Technical Information

Honeywell

HC900 Process Controller Controlware Specifications

51-52-03-42, October 2015

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 Process Controller 51-52-03-31
HC900 Process Controller Modules 51-52-03-41
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 Designer configuration software or via the 900 Control Station. Simply read the configuration from the controller to exactly duplicate the original configuration, including all text descriptions. 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 Designer software allows configuration changes while in the Run/Program 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/C75 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 widgets provided in Honeywell Station Designer/Control Station. 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. Validated Output function blocks provide two additional fault monitoring pins. FBFAIL, stands for Feedback Fail, and activates when the corresponding INPUT channels fails, VFAIL, stands for Verification Fail, and activates when the associated input does not match the driven output. Voting INPUT function blocks also provide two additional fault monitoring pins, SFAIL, stands for Source Fail, it activates when one or more of the configured INPUT channels fail, VFAIL activates when one or more of the channels disagree. All of these validated function blocks contain a disable pin that may be used to disable the function block and its associated FAIL logic. The validated I/O function blocks contain a restart pin that allows the user to maintain the output and fault outputs until an OFF to ON transition occurs. This is functionality is useful to maintain a safe condition while repairs are being made.

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 Process 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 10 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.

Example Sequence Control

			Outputs															
Step	**State**	**State Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	**1**	**PURGE**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**1**
2	**5**	**AGITATE**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**1**
3	**2**	**FEED B**	**0**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**1**
4	**3**	**MIX**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**1**
5	**8**	**PREHEAT**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**1**
↓																		
64	**50**	**STOP**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

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.

Example Setpoint Profile Table

Seg	Ramp/ Soak	SP Value	Time/ Rate	Aux Out	Guar Hold	Events
1	Ramp	100	20	0.0	OFF	100110000000000
2	Ramp	500	30	1.1	OFF	100100100000000
3	Soak	1300	90	1.1	ON	101110100000000
4	Ramp	1300	50	1.1	OFF	100100100000000
5	Soak	100	0.1	0.0	OFF	00000000100000

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.

