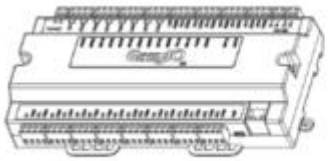
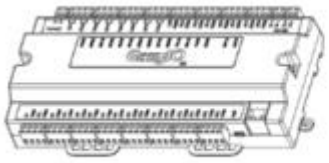


EasyIO VAV AHU Type 1, Application Module

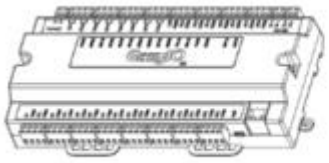
28 March 2015



Document Change Log

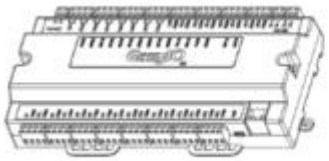
28th March 2015
Document created.

8th May 2015
Updated UI information & site layout.

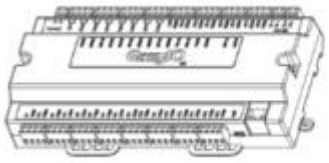


Disclaimer

EasyIO FG-32 and EasyIO FG-20 are products by EasyIO Holdings Pte Ltd
The EasyIO FG Series contains the Sedona Framework®.
Sedona Framework is a trademark of Tridium, Inc.



Contents



System Information

The EasyIO VAV AHU control application utilises the EasyIO FG platform operating on the Sedona Framework.

Current communication protocols supported by the application are

- TCOM V3.8.28.11
- Bacnet IP
- Bacnet MSTP
- SOX V1.0.45

The control program is a custom application that requires licensing.

User Interface

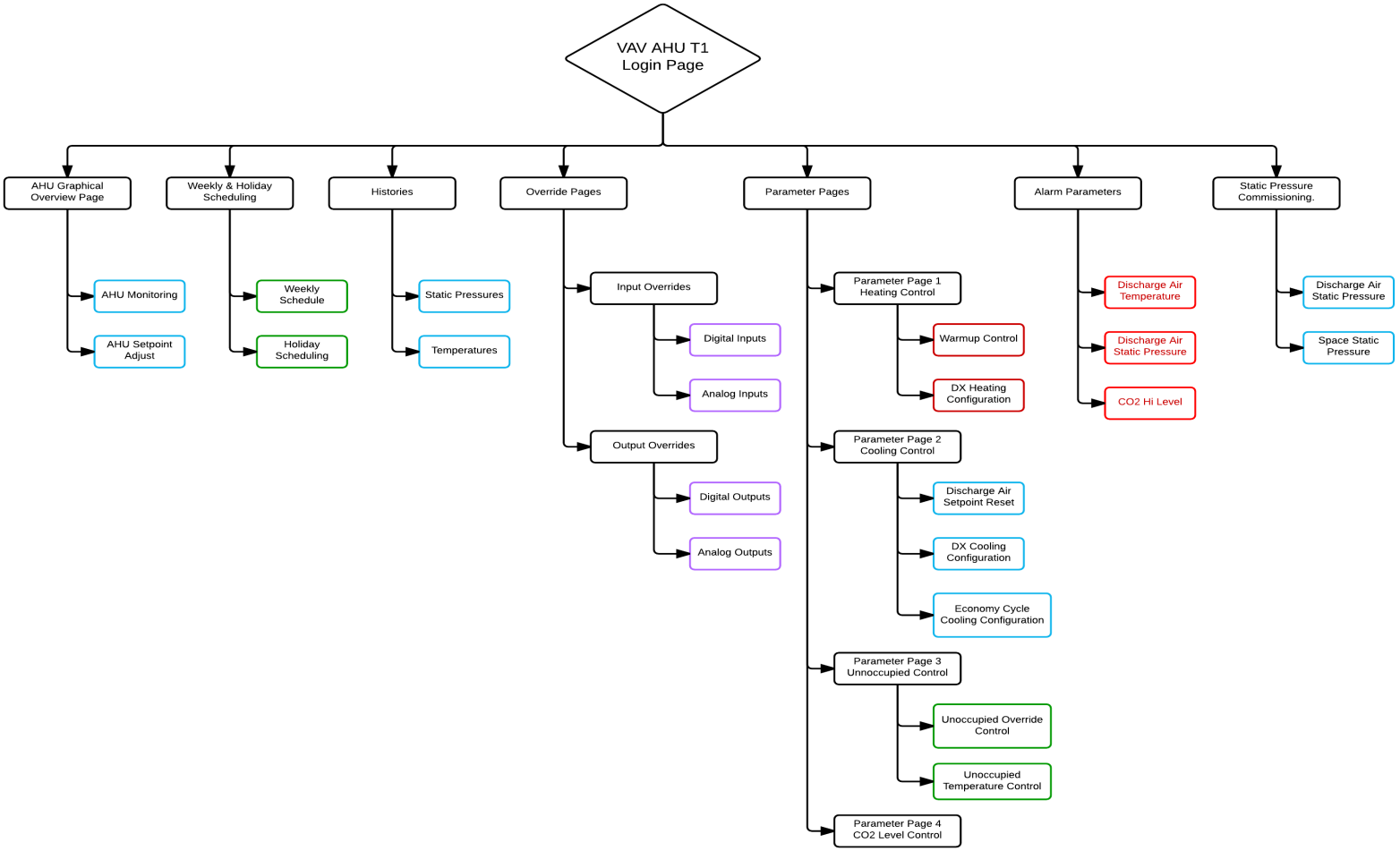
The user interface consists of html 11 pages served through the built in Web Server for access to the system for configuration, monitoring and control overrides.

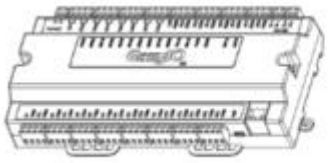
Navigation throughout the system is via the standard EasyIO FG menu on each page.

The user interface consists of

- AHU Overview Monitoring & Control
- Weekly & Holiday Scheduling
- History
- Overrides
- Parameter Setup
- Commissioning

Site Map


VAV AHU T1
Login Page
AHU Graphical Overview Page
Weekly & Holiday Scheduling
Histories
Override Pages
Parameter Pages
Alarm Parameters
Static Pressure Commissioning.
AHU Monitoring
AHU Setpoint Adjust
Weekly Schedule
Holiday Scheduling
Static Pressures
Temperatures
Input Overrides
Digital Inputs
Analog Inputs
Output Overrides
Digital Outputs
Analog Outputs
Parameter Page 1 Heating Control
Warmup Control
DX Heating Configuration
Parameter Page 2 Cooling Control
Discharge Air Setpoint Reset
DX Cooling Configuration
Economy Cycle Cooling Configuration
Parameter Page 3 Unnoccupied Control
Unoccupied Override Control
Unoccupied Temperature Control
Parameter Page 4 CO2 Level Control
Discharge Air Temperature
Discharge Air Static Pressure
CO2 Hi Level
Discharge Air Static Pressure
Space Static Pressure



AHU Control

The VAV AHU Type 1 control application module gives engineers a base application to control an AHU serving a VAV system with DX heating and cooling.

It is designed to work as a complete solution with only parameter configuration required.

The VAV AHU Type 1 control application module contains the following tuneable control functions

- Occupancy control. Occupied & Unoccupied setpoint control.
- Smoke control.
- Anti-freeze control.
- Morning Warmup control.
- Supply air fan VSD control to supply air static pressure setpoint
    - Incorporating VAV fan reset module.
- Return air fan VSD control to zone static pressure setpoint.
- Cooling control for up to 4 stages of DX cooling to discharge air setpoint. Reset by either
    - Outside air temperature.
    - Return air temperature.
- Heating control for up to 4 stages of DX heating to discharge air warmup setpoint.
- Economy control for modulating dampers.
- CO2 damper override control.

