Overview

The Honeywell HC900 Hybrid Controller is an advanced loop and logic controller offering a modular design sized to satisfy the control and data management needs of a wide range of process equipment. When combined with the optional 900 Control Station operator interface that is highly integrated with the controller’s database, configuration and setup time is minimized. This powerful combination together with Honeywell’s performance proven control technology provides users an ideal solution for process control. Open Ethernet connectivity with Modbus TCP Protocol also allows network access using a variety of HMI/SCADA software.

Easy-to-use Windows-based Hybrid Control Designer software, operable over Ethernet, an RS232 port or modem connection, simplifies controller and operator interface configuration. It provides advanced monitoring functions for debug, allows run-mode configuration changes while maintaining process control uploads the complete, annotated graphic controller configuration, plus supplies an array of reports for enhanced documentation. The HC900 Controller provides superior PID loop control and more robust analog processing than most logic controllers without compromising logic performance. A separate, fast scan cycle executes a rich assortment of logic and calculation function blocks. Logic blocks may also execute in the same scan with analog function blocks for time critical events. These function blocks may be fully integrated into a combined analog and logic control strategy for uncompromising control performance.

For more information see specification sheets:

- HC900 Hybrid Controller Modules 51-52-03-41
- Hybrid Control Designer Software 51-52-03-43
- 1042 & 559 Operator Interfaces 51-52-03-32.

Applications

- Pump stations
- Boilers
- Water treatment
- Pilot operations
- Fermenters
- Utility DAQ
- Sterilizers
- Dryers
- Furnaces
- Kilns
- Autoclaves
- Extruders
- Reactors
- Retorts
- Crystal Growing

Features Summary

- Non-redundant and Redundant Architectures
- PID Control with advanced Accutune III auto-tuning
- Adjustable recipe pool memory lets you allocate memory for recipes, SP Profiles, sequences and schedules to meet your needs.
- Up to 1920 points with remote I/O
- Boolean Logic programming. Robust assortment of over 100 algorithms
- Advanced Floating Point Math Functions. Extensive alarm and event monitoring
- Up to 960 Isolated, Analog Inputs
HC900 Hybrid Controller

- Remote I/O Racks with wire or fiber optics for extended distance.
- I/O Insert/Remove under power
- LED on/off indicators on digital I/O
- Graphic Function Block Configuration – 400, 2000 or 5000 blocks
- Fast updates – 27 ms logic, 0.5 sec analog
- Open 10MB or 10/100MB Ethernet interface using Modbus/TCP. Peer-to-peer communications via Ethernet
- E-mail alarm/event messaging on priority

- Ramp/Soak Setpoint Programmers
- Setpoint Schedulers with multiple outputs
- Sequencers with 16 Outputs each
- Modbus read/write parameters assignable to either fixed or custom addresses for access by HMI or supervisory software.
- Modbus TCP Initiator
- Gas flow function blocks per American Gas Association specs
- Calendar block for triggering events

Non-redundant Architectures

Single process/single rack

Single process/ multiple remote I/O Racks
Multiple processes/multiple racks

Ethernet 10/100 Base-T <100m each
Fiber optic <750m each

E-Net Switches

PC HMI

Remote I/O Racks

Process A

Process B

Process C

Process D

Multiple processes/multiple racks/C70 controller redundant networks
HC900 Controller

- The rack based HC900 Controller is available in 3 rack sizes with 4, 8 or 12 I/O slots each to support a wide range of requirements.
- Redundant C70R controllers use a separate controller rack for CPUs without local I/O. Two power supplies provide separate CPU power. A redundant controller switch module provides status and performs mode changes.

CPU Modules

- The CPU options available for the HC900 Controller include:
  - C30 and C50 for non-redundant applications.
  - C70 for redundant networking
  - C70R for redundant CPU applications and redundant networking.
- All HC900 CPU modules are based on the 32-bit NS9750 ARM9 microprocessor. The operating system and configuration files are stored in 4MB flash memory organized as 2,097,152 by 16-bit words. The controller operates out of a battery-backed 16MB mobile SDRAM organized as 4 banks of 1,048,576 by 32-bit words.
- All HC900 CPU modules offer open Ethernet communications for access by a variety of HMI and SCADA software applications and peer to peer communications for control data exchanges between controllers. The C70 and C70R provide redundant Ethernet ports for high network availability installations.
- HC900 CPU modules use a dual scan method to handle fast digital scanning and normal analog input scanning in the same integrated control environment. Both scans support a wide range of computational function block algorithms and a user adjustable execution sequence order.
- HC900 CPUs use Flash memory for permanent user configuration program storage and battery-backed memory for dynamic data storage allowing for graceful recovery following a power interruption or other discontinuous operations.

I/O Scanners

HC900 Remote I/O is processed and communicated to the main CPU module through a remote I/O Scanner module. Two I/O scanner modules are available: a single port model for non-redundant CPU systems and a dual port model for redundant CPU systems. Scanner addressing in multi-rack systems is selectable via DIP switch setting.

All HC900 I/O Scanner modules are based on the 32-bit NS9750 ARM9 microprocessor. The operating system is stored in flash memory organized as 2,097,152 by 16-bit words. The scanner operates out of a 16MB mobile SDRAM organized as 4 banks of 1,048,576 by 32-bit words.

Inputs and Outputs - A variety of I/O modules are available for selection in creating a custom control solution. These include:

- 8 point universal analog input modules: Inputs may be mixed on a module and may include multiple thermocouple types, RTDs, ohms, voltage or millivoltage types – all easily assigned using the Hybrid Control Designer configuration tool. High point-to-point isolation simplifies installation and saves the expense of external isolation hardware.
- 16 point high level analog input module: each point is configurable for V or mA. Point-to-point isolation.
- 4 point isolated analog output module: Supports from 0 to 20mA each.
- 8 point analog output module. Isolated in two groups of 4. Supports 0 to 20mA.
- 16 point analog output module. Isolated in four groups of 4. Supports 0 to 20mA.
- 16 point digital input modules: Contact closure type, DC voltage and AC voltage types.
- 32 point digital input module: DC voltage
- 8 point AC or 16 point DC digital output modules
- 32 point digital output: DC voltage
- 8 point relay output module: four form C type and four forms A type relays.
- 4 channel Pulse/ Frequency/Quadrature I/O module

See Module Specification sheet 51-52-03-41 for details.
**Insert & removal of I/O under power** - For ease of maintenance, the HC900 controller supports removing and inserting I/O modules from the card rack without removing power from the controller. Each card is sensed for validity by the controller and auto-configured on insertion.

**I/O Terminal Blocks** – 20-screw Terminal Blocks are available with either barrier style or Euro style screw connections. A module label area is provided for field wiring identification. An available 36-screw Euro Terminal block is required for certain high capacity modules.

**Remote I/O** - I/O racks may be remotely mounted from the controller via a dedicated Ethernet 10/100Base-T connection at up to 300 meters (984 feet) between the controller and the most remote rack using two Ethernet switches. Use of fiber optic cable extends distance to 1500 meters.

**Remote Terminal Panels** - Optional DIN rail mounted Remote Terminal Panels (RTPs) are available for use with pre-wired cables to reduce installation time and labor expense. RTP types available: analog input, relay output, discrete input, discrete output, analog output. Three cable lengths are also available to match hardware to installation variations. See Module Specification sheet 51-52-03-41 for more details.

**Redundant Power** - A second (backup) power module may be added to each HC900 controller rack. An extended rack is available that expands the standard I/O rack to accommodate a second (redundant) power supply and power status module.

### Table 1 CPU Capacities

<table>
<thead>
<tr>
<th>Function</th>
<th>Point per Module</th>
<th>Max. for C30 CPU</th>
<th>Max. for C50 CPU</th>
<th>Max. for C70/C70R CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog In</td>
<td>Universal: 8</td>
<td>Universal: 96</td>
<td>Universal: 480</td>
<td>Universal: 480</td>
</tr>
<tr>
<td></td>
<td>High level: 16</td>
<td>High level: 192</td>
<td>High level: 960</td>
<td>High level: 960</td>
</tr>
<tr>
<td>Analog Out</td>
<td>4, 8, 16</td>
<td>40</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Analog Out</td>
<td>8, 16</td>
<td>192</td>
<td>960</td>
<td>960</td>
</tr>
<tr>
<td>(External power)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital In</td>
<td>16 or 32</td>
<td>384</td>
<td>1920</td>
<td>1920</td>
</tr>
<tr>
<td>Digital Out</td>
<td>8 AC or 16 DC, 32</td>
<td>384</td>
<td>1920</td>
<td>1920</td>
</tr>
<tr>
<td>Function Blocks</td>
<td>n/a</td>
<td>400</td>
<td>2000</td>
<td>5000</td>
</tr>
</tbody>
</table>
Redundant Architectures

Single process/ Non-redundant network

Multiple systems/ multiple I/O Racks
**Redundant Architectures**

**Redundant Controller**

Two redundant C70R CPUs operate in a separately mounted controller rack, each with an independent power supply. A Redundant Switch Module (RSM) is located in the rack between the two C70R CPUs. A key switch on the RSM allows the user to change the operating mode of the Lead CPU. There is no I/O in the controller rack; the CPUs communicate with up to 5 racks of I/O over a 100 base-T Ethernet physical communication link or fiber optic for greater distance. When more than one I/O rack is used in the system, Ethernet switches are required, one for each Scanner connection. In operation, all control functions and host communication exchanges are handled by the Lead controller, including configuration and operator changes. The Lead controller updates the Reserve controller with all the information needed to assume control in the event of a fault condition.

After power-up of the C70R CPUs, the first available CPU assumes the Lead function. The Lead may be transferred to the Reserve controller by:

- Failure of the Lead controller,
- Manually changing a keyed switch located on the Redundant Switch Module,
- Input pin on Redundancy Status function block, or
- Instruction from host communication.

Redundant Networks for Host communications are provided on the C70R CPU. Both network ports are continuously active on the Lead controller. An OPC server is available from Honeywell to support redundant Ethernet communications and automatically transfer communications.

The C70R network ports may otherwise be used in non-redundant mode where only one of the communication ports is used.

**Remote I/O** - To extend the distance between the CPU rack and the most distant I/O rack to 300m (984 ft.) up to two Ethernet switches may be used in each I/O connection. Distances up to 1500m (4920 ft.) are possible with fiber optic cable and two switches.

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**Operator Interface** – The 900 Control Station operator interfaces is supported with the C70R CPU. An Ethernet connection is made to a switch connected to the Ethernet port of each CPU. The operator interface communication to the controller follows the Lead controller assignment.

**Status/Diagnostics** - An output parameter of the system monitor function block of C70R CPUs provides a digital status of the Reserve controller to allow integration of this information into the control strategy. C70R CPUs also provide diagnostic status on redundancy operation that may be observed using Hybrid Control Designer configuration software. A Redundancy status function block is also available to monitor redundant controller operation.

**Function Blocks**

A large assortment of analog and digital function blocks are available to solve the most demanding control requirements. Function blocks are grouped by scan rate, fast or normal, and by function, Principal or Standard.

**Function Block Execution** - All function blocks operate synchronously with I/O processing. Inputs are measured at the start of every scan and outputs are updated at the end of every scan. Function blocks such as Time Proportioning Outputs (TPO) and Position Proportioning outputs (PPO) require higher output resolution and are updated when the function blocks are executing. Micro-controllers on digital I/O modules can maintain TPO duty cycle operation during failsafe conditions. Micro-controllers on all I/O modules allow outputs to be configured to assume a default state in the event of a fault condition.

**Normal Scan**: Function blocks that execute during the Normal Scan are synchronized to the analog input measurements. The fastest update rate is 500ms.

**Fast Scan**: The fastest update rate for fast scan function blocks in a single controller rack is 27ms. The update rate starts at 53ms when remote racks are used and for redundant systems.

**Principal Function Blocks** – These function blocks are supported by dedicated Widget objects in Station Designer software for configuring 900 Control Station operator interfaces. They have Tag names and other attributes to support on-line user interaction. Principal function blocks can be used any number of times in a configuration. Typical Principal function blocks include PID, Set Point Programming, Sequencers, Alternators, Stage, etc.
**Standard Function Blocks** – The number of standard function blocks that may be used in a configuration is virtually unlimited. Typical Standard blocks include totalizer, free-form math, average, mass flow, function generator, periodic timers based on real-time, carbon potential, RH, Dew Point, signal selection, comparison, gas flow, real time clock, and many others. These blocks may be configured to create control schemes that precisely address the needs of your process.

Digital status outputs are also provided on many of the analog function blocks to facilitate intelligent signal alarming and default operation strategies. Typical logic function blocks include AND, OR, XOR, NOT, Latch, Flip-flop, On/Off Delay and Resettable timers, Counters, Free-form Boolean logic and more. The execution of analog and digital functions is seamlessly integrated into a single control strategy in the controller.

**Recipes**

Recipes are groups of data defined by the user that are used to make multiple value changes in the controller through a single action. Function block types that accept recipe data and the quantity of recipes stored in the controller are listed in Table 2. Recipes may also include Variables, which are dynamic analog and digital values used as inputs to standard and principal function blocks. Recipes may be loaded through the 900 Control Station operator interface by name or number, or via a dedicated recipe load function block and user configured logic.

**Alarms/Events**

Alarms and events represent changes in digital status that require user notification. The HC900 controller supports an internal alarm annunciation system that may be setup to operate via e-mail to a remote computer (see Communications, E-mail Alarming). Up to 360 alarm points per controller may be grouped in 30 groups of 12.

Events are digital status changes that cause messages to be presented on the 900 Control Station operator interface. Controller events may prompt e-mail messages, do not require acknowledgement, and are reported and logged in a separate group. Up to 64 event points are supported in a controller.

Alarms and events are time stamped in the controller to a one second resolution.

**Table 2 Recipe capacities**

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Content</th>
<th>Recipe size</th>
<th># of recipes stored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setpoint</td>
<td>Profiles</td>
<td>Ramp/Soak values, times and event actions</td>
<td>50 Segments</td>
<td>Configurable</td>
</tr>
<tr>
<td>Programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setpoint</td>
<td>Schedules</td>
<td>Ramp/Soak values, times and event actions</td>
<td>50 Segments</td>
<td>Configurable</td>
</tr>
<tr>
<td>Schedules</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequencer</td>
<td>Sequences</td>
<td>State sequence, analog values</td>
<td>64 steps</td>
<td>Configurable</td>
</tr>
<tr>
<td>Variable</td>
<td>Recipe Variables</td>
<td>Analog and digital values</td>
<td>50 Variables</td>
<td>Configurable</td>
</tr>
</tbody>
</table>
**Configuration**

Controller configuration is performed using Hybrid Control Designer Configuration software on a PC operating with a Microsoft Windows® operating system. Configuration files may be built independently on the PC and downloaded to the controller in a separate operation. Validation of proper physical I/O to support the configuration is provided along with appropriate warnings.

**Configuration Back-build** - In the event a PC configuration file is lost or misplaced, it can be easily reconstructed using the upload function of the Hybrid Control Designer configuration software. Simply read the configuration from the controller to exactly duplicate the original configuration, including all text descriptions and operator interface display selections.

**Configuration edit** - In the event edits to a controller’s configuration are required after the unit is in operation, an uploaded file may monitored during process operation, edited, and downloaded with the on-line download function of the HC900 Hybrid Control Designer. The software allows configuration changes while in the Run mode, limiting process disturbances.

**Operator Interfaces**

A HC900 controller can support up to three 900 Control Station operator interfaces via Ethernet or Serial communications. The interface is configured with Station designer software using a database import function to simplify setup. See specification sheet 51-52-03-46 for more information on this interface.

**Communications**

**Remote I/O Rack Port (C50, C70, C70R)** – An Ethernet port is dedicated to supporting remote I/O racks. This 10/100Base-T Connection on the C50 and C70 CPU supports a single direct connected remote rack or up to 4 remote racks when connected through an external Ethernet switch. The C70R CPU supports a single direct connected rack or up to 5 remote racks using external switches.

**User Interface Support** – The 900 Control Station interface may be connected via Ethernet or serial communications. Up to three interfaces may be connected to a controller for distances up to 328 feet (100Meters) via Ethernet or 2000 feet (609 meters) between the controller and operator interface.

3rd party user Interface support is provided through RS232 and/or RS485 port connections using Modbus/RTU protocol, or Ethernet with Modbus/TCP protocol.

**Ethernet Modbus/TCP Communications** – HC900 controllers communicate with their host PC interfaces over an Ethernet 10/100Base-T communication network using the Modbus/TCP protocol, an open protocol interface available for most popular HMI software packages. The C30/C50 support up to 5 host connections while the C70/C70R supports up to 10 host connections concurrently over an Ethernet network for control supervision and data acquisition. The Hybrid Control Designer software can also address any of the controllers concurrently over Ethernet for configuration monitoring, diagnostic interrogation, upload/download, or on-line configuration changes. As a result, a HC900 network of controllers and operator interfaces can be partitioned into process segments to assure proper control performance. Each of these process segments, in turn, can be accessed via common HMI software within the plant environment using an Ethernet LAN.

**Ethernet Peer to Peer Communications** - Peer data communications between one HC900 controller and up to 32 other HC900 controllers is supported over Ethernet via UDP protocol for process interlocks or data sharing. Both digital and analog data exchange are supported using peer data exchange function blocks, up to 2240 parameters between peer controllers. No specialized software is required. Peer data can be given signal tag references for use in a control or data acquisition strategy. Peer to peer data interchange does not consume one of the host connections.

**Serial Modbus RTU Communications** - Serial Modbus RTU communications is available on the RS232 and RS485 (2 wire) ports of the HC900 Controller CPU assembly in a Master or Slave mode. The protocol of these ports is user selectable between ELN protocol for use with HC Designer software and Honeywell operator interfaces, or Serial Modbus to interface with other compatible devices.
**Modbus RTU Slave** - The RS232 and RS485 ports may be configured for simultaneous operation as a Modbus slave port to allow each to communicate with a single Modbus master.

The Modbus protocol supports read and write access to a default address map of certain function blocks and parameters.

In configurations 4.0 and later, a map of customized addresses, blocks and parameters can be created either by editing the default map or from scratch.

In the default map (fixed), a 1000 register array is available to allow the user to specify the address locations of specific controller data to optimize controller communications.

The data in the array may also be accessed in user specified formats (data types) such as analog data in Float 32, unsigned 16, signed 16, unsigned 32, signed 32, and digital data in signed 16 or unsigned 16.

The data type selections in the 1000 register array provide compatibility with devices such as 3rd party touch panels. In the custom map, all data formats are adjustable.

**Modbus RTU Master** - Either of the ports may be configured as a Modbus RTU master, one per controller. Up to 32 devices may be multi-dropped on the RS485 port. Function blocks are available in the HC900 controller to allow the user to specify read and write operations to up to 32 external Modbus compatible slave devices and up to 1024 data points.

**Modbus TCP Initiator** – The Ethernet ports may be configured as a Modbus TCP initiator. Function blocks are available in the HC900 controller to allow the user to specify read and write operations to compatible slave devices for up to 1024 data points.

**Profibus** – The HC900 can access data from Profibus slave devices using a Modbus-to-Profibus gateway device attached to the serial port of the controller. The gateway device is a Profibus Master on the fieldbus network and a Modbus slave to the HC900. The Profibus data is connected into the control strategy using Modbus function blocks. This application has been validated with a ProLinx 5104-MCM-PDPM gateway (from ProSoft® Technology).

**E-mail Alarms/Events** – HC900 alarms or events can be individually configured to send an e-mail alarm (or event) message to e-mail addresses with the assigned alarm priority.

- Number of e-mail addresses: 3 based on alarm priority
- From: Controller name (up to 16 characters)
- Subject: text (up to 32 characters)
- Content: date and time of alarm/event, alarm/event tag name, alarm/event state
- Message: 48 character text (for alarms only)
- Priority Levels: 4 for alarms, 1 for events

**Controller Configuration Access** – HC Designer software supports communicating with HC900 controllers using an Ethernet or serial connection using ELN protocol to support direct PC connection for configuration upload, download, debug and maintenance. Modbus RTU protocol is also supported through the serial port interface. Once the HC900 controller has been configured using Hybrid Control Designer Software, on-line configuration changes may be made while maintaining process control. Configurations may also be loaded into the controller via the Ethernet TCP/IP network from a host PC. On-line monitoring for program debug and on-line program edit functions are also supported via the Ethernet port.

