WOODWARD

505CC-2 Steam Turbine and Compressor Control

Volume 1
Installation and Operation Manual
Part Number 8701-1356

Manual 26451 consists of 4 volumes (26451V1, 26451V2, 26451V3, & 26451sup).

Installation and Operation Manual

Contents

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 and/or a one- or two-loop dynamic compressor. This manual should be used along with the standard Atlas-II™ hardware manual (26415), and therefore, the scope of this document is only to describe the 505CC-2 application software functionality and assist the customer in configuration and start-up of the control. Refer to manual 26415 for information on hardware specifications, mounting information, and wiring details.

This manual, 26451, encompasses three separate volumes:
- Volume 1—Installation and Operation
- Volume 2—Steam Turbine Control
- Volume 3—Compressor Control

This volume provides a variety of useful information for the user ranging from simple basic descriptions to detailed information on functionality and initial software configuration. Included are:
- A description of available options
- I/O Allocation on the Atlas-II control
- Information on Atlas-II communications interfaces
- Installation and configuration of the 505CC-2 HMI (Human Machine Interface) & Configuration Tool (CCT) software

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**. As described above, refer to Manual 26415 for information on the physical installation and wiring of the Atlas-II control.

Topic	Location (manual 26451)
Software / System Configuration	Volume 1, Chapter 2
Configuration File Management	Volume 1, Chapter 2
Modbus® *	Volume 1, Chapter 2
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 kit consists of a 15 inch (381mm) industrial touch-panel computer and 10 foot (3 meter) Ethernet cable (Woodward part number 5417-1033).

Control Layout and Mounting

Figures 1-1 and 1-2 show the 505CC-2 control layout and mounting pattern. The 505CC-2 digital control must be mounted in an appropriate enclosure for the surrounding environment. This equipment is designed for installation within a control room panel or cabinet. An IP54 minimum rated enclosure is required for European Zone 2 applications (per EN50021).

The standard 505CC-2 package must be mounted to allow sufficient room for wiring access. Eight front-panel mounting holes permit secure mounting. Depending on its configuration, the 505CC-2 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 505CC-2 is adequate for ventilation, however approximately 75 mm (3 inches) of space may be required for wiring, depending on wire size.

Control Accessories

The Atlas-II 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 Atlas-II control through serial or Ethernet connections to provide operator access and control of the application machinery.
- **Optional Touchscreen HMI (8269-1006)**—An Ethernet-based HMI package (9928-1174) 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 a preloaded, optional 15-inch Touchscreen HMI (as Woodward part number 8269-1006; see Chapter 9).
- **Optional Relay Output Module (8928-459)**—Because the Atlas-II 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).
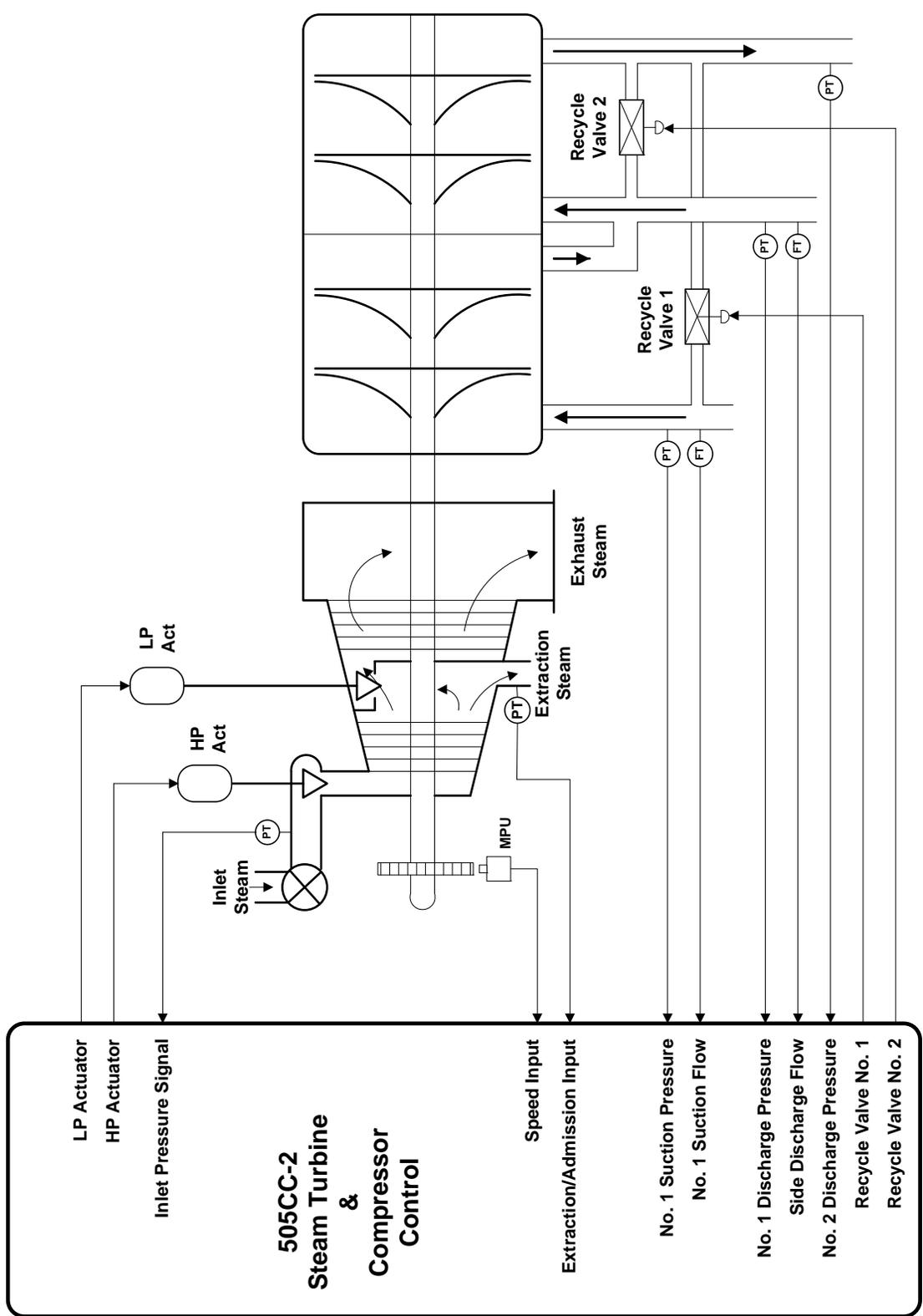
Figure 1-1. 505CC-2 Block Diagram
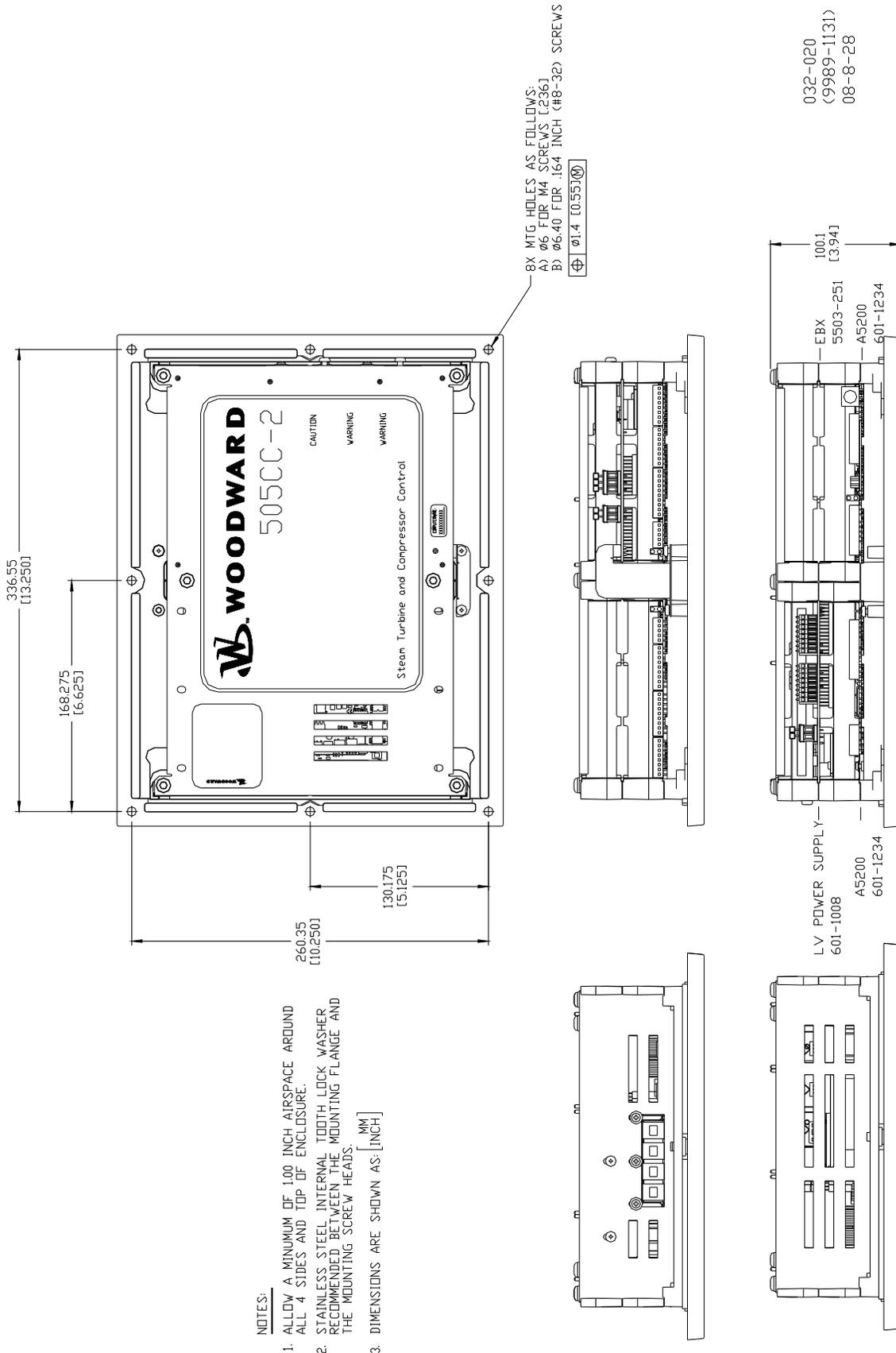
Figure 1-2. 505CC-2 Outline Drawing

Chapter 2.
Wiring, Communications, and Setup

General Description

Turbine and compressor I/O are divided among the Atlas-II™ 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 (bottom) and Analog Combo (top) 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 2-1 for the 505CC-2's Atlas-II module layout.
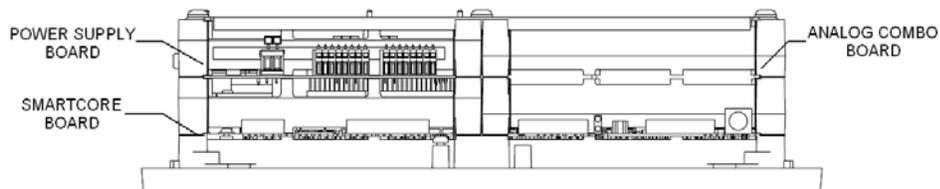
Figure 2-1. Atlas-II Module Layout

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 Atlas-II SmartCore Board, which is the bottom, full size board in the stack. Table 2-1 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
		Not Used	SCM-TB4/5	27-36
Analog Input	AI_01	Analog Input #1 - Turbine Configurable	SCM-TB6	37-39
Analog Input	AI_02	Analog Input #2 - Turbine Configurable	SCM-TB6	40-42
Analog Input	AI_03	Analog Input #3 - Turbine Configurable	SCM-TB6	43-45
Analog Input	AI_04	Analog Input #4 - Turbine Configurable	SCM-TB7	46-48
Analog Input	AI_05	Analog Input #5 - Turbine Configurable	SCM-TB7	49-51
Analog Input	AI_06	Analog Input #6 - Turbine Steam Pressure	SCM-TB7	52-54
Speed Input	SS_01	Speed Input #1 - Unit Speed Input (MPU or Prox)	SCM-TB8	55-58
Speed Input	SS_02	Speed Input #2 – Unit Speed Input (MPU or Prox)	SCM-TB8	59-62
Actuator Output	ACT_01	Actuator Output #1 - Turbine Actuator Output (V1)	SCM-TB9	63-65
Actuator Output	ACT_02	Actuator Output #2 - Turbine Actuator Output (V2)	SCM-TB9	66-68
Analog Output	AO_01	Analog Output #1 - Turbine Configurable	SCM-TB10	69-71
Analog Output	AO_02	Analog Output #2 - Turbine Configurable	SCM-TB10	72-74
Analog Output	AO_03	Analog Output #3 - Compressor Configurable	SCM-TB10	75-77
Analog Output	AO_04	Analog Output #4 - Compressor Configurable	SCM-TB10	78-80
Serial Port #1	SIO #1	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB11	81-90
Serial Port #2	SIO #2	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB12	91-100