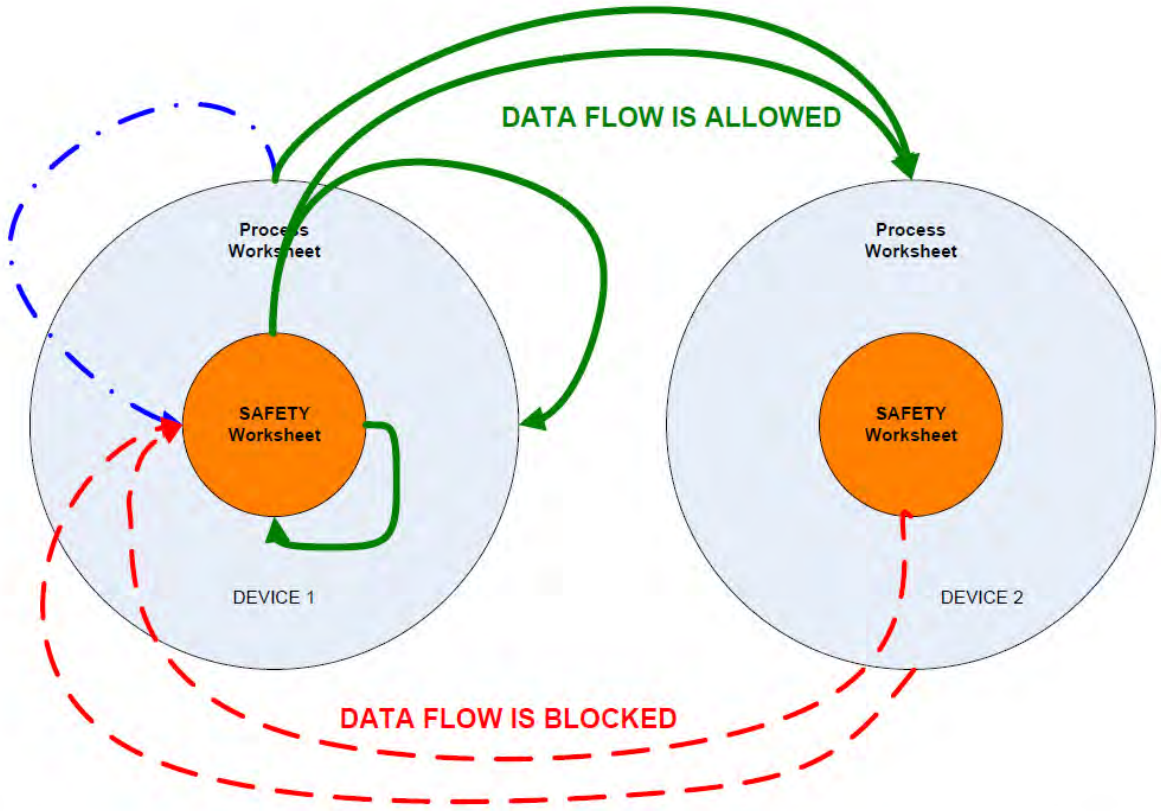
Example Recipe

Recipe: P1023-F7
TYPE 1023 HARDEN

Variable		Value
Tag	**Descriptor**	
PROFNUM	Profile Number	2
BIAS2	TempBias–Zone2	12
BIAS3	TempBias–Zone3	18

Up to 50 Variables

	HIALMSP1 F1 Hi Temp Alarm	1280



Data flow	Definition	Functions
	Permissible dataflow between external devices, worksheets and I/O devices	Safety Critical functions
	Prohibited dataflow between external devices, worksheets and I/O devices	Process Functions
	Limited dataflow between external devices, worksheets and I/O devices. WVAR used for transfer.	Non-Critical Safety Functions

Process and Safety controller configuration worksheets

Safety Controller configuration can consist of two worksheet types, process and safety. Safety applications are restricted to the configuration on the safety worksheet. Function block execution can be distributed across the worksheet types; safety worksheets are isolated from dataflow elements from the process worksheet (Process outputs, MODBUS communications, Writes) while operating in the safety "RUN" (locked) mode of operation with the exception of the WVAR function block. WVAR function blocks may be used to transfer information from the process worksheet into safety worksheet variables. WVARS used for this purpose are restricted to variables used for non-critical safety functions. Non-critical safety functions is functionality that cannot interfere with critical safety functionality. The dataflow restrictions are removed while operating in the "RUN/PROGRAM" or "PROGRAM" modes of operation. Dataflow is allowed to flow out of the safety worksheet in all modes of operation. This semi-permeable membrane protects the integrity of the safety functionality.

Additionally a limited number of process type function blocks (i.e. AGA blocks) are restricted inside a safety worksheet. Safety applications must run in the "RUN" mode to ensure proper operation.
Switching from "PROGRAM", "RUN/PROGRAM" into the "RUN" mode will not be permitted with forced blocks on the Safety worksheet.

HC900 Function Block Types

I/O Blocks (F=Fast Scan Rate, N=Normal Rate)		
Analog Input	N	Universal Analog Input, with table selection of input type. (For input types see HC900 Process Controller Module Specification 51-52-03-41) Filter – 1st order lag, 0 to 120 seconds Bias – Input value adjust for calibration correction Burnout – Off, Upscale, Downscale, Default Value Warn Output – activates if thermocouple resistance > 100 ohms. Input Disable –digital input when ON disables input, sets output to a defined default Bad Channel Detection – Optional selection to treat a sensor failure and hardware fault the same.
Analog Input with Voting	N	Universal Analog Input, with table selection of input type. (For input types see HC900 Process Controller Module Specification 51-52-03-41). AI-V differs from AI in that multiple inputs (up to 3) may be specified, the values of the inputs (whose channel has not failed) must match within 3% for the input value to be considered good overall. The block output pin reflects the first channel that is within the 3% tolerance. This block contains three output status pins: *Fail PIN* – reflects the highest failure level where the value of the block cannot be determined. The Blocks Output will reflect the programmed failsafe value. *SFAIL* – Stands for Source failure. This pin turns ON if a channel/module has failed *VFAIL* – Stands for Validation Failure. This pin turns ON if the SFAIL Pin is OFF and one of the selected channels is outside the 3% tolerance band. Monitoring the block directs the operator to the failure source. • Filter – 1st order lag, 0 to 120 seconds • Bias – Input value adjust for calibration correction • Bad Channel Detection – Optional selection to treat a sensor failure and a hardware fault as the same. • Disable Pin – Places the block output to the selected Failsafe value and turns the Output status pins OFF. For safety configurations it is recommended that the channel inputs physical source be from different input modules. This provides a means to correct the failure achieving higher reliability. Additionally locating the modules on independent racks increases availability to the highest level.
Analog Input RCJ	N	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)
Analog Output	N	Regulated analog output current Input scaling in Engineering Units, Output scaling within 0 and 20 mA Slew rate (rate of change in mA/sec.) definable, Fail output pin is ON when output fail sensed. Failsafe definable as High, Low, Hold or go to a user specified value