**Modem Access** – Communications to the HC900 controller may be via an external modem connected to the controller’s RS232 port. HC Designer software supports configuration upload, download and on-line edits via modem. When modem communication is selected, Modbus RTU communication timeouts are extended.

**Vista Supervisory Software** – Honeywell’s Windows 2000 version is available when PC-based supervisory control and data acquisition is required. Ethernet network interface to a Vista server is via the controller host Ethernet 100 Base-T port using Modbus/TCP protocol. Client Stations over Ethernet allow multiple user access to an HC900 network. Using the large selection of standard operating display templates in Vista saves development time. When further customization is needed, the full graphic display development environment of Vista may be used to fully animate your process supervisory displays.
A batch reporting option is offered in Release 400 which enables batch reports to be created using a standard template. User-entered lot data is supported and up to 50 parameters can be defined for batch logging. The file can be exported in .csv format using a lot number-encoded filename.

**SpecView32 Supervisory Software** – SpecView32 software can be used as a supervisory interface for thermal-based applications, offering historical trending, batch reporting, recipe development involving setpoint programs and simplified graphics configuration.

HC900 parameters are simply selected from categorized lists for placement on user-configured displays or onto display objects.

Network connection is via the controller host Ethernet 10/100Base-T port using Modbus/TCP protocol. A variety of Windows operating environments are supported including Windows NT, 2000, XP and Vista.

**OPC Server** – Network communication access to HC900 controllers through third party PC interfaces is simplified with Honeywell’s OPC server software program. This software supports the Modbus/TCP interface to either redundant or non-redundant HC900 controllers. In redundant applications, Honeywell’s OPC Server software supports dual redundant Ethernet connections to both C70R CPUs.

Communications to the controller is maintained during a single network failure and/or following the transfer of the Lead function from one CPU to another. Compatible OPC client programs can use the Ethernet connection to the HC900 via Honeywell’s OPC Server for remote supervision, data collection or other supervisory functions.

**Capacity**

The capacity of the HC900 system is determined by the type of CPU selected, the quantity of I/O racks, the quantity’s type of I/O modules, the update rate (scan rate) required, and CPU memory. In most applications, the CPU memory limit has a low probability of limiting capacity.

**How many I/O channels?**

Number of I/O is limited only by physical space. Namely, the number of racks, the number of modules per rack, and the number of channels in the modules.

In general,

\[
\text{Maximum I/O channels} = (\text{max. number of I/O racks}) \times (\text{max. number of modules in each rack}) \times (\text{max. number of channels per module})
\]

**Examples**

Maximum C30 I/O = 1 rack x 12 modules x 32 channels per module = 384 I/O channels

Maximum C50, C70,C70R I/O = 5 racks x 12 modules per rack x 32 channels per module = 1920 I/O channels

**How many function blocks (loops, programmers, etc.)?**

Fixed limits are not imposed on function block types. Your configuration can probably contain as many of each function block as needed. The limit is reached when either

a) Dynamic memory is full or

b) Maximum function block quantity is reached or

c) Configuration memory is full or

d) Over 65,535 block configuration parameters or block inputs used (but not Block Outputs).
These limits are explained below.

\(a) \text{Dynamic Memory}\)

The rule of thumb is
\[
\text{Max. number of function blocks} = \text{Dynamic memory} \div \text{memory per function block}
\]

The smaller the function block, the more of them can fit in your configuration.

\(b) \text{Quantity}\)

Regardless of memory availability, the total number of all function blocks regardless of type is:
- C30 \(\leq 400\) function blocks
- C50 \(\leq 2000\) function blocks
- C70/C70R \(\leq 5000\) function blocks

Complex blocks such as PID, Programmer, Scheduler, Sequencer use more memory than simpler blocks like On/Off, Device Control, Auto/Manual Bias. For example, several thousand Auto/Manual Bias blocks would fit in the C30’s memory if not for the quantity limit of 400. Conversely, about 300 Scheduler blocks will consume all the C30’s memory despite the higher quantity limit of 400.

\textit{Scan Time Consideration}

Another consideration when configuring function blocks is scan time and the potential for CPU scan time to become insufficient for the application.

The scan time of a controller increases in fixed increments. As function block are added to a configuration, the time needed to execute the total configuration is recalculated. If additional time is needed, the scan time will be increased to the next increment in sequence. (See Specification section for scan time increments)

\textit{How many recipes in my pool?}

Unlike with function blocks, there is no quantity limit to recipes. The only limiting factor to recipe pool size is available memory. Whatever memory is unused by the rest of your configuration (that is, function blocks) can be allocated for recipes. As long as memory is available, allocate as many recipes as needed.

The rule of thumb is
\[
\text{Max. number of recipes} = \text{Recipe memory allocation} \div \text{memory per recipe}
\]

\textit{Configuration memory allocation}

The configuration memory comprises one allocation for the function block configuration and one allocation for recipes. In general,
\[
\text{Total configuration memory} = \text{Configuration} + \text{Recipe allocation}
\]

Whatever memory has not been allocated to recipes is available for your configuration. By changing the size of the recipe pool allocation you control the amount of memory available for recipes and therefore configuration. Need a small configuration but many recipes? Allocate more recipe space. Need a large configuration but few recipes? Allocate less recipe space.

\textit{Where are usage/capacities presented?}

File Properties in HC Designer displays statistics on usage/availability of:
- configuration memory (recipes + function block configuration),
- dynamic memory (function block configuration only)
- fast scan time,
- Normal scan time,
- Normal CPU% used,
- Fast CPU% used,
- each component of a configuration (variables, constants, etc.).

\textit{Controller Data Storage}

The controller may log process data values in the available memory that is not used by the configuration. Up to 250 signal values may be logged in a rotating buffer using three different sample rates with oldest data being replaced with new data after the buffer is full.

Data is extracted from the controller using HC Historian data harvesting software via Ethernet or Serial connection.
## Specifications

<table>
<thead>
<tr>
<th></th>
<th>C30</th>
<th>C50</th>
<th>C70</th>
<th>C70R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controller Design</strong></td>
<td>Modular design with metal rack enclosure, power supply, controller CPU and user selectable I/O module types.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rack Mounting and Installation</strong></td>
<td>Surface mounting with 4 screws in back of rack. Installation Category II, Pollution Degree 2, IEC 664, UL840 Installation coordination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Controller I/O support</strong></td>
<td>4, 8, or 12 I/O slots per Rack</td>
<td>None (requires remote I/O racks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remote I/O racks</strong></td>
<td>None</td>
<td>1 w/o switch, using Ethernet direct cable. Up to 4 with recommended Honeywell switches (part no. 50008930-001).</td>
<td>1 w/o switch, using Ethernet direct cable. Up to 5 with recommended Honeywell switches (part no. 50008930-001).</td>
<td></td>
</tr>
<tr>
<td><strong>Remote I/O interface type</strong></td>
<td>None</td>
<td>Separate Ethernet 100Base-T port on CPU, RJ-45 connection, dedicated communications link</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remote I/O Distance</strong></td>
<td>None</td>
<td>100 m (328 ft.) – Ethernet cable, controller to remote rack or controller to switch. Up to two switches per connection, 300m (984 ft.), maximum distance.</td>
<td>750m (2460 ft.) – Fiber optic cable, controller to remote rack or controller to switch. Up to two switches per connection, 1500m (4920 ft) maximum distance.</td>
<td></td>
</tr>
<tr>
<td><strong>Fiber Optics Equipment Recommendations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet Switch</td>
<td>Moxa Unmanaged Ethernet Switch model EDS-308-MM-SC with (6) 10/100 Ethernet ports, (2) multi-mode fiber ports with SC Connectors (require 24VDC power)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Converter</td>
<td>Moxa Media Converter model IMC-101-M-SC with (1) 10/100BaseT(X) to 100BaseFX multi-mode fiber port with SC connectors (require 24VDC power)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber Cable</td>
<td>Multi-mode, Duplex, 62.5/125 with SC connectors on both ends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Ethernet Cable</td>
<td>Shielded Cat5 Ethernet</td>
<td></td>
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</tr>
<tr>
<td><strong>I/O Capacity</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Combined Analog and Digital</td>
<td>384</td>
<td>1920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Inputs</td>
<td>192</td>
<td>960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Outputs</td>
<td>40</td>
<td>200</td>
<td>48 with heat de-rating</td>
<td>240 with heat de-rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>192 with external power source</td>
<td>960 with external power source</td>
</tr>
<tr>
<td>Rack Size</td>
<td>C30</td>
<td>C50</td>
<td>C70</td>
<td>C70R</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>4 I/O slot chassis</td>
<td>5.4*(137mm) H x 10.5*(266.7mm) W x 6.0* (151.7 mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 I/O slot chassis</td>
<td>5.4*(137mm) H x 16.5*(419.1mm) W x 6.0* (151.7mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8 I/O slot chassis with redundant power support</td>
<td>5.4*(137mm) H x 20.9*(530.9.1mm) W x 6.0* (151.7mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12 I/O slot chassis</td>
<td>5.4*(137mm) H x 22.5*(571.5mm) W x 6.0* (151.7mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 I/O slot chassis with redundant power support</td>
<td>5.4*(137mm) H x 26.9*(683.3mm) W x 6.0* (151.7mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
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</tr>
<tr>
<td>Redundant CPU rack</td>
<td>N/A</td>
<td></td>
<td></td>
<td>5.4*(137mm) H x 10.3*(261.6mm) W x 6.0, (151.7mm) D (rear mounting plate extends height to 6.9* (175.3mm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/O Wiring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Removable terminal blocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Block Styles</td>
<td>20 screw: Barrier or Euro-style, tin-plated or gold-plated (for DC connections)</td>
<td>36 screw: Euro style gold plated (Required with certain higher capacity modules)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauge wires</td>
<td>20 screw: Barrier style – #14 to 26 AWG, solid or stranded</td>
<td>36 screw: Euro-style - #14 to 26 AWG, solid or stranded</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Euro-style - #14 to 26 AWG, solid or stranded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shield terminals</td>
<td>Optional brackets mounted top/bottom of rack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power (P01)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>Universal power, 90 to 264VAC, 47 to 63 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Rush Current</td>
<td>7 Amps peak-to-peak for 150 ms at 240VAC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input rating</td>
<td>130 VA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output rating</td>
<td>60W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>Internal non-replaceable fuse. User installed external fuse.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power (P02)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>Universal power, 90 to 264VAC, 47 to 63 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Rush Current</td>
<td>7 Amps peak-to-peak for 120 ms at 240VAC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input rating</td>
<td>90 VA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output rating</td>
<td>28W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>Internal non-replaceable fuse. User installed external fuse.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Specifications

<table>
<thead>
<tr>
<th>Features</th>
<th>C30</th>
<th>C50</th>
<th>C70</th>
<th>C70R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power (P24)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>21 to 29VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Rush Current</td>
<td>30A for 3ms @29VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input rating</td>
<td>72.5W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output rating</td>
<td>60W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>Internal non-replaceable fuse, User installed external fuse.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Normal Scan Time</strong></td>
<td>500ms. Each analog input card has its own A/D converter providing parallel processing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fast Scan Time</strong></td>
<td>53ms for up to ~250 fast logic blocks</td>
<td>27ms for up to ~300 fast logic blocks</td>
<td>27ms for up to ~330 fast logic blocks</td>
<td>53ms for up to ~500 fast logic blocks</td>
</tr>
<tr>
<td></td>
<td>67ms for up to ~315 fast logic blocks</td>
<td>53ms for up to ~500 fast logic blocks</td>
<td>53ms for up to ~660 fast logic blocks</td>
<td>67ms for up to ~780 fast logic blocks</td>
</tr>
<tr>
<td></td>
<td>107ms for up to ~400 fast logic blocks</td>
<td>67ms for up to ~780 fast logic blocks</td>
<td>67ms for up to ~1040 fast logic blocks</td>
<td>107ms for up to ~1040 fast logic blocks</td>
</tr>
<tr>
<td><strong>Detection+Failover Time from Lead to Reserve CPU</strong></td>
<td>N/A</td>
<td>Up to 4 analog scan cycles</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Run-Mode Edit Transfer Time</strong></td>
<td>3 normal scan times (1.5 sec. typical) for all configuration edits not including I/O changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operating Modes</strong></td>
<td>Run (No configuration download in this position)</td>
<td>Run/Program (Download allowed)</td>
<td>Program (Outputs Off, initialization on download).</td>
<td>Offline mode is available via software selection (for AI calibration).</td>
</tr>
</tbody>
</table>

<p>| Maximum user-configurable Function Blocks      | 400  | 2000 | 5000 |      |
| Maximum Control Loops                          | Quantity based on available memory |      |      |      |
| System Blocks (Not user configurable)          | 100 (not part of 400, 2000 or 5000), for Alarm Group blocks, System block, Rack Monitor blocks, Communications |      |      |      |
| Loop Outputs                                  | Current, time proportional, position proportional, 3-position step (motor positioning), dual output [heat/cool] |      |      |      |
| Control Loop Types                            | PID A, PID B, Duplex A, Duplex B, Ratio, Cascade, % Carbon, Dewpoint, Relative Humidity, On-Off, Auto/Manual-Bias |      |      |      |</p>
<table>
<thead>
<tr>
<th>Features</th>
<th>C30</th>
<th>C50</th>
<th>C70</th>
<th>C70R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auto-tuning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accutune III, fuzzy logic overshoot suppression, applicable to all control loops</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Setpoint Programmers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramp Types:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramp Rate or Ramp Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Units:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours or Minutes</td>
<td></td>
<td></td>
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<tr>
<td>Segment Time:</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>0-99,999.999 hours or minutes</td>
<td></td>
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</tr>
<tr>
<td>Program Cycles:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 100 or infinite, configurable segment range</td>
<td></td>
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</tr>
<tr>
<td><strong>Programmer Events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignable to DO or internal status</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Setpoint Profiles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 segments per profile. Number of stored profiles is user-configurable.</td>
<td></td>
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</tr>
<tr>
<td><strong>Setpoint Scheduler</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ramp type:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ramp time</td>
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<tr>
<td>Time units:</td>
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</tr>
<tr>
<td>Hours or minutes</td>
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<td></td>
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<tr>
<td>Segment time:</td>
<td></td>
<td></td>
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<tr>
<td>0.001 to 9999.999 hours or minutes</td>
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<tr>
<td>Cycles:</td>
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<tr>
<td>Per segment to 999 or infinite</td>
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<tr>
<td><strong>Auxiliary Scheduler</strong></td>
<td></td>
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<tr>
<td><strong>Setpoints</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 8 setpoints, soak only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Schedule events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 16, assignable to DO or internal status</td>
<td></td>
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</tr>
<tr>
<td><strong>Setpoint Scheduler</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 segments per schedule. Number of stored schedules is configurable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sequencers</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>States: 50</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>State text: 12 characters</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Steps: 64</td>
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</tr>
<tr>
<td>Time Units: Minutes or Seconds</td>
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</tr>
<tr>
<td>Digital Outputs: 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Output: 1, configurable value/step</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step Execution: On Time, Event 1, Event2, or via Advance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Next Step: Any step</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Sequences</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Number of stored Sequences is user-configurable</td>
<td></td>
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<tr>
<td><strong>Recipes (Variables)</strong></td>
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<td></td>
</tr>
<tr>
<td>Number of stored Recipes (Variables) is user-configurable</td>
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<td></td>
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<tr>
<td><strong>Recipe Parameters</strong></td>
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</tr>
<tr>
<td>Up to 50 analog or digital Variables — (may include profile numbers)</td>
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<td></td>
</tr>
<tr>
<td><strong>Signal Tags (Read only)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Up to 65,535</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tag Identification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-character tagname, 16-character descriptor,6-character units of measure (analog only), 6 character on/off state (digital only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variables (Read/Write)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 2048</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variable Identification</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>16-character tagname, 16-character descriptor,6-character units of measure (analog only), 6 character on/off state (digital only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Controller Data Storage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Data types: Signals, Alarms, Events</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maximum signals tags: 250</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• Maximum points per group: 50</td>
<td></td>
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<tr>
<td>• Selectable storage rates: 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Storage rate resolution, 10 sec. to 24hr</td>
<td></td>
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</tr>
<tr>
<td>• Data Access - via HC Historian PC software, manual upload using Ethernet or Serial communications.</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
# Specifications

## Communications

<table>
<thead>
<tr>
<th></th>
<th>C30</th>
<th>C50</th>
<th>C70</th>
<th>C70R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Network Communications Ports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Ethernet 10/100Base-T connections</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Ethernet 10/100Base-T, RJ-45 connection</strong></td>
<td>Supports Modbus/TCP Protocol to PC supervisory and data acquisition software packages, OPC server, Modbus/TCP Initiator, Peer to Peer, and Hybrid Control Designer configuration software</td>
<td>Supports redundant Modbus/TCP Protocol to PC supervisory and data acquisition software packages, OPC server, Modbus/TCP Initiator (non-redundant), Peer to Peer, and Hybrid Control Designer configuration software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. number of concurrent Ethernet host connections</td>
<td>Up to 5 (peer data exchange does not consume a host connection)</td>
<td>Up to 10 shared between two ports (peer data exchange does not consume a host connection)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RS-232 Ports

- **Ports per controller**: Two, user selectable between RS 232 and RS-485 with Modbus RTU or Honeywell protocol. 3-Plug connectors supplied.
- **Baud rates**: 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6 K, 115.2K configured by Hybrid Control Designer software or OI.
- **Modem**: For remote connection to Hybrid Control Designer software, requires external modem at controller, 1200 baud to 57.6KB

### RS-485 Ports

- **Ports per controller**: Two, user selectable between RS-485 and RS-232 (connector supplied), Honeywell or Modbus RTU protocol. Only one port for the 559 operator interface support.
- **Cable type**: 2-wire plus shield, Belden 9271 or equivalent
- **1042, 559 Distance from controller**: 2000 ft. (600 m.)
- **1042, 559 Power to OI**: 24VDC, user-provided at OI
- **Unit addresses**: 1 to 247

### RS-232, RS-485 Ports

- **Parity (user selectable)**: Odd, even, none
- **Stop bits (user selectable)**: 1 or 2
- **Speed (user selectable)**: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
- **Double Register Format for Modbus RTU Slave and Master data (User selectable)**: Selectable byte order

### RS-232, RS-485 Modbus, Slave Operation

- **Number of ports per controller**: Up to two
- **Masters per port**: One
- **Principal Function Block Address Range**: User selectable starting address range for registers assigned to each principal block type.
<table>
<thead>
<tr>
<th><strong>Communications</strong></th>
<th><strong>C30</strong></th>
<th><strong>C50</strong></th>
<th><strong>C70</strong></th>
<th><strong>C70R</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RS-232, RS-485 Modbus Master Operation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ports per controller</td>
<td>One (RS232 or RS485)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function Block Types</td>
<td>Slave – 4 read and 4 write data points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Read (Slave extension block ) up to 16 parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write (Slave extension) up to 8 parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(No limit on the number of Read and Write extension blocks per Slave block up to the maximum 1024 parameters per controller.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slave devices per controller</td>
<td>Up to 32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of read/write Modbus Parameters</td>
<td>Up to 1024 max. per controller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Register Format</td>
<td>Selectable per device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>1 second fastest – load dependent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus Master Advanced Application Speed</td>
<td>Recommended for use with gateway devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>As fast as 500ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethernet Modbus/TCP Initiator Operation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ports per controller</td>
<td>One (Models C30 and C50) - Two (Models C70 and C70R) RS232 or RS485</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function Block Types</td>
<td>Slave – 4 read and 4 write data points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Read (Slave extension block ) up to 16 parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write (Slave extension) up to 8 parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(No limit on the number of Read and Write extension blocks per Slave block up to the maximum 1024 parameters per controller.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slave devices per controller</td>
<td>Up to 32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of read/write Modbus Parameters</td>
<td>Up to 1024 max. per controller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Register Format</td>
<td>Selectable per device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>1 second fastest – load dependent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Peer-to-peer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/100Base-T via Network port</td>
<td>Supports UDP protocol and Peer Data Exchange function blocks for peer data exchange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Peers/Controller</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update rate</td>
<td>500 ms to 5 sec., selectable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer Data</td>
<td>Digital and Analog Signal Tags, Variables - up to 2240 parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet Network Connection</td>
<td>10/100 Base-T, RJ-45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Host Network Protocol</td>
<td>Modbus/TCP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Maximum distances per Ethernet specifications

<table>
<thead>
<tr>
<th>Connection</th>
<th>Cable Type</th>
<th>Distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller rack to I/O Rack</td>
<td>Ethernet CAT5 cable with RJ-45 connectors</td>
<td>100m /328 ft</td>
</tr>
<tr>
<td></td>
<td>Fiber Optic cable with switch</td>
<td>750m</td>
</tr>
<tr>
<td></td>
<td>Fiber Optic cable with switch and repeater</td>
<td>1500m</td>
</tr>
<tr>
<td>Controller to Ethernet Switch</td>
<td>Ethernet CAT5 cable with RJ-45 connectors</td>
<td>100m /328 ft</td>
</tr>
<tr>
<td>Ethernet Switch to I/O Rack</td>
<td>Ethernet CAT5 cable with RJ-45 connectors</td>
<td>100m /328 ft</td>
</tr>
<tr>
<td>Controller to Network Switch</td>
<td>Ethernet CAT5 cable with RJ-45 connectors</td>
<td>100m /328 ft</td>
</tr>
<tr>
<td>Network Switch to PC</td>
<td>Ethernet CAT5 cable with RJ-45 connectors</td>
<td>100m /328 ft</td>
</tr>
<tr>
<td>Controller to 1042 Operator</td>
<td>Shielded, Twisted pair</td>
<td>610m /2000 ft</td>
</tr>
<tr>
<td>Interface</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Approvals

**CE Conformity**
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. EN61326: Electrical Equipment For Measurement, Control and Laboratory use. EMC requirements.