The application module requires the following physical IO connections to operate as designed. There are several network IO connections that may be used as an alternative to the physical connections to utilise network sharing of global information. These will be discussed below.

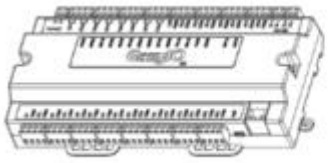
Input Points

The following points are physical input points wired to the EasyIO FG32 controller.

All inputs reside under the EasyIOFG/EasyIO/IO, folder.

Point Description	Point Name	Input	Type	Control
Supply Fan Status	**UI1_SFS**	UI-1	Digital	Yes - Multiple
Smoke Alarm	**UI2_SMK**	UI-2	Digital	Yes – Smoke Control
Freeze Alarm	**UI3_FRZ**	UI-3	Digital	Yes – Coil Freeze Control
Return Fan Status	**UI4_RFS**	UI-4	Digital	Yes - Multiple
Hi Static Pressure	**UI5_HiS**	UI-5	Digital	Yes - Control
Spare	**NA**	UI-6	NA	NA
Spare	**NA**	UI-7	NA	NA
Spare	**NA**	UI-8	NA	NA
Zone Temperature[1]	**UI9_ZNT**	UI-9	Thermistor 10k Type 3	Yes – Temperature Control

[1] Physical point is not required if the networked input point is utilised.



Discharge Air Temperature	**UI10DAT**	UI-10	Thermistor 10k Type 3	Yes – Temperature Control
Outside Air Temperature[1]	**UI11OAT**	UI-11	Thermistor 10k Type 3	Yes – Economy Control
Return Air Temperature	**UI12RAT**	UI-12	Thermistor 10k Type 3	Yes – Economy Control
Mixed Air Temperature	**UI13MAT**	UI-13	Thermistor 10k Type 3	Yes – Economy Control
Carbon Dioxide Level	**UI14CO2**	UI-14	Voltage. 0 – 10V DC	Control
Static Duct Pressure	**UI15SDS**	UI-15	Voltage. 0 – 10V DC	Control
Sp Static Pressure	**UI16SpS**	UI-16	Voltage. 0 – 10V DC	Control

Output Points

The following points are physical output points wired to the EasyIO FG32 controller.

All inputs reside under the EasyIOFG/EasyIO/IO, folder.

Point Description	Point Name	Output	Type
Supply Fan Command	**DO1_SFC**	DO-1	Digital. NO.
Return Fan Command	**DO2_RFC**	DO-2	Digital. NO.
Cooling Stage 1	**DO3_CL1**	DO-3	Digital. NO.
Cooling Stage 2	**DO4_CL2**	DO-4	Digital. NO.
Cooling Stage 3	**DO5_CL3**	DO-5	Digital. NO.
Cooling Stage 4	**DO6_CL4**	DO-6	Digital. NO.
Heating Stage 1	**DO7_HT1**	DO-7	Digital. NO.
Heating Stage 2	**DO8_HT2**	DO-8	Digital. NO.
Heating Stage 3	**DO15HT3**	DO-15 / UO-7	Digital. NO.
Heating Stage 4	**DO16HT4**	DO-16 / UO-8	Digital. NO.
Mixed Air Damper	**UO1-MAD**	UO-1	Voltage 0 – 10V DC
Supply Fan VFD	**UO2-SFV**	UO-2	Voltage 0 – 10V DC
Return Fan VFD	**UO3-RFV**	UO-3	Voltage 0 – 10V DC

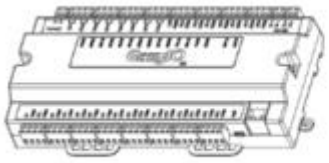
Network Points

All network points reside under the EasyIOFG/EasyIO/NetIO, folder.

The following points are network input points.

Note that all application module parameters are also available as network input points.

Point Name	Point Description	Point Type	Type
Occ_Net	Networked occupancy signal. Enables the AHU control in occupied mode when active. Alternative to utilizing controller scheduling	BV	Digital. Occupied = True

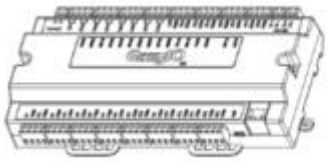


OAT_Net	Network point to allow for network outside air temperature information. Alternative to physical input	AV	Analog. Deg F.
ZNT_Net	Network point to allow for network outside air temperature information. Alternative to physical input	AV	Analog. Deg F.

The following points are network output points.

Note that all application module physical IO are also available as network output points.

Point Name	Point Description	Point Type	Type
ClgStgs	Outputs the number of active cooling stages currently running	AV	Analog. %
HtgStgs	Outputs the number of active heating stages currently running	AV	Analog. %



Air Handling Unit Control Strategy

The VAV AHU Type 1 application module starts upon power up or restart in the off mode. While in the off mode all controller outputs will remain off.

Once the controller has completed startup, the application will begin to process the physical inputs and upon network connectivity the network inputs.

The application control program will constantly scan the smoke input, ***UI2_SMK*****,** the freeze input, ***UI3_FRZ*****,** the controller time schedule object, **Schedul,** the network occupied call, ***Occ_Net*** and the unoccupied AHU control function call, ***NSU_NSB*****.**

The AHU control mode will not be enabled and an active AHU permit call, ***Permit***, will be overridden off should any of the following conditions occur

- Smoke Mode. ***UI2_SMK***
- Freeze Mode. ***UI3_FRZ***

An AHU permit call, **Permit**, can be activated when the above conditions are false and either of the following are true

- Controller time schedule active. ***Schedul***
- Network occupied call. ***Occ_Net***
- Unoccupied AHU control call. ***NSU_NSB***

Smoke Mode

Upon receipt of a smoke input, ***UI2_SMK*** the AHU permit call, ***Permit***, will be disabled and the AHU mode will turn off. The active cooling or heating stages will be disabled, the supply and return fans turn off and the economy dampers will drive to the smoke mode position, ***SmkDmP***.

Freeze Mode

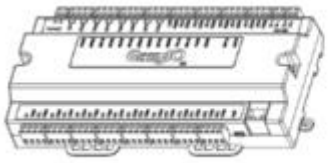
Upon receipt of a freeze input, ***UI3_FRZ*** the AHU permit call, ***Permit***, will be disabled and the AHU mode will turn off. The active cooling or heating stages will be disabled, the supply and return fans turn off and the economy dampers will drive to the freeze mode position, ***FrzDmP***.

Occupied Mode

The VAV AHU application will operate in occupied mode when at least one of two objects are active as follows

- The controller time schedule, ***Schedul***.
- The network occupied call, ***Occ_Net***.

The VAV AHU application utilises the EasyIO, EasyIOSchedule kit and the HolidayCalendar and Schedule objects.



The application allows a user to set holidays within the ***Holiday***, object, based on dates or date ranges as per the instructions in the *'EasyIO Basic 04 – Sedona kits v1.4.pdf*'.

The application controller time schedule is a 7 day schedule, with 2 holiday calendar schedules. Each day and holiday allows for 2 time schedules as per the description in the *'EasyIO Basic 04 – Sedona kits v1.4.pdf*'. The first schedule per daily event and the first holiday schedule can be written to through the network. The second schedule per daily event and holiday schedule can be set by the user directly at the schedule, ***Schedul***.

