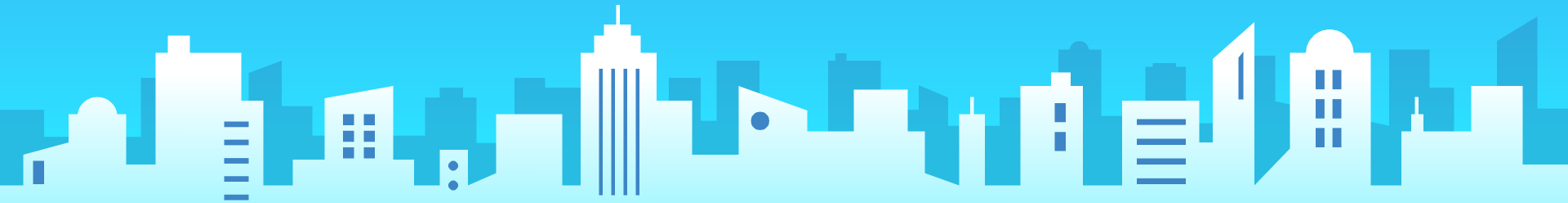


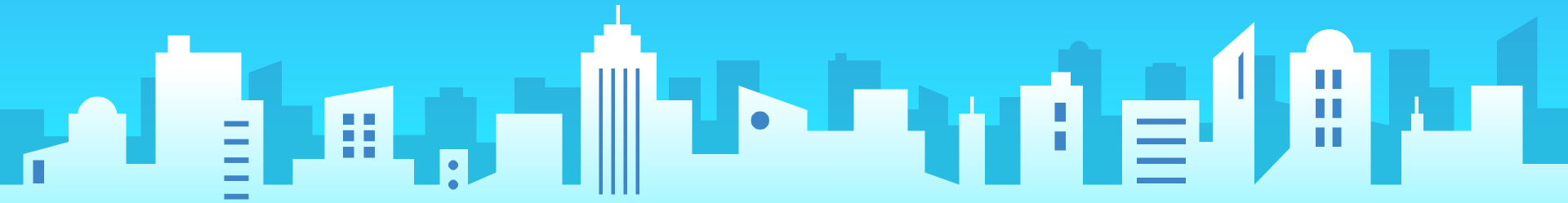
Building Tuning and Optimisation

By Mike Dowling (Alerton Australia)





- **Australia's Largest Independent**
- **250 Staff**
- **Twice listed BRW Fast 100**
- **100,000 Systems and counting**



FD and Control Strategies, interface schedule

FUNCTIONAL DESCRIPTION

1. Air Conditioning

1.1. Air Handling Units (AHU)

1.1.1. System Overview

There are 3 Air Handling Units that provides tempered fresh air to each level of the buildings. Each unit comprises of a supply air fan, supply air temperature and pressure sensors, a chilled water coil and control valve, and outside air and return air dampers.

As a part of the upgrade Aletion will implement return air temperature and humidity monitoring for reduced economy control.

VAV units provide zoning control and will respond to the demand in their particular zone.

1.1.2. Controlled Equipment

EQUIPMENT	SERVES
AHU1	North Side VAVs
AHU2	Centre Zone VAVs
AHU3	South Side VAVs

1.1.3. Points List

POINTS	TYPE	COMMENTS
Supply Fan Status	BI	Volt Free Contact (VFC) from Current Switch
Duct Heater Status	BI	Volt Free Contact (VFC) from Current Switch
Supply Air Temperature	AI	Duct Mounted Temperature Sensor
Supply Fan Static Pressure	AI	Duct Mounted Pressure Sensor
Return Air Temperature	AI	Duct Mounted Temperature Sensor
Supply Fan Start/Stop	BO	Relay at MSSB
Supply Fan VSD Speed	AO	VSD Output
Chilled Water Valve	AO	Modulating Control Valve
Return Air Damper	AO	Modulating Damper Actuator
Outside Air Damper	AO	Modulating Damper Actuator

1.1.4. Start/Stop Control

Each unit is enabled when any of the following condition are met:

- The time of day is equal to or passed the unit's schedule start time.
- Any VAV served by the respective AHU afterhours pushbutton has been activated.

Or

Each unit is disabled when the following conditions is met:

- The time of day is equal to or passed the unit's schedule stop time.

