2 Chiller Operation

The Allen-Bradley Logix system is a fully integrated control system for Titan chillers. It controls all aspects of chiller operation, monitoring vital parameters and making real-time adjustments as necessary to ensure safe and efficient operation of primary system components.

A full-color, animated TFT operator interface provides the operator access to all real-time sensor data, and is equipped with both sensor history logging and complete alarm/system trip history features. Manual adjustments to operational parameters may be made by a qualified service technician. Among the monitored operating parameters are:

- Chilled liquid temperatures
- Refrigerant pressures and temperatures
- Cooling liquid temperatures
- Compressor data
- Pre-rotation vane position
- Evaporator data
- Condenser data
- Subcooler data
- Oil pump pressures
- Motor Load
- General system data and data trending

The system setpoints are operator entered and include:

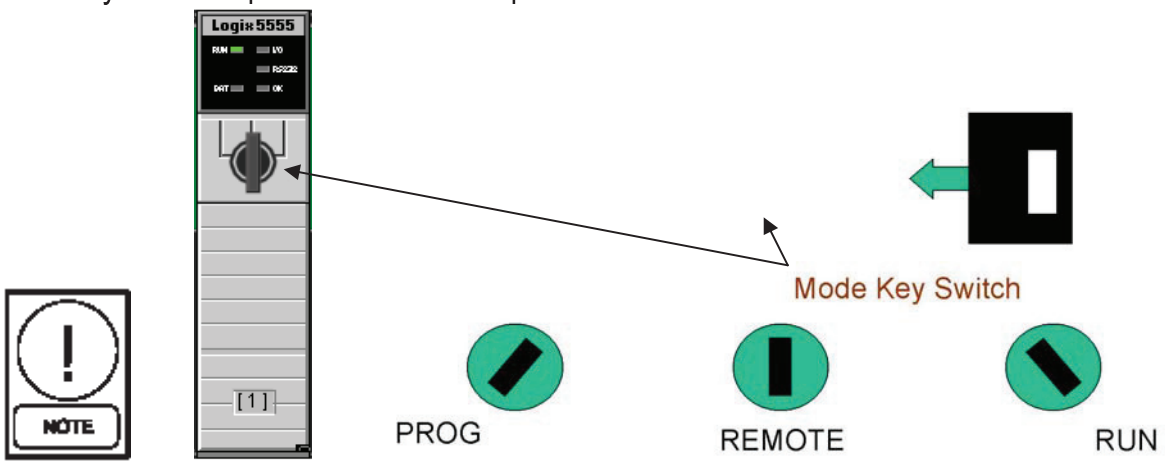
- Local Chilled liquid temperature setpoint
- Remote setpoint temperature
- Percent load limit
- Clock

Additional modifications may be made to system PID tuning. All data and control features are accessible from the Graphic Plus operator interface panel.

2.1.1 SYSTEM ARCHITECTURE

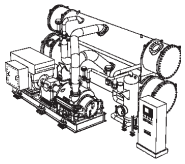
The fully integrated Allen-Bradley Logix Control System is responsible for monitoring and controlling all aspects of chiller operation, and is provided with a multifunctional TFT operator interface control panel linked to an Allen-Bradley processor that comprises the Control System. The operator interface panel is the exclusive means by which the user interacts with the chiller control system with the use of animated full color screens coupled with soft buttons and a numeric keypad.

The TITAN chiller control system is shipped with the PLC processor in a “PROGRAM” mode or Standby Mode. The keyswitch is placed in such a position that the ladder logic will not run unless the keyswitch is placed in a “RUN” position.



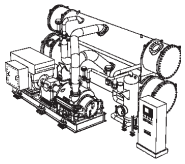
2.1.1.1 PLC Processor Status LEDs

Indicator:	Color:	Description:
RUN	off	The controller is in Program or Test mode.
	solid green	The controller is in Run mode.
OK	off	No power is applied.
	flashing red	Either of the following: If the controller is a new controller, then it requires a firmware update. If the controller is not a new controller, then a major fault occurred. To clear the fault, either turn the keyswitch from PROG to RUN to PROG or go online with RSLogix 5000.
	solid red	The controller detected a non-recoverable fault, so it cleared the project from memory. To recover: 1. Cycle power to the chassis. 2. Download the project. 3. Change to Run mode. If the OK LED remains solid red, contact your local Rockwell Automation representative or distributor.
	flashing green	An NVS Program save or restore on the controller is occurring.
	solid green	The controller is OK.
BATTERY	off	The battery supports memory.
	solid red	Either of the following: The battery is not installed. The battery is 95% discharged and should be replaced.
I/O	off	Either of the following: The controller project is not downloaded (the condition after power up). No I/O **or** communications configured
	solid green	The controller is communicating to **all** devices.
	flashing green	One or more devices are not responding.



2.1.1.2 PLC Battery

Follow the Allen-Bradley recommended schedule for replacing the PLC battery, which provides battery backup for the ladder logic and memory.



Connect the 1769-BA Battery

The controller is shipped with the 1769-BA battery packed separately. To connect the battery, follow the procedure shown below.

ATTENTION

The 1769-BA battery is the only battery you can use with the 1769-L32, -L35E controller. The 1747-BA battery is not compatible with the 1769-L32E, -L35E controller and may cause problems.

1. Slide the battery door forward.

IMPORTANT

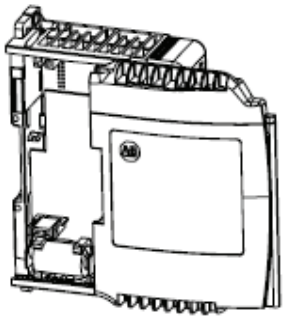
Do not remove the plastic insulation covering the battery. The insulation is necessary to protect the battery contacts.

2. Insert the battery into the battery port. Insert the battery connector into the connector port. The connector is keyed to engage in the correct polarity.
3. Slide the battery door back until it clicks into position.

WARNING

When you connect or disconnect the battery an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

For Safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see *Guidelines for Handling Lithium Batteries*, publication AG 5-4.

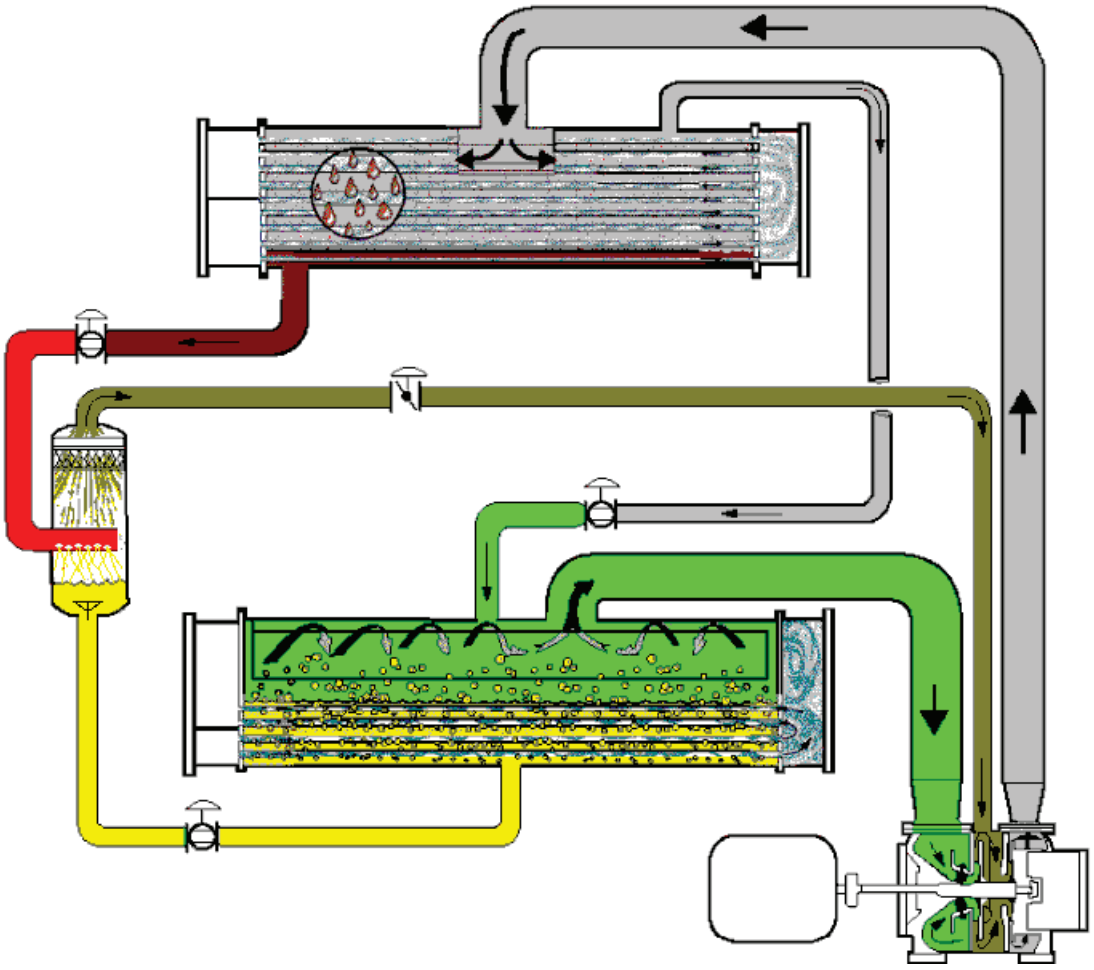


A-B catalog# 1769-BA battery
YORK P/N 025-40298-001

2.1.2 Control System Diagrams

Refer to Section 4 of the IOM for chiller specific Control Panel drawings and Elementary Wiring Diagrams.

2.2 General Operating Sequence



2.2.1 Unit not operating

1. Control power is available to the control panel.

2. Compressor sump oil heaters are thermostatically controlled above saturation.

Only apply auxiliary control voltage to the chiller when the oil sumps have been filled with oil. Uncovered oil heater assemblies will produce high temperatures and destroy compressor oil sump components.

3. The capacity controls are disabled.
   -The compressor pre-rotation vanes are closed.
   -The hot gas bypass is closed when the evaporator pressure is below a freezing potential / open above freezing
   -The subcooler level valve is open.
   -The intercooler level valve is open.
   -The interstage side load valve is closed.

2.2.2 System startup

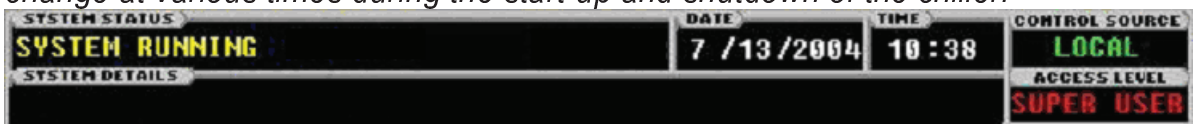
1. All chiller safety logic must be satisfied prior to starting, with the exception of the compressor and gear low oil pressure, the chilled water and condenser water low differential pressure, and the Vibration Monitor (optional). The oil pressure safeties are bypassed initially, until the auxiliary oil pumps can establish pressures. The differential pressure safeties are bypassed until the water pumps can establish flows. The Vibration Monitor Trip signals are bypassed at shutdown and until 2 seconds after the compressor motor has started to prevent nuisance trips caused by the temporary excessive vibrations during start-up and shutdown. The flow safeties are bypassed until the water pumps can establish flows. 5 seconds before the Pre-lubrication cycle completes the flows must be established, or the unit will trip on loss of water flow.

*The hardwired "**SYSTEM RESET**" button **must** be pushed to clear any previous safety trips or power failures (if any). The R1 hardwired safety relay must be physically reset by the Reset Pushbutton. The R1 relay is hardwired in series with the*

high-pressure cutout and the emergency stop to shut down the main motors in the most extreme danger.

During the commissioning procedures, the Emergency Stop button should be pulled, and R1 relay should be removed to prevent any undesired operation of the main motor starters.

The System Status indicator box in the upper left corner of the GRAPHIC DISPLAY screen will display the GREEN text "READY TO START." This display will change at various times during the start-up and shutdown of the chiller.

2. 

See section 2.6 - Graphic Displays *for further details on the operator interface.*

If the chiller has been recently started and shut down, the motor must remain off for sufficient time to cool down. See "Anti-recycle operation" for further details.

3. The chiller start may be initiated at this time by pushing the "**START**" button.

***NOTE**: Local vs. Remote control of the start is established by the condition of the "LOCAL-REMOTE START" buttons on the "Cooler" Screen. A start mode change may only be made with the unit stopped.*

When in LOCAL, the start sequence begins as soon as the operator pushes the "**START**" button on the front of the chiller control panel.

When in REMOTE, the "DCS CHILLER REMOTE START CONTACT" (Across the network interface) must momentarily close to energize PLC and initiate the chiller start sequence. Alternately, the chiller can be started by a remote run contact (Refer to the wiring diagram). The option for remote hardwired start must be configured on the Evaporator Screen. This will be covered in greater detail in section 2.6

The chilled and condenser water flows must be established by the customer's pump control system or manually by the operator within 25 seconds after a start is initiated in order to close the chilled and condenser water low flow cutout contacts and continue with the start sequence.

4. With the above "**INITIATE START**" signal, the chiller controls start the compressor and gear auxiliary oil pumps, and their respective symbols on the display change from GREEN to RED. If the pumps fail to start within 2 seconds after the PLC output is energized, an alarm signal will be transmitted to the display for indication and recording.

5. Twenty-five seconds after the "**INITIATE START**," the compressor and gear low oil pressure signals and low pressure cutout switches are checked. The chilled and condenser water low differential pressure cutout switches are also checked.

   If the minimum oil pressures are not established, startup will be prevented and an alarm signal will be transmitted to the display for indication and recording. At this point, the operator would manually turn on the auxiliary oil pumps by pressing the "AUTO MANUAL" button on the appropriate display screen. After adequate pressure is established, the starting may continue.

6. At 30 seconds after the "INITIATE START," with the oil pressures and water flows established, a signal is provided to energize the compressor drive motor start control relay in series with (R1) to close its contact and energize the motor starter control circuit. When the starter has completed and the transition to full voltage operation, an auxiliary contact from the starter run (full voltage) contractor is input to the chiller control panel PLC to operate the following:

   a) Compressor pre-rotation vanes start from fully closed when the main motor contactor pulls in.
   The vanes are then open to a minimum startup position (approximately 10%) when the motor starter reports that the motor is up-to-speed. Then the vanes are released to a ramp, and the calculated minimum anti-surge position based on compressor head and minimum vane position.

   b) Hot gas bypass valve will now begin to ramp open / closed respectively at a predetermined programmable rate.

c) The Intercooler Level control valve LCV-116 will start ramping closed to maintain a level in the intercooler. The LCV-116 will maintain the intercooler level until shutdown. This refrigerant inventory management procedure insures that vast quantities of refrigerant aren't accumulated in the evaporator, which can cause liquid carryover.

After the interlock is established, the compressor pre-rotation vanes are opened to their minimum position necessary to prevent "surging" during the initial acceleration at start-up.

7. An auxiliary contact from the starter main (start) contactor is input to the chiller control panel PLC to enable the anti-recycle logic.

   If the starter auxiliary (start) contact does not close within the transition time of the starter, an alarm signal will be transmitted to the display for indication and recording and the start relay will be de-energized.

8. At 2 seconds after the starter auxiliary (start) contact closes, the Vibration Monitor Trip Bypass contact is opened to allow vibration trips to occur. (optional)

9. When the starter has completed and the transition to full voltage operation, an auxiliary contact from the starter run (full voltage) contractor is input to the chiller control panel PLC to operate the following:

   a) Enable the capacity control circuit. Compressor pre-rotation vanes and hot gas bypass valve will now begin to ramp open / "closed at a predetermined rate. See section on Capacity Control Ramp for further details on the ramp-up of the controls.
   b) De-energize the compressor oil heaters, and energize the auxiliary cooling water solenoid valve.

10. The system status display will display "**SYSTEM RUNNING**". When the shaft pumps maintain the gear and compressor oil pressures for a 100 second time period (through the respective auxiliary oil pump control logic), the auxiliary motor driven oil pumps will be stopped.

    NOTE: Whenever either the gear or compressor shaft pump oil pressure falls below the auxiliary oil pump control logic setting, the auxiliary pump motors will be restarted and an alarm signal will be transmitted to the display for indication and recording.

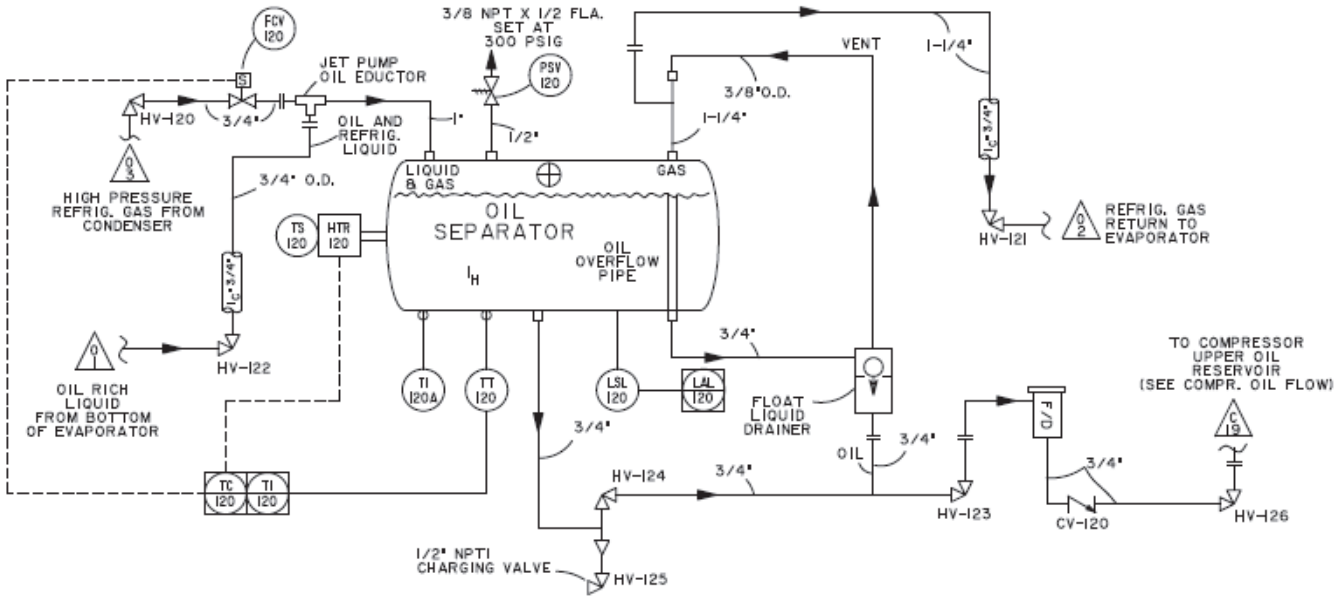
    If either shaft pump does not produce sufficient oil pressure to satisfy the auxiliary oil pump control logic within five minutes after start, an alarm signal will be transmitted.

11. The compressor sump vent solenoid valve is energized 20 seconds after the compressor shaft oil pump maintains sufficient pressure for a 100 second time period. It then remains energized until the next shutdown.

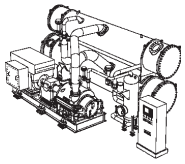
    This allows the sump vent ball valve to slowly open at a rate determined by the setting of the needle valve located in the air supply line upstream of the solenoid valve (see Compressor Oil Flow Diagram).

    The needle valve must be adjusted so that the valve opens slowly enough to prevent foaming in the compressor sump caused by too rapid a sump pressure reduction on startup.

12. 100 Seconds after the motor starter auxiliary (run) contact closes, the oil separator heaters are energized. When the oil temperature in the separator reaches approximately 100°F, the temperature control switch closes to actuate the solenoid valve in the high pressure gas supply line to the eductor. The eductor will then pull a fresh oil and refrigerant mixture from the bottom of the evaporator, into the separator. The refrigerant is boiled off and returned to the evaporator. The oil level increases and flows out of the separator, to return to the compressor. Refer to the Refrigerant Flow Diagram for further details.



13. 5 Minutes after the motor starter auxiliary (run) contact closes, the subcooler level control valve begins to ramp closed to allow liquid refrigerant to accumulate in the subcooler.

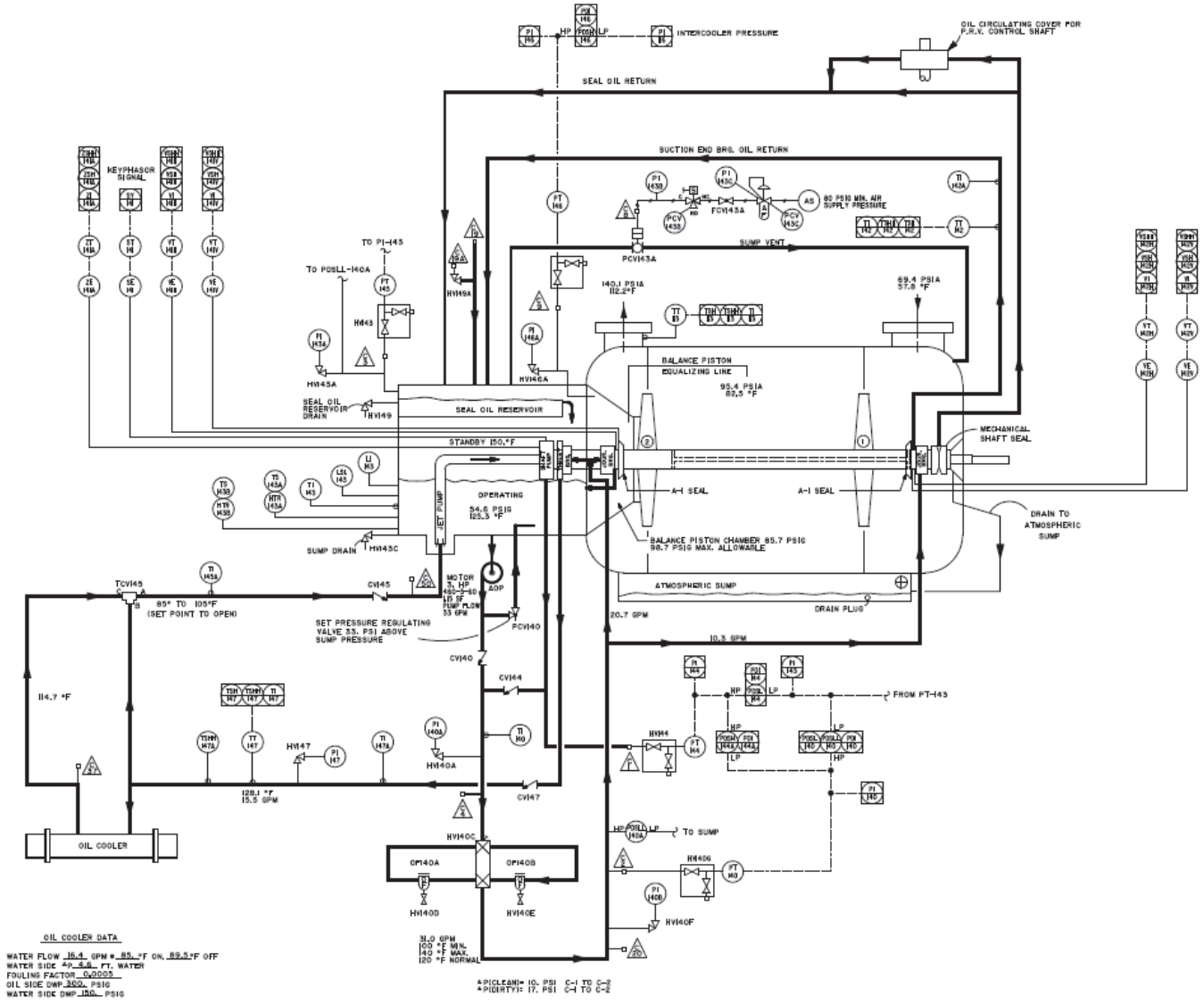


14. 10 Minutes after the motor starter auxiliary (run) contact closes, the interstage valve begins to ramp open to reduce the pressure in the intercooler.

15. 11 Minutes after the motor starter auxiliary (run) contact closes, the interstage liquid injection solenoid valve is energized.

16. The capacity controls operate to control chiller capacity in response to chilled water outlet temperature. The hot gas will ramp closed first while maintaining a minimum vane anti-surge position on the vanes. The capacity controls are further described by flowchart in a later section. After the ramp-up is completed, the capacity controls operate to control chiller capacity in response to chilled water outlet temperature.

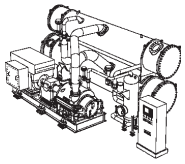
Compressor Oil Flow Diagram
(typical)



2.2.3 Ramp-up of capacity controls

The ramp-up feature is used to provide a gradual increase in chiller capacity during start-up.

Refer to Capacity Control Diagram along with the following description to best understand the operation:



The GRAPHIC DISPLAY will indicate when the chilled water out temperature control is in the manual mode. This occurs when the unit is shut down, during ramp-up and when the “MAX POWER DEMAND LIMITER” or the “EVAP LOW PRESS. OVERRIDE” control signal is being used to control the capacity of the chiller.

With the unit stopped, the chilled water out temperature control is in manual, its setpoint is equal to the chilled water out temperature and its output is equal to the PRV signal. (When in manual, the controller drives its output to the same as the tieback valve, which would be 0% with unit off.)

When start is initiated, the PRV signal goes to the “START-UP SIGNAL” value. This value determines the position of the compressor pre-rotation vanes at the instant the main motor starts. It is adjusted to keep the starting load on the motor low but also allow enough gas flow through the compressor to prevent surging at start-up.

After the compressor motor starts, the “START-UP SIGNAL” value increases at a rate determined by the “START_UP RAMP TO MIN. PRV SIGNAL TIME” setpoint until it reaches PROGRAMMED CAPACITY CONTROL FUNCTIONS, the “MIN PRV SIGNAL” value (minimum PRV signal allowed with the compressor running), and then holds at this value.

The “HGV RAMP CONTROL” output begins to decrease at this time to start closing the hot gas bypass valve.

After the motor power drops below the “MAX. POWER DEMAND LIMITER” setpoint, its output signal increases rapidly to 100%. LSR-3 and LSR-4 will then select the lower “PRV RAMP CONTROL” output signal.

The hot gas valve will continue closing during the ramp-up period at a rate determined by the “HGV RAMP TIME” setpoint as long as the “HOT GAS CONTROL” output remains below the HGV ramp output signal.

During the ramp-up period, the “CHILLED WATER OUT TEMP. CONTROL” setpoint will track the chilled water out temperature and its output will be driven to equal the PRV signal. The vanes will continue to open at a rate determined by the “PRV RAMP TIME” setpoint as long as the “CHILLED WATER OUT TEMP. CONTROL” remains in “MANUAL.”

If during ramp-up the capacity increases sufficiently to lower the chilled water outlet temperature to less than 2° above the desired setpoint, the “CHILLED WATER OUT TEMP. CONTROL” is changed to the automatic mode and its output now changes in response to load changes.

If the chilled water temperature continues to fall, the “CHILLED WATER OUT TEMP. CONTROL” output will decrease causing the hot gas valve and PRV to move to whatever positions are required to maintain the chilled water at setpoint and provide stable compressor operation.

When the ramp-up is completed (PRV signal at 100%) and/or the “CHILLED WATER OUT TEMP. CONTROL” is changed to automatic, its setpoint will return to whatever setpoint is stored in the PLC memory at that time (if in “LOCAL SETPOINT” mode), or will change to the PROGRAMMED remote setpoint (if in “REMOTE SETPOINT” mode). The setpoint will change slowly at a rate determined by the “SETPOINT RAMP” rate value to the desired value.

The above tracking and reset tieback controls disable the “CHILLED WATER OUT TEMP. CONTROL” during shutdown and ramp-up when other logic is in control and provide for a smooth transition to automatic control as required.

The GRAPHIC DISPLAY “CAPACITY CONTROLS DIAGRAM” Screen will indicate which signals are currently in control of the pre-rotation vanes and valves during start-up.

2.2.4 System shutdown

1. The chiller may be shutdown normally by momentarily closing the DCS REMOTE STOP CONTACT to energize PLC Remote Controlled Stop Input, or by depressing the local **STOP** pushbutton. Also, the chiller may be stopped via a safety control, in which event the GRAPHIC DISPLAY displays and records the cause of shutdown.

2. Avoid shutting down the chiller while still under high head conditions. Backspin can be violent and damaging to the compressor. It is best practice to unload the chiller before shutting down. During a controlled stop unload procedure, the vanes are brought closed, the and Hot Gas Valve is opened to drop the head across the vessels. Process Chiller controlled stops are generally shorter than Comfort Cooling Controlled stops.

The following safeties are "Hardwired" to stop the chiller regardless of the condition of the PLC Output controlling the motor starter:

Emergency Stop-Pull to Stop Pushbutton
Compressor Discharge High Pressure Cutout
Chilled Water Low Differential Pressure Cutout

Condenser Water Low Differential Pressure Cutout
All Compressor Motor Starter Safeties
Compressor Oil Low Differential Pressure Cutout
Compressor Thrust Bearing Oil High Temperature Cutout

a) The Vibration Monitor Trip Bypass contact is closed to prevent nuisance alarms.

b) The compressor pre-rotation vanes are closed to minimize back flow of gas through the compressor. The hot gas valve is opened (above freezing conditions) to equalize the condenser pressure with the evaporator. The sideload valve is closed. These actions are taken to reduce backspin of the compressor on shutdown.

c) The compressor motor start relays are de-energized to open their contacts and de-energize the motor starter control circuits. The compressor post-lube timing logic is enabled and the auxiliary oil pumps will run for 3 minutes to cool the oil system with the auxiliary water solenoid valve opened.

d) The compressor sump vent solenoid is de-energized to close the sump vent line ball valve.

e) The subcooler level control and intercooler level control valves are opened fully to drain the refrigerant out.

f) The water flow, and low oil pressure safety logic is inactivated to prevent nuisance alarms.

g) The anti-recycle timer is activated at this time. The anti-recycle (cool down) time depends on the description under " Anti-recycle operation " at the end of this section.

During this time, further restarts of the motor are prevented and the "**ANTI-RECYCLE**" text on the GRAPHIC DISPLAY screen is YELLOW.

3. The condenser water flow may be shut off after the postlube cycle is complete.

If the shutdown is caused by Low Refrigerant Pressure, this could be an indication of a major refrigerant leak. In this event, the chilled water flow must be

maintained to prevent freeze-up and damage to the tubes.

4. Five seconds after the oil pumps shut down, the compressor oil heaters are energized if the temperature of the oil requires it.

2.2.5 Anti-recycle operation

1. **Cold Starts**

   If the motor has been shut down for 8 hours, the cool down (anti-recycle) time will be 2 minutes for the first and second cold start.

   To start a third time, the chiller must be off for 30 minutes.

   Any additional starts would be considered hot starts.

2. **Hot Starts**

   If the chiller has been running less than 20 minutes, the cool down time will be the difference between 45 minutes and the hot motor running time since last start. For example, if chiller has run 5 minutes since last start, cool down time would be…
   45-5 = 40 minutes

   If the chiller has been running 20 minutes or longer, the cool down time will be 2 minutes.

Excessive Starts

When the motor is started, a 24-hour counter is enabled. During the next 24-hour period, a total of 5 additional starts are allowed. If 6 starts are attempted in any 24-hour period, the chiller start logic is locked out for a minimum of 3 hours.

2.3 Capacity Control Operation

Much of the function of the Control System is dedicated to chiller capacity control. Sensors register system conditions that are used to infer the total cooling load and make necessary adjustments to the system components.

There are two primary mechanisms by which cooling capacity is controlled: pre-rotation vanes, and the hot gas bypass valve. The primary directive of the Control System is first to maintain

safe operating conditions, then to keep the system online, and finally to efficiently maintain setpoints.

The interaction of capacity control subsystems is complex, and can be better understood by referring to the capacity control diagram in the accompanying figures

2.3.1 Major capacity control devices

1. **Compressor Pre-rotation Vanes:**

The compressor pre-rotation vanes (PRV's) are internal guide vanes in the suction flow path to the impeller wheel. The PRV's are used to throttle the refrigerant flow through the system as a means of controlling capacity in response to the leaving chilled water temperature. If the leaving chilled water temperature falls below the setpoint, the PRV's are partially closed until the net cooling is reduced and the leaving chilled water returns to setpoint.

In the event of high motor power, the capacity control signal is over-ridden and the compressor PRV's are closed to keep the motor power down. On start-up, the PRV's are closed to reduce the starting load torque of the compressor.

The compressor pre-rotation vanes are closed on shutdown to reduce backflow of high-pressure gas from the condenser, which might otherwise cause the compressor to spin backwards at a high rate of speed.

The mechanical pre-rotation vane linkage at the compressor is operated by a Conoflow piston operator, which has a pneumatic 3-15 psig / 0.2-1.0 barg direct acting positioner (increasing air signal opens the PRV's). The capacity control signal from the PLC is converted from 4-20 mA DC to a 3-15 psi / 0.2-1.0 barg pneumatic signal by an I/P transducer. The vanes will be fully closed at 4 mA DC, fully open at 20 mA DC.

