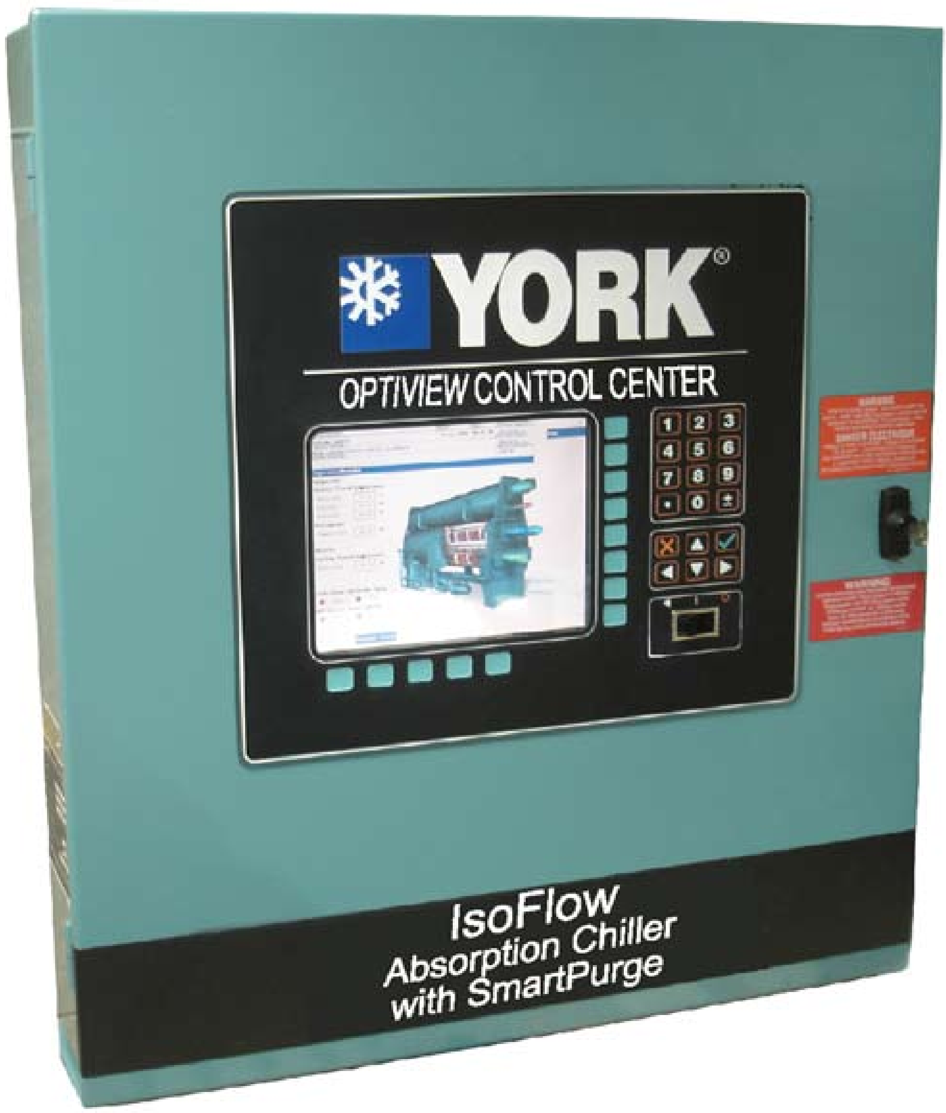
YORK BY JOHNSON CONTROLS	SINGLE STAGE YIA ABSORPTION CHILLERS WITH OPTIVIEW™ CONTROL CENTER	
SERVICE INSTRUCTIONS	New Release	Form 155.21-M1 (810)

YIA MOD D
SINGLE STAGE
STEAM / HOT WATER
WITH OPTIVIEW™ CONTROL CENTER



LD13714

1A1 through 14F3

IMPORTANT!
READ BEFORE PROCEEDING!
GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

NOTE

NOTE is used to highlight additional information which may be helpful to you.

WARNING

External wiring, unless specified as an optional connection in the manufacturer's product line, is NOT to be connected inside the micro panel cabinet. Devices such as relays, switches, transducers and controls may NOT be installed inside the micro panel. NO external wiring is allowed to be run through the panel. All wiring must be in accordance with YORK's published specifications and must be performed ONLY by qualified Johnson Controls personnel. Johnson Controls will not be responsible for damages/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this will void the manufacturer's warranty and cause serious damage to property or injury to persons.

CHANGEABILITY OF THIS DOCUMENT

In complying with YORK/Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest YORK/ Johnson Controls Service Office.

It is the responsibility of operating/service personnel as to the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then, prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

REFERENCE MANUALS LIST

DESCRIPTION	FORM NO.
OPERATION – YIA UNIT	155.21-O1
MAINTENANCE – YIA UNIT	155.21-OM1
INSTALLATION – YIA UNIT	155.21-N1
RENEWAL PARTS – YIA UNIT	155.21-RP1
RENEWAL PARTS – YIA OPTIVIEW CONTROL CENTER	155.21-RP1
WIRING DIAGRAM – YIA FIELD CONTROL MODIFICATIONS	155.21-W2
WIRING DIAGRAM – YIA SINGLE STAGE OPTIVIEW	155.21-W1
WIRING DIAGRAM – YIA FIELD CONNECTIONS	155.21-W3
INSTALLATION / START-UP CHECKLISTS	155.21-CL1 & 155.21-CL2

NOMENCLATURE

YIA ST 1A1 46 C S D

DESIGN LEVEL (D)
D = OptiView Panel

SPECIAL (S)
S = Std Tubes
X = Special Tubes

COOLING ONLY (C)

VOLTAGE CODE (46)
17=208-3-60
28=230-3-60
46=460-3-60
50=380/400/415-3-50
58=575-3-60

UNIT SIZE (1A1)
1A1 through 14F3

HEAT SOURCE (ST)
ST=Steam
HW=Hot Water

UNIT TYPE (YIA)
YORK IsoFlow Absorption Chiller

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SECTION 1 - INTRODUCTION

This document explains the operation of printed circuit boards and major components of the OptiView Control Center to a level that allows a service technician to locate, troubleshoot and repair the source of the problem.

The overall system architecture is described and illustrated with block diagrams. This describes the general function of each component and provides the system interface and signal flow. The function of each component and signal flow between components must be understood before the effective troubleshooting can commence.

The operation of each printed circuit board is described and illustrated with a block diagram that is a simplified representation of board circuitry. The expected voltage level at all inputs and outputs of each board for any operating condition is provided.

Included in this document are procedures that have to be performed at chiller commissioning or during service. They should not be performed by anyone other than a qualified Johnson Controls service technician. For example, certain components need to be verified for proper operation at system commissioning or when a component is replaced. Certain safety shutdowns require special reset procedures to be performed before the chiller can be restarted.

In addition to this document, several levels of supporting documentation are required while servicing the system. Operations manual 155.21-O1 explains the operation of the OptiView Control Center Keypad, how to enter Operator setpoints, and explains the messages displayed. It also covers operator functions such as:

- Purge Pump Operation
- Purge Trending
- System Trending
- History
- How To Print

The appropriate wiring diagrams are shown in the Reference Manuals List table in the front of this book. There wiring diagrams provide component interconnections within the OptiView Control Center and the connections between these components and the chiller components.