Table 2-1. Atlas-II SmartCore Board I/O List

Figure 2-2. Turbine I/O / SmartCore 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 half-size board in the PC/104 stack on the top of the control. Tables 2-2 and 2-3 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
		Not Used	SCM-TB4/5	27-36
Analog Input	AI_01	Analog Input #1 - Turbine Configurable	SCM-TB6	37-39
Analog Input	AI_02	Analog Input #2 - Turbine Configurable	SCM-TB6	40-42
Analog Input	AI_03	Analog Input #3 - Turbine Configurable	SCM-TB6	43-45
Analog Input	AI_04	Analog Input #4 - Turbine Configurable	SCM-TB7	46-48
Analog Input	AI_05	Analog Input #5 - Turbine Configurable	SCM-TB7	49-51
Analog Input	AI_06	Analog Input #6 - Turbine Steam Pressure	SCM-TB7	52-54
Speed Input	SS_01	Speed Input #1 - Unit Speed Input (MPU or Prox)	SCM-TB8	55-58
Speed Input	SS_02	Speed Input #2 - Unit Speed Input (MPU or Prox)	SCM-TB8	59-62
Actuator Output	ACT_01	Actuator Output #1 - Turbine (HP/V1) Actuator	SCM-TB9	63-65
Actuator Output	ACT_02	Actuator Output #2 - Turbine (LP/V2) Actuator	SCM-TB9	66-68
Analog Output	AO_01	Analog Output #1 - Turbine Configurable	SCM-TB10	69-71
Analog Output	AO_02	Analog Output #2 - Turbine Configurable	SCM-TB10	72-74
Analog Output	AO_03	Analog Output #3 - Compressor Configurable	SCM-TB10	75-77
Analog Output	AO_04	Analog Output #4 - Compressor Configurable	SCM-TB10	78-80
Serial Port #1	SIO #1	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB11	81-90
Serial Port #2	SIO #2	RS-232 / RS-422 / RS-485 Serial Port	SCM-TB12	91-100

Table 2-2. Atlas-II 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 #5 – Comp 1 Anti-Surge Vlv Output	ANA1-TB6	51-53
Analog Output	AO_02	Analog Output #6 - 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 2-3. Atlas-II Analog Combo Board I/O List
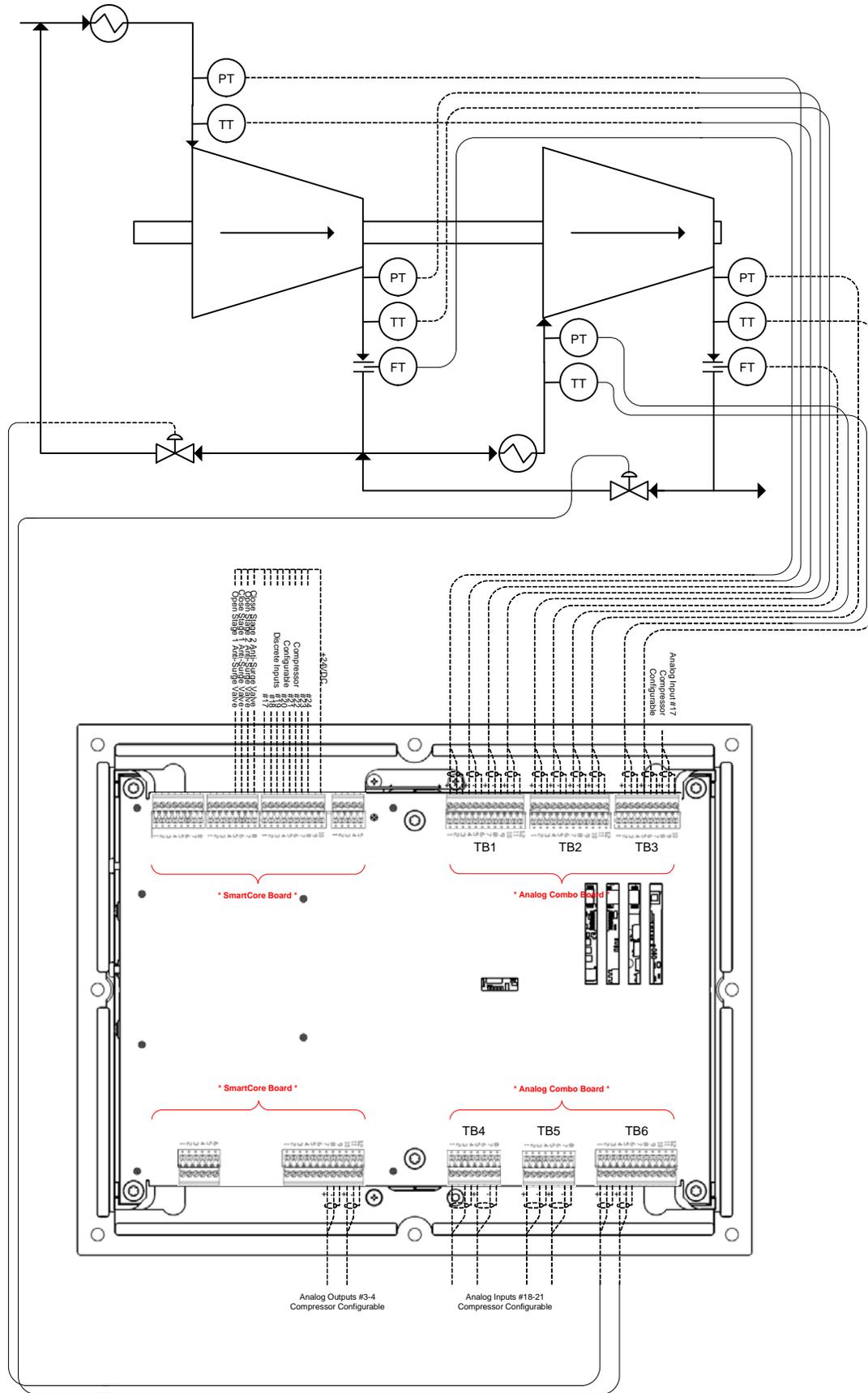
Figure 2-3. Compressor I/O / SmartCore / Analog Combo Connections

Discrete Outputs / Power Supply Board

All discrete outputs for both turbine and compressor are located on the Power Supply Board, the half-size board in the PC/104 stack on the bottom of the control. 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 2-4 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
		Not Used	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 2-4. Atlas-II Power Supply Board I/O List

See Figure 2-4 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.
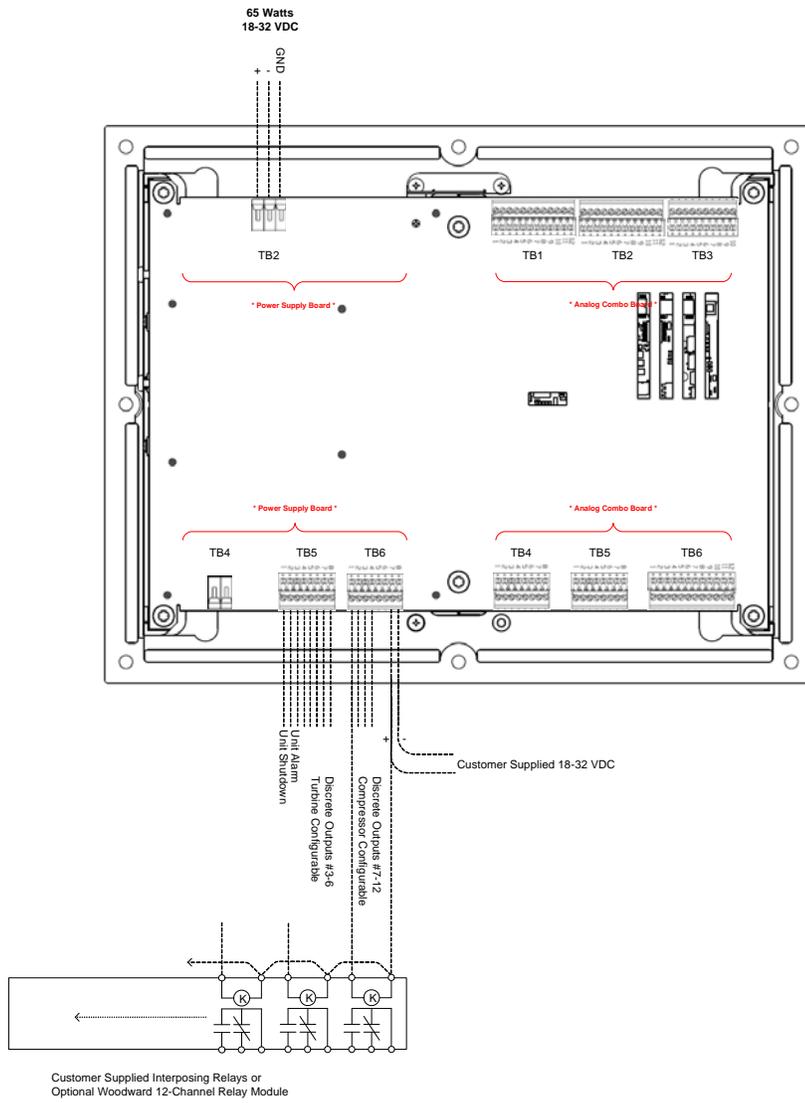
Figure 2-4. Atlas-II Power Supply Board Connections
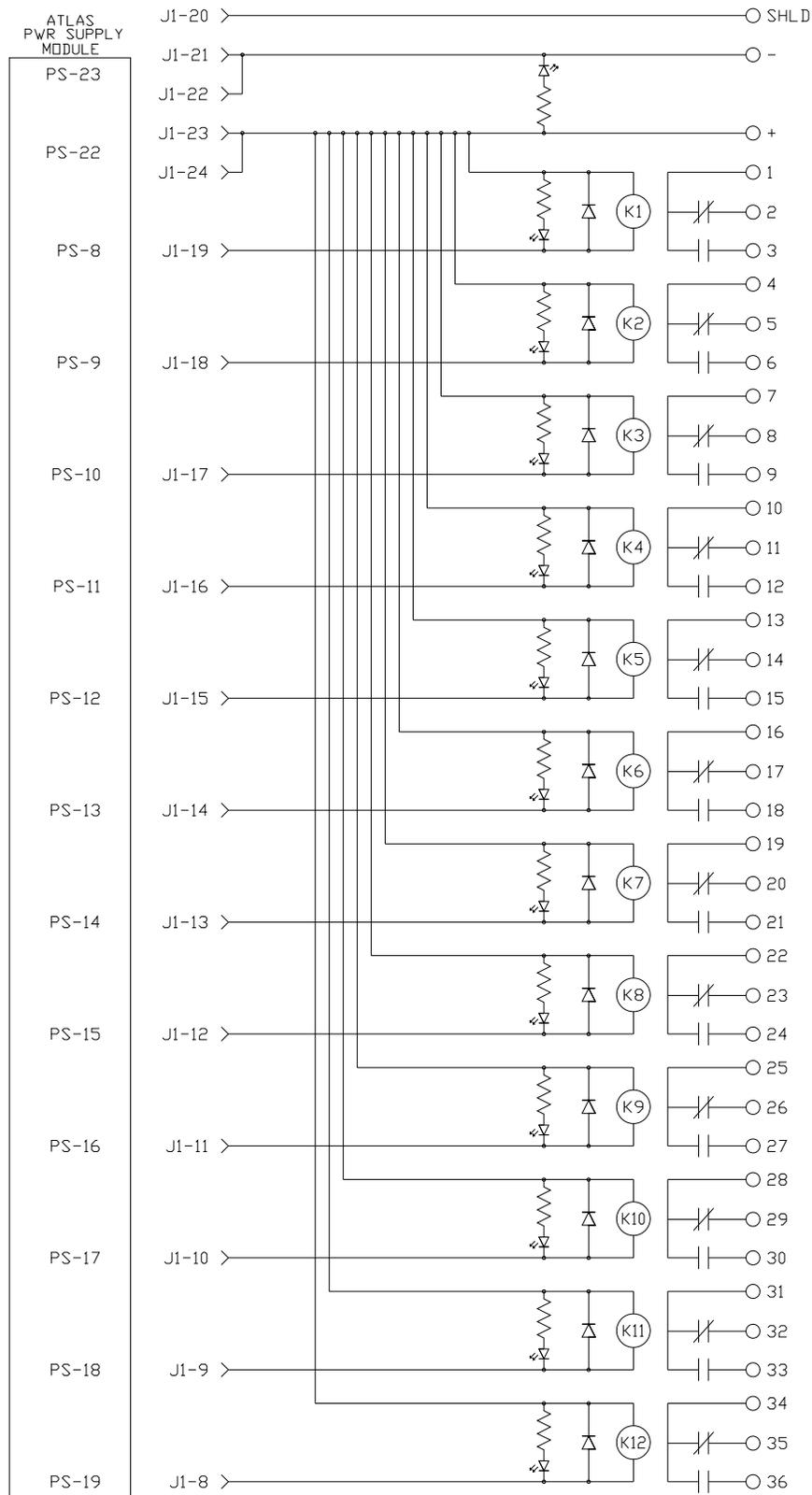
Figure 2-5. Optional 12-Channel Relay Module Connections

CPU

The CPU is integral to the Atlas-II's SmartCore board, the bottom, full size board in the stack. It includes four RJ-45 10/100 Base-Tx Ethernet jacks on the bottom side of the control.

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 jacks are used. The control may be installed on a local area network (LAN) through an Ethernet hub or switch or connected directly to a PC or the optional touchscreen HMI. In either case, normal, straight Ethernet cables may be used.

