Honeywell

900 Control Station
For use with HC900 Controller

User Guide

Doc. No.: 51-52-25-148
Revision: 8
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Notices and Trademarks

Revision 8, September 2013

Warranty/Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Honeywell Process Solutions

1250 W Sam Houston Pkwy S

Houston, TX 77042

About This Document

Abstract

This manual describes the installation and operation of the 900 Control Station Operator Interface.

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document Title	Doc ID
HC900 Control Station Installation	51-52-33-147
900 Control Station Specification	51-52-03-46
Legacy HC900 Controller Installation and User Guide	51-52-25-107
Station Designer User Guide	51-52-25-149
HC900 Designer User Guide	51-52-25-110
Control Designer Function Block Reference Guide	51-52-25-109
HC900 Controller Communications User Guide	51-52-25-111
HC900 Controller Redundancy Overview & System Operation	51-52-25-133

Revision Information

Document Name This manual … **51-52-25-148 900 Control Station**	Revision Number	Publication Date
New	**Error! Unknown document property name.**	April 2009
Languages added, IP address setup, model specific notes	Revision 2	October 2009
Summary Displays added, Alarms & Events added, batch Logging and Download and upload configurations + others	Revision 3	March 2010
Variable Recipes added, Alarm & Events section updated, Compact Flash Min/Max added	Revision 4, 5	October 2010
CS 15” USB conflict note added	Revision 6	September 2011
“USB 3.0 support is only available for 900CS10” note added	Revision 7	March 2013
Information on I/O Safety Function block added	Revision 8	September 2013

Support & Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Honeywell Process Solutions	*http://www.hpsweb.honewell.com/ps*
HPS Technical tips	*http://hpsweb.honeywell.com/Cultures/en-US/Products/Instrumentation/hybrid/hc900/TechnicalTips/documents.htm*

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	Email: (Sales) **FP-Sales-Apps@Honeywell.com** or (TAC) **hfs-tac-support@honeywell.com**

Symbol Definitions

The following table lists those symbols that may be used in this document to denote certain conditions.

Symbol	Definition
DANGER	This **DANGER** symbol indicates an imminently hazardous situation, which, if not avoided, **will result in death or serious injury**.
WARNING	This **WARNING** symbol indicates a potentially hazardous situation, which, if not avoided, **could result in death or serious injury**.
CAUTION	This **CAUTION** symbol may be present on Control Product instrumentation and literature. If present on a product, the user must consult the appropriate part of the accompanying product literature for more information.
CAUTION	This **CAUTION** symbol indicates a potentially hazardous situation, which, if not avoided, **may result in property damage**.
	**WARNING** **PERSONAL INJURY:** Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. **Failure to comply with these instructions could result in death or serious injury.**
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

Tables

Figures

Introduction

Overview

What's in this guide

This guide contains instructions on assembly, installation, wiring, and operation of the 900 Control Station, shown in Figure 1.

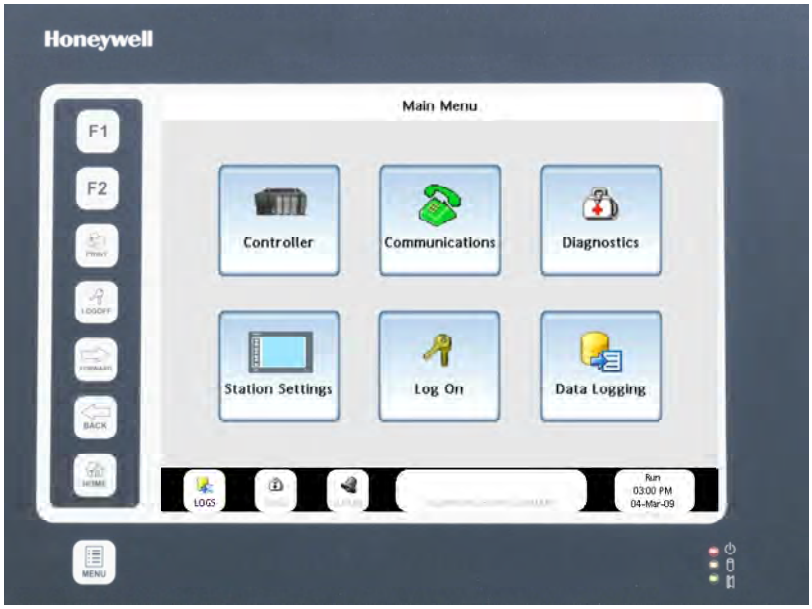

Figure 1 900 Control Station menu

Typical readers of this guide

The typical users of this guide are:

- the technician who installs the Control Station,
- the engineer who configures the Control Station,
- the operator who views/controls/monitors the process.

What you can do with the Control Station

The Control Station lets you perform these tasks:

- Monitor and control a process.
- Load/Store/Run Recipes, Profiles, Schedules, Sequences.
- Display various process data such as trends, alarms, diagnostics, setpoint profiles, and control loops.
- Store process data to disk.

Specifications

Refer to 900 Control Station Specifications document #51-52-03-46.

CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.

ATTENTION

The emission limits of EN 50081-2 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters to the antenna(e). In special cases, when highly susceptible apparatus is used in close proximity, the user may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

Components

PC

- Honeywell's HC Designer application configures your HC900 Controller's process
- Honeywell's Station Designer application configures how your Control Station interfaces with the HC900 Controller. Build custom displays using pre-configured objects (called "widgets") for interfacing with principal function blocks such as loops and SPPs. Configure data logs for storage and trend viewing.

900 Control Station

- Lets you monitor and adjust the HC900's process through custom-built displays and pre-configured "widgets"
- Load/store/run recipes, profiles, data logs
- Monitor alarms, diagnostics, events
- Store data logs

HC900 Controller

- Integrate loops of control with digital I/O
- Setpoint programming
- Setpoint scheduling
- Sequencing
- Recipe management
- Alarm processing
- PID control, Advanced control, autotuning, fuzzy logic

Preparation and startup

Site Preparation

The cable that connects the Control Station to the controller module contains low voltages. Keep the cable away from high voltage wires that can cause interference.

Control Station Mounting

See HC900 Control Station Installation document #51-52-33-157.

Noise Protection

See document 51-52-05-01, *How to Apply Digital Instrumentation in Severe Electrical Noise Environments*.

How to configure your Control Station

The Control Station is shipped from the factory unconfigured. Use Honeywell's Station Designer application to configure your Control Station.

The overall steps for configuration are as follows.

Step	Action
1	Using Station Designer application, open .sds file, add device, update IP address and create data tags from your HC900's .cde configuration file.
2	In Station Designer, build custom displays to be used by Control Station for viewing and interacting with your HC900 Controller process.
3	In Station Designer, assign data tags to the custom displays.
4	Save the Station Designer configuration as an .sds file.
5	Download the .sds file via USB or Ethernet to the Control Station.
6	Your Control Station is now configured and ready to use.

Startup

After connecting the Controller and Control Station and downloading your .sds file to the Control Station, the Home display appears with 16 buttons. (Actual button text may vary.)

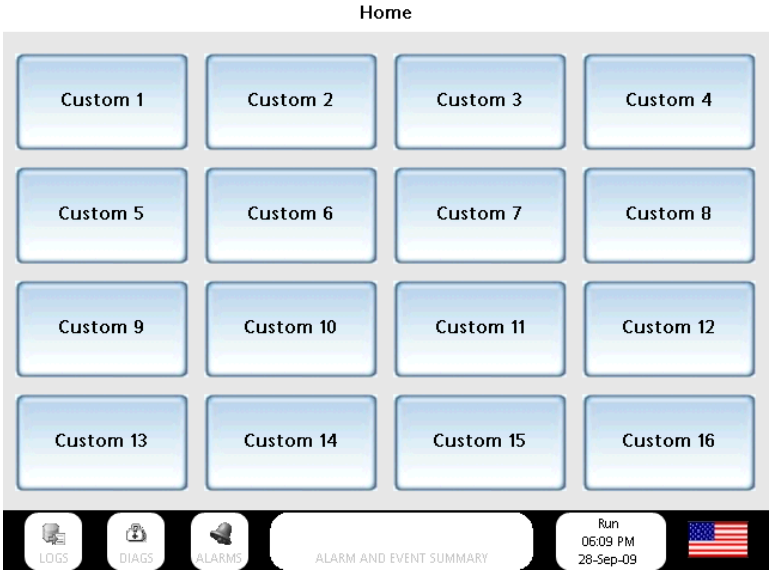

Figure 2 Home display

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Features

Overview

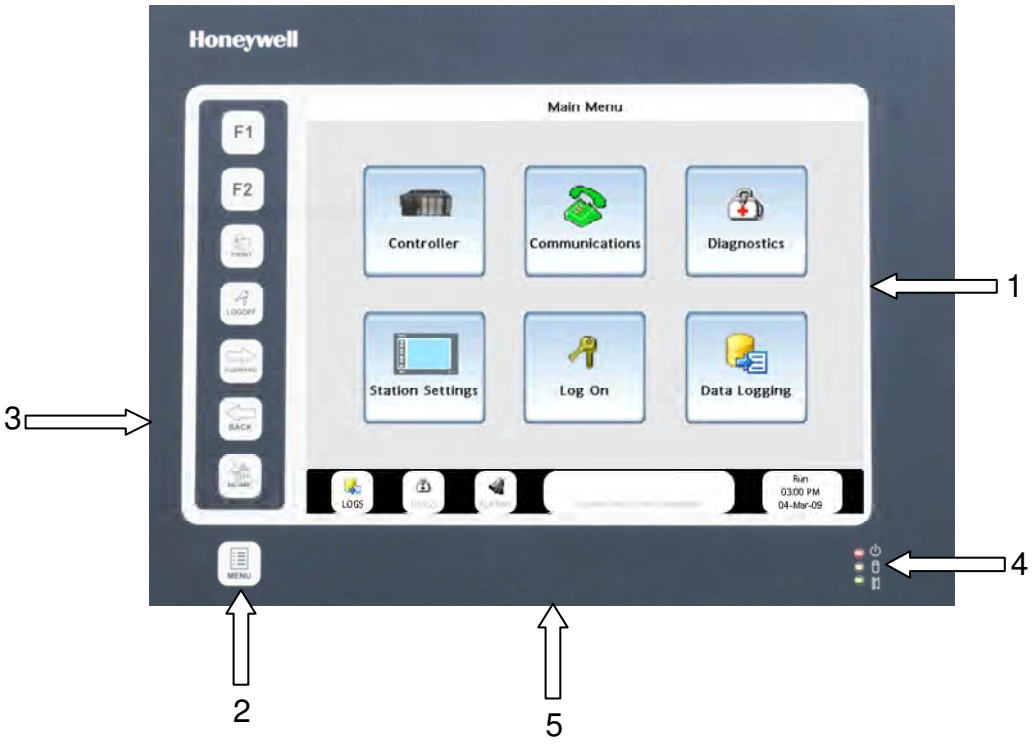
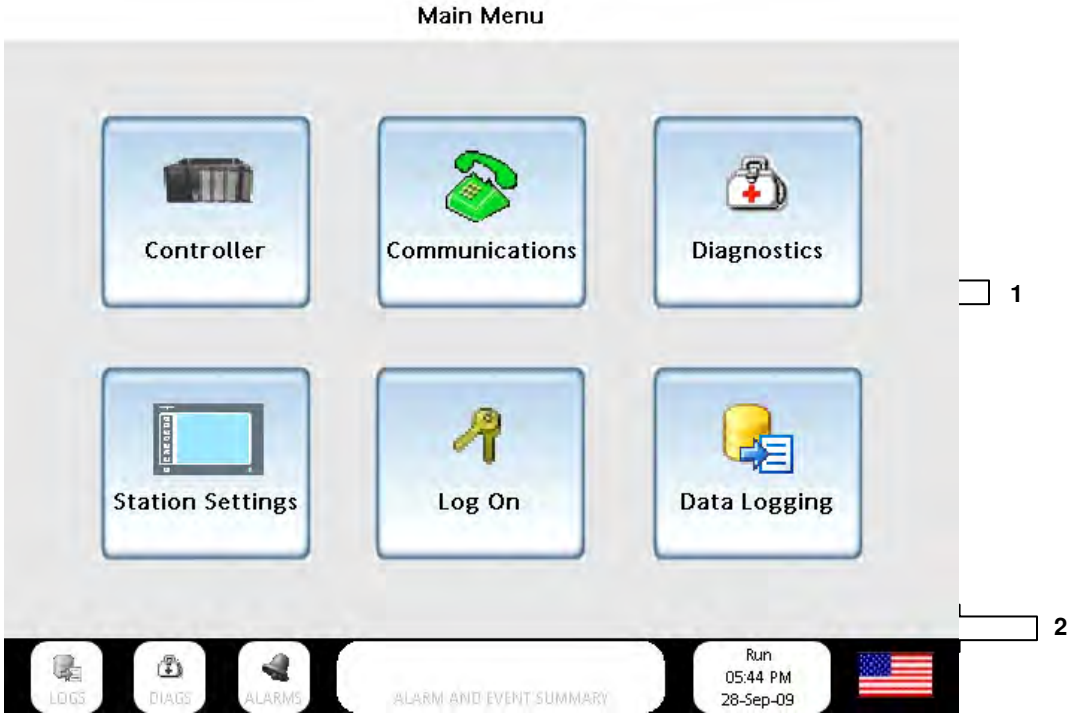


Figure 3 Features

Item	Feature	Description	Details
1	Touch screen	Interactive touch screen shows menus and displays. (Optional protective film available.)	See page 8
2	Keys	Key functions are more generic than button functions.	See page 11
3	CompactFlash	For data storage and booting up from an image file.	See page 11
4	Status LEDs	Status of power, CompactFlash and alarms.	See page 12
5	Ports	Connections for data storage and communications.	See page 13

Touch screen



Item	Feature	Description	Details
1	Navigation and data entry	A button is an onscreen object that when touched causes an action. Shown here are the buttons on the Main Menu. Buttons come in various shapes, sizes and colors but a graduated blue background is the most common.	See page 9.
2	Status bar	Always visible. Shows status of: • Logs • Diagnostics • Alarms • Events • Controller • Language	See page 10.

Navigation and data entry

A button is an object you touch on the display to go to another menu or display or to cause an action. Buttons come in various shapes, colors and sizes.

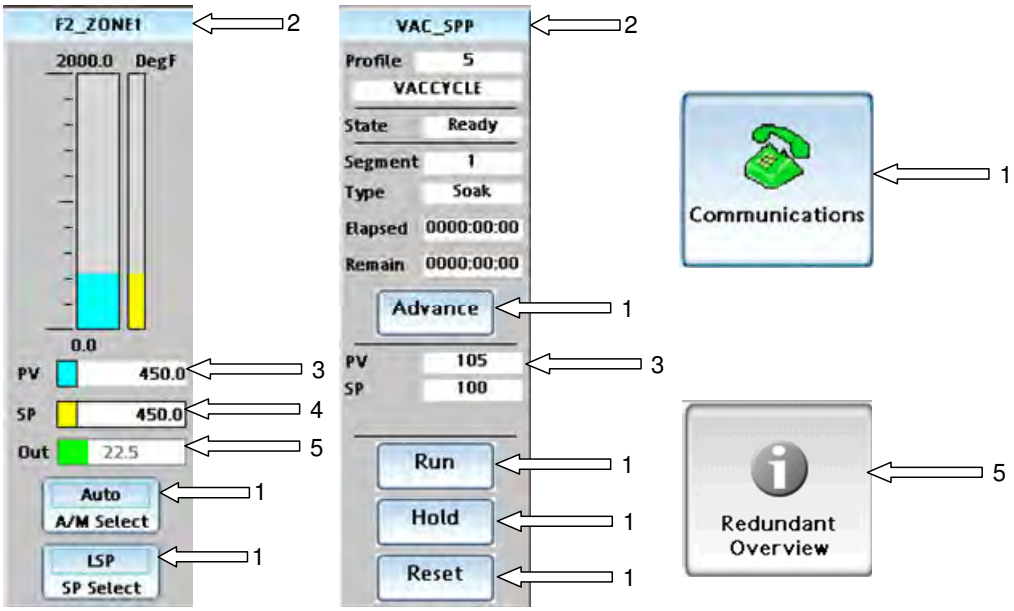


Figure 4 Examples of buttons and data entry fields

Item	Description	Function
1	Buttons with graduated blue background appear on virtually every menu under the Menu key (page 11) and on many displays. Various sizes, shapes and functions.	Touch to activate.
2	Graduated blue background in the title bar of the object indicates a link to additional displays related to the object.	Touch light blue title bar of object to jump to detailed displays for that object. Example: Touch PID title bar to jump to loop tuning, tuning constants, etc. Example: Touch SPP title bar to jump to setpoint programmer events, etc.
3	Black value or text on white unlined box. Read only.	Read-only.
4	Black value or text on white lined box. Read/write.	Touch to edit. A popup appears where you can enter a new value, type text, or select from a list of choices. See page 89
5	Grayed out text, field or button. Not accessible or applicable under current conditions.	Example: Loop output not adjustable in Auto mode. Example: Redundant Overview button is not active for non-redundant HC900s.

Status bar

The status bar is always visible at the bottom of all menus and displays.

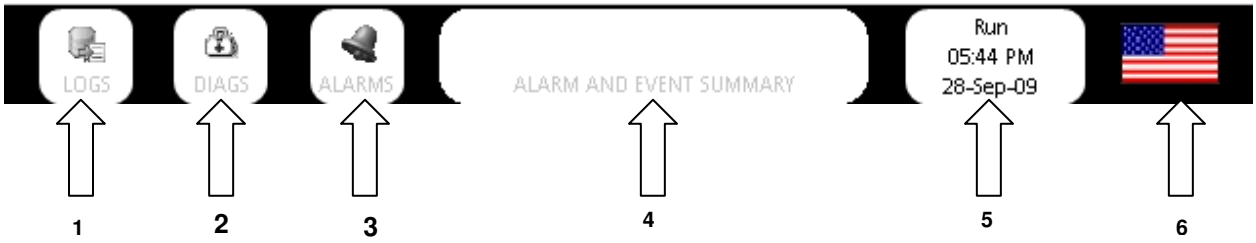


Figure 5 Status bar

Button	Description	Function
1	Data Log indicator/Data Log menu button. Gray text when no data logging is occurring on the Control Station. When data logging is occurring, the icon becomes colorful and the text becomes black.	Touch to go to Data Log menu. See page 64.
2	Diagnostic indicator. Gray text when there is no controller diagnostic present. When a controller diagnostic is present, the button flashes.	Touch to go to System Diagnostics page. See page 36.
3	Alarm indicator. Gray text when there are no active alarms. When there is an active alarm present (either acknowledged or unacknowledged), the white background turns red and the icon becomes colorful and the text becomes white. When there are any unacknowledged alarms, the button flashes. When all alarms become acknowledged, the flashing stops.	Touch to go to Alarms console or Alarm Group display depending on how the Control Station was configured (see Station Designer manual section on Alarms). Here all alarms are displayed, with buttons that let you mute and acknowledge alarms. Note: To see alarm history, go to Alarm and Event Summary.
4	Event indicator/Alarm and Event Summary button. Gray text when no event is present. When an event occurs, a description appears in black text and the background changes to a pale yellow.	Touch to go to Alarm and Event Summary, where they can be viewed or cleared.
5	Controller mode, time and date.	Touch to go to Controller Setup. See page 19.
6	Language of displayed text is indicated by flag icon.	Touch to go to Language Setup. See page 68

Keys

Unless otherwise noted, the membrane keys on the left side of the front panel always behave as described here.

Press key	For this result
	• Programmable function
	• Programmable function
	• Print contents of the display to a .bmp file on CompactFlash.
	• Log off current user.
	• Go to next display. Works only after Back key was pressed.
	• Go to previous display.
	• Go to Home display. This is the default display upon startup. It contains links to displays for viewing your HC900's process. See page 87.
	• Go to main menu. See page 15.

CompactFlash

CompactFlash socket is on the left side. Use CompactFlash card for:

- storing data logs (.csv)
- storing print screen images (.bmp)
- loading image file (.sdi).

NOTE: Maximum Compact Flash memeory size is 2GB, minimum Compact Flash size is 4MB.

Status LEDs

The Status LEDs indicate:

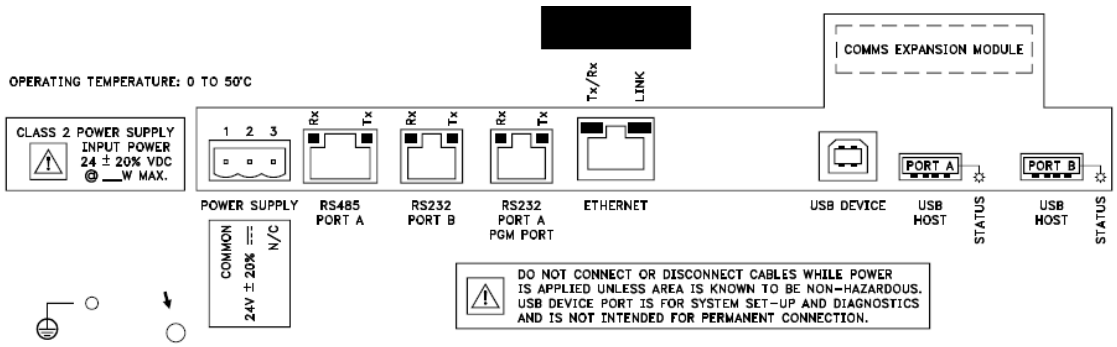
- Run status of the Control Station
- CompactFlash card status
- Alarm status.

Figure 6 Status LEDs

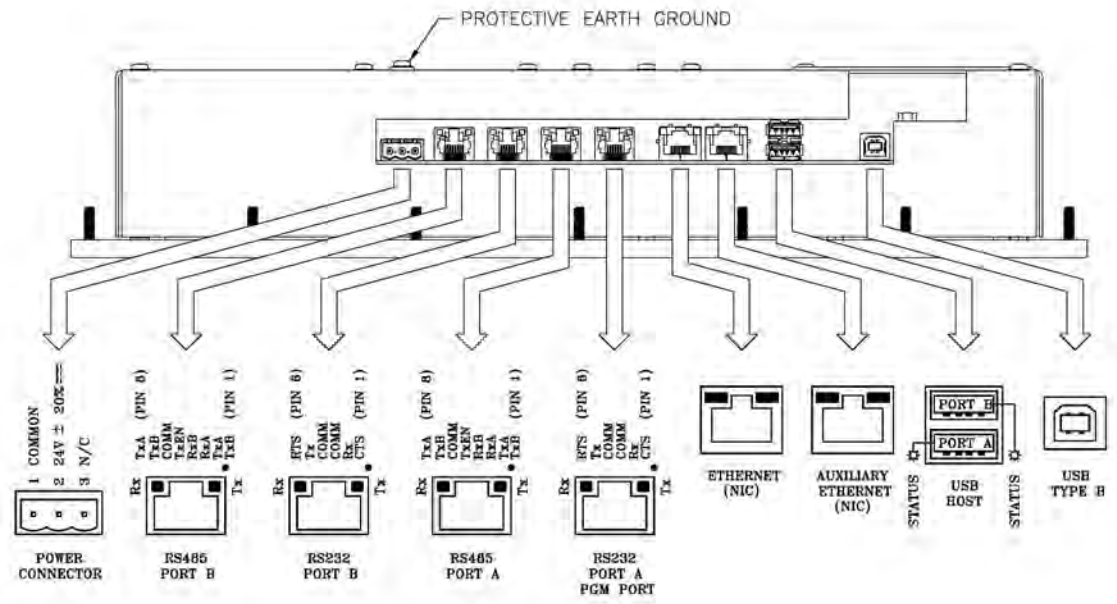
Green LED	Indication
Flashing	Unit is in the boot loader, no valid configuration is loaded.
Steady	Unit is powered and running an application.
Yellow LED	**Indication**
Off	No CompactFlash card present.
Steady	CompactFlash card present.
Flashing rapidly	CompactFlash being checked.
Flickering	Unit is writing to the CompactFlash, either because it is storing data, or because the PC connected via the USB port has locked the drive.
Flashing slowly	Incorrectly formatted CompactFlash card present.
Red LED	**Indication**
Flashing	A tag is in alarm state.
Steady	Valid configuration is loaded and no alarms are present.

Ports

900 Control Station 10 inch model



900 Control Station 15 inch model



USB Device

The USB Device port is for downloading a configuration from Station Designer to the Control Station. Type B connector. **Note:** ***USB 3.0 support is only available on the 900CS10.***

USB Host

USB Host Port A is for exporting data logs to a USB storage device with Type A connector.

USB Host Port B is not used.

Ethernet

The Ethernet port is for fastest communication with your HC900 Controller, PC, or other devices. Use an Ethernet switch to link multiple devices.

RS485

The RS485 port is for communication with HC900 Controller if Ethernet is not desired or available.

RS232

The RS232 ports are not recommended due to reduced performance. Port B may be used to connect to HC900. Port A PGM Port may be connected to your PC.

NOTE: The 15" model has two Ethernet ports and two RS485 ports whereas the 10" model has one of each.

Main Menu

Overview

Access

To access the Main Menu, press the Menu key.

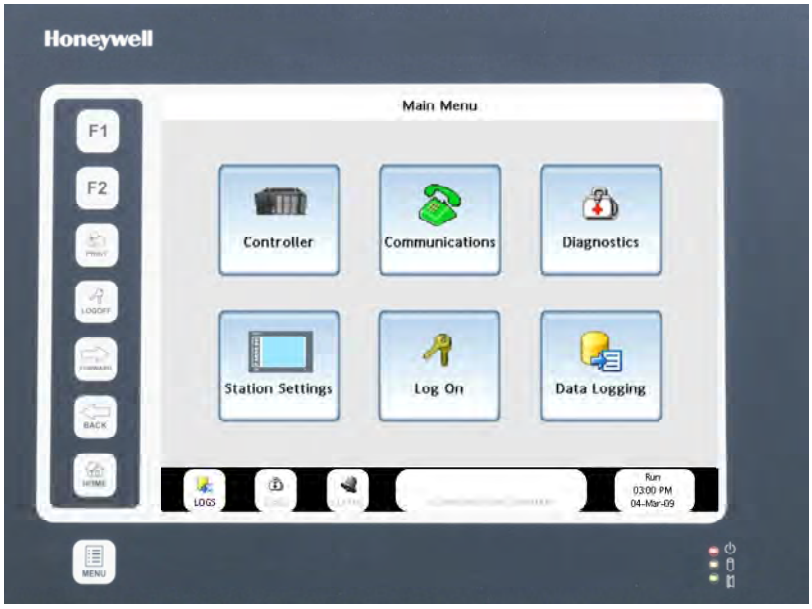


Figure 7 Main Menu

Functions

The Main Menu is for viewing and adjusting settings for your Control Station and HC900 Controller.

Process displays are accessed under the Home key.

Table 1 Main menu functions

Menu Item	Function
Controller	Controller status and setup.
Communications	Controller communications. Serial ports, Ethernet ports, I/O, Modbus, Hosts, Peers.
Diagnostics	Diagnostic status of controller, I/O, communications.
Station Settings	File management of CompactFlash and USB device. Adjust/calibrate/clean touch screen. View status of communication ports. Set passwords.
Log On	Security manager for logging on.
Data Logging	File management of Data Logs.

Main menu tree

Access the Main Menu by pressing  . The menu is organized as shown in Table 2.

Table 2 Main menu tree

See Page	*Main menu button*	*Submenu*			
17	Controller	Controller Status			
		Controller Setup			
		Summary Displays	Analog Input Summary		
			Analog Output Summary		
			Analog Variable Summary		
			Digital Input Summary		
			Digital Output Summary		
			Digital Variable Summary		
20		Serial Port S1			
		Serial Port S2			
		Ethernet Port E1			
		Ethernet Port E2			
		Expansion Rack Communications			
		Modbus Slave Devices	Modbus Slave Device *n*	Modbus Slave *n* Status	
			Modbus/TCP Slave Device *n*	Modbus/TCP Slave *n* Status	
		Host Connections	Host Connection *n*	Host Connection *n* Status	
		Peer Connections	Peer Connections *n*	Peer Connection *n* Status	
36	Diagnostics	Controller Diagnostics	Rack *n*	I/O Module	Module Details
				Details	
		I/O Module Diagnostics	Rack *n* I/O Modules	Module Details	
			I/O Calibration		
			Motor Setup		
		Communication Diagnostics	Controller Communications		
		Redundant Overview			
		Lead CPU Diagnostics			
		Reserve CPU Diagnostics			
61	Station Settings	View Data			
		Delete Data			
		Export Data to USB			
		Memory Device Utilities	Download Controller Configuration		
			Upload Controller Configuration		
			Download Recipes		
			Upload Recipes		
			Download Security		
			Upload Security		
			Export Data Logs		
			Export Data to USB		
			Upload Database Image		
			Format Memory Device		

See Page	*Main menu button*	*Submenu*		
		Cellular Modem		
		Station Setup	Languages	
			Adjust Display Brightness	
			Touch Calibration	
			Touch Test	
			Soft Key Test	
			Clean Screen	
		Station Status		
		Station Comm Ports		
		Change Passwords		
62	Log On			
64	Data Logging	View Alarm & Event Logs		
		View Data Logs		
		View Audit Logs		
		Export Data Logs to USB		
		View Batch Groups	Batch Groups	Batch Header (if the batch group selected is not running a batch)
				Batch Status (f the batch group selected is running a batch). The Batch Status is for this batch group only.
		View Batch Status	Batch Status (for all batch groups)	
		Delete Data Log		

Controller

Controller Status

This is a read-only display giving the status of various controller parameters.

Table 3 Controller status details

Item	Description
Controller Type	900C30, 900C50, 900C70 and 900C75
Controller Name	Configured controller name
Local Alias	A locally referenced alias for the controller.
Control Firmware Revision Level	Revision level of the Controller software.

Item	Description
Controller Mode	Controller's mode of operation: RUN: Controller is running normally. Note: (For C30S, C50S, C70S and C75S Controllers only) Blinking RUN text on master slide on lower right hand corner indicates controller is in invalid mode, which means there are some forced output(s) present in Safety portion of the controller configuration and user changed the controller mode to RUN-LOCKED mode from RUN-PRGM mode. PROG: Controller is in Program mode. OFLN: Controller is in Offline mode. FAULT: A fault was found reading the Controller switch. NO COMM: This is displayed if controller is not responding.
Frequency (Hz)	Line frequency. Used for configuring the conversion time of the A/D converter.
Cycle Time (Sec)	The analog control cycle time in seconds. This value is determined from the execution time estimated from the configured control scheme. Cycle Time and Fast Cycle Time increase (slow down) as the following increase: CPU % Used, Fast CPU % Used, Dynamic Memory, Config Memory. Also, extensive use of Free Form Logic blocks (as opposed to equivalent gate logic) can substantially increase Fast Cycle Time.
CPU Percent used	Calculation of percentage of time the CPU is active during the analog cycle time
Peak time (sec)	Maximum time used to complete the analog cycle
Control Block Overruns	Number of times that the processing of the analog control blocks exceeds the allocated analog cycle time
Fast Logic Cycle Time (Sec)	Cycle Time and Fast Cycle Time increase (slow down) as the following increase: CPU % Used, Fast CPU % Used, Dynamic Memory, Config Memory. Also, extensive use of Free Form Logic blocks (as opposed to equivalent gate logic) can substantially increase Fast Cycle Time.
Fast Logic CPU Per Cent Used	Calculation of percentage of time the CPU is active during the processing of digital control blocks
Fast Logic Peak Time (Sec)	Maximum time used to complete the digital control cycle
Fast Logic CB Overruns	Number of times that the processing of the digital control blocks exceeds the allocated digital cycle time

Controller Setup

The current controller mode is indicated on the bottom right of the display.

Table 4 Controller Setup details

Item	Description
Set Controller Time and Date	Set the controller time and date.
Change mode of the controller	Run Mode: Select this to resume running the process. Offline Mode: Select this before performing AI calibration. Program mode: Select this: • Before performing AI and AO Calibration. • To turn off all of the controller outputs while reconfiguring a control strategy. Cold Start: Refreshes the Flash memory of the controller so that if your battery goes dead the data in Flash is up to date. Use the Program mode for changes whenever possible.
Write To Flash	Write controller database to Flash memory. Controller must be in the Run, Run Locked, or Offline Mode. Saves any parameters that you may have changed in the controller to the controller's non-volatile Flash memory. The affected parameters include: Loop tuning parameters (gain, rate, reset, etc.) Changes to Recipes, Profiles, Schedules, and Sequences. If the write fails, upload the controller's configuration to the PC (using HC Designer) and save the uploaded configuration to disk to make sure that you have captured all of the non-volatile parameter changes.

Table 5 Controller modes defined

Mode	Function Blocks Executed?	Output status?	Effect upon return to RUN mode?
RUN	Yes	Outputs updated	None
OFFLINE	No	Outputs held	Resume
PROGRAM	No	Outputs off	Cold start

ATTENTION

You cannot change the controller mode from this display if the controller's mode switch is in the RUN LOCKED or PROGRAM LOCKED position. If the switch is in either of these locked positions, this display will show the message "MODE MUST NOT BE LOCKED OR FAULT."

TIP

- If the controller switch is set to RUN but the mode was set to PROGRAM or OFFLINE here, following a power cycle the mode will return to RUN.
- Changing from Program to Run causes data in RAM (setpoint profiles, recipes, schedules, sequences) to be copied to non-volatile (FLASH) memory.
- In a cold start, all data storage and display buffers are cleared and accumulated values of some function blocks (such as totalizers) are reset.
- In a resume, all buffered data and values are retained and the process resumes where it left off.

Summary Displays

About Summary Displays

There are six summary displays to show the I/O blocks present in the Controller and the variables in the configuration. The six summary displays are:

- Analog Input Summary
- Analog Output Summary
- Analog Variable Summary
- Digital Input Summary
- Digital Output Summary
- Digital Variable Summary

The Analog Input and Output Summary Displays show the following fields.

1. Physical Address of the Block (RMC)
    - Rack Number
    - Module Number
    - Channel Number
2. Tag
3. Description
4. Value
5. Units
6. Error Status

The following additional fields are displayed when an I/O Safety Function block Analog Input Voting is configured.

7. Channels A,B, and C
8. VFAIL
9. SFAIL

The following additional fields are displayed when an I/O Safety Function Block Analog Output Validated is configured.

7. VFAIL

8. FBFAIL

The Analog Variable Summary Display shows the following fields:

1. Variable Number
2. Tag
3. Description

4. Value
5. Units

The Digital Input Summary Display shows the following fields:

1. Physical Address of the DI Block (RMC)
    - Rack Number
    - Module Number
    - Channel Number
2. Tag
3. Description
4. State
5. Error Status

The following additional fields are displayed when an I/O Safety Function block Digital Input Voting is configured.

6. Channels A,B, and C
7. VFAIL
8. SFAIL

The following additional fields are displayed when an I/O Safety Function Block Digital Output Validated is configured.

6. VFAIL

7. FBFAIL

The Digital Output Summary Display shows the same information as above plus the Type of the module. The Digital Variable Summary Display shows following fields:

1. Variable Number
2. Tag
3. Description
4. Data

Communications

Menu Overview

Menu	Submenu	
Serial Port S1 (p. 22)		
Serial Port S2 (p. 22)		
Ethernet Port E1 (p. 27)		
Ethernet Port E2 (p. 27)		
Expansion Port Communications (p. 29)		
Modbus Slave Devices (p. 31)	Modbus Slave Device *n*	Modbus Slave *n* Status
	Modbus/TCP Slave Device *n*	Modbus/TCP Slave *n* Status
Host Connections (p. 32)	Host Connection *n*	Host Connection *n* Status
Peer Connections (p. 33)	Peer Connections *n*	Peer Connection *n* Status

NOTE: The 15" control station can be programmed using only the Ethernet, serial and compact flash card. The 900CS15's USB programming port conflicts with today's PCs so it's advisable to use Ethernet ports for configuration changes. This problem has been observed only with the 15" control station; the 10" control station has not shown any problems with its USB ports.

Serial Port S1/S2

The Serial Port S1 and Serial Port S2 screens both show Statistics (Table 6) and Settings (Table 8) for those controller serial ports.

Table 9 shows the relationship between the setup parameters and each protocol.

The controller's Serial Port S1 can be set-up as an ELN Configuration port, a Modbus Master port, or a Modbus Slave port. The ELN protocol allows the controller to communicate with the Process Control Designer package on the PC using the proprietary ELN protocol. The Modbus Master protocols allow the controller to act as a Modbus Master, retrieving data from other instruments that have been configured as Modbus slave devices. The three Modbus Slave protocols allow the controller to act as a slave to various host devices, including a PC running HC Designer.

The information presented in Table 6 and Table 9 also applies to Serial Port S1 when a Redundant Controller is used.

