21).

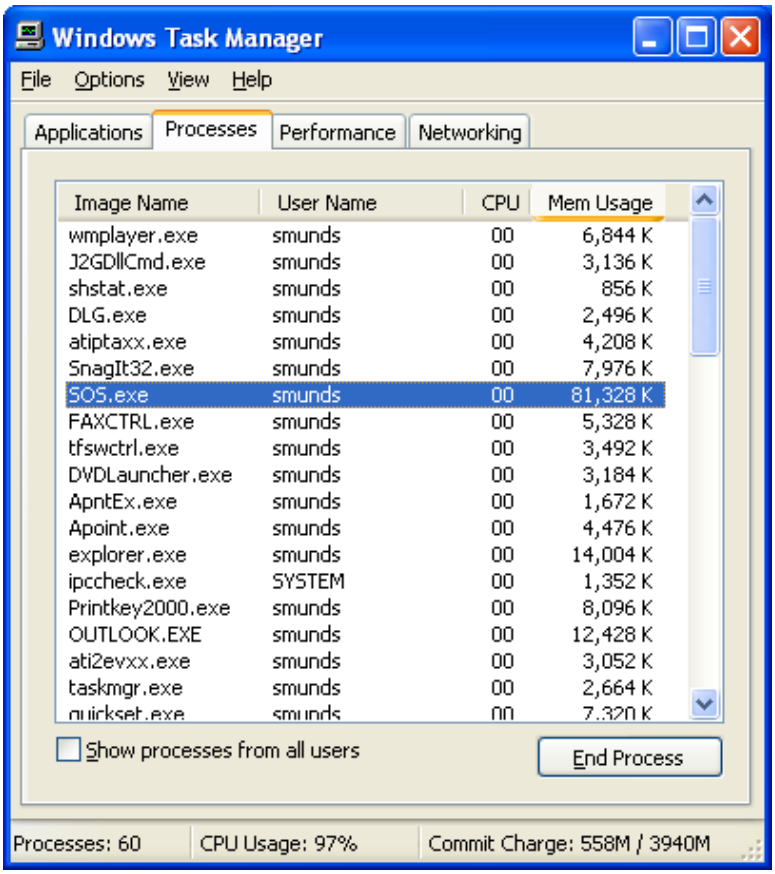


Figure 3-21. Windows Task Manager – SOS.exe Process

HMI/CCT Start-Up / Screen Navigation

IMPORTANT

The HMI/CCT application requires a license key (included) for normal runtime. The key must be properly installed (parallel port or USB hardware keys) or configured (software keys) for the HMI/CCT to run properly.

Upon launching the 505CC-2 HMI/CCT application, the SOS Server is automatically initiated as a background task. After it connects to the 505CC-2 and polls for its OPC tags, it will be minimized to the HMI/CCT computer's system tray.

Simultaneously, the HMI/CCT is establishing a Modbus connection to the control. During this time, the splash screen shown in Figure 3-22 is briefly displayed. If there is no control to which to connect or the HMI/CCT has never been configured, select the *Go To Offline Configuration* button to enter the Offline mode.

Figure 3-22. Splash Screen

After Modbus has connected successfully, the Main Menu will be displayed. The screens are arranged in a traditional drill-down menu tree orientation, with separate branches for configuration and operation of both the turbine and compressor, as well as for overall system functions (file management, alarming, trending, etc.). The header and footer are common across all screens. The former indicates the login level, screen name, date, and time. The latter displays status messages and data for the turbine and compressor, navigation buttons, and indicators for active alarm and communication link health. Upon startup, the uppermost, or home screen, the Main Menu, is available. See Figure 3-23 for an example of the Main Menu Screen and the common screen header and footer.

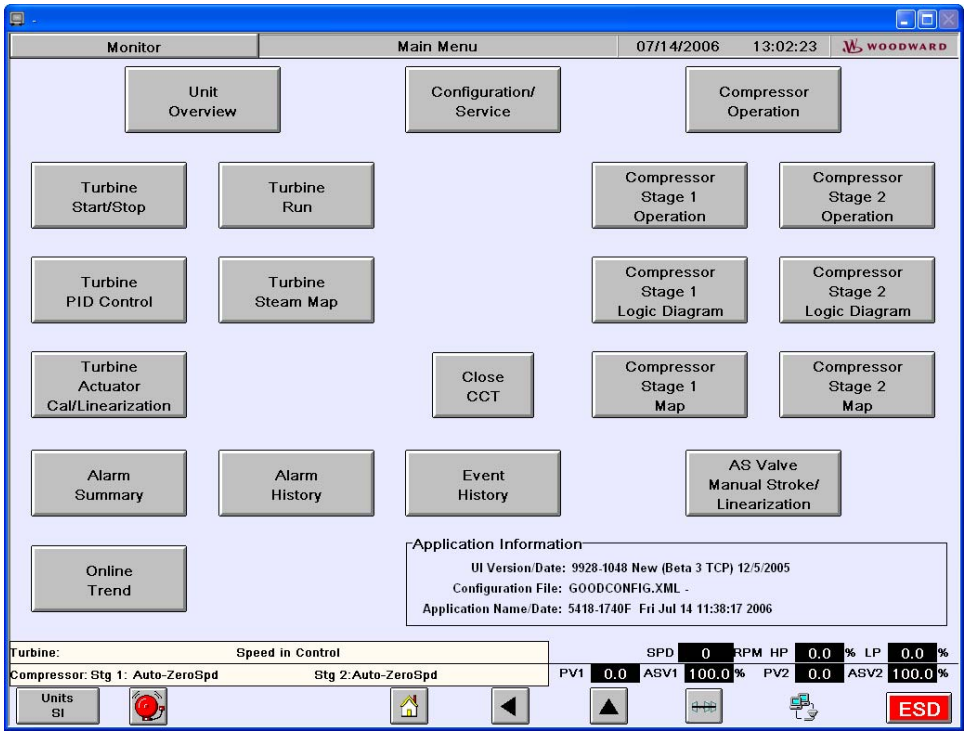


Figure 3-23. Main Menu

Select the Units button to toggle between Imperial (English) and SI (System International) units.

The Alarm indicator will blink to indicate an active, unacknowledged alarm. Click the button to jump to the Alarm Summary screen.

Select the Local/Remote button to toggle between Local and Local/Remote modes, if configured.

Select the Home button to jump to the Main Menu screen.

Select the Back button (left arrow) to jump to the previously viewed screen.

Select the Up button to jump to the previous, upper level screen.

Select the Unit Overview button to jump to the Unit Overview graphics screen.

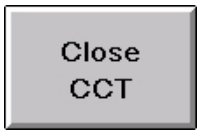
The Communications Health indicator will blink if the communications link (Modbus) is failed. Once communications are restored and the alarm acknowledged and reset, the indicator will return to normal.

Once the control is powered-up and communications are established, the Communications Health indicator will change and online functionality will be available.

In the Offline configuration mode, the HMI/CCT, even if physically connected to a control, is “offline” relative to that control. Any configuration changes are not maintained, unless saved to a configuration file. Configuration parameters are not written to the control in this login level.

IMPORTANT **For proper communications, verify that the control and all connected Ethernet devices have properly configured IP addresses. See the *IP Addresses* section later in this chapter.**

The Shutdown indicator will blink to indicate an active shutdown. Click the button to initiate an emergency shutdown.



Near the center of the Main Menu screen, the Close CCT button will terminate the HMI/CCT application but has no effect on the 505CC-2 or its controlling of the turbine/compressor unit.

Alarm Summary/History, Event History

The Alarm Summary screen, shown in Figure 3-24, provides a time-stamped summary of 505CC-2 alarm conditions. The alarm messages are expanded text to provide intuitive feedback to the Operator as to the alarm condition. New, active, unacknowledged alarms are displayed in red. Use the Ack or Ack All buttons to acknowledge alarms and the Reset button to issue a system reset. Active, acknowledged alarms are shown in blue, and inactive, unacknowledged alarms are shown in green.

The appearance of the alarm summary can be customized with the Columns button, allowing the Operator to add or delete columns of pertinent information. Column widths and sorting are also adjustable via the column headers.

The Alarm History screen, similar to the Summary screen shown above, maintains a running list of alarm, acknowledge, and return-to-normal events. The Event History screen lists pre-defined, time-stamped control events.

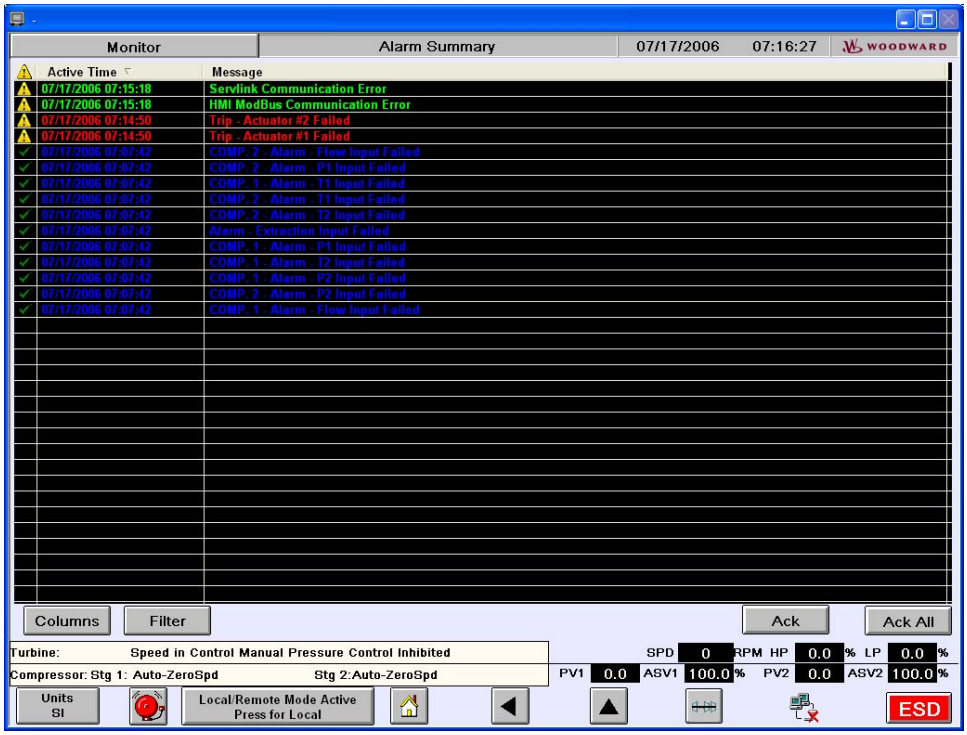


Figure 3-24. Alarm Summary Screen

Online / Historical Trend

From the Main Menu shown in Figure 3-23, select the Online Trend or Historical Trend button to access the trend screen, shown in Figure 3-25. The historical and online trend screens are similar in appearance and control—The descriptions below apply to both except where noted.

The same Online Trending screen may be launched by trend buttons located throughout the HMI—The trend will be loaded with data relevant to the button's location.

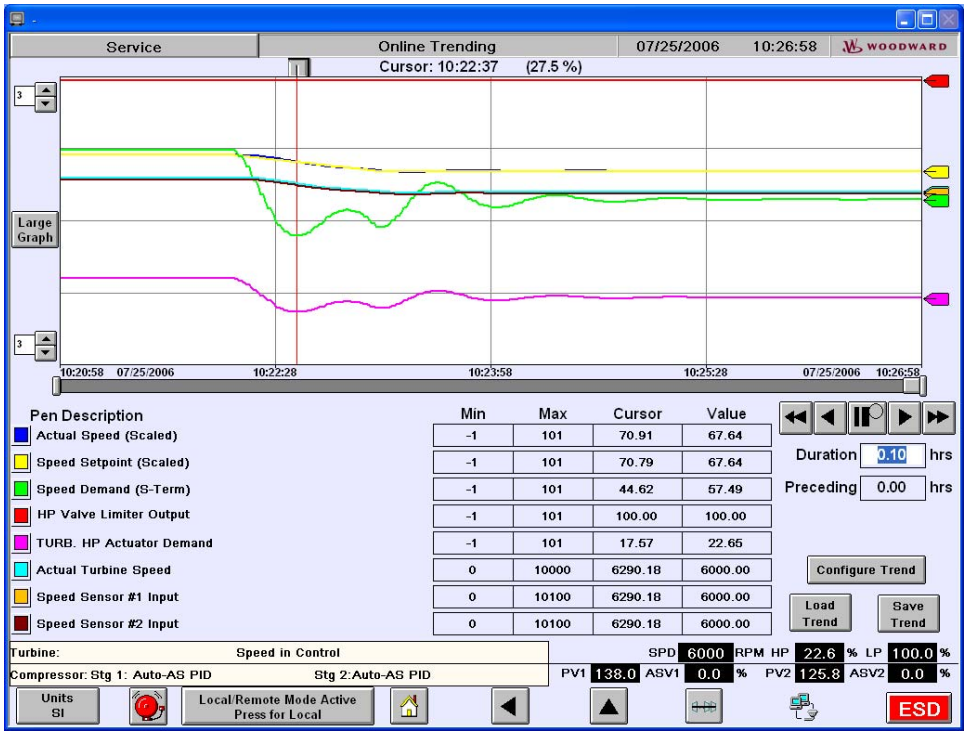
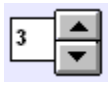


Figure 3-25. Online Trend Screen

The trend may display up to eight pens at a time. Individual pens may be turned on and off by selecting their color squares in the legend. Along with the description, minimum and maximum trend values (Y-axis limits), a cursor value, and current value (Online Trending only) are displayed for each pen. The min and max limits are adjustable for each pen. The cursor value is the value of the pen at its intersection with the vertical cursor, which may be moved horizontally across the trend window. The current value is the pen value at the right edge of the trend (Online Trending only).



Gridlines may be added to or removed from the trend window by adjusting the horizontal (located at the top of the Y-axis) and vertical (located at the bottom of the Y-axis) gridline settings.

Select the Large Graph button to expand the trend window. In this format, the trend legend and controls are unavailable.

To the right of the trend screen, the trend window's Duration and Preceding Hours values are displayed. These parameters are adjustable and define the X-axis time values of the current trend. The Duration is defaulted to 15 minutes for Online Trending and four hours for Historical Trending. It may be expanded to 24 hours in either case. The slider at the bottom of the trend will adjust the current view within a 24-hour period. Simply adjusting the Preceding Hours value will do the same.

The adjustment arrows also manipulate the Preceding Hours value, but in fixed time increments:

Shifts the view to the left:	One hour for Online Trending Four hours for Historical Trending	
Shifts the view to the left:	15 minutes for Online Trending One hour for Historical Trending	
Shifts the view to the right:	15 minutes for Online Trending One hour for Historical Trending.	
Shifts the view to the left:	One hour for Online Trending Four hours for Historical Trending.	
Pauses Online Trending (disabled for Historical trending)		

At the bottom right of the screen, controls are provided to customize, save, and load a configured trend. Select the Configure Trend button to access the trend configuration pop-up shown in Figure 3-26.

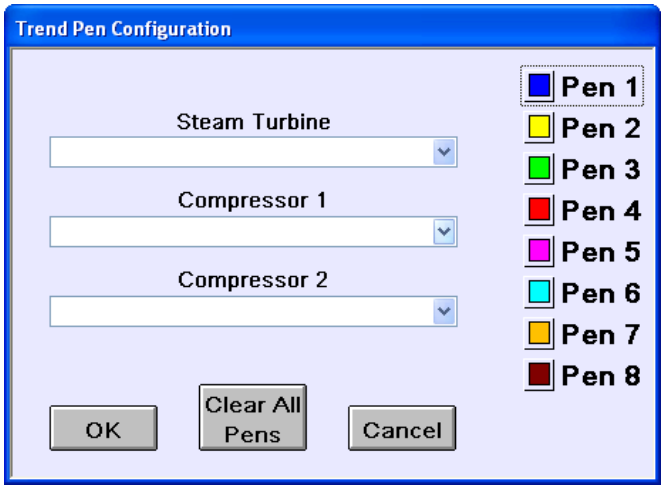


Figure 3-26. Trend Configuration Pop-up

Any or all pens on the current trend may be modified by first selecting the pen in the legend and then selecting the desired point from one of the available lists. If more than one point is selected from the lists after designating the pen, the last one selected will be assigned to the pen. Select OK to view the configured trend.

Once a customized trend is configured, it may be saved for later access. Select the Save Trend button to access the Trend File Save pop-up. Assign a file name as desired and select Save.

A custom configured trend, as well as any existing default trend, may be loaded via the Load Trend button. Select any available trend from the browse window, and select Load.

The HMI/CCT has been configured to archive typical data for the turbine and compressor. Historical trend files are maintained on the HMI computer for 30 days, after which time they are deleted. After one day, they are compressed to conserve disk space on the HMI computer. The list of available data points has been limited to keep the trend files to a manageable size. If other parameters or more significant archiving is required, an external data logger is recommended. If higher resolution is required for troubleshooting, see the information on high-speed datalogs elsewhere in this manual.

IMPORTANT

Because of limited storage space, historical trending is not available on the optional touchscreen HMI. Historical data archiving is automatically suspended if disk free space on any HMI computer falls below 500 MB.

Log-in / Security Levels

In the upper left corner of the screen is an indicator of the current log-in level—Click the button to change levels as shown in Figure 3-27.

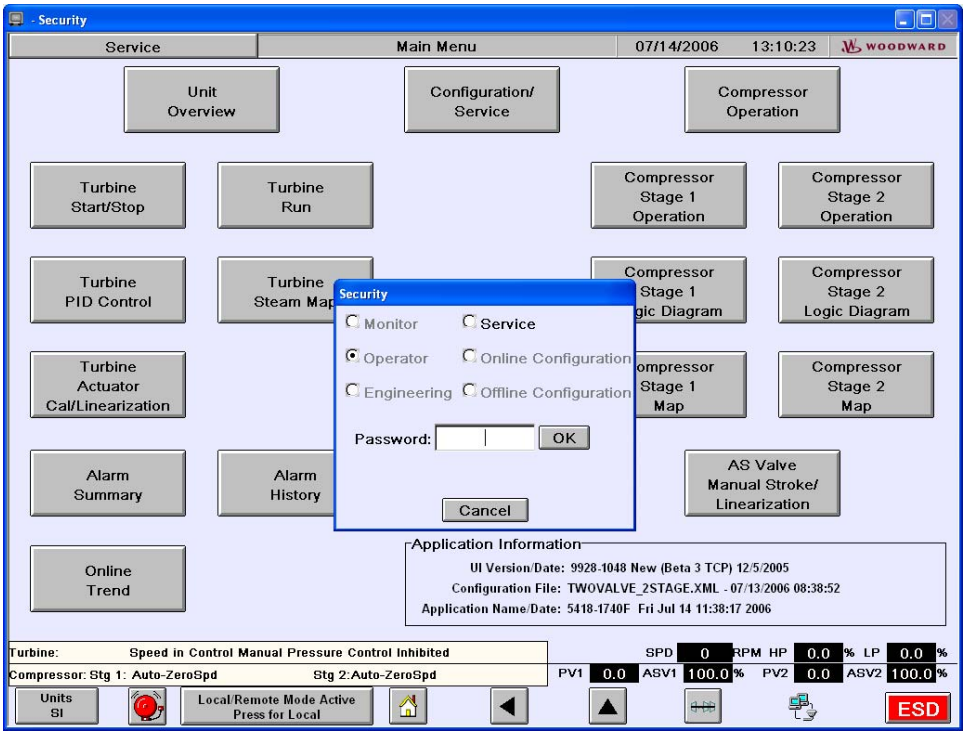


Figure 3-27. Log-in Level

There are six levels of log-in with varying degrees of security applied to configuration and operation actions. See Table 3-5 for details. See Appendix A for a list of default log-in passwords.

Log-in Level	Security Level
Monitor	No configuration permissions. Operational permissions limited to alarm acknowledge. In this login, the HMI acts merely as a “dumb” terminal.
Operator	Full command of all operating screen functions with the exception of PID tuning, valve calibrations, Online compressor map adjustments, and compressor Full Manual operating mode.
Engineering	Full operation permissions (same as Operator but without its exceptions).
Service	Full operation and configuration permissions.
Online Configuration	Full configuration permissions. Highest security level. Requires that the turbine/compressor unit is shutdown. The 505CC-2 is forced into I/O lock.
Offline Configuration	Off-line configuration mode. Full configuration permissions. The HMI/CCT is not connected to the control. Or, if connected, any configuration changes are not written to the 505CC-2. Offline is not meant to imply that the turbine/compressor is not running.

Table 3-5. Log-in / Security Levels

NOTICE

The Service log-in provides access to all turbine and compressor configuration parameters. Some parameters, if adjusted while the unit is running, could cause unpredictable or dangerous control behavior. It is strongly advised not to adjust critical parameters (Turbine General Configuration and Compressor General Configuration screens, for example) while the unit is running. For safety, some of these parameters, if changed while the unit is running, will not be acknowledged by the control.

NOTICE

The Online Configure security login will force an I/O Lock on the AtlasPC control and, therefore, can only be accessed when the turbine is shut down. This mode is inhibited if the turbine is running. I/O Lock is indicated by the Turbine Status message in the HMI/CCT screen footer and by red LEDs active on the 505CC-2’s I/O boards. I/O Lock is cleared when leaving the Online Configuration login—If I/O Lock remains while in any other security level, return to Online Configuration, then revert back to Monitor to clear I/O Lock.

These security levels determine what functions and configuration permissions are available to the user. In general, the higher the log-in level, the more functions and configurables are available. Some turbine parameters (Teeth Seen by MPU and Gear Ratio) require re-initialization of the control to take effect--They can be changed at any time, but until re-initialization, the new value is ignored by the control. This is accomplished by tuning these parameters in the Online Configuration mode when the unit is shutdown. Upon exiting Online Configuration into Monitor, the control is re-initialized and the new settings will take effect. Other parameters (PID tuning, speed setpoints, etc.) can safely be changed online and, as such, are available in the Engineering and Service levels.

To prevent multiple connections of the HMI/CCT from fighting for control of a single 505CC-2, a configuration token scheme is applied to the security login levels. If a connection is established in Operator, Engineering, Service, or Online Configuration modes, any other HMI/CCT session is limited to Monitor and Offline Configuration. The HMI/CCT session in control will remain so until its security level is changed to Monitor or Offline Configuration, thereby freeing the 505CC-2 for another HMI/CCT session. For similar reasons of security, loss of communications (Modbus) will force the control back to Monitor mode.

Discrete selections are made via check boxes where an “X” indicates an enabled or chosen function. Adjustable analog values are indicated by up/down arrows to the right of the value. Selecting the analog field box will open an adjustment pop-up. Use the adjustment arrows to increase or decrease the value, or select (highlight) the numerical value within the pop-up for direct entry of a value.

In Service mode or lower, changes to some analog configuration value by direct numerical entry are limited to ten percent (10%) of the current value. This is intended to prevent inadvertent entry of a substantially incorrect value and the subsequent configuration errors or operational upsets that could result on a running turbine. Therefore, ramp buttons are provided to adjust the value in fine (1%) or course (10%) increments. Once within 10% of the target value, the value may be entered directly. Direct entry is always enabled in either Configure mode. For this reason, and because of the re-initialization requirement mentioned previously, the Online Configuration mode is recommended for initial configuration of a control.

Analog values on operating screens (setpoints, demands, presets, etc.) may be adjusted with ramp buttons, as described above, or direct entry of an analog value. Some of these may be limited by the 10% rule defined above if their function is somehow related to configuration. If the control rejects a value that is greater than 10%, re-enter smaller values until the desired value is reached.

See the applicable turbine and compressor control manuals for detailed configuration and operation instructions. The following sections provide system level configuration instructions.

Configuration Menu / System Configuration

The Main Menu screen provides single button access to all turbine and compressor operating screens. Select the Configuration / Service button to access the configuration menu, shown in Figure 3-28.

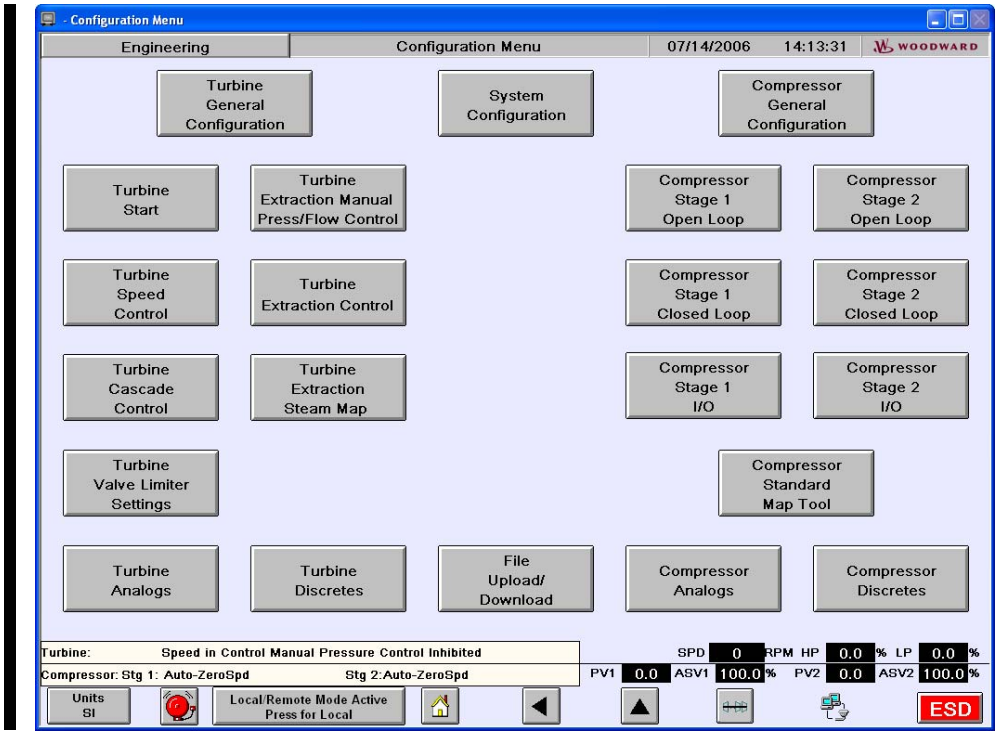


Figure 3-28. Configuration Menu

The Configuration Menu screen provides single button access to all turbine and compressor configuration screens, configuration file management, and system configuration. Select the System Configuration button to access that screen, facilitating system level configuration including Modbus setup. See Figure 3-29.

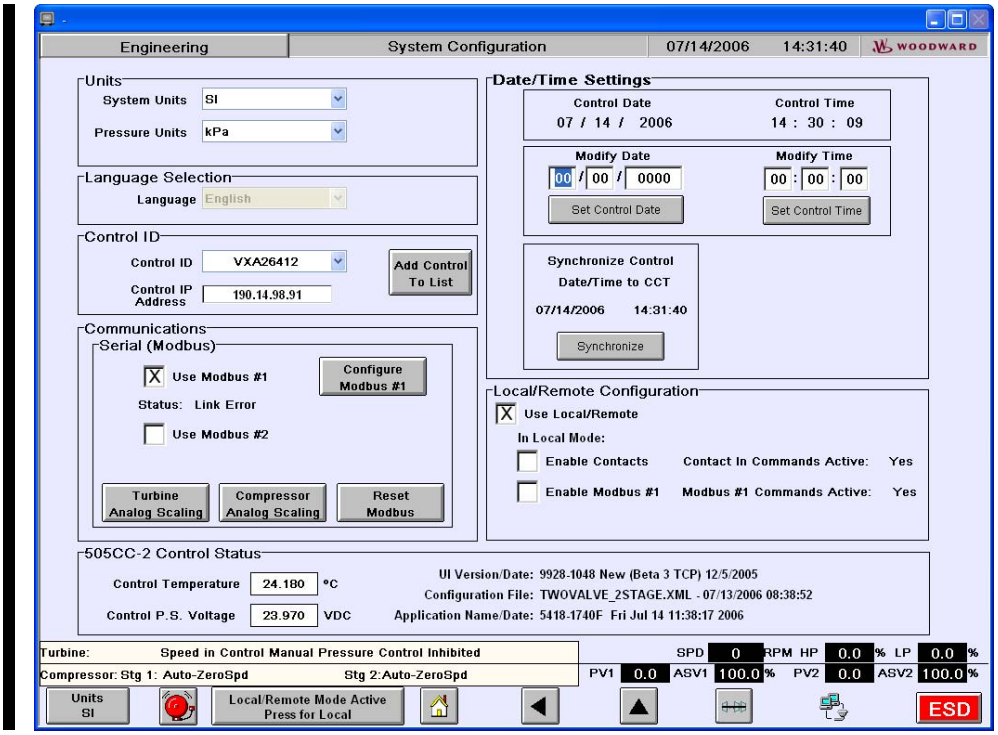


Figure 3-29. System Configuration Screen

- **Units**
  Select the desired units convention and base pressure unit. These selections will customize the HMI/CCT appearance. The compressor control software is written in SI units (kPa, ˚C). So, compressor input signals (flow, pressure, temperature) must be calibrated in these units or the 505CC-2 input ranges adjusted accordingly. But, the HMI/CCT will convert values where appropriate for display. The turbine software normalizes all values, so this unit selection is necessary for display only.

- **Language Selection**
  The default language selection is English. Future versions of the 505CC-2 may support other languages.

- **Control ID**
  Enter the Control ID and IP Address of the 505CC-2 to which the HMI/CCT is to connect. The Control ID can be found as the "ComputerName" on a tag on the top of the AtlasPC control. The IP Address is defaulted to 190.14.99.220, but it, along with the Control ID, may be verified by connecting to the control with Woodward's App Manager software, available on the installation CD. These parameters may be configured in the Offline Configuration mode—Then, revert to Monitor and await a connection.

- **Communications**
  See the Modbus section later in this chapter for details on Modbus communications, including port configuration, Modbus addresses, etc.

- **Date/Time Settings**
  The current date and time of the connected control are shown in the Date/Time Settings box. If desired, enter a new date and/or time and press the respective button to update the connected control. Alternatively, the control's date/time can be synchronized to that of the HMI/CCT by pressing the Synchronize button. If a turbine configurable discrete input is assigned as Real Time Clock Auto Sync, input fields are provided, as shown in Figure 3-29, for a synchronizing time. This time value, in 24-hour format (00:00 – 23:59), will be written to the control's real time clock whenever the assigned discrete input is pulsed. Because the day is not being synchronized by this function, it is advised that the synchronization pulse not be configured for near midnight (00:00). Otherwise, the possibility exists for the dates on the control and the master device to become unsynchronized.

- **505CC-2 Control Status**
  The 505CC-2 Control Status box provides basic control information—No configuration is required. If connected to a control, the power supply voltage and cold junction temperature are indicated. Also displayed are the names and time/date stamps of the current HMI/CCT application, configuration file, and control software.

Local/Remote Function

The Local/Remote function allows an operator using the HMI/CCT to disable any remote command, discrete input or Modbus command from a remote control room for example, that may put the system in an unsafe condition. This function is typically used during a system startup or shutdown to allow only one operator to manipulate the 505CC-2's control modes and settings. If Local/Remote is not configured, discrete inputs and Modbus commands, if configured, are enabled at all times.

IMPORTANT	**The optional touchscreen HMI, or a similar HMI/CCT computer provided by the user, may be installed anywhere, even some distance from the 505CC-2 and/or the turbine/compressor unit. With regard to the Local/Remote functionality the HMI/CCT is always considered Local, no matter where it is installed.**

When configured, the Local/Remote function provides a Local-only mode, in which the HMI/CCT is the sole control station. This Local mode can be further customized to enable discrete inputs and/or Modbus commands if necessary. Regardless of this supplemental configuration, the following inputs/commands are always enabled in the Local control mode:

External Trip Discrete Input
External Trip 2 Discrete Input
External Trip 3 Discrete Input
External Trip 4 Discrete Input
External Trip 5 Discrete Input
Override MPU Fault Discrete Input
Start Permissive Discrete Input
Select Online Dynamics Discrete Input
Local/Remote Discrete Input
Local/Remote Modbus Command (if Modbus is configured)
Trip/ESD Modbus Command (if Modbus is configured)

If the control mode is switched from Local to Local/Remote, the 505CC-2 can be operated through the HMI/CCT, discrete inputs, and/or all Modbus commands.

When using a discrete input to select between Local and Local/Remote modes, a closed contact, or high input, selects the Local/Remote mode and an open contact, or low input, selects the Local mode.

A turbine configurable discrete output may be assigned to indicate (energized) when Local mode is selected. There is also indication of the Local/Remote mode selection through Modbus (TRUE for Local/Remote mode, FALSE for Local mode).

Local/Remote Configuration

If Local/Remote is not configured, all available sources, the HMI/CCT, discrete inputs, and Modbus, are enabled for control commands. However, Modbus commands are enabled only if one or both Modbus ports are configured, and the Enable Commands check box is selected in the respective Modbus configuration pop-up. See Figure 3-30.