The first schedule for each day and the first holiday schedule can be written to through the network or may be set by the user. Each schedule occupied time and unoccupied time can be set using string and 24 hour time format.

To enter the time schedule follow the examples as follows
To set the time schedule to

Turn on at	Turn off at	Enter Time as a string
6:30am	11:00am	0630-1100
8:00am	8:30pm	0800-2030

Unoccupied Mode

During periods that there is no active controller schedule, ***Schedul*** or network occupancy, ***Occ_Net*** active the unit will revert to 'Off mode'.

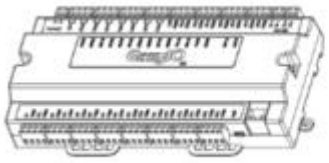
Should either of the following conditions become active, the unit permit call, **Permit**, will be enabled in unoccupied mode.

- The zone temperature, ***UI9_ZNT*** or ***ZNT_Net*** is greater than the unoccupied cooling setpoint, ***NSU_SP***
- The zone temperature, ***UI9_ZNT*** or ***ZNT_Net*** is less than the unoccupied heating setpoint, ***NSB_SP***
- The outside air temperature, ***UI11OAT*** or ***OAT_Net*** is greater than the outside air temperature high limit cooling override setpoint, ***OATHovr***
- The outside air temperature, ***UI11OAT*** or ***OAT_Net*** is less than the outside air temperature low limit cooling override setpoint, ***OATLovr***

The unit will return to normal occupied mode should either the ***Schedul*** or ***Occ_Net*** become active.

The unit will return to off mode when all of the following conditions are met

- The zone temperature, ***UI9_ZNT*** or ***ZNT_Net*** is less than the unoccupied cooling setpoint, ***NSU_SP*** minus the unoccupied cooling differential, ***NSUDiff***.
- The zone temperature, ***UI9_ZNT*** or ***ZNT_Net*** is greater than the unoccupied heating setpoint, ***NSB_SP*** plus the unoccupied heating differential, ***NSBDiff***.



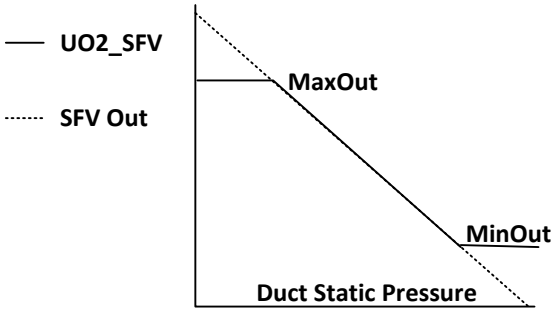
- The outside air temperature, ***UI11OAT*** or ***OAT_Net*** is less than the outside air temperature high limit cooling override setpoint, ***OATHovr*** minus the ***OATDiff***.
- The outside air temperature, ***UI11OAT*** or ***OAT_Net*** is greater than the outside air temperature low limit cooling override setpoint, ***OATLovr*** plus the ***OATDiff***.
- The ***Schedul*** or ***Occ_Net*** are inactive.

Supply Air Fan Control

Upon receipt of an AHU control permit call, ***Permit***, the supply air fan will be started. ***DO1_SFC***

On receipt of a start call for the supply air fan the following sequence is activated.

- The supply air fan speed output, ***UO2_SFV*** will ramp up to minimum set speed (Set during commissioning).
- The supply air fan speed output, ***UO2_SFV*** will modulate according to the Loop component, ***SFV*****,** a PI Loop, to maintain the duct static pressure set point, ***DS_SP***, (Set during commissioning). The proportional gain, ***SFVP*** and integral gain, ***SFVI*** will be set during commissioning.



Upon the loss of a permit call the supply air fan VSD, ***DO1_SFC***, is commanded off and the supply air fan speed output, ***UO2_SFV***, is commanded to zero.

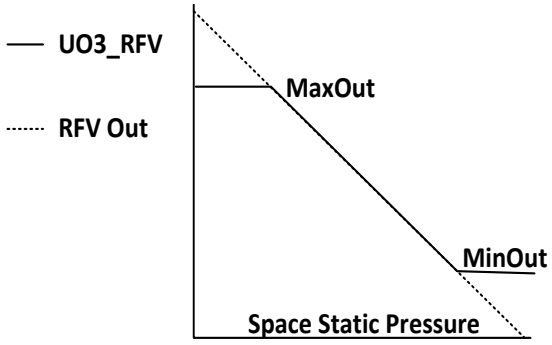
Return Air Fan Control

Upon receipt of an AHU control permit call, ***Permit***, the return air fan will be started. ***DO2_RFC***

On receipt of a start call for the return air fan the following sequence is activated.

- The return air fan speed output, ***UO3_RFV*** will ramp up to minimum set speed (Set during commissioning).
- The supply air fan speed output, ***UO3_RFV*** will modulate according to the Loop component, ***RFV*****,** a PI Loop, to maintain the space static pressure set point, ***SpcStSP***, (Set during

commissioning). The proportional gain, ***RFVP*** and integral gain, ***RFVI*** will be set during commissioning.



Upon the loss of a permit call the return air fan VSD, ***DO2_RFC***, is commanded off and the return air fan speed output, ***UO3_RFV***, is commanded to zero.

Temperature Control

The DX VAV AHU can run in three different temperature control modes.

- Economy Temperature Control.
- DX Cooling Temperature Control.
- DX Heating Temperature Control.

Only one mode can be active at any given time.

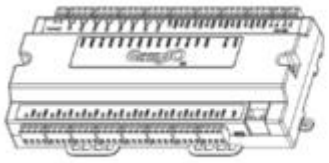
Economy Temperature Control

Economy control can be enabled, ***EconEna***, through two different outside air temperature ranges when the AHU requires cooling.

When the carbon dioxide (CO2), control ***CObot***, allows only economy and CO2 control without DX cooling, the effective range that economy control is enabled is outside air temperatures

- Below the Economy discharge setpoint, ***EcnDSP***.
- To outside air temperatures above the Dx discharge setpoint, ***DxDSP***.
- At outside air temperatures below the Dx discharge setpoint, ***DxDSP***, economy temperature control is disabled.

When the carbon dioxide (CO2), control ***CObot***, allows both economy and CO2 control DX cooling, the effective range that economy control is enabled is outside air temperatures

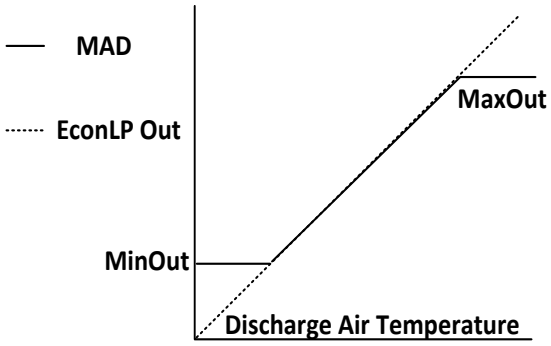


- Below the Economy discharge setpoint, ***EcnDSP***.
- To outside air temperatures above the Dx discharge setpoint, ***DxDSP*** minus the carbon dioxide differential, ***EcnDiff***.
- At outside air temperatures below the Dx discharge setpoint, ***DxDSP***, minus the carbon dioxide differential, ***EcnDiff***, economy temperature control is disabled.

Economy temperature control, ***EcTmCtl***, will be enabled when

- The AHU permit call, ***Permit***, is active,
- The economy control is enabled, ***EconEna***.
- There is a confirmed supply fan status, ***UI1_SFS***.