And

- The afterhours run time for all VAVs has elapsed.

1.1.5. Supply Fan Operation

The supply air fan speed modulates via a PI loop in response to a single static pressure sensor located in the supply air duct. Once the fan is enabled the supply air static duct pressure set point shall be fixed at its maximum for a period of 10 minutes and no pressure reset strategy is employed within this time.

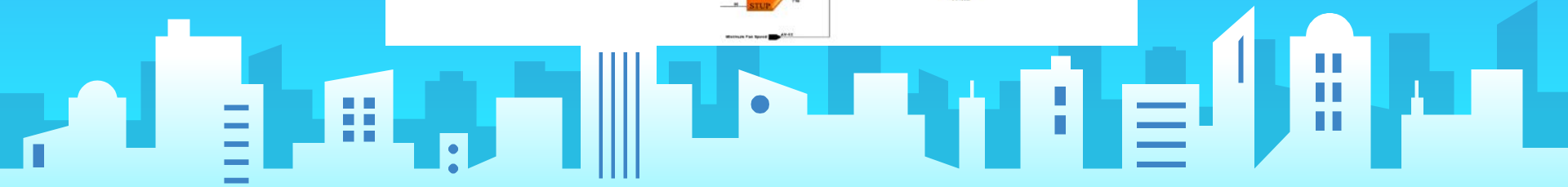
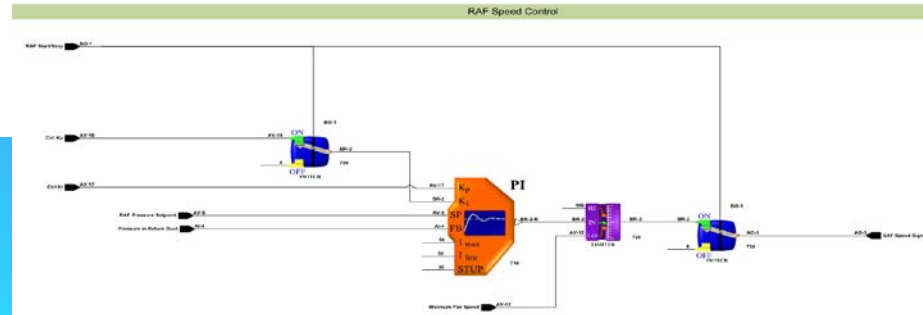
1.1.6. Supply Air Pressure Reset

Each unit employs a supply air differential pressure set point reset strategy whereby the duct static pressure set point will be adjusted upwards and downwards as required but only before the original set point.

The average zone temperature of the VAVs served by an AHU is monitored and compared to the average zone temperature set point of those VAVs. If the temperature is within $\pm 0.5^\circ\text{C}$ of the set point the static pressure set point will be adjusted down at a rate of 5Pa per minute until the minimum static pressure set point is achieved (TBA during commissioning, normally 30% of maximum air flow). Once the minimum static pressure is achieved the static pressure set point will remain fixed for a period of at least 2 minutes (adjustable).

If average temperature drifts $\pm 1^\circ\text{C}$ outside of the set point for a period of 2 minutes (adjustable) then the static pressure set point will be reset upwards at a rate of 5Pa per minute until the maximum static pressure set point is achieved. Should the static pressure set point be increased back to the nominal set point (determined during commissioning), all further set point change requests will be disregarded for a period of 5 minutes. The pressure set point will then return to the set point as per the differential pressure reset strategy.

Service	Points	Preferred Protocol	Ports	VLAN
Integration Platform		SNMP	10	1
BMCS	20,000	BACnet/Modbus	70	2
Mechanical	300	BACnet/Modbus	Included in BMCS	2
HVAC Feedback System	100	BACnet/Modbus	Included in BMCS	2
Water + Gas Metering	100	M Bus/BACnet/Modbus	70	2
Electrical	1,000	BACnet/Modbus	120	2
Lighting and Emergency Light	2500	KNX/BACnet/Dali/SQL	30	2
Fire	100	Modbus/BACnet	15	2
Security (CCTV)	250	nvis/Milestone mobile client/SNMP	250 (POE)	3
Security Access Control	1000	OPC/BACnet	70	3
Vertical Transport	100	OPC/BACnet	15	4
Hydraulic	100	BACnet/Modbus	15	2
AV Distribution System	NA	NA	7	5
Base Building Wi-Fi	500	SNMP	66	6
Waste Management System	100	API	7	7
People Counting System	100	API	9	8
Car park Management System	100	API	7	9
VOIP	NA	NA	6	10
Smart Lockers	100	API/OPC	22	11
Irrigation System	100	API/BACnet	5	2
		SNMP	-	1
			7 (Fibre)	



