Universal Controller

Overview and Configuration Manual

808-346 Rev. 03/06

Manual Revisions

The *Universal Controller Overview and Configuration Manual* is catalog number 808-346, Rev. 03/06. This manual replaces the *Universal Controller Overview and Configuration Manual* catalog number 808-346, Rev. 06/05. The following changes have been made since the Rev. 06/05 version.

Section/Chapter	Changes
Algorithms	1. On page 176, under DO - Analog Comparison, changed the Block Iteration Rate decision's Allowable Entries from 10 to 900 seconds to read: 60 to 900 seconds.

Overview

Overview

About this Manual

This manual contains information about the operations of the Universal Controller and how you must configure the controller to perform those operations. The table below describes the contents of this manual.

Chapter Name	Description
Overview	Presents an overview of the manual.
Introduction	Provides an overview of the Universal Controller. This section also provides a configuration overview, flow diagrams overview, and a discussion on foreign language conversion.
Service Configuration	Provides the procedure for configuring a newly installed Universal Controller using ComfortVIEW as well as a description of each of the Universal Controller's Service Configuration tables, including a list of service configuration decisions, and a description of each decision that includes allowable entries and default values.
Point Types	Provides the following information for each point: purpose, typical application, list of configuration decisions, and a description of each decision that includes allowable entries and default values. This chapter also includes a list of applicable maintenance decisions and a description of each decision.

Chapter Name	Description
Algorithms	This chapter provides the following information for each analog, discrete, and global algorithm: purpose, block diagram illustrating flow of inputs and outputs, list of configuration decisions, and a description of each decision that includes allowable entries and default values. This chapter also includes a list of applicable maintenance decisions and a description of each one.
Schedules	This chapter provides the following information for each schedule: purpose, typical application, list of configuration decisions, and a description of each decision that includes allowable entries and default values. This chapter also includes a list of applicable maintenance decisions and a description of each one.
Alarms	This chapter provides the following information for each alarm: purpose, typical application, block diagram illustrating flow of inputs and outputs, list of configuration decision that includes allowable entries and default values. This section also includes a list of maintenance decision and a description of each maintenance decision.

Chapter Name	Page	Description
System Functions		This chapter provides the following information for each system function: purpose, typical application, list of configuration decisions and a description of each decision that includes allowable entries and default values. This chapter also includes a list of applicable maintenance decisions and a description of each one.
Appendix A		This appendix contains Universal Controller HVAC function and alarm flowcharts. You can use these flowcharts to understand the operation of the various algorithms or as a reference when troubleshooting. For your convenience, the flowcharts are arranged in alphabetical order.
Appendix B		This appendix contains the following tables and charts: Analog Engineering Units, Discrete States, Setpoint Schedule Defaults, and Temperature Sensor Types.
Appendix C		This appendix lists alarm levels, alarm sources, alarm description indexes, and standard control characters for alarm messages.
Appendix D		The tables in this appendix provide the engineering units, ranges, resolutions, and accuracy for the standard input and output devices that the Universal Controller supports.

Chapter Name	Description
Appendix E	This section provides instructions on using the System Pilot to configure a newly installed Universal Controller.

Introduction

Introduction

The Universal Controller provides general purpose HVAC control and monitoring capability in a stand-alone or network environment using closed-loop, direct digital control. This product can also control and monitor equipment such as lighting, pumps, and fans. The Universal Controller gives the Carrier Comfort Network (CCN) the capability to control non-Carrier equipment and Carrier HVAC equipment not equipped with Product Integrated Controls (PICs).

The Universal Controller is designed to function as part of a CCN-based VVT system that requires an auxiliary controller to interface to lighting, fans, pumps, boilers and other HVAC equipment. The Controller can be installed on a primary or secondary bus.

The following CCN operator interface devices can be used to view and modify data in the Universal Controller:

- System Pilot
- CCNWeb
- ComfortVIEW
- Network Service Tool

Hardware Overview

16 field points (8 inputs and 8 outputs) can be connected to the Universal Controller. The Universal Controller also includes 4 software input and 4 software output points.

Figure 2-1 lists the sensors and devices supported by the Universal Controller's I/O channels. To determine these sensors' and devices' engineering units, ranges, resolutions, and accuracy, refer to Appendix B and D.

Figure 2-1
Sensors and Devices Supported by the Universal Controller

8 INPUTS	
Channels	Specifications
1 to 8	Discrete, analog, or temperature Discrete Dry contact Pulsed dry contact Analog 4-20 mA (2 wire and 4 wire) 0-10 Vdc Temperature 5K & 10K ohm thermistors (YSI and MCI)

8 OUTPUTS	
Channels	Specifications
1 to 8	Discrete or analog Discrete 24 Vdc@80 mA Analog 4-20 mA 0-10 Vdc

Software Overview

Each of the Universal Controller's hardware and software input and output points can be configured to be one of several analog or discrete point types, through a Service Configuration table provided for each point. The Service Configuration Table is also where the installer specifies each point's sensor type/units/state, point name and description, and for output points, specifies the algorithm that is to be applied to the point.

Algorithms

An algorithm is a pre-engineered group of processes that provides you with the capability to control and monitor HVAC devices in a safe, energy efficient manner.

Each pre-engineered algorithm contains some combination of points, schedules, systems functions, and HVAC functions that provide information to the algorithm. A typical grouping of items for an algorithm is shown in the flow diagram in Figure 2-3.

After the Universal Controller is installed, you must configure its database to meet the needs of your site's control applications.

As you configure the database, you answer a series of questions called configuration decisions, which provide details about the specified algorithm. For example, if a heating coil algorithm was selected, the installer would specify such things as the point that is controlling the air handler's hot water valve, the point that provides the on/off status of the air handler's fan, and the Optimal Start/Stop algorithm that provides the occupancy and temperature setpoints for the algorithm.

This manual's Algorithms chapter contains a detailed description of each algorithm's configuration decisions, including allowable entries and default values.

Flow diagrams are used in this manual to illustrate the flow of inputs and outputs among blocks of data within an algorithm, alarm, or schedule. The figure on the next page is the flow diagram for the DO—Electric Heat CV algorithm.

Interpreting Flow Diagrams

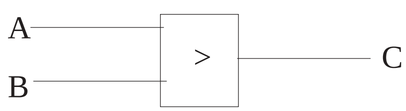
Each block of data within an algorithm, alarm, or schedule represents a configuration decision, whose name appears at the top of the block. Each block requires one or more inputs and outputs.

As shown in the figure below, inputs appear on the left side of the block with arrows pointing inward, while outputs are shown on the right side of the block with arrows pointing outward.

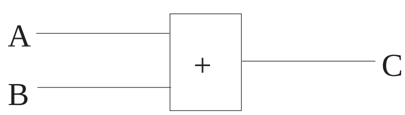
One block's output becomes another block's input. Sometimes an output serves as an input to more than block. When that occurs, a filled circle is placed on the output's arrow to indicate the location where its direction branches off.

Logical and relational operators are often used to connect inputs and outputs. Sample interpretations are shown below.

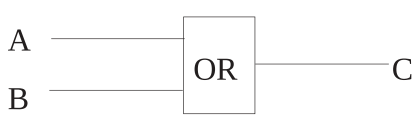
Figure 2-2
Logical and Relational Operator Usage Interpretations



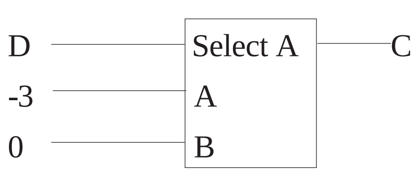
Interpretation: If A>B, then C=1 otherwise C=0



Interpretation: C=A+B

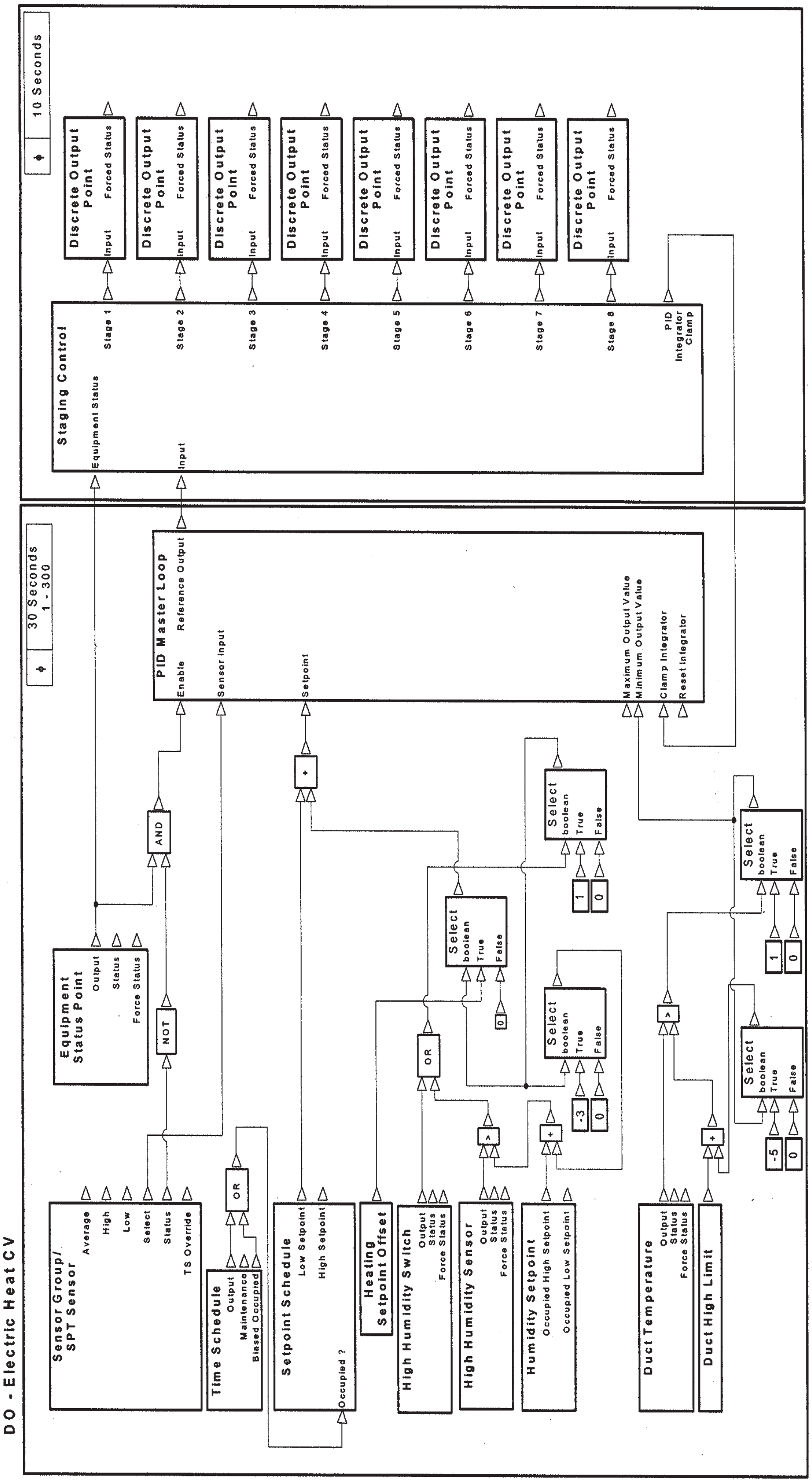


Interpretation: If A=1 or B=1, then C=1 otherwise C=0



Interpretation: If D=1, then C=-3 otherwise C=0

Figure 2-3
Sample Flow Diagram



Foreign Language Conversion

The Universal Controller software can be converted to any language whose alphabet is supported by the ANSI ASCII code set. Contact your local Carrier distributor for more information on converting the Universal Controller software to the language you desire.

Service Configuration

Service Configuration

Overview

This chapter provides you with the procedures that are necessary to configure a newly installed Universal Controller using the ComfortVIEW user interface, as well as an explanation of the Universal Controller's Service Configuration tables. For instructions on configuring a newly installed Universal Controller using the Smart Sensor, refer to Appendix E of this manual.

When configuring a Universal Controller using ComfortVIEW, you must perform a number of steps in a particular order.

- Create the Universal Controller’s database using the Service Configuration Tables. Each of these tables is described in this chapter including a description of and allowable entries for each decision.

- Configure the database using the configuration tables.

The term create, as it applies to the Universal Controller, means to specify information about the items being selected in the Service Configuration Tables. You must specify information such as channel types, sensor type or units, channel names, function types and function units. For example, the AO-Cooling CV algorithm’s function type is *1* and its function units might be *2*, which indicates 0-100%.

The term configure, as it is used in relation to the Universal Controller, means to specify to the Universal Controller the information that it needs to control and monitor HVAC devices in the desired manner. For example, when configuring the AO-Cooling CV algorithm, you must enter information such as the name of the controlling setpoint table and the Sensor Group or space temperature sensor that is providing the space temperature inputs.

Configuring a Newly Installed Universal Controller Using ComfortVIEW

Follow the procedures below to configure a newly installed Universal Controller using the ComfortVIEW user interface.

1. Use the Smart Sensor user interface, the Address Search utility program, the Network Service Tool's Address Search function, or the Service Pack Element Setup utility to set the Universal Controller address.

2. Add and Upload the Universal Controller to the ComfortVIEW database by displaying the Controller List window and using the *Configure, New* menu items. If necessary, refer to the *ComfortVIEW Operation Manual* (808-239) for step-by-step instructions.

   At completion of the Upload, a process begins where the Universal Controller is actually added to the ComfortVIEW database. Note that this will take several minutes to complete after the actual Upload stops. When that process is complete, a dialog box will be displayed, indicating that the controller has been successfully added to the database.

   Click *OK* to close the dialog box. The Universal Controller will appear in the ComfortVIEW Controller List as a "ghost" (greyed out) controller. Select *Window, Refresh* to make the controller appear as an active controller.

3. Configure each of the Universal Controller's Service Configuration Tables. Refer to the explanation of each Service Configuration Table, which appears later in this chapter for an explanation of and allowable entries and default values for each Service Configuration Table decision.

4. *Download* each Service Configuration Table from ComfortVIEW to the Universal Controller.

   Note: After downloading each Service Configuration Table, use the UCMAINT Maintenance Table to verify the validity and contents of the table. Refer to UCMAINT Maintenance Table, which appears later in this Service Configuration chapter.

5. At the completion of the download process, you must now delete the newly-added Universal Controller from ComfortVIEW. To do so, display the Controller List and then use the *Configure, Delete* menu items.

6. Now add the Universal Controller back to the ComfortVIEW database, and perform an *Upload* to copy the configuration from the Universal Controller to ComfortVIEW.

7. You must now configure the Universal Controller's points, algorithms, alarms, etc. All the tables to be configured will be listed in the Controller Table list.

Caution

If you modify the Service-Configuration Tables IN ANY WAY after this initial configuration, you must perform steps 5 and 6 to delete, add, and upload the Universal Controller back into the ComfortVIEW database.

UCMAINT Maintenance Table

Whenever a service table is downloaded to the Universal Controller, its contents can be verified and displayed in the UCMAINT maintenance table. As indicated above, any time a service table is modified, you must remove the Universal Controller from the database, and perform another upload.

The maintenance values displayed in the UCMAINT table are read-only values that display diagnostic information on all Universal Controller points. The following is an explanation of the displayed diagnostics. A point that has been successfully created with no error conditions will display a value of *1* (In System).

-4 = Out of range Function/Algorithm
-3 = Out of range Sensor Type, Units, or State
-2 = Duplicate Point Name
-1 = Missing Point Name
0 = Not in System
1 = In System

Service Configuration Tables

The section which follows provides the following information for each of the Universal Controller's Service Configuration Tables. The following information is provided:

- Purpose
- List of service configuration decisions
- Description of each service configuration decision including allowable entries and default values

For easy reference, the Service Configuration Tables are presented alphabetically in this manual, as follows:

- Global Occupancy Time Schedule and Override
- Hardware Input Point Service Configuration
- Hardware Output Point Service Configuration
- Network Input Point Service Configuration
- Software Output Point Service Configuration
- Software Input Point Service Configuration

Global Occupancy (Time Schedule) and Override

The Universal Controller contains a single Global Occupancy and Override service configuration table, GBLOCC_S.

A Global Time Schedule with the name OCCPC65S or greater will broadcast occupancy mode information over the CCN to any system element with a corresponding Network Time Schedule, OCCPC65E or greater. For example, a Universal Controller with a Time Schedule named OCCPC68S will broadcast its occupancy mode over the CCN to system elements with a Network Time Schedule named OCCPC68E.

To set up the Controller to broadcast the occupancy mode of one of its Time Schedules to other system elements on the CCN, one of the Controller's Time Schedules (OCCPC*nn*S) must be renamed so that *nn* is a number greater than or equal to 65, and Broadcast is set to *Yes* in the Global Occupancy and Override configuration table.

To set up the Controller so that the occupancy mode of one of its Time Schedules will be controlled by a Global Time Schedule in another system element on the CCN, the Controller's Network Time Schedule OCCPC*nn*E, must be renamed so that *nn* is a number greater than or equal to 65 in the Schedule Number decision, and the associated Time Schedule (OCCPC*nn*S), must be disabled by setting its Broadcast decision to *No*, in the Global Occupancy and Override configuration table.

Note: Valid Schedule Number entry is limited to each schedule's instance number (1-8) or a unique global number (65-99). Invalid or duplicate entry causes the schedule to revert to its instance number which will also be reflected in the Service Table when uploaded.

Two service configuration decisions provide for Global Occupancy:

Broadcast	No/Yes
Schedule Number	1-8 and 65-99

The combination of these decisions provides the following functionality.

Broadcast	Schedule Number	Table Names (Sample)	Controller Action
No	1-8	OCCPC01S, OCCPC01E	Use local schedule. No broadcast of occupancy mode.
Yes	65-99	OCCPC65S, OCCPC65E	Use local schedule. Broadcast occupancy mode as OCCPC65E. Receive override command.
Yes	1-8	OCCPC01S, OCCPC01E	Invalid combination. Default to local occupancy. No broadcast of occupancy mode.
No	65-99	OCCPC65S, OCCPC65E	Use global occupancy - network time schedule OCCPC65E. Disable local Supervisory POC OCCPC65S. No broadcast of occupancy. Transmit override command.

Global Time Schedule Manual Override:

An occupied time period may be commanded by setting the Manual Override Hours decision to a value from *1* to *4* hours in the Global Time Schedule, as described in this manual's Schedules chapter under Occupancy (Time Schedule) Tables.

The Global Time Schedule Override mode can be cancelled by setting the Manual Override Hours decision to zero (0) in the Global Time Schedule, regardless of the source. The schedule will become unoccupied immediately.

Local Push Button Override feature:

An occupied time period can be commanded by:

- pressing and holding the override button on a T-56 Space Temperature Sensor with Override for 1 to 10 seconds when unoccupied.

- closing a Latched Discrete Input Point when unoccupied.

This action will command a timed override when unoccupied. The value of the Override Duration decision will indicate the number of minutes the override will be in effect. If the mode is occupied when a timed override is commanded, the button push shall be ignored.

For the Push Button Override feature to be enabled, the Override Sensor must be configured with a valid name of a Latched Discrete Input Point or a T-56 Space Temperature Sensor or a Sensor Group of T-56 Space Temperature Sensors, and the associated Override Duration must be greater than zero.

Configuration of the Override Sensor and its associated Override Duration for each Occupancy table will be provided through the Global Occupancy and Override table.

When a timed override extends into a scheduled occupied period, the scheduled occupied period will pick up directly from the timed override with no return to unoccupied status.

Global Time Schedule Push Button Override:

In the event where the Controller is broadcasting a Global Time Schedule on the CCN the Controller will have the ability to receive an override command from other system elements that are following the same global schedule and to apply its own Override Duration to the schedule when unoccupied.

In the event where the Controller is following a Global Time Schedule and a local push button override is commanded for that schedule the Controller will have the ability to transmit the override command to the system element that is broadcasting the global schedule when unoccupied.

For the Push Button Override feature to be enabled, the Override Sensor must be configured with a valid name of a Latched Discrete Input Point or a T-56 Space Temperature Sensor or a Sensor Group of T-56 Space Temperature Sensors.

The Global Time Schedule Push Button Override function can be disabled in the Global Time Schedule by setting the Override Duration to zero (0), its default value.

List of Service Configuration Decisions

The Global Occupancy and Override service configuration decisions related to each of the eight (8) Occupancy Supervisory tables are as follows:

Time Schedule 1-8
- Schedule Number
- Broadcast
- Override Sensor
- Override Duration

Service Configuration Decisions

Time Schedule 1-8

Schedule Number

Use this decision to specify the number that the Occupancy Supervisory and/or Equipment table(s) will be renamed in order to render them local or global. Valid Schedule Number entry is limited to each schedule's instance number (1-8) or a unique global number (65-99). Invalid or duplicate entry will cause the schedule to revert to its instance number.

Allowable Entries	01 to 99 where: 01-08 indicate a local schedule - must be table instance number 65-99 indicate a global schedule - must not duplicate an existing table 09-64 are always invalid
Default Value	default Occupancy Supervisory table number from 01 to 08

Broadcast
Use this decision to specify whether to use the local time schedule configuration as the source of the occupancy mode, or whether to use the global time schedule that another system element is broadcasting.

Allowable Entries	No/Yes
Default Value	No

Override Sensor
Use this decision to specify either the Latched Discrete Input Point (momentary input) or the T-56 Space Temperature Sensor (with the timed override button) or T-56 Sensor Group that will indicate when a push button timed override is requested. Duplicate point names will not be accepted.

Allowable Entries	Valid point name
Default Value	POINT0

Override Duration
Use this decision to indicate the number of minutes that will be added to the Time Schedule if a push button override is initiated.

Allowable Entries	0 to 240
Default Value	0

Hardware Input Point Service Configuration

The Universal Controller's Hardware Input Point (HW_IN*xx*S) service configuration decisions are as follows:

List of Service Configuration Decisions

Hardware In Point 1 to 8
- In System
- Input Type
- Sens Type/Units/State
- Point Name
- Point Description

Service Configuration Decisions

Hardware In Point 1 to 8

In System
Setting this decision to *Yes* allows you to create the point, causing it to be inserted into the hardware point display table. Setting this decision to *No* causes the point to be removed from the hardware point display table.

Allowable Entries	No/Yes
Default Value	No

Input Type
Use this decision to specify the input point type to be assigned. See the table below.

Allowable Entries	0 to 6
Default Value	0

Index	Decision Input Type	Defaults Sensor Type/Units/State
0	Temperature (default)	10K Type II (CP/MCI)
1	Milliamp	ma
2	Voltage	Volts
3	Setpoint Offset	%
4	Sensed discrete	Off/On
5	Pulsed discrete	kW
6	Latched discrete	Close/Open

Sens Type/Units/State

Use this decision to specify the temperature sensor type, analog engineering units, or the discrete state text to be assigned to the point.

Allowable Entries	0 = Units to be supplied based on the default for the Input Type decision as specified above Sensor Type = 1 to 3 Analog Units = 1 to 56 (standard); 57 to 72 (custom) Discrete Units = 1 to 37 (standard); 38 to 53 (custom)

Note: Refer to Appendix B for a list of temperature Sensor Types, Analog Units and Discrete Units, along with limits.

Default Value	0

Point Name

Use this decision to specify the point name to be used in the hardware point display table, for forcing, and for algorithm and alarm configuration. It will be limited to six characters in order to append a "_C" and "_M" to provide custom configuration and maintenance tables for each point.

Allowable Entries	Up to 6 characters - upper case letters; numbers, - or _
Default Value	HW_IN*n* where *n* is from 1 to 8

Point Description

Use this decision to specify the point description to be used in the hardware point display table.

Allowable Entries	Up to 24 characters
Default Value	Hardware In Point *n* where *n* is from 1 to 8

Hardware Output Point Service Configuration

The Universal Controller's Hardware Output Point (HW_OUT*xx*S) service configuration decisions are as follows:

List of Service Configuration Decisions

Hardware Out Point 1 to 8
- In System
- Output Type
- Units/State
- Point Name
- Point Description
- Function/Algorithm
- Algorithm Units

Service Configuration Decisions

Hardware Out Point 1 to 8

In System

Setting this decision to *Yes* allows you to create the point, causing it to be inserted into the hardware point display table. Setting this decision to *No* causes the point to be removed from the hardware point display table.

Allowable Entries	0 = No 1 = Yes
Default Value	0

Output Type

Use this decision to specify the point type to be assigned.

Allowable Entries	0 = Milliamp (analog) 1 = Voltage (analog) 2 = Discrete (discrete)
Default Value	0

Units/State

Use this decision to specify the analog engineering units or the discrete state text to be assigned to the point. In the algorithms where a submaster loop is implemented, this decision also determines the submaster loop units.

In certain exceptions, as noted in the table which appears in the Function/Algorithm decision explanation below, the control units are fixed, or predetermined for the algorithm.

Allowable Entries	0 = Units to be supplied based on the default for the Output Type and Function/Algorithm decisions. Analog Units = 1 to 56 (standard); 57 to 72 (custom) Discrete Units = 1 to 37 (standard); 38 to 53 (custom)

Note: Refer to Appendix B for a list of analog and discrete units along with limits.

Default Value	0

Point Name

Use this decision to specify the point name to be used in the hardware point display table, for forcing, and for algorithm and alarm configuration. It will be limited to six characters in order to append a "_C" and "_M" to provide custom configuration and maintenance tables for each point.

Allowable Entries	Up to 6 characters - upper case letters; numbers, - or _
Default Value	HW_OUT*n* where *n* is from 1 to 8

Point Description

Use this decision to specify the point description to be used in the hardware point display table.

Allowable Entries	Up to 24 characters
Default Value	Hardware Out Point n where *n* is from 1 to 8

Function/Algorithm

Use this decision to specify which algorithm is to be applied to the point. Each algorithm has a default Units/State for its output and default algorithm units for its input, as noted in the table which follows. Algorithms are assigned by analog and discrete output point types as shown in the table which follows.

Allowable Entries	0 to 11
Default Value	0

Index		Decision Function/Algorithm	Defaults Units/State Point	Algorithm
0	=	Slave Point (default AO)	%	na
1	=	AO Cooling CV	%	°F fixed
2	=	AO Adaptive Dual Loop PID	%	°F
3	=	AO Heating CV	%	°F fixed
4	=	AO Mixed Air CV w/IAQ	%	°F fixed
5	=	AO Adaptive Single Loop PID	%	°F
0	=	Slave Point (default DO)	Stop/Start	na
1	=	DO Analog	Stop/Start	°F
2	=	DO Electric Heat CV	Stop/Start	°F fixed (% as output)
3	=	DO Enthalpy	Stop/Start	BTU/lb fixed
4	=	DO Fan Control	Stop/Start	°F fixed
5	=	DO Interlock	Stop/Start	na
6	=	DO Lead Lag Control	Stop/Start	°F
7	=	DO Lighting Control	Stop/Start	na
8	=	DO Staging Control	Stop/Start	°F fixed (% as output)
9	=	DO/FP Cooling CV	Off/On	°F fixed
10	=	DO/FP Heating CV	Off/On	°F fixed
11	=	DO/FP Mixed Air CV w/IAQ	Off/On	°F fixed

Algorithm Units

Use this decision to specify the engineering units of the controlling sensor(s) used by the algorithm.

Note: In certain exceptions, as noted in the table above, the algorithm units are fixed, or predetermined for the algorithm. Therefore, this value will be ignored.

Allowable Entries

0 = Units to be supplied based on the default for the Output Type and Function/Algorithm decisions.
Analog Units = 1 to 56 (standard); 57 to 72 (custom)
Discrete Units = 1 to 37 (standard); 38 to 53 (custom)

Note: Refer to Appendix B for a list of analog and discrete units along with limits.

Default Value 0

Network Input Point Service Configuration

The Universal Controller's Network Input Point (NETIN*xx*S) service configuration decisions are as follows:

List of Service Configuration Decisions

In System
Display Units
Point Name
Point Description

Service Configuration Decisions

In System
Setting this decision to *Yes* allows you to create the point, causing it to be inserted into the software point display table. Setting this decision to *No* causes the point to be removed from the software point display table.

Allowable Entries	No/Yes
Default Value	0

Display Units
Use this decision to specify the analog engineering units to be assigned to the point.

Point Type	Index	Defaults
Network Input	1	°F

Allowable Entries
0 = Units to be supplied based on the default for the Network Input point as defined above.
Analog Units = 1 to 56 (standard);
57 to 72 (custom)

Note: Refer to Appendix B for a list of analog and discrete units along with limits.

Default Value 0

Point Name
Use this decision to specify the point name to be used in the software point display table, for forcing, and for algorithm and alarm configuration. It will be limited to six characters in order to append “_C” and “_M” to provide custom configuration and maintenance tables for each point.

Allowable Entries	Up to 6 characters - upper case letters; numbers, - or _
Default Value	NETIN*n* where *n* is from 1 to 4

Point Description
Use this decision to specify the point description to be used in the software point display table.

Allowable Entries	Up to 24 characters
Default Value	Network In Point *n* where *n* is from 1 to 4

Software Input Point Service Configuration

The Universal Controller's Software Input Point (SW_IN*xx*S) service configuration decisions are as follows:

List of Service Configuration Decisions

Software In Point 1 to 4
In System
Point Type
Display Units/State
Point Name
Point Description

Service Configuration Decisions

Software In Point 1 to 4

In System

Setting this decision to *Yes* allows you to create the point, causing it to be inserted into the software point display table. Setting this decision to *No* causes the point to be removed from the software point display table.

Allowable Entries	No/Yes
Default Value	No

Point Type

Use this decision to specify the point type to be assigned.

Allowable Entries	Discrete/Analog
Default Value	Discrete

Decision Input Type	Defaults Sensor Type/Units/State
Discrete	Off/On
Analog	°F

Display Units/State
Use this decision to specify the analog engineering units or the discrete state text to be assigned to the point.

Allowable Entries	0 = Units to be supplied based on the default for the Point Type decision as specified above Analog Units = 1 to 56 (standard); 57 to 72 (custom) Discrete Units = 1 to 37 (standard); 38 to 53 (custom)

Note: Refer to Appendix B for a list of Analog Units and Discrete Units, along with limits.

Default Value	0

Point Name
Use this decision to specify the point name to be used in the software point display table, for forcing, and for algorithm and alarm configuration. It is limited to six characters in order to append a "_C" and "_M" to provide custom configuration and maintenance tables for each point.

Allowable Entries	Up to 6 characters - upper case letters; numbers, - or _
Default Value	SW_IN*n* where *n* is from 1 to 4

Point Description
Use this decision to specify the point description to be used in the software point display table.

Allowable Entries	Up to 24 characters
Default Value	Software In Point *n* where *n* is from 1 to 4

Software Output Point Service Configuration

The Universal Controller's Software Output Point (SW_OUT*xx*S) service configuration decisions are as follows:

List of Service Configuration Decisions

Software Output Point 1 to 4
- In System
- Point Type
- Display Units/State
- Point Name
- Point Description
- Function/Algorithm
- Algorithm Units

Service Configuration Decisions

Software Output Point 1 to 4

In System

Setting this decision to *Yes* allows you to create the point, causing it to be inserted into the software point display table. Setting this decision to *No* causes the point to be removed from the software point display table.

Allowable Entries	No/Yes
Default Value	No

Point Type

Use this decision to specify the output point type to be assigned.

Allowable Entries	Discrete/Analog
Default Value	Discrete

Display Units/State

Use this decision to specify either the analog engineering units or the discrete state text to be assigned to the point.

In certain exceptions, as noted in the table which appears in the Function/Algorithm decision below, the control units are fixed, or predetermined for the algorithm.

In algorithms where a PID loop is implemented, this decision also determines the submaster loop units.

Allowable Entries	0 = Units to be supplied based on the default for the Point Type and Function/ Algorithm decisions Analog Units = 1 to 56 (standard); 57 to 72 (custom) Discrete Units = 1 to 37 (standard); 38 to 53 (custom)

Note: Refer to Appendix B for a list of analog and discrete units along with limits.

Default Value	0

Point Name

Use this decision to specify the point name to be used in the software point display table, for forcing, and for algorithm and alarm configuration. It will be limited to six characters in order to append "_C" and "_M" to provide custom configuration and maintenance tables for each point.

Allowable Entries	Up to 6 characters - upper case letters; numbers, - or _
Default Value	SW_OUT*n* where *n* is from 1 to 4

Point Description

Use this decision to specify the point description to be used in the software point display table.

Allowable Entries	Up to 24 characters
Default Value	Software Out Point *n* where *n* is from 1 to 4

Function/Algorithm

Use this decision to specify which algorithm is to be applied to the point. Each algorithm has a default Units/State for its output and default algorithm units for its input, as noted in the table which follows. Algorithms are assigned by analog and discrete output point types as shown in the table which follows.

Allowable Entries	0 to 11
Default Value	0

		Decision Function/Algorithm	Index	Defaults Units/State	Index	Algorithm
0	=	Slave Point (default AO)	2	%		na
1	=	AO Cooling CV	2	%		°F fixed
2	=	AO Adaptive Dual Loop PID	2	%	1	°F
3	=	AO Heating CV	2	%		°F fixed
4	=	AO Mixed Air CV w/IAQ	2	%		°F fixed
5	=	AO Adaptive Single Loop PID	2	%	1	°F
0	=	Slave Point (default DO)	3	Stop/Start		na
1	=	DO Analog	3	Stop/Start	1	°F
2	=	DO Electric Heat CV	3	Stop/Start		°F fixed (% as output)
3	=	DO Enthalpy	3	Stop/Start		BTU/lb fixed
4	=	DO Timeclock with Opt. Check	3	Stop/Start		°F fixed
5	=	DO Interlock	3	Stop/Start		na
6	=	DO Lead Lag Control	3	Stop/Start	1	°F
7	=	DO Lighting Control	3	Stop/Start		na
8	=	DO Staging Control	3	Stop/Start		°F, %RH fixed % as output
9	=	DO/FP Cooling CV	9	Open/Close		°F fixed
10	=	DO/FP Heating CV	9	Open/Close		°F fixed
11	=	DO/FP Mixed Air CV w/IAQ	9	Open/Close		°F fixed

Algorithm Units

Use this decision to specify the engineering units of the controlling sensor(s) used by the algorithm.

Note: In certain exceptions, as noted in the table above, the algorithm units are fixed, or predetermined for the algorithm. Therefore, this value will be ignored.

In algorithms where a PID loop is implemented, this decision also determines the master loop units with the exception of AO Adaptive Control Single Loop PID where the master loop units are derived from the AO Point units.

Allowable Entries	0 = Units to be supplied based on the default for the Output Type and Function/Algorithm decisions. Analog Units = 1 to 56 (standard); 57 to 72 (custom)

Note: Refer to Appendix B for a list of engineering units and limits.

Default Value	0

Point
Types

Point Types

Overview

This section provides the following information for each point type:

- Purpose
- Typical application
- List of configuration decisions
- Description of each configuration decision that includes allowable entries and default values
- List of maintenance decisions
- Description of each maintenance decision

Point Types

The Universal Controller supports 8 hardware input points, 8 hardware output points, 4 software input points, 4 software output points, and 4 network input points.

The Universal Controller's hardware and software points are universal in that each point can be configured to be one of several analog or discrete point types, through a Service Configuration table provided for each point type. Once configured, the hardware input point sensors are read every second and evaluated by the alarm algorithm, with appropriate updates made to the point status and to the appropriate status display table.

For easy reference, all point types are presented in this section of the manual in alphabetical order:

Analog Input Software
Analog Output Software
Discrete Input Software
Discrete Output Hardware
Discrete Output Software
Latched Discrete Input Hardware
Milliamp Input Hardware
Milliamp Output Hardware
Network Input
Pulsed Discrete Input Hardware
Sensed Discrete Input Hardware
Setpoint Offset Input Hardware
Temperature Input Hardware
Voltage Input Hardware
Voltage Output Hardware

Analog Input Software

An Analog Input Software point provides the capability to display analog values based on the selected engineering units. Refer to Appendix B for a list of engineering units.

Analog Input Software points are displayed in the software point display table. Analog Input Software points support the CCN force, auto, and timed auto functionality. Any Software Input point can be configured as an Analog Input by specifying that point type in the point’s Service data. Software Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Once configured, each Software Input point value is evaluated by the assigned alarm algorithm every second, with appropriate updates made to the point status and to the appropriate status display table as necessary.

Typical Applications

- An Analog Input Software point can be used as input to standard algorithms.
- An Analog Input Software point can also serve as the destination of a Broadcast or Data Transfer point.

List of Configuration Decisions

The Analog Input Software point itself has no configuration decisions.

Alarm Configuration Decisions: Analog Input Software point configuration does, however, include decisions for both Limit and Setpoint Limit alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

System Value
Force
Status

Alarm Maintenance Decisions: Analog Input Software points also include alarm maintenance data, as described in this manual's Alarms chapter.

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 =	No force in effect
	1 =	Fire Force
	2 =	Safety Force
	3 =	Service Force
	4 =	Building Supervisor Force
	5 =	Monitor/Remote Force
	6 =	Min Off Time Force
	7 =	Controlling POC Force
	8 =	BEST Force
	9 =	Temp Override Force
	10 =	Loadshed Force

Status

This decision does not apply to this point type.

Valid Display	0 = Unused

Analog Output Software

An Analog Output Software point provides the capability to display analog values based on the selected engineering units. Refer to Appendix B for a list of engineering units.

Analog Output Software points are displayed in the software point display table. Analog Output Software points support the CCN force, auto, and timed auto functionality. Any Software Output point can be configured as an Analog Output by specifying that point type in the point's Service data. Software Output Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

An Analog Output Software point can be used to make the output of any analog type algorithm the input to another algorithm.

List of Configuration Decisions

The Analog Output Software point itself has no configuration decisions.

Algorithm Configuration: Analog Output Software point configuration does include decisions for the assigned algorithm configuration. If the assigned algorithm is Slave Point, which has no configuration decisions, then the point does not have a configuration table. Refer to this manual's Algorithms chapter for a list and description of algorithm configuration and maintenance decisions.

List of Maintenance Decisions

System Value
Force
Status

Algorithm Maintenance Decisions: Analog Output Software points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0	=	No force in effect
	1	=	Fire Force
	2	=	Safety Force
	3	=	Service Force
	4	=	Building Supervisor Force
	5	=	Monitor/Remote Force
	6	=	Min Off Time Force
	7	=	Controlling POC Force
	8	=	BEST Force
	9	=	Temp Override Force
	10	=	Loadshed Force

Status

This decision does not apply to this point.

Valid Display 0 = Unused

Discrete Input Software

A Discrete Input Software point provides the capability to display discrete values based on the selected discrete state text. For a list of discrete state text, refer to Appendix B.

Discrete Input Software points are displayed in the software point display table. Discrete Input Software points support the CCN force, auto, and timed auto functionality. Any Software Input point can be configured as a Discrete Input by specifying that point type in the point's Service data. Software Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Applications

- A Discrete Input Software point can be used as input to standard algorithms.
- A Discrete Input Software point can serve as the destination of a Broadcast or Data Transfer point.

List of Configuration Decisions

The Discrete Input Software point itself has no configuration decisions.

Alarm Configuration Decisions: Discrete Input Software point configuration does include decisions for both Discrete Comparison and Change Of State alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status

Alarm Maintenance Decisions: Discrete Input Software points also include alarm maintenance data, as described in this manual's Alarms chapter.

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters.

This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display Actual discrete text

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display

0 = No force in effect
1 = Fire Force
2 = Safety Force
3 = Service Force
4 = Building Supervisor Force
5 = Monitor/Remote Force
6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status

This decision does not apply to this point type.

Valid Display 0 = Unused

Discrete Output Hardware

A Discrete Output is a hardware point that converts a desired state (on or off) to a configurable discrete output signal that is used to drive a relay. Two output signal types can be configured: normal or inverted. For a list of discrete state text, refer to Appendix B.

Upon power-up the default output state will be off, but the minimum off timer will not be started. If the desired state is determined by the algorithm to be off then the output will remain off and the delay timer will be stopped.

If the desired state transitions from off to on, the algorithm checks to see whether the delay timer and minimum off timer have expired.

- If the timers have expired, the algorithm turns on the output and starts the minimum on timer.

- If the timers have not expired, the Universal Controller waits until the timers do expire, and then turns the output on, and starts the minimum on timer.

If the desired state transitions from on to off, the algorithm checks to see whether the minimum on timer has expired.

- If the minimum on timer has expired, the algorithm turns the output off and starts the minimum off timer.

- If the minimum on timer has not expired, the algorithm waits until the timer does expire, and then turns the output off, and starts the minimum off timer.

The output signal type configuration decision is applied as follows:

- If the output signal type is configured as normal then the output state is applied directly to the hardware output signal.

- If the output signal type is configured as inverted then the output state is inverted before being applied to the hardware output signal.

Floating Point

Floating Point output consists of a pair of discrete output points that are combined within a Floating Point algorithm to control a pair of output signals, the first to open the controlled device and the second to close the controlled device.

- The first Discrete Output (open) is assigned the Floating Point algorithm.

- The second Discrete Output (close) is assigned the Slave Point algorithm, and is linked to the first through a configuration decision within the Floating Point algorithm.

Standard Discrete Output configuration and maintenance applies to both the first and second Discrete Output points. Standard Discrete Output functionality as described in this section applies to both the first and second Discrete Output points. The first Discrete Output point configuration also includes decisions for the selected Floating Point algorithm configuration. The first Discrete Output point maintenance also includes decisions for the selected Floating Point algorithm maintenance.

Discrete Output points are displayed in the hardware point display table. Discrete Output points support the CCN force, auto, and timed auto functionality. Any hardware output point can be configured as a Discrete Output by specifying that point type in the point's Service data. Hardware Output Point Service configuration decisions are listed in this manual's Service Configuration chapter.

- Standard force precedence logic is enforced before a force is applied.

- The force is applied without further qualification if the force precedence is within the range of Fire through Monitor/Remote (1 through 5), inclusive. In this case the minimum off/on timer will be stopped.

- Forces with a precedence of Min Off Time or lower (6 or greater) are subject to the minimum off/on timer.

    - If the force will cause the output to transition from off to on and the minimum off timer has expired, the force will be applied and an acknowledgement (ACK) will be returned and the minimum on timer will be started.

- If the force will cause the output to transition from off to on and the minimum off timer has not expired, a NACK (not acknowledged) will be returned with a status of Insufficient Priority.

- If the force will cause the output to remain on, then the force will be applied and an acknowledgement (ACK) will be returned, but the minimum on timer will remain in its current state.

- If the force will cause the output to transition from on to off and the minimum on timer has expired, the force will be applied and an acknowledgement (ACK) will be returned and the minimum off timer will be started.

- If the force will cause the output to transition from on to off and the minimum on timer has not expired, an acknowledgement (ACK) will be returned with a status of Insufficient Priority.

- If the force will cause the output to remain off, then the force will be applied and an acknowledgement will be returned but the minimum off timer shall remain in its current state.

- Forces will not be subject to the delay timer. However, if the delay timer is active when a force is applied then the delay timer will be stopped, regardless of the forced output state. This will apply to forces received over CCN and to retained forces applied after a power-up.

- The auto command will remove the force from the point, which will remain in the current state until an algorithm determines a new desired state or until a new force state is applied.

List of Configuration Decisions

Logic Type
Minimum Off Time
Minimum On Time
Delay Time

Algorithm Configuration Decisions: Discrete Output Hardware point configuration includes decisions for the assigned algorithm configuration. Algorithm configuration is described in this manual's Algorithms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Control Value
Hardware Value
Channel Number

Algorithm Maintenance Decisions: Discrete Output Hardware points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

Configuration Decisions

Logic Type
Use this decision to indicate the conversion logic you desire.

Normal	=	Standard Logic When the algorithm determines that the output should be *0* (off), the DO point will be turned off. When the algorithm determines that the output should be *1* (on), the DO point will be turned on.
Invert	=	Reverse Logic When the algorithm determines that the output should be *0* (off), the DO point will be turned on. When the algorithm determines that the output should be *1* (on), the DO point will be turned off.

Allowable Entries	Normal/Invert
Default Value	Normal

Minimum Off Time
Use this decision to indicate the number of seconds the output must remain off.

Allowable Entries	1 to 3600 seconds
Default Value	0

Minimum On Time

Use this decision to indicate the number of seconds the output must remain on.

Allowable Entries	1 to 3600 seconds
Default Value	0

Delay Time

Use this decision to indicate the number of seconds that must elapse before the output is turned on by an algorithm, including after power-up. This Delay Time does not apply to forcing of any precedence.

Note: This value should be coordinated with the associated algorithm's Power on Delay decision. The Delay Times are additive.

Allowable Entries	1 to 3600 seconds
Default Value	0

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	Actual discrete text

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force

5 = Monitor/Remote Force
6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status

For output points, this decision is unused.

Valid Display	0 = Valid output signal

Control Value

The value in this decision displays the converted value of the output signal into the configured engineering units or discrete text, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	Actual discrete text

Hardware Value

This decision displays the actual output signal in unconverted units or discrete text. This value is the measurable result of the output signal.

Valid Display	0 to 1 fixed as Open/Close

Channel Number

The value in this decision indicates the configured hardware point number for this point.

Valid Display	9 to 16

Discrete Output Software

A Discrete Output Software point provides the capability to display discrete values based on the selected discrete state text. For a list of discrete state text, refer to Appendix B.

Discrete Output Software points are displayed in the software point display table. Discrete Output Software points support the CCN force, auto, and timed auto functionality. Any Software Output point can be configured as a Discrete Output by specifying that point type in the point's Service data. Software Output Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

A Discrete Output Software point can be used to make the output of any discrete type algorithm the input to another algorithm.

List of Configuration Decisions

The Discrete Output Software point itself has no configuration decisions.

Algorithm Configuration: Discrete Output Software point configuration does, however, include decisions for the assigned algorithm configuration. If the assigned algorithm is Slave Point, which has no configuration decisions, then the point will not have a configuration table. Refer to this manual's Algorithms chapter for a list and description of algorithm configuration and maintenance decisions.

List of Maintenance Decisions

System Value
Force
Status

Maintenance Decisions

Algorithm Maintenance Decisions: Discrete Output Software points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces.

Valid Display	Actual discrete text

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0	=	No force in effect
	1	=	Fire Force
	2	=	Safety Force
	3	=	Service Force
	4	=	Building Supervisor Force
	5	=	Monitor/Remote Force
	6	=	Min Off Time Force
	7	=	Controlling POC Force
	8	=	BEST Force
	9	=	Temp Override Force
	10	=	Loadshed Force

Status

This decision does not apply to this point.

Valid Display 0 = Unused

Latched Discrete Input Hardware

A Latched Discrete Input is a hardware point that detects a momentary input from a dry-contact, converts the input to a logic state based on the selected discrete state text, and saves it until it is read by the algorithm that is monitoring the point. For a list of discrete state text, refer to Appendix B.

Latched Discrete Input points are displayed in the hardware point display table. Latched Discrete Input points support the CCN force, auto, and timed auto functionality. Any hardware input point can be configured as a Latched Discrete Input by specifying that point type in the point's Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

You can use this point to capture momentary contact closures such as the closing of a door.

The Latched Discrete Input point itself has no configuration decisions.

List of Configuration Decisions

Alarm Configuration Decisions: Latched Discrete Input Hardware point configuration does, however include decisions for both Discrete Comparison and Change of State alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Alarm Maintenance Decisions: Latched Discrete Input Hardware points also include alarm maintenance data, as described in this manual's Alarms chapter.

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on sensor type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	Actual discrete text

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision displays the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 = Valid sensor reading
	1 = Reading out of range for this type of sensor

Sensor Value

The value in this decision displays the converted value of the physical sensor into discrete text, disregarding any applied forces.

Valid Display	Actual discrete text

Hardware Value

The value in this decision represents the actual sensor reading in discrete text. This value is the measurable result of the physical sensor.

Valid Display	Not provided

Channel Number

The value in this decision represents the configured hardware point number for this point.

Valid Display	1 to 8

Milliamp Input Hardware

A Milliamp Input is a hardware point that converts an input signal with a maximum range of 0-22 mA to a configurable range of engineering units. Refer to Appendix B for a list of engineering units and their conversion limits.

The equation for the input conversion is:
[(Input-Low Input Endpoint) * (High Conversion Endpoint-Low Conversion Endpoint) / (High Input Endpoint - Low Input Endpoint)] + Low Conversion Endpoint

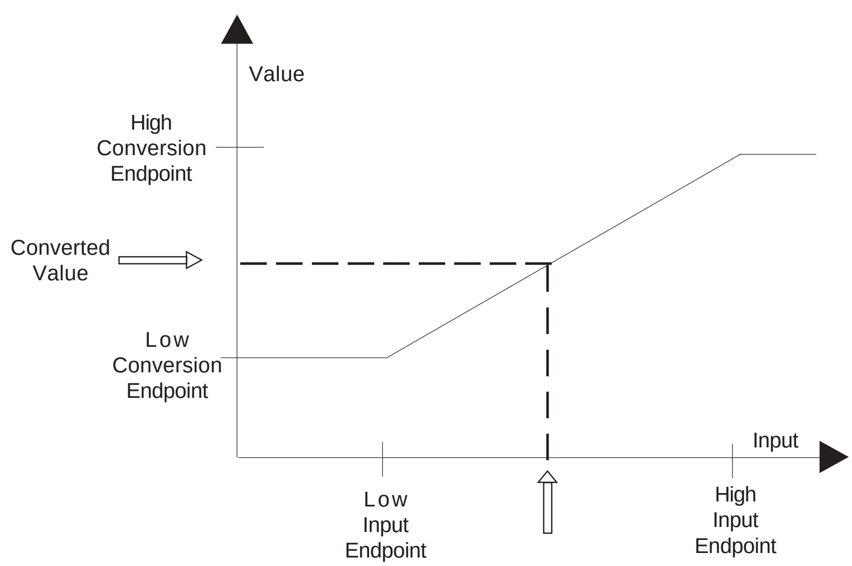
The conversion is a linear interpolation of the input between the Low and High Input Endpoint to the Low and High Conversion Endpoint.

Milliamp Input points are displayed in the hardware point display table. Milliamp Input points support the CCN force, auto, and timed auto functionality. Any hardware input point can be configured as a Milliamp Input by specifying that point type in the point's Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

This point can provide input to standard algorithms or alarms.

Figure 4-1
Linear Interpolation of Milliamp Input



List of Configuration Decisions

Low Input Endpoint
High Input Endpoint
Low Conversion Endpoint
High Conversion Endpoint
Low Input Fault
High Input Fault
Offset
Externally Powered

Alarm Configuration Decisions: Milliamp Input Hardware point configuration includes decisions for both Limit and Setpoint Limit alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Alarm Maintenance Decisions: Milliamp Input Hardware points also include alarm maintenance data, as described in this manual's Alarms chapter.

Configuration Decisions

Low Input Endpoint
Use this decision to indicate the minimum input signal that will be converted.

Allowable Entries	0.0 to 22.0 mA
Default Value	4.0

High Input Endpoint
Use this decision to indicate the maximum input signal that will be converted.

Allowable Entries	0.0 to 22.0 mA
Default Value	20.0

Low Conversion Endpoint
Use this decision to indicate the conversion value when the input signal is less than or equal to the Low Input Endpoint.

Allowable Entries	-9999.9 to 9999.9 units range based upon selected display units
Default Value	0.0

High Conversion Endpoint
Use this decision to indicate the conversion value when the input signal is greater than or equal to the High Input Endpoint.

Allowable Entries	-9999.9 to 9999.9 units range based upon selected display units
Default Value	0.0

Low Input Fault
Use this decision to specify the lower limit that indicates that the input sensor is out of range.

Allowable Entries	0.0 to 22.0 mA
Default Value	4.0

High Input Fault
Use this decision to specify the upper limit that indicates that the input sensor is out of range.

Allowable Entries	0.0 to 22.0 mA
Default Value	20.0

Offset
Use this decision to indicate the value that is added to or subtracted from the converted value in order to compensate for sensor inaccuracy. These limits apply to all units.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Externally Powered
Setting this decision to *Yes* indicates whether the sensor connected to this point is externally powered.

Allowable Entries	No/Yes
Default Value	No

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters including the configuration offset. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 = Valid sensor reading
	1 = Reading out of range for this type of sensor

Sensor Value

The value in this decision represents the converted value of the physical sensor into the configured engineering units, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Hardware Value
The value in this decision represents the actual sensor reading in unconverted units. This value is the measurable result of the physical sensor, disregarding any offset.

Valid Display 0.0 to 22.0 mA

Channel Number
The value in this decision indicates the configured hardware point number for this point.

Valid Display 1 to 8

Milliamp Output Hardware

A Milliamp Output is a hardware point that converts an output signal with a maximum range of 0-20 mA to a configurable range of engineering units. Refer to Appendix B for a list of engineering units and their input limits.

The equation for the output conversion is:
[(Output-Low Conversion Endpoint) * (High Output Endpoint-Low Output Endpoint) / (High Conversion Endpoint - Low Conversion Endpoint)] + Low Output Endpoint

The conversion is a linear interpolation of the output between the Low and High Output Endpoint to the Low and High Conversion Endpoint.

Milliamp Output points are displayed in the hardware point display table. Milliamp Output points will support the CCN force, auto, and timed auto functionality. Standard force precedence will be applied. The point's system value will be set to the force value by the force function. The point's system value will be set to its latest control value by the auto function. Any hardware output point can be configured as a Milliamp Output by specifying that point type in the point's Service data. Hardware Output Point Service configuration decisions are listed in this manual's Service Configuration chapter.

List of Configuration Decisions

Low Output Endpoint
High Output Endpoint
Low Conversion Endpoint
High Conversion Endpoint

Algorithm Configuration: Milliamp Output Hardware point configuration includes decisions for the assigned algorithm configuration. Refer to this manual's Algorithms chapter for a list and description of algorithm configuration and maintenance decisions.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Control Value
Hardware Value
Channel Number

Algorithm Maintenance Decisions: Milliamp Output Hardware points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

Configuration Decisions

Low Output Endpoint
Use this decision to indicate the lowest value the output signal can be as a result of converting the control value.

Allowable Entries	0.0 to 22.0 mA
Default Value	4.0

High Output Endpoint
Use this decision to indicate the highest value the output signal can be as a result of converting the control value.

Allowable Entries	0.0 to 22.0 mA
Default Value	20.0

Low Conversion Endpoint
Use this decision to indicate the minimum control value. When the control value is less than or equal to the Low Conversion Endpoint, the output signal will equal the Low Output Endpoint.

Allowable Entries	-9999.9 to 9999.9 units range based upon selected display units
Default Value	0.0

High Conversion Endpoint
Use this decision to indicate the maximum control value. When the control value is greater than or equal to the High Conversion Endpoint, the output signal will equal the High Output Endpoint.

Allowable Entries	-9999.9 to 9999.9 units range based upon selected display units
Default Value	0.0

Maintenance Decisions

System Value
The value in this decision represents the actual value used by algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 units range based upon selected display units

Force
The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display

0 = No force in effect
1 = Fire Force
2 = Safety Force
3 = Service Force
4 = Building Supervisor Force
5 = Monitor/Remote Force
6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status
This decision does not apply to this point.

Valid Display	0 = Unused

Control Value
The value in this decision represents the converted value of the output signal into the configured engineering units, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 units range based upon selected display units

Hardware Value
The value in this decision represents the actual output signal in unconverted units. This value is the result of the output signal.

Valid Display 0.0 to 22.0 mA

Channel Number
The value in this decision indicates the configured hardware point number for this point.

Valid Display 9 to 16

Network Input Point

A total of four (4) Network Input Points are provided.

Network Input points provide the capability to display analog values based on the selected engineering units. Refer to Appendix B for a list of engineering units. Network Input points only support the analog point type. Discrete values are accepted as analog 0.0 and 1.0 values and can be displayed with no units.

A Network Input point requests data from a point in another device on the CCN at a configured timed interval. In order for this point to retrieve data, it must be referenced by at least one standard algorithm, alarm, or system function.

Network Input points are displayed in the software point display table. Network Input points support the CCN force, auto, and timed auto functionality. Note that when a Network Input point has a Force applied, polling is disabled. Unlike other Universal Controller input point types, Network Input points do not support alarm functionality. After the factory software download, the Network Input points will be unconfigured, and will not display in the software point display table. Each Network Input point can be configured through a Service Configuration table provided for each point. Network Input point Service decisions are listed in this manual's Service Configuration chapter.

Typical Application

You can configure this point to provide the fan status or return air temperature of a remote air handler as input to a standard algorithm.

List of Configuration Decisions

CCN Element Number
CCN Bus Number
Point Name
Communication Rate

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status

Configuration Decisions

CCN Element Number
Use this decision to enter the element number of the system element from which the point will be read.

Allowable Entries	1 to 239
Default Value	1

CCN Bus Number
Use this decision to enter the bus number of the system element from which the point will be read.

Allowable Entries	0 to 239
Default Value	0

Point Name
Use this decision to specify the point name used in the system element where the data is being requested. If this decision is blank (default) then polling will be disabled and the status set to *2* for Software Error.

Allowable Entries	Any valid point name
Default Value	blank

Communication Rate
Use this decision to indicate how often (in seconds) the value will be read from the selected system element.

Allowable Entries	5 to 3600 seconds
Default Value	300

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision represents the system status for this network point. It indicates whether the value of this point was successfully read.

Valid Display	0 = Value read successfully
	1 = CCN Communication Bus failure
	2 = Software Error (Blank name)

Pulsed Discrete Input Hardware

A Pulsed Discrete Input is a hardware point that:

- Converts a pulsed dry-contact input to a configurable range of engineering units (usage rate). Refer to Appendix B for a list of engineering units. The conversion is done using configurable parameters for the conversion factor and sample time.

  The converted value is expressed as follows:

  Converted value = (# of pulses over sample time) * conversion factor

  Note: Pulsed discrete inputs that are assigned a unit type of "Pulses" are not converted.

- Displays the number of accumulated pulses. This can be accomplished by selecting the engineering unit to be Type 46, which represents pulses.

Pulsed Discrete Input points are displayed in the hardware point display table as a usage rate. Pulsed Discrete Input points support the CCN force, auto, and timed auto functionality. A Pulsed Discrete Input point will be forced as a consumable usage. Unlike other Universal Controller input point types, Pulsed Discrete Input points do not support alarm functionality. Any hardware input point can be configured as a Pulsed Discrete Input by specifying that point type in the point's Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Applications

You can use this point to:

- Convert a pulsed dry-contact to frequency using one second as the sample time and Hertz as the conversion factor.

- Determine Kw demand by multiplying the number of pulses by a wattmeter conversion factor.

List of Configuration Decisions

Conversion Factor
Sample Time

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Configuration Decisions

Conversion Factor
Use this decision to specify the amount that each pulse represents. For example, in a wattmeter application, the value you enter in this decision would represent the number of Kilowatt Hours for each pulse.

Allowable Entries	0 to 9999.99
Default Value	1.00

Sample Time
Use this decision to specify the time period over which the Universal Controller collects input pulses before multiplying them by the Conversion Factor.

Allowable Entries	1 to 1800 seconds
Default Value	60

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	0.00 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with *1* being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 = Valid sensor reading
	1 = Reading out of range for this type of sensor

Sensor Value

The value in this decision represents the converted value of the physical sensor into the configured engineering units, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	0.00 to 9999.9 range based upon selected display units

Hardware Value

The value in this decision represents the actual sensor reading in pulses. This value is the measurable result of the physical sensor.

Valid Display	0 to 9999 pulses

Channel Number

The value in this decision indicates the configured hardware point number for this point.

Valid Display	1 to 8

Sensed Discrete Input Hardware

A Sensed Discrete Input is a hardware point that converts a dry-contact input to a logic state based on the selected display units. For a list of discrete engineering units, refer to Appendix B.

Sensed Discrete Input points are displayed in the hardware point display table. Sensed Discrete Input points support the CCN force, auto, and timed auto functionality. Any hardware input point can be configured as a Sensed Discrete Input by specifying that point type in the point's Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

This point can provide input to standard algorithms or alarms.

List of Configuration Decisions

Input Logic Type

Alarm Configuration Decisions: Sensed Discrete Input Hardware point configuration includes decisions for both Discrete Comparison and Change of State alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Alarm Maintenance Decisions: Sensed Discrete Input Hardware point configuration includes decisions for both Discrete Comparison and Change of State alarm maintenance, as described in this manual's Alarms chapter.

Configuration Decisions

Input Logic Type

Use this decision to indicate the conversion logic you desire.

Normal = Standard Logic
The operator interface displays *On* when the sensor contacts for this DI point are closed. The operator interface displays *Off* when the sensor contacts are open.

Invert = Reverse Logic
The operator interface displays *On* when the sensor contacts for this DI point are open. The operator interface displays *Off* when the sensor contacts are closed.

Allowable Entries	Normal/Invert
Default Value	Normal

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on sensor type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	Actual discrete text

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with *1* being the highest force priority.

Valid Display

0 = No force in effect
1 = Fire Force
2 = Safety Force
3 = Service Force
4 = Building Supervisor Force
5 = Monitor/Remote Force
6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status

The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 =	Valid sensor reading
	1 =	Reading out of range for this type of sensor

Sensor Value

The value in this decision displays the converted value of the physical sensor into the discrete text, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display   Actual discrete text

Hardware Value

This decision displays the actual sensor reading in discrete text. This value is the measurable result of the physical sensor.

Valid Display   Open/Close

Channel Number

The value in this decision indicates the configured hardware point number for this point.

Valid Display   1 to 8

Setpoint Offset Input Hardware

A Setpoint Offset Input point such as a T-56 slide bar input is a hardware point that converts a 0-100K Ohm input signal to a range of 0.0 to 100.0 %.

Setpoint Offset Input points support a single algorithm, Setpoint Offset, which is automatically selected when the point is created. Any AO/DO algorithm can be configured with a Setpoint Offset Input point as its setpoint schedule and as its time schedule. The Setpoint Offset algorithm itself has configuration decisions that allow the user to assign a Time Schedule and a Setpoint Schedule, along with Max. Decrease and Max Increase Amounts. Based on these parameters and the current offset value, new setpoints are generated, which along with the Time Schedule parameters, are then used by the assigned AO/DO algorithm.

Setpoint Offset Input points are displayed in the hardware point display table. Setpoint Offset points support the CCN force, auto, and timed auto functionality. Unlike other Universal Controller input point types, Setpoint Offset does not support alarm functionality. Any hardware input point can be configured as a Setpoint Offset Input by specifying that point type in the point’s Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

This point can provide input to standard algorithms that utilize a biased temperature setpoint value.

List of Configuration Decisions

The Setpoint Offset Input point itself has no configuration decisions.

Algorithm Configuration: Setpoint Offset Input point configuration includes decisions for the assigned algorithm configuration. Refer to this manual's Algorithms chapter for a list and description of algorithm configuration and maintenance decisions.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Algorithm Maintenance Decisions: Setpoint Offset Input Hardware points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display 0.0 to 100.0%

Force
The value in this decision displays the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with *1* being the highest force priority.

Valid Display
0 = No force in effect
1 = Fire Force
2 = Safety Force
3 = Service Force
4 = Building Supervisor Force
5 = Monitor/Remote Force
6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status
The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display
0 = Valid sensor reading
1 = Reading out of range for this type of sensor

Sensor Value
The value in this decision represents the converted value of the physical sensor into the engineering units, disregarding any applied forces.

Valid Display 0.0 to 100.0%

Hardware Value
The value in this decision represents the actual sensor reading in unconverted units or discrete text. This value is the measurable result of the physical sensor.

Valid Display 0.0 to 100 %

Channel Number
The value in this decision indicates the configured hardware point number for this point.

Valid Display 1 to 8

Temperature Input Hardware

A Temperature Input is a hardware point that converts resistive input from a thermistor-type transducer for the following sensor types:

- 10K Type III (AN/YSI)
- 5K Thermistor
- 10K Type II (CP/MCI)

Refer to Appendix B for a list of resolution and accuracy.

Temperature Input points are displayed in the hardware point display table. Temperature Input points support the CCN force, auto, and timed auto functionality. Any hardware input point can be configured as a Temperature Input by specifying that point type in the point's service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

You can use this point to interface with a Carrier-approved temperature sensor to provide duct discharge temperature as input to standard algorithms or alarms.

List of Configuration Decisions

The following decision is applicable to this point type. Configuring it is optional.

Offset

Alarm Configuration Decisions: Temperature Input Hardware point configuration includes decisions for both Limit and Setpoint Limit alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Alarm Maintenance Decisions: Temperature Input Hardware points also include alarm maintenance data, as described in this manual's Alarms chapter.

Configuration Decisions

Offset

Use this decision to indicate the value that is added to or subtracted from the converted temperature value in order to compensate for sensor inaccuracy.

Allowable Entries	-10.0 to 10.0^F
Default Value	0.0

Maintenance Decisions

System Value

The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters, including the configurable offset. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-40.0 to 245.0 °F

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with *1* being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 = Valid sensor reading
	1 = Reading out of range for this type of sensor

Sensor Value
The value in this decision represents the converted value of the physical sensor into the configured engineering units, disregarding any applied forces.

Valid Display	-40.0 to 245.0 °F

Hardware Value
The value in this decision represents the actual sensor reading in unconverted units or discrete text. This value is the measurable result of the physical sensor, disregarding any offset.

Valid Display	-40.0 to 245.0 °F

Channel Number
The value in this decision indicates the configured hardware point number for this point.

Valid Display	1 to 8

Voltage Input Hardware

A Voltage Input is a hardware point that converts an input signal with a maximum range of 0-10 Vdc to a configurable range of engineering units. Refer to Appendix B for a list of engineering units and their conversion limits.

The equation for the input conversion is:
[(Input - Low Input Endpoint) * (High Conversion Endpoint - Low Conversion Endpoint) / (High Input Endpoint - Low Input Endpoint)] + Low Conversion Endpoint

The conversion is a linear interpolation of the input between the Low and High Input Endpoint to the Low and High Conversion Endpoint.

Voltage Input points are displayed in the hardware point display table. Voltage Input points support the CCN force, auto, and timed auto functionality. Any hardware input point can be configured as a Voltage Input by specifying that point type in the point's Service data. Hardware Input Point Service configuration decisions are listed in this manual's Service Configuration chapter.

Typical Application

You can use this point to provide input to standard algorithms or alarms.

List of Configuration Decisions

Low Input Endpoint
High Input Endpoint
Low Conversion Endpoint
High Conversion Endpoint
Low Input Fault
High Input Fault
Offset

Alarm Configuration Decisions: Voltage Input Hardware point configuration includes decisions for both Limit and Setpoint Limit alarm configuration, as described in this manual's Alarms chapter.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Sensor Value
Hardware Value
Channel Number

Alarm Maintenance Decisions: Voltage Input points also include alarm maintenance data, as described in this manual's Alarms chapter.

Configuration Decisions

Low Input Endpoint
Use this decision to indicate the minimum input signal that will be converted.

Allowable Entries	0.0 to 11.0 Volts
Default Value	2.0

High Input Endpoint
Use this decision to indicate the maximum input signal that will be converted.

Allowable Entries	0.0 to 11.0 Volts
Default Value	10.0

Low Conversion Endpoint
Use this decision to indicate the conversion value when the input signal is less than or equal to the Low Input Endpoint.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units
Default Value	0.0

High Conversion Endpoint
Use this decision to indicate the conversion value when the input signal is greater than or equal to the High Input Endpoint.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units
Default Value	0.0

Low Input Fault
Use this decision to specify the lower limit that indicates that the input sensor is out of range.

