



GUARDIAN GC-45 Plant Control

Energy optimizing control of Evaporative Condensers

Up to fifteen percent of the energy costs of powering industrial refrigeration cooling towers can be saved by using Guardian *Optimizing controls and variable speed fan motors.*

Variable speed fan controllers cooperate via the optimization network to ensure that optimum discharge temperatures are maintained whilst maintaining a stable refrigerant flow and thus saving energy.



GC-45 VS Plant Controller

This flexible refrigeration Plant Controller provides discharge pressure control with normal or variable speed Condenser Fans.

LED-485 Display

Pack status, temperatures, pressures, control setpoint and timers settings may be viewed or changed locally at the pack.



- **Refrigeration system savings of up to 15%** of condenser energy costs per year when used with Guardian *Optimizing evaporative condenser controls and variable speed drives.*
- **Fully automatic optimized environmental control of cooling tower discharge pressures.**
- **Flexible allocation of pumps, heaters and fans in three control loops.**
- **Liquid level monitoring and alarms.**
- **Condenser load AMPS monitoring** with energy (kWh) usage.
- **Variable speed pump and condenser Fan control.**
- **Fault inputs for all pumps, heaters, VSD Drives, fans & common system faults.**
- **Ethernet and RS485 communications for displays and graphs.**
- **Local display and setup** with LED-485 display unit.

- **Stable compressor pack operation** is achieved by very stable evaporator controls. Stable pack operation avoids unnecessary compressor starts and stops which reduces failures and maintenance costs and prolongs plant life.
- **Energy optimization of pack capacity** is achieved by using a combination of compressors, loading valves and variable speed drives
- **Stable discharge pressure condenser fan control** is largely achieved as a result of variable speed motors and a stable pack.
- **Energy optimization of condenser capacity** uses fan staging and/or variable speed drives to achieve the desired discharge pressure.
- **Optimized discharge temperature setpoint control** of condensers fans depends on environmental conditions at the condenser.
- **Fan power monitoring and trip recording for EBM Papst variable speed condenser fans** is available using the EBM-16 Ethernet interface.



MU-10 Marshalling unit

Provides easy plug and socket marshalling for RS485 and Ethernet communications and power cables for GC-45 and displays.



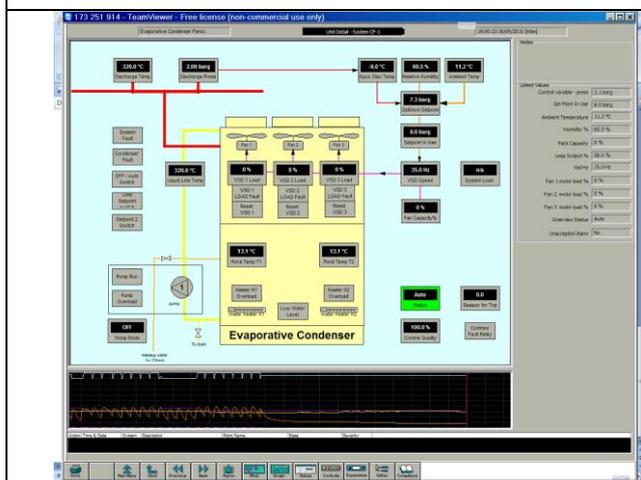
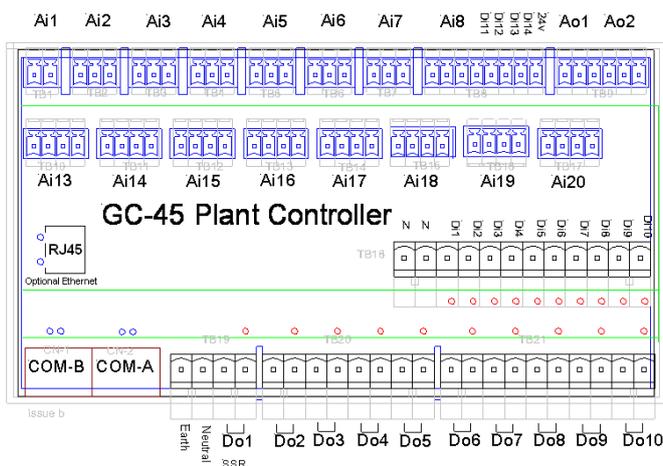
Ethernet interface for multiple EBM Fans