When the chiller shuts down on a safety or cycling shutdown or is being prevented from starting, a message is displayed providing the reason for the shutdown. This message, along with all the chiller operation conditions when they happen is stored in the microboard battery-backed memory. This history data can be displayed or printed using an optional printer or laptop computer. The Operation Manual, 155.21-O1, also covers a detailed description of messages, including the conditions required to produce the message and conditions required to restart the chiller.

Near the end of this document is a Diagnostic and Troubleshooting Section which explains the service analysis of the following functions:

- Keypad
- Display
- Serial I/O
- Digital I/O
- Analog I/O

Before beginning any troubleshooting, observe the shutdown message and retrieve the history data of that event. Refer to the above reference manual for an explanation of the fault message. The conditions required to produce the message must be clearly understood before proceeding. (If this is not heeded, much time will be wasted). Armed with knowledge of the overall system architecture and the function of each printed circuit board and signal flow provided by this manual, proceed with the appropriate Wiring Diagram to trace the problem through the system. Use the Diagnostics routines where appropriate.

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SECTION 2 - SYSTEM ARCHITECTURE

INTRODUCTION

The OptiView Control Center performs the following functions:

- Controls chiller capacity to chill liquid to the chilled liquid temperature setpoint.
- Controls chiller devices such as: solenoid valves, relays, actuators, and pump contactors per the operating program.
- Displays chiller operating conditions, alarms, shutdown messages, trending, and history data.
- Accepts operator-programmed setpoints and controls the chiller accordingly.
- Allows manual control of chiller actuators, pumps, and valves.
- Monitors chiller operating conditions and shuts down chiller when safety or cycling thresholds are exceeded.
- Allows local manual start/stop and accepts start/stop commands from remote devices, via contact closures or serial communications.
- Allows certain setpoints to be changed from a remote location via 0 to 10VDC, relay contact closure or serial communications.
- Provides chiller operation data and status to remote devices via serial communications and contact closure.
- Allows real-time data and history data to be printed on an optional printer or computer.
- Controls the system pumps and supports devices on older models for retrofit purposes.
- Allows auto or manual control of auto-purge cycle to expel non-condensables out of the system to the atmosphere.
- Allows operators accessibility to warm up and change purge pump oil for maintenance purposes.

The OptiView Control Center is a microprocessor based control system that receives analog, digital and serial data inputs and controls analog, digital and serial data outputs per instructions in the operation program. A panel mounted display and touch-sensitive keypad permit local operation.

System pressures are sensed by pressure transducers (see Figure 33 in Section 13). The output of each transducer is a DC voltage that is analogous to the pressure input. System temperatures are sensed by thermistors (see Section 14, Tables 8 - 14). The output of each thermistor is a DC voltage that is analogous to the temperature it is sensing. Typical output voltage range of both is 0.5 to 4.5VDC. These are analog inputs to the OptiView Control Center.

Digital Inputs are ON/OFF inputs to the OptiView Control Center in the form of a switch and relay contacts. These inputs are 115VAC when the contacts are closed and 0VAC when the contacts are open.

Digital inputs include:

- Flow Switches
- Local Start/Stop Switch
- Remote Cycling
- High Pressure/Temperature Safety Devices
- Low Refrigerant Temperature Cutouts, Etc.

Digital Outputs are ON/OFF outputs from the OptiView Control Center in the form of relay contacts and triacs. The relay contacts typically switch 115VAC ON and OFF.

Relay outputs could include:

- Status/Alarm
- Chiller Solenoid Valves
- Chilled And Condenser Water Pumps, Etc.

Triac outputs operate two system solenoid valves and on older units (retrofit panels) they control a digital control valve.

Serial Data is transmitted to and received from devices in the RS-232, RS-485 and TX/RX (opto-coupler) form.

The OptiView Control Center supports two types of pumps, Buffalo and Franklin; and two styles of control valve signals, analog and digital. Standard components in all OptiView panels are:

- Microboard
- I/O (Input/Output) Board
- Keypad

- Display
- Power Supply
- Analog I/O Expansion Board

The microprocessor and all supporting logic circuits, along with the memory devices containing the operation program, reside on the microboard. All chiller operation decisions are made here. It receives analog and digital inputs from the chiller and remote devices. The analog inputs are connected directly to the microboard. The digital inputs are received via the I/O board. Under program control, the microboard operates the relays and triacs that are located on the I/O board.

The control center is equipped with a 031-02430-005 microboard. This board will ship in all Mod "D" YIA units starting in May 2010. The logic program resides in non-removable onboard memory. The software version is viewable on the DIAGNOSTICS screen in SERVICE access level. The program can be upgraded by downloading new programs from a Program Card. Program Cards are shirt-pocket-size portable memory storage devices available from the Baltimore Parts Center.

Software versions (C.OPT.15.xx.yzz) are alpha-numeric codes that represent the application, language package and revision levels per data below. Each time the controls portion or language section is revised, the respective revision level increments.

- C – Commercial chiller
- OPT – Used on microboard 031-02430-005
- 15 – YIA absorption chiller
- xx – Controls revision level (00, 01, etc)
- y – Language package (0 = English only, 1 = NEMA, 2 = CE, 3 = NEMA/CE)
- zz – Language package revision level

The I/O board acts as an input/output device for the microboard. It conditions the digital input signals for the microboard and contains relays and triacs that are controlled by the microboard to control solenoids, motor contactors and actuators. The 115VAC digital inputs from switch and relay contacts are converted to logic level voltages by opto-couplers. The relays have +12VDC coils that are energized and de-energized by the microboard. The contacts of these relays control the 115VAC system solenoids, relays and motor contactors. The triacs are turned ON and OFF by the microboard. The outputs of these triacs control two system control valves and the control valve actuator for digital control valves (retrofit applications).

A front panel-mounted keypad allows the operator and service technician user interface. Membrane keys are used to display chiller and system parameters, enter setpoints, and perform chiller and OptiView Control Center diagnostics. It also contains a Start-Run-Stop/Reset switch that is used to locally start and stop the chiller and perform manual reset functions.

A front panel mounted Liquid Crystal Display allows the graphic animated display of the chiller, chiller subsystems and system parameters. The chiller and working components of the chiller are displayed, along with chiller operating pressures and temperatures. The keypad is used to select displays showing levels of detail of chiller working components.

A self-contained power supply supplies the necessary DC voltages for all the components within the OptiView Control Center.