2. **Hot Gas Bypass Valve:**

The hot gas bypass valve is used primarily at low loads to maintain a minimum suction gas flow required by the compressor for stability. When the compressor has reduced capacity to its minimum flow (via pre-rotation vane throttling), further capacity reductions are accomplished by opening the hot gas bypass valve. This maintains the flow to the compressor by bypassing the discharge gas back to the compressor suction.

However, the hot gas flow replaces the useful evaporation in the cooler since the compressor flow is at minimum. Thus, the net chilling capacity is reduced (albeit not efficiently).

The minimum suction flow or minimum compressor PRV position will vary. As the differential "head" pressure is lowered (due to colder condenser water) the compressor is capable of stable operation at lower loads. The programming in the chiller panel thus uses the differential "HEAD" pressure to establish when the hot gas may be needed.

- On a water chilling application, this valve goes open on shutdown.
- On a brine application this valve is closed at shutdown to allow the pressures to drop slowly. Allowing low pressure cold refrigerant from the evaporator to migrate into the condenser, would create a freezing hazard for the condenser water.

The hot gas valve is a pneumatic rotary ball type control valve with pneumatic positioner. The control signal from the PLC is 4-20 mA DC, which is converted to a 3-15 psig / 0.2-1.0 barg pneumatic signal by an I/P transducer. The valve will be fully open at 4 mA DC, fully closed at 20 mA DC.

3. Subcooler Liquid Level Valve LCV-114:

The subcooler liquid level valve controls the refrigerant liquid level in the subcooler located in the bottom of the condenser to maintain the proper amount of subcooling and provide the most efficient operation at all loads.

This valve is opened after shutdown to allow a slow change in pressure between evaporator and condenser. The pressure in the condenser forces the liquid out of the condenser into the intercooler and the evaporator. Allowing low-pressure cold refrigerant from the evaporator to migrate into the condenser would create a freezing hazard for the condenser water. It opens at start-up and then slowly closes until it reaches the position dictated by the liquid level control PID instruction in the PLC logic.

The liquid level valve is a pneumatic rotary ball type control valve with pneumatic positioner. The control signal from the PLC is 4-20 mA DC, which is converted to a 3-15 psig / 0.2-1.0 barg pneumatic signal by an I/P Transducer. The valve will be fully open at 4 mA DC, fully closed at 20 mA DC.

4. Intercooler Liquid Level Valve LCV-116:

The Intercooler liquid level valve controls the refrigerant liquid level in the intercooler to maintain a good liquid seal between the flash gas in the top of the intercooler and the liquid to the evaporator, this provides the most efficient operation at all loads.

The liquid level valve is a pneumatic rotary ball type control valve with pneumatic positioner. The control signal from the PLC is 4-20 mA DC, which is converted to a 3-15 psig / 0.2-1.0

barg pneumatic signal by an I/P Transducer. The valve will be fully open at 4 mA DC, fully closed at 20 mA DC.

5. **Interstage Gas Sideload Valve PCV-116:**

The interstage sideload valve controls refrigerant flash gas, from the intercooler to the second stage compressor impeller wheel when required to maintain a minimum pressure differential between the intercooler and the evaporator.

At normal conditions, the interstage valve will remain fully open during compressor operation and close on shutdown to reduce compressor backspin.

This valve remains closed for after start-up to allow the subcooler level controller to establish a liquid level in the subcooler and then slowly opens until it reaches the position dictated by the capacity controls.

When the intercooler liquid seal pressure differential pressure (intercooler pressure minus evaporator pressure) falls below the minimum allowed (due to colder than normal condenser water temperatures), the interstage valve is driven closed by the "INTERCOOLER MIN. DIFF. PRESS. CONTROL" in software. This maintains a minimum pressure in the intercooler and ensures that the intercooler refrigerant level valve will have sufficient pressure drop to accommodate the design flow of liquid being expanded to the evaporator.

The interstage valve is a pneumatic rotary butterfly type control valve with pneumatic positioner. The control signal from the PLC is 4-20 mA DC, which is converted to a 3-15 psig / 0.2-1.0 barg pneumatic signal by an I/P Transducer. The valve will be fully closed at 4 mA DC, fully open at 20 mA DC.

2.3.2 Programmed capacity control functions

2.3.2.1 Temperature Control

Using the input signal from a temperature sensor in the leaving chilled water line, this control provides an output signal, which decreases as water temperature drops below set point to reduce the capacity of the chiller. When override and anti-surge conditions are satisfied, the temperature control subsystem may dominate. Since temperature control is the highest function associated with capacity control, its task must be concurrent and compliant with all other subsystems and subsystem directives. It indirectly controls the hot gas valve, and pre-

rotation vanes in its attempt to maintain the chilled water temperature setpoint while keeping the compressor out of surge.

2.3.2.2 Dynamic Override Controls

There are four operating parameters that are primarily concerned with the safe operation of the system: evaporator pressure, condenser pressure, intercooler pressure, and motor load. If any of these parameters were to exceed the limits defined by the setpoints, it could lead to a shutdown of the chiller by the safety setpoints. Maintaining chiller operation is the function of the Dynamic Override subsystem.

This power override control function uses the motor power input signals to limit capacity. When one of the motor powers exceeds the setpoint, the control puts out a decreasing signal. The LSR-2, LSR-3 and SS-1 will then pass this lower signal on to close the compressor pre-rotation vanes, thus reducing the demand on the motor and returning the motor demand limit to below the maximum threshold.

The pressure override systems prevent a system operation condition from shutting down a chiller prematurely.

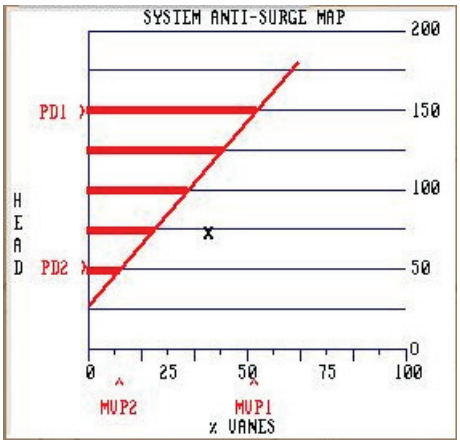
The discharge pressure override produces an unloading effect on the chiller if the cooling water to the chiller goes above design. If the chiller were not unloaded in this condition, the high-pressure cutout would shut the chiller down, and no cooling would be done. The intercooler pressure override operates the same way, to protect the pressure limitations of the economizer vessel.

The low evaporator pressure override is a key override in preventing the unit from either freezing or going down on low evaporator conditions. A system overshoot, or a low temperature transition in process water can result in a low suction pressure condition. During startup, the condensing pressure may initially be low. This can cause the refrigerant to back up. If this occurs, the low level of evaporator liquid uncovers a portion of the tube bundle, thereby reducing the heat exchanger performance, and lowering the evaporator pressure. The low evaporator pressure override unloads the chiller rapidly, and often opens the hot gas valve to try to maintain a suction pressure in the chiller. As the fault condition subsides, the override backs off and returns the chiller to normal temperature controlled operation.

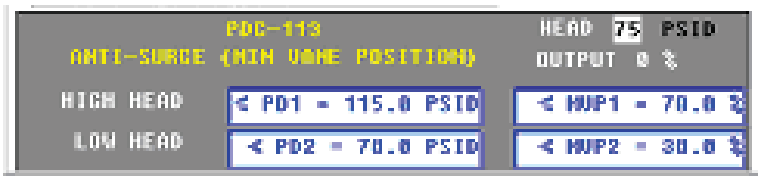
2.3.2.3 Anti-surge

Compressor surge is an undesirable condition occurring at low partial loading in which the system head pressure exceeds the dynamic pressure developed at the compressor discharge volute, causing localized reverse fluid flow through the impeller accompanied with loud noise and mechanical stresses. Opening the hot gas bypass valve, and keeping the vanes at a

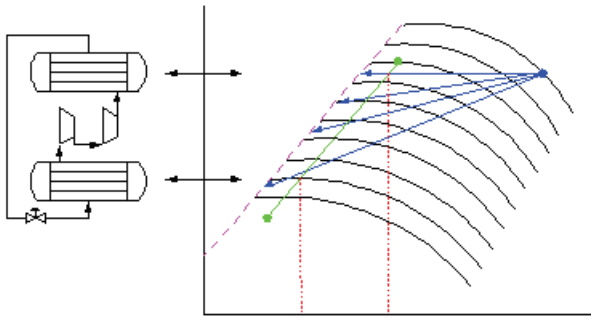
calculated position according to head mitigates surge. Keeping the compressor out of surge is the function of the anti-surge subsystem. The anti-surge system is based on a straight-line approximation of the compressor surge curve.



The anti-surge line is biased to the right of the actual surge line. When the compressor needs to move left on the map, and move less mass flow, the vanes can only be reduced so far, before a lack of mass flow causes a surge condition. The anti-surge system supplements mass flow to the compressor by using the Hot Gas Bypass valve. This allows the chiller to be unloaded without danger of surge. Once the anti-surge system has been set for the maximum head condition, and the minimum head condition, the compressor is protected from surge. The point represented by the intersection of PD1 and MVP1 is the worst case operating condition of the compressor, with high head and low load. The other condition that defines the anti-surge line is at low head and low load, represented by the intersection of PD2 and MVP2. The shaded area of the left side of the map is the surge area. The vanes cannot close more than a given percentage for a given head condition, defined by this line. As the capacity control system unloads the chiller, the Hot Gas Bypass valve is opened proportionally to maintain stable operation and control the process.



Anti-surge override acts at HSR-1 on the capacity controls diagram.



2.3.2.3.1 Antisurge Calculation

The anti-surge tuning values are based on estimated part load conditions and minimum vane signals required at these conditions to prevent unstable operation (surging):

	Compressor Differential (Head) Pressure	Minimum PRV Signal Setpoint for Stable Operation
High Head (PD1)	185 psid	MVP1 = 35% Open
Low Head (PD2)	120 psid	MVP2 = 12% Open

It is very important that this control be adjusted to suit chiller operating conditions to achieve maximum efficiency of operation.

ANTI-SURGE TUNING

- With the chiller running in automatic, take the condensing conditions to the highest inlet temperature attainable in the system (without tripping on high discharge pressure). Increase tower inlet temperature or reduce tower flow.
- At the highest condensing temperature, start reducing the load on the chiller, by reducing the flow, or decreasing the inlet temperature. This will cause the capacity control system to back the vanes in an unload sequence.
- If the chiller surges before the Hot Gas valve begins to open, then the anti-surge line must move right on the map.
- If the chiller never surges down to minimum load, then the anti-surge parameters are adequate for protection, but may not be most efficient.
- During the unload sequence, record the operating head as PD1

- Increasing and decreasing the parameter MVP1 will move the anti-surge line right and left on the map. Listen for a surge, and move the anti-surge line right several percent, to increase refrigerant flow, by supplementing hot gas.
- Repeat the procedure for low head operation.
- At the lowest condensing temperature, start reducing the load on the chiller, by reducing the flow, or decreasing the inlet temperature. This will cause the capacity control system to back the vanes in an unload sequence.
- If the chiller surges before the Hot Gas valve begins to open, then the anti-surge line must move right on the map.
- If the chiller never surges down to minimum load, then the anti-surge parameters are adequate for protection, but may not be most efficient.
- During the unload sequence, record the operating head as PD2
- Increasing and decreasing the parameter MVP2 will move the anti-surge line right and left on the map. Listen for a surge, and move the anti-surge line right several percent, to increase refrigerant flow, by supplementing hot gas.

The plant condenser water control system will determine the actual high and low head conditions depending on the range of condenser water temperature allowed.

If actual operating conditions are different than those shown above, you must enter the new values for the anti-surge parameter calculation to produce the required output signals as shown in the following example:

	Compressor Differential (Head) Pressure	Minimum PRV Signal Setpoint for Stable Operation
High Head (PD1)	?? psid / ?? bar	MVP1 = ??% Open
Low Head (PD2)	?? psid / ?? bar	MVP2 = ??% Open

The "ANTI-SURGE MIN PRV POS" output (Y%) is calculated based on the actual calculated differential pressure (head) as follows:

PD (Head) = Compressor. Discharge. Pressure. minus Evaporator. Pressure.

Y% = (PD-PD2) x (MVP1-MVP2) / (PD1-PD2) + MVP2

at High Head (92 psid), Y% = (92-40) x (38-12) / (92-40) + 12 = 38%

at Medium Head (66 psid), Y% = (66-40) x (38-12) / (92-40) + 12 = 25%

at Low Head (40 psid), Y% = (40-40) x (38-12) / (92-40) + 12 = 12%

2.3.2.3.2 Hot Gas Control Tuning

The “HOT GAS CONTROL” is automatically adjusted to achieve full hot gas (100% output change) as a decreasing load causes the “CHILLED WATER OUT TEMP. CONTROL” output to drop below the “ANTI-SURGE (MIN. PRV POSITION)” output to 0%.

The “HOT GAS CONTROL” output is calculated based on the “ANTI-SURGE (MIN PRV POSITION)” output signal and the actual capacity control signal (input %) as follows:

Output % = 100 x SS-2 % / Minimum Vane Calculation %

If the chiller was operating at the above low head condition (Minimum Vane Calculation =12%), the outputs would be as follows as the load decreases causing the capacity control signal to drop to 0%.

Capacity Control Signal at 12%
Output % = 100 x 12 / 12 = 100% (Valve Fully Closed)

Capacity Control Signal at 5%
Output % = 100 x 5 / 12 = 41.7% (Valve Partially Open)

Capacity Control Signal at 0%
Output % = 100 x 0 / 12 = 0% (Valve Fully Open)

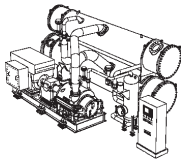
2.4 Capacity Controls Tuning

The PID controls are configured using the following tuning parameters:

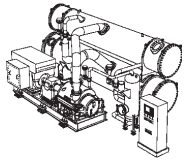
SP	=	Setpoint
P	=	Proportional
I	=	Integral Gain / Reset Time (Minutes/Repeat)
D	=	Derivative Gain / Rate (Minutes)

Refer to the Software “Instruction Set Reference” Manual for additional information on the PID instruction.

The setpoints of the “MAX POWER DEMAND LIMITER” and the “CHILLED WATER OUT TEMP CONTROL” are being controlled remotely if the GRAPHIC DISPLAY indicator on the “CAPACITY CONTROLS DIAGRAM” screen reads “REMOTE.” Refer to the “COOLER” screen section of the displays section describing the Local / Remote setpoint operation.



The tuning values are estimated only and may require adjustment depending on actual chiller operating conditions. See section 2.6 “Graphic Display Description” for details on entering new tuning values on the “CAPACITY CONTROLS TUNING” screen.



2.5 Capacity Control Diagrams

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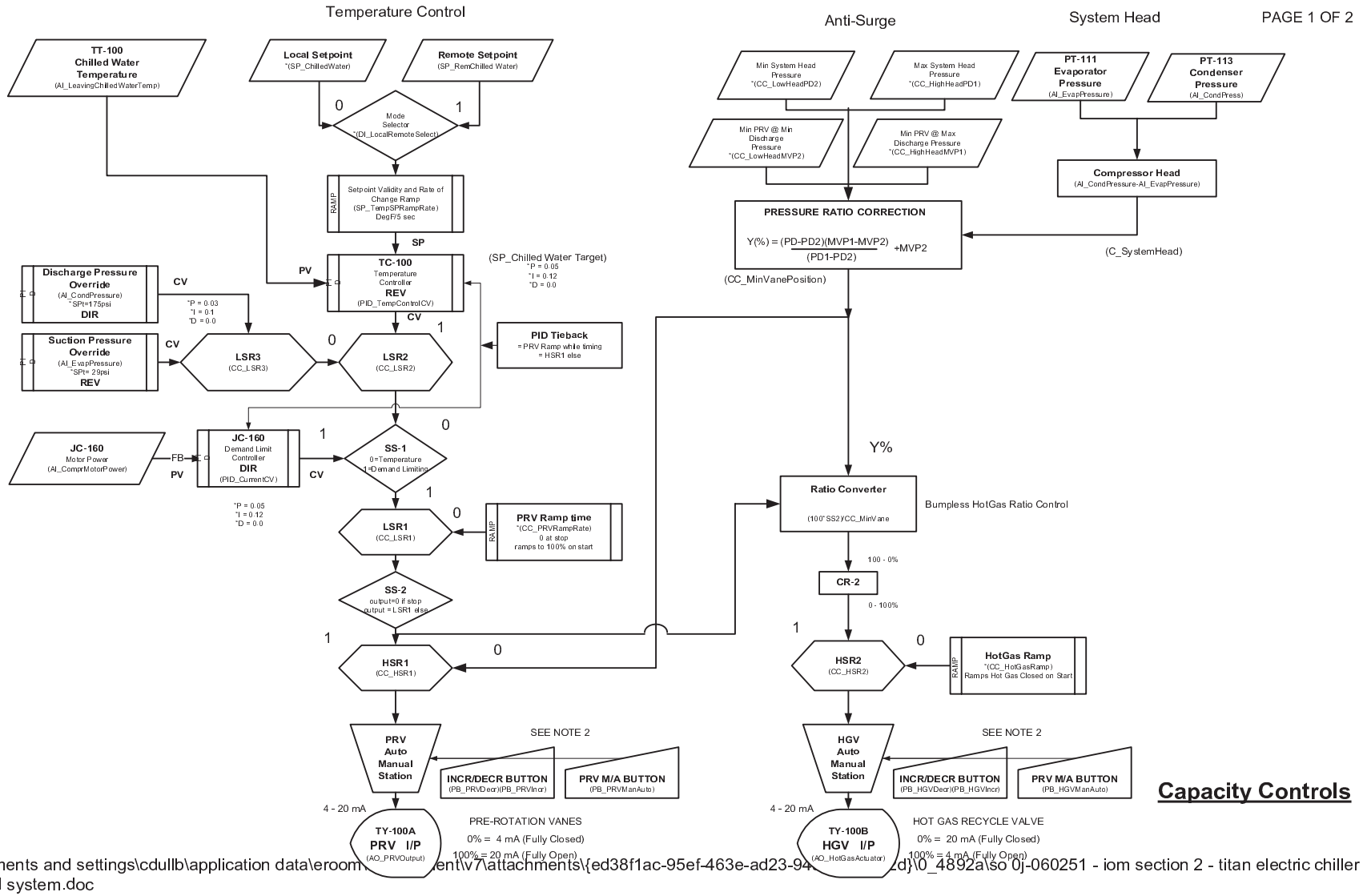
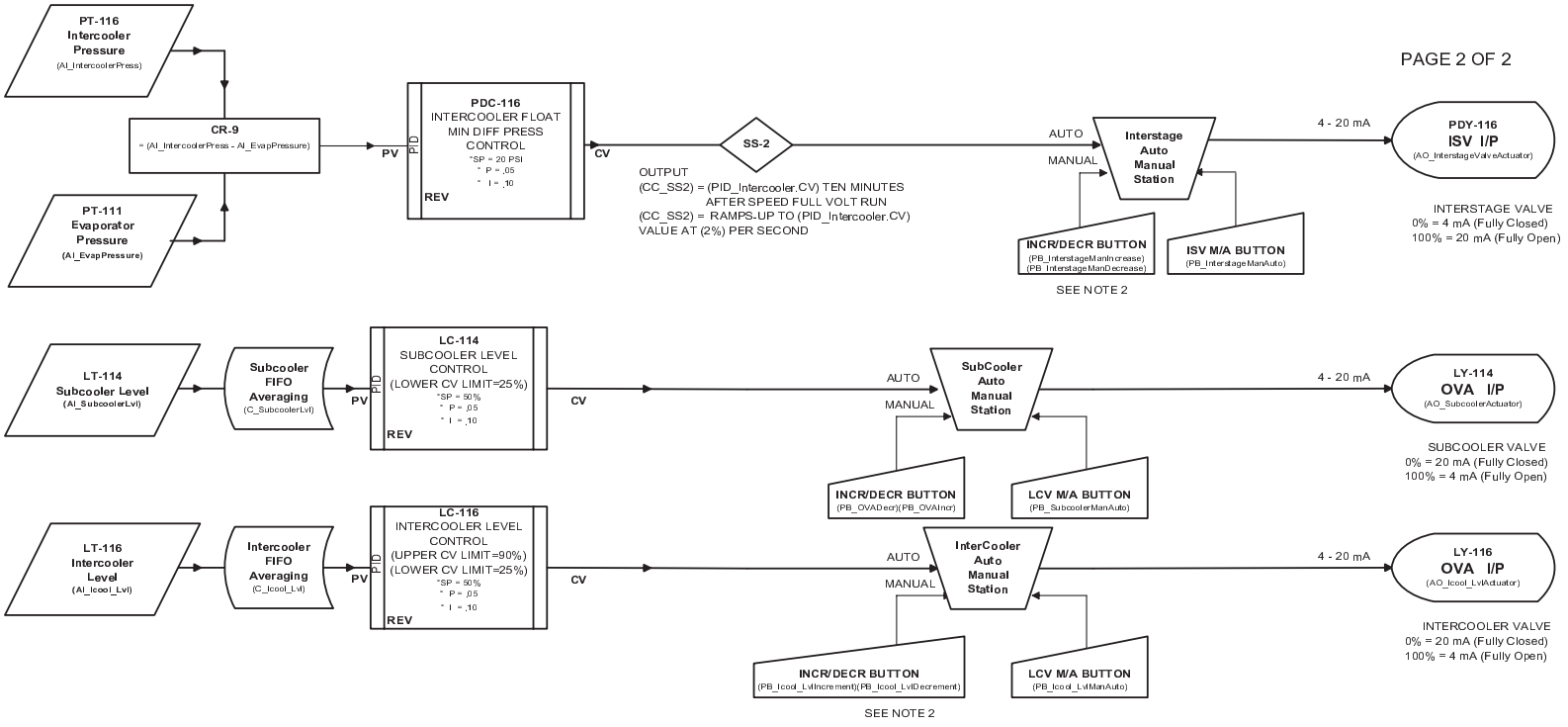


Capacity Controls



LEGEND

CR	- COMPUTING RELAY
HSR	- HIGH SELECTOR RELAY
I / P	- PNEUMATIC TRANSDUCER
LSR	- LOW SELECTOR RELAY
M / A	- MANUAL / AUTOMATIC STATION
MCO	- MANUAL CONTROL OVERRIDE
MVP1	- HIGH HEAD VANE MIN. % OPEN
MVP2	- LOW HEAD VANE MIN. % OPEN
MSP1	- HIGH HEAD MIN. SPEED RPM
MSP2	- LOW HEAD MIN. SPEED RPM
SS	- SIGNAL SELECTOR
PD	- PRESSURE DIFFERENTIAL (HEAD)
PD1	- HIGH HEAD DIFFERENTIAL PRESS (PSID)
PD2	- LOW HEAD DIFFERENTIAL PRESS (PSID)
X	- CALCULATED MINIMUM SPEED
Y %	- CALCULATED MINIMUM VANE % OPEN
Y	- CALCULATED MINIMUM VANE POSITION
( )	- DATA TABLE ADDRESS
[ ]	- OPERATOR ADJUSTABLE VALUE ON CRT SCREEN.

PID CONTROL LEGEND

CV	- CONTROL VARIABLE (OUTPUT)
DIR	- DIRECT ACTING (ERROR = SP - PV)
I	- INTEGRAL GAIN
P	- PROPORTIONAL GAIN
PV	- PROCESS VARIABLE (INPUT)
REV	- REVERSE ACTING (ERROR = PV - SP)
SP	- SET POINT
D	- DERIVATIVE GAIN

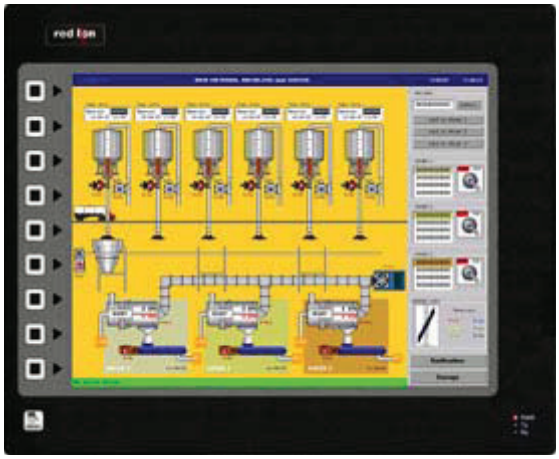
NOTES:

1. ALL PID OUTPUTS (CV) HAVE AND SCALED RANGE OF 0 - 100. THESE ARE SCALED 0 - 100% FOR CRT DISPLAY. SEE "Logix 5000 INSTRUCTION SET REFERENCE" FOR DETAILED INFORMATION ON THE PID PROCESS CONTROL INSTRUCTION.
2. MANUAL VALUES ARE OPERATOR ADJUSTABLE (INCR/DECR BUTTONS) ON CRT "MANUAL/AUTO" STATIONS.

Capacity Controls

2.6 Graphic Displays

The Red Lion Controls G315 operator interface is furnished standard on the chiller and provides the ultimate in efficiency, automation, monitoring, data trending and chiller protection. The Control Center is a factory-mounted, wired and tested control system for TITAN centrifugal chillers. The panel is configured with a color TFT touch screen display with 10-button keypad that are redefined based on the screen being displayed. This makes chiller operation quicker and easier with a single button revealing a wide array of information of the appropriate component.



The TFT display features graphic animated display of the chiller, chiller subsystems and system parameters, allowing the presentation of several operating parameters at once.

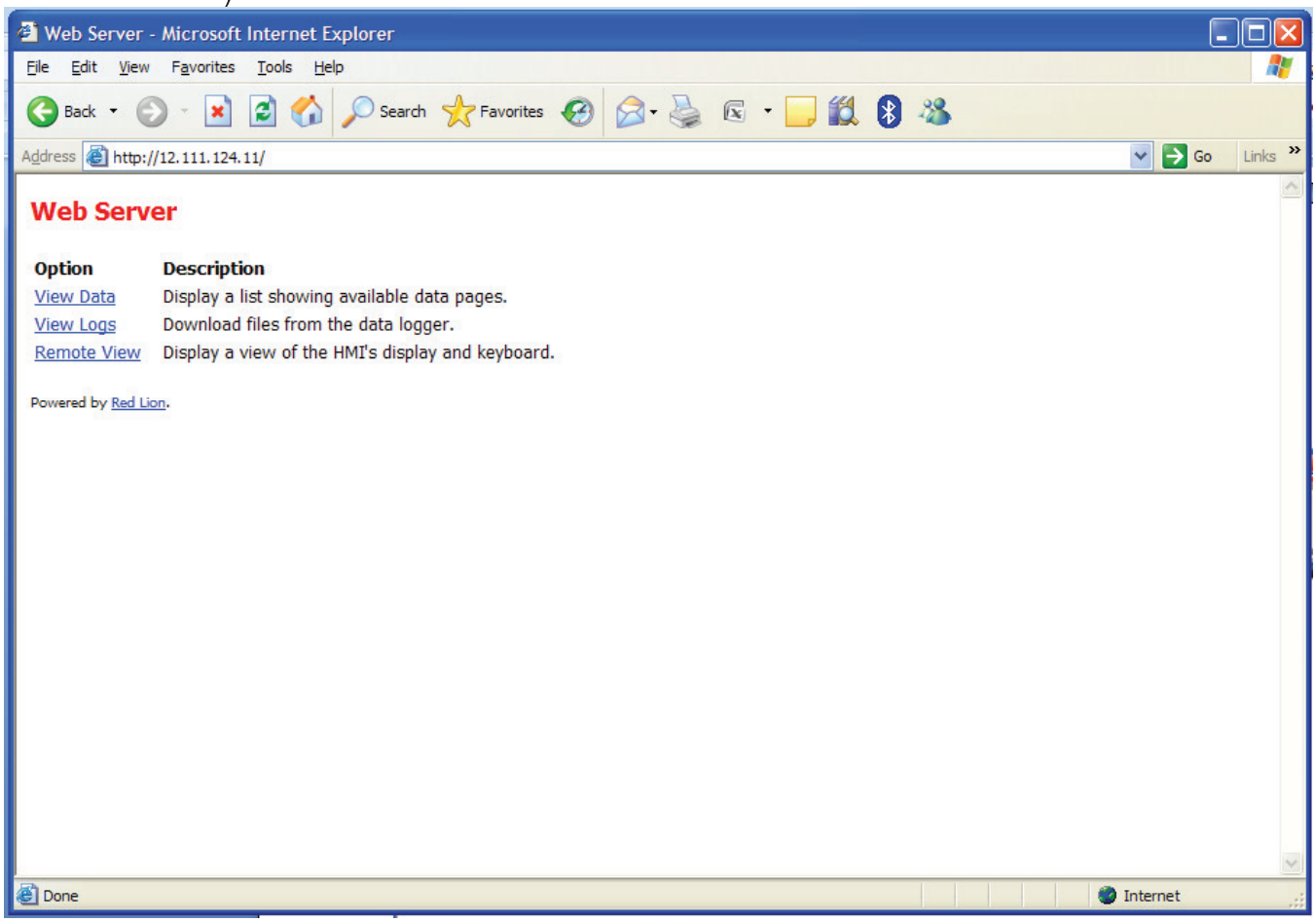
During startup, operation and shutdown, the system will display vital information available at any time. The locations of various chiller parameters are clearly marked and instructions for specific operation are provided on many of the screens.

The G315 is able to communicate with many different types of hardware using high-speed RS232/422/485 communication ports and Ethernet 10 Base T/100 Base-T communications. In addition, a USB port is available for fast download of configuration files and access to trending and data logging. A CompactFlash socket is provided so that Flash cards can be used to collect your trending and data logging information, as well as store larger configuration files and allows field service to easily update programs and firmware.

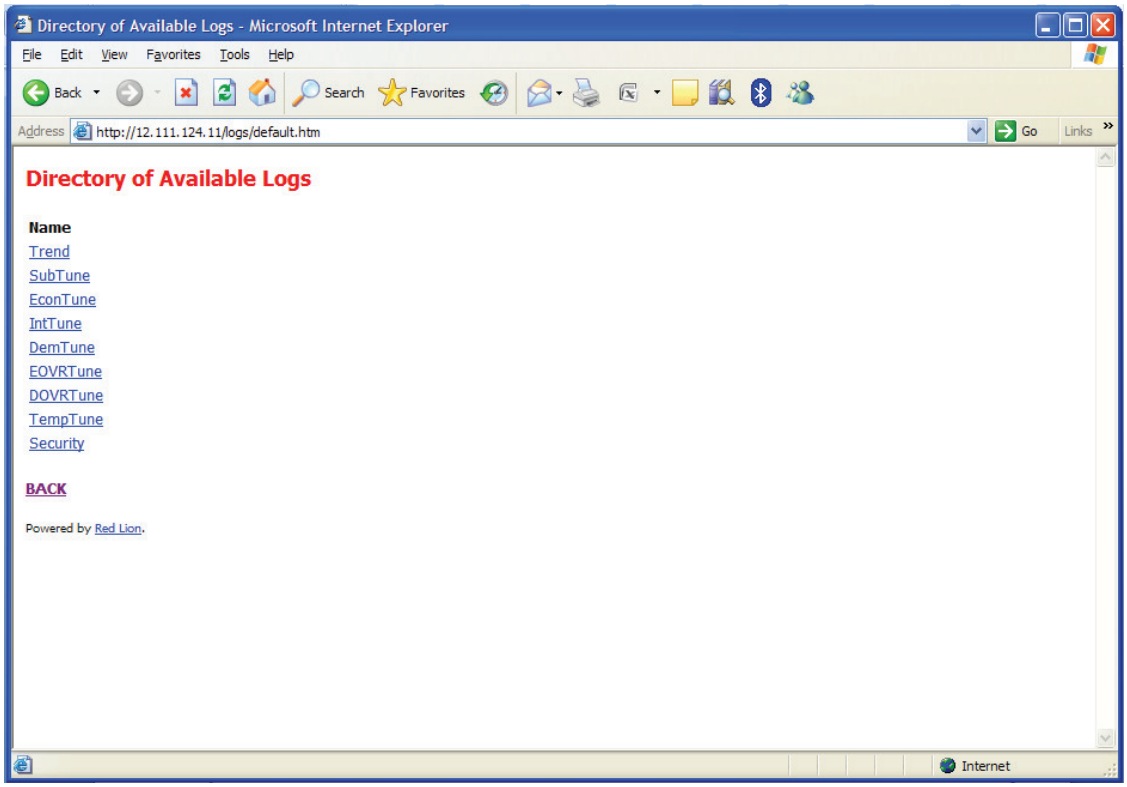
2.6.1 Remote Access

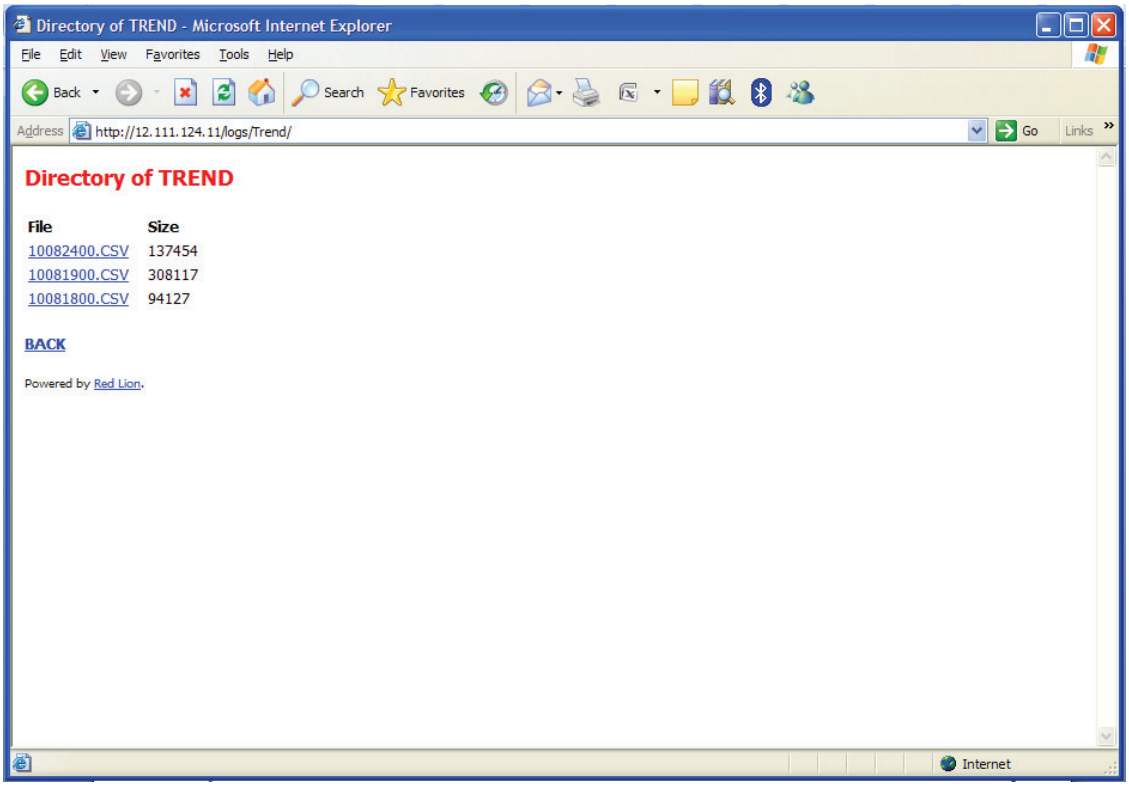
The G315 also has Web Server capabilities via the Aux Ethernet port, allowing remote access to diagnostic information or to values recorded by the Data Logger. Depending on customer needs, this feature has other configuration options. See Red Lion Controls C3 manual.