**ATEX**
The apparatus fulfills the requirements for Group II, Category 3 equipment in accordance with Directive 94/9/EC.

**ABS Type Approval**
Certificate of Design Assessment - No. 06-HS186538-PDA
Certificate of Manufacturing Assessment - No. 06-BA766694-X

**General Purpose Safety**
Compliant with EN61010-1, UL, UL 61010C-1, CSA C22.2 No. 1010-1

**Hazardous (Classified) Location Safety**
FM Class I, Div. 2, Groups A, B, C, D
CSA Class I, Div. 2 Groups A, B, C, D
Class 1, Zone 2, IIC

**Module Temperature Classifications**

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Module Type</th>
<th>Temperature Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundant CPU Rack</td>
<td>Scanner 2 Port</td>
<td>T6 *</td>
</tr>
<tr>
<td>Redundant PS Ext. Rack</td>
<td>Analog Input (8 chan)</td>
<td>T6 *</td>
</tr>
<tr>
<td>8 Slot Redundant PS Ext. Rack</td>
<td>Analog Input (16 chan)</td>
<td>T6 *</td>
</tr>
<tr>
<td>12 Slot Redundant PS Ext. Rack</td>
<td>Analog Output (4 chan)</td>
<td>T4 *</td>
</tr>
<tr>
<td>4 I/O Slot Rack</td>
<td>Analog Output (8 chan)</td>
<td>T4 *</td>
</tr>
<tr>
<td>12 I/O Slot Rack</td>
<td>Analog Output (16 chan)</td>
<td>T3C *</td>
</tr>
<tr>
<td>8 I/O Slot Rack</td>
<td>Digital Input, Contact type (16 chan)</td>
<td>T5 *</td>
</tr>
<tr>
<td>12 I/O Slot Rack</td>
<td>Digital Input, 24 Vdc (16 chan)</td>
<td>T4 *</td>
</tr>
<tr>
<td>Power Supply (P01)</td>
<td>Digital Input, 120/240 Vac (8 chan)</td>
<td>T3C @ Ta = 60 deg. C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4 @ Ta = 40 deg. C</td>
</tr>
</tbody>
</table>
### Approvals

<table>
<thead>
<tr>
<th>Module</th>
<th>Port</th>
<th>Description</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply (P02)</td>
<td>T4</td>
<td>Digital Input Vdc (32 chan)</td>
<td>T5 *</td>
</tr>
<tr>
<td>Power Supply (P24)</td>
<td>T4 *</td>
<td>Digital Output, Relay type (8 chan)</td>
<td>T5</td>
</tr>
<tr>
<td>Power Status Module (PSM)</td>
<td>T6 *</td>
<td>Digital Output, 24 Vdc, (16 chan)</td>
<td>T4</td>
</tr>
<tr>
<td>C30/C50/C70/C70R CPU</td>
<td>T5 *</td>
<td>Digital Output, 120/240 Vac (8 chan)</td>
<td>T4</td>
</tr>
<tr>
<td>Redundancy Switch Module (RSM)</td>
<td>T6 *</td>
<td>Digital Output Vdc (32 chan)</td>
<td>T6 *</td>
</tr>
<tr>
<td>Scanner 1 Port</td>
<td>T6 *</td>
<td>Pulse/Frequency/Quadrature (4 chan)</td>
<td>T5 *</td>
</tr>
</tbody>
</table>

* Modules included in the ATEX declaration.

### Specifications

#### Environmental Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Reference</th>
<th>Rated</th>
<th>Extreme</th>
<th>Transportation &amp; Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>77 +/- 5°F</td>
<td>32 to 140</td>
<td>32 to 140</td>
<td>-40 to 158</td>
</tr>
<tr>
<td></td>
<td>25 +/-3°C</td>
<td>0 to 60</td>
<td>0 to 60</td>
<td>-40 to 70</td>
</tr>
<tr>
<td>Ambient Relative Humidity</td>
<td>*45 % to 55 % RH non-condensing</td>
<td>*10% to 90 % RH non-condensing</td>
<td>*5 % to 90 % RH non-condensing</td>
<td>*5 % to 95 % RH non-condensing</td>
</tr>
<tr>
<td>Mechanical Acceleration Duration</td>
<td>0 g</td>
<td>1 g</td>
<td>1 g</td>
<td>Not rated</td>
</tr>
<tr>
<td></td>
<td>0 ms</td>
<td>30 ms</td>
<td>30 ms</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>0 Hz</td>
<td>0 Hz to 14 Hz—amplitude 2.5 mm (peak-to-peak)</td>
<td>0 Hz to 14 Hz—amplitude 2.5 mm (peak-to-peak)</td>
<td>0 Hz to 14 Hz—acceleration 1 g</td>
</tr>
<tr>
<td></td>
<td>0 g</td>
<td>14 Hz to 250 Hz—acceleration 1 g</td>
<td>14 Hz to 250 Hz—acceleration 1 g</td>
<td></td>
</tr>
</tbody>
</table>

* Applies up to 40°C
**Dimensions**

![Dimensions Diagram]

- **4 Slots**: 10.5 in (266.7 mm)
- **8 Slots**: 16.5 in (419.1 mm)
- **12 Slots**: 22.5 in (571.5 mm)
- **Redundant CPU**: 10.3 in (261.6 mm)
- **Redundant Power Supply**: 20.9 in (530.9 mm)
- **12 Slots**: 26.9 in (684.0 mm)

Key:
- * 6.9 with mounting flanges
- **Total depth (rack + components)
- 6.4 (162.6) for 32 DI/DO and 16 AI Modules

Figure 2 HC900 Hybrid Controller Dimensions
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.
For More Information
Learn more about how Honeywell’s HC900 Hybrid Controller can provide a cost-effective platform for combining loop and logic control, visit our website www.honeywell.com/ps/hfs or contact your Honeywell account manager.

Honeywell Process Solutions
1860 West Rose Garden Lane
Phoenix, Arizona 85027
Tel: 1-800-423-9883 or 1-800-343-0228
www.honeywell.com/ps/
Overview
The Honeywell HC900 Hybrid Controller is an advanced loop and logic controller offering a modular design sized to satisfy the control and data acquisition needs of a wide range of process equipment.

I/O Modules
The following I/O modules are available to create a custom control solution.

- 8 point universal analog input modules: Inputs may be mixed on a module and may include multiple thermocouple types, RTDs, ohms, voltage or millivoltage types – all easily assigned using the Hybrid Control Designer configuration tool. High point-to-point isolation simplifies installation and saves the expense of external isolation hardware. (p. 5)
- 16 point high level analog input module: each point is configurable for V or mA. Point-to-point isolation. (p. 9)
- 4 point isolated analog output module. Supports from 0 to 20mA each. (p. 11)
- 8 point analog output, isolated in 2 groups of 4 points. Supports from 0 to 20mA each (p 12)
- 16 point analog output, isolated in 4 groups of 4 points. Supports from 0 to 20mA each (p 13)
- 16 point digital input modules: Contact closure type, DC Voltage and AC/DC voltage types. (p. 14)
- 32 point digital input module: DC voltage. (p. 18)
- 8 point AC or 16 point DC digital output modules (sinking type). (p. 19)
- 32 point digital output: DC voltage (sourcing type) (p. 21)
- 8 point relay output module: four form C type and four form A type relays. (p. 22)
- 4 channel Pulse/Frequency/Quadrature I/O module (p. 23)

Insert and Removal of I/O under Power
For ease of maintenance, the HC900 controller supports removing and inserting I/O modules from the module rack without removing power from the controller. Each module is sensed for validity by the controller and auto-configured on insertion.

Other Modules
In addition to I/O, the following modules are available.

- Scanner module, single port (p. 26)
- Scanner 2 Module, dual port (p. 27)
- Universal AC Power Supply, 60W (p. 3)
- Universal AC Power Supply 28W (p. 3)
- Power Supply 24VDC, 60W (p. 3)
- Redundant Switch Module (p. 28)
- Power Status Module (p. 28)

Failsafe
All HC900 I/O modules support a user specified failsafe value (analog) or state (digital) that the module outputs or inputs will assume if communication between the controller and the module is interrupted. Output modules are also disabled if the controller fails to start. Module diagnostics are not initiated if the control strategy does not call for the inputs or outputs on the modules to execute.

Remote Terminal Panels
Optional DIN rail mounted Remote Terminal Panels (RTPs) are available for use with pre-wired cables to reduce installation time and labor expense. Three types of RTPs are available: analog inputs relay outputs and other I/O modules. Three cable lengths are also available to match hardware to installation variations. Analog inputs RTPs include transmitter shunt resistors and transmitter power terminals with individual circuit fuses.
HC900 Hybrid Controller Modules

The RTP panels also switch field power to allow module removal and installation under controller power. See page 28.

**Terminal Blocks**
20-screw Barrier style and Euro style terminal blocks are available for use with all HC900 I/O Modules.

**Specifications for modules**

<table>
<thead>
<tr>
<th>I/O Module Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove &amp; Insert under power</td>
<td>Standard. Modules are automatically sensed and configured on insertion. Field power shall be disconnected before removing field terminal blocks.</td>
</tr>
<tr>
<td>LED status indicators</td>
<td>Via light pipes at front of module for each digital I/O point – green indicates ON, logic side</td>
</tr>
<tr>
<td>LED diagnostic indicator</td>
<td>Via light pipe, one per module, tri-color to represent status, Green = OK, Red = Fault (# of flashes indicates fault), Amber = Override (Force)</td>
</tr>
<tr>
<td>I/O Labels</td>
<td>Color-coded, on module door, removable, with write-on area to label I/O</td>
</tr>
<tr>
<td>Processor</td>
<td>Micro-controller per module for parallel processing</td>
</tr>
<tr>
<td>Terminal Boards</td>
<td>20 screw: Barrier or Euro style, tin-plated or gold-plated (for DC connections) 36 screw: Euro style gold plated (Req’d with certain higher capacity modules)</td>
</tr>
<tr>
<td>Keying</td>
<td>Hardware keying matches module to connector</td>
</tr>
</tbody>
</table>

**I/O module Compliance**

| CE Conformity | This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive (evaluated to EN61010-1) 89/336/EEC, the EMC Directive (evaluated to EN61326). Conformity of this product with any other European Council Directive(s) shall not be assumed. |
| General Purpose Safety | Compliant with EN61010-1, UL61010C-1, CSA C22.2 No. 1010-1 |
| Hazardous (Classified) Location Safety | FM Class 1, Div. 2, Groups A, B, C, D Class 1, Zone 2, IIC |

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Temperature Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller (C30, C50, C70, C70R)</td>
<td>T5</td>
</tr>
<tr>
<td>Power Supply (P01, P02, P24)</td>
<td>T4</td>
</tr>
<tr>
<td>Power Status</td>
<td>T6</td>
</tr>
<tr>
<td>Scanner (1 or 2 Port)</td>
<td>T6</td>
</tr>
<tr>
<td>Redundant Switch</td>
<td>T6</td>
</tr>
<tr>
<td>Analog Input (Universal 8 channel)</td>
<td>T6</td>
</tr>
<tr>
<td>Analog Input (High Level 16 channel)</td>
<td>T6</td>
</tr>
<tr>
<td>Analog Output (4 Channel)</td>
<td>T4</td>
</tr>
<tr>
<td>Analog Output (8 channel)</td>
<td>T4</td>
</tr>
<tr>
<td>Analog Output (16 channel)</td>
<td>TC3</td>
</tr>
<tr>
<td>Digital Input, Contact type (16 Channel)</td>
<td>T5</td>
</tr>
<tr>
<td>Digital Input, 24 Vdc (16 channel)</td>
<td>T4</td>
</tr>
<tr>
<td>Digital Input, 120/240 Vac (16 channel)</td>
<td>T3C @ Ta = 60 deg. C T4 @ Ta = 40 deg. C</td>
</tr>
</tbody>
</table>
Specifications (continued)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
</table>
| Digital Input, 120/240 Vac (16 channel 125 Vdc) | T3C@ Ta = 60 deg. C  
| | T4@ Ta = 40 deg. C  |
| Digital Input Vdc (32 channel) | T5 |
| Digital Output, Relay type (8 channel) | T5 |
| Digital Output, 24 Vdc, (16 channel) | T4 |
| Digital Output, 120/240 Vac (8 channel) | T4 |
| Digital Output Vdc (32 channel) | T6 |
| Pulse/Frequency/Quadrature (4 channel) | T5 |

Power Supply

P01 Power Supply (900P01-xxxx)
The P01 power supply provides 5VDC and 24VDC to satisfy the power requirements of a single controller with I/O, a Remote I/O rack, or a redundant controller rack. The 60 watt capacity requires minimal de-rating of the available HC900 I/O modules. See Module Specifications starting on page 6. A tool-secured door covers the high voltage connections; test jacks behind the door allow for quick verification of proper operation. An internal non-replaceable fuse limits supply current under certain fault conditions.

P02 Power Supply (900P02-xxxx)
The P02 power supply provides 5VDC and 24VDC to satisfy the power requirements of a single controller with I/O, a Remote I/O rack or a Redundant C70R CPU. The 28 watt capacity provides a cost-effective solution for smaller I/O configurations. A tool-secured door covers the high voltage connections. An internal non-replaceable fuse limits supply current under certain fault conditions.

P24 Power Supply (900P24-xxxx)
The P24 power supply provides 5VDC and 24VDC to satisfy the power requirements of a single controller with I/O, a Remote I/O rack or a Redundant C70R CPU. The 60 watt capacity requires minimal de-rating of the available HC900 I/O modules. A tool-secured door covers the voltage connections. An internal non-replaceable fuse limits supply current under certain fault conditions.

<table>
<thead>
<tr>
<th>Specifications</th>
<th>P01 Power Supply (900P01-xxxx)</th>
<th>P02 Power Supply (900P02-xxxx)</th>
<th>P24 Power Supply (900P24-xxxx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring</td>
<td>Screw type terminals, Wire gauge #12-22 AWG</td>
<td>Screw type terminals, Wire gauge #12-22 AWG</td>
<td>Screw type terminals, Wire gauge #12-22 AWG</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>Universal Power, 90-264VAC, 47-63 Hz</td>
<td>Universal Power, 90-264VAC, 47-63 Hz</td>
<td>21-29VDC</td>
</tr>
<tr>
<td>Input Rating</td>
<td>130VA</td>
<td>90VA</td>
<td>72.5V</td>
</tr>
<tr>
<td>Output Rating</td>
<td>60W</td>
<td>28W</td>
<td>60W</td>
</tr>
<tr>
<td>In Rush Current</td>
<td>7 Amps peak-to-peak for 150 ms at 240 VAC</td>
<td>7 Amps peak-to-peak for 120 ms at 240 VAC</td>
<td>In-rush current: 30A for 3ms @29VDC</td>
</tr>
<tr>
<td>Fuse</td>
<td>Internal, non-replaceable</td>
<td>Internal, non-replaceable</td>
<td>Internal, non-replaceable</td>
</tr>
<tr>
<td>Test jacks</td>
<td>5 volt, 24 Volt</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

See next page for how to choose an AC power supply.
# How to choose an AC Power Supply

<table>
<thead>
<tr>
<th>Module type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enter Quantity</td>
<td>Max Current @ 5 V</td>
<td>Max Current @ 24 V</td>
<td>Calculate 5V current (D = A * B)</td>
<td>Calculate 24V current (E = A * C)</td>
</tr>
<tr>
<td>Controller (C30)</td>
<td>(</td>
<td>820 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Controller (C50)</td>
<td>(</td>
<td>930 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Controller (C70)</td>
<td>(</td>
<td>1150 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Controller (C70R)</td>
<td>(</td>
<td>1500 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Scanner 1 Port</td>
<td>(</td>
<td>670 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Scanner 2 Port</td>
<td>(</td>
<td>770 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Power Status Module (PSM)</td>
<td>(</td>
<td>22 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Analog Input (8 pts)</td>
<td>(</td>
<td>40 mA</td>
<td>25 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Analog Input (16 pts)</td>
<td>(</td>
<td>75 mA</td>
<td>50 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Analog Output (4 pts)*</td>
<td>(</td>
<td>40 mA</td>
<td>200 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Analog Output (8 pts)***</td>
<td>(</td>
<td>225 mA</td>
<td>350 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Analog Output (16 pts)***</td>
<td>(</td>
<td>350 mA</td>
<td>700 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>AC Digital Input (16 pts)</td>
<td>(</td>
<td>130 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>DC Digital Input (16 pts)</td>
<td>(</td>
<td>130 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>AC/DC Digital Input (16 pts)</td>
<td>(</td>
<td>130 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Contact Input (16 pts)</td>
<td>(</td>
<td>130 mA</td>
<td>40 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>DC Digital Input (32 pts)</td>
<td>(</td>
<td>215 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>AC Digital Output (8 pts)</td>
<td>(</td>
<td>220 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>DC Digital Output (16 pts)</td>
<td>(</td>
<td>340 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>DC Digital Output (32 pts)</td>
<td>(</td>
<td>235 mA</td>
<td>0 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Relay Output (8 pts)</td>
<td>(</td>
<td>110 mA</td>
<td>100 mA</td>
<td>(</td>
<td>(</td>
</tr>
<tr>
<td>Pulse/Frequency/Quadrature**</td>
<td>(</td>
<td>110 mA</td>
<td>200 mA</td>
<td>(</td>
<td>(</td>
</tr>
</tbody>
</table>

*Limit 10 Analog Output modules per I/O rack.

** Limit 4 PFQ modules per I/O rack.

*** Limit 2 16-pt. modules per rack. Limit 5 8-pt. modules per rack with internal power supply. Use 0 mA for 24V value when using an external 24V supply.

<table>
<thead>
<tr>
<th></th>
<th>Total mA @ 5V</th>
<th>Total mA @ 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete columns A, D and E above.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is column D total mA @ 5V less than 2000mA?</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>Is column E total mA @ 24V less than 900mA?</td>
<td>Yes/No</td>
<td></td>
</tr>
</tbody>
</table>

If the answers to 1 and 2 are YES, go to 4. If the answer to 1 or 2 is NO, use power supply 900P01-0001.

Multiply 5V total by 5.1.
Multiply 24V total by 24.5.
Sum results of 4 and 5.
Divide results of 6 by 1000
Is the result of 7 less than 28? Yes/No

If the answer to 8 is Yes, use power supply 900P02-0001
If the answer to 8 is No, use power supply 900P01-0001
Analog Input Module (900A01-xxxx)
The Universal Analog Input module supports up to 8 user-configurable inputs on a per point basis for thermocouple, RTD, Resistance, V, mV, mA or slidewire. Point-to-point isolation and back-plane isolation are provided. Modules perform analog to digital conversion in synchronization with CPU control execution, eliminating data interchange latency. All analog input modules are processed in parallel, eliminating scan time increases as modules are added.

