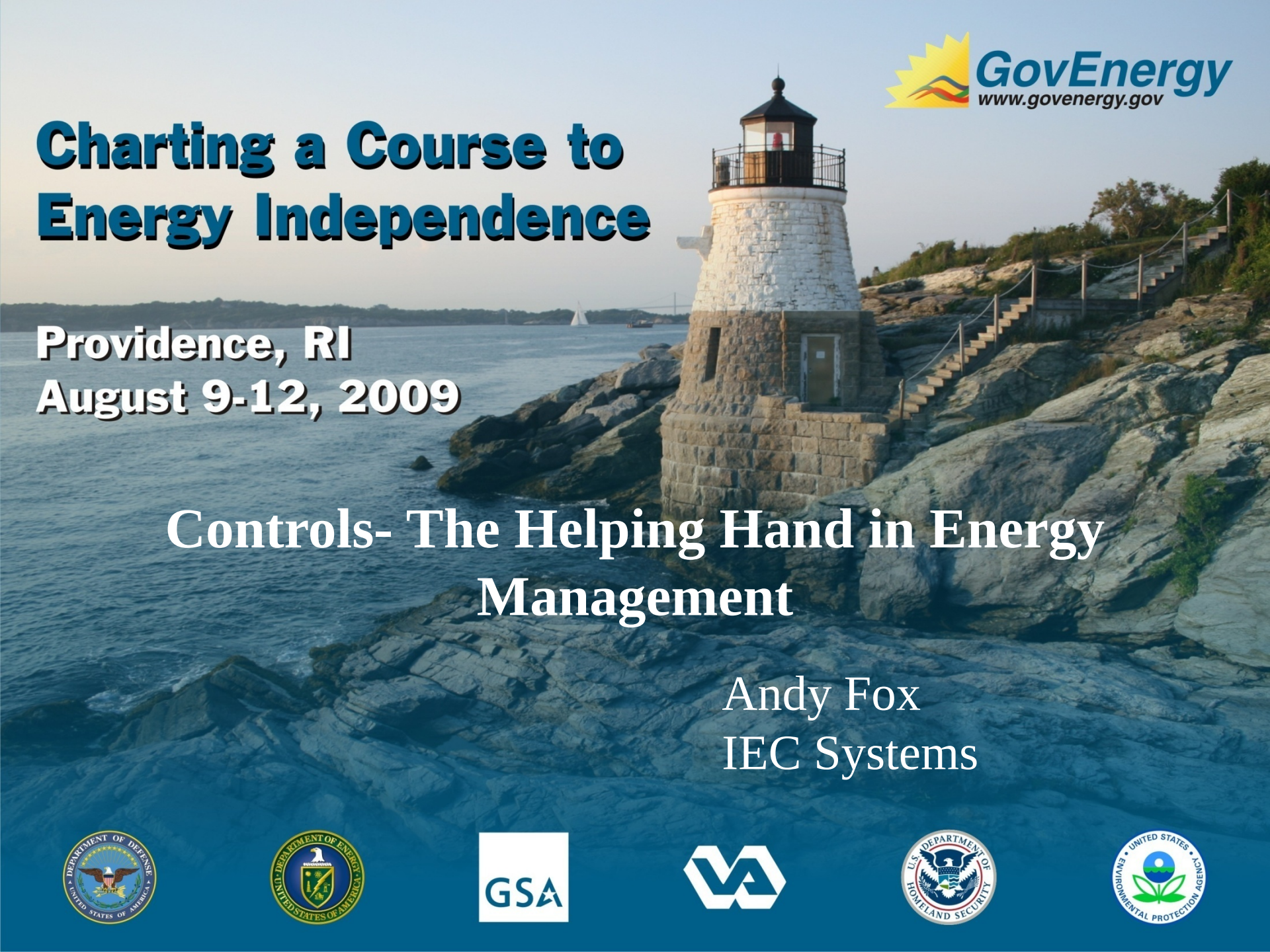
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Charting a Course to Energy Independence
Providence, RI
August 9-12, 2009
Controls- The Helping Hand in Energy Management
Andy Fox
IEC Systems
GSA

Control Interfaces

- What is a control interface and how does it work?
- Cost of interface vs. traditional installation.
- What is the additional data can be gained? How can it be used?