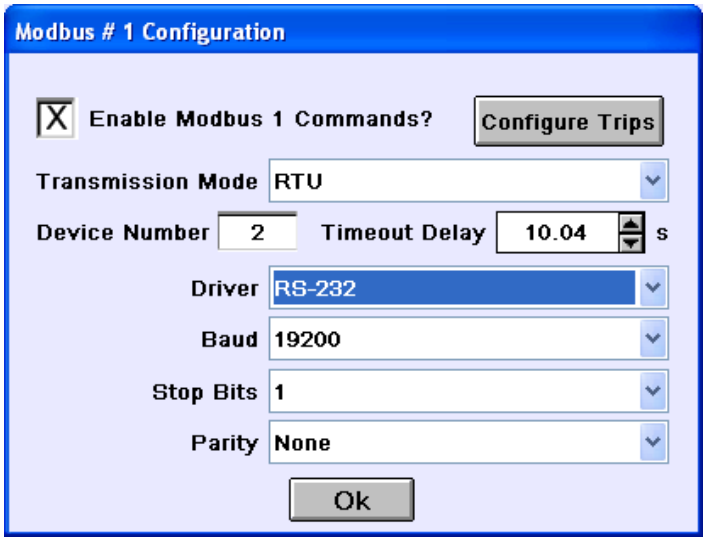


Figure 3-30. Modbus Configuration Pop-up

If Local/Remote control mode switching is desired, configure the Local/Remote functionality by selecting the Use Local/Remote check box from the System Configuration screen, as shown in Figure 3-29. When configured, a new Local/Remote mode select button becomes available in the screen footer—It indicates the current mode and will toggle between modes when pressed. The default Local/Remote configuration is for only HMI/CCT control in Local mode. Select the Enable Contacts option to also enable discrete input commands in Local mode. Likewise, Modbus commands can be enabled in Local mode, but one or both Modbus ports must be configured and the respective Enable Commands option selected, as described above and shown in Figure 3-30.

A status message indicates whether or not discrete inputs and Modbus commands are active under the current configuration. As an example, in Figure 3-31, the unit is configured for Local/Remote with discrete inputs and Modbus #1 commands enabled in Local. Modbus port #2 is configured, but commands from it have not been enabled in Local mode. Note that the Local/Remote button in the screen footer indicates Local mode, discrete inputs and Modbus #1 commands are indicated active, but Modbus #2 commands are not active. If the mode were switched to Local/Remote, all commands would be enabled.

Configuration File Management

As shown in Figure 3-28, the Configuration Menu screen provides a File Upload/Download button to access the Configuration File Management screen, shown in Figure 3-32.

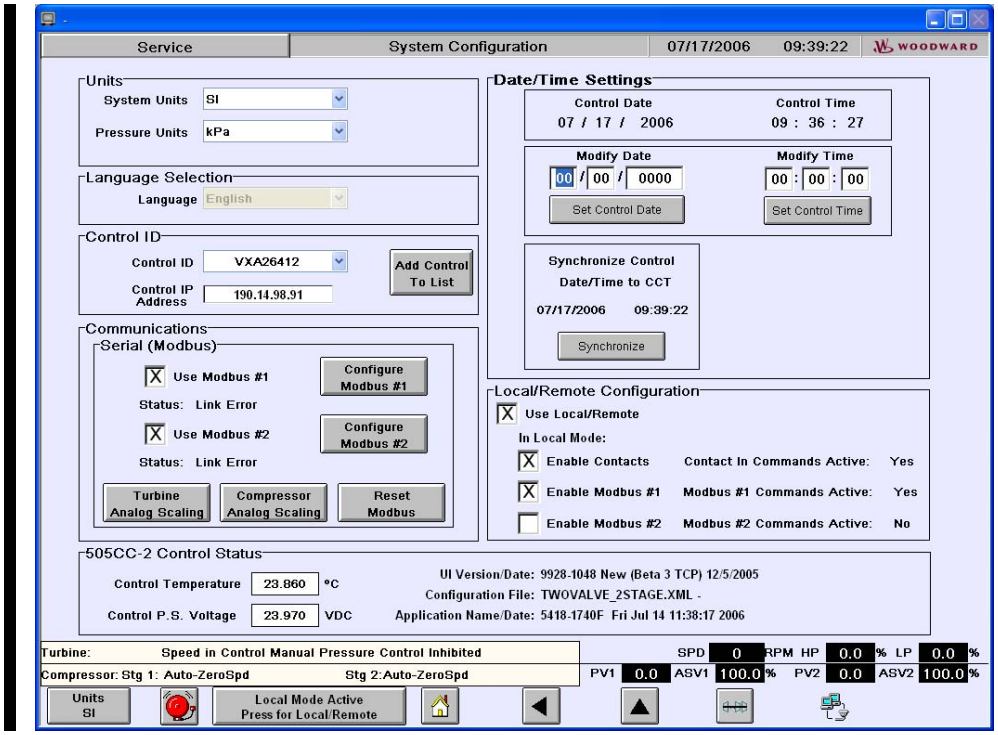


Figure 3-31. System Configuration Screen

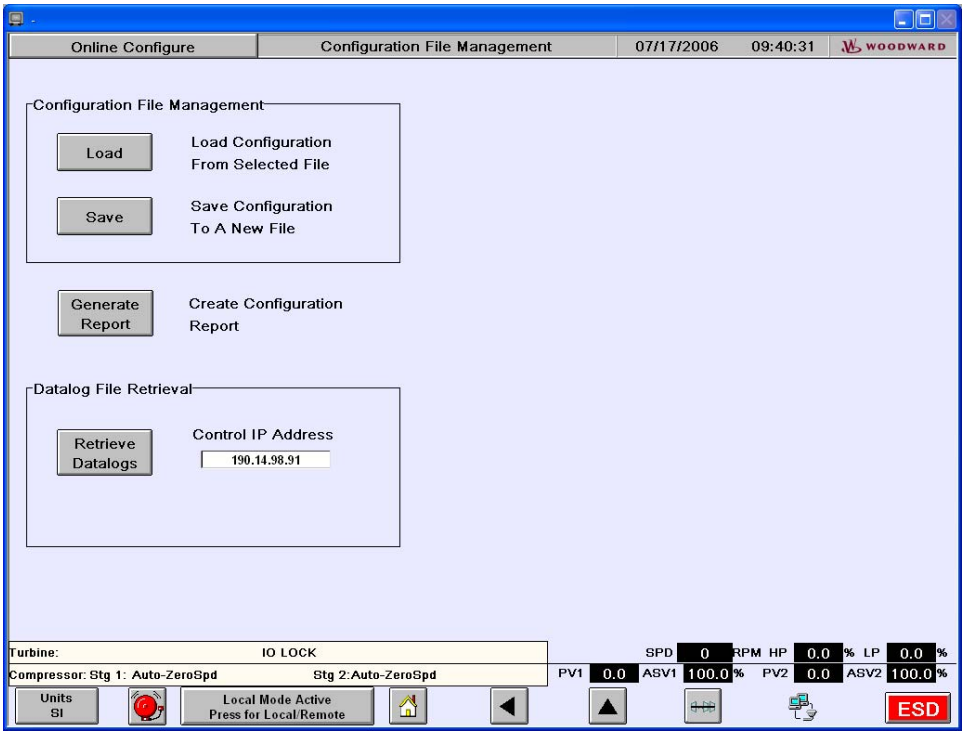


Figure 3-32. Configuration File Management Screen

This facility allows saving a configuration file for archival purposes, generating and saving a default configuration file that might apply to multiple units, and loading such a default file to the 505CC-2 control. The current configuration can be saved at any time, and in any login level, by pressing the Save button. A pop-up prompts for a filename as shown in Figure 3-33. The default filename is generated from the current date and time but may be modified as desired.

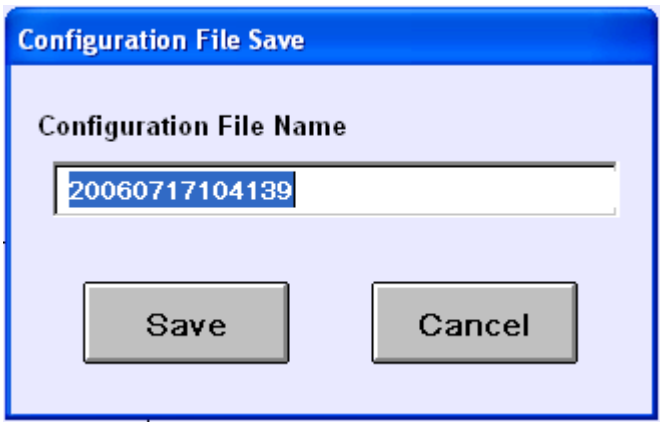


Figure 3-33. Configuration File Save Pop-up

The configuration is saved as a .XML recipe file in the \WGFiles subdirectory of the Advantech Studio program installation. A typical path would be *C:\Program Files\Advantech Studio v6.0\Projects\505CC-2\WGFiles*, but this will vary if the path was altered during installation.

Selecting the Load button from the Configuration File Management screen will initiate a similar pop-up prompting for a saved configuration file to load, as shown in Figure 3-34. Select the browse button to locate the desired .XML recipe file.

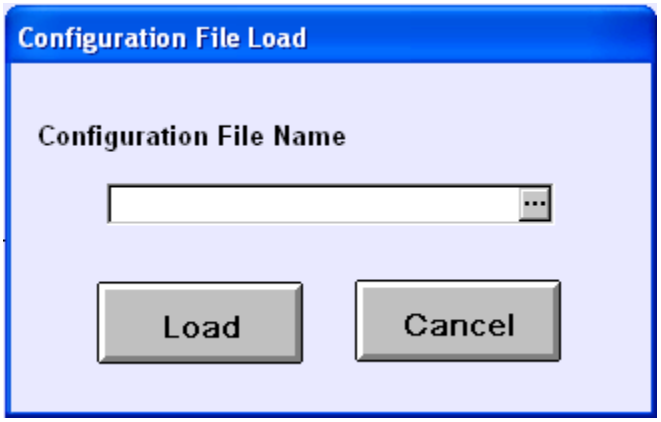


Figure 3-34. Configuration File Load Pop-up

If the HMI/CCT is connected to a control, loading a configuration from a file would attempt to overwrite the running configuration with unpredictable, but likely dangerous consequences. Therefore, configuration file loading can only be performed in one of the two configuration login levels—The Load button is disabled in any lower security level. The Online Configuration login commands an I/O lock on the AtlasPC control, and can therefore only be accessed when the turbine/compressor unit is shutdown. Loading a file from this login level will load the file to the HMI/CCT and simultaneously write the same data to the 505CC-2 control. The configuration can then be modified as necessary. When the configuration is satisfactory, revert to the Monitor login—This will release the I/O lock and reset the control. Utilize the Offline Configuration login to disconnect the HMI/CCT from a connected control and load a configuration file for any required modifications. The configuration must be resaved to maintain any changes that are made before reconnecting to a control.

Select the Generate Report button to create a text-based configuration worksheet for archiving or transmittal to others (no pop-up or acknowledge message will appear). This text file is generated in the 505CC-2 project folder under the Advantech AStudio installation (*C:\Program Files\Advantech Studio v6.0\Projects\505CC-2* for example).

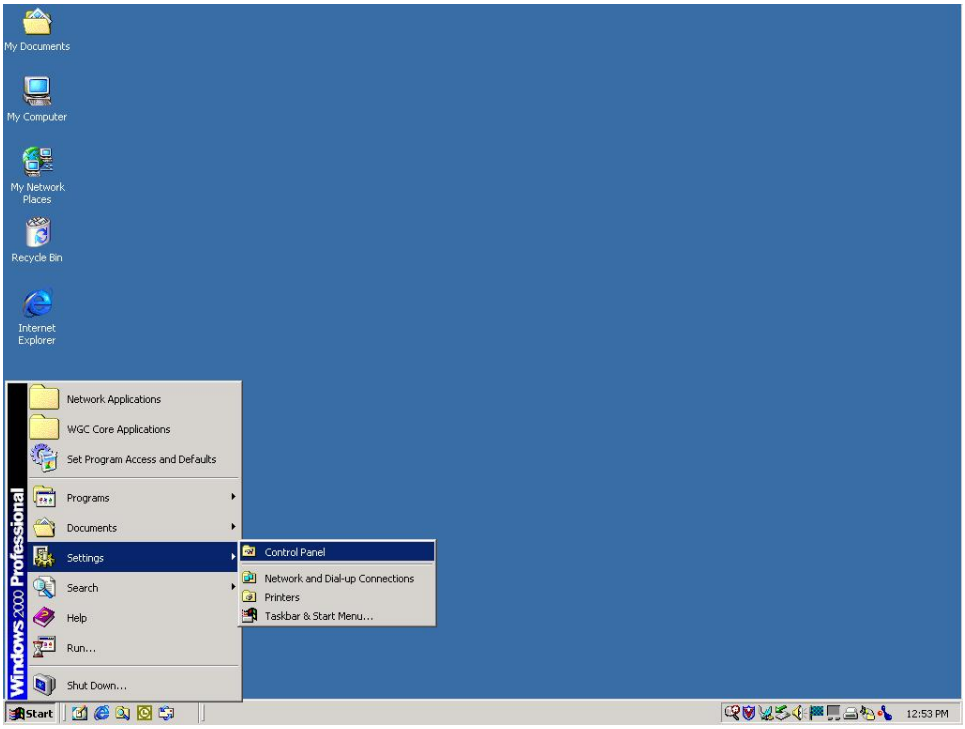
The Retrieve Datalogs command will copy any available high-speed datalogs from the 505CC-2 onto the HMI/CCT computer—Pressing the button does not generate a pop-up or acknowledgement. The files will be named by date and time and saved in a folder called *Datalogs* in the 505CC-2 project folder under the Advantech AStudio installation. A typical path would be *C:\Program Files\Advantech Studio v6.0\Projects\505CC-2\Datalogs*, but this will vary if the path was altered during installation. These datalogs are viewable with Woodward's Control Assistant software, available on the installation CD. Their format is comma-delimited text, so they may also be opened in other editing or trending software. See the Datalogs sections in each of the Turbine and Compressor Control volumes of this manual for more details on the contents and function of high-speed datalogs.

IP Addresses

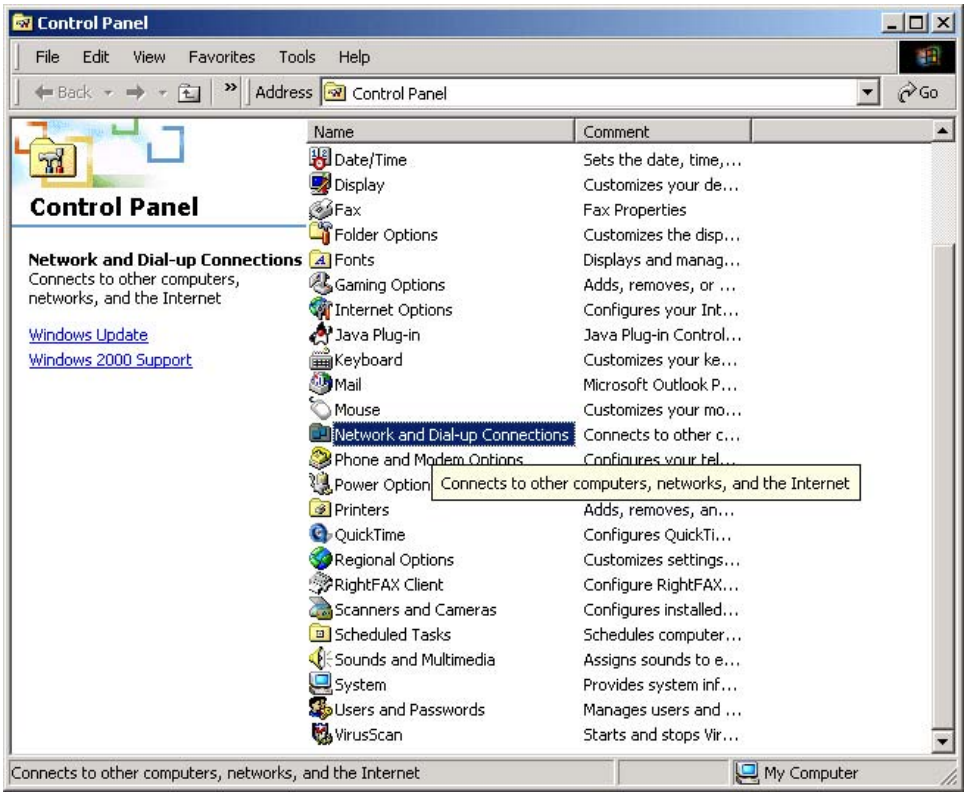
For Ethernet communications, all network devices must have similar but distinct IP addresses. From the factory, the 505CC-2's AtlasPC control is preconfigured with an address of 190.14.99.220. Likewise, the optional touchscreen HMI comes addressed as 190.14.129.75 (port 1). Therefore, the two are able to communicate immediately, without additional configuration. Similarly, any connected computer running the HMI/CCT software must be configured with an address of the same form.

Changing a Computer's IP Address

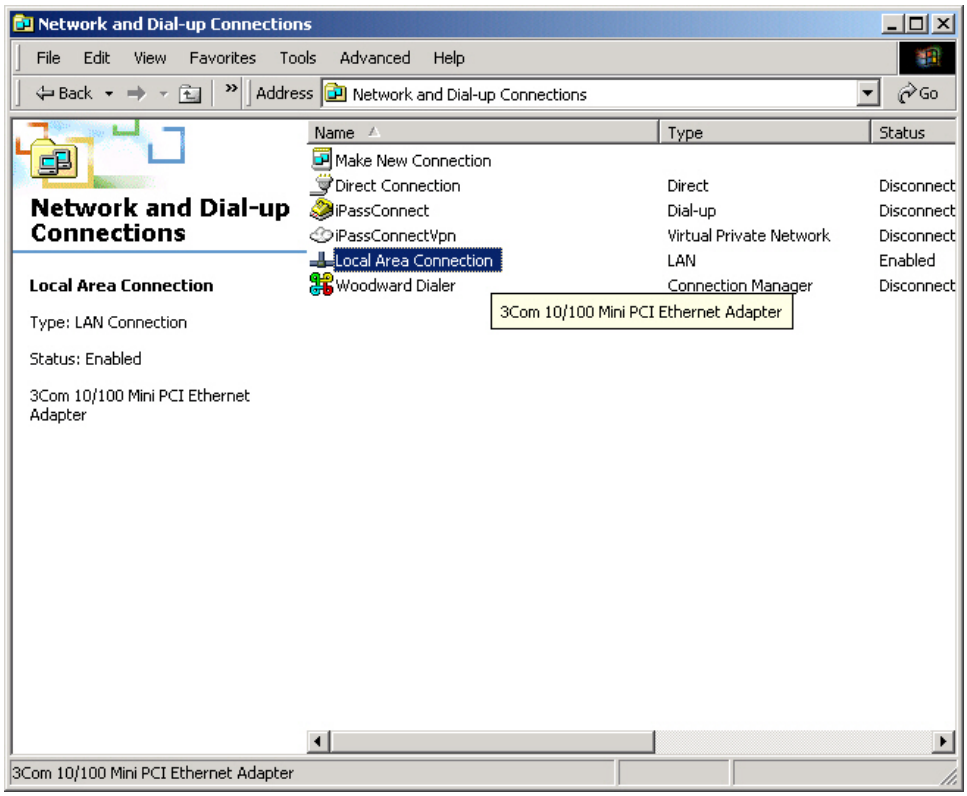
For example, assume that the 505CC-2 is ordered without the touchscreen HMI and will not be connected to a network. The HMI/CCT software will be installed from the supplied CD onto a user's laptop computer to facilitate configuration of the control. The IP address of the laptop computer must be changed to "match" that of the control for the two to communicate. Below are typical instructions for changing the IP address of a Microsoft Windows 2000 compatible computer.



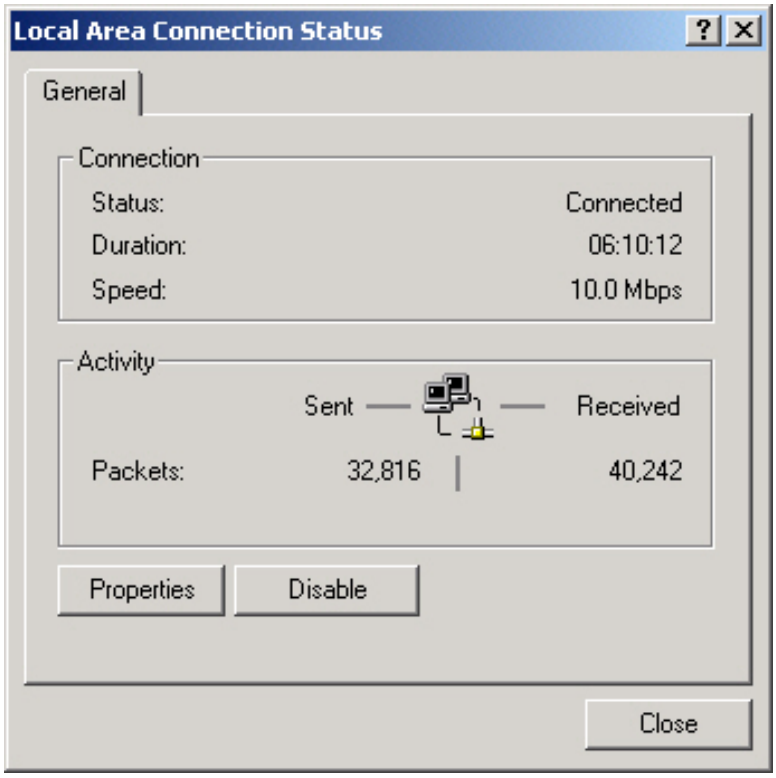
Select *Settings … Control Panel* from the *Start Menu*.



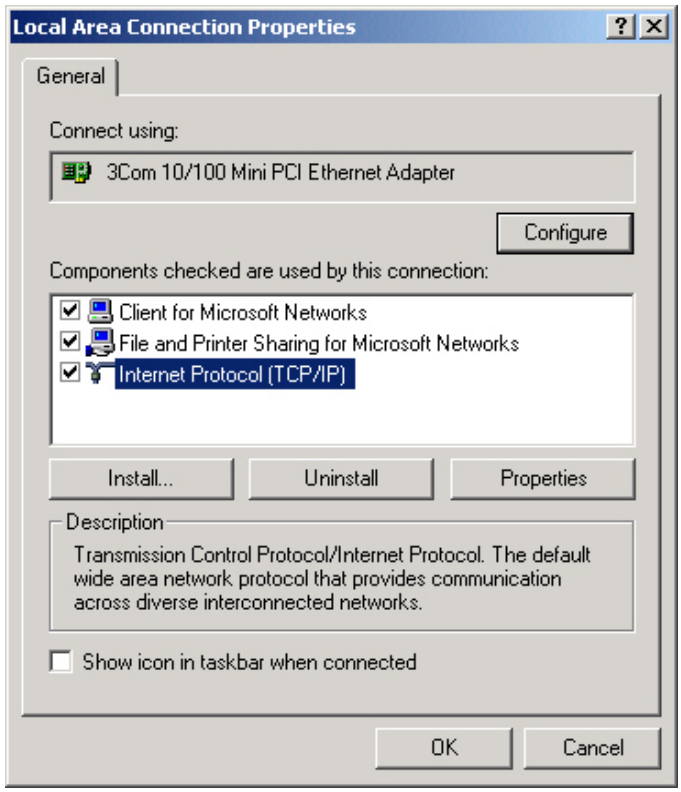
Select *Network and Dial-up Connections*.



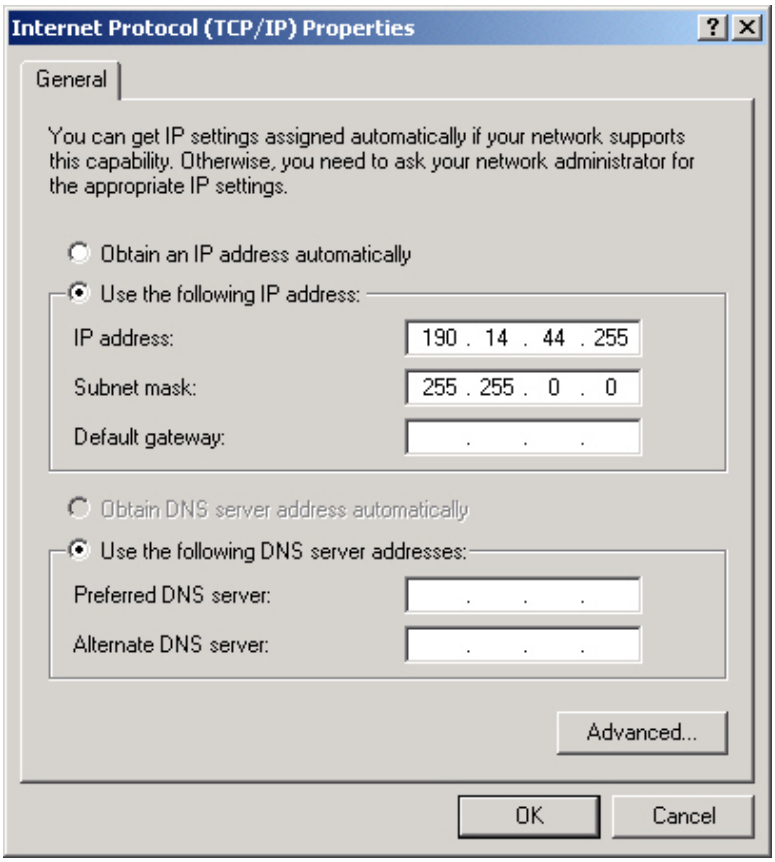
Select *Local Area Connection*.



Click the *Properties* button.



In the *Local Area Connection Properties* window, verify that *Internet Protocol (TCP/IP)* is checked and selected. Click the *Properties* button.



Click the *Use the following IP address:* radio button and enter an address in the correct format. The *Subnet Mask* will default to 255.255.0.0, which means that the first two numbers in the devices' addresses must match to facilitate proper communications. For example, since the control's default address is 190.14.99.220, enter an address for the computer in the form 190.14.XXX.XXX. Click *OK*. The computer may require rebooting.

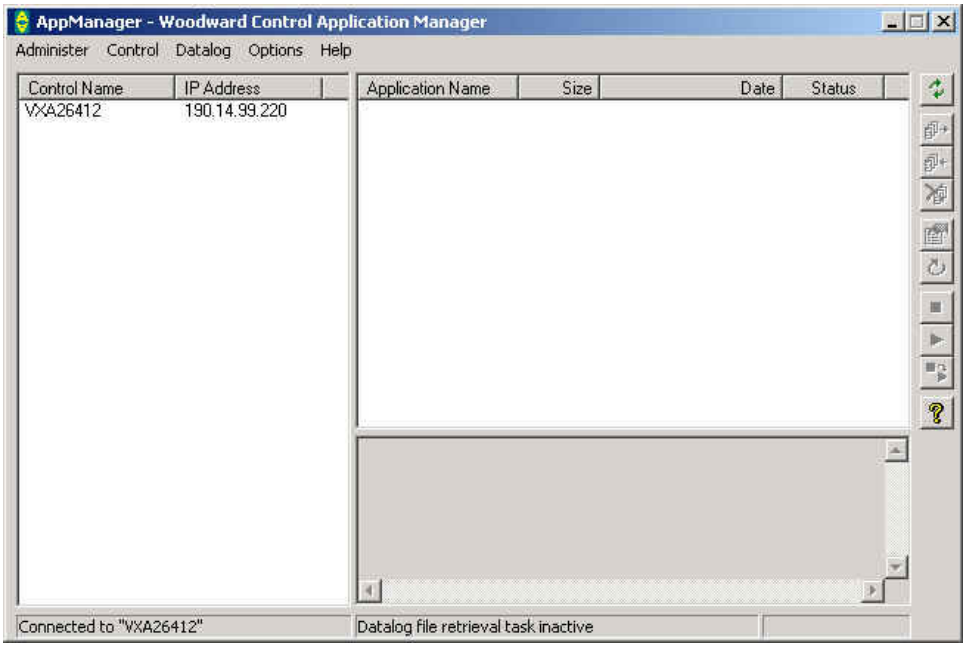
Changing the Control's IP Address

On the other hand, if the control will operate on an existing network, as shown in Figure 3-16, it may be necessary to change the IP addresses of the control and HMI, if utilized.

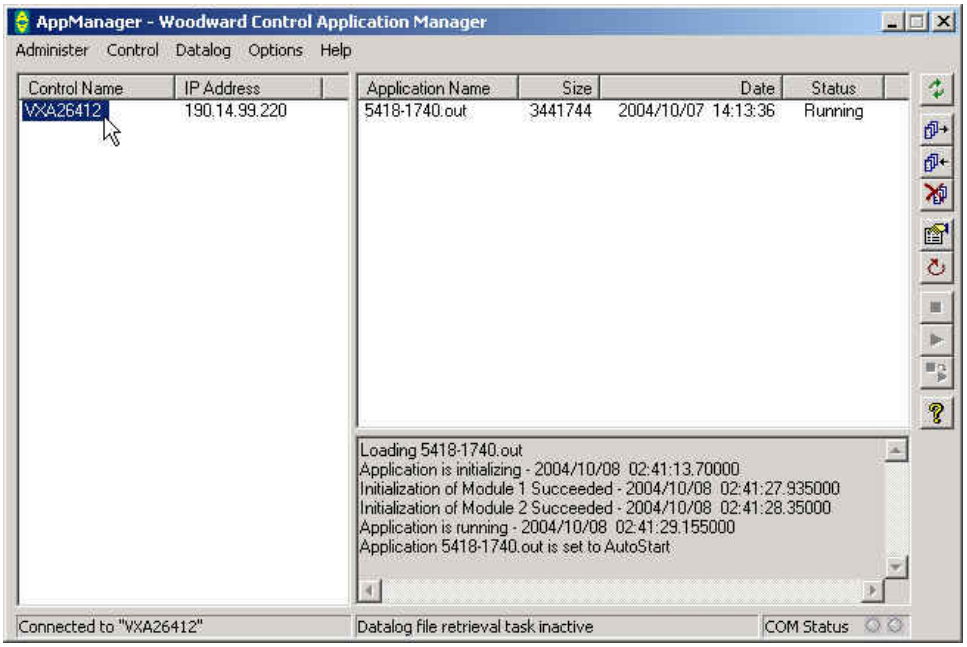
NOTICE

To change the AtlasPC's IP address, the application software must be stopped. Therefore, this procedure can only be performed when the turbine/compressor is shut down.

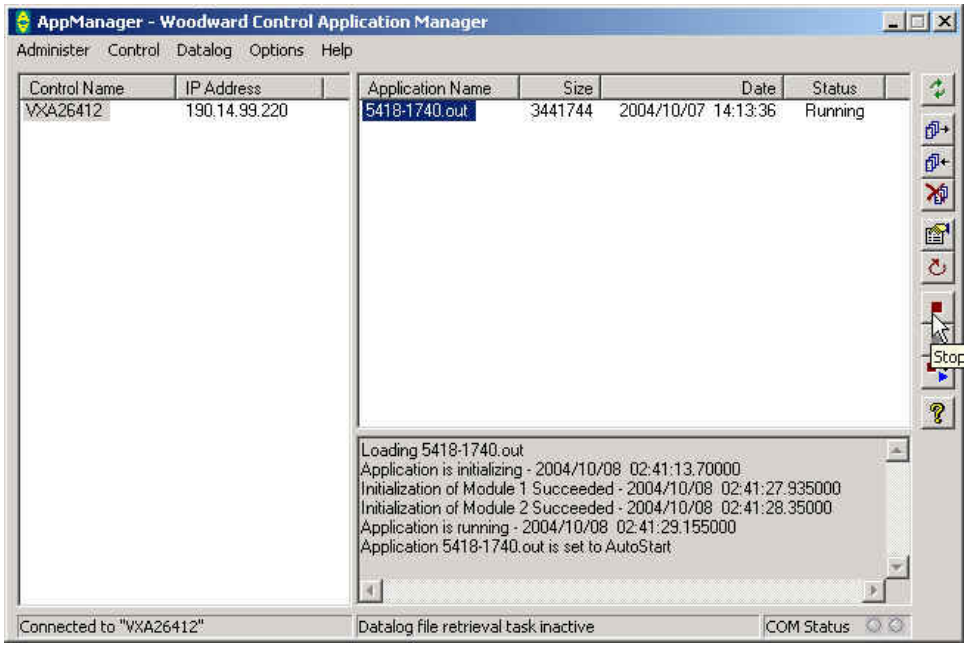
To change the control's IP address, use the provided Application Manager (AppManager) software from a laptop or other connected computer. When AppManager is launched, it will search for all connected controls, whether one connected directly by an Ethernet crossover cable or several on an Ethernet LAN. All connected controls will be displayed by name and IP address in the left pane of the AppManager window.