Below is an example of Web Server screens. Type the WAN address of the HMI screen into an Internet Explorer Web Browser. (See Communication Setup Screen for details on Ethernet communication.)

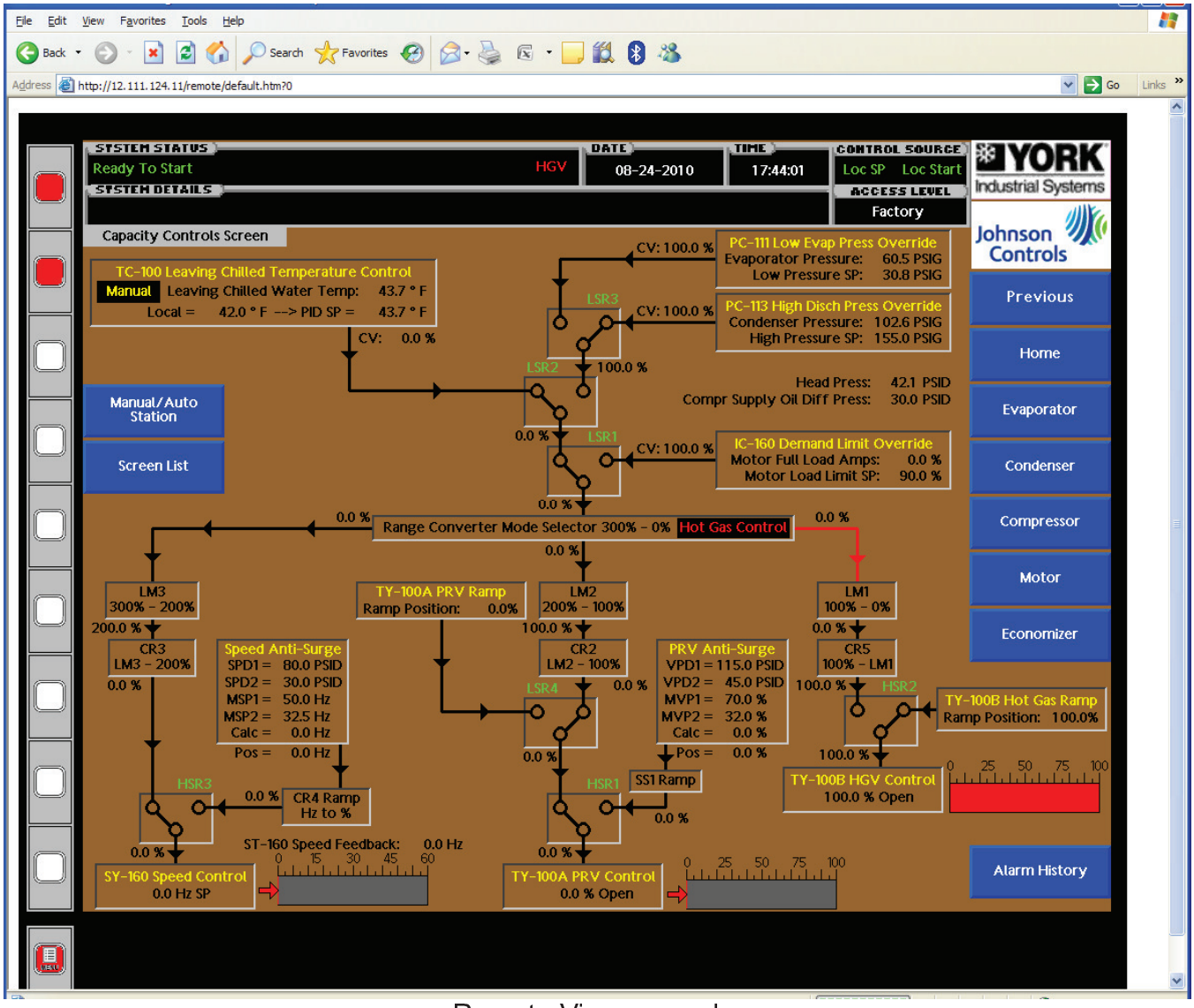


View Logs allows access to Data Log files and Security files. Security files show a list of changes made using the HMI terminal. Remote View shows the current screen of the HMI.


Directory of Available Logs - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://12.111.124.11/logs/default.htm
Go Links
Directory of Available Logs
Name
Trend
SubTune
EconTune
IntTune
DemTune
EOVRTune
DOVRTune
TempTune
Security
BACK
Powered by Red Lion.
Internet



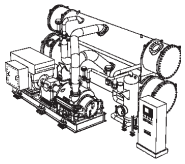
Data Logs access and files for downloading.



Remote View example.

2.7 Navigating the Graphic Interface

Navigating through the various screens of the operator interface panel is highly intuitive. Touch screen buttons on the display screen will allow the user to select from the available screen displays and make set point adjustments. The MENU keypad button at the bottom left of the HMI will take you to a screen list of all the available screens. Not all screens are accessible depending on user access level. The top keypad button on the left side will accept any alarms or trips and the one below that will bring up a refrigeration saturation calculator.



SCREEN SELECTION

Graphical, animated screens provide a means of data display and service for various system components. Screens indicate all aspects of operation and sensor data pertaining to the particular component depicted.

At the top of each main screen is displayed the system status, present date and time, local or remote control source and system access level. Sub-screens may also be available for some system components, providing additional data access. Screens are selected by selecting the appropriate tabs on the sides of the display. Press the button corresponding to a particular screen tab.

DISPLAY FEATURES

Display features are those that are available for viewing only, and include read-only parameters such as temperatures and pressures. Display features may be given as numerical values or graphics in the form of sliding bar graphs, red LED indicator, color changing text, XY graphs, etc.

INTERACTIVE SCREEN FEATURES

Various aspects of chiller operation may be adjusted by the operator within the appropriate screen. BLUE with WHITE text is a programmable value allowing the operator to make adjustments. Some interactive controls are depicted graphically while others, such as set points, appear as entry fields in which the operator may enter values directly.

The operator may move between entry fields using the PREVIOUS or NEXT keys of the pop-up keypad. When an entry field text is highlighted in white, touching the field on the screen opens a window on the display depicting the keypad itself. The operator may then enter a value on the keypad by pressing the corresponding keys and then ENTER. An entry may be voided by pressing the EXIT key.

PROGRAMMABLE FEATURES

Programmable features are supplied as entry fields into which numeric values may be entered. These include set points and PID tuning parameters as well as set point values and anti-surge parameters.

The chiller Control System has four access levels: VIEW, OPERATOR, SERVICE and FACTORT. This instruction is intended only as a service manual. As such, depicted here are the system parameters available at the SERVICE and FACTORY levels of access, which require user login. User access codes are supplied by the factory.

The system is provided with four levels of security access.

VIEW: The View mode allows curtain screens to be viewed, but no set points to be changed. The View mode may not take manual control of the capacity devices.

OPERATOR: Operator is the privileged user. The operator may look at any status item. The operator also may change the chilled water set point. The operator may use the Manual / Auto stations. The Operator user's password is 9675

SERVICE: The service user is privileged to access any screen. This user may also change tuning parameters.

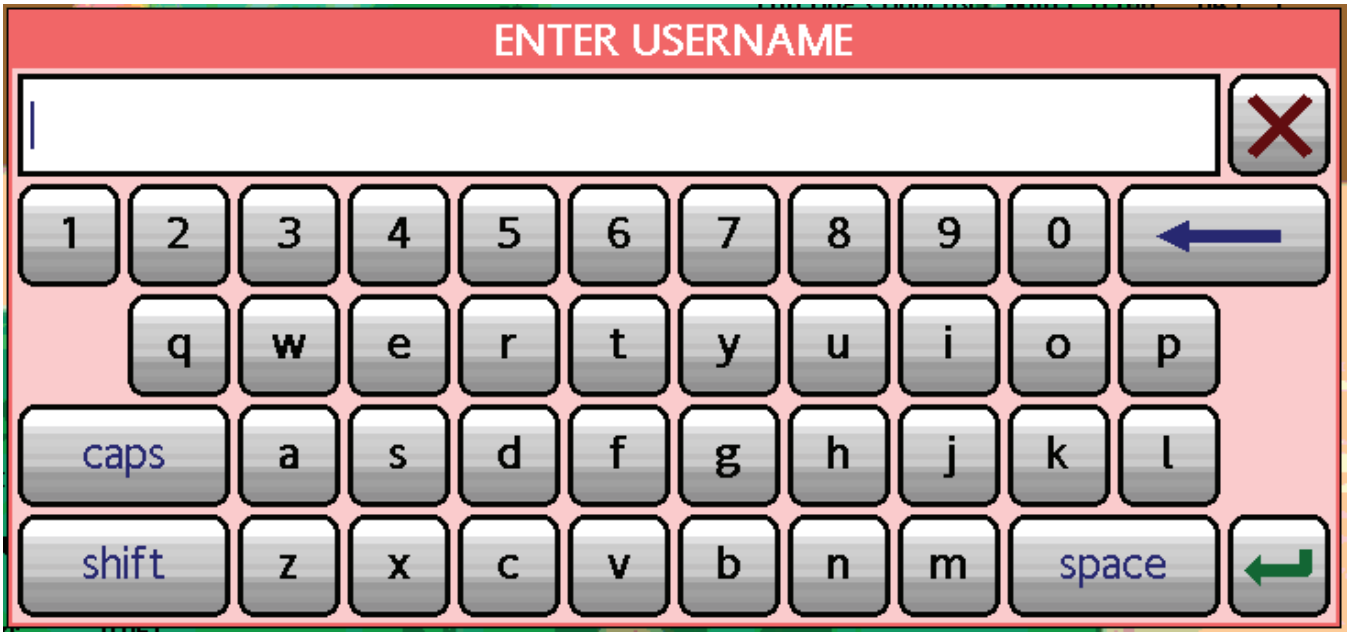
FACTORY: This user is privileged above all other users.

Important: System adjustments should be performed only by a qualified service person. Read all instructions carefully before making adjustments

2.7.1.1.1 USER LOGIN

In order to gain access to service authorized features, it is necessary to log into the system. On the HOME screen is the **LOGIN** button. Selecting this button brings up the SECURITY MANAGER display depicted below.

Press the GREEN ENTER and a keyboard will appear on the display as below.



Enter the user name and press ENTER. Enter the access code associated with that login name. Press ENTER on the keyboard, the System Status display at the top of the screen shows the current login access level. If the touch screen is inactive for 30 minutes, you will be logged out automatically.

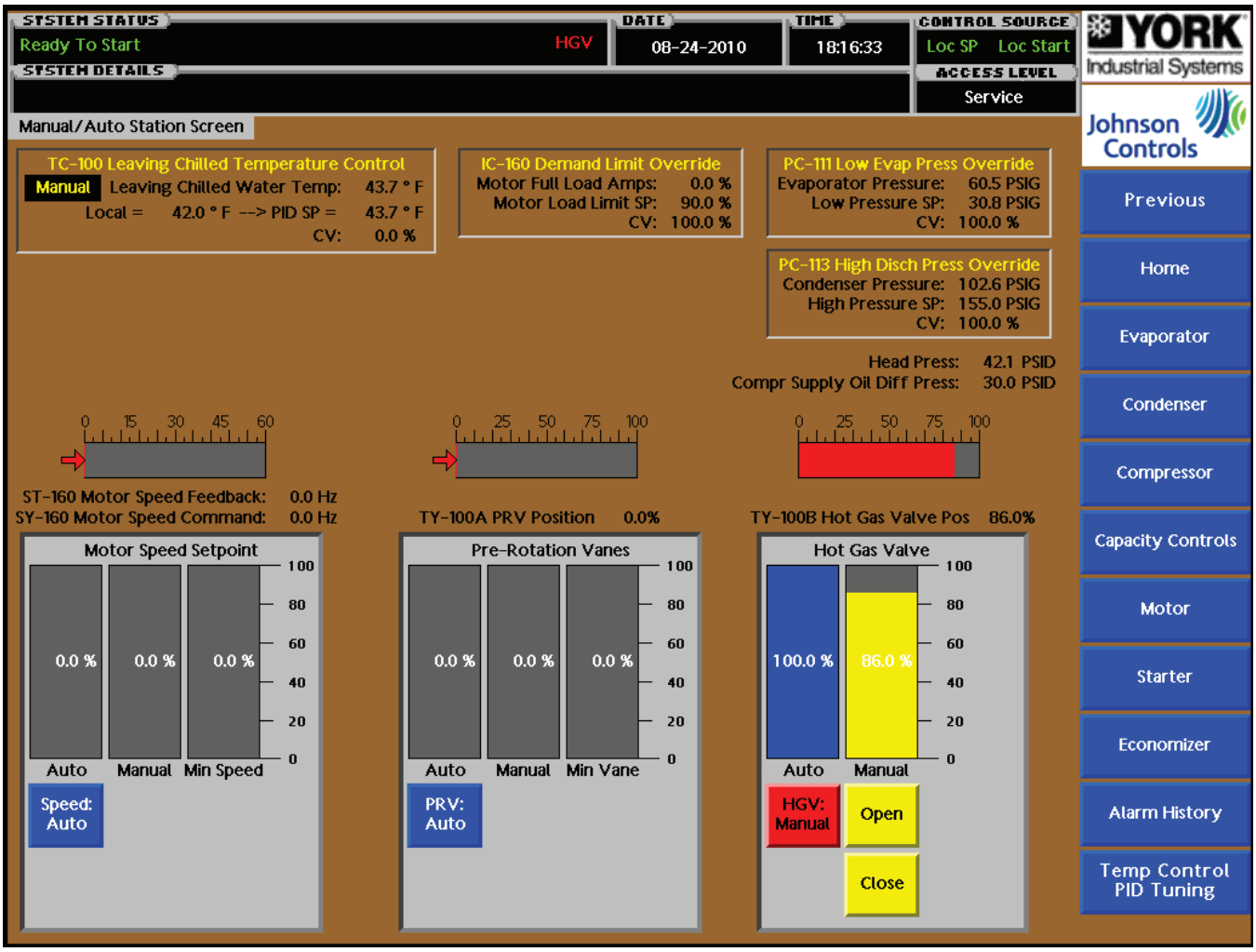
Pressing **LOGOUT** on the HOME screen will log out the current user and return the access level to VIEW.

2.7.1.1.2 Manual Automatic Stations

Manual automatic stations allow analog control of valves, vanes and speed. The analog process control system of the PLC is based on a 0 – 100% range. The speed range is based on 0 to 60 Hz (0-100%) signal. The automatic control system drives the valves, vanes or speed with a percentage of drive signals. The operator interface allows an experienced technician to take manual control of a device. Pressing the button marked AUTO toggles the device into a manual control state. The button turns red and the INCREASE/DECREASE buttons appear. Pressing MANUAL will toggle the device into an automatic state if it is not in an inhibit state.

While in manual control, the INCREASE or DECREASE buttons may be used to manipulate the valves, vanes or speed. The actual position of the valve, vanes or speed is shown about the bar graphs. The automatic bar graph, in blue, shows where the automatic control system wants the device to be. The minimum speed and vane anti-surge positions are shown with a red bar graph.

To provide a bumpless transfer of manual back to automatic operation, devices such as the PRV's and speed must be above anti-surge to return to automatic operation. The Hot Gas Bypass valve shown in this example has an inhibit function. The Hot Gas Valve must be within 5 percent of its automatic value before it can be returned to automatic operation.



2.7.1.2 Screen Indicators

On (output energized) and Off (output de-energized) signals are represented by LED symbols. A red LED symbol is ON , and a grey LED symbol is OFF .

Running Pumps are shown as RED  and pumps not running are shown as GREY  .

Energized solenoid outputs are shown as RED  and are GREY  when de-energized.

GREEN check symbol  means OK or an input is ON and a RED check symbol  means NOT OK or input is OFF.

Pre-Trip Alarm (Yellow Text ) and Trip (Red Text ) appear descriptive text of the measurement parameter whenever applicable.

The measurement parameter text () changes to GREEN blinking if the analog input signal goes out of range and will remain in this state until the RESET pushbutton is pushed after the input signal returns to normal.

The Pre-Alarm indicator will remain in the alarm state until the RESET pushbutton is pressed after the conditions have returned to normal.

The Trip Alarm indicator will remain in the alarm state until the RESET pushbutton is pressed after the conditions have returned to normal.

The main status indicator bar at the top of the screen will display the SYSTEM STATUS.

System Details will indicate any Alarms. Warnings are yellow and Shutdowns are red. If a warning or shutdown is acknowledged, it will turn grey but still cycle through the list until it is cleared with a System Reset.

The System Status will indicate the following messages:

READY TO START	Unit is ready to start in Local Mode
REMOTE START ENABLED	Unit is ready to start in Remote Mode
PRELUBE (Loc) = XXX sec	Local initiated start / Prelube cycle
PRELUBE (Rem) = XXX sec	Remote initiated start / Prelube cycle
SYSTEM RUNNING	System Running
POSTLUBE = XXX sec	System stopping / Postlube cycle
SYSTEM TRIPPED	System Tripped Offline
ANTIRECYCLE = XX Hours XX Mins/Secs	Anti-recycle Countdown
Control Stop	Control Stop initiated
Remote Start Inhibit, Press Local Start Button	Remote mode selected / not confirmed
Capacity Control Override	System Running in dynamic override
Processor Fault	PLC processor is not responding

2.8 Operator Interface Screens

2.8.1 Home

DISPLAY

- **MOTOR RUN OUTPUT** – Displays the state of the digital output channel for the compressor motor run relay.
- **MOTOR FULL VOLTAGE RUN** – Displays the state of the digital input channel being received from the motor starter when full voltage transition occurs.
- **APPROX KW/TON** – Displays instantaneous compressor motor power per calculated cooling tons.
- **APPROX CHILLER TONS** – Displays instantaneous cooling tons from water temperature and flow transmitter readings.
- **CHILLER CAPACITY** – Displays the percent chiller capacity, calculated chiller tons

over design tons.

- **MOTOR FLA** – Displays the percent full load amps, calculated from actual motor amps over design full load motor amps.
- **TOTAL CHILLER STARTS** – Total motor full voltage run contact transitions.
- **TOTAL RUNTIME HOURS** – Total hours the compressor motor is running based off of the full voltage run contact.
- **LADDER REV** – The current software version that is running in the PLC.
- **HMI REV** – The current software version that is running in the HMI.
- **PLC CLOCK** – The PLC clock is shown to ensure that the PLC processor is scanning. This should automatically update with changes to the HMI clock. The DATE and TIME can be changed in the screen banner at the top of the page.
- **LY-114** – Displays the scaled signal being transmitted to the subcooler liquid level control valve I/P.
- **LY-116** – Displays the scaled signal being transmitted to the low pressure economizer liquid level control valve I/P.
- **PDY-116** – Displays the scaled signal being transmitted to the low pressure interstage pressure differential control valve I/P.
- **TY-100A** – Displays the scaled signal being transmitted to the compressor pre-rotation vanes control I/P.
- **TY-100B** – Displays the scaled signal being transmitted to the hot gas by-pass control valve I/P.
- **LEAVING/ENTERING CONDENSER/EVAPORATOR WATER TEMP** – Displays the scaled value from the temperature sensors installed in the vessel water lines.
- **CONDENSER/EVAPORATOR WATER FLOW** – Displays the scaled value from the flow sensor installed in the vessel water lines.
- **CONDENSER/EVAPORATOR FLOW SWITCH** – Displays the digital input status of the hardwired flow safety.
- **CONDENSER/EVAPORATOR FLOW VALVE OUTPUT** – Displays the digital output status of the contact relay.
- **EMERGENCY CHILLED WATER PUMP START OUTPUT** – Displays the digital output status of the contact relay.
- **CONTROL AIR SUPPLY PRESSURE** – Displays the scaled value from the pressure transmitter measuring the control air supply in the pneumatic header.
- **COMPR SUPPLY OIL DIFF PRESSURE** – Displays the calculated value, oil supply pressure minus the sump pressure.

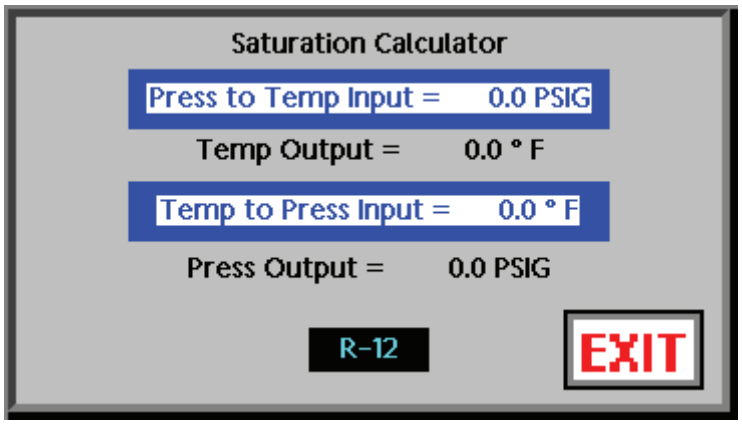
<u>INTERACTIVE</u>

- Blue function keys with white letters are screen navigation buttons. Screen access is limited by the security access level of the user.
- **LOGIN** – Pressing this button will bring up the Security Manager (see above). Enter the

user login and press enter. Enter the password associated with the user and press enter. See the ACCESS LEVEL in the banner to see the current user.

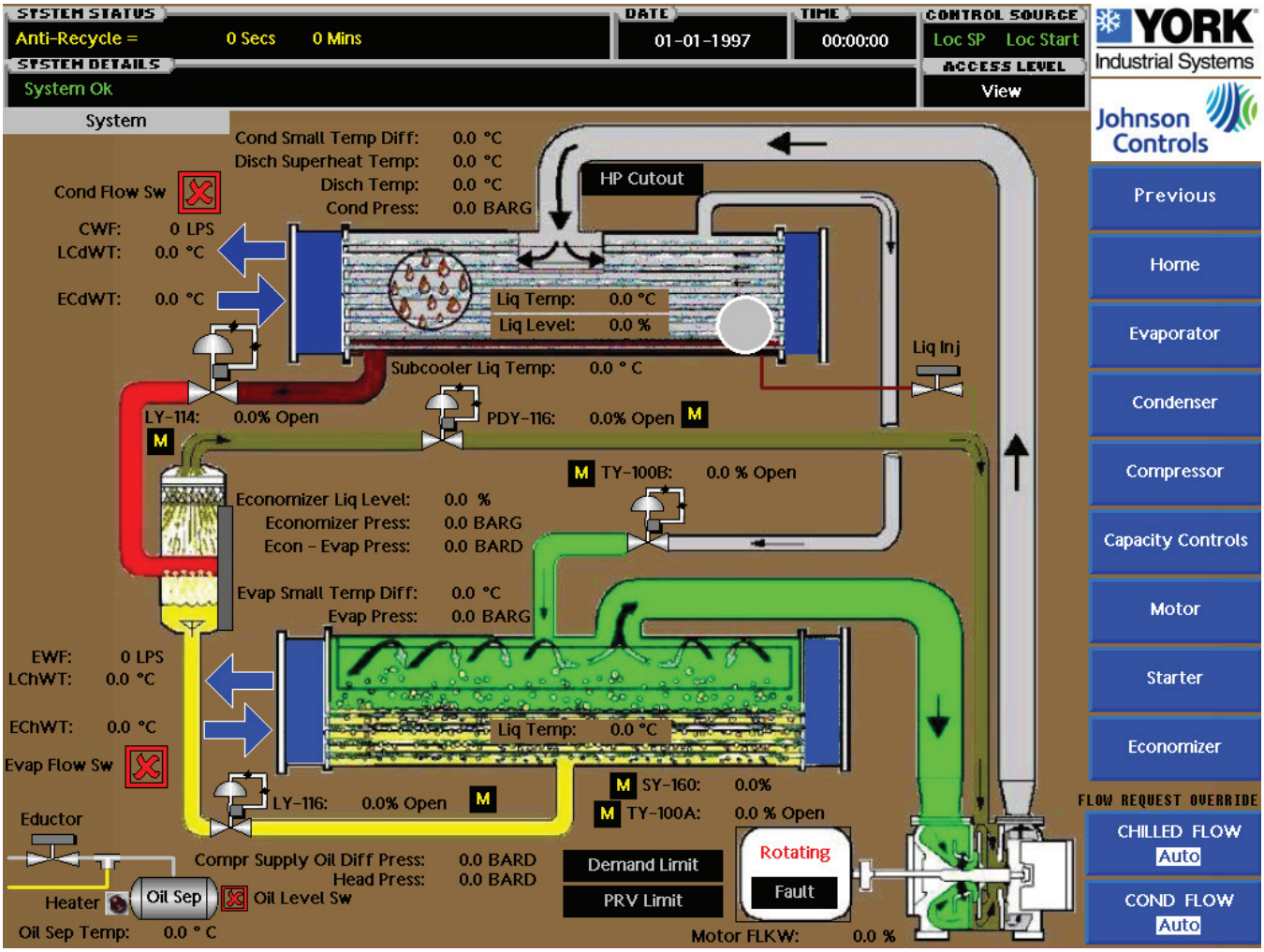
- **LOGOUT** – Pressing this button will log out the current user, back to the VIEW level.
- **SYSTEM RESET** – This button will attempt to reset any alarms experienced by the control system. Alarms stay active until reset.

See Section 2.6 “REMOTE VIEW EXAMPLE” graphic for highlighted keypad buttons. These buttons are global and will be the same on any screen. The first top left hand button will acknowledge any alarms. The second from the top left hand button will bring a pop-up saturation calculator. Depending on the hard coded refrigerant type, enter a pressure or temperature to calculate the output.



The MENU button in the bottom left will take to a list of screens. See below in this manual for a screen shot.

2.8.2 SYSTEM

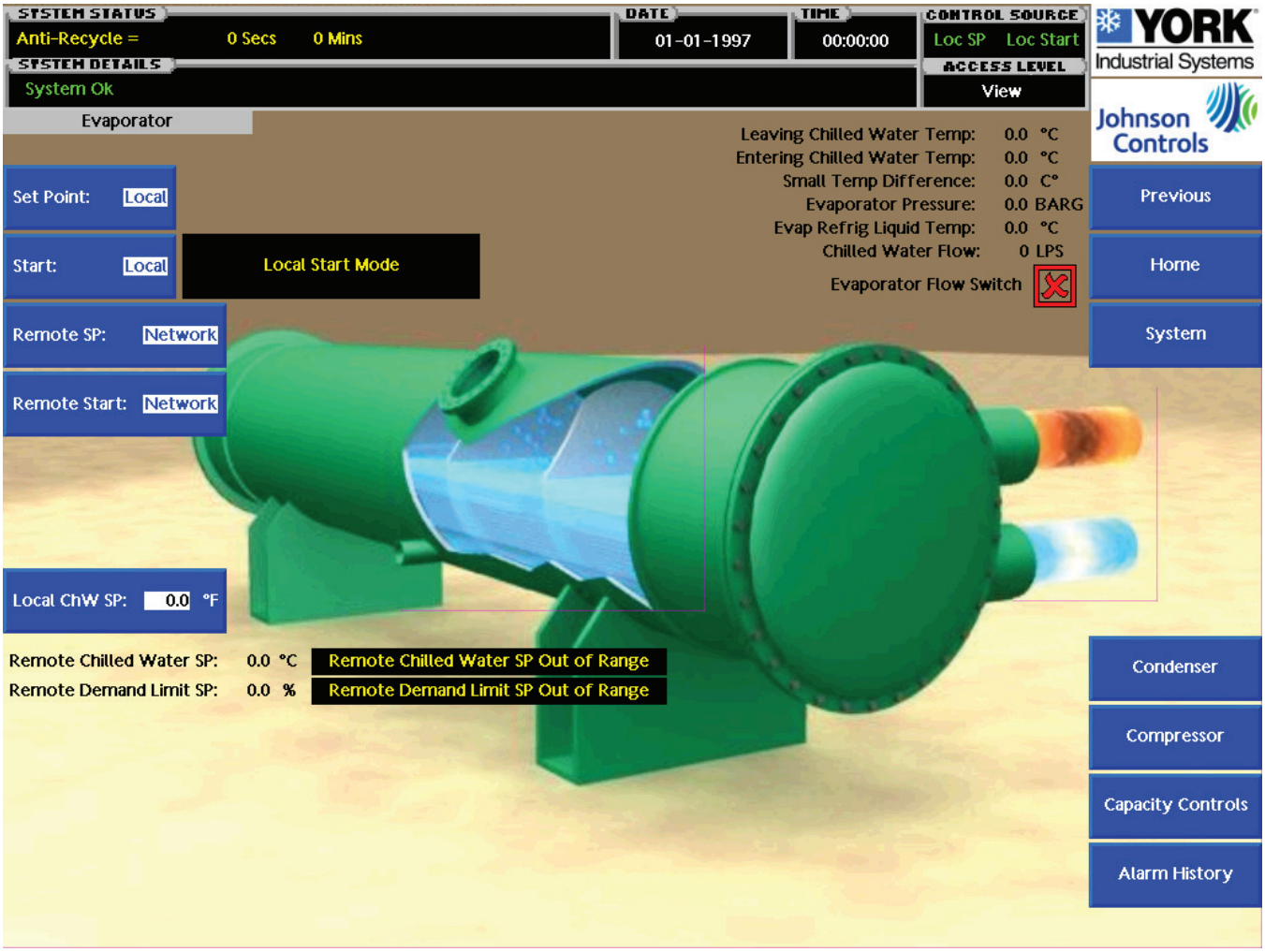


DISPLAY

The system screen of the TITAN chiller is a representation of the refrigerant circuit. It shows key pressures and temperatures around the system at a glance.

- **M** – Indicates that the control device is manually being controlled by an auto/manual station.
- The state of the digital output for the solenoid valves. RED the output is energized.

2.8.3 EVAPORATOR

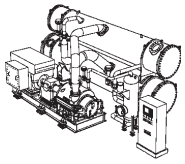


DISPLAY

This screen shows the parameters associated with the evaporator heat exchanger. Leaving and entering water temperatures are shown, along with evaporator refrigerant temperature and pressure. The small difference temperature is calculated from the difference between the leaving process liquid and the evaporator refrigerant temperature. A high small difference temperature could indicate fouled tubes or improper charge. The remote chilled water and remote demand limit set points are shown for reference.