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.**
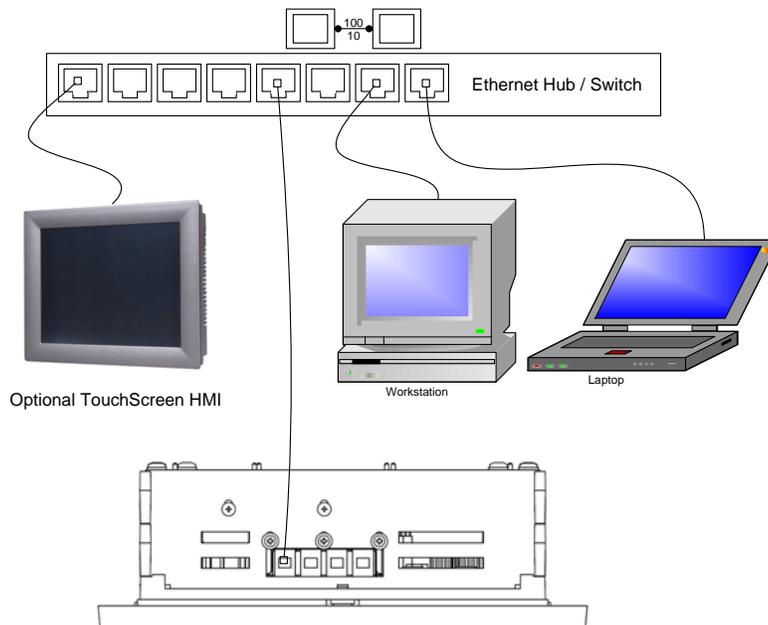
Figure 2-6. Connection to an Ethernet LAN

Optional TouchScreen HMI
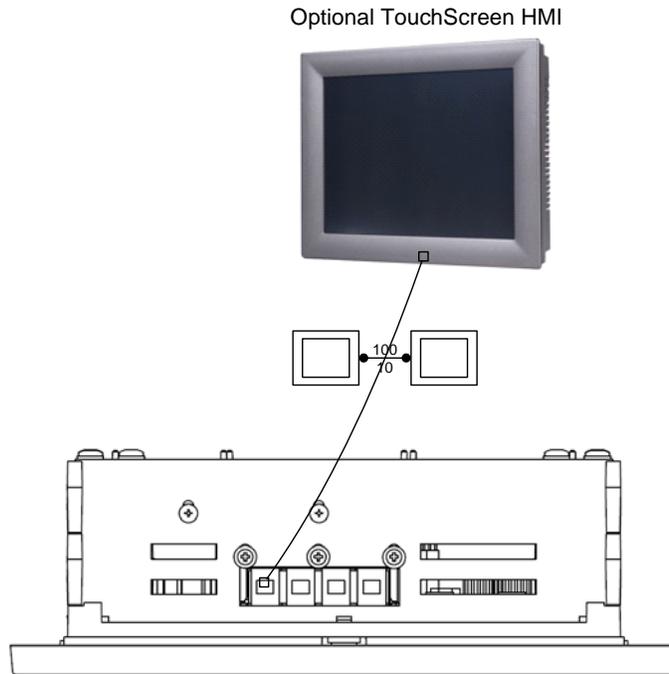
Figure 2-7. Peer-to-peer Ethernet Connection

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 Indusoft's Web Studio automation software. The supplied CD will not only install the 505CC-2's HMI/CCT application, but also a fully functional version of Indusoft's Web Studio software. The supplied license key will facilitate runtime operation of the 505CC-2 HMI/CCT. A development key is also available from Indusoft that would permit customization of the 505CC-2 HMI & Configuration Tool, or use of Indusoft 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 Indusoft 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 Indusoft components will be copied. If desired, deselect *Demo Files*, *WinCE 3.0*, *WinCE 4.x*, and *Web Tunneling Gateway* as shown in Figure 2-8—These are not used by the 505CC-2 HMI/CCT. However, leaving them selected will not cause any problems.
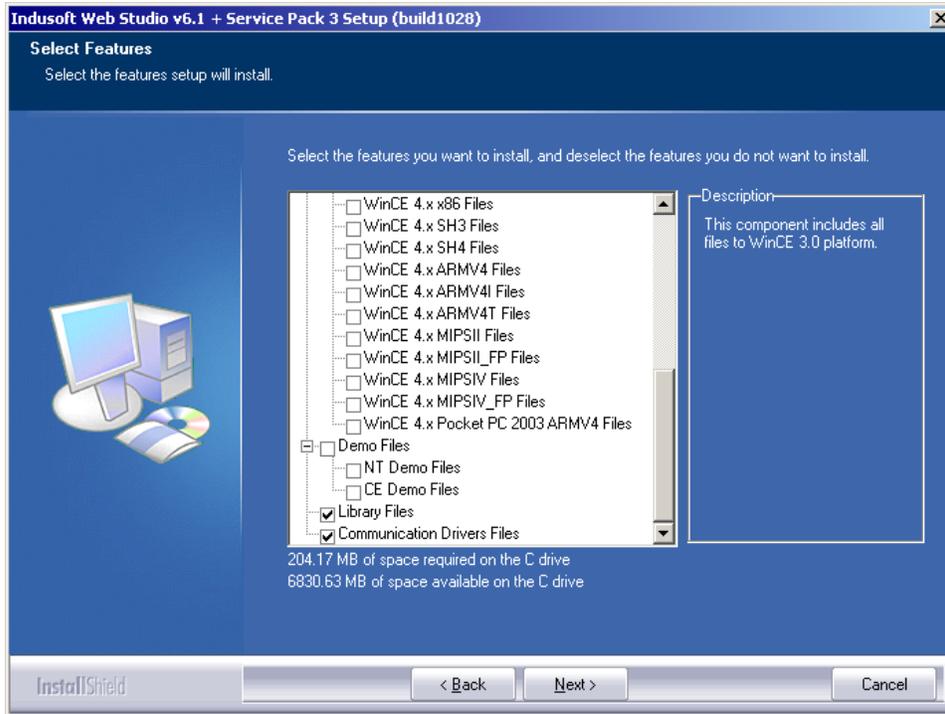
Figure 2-8. Indusoft Installation Components

Depending upon the Windows components currently installed on the computer, you may receive warnings or error messages during the Indusoft 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 Indusoft 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.

Woodward software tools, such as ServLink OPC Server (SOS) and Application Manager (AppManager) will also be installed. 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 and SOS installers.

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.

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 HMI/CCT is establishing a Modbus connection to the control. During this time, the splash screen shown in Figure 2-9 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 2-9. 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 2-10 for an example of the Main Menu Screen and the common screen header and footer.
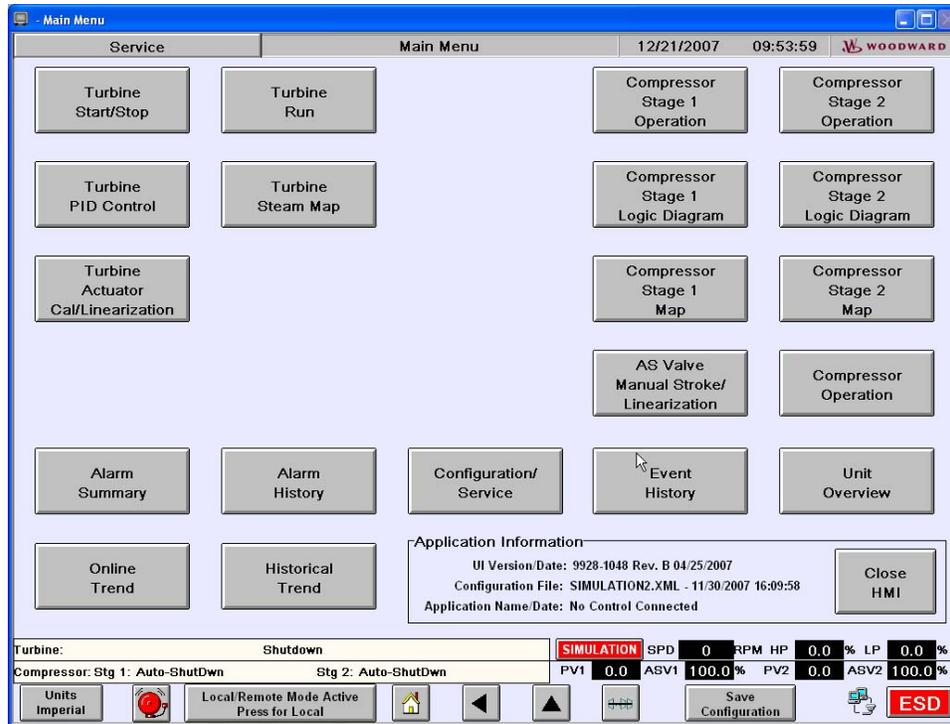
Figure 2-10. Main Menu

  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 Save Configuration button is available in Engineering, Service, and Online Configuration modes. Select it to save all configuration parameters into the 505CC-2's non-volatile memory.

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.

In the lower right corner of the Main Menu screen, the Close HMI 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 2-11, 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 below, maintains a running list of alarm, acknowledge, and return-to-normal events. The Event History screen lists pre-defined, time-stamped control events.
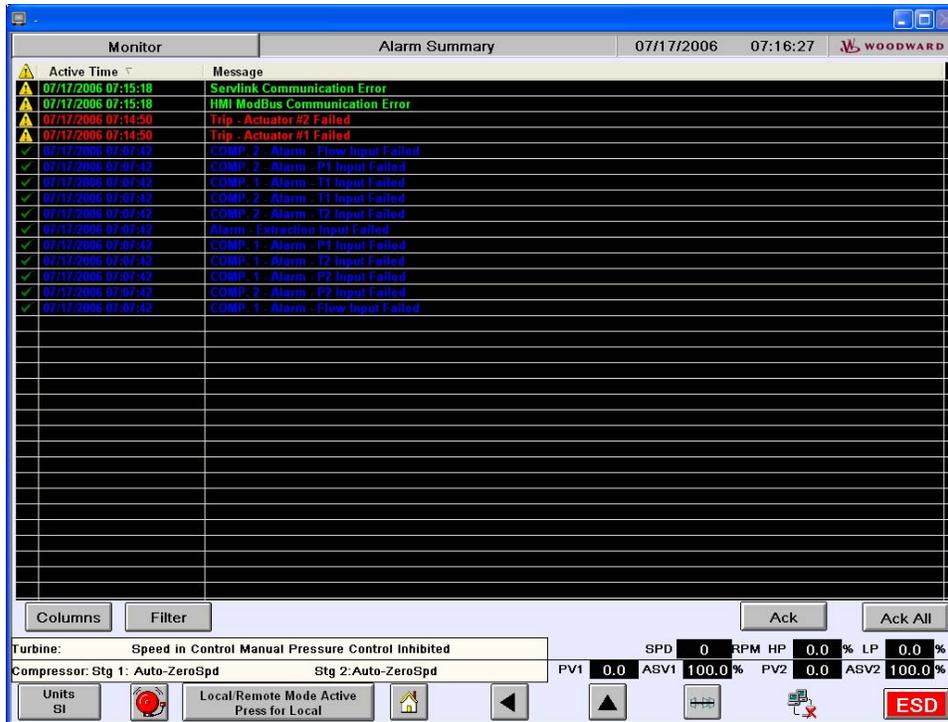
Figure 2-11. Alarm Summary Screen

Online / Historical Trend

From the Main Menu shown in Figure 2-10, select the Online Trend or Historical Trend button to access the trend screen, shown in Figure 2-12. 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 2-12. 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).
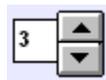
Gridlines may be added to or removed from the trend window by adjusting the horizontal (located at the top of the Y-axis) and vertical (located at the bottom of the Y-axis) gridline settings.

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: 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 2-13.
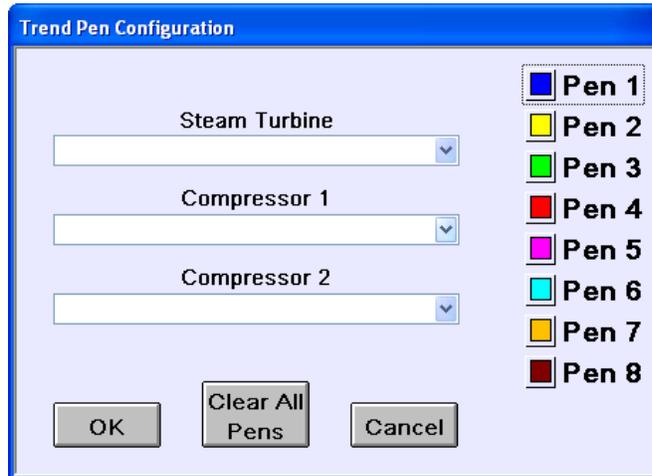
Figure 2-13. Trend Configuration Pop-up

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 2-14.
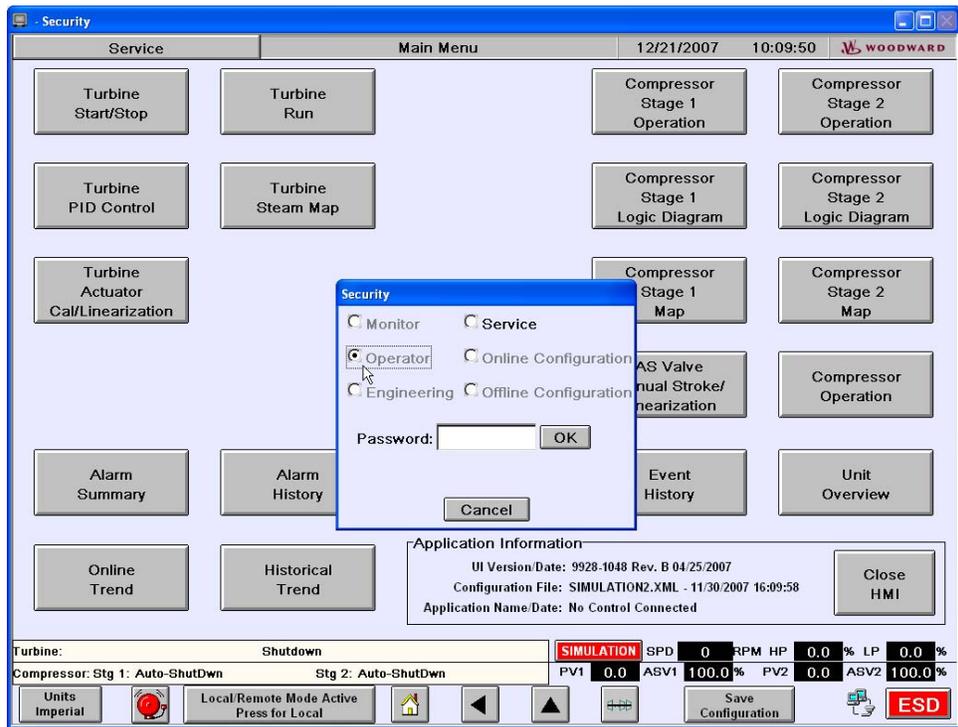
Figure 2-14. Log-in Level

There are six levels of log-in with varying degrees of security applied to configuration and operation actions. See Table 2-5 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 2-5. 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 Atlas-II 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.