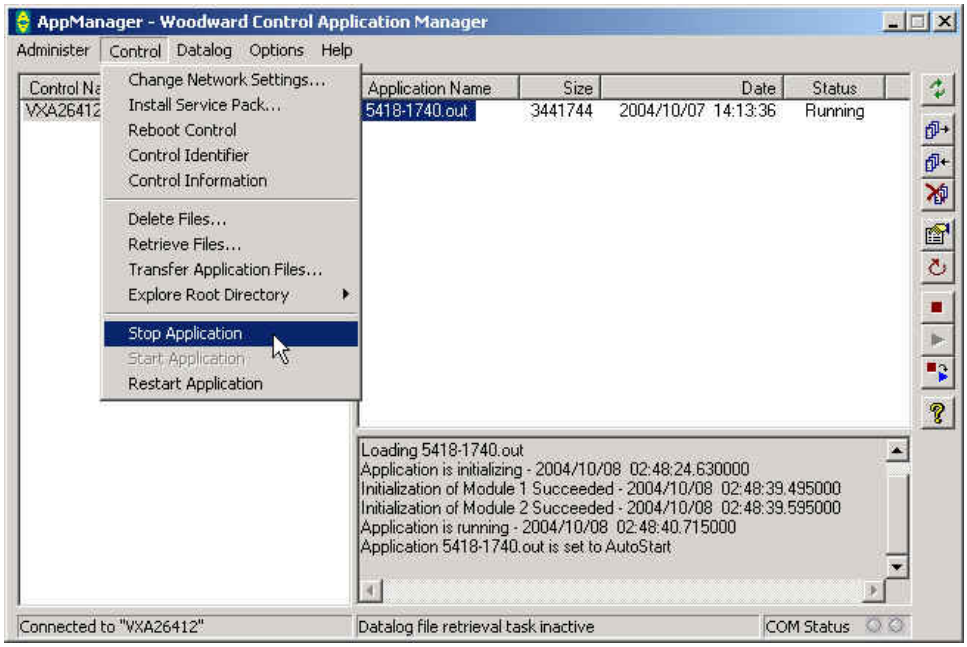


Select the control name to highlight it. The name, size, date, and status of the application software will appear in the pane to the right.



To allow changing the IP address, the application software must be stopped. Select the application name, *5418-1740.out*, in the right pane of the AppManager window. Then, click the Stop button in the toolbar, or select *Stop Application* from the *Control* menu.

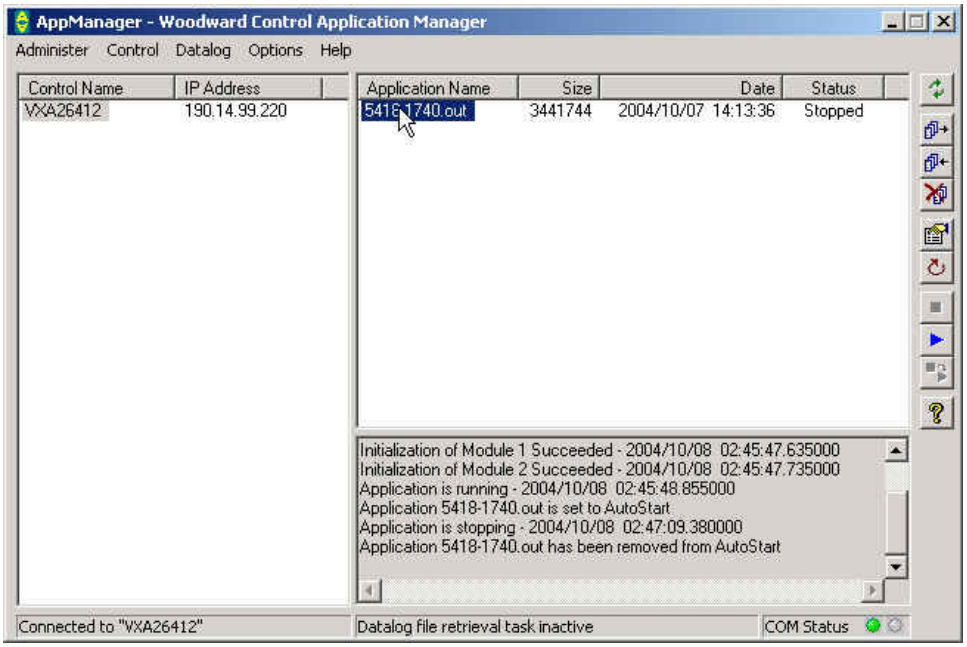




AppManager will request confirmation before stopping a running application.

Select *Yes* and, if prompted, enter *ServiceUser* as the *Connect As:* and *Password:*.

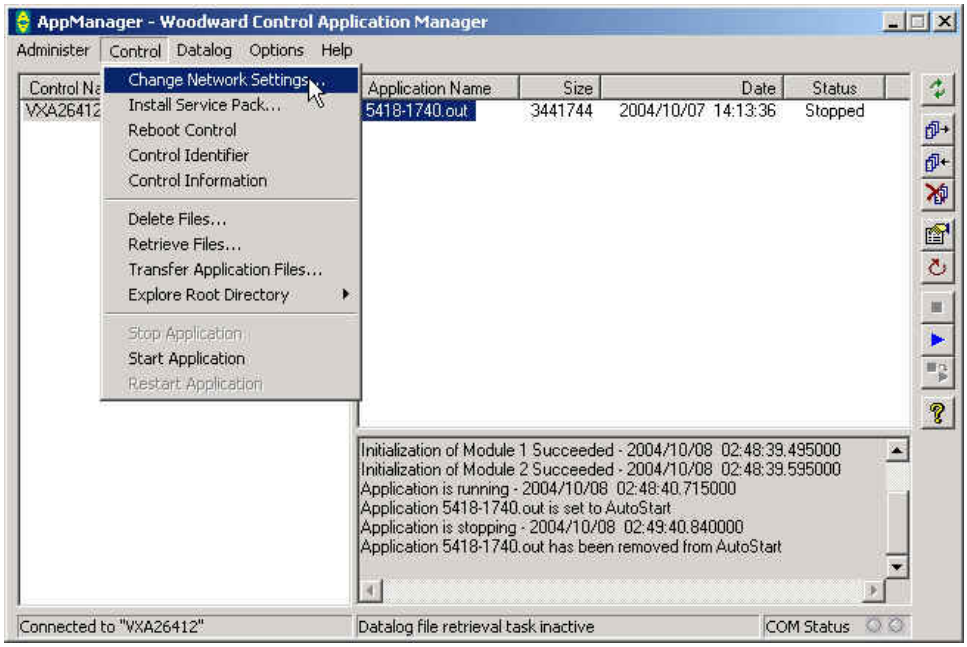
Once the application is stopped, it will be indicated as such in the *Status* column in the right pane of the AppManager window.



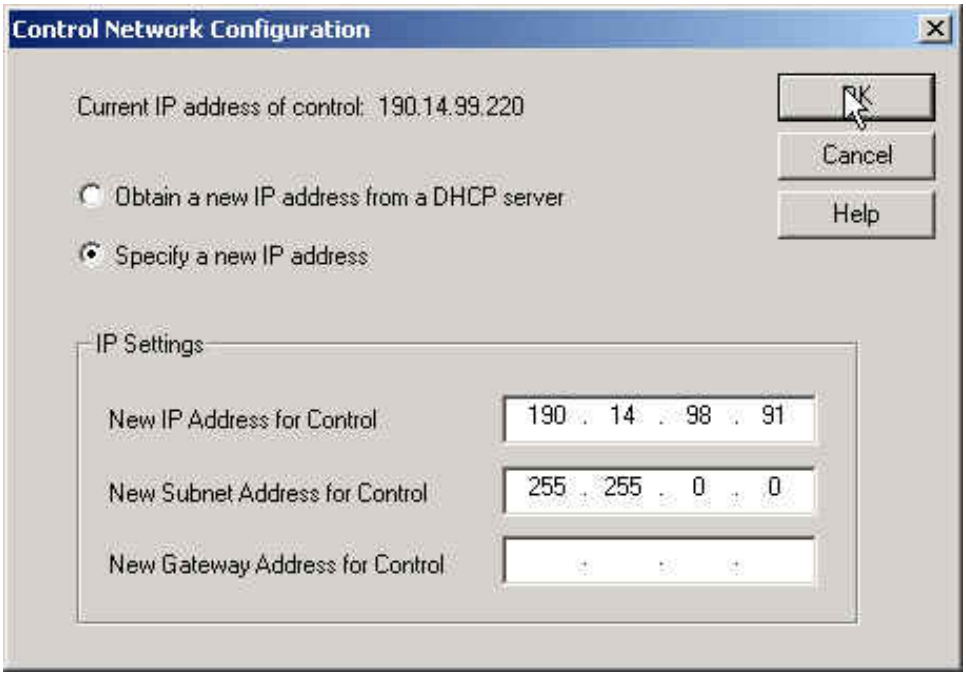
The IP address can now be changed by selecting *Change Network Settings* from the *Control* menu.

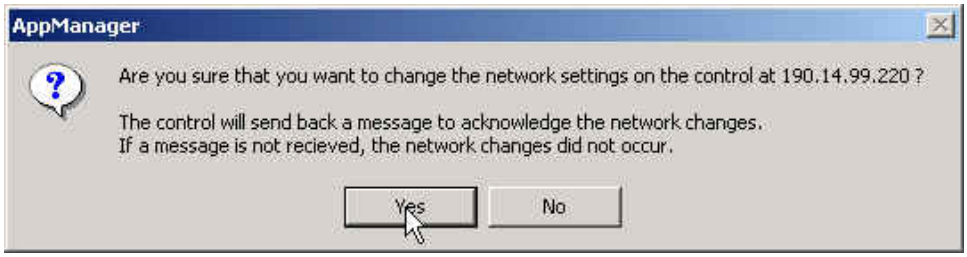
NOTICE

If no control is selected when *Change Network Settings* is initiated, AppManager will prompt for the IP address of the control that is to be readdressed. If a valid address is entered, the readdressing process will continue as described below, but on its own, AppManager will stop the application software, if running. It is always preferred to manually stop the application as described above, thereby ensuring that the unit has been properly secured.



AppManager will prompt for a new IP address. If installed on an Ethernet LAN, a DHCP server can assign the address, or one may be specified directly. Select *OK*. Then, select *Yes* at the confirmation prompt to proceed with the change.

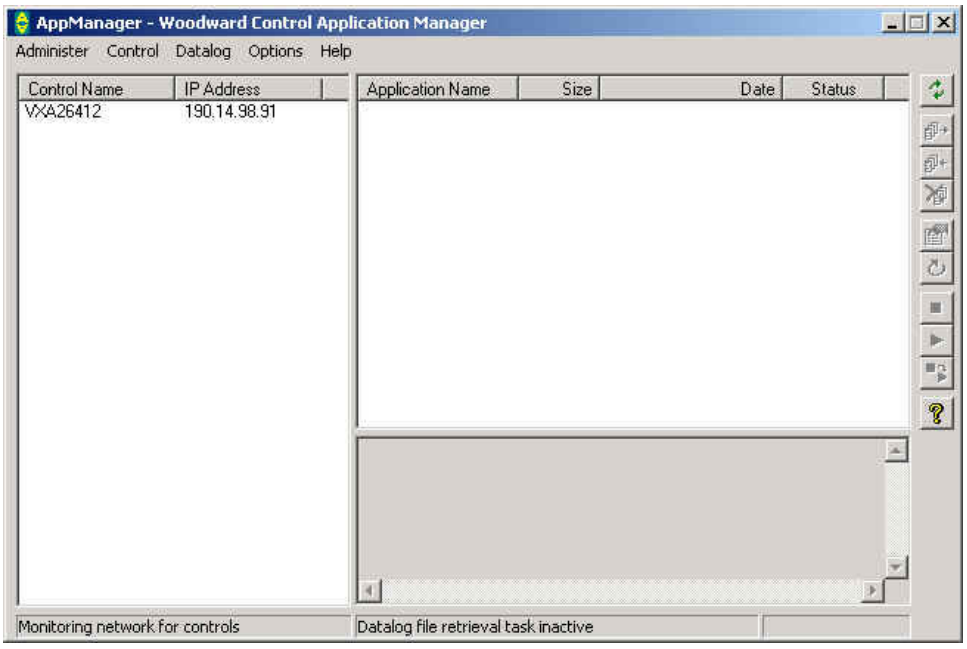




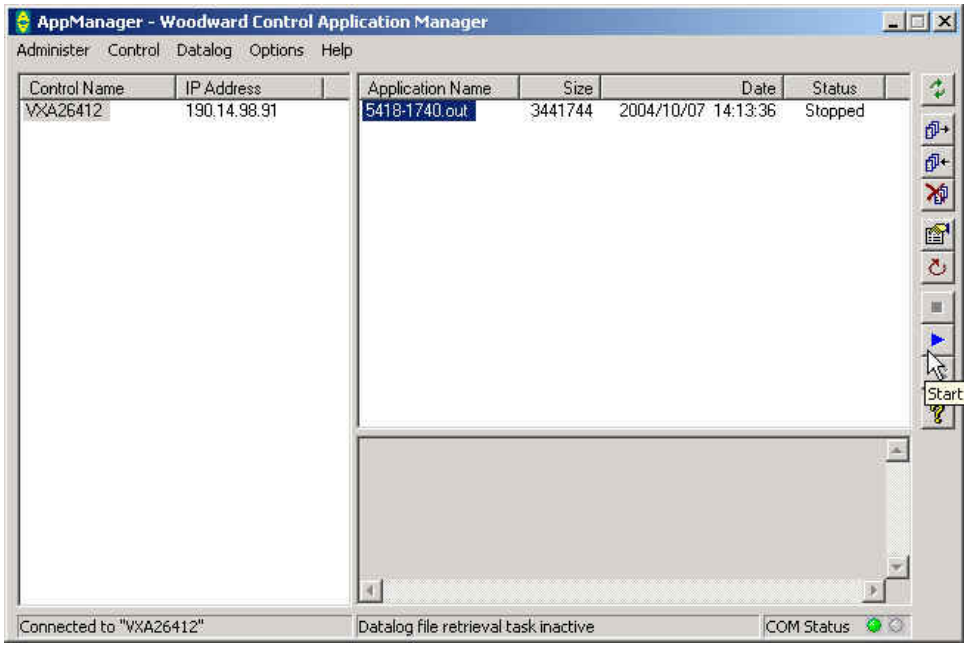
IMPORTANT

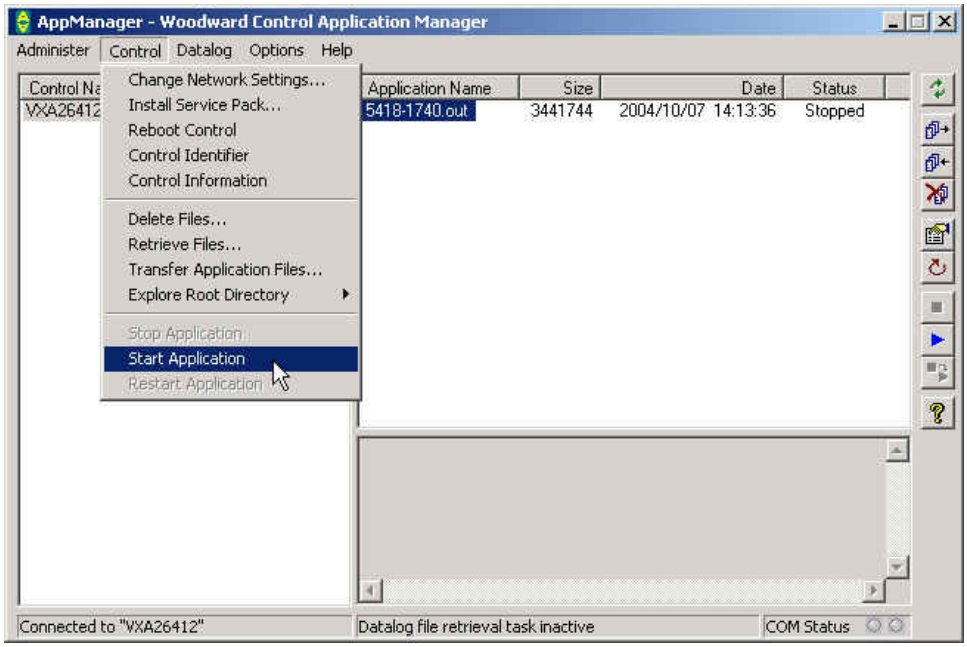
Depending upon the version of AppManager being used, the confirmation pop-up may indicate that AppManager will display a confirmation message after successfully readdressing the control. This confirmation of completion may or may not be displayed, depending upon the versions of the control and AppManager in use. If the confirmation message does not appear, it does not necessarily mean that the readdressing failed.

After the IP address is changed, the control will reboot and will eventually be displayed again in the AppManager control list. This process typically takes 45~60 seconds. Success of the address change can be confirmed by verifying the newly displayed IP address in AppManager's control list.

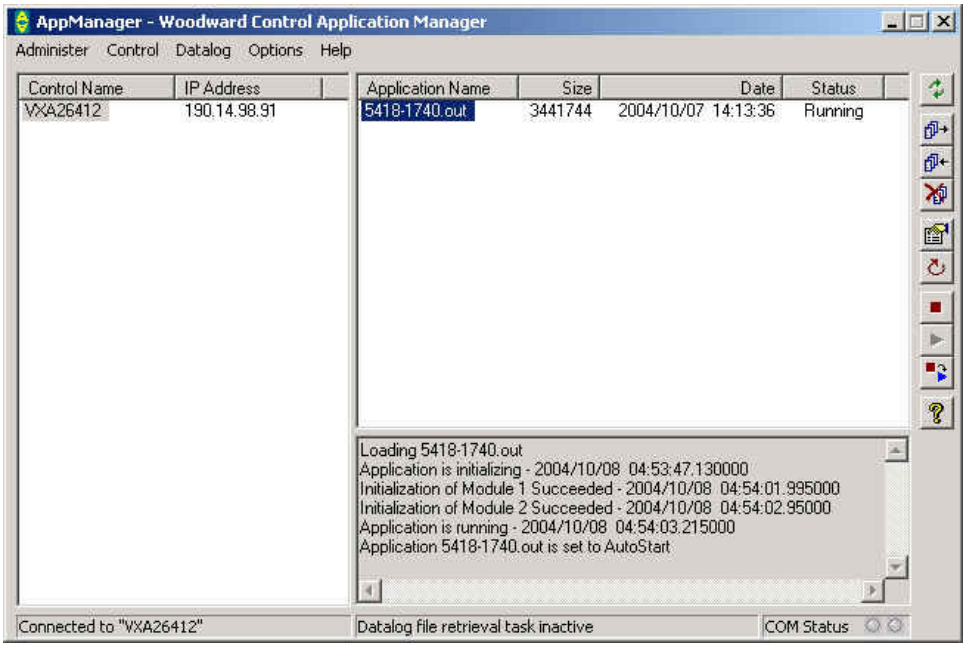


The application software must now be restarted. As before, select the control name to highlight it. Then, select the application name, *5418-1740.out*, in the right pane. Click the Start button in the toolbar, or select *Start Application* from the *Control* menu





The application will initialize, as indicated in the *Status* column and by messages displayed in the lower right box of the AppManager window. Once complete, the *Status* column should display *Running*.



Changing the HMI's IP Address

The HMI computer is like any other Microsoft Windows computer, and its IP address can be changed as described in the earlier section, *Changing a Computer's IP Address*. Attach a standard keyboard and mouse to the HMI computer for ease of use.

Modbus

The 505CC-2 has available a fixed and complete set of process data for transfer to an external device "master" through two serial data ports using the Modbus communication protocol (See Chapter 6 of this manual for port locations and wiring pinouts on the SmartCore board). The Modbus protocol determines how the master and slaves establish and break off contact, how the sender and receiver are identified, how messages are exchanged in an orderly manner, and how errors are detected. The 505CC-2 control acts as a slave to give the external device more flexibility in requesting data. The data made available by the control is constantly updated and, thus, always current. The master initiates all data transactions (requests from the master to the slave and responses from the slave).

For data transactions to take place, address lists, or Modbus lists, are created in the Modbus master and slave. The control contains one list consisting of analog and Boolean inputs and outputs ("reads" and "writes"). The slave must have a dedicated list in the master. The slave list must match the corresponding master list(s) in order for all data to be transferred.

As a slave, the control system is set up to use input coils and holding registers as memory locations for outputs received from the master, meaning any value written here by the master is intended to be used as a command function in the control (remote setpoint, raise/lower, etc.). Therefore, input coils and holding registers are "write only" memory and cannot be used as read memory by the slave. Input coils and holding registers are read by the control only to see what data was last written. All reads input from the control must be an input status or an input register and are therefore "read only" memory.

Address 0:XXXX … Input Coils … Boolean Writes to the control
Address 1:XXXX … Input Status … Boolean Reads from the control
Address 3:XXXX … Input Register … Analog Reads from the control
Address 4:XXXX … Holding Register … Analog Writes to the control

The analog values stored in the control are floating point numbers representing engineering units (e.g. kPa, rpm, m^3/hr). However, values sent to and received from the master are signed integers ranging from -32767 to +32767. Decimals are truncated before being passed. Thus, any value sent to or received from the master, whose decimal bits are significant, will require an appropriate scalar. In addition to providing this decimal point resolution, the scalar also facilitates large numbers (greater than 32767) to be transferred.

For many analog values that have defined ranges, the scalar can be fixed. For example, valve position is always between 0 and 100 percent. Therefore, a fixed multiplier of 100 can provide two decimal points of resolution. The fixed analog scalars shown in the Modbus list are multipliers with respect to the control. That is, analog reads from the control are multiplied by this scalar before being passed to the master device—The value received by the master device must be divided by the same scalar. Conversely, the control will multiply analog writes from the master by this scalar before being used. So, the master device should divide its analog write value by the same scalar before sending.

Some data, however, such as pressures, flows, etc. will vary according to the size of the turbine/compressor and the nature of the process in which it operates. In these cases, the scalar must be selected by the user according to the specific application (See the Analog Scaling section below for details).

Modbus Configuration

The 505CC-2's Modbus ports are configured on the System Configuration screen described earlier in this chapter. Select Use Modbus #1 (or 2) to enable the port and continue its configuration. The port status is indicated, and buttons become available for Configure Modbus #1 (or 2), Reset Modbus, Turbine Analog Scaling, and Compressor Analog Scaling. See Figure 3-35.

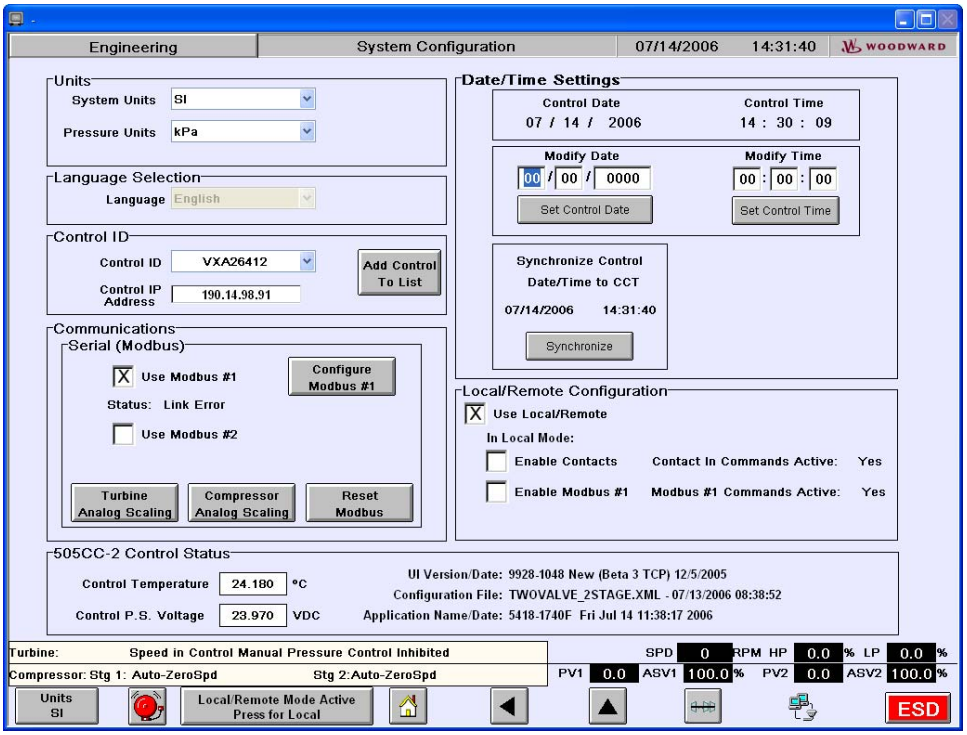


Figure 3-35. System Configuration Screen – Modbus

Port Configuration

Select the Configure Modbus #1 (or 2) button to view the Modbus Configuration pop-up, shown in Figure 3-36. In the Modbus #1 (or 2) Configuration pop-up, select the Transmission Mode as ASCII or RTU. The latter is generally preferred for Modbus speed and efficiency. The Device Number is defaulted to 2 but can be tuned if the control is on a serial multi-drop network.

IMPORTANT

For any TCP Modbus connection, the 505CC-2 must have a unique device number. Device Number 1 is reserved for the HMI/CCT running on TCP/IP Ethernet, therefore the Modbus selection allows Device Number 2 or higher. For simplicity, the same default is used for serial connections.

Adjust the Timeout Delay, which defines the Modbus link dead time allowed before a link error is assumed and an alarm generated. Select the Driver Protocol as desired for RS-232, RS-422, RS-485 (see Chapter 6 of this manual for serial port locations and wiring pinouts on the SmartCore board), or TCP/IP Ethernet. If a serial protocol is selected, complete the port configuration by selecting the appropriate Baud Rate, Stop Bits, and Parity to match those of the master device.

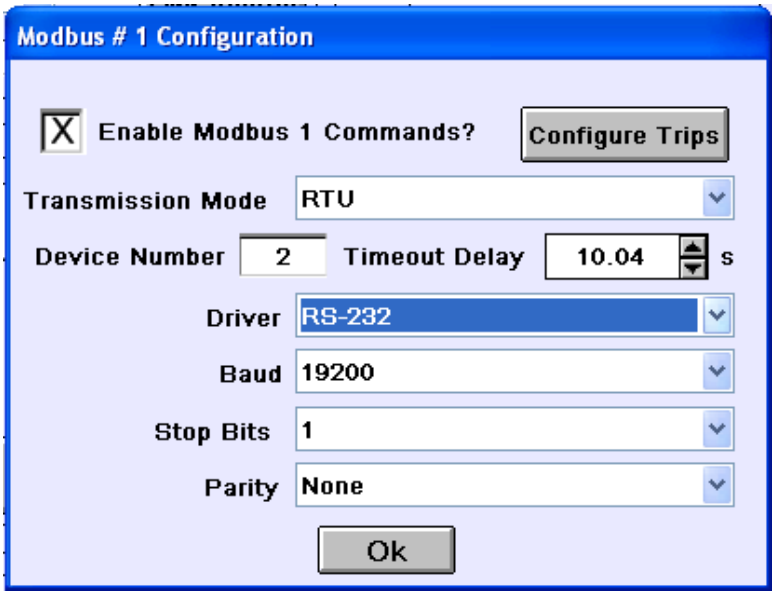


Figure 3-36. Modbus #1 (or 2) Configuration Pop-Up

Select Enable Modbus 1 (or 2) Commands to enable Modbus commands to the control. Without this selection, the Modbus port will function as read-only. If selected, the Configure Trips button will launch the Modbus #1 (or 2) Trip Configuration pop-up, shown in Figure 3-37. It will facilitate customization of shutdown commands from the Modbus port.

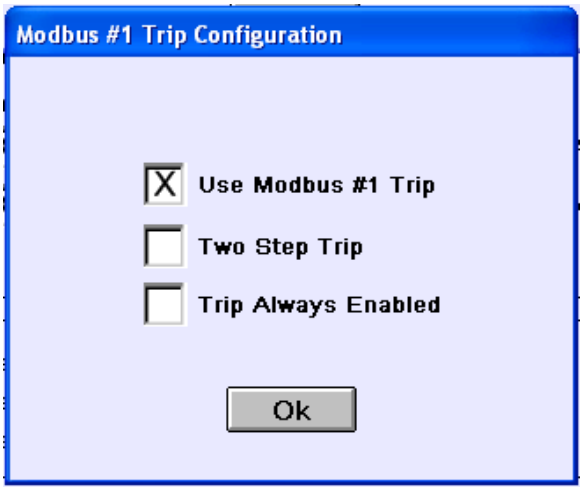


Figure 3-37. Modbus #1 (or 2) Configuration Pop-Up

Trip Configuration

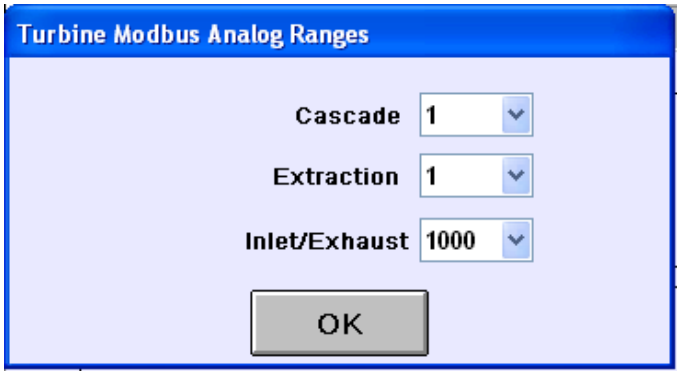
In the Modbus #1 (or 2) Trip Configuration pop-up, shown in Figure 3-37, select Use Modbus #1 (or 2) Trip to allow the Modbus port to initiate system shutdowns. If de-selected, Modbus ESD commands are ignored. If selected, two additional features become available. Select Two Step Trip to configure the ESD Acknowledge function, which requires the ESD command (0:0001) be followed by the ESD Acknowledge command (0:0002) within 5 seconds to initiate a shutdown. Select Trip Always Enabled to enable the Modbus ESD even when in Local Mode. If de-selected, and with Local/Remote configured, the Modbus ESD will only function in Local/Remote Mode, not in Local. This selection has no effect if Local/Remote is not configured, in which case the Modbus ESD is active if Use Modbus #1 (or 2) Trip was selected previously.

Reset Modbus

The Reset Modbus command will reset both Modbus ports to clear exception errors caused by illegal function calls, data addresses, or values; checksum errors; or garbled messages.

Analog Scaling

Depending upon the configured application, there are up to eleven groups of process data that require user-selected analog scaling for Modbus. These are data that will vary in magnitude according to the process and/or size of the turbine/compressor. See Figure 3-38 for the Turbine and Compressor Analog Scaling pop-ups. The groups of parameters requiring scalers are listed in Table 3-6, each with the various data onto which the selected scaler will apply. A group will not be listed in the scaling pop-up if that function has not been configured in the control.