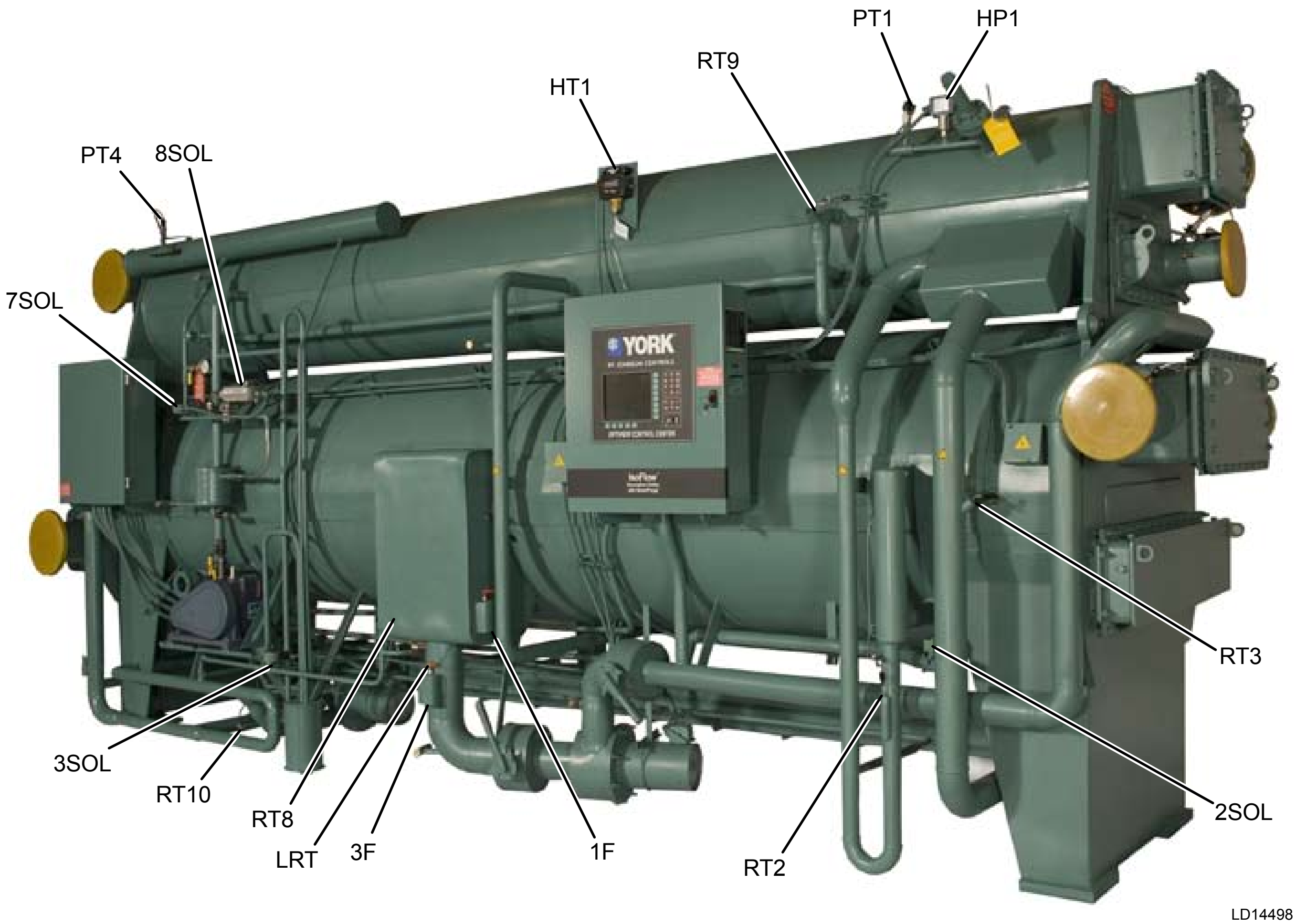
Serial data interface to the building automated system is through the optional E-Link Gateway. This printed circuit board requests the required data from the microboard and makes it available for the BAS network. Available network protocols are:

- BACNET
- MS/TP
- Modbus
- RTU
- N2
- Metasys
- LON Works

Throughout this document references will be made to specific system devices on the unit. Figure 1 shows the general location of these devices on the unit.

NOTE

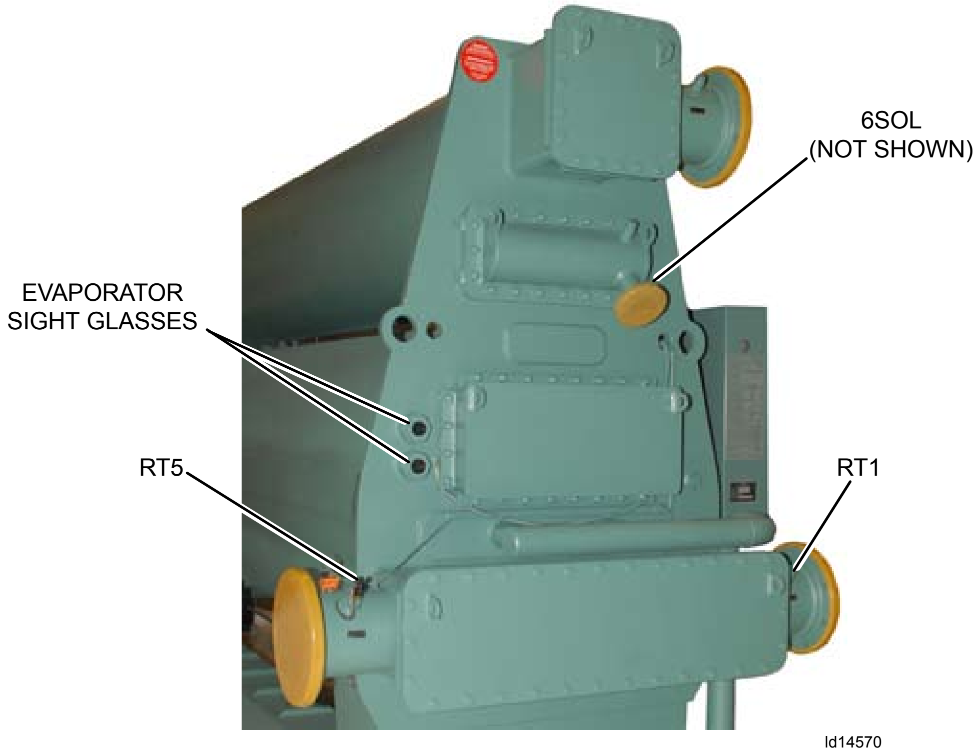
The figure is general in nature and not all models may incorporate all of the devices as shown.