Allowable Entries	0.0 to 11.0 Volts
Default Value	2.0

High Input Fault
Use this decision to specify the upper limit that indicates that the input sensor is out of range.

Allowable Entries	0.0 to 11.0 Volts
Default Value	10.0

Offset
Use this decision to indicate the value that is added to or subtracted from the converted value in order to compensate for sensor inaccuracy. These limits apply to all units.

Allowable Entries	-9999.9 to 9999.9 units
Default Value	0.0

Maintenance Decisions

System Value
The value in this decision represents the actual value used by any algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters, including the configurable offset. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with 1 being the highest force priority.

Valid Display	0 = No force in effect
	1 = Fire Force
	2 = Safety Force
	3 = Service Force
	4 = Building Supervisor Force
	5 = Monitor/Remote Force
	6 = Min Off Time Force
	7 = Controlling POC Force
	8 = BEST Force
	9 = Temp Override Force
	10 = Loadshed Force

Status

The value in this decision represents the system status for this hardware point. It indicates whether the sensor reading of this device is valid.

Valid Display	0 = Valid sensor reading
	1 = Reading out of range for this type of sensor

Sensor Value

The value in this decision represents the converted value of the physical sensor into the configured engineering units, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Hardware Value

The value in this decision represents the actual sensor reading in unconverted units. This value is the measurable resultof the physical sensor, disregarding any offset.

Valid Display	0.0 to 11.0 Volts

Channel Number

The value in this decision indicates the configured hardware point number for this point.

Valid Display	1 to 8

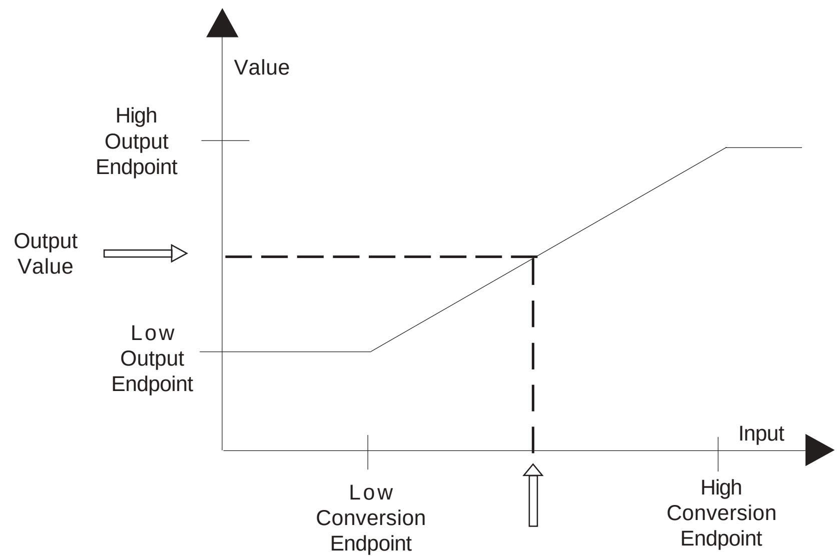
Voltage Output Hardware

A Voltage Output is a hardware point that converts an output signal with a maximum range of 0-10 Vdc to a configurable range of engineering units. Refer to Appendix B for a list of engineering units and their input limits.

The equation for the output conversion is:
[(Output - Low Conversion Endpoint) * (High Output Endpoint - Low Output Endpoint) / (High Conversion Endpoint - Low Conversion Endpoint)] + Low Output Endpoint

The conversion is a linear interpolation of the output between the Low and High Output Endpoint to the Low and High Conversion Endpoint.

Figure 4-2
Linear Interpolation of Voltage Ouput



Voltage Output points are displayed in the hardware point display table. Voltage Output points support the CCN force, auto, and timed auto functionality. Standard force precedence will be applied. The point's system value will be set to the force value by the force function. The point's system value will be set to its latest control value by the auto function. Any hardware output point can be configured as a Voltage Output by specifying that point type in the point's Service data. Hardware Output Point Service configuration decisions are listed in this manual's Service Configuration chapter.

List of Configuration Decisions

Low Output Endpoint
High Output Endpoint
Low Conversion Endpoint
High Conversion Endpoint

Algorithm Configuration: Voltage Output Hardware point configuration includes decisions for the assigned algorithm configuration. Refer to this manual's Algorithms chapter for a list and description of algorithm configuration and maintenance decisions.

List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this point type. They provide useful information regarding the status and configuration of this point.

System Value
Force
Status
Control Value
Hardware Value
Channel Number

Algorithm Maintenance Decisions: Voltage Output Hardware points also include algorithm maintenance data, as described in this manual's Algorithms chapter.

Configuration Decisions

Low Output Endpoint
Use this decision to indicate the lowest value the output signal can be as a result of converting the control value.

Allowable Entries	0.0 to 11.0 Volts
Default Value	2.0

High Output Endpoint
Use this decision to indicate the highest value the output signal can be as a result of converting the control value.

Allowable Entries	0.0 to 11.0 Volts
Default Value	10.0

Low Conversion Endpoint

Use this decision to indicate the minimum control value. When the control value is less than or equal to the Low Conversion Endpoint, the output signal will equal the Low Output Endpoint.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units
Default Value	0.0

High Conversion Endpoint

Use this decision to indicate the maximum control value. When the control value is greater than or equal to the High Conversion Endpoint, the output signal will equal the High Output Endpoint.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units
Default Value	0.0

Maintenance Decisions

System Value

The value in this decision represents the actual value used by the algorithms that reference this point. The range of values is determined by the type of data that this point represents. This value includes any conversions that are made based on point type, units, or configured parameters. This value also includes the effect of any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Force

The value in this decision represents the force level, if any, that has been applied to this point. The forces are listed in order from highest to lowest priority, with *1* being the highest force priority.

Valid Display	0 = No force in effect 1 = Fire Force 2 = Safety Force 3 = Service Force 4 = Building Supervisor Force 5 = Monitor/Remote Force

6 = Min Off Time Force
7 = Controlling POC Force
8 = BEST Force
9 = Temp Override Force
10 = Loadshed Force

Status
This decision does not apply to this point.

Valid Display 0 = unused

Control Value
The value in this decision represents the converted value of the output signal into the configured engineering units, disregarding any applied forces. Refer to Appendix B for a list of engineering units.

Valid Display -9999.9 to 9999.9 range based upon selected display units

Hardware Value
The value in this decision represents the actual output signal in unconverted units. This value is the measurable result of the physical sensor.

Valid Display 0.0 to 11.0 Volts

Channel Number
The value in this decision indicates the configured hardware point number for this point.

Valid Display 9 to 16

Algorithms

Schedules

Algorithms

This section provides the following information for each algorithm:

- Purpose
- List of configuration decisions
- List of maintenance decisions
- Block diagram
- Description of each configuration decision including allowable entries and default values
- Description of each maintenance decision including valid display

Definition of an Algorithm

An algorithm is a pre-engineered group of processes that provides the capability to control and monitor HVAC devices in a safe, energy efficient manner. An algorithm can consist of one or more HVAC control routines, schedules, input and output points, alarms, and system functions.

For easy reference, the algorithms are presented alphabetically in this chapter beginning with AI algorithms followed by AO and DO algorithms. Global algorithms (AOSS, NTFC, etc.) are presented last.

The following algorithms are presented in this chapter:

AI - Setpoint Offset
AO - Adaptive Dual Loop PID
AO - Adaptive Single Loop PID
AO - Cooling Constant Volume (CV)
AO - Heating Constant Volume (CV)
AO - Mixed Air Constant Volume (CV) with IAQ
AO - Permissive Interlock
AO - Slave Point
DO - Analog Comparison
DO - Electric Heat Constant Volume (CV)
DO - Enthalpy Comparison
DO - Timeclock with Optional Check
DO - Floating Point Cooling Constant Volume (CV)

DO - Floating Point Heating Constant Volume (CV)
DO - Floating Point Mixed Air Constant Volume (CV) with IAQ
DO - Interlock
DO - Lead/Lag Control
DO - Lighting Control
DO - Permissive Interlock
DO - Slave Point
DO - Staging Control
Air Source Linkage with Optimal Start/Stop
Night Time Free Cool with Enthalpy Check
Optimal Start/Stop
Sensor Group

AI—Setpoint Offset

The Setpoint Offset algorithm provides a set of temperature setpoint values biased by a temperature offset value determined, for example, by a T-56 slide bar position.

This algorithm is selected automatically when a Setpoint Offset input point is created.

Any AO/DO algorithm or AI/DI alarm or system algorithm can be configured with a Setpoint Offset input point, by name, as its setpoint schedule.

The Setpoint Offset algorithm itself has configuration decisions that allow the user to assign a Time Schedule and a Setpoint Schedule, along with Max Decrease and Max Increase Amounts. Based on these parameters and the current offset value, new setpoints are generated, which along with the Time Schedule parameters, are then used by the AO/DO algorithm or AI/DI alarm or system algorithm with the Setpoint Offset point as its Setpoint Schedule.

The equation to convert, for example, the slider bar position in % (Setpoint Offset Input) into an offset value in ^F is as follows:

If the Setpoint Offset Input is less than 50%:
[(50 - Setpoint Offset Input)/50] * Max Decrease Amount

If the Setpoint Offset Input is not less than 50%:
[(Setpoint Offset Input - 50)/50] * Max Increase Amount

where:

Parameter		Low Range Limit	High Range Limit
Setpoint Offset Input	Variable	0.0 %	100.0 %
Max Decrease Amount	Configurable	-10.0 ^F	0.0 ^F
Max Increase Amount	Configurable	0.0 ^F	10.0 ^F

The offset value calculated by the equation is added to the low and high setpoint values determined by the configured Time Schedule and Setpoint Schedule, in order to adjust them up or down, and these adjusted setpoints are presented to each AO/DO algorithm or AI/DI alarm or system algorithm that has selected the Setpoint Offset Input Point as its Setpoint Schedule.

Setpoint Offset Input Points support the CCN force, auto, and timed auto functionality.

If the input sensor is out of range, for example if disconnected, the algorithm is disabled and the Setpoint Offset value set to 0.0 ^F. The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the Universal Controller is using the occupied setpoints. When unoccupied the algorithm will be disabled and the Setpoint Offset value will be set to 0.0 ^F.

Application Note

The controlling algorithm's Time Schedule should be the same as that configured for the Setpoint Offset Input Point used by that algorithm.

Typical Application

This algorithm provides input to standard AO/DO algorithms or AI/DI alarm or system algorithms that utilize a biased temperature value.

The Setpoint Offset algorithm requires that its engineering units be set to degrees (°F or °C).

List of Configuration Decisions

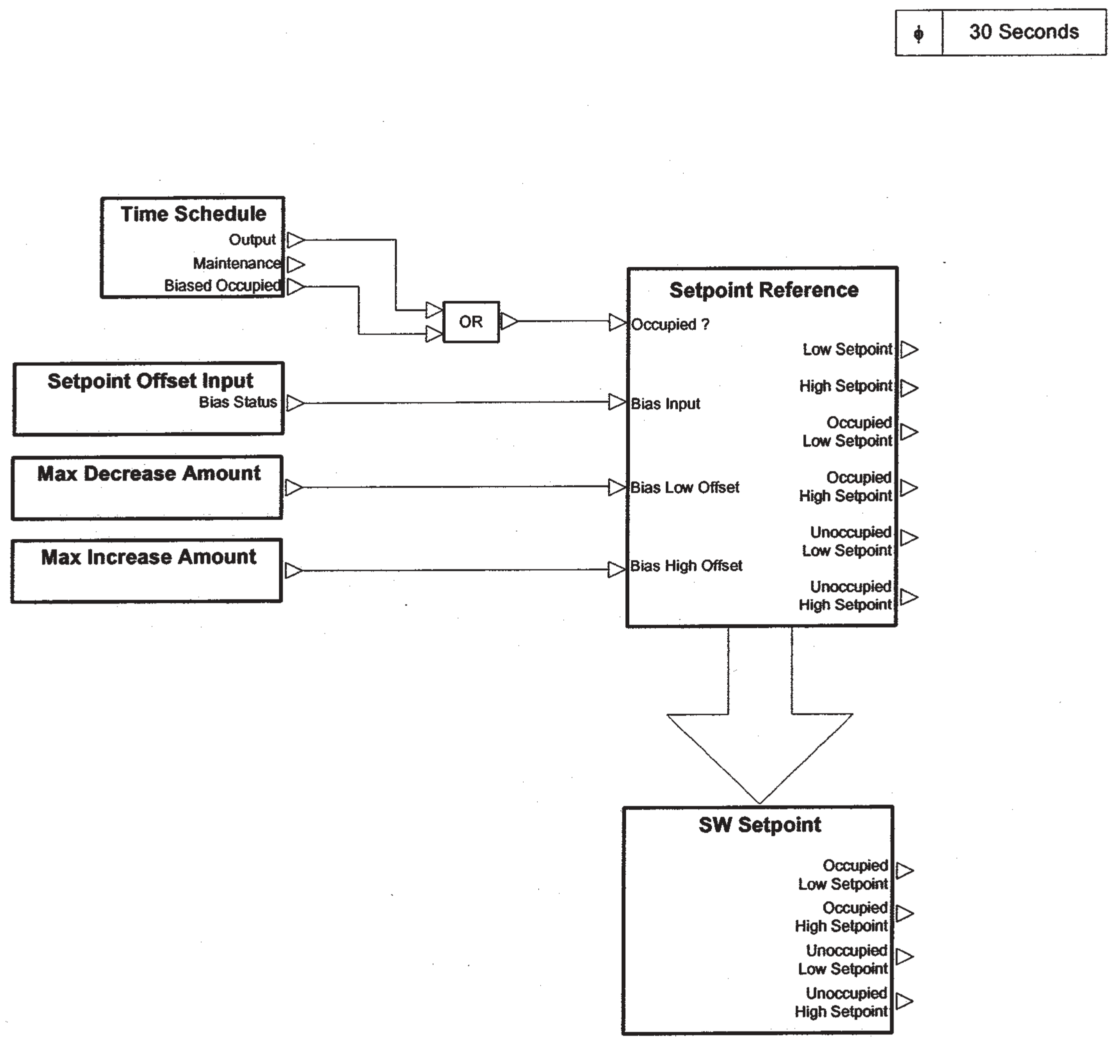
Time Schedule
Setpoint Schedule
Max Decrease Amount
Max Increase Amount

List of Maintenance Decisions

Occupied/Biased ?
Setpoint Offset Input
Setpoint Bias
Low Biased Setpoint
High Biased Setpoint
High Biased Setpoint
Task Timer

Figure 5-3
AI-Setpoint Offset

Setpoint Offset (slider bar)



Configuration Decisions

Time Schedule
Use this decision to specify the name of the Time Schedule that will determine the occupancy mode for this algorithm. If a Time Schedule is not specified in this decision, the algorithm defaults to a 24-hour occupied state.

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01
Default Value	OCCPC00

Setpoint Schedule
Use this decision to specify the name of the Setpoint Schedule that will provide the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Allowable Entries	SETPT*nn* where *nn* is from 01 to 02, OPSS_01
Default Value	SETPT00 where 00 represents an invalid schedule number

Max Decrease Amount
Use this decision to specify the offset value that will be applied to the setpoint values when, for example, the T-56 slide bar is all the way to the left (minimum position, or 0.0 %).

Allowable Entries	-10.0 to 0.0 ^F
Default Value	0.0 ^F

Max Increase Amount
Use this decision to specify the offset value that will be applied to the setpoint values when, for example, the T-56 slide bar is all the way to the right (maximum position, or 100.0 %).

Allowable Entries	0.0 to 10.0 ^F
Default Value	0.0 ^F

Maintenance Decisions

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, the default mode is *Yes*.

Valid Display No/Yes

Setpoint Offset Input
This decision displays the current value of the Setpoint Offset Input Point.

Valid Display 0.0 to 100.0 %

Setpoint Bias
This decision displays the bias value that is being applied to the setpoint values.

Valid Display -10.0 to 10.0 ^F

Low Biased Setpoint
This decision displays the current low setpoint value that has been biased by the Setpoint Offset.

Valid Display	-50.0 to 255.0 °F	(-45.6 to 123.9°C)

High Biased Setpoint
This decision displays the current high setpoint value that has been biased by the Setpoint Offset.

Valid Display	-50.0 to 255.0 °F	(-45.6 to 123.9°C)

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every 30 seconds.

Valid Display	0 to 30 seconds

AO—Adaptive Control—Single Loop PID

The AO Adaptive Control Single Loop PID algorithm provides single loop PID analog control based on a setpoint value that can be reset between either the occupied or unoccupied high and low setpoint values. A user-configurable Reset Sensor is used to determine the amount of reset.

The equation to calculate the Controlling Setpoint is as follows:

[(Input - Lo Reset) * (High Setpoint - Low Setpoint) / (Hi Reset - Lo Reset)]
+ Low Setpoint

where: Input is the Reset Sensor value

Both the Y-axis and the X-axis parameters of the reset schedule are adjustable. By adjusting the setpoint schedule along with the Lo and Hi Reset decisions, a positive, negative, or constant setpoint slope can be created. Whenever the Hi Reset decision is less than the Lo Reset decision, the slope of the setpoint line is negative (the setpoint decreases as the reset sensor value increases). If the Hi Reset value is greater than the Lo Reset value, the slope of the setpoint line is positive (the Controlling Setpoint increases as the Reset Sensor value increases).

Note that the following three conditions will defeat the reset calculation and produce a Controlling Setpoint equal to the configured low setpoint value:

> If the Hi Reset and Lo Reset are equal
> If the Low Setpoint is greater than or equal to the High Setpoint
> If no Reset Sensor is configured or the value is out of range - error status.

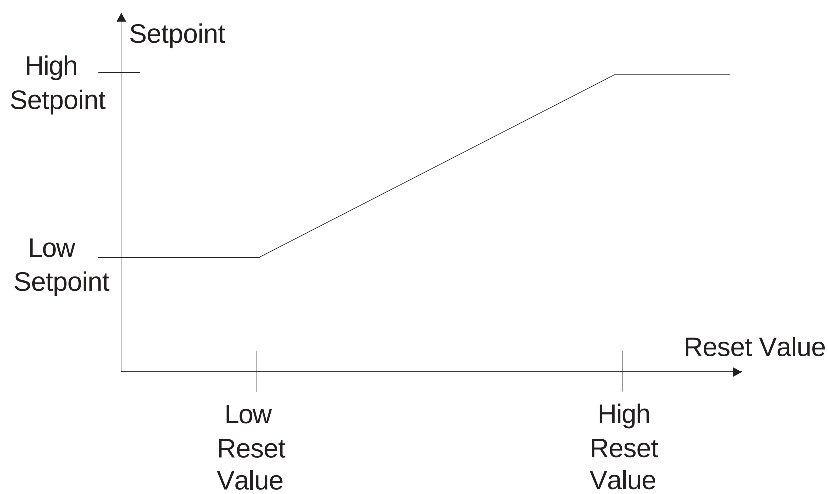
The PID Master Loop calculates the analog output value by obtaining the control value from the Control/Sensor Group sensor and comparing it to the Controlling Setpoint calculated by the Setpoint Reset function. The Sensor Group by default utilizes its sensor select function to obtain the control sensor value. The output is set to the Disabled Output Value whenever the Equipment Status Point is off or the Control/Sensor Group Sensor status is invalid.

If the Analog Output Point is forced, the algorithm resets the integrator and the forced value takes precedence over the algorithm as the Analog Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied high and low setpoints.

The Setpoint Schedule allows configuration of high and low setpoints for both occupied and unoccupied states.

The AO Adaptive Single Loop PID algorithm allows any engineering units for the control and reset sensors, and for the output channel. Note that the units for the control and reset sensors must be the same.



Typical Application

The most common application of setpoint reset is to vary a setpoint with outside air such that the setpoint increases as the OAT sensor decreases. When graphed, such an arrangement produces a line with a negative slope. For example, to adjust a hot water setpoint from 90.0 degrees F (32.2 degrees C) to 140 degrees F (60.0 degrees C), as the OAT decreases from 60 degrees F (15.6 degrees C) to 0 degrees F (-17.8 degrees C), the following configuration decisions would apply:

Low Setpoint = 90 deg.F (32.2 deg.C)
High Setpoint = 140 deg.F (60.0 deg.C)
Lo Reset = 60 deg.F (15.6 deg.C)
Hi Reset = 0 deg.F (-17.8 deg.C)

Whenever the OAT is less than or equal to 0 deg.F (-17.8 deg.C), the setpoint is clamped at 140 deg.F (60.0 deg.C.) Whenever the OAT is greater than or equal to 60 deg.F (15.6 deg.C), the setpoint is clamped at 90 deg.F (32.2 deg.C.) When the reset sensor is between 0 degrees F (-17.8 deg.C) and 60 degrees F (15.6 deg.C), the setpoint is adjusted in a linear fashion.

List of Configuration Decisions

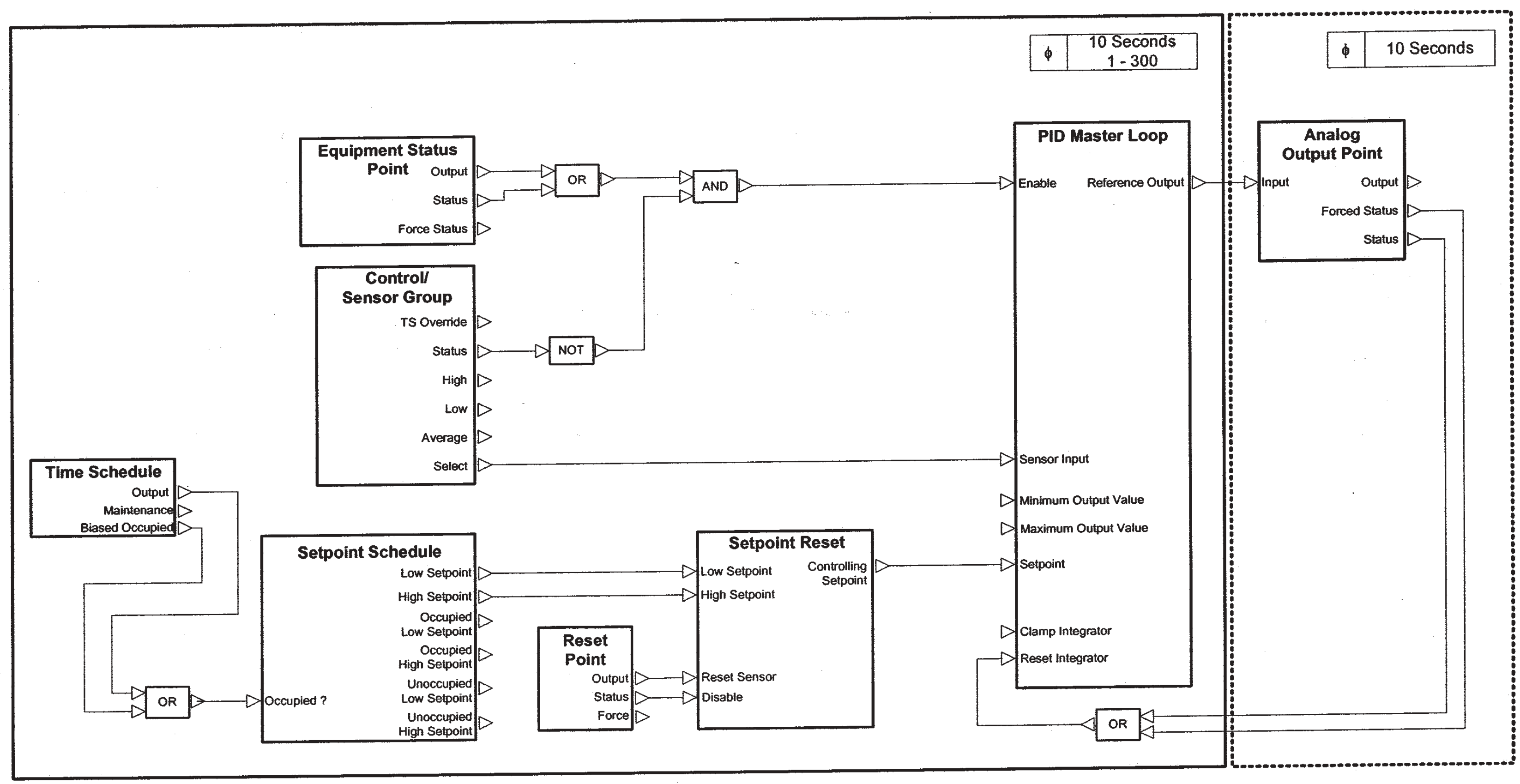
- Equipment Status Point
- Time Schedule
- Setpoint Schedule
- Reset Sensor
- Reset
  - Lo Reset Value
  - Hi Reset Value
- Control/Sensor Group
- PID Master Loop
  - Proportional Gain
  - Integral Gain
  - Derivative Gain
  - Disabled Output Value
  - Minimum Output Value
  - Maximum Output Value
  - Starting Value
  - Block Iteration Rate
- Power On Delay

List of Maintenance Decisions

- Analog Output Point
- Equipment Status Point
- Occupied/Biased?
- Reset Sensor
- Controlling Setpoint
- Control/Sensor Group
- PID Master Loop
  - Reference Output
  - Proportional Term
  - Integral Term
  - Derivative Term
  - Integrator Flags
- Task Timer

Figure 5-2
AO- Adaptive Control -
Single Loop PID

AO - Adaptive Single Loop PID



Configuration Decisions

Equipment Status Point
Use this decision to specify the Discrete point that provides the on/ off status to enable this algorithm. If this point is not configured, then this decision will display *Off* but the actual state will be *On*.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule
Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm will default to the occupied state.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00

Setpoint Schedule
Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Allowable Entries	SETPT*nn* where *nn* is from 01 to 04, LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

Reset Sensor
Use this decision to specify the AI point that provides the input for determining the amount of reset. The Controlling Setpoint is reset between the configured high and low setpoints, based upon the value of the sensor specified in this decision. If no valid sensor is configured then the Low Setpoint shall be used as the Controlling Setpoint.

Allowable Entries	Any valid point name
Default Value	POINT0

Reset

Reset calculates the desired Controlling Setpoint for the PID Master Loop based on the Reset Sensor.

Lo Reset Value

Use this decision to specify the X-axis parameters of the reset schedule (the Y-axis parameters are set by the setpoint schedule.) If the configured Lo Reset value is greater than the Hi Reset value, then the setpoint decreases as the reset sensor value increases. If the configured Lo Reset value is less than the configured Hi Reset value, then the setpoint increases as the reset sensor value increases.

Note: The Lo Reset Value correlates to the Low Setpoint value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Hi Reset Value

Use this decision to specify the X-axis parameters of the reset schedule (the Y-axis parameters are set by the Reset Values.) If the configured Hi Reset value is greater than the Lo Reset value, then the setpoint increases as the reset sensor value increases. If the configured Hi Reset value is less than the Lo Reset value, then the setpoint decreases as the reset sensor value increases.

Note: The Hi Reset Value correlates to the High Setpoint value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Control/Sensor Group
Use this decision to specify the Control Sensor or Sensor Group that the PID Master Loop will compare to the calculated Controlling Setpoint. A valid entry is required for the algorithm to operate.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR00 where 00 represents an invalid group number

PID Master Loop
The master loop is a Proportional Integral Derivative (PID) control loop that calculates the output required to maintain the calculated Controlling Setpoint. In Figure 5-2, Reference Output = Analog Output Point

Proportional Gain
Use this decision to specify the value that will be multiplied by the error to produce the proportional term. The value in this decision is expressed in units-of-output-per-unit of error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Integral Gain
Use this decision to specify the value that will be multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-of-output-per-unit of error per unit of time.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Derivative Gain
Use this decision to specify the value that will be multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-of-output-per-unit of delta error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Disabled Output Value

Use this decision to specify the Analog Output Point value to be maintained when the Equipment Status Point is off or the control sensor becomes invalid.

Allowable Entries	-9999.9 to 9999.9 based on selected display units
Default Value	0.0

Minimum Output Value

Use this decision to specify the lowest allowable Analog Output Point value.

Allowable Entries	-9999.9 to 9999.9 based on selected analog output point units
Default Value	0.0

Maximum Output Value

Use this decision to specify the highest allowable Analog Output Point value.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	100.0

Starting Value

Use this decision to specify the output's starting value when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	0.0

Block Iteration Rate

Use this decision to specify how often the PID Master Loop calculates the output value.

Allowable Entries	1 to 300 seconds
Default Value	10

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Analog Output Point

This decision displays the output's actual value of the AO point being controlled by this algorithm.

Application Note: The output value is normally expressed as a percentage of full capacity.

Valid Display	-9999.9 to 9999.9 based on selected display units

Equipment Status Point

This decision displays the actual state of the status point that determines whether this algorithm is enabled. If this point is not configured, then this decision will display *Off* but the actual state will be *On*.

Valid Display	Off/On

Occupied/Biased ?

This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied*.

Valid Display	No/Yes

Reset Sensor

This decision displays the value of the reset sensor. The configured Controlling Setpoint is reset based upon the value of this decision.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Controlling Setpoint
This decision displays the calculated setpoint for the PID Master Loop based on the setpoint schedule and reset values.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Control/Sensor Group
This decision displays the value of the input sensor to which this algorithm is controlling.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

PID Master Loop
PID Master Loop function calculates the desired output based on the configured PID gains and the current deviation from setpoint. The calculated output is re-adjusted periodically to maintain the desired setpoint. In Figure 5-2 and in Appendix A Figure 17, Setpoint = Controlling Setpoint and Sensor Input = Control/Sensor Group

Reference Output
This decision displays the calculated output that is used to drive the Analog Output Point.
Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-9999.9 to 9999.9 based on selected display units clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.
Proportional Term = (Controlling Setpoint - Control/Sensor Group) * Proportional Gain

Valid Display	-9999.9 to 9999.9 based on selected display units (or ^ equivalent)

Integral Term

This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Controlling Setpoint - Control/Sensor Group) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9 based on selected display units (or ^ equivalent)

Derivative Term

This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain

Error = (Controlling Setpoint - Control/Sensor Group)

Valid Display	-9999.9 to 9999.9 based on selected display units (or ^ equivalent)

Integrator Flags

This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp 1 = Integrator clamp active
Valid Display	000 to 111

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every ten seconds.

Valid Display	0 to 10 seconds

AO—Adaptive Control—Dual Loop PID

The AO Adaptive Control Dual Loop PID algorithm provides dual loop PID analog control based on a setpoint value that can be reset between either the occupied or unoccupied high and low setpoint values. A user-configurable Reset Sensor is used to determine the amount of reset.

The equation to calculate the Controlling Setpoint is as follows:

[(Input - Lo Reset) * (High Setpoint - Low Setpoint) / (Hi Reset - Lo Reset)] + Low Setpoint
where Input is the Reset Sensor value

Both the Y-axis and the X-axis parameters of the reset schedule are adjustable. By adjusting the setpoint schedule along with the Lo and Hi Reset decisions, a positive, negative, or constant setpoint slope can be created. Whenever the Hi Reset decision is less than the Lo Reset decision, the slope of the setpoint line is negative (the setpoint decreases as the reset sensor value increases). If the Hi Reset value is greater than the Lo Reset value, the slope of the setpoint line is positive (the Controlling Setpoint increases as the Reset Sensor value increases).

Note that the following three conditions will defeat the reset calculation and produce a Controlling Setpoint equal to the configured low setpoint value:

If the Hi Reset and Lo Reset are equal
If the Low Setpoint is greater than or equal to the High Setpoint
If no Reset Sensor is configured or the value is out of range - error status.

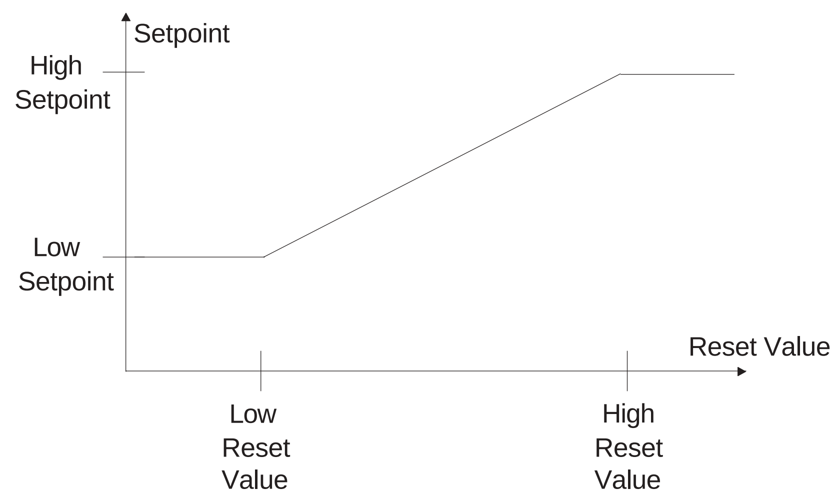
This algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a (Proportional) Submaster Loop to control the analog output. The PID Master Loop calculates the submaster reference by obtaining the control sensor value from the Control/Sensor Group sensor and comparing it to the Controlling Setpoint calculated by the Setpoint Reset function. The Sensor Group by default, utilizes its sensor select function to obtain the control sensor value. The PID Master Loop output is set to the Disabled Output Value whenever the Equipment Status Point is off or the Control/Sensor Group Sensor status is invalid. The Submaster Loop is a proportional loop that computes the analog out value by comparing the calculated submaster reference output to the Submaster Sensor value.

If the Analog Output Point is forced, the algorithm resets the integrator and the forced value takes precedence over the algorithm as the Analog Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied high and low setpoints.

The Setpoint Schedule allows configuration of high and low setpoints for both occupied and unoccupied states.

The AO Adaptive Dual Loop PID algorithm allows any engineering units for the control and reset sensors. Note that the units for the control and reset sensors must be the same.



Typical Application

A common application of dual loop PID control with setpoint reset is to vary a setpoint with outside air such that the setpoint increases as the OAT sensor increases. When graphed, such an arrangement will produce a line with a positive slope. This takes advantage of the fact that occupants will feel comfortable at a higher indoor air temperature when the OAT and SPT are allowed to track together. For example, to adjust a space temperature setpoint (for constant volume cooling equipment) from 74 degrees F (22.2 degrees C) to 77 degrees F (25.0 degrees C) as the OAT increases from 65 degrees F (18.3 degrees C) to 90 degrees F (32.2 degrees C) use the following configuration decisions:

Low Setpoint = 74 deg.F (22.2 deg.C)
High Setpoint = 77 deg.F (25.0 deg.C)
Lo Reset = 65 deg.F (18.3 deg.C)
Hi Reset = 90 deg.F (32.2 deg.C)

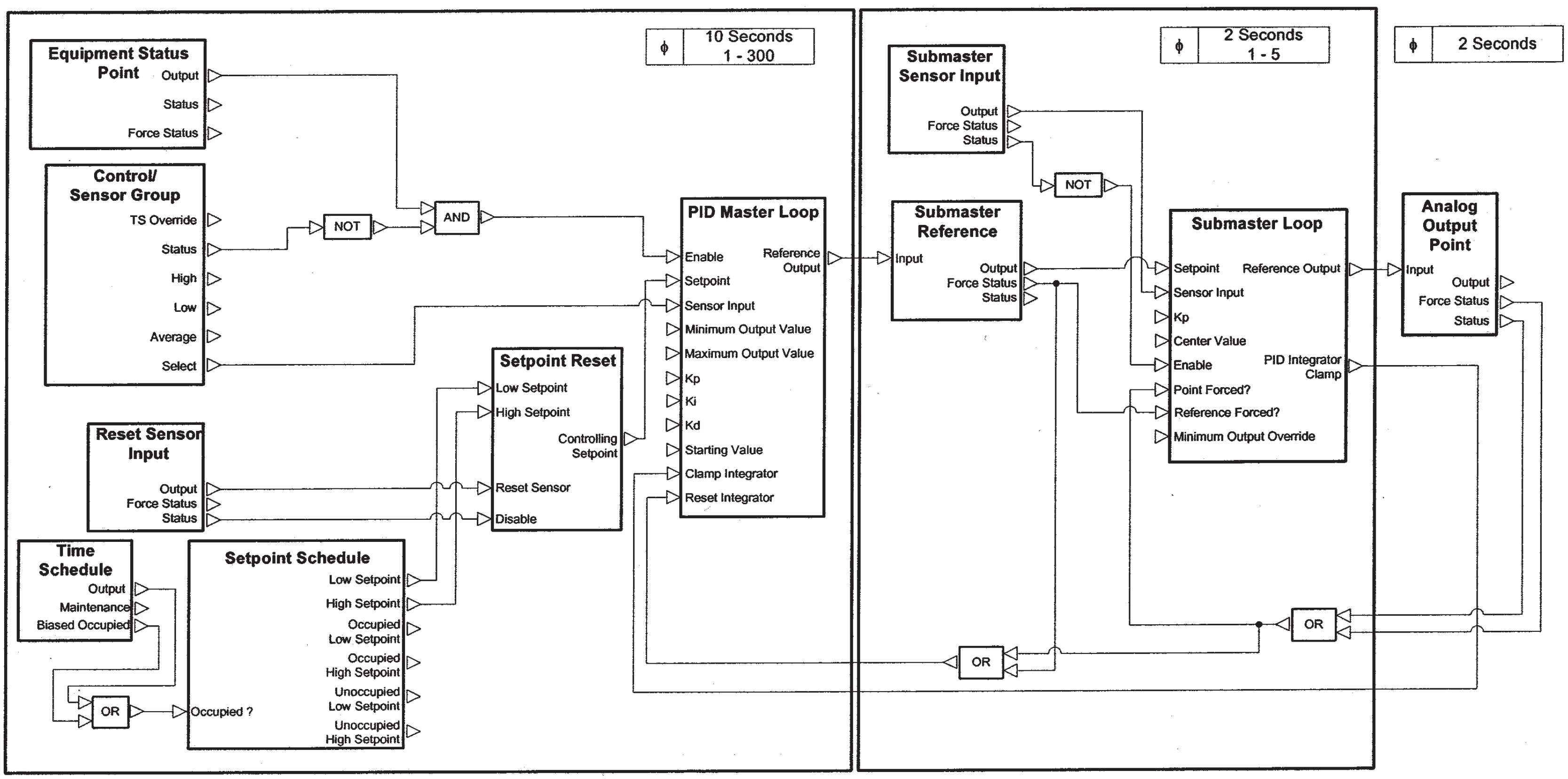
Whenever the OAT is less than or equal to 65 deg.F (18.3 deg.C) the setpoint is clamped at 74 deg.F (22.2 deg.C) . Whenever the OAT is greater than or equal to 90 deg.F (32.2 deg.C) the setpoint is clamped at 77 deg.F (25.0 deg.C) . When the reset sensor is between 65 deg.F (18.3 deg.C) and 90 deg.F (32.2 deg.C), the setpoint is adjusted.

List of Configuration Decisions

Equipment Status Point
Time Schedule
Setpoint Schedule
Reset Sensor
Reset
  Lo Reset Value
  Hi Reset Value
Control/Sensor Group
PID Master Loop
  Proportional Gain
  Integral Gain
  Derivative Gain
  Disabled Output Value
  Minimum Output Value
  Maximum Output Value
  Starting Value
  Block Iteration Rate
Submaster Sensor
Submaster Loop
  Proportional Gain
  Disabled Output Value
  Minimum Output Value
  Maximum Output Value
  Center Value
  Block Iteration Rate
Power On Delay

Figure 5-3
AO - Adaptive Control - Dual
Loop PID

AO - Adaptive Dual Loop PID



List of Maintenance Decisions

Analog Output Point
Equipment Status Point
Occupied/Biased ?
Reset Sensor
Controlling Setpoint
Control/Sensor Group
PID Master Loop
  Reference Output
  Proportional Term
  Integral Term
  Derivative Term
  Integrator Flags
Submaster Reference
Submaster Sensor
Submaster Loop
  Reference Output
  Proportional Term
  Submaster Flags
Task Timer

Configuration Decisions

Equipment Status Point

Use this decision to specify the Discrete point that provides the on/off status to enable this algorithm. If this point is not configured, then this decision will display *Off* but the actual state will be *On*.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm will default to the occupied state.

Allowable Entries OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value OCCPC00

Setpoint Schedule
Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Allowable Entries	SETPT*nn* where *nn* is from 01 to 04, LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

Reset Sensor
Use this decision to specify the AI point that provides the input for determining the amount of reset. The Controlling Setpoint is reset between the configured high and low setpoints, based upon the value of the sensor specified in this decision. If no valid sensor is configured then the Low Setpoint shall be used as the Controlling Setpoint.

Allowable Entries	Any valid point name
Default Value	POINT0

Reset
Reset calculates the desired setpoint for the PID master loop based on the Reset Sensor.

Lo Reset Value
Use this decision to specify the X-axis parameters of the reset schedule (the Y-axis parameters are set by the setpoint schedule.) If the configured Lo Reset value is greater than the Hi Reset value, then the setpoint will decrease as the reset sensor value increases. If the configured Lo Reset value is less than the configured Hi Reset value, then the setpoint will increase as the reset sensor value increases.

Note: The Lo Reset Value correlates to the Low Setpoint value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Hi Reset Value

Use this decision to specify the X-axis parameters of the reset schedule (the Y-axis parameters are set by the setpoint schedule.) If the configured Hi Reset value is greater than the Lo Reset value, then the setpoint will increase as the reset sensor value increases. If the configured Hi Reset value is less than the Lo Reset value, then the setpoint will decrease as the reset sensor value increases.

Note: The Hi Reset Value correlates to the High Setpoint value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Control/Sensor Group

Use this decision to specify the Control Sensor or Sensor Group that the PID Master Loop will compare to the calculated setpoint. Valid entry is required for the algorithm to operate.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

PID Master Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the submaster reference required to maintain the calculated Controlling Setpoint. In Figure 5-2 and the flowchart shown in Appendix A, Reference Output = Submaster Reference.

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Integral Gain

Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Derivative Gain

Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision shall be expressed in units-per-unit of error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Disabled Output Value

Use this decision to specify the Submaster Reference value to be maintained when the Equipment Status Point is off or the control sensor becomes invalid.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Minimum Output Value

Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Maximum Output Value

Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	100.0

Starting Value
Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	-9999.9 to 9999.9 based on selected algorithm units
Default Value	0.0

Block Iteration Rate
Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	10

Submaster Sensor
Use this decision to specify the AI point that provides the submaster feedback value to this algorithm. The submaster loop controls to the difference between the submaster reference and the value of the point that you specify in this decision. Valid entry is required for the algorithm to operate.

Allowable Entries	Any valid point name
Default Value	POINT0

Submaster Loop
The submaster loop is a proportional control loop that computes the output value by comparing the calculated submaster reference to the Submaster Sensor. Units for output values are user-configurable.

Proportional Gain
Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision should be expressed in units-of-output-per-unit of error.

Allowable Entries	-1000.0 to 1000.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the output when the Submaster Sensor is invalid.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	0.0

Minimum Output Value
Use this decision to specify the lowest allowable output value.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	0.0

Maximum Output Value
Use this decision to specify the highest allowable output value.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	100.0

Center Value
Use this decision to specify the output value appropriate for the no error condition.

Allowable Entries	-9999.9 to 9999.9 based on selected output point units
Default Value	0.0

Block Iteration Rate
Use this decision to specify how often the submaster loop calculates a new output value.

Allowable Entries	1 to 5 seconds
Default Value	2

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a power failure occurs.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Analog Output Point

This decision displays the output's actual value of the AO point being controlled by this algorithm.

Application Note: The value is normally expressed as a percentage of full capacity.

Valid Display	-9999.9 to 9999.9 based on selected display units.

Equipment Status Point

This decision displays the actual state of the equipment status point that determines whether this algorithm is enabled. If this point is not configured, then this decision will display *Off* but the actual state will be *On*.

Valid Display	Off/On

Occupied/Biased ?

This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode is *Occupied*.

Valid Display	No/Yes

Reset Sensor

This decision displays the value of the reset sensor. The Controlling Setpoint is determined by the value of this decision.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Controlling Setpoint
This decision displays the calculated setpoint for the PID Master Loop based on the setpoint schedule and reset sensor.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Control/Sensor Group
This decision displays the value of the input sensor, which is the Master Loop feedback sensor.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

PID Master Loop
The PID Master Loop function calculates the desired Submaster Reference based on the configured PID gains and the current deviation from Controlling Setpoint.

In Figure 5-3 and in Appendix A, Figure 17,
Setpoint = Controlling Setpoint
Sensor Input = Control/Sensor Group

Reference Output
This decision displays the calculated Submaster Reference.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-9999.9 to 9999.9 based on selected algorithm units, clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the calculated proportional term.

Proportional Term = (Controlling Setpoint - Control/Sensor Group) * Proportional Gain

Valid Display	-9999.9 to 9999.9 based on selected algorithm units (or ^ equivalent)

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Controlling Setpoint - Control/Sensor Group) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9 based on selected algorithm units (or ^ equivalent)

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain Error = (Controlling Setpoint - Control/Sensor Group)

Valid Display	-9999.9 to 9999.9 based on selected algorithm units (or ^ equivalent)

Integrator Flags
This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp 1 = Integrator clamp active
Valid Display	000 to 111

Submaster Reference
This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Submaster Sensor by the Submaster Loop. To override the submaster reference, force this decision.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Submaster Sensor
This decision displays the value of the input sensor, which is the Submaster Loop feedback sensor.

Valid Display	-9999.9 to 9999.9 based on selected algorithm units

Submaster Loop
The (Proportional) Submaster Loop controls to the difference between the submaster reference and the Submaster Sensor. This loop executes every two seconds (default).

In Figure 5-3 and Appendix A, Figure 23,
Setpoint = Submaster Reference
Sensor Input = Submaster Sensor

Reference Output
This decision displays the calculated output that is used to drive the algorithm output point.

Reference Output = (Submaster Proportional Term + Submaster Center Value)

Valid Display	-9999.9 to 9999.9 based on selected display units

Proportional Term
This decision displays the proportional error term as it is calculated by the submaster loop.

Proportional Term = (Submaster Reference - Submaster Sensor) * Submaster Proportional Gain

Valid Display	-9999.9 to 9999.9 based on selected display units (or ^ equivalent)

Submaster Flags

This two-digit field displays the status of the Submaster Loop.

Left Digit	0 = Submaster Loop is Active
	1 = Submaster Loop is Inactive (Disabled or Output is forced)
Right Digit	0 = No PID Integrator Clamp
	1 = PID Integrator Clamp Active
Valid Display	00 to 11

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every two seconds.

Valid Display 0 to 2 seconds

AO—Cooling CV

The AO Cooling CV algorithm modulates the analog output to control a chilled water valve in a constant volume air handler to maintain temperature at the configured setpoint. This algorithm can also be configured to perform dehumidification.

The AO Cooling CV algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a (Proportional) Submaster Loop to control the valve. The PID Master Loop calculates the submaster reference required to maintain the high setpoint. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the high setpoint from the Setpoint Schedule. The Sensor Group by default utilizes its sensor select function to obtain the space temperature sensor value. The submaster reference is set to the Disabled Output Value if the Sensor Group/SPT Sensor status is invalid. During dehumidification, the submaster reference is set to its PID Minimum Output Value. The Submaster Loop computes the chilled water valve's position by comparing the calculated submaster reference to the Supply Air Temperature. The output is set to the Disabled Output Value whenever the equipment status point is off or the Supply Air Temperature status is invalid.

If the Analog Output Point is forced, the algorithm resets the integrator and the forced value takes precedence over the algorithm as the Analog Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied high setpoint.

The Setpoint Schedule allows for the configuration of high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the high setpoint.

The AO Cooling CV algorithm allows any engineering units for the output point, but requires that the engineering units of the control sensors be in degrees (°F or °C).

Typical Application

You can use this algorithm to control a chilled water valve serving an air handler's cooling coil in a constant volume system.

List of Configuration Decisions

Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
PID Master Loop
  - Proportional Gain
  - Integral Gain
  - Derivative Gain
  - Disabled Output Value
  - Minimum Output Value
  - Maximum Output Value
  - Center Value
  - Block Iteration Rate

Supply Air Temperature
Submaster Loop
  - Proportional Gain
  - Disabled Output Value
  - Minimum Output Value
  - Maximum Output Value
  - Center Value
  - Block Iteration Rate

Power On Delay

List of Maintenance Decisions

Cooling Coil Valve
Equipment Status Point
Sensor Group/SPT Sensor
Occupied/Biased ?
Setpoint Schedule
High Humidity Setpoint
High Humidity Sensor
PID Master Loop
  - Reference Output
  - Proportional Term
  - Integral Term
  - Derivative Term
  - Integrator Flags

Cooling Coil Subm Ref

Supply Air Temperature
Submaster Loop
    Reference Output
    Proportional Term
    Submaster Flags
Task Timer

Configuration Decisions

Equipment Status Point
Use this decision to specify the discrete point that provides the on/off status of the equipment. The discrete point provides the actual state of the equipment. If this point is not configured or the state is Off, then the Submaster Loop output will be set to the Disabled Output Value.

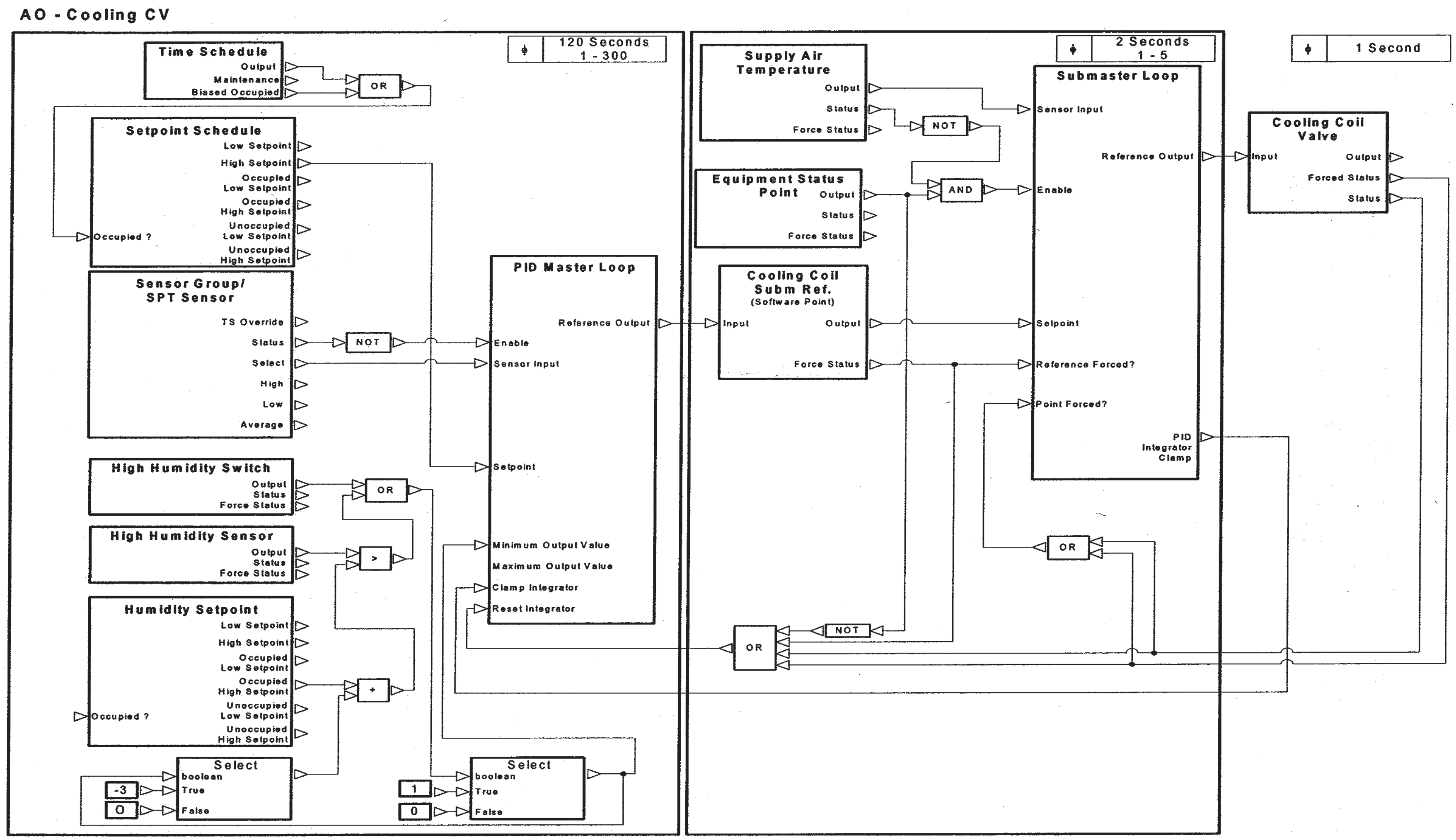
Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor
Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter. If this point is not configured, then the PID Master Loop output will be set to the PID Disabled Output Value.

Application Note: Use the same Sensor Group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Figure 5-4
AO - Cooling CV



Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Application Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries: OCCPC*nn*
where *nn* is from 01 to 99, LINK_01, or OPSS_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value: OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Application Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries: SETPT*nn*
where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point

Default Value: SETPT00

High Humidity Switch

If the system is performing dehumidification, use this decision to specify the DI point that indicates when dehumidification needs to be performed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured then dehumidification will not take place.

Application Note: If performing reheat, the sensor specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries: Any valid point name

Default Value: POINT0

Humidity Setpoint

If the system is performing dehumidification, use this decision to specify the Setpoint Schedule that provides the humidity setpoint for this algorithm. If the decision is not configured, the high setpoint will default to 99% RH, which will prevent any dehumidification.

Application Note: If performing reheat, the schedule specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	SETPT*nn*, where *nn* is 03 (humidity)
Default Value	SETPT00

High Humidity Sensor

If the system is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the occupied high setpoint from the Humidity Setpoint schedule.

Application Note: If performing reheat, the sensor specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

PID Master Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the Submaster Reference required to maintain the desired space temperature.

In Figure 5-4 and Appendix A Figure 17:
Reference Output = Submaster Reference

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain
Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain
Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the Submaster Reference value to be maintained when the SPT sensor becomes invalid.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	150.0	

Minimum Output Value
Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	45.0	

Maximum Output Value
Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	150.0	

Starting Value

Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	55.0	

Block Iteration Rate

Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	120

Supply Air Temperature

Use this decision to specify the AI point that provides the equipment's supply air temperature to this algorithm. The Supply Air Temperature is used as the Submaster Sensor Input. The submaster loop controls to the difference between the submaster reference and the value of the point specified in this decision. If this point is not configured then the Submaster Loop output will be set to the Disabled Output Value.

Allowable Entries	Any valid point name
Default Value	POINT0

Submaster Loop

The submaster loop is a proportional control loop that computes the chilled water valve's position by comparing the calculated submaster reference to the Supply Air Temperature. Units for output values shall be user configurable.

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-of-output-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	-9.0

Disabled Output Value
Use this decision to specify the output when the Equipment Status Point is off or when the Submaster sensor is invalid.

Allowable Entries	-9999.9 to 9999.9 based upon selected display units.
Default Value	0.0

Minimum Output Value
Use this decision to specify the lowest allowable output value.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units.
Default Value	0.0

Maximum Output Value
Use this decision to specify the highest allowable output value.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units.
Default Value	100.0

Center Value
Use this decision to specify the output value appropriate for the no error condition.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units.
Default Value	30.0

Block Iteration Rate
Use this decision to specify how often the submaster loop calculates a new output value.

Allowable Entries	1 to 5 seconds
Default Value	2

Power on Delay
Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Cooling Coil Valve
This decision displays the value of the AO point being controlled by this algorithm.

Application Note: The value is normally expressed as a percentage of full capacity.

Valid Display	-9999.9 to 9999.9 based upon selected display units.

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display	Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the sensor selected by the sensor group (if chosen).

Valid Display	-40.0°F to 245.0°F	(-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display	No/Yes

Setpoint Schedule
This decision displays the high setpoint from the configured Setpoint Schedule. The occupancy mode and any Setpoint Offset are taken into effect when this value is determined.

Valid Display	-50.0 to 255.0°F (-45.6 to 123.9°C)

High Humidity Switch
This decision displays the value of the high humidity switch sensor being monitored. If the decision was not configured, this value will default to the *Off* state.

Valid Display	Off/On

High Humidity Setpoint
This decision displays the high humidity setpoint for this algorithm. If the decision was not configured, this value will default to 99% RH, which will prevent any dehumidification. The algorithm obtains the occupied high setpoint from the humidity Setpoint Schedule.

Valid Display	0.0 to 100.0% RH

High Humidity Sensor
This decision displays the value of the space or return air humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display	0.0 to 100.0% RH

PID Master Loop
PID Master Loop function calculates the Submaster Reference based on the configured PID gains and the current deviation from setpoint. The calculated output is readjusted periodically to maintain the desired setpoint.

In Figure 5-4 and Appendix A Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output
This decision displays the calculated Submaster Reference that is used by the Submaster Loop to drive the Analog Output Point.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-40.0 to 245.0°F (-40.0 to 118.3°C) clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule – Sensor Group/SPT Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Sensor Group/SPT Sensor) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integrator Flags

This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active
	1 = PID Inactive
	(Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally
	1 = Integrator has been reset
Right Digit	0 = No Integrator Clamp
	1 = Integrator Clamp active

Valid Display 000 to 111

Cooling Coil Subm Ref

This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Supply Air Temperature by the Submaster Loop. To override the submaster reference, force this decision.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Supply Air Temperature

This decision displays the value of the AI point that provides the equipment's supply air temperature.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Submaster Loop

The (proportional) Submaster Loop controls to the difference between the submaster reference and the Supply Air Temperature. This loop executes every two seconds (default).

In Figure 5-3 and Appendix A Figure 23:
Setpoint = Submaster Reference
Sensor Input = Supply Air Temperature

Reference Output
This decision displays the calculated output that is used to drive the algorithm output point.

Reference Output = (Submaster Proportional Term + Submaster Center Value)

Valid Display	-9999.9 to 9999.9 based upon selected display units

Proportional Term
This decision displays the proportional error term as it is calculated by the submaster loop.

Proportional Term = (Submaster Reference - Supply Air Temperature) * Submaster Proportional Gain

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Submaster Flags
This two-digit field displays the status of the Submaster Loop.

Left Digit	0 = Submaster Loop is Active 1 = Submaster Loop is Inactive (Disabled or Output is forced)
Right Digit	0 = No PID Integrator Clamp 1 = PID Integrator Clamp Active
Valid Display	00 to 11

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every second.

Valid Display 0 to 1 second

AO—Heating CV

The AO Heating CV algorithm modulates the analog output to control a hot water or steam valve in a constant volume air handler to maintain temperature at the configured setpoint.

The AO Heating CV algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a (Proportional) Submaster Loop to control the valve. The PID Master Loop calculates the submaster reference required to maintain the low setpoint. The space temperature setpoint is increased by the Heating Setpoint Offset if dehumidification is being performed by the associated Cooling CV algorithm. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the low setpoint from the Setpoint Schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The PID Master Loop output is set to the Disabled Output Value whenever the Equipment Status Point is off or the Sensor Group/SPT Sensor status is invalid. The Submaster Loop is a proportional loop that computes the hot water or steam valve’s position by comparing the calculated submaster reference to the Supply Air Temperature. The output is set to the Disabled Output Value whenever the Supply Air Temperature status is invalid.

During dehumidification, the Heating Setpoint Offset is added to the heating setpoint.

If the Analog Output point is forced, the algorithm resets the integrator and the forced value takes precedence over the algorithm as the Analog Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied low setpoint.

The Setpoint Schedule allows for the configuration of high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the low setpoint.

The AO Heating CV algorithm allows any engineering units for the output point, but requires that the engineering units of the control sensors be in degrees (°F or °C).

List of Configuration Decisions

Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
Heating Setpoint Offset
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Supply Air Temperature
Submaster Loop
- Proportional Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Center Value
- Block Iteration Rate

Power On Delay

List of Maintenance Decisions

Heating Coil Valve
Equipment Status Point
Sensor Group/SPT Sensor
Occupied/Biased ?
Setpoint Schedule
High Humidity Switch
High Humidity Setpoint
High Humidity Sensor
PID Master Loop
- Reference Output
- Proportional Term
- Integral Term
- Derivative Term
- Integrator Flags

Heating Coil Subm Ref

(*continued*)

Supply Air Temperature
Submaster Loop
  Reference Output
  Proportional Term
  Submaster Flags
Task Timer

Configuration Decisions

Equipment Status Point
Use this decision to specify the discrete point that provides the on/off status of the equipment. The discrete point provides the actual state of the equipment. If this point is not configured or the state is Off, then the PID Master Loop output will be set to the PID Disabled Output Value.

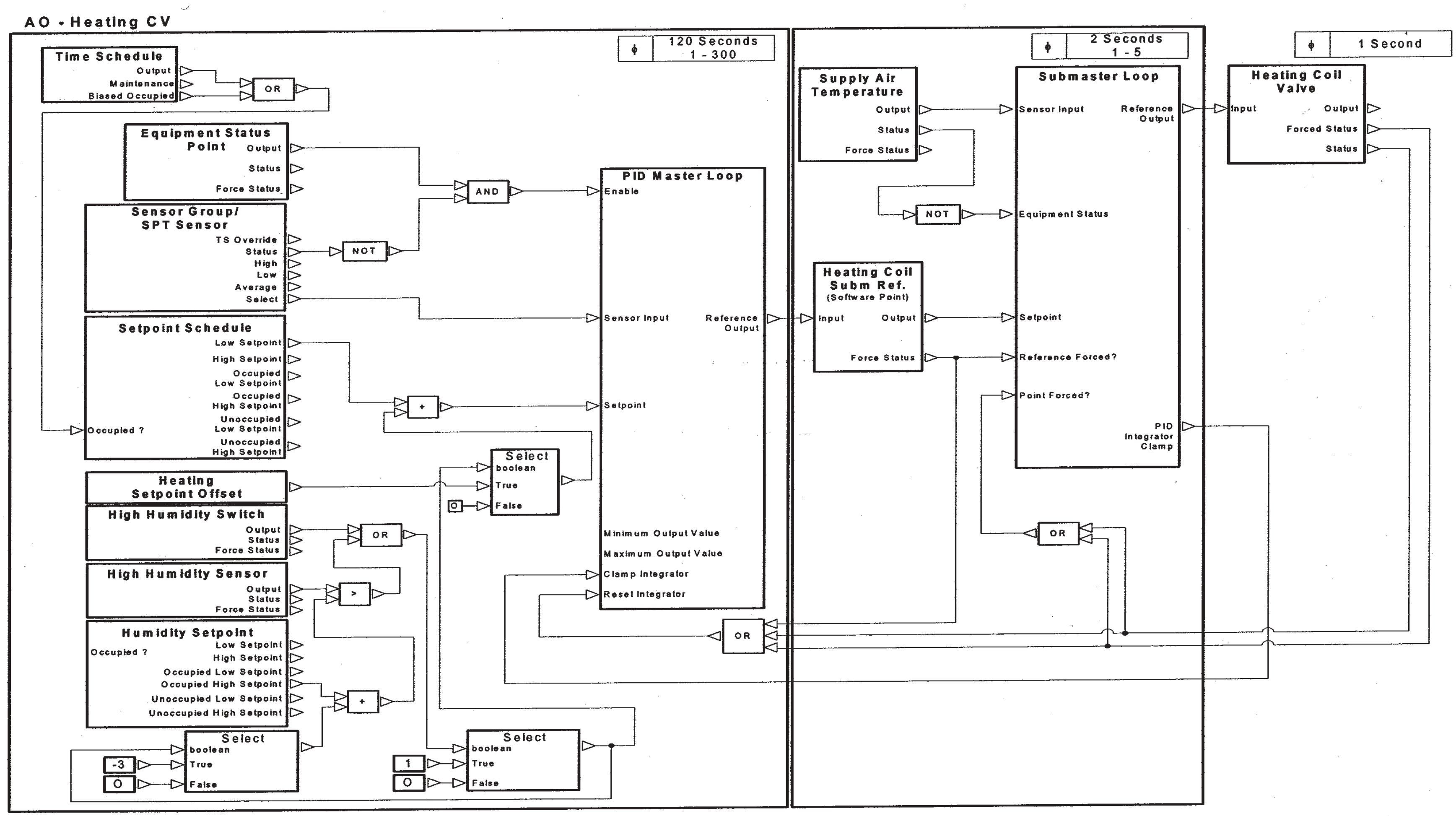
Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor
Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter. If this point is not configured, then the PID Master Loop output will be set to the PID Disabled Output Value.

Application Note: Use the same Sensor Group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Figure 5-5
AO - Heating CV



Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Application Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Application Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn* where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

Heating Setpoint Offset

If the system is performing dehumidification, use this decision to specify the offset that will be added to the low heating setpoint during dehumidification.

Allowable Entries	0.0 to 10.0^F	(0.0 to 5.6^C)
Default Value	3.0	(1.6)

High Humidity Switch

If the system is performing dehumidification, use this decision to specify the DI point that indicates when dehumidification needs to be performed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured then the Heating Setpoint Offset will not be applied during dehumidification.

Application Note: If performing dehumidification, the sensor specified here should be the same one that is specified in the associated Cooling CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

Humidity Setpoint

If the system is performing dehumidification, use this decision to specify the Setpoint Schedule that provides the humidity setpoint for this algorithm. If the decision is not configured, the high setpoint will default to 99% RH, which will prevent any dehumidification.

Application Note: If performing dehumidification, the schedule specified here should be the same one that is specified in the associated Cooling CV algorithm.

Allowable Entries	SETPT*nn*, where *nn* is 03 (humidity)
Default Value	SETPT00

High Humidity Sensor

If the system is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the occupied high setpoint from the Humidity Setpoint schedule.

Application Note: If performing dehumidification, the same setpoint that is specified here should be used in the associated Cooling CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

PID Master Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the Submaster Reference required to maintain the desired space temperature.

In Figure 5-5 and Appendix A Figure 17:
Reference Output = Submaster Reference

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain

Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain

Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision should be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value

Use this decision to specify the Submaster Reference value when the Equipment Status Point is Off or the SPT sensor becomes invalid.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	45.0	

Minimum Output Value
Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	40.0	

Maximum Output Value
Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	140.0	

Starting Value
Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	-40.0 to 245.0 °F	(-40.0 to 118.3°C)
Default Value	80.0	

Block Iteration Rate
Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	120

Supply Air Temperature
Use this decision to specify the AI point that provides the supply air temperature to this algorithm. The Supply Air Temperature is used as the Submaster Sensor Input. The submaster loop controls to the difference between the submaster reference and the value of the point specified in this decision. If this point is not configured then the Submaster Reference value shall be set to the Disabled Output Value.

Allowable Entries	Any valid point name
Default Value	POINT0

Submaster Loop

The submaster loop is a proportional control loop that computes the hot water valve's position by comparing the calculated submaster reference to the Supply Air Temperature. Units for output values shall be user configurable.

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-of-output-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	-5.5

Disabled Output Value

Use this decision to specify the output when the Supply Air Temperature sensor is invalid.

Allowable Entries	-9999.9 to 9999.9 based upon selected display units.
Default Value	0.0

Minimum Output Value

Use this decision to specify the lowest allowable output value.

Allowable Entries	-9999.9 to 9999.9 based upon selected display units.
Default Value	0.0

Maximum Output Value

Use this decision to specify the highest allowable output value.

Allowable Entries	-9999.9 to 9999.9 based upon selected display units.
Default Value	100.0

Center Value
Use this decision to specify the output value appropriate for the no error condition.