With the economy temperature control enabled, ***EcTmCtl***, the economy dampers, ***UO1_MAD***, will modulate according to the economy control loop, ***EconLP***, a proportional, P, only Loop, using set point, ***EfCLDSP***, to maintain the AHU discharge air temperature. The proportional gain, ***EcLp*P** and is set during commissioning.



Cooling Control

Cooling control is enabled, ***ClgEna***, when

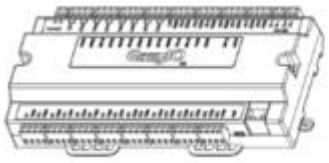
- The outside air temperature is above the maximum Dx discharge setpoint, ***DxDSP***.

Cooling control is disabled, ***ClgEna***, when

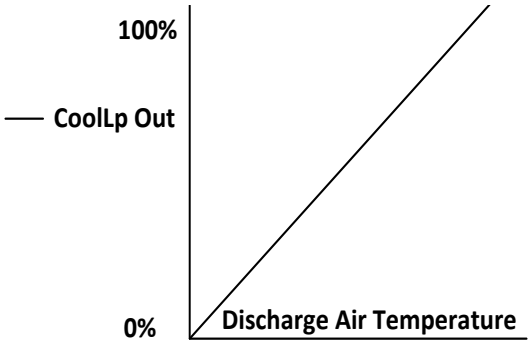
- The outside air temperature is below the maximum Dx discharge setpoint, ***DxDSP***, minus the ***EcnDiff***.

Cooling temperature control, ***ClTmCtl***, is enabled when

- The AHU permit call, ***Permit***, is active.
- The cooling control, ***ClgEna***, is enabled.
- There is a confirmed supply fan status, ***UI1_SFS***.



With the cooling temperature control, ***ClTmCtl***, enabled the Dx cooling stages will be enabled and disabled as the cooling loop, ***CoolLp***, a P Loop, modulates in response to the reset discharge air setpoint, ***DASP***, and the discharge air temperature. The cooling loop, ***CoolLp***, proportional gain, ***CLpP*** will be set during commissioning.



Cooling temperature control, ***ClTmCtl***, is disabled when any of the below occur for a period greater than 60 seconds.

- The AHU permit call, ***Permit***, is false.
- The cooling control, ***ClgEna***, is disabled.
- There is no confirmed supply fan status, ***UI1_SFS***.

The discharge air setpoint, ***DASP***, can reset against either outside air temperature or return air temperature. When the discharge air setpoint outside air, ***DASPOA***, is true ***DASP*** is reset against outside air. When ***DASPOA*** is false, ***DASP*** is reset against return air temperature.

Var is the variable used to reset the discharge air setpoint against. Either outside air temperature, when ***DASPOA*** true or return air temperature when ***DASPOA*** is false.

DASP_LO is ***DASP_LO***
DAV_LO is ***DAV_LO***
DAV_HI is ***DAV_HI***
DASP_HI is ***DASP_HI***

DASp = DASP_LO + [(Var - DAV_LO)/(DAV_HI – DAV_LO)] x (DASP_HI – DASP_LO)

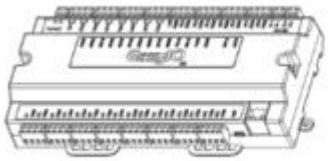
As the cooling loop, ***CoolLp***, output increases, the control kit LSeq, linear sequence object, will enable/disable cooling stage calls as per the following

Cooling Stage On Value = [(100% ÷ Number of Stages) x Stage Number]

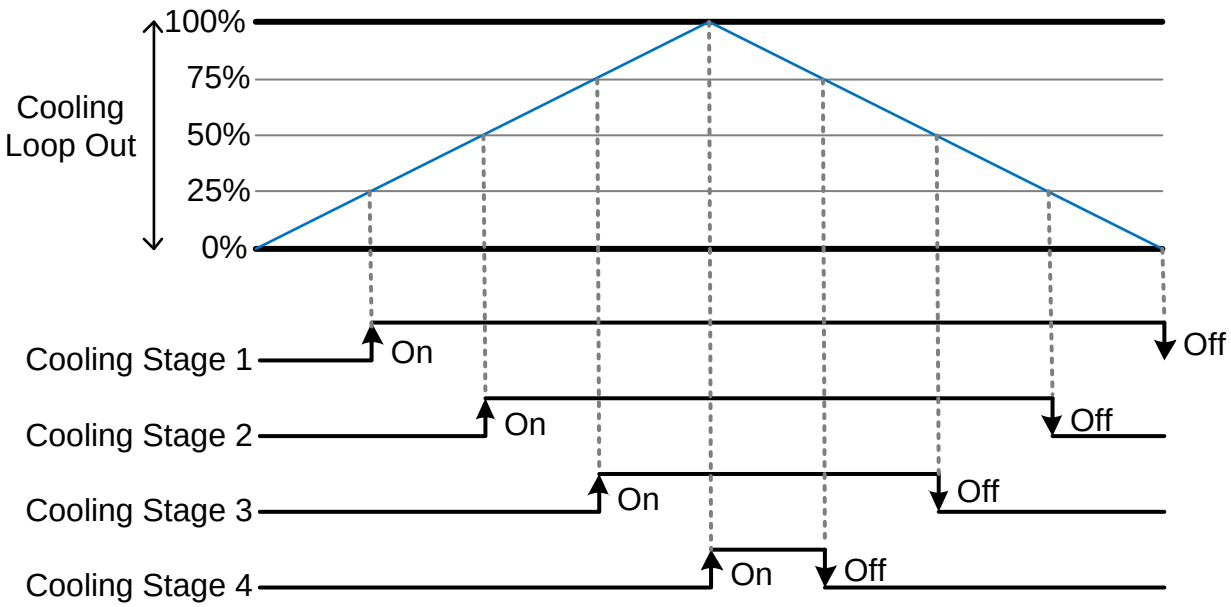
EG. Cooling Stage 1 On Value = [(100% ÷ 4) x 1]

Cooling Stage 1 On Value = 25%.

As the input increases, the stages will continue to be enabled, with cooling stage 4 enabled once the cooling loop, ***CoolLp***, output reaches 100%.



As the cooling loop decreases, the ON value for the previous stage will become the OFF value for the current stage. Once the output reaches 0%, cooling stage 1 will be disabled.



There is an interstage delay time, ***ClIntDy***, between enabling each stage and a delay off time, ***ClOffDy***, to reduce short cycling of compressors/stages.

Heating Control

Heating control is enabled, ***HtgEna***, when

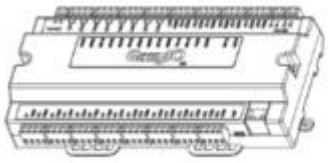
- The outside air temperature is below the outside air heating lock out setpoint, ***OAHtLO***, minus the outside air heat differential, ***OAHtDff***.

Heating control is disabled, ***HtgEna***, when

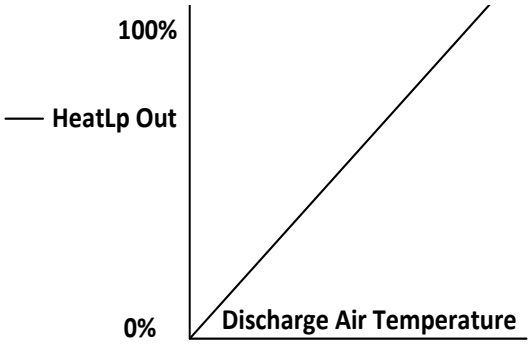
- The outside air temperature is above the outside air heating lock out setpoint, ***OAHtLO***.