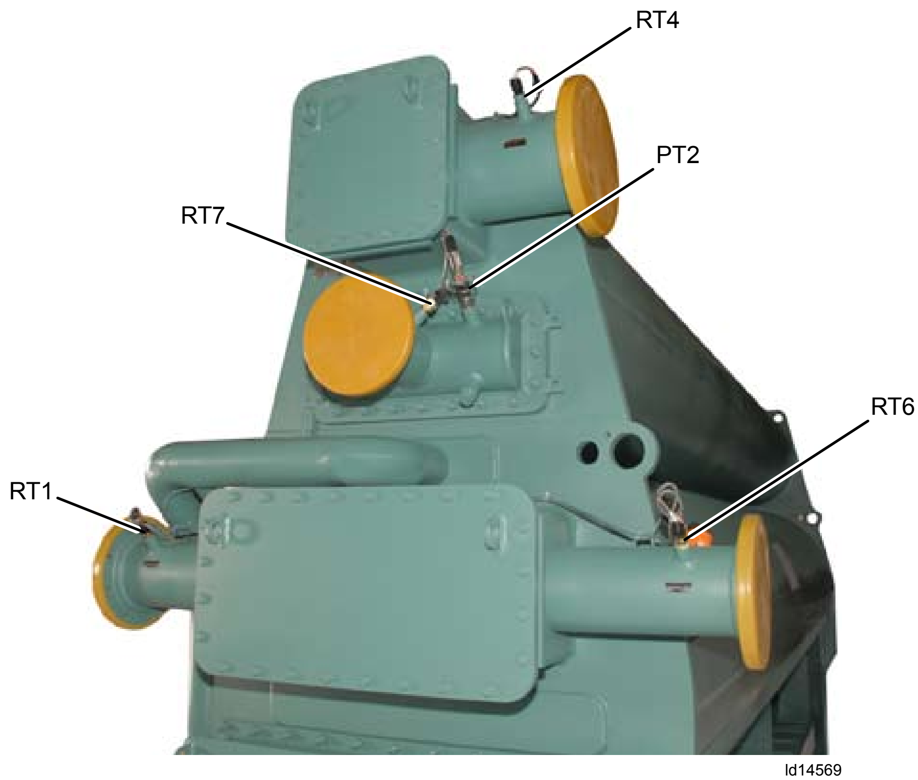
LEGEND

1F	REFRRIGERANT LEVEL SWITCH
3F	REFFRIGERANT PUMP CUTOUT SWITCH
HP1	HIGH PRESSURE CUTOUT SWITCH
HT1	HIGH TEMPERATURE. CUTOUT SWITCH
PT1	GENERATOR PRESSURE TRANSDUCER
PT2	STEAM SUPPLY PRESSURE TRANSDUCER (STEAM UNITS ONLY)
RT1	TEMPERATURE SENSOR LEAVING CHILLED WATER
RT2	TEMPERATURE SENSOR AUTO-DE-CRYSTALLIZATION
RT3	TEMPERATURE SENSOR STRONG SOLUTION
RT4	TEMPERATURE SENSOR LEAVING TOWER WATER
RT5	TEMPERATURE SENSOR ENTERING TOWER WATER
RT6	TEMPERATURE SENSOR ENTERING CHILLED WATER
RT7	TEMPERATURE SENSOR STEAM / HOT WATER SUPPLY
RT8	REFIGERANT TEMPERATURE SENSOR
RT9	REFRIGERANT TEMPERATURE. LEAVING THE CONDENSER
RT10	STRONG SOLUTION TEMPERATURE. LEAVING HEAT EXCHANGER
2SOL	STABILIZER REFRIGERANT SOLENOID (FOR DE-CRYSTALLIZATION)
3SOL	REFRIGERANT LEVEL SOLENOID (UNLOADING)
6SOL	STEAM CONDENSATE DRAIN SOLENOID VALVE (NOT SHOWN) (NOT APPLICABLE ON ALL UNITS)
7SOL	PURGE TANK SOLENOID
8SOL	PURGE PUMP ACTUATOR BALL VALVE
LRT	LOW REFRIGERANT TEMPERATURE CUTOUT SWITCH

FIGURE 1 - SYSTEM CONTROL COMPONENT LOCATIONS



LEFT END OF UNIT



RIGHT END OF UNIT

FIGURE 1 (CONT'D) – SYSTEM CONTROL COMPONENT LOCATIONS

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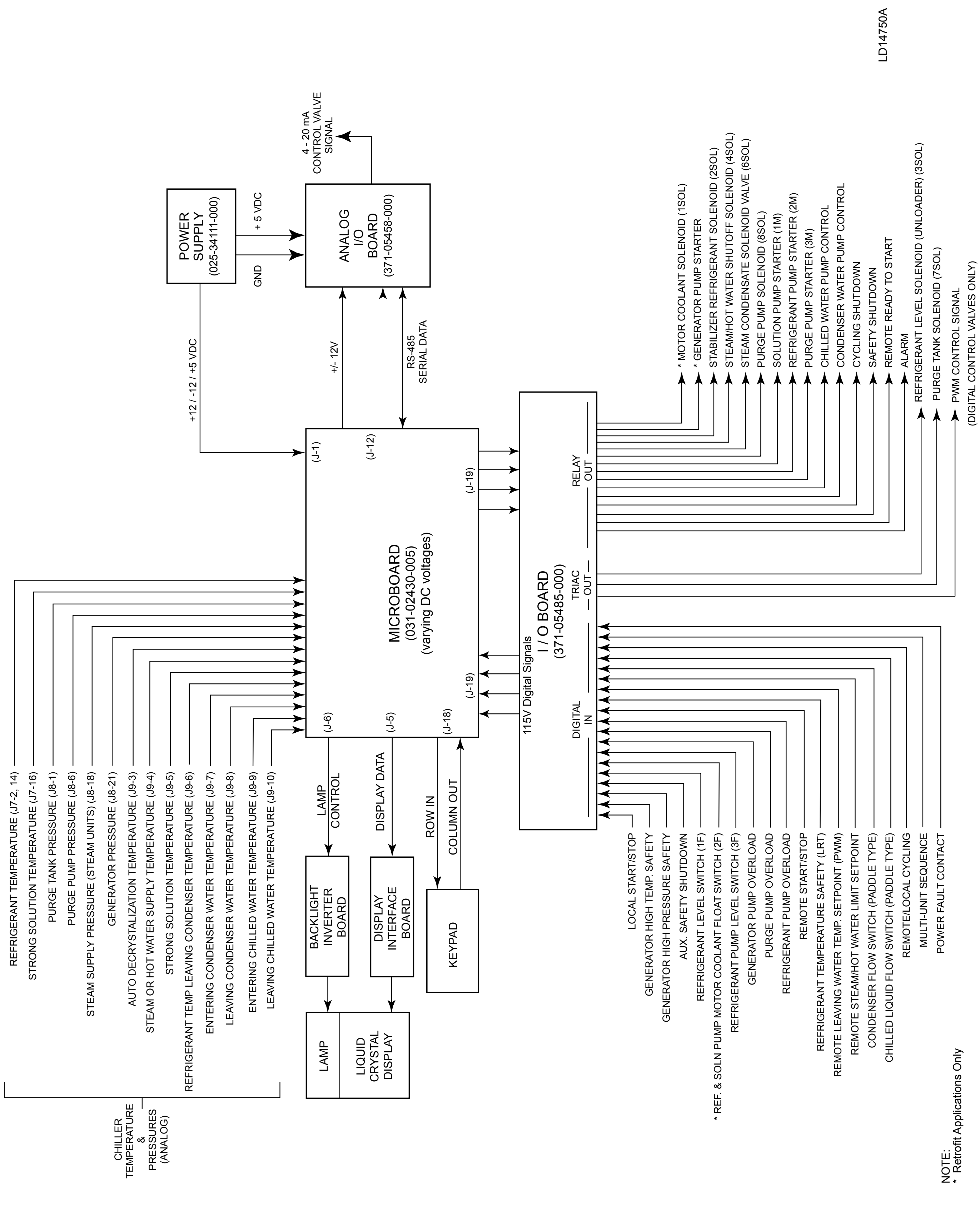