NOTICE

In the Engineering, Service, or Online Configuration modes, the Save Configuration button becomes available in the HMI/CCT screen footer. This button will save all configuration values into the 505CC-2's non-volatile memory. Although this action is automatic when leaving one of these logins, and periodically within, it is advisable to press the button occasionally while configuring the unit.

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. After configuration of these parameters, select the Save Configuration button. Then, reboot the control by cycling power. Upon restarting the control, the new values will be used. 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.
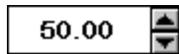
In general, changes to analog configuration values are bound only by the parameter's design limits within software. An additional constraint is placed upon PID tuning parameters—No change of more than 10% of current value is allowed to protect against erroneous entries causing dangerous control conditions.

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. Entered setpoints are limited by their configured minimum and maximum values.

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

Configuration Menu / System Configuration

The Main Menu screen provides single button access to all turbine and compressor operating screens. Select the Configuration / Service button in the lower center of the screen to access the configuration menu, shown in Figure 2-15.
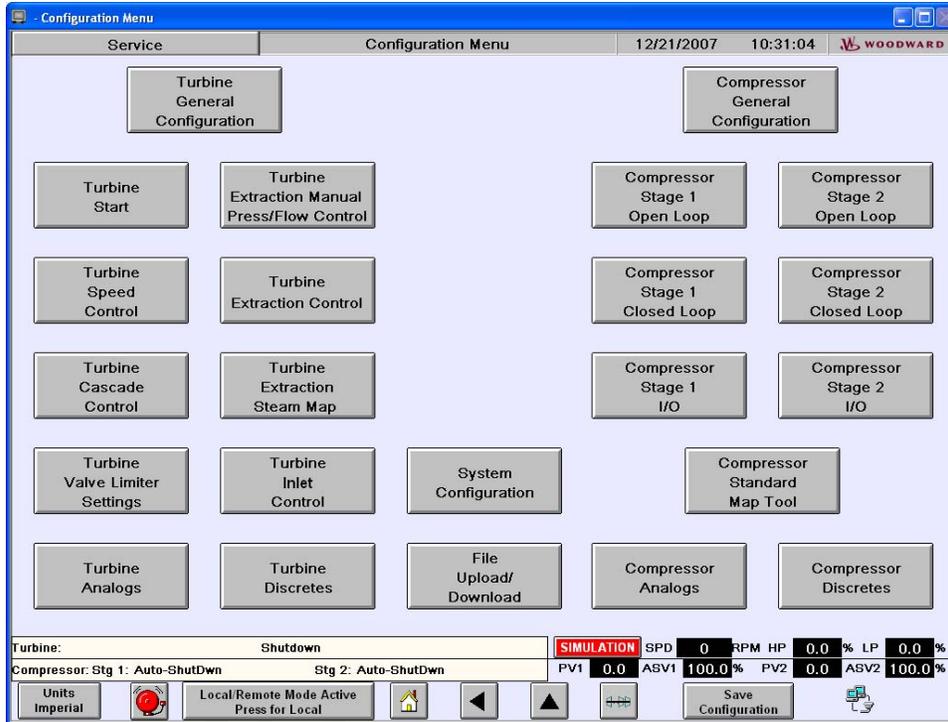
Figure 2-15. Configuration Menu

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 2-16.
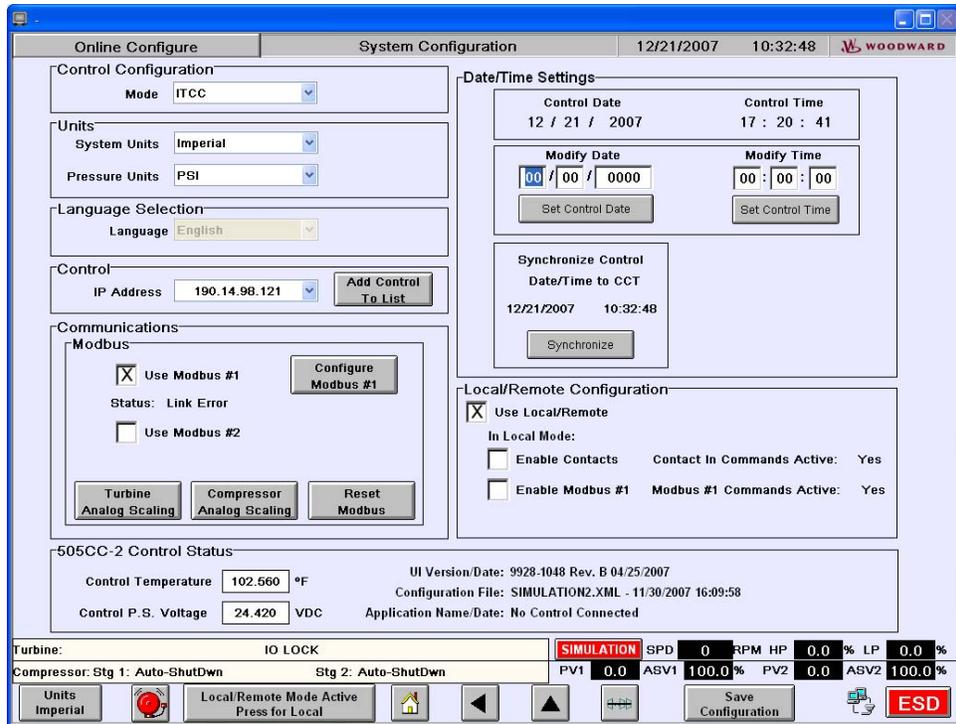
Figure 2-16. System Configuration Screen

- **Control Configuration**
  The 505CC-2 is designed as an integrated turbine and compressor anti-surge control (ITCC), but it may also be configured to act in Turbine-Only and Compressor-Only Modes. In the former, the control functions similarly to a Woodward 505E, providing speed governing, steam header pressure control, and process control (Cascade). In the latter mode, the unit acts as a stand-alone compressor anti-surge control for a two-section machine (the Cascade controller is also available in this mode).

- **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**
  Select the IP Address of the 505CC-2 to which the HMI/CCT is to connect. Additional IP addresses may be added to the list using the provided button. The 505CC-2's IP Address is defaulted from the factory (see the Atlas-II Manual 26415), but it may be verified by connecting to the control with Woodward's AppManager software, available on the installation CD.

- **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 2-16, 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 2-17.
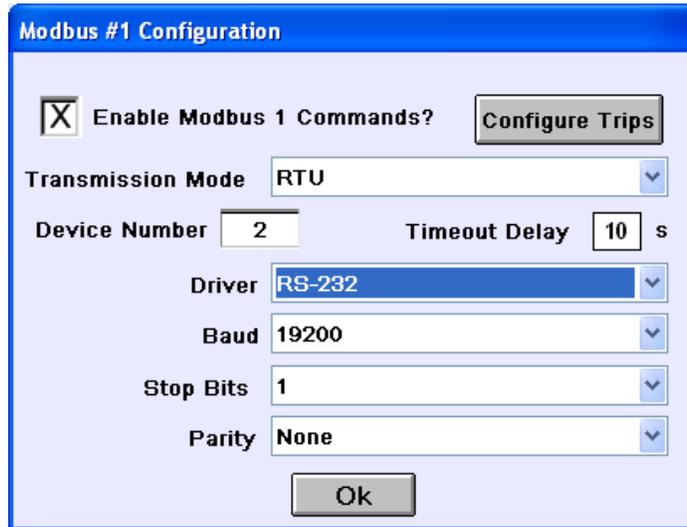
Figure 2-17. Modbus Configuration Pop-up

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 2-16. 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 2-17.

A status message indicates whether or not discrete inputs and Modbus commands are active under the current configuration. As an example, in Figure 2-18, 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 2-15, the Configuration Menu screen provides a File Upload/Download button to access the Configuration File Management screen, shown in Figure 2-19.
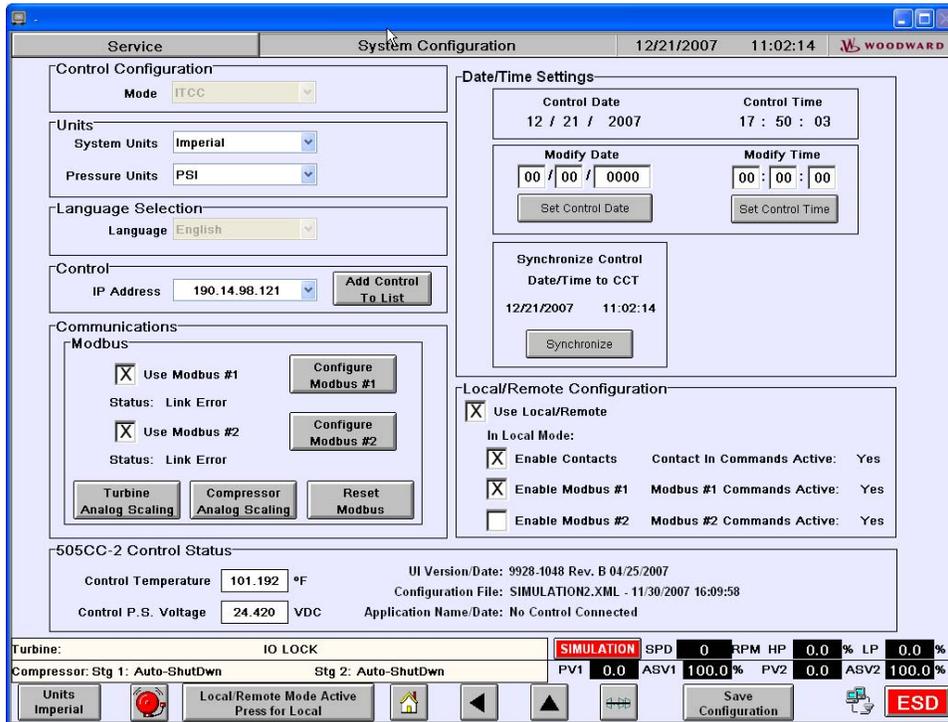
Figure 2-18. System Configuration Screen
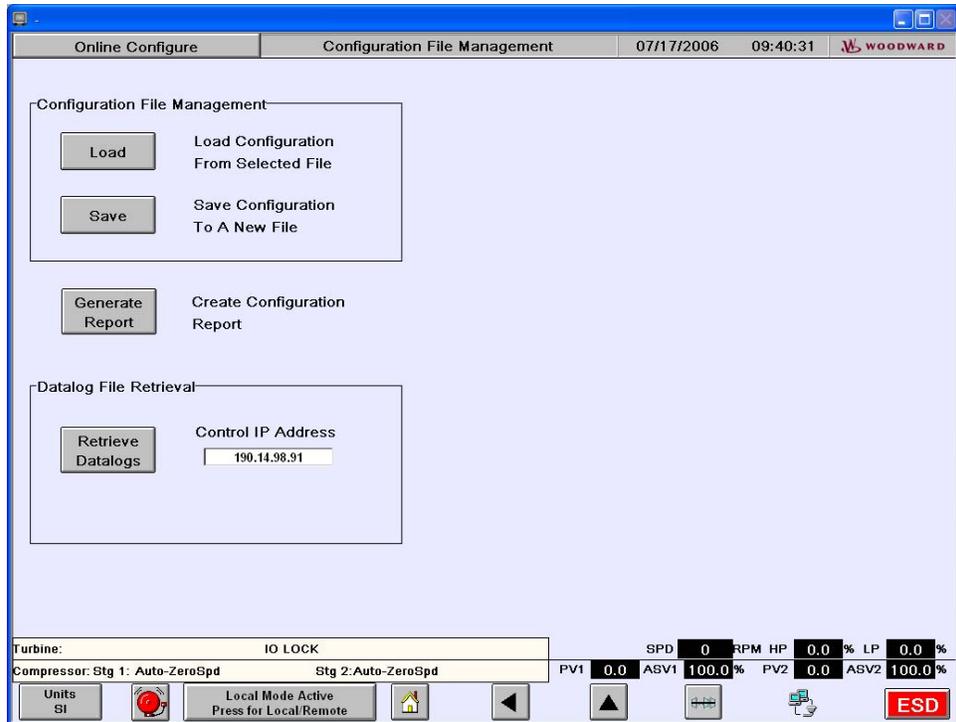
Figure 2-19. Configuration File Management Screen

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 2-20. The default filename is generated from the current date and time but may be modified as desired.
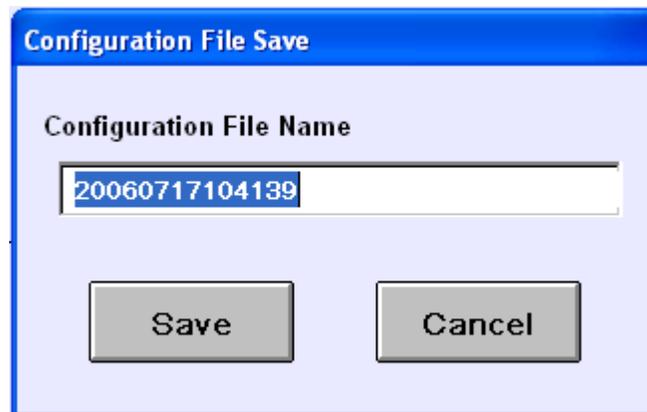
Figure 2-20. Configuration File Save Pop-up

The configuration is saved as a .XML recipe file in the \WGFiles subdirectory of the Indusoft Studio program installation. A typical path would be *C:\Program Files\Indusoft Web Studio v6.1\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 2-21. Select the browse button to locate the desired .XML recipe file.

Configuration File Load

Configuration File Name

[   ] [...]