A tri-color status LED on the module indicates when the modules are being scanned, when input channels are forced and when module diagnostics exist. A user-selectable failsafe value is supported on a per channel basis. A warning signal is provided for thermocouple inputs to indicate maintenance is needed prior to a sensor failure. A sensor failure signal is also provided.

### Table 1 - Analog Input Specifications

<table>
<thead>
<tr>
<th>Inputs per module</th>
<th>8 (isolated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input types</td>
<td>mV, V, T/C, RTD, ohms, mA, slidewire assigned to any channel</td>
</tr>
<tr>
<td>Signal Source</td>
<td>See Table 2 on page 7 for range types. Thermocouple with cold junction compensation RTD, PT100 3 wire, 40 ohms balanced maximum Thermocouples: 100 Ohms/Leg 100 (except Low), 500 &amp; 1000 RTD: 100 Ohms/Leg 100 YIS: 100 Ohms/Leg 100-Low RTD &amp; 10 ohm Cu: 10 Ohms/Leg Slidewire 100 to 6,500 Ohms: 10% of total res./leg</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>10 megohms for T/C and mV inputs; &gt;1 megohm for volts and 250 ohms for mA inputs</td>
</tr>
<tr>
<td>Input Isolation</td>
<td>400 VDC point to point, solid state switching; 1K VDC to logic RTDs are isolated in pairs (IRT) is common to two inputs</td>
</tr>
<tr>
<td>Noise Rejection</td>
<td>Series Mode &gt;60dB. Common Mode &gt;130dB at 120VAC.</td>
</tr>
<tr>
<td>Burnout</td>
<td>T/C, mV, V (except for following ranges) configurable to upscale, downscale, defined value, or none. Volt: −500 mV to 500 mV; −1 V to 1 V; −2 V to 2 V; −5 V to 5 V; 0 V to 10 V; −10 V to 10 V; inherent to zero volt RTD: Inherent upscale mA: Inherent downscale</td>
</tr>
<tr>
<td>Over-range limit</td>
<td>+/- 10% for linear ranges (volts). +/-1% for non-linear ranges (T/C, RTD).</td>
</tr>
</tbody>
</table>

Cont’d
Analog Input Module (900A01-xxxx) (cont’d)

<table>
<thead>
<tr>
<th>Table 1 - Analog Input Specifications (cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T/C Break Detection</strong></td>
</tr>
<tr>
<td><strong>Faulty thermocouple detection</strong></td>
</tr>
</tbody>
</table>
| **Accuracy** | Factory configured accuracy = ± 0.1 % of range (± 0.2 % of range for 0V to 10V and -10V to 10V)  
| | Cold junction accuracy = ± 0.7 °C  
| | Field calibration accuracy = ± 0.05 % of range  
| **Reference conditions:** |  
| | Temperature = 25 °C ± 3 °C (77 °F ± 5 °F)  
| | Humidity = 45 % to 55 % RH non-condensing  
| | Line voltage = Nominal ± 1 %  
| | Source resistance = 0 ohm  
| | Series mode and common mode = 0 V  
| | Frequency = Nominal ± 1 % |
| **Temp. Effect on Accuracy** | ± 0.01% of full scale per degree Celsius maximum |
| **A/D Converter** | One per module |
| **A/D Resolution** | 15 Bits |
| **Reference Junction Sensing** | Via 2 RTDs at top/bottom of module |
| **Update rate** | 500ms (Analog to Digital Converter per module) |
| **Long term Stability** | 0.1% per year |
| **Calibration** | Data is stored in non-volatile memory  
| | Redundant Factory Calibration  
| | Individual Channel Field Calibration |
| **Diagnostics** | Monitoring of Factory Calibration, Field Calibration, 24 VDC supply, and configuration. |
| **Channel Configuration Data** | Stored in non-volatile memory. |
| **Power supply loading** | 5V; 40mA max  
| | 24V; 25mA max |

<table>
<thead>
<tr>
<th>Table 2 – Analog Input Reference Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Type</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>B T/C</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>E T/C</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>J T/C</td>
</tr>
</tbody>
</table>

Cont’d
### Table 2 – Analog Input Reference Accuracy (cont’d)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Range</th>
<th>Reference Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>J (low) T/C</td>
<td>20 to 770°F</td>
<td>1.0°F, 0.5°C</td>
</tr>
<tr>
<td>J T/C</td>
<td>-292 to 32°F</td>
<td>1.0°F, 0.5°C</td>
</tr>
<tr>
<td>K T/C</td>
<td>0 to 2400°F</td>
<td>2.0°F, 1.2°C</td>
</tr>
<tr>
<td>K (low) T/C</td>
<td>-29 to 538°F</td>
<td>1.6°F, 0.8°C</td>
</tr>
<tr>
<td>K T/C (mid)**</td>
<td>-18 to 982°F</td>
<td>1.8°F, 1.0°C</td>
</tr>
<tr>
<td>K T/C</td>
<td>0 to 1200°F</td>
<td>2.0°F, 1.2°C</td>
</tr>
<tr>
<td>Ni-NiMo (NNM68)</td>
<td>32 to 500°F</td>
<td>2.0°F, 1.2°C</td>
</tr>
<tr>
<td>Ni-NiMo (low)</td>
<td>32 to 1260°F</td>
<td>1.5°F, 0.8°C</td>
</tr>
<tr>
<td>NiMo-NiCo (NM90)</td>
<td>32 to 500°F</td>
<td>1.5°F, 0.7°C</td>
</tr>
<tr>
<td>NiMo-NiCo (low)</td>
<td>32 to 1260°F</td>
<td>1.3°F, 0.7°C</td>
</tr>
<tr>
<td>N T/C</td>
<td>0 to 2372°F</td>
<td>2.0°F, 1.2°C</td>
</tr>
<tr>
<td>N T/C</td>
<td>0 to 1472°F</td>
<td>1.4°F, 0.9°C</td>
</tr>
<tr>
<td>N T/C</td>
<td>32 to 2192°F</td>
<td>2.0°F, 1.2°C</td>
</tr>
<tr>
<td>R T/C</td>
<td>0 to 500°F</td>
<td>5.0°F, 2.8°C</td>
</tr>
<tr>
<td>S T/C</td>
<td>0 to 500°F</td>
<td>4.5°F, 2.5°C</td>
</tr>
<tr>
<td>T (low) T/C</td>
<td>-18 to 260°F</td>
<td>5.0°F, 2.8°C</td>
</tr>
<tr>
<td>W&lt;sub&gt;5&lt;/sub&gt; W26 (low) T/C*</td>
<td>0 to 2240°F</td>
<td>2.5°F, 1.4°C</td>
</tr>
</tbody>
</table>

**W<sub>5</sub>W26 is also known as type “C” Thermocouple.**

** Type K thermocouple (mid-range) has a working range from 75 to 1800 degF, 25 to 982 degC. Input measurements below 75°F or 25°C may cause the input to default to the programmed failsafe value. Use type K low or full ranges if measurements are required outside the mid-working range.

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### Table 2 - Analog Input Reference Accuracy (cont’d)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Range</th>
<th>Reference Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohms, 200</td>
<td>0 to 200</td>
<td>+/- 0.4 ohms</td>
</tr>
<tr>
<td>Ohms, 500</td>
<td>0 to 500</td>
<td>+/- 1.0 ohms</td>
</tr>
<tr>
<td>Ohms, 1000</td>
<td>0 to 1000</td>
<td>+/- 2.0 ohms</td>
</tr>
<tr>
<td>Ohms, 2000</td>
<td>0 to 2000</td>
<td>+/- 4.0 ohms</td>
</tr>
<tr>
<td>Ohms, 4000</td>
<td>0 to 4000</td>
<td>+/- 8.0 ohms</td>
</tr>
<tr>
<td>Milliamperes</td>
<td>4 to 20 mA</td>
<td>± 0.2% F.S. (mA)**</td>
</tr>
<tr>
<td></td>
<td>0 to 20 mA</td>
<td>± 0.2% F.S. (mA)**</td>
</tr>
</tbody>
</table>

**Tolerances for these input types include that of the external Dropping Resistors.

<table>
<thead>
<tr>
<th>Millivolts</th>
<th>Range</th>
<th>Reference Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 10 mVDC</td>
<td>± 0.17% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 50 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 100 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-10 to 10 mVDC</td>
<td>± 0.2% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-50 to 50 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-100 to 100 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-500 to 500 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td>Volts</td>
<td>1 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 1 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 2 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 10 VDC</td>
<td>± 0.2% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-1 to 1 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-2 to 2 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-5 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-10 to 10 VDC</td>
<td>± 0.2% F.S. (mV)</td>
</tr>
<tr>
<td>Slidewire</td>
<td>≤ 250 ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>250 to 1250 ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1250 to 4000 ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4000 to 6500 ohms</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>0 to 1250 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td>Oxygen</td>
<td>-30 to 510 mVDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
</tbody>
</table>

Calibration standards are based on ITS-90; except Ni-NiMo is based on IPTS-68.
High Level Analog Input Module (900A16-xxxx)
The High Level Analog Input module supports up to 16 user-configurable inputs on a per point basis for Voltage or current. Point-to-point isolation and back-plane isolation are provided. Modules perform analog to digital conversion in synchronization with CPU control execution, eliminating data interchange latency. All analog input modules are processed in parallel, eliminating scan time increases as modules are added.

A tri-color status LED on the module indicates when the modules are being scanned, when input channels are forced and when module diagnostics exist. A user-selectable failsafe value is supported on a per channel basis. The module supports field calibration. Each of the inputs has its own integrated 250-ohm shunt resistor which is activated through DIP switches. Requires Low Voltage Euro style 36-terminal terminal block.

### Table 3 - High Level Analog Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs per module</td>
<td>16(isolated)</td>
</tr>
<tr>
<td>Input types</td>
<td>V, mA</td>
</tr>
<tr>
<td>Signal Source</td>
<td>See Table 4 on next page for range types.</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>&gt;1 mega ohm for volts and 250 ohms for mA inputs</td>
</tr>
<tr>
<td>Input Isolation</td>
<td>400 VDC point to point, solid state switching; 1K VDC to logic</td>
</tr>
<tr>
<td>Noise Rejection</td>
<td>Series Mode &gt;31dB&lt;br&gt;Common Mode &gt;90dB at 120VAC</td>
</tr>
<tr>
<td>Over-range limit</td>
<td>+/- 10% for linear ranges (volts).</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Factory configured accuracy = ± 0.1 % of range. &lt;br&gt;Field calibration accuracy = ± 0.05 % of range</td>
</tr>
</tbody>
</table>
### Table 3 - High Level Analog Input Specifications

<table>
<thead>
<tr>
<th>Reference conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>25 °C ± 3 °C (77 °F ± 5 °F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>45 % to 55 % RH non-condensing</td>
</tr>
<tr>
<td>Line voltage</td>
<td>Nominal ± 1 %</td>
</tr>
<tr>
<td>Source resistance</td>
<td>0 ohm</td>
</tr>
<tr>
<td>Series mode and common mode</td>
<td>0 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>Nominal ± 1 %</td>
</tr>
</tbody>
</table>

**Temp. Effect on Accuracy ±0.01% of full scale per degree Celsius maximum**

- **A/D Converter**: One per module
- **A/D Resolution**: ±15 Bits
- **Update rate**: 500ms (Analog to Digital Converter per module)
- **Long term Stability**: 0.1% per year
- **Calibration**: Data is stored in non-volatile memory
  - Redundant Factory Calibration
  - Individual Channel Field Calibration
- **Diagnostics**: Monitoring of Factory Calibration, Field Calibration, 24 VDC supply, and configuration.
- **Channel Configuration Data**: Stored in non-volatile memory.
- **Power supply loading**: 5V; 75mA max
  - 24V; 50mA max

### High Level Analog Input Module (900A16-xxxx) (cont’d)

### Table 4 - High Level Analog Input Reference Accuracy

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Range</th>
<th>Reference Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milliamperes</td>
<td>4 to 20 mAdc</td>
<td>± 0.15% F.S. (mA)**</td>
</tr>
<tr>
<td></td>
<td>0 to 20 mAdc</td>
<td>± 0.15% F.S. (mA)**</td>
</tr>
<tr>
<td>Volts</td>
<td>0 to 1 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 2 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>0 to 10 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>1 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-1 to 1 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-2 to 2 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-5 to 5 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
<tr>
<td></td>
<td>-10 to 10 VDC</td>
<td>± 0.1% F.S. (mV)</td>
</tr>
</tbody>
</table>

**Tolerances for these input types include that of the internal Dropping Resistors.**
Analog Output Module (900B01-xxxx)

The Analog Output module provides 4 isolated 0 to 21.8 mA outputs that may be scaled by the user to any span within this range on a per output basis.

A tri-color status LED provides indication of when the module is scanned, open output circuits and when diagnostics exist on the module. A user specified failsafe value is supported to allow predictable operation in the event communication between the module and the controller is interrupted.

Outputs are updated synchronous with control execution. A user specified rate of change limit may be applied to each output when needed.

<table>
<thead>
<tr>
<th>Outputs per module</th>
<th>4 (isolated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0 to 21.8 mA, range selectable</td>
</tr>
<tr>
<td>Load resistance</td>
<td>750 ohms max</td>
</tr>
<tr>
<td>Isolation</td>
<td>500VDC Channel to Channel</td>
</tr>
<tr>
<td>Isolation from logic</td>
<td>600 VDC</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.1% full scale at reference conditions</td>
</tr>
<tr>
<td>Modules per rack</td>
<td>10 max, up to 12 with heat de-rating (see figure below)</td>
</tr>
<tr>
<td>Minimum current sensing</td>
<td>&gt; 3.5 mA per output</td>
</tr>
<tr>
<td>Calibration Data</td>
<td>Data is stored in non-volatile memory. Redundant Factory Calibration, with automatic rejection of Bad version. Individual Channel Field Calibration</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Monitoring of Factory Calibration, Field Calibration, Configuration, and +24 VDC power supply.</td>
</tr>
<tr>
<td>Output Verification</td>
<td>Feedback to controller that indicates output current flowing.</td>
</tr>
<tr>
<td>D/A Resolution</td>
<td>12 bits</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 40mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 200mA max</td>
</tr>
</tbody>
</table>
**Analog Output Module (900B08-xxxx)**

The Analog Output module provides eight 0 to 21.0 mA outputs that may be scaled by the user to any span within this range on a per output basis. Outputs are isolated in groups of 4 with no isolation between outputs in a group. All points are isolated from controller logic.

A tri-color status LED provides indication of when the module is scanned, open output circuits and when diagnostics exist on the module. A user specified failsafe value is supported to allow predictable operation in the event communication between the module and the controller is interrupted.

Outputs are updated synchronous with control execution. A user-specified rate of change limit may be applied to each output when needed.

<table>
<thead>
<tr>
<th>Outputs per module</th>
<th>8, isolated in 2 groups of 4 outputs (1-4, 5-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0 to 21.0 mA, range selectable</td>
</tr>
<tr>
<td>Load resistance</td>
<td>750 ohms max</td>
</tr>
<tr>
<td>Isolation</td>
<td>500VDC group to group</td>
</tr>
<tr>
<td>Isolation from logic</td>
<td>500 VDC</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.1% full scale at reference conditions</td>
</tr>
<tr>
<td>Modules per rack</td>
<td>4 max when powered from internal 24V backplane power</td>
</tr>
<tr>
<td>Minimum current sensing</td>
<td>&gt;0.5mA per output</td>
</tr>
</tbody>
</table>

**Calibration Data**

Data is stored in non-volatile memory. Redundant Factory Calibration, with automatic rejection of Bad version.

**Diagnostics**

Monitoring of Factory Calibration, Field Calibration, Configuration

**Output Verification**

Feedback to controller to indicate output current is flowing.

**D/A Resolution**

13+ bits (1 part in 13332)

**Power Supply Loading**

5V; 225 mA max
24V; 350 mA max

**Terminal Block**

36 Position – Euro style, (Model 900TCK-0001)

A DIP switch on the module selects the use of controller rack (internal) power or external loop power via a separate 24V DC power source. The as-shipped (default) switch setting is external power.

**External Power Source requirements:**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Vin: 18 to 36 Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>350 mA per module</td>
</tr>
</tbody>
</table>
Analog Output Module (900B16-xxxx)
The Analog Output module provides 16, 0 to 21.0 mA outputs that may be scaled by the user to any span within this range on a per output basis. Outputs are isolated in groups of 4 with no isolation between outputs in a group. All points are isolated from controller logic.

A tri-color status LED provides indication of when the module is scanned, open output circuits and when diagnostics exist on the module. A user specified failsafe value is supported to allow predictable operation in the event communication between the module and the controller is interrupted. Outputs are updated synchronous with control execution.

A user-specified rate of change limit may be applied to each output when needed.

<table>
<thead>
<tr>
<th>Outputs per module</th>
<th>16, isolated in 4 groups of 4 outputs (1-4, 5-8, 9-12, 13-16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0 to 21.0 mA, range selectable</td>
</tr>
<tr>
<td>Load resistance</td>
<td>750 ohms max</td>
</tr>
<tr>
<td>Isolation</td>
<td>500VDC group to group</td>
</tr>
<tr>
<td>Isolation from logic</td>
<td>500 VDC</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.1% full scale at reference conditions</td>
</tr>
<tr>
<td>Modules per rack</td>
<td>2 max when powered from internal 24V backplane power.</td>
</tr>
<tr>
<td>Minimum current</td>
<td>&gt; 0.5mA per output</td>
</tr>
<tr>
<td>Sensing</td>
<td></td>
</tr>
<tr>
<td>Calibration Data</td>
<td>Data is stored in non-volatile memory. Redundant Factory</td>
</tr>
<tr>
<td></td>
<td>Calibration, with automatic rejection of Bad version.</td>
</tr>
<tr>
<td></td>
<td>Individual Channel Field Calibration</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Monitoring of Factory Calibration, Field Calibration,</td>
</tr>
<tr>
<td></td>
<td>Configuration.</td>
</tr>
<tr>
<td>Output Verification</td>
<td>Feedback to controller to indicate output current is</td>
</tr>
<tr>
<td></td>
<td>flowing.</td>
</tr>
<tr>
<td>D/A Resolution</td>
<td>13+ bits (1 part in 13332)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>5V; 350 mA max</td>
</tr>
<tr>
<td>Loading</td>
<td>24V; 700 mA max</td>
</tr>
<tr>
<td>Terminal Block</td>
<td>36 Position – Euro style, (Model 900TCK-0001)</td>
</tr>
</tbody>
</table>

External Power Source requirements:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>18 to 36 Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>700 mA per module</td>
</tr>
</tbody>
</table>

A DIP switch on the module selects the use of (internal) controller rack power or external loop power via a separate 24V DC power source. The as-shipped (default) switch setting is external power.
Digital Input Module – Contact Closure Type (900G01-xxxx)
The Contact Closure Digital Input Module is self-powered, providing 15VDC to external switching hardware to close the input loop. A closed external circuit causes current flow to the input to establish an ON state. Logic in the controller allows this state to be inverted when necessary. Four common terminals are provided to simplify field wiring.

Green LED indicators on the module indicate when a digital input is ON. A tri-color LED is provided to indicate when the module is scanned, when inputs are forced or when module diagnostics exist.