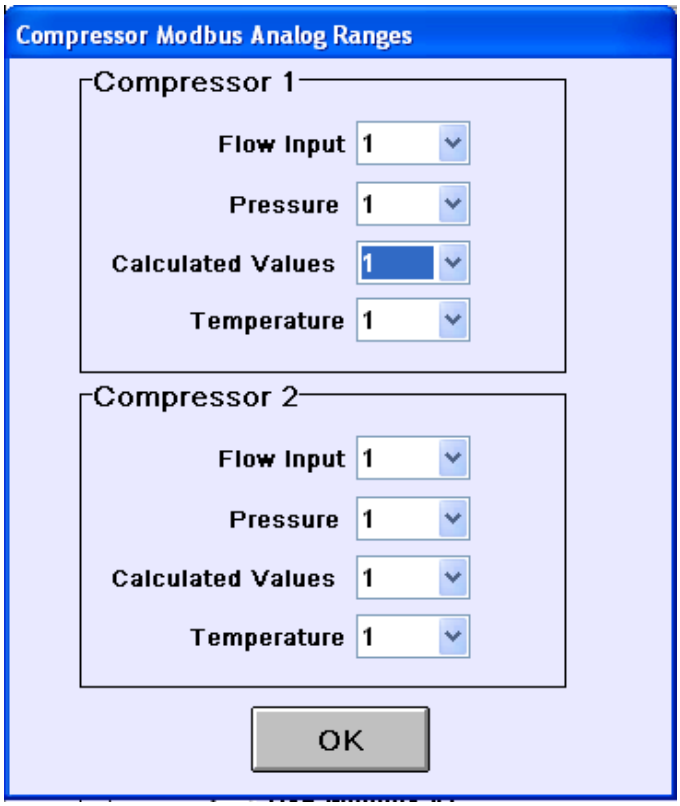


Figure 3-38. Modbus Analog Scaling Pop-Ups

Turbine Cascade Control Turbine Extr/Adm Control Turbine Inlet/Exhaust Control	Modbus Writes for Setpoint
	Modbus Reads for Reference
	Modbus Reads for Process Variable Input
	Modbus Reads for Remote Setpoint Value
	Modbus Reads for Modbus Entered Setpoint Values
Comp. 1/2 Flow Input	Modbus Reads for Compressor 1/2 Filtered Flow Input
Comp. 1/2 Pressure	Modbus Writes for Compressor 1/2 Suction Pressure Override Setpoint
	Modbus Writes for Compressor 1/2 Discharge Pressure Override Setpoint
	Modbus Reads for Compressor 1/2 Filtered Suction Pressure Input
	Modbus Reads for Compressor 1/2 Filtered Discharge Pressure Input
	Modbus Reads for Compressor 1/2 Filtered Flow Pressure Input
	Modbus Reads for Compressor 1/2 Suction Pressure Control Value
	Modbus Reads for Compressor 1/2 Discharge Pressure Control Value
	Modbus Reads for Compressor 1/2 Flow Pressure Control Value
	Modbus Reads for Compressor 1/2 Suction Pressure Surge Signature Value
	Modbus Reads for Compressor 1/2 Discharge Pressure Surge Signature Value
Comp. 1/2 Temperature	Modbus Reads for Compressor 1/2 Filtered Suction Temperature Input
	Modbus Reads for Compressor 1/2 Filtered Discharge Temperature Input
	Modbus Reads for Compressor 1/2 Filtered Flow Temperature Input
	Modbus Reads for Compressor 1/2 Suction Temperature Control Value
	Modbus Reads for Compressor 1/2 Discharge Temperature Control Value
	Modbus Reads for Compressor 1/2 Flow Temperature Control Value
Comp. 1/2 Calculated Values .	Modbus Reads for Compressor 1/2 Calculated Polytropic Head
	Modbus Reads for Compressor 1/2 Calculated Corrected Suction Flow
	Modbus Reads for Compressor 1/2 Calculated Sensor Flow
	Modbus Reads for Compressor 1/2 Surge Control Line Setpoint Flow
	Modbus Reads for Compressor 1/2 Calculated Actual Suction Flow
	Modbus Reads for Compressor 1/2 Calculated Mass/Normal/Standard Flow
	Modbus Reads for Compressor 1/2 Flow Surge Signature Value
	Modbus Reads for Compressor 1/2 Operating Point Surge Signature Value
	Modbus Reads for Compressor 1/2 Current Operating Suction Flow
	Modbus Reads for Compressor 1/2 Current Operating Polytropic Head

Table 3-6. User-Selected Modbus Analog Scaling Groups

When selecting these scalers, the value is that which the master device must multiply analog reads received from the control and divide into analog writes that are sent to the control. In other words, the selected value is used in the control to scale down analog reads before sending to the master and scale up analog writes received from the master.

For example, assume that the Cascade Control is configured for compressor discharge pressure, which normally runs 40,000 to 50,000 kPa. These values are too large to pass across Modbus, which is limited to an integer value of 32,767. So, an appropriate scaler might be selected as 10. In this case, if the Cascade process variable (compressor discharge pressure) is running at 45,000 kPa, it will be scaled down to 4,500 before sending to the Modbus master. The master must then scale up by the 10 to achieve the actual value of 45,000 kPa. Similarly, a Modbus entered setpoint of 48,000 kPa must be scaled down by the value of 10 before being written to the control. The control will scale up the 4,800 value that is received to achieve the desired setpoint of 48,000 kPa.

The Modbus values are sent directly from the control to the master device, such as a DCS. Unit conversion, if necessary, is handled by the HMI/CCT for display purposes. The turbine control software normalizes most control values, so their units are generally disregarded by the 505CC-2 and defined by the user as desired. However, the 505CC-2 uses only SI units for the compressor control. For example, if Imperial units of pressure are configured as psi, the HMI/CCT displays psi for all pressure values. But, all of these values are converted to/from kPa when they are sent to or received from the control. Therefore, the compressor data received via Modbus from the 505CC-2 will be in SI units regardless of the configuration of the HMI/CCT. Engineering units, where applicable, are included in the Modbus list for clarification. If no unit is specified, the value is dimensionless, or its units are dependent upon the configuration.

The 505CC-2 Modbus list is based upon that from the Woodward 505/505E control. Thus, if replacing a 505/505E with the 505CC-2, any existing Modbus interface will require minimal changes. Specifically, new turbine features and compressor data were added to the end of the list. 505/505E data that no longer apply remain in the list but are not used. The list shown here is the same for both of the 505CC-2's Modbus ports with the exception of some Booleans reads (1:0065, 1:0141, 1:0177, 1:0186, 1:0192, 1:0198), which apply specifically to the individual port in use.

Modbus List

Boolean Writes (writes from the master device to the 505CC-2)

Addr	Description
0:0001	Emergency Shutdown
0:0002	Emergency Shutdown Acknowledge
0:0003	Controlled Shutdown
0:0004	Abort Controlled Shutdown
0:0005	System Reset
0:0006	Start / Run
0:0007	Open HP Valve Limiter
0:0008	Close HP Valve Limiter
0:0009	Lower Speed Setpoint
0:0010	Raise Speed Setpoint
0:0011	Go To Rated (Idle / Rated)
0:0012	Go To Idle (Idle / Rated)
0:0013	Halt Auto Start Sequence
0:0014	Continue Auto Start Sequence
0:0015	Enable Remote Speed Setpoint Control
0:0016	Disable Remote Speed Setpoint Control
0:0017	Go To Modbus Entered Speed Setpoint
0:0018	Spare
0:0019	Arm Frequency Control (Not Used)
0:0020	Disarm Frequency Control (Not Used)
0:0021	Sync Enable (Not Used)
0:0022	Sync Disable (Not Used)
0:0023	Enable Cascade Control
0:0024	Disable Cascade Control
0:0025	Lower Cascade Setpoint
0:0026	Raise Cascade Setpoint
0:0027	Enable Remote Cascade Setpoint Control
0:0028	Disable Remote Cascade Setpoint Control
0:0029	Go to Modbus Entered Cascade Setpoint
0:0030	Spare
0:0031	Enable Aux Control (Not Used)
0:0032	Disable Aux Control (Not Used)
0:0033	Lower Aux Setpoint (Not Used)

0:0034	Raise Aux Setpoint (Not Used)
0:0035	Enbl Rmt Aux Stpnt Control (Not Used)
0:0036	Dsbl Rmt Aux Stpnt Control (Not Used)
0:0037	Go To Modbus Entrd Aux Setpt (Not Used)
0:0038	Spare
0:0039	Select Remote Control (Remote/Local)
0:0040	Select Local Control (Remote/Local)
0:0041	Spare
0:0042	Modbus Alarm Acknowledge
0:0043	Energize Relay 1 (Not Used)
0:0044	De-Energize Relay 1 (Not Used)
0:0045	Energize Relay 2 (Not Used)
0:0046	De-Energize Relay 2 (Not Used)
0:0047	Energize Relay 3 (Not Used)
0:0048	De-Energize Relay 3 (Not Used)
0:0049	Energize Relay 4 (Not Used)
0:0050	De-Energize Relay 4 (Not Used)
0:0051	Energize Relay 5 (Not Used)
0:0052	De-Energize Relay 5 (Not Used)
0:0053	Energize Relay 6 (Not Used)
0:0054	De-Energize Relay 6 (Not Used)
0:0055–56	Spare
0:0057	Enable Extraction Control
0:0058	Disable Extraction Control
0:0059	Lower Extraction Setpoint
0:0060	Raise Extraction Setpoint
0:0061	Enable Remote Extr Setpoint Control
0:0062	Disable Remote Extr Setpoint Control
0:0063	Go To Modbus Entered Extraction Setpoint
0:0064	Open LP Valve Limiter
0:0065	Close LP Valve Limiter
0:0066	Decrease Extr/Adm Demand
0:0067	Increase Extr/Adm Demand
0:0068	Enable Extr/Adm Priority
0:0069	Disable Extr/Adm Priority
0:0070	Spare
0:0071	Enbl Forcing of Turb Rly 1 (Not Used)
0:0072	Enbl Forcing of Turb Rly 2 (Not Used)
0:0073	Enbl Forcing of Turb Rly 3 (Not Used)
0:0074	Enbl Forcing of Turb Rly 4 (Not Used)
0:0075	Momentarily Energize Relay 1 (Not Used)
0:0076	Momentarily Energize Relay 2 (Not Used)
0:0077	Momentarily Energize Relay 3 (Not Used)
0:0078	Momentarily Energize Relay 4 (Not Used)
0:0079	Momentarily Energize Relay 5 (Not Used)
0:0080	Momentarily Energize Relay 6 (Not Used)
0:0081	Spare
0:0082	Enable Inlet/Exhaust Dcpl Control (Not Used)
0:0083	Disable Inlet/Exhaust Dcpl Control (Not Used)
0:0084	Lower Inlet/Exhaust Decoupling Setpoint
0:0085	Raise Inlet/Exhaust Decoupling Setpoint
0:0086	Enable Remote Inlet/Exhaust Setpoint
0:0087	Disable Remote Inlet/Exhaust Setpoint
0:0088	Go To Modbus Entered Inlet/Exhaust Setpoint
0:0089	Spare
0:0090	Enable Manual E/A Pressure Control
0:0091	Disable Manual E/A Pressure Control
0:0092	Lower Manual E/A Demand (Not Used)
0:0093	Raise Manual E/A Demand (Not Used)
0:0094	Enable Remote Manual E/A Demand
0:0095	Disable Remote Manual E/A Demand
0:0096	Go To Modbus Entered E/A Demand
0:0097	Spare

0:0098	HP/V1 Valve Go To Manual
0:0099	HP/V1 Valve Revert to Automatic
0:0100	Close HP/V1 Valve in Manual
0:0101	Open HP/V1 Valve in Manual
0:0102	Enable Rmt HP/V1 Position (Not Used)
0:0103	Disable Rmt HP/V1 Position (Not Used)
0:0104	Goto MB Entered HP/V1 Pos. (Not Used)
0:0105	Spare
0:0106	LP/V2 Valve Go To Manual
0:0107	LP/V2 Valve Revert To Automatic
0:0108	Close LP/V2 Valve in Manual
0:0109	Open LP/V2 Valve in Manual
0:0110	Enable Rmt LP/V2 Position (Not Used)
0:0111	Disable Rmt LP/V2 Position (Not Used)
0:0112	Goto MB Entered LP/V2 Pos. (Not Used)
0:0113–114	Spare
0:0115	Comp. 1 - Lower Surge Control Margin
0:0116	Comp. 1 - Raise Surge Control Margin
0:0117	Comp. 1 - Auxiliary OnLine Input
0:0118	Comp. 1 - Initiate Purge Sequence
0:0119	Comp. 1 - Reset Surge Minimum Position (SMP)
0:0120	Comp. 1 - Reset Surge Capture Information
0:0121	Comp. 1 - Emergency Compressor Trip
0:0122	Comp. 1 - Controlled Compressor Trip
0:0123	Comp. 1 - Select AUTO Mode
0:0124	Comp. 1 - Select MANUAL with BACKUP Mode
0:0125	Comp. 1 - Select FULL MANUAL Mode
0:0126	Comp. 1 - Close Anti-Surge Valve
0:0127	Comp. 1 - Open Anti-Surge Valve
0:0128	Comp. 1 - Go To Modbus Entered Valve Position
0:0129	Comp. 1 - Initiate Start Sequence
0:0130	Comp. 1 - Enable Suction Pressure Override
0:0131	Comp. 1 - Goto Modbus Suction Pressure Override Setpoint
0:0132	Comp. 1 - Enable Discharge Pressure Override
0:0133	Comp. 1 - Goto Modbus Discharge Pressure Override Setpoint
0:0134–139	Spare
0:0140	Comp. 2 - Lower Surge Control Margin
0:0141	Comp. 2 - Raise Surge Control Margin
0:0142	Comp. 2 - Auxiliary OnLine Input
0:0143	Comp. 2 - Initiate Purge Sequence
0:0144	Comp. 2 - Reset Surge Minimum Position (SMP)
0:0145	Comp. 2 - Reset Surge Capture Information
0:0146	Comp. 2 - Emergency Compressor Trip
0:0147	Comp. 2 - Controlled Compressor Trip
0:0148	Comp. 2 - Select AUTO Mode
0:0149	Comp. 2 - Select MANUAL with BACKUP Mode
0:0150	Comp. 2 - Select FULL MANUAL Mode
0:0151	Comp. 2 - Close AntiSurge Valve
0:0152	Comp. 2 - Open AntiSurge Valve
0:0153	Comp. 2 - Goto Modbus Entered Valve Position
0:0154	Comp. 2 - Initiate Start Sequence
0:0155	Comp. 2 - Enable Suction Pressure Override
0:0156	Comp. 2 - Goto Modbus Suction Pressure Override Setpoint
0:0157	Comp. 2 - Enable Discharge Pressure Override
0:0158	Comp. 2 - Goto Modbus Discharge Pressure Override Setpoint

Table 3-7. Modbus Boolean Writes

Boolean Reads (reads from the 505CC-2 by the master device)

Addr	Description
1:0001	Alarm - MPU #1 Failed
1:0002	Alarm - MPU #2 Failed
1:0003	Alarm - Cascade Input Failed
1:0004	Alarm - Aux Input Failed (Not Used)
1:0005	Alarm - KW Input Failed (Not Used)
1:0006	Alarm - Sync Input Failed (Not Used)
1:0007	Alarm - First Stage Press Input Failed (Not Used)
1:0008	Alarm - Remote Speed Input Failed
1:0009	Alarm - Remote Cascade Input Failed
1:0010	Alarm - Remote Aux Input Failed (Not Used)
1:0011	Alarm - Loadshare Input Failed (Not Used)
1:0012	Alarm - Actuator #1 Failed
1:0013	Alarm - Actuator #2 Failed
1:0014	Alarm - Start Permissive Not Met
1:0015	Alarm - Communication Link #1 Failed
1:0016	Alarm - Communication Link #2 Failed
1:0017	Alarm - Generator Breaker Open (Not Used)
1:0018	Alarm - Turbine Trip
1:0019	Alarm - Tie Breaker Open (Not Used)
1:0020	Alarm - Overspeed Alarm
1:0021	Alarm - Tie Breaker Open / No Aux (Not Used)
1:0022	Alarm - Gen Breaker Open / No Aux (Not Used)
1:0023	Alarm - Tie Breaker Open / No Casc (Not Used)
1:0024	Alarm - Gen Breaker Open / No Casc (Not Used)
1:0025	Alarm - Tie Breaker Open / No Remote (Not Used)
1:0026	Alarm - Gen Breaker Open / No Remote (Not Used)
1:0027	Alarm - Stuck in Critical Alarm
1:0028	Alarm - Extraction / Admission Input Failed
1:0029	Alarm - Extraction / Admission Remote Setpoint Input Failed
1:0030	Alarm - HP Pressure Compensation Input Failed
1:0031	Alarm - LP Pressure Compensation Input Failed
1:0032	Alarm - Speed Setpoint Configuration Error
1:0033	Alarm - Steam Map Configuration Error
1:0034	Alarm - Speed Setpoint in Critical Band
1:0035	Alarm - Inlet / Exhaust Remote Setpoint Input Failed
1:0036	Alarm - Spare
1:0037	Alarm - Extraction / Admission Remote Manual Input Failed
1:0038	Alarm Not Acknowledged
1:0039	Alarm Acknowledge
1:0040	Alarm Exists (Common Alarm Indication)
1:0041	Trip - Power up
1:0042	Trip - HMI ESD Button
1:0043	Trip - Overspeed Trip
1:0044	Trip - Loss of Speed Signals
1:0045	Trip - Actuator # 1 Fault
1:0046	Trip - Actuator # 2 Fault
1:0047	Trip - Speed in Critical Band Too Long
1:0048	Trip - External Trip 2
1:0049	Trip - External Trip 3
1:0050	Trip - Modbus Link 1 Trip
1:0051	Trip - Modbus Link 2 Trip
1:0052	Trip - Spare
1:0053	Trip - Tie Breaker Open (Not Used)
1:0054	Trip - Gen Breaker Open (Not Used)
1:0055	Trip - External Trip (BI_01)
1:0056	Trip - Controlled Shutdown Complete
1:0057	Trip - External Trip 4
1:0058	Trip - External Trip 5
1:0059	Trip - Extraction / Admission Pressure Input Failed
1:0060–63	Trip - Spare

1:0064	Shutdown Exists (Trip Indication)
1:0065	ESD Acknowledge Enable
1:0066	Moving to Minimum Setpoint
1:0067	Ramping to Idle (Idle / Rated)
1:0068	Idle / Rated at Idle
1:0069	Ramping to Rated (Idle / Rated)
1:0070	Idle Rated At Rated (Idle / Rated)
1:0071	Auto Seq - Setpoint at Low Idle
1:0072	Auto Seq - Ramping to High Idle
1:0073	Auto Seq - Setpoint at High Idle
1:0074	Auto Seq - Ramping to Rated
1:0075	Auto Seq - At Rated
1:0076	Speed PID In Control of LSS
1:0077	Speed Sensor 1 Failed Override ON
1:0078	Speed Sensor 2 Failed Override ON
1:0079	Overspeed Test Permissive
1:0080	Overspeed Test In Progress
1:0081	Speed At or above Minimum Governor
1:0082	Turbine In Critical Speed Band
1:0083	Remote Speed Setpt Is Enabled
1:0084	Remote Speed Setpt Is Active
1:0085	Remote Speed Setpt Is In Control
1:0086	Remote Speed Setpt Is Inhibited
1:0087	Speed PID In Control
1:0088–89	Spare
1:0090	Generator Breaker Closed (Not Used)
1:0091	Utility Tie Breaker Closed (Not Used)
1:0092	Synchronizing Rate Selected (Not Used)
1:0093	Synchronizing Is Enabled (Not Used)
1:0094	Sync / Load Share In Control (Not Used)
1:0095	Sync / Load Share Inhibited (Not Used)
1:0096	Spare
1:0097	Frequency Control Armed (Not Used)
1:0098	Frequency Control Active (Not Used)
1:0099	Spare
1:0100	Cascade Is Enabled
1:0101	Cascade Is Active
1:0102	Cascade Is In Control
1:0103	Cascade Is Inhibited
1:0104	Remote Cascade Setpoint Is Enabled
1:0105	Remote Cascade Setpoint Is Active
1:0106	Remote Cascade Setpoint Is In Control
1:0107	Remote Cascade Setpoint Is Inhibited
1:0108	Spare
1:0109	Auxiliary Is Enabled (Not Used)
1:0110	Auxiliary Is Active (Not Used)
1:0111	Auxiliary Is In Control (Not Used)
1:0112	Aux Active / Not Limiting (Not Used)
1:0113	Aux Active / Not In Control (Not Used)
1:0114	Auxiliary is Inhibited (Not Used)
1:0115	Remote Aux Is Enabled (Not Used)
1:0116	Remote Aux Is Active (Not Used)
1:0117	Rmt Aux Is In Control (Not Used)
1:0118	Rmt Aux Is Inhibited (Not Used)
1:0119	Spare
1:0120	Extraction / Admission Is Enabled
1:0121	Extraction / Admission Is Active
1:0122	Extraction / Admission Is In Control (not limited)
1:0123	Extraction / Admission is Inhibited
1:0124	Remote Extraction / Admission Setpoint Is Enabled
1:0125	Remote Extraction / Admission Setpoint Is Active
1:0126	Remote Extraction / Admission Setpoint Is In Control
1:0127	Remote Extraction / Admission Setpoint Is Inhibited

1:0128	Pressure Priority Enabled (Not Used)
1:0129	Pressure Priority Active (Not Used)
1:0130	Speed Priority Active
1:0131	Priority Transfer Permiss. (Not Used)
1:0132	Spare
1:0133	Controlled Stop In Progress
1:0134	LP Valve Limiter Is Open
1:0135	LP Valve Limiter Is Closed
1:0136	LP Valve Limiter In Control
1:0137	HP Valve Limiter Is Open
1:0138	HP Valve Limiter Is Closed
1:0139	HP Valve Limiter In Control
1:0140	Remote/Local Remote Selected
1:0141	MODBUS 1 Active
1:0142	Start Permissive
1:0143	At Steam Map Limit
1:0144	At Min Press Limit (Not Used)
1:0145	At HP MAX Limit
1:0146	At HP MIN Limit
1:0147	At LP MAX Limit
1:0148	At LP MIN Limit
1:0149	At Max Power Limit (Not Used)
1:0150	At Max Press Limit (Not Used)
1:0151	Shutdown Relay Energized
1:0152	Alarm Relay Energized
1:0153	Discrete Output 1 Energized
1:0154	Discrete Output 2 Energized
1:0155	Discrete Output 3 Energized
1:0156	Discrete Output 4 Energized
1:0157	Relay 5 Energized (Not Used)
1:0158	Relay 6 Energized (Not Used)
1:0159	ESD Discrete Input Closed
1:0160	Reset Discrete Input Closed
1:0161	Raise Speed Discrete Input Closed
1:0162	Lower Speed Discrete Input Closed
1:0163	Discrete Input 1 Closed
1:0164	Discrete Input 2 Closed
1:0165	Discrete Input 3 Closed
1:0166	Discrete Input 4 Closed
1:0167	Discrete Input 5 Closed
1:0168	Discrete Input 6 Closed
1:0169	Discrete Input 7 Closed
1:0170	Discrete Input 8 Closed
1:0171	Contact In 9 Closed (Not Used)
1:0172	Contact In 10 Closed (Not Used)
1:0173	Contact In 11 Closed (Not Used)
1:0174	Contact In 12 Closed (Not Used)
1:0175	Aux Enbl/Dsbl Configured (Not Used)
1:0176	Sync Function Configured (Not Used)
1:0177	2-Step ESD Configured
1:0178	Manual Start Configured
1:0179	Auto Start Configured
1:0180	Semi-Auto Start Configured
1:0181	Idle/Rated Start Configured
1:0182	Auto Start Sequence Configured
1:0183	1st Stage Press. Configured (Not Used)
1:0184	Remote Speed Control Configured
1:0185	Loadsharing Configured (Not Used)
1:0186	ESD (Trip) Configured
1:0187	Gen Set Configured (Not Used)
1:0188	Cascade Control Configured
1:0189	Remote Cascade Setpoint Configured
1:0190	Aux Control Configured (Not Used)

1:0191	Remote Aux Configured (Not Used)
1:0192	Modbus 1 Local / Remote Active Configured
1:0193	Start Permissive Configured
1:0194	Freq. Arm/Disarm Configured (Not Used)
1:0195	Freq. Control Configured (Not Used)
1:0196	MPU 2 Configured
1:0197	Local / Remote Configured
1:0198	Local / Remote ESD Always Active
1:0199	Cascade Setpoint Tracking Configured
1:0200	KW Input Cfgd & Not Fld (Not Used)
1:0201	Extraction / Admission Configured
1:0202	Admission-only Configured
1:0203	Extraction / Admission Enable / Disable Configured
1:0204	Priority Selection Config. (Not Used)
1:0205	Extraction / Admission Remote Setpoint Configured
1:0206	Extraction / Admission Setpoint Tracking Configured
1:0207	Spare
1:0208	T for 505E/ F for 505D (Not Used)
1:0209–298	Spare
1:0299	Alarm - Invalid Compressor Configuration
1:0300	Alarm - Comp. 1 Flow Input Failed
1:0301	Alarm - Comp. 1 Suction Pressure Input Failed
1:0302	Alarm - Comp. 1 Discharge Pressure Input Failed
1:0303	Alarm - Comp. 1 Suction Temperature Input Failed
1:0304	Alarm - Comp. 1 Discharge Temperature Input Failed
1:0305	Alarm - Comp. 1 Flow Element Pressure Input Failed
1:0306	Alarm - Comp. 1 Flow Element Temperature Input Failed
1:0307	Alarm - Comp. 1 Decoupling Input 1 Failed
1:0308	Alarm - Comp. 1 Decoupling Input 2 Failed
1:0309	Alarm - Comp. 1 HSS Auxiliary Input 1 Failed
1:0310	Alarm - Comp. 1 HSS Auxiliary Input 2 Failed
1:0311	Alarm - Comp. 1 Remote Manual Input Failed
1:0312	Alarm - Comp. 1 Redundant Flow Input Failed
1:0313	Alarm - Comp. 1 Redundant Suction Pressure Input Failed
1:0314	Alarm - Comp. 1 Redundant Discharge Pressure Input Failed
1:0315	Alarm - Comp. 1 Started-Not in AUTO
1:0316	Alarm - Comp. 1 Surge Recovery not Enabled in FULL MANUAL
1:0317	Alarm - Comp. 1 Steady State Condition Failed
1:0318	Alarm - Comp. 1 Surge Detected
1:0319	Alarm - Comp. 1 Surge Minimum Position (SMP) Active
1:0320	Alarm - Comp. 1 Anti-Surge Valve Output Failed
1:0321–329	Spare
1:0330	Comp. 1 - Anti-Surge PID In Control
1:0331	Comp. 1 - HSS Auxiliary Input 1 In Control
1:0332	Comp. 1 - HSS Auxiliary Input 2 In Control
1:0333	Comp. 1 - HSS Auxiliary Input 3 In Control
1:0334	Comp. 1 - BOOST In Control
1:0335	Comp. 1 - Deactivation Routine In Control
1:0336	Comp. 1 - MANUAL with BACKUP In Control
1:0337	Comp. 1 - Suction Pressure Override In Control
1:0338	Comp. 1 - Discharge Pressure Override In Control
1:0339	Comp. 1 - Rate PID In Control
1:0340	Comp. 1 - Sequence Positioning In Control
1:0341	Comp. 1 - Surge Recovery In Control
1:0342	Comp. 1 - Valve Freeze Active
1:0343	Comp. 1 - AUTO Mode
1:0344	Comp. 1 - MANUAL with BACKUP Mode
1:0345	Comp. 1 - FULL MANUAL Mode
1:0346	Comp. 1 - Online
1:0347	Comp. 1 - Suction Pressure Default Value in Use
1:0348	Comp. 1 - Suction Pressure Last Good Value in Use
1:0349	Comp. 1 - Discharge Pressure Default Value in Use

1:0350	Comp. 1 - Discharge Pressure Last Good Value in Use
1:0351	Comp. 1 - Flow Element Pressure Default Value in Use
1:0352	Comp. 1 - Flow Element Pressure Last Good Value in Use
1:0353	Comp. 1 - Surge Detected
1:0354	Comp. 1 - Surged by Flow Derivative
1:0355	Comp. 1 - Surged by Minimum Flow
1:0356	Comp. 1 - Surged by Suction Pressure Derivative
1:0357	Comp. 1 - Surged by Discharge Pressure Derivative
1:0358	Comp. 1 - Surged by Speed Derivative
1:0359	Comp. 1 - Surge Limit Line Crossed
1:0360	Comp. 1 - Surge Minimum Position (SMP) Active
1:0361	Comp. 1 - Purge Active
1:0362	Comp. 1 - Emergency Shutdown Active
1:0363	Comp. 1 - Controlled Shutdown Active
1:0364	Comp. 1 - Start Active
1:0365	Comp. 1 - Zero Speed
1:0366	Comp. 1 - Suction Temperature Default Value in Use
1:0367	Comp. 1 - Suction Temperature Last Good Value in Use
1:0368	Comp. 1 - Discharge Temperature Default Value in Use
1:0369	Comp. 1 - Discharge Temperature Last Good Value in Use
1:0370	Comp. 1 - Flow Element Temperature Default Value in Use
1:0371	Comp. 1 - Flow Element Temperature Last Good Value in Use
1:0372	Comp. 1 - Steady State Condition Failed
1:0373–399	Spare
1:0400	Alarm - Comp. 2 Flow Input Failed
1:0401	Alarm - Comp. 2 Suction Pressure Input Failed
1:0402	Alarm - Comp. 2 Discharge Pressure Input Failed
1:0403	Alarm - Comp. 2 Suction Temperature Input Failed
1:0404	Alarm - Comp. 2 Discharge Temperature Input Failed
1:0405	Alarm - Comp. 2 Flow Element Pressure Input Failed
1:0406	Alarm - Comp. 2 Flow Element Temperature Input Failed
1:0407	Alarm - Comp. 2 Decoupling Input 1 Failed
1:0408	Alarm - Comp. 2 Decoupling Input 2 Failed
1:0409	Alarm - Comp. 2 HSS Auxiliary Input 1 Failed
1:0410	Alarm - Comp. 2 HSS Auxiliary Input 2 Failed
1:0411	Alarm - Comp. 2 Remote Manual Input Failed
1:0412	Alarm - Comp. 2 Redundant Flow Input Failed
1:0413	Alarm - Comp. 2 Redundant Suction Pressure Input Failed
1:0414	Alarm - Comp. 2 Redundant Discharge Pressure Input Failed
1:0415	Alarm - Comp. 2 Started-Not in AUTO
1:0416	Alarm - Comp. 2 Surge Recovery not Enabled in FULL MANUAL
1:0417	Alarm - Comp. 2 Steady State Condition Failed
1:0418	Alarm - Comp. 2 Surge Detected
1:0419	Alarm - Comp. 2 Surge Minimum Position (SMP) Active
1:0420	Alarm - Comp. 2 Anti-Surge Valve Output Failed
1:0421–429	Spare
1:0430	Comp. 2 - Anti-Surge PID In Control
1:0431	Comp. 2 - HSS Auxiliary Input 1 In Control
1:0432	Comp. 2 - HSS Auxiliary Input 2 In Control
1:0433	Comp. 2 - HSS Auxiliary Input 3 In Control
1:0434	Comp. 2 - BOOST In Control
1:0435	Comp. 2 - Deactivation Routine In Control
1:0436	Comp. 2 - MANUAL with BACKUP In Control
1:0437	Comp. 2 - Suction Pressure Override In Control
1:0438	Comp. 2 - Discharge Pressure Override In Control
1:0439	Comp. 2 - Rate PID In Control
1:0440	Comp. 2 - Sequence Positioning In Control
1:0441	Comp. 2 - Surge Recovery In Control
1:0442	Comp. 2 - Valve Freeze Active
1:0443	Comp. 2 - AUTO Mode
1:0444	Comp. 2 - MANUAL with BACKUP Mode
1:0445	Comp. 2 - FULL MANUAL Mode

1:0446	Comp. 2 - Online
1:0447	Comp. 2 - Suction Pressure Default Value in Use
1:0448	Comp. 2 - Suction Pressure Last Good Value in Use
1:0449	Comp. 2 - Discharge Pressure Default Value in Use
1:0450	Comp. 2 - Discharge Pressure Last Good Value in Use
1:0451	Comp. 2 - Flow Element Pressure Default Value in Use
1:0452	Comp. 2 - Flow Element Pressure Last Good Value in Use
1:0453	Comp. 2 - Surge Detected
1:0454	Comp. 2 - Surged by Flow Derivative
1:0455	Comp. 2 - Surged by Minimum Flow
1:0456	Comp. 2 - Surged by Suction Pressure Derivative
1:0457	Comp. 2 - Surged by Discharge Pressure Derivative
1:0458	Comp. 2 - Surged by Speed Derivative
1:0459	Comp. 2 - Surge Limit Line Crossed
1:0460	Comp. 2 - Surge Minimum Position (SMP) Active
1:0461	Comp. 2 - Purge Active
1:0462	Comp. 2 - Emergency Shutdown Active
1:0463	Comp. 2 - Controlled Shutdown Active
1:0464	Comp. 2 - Start Active
1:0465	Comp. 2 - Zero Speed
1:0466	Comp. 2 - Suction Temperature Default Value in Use
1:0467	Comp. 2 - Suction Temperature Last Good Value in Use
1:0468	Comp. 2 - Discharge Temperature Default Value in Use
1:0469	Comp. 2 - Discharge Temperature Last Good Value in Use
1:0470	Comp. 2 - Flow Element Temperature Default Value in Use
1:0471	Comp. 2 - Flow Element Temperature Last Good Value in Use
1:0472	Comp. 2 - Steady State Condition Failed
1:0473–481	Spare
1:0482	Compressor Discrete Output 1 Energized
1:0483	Compressor Discrete Output 2 Energized
1:0484	Compressor Discrete Output 3 Energized
1:0485	Compressor Discrete Output 4 Energized
1:0486	Compressor Discrete Output 5 Energized
1:0487	Compressor Discrete Output 6 Energized
1:0488	Open #1 AS Valve Discrete Input Closed
1:0489	Close #1 AS Valve Discrete Input Closed
1:0490	Open #2 AS Valve Discrete Input Closed
1:0491	Close #2 AS Valve Discrete Input Closed
1:0492	Compressor Discrete Input 1 Closed
1:0493	Compressor Discrete Input 2 Closed
1:0494	Compressor Discrete Input 3 Closed
1:0495	Compressor Discrete Input 4 Closed
1:0496	Compressor Discrete Input 5 Closed
1:0497	Compressor Discrete Input 6 Closed
1:0498	Compressor Discrete Input 7 Closed
1:0499	Compressor Discrete Input 8 Closed

Table 3-8. Modbus Boolean Reads

Analog Reads (reads from the 505CC-2 by the master device)