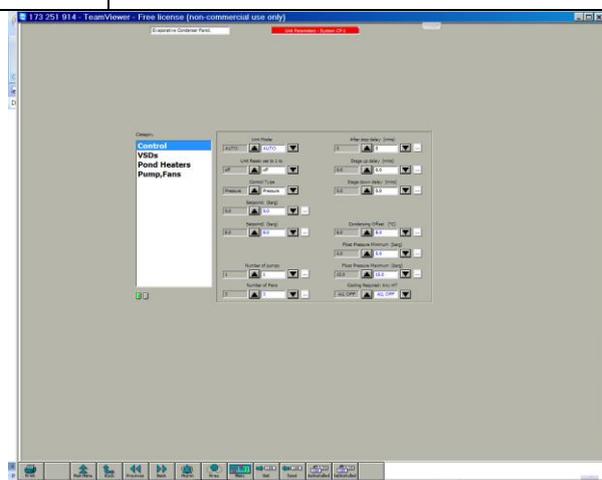
EBM-16 provides parameter displays, alarms and trip status from up to 16 EBM Variable speed condenser fans.



Qty	REF #	GC-45 INPUT OUTPUT SIGNALS	Evaporative Condensers																																				
1	Ai1	Motor Load AMPS (0-5A from CT)	<table border="1" style="width: 100%; border-collapse: collapse; background-color: #e0ffe0;"> <thead> <tr> <th colspan="3" style="background-color: #008000; color: white;">GC-45 Specification CE</th> </tr> </thead> <tbody> <tr> <td style="width: 30%;">Power</td> <td style="width: 30%;"></td> <td style="width: 40%;">24Vdc 0.3A 50-60Hz</td> </tr> <tr> <td>Operation</td> <td></td> <td>0 to 50 °C</td> </tr> <tr> <td>Dimensions</td> <td></td> <td></td> </tr> <tr> <td>Height</td> <td></td> <td>86 mm</td> </tr> <tr> <td>Length</td> <td></td> <td>156 mm</td> </tr> <tr> <td>Depth</td> <td></td> <td>59 mm</td> </tr> <tr> <td>Mounting</td> <td></td> <td>DIN rail</td> </tr> <tr> <td colspan="3" style="background-color: #008000; color: white;">Connectors</td> </tr> <tr> <td>Terminals No./ Size type</td> <td>34 6</td> <td>5.08mm 3.50mm 2-part Screw clamp</td> </tr> <tr> <td>Power and RS485</td> <td>2</td> <td>4-way sockets Modbus RTU</td> </tr> <tr> <td>Ethernet</td> <td>1</td> <td>RJ45 TCP/IP, SNMP</td> </tr> </tbody> </table>	GC-45 Specification CE			Power		24Vdc 0.3A 50-60Hz	Operation		0 to 50 °C	Dimensions			Height		86 mm	Length		156 mm	Depth		59 mm	Mounting		DIN rail	Connectors			Terminals No./ Size type	34 6	5.08mm 3.50mm 2-part Screw clamp	Power and RS485	2	4-way sockets Modbus RTU	Ethernet	1	RJ45 TCP/IP, SNMP
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6	Ai2 Ai3-6 Ai7	Pressures @ 4-20ma Discharge pressure (-1 to 24bar) VSD Load % @ 4-20ma VSD-1, VSD-2,VSD-3,VSD-4 Humidity % @ 4-20ma Ambient RH %																																					
1	Ai8	Liquid Level (0-10vdc) Hansen Liquid level transducer																																					
4	Di11-Di14	Switch inputs and faults @ 24vac Auto/Off ,2 nd setpoint, Noise reduction, System Fault																																					
2	Ao1- Ao2	Speed outputs @ 0-10vdc or 4-20ma Condenser fans VSDs ,																																					
8	Ai13- Ai20	Temperatures PT1000 or 2k2 Liquid line, 2 Pond water, Discharge, Ambient air																																					
10	Di1- Di10	Compressor & Fan running inputs @ 24vac Pump and Heater Overloads , Condenser Fan VSD faults Low water level, general fault																																					
10	Do1- Do10	Relay outputs n/o @ 5A Pumps, Heaters, VSD Condenser Fans, Alarm,																																					
2	COM-A COM-B	RS485 communication links @19600baud Uses Modbus RTU protocol for LCD-8, LED-485 displays, extension units and remote PC monitoring.																																					