Table 6 Serial Port S1/S2 Statistics (left side of display)

Item	Description
Port Diagnostic	Shows the overall condition of the Serial Port S1. See the list of Serial Port S1 diagnostic conditions in Table 7 on page 24.
Port Status	This is the current status of the port. The possible status conditions are: GOOD: the protocol is set to ELN. REQUIRES SETUP: the protocol is set to one of the Modbus Slave protocols, and the Slave Address is set to 255. Messages on the communication link are ignored in this state. OFFLINE: the protocol is set to one of the Modbus Slave protocols, and the Slave Port Enable is set to DISABLE. Messages on the communication link are ignored in this state. ONLINE: the protocol is set to one of the Modbus Slave protocols, and the Slave Port Enable is set to ENABLE. Messages on the communication link are being processed in this state. NO MODBUS SLAVE BLOCKS: the protocol is set to one of the Modbus Slave protocols, but there are no Modbus slave function blocks present in the controller's configuration. PROGRAM MODE: the protocol is set to one of the Modbus Slave protocols, but the controller is in Program Mode. The controller does not scan the slave devices in this state. ELN SLAVE: the protocol is set to one of the Modbus Slave protocols, but the controller is in Program Locked Mode. The port automatically reverts to ELN protocol and the controller becomes a slave device whenever the mode selection switch is placed in the Program Locked position. SCANNING SLAVES: the protocol is set to one of the Modbus Slave protocols, and the controller is actively scanning the slave devices attached to the port.
Messages Received	The number of messages that were received and processed correctly.
Data Link Errors	The number of basic link-level errors detected by the controller. If the protocol is Modbus Master, the errors may be due to a slave device that does not reply when it is scanned. Refer to the section "Troubleshooting Data Link Errors" (page 35) for more information.
Application Errors	The number of messages that were responded to with an exception code. For example, application errors can be caused by (a) writing to a read-only register, (b) accessing a register that is not supported by the slave device, or (c) using a Modbus function code that is not supported by the slave device.
Clear Statistics	This item resets the message counters for this port back to zero (Messages Received, Data Link Errors, and Application Errors). Note: the counters will only be reset if the controller is in Run Mode.

Table 7 Serial Port S1/S2: Port Diagnostic status

Status	Possible Cause	Controller Action	What to do
GOOD	N/A	N/A	N/A
APPLICATION ERROR	Applies to Port S2 only. At least one response to a host resulted in an exception code or NAK.	1. Rack 1 monitor block's COMPORT DIAG is set to WARNING. 2. Rack 1 monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	At host, determine which message is causing the exception code and fix it.
DATA LINK ERROR	A large number of messages are resulting in data link errors.	1. Rack 1 monitor block's COMPORT DIAG is set to FAILED. 2. Rack 1 monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off. 4. If configured as Modbus Master port, associated slave blocks have their read pin values frozen to the last value read.	1. Check baud rate. 2. Check connectors. 3. Check cable polarity. 4. Isolate cable from electrical interference. 5. If RS232-to-RS485 converter used, check its power, switch/jumper settings, and polarity.
HARDWARE FAILURE	The DUART is failing to operate properly.		Replace the controller CPU module.

Table 8 Serial Port S1/S2 Settings (right side of display)

Setting	Description
Protocol	ELN: The default protocol, used to communicate with the HC Designer configuration software. MODBUS MASTER: The controller acts as a Modbus Master device on the communication link. MB MASTER ADVANCED: The controller acts as a Modbus Master device on the communication link. This protocol provides enhanced data throughput for applications where the HC900 is being used with a "Modbus-to-fieldbus" gateway device. MODBUS SLAVE MULTI: The controller acts as a Modbus Slave device. This protocol allows more than one slave device to be present on the communications link (multi-drop). MODBUS SLAVE PTP: The controller acts as a Modbus Slave device. This protocol can be used if the controller is the only slave device on the link (Point-to-point). MODBUS SLAVE MODEM: The controller acts as a Modbus Slave device. This protocol provides the extended delays that are needed to access the controller via a modem.
Baud Rate (Bps)	Select 9600, 19200, 38400, 57600 or 115200 bits per second.
Modbus Parity	Select None, Odd, or Even parity.
Modbus Stop Bits	Select 1 or 2 Stop Bits.
Slave Address (1-247 or 255)	This is the address of the controller on the Modbus link when one of the three Modbus Slave protocols is selected. All devices on the link must have a unique Modbus address. The address may be set to a value of 1 to 247, or it may be set to 255. A value of 255 disables the port for this controller.
Slave Port Enable	This item allows you to enable or disable the port: ENABLE: The port will respond to communication requests. DISABLE: The port will ignore communication requests.
Double Register Format	Under the Modbus protocol, each IEEE 32-bit floating-point number requires two consecutive Modbus registers, for a total of four bytes. The stuffing order of the bytes within these registers differs among Modbus devices. To provide compatibility with the various hosts, the double-register format is configurable. The selections are: FP B Big Endian format Byte order: 4, 3, 2, 1 FP L Little Endian format Byte order: 1, 2, 3, 4 FP BB Big Endian with byte-swap Byte order: 3, 4, 1, 2 FP LB Little Endian with byte-swap Byte order: 2, 1, 4, 3

Table 9 Protocol selection versus setup parameters for the Serial Port S1/S2

Setup parameter	Protocol selection				
	ELN	**Modbus Master or Modbus Master Advanced**	**Modbus Slave Multidrop**	**Modbus Slave Point to Point (PTP)**	**Modbus Slave Modem**
Baud Rate (BPS)	**X**	**X**	**X**	**X**	**X**
Modbus Parity		**X**	**X**	**X**	**NONE**
Modbus Stop Bits		**X**	**X**	**X**	**1 BIT**
Slave Address			**X**	**X**	**X**
Slave Port Enable			**X**	**X**	**X**
Double Register Format			**X**	**X**	**X**

Note: When “Modbus Slave Modem” protocol is selected, the Modbus Parity and Modbus Stop Bits are fixed at “None” and “1 Bit” respectively and cannot be changed.

Ethernet Port E1/E2 Status

The Ethernet Port E1 and Ethernet Port E2 screens both show the following details for each Ethernet port on the controller.

Table 10 Ethernet Port E1/E2 details

Item	Description
Port Diagnostic	Shows condition of Ethernet port. See Table 11 for status details.
Controller Name	Configured controller name
Network Name	The network name to which the controller belongs.
Local Alias	A locally referenced alias for the controller.
Mac Address	The controller's Media Access Control address.
IP Address	The controller's Internet Protocol address.
Subnet Mask	The controller's subnet mask address.
Gateway IP Address	The Internet Protocol address for the controller's gateway device.
Double Register Format	Each IEEE 32-bit floating point number requires two consecutive registers (four bytes, MSB=4, LSB=1 in byte order below) starting with the register defined as the starting register for the information. The stuffing order of the bytes into the two registers differs among Modbus hosts. To provide compatibility, the Double register format is configurable. Selections are: **FPB** Floating Point Big Endian Format Byte order – 4, 3, 2, 1 (Default) **FP BB** Floating Point Big Endian with byte-swapped Byte order – 3, 4, 1, 2 **FP L** Floating Point Little Endian Format Byte order – 1, 2, 3, 4 **FP LB** Floating Point Little Endian with byte-swapped Byte order – 2, 1, 4, 3

Table 11 Ethernet Port E1/E2: Port Diagnostic status

Status	Possible Cause	Controller Action	What to do
GOOD	N/A	N/A	N/A
SETUP ERROR	Controller/network names determined on network are illegal	Rack 1 monitor block's COMPORT DIAG is set to FAILED. Rack 1 monitor block's RACK OK pin is turned off. ASYS (SYSTEM MONITOR) block's HW OK pin is turned off.	Correct the setup problem.
NO IP ADDRESS	IP address is not configured	Same as above	If a DHCP server is present, download a configuration that uses DHCP. Enter an IP address.
HARDWARE FAILURE	Ethernet port tests failed during power-up.	Same as above	Replace CPU module.
DHCP Failure	DHCP is configured, and no IP address has been granted.	Same as above	Check the DHCP server. Download a configuration with DHCP required.

Expansion Rack Communications

Shows status of each controller expansion I/O rack.

Table 12 Expansion Rack Communication details

Item	Description
Diagnostics Status	Status of the rack's communication port.
Message Count	Number of message attempts to the rack.
Link Error Count	Number of message attempts to the rack that resulted in failed response.
Total Count	Total for all racks.
Clear Statistics	Reset the messages and link error counters for all racks to zero.

Table 13 Expansion Rack Communication Status

Status	Possible Cause	Controller Action	What to do
GOOD	Comm port is functioning properly or comm port is not used	N/A	N/A
DATA LINK FAILURE	The communications to a particular rack is resulting in a lot of communication errors.	1. Related rack monitor block's RACK OK pin is turned off. 2. Depending on the nature of the communication errors, the associated rack monitor block's module diagnostics, and pins could be affected. 3. Associated rack's COMPORT DIAGNOSTIC is set to FAILED. 4. Rack 1 COMPORT DIAGNOSTIC is set to FAILED.	1. Use the OI to determine which rack is experiencing the comm errors. Verify that the expansion rack should be in the configuration 2. Verify that the jumpers on the scanner are setup for the correct rack address. 3. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, and that hub is powered. 4. Cycle power to the rack. 5. Cycle power to the hub. 6. Replace the expansion rack's power supply. 7. Replace the expansion rack. 8. Replace the expansion rack's scanner board. 9. Replace the main CPU.
HARDWARE FAILURE	The power-up test of the expansion rack Ethernet controller failed.	1. All rack monitor block XIO PORT DIAG are set to HWFAIL and COMPORT DIAGNOSTIC is set to FAIL. 2. All rack monitor block RACK OK pins are turned off. 3. All modules in the configuration have their diagnostic set to MOD_NOCOMM, their rack monitor module fail pin is turned on., and the rack monitor block's RACK OK pin is turned off. 4. SYSTEM MONITOR block's HW OK pin is turned off. 5. The statuses for the AO, AI, DI, DO channels that are affected are set to BAD_CHANNEL.	Replace main-CPU module

Modbus Slave Devices

This display gives you an overview of the individual Modbus or Modbus/TCP slave devices attached to the controller. Navigate to the desired device to see its status.

Table 14 Modbus Slave Status

Item	Description
Slave Name	Name of slave device.
Slave Address	For Modus: 1-247 or 255. For Modbus/TCP: IP address.
In Scan	Current scan status of slave device. **YES**: The slave device is being scanned at its optimum rate. The scan rate is computed by the controller. **NO:** The slave device is being scanned at a reduced rate, or it is not being scanned at all. The possible reasons are: • SCAN ENABLED is set to NO. • COMM QUALITY is NONE or BAD. • the Modbus address of the slave device is set to 255. • the slave device is not defined in the controller configuration. • The RS-232 port protocol is not set to one of the Modbus Master protocols.
Comm Quality	**NONE:** This slave device is not defined in the controller configuration. **GOOD**: The slave device is being scanned at its optimum rate because its operation on the communications link is acceptable. **BAD**: The slave device is being scanned at a reduced rate because it has experienced an abnormal number of failed responses. Refer to the section "Troubleshooting a Comm Quality Problem" below.
Messages Received	The number of messages that were received and processed correctly since the last controller Cold Start.
Data Link Errors	The number of basic link-level errors generated by this slave since the last controller Cold Start. Refer to the section "Troubleshooting Data Link Errors" for more information.
Application Errors	The number of application errors generated by this slave since the last controller Cold Start. Application errors are messages that the slave device responded to with an exception code. For example, application errors can be caused by (a) writing to a read-only register, (b) accessing a register that is not supported by the slave device, or (c) using a Modbus function code that is not supported by the slave device.
Scan Enabled	**YES**: Scanning has been enabled **NO**: Scanning has been disabled

Host Connections

Table 15 Host Connections

Item	Description
Connection Status	Shows condition of each virtual connection. See Host Connection Diagnostics Status Indicators, Table 16
Protocol	The protocol used by the host to communicate with the controller (Modbus TCP).
IP Address	The IP address of the host device that is using this connection.
Messages Received	Number of messages received without errors.
Application Errors	Number of message requests that resulted in an exception.
Clear Statistics	Resets to zero the number of messages received and application errors.

Table 16 Host Connection Status Indicators

Status	Possible Cause	Controller Action	What to do
GOOD	N/A	N/A	N/A
APPLICATION ERROR	At least one response to a host resulted in an exception code.	1. Rack 1 monitor block's COMPORT DIAG is set to WARNING. 2. Rack 1 monitor block's RACK OK pin is turned off. 3. ASYS block's HW OK pin is turned off	At host, determine which message is causing the exception code and fix.

Peer Connections

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Table 17 Peer Connections

Item	Description
Peer Controller Name	Controller name of the peer device. All peer devices must have the same network name. All peer devices that share a common network name must have unique controller names.
IP Address	IP address of the peer. The IP address is automatically determined when a peer device is discovered via its network and controller names.
Peer Status	See Peer Connection Status Indicators, Table 18.
Messages Received	Number of messages received from the peer device.
Messages Transmitted	Number of messages sent to the peer device.
Write Requests	Number of write event messages sent to the peer device.
Write Request Failures	Number of write event messages that have not been acknowledged by the peer device within the scan rate configured for the peer data exchange. A non-zero value means the network is congested and message transfer is being impeded.
Producer Failures	Number of times the peer device has not responded to a data exchange connection request. Non-zero value means the peer device is not available because the controller is in Program mode, controller power is off, or controller name does not exist in the network. The network is defined as all devices that: • are on the same physical network, • are within the IP address range per the configured IP mask, • share the same peer network name.
Clear Statistics	Reset to zero the number of messages received and application errors.

Table 18 Peer Connection Status

Status	Possible Cause	Controller Action	What to do
GOOD	N/A	Peer is connected and updating normally	N/A
APPLICATION ERROR	The peer connection could not be established due to an internal program problem.	N/A	1. Reset the controller to restart the UDP/IP protocol stack and reset buffer allocations. 2. Contact Honeywell Technical Assistance if the problem exists.
SETUP ERROR	The peer device indicated that the one or more data item is not valid.	The error will occur when an incompatibility exists between peer devices with regard to variable or signal assignments. This error should not occur when exchanging data between HC900 controllers.	Contact Honeywell Technical Assistance if the status occurs.
PEER FAIL	The assigned peer could not be located on the network.	N/A	1. Check the controller name and network name of the peer device to assure that they match that specific PDE block. 2. Check that the IP addresses of the peer devices are all within the range of the IP mask. 3. Check that the peer devices have the same IP subnet mask. See Network parameters for IP mask setting.
PORT FAIL	The peer data exchange IO subsystem could not be started due to internal resource problem.	N/A	1. Reset the controller to restart the Ethernet IO hardware and reassign processor IO mapping. 2. Contact Honeywell Technical Assistance if the problem exists.
NOT STARTED	The assigned peer IO connection has not yet been attempted. Normal state during startup and during configuration mode. This status should automatically change to GOOD after both peer controllers are in the RUN mode.		1. If this status persists during run time, check that the peer device is properly connected and that the control name and network name is correct. 2. Check that the IP masks of all peer devices to assure that all IP addresses are within the same subnet. 3. Check that all external network components such as switches and routers allow passing of UDP packets on port 502. 4. Check that the peer device is powered on and is in RUN mode.

Troubleshooting a Comm Quality problem

If a slave device is reporting a Comm Quality value of "BAD", check the following items:

5. Verify that the slave device is powered-up.
6. Verify that the slave device is wired correctly.
7. Verify that the slave device has the correct slave address.
8. Verify that all slave devices on the link have a unique slave address.
9. Verify that the slave device has the correct baud rate and parity settings.
10. Verify that all slave devices on the link have the same baud rate and parity settings.
11. Verify that the slave is set-up for half-duplex operation.
12. If all slave devices report a BAD status, check the physical connection of the link to the controller's RS-232 port. If this connection is OK, check the connection to each slave device on the link.
13. If there is more than one slave device on the link, verify that the RS-232/RS-485 converter box is working correctly.
14. Verify controller is set to unterminated for RS-485 communications.

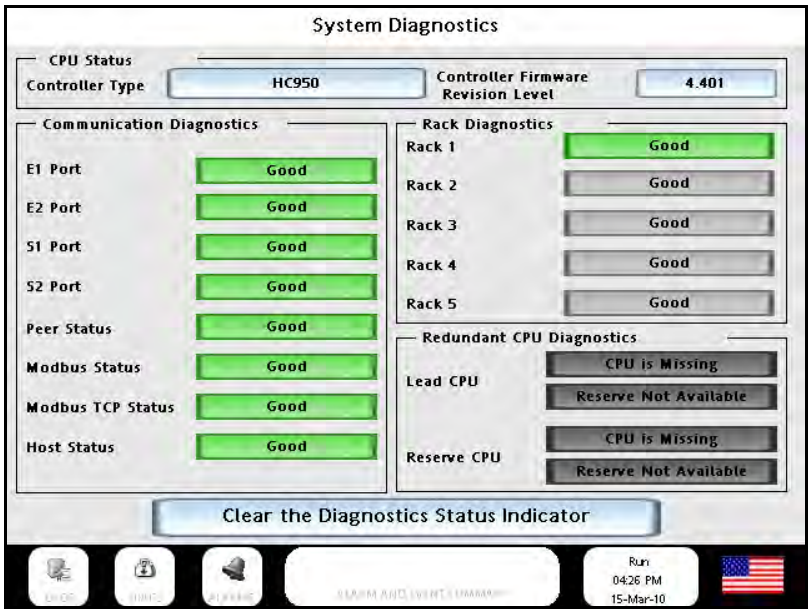
Troubleshooting Data Link Errors

Data Link Errors can be caused by electrical noise, physical wiring problems, or incorrect configuration settings. If a Master or Slave device is reporting Data Link Errors, check the following items:

15. Verify that the physical wiring of the communication link is correct.
16. Verify that the physical wiring is shielded from electrical noise.
17. Verify that all devices on the link have the correct baud rate and parity settings.
18. Verify that all terminating resistors are installed properly. Verify that the ohm-value of the terminating resistors is correct.
19. Verify controller is set to unterminated for RS-485 communications.

Diagnostics

Touching the DIAGS indicator on the status bar will go to the System Diagnostics page so that you can see at a glance the status of the H900 Controller. As the screen shot below shows, diagnostic information on the CPU, Communications, and I/O Rack is displayed with green highlights indicating a good status or red if there is a diagnostic. Touching the various buttons will direct you to the various detailed screens per the menu tree below.



Menu Overview

Menu	Submenu		
Controller Diagnostics *(p. 37)*	Rack n Diagnostics	I/O Module Diagnostics *(p. 42)*	Module Details *(p. 43)*
		Details. *This links to the main Communications menu. See page 22.*	
I/O Module Diagnostics *(p. 42)*	Rack n I/O Modules *(p. 42)*	Module Details *(p. 43)*	
	I/O Calibration *(p. 159)*		
	Motor Setup *(p. 172)*		
Communication Diagnostics *This links to the main Communications menu. See page 22.*	Controller Communications		
Redundant Overview *(p. 48)*			
Lead CPU Diagnostics *(p. 56)*			
Reserve CPU Diagnostics *(p. 56)*			

Controller Diagnostics

Select a rack number to see its diagnostics. For I/O diagnostics and details, see pages 42 and 43.

Table 19 Rack n diagnostics

Item	Status	Possible Cause	Controller Action	What to do
Rack Configured?	YES	N/A	N/A	N/A
	NO	N/A	N/A	N/A
Controller Status	GOOD	N/A	N/A	N/A
	FORCED OUTPUT	A block has an output that is forced.	None	Remove force on block output..
	INVALID CONFIG.	A configuration that exceeds the loop capacity of the controller was downloaded or an invalid configuration exists.	An empty database is created.	Download a valid configuration.
	SWITCH FAULT	A failure is detected in the switch reading.	1. All control blocks stop running 2. All I/O scanning ceases. This forces the modules into failsafe.	Replace CPU.
	NO MASTER PORT	The controller configuration contains at least one Modbus slave block, but neither the RS-232 nor the RS-485 port is set up as a Modbus Master port.	The controller is not scanning the Modbus slave devices.	Select Modbus Master or Modbus Master Advanced protocol for either the RS-232 or RS-485 port.

Item	Status	Possible Cause	Controller Action	What to do
CPU Status	GOOD	N/A	N/A	N/A
	WATCHDOG ERROR	Watchdog reset resulting from software failure	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Upgrade controller module software. 3. Replace CPU board. 4. Contact Honeywell Personnel.
	PREFETCH ERROR	CPU failed when attempting to fetch an instruction from the prefetch register.	1. Controller performs a restart 2. Associated rack monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Isolate system from noise and force a cold start. 3. Replace CPU board.
	ADDRESS ERROR	The reserved exception occurred for an unknown reason.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	UNDEFINED INSTR ERROR	Bad Instruction Detected	*See PREFETCH ERROR*	*See PREFETCH ERROR.*
	DATA ABORT ERROR	CPU failed when attempting to access data.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	S/W INTERRUPT ERR	Software Interrupt occurred which is not supported by the software.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	VECTOR ERROR	Corrupted interrupt vectors in RAM.	Interrupt vectors were restored.	*See WATCHDOG ERROR.*
Memory Status	GOOD	N/A	N/A	N/A
	5 DAY BATTERY WARNING	Estimated battery life is less than 5 days.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.
	LOW BATTERY	Battery voltage is low.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's LOW BATTERY pin is turned on. 3. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.
	FLASH ERROR	Flash failed to burn	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Replace CPU board.
I/O Status	GOOD	N/A	N/A	N/A

Item	Status	Possible Cause	Controller Action	What to do
	MODULE ERROR	One of the module diagnostics in the associated rack is set to MISMATCH, BAD MODULE, BAD CHANNEL., or MISSING/NO COMM (if the communications is failing due to the module not installed—could occur if the module is installed but CPU can't communicate to it).	*Select I/O from the menu to see details on the faulty module. See I/O Module Diagnostics on page 42.*	*Select I/O from the menu to see details on the faulty module. See I/O Module Diagnostics on page 42.*
	MODULE HI CJ TEMP	One of the module diagnostics in the associated rack is set to HI CJ TEMPERATURE.	*Select I/O from the menu to see details on the faulty module. See I/O Module Diagnostics on page 42.*	*Select I/O from the menu to see details on the faulty module. See I/O Module Diagnostics on page 42.*
	FAILURE	The Controller module is unable to successfully communicate to any modules that are in its SPI backplane.	All associated module diagnostics are set to MISSING/NO COMM. *See MISSING/NO COMM in Table 22 I/O Module Error Status on page 44 for further details.*	1. Remove modules and check for bent pins on connectors. 2. Reinsert modules one at a time and note which module the diagnostic reoccurs, and replace that module. 3. Cycle power to the rack. 4. Replace the power supply. 5. Replace the rack. 6. Replace the CPU board.
	NO COMM	The Main CPU is unable to successfully communicate to an expansion rack that is in its configuration.	*See FAILURE.*	1. Verify that the expansion rack should be in the configuration 2. Verify that the jumpers on the scanner are setup for the correct rack address. 3. Check that expansion rack is on. 4. Check the expansion rack's status LED for diagnostic information. 5. Check that cable is connected to expansion rack. 6. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, and that hub is powered. 7. Cycle power to the rack. 8. Cycle power to the hub. 9. Replace the expansion rack's power supply. 10. Replace the expansion rack. 11. Replace the expansion rack's scanner board. 12. Replace the main CPU.

Item	Status	Possible Cause	Controller Action	What to do
	BAD VERSION	The Main CPU determined that its software is not compatible with the scanner module.	All associated module diagnostics are set to MISSING/NO COMM. Refer to MISSING/NO COMM diagnostic for further details.	1. Upgrade the scanner software either by replacing the module or doing a code-download. 2. Update Main CPU software either by replacing the module or doing a code download.
RTC Status	GOOD	N/A	N/A	N/A
	NOT PROGRAMMED	RTC not programmed	1. Time and date is set to 00:00:00, January 1, 1970. 2. Associated rack monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	Program RTC.
	BAD DATA	Bad date and time	*See NOT PROGRAMMED.*	1. Program RTC. 2. Cycle power. 3. Replace CPU. 4. Replace boards in rack. 5. Replace rack.
	PROGRAMMING FAILURE	RTC failed to program	*See NOT PROGRAMMED.*	*See BAD DATA.*
	READ FAILURE	Unable to read RTC	*See NOT PROGRAMMED.*	*See BAD DATA.*
Comm Port Status (Rack 1) IO Comm Link Status (Rack 2-5)	Good	N/A	N/A	N/A

Item	Status	Possible Cause	Controller Action	What to do
	Data Link Failure	The communications to a particular rack is resulting in a lot of DLL errors.	1. Related rack monitor block's RACK OK pin is turned off. 2. Depending on the nature of the DLL errors, the associated rack monitor block's module diagnostics, and pins could be affected.	1. Use the OI to determine which rack is experiencing the DLL errors. Verify that the expansion rack should be in the configuration 2. Verify that the jumpers on the scanner are setup for the correct rack address. 3. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, and that hub is powered. 4. Cycle power to the rack. 5. Cycle power to the hub. 6. Replace the HC900-C50 expansion rack's power supply. 7. Replace the HC900-C50 expansion rack. 8. Replace the HC900-C50 expansion rack's scanner board. 9. Replace the main CPU.
	Hardware Failure	The power-up test of the expansion rack Ethernet controller failed.	1. All rack monitor block XIO PORT DIAG are set to HWFAIL. 2. All rack monitor block RACK OK pin are turned off. 3. All modules in the configuration have their diagnostic set to MOD_NOCOMM, their rack monitor module fail pin is turned on., and the rack monitor block's RACK OK pin is turned off. 4. ASYS block's HW OK pin is turned off. 5. The statuses for the AO and AI channels that are affected are set to BAD_CHANNEL.	Replace main-CPU module
	Port A/B Cable Mismatch	C70R only. The I/O cables from CPUA and CPUB are connected to the wrong ports on the I/O scanner CPU	Controller continues to run but is not able to access the I/O on the associated rack	Swap the cables so that I/O A is connected to I/O on CPUA and I/O B is connected to I/O on CPUB

Item	Status	Possible Cause	Controller Action	What to do
	Protocol Mismatch	C70R only. The firmware version in the controller CPU is not compatible with the firmware version in the I/O scanner	Controller continues to run but is not able to access the I/O on the associated rack	Upgrade the firmware in the CPU and/or scanner to be compatible versions

I/O Module Diagnostics and I/O Calibration

Select a rack to see its I/O module diagnostics. For I/O Calibration, see page 159.

Table 20 I/O module diagnostics

Item	Description
MODULE	Slot number in the rack.
PHYSICAL TYPE	NONE AI UNIVERSAL 8-CHAN AI LO-LEVEL 16-CHAN AI HI-LEVEL 8-CHAN AO CURRENT 4-CHAN AO VOLTAGE 4-CHAN DI DRY-CONTACT 16-CHAN DI 120/240 VAC 16-CHAN DI 24 VDC 16-CHAN DO LO-CURRENT RLY 8-CHAN DO HI-CURRENT RLY 4-CHAN DO 120/240 VAC 8-CHAN DO 24 VDC 16-CHAN AI HI-LEVEL 16-CHAN DI 24 VDC 32-CHAN DO 24 VDC 32-CHAN PULSE/FREQ/QUAD 4-CHAN HIGH LEVEL AO 8 CHANNEL HIGH LEVEL AO 16 CHANNEL
CONFIGURED AS	Analog Input, Analog Output, Digital Input, Digital Output, Pulse Frequency Quadrature
ERROR STATUS	See Table 22.

Table 21 I/O module Details

Item	Description
MODULE	Slot number in the rack.
PHYSICAL TYPE	NONE AI UNIVERSAL 8-CHAN AI LO-LEVEL 16-CHAN AI HI-LEVEL 8-CHAN AO CURRENT 4-CHAN AO VOLTAGE 4-CHAN DI DRY-CONTACT 16-CHAN DI 120/240 VAC 16-CHAN DI 24 VDC 16-CHAN DO LO-CURRENT RLY 8-CHAN DO HI-CURRENT RLY 4-CHAN DO 120/240 VAC 8-CHAN DO 24 VDC 16-CHAN AI HI-LEVEL 16-CHAN DI 24 VDC 32-CHAN DO 24 VDC 32-CHAN PULSE/FREQ/QUAD 4-CHAN HIGH LEVEL AO 8 CHANNEL HIGH LEVEL AO 16 CHANNEL
PART NUMBER	The re-order part number of the module.
FIRMWARE REV.	Revision level of the firmware running on this module.

I/O Module Error Status

Table 22 I/O Module Error Status

Status	Possible Cause	Controller Action	What to do
HI CJ TEMP	Possible causes of this diagnostic are: 1. One of the two CJs on the module is indicating a temperature reading greater than 70 degrees C. 2. Both cold-junction sensors are failing to convert. 3. The CJs are converting properly, but their differential is greater than 10 degrees C.	1. Associated AI blocks that are configured as T/Cs set their fail pin on, their warn pin off, and their output pin to the failsafe value. 2. Associated AI blocks that are configured as T/Cs set their IO status to “CJ High Temperature” for reason 1 or “CJ Failure” for possible causes 2 and 3. 3. Associated rack monitor block’s module fail pin is turned on. 4. Associated rack monitor block’s RACK OK pin is turned off. 5. Associated rack monitor block’s HITEMP pin is turned on. 6. SYSTEM MONITOR block’s HITEMP pin is turned on. 7. SYSTEM MONITOR block’s HW OK pin is turned off.	1. Improve ventilation to rack 2. Replace AI module
MISMATCH	The installed module does not agree with the module required for the control strategy downloaded in the configuration file.	1. Associated blocks set their fail pin on, their warn pin off, and their output pin to the failsafe value. 2. Associated blocks set their IO status to “Channel No Comm”. 3. Associated rack monitor block’s module fail pin is turned on. 4. Associated rack monitor block’s RACK OK pin is turned off. 5. SYSTEM MONITOR block’s HW OK pin is turned off.	1. Verify configuration 2. Replace module with the correct one.

Status	Possible Cause	Controller Action	What to do
MISSING/NO COMM	Main CPU is unable to communicate to the module for one of the following reasons: 1. Module is not installed 2. The module cannot communicate with the controller CPU or the expansion rack CPU because of a backplane problem. 3. Module is on an expansion rack and the expansion rack communications is failing	*See MISMATCH.*	Action is based on the RACK STATUS indication. If RACK STATUS is not MODULE ERROR, then follow the prescribed action defined for the RACK STATUS diagnostic. For MODULE ERROR, do the following: 1. Verify configuration 2. Install module.
BAD MODULE	Module is reporting a diagnostic condition. *See* Table 23.	*See MISMATCH.*	User should inspect the module's status LED to determine the nature of the problem. Table 23 describes the user action for the various LED diagnostics.
BAD CHANNEL	See Table 24	1. Associated block sets its fail pin on, its warn pin off, and its output pin to the failsafe value. 2. Associated block sets its IO status as denoted in Table 24. 3. Associated rack monitor block's module fail pin is turned on. 4. Associated rack monitor block's RACK OK pin is turned off. 5. SYSTEM MONITOR block's HW OK pin is turned off.	*See* Table 24

Bad module details

When an I/O module's error status is BAD MODULE, the module's status LED on the controller is flashed red with a number of quick strobes followed by a long off time. Table 23 outlines the potential module diagnostics.

Table 23 Bad module details

Number of Strobes	Failure	Description	AI	AO	DI			DO			PFQ	User Action
					Contact	AC	DC	Relay	AC	DC		
1	FAIL SAFE	The module is in the failsafe state because it is not receiving message requests from the CPU or Scanner at a rate that satisfies the configured failsafe timeout.	√	√	√	√	√	√	√	√	√	1. If expansion I/O rack, go to step 2. If no expansion I/O rack, go to step 3. 2. Check the Scanner status LED (see Scanner Indicators in HC900 Process Controller manual, #51-52-25-107). If it's flashing 6 times, proceed with step 3. If it's flashing some other red status code (refer to Scanner Indicators in HC900 Process Controller manual, #51-52-25-107) to solve that problem first. If it's flashing green, the module probably is not required in the configuration. If it's not on or steady, cycle power to the scanner. 3. Make sure the module is the correct one for the configuration. 4. Remove the module and check for a bent pin, then reinsert the module 5. Replace the module 6. Remove other modules and replace one at a time until the problem reoccurs. Most likely the last module inserted needs to be replaced. 7. Replace the rack.
2	EAROM	EA ROM Failed its checksum	√	√								1. Remove/reinsert module. 2. Replace module.
3	RAM		√	√	√	√	√	√	√	√	√	
4	ROM			√	√	√	√	√	√	√		
5	+24 V		√	√	√			√				1. Remove the module and check for a bent pin, then reinsert the module 2. Measure power supply voltage. If not correct, replace power supply. 3. Replace module 4. Replace rack
6	FACTORY CAL	CRC failure of primary and backup factory calibration	√	√								Replace module.
7	FIELD CAL	CRC failure of field calibration values	√	√								1. Remove/reinsert module. 2. Replace module.
8	HARDWARE	General Hardware Failure (AI=convertor not working)	√									Replace module.
9	HW/SW Key	The software residing on the module does not match the module type. This diagnostic should only result in the factory.			√	√	√	√		√		Replace module

Number of Strobes	Failure	Description	AI	AO	DI			DO			PFQ	User Action
					Contact	AC	DC	Relay	AC	DC		
11	Shift Register	The loopback test of the shift register failed.			√	√	√	√	√	√		Replace module

Bad channel details

Below is a list of conditions that can cause a BAD CHANNEL I/O module diagnostic.

Table 24 Bad Channel details

I/O Summary Error Status	Description	What to do
Bad Channel	If the channel is an Analog Output: There is no physical output device connected to this channel, or the output device is showing an open connection. If the channel is a Pulse Output: The channel is failing to output the correct value. A BAD CHANNEL I/O module diagnostic is posted.	Check terminal block connections. Replace module.
Burnout Fail	The sensor – T/C, RTD, or mV source -- is failing burnout checks. A BAD CHANNEL I/O module diagnostic is posted.	Check terminal block connections Replace source element Replace module.
Convert Fail	When attempting to take a reading, the analog-to-digital (ADC) fails. This can occur if the incoming signal is either too large or too small. It also could result if the ADC circuit is failing. If the problem is the ADC circuit, most likely other channels will have the same failure. A BAD CHANNEL I/O module diagnostic is posted.	Check the signal level being applied to the terminals. Replace module.
No Channel	There is no hardware on the I/O module to support this channel. For example, the customer configured Channel #15 for a given module, but there is an 8-channel module installed in the rack. A BAD CHANNEL I/O module diagnostic is posted.	
Over Current	A Digital Output module detected an excessive amount of current on its output terminals. Note that this message will only appear for the 32-channel DO module. A BAD CHANNEL module diagnostic is posted.	

Communication Diagnostics

This links to the main Communications menu. See page 20.

Redundant Overview

This display summarizes the status of all of the major components of a redundant system.

Table 25 Redundant Overview

Item	Status	Possible Cause	Controller Action	What to do
RESERVE STATUS	RESERVE AVAILABLE	Normal operation	N/A	N/A
	RESERVE NOT AVAILABLE	1. Reserve not installed in rack. 2. Power not applied to reserve CPU 3. Neither lead nor reserve CPU has a valid configuration database 4. Firmware mismatch (lead and reserve CPUs have different firmware revisions 5. Database not synchronized with the lead	The lead controller will continue to control the process, but failover is not possible.	Install reserve CPU Apply power to reserve CPU Download a configuration and cold start the controller Perform a firmware upgrade so both CPUs have the same version Replace the reserve CPU. If this doesn't help, replace the lead CPU. If this doesn't help, replace the backplane.
REDUNDANCY STATUS	GOOD	Normal operation	N/A	N/A
	NO RSM MODULE DETECTED	Switch on RSM is set between two positions. RSM Module is not inserted RSM Module has failed	The controller will continue to operate with a missing RSM. Automatic failover is still possible if required.	Make sure switch is in desired position Install RSM module Replace RSM
	RSM SWITCH IS BAD	Switch is indicating an invalid position	The controller will continue to operate with a bad RSM. Automatic failover is still possible if required.	Replace RSM

Item	Status	Possible Cause	Controller Action	What to do
	I/O COMM ERROR ON RESERVE	Reserve CPU is unable to communicate with one or more of the I/O racks.	The lead controller will continue to control the process. Failover to the reserve is still possible if a subsequent failure renders the current lead less capable than the reserve.	Verify all cabling between the reserve CPU and the scanners. Replace any Ethernet switches between the reserve CPU and the I/O rack(s). Replace the reserve CPU Replace the scanner CPU Contact Honeywell service
	DATABASE NOT SYNCHRONIZED	Hardware failure on the reserve CPU Hardware failure on the lead CPU Hardware failure on the CPU rack backplane	The lead controller will continue to control the process, but failover is not possible.	Replace the reserve CPU Replace the lead CPU Replace the CPU rack backplane Contact Honeywell service
	INVALID CONFIG.	Neither CPU has a valid configuration database	An empty database is created.	Download the desired configuration file and perform a cold start.
	FIRMWARE VERSION MISMATCH	The reserve controller does not have the same version of controller firmware installed	The lead controller will continue to control the process, but failover is not possible.	Upgrade the CPU firmware so both the lead and reserve have the same version.
CONTROLLER STATUS	GOOD	N/A	N/A	N/A
	FORCED OUTPUT	A block has an output that is forced.	None	Remove force on block output..
	INVALID CONFIG.	A configuration that exceeds the loop capacity of the controller was downloaded or an invalid configuration exists.	An empty database is created.	Download a valid configuration.
	SWITCH FAULT	RMS switch is indicating an invalid position	The controller will continue to operate with a bad RSM. Automatic failover is still possible if required.	Replace RSM
	NO MASTER PORT	The controller configuration contains at least on Modbus slave block, but Serial Port S1 is not set up as a Modbus Master port.	The controller is not scanning the Modbus slave devices.	Select Modbus Master or Modbus Master Advanced protocol for either the RS-232 or RS-485 port.