Addr	Description	Multiplier	Units
3:0001	Cause of last turbine trip	1	
3:0002	Speed Sensor #1 Input (RPM)	1	rpm
3:0003	Speed Sensor #2 Input (RPM)	1	rpm
3:0004	Actual Turbine Speed (RPM)	1	rpm
3:0005	Actual Speed (%) x 100	100	%
3:0006	Speed Setpoint (%) x 100	100	%
3:0007	Speed Setpoint (RPM)	1	rpm
3:0008	Speed Droop Setpoint (%)	100	%
3:0009	Load (%) x 100 (Not Used)		
3:0010	Speed PID Output (%) x 100	100	%
3:0011	Minimum Governor Speed Setpoint (RPM)	1	rpm
3:0012	Highest Speed Reached (RPM)	1	rpm
3:0013	Idle / Rated - Idle Speed (RPM)	1	rpm
3:0014	Idle / Rated - Rated Speed (RPM)	1	rpm
3:0015	Auto Seq - Low Idle Speed Setpt (RPM)	1	rpm
3:0016	Auto Seq - Low Idle Delay (MIN*100)	1.66666667	mins
3:0017	Auto Seq - Minutes Left At Low Idle x 100	1.66666667	mins
3:0018	Auto Seq - Low to High Idle Rate RPM/SEC	1	rpm/s
3:0019	Auto Seq - High Idle Speed Setpt (RPM)	1	rpm
3:0020	Auto Seq - High Idle Delay (MIN*100)	1.66666667	mins
3:0021	Auto Seq - Minutes Left At High Idle x100	1.66666667	mins
3:0022	Auto Seq - High Idle to Rated Rate RPM/SEC	1	rpm/s
3:0023	Auto Seq - Rated Speed Setpt (RPM)	1	rpm
3:0024	Auto Seq - Run Time Hours	1	hrs
3:0025	Auto Seq - Hours Since Trip	1	hrs
3:0026	Cascade Setpoint (Scaled)	Configurable	
3:0027	Cascade PID Output (%) x 100	100	%
3:0028	Cascade Input (%) x 100	100	%
3:0029	Cascade Setpoint (%) x 100	100	%
3:0030	Cascade Scale Factor	1	
3:0031	Cascade Input (Scaled)	Configurable	
3:0032	Remote Cascade Input (Scaled)	Configurable	
3:0033	Aux Setpoint (Scaled) (Not Used)		
3:0034	Aux PID Output (%) x 100 (Not Used)		
3:0035	Aux Input (%) (Not Used)		
3:0036	Aux Setpoint (%) (Not Used)		
3:0037	Aux Scale Factor (Not Used)		
3:0038	Aux Input (Scaled) (Not Used)		
3:0039	Remote Aux Input (Scaled) (Not Used)		
3:0040	Remote Speed Setpoint Input	1	rpm
3:0041	FSP Scale Factor (Not Used)		
3:0042	FSP Input (Scaled) (Not Used)		
3:0043	Loadshare Scale Factor (Not Used)		
3:0044	Sync / Ldshr Input (Scaled) (Not Used)		
3:0045	KW Scale Factor (Not Used)		
3:0046	KW Input (Scaled) (Not Used)		
3:0047	HP Valve Limiter Output	100	%
3:0048	LP Valve Limiter Output	100	%
3:0049	Actuator 1 Demand (%) x100	100	%
3:0050	Actuator 2 Demand (%) x100	100	%
3:0051	Extraction / Admission Manual Demand	100	%
3:0052	Extraction / Admission Setpoint (Scaled)	Configurable	
3:0053	Extraction / Admission PID Output (%) x 100	100	%
3:0054	Extraction / Admission Input (%) x 100	100	%
3:0055	Extraction / Admission Setpoint (%) x 100	100	%
3:0056	Extraction / Admission Scale Factor	1	
3:0057	Extraction / Admission Input (Scaled)	Configurable	
3:0058	Extraction / Admission Remote Setpoint Input (Scaled)	Configurable	
3:0059	Spare		
3:0060	Modbus Entered Speed Setpoint (feedback)	1	rpm

3:0061	Modbus Entered Cascade Setpoint (feedback)	Configurable	
3:0062	Mdbs Entrd Aux Stpnt (fdbk) (Not Used)		
3:0063	Modbus Entered Extr / Adm Setpoint (feedback)	Configurable	
3:0064	S-demand Limited (from ratio/limiter)	100	%
3:0065	P-demand Limited (from ratio/limiter)	100	%
3:0066	HP Map Demand (from ratio/limiter)	100	%
3:0067	LP Map Demand (from ratio/limiter)	100	%
3:0068	S-term (from LSS to ratio/limiter)	100	%
3:0069	P-term (from LSS to ratio/limiter)	100	%
3:0070	Control Parameter (Line 1) (Not Used)		
3:0071	Control Parameter (Line 2) (Not Used)		
3:0072	Turbine Analog Input 1 (% x 100)	100	%
3:0073	Turbine Analog Input 2 (% x 100)	100	%
3:0074	Turbine Analog Input 3 (% x 100)	100	%
3:0075	Turbine Analog Input 4 (% x 100)	100	%
3:0076	Turbine Analog Input 5 (% x 100)	100	%
3:0077	Turbine Analog Input 6 (% x 100)	100	%
3:0078	Turbine Analog Output 1 (mA x 100)	100	mA
3:0079	Turbine Analog Output 2 (mA x 100)	100	mA
3:0080	Turbine Analog Output 3 (mA x 100)	100	mA
3:0081	Turbine Analog Output 4 (mA x 100)	100	mA
3:0082	Analog Output 5 (mA x 100) (Not Used)		
3:0083	Analog Output 6 (mA x 100) (Not Used)		
3:0084	Turbine Actuator 1 Output (mA x 100)	100	mA
3:0085	Turbine Actuator 2 Output (mA x 100)	100	mA
3:0086	Spare		
3:0087	KW Units (3=MW 4=KW) (Not Used)		
3:0088	Spare		
3:0089	Turbine Analog Input 1 Configuration	1	
3:0090	Turbine Analog Input 2 Configuration	1	
3:0091	Turbine Analog Input 3 Configuration	1	
3:0092	Turbine Analog Input 4 Configuration	1	
3:0093	Turbine Analog Input 5 Configuration	1	
3:0094	Turbine Analog Output 1 Configuration	1	
3:0095	Turbine Analog Output 2 Configuration	1	
3:0096	Turbine Analog Output 3 Configuration	1	
3:0097	Turbine Analog Output 4 Configuration	1	
3:0098	Analog Output 5 Config. (Not Used)		
3:0099	Analog Output 6 Config. (Not Used)		
3:0100	Turbine Discrete Output 1 Configuration	1	
3:0101	Turbine Discrete Output 2 Configuration	1	
3:0102	Turbine Discrete Output 3 Configuration	1	
3:0103	Turbine Discrete Output 4 Configuration	1	
3:0104	Relay 5 Configuration (Not Used)		
3:0105	Relay 6 Configuration (Not Used)		
3:0106	Turbine Discrete Input 1 Configuration	1	
3:0107	Turbine Discrete Input 2 Configuration	1	
3:0108	Turbine Discrete Input 3 Configuration	1	
3:0109	Turbine Discrete Input 4 Configuration	1	
3:0110	Turbine Discrete Input 5 Configuration	1	
3:0111	Turbine Discrete Input 6 Configuration	1	
3:0112	Turbine Discrete Input 7 Configuration	1	
3:0113	Turbine Discrete Input 8 Configuration	1	
3:0114	Contact Input 9 Config. (Not Used)		
3:0115	Contact Input 10 Config. (Not Used)		
3:0116	Contact Input 11 Config. (Not Used)		
3:0117	Contact Input 12 Config. (Not Used)		
3:0118	Aux Units Configured (Not Used)		
3:0119	Cascade Units Configured	1	
3:0120	Extraction / Admission Units Configured	1	
3:0121	Spare		
3:0122	Inlet / Exhaust Setpoint (Scaled)	Configurable	
3:0123	Inlet / Exhaust PID Output (%) x 100	100	%

3:0124	Inlet / Exhaust Input (%) x 100	100	%
3:0125	Inlet / Exhaust Setpoint (%) x 100	100	%
3:0126	Inlet / Exhaust Scale Factor	1	
3:0127	Inlet / Exhaust Input (Scaled)	Configurable	
3:0128	Inlet / Exhaust Remote Setpoint Input (Scaled)	Configurable	
3:0129	Modbus Entered Inlet/Exhaust Setpoint (feedback)	Configurable	
3:0130	Turbine Alarm -- First-out	1	
3:0131–191	Spare		
3:0192	Comp. 1 - Anti-Surge PID Output	100	%
3:0193	Comp. 1 - BOOST Output	100	%
3:0194	Comp. 1 - Anti-Surge Valve Decoupling Output	100	%
3:0195	Comp. 1 - Speed Control Decoupling Output	100	%
3:0196	Comp. 1 - Flow Filtered Input Signal	Configurable	kg/hr,
3:0197	Comp. 1 - Gain Compensation Factor	100	
3:0198	Comp. 1 - Calculated Polytropic Head	Configurable	N-m/kg
3:0199	Comp. 1 - Calculated Reduced Head	100	
3:0200	Comp. 1 - Calculated Specific Heat Ratio	100	
3:0201	Comp. 1 - Manual Valve Position	100	%
3:0202	Comp. 1 - Manual Position Ramp	100	%
3:0203	Comp. 1 - Surge Control Line Margin	100	%
3:0204	Comp. 1 - Suction Pressure Override PID Output	100	%
3:0205	Comp. 1 - Discharge Pressure Override PID Output	100	%
3:0206	Comp. 1 - Calculated Pressure Ratio	100	
3:0207	Comp. 1 - Suction Pressure Value Used for Control	Configurable	kPaG,
3:0208	Comp. 1 - Suction Pressure Filtered Input Signal	Configurable	kPaG,
3:0209	Comp. 1 - Discharge Pressure Value Used for Control	Configurable	kPaG,
3:0210	Comp. 1 - Discharge Pressure Filtered Input Signal	Configurable	kPaG,
3:0211	Comp. 1 - Flow Element Pressure Value Used for Ctrl	Configurable	kPaG,
3:0212	Comp. 1 - Flow Element Pressure Filtered Input Signal	Configurable	kPaG,
3:0213	Comp. 1 - "Corrected" Suction Flow	Configurable	Am3/h
3:0214	Comp. 1 - Sensor Flow	Configurable	kg/hr,
3:0215	Comp. 1 - Surge Control Line Flow	Configurable	Am3/h
3:0216	Comp. 1 - Actual Suction Flow	Configurable	Am3/h
3:0217	Comp. 1 - Stage Flow	Configurable	kg/hr,
3:0218	Comp. 1 - Rate PID Output	100	%
3:0219	Comp. 1 - Surge Event Counter	1	
3:0220	Comp. 1 - Total Number of Surges	1	
3:0221	Comp. 1 - S_PV Surge Process Variable	100	%
3:0222	Comp. 1 - Surge Capture Flow Deriv.	Configurable	Am3/h
3:0223	Comp. 1 - Surge Capture Suction Pressure Derivative	Configurable	kPa/s
3:0224	Comp. 1 - Surge Capture Discharge Press. Derivative	Configurable	kPa/s
3:0225	Comp. 1 - Surge Capture Speed Derivative	1	rpm/s
3:0226	Comp. 1 - Calculated Sigma	1000	
3:0227	Comp. 1 - Surge Minimum Position (SMP)	100	%
3:0228	Comp. 1 - Sequence Positioning Output	100	%
3:0229	Comp. 1 - Surge Recovery Output	100	%
3:0230	Comp. 1 - Suction Temp. Value Used for Control	Configurable	Deg C
3:0231	Comp. 1 - Suction Temp. Filtered Input Signal	Configurable	Deg C
3:0232	Comp. 1 - Discharge Temp. Value Used for Control	Configurable	Deg C
3:0233	Comp. 1 - Discharge Temp. Filtered Input Signal	Configurable	Deg C
3:0234	Comp. 1 - Flow Element Temp. Value Used for Ctrl.	Configurable	Deg C
3:0235	Comp. 1 - Flow Element Temp. Filtered Input Signal	Configurable	Deg C
3:0236	Comp. 1 - HSS Output	100	%
3:0237	Comp. 1 - Valve Final Output	100	%
3:0238	Comp. 1 - Valve Demand Percent	100	%
3:0239	Comp. 1 - Calculated Average Compressibility	100	
3:0240	Comp. 1 - Calculated Suction Compressibility	100	
3:0241	Comp. 1 - Calculated Flow Compressibility	100	
3:0242	Comp. 1 - HSS Auxiliary Input 1	100	%
3:0243	Comp. 1 - HSS Auxiliary Input 2	100	%
3:0244	Comp. 1 - Adjacent Stage Valve Demand	100	%
3:0245	Comp. 1 - Surge Capture Operating Point	Configurable	
3:0246	Comp. 1 - Deactivation Routine Output	100	%

3:0247	Comp. 1 - Operating Point Rate	100	
3:0248	Comp. 1 - Rate PID Setpoint	100	
3:0249	Comp. 1 - Operating Point (Map X-axis Value)	Configurable	Am3/h
3:0250	Comp. 1 - Operating Point (Map Y-axis Value)	Configurable	N-m/k
3:0251	Comp. 1 - Mode Selected	1	
3:0252	Comp. 1 - Status	1	
3:0253	Comp. 1 - Active Control Routine	1	
3:0254	Comp. 1 - Active Mode and Control Routine	1	
3:0255	Comp. 1 - Alarm First-out	1	
3:0256–262	Spare		
3:0263	Comp. 2 - Anti-Surge PID Output	100	%
3:0264	Comp. 2 - BOOST Output	100	%
3:0265	Comp. 2 - Anti-Surge Valve Decoupling Output	100	%
3:0266	Comp. 2 - Speed Control Decoupling Output	100	%
3:0267	Comp. 2 - Flow Filtered Input Signal	Configurable	kg/hr,
3:0268	Comp. 2 - Gain Compensation Factor	100	
3:0269	Comp. 2 - Calculated Polytropic Head	Configurable	N-m/k
3:0270	Comp. 2 - Calculated Reduced Head	100	
3:0271	Comp. 2 - Calculated Specific Heat Ratio	100	
3:0272	Comp. 2 - Manual Valve Position	100	%
3:0273	Comp. 2 - Manual Position Ramp	100	%
3:0274	Comp. 2 - Surge Control Line Margin	100	%
3:0275	Comp. 2 - Suction Pressure Override PID Output	100	%
3:0276	Comp. 2 - Discharge Pressure Override PID Output	100	%
3:0277	Comp. 2 - Calculated Pressure Ratio	100	
3:0278	Comp. 2 - Suction Pressure Value Used for Control	Configurable	kPaG,
3:0279	Comp. 2 - Suction Pressure Filtered Input Signal	Configurable	kPaG,
3:0280	Comp. 2 - Discharge Pressure Value Used for Control	Configurable	kPaG,
3:0281	Comp. 2 - Discharge Pressure Filtered Input Signal	Configurable	kPaG,
3:0282	Comp. 2 - Flow Element Pressure Value Used for Ctrl	Configurable	kPaG,
3:0283	Comp. 2 - Flow Element Pressure Filtered Input Signal	Configurable	kPaG,
3:0284	Comp. 2 - "Corrected" Suction Flow	Configurable	Am3/h
3:0285	Comp. 2 - Sensor Flow	Configurable	kg/hr,
3:0286	Comp. 2 - Surge Control Line Flow	Configurable	Am3/h
3:0287	Comp. 2 - Actual Suction Flow	Configurable	Am3/h
3:0288	Comp. 2 - Stage Flow	Configurable	kg/hr,
3:0289	Comp. 2 - Rate PID Output	100	%
3:0290	Comp. 2 - Surge Event Counter	1	
3:0291	Comp. 2 - Total Number of Surges	1	
3:0292	Comp. 2 - S_PV Surge Process Variable	100	%
3:0293	Comp. 2 - Surge Capture Flow Deriv.	Configurable	Am3/h
3:0294	Comp. 2 - Surge Capture Suction Pressure Derivative	Configurable	kPa/s
3:0295	Comp. 2 - Surge Capture Discharge Press. Derivative	Configurable	kPa/s
3:0296	Comp. 2 - Surge Capture Speed Derivative	1	rpm/s
3:0297	Comp. 2 - Calculated Sigma	1000	
3:0298	Comp. 2 - Surge Minimum Position (SMP)	100	%
3:0299	Comp. 2 - Sequence Positioning Output	100	%
3:0300	Comp. 2 - Surge Recovery Output	100	%
3:0301	Comp. 2 - Suction Temp. Value Used for Control	Configurable	Deg C
3:0302	Comp. 2 - Suction Temp. Filtered Input Signal	Configurable	Deg C
3:0303	Comp. 2 - Discharge Temp. Value Used for Control	Configurable	Deg C
3:0304	Comp. 2 - Discharge Temp. Filtered Input Signal	Configurable	Deg C
3:0305	Comp. 2 - Flow Element Temp. Value Used for Ctrl.	Configurable	Deg C
3:0306	Comp. 2 - Flow Element Temp. Filtered Input Signal	Configurable	Deg C
3:0307	Comp. 2 - HSS Output	100	%
3:0308	Comp. 2 - Valve Final Output	100	%
3:0309	Comp. 2 - Valve Demand Percent	100	%
3:0310	Comp. 2 - Calculated Average Compressibility	100	
3:0311	Comp. 2 - Calculated Suction Compressibility	100	
3:0312	Comp. 2 - Calculated Flow Compressibility	100	
3:0313	Comp. 2 - HSS Auxiliary Input 1	100	%
3:0314	Comp. 2 - HSS Auxiliary Input 2	100	%
3:0315	Comp. 2 - Adjacent Stage Valve Demand	100	%

3:0316	Comp. 2 - Surge Capture Operating Point	Configurable	
3:0317	Comp. 2 - Deactivation Routine Output	100	%
3:0318	Comp. 2 - Operating Point Rate	100	
3:0319	Comp. 2 - Rate PID Setpoint	100	
3:0320	Comp. 2 - Operating Point (Map X-axis Value)	Configurable	Am3/h
3:0321	Comp. 2 - Operating Point (Map Y-axis Value)	Configurable	N-m/k
3:0322	Comp. 2 - Mode Selected	1	
3:0323	Comp. 2 - Status	1	
3:0324	Comp. 2 - Active Control Routine	1	
3:0325	Comp. 2 - Active Mode and Control Routine	1	
3:0326	Comp. 2 - Alarm First-out	1	
3:0327–333	Spare		
3:0334	Comp. 1 Flow Input (% x 100)	100	%
3:0335	Comp. 1 Suction Pressure Input (% x 100)	100	%
3:0336	Comp. 1 Discharge Pressure Input (% x 100)	100	%
3:0337	Comp. 1 Suction Temperature Input (% x 100)	100	%
3:0338	Comp. 1 Discharge Temperature Input (% x 100)	100	%
3:0339	Comp. 2 Flow Input (% x 100)	100	%
3:0340	Comp. 2 Suction Pressure Input (% x 100)	100	%
3:0341	Comp. 2 Discharge Pressure Input (% x 100)	100	%
3:0342	Comp. 2 Suction Temperature Input (% x 100)	100	%
3:0343	Comp. 2 Discharge Temperature Input (% x 100)	100	%
3:0344	Comp. Configurable Analog Input 1 (% x 100)	100	%
3:0345	Comp. Configurable Analog Input 2 (% x 100)	100	%
3:0346	Comp. Configurable Analog Input 3 (% x 100)	100	%
3:0347	Comp. Configurable Analog Input 4 (% x 100)	100	%
3:0348	Comp. Configurable Analog Input 5 (% x 100)	100	%
3:0349	Comp. Configurable Analog Out 1 (mA x 100)	100	mA
3:0350	Comp. Configurable Analog Out 2 (mA x 100)	100	mA
3:0351	Comp. 1 Anti-Surge Valve Output (mA x 100)	100	mA
3:0352	Comp. 2 Anti-Surge Valve Output (mA x 100)	100	mA
3:0353	Spare		
3:0354	Comp. Analog Input 1 Configuration	1	
3:0355	Comp. Analog Input 2 Configuration	1	
3:0356	Comp. Analog Input 3 Configuration	1	
3:0357	Comp. Analog Input 4 Configuration	1	
3:0358	Comp. Analog Input 5 Configuration	1	
3:0359	Comp. Analog Output 1 Configuration	1	
3:0360	Comp. Analog Output 2 Configuration	1	
3:0361	Comp. Discrete Output 1 Configuration	1	
3:0362	Comp. Discrete Output 2 Configuration	1	
3:0363	Comp. Discrete Output 3 Configuration	1	
3:0364	Comp. Discrete Output 4 Configuration	1	
3:0365	Comp. Discrete Output 5 Configuration	1	
3:0366	Comp. Discrete Output 6 Configuration	1	
3:0367	Comp. Discrete Input 1 Configuration	1	
3:0368	Comp. Discrete Input 2 Configuration	1	
3:0369	Comp. Discrete Input 3 Configuration	1	
3:0370	Comp. Discrete Input 4 Configuration	1	
3:0371	Comp. Discrete Input 5 Configuration	1	
3:0372	Comp. Discrete Input 6 Configuration	1	
3:0373	Comp. Discrete Input 7 Configuration	1	
3:0374	Comp. Discrete Input 8 Configuration	1	
3:0375–393	Spare		

Table 3-9. Modbus Analog Reads

Analog Writes (writes from the master device to the 505CC-2)

Addr	Description	Multiplier	Units
4:0001	Modbus Entered Speed Setpoint	1	rpm
4:0002	Modbus Entered Cascade Setpoint	Configurable	
4:0003	Modbus Entered Aux Setpoint (Not Used)	1	
4:0004	Modbus Entered Extraction / Admission Setpoint	Configurable	
4:0005	Modbus Entered Inlet / Exhaust Setpoint	Configurable	
4:0006	Modbus Entered Extr / Adm Manual Pressure Demand	100	%
4:0007	Modbus Entered Manual HP/V1 Valve Demand	100	%
4:0008	Modbus Entered Manual LP/V2 Valve Demand	100	%
4:0009	Spare		
4:0010	Comp. 1 - MB Entered Suction Press. Ovrd. Setpoint	Configurable	KPa
4:0011	Comp. 1 - MB Entered Disch. Press. Ovrd. Setpoint	Configurable	kPa
4:0012	Comp. 1 - MB Entered Manual Valve Position	100	%
4:0013	Spare		
4:0014	Comp. 2 - MB Entered Suction Press. Ovrd. Setpoint	Configurable	KPa
4:0015	Comp. 2 - MB Entered Disch. Press. Ovrd. Setpoint	Configurable	KPa
4:0016	Comp. 2 - MB Entered Manual Valve Position	100	%
4:0017–22	Spare		

Table 3-10. Modbus Analog Writes

Analog Lookup Table

Some of the analog reads shown in the Modbus list are reference values, such as first-out alarm or I/O configuration indicators. Reference Table 3-11 to correctly interpret such values.

3:0001 Cause of Last Turbine Trip	0 – No Shutdowns
	1 – Control Power-Up
	2 – ESD from HMI
	3 – Overspeed Trip
	4 – Both MPUs Failed
	5 – Actuator 1 Failed
	6 – Actuator 2 Failed
	7 – Speed Stuck in Critical
	8 – External Trip Input 2
	9 -- External Trip Input 3
	10 – ESD from Modbus 1
	11 – ESD from Modbus 2
	12–13 – Not Used
	14 – External Trip Input 1 (BI01)
	15 – Controlled Shutdown Complete
	16 – External Trip Input 4
	17 – External Trip Input 5
	18 – Extraction / Admission Pressure Input Failed
3:0089 – 3:0093 Turbine Analog Input Configuration	0 – Not Configured
	1 – Remote Speed Setpoint
	2–4 – Not Used
	5 – Cascade Process Variable Input
	6 – Remote Cascade Setpoint
	7–8 – Not Used
	9 – Inlet / Exhaust Pressure Input
	10 – Remote Extraction / Admission Setpoint
	11 – Remote Inlet / Exhaust Setpoint
	12 – Pressure Input for HP Valve Compensation
	13 – Remote Manual Extraction / Admission Pressure Demand
	14 – Pressure Input for LP Valve Compensation
3:0094 – 3:0097 Turbine Analog Output	1 – Not Configured
	2 – Turbine Speed

Configuration	3 – Turbine Speed Setpoint
	4 – Remote Speed Setpoint
	5–7 – Not Used
	8 – Extraction / Admission Pressure Input
	9 – Extraction / Admission Setpoint
	10 – Remote Extraction / Admission Setpoint
	11 – Cascade Process Variable Input
	12 – Cascade Setpoint
	13 – Remote Cascade Setpoint
	14–16 – Not Used
	17 – Speed Demand (PID Output)
	18 – Extraction / Admission Demand (PID Output)
	19 – HP / V1 Valve Limiter
	20 – LP / V2 Valve Limiter
	21 -- HP / V1 Valve Demand
	22 -- LP / V2 Valve Demand
	23 – Not Used
3:0100 – 3:0103 Turbine Discrete Output Configuration	1 – Relay Not Configured
	2 – Shutdown Active
	3 – Trip Relay Output
	4 – Alarm Active
	5 – AtlasPC Control Status OK
	6 – Overspeed Trip
	7 – Overspeed Test Enabled
	8 – Speed PID In Control
	9 – Remote Speed Setpoint Enabled
	10 – Remote Speed Setpoint Active
	11 – Not Used
	12 – Auto Start Sequence Halted
	13 – Online PID Dynamics Selected
	14 – Local Control Mode Selected
	15–19 – Not Used
	20 – Extraction / Admission Control Enabled
	21 – Extraction / Admission Control Active
	22 – LP / V2 Valve Map In Control (Not Limited)
	23 – Remote Extraction / Admission Setpoint Enabled
	24 – Remote Extraction / Admission Setpoint Active
	25 – Cascade Control Enabled
	26 – Cascade Control Active
	27–31 – Not Used
	32 – HP / V1 Valve Limiter In Control
	33 – LP / V2 Valve Limiter In Control
	34 – Extraction / Admission Priority Enabled
	35 – Extraction / Admission Priority Active
	36 – Any Steam Map Limit Reached
	37 – Modbus Commands Enabled
	38 – Level Switch Not Configured
	39 – Turbine Speed Level Switch
	40 – Speed Setpoint Level Switch
	41–42 – Not Used
	43 – Extraction / Admission Pressure Input Level Switch
	44 – Extraction / Admission Setpoint Level Switch
	45 – Cascade Process Variable Input Level Switch
	46 – Cascade Setpoint Level Switch
	47–48 – Not Used
	49 – Speed Demand (PID Output) Level Switch
	50 – Extraction / Admission Demand (PID Output) Level Switch
	51 – HP / V1 Valve Limiter Level Switch
	52 – LP / V2 Valve Limiter Level Switch
	53 -- HP / V1 Valve Demand Level Switch
	54 -- LP / V2 Valve Demand Level Switch
	55 – Not Used
3:0106 – 3:0113	0 – Not Configured

Turbine Discrete Input Configuration .	1–2 – Not Used
	3 – Overspeed Test Enable
	4 – External Run / Start Command
	5 – Start Permissive
	6 – Idle / Rated
	7 – Halt / Continue Auto Start Sequence
	8 – Override MPU Fault
	9 – Select Online PID Dynamics
	10 – Local / Remote
	11 – Remote Speed Setpoint Enable
	12–13 – Not Used
	14 – Extraction / Admission Setpoint Raise
	15 – Extraction / Admission Setpoint Lower
	16 – Extraction / Admission Control Enable
	17 – Extraction / Admission Remote Setpoint Enable
	18 – Not Used
	19 – Cascade Setpoint Raise
	20 – Cascade Setpoint Lower
	21 – Cascade Control Enable
	22 – Cascade Remote Setpoint Enable
	23–26 – Not Used
	27 – HP / V1 Valve Limiter Open
	28 – HP / V1 Valve Limiter Close
	29 – LP / V2 Valve Limiter Open
	30 – LP / V2 Valve Limiter Close
	31 – Extraction / Admission Manual Demand Raise
	32 – Extraction / Admission Manual Demand Lower
	33 – External Trip 2
	34 – External Trip 3
	35 – External Trip 4
	36 – External Trip 5
	37 – Controlled Shutdown
	38 – Inlet / Exhaust Setpoint Raise
	39 – Inlet / Exhaust Setpoint Lower
	40 – Inlet / Exhaust Remote Setpoint Enable
	41–43 – Not Used
	44 – Extraction / Admission Remote Manual Demand Enable
	45 – Real Time Clock Auto-Synchronize
3:0119 – 3:0120 Turbine Cascade (119) and Extraction /Admission (120) Control Units Configured	0 – Not Configured
	1 – kPa
	2 – kg/cm2
	3 – Atm
	4 – Bar
	5 – mBar
	6 – PSI
	7 – ftH2O
	8 – Ton/ft
	9 – inHg
	10 – kg/h
	11 – t/h
	12 – lb/h
	13 – klb/h
3:0130 Turbine Alarm First-Out	0 – No Alarms
	1 – Speed Sensor 1 Failed
	2 – Speed Sensor 2 Failed
	3 – Remote Cascade Setpoint Input Failed
	4–6 – Not Used
	7 – Inlet / Exhaust Pressure Input Failed
	8 – Remote Speed Setpoint Input Failed
	9 – Remote Cascade Setpoint Input Failed
	10–11 – Not Used
	12 – HP / V1 Actuator Failed
	13 – LP / V2 Actuator Failed

	14 – Start Permissives Not Met
	15 – Modbus 1 Communications Error
	16 – Modbus 2 Communications Error
	17 – Not Used
	18 -- Shutdown
	19 – Not Used
	20 -- Overspeed
	21–26 – Not Used
	27 – Turbine Speed Stuck in Critical Band
	28 – Extraction / Admission Pressure Input Failed
	29 – Extraction / Admission Remote Setpoint Input Failed
	30 – HP Pressure Compensation Input Failed
	31 – LP Pressure Compensation Input Failed
	32 – Speed Setpoint Configuration Error
	33 – Steam map Configuration Error
	34 – Remote Speed Setpoint in Critical Band
	35 – Inlet / Exhaust Remote Setpoint Input Failed
	36 – Not Used
	37 – Extraction / Admission Remote Manual Demand Input Failed
3:0251, 3:0322 Compressor 1 (251) and Compressor 2 (322) Mode Selected	0 – None Selected
	1 – AUTO Mode Selected
	2 – MANUAL with BACKUP Mode Selected
	3 – FULL MANUAL Mode Selected
3:0252, 3:0323 Compressor 1 (252) and Compressor 2 (323) Status	0 – None Selected
	1 – Offline / Controlled Shutdown
	2 – Offline / Emergency Shutdown
	3 – Offline / Zero Speed
	4 – Offline / Purge
	5 – Offline / Start
	6 – Online
3:0253, 3:0324 Compressor 1 (253) and Compressor 2 (324) Active Control Routine	0 – None Selected
	1 – Anti-Surge PID
	2 – Surge Recovery
	3 – BOOST / Valve Step Opening
	4 – MANUAL with BACKUP
	5 – Suction Pressure Override
	6 – Discharge Pressure Override
	7 – Rate PID
	8 – Sequence Positioning
	9 – Auxiliary HSS Input 1
	10 -- Auxiliary HSS Input 2
	11 – Adjacent Stage Valve Demand
	12 – Deactivation Routine
	13 – FULL MANUAL
3:0254, 3:0325 Compressor 1 (254) and Compressor 2 (325) Active Mode and Control Routine	0 – None Selected
	1 – AUTO / Shutdown Positioning
	2 – AUTO / Zero Speed Positioning
	3 – AUTO / Purge Positioning
	4 – AUTO / Start Positioning
	5 – AUTO / Anti-Surge PID
	6 – AUTO / Rate PID
	7 – AUTO / Surge Recovery
	8 – AUTO / BOOST / Valve Step Opening
	9 – Not Used
	10 – AUTO / Suction Pressure Override
	11 – AUTO / Discharge Pressure Override
	12 – AUTO / Sequence Positioning
	13 – AUTO / Auxiliary HSS Input 1
	14 – AUTO / Auxiliary HSS Input 2
	15 – AUTO / Adjacent Stage Valve Demand
	16 – AUTO / Deactivation Routine
	17 – MANUAL with BACKUP / Shutdown Positioning
	18 – MANUAL with BACKUP / Zero Speed Positioning