<table>
<thead>
<tr>
<th>Inputs per module</th>
<th>16 (single-ended)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Supplied by controller</td>
<td>15 VDC nominal</td>
</tr>
<tr>
<td>Maximum contact resistance</td>
<td>1000 ohms</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>4 ms max</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>6 ms max</td>
</tr>
<tr>
<td>Switching current</td>
<td>2.6 mA nominal</td>
</tr>
<tr>
<td>Power supply loading</td>
<td>5V; 130mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 40mA max</td>
</tr>
</tbody>
</table>

Digital Input Module – AC Voltage type (900G03-xxxx)
The AC Digital Input modules are externally powered and accommodate two circuit voltages for up to 8 inputs each. Two common terminals are provided for each circuit. AC power applied between the common terminal and an input cause the input to turn ON. A green LED on the module provides indication of an ON state. Logic in the controller allows the state to be inverted when necessary.
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs per module</td>
<td>16</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>80 VAC to 264 VAC</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>264 VAC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>47 Hz to 63 Hz</td>
</tr>
<tr>
<td>Isolation</td>
<td>2 groups of 8 inputs (350VAC max.)</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>75 VAC</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>20 VAC</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>48 K ohms nominal</td>
</tr>
<tr>
<td>Input Current</td>
<td>1 mA nominal @ 120 VAC, 60 Hz</td>
</tr>
<tr>
<td></td>
<td>2 mA nominal @ 230 VAC, 50 Hz</td>
</tr>
<tr>
<td>Minimum ON Current</td>
<td>0.3 mA</td>
</tr>
<tr>
<td>Maximum OFF Current</td>
<td>0.2 mA</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>4 ms + 1.5 line cycles maximum</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>4 ms + 2 line cycles maximum</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 130mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 0mA</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane
Digital Input Module - DC Voltage type
(900G02-xxxx)

The DC Digital Input module provides two groups of 8 inputs, each with a pair of terminals for connection to common. DC power applied between the common terminal and an input cause the input to turn ON. A green LED on the module provides indication of an ON state. Logic in the controller allows the state to be inverted when necessary.

<table>
<thead>
<tr>
<th>Inputs per module</th>
<th>16 (sinking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>10 VDC to 32 VDC</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>32 VDC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>N/A</td>
</tr>
<tr>
<td>Isolation</td>
<td>2 groups of 8 inputs (42.4VDC max.)</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>9.5 VDC minimum</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>3.5 VDC maximum</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>2.6 K ohms nominal</td>
</tr>
<tr>
<td>Input Current</td>
<td>2.3 mA @ 12 VDC 6.9 mA @ 24 VDC nominal</td>
</tr>
<tr>
<td>Minimum ON Current</td>
<td>1.0 mA</td>
</tr>
<tr>
<td>Maximum OFF Current</td>
<td>0.7 mA</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>4 ms max</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>4 ms max</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 130mA max 24V; 0mA</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane
Digital Input Module – AC DC Voltage type (900G04-xxsx)

The AC Digital Input modules are externally powered and accommodate sixteen circuit voltages inputs each. Two terminals are provided for each circuit. AC or DC power applied between the input terminals cause the inputs to turn ON. A green LED on the module provides indication of an ON state. Logic in the controller allows the state to be inverted when necessary.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AC Application</th>
<th>DC Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs per Module</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>80 VAC to 264 VAC</td>
<td>80 VDC to 125 VDC</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>264 VAC</td>
<td>150 VDC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>47 Hz to 63 Hz</td>
<td>NA</td>
</tr>
<tr>
<td>Isolation</td>
<td>Input to Input &amp; Input to Chassis (350VAC max)</td>
<td>Input to Input &amp; Input to Chassis (350VAC max)</td>
</tr>
<tr>
<td>On Voltage Level</td>
<td>75 VAC</td>
<td>75 VDC</td>
</tr>
<tr>
<td>Off Voltage Level</td>
<td>20 VAC</td>
<td>30 VDC</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>48 k ohms nominal</td>
<td>48 k ohms nominal</td>
</tr>
<tr>
<td>Input Current</td>
<td>1 mA nom. @120 VAC, 60 Hz</td>
<td>2 mA nom. @125 VDC</td>
</tr>
<tr>
<td></td>
<td>2 mA nom. @240VAC, 50 Hz</td>
<td></td>
</tr>
<tr>
<td>Minimum On Current</td>
<td>0.3 mA</td>
<td>0.3 mA</td>
</tr>
<tr>
<td>Maximum Off Current</td>
<td>0.2 mA</td>
<td>0.2 mA</td>
</tr>
<tr>
<td>Off to On response time*</td>
<td>6 ms + 1.5 line cycles max.</td>
<td>6 ms + 2 line cycles max.</td>
</tr>
<tr>
<td>On to Off response time*</td>
<td>6 ms + 2 line cycles max.</td>
<td>6 ms + 2 line cycles max.</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5 V, 130 mA max.</td>
<td>5 V, 130 mA max.</td>
</tr>
<tr>
<td></td>
<td>24V 0 mA.</td>
<td>24V 0 mA.</td>
</tr>
</tbody>
</table>

* Nominal times excluding controllers scan time and excluding transmission time from module to backplane. DC application must include controller line filter setting of 50/60 Hz.
32 Point Digital Input Module - DC Voltage type (900G32-xxxx)

The DC Digital Input module provides two groups of 16 inputs, each with a pair of terminals for connection to common. DC power applied between the common terminal and an input cause the input to turn ON. A green LED on the module provides indication of an ON state. Logic in the controller allows the state to be inverted when necessary.

Requires Low Voltage Euro style 36-terminal terminal block.

<table>
<thead>
<tr>
<th>Inputs per module</th>
<th>32 (sinking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>10 VDC to 32 VDC</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>32 VDC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>N/A</td>
</tr>
<tr>
<td>Isolation</td>
<td>2 groups of 16 inputs (30VDC max.)</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>9.5 VDC minimum</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>3.5 VDC maximum</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>6.9 K ohms nominal</td>
</tr>
<tr>
<td>Input Current</td>
<td>1.7 mA @ 12 VDC 3.5 mA @ 24 VDC nominal</td>
</tr>
<tr>
<td>Minimum ON Current</td>
<td>1.0 mA</td>
</tr>
<tr>
<td>Maximum OFF Current</td>
<td>0.7 mA</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>5 ms max</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>5 ms max</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 215mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 0mA</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane
Digital Output Module – DC Type (900H02-xxxx)

The DC Digital Output module provides 16 externally powered outputs in two groups of 8. The outputs are low side switching (current sinking) type. Overload protection is built into each output; when tripped the power must be recycled to reset the module.

A green LED on the module provides indication of an ON state for each output.

<table>
<thead>
<tr>
<th>Outputs per module</th>
<th>16 (current sinking, low side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>2 groups of 8 outputs</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>6.5 to 32 VDC (5.0 to 6.5 V @ &lt;0.5A per channel)</td>
</tr>
<tr>
<td>Output Type</td>
<td>Intelligent power switch (IPS)</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>34 VDC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>N/A</td>
</tr>
<tr>
<td>ON Voltage Drop</td>
<td>0.3VDC @ 1 A load</td>
</tr>
<tr>
<td>Overload Protection</td>
<td>Electronic high current and high temperature limiting, resets after cycling field power</td>
</tr>
<tr>
<td>Maximum Load Current</td>
<td>1 A per point, 8 A max. per module, resistive load 0.5 A per point incandescent lamp load (5 mH max)</td>
</tr>
<tr>
<td>Maximum Leakage Current</td>
<td>0.15mA @ 32 VDC</td>
</tr>
<tr>
<td>Maximum Inrush Current</td>
<td>4 A for 10 ms</td>
</tr>
<tr>
<td>Minimum Load</td>
<td>0.0 mA</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>6 ms</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>6 ms</td>
</tr>
<tr>
<td>Fuses</td>
<td>Electronic limiting</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 340mA 24V; 0mA</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane
Digital Output – AC Type (900H03-xxxx)

The AC Digital Output module provides 8 isolated zero switching Triac solid-state outputs. A shorting comb is available for use with barrier type terminal blocks to simplify connecting a common voltage source to all outputs. A field-replaceable fuse and MOV over-voltage transient protection is provided for each output.

A green LED on the module provides indication of an ON state for each output.

<table>
<thead>
<tr>
<th>Outputs per Module</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>Per output</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>85 VAC to 240 VAC</td>
</tr>
<tr>
<td>Output Type</td>
<td>Triac (zero switching voltage)</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>250 VAC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>47 Hz to 63 Hz</td>
</tr>
<tr>
<td>ON Voltage Drop</td>
<td>&lt;2.0 VAC (&gt;0.1 A)</td>
</tr>
<tr>
<td></td>
<td>&lt;3.0 VAC (&lt;0.1 A)</td>
</tr>
<tr>
<td>Transient Over voltage Protection</td>
<td>MOV</td>
</tr>
<tr>
<td>Maximum Load Current</td>
<td>2 A per point, 8 A max. per module, resistive load</td>
</tr>
<tr>
<td>Maximum Leakage Current</td>
<td>4 mA (240 VAC, 60 Hz)</td>
</tr>
<tr>
<td></td>
<td>1.2 mA (100 VAC, 60 Hz)</td>
</tr>
<tr>
<td></td>
<td>0.9 mA (100 VAC, 50 Hz)</td>
</tr>
<tr>
<td>Maximum Inrush Current</td>
<td>15 A for 10 ms</td>
</tr>
<tr>
<td>Minimum Load</td>
<td>50 mA</td>
</tr>
<tr>
<td>OFF to ON response time*</td>
<td>3 ms + 0.5 line cycle max</td>
</tr>
<tr>
<td>ON to OFF response time*</td>
<td>3 ms + 0.5 line cycle max</td>
</tr>
<tr>
<td>Fuses</td>
<td>1 per output, 3.15 A Time-lag. Replaceable; Wickmann part #3741315041</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 220mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 0mA</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane
32 Point Digital Output Module – DC Type (900H32-xxxx)

The DC digital Output module provides 32 externally powered outputs in 2 groups of 16. The outputs are high side switching (current sourcing) type. Overcurrent protection is provided for each channel, in 4 groups of 8 channels. In case of short circuit for any output channel, that whole group of 8 is switched off. Power cycling is not required to reset the module.

A green LED on the module provides indication of an ON state for each output. Requires Low Voltage Euro style 36-terminal terminal block.

<table>
<thead>
<tr>
<th>Outputs per module</th>
<th>32 (current sourcing, high side). Note: Outputs 17 through 32 may not be used for TPO (Time Proportioning Output), PPO (Position Proportioning Output) or TPSC (Three Position Step Output) output types.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>2 groups of 16 outputs</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>10.5 to 32 VDC</td>
</tr>
<tr>
<td>Output Type</td>
<td>High side driver</td>
</tr>
<tr>
<td>Peak Voltage</td>
<td>32 VDC</td>
</tr>
<tr>
<td>AC Frequency</td>
<td>N/A</td>
</tr>
<tr>
<td>ON Voltage Drop</td>
<td>0.15 VDC @ 0.5 A load</td>
</tr>
<tr>
<td>Overload Protection</td>
<td>Active Current Limiting is integrated into the output driver. Power cycling is not required to reset the module after a fault condition.</td>
</tr>
</tbody>
</table>
| Maximum Load Current| 0.5 A per point, 6 A max per channel group  
12 A max. per module, resistive load  
0.25 A per point incandescent lamp load (5 mH max) |
| Maximum Leakage Current| 0.15mA @ 32 VDC                                                                                                                                                                      |
| Maximum Inrush Current| 2 A for 10 ms                                                                                                                                                                             |
| Minimum Load      | 0.0 mA                                                                                                                                                                                        |
| OFF to ON response time*| 6 ms                                                                                                                                                                                                        |
| ON to OFF response time*| 6 ms                                                                                                                                                                                                       |
| Fuses             | Electronic limiting                                                                                                                                                                           |
| Power Supply Loading| 5V; 235mA  
24V; 0mA                                                                                                                                                                              |

*excluding controller’s scan time and excluding transmission time from module to backplane
Relay Output Module (900H01-xxxx)

The Relay Output Module provides eight individually isolated, electromechanical relay outputs. Four of the outputs are Form-C, and the other four are Form-A. Outputs are not fused in the Relay module. Install a fuse for each output at the field device that is appropriate for the load and the wire used.

A green LED on the module provides indication of an ON state for each output.

<table>
<thead>
<tr>
<th>8 Relays per module</th>
<th>4 form A, 4 form C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Device</td>
<td>Electromechanical relay</td>
</tr>
<tr>
<td>Voltage</td>
<td>120/240 VAC, 30 VDC</td>
</tr>
<tr>
<td>Current Rating</td>
<td>4A @ 240VAC or 30VDC resistive load</td>
</tr>
<tr>
<td></td>
<td>0.5 A @ 240VAC or 30VDC incandescent lamp load</td>
</tr>
<tr>
<td>Max. Leakage Current</td>
<td>1 mA @ 350 VDC</td>
</tr>
<tr>
<td>De-rating</td>
<td>Max. outputs at max. load – none</td>
</tr>
<tr>
<td></td>
<td>Max. modules per rack - none</td>
</tr>
<tr>
<td>OFF to ON response</td>
<td>11 ms max</td>
</tr>
<tr>
<td>time*</td>
<td></td>
</tr>
<tr>
<td>ON to OFF response</td>
<td>8 ms max</td>
</tr>
<tr>
<td>time*</td>
<td></td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 110mA max</td>
</tr>
<tr>
<td></td>
<td>24V; 100mA max</td>
</tr>
<tr>
<td>Expected life (min.</td>
<td>Mechanical at 180 cpm: 5 x 10E7</td>
</tr>
<tr>
<td>operations)</td>
<td>Electrical: 10E5</td>
</tr>
</tbody>
</table>

*excluding controller’s scan time and excluding transmission time from module to backplane

Life expectancy curves (1a1b type)
The 4 Channel Pulse/Frequency/Quadrature Module provides four different functionalities in the form of Pulse Input, Frequency measurement, Quadrature encoder input and Pulse Output. Each of these channels can be configured for any one of these four functionalities; with the exception that quadrature encoder input (A and B pulses) can be applied to only Channels 1 and 2 respectively. When configured for quadrature, the other two channels will still be available for use. The Pulse Output functionality uses the digital output available on the module for outputting pulses.

### Inputs per module
4

### Outputs per module
4

### Digital Output type
Open collector, 5 to 24V, 30mA max, used for fast signalling

### Power Supply Loading
- 5V: 110mA max
- 24V: 250mA max (with Encoder)
- 24V: 100mA max (without Encoder)

---

### Pulse Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>0 VDC to 24 VDC</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>3.0 VDC minimum</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>1.0 VDC maximum</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>25K ohm</td>
</tr>
<tr>
<td>Frequency</td>
<td>10 KHz maximum</td>
</tr>
<tr>
<td>Minimum Pulse Width</td>
<td>3 µsec</td>
</tr>
<tr>
<td>Pulse Counter</td>
<td>32 bits</td>
</tr>
<tr>
<td>Preset Value</td>
<td>User may configure a preset count value within the range of 32 bit counter</td>
</tr>
<tr>
<td>Preset Action</td>
<td>Settable as ON or OFF in HC Designer</td>
</tr>
<tr>
<td>Digital Output</td>
<td>If preset action ON, output turns ON for 1 second. If preset action OFF, output latches ON, and remains ON until counter reset command.</td>
</tr>
<tr>
<td>Counting based on Preset</td>
<td>When the count equals preset value:</td>
</tr>
<tr>
<td></td>
<td>- If preset action ON, counter is reset and immediately resumes count.</td>
</tr>
<tr>
<td></td>
<td>- If preset action OFF, counter is not reset and counts beyond preset value.</td>
</tr>
<tr>
<td>Counter HOLD</td>
<td>When the HOLD input to the pulse input function block is ON in HC Designer, the counter holds its current value.</td>
</tr>
<tr>
<td>Counter RESET</td>
<td>The counter may be reset only via its function block in HC Designer, when an OFF to ON transition occurs on the ^RST input in Monitor mode.</td>
</tr>
<tr>
<td>Counter Flags</td>
<td>The OVERFLOW flag gets set when the module counter overflows. This flag can be reset only with the ^CLFG command sent through HC Designer. Also, the PREI flag is set when the digital output of the module turns ON.</td>
</tr>
</tbody>
</table>

Note: For Quadrature input Differential mode, connect wires using reverse polarity (+ to -) on Input 1, Input 2 and Index.
### Frequency Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>0 VDC to 24 VDC</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>3.0 VDC minimum</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>1.0 VDC maximum</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>25K ohm</td>
</tr>
<tr>
<td>Frequency</td>
<td>10 Hz minimum, 100 KHz maximum</td>
</tr>
<tr>
<td>Minimum Pulse width</td>
<td>Settable only through HC Designer:</td>
</tr>
<tr>
<td></td>
<td>500 µsec (10 Hz to 500 Hz)</td>
</tr>
<tr>
<td></td>
<td>50 µsec (10 Hz to 5 KHz)</td>
</tr>
<tr>
<td></td>
<td>2.5 µsec (10 Hz to 100 KHz)</td>
</tr>
<tr>
<td>Digital Output</td>
<td>ON if input frequency out of range, else OFF</td>
</tr>
</tbody>
</table>

### Quadrature Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels Used</td>
<td>Only channels 1 and 2 can be used for quadrature pulses A and B respectively. Index pulse is provided in addition.</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>Differential: -6 VDC to +6 VDC</td>
</tr>
<tr>
<td></td>
<td>Single-ended: 0 VDC to 24 VDC</td>
</tr>
<tr>
<td>ON Voltage Level</td>
<td>Differential: 0.2 VDC minimum</td>
</tr>
<tr>
<td></td>
<td>Single-ended: 3.0 VDC minimum</td>
</tr>
<tr>
<td>OFF Voltage Level</td>
<td>Differential: -0.2 VDC maximum</td>
</tr>
<tr>
<td></td>
<td>Single-ended: 1 VDC maximum</td>
</tr>
<tr>
<td>Common Mode Voltage</td>
<td>+/- 12 VDC</td>
</tr>
<tr>
<td>Input Sensitivity</td>
<td>+/- 200mV</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>+/- 50mV</td>
</tr>
<tr>
<td>Module powered encoder</td>
<td>5V DC, 0.50A</td>
</tr>
<tr>
<td>Frequency</td>
<td>200 KHz maximum</td>
</tr>
<tr>
<td>Minimum Pulse Width</td>
<td>2.25 µsec</td>
</tr>
<tr>
<td>Quadrature Counter</td>
<td>32 bits signed</td>
</tr>
<tr>
<td>Quadrature Modes</td>
<td>For variable resolution there are three count modes for the Pulse/Quadrature input: X1: rising edges of signal A are counted (increment); falling edges of signal A (decrement) X2: rising &amp; falling edges of signal A are counted X4: rising &amp; falling edges of signals A &amp; B are counted</td>
</tr>
<tr>
<td>Quadrature LEDs</td>
<td>Two LEDs indicate UP and DOWN direction of counting.</td>
</tr>
</tbody>
</table>
4 Channel Pulse/Frequency/Quadrature Module - DC Voltage type (900K01-xxxx) (cont’d)

**Pulse Output Specifications**

<table>
<thead>
<tr>
<th>Channels Used</th>
<th>Any one of the channels can be used for Pulse Output. However, the use of a particular channel for outputting pulses will render the particular input channel unusable for either of pulse, frequency or quadrature input.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Output Type</td>
<td>Open Collector, 5 to 24V, 30 mA max</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>25 Hz – 10 KHz</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>Always 50%</td>
</tr>
<tr>
<td>Pulse Output Duration</td>
<td>Selectable CONTINUOUS or NUMBERED PULSES.</td>
</tr>
</tbody>
</table>

**Terminal Blocks (900TEK-xxxx, 900TBK-xxxx, 900TER-xxxx, 900TBR-xxxx)**

HC900 I/O modules use terminal blocks with various features available. Terminals are available in Barrier style and Euro style. The Barrier style terminal block provides a floating washer to accommodate two different size conductors. The Euro style offers a more compact terminal design providing more room within the terminal block cavity for conductors.

All terminal blocks support customer wiring entering the block from the top or bottom when mounted in the controller. A locking swing out door provides easy access for wiring and covers potential high voltage connections during operation. For low voltage terminals accepting thermocouple inputs, cold junction compensation is provided by the AI modules.

Terminal blocks are secured to the rack assembly with screws. These screws provide vibration immune terminal connections during operation and also serve as jacking screws when removing modules to minimize the extraction force required.

The rear of the Terminal block provides keying to prevent accidental terminal block insertion into incorrect module slots. Labels are provided to identify the module type by name and color, offer wiring instructions and provide an area for customer identification of field circuits.

Shorting combs are available for use with Barrier terminal blocks to connect common signal pairs together or to jumper together common signals on AC and Relay output modules.