Item	Status	Possible Cause	Controller Action	What to do
	RSM SWITCH MISMATCH	The lead and reserve controller are both reading the switch on the RSM, but are getting different values.	The controller will continue to operate with a bad RSM. Automatic failover is still possible if required.	Replace the RSM Replace the reserve CPU Force a failover and replace the new reserve CPU Contact Honeywell service
	NO RSM MODULE DETECTED	Switch on RSM is set between two positions. RSM Module is not inserted RSM Module has failed	The controller will continue to operate with a missing RSM. Automatic failover is still possible if required.	Make sure switch is in desired position Install RSM module Replace RSM
	BAD RSM SWITCH (LEAD)	Switch is indicating an invalid position	The controller will continue to operate with a bad RSM. Automatic failover is still possible if required.	Replace RSM Force a failover and replace the CPU (formerly the lead, now the reserve)
	BAD RSM SWITCH (RESERVE)	Switch is indicating an invalid position	The controller will continue to operate with a bad RSM. Automatic failover is still possible if required.	Replace RSM Replace the reserve CPU

Item	Status	Possible Cause
CPU STATUS	GOOD	
MEMORY STATUS	ERROR IN RACK 1	REFER TO Table 26 (page 51)
RTC STATUS	ERROR IN RACK 2	REFER TO Table 26 (page 51)
I/O RACK COMM PORT STATUS	ERROR IN RACK 3	REFER TO Table 26 (page 51)
RACK I/O MODULE STATUS	ERROR IN RACK 4	REFER TO Table 26 (page 51)
COMM PORTS E1/E2/S1/S2 STATUS	ERROR IN RACK 5	REFER TO Table 26 (page 51)
	ERROR IN LEAD CPU	REFER TO Table 27 (page 57)
	ERROR IN RESERVE CPU	REFER TO Table 27 (page 57)
	ERROR ON SERIAL PORT S1	REFER TO Table 7 (page 24)
	ERROR ON SERIAL PORT S2	REFER TO Table 7 (page 24)
	ERROR ON E1 NETWORK PORT	REFER TO Table 11 (page 28)
	ERROR ON E2 NETWORK PORT	REFER TO Table 11 (page 28)
	ERROR ON SCANNER I/O LINK	REFER TO Table 26 (page 51)

Table 26 Details of Rack diagnostics error status messages

Item	Status	Possible Cause	Controller Action	Fix
CPU	GOOD	N/A	N/A	N/A
	ADDRESS ERROR	The reserved exception occurred for an unknown reason.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	PREFETCH ERROR	CPU failed when attempting to fetch an instruction from the prefetch register.	1. Controller performs a restart 2. Associated rack monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Isolate system from noise and force a cold start. 3. Replace CPU board.
	DATA ABORT ERROR	CPU failed when attempting to access data.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	S/W INTERRUPT ERR	Software Interrupt occurred which is not supported by the software.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	UNDEFINED INSTR ERROR	Bad Instruction Detected	*See PREFETCH ERROR*	*See PREFETCH ERROR.*
	WATCHDOG ERROR	Watchdog reset resulting from software failure	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Upgrade controller module software. 3. Replace CPU board. 4. Contact Honeywell Service.
	VECTOR ERROR	Corrupted interrupt vectors in RAM.	Interrupt vectors were restored.	*See WATCHDOG ERROR.*
MEMORY	GOOD	N/A	N/A	N/A
	5 DAY BATTERY WARNING	Estimated battery life is less than 5 days.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.
	LOW BATTERY	Battery voltage is low.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's LOW BATTERY pin is turned on. 3. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.

Item	Status	Possible Cause	Controller Action	Fix
	FLASH ERROR	Flash failed to burn	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Replace CPU board.
POWER SUPPLY DIAG	GOOD	N/A	N/A	N/A
	POWER SUPPLY PS-1 FAILED	A scanner has redundant power supplies installed and the one identified as PS-1 is not working	I/O rack continues to function normally using the remaining power supply	Verify that the power supply is connected to a power source
		Failed Power Supply		Replace power supply
		Failed Redundant Power Backplane detection circuit		Requires unit shutdown – replace redundant power backplane
		Failed Rack backplane status signal		Requires unit shutdown – replace rack backplane.
		Failed Scanner2 status input		Requires unit shutdown – replace Scanner2.
				Contact Honeywell Service.
	POWER SUPPLY PS-2 FAILED	A scanner has redundant power supplies installed and the one identified as PS-2 is not working	I/O rack continues to function normally using the remaining power supply	Verify that the power supply is connected to a power source
		Failed Power Supply		Replace power supply
		Failed Redundant Power Backplane detection circuit		Requires unit shutdown – replace redundant power backplane
		Failed Rack backplane status signal		Requires unit shutdown – replace rack backplane.
		Failed Scanner2 status input		Requires unit shutdown – replace Scanner2.
				Contact Honeywell Service.
POWER SUPPLY STATUS	UNKNOWN	No Rack communication	If under power, I/O will switch to failsafe values	Determine and correct cause of communication failure.
			Loss of Comms	Determine and correct cause of communication failure.
			If not powered (un-powered outputs)	Restore rack operation
			Loss of AC mains	Restore AC mains power, reset breaker
			Bad Power Supply	Replace Power Supply
			Failed Scanner2	Replace Scanner2

Item	Status	Possible Cause	Controller Action	Fix
	REDUNDANT P/S IS NOT PRESENT	Single Power Supply configuration Redundant Power Backplane not detected	Rack continues to function properly	No action required if single power supply rack If dual power supply is installed: Replace Redundant Power Backplane Replace rack backplane Replace Scanner2
	POWER SUPPLY PS-1 FAILED	A scanner has redundant power supplies installed and the one identified as PS-1 is not working Failed Power Supply Failed Redundant Power Backplane detection circuit Failed Rack backplane status signal Failed Scanner2 status input	I/O rack continues to function normally using the remaining power supply	Verify that the power supply is connected to a power source Replace power supply Requires unit shutdown – replace Redundant Power Backplane Requires unit shutdown – replace rack backplane. Requires unit shutdown – replace Scanner2. Contact Honeywell Service.
	POWER SUPPLY PS-2 FAILED	A scanner has redundant power supplies installed and the one identified as PS-2 is not working Failed Power Supply Failed Redundant Power Backplane detection circuit Failed Rack backplane status signal Failed Scanner2 status input	I/O rack continues to function normally using the remaining power supply	Verify that the power supply is connected to a power source Replace power supply Requires unit shutdown – replace redundant power backplane Requires unit shutdown – replace rack backplane. Requires unit shutdown – replace Scanner2. Contact Honeywell Service.
	BOTH POWER SUPPLIES ARE GOOD	N/A	None	None
LEAD CPU POSITION	CPU-A	CPU-A is currently the lead	N/A	N/A
	CPU-B	CPU-B is currently the lead	N/A	N/A
	CPU IS MISSING	Reserve CPU is not installed or not powered. CPU rack backplane failure	The lead controller will continue to control the process, but failover is not possible.	Install reserve CPU Apply power to reserve CPU Replace CPU rack backplane Contact Honeywell Service.

Item	Status	Possible Cause	Controller Action	Fix
LEAD I/O COMM DIAG	GOOD	Normal operation	N/A	
	DATA LINK FAILURE	• Scanner2 address switches are not in the correct position • An I/O cable is unplugged. • Cables are defective or are not properly shielded • If a hub is used, it may be powered down. • The Scanner2 is powered down. • The Scanner2 is defective	Controller continues to run but is not able to access the I/O on the associated rack	1. Verify that the address switches on the scanner 2 are set correctly. 2. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, that the hub is powered, and it supports 100 Base-T. 3. Check cable shielding for proper grounding and noise immunity. 4. Make sure the cables have the correct pin out. 5. Cycle power to the Scanner 2. 6. Cycle power to the hub. 7. Cycle power to the C70R. 8. Replace the expansion rack's scanner module. 9. Replace the expansion rack's power supply. 10. Replace the expansion rack. 11. Replace the main CPU.
	HARDWARE FAILURE	The I/O interface has a hardware failure.	Controller continues to run but is not able to access any I/O.	Replace the CPU.
	PORT A/B CABLE MISMATCH	The I/O cables from CPUA and CPUB are connected to the wrong ports on the I/O scanner CPU	Controller continues to run but is not able to access the I/O on the associated rack	Swap the cables so that I/O A is connected to I/O on CPUA and I/O B is connected to I/O on CPUB
	PROTOCOL MISMATCH	The firmware version in the controller CPU is not compatible with the firmware version in the I/O scanner	Controller continues to run but is not able to access the I/O on the associated rack	Upgrade the firmware in the CPU and/or scanner to be compatible versions
LEAD I/O COMM STATUS	NO COMMUNICATIONS	Possible causes are defined by the LEAD I/O COMM DIAG that is being reported.	Controller continues to run but is not able to access the I/O on the associated rack	See the fix defined for the LEAD I/O COMM DIAG that is being reported.
	MARGINAL: PORT I/O A	Rack communication with CPU-A is experiencing a high error rate	Controller continues to run but is marginally accessing the I/O on the associated rack	1. Check cable shielding for proper grounding and noise immunity. 2. Check connectors of all cables. 3. If a hub/switch is being used, verify that it is one that is recommended by Honeywell 4. Replace cables.

Item	Status	Possible Cause	Controller Action	Fix
	MARGINAL: PORT I/O B	Rack communication with CPU-B is experiencing a high error rate	Controller continues to run but is marginally accessing the I/O on the associated rack	1. Check cable shielding for proper grounding and noise immunity. 2. Check connectors of all cables. 3. If a hub/switch is being used, verify that it is one that is recommended by Honeywell 4. Replace cables
	GOOD: PORT I/O A	Normal operation	N/A	N/A
	GOOD: PORT I/O B	Normal operation	N/A	N/A
	NOT USED IN THIS CONFIGURATION	None of the I/O modules contained in this rack are being used to execute the control configuration that is currently running in the controller.	N/A	N/A
RESERVE I/O COMM DIAG	GOOD	N/A	N/A	N/A
	DATA LINK FAILURE	• Scanner2 address switches are not in the correct position • An I/O cable is unplugged. • Cables are defective or are not properly shielded • If a hub is used, it may be powered down. • The Scanner2 is powered down. • The Scanner2 is defective	Controller continues to run but is not able to access the I/O on the associated rack	1. If LEAD I/O COMM DIAG is also “DATA LINK FAILURE”, follow the Fix defined for that diagnostic. 2. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, that the hub is powered, and it supports 100 Base-T. 3. Check cable shielding for proper grounding and noise immunity. 4. Make sure the cables have the correct pin out. 5. Cycle power to the hub. 6. Cycle power to the C70R. 7. Replace the main CPU. 8. Cycle power to the Scanner 2. 9. Replace the expansion rack’s scanner module. 10. Replace the expansion rack’s power supply. 11. Replace the expansion rack.
	HARDWARE FAILURE	The I/O interface has a hardware failure.	Controller continues to run but is not able to access any I/O.	Replace the CPU.
	PORT A/B CABLE MISMATCH	The I/O cables from CPUA and CPUB are connected to the wrong ports on the I/O scanner CPU	Controller continues to run but is not able to access the I/O on the associated rack	Swap the cables so that I/O A is connected to I/O on CPUA and I/O B is connected to I/O on CPUB

Item	Status	Possible Cause	Controller Action	Fix
	PROTOCOL MISMATCH	The firmware version in the controller CPU is not compatible with the firmware version in the I/O scanner	Controller continues to run but is not able to access the I/O on the associated rack	Upgrade the firmware in the CPU and/or scanner to be compatible versions
RESERVE I/O COMM STATUS	NO COMMUNICATIONS	Possible causes are defined by the RESERVE I/O COMM DIAG that is being reported.	Controller continues to run but is not able to access the I/O on the associated rack	See the fix defined for the RESERVE I/O COMM DIAG that is being reported.
	MARGINAL: PORT I/O A	Rack communication with CPU-A is experiencing a high error rate	Controller continues to run but is marginally accessing the I/O on the associated rack	1. Check cable shielding for proper grounding and noise immunity. 2. Check connectors of all cables. 3. If a hub/switch is being used, verify that it is one that is recommended by Honeywell 4. Replace cables.
	MARGINAL: PORT I/O B	Rack communication with CPU-B is experiencing a high error rate	Controller continues to run but is marginally accessing the I/O on the associated rack	1. Check cable shielding for proper grounding and noise immunity. 2. Check connectors of all cables. 3. If a HUB/switch is being used, verify that it is one that is recommended by Honeywell 4. Replace cables.
	GOOD: PORT I/O A	Normal operation	N/A	N/A
	GOOD: PORT I/O B	Normal operation	N/A	N/A
	NOT USED IN THIS CONFIGURATION	None of the I/O modules contained in this rack are being used to execute the control configuration that is currently running in the controller.	N/A	N/A
I/O MODULE DIAGNOSTICS	GOOD	The detailed information for the I/O MODULE DIAGNOSTICS entry in the table above is also shown in Table 19 in the main part of the manual, under the “I/O” Class.		
	MODULE ERROR			
	MODULE HI CJ TEMP			
	FAILURE			
	NO COMM			
	BAD VERSION			

Lead/Reserve CPU Diagnostics

These displays show the status of the Lead and Reserve CPU modules in the redundant system. The same categories of status information are shown for Lead or Reserve. The CPU Position parameter on each display identifies which physical CPU module is currently acting as the Lead or Reserve.

Refer to Table 27 through for a description of the information contained on these displays.

Table 27 Details of Lead or Reserve CPU diagnostics error status messages

Class	Status	Possible Cause	Controller Action	Fix
RESERVE STATUS	RESERVE AVAILABLE	Normal operation	N/A	N/A
	RESERVE NOT AVAILABLE	1. Reserve not installed in rack. 2. Power not applied to reserve CPU 3. Neither lead nor reserve CPU has a valid configuration database 4. Firmware mismatch (lead and reserve CPUs have different firmware revisions 5. Database not synchronized with the lead	The lead controller will continue to control the process, but failover is not possible.	Install reserve CPU Apply power to reserve CPU Download a configuration and cold start the controller Perform a firmware upgrade so both CPUs have the same version Replace the reserve CPU. If this doesn't help, replace the lead CPU. If this doesn't help, replace the backplane.

Class	Status	Possible Cause	Controller Action	Fix
CPU POSITION	CPU-A	N/A	Normal operation	
	CPU-B	N/A	Normal operation	
	CPU IS MISSING	Reserve CPU is not installed or not powered. CPU rack backplane failure	The lead controller will continue to control the process, but failover is not possible.	Install reserve CPU Apply power to reserve CPU Replace CPU rack backplane Call Honeywell service
CPU	GOOD	N/A	N/A	N/A
	ADDRESS ERROR	The reserved exception occurred for an unknown reason.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	PREFETCH ERROR	CPU failed when attempting to fetch an instruction from the prefetch register.	1. Controller performs a restart 2. Associated rack monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Isolate system from noise and force a cold start. 3. Replace CPU board.
	DATA ABORT ERROR	CPU failed when attempting to access data.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	S/W INTERRUPT ERR	Software Interrupt that is not supported by the software occurred.	*See PREFETCH ERROR.*	*See PREFETCH ERROR.*
	UNDEFINED INSTR ERROR	Bad Instruction Detected	*See PREFETCH ERROR*	*See PREFETCH ERROR.*
	WATCHDOG ERROR	Watchdog reset resulting from software failure	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Upgrade controller module software. 3. Replace CPU board. 4. Contact Honeywell Personnel.
	VECTOR ERROR	Corrupted interrupt vectors in RAM.	Interrupt vectors were restored.	*See WATCHDOG ERROR.*
MEMORY	GOOD	N/A	N/A	N/A
	5 DAY BATTERY WARNING	Estimated battery life is less than 5 days.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.

Class	Status	Possible Cause	Controller Action	Fix
	LOW BATTERY	Battery voltage is low.	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's LOW BATTERY pin is turned on. 3. SYSTEM MONITOR block's HW OK pin is turned off.	Replace battery.
	FLASH ERROR	Flash failed to burn	1. Associated rack monitor block's RACK OK pin is turned off. 2. SYSTEM MONITOR block's HW OK pin is turned off.	1. Force a cold start. 2. Replace CPU board.
RTC	GOOD	N/A	N/A	N/A
	NOT PROGRAMMED	RTC not programmed	1. Time and date is set to 00:00:00, January 1, 1970. 2. Associated rack monitor block's RACK OK pin is turned off. 3. SYSTEM MONITOR block's HW OK pin is turned off.	Program RTC.
	BAD DATA	Bad date and time	*See NOT PROGRAMMED.*	1. Program RTC. 2. Cycle power. 3. Replace CPU. 4. Replace boards in rack. 5. Replace rack.
	PROGRAMMING FAILURE	RTC failed to program	*See NOT PROGRAMMED.*	*See BAD DATA.*
	READ FAILURE	Unable to read RTC	*See NOT PROGRAMMED.*	*See BAD DATA.*

Class	Status	Possible Cause	Controller Action	Fix
I/O RACK COMM PORT	GOOD	Normal operation	N/A	
	DATA LINK FAILURE	• Scanner2 address switches are not in the correct position • An I/O cable is unplugged. • Cables are defective or are not properly shielded • If a hub is used, it may be powered down. • The Scanner2 is powered down. • The Scanner2 is defective	Controller continues to run but is not able to access the I/O on the associated rack	1. Verify that the address switches on the scanner 2 are set correctly. 2. If a hub is used, check that all cables are properly connected to the hub, proper crossover cables are used, that the hub is powered, and it supports 100 Base-T. 3. Check cable shielding for proper grounding and noise immunity. 4. Make sure the cables have the correct pin out. 5. Cycle power to the Scanner 2. 6. Cycle power to the hub. 7. Cycle power to the C70R. 8. Replace the expansion rack's scanner module. 9. Replace the expansion rack's power supply. 10. Replace the expansion rack. 11. Replace the main CPU.
	HARDWARE FAILURE	The I/O interface has a hardware failure.	Controller continues to run but is not able to access any I/O.	Replace the CPU.
	PORT A/B CABLE MISMATCH	The I/O cables from CPUA and CPUB are connected to the wrong ports on the I/O scanner CPU	Controller continues to run but is not able to access the I/O on the associated rack	Swap the cables so that I/O A is connected to I/O on CPUA and I/O B is connected to I/O on CPUB
	PROTOCOL MISMATCH	The firmware version in the controller CPU is not compatible with the firmware version in the I/O scanner	Controller continues to run but is not able to access the I/O on the associated rack	Upgrade the firmware in the CPU and/or scanner to be compatible versions
NETWORK PORT E1	REFER TO Table 11 Ethernet Port E1/E2: Port Diagnostic status page 28			
NETWORK PORT E2	REFER TO Table 11 Ethernet Port E1/E2: Port Diagnostic status page 28			
SERIAL PORT S1	REFER TO Table 7 Serial Port S1/S2: Port Diagnostic status page 24			
SERIAL PORT S2	REFER TO Table 7 Serial Port S1/S2: Port Diagnostic status page 24			

Station Settings

View Data

Lets you view data on the CompactFlash card. Touch the + and – buttons to scroll through the folder and file names. Touch Open button to open a folder or file. Touch Back to go back to the top level folder.

Delete Data

Lets you delete data on the CompactFlash card. Touch the + and – buttons to scroll through the folder and file names. Touch Delete button to delete a file or folder. Touch Delete All to delete all data on CompactFlash card.

Export Data to USB

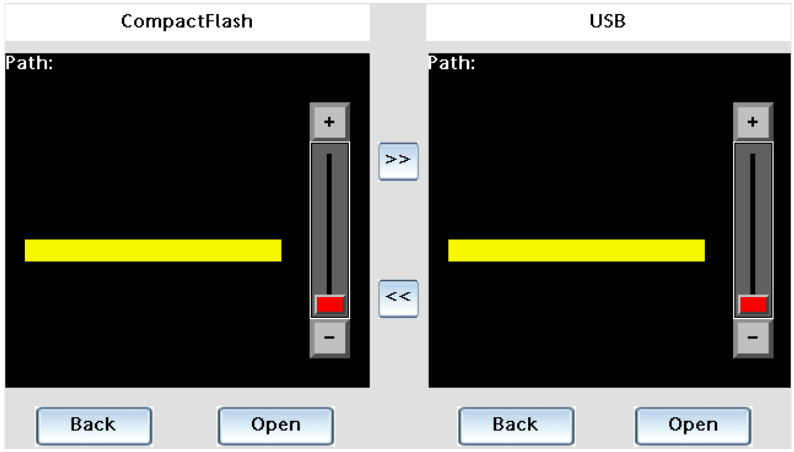
Note. ***USB 3.0 support is only available on the 900CS10.***

Lets you export data from the CompactFlash to USB. Insert USB memory device into Port A. (Export does not function without USB device inserted.)

Total Memory and Free Memory are displayed for CompactFlash and USB memory device. Touch the Get CF Status or Get USB Status buttons to update status.

Touch Export All Data button to export CompactFlash data to the USB device. USB device must have enough free memory.

Export Selected Data button shows CompactFlash data and USB memory device data. Press >> and << to transfer data between the two devices.



Note:

1. File/ folders can't be copied from USB memory device to CompactFlash's LOG folder.
2. There may be a delayed response in actions involving the USB memory device since it is an external device.

Format Memory Device

Lets you format CompactFlash or USB device.

Note that the Control Station uses the FAT16 file system. You may achieve better performance if the memory device is formatted on the Control Station as opposed to your computer.

Station Setup

Lets you:

- Change languages
- Adjust display brightness
- Calibrate the touch screen
- Test the touch screen
- Test the soft membrane keys left of the display
- Clean the screen – this disables the touch screen. Use when cleaning the screen or when replacing the optional protective film that covers the screen.

Station Status

Shows the status of the Control Station.

- Versions of boot loader, firmware, application
- Path and name of HC900 configuration file being monitored by the Control Station
- Time and cause of last several Control Station restarts

Station Comm Ports

Shows status of the Control Station's communication ports (Ethernet, RS232 program, RS232 Comm, RS485).

Change Passwords

Lets you change user passwords.

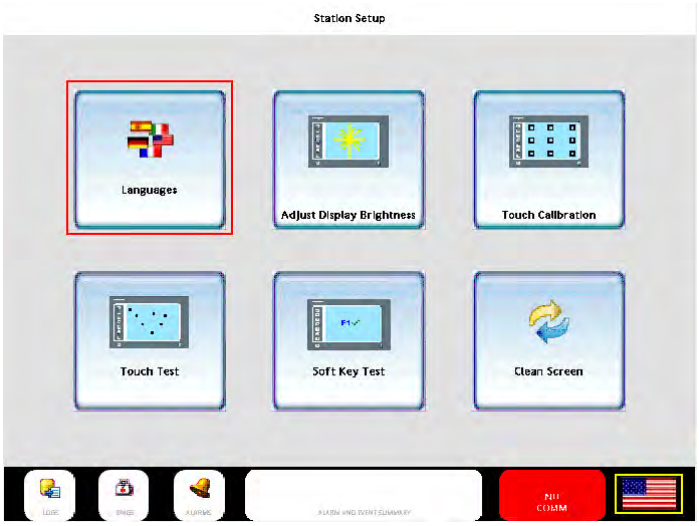
Language Menu Selection

Lets you change the language on the Control Station UI. Use one of the following methods to change the language.

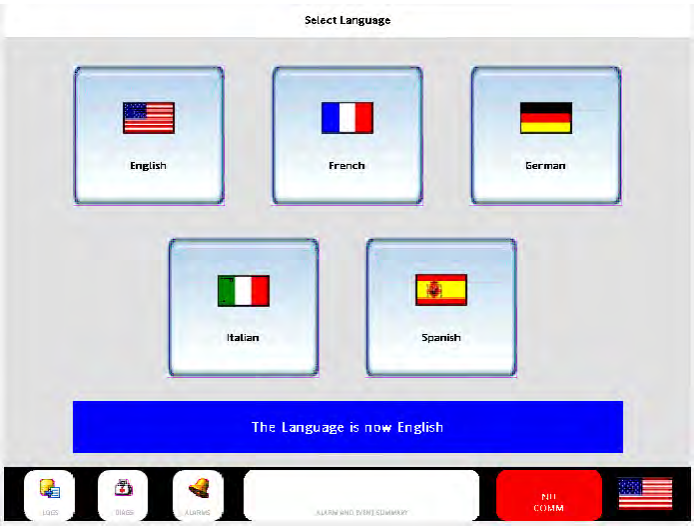
- Go to Station Setup Menu > Languages.

or

- Click the flag icon present on the screen.



Select the required language.



Log On

Enter name and password. Once logged on, your level of access to displays and functions depends on the security credentials you were configured for.

Alarms and Events

Alarm Access

Use the Alarms icon to access all the alarms present in Control Station.

Alarm Definition

- 900 Control Station shows both the HC900 Controller alarms and Station alarms on the same alarm console.
- Station alarms can be configured for a .cde file tag present in the .sds configuration. An alarm can be defined in the desired tag properties.
- In Controller configuration, a desired tagged point present in the controller can be designated as an alarm point.

Alarm Indicator

- When there are no alarms present, alarm icon and text on status indicator are grayed out.
- When an alarm is active, the text is displayed in white color and the background turns red.
- Status indicator flashes when an alarm is active and not acknowledged. Acknowledge the alarm to stop the flashing.
- If the alarm condition goes away (clears) before the operator acknowledges the alarm, the indicator will turn yellow and continue to flash until acknowledged.

Display Details

- Alarm Console - 900 Control Station shows both the HC900 Controller alarms and Station alarms on the same alarm console.
- Alarms programmed to automatically acknowledge when the alarm clears may also be manually acknowledged while the alarm is active, halting the flashing indications on the alarm displays.

Alarm Groups

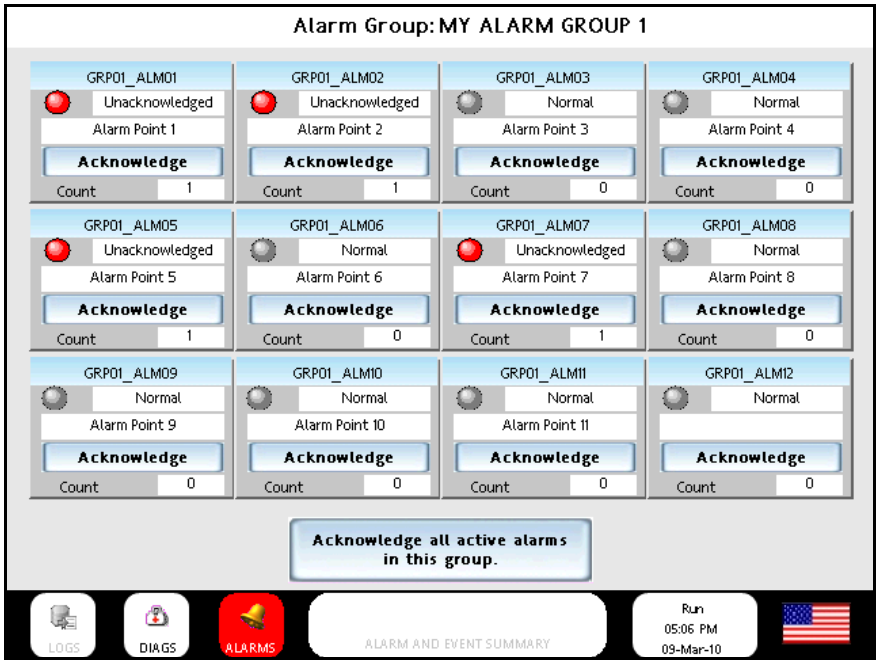
The **Alarm Groups** screen shows the status of the alarm groups of the controller. Touch an Alarm Group button to open its **Alarm Group** display. There is a button at the bottom of the **Alarm Groups** screen to access Station alarms.

Alarm Group Indication

- When there are no active alarms present, the background is gray with black text indicating NORMAL.
- When any alarm within a group is active, the text is displayed in white color and the background turns red.
- For active, non-acknowledged alarms the background turns red, text changes to Unacknowledged and flashes.
- Once acknowledged, the alarm background remains red until the alarm condition goes away, the text changes to Acknowledged and the background stops flashing.
- If the alarm condition goes away (clears) before the operator acknowledges the alarm, the background will turn yellow, the text will remain Unacknowledged and continue to flash until acknowledged.

Alarm Group Overview

The **Alarm Group** screen shows the status of each point present in the selected Alarm Group.



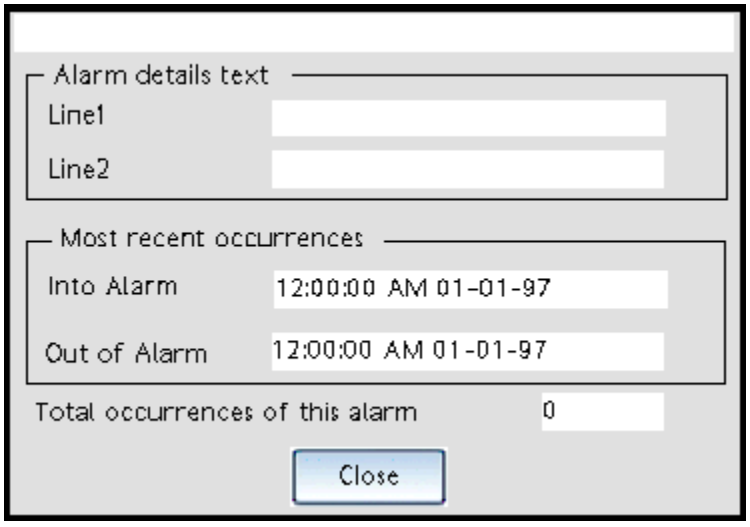
Alarm Point Indication

- When an alarm is not active, the background is white with black text indicating Normal and the alarm indicator light is gray.
- When any alarm is active, the alarm indicator light turns red, flashes and the text changes to Unacknowledged.
- Once acknowledged, the alarm indicator light stops flashing, remains red until the alarm condition goes away and the text changes to Acknowledged.
- If the alarm condition goes away (clears) before the operator acknowledges the alarm, the alarm indicator light will turn yellow and continue to flash until acknowledged. The text will change to Cleared.

Alarm Point Detail

Following details are displayed.

- Tag name
- Alarm details text
- Last time the selected point was in alarm state
- Last time the selected point went out of alarm state
- Number of occurrences



Alarm Acknowledgement

- When 900CS is connected to C30S, C50S, C70S and C75S Controllers then it will not be allowed to Acknowledge Alarms in Safety portion of the configuration when controller is in RUN-LOCKED mode, it is allowed when controller is RUN-program mode.

Event Access

All the events are accessed through the **Alarm and Event Summary** indicator present on the bottom of all pages.

Event Definition

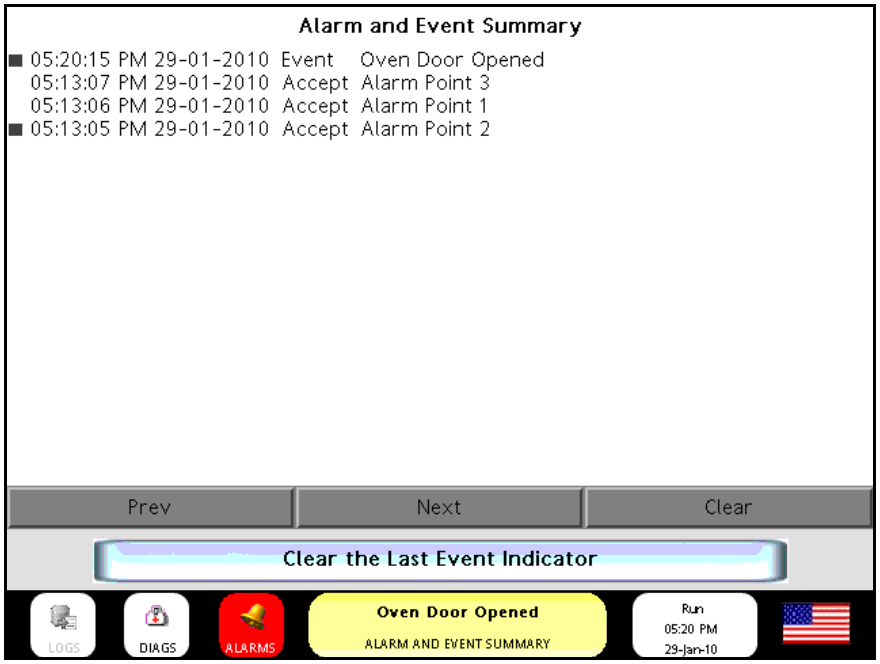
- 900 Control Station shows both the HC900 Controller events and Station events on the same Alarm and Event Summary console.
- Station events can be configured for a .cde file tag present in the .sds configuration. An event can be defined in the Alarms tab of the desired tag properties.
- In Controller configuration, a desired tagged point present in the controller can be designated as an event point.

Event Indication

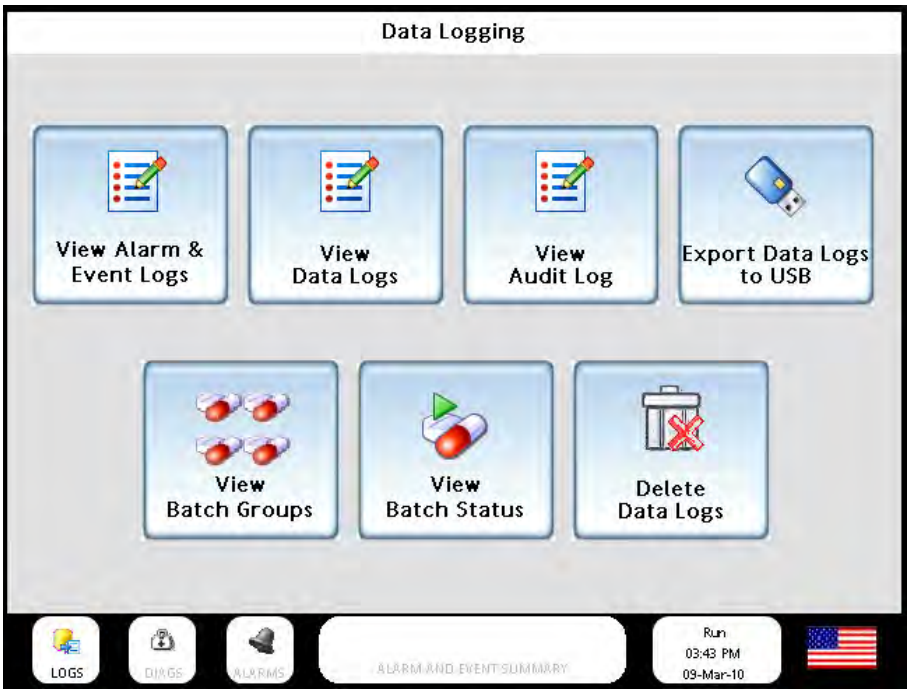
- When an Event exists, the event text appears in black color and the background of Alarms and Event Status indicator turns yellow.
- When no event exists, no text is present on status indicator and it is grayed out.

Display Details

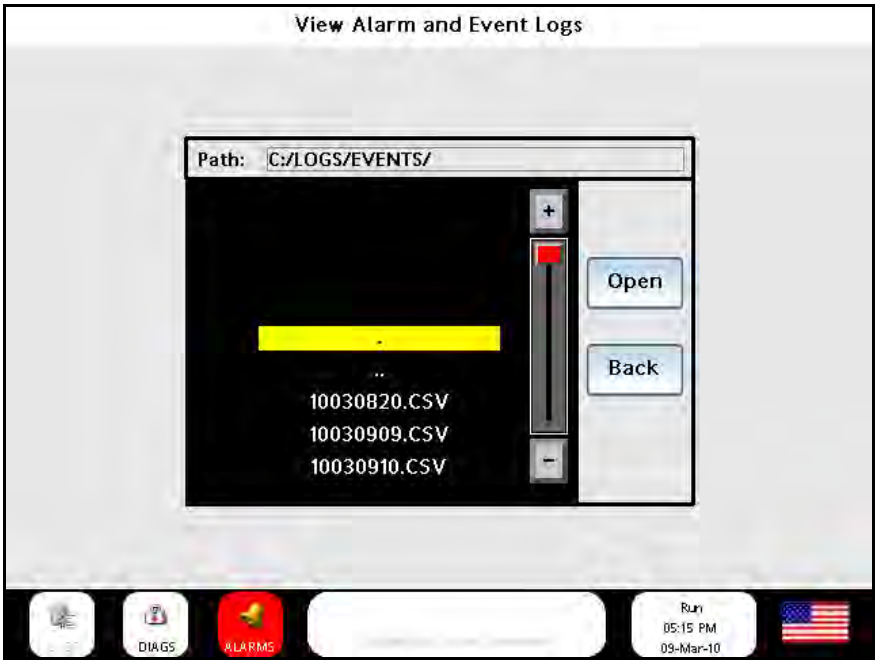
- Alarm and Event Summary – It displays the time stamp and text of each alarm and event.