'Consultant' PC Evaporative Condenser Display Screen



'Consultant' PC Evaporative Condenser Setup Screen



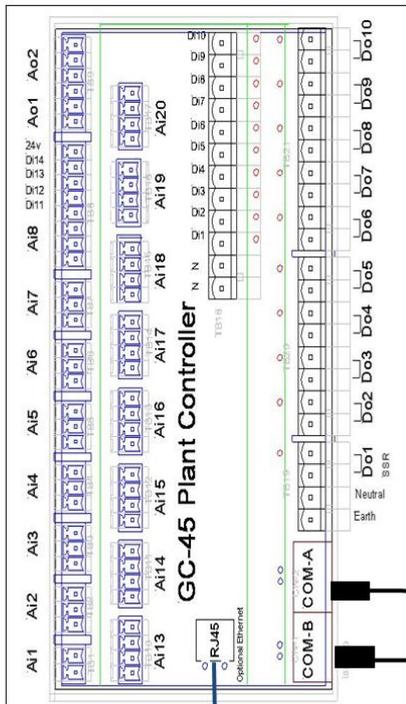
GC-E45 VSEC_1ABB EVAP CONDENSER

ANALOG INPUTS (Lower Terminals)

Ao2	Compressor VSD Speed
Ao1	Condenser VSD Speed
D14	
D13	
D12	
D11	RUN INPUT
Ai8	
Ai7	RELATIVE HUMIDITY 4-20ma (0-100%)
Ai6	
Ai5	
Ai4	
Ai3	
Ai2	DISCHARGE PRESSURE 4-20ma (-1 to 24bar)
Ai1	

TEMPERATURE INPUTS (Upper Terminals)

Ai20	
Ai19	
Ai18	
Ai17	POND TEMPERATURE T2 Thermistor 2k253 100mm
Ai16	DISCHARGE TEMPERATURE Thermistor 22k 100mm
Ai15	LIQUID LINE TEMPERATURE Thermistor 2k253 100mm
Ai14	POND TEMPERATURE T1 Thermistor 2k253 100mm
Ai13	AMBIENT AIR TEMPERATURE Thermistor 2k253 air



AIC DIGITAL INPUTS (Upper Terminals)

Di10	Condenser General Fault
Di9	LOW WATER LEVEL
Di8	
Di7	
Di6	
Di5	
Di4	HEATER-2 OVERLOAD
Di3	HEATER-1 OVERLOAD
Di2	PUMP-2 OVERLOAD
Di1	PUMP-1 OVERLOAD
N	NEUTRAL
N	NEUTRAL

RELAY OUTPUTS (Lower Terminals)

c Do10	info
c Do9	info
c Do8	info
c Do7	info
c Do6	info
c Do5	info
c Do4	info
c Do3	info
c Do2	info
c Do1	info
c Do1 SSR	info
Neutral	info
Earth	info