[Load]   [Cancel]
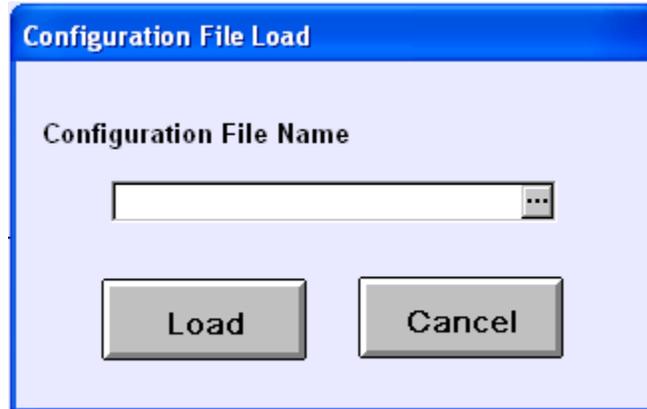
Figure 2-21. Configuration File Load Pop-up

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 Atlas-II 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 Indusoft Studio installation (*C:\Program Files\Indusoft Web Studio v6.1\Projects\505CC-2\505Configuration.txt* for example). The file has applied formatting so it is best viewed in a word processing application, not a simple text editor.

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 Indusoft Studio installation. A typical path would be *C:\Program Files\Indusoft Web Studio v6.1\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.

IMPORTANT — Datalogs retrieval command will only work if the default IP address is left unchanged. If a change in IP address is required, the CMDP.BAT file must be updated with the new IP address for this function to work.

IP Addresses

For Ethernet communications, all network devices must have similar but distinct IP addresses. From the factory, the 505CC-2's Atlas-II control is preconfigured with fixed addresses on each of its four Ethernet ports. Likewise, the optional touchscreen HMI comes addressed as 172.16.100.45 (port 1) to permit immediate connectivity to the 505CC-2. Similarly, any connected computer running the HMI/CCT software must be configured with an address of the same form. Per the Atlas-II Manual 26415, its Ethernet port #1 must be used for Woodward software tools. Therefore, this is the default port for connection of the HMI/CCT. However, if desired, the other ports may be used if their IP addresses are modified as necessary.

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/XP compatible computer.
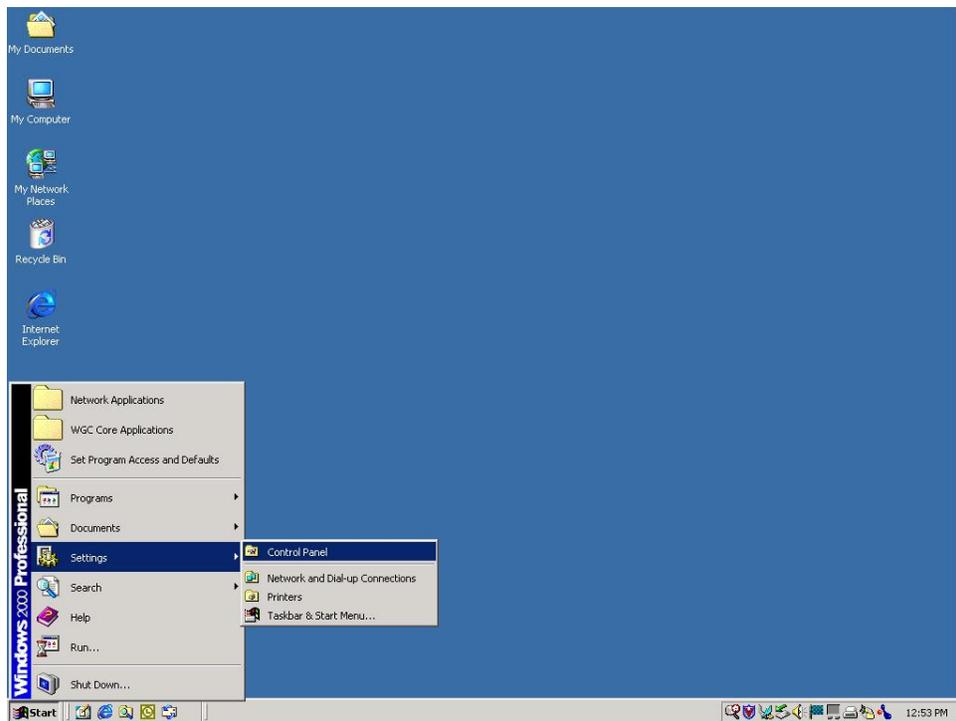
Select *Settings … Control Panel* from the *Start Menu.*
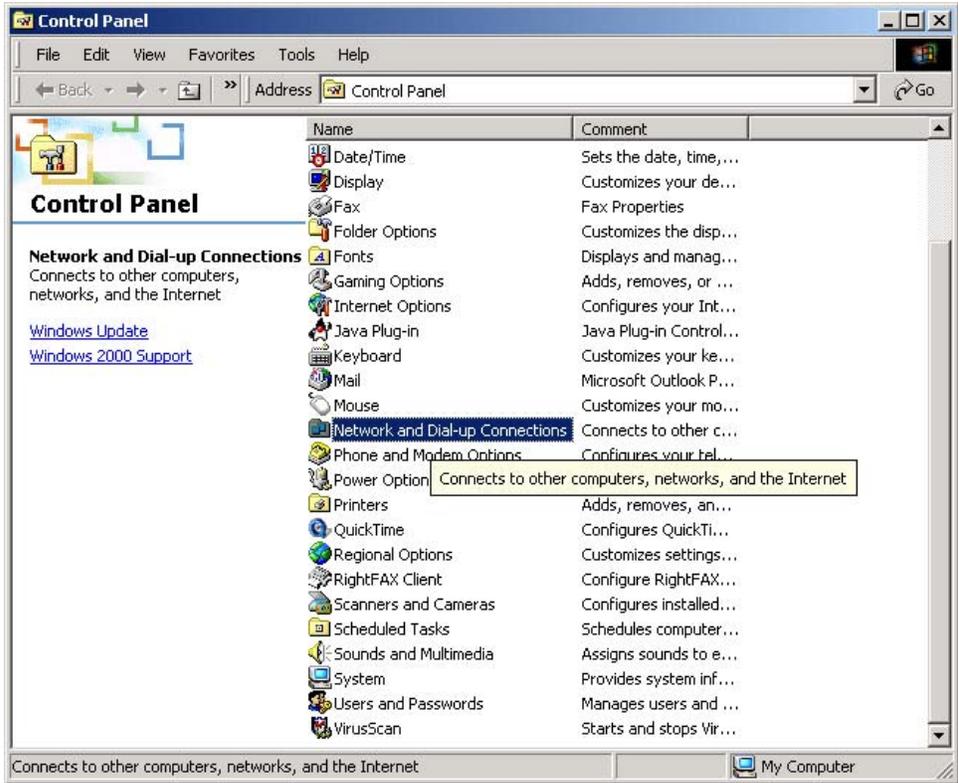
Select *Network and Dial-up Connections*.
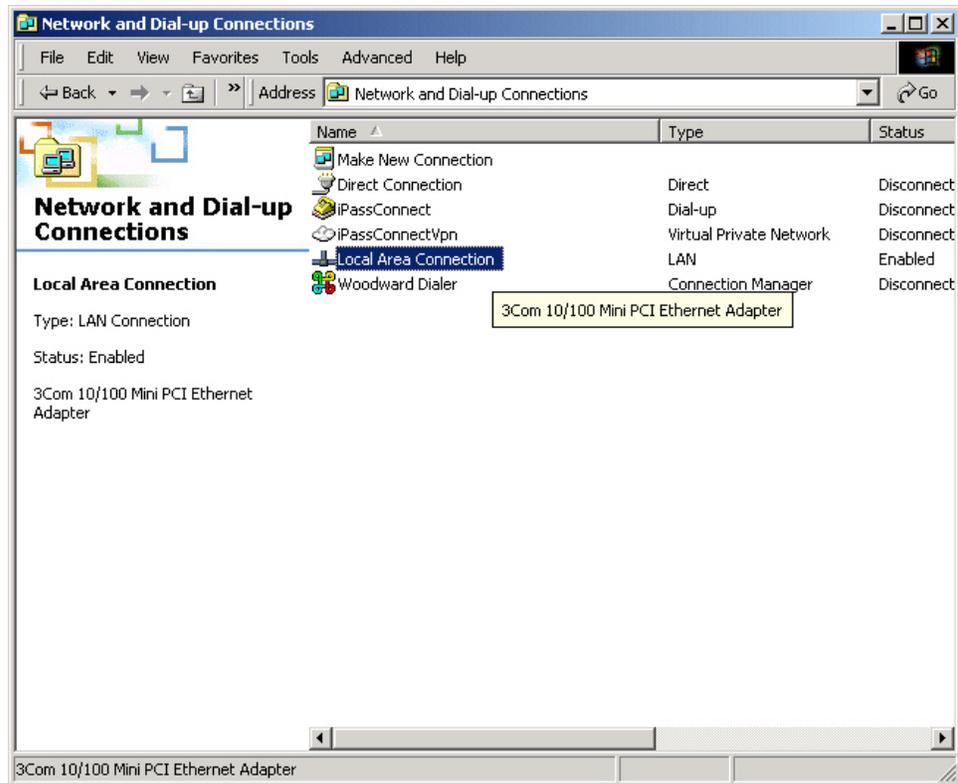
Select *Local Area Connection*.
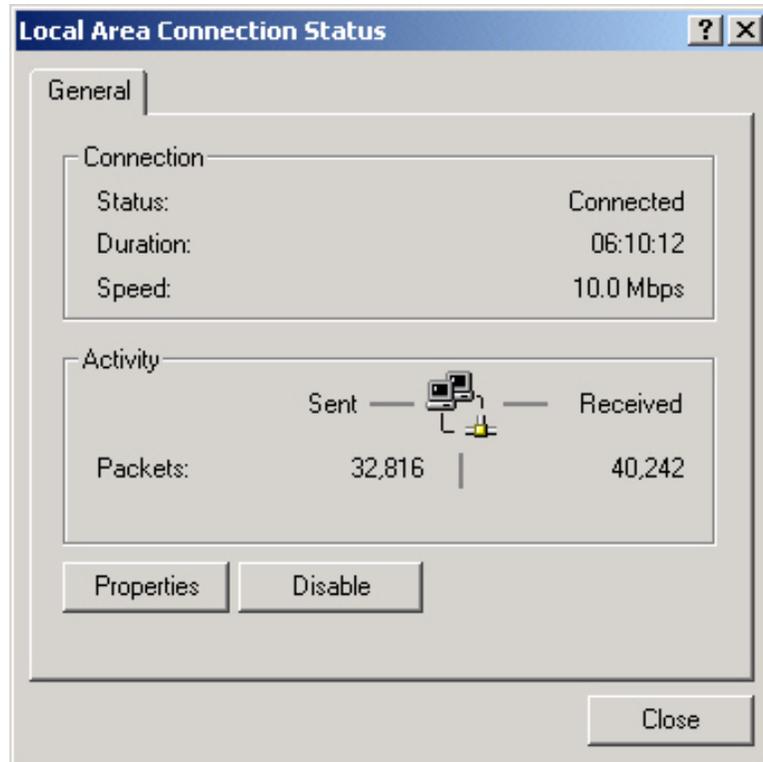
Click the *Properties* button.
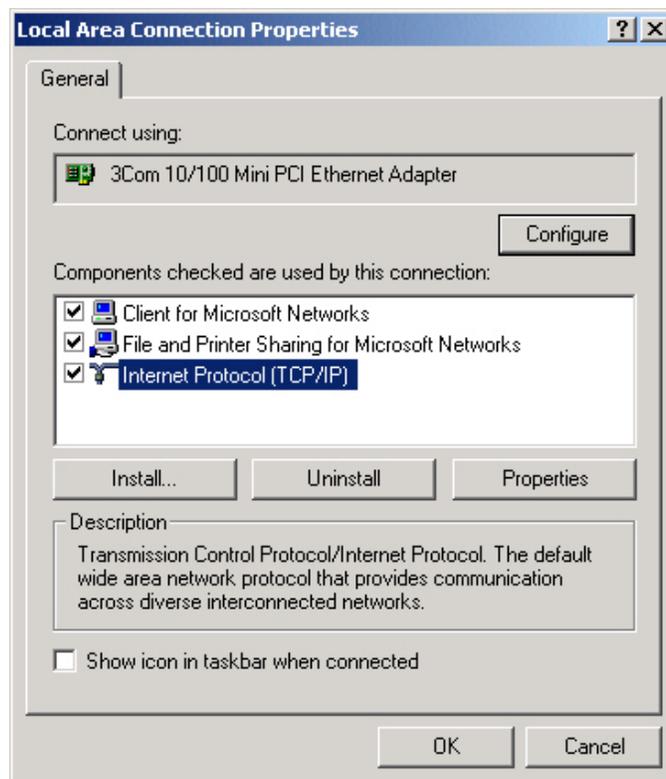
In the *Local Area Connection Properties* window, verify that *Internet Protocol (TCP/IP)* is checked and selected. Click the *Properties* button.
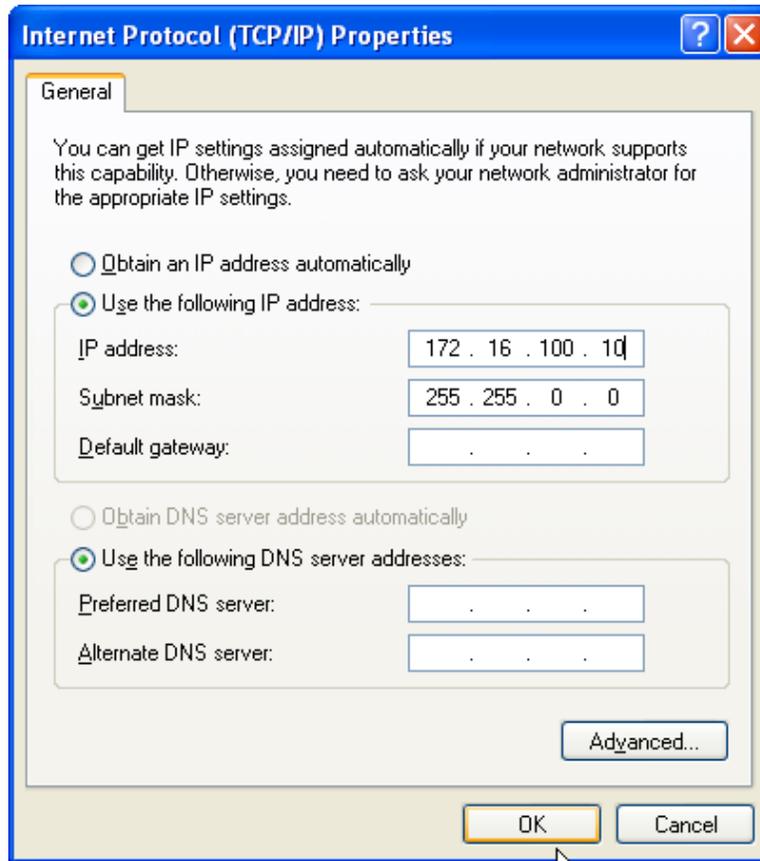
Click the *Use the following IP address:* radio button and enter an address in the correct format. The *Subnet Mask* will default to 255.255.0.0, which means that the first two numbers in the devices' addresses must match to facilitate proper communications. For example, to match the default IP address of the Atlas-II's port #1, enter an address for the computer in the form 172.16.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 2-6, it may be necessary to change the IP addresses of the control and HMI, if utilized.