Data Logging

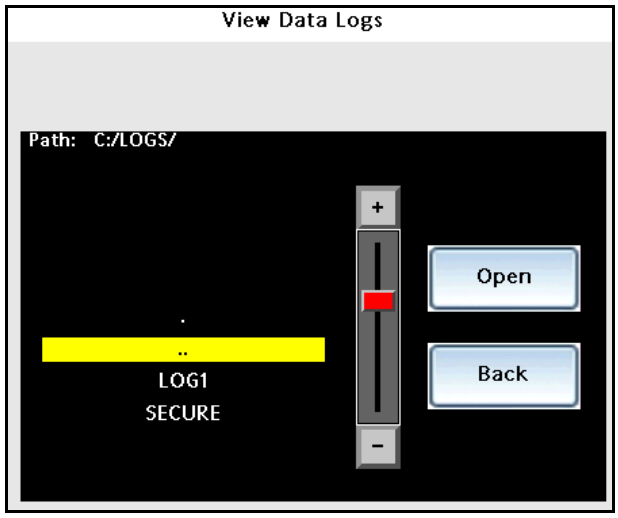


View Alarm & Event Logs



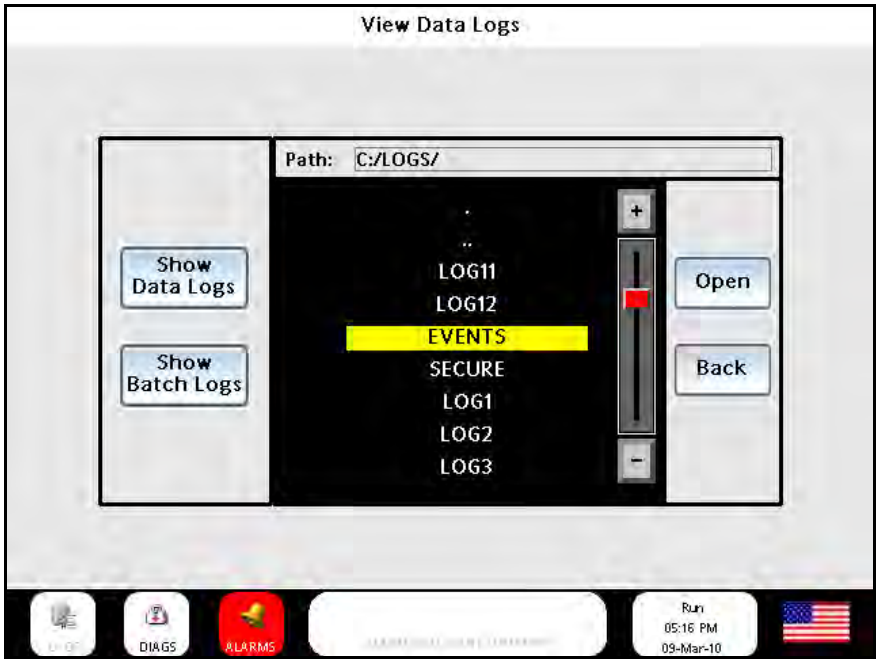
Lets you view the alarm and event logs. Touch the + and – buttons to scroll through the folder and file names. Touch Open button to open a folder or file. Touch Back to go back to the top level folder.

View Data Logs



Lets you view the data log files on CompactFlash. Touch the + and – buttons to scroll through the folder and file names. Touch Open button to open a folder or file. Touch Back to go back to the top level folder.

View Audit Logs



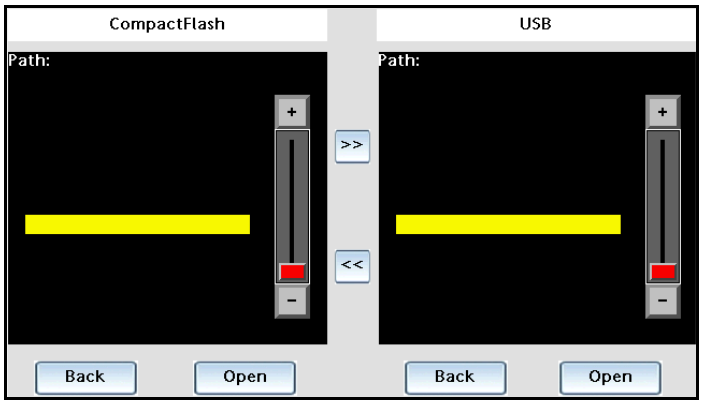
Lets you view the audit log. The audit log is a record of actions performed by users. Touch the + and – buttons to scroll through the folder and file names. Touch Open button to open a folder or file. Touch Back to go back to the top level folder. Touch the Show Data Logs button to view the data logs and touch the Show Batch Logs button to view the batch logs.

Export Data Logs to USB

Lets you export data logs from the CompactFlash to USB. Insert USB memory device into Port A. (Export does not function without USB device inserted.). **Note:** ***USB 3.0 support is only available on the 900CS10.***

Total Memory and Free Memory are displayed for CompactFlash and USB memory device. Touch the Get CF Status or Get USB Status buttons to update status. Touch Export All Data button to export CompactFlash data to the USB device. USB device must have enough free memory.

Export Selected Data button shows CompactFlash data and USB memory device data. Press >> and << to transfer data between the two devices.



File/ folders can't be copied from USB memory device to CompactFlash's LOG folder.

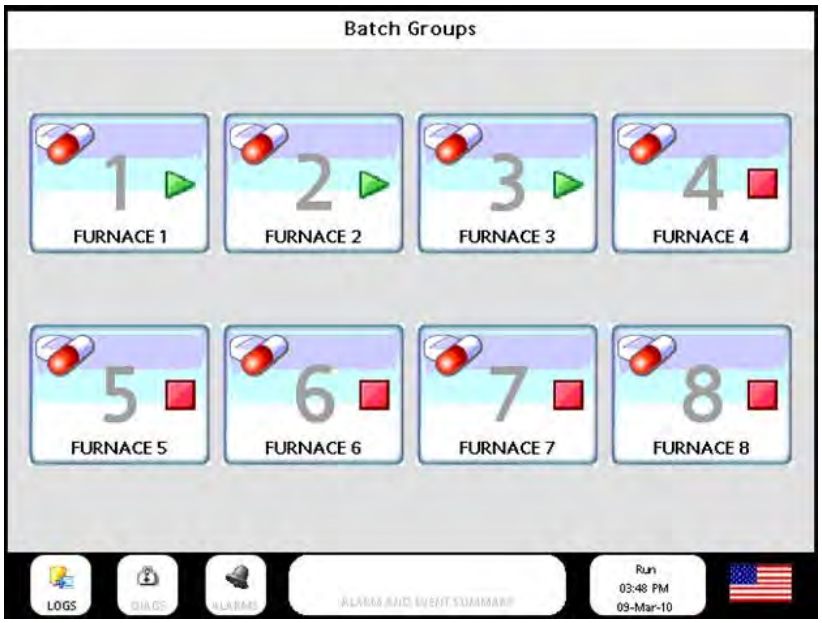
View Batch Groups & View Batch Status

(Concurrent Batch for Control Station)

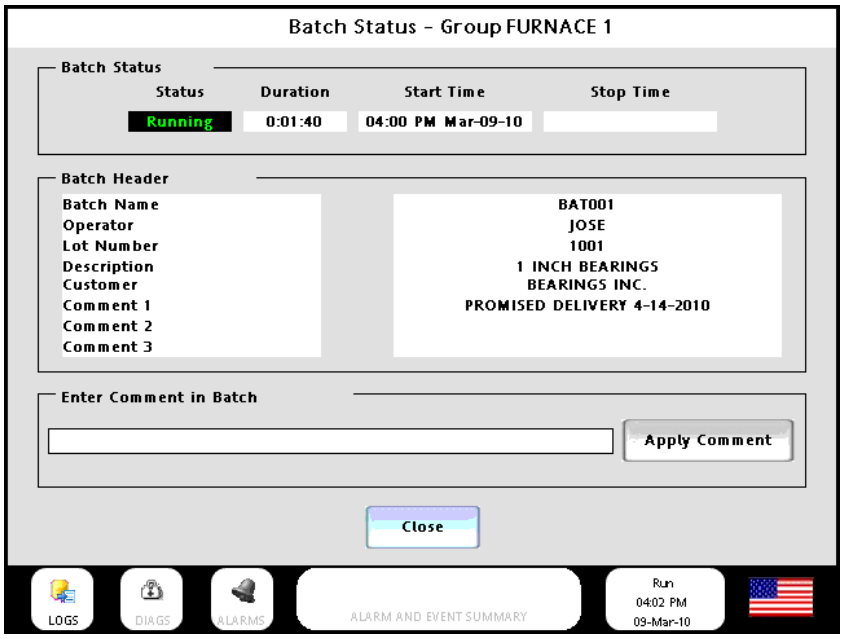
The operator at the 900 Control Station can simply touch the **LOGS** button on the master slide to access the Data Logging menu. (Alternately, you can touch the soft key **Menu > Data Logging**.) The Data Logging menu has two buttons on it for concurrent batch. **View Batch Groups** and **View Batch Status**.

View Batch Groups Summary Display

The operator can touch the **View Batch Groups** button on the **Data Logging** menu to display the **Batch Groups** display. This display shows a summary of which batch groups have a batch running in them. A green arrow on a batch group button means a batch is running, while a red square means a batch is not running:



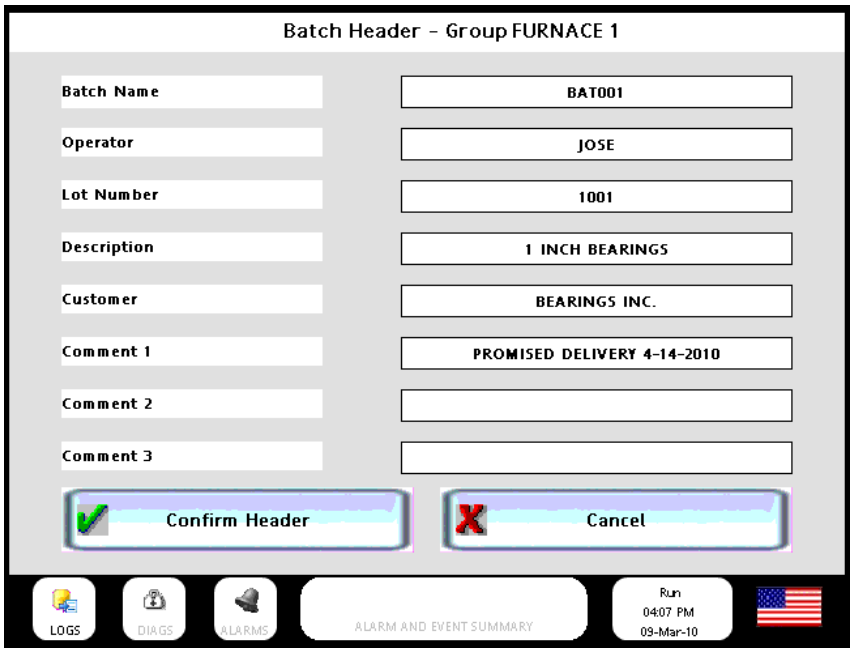
Touching a batch group button that has a batch running retrieves the details for that batch:



Touching a batch group button that does not have a batch running retrieves the batch header display so that the identification details of the next batch can be entered. Note that in the picture which follows, the values entered from the last batch were retained. This is Data Logger property Retain Header in Station Designer under the Data Logger's Groups tab, so the field values shown are not empty.

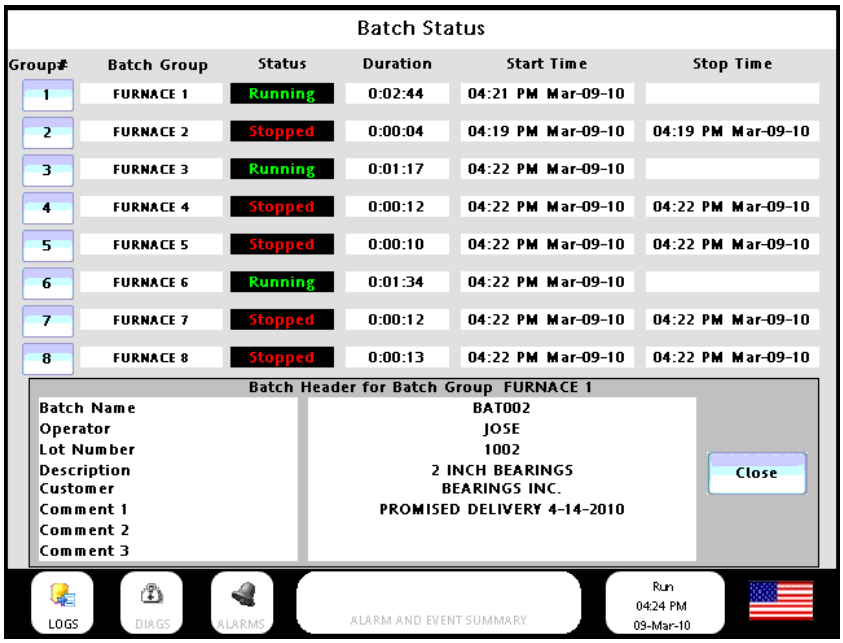
NOTE: The batch names for the batches within a batch group (batch set) must be unique and must be between 1 and 8 characters in length and must contain only characters that are valid in a folder name.

The other header field values can be of any length, although a maximum of 48 characters is recommended. If you specify a very long value, note that it can overflow its data box. Just touch on a data box to the right of a field name to specify its value. Touch the **Confirm Header** button when you are satisfied with your entries:



View Batch Groups Detail Display

The operator can touch the **View Batch Status** button on the **Data Logging** menu to display the **Batch Status** display. This display shows detailed information for all of the batch groups. For each batch group, it indicates whether a batch is running or not, when the batch starts, when the batch stops, and the duration for each running and stopped batch. By touching one of the small blue batch group buttons on the left-hand side of the display, you can view the batch header details for any batch group. Touch the **Close** button to close the batch header details box:



Delete Data Logs

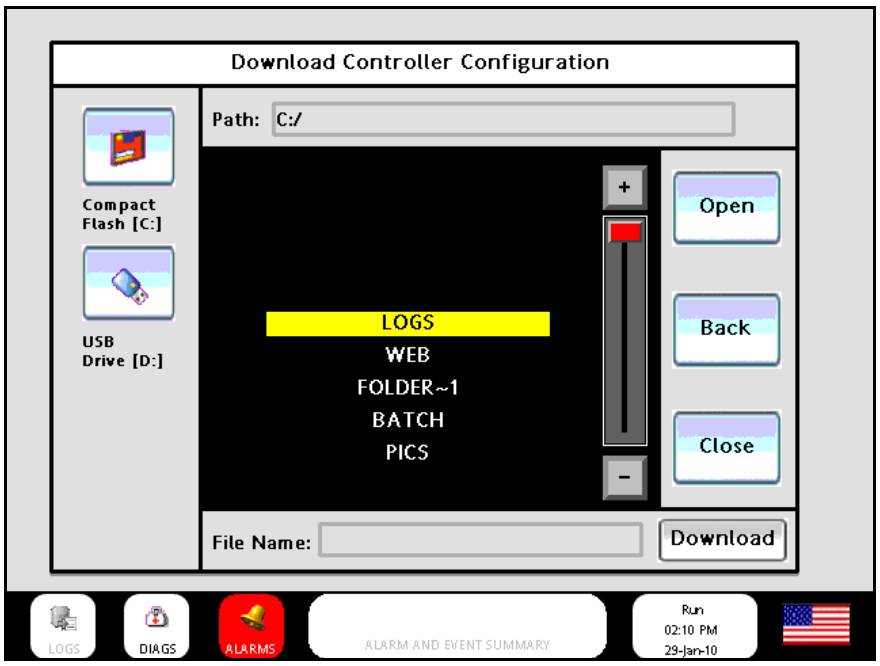
Lets you view one or all data log files on CompactFlash. Use the + and – buttons to navigate through the folder and files.

Downloading and Uploading Controller Configuration

Lets you download the .cde configuration file directly from the Control Station onto the HC900 controller. You can also upload the .cde configuration file from the HC900 controller to the Control Station.

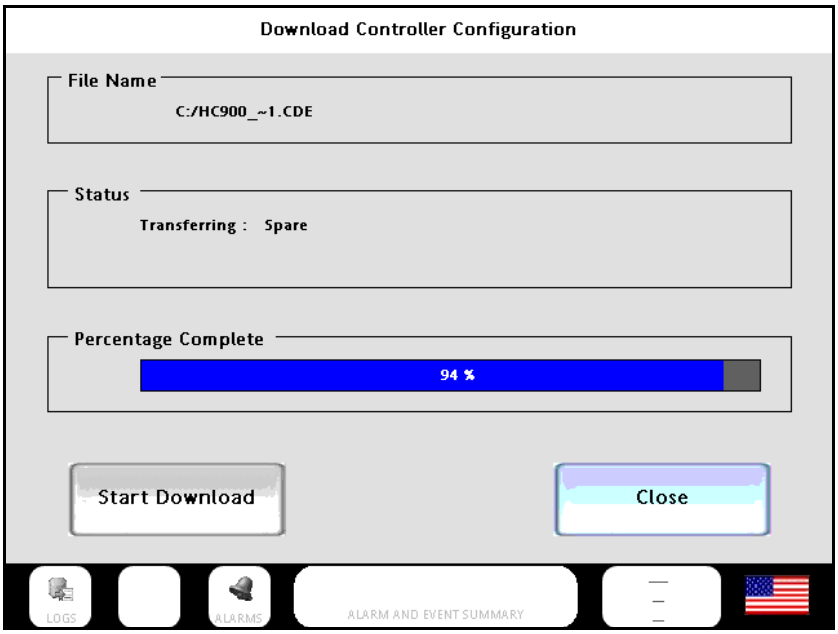
Download Configuration Files

1. Go to **Station Settings > Memory Device Utilities > Download Controller Configuration** Display. The **Download Controller Configuration** dialog box appears.

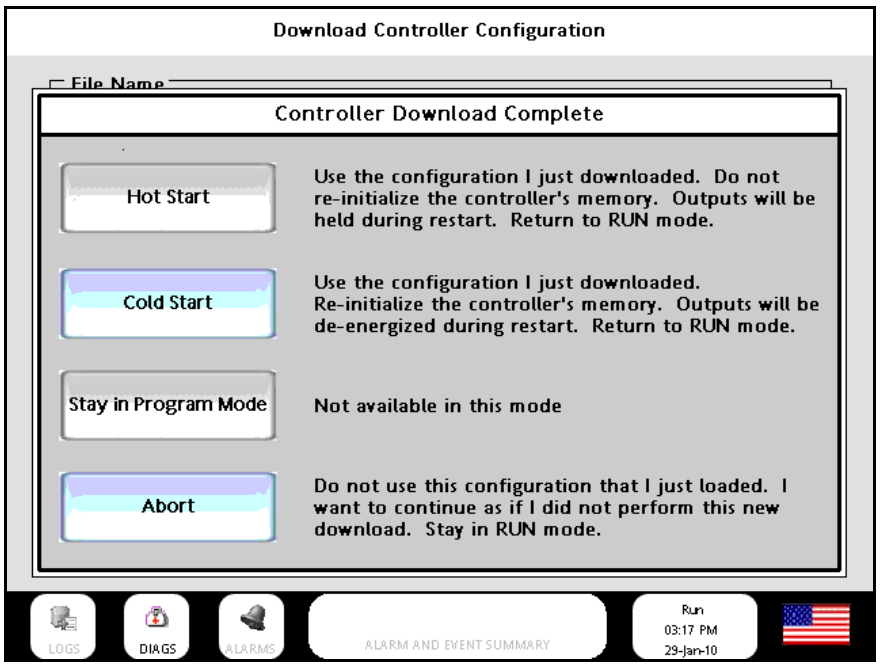


2. All the .cde files and folders present in the Compact Flash and USB Drive are listed. Select a drive to view the files present in that drive. Press **Open** to open the file/folder and to show its contents. Press **Back** to close the opened file/folder. Press **Close** to close the dialog box.

3. Select a file and press **Download**. The **Download Controller Configuration** dialog box appears.

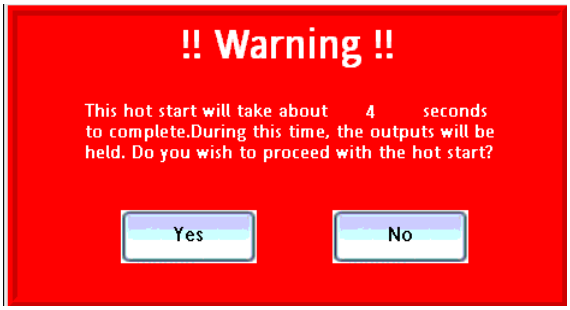


4. Press **Start Download** to start the process. A progress bar indicates the percentage of completion.
5. Once the download is complete, the **Controller Download Complete** dialog box appears.



6. Select one of the following options as required and continue.
   - Hot Start: Updated the configuration settings.
   - Cold Start: To re-initialize the memory.
   - Stay in Program Mode: Remains in program mode.
   - Abort: To cancel the download operation.

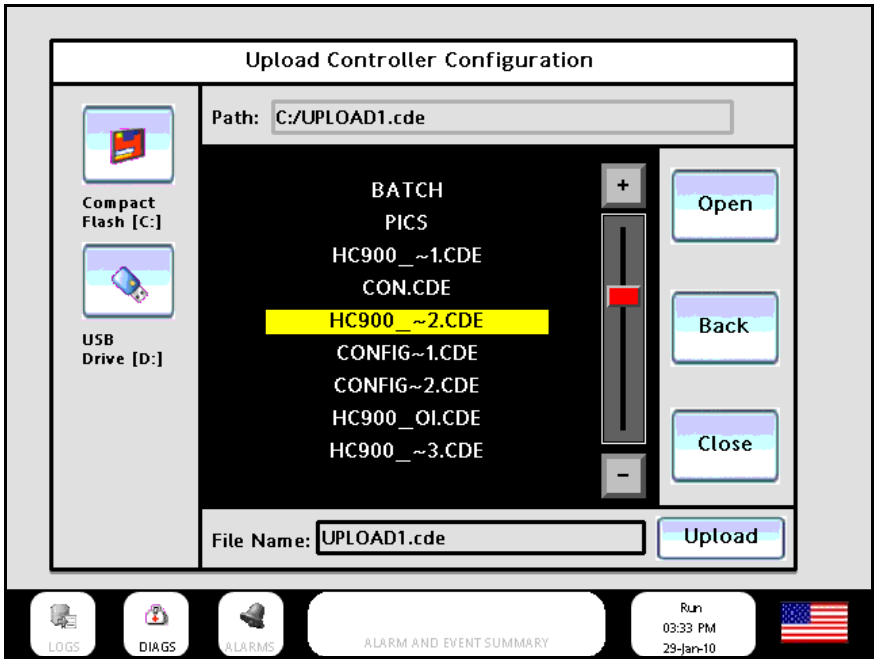
In case you select Hot Start the following warning appears on the screen.



Press **Yes** to continue and complete the operation.

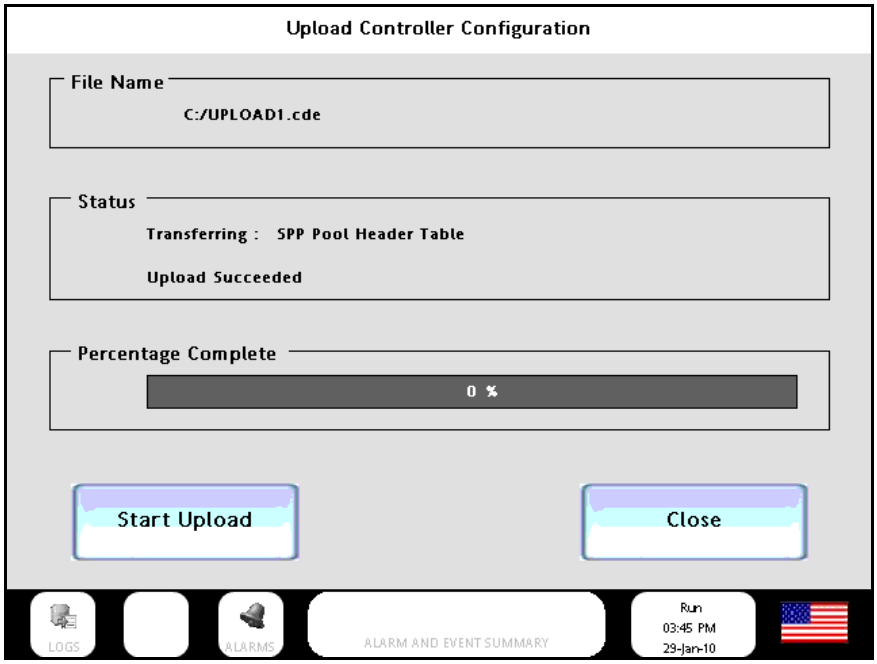
Upload Controller Configuration

1. Go to **Station Settings > Memory Device Utilities > Upload Controller Configuration Display**. The **Upload Controller Configuration** dialog box appears.



2. All the .cde files and folders present in the Compact Flash and USB Drive are listed. Select a drive to view the files present in that drive. Press **Open** to open a folder and to show its contents. Press **Open** to select a file. Press **Back** to close the opened file/folder. Press **Close** to close the dialog box.

3. Select a file and press **Upload**. The **Upload Controller Configuration** dialog box appears.

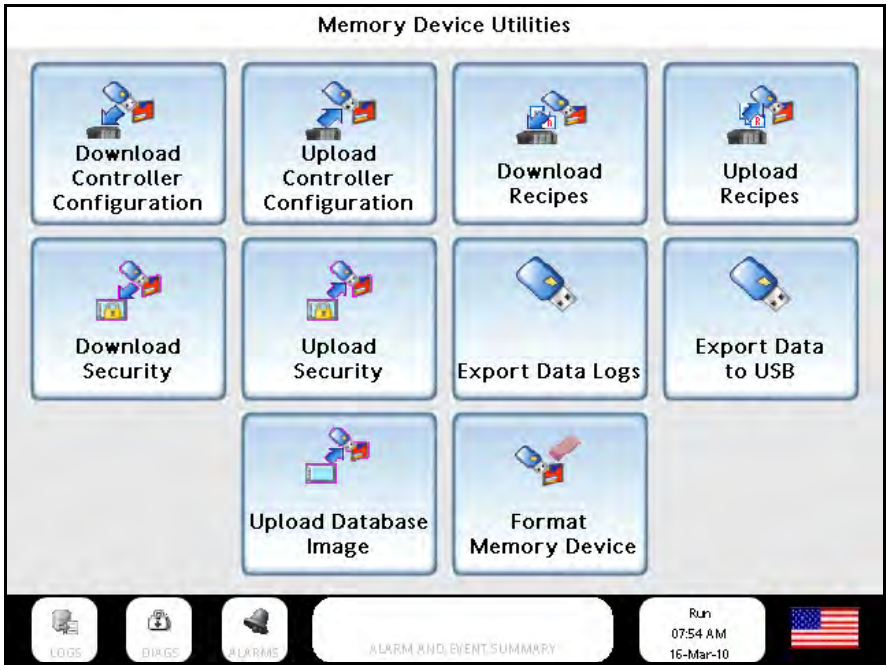


4. Press **Start Upload** to start the process. A progress bar indicates the percentage of completion.
5. Once the upload is complete, the **Controller Upload Complete** dialog box appears.

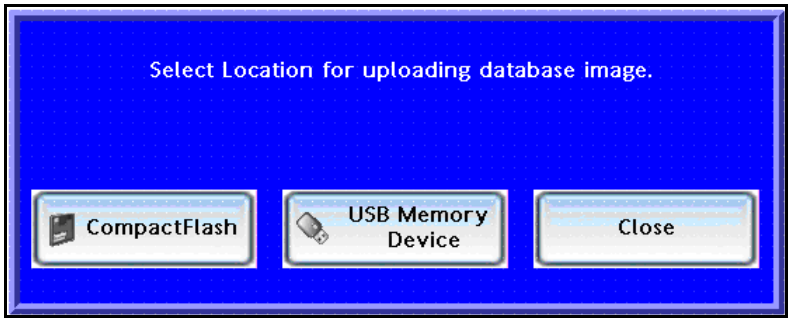
Uploading Database Image

Lets you upload an image.sdi file from Control Station to an external device (compact flash or USB memory device).

1. On the **Memory Device Utilities** menu, press **Upload Database Image**. Use this option to export an image file to a memory device.



2. The **Select Location for uploading database image** dialog box is displayed. Select a location.



   Depending on your device selection, image.sdi file is created on either compact flash or USB memory device. On successful file upload, **Successfully Uploaded Database Image** message is displayed. In case the upload fails, **Error in uploading database image** message is displayed.

3. When the Control Station is powered on, the image.sdi file is automatically detected from the compact flash and starts uploading the file to the Control Station. **Loading From CF** message appears on the screen.

To upload an image .sdi file from a memory stick appropriate settings must be enabled via Station Designer, the PC configuration tool. (see manual 51-52-25-149).

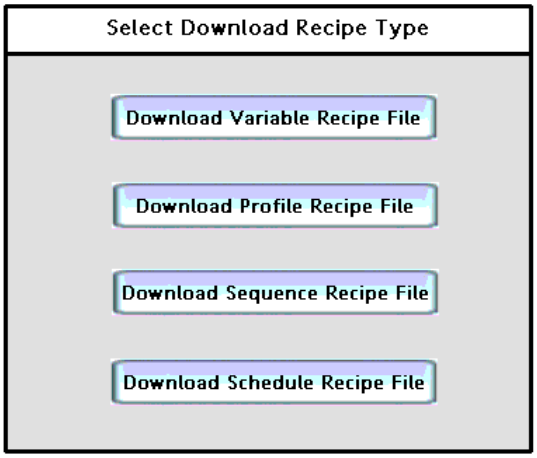
Uploading and Downloading Recipe Files

Using the 900 Control Station you can upload the recipe files from a controller to a USB memory device. You can also download the recipe files present in the USB Memory device or Compact Flash card onto the controller. You can upload and download the following recipe files.

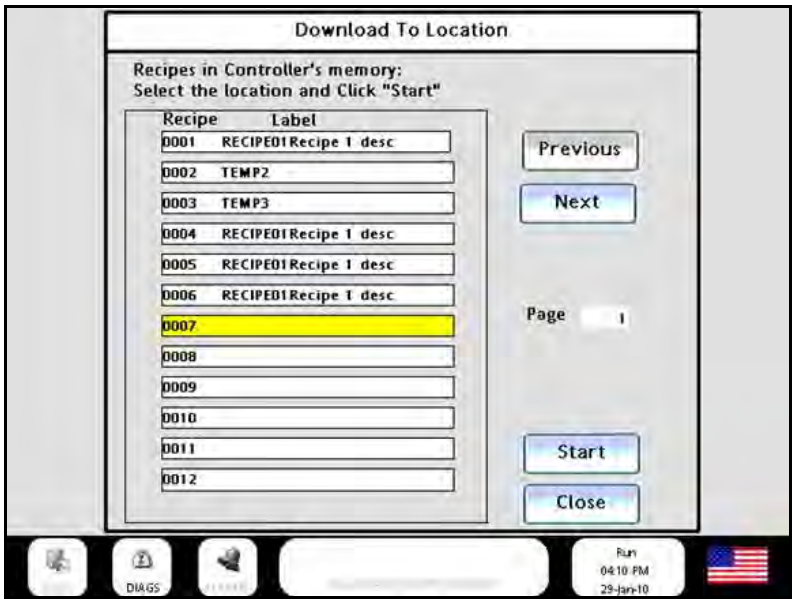
- Variable Recipe (.rcp)
- Profile Recipe (.prf)
- Sequence Recipe (.seq)
- Schedule Recipe (.sch)

Download Recipe Files

1. Go to **Main Menu > Station Settings > Memory Device Utilities > Download Recipe**. The **Select Download Recipe Type** dialog box appears.

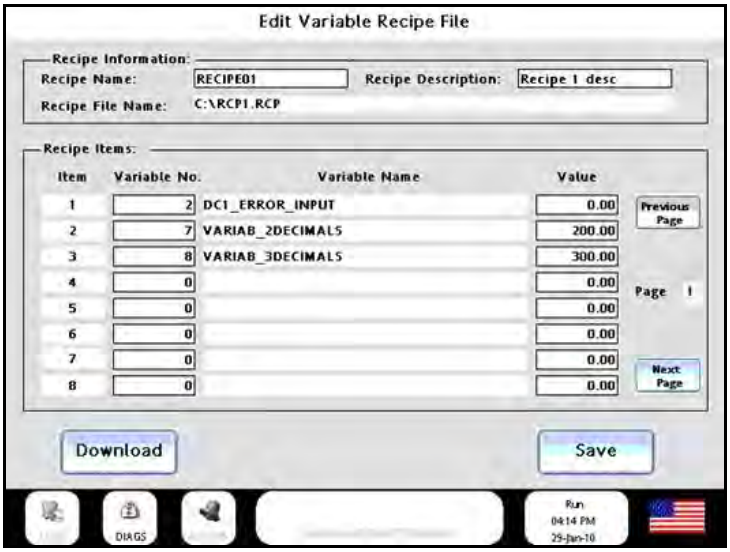


2. Select a file to download. You can select **Download Variable Recipe File**, **Download Profile Recipe File**, **Download Sequence Recipe File**, or **Download Schedule Recipe File**.
3. Browse to the file that you want to download. File can be present in C: or D: drive.
4. Click **Download**. The **Download to Location** dialog box appears. Please note that the below screen appears only when you select Download Variable Recipe File in step 1.



5. Select a recipe location and press **Start** to proceed. Use the **Previous** and **Next** buttons to toggle between the various recipe pages.

6. The **Edit Variable Recipe** page is displayed. Click **Download** to download the edited or selected recipe file onto the controller.



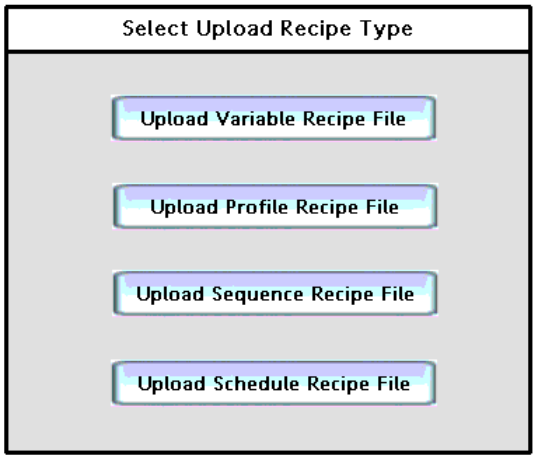
7. Press **Save** to save the changes made in the recipe file. The changes are saved to the file in the memory device.

On successful file download, **File Downloaded Successfully** message is displayed. In case the download fails, an error message is displayed.

Similar method is used for downloading different types of recipe file.

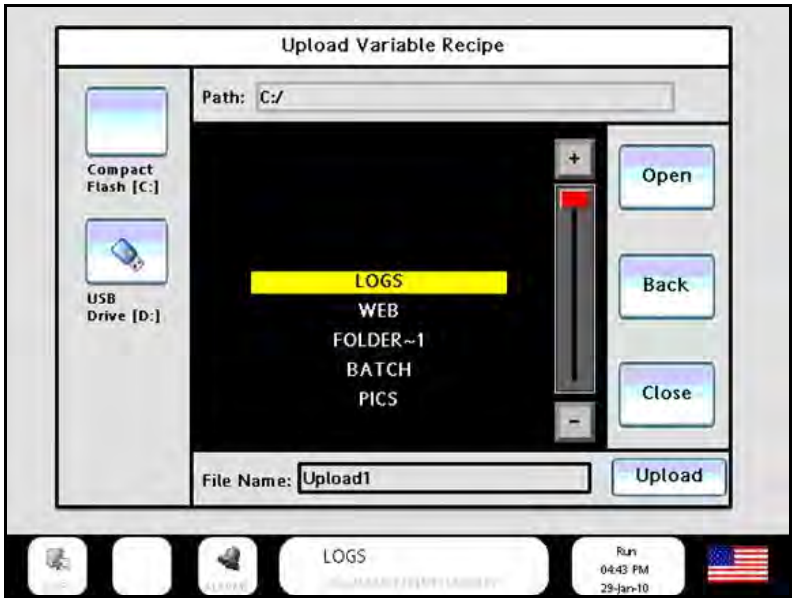
Upload Recipe Files

1. Go to Main Menu > Station Settings > Memory Device Utilities > Upload Recipe. The Select Upload Recipe Type dialog box appears.