ETHERNET TCP / IP MODBUS TO SCADA PC

LED-485 Display



RS485 Modbus (Monitor) to Consultant PC

RS485 Modbus(Control) ABB ACS550(18.5kW) VSD-1

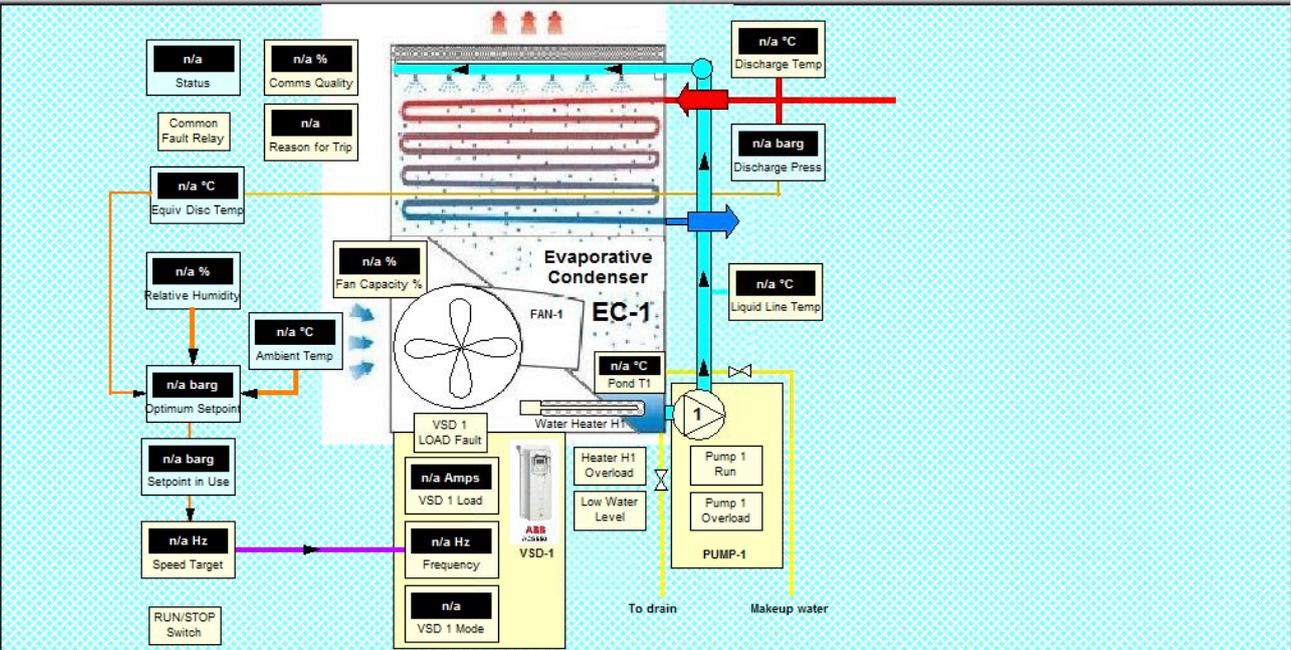
RS485 Modbus(Control) ABB ACS550(18.5kW) VSD-2

RS-485 Modbus RTU

Evaporative Condenser Fans1

Unit Mimic - System CF-1

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Navigation bar with icons for Print, Main Menu, Back, Previous, Next, Alarm, Area, Graph, Values, and Parameters.



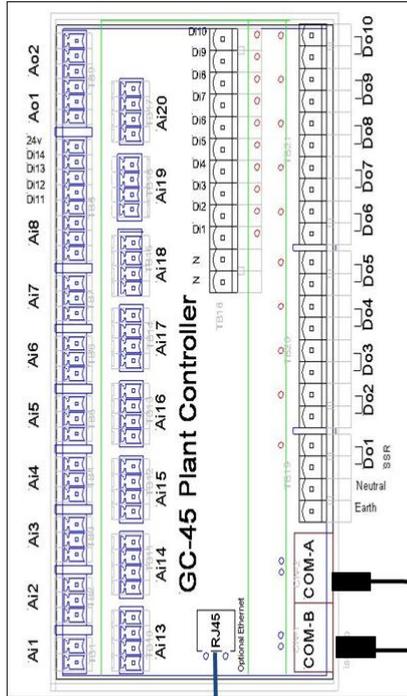
GC-E45 VSEC_2ABB EVAP CONDENSER

ANALOG INPUTS (Lower Terminals)

Ao2	Compressor VSD Speed
Ao1	Condenser VSD Speed
24v	24vdc
Di14	
Di13	
Di12	
Di11	RUN INPUT
Ai8	
Ai7	RELATIVE HUMIDITY 4-20ma (0-100%)
Ai6	
Ai5	
Ai4	
Ai3	
Ai2	DISCHARGE PRESSURE 4-20ma (-1 to 24bar)
Ai1	