PROGRAMMABLE

- **LOCAL CHILLED WATER SET POINT** = XX.X - Pressing the button will allow the user to change the leaving chilled water set point. Water duty machines are limited to a minimum of 36 degrees leaving to prevent freezing. Brine duty machines are limited to

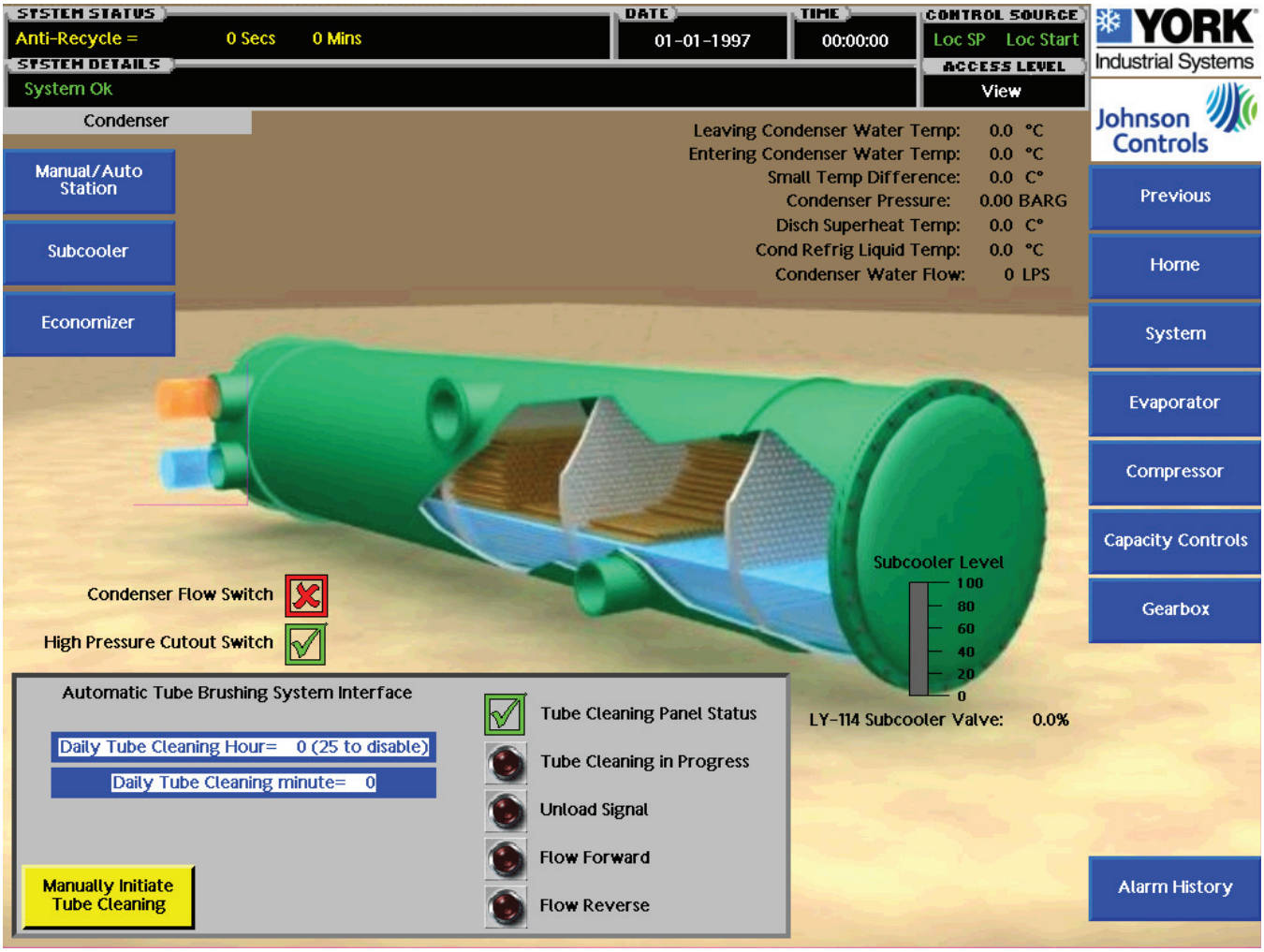


the specific temperature of the brine concentration. Press Enter to confirm the new set point.

INTERACTIVE

- **SET POINT LOCAL/REMOTE** – This button toggles between the local set point as defined by this screen or a remotely defined set point from another source.
- **START LOCAL/REMOTE** – This button toggles between a local initiated start from the chiller control panel START pushbutton and a remote start from an external source. Once the button is toggled on the HMI, the local START pushbutton on the front of the control panel needs to be pressed to finalize the MODE switch.
- **REMOTE SET POINT NETWORK/HARDWIRED** – This button toggles between the source of the remote set points. The leaving chilled water remote set point can either be sourced from **F16:0** across the network or from a remote analog signal on **TB02 Ch. 10 input**. The motor demand limit remote set point can either be sourced from **F16:1** across the network or from a remote analog signal on **TB02 Ch. 12 input**.
- **REMOTE START NETWORK/HARDWIRED** – This button toggles between the sources of the remote start signals. They can either come from the **N17:0** bit across the network or from **TB11 Ch. 15 input** on the second digital input module. Remote Stop network signal is **N17:1** (Network points should be setup as momentary high to initiate). The hardwired digital input must be maintained to run.

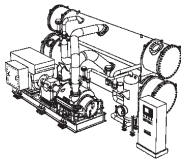
2.8.4 CONDENSER



DISPLAY

The condenser screen shows the operational nature of the condensing heat exchanger. The temperatures of the water entering and leaving the condenser are shown. The Condensing pressure and saturation temperature are also shown on this screen. The temperature of the subcooled refrigerant liquid coming out of the exit of the condenser is displayed here.
The conditions of the High Pressure Cutout will always be closed under normal operation. If the High Pressure Cutout switch ever shows open, investigate the pressure of the condenser vessel and evaluate the integrity of the switch. This switch is installed per code with no intervening stop valve.

The Automatic Tube Brushing system interface appears on this page. The tube brushing system can be initiated here manually, or on a daily schedule per hour and minute in 24 hour military time.

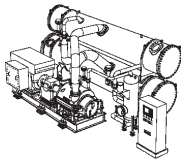


TUBE CLEANING PANEL STATUS – A Green Check Mark means that the R4 tube cleaning panel is running normally. A Red X means that there is a malfunction at the R4 panel.
TUBE CLEANING IN PROCESS – Illuminated means that the chiller is unloading to clean the tubes with reverse condenser water flow.
UNLOAD SIGNAL – Illuminated means that the chiller is unloading to anti-surge for the duration of the reverse water flow.
FLOW FORWARD – Means that the limit switch on the 4-way valve is in the normal flow position.
FLOW REVERSE – Means that the limit switch on the 4-way valve is in the reverse flow position.

2.8.5 COMPRESSOR

DISPLAY

- OIL SUPPLY PRESSURE - Displays the oil supply pressure
- OIL SUPPLY TEMPERATURE - Displays the oil supply temperature
- DISCHARGE TEMPERATURE - Displays the temperature of the refrigerant gas at the compressor outlet
- DISCHARGE SUPERHEAT - Displays the temperature expressed as the differential between the discharge temperature and the condenser saturation temperature
- BALANCE PISTON PRESSURE – The balance piston pressure should not exceed 8 psi difference from the intercooler refrigerant pressure.
- PERCENT FULL LOAD POWER – Displays the power usage of the chiller.
- PRV POSITION - Displays the position of the pre-rotation vanes in percent



- SUMP VENT SOLENOID – Displays the status of the sump vent solenoid ball valve.

The Vibration Monitoring Equipment can be observed from this page.

- The current vibration level will show up with a blue bar graph.
- The alert level limit will appear below it as a yellow bar graph.
- The danger level limit will appear below it as a red bar graph.

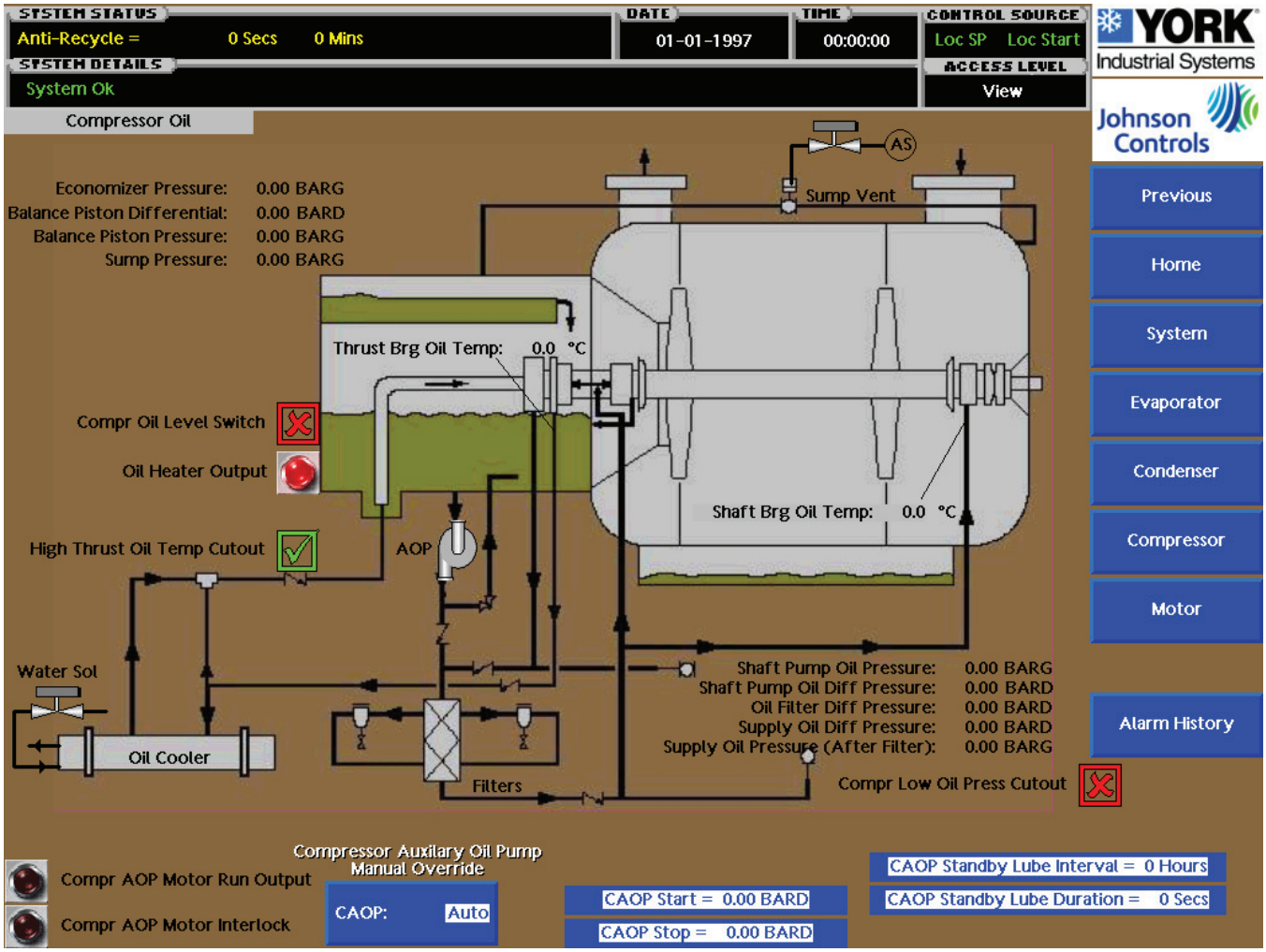
INTERACTIVE

PRE-ROTATION VANE MANUAL / AUTO STATION

Operator may manually adjust the position of the pre-rotation vanes

Pressing the Auto button allows the operator to adjust the pre-rotation vane setting from 0 – 100% open using the Open and Close keys on the bottom of the display. Pressing the Manual tab while in manual control mode toggles back to automatic control.

2.8.6 COMPRESSOR LUBRICATION



DISPLAY

- OIL SUMP TEMPERATURE - Displays the oil sump temperature
- OIL SUMP PRESSURE - Displays the pressure at the low pressure side of the oil loop
- OIL SUPPLY PRESSURE - Displays the oil supply differential pressure (pump – sump)
- SHAFT OIL PUMP PRESSURE - Displays the oil supply differential pressure (pump – sump)
- OIL FILTER PRESSURE DROP – Displays the pressure drop across the supply oil filter. The pressure drop will indicate when the filter needs cleaned.
- AUX OIL PUMP RUN OUTPUT - Indicates the operational status of the electric auxiliary oil pump
- AUX PUMP INTERLOCK – Indicates the interlock status of the motor starter.
- OIL RETURN SOLENOID - Indicates the status of the oil return solenoid

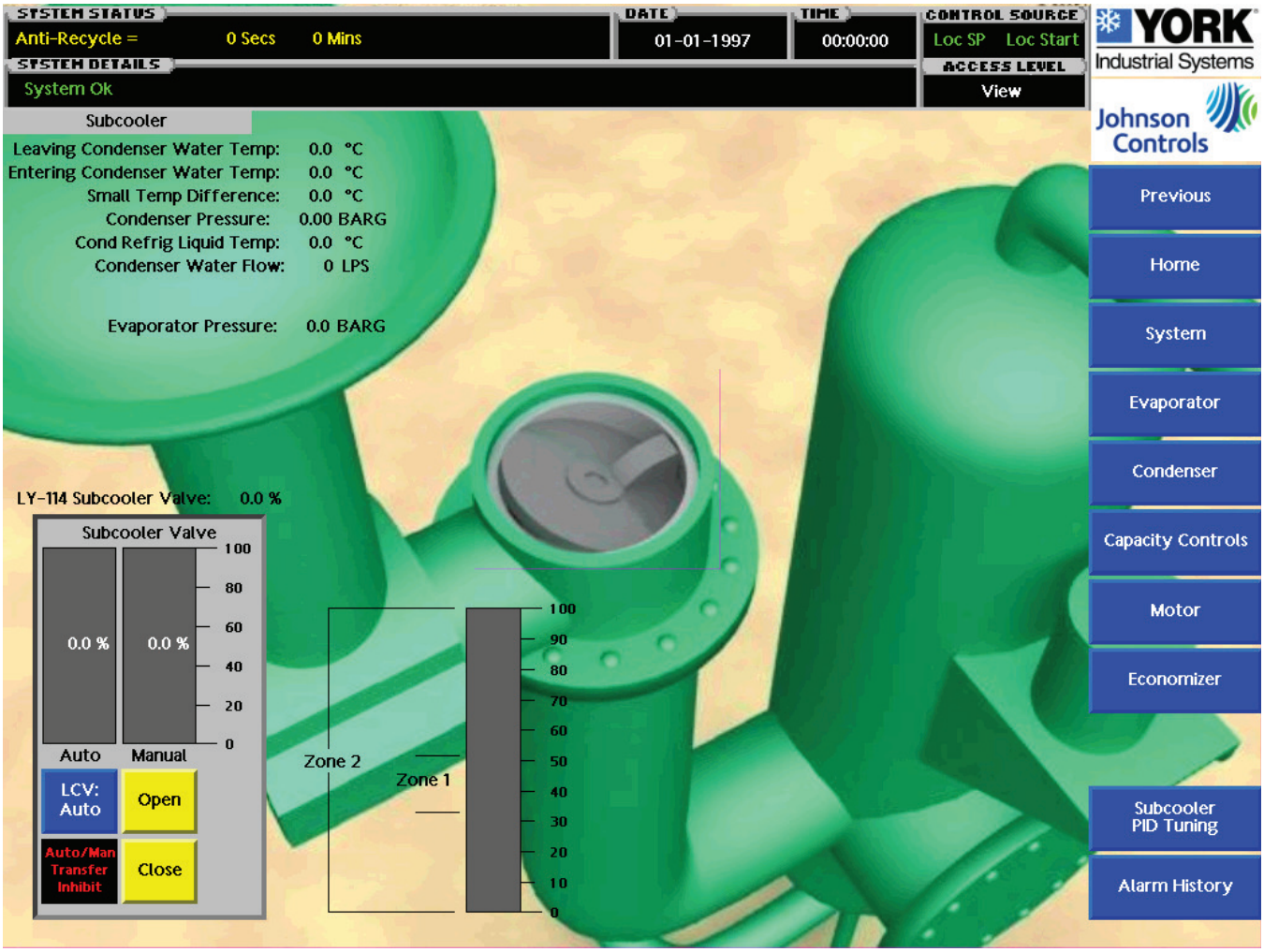
- AUXILIARY COOLING WATER SOLENOID – Shows whether the cooling water is on or off.
- OIL SUMP HEATER - Indicates the operational status of the oil heater
- OIL SEPERATOR HEATER – Indicates the operational status of the oil still heater.

INTERACTIVE

CAOP AUTO / MANUAL

Toggles the auxiliary oil pump off/on. This can be used for running the oil lubrication circuit.

07 SUBCOOLER



DISPLAY

- RETURN CONDENSER WATER TEMPERATURE - Displays the temperature of the condenser water returning to the condenser

- LEAVING CONDENSER WATER TEMPERATURE - Displays the temperature of the condenser water returning to the condenser
- CONDENSER REFRIGERANT TEMPERATURE - Displays the current temperature of the condenser refrigerant
- SUBCOOLER TEMPERATURE – Displays the temperature of the refrigerant in the
- subcooler
- CONDENSER SMALL TEMPERATURE DIFFERENCE - Displays the temperature expressed as a differential between the water leaving and the water entering the condenser
- CONDENSER REFRIGERANT LEVEL - (Graphical) Displays the condenser refrigerant level in percent

INTERACTIVE
SUBCOOLER VALVE MANUAL/AUTO STATION

Operator may manually adjust the position of the subcooler valve.

Pressing the LCV AUTO button switches the valve control into MANUAL. This allows the operator to adjust the subcooler valve setting from 0 – 100% open using the OPEN and CLOSE buttons. Pressing the LCV MANUAL button, while in manual control mode, toggles back to AUTO control.

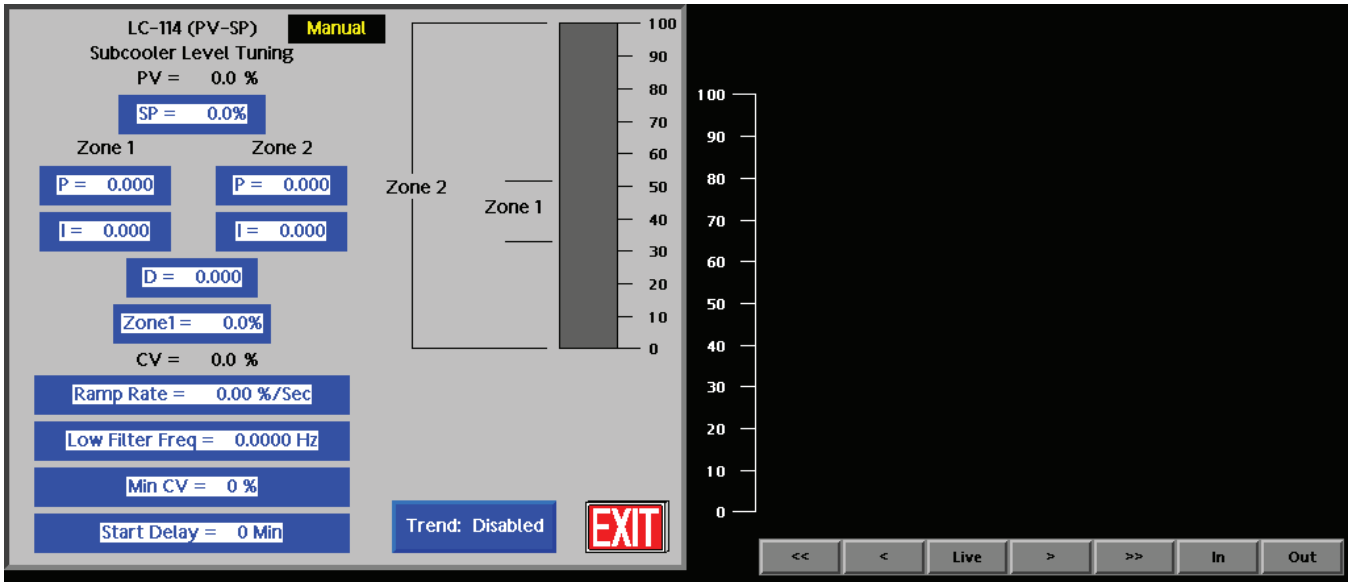
Zone 1/Zone 2 PID controller

The level controller used on the YORK Industrial Products has adopted an advanced control algorithm for refrigerant level control. The Zone 1 / Zone 2 controller allows a variable reaction system to better control refrigerant level. Since the level controller can be easily upset by a sudden CV change, a highly integral controller is required to maintain a stable operation. Since the highly integral nature of the controller produces a very long time lag, the normal refrigerant level controller does not react well to system changes and takes a long time to reestablish design level.

This advanced algorithm uses the control loop as two PID reactions. When the process variable is within a defined Zone around the desired set point, the Zone 1 tuning parameters are used. This allows a slower reaction to insure a stable highly integral controller.

If the process variable deviates from the set point, the Zone 2 parameters are used to quickly reestablish the set point. The Zone 2 parameters should be tuned faster and with less integral gain than the Zone 1 parameters. See the Subcooler PID Tuning Screen below for set points.

2.8.7 SUBCOOLER



DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data. This screen pop-up is available from the SUBCOOLER screen, if the loop gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE

LC-114 is the subcooler level control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(SP) Subcooler Level Set Point - Operator uses this entry field to adjust the subcooler level set point
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **ZONE 1** – Is the steady state control loop gains.
- **ZONE 2** – Is the transient and more aggressive control loop gains.
- **ZONE** – Defines the zone around the SP to create ZONE 1 range.
- **RAMP RATE** – When the compressor motor full voltage run contact transitions, it enables the START DELAY timer. After time out, the subcooler valve will ramp closed

at the RAMP RATE set point to build a level in the subcooler. The ramp will stop if the PV reaches or goes above SP.

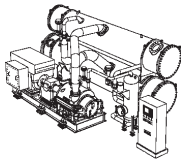
- **LOW FILTER FREQ** – The liquid refrigerant is a large fluid mass affected by entering high velocity gas, constant high frequency wave and ripple motion are measured by the level probe. The processor will filter out the high frequency signal changes based on the LOW FILTER FREQ set point. Frequencies at or below the LOW FILTER FREQ set point will be passed to the PID controller.
- **MIN CV** – The subcooler level control valve cannot be allowed to close. The control variable signal is limited to this percentage, to keep the valve from completely closing and the unit from going down on low suction pressure.
- **START DELAY** – Time period that the ramp will be delayed after compressor motor full voltage run is established.

Zone 1 / Zone 2 PID controller

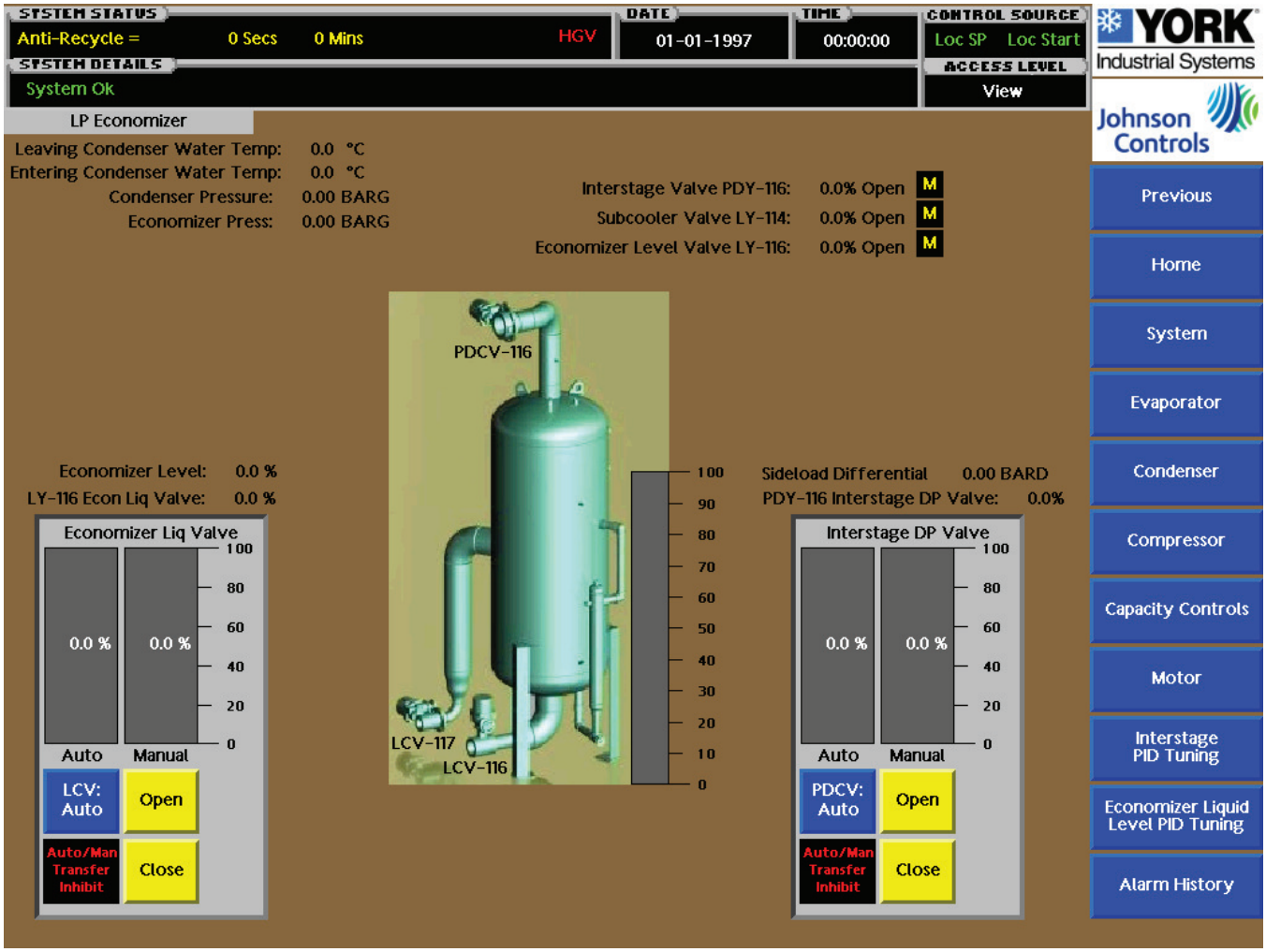
The level controllers used on the YORK Industrial Products have adopted an advanced control algorithm for refrigerant level control. The Zone 1 / Zone 2 controller allows a variable reaction system to better control refrigerant level. Since the level controller can be easily upset by a sudden CV change, a highly integral controller is required to maintain a stable operation. Since the highly integral nature of the controller produces a very long time lag, the normal refrigerant level controller does not react well to system changes, and takes a long time to reestablish design level.

This advanced algorithm uses the control loop as two PID reactions. When the process variable is within a defined deadband around the desired set point, the Zone 1 tuning parameters are used. This allows a slow methodical reaction to insure a stable highly integral controller.

If the process variable deviates from the set point, the Zone 2 parameters are used to quickly reestablish the set point. The Zone 2 parameters should be tuned faster and with less integral gain than the Zone 1 parameters.



2.8.8 Economizer



The economizer screen depicts the operation of the economization vessel, which is mounted beside the main heat exchanger vessels. The economizer takes subcooled liquid into its side port from the subcooler level control valve LCV-114. This liquid is decelerated thru a spray-pipe and a vortex breaker. The decelerated liquid is exposed to intermediate interstage pressure. Some small amount of the liquid flashes into a gas and travels thru the top port (thru an eliminator) and out into the interstage. The remaining liquid travels thru the bottom of the economizer, where its level is controlled by the outlet level control valve LCV-116. This action provides a cycle efficiency improvement by adding flash-gas to the suction of the booster compressor. The level control of the economizer provides a liquid seal between the intermediate gas pressure and the evaporator pressure on the other side of the LCV-116 level control valve. A 40 to 50% level is typical for the economizer vessel level. The level set point is not critical, just that the liquid seal is maintained.

On startup, the economizer level control will ramp the valve closed after a delay period to build sufficient level. The ramp will be completed once the level measurement is at or above set point. The refrigerant management aspect of the economizer must be maintained during normal operation. This prevents slugging liquid into the suction of the compressor.

INTERACTIVE

ECONOMIZER VALVE MANUAL/AUTO STATION

Operator may manually adjust the position of the economizer valve.

Pressing the LCV AUTO button switches the valve control into MANUAL. This allows the operator to adjust the economizer valve setting from 0 – 100% open using the OPEN and CLOSE buttons. Pressing the LCV MANUAL button, while in manual control mode, toggles back to AUTO control.

There is a sideload pressure control valve for each additional stage on a Titan M-compressor chiller. On a two-stage M-compressor there will only be PDC-116 visible.

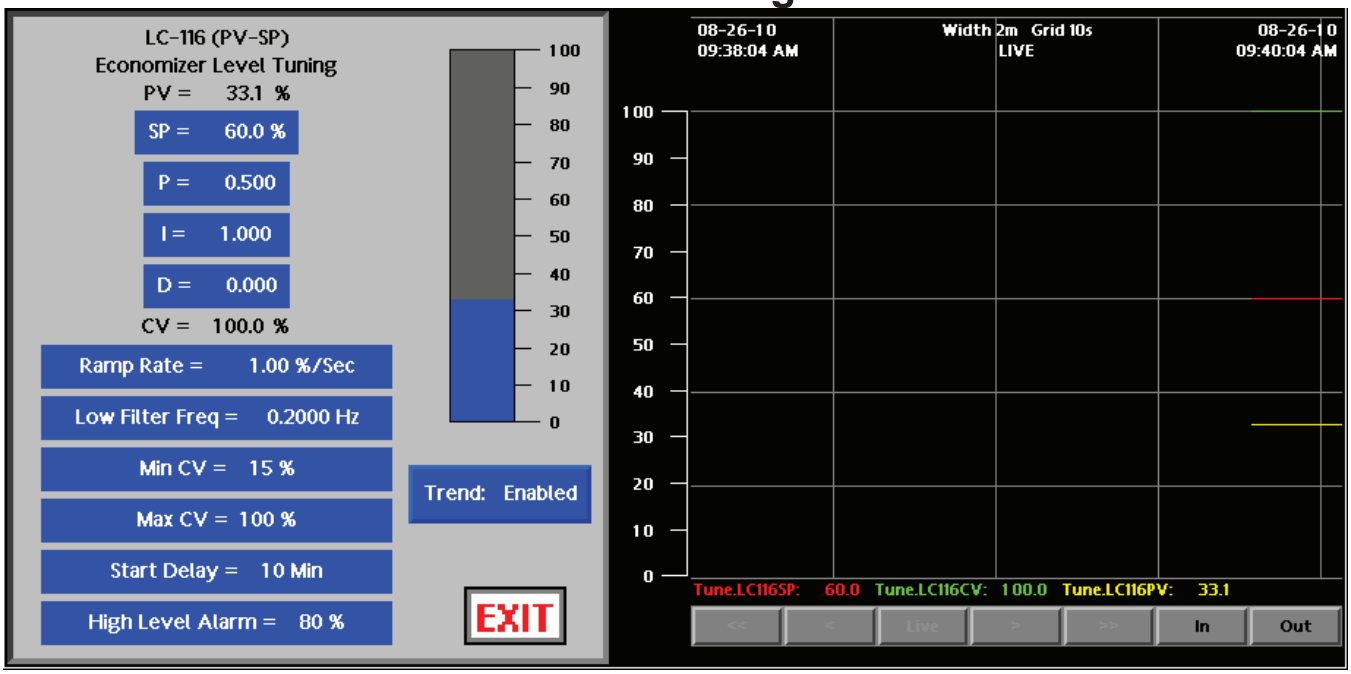
The sideload control valves are used to insure a pressure drop occurs across the expansion devices on the bottom of each economizer stage. If the pressure drop isn't sufficient, then the sideload valve will start to throttle back and create a pressure difference. The sideload control valve is also used to prevent backspin at shutdown. When the unit goes into a controlled stop, the sideload is closed to prevent pressure from forcing the compressor to spin backwards. The interstage sideload valve also protects the compressor from liquid slugging, by closing, if a high economizer level occurs.

INTERSTAGE SIDELOAD DP MANUAL/AUTO STATION

Operator may manually adjust the position of the interstage valve.

Pressing the PDCV AUTO button switches the valve control into MANUAL. This allows the operator to adjust the interstage valve setting from 0 – 100% open using the OPEN and CLOSE buttons. Pressing the PDCV MANUAL button, while in manual control mode, toggles back to AUTO control.