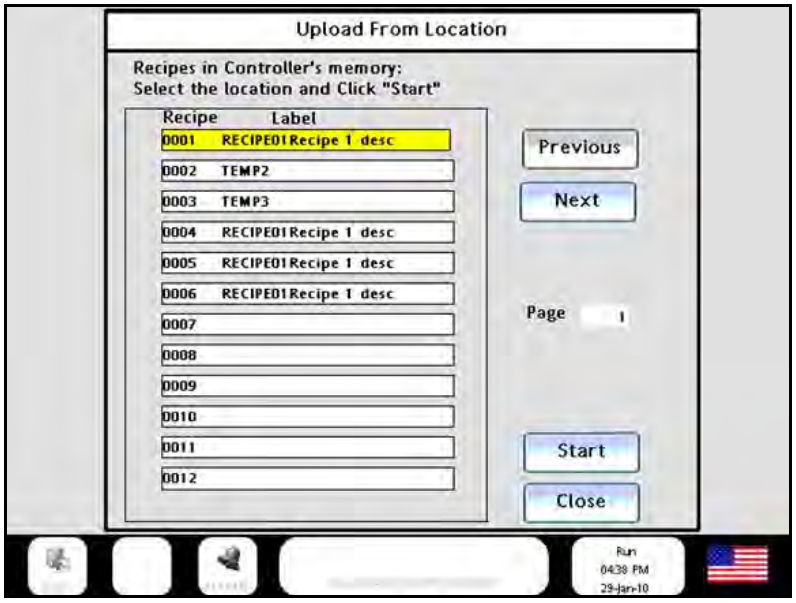


2. Select a file to upload. You can select **Upload Variable Recipe File**, **Upload Profile Recipe File**, **Upload Sequence Recipe File**, or **Upload Schedule Recipe File**.

3. Select a location to save the file. File can be saved in C: or D: drive. By default file is saved as Upload1. However, you can overwrite the file name.

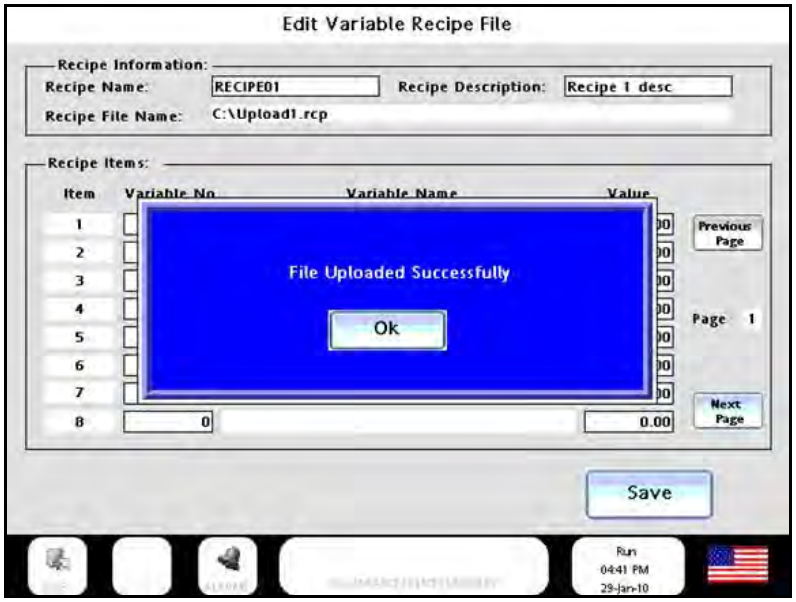


4. Click **Upload**. The **Upload from Location** dialog box appears. Please note that the below screen appears only when you select Upload Variable Recipe File in step 1



5. Select a recipe location and press **Start** to proceed. Use the **Previous** and **Next** buttons to toggle between the various recipe pages.

6. The **Edit Variable Recipe** page is displayed. Click **Upload** to upload the edited or selected recipe file.



7. Press **Save** to save the changes made in the recipe file. The changes are saved to the file in the memory device.

On successful file upload, **File Uploaded Successfully** message is displayed. In case the upload fails, an error message is displayed.

Similar method is used for uploading different types of recipe file.

Uploading and Downloading Security Settings

You can upload the security settings (password) from Control Station to memory Devices and download them to the Control Station holding database with the same GUID.

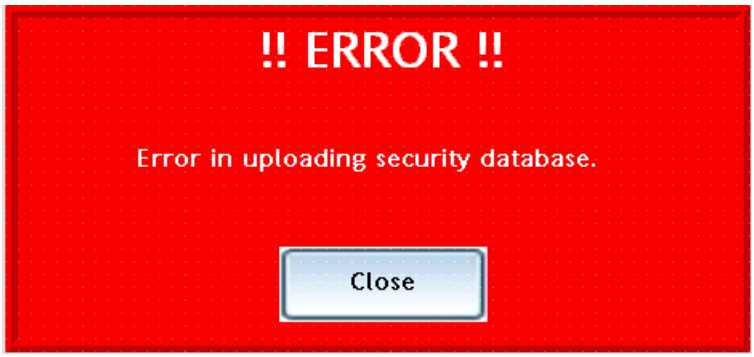
Upload Security Displays and Functionality

1. Go to Main Menu > Station Settings > Memory Device Utilities > Upload Security. The Upload Security Database dialog box appears.

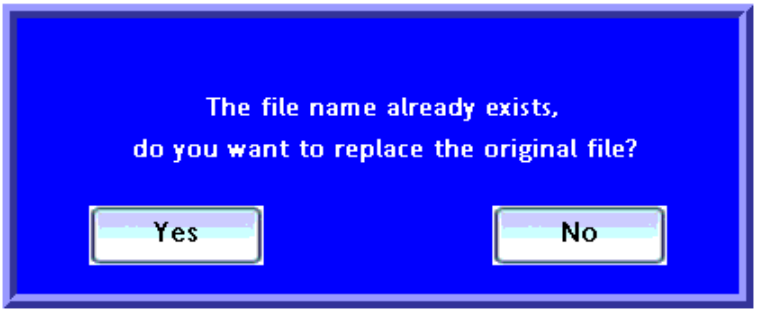
2. Select a location and type a file name to save the security settings. The **Upload** button is enabled and '.dat' extension is added to the file name.

3. Press **Upload** to upload the file to the database. The following message appears indicating the successful upload of security file.

In case the upload fails, the following message is displayed.



By default, Security is used as the file name. If you over write the file name, you are prompted with the following message. Press **Yes** or **No** as required.



Download Security Displays and Functionality

1. Go to **Main Menu > Station Settings > Memory Device Utilities > Download Security**. The **Download Security Database** dialog box appears.

Note: A USB memory device or CompactFlash card must be connected to Control Station or else an error message is displayed.

2. Browse and open the file that you want to download.
3. Press **Download**. The selected file gets downloaded from the selected location. A success message appears on successful completion of file download.

In case the download fails, an error message is displayed.

Using Barcode Reader

1. Touch a data box on the Control Station. A keypad appears.
2. Scan a bar code. Data appears in the entry area of keypad pop-up.

If the bar code reader includes carriage return and line feed, the keypad pop-up goes away and the data appears in the data box.

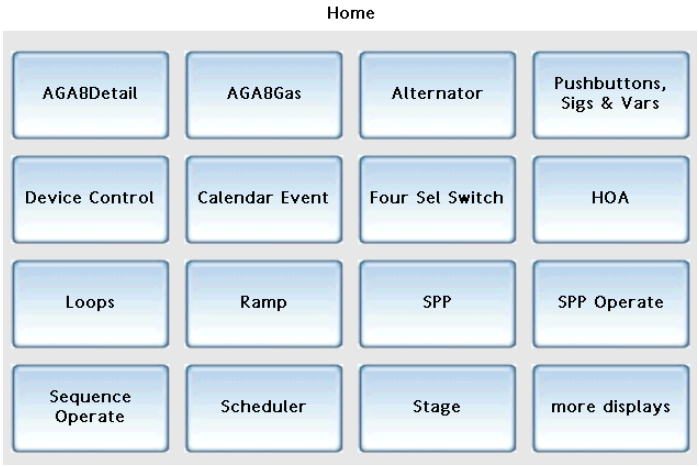
If carriage return and line feed are not included in the scan, the user touches the **Enter** button on the keypad, the pop-up goes away, and the data appears in the data box.

Process Displays

Overview

Access

Press the Home key to access an array of 16 buttons. See example below. Your actual buttons may vary. Each button takes you to a display that was custom-configured for your HC900's process.



Widget displays

Your Control Station's process displays were configured using a variety of objects such as figures, symbols, text boxes, and widgets. A widget is a graphical object designed to work with a specific function block type in your HC900's process configuration. For example, some widgets, like Digital Pushbutton, perform a simple on/off function for monitoring and controlling a digital signal. Other widgets have many functions. For example, a loop PID widget lets you not only view and adjust the loop's SP and output, but also lets you jump to detailed displays for the loop (such as loop setup, trending, tuning, alarm setpoints, and output limiting).

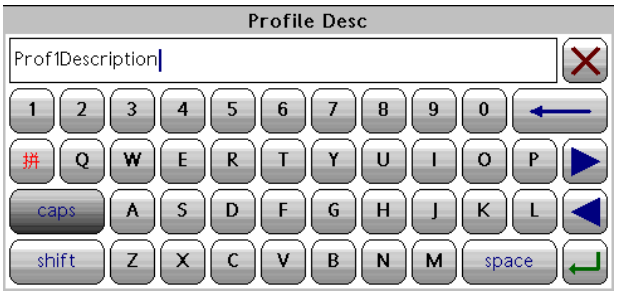
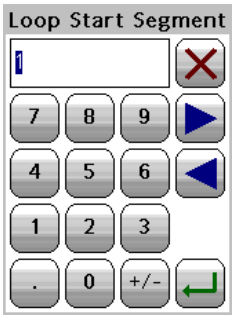
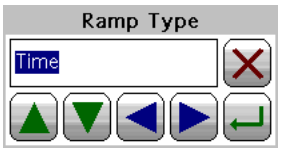
The table below lists all the widgets that may appear on your displays. Your actual displays may vary.

Widget type	See page
Pushbuttons, signals and variables	90
AGA8DL & AGA8GS	91
4-Selector Switch	97
Device Control	98
Hand/Off/Auto Switch	100
Stage	101
Ramp	103
Alternator	105
Calendar Event	109
Wireless transmitters	113
Setpoint Programmers	119
Setpoint Schedulers	133
Sequencers	141
Loops (A/M Bias, Carbon, On/Off, PID, 3 Position Step Control)	147

How to edit a parameter

On all displays, a white box with black border indicates an editable parameter. In the example below, Profile Name is editable. A white box with no border is read-only (for example, Profile Number).

When you touch the box a popup appears. See popup types below.

Popup type	Example	Details
Text entry		Functions like typical keyboard.
Alphanumeric entry		Functions like typical numeric keypad.
Menu		Use  to scroll through available choices.

Buttons common to all popups:

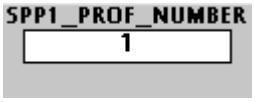
 Cancel change or exit without saving changes.

 Save changes.

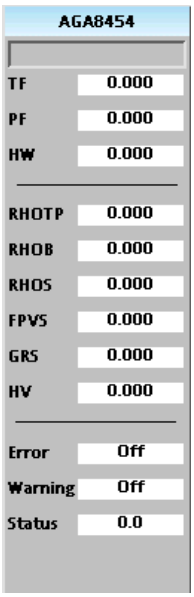
 Tab to other writable fields on the display.

Pushbuttons, signals and variables

This table shows the widgets that are simplest in appearance and function.

Example	Widget type	Function
	Analog Pushbutton	Push button to change displayed value.
	Digital Pushbutton	Push button to toggle displayed state.
	Analog Signal	Read-only shows value of analog signal. No actions.
	Digital Signal	Read-only shows state of a digital signal. No actions.
	Analog Variable	Touch value to edit.
	Digital Variable	Touch state to edit.

AGA8DL & AGA8GS



The Detail method (AGA8DL) uses the gas analysis of up to 21 components. From the gas analysis, the super-compressibility factor, gas density at flowing and standard conditions, and gas relative density at standard conditions are calculated for input into the AGA calculation for the meter type chosen. Used when accurate gas analysis is available either via an on-line gas analyzer or from laboratory measurements. The Detail method can handle up to 21 gas components typically found in natural gas. If this information is available, the Detail method is preferable, as accurate results are obtainable over a wider range of conditions than the Gross method.

The Gross method (AGA8GS) is used to approximate natural gas by treating it as a mixture of three components, equivalent hydrocarbon component, Nitrogen and Carbon Dioxide. It is typically used for dry, sweet (no H_2S) natural gas. There are two methods used: Gross Method 1 calculates the super-compressibility and gas density from knowledge of the relative density, heating value and carbon dioxide, hydrogen and carbon monoxide components. Gross Method 2 calculates the super-compressibility and gas density from knowledge of the relative density, Nitrogen, carbon dioxide, hydrogen and carbon monoxide components.

Table 28 AGA Parameters

Parameter	Description
TF	Temperature at flow in units selected by the UNITS configuration parameter.
PF	Pressure at flow in units selected by the UNITS configuration parameter.
HW	Differential pressure in the units selected by the UNITS configuration parameter. (Only required if the meter block is AGA3.)
RHOTP	Density at flow temperature and pressure conditions in units selected by the UNITS configuration parameter.
RHOB	Density at base conditions in units selected by the UNITS configuration parameter.
RHOS	Density at standard conditions in units selected by the UNITS configuration parameter.
FPVS	Super-compressibility factor
GRS	Real Gas relative density at 60 deg F/14.73 PSI $(M_{gas}*Z_{air})/(M_{air}*Z_{gas})$ where Z_{air} = .9995844 and M_{air} = 28.96256
HV	Heating Value in units selected by the UNITS configuration parameter.
ERR	On when calculation status is indicating an error condition. See Status.
WARN	On when calculation status is indicating a warning condition. See Status.
STATUS	Use the Status number to cross-reference the error or warning. See Table 29 AGA Error Codes.

Table 29 AGA Error Codes

Status number	Block type	Severity	Description
0	ALL	Good	OK – NO ERRORS OR WARNINGS ENCOUNTERED
1	AGA 8 - DETAIL	Error	PRESSURE HAS A NEGATIVE DERIVATIVE
2	AGA 8 - DETAIL	Warning	DENSITY IN BRAKET EXCEEDS MAXIMUM DEFAULT PROCEDURE USED
3	AGA 8 - DETAIL	Error	MAXIMUM ITERATIONS EXCEEDED IN BRAKET
4	AGA 8 - DETAIL	Error	MAXIMUM ITERATIONS IN DDETAIL EXCEEDED
5	AGA 8 - GROSS	Error	THE ROOT WAS NOT BOUNDED IN DGROSS
6	AGA 8 - GROSS	Error	NO CONVERGENCE IN DGROSS
7	AGA 8 - GROSS	Error	VIRGS SQUARE ROOT NEGATIVE
8	AGA 8 - GROSS	Error	COMBINED VALUES OF GRGR, X[2] AND HV NOT CONSISTENT
9	AGA 8 - GROSS	Error	INVALID TERM IN VIRGS
12	AGA 8 - GROSS	Error	FLOWING PRESSURE (PF) <= 0.0 PR > 1740.0 PSIA
13	AGA 8 - GROSS	Error	FLOWING TEMPERATURE (TF) < 14.0 OR > 149.0 DEG F

Status number	Block type	Severity	Description
14	AGA 8 - GROSS	Error	HEATING VALUE (HV) < 477.0 OR > 1211.0 BTU/FT^3
15	AGA 8 - GROSS	Error	GAS RELATIVE DENSITY (GRGR) < 0.55 OR > 0.870
16	AGA 8 - GROSS	Error	MOLE FRACTION FOR N2 < 0.0 OR > 0.50
			OR FOR CO2 < 0.0 OR > 0.30
			OR FOR H2 < 0.0 OR > 0.10
			OR FOR CO < 0.0 OR > 0.03
17	AGA 8 - GROSS	Error	REFERENCE TEMPERATURE < 32.0 OR > 77.O DEG F
18	AGA 8 - GROSS	Error	REFERENCE PRESSURE < 13.0 OR > 16.0 PSIA
22	AGA 8 - GROSS	Warning	FLOWING PRESSURE (PF) <=0.0 OR > 1200.0 PSIA
23	AGA 8 - GROSS	Warning	FLOWING TEMPERATURE (TF) < 32.0 OR > 130.0 DEG F
24	AGA 8 - GROSS	Warning	HEATING VALUE (HV) < 805.0 OR > 1208.0 BTU/FT^3
25	AGA 8 - GROSS	Warning	GAS RELATIVE DENSITY (GRGR) < 0.55 OR > 0.800
26	AGA 8 - GROSS	Warning	MOLE FRACTION FOR N2 < 0.0 OR > 0.20
			OR FOR CO2 < 0.0 OR > 0.20
			OR FOR H2 < 0.0 OR > 0.0
			OR FOR CO < 0.0 OR > 0.0
32	AGA 8 - DETAIL	Error	FLOWING PRESSURE (PF) < 0.0 OR > 40,000. PSIA
33	AGA 8 - DETAIL	Error	FLOWING TEMPERATURE (TF) < -200 OR > 760 DEG F
36	AGA 8 - DETAIL	Error	MOLE FRACTION FOR METHANE < 0.0 OR > 1.0
			FOR NITROGEN < 0.0 OR > 1.0
			FOR CARBON DIOXIDE < 0.0 OR > 1.0
			FOR ETHANE < 0.0 OR > 1.0
			FOR PROPANE < 0.0 OR > 0.12
			FOR WATER < 0.0 OR > 0.10
			FOR H2S < 0.0 OR > 1.0
			FOR HYDROGEN < 0.0 OR > 1.0
			FOR CARBON MONOXIDE < 0.0 OR > 0.03
			FOR OXYGEN < 0.0 OR > 0.21
			FOR BUTANES < 0.0 OR > 0.06
			FOR PENTANES < 0.0 OR > 0.04
			FOR HEXANES + < 0.0 OR > 0.10
			FOR HELIUM < 0.0 OR > 0.03
			FOR ARGON < 0.0 OR > 1.0
37	AGA 8 - DETAIL	Error	REFERENCE TEMPERATURE < 32.0 OR > 77.0 DEG F
38	AGA 8 - DETAIL	Error	REFERENCE PRESSURE < 13.0 OR > 16.0 PSIA
39	AGA 8 - DETAIL	Error	SUM OF MOLE FRACTIONS < 0.98 OR > 1.020
42	AGA 8 - DETAIL	Warning	FLOWING PRESSURE (PF) < 0.0 OR > 1750. PSIA
43	AGA 8 - DETAIL	Warning	FLOWING TEMPERATURE (TF) < 17 OR > 143 DEG F

Status number	Block type	Severity	Description
46	AGA 8 - DETAIL	Warning	MOLE FRACTION FOR METHANE < 0.45 OR > 1.0
			FOR NITROGEN < 0.0 OR > 0.5
			FOR CARBON DIOXIDE < 0.0 OR > 0.3
			FOR ETHANE < 0.0 OR > 0.1
			FOR PROPANE < 0.0 OR > 0.04
			FOR WATER < 0.0 OR > 0.0005
			FOR H2S < 0.0 OR > 0.0002
			FOR HYDROGEN < 0.0 OR > 0.1
			FOR CARBON MONOXIDE < 0.0 OR > 0.03
			FOR OXYGEN < 0.0 OR > 0.0
			FOR BUTANES < 0.0 OR > 0.01
			FOR PENTANES < 0.0 OR > 0.003
			FOR HEXANES + < 0.0 OR > 0.002
			FOR HELIUM < 0.0 OR > 0.002
			FOR ARGON < 0.0 OR > 0.0
49	AGA 8 - DETAIL	Warning	SUM OF MOLE FRACTIONS < 0.9999 OR > 1.0001
52	AGA 3 - ORIFICE	Error	FLOWING PRESSURE WAS <= 0.0 OR > 40000. PSIA
53	AGA 3 - ORIFICE	Error	FLOWING TEMPERATURE < -200. OR > 760. DEG F
55	AGA 3 - ORIFICE	Error	ORIFICE DIAMETER WAS >= 100.0 INCHES
56	AGA 3 - ORIFICE	Error	PIPE DIAMETER WAS >= 100.0 INCHES
57	AGA 3 - ORIFICE	Error	FLOWING OR STANDARD DENSITY WAS <= 0.0 LBM/FT^3
58	AGA 3 - ORIFICE	Error	DIFFERENTIAL PRESSURE WAS <= 0.0 INCHES H2O
65	AGA 3 – ORIFICE	Error	SUPERCOMPRESSIBILITY FACTOR WAS <= 0.0
66	AGA 3 – ORIFICE	Error	RELATIVE DENSITY AT STANDARD CONDITIONS WAS < 0.07 OR > 1.52
68	AGA 3 – ORIFICE	Error	COMPRESSIBILITY FACTOR AT STANDARD CONDITIONS <= 0.0
69	AGA 3 – ORIFICE	Error	BETA RATIO (DO/DM) <= 0.0 OR => 1.0
75	AGA 3 – ORIFICE	Warning	ORIFICE DIAMETER WAS < = 0.45 INCHES
76	AGA 3 – ORIFICE	Warning	PIPE DIAMETER WAS <= 2.0 INCHES
77	GENERAL CONFIG	Error	ERROR INVALID COMPANION BLOCK INTERCONNECTION
78	GENERAL CONFIG	Error	METER/COMPRESSIBLITY BLOCK UNITS ARE INCONSISTENT
79	AGA 3 - ORIFICE	Warning	BETA RATIO (DO/DM) WAS < 0.1 OR > 0.75
99	GENERAL OPERATION	N/A	Block is disabled – process value outputs are set to 0 and error/warning pins are turned off.

AGA Detail Gas Components

Accessed from the AGA8 Detail widget, this display shows the values of the 21 gas components and other setup parameters. You can edit the local values here.

Item	Description
Active Gas Component Values	Local values: Uses Local Values of gas components. Remote values: Uses the block's Remote Values (input pin values from an online analyzer).
Override Range Error	Under certain situations, the gas component values may exceed the expanded range recommended by the AGA 8 Report. In Override mode a flow rate will be calculated. It should be noted that calculated flow rates for conditions where the expanded range is exceeded are outside of the recommended uncertainty values for AGA 8 calculations.
Sum of New Local Values	When you edit the New Local Values this shows the sum of all 21 values. Values must total 1.0 (100%).
Gas Component	This column lists the 21 gas components.
Local Values	This column lists the local value of each component.
Remote Values	This column lists the remote value of each component (via the AGA block input).
New Local Values	This column lets you enter new local values. Values must total 1.0 (100%). After entering new values, Apply New Local Values.
Apply New Local Values	Select to transfer the New Local Values to the Local Values. These values do not take effect unless Active Gas Component Values is set to Local Values, above.

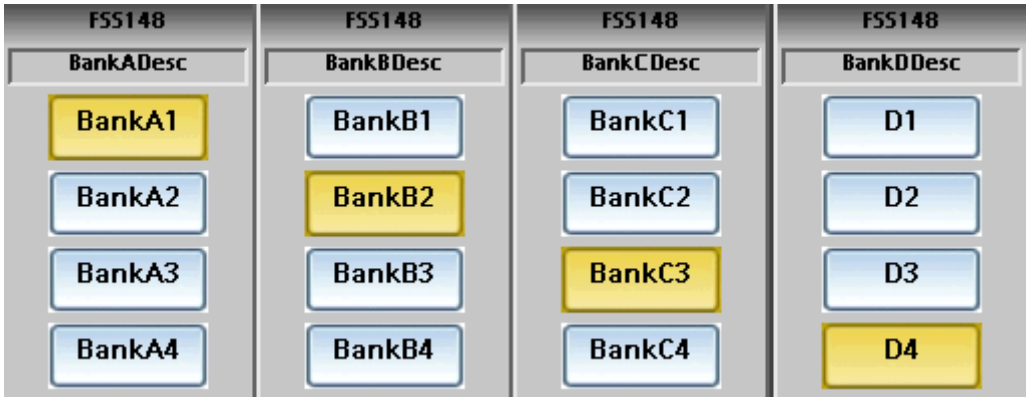
AGA8 Gross Setup

Accessed from the AGA8 Gross widget, this display shows the values of the 4 gas components and other setup parameters. You can edit the local values here.

Item	Description
Active Gas Component Values	Local values: Uses Local Values of gas components. Remote values: Uses the block's Remote Values (input pin values from an online analyzer).
Override Range Error	Under certain situations, the gas component values may exceed the expanded range recommended by the AGA 8 Report. In Override mode a flow rate will be calculated. It should be noted that calculated flow rates for conditions where the expanded range is exceeded are outside of the recommended uncertainty values for AGA 8 calculations.
Gross Method Used	Method 1 calculates the super-compressibility and gas density from knowledge of the relative density, heating value and carbon dioxide, hydrogen and carbon monoxide components. Method 2 calculates the super-compressibility and gas density from knowledge of the relative density, Nitrogen, carbon dioxide, hydrogen and carbon monoxide components.
Setup for Method 1&2	
Relative Density	Gas Relative Density
Relative Density Ref Temperature	Relative density reference temperature in units selected by the UNITS configuration parameter.
Relative Density Ref Pressure	Relative density reference pressure in units selected by the UNITS configuration parameter.
Setup for Method 1 Only	
Heating Value	Heating value in units selected by the UNITS configuration parameter.
Calorimeter Ref Temp	Calorimeter reference temperature in units selected by the UNITS configuration parameter.
Calorimeter Ref Pres	Calorimeter reference pressure in units selected by the UNITS configuration parameter.
Combustion Ref Temp	Combustion reference temperature in units selected by the UNITS configuration parameter.
	continued

Item	Description
Gas Component Values	
Gas Component	This column lists the 4 gas components. Each of the 4 gas component fractions is configured with either a constant fraction value derived from a lab report (local) or from an on-line gas chromatograph (remote).
Local Values	This column lists the local value of each component.
Remote Values	This column lists the remote value of each component (via the AGA block input).
New Local Values	This column lets you enter new local values. Values must total 1.0 (100%). After entering new values, Apply New Local Values.
Sum of New Local Values	When you edit the New Local Values this shows the sum of all 4 values. Values must total 1.0 (100%).
Apply New Local Values	Select to transfer the New Local Values to the Local Values. These values do not take effect unless Active Gas Component Values is set to Local Values, above.

4-Selector Switch



This display has four banks of functions (A, B, C, D). Each function has 4 buttons that act as a 4-position rotary switch, with one and only one state in effect at any time for that function.

To operate, press the desired state button for each function. When pressed, the buttons turn yellow to indicate the selected state.

Device Control

The Device Control function block is normally used to control pumps. Based on certain events the device will be placed into the appropriate state.

Table 30 Device control display details

Item	Description
State	READY, PRESTART, STARTING, RUNNING, STOPPING, DISABLED, or FAILED. READY (off state) is the initial state of the block. See Table 31 Device states.
Seconds	Current Timer value. READ ONLY – Counts down to zero. • The Start Delay Timer is active in the Prestart state • The Stop Delay Timer is active in the Stopping state • The Feedback timer is active in the Starting state while the Feedback input pin is OFF. • The Feedback timer is active in the Running state (if the Feedback input turned on in the starting state.)
Run Request	Green when device is requested to be put in the Starting or Running state.
Active	Green when state is Running or Stopping.
Failed	Red when the control is in the Failed state (the controlled device reported a failure or did not start up in time; device is being monitored for a manual or automatic reset).
Reset	Select to reset the control when it is in the FAILED state to return it to the READY state.

Table 31 Device states

MONITORED EVENTS	DEVICE STATES						
	READY (Note 1)	PRE-START	STARTING	RUNNING	DISABLED (Notes 1,2)	STOPPING	FAILED
Run Request turns ON	X					X	
Run Request turns OFF		X	X	X			
Disable (ON)	X	X	X	X		X	
Disable (OFF)					X		
Feedback from Device			X	X			
Device (ERR) Fail ON	X		X	X		X	
Device (ERR) Fail OFF							X Note 3
Reset (Rising Edge)							X
Start Delay Timer Expires (edge)		X					
Feedback Timer Expires (edge)			X	X			
Stop Delay Timer Expires (edge)						X	

Note 1: If a device fails while in the state of READY or DISABLE, the device failure is not recognized until the control goes into the PRESTART state.

Note 2: There are restrictions when the control goes into the Disable state from the Running State. The device is immediately turned OFF without a Stop Delay. When the disable turns OFF, the control changes to the Ready state.

Note 3: ERR Off (device fail) is monitored in Failed state, only if a) failed input caused the failure, and b) Auto Reset is enabled.

Device Control Setup

Touch the blue title bar to access the setup display.

Item	Description
START DELAY	Current start delay time in seconds
STOP DELAY	Current stop delay time in seconds
FEEDBACK FAIL DELAY	Current feedback fail delay time in seconds

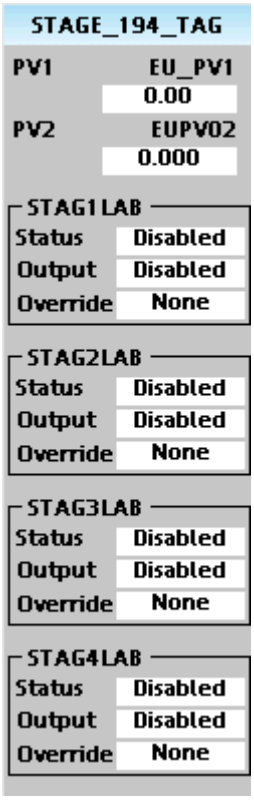
Hand/Off/Auto Switch

The Hand – Off – Auto (HOA) switch permits state change requests. The block states are: Hand (manual operation from an operator interface), Auto (default – requests are operated automatically), or Off (relay to be switched to Bypass, Hand, or Auto), or Bypass (external manual operation of a device).

The HOA switch is also used with the Device Control function block to comprise a Pump Control algorithm which is used to manipulate the state of a controlled device (pump).

Item	Description
Feedback state	State of the feedback signal. If connected to a Device Control block, this shows the status of the device. See Table 31 Device states on page 99. When the HOA block is used in conjunction with a Device Control block, the feedback is typically referenced to the (STI) status output pin of the Device Control block.
Current state indicator	The rotary dial and yellow button indicate the selected state (Hand, Off, Auto. Use buttons to change state. If the current state is BYPASS, any requests to change the state are ignored.

Stage



The Stage function block provides differential On/Off control and is typically used to monitor pressure and flow for controlling pumps and operating valves.

There are four individual stages grouped together in the function block. The block monitors from one to two analog inputs (PV1, PV2) which are common to all four stages, compares them for each stage by a configurable comparator, and provides On/Off control outputs for the four stages based on configurable setpoints for each stage. Each stage can be individually enabled and forced ON or OFF.

Item	Description
PV1	PV1 input pin of the function block (pressure)
PV2	PV2 input pin of the function block (flow)
Status	Enabled = stage is enabled. Disabled = stage output is off. This condition overrides the Override status. When Status = Enabled the stage algorithm is reevaluated to determine the state of Output (request).
Output	Output of the stage. Off, On, or Disabled.
Override	Override On input pins and Override Off input pins of the function block. None, On, or Off.

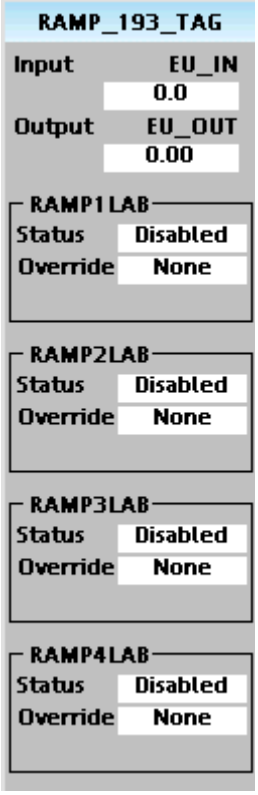
Stage setup display

Touch the blue title bar to open the setup display and edit parameters for each stage.

Table 32 Stage setup details

Item	Description
ON delay time	Delay prior to latching the output ON
OFF delay time	Delay prior to latching the output OFF
ON Compare: Setpoint	Setpoint used with ON comparator – No range limit
OFF Compare: Setpoint	Setpoint used with OFF comparator – No range limit
Interlock with Prev Stage	Set to YES to prevent a stage's output from turning ON until the previous stage has turned ON.
Interlock with Next Stage	Set to YES to prevent a stage's output from turning OFF until the output of the next stage in sequence has turned OFF.

Ramp



The Ramp function block is typically used for variable speed, valve position, and chemical feed control applications to reduce the output value as more external devices are enabled.

For example, if one pump is running at 100 % and a second pump is enabled, the output value may be re-scaled to 50 % by the pump 2 enable signal.

The ramp block references an analog signal, and using four separate scales multiplexed together, provides a single analog output over a programmed range.

Table 33 Ramp operator display details

Item	Description
INPUT	PV input pin of function block
OUTPUT	Output pin of function block
STATUS	Enable (YES) or Disable (NO) of the ramp.
OVERRIDE	OFF, LOW, or HIGH – Override status of each ramp input pin.

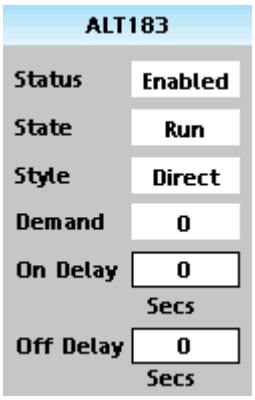
Ramp setup display

Touch the blue title bar to edit the parameters for each ramp.

Table 34 Edit ramp display details

Item	Description
OUT SCALE HIGH	High output limit after rescale. Range: Full scale +/– within PV range limits.
OUT SCALE LOW	Low output limit after rescale. Range: Full scale +/– within PV range limits.
IN HIGH LIMIT	Input high limit value applied to the PV after signal lag. Range: Full scale +/– within PV range limits.
IN LOW LIMIT	Input low limit value applied to the PV after signal lag. Range: Full scale +/– within PV range limits.

Alternator



The Alternator is typically used to alternate the starting sequence of a group of pumps, valves, filters, etc. Each block accepts up to 16 inputs and controls up to 16 outputs.

There are four unique alternation styles used to control the output starting sequence so that you can limit the amount of repeat or continuous usage of a single device (pumps, valves, etc.). If an output device fails, or has been disabled, then an alternate device will be used in order to meet the requested demand. You may specify the alternators active outputs and the order in which the outputs are manipulated.

Item	Description
Status	OK, DISABLED, or HIGH
State	OFF or RUN
Style	ROTARY, FOFO, FIXED, or DIRECT NOTE: If the current style is DIRECT, the OUT number corresponds to the Input sequence that requests the OUT to turn ON. With any other style, the OUT number corresponds to the number of IN's (DMND) that need to be ON to turn the OUT on.
Demand	Input count, between 0 and 16
On Delay (Sec)	Delay time used before turning ON the next output in the sequence. Range: 0-99999 seconds
Off Delay (Sec)	Delay time used before turning OFF the next output in the sequence. Range: 0-99999 seconds

Alternator Setup display

Touch the blue title bar to edit the setup parameters.

Item	Description
Input Status	On or Off.
Output Status	Blank – Normal operating output (no designation) DNR – Device Not Ready (see Alternator Operator display for example)
Output Sequence	Integer between 0 and 16 “0” indicates the output is not in the Output sequence.
Advance	Advances the output sequence. Not available for style DIRECT.
Edit	Select to edit the sequence. See Alternator Edit Setup.

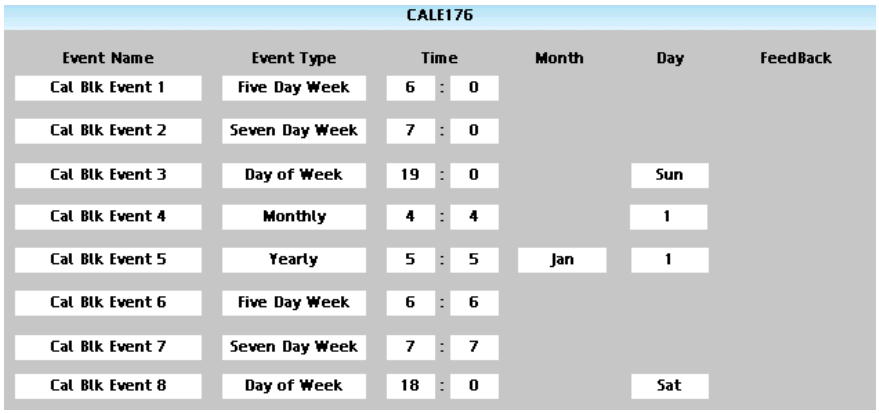
Alternator Edit Setup display

Item	Description
Make/Break	MAKE – (Make before Break) Next output in the sequence is activated before deactivating an output. BREAK – (Break before Make) The output is removed before advancing the sequence and activating the next output. MAKE/BREAK is READ ONLY.
Max Out	Maximum number of outputs used.