Allowable Entries	-9999.9 to 9999.9 based upon selected display units.
Default Value	30.0

Block Iteration Rate
Use this decision to specify how often the submaster loop calculates a new output value.

Allowable Entries	1 to 5 seconds
Default Value	2

Power on Delay
Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Heating Coil Valve
This decision displays the value of the AO point being controlled by this algorithm.

Application Note: The value is normally expressed as a percentage of full capacity.

Valid Display	-9999.9 to 9999.9 based upon selected display units.

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display	Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the sensor selected by the sensor group (if chosen).

Valid Display -40.0°F to 245.0°F (-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display No/Yes

Setpoint Schedule
This decision displays the low setpoint from the configured Setpoint Schedule. The occupancy mode and any Setpoint Offset are taken into effect when this value is determined.

Valid Display -50.0 to 255.0°F (-45.6 to 123.9°C)

High Humidity Switch
This decision displays the value of the high humidity switch sensor being monitored. If the decision was not configured, this value will default to the *Off* state.

Valid Display Off/On

High Humidity Setpoint
This decision displays the high humidity setpoint for this algorithm. If the decision was not configured, this value will default to 99% RH, which will prevent any dehumidification. The algorithm obtains the occupied high setpoint from the humidity Setpoint Schedule.

Valid Display 0.0 to 100.0% RH

High Humidity Sensor
This decision displays the value of the space or return air humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display 0.0 to 100.0% RH

Maintenance Decisions

PID Master Loop

PID Master Loop function calculates the Submaster Reference based on the configured PID gains and the current deviation from setpoint. The calculated output is readjusted periodically to maintain the desired setpoint. In Figure 5-4 and Appendix A, Figure 17:

Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output

This decision displays the calculated Submaster Reference that is used by the Submaster Loop to drive the Analog Output Point.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-40.0 to 245.0°F (-40.0 to 118.3°C) clamped to Minimum and Maximum Output Values

Proportional Term

This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule – Sensor Group/SPT Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integral Term

This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Sensor Group/SPT Sensor) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Derivative Term

This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integrator Flags

This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator Clamp 1 = Integrator Clamp active

Valid Display	000 to 111

Heating Coil Subm Ref

This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Supply Air Temperature by the Submaster Loop. To override the submaster reference, force this decision.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Supply Air Temperature

This decision displays the value of the AI point that provides the supply air temperature.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Submaster Loop

The (proportional) Submaster Loop controls to the difference between the submaster reference and the Supply Air Temperature. This loop executes every two seconds (default).

In Figure 5-5 and Appendix A, Figure 23,
Setpoint = Submaster Reference and
Sensor Input = Supply Air Temperature

Reference Output

This decision displays the calculated output that is used to drive the algorithm output point.

Reference Output = (Submaster Proportional Term + Submaster Center Value)

Valid Display	-9999.9 to 9999.9 based upon selected display units.

Proportional Term

This decision displays the proportional error term as it is calculated by the submaster loop.

Proportional Term = (Submaster Reference - Supply Air Temperature) * Submaster Proportional Gain

Valid Display	-9999.9 to 9999.9 based upon selected display units.

Submaster Flags

This two-digit field displays the status of the Submaster Loop.

Left Digit	0 = Submaster Loop is Active 1 = Submaster Loop is Inactive (Disabled or Output is forced)
Right Digit	0 = No PID Integrator Clamp 1 = PID Integrator Clamp Active
Valid Display	00 to 11

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every second.

Valid Display	0 to 1 second

AO—Mixed Air CV w IAQ

The AO Mixed Air CV w IAQ algorithm controls the outside air, return air, and exhaust dampers in a constant volume air handler.

When outside air conditions are unsuitable for cooling, the algorithm holds the dampers at an adjustable, minimum position. If outside air conditions are suitable for cooling, the algorithm modulates the mixed air dampers as required to maintain a space temperature to the high setpoint.

PID Master Loop and P Submaster Loop

The AO Mixed Air CV w IAQ algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a P (Proportional) Submaster Loop to control the damper position. The PID Master Loop calculates the submaster reference required to maintain the high setpoint. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the NTFC setpoint, when configured, or else to the Occupied High Setpoint from the setpoint schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. If the outside air conditions are unacceptable for cooling, the submaster reference is set to its configured maximum value. The PID Master Loop's reference output is set to the Disabled Output Value whenever the Sensor Group/SPT Sensor status is invalid. The Submaster Loop computes the damper's position by comparing the calculated submaster reference to the Mixed Air Temperature. If the equipment is off or if the Mixed Air Temperature sensor is out of range, the output is set to the configured Disabled Output Value. If unoccupied, the Minimum Output Value will be set to 0.0.

Indoor Air Quality

Indoor Air Quality (IAQ) allows the algorithm to override the damper position, thus allowing additional outside air into the building when the indoor air quality is above the configured limit. The damper position is computed every two minutes. IAQ controls the level of carbon dioxide (CO_2) by modulating the mixed air damper. Varying quantities of outdoor air are admitted during the occupied period to maintain pollutants at or below the configured setpoints of the IAQ sensors. The IAQ output value is compared to the Submaster Loop reference output and whichever is greater is used to control the damper.

CO2 sensors can be field-supplied and installed, and configured in two ways:

- One sensor can be installed in either the space or return air stream to continuously monitor a single gas.

- Two sensors can be installed inside and outside the occupied space for comparative measurements. The control is configured to modify the damper position based on the value of the sensor in the occupied space, but before admitting outside air, the control performs a differential check to determine if the value of the sensor measuring the outside air is higher. If the outside sensor has a higher CO2 value the damper is unaffected by IAQ.

Freeze Protection

The algorithm implements freeze protection for IAQ. If the Mixed Air Temperature is less than or equal to 40°F, then the Submaster Loop Minimum Output Value is compared to the IAQ output and whichever is less is used as the IAQ output value. If the Mixed Air Temperature is between 40°F and 50°F, then a freeze protection damper position is determined by resetting between the Submaster Loop Minimum Output Value and 100% and is compared to the IAQ output and whichever is less is used as the IAQ output value. If the Mixed Air Temperature is greater than or equal to 50°F then freeze protection does not apply.

If the Analog Output Point is forced, the algorithm resets the integrator and the forced value takes precedence over the algorithm as the Analog Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied high setpoint.

The Setpoint Schedule allows you to configure high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the high setpoint.

Night Time Free Cooling

NTFC with Enthalpy Check is required if the system is equipped to use outside air as a suitable source for cooling the space during night time unoccupied hours or if the system needs to modulate the dampers in either a drybulb or enthalpy type economizer operation.

The AO Mixed Air CV with IAQ algorithm allows any engineering units for the output point, but requires that the engineering units of the control sensors be in degrees (°F or °C).

Typical Application

You can use this algorithm to store excess internal heat within the structure during winter months, or to use cool outside air during summer months to the greatest possible extent. This minimizes the need for heating or mechanical cooling.

List of Configuration Decisions

Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
High Humidity Setpoint
High Humidity Sensor
NTFC Algorithm
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Mixed Air Temperature
Submaster Loop
- Proportional Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Center Value
- Block Iteration Rate

Indoor AQ Sensor PPM
Outdoor AQ Sensor PPM

(*continued*)

Indoor Air Quality
- IAQ Setpoint PPM
- Proportional Gain
- Integral Gain
- Temp & Humidity Test
- Differential Gas
- Minimum Output Value
- Maximum Output Value

Power on Delay

List of Maintenance Decisions

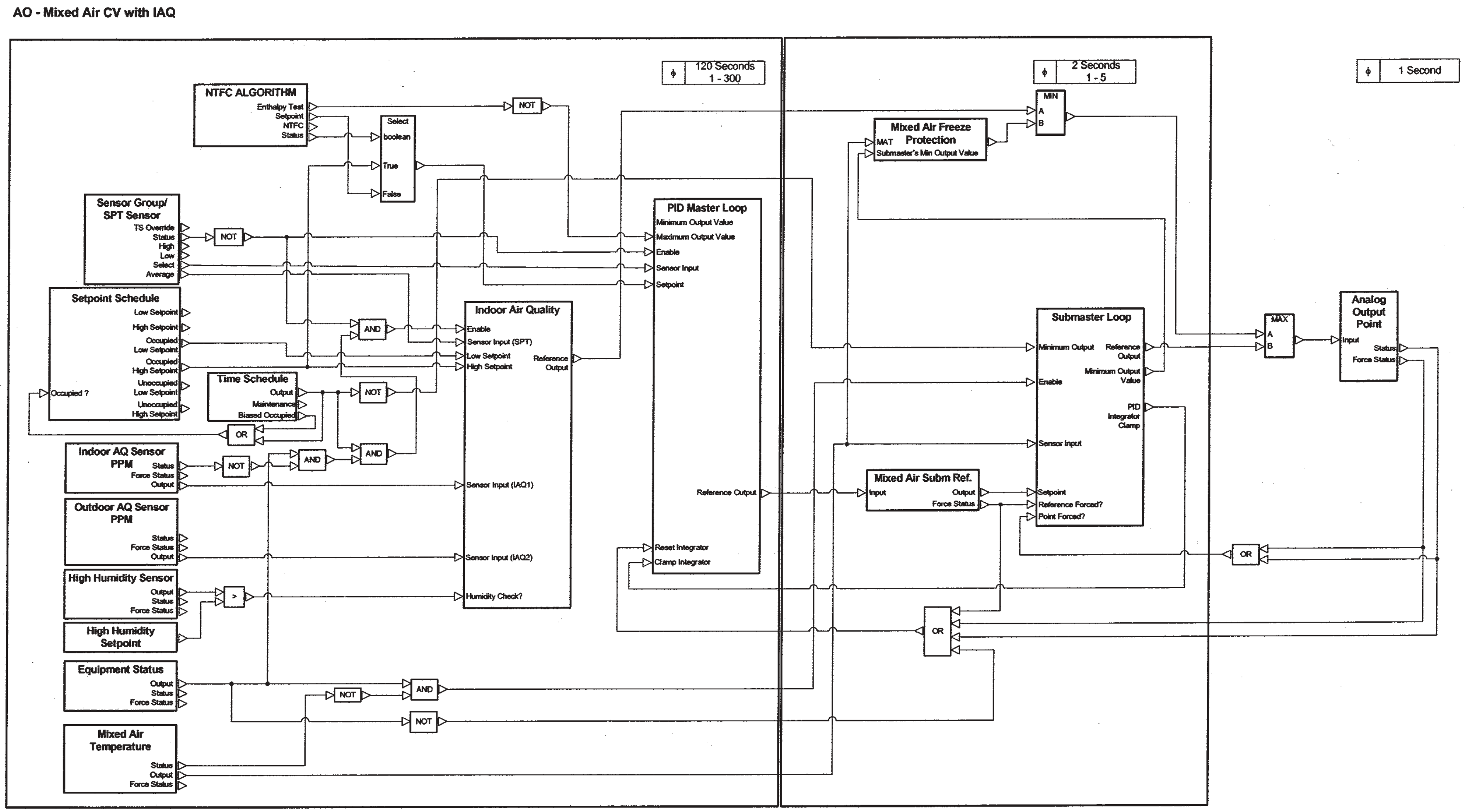
Analog Output Point
Equipment Status Point
Sensor Group/SPT Sensor
Occupied/Biased ?
High Humidity Sensor
NTFC Active?
NTFC Setpoint
Outside Enthalpy Good?
PID_Master_Loop
- Reference Output
- Proportional Term
- Integral Term
- Derivative Term
- Integrator Flags

Mixed Air CV Subm Ref
Mixed Air Temperature
Submaster_Loop
- Reference Output
- Proportional Term
- Submaster Flags

IAQ Sensor
Outdoor AQ Sensor
IAQ Setpoint
Indoor Air Quality
- Reference Output
- Proportional Term
- Integral Term
- Clamp

Task Timer

Figure 5-6
AO—Mixed Air CV w IAQ



Configurations Decisions

Equipment Status Point

Use this decision to specify the discrete point that provides the on/off status of the equipment. The discrete point provides the actual state of the equipment. If this point is not configured or the state is Off, then the Submaster Loop output will be set to the Disabled Output Value.

Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to Sensor Group section of this Algorithms chapter. If this point is not configured, then the PID Master Loop output will be set to the PID Disabled Output Value.

Note: Use the same sensor group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR00 where 00 represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm will assume to be in the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied space temperature setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn* where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01, or Setpoint Offset AI point
Default Value	SETPT00

High Humidity Setpoint

If the indoor air quality is being monitored and Temp & Humidity Test is set to *Yes*, use this decision to specify the maximum allowable return air humidity before the IAQ control routine is disabled.

Allowable Entries	0.0 to 100.0 %RH
Default Value	99.0

High Humidity Sensor

If the indoor air quality is being monitored and Temp & Humidity Test is set to *Yes*, use this decision to specify the AI point that provides the return air humidity. When the High Humidity Sensor value is greater than the High Humidity Setpoint, the IAQ control routine will be disabled. If this point is not configured then its value will be set to 0.0%.

Allowable Entries	Any valid point name
Default Value	POINT0

NTFC Algorithm

If Night Time Free Cooling will be performed or the dampers will modulate in either a drybulb or enthalpy type economizer operation, use this decision to specify the algorithm that will determine if the outside air is suitable for cooling the space. If the outside air is not suitable for cooling, the submaster reference is held to the configured Maximum Output Value. By default NTFC is enabled. To disable, change the entry to NTFC_00.

Allowable Entries	NTFC_*nn*, where *nn* is 00 or 01
Default Value	NTFC_01

PID_Master_Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the submaster reference required to achieve the desired space temperature.

In Figure 5-6 and Appendix A, Figure 17
Reference Output = Submaster Reference

Proportional Gain
Use this decision to enter the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain
Use this decision to enter the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain
Use this decision to enter the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the Submaster Reference value to be maintained when the space temperature sensor becomes invalid

Allowable Entries	-40.0 to 245.0·F	(-40.0 to 118.3·C)
Default Value	240.0	(115.6)

Minimum Output Value
Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0·F	(-40.0 to 118.3·C)
Default Value	40.0	(4.4)

Maximum Output Value

Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0·F	(-40.0 to 118.3·C)
Default Value	150.0	(65.6)

Starting Value

Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled.

Allowable Entries	-40.0 to 245.0·F	(-40.0 to 118.3·C)
Default Value	65.0	(18.3)

Block Iteration Rate

Use this decision to specify how often the PID Master Loop calculates the Submaster Reference.

Allowable Entries	1 to 300 seconds
Default Value	120

Mixed Air Temperature

Use this decision to specify the AI point that provides the mixed air temperature to this algorithm. The submaster loop controls to the point that you specify in this decision. If this point is not configured then the Submaster Reference value shall be set to the Disabled Output Value.

Allowable Entries	Any valid point name
Default Value	POINT0

Submaster_Loop

The submaster loop is a proportional control loop that computes the outside air, return air, and exhaust damper positions by comparing the calculated submaster reference (mixed air temperature setpoint) to the Mixed Air Temperature. The damper positions will be controlled by the Indoor Air Quality control or the Submaster Loop (temperature control), depending on whose calculated output value is higher. Units for output values are user-configurable.

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	-9.0

Disabled Output Value

Use this decision to specify the output to the dampers when the Equipment Status Point is off or when the Mixed Air Temperature sensor is invalid.

Allowable Entries	-9999.9 to 9999.9 Valid range based upon selected display units.
Default Value	0.0

Minimum Output Value

Use this decision to specify the lowest allowable output to the outside air, return air, and exhaust dampers. During the unoccupied state, the Minimum Output Value is overridden to *0*, thus allowing the dampers to fully close.

Allowable Entries	-9999.9 to 9999.9 Valid range based upon selected display units.
Default Value	0.0

Maximum Output Value

Use this decision to specify the highest allowable output to the outside air, return air, and exhaust dampers.

Allowable Entries	-9999.9 to 9999.9 Valid range based upon selected display units.
Default Value	100.0

Center Value

Use this decision to specify the output value appropriate for the no error condition.

Allowable Entries	-9999.9 to 9999.9 Valid range based upon selected display units.
Default Value	30.0

Block Iteration Rate

Use this decision to specify how often the submaster loop calculates a new output value.

Allowable Entries	1 to 5 seconds
Default Value	2

Indoor AQ Sensor PPM

If the indoor air quality is being monitored, use this decision to specify the indoor air quality sensor. If this sensor is not configured then the Indoor Air Quality output will be set to 0.0.

Allowable Entries	Any valid point name
Default Value	POINT0

Outdoor AQ Sensor PPM

If Differential Gas is configured to *Yes*, use this decision to specify the outdoor air quality sensor.

Allowable Entries	Any valid point name
Default Value	POINT0

Indoor Air Quality

Indoor Air Quality is a proportional and integral control loop that compares the IAQ setpoint to the IAQ sensors in order to compute the return air, outside air, and exhaust air damper positions. The damper positions will be controlled by the Indoor Air Quality or the Submaster Loop, depending on whose calculated output value is higher.

IAQ Setpoint PPM

Use this decision to specify the Indoor Air Quality setpoint.

Allowable Entries	0 to 2000 PPM
Default Value	1000

Proportional Gain

Use this decision to enter the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-1.00 to 1.00
Default Value	0.10

Integral Gain
Use this decision to enter the value that is multiplied by the error plus the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-1.00 to 1.00
Default Value	0.03

Temp & Humidity Test
Use this decision to disable the IAQ control routine if either the space temperature setpoint or High Humidity Setpoint is exceeded.

Allowable Entries	No/Yes
Default Value	No

Differential Gas
Use this decision to indicate if the outside air is being tested to determine its suitability for use. If the Outdoor AQ Sensor value (outside air quality sensor value) is greater than the Indoor AQ Sensor value (indoor air quality value), the IAQ control routine will be disabled.

Allowable Entries	No/Yes
Default Value	No

Minimum Output Value
Use this decision to specify the lowest allowable output to the mixed air damper for the IAQ control routine.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units.
Default Value	0.0

Maximum Output Value
Use this decision to specify the highest allowable output to the mixed air damper for the IAQ control routine.

Allowable Entries	-9999.9 to 9999.9 range based upon selected display units.
Default Value	50.0

Power on Delay
Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Analog Output Point
This decision displays the value of the AO point being controlled by this algorithm. This value is normally expressed as a percentage of full capacity.

Valid Display	-9999.9 to 9999.9 Valid range based upon selected display units.

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display	Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the average of the Sensor Group (if chosen).

Valid Display	-40.00 to 245.00°F	(-40.00 to 118.30°C)

Occupied/Biased ?
This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be Occupied and *Yes* will be displayed.

Valid Display	No/Yes

High Humidity Sensor
This decision displays the value of the return air humidity sensor being monitored. If this value exceeds the High Humidity Setpoint, the IAQ control routine will be disabled.

Valid Display	0.00 to 100.00% RH

NTFC Active?
This decision indicates when Night Time Free Cooling is active. If the NTFC w Enthalpy Check algorithm was not selected as part of the configuration, Night Time Free Cooling will be inactive and *No* will be displayed.

Valid Display No/Yes

NTFC Setpoint
This decision displays the space temperature setpoint provided by Night Time Free Cooling, taking into account any Setpoint Offset , or by the Setpoint Schedule

Valid Display -50.00 to 255.00°F (-45.6 to 123.9°C)

Outside Enthalpy Good?
This decision indicates when the outside air is suitable for cooling. If the value displayed in this decision is *No*, the submaster reference is maintained at its configured maximum value.

Valid Display No/Yes

PID Master Loop
The PID Master Loop function calculates the Sub master Reference based on the configured PID gains and the current deviation from setpoint. The calculated output is re-adjusted periodically to maintain the desired setpoint.

In Figure 5-6 and Appendix A, Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output
This decision displays the calculated Submaster Reference that is used by the Submaster Loop to drive the Analog Output point.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C) clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint - Sensor Group/SPT Sensor) * Proportional Term

Valid Display	-9999.9 to 9999.9 (-5555.5 to 5555.5°C)

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = (Setpoint - Sensor Group/SPT Sensor) * Integral Gain + Previous Integral Term

Valid Display	-9999.9 to 9999.9 (-5555.5 to 5555.5°C)

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain

Note: Error = (Setpoint - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9 (-5555.5 to 5555.5°C)

Integrator Flags
This three digit field displays the status for the PID Master Loop.

Left Flag	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Flag	0 = Integrator calculating normally 1 = Integrator has been reset
Right Flag	0 = No Integrator Clamp 1 = Integrator Clamp Active
Valid Display	000 to 111

Mixed Air CV Subm Ref

This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Mixed Air Temperature by the Submaster Loop. To override the submaster reference, force this decision.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3·C)

Mixed Air Temperature

This decision displays the value of the AI point that provides the mixed air temperature.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3·C)

Submaster_Loop

The P (proportional) Submaster Loop controls to the difference between the submaster reference and the Mixed Air Temperature. This loop executes every two seconds (default).

In Figure 5-6 and Appendix A, Figure 23:
Setpoint = Submaster Reference
Sensor Input = Mixed Air Temperature

Reference Output

This decision displays the calculated output that is used to determine the algorithm's output point.

Reference Output = (Submaster Proportional Term + Submaster Center Value)

Valid Display -9999.9 to 9999.9
Valid range based upon selected display units.

Proportional Term

This decision displays the proportional error term as it is calcu lated by the submaster loop.

Proportional Term = (Submaster Reference - Mixed Air Tem perature) * Submaster Proportional Gain

Valid Display -9999.9 to 9999.9
Valid range based upon selected display units.

Submaster Flags

This two-digit field displays the status of the Submaster Loop.

Left Digit	0 = Submaster Loop is Active 1 = Submaster Loop is Inactive (Dis abled or Clamped)
Right Digit	0 = No PID clamp 1 = PID Clamp Active
Valid Display	00 to 11

Indoor AQ Sensor

This decision displays the value of the indoor air quality in parts per million (ppm).

Valid Display -9999.9 to 9999.9

Outdoor AQ Sensor

This decision displays the value of the outdoor air quality in parts per million (ppm).

Valid Display -9999.9 to 9999.9

IAQ Setpoint

This decision displays the value of the configured indoor air quality setpoint in parts per million (ppm).

Valid Display 0.0 to 2000.0

IAQ Quality

This function monitors the indoor air quality, and if desired, the outdoor air quality. This loop executes every minute.

Reference Output

This decision displays the calculated output that is used to determine the algorithm's output point value. The algorithm's output point value will be either that of the Submaster Loop's Reference Output or the value displayed in this decision, depending on which is higher.

Reference Output = (Proportional Term + Integral Term)

Valid Display	-9999.9 to 9999.9 Valid range based upon selected display units.

Proportional Term

This decision displays the proportional error term as it is calcu lated by the IAQ Submaster Loop.

Proportional Term = (IAQ Setpoint - IAQ Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9 Valid range based upon selected display units.

Integral Term

This decision displays the integral error term as it is calculated by the IAQ Submaster Loop.

Integral Term = (IAQ Setpoint - IAQ Sensor) * Integral Gain + Previous Integral Term

Valid Display	-9999.9 to 9999.9 Valid range based upon selected display units.

Clamp

This decision displays whether the IAQ control routine is being clamped. The clamp is set whenever the output is less than the minimum output value or greater than the maximum output value.

Valid Display Off/On

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every second.

Valid Display 0 to 1 seconds

AO—Permissive Interlock

The AO Permissive Interlock algorithm overrides the value of an Analog Output point. The algorithm bases its decision on the current state of the Discrete Control Point compared to a configured state or the current value of the Analog Control Point compared to a setpoint.

Four AO Permissive Interlocks with no units are provided as system tables and are made available after the factory software download.

If you configure the Control Point Type decision to be discrete and the Discrete Control Point is equal to the configured Occupied or Unoccupied Discrete State for the Persistence Time, the algorithm forces the Analog Output Point to the Override Value. When the Discrete Control Point is no longer equal to the configured Occupied or Unoccupied Discrete State for the Persistence Time, the algorithm sets the Analog Output Point to automatic control.

If you configure the Control Point Type decision to be analog and the Analog Control Point is higher or lower (based on the Occupied or Unoccupied Analog Test decision) than the configured low setpoint for the Persistence Time, the algorithm forces the Analog Output Point to the Override Value. If this condition is not true applying the configured Hysteresis for the Persistence Time, the algorithm sets the Analog Output Point to automatic control.

The algorithm supports two levels of forcing (Force Precedence) to enable the user to configure two Permissive Interlocks to control the same point. The Force Precedence value indicates whether the algorithm has high (Control) or low (BEST) precedence over the controlled point.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoint and indicates the test conditions used to override the point. If a Time schedule is not configured for this algorithm, the algorithm will default to the occupied state.

The AO Permissive Interlock algorithm will be preset to no analog engineering units for the control sensors, and for the output point.

Typical Application

This algorithm can be used to control a preheat coil’s two-way steam valve. For example, when the outside air temperature is above 38°F, the valve would be forced closed. When the outside air temperature is below 38°F, the force would be removed so that the valve could be modulated to maintain a 45°F setpoint.

List of Configuration Decisions

The following decisions are applicable to this algorithm.

Analog Output Point
Time Schedule
Occupied Setpoint
Unoccupied Setpoint
Permissive Interlock
- Control Point Type
- Occ Discrete State
- Unocc Discrete State
- Occ Analog Test
- Unocc Analog Test
- Override Value
- Hysteresis
- Persistence Time
- Force Precedence

Analog Control Point
Discrete Control Point
Power on Delay

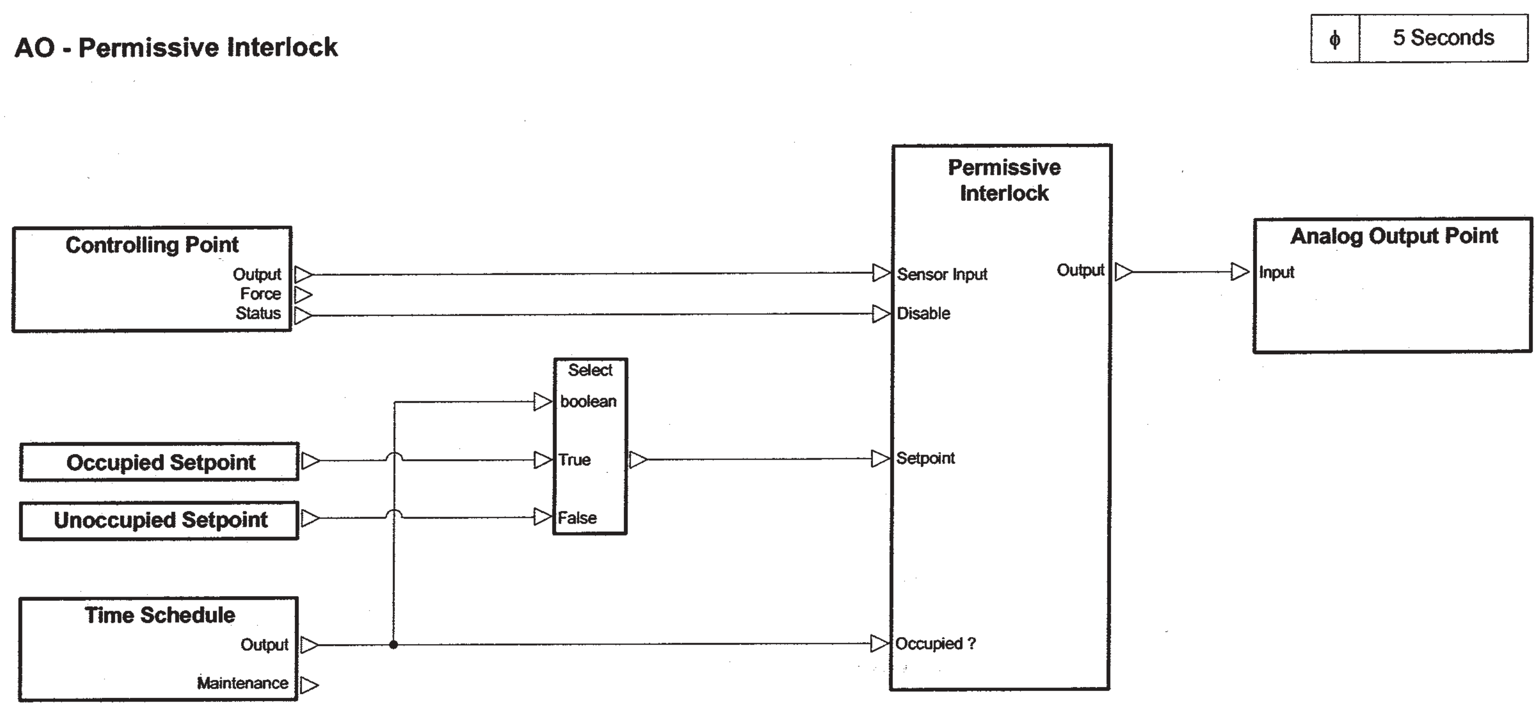
List of Maintenance Decisions

The following maintenance decisions are applicable to this algorithm.

Analog Output Point
Occupied?
Permissive Interlock
- Reference Output
- Perm Interlock Flag
- Conditional
- Modified Setpoint
- Persistence Timer
- Force Precedence

Analog Control Point
Discrete Control Point
Task Timer

Figure 5-7
AO—Permissive Interlock



Configuration Decisions

Analog Output Point

Use this decision to specify the AO point that will be overridden when the test conditions have been met for the configured Persistence Time. Valid entry is required for the algorithm to operate.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm will assume to be in the occupied state.

Application Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99, or LINK_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Occupied Setpoint

If the Control Point Type decision is set to *Analog*, use this decision to specify the Occupied Setpoint (no units) that provides the occupied setpoint to which the controlling point will be compared.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Unoccupied Setpoint

If the Control Point Type decision is set to *Analog*, use this decision to specify the Unoccupied Setpoint (no units) that provides the unoccupied setpoint to which the controlling point will be compared.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Permissive Interlock
Permissive Interlock determines if the Analog Output Point should be forced to the configured override value when the input conditions are met.

Control Point Type
Use this decision to define whether the Control Point is an analog or discrete type point.

Allowable Entries	Analog/Discrete
Default Value	Analog

Occ Discrete State
If the Control Point Type is discrete, use this decision to define the input state when the Time Schedule is occupied that will cause the Analog Output Point to be overridden.

Allowable Entries	Off/On
Default Value	On

Unocc Discrete State
If the Control Point Type is discrete, use this decision to define the input state when the Time Schedule is unoccupied that will cause the Analog Output Point to be overridden.

Allowable Entries	Off/On
Default Value	Off

Occ Analog Test
If the Control Point Type is analog, use this decision to indicate if the Analog Control Point must be higher or lower than the occupied low setpoint in order to override the Analog Output Point.

Allowable Entries	Low/High
Default Value	High

Unocc Analog Test
If the Control Point Type is analog, use this decision to indicate if the Analog Control Point must be higher or lower than the unoccupied low setpoint in order to override the Analog Output Point.

Allowable Entries	Low/High
Default Value	Low

Override Value

Use this decision to specify the value to which the Analog Output Point is forced when the proper input condition for the configured Persistence Time exists.

Allowable Entries	-9999.9 to 9999.9 (No units assigned)
Default Value	0.0

Hysteresis

If the Control Point Type is analog, use this decision to specify the value above or below the setpoint (based upon the analog test) that the Analog Control Point must be before the override is released.

Allowable Entries	0.0 to 9999.9
Default Value	1.0

Persistence Time

Use this decision to indicate how long the input condition must exist before the Analog Output Point is overridden or how long the input condition must not exist before the Analog Output Point is returned to automatic control.

Allowable Entries	0 to 3600 seconds
Default Value	30

Force Precedence

Use this decision to configure the Force Precedence for the Permissive Interlock algorithm: Low (BEST) or High (Control).

Note: If two permissive interlocks are used, each must have a different force precedence state.

Allowable Entries	Low/High
Default Value	Low

Analog Control Point

Use this decision to configure the analog point that the algorithm tests to determine if the Analog Output Point should be overridden. If this decision is not configured, the Analog Control Point value is set to 0.0 and the algorithm is disabled.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Control Point

Use this decision to configure the discrete point that the algorithm tests to determine if the Analog Output Point should be overridden. If this decision is not configured, the Discrete Control Point state is set to Off and the algorithm is disabled.

Allowable Entries	Any valid point name
Default Value	POINT0

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Analog Output Point

This decision displays the output value of the AO point being controlled by this algorithm.

Valid Display	-9999.9 to 9999.9 (no units assigned)

Occupied ?

This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Yes*.

Valid Display	No/Yes

Permissive Interlock

This function determines if a configured condition has occurred, and if so, the Output point is overridden and set equal to the Reference Output, until the causal condition no longer exists.

Reference Output

This decision displays the configured Override Value when it is applied to the Analog Output Point.

Valid Display	-9999.9 to 9999.9

Perm Interlock Flag

This decision indicates whether Permissive Interlock is in effect.

Valid Display	False/True

Conditional
This decision displays the current analog conditional value (High or Low) based on the Occupancy state.

Valid Display Low/High

Modified Setpoint
This decision displays the modified Setpoint Value that is currently being used to compare with the Analog Control point. It includes a configured hysteresis, and allows for the conditional check being performed (High or Low). This value will be *0* if the Control Point Type is discrete.

Valid Display -9999.9 to 9999.9

Persistence Timer
This decision displays how much time is left before the Permissive Interlock condition will take effect.

Valid Display 0 to 3600 seconds

Force Precedence
This decision displays the configured Force Precedence used by the Permissive Interlock algorithm to control (override) the output point.

Valid Display Low/High

Setpoint Limit
This decision displays the setpoint that is being compared to determine if the Permissive Interlock condition will take effect.

Valid Display -9999.9 to 9999.9

Analog Control Point
This decision displays the value of the configured Analog Point which is being used to determine when the Permissive Interlock will occur when the Control Point Type is analog.

Valid Display -9999.9 to 9999.9

Discrete Control Point
This decision displays the value of the configured Discrete Point which is being used to determine when the Permissive Interlock will occur when the Control Point Type is discrete.

Valid Display Off/On

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every five seconds.

Valid Display 0 to 5 seconds

AO—Slave Point

An AO slave point can be controlled by a Permissive Interlock. It has no control algorithm of its own.

An AO slave point can also be controlled as a Network Output point of another controller.

If the Analog Output Point is forced, the forced value takes precedence over any algorithm as the Analog Output value.

A slave point has no algorithm configuration or maintenance decisions.

DO—Analog Comparison

The DO Analog Comparison algorithm compares the lowest and highest control sensor values to the configured low and high setpoints. This algorithm can function with a single Control Sensor or a Sensor Group with multiple sensors. In the case of a single Control Sensor the lowest and highest Control Sensor values are the same. If either low or high sensor value is outside of the setpoint range, the output point is commanded on. When both sensors are within the region bordered by low setpoint plus hysteresis and high setpoint minus hysteresis, the output point is commanded off.

If the Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows you to configure high and low setpoints for both occupied and unoccupied states.

The DO Analog Comparison algorithm allows any engineering units for the control sensors. The algorithm's output discrete units are the same as the units for the Discrete Output Point.

Typical Application

You can use this algorithm to start a hot water pump when the outside air temperature is below 50°F and stop the pump when the outside air temperature is above 51°F.

List of Configuration Decisions

Time Schedule
Setpoint Schedule
Analog
- Hysteresis
- Block Iteration Rate

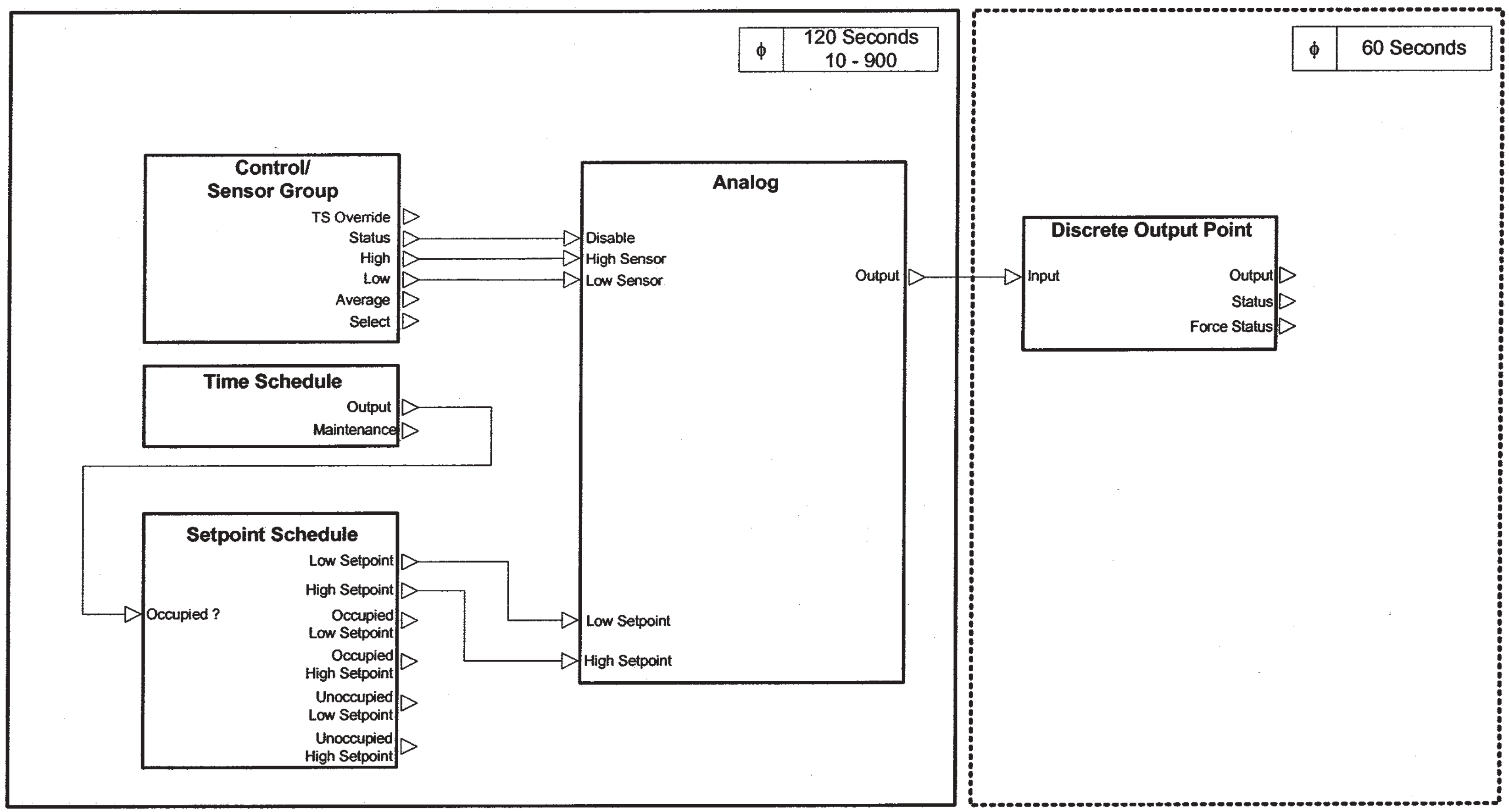
Power on Delay

List of Maintenance Decisions

Discrete Output Point
Sensor Group/SPT Sensor
Low Control Sensor
High Control Sensor
Occupied?
Analog
- Reference Output
- Hysteresis
- Low Setpoint
- High Setpoint
- Low Sensor Region
- High Sensor Region
- Task Timer

Figure 5-8
DO—Analog Comparison

DO - Analog Comparison



Configuration Decisions

Control/Sensor Group

Use this decision to specify the Control Sensor or Sensor Group that is providing the low and high control input. Default Sensor Group usage is disabled for this algorithm. That is, if the SNSGR*nn* name is entered then it shall provide the low and high control inputs. If this point is not configured then the output point will be commanded Off.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01.
Default Value	SNSGR*00* where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm defaults to the occupied state.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99 or LINK_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00 where 00 represents an invalid schedule number

Setpoint Schedule

Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints for this algorithm. If this decision does not contain a valid Setpoint Schedule name the defaults listed in Appendix B will be utilized.

Allowable Entries	SETPT*nn* where *nn* is from 01 to 04, LINK_01,
OPSS_01 or	Setpoint Offset AI point
Default Value	SETPT*00* where *00* represents an invalid schedule number

Analog

Analog controls a discrete output by comparing the highest and lowest space sensor values to the configured setpoint values.

Hysteresis

Use this decision to specify the amount that is added to the low setpoint and subtracted from the high setpoint to create the ranges for turning the point off.

Allowable Entries	0.0 to 9999.9 valid range is based on the selected display units
Default Value	1.0

Block Iteration Rate

Use this decision to specify how often the input conditions are checked to determine if the output state must change.

Allowable Entries	60 to 900 seconds
Default Value	120

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point

This decision displays the actual state of the DO point being controlled by this algorithm.

Valid Display	Actual discrete text of the Discrete Output point

Sensor Group/SPT Sensor

This decision displays either the value of the single AI sensor or the average value of the sensor group.

Valid Display	-40.0 to 245.0°F (-40.0 to 118.3°C)

Low Control Sensor
This decision displays the value of the single sensor or the lowest of the sensor group, depending on which is selected.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

High Control Sensor
This decision displays the value of the single sensor or the highest of the sensor group, depending on which is selected.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Occupied ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, the default mode will be *Yes*.

Valid Display	No/Yes

Analog
Analog displays the current controlling setpoint data and Sensor Regions, based on the occupancy mode.

Reference Output
This decision displays the calculated output state that is used to drive the Discrete Output Point.

Valid Display	False/True

Hysteresis
This decision displays the amount that is added to the low setpoint and subtracted from the high setpoint.

Valid Display	0.0 to 9999.9 units range based upon selected display units

Low Setpoint

This decision displays the low setpoint value, excluding Hysteresis. If the Low Control Sensor falls below this value, the Discrete Output Point will be commanded on.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

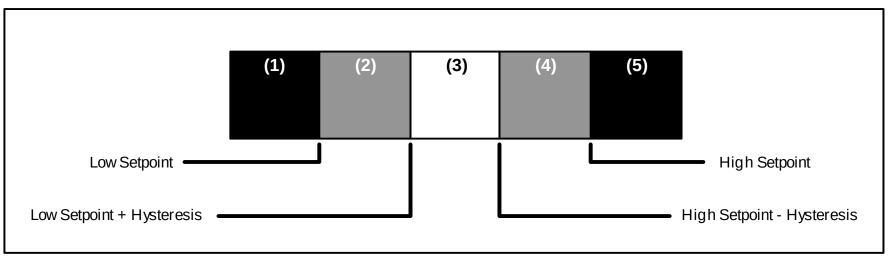
High Setpoint

This decision displays the High Setpoint value, excluding Hysteresis. If the High Control Sensor exceeds this value, the Discrete Output Point will be commanded on.

Valid Display	-9999.9 to 9999.9 range based upon selected display units

Low Sensor Region

This decision displays the temperature region of the single AI sensor or the lowest of the Sensor Group, depending on which is selected, where the regions are defined as follows, with 0 displayed when the algorithm is inactive.



Valid Display	0 to 5

High Sensor Region

This decision displays the temperature region of the single AI sensor or the highest of the Sensor Group, depending on which is selected, where the regions are defined above, with 0 displayed when the algorithm is inactive.

Valid Display	0 to 5

Task Timer

This decision displays the number of seconds remaining before the algorithm executes again. This algorithm will execute every 60 seconds.

Valid Display	0 to 60 seconds

DO—Electric Heat CV

The DO Electric Heat CV algorithm controls up to eight stages of electric heat in a constant volume system.

The Electric Heat CV algorithm uses a PID (Proportional Integral Derivative) Master Loop to control the output stages. The PID Master Loop calculates the percent of heating capacity required to maintain the desired space temperature setpoint. The PID Master Loop calculates the required number of output stages by obtaining the space temperature from the Sensor Group/SPT Sensor and comparing it to the low temperature setpoint configured in the Setpoint Schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The space temperature setpoint is increased by the Heating Setpoint Offset when dehumidification is being performed. The stages are activated sequentially, allowing for a configured delay time between each stage. Once a stage is activated, it will not be de-activated until the calculated number of stages has decreased by a full stage. This hysteresis prevents short cycling of stages. While the time delay of a newly activated stage is active, that is while waiting for it to have an effect on the controlled space temperature, the algorithm clamps the PID Master Loop integrator at its current value.

If the Equipment Status Point is off, all stages of electric heat are turned off. If the Sensor Group Status is invalid, the PID Master Loop sets the output to the Disabled Output Value. If the Duct Temperature input exceeds the configured Duct High Limit, the PID Master Loop sets the output to the Minimum Output Value.

If the Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value, but the algorithm will not be effected.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows you to configure high and low space temperature setpoints for both occupied and unoccupied states. The algorithm uses the low setpoint.

The DO Electric Heat CV algorithm limits engineering units for the control sensors to humidity and temperature. The algorithm's output discrete units are the same as the units for the Discrete Output Point.

Note that the Discrete Output Point that is controlling the first stage of electric heating has been specified as the default for the algorithm, that is, it is the point whose algorithm is now being configured.

Typical Application

You can use this algorithm to control up to eight stages of electric heat in a constant volume system.

List of Configuration Decisions

Discrete Output Point 2
Discrete Output Point 3
Discrete Output Point 4
Discrete Output Point 5
Discrete Output Point 6
Discrete Output Point 7
Discrete Output Point 8
Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
Duct Temperature
Duct High Limit
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Heating Setpoint Offset
Staging Control
- Total Number of Stages
- On Time Delay
- Off Time Delay

Power on Delay

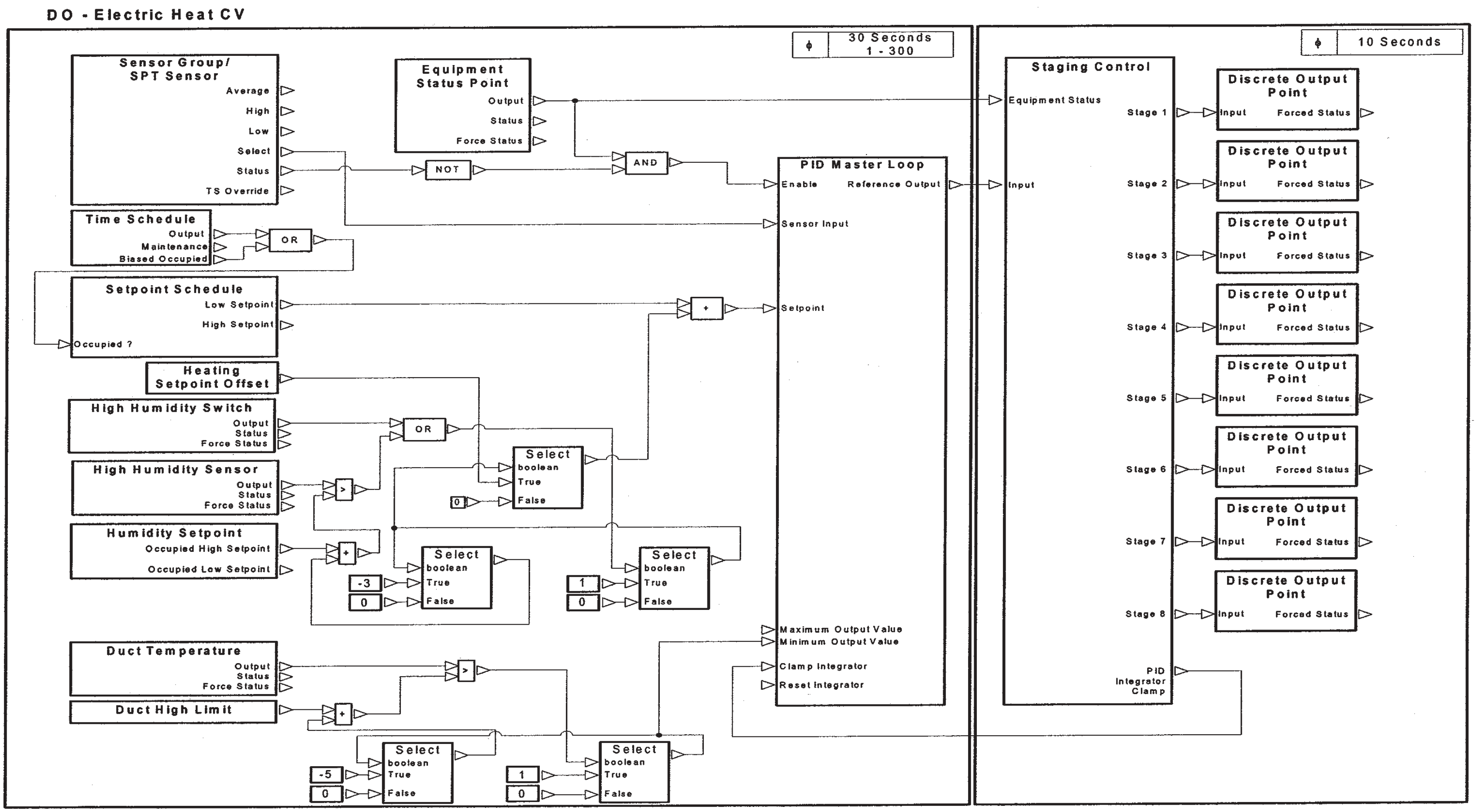
List of Maintenance Decisions

Discrete Output Point 1
Discrete Output Point 2
Discrete Output Point 3
Discrete Output Point 4
Discrete Output Point 5
Discrete Output Point 6
Discrete Output Point 7
Discrete Output Point 8
Equipment Status Point
Sensor Group/SPT Sensor
Occupied/Biased?
High Humidity Switch
High Humidity Setpoint
High Humidity Sensor
Duct Temperature
Duct High Limit
PID_Master_Loop
- Reference Output
- Proportional Term
- Integral Term
- Derivative Term
- Integrator Flags

Setpoint Schedule
Staging Control
- Number of Stages
- Requested Stages
- Delta Stages
- Delay Timer
- PID Integrator Clamp

Task Timer

Figure 5-9
DO—Electric Heat CV



Configuration Decisions

Discrete Output Point 2
You must configure this decision to specify the DO point that is controlling the second stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 3
Use this decision to specify the DO point that is controlling the third stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 4
Use this decision to specify the DO point that is controlling the fourth stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 5
Use this decision to specify the DO point that is controlling the fifth stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 6
Use this decision to specify the DO point that is controlling the sixth stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 7
Use this decision to specify the DO point that is controlling the seventh stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 8

Use this decision to specify the DO point that is controlling the eighth stage of electric heating.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status Point

You must configure this decision to specify the Discrete point that provides the on/off status of the equipment. If this point is not configured or the state is Off, then all stages of electric heat shall be turned off.

Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor

You must configure this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. If this point is not configured then the PID Master Loop output will be set to the PID Disabled Output value.

Note: Use the same Sensor Group or SPT Sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm defaults to the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *xx* is from 01 to 99, LINK_01, or OPSS_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00

Setpoint Schedule
You must configure this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If this decision does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn* where *nn* is 01 to 02 (temperature), LINK_01, OPSS_01, or Setpoint Offset AI point
Default Value	SETPT00

High Humidity Switch
If the equipment is performing dehumidification, use this decision to specify the DI point that indicates when dehumidification is needed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured then the Heating Setpoint Offset will not be applied during dehumidification.

Note: If reheat is being performed, the schedule specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT 0

Humidity Setpoint
If the air handler is performing dehumidification, use this decision to specify the Setpoint Schedule that provides the humidity setpoint for this algorithm.

Note: If dehumidification is being performed, the schedule that is specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	SETPT*nn* where *nn* is 03 (humidity)
Default Value	SETPT00

High Humidity Sensor
If the air handler is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the high setpoint from Humidity Setpoint schedule. If this point is not configured, then its value will be set to 0.0%.

Note: If reheat is being performed, the sensor specified here should be the same one that is specified in the associated Cooling CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

Duct Temperature
Use this decision to specify the AI point that is used as a safety to prevent the duct temperature from exceeding the Duct High Limit. If this point is not configured then the value will be set to 0.0°F.

Allowable Entries	Any valid point name
Default Value	POINT0

Duct High Limit
Use this decision to specify a maximum duct temperature before the PID Master Loop output is clamped to the Minimum Output Value.

Allowable Entries	80.00 to 245.00°F	(26.7 to 118.3°C)
Default Value	150.00	(65.6)

PID Master Loop
The master loop is a Proportional Integral Derivative (PID) control loop that calculates the percent of heating stages required to achieve the desired setpoint.

Proportional Gain
Use this decision to enter the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	5.0

Integral Gain

Use this decision to enter the value that is multiplied by the error plus the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error per unit of time.

Allowable Entries	-100.0 to 100.0
Default Value	0.4

Derivative Gain

Use this decision to enter the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of delta error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value

Use this decision to specify the percent of stage requested when the equipment is off, or the SPT sensor becomes invalid.

Note: This decision should always be set to 0.0%.

Allowable Entries	0.0 to 100.0%
Default Value	0.0

Minimum Output Value

Use this decision to specify the minimum percent of stages that will always be activated. The output will equal this value if the Duct Temperature exceeds the High Duct Limit.

Allowable Entries	0.0 to 100.0%
Default Value	0.0

Maximum Output Value

Use this decision to specify the maximum percent of stages that can be activated.

Allowable Entries	0.0 to 100.0%
Default Value	100.0

Starting Value

Use this decision to specify the percent of stages that will be activated when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	0 to 100.0%
Default Value	0.0

Block Iteration Rate

The value in this decision indicates how often the PID Master Loop calculates the percentage of heating stages.

Allowable Entries	10 to 300 seconds
Default Value	30

Heating Setpoint Offset

If the system is performing dehumidification, use this decision to specify how much the space temperature setpoint is offset during dehumidification.

Allowable Entries	-10.00 to 10.00^F	(-5.5 to 5.6^C)
Default Value	3.00	(1.7)

Staging Control

Staging Control starts and stops up to eight discrete stages of electric heating based on the PID Master Loop Reference Output, whose value can range from 0 to 100%. You can configure the minimum time between starting and stopping stages.

Total Number of Stages

You must configure this decision to specify the number of discrete stages of electric heating the algorithm will control.

Allowable Entries	1 to 8
Default Value	8

On Time Delay

Use this decision to specify the minimum time delay between the starting of stages. This value should represent the time required by a newly activated stage to have its effect on the space temperature.

Allowable Entries	0 to 30 minutes
Default Value	1

Off Time Delay

Use this decision to specify the minimum time delay between the stopping of stages. This value should represent the time from when the algorithm stops the stage to the time there is an effect on the controlled space temperature.

Allowable Entries	0 to 30 minutes
Default Value	0

Power on Delay

Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point 1

This decision displays the value of the point controlling the first stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 2

This decision displays the value of the point controlling the second stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 3

This decision displays the value of the point controlling the third stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 4

This decision displays the value of the point controlling the fourth stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 5
This decision displays the value of the point controlling the fifth stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 6
This decision displays the value of the point controlling the fifth stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 7
This decision displays the value of the point controlling the fifth stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Discrete Output Point 8
This decision displays the value of the point controlling the fifth stage of electric heating.

Valid Display	Actual discrete text of Discrete Output Point 1

Equipment Status Point
This decision displays the actual state of the air equipment, which determines whether this algorithm is enabled.

Valid Display	Off/On (Off=0, On=1)

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the lowest sensor in the sensor group (if chosen).

Valid Display	-40.00 to 245.00°F	-40.00 to 118.33°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Yes*.

Valid Display	No/Yes

High Humidity Switch
This decision displays the value of the high humidity switch sensor being monitored. If this decision is not configured, this value will default to the Off state.

Valid Display Off/On

High Humidity Setpoint
This decision displays the high humidity setpoint for this algorithm. If the decision was not configured, this value will default to 99% RH, which will prevent any dehumidification. The algorithm uses the occupied high setpoint from the High Humidity schedule.

Valid Display 0.00 to 100.00% RH

High Humidity Sensor
This decision displays the value of the space or return air humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display 0.00 to 100.00% RH

Duct Temperature
This decision displays the duct temperature sensor value used as a safety value to prevent exessive duct temperatures.

Valid Display -40.00 to 245.00°F (-40.00 to 118.3°C)

Duct High Limit
This decision displays the maximum duct temperature, that, if exceeded, will cause the PID Master Loop output to clamp to the minimum output value.

Valid Display -80.00 to 245.00°F (26.6 to 118.3°C)

PID_Master_Loop
The PID Master Loop function calculates the desired % of heating capacity based on the configured PID gains and the current deviation from setpoint. The calculated output is re-adjusted periodically to maintain the desired setpoint.

In Figure 5-8 and Appendix A Figure 17,
Setpoint = Setpoint Schedule, Sensor Input = Sensor Group/SPT Sensor

Reference Output
This decision displays the calculated output that is used to deter mine the percentage of Discrete Output Points required.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	0 to 100%, clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calcu lated by the PID equation.

Proportional Term = (Setpoint - Sensor Group/SPT Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9%

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint - Sensor Group/SPT Sensor) * Integral Gain)+ Previous Integral Term)

Valid Display	-9999.9 to 9999.9%

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Proportional Term = (Current Error - Previous Error) * Derivative Gain

Note: Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9%

Integrator Flags
This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally
Right Digit	0 = No Integrator clamp 1 = Integrator clamp active
Valid Display	000 to 101

Setpoint Schedule
This decision displays the low space temperature setpoint from the configured Setpoint Schedule. The occupancy mode is taken into account when this value is determined.

Valid Display -50.00 to 255.00°F (-45.6 to 123.9°C)

Staging Control
This function starts and stops up to eight stages of electric heating. The control is based on the reference output from the PID Master Loop.

Number of Stages
This decision displays the number of stages that are currently on.

Valid Display 0 to 8

Requested Stages
This decision displays the number of stages that the algorithm requests on. The number is determined by percent of stages requested from the PID Master Loop in relation to the configured Total Number of Stages.

Valid Display 0 to 8

Delta Stages
This decision displays the difference between the Number of Stages from the number of Requested Stages.

Valid Display 0 to 8

Delay Timer
This decision displays the number of minutes that must elapse before another stage can be started or stopped.

Valid Display 0 to 30 minutes

PID Integrator Clamp
This decision displays whether or not the PID Clamp is currently in effect for the staging control function.

Valid Display Off/On

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every ten seconds.

Valid Display 0 to 10 seconds

DO—Enthalpy Comparison

The DO Enthalpy Comparison algorithm compares values from two air streams and indicates if the outside air is suitable for conditioning the space.

This algorithm performs up to three checks to determine if the air is suitable for conditioning the space. The checks are performed in the following order:

OA Enthalpy compared to Max Outside Air Enthalpy
OAT compared to RAT
OA Enthalpy compared to RA Enthalpy

If the Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The DO Enthalpy Comparison algorithm limits engineering units for the control sensors to RH, dewpoint and temperature. The algorithm's output units are the same as the units for the Discrete Output Point. The Outside Air Temperature and either the Outside Air Dewpoint or Return Air Humidity must be available to calculate OA Enthalpy, or else the algorithm uses the value in the Default OA Enthalpy decision.

Typical Application

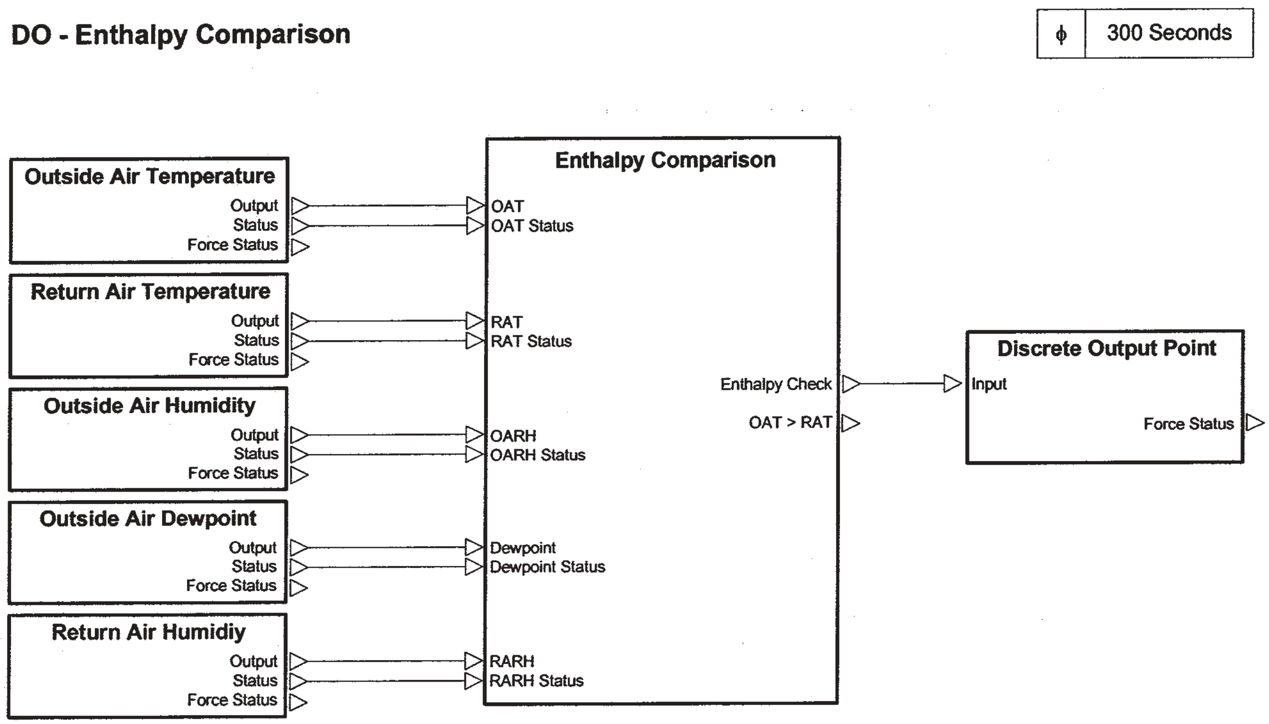
This algorithm normally controls a discrete output point based on an analog (heat content) comparison of two airstreams: i.e., outside and return air. The discrete output point may be used to drive a relay or solenoid air valve as required to accomplish enthalpy switch-over of dampers.

List of Configuration Decisions

Outside Air Temperature
Return Air Temperature
Outside Air Humidity
Return Air Humidity
Outside Air Dewpoint
Enthalpy Comparison
- Default OA Enthalpy
- Default RA Enthalpy
- Maximum OA Enthalpy

Power on Delay

Figure 5-10
DO—Enthalpy Comparison



List of Maintenance Decisions

Discrete Output Point
Outside Air Temperature
Return Air Temperature
Outside Air Humidity
Return Air Humidity
Outside Air Dewpoint
Enthalpy Comparison
  Reference Output
  OA Enthalpy
  RA Enthalpy
  OAT > RAT ?
Task Timer

Configuration Decisions

Outside Air Temperature
Use this decision to specify the AI point that provides the outside air temperature to the algorithm. If the AI point is not available, the algorithm uses the value in the Default OA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Return Air Temperature
Use this decision to specify the AI point that provides the return air temperature to this algorithm. If the AI point is not available, the algorithm uses the value in the Default RA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Outside Air Humidity
This decision defines the AI point that provides the outside air humidity to the algorithm. If the AI point is not available, the algorithm uses Outside Air Dewpoint or else the value in the Default OA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Return Air Humidity
Use this decision to specify the AI point that provides the relative humidity of the return air to this algorithm. If the AI point is not available, the algorithm uses the value in the Default RA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Outside Air Dewpoint
If an Outside Air Humidity sensor is not used, this decision defines the AI point that provides the outside air dewpoint to the algorithm. If neither AI point is available, the algorithm uses the value in the Default OA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Enthalpy Comparison
Enthalpy Comparison calculates the heat content of outside air and return air. It determines if the outside air is suitable for conditioning the space.

Default OA Enthalpy
If an Outside Air Humidity or Outside Air Dewpoint sensor is not available, use this decision to specify the outside air enthalpy that Return Air Humidity must exceed for the output to be activated.

Allowable Entries	0 to 51 BTU/lb
Default Value	51

Default RA Enthalpy
If a Return Air Humidity sensor is not available, use this decision to specify the return air enthalpy that the Outside Air Humidity cannot exceed.

Allowable Entries	0 to 51 BTU/lb
Default Value	50

Maximum OA Enthalpy
Use this decision to specify the maximum outside air enthalpy that the algorithm can use to condition the space.

Allowable Entries	0 to 51 BTU/lb
Default Value	30

Power on Delay

Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point

This decision displays the actual state of the DO point being controlled by this algorithm.

Valid Display	Actual discrete text of output point

Outside Air Temperature

This decision displays the value of the outside air temperature sensor being used by this algorithm.

Valid Display	-40.00 to 245.00°F (-40.0 to 118.3°C)

Return Air Temperature

This decision displays the value of the return air temperature sensor being used by this algorithm.

Valid Display	-40.00 to 245.00°F (-40.0 to 118.3°C)

Outside Air Humidity

This decision displays the value of the outside air humidity sensor being used by this algorithm.

Valid Display	0.00 to 100.00% RH

Return Air Humidity

This decision displays the value of the return air humidity sensor being used by this algorithm.

Valid Display	0.00 to 100.00% RH

Outside Air Dewpoint

This decision displays the value of the outside air dewpoint sensor being used by this algorithm.

Valid Display	-40.00 to 245.00°F (-40.0 to 118.3°C)

Enthalpy Comparison

Enthalpy Comparison determines if outside air can be used for conditioning the space, based on a drybulb or enthalpy comparison of the outside and return air.

Reference Output

This decision displays the result of the enthalpy comparison, which indicates when true that the outside air is suitable for cooling.

Valid Display False/True

OA Enthalpy

This decision displays the value of the enthalpy of the outside air expressed in units of BTU/lb.

Valid Display -9999.9 to 9999.9 Btu/lb

RA Enthalpy

This decision displays the value of the enthalpy of the return air expressed in units of BTU/lb.

Valid Display -9999.9 to 9999.9 Btu/lb

OAT > RAT ?

This decision indicates if the outside air temperature is greater than the return air temperature. If the outside air temperature is greater, than the OAT will be deemed not suitable for cooling.

Valid Display No/Yes

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every 300 seconds.

Valid Display 0 to 300 seconds

DO—Timeclock with Optional Check

The DO Timeclock with Optional Check algorithm controls a discrete output point based on the occupancy state of a Time Schedule, with the capability to duty cycle the output based on space temperature when unoccupied and optionally when occupied.

The algorithm turns the output On whenever the Time Schedule is occupied and Cycling is disabled, or Optimal Start is active, or when Night Time Free Cooling is enabled.

The algorithm turns the output Off whenever the Time Schedule is unoccupied or occupied and Occupied Cycling is enabled, and the space temperature is within setpoints.

The algorithm turns the output On whenever the Time Schedule is unoccupied or occupied and Occupied Cycling is enabled, and the space temperature is outside of setpoints.

A setpoint Hysteresis is applied to stabilize the control if the configured hysteresis is more than ½ of Setpoint range (i.e. Hi Setpoint - Lo Setpoint).

The algorithm functions with a single Space Temperature Sensor or a Sensor Group with multiple sensors. In the case of a single Space Temperature Sensor the lowest and highest control sensor values will be the same.

If a Redline alert from the configured Loadshed Schedule exists, the setpoints will be expanded by 2 °F.

If the Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows for the configuration of high and low setpoints for both occupied and unoccupied states.

The NTFC algorithm enables the output to allow the system to cool the space during nighttime unoccupied hours if the outside air is suitable.

The Timeclock with Optional Check algorithm limits engineering units for the control sensors to temperature. The algorithm output discrete units are the same as the Discrete Output Point.