2.8.9 Economizer Level PID Tuning Screen



DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data. This screen pop-up is available from the ECONOMIZER screen, if the loop gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE

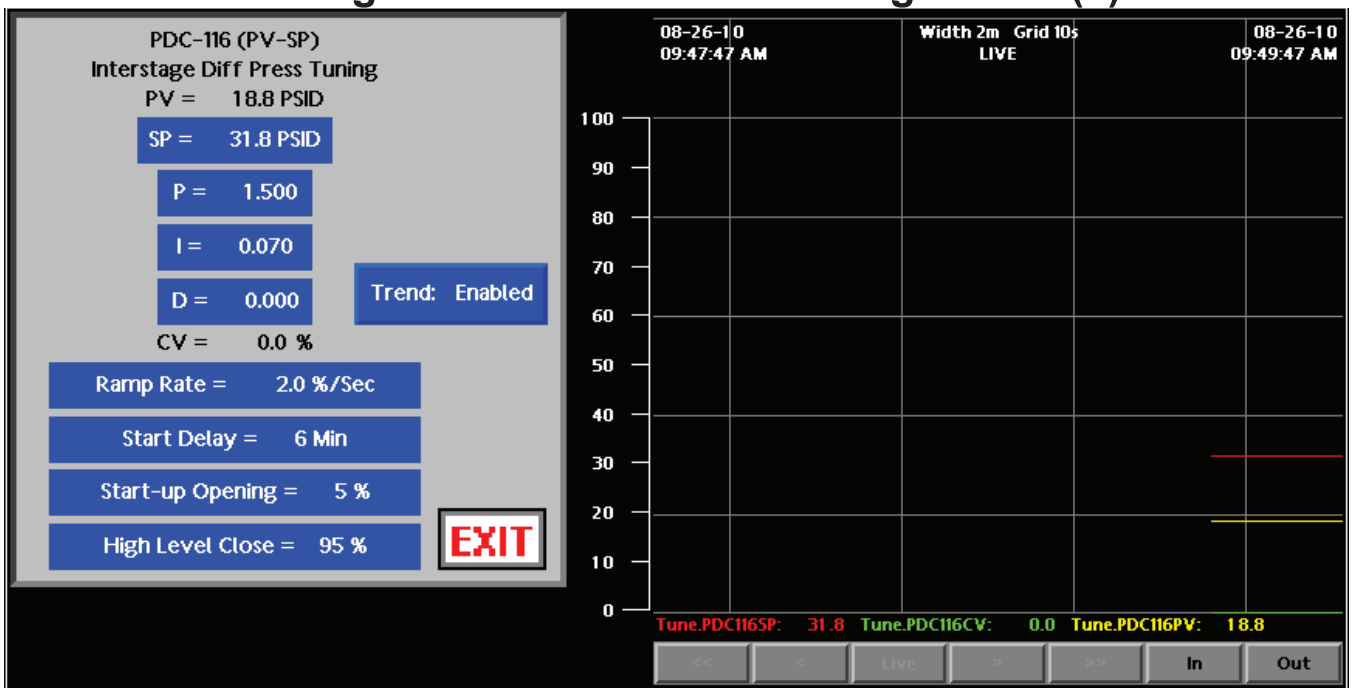
LC-116 is the economizer level control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(SP) Economizer Level Set Point - Operator uses this entry field to adjust the economizer level set point
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **RAMP RATE** – When the compressor motor full voltage run contact transitions, it enables the START DELAY timer. After time out, the economizer valve will ramp closed at the RAMP RATE set point to build a level in the economizer. The ramp will stop if the PV reaches or goes above SP.

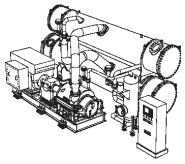
- **LOW FILTER FREQ** – The liquid refrigerant is a large fluid mass affected by entering high velocity gas, constant high frequency wave and ripple motion are measured by the level probe. The processor will filter out the high frequency signal changes based on the LOW FILTER FREQ set point. Frequencies at or below the LOW FILTER FREQ set point will be passed to the PID controller.
- **MIN CV** – The economizer level control valve cannot be allowed to close. The control variable signal is limited to this percentage, to keep the valve from completely closing and the unit from going down on low suction pressure.
- **MAX CV** – The control variable signal is limited to this percentage, to keep the valve from completely opening.
- **START DELAY** – Time period that the ramp will be delayed after compressor motor full voltage run is established.
- **HIGH LEVEL ALARM** – If the level measurement is above this set point an alarm indicator will be displayed on the HMI. This should be investigated to insure that liquid does not slug the compressor through the interstage line.

2.8.10 Interstage Diff Pressure PID Tuning Screen(s)



DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data.



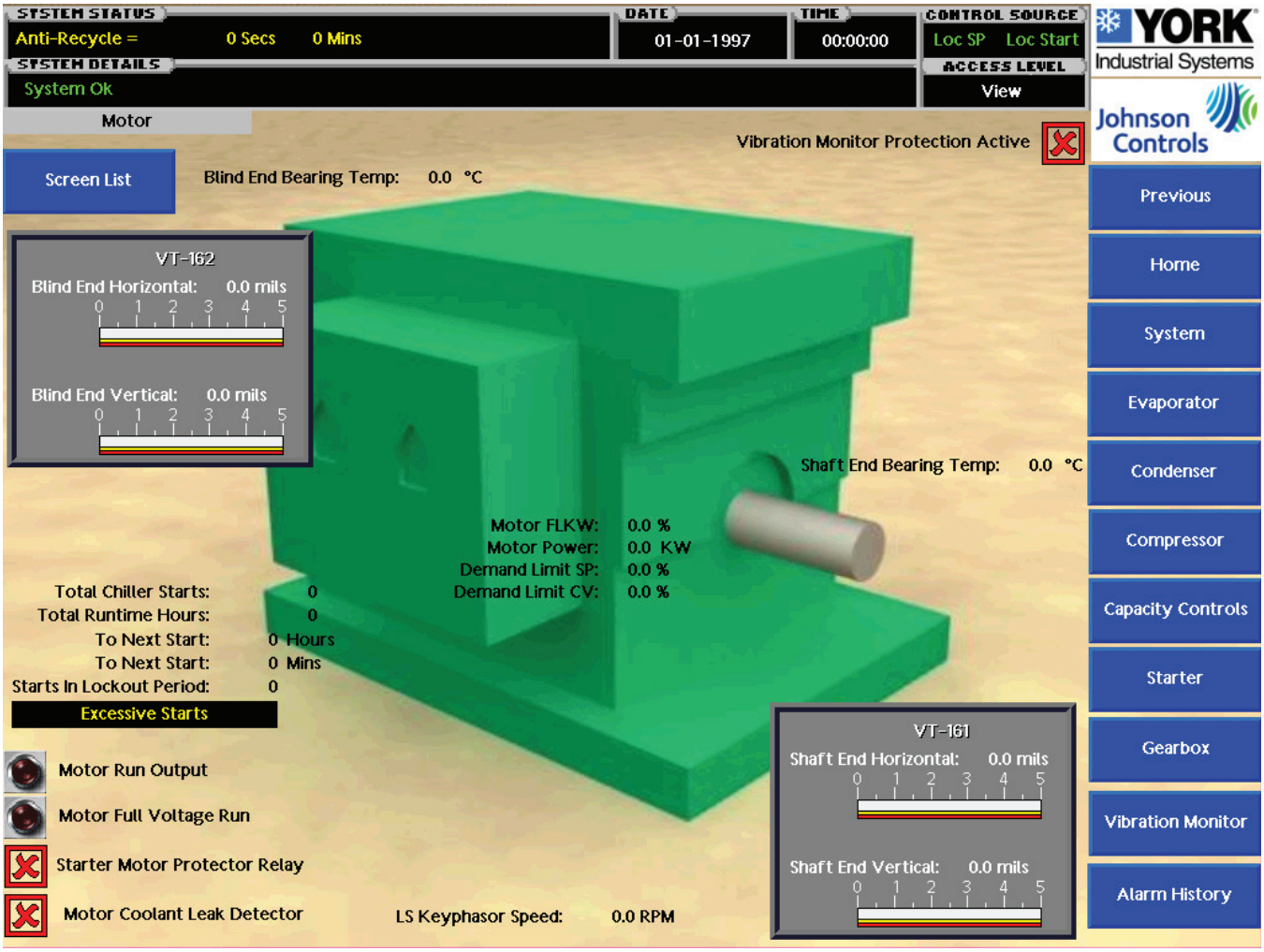
This screen pop-up is available from the ECONOMIZER screen, if the loop gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE
PDC-116 is the interstage differential pressure control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(SP) Differential Set Point - Operator uses this entry field to adjust the interstage diff pressure set point
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **RAMP RATE** – When the compressor motor full voltage run contact transitions, it enables the START DELAY timer. After time out, the interstage valve will ramp closed at the RAMP RATE set point. The ramp will stop if the PV reaches or goes above SP.
- **START DELAY** – Time period that the ramp will be delayed after compressor motor full voltage run is established.
- **START-UP OPENING** – The position the valve will move to when a chiller start is initiated.
- **HIGH LEVEL CLOSE** – If the level measurement is above this set point the interstage valve will immediately close. This is to insure that liquid does not slug the compressor through the interstage line.

2.8.11 MOTOR



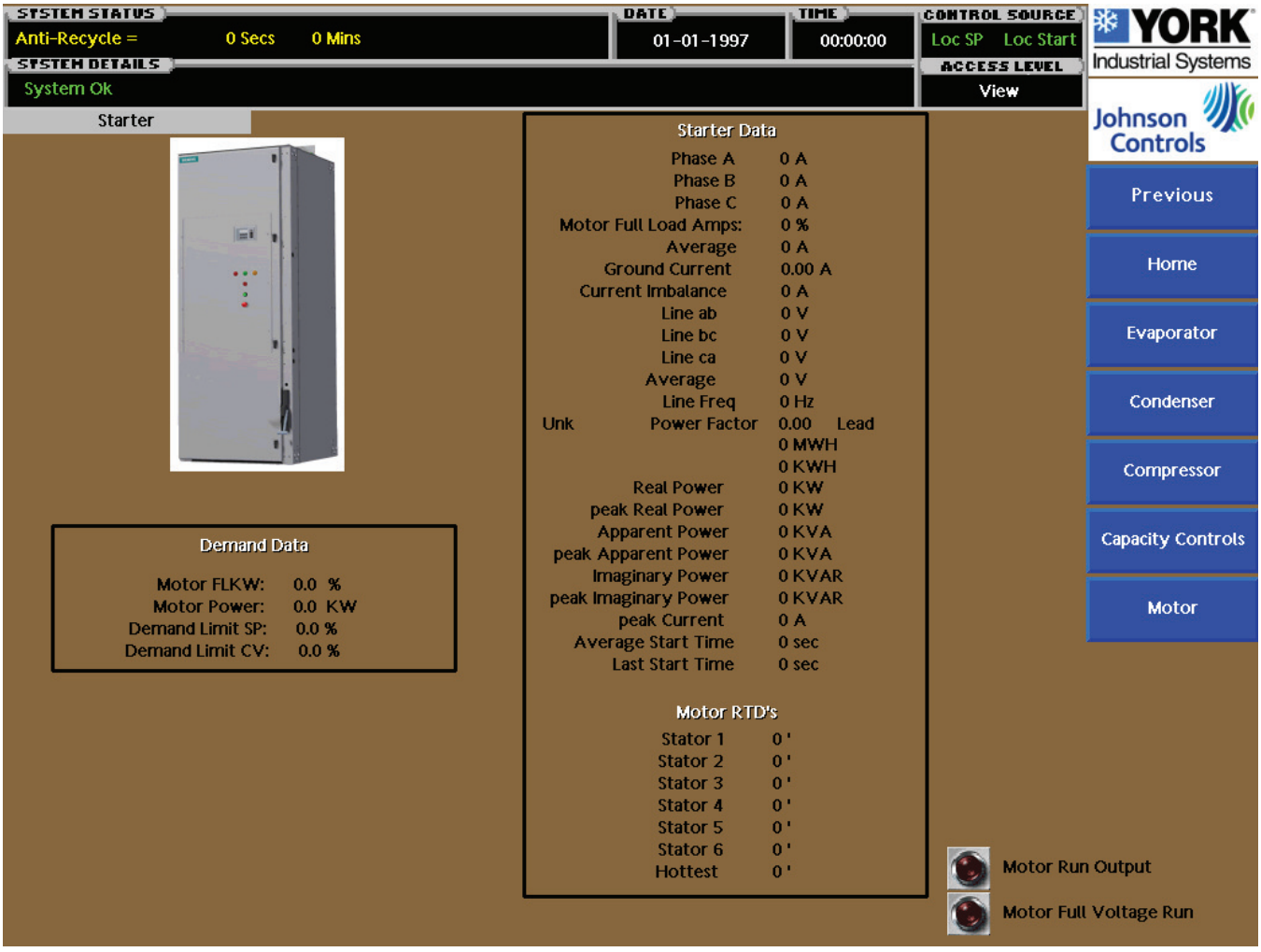
DISPLAY

- BLIND END BEARING TEMPERATURE – The temperature of the blind end bearing temperature is measured and alarmed upon if the temperature increases beyond the manufacturer's recommendations.
- SHAFT END BEARING TEMPERATURE – The temperature of the blind end bearing temperature is measured and alarmed upon if the temperature increases beyond the manufacturer's recommendations.
- MOTOR POWER – The motor power box shows the motor load in percent as well as the demand limiter setpoint and the demand limiter algorithm output. Normally, the algorithm result will be 100%. When the load increases, and the vanes must be throttled back to unload the chiller, the algorithm will slowly reduce this number until the load limit is no exceeded.

The Vibration Monitoring Equipment can be observed from this page.

- The current vibration level will show up with a blue bar graph.
- The alert level limit will appear below it as a yellow bar graph.
- The danger level limit will appear below it as a red bar graph.

2.8.12 MAIN MOTOR STARTER

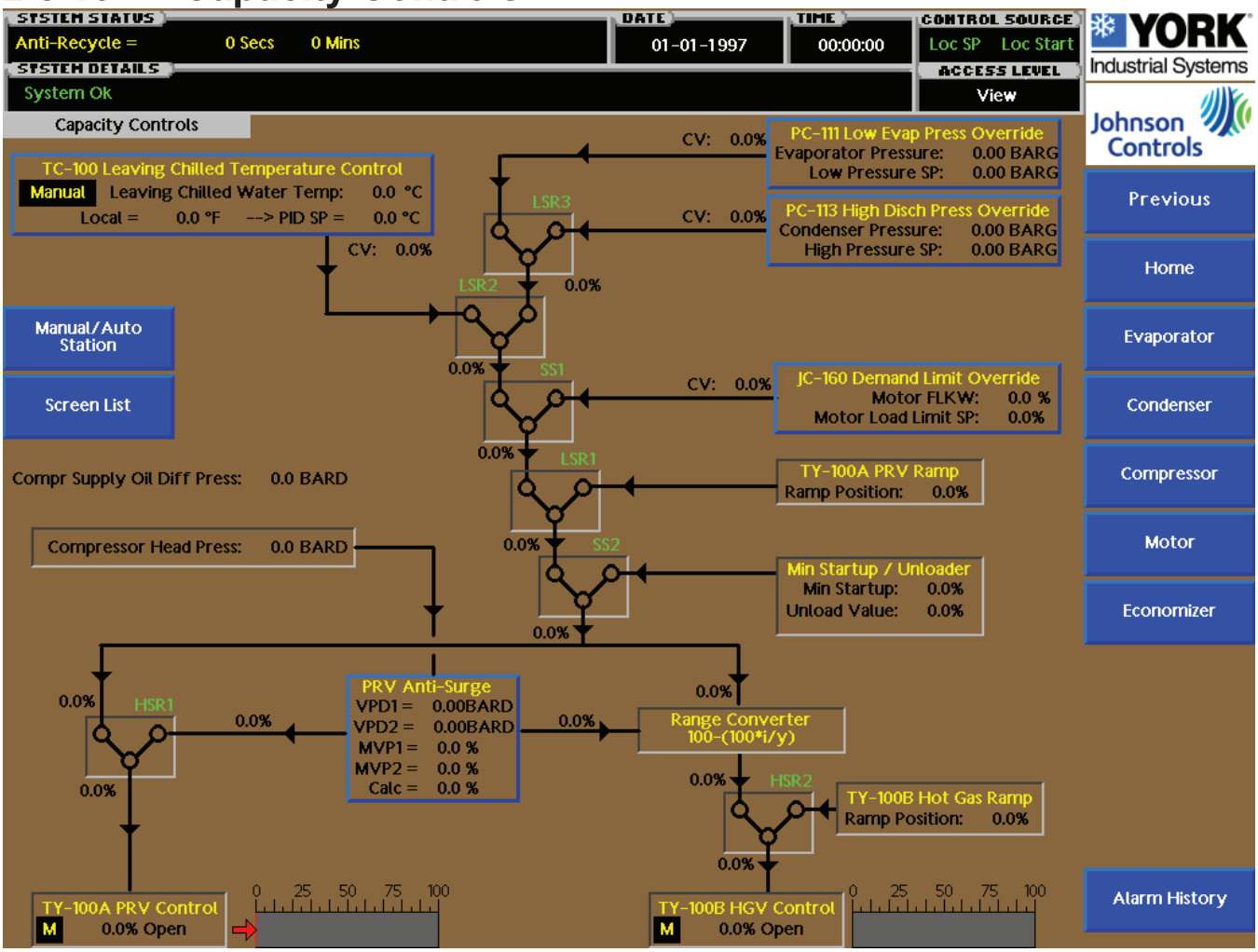


This screen is informational only.

The Solid State Starter information screen shows the basic parameters read from the Starter. Voltage, Current, Averages, Power, Power Factor, Frequency, and Runtime counters.

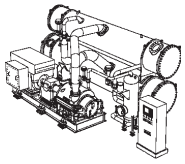
The Solid State Starter controls the runtime and the anti-recycle timers. Refer to the Starter section of this manual for greater detail on this functionality.

2.8.13 Capacity Controls



The Capacity Controls Screen schematically illustrates the logical operations of chiller capacity control. Sensor readings are linked with set point values and compared. PID loops, depicted in each box, pass signals through high or low-pass relay (HSR/LSR) junctions. The relay makes a simple comparison of two signals and passes the higher or lower of the two, depending on whether the relay is high or low pass.

Leaving Water temperature TC-100 from the evaporator heat exchanger is the process signal. The TITAN control system will adjust the vanes and hot gas valve to attempt to generate the desired process temperature.



The capacity drive signal at SS-2 is fed into the RANGE CONVERTER, which turns the 0 to 100% signal into a signal to control the hot gas valve when the vanes are at their anti-surge position. Outputs are graphically represented by bar graphs at the bottom of the screen. For compressor motor speed and PRV position, a red arrow pointing right indicates that the vane position should be even or to the right of this point. This indicates the minimum anti-surge positions.

Touching the PID control block navigates to the individual PID tuning screen.

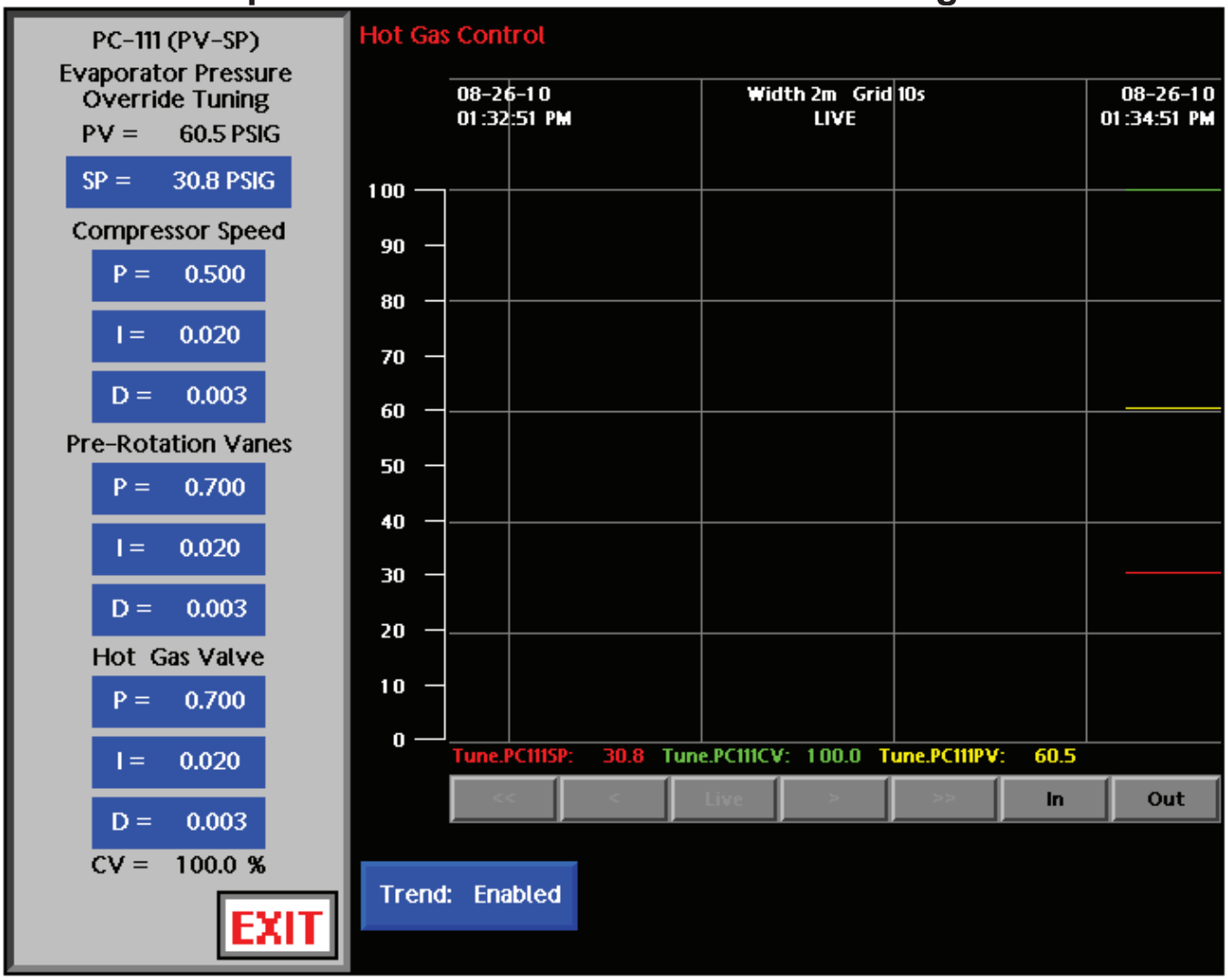
DISPLAY

- **TC-100 LEAVING CHILLED TEMPERATURE CONTROL** – Displays the leaving water temperature, if the set point is LOCAL or REMOTE and the current PID set point. Depending on the user access level, when pushing this box, the capacity control tuning screen will appear.
- **TY-100B HGV RAMP** – Displays the hot gas valve ramp position.
- **TY-100B HGV CONTROL** – Displays the scaled signal being transmitted to the hot gas by-pass control valve I/P.
- **TY-100A PRV RAMP** – Displays the pre-rotation vanes ramp position.
- **TY-100A PRV CONTROL** – Displays the scaled signal being transmitted to the compressor pre-rotation vanes control I/P.
- **PRV ANTI-SURGE CALCULATION –** The calculated minimum PRV position as a function of head pressure.

OVERRIDES

- **PC-111 EVAPORATOR PRESSURE OVERRIDE** – Displays the current evaporator pressure and low pressure override set point. The override set point is the threshold which the chiller will unload if the evaporator pressure is below this value. Depending on the user access level, when pushing this box, a PID tuning pop-up will appear to adjust loop tuning and set points.
- **PC-113 CONDENSER PRESSURE OVERRIDE** – Displays the current condenser pressure and high pressure override set point. The override set point is the threshold which the chiller will unload if the condenser pressure is above this value. Depending on the user access level, when pushing this box, a PID tuning pop-up will appear to adjust loop tuning and set points.
- **IC-160 DEMAND LIMIT OVERRIDE** – Displays the current motor percent FLA and motor load override set point. The override set point is the threshold which the chiller will unload if the motor load is above this value. Depending on the user access level, when pushing this box, a PID tuning pop-up will appear to adjust loop tuning and set points.

2.8.14 Evaporator Low Pressure Override Tuning



Contact a YORK Service Agent if adjustments are required to the Capacity Controls tuning.

Evaporator Low Pressure Override is the most important override, which allows a quick response to a system which is approaching a freezing condition of low suction pressure. This controller should be set somewhat aggressively to provide a minimum suction pressure control.

DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour

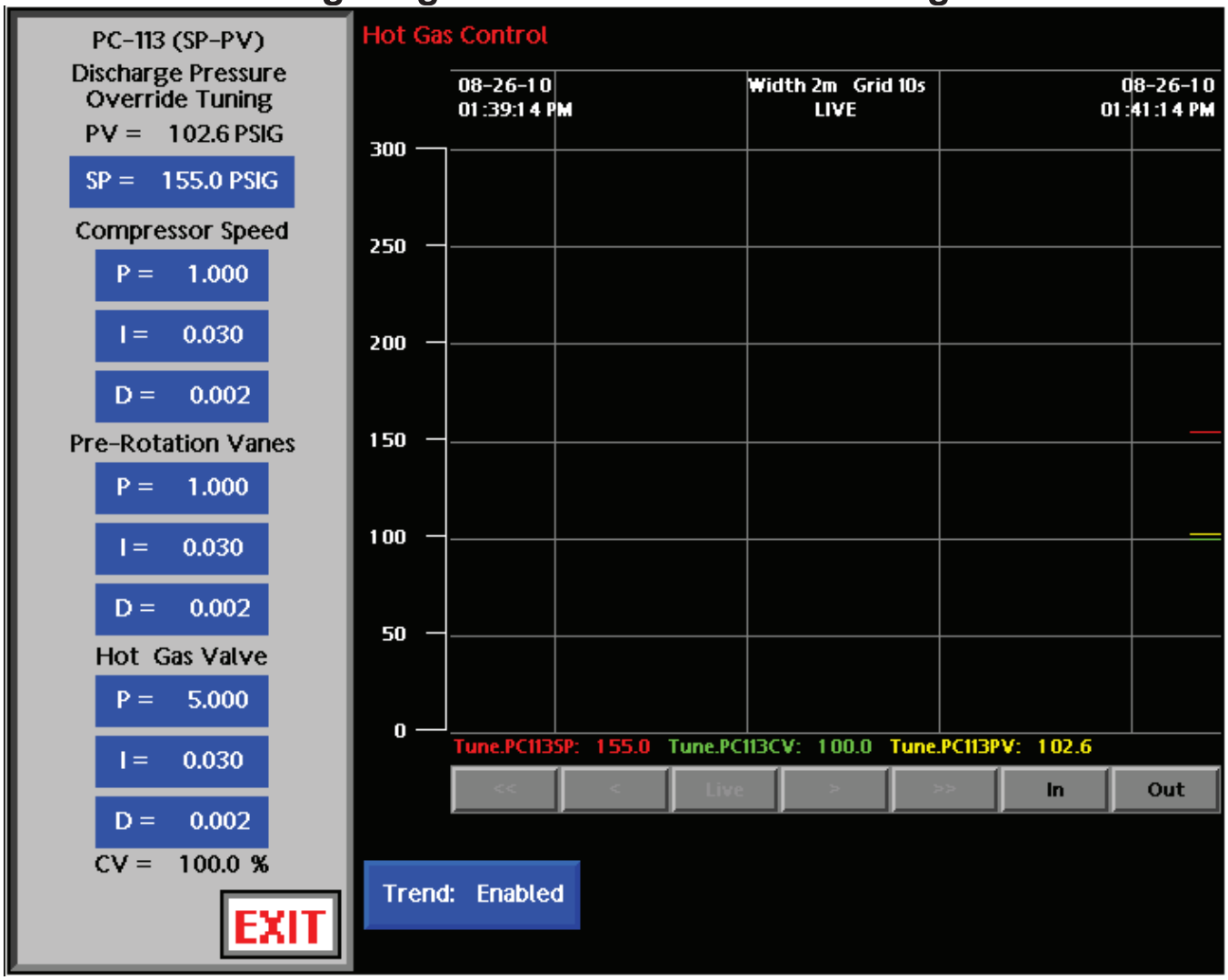
(3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data. This screen pop-up is available from the CAPACITY TUNING or MANUAL/AUTO STATION screen, if the chiller gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE
PC-111 is the evaporator low pressure override control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(LOC/REM SP) Temp Set Point - Operator this adjust the leaving chilled water temperature set point, either remotely or locally
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **SP** – The evaporator low pressure threshold that unloads the compressor.

2.8.15 Discharge High Pressure Override Tuning

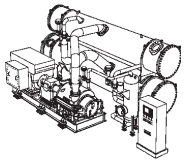


Contact a YORK Service Agent if adjustments are required to the Capacity Controls tuning.

Discharge High Pressure Override prevents shutdowns on high pressure conditions. If the condenser tower system malfunctions and cannot reject enough heat from the chiller, this override keeps the chiller unloaded until the discharge pressure returns to normal.

DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data.



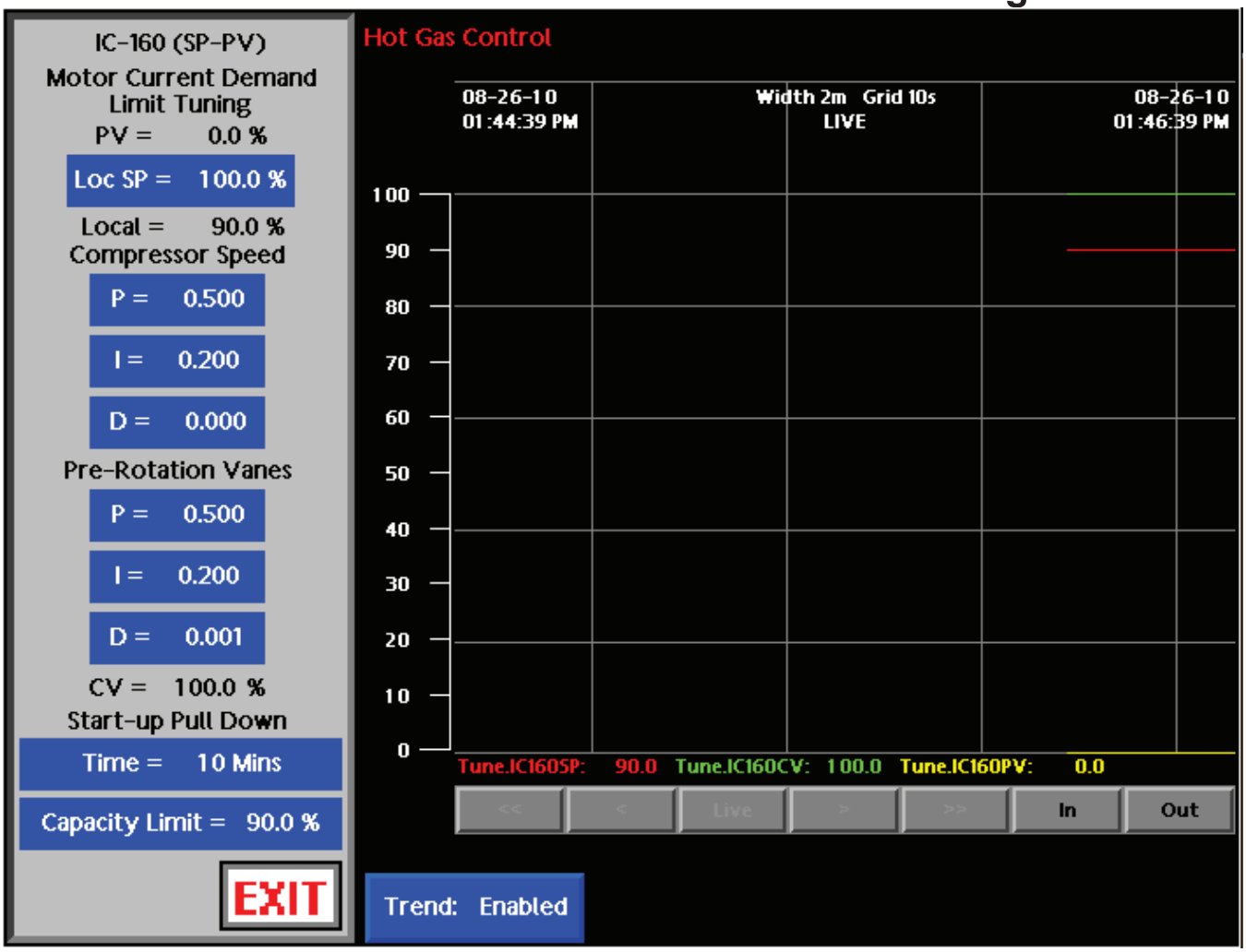
This screen pop-up is available from the CAPACITY TUNING or MANUAL/AUTO STATION screen, if the chiller gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE
PC-113 is the discharge high pressure override control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(LOC/REM SP) Temp Set Point - Operator this adjust the leaving chilled water temperature set point, either remotely or localy
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **SP** – The discharge high pressure threshold that unloads the compressor.

2.8.16 Motor Current Demand Limit Override Tuning

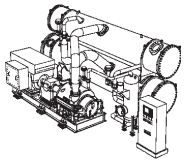


Contact a YORK Service Agent if adjustments are required to the Capacity Controls tuning.

Motor Demand Limit keeps the motor from going into an overcurrent situation. The unloading will be limited down to anti-surge, without using recycle gas.

DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data. This screen pop-up is available from the CAPACITY TUNING or MANUAL/AUTO STATION screen, if the chiller gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.