Item	Description
Style	A style is a method used to control the cycling of the 16 outputs. If different style is selected, the change will not occur until all outputs are in the OFF state. DIRECT: Monitors up to 16 inputs and maps them, using the user adjustable map order on the Output tab, directly to the outputs. If the Inputs selected are 1, 2, 3, 4, 5, 6 and the Output order mapped is 6, 3, 4, 1, 5, 2; when Input 3 is activated, Output 4 is enabled; or if Input 1 is activated then Output 6 is enabled. ROTARY: Uses the sum of the 16 inputs that are set to ON to determine the required demand for outputs. The output order is managed in a Last ON/First OFF basis (LOFO). If the Inputs selected are 1, 2, 3 and the mapped sequence is 1, 2, 3 the alternator sequence changes when NO outputs (pumps) are required or there is a request to Advance (see Advance). Depending on the capacity required, Outputs 1, 2, 3 come on in order. When the demand falls, Output 3 goes OFF, then Output 2, then Output 1. When Output 1 turns off, the Rotary sequence advances and Output 2 starts the next cycle. If an input pin is set to "not available", then that output is forced to OFF and the next available output in the mapping order is turned ON. If the previously bypassed output later becomes enabled, then it will not be used until the demand increases. FOFO Uses the sum of the 16 inputs that are set to ON to determine the required demand for outputs. The output order is managed in a First ON/First OFF basis (FOFO). If 3 Inputs are ON (no mapping), the Alternator sequence changes (first one in the list moves to the end of the list) as the inputs turn OFF or, when there is a request for Advance (see Advance). If an input pin is set to "not available", then that output is forced to OFF and the next available output is turned ON. If the previously bypassed output later becomes enabled, then it will not be used until the demand increases. FIXED Uses the sum of the 16 inputs that are set to ON to determine the required demand for outputs. The output order is managed in a FirstON/First OFF basis (FOFO). If the Inputs selected are 1, 2, 3, 4 and you map a fixed sequence 4, 2, 3, 1 the sequence will not change unless you select the Advance feature (see Advance). It takes a direct command (OFF to ON signal) before the output order map rotates to the 2, 3, 1, 4 sequence. If an output pin is not available then that output is forced OFF and the next available output in the mapping order is turned ON. If the previously bypassed output later becomes enabled, then it will not be used until the demand increases.
Input Status	On or Off.
Output Status	Blank – Normal operating output (no designation) On or Off.

Item	Description
Output Sequence	Integer between 0 and 16 “0” indicates the output is not in the Output sequence. Examples of reasons to change it include: • If you are having trouble with a motor or pump (e.g., a bearing is going bad) and you want to limit the amount of time it is used. • If you have 3 motors and one uses more electricity than another, you may want to use two small motors first before you use the one large motor. This could be handled by changing the sequence. • Taking a pump out of service for maintenance. After editing, save the output sequence.

Calendar Event



The Calendar Event compares user-entered time-and-date setpoints to the real-time clock to generate digital Event outputs. These Event outputs can be integrated into a control strategy to activate time-synchronized activities. For example, the Event outputs can be used to schedule when to turn lights on and off in an office building. Each Calendar Event block supports up to eight Event outputs.

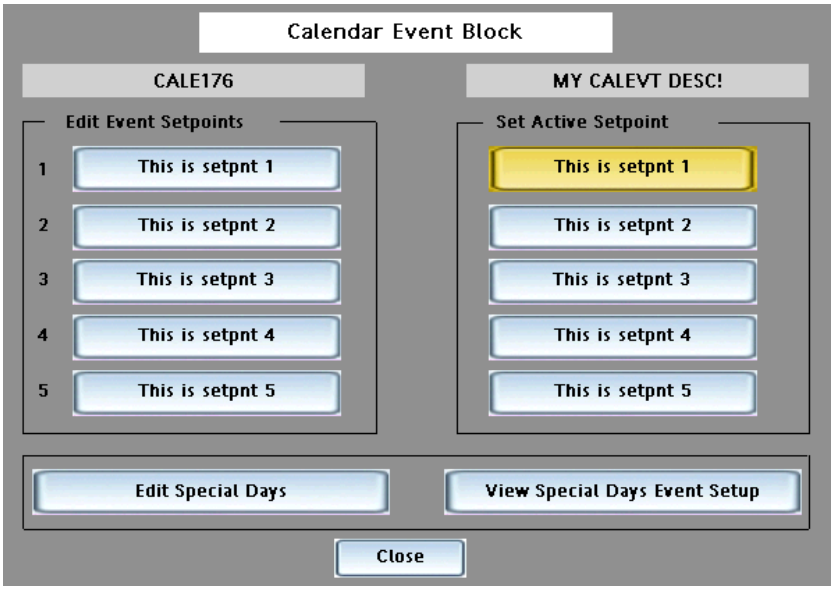
In addition, the block allows you to configure up to five sets of time-and-date setpoints, called Setpoint Groups. These Setpoint Groups can be used to activate different sets of time-and-date setpoints to handle different conditions. Using the example of office building lights, Setpoint Groups can be used to activate a different set of time-and-date setpoints for each season of the year (Spring, Summer, Fall, and Winter). Each Calendar Event block supports five Setpoint Groups. The screen shown above is an example of one of these Setpoint Groups. You can select which Setpoint Group is in effect; the values in each column will change according to the Setpoint Group you select. Each Setpoint Group is editable.

The block also allows you to configure up to 16 Special Days. On these Special Days the Calendar Event Block will override its normal Event processing for a 24-hour period. For example, you can configure selected Event outputs to remain off on designated holidays.

Item	Description
Event Name	The names assigned to Events 1 through 8.
Event Type	The configured Event Type for Events 1 through 8. Choices: DISABLE – The Event is Disabled 5 - DAY – The Event will occur at the same time Monday through Friday. 7 - DAY – The Event will occur at the same time every day of the week, Sunday through Saturday. DAY OF WEEK – The Event will occur once a week at the configured time. MONTHLY – The Event will occur once every month at configured date and time. YEARLY – The Event will occur once a year at the specified date and time.
Time/Month/Day	This is the currently active time-and-date Setpoint value for Events 1 through 8.
Feedback	The value of the Feedback Signal for Events 1 through 8. The assignment of a feedback signal is optional. If no feedback signal is assigned this column of the display will be blank.

Calendar Event Block Menu

Touch the blue title bar to access the the top-level menu for the Calendar Event Block, below.



From here you can access the buttons that will allow you to edit Event Setpoints, select the active Setpoint Group, and view or edit Special Days.

Item	Description
Edit Event Setpoints	Select the Setpoint Group you wish to edit. See Edit Event Setpoints.
Set Active Setpoint	This shows the five Setpoint Group buttons. The currently active Setpoint Group is highlighted in yellow. Touch any button to activate a different Setpoint Group.
Edit Special Days	Select this to edit one of the 16 Special Days.
View Special Days Event Setup	Select this item to see how the Events will behave when a Special Day occurs (see page 112).

Edit Event Setpoints

This menu allows you to edit the setpoints within a Setpoint Group.

Item	Description
Event Name	Configured name for each event. Read only.
Event type	Configured Type for each Event. Read only. DISABLE – The Event is Disabled. 5 - DAY – The Event will occur at the same time Monday through Friday. 7 - DAY – The Event will occur at the same time every day of the week, Sunday through Saturday. DAY OF WEEK – The Event will occur once a week at the configured time. MONTHLY – The Event will occur once every month at configured date and time. YEARLY – The Event will occur once a year at the specified date and time.
Hours	Select a value between 0 and 23. This menu item will not appear if the configured Event Type is DISABLE.
Minutes	Select a value between 0 and 59. This menu item will not appear if the configured Event Type is DISABLE.
Month	Select a Month of the Year. This menu item will only appear when the configured Event Type is MONTHLY.
Day	This menu item will only appear when the configured Event Type is MONTHLY, YEARLY, or DAY OF WEEK. When Event Type = YEARLY or MONTHLY, Select a value between 1 and 31. When Event Type = DAY OF WEEK, select a value between Sunday and Saturday. When Event Type = MONTHLY, entering a value of “31” means “the last day of the month”, even for months with less than 31 days.

Set Active Setpoint Group

The currently selected button is highlighted yellow. Select any group to activate it. The button will turn yellow and the selected setpoint group will be displayed on the main widget.

Edit Special Days

This menu allows you to edit any of the 16 Special Days. Note that the word “OFF” will be displayed in place of the Month and Day when the Special Day is disabled.

Item	Description
MONTH	Select a Month of the Year (or a value of OFF to disable the Special Day).
DAY	Select a value between 1 and 31 (or a value of OFF to disable the Special Day).
	Note: If either the MONTH or the DAY has a value of OFF, the Special Day is disabled. Both the MONTH and the DAY must be set to a legal value to activate a Special Day.

View Special Days Event Setup

The Calendar Event Block can be configured to override its normal Event processing when any of the 16 Special Days occurs. This override will remain in effect for the 24-hour period associated with the Special Day. This feature can be used to force selected Event outputs to remain off on designated holidays, for example.

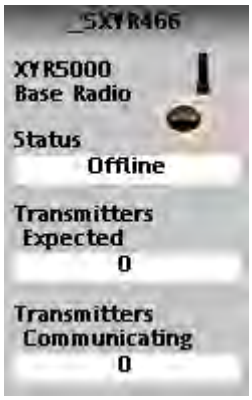
This display allows you to see how the eight Event outputs will behave when a Special Day occurs.

Item	Description
Event Name	Name of Events 1 through 8
Setpoint Handling	This title is displayed when the Special Day Mode is configured as “Use Alternate Event Times”
Alternate Setpoint	Displays the Alternate Setpoint Times (Hours:Minutes). This information will only appear if the Special Day Mode is configured as “Use Alternate Event Times”.

Special Day Mode	Event output behavior
Disable Output	The Event output is disabled on Special Days (for the entire 24 hour period).
Use Alternate Setpoint	On Special Days, the Event output will trigger at the Alternate Setpoint Time shown on this display.
Normal	The behavior of the Event output is not overridden on Special Days. The Event output will trigger the way it normally triggers, based on the configuration of the currently active Setpoint Group.

Wireless transmitters

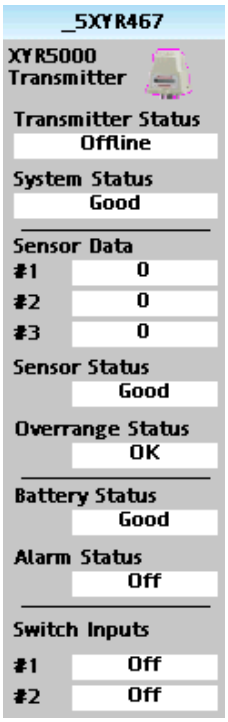
XYR5000 Base Radio



This read-only widget allows the HC900 controller to act as a Modbus master device and communicate with XYR5000 base radios via the serial port of the controller. For attached transmitters there is a separate XYR5000 transmitter widget which is connected to the base radio block via the address output.

Item	Description
Status	Last read value of base radio. Offline or Online.
Transmitters expected	Number of Expected Transmitters communicating to the base station.
Transmitters communicating	Number of Transmitters actually communicating with the base radio.

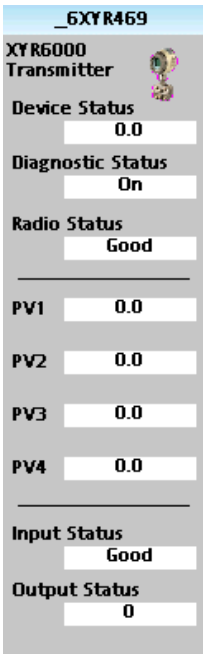
XYR5000 Transmitter



Item	Description
Transmitter status	Transmitter online status. Online or offline.
System status	System error condition. Error or Good.
Sensor #1 Data	Primary Sensor Value.
Sensor #2 Data	Secondary Sensor Value.
Sensor #3 Data	Tertiary Sensor Value.
Battery Status	Low or Good.
Alarm Status	On or Off
Overrange Status	Sensor over range condition. Over range or OK.
Sensor Status	Error or Good.
Switch Input #1	On or Off
Switch Input #2	On or Off

Touch the blue title bar to open the XYR5000 Transmitter Setup display. This shows the Square root of primary Differential Transmitter output status: On or Off.

XYR6000 Transmitter



Five parameters—PV1, PV2, PV3, PV4 and Device Status—are read from the XYR6000 transmitter.

Item	Description
Device status	Transmitter online status. Online or offline.
Diagnostic status	System error condition. Error or Good. When status is Error, press the blue title bar to see the details of diagnostics. • Battery: Low or Good. • External power: Error or Good • Electrical: Error or Good. • Mechanical: Error or Good • Configuration: Error or Good • Calibration: Error or Good • Memory: Error or Good • Firmware: Error or Good • Watchdog Timer: Error or Good
Radio status	Error or Good
PV1, PV2, PV3, PV4	Value of each Process Variable
Input Status	Error or Good
Output Status	Error or Good

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VARIABLE RECIPES

Overview

Description

A Variable Recipe is a list of Grouped Variables that define the values (ingredient quantities) needed to make a product or run a particular batch. The items represent Analog and/or Digital Points that were assigned in the Function Block Configuration and are identified by their Variable Names. Variable Recipes have these basic attributes:

Recipe Number - A unique number assigned for each recipe that is configured. Numbers are assigned during configuration or through an upload/download operation. They may have been assigned in any sequence with gaps between numbers, but no two recipes can be given the same number.

Recipe Name - A descriptive name assigned to the recipe consisting of letters or numbers with no spaces, up to 8 characters.

Recipe Description – Additional text used to identify the recipe, up to 16 characters.

Recipe Variables - A list of Variables and their values for each recipe, up to 50 variables each.

Variable Recipe Load vs. Variable Recipe Upload/Download

Recipes are stored in the memory of the HC900 controller in a recipe pool. Variable recipes may be read (uploaded) from the pool into the displays of the operator interface where they may be viewed, edited, exported and duplicated before being returned (downloaded) to the recipe pool of the controller. (see Uploading and Downloading Recipe Files in a previous section)

Once the variable recipe is in the controller's recipe pool, a Variable Recipe Load widget is used from the operator interface to select a recipe from the pool and have its values transferred to the various analog and digital variables in the controller's configuration. See Figure 8.

NOTE: *The contents of the variable recipe cannot be edited from the recipe selection widget. For editing, the recipe must be uploaded, modified, then downloaded to the controller.*

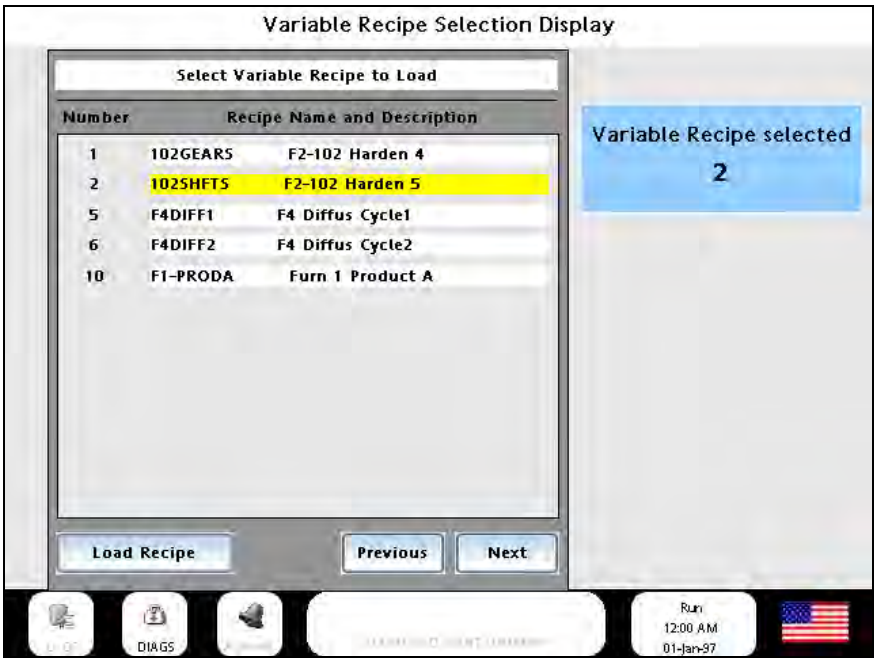


Figure 8 Variable Recipe Selection Display

To transfer the values of a variable recipe from the recipe pool of the controller to the various analog and digital variables in the controller configuration, touch the desired recipe on the display, a yellow highlight will verify your selection, then press the LOAD RECIPE button on the display widget.

Hint: When making variable recipes, users may wish to include a variable that will be used to identify the recipe number. The value of this variable may then be added to the Variable Recipe Load display to receive verification that the desired recipe operation has been executed in the controller. See Figure 8

Setpoint Programmers

Overview

Description

A setpoint programmer supplies a time-varying setpoint to a control loop. A program contains multiple segments; each segment can be a ramp or a soak and has digital switches called “events.” This menu lets you edit setpoint program segments, segment events, or other parameters and save the changes to the controller’s memory.

Each program contains multiple segments. Each segment of the program may be a ramp or soak except the last segment must be a soak.

Multiple programs can be running concurrently. Programmers can run any of the profiles in controller memory. Once loaded from memory into the Setpoint Programmer (SPP) function, these profiles are referred to as “programs.” Any program can be edited and saved as a profile in one of the “slots” in the controller’s memory.

In addition to the main output value, a second analog value is available for each step of the program. This output is a fixed soak value, which may be used as an input to another function or to provide a setpoint value for a secondary control loop in the process.

A Setpoint guarantee function (known as guaranteed hold) is provided that holds the program if a process variable exceeds a predefined deviation from setpoint. Selections allow setpoint guarantee to be active for the entire program, for soak segments only, or for user specified segments.

Up to 3 Process Variables may be configured as inputs to the block for setpoint guarantee.

The program may be changed (with some exceptions) from the current state to a new state by the operator as well as by inputs to the SPP block. Table 35 lists the resulting states.

Table 35 SPP inputs and current state

Input	Current State				
	READY	**HOLD**	**RUN**	**GHOLD**	**STOP**
RESET	READY	READY	RUN	READY	READY
HOLD	HOLD	HOLD	HOLD	HOLD	STOP
RUN	RUN	RUN	RUN	GHOLD	STOP
GHOLD	READY	HOLD	GHOLD	GHOLD	STOP

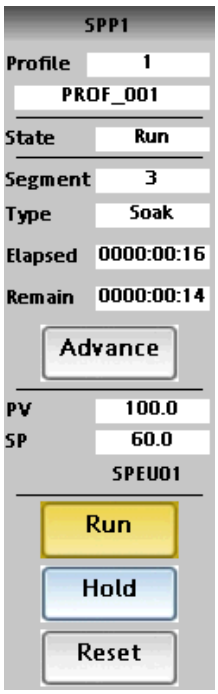
With regard to changing program state, if more than one function block input is on in the same execution cycle, RESET has priority over HOLD and RUN, and GHOLD has priority over RUN.

Also, function block inputs will override inputs from the Control Station, which occur during the same execution cycle. Finally, state changes from the Control Station are processed on the basis of the “last change wins.”

Setpoint Programmer Overview widgets

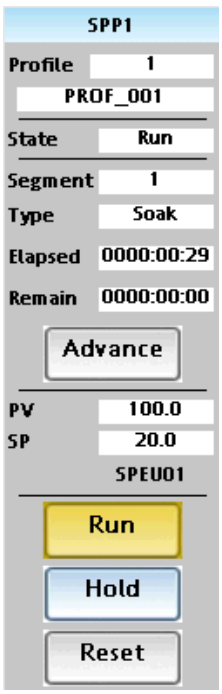
Setpoint Programmer data is displayed on the Setpoint Programmer widgets.

Setpoint Programmer



Shows status of the Setpoint Programmer's current profile. Use buttons to advance to next step, run, hold, or reset.

Setpoint Programmer with jump



Shows status of the Setpoint Programmer's current profile. Use buttons to advance to next step, run, hold, or reset. Touch blue title bar to jump to SPP Operate display.

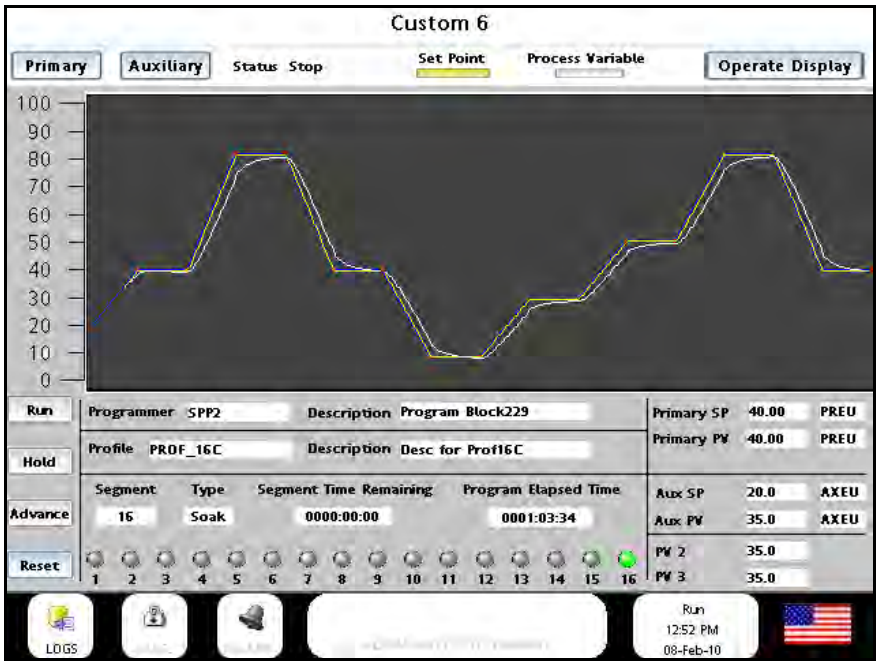
Table 36 Setpoint Progammer Overview widget features

Item	Description
Title	Name of the selected programmer block. Touch the blue title bar (if available) to jump to the SPP Operate display. See page 122.
Profile number	Location of this profile in controller RAM.
Profile name	Name of the selected profile.
State	READY: Profile is at the beginning of segment and is ready to run. All events are OFF. HOLD: Profile is paused at the setpoint value shown. RUN: Profile is executing normally. GHOLD: Profile is paused because of excessive deviation. STOP: Profile has reached the end of the last segment. DISABLE: Profile is prevented from starting until the programmer disable control is ON.

Item	Description
Segment	Current segment
Type	Type of current segment: ramp or soak
Elapsed	Time elapsed in the segment
Remain	Time remaining in the indicated segment
Advance	Push button to cause the program to jump to the next segment. When the program is already in the last segment, the advance request is ignored. Programs cannot be advanced to the first segment. Current state must either READY or HOLD.
PV	Value of Process Variable.
SP	Value of setpoint.
Units	Engineering units of the setpoint.
Run	Touch to start a program that is in HOLD or READY state.
Hold	Touch to put program in HOLD.
Reset	Touch to reset a HOLD or STOP program to the first segment. Any edits made to the program are lost unless they were SAVED. See SAVE on the display.

Setpoint programmer – Pre Plot Display

Go to **Home** page > **Custom Display**.

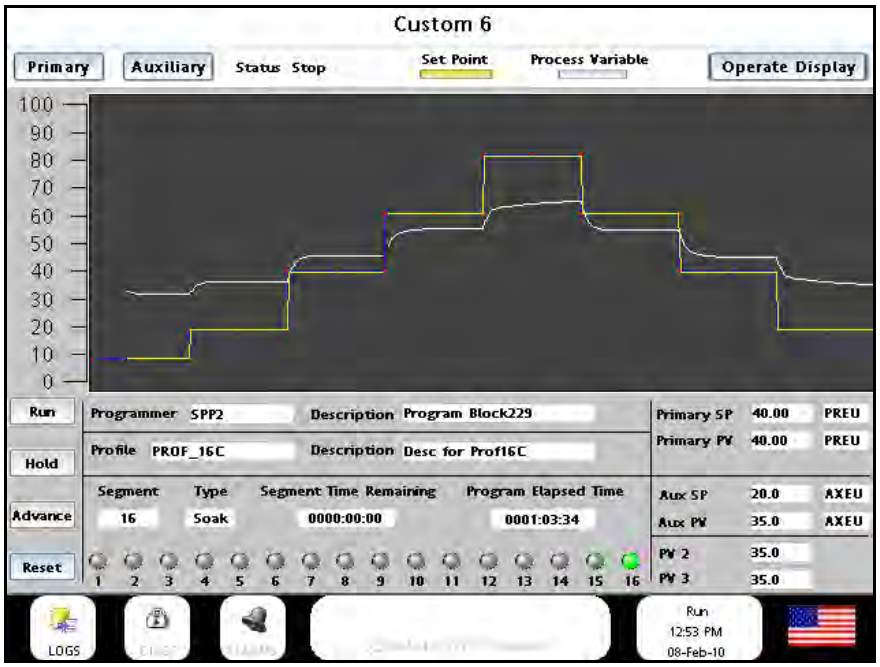


General Description

- This display graphically indicates a user's ramp and soak profile for a Setpoint Programmer function block. When the associated Setpoint Programmer function block is running, Process Variable # 1 input (PV1) of the associated function block is plotted against the pre-plot of the Setpoint Profile.
- To supplement the Setpoint profile pre-plot, the display contains the following buttons and information:
  - Setpoint Programmer Function Block tag Name and Description
  - Setpoint Profile recipe name and Description
  - Current Segment number
  - Current segment Type (Ramp/Soak)
  - Segment Time Remaining
  - Program Elapsed Time
  - Buttons used to Run, Hold, Advance and Reset a Programmer
  - Status of the Setpoint Programmer Events (1-16)
  - Current Primary SP value
  - Current Primary PV value
  - Primary PV Engineering Units
  - Current Auxiliary SP Value
  - Current Auxiliary PV Value

- Auxiliary PV Engineering Units
- Current PV2 value
- Current PV3 value
- Primary button to select Primary PV graph
- Auxiliary button to select Auxiliary PV graph
- Setpoint Programmer current Status
- Set Point indicator to indicate color of Setpoint plot
- Process Variable indicator to indicate color of Process Variable plot
- Operate Display button to navigate to associated Setpoint Programmer Operate Display

➢ As shown below a second pre-plot indicates the profile of the SPP Auxiliary Setpoint output profile (soaks only). The SPP Process Variable # 4 input (PV4) is plotted against the Auxiliary Setpoint output pre-plot graph.



Setpoint Programmer Pre-Plot Graph attributes

1. The content of the pre-plot graph is determined by reading the profile content of the Setpoint Programmer function block. Time is presented on the X axis and the SP value is presented on the Y axis of the graph.

2. The amount of time contained within the pre-plot graph is determined by:

   a) The number of user programmed segments in the profile (The user may use from 2 to 50 of the available segments for his program.)

   b) The time units specified for the profile (minutes or hours)

c) The sum of the amount of time specified for each segment of the profile (Note: setpoint ramps may be programmed in units of time (hours or minutes) or by Rate and values (e.g. ramp from 100 to 500 at 450 units per hour.)

3. The Y axis limits (SP) for the graph are entered by the user in Station Designer at the time of display configuration.

4. The SP limits and intermediate values are presented on the left edge of the pre-plot graph.

5. The pre-plot graph presents the entire contents of the setpoint profile on a single display graph.

6. The color of the pre-plot trend line is alterable by the user. The default color shall be yellow.

7. When a Setpoint Programmer is reset, the pre-plot is re-drawn using the Setpoint Programmer profile content.

8. The pre-plot profile is re-drawn following an on-line edit of the profile.

Process Variable Trend Plot attributes

1. Process Variable #1 of the Setpoint Programmer function block is plotted on the same graph as the Setpoint pre-plot.

2. The Process Variable plot uses the time units determined by the Setpoint profile pre-plot.

3. PV plotting on the graph begins when the Programmer is placed in the Run mode.

4. The Process Variable trend stops plotting when the Setpoint Programmer is in the Hold mode and resumes when returning to the Run mode from the Hold mode.

5. The Process Variable plotting stops when the programmer is in the Stop mode.

6. The Process Variable plot remains on the graph until the Setpoint Programmer is Reset.

7. Once started, the Process Variable plotting continues in the background if another display is accessed. (Allows the user to periodically check the program progress while viewing and operating his process from other displays of the interface.)

8. The color of the PV trend line is user selectable. The default color shall be Aqua.

Special cases and actions

1. Recycle – A Recycle of a Setpoint Programmer is pre-determined by the user as part of his profile. A Recycle is when the program exits one segment, but before entering the next segment, it returns to the start of a previous segment and duplicates a portion of the profile. The user can specify the number of times he would like the program to recycle before continuing to the end of the program. If the recycle quantity is set to zero, the recycle quantity is infinite and the program will recycle until reset.

Following a Recycle event, the Process Variable plot is cleared and redrawn. The PV plot starts plotting from the beginning of the start recycle segment. The PV plot (line) leading up to the recycle event is plotted on the graph to the left of the new start location on the graph.

2. Jog – A jog of the setpoint program is initiated by a digital input to the Setpoint Programmer function block. The setpoint program will immediately go to the start of the Jog-to segment when the digital input turns ON. The Jog-to segment is determined by the user when creating his ramp/soak profile. The Jog-to segment can cause the program to go to a higher or lower segment number from its current segment.

Following a Jog-to event, the Process Variable plot starts plotting from the beginning of the Jog-to segment.

3. Advance – Advance is an action that can be initiated manually from the SPP user interface or from the control strategy via a digital input to the SPP function block. The Setpoint Programmer must be in the Hold state to accept an Advance input. Advance is a single shot action and each rising edge of the input will cause the program to advance one segment through its sequence. Advance may be used through multiple actions to completely cycle through a program and restart at a previous segment.

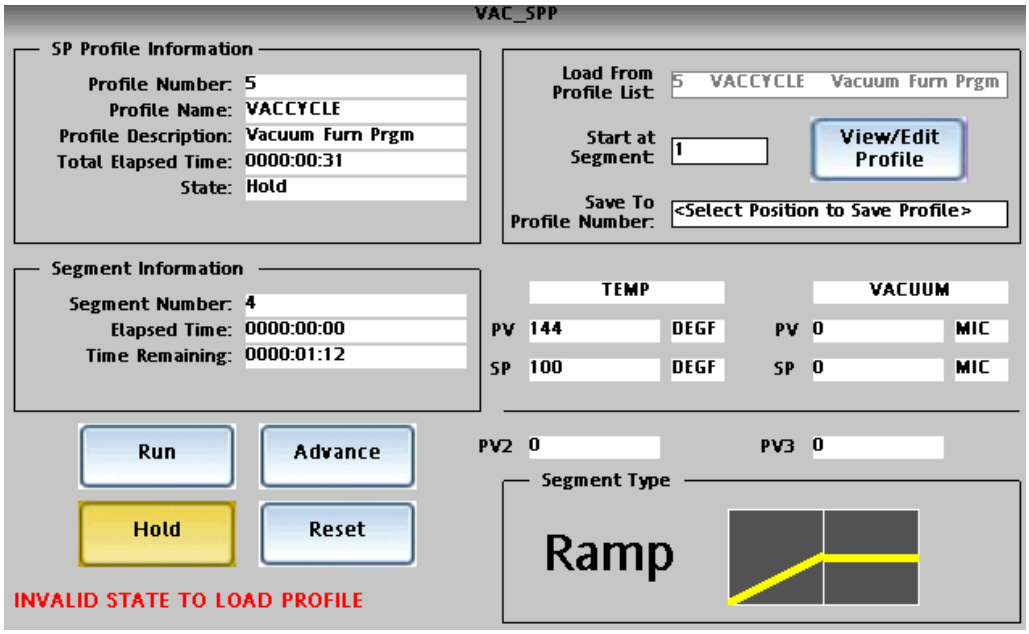
Following an Advance action, the Process Variable plot starts plotting from the beginning of the segment determined by the Advance action.

Auxiliary SP and PV Pre-plot

1. The actions and responses of the Auxiliary PV4 and the Auxiliary SP pre-plot graph will be the same as the PV1 value on the SPP profile pre-plot graph for the special cases above.

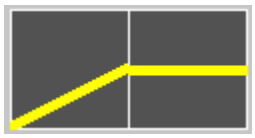
2. The default colors of the Auxiliary SP Pre-plot and PV are the same as the Setpoint Profile colors. (Yellow and aqua).

Setpoint programmer Operate



This widget may be accessed either from a Home display button or by jumping from the Setpoint Programmer Overview widget.

It shows the details of the profile currently running in the Setpoint Programmer. You can also load a different profile from memory into the Setpoint Programmer, edit the current profile, and save the edited profile to any slot (profile number) in memory.

Item	Description
Title	Name of the selected setpoint programmer block.
SP Profile Information	
Profile Number	Memory location of the profile that is being run by the Setpoint Programmer.
Profile Name	Name of the selected profile.
Profile Description	Description of the selected profile.
Total Elapsed Time	Total time the profile has been in Run, Hold and GHold states.
State	READY: Profile is at the beginning of segment and is ready to run. All events are OFF. HOLD: Profile is paused at the setpoint value shown. RUN: Profile is executing normally. GHOLD: Profile is paused because of excessive deviation. STOP: Profile has reached the end of the last segment. DISABLE: Profile is prevented from starting until the programmer disable control is ON.
Segment Information	
Segment number	Current segment
Elapsed Time	Time elapsed in the segment. Run time only.
Time Remaining	Time remaining in the segment.
Segment Type	Text shows type of current segment: ramp or soak.  The current and next segment types are shown graphically. In the above example, the current segment is ramping up, the next segment is a soak.
Operation Buttons	
Run	Start a program that is in HOLD or READY state.
Hold	Put program in HOLD.
Advance	Jump to the next segment. When the program is already in the last segment, the advance request is ignored. Programs cannot be advanced to the first segment. Current state must either READY or HOLD.

Item	Description
Reset	Reset a HOLD or STOP program to the first segment. Any edits made to the program are lost unless they were saved. See Save To Profile Number.
PVs and SPs	
PV (left)	Value of primary process variable.
SP (left)	Value of primary setpoint.
PV (right)	Value of auxiliary process variable (PV4)
SP (right)	Value of auxiliary setpoint
PV2	Value of process variable #2
PV3	Value of process variable #3
Profile load/view/edit/save	
Load From Profile List	Loads a profile from memory into the Setpoint Programmer. Program must be in READY state. See Figure 9 Recipe Load. You are presented with a list of profiles (recipes) in controller memory. Scroll to the desired profile and touch to highlight it. Touch Load Profile button to load the selected profile into the setpoint programmer. The loaded profile overwrites the current profile from the programmer. To erase the currently loaded profile from the Setpoint Programmer, select <Clear Profile> and load it. Any profile edits are lost unless you save them first with Save To Profile Number.
Start at segment	After loading, the program will start at this segment. Subsequent runs will start at Segment #1. If the segment number is within a loop, the profile cycles through the looped segments according to the number of loop cycles.
Save To Profile Number	Saves the currently running profile (and any edits) to a selected slot in controller memory. Scroll to the desired slot in the controller's profile memory. Once saved, it can be loaded and run later. See Figure 10 Recipe Save.
View/Edit Profile	Press to view/edit the current profile. Edits take effect immediately in the current profile but they are not saved to profile memory. (To save your edits, see Save To Profile Number.) When the profile is RESET, any edits are lost unless they are first saved with Save To Profile Number. See View/Edit profile on page 129.