NOTICE | To change the Atlas-II'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 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.
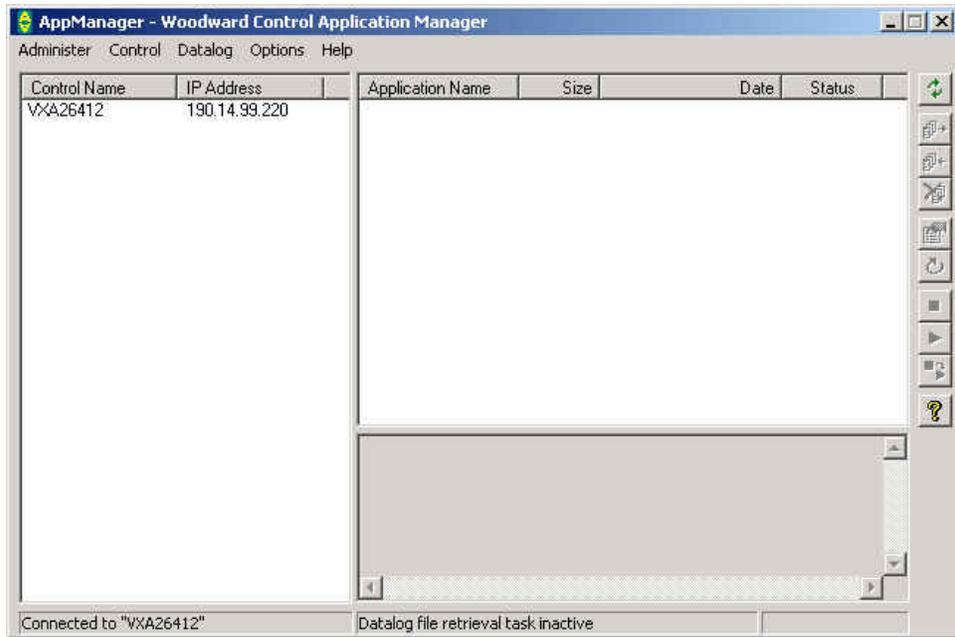
Select the control name to highlight it. The name, size, date, and status of the application software will appear in the pane to the right.
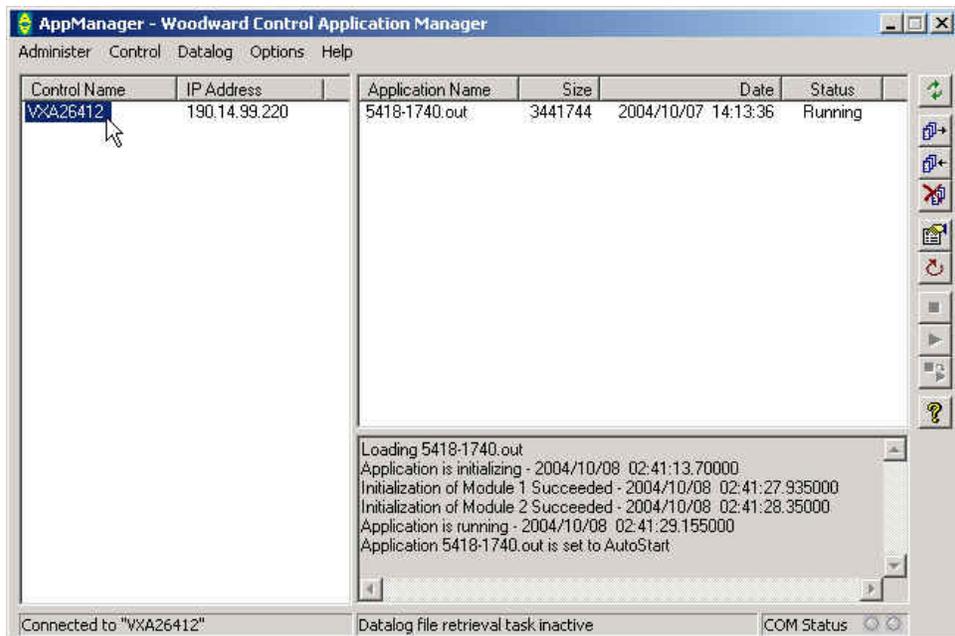
To allow changing the IP address, the application software must be stopped. Select the application name, *XXXX-XXXX.out*, in the right pane of the AppManager window. Then, click the Stop button in the toolbar, or select *Stop Application* from the *Control* menu.
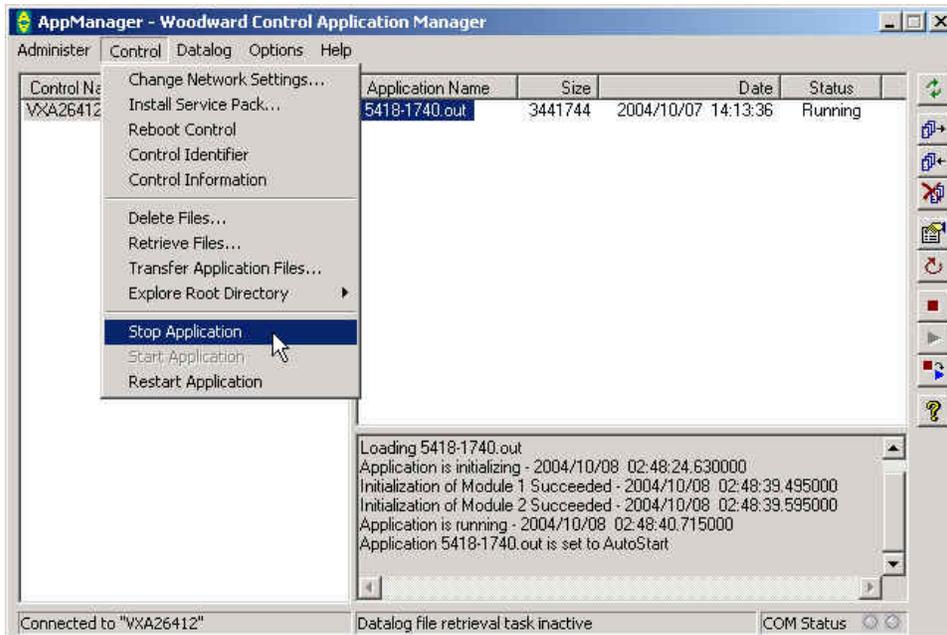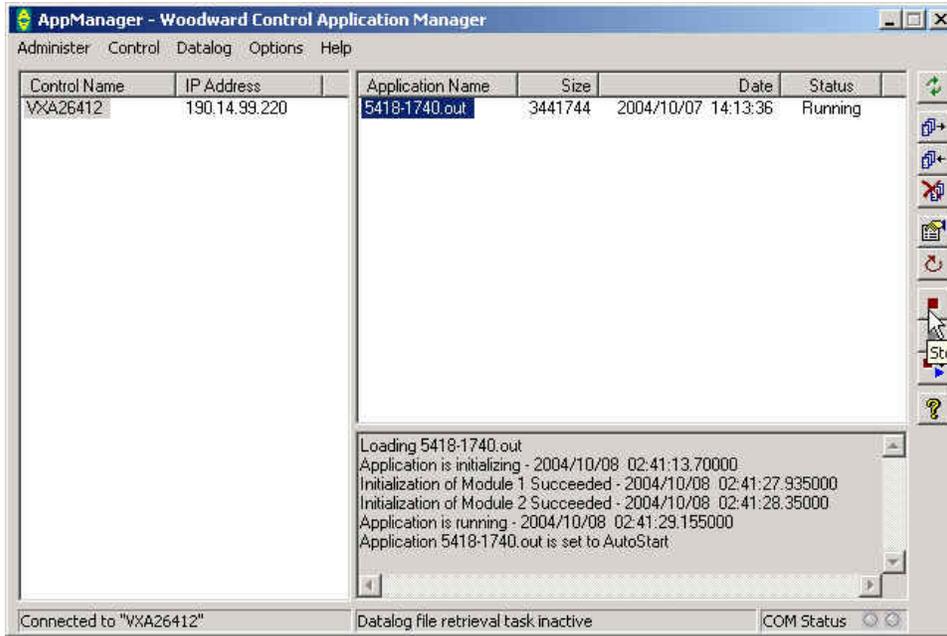
AppManager will request confirmation before stopping a running application.
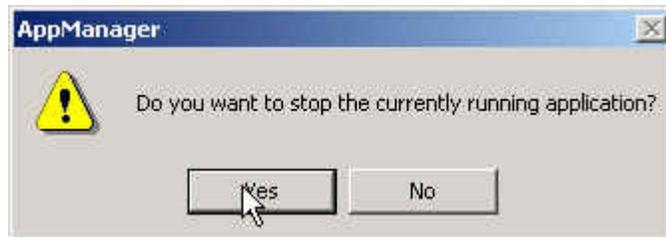
Select *Yes* and, if prompted, enter *ServiceUser* as the *Connect As:* and *Password:.*

Once the application is stopped, it will be indicated as such in the *Status* column in the right pane of the AppManager window.
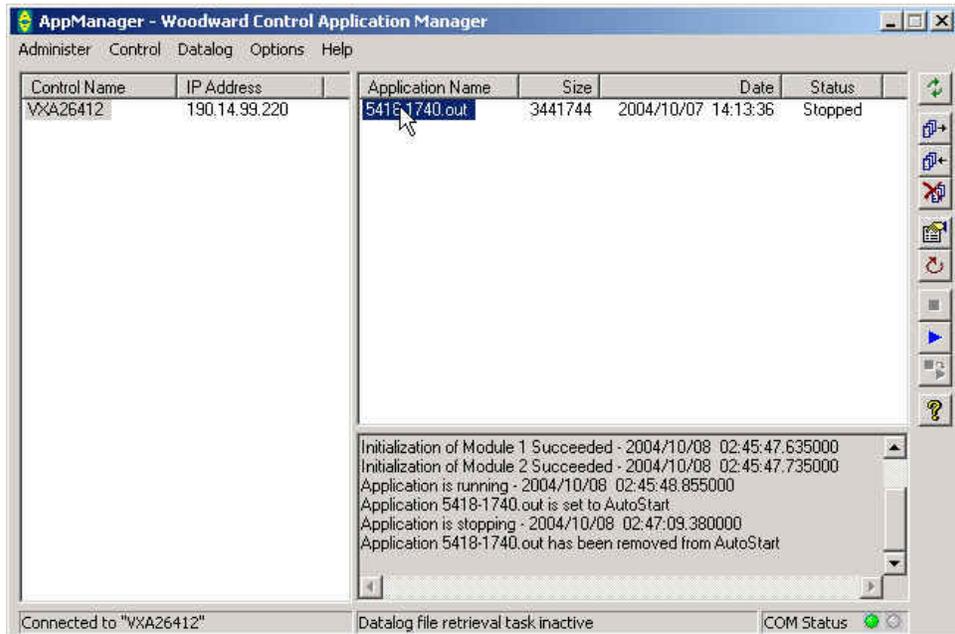
The IP address can now be changed by selecting *Change Network Settings* from the *Control* menu.