Graphic page design

Main Menu
Previous
Settings

Building A - AHU-1

Serves VAV Perimeter Zones

Monday, 4-4-2018 8:02:24
General Fire Alarm Normal
Outside Air Temperature 11.5 °C

waiting 603 ppm
20.2 °C

waiting

waiting 11.6 °C

waiting

R/A Fan Speed waitir

13 °C
250 Pa

waiting

Supply Air Fan Control

Afterhours Enable	Off
VAV Enable	On
Fan Override	Auto
Fan Control	On
Fan Status	Running
Fan Mismatch Fault	Normal
Fan Runhours	5,417 hrs

Supply Air Fan Speed Control

Static Duct Pressure	250 Pa
Calculated Pressure SP	250 Pa
Fan Speed Override	Auto %
Fan Speed Control	93 %

Filter Monitoring

Filter Status	Clean
Filter Alarm Reset	<input type="checkbox"/>

S/A Fan Speed waitir

CHW Valve 0 %

Return Air Fan Control

Fan Override	Auto
Fan Control	On
Fan Status	Running
Fan Mismatch Fault	Normal
Fan Runhours	5,358 hrs

Return Air Fan Speed Control

Fan Speed Override	Auto %
Fan Speed Control	47 %

Supply Air Temperature Control

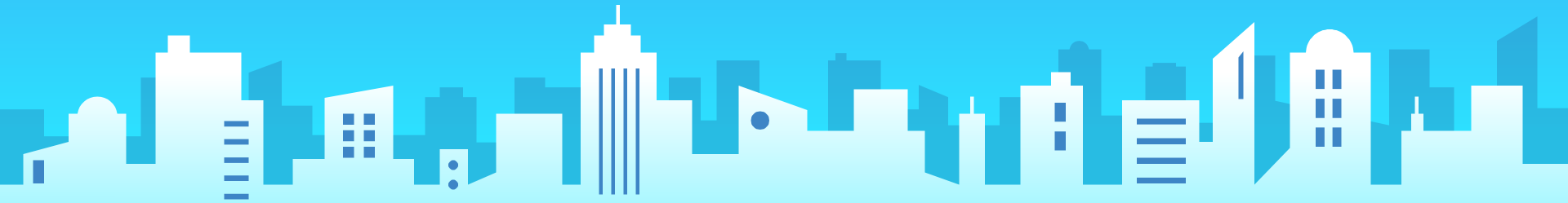
Supply Air Temperature	13 °C
Calculated S/A Temp SP	13 °C
CHW Valve Override	Auto %
CHW Valve Control	0 %

Economy Damper Control

Economy Mode Enabled	On
Economy Mode %	60 %
O/A Damper Override	Auto %
O/A Damper Control	60 %
R/A Damper Override	Auto %
R/A Damper Control	40 %
Spill Air Damper Override	Auto %
Spill Air Damper Control	60 %

Minimum Outside Air Damper Control

Highest R/A CO2	603 ppm
Minimum CO2 Setpoint	600 ppm
Maximum CO2 Setpoint	900 ppm
Min O/A Damper Override	Auto %
Min O/A Damper Control	1 %



Tuning pages and control strategies

Live data tuning page

Monday, 20-5-2018 10:45:46
 General Fire Alarm Normal
 Outside Air Temperature 23.5 °C
 Outside Air Humidity 35 %rh

AHU B2-01

General Setup Page

Link
 S/A Temp Reset Control Static Press. Reset Control Min. O/A Control Economy Mode