Shield terminal strips are also available to terminate the shields of shielded cables at the controller.
The I/O Scanner module resides in a remote I/O rack along with the I/O modules. The Scanner and the controller are connected to each other’s I/O port (see photo). The scanner collects data from the I/O rack’s input modules and communicates the information to the controller. Output data is sent from the controller to the Scanner module to the appropriate output module. Data exchanges are synchronous with the controller scan time to maintain deterministic operation. Diagnostic status of I/O modules is also monitored and reported to the controller when detected. Module addressing is via DIP switches on the Scanner’s circuit board. Connection to the controller uses IEEE 802.4 Ethernet 10base-T Physical Layer. An external Ethernet Hub is required when multiple I/O scanners are used with a single controller. Scanner modules do not support removal and insertion under power.

<table>
<thead>
<tr>
<th>Number of terminals</th>
<th>20</th>
<th>36*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Terminal blocks removable under instrument power. (Field power disconnected)</td>
<td>Terminal blocks removable under instrument power. (Field power disconnected)</td>
</tr>
<tr>
<td>Gauge Wires</td>
<td>Barrier and Euro: #14 to 26 AWG, solid or stranded</td>
<td>Euro: #12 to 26 AWG, solid or stranded</td>
</tr>
<tr>
<td>Terminal color</td>
<td>High voltage: Red</td>
<td>Low voltage: Black</td>
</tr>
<tr>
<td></td>
<td>Low Voltage: Black</td>
<td>Low Voltage: Gold Plated</td>
</tr>
<tr>
<td>Contacts</td>
<td>High Voltage: Tin Coated</td>
<td>Gold plated</td>
</tr>
<tr>
<td></td>
<td>Low Voltage: Gold Plated</td>
<td></td>
</tr>
<tr>
<td>Contact Style</td>
<td>Post and socket</td>
<td>Post and socket</td>
</tr>
<tr>
<td>Door Access</td>
<td>Tool accessible</td>
<td>Tool accessible</td>
</tr>
<tr>
<td>Cold Junction compensation for thermocouples</td>
<td>Yes (provided by AI module)</td>
<td>N/A—thermocouples not used</td>
</tr>
</tbody>
</table>

*Required with modules: High Level AI, 32 DI, 32 DO.

### I/O Scanner Module (900C53-xxxx)

The I/O Scanner module resides in a remote I/O rack along with the I/O modules. The Scanner and the controller are connected to each other’s I/O port (see photo). The scanner collects data from the I/O rack’s input modules and communicates the information to the controller. Output data is sent from the controller to the Scanner module to the appropriate output module. Data exchanges are synchronous with the controller scan time to maintain deterministic operation. Diagnostic status of I/O modules is also monitored and reported to the controller when detected. Module addressing is via DIP switches on the Scanner’s circuit board. Connection to the controller uses IEEE 802.4 Ethernet 10base-T Physical Layer. An external Ethernet Hub is required when multiple I/O scanners are used with a single controller. Scanner modules do not support removal and insertion under power.

<table>
<thead>
<tr>
<th>Type</th>
<th>I/O Scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status indicators</td>
<td>Scanner: Red/Green LED indicates mode or error</td>
</tr>
<tr>
<td></td>
<td>Expansion I/O port: Green LEDs indicate receive/transmit</td>
</tr>
<tr>
<td>Power supply loading</td>
<td>5V; 670 mA max</td>
</tr>
</tbody>
</table>
I/O Scanner 2 Module (900C73-xxxx-xx)
The I/O Scanner 2 module resides in a remote I/O rack along with the I/O modules. The Scanner has one connection each (see photo, I/O A and I/O B) to CPU-A and CPU-B in the controller rack. The scanner collects data from the I/O rack’s input modules and communicates the information to the Lead controller. Output data is sent from the Lead controller to the Scanner module to the appropriate output module. Data exchanges are synchronous with the controller scan time to maintain deterministic operation. Diagnostic status of I/O modules is also monitored and reported to the controller when detected.

Module addressing is via switches on the module. Connection to the controllers is made using two ports, each conforming to IEEE 802.4 Ethernet 100base-T Physical Layer. An external Ethernet Switching Hub is required when multiple I/O scanners are used with a single controller.

Scanner modules do not support removal and insertion under power.

<table>
<thead>
<tr>
<th>Type</th>
<th>I/O Scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status indicators</td>
<td>Scanner: Red/Green LED indicates mode or error</td>
</tr>
<tr>
<td></td>
<td>I/O A Port: Green and Yellow LEDs indicate receive/transmit</td>
</tr>
<tr>
<td></td>
<td>I/O A Port: Green and Yellow LEDs indicate receive/transmit</td>
</tr>
<tr>
<td>Power supply loading</td>
<td>5V; 770mA max</td>
</tr>
</tbody>
</table>
**Redundant Switch Module (RSM) (900RSM-xxxx)**

The Redundant Switch Module resides in a redundant HC900 controller rack and interfaces with both CPUs of a redundant system to indicate which CPU is functioning as the Lead controller and which is the Reserve. A key switch on the module sets the mode of both the Lead and Reserve controllers, guaranteeing synchronization of CPUs. A momentary contact position of the key switch allows the user to switch the Lead control function from CPU-A to CPU-B or vice versa.

The RSM module supports insertion and removal under power.

<table>
<thead>
<tr>
<th>Type</th>
<th>Redundant CPU Status and Mode control Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead/Reserve indication</td>
<td>Green arrow LEDs</td>
</tr>
<tr>
<td>Mode Switch</td>
<td>Removable key (2 keys supplied), three stationary positions, one momentary</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 22mA max</td>
</tr>
</tbody>
</table>

**Power Status Module (PSM) (900PSM-xxxx)**

The Power Status Module resides in an I/O rack containing redundant power supplies and I/O modules. The PSM and second power supply are contained in a rack extension assembly. The PSM module is positioned in a dedicated slot between the two power supplies.

Redundant power and the PSM may be used with the controller racks of non-redundant systems and I/O racks of redundant systems.

Directional indicators on the module indicate when both voltage sources of the power supply are operating properly.

<table>
<thead>
<tr>
<th>Type</th>
<th>Redundant Power Supply Status indicating Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status indication</td>
<td>Green directional indicators using LEDs</td>
</tr>
<tr>
<td>Power Supply Loading</td>
<td>5V; 22mA max</td>
</tr>
</tbody>
</table>
Remote Terminal Panels

DIN rail mounted Remote Terminal Panels (RTPs) are available for use with pre-wired cables to reduce installation time and labor expense. Three types of RTPs are available: analog inputs relay outputs and other I/O modules. Two cable lengths are available; one for high voltage I/O and one for low voltage I/O. Analog input RTPs include transmitter shunt resistors and transmitter power terminals with individual circuit fuses. The RTP panels also switch field power to allow module removal and installation under controller power.

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Provides connection of field wiring to controller I/O within an enclosure only.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 35mm wide DIN Rail</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>4.38” (111.1 mm) x 3.70” (94.0mm) x 2.60” (66.0mm) (L x W x H)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Vibration</th>
<th>Amplitude: 5Hz to 15.77Hz, 2.03mm (0.08”)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acceleration: 15.77 to 250Hz, 1.0-g</td>
</tr>
<tr>
<td></td>
<td>Vibration: Sweeping, at rate of .33 octave/min.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tray material</th>
<th>Polyvinyl Chloride (PVC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tray and end caps</td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>UL94-V0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Operating: 0 deg. C (32F) to 60 deg. C (140F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Storage: -40 deg. C (140F) to 70 deg. C (158F)</td>
</tr>
<tr>
<td></td>
<td>Operating: 10% to 90% Non-condensing</td>
</tr>
<tr>
<td></td>
<td>Storage: 5% to 95% Non-condensing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certifications</th>
<th>EN61326, EN61010-1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UL 61010C – 1</td>
</tr>
<tr>
<td></td>
<td>CSA 22.2 – 1010-1</td>
</tr>
<tr>
<td></td>
<td>Class 1, Div. 2 Module Temperature Classifications T6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cables</th>
<th>Lengths: 1.0, 2.5, 5.0 meters. Cable power is limited to 24 Amps per module at 60C (140 degrees F) and 32 Amps at 54C (129 degrees F).</th>
</tr>
</thead>
<tbody>
<tr>
<td>High voltage</td>
<td></td>
</tr>
<tr>
<td>Low voltage</td>
<td>Lengths: 1.0, 2.5, 5.0 meters.</td>
</tr>
</tbody>
</table>
Remote Terminal Panel for Analog Input Modules (900RTA-xxxx)

The Analog Input RTP integrates some of the typical externally connected components such as switch selectable shunt resistors for current loops and common power supply terminals with individual fuses for powering two-wire transmitters. A power switch is provided to disconnect power from all transmitters for I/O module maintenance.

The RTP also minimizes the need for multiple wires under a single screw connection by expanding the connectivity of the shared terminals of the I/O module.

The analog input RTP cannot be used for thermocouple inputs.

Note: You must set switches 1-8 for transmitters.
Remote Terminal Panel for Analog Input Modules (900RTA-xxxx) (cont’d)

<table>
<thead>
<tr>
<th>Analog input Module</th>
<th>Excludes Thermocouple Input types.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accuracy De-rating (Module + RTP)</td>
</tr>
<tr>
<td></td>
<td>100 ohm Plat. RTD = +/- 0.14% of range</td>
</tr>
<tr>
<td></td>
<td>JIS RTD = +/- .22% of range</td>
</tr>
<tr>
<td></td>
<td>10 ohm Cu. RTD = +/- .67% of range</td>
</tr>
<tr>
<td></td>
<td>200 ohm = +/- 0.17% of range</td>
</tr>
<tr>
<td></td>
<td>0 – 10 mV = +/- 0.14% of range</td>
</tr>
</tbody>
</table>

Transmitter power
- Common supply terminals – selectable per circuit.
- Fuse per circuit - 80mA, time lag type

Shunt Resistor
- Selectable per circuit
- 250 Ohms, 0.05% - 15ppm

Remote Terminal Panel for Relay Output Modules (900RTR-xxx)
The RTP for Relay Output modules provides individual fuses for each output. A load disconnect switch is also provided for each output to support maintenance of the relay module under instrument power.

<table>
<thead>
<tr>
<th>Relay Output RTP</th>
<th>Used with Relay Output Module</th>
<th>Relay common disconnect per circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fuse per circuit – 6.3A, time lag type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24A maximum per RTP</td>
</tr>
</tbody>
</table>

![Diagram of HC900 Terminal Block TB1 and J1 connections]
Remote Terminal Panel for Other HC900 Modules (900RTS-xxxx)

Remote Terminal Panel(s) may be used with the following HC900 I/O Modules:

- 16 Point Digital Input Module, Contact Type
- 16 Point Digital Input Module, AC & DC Types
- 8 Point Digital Output Module, AC type
- 16 Point Digital Output Module, DC type
- 4/8/16 Point Analog Output Module
- 16 Point Digital Input Module, AC/DC types not available

Jumpers on the Remote Terminal Panel may be positioned to accommodate the above input and output modules.

A switch on the module is used to disconnect field power from I/O modules to facilitate maintenance of the module under instrument power.
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.

For More Information
Learn more about how Honeywell’s HC900 Hybrid Controller Modules can satisfy control and data acquisition needs of a wide range of process equipments, visit our website www.honeywell.com/ps/hfs or contact your Honeywell account manager.

Honeywell Process Solutions
1860 West Rose Garden Lane
Phoenix, Arizona 85027
Tel: 1-800-423-9883 or 1-800-343-0228
www.honeywell.com/ps/
Overview

HC900 Controller Controlware is the execution environment, control algorithms and firmware infrastructure programmed into the controller’s memory to allow users to apply the product in process control applications.

Operation

A control strategy configuration in the HC900 controller consists of function blocks, or predefined algorithms that get executed in a sequential manner during a scan cycle. During controller configuration the user specifies the quantity and type of function blocks needed for the application.

Two scan engines (Fast and Normal) contain the specific function blocks and the execution sequence to run its blocks. Physical inputs are read at the start of each scan cycle, then all function blocks are executed according to the execution order, then physical outputs are updated. Due to their nature, TPS, TPO and PPO functions have their physical outputs updated during their execution.

The execution environment for the controller is based on two deterministic execution cycles, one for fast logic type operations and a second cycle for normal analog based operations. Within these two fixed time cycle operations, time is allocated by the system to execute other functions such as communication tasks, and background diagnostic checking. These tasks are assigned function block numbers 1 through 100 and may not be altered by the user. The user’s configuration begins with function block number 101.

In order to maintain the deterministic operation of the controller, time may be added to the scan cycles in fixed increments based on the size and scope of the user’s configuration. The maximum time required to execute the user’s configuration is determined when a configuration is loaded into the controller and does not change during on-line operation.

The time needed to execute communications and other background tasks is accounted for in the configuration timing and does not impact the deterministic operation of the controller.

For more information see specification sheets:
HC900 Hybrid Controller 51-52-03-31
HC900 Hybrid Controller Modules 51-52-03-41
Hybrid Control Designer Software 51-52-03-43
900 Control Station Operator Interfaces 51-52-03-46.

Controller Configuration

User configurations are permanently retained in flash memory in the controller. In the event a PC configuration file is lost or misplaced, it can be easily reconstructed using the upload function of the Hybrid Control Designer configuration software or via the 559 operator interface. Simply read the configuration from the controller to exactly duplicate the original configuration, including all text descriptions and operator interface display selections. In the event edits to a controller’s configuration are required after the unit is in operation, the on-line download function of the HC900 Hybrid Control Designer software allows configuration changes while in the Run mode, limiting process disturbances.

During power interruptions to the controller the dynamic control status is retained in battery backed RAM memory. This function minimizes process upsets during momentary power interruptions and other discontinuous operation. If power is lost and the battery is not available, the controller defaults to the configuration stored in Flash memory and a cold start is performed.

Function Block Attributes

The CPUs of the HC900 Controller provide different function block capacities to allow matching controller performance to application needs. The C30 CPU provides up to 400 function blocks, the C50 up to 2000, and the C70/C70R up to 5000 function blocks.
Similar proportions apply to available support items such as soft-wire connections and page connectors.

Principal function blocks may be identified with tag names and they have dedicated displays provided in Honeywell operator interfaces. All function blocks support user-entered tags on their outputs.

Function blocks that define the operation of physical inputs and outputs provide a failsafe state. The failsafe state will be the state of the physical output resulting from a fault condition. See HC900 Function Block Types (page 5) for available failsafe actions. Function blocks that depend on physical hardware for their operation have also a fail output pin on the block that may be used in a control strategy to trigger appropriate default operations. A fail pin on a function block activates when the associated I/O module fails or when communications to a module in a remote rack fails.

**Customizable memory allocation**

The percentage of memory for recipes (Setpoint Profiles, Setpoint Schedules, Sequences, Variable recipes) is adjustable, allowing more space for recipes or for configuration (i.e., function blocks), whichever is needed. For details see HC900 Hybrid Controller specification 51-52-03-31, section “Capacity.”

**Advanced control and computational capability**

A large assortment of analog and digital function blocks are available to solve the most demanding control requirements. Typical analog function blocks include totalizer, free-form math, average, mass flow, function generator, periodic timers based on real-time, carbon potential, RH, Dew Point, signal selection, comparison, and many others. These blocks may be configured to create control schemes that precisely address the needs of your process. Digital status outputs are also provided on many of the analog function blocks to facilitate intelligent signal alarming and default operation strategies. Typical logic function blocks include AND, OR, XOR, NOT, Latch, Flip-flop, On/Off Delay and Resettable timers, Counters, Free-form Boolean logic and more. The execution of analog and digital functions is seamlessly integrated into a single control strategy in the controller.

**Loop Control**

The robust control loops of the HC900 Controller support configurations from simple PID to interactive cascade, ratio, duplex, position proportioning and three position step for motor positioning or custom control strategies. Standard for every control loop is auto-tuning using Honeywell’s performance proven Accutune III tuning algorithm. A selectable “Fuzzy Logic” algorithm is also provided for each loop to suppress unwanted process setpoint overshoot. A soft start feature allows output rate limiting for protection of a process load on startup or after power failure.

**Setpoint Scheduling**

The scheduler function provides up to 8 ramp and soaks outputs plus up to 8 soak only outputs that operate on a common time base. The scheduler also supports up to 16 event digital outputs. Soak guarantee, jog to a segment and nested looping features are also provided. Applications include multi-zone diffusion furnaces, CVD furnaces, and environmental chambers.

**Logic**

Logic programming may be used to implement more robust and higher speed logic functions in the controller. The fast scan program executes all inputs, outputs and function blocks as fast as 27 milliseconds. The fast scan instruction set includes 2, 4 and 8 input logic blocks with selectable input inversion plus timers, triggers, latches, counters, timers, math and other supporting functions. A Sequencer function is also included with functionality beyond typical drum sequencers.

**Stage**

Stage blocks may be configured to control the on and off states of up to 4 outputs, for the control of processes such as tank level. Interlocking between stages and between multiple stage function blocks is available to guarantee proper output sequencing.

**Alternator**

Alternator function blocks accept digital inputs and drive digital outputs in an alternating sequence as determined by the user. The user may select from 4 alternating styles: Direct, Rotary, FOFO and Fixed.
AGA (American Gas Association)

The AGA function blocks are divided into two categories: Gas Compressibility calculations AGA8 Detail (AGA8DL) and Gross Method (AGA8GS) and Meter Calculations (AGA3OM- Orifice, AGA7TM – Turbine, and AGA9UM – Ultrasonic). In almost all configurations, a complete calculation will consist of a compressibility calculation followed by a meter calculation.

Calendar Event

The Calendar Event block compares user entered time and date set points to the real time clock to generate digital status (one-shot) outputs that can be integrated into a control strategy to activate time synchronized activities. The setpoints of the block’s outputs are grouped into sets to provide a convenient method to perform periodic changes. Up to 5 setpoint groups are available for items such as seasonal time changes. Up to 16 special days can be designated which override the normal event processing on that day. For example, selected outputs can be configured to remain off on holidays.

Sequencers

The HC900 controller supports sequencer function blocks, greatly enhancing configuration of sequence operations. Each sequencer supports up to 16 digital outputs that may be either on or off in each of 50 states e.g. PURGE, FILL, HEAT, etc. The sequencer may have up to 64 sequential steps that activate the states of the sequence. Steps of the sequencer may be configured to advance based on time, on event (2 per step), or a manual advance. A separate jog function is also provided. The function can also output an analog value on a step basis. The operational sequence for the steps is retained in a separate sequence file in the memory of the controller that may be selected on-demand through a user interface or via a recipe.

<table>
<thead>
<tr>
<th>Step</th>
<th>State</th>
<th>State Name</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>PURGE</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>AGITATE</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>FEED B</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>MIX</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>PREHEAT</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The operational sequence for the steps is retained in a separate sequence file in the memory of the controller that may be selected on-demand through a user interface or via a recipe.
### Set Point Programming

Set point programmers, each with an auxiliary soak output, may be configured. A pool of profiles, each with up to 50 segments may be stored in controller memory for user selection. Each programmer may have up to 16 event outputs for integration with the sequence control functions. Also provided are guaranteed soak, jog to a segment and looping.