	19 – MANUAL with BACKUP / Purge Positioning
	20 – MANUAL with BACKUP / Start Positioning
	21 – MANUAL with BACKUP / Anti-Surge PID
	22 – MANUAL with BACKUP / Rate PID
	23 – MANUAL with BACKUP / Surge Recovery
	24 – MANUAL with BACKUP / BOOST / Valve Step Opening
	25 – Not Used
	26 – MANUAL with BACKUP / Suction Pressure Override
	27 – MANUAL with BACKUP / Discharge Pressure Override
	28 – MANUAL with BACKUP / Sequence Positioning
	29 – MANUAL with BACKUP / Auxiliary HSS Input 1
	30 – MANUAL with BACKUP / Auxiliary HSS Input 2
	31 – MANUAL with BACKUP / Adjacent Stage Valve Demand
	32 – MANUAL with BACKUP / Deactivation Routine
	33 – FULL MANUAL / Offline
	34 – FULL MANUAL / Online
3:0255, 3:0326 Compressor 1 (255) and Compressor 2 (326) Alarm First-Out	0 – No Alarms
	1 – Primary Flow Input Failed
	2 – Primary Suction Pressure Input Failed
	3 – Primary Discharge Pressure Input Failed
	4 – Suction Temperature Input Failed
	5 – Discharge Temperature Input Failed
	6 – Raw PF (Flow Element Pressure) Input Failed
	7 – Raw TF (Flow Element Temperature) Input Failed
	8 – Decoupling Input 1 Failed
	9 – Decoupling Input 2 Failed
	10 – Auxiliary HSS Input 1 Failed
	11 – Auxiliary HSS Input 2 Failed
	12 – Remote Manual Valve Demand Input Failed
	13 – Redundant Flow Input Failed
	14 – Redundant Suction Pressure Input Failed
	15 – Redundant Discharge Pressure Input Failed
	16 – Redundant Flow Inputs Difference Alarm
	17 – Redundant Suction Pressure Inputs Difference Alarm
	18 – Redundant Discharge Pressure Inputs Difference Alarm
	19 – Start Initiated in FULL MANUAL Mode
	20 – Surge Recovery Not Enabled in FULL MANUAL Mode
	21 – Compressor Steady-State Condition Failed
	22 – Surge Detected
	23 – Surge Minimum Position Active
	24 – Anti-Surge Valve Output Failed
	25 – Invalid Compressor Configuration
3:0354 – 3:0358 Compressor Analog Input Configuration	0 – Not Configured
	1 – Compressor 1 Raw PF (Flow Element Pressure) Input
	2 – Compressor 1 Raw TF (Flow Element Temperature) Input
	3 – Compressor 1 Decoupling Input 1
	4 – Compressor 1 Decoupling Input 2
	5 – Compressor 1 Auxiliary HSS Input 1
	6 – Compressor 1 Auxiliary HSS Input 2
	7 – Compressor 1 Remote Manual Valve Demand
	8 – Compressor 1 Redundant Flow Input
	9 – Compressor 1 Redundant Suction Pressure Input
	10 – Compressor 1 Redundant Discharge Pressure Input
	11 – Compressor 2 Raw PF (Flow Element Pressure) Input
	12 – Compressor 2 Raw TF (Flow Element Temperature) Input
	13 – Compressor 2 Decoupling Input 1
	14 – Compressor 2 Decoupling Input 2
	15 – Compressor 2 Auxiliary HSS Input 1
	16 – Compressor 2 Auxiliary HSS Input 2
	17 – Compressor 2 Remote Manual Valve Demand
	18 – Compressor 2 Redundant Flow Input
	19 – Compressor 2 Redundant Suction Pressure Input
	20 – Compressor 2 Redundant Discharge Pressure Input

3:0359 – 3:0360 Compressor Analog Output Configuration	1 – Not Configured
	2 – Compressor 1 Surge Process Variable (S_PV)
	3 – Compressor 1 Actual Suction Volumetric Flow
	4 – Compressor 1 Corrected Suction Volumetric Flow
	5 – Compressor 1 Stage Flow
	6 – Compressor 1 Polytropic Head
	7 – Compressor 1 Pressure Ratio
	8 – Compressor 1 Suction Pressure used for Control
	9 – Compressor 1 Discharge Pressure used for Control
	10 – Compressor 1 Suction Temperature used for Control
	11 – Compressor 1 Discharge Temperature used for Control
	12 – Compressor 1 Sensor Flow
	13 – Compressor 1 HSS Output
	14 – Compressor 1 Valve Demand
	15 – Compressor 2 Surge Process Variable (S_PV)
	16 – Compressor 2 Actual Suction Volumetric Flow
	17 – Compressor 2 Corrected Suction Volumetric Flow
	18 – Compressor 2 Stage Flow
	19 – Compressor 2 Polytropic Head
	20 – Compressor 2 Pressure Ratio
	21 – Compressor 2 Suction Pressure used for Control
	22 – Compressor 2 Discharge Pressure used for Control
	23 – Compressor 2 Suction Temperature used for Control
	24 – Compressor 2 Discharge Temperature used for Control
	25 – Compressor 2 Sensor Flow
	26 – Compressor 2 HSS Output
	27 – Compressor 2 Valve Demand
3:0361 – 3:0366 Compressor Discrete Output Configuration	1 – Not Configured
	2 – Compressor 1 Surge Detected
	3 – Compressor 1 Surge Minimum Position (SMP) Active
	4 – Compressor 1 Online
	5 – Compressor 1 AUTO Mode
	6 – Compressor 1 MANUAL with BACKUP Mode
	7 – Compressor 1 FULL MANUAL Mode
	8 – Compressor 2 Surge Detected
	9 – Compressor 2 Surge Minimum Position (SMP) Active
	10 – Compressor 2 Online
	11 – Compressor 2 AUTO Mode
	12 – Compressor 2 MANUAL with BACKUP Mode
	13 – Compressor 2 FULL MANUAL Mode
3:0367 – 3:0374 Compressor Discrete Input Configuration	0 – Not Configured
	1 – Compressor 1 Reset Surge Minimum Position (SMP)
	2 – Compressor 1 Reset Surge Capture Information
	3 – Compressor 1 Select AUTO Mode
	4 – Compressor 1 Select MANUAL with BACKUP Mode
	5 – Compressor 1 Select FULL MANUAL Mode
	6 – Compressor 1 Purge Position
	7 – Compressor 1 Online Auxiliary Input
	8 – Compressor 1 Control Margin Increase
	9 – Compressor 1 Control Margin Decrease
	10 – Compressor 1 Anti-Surge Valve Output Failed
	11 – Compressor 1 Start Position
	12 – Compressor 1 Shutdown Position
	13 – Compressor 2 Reset Surge Minimum Position (SMP)
	14 – Compressor 2 Reset Surge Capture Information
	15 – Compressor 2 Select AUTO Mode
	16 – Compressor 2 Select MANUAL with BACKUP Mode
	17 – Compressor 2 Select FULL MANUAL Mode
	18 – Compressor 2 Purge Position
	19 – Compressor 2 Online Auxiliary Input
	20 – Compressor 2 Control Margin Increase
	21 – Compressor 2 Control Margin Decrease
	22 – Compressor 2 Anti-Surge Valve Output Failed

	23 – Compressor 2 Start Position
	24 – Compressor 2 Shutdown Position

Table 3-11. Modbus Analog Read Lookup Table

Summary of Initial Setup Procedure

The following is a typical procedure to install and establish communications with a new 505CC-2. All of the instructions below are detailed in the previous sections.

1. Install the 505CC-2 in accordance with the guidelines in Chapter 2. Note the ComputerName of the 505CC-2 (VXAxxxxx) from the tag on its chassis.

2. Wire the 505CC-2 to field devices according to the I/O lists and wiring diagrams shown earlier in Chapter 3. Wiring diagrams are also available in .PDF and .DWG formats on the installation CD.

3. Install the HMI/CCT software from the supplied installation CD onto the target computer (if other than the optional touchscreen HMI). This installation can be repeated on any number of target computers, but only one run-time license is provided. Refer to the installation notes earlier in Chapter 3.

4. Install the optional touchscreen HMI or other computer and connect to the 505CC-2 as detailed earlier in Chapter 3.
   a. Direct Ethernet connection requires a null (crossover) cable.
   b. Networked Ethernet connection requires a regular (straight) cable.

5. Use Woodward's AppManager software (available on the installation CD) to verify the 505CC-2's IP address and control name.
   a. If the IP address of the control must be changed for installation on an existing network, do so now using the AppManager software and the procedure outlined in Chapter 3. If installed, the IP address of the touchscreen HMI must also be changed.
   b. If the 505CC-2 will not be installed on a network, its IP address does not need to be changed. However, the HMI/CCT computer that will be used to configure and/or operate the control must have an IP address matching that of the 505CC-2.
   c. Close AppManager. For routine configuration and operation of the 505CC-2, AppManager is not needed.

6. With corresponding IP addresses on both the 505CC-2 and the HMI/CCT computer, launch the HMI/CCT software.
   a. The ServLink OPC Server will launch automatically with the HMI/CCT and attempt to connect to 190.14.99.220. If the IP address of the 505CC-2 was previously modified from its default, modify the SOS session as described earlier in Chapter 3.

7. If the HMI/CCT software has never before connected to the target 505CC-2, it must be configured.
   a. Select Go To Offline Configuration at the HMI/CCT splash screen shown in Figure 3-22.
   b. Go to the System Configuration screen shown in Figure 3-29 and select Add Control to List. In the configuration pop-up, enter the appropriate Control Name and IP Address as shown in Figure 3-39.
   c. Select OK, then select the Control ID that was just configured from the Control ID list box.

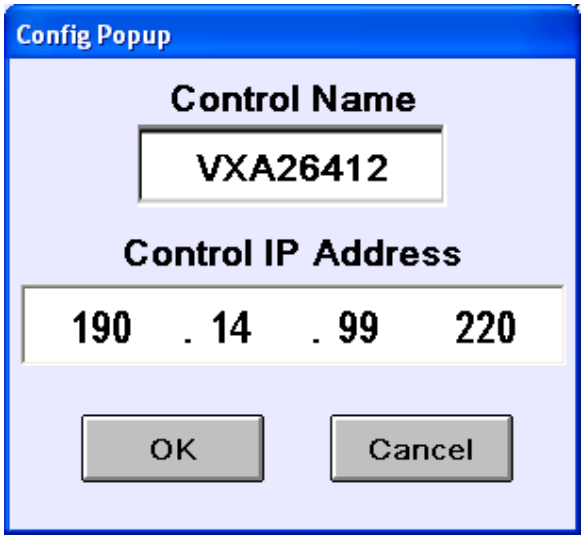


Figure 3-39. Add Control Configuration Pop-up

8. Switch to the Monitor login. The HMI/CCT should now connect to the configured 505CC-2. Proceed with manual configuration or go to the Online Configuration mode to upload a configuration file as detailed earlier in Chapter 3. Each time it is launched from this point, the HMI/CCT is configured to connect to the specified control—These steps are no longer required to establish communications on successive sessions.

Chapter 4.
Power Supply Board

General Description

The AtlasPC power supply board 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 AtlasPC Control platform.

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

WARNING

The AtlasPC 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.

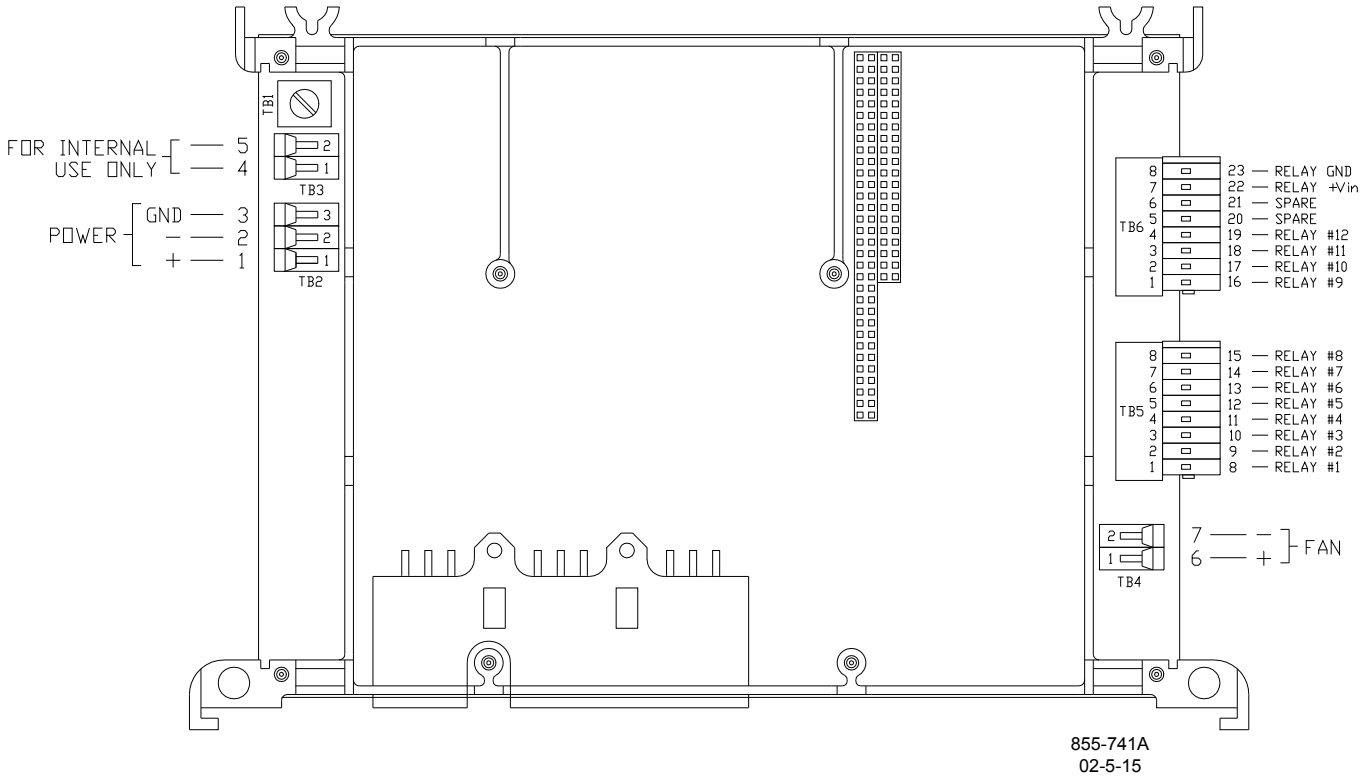


Figure 4-1. Power Supply Board Connections (5503-216)

Specifications

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 AtlasPC control platform shall be wired such that no other device receives power from the wiring between the AtlasPC Control Platform and the power supply source.

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

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

Electric Shock

The AtlasPC 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.

Troubleshooting Guide

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 AtlasPC control only?

Discrete Output Checks

The AtlasPC 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 AtlasPC 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?

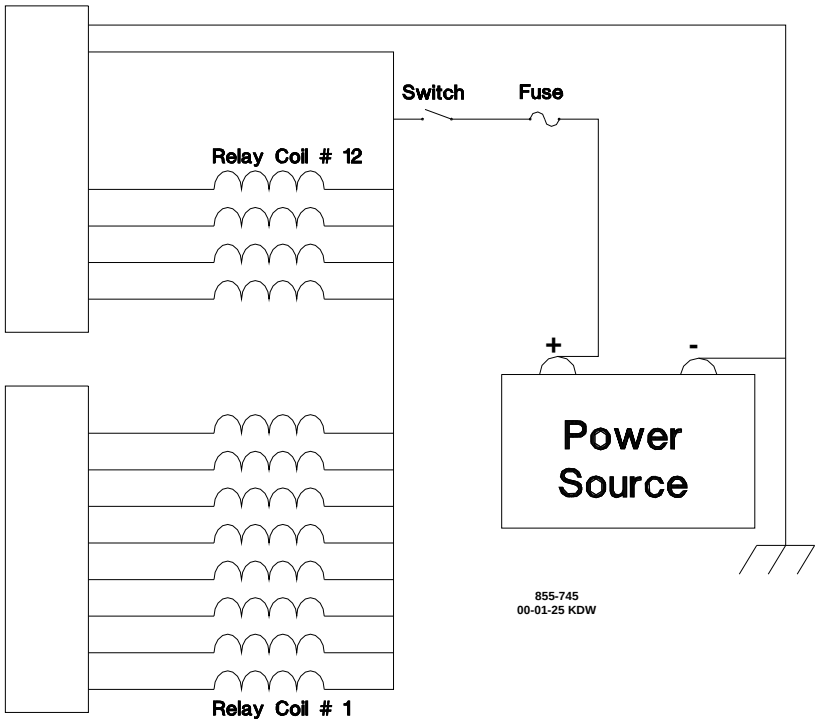


Figure 4-2. Discrete Output Wiring Example
(Discrete Output Interface Wiring to the Power Supply Board)

Configuration Notes

- Refer to Figure 4-2 for discrete output wiring.
- 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 8 details an optional relay module that can be used with these discrete outputs.

Chapter 5.
Pentium CPU Board

General Description

The AtlasPC™ control contains one Pentium CPU board. The CPU board runs the application program automatically upon boot-up. The Pentium CPU board runs a real-time operating system whose functions are not re-documented in this manual.

A solid state hard-drive contains the operating system, Real Time kernel, Control Application, and appropriate utilities. The CPU board supports a standard PC/104 interface to read and write to the I/O boards.

When power is applied to the AtlasPC control system, the Pentium CPU board will perform a Power On Self-Test (POST), load the operating system, and then run the application program. The application will initialize each AtlasPC hardware module and begin gathering I/O data. Upon successful initialization, a red LED on each hardware module will be turned off.

NOTICE

Do not connect any non-isolated serial port device into the COM1 or COM2 CPU serial ports! Isolation is required! A system ground fault may be created, causing system shutdown and/or permanent damage to the Control System.

Use the SmartCore Board's SIO #1 and #2 for serial Modbus connections and COM #3 for software troubleshooting tools.

IMPORTANT

The VX Works operating system on the hard drive is an embedded version that is designed for use with a real-time system only. No other applications are permitted.

Hardware Specifications

The Pentium CPU conforms to the Ampro/Motorola EBX v1.1 mechanical format and contains both PC/104 and PC/104+ bus connectors for interfacing with other Woodward and PC/104 compatible modules.

Electrical

- Power requirements are 5.0 Vdc, 2.5 A (max), 2.25 A (typical)
- 266 MHz Pentium processor, low power version, Tcase rating of 85 °C
- Processor uses a fan-heat sink
- Industrial rated solid state hard drive (CompactFlash)
- 64 MB Synchronous DRAM
- 8/16 bit PC/104 Interface (ISA bus)
- 32 bit PC/104+ Interface (PCI bus)
- (2) RS-232 Serial ports, 115K baud max, non-isolated (shield connected at chassis)
- (1) RJ45 10/100 Base-TX Ethernet (shield ac coupled at chassis)

Mechanical

- Stack-through PC/104 connector.
- Mechanical conformance to Ampro/Motorola EBX 1.1 specification (available at www.ampro.com). This specification defines board dimensions of 5.75 x 8.00 inches (146.0 x 203.2 mm), mounting hole locations, component locations, and component clearances.

CPU Interface Connections

The Pentium CPU supports 10/100 Ethernet and Serial communications. Each interface is cabled to the AtlasPC chassis through the use of "gland plates". These gland plates are also intended to support I/O connections to other I/O modules like Profibus. The connectors, pinouts, and interface requirements for the CPU communication ports are detailed in this section.

CPU Remote Reset Capability

Remote reset is supported using AtlasPC Remote Control Software over Ethernet or modem connections. The user may perform either an application reset or a system reset.

An application reset is purely software and consists of terminating and re-starting the application using Application Manager. A system reset may also be executed by using NetMeeting Remote Control to login to the AtlasPC and perform an operating system shutdown and re-boot. NetMeeting can only be used on systems with Windows NT.

IMPORTANT **Appropriate security permissions are required to perform these functions.**

10/100 Base-TX Ethernet

An auto-switching 10/100 Base-TX RJ45 Ethernet connector is available for system use. This connection will be used for control configuration, data gathering, remote monitoring, maintenance, and networking of multiple controls.

To ensure signal integrity and robust operation of Ethernet devices, double shielded Ethernet cables (SSTP) are required for customer installations. Their primary function is to provide EMI shielding and proper shield termination of the Ethernet cable.

IMPORTANT **To fully realize 100 Base-TX connectivity, downstream devices must be 100 Base-TX capable. As such, when using an Ethernet hub for multiple connections, either a fixed 100 Base-TX or an auto-switching 10/100 Base-TX hub would be necessary.**

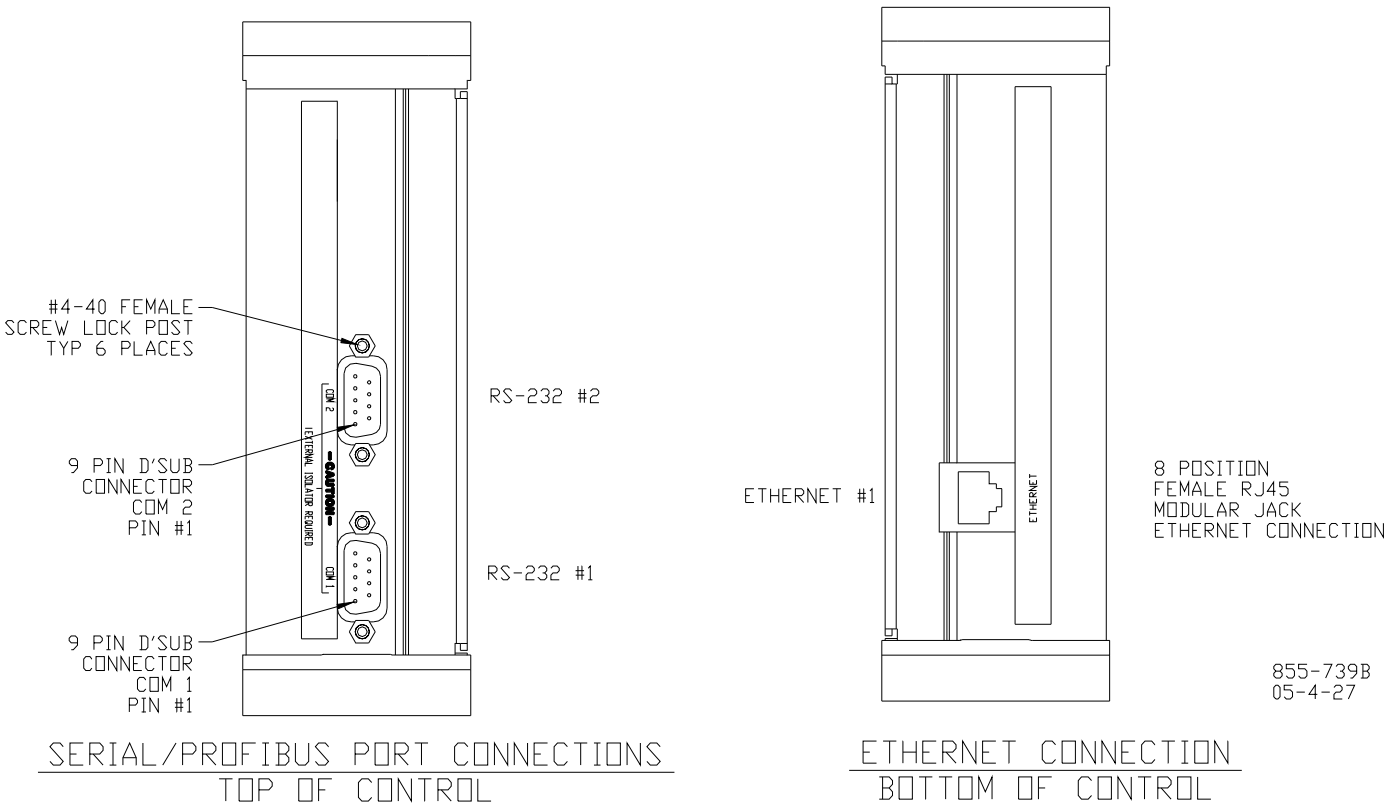


Figure 5-1. Pentium CPU Board Connections

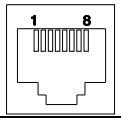
Connector	Signal Mnemonic
RJ45F 	Shielded RJ45 female receptacle
1	TX+
2	TX-
3	RX+
4	--
5	--
6	RX-
7	--
8	--
Shield	AC Coupled to Chassis GND

Table 5-1. Ethernet Port Pinout

NOTICE

Use shielded Ethernet cable only! Use of non-shielded cable may result in permanent system damage.

Chapter 6.
SmartCore Board with Actuators

General Description

This chapter covers the SmartCore board with actuators, part number 5503-302. Each SmartCore board contains circuitry for two speed sensor inputs, six analog inputs, six analog outputs, 2 proportional actuator drivers, 3 serial ports, and 24 discrete inputs. Each speed sensor input may be from a magnetic pick-up or from a proximity probe. Analog inputs are 4–20 mA. Two of the serial ports, may be RS-232, RS-422, or RS-485. The other serial port is a dedicated RS-232 port for software troubleshooting only.

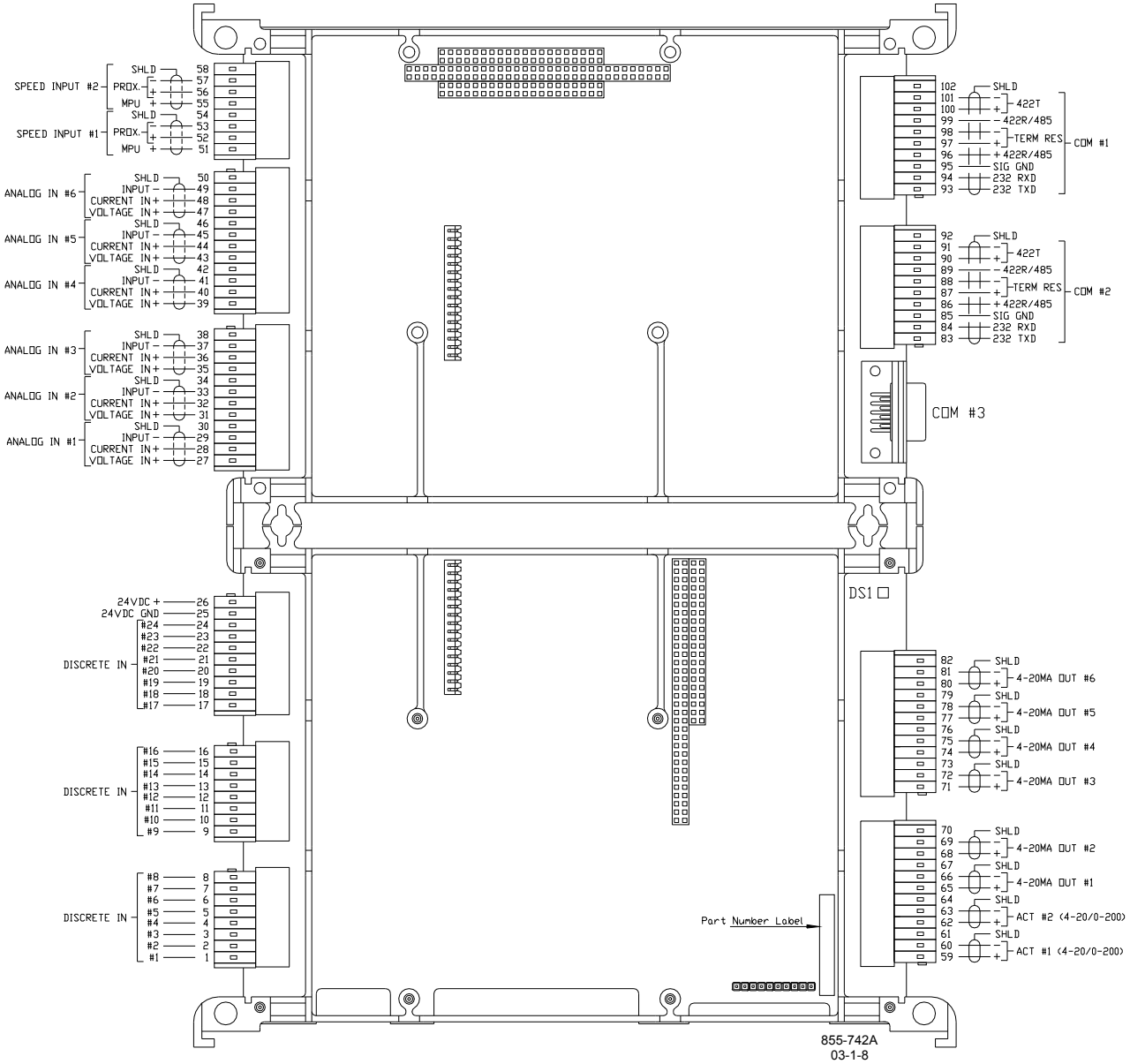


Figure 6-1. SmartCore Board with Actuators, Connectors

Features

- 5 ms update rate
- On-board processor for automatic calibration of the I/O channels
- Analog inputs have 14 bit resolution
- Analog outputs have 12 bit resolution

Physical

The AtlasPC™ 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 screws. The SmartCore board is the size of two analog boards.

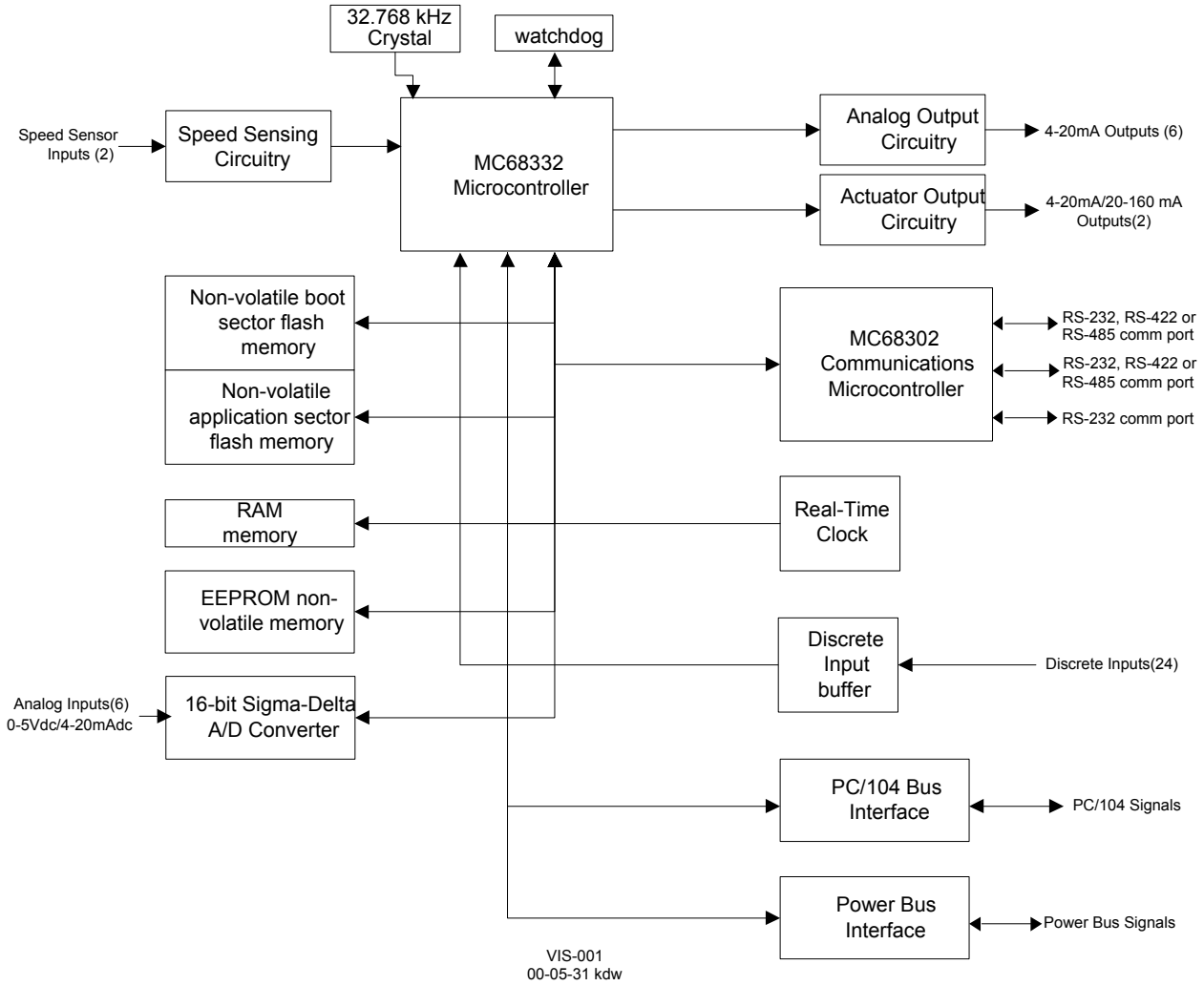


Figure 6-2. AtlasPC SmartCore Board Block Diagram

Specifications

Digital Speed Sensor Inputs

Number of channels	2 selectable as MPU or proximity probe, by terminal block wiring
Input frequency	100—24 950 Hz
Resolution	dependent on frequency, 13 bit minimum at maximum speed
Accuracy	less than ±0.08% full scale from –40 to +85 °C internal temperature

MPU Inputs

Minimum input amplitude	See Figure 6-3
Input amplitude	70 V peak-to-peak
Input impedance	>1.5 kΩ
Isolation voltage	500 Vac minimum, each channel is isolated from all other channels and from the AtlasPC platform

Proximity Probe Inputs

Voltage threshold /duty cycle at 1 kHz	at 16 Vin, duty cycle = 10–80% at 24 Vin, duty cycle = 10–80% at 28 Vin, duty cycle = 10–80%
Voltage threshold /duty cycle at 3 kHz	at 16 Vin, duty cycle = 15–65% at 24 Vin, duty cycle = 10–60% at 28 Vin, duty cycle = 10–55%
Input voltage range	16–28 Vdc
Available power	None
Isolation	500 Vac minimum, each channel is isolated from all other channels and from the AtlasPC platform
Input frequency	0.5–3 kHz

- A derivative output is provided to the application software. The inherent noise on this output, due to resolution, increases with frequency. At 1000 Hz, it can be as much as 2.5 Hz/s. At 5000 Hz, it can be as much as 12.5 Hz/s. At 10 kHz, it can be as much as 25 Hz/s. At 20 kHz, it can be as much as 80 Hz/s. Typically, at 3600 Hz, noise on the MPU signal due to wiring runs will make the noise contribution due to resolution insignificant.
- No proximity probe power provided.
- If the proximity probe inputs are used, the corresponding MPU inputs must be jumpered.