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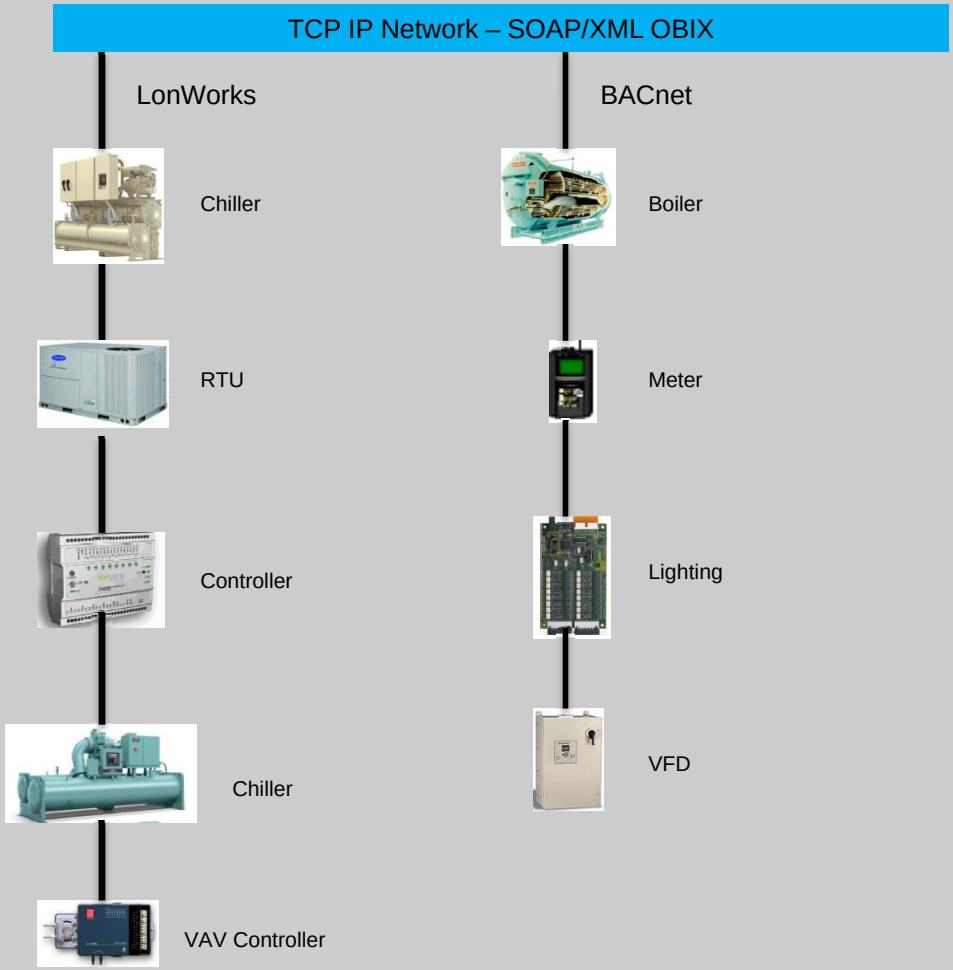
What is Control Interface ?

- It is either a factory installed or field retrofitted communication board (Interface) that reads and/or writes to the equipment manufactures controls that is required to operate the equipment in a safe and efficient manner.
- The interface is installed on some control network peer to peer with other controllers or interfaces.

What is Control Interface ?

- The interface can be provided with many standard industry protocols.
  - LonMark
  - BACnet
  - Modbus