TEMPERATURE INPUTS (Upper Terminals)

Ai20	
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Ai16	DISCHARGE TEMPERATURE Thermistor 22k 100mm
Ai15	LIQUID LINE TEMPERATURE Thermistor 2k253 100mm
Ai14	POND TEMPERATURE T1 Thermistor 2k253 100mm
Ai13	AMBIENT AIR TEMPERATURE Thermistor 2k253 air



A/C DIGITAL INPUTS (Upper Terminals)

Di10	Condenser General Fault
Di9	LOW WATER LEVEL
Di8	
Di7	
Di6	
Di5	
Di4	HEATER-2 OVERLOAD
Di3	HEATER-1 OVERLOAD
Di2	PUMP-2 OVERLOAD
Di1	PUMP-1 OVERLOAD
N	NEUTRAL
N	NEUTRAL

RELAY OUTPUTS (Lower Terminals)

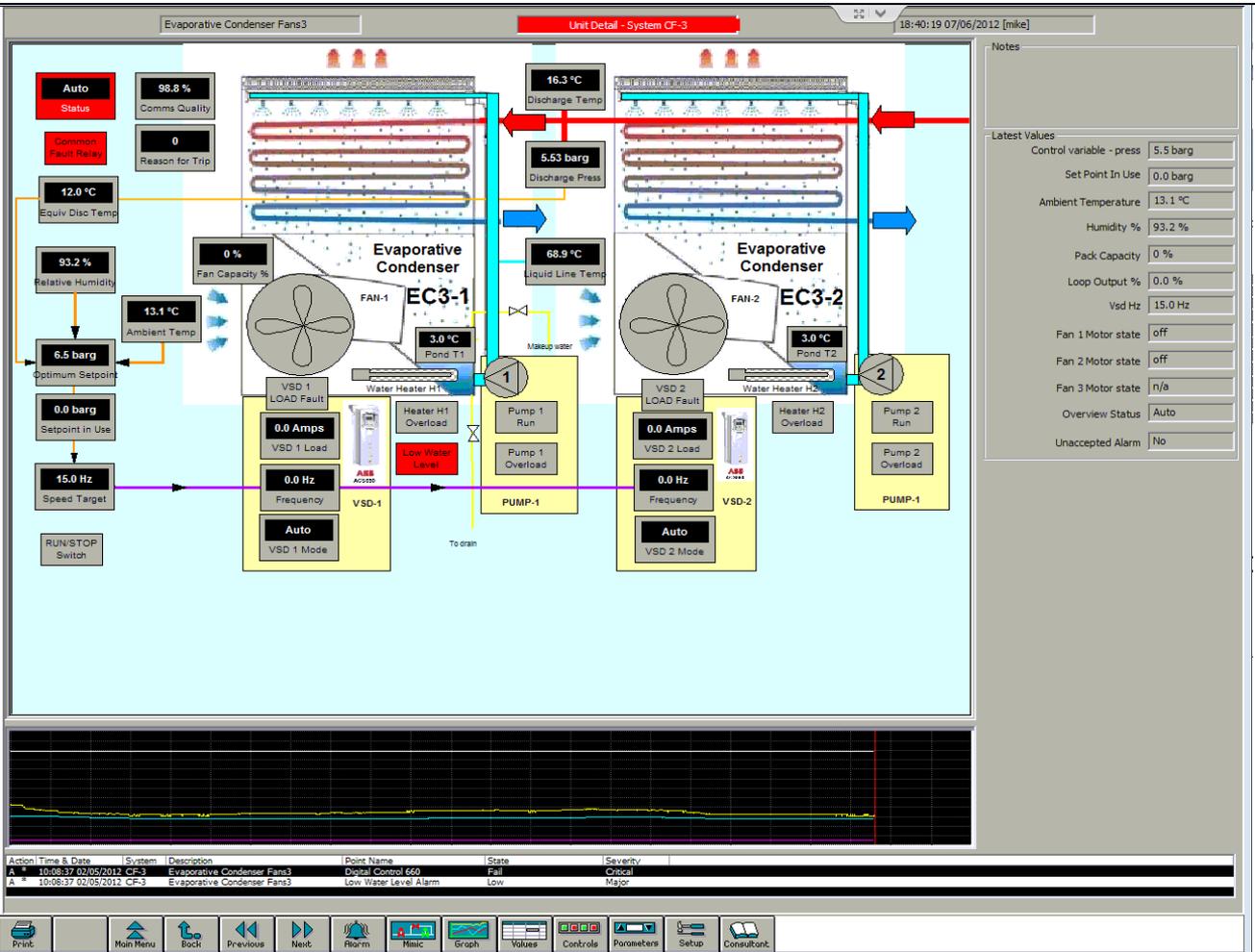
Co10	
Co9	
Co8	
Co7	
Co6	
Co5	HEATER-2
Co4	HEATER-1
Co3	PUMP-2
Co2	PUMP-1
Co1	ALARM RELAY
N	NEUTRAL
N	EARTH
RS485 Modbus (Monitor) to Consultant PC	
RS485 Modbus(Control) ABB ACS550(18.5kW) VSD-1	
RS485 Modbus(Control) ABB ACS550(18.5kW) VSD-2	
RS-485 Modbus RTU	