AHU Overview		Supply Air Fan Speed Control		Supply Air Temp Control	
AHU Override	Auto	S/A Static Pressure	254 Pa	Supply Air Temp	15.9 °C
AHU Call	On	Maximum Static Pressure SP	300 Pa	Supply Air Temp SP	15.5 °C
AHU Status	On	Kp	0.4	Kp	0.3
AHU Mismatch Fault	Normal	Ki	1.5	Ki	2
AHU Start Delay	120 secs	Fan VSD Speed	54 %	Main Valve Position	52.7 %
AHU Run Hours	8,871 Hrs				

Filter Alarm		Pre-Cool Control	
Filter Dirty Alarm	Normal	Mixing Box Temp	22.5 °C
		Mixing Box Temp SP	22 °C
		RA Humidity	44 %
		RA Humidity SP	70 %
		RA Humidity On Delay	25 %
		Kp	0.6
		Ki	1.5
		Pre-Cool Valve Position	100 %

24-May-18 1:57 PM AWT
 General Fire Alarm Normal
 Outside Air Temperature 26.6 °C
 Outside Air Humidity 23 %RH

AHU-3 PI Loop

Economy Mode Night Purge Mode Humidity Mode Dehumidifier Mode

CHW valve PI Loop

CHW valve Kp: 25.0
 CHW valve Ki: 1.0
 AHU-Room Temp Setpoint: 22.0 °C
 Room Temp Reference: 21.9 °C

50 % CHW Valve Output
 38 % CHW Valve Pos.

Humidifier PI Loop

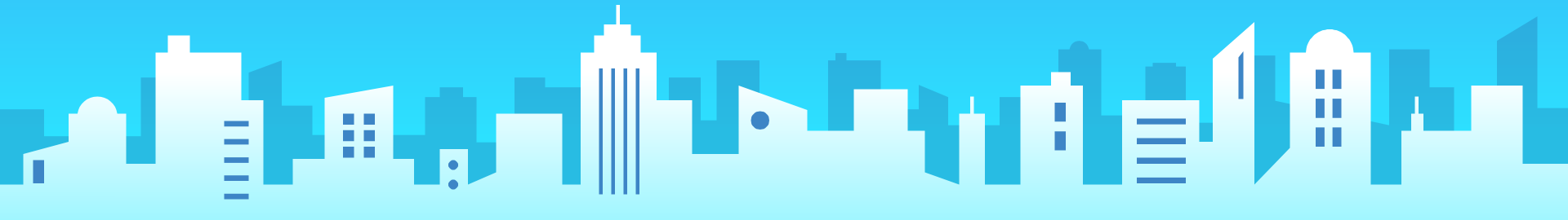
Humidifier Kp: 1.0
 Dehumidifier Ki: 1.0
 Humidity Setpoint: 37 %RH
 Room Humidity Reference: 36 %