Typical Applications

You can use this algorithm to control a fan motor to start during occupied hours or stop during unoccupied hours. If the outside air is suitable for cooling during night time hours you could start the fan to cool the building. You can also use this algorithm to duty cycle the fan during occupied hours based on the space temperature.

Note: The default, unconfigured state of this algorithm is for the Discrete Output Point to be On. This occurs as soon as the Discrete Output Point is created.

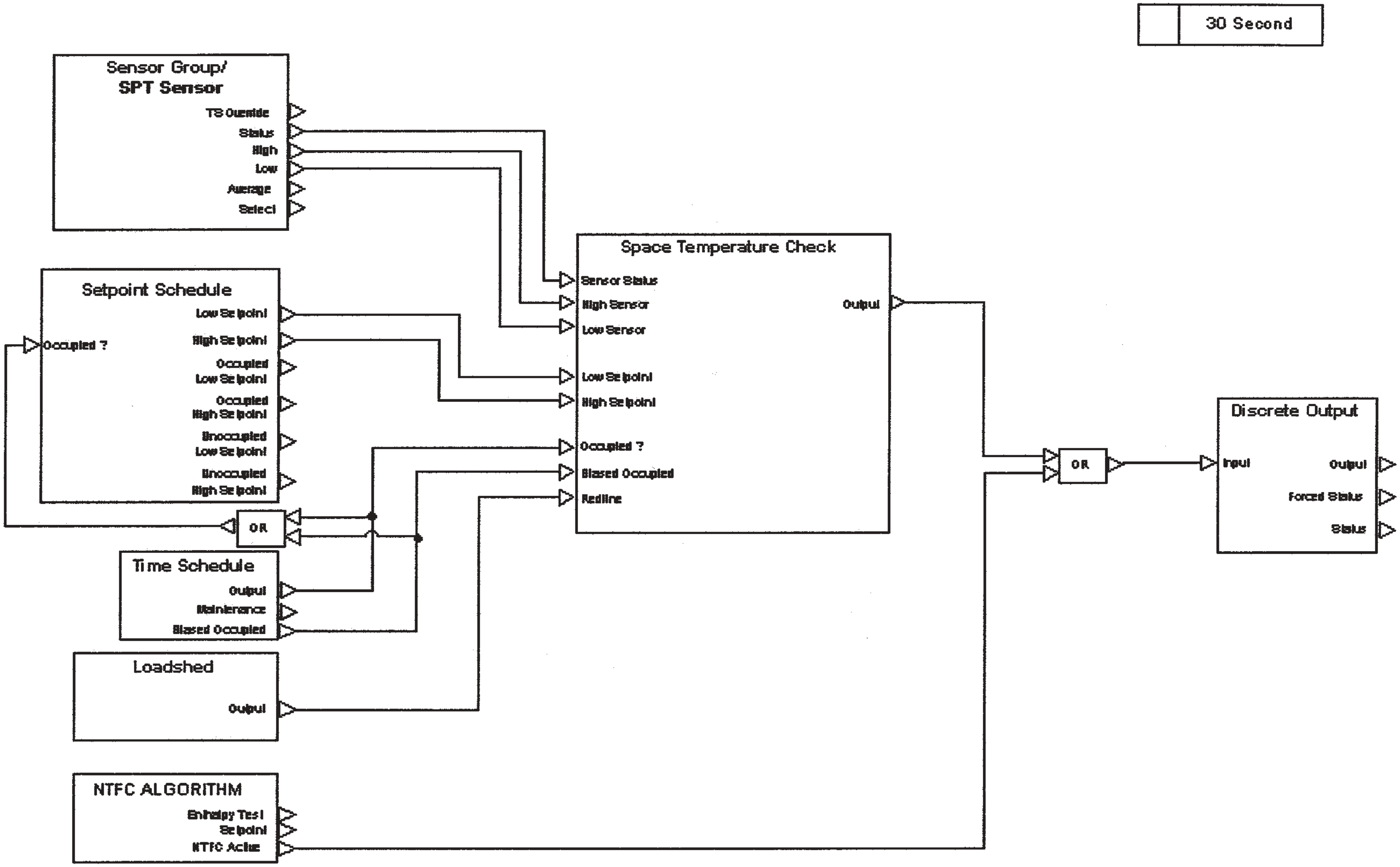
List of Configuration Decisions

Sensor Group/SPT
Time Schedule
Setpoint Schedule
Loadshed Schedule
NTFC Algorithm
Temperature Check
    Hysteresis
    Occupied Cycling
Power on Delay

List of Maintenance Decisions

Discrete Output Point
Sensor Group/SPT Sensor
Low SPT Sensor
High SPT Sensor
Occupied/Biased?
Redline Active?
NTFC Active?
Fan Control
    Reference Output
    Cycle Flag
    Low Setpoint
    High Setpoint
    Low Sensor Region
    High Sensor Region
    Hysteresis

Figure 5-11
DO—Timeclock with Optional Check



Configuration Decisions

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the low and high space temperature inputs. Default Sensor Group usage is disabled for this algorithm. That is, if the SNSGR*nn* name is entered, then it shall provide the low and high space temperature inputs. If this point is not configured then the value shall be set to 0.0°F and control based on Timeclock only. Also, if the sensor has failed, control will be based on Timeclock only.

Allowable Entries	Any valid sensor group or point name or LINK_01
Default Value	SNSGR*00*, where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm will assume to be in the occupied state.

Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC*00*, where *00* represents an invalid schedule number

Setpoint Schedule

Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints. If this decision does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be used.

Allowable Entries	SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT*00*, where *00* represents an invalid schedule number

Loadshed Schedule
Use this decision to specify the Loadshed equipment part that will indicate the Redline Alert data from the Loadshed Option.

Allowable Entries	LDSHD*nn*, where *nn* is the schedule number from 01 to 16
Default Value	LDSHD*00*, where *00* represents an invalid schedule number

NTFC Algorithm
If Night Time Free Cooling with Enthalpy Check will be performed, use this decision to specify the algorithm that will determine if the outside air is suitable for cooling the space. If the outside air is suitable for cooling during unoccupied hours, the output will be activated. It will not cycle off during this time. By default NTFC is enabled. To disable, change entry to NTFC_00.

Allowable Entries	NTFC_*nn*, where *nn* is limited to 00 or 01
Default Value	NTFC_01

Temperature Check
The unoccupied and optional occupied cycling is based on space temperature and a Hysteresis value.

Hysteresis
Use this decision to specify the value to be added to the low setpoint or subtracted from the high setpoint and compared with the space temperature to determine what action should be taken. The applied hysteresis is not allowed to be greater than ½ of Setpoint range (i.e. Hi Setpoint - Lo Setpoint).

Allowable Entries	0.0 to 10.0^F	(0.0 to 5.6^C)
Default Value	2.0	(1.1)

Occupied Cycling
Use this decision to specify whether Occupied Cycling is enabled or disabled. When enabled, the algorithm will turn the output ON whenever the Time Schedule is occupied.

Allowable Entries	Disable/Enable
Default Value	Disable

Power on Delay
Use this decision to specify the number of seconds the controller must wait to activate this algorithm after a power restart occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point
This decision displays the actual state of the DO point being controlled by this algorithm.

Valid Display   Actual discrete text of DO point

Sensor Group/SPT Sensor
This decision displays either the value of the single AI sensor (if chosen) or the average value of the sensor group (if chosen).

Valid Display   -40.0 to 245.0°F   (-40.0 to 118.3°C)

Low SPT Sensor
This decision displays the value of the single AI sensor or the lowest of the sensor group, depending on which is selected
.
Valid Display   -40.0 to 245.0 °F   (-40.0 to 118.3°C)

High SPT Sensor
This decision displays the value of the single AI sensor or the highest of the sensor group, depending on which is selected.

Valid Display   -40.0 to 245.0 °F   (-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Yes*.

Valid Display   No/Yes

Redline Active?
This decision displays the current Redline status based on the configured Loadshed Schedule. If a Loadshed Schedule has not been selected, the default mode will be No.

Valid Display No/Yes

NTFC Active ?
This decision displays the current NTFC status based on the configured NTFC algorithm. If NTFC has not been selected, the default mode will be *No*.

Valid Display No/Yes

Fan Control
Fan Control displays the current controlling setpoint data and Sensor Regions, based on the occupancy mode.

Reference Output
This decision shall display the calculated output state that is used to drive the Discrete Output Point. It shall display True when the Fan is commanded On.

Valid Display False/True

Cycle Flag
This decision shall display the current Cycle Flag status based on the configured Fan Control Algorithm. It shall display True when the Fan is On due to the space temperature check function.

Valid Display False/True

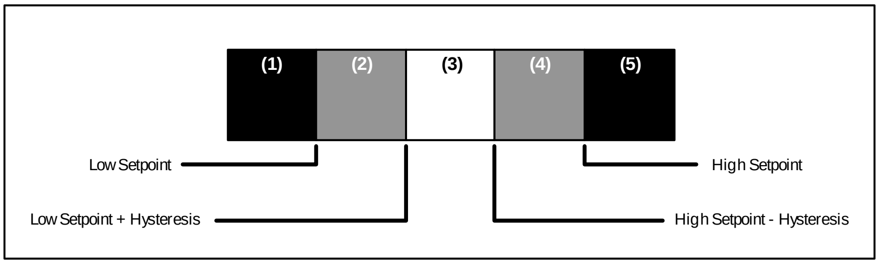
Low Setpoint
This decision displays the low setpoint value, taking into account any Setpoint Offset, and excluding Hysteresis. If the space temperature falls below this value, the Discrete Output Point will be commanded on.

Valid Display -50.0 to 255.0°F (-45.6 to 123.9°C)

High Setpoint
This decision displays the High Setpoint value, taking into account any Setpoint Offset, and excluding Hysteresis. If the space temperature exceeds this value, the Discrete Output Point will be commanded on.

Valid Display   -50.0 to 255.0°F   (-45.6 to 123.9°C)

Low Sensor Region
This decision displays the temperature region of the single AI sensor or the lowest of the sensor group, depending on which is selected, where the regions are defined as follows, with 0 displayed when the algorithm is inactive:



Valid Display   0 to 5

High Sensor Region
This decision displays the temperature region of the single AI sensor or the highest of the sensor group, depending on which is selected, where the regions are defined above, with 0 displayed when the algorithm is inactive.

Valid Display   0 to 5

Hysteresis
This decision displays the amount that is added to the low setpoint and subtracted from the high setpoint.

Valid Display   0.0 to 10.0 ^F   (0.0 to 5.6 ^C)

Task Timer
This decision displays the number of seconds remaining before the algorithm executes again. This algorithm executes every 30 seconds.

Valid Display   0 to 30 seconds

DO—Floating Point Cooling CV

The DO Floating Point (DO/FP) Cooling CV algorithm modules two discrete outputs to control a chilled water valve in a constant volume system to maintain temperature at a configured setpoint. This algorithm can also be configured to perform dehumidification.

The DO/FP Cooling CV algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a Floating Point Control algorithm to control the output valves. The PID Master Loop calculates the submaster reference required to maintain the desired space temperature setpoint. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the high setpoint from the Setpoint Schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The submaster reference is set to the Disabled Output Value if the Sensor Group/SPT Sensor status is invalid.

During dehumidification, the submaster reference is set to its Minimum Output Value. The Floating Point Control algorithm computes the chilled water valve's stroke and duration by comparing the calculated submaster reference to the Supply Air Temperature. The valve is Closed whenever the Equipment Status Point is Off, the Supply Air Temperature status is invalid, the first discrete output (Cooling Coil Valve Open) is forced, the second discrete output is forced (Cooling Coil Valve Close) or the submaster reference equals or exceeds the PID Master Loop's Maximum Output Value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows for the configuration of high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the high setpoint.

The DO/FP Cooling CV algorithm allows any engineering units for the output point, which will appear in the display table. The Cooling Valve Open/Close maintenance decisions will be fixed to Off/On. The engineering units of the control sensors will be fixed to degrees (°F or °C).

The Discrete Output Point that is controlling (Opening) the equipment's chilled water valve has been specified as the default for the algorithm. That is, it is the point whose algorithm is now being configured.

Typical Application

This algorithm can be used to control a chilled water valve serving an air handler's cooling coil in a constant volume system.

List of Configuration Decisions

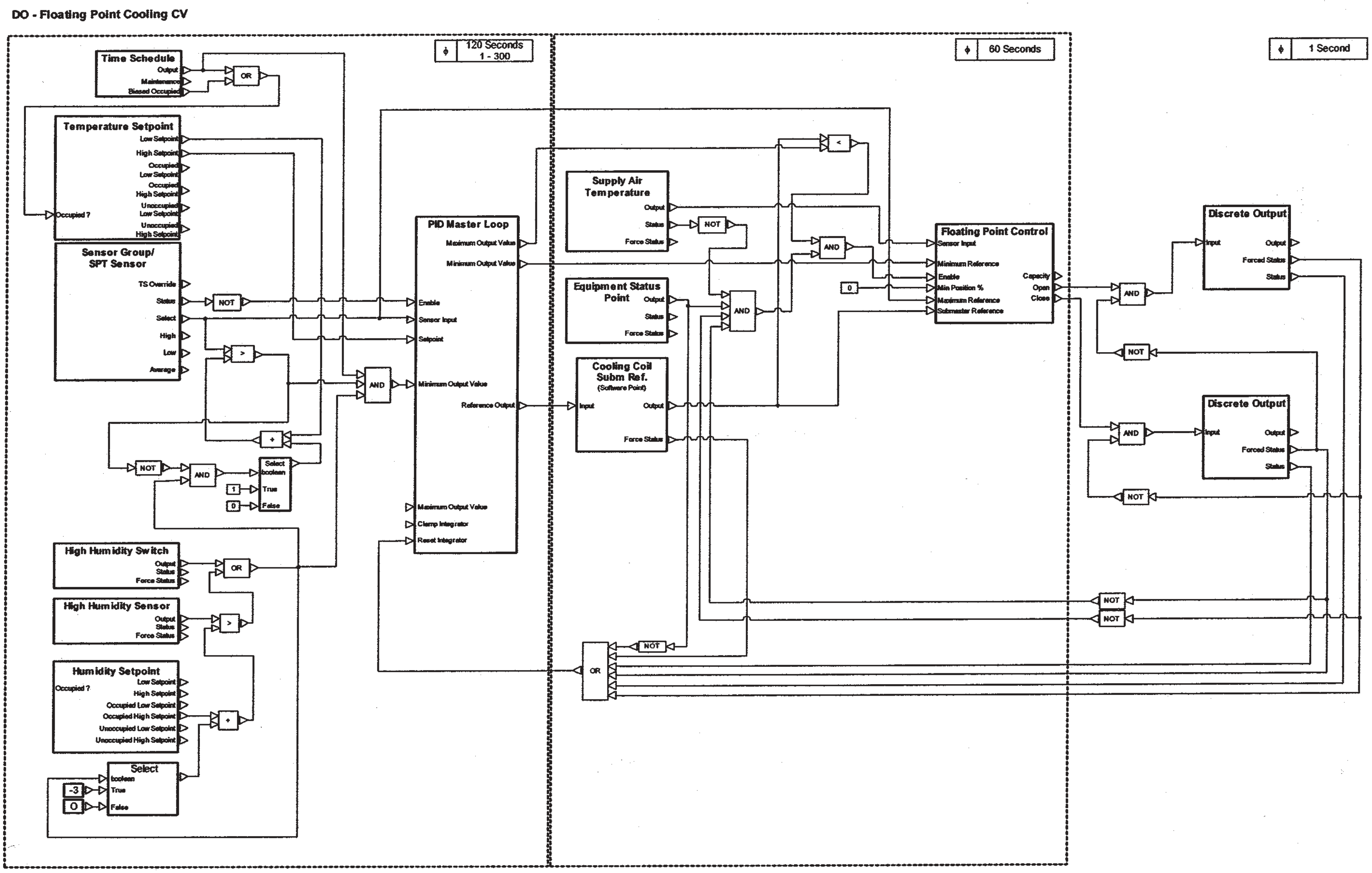
Cooling Valve Close
Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
PID Master Loop
  Proportional Gain
  Integral Gain
  Derivative Gain
  Disabled Output Value
  Minimum Output Value
  Maximum Output Value
  Starting Value
  Block Iteration Rate
Supply Air Temperature
Floating Point Output
  Valve Stroke Time
  Deadband
Power on Delay

List of Maintenance Decisions

Cooling Valve Open
Cooling Valve Close
Equipment Status Point
Sensor/SPT Sensor
Occupied/Biased?
Setpoint Schedule

(*continued*)

Figure 5-12
DO—Floating Point Cooling CV



High Humidity Switch
High Humidity Setpoint
High Humidity Sensor
PID Master Loop
  Reference Output
  Proportional Term
  Integral Term
  Derivative Term
  Integrator Flags
Cooling Coil Subm Ref
Supply Air Temperature
Valve Capacity
Task Timer

Configuration Decisions

Cooling Valve Close

Use this decision to specify the DO point that is controlling the Close signal of the equipment's chilled water valve. Valid entry is required for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status Point

Use this decision to specify the Discrete point that provides the on/off status of the equipment. The Discrete point provides the actual state of the equipment. If this point is not configured or the state is Off, then the valve is closed.

Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter. Valid entry is required for the algorithm to operate. If this point is not configured then the PID Master Loop output is set to the PID Disabled Output Value.

Note: Use the same Sensor Group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

High Humidity Switch

If the system is performing dehumidification, use this decision to specify the DI point that indicates when dehumidification needs to be performed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured then dehumidification will not take place.

Note: If reheat is being done, the sensor specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

Humidity Setpoint

If the system is performing dehumidification, use this decision to specify the Setpoint Schedule that provides the humidity setpoint for this algorithm. If the decision is not configured, the high setpoint will default to 99% RH, which will prevent any dehumidification.

Note: If performing reheat, the schedule specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	SETPT*nn*, where *nn* is 03 (humidity)
Default Value	SETPT00

High Humidity Sensor

If the system is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the high setpoint from the Humidity Setpoint schedule.

Note: If performing reheat, the sensor specified here should be the same one that is specified in the associated Heating CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

PID Master Loop
The master loop is a Proportional Integral Derivative (PID) control loop that calculates the submaster reference required to maintain the desired space temperature. Units of temperature are be fixed for output values.

In Figure 5-12 and Attachment A Figure 17:
Reference Output = Submaster Reference

Proportional Gain
Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision will be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain
Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error per unit of time.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain
Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of delta error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the Submaster Reference value to be maintained when the SPT sensor becomes invalid.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	150.0

Minimum Output Value
Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	45.0

Maximum Output Value
Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	150.0

Starting Value
Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	55.0

Block Iteration Rate
Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	120

Supply Air Temperature
Use this decision to specify the AI point that provides the supply air temperature to this algorithm. The Floating Point output controls to the difference between the submaster reference and the value of the point specified in this decision. If this point is not configured then the valve is Closed.

Allowable Entries	Any valid point name
Default Value	POINT0

Floating Point Output

Floating Point output consists of a pair of Discrete Output points that are combined within a Floating Point algorithm to control a pair of output signals, the first to turn the controlled device On (Cooling Valve Open) and the second to turn the controlled device Off (Cooling Valve Close).

Valve Stroke Time

Use this decision to specify the maximum allowable time for the valve to open/close.

Allowable Entries	20 to 300 seconds
Default Value	45

Deadband

Use this decision to specify the amount the Floating Point Control calculated error must be greater than in order for the valve to be repositioned.

Allowable Entries	0.0 to 20.0 ^F (0.0 to 11.1 ^C)
Default Value	1.5

Power on Delay

Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Cooling Valve Open

This decision displays the state of the first DO point being controlled by this algorithm.

Valid Display	Off/On

Cooling Valve Close

This decision displays the state of the second DO point being controlled by this algorithm.

Valid Display	Off/On

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display   Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the selected sensor in the sensor group (if chosen).

Valid Display   -40.0°F to 245.0°F   (-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display   No/Yes

Setpoint Schedule
This decision displays the low setpoint from the configured Setpoint Schedule. The occupancy mode and any Setpoint Offset are taken into account when this value is determined.

Valid Display   -50.0 to 255.0°F   (-45.6 to 123.9°C)

High Humidity Switch
This decision displays the value of the high humidity switch sensor being monitored. If the decision was not configured, this value will default to the Off state.

Valid Display   Off/On

High Humidity Setpoint
This decision displays the high humidity setpoint for this algorithm. If the decision was not configured, this value defaults to 99% RH, which prevents any dehumidification. The algorithm obtains the occupied high setpoint from the humidity Setpoint Schedule.

Valid Display   0.0 to 100.0% RH

High Humidity Sensor

This decision displays the value of the space or return air humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display 0.0 to 100.0% RH

PID Master Loop

The PID Master Loop function calculates the Submaster Reference based on the configured PID gains and the current deviation from setpoint. The calculated output is readjusted periodically to move closer toward the desired setpoint.

In Figure 5-12 and Appendix A Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output

This decision displays the calculated Submaster Reference that is used by the Floating Point Control to drive the Discrete Output points.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C) clamped to Minimum and Maximum Output Values

Proportional Term

This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule - Sensor Group/SPT Sensor) * Proportional Gain

Valid Display -9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integral Term

This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Sensor Group/SPT Sensor) * Integral Gain) + Previous Integral Term

Valid Display -9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Derivative Term

This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain

Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display -9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integrator Flags

This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp

Valid Display 000 to 110

Cooling Coil Subm Ref

This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Supply Air Temperature by the Floating Point Control algorithm. To override the submaster reference, force this decision.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Supply Air Temperature
This decision displays the value of the AI point that provides the supply air temperature

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Valve Capacity
This decision is a calculated value that is used to approximate the position of the output device. Please note that this is not a measured value, but a calculated value based on the internal calculations of the control algorithm. This decision does not necessarily reflect the true device position.

Valid Display	0.0 to 100.0 %

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every second.

Valid Display	0 to 1 second

DO—Floating Point Heating CV

The DO Floating Point (DO/FP) Heating CV algorithm modulates two discrete outputs to control a hot water or steam valve in a constant volume system to maintain temperature at a configured setpoint.

The DO/FP Heating CV algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a Floating Point Control algorithm to control the output valves. The PID Master Loop calculates the Supply Air Temperature setpoint (heating coil submaster reference) required to maintain the desired space temperature setpoint. The space temperature setpoint is increased by the Heating Setpoint Offset if dehumidification is being performed by the associated Cooling CV algorithm. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the low setpoint from the Setpoint Schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The PID Master Loop output is set to the Disabled Output Value whenever the Equipment Status Point is off or the Sensor Group/SPT Sensor status is invalid. The Floating Point Control algorithm computes the hot water or steam valve's position by comparing the calculated submaster reference to the Supply Air Temperature. The valve is Closed whenever the Supply Air Temperature status is invalid, the first discrete output (Heating Coil Valve Open) is forced, the second discrete output is forced (Heating Coil Valve Close) or the submaster reference is less than or equal to the PID Master Loop's calculated Minimum Output Value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows for the configuration of high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the low setpoint.

The DO/FP Heating CV algorithm allows any engineering units for the output point, which will appear in the display table. The Heating Valve Open/Close maintenance decisions will be fixed to Off/On. The engineering units of the control sensors will be fixed to degrees (°F or °C).

The Discrete Output point that is controlling (Opening) the equipment's hot water valve has been specified as the default for the algorithm. That is, it is the point whose algorithm is now being configured.

Typical Application

This algorithm can used to control a hot water or steam valve serving an air handler's heating coil in a constant volume system.

List of Configuration Decisions

Heating Valve Close
Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
Heating Setpoint Offset
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Supply Air Temperature
Floating Point Output
- Valve Stroke Time
- Deadband

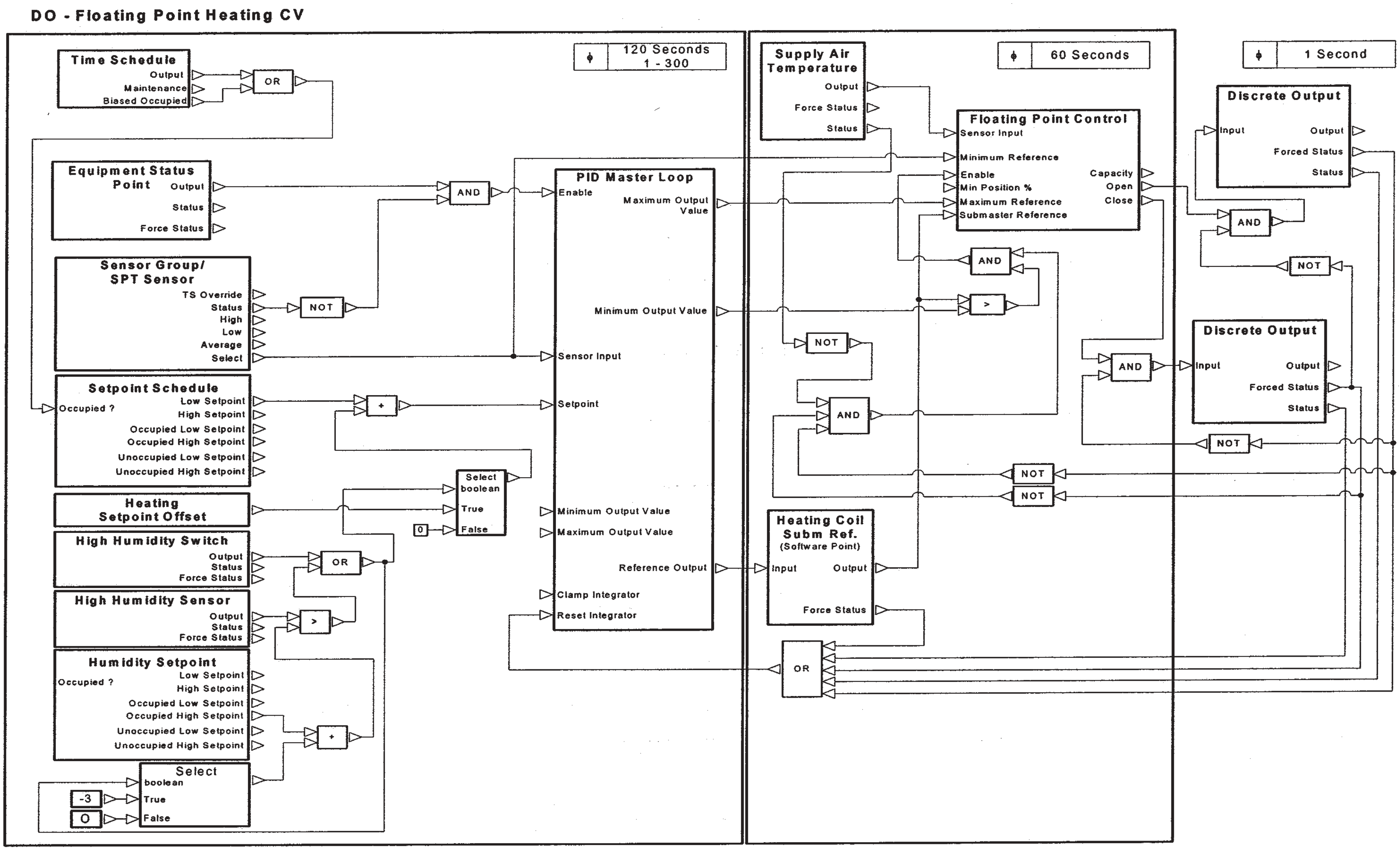
Power on Delay

List of Maintenance Decisions

Heating Valve Open
Heating Valve Close
Equipment Status Point
Sensor/SPT Sensor
Occupied/Biased?

(*continued*)

Figure 5-13
DO—Floating Point Heating CV



Setpoint Schedule
High Humidity Switch
High Humidity Setpoint
High Humidity Sensor
PID Master Loop
   Reference Output
   Proportional Term
   Integral Term
   Derivative Term
   Integrator Flags
Heating Coil Subm Ref
Supply Air Temperature
Valve Capacity
Task Timer

Configuration Decisions

Heating Valve Close
Use this decision to specify the DO point that is controlling (Close) the hot water or steam valve. Valid entry is required for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status Point
Use this decision to specify the Discrete point that provides the on/off status of the equipment. The Discrete point provides the actual state of the equipment. If this point is not configured then the PID Master Loop output is set to the PID Disabled Output Value.

Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor
Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter. If this point is not configured then the PID Master Loop output is set to the PID Disabled Output Value.

Note: Use the same Sensor Group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Time Schedule
Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule
Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

Heating Setpoint Offset

If the system is performing dehumidification, use this decision to specify the offset that will be added to the low heating setpoint during dehumidification.

Allowable Entries	0.0 to 10.0^F	(0.0 to 5.6^C)
Default Value	3.0	(1.7)

High Humidity Switch

If the system is performing dehumidification, use this decision to specify the DI point that indicates when dehumidification needs to be performed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured then the Heating Setpoint Offset will not be applied during dehumidification.

Note: If dehumidification is being done, the sensor specified here should be the same one that is used in the associated Cooling CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

Humidity Setpoint

If the system is performing dehumidification use this decision to specify the Setpoint Schedule that provides the humidity setpoint for this algorithm.

Note: If performing dehumidification the same schedule that is used here should be used in the associated Cooling CV algorithm.

Allowable Entries	SETPT*nn*, where *nn* is 03 (humidity)
Default Value	SETPT00

High Humidity Sensor

If the system is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the high setpoint from the Humidity Setpoint schedule.

Note: If performing dehumidification, the same sensor setpoint that is specified here should be used in the associated Cooling CV algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

PID Master Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the submaster reference required to maintain the desired space temperature. Units of temperature are be fixed for output values.

In Figure 5-13 and Appendix A Figure 17:
Reference Output = Submaster Reference

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision will be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain

Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain
Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the Submaster Reference value to be maintained when the SPT sensor becomes invalid.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	45.0

Minimum Output Value
Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	40.0

Maximum Output Value
Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	140.0

Starting Value
Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled by the Equipment Status Point.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	80.0

Block Iteration Rate

Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	120

Supply Air Temperature

Use this decision to specify the AI point that provides the supply air temperature to this algorithm. The Floating Point output controls to the difference between the submaster reference and the value of the point specified in this decision. If this point is not configured then the valve is Closed.

Allowable Entries	Any valid point name
Default Value	POINT0

Floating Point Output

Floating Point output consists of a pair of Discrete Output points that are combined within a Floating Point algorithm to control a pair of output signals, the first to Open the controlled device (Heating Valve Open) and the second to Close the controlled device (Heating Valve Close).

Valve Stroke Time

Use this decision to specify the maximum allowable time for the valve to open/close.

Allowable Entries	20 to 300 seconds
Default Value	45

Deadband

Use this decision to specify the amount the Floating Point Control calculated error must be greater than in order for the valve to be repositioned.

Allowable Entries	0.0 to 20.0 ^F (0.0 to 11.1 ^C)
Default Value	1.5

Power on Delay
Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Heating Valve Open
This decision displays the state of the first DO point being controlled by this algorithm.

Valid Display Off/On

Heating Valve Close
This decision displays the state of the second DO point being controlled by this algorithm.

Valid Display Off/On

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the selected sensor in the sensor group (if chosen).

Valid Display -40.0°F to 245.0°F (-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display No/Yes

Setpoint Schedule
This decision displays the high setpoint from the configured Setpoint Schedule. The occupancy mode and any Setpoint Offset are taken into account when this value is determined.

Valid Display	-50.0 to 255.0°F	(-45.6 to 123.9°C)

High Humidity Switch
This decision displays the value of the high humidity switch sensor being monitored. If the decision was not configured, this value will default to the Off state.

Valid Display	Off/On

High Humidity Setpoint
This decision displays the high humidity setpoint for this algorithm. If the decision was not configured, this value defaults to 99% RH, which prevents any dehumidification. The algorithm obtains the occupied high setpoint from the humidity Setpoint Schedule.

Valid Display	0.0 to 100.0% RH

High Humidity Sensor
This decision displays the value of the space or return air humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display	0.0 to 100.0% RH

PID Master Loop
The PID Master Loop function calculates the desired output based on the configured PID gains and the current deviation from setpoint. The calculated output is readjusted periodically to maintain the desired setpoint.

In Figure 5-13 and Appendix A Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output
This decision displays the calculated Submaster Reference that is used by the Floating Point Control to drive the Discrete Output points.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-40.0 to 245.0°F clamped to Minimum and Maximum Output Values	(-40.0 to 118.3°C)

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule - Sensor Group/SPT Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9^F	(-5555.5 to 5555.5^C)

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Sensor Group/SPT Sensor) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9^F	(-5555.5 to 5555.5^C)

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain

Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9^F	(-5555.5 to 5555.5^C)

Integrator Flags
This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp
Valid Display	000 to 110

Heating Coil Subm Ref
This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Supply Air Temperature by the Floating Point Control algorithm. To override the submaster reference, force this decision.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Supply Air Temperature
This decision displays the value of the AI point that provides the supply air temperature

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Valve Capacity
This decision is a calculated value that is used to approximate the position of the output device. Please note that this is not a measured value, but a calculated value based on the internal calculations of the control algorithm. This decision does not necessarily reflect the true device position.

Valid Display 0.0 to 100.0 %

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every second.

Valid Display 0 to 1 second

DO—Floating Point Mixed Air CV w/IAQ

The DO Floating Point (DO/FP) Mixed Air CV with IAQ algorithm controls the outside air, return air, and exhaust dampers in a constant volume system.

When outside air conditions are unsuitable for cooling, the algorithm holds the dampers at an adjustable, minimum position. If outside air conditions are suitable for cooling, the algorithm modulates the mixed air dampers as required to maintain a space temperature to the high setpoint.

The DO/FP Mixed Air CV with IAQ algorithm uses both a PID (Proportional Integral Derivative) Master Loop and a Floating Point Control algorithm to control the damper position. The PID Master Loop calculates the submaster reference required to maintain the high setpoint. The PID Master Loop calculates the submaster reference by obtaining the space temperature sensor value from the Sensor Group/SPT Sensor and comparing it to the NTFC setpoint, when configured or else to the Setpoint Schedule's Occupied High Setpoint. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The PID Master Loop's reference output is set to the Disabled Output Value whenever the Sensor Group/SPT Sensor status is invalid. The Floating Point Control algorithm computes the damper's position by comparing the calculated submaster reference to the Mixed Air Temperature. The damper is Closed whenever the Outside Air Temperature status is invalid, the first discrete output (Mixed Air Damper Open) is forced, the second discrete output is forced (Mixed Air Damper Close) or the submaster reference is greater than or equal to the PID Master Loop’s Maximum Output Value and there is no value to drive the damper (i.e. IAQ Control Point output is 0%).

Indoor Air Quality

Indoor Air Quality (IAQ) allows the algorithm to override the damper position, thus allowing additional outside air into the building when the indoor air quality is above the configured limit. The damper position is computed every two minutes. IAQ controls the level of carbon dioxide (CO_2) by modulating the mixed air damper. Varying quantities of outdoor air are admitted during the occupied period to maintain pollutants at or below the setpoints of the IAQ sensors.

CO_2 sensors can be field-supplied and installed, and configured in two ways:

- One sensor can be installed in either the space or return air stream to continuously monitor a single gas.
- Two sensors can be installed inside and outside the occupied space for comparative measurements. The control is configured to modify the damper position based on the value of the sensor in the occupied space, but before admitting outside air, the control performs a differential check to determine if the value of the sensor measuring the outside air is higher. If the outside sensor has a higher CO_2 value, the damper is unaffected by IAQ.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows for the configuration of high and low space temperature setpoints for both occupied and unoccupied states. This algorithm uses the high setpoint.

The DO/FP Mixed Air CV with IAQ algorithm allows any engineering units for the output points, which will appear in the display table. The Mixed Air Damper Open/Close maintenance decisions will be fixed to Off/On. The engineering units of the control sensors will be fixed to degrees (°F or °C).

Night Time Free Cooling

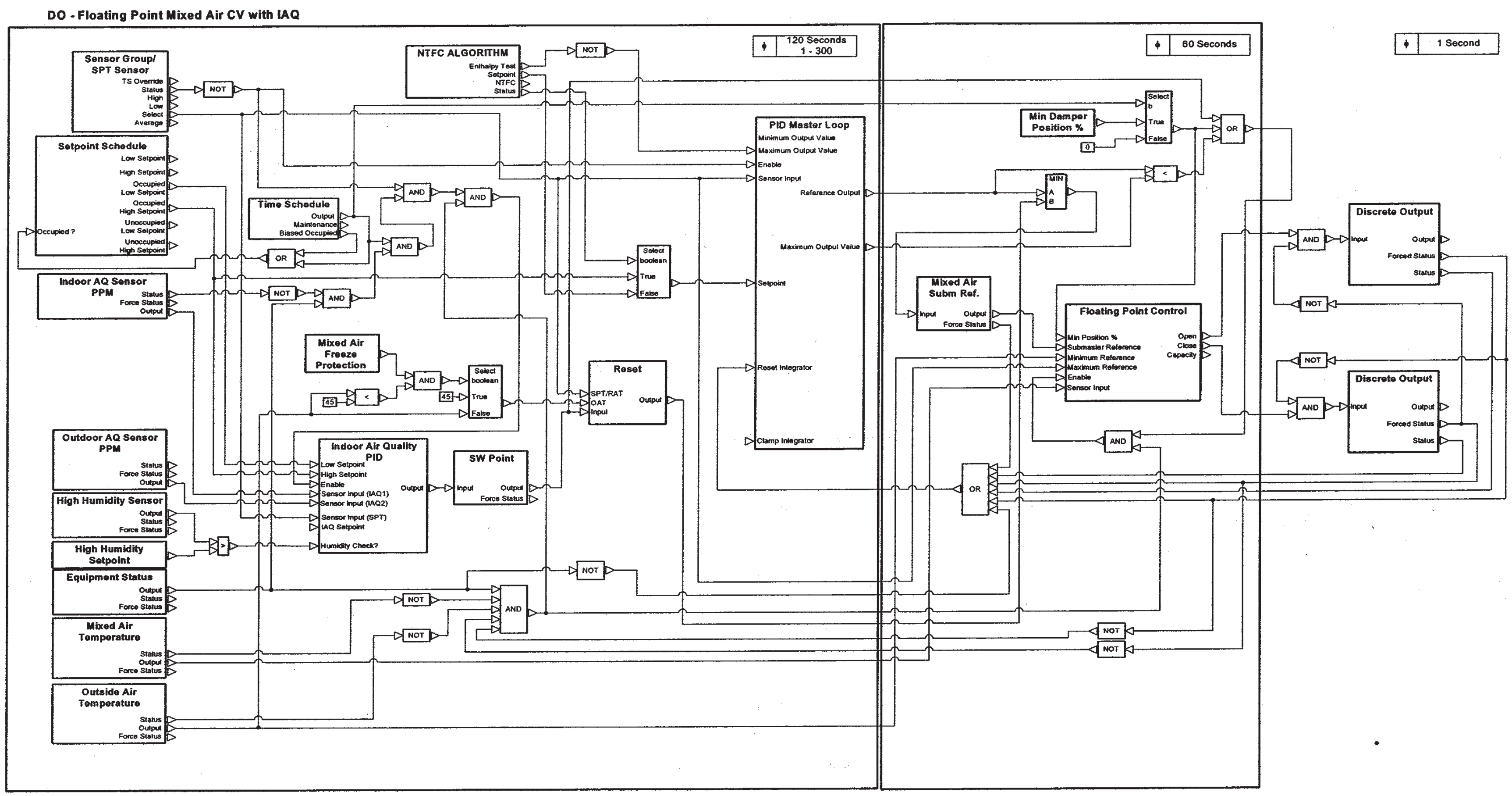
NTFC with Enthalpy Check is required if the system is equipped to use outside air as a suitable source for cooling the space during night time unoccupied hours or if the system needs to modulate the dampers in either a dry bulb or enthalpy type economizer operation.

The DO point that is controlling (Opening) the outside air, return air, and exhaust dampers has been specified as the default for the algorithm. That is, it is the point whose algorithm is now being configured.

Typical Application

This algorithm can be used to store excess internal heat within the structure during winter months, or to use cool outside air during summer months to the greatest possible extent. This minimizes the need for heating or mechanical cooling.

Figure 5-14
DO—Floating Point Mixed Air CV



List of Configuration Decisions

Mixed Air Damper Close
Equipment Status Point
Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
High Humidity Setpoint
High Humidity Sensor
NTFC Algorithm
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Mixed Air Temperature
Outside Air Temperature
MAT Freeze Protection
Min Damp Position
Floating Point Output
- Valve Stroke Time
- Deadband

Indoor AQ Sensor PPM
Outdoor AQ Sensor PPM
Indoor Air Quality
- IAQ Setpoint PPM
- Proportional Gain
- Integral Gain
- Temp & Humidity Test
- Differential Gas
- Minimum Output Value
- Maximum Output Value

Power on Delay

List of Maintenance Decisions

Mixed Air Damper Open
Mixed Air Damper Close
Equipment Status Point
Sensor/SPT Sensor
Occupied/Biased?
High Humidity Sensor
NTFC Active?
NTFC/Setpnt Schedule
Outside Enthalpy Good?
IAQ Control Point
PID Master Loop
  Reference Output
  Proportional Term
  Integral Term
  Derivative Term
  Integrator Flags
Mixed Air CV Subm Ref
Mixed Air Temperature
Outside Air Temperature
Valve Capacity
Indoor AQ Sensor
Outdoor AQ Sensor
IAQ Setpoint
Indoor Air Quality
  Reference Output
  Proportional Term
  Integral Term
  Clamp
Task Timer

Configuration Decisions

Mixed Air Damper Close

Use this decision to specify the DO point that is controlling (Close) the outside air, return air, and exhaust dampers. Valid entry is required for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status Point
Use this decision to specify the Discrete point that provides the on/off status of the equipment. The Discrete point provides the actual state of the equipment. If this point is not configured then the valve is Closed.

Allowable Entries	Any valid point name
Default Value	POINT0

Sensor Group/SPT Sensor
Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter. If this point is not configured then the PID Master Loop's Reference Output is set to the Disabled Output Value.

Note: Use the same Sensor Group or SPT sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00* where *00* represents an invalid group number

Time Schedule
Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

High Humidity Setpoint

If the indoor air quality is being monitored and Temp & Humidity Test is set to *Yes*, use this decision to specify the maximum allowable return air humidity before the IAQ control routine is disabled.

Allowable Entries	0.0 to 100.0%Rh
Default Value	99.0%Rh

High Humidity Sensor

If the indoor air quality is being monitored and Temp & Humidity Test is set to *Yes*, Use this decision to specify the AI point that provides the return air humidity. When the High Humidity Sensor value is greater than the High Humidity Setpoint, the IAQ control routine will be disabled.

Allowable Entries	Any valid point name
Default Value	POINT0

NTFC Algorithm

If Night Time Free Cooling will be performed or the dampers will modulate in either a dry bulb or enthalpy type economizer operation, use this decision to specify the algorithm that will determine if the outside air is suitable for cooling the space. If the outside air is not suitable for cooling during unoccupied hours, the submaster reference will be held to the configured Maximum Output Value. By default NTFC is enabled; to disable, change entry to NTFC_00.

Allowable Entries	NTFC_*nn* where *nn* is 00 or 01
Default Value	NTFC_01

PID Master Loop

The master loop is a Proportional Integral Derivative (PID) control loop that calculates the submaster reference required to maintain the desired space temperature. Units of temperature are be fixed for output values.

In Figure 5-14 and Appendix A Figure 17:
Reference Output = Submaster Reference

Proportional Gain

Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision will be expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	10.0

Integral Gain

Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	1.0

Derivative Gain

Use this decision to specify the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value

Use this decision to specify the Submaster Reference value to be maintained when the SPT sensor becomes invalid.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	240.0

Minimum Output Value

Use this decision to specify the lowest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	40.0

Maximum Output Value

Use this decision to specify the highest allowable Submaster Reference value.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	150.0

Starting Value

Use this decision to specify the Submaster Reference's starting value when the PID Master Loop is enabled.

Allowable Entries	-40.0 to 245.0 °F (-40.0 to 118.3°C)
Default Value	65.0

Block Iteration Rate

Use this decision to specify how often the PID Master Loop calculates the Submaster Reference value.

Allowable Entries	1 to 300 seconds
Default Value	120

Mixed Air Temperature

Use this decision to specify the AI point that provides the mixed air temperature to this algorithm. The Floating Point Output controls with the point specified in this decision. If this point is not configured then the valve is Closed.

Allowable Entries	Any valid point name
Default Value	POINT0

Outside Air Temperature

Use this decision to specify the AI point that provides the temperature input for the outside air temperature. If this point is not configured then the valve is closed.

Allowable Entries	Any valid point name
Default Value	POINT0

MAT Freeze Protection

Use this decision to specify whether Mixed Air Temperature freeze protection is enabled (active) for this algorithm. If the decision is set to *Yes* and the Outside Air Temperature (OAT) is less than 45 °F, then the algorithm will use 45 °F for its calculation to control the damper. Otherwise, the algorithm will use the current OAT value to control the damper.

Allowable Entries	No/Yes
Default Value	Yes

Min Damp Position

Use this decision to specify the minimum allowable damper position for this algorithm.

Allowable Entries	0.0 to 100.0 %
Default Value	0.0

Floating Point Output

Floating Point output consists of a pair of Discrete Output points that are combined within a Floating Point algorithm to control a pair of output signals, the first to Open the damper (Mixed Air Damper Open) and the second to Close the damper (Mixed Air Damper Close).

Valve Stroke Time

Use this decision to specify the time for the damper to travel from the fully Open position to the fully Closed position.

Allowable Entries	20 to 300 seconds
Default Value	45

Deadband
Use this decision to specify the amount the Floating Point Control calculated error must be greater than in order for the value to be repositioned.

Allowable Entries	0.0 to 20.0 ^F (0.0 to 11.1 ^C)
Default Value	1.5

Indoor AQ Sensor PPM
If the indoor air quality is being monitored, use this decision to specify the indoor air quality sensor.

Allowable Entries	Any valid point name
Default Value	POINT00

Outdoor AQ Sensor PPM
If Differential Gas is set to *Yes*, use this decision to specify the outdoor air quality sensor.

Allowable Entries	Any valid point name
Default Value	POINT0

Indoor Air Quality
Indoor Air Quality is a proportional and integral control loop that compares the IAQ setpoint to the IAQ sensors in order to compute the return air, outside air, and exhaust air damper positions. The damper positions are controlled by the Indoor Air Quality or the Mixed Air PID, depending on whose calculated output value is lower.

IAQ Setpoint PPM
Use this decision to specify the Indoor Air Quality setpoint.

Allowable Entries	0 to 2000 PPM
Default Value	1000

Proportional Gain
Use this decision to specify the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-of-output-per-unit of error.

Allowable Entries	-1.00 to 1.00
Default Value	0.10

Integral Gain
Use this decision to specify the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-of-output-per-unit of error.

Allowable Entries	-1.00 to 1.00
Default Value	0.03

Temp & Humidity Test
This decision disables the IAQ control routine if either the space temperature setpoint or High Humidity Setpoint is exceeded.

Allowable Entries	No/Yes
Default Value	No

Differential Gas
This decision indicates if the outside air is being evaluated to determine its suitability for use. If the Outdoor AQ Sensor value (outside air quality sensor value) is greater than the Indoor AQ Sensor value (indoor air quality value), the IAQ control routine will be disabled.

Allowable Entries	No/Yes
Default Value	No

Minimum Output Value
Use this decision to specify the lowest allowable output to the mixed air damper for the IAQ control routine.

Allowable Entries	0.0 to 100.0 %
Default Value	0.0

Maximum Output Value
This decision shall specify the highest allowable output to the mixed air damper for the IAQ control routine.

Allowable Entries	0.0 to 100.0 %
Default Value	50.0

Power on Delay
Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

The following maintenance decisions are applicable to this algorithm.

Mixed Air Damper Open
This decision displays the value of the first DO point being controlled by this algorithm.

Valid Display Off/On

Mixed Air Damper Close
This decision displays the value of the second DO point being controlled by this algorithm.

Valid Display Off/On

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display Off/On

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor (if chosen) or the selected sensor in the sensor group (if chosen).

Valid Display -40.0°F to 245.0°F
(-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be Occupied and *Yes* will be displayed.

Valid Display No/Yes

High Humidity Sensor
This decision displays the value of the return air humidity sensor being monitored. If this value exceeds the High Humidity Setpoint, the IAQ control routine will be disabled.

Valid Display	0.0 to 100.0% RH

NTFC Active?
This decision indicates when Night Time Free Cooling is active. If the NTFC w Enthalpy Check algorithm was not selected as part of the configuration, Night Time Free Cooling shall be inactive and *No* will be displayed.

Valid Display	No/Yes

NTFC/Setpnt Schedule
This decision displays the space temperature setpoint when Night Time Free Cooling is active. The space temperature setpoint will be the occupied high setpoint from the configured Setpoint Schedule.

Valid Display	-40.0 to 245.0°F (-40.0 to 118.3°C)

Outside Enthalpy Good?
This decision indicates when the outside air is suitable for cooling. If the value displayed in this decision is *No*, the temperature control PID will be set to the Maximum Output Value.

Valid Display	No/Yes

IAQ Control Point
This decision displays the Indoor Air Quality output value.

Valid Display	0.0 to 100.0%

PID Master Loop
PID Master Loop function calculates the desired output based on the configured PID gains and the current deviation from setpoint. The calculated output is readjusted periodically to maintain a desired setpoint.

In Figure 5-14 and Appendix A Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Sensor Group/SPT Sensor

Reference Output
This decision displays the calculated Submaster Reference that is used by the Floating Point Control to drive the Discrete Output points.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display	-40.0 to 245.0°F (-40.0 to 118.3°C) clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule - Sensor Group/SPT Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integral Term
This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Sensor Group/SPT Sensor) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Derivative Term
This decision displays the derivative error term as it is calculated by the PID equation.

Derivative Term = (Current Error - Previous Error) * Derivative Gain
Error = (Setpoint Schedule - Sensor Group/SPT Sensor)

Valid Display	-9999.9 to 9999.9^F (-5555.5 to 5555.5^C)

Integrator Flags
This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp
Valid Display	000 to 110

Mixed Air CV Subm Ref
This decision displays the value of the calculated submaster reference from the PID Master Loop. This value is used with the Mixed Air Temperature by the Floating Point Control. To override the submaster reference, force this decision.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Mixed Air Temperature
This decision displays the value of the AI point that provides the mixed air temperature.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Outside Air Temperature
This decision displays the value of the outside air temperature being used by this algorithm.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Valve Capacity
This decision is a calculated value that is used to approximate the position of the output device. Please note that this is not a measured value, but a calculated value based on the internal calculations of the control algorithm. This decision does not necessarily reflect the true device position.

Valid Display 0.0 to 100.0 %

Indoor AQ Sensor
This decision displays the value of the indoor air quality in parts per million (PPM).

Valid Display -9999.9 to 9999.9

Outdoor AQ Sensor
This decision displays the value of the outdoor air quality in parts per million (PPM).

Valid Display -9999.9 to 9999.9

IAQ Setpoint
This decision displays the value of the configured indoor air quality setpoint in parts per million (PPM).

Valid Display 0.0 to 2000.0

Indoor Air Quality
This function monitors the indoor air quality, and if desired, the outdoor air quality. This loop executes every minute.

Reference Output
This decision displays the calculated value that is used as the Submaster Reference. The algorithm's output point value will be either that of the PID Master Loop Reference Output or the value displayed in this decision, depending on which is lower.

Reference Output = (Proportional Term + Integral Term)

Valid Display 0.0 to 100.0 %

Proportional Term

This decision displays the proportional error term as it is calculated by the IAQ PID Loop.

Proportional Term = (IAQ Setpoint - IAQ Sensor) * Proportional Gain

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Integral Term

This decision displays the integral error term as it is calculated by the IAQ PID Loop.

Integral Term = ((IAQ Setpoint - IAQ Sensor) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Clamp

This decision displays whether the IAQ control routine is being clamped. The clamp is set whenever the output is less than the minimum output value or greater than the maximum output value.

Valid Display	Off/On

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm executes every second.

Valid Display	0 to 1 second

DO—Interlock

The DO Interlock algorithm provides a Discrete Output point that is controlled by the state of either a single or a pair of discrete points. The algorithm commands the output On whenever the state of the single or pair of inputs equals its respective comparison states for the On Persistence Time. The output remains On until the state of the single or either of the pair of inputs does not equal the respective comparison state for the Off Persistence Time.

If the Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The DO Interlock algorithm allows any engineering units for the discrete input points, but displays all related state text as Off/On. The algorithm's output discrete text is the same as the text for the discrete output point.

Typical Application

You could use this algorithm to control an output device when either of two input devices are on (a logical OR), set the Input 1 and Input 2 comparisons to Off, and set the Output Logic type to Invert. The On Persistence and Off Persistence timers can be set as needed.

Note: The default, unconfigured state of this algorithm is for the Discrete Output Point to be On. This occurs as soon as the Discrete Output Point is created.

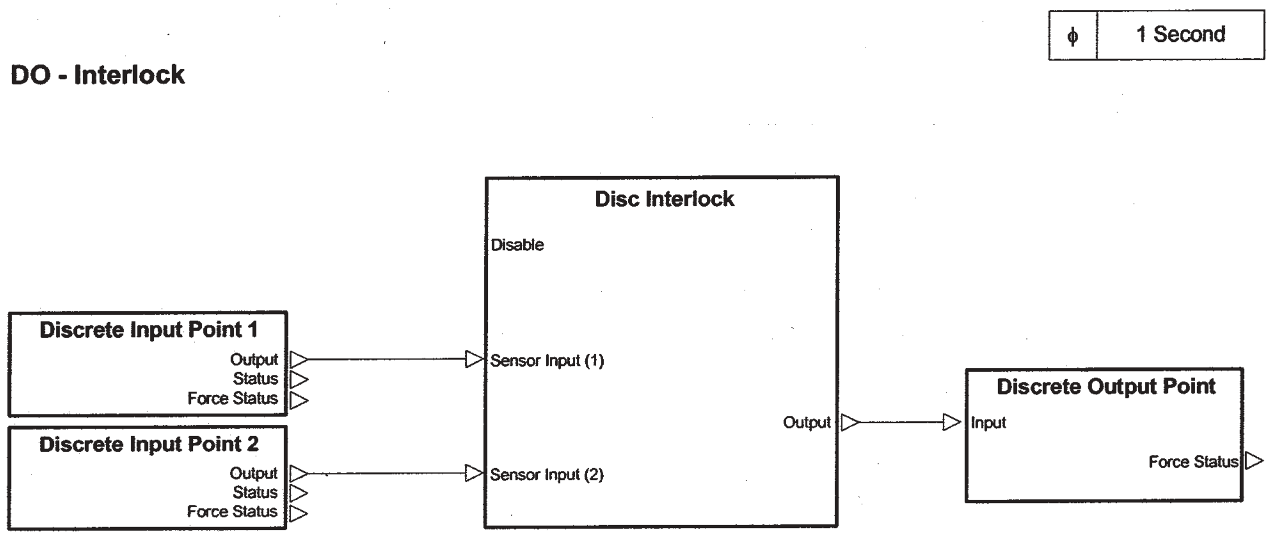
List of Configuration Decisions

Discrete Input Point 1
Discrete Input Point 2
Discrete Interlock
  Input 1 Comparison
  Input 2 Comparison
  Off Persistence Time
  On Persistence Time
  Output Logic Type
Power on Delay

List of Maintenance Decisions

Discrete Output Point
Discrete Input Point 1
Discrete Input Point 2
Reference Output
Task Timer

Figure 5-15
DO—Interlock



Configuration Decisions

Discrete Input Point 1
You must configure this decision to specify the DO or DI point that is compared to Input 1 Comparison state. If this point is not configured then the state will be set to Off.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Input Point 2
Use this decision to specify the DO or DI point that is compared to Input 2 Comparison state. If this point is not configured then the state will be set to Off.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Interlock
Discrete Interlock determines the output state by comparing the inputs to their configured comparison states. These states must exist for the duration of the persistence time to activate or deactivate the output.

Input 1 Comparison
Use this decision to specify the active comparison state for Discrete Input 1.

Allowable Entries	Off/On
Default Value	Off

Input 2 Comparison
Use this decision to specify the active comparison state for Discrete Input 2.

Allowable Entries	Off/On
Default Value	Off

Off Persistence Time
Use this decision to specify the amount of time the input conditions must remain not equal to their comparison states before the algorithm turns off the output point, qualified by the Output Logic Type.

Allowable Entries	0 to 300 seconds
Default Value	30

On Persistence Time

Use this decision to specify the amount of time the input conditions must remain equal to their comparison states before the algorithm turns on the output point, qualified by the Output Logic Type.

Allowable Entries	0 to 300 seconds
Default Value	30

Output Logic Type

Use this decision to specify if normal or inverted logic is desired. Normal logic will drive the output on when the conditions are met. Invert logic will drive the output off when the conditions are met.

Allowable Entries	Normal/Invert
Default Value	Normal

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point

This decision displays the actual state of the Discrete Output Point being controlled by this algorithm.

Valid Display	Actual discrete text of discrete output point

Discrete Input Point 1

This decision displays the state of Discrete Input 1. This value is compared with the configured Input 1 Comparison state to help determine the output state.

Valid Display	Off/On

Discrete Input Point 2
This decision displays the state of Discrete Input 2. This value is compared with the configured Input 2 Comparison state to help determine the output state.

Valid Display Off/On

Reference Output
This decision displays the output state of the Discrete Interlock function, without regard to the Output Logic Type. The Discrete Output Point is driven to this value during *Normal* logic, and driven to the opposite value when Output Logic Type is *Invert*.

Valid Display Off/On

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every second.

Valid Display 0 to 1 seconds

DO—Lead/Lag Control

The DO Lead/Lag Control algorithm controls two pieces of equipment such as a pair of pumps in either a fixed or a rotating sequence. The first device is known as the primary or the lead device. The second device is known as the secondary or the lag device.

When using a fixed sequence, the lag device serves as backup in case the lead device fails. After the lead device has been restored, a rotation of the devices can be manually initiated by changing the value in the Rotate Now configuration decision. In order to manually rotate the fixed sequence while running, change the Sequence Type and set Rotate Now to *Yes*.

For a rotating sequence, the algorithm may be configured to switch the primary and secondary devices according to the Day of Week, Day of Month, or Hours of Runtime. A rotation of the devices can be manually initiated by changing the value in the Rotate Now configuration decision.

The algorithm can start the primary device according to the following:

- One of three control methods, shown in order of precedence:
    - The analog comparison of a Control Sensor value such as temperature to a Setpoint Schedule
    - A Time Schedule
    - An Equipment Status point
- And auto restart, which is independent of the above control methods.

If an analog comparison is used as a basis for starting the primary device (a valid Control Sensor is configured), the algorithm will start the device when the Control Sensor is outside the high and low setpoints. When the sensor returns to the region bordered by Low Setpoint plus Hysteresis and High Setpoint minus Hysteresis, the algorithm will stop the primary device.

If a Time Schedule is used as the basis for starting the primary device (a valid Time Schedule is configured; a Control Sensor is not), the algorithm will start the device when the Time Schedule is in the occupied state. Otherwise, the device will remain stopped.

If an Equipment Status point is used as a basis for starting the primary device (a valid Equipment Status point is configured; neither a Control Sensor nor a Time Schedule is configured), the algorithm will start the device when the an Equipment Status point is On. Otherwise, the device will remain Off.

Whenever the algorithm starts the lead device, the device status will be confirmed. The Universal Controller will wait the configured time delay and, if the status remains off, will stop the lead device and attempt to start the lag device using the same procedure. Whenever both devices fail to start, the algorithm will initiate an alarm on the CCN, and will disable both devices until a rotation of the devices is manually initiated. An optional auto-restart function will attempt to restart the device(s) every five (5) minutes after both have failed.

If the algorithm successfully starts the primary device, and the primary device status later indicates it is off, the algorithm will start the secondary device as described above for the primary device.

Application Note: A separate status point for each pump must be configured in order for the algorithm to operate correctly.

An alarm will be initiated on the CCN whenever both devices fail to start, and a Return To Normal will be initiated thereafter when a device successfully starts. An internal software point will be created for the algorithm that will reflect the alarm state. It will be named, for example, *POINT1_A* where *POINT1* is the name of the Discrete Out Point attached to the algorithm. The alarm configuration will be attached to the Discrete Out Point when this algorithm is selected.

Application Note: The software point may be utilized as a trigger to start a backup pump controlled by a DO Interlock algorithm.

If the control sensor is out of range, the algorithm will revert to the next control method (Time Schedule).

If either Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode also defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows for the configuration of high and low setpoints for both occupied and unoccupied states.

The DO Lead/Lag Control algorithm will allow any engineering units for the analog control sensors. The algorithm output discrete text will be the same as the first Discrete Output Point. However, Discrete In state will be displayed as Off/On.

Typical Application

This algorithm can be used to automatically start a secondary pump whenever the primary pump fails.

List of Configuration Decisions

Discrete Out Point 2
Discrete In Point 1
Discrete In Point 2
Time Schedule
Setpoint Schedule
Equipment Status Point
Lead Lag Control
    Sequence Type
    Rotate Now
    Day of Week
    Day of Month
    Hours of Runtime
    Device Start Delay
Auto-Restart
Control Sensor
Analog
    Hysteresis
    Block Iteration Rate
Power on Delay

DO Lead/Lag Control algorithm configuration includes decisions for the Alarm Processor configuration as defined in the Alarms chapter of this manual.

List of Maintenance Decisions

Discrete Output Point 1
Discrete Output Point 2
Discrete Input Point 1
Discrete Input Point 2
Occupied?
Equipment Status Point
Lead/Lag Control
  Lead Device
  Device 1 Runtime
  Device 2 Runtime
  Failed Flag
    Lead Status
Control Sensor
Analog
  Reference Output
  Hysteresis
  Low Setpoint
  High Setpoint
  Low Sensor Region
  High Sensor Region
Task Timer

DO Lead/Lag Control algorithm maintenance includes decisions for the Alarm Processor maintenance as defined in the Alarms chapter of this manual.

Configuration Decisions

Discrete Out Point 2
You must configure this decision to specify the DO point that controls the second of two devices. Valid entry is required for the algorithm to operate.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete In Point 1
You must configure this decision to specify the DI point that provides the on/off status for the first device. This point provides the actual

state of the device. If this point is not configured then the state will be set to Off.

Note: You must configure a separate status point for each device in order for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete In Point 2
You must configure this decision to specify the DI point that provides the on/off status for the second device. This point provides the actual state of the device. If this point is not configured then the state will be set to Off.

Note: You must configure a separate status point for each device in order for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule
Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. For the Time Schedule to control device activation, the Control Sensor should remain unconfigured.

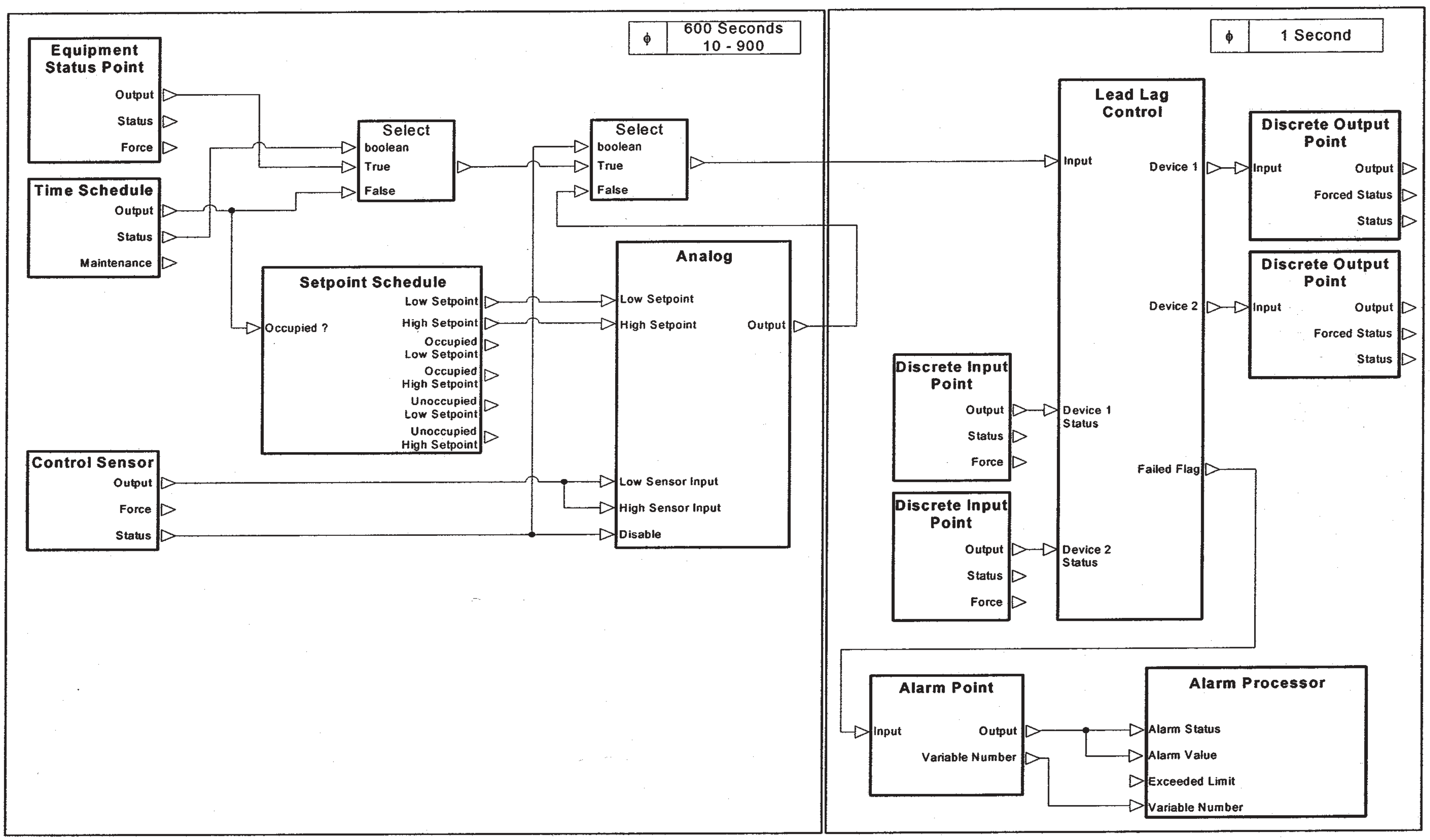
Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99 or LINK_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC*00*, where *00* represents an invalid schedule number

Setpoint Schedule
If using an analog comparison as a basis for starting a device, use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints. A Time Schedule can be configured to determine the occupied and unoccupied states, or else the occupied setpoint will be used.

Allowable Entries	SETPT*nn*, where *nn* = 01 to 04, LINK_01, or Setpoint Offset AI point
Default Value	SETPT*00*, where *00* represents an invalid schedule number

Figure 5-16
DO—Lead/Lag Control

DO - Lead Lag Control



Equipment Status Point
Use this decision to specify a discrete point to control device activation. If this point is configured, a device will start when this point is on. If this point is not configured, it will have no effect on the device activation.

Allowable Entries	Any valid point name
Default Value	POINT0

Lead Lag Control
Pump Control controls two devices in either a fixed or a rotating sequence.

Sequence Type
Use this decision to indicate whether the devices have a fixed or rotating sequence. A fixed sequence consists of a lead device with a backup device. The lead device can be configured as the first or second device. A rotating sequence consists of devices that alternate at a configured time between being a lead device and a lag device.