Peer to Peer Network



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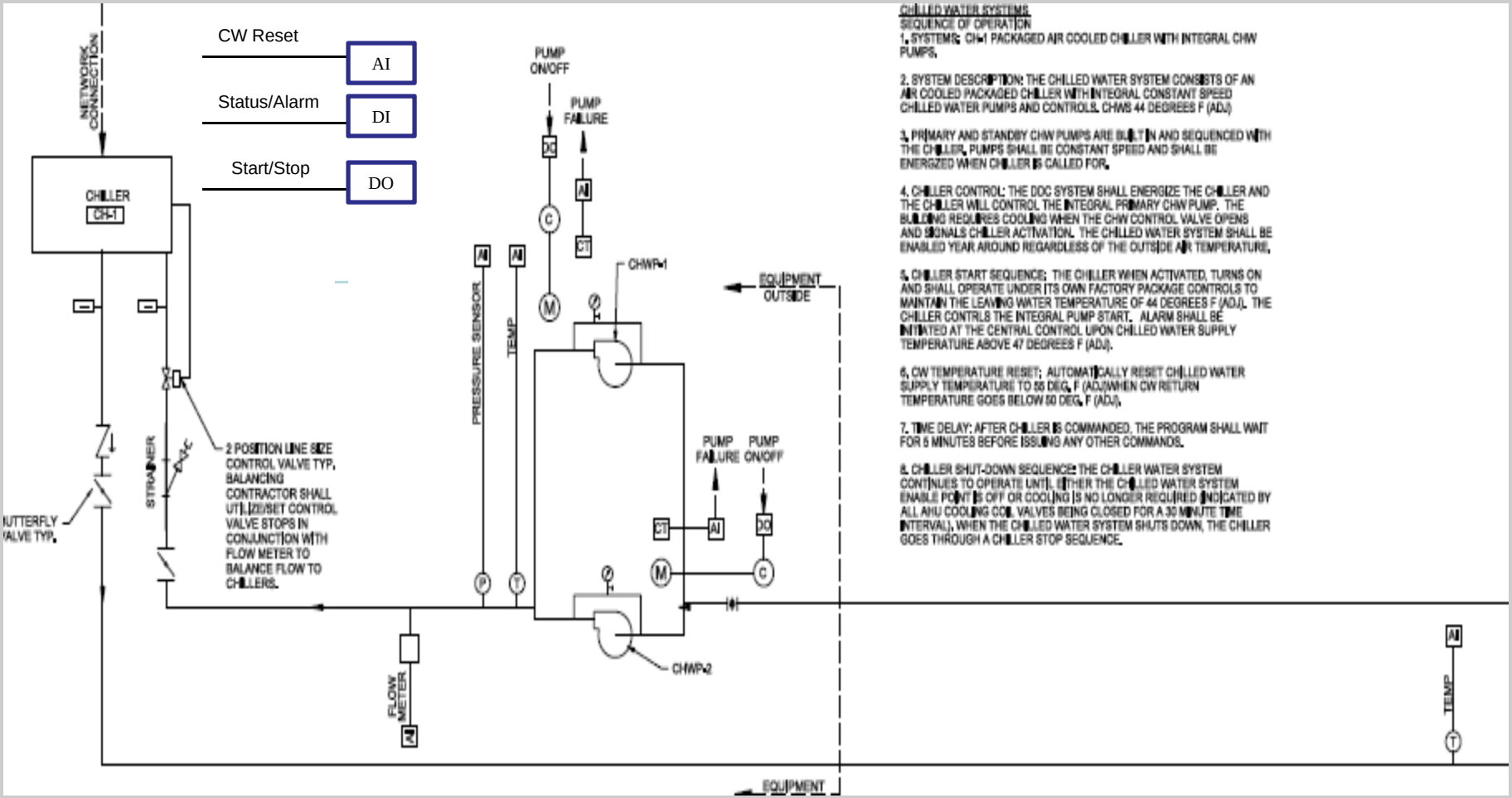
Interface Cost

- Interface can cost from $500.00 to $5,000.00.
- The cost is significantly less if purchased with the equipment from the manufacture.
- The interface is typically pre configured but not always when purchased with the equipment.
- This may required additional start-up (cost and/or fee) during commissioning of new equipment.