FIGURE 2 - BLOCK DIAGRAM

TIMING DIAGRAM

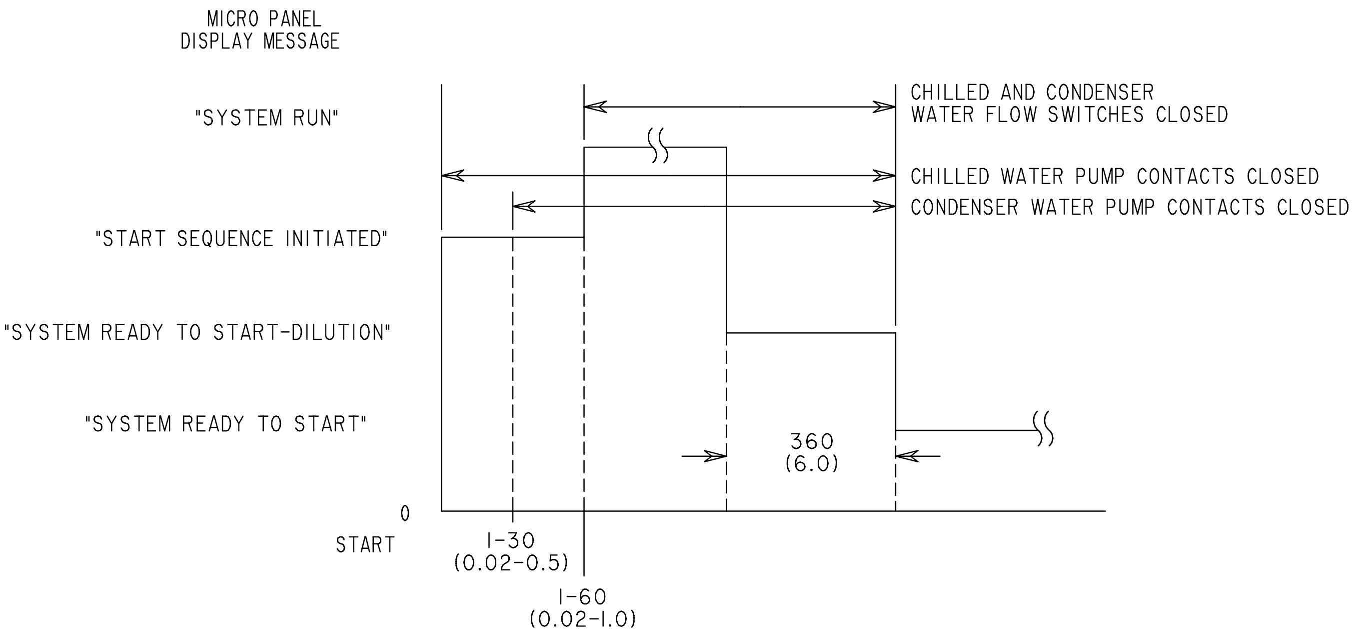

FIGURE 3 - TIMING DIAGRAM

SECTION 3 - MICROBOARD (031-02430-005)

INTRODUCTION

The microboard contains the operating software (program), microprocessor, and supporting circuits for the microprocessor. The program is a set of instructions to control the chiller, the display and peripheral devices. It also contains the safety and cycling shutdown thresholds (non-changeable) and display messages and screens. An on-board program is stored in a linear flash memory Program Card that can be downloaded with the chiller's operating program.

Microboard 031-02430-005 is supplied with all the OptiView panels starting with new production chillers produced May 2010 and after.

NOTE

The board part number will be silk screened directly under the U37 and U38 positions.

It is the only board that will support all the features and options included with the OptiView panel release. This includes the auto-purge feature on new production YIA chillers. The microboard and operating software will support units operating with the old-style Franklin pumps and units operating with a digital control valve.

The board is supplied with +12VDC (J1-3), -12VDC (J1-4), +5VDC (J1-1) and ground (J1-2) from the power supply as shown in Figure 4.

The -12VDC is not used on the microboard but passes through to supply -12VDC to the expansion I/O board. The +5VDC (fused by F1) can be monitored at Test Point (TP3) and ground (TP1). A minimum of +5.0VDC MUST be read at this point, anything less than +5.0VDC will cause the Watchdog circuit to activate. It is applied to a +3.3VDC regulator, +2.5VDC regulator and used directly by the microboard circuits as the supply voltage. The outputs of these regulators