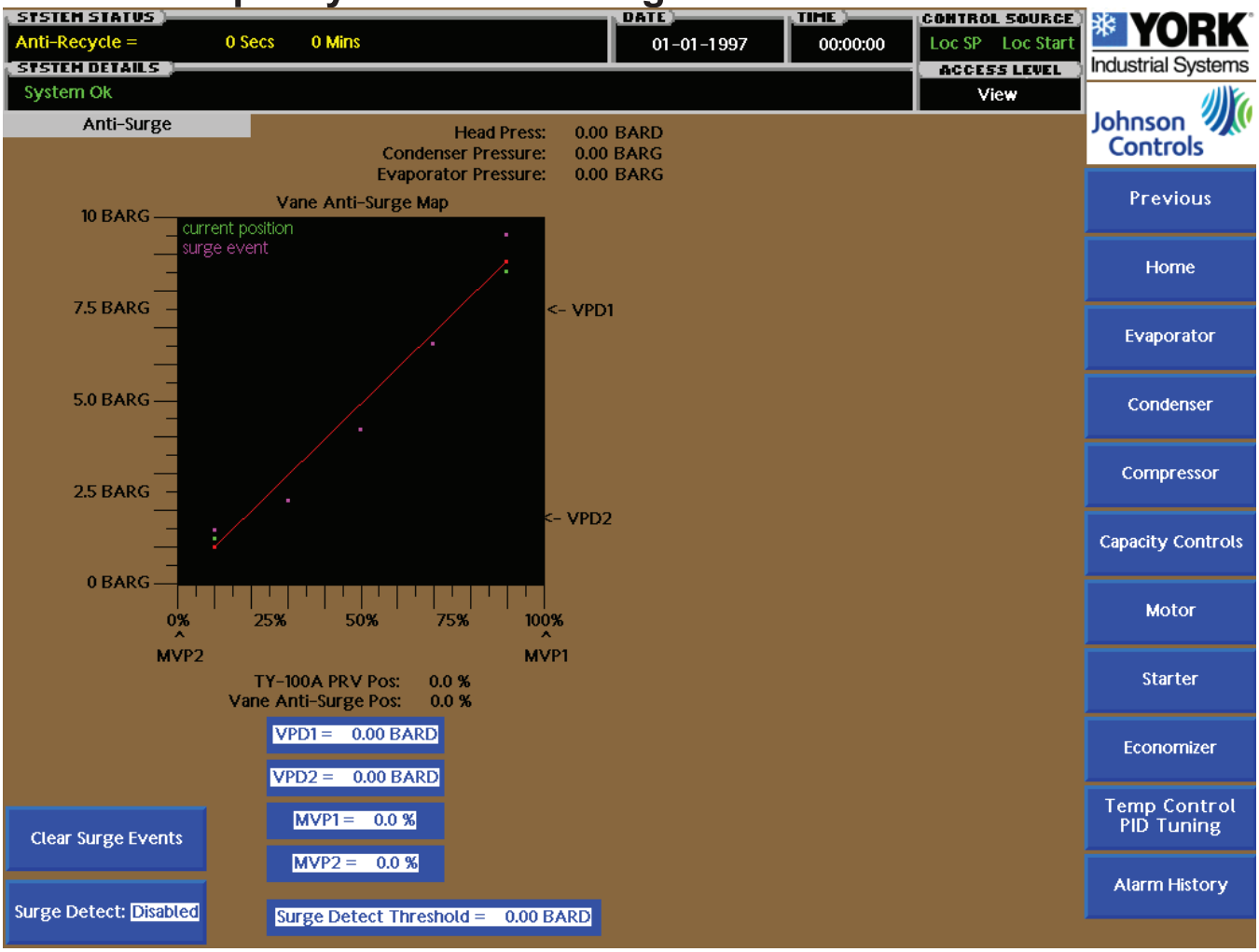
PROGRAMMABLE

IC-160 is the motor current demand limit override control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(LOC/REM SP) Temp Set Point - Operator this adjust the leaving chilled water temperature set point, either remotely or localy
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **LOC/REM SP** – The motor current threshold that unloads the compressor to minimum anti-surge position without utilizing hot gas.
- **START-UP PULL DOWN TIME** – The time used to limit the motor current at start-up per the start-up pull down capacity limit set point.
- **START-UP PULL DOWN CAPACITY LIMIT** – The motor current threshold that unloads the compressor during the pull down time.

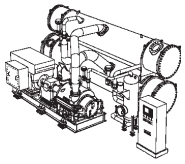
2.8.17 Capacity Controls Tuning Screen



Contact a YORK Service Agent if adjustments are required to the Capacity Controls tuning.

ANTI-SURGE MAP

Depicted on the Anti-surge tuning parameters screen are plots showing the surge area as a function of compressor head versus PRV position and motor speed. The area to the left the line, highlighted in red, are the conditions under which surge can be expected to occur.
VPD1 is the maximum system head pressure as defined by the entry fields.
VPD2 is the minimum system head pressure as defined by the entry fields.
MVP1 is the minimum allowable vane position at the maximum system head pressure VPD1.
MVP2 is the minimum allowable vane position at the minimum system head pressure VPD2.



The Anti-surge parameters must be determined experimentally during the commissioning procedure. Values shipped with the unit are only default.

GREEN dots on the plots show the current system running points.

RED dots on the plots show the current VPD1, VPD2, MVP1, and MVP2 set points.

MAGENTA dots on the plots show recorded surge points.
Surge Detection logic can be ENABLED or DISABLED. When ENABLED, if surge event is detected and alarm indicator will appear in the system details banner and recorded in alarm history. If excessive surges are detected in a 5 minute period, the chiller will trip. A message will be displayed in the system details banner and recorded in the alarm history. The surge head set point is the threshold used to indicate a surge event. This change in head would indicate that high pressure gas from the condenser flow backwards through the compressor.

2.8.18 Temperature Control PID Tuning Screen

Contact a YORK Service Agent if adjustments are required to the Capacity Controls tuning.

This screen would normally only be used on initial start-up by a York Service Technician to fine tune the capacity controls. The effects of changes to the PID tuning are observed by changing back to Capacity Controls Screen.

DISPLAY

A trend is available, depending on the user access level, to assist in tuning the PID loop. The trend can be ENABLED / DISABLED to save memory. If the trend is not being used, it should

be disabled so that data is not being stored in memory. Data will only be stored for 1 hour (3600 samples per hour) and the file will be overwritten to start storing another 1 hour of data. This screen pop-up is available from the CAPACITY TUNING or MANUAL/AUTO STATION screen, if the chiller gets unstable, EXIT and stabilize the system using the MANUAL/AUTO STATION.

PROGRAMMABLE
TC-100 is the leaving chilled water temperature control box. Parameters include:

(PV) Process Variable - Indicates the process variable value
(LOC/REM SP) Temp Set Point - Operator this adjust the leaving chilled water temperature set point, either remotely or locally
PID - Proportional variable (P), Integral variable (I), and
Derivative variable (D)

- **PID SET POINT RAMP RATE** – The rate at which the PID set point will ramp when the local or remote set point is changed.
- **HOT GAS VALVE RAMP RATE** – The rate at which the hot gas valve will ramp to fully closed position.
- **PRV RAMP RATE** – The rate at which the pre-rotation vanes will ramp to fully open position.
- **MIN START POS** – The position the vanes will move to when the compressor motor full voltage run is established.

The present status of the adjustable tuning parameters are shown for each PID controller and other programmed control functions. The PID controllers are configured using ISA equations, with the following values:

SP	=	Set Point
P	=	Proportional Controller Gain
I	=	Integral Gain (Reset)
D	=	Derivative Gain

For the setpoint of TC-100 and JC-160, the "LOC SP=" text changes to “REM SP=” when being controlled remotely. See Evaporator Screen in Chiller Mode for details on changing the setpoint of the temperature control.

Refer to the software "INSTRUCTION SET REFERENCE" Manual for additional information on the PID instruction and proper methods for tuning.
http://support.rockwell.com

Changing Tuning Parameters

To change tuning parameters, press the RIGHT and LEFT TAB keys (⇆) on the keypad to select the numeric entry point by moving cursor point. The cursor appears as a green highlight box around the numeric entry point.

Enter the new value (with decimal if required) using the number keys on the terminal keypad.

After entering the new value in the scratchpad area, press the “ENTER” ↵ key to replace the existing value at the cursor.

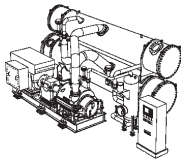
The tuning values shown are estimated only and may require adjustment depending on actual chiller operating conditions.

(TC-100) Chilled Water Out
(PC-111) Evaporator Pressure Override
(PC-113) Compressor Discharge Pressure Override
(LC-114) Subcooler Level Controller
(JC-160) Motor Load Limiter

Ramp Values

The Ramp Rates are used on chiller startup. The PID controls are put into manual, and ramped slowly to reach their setpoints without overshoot. The actual running conditions of the water system will determine whether faster or slower ramp rates are appropriate.

MIN PRV SIGNAL	=	Percent opening of vanes at motor start to the minimum position “DURING RAMP-UP”
PRV RAMP TIME	=	Total Time for vanes to open fully (assuming adequate load)
HGV RAMP TIME	=	Total Time for Hot Gas Valve to ramp close fully



ANTI-SURGE MAP

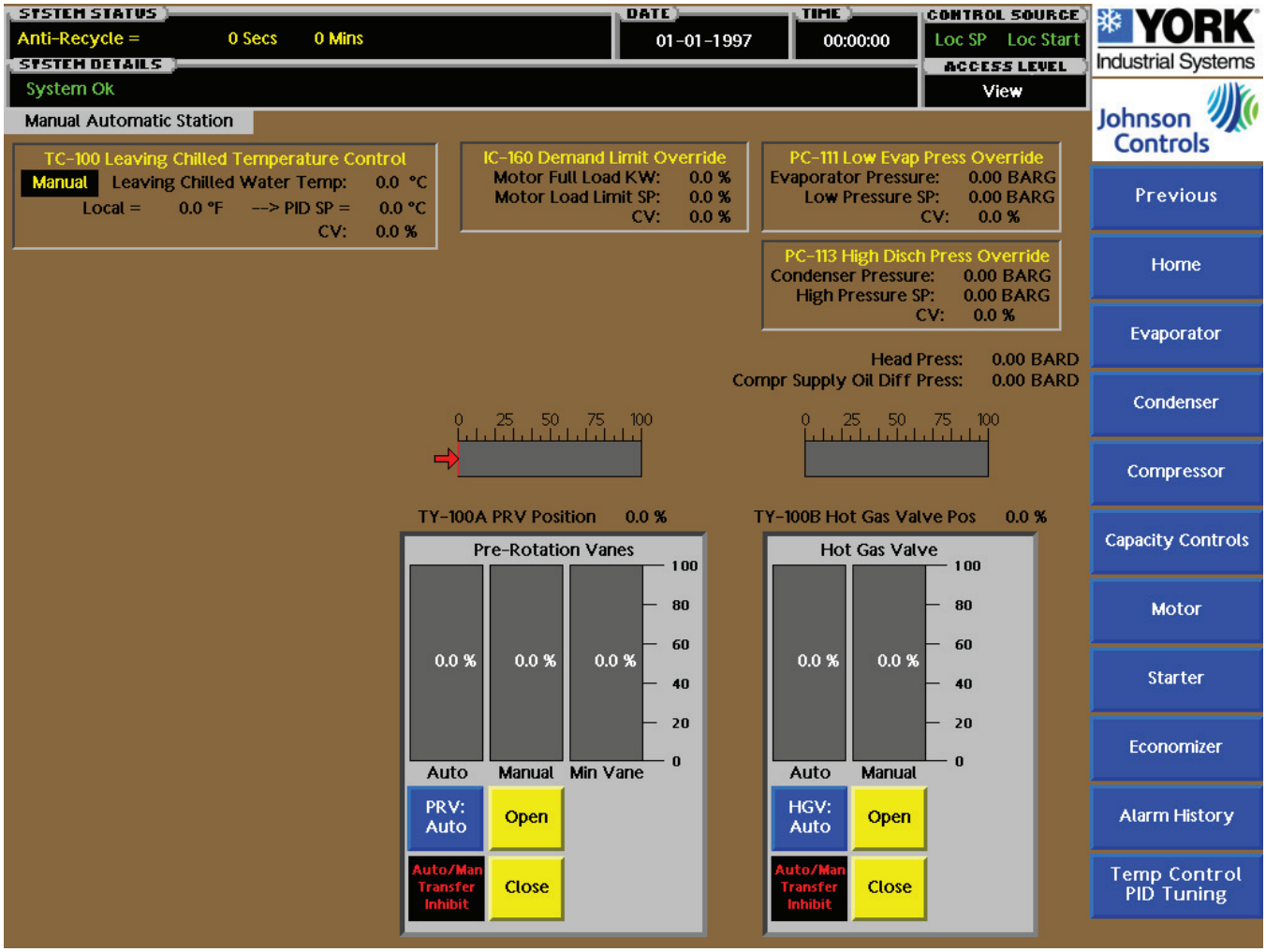
Depicted on the Anti-surge tuning parameters screen is plot showing the surge area as a function of compressor head versus PRV position. The area to the left the line, highlighted in red, are the conditions under which surge can be expected to occur.

PD1 is the maximum system head pressure as defined by the entry fields.
PD2 is the minimum system head pressure as defined by the entry fields.
MVP1 is the minimum allowable vane position at the maximum system head pressure PD1.
MVP2 is the minimum allowable vane position at the minimum system head pressure PD2.

An “X” on the plot shows the current vane operating point.

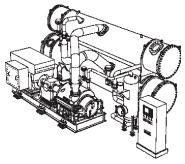
The Anti-surge parameters must be determined experimentally during the commissioning procedure. Values shipped with the unit are only default.

2.8.19 Manual / Auto Station Screen



The capacity controls manual / auto station screen can be used to take manual control of all capacity controls devices. Anti-surge values for the vanes are depicted as a RED bar graph to the right of the manual bar graph.

If the vanes or motor speed are put back into automatic control, above the calculated anti-surge value, the Capacity Controls algorithm will adjust to the manual value and calculate from that point. If released below anti-surge calculation, the station will go into an inhibit condition. The manual value must be increased above anti-surge to transition back to automatic operation.



INTERACTIVE

PRE-ROTATION VANE MANUAL/AUTO STATION

Operator may manually adjust the position of the pre-rotation vanes.

Pressing the PRV AUTO button switches the vane control into MANUAL. This allows the operator to adjust the pre-rotation vane setting from 0 – 100% open using the OPEN and CLOSE buttons. Pressing the PRV MANUAL button, while in manual control mode, toggles back to AUTO control. If below minimum anti-surge position, the switch back to AUTO will be inhibited until the vane position is above minimum anti-surge position.

HOT GAS VALVE MANUAL/AUTO STATION

Operator may manually adjust the position of the hot gas valve.

Pressing the HGV AUTO button switches the valve control into MANUAL. This allows the operator to adjust the hot gas valve setting from 0 – 100% open using the OPEN and CLOSE buttons. Pressing the HGV MANUAL button, while in manual control mode, toggles back to AUTO control.

2.8.20 VIBRATION MONITOR SETPOINTS

(Write access to this screen is only available at the highest access level)

Vibration Monitoring is an optional feature on Titan chillers. Bently-Nevada 3300RAM proximity probes are embedded in the casing of the driveline components. The probes are monitored by an Allen-Bradley XM-120 monitoring system. The XM modules transmit the vibration data back to the PLC by DeviceNet.

To change tuning setpoints, press the RIGHT and LEFT TAB keys (⇆) on the keypad to select the numeric entry point by moving cursor point. The cursor appears as a green highlight box around the numeric entry point.

Consult the York Factory before attempting to change any safety setpoints. These thresholds protect the TITAN chiller from operations outside its design parameters. Safe operation of the chiller, and warranty claims, will be compromised by unauthorized changes.

Enter the new value (with decimal if required) using the number keys on the terminal keypad.

After entering the new value in the scratchpad area, press the “ENTER” ↵ key to replace the existing value at the cursor.

Remember to press the “ENTER” ↵ key to confirm a setpoint change.

The Thrust Probe requires a zeroing calibration procedure during commissioning. The auxiliary oil pump will run to position the shaft as it will be with oil pressure present.

Press the ZERO THRUST PROBE button to begin the calibration procedure. The oil pump will start automatically.

Press the ACCEPT CALIBRATION button to accept a zero value into the Zero Position register.

Press the CANCEL CALIBRATION button to end the calibration procedure, which will automatically turn off the auxiliary oil pump.

2.8.20.1 XM Serial Configuration Utility

The XM Serial Configuration Utility provides additional diagnostic capability to the XM-120 Vibration Protection System. YORK service kit P/N 025-43003-000

See additional documentation from Rockwell Automation:
http://literature.rockwellautomation.com/idc/groups/literature/documents/gr/xmscu-gr002_-en-e.pdf

2.8.21 Scaling 1 Screen

Set point and scaling changes on this screen are only available under the highest access level.

The Safety set points are the thresholds of safe operation for the York TITAN chiller. Each TITAN is designed with unique applications in mind; therefore each will have unique safety set points. Reference Wiring Diagram drawing -999 for the factory specified set points.

Consult the York Factory before attempting to change any safety set points. These thresholds protect the TITAN chiller from operations outside its design parameters. Safe operation of the chiller, and warranty claims, will be compromised by unauthorized changes.

Scaling values in the processor must agree with the marked scaling values on each instrument. If the scaling is not correct, the safe operation of the chiller is jeopardized. Only change scaling under the direction of the factory.

DISPLAY

- **INPUT** – Displays the input channel for that slot,
- **RAW** – Displays the value from the input card.
- **EU MIN** – Displays the low engineering unit used to scale the raw value. (ex. 0 PSIG)
- **EU MAX** – Displays the high engineering unit used to scale the raw value. (ex. 300 PSIG)
- **EU SCALED** – Displays the calculated scaled engineering units using the raw input, EU Min and EU Max.
- **OOR** – Indicates an out of range condition for the input channel.
- L – Indicates a low alarm condition using SL as the threshold.
- L – Indicates a low low alarm (shutdown) condition using SLL as the threshold.
- H – Indicates a high alarm condition using SH as the threshold.
- H – Indicates a high high alarm (shutdown) condition using SHH as the threshold.
- **SLL** – Displays the low low alarm (shutdown) threshold.
- **SL** – Displays the low alarm threshold.
- **SHH** – Displays the high high alarm (shutdown) threshold.
- **SH** – Displays the high alarm threshold.
-  - Indicates an active alarm in the associated column. There should be a set point value and a time delay value if a GREEN check appears.
-  - Indicates an inactive alarm in the associated column.

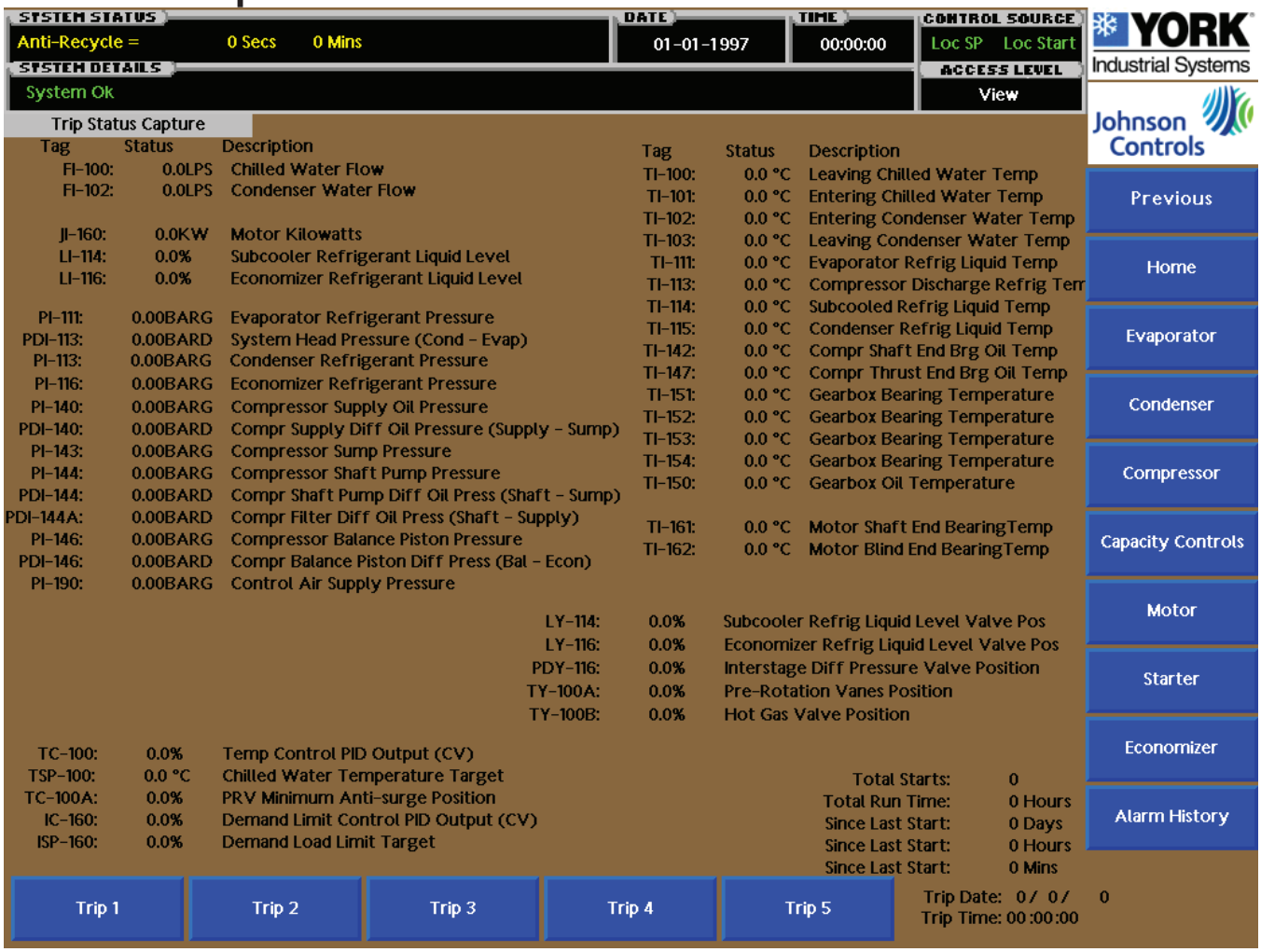
2.8.22 Scaling 2 Screen

2.8.23 Scaling 3 Screen

2.8.24 Scaling 4 Screen

2.8.25 Scaling 5 Screen

2.8.26 Trip Status 1 Screen



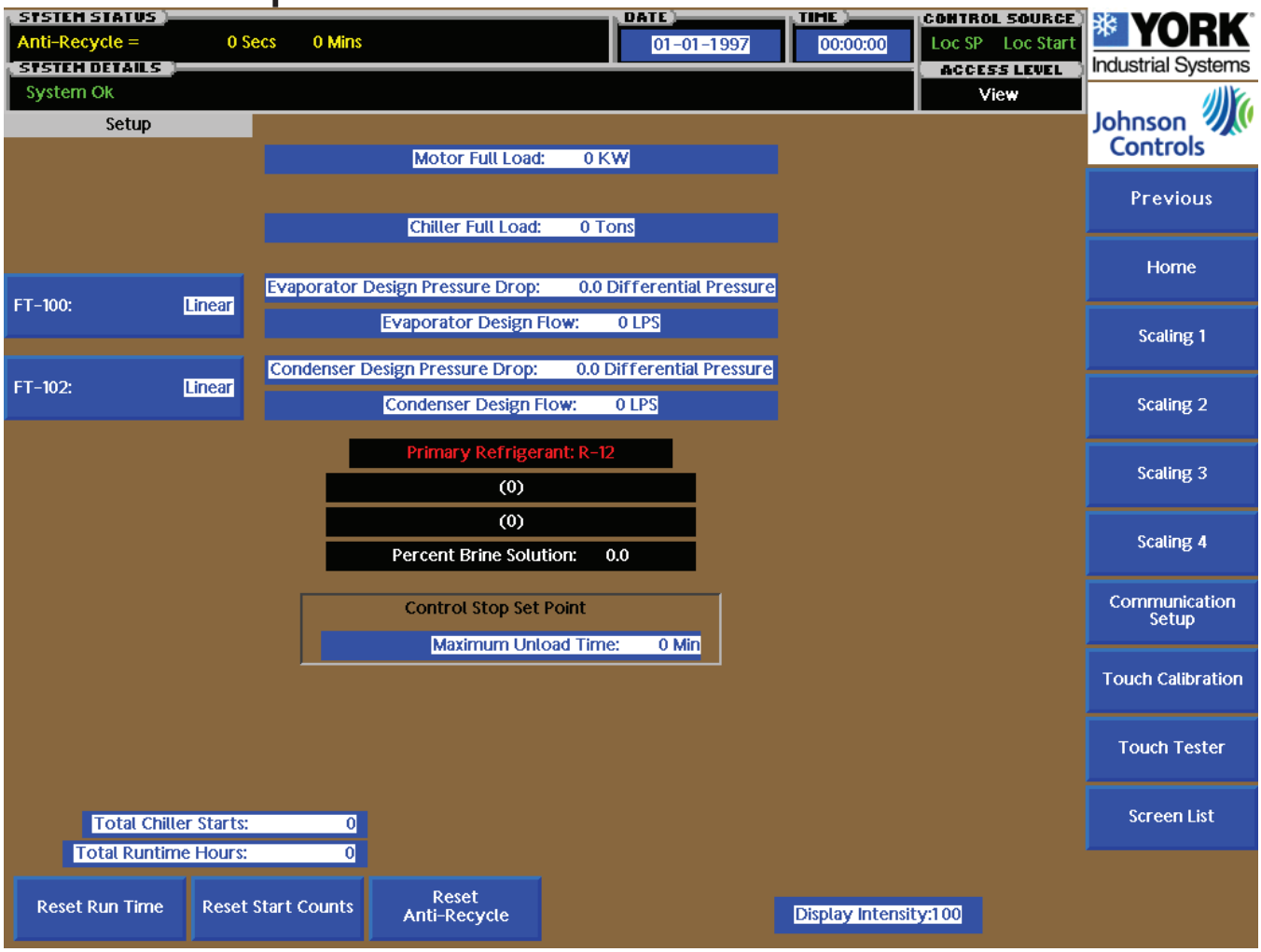
This screen provides a list of various chiller parameters, which were recorded at the instant the chiller was tripped by any safety device. A list is recorded for each of the last five chiller trips.

To display data for the five trips press **TRIP 1** to show the most recent trip. **TRIP 2**, **TRIP 3**, **TRIP 4** and **TRIP 5** show subsequently older trip value captures.

Whenever a revised program is downloaded to the PLC, the data in the trip status files will be replaced by whatever resides in the revised program's files.

Record desired data prior to downloading.

2.8.27 Setup Screen

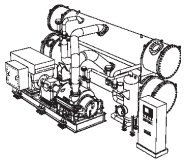


INTERACTIVE

- **RESET RUN TIME** – Resets the run time accumulator.
- **RESET START COUNTS** – Resets the starter counter accumulator.
- **RESET ANTI-RECYCLE** – Resets the anti-recycle.
- **FT-100/102 LINEAR/NON-LINEAR DP SQRT** – Toggles between a linear GPM flow transmitter and a DP flow transmitter. Non-Linear DP Sqrt option uses a calculation to convert differential pressure to GPM.
- **DISPLAY INTENSITY** – This value will change the brightness of the HMI display.

PROGRAMMABLE

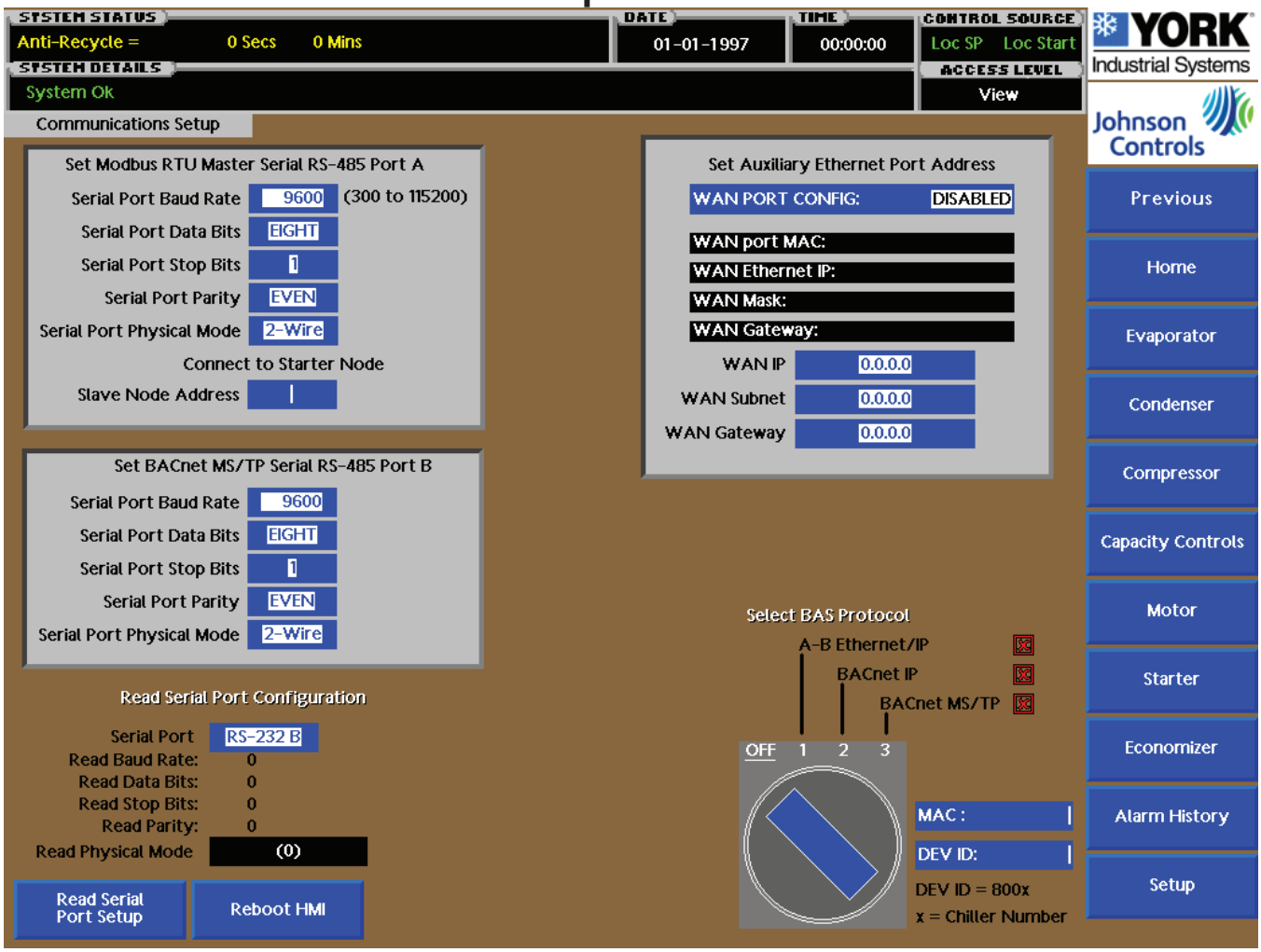
- **MOTOR FULL LOAD** – Enter motor design full load kilowatts, if this numbers is not correct some calculations will be incorrect.



- **MOTOR FULL LOAD** – Enter motor design full load amps, if this numbers is not correct some calculations will be incorrect.
- **CHILLER FULL LOAD** – Enter chiller design full load tonnage, if this numbers is not correct some calculations will be incorrect.
- **EVAP/COND DESIGN PRESSURE DROP** – If setup for non-linear DP sqrt method, the vessel design pressure drop must be entered to accurately calculate flow.
- **EVAP/COND DESIGN FLOW** – If setup for non-linear DP sqrt method, the vessel design flow must be entered to accurately calculate flow.
- **MAXIMUM UNLOAD TIME** – This is the maximum time the chiller will unload. If the chiller does not unload in this time period, it will automatically de-energize the compressor motor starter control relay.

The Control Stop functionality ramps the system to unload within the given time period.

2.8.28 Communication Setup Screen



DISPLAY

- **READ BAUD RATE** – Displays the baud rate for selected serial port.
- **READ DATA BITS** – Displays the data bits for the selected serial port.
- **READ STOP BITS** – Displays the stop bits for the selected serial port.
- **READ PARITY** – Displays the parity for the selected serial port.
- **READ PHYSICAL MODE** – Displays the physical mode of selected serial port.

INTERACTIVE

- **READ COMM SETUP** – Reads above displayed data for selected serial port.
- **REBOOT HMI** – Reboot is required for any changes made to the programmable data on this page.

RS-485 Port A: RTU MASTER Serial Port

These parameters must match the serial port settings on the Toshiba VFD.

- **BAUD RATE** – Enter baud rate from 300 to 115,200.
- **DATA BITS** – Enter data bits from 0 to 1 (0 = 8, 1 = 7).
- **STOP BITS** – Enter stop bits from 0 to 1 (0 = 1, 1 = 2).
- **PARITY** – Enter parity from 0 to 2 (0 = none, 1 = odd, 2 = even).
- **PHYSICAL MODE** – Enter mode from 0 to 1 (0 = 2-wire, 1 = 4-wire).
- **SLAVE NODE ADDRESS** – Enter Modbus Slave node address of the starter
    - (typically 1)

BACnet MS/TP

- **RS-485 PORT B BAUD RATE** – Enter baud rate from 300 to 115,200.
- **RS-485 PORT B DATA BITS** – Enter data bits from 0 to 1 (0 = 8, 1 = 7).
- **RS-485 PORT B STOP BITS** – Enter stop bits from 0 to 1 (0 = 1, 1 = 2).
- **RS-485 PORT B PARITY** – Enter parity from 0 to 2 (0 = none, 1 = odd, 2 = even).
- **RS-485 PORT B PHYSICAL MODE** – Enter mode from 0 to 1 (0 = 2-wire, 1 = 4-wire).