Traditional Points List

DESCRIPTION:	DIGITAL OUTPUTS	DIGITAL INPUTS	ANALOG OUTPUTS	ANALOG INPUTS	NETWORK CONECT.	REMARKS
CHILLED WATER SYSTEM						
CHILLED WATER SUPPLY TEMP				1		
CHILLED WATER RETURN TEMP				1		
PUMP 1 ON/OFF	1					HAND-OFF-OVERRIDE SWITCH (NOTE 3)
PUMP 1 STATUS				1		CURRENT SENSING RELAY
PUMP 2 ON/OFF	1					HAND-OFF-OVERRIDE SWITCH (NOTE 3)
PUMP 2 STATUS				1		CURRENT SENSING RELAY
SYSTEM PRESSURE DOWNSTREAM OF PUMPS				1		
SYSTEM TEMP DOWNSTREAM OF PUMPS				1		
CHILLER ON/OFF	1					HAND-OFF-OVERRIDE SWITCH (NOTE 3)
CHILLER STATUS		1				CHILLER CONTROL PANEL
CHILLER ALARM		1				CHILLER CONTROL PANEL
CHILLER RESET			1			0-10V SIGNAL TO PACKAGED CONTROLS (NOTE 3)
DIFFERENTIAL PRESSURE				1		
TOTALS:	3	2	1	7	0	

Traditional Installation



CHILLED WATER SYSTEMS
SEQUENCE OF OPERATION

1. SYSTEMS: CH-1 PACKAGED AIR COOLED CHILLER WITH INTEGRAL CHW PUMPS.

2. SYSTEM DESCRIPTION: THE CHILLED WATER SYSTEM CONSISTS OF AN AIR COOLED PACKAGED CHILLER WITH INTEGRAL CONSTANT SPEED CHILLED WATER PUMPS AND CONTROLS. CHWS 44 DEGREES F (ADJ.)

3. PRIMARY AND STANDBY CHW PUMPS ARE BUILT IN AND SEQUENCED WITH THE CHILLER. PUMPS SHALL BE CONSTANT SPEED AND SHALL BE ENERGIZED WHEN CHILLER IS CALLED FOR.

4. CHILLER CONTROL: THE DDC SYSTEM SHALL ENERGIZE THE CHILLER AND THE CHILLER WILL CONTROL THE INTEGRAL PRIMARY CHW PUMP. THE BUILDING REQUIRES COOLING WHEN THE CHW CONTROL VALVE OPENS AND SIGNALS CHILLER ACTIVATION. THE CHILLED WATER SYSTEM SHALL BE ENABLED YEAR AROUND REGARDLESS OF THE OUTSIDE AIR TEMPERATURE.

5. CHILLER START SEQUENCE: THE CHILLER WHEN ACTIVATED, TURNS ON AND SHALL OPERATE UNDER ITS OWN FACTORY PACKAGE CONTROLS TO MAINTAIN THE LEAVING WATER TEMPERATURE OF 44 DEGREES F (ADJ.). THE CHILLER CONTRLS THE INTEGRAL PUMP START. ALARM SHALL BE INITIATED AT THE CENTRAL CONTROL UPON CHILLED WATER SUPPLY TEMPERATURE ABOVE 47 DEGREES F (ADJ.).

6. CW TEMPERATURE RESET: AUTOMATICALLY RESET CHILLED WATER SUPPLY TEMPERATURE TO 55 DEG. F (ADJ.)WHEN CW RETURN TEMPERATURE GOES BELOW 60 DEG. F (ADJ.).

7. TIME DELAY: AFTER CHILLER IS COMMANDED, THE PROGRAM SHALL WAIT FOR 5 MINUTES BEFORE ISSUING ANY OTHER COMMANDS.

8. CHILLER SHUT-DOWN SEQUENCE: THE CHILLER WATER SYSTEM CONTINUES TO OPERATE UNTIL EITHER THE CHILLED WATER SYSTEM ENABLE POINT IS OFF OR COOLING IS NO LONGER REQUIRED (INDICATED BY ALL AHU COOLING COIL VALVES BEING CLOSED FOR A 30 MINUTE TIME INTERVAL), WHEN THE CHILLED WATER SYSTEM SHUTS DOWN, THE CHILLER GOES THROUGH A CHILLER STOP SEQUENCE.