I/O Blocks (F=Fast Scan Rate, N=Normal Rate)		
Analog output with Validation	N	Regulated analog output current with assignable feedback channel for output validation. Input scaling in Engineering Units, Output scaling within 0 and 20 mA Slew rate (rate of change in mA/sec.) definable. The feedback channel range is fixed to the output range with selection of the appropriate shunt (62.5, 100, 250, 500 ohms). Failsafe definable as High, Low, Hold or go to a user specified value on the Process worksheet. Failsafe value on the Safety worksheet is set to OFF. This block contains three output status pins: *FAIL PIN* – reflects the highest failure level where the value of the output may be in error or the output modules loses communication to the controller. The Blocks Output will reflect the programmed failsafe value and the physical channel's output will be driven to its configured Failsafe value. *FBFAIL PIN* – Stands for Feedback failure. This pin turns ON if an assigned input channel fails. *VFAIL PIN* – Stands for Validation Failure. This pin turns ON if the FBFAIL Pin is OFF and the assigned input channel is outside the 3% tolerance band. **Input Pins** Restart PIN – This Pin, if connected, releases the output from failsafe mode. A transition from Low to High with error free inputs is required for the operation to work. This provides a means to correct the failure and resume operation in a safe controlled fashion. Disable Pin – Places the block output to the selected Failsafe value and turns the Output status pins OFF.
Digital Input (1)	F, N	Provides the digital status of a digital input point. The output status may be inverted. Failsafe definable as ON, OFF or Hold last state
Digital Input with Voting	F,N	Digital Input, with voting DI-V differs from AI-V in that multiple inputs (up to 3) may be specified. Voting is achieved using a binary, On – OFF state. The block output pin reflects vote of the majority of valid, no failures, input channels. This block contains three output status pins: *Fail PIN* – reflects the highest failure level where the value of the block cannot be determined. The blocks output will reflect the programmed failsafe value. *SFAIL* – Stands for Source failure. This pin turns ON if an assigned channel has failed. *VFAIL* – Stands for Validation Failure. This pin turns ON if the SFAIL Pin is OFF and one of the assigned channels is in the minority. Monitoring the block directs the operator to the failure source. For safety configurations it is recommended that the channel inputs physical source be from different input modules. This provides a means to correct the failure achieving higher reliability. Additionally locating the modules on independent racks increases availability to the highest level.
Digital Input (Up to 8 inputs)	F, N	Provides the digital status of the first or last 8 digital inputs of a 16 point input card. The output status may be inverted. Failsafe definable per input as ON, OFF or Hold last state
Digital Output (1)	F, N	Directs a digital status to a physical logic output. Output status may be inverted. Failsafe definable as ON, OFF or Hold last state