(Typically 38.4k, 8, N, 1, 2-wire for BACnet)

The auxiliary Ethernet port is used to put the HMI on a local area network to use the virtual features. See Red Lion Controls Crimson 3.0 manual for more information.

- **WAN Port Config** – Select **Disabled**, **DHCP**, or **STATIC**
- **IP** – Enter a free IP address on the connected network (if Static is selected)
- **Subnet** – Enter a subnet mask (if Static is selected)
- **Gateway** – Enter a gateway (if Static is selected)

Select BAS Protocol

The BAS Protocol is optionally selected from this screen. Touch the selector switch icon to switch between BAS Protocols. Only one BAS protocol can be selected at a time.
The Device ID and MAC for BACnet MS/TP are field configurable. BACnet IP addresses are set at the factory to correspond to the Chiller Unit Sequence number as the chiller was built. Consult the nameplate inside the chiller control center to determine the sequence number.

Options are:

- **BACnet MS/TP** over serial on the RS-485 Port B
- **BACnet / IP** over Ethernet on the Auxiliary Ethernet Port
- **Ethernet Industrial Protocol** with A-B data tables on the Auxiliary Ethernet Port

2.8.29 Alarm History Screen

The History Screen provides a comprehensive report of all system events (transmitter failures, alarms and trips). Given is the date and time of the event, along with a description of each. When an event is acknowledged, the system stamps the event with the date. It shows that the event was accepted and changes the text to a TAN color.

In the case of a Processor Fault, the codes are displayed in the center of this page. Report these values to Factory Technical Support if the processor enters a faulted condition.

DISPLAY

- **PROCESSOR FAULT TYPE** – Displays the major processor fault type.
- **PROCESSOR FAULT CODE** – Displays the major processor fault code.

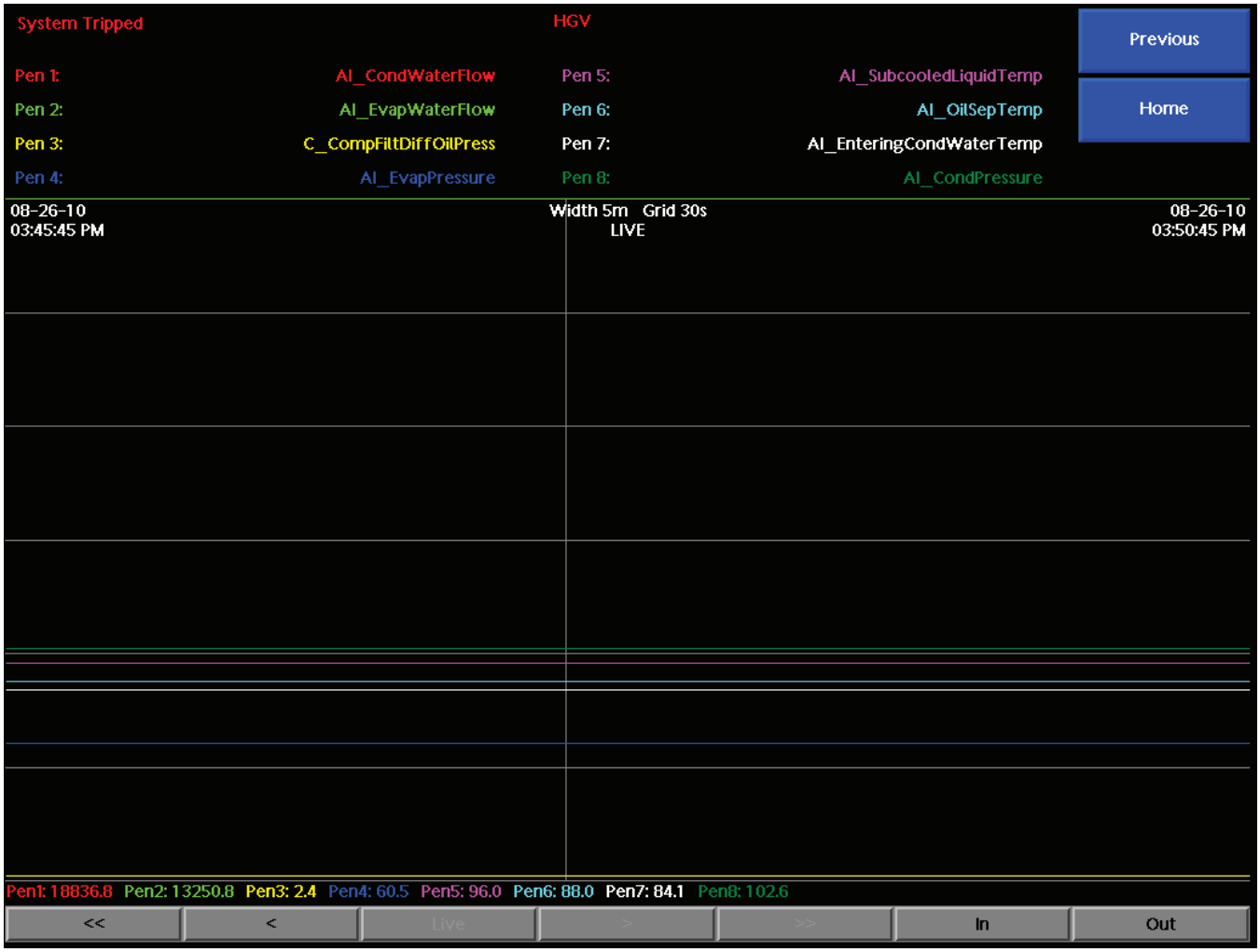
INTERACTIVE

- **CLEAR FAULTS** – Clears the present processor fault record. Switch the Processor Keyswitch from Run to Prog and back to Run, twice to clear the faulted condition.

2.8.30 Active Alarm Screen

The Active Alarm Screen provides a list of events that are currently triggered. YELLOW is an alarm, RED is a TRIP and GREEN is a TRANSMITTER FAILURE.

2.8.31 Trend Screen



The Trending Screen provides a graphical display of sensor values over the entire period of operation of the chiller at a sample rate of 5 sec. A total of 5 files are kept in memory, each file contains 24 hours of 8 pen data. To change pens, touch the screen in the area of the pen you wish to change. A pop-up will appear allowing you to scroll the available pens.

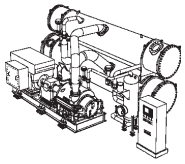
When the graph itself is highlighted (paused), the arrow buttons move along the horizontal axis of the graph. To change the grid time display, use the in/out buttons to zoom the graph. The LIVE button will restart graph time movement. Pens are color coded for clarity.

2.8.32 Screen List Screen

This is a list of available screens in the HMI application. To navigate to this page, find the SCREEN LIST button or use the MENU key in the bottom left had corner of the HMI..

2.8.33 Sales Order Screen

This is a configurable screen that lists all the sales order information. This should be filled out by field service during chiller commissioning.



2.9 Protocol Data Map

---------- Protocol Listing Data Map after this page ----------

BACnet	Address	TagType	Tagname	Description	Type
	F10	IEEE/Float	**RemoteAnalogs**		
AI0001	F10:0	IEEE/Float	PT111.scaled	evaporator pressure	Read
AI0002	F10:1	IEEE/Float	PT113.scaled	condenser pressure	Read
AI0003	F10:2	IEEE/Float	PT116.scaled	LP intercooler pressure	Read
AI0004	F10:3	IEEE/Float	PT146.Scaled	compressor balance piston pressure	Read
AI0005	F10:4	IEEE/Float	PT140.Scaled	compressor supply oil pressure	Read
AI0006	F10:5	IEEE/Float	PT143.Scaled	compressor sump oil pressure	Read
AI0007	F10:6	IEEE/Float	PT144.Scaled	compressor shaft oil pump pressure	Read
AI0008	F10:7	IEEE/Float	TE161.Scaled	motor shaft end bearing temperature	Read
AI0009	F10:8	IEEE/Float	TE162.Scaled	motor blind end bearing temperature	Read
AI0010	F10:9	IEEE/Float	AI_TE151.Scaled	gearbox hs shaft end	Read
AI0011	F10:10	IEEE/Float	AI_TE152.Scaled	gearbox hs blind end	Read
AI0012	F10:11	IEEE/Float	AI_TE153.Scaled	gearbox ls blind end	Read
AI0013	F10:12	IEEE/Float	AI_TE154.Scaled	gearbox ls shaft end	Read
AI0014	F10:13	IEEE/Float	AI_TE150.Scaled	gearbox oil supply temperature	Read
AI0015	F10:14	IEEE/Float	AI_EvapWaterFlow	evaporator water flow	Read
AI0016	F10:15	IEEE/Float	AI_CondWaterFlow	condenser water flow	Read
AI0017	F10:16	IEEE/Float	TT111.Scaled	evaporator refrigerant temperature	Read
AI0018	F10:17	IEEE/Float	TT113.Scaled	compressor discharge temperature	Read
AI0019	F10:18	IEEE/Float	TT115.Scaled	condenser refrigerant liquid temperature	Read
AI0020	F10:19	IEEE/Float	TT147.Scaled	compressor thrust bearing oil temperature	Read
AI0021	F10:20	IEEE/Float	TT142.Scaled	compressor shaft bearing oil temperature	Read
AI0022	F10:21	IEEE/Float	PT190.Scaled	control supply air pressure	Read
AI0023	F10:22	IEEE/Float	TT120.Scaled	oil seperator temperature	Read
AI0024	F10:23	IEEE/Float		spare	Read
AI0025	F10:24	IEEE/Float		spare	Read
AI0026	F10:25	IEEE/Float	TT100.Scaled	leaving chilled water temperature	Read
AI0027	F10:26	IEEE/Float	TT101.Scaled	entering chilled water temperature	Read
AI0028	F10:27	IEEE/Float	TT102.Scaled	entering condenser water temperature	Read
AI0029	F10:28	IEEE/Float	TT103.Scaled	leaving condenser water temperature	Read
AI0030	F10:29	IEEE/Float	C_SubcoolerLevel	subcooler refrigerant level	Read
AI0031	F10:30	IEEE/Float	TT114.Scaled	subcooled refrigerant temperature	Read

BACnet	Address	TagType	Tagname	Description	Type
AI0032	F10:31	IEEE/Float	JT160.Scaled	compressor motor power in kilowatts	Read
AI0033	F10:32	IEEE/Float			Read
AI0034	F10:33	IEEE/Float		spare	Read
AI0035	F10:34	IEEE/Float		spare	Read
AI0036	F10:35	IEEE/Float		spare	Read
AI0037	F10:36	IEEE/Float	AI_ChilledWaterSetpointREMOTE	Chilled water remote setpoint	Read
AI0038	F10:37	IEEE/Float		spare	Read
AI0039	F10:38	IEEE/Float			Read
AI0040	F10:39	IEEE/Float	C_IntercoolerLevel	intercooler liquid level	Read
AI0041	F10:40	IEEE/Float			Read
AI0042	F10:41	IEEE/Float			Read
AI0043	F10:42	IEEE/Float			Read
AI0044	F10:43	IEEE/Float			Read
AI0045	F10:44	IEEE/Float			Read
AI0046	F10:45	IEEE/Float			Read
AI0047	F10:46	IEEE/Float		spare	Read
AI0048	F10:47	IEEE/Float		spare	Read
AI0049	F10:48	IEEE/Float		spare	Read
AI0050	F10:49	IEEE/Float		spare	Read
AI0051	F10:50	IEEE/Float	VI_AxialThrustDirection	1=forward axial thrust, 0=reverse axial thrust	Read
AI0052	F10:51	IEEE/Float	VI_ComprAxialThrust	compressor axial thrust	Read
AI0053	F10:52	IEEE/Float	VI_ComprShaftEndHorz	compressor shaft end horizontal radial vibration	Read
AI0054	F10:53	IEEE/Float	VI_ComprShaftEndVert	compressor shaft end vertical radial vibration	Read
AI0055	F10:54	IEEE/Float	VI_ComprSumpEndHorz	compressor sump end horizontal radial vibration	Read
AI0056	F10:55	IEEE/Float	VI_ComprSumpEndVert	compressor sump end vertical radial vibration	Read
AI0057	F10:56	IEEE/Float	VI_MotorBlindEndHorz	motor blind end horizontal radial vibration	Read
AI0058	F10:57	IEEE/Float	VI_MotorBlindEndVert	motor blind end vertical radial vibration	Read
AI0059	F10:58	IEEE/Float	VI_MotorShaftEndHorz	motor shaft end horizontal radial vibration	Read
AI0060	F10:59	IEEE/Float	VI_MotorShaftEndVert	motor shaft end vertical radial vibration	Read
AI0061	F10:60	IEEE/Float	VI_GearHSBEHorz	GEAR HS BLIND END HORIZ VIBRATION	Read
AI0062	F10:61	IEEE/Float	VI_GearHSBEVert	GEAR HS BLIND END VERT VIBRATION	Read
AI0063	F10:62	IEEE/Float	VI_GearHSSEHorz	GEAR HS SHAFT END HORIZ VIBRATION	Read

BACnet	Address	TagType	Tagname	Description	Type
AI0064	F10:63	IEEE/Float	VI_GearHSSEVert	GEAR HS SHAFT END VERT VIBRATION	Read
AI0065	F10:64	IEEE/Float	VI_GearLSBEHorz	GEAR LS BLIND END HORIZ VIBRATION	Read
AI0066	F10:65	IEEE/Float	VI_GearLSBEVert	GEAR LS BLIND END VERT VIBRATION	Read
AI0067	F10:66	IEEE/Float	VI_GearLSSEHorz	GEAR LS SHAFT END HORIZ VIBRATION	Read
AI0068	F10:67	IEEE/Float	VI_GearLSSEVert	GEAR LS SHAFT END VERT VIBRATION	Read
AI0069	F10:68	IEEE/Float	SY160.Scaled	0-100% to starter	Read
AI0070	F10:69	IEEE/Float	LY116.Scaled	intercooler valve output signal	Read
AI0071	F10:70	IEEE/Float	TY100A.Scaled	PRV output signal	Read
AI0072	F10:71	IEEE/Float	PDY116.Scaled	LP interstage output signal	Read
AI0073	F10:72	IEEE/Float	TY100B.Scaled	Hot Gas output signal	Read
AI0074	F10:73	IEEE/Float	LY114.Scaled	Subcooler Valve output signal	Read
AI0075	F10:74	IEEE/Float	AO_HPInterstageValveActuator	HP interstage output signal	Read
	F11	IEEE/Float	**RemoteCalculated**		
AI0500	F11:0	IEEE/Float	C_BalancePistonDiffPress	compressor balance piston differential pressure	Read
AI0501	F11:1	IEEE/Float	C_ChillerTons	instantaneous chiller tons	Read
AI0502	F11:2	IEEE/Float	C_CompFiltDiffOilPress	compressor oil filter differential pressure	Read
AI0503	F11:3	IEEE/Float	C_ComprHead	compressor head pressure	Read
AI0504	F11:4	IEEE/Float	C_CompShaftPumpDiffPress	compressor shaft pump differential pressure	Read
AI0505	F11:5	IEEE/Float	C_CompSupplyOilDiff	compressor supply oil differential pressure	Read
AI0506	F11:6	IEEE/Float	C_EvapSmallTempDiff	evaporator small difference temperature	Read
AI0507	F11:7	IEEE/Float	C_CondSmallTempDiff	condenser small difference temperature	Read
AI0508	F11:8	IEEE/Float	C_DischSuperheatTempDiff	discharge temp minus cond sat temp	Read
AI0509	F11:9	IEEE/Float			Read
AI0510	F11:10	IEEE/Float			Read
AI0511	F11:11	IEEE/Float	C_CondWaterPressDrop	condenser water pressure drop across heat exchanger	Read
AI0512	F11:12	IEEE/Float	C_EvapWaterPressDrop	evaporator water pressure drop across heat exchanger	Read
AI0513	F11:13	IEEE/Float			Read
AI0514	F11:14	IEEE/Float	AOI_AntiRecycle.Time2NextStart_Hour	time in hours until next available start	Read
AI0515	F11:15	IEEE/Float	AOI_AntiRecycle.Time2NextStart_Min	time in mins until next available start	Read
AI0516	F11:16	IEEE/Float			Read
AI0517	F11:17	IEEE/Float	C_IntercoolerFloatDiff	intercooler float differential pressure	Read
AI0518	F11:18	IEEE/Float	C_KWPerTon	instantaneous kilowatts consumed per ton of refrig.	Read

BACnet	Address	TagType	Tagname	Description	Type
AI0519	F11:19	IEEE/Float	C_PercentChillerLoad	percent of chiller full load	Read
AI0520	F11:20	IEEE/Float	C_PercentFLKW	percent of chiller full load kilowatt consumption	Read
AI0521	F11:21	IEEE/Float	C_PostLubeTimeRem	postlubrication time remaining	Read
AI0522	F11:22	IEEE/Float	C_PreLubeTimeRem	prelubrication time remaining	Read
AI0523	F11:23	IEEE/Float	AOI_AntiRecycle.C_StartsIn24HourPeriod	number of starts remaining for this 24 hour period	Read
AI0524	F11:24	IEEE/Float	C_SubcoolerLevel	filtered subcooler refrigerant level	Read
AI0525	F11:25	IEEE/Float	C_IntercoolerLevel	filtered intercooler refrigerant level	Read
AI0526	F11:26	IEEE/Float	C_EvapWaterTempSafeLowerSP	safe freeze point of secondary refrig (water, brine)	Read
AI0527	F11:27	IEEE/Float	AOI_AntiRecycle.SinceLastStart_Day	days since last start	Read
AI0528	F11:28	IEEE/Float	AOI_AntiRecycle.SinceLastStart_Hr	hours since last start	Read
AI0529	F11:29	IEEE/Float	AOI_AntiRecycle.SinceLastStart_Min	mins since last start	Read
AI0530	F11:30	IEEE/Float	C_TotalMachineStarts	total machine starts	Read
AI0531	F11:31	IEEE/Float	C_TotalRunHours	total run hours	Read
AI0532	F11:32	IEEE/Float	CC_LSR1	Low Select Relay 1 output	Read
AI0533	F11:33	IEEE/Float	CC_LSR2	Low Select Relay 2 output	Read
AI0534	F11:34	IEEE/Float	CC_LSR3	Low Select Relay 3 output	Read
AI0535	F11:35	IEEE/Float	CC_LSR4	Low Select Relay 3 output	Read
AI0536	F11:36	IEEE/Float	CC_HSR1	High Select Relay 1 output	Read
AI0537	F11:37	IEEE/Float	CC_HSR2	High Select Relay 2 output	Read
AI0538	F11:38	IEEE/Float	CC_HSR3	High Select Relay 3 output	Read
AI0539	F11:39	IEEE/Float	CC_RangeConverter	Range Converter for Hotgas signal inversion	Read
AI0540	F11:40	IEEE/Float	CC_SS1	Signal Selector 1 output	Read
AI0541	F11:41	IEEE/Float	CC_CR2	Calculation Relay 2 output	Read
AI0542	F11:42	IEEE/Float	CC_CR3	Calculation Relay 3 output	Read
AI0543	F11:43	IEEE/Float	CC_CR4	Calculation Relay 4 output	Read
AI0544	F11:44	IEEE/Float	CC_CR5	Calculation Relay 5 output	Read
AI0545	F11:45	IEEE/Float			Read
AI0546	F11:46	IEEE/Float			Read
AI0547	F11:47	IEEE/Float			Read
	N12	INT	**RemoteAlarm**		
BI0001	N12:0/0	Bit	ALM_BrushCleaningAlarm	ALARM: Brush Cleaning System Fault	Read
BI0002	N12:0/1	Bit	ALM_ChilledWtrPmpFail	ALARM: CHILLED WATER PUMP FAILED	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0003	N12:0/2	Bit	ALM_CloseSideload	ALARM: PDCV-116 SIDELOAD VALVE CLOSE HIGH L	Read
BI0004	N12:0/3	Bit	ALM_ComprMotorRun	ALARM: COMPRESSOR MOTOR DID NOT START	Read
BI0005	N12:0/4	Bit	ALM_CompSumpOilLvl	ALARM: LSL-143 LOW COMPRESSOR SUMP OIL LEV	Read
BI0006	N12:0/5	Bit	ALM_CondWtrPmpFail	ALARM: CONDENSER WATER PUMP FAILED	Read
BI0007	N12:0/6	Bit	ALM_DemLimOverload	ALARM: OVERLOAD ON DEMAND LIMIT	Read
BI0008	N12:0/7	Bit	ALM_HardwireNotReset	ALARM: .HARDWIRE SAFETY NOT RESET	Read
BI0009	N12:0/8	Bit	ALM_HighBalancePistonPress	ALARM: PDSH-146 HIGH BALANCE PISTON PRESSU	Read
BI0010	N12:0/9	Bit	ALM_HighOilFiltPress	ALARM: PDSH-144A HIGH COMPRESSOR OIL FILTE	Read
BI0011	N12:0/10	Bit	ALM_InvalidAntiSurge	ALARM: INVALID ANTI-SURGE PARAMETERS	Read
BI0012	N12:0/11	Bit	ALM_LowCondWaterFlow	ALARM: FSL-102 LOW CONDENSER WATER FLOW	Read
BI0013	N12:0/12	Bit	ALM_LowEvapWaterFlow	ALARM: FSL-100 LOW EVAPORATOR WATER FLOW	Read
BI0014	N12:0/13	Bit	ALM_LowOilSepTemp	ALARM: TSL-120 LOW OIL SEPARATOR TEMP	Read
BI0015	N12:0/14	Bit	ALM_LowShaftPumpPress	ALARM: PDSL-144 LOW COMPRESSOR SHAFT PUM	Read
BI0016	N12:0/15	Bit	ALM_LowSupplyOilPress	ALARM: PDSL-140 LOW COMPRESSOR SUPPLY OIL	Read
BI0017	N12:1/0	Bit	ALM_GearHighDiffPress	ALARM: HIGH GEARBOX OIL FILTER DIFFERENTIAL	Read
BI0018	N12:1/1	Bit	ALM_GearOilPumpRun	ALARM: PSL-156 GEAR AUX PUMP RUNNING UNSCI	Read
BI0019	N12:1/2	Bit			Read
BI0020	N12:1/3	Bit			Read
BI0021	N12:1/4	Bit	ALM_OilPumpRun	ALARM: COMPRESSOR AUX OIL PUMP RUN UNSCH	Read
BI0022	N12:1/5	Bit	ALM_OilSepLvlLow	ALARM: LSL-120 OIL SEPARATOR LEVEL LOW	Read
BI0023	N12:1/6	Bit	ALM_RemoteStartDeny	ALARM: REMOTE START DENIED	Read
BI0024	N12:1/7	Bit	ALM_ReplaceBattery	ALARM: REPLACE PROCESSOR BATTERY	Read
BI0025	N12:1/8	Bit	ALM_StopButtonMalf	ALARM: STOP BUTTON MALFUNCTION	Read
BI0026	N12:1/9	Bit	ALM_SurgeEvent	ALARM: COMPRESSSOR SURGE EVENT DETECTED	Read
BI0027	N12:1/10	Bit	ALM_LowOilTemp	ALARM: TSL-140 LOW COMPRESSOR OIL TEMP	Read
BI0028	N12:1/11	Bit			Read
BI0029	N12:1/12	Bit			Read
BI0030	N12:1/13	Bit			Read
BI0031	N12:1/14	Bit			Read
BI0032	N12:1/15	Bit			Read
BI0033	N12:2/0	Bit	LT116.AH	ALARM: LSH-116 INTERCOOLER REFRIG LEVEL HIG	Read
BI0034	N12:2/1	Bit	PT111.AL	ALARM: PSL-111 LOW EVAPORATOR PRESSURE	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0035	N12:2/2	Bit	PT113.AH	ALARM: PSH-113 HIGH DISCHARGE PRESSURE	Read
BI0036	N12:2/3	Bit	PT190.AL	ALARM: PSL-190 LOW CONTROL AIR PRESSURE	Read
BI0037	N12:2/4	Bit	TT100.AL	ALARM: TSL-100 LOW LEAVING CHILLED WATER TE	Read
BI0038	N12:2/5	Bit	TT111.AL	ALARM: TSH-111 LOW EVAPORATOR REFRIGERAN	Read
BI0039	N12:2/6	Bit	TT113.AH	ALARM: TSH-113 HIGH DISCHARGE TEMPERATURE	Read
BI0040	N12:2/7	Bit	TT142.AH	ALARM: TSH-142 COMPRESSOR HIGH SHAFT BEAR	Read
BI0041	N12:2/8	Bit	TT147.AH	ALARM: TSH-147 COMPRESSOR HIGH THRUST BEA	Read
BI0042	N12:2/9	Bit	AI_TE151.AH	ALARM: TSH-151 GEAR HS SHAFT TEMPERATURE H	Read
BI0043	N12:2/10	Bit	AI_TE152.AH	ALARM: TSH-152 GEAR HS BLIND TEMPERATURE H	Read
BI0044	N12:2/11	Bit	AI_TE153.AH	ALARM: TSH-153 GEAR LS BLIND TEMPERATURE H	Read
BI0045	N12:2/12	Bit	AI_TE154.AH	ALARM: TSH-154 GEAR LS SHAFT TEMPERATURE H	Read
BI0046	N12:2/13	Bit	AI_TE150.AH	ALARM: TSH-150 GEAR SUPPLY OIL TEMPERATURE	Read
BI0047	N12:2/14	Bit			Read
BI0048	N12:2/15	Bit	TE161.AH	ALARM: TSH-161 HIGH MOTOR SHAFT BEARING TE	Read
BI0049	N12:3/0	Bit	TE162.AH	ALARM: TSH-162 HIGH MOTOR BLIND BEARING TEM	Read
BI0050	N12:3/1	Bit	PT116.AH	ALARM: PSH-116 HIGH ECONOMIZER PRESSURE	Read
BI0051	N12:3/2	Bit	AI_PT150.AL	ALARM: PSL-150 LOW GEARBOX SUPPLY OIL PRES	Read
BI0052	N12:3/3	Bit	AI_PT156.AL	ALARM: PSL-156 GEAR SHAFT PUMP OIL PRESSUR	Read
BI0053	N12:3/4	Bit			Read
BI0054	N12:3/5	Bit			Read
BI0055	N12:3/6	Bit			Read
BI0056	N12:3/7	Bit			Read
BI0057	N12:3/8	Bit			Read
BI0058	N12:3/9	Bit			Read
BI0059	N12:3/10	Bit			Read
BI0060	N12:3/11	Bit			Read
BI0061	N12:3/12	Bit			Read
BI0062	N12:3/13	Bit			Read
BI0063	N12:3/14	Bit			Read
BI0064	N12:3/15	Bit			Read
BI0065	N12:4/0	Bit	TRIP_HighPressCutout	TRIP: PSHH-113A HIGH PRESSURE CUTOUT	Read
BI0066	N12:4/1	Bit	TRIP_LowOilPressCutout	TRIP: PDSLL-140A LOW COMPRESSOR OIL PRESSU	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0067	N12:4/2	Bit	TRIP_LowSupplyOilPress	TRIP: PDSLL-140 LOW COMPRESSOR SUPPLY OIL P	Read
BI0068	N12:4/3	Bit	TRIP_ThrustBrgTempCutout	TRIP: TSHH-147A THRUST BEARING TEMP CUTOUT	Read
BI0069	N12:4/4	Bit	TRIP_LowChilledWaterFlowSW	TRIP: FSLL-101 LOW CHILLED WATER FLOW CUTOU	Read
BI0070	N12:4/5	Bit	TRIP_LowCondWaterFlowSW	TRIP: FSLL-103 LOW COND WATER FLOW CUTOUT	Read
BI0071	N12:4/6	Bit	TRIP_LowCondWaterFlow	TRIP: FSLL-102 LOW CONDENSER WATER FLOW	Read
BI0072	N12:4/7	Bit	TRIP_LowEvapWaterFlow	TRIP: FSLL-100 LOW EVAPORATOR WATER FLOW	Read
BI0073	N12:4/8	Bit	TRIP_ComprMotorNoStart	TRIP: COMPRESSOR MOTOR DIDN'T START	Read
BI0074	N12:4/9	Bit	TRIP_EmergencyStop	TRIP: EMERGENCY STOP	Read
BI0075	N12:4/10	Bit	TRIP_ExcessiveSurge	TRIP: EXCESSIVE SURGE DETECTED	Read
BI0076	N12:4/11	Bit	TRIP_MotorCoolantLeak	TRIP: LSHH-167 LOW MOTOR COOLANT LEVEL	Read
BI0077	N12:4/12	Bit	TRIP_MotorStarterFault	TRIP: MOTOR STARTER FAULT	Read
BI0078	N12:4/13	Bit			Read
BI0079	N12:4/14	Bit	TRIP_GearAuxPmpNoStart	TRIP: GEARBOX AUX OIL PUMP DID NOT START	Read
BI0080	N12:4/15	Bit	TRIP_OilPumpNoStart	TRIP: COMPRESSOR AUX OIL PUMP DID NOT STAR	Read
BI0081	N12:5/0	Bit	TRIP_PowerFailure	TRIP: POWER FAILURE	Read
BI0082	N12:5/1	Bit	TRIP_RemEmStop	TRIP: REMOTE EMERGENCY STOP	Read
BI0083	N12:5/2	Bit	TRIP_StarterLockout	TRIP: STARTER LOCKOUT	Read
BI0084	N12:5/3	Bit	TRIP_CommFault_Rack0_Module0	TRIP: COMM FAULT RACK 0 MODULE 0	Read
BI0085	N12:5/4	Bit	TRIP_CommFault_Rack0_Module1	TRIP: COMM FAULT RACK 0 MODULE 1	Read
BI0086	N12:5/5	Bit	TRIP_CommFault_Rack0_Module2	TRIP: COMM FAULT RACK 0 MODULE 2	Read
BI0087	N12:5/6	Bit	TRIP_CommFault_Rack0_Module3	TRIP: COMM FAULT RACK 0 MODULE 3	Read
BI0088	N12:5/7	Bit	TRIP_CommFault_Rack0_Module4	TRIP: COMM FAULT RACK 0 MODULE 4	Read
BI0089	N12:5/8	Bit	TRIP_CommFault_Rack0_Module5	TRIP: COMM FAULT RACK 0 MODULE 5	Read
BI0090	N12:5/9	Bit	TRIP_CommFault_Rack1_Module0	TRIP: COMM FAULT RACK 1 MODULE 0	Read
BI0091	N12:5/10	Bit	TRIP_CommFault_Rack1_Module1	TRIP: COMM FAULT RACK 1 MODULE 1	Read
BI0092	N12:5/11	Bit	TRIP_CommFault_Rack1_Module2	TRIP: COMM FAULT RACK 1 MODULE 2	Read
BI0093	N12:5/12	Bit	TRIP_CommFault_Rack1_Module3	TRIP: COMM FAULT RACK 1 MODULE 3	Read
BI0094	N12:5/13	Bit			Read
BI0095	N12:5/14	Bit	TRIP_24HRExcessiveStarts	TRIP: EXCESSIVE STARTS IN 24 HOUR PERIOD	Read
BI0096	N12:5/15	Bit	TRIP_ProgFault	TRIP: MAJOR PROGRAM FAULT	Read
BI0097	N12:6/0	Bit	PT111.ALL	TRIP: PSLL-111 LOW EVAPORATOR PRESSURE	Read
BI0098	N12:6/1	Bit	PT113.AHH	TRIP: PSHH-113 HIGH DISCHARGE PRESS	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0099	N12:6/2	Bit	PT190.ALL	TRIP: PSLL-190 CONTROL AIR PRESSURE INSUFFIC	Read
BI0100	N12:6/3	Bit	TT100.ALL	TRIP: TSLL-100 LOW LEAVING CHILLED WATER TEM	Read
BI0101	N12:6/4	Bit	TT111.ALL	TRIP: TSLL-111 LOW EVAPORATOR REFRIGERANT	Read
BI0102	N12:6/5	Bit	TT113.AHH	TRIP: TSHH-113 HIGH DISCHARGE TEMP	Read
BI0103	N12:6/6	Bit	TT142.AHH	TRIP: TSHH-142 HIGH COMPRESSOR SHAFT BEARI	Read
BI0104	N12:6/7	Bit	TT147.AHH	TRIP: TSHH-147 HIGH COMPRESSOR THRUST BEAR	Read
BI0105	N12:6/8	Bit	AI_TE151.AHH	TRIP: TSHH-151 GEAR HS SHAFT TEMPERATURE H	Read
BI0106	N12:6/9	Bit	AI_TE152.AHH	TRIP: TSHH-152 GEAR HS BLIND TEMPERATURE HI	Read
BI0107	N12:6/10	Bit	AI_TE153.AHH	TRIP: TSHH-153 GEAR LS BLIND TEMPERATURE HI	Read
BI0108	N12:6/11	Bit	AI_TE154.AHH	TRIP: TSHH-154 GEAR LS SHAFT TEMPERATURE HI	Read
BI0109	N12:6/12	Bit	AI_TE150.AHH	TRIP: TSHH-150 GEAR SUPPLY OIL TEMPERATURE	Read
BI0110	N12:6/13	Bit			Read
BI0111	N12:6/14	Bit	TE161.AHH	TRIP: TSHH-161 HIGH MOTOR SHAFT BEARING TEM	Read
BI0112	N12:6/15	Bit	TE162.AHH	TRIP: TSHH-162 HIGH MOTOR BLIND BEARING TEM	Read
BI0113	N12:7/0	Bit	PT116.AHH	TRIP: PSHH-116 HIGH ECONOMIZER PRESS	Read
BI0114	N12:7/1	Bit	AI_PT150.ALL	TRIP: PSLL-150 LOW GEARBOX SUPPLY OIL PRESS	Read
BI0115	N12:7/2	Bit			Read
BI0116	N12:7/3	Bit			Read
BI0117	N12:7/4	Bit			Read
BI0118	N12:7/5	Bit			Read
BI0119	N12:7/6	Bit			Read
BI0120	N12:7/7	Bit			Read
BI0121	N12:7/8	Bit			Read
BI0122	N12:7/9	Bit			Read
BI0123	N12:7/10	Bit			Read
BI0124	N12:7/11	Bit			Read
BI0125	N12:7/12	Bit			Read
BI0126	N12:7/13	Bit			Read
BI0127	N12:7/14	Bit			Read
BI0128	N12:7/15	Bit			Read
BI0129	N12:8/0	Bit	FT100.OOR	XMTR: FT-100 CHILLED WATER FLOW FAIL	Read
BI0130	N12:8/1	Bit	FT102.OOR	XMTR: FT-102 CONDENSER WATER FLOW FAIL	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0131	N12:8/2	Bit	IT160.OOR	XMTR: IT-160 MOTOR CURRENT FAIL	Read
BI0132	N12:8/3	Bit	JT160.OOR	XMTR: JT-160 COMPRESSOR MOTOR POWER FAIL	Read
BI0133	N12:8/4	Bit	LT114.OOR	XMTR: LT-114 SUBCOOLER LIQUID LEVEL FAIL	Read
BI0134	N12:8/5	Bit	LT116.OOR	XMTR: LT-116 ECONOMIZER LEVEL FAILURE	Read
BI0135	N12:8/6	Bit	PT111.OOR	XMTR: PT-111 EVAPORATOR PRESS FAIL	Read
BI0136	N12:8/7	Bit	PT113.OOR	XMTR: PT-113 CONDENSER PRESS FAIL	Read
BI0137	N12:8/8	Bit	PT116.OOR	XMTR: PT-116 ECONOMIZER PRESS FAIL	Read
BI0138	N12:8/9	Bit	PT140.OOR	XMTR: PT-140 COMPRESSOR SUPPLY OIL PRESS F	Read
BI0139	N12:8/10	Bit	PT143.OOR	XMTR: PT-143 COMPRESSOR SUMP OIL PRESS FAI	Read
BI0140	N12:8/11	Bit	PT144.OOR	XMTR: PT-144 COMPRESSOR SHAFT OIL PRESS FA	Read
BI0141	N12:8/12	Bit	PT146.OOR	XMTR: PT-146 BALANCE PISTON PRESS FAIL	Read
BI0142	N12:8/13	Bit	PT190.OOR	XMTR: PT-190 CONTROL SUPPLY AIR PRESS FAIL	Read
BI0143	N12:8/14	Bit			Read
BI0144	N12:8/15	Bit	TT100.OOR	XMTR: TT-100 LEAVING CHILLED WATER TEMP FAI	Read
BI0145	N12:9/0	Bit	TT101.OOR	XMTR: TT-101 ENTERING CHILLED WATER TEMP FA	Read
BI0146	N12:9/1	Bit	TT102.OOR	XMTR: TT-102 ENTERING CONDENSER WATER TEM	Read
BI0147	N12:9/2	Bit	TT103.OOR	XMTR: TT-103 LEAVING CONDENSER WATER TEMP	Read
BI0148	N12:9/3	Bit	TT111.OOR	XMTR: TT-111 EVAPORATOR REFRIGERANT TEMP	Read
BI0149	N12:9/4	Bit	TT113.OOR	XMTR: TT-113 COMPRESSOR DISCHARGE TEMP FA	Read
BI0150	N12:9/5	Bit	TT114.OOR	XMTR: TT-114 SUBCOOLED LIQUID TEMP FAIL	Read
BI0151	N12:9/6	Bit	TT115.OOR	XMTR: TT-115 CONDENSER REFRIGERANT LIQUID	Read
BI0152	N12:9/7	Bit	TT120.OOR	XMTR: TT-120 OIL SEPERATOR TEMPERATURE FAI	Read
BI0153	N12:9/8	Bit	TT142.OOR	XMTR: TT-142 COMPR SHAFT BEARING OIL TEMP F	Read
BI0154	N12:9/9	Bit	TT147.OOR	XMTR: TT-147 COMPRESSOR THRUST BEARING OI	Read
BI0155	N12:9/10	Bit	AI_TE151.OOR	XMTR: TE-151 GEAR HS SHAFT END TEMPERATURI	Read
BI0156	N12:9/11	Bit	AI_TE152.OOR	XMTR: TE-152 GEAR HS BLIND END TEMPERATURE	Read
BI0157	N12:9/12	Bit	AI_TE153.OOR	XMTR: TE-153 GEAR LS BLIND END TEMPERATURE	Read
BI0158	N12:9/13	Bit	AI_TE154.OOR	XMTR: TE-154 GEAR LS SHAFT END TEMPERATURE	Read
BI0159	N12:9/14	Bit	AI_TE150.OOR	XMTR: TE-150 GEAR SUPPLY OIL TEMPERATURE F	Read
BI0160	N12:9/15	Bit			Read
BI0161	N12:10/0	Bit	TE161.OOR	XMTR: TE-161 MOTOR SHAFT BEARING TEMP FAIL	Read
BI0162	N12:10/1	Bit	TE162.OOR	XMTR: TE-162 MOTOR BLIND BEARING TEMP FAIL	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0163	N12:10/2	Bit	RST100.OOR	XMTR: RST-100 REMOTE LEAVING CHILLED WATER	Read
BI0164	N12:10/3	Bit	RST160.OOR	XMTR: RST-160 REMOTE DEMAND LIMIT SP FAIL	Read
BI0165	N12:10/4	Bit	AI_PT156.OOR	XMTR: TE-156 GEAR SHAFT PUMP PRESSURE FAIL	Read
BI0166	N12:10/5	Bit	AI_PT150.OOR	XMTR: TE-156 GEAR SUPPLY OIL PRESSURE FAIL	Read
BI0167	N12:10/6	Bit			Read
BI0168	N12:10/7	Bit			Read
BI0169	N12:10/8	Bit			Read
BI0170	N12:10/9	Bit			Read
BI0171	N12:10/10	Bit			Read
BI0172	N12:10/11	Bit			Read
BI0173	N12:10/12	Bit			Read
BI0174	N12:10/13	Bit			Read
BI0175	N12:10/14	Bit			Read
BI0176	N12:10/15	Bit			Read
BI0177	N12:11/0	Bit			Read
BI0178	N12:11/1	Bit			Read
BI0179	N12:11/2	Bit			Read
BI0180	N12:11/3	Bit			Read
BI0181	N12:11/4	Bit			Read
BI0182	N12:11/5	Bit			Read
BI0183	N12:11/6	Bit			Read
BI0184	N12:11/7	Bit			Read
BI0185	N12:11/8	Bit			Read
BI0186	N12:11/9	Bit			Read
BI0187	N12:11/10	Bit			Read
BI0188	N12:11/11	Bit			Read
BI0189	N12:11/12	Bit			Read
BI0190	N12:11/13	Bit			Read
BI0191	N12:11/14	Bit			Read
BI0192	N12:11/15	Bit			Read
BI0193	N12:12/0	Bit	ALM_V_ComprAxialForward	ALARM: ZSH-141 COMPRESSOR AXIAL FORWARD T	Read
BI0194	N12:12/1	Bit	ALM_V_ComprAxialReverse	ALARM: ZSL-141 COMPRESSOR AXIAL REVERSE TH	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0195	N12:12/2	Bit	ALM_V_ComprShaftEndHorz	ALARM: VSH-142H COMPRESSOR SHAFT HORZ VIB	Read
BI0196	N12:12/3	Bit	ALM_V_ComprShaftEndVert	ALARM: VSH-142V COMPRESSOR SHAFT VERT VIB	Read
BI0197	N12:12/4	Bit	ALM_V_ComprSumpEndHorz	ALARM: VSH-141H COMPRESSOR SUMP HORZ VIB	Read
BI0198	N12:12/5	Bit	ALM_V_ComprSumpEndVert	ALARM: VSH-142V COMPRESSOR SUMP VERT VIB	Read
BI0199	N12:12/6	Bit	ALM_V_GearHSBEHorz	ALARM: VSH-152H GEAR HS BLIND HORZ VIB	Read
BI0200	N12:12/7	Bit	ALM_V_GearHSBEVert	ALARM: VSH-152V GEAR HS BLIND VERT VIB	Read
BI0201	N12:12/8	Bit	ALM_V_GearHSSEHorz	ALARM: VSH-151H GEAR HS SHAFT HORZ VIB	Read
BI0202	N12:12/9	Bit	ALM_V_GearHSSEVert	ALARM: VSH-151V GEAR HS SHAFT VERT VIB	Read
BI0203	N12:12/10	Bit	ALM_V_GearLSBEHorz	ALARM: VSH-154H GEAR LS BLIND HORZ VIB	Read
BI0204	N12:12/11	Bit	ALM_V_GearLSBEVert	ALARM: VSH-154V GEAR LS BLIND VERT VIB	Read
BI0205	N12:12/12	Bit	ALM_V_GearLSSEHorz	ALARM: VSH-153H GEAR LS SHAFT HORZ VIB	Read
BI0206	N12:12/13	Bit	ALM_V_GearLSSEVert	ALARM: VSH-153V GEAR LS SHAFT VERT VIB	Read
BI0207	N12:12/14	Bit	ALM_V_MotorBlindEndHorz	ALARM: VSH-162H MOTOR BLIND HORZ VIB	Read
BI0208	N12:12/15	Bit	ALM_V_MotorBlindEndVert	ALARM: VSH-162V MOTOR BLIND VERT VIB	Read
BI0209	N12:13/0	Bit	ALM_V_MotorShaftEndHorz	ALARM: VSH-161H MOTOR SHAFT HORZ VIB	Read
BI0210	N12:13/1	Bit	ALM_V_MotorShaftEndVert	ALARM: VSH-161V MOTOR SHAFT VERT VIB	Read
BI0211	N12:13/2	Bit		SPARE GROUP 13 BIT 2	Read
BI0212	N12:13/3	Bit		SPARE GROUP 13 BIT 3	Read
BI0213	N12:13/4	Bit		SPARE GROUP 13 BIT 4	Read
BI0214	N12:13/5	Bit		SPARE GROUP 13 BIT 5	Read
BI0215	N12:13/6	Bit		SPARE GROUP 13 BIT 6	Read
BI0216	N12:13/7	Bit		SPARE GROUP 13 BIT 7	Read
BI0217	N12:13/8	Bit		SPARE GROUP 13 BIT 8	Read
BI0218	N12:13/9	Bit		SPARE GROUP 13 BIT 9	Read
BI0219	N12:13/10	Bit		SPARE GROUP 13 BIT 10	Read
BI0220	N12:13/11	Bit		SPARE GROUP 13 BIT 11	Read
BI0221	N12:13/12	Bit		SPARE GROUP 13 BIT 12	Read
BI0222	N12:13/13	Bit		SPARE GROUP 13 BIT 13	Read
BI0223	N12:13/14	Bit		SPARE GROUP 13 BIT 14	Read
BI0224	N12:13/15	Bit		SPARE GROUP 13 BIT 15	Read
BI0225	N12:14/0	Bit	TRIP_V_ComprAxialForward	TRIP: ZSHH-141 COMPRESSOR AXIAL FORWARD TH	Read
BI0226	N12:14/1	Bit	TRIP_V_ComprAxialReverse	TRIP: ZSLL-141 COMPRESSOR AXIAL REVERSE THR	Read