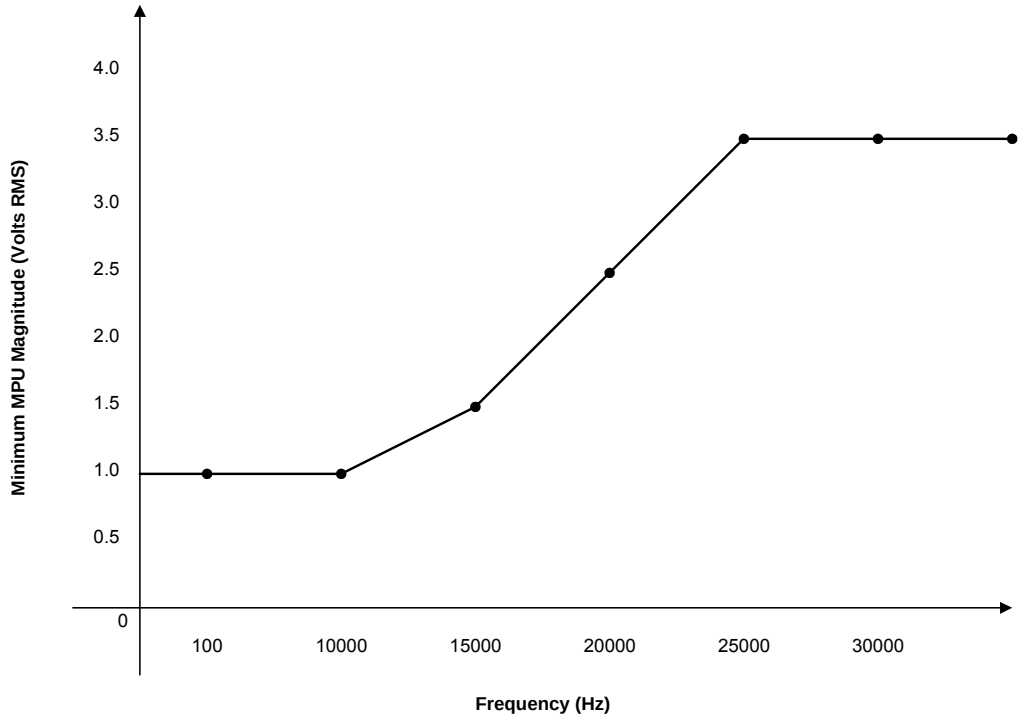


Figure 6-3. Minimum MPU Voltage

Analog Inputs

Number of channels	6
Input type	4–20 mA
Max. input current	25 mA ±5% if configured for 4–20 mA
Common mode rejection	80 dB minimum
Input common mode range	±11 V minimum
Safe input common mode volt	±40 V minimum
Input impedance	200 Ω (±1%)
Anti-aliasing filter	2 poles at 10 ms
Resolution	14 bits
Accuracy @ 25 °C	less than ±0.1% of full scale, 0.025 mA
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	2 channels at 1 ms, 2 channels at 3 ms, and 2 channels at 5 ms

- Loop power for the analog inputs is NOT available.

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

Analog Outputs

Number of channels	6
Output type	4–20 mA outputs, non-isolated
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	12 bits
Accuracy @ 25 °C	less than ±0.1% of full scale, 0.025 mA
Temperature Drift	140 PPM/°C, 0.23 mA maximum 70 ppm/°C, typical (0.45% of full scale, 0.11375 mA)

Actuator Outputs

Number of channels	2	
Actuator Type	Proportional, non-isolated	
Output Type	4–20 or 20-160 mA, software selectable	
Isolation	none	
Max current output	25mA ±5% 200 mA ±5%	(4–20 mA output scale) (20-160 mA output scale)
Min. load resistance	0 Ω	
Max load resistance	300 Ω at 22 mA 45 Ω at 200 mA	(4–20 mA output scale) (20-160 mA output scale)
Resolution	12 bits	
Accuracy @ 25 °C	less than ±0.1% of full scale, 0.026 mA 0.2 mA	 (4–20 mA output scale) (20-160 mA output scale)
Readback Accuracy @ 25 °C	0.5%	
Temperature Drift	140 PPM/°C maximum, 0.24 mA maximum 1.82 mA maximum 70 ppm/°C typical 0.12 mA 0.91 mA	 (4–20 mA output scale) (20-160 mA output scale) 0.45% of full scale, (4–20 mA output scale) (20-160 mA output scale)
Readbacks	Actuator source and return currents	
Dither Current	25 Hz, fixed duty cycle, software variable amplitude	

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
Max input voltage	28 Vdc
Isolation voltage	500 Vac, all channels are isolated from the AtlasPC platform

- 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 AtlasPC platform and other I/O types.

Serial I/O

Number of channels	3
Channel configuration	1 & 2 - RS-232/RS-485/RS-422 software configurable, terminal block connections 3 - RS-232, 9 pin sub D connector
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

SmartCore Board Operation

This board includes no potentiometers and requires no field calibration. A SmartCore board may be replaced with another board of the same part number without any adjustment.

Speed Sensor Inputs

The MPU and proximity probe inputs are read and the speed is provided to the application program. A derivative output is also provided. The speed sensor inputs are filtered by the SmartCore board, and the filter time constant is selectable at 8 milliseconds or 16 milliseconds. Eight milliseconds should be acceptable for most turbine applications and is configured for the 505CC-2. The speed range is selected in the application software 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 board uses speed sensing probes mounted on a gear connected or coupled to the turbine's rotor to sense turbine rotor speed. Any of the board's speed channels accept 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 turbine speed from a gear coupled the mechanical drive side of a system's rotor coupling.

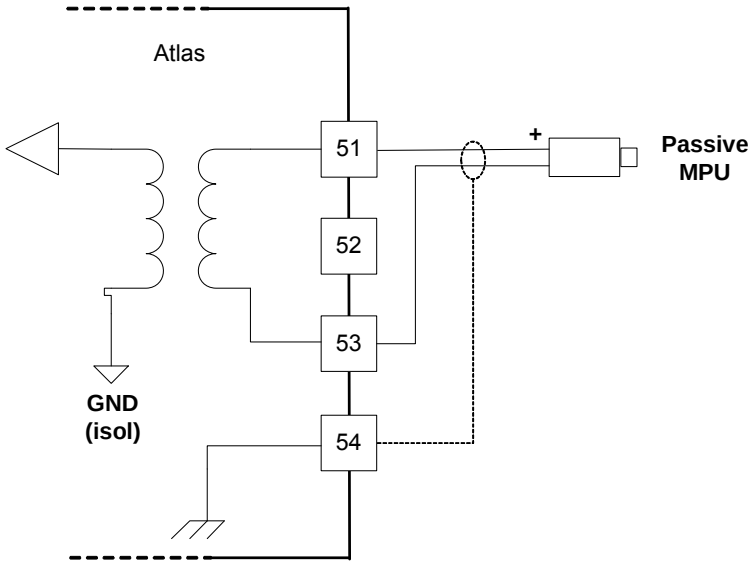


Figure 6-4. Wiring Example–MPU Interface to the SmartCore Board

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 board.

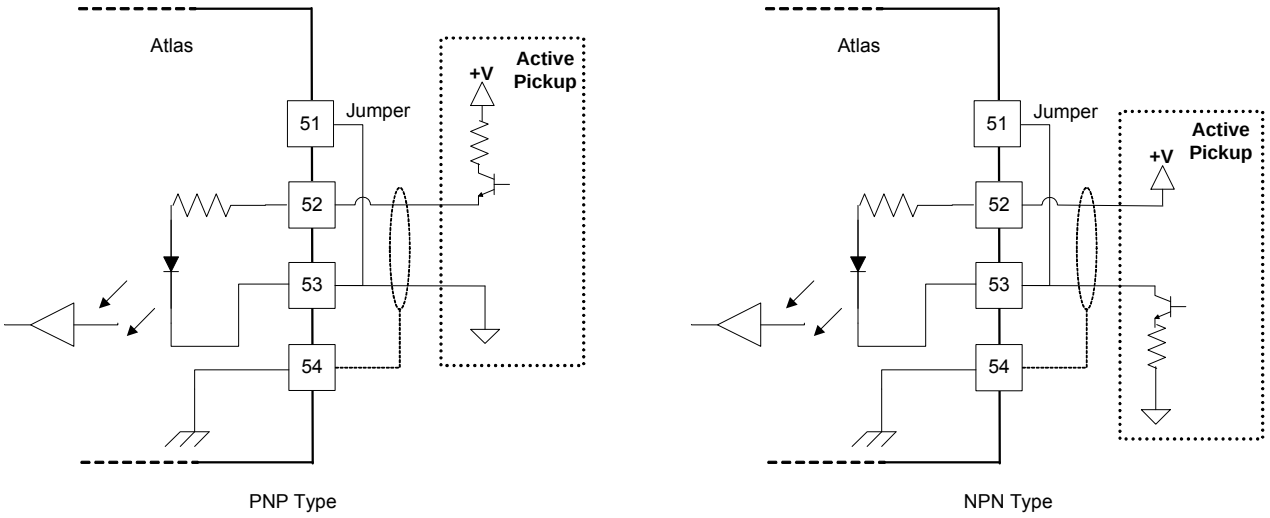


Figure 6-5. Wiring Example–Proximity Probe to the SmartCore Board

Configuration Notes

- Refer to Figures 6-4 and 6-5 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 Software Configuration Limitations

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

Analog Inputs

The analog inputs are 4–20 mA current type, which require a jumper on the terminal block. This allows the SmartCore card to use the applicable hardware calibration values. See Figure 6-6 for jumper locations.

All Analog inputs may be used with two-wire ungrounded (*loop powered) transducers or isolated (self-powered) transducers, but no loop power is provided for the former. All Analog inputs have 10 Vdc of common mode rejection. If interfacing to a non-isolated device, which may have the potential of reaching over 10 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 board uses a 200 Ω resistor across the input.

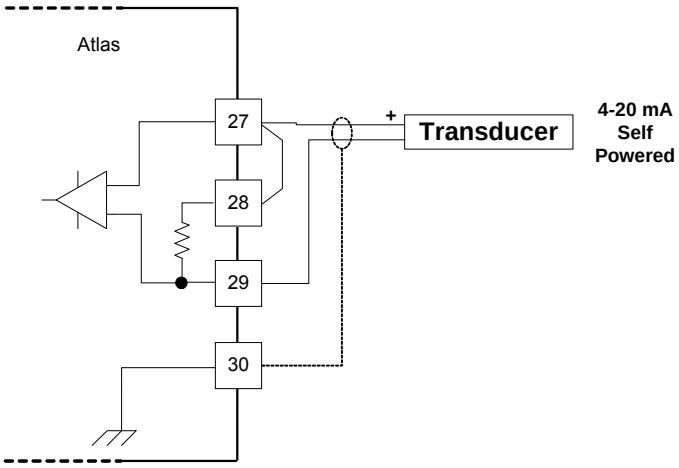


Figure 6-6a. Wiring Example–4–20 mA Input Interface to the SmartCore Board

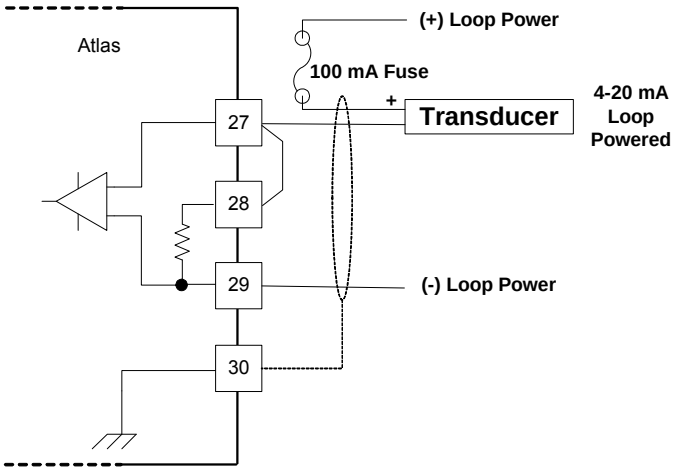


Figure 6-6b. Wiring Example–4–20 mA Input Interface using External Loop Power

Configuration Notes

- Refer to Figure 6-6 for analog input wiring.
- All 4–20 mA inputs have an input impedance of 200 Ω.
- When a 4–20 mA input is used, a terminal block jumper must be installed, per Figure 6-6.
- 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.

Analog Outputs

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

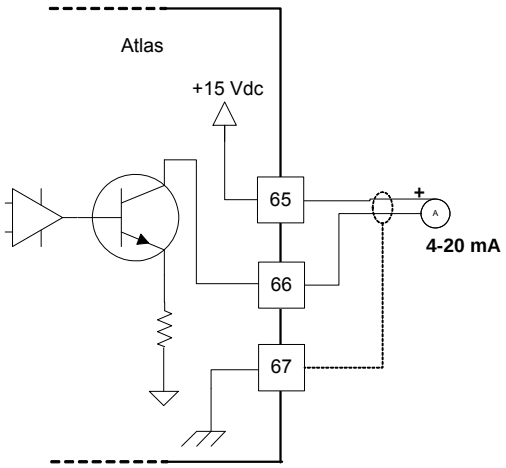


Figure 6-7. Wiring Example–Analog Output Interface to the SmartCore Board

Configuration Notes

- Refer to Figure 6-7 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 AtlasPC control common.

NOTICE

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

Actuator Outputs

The proportional actuator driver outputs are 4–20 mA or 20-160 mA with a full scale range of 0–24 mA or 0–200 mA. The SmartCore board has two proportional actuator driver outputs, each output with source and return current readbacks.

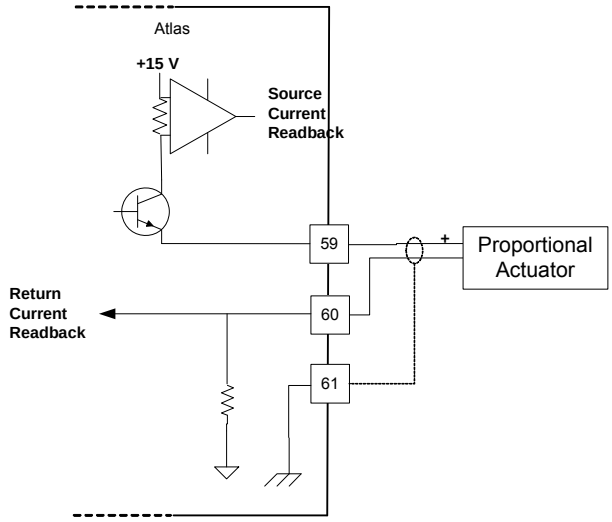


Figure 6-8. Wiring Example–Actuator Output Interface to the SmartCore Board

Configuration Notes

- Refer to Figure 6-8 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.
- The readbacks can be used in the application software for fault detection.

NOTICE

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

Discrete Inputs

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

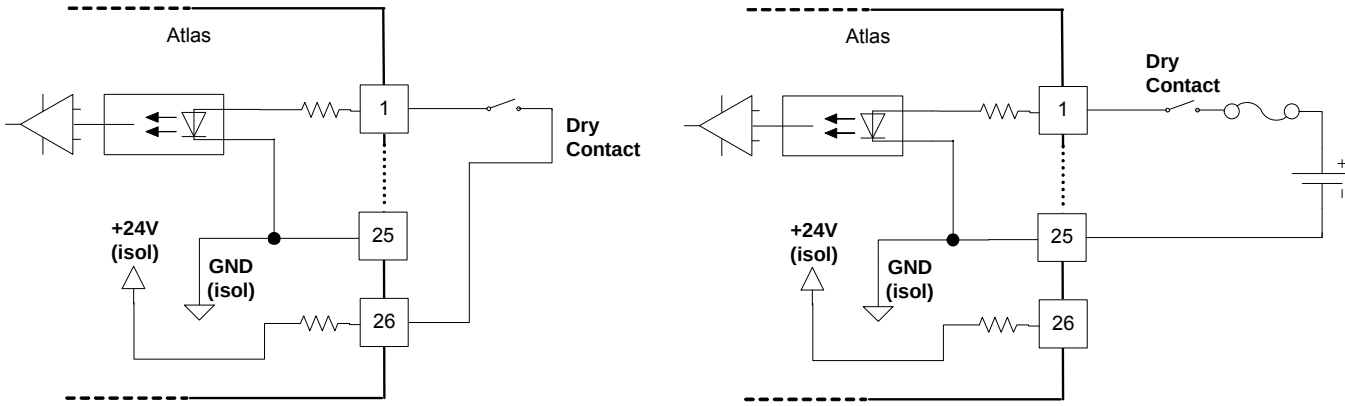


Figure 6-9. Wiring Example–Discrete Input Interface to the SmartCore Board

Configuration Notes

- Refer to Figure 6-9 for discrete input wiring.
- The discrete input commons are tied together, so each SmartCore 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 0.2 A poly switch. 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.

Serial I/O

The SmartCore board accepts three serial I/O connections. The first two ports are configurable for RS-232, RS-422, or RS-485. The last port is for RS-232 only. RS-232 is specified to 50 feet (15 m), and RS-485 and RS-422 are specified to 4000 feet (1219 m).

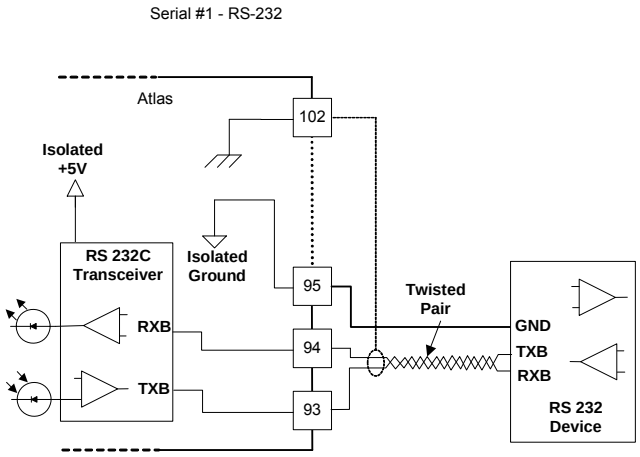


Figure 6-10. Serial #1–RS-232 Pinouts

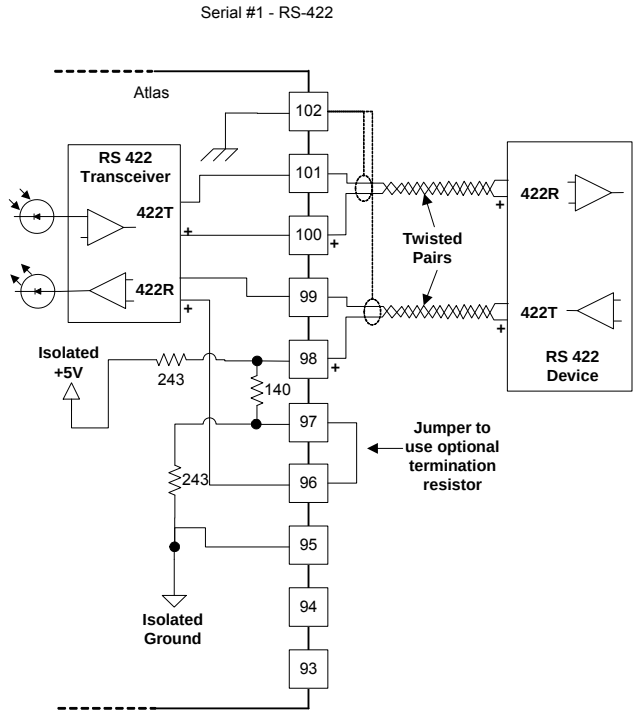


Figure 6-11. Serial #1–RS-422 Pinouts

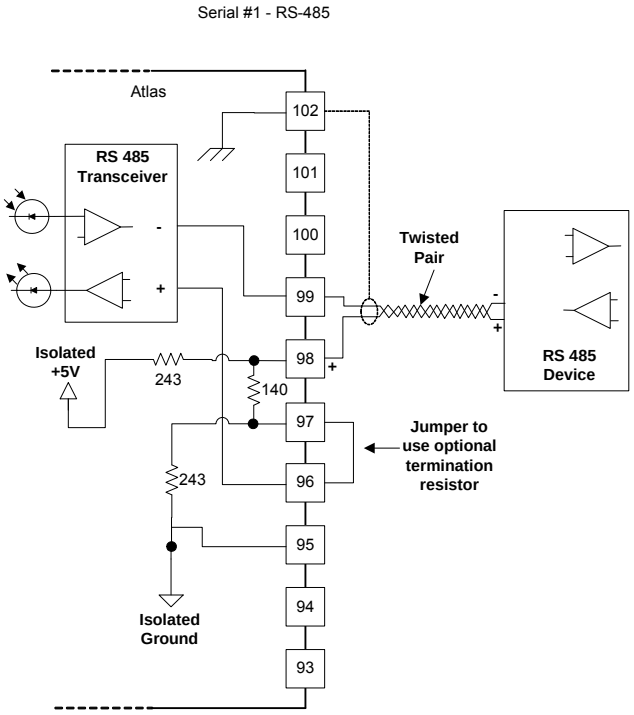


Figure 6-12. Serial #1–RS-485 Pinouts

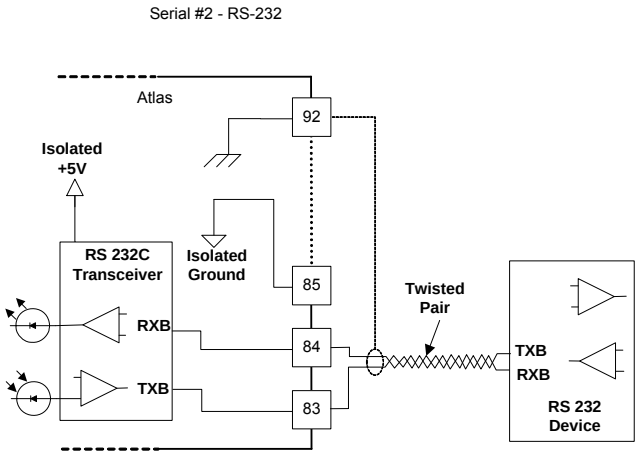


Figure 6-13. Serial #2–RS-232 Pinouts

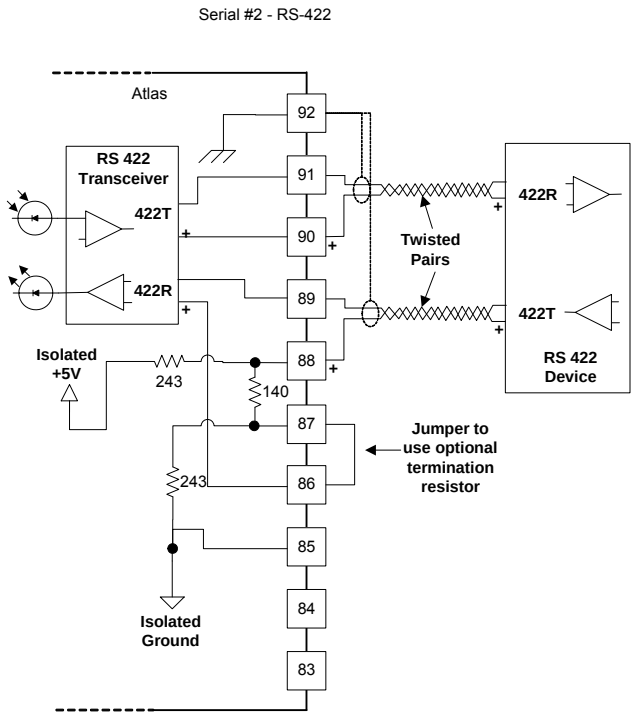


Figure 6-14. Serial #2–RS-422 Pinouts

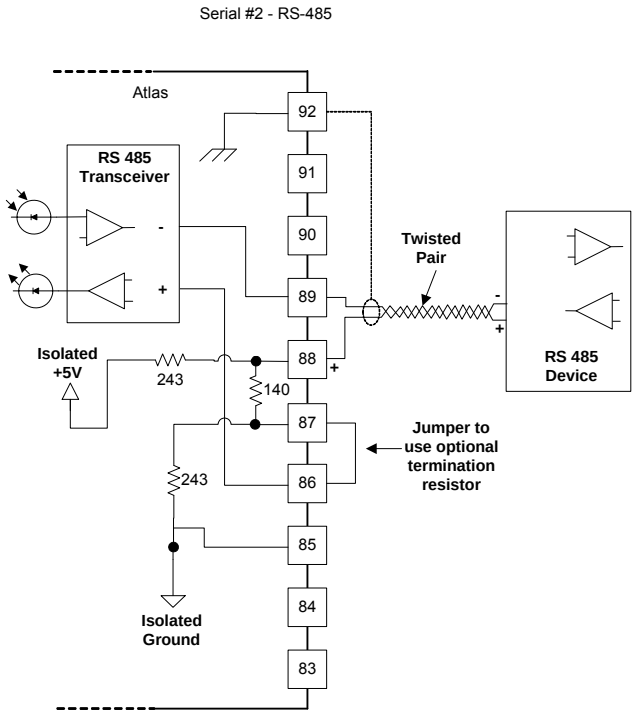


Figure 6-15. Serial #2–RS-485 Pinouts

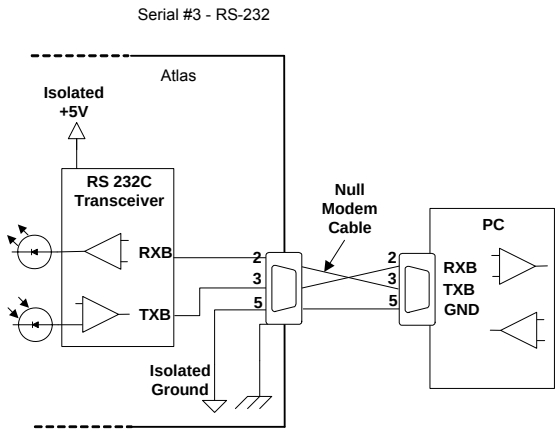


Figure 6-16. Serial #3–RS-232 Pinouts

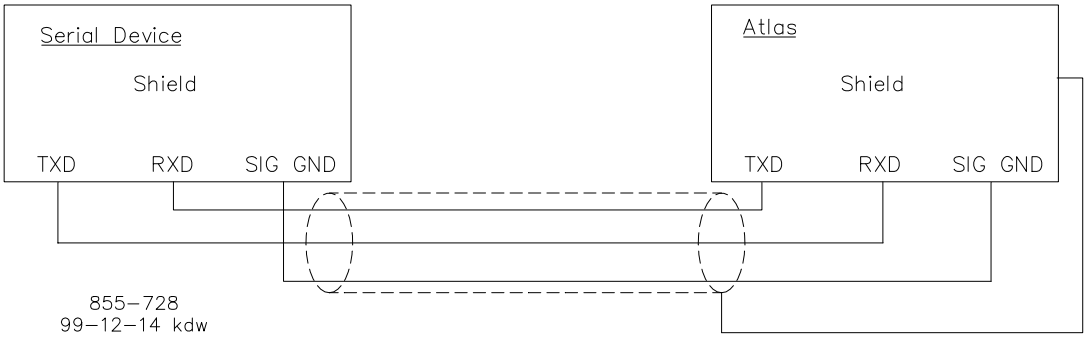


Figure 6-17. Wiring Example–RS-422 Interface to the SmartCore Board

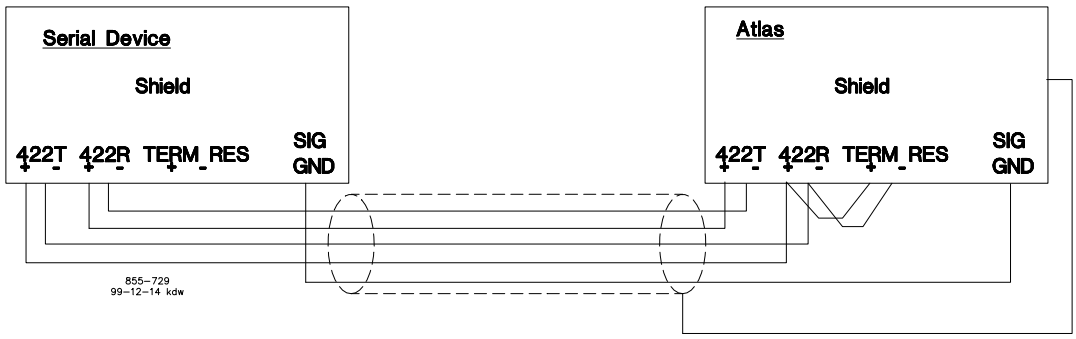


Figure 6-18. Wiring Example–RS-422 Interface to the SmartCore Board

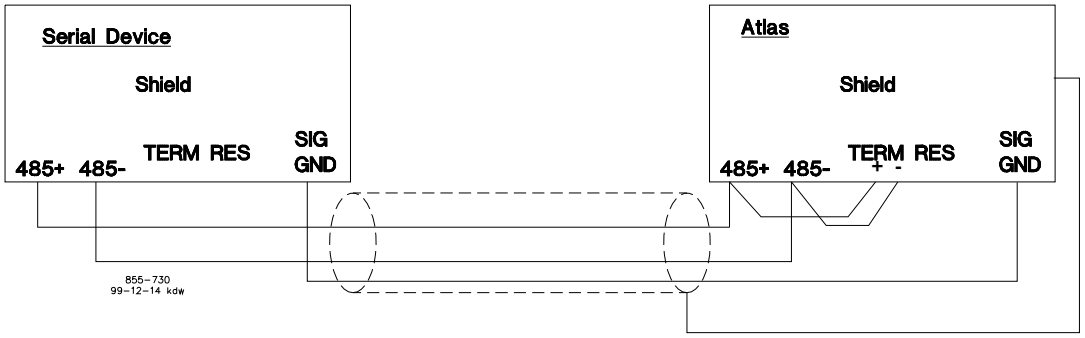


Figure 6-19. Wiring Example–RS-485 Interface to the SmartCore Board

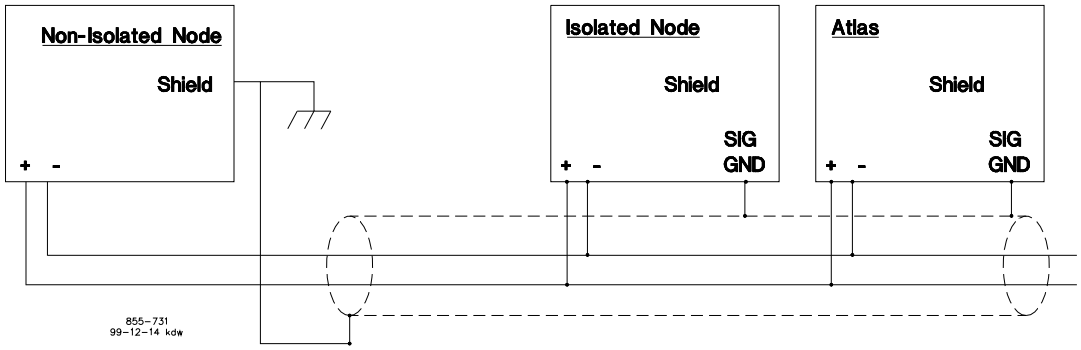


Figure 6-20. Wiring Example–Alternate Multipoint Wiring (RS-422/485)
(without a separate signal ground wire for the SmartCore board)

Configuration Notes

- Refer to Figure 6-17 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.
- Refer to Figure 6-18 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. The last unit in the network chain, and only the last unit, should have it's receiver terminated with a resistor. The AtlasPC has resistors built in (TERM RES) for this purpose. The unit at each end of the network should be terminated.
- Refer to Figure 6-19 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 last unit in the chain, and only the last unit, should be terminated with a resistor. The AtlasPC has resistors built in (TERM RES) for this purpose. The unit at each end of the network should be terminated.
- The serial ports must be properly configured for the appropriate communication parameters.
- Termination resistors are available on the SmartCore board and should be wired across the network at the ends of the line.

- The serial ports are individually isolated from each other, and from the rest of the AtlasPC 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.