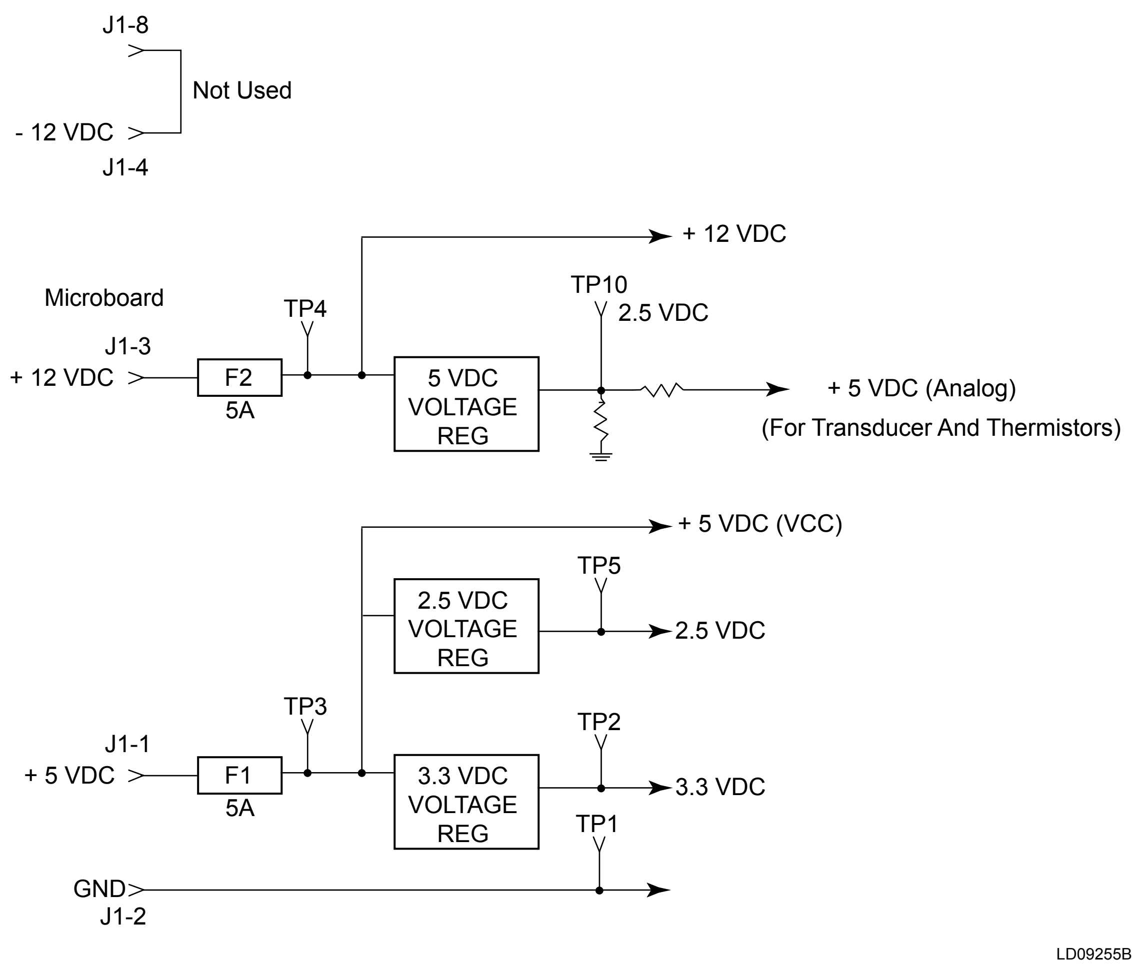

FIGURE 4 - MICROBOARD (031-02430-005) DIAGRAM

are applied to microboard circuits and can be monitored at TP2 and TP5 respectively. The +12VDC (fused by F2) can be monitored at TP4. The value measured must be a minimum of +11.7VDC. It is applied to a +5VDC regulator and used directly by microboard circuits. The output of the regulator is the +5VDC (analog) supply that powers all analog circuits and is the source voltage for all transducers and thermistors. It can be monitored at TP10 as a 2.5VDC value created by 1K ohm resistor voltage divider circuit as shown in Figure 4.

TEST POINTS (REFERENCE FIGURE 5)

The power supply voltages can be measured at the following test points:

- TP1 = Ground (GND)
- TP2 = +3.3VDC
- TP3 = +5.0VDC
- TP4 = +12.0VDC
- TP5 = +2.5VDC
- TP10 = +2.5VDC

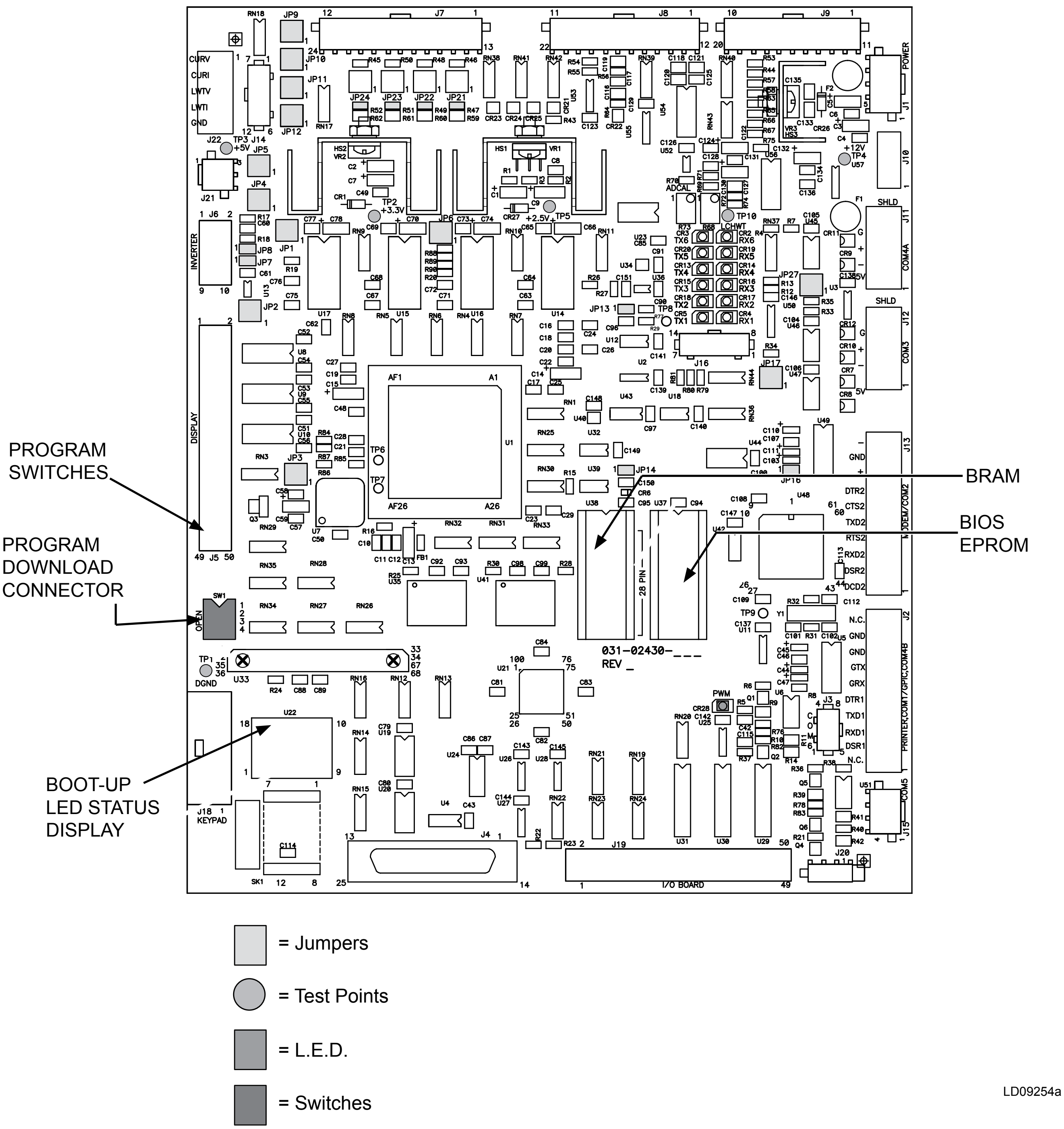

FIGURE 5 - POWER SUPPLY VOLTAGE TEST POINTS

BOOT-UP PROGRAM, BIOS (U37)

The BIOS (Basic Input Output System) EPROM U37 contains the boot-up program. It is a replaceable part. The YORK/Johnson Controls part number is 031-02429-003. The version is an alphanumeric code that identifies the application and the program revision level. The part number and version are printed on the label adhered to the surface of the EPROM.

The version at the time of printing is:

C. OPT. 00. 03

Where:

C = Commercial Chiller

OPT = OptiView Control Center

00 = BIOS EPROM

03 = Revision Level

When power is first applied to the OptiView Control Center, a white screen is displayed while the boot-up is performed. The duration of boot-up is normally about 2 to 5 minutes. During the boot-up, the program in the BIOS EPROM configures the microprocessor and related components and performs testing of certain components to assure those components are operational.

The sequence of events in the boot-up process is listed in Table 1. The progress and pass/fail status of each step is displayed on the microboard 7-segment LED display (U22). Due to the speed at which the boot-up proceeds, not all steps will be visible during the process. Not all pass/fail status is displayed on the white screen.

When installing a new BIOS EPROM, keep the notch on the surface of the BIOS EPROM aligned with the notch printed in white on the microboard surface. Installing the BIOS EPROM in any other position other than this will destroy the internal workings of the BIOS EPROM.