Heating temperature control, ***HtTmCtl***, will be enabled when

- The AHU permit call, ***Permit***, is active.
- The cooling control, ***HtgEna***, is enabled.
- There is a confirmed supply fan status, ***UI1_SFS***.
- The return air temperature, ***UI12_RAT***, is below the morning warmup setpoint, ***MWU_SP***.



With the heating temperature control, ***HtTmCtl***, enabled the Dx heating stages will be enabled and disabled as the heating loop, ***HeatLP***, a P Loop, modulates in response to the heating discharge air setpoint, ***HtgDASP***, and the discharge air temperature. The heating loop, ***HeatLP***, proportional gain, ***HLpP*** will be set during commissioning.



Heating temperature control, ***HtTmCtl***, is disabled when any of the below occur for a period greater than 60 seconds.

- The AHU permit call, ***Permit***, is false.
- The heating control, ***HtgEna***, is disabled.
- There is no confirmed supply fan status, ***UI1_SFS***.
- The return air temperature, ***UI12_RAT***, is above the morning warmup setpoint, ***MWU_SP***, plus the ***MWUDiff***.

The heating discharge air setpoint, ***HtDASP***, is a static setpoint that is used only when the VAV AHU system enters a heating mode.

As the heating loop, **Heat*Lp***, output increases, the control kit LSeq, linear sequence object, will enable/disable heating stage calls as per the following

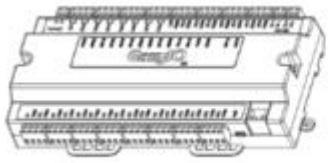
Heating Stage On Value = [(100% ÷ Number of Stages) x Stage Number]

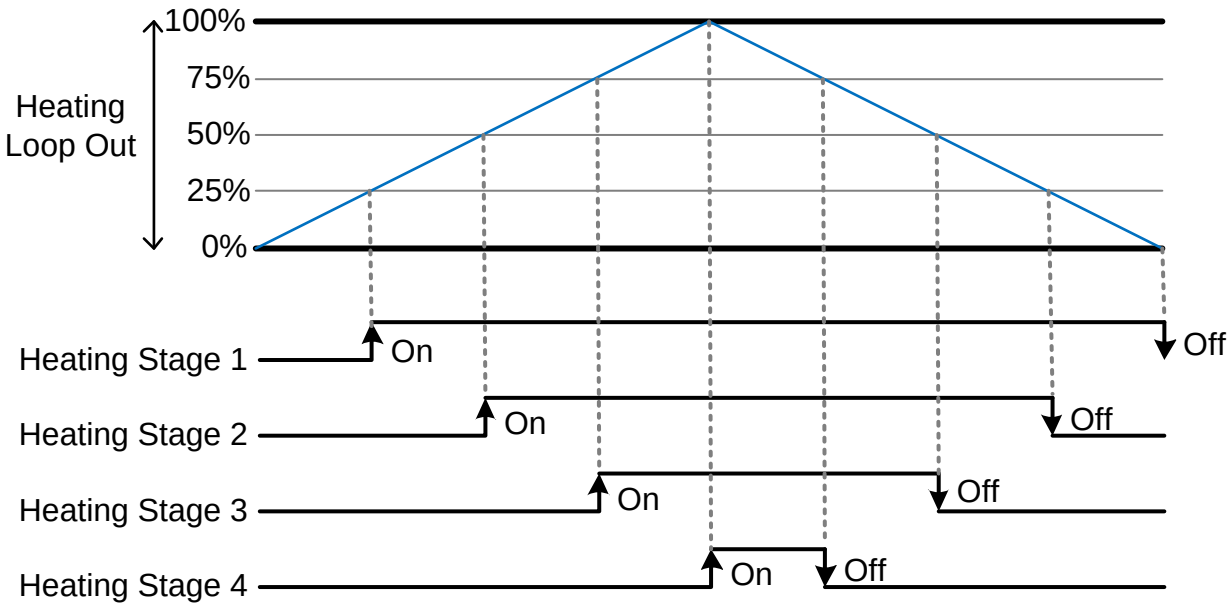
EG. Heating Stage 1 On Value = [(100% ÷ 2) x 1]

Heating Stage 1 On Value = 50%.

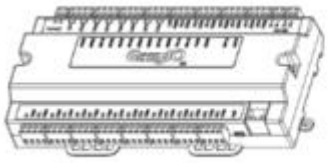
As the input increases, the stages will continue to be enabled, with cooling stage 4 enabled once the heating loop, ***HeatLp***, output reaches 100%.

As the heating loop decreases, the ON value for the previous stage will become the OFF value for the current stage. Once the output reaches 0%, heating stage 1 will be disabled.





There is an interstage delay time, ***HtIntDy***, between enabling each stage and a delay off time, ***HtOffDy***, to reduce short cycling of compressors/stages.



Carbon Dioxide Control

Carbon Dioxide, CO2, control, ***CO2Ctl***, is enabled when

- The AHU permit call, ***Permit***, is active.
- There is a confirmed supply fan status, ***UI1_SFS***.

With the CO2 control, ***CO2Ctl***, enabled, the mixed air dampers, ***UO1_MAD***, will modulate in response to the highest call from either the economy loop, ***EconLp***, or the reset CO2 mixed air setpoint, ***CO2MASp***.

The reset CO2 mixed air damper setpoint, ***CO2MASp***, is calculated from the zone CO2 level, ***UI14_CO2***, as follows

Where

Min_OA is ***Min_OA***
CO2LoSp is ***CO2LoSp***
CO2HiSp is ***CO2HiSp***
CO2DmSp is ***CO2DmSp***

CO2MASp = Min_OA + [(CO2 - CO2LoSP)/(CO2HiSp – CO2LoSp)] x (CO2DmSp – Min_OA)

CO2MASp is limited to a minimum value of ***Min_OA*** and a maximum value of ***CO2DmSp***.

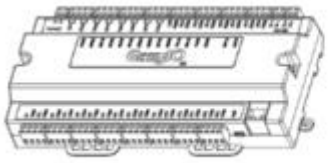
Carbon Dioxide, CO2, control, ***CO2Ctl***, is disabled when any of the below occur for a period greater than 60 seconds.

- The AHU permit call, ***Permit***, is false.
- There is no confirmed supply fan status, ***UI1_SFS***.

Air Handling Unit Alarms

Each AHU will have alarms generated should the following conditions occur:

- Discharge/Return Fan Status mismatch. Fan Command On and Fan Status Off mismatched for greater than 60 seconds.
- Discharge Air Temperature Mismatch Cooling.
    - Discharge air temperature, ***UI10DAT***, higher/lower than effective discharge air setpoint, ***EffDASP***, by more than 5 deg C.
- Discharge Air Temperature Mismatch Heating.
    - Discharge air temperature, ***UI10DAT***, higher/lower than effective discharge air setpoint, ***EffDASP***, by more than 10 deg C.
- Static Duct pressure Out of Range.
    - Static Duct pressure, ***UI15SDS***, higher/lower than effective static duct pressure setpoint, by more than 10 Pa.
- Override Alert. Any input/output in override.
- CO2 High Level. CO2 levels greater than ***CO2HiSp*** by more than 50ppm.



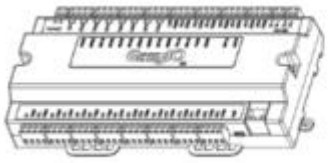
Configuration Parameters

Parameters

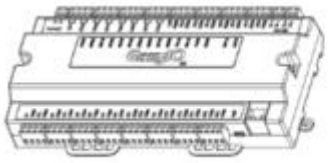
The following parameters are user configurable values.