Allowable Entries	0 = Rotating 1 = Fixed Rotation with Device1 as Lead 2 = Fixed Rotation with Device2 as Lead
Default Value	0

Rotate Now
Use this decision to indicate whether to switch the designation of the lead and lag devices.

For a Fixed Sequence this decision shall specify whether to start the lead device after a failure.

Note: When both devices fail, use this decision to restart the algorithm.

Allowable Entries	No/Yes
Default Value	No

Day of Week

This decision only applies to devices with a rotating sequence. To rotate the devices on a weekly basis, use this decision to specify the day of the week on which to rotate the devices.

0 = Disabled	4 = Thursday
1 = Monday	5 = Friday
2 = Tuesday	6 = Saturday
3 = Wednesday	7 = Sunday

Allowable Entries	0 to 7
Default Value	0

Day of Month

This decision only applies to devices with a rotating sequence. To rotate the pumps on a monthly basis, use this decision to specify the day of the month on which to rotate the pumps. This decision is limited to 28 days to ensure that the devices rotate each month, regardless of the number of days in the month.

0 = Disabled
1 = first day of month, 2 = second day of month, etc.,
28 = 28th day of month

Allowable Entries	0 to 28
Default Value	0

Hours of Runtime

This decision only applies to devices with a rotating sequence. To rotate the pumps according to accumulated runtime, use this decision to indicate the amount of time the device must run before the rotation occurs.

Allowable Entries	0 to 8760 hours
Default Value	0

Device Start Delay

Use this decision to indicate the amount of time to wait after starting a device before verifying that the device is running.

Allowable Entries	0 to 900 seconds
Default Value	15

Auto Restart
Use this decision to specify whether to enable the auto restart function, which attempts to restart the device(s) every five minutes after both have failed.

Allowable Entries	Disable/Enable
Default Value	POINT0

Control Sensor
Use this decision to specify the analog type input that will be compared to the Setpoint Schedule to determine if a device should be started.

Allowable Entries	Any valid point name
Default Value	POINT0

Analog
Analog provides a discrete output by comparing an analog sensor value to the configured setpoint values. If the Control Sensor is outside the setpoints, the device is commanded On and remains On until the Control Sensor is within the region bordered by low setpoint plus Hysteresis and high setpoint minus Hysteresis. This prevents short cycling of the controlled device.

Hysteresis
Use this decision to specify the amount that is added to the low setpoint and subtracted from the high setpoint.

Allowable Entries	Valid range based upon selected display units.
Default Value	0.0

Block Iteration Rate
Use this decision to specify how often the input conditions are checked to determine if the output state must change.

Allowable Entries	10 to 900 seconds
Default Value	600

Power on Delay
Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point 1
This decision displays the commanded state of the first device.

Valid Display	Actual discrete text of the first Discrete Output Point

Discrete Output Point 2
This decision displays the commanded state of the second device.

Valid Display Actual discrete text of the first Discrete Output Point

Discrete Input Point 1
This decision displays the status of the first device.

Valid Display	Off/On

Discrete Input Point 2
This decision displays the status of the second device.

Valid Display	Off/On

Occupied ?
This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Yes*.

Valid Display	No/Yes

Equipment Status Point
This decision displays the actual state of the discrete control point. *On* will cause a device to start.

Valid Display	Off/On

Lead Lag Control
Lead Lag Control function displays the current device sequence, runtime, and status for this algorithm.

Lead Device
This decision displays the value of the current lead device.

Valid Display	1 (First Discrete Output Point) 2 (Second Discrete Output Point)

Device 1 Runtime
This decision displays how long, in hours, that Device1 has been On.

Valid Display 0 to 65535 hours

Device 2 Runtime
This decision displays how long, in hours, that Device2 has been On.

Valid Display 0 to 65535 hours

Failed Flag
This decision indicates when both devices fail. If neither the lead nor lag device can be started, the Failed Flag will be set to *Alarm*.

Valid Display Normal/Alarm

Lead Status
This decision displays the current state of the lead device.

Valid Display Off/On

Control Sensor
This decision displays the current value of the Control Sensor. This value is used by the Analog function to compare against the configured Setpoint Schedule. The result determines whether a device should be started.

Valid Display -9999.9 to 9999.9 range based upon selected display units.

Analog
Analog function is one of three methods that can be used to control device operation. The setpoint values are compared with the Control Sensor to determine whether a device should be started.

Reference Output
This decision shall display the calculated output state that is used to drive the Discrete Output Point.

Valid Display	False/True

Hysteresis
This decision displays the amount that is added to the low setpoint and subtracted from the high setpoint.

Valid Display	0.0 to 9999.9 range based upon selected display units.

Low Setpoint
This decision displays the low setpoint value, excluding Hysteresis. If the Control Sensor is below this value, the Discrete Output Point will be commanded On.

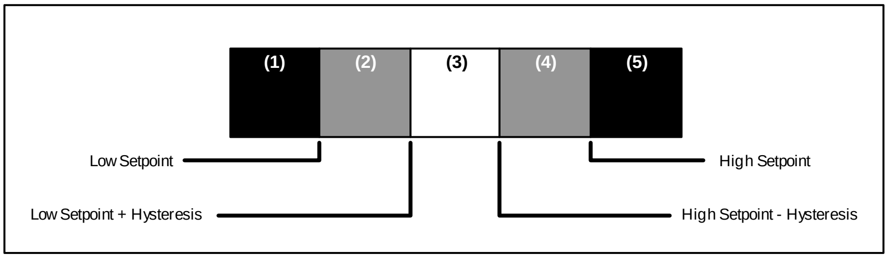
Valid Display	0.0 to 9999.9 range based upon selected display units.

High Setpoint
This decision displays the High Setpoint value, excluding Hysteresis. If the Control Sensor exceeds this value, the Discrete Output Point will be commanded On.

Valid Display	0.0 to 9999.9 range based upon selected display units.

Low Sensor Region
This decision displays the temperature region of the single Control Sensor where the regions are defined as follows, with 0 displayed when the algorithm is inactive:

Valid Display	0 to 5



High Sensor Region

This decision displays the temperature region of the single Control Sensor where the regions are defined as shown above, with 0 displayed when the algorithm is inactive.

Valid Display 0 to 5

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every second.

Valid Display 0 to 300 seconds

DO—Lighting Control

The DO Lighting Control algorithm controls the state of two discrete points. These points are pulsed On based upon the current state of the Control Point or upon a Time Schedule. One point is the Pulsed On Output and the other is the Pulsed Off Output.

If the input transitions from Off to On, or if the Time Schedule goes occupied, the algorithm turns On the Pulsed On Output for one second. If the input transitions from On to Off, and the Time Schedule is unoccupied or unused, the algorithm turns On the Pulsed Off Output for one second. If the Time Schedule goes unoccupied and the input is Off, the algorithm turns On the Pulsed Off Output for one second. Optionally, the Pulsed Off Output can be continually re-pulsed On at configured intervals. Optionally, the Pulsed Off Output can be pulsed and then after two seconds the Pulsed On Output can be pulsed, at a configured number of minutes before an unoccupied period if the input is Off.

If either Discrete Output Point is forced, the forced value takes precedence over the algorithm as the Discrete Output value.

The Time Schedule indicates the current occupancy mode for this algorithm. Control can be based on either the Time Schedule, or the Control Point, or both simultaneously. If neither is configured, the algorithm will be disabled.

The Discrete Output Point 1 that acts as the Pulsed On Output has been specified as the default for the algorithm. That is, it is the point whose algorithm is now being configured.

The algorithm output discrete units will be the same as the Pulsed On Discrete Output Point 1. However, Discrete In state will be displayed as Off/On.

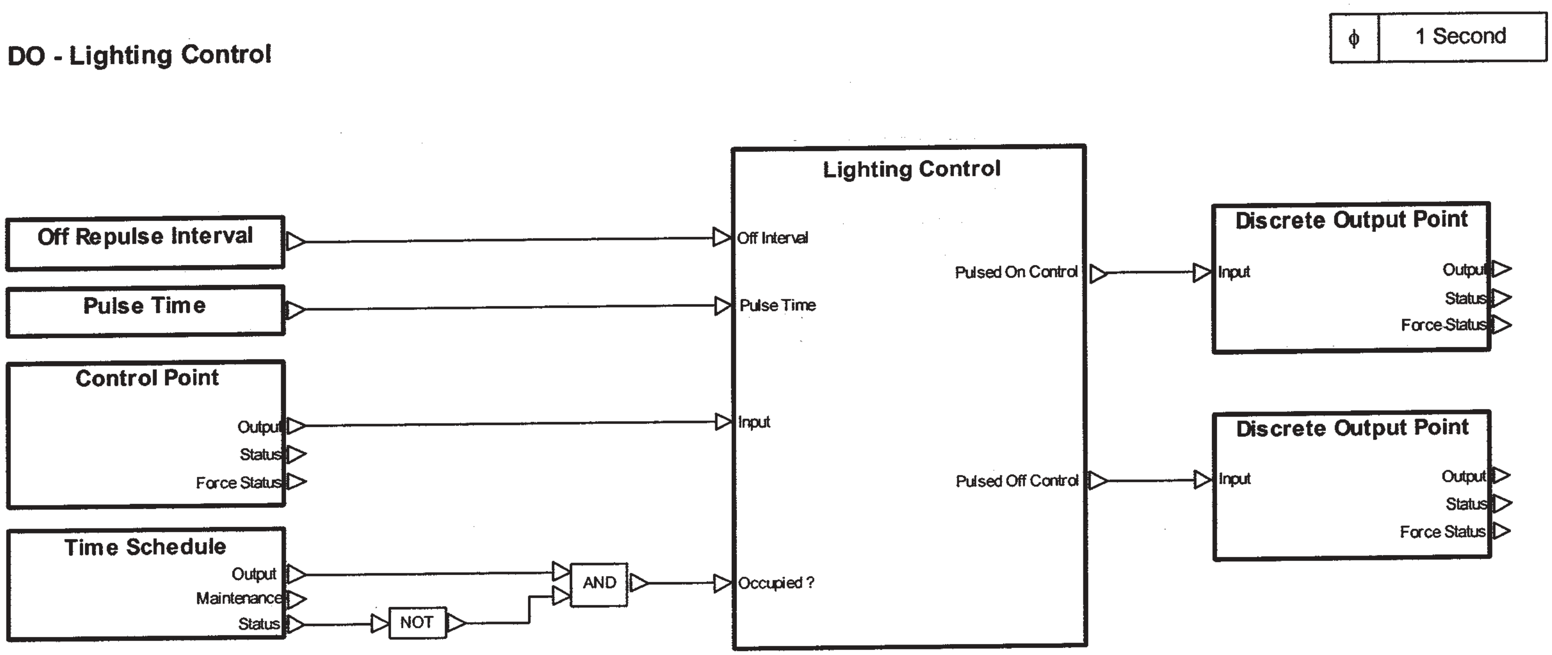
Typical Application

This algorithm can be used to interface with a commercial lighting control panel.

List of Configuration Decisions

Discrete Output Point 2
Control Point
Time Schedule
Unoccupied Pulse Time
Off Re-Pulse Interval
Power on Delay

Figure 5-17
Lighting Control



List of Maintenance Decisions

Discrete Output Point 1
Discrete Output Point 2
Control Point
Occupied?
Task Timer

Configuration Decisions

Discrete Output Point 2

You must configure this decision to specify the DO point that acts as the Pulsed Off Output whenever the input transitions to the OFF state. Valid entry is required for the algorithm to operate correctly.

Allowable Entries	Any valid point name
Default Value	POINT0

Control Point

Use this decision to specify the discrete point that will be monitored to determine when to turn the lights On or Off. Valid entry is required for the Control Point part of the algorithm to operate.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. Valid entry is required for the Time Schedule part of the algorithm to operate.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, or LINK_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00 where 00 represents an invalid schedule number

Unoccupied Pulse Time

Use this decision to specify the number of minutes before an unoccupied period when the Pulsed Off Output is to be pulsed on for two seconds. An entry of 0 shall disable this function.

Allowable Entries	0 to 10 minutes
Default Value	0

OFF Re-Pulse Interval

Use this decision to configure the interval, in minutes, that the Pulsed Off Output will re-pulse automatically when in the Off state.

Allowable Entries	0 to 240 minutes
Default Value	60

Power on Delay

Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point 1

This decision displays the status of the Pulsed On Output point.

Valid Display	Actual discrete text of Pulsed On Discrete Output Point 1

Discrete Output Point 2

This decision displays the status of the Pulsed Off Output point.

Valid Display	Actual discrete text of the Pulsed Off Output Point 1

Control Point

This decision displays the value of the discrete point that determines the lighting condition.

Valid Display	Off/On (Off = 0 or On = 1)

Occupied?

This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, the decision will be Yes, but control is unaffected.

Valid Display	No/Yes (No = 0 or Yes = 1)

Task Timer

This decision displays the number of seconds remaining before this algorithm executes again. This algorithm will execute every 1 second.

Valid Display	0 to 1 second

DO—Permissive Interlock

The DO Permissive Interlock algorithm overrides the state of a Discrete Outpit point. The algorithm bases its decision on the current state of the Discrete Control Point compared to a configured state or the current value of the Analog Control Point compared to a setpoint.

Four DO Permissive Interlocks with no units are provided as system tables and are made available after the factory software download.

If the Control Point Type decision is configured to be discrete and the Discrete Control Point is equal to the configured Occ Discrete State or Unocc Discrete State for the Persistence Time, the algorithm forces the Discrete Output Point to the Override Value. An Override Value of *0* forces the point Off. A value greater than zero forces the point On. When the Discrete Control Point is no longer equal to the configured Occ or Unocc Discrete State for the Persistence Time, the algorithm sets the Discrete Output Point to automatic control.

If the Control Point Type decision is configured to be analog and the Analog Control Point is higher or lower (based on the Occ or Unocc Analog Test decision) than the configured low setpoint for the Persistence Time, the algorithm forces the Discrete Output Point to the Override Value. If this is not true, applying the configured Hysteresis for the Persistence Time, the algorithm sets the Discrete Output Point to automatic control.

The algorithm supports two levels of forcing (Force Precedence) to enable the user to configure two Permissive Interlocks to control the same point. The Force Precedence value indicates whether the algorithm has high (Control) or low (BEST) precedence over the controlled point.

The Time Schedule indicates the current occupancy mode for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoint and indicates the test conditions used to override the point. If a Time schedule is not configured for this algorithm, the algorithm will default to the occupied state.

The DO Permissive Interlock algorithm will be preset to no analog engineering units for the control sensors, and will limit the discrete text of the algorithm to Off/On.

Typical Application

If a DO Analog Comparison normally controls a reheat coil hot water pump, then this algorithm can be used to prevent the pump from starting when the supply fan is off.

List of Configuration Decisions

Discrete Output Point
Time Schedule
Occupied Setpoint
Unoccupied Setpoint
Permissive Interlock
- Control Point Type
- Occ Discrete State
- Unocc Discrete State
- Occ Analog Test
- Unocc Analog Test
- Override Value
- Hysteresis
- Persistence Time
- Force Precedence

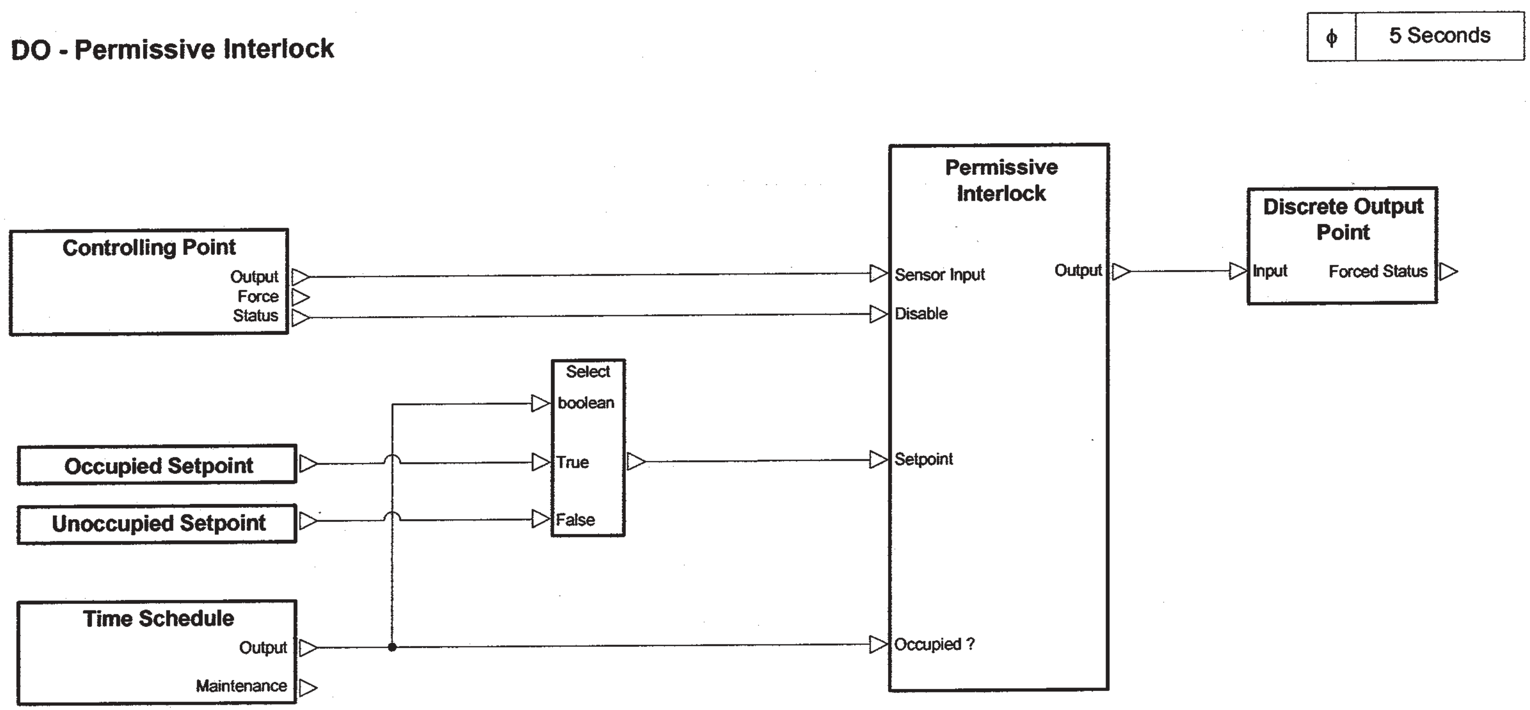
Analog Control Point
Discrete Control Point
Power on Delay

List of Maintenance Decisions

Discrete Output Point
Occupied?
Permissive Interlock
- Reference Output
- Perm Interlock Flag
- Conditional
- Modified Setpoint
- Persistence Timer
- Force Precedence

Setpoint Limit
Analog Control Point
Discrete Control Point
Task Timer

Figure 5-18
DO—Permissive Interlock



Configuration Decisions

Discrete Output Point
Use this decision to specify the DO point that will be overridden when the test conditions have been met for the configured Persistence Time. Valid entry is required for the algorithm to operate.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule
Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm will assume to be in the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99, or LINK_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Occupied Setpoint
If the Control Point Type decision is set to *Analog*, use this decision to specify the Occupied Setpoint (no units) to which the controlling point will be compared.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Unoccupied Setpoint
If the Control Point Type decision is set to *Analog*, use this decision to specify the Unoccupied Setpoint (no units) to which the controlling point will be compared.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Permissive Interlock

Permissive Interlock determines if the Discrete Output Point should be forced to the configured override value when the input conditions are met.

Control Point Type
Use this decision to define whether the Control Point is analog or discrete.

Allowable Entries	Analog/Discrete
Default Value	Analog

Occ Discrete State
If the Control Point Type is Discrete, use this decision to define the input state when the Time Schedule is occupied that will cause the Discrete Output Point to be overridden.

Allowable Entries	On/Off
Default Value	On

Unocc Discrete State
If the Control Point Type is Discrete, use this decision to define the input state when the Time Schedule is unoccupied that will cause the Discrete Output Point to be overridden.

Allowable Entries	Off/On
Default Value	Off

Occ Analog Test
If the Control Point Type is Analog, use this decision to indicate if the Analog Control Point must be higher or lower than the occupied low setpoint in order to override the Discrete Output Point.

Allowable Entries	Low/High
Default Value	High

Unocc Analog Test

If the Control Point Type is Analog, use this decision to indicate if the Analog Control Point must be higher or lower than the unoccupied low setpoint in order to override the Discrete Output Point.

Allowable Entries	Low/High
Default Value	Low

Override Value

Use this decision to specify the value to which the Discrete Output Point is forced when the proper input condition for the configured Persistence Time exists.

Note: You should only enter either *0.0* (off) or *1.0* (on). Any non-zero value indicates an on state.

Allowable Entries	-9999.9 to 9999.9
Default Value	0.0

Hysteresis

If the Control Point Type is Analog, use this decision to specify the value above or below the setpoint (based upon the analog test) that the Analog Control Point must be before the override is released.

Allowable Entries	0.0 to 9999.9
Default Value	1.0

Persistence Time

Use this decision to indicate how long the input condition must exist before the Discrete Output Point is overridden or how long the input condition must not exist before the Discrete Output Point is released to automatic control.

Allowable Entries	0 to 3600 seconds
Default Value	30

Force Precedence
Use this decision to configure the Force Precedence for the Permissive Interlock algorithm.

Application Note: If two permissive interlocks are used, each must have a different force precedence state: Low (BEST) and High (Control).

Allowable Entries	Low/High
Default Value	Low

Analog Control Point
Use this decision to specify the analog point that the algorithm tests to determine if the Discrete Output Point should be overridden. If this decision is not configured, the Analog Control Point value is set to *0.0* and the algorithm is disabled.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Control Point
Use this decision to configure the discrete point that the algorithm tests to determine if the Discrete Output Point should be overridden. If this decision is not configured, the Discrete Control Point state is set to *Off* and the algorithm is disabled.

Allowable Entries	Any valid point name
Default Value	POINT0

Power on Delay
Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point
This decision displays the actual state of the DO point being controlled by this algorithm.

Valid Display	Off/On

Occupied ?
This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Yes*.

Valid Display No/Yes

Permissive Interlock
This function determines if a configured condition has occurred, and if so, the Output point is overridden and set equal to the Reference Output, until the causal condition no longer exists.

Reference Output
This decision displays the override Discrete State when it is applied to the Discrete Output point.

Valid Display 0.0/1.0

Perm Interlock Flag
This decision indicates whether the Permissive Interlock condition is in effect.

Valid Display False/True

Conditional
This decision displays the current analog conditional value (High or Low) based on the Occupancy state.

Valid Display Low/High

Modified Setpoint
This decision displays the modified Setpoint Value that is currently being used to compare with the Analog Control point. It includes a configured hysteresis, and allows for the conditional check being performed (High or Low). This value will be *0* if a Discrete Control point is being used.

Valid Display -9999.9 to 9999.9

Persistence Timer
This decision displays how much time is left before the Permissive Interlock condition will take effect.

Valid Display 0 to 3600 seconds

Force Precedence
This decision displays the configured Force Precedence used by the Permissive Interlock algorithm to control (override) the output point.

Valid Display Low/High

Setpoint Limit
This decision displays the setpoint that is being compared to determine if the Permissive Interlock condition will take effect.

Valid Display -9999.9 to 9999.9

Analog Control Point
This decision displays the value of the configured Analog Point which is being used to determine when the Permissive Interlock will occur when the Control Point Type is analog.

Valid Display -9999.9 to 9999.9

Discrete Control Point
This decision displays the value of the configured Discrete Point which is being used to determine when the Permissive Interlock will occur when the Control Point Type is discrete.

Valid Display Off/On

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every five seconds.

Valid Display 0 to 5 seconds

DO—Slave Point

A DO slave point is controlled by another point's algorithm such as Floating Point control, or by a Permissive Interlock. It has no control algorithm of its own.

A DO slave point can also be controlled as a Network Output point of another controller.

If the Discrete Output Point is forced, the forced value takes precedence over any algorithm as the Discrete Output value.

A slave point has no algorithm configuration or maintenance decisions.

DO—Staging

The DO Staging algorithm controls up to eight stages of cooling based on user-defined setpoints. This algorithm can also be configured to perform dehumidification.

The DO Staging algorithm uses a PID (Proportional Integral Derivative) Master Loop to control the output stages. The PID Master Loop calculates the percentage of output stages required to maintain the high setpoint. The PID Master Loop calculates the required percentage of output stages by obtaining the sensor input from the Control/Sensor Group and comparing it to the high setpoint configured in the Setpoint Schedule. The Sensor Group by default, utilizes its sensor select function to obtain the space temperature sensor value. The Master Reference will be set to the Maximum Output value when dehumidification is being performed.

The stages are activated sequentially, allowing a configured delay time between each stage. Once a stage is activated, it will not be de-activated until the calculated number of stages has decreased by a full stage. This hysteresis prevents short cycling of stages. While the time delay of a newly activated stage is active, that is while waiting for it to have an effect on the controlled space temperature, the algorithm clamps the PID Master Loop integrator at its current value.

If the Equipment Status Point is Off, all stages are turned Off. If the Sensor Group/SPT Sensor status is invalid, the PID Master Loop sets the output to the Disabled Output Value.

Forcing of any Discrete Output Point takes precedence over the algorithm as the Discrete Output value, but the algorithm will not be affected.

The Time Schedule indicates the current occupancy state for this algorithm. The occupancy mode defines when the controller is using the occupied or unoccupied setpoints.

The Setpoint Schedule allows you to configure high and low setpoints for both occupied and unoccupied states. The algorithm uses the high setpoint.

The DO Staging algorithm limits engineering units for the control sensors to humidity and temperature. The algorithm's output discrete units are the same as the first Discrete Output Point. However, Equipment Status Point is displayed as Off/On and the PID Master Loop's output is displayed as % capacity.

Typical Application

You can use this algorithm to control up to eight DX cooling stages in a constant volume system.

Note that the Discrete Output Point 1 that is controlling the first stage has been specified as the default for the algorithm. That is, it is the point whose algorithm is now being configured.

List of Configuration Decisions

Discrete Output Point 2
Discrete Output Point 3
Discrete Output Point 4
Discrete Output Point 5
Discrete Output Point 6
Discrete Output Point 7
Discrete Output Point 8
Equipment Status Point
Control/Sensor Group
Time Schedule
Setpoint Schedule
High Humidity Switch
Humidity Setpoint
High Humidity Sensor
PID Master Loop
- Proportional Gain
- Integral Gain
- Derivative Gain
- Disabled Output Value
- Minimum Output Value
- Maximum Output Value
- Starting Value
- Block Iteration Rate

Staging Control
- Total Number of Stages
- On Time Delay
- Off Time Delay

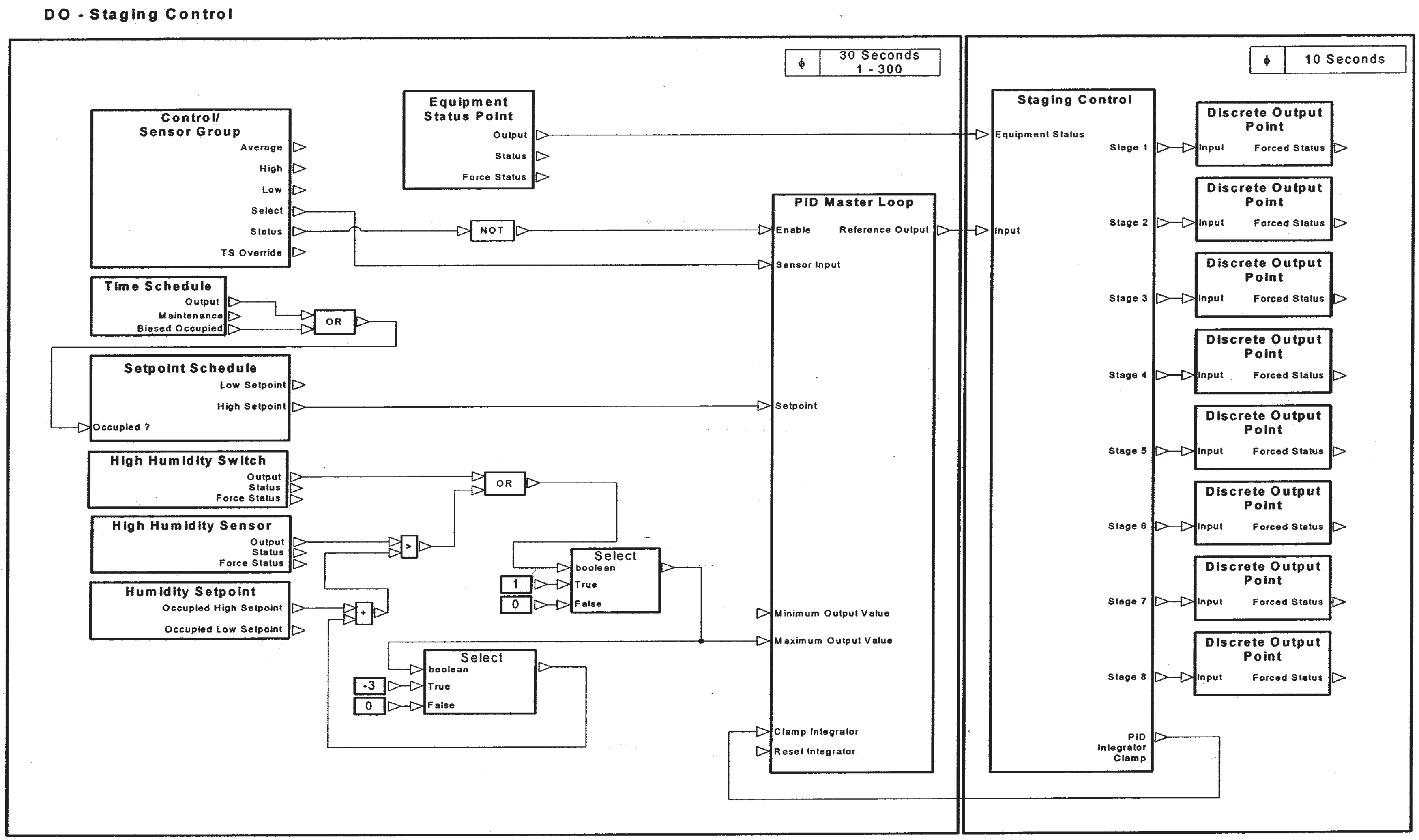
Power on Delay

List of Maintenance Decisions

Discrete Output Point 1
Discrete Output Point 2
Discrete Output Point 3
Discrete Output Point 4
Discrete Output Point 5
Discrete Output Point 6
Discrete Output Point 7
Discrete Output Point 8
Equipment Status Point
Control/Sensor Group
Occupied/Biased?
Setpoint Schedule
High Humidity Switch

(*continued*)

Figure 5-19
DO—Staging



- High Humidity Setpoint
- High Humidity Sensor
- PID Master Loop
  - Reference Output
  - Proportional Term
  - Integral Term
  - Derivative Term
  - Integrator Flags
- Staging Control
  - Number of Stages
  - Requested Stages
  - Delta Stages
  - Delay Timer
  - PID Integrator Clamp
- Task Timer

Configuration Decisions

Discrete Output Point 2
Use this decision to specify the DO point that is controlling the second stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 3
Use this decision to specify the DO point that is controlling the third stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 4
Use this decision to specify the DO point that is controlling the fourth stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 5
Use this decision to specify the DO point that is controlling the fifth stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 6

Use this decision to specify the DO point that is controlling the sixth stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 7

Use this decision to specify the DO point that is controlling the seventh stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Discrete Output Point 8

Use this decision to specify the DO point that is controlling the eighth stage.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status Point

Use this decision to specify the Discrete point that provides the on/off status of the equipment. The Discrete point provides the actual state of the equipment. If this point is not configured or the state is Off, all stages will be turned Off.

Allowable Entries	Any valid point name
Default Value	POINT0

Control/Sensor Group

Use this decision to specify the Control Sensor or Sensor Group that is providing the control inputs. If this point is not configured, the PID Master Loop output will be set to the PID Disabled Output Value. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter.

Note: Use the same Sensor Group or Control Sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR00, where 00 represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm will assume to be in the occupied state.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn*, where *nn* is from 01 to 99, LINK_01, or OPSS_01
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied space temperature setpoints for this algorithm. If this decision does not contain a valid Setpoint Schedule name the defaults listed in Appendix B will be used.

Note: Use the same Space Temperature Setpoint for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point
Default Value	SETPT00

High Humidity Switch

If the equipment is performing dehumidification, use this decision to specify the Discrete point that indicates when dehumidification is needed. The algorithm can use a High Humidity Switch or High Humidity Sensor to determine if dehumidification is needed. If neither is configured, dehumidification will not take place.

Allowable Entries	Any valid point name
Default Value	POINT0

Humidity Setpoint

If the system is performing dehumidification, use this decision to specify the humidity Setpoint Schedule that provides the high humidity setpoint for this algorithm.

Allowable Entries	SETPT*nn*, where *nn* = 03 (humidity)
Default Value	SETPT00

High Humidity Sensor
If the air handler is performing dehumidification, use this decision to specify the AI point that provides the space or return air humidity sensor being monitored. Dehumidification is required if the High Humidity Sensor value is greater than the occupied high setpoint from the Humidity Setpoint.

Allowable Entries	Any valid point name
Default Value	POINT0

PID Master Loop
The master loop is a Proportional Integral Derivative (PID) control loop that calculates the percentage of output stages required to achieve the desired space temperature setpoint. The percent of output stages will be activated in whole stage increments.

Proportional Gain
Use this decision to enter the value that is multiplied by the error to produce the proportional term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	-5.0

Integral Gain
Use this decision to enter the value that is multiplied by the error and then added to the current integral term to produce the new integral term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	-0.4

Derivative Gain
Use this decision to enter the value that is multiplied by the current error minus the previous error to produce the derivative term. The value in this decision is expressed in units-per-unit of error.

Allowable Entries	-100.0 to 100.0
Default Value	0.0

Disabled Output Value
Use this decision to specify the percentage of available outputs that will be activated if the sensor becomes invalid.

Allowable Entries	0.0 to 100.0%
Default Value	0.0

Minimum Output Value
Use this decision to specify the minimum percentage of available output stages that will always be activated. For example, if five stages are available, each stage is worth 20%. Therefore, if this decision is set to 20%, one output will always be activated.

Allowable Entries	0.0 to 100.0%
Default Value	0.0

Maximum Output Value
Use this decision to specify the maximum percentage of available output stages that can be activated. For example, if five stages are available, each stage is worth 20%. Therefore, if this decision is set to 80%, one output cannot be activated.

Allowable Entries	0.0 to 100.0%
Default Value	100.0

Starting Value
Use this decision to specify the percentage of the available output stages that are activated when the algorithm is started.

Allowable Entries	0.0 to 100.0%
Default Value	0.0

Block Iteration Rate
The value in this decision indicates how often the PID Master Loop calculates the output value.

Allowable Entries	1 to 300 seconds
Default Value	30

Staging Control

Staging Control starts and stops up to eight discrete stages based on the output (percentage) from the PID Master Loop. You can configure the minimum time between starting and stopping stages.

Total Number of Stages

Use this decision to specify the number of discrete stages the algorithm will control.

Allowable Entries	1 to 8
Default Value	8

On Time Delay

Use this decision to specify the minimum time delay between the starting of stages. This value represents the time from starting the stage to its effect on the controlled temperature.

Allowable Entries	0 to 30 minutes
Default Value	1

Off Time Delay

Use this decision to specify the minimum time delay between the stopping of stages. This value represents the time from stopping the stage to its effect on the controlled temperature.

Allowable Entries	0 to 30 minutes
Default Value	5

Power on Delay

Use this decision to specify the number of seconds the Universal Controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Discrete Output Point 1

This decision displays the actual state of the discrete point controlling the first stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 2
This decision displays the actual state of the discrete point controlling the second stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 3
This decision displays the actual state of the discrete point controlling the third stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 4
This decision displays the actual state of the discrete point controlling the fourth stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 5
This decision displays the actual state of the discrete point controlling the fifth stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 6
This decision displays the actual state of the discrete point controlling the sixth stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 7
This decision displays the actual state of the discrete point controlling the seventh stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Discrete Output Point 8
This decision displays the actual state of the discrete point controlling the eighth stage.

Valid Display	Actual discrete text of the Discrete Output Point 1

Equipment Status Point
This decision displays the actual state of the equipment that determines whether this algorithm is enabled.

Valid Display	Off/On

Control/Sensor Group
This decision displays the value of the single AI sensor (if chosen) or the selected sensor in the sensor group (if chosen).

Valid Display	-40.0°F to 245.0°F (-40.0 to 118.3°C)

Occupied/Biased ?
This decision displays the current occupancy status based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be occupied and *Yes* will be displayed.

Valid Display	No/Yes

Setpoint Schedule
This decision displays the high setpoint of the configured Setpoint Schedule. The occupancy state and any Setpoint Offset are taken into account when this value is determined.

Valid Display	-50.00 to 255.00°F (-45.6 to 129.3°C)

High Humidity Switch
This decision displays the state of the high humidity switch sensor being monitored. If the decision was not configured, this value will default to *Off*.

Valid Display	Off/On

High Humidity Setpoint
This decision specifies the current high humidity setpoint for this algorithm. If the decision was not configured, this value will default to 99% RH, which will prevent any dehumidification.

Valid Display 0.00 to 100.00% RH

High Humidity Sensor
This decision displays the value of the humidity sensor being monitored. Dehumidification is required only if this value exceeds the High Humidity Setpoint.

Valid Display 0.00 to 100.00% RH

PID Master Loop
The PID Master Loop function calculates the desired output based on the configured PID gains and the current deviation from setpoint. The calculated output is re-adjusted periodically to move closer toward the desired setpoint.

In Figure 5-19 and Appendix A Figure 17:
Setpoint = Setpoint Schedule
Sensor Input = Control/Sensor Group

Reference Output
This decision displays the calculated output that is used to determine the number of Discrete Output Points required.

Reference Output = (Proportional Term + Integral Term + Derivative Term + Starting Value)

Valid Display 0.0 to 100.0%, clamped to Minimum and Maximum Output Values

Proportional Term
This decision displays the proportional error term as it is calculated by the PID equation.

Proportional Term = (Setpoint Schedule - Control/Sensor Group) * Proportional Gain

Valid Display -9999.9 to 9999.9%

Integral Term

This decision displays the integral error term as it is calculated by the PID equation.

Integral Term = ((Setpoint Schedule - Control/Sensor Group) * Integral Gain) + Previous Integral Term

Valid Display	-9999.9 to 9999.9%

Derivative Term

This decision displays the derivative error term as it is calcu lated by the PID equation.

Proportional Term = (Current Error - Previous Error) * Deriva tive Gain

Note: Error = (Setpoint Schedule - Control/Sensor Group)

Valid Display	-9999.9 to 9999.9%

Integrator Flags

This three-digit field displays the status of the PID Master Loop.

Left Digit	0 = PID Active 1 = PID Inactive (Disabled or Min/Max Clamp)
Center Digit	0 = Integrator calculating normally 1 = Integrator has been reset
Right Digit	0 = No Integrator clamp 1 = Integrator clamp active
Valid Display	000 to 101

Staging Control

This function starts and stops up to eight stages of cooling or cooling tower fans. The control is based on the reference output from the PID Master Loop.

Number of Stages

This decision displays the number of stages that are currently On.

Valid Display	0 to 8

Requested Stages

This decision displays the number of stages that the algorithm requests On. The number is determined by the Reference Output value in relation to the configured Total Number of Stages.

Valid Display 0 to 8

Delta Stages

This decision displays the difference between the Number of Stages and the number of Requested Stages.

Valid Display 0 to 8

Delay Timer

This decision displays the number of minutes remaining in the configured On Time Delay or Off Time Delay decision (whichever is applicable) that must elapse before another stage can be added or taken away. When Delta Stages equals *0*, the value in this decision will equal *0*.

Valid Display 0 to 30 minutes

PID Integrator Clamp

This decision displays whether or not the PID Clamp is currently in effect for the staging control function.

Valid Display Off/On

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every ten seconds.

Valid Display 0 to 10 seconds

Linkage/OPSS Schedule

As part of an integrated systems approach, the Controller supports linkage to Carrier electronically-controlled air terminals. Each Controller can support one Air Source linkage controlled system. The Carrier zoning system uses linkage to provide optimum comfort without sacrificing energy efficiency. This is done by providing the air handler as configured in the Controller with the dynamic information necessary to condition the spaces without over or under conditioning.

One (1) Air Source Linkage with Optimal Start/Stop (OPSS) algorithm is provided as a system table and made available after the factory software download.

To allow the air source to respond to changing conditions in the zones, a Linkage Master zone sends compiled linkage information to the controller (e.g. temperature, occupancy).

Additionally, as part of the linkage strategy, the controller is provided information such as occupancy mode, average setpoints, and earliest occupied time of any zone. The information is used by the controller algorithms to determine the mode of control, to reset supply air, to increase indoor air quality, and to minimize energy consumption. The information is also used by the Optimal Start and Stop routines.

The controller sends information such as operating mode, optimal start bias time, and supply air temperature to the Master Linkage Control so it can properly control the zone's temperatures.

In the event that linkage communication fails, the Linkage/OPSS Schedule algorithm uses the configured Time Schedule to determine occupancy and uses the configured Setpoint Schedule to determine the occupied and unoccupied setpoints. If a Time Schedule is not configured and linkage fails, the algorithm defaults to the occupied state. If a Setpoint Schedule is not configured, the algorithm uses default occupied setpoints. If the Sensor Group/SPT Sensor is not configured, the algorithm uses the default value of 0°F. However, in the event that linkage communications fails, the Linkage/OPSS algorithm will be disabled.

To configure an algorithm to use Linkage, the user must enter LINK_01 name in one or more of the algorithm's configuration decisions (Time Schedule, Setpoint Schedule, Sensor Group/SPT Sensor).

List of Configuration Decisions

- Setpoint Schedule
- Optimal Start
  - Cooling Factor
  - Heating Factor
- Sensor Group/SPT Sensor
- Time Schedule
- NTFC Algorithm
- Supply Air Temp
- Equipment Status
- Optimal Stop
  - Stop Time Bias
  - Setpoint Delta
  - Evacuation
  - Pressurization
  - Power on Delay

List of Maintenance Decisions

- Optimal Start
  - Start Bias
  - Biased Start Day
  - Biased Start Time
  - Biased Occupied
- Sensor Group/SPT Sensor
- Sensor Group Low
- Sensor Group High
- Occupied?
- Linkage Time Schedule
  - Mode
  - Biased Occupied
  - Next Occupied Day
  - Next Occupied Time
  - Next Unoccupied Day
  - Next Unoccupied Time
  - Last Unoccupied Day
  - Last Unoccupied Time
  - Status
  - Override Is Set
- Linkage Setpoint Schedule
  - Occupied Lo Setpoint
  - Occupied Hi Setpoint
  - Unoccupied Lo Setpoint
  - Unoccupied Hi Setpoint

Linkage Space Temp
Supply Air Temp
Equipment Status
Air Side Linkage
- Linkage Status
- Supervisory Element
- Supervisory Bus
- Supervisory Block No.
- Avg Occ Heat Setpoint
- Avg Occ Cool Setpoint
- Avg Unocc Heat Setpoint
- Avg Unocc Cool Setpoint
- Avg Zone Temperature
- Avg Occ Zone Temp

Optimal Stop
- Biased Low Setpoint
- Biased High Setpoint
- Biased Stop
- Biased Stop Day
- Biased Stop Time

Evacuation
Pressurization
Task Timer

Configuration Decisions

Setpoint Schedule
Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied low setpoints for this algorithm as a backup in the event that linkage fails. If a Setpoint Schedule is not configured, the algorithm will use the default occupied setpoints.

Allowable Entries SETPT*nn*, where *nn* = 01 or 02 (temperature)
Default Value SETPT00

Optimal Start
Optimal Start heats up or cools down the controlled space prior to it becoming occupied. It allows the space temperature to gradually approach and then achieve the occupied setpoint at the time of occupancy.

Cooling Factor
Use this decision to specify the time (in minutes per degree F of error) for achieving the cooling setpoint.

Allowable Entries	0 to 60
Default Value	0

Heating Factor

Use this decision to specify the time (in minutes per degree F of error) for achieving the heating setpoint.

Allowable Entries	0 to 60
Default Value	0

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs as a backup in the event that linkage fails. If the Sensor Group/SPT Sensor is not configured, the algorithm will use the default value of 0.0°F. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter.

Note: Use the same Sensor Group or SPT Sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name
Default Value	SNSGR*00*, where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm in the event that linkage fails.

Note: Use the same Time Schedule for all algorithms that contain a common air handler.

Allowable Entries OCCPC*nn*, where *nn* = 01 to 99

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

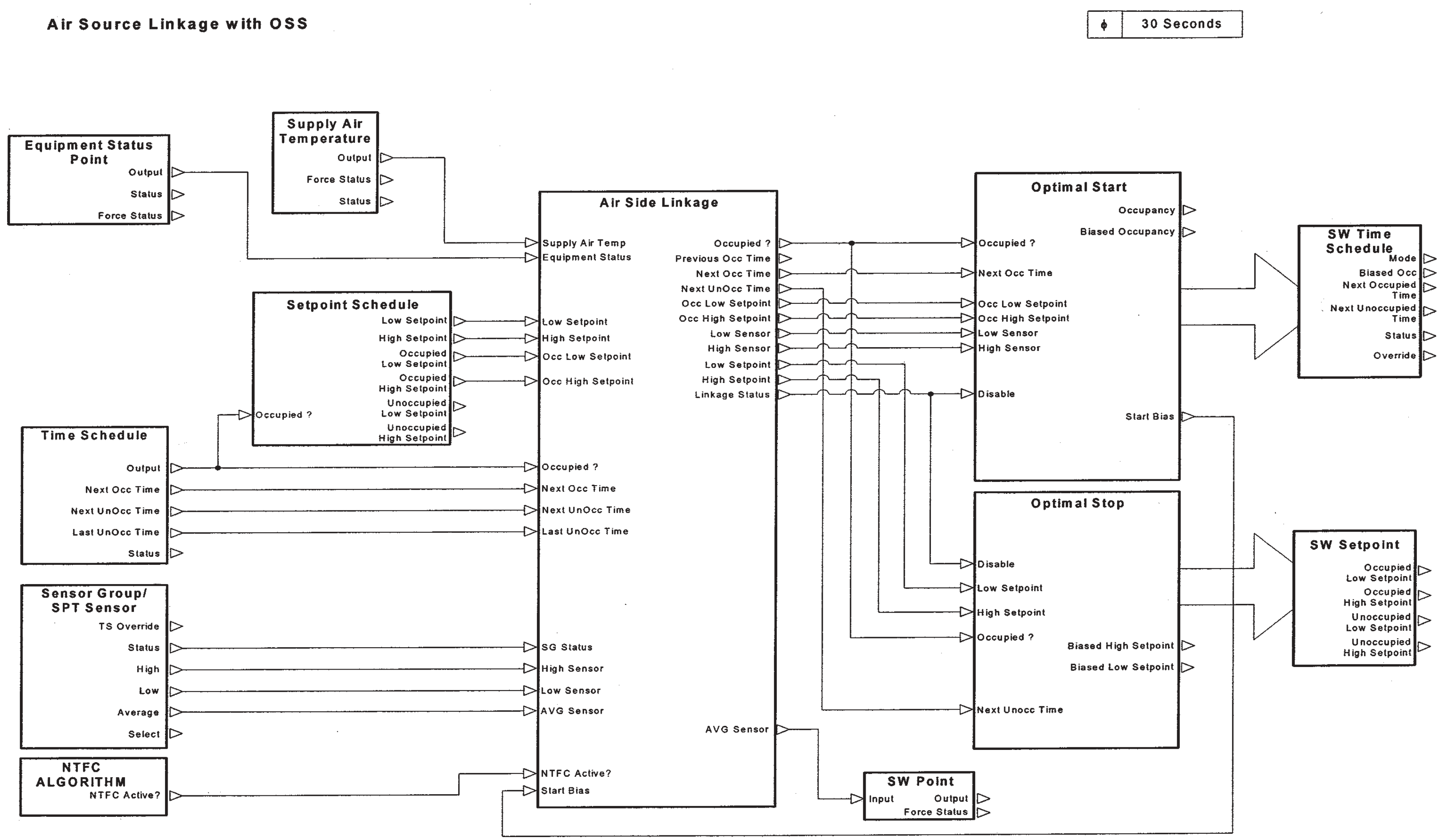
Default Value OCCPC00

NTFC Algorithm

Use this decision to identify the NTFC w Enthalpy Check algorithm name that linkage uses to determine if the system is in the Night Time Free Cooling (NTFC) operating mode.

Allowable Entries	NTFC_*nn*, where *nn* = 00 or 01
Default Value	NTFC_01

Figure 5-20
Linkage/OPSS Schedule



Supply Air Temp
Use this decision to specify the AI point that provides the supply air temperature to this algorithm. If this point is not configured then the value will be set to 0.0°F.

Allowable Entries	Any valid point name
Default Value	POINT0

Equipment Status
Use this decision to specify the discrete point that provides the on/off status of the equipment. The discrete point provides the actual state of the equipment. If this point is not configured then the state will be set to *Off*.

Allowable Entries	Any valid point name
Default Value	POINT0

Optimal Stop
Optimal Stop expands the occupied setpoints during the last portion of the occupied time.

Stop Time Bias
Use this decision to specify the number of minutes that the expanded occupied setpoints can be used prior to the controlled space becoming unoccupied.

Allowable Entries	0 to 60 minutes
Default Value	0

Setpoint Delta
Use this decision to enter the number of degrees that are applied to expand the occupied setpoints during Optimal Stop.

Allowable Entries	0.0 to 5.0^F	(0.0 to 2.8^C)
Default Value	2.0	

Evacuation
Use this decision to specify the discrete point that indicates when the air handler is in evacuation mode.

Allowable Entries	Any valid point name
Default Value	POINT0

Pressurization
Use this decision to specify the discrete point that indicates when the air handler is in pressurization mode.

Allowable Entries	Any valid point name
Default Value	POINT0

Power on Delay
Use this decision to specify the number of seconds the controller must wait to activate this algorithm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Optimal Start
Optimal Start is used to bring comfort conditions to prescribed levels by the beginning of the next occupied period.

Start Bias
This decision displays the adjustment value, in minutes, for the Optimal Start routine.

Valid Display 0 to 9999 minutes

Biased Start Day
This decision displays the day of the week that the next biased start time will occur.

Valid Display Sun through Sat or blank

Biased Start Time
This decision displays the time of day that the next biased start will occur. This value is determined by subtracting the calculated start time bias from the next configured occupied time.

Valid Display 00:00 to 23:59

Biased Occupied

This decision displays when the Time Schedule is currently in an occupied mode due to optimal Start/Stop.

For example, if a Time Schedule has a normal occupied time of 0800 and Optimal Start has calculated a start time offset of 15 minutes, Biased occupied will be noted at 0745.

Valid Display No/Yes

Sensor Group/SPT Sensor

This decision displays the value of the backup single AI sensor or the average of the sensor group, depending on which is selected.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Sensor Group Low

This decision displays the value of the single Analog Input sensor or the low sensor of the sensor group, depending on which is selected.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Sensor Group High

This decision displays the value of the single AI sensor or the high sensor of the sensor group, depending on which is selected.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Occupied ?

This decision displays the current occupancy mode based on the configured data in the backup Time Schedule that will be used in the event that linkage fails. If a Time Schedule has not been selected, the default mode will be Occupied.

Valid Display No/Yes

Linkage Time Schedule

Linkage Time Schedule displays the Time Schedule information as configured and used by the optimal Start and Stop routines.

Mode
This decision displays the current occupancy mode from Optimal Start.

Valid Display	0 = Unoccupied 1 = Occupied

Biased Occupied
This decision identifies when a biased occupancy condition exists.

Valid Display	0 = Not in effect 1 = Biased occupied in effect

Next Occupied Day
This decision displays the day of the week on which the next occupied period will occur.

Valid Display Sun through Sat or blank

Next Occupied Time
This decision displays the time of day when the next occupied period will occur.

Valid Display 00:00 to 24:00

Next Unoccupied Day
This decision displays the day of the week on which the next unoccupied period will occur.

Valid Display Sun through Sat or blank

Next Unoccupied Time
This decision displays the time of day when the next unoccupied period will occur.

Valid Display 00:00 to 24:00

Last Unoccupied Day
This decision displays the day of the week on which the last unoccupied period occurred.

Valid Display Sun through Sat or blank

Last Unoccupied Time

This decision displays the time of day when the last unoccupied period occurred.

Valid Display 00:00 to 24:00

Status

This decision displays the current status of the OPSS Time Schedule.

Valid Display 0 = Time Schedule found
1 = Time Schedule not found

Override Is Set

This decision identifies when the Time Schedule has been overridden from an unoccupied state to an occupied state.

Valid Display 0 = Override not in effect
1 = Override in effect

Linkage Setpoint Schedule

Linkage Setpoint Schedule displays information about the Setpoint Schedule provided by linkage for use by the equipment.

Occupied Lo Setpoint

This decision displays the Occupied Low Setpoint value, taking into account any Setpoint Offset, used by any algorithm configured to use this Linkage Setpoint Schedule. The setpoint value is dependent on the state of the communications between the Linkage Supervisory and Equipment parts. If the communication is normal, this value will be the value transmitted by the Linkage Supervisory part from the Master Linkage Control. If communication has been disrupted, the value will be determined from the locally defined Setpoint Schedule and, if configured, the OPSS Schedule algorithm.

Valid Display -50.0 to 255.0^{o}F (-45.6 to 123.9^{o}C)

Occupied Hi Setpoint

This decision displays the Occupied High Setpoint value, taking into account any Setpoint Offset, used by any algorithm configured to use this Linkage Setpoint Schedule. The setpoint value is dependent on the state of the communication between the Linkage Supervisory and Equipment parts. If the communication is normal, this value will be the value transmitted by the Linkage Supervisory part from the Master Linkage Control. If communication has been disrupted, the value will be determined from the locally defined Setpoint Schedule and, if configured, the OPSS Schedule algorithm.

Valid Display	-50.0 to 255.0°F	(-45.6 to 123.9°C)

Unoccupied Lo Setpoint

This decision displays the Unoccupied Low Setpoint value used by any algorithm configured to use this Linkage Setpoint Schedule. The setpoint value is not dependent on the state of the communication between the Linkage Supervisory and Equipment Part from the Master Linkage Control. The value will be determined from the locally defined Setpoint Schedule and if configured, the OPSS Schedule algorithm.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Unoccupied Hi Setpoint

This decision displays the Unoccupied High Setpoint value used by any algorithm configured to use this Linkage Setpoint Schedule. The setpoint value is not dependent on the state of the communication between the Linkage Supervisory and Equipment Part from the Master Linkage Control. The value will be determined from the locally defined Setpoint Schedule and if configured, the OPSS Schedule algorithm.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Linkage Space Temp

This decision displays the space temperature value used by any algorithm configured to use this Linkage Space Temp. The value is dependent on the state of the communication between the Linkage

Supervisory and Equipment parts. If the communication is normal, this value will be the value transmitted by the Linkage Supervisory part, specifically AZT or AOZT from the Master Linkage Control. If communication has been disrupted, the value will be determined from the locally defined Sensor Group.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Supply Air Temp
This decision displays the value of the supply air temperature.

Valid Display	-40.00 to 245.00°F	(-40.0 to 118.3°C)

Equipment Status
This decision displays the status of the equipment.

Valid Display	Off/On

Air Side Linkage
Air Side Linkage provides current linkage information such as linkage status, supervisory bus, element, and block numbers, average setpoints, and average zone temperatures.

Linkage Status
This decision displays the current status of the Linkage routine.

Valid Display	0 =	Normal communication
	1 =	Communication failure
	2 =	Linkage routine not configured
	3 =	Change in communication status between Supervisory and Equipment parts of Linkage

Supervisory Element
This decision displays the element number of the system element Master Linkage Control containing the Linkage Supervisory Part that supplies data to this air source.

Valid Display	0 = No Linkage Supervisory Part
	1 to 239

Supervisory Bus
This decision displays the bus number of the system element Master Linkage Control containing the Linkage Supervisory Part that supplies data to this air source.

Valid Display	0 to 239

Supervisory Block No.
This decision displays the Linkage air source number of this unit for diagnostic purposes only.

Valid Display	3 to 6 (where 3 = Air Source 1, and 6 = Air Source 4)

Avg Occ Heat Setpoint
This decision displays the average occupied heating setpoint of all the temperature zones served by this air source. This value is computed by the Linkage Supervisory Part in the Master Linkage Control and communicated to the air source. The controller algorithms use this value as the setpoint for its algorithms instead of its own configured setpoint when Linkage is active. When Linkage is not active, the unit will use its configured setpoint.

Valid Display	-40.00 to 245.00°F (-40.0 to 118.3°C)

Avg Occ Cool Setpoint
This decision displays the average occupied cooling setpoint of all the temperature zones served by this air source. This value is computed by the Linkage Supervisory Part in the Master Linkage Control and communicated to the air source. The controller algorithms use this value as the setpoint for its algorithms instead of its own configured setpoint when Linkage is active. When Linkage is not active, the unit will use its configured setpoint.

Valid Display	-40.00 to 245.00°F (-40.0 to 118.3°C)

Avg Unocc Heat Setpoint
This decision displays the average unoccupied heating setpoint of all the temperature zones served by this air source. This value is computed by the Linkage Supervisory Part in the Master Linkage

Control and communicated to the air source. The controller algorithms use this value as the setpoint for its algorithms instead of its own configured setpoint when Linkage is active. When Linkage is not active, the unit will use its configured setpoint.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Avg Unocc Cool Setpoint
This decision displays the average unoccupied cooling setpoint of all the temperature zones served by this air source. This value is computed by the Linkage Supervisory Part in the Master Linkage Control and communicated to the air source. The controller algorithms use this value as the setpoint for its algorithms instead of its own configured setpoint when Linkage is active. When Linkage is not active, the unit will use its configured setpoint.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Avg Zone Temperature
This decision displays the current average zone temperature of all temperature zones served by this air source. This value is computed by the Linkage Supervisory Part in the Master Linkage Control and communicated to the air source. The Controller algorithms use this value as the space temperature for its algorithms instead of its own configured space temperature when Linkage is active. When Linkage is not active, the unit will use its configured setpoint.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Avg Occ Zone Temp
This decision displays the current average zone temperature of all temperature zones served by this air source that are currently in the occupied mode. This value is computed by the Linkage Supervisory Part and communicated to the air source. The controller algorithms use this value as the space temperature for its algorithms instead of its own configured space temperature when Linkage is active. When Linkage is not active, the unit will use its local sensor.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Optimal Stop
Optimal Stop is used to save energy by relaxing the setpoint restrictions toward the end of an occupied period.

Biased Low Setpoint
This decision displays the adjusted Occupied Lo Setpoint that is used when Biased Stop Day and Biased Stop Time are reached. This value will be used until unoccupied time is reached.

Valid Display -55.0 to 260.0°F (-48.3 to 126.7°C)

Biased High Setpoint
This decision displays the adjusted Occupied Hi Setpoint that is used when Biased Stop Day and Biased Stop Time are reached. This value will be used until unoccupied time is reached.

Valid Display -55.0 to 260.0°F (-48.3 to 126.7°C)

Biased Stop
This decision displays when the algorithms are controlling to the Biased Low and Biased High Setpoints during Optimal Stop.

Valid Display No/Yes

Biased Stop Day
This decision displays the day of the week that the next Biased Stop will occur.

Valid Display Sun through Sat or blank

Biased Stop Time
This decision displays the time of day that the next Biased Stop will occur. This value is determined by subtracting the calculated stop time bias from the next configured unoccupied time.

Valid Display 00:00 to 23:59

Evacuation
This decision displays the status of the air handler's evacuation mode indicator. When *True*, the mode returned to the Linkage Supervisory Part is Evacuation.

Valid Display True = In evacuation mode
False = Not in evacuation mode

Pressurization
This decision displays the status of the air handler's pressurization mode indicator. When *True*, the mode returned to the Linkage Supervisory Part is Pressurization.

Valid Display	True = In pressurization mode False = Not in pressurization mode

Task Timer
This decision displays the number of remaining seconds before the next execution of this algorithm. This algorithm executes every 30 seconds.

Valid Display	0 to 30 seconds

NTFC w/Enthalpy Check

The NTFC (Night Time Free Cooling) with Enthalpy Check algorithm enables equipment to cool the space during unoccupied hours (from 12 a.m. to 7 a.m.) if the outside air is suitable. This global algorithm starts the fans on cool nights to pre-cool a structure by using only outside air, thus minimizing the need for mechanical cooling during occupied hours. Once the space is sufficiently cooled, the algorithm stops the fans.

One Night Time Free Cooling (NTFC) algorithm is provided as a system table and is made available after the factory software download.

Note: NTFC can only be performed by air handlers equipped with mixed air dampers, at least one space temperature sensor, and an outside air temperature sensor.

NTFC with Enthalpy Check must be used in conjunction with either the AO Mixed Air Damper CV w/IAQ, DO Floating Point Mixed Air Damper CV w/IAQ, or DO Timeclock with Optional Check algorithm to ensure that both the fan is activated and the dampers are open.

The NTFC w/Enthalpy Check algorithm calculates the mixed air damper setpoint. The calculated setpoint is a midpoint between the occupied low setpoint and the occupied high setpoint.

Typical Application

To lessen the need for mechanical cooling, you can use this algorithm to cool a building prior to it being occupied.

List of Configuration Decisions

Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
Night Time Free Cool
  NTFC Enable
  NTFC Start Time AM
  Minimum OAT
  Maximum OAT
  NTFC Delta Temperature
Outside Air Temperature
Return Air Temperature
Outside Air Humidity

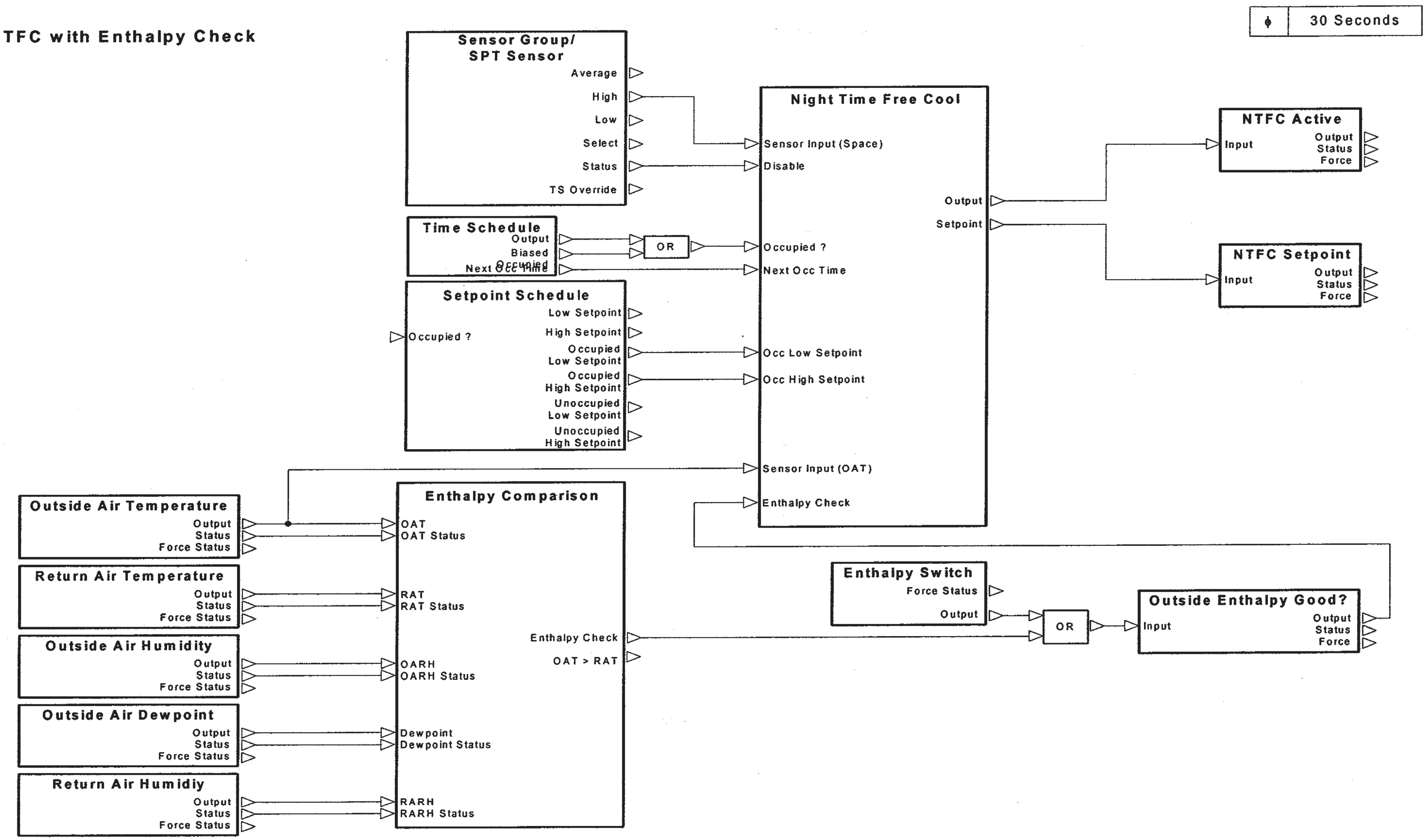
- Return Air Humidity
- Outside Air Dewpoint
- Enthalpy Switch
- Enthalpy Comparison
  - Default OA Enthalpy
  - Default RA Enthalpy
  - Maximum OA Enthalpy
- Power on Delay

List of Maintenance Decisions

- Sensor Group/SPT Sensor
- Occupied?
- Outside Air Temperature
- Return Air Temperature
- Outside Air Humidity
- Return Air Humidity
- Outside Air Dewpoint
- Enthalpy Switch
- Enthalpy Comparison
  - Reference Output
  - OA Enthalpy
  - RA Enthalpy
  - OAT > RAT?
- NTFC Active?
- Outside Enthalpy Good?
- NTFC Setpoint
- Task Timer

Figure 5-21
NTFC w Enthalpy Check

NTFC with Enthalpy Check



Configuration Decisions

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the space temperature inputs. Default Sensor Group usage is disabled for this algorithm. That is, if the SNSGR*nn* name is entered then it will provide the high control input. Valid entry is required for the algorithm to operate. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter.

Note: Use the same Sensor Group/SPT Sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name or LINK_01
Default Value	SNSGR*00*, where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy state for this algorithm. If you do not specify a Time Schedule in this decision, the algorithm will assume to be in the occupied state.

Note: Use the same Time Schedule for all algorithms that contain a common air handler.

Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99, LINK_01, or OPSS_01 **Note:** 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints for this algorithm. If this decision does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	SETPT*nn*, where *nn* = 01 or 02 (temperature),LINK_01, OPSS_01, or Setpoint Offset AI point
Default Value	SETPT00

Night Time Free Cool

Night Time Free Cool calculates the space temperature setpoint and determines if the outside air is suitable for cooling the space during unoccupied hours.

NTFC Enable

Use this decision to enable Night Time Free Cooling. The space temperature setpoint is still calculated, whether or not this decision is enabled. The calculated setpoint is a midpoint between the occupied low setpoint and the occupied high setpoint.

Allowable Entries	Dsable/Enable
Default Value	Dsable

NTFC Start Time AM

Use this decision to specify the hour after midnight at which NTFC goes into effect.