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.
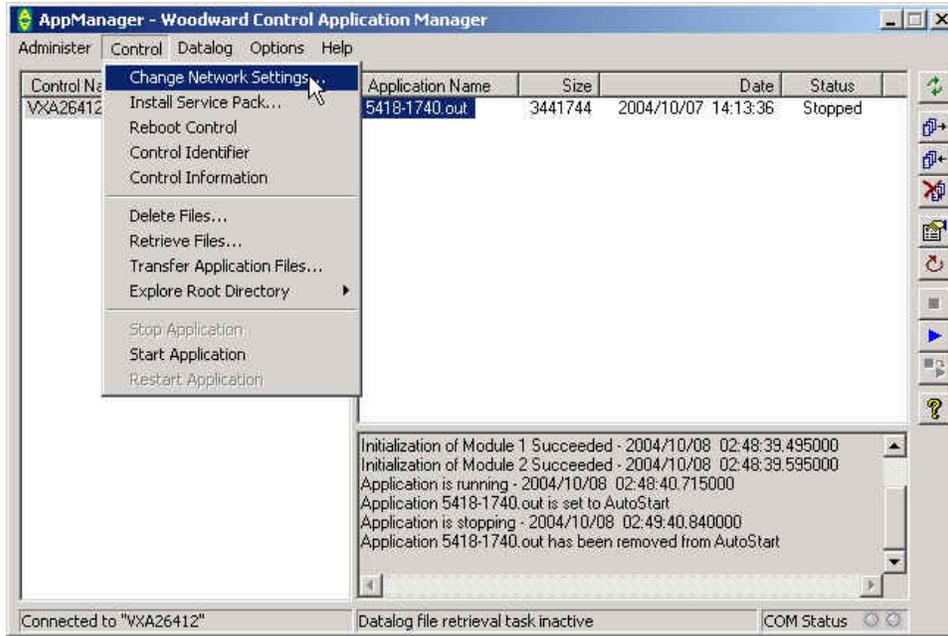
AppManager will prompt for a new IP address. If installed on an Ethernet LAN, a DHCP server can assign the address, or one may be specified directly. Select *OK*. Then, select *Yes* at the confirmation prompt to proceed with the change.
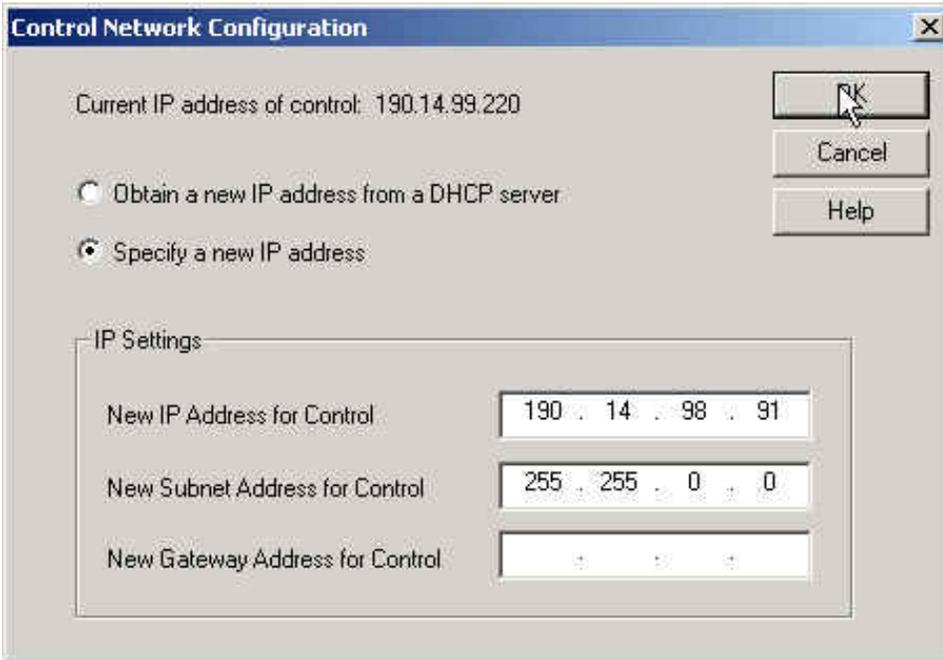
IMPORTANT	**Depending upon the version of AppManager being used, the confirmation pop-up may indicate that AppManager will display a confirmation message after successfully readdressing the control. This confirmation of completion may or may not be displayed, depending upon the versions of the control 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.
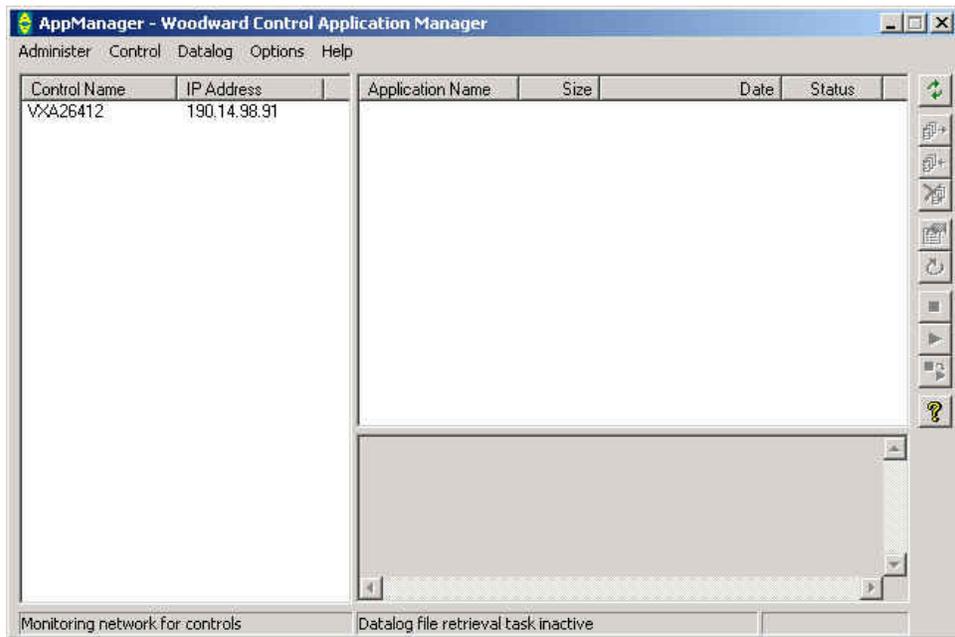
The application software must now be restarted. As before, select the control name to highlight it. Then, select the application name, *XXXX-XXXX.out*, in the right pane. Click the Start button in the toolbar, or select *Start Application* from the *Control* menu
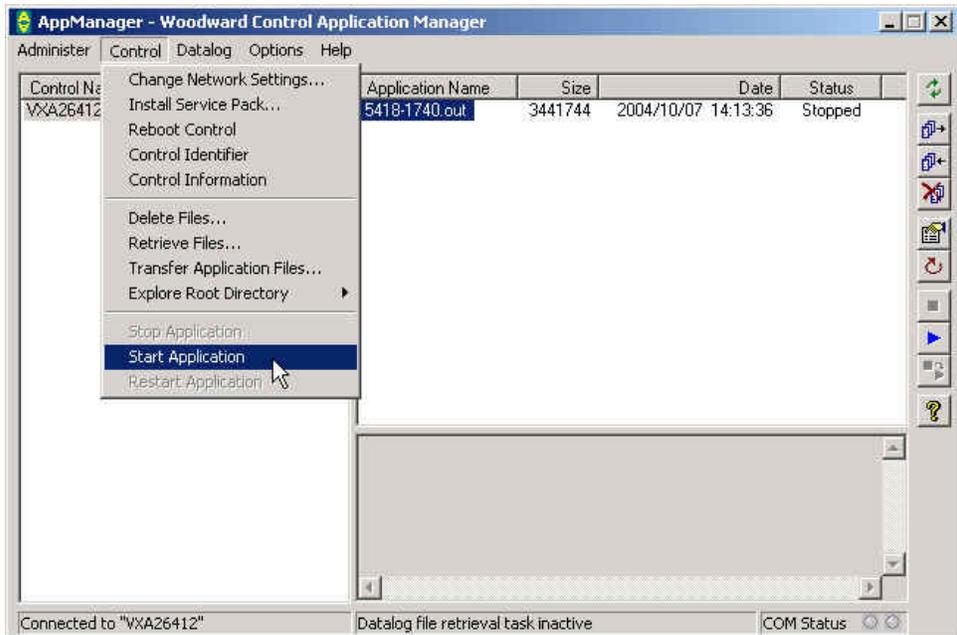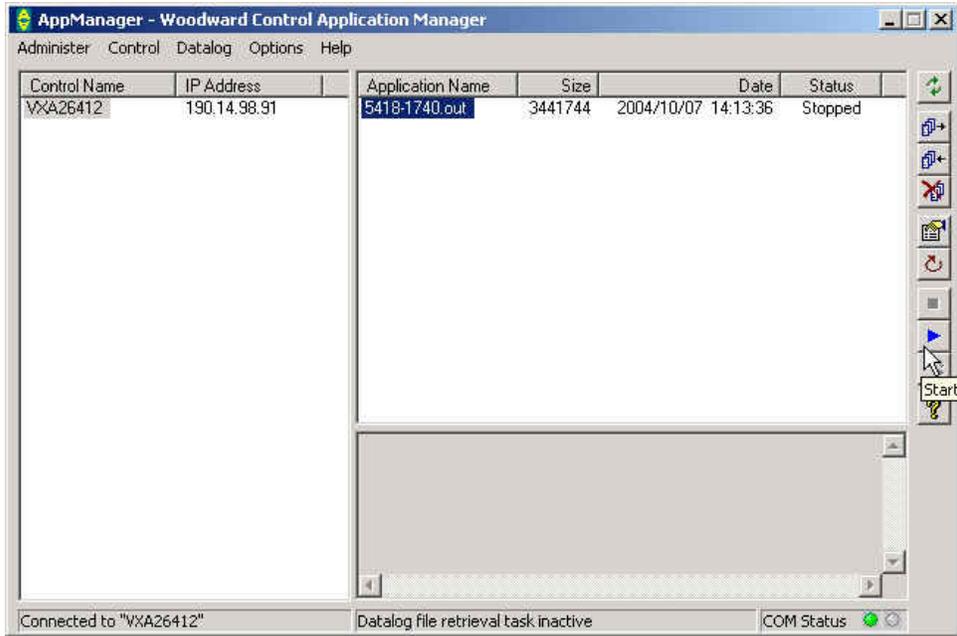
The application will initialize, as indicated in the *Status* column and by messages displayed in the lower right box of the AppManager window. Once complete, the *Status* column should display *Running*.
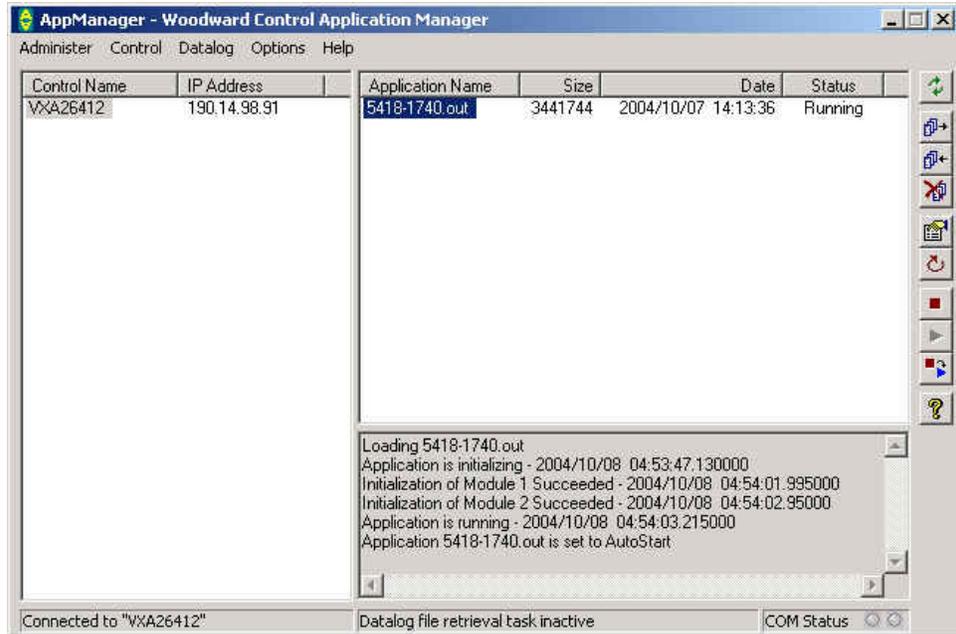
Changing the HMI's IP Address

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 or Ethernet using the Modbus communication protocol (See Manual 26415 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 2-22.
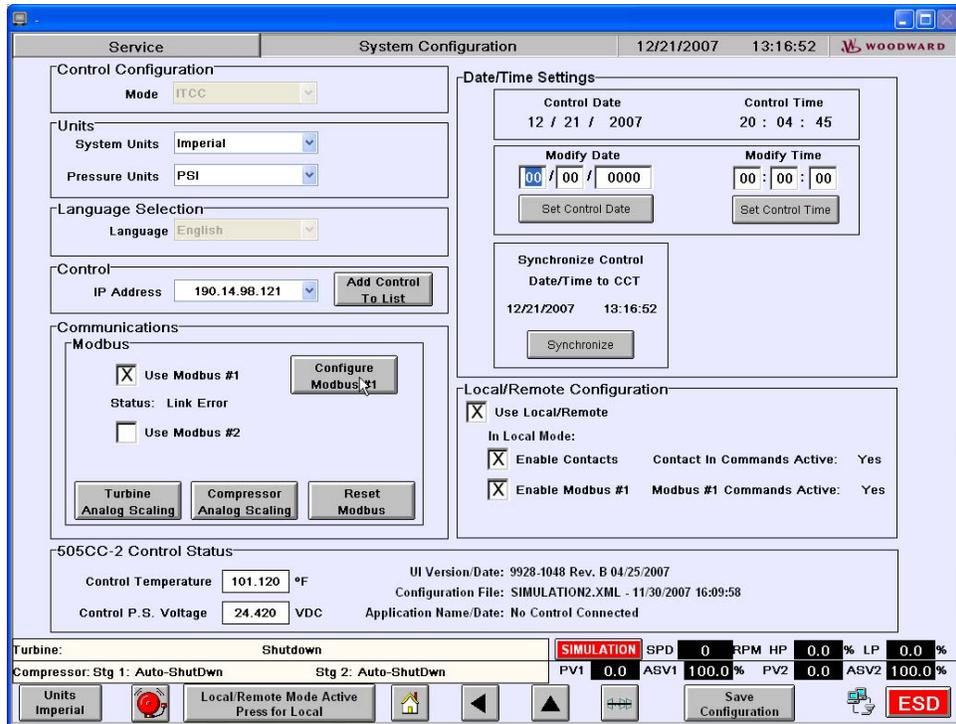
Figure 2-22. System Configuration Screen – Modbus

Port Configuration

Select the Configure Modbus #1 (or 2) button to view the Modbus Configuration pop-up, shown in Figure 2-23. 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.