I/O Blocks (F=Fast Scan Rate, N=Normal Rate)		
Digital output with Validation	N	Digital output current with assignable feedback channel for output validation. Two physical channels are configured in this block. One output channel and a matching input type channel. Failsafe definable as High, Low, or Hold on the Process worksheet. Failsafe value on the Safety worksheet is set to Low. This block contains three output status pins: *FAIL PIN* – reflects the highest failure level where the state of the output may be in error or the output modules loses communication to the controller. The Blocks Output will reflect the programmed failsafe state and the physical channels output will be driven to the configured Failsafe state. *FBFAIL PIN* – Stands for Feedback failure. This pin turns ON if an assigned input channel fails. *VFAIL PIN* – Stands for Validation Failure. This pin turns ON if the FBFAIL Pin is OFF and the remaining inputs do not agree. **Input Pins - Restart** PIN – This Pin, if connected, releases the output from failsafe mode. A transition from Low to High with error free inputs is required for the operation to work. This will provide a means to correct the failure and resume operation in a controlled fashion. Disable Pin – Places the block output to the selected Failsafe value and turns the Output status pins OFF.
Digital Output (Up to 8 outputs)	F, N	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. Failsafe definable per input as ON, OFF or Hold last states.
Time Proportioning Output (applied to any PID output)	N	Proportions the amount ON time and OFF time of a digital output. Input scaling in engineering units Cycle time—2 second to 120 seconds Output minimum ON and OFF time—0 seconds to 15 seconds Failsafe definable per input as ON, OFF or Hold last duty cycle

I/O Blocks (F=Fast Scan Rate, N=Normal Rate)		
Position Proportional Output	N	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.
Pulse Input	F, N	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.
Pulse Output	F, N	Outputs a pulse train of user controllable duration. It controls a relay on a Pulse/Frequency/Quadrature module.
Frequency Input	F, N	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.
Quadrature Input	F, N	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.

Control Loop Function Blocks (F=Fast Scan Rate, N=Normal Rate)		
PID	N	PID algorithm includes: • Accutune III auto-tuning and selectable fuzzy logic overshoot suppression • 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 • Two sets of PID constants selectable via program control. Choice of Gain or Proportional Band entry and Integral time or Repeats/minute entry • Setpoints—Two setpoint values or one value and one remote setpoint • Setpoint tracking – Local SP tracks PV or RSP on a RSP to LSP change • Setpoint limits, output limits, SP rate of change • Soft start for output rate limiting on startup or after power fail (not available with output tracking) • Ratio and Local/Remote Bias selections for Ratio control applications • Feedforward input (scaled in % of output) • Back calculation output for Cascade operation (supplied to primary loop) • Output tracking to track a remote input (for backup applications) • Remote A/M, R/L mode switching and mode status outputs • Function block access to tuning constants for gain scheduling • Alarms—Two outputs with up to two high, low, or dev band conditions each Inputs: PV, remote setpoint, feedforward, output track and track command, ratio, bias, switch block connection, mode switch block connection, and back calculations Outputs: Control output, working setpoint, alarm status (2), Autotune indication, mode status
PID for Carbon Potential (displaces PID)	N	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.
PID with 3 Position Step Output	N	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.
ON/OFF Control (displaces PID)	N	ON/OFF control algorithm with selectable hysteresis. Consumes 1 loop.
Loop Switch Inputs	N	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.
Loop Mode Switch	N	Digital interface to control loops to select automatic or manual modes and/or local or remote setpoint. Connects to all control loop types.
Mode Decoder (Mode Flags)	N	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
Write Tuning Constants	N	Automatically changes the GAIN, RATE, and RESET parameters of an internal PID loop without operator interaction. A digital input controls changes.
Auto-Manual Bias (for Boiler Control applications) (displaces PID)	N	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.

Setpoint Programmer and Recipe Function Blocks (F=Fast Scan Rate, N=Normal Rate)		
Setpoint Programmer	N	Produces a setpoint output for a time-based ramp/soak profile that is loaded into the block. Inputs: 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
Setpoint Program Events (up to 16 events per block)	N	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.
Setpoint Program Synchronizer	N	Used to synchronize the operation of two setpoint programs given the Run, Hold and Reset signals from each program.
Recipe Block	F,N	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.

Setpoint Scheduler Function Blocks (F=Fast Scan Rate, N=Normal Rate)		
Setpoint Scheduler	N	Produces up to 8 ramp or soak setpoint outputs on a common single time base. (See Scheduler description for details.) Inputs: 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.
State Switch Block	N	Provides digital switch status inputs to the Scheduler block for Run, Hold, Reset, Ghold, Advance and Jog.
State Flags Block	N	Accepts status output from the Scheduler block and provides digital output signals for Run, Hold, Ghold, Ready and Stop.
Setpoint Scheduler Auxiliary Output Block	N	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.
Event Decoder	N	Provides up to 16 digital outputs that may be ON or OFF on a per segment basis.