Allowable Entries	0 to 7
Default Value	3

Minimum OAT

Use this decision to set the minimum OAT temperature below which the NTFC function will be disabled.

Allowable Entries	40.0 to 200.0°F	(4.44 to 93.3°C)
Default Value	40.0	

Maximum OAT

Use this decision to specify the maximum OAT temperature above which the NTFC function will be disabled.

Allowable Entries	40.0 to 200.0°F	(4.44 to 93.3°C)
Default Value	72.0	

NTFC Delta Temperature

Use this decision to specify how many degrees lower than the space temperature the Outside Air Temperature must be before outside air is used to cool the space.

Allowable Entries	4.0 to 10.0^F	(2.2 to 5.6^C)
Default Value	8.0	

Outside Air Temperature

Use this decision to specify the Analog Input point that provides the outside air temperature to the algorithm. If the decision is not configured, outside air temperature will default to 0.0°F, which will disable NTFC due to the Minimum OAT.

Note: To reset the space temperature based on the Outside Air Temperature, you must configure this decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Return Air Temperature

Use this decision to specify the Analog Input point that provides the return air temperature to this algorithm.

Allowable Entries	Any valid point name
Default Value	POINT0

Outside Air Humidity

If Night Time Free Cooling is enabled, use this decision to specify the Analog Input point that provides the outside air humidity to the algorithm. The algorithm is capable of using either a humidity or dewpoint sensor. If neither are available, the system will use the Default OA Enthalpy.

Allowable Entries	Any valid point name
Default Value	POINT0

Return Air Humidity

Use this decision to specify the Analog Input point that provides the relative humidity of the return air to this algorithm. If the AI point is not configured, the algorithm will use the value in the Default RA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Outside Air Dewpoint

If Night Time Free Cooling is enabled, use this decision to specify the Analog Input point that provides the outside air dewpoint to the algorithm. The algorithm is capable of using either a humidity or dewpoint sensor. If neither are available, the algorithm will use the value in the Default OA Enthalpy decision.

Allowable Entries	Any valid point name
Default Value	POINT0

Enthalpy Switch

Instead of computing the outside air enthalpy and return air enthalpy, use this decision to specify a discrete point that indicates if the outside air is suitable for cooling.

Allowable Entries	Any valid point name
Default Value	POINT0

Enthalpy Comparison

Enthalpy Comparison calculates the heat content of outside air and return air. It determines if the outside air is suitable for conditioning the space.

Default OA Enthalpy

If Outside Air Humidity and Outside Air Dewpoint sensors are not available, use this decision to specify the outside air enthalpy that Return Air Humidity must exceed in order to close the damper.

Allowable Entries	0 to 51 BTU/lb
Default Value	51

Default RA Enthalpy
If a Return Air Humidity sensor is not available, use this decision to specify the return air enthalpy that the Outside Air cannot exceed.

Allowable Entries	0 to 51 BTU/lb
Default Value	50

Maximum OA Enthalpy
Use this decision to specify the maximum outside air enthalpy that is acceptable for atmospheric cooling.

Allowable Entries	0 to 51 BTU/lb
Default Value	30

Power on Delay
Use this decision to specify the number of seconds the controller must wait to activate this system function after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Sensor Group/SPT Sensor
This decision displays the value of the single AI sensor or the highest sensor group, depending on which is selected.

Valid Display	-40.0 to 245.0°F	(-40.0 to 118.3°C)

Occupied ?
This decision displays the current occupancy status mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display	No/Yes

Outside Air Temperature
This decision displays the value of the outside air temperature being used by this algorithm.

Valid Display	-40.00 to 245.00°F	(-40.0 to 118.3°C)

Return Air Temperature
This decision displays the value of the return air temperature being used by this algorithm.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Outside Air Humidity
This decision displays the value of the outside air humidity being used by this algorithm.

Valid Display 0.00 to 100.00% RH

Return Air Humidity
This decision displays the value of the return air humidity being used by this algorithm.

Valid Display 0.00 to 100.00% RH

Outside Air Dewpoint
This decision displays the value of the outside air dewpoint being used by this algorithm.

Valid Display -40.00 to 245.00°F (-40.0 to 118.3°C)

Enthalpy Switch
This decision displays whether the outside air is currently suitable for cooling. When this value is *On*, the outside air is suitable for cooling.

Valid Display Off/On

Enthalpy Comparison
Enthalpy Comparison determines if outside air can be used for conditioning the space, based on enthalpy content of the outside and return air.

Reference Output
This decision displays the result of the enthalpy comparison, which indicates if using outside air is suitable at this time.

Valid Display False/True

OA Enthalpy

This decision displays the value of the enthalpy of the outside air expressed in units of BTU/lb.

Valid Display -9999.99 to 9999.99 Btu/lb
(-23267.6 to 23232.0 kJ/kg)

RA Enthalpy

This decision displays the value of the enthalpy of the return air expressed in units of BTU/lb.

Valid Display -9999.99 to 9999.99 Btu/lb
(-23267.6 to 23232.0 kJ/kg)

OAT > RAT ?

This decision displays whether the outside air temperature is greater than the return air temperature. If the outside air temperature is greater, the OAT will be deemed not suitable for cooling.

Valid Display No/Yes

NTFC Active?

This decision displays whether the NTFC w Enthalpy Check algorithm is active.

Valid Display No/Yes

Outside Enthalpy Good?

This decision displays whether or not outside air can be used, if desired. If this value is *No*, the NTFC will be inactive.

Valid Display No/Yes

NTFC Setpoint

This decision displays the calculated setpoint value from the NTFC w/Enthalpy Check algorithm.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Task Timer

This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every 30 seconds.

Valid Display 0 to 30 seconds

Optimal Start/ Stop

Optimal Start/Stop (OPSS) gives the user the capability to pre-condition a space prior to occupancy and to relax the setpoints at the end of occupancy.

One Optimal Start/Stop (OPSS) algorithm is provided as a system table and is made available after the factory software download.

Algorithms serving a common air handler or building space will usually be under the control of the same Time Schedule and Setpoint Schedule. OPSS provides both of these schedules and serves two basic purposes:

- Optimal Start causes the controlled space to heat up or cool down prior to becoming occupied. This algorithm allows the space temperature to gradually approach and then maintain the occupied setpoint at the time of occupancy.

- Optimal Stop expands the occupied setpoints during the last portion of the occupied time.

To configure an algorithm to use Optimal Start/Stop, you must enter OPSS_01 in the algorithm's Time Schedule and Setpoint configuration decision.

Calculating Start Time Offset

OPSS calculates start time offset for each occupied period in the Time Schedule. The factors that affect time offset calculations are:

- Low and high space temperatures
- Occupied setpoints
- The Heating and Cooling Factors in min/°F

If Optimal Start is not desired (i.e., capability to pre-condition the space is not desired), then Optimal Start's Heating and Cooling Factors should be set to *0*.

Calculating Expanded Occupied Setpoints

The value entered in Optimal Stop's Setpoint Delta decision determines the expanded occupied setpoints. If the value entered is 2°F and the occupied setpoints are 68°F and 78°F, the expanded occupied setpoints will be 66°F and 80°F.

The value entered in Stop Time Bias determines the amount of time that expanded occupied setpoints will be in effect prior to the space becoming unoccupied. For example, if the occupied time is 0800 through 1700, and the desired stop time is 15 minutes, then the expanded occupied setpoints will come into effect at 1645.

If Optimal Stop is not desired (i.e., no relaxation of the setpoints is desired), then either Optimal Stop's Setpoint Delta or Stop Time Bias should be set to *0*.

The Heating and Cooling Factors represent an estimate of the time in minutes required for the space to change temperature by 1 °F via mechanical means.

List of Configuration Decisions

Sensor Group/SPT Sensor
Time Schedule
Setpoint Schedule
Optimal Start
- Cooling Factor
- Heating Factor

Optimal Stop
- Stop Time Bias
- Setpoint Delta

Power on Delay

List of Maintenance Decisions

Sensor Group/SPT Sensor
- Sensor Group Low
- Sensor Group High
- Occupied?

OPSS Time Schedule
- Mode
- Biased Occupied
- Next Occupied Day
- Next Occupied Time
- Next Unoccupied Day
- Next Unoccupied Time
- Last Unoccupied Day
- Last Unoccupied Time
- Status
- Override is Set

(*continued*)

OPSS Setpoint Schedule
- Occupied Lo Setpoint
- Occupied Hi Setpoint
- Unoccupied Lo Setpoint
- Unoccupied Hi Setpoint

Optimal Start
- Start Bias
- Biased Start Day
- Biased Start Time
- Biased Occupied

Optimal Stop
- Biased Low Setpoint
- Biased High Setpoint
- Biased Stop
- Biased Stop Day
- Biased Stop Time

Task Timer

Configuration Decisions

Sensor Group/SPT Sensor

Use this decision to specify the Sensor Group or SPT sensor that is providing the low and high space temperature inputs. Default Sensor Group usage is disabled for this algorithm, that is, only the SNSGR*nn* name is valid and it provides the low and high space temperature input. Valid entry is required for the algorithm to operate. For more information on Sensor Group, refer to the Sensor Group section of this Algorithms chapter.

Note: Use the same Sensor Group/SPT Sensor for all algorithms that control a common air handler.

Allowable Entries	Any valid Sensor Group name or point name
Default Value	SNSGR*00*, where *00* represents an invalid group number

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. Valid entry is required for the algorithm to operate.

Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn*, where *nn* = 01 to 99
	Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.
Default Value	OCCPC00

Setpoint Schedule
Use this decision to specify the Setpoint Schedule that is providing the space temperature setpoints for this algorithm. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized. Optimal Start and Optimal Stop are based on the configured setpoint values.

Allowable Entries	SETPT*nn*, where *nn* = 01 or 02 (temperature), or Setpoint Offset AI point
Default Value	SETPT00

Optimal Start
Optimal Start heats up or cools down the controlled space prior to becoming occupied. It allows the space temperature to gradually approach and then maintain the occupied setpoint at the time of occupancy.

Cooling Factor
Use this decision to specify the time (in minutes per degree F of error) for achieving the cooling setpoint.

Allowable Entries	0 to 60
Default Value	0

Heating Factor
Use this decision to specify the time (in minutes per degree F of error) for achieving the heating setpoint.

Allowable Entries	0 to 60
Default Value	0

Optimal Stop

Optimal Stop allows the temperature of the occupied space to drift to the expanded occupied setpoints during the last portion of the occupied time.

Stop Time Bias

Use this decision to specify the desired number of minutes that the expanded occupied setpoints will be used prior to the controlled space becoming unoccupied.

Allowable Entries	0 to 60 minutes
Default Value	0

Setpoint Delta

Use this decision to enter the number of degrees that are applied to expand the occupied setpoints during Optimal Stop.

Allowable Entries	0.0 to 5.0^F (0.0 to 2.8^C)
Default Value	2.0

Power on Delay

Use this decision to specify the number of seconds the controller must wait to activate this system function after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

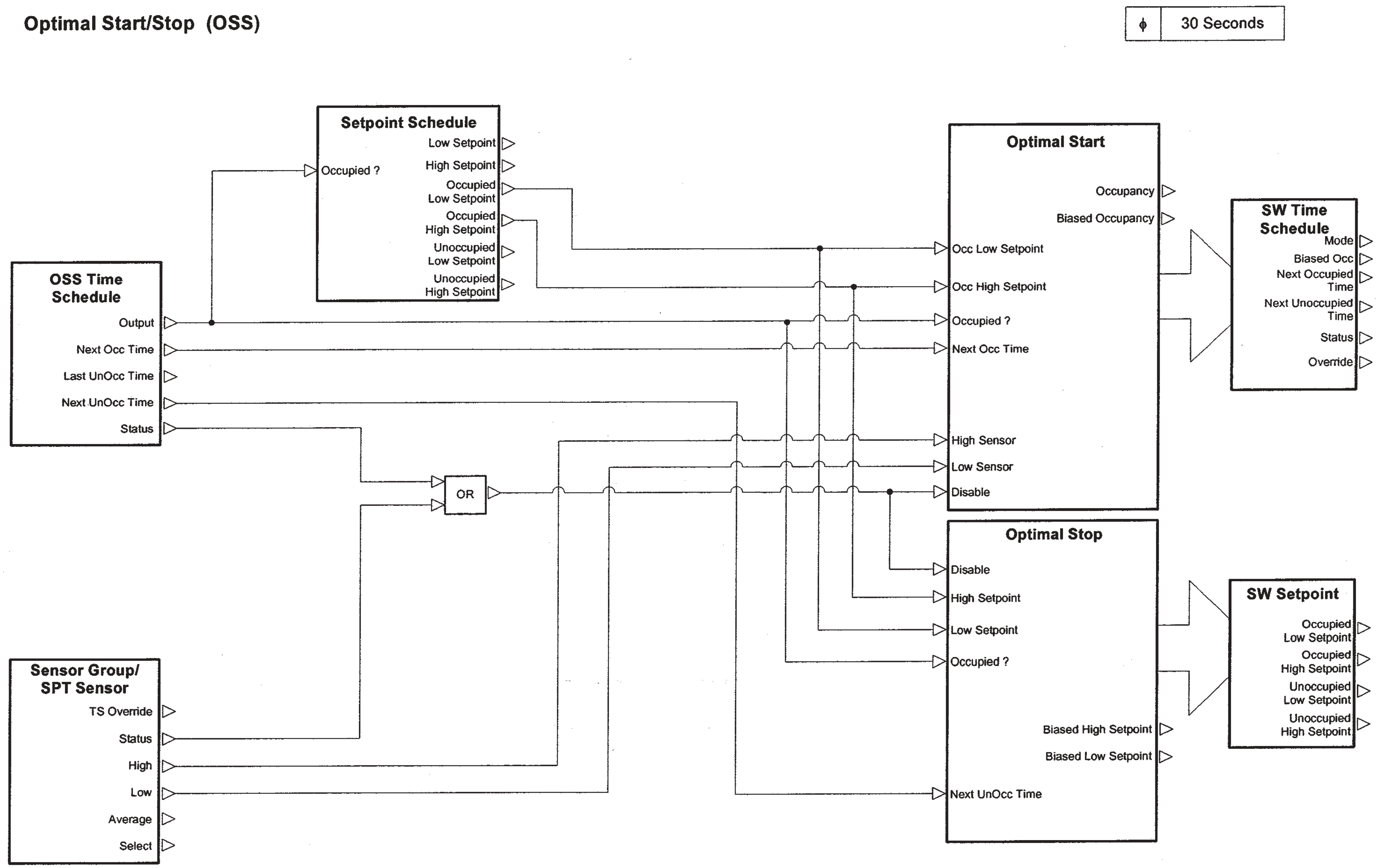
Maintenance Decisions

Sensor Group/SPT Sensor

This decision displays the space temperature value of the single AI sensor or the average of the sensor group, depending on which is selected.

Valid Display	-40.0 to 245.0°F	(40.0 to 118.3°C)

Figure 5-22
OPSS



Sensor Group Low

This decision displays the value of the single Analog Input sensor or the low sensor of the sensor group, depending on which is selected.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Sensor Group High

This decision displays the value of the single Analog Input sensor or the high sensor of the sensor group, depending on which is selected.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Occupied ?

This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, the default mode will be occupied (Yes).

Valid Display No/Yes

OPSS Time Schedule

OPSS Time Schedule displays the Time Schedule information as configured and used by the Optimal Start and Stop routines.

Mode

This decision displays the current Occupancy Mode from Optimal Start.

Valid Display Unoccupied/Occupied

Biased Occupied

This decision identifies when a biased occupancy condition exists.

Valid Display Not in effect/Biased Occupied in effect

Next Occupied Day

This decision displays the day of the week on which the next occupied period will occur.

Valid Display Sun, Mon, Tue, Wed, Thu, Fri, Sat or blank

Next Occupied Time
This decision displays the time of day when the next occupied period will occur.

Valid Display	00:00 to 24:00

Next Unoccupied Day
This decision displays the day of the week on which the next unoccupied period will occur.

Valid Display	Sun, Mon, Tue, Wed, Thu, Fri, Sat or blank

Next Unoccupied Time
This decision displays the time of day when the next unoccupied period will occur.

Valid Display	00:00 to 24:00

Last Unoccupied Day
This decision displays the day of the week on which the last unoccupied period occurred.

Valid Display	Sun, Mon, Tue, Wed, Thu, Fri, Sat or blank

Last Unoccupied Time
This decision displays the time of day when the last unoccupied period occurred.

Valid Display	00:00 to 24:00

Status
This decision displays the current status of the OPSS Time Schedule.

Valid Display	0 = Time Schedule found 1 = Time Schedule not found

Override is set
This decision identifies when the Time Schedule has been overridden from an unoccupied state to an occupied state.

Valid Display	0 = Override not in effect 1 = Override in effect

OPSS Setpoint Schedule
OPSS Setpoint Schedule displays the Setpoint Schedule information as configured and used by the Optimal Start and Stop routines.

Occupied Lo Setpoint
This decision displays the Occupied Lo Setpoint value, including any adjustment for T-56 Slider Bias.

Valid Display -50.0 to 255.0°F (-45.6 to 123.9°C)

Occupied Hi Setpoint
This decision displays the Occupied Hi Setpoint value, including any adjustment for T-56 Slider Bias.

Valid Display -50.0 to 255.0°F (-45.6 to 123.9°C)

Unoccupied Lo Setpoint
This decision displays the Unoccupied Lo Setpoint value, including any adjustment for T-56 Slider Bias.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Unoccupied Hi Setpoint
This decision displays the Unoccupied Hi Setpoint value, including any adjustment for T-56 Slider Bias.

Valid Display -40.0 to 245.0°F (-40.0 to 118.3°C)

Optimal Start
Optimal Start is used to bring comfort conditions to prescribed levels by the beginning of the next occupied period.

Start Bias

This decision displays the adjustment value, in minutes, for the Optimal Start routine.

Valid Display 0 to 9999 minutes

Biased Start Day

This decision displays the day of the week that the next biased start time will occur.

Valid Display Sun, Mon, Tue, Wed, Thu, Fri, Sat, or blank

Biased Start Time

This decision displays the time of day that the next biased start will occur. This value is determined by subtracting the calculated Start Bias from the next configured occupied time.

Valid Display 00:00 to 23:59

Biased Occupied

This decision displays when the Time Schedule is currently in an occupied state due to Optimal Start/Stop. For example, if a Time Schedule has a normal occupied time of 0800 and Optimal Start has calculated a start time offset of 15 minutes, Biased Occupied will be noted at 0745.

Valid Display No/Yes

Optimal Stop

Optimal Stop is used to save energy by relaxing the setpoint restrictions toward the end of an occupied period.

Biased Low Setpoint

This decision displays the adjusted Occupied Lo Setpoint that is used when Biased Stop Day and Biased Stop Time are reached. This value will be used until unoccupied time is reached.

Valid Display -55.0 to 260.0°F (-48.3 to 126.7°C)

Biased High Setpoint
This decision displays the adjusted Occupied Hi Setpoint that is used when Biased Stop Day and Biased Stop Time are reached. This value will be used until unoccupied time is reached.

Valid Display -55.0 to 260.0°F (-48.3 to 126.7°C)

Biased Stop
This decision displays when the algorithms are controlling to the Biased Low and Biased High Setpoints during Adaptive Optimal Stop.

Valid Display No/Yes

Biased Stop Day
This decision displays the day of the week that the next Biased Stop will occur.

Valid Display Sun, Mon, Tue, Wed, Thu, Fri, Sat, or blank

Biased Stop Time
This decision displays the time of day that the next Biased Stop will occur. This value is determined by subtracting the calculated stop time bias from the next configured unoccupied time.

Valid Display 00:00 to 23:59

Task Timer
This decision displays the number of remaining seconds before the next execution of this algorithm. This algorithm executes every 30 seconds.

Valid Display 0 to 30 seconds

Sensor Group

This global algorithm provides the input of up to six sensors, of the same type, to AO and DO algorithms.

Four (4) Sensor Groups are provided as system tables and made available after the factory software download:

- Two (2) with temperature units
- Two (2) with no units

The Sensor Group will implement a sensor select function as its default output, when the Sensor Group name, SNSGR*nn* (where *nn* is the function number of the Sensor Group), is entered in the desired algorithm's analog sensor input decision, i.e., Sensor Group/SPT Sensor. This function provides either the lowest sensor input or the highest sensor input, based on the current setpoint values. It selects the highest sensor input unless the lowest sensor input is less than the low setpoint, at which point it continues to select the lowest sensor input until it is above the midpoint of the low and high setpoints. If NTFC is active, then the highest sensor input is selected. This function ensures that the cooling, heating, and mixed air algorithms are controlling to the same sensor.

The Sensor Group also provides the highest sensor input, lowest sensor input, and the computed average sensor value. A Sensor Group contains three software variables used to provide the high, low, and average sensor values from a group of sensors. These software variable names can be entered in any analog sensor input configuration decision. This must be done in order to override the default value from the sensor group sensor select function.

- To obtain the highest sensor reading, enter SGHI*nn* (where *nn* is the function number of the Sensor Group) in the desired algorithm's analog sensor input decision, i.e., Sensor Group/SPT Sensor.
- To obtain the lowest sensor reading, enter SGLO*nn*.
- To obtain the average sensor reading, enter SGAVG*nn*.
- To obtain the sensor select reading, enter SGSEL*nn*.

The sensors in a Sensor Group must be of the same type. If an algorithm requires input from more than one type of sensor, separate Sensor Groups must be configured.

One or more of the sensors in the group may be used to signal a Push Button (Time Schedule) Override.

Sensors with invalid status will be ignored. If the status of all input sensors are invalid, the Sensor Group status will be invalid.

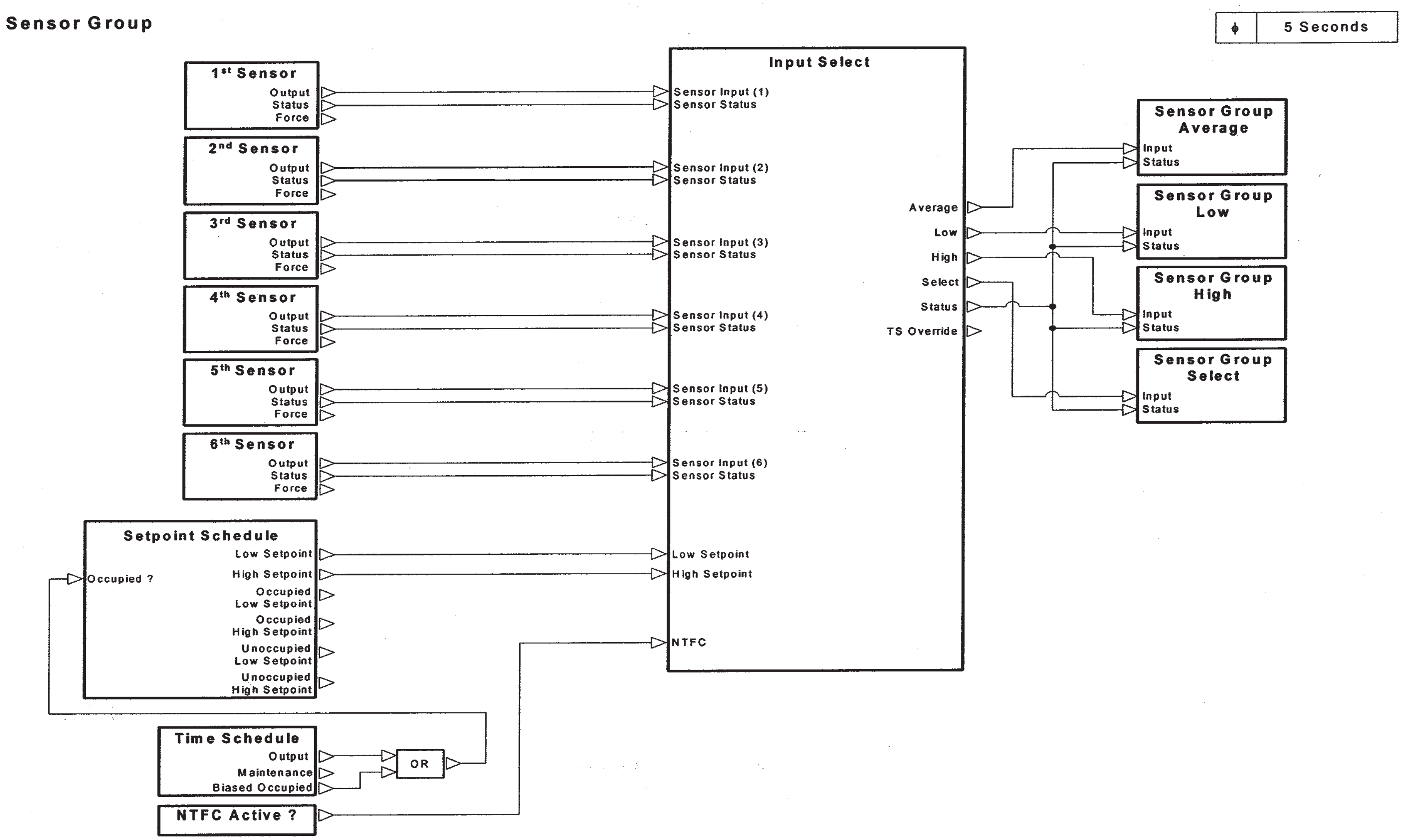
The Time Schedule will indicate the current occupancy mode for the sensor select function. The occupancy mode will also define when the controller is using the occupied or unoccupied setpoints. If a valid Time Schedule is not specified in this decision, the algorithm will default to the occupied state.

The Setpoint Schedule will allow for the configuration of high and low setpoints for both occupied and unoccupied states to be used by the sensor select function.

List of Configuration Decisions

1st Sensor
2nd Sensor
3rd Sensor
4th Sensor
5th Sensor
6th Sensor
Time Schedule
Setpoint Schedule
NTFC Algorithm
Power on Delay

Figure 5-23
Sensor Group



List of Maintenance Decisions

The following read-only, maintenance decisions are applicable to this algorithm.

1st Sensor
2nd Sensor
3rd Sensor
4th Sensor
5th Sensor
6th Sensor
Sensor Group Select
Sensor Group Low
Sensor Group High
Sensor Group Average
Low Setpoint
High Setpoint
Occupied/Biased?
NTFC Active?
Task Timer

Configuration Decisions

1st Sensor
Use this decision to specify the first analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

2nd Sensor
Use this decision to specify the second analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

3rd Sensor
Use this decision to specify the third analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

4th Sensor

Use this decision to specify the fourth analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

5th Sensor

Use this decision to specify the fifth analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

6th Sensor

Use this decision to specify the sixth analog point that is providing sensor input.

Allowable Entries	Any valid point name
Default Value	POINT0

Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this algorithm. If a valid Time Schedule is not specified in this decision, the algorithm defaults to the occupied state.

Application Note: Use the same Time Schedule for all algorithms that control a common air handler.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99, LINK_01, or OPSS_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00

Setpoint Schedule

Use this decision to specify the Setpoint Schedule (temperature type) that provides the occupied and unoccupied setpoints. If it does not contain a valid Setpoint Schedule name then the defaults listed in Appendix B will be utilized.

Application Note: Use the same space temperature Setpoint Schedule for all algorithms that control a common air handler.

Allowable Entries	Groups 1 & 2: SETPT*nn*, where *nn* is 01 or 02 (temperature), LINK_01, OPSS_01 or Setpoint Offset AI point Groups 3 & 4: SETPT04
Default Value	SETPT00

NTFC Algorithm

If NTFC is active then the highest sensor input will be selected by the Sensor Select function. By default NTFC is enabled. To disable, change the entry to NTFC_00. This will only apply to the first two Sensor Groups.

Allowable Entries	NTFC_nn where nn is 00 or 01
Default Value	NTFC_01 for Groups 1 & 2; NTFC_00 for Groups 3 & 4

Power on Delay

Use this decision to specify the number of seconds the controller must wait to activate this system function after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

1st Sensor

This decision displays the current value of the first sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

2nd Sensor

This decision displays the current value of the second sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

3rd Sensor
This decision displays the current value of the third sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

4th Sensor
This decision displays the current value of the fourth sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

5th Sensor
This decision displays the current value of the fifth sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

6th Sensor
This decision displays the current value of the sixth sensor in the configured Sensor Group.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Sensor Group Select
This decision displays either the lowest or the highest value of the configured sensors, excluding any sensors with an invalid status, based on the Sensor Select function.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Sensor Group Low
This decision displays the lowest value of the configured sensors, excluding any sensors with an invalid status.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Sensor Group High
This decision displays the highest value of the configured sensors, excluding any sensors with an invalid status.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Sensor Group Average
This decision displays the average value of the configured sensors, excluding any sensors with an invalid status.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Low Setpoint
This decision displays the current low setpoint used by the Sensor Select function.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

High Setpoint
This decision displays the current high setpoint used by the Sensor Select function.

Valid Display	-9999.9 to 9999.9 range based upon selected display units.

Occupied/Biased ?
This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be Occupied and *Yes* will be displayed.

Valid Display	No/Yes

NTFC Active?
This decision indicates when Night Time Free Cooling is active. If the NTFC w/Enthalpy Check algorithm was not selected as part of the configuration, Night Time Free Cooling will be inactive and *No* will be displayed.

Valid Display	No/Yes

Task Timer
This decision displays the number of remaining seconds before the next execution of this algorithm. This algorithm executes every 5 seconds.

Valid Display	0 to 5 seconds

Schedules

Overview

This chapter provides the following information for each schedule:

- Purpose
- List of configuration decisions
- Description of each configuration decision including allowable entries and default values
- List of maintenance decisions (if applicable)
- Description of each maintenance decision (if applicable)

Definition of a Schedule

A schedule provides algorithms with occupancy status or setpoints. A schedule is a shared resource, which means that you can assign the same schedule to more than one algorithm. Typically, you should assign all algorithms serving a common air handler system or building space to the same schedules. For example, three algorithms can use the same Time Schedule and Setpoint Schedule.

For easy reference, the schedules are presented alphabetically in this manual, as follows:

- Holiday
- Time (Occupancy)
- Setpoint

Holiday Schedules

The Universal Controller contains 18 holiday tables, HOLDY*nn*S where *nn* is 01 to 18.

A Holiday Schedule provides the capability to specify days of the year (holidays) on which the Universal Controller's algorithms will operate according to time period(s) that differ from normal time periods, as configured in the Time Schedules. To cause the Universal Controller to recognize a day of the week as a holiday, enter a *1* in the holiday (H) column of a Time Schedule and configure occupied and unoccupied times for the holiday. Then, configure one Holiday Schedule for every holiday the Universal Controller is to recognize. In the Holiday Schedule, configure the month and day on which the schedule will go into effect, and how many days the schedule will be in effect.

A holiday can be configured to last for more than one day. For example, a five-day vacation period may be configured as one holiday by entering the appropriate month, the day on which the holiday will begin, and the duration of the holiday as five consecutive days.

List of Configuration Decisions

Start Month
Start Day
Duration

Configuration Decisions

Start Month
Use this decision to specify the month in which the holiday will begin.

Allowable Entries	1 to 12
Default Value	1

Start Day
Use this decision to specify the day of the month on which the holiday will begin.

Allowable Entries	1 to 31
Default Value	1

Duration
Use this decision to specify the number of consecutive days the holiday will last. Entering *0* in this decision disables this holiday schedule.

Allowable Entries	0 to 365
Default Value	0

Occupancy (Time) Schedules

The Universal Controller contains 8 occupancy (time schedule) tables, OCCPC*nn*S where *nn* is 01 to 08.

A Time Schedule provides the capability to define the occupied and unoccupied periods for devices controlled by the Universal Controller. Each Time Schedule is divided into eight separate days—Monday through Sunday and holiday. Within each schedule, eight separate occupied and unoccupied periods are provided. Occupied and unoccupied periods are configured in military format, where 00:00 is the beginning of any 24-hour day and 24:00 is the end of any 24-hour day. An occupied time of 00:00 and an unoccupied time of 24:00 provide occupied operation for a full 24-hour day. An occupied time of 00:00 and an unoccupied time of 00:00 provide unoccupied operation for a full 24-hour day. An occupied time of 24:00 and an unoccupied time of 00:00 also provide unoccupied operation for a full 24-hour day.

Typical Application

Any number of algorithms can use the same Time Schedule. In general, the same Time Schedule should be assigned to all algorithms that control a single air handler or building space.

Override feature: An occupied time period can be commanded in three ways:

- By setting the Manual Override Hours decision to a value from 1 to 4 hours
- By pressing and holding the override button on a T-56 Space Temperature Sensor with Override for 1 to 10 seconds during unoccupied hours - as described in this manual's Service Configuration chapter under Global Occupancy (Time Schedule) and Override.
- By closing a Latched Discrete Input point during unoccupied hours - as described in this manual's Service Configuration chapter under Global Occupancy (Time Schedule) and Override.

The Override Sensor configuration is accomplished through the Global Occupancy and Override table as described in this manual's Algorithms chapter under Global Occupancy (Time Schedule) and Override Functions.

The Tenant Billing Option function within each Time Schedule will track the number and duration of the push button overrides.

List of Configuration Decisions

Manual Override Hours
Period *n*: Day of Week
Period *n*: Occupied from
Period *n*: Occupied to

List of Maintenance Decisions

Time Schedule
- Mode
- Current Occupied Period
- Override in Progress
- Override Duration
- Occupied Start Time
- Unoccupied Start Time
- Next Occupied Day
- Next Occupied Time
- Next Unoccupied Day
- Next Unoccupied Time
- Last Unoccupied Day
- Last Unoccupied Time

Configuration Decisions

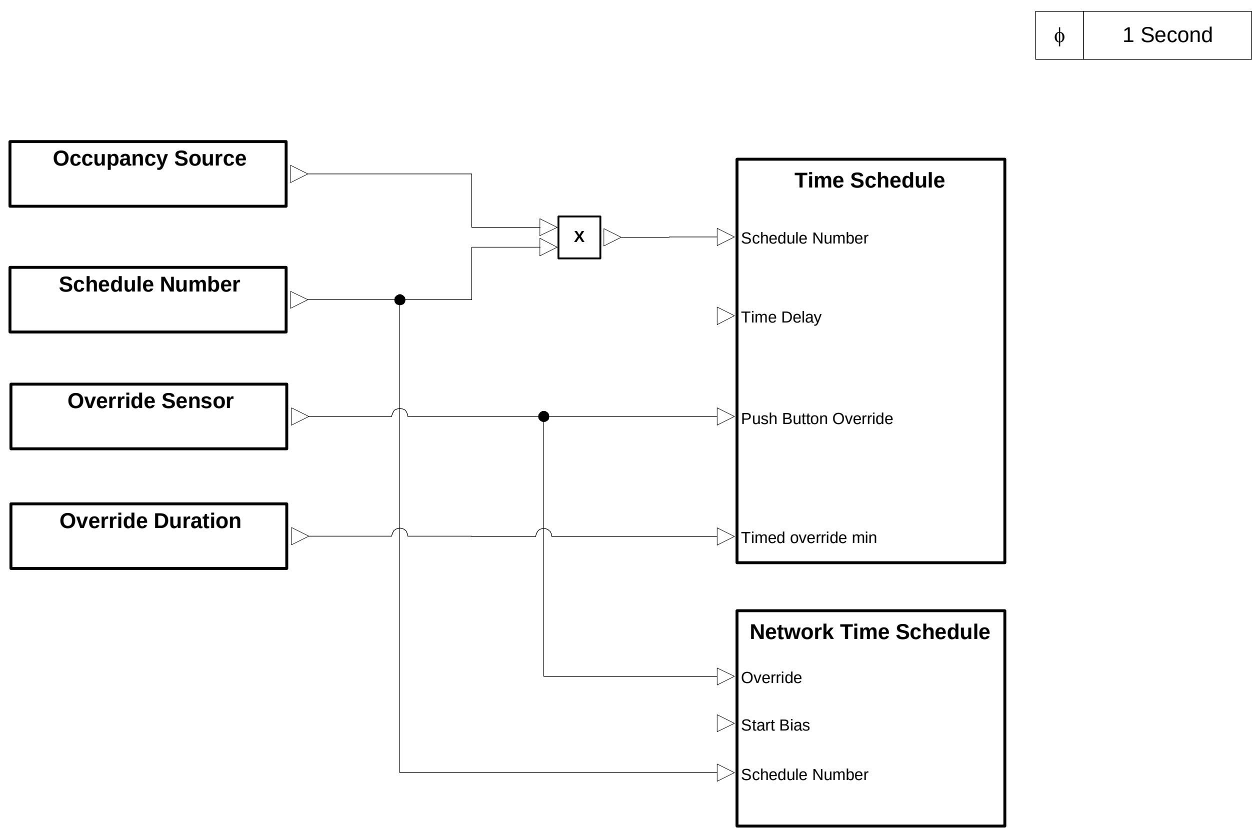
Manual Override Hours
Use this decision to command a timed override. Its value indicates the number of hours that the override will be in effect. If the mode is occupied when a timed override is commanded, the OCCPC*nn*S Table will extend the occupied period by the amount of the Manual Override Hours. If the mode is unoccupied when a timed override is initiated, the mode changes to an occupied status for the length of the timed override.

When a timed override extends into a scheduled occupied period, the scheduled occupied period picks up directly from the timed override with no return to unoccupied status.

A value downloaded in this decision does not become part of the table's permanent configuration. The decision is reset to *0* in the Universal Controller at the end of the timed override mode. A new timed override, zero hours in length, can be downloaded at any time to cancel a timed override that has already been commanded. A *0* in this decision will cause the Time Schedule to immediately switch to unoccupied mode, if already in timed override mode, regardless of the source, or to cancel a pending timed override that would have extended a current occupied mode.

Figure 6-1
Occupancy

Occupancy



The length of a timed override mode may not be changed after this decision is downloaded. From that time until the end of the timed override, the Time Schedule will ignore any value, except *0*, that is downloaded to it using this decision.

Allowable Entries	0 to 4 hours
Default Value	0

Period *n*: Day of Week

Use this decision to specify the day(s) of the week on which Period *n*: Occupied from and Period *n*: Occupied to times are in effect. From left to right, the first seven positions of the decision's data entry field represent Monday through Sunday. The eighth position represents a holiday.

Allowable Entries	0 = period not in effect for that day 1 = period is in effect for that day
Default Value	11111111 for Period 1 00000000 for Period 2 to 8

Period n: Occupied from

Use this decision to specify the hour and minute, in military format, at which time this occupied period begins.

To specify a 24-hour occupied period, enter *00:00* in this decision and *24:00* in the Period *n*: Occupied to decision. To specify a 24-hour unoccupied period, enter *00:00* in both this decision and in the Period *n*: Occupied to decision.

Allowable Entries	00:00 to 24:00
Default Value	00:00

Period n: Occupied to

Use this decision to specify the hour and minute, in military format, at which time this occupied period ends.

Allowable Entries	00:00 to 24:00
Default Value	00:00

Maintenance Decisions

Time Schedule

Time Schedule provides information regarding the current occupancy mode for this schedule.

Mode

This decision displays the current occupancy mode for this schedule.

Valid Display	Unoccupied Mode/ Occupied Mode

Current Occupied Period

This decision displays the period number that is currently reflecting the occupancy mode for this schedule. When the current mode is *1* (occupied), the value displayed in this decision represents the period number that determines this mode. A value of *0* indicates that the mode is unoccupied.

Valid Display	0 = Unoccupied Mode 1 to 8 = Period number determining the Occupied Mode

Override in Progress

This decision indicates whether a manual override is currently in effect.

Valid Display	No/Yes

Override Duration

This decision displays the number of minutes remaining in the override period. The override period can be as a result of a manual, push button, or thermostat override condition.

Valid Display	0 = No manual override in effect 1 to 240 = Number of minutes remaining in override period

Occupied Start Time

This decision displays the time that the current occupied mode began. If the current mode is unoccupied, the value in this decision is *00:00*.

Valid Display	00:00 to 23:59 = Start time of this occupied period

Unoccupied Start Time

This decision displays the time that the current occupied mode will end. This value also represents the beginning of the next unoccupied period. If the current mode is unoccupied, the value in this decision is *00:00*.

Valid Display	00:00 to 24:00 = Start time of next unoccupied period

Next Occupied Day

This decision indicates the day of the week when the next occupied period will begin.

Valid Display	Sun through Sat or blank

Next Occupied Time

This decision indicates the time of the day when the next occupied period will begin.

Valid Display	00:00 to 23:59

Next Unoccupied Day

This decision indicates the day of the week when the next unoccupied period will begin.

Valid Display	Sun through Sat or blank

Next Unoccupied Time

This decision indicates the time of the day when the next unoccupied period will begin.

Valid Display	00:00 to 24:00

Last Unoccupied Day

This decision indicates the day of the week when the most recent unoccupied period began. If the current mode is unoccupied, the value in this decision indicates the day the mode went into effect.

Valid Display	Sun through Sat or blank

Last Unoccupied Time

This decision indicates the time of the day when the most recent unoccupied period began. If the current mode is unoccupied, the value in this decision indicates the time of day when the mode went into effect.

Valid Display	00:00 to 24:00

Setpoint Schedules

The Universal Controller contains 4 setpoint schedule tables, SETPT*nn*S where *nn* is 01 to 04.

A Setpoint Schedule provides the capability to configure the limits (setpoints) to which analog signals are controlled. Two sets of setpoints can be configured:

- high and low setpoints for occupied times
- high and low setpoints for unoccupied times

The following Setpoint Schedules are available:

- Two (2) with temperature units
- One (1) for percent units
- One for no units

The allowable entries for each Setpoint Schedule depend on the assigned engineering units and are defined below.

Typical Application

For space temperature control, the high setpoints are typically associated with the cooling cycle, which means that when the space temperature exceeds the high setpoint, the air handler will perform cooling.

The low setpoints are typically associated with the heating cycle, which means that when the space temperature falls below the low setpoint, the air handler will perform heating.

There is no limit to the number of algorithms that can use the same Setpoint Schedule. In general the same Setpoint Schedule is assigned to all algorithms that control a common air handler or space.

List of Configuration Decisions

Occupied Low Setpoint
Occupied High Setpoint
Unoccupied Low Setpoint
Unoccupied High Setpoint

Configuration Decisions

Occupied Low Setpoint

Use this decision to specify the low setpoint for occupied times.
When algorithms control space temperatures, they use this setpoint as the heating setpoint.

Allowable Entries

	Low Limit	High Limit	Default
Temperature	-40.0	245.0	68.0
Percent	0.0	100.0	40.0
No Units	-9999.9	9999.9	0.0

Occupied High Setpoint

Use this decision to specify the high setpoint for occupied times.
When algorithms control space temperatures, they use this setpoint as the cooling setpoint.

Allowable Entries

	Low Limit	High limit	Default
Temperature	-40.0	245.0	72.0
Percent	0.0	100.0	60.0
No Units	-9999.9	9999.9	0.0

	Low Limit	High limit	Default
Temperature	-40.0	245.0	55.0
Percent	0.0	100.0	40.0
No Units	-9999.9	9999.9	0.0

Unoccupied High Setpoint
Use this decision to specify the high setpoint for unoccupied times. When algorithms control space temperatures, they use this setpoint as the cooling setpoint.

Allowable Entries

	Low Limit	High limit	Default
Temperature	-40.0	245.0	85.0
Percent	0.0	100.0	60.0
No Units	-9999.9	9999.9	0.0

Alarms

Alarms

Input points are provided with alarm functionality integrated into each point. Exceptions are Pulsed Discrete, Setpoint Offset, Network Input Points, and Output Points, which do not support alarms.

Analog Input Points support both Limit Check and Setpoint Limit Check alarm configuration and functionality, combined into a single Analog Limit Alarm function, with configuration decisions available in each Analog Input Point's configuration table. The Setpoint Schedule decision arbitrates between the two alarm types. If the Setpoint Schedule decision contains a valid Setpoint Schedule name then the Setpoint Limit Check functionality is utilized, or else the Limit Check functionality is utilized.

Discrete Input Points support both Discrete Comparison and Change Of State alarm configuration and functionality, combined into a single Discrete State Alarm function, with configuration decisions available in each Discrete Input Point's configuration table. The Comparison Point decision arbitrates between the two alarm types. If the Comparison Point decision contains a valid point name then the Discrete Comparison functionality is enabled, or else the Change Of State functionality is enabled, utilizing the Comparison Point in its default state of 0 (i.e. Off, Stop, etc.)

The alarm algorithms run every five (5) seconds, with appropriate updates made to the point status. If an alarm is transmitted onto the CCN and it is not acknowledged, it will be re-transmitted every five minutes until it is acknowledged or until it returns to normal.

Input Point alarm configuration includes alarm processor configuration that determines how the alarm message will be sent on the CCN.

List of Configuration Decisions

The following configuration decisions are common to all alarms:

Alarm Processor
- Alarm Processing
- Re-Alarm Interval
- Alarm=1 or Alert=0
- Alarm Level
- Alarm Source
- Alarm Routing
- Description Index
- Message Part 1-4

Power on Delay

List of Maintenance Decisions

Alarm Processor
- Alarm Type
- Time of Last Message
- Month of Last Message
- Day of Last Message
- Year of Last Message

Task Timer

Configuration Decisions

Alarm Processor

Alarm Processing

Use this decision to indicate whether alarm processing will be enabled for this point.

Allowable Entries	Disable/Enable
Default Value	Disable

Re-Alarm Interval

Use this decision to indicate the number of minutes that will elapse between re-alarms. A re-alarm occurs when the monitored input point remains in the Alarm state. Re-alarming will continue to occur at the specified interval until a Return To Normal state.

Allowable Entries	0 to 1440 minutes
Default Value	0 (disables Re-Alarming)

Alarm=1 or Alert=0

Use this decision to indicate whether an alarm or alert will be generated.

Note: Alarms are displayed before alerts by Carrier front ends, and are transmitted by the TeLink.

Allowable Entries	Alert/Alarm
Default Value	Alarm

Alarm Level

Use this decision to indicate the priority level that will be assigned to this alarm, with 0 being the highest and 6 the lowest. The value entered in this decision is used by Carrier front ends when sorting alarms. For a list of alarm levels and their meaning, refer to Appendix C.

Allowable Entries	0 to 6
Default Value	6

Alarm Source

Use this decision to indicate the type of equipment that is generating the alarm. The value entered in this decision is used by Carrier front ends when sorting alarms from the same source by level. For a list of equipment types, refer to Appendix C.

Allowable Entries	0 to 7
Default Value	5

Alarm Routing

Use this decision to indicate which CCN system elements will receive and process alarms sent by the Universal Controller. Input for this decision consists of eight digits. Each digit represents a CCN system element and can be set to either *0* or *1*. Setting a digit to *1* indicates that alarms should be processed by the system element. A setting of *0* indicates that the system element should ignore alarms from the Universal Controller. Setting all digits to *0* will prevent Universal Controller alarms from being transmitted onto the CCN.

Allowable Entries	00000000 to 11111111
Default Value	11010000 which specifies:

Bit	7	6	5	4	3	2	1	0

Alarm Printer Interface Module (bit 4)

TeLink (bit 6)

Local Carrier Front End (bit 7)

Bits 0, 1, 2, 3, 5 unused

Description Index

Use this decision to specify the index number that represents one of the 16 standard alarm messages that will be generated when the alarm condition exists. For analog alarms the default standard alarm message is 7, “outside limit of” and for discrete alarms, 4, “commanded state is”.

For a list of the 16 standard alarm messages, refer to Appendix C. If a custom alarm message is entered in any of the four Alarm Message configuration decisions, that custom message will override the value in this decision and be sent on the CCN.

Allowable Entries	0 to 15
Default Value	7 for analog or 4 for discrete

Message - Part 1-4

Use each of these 4 decisions to indicate 16 characters of the custom message that will be appended together and sent on the CCN when the alarm condition exists. Refer to Appendix C for a list of supported control characters.

Allowable Entries	0 to 16 ASCII characters
Default Value	blank

Power on Delay

Use this decision to specify the number of seconds the Controller must wait to activate this alarm after a power re-start occurs.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Alarm Processor

Input point alarm maintenance includes alarm processor maintenance that provides information regarding the last alarm message sent on the network.

Alarm Type
This decision displays the condition that caused the current alarm message to be sent.

Valid Display	0 = First Alarm Occurrence 1 = Re-Alarm 2 = Return-To-Normal

Time of Last Message
This decision displays the time when the last alarm message was sent.

Valid Display	00:00 to 23:59

Month of Last Message
This decision displays the month when the last alarm message was sent.

Valid Display	1 to 12

Day of Last Message
This decision displays the day of month when the last alarm message was sent.

Valid Display	1 to 31

Year of Last Message
This decision displays the year when the last alarm message was sent.

Valid Display	0 to 99

Task Timer
This decision displays the number of remaining seconds before this alarm routine executes again. This alarm routine executes every five seconds.

Valid Display	0 to 5 seconds

Analog Limit

Analog Input points will support both Limit Check and Setpoint Limit Check alarm configuration and functionality, combined into a single Analog Limit alarm function, with configuration decisions available in each Analog Input Point's configuration table. The Setpoint Schedule decision arbitrates between the two alarm types. If the Setpoint Schedule decision contains a valid Setpoint Schedule name then the Setpoint Limit Check functionality is utilized, or else the Limit Check functionality is utilized.

Setpoint Limit Check functionality determines the high and low alarm and return to normal (RTN) limits as follows:

High alarm limit = [High Setpoint + High Setpoint Offset]
Low alarm limit = [Low Setpoint - Low Setpoint Offset]
High RTN limit = [High Setpoint + High Setpoint Offset - Hysteresis]
Low RTN limit = [Low Setpoint - Low Setpoint Offset + Hysteresis]

Limit Check functionality determines the high and low alarm and return to normal (RTN) limits as follows:

High alarm limit = [High Limit]
Low alarm limit = [Low Limit]
High RTN limit = [High Limit - Hysteresis]
Low RTN limit = [Low Limit + Hysteresis]

The Analog Limit alarm will monitor an analog point and compare it to the alarm limits determined from its configuration decisions. When the value of the analog point is below the low alarm limit or is above the high alarm limit for the Persistence Time, an alarm will be generated.

Once an alarm status has been determined, the analog point must return within the RTN limits for the configured Persistence Time before a return to normal status is determined.

The alarm engineering units will be the same as the Monitored Input Point.

Typical Application

An Analog Limit alarm can be used to monitor a space temperature.

List of Configuration Decisions

Enable Point
Time Schedule
Setpoint Schedule
Analog Limit Check
  Low Setpoint Offset
  High Setpoint Offset
  Setpoint Change Delay
  Low Limit
  High Limit
  Enable Delay Time
  Persistence Time
  Hysteresis

Analog Limit alarm configuration also includes decisions for alarm configuration as listed at the beginning of this Alarms chapter.

List of Maintenance Decisions

Monitored Input Point
Enable Point
Occupied?
Analog Limit Check
  Alarm Status
  Alarm Value
  Exceeded Limit
  High Setpoint+Offset
  Lo Setpoint-Offset

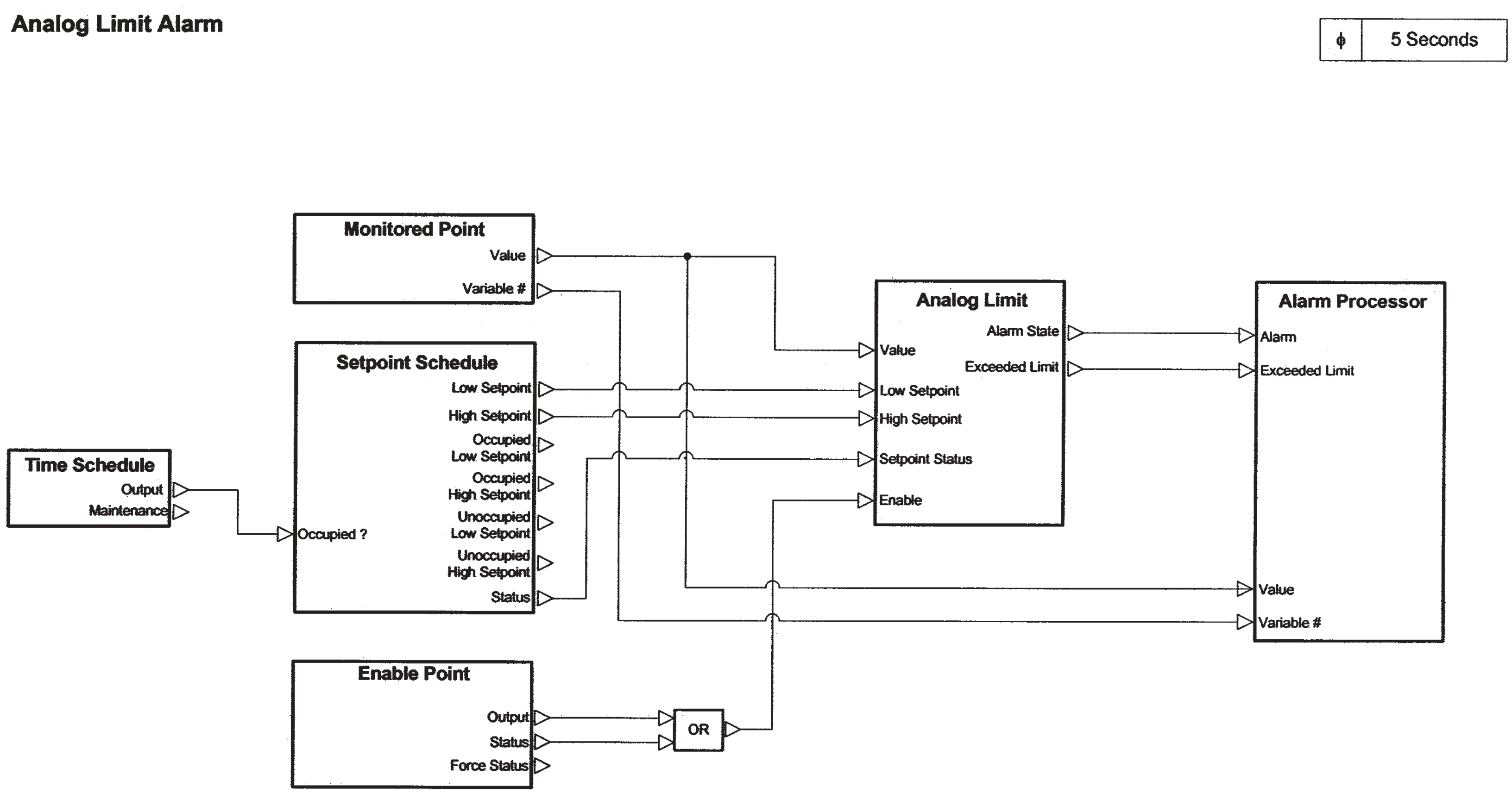
Analog Limit alarms also include decisions for alarm maintenance as listed at the beginning of this Alarms chapter.

Configuration Decisions

Enable Point
Use this decision to indicate the discrete point that allows the alarm logic to be executed. If this decision is not configured, the alarm is always enabled. This alarm is enabled whenever the point configured in this decision is active (1 state).

Allowable Entries	Valid point name
Default Value	POINT0

Figure 7-1
Analog Limit Alarm



Time Schedule

Use this decision to specify the Time Schedule that determines the occupancy mode for this alarm. If a Time Schedule is not specified in this decision, the alarm will default to a 24-hour occupied state.

Allowable Entries	OCCPC*nn* where *nn* is from 01 to 99 or LINK_01

Note: 01 to 08 are default local schedules and 65 to 99 are global schedules.

Default Value	OCCPC00 where 00 represents an invalid schedule number

Setpoint Schedule

Use this decision to specify the Setpoint Schedule that provides the occupied and unoccupied setpoints. It must contain a valid Setpoint Schedule name for the Setpoint Limit Check functionality to be utilized.

Allowable Entries	SETPT*nn* where *nn* is from 01 to 04 or Setpoint Offset AI point
Default Value	SETPT00 where 00 represents an invalid schedule number

Analog Limit Check

Low Setpoint Offset

Use this decision to specify the amount by which the Monitored Input Point must fall below the low setpoint before an alarm is generated.

Allowable Entries	0.0 to 9999.9 ^°F
Default Value	5.0

Note: Certain units have fixed limits. See Appendix B for details.

High Setpoint Offset

Use this decision to specify the amount by which the Monitored Input Point must exceed the high setpoint before an alarm is generated.

Allowable Entries	0.0 to 9999.9 ^°F
Default Value	5.0

Note: Certain units have fixed limits. See Appendix B for details.

Setpoint Change Delay

Use this decision to specify the amount of time that must elapse after any change to a setpoint value before an alarm can be generated, in order to prevent nuisance alarms. This may be initiated by a manual Setpoint table change or by a change from the Unoccupied to Occupied mode, or vice versa.

Allowable Entries	0 to 3600 seconds
Default Value	300

Low Limit

Use this decision to specify the value the Monitored Input Point must fall below before an alarm is generated.

Allowable Entries	-9999.9 to 9999.9 ^°F
Default Value	0.0

Note: Certain units have fixed limits. See Appendix B for details.

High Limit

Use this decision to specify the value the Monitored Input Point must exceed before an alarm is generated.

Allowable Entries	-9999.9 to 9999.9 ^°F
Default Value	0.0

Note: Certain units have fixed limits. See Appendix B for details.

Enable Delay Time
Use this decision to specify the amount of time that must elapse after being enabled before this alarm can be generated, in order to prevent nuisance alarms.

Allowable Entries	0 to 3600 seconds
Default Value	300

Persistence Time
Use this decision to specify the amount of time the Monitored Input Point must remain in an alarm condition before an alarm is generated or the amount of time the Monitored Input Point must remain in the operating range before a return to normal message is generated.

Allowable Entries	5 to 3600 seconds
Default Value	60

Hysteresis
Use this decision to specify the amount by which the Monitored Input Point must fall below the high alarming condition or rise above the low alarming condition before a return to normal message can be generated.

Allowable Entries	0.0 to 9999.9 ^°F
Default Value	2.0

Note: Certain units have fixed limits. See Appendix B for details.

Maintenance Decisions

Monitored Input Point
This decision displays the current value of the point being monitored.

Valid Display	-9999.9 to 9999.9 units

Note: Certain units have fixed limits. See Appendix B for details.

Enable Point
This decision displays *On*, when alarm processing is enabled. However, this decision will display *Off* when the Enable Point configuration decision is not configured, even though in this case alarm processing is enabled by default.

Valid Display	Off/On

Occupied ?

This decision displays the current occupancy mode based on the configured data in the Time Schedule. If a Time Schedule has not been selected, then the default mode will be *Occupied* and *Yes* will be displayed.

Valid Display No/Yes

Analog Limit Check

Alarm Status

This decision displays the current alarm state of the Monitored Input Point — Normal or Alarm Condition.

Valid Display Normal/Alarm

Alarm Value

This decision displays the value of the Monitored Input Point that caused the alarm condition. A value of *0.0* displays when the point is not in alarm.

Valid Display -9999.9 to 9999.9 units

Note: Certain units have fixed limits. See Appendix B for details.

Exceeded Limit

This decision displays the limit that was surpassed. A value of *0.0* displays when the point is not in alarm.

Valid Display -9999.9 to 9999.9 units

Note: Certain units have fixed limits. See Appendix B for details.

Hi Setpoint + Offset

This decision displays the high setpoint value plus the Offset, allowing for the current occupancy mode. If Limit Check functionality is active then this decision displays *0.0*.

Valid Display -9999.9 to 9999.9 units

Note: Certain units have fixed limits. See Appendix B for details.

Lo Setpoint - Offset

This decision displays the low setpoint value minus thr Offset, allowing for the current occupancy mode. If Limit Check functionality is active then this decision displays *0.0*.

Valid Display	-9999.9 to 9999.9 units

Note: Certain units have fixed limits. See Appendix B for details.

Discrete State

Discrete Input points will support both Discrete Comparison and Change Of State alarm configuration and functionality, combined into a single Discrete State alarm function, with configuration decisions available in each Discrete Input point's configuration table. The Comparison Point decision will arbitrate between the two alarm types. If the Comparison Point decision contains a valid point name then the Discrete Comparison functionality is enabled, or else the Change Of State functionality is enabled, utilizing the Comparison Point in its default state of 0 (i.e. Off, Stop, etc.).

The Discrete State alarm monitors the discrete point and compares it to the Comparison Point. When the discrete point state equals the Comparison Point state qualified by the configured Alarm Logic and Persistence Time period, an alarm will be generated.

Once an alarm status has been determined, the discrete point must return to its normal state for the configured Persistence Time before a return to normal status is determined.

Typical Application

The Discrete State alarm can be used with a Latched Discrete Input point by setting Persistence Time to *0*, setting Alarm Logic to *Normal* and not configuring the Comparison Point. Setting Alarm Logic to *Invert* causes an alarm to be generated as soon as the Monitored Input Point goes to the *On* state.

The alarm discrete units will be the same as the Monitored Input Point.

List of Configuration Decisions

Comparison Point
Enable Point
Discrete Alarm
  Alarm Logic
  Enable Delay Time
  Persistence Time

Discrete State alarm configuration also includes decisions for alarm configuration as listed at the beginning of this Alarms chapter.

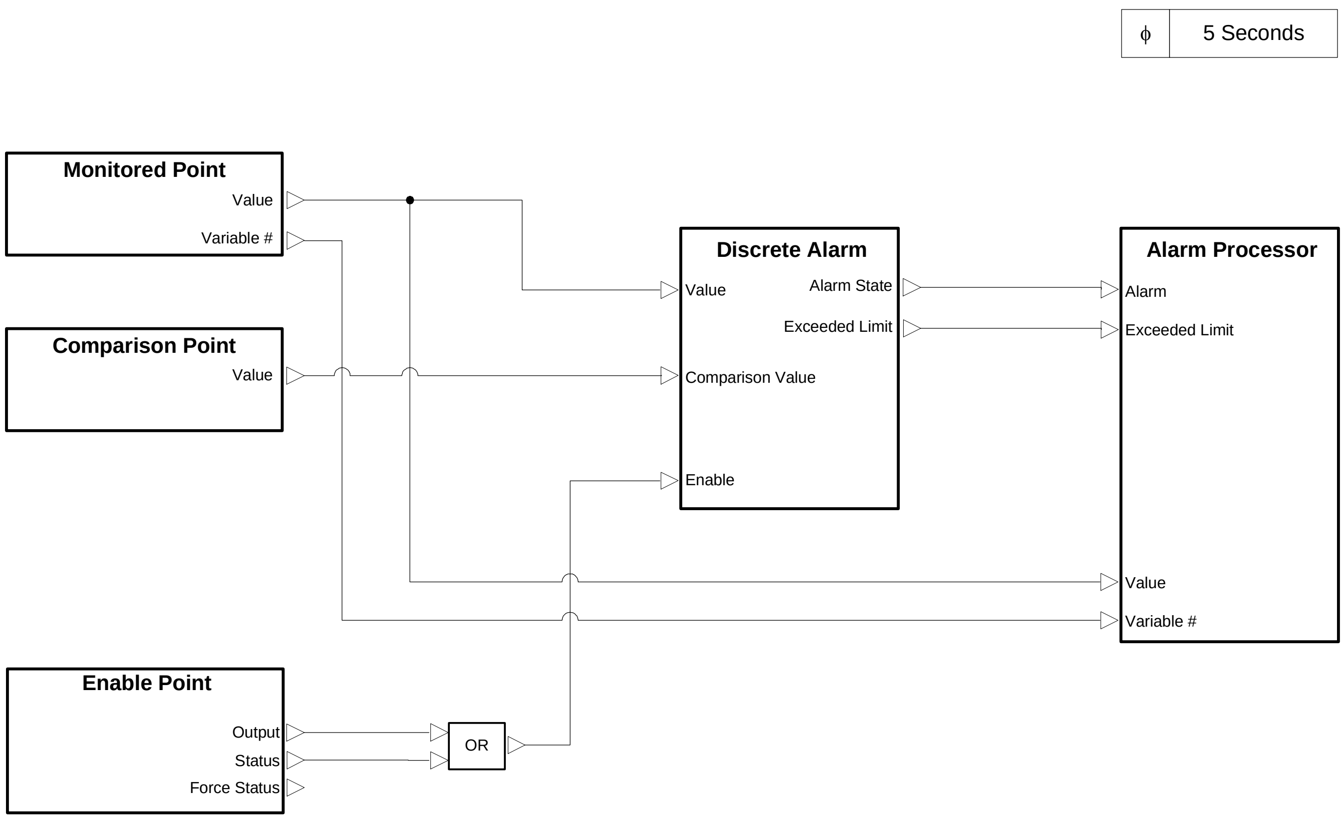
List of Maintenance Decisions

Monitored Input Point
Comparison Point
Enable Point
Alarm Status

Discrete State alarms also include decisions for alarm maintenance as listed at the beginning of this Alarms chapter.

Figure 7-2
Discrete Alarm

Discrete Alarm



Configuration Decisions

Comparison Point

Use this decision to specify the discrete point to which the Monitored Input Point is compared. The state of the Monitored Input Point is either equal to or not equal to the state of the point specified in this decision. The Comparison Point decision arbitrates between the two alarm types. If the Comparison Point decision contains a valid point name then the Discrete Comparison functionality is enabled, or else the Change Of State functionality is enabled, utilizing the Comparison Point in its default state of 0 (i.e. Off, Stop, etc.).

Allowable Entries	Valid point name
Default Value	POINT0

Enable Point

Use this decision to specify the discrete point that allows the alarm logic to be executed. If this decision is not configured, the alarm always is enabled. This alarm is enabled whenever the point configured in this decision is active (1 state).

Allowable Entries	Valid point name
Default Value	POINT0

Discrete Alarm

Alarm Logic

Use this decision to specify the alarming logic. When this decision is set to *Normal*, the alarm will occur when the Monitored Input Point is not equal to the Comparison Point for the Persistence Time. When this decision is set to *Invert*, the alarm will occur when Monitored Input Point is equal to the Comparison Point for the Persistence Time.

Allowable Entries	Normal/Invert
Default Value	Normal

Enable Delay Time

Use this decision to specify the amount of time that must elapse after being enabled before this alarm can be generated, in order to prevent nuisance alarms.

Allowable Entries	0 to 3600 seconds
Default Value	300

Persistence Time
Use this decision to specify the amount of time the Monitored Input Point must remain in an alarm condition before an alarm is generated or the amount of time the Monitored Input Point must remain in the desired state before a return to normal message is generated.

Allowable Entries	5 to 3600 seconds
Default Value	60

Maintenance Decisions

Monitored Input Point
This decision displays the current value of the point being monitored.

Valid Display	Actual discrete text of Monitored Input Point

Comparison Point
This decision displays the current value of the point to which the monitored point is being compared.

Valid Display	Actual discrete text of Comparison Input Point

Enable Point
This decision displays *On* when alarm processing is enabled. However, this decision displays *Off* when the Enable Point configuration decision is not configured, even though in this case alarm processing is enabled by default.

Valid Display	Off/On

Alarm Status
This decision displays the current alarm state of the Monitored Input Point — Normal or Alarm Condition.

Valid Display	Normal/Alarm

System Functions

System Functions

Overview

This chapter provides the following information for each system function:

- Purpose
- List of configuration decisions
- Description of each configuration decision that includes allowable entries and default values
- List of maintenance decisions
- Description of each maintenance decision

For easy reference, the System Functions are presented alphabetically in this manual, as follows:

- Data Collection - Consumable
- Data Collection - Runtime
- Loadshed Schedule
- Network Broadcast
- Time and Date
- Time and Date Broadcast

Data Collection - Consumable

The Data Collection Consumable function will calculate, for example, the amount of energy or unit flow used over time. A combination of up to 8 discrete pulse counters or analog inputs of type milliamp plus up to 8 software points can be configured in the single Data Collection POC Equipment Part Consumable (CONSUME) Table.