100 % Humidifier Valve Pos.
 Humidifier Active when output > 2%

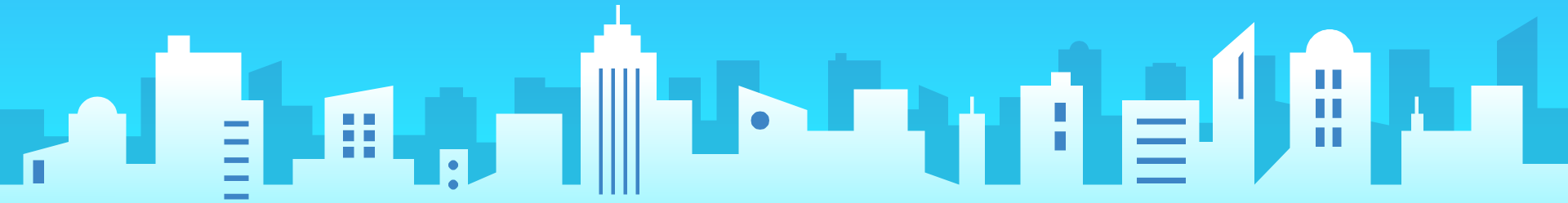
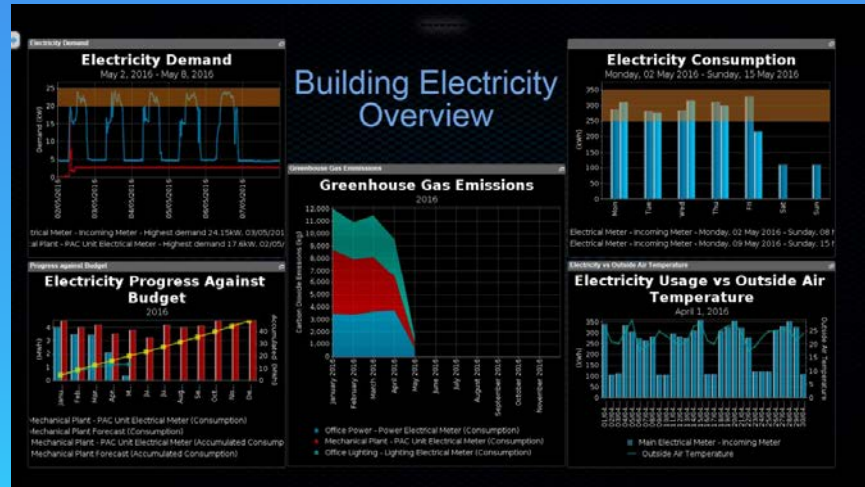
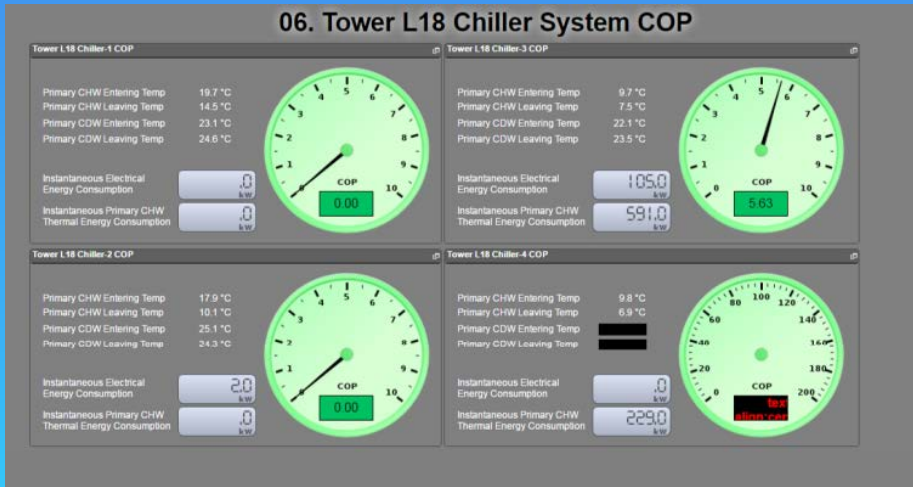
Disable Dehumidification by CHW Valve

Humidity Setpoint: 34.0 %RH
 Room Humidity Reference: 36 %

If dehumidification is enabled then CHW valve will open to 100% provided that humidity is above setpoint and break after 10 min.



COP calculations and dashboards



Documentation

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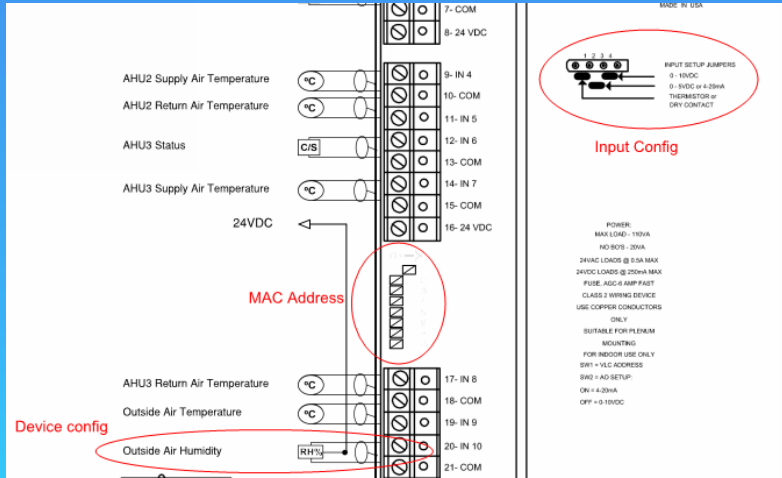
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6.0 APPENDIX B - COMMISSIONING DATA (FUNCTIONALITY) (TO BE PROVIDED AFTER COMPLETION OF PROJECT) 22