Auxiliary Control Function Blocks (F=Fast Scan Rate, N=Normal Rate)		
Lead Lag Signal Conditioner	N	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
Function Generator	N	Generates an output characteristic curve based on up to 11 configurable "breakpoints" for input and output values.
High/Low Limiter	F, N	Limits an analog variable between high and low limit values. Provides separate digital status outputs when high or low limit values are exceeded.
Rate (Velocity) Limiter	F, N	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.
Rate of Change	F, N	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.
Read Constant	F, N	Provides a read access to internal static parameters of selected blocks by Block number and parameter index number.
Write Constant	F, N	Provides write access to internal static parameters of selected blocks by Block number and parameter index number.
Write Variable	F, N	Provides a write of a value to a selected analog or digital variable number based on the ON state of a digital input. Writes into the safety worksheet (Safety controllers) are only configurable when the variable is enabled for non-critical safety functions. When operating in Run-Locked/Safe Mode.
Track and Hold	N	Allows updating or holding the value of an analog input based on the state of a digital input.
BCD Translator	F, N	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.
Digital Encoder	N	A 16 input block whose output is the decimal value of the number of ON inputs.
Digital Decoder	N	A block whose 16 outputs are the binary equivalent of the input's decimal value.

Specific Application Principal Blocks (F=Fast Scan Rate, N=Normal Rate)		
Device Control (for Pump Control)	N	Provides device control (pumps, etc) including Start, Stop, Feedback Delay times along with feedback confirmation and failure check.
Stage	N	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.
Ramp	N	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.
Alternator	N	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)		
High Selector/Low Selector	F, N	Provides the highest (high select) or lowest (low select) of two analog input variables.
Switch	F, N	Output switches between two analog input values based on the status of a digital input.
Bumpless Analog Transfer	N	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.
Rotary Switch	F, N	Single output is selected from up to 8 analog values based on the numerical value of a select input (1 to 8).

Calculation Function Blocks (F=Fast Scan Rate, N=Normal Rate)		
Compare	F, N	Compares one analog variable to a second analog variable and generates separate digital outputs to indicate greater than, equal, or less than status.
Absolute Value	F, N	Provides an absolute value output for a single analog variable input.
Square Root	F, N	Output is the square root of a single analog variable input.
Mass Flow	N	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.
Minimum – Maximum – Average – Sum	N	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.
Negate	F, N	Accepts a single analog variable input and negates the output.
Totalize	F, N	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.
Deviation Compare	N	Compares up to 6 analog variables to deviation limits set around a 7^{th} variable. If any variable is outside the limits, a digital signal is provided.
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 H_2S) natural gas. There are two methods used: **Gross Method 1** calculates the super-compressibility and gas density from knowledge of the relative density, heating value and carbon dioxide, hydrogen and carbon monoxide components. **Gross Method 2** calculates the super-compressibility and gas density from knowledge of the relative density, Nitrogen, carbon dioxide, hydrogen and carbon monoxide components. 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)		
Scale and Bias	F, N	Output = (K * X) + b with single analog variable input X.
Two and Four Input Math	F, N	Executes +, – or * on two or four analog variable inputs, / on two inputs.
Free Form Math	N	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: +, -, , /, ^, and multiple levels of parentheses. Functions include: absolute value, exp, ln, Log, neg, sqrt. Example: a*(sqrt(b+c))+d

Logic Function Blocks (F=Fast Logic Rate, N=Normal Rate)		
AND, OR, XOR (2 inputs) Boolean logic blocks	F, N	Provides 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.
AND, OR (4 and 8 inputs) Boolean logic blocks	F, N	Provides 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.
NOT (Complement)	F, N	Inverts a logic input status.
Latch	F, N	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.
Edge Detection Element (One-shot) [Trigger]	F, N	Provides an ON state of its output for one controller scan when a digital input goes from OFF to ON.
Selectable Trigger	F, N	Provides selectable input conditions for triggering its digital output.
Toggle (Flip-Flop)	F, N	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.
Free Form Logic	F, N	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**
Pushbutton	F, N	Provides a one-shot output based on an OFF to ON change of an operator interface key action. Supports four pushbuttons per block.
Four Selector Switch	N	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.
Sequencer	F, N	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 “State” 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.
Hand/Off/Auto	N	Provides Hand-Off-Automatic outputs based on digital inputs emulating a standard H-O-A panel switch