Data Collection - Consumable calculates either an analog input milliamp average value or a discrete input pulse count, on a 15-minute period, for each point configured in the Consumable Table, based on the configured point type.

Note that forcing an input point will have no effect on the consumable value, which is derived from the point's hardware value. Moreover, for the same reason software points can not be used as consumables.

List of Configuration Decisions

Point 1-16 Name
Point 1-16 Type

Configuration Decisions

Point 1-16 Name
Use this decision to specify the analog or discrete point being monitored.

Allowable Entries	Valid point name
Default Value	blank

Point 1-16 Type
Use this decision to specify the type of point being monitored.

Allowable Entries	Discrete/Analog
Default Value	Discrete

Data Collection - Runtime

The Data Collection Runtime function determines how long the configured discrete points have been On. Up to 8 sensed discrete inputs plus up to 8 software points can be configured in the single Data Collection Equipment Part Runtime (RUNTIME) Table.

List of Configuration Decisions

Point 1-16 Name
Point 1-16 Type

Configuration Decisions

Point 1-16 Name
Use this decision to specify the discrete point being monitored.

Allowable Entries	Valid point name
Default Value	blank

Point 1-16 Type
Use this decision to specify the type of point being monitored.

Allowable Entries	Normal/Invert
Default Value	Normal

Normal = Standard Logic
The operator interface displays *On* when the sensor contacts for this DI point are closed. The operator interface displays *Off* when the sensor contacts are open.

Invert = Reverse Logic
The operator interface displays *On* when the sensor contacts for this DI point are open. The operator interface displays *Off* when the sensor contacts are closed.

Loadshed Schedule

The Universal Controller contains a single Loadshed Schedule. This schedule provides the capability to receive a Redline Alert signal from a Loadshed Supervisory part of the same number, 01 to 16.

The Universal Controller contains a Configuration Table, LDSHED_C , which allows for the renaming of the Loadshed Equipment table from LDSHD00E, the default with Loadshed disabled, to LDSHD01E through LDSHD16E.

Algorithms that respond to a Redline Alert signal, such as DO Timeclock with Optional Check, can be configured with the enabled Loadshed Equipment table name in order to receive the signal.

The Loadshed Equipment part itself has no configuration decisions. The Loadshed Configuration Table LDSHED_C configuration decisions are as follows:

List of Configuration Decisions

Group Number
Maximum Loadshed Time

List of Maintenance Decisions

Redline
Loadshed
Loadshed Timer

Configuration Decisions

Group Number
Use this decision to specify the number that the Loadshed Equipment table will be renamed to in order to receive Redline Alert signal from a Loadshed Supervisory part of the same number, 01 to 16.

Allowable Entries	0 to 16, where 1 to 16 indicate a valid schedule and 0 is invalid, which will disable the function
Default Value	0

Maximum Loadshed Time
Use this decision to specify the maximum time, in minutes, for which the current Redline Alert may remain in effect. If a Redline Alert cancellation is not received within this time span, then the Redline Alert will be cancelled by the Loadshed Equipment POC.

Allowable Entries	30 to 480 minutes
Default Value	120

Maintenance Decisions

Redline
This decision indicates whether a Redline Alert is in effect.

Valid Display	No/Yes

Loadshed
When this decision displays Yes, this indicates that a Loadshed condition is in effect, but loadshedding has not been implemented in this controller.

Valid Display	No/Yes

Loadshed Timer
This decision displays the time remaining before the Redline Alert is cancelled by Loadshed.

Valid Display	0 to 480 minutes

Network Broadcast

This global algorithm sends data from a Source Point in the Universal Controller to all CCN system elements containing the point name specified in the Point Name configuration decision. The broadcasts can be configured to occur on the hour, at a specific time of day, or at a timed interval.

Two (2) Network Broadcasts are provided as system tables and made available after the factory software download:

- One (1) with temperature units
- One (1) with no units

If the algorithm is not enabled or the Source Point is not found or is in a hardware alarm state or the Broadcast Point Name is blank then the broadcast shall is not initiated.

Typical Application

A Network Broadcast can be used to transmit the outside air temperature every five minutes to all CCN system elements containing the specified Point Name.

List of Configuration Decisions

Source Point
Broadcast Point
  Enable
  Broadcast Address
  Broadcast Bus
  Point Name
  Reschedule Type
  Rescheduled Time
Power on Delay

List of Maintenance Decisions

Source Point
Network Status
Task Timer

Configuration Decisions

Source Point
Use this decision to indicate the name of the point in the Universal Controller that will provide the data to broadcast.

Allowable Entries	Any valid point name
Default Value	POINT0

Broadcast Point
Broadcast Point determines the configuration data for the network broadcast point(s) and also specifies the broadcast parameters.

Enable
Use this decision to give the Universal Controller the capability to broadcast the value of the Source Point to all CCN system elements containing the point name specified in the Point Name decision.

Allowable Entries	No/Yes
Default Value	No

Broadcast Address
Use this decision to indicate the element number of the devices(s) receiving the data.

Note: Address 241 represents a global broadcast element number.

Allowable Entries	0 to 251
Default Value	241

Broadcast Bus
Use this decision to indicate the bus number of the device(s) receiving the data.

Note: Address 241 represents a global broadcast bus.

Allowable Entries	0 to 251
Default Value	241

Point Name
Use this decision to indicate the actual point name that will receive the broadcasted data.

Allowable Entries	Any valid point name
Default Value	blank

Reschedule Type
Use this decision to indicate when the broadcast will occur.

0 (timed) =	indicates that the broadcast will occur on a timed basis, as determined by Rescheduled Time
1 (hourly) =	indicates that the broadcast will occur at the beginning of every hour
2 (daily) =	indicates that the broadcast will occur daily, based on Rescheduled Time

Allowable Entries	0 to 2
Default Value	0

Rescheduled Time
With a 2 entered in Reschedule Type, this decision is used to indicate the hour and minute of each day that the broadcast will occur. If you entered a *0* in Reschedule Type, use this decision to indicate exactly how many hour(s) and minute(s) must elapse between broadcasts, where *00:00* will cause the broadcast to be rescheduled at the task execution time of 60 seconds.

Allowable Entries	00:00 to 24:00
Default Value	00:05

Power On Delay
Use this decision to indicate the number of seconds that must elapse after a power restart before this algorithm executes again.

Note: Entering 65535 will disable the task on power-up.

Allowable Entries	0 to 65535 seconds
Default Value	0

Maintenance Decisions

Source Point
This decision displays the current value to be broadcast, with temperature or no units.

Valid Display	-9999.9 to 9999.9 range based upon selected Source Point display units.

Network Status
This decision displays the communication status of the network broadcast.

Valid Display	1 = Successful Broadcast 0 = Not Enabled -1 = No Broadcast acknowledge received -2 = Broadcast Point Name not configured (blank) -3 = Source Point error (name not found or point in alarm)

Task Timer
This decision displays the number of remaining seconds before this algorithm executes again. This algorithm will execute every 60 seconds.

Valid Display	0 to 60 seconds

Time and Date

The Universal Controller supports the time and date functionality in Carrier front ends.

Time and Date Broadcast

This system function gives you the capability to:

- broadcast current time on CCN.
- configure the start of daylight saving.
- configure the end of daylight saving.

A Time Broadcast Enable decision is available through a Carrier front-end device. Setting this decision to *Enable* will immediately cause the Universal Controller to serve as the CCN's Time Broadcaster.

The Universal Controller will broadcast time, date, day of week, and holiday today flag whenever:

- it receives date/time information from the CCN, for example, through a manually initiated time change request initiated with ComfortVIEW.

- there is a change in date and/or day of week other than the midnight change.

- the current time and date matches that configured for daylight saving, after effecting the change in time due to daylight saving/standard time crossover.

Only one daylight saving time change is permitted during a single day. That is, when changing between daylight saving time and normal time, the backwards time change is performed only once.

List of Configuration Decisions

Time Broadcast Enable
Daylight Savings
- Start Month
- Start Day of Week
- Start Week
- Start Time
- Start Advance
- Stop Month
- Stop Day of Week
- Stop Week
- Stop Time
- Stop Back

Configuration Decisions

Time Broadcast Enable

Use this decision to specify whether the Universal Controller will broadcast the time and date to other system elements on the CCN.

Allowable Entries	Disable/Enable
Default Value	Disable

Daylight Savings

These decisions specify the start and end of daylight saving.

Start Month

Use this decision to specify the month in which the real time clock will adjust the time for the start of daylight saving time.

Allowable Entries	1 to 12
Default Value	4

Start Day of Week

Use this decision to specify the day of the week in which the real time clock will adjust the time for the start of daylight saving time, where *1* = Monday.

Allowable Entries	1 to 7
Default Value	7

Start Week

Use this decision to specify the week of the month when the real time clock will adjust the time for the start of daylight saving time.

Allowable Entries	1 to 5
Default Value	1

Start Time

Use this decision to specify the time of day at which the real time clock will adjust the time for the start of daylight saving time. Use a colon to separate hours from minutes.

Allowable Entries	00:00 to 24:00
Default Value	02:00

Start Advance
Use this decision to specify the number of minutes by which the real time clock will adjust the time for the start of daylight saving time. An entry of *0* will disable this feature.

Allowable Entries	0 to 360 minutes
Default Value	60

Stop Month
Use this decision to specify the month in which the real time clock will adjust the time for the end of daylight saving time.

Allowable Entries	1 to 12
Default Value	10

Stop Day of Week
Use this decision to specify the day of the week on which the real time clock will adjust the time for the end of daylight saving time, where *1* = Monday.

Allowable Entries	1 to 7
Default Value	7

Stop Week
Use this decision to specify the week of the month in which the real time clock will adjust the time for the end of daylight saving time.

Allowable Entries	1 to 5
Default Value	5

Stop Time
Use this decision to specify the time of day at which the real time clock will adjust the time for the end of daylight saving time. Use a decimal, or colon, to separate hours from minutes.

Allowable Entries	00:00 to 24:00
Default Value	02:00

Stop Back

Use this decision to specify the number of minutes by which the real time clock will adjust the time for the end of daylight saving time. An entry of *0* will disable this feature.

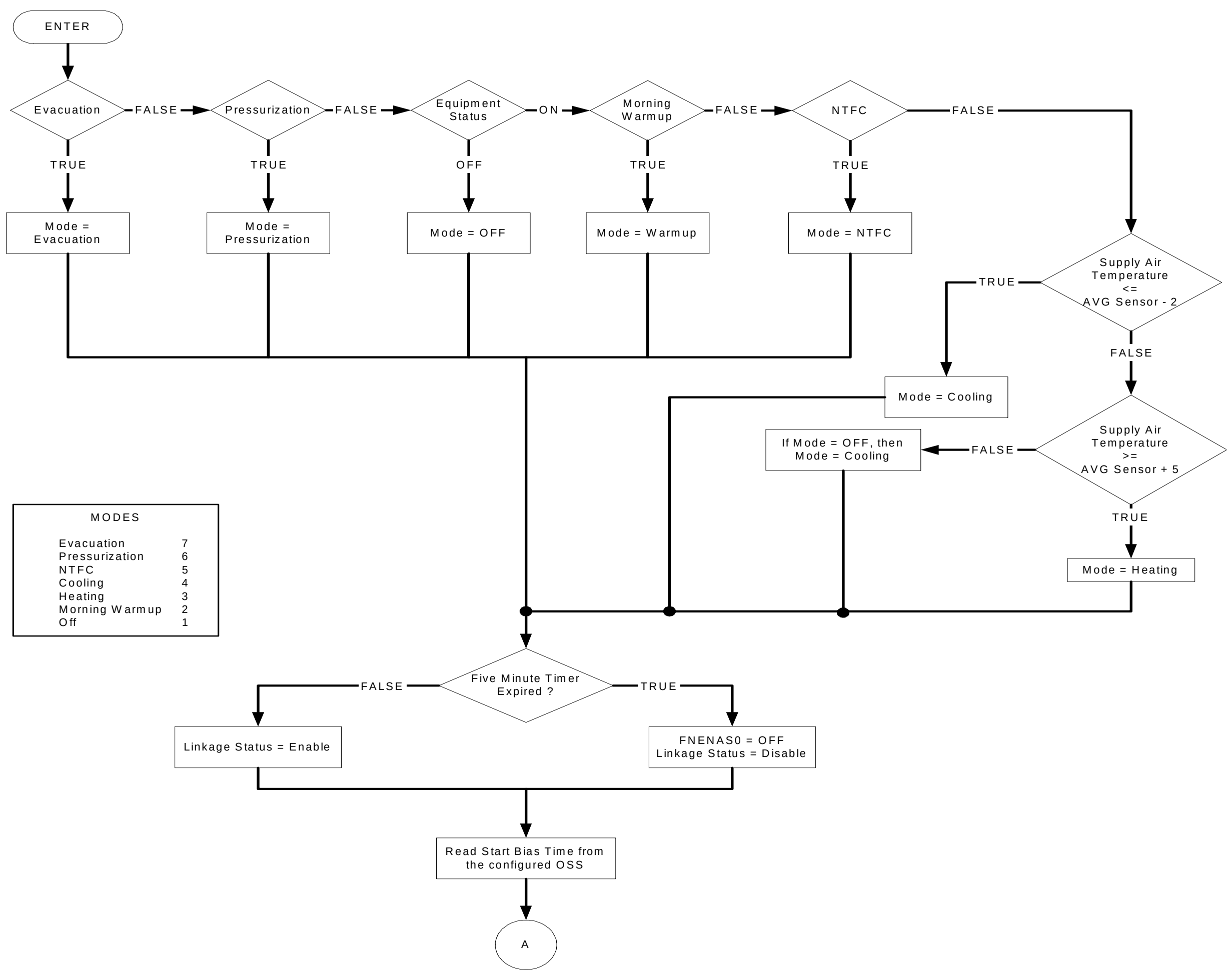
Allowable Entries	0 to 360 minutes
Default Value	60

Appendixes

Appendix A - Flowcharts

The following flowcharts are shown in this appendix:

Figure 1
Airside Linkage Equipment



(Continued)

Figure 1
Airside Linkage Equipment
(continued)

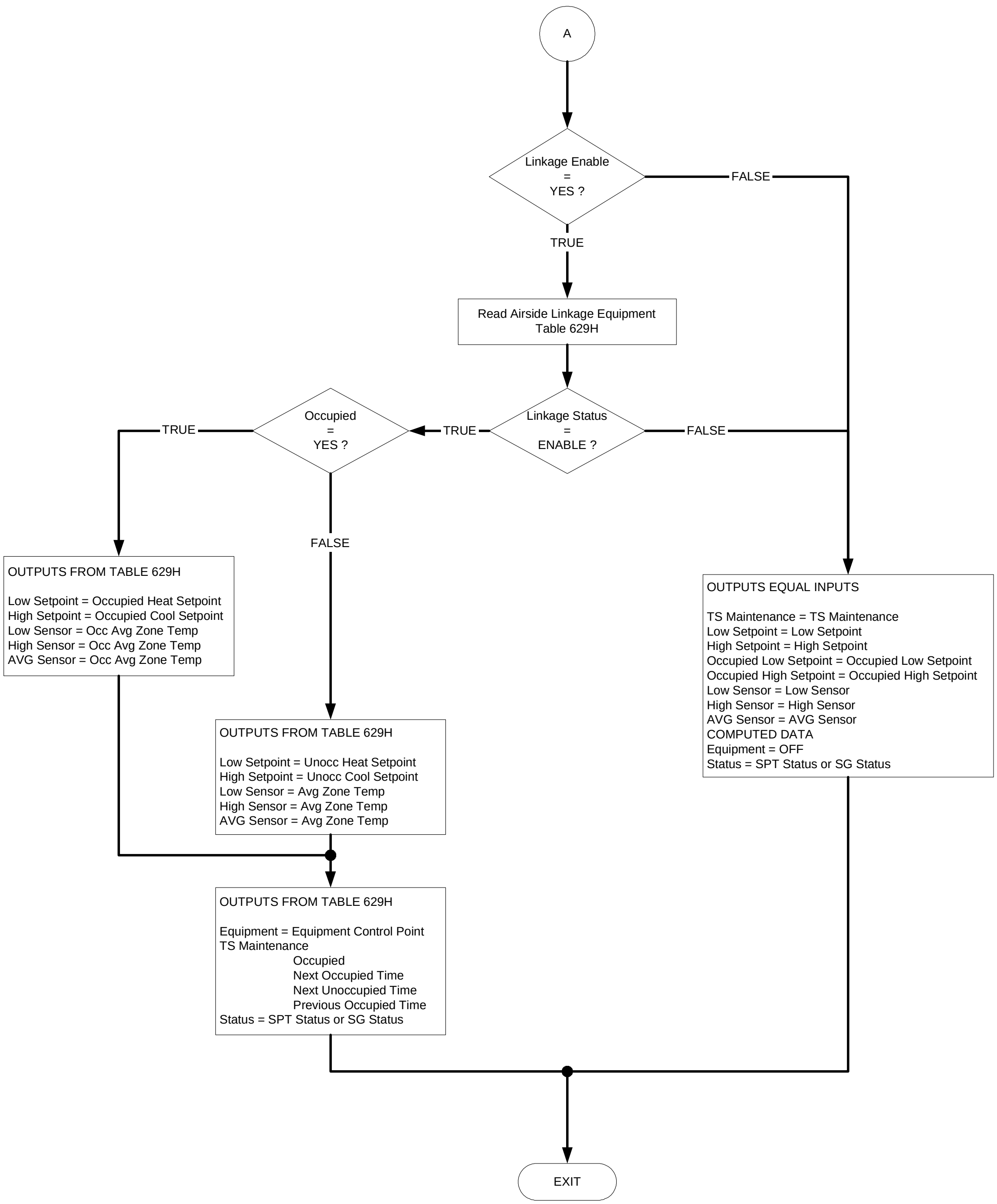


Figure 2
Analog Limit Alarm

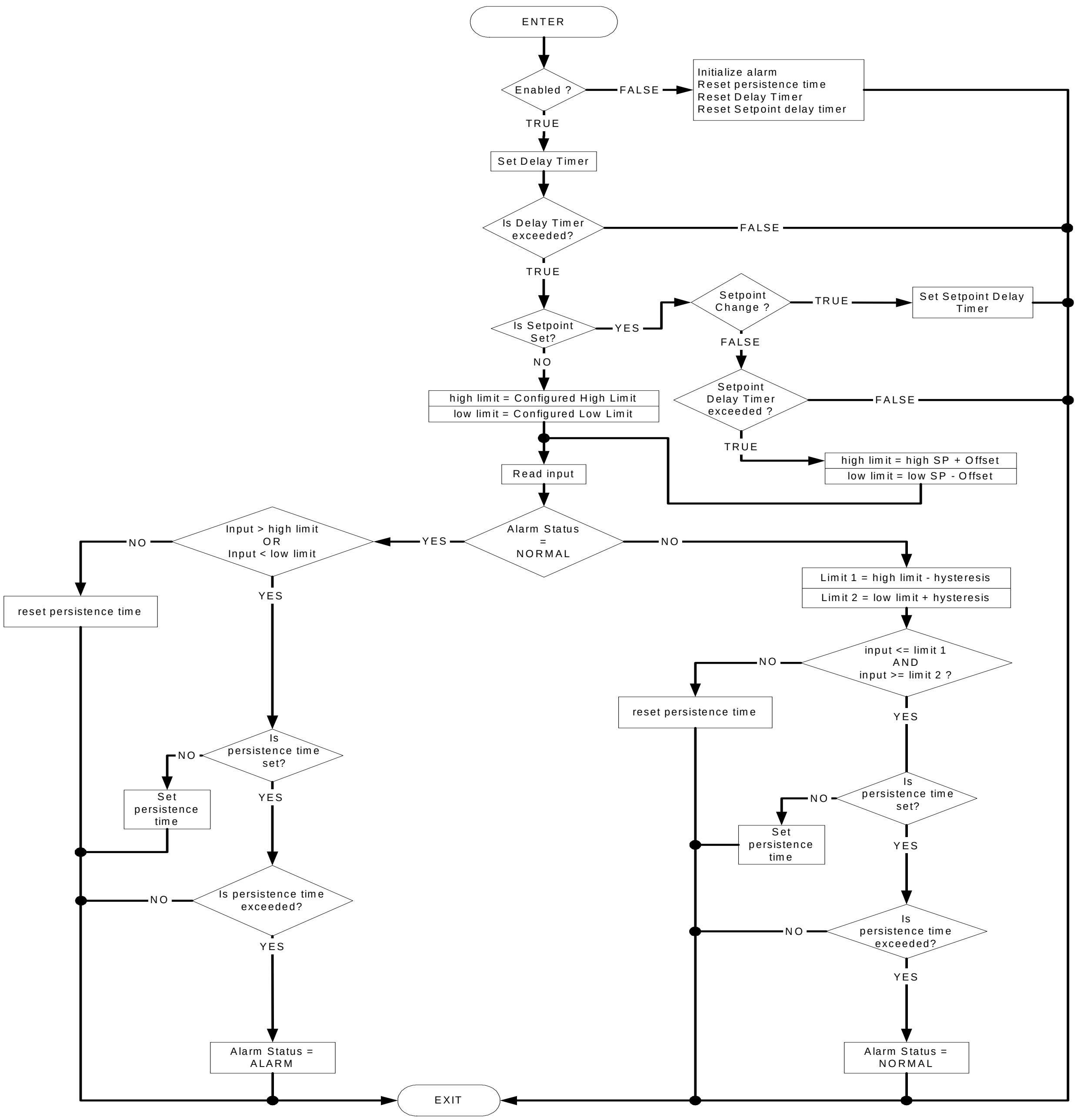


Figure 3
Analog

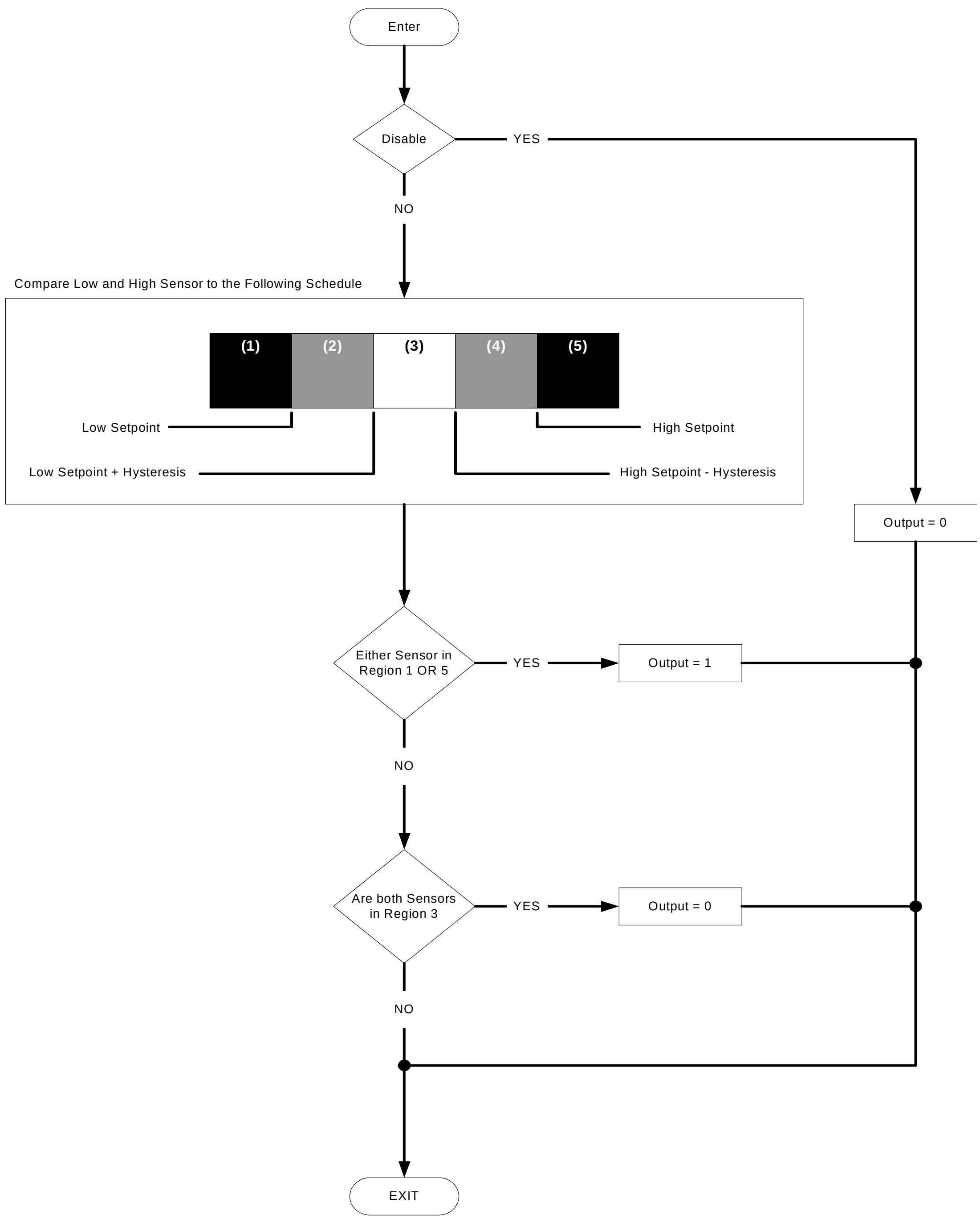


Figure 4
Discrete Alarm

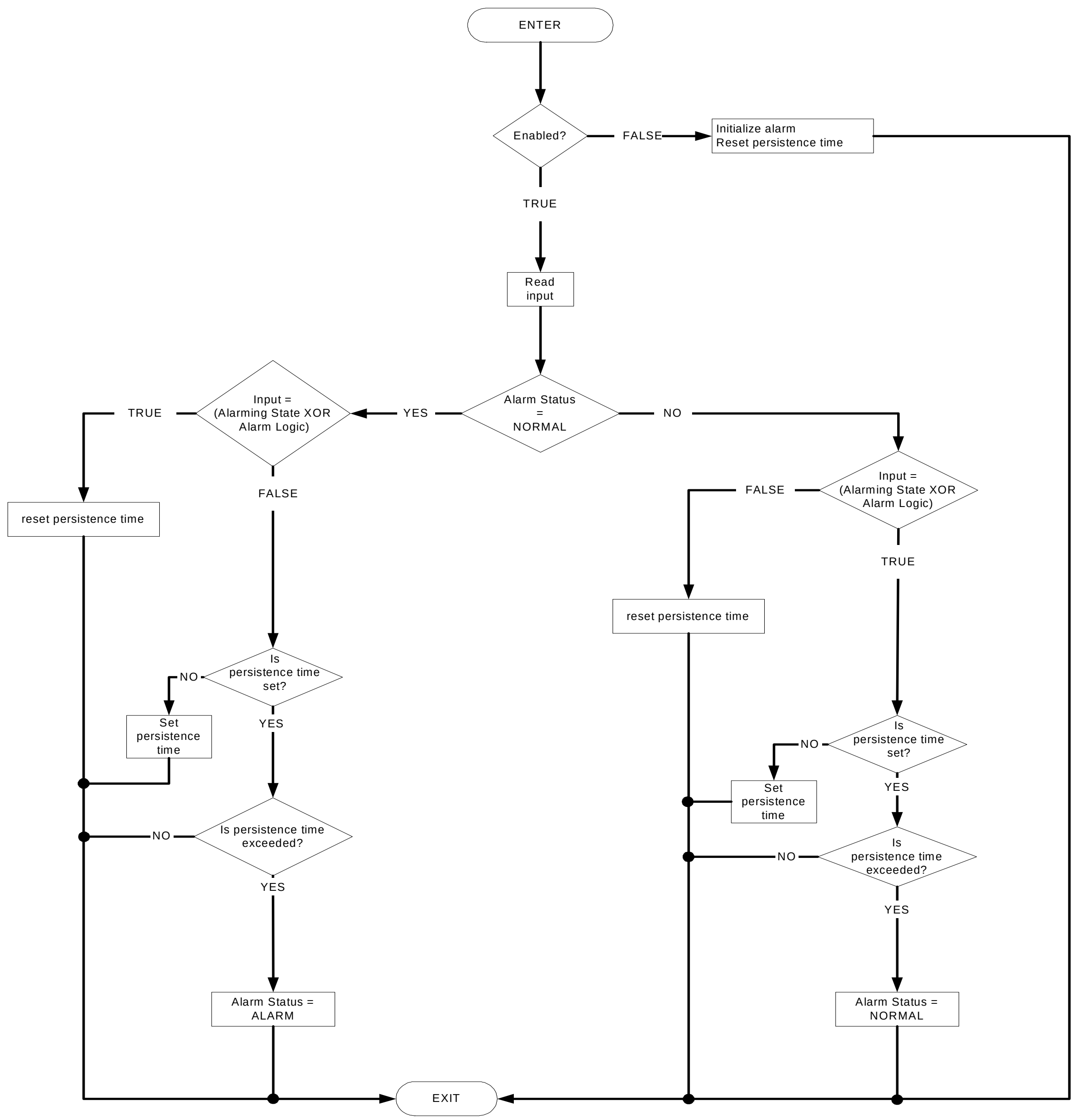


Figure 5
Discrete Interlock

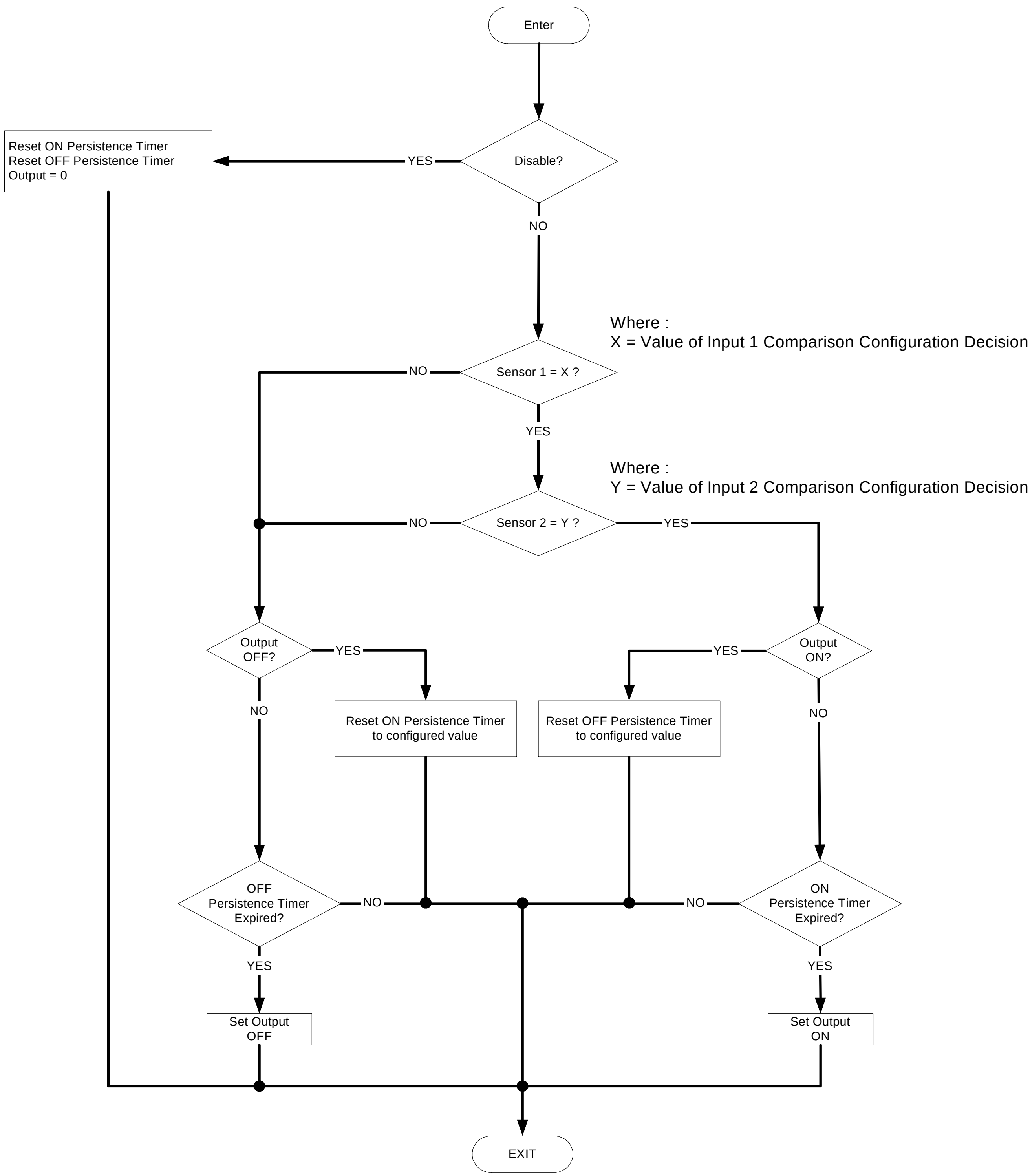


Figure 6
Enthalpy Comparison

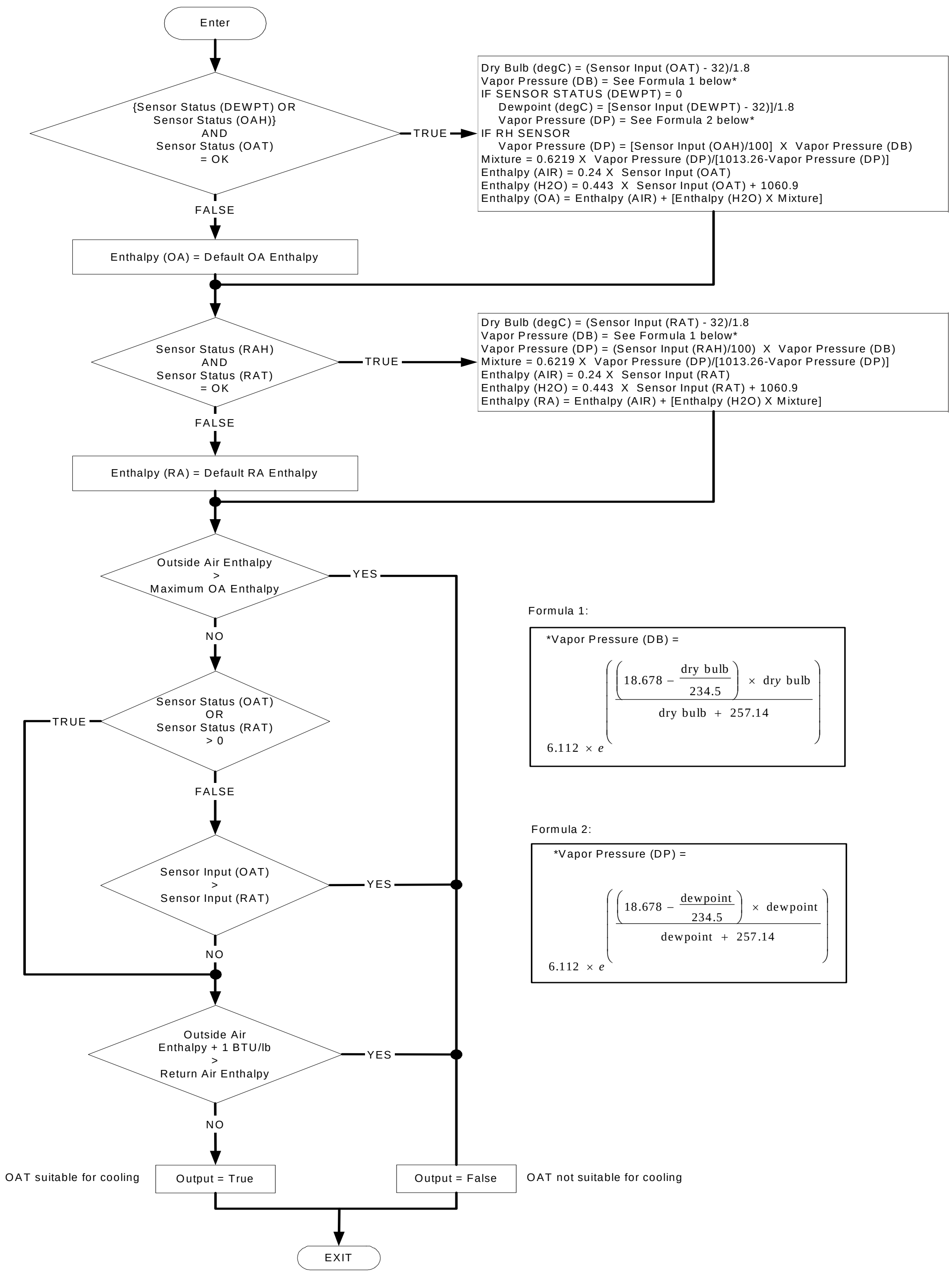
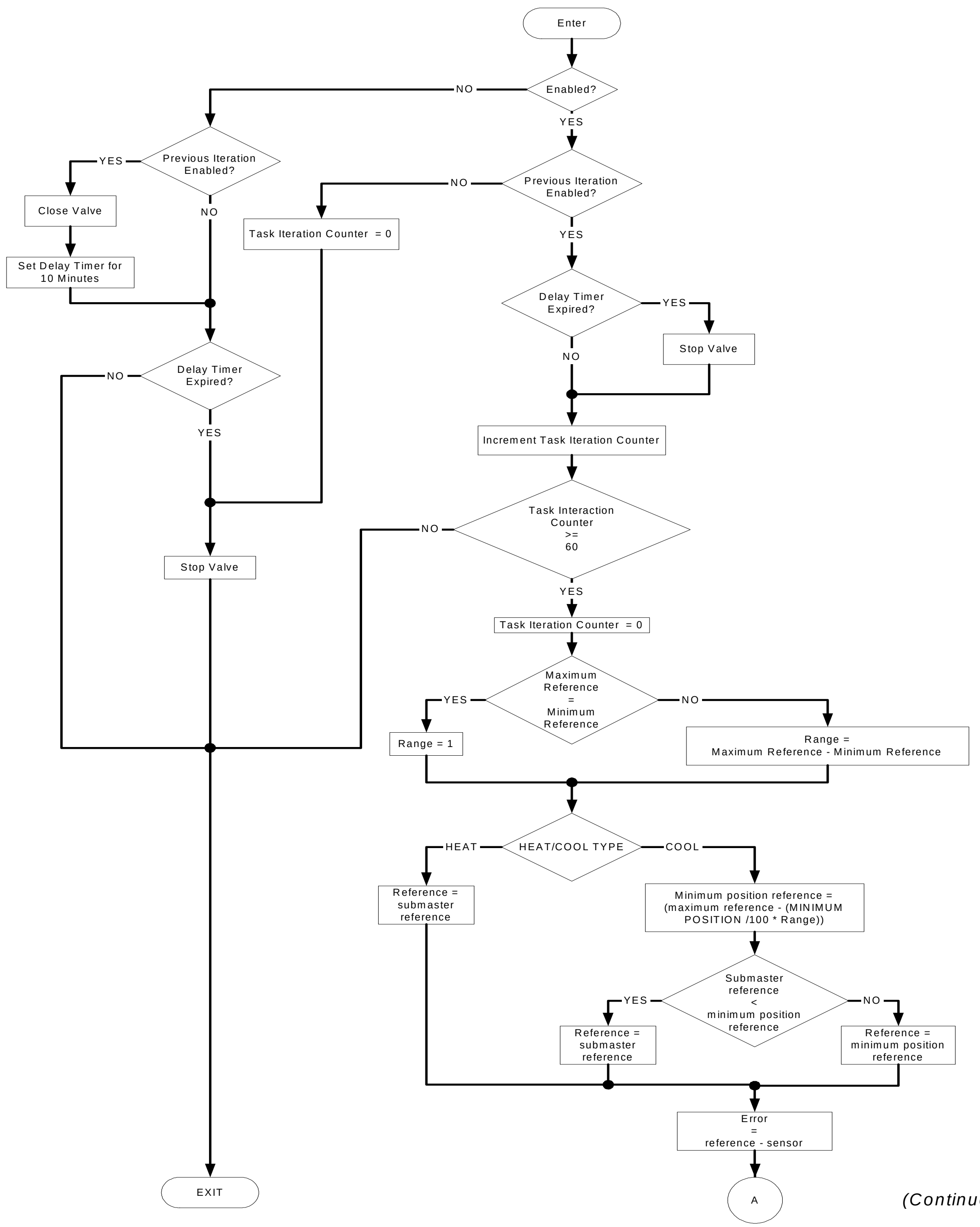


Figure 7
Floating Point



(Continued)

Figure 7
Floating Point
(continued)

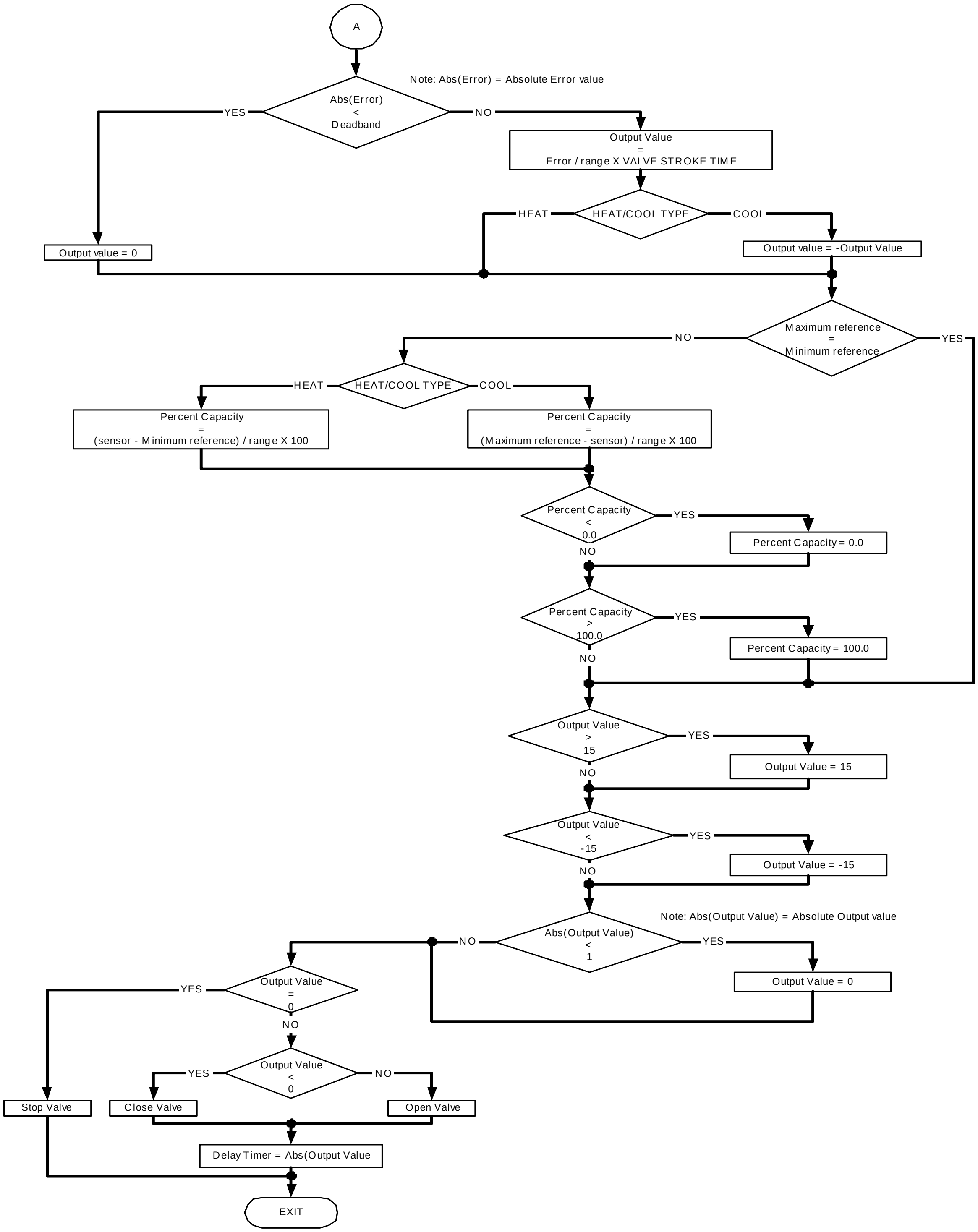


Figure 8
Holiday

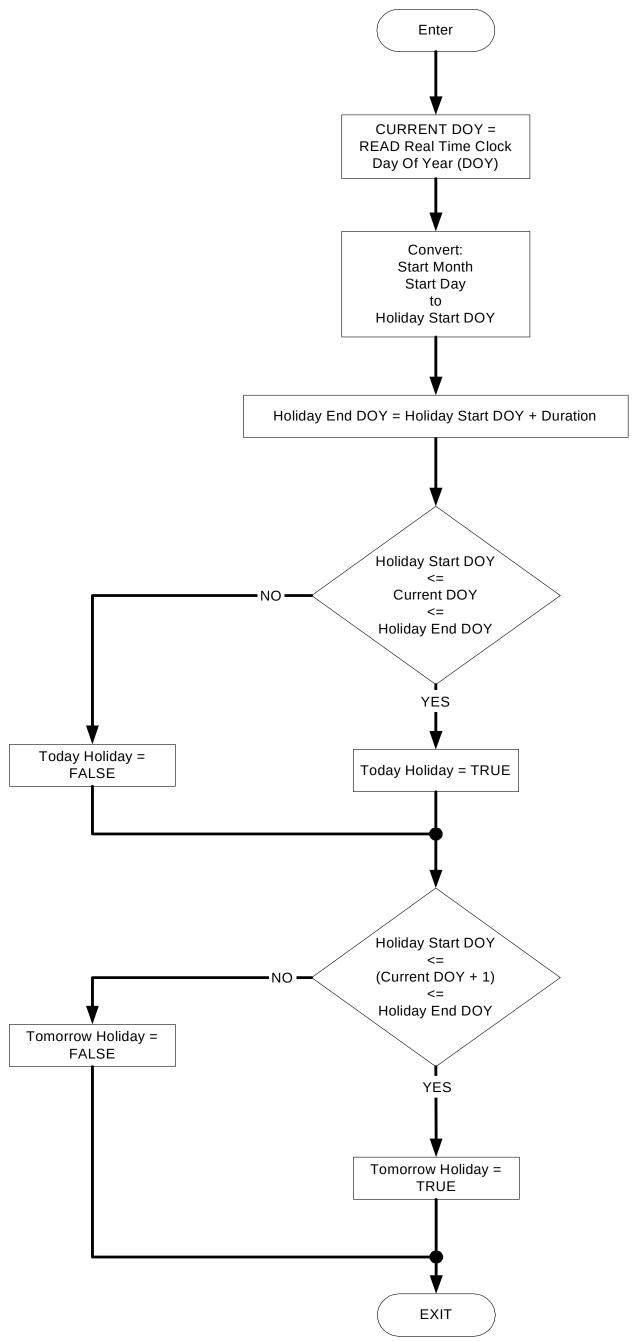


Figure 9
Indoor Air Quality

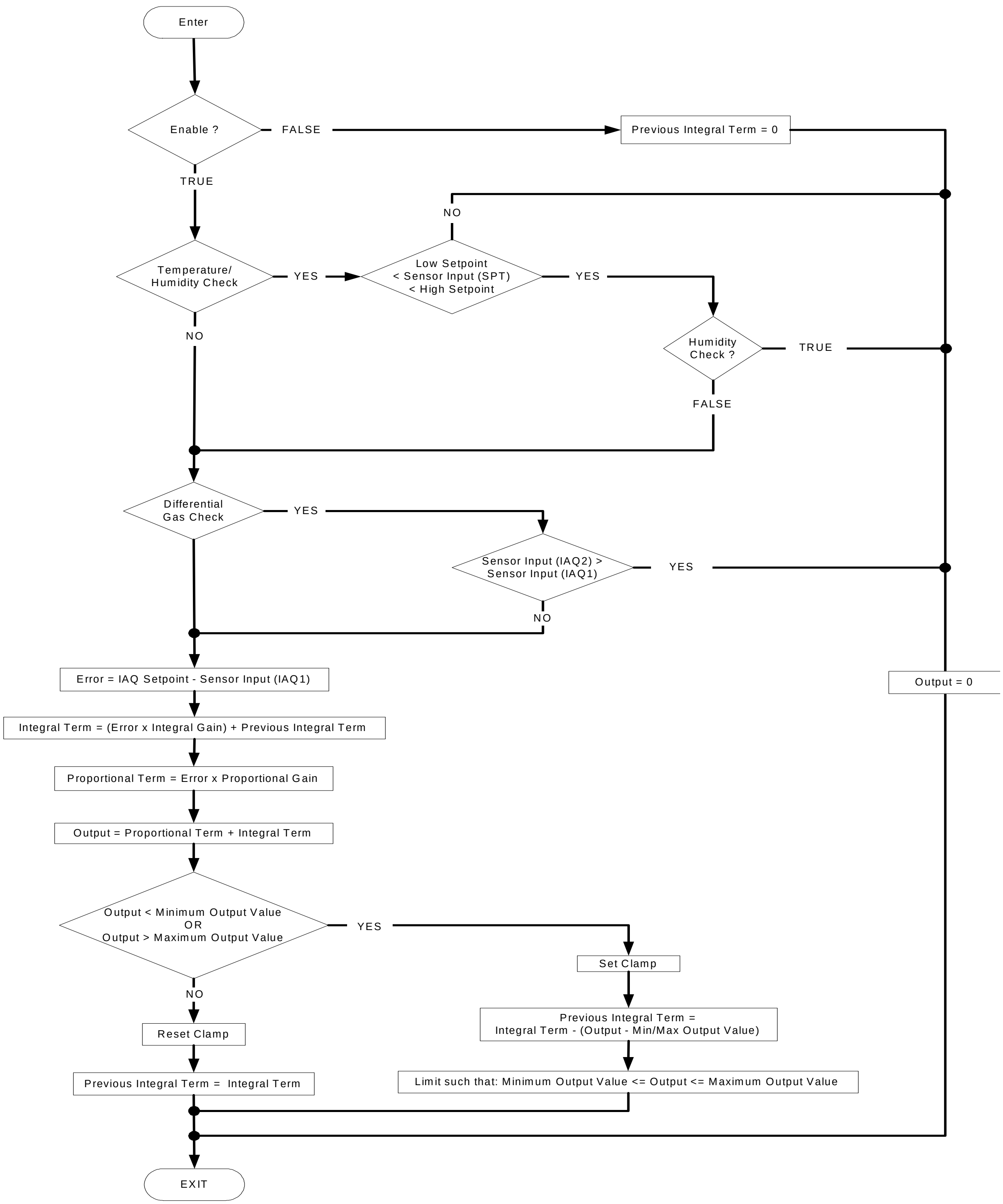
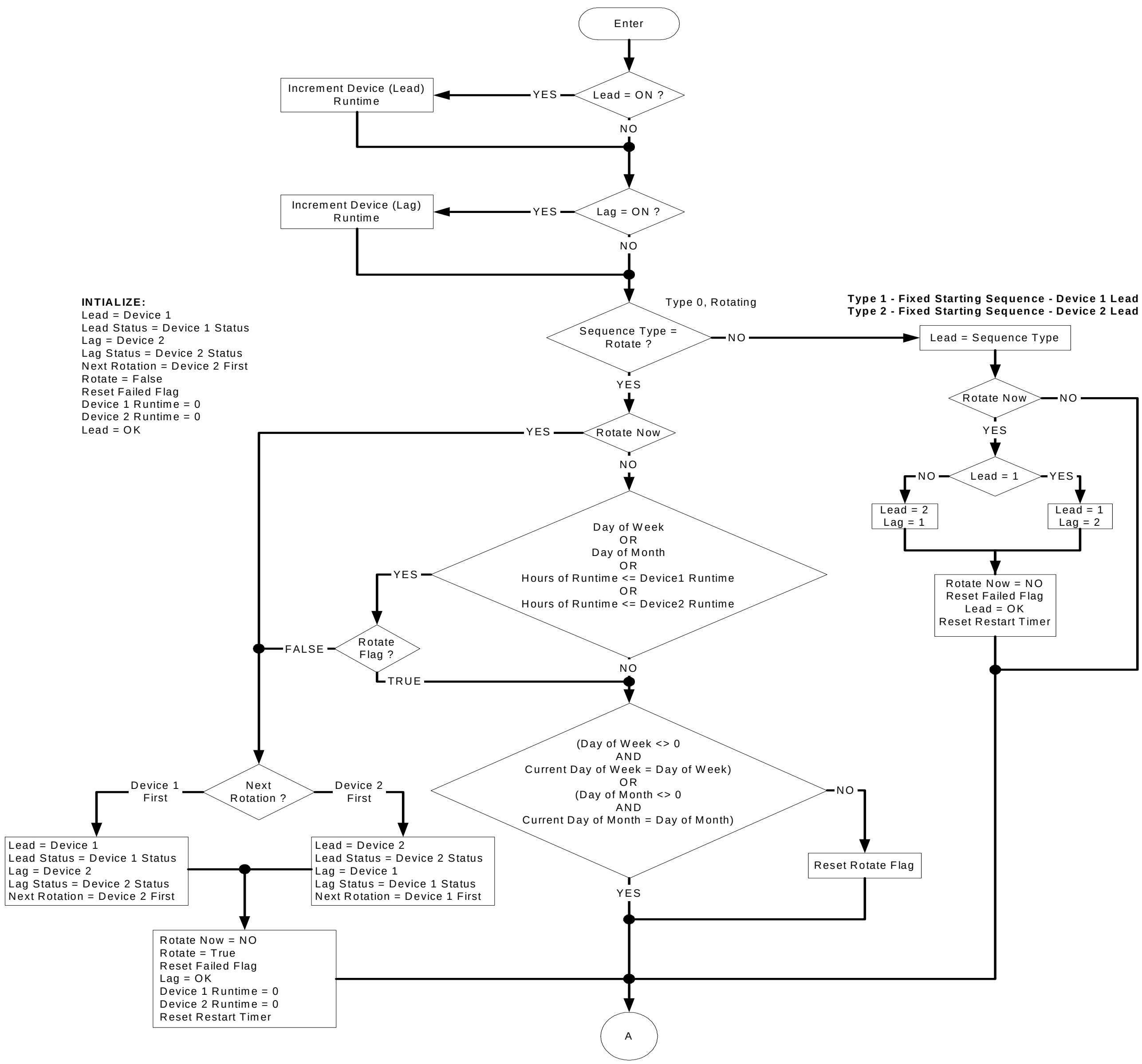


Figure 10
Lead/Lag Control



(Continued)

Figure 10
Lead/Lag Control
(continued)

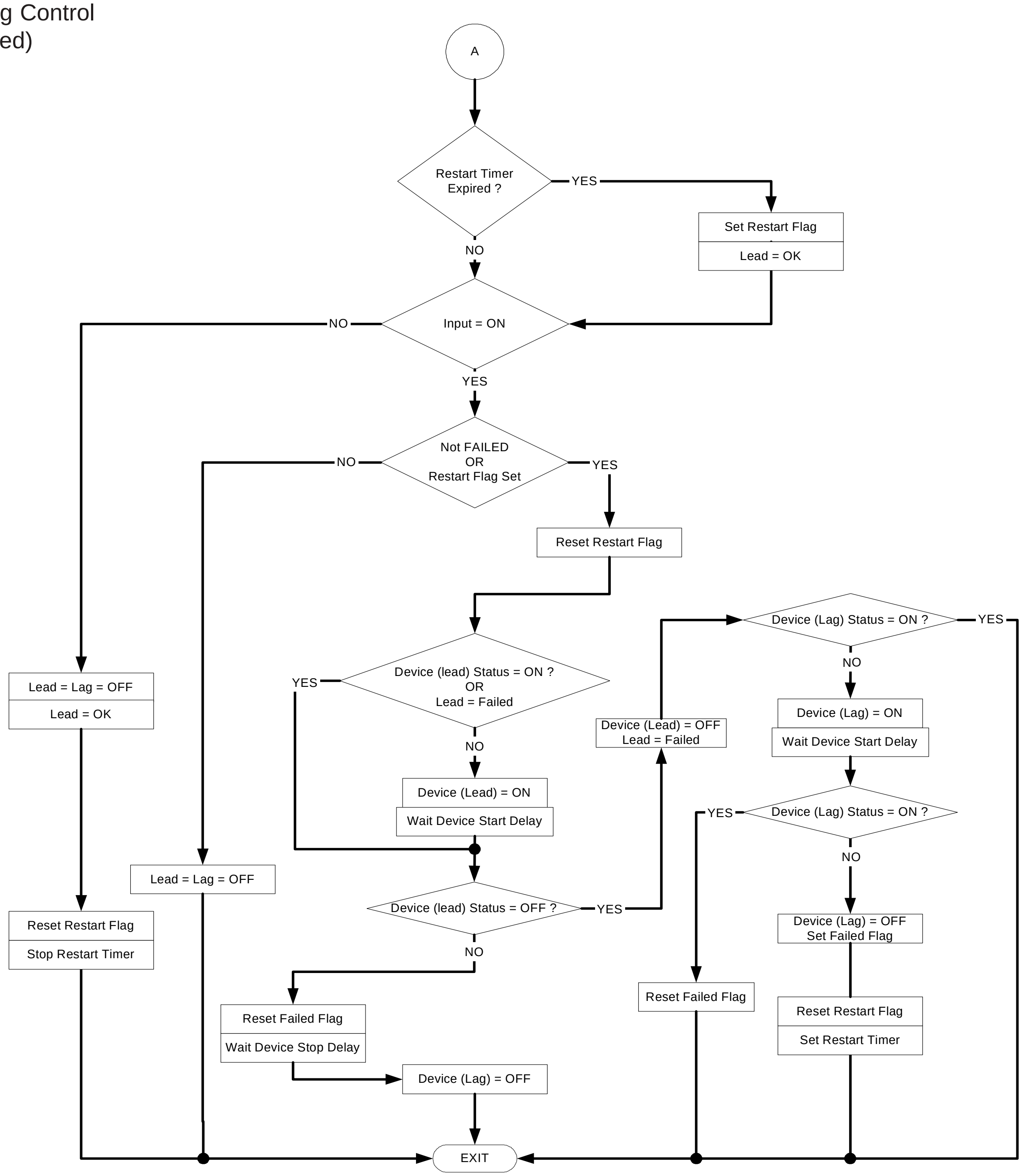


Figure 11
Lighting Control

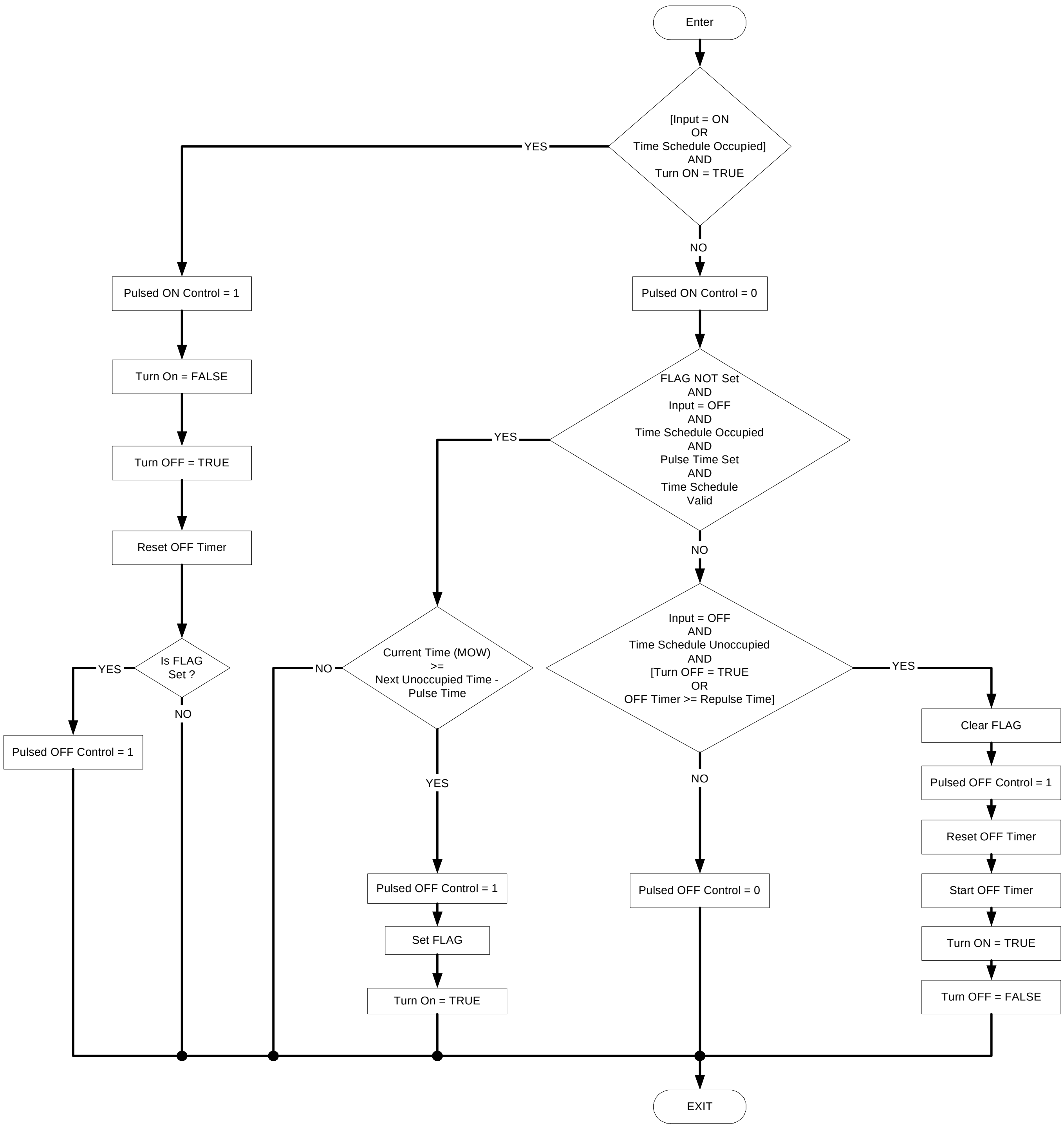


Figure 12
Loadshed

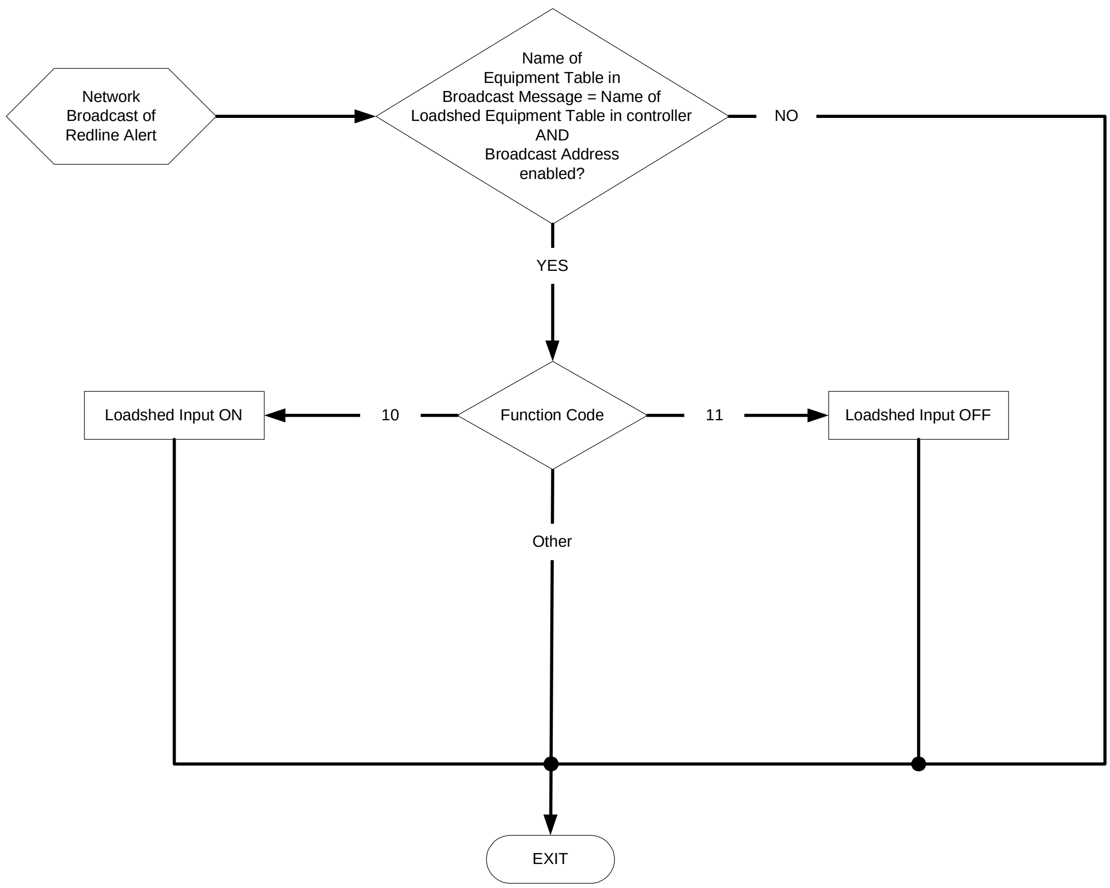


Figure 13
Night Time Free Cooling
(NTFC)