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TABLE 1 - DIAGNOSTIC DISPLAY CODES

TEST	PASS CODE	FAIL ACTION	DISPLAY ON WHITE SCREEN
First initial table complete	00	Watchdog will cause reboot	No
SDRAM registers configured	01	Watchdog will cause reboot	No
Switch to protected mode	02	Watchdog will cause reboot	No
Jump to 32-bit code	03	Watchdog will cause reboot	No
Low memory test start	04	Watchdog will cause reboot	No
Low memory test complete	P1	“F1” on display and halt	No
Full memory test complete	P2	“F2” on display and halt	No
FPGA configuration	05	“P2” will remain on LED display	No
Display cont. configured	06	“05” will remain on LED display	No
Flash checksum test	P3	“F3” will remain on LED display	Yes
BRAM test	P4	“F4” will remain on LED display	Yes
Flash query test	Passed	“Failed” and halt	Yes
Flash checksum	Passed	“Failed”, halt & display code = F3	Yes
BRAM test	Passed	“Failed” and halt	Yes

MISCELLANEOUS CODES

LED DISPLAY CODE	DESCRIPTION
FF	FPGA configuration failed, trying again
CH	Flash Checksum Test in progress
AP	Application setup in progress

CRITICAL CODES

LED Display Code	Description
Ni	NMI handler invoked (should never occur)
[]	GPF has occurred (should never occur)

CHILLER OPERATING PROGRAM

The chiller operating program is a set of instructions that controls the chiller. It contains the safety and cycling shutdown thresholds (non-changeable) and display screen messages and graphics. The chiller operating program operates on 32 Megs of flash, stored in two non-removable flash memory chip locations U35 and U41; both are soldered to the microboard. New chillers are supplied programmed with the latest program available at the time of manufacture. The on-board program can be upgraded by down loading the latest version from a Program Card.

PROGRAM CARD

The on-board program can be upgraded by downloading the latest program version from a Program Card. This is a 2-1/8 x 3-3/8 x 1/8 inch card that holds a pre-programmed version of the chiller's operating program. The part number for this card is 031-02876-001 and is available through the Baltimore Parts Distribution Center (PDC). The part number will not change on this card unless it is absolutely necessary, this way you will always be assured you are getting the latest operating version for your chiller at card purchase. All cards are reprogrammable but have a write protect switch on the back edge of every card. A Program Card for a particular chiller type can be used to reprogram other chillers of the same type. It is not necessary to have more than one card; one card can be used to program multiple chillers. After the operating program is entered into the OptiView Control Center, the card is removed.

A label affixed to the Program Card contains the part number and version. The version is an alpha-numeric code that identifies the chiller model applicability, language package, language packing revision level and chiller operating program revision level. The Program Card version analysis is as follows:

C. OPT. 15. nn. n00

Where:

C = Commercial chiller

OPT = OptiView Control Center, chiller type (15 = YIA)

nn = Controls Revision Level (00, 01, etc)

n = Language package (2 = All European languages)

00 = Not used at this time

A write protect switch on the edge of the Program Card prevents inadvertent writing to the card during program downloading. Please handle each card carefully and observe the precautions below:

- Do not allow dirt to enter the connector.
- Always carry the card in its protective sleeve.
- Observe card storage ranges – 4 to 140°F (-20 to 65°C)

The card is inserted into connector U33 on the microboard to download a program. This connector has a protective cover on it. Except for programming the chiller, it is very important to keep this cover in place at all times.

BRAM (U38)

The BRAM (Battery Backup Random Access Memory) device contains a battery that preserves the stored data during power failures. The part number for the YIA BRAM is 031-02565-000. It is a 128KB, 32 pin

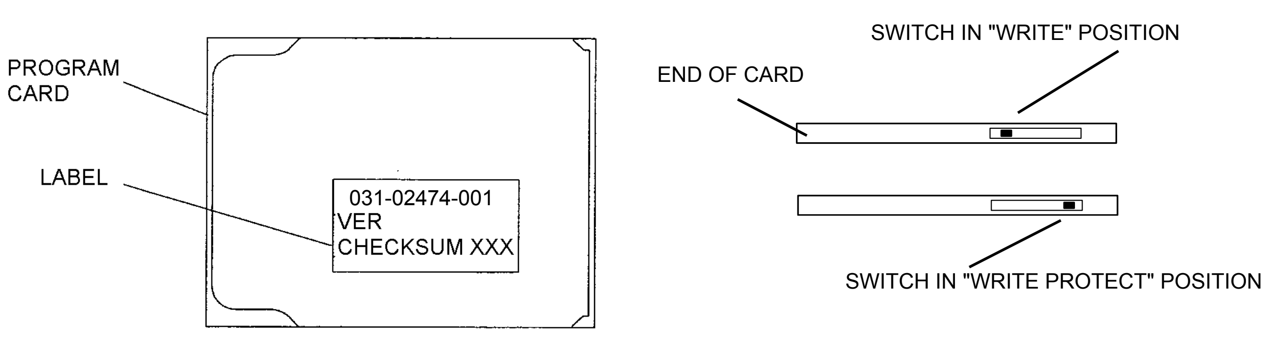


FIGURE 6 - PROGRAM CARD

chip (a 128KB BRAM will have a “129V” printed in the model number). All of the programmed setpoints, sales order data, history data time of day, calendar, operating hours, number of starts, etc are stored in the BRAM. When removing the BRAM carefully insert a flat blade screwdriver in the BRAM’s sub base slot and twist the screwdriver to pry the BRAM OFF. Do this on both ends to loosen, and then remove. When installing a new BRAM, be careful to align the half-moon marking on the BRAM surface to the notch that is printed in white on the microboard surface (at top) (ensure there is no jumper on JP14 when using the 128KB BRAM). Installing the BRAM in an incorrect position will erase any information stored on the BRAM. BRAM’s on the YIA 031-02430-005 microboard’s are interchangeable from board-to-board (031-02430-000 to 031-02430 -000). They are not interchangeable between different part number boards (031-01730-000 to 031-02430-000). After a new BRAM is installed the unit total operating hours and total unit starts can be re-entered into the new BRAM. Do this by performing the following procedure:

1. Enter the 1380 code to change the mode to SERVICE.
2. Press SALES ORDER key.
3. Press CONFIGURE key.
4. Press UNIT HRS or UNIT STATUS key. (Pop up black box will appear.)
5. Using the number keys, enter the amount of total unit running hours or total unit starts that you would like the new BRAM to continue at.
6. Press the “✓” key to confirm the entry. (Pop up box will disappear and entry will remain in the appropriate field on the HOME screen.)

WATCHDOG CIRCUIT

The Watchdog circuit performs two functions as follows:

- Power Failure Detection
- Program Latch-up Detection/Prevention

The Watchdog circuit monitors the +5VDC from the power supply and the +3.3VDC from the onboard regulator, to determine when a power failure is occurring. If the +5VDC decreases to the threshold of +4.75VDC to +4.5VDC, or the +3.3VDC decreases to the threshold of +3.04 to +2.8VDC, a reset is issued to the microprocessor and the chiller shuts down. When power is restored, the white screen is displayed and a boot-up is performed as described above. When the graphic screen is displayed, the message POWER FAILURE OCCURRED is displayed.