Counters/Timers Function Blocks (F=Fast Logic Rate, N=Normal Rate)		
Resettable Timer	F, N	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.
Periodic Timer	F, N	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.
Up/Down Counter	F, N	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).
ON-Delay Timer	F, N	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).
OFF-Delay Timer	F, N	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).
ON/OFF Delay Timer	F, N	Programmable as either ON-Delay Timer or OFF-Delay Timer (above).
Calendar Event	N	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.
Real Time Clock	N	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.
Time and Date	N	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.

Alarm and Signal Monitoring Blocks (F=Fast Scan Rate, N=Normal Rate)		
High Monitor	F, N	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.
Low Monitor	F, N	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.
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) – (does 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– (does 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 C75. The output pins indicate the lead/reserve status of CPU A and CPU B. The input can force a failover between CPUs.

Alarm and Signal Monitoring Blocks (F=Fast Scan Rate, N=Normal Rate) continued ..		
Four Alarm with Hysteresis	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.
Fault Monitor	F, N	Provides Control Application a means to take action on numerous fault conditions. The reaction on detected faults is configurative depending on the applications for which the HC900 is used. The FMON block has a fault clear input pin used for clearing all the faults generated and a fault output pin to display the selected diagnostic fail status. Each FMON function block requires a rack number, module number and a corresponding diagnostic to be selected during configuration, depending on the type of diagnostic group selected
Configuration Access Status	N	Provides read access to configuration access status values including the configuration file CRC (Cyclic Redundancy Check). The function block provides pins to generate the number of times the configuration is downloaded to the controller, number of times unauthorized TCP write is requested, number of times the controller password is changed.

Communications Blocks (Peer to Peer) (F=Fast Scan Rate, N=Normal Rate)		
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)		
Analog Variable	F, N	Connects to a function block's inputs and can be changed from the operator interface or via serial communications addressing. May be enabled by the safety application engineer for writes from the process worksheet into the safety worksheet when used in a non-critical safety function while operating in the "Run-Locked/ Safe".

Digital Variable	F, N	Connects to a function block's inputs and can be changed from the operator interface or via serial communications addressing. May be enabled by the safety application engineer for writes from the process worksheet into the safety worksheet when used in a non-critical safety function while operating in the "Run-Locked/ Safe".
T (Text)	F, N	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.
Soft Wire	F, N	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).
Connector	F, N	Connects tagged signals to function block inputs.

Other Diagram Items (F=Fast Scan Rate, N=Normal Rate)		
Signal Tag	F, N	Allows a name to be assigned to a wire and accessed by the operator interface or via serial communications.
Numeric Constant	F, N	A user-specified constant value that can be connected to function block inputs.
Page Connector	F, N	Connects a signal from a worksheet page to another page and across worksheets.

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.

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.

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 a log file on the 900 Control Station. 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 logged on the Control Station or
3. be displayed on the status line of the Control Station 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 the Designer software to exchange configuration and dynamic data with the 900 Control Station.

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 when Honeywell's fixed Modbus mapping is selected. A listing of available Modbus parameters, by address, is available via 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. User's may configure their own Modbus register mapping by selecting the Custom Modbus Map if the configurations require additional register access.

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.

Up to 1024 parameters between peer controllers is supported. No specialized software is required to setup a peer network.

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.

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 e-mail alarm (or event) message to an e-mail address. Alarm priorities are combined with individual alarm and event e-mail enable selections to group messages to be sent. An email message provides the following information:

From: Controller Name
Subject: (Configurable Text)
Body of E-mail:

- Date & Time
- Alarm or Event Tag Name
- Alarm State
- 48 Character alarm or event text

Sales and Service

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

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