These should only require adjusting at the time of commissioning.

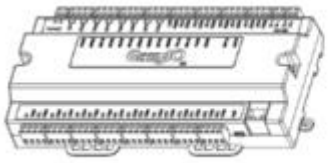
Parameter Name	Parameter Description	Default Value	Suggested Range	Control Operation
DxDSP	Outside Air Cooling Lockout Setpoint	55°F		The cooling will be locked out at this set point minus the economy differential. The Economy Cycle will be enabled at this setpoint minus the Economy Differential, EcnDiff.
EcnDSP	Economy Disable Setpoint	70°F		The Economy Cycle will be enabled up to this set point when the unit is operating in dual mechanical/economy mode and the DX Cooling will be enabled.
CObot	AHU operating in dual mechanical/economy mode	False	True/False	When the unit is operating in dual mechanical/economy mode, CObot = true, the AHU economy cycle is enabled in the range, Low setpoint is calculated as DxDSP – EcnDiff High setpoint is the EcnDSP. When the unit is operating in mechanical or economy mode only, the AHU economy cycle is enabled in the range, Low setpoint is calculated as High setpoint is
EcnDiff	Economy Cycle Differential	4°F	1 – 10°F	The DX cooling will be locked out at the DxDSP minus this EcnDiff.
OAHtLO	Outside Air Heating Lockout setpoint	75°F		Heating control will be disabled when the outside air temperature is above this setpoint.
OAHtDff	Outside air heating differential	4°F	0.5 – 5° F	Heating control will be re-enabled when the outside air drops below the OAHtLO – OAHHtDff.
DS_SP	Supply Duct Static Pressure Set point	TBC	TBC	Discharge Static Pressure Set point that the Supply Fan VFD will control to. This SP may be static or dynamically controlled to maintain minimum required flow on the most open VAV. See VAV Index Flow Control Mode
DSHiLim	Supply Duct Static Pressure High Limit	TBC	TBC	TBA
SpcStSp	Space Static Pressure Set point	TBC	TBC	Zone/Space Static Pressure Set point that the Return Fan VFD will control to.



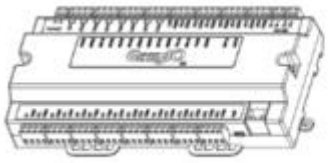
Holiday	Holiday Schedule	NA	NA	16 Day Schedule to allow for user configuration of public holidays.
NSU_Sp	Unoccupied Cooling Set point	80°F	???	On an increase in Zone Temperature above this Sp during unoccupied times, the AHU fan and cooling control will be enabled.
NSUDiff	Unoccupied cooling differential	3°F	0.5 – 10° F	With the AHU running in Unoccupied cooling mode, as the Zone Temperature drops below the NSU_Sp – DiffNSU the unit will change from an Unoccupied cooling mode to Unoccupied. Fan and cooling control will be disabled.
NSB_Sp	Unoccupied Heating Set point	62°F	???	On an decrease in Zone Temperature below this Sp during unoccupied times, the AHU fan and heating control will be enabled.
NSBDiff	Unoccupied heating differential	3°F	0.5 – 10°F	With the AHU running in Unoccupied heating mode, as the Zone Temperature rises above the NSB_Sp + DiffNSB the unit will change from an Unoccupied heating mode to Unoccupied. Fan and heating control will be disabled.
OATHovr	High Ambient Temperature Unoccupied setpoint	95°F		When the outside air temperature is above this setpoint the unit is permitted to run in Unoccupied heating/cooling mode.
OATLovr	Low Ambient Temperature Unoccupied setpoint	5°F		When the outside air temperature is below this setpoint the unit is permitted to run in Unoccupied heating/cooling mode.
DAV_LO	Discharge Air Temperature Reset, Variable Low Limit	30°F		Outside air temperature low limit for the discharge air temperature setpoint reset.
DAV_HI	Discharge Air Temperature Reset, Variable High Limit	70°F		Outside air temperature high limit for the discharge air temperature setpoint reset.
DASP_HI	Discharge Air Temperature maximum value	66°F		Discharge Air Setpoint maximum value. The discharge air temperature setpoint is at this value when the outside air temperature is at the low limit.
DASP_LO	Discharge Air Temperature minimum value	51°F		Discharge Air Setpoint minimum value. The discharge air temperature setpoint is at this value when the outside air temperature is at the high limit.
ClOffDy	Cooling Stage Off delay	180S		Delay time before each cooling stage is disabled following the loss of the stage cooling call.
ClIntDy	Cooling Interval Stage Delay	180S		The delay time between stages being enabled.



ClStgs	Number of cooling stages required	4	1 – 4	Defines how many cooling stage outputs will be used.
MWUDASP	Morning warmup discharge air temperature setpoint	110°F		Discharge air temperature setpoint that the AHU controls to while running in morning warmup mode.
HtOffDy	Heating Stage Off delay	30S		Delay time before each heating stage is disabled following the loss of the stage heating call.
HtIntDy	Heating Interval Stage Delay	180S		The delay time between stages being enabled.
HtStgs	Number of heating stages required	2	1 – 4	Defines how many heating stage outputs will be used.
MWU_SP	Morning Warmup return air setpoint	69°F		Morning warmup mode will be enabled when the return air temperature is below this set point.
MWU_Dif	Morning Warmup Differential	3°F		Morning warmup differential. When morning warmup mode is enabled the AHU will return to normal control mode when the return air temperature is above the MWU_SP + MWUDiff.
EcLLSP	Economy Low Lockout Setpoint	42°F		At discharge air temperatures below this setpoint the economy output will be 0%. The maximum allowable value of the economy output will reset linearly from this setpoint to this setpoint + 10Deg F.
Min_OA	Minimium outside air damper position	11%		Minimum position of the outside air dampers while the AHU is enabled.
CO2LoSP	Minimum CO2 Ventilation Setpoint	800		At CO2 levels below this setpoint, outside air damper minimum allowable position is Min_OA
CO2HiSp	Maximum CO2 Ventilation Setpoint	1000		At CO2 levels at or above this setpoint, minimum allowable outside air damper will be at CO2dmSP.
CO2dmSP	Maximum CO2 Ventilation Damper Setpoint	25%		CO2 outside air damper position when the CO2 levels are at or above CO2HiSp.
LowDiff **DATalrm alarm folder**	Low Differential Discharge air temperature Alarm SP	5		Differential for discharge air temperature alarm with Eff_SP less than 80Deg F. At discharge air temperatures above and below the following a discharge air temperature alarm will be triggered. Eff_SP ± LowDiff
HiDiff	High Differential Discharge air	5		Differential for discharge air temperature alarm with Eff_SP greater than 80Deg F. At discharge air temperatures above and



DATalrm alarm folder	temperature Alarm SP			below the following a discharge air temperature alarm will be triggered. Eff_SP ± HiDiff
LowDiff **SStcAlm alarm folder**	Low Differential Discharge air static pressure Alarm SP	5		Differential for discharge air static pressure alarm with static pressure setpoint greater than 0.5Bar. At discharge air static pressures above and below the following a discharge air static pressure alarm will be triggered. Effective static pressure SP ± LowDiff
HiDiff **SStcAlm alarm folder**	High Differential Discharge air static pressure Alarm SP	5		Differential for discharge air static pressure alarm with effective static pressure setpoint less than 0.5Bar. At discharge air static pressures above and below the following a discharge air static pressure alarm will be triggered. Effective static pressure SP ± HiDiff
LowDiff **CO2Alrm alarm folder**	Low Differential CO2 Alarm SP	5		Differential for discharge air static pressure alarm with static pressure setpoint greater than 0.5Bar. At discharge air static pressures above and below the following a discharge air static pressure alarm will be triggered. Effective static pressure SP ± LowDiff
HiDiff **CO2Alrm alarm folder**	High Differential CO2Alrm Alarm SP	5		Differential for discharge air static pressure alarm with effective static pressure setpoint less than 0.5Bar. At discharge air static pressures above and below the following a discharge air static pressure alarm will be triggered. Effective static pressure SP ± HiDiff



Histories

The application module utilizes the EasyIO, easyioFGSql and easyioPstore kits to store histories as SQL tables to the easyIOFG's SD card.