ETHERNET TCP / IP MODBUS TO SCADA PC

LED-485 Display

DR4524 24vdc PSU

MU-10 Marshalling





INPUT OUTPUT POINTS LIST

GC45 VSEC Evaporative Condensers

GC45 KSF Evap Condensers FH			HOLDING			
Modbus	Point No.	Point name	Modbus	Gcomms	Read/Write parameters	
	313	Last Comms Update Timer		1000	12000	Pack Reset
	331	Comms Fault Alarm		1001	12001	Operating Mode
	337	Fan Overload Alarm	vsd	1002	12002	Number of Pumps
	338	Fan Overload Alarm	vsd	1003	12003	Control Setpoint
	339	Fan Overload Alarm	vsd	1004	12004	Control Setpoint 2
	390	Unknown Point		1005	12005	After Stop delay(mins)
	504	Parameters Locked		1006	12006	Stage up delay(0.1mins)
	520	Unit Cleaning		1007	12007	Stage down delay (0.1mins)
	521	Clean Inhibit Duration		1008	12008	Condensing Offset (C)
	533	Low Water Level Alarm	Di9	1009	12009	Float Min Pressure
	602	Alarms Inhibited		1010	12010	Float Max Pressure
	603	Alarm Inhibit Duration		1011	12011	Cooling Required
	604	Alarm Inhibit Remaining		1012	12012	Pack vsd max Hz
	605	Comms Alarm Delay		1013	12013	Pack vsd min Hz
	608	Unknown Point		1014	12014	Pack vsd P term
	654	Pump 1 Overload	Di1	1015	12015	Pack vsd I term
	656	Pump 2 Overload	Di2	1016	12016	Pack vsd D term
	1146	Communications Quality		1017	12017	Pack vsd period
	1329	Data Point Mapping Alarm		1018	12018	No of fans
	1562	Unit Number		1019	12019	Control Type
	2155	Alarms inhibited during off mode		1020	12020	GComms Setpoint
	2156	Alarms inhibited during fans mode.		1021	12021	Control Input Type(Run\Stop)
	2224	Controller type		1100	12100	P1 Total hours run
	2225	Controller type		1101	12101	Motor Enabled = 1
	2226	Controller type		1150	12150	P2 Total hours run
	2227	Controller type		1151	12151	Motor Enabled = 1
	2228	Controller type		1200	12200	P3 Total hours run
	2229	Controller type		1201	12201	Motor Enabled = 1
	2230	Controller type		1250	12250	P4 Total hours run
	2231	Controller type		1251	12251	Motor Enabled = 1
	5583	Pack ID		1500	12500	F1 Total hours run
	5597	Pack ID End		1501	12501	Motor Enabled = 1
	5660	Condenser General Fault	Di10	1550	12550	F2 Total hours run
	6001	Overview status		1551	12551	Motor Enabled = 1
	6003	Unaccepted alarm		1600	12600	F3 Total hours run
	6005	Parameters Queued		1601	12601	Motor Enabled = 1
	6105	Heater 1 Overload alarm	Di3	2000	13000	H1 Total hours run
	6106	Heater 2 Overload alarm	Di4	2001	13001	Motor Enabled = 1
				2002	13002	Control Cut-In Temp Setpt
				2003	13003	Control Cut-In Diff
				2050	13050	H2 Total hours run
				2051	13051	Motor Enabled = 1
				2052	13052	Control Cut-In Temp Setpt
				2053	13053	Control Cut-In Diff