Fault Detection (Board Hardware)

Each SmartCore 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 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
3	Failure during RAM test
4	Local watchdog timeout
5	Failure during EE test
6	Failure during FLASH programming or erasing
7	Kernel software watchdog count error
10	Failure during 68302 test
11	Failure during RTC test
12	TPU RAM Failure
20+	Operating system specific errors use 20 & above

Table 6-1. SmartCore Failure Codes

Fault Detection (I/O)

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

- Analog Input Faults—The application software may set a high and low latch set point to detect input faults.
- Speed Sensor Input Faults—The application software may set a high and low latch set point to detect input faults.
- Serial Port Faults—The system monitors the serial communications on the three serial ports, for various communication errors.
- 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.

Troubleshooting Guide

Speed Sensor Inputs

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 ground connection exists and that the resulting 60 Hz signal 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 AtlasPC should be returned for service.

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 ground connection exists and that the resulting 60 Hz signal 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 AtlasPC should be returned for service.

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.
- 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. 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 AtlasPC should be returned for service.

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 AtlasPC should be returned for service.

Proportional 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 AtlasPC should be returned for service.

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.
- 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 AtlasPC should be returned for service.

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 AtlasPC should be returned for service.

Chapter 7.
Analog Combo Board

General Description

Each Analog Combo board contains circuitry for two speed sensor inputs, fifteen 4–20 mA analog inputs, and two Analog outputs. These two speed inputs are not used on the 505CC-2—Turbine/compressor speed is input on the SmartCore Board as described in Chapter 6.

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
- First 11 analog inputs are isolated as a group, from the other inputs, and from control common
- Last 4 analog inputs are isolated as a group, from the other inputs, and from control common

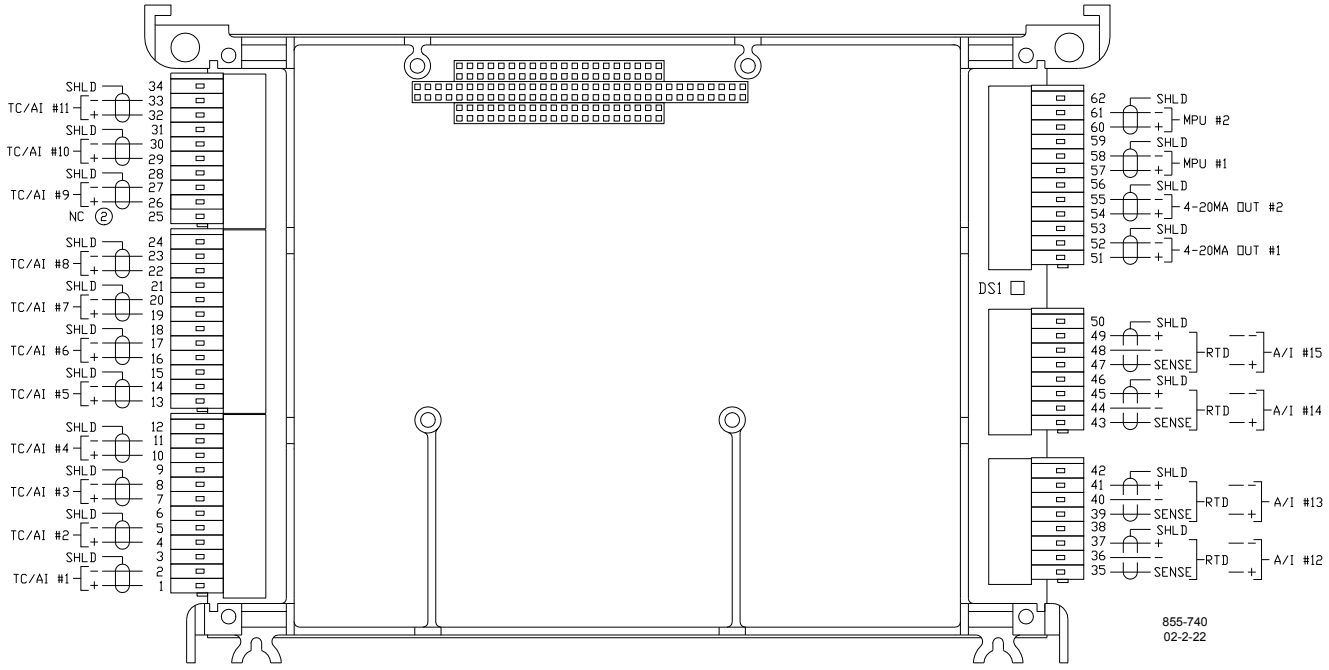


Figure 7-1. AtlasPC Analog Combo Board Connections

Physical

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

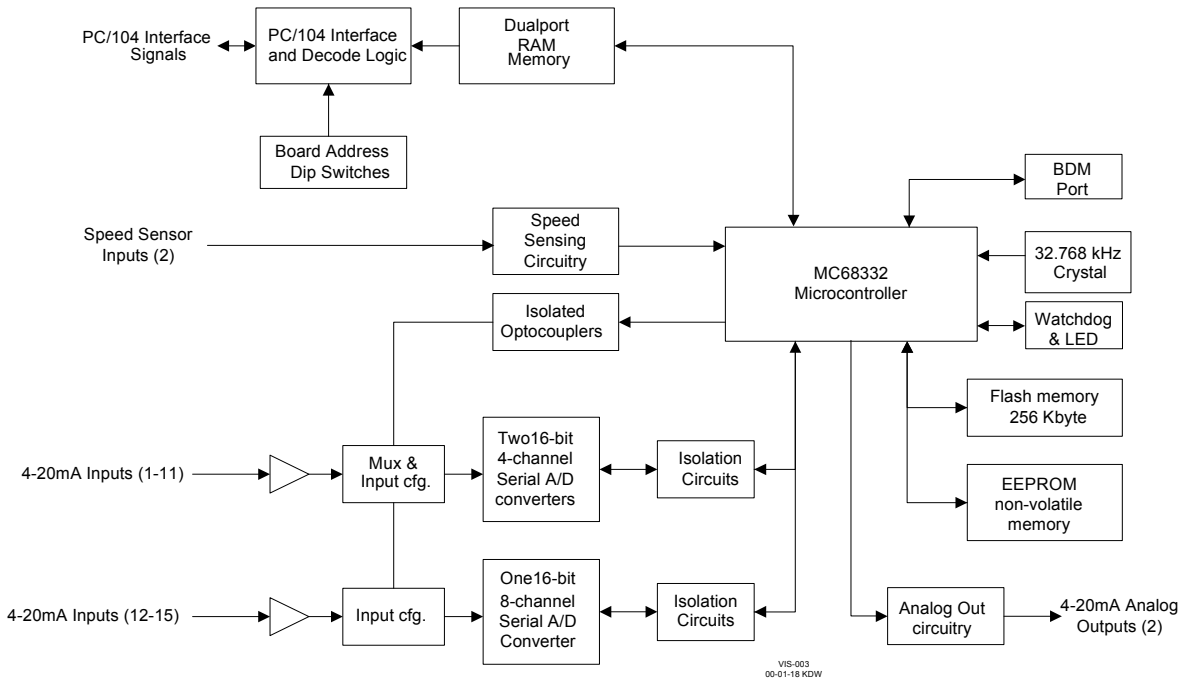


Figure 7-2. AtlasPC Analog Combo Board Block Diagram

Specifications

4–20 mA Analog Inputs #1-11

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

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

IMPORTANT

The 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.

Temperature Drift				
Input Type	Typ (ppm/°C)	Typ error (%)	Max (ppm/°C)	Max error (%)
4–20 mA	105	0.68	160	1.04

IMPORTANT

For 4–20 mA inputs, percent error is for 25 mA full scale input for 65 degree delta (25 to –40 °C).

Latency 1 ms for odd channels and 3 ms for even numbered channels

Isolation All input channels are isolated from the rest of the AtlasPC platform to 500 Vac, however they are not isolated from each other. The inputs are differential, with a 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.
- 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.

4–20 mA Analog Inputs #12-15

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

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

IMPORTANT

The 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.

Temperature Drift				
Input Type	Typ (ppm/°C)	Typ error (%)	Max (ppm/°C)	Max error (%)
4–20 mA	105	0.68	160	1.04

IMPORTANT **For 4–20 mA inputs, percent error is for 25 mA full scale input for 65 degree delta (25 to –40 °C).**

Update time	5 ms
I/O Latency	1 ms
Isolation	All input channels are isolated from the rest of the AtlasPC platform to 500 Vdc, however inputs are not isolated from each other.

- 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.

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

Analog Outputs

Number of channels	2
Output type	4–20 mA outputs, non-isolated
Current output	4–20 mA
Max current output	25mA ±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.

AtlasPC Analog Combo Board Operation

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

Analog Inputs

All 4–20 mA inputs may be used with two-wire ungrounded (*loop powered) transducers or isolated (self-powered) transducers, but no loop power is provided for the former. 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.

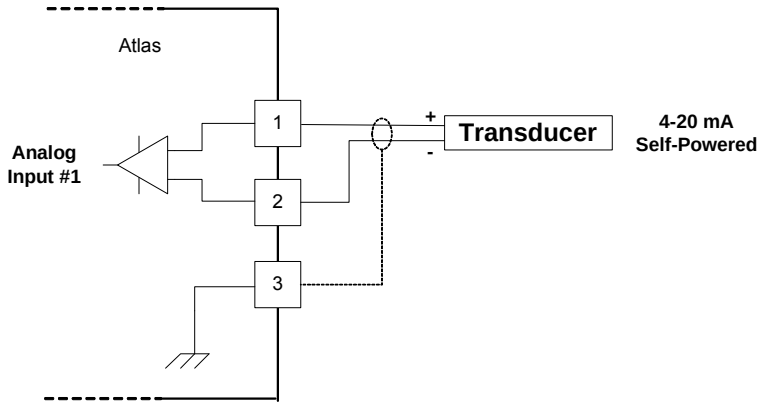


Figure 7-3a. Wiring Example–Analog Input Interface (Channels 1-11)

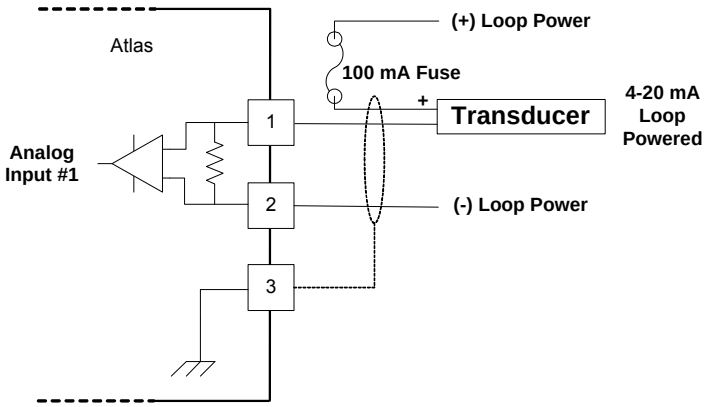


Figure 7-3b. Wiring Example–Analog Input Interface (Channels 1-11) with External Loop Power

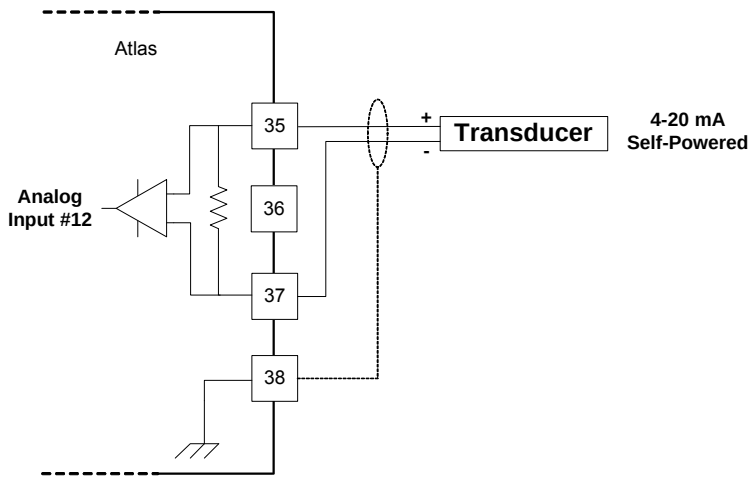


Figure 7-4a. Wiring Example–Analog Input Interface (Channels 12–15)

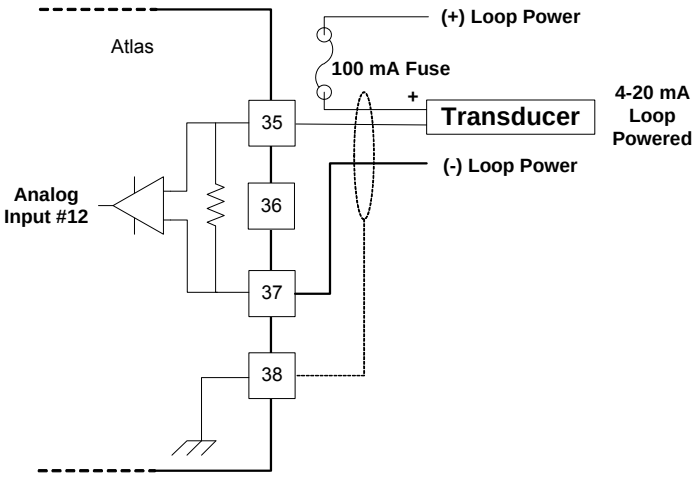


Figure 7-4b. Wiring Example–Analog Input Interface (Channels 12-15) with External Loop Power

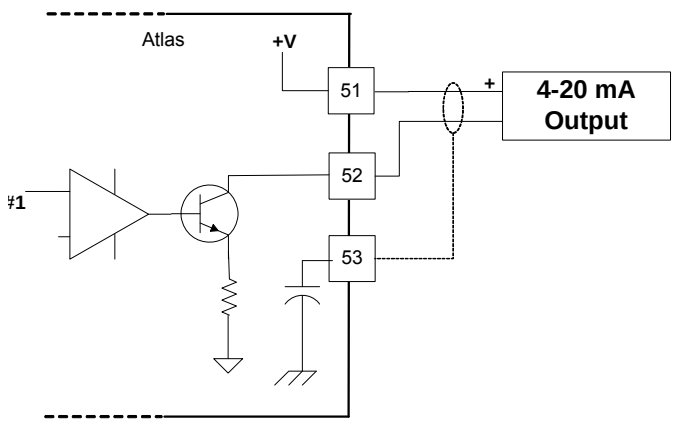
Configuration Notes

- Refer to Figures 7-3 and 7-4 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.**

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.



IMPORTANT

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

Figure 7-5. Wiring Example–Analog Output Interface

Configuration Notes

- Refer to Figure 7-5 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 AtlasPC 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 Board with actuators is installed in the control.

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 7-1. Analog Combo Failure

Fault Detection (I/O)

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

- Analog Input Faults—The application software may set a high and low latch set point to detect input faults. For thermocouple inputs, open wire detection is provided.
- Speed Sensor Input Faults—The application software may set a high and low latch set point to detect input faults.
- 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.

Troubleshooting Guide

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.
- 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 AtlasPC should be returned for service.

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 AtlasPC should be returned for service.

Chapter 8.
12-Channel Relay Module (Optional)

General Information

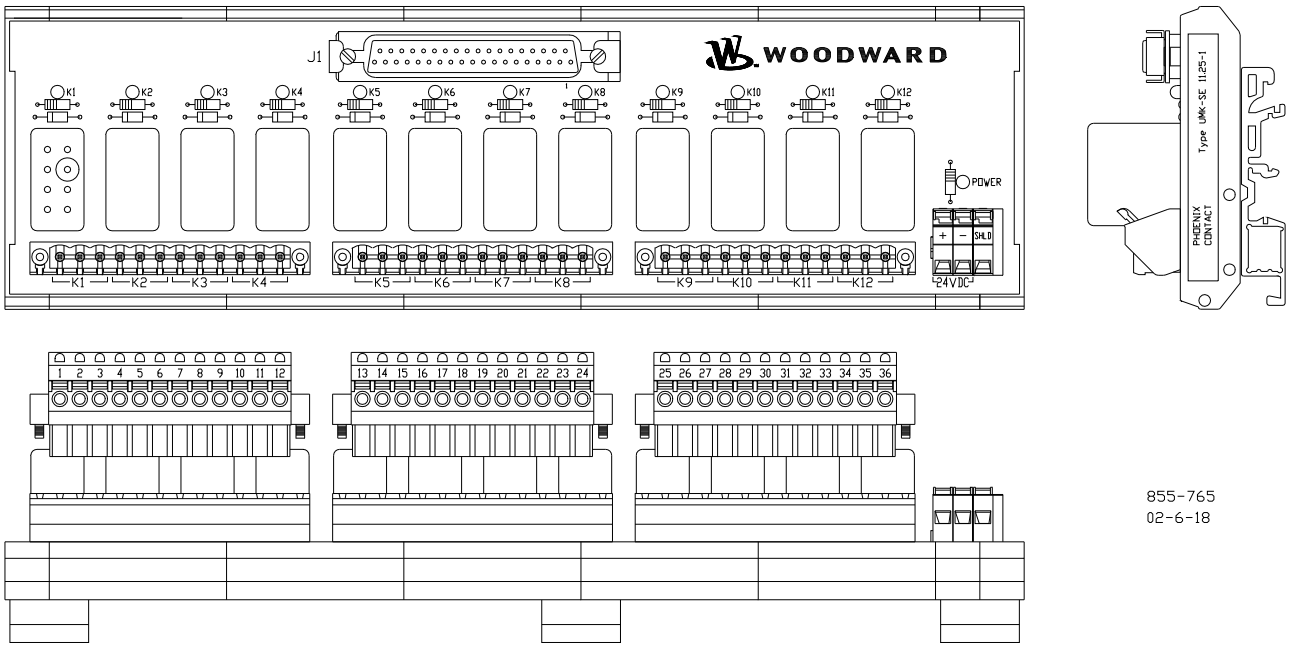


Figure 8-1. 12-Channel Relay Module

The 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, and marine 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
- Kit, Item Number 8928-459 (this part number contains both the relay module and cable together)

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

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.

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.

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.

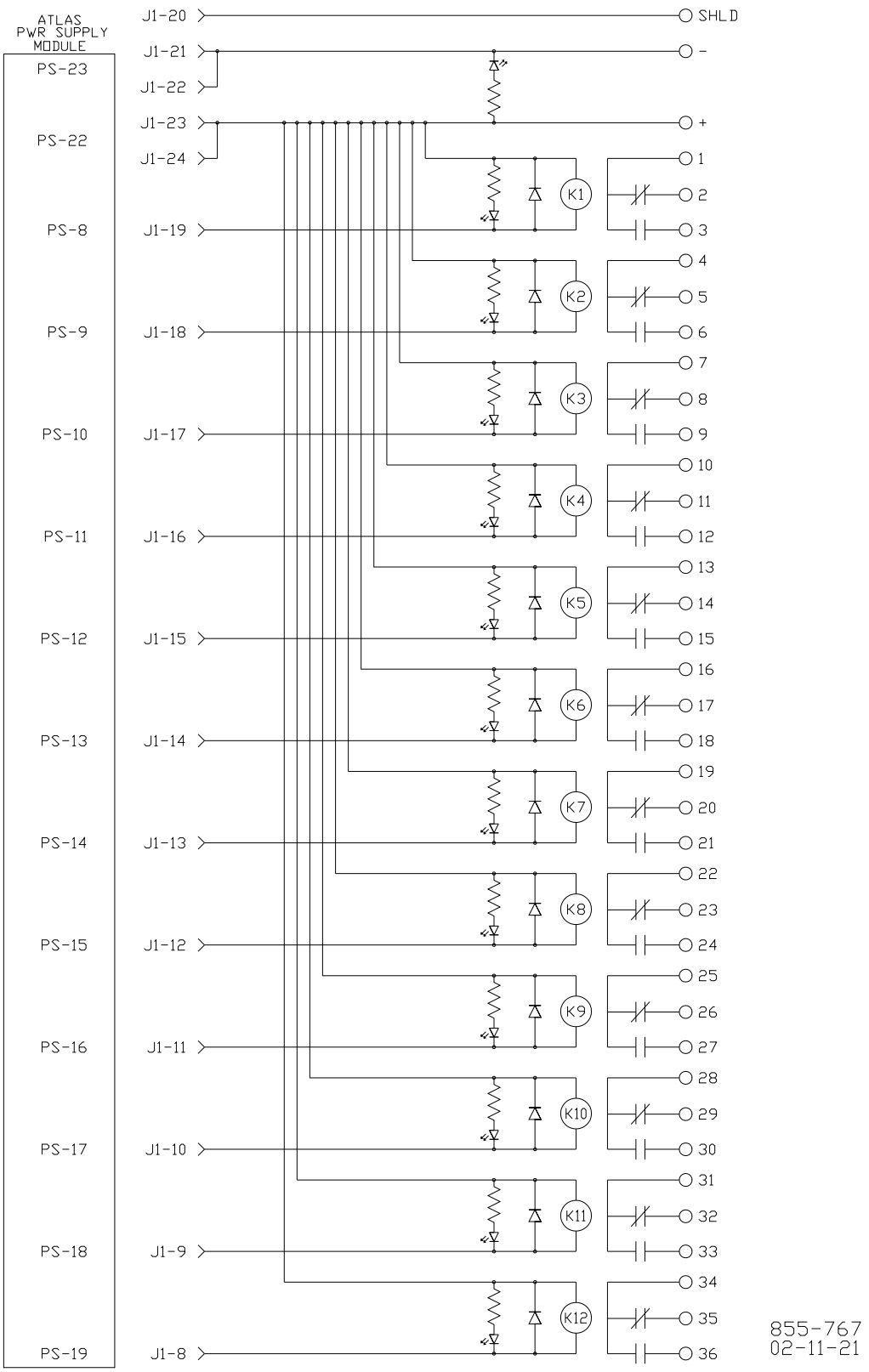


Figure 8-2. 12-Channel Relay Module Wiring Diagram

Chapter 9.
Touchscreen HMI (Optional)

General Information

The 505CC-2 Steam Turbine and Compressor Control comes optionally with a 381 mm (15 inch) TFT LCD touchscreen HMI (Human Machine Interface) that permits full configuration, operation, and monitoring of the turbine/compressor train. The flat panel monitor is driven by a compact, industrial computer through standard DB15 VGA and DB9 serial cables. The computer also accepts standard PS/2 keyboard and mouse. The HMI communicates with the AtlasPC control via TCP/IP Ethernet connection.

- HMI Touchscreen Monitor, Item Number 1790-3013
- HMI Computer, Item Number 1790-9016
- HMI Software, Item Number 9928-1048
- HMI Kit, Item Number 8928-7037 (this part number contains the HMI computer, touchscreen monitor, software, and a crossover Ethernet cable together)

Figure 9-1. 381 mm (15 inch) LCD Touchscreen HMI

Specifications

Dimensions		Weight
Monitor 383 mm X 307 mm X 48 mm (15.08” X 12.09” X 1.89”) Comp. 189 mm X 107 mm X 36 mm (7.5” X 4.2” X 1.4”)		Monitor 4.5 kg (9.9 lb) Comp. 0.8 kg (1.7 lb)
Input Power		**Operating Temperature**
Monitor External 100–230 Vac power adapter, 12 Vdc/4A max Comp. 24 Vdc/1 A or 12 Vdc/1.5 A		Monitor 0 to 50 °C (32 to 122 °F) Comp. –10 to +55 °C (14 to 131 °F)

Mounting

The HMI’s flat panel monitor is designed for panel, wall, desktop, rack, or VESA arm mounting with provided hardware.

The computer may be surface or rail mounted in any convenient location, even directly on the rear of the monitor. See Figure 9-2 for an outline drawing and panel cutout of the monitor. When panel mounted, a water resistant gasket on the back of the bezel provides NEMA 4 / IP65 environmental protection.

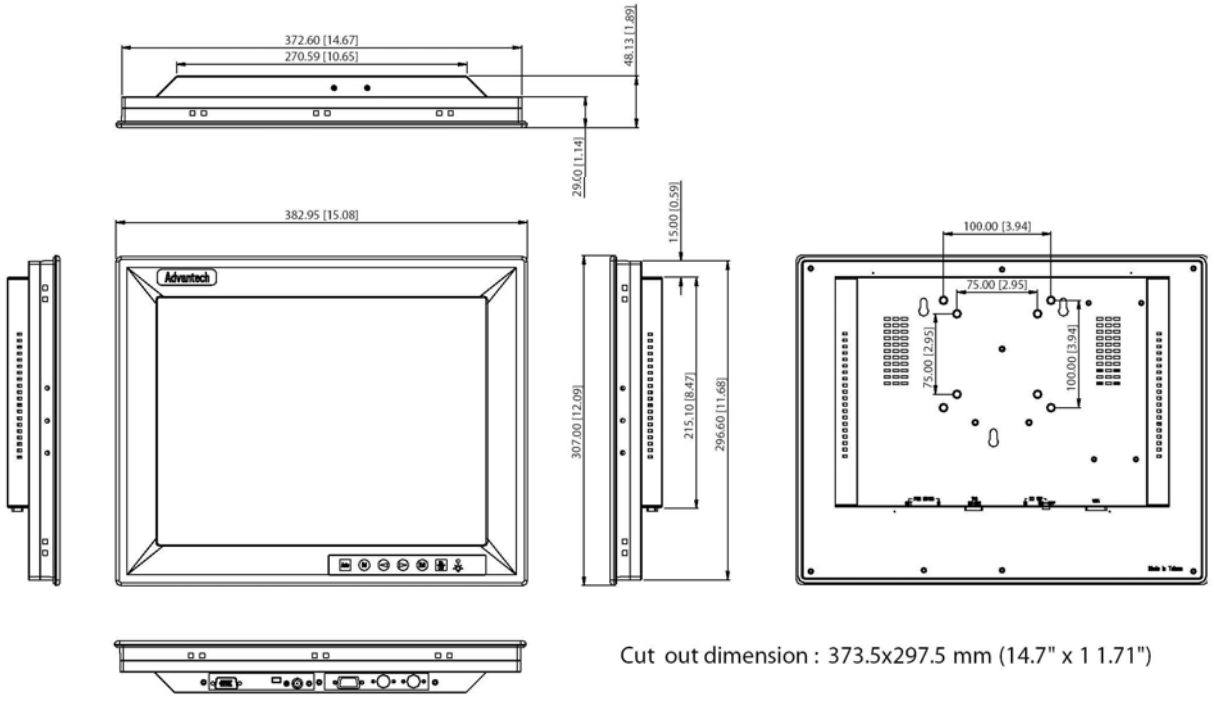


Figure 9-2. Monitor Outline and Dimensions (mm (inches))

Wiring

The HMI requires only 24 Vdc (1 A) power to the computer and an Ethernet connection between it and the AtlasPC control. A direct Ethernet connection to the control should utilize a null, or crossover, Ethernet cable (supplied in the HMI kit). If the HMI and AtlasPC will be connected on a local network through an Ethernet hub or switch, a normal, or straight, cable is required (not supplied). In either case, use port 1, or LAN1, on the HMI computer—LAN2 is a spare port. The input power terminal block may be removed for ease of wiring and installation.

IMPORTANT **The HMI/CCT application requires a hardware key (included) for normal runtime. The key should be installed on the computer's parallel port.**

The flat panel monitor is supplied with a 100–230 Vac power supply. Connections between it and the computer, a standard VGA cable and serial/USB interface for the touchscreen functionality, are also supplied.

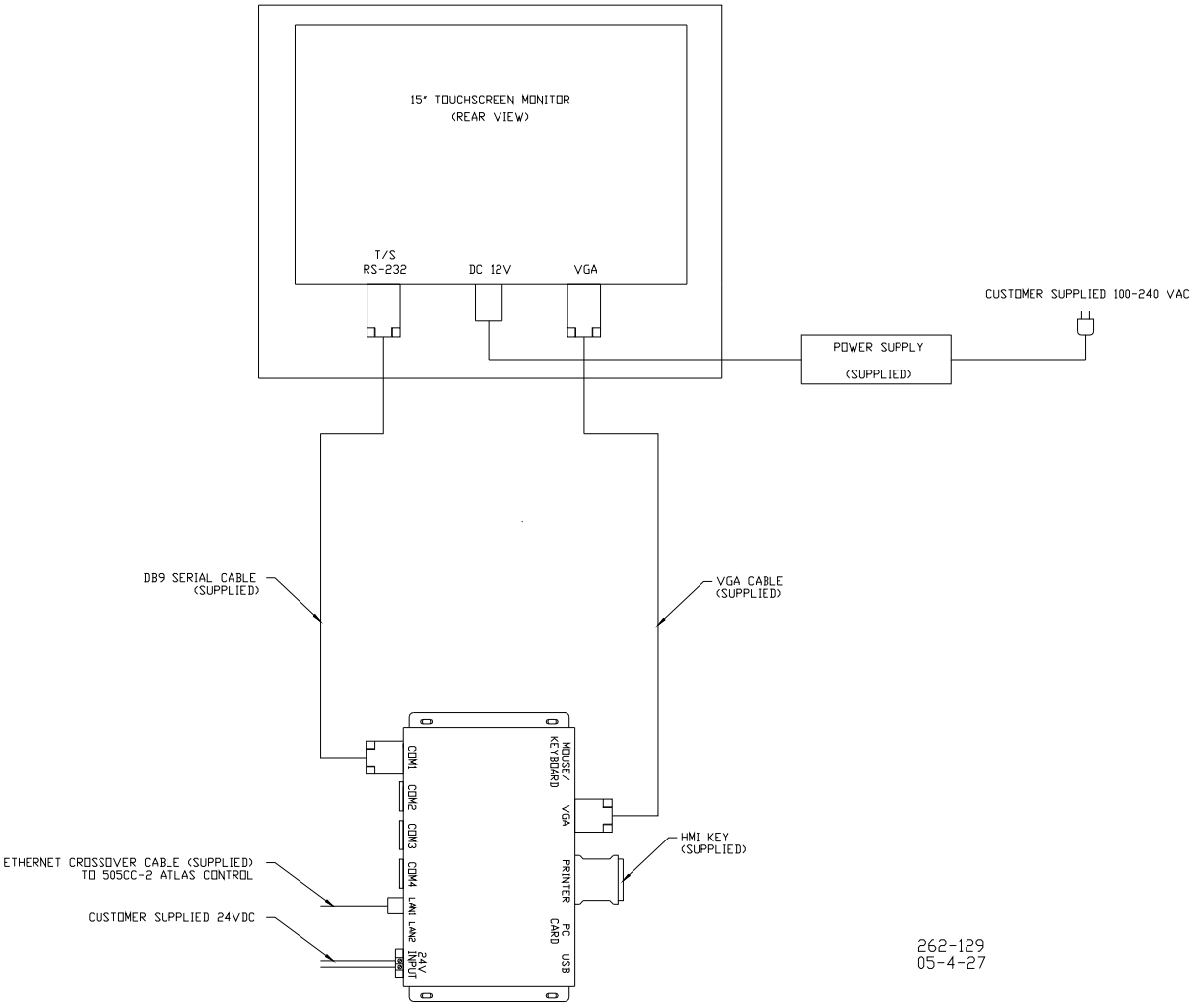


Figure 9-3. HMI Connections

Appendix A.
Default Log-in/Security Level Passwords

The following passwords are the defaults for the 505CC-2's various login levels.

Monitor	No Password
Operator	1111
Engineering	2222
Service	3333
Online Configure	4444
Offline Configure	5555

Appendix B.
Flash Codes

Number of LED Flashes	Failure
1	Microprocessor failure
2	Bus, address, any unexpected exception error
3	Failure during RAM test
4	Local watchdog timeout
5	Failure during EE test
6	Failure during FLASH programming or erasing
7	Kernel software watchdog count error
10	Failure during 68302 test
11	Failure during RTC test
12	TPU RAM Failure
20...	Operating system specific errors use 20 & above

Table B-1. SmartCore with Actuators 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 B-2. Analog Combo Failure Codes

Appendix C.
Configuration Worksheet

The Configuration Worksheet is contained on the next 11 pages, which can be copied, filled in, and faxed as necessary. Or, you can download publication number 26240sup from the Woodward website (**www.woodward.com/publications**), which is a Microsoft Word form containing the same information, which can be filled out on-screen and e-mailed.

PUT 26240sup HERE

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

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 PC Platform
Conformance to Directive(s):	89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility as amended by 92/31/EEC and 93/68/EEC. 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 73/23/EEC COUNCIL DIRECTIVE of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.
Applicable Standards:	EN61000-6-4, 2001: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN61000-6-2,2001: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments EN50178, 1997: Electronic Equipment for Use in Power Installations EN50021, 1999: Electrical apparatus for potentially explosive atmospheres - Type of protection 'n'
3rd Party Certification: Notified Body for ATEX:	DEMKO 02 ATEX 0220460U to EN50021

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

MANUFACTURER

Signature

Douglas W. Salter

Full Name

Engineering Manager

Position

WIC, Fort Collins, CO, USA

Place

3/4/03

Date

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

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

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)

Middletown August 15, 2002
(Place and Date of issue)

(Signature)

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

Engineering Manager
(Title)

(Signature)

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

Chief Standards Engineer
(Title)

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