The application stores histories at 1 minute intervals for

- Zone Temperature
- Discharge Air Temperature
- Outside Air Temperature
- Return Air Temperature
- Mixed Air Temperature
- Carbon Dioxide Level
- Discharge Air Duct Static Pressure
- Zone Static Pressure

Communication Priorities

The application supports both Bacnet IP and Bacnet MSTP.

The controller IO, application network points and parameter configuration is available through the Bacnet interface.

All Bacnet points should be written to at Bacnet priority 15 or higher.

Controller Input points may be overridden through the Bacnet interface. The control priority is

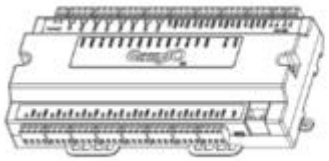
1. EasyIO FG Input Overrides
2. Bacnet Input Overrides
3. Default @ EasyIO FG Input

Controller Output points may be overridden through the Bacnet interface. The control priority is

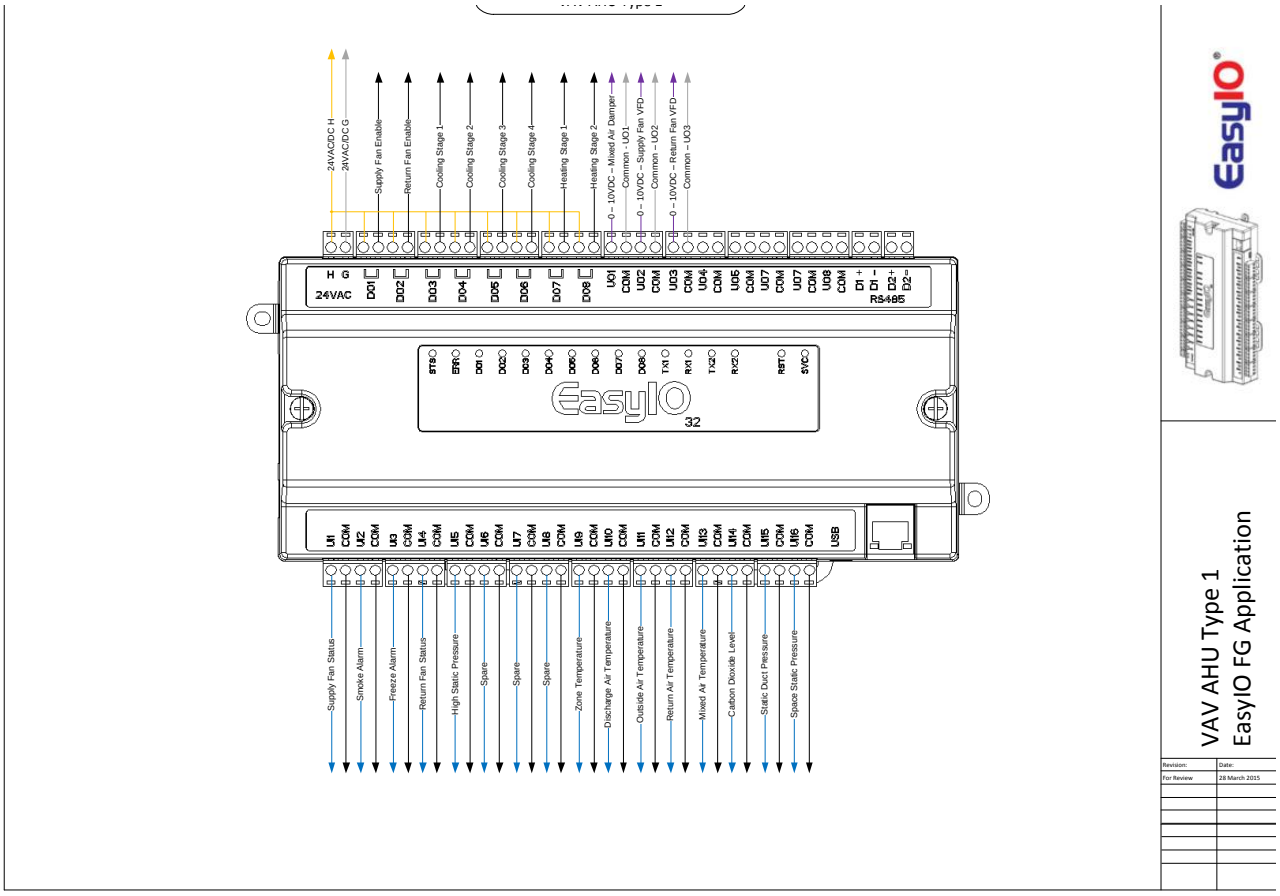
1. Bacnet Output Overrides
2. EasyIO FG Output Overrides
3. Default @ EasyIO FG Control Program

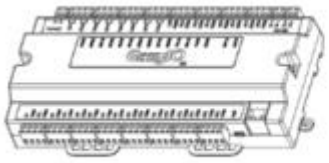
Controller Parameter configuration is also possible through the Bacnet interface. The priority is

1. Bacnet Parameter Settings
2. EasyIO FG Parameter Settings



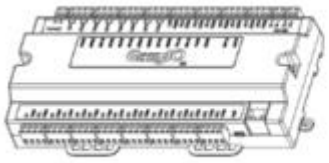
Drawings


24VAC/DC H
24VAC/DC G
Supply Fan Enable
Return Fan Enable
Cooling Stage 1
Cooling Stage 2
Cooling Stage 3
Cooling Stage 4
Heating Stage 1
Heating Stage 2
0 – 10VDC – Mixed Air Damper
Common - UO1
0 – 10VDC – Supply Fan VFD
Common – UO2
0 – 10VDC – Return Fan VFD
Common – UO3
H G
24VAC
DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8
UO1 COM UO2 COM UO3 COM UO4 COM UO5 COM UO7 COM UO7 COM UO8 COM
D1 + D1 – D2+ D2–
RS485
STS ERR D01 D02 D03 D04 D05 D06 D07 D08 TX1 RX1 TX2 RX2 RST SYC
EasyIO
32
UI1 COM UI2 COM UI3 COM UI4 COM UI5 COM UI6 COM UI7 COM UI8 COM UI9 COM UI10 COM UI11 COM UI12 COM UI13 COM UI14 COM UI15 COM UI16 COM USB
Supply Fan Status
Smoke Alarm
Freeze Alarm
Return Fan Status
High Static Pressure
Spare
Spare
Spare
Zone Temperature
Discharge Air Temperature
Outside Air Temperature
Return Air Temperature
Mixed Air Temperature
Carbon Dioxide Level
Static Duct Pressure
Space Static Pressure
EasyIO
VAV AHU Type 1
EasyIO FG Application
Revision:
Date:
For Review
28 March 2015