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Interface Points List

Inputs										
Chiller Enable/Disable Command	X	X	X	X	X	X	X	X	X	X
Chiller Mode [9, 10]	X	X	X	X	X	X	X	X	X	X
Base Loading Auto/On Request	X	X	X							
Base Loading Setpoint Input	X	X	X							
Chilled Water Setpoint	X	X	X	X	X	X	X	X	X	X
Current Limit Setpoint	X	X	X	X	X	X	X	X	X	X
Heating Setpoint	X[11]	X[11]			X[11]	X	X[1]			X[11]
Noise Reduction Auto/On Request					X	X				
Outputs										
Evaporator Water Pump Request	X	X	X	X	X	X	X	X	X	X
Condenser Water Pump Request	X	X	X		X		X	X		X
Evaporator Water Flow Status	X	X	X	X	X	X	X	X	X	X
Condenser Water Flow Status	X	X	X		X		X	X		X
Evaporator Flow Rate [4]	X	X								X
Condenser Flow Rate [4]	X	X								X
Evaporator Leaving Water Temp	X	X	X	X	X	X	X	X	X	X
Evaporator Entering Water Temp	X	X	X	X	X	X	X	X	X	X
Condenser Entering Water Temp	X	X	X		X		X	X		X
Condenser Leaving Water Temp	X	X	X		X		X	X		X
2nd Condenser Entering Water Temp [7]		X								
2nd Condenser Leaving Water Temp [7]		X								
Evaporator Refrigerant Temp/circuit	X	X	X	X	X	X	X	X	X	X
Evaporator Refrigerant Press/circuit	X	X	X	X	X	X	X	X	X	X
Condenser Refrigerant Temp/circuit	X	X	X	X	X	X	X	X	X	X
Condenser Refrigerant Press/circuit	X[5]	X[5]	X	X	X	X	X	X	X	X
Refrigerant Discharge Temp/circuit	X[6]	X[6]	X		X					
Outdoor Air Temperature				X	X	X	X	X	X	X

Interface Points List

Outdoor Air Temperature				X	X	X	X	X	X	X
Condenser Fan Running Output							X	X	X	
Condenser Control Output			X		X					
Condenser Airflow				X	X		X	X	X	X
Active Chilled/Hot Water Setpoint	X	X	X	X	X	X	X	X	X	X
Active Current Limit Setpoint	X	X	X	X	X	X	X	X	X	X
Active Baseloading Setpoint	X	X	X							
Head Relief Request	X	X	X		X					
Compressor Running Output	X	X	X	X	X	X	X	X	X	X
Maximum Capacity	X	X		X	X	X	X	X	X	X
Noise Reduction Mode					X	X				
Defrost Mode						X				
Alarm Description [2]	X	X	X	X	X	X	X	X	X	X
Run Modes	X	X	X	X	X	X	X	X	X	X
Operating Modes [9, 10]	X	X	X	X	X	X	X	X	X	X
State (Alarm, Run, Local, Limited)	X	X	X	X	X	X	X	X	X	X
Base Loading	X	X	X							
Hot Gas Bypass [8]		X						X	X	
Actual Capacity (% RLA)	X	X	X	X	X	X	X	X	X	X
Current per Line	X	X	X	X	X	X	X	X	X	
Voltage per Phase	X	X	X	X	X	X	X			
Power per compressor (kW)	X	X			X[12]					
Oil Temp per Compressor	X	X		X		X	X			
High Side Oil Pressure/compressor	X	X	X	X	X	X				
Low Side Oil Pressure/compressor	X	X								
Compressor Starts	X	X	X	X	X	X	X	X		X
Compressor Run Time	X	X	X	X	X	X	X	X		X
Purge Status [3]	X	X								
24 Hour Pumpout Average/circuit	X	X								