INPUT			INPUT (cont.)				
Modbus	Gcomms	Controller Read only values	Modbus	Gcomms	Controller Read only values		
1000	10000	Condenser State	1600	10600	Fan 3 State		
1001	10001	Coolant temperature	Ai13	1601	10601	Operating Mode	
1002	10002	Control Action	1602	10602	Compr 1 Capacity %		
1003	10003	Pack capacity	1603	10603	Fan 3 Motor state	vsd	
1004	10004	Stage up timer(secs)	1605	10605	After stop timer(secs)		
1005	10005	Stage down timer(secs)	1606	10606	Fan Fault		
1006	10006	Restart timer(secs)	1607	10607	Motor Load %		
1007	10007	Reason for trip	1608	10610	Fan vsd 3 Status reg		
1008	10008	Ambient Air temperature	Ai13	1609	10611	Fan vsd 3 Comms Fails	
1009	10009	Humidity	Ai7	2000	11000	Heater 1 State	
1010	10010	Setpoint in use	2001	11001	Operating Mode		
1011	10011	Output to Vsd %	2002	11002	Compr 1 Capacity %		
1012	10012	VSD Hz	2003	11003	Heater 1 relay	Do4	
1013	10013	Liquid Line Temperature.	Ai15	2006	11006	Heater Fault	
1014	10014	Discharge Temperature	Ai16	2007	11007	Pond 1 Temperature	Ai14
1015	10015	Discharge Pressure	Ai2	2008	11008	Setpoint in use	
1016	10016	Equivalent Discharge temperature	2009	11009	Control Action		
1017	10017	Floating Setpoint	2050	11050	Heater 2 State		
1018	10018	Evap cond Loop SetPt	2051	11051	Operating Mode		
1019	10019	Control Input Type(Run\Stop)	Di11	2052	11052	Compr 1 Capacity %	
1100	10100	Pump 1 State	2053	11053	Heater 2 relay	D05	
1101	10101	Operating Mode	2056	11056	Heater Fault		
1102	10102	Compr 1 Capacity %	2057	11057	Pond 2 Temperature	Ai17	
1103	10103	Pump 1 Motor state	Do2	2058	11058	Setpoint in use	
1105	10105	After stop timer(secs)	2059	11059	Control Action		
1106	10106	Pump Fault					
1150	10150	Pump 2 State					
1151	10151	Operating Mode					
1152	10152	Compr 1 Capacity %					
1153	10153	Pump 2 Motor state	Do3				
1155	10155	After stop timer(secs)					
1156	10156	Pump Fault					
1500	10500	Fan 1 State					
1501	10501	Operating Mode					
1502	10502	Compr 1 Capacity %					
1503	10503	Fan 1 Motor state	vsd				
1505	10505	After stop timer(secs)					
1506	10506	Fan Fault					
1507	10507	Motor Load %					
1510	10510	Fan vsd 1 Status reg					
1511	10511	Fan vsd 1 Comms Fails					
1550	10550	Fan 2 State					
1551	10551	Operating Mode					
1552	10552	Compr 1 Capacity %					
1553	10553	Fan 2 Motor state	vsd				
1555	10555	After stop timer(secs)					
1556	10556	Fan Fault					
1557	10557	Motor Load %					
1560	10560	Fan vsd 2 Status reg					
1561	10561	Fan vsd 2 Comms Fails					