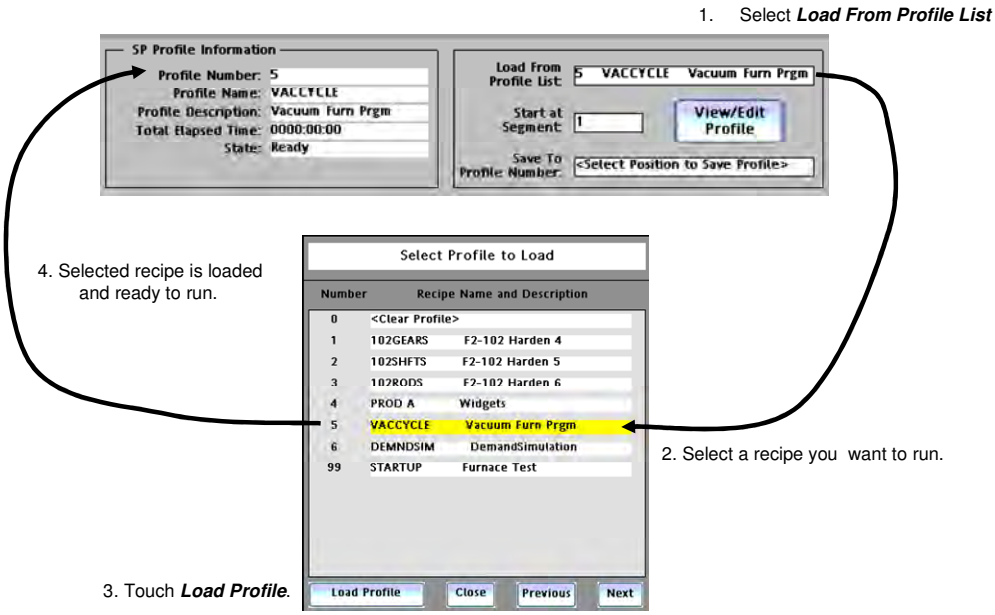


Figure 9 Recipe Load

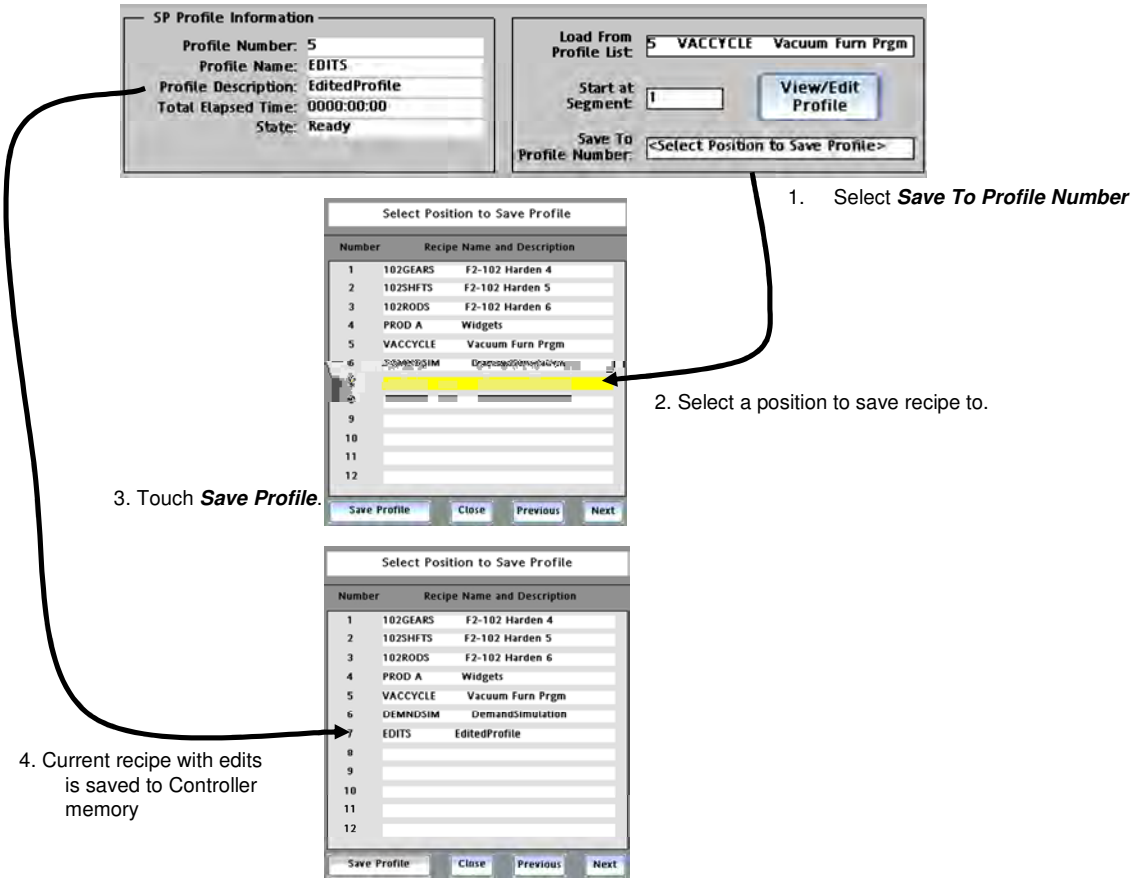


Figure 10 Recipe Save

View/Edit profile

This display lets you view or edit parameters of the currently working profile. Edits affect only the currently working program (not the profile in memory) and are lost if the profile is Reset, unless you Save Profile to Memory.

ATTENTION

Program must be in READY state to be edited.

Item	Description
View/Edit Segments Button	Accesses View/Edit Profile Segments (page 131) where you can edit each segment.
Profile number	Memory location of the profile that is being run by the Setpoint Programmer.
Profile Name	Name of the selected profile.
Profile Description	Description of the profile.
Ramp Type	TIME: Each ramp segment's time is the TIME allotted to the profile's output to reach the next soak segment's value in hours or minutes. OR RATE: Each ramp segment's time specifies the RATE at which that profile's output will reach the next soak segment, where the rate is specified in EU/hour or EU/minute. Make this selection before entering any Ramp during Profile Edit. NOTE: When Ramp unit is configured for TIME, entering "0" will imply an immediate step change in setpoint to the next soak.
Time Units	This selection assigns the time units (hours or minutes) for the ramp type selected. For Time ramp type: Time = Hours or Minutes For Rate ramp type: Rate = EU/Hour or EU/Minutes
Primary Output Label	Label associated with the PV.
Primary Engineering Units	Engineering Units of the PV
Guaranteed Hold High Limit	The profile will hold if a PV deviates more than this amount above the profile setpoint.
Guaranteed Hold Low Limit	The profile will hold if a PV deviates more than this amount below the profile setpoint.

Item	Description
Guaranteed Hold Type	Guaranteed Hold, if enabled here, will hold the profile value if a PV to the profile (typically a control loop's PV) deviates specified amounts above or below the profile output. None: No segments have guaranteed hold enabled. Per Seg: Lets you select specific segments for guaranteed hold where you set up the profile ramps and soaks. All Soaks: All soak segments will have a guaranteed hold enabled. All Segs: All segments will have guaranteed hold enabled.
Loop Start Segment	The first segment of the loop.
Loop End Segment	The last segment of the loop.
Loop Cycles	Number of times the loop segments will execute. Zero (0) means the segments will be repeated forever.
Jog Segment	Segment to which the program will jump to when the JOG discrete input is pulsed.
Restart Rate	This recovery ramp rate is provided in the event of a power loss while a program is running. The Restart Rate value is used to return the process to the last operating setpoint prior to power loss.
Auxiliary Output Label	A second analog value is available for each segment of the program. It is a fixed soak value and can be used to provide a setpoint value for a secondary control loop in the process.
Auxiliary Engineering Units	This is the engineering unit text associated with the AUX OUT.
Fast Forward	Fast Forward is a way to check for proper functioning of the profile's events and outputs, without having to wait for the profile to execute at its normal speed. When FAST FORWARD is ON, the program will run at a speed 60 times faster. When FAST FORWARD is OFF, the program will run at normal speed.

View/Edit Profile Segments

This display lets you edit the profile segments (setpoints and events) of the working program. Edits do not affect profiles in memory unless you save them.

ATTENTION

Program must be in READY, HOLD, or STOP state before segments can be edited.

TIP

- Edits are allowed to any segment of the program, including the current segment.
- If edit is to current segment and segment is a ramp:

  - If the ramp type is edited, then the time remaining is recalculated and the ramp rate is adjusted accordingly.

  - If the ramp rate is edited, then the time remaining is adjusted accordingly.

  - Changes to the ramp starting setpoint will be ignored for the current execution of the segment, but will be used for subsequent execution if the segment is included in a loop.

- If edit is to current segment and segment is a soak:

  - Changes to the soak setpoint will result in a step change.

  - Changes to the time will cause recalculation of the segment time remaining. If the result is less than or equal to 0, the program will advance to the next segment upon returning to RUN state.

- If the current segment is a ramp and the starting value of the following segment is changed, then the time remaining in the ramp segment will be adjusted accordingly but the ramp rate will remain unchanged.
- Edits to soak setpoints will result in a step change at the next segment unless the starting value of that segment is changed to the same value as well.

Edit Type and Value

Press the Edit Type and Value button to display the setpoint parameters below.

Item	Description
Profile number	Memory location of the profile that is being run by the Setpoint Programmer.
Profile Name	Name of the selected profile.
Profile Description	Description of the profile.
Segment #	Segment being edited.
Segment Type	Ramp or Soak. Last segment must be a soak.
Starting Value	Starting value of the segment.
Time/Rate	Range = 0.00 hr. to 999.99 hr. or 0.00 min. to 999.99 min. The function of this value depends on the Ramp Type.

Item	Description
Auxiliary Value	Select a fixed soak value for this segment.
Guar Hold	Select ON to enable setpoint guarantee if Guaranteed Hold Type is Per Segment.

Edit Events

Press the Edit Events 1-8 and Edit Events 9-16 buttons to display the event parameters.

You can configure 1 to 16 segment events to turn ON or OFF at the beginning of each segment. Segment events are digital switches that provide ON/OFF outputs. When a segment event is turned ON, it remains ON until the end of the segment at which time it is turned OFF unless it is configured to turn ON in the next segment. Note that segment events are not interrupted by soak time delays when the process variable is outside the guaranteed soak band. Events turn ON as soon as the previous segment is completed even if the process variable has not reached the soak setpoint.

TIP

Events can be edited only while program is in READY state.

Setpoint Scheduler

Overview

A setpoint schedule produces multiple setpoint outputs on a common time base. A setpoint schedule contains multiple segments. Each segment contains multiple ramp or soak setpoints, multiple auxiliary soak outputs, and multiple events. The last segment setpoint is always a soak (because there is no subsequent setpoint to ramp to).

The Setpoint Scheduler can run any of the schedules in controller memory. Any schedule can be edited and saved in one of the "slots" in the controller's memory.

A Setpoint guarantee function (known as guaranteed hold) is provided that holds the Scheduler if a process variable exceeds a predefined deviation from setpoint. Guaranteed hold is set on a per-segment basis and can be set for high deviation, low deviation, high and low deviation, or none.

The schedule may be changed (with some exceptions) from the current state to a new state by the operator as well as by inputs to the Scheduler function block in the controller configuration. Table 37 lists the resulting states.

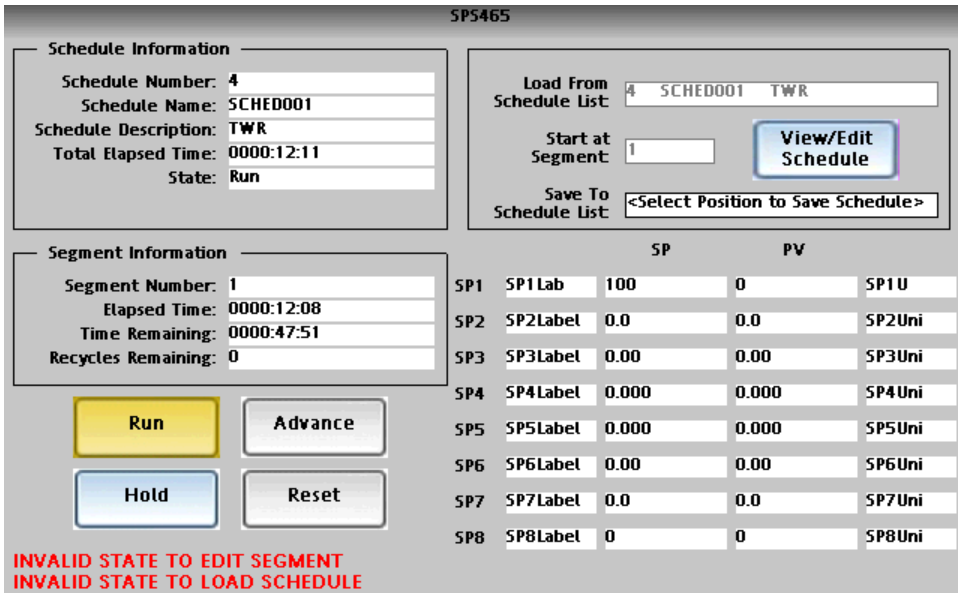
Table 37 SPS inputs and current state

Input	Current State					
	READY	**HOLD**	**RUN**	**GHOLD**	**STOP**	**DISABLE**
RESET	READY	READY	RUN	READY	READY	READY
HOLD	HOLD	HOLD	HOLD	HOLD	STOP	HOLD
RUN	RUN	RUN	RUN	GHOLD	STOP	RUN
GHOLD	READY	HOLD	GHOLD	GHOLD	STOP	READY

With regard to changing schedule state, if more than one function block input is on in the same execution cycle, RESET has priority over HOLD and RUN, and GHOLD has priority over RUN.

Also, function block inputs will override inputs from the Control Station, which occur during the same execution cycle. Finally, state changes from the Control Station are processed on the basis of the "last change wins."

Setpoint Scheduler Operate



This widget may be accessed from a Home display button. It shows the details of the schedule currently running in the Setpoint Scheduler. You can also load a different schedule from memory into the Setpoint Scheduler, edit the current schedule, and save the edited schedule to any slot (schedule number) in memory.

Item	Description
Title	Name of the selected scheduler block.
Schedule Information	
Schedule number	Memory location of the schedule that is being run by the Setpoint Scheduler.
Schedule name	Name of the selected schedule.
Schedule Description	Description of the schedule.
Total Elapsed Time	Total time the schedule has been in Run, Hold and Ghold states.
State	READY: Schedule is at the beginning of segment and is ready to run. All events are OFF. HOLD: Schedule is paused at the setpoint value shown. RUN: Schedule is executing normally. GHOLD: Schedule is paused because of excessive deviation. STOP: Schedule has reached the end of the last segment. DISABLE: Schedule is prevented from starting until the Scheduler disable control is ON.
Segment Information	
Segment number	Current segment

Item	Description
Elapsed Time	Time elapsed in the segment. Run time only.
Time Remaining	Time remaining in the segment.
Recycles Remaining	Number of recycles remaining, according to the highest numbered segment so far encountered in the schedule. *Example:* Segment #30 has recycle count = 10 and recycle segment #5. Therefore, the first time the schedule reaches Segment #30, the schedule will recycle (repeat) Segments #5 through #30 ten times. During the first recycling, it will display “10”, during the second recycling it will display “9”, etc.
Operation Buttons	
Run	Start a schedule that is in HOLD or READY state.
Hold	Put schedule in HOLD.
Advance	Jump to the next segment. When the schedule is already in the last segment, the advance request is ignored. Schedules cannot be advanced to the first segment. Current state must either READY or HOLD.
Reset	Reset a HOLD or STOP schedule to the first segment. Any edits made to the schedule are lost unless they were saved. See Save To Schedule List.
PVs and SPs	
SP1 through SP8	Value of all setpoints
PV1 through PV8	Value of all PVs.

Item	Description
Schedule load/view/edit/save	
Load From Schedule List	Loads a schedule from memory into the Setpoint Scheduler. Schedule must be in READY state. You are presented with a list of schedules (recipes) in controller memory. Scroll to the desired schedule and touch to highlight it. Touch Load Schedule button to load the selected schedule into the scheduler. The loaded schedule overwrites the current schedule in the programmer. To erase the currently loaded schedule from the Setpoint Scheduler, select <Clear Schedule> and load it. When the schedule is cleared, any edits are lost unless you saved them first with Save To Schedule List. See Figure 9 Recipe Load on page 128. All recipe types (profiles, sequences, schedules) are saved the same way.
Start at segment	After loading, the schedule will start at this segment. Subsequent runs will start at Segment #1. If the segment number is within a recycle loop, the schedule cycles through the looped segment according to the recycle count.
Save To Schedule List	Saves the currently running schedule (and any edits) to a selected slot in controller memory. Scroll to the desired slot in the controller's schedule memory. Once saved, it can be loaded and run later. See Figure 10 Recipe Save on page 128. All recipe types (profiles, schedules, sequences) are saved the same way.
View/Edit Schedule	Press to view/edit the current schedule. Edits take effect immediately in the current schedule but they are not saved to schedule memory. When the schedule is RESET, any edits are lost. To save your edits, see Save To Schedule List. See View/Edit schedule on page 137.

View/Edit schedule

This display lets you edit parameters of the selected schedule. Edits affect only the currently working schedule, not the schedule in memory, unless you save the schedule .

ATTENTION

Schedule must be in READY state to edit the values on this display.

Item	Description
View/Edit Segments Button	Accesses View/Edit Schedule Segments (page 138) where you can edit each segment.
Schedule Information	
Schedule number	Memory location of the schedule that is being run by the Setpoint Programmer.
Schedule Name	Name of the selected schedule.
Schedule Description	Description of the schedule.
Time Units	This selection assigns the time units (hours or minutes) that applies to all segments.
Jog Segment	Segment to which the schedule will jump to when the JOG discrete input is pulsed.
Guaranteed Hold Limits	This lets you specify the amount of deviation needed between a setpoint and its PV for the schedule to automatically switch to GHOLD state. If any setpoint's guarantee hold limit is exceeded, the entire schedule enters GHOLD state (all setpoints, auxiliary setpoints, and segment events freeze on their current value or state) until none of the limits are exceeded, whereupon the schedule will resume RUN state.

View/Edit Schedule Segments

This display lets you view and edit segment parameters.

- Setpoints
- Auxiliary Setpoints
- Time and Recycles
- Guaranteed Hold
- Events

Edits do not affect schedules in memory unless you save them.

ATTENTION

Schedule must be in READY or STOP state before segments can be edited from this menu.

TIP

- Edits are allowed to any segment of the schedule, including the current segment.
- If edit is to current segment:
  - Changes to the setpoint will result in a step change.
  - Changes to the time will cause recalculation of the segment time remaining. If the result is less than or equal to 0, the schedule will advance to the next segment.
- If the starting value of the following segment is changed, then the ramp rate in the current segment will be adjusted accordingly but the time remaining will remain unchanged.

Edit Setpoints

This display lets you edit the 8 setpoint values for each segment. All values are as of the beginning (not end) of the segment. The last segment must be a soak.

Edit Auxiliary Setpoints

This display lets you edit the 8 auxiliary setpoint values for each segment. All values are as of the beginning of the segment.

Edit Time & Recycles

Item	Description
Time	Enter the amount of time for the segment to last (in Time Units shown). Range 0-9999.
Recycle Count	Enter the number of times a schedule is to be repeated. 1-999. 0=infinite. *Example:* Segment #30 has recycle count = 10 and recycle segment #5. Therefore, the first time the schedule reaches Segment #30, the schedule will recycle (repeat) Segments #5 through #30 ten times. During the first recycling, it will display “10”, during the second recycling it will display “9”, etc.
Recycle Segment #	Enter the segment number at which a recycle will start.

Edit guarantee hold

This lets you specify the conditions under which a segment will GHOLD when deviation exceeds the guarantee hold limits. If *any* setpoint’s guarantee hold limit is exceeded, the entire schedule enters GHOLD state (all setpoints, auxiliary setpoints, and segment events freeze on their current value or state) until *none* of the limits are exceeded, whereupon the schedule will resume RUN state.

Item	Description
Guar Hold 1 through Guar Hold 8	OFF: Segment will not GHOLD when the PV deviates from SP by its guarantee hold limit. HIGH: Segment will GHOLD if PV deviates above SP by more than the SP guarantee hold limit. LOW: Segment will GHOLD if PV deviates below SP by more than the SP guarantee hold limit. HIGH/LOW: Segment will GHOLD if PV deviates above or below SP by more than the SP guarantee hold limit.

Edit segment events

This lets you edit the state of up to 16 events for the selected segment. You can configure 1 to 16 segment events to turn ON or OFF at the beginning of each segment. Segment events are digital switches that provide ON/OFF outputs. When a segment event is turned ON, it remains ON until the end of the segment at which time it is turned OFF unless it is configured to turn ON in the next segment.

TIP

Events can be edited only while schedule is in READY state.

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Sequencers

Overview

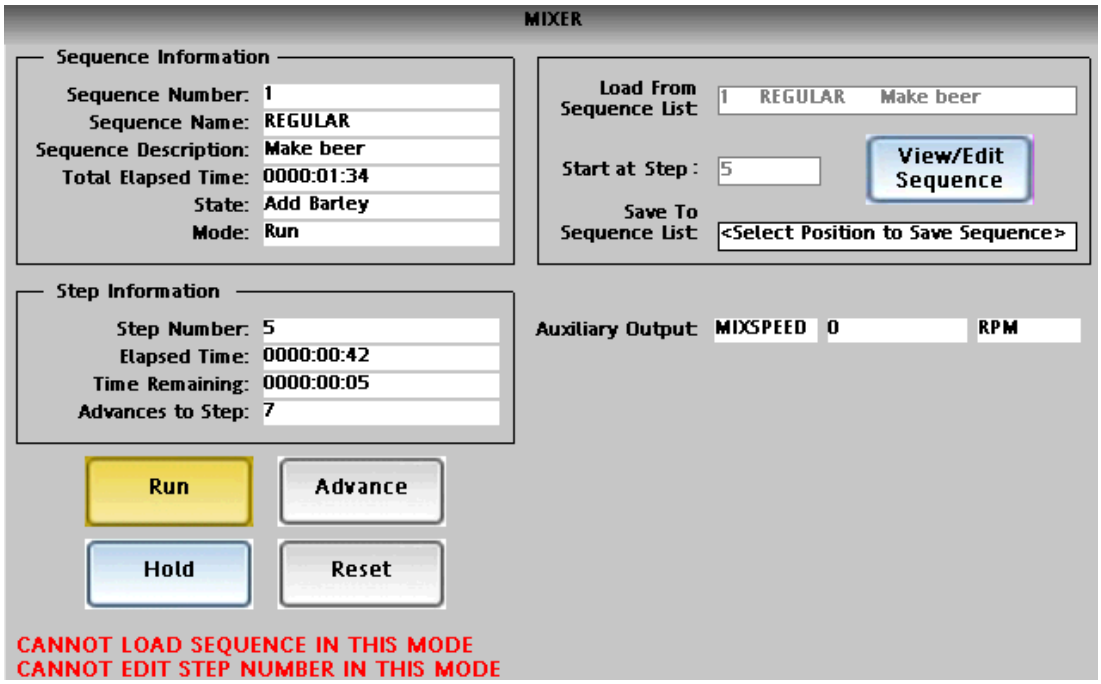
The Sequencer function block controls the states of up to 16 digital outputs and one analog output. Each combination of output states represents a "State" of the Sequencer block, such as PURGE, FILL, HEAT, or COOL. Each function block supports up to 50 States. The user sets up these states during the configuration of the function block.

The user-configurable program that runs within the Sequencer function block is called a "Sequence." Each Sequence contains up to 64 "Steps"; each Step activates one of the 50 States supported by the function block. Note that the same State can be used by more than one Step within a Sequence.

Each Step within a Sequence may be configured to advance to any other Step based on time (hours or minutes), digital event (2 per Step), or manual advance. A separate jog function is also provided.

The controller maintains a pool of 20 user-configurable Sequences in its memory. The Sequences in the pool can be assigned to run within any of the Sequencer function blocks. Once it has been loaded into a Sequencer function block, a Sequence can be modified through the menus provided on this Control Station. A modified Sequence can also be saved back to the pool for later recall, if desired.

Sequencer Operate



This widget may be accessed from a Home display button. It shows the details of the sequence currently running in the Sequencer. You can also load a different sequence from memory into the Sequencer, edit the current sequence, and save the edited sequence to any slot (sequence number) in memory.

Item	Description
Title	Name of the selected Sequencer block.
Sequence Information	
Sequence Number	Memory location of the sequence that is being run by the Sequencer.
Sequence Name	Name of the selected sequence.
Sequence Description	Description of the sequence.
Total Elapsed Time	Total time the sequence has been in Run and Hold states.
State	Description of the current step's state.
Mode	READY: Sequence is at the beginning of step and is ready to run. HOLD: Sequence is paused at the setpoint value shown. RUN: Sequence is executing normally. STOP: Sequence has reached the end of the last step.

Item	Description
Step Information	
Step number	Current step number
Elapsed Time	Time elapsed in the step. Run time only.
Time Remaining	Time remaining in the current step.
Advances to step	The sequence will Advance to this step.
Operation Buttons	
Run	Run a sequence that is in HOLD or READY state.
Hold	Put sequence in HOLD.
Advance	Advance to the step indicated by Advances to Step. When the sequence is already in the last step, the advance request is ignored. Sequences cannot be advanced to the first step. Current state must either READY or HOLD.
Reset	Reset a HOLD or STOP sequence to the first step. Any edits made to the sequence are lost unless they were saved. See Save To Sequence Number.
Sequence load/view/edit/save	
Load From Sequence List	Loads a sequence from memory into the Sequencer. Sequencer must be in READY state. You are presented with a list of sequences (recipes) in controller memory. Scroll to the desired sequence and touch to highlight it. Touch Load Sequence to load it into the Sequencer. Loading a sequence overwrites the current sequence from the Sequencer. To erase the currently loaded sequence from the Sequencer, select <Clear Sequence> and load it. When the sequence is cleared, any edits are lost unless you saved them first with Save To Sequence Number. See Figure 9 Recipe Load on page 128. All recipe types (profiles, sequences, schedules) are saved the same way.
Start at step	After loading, the sequence will start at this step. Subsequent runs will start at Step #1.
Save To Sequence List	Saves the currently running sequence (and any edits) to a selected slot in controller memory. Scroll to the desired slot in the controller's sequence memory. Once saved, it can be loaded and run later. See Figure 10 Recipe Save on page 128. All recipe types (profiles, schedules, sequences) are saved the same way.
View/Edit Sequence	Press to view/edit the current sequence. Edits take effect immediately in the current sequence but they are not saved to sequence memory. When the sequence is RESET, any edits are lost unless you saved them first with Save To Sequence Number. See View/Edit Sequence on page 144.

View/Edit Sequence

This display lets you edit parameters of the selected sequence. Edits affect only the currently working sequence, not the sequence in memory, unless you save the sequence.

ATTENTION

Sequence must be in READY state to edit the values on this display.

Item	Description
View/Edit Steps button	Accesses View/Edit Sequence Steps (page 145) where you can edit each step.
Sequence Information	
Sequence number	Memory location of the sequence that is being run by the Sequencer.
Sequence name	Name of the selected sequence.
Sequence Desc	Description of the sequence.
Jog to Step	When the sequencer's JOG input is triggered, the sequencer will jump to the start of this step then continue.
Time Units	Hours or minutes.

View/Edit Sequence Steps

This display lets you view and edit step parameters.

- Time/Events
- Auxiliary
- Outputs 1-8 and 9-16

Edits do not affect the sequence in memory unless you save the sequence.

ATTENTION

Sequence must be in READY or STOP state before steps can be edited.

Edit Time/Events

Item	Description
Step	Step number
State	Enter a State Number to assign to the step. 1-50.
State Name	Name of state. A unique State, “State 0”, can be used to indicate the last step in a Sequence. The Sequencer function block will go to Stop mode when it encounters any Step whose State is State 0.
Timer Duration	Length of the step in Time Units. When Timer Duration expires, the sequence will jump to Timer Next Step. If you specify a “next step” of zero, the Sequence will STOP when its “next step” trigger is received. For example, if Step 1 has a Timer Duration of one minute and a “Timer Next Step” of zero, the Sequence will stay in Step 1 for one minute and then STOP. If you specify a Timer Duration value of zero, the Sequence will remain at that Step until Event 1 or Event 2 occurs, or an Advance input or command is received.
Timer Next Step	When Timer Duration expires, the sequence will jump to Timer Next Step.
Event Signal 1	When Event Signal 1 is triggered the sequence will jump to Event 1 Next Step.
Event 1 Next Step	When Event Signal 1 is triggered the sequence will jump to Event 1 Next Step.
Event Signal 2	When Event Signal 2 is triggered the sequence will jump to Event 2 Next Step.
Event 2 Next Step	When Event Signal 2 is triggered the sequence will jump to Event 2 Next Step.

Edit Auxiliary

Item	Description
Advance Next Step	When manually advanced the sequence will jump to this step.
Aux Output	Value of auxiliary analog output

View Outputs 1-8/9-16

These buttons take you to displays that show the state of each step's 16 outputs. Read only.

Loops

Overview

Loop widgets

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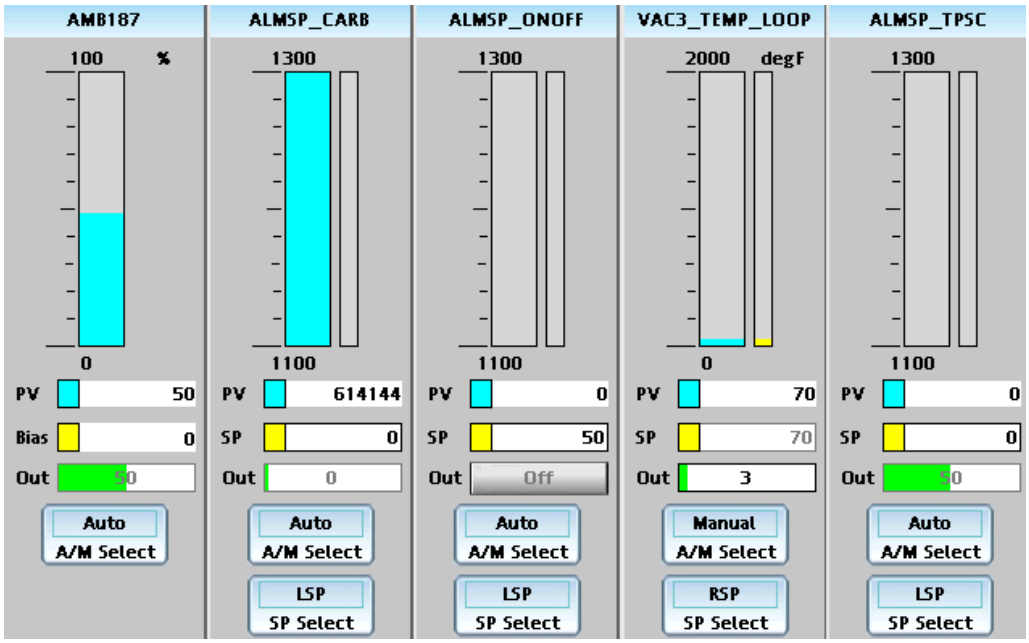


Each loop type has its own widget, shown above. From left to right the widgets are:

- Auto/Manual Bias
- Carbon
- On/Off
- PID
- TPSC (Three Position Step Control)

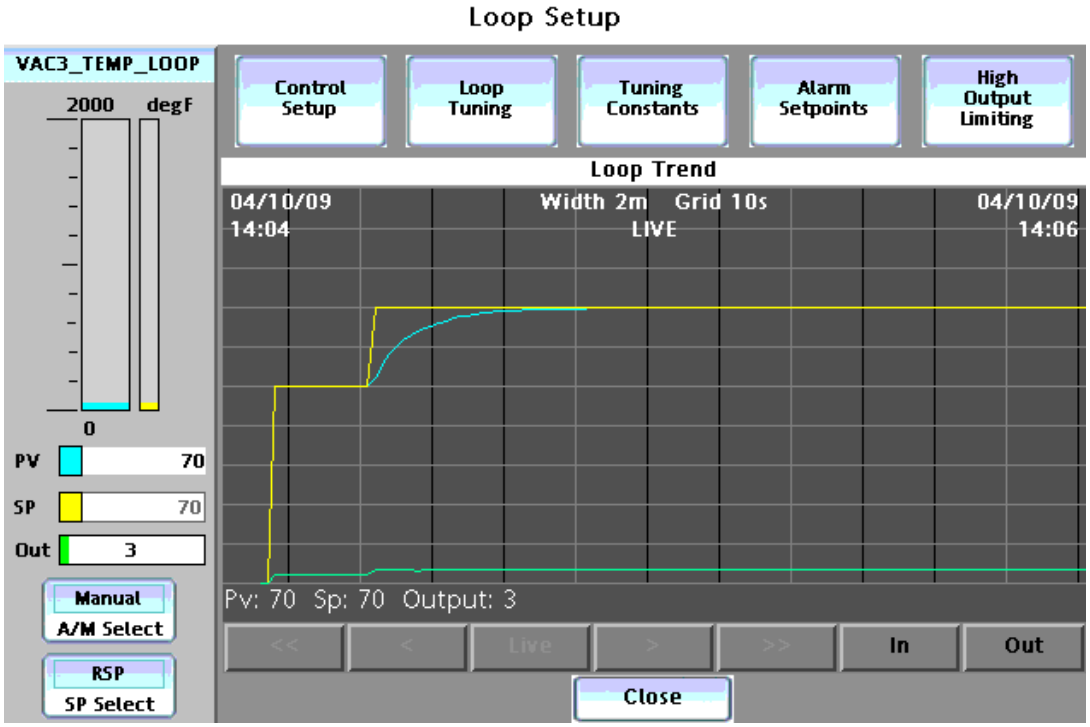
Each widget displays the PV (aqua), SP or Bias (yellow), and Output (green). Use the A/M button to switch between Auto and Manual. Use the SP Select button to change between LSP (local set point) and RSP (remote set point).You can change the SP, Bias and Output values/states when LSP and Manual modes are selected.

Touch the blue title bar at the top of the widget to jump to the Loop Setup display for more details.

Loop Setup

Overview

All the loop widgets let you jump to the Loop Setup display. See example below.



Above is an example of the PID Loop Setup display. At left is the loop widget, with operable buttons and parameters.

At bottom is a loop trend. The points on the trend typically correspond to PV, SP and Output, whose pen colors match the values on the left (aqua, yellow, green). Additional points of different colors may be visible, depending on configuration. Use the gray buttons at the bottom to navigate and zoom.

At the top are buttons that take you to detailed popups for various loop parameters. Buttons are accessible depending on the loop type, shown below.

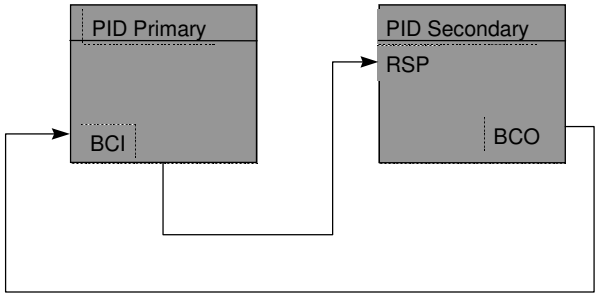
	Loop type				
Button	**PID**	**ON/OFF**	**3 POS**	**CARBON**	**A/M BIAS**
Control Setup (p. 150)	X	X	X	X	X
Loop Tuning (p. 151)	X		X	X	
Tuning Constants (p. 155	X		X	X	
Alarm Setpoints (p. 156)	X	X	X	X	X
High Output Limiting (p. 157)	X			X	
X indicates button is accessible					

Loop modes

All loop displays indicate the current operating mode of the selected loop. Loop modes are described in Table 38.

Table 38 Loop modes

Loop mode	Meaning
AUTO RSP	Loop is controlling the process and Remote Setpoint is selected.
MAN RSP	Loop output can only be changed manually. Remote Setpoint is selected.
IMAN RSP	IMAN (Initialization Manual) occurs with Cascade loops only. Figure 11. Secondary Cascade is in MAN or LSP, therefore Primary Cascade output is tracking Secondary Cascade's PV. Remote Setpoint is selected.
LO RSP	LO (Local Override): loop output is tracking the loop's Output Tracking value. Remote Setpoint is selected or High Limit Override Status Is ON.
AUTO LSP	Loop is controlling the process and Local Setpoint is selected.
MAN LSP	Loop output can only be changed manually. Local Setpoint is selected.
IMAN LSP	IMAN (Initialization Manual) occurs with Cascade loops only. Figure 11. Secondary Cascade is in MAN or LSP, therefore Primary Cascade output is tracking Secondary Cascade's PV. Local Setpoint is selected.
LO LSP	LO (Local Override): loop output is tracking the loop's Output Tracking value. Local Setpoint is selected or High Limit Override is ON.



When PID Secondary is in Manual or when Local Setpoint is selected, PID Primary mode is IMAN. IMAN causes the PID Primary output to track the PID Secondary PV.

Figure 11 IMAN loop mode

Loop control setup

The Loop Control Setup Display shows parameters of the selected loop. The table below lists all parameters for all loop types. Items marked with * are visible depending on loop type.

Item	Description
Local Setpoint*	Value of Local Setpoint.
Remote Setpoint*	Value of Remote Setpoint. This value is changeable only if it is configured as a second Local Setpoint (LSP2). It is read-only if it is connected to a function block within the configuration.
Failsafe Output	Loop's output during a failure.
SP High Lim*	Highest allowable setpoint value.
SP Low Lim*	Lowest allowable setpoint value.
SP Rate Up Lim*	Highest allowable rate at which a setpoint changes to a higher value.
SP Rate Down Lim*	Highest allowable rate at which a setpoint changes to a lower value.
PV High Lim	Highest allowable PV value.
PV Low Lim	Lowest allowable PV value.
Out High Lim*	Highest allowable loop output value.
Out Low Lim*	Lowest allowable loop output value.
Autotune Out High Lim*	Highest value of the output beyond which the motor no longer affects the process.
Autotune Out Low Lim*	Lowest value of the output beyond which the motor no longer affects the process.
Ratio Gain *	Gain value for a ratio loop.
Ratio Bias *	Local bias value in engineering units. Enterable only if it is configured for local bias. It is read-only if it is configured for remote bias.
Motor Deadband % *	Value of adjustable deadband in %.
Motor Traverse Time (Sec) *	Motor travel time in seconds.
Hysteresis*	Loop alarm's hysteresis. 0 to 10% of PV range.
Furnace Factor*	Lets you adjust the % Carbon as measured by the controller to agree with the results of actual shim stock tests. This adjustment may be needed to correct for specific furnace characteristics such as atmosphere differences, probe location, and furnace leaks.
Anti-Sooting*	Lets you adjust the anti-sooting factor, which limits the %C working setpoint of the downstream control block to a value which will not permit sooting to occur in the furnace. When anti-sooting is ON, then the anti-sooting factor is calculated as a linear translation of probe temperature to %C clamped at 0.75% and 2.0%. When anti-sooting is OFF, then the factor is fixed at 2.0% for all temperatures.
% Hydrogen*	Lets you adjust % hydrogen, one of the factors in the dewpoint calculation. The dewpoint calculation is a function of the mV input (IN) from the oxygen probe, temperature of the probe, and %H. The equations used are probe-type dependent and are supplied by the manufacturer.