BACnet	Address	TagType	Tagname	Description	Type
BI0227	N12:14/2	Bit	TRIP_V_ComprShaftEndHorz	TRIP: VSH-142H COMPRESSOR SHAFT END HORZ V	Read
BI0228	N12:14/3	Bit	TRIP_V_ComprShaftEndVert	TRIP: VSH-142V COMPRESSOR SHAFT END VERT V	Read
BI0229	N12:14/4	Bit	TRIP_V_ComprSumpEndHorz	TRIP: VSH-141H COMPRESSOR SUMP END HORZ V	Read
BI0230	N12:14/5	Bit	TRIP_V_ComprSumpEndVert	TRIP: VSH-141V COMPRESSOR SUMP END VERT VI	Read
BI0231	N12:14/6	Bit	TRIP_V_GearHSBEHorz	TRIP: VSH-152H GEAR HS BLIND END HORZ VIB	Read
BI0232	N12:14/7	Bit	TRIP_V_GearHSBEVert	TRIP: VSH-152V GEAR HS BLIND END VERT VIB	Read
BI0233	N12:14/8	Bit	TRIP_V_GearHSSEHorz	TRIP: VSH-151H GEAR HS SHAFT END HORZ VIB	Read
BI0234	N12:14/9	Bit	TRIP_V_GearHSSEVert	TRIP: VSH-151V GEAR HS SHAFT END VERT VIB	Read
BI0235	N12:14/10	Bit	TRIP_V_GearLSBEHorz	TRIP: VSH-154H GEAR LS BLIND END HORZ VIB	Read
BI0236	N12:14/11	Bit	TRIP_V_GearLSBEVert	TRIP: VSH-154V GEAR LS BLIND END VERT VIB	Read
BI0237	N12:14/12	Bit	TRIP_V_GearLSSEHorz	TRIP: VSH-153H GEAR LS SHAFT END HORZ VIB	Read
BI0238	N12:14/13	Bit	TRIP_V_GearLSSEVert	TRIP: VSH-153V GEAR LS SHAFT END VERT VIB	Read
BI0239	N12:14/14	Bit	TRIP_V_MotorBlindEndHorz	TRIP: VSH-162H MOTOR BLIND END HORZ VIB	Read
BI0240	N12:14/15	Bit	TRIP_V_MotorBlindEndVert	TRIP: VSH-162V MOTOR BLIND END VERT VIB	Read
BI0241	N12:15/0	Bit	TRIP_V_MotorShaftEndHorz	TRIP: VSH-161H MOTOR SHAFT END HORZ VIB	Read
BI0242	N12:15/1	Bit	TRIP_V_MotorShaftEndVert	TRIP: VSH-161V MOTOR SHAFT END VERT VIB	Read
BI0243	N12:15/2	Bit		SPARE GROUP 15 BIT 2	Read
BI0244	N12:15/3	Bit		SPARE GROUP 15 BIT 3	Read
BI0245	N12:15/4	Bit		SPARE GROUP 15 BIT 4	Read
BI0246	N12:15/5	Bit		SPARE GROUP 15 BIT 5	Read
BI0247	N12:15/6	Bit		SPARE GROUP 15 BIT 6	Read
BI0248	N12:15/7	Bit		SPARE GROUP 15 BIT 7	Read
BI0249	N12:15/8	Bit		SPARE GROUP 15 BIT 8	Read
BI0250	N12:15/9	Bit		SPARE GROUP 15 BIT 9	Read
BI0251	N12:15/10	Bit		SPARE GROUP 15 BIT 10	Read
BI0252	N12:15/11	Bit		SPARE GROUP 15 BIT 11	Read
BI0253	N12:15/12	Bit		SPARE GROUP 15 BIT 12	Read
BI0254	N12:15/13	Bit		SPARE GROUP 15 BIT 15	Read
BI0255	N12:15/14	Bit		SPARE GROUP 15 BIT 14	Read
BI0256	N12:15/15	Bit		SPARE GROUP 15 BIT 15	Read
	N13	INT	**RemoteDigitals**		
	N13:0/0	Bit	DI_EmergencyStop	0=emegency stop,1=normal	Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:0/1	Bit	DI_LocalStartPB	1=Start Chiller	Read
	N13:0/2	Bit	DI_ChillerStopPB	0=Controlled Chiller Stop	Read
	N13:0/3	Bit			Read
	N13:0/4	Bit	DI_SystemResetPB	1=System Reset	Read
	N13:0/5	Bit	DI_HardwireSafetyRelay	1=safeties are reset	Read
	N13:0/6	Bit	DI_ComprMotorSafetyRelay	0=Compressor Motor Safety Trip	Read
	N13:0/7	Bit	DI_OilPumpAuxInput	1=Compressor Auxilary Oil Pump Interlocked	Read
	N13:0/8	Bit	DI_GearAuxOilPumpAux	1=Gear Aux Oil Pump Interlocked	Read
	N13:0/9	Bit	DI_CondWaterLowFlow	0=Condenser Water Low Flow Trip (Hardwired)	Read
	N13:0/10	Bit	DI_ChilledWaterLowFlow	0=Chilled Water Low Flow Trip (Hardwired)	Read
	N13:0/11	Bit	DI_HighPressCutout	1=High Discharge Pressure Cutout (Hardwired)	Read
	N13:0/12	Bit	DI_LowOilPressCutout	0=Low Compressor Oil Pressure Cutout	Read
	N13:0/13	Bit			Read
	N13:0/14	Bit	DI_ThrustBrgOilCutout	1=Thrust Bearing High Temperature Cutout	Read
	N13:0/15	Bit	DI_ComprMotorRunFullVolt	1=Main Compressor Motor Interlock Full Voltage Run	Read
	N13:1/0	Bit	DI_CompressorSumpOilLevel	0=compr low oil sump level alarm	Read
	N13:1/1	Bit	DI_SepOilLevel	0=oil separator low oil level alarm	Read
	N13:1/2	Bit	DI_MotorCoolantLeak	1=motor coolant leak trip	Read
	N13:1/3	Bit			Read
	N13:1/4	Bit			Read
	N13:1/5	Bit			Read
	N13:1/6	Bit			Read
	N13:1/7	Bit			Read
	N13:1/8	Bit			Read
	N13:1/9	Bit			Read
	N13:1/10	Bit			Read
	N13:1/11	Bit	DI_ATB_MalfunctionR4	ATB R4 panel malfunction	Read
	N13:1/12	Bit	DI_ATB_UnloadChiller	Chiller Unload Command	Read
	N13:1/13	Bit	DI_ATB_ForwardFlow	4-Way Valve Forward Flow	Read
	N13:1/14	Bit	DI_ATB_ReverseFlow	4-Way Valve Reverse Flow	Read
	N13:1/15	Bit	DI_HardwireRemStartStop	1=chiller start/0=stop	Read
	N13:2/0	Bit	DO_ComprMotorStartRelay	Main Compressor Motor Start Relay	Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:2/1	Bit	DO_OilPumpStarterOutput	Compr Aux Oil Pump Starter	Read
	N13:2/2	Bit	DO_GearAuxOilPump	Gear Aux lube oil pump starter	Read
	N13:2/3	Bit	DO_AuxCoolingWater	Aux Cooling Water Solenoid Valve	Read
	N13:2/4	Bit	DO_ComprOilHtr	Compressor Sump Oil Heater outpur energized	Read
	N13:2/5	Bit	DO_OilSeperatorHeaterA	oil separator heater output energized	Read
	N13:2/6	Bit	DO_GasEductorSolenoid	Gas Eductor Solenoid Valve	Read
	N13:2/7	Bit	DO_LPInterstageSolenoid	Liquid Line Solenoid Valve	Read
	N13:2/8	Bit		spare	Read
	N13:2/9	Bit		spare	Read
	N13:2/10	Bit		spare	Read
	N13:2/11	Bit		spare	Read
	N13:2/12	Bit		spare	Read
	N13:2/13	Bit		spare	Read
	N13:2/14	Bit		spare	Read
	N13:2/15	Bit		spare	Read
	N13:3/0	Bit	DO_ComprSumpVentSolenoid	Compressor Sump Vent Solenoid Valve	Read
	N13:3/1	Bit	DO_EmergencyChilledWaterPump	Start Emergency Chilled Water Pump	Read
	N13:3/2	Bit	DO_StartupBypassRelay	Hardwired Safety Startup Bypass Relay	Read
	N13:3/3	Bit		spare	Read
	N13:3/4	Bit	DO_ATB_Start	ATB Start Command	Read
	N13:3/5	Bit	DO_ChillerAlarm	Chiller Alarm Signal = 0	Read
	N13:3/6	Bit	DO_ChillerTrip	Chiller Trip Output = 0	Read
	N13:3/7	Bit	DO_ChillerRunning	Chiller Running Output = 1	Read
	N13:3/8	Bit		spare	Read
	N13:3/9	Bit		spare	Read
	N13:3/10	Bit		spare	Read
	N13:3/11	Bit		spare	Read
	N13:3/12	Bit		spare	Read
	N13:3/13	Bit		spare	Read
	N13:3/14	Bit		spare	Read
	N13:3/15	Bit		spare	Read
	N13:4/0	Bit	B_CAOPDPDeadbandSwitch	1=run CAOP	Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:4/1	Bit	B_CAOPLowSpeedDeadbandSwitch	1=run CAOP	Read
	N13:4/2	Bit	B_ComprMotorRunFullVolt	1=run output energized and motor running full volt	Read
	N13:4/3	Bit	B_DrivelineRotating	1=rotation detected from VFD feedback signal	Read
	N13:4/4	Bit	B_HotGasAutoInhibit	inhibit hot gas transfer to automatic	Read
	N13:4/5	Bit	B_HotGasManAuto	hot gas in manual	Read
	N13:4/6	Bit	B_HPInterstageManAutoInhibit	HP interstage inhibited	Read
	N13:4/7	Bit	B_HPInterstageManualAuto	HP interstage in manual	Read
	N13:4/8	Bit	B_Icool_LvlManAuto	inhibit intercooler level transfer to automatic	Read
	N13:4/9	Bit	B_Icool_LvlManAutoInhibit	intercooler level in manual	Read
	N13:4/10	Bit	B_InterstageManAutoInhibit	interstage transfer to auto inhibited	Read
	N13:4/11	Bit	B_InterstageManualAuto	interstage valve in manual	Read
	N13:4/12	Bit	B_InterstageRampDone	interstage done ramping	Read
	N13:4/13	Bit	B_LowLoadStart	chiller started in load condition	Read
	N13:4/14	Bit	B_OilSepON	oil separator heater output energized	Read
	N13:4/15	Bit	B_Postlubing	chiller is in postlube cycle	Read
	N13:5/0	Bit	B_Prelubing	chiller is in prelube cycle	Read
	N13:5/1	Bit	B_PRVAutoInhibit	prv is below antisurge and inhibits auto	Read
	N13:5/2	Bit	B_PRVManAuto	prvs are in manual	Read
	N13:5/3	Bit	B_RemStartPermit	remote starts permitted	Read
	N13:5/4	Bit	B_SpeedAutoInhibit	speed transfer to auto inhibited	Read
	N13:5/5	Bit	B_SpeedManAuto	speed control in manual	Read
	N13:5/6	Bit	B_StartButtonSignal	start button or remote start is high	Read
	N13:5/7	Bit	B_SubcoolerManAuto	subcooler is in manual	Read
	N13:5/8	Bit	B_SubcoolManAutoInhibit	subcooler is inhibited from auto transfer	Read
	N13:5/9	Bit	B_SubCoolRampDone	subcooler ramp is complete	Read
	N13:5/10	Bit	B_TC100MANUAL	tc-100 is in manual	Read
	N13:5/11	Bit	B_TempControlAuto	temp control is in auto	Read
	N13:5/12	Bit	B_TripRecord	one shot on chiller fault for recording chiller status	Read
	N13:5/13	Bit	CCB_HSR1Select	0=antisurge, 1=temp	Read
	N13:5/14	Bit	CCB_HSR2Select	0=ramp, 1=antisurge	Read
	N13:5/15	Bit	CCB_HSR3Select	0=ramp, 1=antisurge	Read
	N13:6/0	Bit	CCB_LSR1Select	0=ramp, 1=SS1	Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:6/1	Bit	CCB_LSR2Select	0=temp, 1=press override	Read
	N13:6/2	Bit	CCB_LSR3Select	0=temp, 1=CR4	Read
	N13:6/3	Bit	MSG_CondFlow	flow switch made or GPM above 100	Read
	N13:6/4	Bit	MSG_EvapFlow	flow switch made or GPM above 100	Read
	N13:6/5	Bit	MSG_Hotgasramping	hot gas is ramping	Read
	N13:6/6	Bit	MSG_HPInterstageRamping	hp interstage valve is ramping	Read
	N13:6/7	Bit	MSG_IntercoolerRamping	intercooler valve is ramping	Read
	N13:6/8	Bit	MSG_InterstageRamping	interstage valve is ramping	Read
	N13:6/9	Bit	MSG_PRVRamping	prvs are ramping	Read
	N13:6/10	Bit	MSG_RemoteCHWLimitRange	remote chilled water sp out of range	Read
	N13:6/11	Bit	MSG_RemoteDemandLimitRange	remote demand limit sp out of range	Read
	N13:6/12	Bit	MSG_RemStartMode	remote start mode	Read
	N13:6/13	Bit	MSG_SubcoolerRamping	subcooler is ramping	Read
	N13:6/14	Bit	S_CommsTrip	rack comms OK	Read
	N13:6/15	Bit	S_DemandLimiting	Demand limiting	Read
	N13:7/0	Bit	S_FlowTrip	flow safeties OK	Read
	N13:7/1	Bit	S_MiscAlarm1	alarms OK	Read
	N13:7/2	Bit	S_MiscAlarm2	alarms OK	Read
	N13:7/3	Bit	S_MiscAlarm3	alarms OK	Read
	N13:7/4	Bit	S_MiscTrip	trips OK	Read
	N13:7/5	Bit	S_PressureOverride	Pressure Override	Read
	N13:7/6	Bit	S_PressureTrip	Pressure Trips OK	Read
	N13:7/7	Bit	S_StartEnabled	start is enabled, chiller is running	Read
	N13:7/8	Bit	S_SystemAlarm	1=common alarm	Read
	N13:7/9	Bit	S_SystemCoastdown	system is coasting down	Read
	N13:7/10	Bit	S_SystemTrip	trips all OK	Read
	N13:7/11	Bit	S_TempTrip	temperature trips OK	Read
	N13:7/12	Bit		spare	Read
	N13:7/13	Bit		spare	Read
	N13:7/14	Bit		spare	Read
	N13:7/15	Bit		spare	Read
	N13:8/0	Bit		spare	Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:8/1	Bit		spare	Read
	N13:8/2	Bit		spare	Read
	N13:8/3	Bit		spare	Read
	N13:8/4	Bit		spare	Read
	N13:8/5	Bit		spare	Read
	N13:8/6	Bit		spare	Read
	N13:8/7	Bit		spare	Read
	N13:8/8	Bit		spare	Read
	N13:8/9	Bit		spare	Read
	N13:8/10	Bit		spare	Read
	N13:8/11	Bit		spare	Read
	N13:8/12	Bit		spare	Read
	N13:8/13	Bit		spare	Read
	N13:8/14	Bit		spare	Read
	N13:8/15	Bit		spare	Read
AI0800	N13:9	Integer	S_DisplayStatus	0=READY TO START 1=REMOTE START ENABLED 2=START INITIATED 3=REMOTE START INTIATED 4=SYSTEM RUNNING 5=SYSTEM COASTDOWN 6=SYSTEM TRIPPED 7=ANTI-RECYCLE 8=CONTROL STOP 9=REMOTE LOCKOUT 10=RUNNING IN OVERRIDE 11=TUBE CLEANING	Read
	N13:10/0	Bit			Read
	N13:10/1	Bit			Read
	N13:10/2	Bit			Read
	N13:10/3	Bit			Read
	N13:10/4	Bit			Read
	N13:10/5	Bit			Read
	N13:10/6	Bit			Read

BACnet	Address	TagType	Tagname	Description	Type
	N13:10/7	Bit			Read
	N13:10/8	Bit			Read
	N13:10/9	Bit			Read
	N13:10/10	Bit			Read
	N13:10/11	Bit			Read
	N13:10/12	Bit			Read
	N13:10/13	Bit			Read
	N13:10/14	Bit			Read
	N13:10/15	Bit			Read
	F16		**RemoteSetpoints**		
AO0001	F16:0	IEEE/Float	RemoteSetpoints[0]	AI_ChilledWaterSetpointREMOTE	Write
AO0002	F16:1	IEEE/Float	RemoteSetpoints[1]	SP_DemandLimitREMOTE	Write
	N17		**RemoteCommands**		
BO0001	N17:0/0	Bit	RemoteComands.0	Remote Start (Network)	Write
BO0002	N17:0/1	Bit	RemoteComands.1	Remote Stop (Network)	Write
BO0003	N17:0/2	Bit	RemoteComands.2	Remote Reset (Network)	Write
BO0004	N17:2/3	Bit	RemoteComands.3	Remote Brush Cleaning Initiate	Write
		INT	**MVSSS_Dat**		
AI0900	N18:0/0	Bit			READ
	N18:0/1	Bit			READ
	N18:0/2	Bit			READ
	N18:0/3	Bit			READ
	N18:0/4	Bit			READ
	N18:0/5	Bit			READ
	N18:0/6	Bit			READ
	N18:0/7	Bit			READ
	N18:0/8	Bit			READ
	N18:0/9	Bit			READ
	N18:0/10	Bit			READ
	N18:0/11	Bit			READ
	N18:0/12	Bit			READ
	N18:0/13	Bit			READ

BACnet	Address	TagType	Tagname	Description	Type
	N18:0/14	Bit			READ
	N18:0/15	Bit			READ
AI0901	N18:1	INT			READ
AI0902	N18:2	INT			READ
AI0903	N18:3	INT			READ
AI0904	N18:4/0	Bit			READ
	N18:4/1	Bit			READ
	N18:4/2	Bit			READ
	N18:4/3	Bit			READ
	N18:4/4	Bit			READ
	N18:4/5	Bit			READ
	N18:4/6	Bit			READ
	N18:4/7	Bit			READ
	N18:4/8	Bit			READ
	N18:4/9	Bit			READ
	N18:4/10	Bit			READ
	N18:4/11	Bit			READ
	N18:4/12	Bit			READ
	N18:4/13	Bit			READ
	N18:4/14	Bit			READ
	N18:4/15	Bit			READ
AI0905	N18:5/0	Bit			READ
	N18:5/1	Bit			READ
	N18:5/2	Bit			READ
	N18:5/3	Bit			READ
	N18:5/4	Bit			READ
	N18:5/5	Bit			READ
	N18:5/6	Bit			READ
	N18:5/7	Bit			READ
	N18:5/8	Bit			READ
	N18:5/9	Bit			READ
	N18:5/10	Bit			READ

BACnet	Address	TagType	Tagname	Description	Type
	N18:5/11	Bit			READ
	N18:5/12	Bit			READ
	N18:5/13	Bit			READ
	N18:5/14	Bit			READ
	N18:5/15	Bit			READ
AI0906	N18:6/0	Bit			READ
	N18:6/1	Bit			READ
	N18:6/2	Bit			READ
	N18:6/3	Bit			READ
	N18:6/4	Bit			READ
	N18:6/5	Bit			READ
	N18:6/6	Bit			READ
	N18:6/7	Bit			READ
	N18:6/8	Bit			READ
	N18:6/9	Bit			READ
	N18:6/10	Bit			READ
	N18:6/11	Bit			READ
	N18:6/12	Bit			READ
	N18:6/13	Bit			READ
	N18:6/14	Bit			READ
	N18:6/15	Bit			READ
AI0907	N18:7/0	Bit			READ
	N18:7/1	Bit			READ
	N18:7/2	Bit			READ
	N18:7/3	Bit			READ
	N18:7/4	Bit			READ
	N18:7/5	Bit			READ
	N18:7/6	Bit			READ
	N18:7/7	Bit			READ
	N18:7/8	Bit			READ
	N18:7/9	Bit			READ
	N18:7/10	Bit			READ

BACnet	Address	TagType	Tagname	Description	Type
	N18:7/11	Bit			READ
	N18:7/12	Bit			READ
	N18:7/13	Bit			READ
	N18:7/14	Bit			READ
	N18:7/15	Bit			READ
AI0908	N18:8	INT			READ
AI0909	N18:9	INT			READ
AI0910	N18:10	INT			READ
AI0911	N18:11	INT			READ
AI0912	N18:12	INT			READ
AI0913	N18:13	INT			READ
AI0914	N18:14	INT			READ
AI0915	N18:15	INT			READ
AI0916	N18:16	INT			READ
AI0917	N18:17	INT			READ
AI0918	N18:18	INT			READ
AI0919	N18:19	INT			READ
AI0920	N18:20	INT			READ
AI0921	N18:21	INT			READ
AI0922	N18:22	INT			READ
AI0923	N18:23	INT			READ
AI0924	N18:24	INT			READ