Field Control / Module	Network Identifier	Device Location	Device Name	TYPE 1 - 20			Device Number	MAC	Commissioned By	Commissioned Date
				FE	FAO	BO				
10,CL108	10,CL108	10,CL108	10T101							
	FMV,CL10 Fan StartStop					8	FMV,CL10 Fan StartStop	05	05/01/14 15:00	
	FMV,CL10 Compressor 1 StartStop					1	FMV,CL10 Compressor 1 StartStop	05	04/01/14 15:00	
	FMV,CL10 Compressor 2 StartStop					2	FMV,CL10 Compressor 2 StartStop	05	04/01/14 15:00	
	FMV,CL10 Pump StartStop					3	FMV,CL10 Pump StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					4	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					5	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,CHW,14 Chw StartStop					6	EC,CHW,14 Chw StartStop	05	04/01/14 15:00	
	EC,CCW,14 Ccw StartStop					7	EC,CCW,14 Ccw StartStop	05	04/01/14 15:00	
	EC,LLI,14 Lli StartStop					8	EC,LLI,14 Lli StartStop	05	04/01/14 15:00	
	EC,HLI,14 Hli StartStop					9	EC,HLI,14 Hli StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					10	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					11	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					12	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					13	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					14	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					15	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					16	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					17	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					18	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					19	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					20	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					21	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					22	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					23	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					24	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					25	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					26	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					27	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					28	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					29	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	
	EC,FCU,14 Fan StartStop					30	EC,FCU,14 Fan StartStop	05	04/01/14 15:00	

Pre commissioning



VLC Inputs/Outputs

Previous

Device Name: VAV-SD
Model Name: VAV-SD
Application Software: AZ60 V 4.02A
BIC: ADVCONTROLAARON_VZ0908_0*92230008
NOTE: The Inputs and Outputs listed are for all Applicable I/O's may be determined based on

BI's	
BI 0	
BI 1	
BI 2	
BI 3	
BI 4	
BI 5	
BI 6	
BI 7	
BI 8	
BI 9	
BI 10	
BI 11	
BI 12	
BI 13	
BI 14	
BI 15	

BO's	
BO 0	
BO 1	
BO 2	
BO 3	
BO 4	
BO 5	
BO 6	
BO 7	
BO 8	
BO 9	
BO 10	
BO 11	
BO 12	
BO 13	
BO 14	
BO 15	

AI's	
AI 0	33.900
AI 1	31.8
AI 2	-69.9
AI 3	4095.0
AI 4	0.000
AI 5	0.000
AI 6	0.000
AI 7	0.000
AI 8	0.000
AI 9	8936.000
AI 10	0.000
AI 11	0.000
AI 12	1192.000
AI 13	0.000
AI 14	0.000
AI 15	0.000

AO's	
AO 0	0.0
AO 1	0.0
AO 2	0.0
AO 3	0.0
AO 4	0.0
AO 5	0.0
AO 6	0.0
AO 7	0.0

Array Index for BO's 0-7

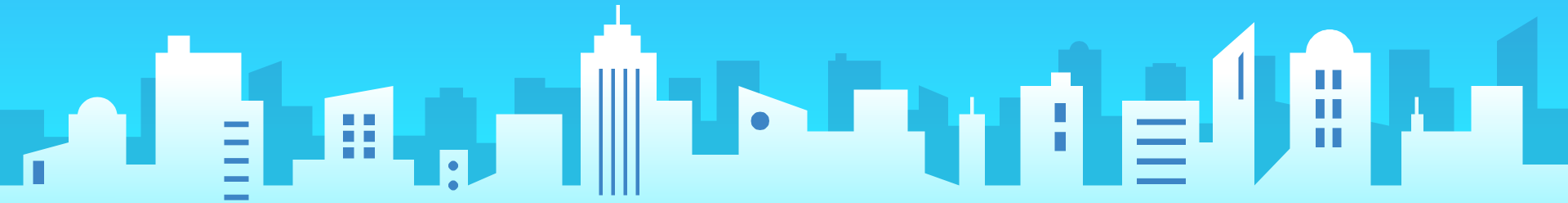
Array Index for BO's 8-15

Array Index for AO's 0-7

VAV 5-4/Extra sensor
VAV-4.2

Commissioning

- Functional Testing
- Client and consultant witnessing
- Training and remote access for support



Thank you