<table>
<thead>
<tr>
<th>Seg</th>
<th>Ramp/Soak</th>
<th>SP Value</th>
<th>Time/Rate</th>
<th>Aux Out</th>
<th>Guar Hold</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ramp</td>
<td>100</td>
<td>20</td>
<td>0.0</td>
<td>OFF</td>
<td>1001100000000000</td>
</tr>
<tr>
<td>2</td>
<td>Ramp</td>
<td>500</td>
<td>30</td>
<td>1.1</td>
<td>OFF</td>
<td>1001000100000000</td>
</tr>
<tr>
<td>3</td>
<td>Soak</td>
<td>1300</td>
<td>90</td>
<td>1.1</td>
<td>ON</td>
<td>1011101000000000</td>
</tr>
<tr>
<td>4</td>
<td>Ramp</td>
<td>1300</td>
<td>50</td>
<td>1.1</td>
<td>OFF</td>
<td>1001000100000000</td>
</tr>
<tr>
<td>5</td>
<td>Soak</td>
<td>100</td>
<td>0.1</td>
<td>0.0</td>
<td>OFF</td>
<td>0000000010000000</td>
</tr>
</tbody>
</table>

### Recipes (Variables)

Recipes consist of up to 50 analog and digital Variables assigned within the configuration. This allows Variables representing setpoint profile, setpoint schedule, or sequencer numbers and/or other Variables for associated loop setpoints, bias values, alarm setpoints, limits, setpoints to external controllers, digital states, tuning constants, etc. to be part of a recipe. Recipes are selected by recipe tag name and descriptor from the HC900 Operator Interface or via a Recipe Selection block with a recipe # input.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFNUM</td>
<td>2</td>
</tr>
<tr>
<td>BIAS2</td>
<td>12</td>
</tr>
<tr>
<td>BIAS3</td>
<td>18</td>
</tr>
</tbody>
</table>

Recipe: P1023-F7
TYPE 1023 HARDEN

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIALMSP1</td>
<td>F1</td>
</tr>
<tr>
<td>Hi Temp Alarm</td>
<td>1280</td>
</tr>
</tbody>
</table>
## HC900 Function Block Types

### I/O Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Block Type</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Input</td>
<td>N</td>
<td>Universal Analog Input, with table selection of input type. (For input types see HC900 Hybrid Controller Module Specification 51-52-03-41)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Filter – 1st order lag, 0 to 120 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bias – Input value adjust for calibration correction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Burnout – Off, Upscale, Downscale, Default Value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warn Output – activates if thermocouple resistance &gt; 100 ohms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input Disable – digital input when ON disables input, sets output to a defined default</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bad Channel Detection – Optional selection to treat a sensor failure and a hardware fault the same.</td>
</tr>
<tr>
<td>Analog Input RCJ</td>
<td>N</td>
<td>This block is used only for Thermocouples when the thermocouple Cold Junction is in a remote location, i.e., NOT connected at the AI module. Cold Junction compensation is performed using the value presented at the RCJ input, which is a temperature value in degrees C of the remote junction and which will come from another AI block. CJ compensation and linearization is performed in the block producing a value in engineering units at the OUT pin. Fail status of the AI block measuring the Remote CJ can be applied to the RSTAT pin. (i.e. if the RCJ measurement Fails, the Thermocouple measurement fails)</td>
</tr>
<tr>
<td>Analog Output</td>
<td>N</td>
<td>Regulated analog output current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input scaling in Engineering Units, Output scaling within 0 and 20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slew rate (rate of change in mA/sec.) definable, Fail output pin is ON when output fail sensed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable as High, Low, Hold or go to a user specified value</td>
</tr>
<tr>
<td>Digital Input (1)</td>
<td>F, N</td>
<td>Provides the digital status of a digital input point. The output status may be inverted. Both fast logic (27 ms) and normal logic (500ms analog rate) blocks available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable as ON, OFF or Hold last state</td>
</tr>
<tr>
<td>Digital Input (Up to 8 inputs)</td>
<td>F, N</td>
<td>Provides the digital status of the first or last 8 digital inputs of a 16 point input card. The output status may be inverted. Both fast logic (27 ms) and normal logic (500ms analog rate) blocks available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable per input as ON, OFF or Hold last state</td>
</tr>
<tr>
<td>Digital Output (1)</td>
<td>F, N</td>
<td>Directs a digital status to a physical logic output. Output status may be inverted. Both fast logic (27 ms) and normal logic (500ms sec analog rate) blocks available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable as ON, OFF or Hold last state</td>
</tr>
<tr>
<td>Digital Output (Up to 8 outputs)</td>
<td>F, N</td>
<td>Directs 8 digital statuses to 8 physical logic outputs of an 8 point output card or to the first or last 8 physical logic outputs of a 16 point output card. Output status may be inverted. Both fast logic (27 ms) and normal logic (500ms analog rate) blocks available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable per input as ON, OFF or Hold last state</td>
</tr>
<tr>
<td>Time Proportioning Output</td>
<td>N</td>
<td>Proportions the amount ON time and OFF time of a digital output. Input scaling in engineering units</td>
</tr>
<tr>
<td>(applied to any PID output)</td>
<td></td>
<td>Cycle time—2 second to 120 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output minimum ON and OFF time—0 seconds to 15 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failsafe definable per input as ON, OFF or Hold last duty cycle</td>
</tr>
</tbody>
</table>
### HC900 Function Block Types (cont’d)

<table>
<thead>
<tr>
<th>I/O Blocks (F=Fast Scan Rate, N=Normal Rate)</th>
<th>Position Proportional Output</th>
<th>Pulse Input</th>
<th>Pulse Output</th>
<th>Frequency Input</th>
<th>Quadrature Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>A combination Input and Output function block that accepts position feedback input and generates forward/reverse digital outputs. Positions actuators with slidewire, current or voltage position feedback sensors. Provides output pins for actuator position (0 to 100%), motor fail, and feedback fail – automatically defaults to 3-position step on feedback fail. Input scaling in engineering units Actuator speeds from 12 to 300 seconds Output limits – adjustable (between 0 and 100%) Deadband – adjustable (0.5 to 5%) Feedback filter – adjustable (0 to 3 sec.) Feedback input types: Slidewire 100 to 250 ohms (requires AI card 900A01-0002) Slidewire 250 to 1000 ohms (requires AI card 900A01-0002) mA - 4 to 20mA mA - 0 to 20mA Voltage - 0 to 1V Voltage - 0 to 5V Feedback calibration – HC Designer, 1042 or 559 Operator Interfaces Automatic, Semi-automatic, and Hand methods supported. Failsafe – Hold last position.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F, N</td>
<td>Reads a single input channel from a Pulse/Frequency/Quadrature input module. It scales pulses from this input to user-configured engineering units. The scaling typically represents a quantity or rate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F, N</td>
<td>Outputs a pulse train of user controllable duration. It controls a relay on a Pulse/Frequency/Quadrature module.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F, N</td>
<td>Used for measuring speed and flow rate. It reads a single frequency channel from a Pulse/Frequency/Quadrature input module. The signal is ignored (filtered) if it does not meet the selected pulse width/frequency range conditions. Otherwise, the signal is scaled from the selected frequency span to the selected output range in engineering units.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F, N</td>
<td>Measures/controls movement of an actuated device. A digital encoder connected to the actuated device produces two channels (A and B) of square waves, offset 90 degrees. The block measures by counting the waves’ rising edges.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Loop Function Blocks (F=Fast Scan Rate, N=Normal Rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PID</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PID algorithm includes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Accutune III auto-tuning and selectable fuzzy logic overshoot suppression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- PID A (normal) or PID B (only integral response to SP change) operation, DUPA and DUPB operation which switches tuning constants for heat/cool applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Two sets of PID constants selectable via program control. Choice of Gain or Proportional Band entry and Integral time or Repeats/minute entry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Setpoints—Two setpoint values or one value and one remote setpoint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Setpoint tracking – Local SP tracks PV or RSP on a RSP to LSP change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Setpoint limits, output limits, SP rate of change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Soft start for output rate limiting on startup or after power fail (not available with output tracking)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ratio and Local/Remote Bias selections for Ratio control applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Feedforward input (scaled in % of output)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Back calculation output for Cascade operation (supplied to primary loop)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Output tracking to track a remote input (for backup applications)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Remote A/M, R/L mode switching and mode status outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Function block access to tuning constants for gain scheduling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Alarms—Two outputs with up to two high, low, or dev band conditions each</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Inputs: PV, remote setpoint, feedforward, output track and track command, ratio, bias, switch block connection, mode switch block connection, and back calculations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Outputs: Control output, working setpoint, alarm status (2), Autotune indication, mode status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PID for Carbon Potential (displaces PID)</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A combined carbon potential calculation and PID algorithm for controlling the carbon potential of furnace atmospheres using a Zirconia probe input and temperature input. Local/remote %CO adjustment, probe manufacturer selection (4 selections), anti-sooting protection, Dewpoint calculation output, and furnace factor adjustment is supported; probe burn-off configurable. Consumes 1 loop.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PID with 3 Position Step Output</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor position control without position sensing. Standard PID features with addition of hysteresis (in %) and full stroke time (in sec.) entries for motor. Forward and Reverse outputs specified within the block. Physical outputs updated during block execution.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ON/OFF Control (displaces PID)</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON/OFF control algorithm with selectable hysteresis. Consumes 1 loop.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Loop Switch Inputs</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital interface to control loops to initiate autotuning, change control action, force bumpless transfer, select tuning set #1 and select tuning set #2. Connects to PID (all) and ON/OFF block switch input.</td>
<td></td>
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</tr>
<tr>
<td><strong>Loop Mode Switch</strong></td>
<td>N</td>
<td></td>
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</tr>
<tr>
<td>Digital interface to control loops to select automatic or manual modes and/or local or remote setpoint. Connects to all control loop types.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Mode Decoder (Mode Flags)</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decodes control loop mode status into a set of discrete (Boolean or digital) mode flags. Outputs activate for states: Auto, Manual, Initialization Manual, Local Override, Local Setpoint, Remote Setpoint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Write Tuning Constants</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatically changes the GAIN, RATE, and RESET parameters of an internal PID loop without operator interaction. A digital input controls changes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auto-Manual Bias (for Boiler Control applications) (displaces PID)</strong></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allows a manually adjusted output to be maintained on transfer to automatic by applying bias to the input signal (from a Steam master to adjust participation of boiler). Bias value is maintained as output value tracks input value changes. Consumes 1 loop.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Function Blocks</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Setpoint Programmer and Recipe Function Blocks</strong> (F=Fast Scan Rate, N=Normal Rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Programmer</strong></td>
<td>N</td>
<td>Produces a setpoint output for a time-based ramp/soak profile that is loaded into the block. Input: Process Variables, up to 3, to establish setpoint guarantee operation based on a deviation band from setpoint. Profile Number (for auto-load of a profile # for next run), New Starting Segment (uses a Set input to enter a new segment number). Digital Inputs: Enable (allows programmer to be operated), Set (to load a program or new start segment), Start, Hold, Restart (from power failure, can allow slower ramp up to previous SP to protect product), Reset, Advance, Jog (to a specified segment), and Guarantee Hold (to synchronize with another programmer). Outputs: Setpoint value, segment number, program number, time remaining in segment, time elapsed in segment, program elapsed time. Digital Outputs: Status (Ready, Running, Hold, Stopped), synchronize hold state, program state.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Program Events</strong> (up to 16 events per block)</td>
<td>N</td>
<td>Provides up to 16 digital status outputs that may be ON or OFF on a per segment basis. Inputs include program number, segment number, and program state (READY, RUN, HOLD, GHOLD, or STOP) from setpoint program block from program state output.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Program Synchronizer</strong></td>
<td>N</td>
<td>Used to synchronize the operation of two setpoint programs given the Run, Hold and Reset signals from each program.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recipe Block</strong></td>
<td>F,N</td>
<td>Used to initiate loading of recipe values into a chosen set of controller variables based on a recipe number. Inputs include recipe number and load command, allowing remote recipe selection.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Scheduler Function Blocks</strong> (F=Fast Scan Rate, N=Normal Rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Scheduler</strong></td>
<td>N</td>
<td>Produces up to 8 ramp or soak setpoint outputs on a common single time base. (See Scheduler description for details.) Input: Process variables, up to 8, to establish setpoint guarantee operation based on deviation from setpoint. Schedule number is used for automatic schedule loading and starting segment number allows first segment selection. Digital inputs: Dedicated input for connection to State Switch block output. Outputs: Up to 8 setpoint values, segment number, schedule number, time remaining in segment, time elapsed in segment, schedule elapsed time. Digital Outputs: Dedicated output for connection to State Flags block input.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>State Switch Block</strong></td>
<td>N</td>
<td>Provides digital switch status inputs to the Scheduler block for Run, Hold, Reset, GHold, Advance and Jog.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>State Flags Block</strong></td>
<td>N</td>
<td>Accepts status output from the Scheduler block and provides digital output signals for Run, Hold, GHold, Ready and Stop.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Setpoint Scheduler Auxiliary Output Block</strong></td>
<td>N</td>
<td>Provides up to 8 additional analog setpoint (soak only) values for each segment of the schedule. Inputs: Up to 8 process variables used for display.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Event Decoder</strong></td>
<td>N</td>
<td>Provides up to 16 digital outputs that may be ON or OFF on a per segment basis.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Auxiliary Control Function Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Lag Signal Conditioner</td>
<td>N</td>
<td>Modifies an analog input value to include lead and lag time constants when a digital input is true. Lead time constant = 0 minutes to 99 minutes Lag time constant = 0 minutes to 99 minutes</td>
</tr>
<tr>
<td>Function Generator</td>
<td>N</td>
<td>Generates an output characteristic curve based on up to 11 configurable “breakpoints” for input and output values.</td>
</tr>
<tr>
<td>High/Low Limiter</td>
<td>F, N</td>
<td>Limits an analog variable between high and low limit values. Provides separate digital status outputs when high or low limit values are exceeded.</td>
</tr>
<tr>
<td>Rate (Velocity) Limiter</td>
<td>F, N</td>
<td>Limits the rate at which an analog variable can change when a logic input is ON. Provides independent increasing and decreasing rate of change limit values. Separate digital status outputs indicate when high or low rate limits are active.</td>
</tr>
<tr>
<td>Rate of Change</td>
<td>F, N</td>
<td>Provides an output value representing the rate of change value of the input in units per minute. Output value is positive for increasing input values and negative for decreasing input values. Two setpoint values and digital outputs are provided to indicate excess increasing or decreasing rates of change or insufficient increasing or decreasing rates of change.</td>
</tr>
<tr>
<td>Read Constant</td>
<td>F, N</td>
<td>Provides a read access to internal static parameters of selected blocks by Block number and parameter index number.</td>
</tr>
<tr>
<td>Write Constant</td>
<td>F, N</td>
<td>Provides write access to internal static parameters of selected blocks by Block number and parameter index number.</td>
</tr>
<tr>
<td>Write Variable</td>
<td>F, N</td>
<td>Provides a write of a value to a selected analog or digital Variable number based on the ON state of a digital input.</td>
</tr>
<tr>
<td>Track and Hold</td>
<td>N</td>
<td>Allows updating or holding the value of an analog input based on the state of a digital input.</td>
</tr>
<tr>
<td>BCD Translator</td>
<td>F, N</td>
<td>Accepts up to 8 digital inputs in sequence and interprets the ON/OFF status of the first 4 inputs as a BCD value between 0 and 9, and the second 4 digits as a value between 10 and 90.</td>
</tr>
<tr>
<td>Digital Encoder</td>
<td>N</td>
<td>A 16 input block whose output is the decimal value of the number of ON inputs.</td>
</tr>
<tr>
<td>Digital Decoder</td>
<td>N</td>
<td>A block whose 16 outputs are the binary equivalent of the input’s decimal value.</td>
</tr>
</tbody>
</table>

### Specific Application Principal Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Control (for Pump Control)</td>
<td>N</td>
<td>Provides device control (pumps, etc) including Start, Stop, Feedback Delay times along with feedback confirmation and failure check.</td>
</tr>
<tr>
<td>Stage</td>
<td>N</td>
<td>Accepts one or two analog variables and compares the values to high and low setpoints for each of 4 stages per block. Outputs are digital signals that remain ON after exceeding one setpoint until exceeding the second setpoint value for the specific stage.</td>
</tr>
<tr>
<td>Ramp</td>
<td>N</td>
<td>Accepts an analog variable and re-scales the value to new, user specified units. Up to 4 re-scale calculations may be configured per block. The re-scale calculation that is currently active is controlled by digital inputs to the block. Digital inputs may also be used to force the output to a high or low limit value.</td>
</tr>
</tbody>
</table>
The alternator accepts up to 16 digital inputs and, on a one for one basis, turns on up to 16 digital outputs as determined by a user specified alternating sequence. Alternator sequences include:
- Direct – Inputs are mapped to specific outputs.
- Rotary – Outputs are managed on a Last ON/First Off (LOFO) basis and the mapped sequence indexes by one each time all of the outputs are off.
- FOFO – First On, First Off alternates the outputs based on the sequence in which the outputs were turned on. The first output to turn on is moved to the end of the list once it turns off.
- Fixed – The output sequence follows a user specified mapping sequence. A manual advance causes the mapping sequence to index by one when enabled.
Both “make-before –break” and “break –before –make” selections are available for the block with user specified time delays for output changes.

### Signal Selector Function Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Fast Scan Rate</th>
<th>Normal Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Selector/Low Selector</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Providing the highest (high select) or lowest (low select) of two analog input variables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Output switches between two analog input values based on the status of a digital input.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bumpless Analog Transfer</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Output switches between two analog input values based on the status of a digital input. When switched, output ramps to the new value at a specified rate. A rate value is available for each direction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotary Switch</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Single output is selected from up to 8 analog values based on the numerical value of a select input (1 to 8).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Calculation Function Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Fast Scan Rate</th>
<th>Normal Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compare</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Comparing one analog variable to a second analog variable and generating separate digital outputs to indicate greater than, equal, or less than status.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute Value</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Provides an absolute value output for a single analog variable input.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square Root</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Output is the square root of a single analog variable input.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass Flow</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Calculates the mass flow of gases when measuring flow using an orifice plate. Output = Kg * sqrt((Kx * X + Bx) (Ky * Y + By)/(Kz * Z + Bz)) With inputs X = differential pressure Y = pressure, and Z = temperature. A low flow cut-off feature provides a user-specified drop-off value below which the output goes to zero.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum – Maximum – Average – Sum</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Accepts inputs from up to 6 analog variables and outputs analog variables representing the highest value, lowest value, average value, sum, and standard deviation. Removes bad inputs and provides an alarm output for deviations of any variable outside user-specified standard deviation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negate</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Accepts a single analog variable input and negates the output.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totalize</td>
<td>F, N</td>
<td></td>
</tr>
<tr>
<td>Integrates an analog variable using a specified rate. Rate may be in units per minute, hour, or day. A preset is provided to indicate when a specific quantity has been accumulated. Separate enable and reset inputs are provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviation Compare</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Compares up to 6 analog variables to deviation limits set around a 7th variable. If any variable is outside the limits, a digital signal is provided.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## HC900 Hybrid Controller Controlware

### Dewpoint

| N | A Dewpoint PV derived from high temperature O2 sensor is supplied to a PID function block for furnace Dewpoint control. Used in conjunction with other blocks including a PID to generate more elaborate control strategies than that provided by the carbon potential function block. |

### Continuous Average

| F, N | Provides the average value of a single analog parameter for a user-specified time period, plus the running average within the time period. Average value is updated at the end of each sample period. Time periods to 1440.0 minutes are supported. A hold input allows excluding samples from the average when active. |

### Orifice Meter (AGA3)

| N | Calculations for Orifice Metering – When connected to an AGA8 block, the input value and multiple related parameters will be obtained from the AGA8 block. The meter block will use this information to inherit the AGA8 block data for use in the calculations. |

### Turbine Meter (AGA7)

| N | Calculations for gas measurement by Turbine Meters – When connected to an AGA8 block, the input value and multiple related parameters will be obtained from the AGA8 block. The meter block will use this information to inherit the AGA8 block data for use in the calculations. |

### Ultrasonic Meter (AGA8)

| N | Calculations for gas flow measurements from multi-path Ultrasonic Meters – When connected to an AGA8 block, the input value and multiple related parameters will be obtained from the AGA8 block. The meter block will use this information to inherit the AGA8 block data for use in the calculations. |

### Detail (AGA8)

| N | 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. |

### Gross (AGA8)

| N | 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 H2S) 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.

