Aztec DDC Program Summary

I. Controller Input/Output Configuration

The Aztec DDC program is designed for use with the Automated Logic I/O Flex 6126 controller. This controller features 12 universal inputs, 6 analog outputs, and 6 binary outputs. Descriptions of the inputs/outputs configured for the Aztec program and their corresponding I/O number are shown below.

Analog Inputs

Input Name	*Input Number*
Supply Air Temperature Thermistor	1
Outside Air Temperature Thermistor	2
Mixed Air Temperature Thermistor	4
Building Pressure Transducer	6
Current Transducer	11
Outside Air Humidity Transducer	12

Binary Inputs

Input Name	*Input Number*
Stage 1 Float Switch	3 (multiplexed if stage 2 present)
Stage 2 Float Switch	3 (multiplexed with stage 1 float switch)
Clogged Filter Status	7
Supply Fan Status	8
0/100% Outside Air Switch	9
Auxiliary Unit Enable	10

Note: Universal input number 5 is not used at this time.

Analog Outputs (0-10 VDC)

Output Name	*Output Number*
Mixed Air Damper Control	1
Supply Air Fan VFD Control	2
Cooling Tower Fan VFD Control	3
Duct Furnace Control	4

Note: Analog outputs 5 and 6 are not used at this time.

Binary Outputs

Output Name	*Output Number*
Supply Fan Start/Stop	1
Cooling Stage 1 Start/Stop	2
Cooling Stage 2 Start/Stop	3
Cooling Tower Fan Start/Stop	4
Cooling Stage 1 Fill/Drain	5
Cooling Stage 2 Fill/Drain	6

II. Program Functions

General

The control program is configurable for zone or supply air temperature control of the space. If room temperature control is selected, the control program is configurable for use with an Aztec-supplied or 3rd party room sensor.

The control program is configurable for single or two stage cooling. The single stage configuration provides indirect cooling via a cooling tower and indirect cooling coil. The two stage configuration provides indirect/direct cooling by incorporating a direct evaporative media section in addition to the features of the indirect system. A DX or chilled water system can be instituted in place of the direct evaporative system for second stage cooling.

The unit runs in one of two modes, unoccupied or occupied. In the unoccupied mode, the program controls the unit to maintain the unoccupied cooling setpoint. In the occupied mode, the program controls the unit to maintain the occupied cooling setpoint.

Run Conditions

There are several ways to enable the supply fan, thereby enabling the unit and initializing all other functions:

- Via an auxiliary unit enable contact provided by the user
- Via a contact closure induced by a BACnet/Modbus/N2/LonWorks protocol signal sent over the network from the user's building automation system to the DDC controller
- Via a user-programmed time-of-day schedule in the WebCTRL interface or the remote keypad (BACview)
- Via a manual override in the program through the WebCTRL interface

Electrical Demand and Usage

A current transducer measures the instantaneous amp draw of all loads in the unit and inputs the information to the DDC controller. The control program multiplies the instantaneous amp draw by the unit design voltage to calculate the instantaneous demand in kilowatt-hours (kW). Total electrical usage is calculated by multiplying the instantaneous demand by the unit runtime. The controller retains the following data and can also write it to BACnet points (see points list):

- Electrical demand and total electrical usage for:
    - Today
    - Month-to-date
    - Year-to-date

Supply Fan Operation

The supply fan speed varies based on one of two modes: supply air temperature control or building pressure control.

In the supply air temperature auto mode, the controller modulates the output to the supply fan VFD using a PID loop that compares the supply air temperature to the supply air temperature setpoint.

In the building pressure auto mode, the controller modulates the output to the supply fan VFD using a PID loop that compares the sensed building pressure to the building pressure setpoint.

With the supply fan enabled, the DDC program prevents the supply fan VFD from running the supply fan motor at less than 25% of full speed.

Cooling Tower Operation

The optional cooling tower fan variable frequency drive varies the cooling tower fan speed based on the supply air temperature. The controller modulates the output to the cooling tower fan VFD using a PID loop that compares the supply air temperature to the supply air temperature setpoint.

Upon enabling the cooling tower fan, the stage 1 circulating pump is enabled if the supply air temperature rises to the supply air temperature setpoint. The stage 2 recirculating pump is enabled when the supply air temperature rises above the supply air temperature setpoint plus the user-specified supply air temperature setpoint offset. The default offset is 2°F and is adjustable via BACview, WebCTRL, or via a 3rd party BAS.

With the cooling tower fan enabled, the program prevents the cooling tower fan VFD from running the cooling tower fan motor at less than 20% of full speed.

Fill and Drain Valve Operation

The fill and drain valves for stage 1 and stage 2 cooling are controlled independently.

The fill and drain valves are controlled via either a user-specified schedule or a runtime odometer in auto mode.

The user-specified schedule mode allows the operator to program a day of week and time of day to drain the sump(s). This mode is user-configurable for each stage independently.

The runtime odometer mode drains the sump(s) after a cooling stage has accumulated a certain amount of runtime. This mode is user-configurable for each stage independently.

The output is locked in the “off” state for a default duration of 15 minutes to allow the system ample time to satisfy the drain command. Once the 15 minutes has elapsed, the output is energized and the sump(s) begin(s) to fill. The duration of the drain period is user-configurable for each stage independently.