Item	Description
Local % CO*	Lets you adjust % Carbon measurement to compensate for variations in the amount of CO in the carrier gas.
Remote % CO*	% Carbon measurement from the function block input within the configuration.
* Visibility depends on loop type.	

TIP

- The controller will ignore entry of Local Setpoint if tracking is on and if the loop is in Manual mode.
- Ratio Bias is enterable only if it is configured for local bias. It is read-only if it is configured for remote bias.

Loop Tuning

This display lets you set up and start the loop Accutune III tuning function. When initiated, the controller will start controlling to the setpoint while it identifies the process, calculates the tuning constants, and begins loop control with the correct tuning parameters.

Item	Description
Tuning Status	Inactive – The Accutune III tuning process is not active. Tuning – The Accutune III tuning progress is active.
Fuzzy Overshoot	Select ON to activate Fuzzy Overshoot Suppression to minimize overshoot after a setpoint change or a process disturbance. Select OFF to disable Fuzzy Logic. The fuzzy logic observes the speed and direction of the PV signal as it approaches the setpoint and temporarily modifies the internal controller response action as necessary to avoid an overshoot. There is no change to the PID algorithm, and the fuzzy logic does not alter the PID tuning parameters. This Item can be independently Enabled or Disabled as required by the application to work with “TUNE” On-Demand tuning.

Item	Description
Accutune III Type	DISABLE - Disables ACCUTUNE III. CYCLE TUNING - Tuning parameter values are derived from the process response to the resultant action of causing the PV to oscillate about the Setpoint value. This tuning method uses the measured ultimate gain and period to produce tuning parameter values. Cycle tuning does not distinguish between process lags and always results in gain based on PV amplitude and calculates values of Reset and Rate based on time of the SP crossings (The Reset value is always 4x the Rate value.) This method does not require a stable process initially and the process may be moving. SP TUNING – Setpoint Tuning based on the process response to a Setpoint change. When initiated, the control loop is put into an initial temporary manual state until the process characteristics are identified. This period may last up to a minute. During this time the Tune status shows Not Ready, and then an initial output step is made using the preconfigured size and direction parameters along with the preset output value. The resultant process action is used to determine the tuning parameters and once the process identification has completed, the loop is returned to automatic control.
Switch Tune Set	Tune Set 1 uses Gain #1, Rate #1, and Reset #1. Tune Set 2 uses Gain #2, Rate #2, and Reset #2.
PV Adaptive Tuning	Tuning method that continuously learns the process as PV deviations are observed and adapts the tuning parameters to the process response. DISABLE - Disables PV Adaptive tune. ENABLE - This method adapts a tuned process to changing system characteristics over time, when the PV deviates from the Setpoint by a certain amount for any reason. This method adapts a tuned process to changing system characteristics over time. It operates by observing a previously tuned process for changes in the system such as changes in deadtime or other process characteristics that can make a tuned process become unstable, unresponsive or over responsive. When the PV deviates from the SP by a certain amount for any reason, the adaptive tuning algorithm becomes active and begins to observe the resulting PV action. If the process becomes unstable and oscillates, PV Adaptive Tuning eventually brings the process into control by retuning parameter values (as needed) using a systematic approach defined by an expert based method of tuning rules. Should the process not oscillate but be observed as too fast or sluggish, a different expert rules set is applied to result in the slowing down or speeding up of the process by adjusting certain tuning parameter values. This method continuously learns the process as PV deviations are observed and adapts the tuning parameters to the process response.
Tuning Criteria	NORMAL - Very conservative tuning designed to calculate critically damped tuning parameter values that produce no overshoot. FAST - More aggressive tuning than Normal. Designed to calculate under damped parameter values providing faster control to the setpoint but may have some overshoot.

Item	Description
Accutune Status	ACCUTUNE III Status and Error prompts: NOT READY - This is shown: - When the control mode is Manual. - For a Setpoint Tune when the difference between the PV and Setpoint is greater than 3%. - When a Setpoint Tune is initiated and the PV is determined, by the adaptive logic to not have enough “historical data”, or the PV is moving too much to begin a Setpoint Tune. Either of these conditions will result in the Not Ready status and the Setpoint Tune algorithm will then wait until the PV is determined to be ready for the Setpoint Tune to begin. READY - Indicates that the PV is at lineout in regards to the Setpoint. Lineout occurs when the PV is within 0.2% of the Setpoint value. TUNE RUNNING - Accutune lll process still active. ID FAILURE - SP Tune failed to properly identify the process. This usually occurs when SP Tune is initiated with a process that is moving. Retry the SP Tune making sure that the process is stable and not moving in any direction. SP ERROR - For Cycle Tuning this occurs for Duplex, Manual Tuning when the SP value is not in the proper range. For cool side tuning the SP must be less than 48% and for heat side tuning the SP must be greater then 52% of the PV range. For SP Tune this error condition occurs if the deviation between the PV and SP is greater than 3% of the PV range when SP Tune is initiated. Retry the SP Tune after adjusting the deviation to be less than 3%. GAIN ERROR - This error condition occurs when the process gain value (Kpg) is not within the range of 0.10 to 10. Adjust this value to 1.00 and retry the SP Tune making sure that the process is stable and not moving in any direction. OUTPUT ERROR - For SP Tune this occurs when the initial output is not within the configured output limits. Check the SP step direction and size to make sure they are correct or modify the SP to use a value closer to the PV middle range. PV ADT RUNNING - PV tuning is active monitoring the process. ABORT - Current Accutune III process was aborted. An active Accutune III process will be aborted is if the loop is placed in the Manual mode.

Item	Description
Duplex Tuning	Selection of three tuning actions when performing a Cycle Tuning procedure on a Duplex control loop. DISABLE - Duplex type tuning is disabled and simplex type tuning is used instead. The resultant is blended tuning which is derived from the process response to cycling the output between the low and the high output limits. The calculated tuning parameter values are stored for each side. MANUAL - Tuning must be initiated manually for each side. The current LSP or RSP value is used as the target SP for the desired heat or cool side tuning. For the heat side, the output cycles between 50 percent and the high output limit and for the cool side the output cycles between 50 percent and the low output limit. Tuning values are calculated and stored only for the side tuned. AUTOMATIC - Heat and Cool tuning are sequentially performed automatically. During the operation of this tuning the target SP used is the mid point between the high output limit and 50 percent for the heat side and the low output limit and 50 percent for the cool side. During tuning for each side the cycling of the output results in the PV oscillating around the target SP value. From the data gathered during the oscillations, tuning values are calculated and stored for each side. After tuning on both sides is completed, the process SP is returned to the value of the last SP used prior to the initiation of the tuning procedure.
SP Step Change	Configuration parameter for Setpoint Tuning. Select a value between 5 and 15%. This defines the value of the initial Setpoint step change that is used as the target Setpoint value for process identification.
SP Tune Step Direction	Configuration parameter for Setpoint Tuning. The selection of UP or DOWN results in the Setpoint change value added to or subtracted from the present Setpoint value.
Process Gain	Configuration parameter for Setpoint Tuning. Gain identification value for the process. Select a value between 0.10 and 10.0. Normal value is 1. This value is used to estimate the size of the initial output step for a Setpoint Tune.
Start Tune	Select this to begin the Accutune III process.

Tuning constants

This display shows the tuning constants for the selected loop.

Item	Description
Switch Tune Set	Lets you select the active tune set (Tune Set 1 or Tune Set 2). Determines which set of Gain/PB, Rate, and Reset parameters are used by the loop.
Gain #1 Or #2 *	Gain is the ratio of the output change (%) over the measured variable change (%) that caused it. Gain = 100/Proportional Band.
Proportional Band (Pb) # 1 Or #2 *	PB is the percent of the range of the measured variable for which a proportional controller will produce a 100% change in its output.
Rate #1 Or #2	Rate affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster.
Reset #1 Or #2	Reset, or integral time, adjusts the controller's output according to the size of the deviation (SP - PV) and the time it lasts. The amount of corrective action depends on the value of Gain. Reset is measured as how many times proportional action is repeated per minute (repeats/minute) or how many minutes before one repeat of the proportional action occurs (minutes/repeat).
Feedforward Gain**	Applies Gain to the feedforward variable (FFV).
Manual Reset**	Manual Reset is only applicable if you do not use Reset. It allows correction of output to account for load changes to bring the PV up to setpoint.
* Either Gain or Proportional Band is displayed but not both. ** Visible for PID and Carbon loop types only.	

Alarm setpoints

This display shows the loop's setpoints and alarm types. A loop can have two alarms; and each loop alarm can have two setpoints and types.

Item	Description
Alarm 1 Setpoint 1	The value at which the alarm will activate.
Alarm 1 Type 1	No Alarm PV High - Alarm when PV is greater than the alarm setpoint PV Low - Alarm when PV is less than the alarm setpoint Dev High - Alarm when PV - SP is greater than the alarm setpoint. Dev Low - Alarm when SP - PV is greater than the alarm setpoint. SP High - Alarm when SP is greater than the alarm setpoint SP Low - Alarm when SP is less than the alarm setpoint Out High - Alarm when output is greater than the alarm setpoint Out Low - Alarm when output is less than the alarm setpoint
Alarm 1 Setpoint 2	same as Alarm 1 Setpoint 1
Alarm 1 Type 2	same as Alarm 1 Type 1
Alarm 2 Setpoint 1	same as Alarm 1 Setpoint 1
Alarm 2 Type 1	same as Alarm 1 Type 1
Alarm 2 Setpoint 2	same as Alarm 1 Setpoint 1
Alarm 2 Type 2	same as Alarm 1 Type 1
Alarm Hysteresis	Affects the point at which an alarm clears. For Out High and Out Low alarms, hysteresis is % of the loop's output span. For all other alarm types, it is % of PV span. PV High - Alarm clears when PV is less than the alarm setpoint by the amount of hysteresis. PV Low - Alarm clears when PV is greater than the alarm setpoint by the amount of hysteresis. SP High - Alarm clears when SP is less than the alarm setpoint by the amount of hysteresis. SP Low - Alarm clears when SP is greater than the alarm setpoint by the amount of hysteresis. Out High - Alarm clears when output is less than the alarm setpoint by the amount of hysteresis. Out Low - Alarm clears when output is greater than the alarm setpoint by the amount of hysteresis. Dev High - Alarm clears when PV - SP is less than the alarm setpoint by the amount of hysteresis. Dev Low - Alarm clears when SP - PV is less than the alarm setpoint by the amount of hysteresis.

TIP

These Loop Alarm parameters are used to set the *conditions* under which loop alarms occur; they do not generate the alarm. To generate the alarm, AL1 and AL2 pins of loops should be connected to the Signal Tags in HC Designer. These signal tags can be configured to generate alarms in Station Designer.

High Output Limiting

On PID loops this feature prevents potentially damaging the product or the process by exposing material to excessive thermal shock caused by applying the maximum PID output during initial startup or product changeover. High output limiting is enabled by the Track digital input, and when active, limits the PID output to a value present on the Track analog input for a user specified time period. After the time period expires, the output limit ramps up at a user specified rate to the normal (non-override) high PID output limit. The operator interface will indicate an OVERRIDE status at the bottom of the loop displays when the High Output Limit is active.

The Output limiting feature is also available for Carbon Potential loops but the output limiting action is only active after the process temperature limit has exceeded the user specified Low Temperature Limit, which forces the output to 0% or 50% for duplex outputs.

Item	Description
Loop type	Loop type is PID or CARBON
High Output Limit Override Enable	YES: Changes the operation of track command and track value to output limit enable and output limit value. NO: Normal output high limit is used.
High Output Limit Override Status	ON: Digital input controlling output limiting is ON. OFF: Digital input controlling output limiting is OFF.
Current High Output Limit %	Current output high limit. When in override status, this changes according to loop's tracking value and ramp rate. It will never exceed the loop's normal (non-override) high output limit.
Time In Override	Elapsed time that High Output Limit Override Status is ON and High Output Limit Override Enable is YES. It will continue counting even after the loop's normal output high limit is reached. It resets to zero when the Override Status changes to NO (i.e., when loop's discrete Output Track Command turns off).
Delay Time (Mins)	Enter number of minutes. When override status is ON, the delay time elapses before the override output limit begins to ramp up at the specified rate. Delay time of zero causes the override high output limit to track the loop's tracking value until override status is OFF.
Ramp Rate (%/Min)	Enter %/minute rate at which the output limit will (after delay time) ramp up to the normal non-override high limit. Rate of zero causes override limit to track the loop's tracking value during the delay time, after which high output limit steps without ramping to the normal output high limit.

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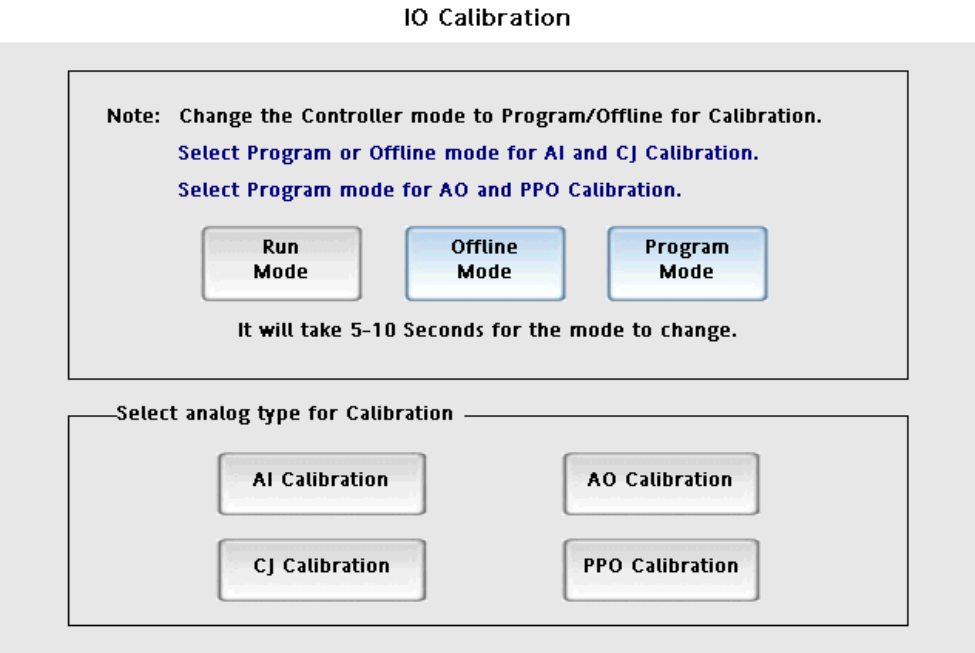
I/O Calibration

Menu Overview

Menu	Submenu
Overview (p. 22)	
AI Calibration(p. **Error! Bookmark not defined.**)	Overview
	Calibration equipment
	Calibrate AI channel
	Cancel Calibration
	Restore AI factory calibration
CJ Calibration (p. **Error! Bookmark not defined.**)	Cancel Calibration
	Restore CJ factory calibration
AO Calibration (p. **Error! Bookmark not defined.**)	Cancel Calibration
	Restore AO factory calibration
PPO Motor Calibration (p. **Error! Bookmark not defined.**)	Overview
	Calibration Status Information
	Cancel Calibration
	Calibration Errors
	Auto Calibration Procedure
	Semi-Auto Calibration Procedure
	Hand Calibration Procedure
Motor Setup (p.**Error! Bookmark not defined.**)	

Overview



This display lets you select the type of calibration. You must change the controller mode before calibrating.

AI Calibration

Overview

Analog inputs are factory calibrated to +/- 0.1% of span unless specifically noted in the range specifications. A field calibration may be performed on any analog input on a point-by-point basis to optimize measurement accuracy. The factory calibration parameters are retained in non-volatile memory and may be re-installed to undo a field calibration using selections from the calibration procedure.

Both Factory and field calibration information is stored on the Analog Input module itself. Therefore, once a module has been calibrated it can be moved to any slot position or any rack without being recalibrated. However, the controller will automatically restore a channel's Factory calibration settings under the following conditions:

- The channel is reconfigured to use a different gain setting. This may happen if you change the input type of the channel (for example, change from a TC to a Voltage or RTD input type).
- The AI module detects an error in its stored field calibration information. In this case, factory calibration is restored for all of the channels on the affected module.

Note that you must configure a channel's input type and range before you try to calibrate it. The calibration will be performed against the gain setting associated with the input type and range. If you change the input type after calibrating, the module will automatically restore the Factory calibration settings for that channel. If necessary, you can use the PC Designer's Monitor Mode feature to determine whether a given channel is using Factory or field calibration.

Calibration equipment

- For best results use a calibration source accurate to 1 microvolt.
- You must use a voltage source and copper lead-wire for channels that are configured as thermocouple and voltage inputs. Do not use a compensated calibrator and TC extension lead-wire to calibrate TC channels.
- Note that Cold Junction sensor and Analog Input calibrations are performed separately; you do not have to calibrate the CJ sensors before calibrating your TC input channels.
- If you are calibrating current-type inputs (0-20 ma or 4-20 ma) and you are using an external shunt resistor, we recommend that you calibrate the channel using a current-source with the actual shunt resistor installed on the terminals. This will allow you to calibrate out any inaccuracies in the shunt resistor. A high-precision shunt resistor should always be used.

Calibrate AI channel

Calibrate AI Channel guides you through a procedure for calibrating an analog input channel. Perform the steps in the order of the menu. Refer to the example AI calibration procedure.

Item	Description
Instrument Status and Instructions	This displays the status at each step of calibration. In order of appearance: Ready Connect AI 0% Reference 0% AI Cal Input Connect AI 100% Reference 100% AI Cal Input Save AI Calibration AI Cal Failed (red) or Done (green) Analog Input calibration may fail for the following reasons. -The physical connection to the calibration source is bad. -The selected Rack, Module, and Channel does not exist, or does not support AI calibration. -The selected input does not support the electrical range that you are trying to calibrate. For example, the 16-channel high-level AI module does not support a range of 0-2 volts.
Reference	Indicates numeric input reference value and engineering units. Also indicates an invalid module or channel.
Rack Number Module Number Channel Number	Enter the rack number, module number, and channel number of the AI to be calibrated, then press Select Input.
Select Input	Select this to verify that the selected rack/module/channel is installed in the controller.
Calibrate 0% Input	Set the calibration source to the value shown next to Reference, then select this to calibrate. Calibration takes 30 seconds. Status will indicate when calibration is complete.
Calibrate 100% Input	Set the calibration source to the value shown next to Reference, then select this to calibrate. Calibration takes 30 seconds. Status will indicate when calibration is complete.
Save	Select this to save the channel calibration.

After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

Cancel Calibration

You can stop the calibration process at any time by pressing the Cancel Calibration button. The status goes to “ready” and the previous calibration is restored.

Restore AI factory calibration

This restores the selected channel to its factory calibration settings. Enter the rack, module, and channel to be restored, then press Restore Factory Calibration. Status will show “Restore AI Input”, then green “Done” or red “Restore AI Failed.” After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

CJ Calibration

Each analog input card has two Cold Junction (CJ) sensors that are used in making thermocouple measurements. These sensors may be re-calibrated in the field if desired to optimize thermocouple measurement accuracy using the following procedure.

ATTENTION

An inaccurate CJ calibration will affect the accuracy of your thermocouple measurements. If you are going to perform CJ calibration, you must use a very accurate temperature-measuring device. It is also important that you allow the temperature around the controller's terminal block to stabilize for 10 minutes or more before you take the CJ temperature reading.

Perform the steps in the order shown in the following table.

Item	Description
Instrument Status And Instructions	This displays the status at each step of calibration. In order of appearance: Ready Measure CJ Temperature & Enter CJ Cal Input CJ Cal Failed (red) or Done (green) Save CJ Calibration
Reference	Indicates CJ temperature reading in Degrees C. Also indicates an invalid module or channel.
Rack Number Module Number Channel Number	Enter the rack number, module number, and channel number of the CJ sensor to be calibrated. Channel 1 is the top CJ sensor, Channel 2 is the bottom sensor.
Select CJ Input	Select this to verify that the displayed module and channel are correct.
User Measured CJ Temperature (Deg C)	Place your temperature-measuring device at the terminal that is closest to the selected CJ sensor. Allow the environment around the terminal block to stabilize for at least 10 minutes before taking the temperature reading. Enter the measured temperature here, in Degrees C.
Calibrate CJ	Select this to start calibration. Calibration takes 30 seconds. Status will indicate when calibration is complete.
Save Cal	Select this to save the calibration.

After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

Cancel Calibration

You can stop the calibration process at any time by pressing the Cancel Calibration button. The status goes to "ready" and the previous calibration is restored.

Restore CJ factory calibration

This restores the selected cold junction sensor to its factory calibration settings. Enter the rack, module and channel, then press Restore Factory Calibration. Status will show "Restore CJ Input", then green "Done" or red "Restore CJ Failed." After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

AO Calibration

ATTENTION

You should not access the Process Control Utilities Calibrate Controller Analog I/O display while the IO calibration display is being displayed, or vice versa. Calibration can't be done as long as both displays are shown; user must exit either display to do a calibration.

Analog outputs are factory calibrated to +/- 0.1% of span. A field calibration may be performed on any analog output on a point-by-point basis to optimize accuracy. The factory calibration parameters are retained in non-volatile memory and may be re-installed to undo a field calibration using selections from the calibration procedure.

Both Factory and field calibration information is stored on the Analog Output module itself. Therefore, once a module has been calibrated it can be moved to any slot position or any rack without being recalibrated.

Item	Description
Instrument Status And Instructions	This shows the status of the calibration. In order of appearance statuses are: Ready Measure AO 0% Output & Enter 0% AO Output Measure AO 100% Output & Enter 100% AO Output AO Cal Failed (red) or Done (green) Save AO Calibration
Reference	Indicates output reference value and engineering units. Also indicates an invalid module or channel.
Rack Number Module Number Channel Number	Enter the rack, module, and channel of the AO channel to be calibrated.
Select Output	Select this to verify that the selected module is installed in the controller.
Measured Values (mA)	Measure the actual output (as mA, mV or Volt) and then enter the measured value in mA here.
Calibrate 0% Output	Select this to calibrate. Status will indicate when calibration is complete.
Calibrate 100% Output	Select this to calibrate. Status will indicate when calibration is complete.
Save	Select this to save the channel calibration.

After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10)

TIP

- The range of an Analog Output is either 0-20 mA or 4-20 mA. If you are using an external resistor to convert the current output to a voltage output, you can calibrate the AO channel with the resistor in place. However, you must still enter the 0 and 100 percent calibration values in milliamps; you cannot enter volts or millivolts.
- AO calibration fails when the value entered by the user is outside of the following limits:
  - For 4 mA dc, the value entered must be between 3.3 and 4.7 mA dc.
  - For 20 mA dc, the value entered must be between 19.3 and 20.7 mA dc.

Cancel Calibration

You can stop the calibration process at any time by pressing the Cancel Calibration button. The status goes to “ready” and the previous calibration is restored.

Restore AO factory calibration

This restores the selected AO channel to its factory calibration settings. Enter the rack, module, and channel of the AO channel to be restored, then press Restore Factory Calibration. Status will show “Restore AO Input”, then green “Done” or red “Restore AO Failed.”

After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

PPO Motor Calibration

Overview

This lets you calibrate a PPO motor three ways:

- Auto – Controller positions the motor and captures the positions. See page 168.
- Semi-Auto – Controller positions the motor and the user captures the positions. See page 169.
- Hand – User positions the motor by hand and captures the positions. See page 170.

The calibration of a motor is similar to that of an AI or AO. However, the motor calibration values are stored as part of the PPO block's configuration data, not on the AI card itself. Therefore, to retain these motor calibration values, you must upload the configuration and save it to disk after motor calibration has been performed.

The basic motor calibration procedure is as follows:

- move the motor to its 0% position and wait until the feedback signal has stabilized.
- capture the 0% feedback value.
- move the motor to its 100% position and wait until the feedback signal has stabilized.
- capture the 100% feedback value.
- measure the true motor speed by:

  d) moving the motor for a fixed period of time.

  e) measuring the position feedback delta.

  f) computing a motor speed from this data.

This value will override any previously configured value.

- save the calibration values as part of the PPO block's configuration data.

After calibration, return the Controller to Run mode. Use IO Calibration display (page 159) or Controller Mode button (page 10).

Calibration Status Information

Instrument Status and Instructions – this field indicates the current status of the calibration procedure.

> *NOTE: If a status of "Calibration Failed" is displayed, take the appropriate corrective action, and then repeat the calibration procedure again, beginning at Step 1. See "Calibration Errors" for more information.*
>
> Time required for current step is shown in % complete. Once this becomes 100% then only Controller will allow to proceed.

Feedback Value– this field shows the motor feedback value [a value between 0.0 and 1.0]. This value should change whenever the motor is actually moving.

Calibration Block– Select the PPO to be calibrated.

Cancel Calibration

You can stop the calibration process at any time by pressing the Cancel button. The status goes to "ready" and the previous calibration is restored. The motor will stop moving when this button is pressed. In order to resume calibration you must start over.

Calibration Errors

The following errors may be reported during the calibration process. Errors are displayed in red. Take the appropriate corrective action and repeat the calibration procedure from the beginning.

Table 39 Calibration Errors

Instrument Status and Instructions	Cause	Corrective Action
Calibration Failed	The calibration was not performed in the correct sequence.	Go back to Step 1 and repeat the calibration process
	The selected motor position has not been configured.	Go back to the SELECT MOTOR TO CALIBRATE display and reselect the desired motor.
Calibration Failed – Bad AI	The AI channel being used for the position feedback signal has failed in some way.	Check for correct wiring and correct AI input type.
Calibration Failed – Bad Feedback	The value of the feedback signal is out of range for the calibration being performed.	Check for reversed wiring of the feedback signal. Forward motor movement should produce increasing feedback values.
Calibration Failed – Wrong AI Version	The firmware on the AI module does not support PPO motor control using a slide wire for the position feedback.	Obtain a new AI module from your supplier.

Auto Calibration Procedure

Table 40 Auto Calibration Procedure

Step	Action
1	Select block for calibration. Select “Auto”. **Status** – Ready
2	Select “Start” **Status** – this field will change as the controller automatically performs the various steps of the motor calibration process described in Step 3 below. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of each step [0 to 100%]
3	RESULT: • **Status** – Wait…Motor Moving To 0% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should decrease until the 0% position is reached. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Wait…Calculating 0% Feedback Value. **Feedback Value** – indicates the current position of the motor. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Wait…Motor Moving To 100% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should increase until the 100% position is reached. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Wait…Calculating 100% Feedback Value. **Feedback Value** – indicates the current position of the motor. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Wait…Calculating Motor Speed. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Wait…Saving Calibration Values. **Percent Complete** – indicates the progress of this step [0 to 100%]. • **Status** – Calibration Completed.
4	Once calibration is completed, select one of the following choices from the Motor Position popup: Position Motor at 0%, Position Motor at 100, Don’t Move Motor.

Semi-Auto Calibration Procedure

ATTENTION

The steps of the Semi-Auto Calibration Procedure must be performed in the order described below. You must wait for each step to complete before selecting and activating the next step.

You can restart the procedure at any time by canceling the calibration and beginning again at Step 1.

Table 41 Semi-Auto Calibration Procedure

Step	Action
1	Select block for calibration. Select "Semi-Auto". **Status** – Ready
2	Select "Start" • **Status** – Wait…Motor Moving To 0% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should decrease until the 0% position is reached. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Motor Is At 0% Position
3	Select "Calibrate 0%" • **Status** – Wait…Calculating 0% Feedback Value. **Feedback Value** – indicates the current position of the motor [0.0 to 1.0]. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – 0% Feedback Value Captured • **Status** – Wait…Motor Moving To 100% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should increase until the 100% position is reached. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Motor Is At 100% Position
4	Select "Calibrate 100% Position" • **Status** – Wait…Calculating 100% Feedback Value. **Feedback Value** – indicates the current position of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – 100% Feedback Value Captured
5	Select "Calibrate Speed". A warning display will appear: **WARNING** **MOTOR SPEED CALIBRATION** **WILL MOVE MOTOR BETWEEN** **THE 0% AND 100% CALIBRATION POINTS.** **PRESS OK TO START** **ELSE PRESS CANCEL**
6	Press OK to start the Motor Speed Calibration. • **Status** – Wait…Calculating Motor Speed. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Motor Speed Calibration Complete

Step	Action
7	Select “Save Cal”. The following information will appear in a popup: Feedback At 0% - a value corresponding to the motor’s 0% position [0.0 to 1.0] Feedback At 100% - a value corresponding to the motor’s 100% position [0.0 to 1.0] Motor Speed (In Seconds). This is the motor speed that was detected during Motor Speed Calibration. This is the time it takes the motor to travel from its calibrated 0% position to its calibrated 100% position. Select OK to save calibration, else select Cancel. • **Status** – Wait…Saving Calibration Values. **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Calibration Complete
8	Once calibration is completed, select one of the following choices from the Motor Position popup: Position Motor at 0%, Position Motor at 100, Don’t Move Motor.

Hand Calibration Procedure

ATTENTION

The steps of the Hand Calibration Procedure must be performed in the order described below. You must wait for each step to complete before selecting and activating the next step.

Table 42 Hand Calibration Procedure

Step	Action
1	Select block for calibration. Select “Hand”. **Status** - Ready
2	Select “Start” • **Status** – Please Move Motor To 0% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should increase when the motor is moved in the forward direction, and decrease when the motor is moved in the reverse direction. **Percent Complete** – will remain at 0% during this step. Move the motor by hand to the 0% position. When complete, go to step 3.
3	Select “Calibrate 0%” • **Status** – Wait…Calculating 0% Feedback Value. **Feedback Value** – indicates the current position of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – 0% Feedback Value Captured
4	• **Status** – Please Move Motor To 100% Position. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0]. This value should increase when the motor is moved in the forward direction, and decrease when the motor is moved in the reverse direction. **Percent Complete** – will remain at 0% during this step. Move the motor by hand to the 100% position. When complete, go to step 5.

Step	Action
5	Select “Calibrate 100” • **Status** – Wait…Calculating 100% Feedback Value. **Feedback Value** – indicates the current position of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – 100% Feedback Value Captured
6	Select “Calibrate Speed”. A warning will appear: **WARNING** **MOTOR SPEED CALIBRATION** **WILL MOVE MOTOR BETWEEN** **THE 0% AND 100% CALIBRATION POINTS.** **PRESS OK TO START** **ELSE PRESS CANCEL**
7	Press OK to start the Motor Speed Calibration. • **Status** – Wait…Calculating Motor Speed. **Feedback Value** – indicates movement and direction of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Motor Speed Calibration Complete
8	Select “Save Cal”. The following information will appear: Feedback At 0% - a value corresponding to the motor’s 0% position [0.0 to 1.0] Feedback At 100% - a value corresponding to the motor’s 100% position [0.0 to 1.0] Motor Speed (In Seconds). This is the motor speed that was detected during Motor Speed Calibration. This is the time it takes the motor to travel from its calibrated 0% position to its calibrated 100% position.
9	Press OK to Save Calibration. • **Status** – Wait…Saving Calibration Values. **Feedback Value** – indicates the current position of the motor [0.0 to 1.0] **Percent Complete** – indicates the progress of this step [0 to 100%] • **Status** – Calibration Completed

Motor Setup

The Motor Setup display lets you set the motor's Deadband, Travel Time, Low Output Limit, and High Output Limit.

Item	Description
Select PPO Block	Select a motor.
Dead Band	Deadband is an adjustable gap between forward and reverse motor operation (the range over which the output can change before a relay is energized).
Travel Time	Travel time is the time it takes the motor to travel from its calibrated 0% position to its calibrated 100% position.
Output Low Limit	Low limit for the motor position.
Output High Limit	High limit for the motor position.

Maintenance

Troubleshooting

What to do if the Control Station has difficulty starting up

If the Control Station does not power up properly or if you have difficulty in downloading a configuration to the Control Station, a "cold start" is a handy way of starting over cleanly.

ATTENTION

A cold start clears the Control Station memory. You will need to re-load the Control Station's configuration. Refer to Station Designer documentation for details on Downloading to a device.

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Performing a cold start

Step	Action
1	Disconnect power from the unit.
2	Press and hold the F1 and F2 keys, then power up the unit while continuing to hold the F1 and F2 keys.
3	Wait until the display says "Soft-Key 1 to clear database", then release the F1 and F2 keys.
4	Press the F1 key to clear the database. The following message will appear with the default IP address: " INVALID DATABASE IP Address is 192.168.1.253 with TCP/IP download enabled on port 789. MAC Address is… Hold 1st and 4th keys on power-up to configure IP"
5	Re-load the Control Station configuration. See Station Designer manual 51-52-25-149 for details on Downloading to a device.

What to do if you want to change the IP Address at the Control Station

For a new Control Station that does not have a valid database, proceed with step 1 in the table below. If the Control Station has a valid database and you want to change the existing IP address, the database memory must first be cleared by performing the cold start procedure listed above. Once the database has been cleared, the following procedure may be used to enter a new IP Address at the Control Station.

Changing or entering IP Address

Step	Action
1	Disconnect power from the unit.
2	Press and hold the F1 and the fourth Soft Key (Logoff for 900CS10 and F4 for 900CS15) simultaneously and hold them down while applying power.
3	Keep the keys pressed until a pop-up keypad appears. Enter an IP Address that has the same subnet as your PC and the HC900 Controller and a unique fourth number. Press the green arrow to enter the IP Address.
4	The following message will appear with the newly entered IP Address: " INVALID DATABASE IP Address is 192.168.1.nnn with TCP/IP download enabled on port 789. MAC Address is… Hold 1st and 4th keys on power-up to configure IP"
5	Using the new IP Address, download a Station Designer database file to the 900 Control Station by means of the Link menu.

How to remove the rear cover and change the battery of the operator interface?

A battery is used to keep time when the unit is without power. Typical accuracy of the Control Station time keeping is less than one minute per month drift. The battery of an operator interface unit does not affect the unit's memory, all configurations and data is stored in non-volatile memory.

Symbol	Definition
⚠ WARNING	EXPLOSION HAZARD - The area must be known to be non-hazardous before servicing/ replacing the unit and before installing or removing I/O wiring and battery. BATTERIES MUST BE UL RECOGNIZED (UL RECOGNIZED COMPONENT DIRECTORY CATEGORY BBCV2) LITHIUM BATTERIES TYPE CR2025 MANUFACTURED BY SANYO ENERGY CORP. OR VARTA BATTERIE AG OR PANASONIC.
⚠ WARNING	EXPLOSION HAZARD - Do not disconnect equipment unless power has been disconnected and the area is known to be non-hazardous.
	CAUTION: RISK OF ELECTRIC SHOCK The inverter board, attached to the mounting plate, supplies the high voltage to operate the backlight. Touching the inverter board may result in injury to personnel.
	CAUTION: The circuit board contains static sensitive components. Before handling the operator interface without the rear cover attached, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the operator interface at a static controlled clean workstation. Also, do not touch the surface areas of the circuit board. Dirt, oil, or other contaminants may adversely affect circuit operation.

Changing the battery of Control Station unit

Step	Action
1	Remove power cabling. Remove the rear cover of the unit. To remove the cover, remove all of the screws on the rear of the unit that are marked with an arrow but not the one screw marked with the earth ground symbol. Lift the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of the PCB.
2	Install in the reverse manner. Remove the old battery* from the holder and replace with the new battery.
3	Replace the rear cover, cables, and re-apply power.

* Please note that the old battery must be disposed of in a manner that complies with your local waste regulations. Also, the battery must not be disposed of in fire, or in a manner whereby it may be damaged and its contents come into contact with human skin.

Parts

⚠ WARNING

EXPLOSION HAZARD

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

Replace parts with appropriate Honeywell parts only. Failure to do so may result in explosion causing death or serious injury.

To order parts below, see the contact information in the front of this manual.

Table 43 Parts

Description	Order part number
Clear protective film for touch screen	50038816-501 for 900CS10-00 and 50038816-502 for 900CS15-00
Replacement backlight	50038818-501 for 900CS10-00 only
Replacement touch screen	50038820-501 for 900CS10-00 only
CompactFlash card (for data logging)	50040636-002
Adapter plate (for replacing 1042 OI)	50039118-501
USB programming cable	50038817-001
Ethernet cable	51451432-010

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Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Honeywell Process Solutions,

(TAC) hfs-tac-support@honeywell.com

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Honeywell Process Solutions,

Phone: + 80012026455 or
+44 (0)1344 656000

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

AMERICA'S

Honeywell Process Solutions,

Phone: (TAC) 1-800-423-9883 or
215/641-3610

(Sales) 1-800-343-0228

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

Specifications are subject to change without notice.

For more information
To learn more about HC 900 Process Controller, visit www.honeywellprocess.com
Or contact your Honeywell Account Manager

Process Solutions
Honeywell

1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

www.honeywellprocess.com

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