The Gross Method only works over a limited range of conditions but requires less instrumentation to implement. |

## HVAC Function Blocks (F=Fast Scan Rate, N=Normal Rate)

| Relative Humidity | N | Calculates the relative humidity using wet bulb, dry bulb, and atmospheric pressure inputs. Output may be in degrees Fahrenheit or Celsius. |

| Humidity and Enthalpy | N | Calculates the Absolute Humidity and Enthalpy based on the inputs for air temperature, air relative humidity and barometric pressure. |

| Psychrometric | N | Accepts Temperature, relative Humidity and Barometric Pressure inputs and calculates humidity ratio, enthalpy, dewpoint, wet bulb temperature and absolute moisture. Calculations may be in Metric or English. |
## Math Function Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Math Function</th>
<th>F, N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale and Bias</td>
<td>F, N</td>
<td>Output = ((K \times X) + b) with single analog variable input (X).</td>
</tr>
<tr>
<td>Two and Four Input Math</td>
<td>F, N</td>
<td>Executes +, – or * on two or four analog variable inputs, / on two inputs.</td>
</tr>
<tr>
<td>Free Form Math</td>
<td>N</td>
<td>Calculates the result of a user-specified equation with double precision. The block accepts up to 8 input signals (including Constants or Variables). Operators include: +, -, <em>, /, ^, and multiple levels of parentheses. Functions include: absolute value, exp, ln, Log, neg, sqrt. Example: (a</em>(\sqrt{b+c})+d)</td>
</tr>
</tbody>
</table>

## Logic Function Blocks (F=Fast Logic Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Logic Function</th>
<th>F, N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND, OR, XOR (2 inputs)</td>
<td>F, N</td>
<td>Boolean logic blocks that provide a digital status output based on the digital status of two digital inputs for logic AND, OR, or XOR (exclusive OR) operations. Input status of each input may be inverted.</td>
</tr>
<tr>
<td>AND, OR (4 and 8 inputs)</td>
<td>F, N</td>
<td>Boolean logic blocks that provide a digital status output based on the digital status of four or eight digital inputs for logic AND or OR operations. Input status of each input may be inverted.</td>
</tr>
<tr>
<td>NOT (Complement)</td>
<td>F, N</td>
<td>Inverts a logic input status.</td>
</tr>
<tr>
<td>Latch</td>
<td>F, N</td>
<td>Provides a digital output that turns ON when a digital input turns ON and remains ON (latched) after the input goes OFF until an unlatch input turns ON.</td>
</tr>
<tr>
<td>Edge Detection Element (One-shot) [Trigger]</td>
<td>F, N</td>
<td>Provides an ON state of its output for one controller scan when a digital input goes from OFF to ON.</td>
</tr>
<tr>
<td>Selectable Trigger</td>
<td>F, N</td>
<td>Provides selectable input conditions for triggering its digital output.</td>
</tr>
<tr>
<td>Toggle (Flip-Flop)</td>
<td>F, N</td>
<td>Provides an ON state output when a digital input goes from OFF to ON and the previous state of the output was OFF, and an OFF state output when the digital input goes from OFF to ON and the previous state of the output was ON. A reset input holds the output OFF when the digital input is ON or active high.</td>
</tr>
<tr>
<td>Free Form Logic</td>
<td>F, N</td>
<td>Reads eight digital inputs and calculates the output based on specified Boolean logic functions (e.g., AND, OR, NOT, etc.) and multiple levels of parentheses. Example: ((A^*B)+C)</td>
</tr>
<tr>
<td>Pushbutton</td>
<td>F, N</td>
<td>Provides a one-shot output based on an OFF to ON change of an operator interface key action. Supports four pushbuttons per block.</td>
</tr>
<tr>
<td>Four Selector Switch</td>
<td>N</td>
<td>Provides up to 16 digital outputs in groups of four outputs each. Only one output from each group may be ON at a time and when selected automatically turns other outputs OFF. Simulates 4-position panel selector switches.</td>
</tr>
<tr>
<td>Sequenter</td>
<td>F, N</td>
<td>The sequencer function block controls the output statuses of up to 16 digital outputs and one auxiliary analog output. Each combination of outputs represents a &quot;State&quot; of the sequence such as Heat, Mix, or Cool, for example. The function block supports up to 50 states. The sequencer contains up to 64 steps. Each step enables a State, allowing for a State to be designated for several steps. Each State supports two digital events as inputs that can designate the end of the associated step. Time in seconds or minutes, a manual advance, or a digital event can be used to terminate a sequencer step and cause the sequence to advance. A pool of sequences, up to 64 steps each, may be stored in controller memory for quick recall and assignment to any of the sequencers.</td>
</tr>
</tbody>
</table>
### Counters/Timers Function Blocks (F=Fast Logic Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resettable Timer F, N</td>
<td></td>
<td>Provides a timing function based on an enable input. Elapsed time value is provided as an output. A Preset value allows settings from 1 second to 999999 seconds. A digital output is ON when time value is equal to the preset. An up/down digital input is provided to allow reverse timing from the preset value. A pre-load value allows initiating the timer to a non-zero starting time.</td>
</tr>
<tr>
<td>Periodic Timer F, N</td>
<td></td>
<td>Provides an ON state output for one controller scan cycle based on a specified time period using the controller real-time clock. Periods may be monthly, weekly, daily, or time period in a day.</td>
</tr>
<tr>
<td>Up/Down Counter F, N</td>
<td></td>
<td>Counts the number of raising edge logic transitions on the input to the block up to a preset value. When the preset value is reached a logic output is enabled. A reset input resets the block. Value may be set to increase to the preset value or decrease from the preset value (1–99999).</td>
</tr>
<tr>
<td>ON-Delay Timer F, N</td>
<td></td>
<td>An OFF to ON change of the digital input is delayed on the block output by a user-specified time (0.1 seconds to 999.9 seconds).</td>
</tr>
<tr>
<td>OFF-Delay Timer F, N</td>
<td></td>
<td>An ON to OFF change of the digital input is delayed on the block output by a user-specified time (0.1 seconds to 999.9 seconds).</td>
</tr>
<tr>
<td>ON/OFF Delay Timer F, N</td>
<td></td>
<td>Programmable as either ON-Delay Timer or OFF-Delay Timer (above).</td>
</tr>
<tr>
<td>Calendar Event N</td>
<td></td>
<td>The Calendar Event Block 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. 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. Each Calendar Event block supports five Setpoint Groups. 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.</td>
</tr>
<tr>
<td>Real Time Clock N</td>
<td></td>
<td>The Real Time Clock block provides outputs pins that you can access in your configuration to make decisions based on the value of the controller’s Real Time Clock value. The RTC function block has the following dynamic outputs based on the value of the real time clock of the controller: Seconds, Minutes, Hours, Day of Week, Day of Month, Day of Year, Month, and Year.</td>
</tr>
<tr>
<td>Time and Date N</td>
<td></td>
<td>Controls change between Daylight Saving and Standard time. Indicates when controller time is in Daylight Saving. If the controller is using a network time server, indicates if the connection to server has failed.</td>
</tr>
</tbody>
</table>

### Alarm and Signal Monitoring Blocks (F=Fast Scan Rate, N=Normal Rate)

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Monitor F, N</td>
<td></td>
<td>Accepts two analog values and provides a digital status output if the first input is higher than the second input. A hysteresis adjustment is provided to prevent output cycling.</td>
</tr>
<tr>
<td>Low Monitor F, N</td>
<td></td>
<td>Accepts two analog values and provides a digital status output if the first input is lower than the second input. A hysteresis adjustment is provided to prevent output cycling.</td>
</tr>
</tbody>
</table>
## Analog Alarm

| N | The analog alarm block accepts an analog signal as a process variable and compares it to a user-entered limit value (setpoint) to determine an alarm condition. The setpoint may be entered by the user or be another analog signal in the controller. Alarm actions may be high, low or high deviation, low deviation or band deviation. For deviation alarming, a second analog signal provides the reference and setpoints represent deviation from the reference. The alarm output may be inverted to create normally active digital output. A user selection for latching until acknowledged or automatically reset is provided. A user-specified hysteresis value in the engineering units of the process variable is provided. An on-delay time value up to 240 seconds is available to prevent momentary alarm actions. A digital reset input is available to disable alarm actions. |

## System Monitor Block

(1 block for normal scan and 1 block for fast logic scan) – (do not count against the maximum block count)

| F, N | Provides system and start-up status outputs including:
- Program scan cycle time
- Newstart pulse (ON for one scan cycle after a “cold” start (reset))
- Restart pulse (to activate a custom control action on power-up after power loss)
- Two common alarm outputs – Active Unacknowledged (ON when at least one alarm not acknowledged), Active alarm (ON when at least one alarm is active), for assignment to digital outputs
- Time off (the time that power has been off previous to restart)
- Low Battery (alert to change battery without power shutdown)
- Hardware OK (ON when all hardware including remote racks are OK)
- Hi Temp (Cold Junction temperature exceeds limits on a rack)
- Bad Block
- Master Fail
- Locked (controller toggle switch is in Run/Locked or Program position)
- DS Limit (OI data storage has reached its alarm limit)
- Reserve status of C70R CPU is active |

## IO Rack Monitor– (do not count against the maximum block count)

| N | One monitor block per rack, 5 racks maximum. Provides I/O module fault status |

## Alarm Group (Up to 20 blocks) – (do not count against the maximum block count)

| N | Supports acknowledgement of a group of up to 12 alarms using a controller digital signal to block, internal or external (for remote acknowledge). Each alarm group consists of up to 12 alarms. Outputs include Unacknowledged alarm and Active alarm states. The 30 blocks support up to 360 alarms. |

## Force Present

| N | Output indicates the presence of any forced blocks in the controller. Input can clear all forces and prevent new forces. |

## Redundancy Status

| N | Used with redundant CPUs only, such as C70R. The output pins indicate the lead/reserve status of CPU A and CPU B. The input can force a failover between CPUs. |

## Four Alarm with Hysteresis

<p>| F, N | Monitors four analog input values and performs up to four high or low alarm comparisons against the PV input. Hysteresis settings for each alarm are used to prevent output cycling. |</p>
<table>
<thead>
<tr>
<th>Communications Blocks (Peer to Peer) (F=Fast Scan Rate, N=Normal Rate)</th>
</tr>
</thead>
</table>
| **PDE (Peer Data Exchange) Control** | N | Interfaces to one HC900 peer device, accessed by controller name, supporting 8 parameter read requests and 4 event-triggered writes. Outputs may be given tag names for use in configuration strategy. Update rate can be configured from 500 ms to 5 sec.  
| **PDE Read** | N | Expands Read access for designated HC900 peer to an additional 16 parameters.  
| **PDE Write** | N | Expands Writes to designated HC900 peer by an additional 8 parameters, each triggered on event.  
| **Modbus Slave** | NA | Interface to one Modbus slave device, accessed by unit address (1 to 247), supporting 4 parameter read requests and 4 event triggered writes. Outputs may be given tag names for use in configuration strategy. Update rate is determined by the system, with the fastest rate being 1000ms per cycle. Max. 32 Modbus slave blocks per controller. A maximum of 1024-Modbus parameters for all slaves are supported per controller.  
When the serial port is used with the Modbus Master Advanced protocol (for gateway applications), the fastest update rate is equal to the Normal Scan rate of the controller (typically 500 ms per cycle). The master’s actual scan rate is determined dynamically by the controller based on the following criteria.  
- Number of slaves present on the serial link  
- Serial port baud rate  
- Maximum number of Modbus registers per transaction defined by the user  
- Number of Modbus registers used in the configuration  
- Number of transactions required per scan cycle  
- User configured slave reply timeout  
| **Modbus Read** | NA | Expands Reads from Modbus Slave devices for Modbus Slave blocks to an additional 16 parameters. Max. 32 Modbus devices.  
| **Modbus Write** | NA | Expands Writes of Modbus Slave blocks to Modbus Slave devices by an additional 8 parameters, each triggered on event. Max. 32 Modbus devices.  
| **Modbus/TCP Slave** | NA | A communication function block allows the controller to act as a master device and communicate with slave devices via the Ethernet port of the controller. Requires one block per slave device, up to 32 devices maximum. Only one block may be assigned to each slave device. It supports 4 read and 4 write parameters plus provides digital indication of communication integrity.  
| **Modbus/TCP Read** | NA | This is a communication function block that expands the read capability of the Modbus/TCP Slave function block to 16 additional data points. Multiple blocks may be connected to the same Modbus/TCP Slave block.  
The Modbus/TCP read block has no inputs and 16 outputs. Up to 16 registers can be configured as the source of data for the outputs.  
| **Modbus/TCP Write** | NA | This is a communication function block that expands the write capability of the Modbus/TCP Slave function block to 8 additional data points. Multiple blocks may be connected to the same Modbus Slave block.  
The Modbus write block has 8 inputs and no outputs. The Modbus destination for each of the eight inputs can be configured. An enable pin lets the data value be written once per scan.  
The configuration data for each point will consist of: the address of the destination device on the Modbus link, the register address of the desired data, and the register type: Integer or Float. |
**XYR5000 Base Station**  
NA  
Provides convenient setup method for accessing XYR5000 transmitter data from XYR5000 Base Stations. Uses a HC900 serial port connection and displaces the Modbus Slave port connection. Provides status of transmitter communications to a base station.  
Maximum of 1024 total parameters supported from up to 32 remote stations.

**XYR5000 Transmitter**  
NA  
The XYR 5000 transmitter function block operates in conjunction with the XYR5000 Base Station to provide process variable and status information from a single XRY5000 wireless transmitter. Up to 100 XYR5000 transmitter blocks may be connected to a single XYR5000 Base Station function block.

**XYR6000 Gateway**  
NA  
The XYR6000 Gateway function block is used to provide access to one or more XRY6000 transmitters from the HC900 controller. The number of Gateways connected to a HC900 controller is not limited, but the total number of parameters per controller is limited to 1024. XYR6000 Transmitter function blocks are connected to the output of the Gateway function block to gain access to transmitter data.

**XYR6000 Transmitter**  
NA  
The XYR 6000 transmitter function block operates in conjunction with the XYR6000 Gateway to provide process variable and status information from a single XRY6000 wireless transmitter. The number of transmitter blocks connected to a gateway is not limited, but the total number of parameters requested from all Gateways is limited to 1024 parameters. The addressing in the Transmitter function block is dependent on the content of the database export file from the XYR6000 Wireless Builder configuration software.

**Other Diagram Items (F=Fast Scan Rate, N=Normal Rate)**

<table>
<thead>
<tr>
<th>Item</th>
<th>F, N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Variable</td>
<td>F, N</td>
<td>Connects to a function block’s inputs and can be changed from the operator interface or via serial communications addressing.</td>
</tr>
<tr>
<td>Digital Variable</td>
<td>F, N</td>
<td>Connects to a function block’s inputs and can be changed from the operator interface or via serial communications addressing.</td>
</tr>
<tr>
<td>T (Text)</td>
<td>F, N</td>
<td>Allows descriptive data to annotate a specific area of a function block diagram to be entered. Four font sizes, four colors, bold/italics/underline supported. Text may be entered multi-line.</td>
</tr>
<tr>
<td>Soft Wire</td>
<td>F, N</td>
<td>For reference only. Soft-wiring method is to double click on a block pin and then clicks on a destination pin to complete soft-wire (or click to change direction en route to destination pin).</td>
</tr>
<tr>
<td>Connector</td>
<td>F, N</td>
<td>Connects tagged signals to function block inputs.</td>
</tr>
<tr>
<td>Signal Tag</td>
<td>F, N</td>
<td>Allows a name to be assigned to a wire and accessed by the operator interface or via serial communications.</td>
</tr>
<tr>
<td>Numeric Constant</td>
<td>F, N</td>
<td>A user-specified constant value that can be connected to function block inputs.</td>
</tr>
<tr>
<td>Page Connector</td>
<td>F, N</td>
<td>Connects a signal from a worksheet page to another page and across worksheets.</td>
</tr>
</tbody>
</table>
Alarms

An alarm may be assigned to any tag applied to a digital status output of a function block. Each control loop has two alarm status outputs, each corresponding to alarm setpoints of various types (e.g. PV Hi, Dev High/Low, etc.). There are specialized alarm blocks for analog alarms with hysteresis adjustment. An expanded function analog alarm block also provides selection of alarm type, an on delay, selective latching, and a disable input to control when the alarm is active.

Alarm assignment is initiated by adding the digital tags to an alarm group from a tag list. Alarm group blocks allow alarm partitioning into groups of 12 alarms. The 30 alarm group blocks allow up to 360 alarms to be defined. Each group may be assigned an alarm acknowledge function which permits external, panel acknowledge via a digital input or via a serial communications write to an internal Variable. Alarm groups may also be assigned to displays for the 1042 and 559 Operator Interfaces (OI).

Alarms can be assigned a priority (one of 4 levels - Low, Medium, High, and Emergency) for use in routing a topic and 48 character alarm message electronically to any of three locations via the e-mail of alarms feature, if selected for an individual alarm. Alarm detection is an off-to-on or on-to-off transition, selectable per alarm. The method of acknowledgement is selectable per alarm; Manual Ack selection requires user acknowledgement while Auto Ack provides automatic acknowledgement on return to the non-alarm state. Active alarm indication is provided on all Operator Interface displays.

Assigned alarm group displays show alarm status and permit group acknowledge of active alarms at the operator interface. An alarm detail display is provided for each alarm point which indicates the time and date of last alarm occurrence and offers up to 48 characters of user-specified text for alarm actions or notes. Alarms may also be stored in an alarm file on the operator interface diskette or ZIP drive media (1042 only) configurable from 150 to 1500 records. A resettable, common alarm output is available from a System block. This output can be directed to a DO or intermediate logic. An acknowledgement from any source can reset this output.

Events

Events are used for user alerts below an alarm priority (a non-alarm process condition) and may be assigned to any digital tag. Up to 64 digital tags may be added to an event list and assigned to:

1. trigger an e-mail for the event condition sent to any of up to 3 locations on occurrence,
2. be stored to the OI archive disk, or
3. be displayed on the status line of the operator interface on occurrence.

Any or all of these three assignments may be selected. Event detection may be on an off-to-on or on-to-off transition, selectable per event.

Communications

ELN Protocol - ELN is a communication protocol used by Honeywell operator interfaces and Hybrid Control Designer software to exchange configuration and dynamic data.

Modbus TCP and Modbus RTU protocol - HC900 Controllers communicate with host systems over an Ethernet Network using Modbus TCP protocol or via serial ports and Modbus RTU protocol. Modbus addresses are pre-assigned to function block parameters and tagged signals in the controller configuration this does not require user setup. A listing of available Modbus parameters, by address, is available via Hybrid Control Designer software reports. For interfaces that require controller data to be provided in a unique sequence, or in a specific data format, the HC900 controllers provides an array of 1000 Modbus registers that may be configured by the user.

The address location of data in the array is determined during configuration. Data formats for this function include: Signed 16 bit, Unsigned 16 bit, Signed 32 bit, Unsigned 32 bit, and float 32.
Profibus – The HC900 can access data from Profibus slave devices using a Modbus-to-Profibus gateway device attached to the serial port of the controller. The gateway device is a Profibus Master on the fieldbus network and a Modbus slave to the HC900. The Profibus data is connected into the control strategy using Modbus function blocks. This application has been validated with a ProLinx 5104-MCM-PDPM gateway (from ProSoft® Technology).

Ethernet Peer to Peer Communications - Peer data communications between one HC900 controller and up to 32 other HC900 controllers is supported over Ethernet via UDP protocol for process interlocks or data sharing. Both digital and analog data exchange are supported using peer data exchange function blocks. Peer functions block types include:

Peer Communications - Defines the data-producing controller by name and the data rate for the requested data. This block supports 8 read parameters and 4 write parameters.

Peer Read – This function block expands the read capability of the Peer Communications block with an additional 16 parameters per Read block.

Peer Write – This function block expands the write capability of a Peer Communications block with an additional 8 parameters per Write block.

Modbus RTU Master – The serial ports of HC900 controllers may be setup as a Modbus Master on a multi-drop network of devices, (one master per controller). Modbus Slave function blocks are used to specify the unit address of field devices and the data to be exchanged. A maximum of 32 Modbus Slave function blocks may be configured in a control strategy. Both read and write data operations are supported.

Modbus Read and Modbus Write function blocks expand the capability of a Slave block up to the maximum of 1024 parameters per controller.

Email alarming - HC900 alarms or events can be individually configured to send an email alarm (or event) message to an email address. Alarm priorities are combined with individual alarm and event email enable selections to group messages to be sent. An email message provides the following information:

From: Controller Name
Subject: (Configurable Text)
Body of Email:
- Date & Time
- Alarm or Event Tag Name
- Alarm State
- 48 Character alarm or event text

Peer data can be given signal tag references for use in a control or data acquisition strategy. Peer to peer data interchange does not consume one of the controller’s host connections.
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.

For More Information

Learn more about how Honeywell’s HC900 Hybrid Controller Controlware can provide a cost-effective platform for combining loop and logic control, visit our website www.honeywell.com/ps/hfs or contact your Honeywell account manager.

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