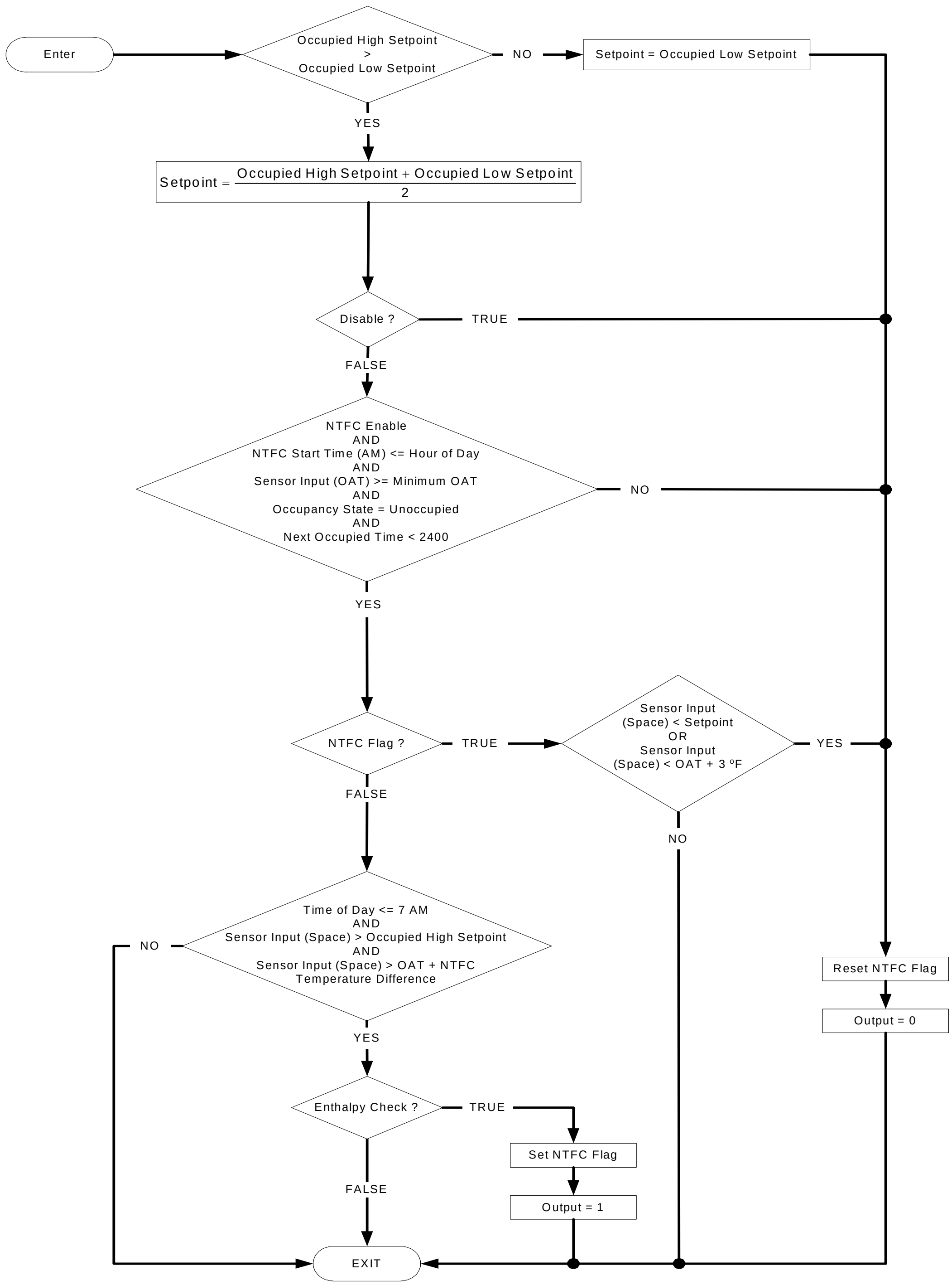


Figure 14
Optimal Start

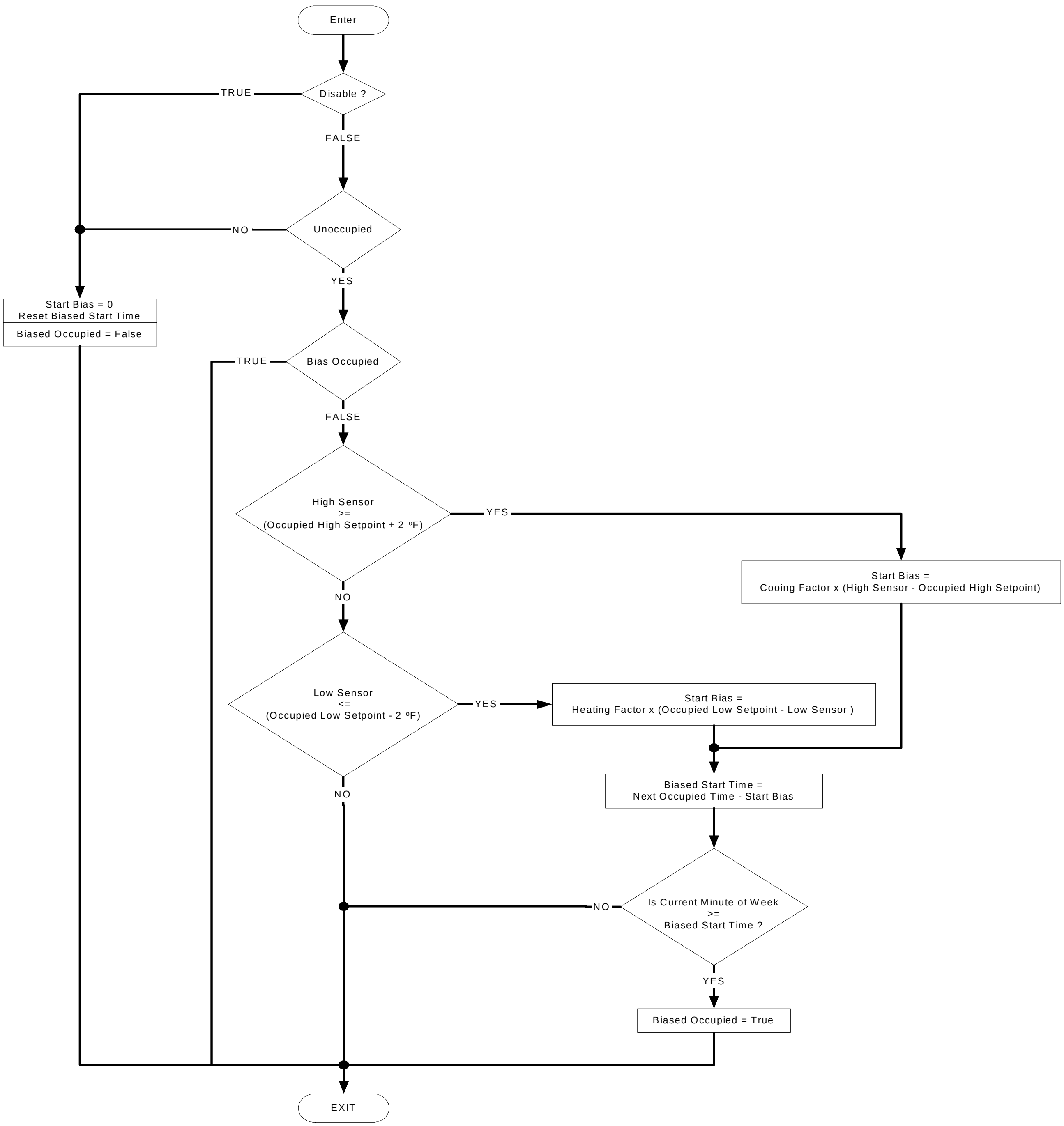


Figure 15
Optimal Stop

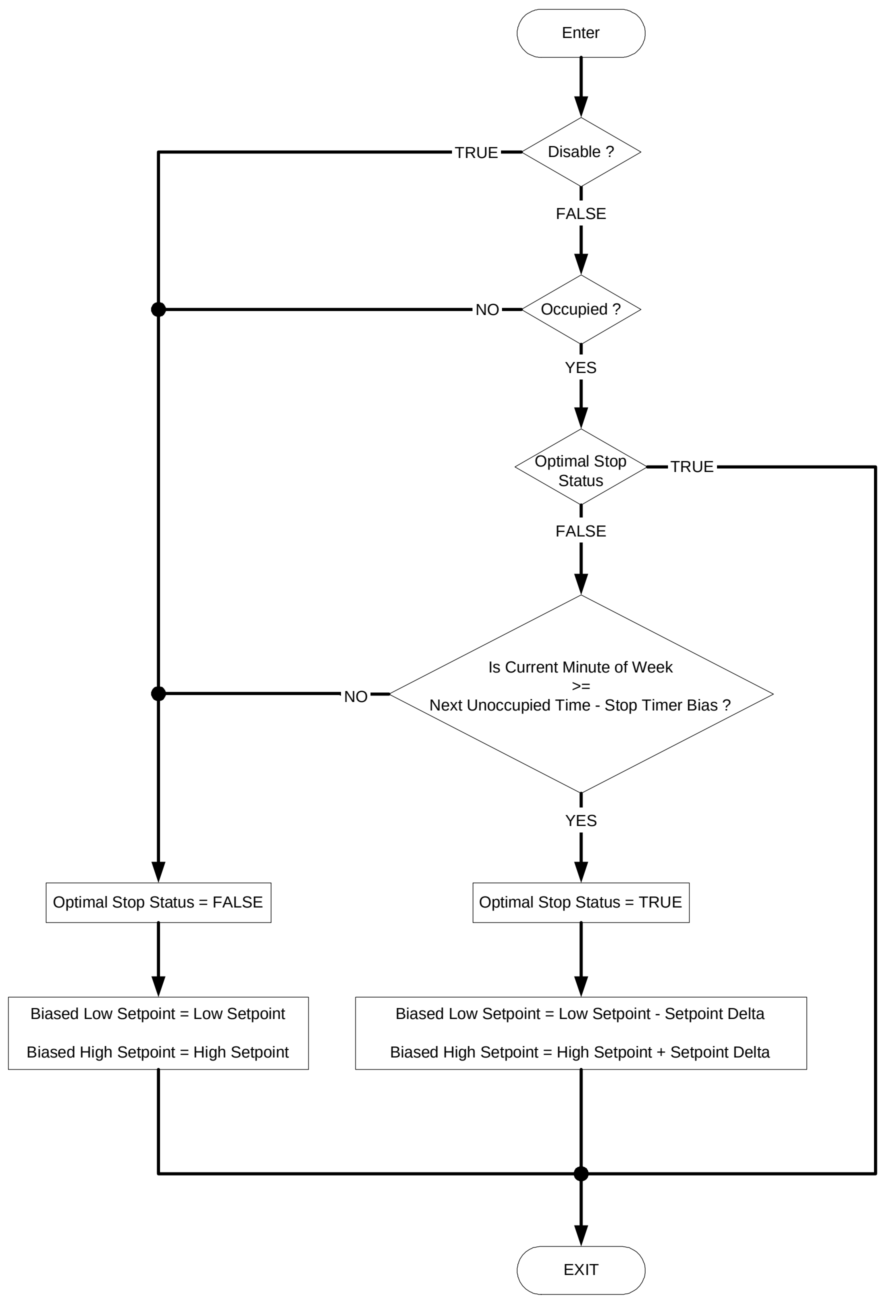


Figure 16
Permissive Interlock

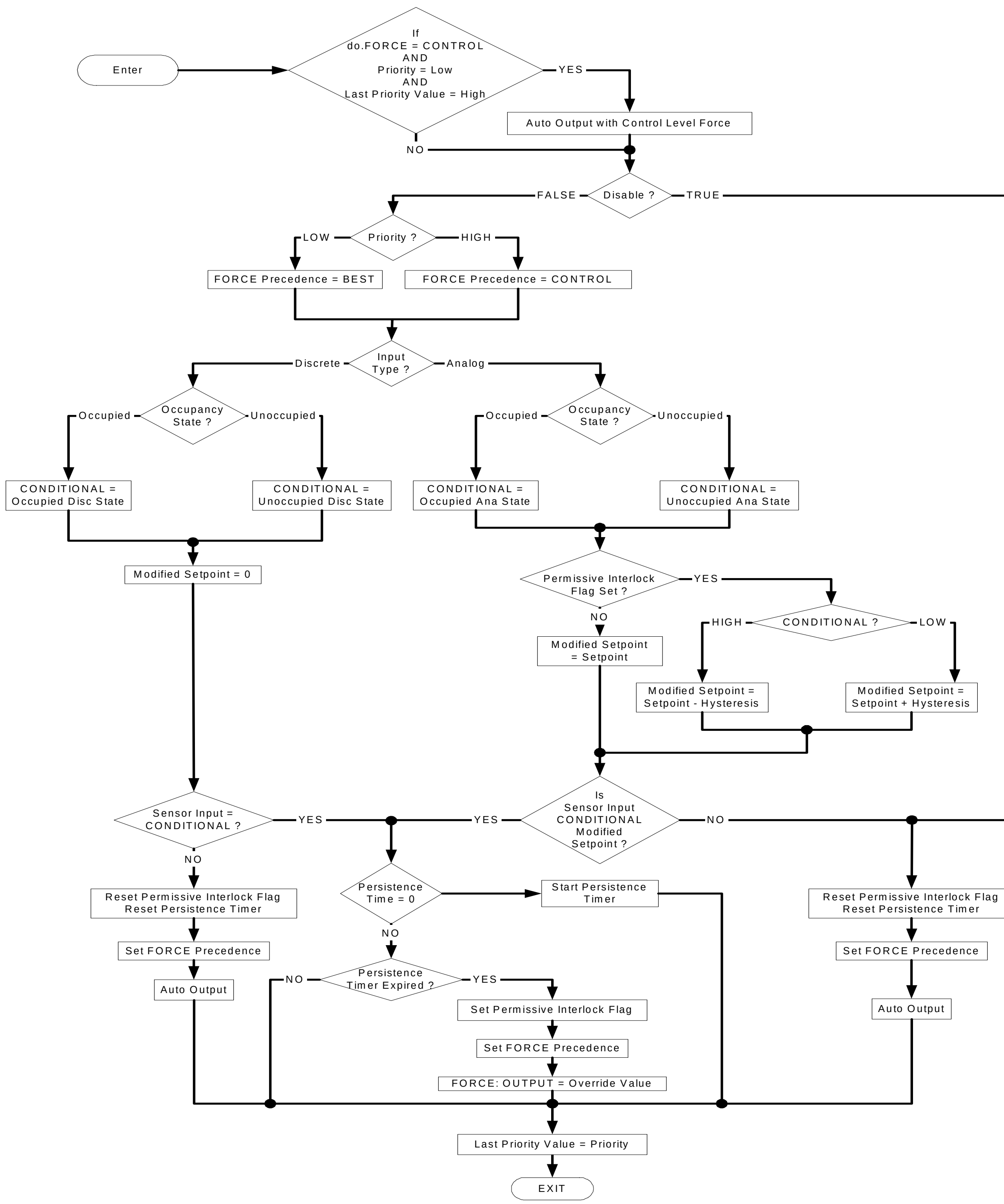


Figure 17
PID Master Loop

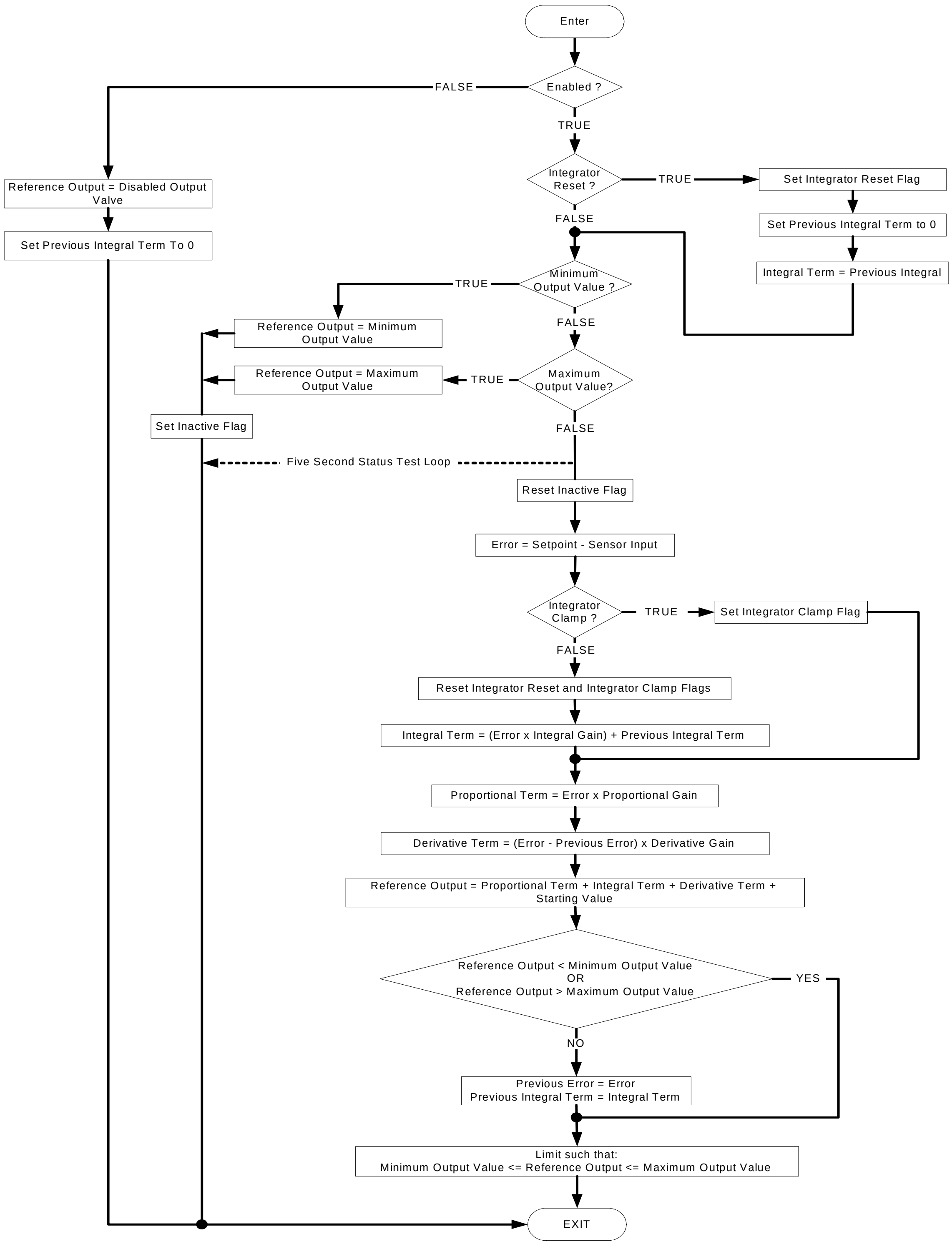


Figure 18
Sensor Group

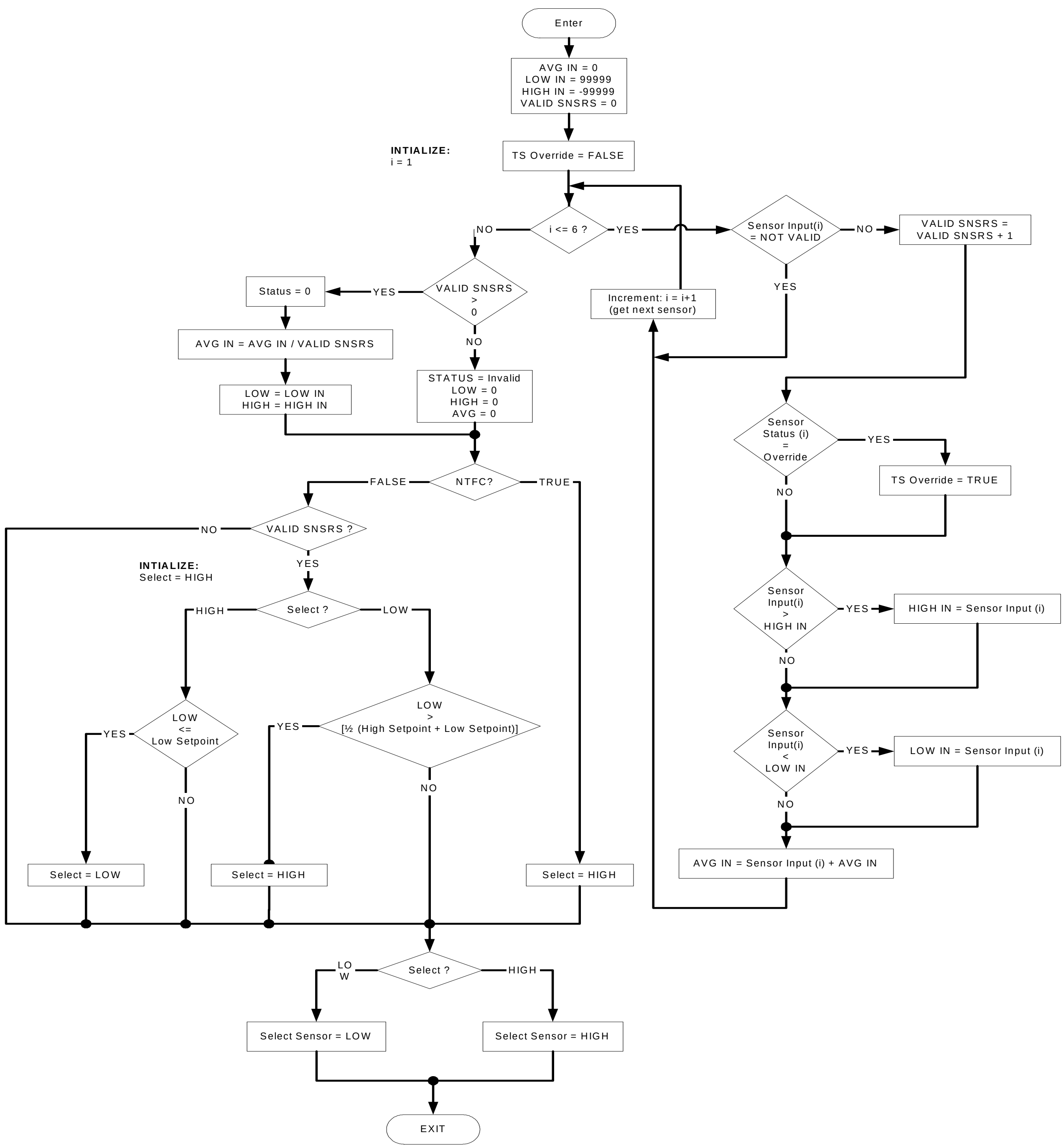


Figure 19
Setpoint Reference

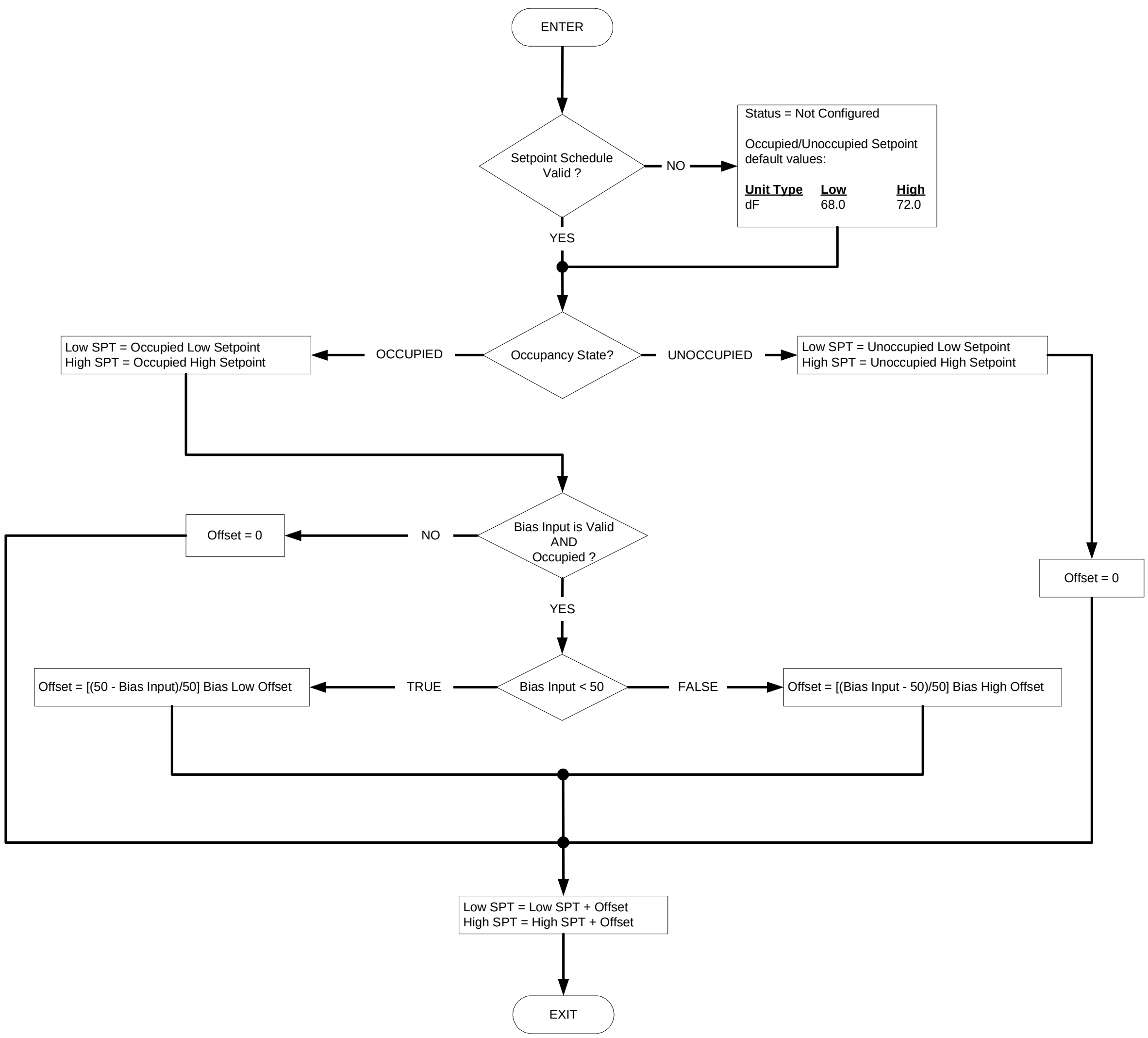


Figure 20
Setpoint Reset

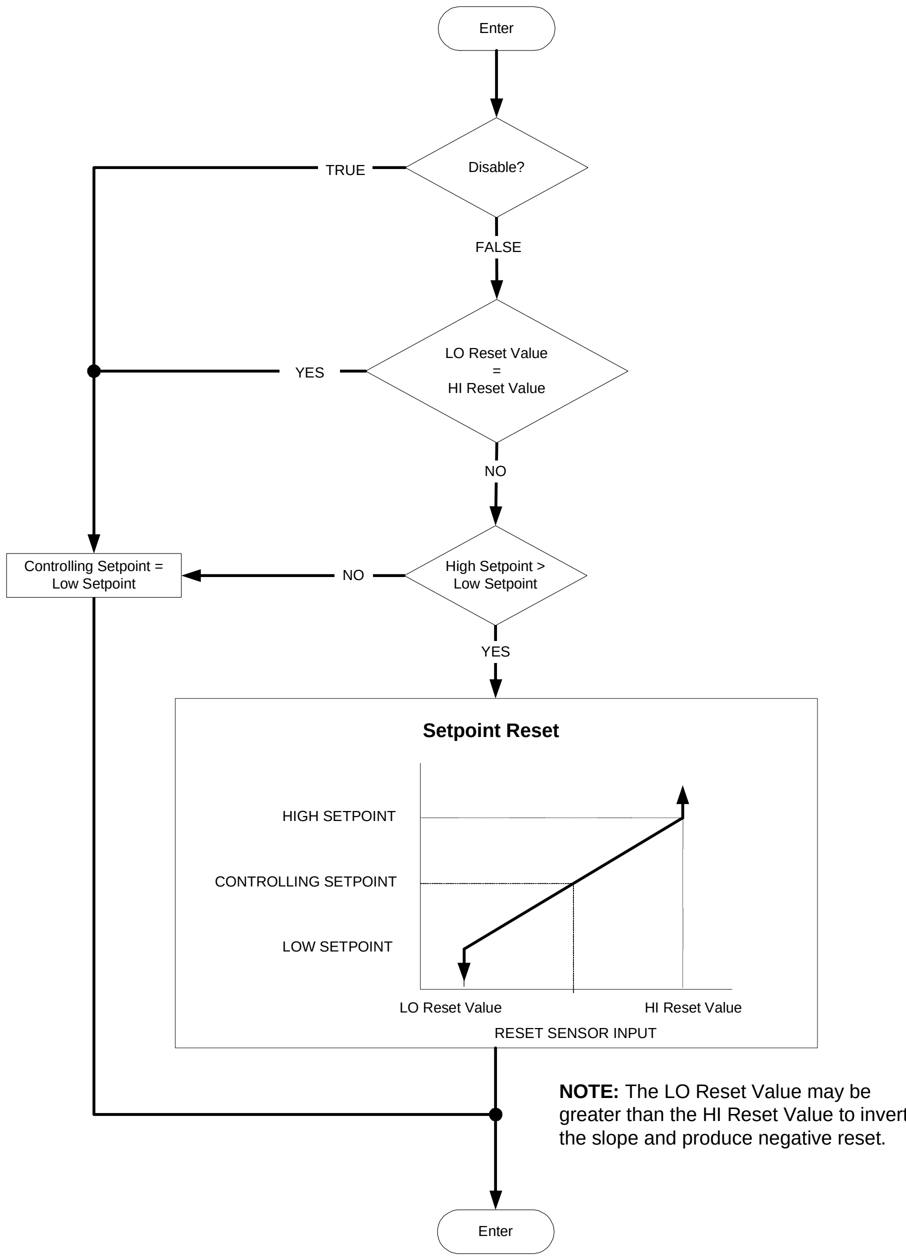


Figure 21
Space Temperature Check

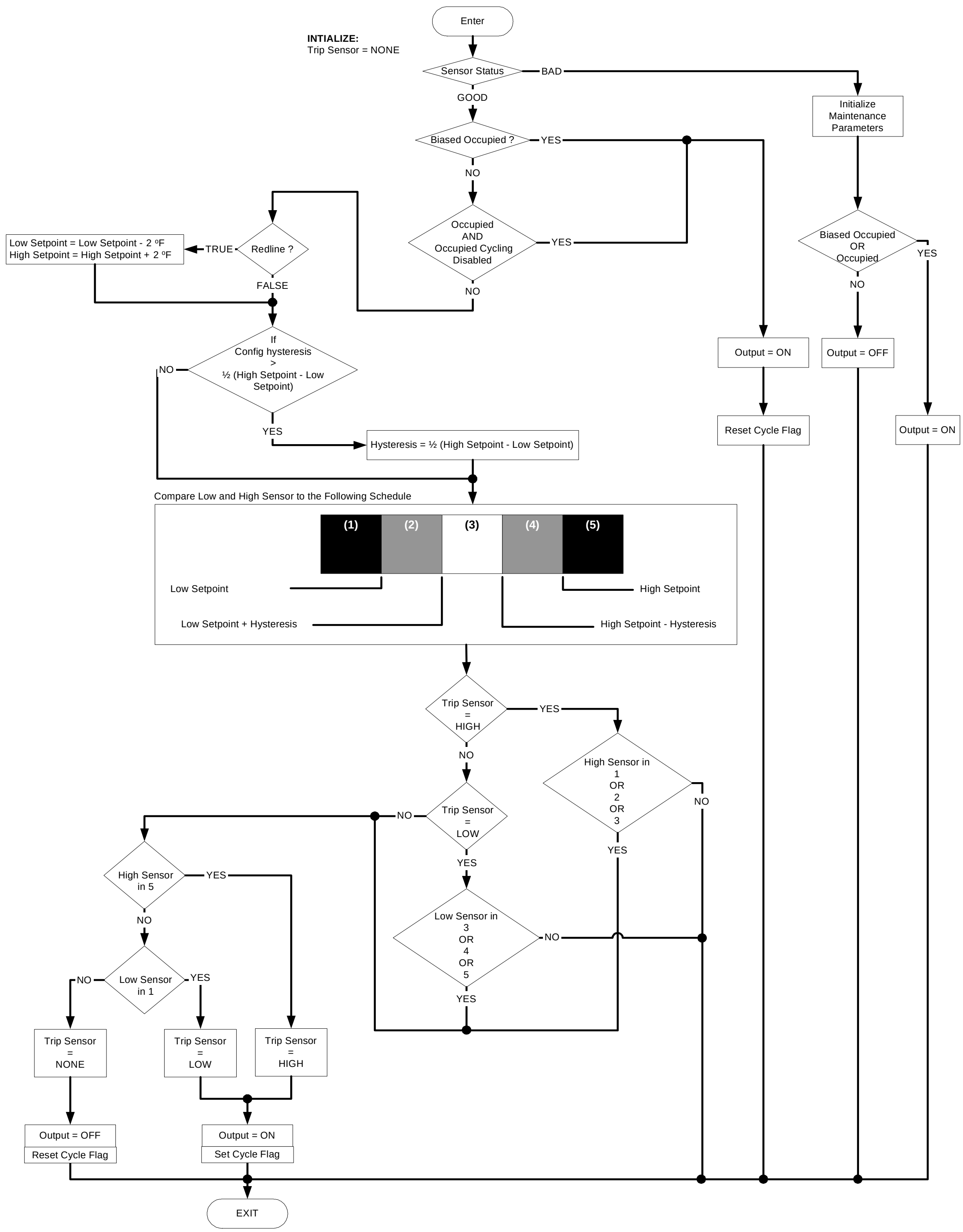


Figure 22
Staging Control

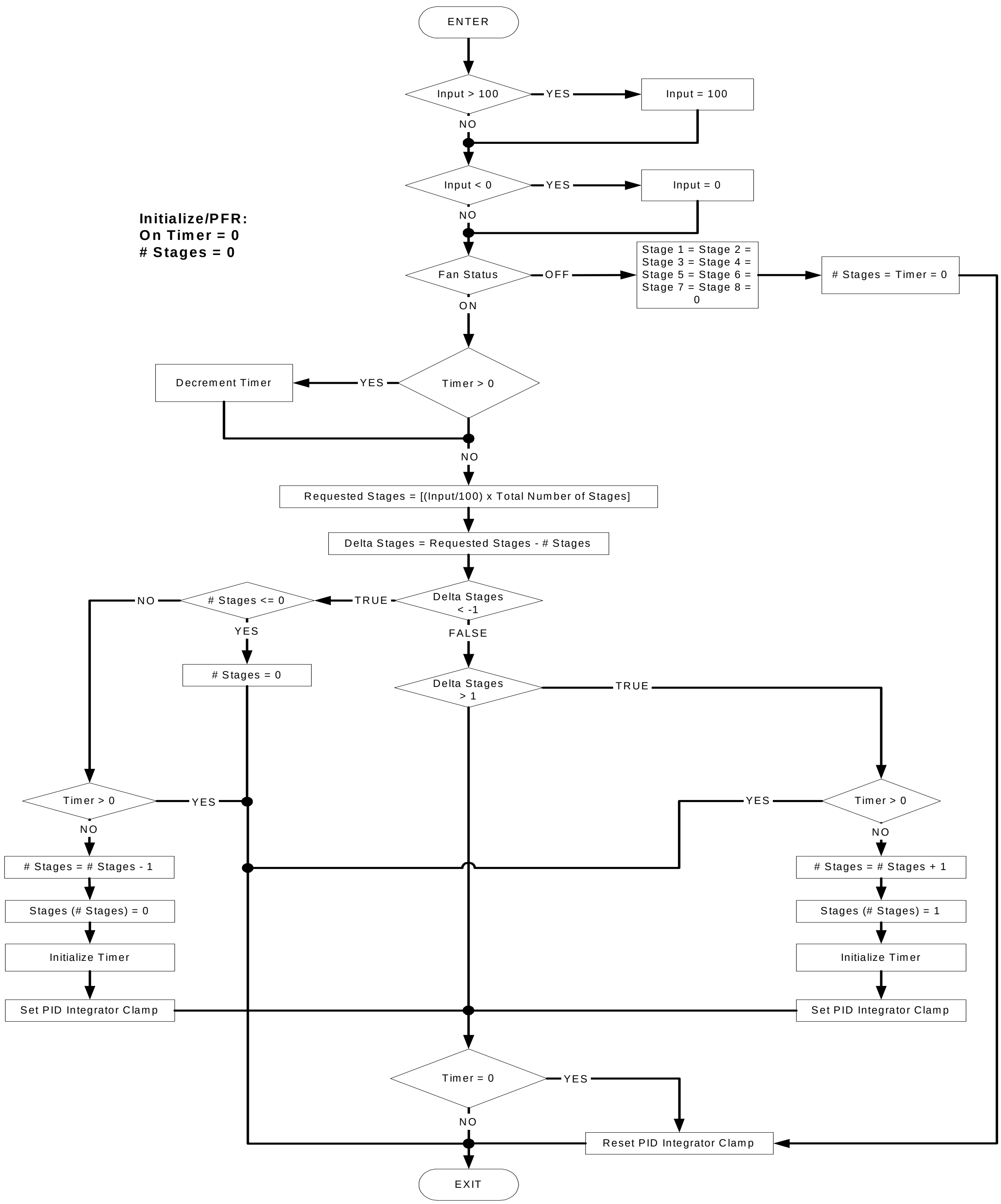


Figure 23
PID Submaster Loop

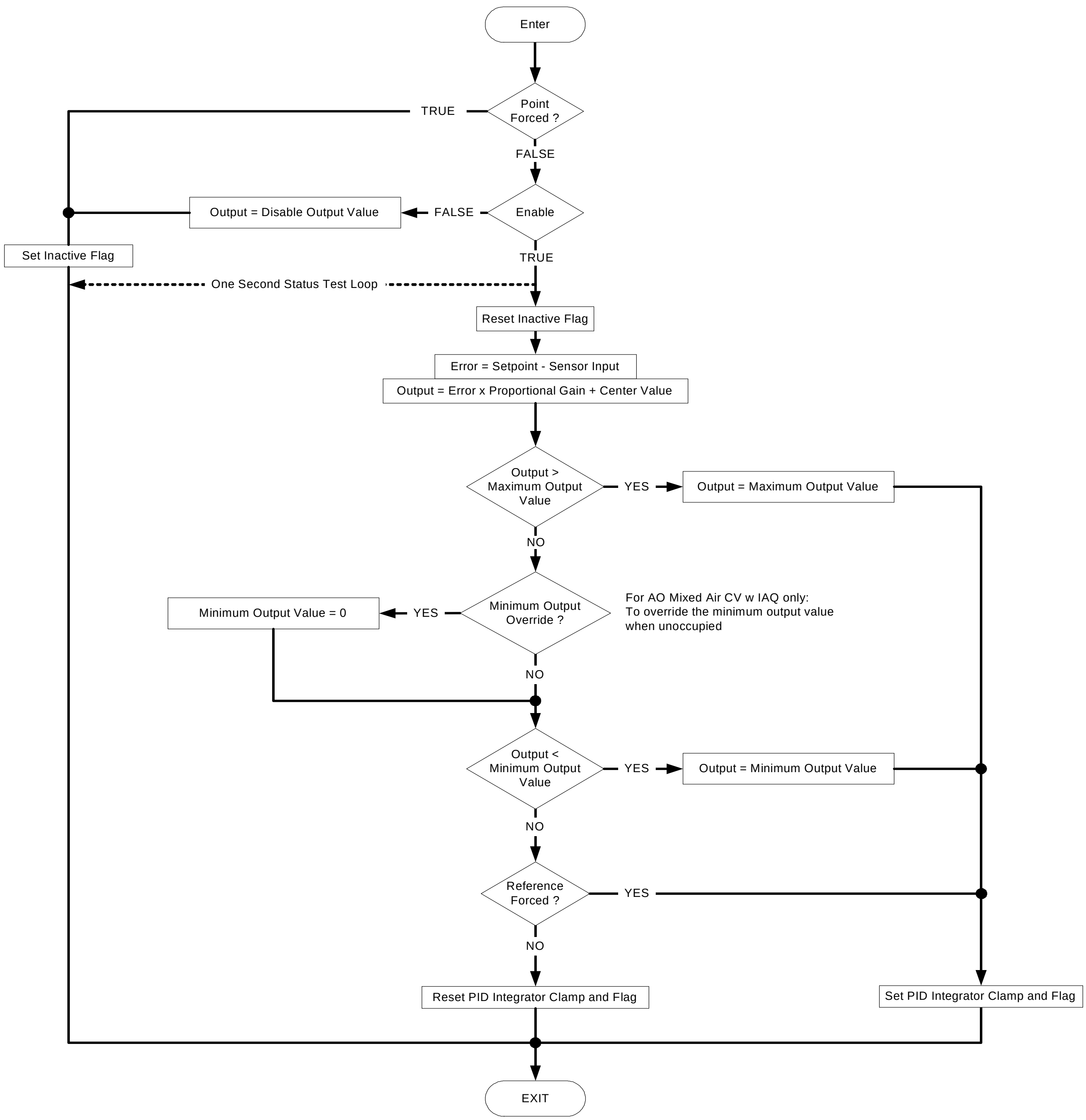
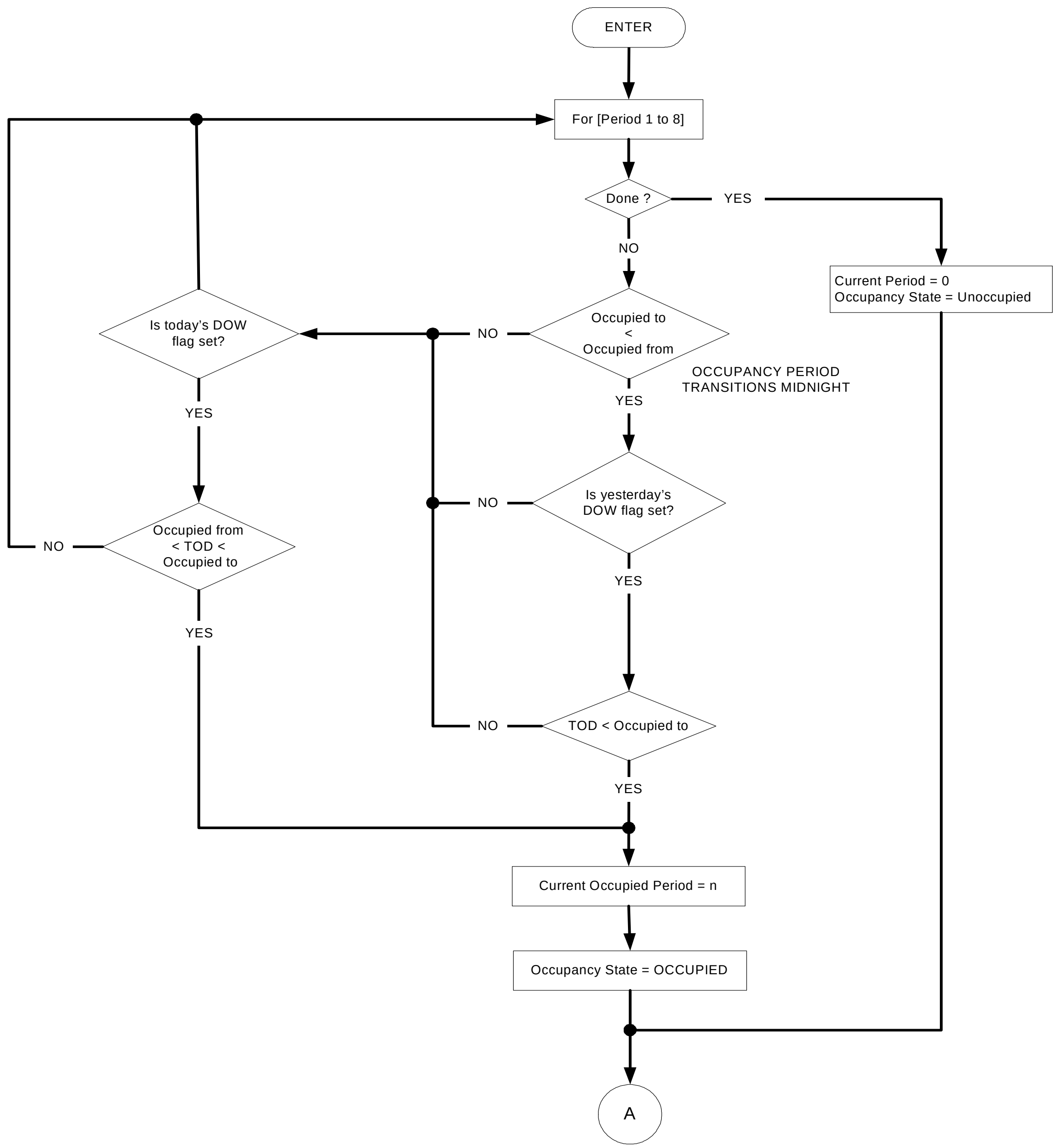
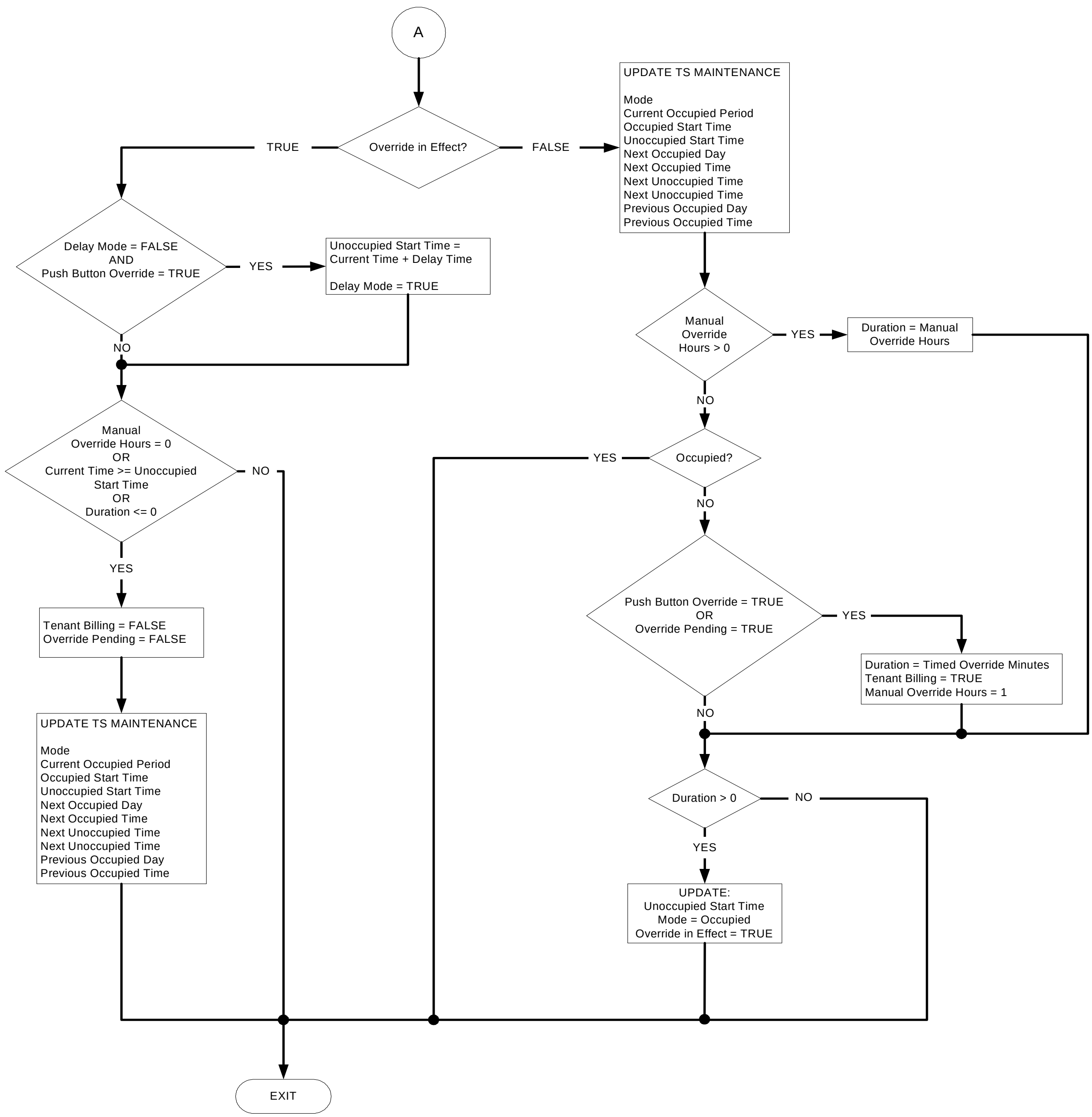


Figure 24
Time Schedule



(Continued)

Figure 24
Time Schedule
(continued)



Appendix B

This appendix contains the following tables and charts:

- Analog Engineering Units
- Discrete States
- Setpoint Schedule Defaults
- Temperature Sensor Types

Analog Engineering Units

Index	Customary US			Metric		
	Display Units	Input Limits Low	Input Limits High	Display Units	Input Limits Low	Input Limits High
1	dF	-40.0	245.0	dC	-40.0	118.3
2	%	0.0	100.0	%	0.0	100.0
3	"H20	0.0	5.0	Pa	0	1244
4	ma	0.0	22.0	ma	0.0	22.0
5	^F	-9999.9	9999.9	^C	-5555.5	5555.5
6	Volts	0.0	11.0	Volts	0.0	11.0
7	PSI	0.0	16.5	KPa	0.0	113.8
8	GPM	-9999.9	9999.9	l/min	-37849.6	37849.6
9	GPH	-9999.9	9999.9	l/h	-37849.6	37849.6
10	KGPM	-9999.9	9999.9	m3/min	-37849.6	37849.6
11	KGPH	-9999.9	9999.9	m3/h	-37849.6	37849.6
12	PSIG	-9999.9	9999.9	KPa	-68949.3	68949.3
13	LBS/H	-9999.9	9999.9	Kg/h	-4535.95	4535.95
14	KLBS/H	-9999.9	9999.9	Kg/h	-4535955	4535955
15	BTU/H	-9999.9	9999.9	KW	-2.9300	2.9300
16	MBTU/H	-9999.9	9999.9	KW	-2929.97	2929.97
17	"H2O	-9999.9	9999.9	mm H2O	-253997	253997
18	"Hg	-9999.9	9999.9	mm Hg	-253997	253997
19	KWH	-9999.9	9999.9	KWH	-9999.9	9999.9
20	KW	-9999.9	9999.9	KW	-9999.9	9999.9
21	dF	-9999.9	9999.9	dC	-5537.7	5537.7
22	%RH	0.0	100.0	%RH	0.0	100.0
23	AMPS	-9999.9	9999.9	AMPS	-9999.9	9999.9
24	VOLTS	-9999.9	9999.9	VOLTS	-9999.9	9999.9
25	CFM	-9999.9	9999.9	m3/min	-283.197	283.197
26	CFH	-9999.9	9999.9	m3/h	-283.197	283.197
27	FPM	-9999.9	9999.9	m/sec	-50.7995	50.7995
28	KCFM	-9999.9	9999.9	m3/min	-283197	283197
29	KCFH	-9999.9	9999.9	m3/h	-283197	283197
30	TONS	-9999.9	9999.9	tons	-9069.9	9069.9
31	TONS/H	-9999.9	9999.9	tons/H	-9069.9	9069.9
32	RPM	-9999.9	9999.9	RPM	-9999.9	9999.9
33	%OPEN	-9999.9	9999.9	%OPEN	-9999.9	9999.9
34	HOURS	-9999.9	9999.9	HOURS	-9999.9	9999.9
35	GALS	-9999.9	9999.9	LITERS	-37849.6	37849.6
36	BTU/lb	-9999.9	9999.9	kJ/kg	-23267.6	23232.0
37	GPS	-9999.9	9999.9	l/sec	-37849.6	37849.6
38	SQFT	-9999.9	9999.9	m2	-928.991	928.991
39	CFM	-9999.9	9999.9	l/sec	-4718.95	4718.95
40	sec	-9999.9	9999.9	sec	-9999.9	9999.9
41	Hz	-9999.9	9999.9	Hz	-9999.9	9999.9
42	min	-9999.9	9999.9	min	-9999.9	9999.9
43	hours	-9999.9	9999.9	hours	-9999.9	9999.9
44	rpm	-9999.9	9999.9	rpm	-9999.9	9999.9
45	KWH/P	-9999.9	9999.9	KWH/P	-9999.9	9999.9
46	PULSES	-9999.9	9999.9	PULSES	-9999.9	9999.9
47	uS	-9999.9	9999.9	uS	-9999.9	9999.9
48	pH	-9999.9	9999.9	pH	-9999.9	9999.9
49	usec	-9999.9	9999.9	usec	-9999.9	9999.9
50	STEPS	-9999.9	9999.9	STEPS	-9999.9	9999.9
51	Feet	-9999.9	9999.9	Meters	-3047.8	3047.8
52	GPM	-9999.9	9999.9	LPS	-630.794	630.794
53	"Hg	-9999.9	9999.9	kPag	-33769.7	33769.7
54	Tons	-9999.9	9999.9	kW	-35139.6	35139.6
55	Tons	-9999.9	9999.9	KCal/min	-503995	503995
56	<none>	-9999.9	9999.9	<none>	-9999.9	9999.9
57	Cust_176	-9999.9	9999.9	Cust_176	-9999.9	9999.9
58-71	Cust_nnn	-9999.9	9999.9	Cust_nnn	-9999.9	9999.9
72	Cust_191	-9999.9	9999.9	Cust_191	-9999.9	9999.9

Note that the “no units” unit (Index 56) does not display any text.

Note that the Custom Units text Cust_nnn where nnn is 176 to 191 displays the indexing used by ComfortVIEW Custom Units.

Discrete States

Index	Discrete State Text	
	Text for Value 0	Text for Value 1
1	0	1
2	Stop	Start
3	Start	Stop
4	Disable	Enable
5	Enable	Disable
6	Off	On
7	On	Off
8	Close	Open
9	Open	Close
10	Low	High
11	High	Low
12	Normal	Alarm
13	Alarm	Normal
14	Emstop	Enable
15	Enable	Emstop
16	No	Yes
17	Yes	No
18	False	True
19	True	False
20	Discrete	Analog
21	Linear	Nonlinear
22	Flow	Energy
23	Normal	Invert
24	(blank)	<blank>
25	Clean	Dirty
26	Cool	Heat
27	Down	Up
28	Slow	Fast
29	Manual	Auto
30	Auto	On
31	Water	Brine
32	Reduced	Full
33	Local	CCN
34	Pulse	Tone
35	And	Or
36	U.S.	Metric
37	Master	Slave
38	Cust26_0	Cust26_1
	Custnn_0	Custnn_1
53	Cust41_0	Cust41_1

Note that the “blank” unit (Index 24) does not display any text.

Note that the Custom Units text Custnn_0 and Custnn_1 where nn is 26 to 41 displays the indexing used by ComfortVIEW Custom Units.

Setpoint Schedule Defaults

Index	Customary US			Metric		
	Display Units	Defaults		Display Units	Defaults	
		Low	High		Low	High
1	dF	68.00	72.00	dC	20.00	22.22
2	%	40.00	60.00	%	40.00	60.00
56	no units	0.00	0.00	no units	0.00	0.00

Temperature Sensor Types

Type	Analog Input Type Temperature Sensor Types	Range (US = Customary US) (M = Metric)
1	10K Type III (AN/YSI) Temperature Sensor	US: -40.0°F to 245.0°F M: -40.0°C to 118.3°C
2	5K Thermistor Temperature Sensor	US: -40.0°F to 245.0°F M: -40.0°C to 118.3°C
3	10K Type II (CP/MCI) Temperature Sensor	US: -40.0°F to 245.0°F M: -40.0°C to 118.3°C

Appendix C

Alarm Information

Refer to the information in this appendix when configuring the following decisions in an ALRMDEF Table:

- Alarm Level
- Alarm Source
- Alarm Description Index
- Alarm Message

A description of each of these decisions and their allowable entries are given below.

Alarm Level

In the Alarm Level configuration decision, enter the priority level (0 to 6) that will be assigned to this alarm. The value in this decision is used when sorting alarms.

Alarm levels range from zero to six, with zero being the highest and six the lowest priority. Each level, along with a description of its meaning, is listed below.

Alarm Level	Meaning
0	Fire/Life Safety
1	Critical
2	Service
3	Reserved
4	Maintenance
5	Reserved
6	Control

Alarm Source

In the Alarm Source configuration decision, enter the type (0 to 7) that represents the equipment generating the alarm. The value in this decision is used when sorting alarms from the same source by level.

Type	Equipment
0	Fire
1	Security
2	Reserved
3	Boiler/Furnace
4	Chiller
5	Air Handler
6	System (POC functions)
7	Thermostat

Alarm Description Index

In the Alarm Description Index configuration decision, enter the index number (0 to 15) that represents the standard alarm message that will be generated when the alarm condition exists.

Index Number	Standard Alarm Message
0	blank
1	discrete state
2	total time exceeds
3	starts, limit is
4	commanded state is
5	safety chain first out
6	interlock
7	outside limit of
8	interlocked, exceeds limit of
9	I/O channel failure
10	has illegal configuration
11	additional cooling capacity required
12	communications error
13	clock error
14	communication alarm buffer full
15	directory not available

Alarm Message

There are four Alarm Message configuration decisions which allow you to create a custom message of up to 64 characters that will be sent when the alarm condition exists. In each decision, you can enter up to 16 ASCII character and/or control characters listed in the table below.

A control character consists of # and a number 2 to 4. When an alarm is generated, the control characters in the custom message are replaced by the actual data supplied by the alarm, i.e., the point name.

The examples below show custom messages with and without control characters.

> *Example custom alarm message entered without control characters:*
>
> Bob, SPT exceeded limit of 72°F. Call Joe at Ext. 5555 when problem is fixed.
>
> *Same custom alarm message entered using control characters:*
>
> Bob, #2 #4. Call Joe at Ext. 5555 when problem is fixed.

Control Characters	Will be replaced with . . . when alarm is sent
#1	Not used
#2	8-character point name*
#3	current variable value and units
#4	exceeded limit and units

* Universal Controller replaces the 6-character point name with the 24-character description.

Appendix D

Standard Input and Output Devices

The tables below provide the engineering units, ranges, resolutions, and accuracy for the standard input and output devices that the Universal Controller supports.

Input Types			
Input Type	Accuracy	Resolution	Range
5K Thermistor	+ 2.5°F	0.75°F	-40 to 30°F
(Type 2)	+ 1.0°F	0.20°F	30 to 60°F
	+ 1.0°F	0.20°F	60 to 80°F
	+ 1.0°F	0.50°F	80 to 160°F
	+ 2.5°F	2.00°F	160 to 245°F
10K Thermistor	+ 2.5°F	0.75°F	-40 to 30°F
(Type 1 = YSI,	+ 1.0°F	0.20°F	30 to 60°F
	+ 1.0°F	0.20°F	60 to 80°F
Type 2 = MCI)	+ 1.0°F	0.50°F	80 to 160°F
	+ 2.5°F	2.00°F	160 to 245°F
0-10V	+ 0.1V	0.01V	
4-20mA	+ 0.2mA	0.02mA	

Output Types		
Input Type	Accuracy	Resolution
0-10V	0.20V	0.020V
4-20mA	0.40mA	0.040mA

Appendix E

Configuring a Newly Installed Universal Controller Using a System Pilot

This chapter provides you with the procedures that are necessary to configure a newly installed Universal Controller using the System Pilot user interface.

When configuring a Universal Controller using the System Pilot, you must perform a number of steps in a particular order. Step-by-step procedures for completing each of these steps are contained in this appendix.

- Creating the Universal Controller's points using the Service Configuration Tables. Each of these tables is described in this manual's Service Configuration chapter including a description of and allowable entries for each decision.
- Verifying that the points were successfully created.
- Configuring the database using the Configuration Tables.

The term create, as it applies to the Universal Controller, means to specify information about the items being selected in the Service Configuration Tables. You must specify information such as channel types, sensor type or units, channel names, function types and function units. For example, the AO Cooling CV algorithm's function type is *1* and its algorithm units might be *2*, which indicates 0-100%.

The term configure, as it is used in relation to the Universal Controller, means to specify to the Universal Controller the information that it needs to control and monitor HVAC devices in the desired manner. For example, when configuring the AO Cooling CV algorithm, you must enter information such as the name of the controlling setpoint table and the Sensor Group or space temperature sensor that is providing the space temperature inputs.

Follow the procedures below to configure the database for a newly installed Universal Controller using the System Pilot user interface. If necessary, refer to the *System Pilot Installation and Operating Instructions* -- 33V2-3SI, Catalog Number 533-30012, for a summary of the System Pilot's pushbutton and rotary knob operation as well as step-by-step System Pilot operating instructions.

Creating Points Using the SETUP Tables

As defined in the following procedure, you must use the SETUP Table as a means to access the Universal Controller's Service Configuration Tables. The System Pilot is designed to automatically refresh all Universal Controller tables at the completion of this procedure. Although the Service Configuration Tables can be directly accessed through the System Pilot, this automatic update does not take place when accessing and editing these tables directly. As such, other configuration tables will not be updated to reflect the current configuration of the controller.

1. Physically connect the System Pilot to the CCN Bus that contains the Universal Controller to be configured.
2. From the System Pilot's Default screen, press the SCROLL UP and SCROLL DOWN buttons (the left-most buttons) together for 3 seconds to display the Program screen.
3. From the System Pilot Program screen, select the *ATTACH* option, navigate to the specific Universal Controller you wish to communicate with, and press the SELECT pushbutton.

   Note: If the Universal Controller is not in the list, navigate to an available slot, press SELECT, and enter the controller address.

   The System Pilot will commence reading the Universal Controller tables and will display the first status display table.
4. Press the SCROLL UP and SCROLL DOWN buttons together for 3 seconds to exit from the status display table and re-display the Program screen.
5. From the Program screen, select the *SETUP* option to access the Universal Controller's custom Setup menu and create each Universal Controller point by following the steps below.
6. From the Setup menu, select one of the following options, depending on what you wish to create:

   Hardware Input
   Hardware Output
   Software Input
   Software Output
   Network Input
   Global Occupancy

   Selecting one of these options will display a new screen that lists all available Service Configuration tables for the selected type (Example: *Hardware In Point 1 to 8*).
7. Use the System Pilot's *NAVIGATE* knob to scroll up/down the list and highlight a point number from the menu list (Example:

Hardware In Point 1), and press the *SELECT* pushbutton to display the point's service configuration table.

8. Scroll down to the InSystem field and press the *SELECT* pushbutton to modify the value. Press the *INC/DEC* pushbutton or turn the MODIFY knob in order to change the InSystem value to *Yes*. Press *SCROLL UP* or *SCROLL DOWN* to exit the field.

9. Scroll through and highlight each of the remaining fields, pressing the *SELECT* pushbutton to modify each field, and setting each field to an appropriate value.

   Note: To modify the point name (PntName) and/or the point description (PntDescr) fields, highlight the field and press *SELECT*. Turn the Navigate knob to position the cursor on the character to modify and then press the *INC/DEC* pushbutton (or turn the MODIFY knob) to modify each letter/digit of the point name/description. You can also use PAGE UP and PAGE DOWN to insert and delete characters. When done, press *SCROLL UP* or *SCROLL DOWN* to exit the field.

   Refer to this manual's Service Configuration chapter for an explanation of and allowable entries and default values for each Service Configuration table decision.

   Note that for some decisions (for example, the HWOUT01S table's Function decision), instead of displaying the numerical allowable entries that are listed in this manual's Service Configuration chapter, the System Pilot will display descriptive text. To modify the value, highlight the field, press the *SELECT* pushbutton to enter edit mode, and then press the *SELECT* pushbutton again to be presented with a list of applicable selections. Use the NAVIGATE knob to scroll up/down the list. Press the *SELECT* pushbutton to select the highlighted value, or the *EXIT* pushbutton to cancel and return to the table screen.

10. When finished configuring all fields, press the *EXIT* pushbutton.

    The System Pilot will prompt you to save the data.

    Highlight *Yes* and press the *SELECT* pushbutton. This will download the table content to the Universal Controller and return you to the Table List screen.

11. Repeat Steps 7 to 10 to create additional points of this type (for example, additional hardware output points) or if you are

finished creating the specified type of points, press the *EXIT* pushbutton to return to the SETUP screen.

12. Repeat Steps 6 to 11 to create the remaining Hardware Input, Hardware Output, Software Input, Software Output, and Network Input points, and Global Occupancy tables.

13. After creating all points and returning to the SETUP screen, press the *EXIT* pushbutton to exit the SETUP screen and return to the PROGRAM screen.

    The System Pilot will then automatically re-attach to the Universal Controller. This will re-upload the tables from the Universal Controller, including new tables that may have been created while in SETUP.

14. It is now recommended that you verify that the newly-created points were successfully created. To do so, follow the instructions listed in the Verifying Points instructions below.

You can now check to see if the points were successfully created. The best way to verify that your points have been successfully created is by checking the UCMAINT maintenance table.

Another method of checking the validity of your newly-created points is to verify that a configuration and maintenance table have been created for each point. The new point names should also appear in the corresponding Status Display Table. For hardware points, look in the HWPOINTS Status Display Table. For software and network input points, look in the SWPOINTS Status Display Table.

Verifying Points

Follow the instructions below to verify that the Universal Controller points were successfully created.

1. To check the *UCMAINT* Table, return to the PROGRAM screen, highlight the *MAINT* option and press the *SELECT* pushbutton. Navigate to the UCMAINT Table, which will be the last table in the maintenance table list. The maintenance values displayed in this table are read-only values that display diagnostic information on all Universal Controller points. The following is an explanation of the displayed diagnostics. A point that has been successfully created with no error conditions will display the following status: *In System*.

   Other messages are listed below. These messages indicate that there is a problem and as a result, the point has not been properly created. If any of these messages are displayed, you should check the point's corresponding service configuration table and modify it as required.

Algorithm mismatch
Type/Units/State limit
Duplicate point name
Missing point name
Not in system

2. To check the configuration and maintenance tables, return to the PROGRAM screen, highlight the *MAINT* or *CONFIG* option and press the *SELECT* pushbutton.

   You will be presented with a list of Universal Controller Maintenance or Configuration Tables. There should be one maintenance and one configuration table for each point that you created in the procedure above. For example, if you created a hardware input point named SPT, the corresponding configuration table will be named SPT_C. The maintenance table will be named SPT_M.

3. To check the Status Display Tables, return to the PROGRAM screen, highlight the *STATUS* option and press the *SELECT* pushbutton. For hardware points, look for the newly created point names in the HWPOINTS Status Display Table. For software and network input points, look in the SWPOINTS Status Display Table.

4. You must now configure the Universal Controller's algorithms, system functions, and alarms. Follow the instructions listed in the Configuring Algorithms, System Functions, Alarms instructions below.

Configuring Algorithms, System Functions, Alarms

Follow these instructions to configure the Universal Controller database.

1. From the PROGRAM screen, highlight the *CONFIG* option and press the *SELECT* pushbutton.

   The System Pilot will display a list of configuration tables from the Universal Controller. The table names will correspond to the points you created in the Creating Points Using the Service Configuration Tables procedure above. (Example: SPT_C would be the configuration table name for a point you created and named SPT.

2. Scroll down to the name of the configuration table you wish to configure and press the *SELECT* pushbutton to display the configuration table.

3. Scroll up/down the table fields, pressing the *SELECT* pushbutton to modify each field, and setting each field to an appropriate value.

   Refer to this manual's Point Types, Algorithms, Schedules, Alarms, and System Functions chapters for explanations of and allowable entries and default values for each configuration table decision.

   Note: For some decisions (for example, the Sensor Group (SNSGR01) configuration table's Sensor_1 decision) you can display a list of applicable points or other selections as follows: Highlight the field, press the *SELECT* pushbutton to enter edit mode, and then press the *SELECT* pushbutton again to be presented with a list of applicable selections. Use the navigate knob to scroll up/down the list. Press the *SELECT* pushbutton to select the highlighted value, or the *EXIT* pushbutton to cancel and return to the table screen.

4. After configuring all decisions in the table, press the *EXIT* pushbutton to return to the list of configuration tables in the Universal Controller.

   The System Pilot will prompt you to save the data. Highlight *Yes* and press *SELECT*, which will download the table content to the Universal Controller.

5. Repeat Steps 2 to 4 to configure the remaining Hardware Input, Hardware Output, Software Input, Software Output, Network Input, and Global Occupancy configuration tables.

Index

Index

E

F

G

H

R

S

T

U

V

Y

Reader's Comments

Your comments regarding this manual will help us improve future editions. Please comment on the usefulness and readability of this manual, suggest additions and deletions, and list specific errors and omissions.

Document Name: ______________________

Publication Date: ______________________

Usefulness and Readability:

____

____

____

Suggested Additions and Deletions:

____

____

____

Errors and Omissions (Please give page numbers):

____

____

____

Date: ______________________
Name: ______________________
Title or Position: ______________________
Organization: ______________________
Address: ______________________

Fold so that the mailing address is visible, staple closed, and mail.

Carrier Corporation
Carrier World Headquarters Building
One Carrier Place
Farmington, CT 06034-4015

Attn: CCN Documentation