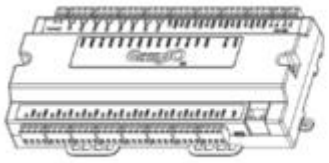


Appendix I – Program Object Reference

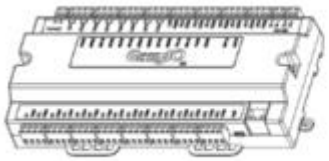
Object Name	Program Location
UI1_SFS	*EasyIOFG/EasyIO/IO*
UI2_SMK	*EasyIOFG/EasyIO/IO*
UI3_FRZ	*EasyIOFG/EasyIO/IO*
UI4_RFS	*EasyIOFG/EasyIO/IO*
UI5_HiS	*EasyIOFG/EasyIO/IO*
NA	*EasyIOFG/EasyIO/IO*
NA	*EasyIOFG/EasyIO/IO*
NA	*EasyIOFG/EasyIO/IO*
UI9_ZNT	*EasyIOFG/EasyIO/IO*
UI10DAT	*EasyIOFG/EasyIO/IO*
UI11OAT	*EasyIOFG/EasyIO/IO*
UI12RAT	*EasyIOFG/EasyIO/IO*
UI13MAT	*EasyIOFG/EasyIO/IO*
UI14CO2	*EasyIOFG/EasyIO/IO*
UI15SDS	*EasyIOFG/EasyIO/IO*
UI16SpS	*EasyIOFG/EasyIO/IO*
DO1_SFC	*EasyIOFG/EasyIO/IO*
DO2_RFC	*EasyIOFG/EasyIO/IO*
DO3_CL1	*EasyIOFG/EasyIO/IO*
DO4_CL2	*EasyIOFG/EasyIO/IO*
DO5_CL3	*EasyIOFG/EasyIO/IO*
DO6_CL4	*EasyIOFG/EasyIO/IO*
DO7_HT1	*EasyIOFG/EasyIO/IO*
DO8_HT2	*EasyIOFG/EasyIO/IO*
DO15HT3	*EasyIOFG/EasyIO/IO*
DO16HT4	*EasyIOFG/EasyIO/IO*
UO1-MAD	*EasyIOFG/EasyIO/IO*
UO2-SFV	*EasyIOFG/EasyIO/IO*
UO3-RFV	*EasyIOFG/EasyIO/IO*
Occ_Net	*EasyIOFG/EasyIO/NetIO*
OAT_Net	*EasyIOFG/EasyIO/NetIO*
ZNT_Net	*EasyIOFG/EasyIO/NetIO*
ClgStgs	*EasyIOFG/EasyIO/NetIO*
HtgStgs	*EasyIOFG/EasyIO/NetIO*
DxDSP	*EasyIOFG/EasyIO/NetIO*
EcnDSP	*EasyIOFG/EasyIO/NetIO*
CObot	*EasyIOFG/EasyIO/NetIO*
EcnDiff	*EasyIOFG/EasyIO/NetIO*



OAHtLO	*EasyIOFG/EasyIO/NetIO*
OAHtDff	*EasyIOFG/EasyIO/NetIO*
DS_SP	*EasyIOFG/EasyIO/NetIO*
DSHiLim	*EasyIOFG/EasyIO/NetIO*
SpcStSp	*EasyIOFG/EasyIO/NetIO*
Holiday	*EasyIOFG/EasyIO/NetIO*
OccT	*EasyIOFG/EasyIO/NetIO*
OccAM	*EasyIOFG/EasyIO/NetIO*
UnOccT	*EasyIOFG/EasyIO/NetIO*
UnOccPM	*EasyIOFG/EasyIO/NetIO*
NSB_Sp	*EasyIOFG/EasyIO/NetIO*
NSUDiff	*EasyIOFG/EasyIO/NetIO*
NSU_Sp	*EasyIOFG/EasyIO/NetIO*
NSBDiff	*EasyIOFG/EasyIO/NetIO*
OATHovr	*EasyIOFG/EasyIO/NetIO*
OATLovr	*EasyIOFG/EasyIO/NetIO*
DAV_LO	*EasyIOFG/EasyIO/NetIO*
DAV_HI	*EasyIOFG/EasyIO/NetIO*
DASP_HI	*EasyIOFG/EasyIO/NetIO*
DASP_LO	*EasyIOFG/EasyIO/NetIO*
ClOffDy	*EasyIOFG/EasyIO/NetIO*
ClIntDy	*EasyIOFG/EasyIO/NetIO*
ClStgs	*EasyIOFG/EasyIO/NetIO*
MWUDASP	*EasyIOFG/EasyIO/NetIO*
HtOffDy	*EasyIOFG/EasyIO/NetIO*
HtIntDy	*EasyIOFG/EasyIO/NetIO*
HtStgs	*EasyIOFG/EasyIO/NetIO*
MWU_SP	*EasyIOFG/EasyIO/NetIO*
MWU_Dif	*EasyIOFG/EasyIO/NetIO*
EcLLSP	*EasyIOFG/EasyIO/NetIO*
Min_OA	*EasyIOFG/EasyIO/NetIO*
CO2LoSP	*EasyIOFG/EasyIO/NetIO*
CO2HiSp	*EasyIOFG/EasyIO/NetIO*
CO2dmSP	*EasyIOFG/EasyIO/NetIO*
LowDiff *DATalrm alarm folder*	*EasyIOFG/EasyIO/NetIO*
HiDiff *DATalrm alarm folder*	*EasyIOFG/EasyIO/NetIO*
LowDiff *SStcAlm alarm folder*	*EasyIOFG/EasyIO/NetIO*



HiDiff *SStcAlm alarm folder*	*EasyIOFG/EasyIO/NetIO*
LowDiff *CO2Alrm alarm folder*	*EasyIOFG/EasyIO/NetIO*
HiDiff *CO2Alrm alarm folder*	*EasyIOFG/EasyIO/NetIO*
Schedul	*EasyIOFG/EasyIO/SchAmPM*
NSU_NSB	*EasyIOFG/EasyIO/UnocCtl*
Permit	*EasyIOFG/EasyIO/Permits*
Holiday	*EasyIOFG/EasyIO/SchAmPm*
SFV	*EasyIOFG/EasyIO/FanCntl*
RFV	*EasyIOFG/EasyIO/FanCntl*
SpcStSP	*EasyIOFG/EasyIO/FanCntl*
RFVI	*EasyIOFG/EasyIO/FanCntl*
EconEna	*EasyIOFG/EasyIO/ChngOvr*
EcTmCtl	*EasyIOFG/EasyIO/EconCtl*
EconLP	*EasyIOFG/EasyIO/EconCtl*
EcLpP	*EasyIOFG/EasyIO/EconCtl*
EfCLDSP	*EasyIOFG/EasyIO/CoolCtl*
ClgEna	*EasyIOFG/EasyIO/ChngOvr*
ClTmCtl	*EasyIOFG/EasyIO/CoolCtl*
CoolLp	*EasyIOFG/EasyIO/CoolCtl*
DASP	*EasyIOFG/EasyIO/CoolCtl*
CLpP	*EasyIOFG/EasyIO/CoolCtl*
HtgEna	*EasyIOFG/EasyIO/ChngOvr*
HtTmCtl	*EasyIOFG/EasyIO/HeatCtl*
HeatLP	*EasyIOFG/EasyIO/HeatCtl*
HtDASP	*EasyIOFG/EasyIO/HeatCtl*
HLpP	*EasyIOFG/EasyIO/HeatCtl*
CO2Ctl	*EasyIOFG/EasyIO/EconCtl*
CO2MASP	*EasyIOFG/EasyIO/EconCtl*
CO2Ctl	*EasyIOFG/EasyIO/EconCtl*



Technical Support

For technical support issues please contact EasyIO technical support below;

Email: appsuppot@easyio.com