The Timeout Delay is defaulted to 10 seconds and is adjustable only with special software tools. This delay 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 Manual 26415 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.
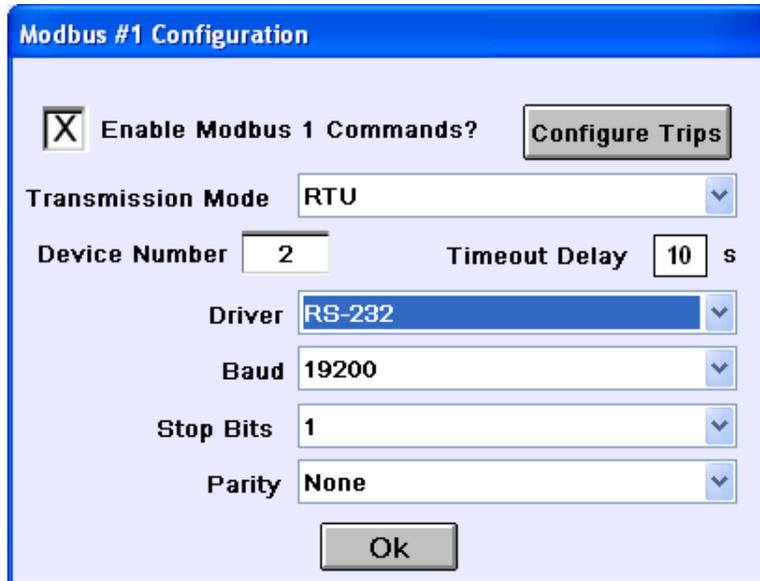
Figure 2-23. Modbus #1 (or 2) Configuration Pop-Up

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 2-24. It will facilitate customization of shutdown commands from the Modbus port.
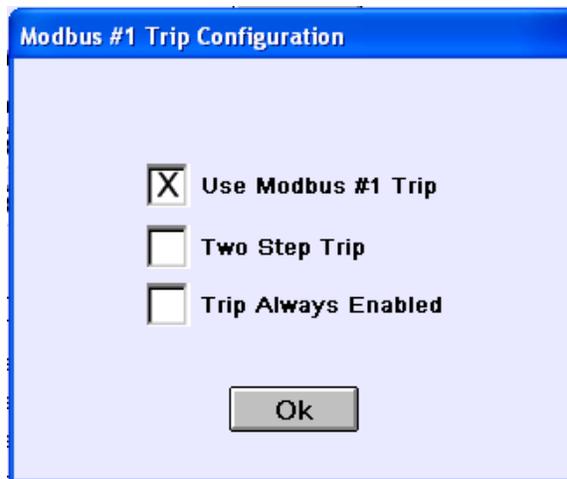
Figure 2-24. Modbus #1 (or 2) Configuration Pop-Up

Trip Configuration

In the Modbus #1 (or 2) Trip Configuration pop-up, shown in Figure 2-24, 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 2-25 for the Turbine and Compressor Analog Scaling pop-ups. The groups of parameters requiring scalers are listed in Table 2-6, 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.
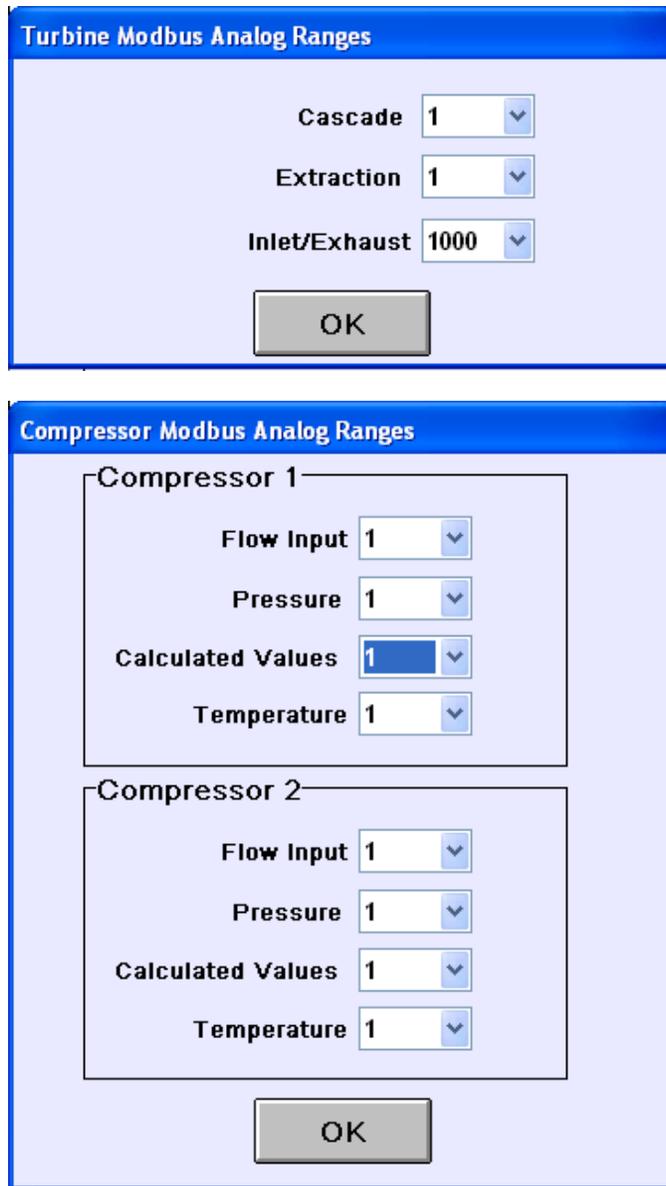
Figure 2-25. Modbus Analog Scaling Pop-Ups

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 2-6. 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
0:0083	Disable Inlet/Exhaust Dcpl Control
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	Enable Manual Inlet/Exhaust Dcpl
0:0099	Disable Manual Inlet/Exhaust Dcpl
0:0100	Lower Manual Inlet/Exhaust Demand
0:0101	Raise Manual Inlet/Exhaust Demand
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 (Not Used)
0:0107	LP/V2 Valve Revert To Automatic (Not Used)
0:0108	Close LP/V2 Valve in Manual (Not Used)
0:0109	Open LP/V2 Valve in Manual (Not Used)
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 2-7. 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 - Inlet / Exhaust Pressure Signal Failed
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 - External Speed Bias Input Failed
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
1:0129	Pressure Priority Active
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	Alarm – Cascade Input Failed (Compressor Only Mode)
1:0322	Alarm – Cascade Rem. Ref. Failed (Compressor Only Mode)
1:0323–329	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 2-8. 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) (Not Used)		
3:0081	Turbine Analog Output 4 (mA x 100) (Not Used)		
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/k
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 2-9. 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 (Not Used)		
4:0008	Modbus Entered Manual LP/V2 Valve Demand (Not Used)		
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 2-10. 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 2-11 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
	15 – External Speed Bias Input

3:0094 – 3:0097 Turbine Analog Output Configuration	1 – Not Configured
	2 – Turbine Speed
	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 – Atlas-II 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 Turbine Discrete Input Configuration .	0 – Not Configured
	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 – Select Extraction/Admission Priority
	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 – Inlet / Exhaust Manual Demand Raise
	42 – Inlet / Exhaust Manual Demand Lower
	43 – Decoupled Mode Enable / Disable
	44 – Extraction / Admission Remote Manual Demand Enable
	45 – Real Time Clock Auto-Synchronize
	46 – Manual Decoupled Mode Enable / Disable
	47 – Manual Coupled Mode Enable / Disable
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 –Cascade 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 – External Speed Bias Input Failed
	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
	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 – AUTO / Manual with Backup
	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
	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 – MANUAL with BACKUP / Manual with Backup
	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 / Surge Recovery
	34 – FULL MANUAL / Offline
	35 – 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
	26 – Cascade Input Failed (Only shown in Compressor Stage 1)
	27 – Remote Cascade Setpoint Input Failed (Only shown in Compressor Stage 1)
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 2-11. 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 manual 26415 for the Atlas-II.

2. Wire the 505CC-2 to field devices according to the I/O lists and wiring diagrams shown earlier in Chapter 2. 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 2.

4. Install the optional touchscreen HMI or other computer and connect to the 505CC-2 as detailed earlier in Chapter 2.

5. Use Woodward's AppManager software (available on the installation CD) to verify the 505CC-2's IP address.
    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 2. 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.

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 2-9.
    b. Go to the System Configuration screen shown in Figure 2-16 and select Add Control to List. In the configuration pop-up, enter the appropriate IP Address as shown in Figure 2-26.
    c. Select OK, then select the IP Address that was just configured from the IP Address list box.
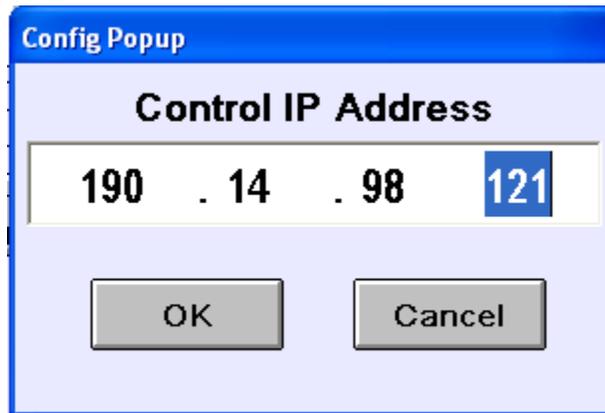
Figure 2-26. Add Control Configuration Pop-up

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 2. 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 3.
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 HMI communicates with the Atlas-II control via TCP/IP Ethernet connection.

- HMI Touchscreen Computer, Item Number 1790-9029
- HMI Software, Item Number 9928-1174
- HMI Kit, Item Number 8269-1006 (this part number contains the HMI computer, touchscreen monitor, software, and a crossover Ethernet cable together)
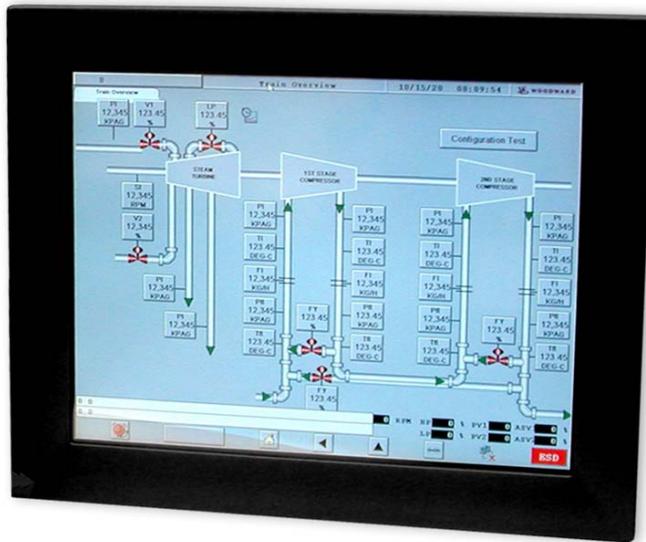
Figure 3-1. 381 mm (15 inch) LCD Touchscreen HMI

Specifications

Dimensions	Weight
383 mm X 307 mm X 65 mm (15.08" X 12.09" X 2.56")	Monitor 5.5 kg (12.13 lb)
Input Power	**Temperature Limits**
60 W, 18~32 Vdc	Operating 0 to 50 °C (32 to 122 °F) Storage -20 to 60 °C (-4 to 140 °F)

Mounting

The HMI 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 chassis. See Figure 3-2 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.

Dimensions: 383 x 307 x 65mm (WxHxD)

Cutout: 373.5 x 297.5 mm (suggested)
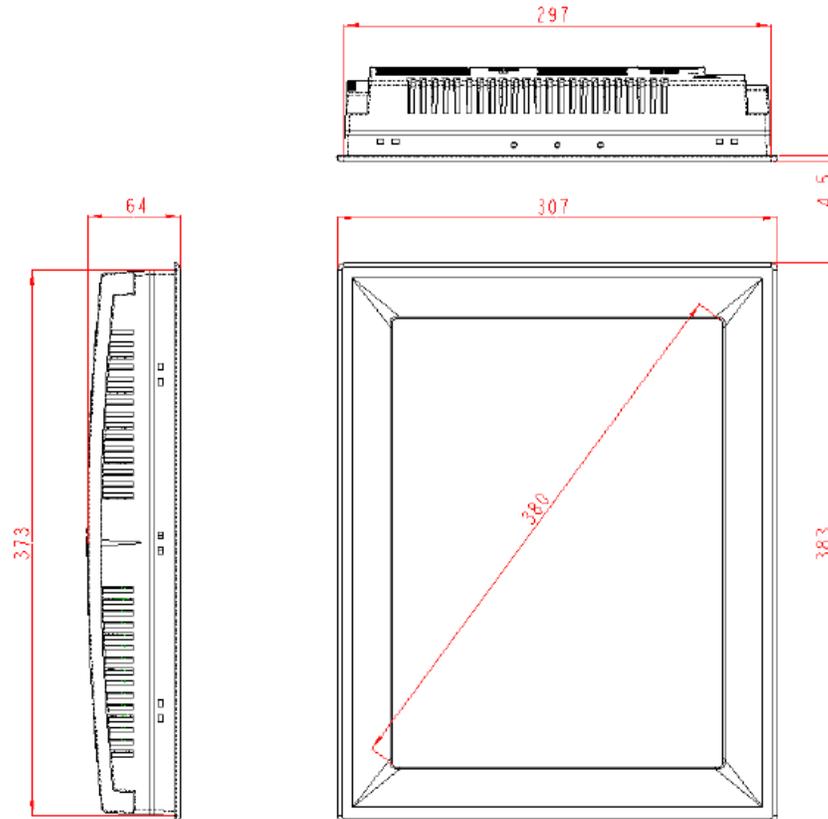
Figure 3-2. Monitor Outline and Dimensions (mm)

Wiring

The HMI requires only 24 Vdc (2.5 A nominal) power to the computer and an Ethernet connection between it and the Atlas-II control. An Ethernet connection to the control should utilize a double-shielded cable (supplied in the HMI kit). 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 or USB port, however supplied.

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.
Configuration Worksheet

The Configuration Worksheet is contained in a separate publication that can be copied, filled in, and faxed as necessary. The electronic version (Microsoft Word) can be downloaded as publication number 26451sup from the Woodward website (**www.woodward.com/publications**).

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26451V1B.

WOODWARD