If the outside air temperature falls below 36°F, the fill and drain outputs are enabled. The outside air temperature to drain sumps setpoint is user-configurable.

The fill and drain valves can also be manually overridden via a BACview, WebCTRL, or a 3rd party BAS.

Clogged Filter Indication

The clogged filter binary input indicates a dirty filter condition. The filter status is displayed on a BACview, WebCTRL, or a 3rd party BAS. A contact closure on this controller input indicates a dirty filter condition.

Damper Control

The mixed air damper operation is selectable for building pressure control, mixed air temperature control, or percent of outside air control via a BACview, WebCTRL, or a 3rd party BAS. The controller modulates the dampers via a 0-10 VDC signal.

The building pressure function has a setpoint adjustable from a BACview, WebCTRL, or a 3rd party BAS. The dampers modulate to maintain the desired setpoint and utilize the building pressure analog input. The building pressure is displayed on a BACview, WebCTRL, or a 3rd party BAS.

The mixed air temperature function has a setpoint adjustable from a BACview, WebCTRL, or a 3rd party BAS. The dampers modulate to maintain the desired setpoint and utilize the mixed air temperature analog input. The mixed air temperature is displayed on a BACview, WebCTRL, or a 3rd party BAS.

The percent of outside air function has a setpoint adjustable from a BACview, WebCTRL, or a 3rd party BAS. The dampers modulate to maintain the desired setpoint.

The mixed air damper has an automatic economizer function. The unit operates in economizer mode when the outside air dry bulb temperature is below 65°F (limit is user-configurable) and the outside air humidity is below 50% RH (limit is user-configurable). The program calculates the outside air enthalpy automatically based on the outside air dry bulb temperature and the outside air humidity. When outside air conditions are favorable, the outside air damper(s) will modulate open to provide free cooling in the space.

III. Alarms

Upon sensing non-ideal operating conditions, the controller will alert the user to an alarm condition that can be monitored via BACview, WebCTRL or a 3rd party BAS. A brief description of each alarm follows.

Room Sensor Failure Alarm

If the room sensor fails to communicate usable data to the controller for more than 6 seconds, the room sensor failure alarm is enabled and the room temp high alarm and room temp low alarms will be disabled.

If the room sensor is functioning, the room sensor failure alarm is disabled.

Supply Air Sensor Failure Alarm

If the supply air temperature sensor indicates to the controller that the supply air temperature has fallen below -45°F or risen above 200°F, the supply air temperature sensor failure alarm is enabled and the supply air temp high alarm and supply air temp low alarms will be disabled.

If the supply air sensor is functioning, the supply air sensor failure alarm is disabled.

Supply Fan Failure Alarm

If the supply fan is commanded to be on and the supply fan status relay is not energized, the supply fan failure alarm is enabled.

If the supply fan is commanded to be off and the supply fan status relay is not energized, or the supply fan is commanded to be on and the supply fan status relay is energized, the supply fan failure alarm is disabled.

Supply Fan Hand Alarm

If the supply fan is commanded to be off and the supply fan status relay is energized, the supply fan hand alarm is enabled.

If the supply fan is commanded to be off and the supply fan status relay is not energized, or the supply fan is commanded to be on and the supply fan status relay is energized, the supply fan failure alarm is disabled.

Freezestat Alarm

If the supply air temperature drops below 45°F and remains

Clogged Filter Alarm

If the pressure sensed by the clogged filter switch exceeds its setpoint, the clogged filter relay energizes and the clogged filter alarm is enabled.

If the filter is replaced and the pressure sensed by the clogged filter switch does not exceed its setpoint, the clogged filter relay de-energizes and the clogged filter alarm is disabled.

Cooling Stage 1 Maintenance Alarm

If the cooling stage 1 circulating pump has amassed 2,200 hours (approximately three months, limit is user-configurable) of runtime since last reset, the cooling stage 1 maintenance alarm is enabled.

If the cooling stage 1 runtime is reset via the BACview, WebCTRL, or 3rd party BAS, the cooling stage 1 maintenance alarm is disabled.

Cooling Stage 2 Maintenance Alarm

If the cooling stage 2 circulating pump has amassed 2,200 hours (approximately three months, limit is user-configurable) of runtime since last reset, the cooling stage 2 maintenance alarm is enabled.

If the cooling stage 2 runtime is reset via the BACview, WebCTRL, or 3rd party BAS, the cooling stage 2 maintenance alarm is disabled.

Cooling Stage 1 Water Level Failure Alarm

If the water level falls below the minimum level required to maintain safe stage 1 circulating pump operation, the cooling stage 1 float switch is de-energized and the cooling stage 1 water level failure alarm is enabled.

If the water level rises above the minimum level required to maintain safe stage 1 circulating pump operation, the cooling stage 1 float switch is energized and the cooling stage 1 water level failure alarm is disabled.

Cooling Stage 2 Water Level Failure Alarm

If the water level falls below the minimum level required to maintain safe stage 2 circulating pump operation, the cooling stage 2 float switch is de-energized and the cooling stage 2 water level failure alarm is enabled.

If the water level rises above the minimum level required to maintain safe stage 2 circulating pump operation, the cooling stage 2 float switch is energized and the cooling stage 2 water level failure alarm is disabled.

Point Locked Alarm

If any input or output values in the control program are locked, the point locked alarm is enabled.