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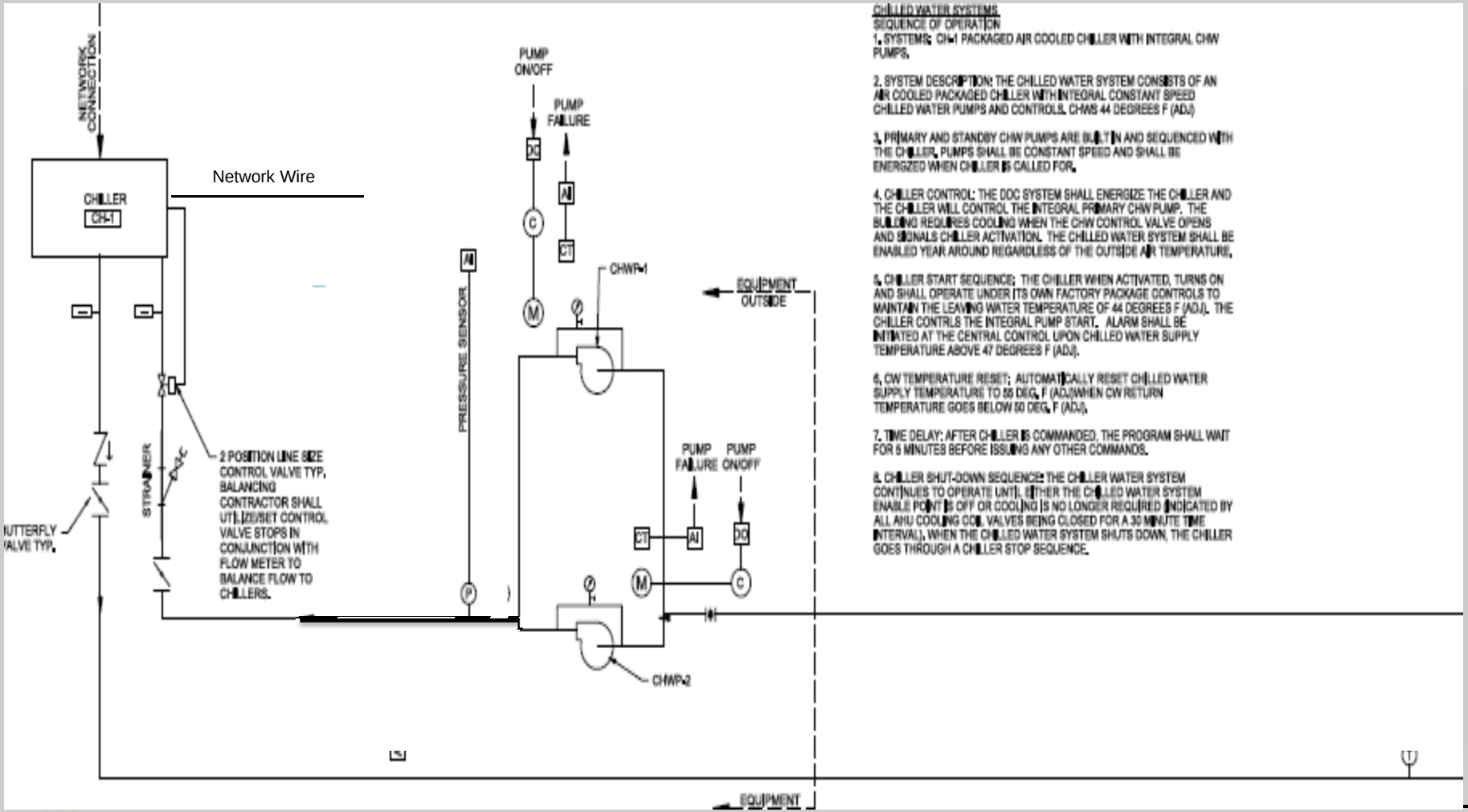
Interface Installation



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What additional data can be gained ? How can it be used?

Chiller Testing and Benchmarking

- Chiller interface can measure everything you need to know about a chiller's operating efficiency. Information can be tracked with the BAS over a wide range of operating conditions to develop a chiller's performance profile "efficiency curve".
- This information can develop baseline operating efficiency and optimize multiple chiller operation.

What additional data can be gained ? How can it be used?

- You will need to measure and record the following 5 points for air cooled and 9 points for water cooled chiller to develop "efficiency curve".
  - Chiller Electrical Power (kW)
  - Chilled Water Flow (gpm)
  - Chilled Water Return Temperature (F)
  - Chilled Water Supply Temperature (F)
  - Condenser Water Flow (gpm)
  - Condenser Water Return Temperature (F)
  - Condenser Water Supply Temperature (F)
  - Outside Air Dry-Bulb
  - Outside Air Humidity