NOTE

The above process does not dictate how long the control panel can endure a power outage, any power failure no matter what the duration, would initiate an instantaneous chiller shut down.

The Watchdog circuit also assures that the entire program is being executed and that the program has not latched-up, bypassing important safety checks. The Watchdog circuit is a timer that times out if not given a reset pulse within its time-out period (1.0 to 2.25 seconds). To prevent a time-out, the microprocessor sends a reset pulse to the Watchdog circuit every time the complete program has been executed. Since it takes less than 1 second to perform the entire program, the Watchdog circuit doesn’t time-out under normal operation. However, if the entire program is not executed or something prevents the microprocessor from sending the reset pulse as described below, the Watchdog circuit times out and sends a reset to the microprocessor, initiating a re-boot. If running, the chiller shuts down. The display momentarily blanks out and a white screen is displayed while the boot-up program executes as described above. When the graphic screen is displayed, the message WATCHDOG – SOFTWARE REBOOT is displayed.

PROGRAM JUMPERS/PROGRAM SWITCHES

The program jumpers (Table 2) and program switches (Table 3) are used to alter the program operation or configure the microboard hardware for specific operation. This allows the program and microboard to be universal for all standard applications. There are a number of jumpers on the OptiView microboard. Refer to Table 2 and Table 3 for the function of each jumper and switch. Many of the jumpers are used for configuring the hardware to support various options and may not be used for the YIA chiller operation. However, the position of the jumper is still important for board configuration. The position of some jumpers can be determined by the service technician to meet the desired operation. Others must be positioned according to the requirements of the size, type or style of components and thus are determined by the YORK/Johnson Controls factory.

The jumpers are plastic sleeves with metal inserts called Shunts that are inserted over 2-prong or 3-prong conductors. The program switches are miniature switches (sometimes called DIP switches) that are placed in either the OPEN or CLOSED position.

NOTE

OPEN and OFF; and CLOSED and ON are the same switch positions.

TABLE 2 - MICROBOARD PROGRAM JUMPERS

JUMPER NO	DESCRIPTION	POSITION	COMMENTS
JP1	Parallel port enabled.	Pins 1-2	Not used
	Parallel port disabled.	Pins 2-3*	
JP2	Display power and logic levels. Determines the power supply voltage applied to the display.	Pins 1-2*	+5VDC Sharp LQ10D367/368 & LQ10D421 (031-01774-000) displays.
		Pins 2-3	+3.3VDC NEC NL6448ACC33-24 & LG Semicon LP104V2-W (031-02046-000) displays.
JP3	Display backlight enable signal level polarity. Jumper must be positioned according to the voltage level required to turn on the display.	Pins 1-2	Enable signal polarity low (inverted).
		Pins 2-3*	Enable signal polarity high (not inverted).
JP4	Display backlight enable signal logic levels. Determines the logic levels of the backlight enable signal.	Pins 1-2	+12VDC/0VDC Sharp LQ10D421 display.
		Pins 2-3*	+5VDC/0VDC Sharp LQ10D367/368 031-01774-000, NEC NL6448AC33-24 & LG Semicon LP104V2-W (031-02046-000) displays.
JP5	Display backlight power, determines the power supply voltage applied to the display Backlight Inverter board.	Pins 1-2*	+12VDC Sharp LQ10D367/368 (031-01774-000) & LQ10D421, NEC NL6448AC33-24 & LG Semicon LP104V2-W (031-02046-000) displays.
		Pins 2-3	+5VDC. Not used.
JP6	Boot-up source. Determines whether the boot-up is performed from the Program Card (U33) or EPROM (U37).	Pins 1-2*	Boot-up from EPROM (U37). Must be in this position unless re-programming from the Program Card. For running the YIA chiller, keep in this position.
		Pins 2-3	Boots up from Program Card (U33). Must be in this position when re-programming from the Program Card.
JP7 JP8	Display brightness control technique. Determines whether the display brightness is controlled by a variable resistance or a variable voltage.	Pins = In*	Variable voltage 0-5.0VDC. Sharp LQ10D367/368 (031-01774-000) & LQ10D421, & LG Semicon LP104V2-W (031-02046-000) displays.
		Pins = Out	Variable resistance NEC NL6448AC33-24 display.
JP9	47K pull up on low voltage digital input 1	Pins 1-2	Not Used
	10K pull down on low voltage digital input 1	Pins 2-3*	
	No pull up or pull down on low voltage digital 1	Out	
JP10	47K pull up on low voltage digital input 2	Pins 1-2	Not Used
	10K pull down on low voltage digital input 2	Pins 2-3*	
	No pull up or pull down on low voltage digital 2	Out	
JP11	47K pull up on low voltage digital input 3	Pins 1-2	Not Used
	10K pull down on low voltage digital input 3	Pins 2-3*	
	No pull up or pull down on low voltage digital 3	Out	
JP12	47K pull up on low voltage digital input 4	Pins 1-2	Not Used
	10K pull down on low voltage digital input 4	Pins 2-3*	
	No pull up or pull down on low voltage digital 4	Out	

* Normal operating position

TABLE 2 - MICROBOARD PROGRAM JUMPERS (CONT'D)

JUMPER NO	DESCRIPTION	POSITION	COMMENTS
JP13	Watchdog Enable/Disable. Soldered wire jumper. (CAUTION- Never disable this feature).	In*	Enabled
		Cut	Disabled
JP14	BRAM size. Soldered wire jumper (cannot be re-positioned by field personnel). Factory positioned according to size of the on-board BRAM (U38).	In	32K x 8
		Cut*	128K x 8
JP16	COM2 serial port modem selection. Configures port to accept either an external modem connected to J13 or an onboard modem mounted in socket SK1. If either modem is used, JP17 must be configured for modem interface. This function is for future use. It is presently not supported.	In*	Use external modem on COM2
		Out	Use on-board modem on COM2
JP17	COM2 serial port configuration. Configures port for either RS-232 modem interface or RS-485 interface. This port is future use, presently not supported.	Pins 1-2	RS – 485 (N2, interface, future use)
		Pins 2-3*	RS – 232 (modem interface)
JP21	Analog input 23 (J7, P14) is 4 to 20mA input.	Pins 1-2	Not used
	Analog input 23 (J7, P14) is temperature input.	Pins 2-3*	RT8
	Analog input 23 (J7, P2) is 0 to 10VDC or pressure input (J7,P14).	Out	Not used
JP22	Analog input 22 (J7, P16) is 4 to 20mA input.	Pins 1-2	Not used
	Analog input 22 (J7, P16) is temperature input.	Pins 2-3*	RT10
	Analog input 22 (J7, P4) is 0 to 10VDC or pressure input (J7, P16).	Out	Not used
JP23	Analog input 21 (J7, P18) is 4 to 20mA input.	Pins 1-2	Not used
	Analog input 21 (J7, P18) is temperature input.	Pins 2-3	Not used
	Analog input 21 (J7, P6) is 0 to 10VDC or pressure input (J7, P18).	Out	Remote Steam/Hot Water Limit setpoint
JP24	Analog input 20 (J7, P20) is 4 to 20mA input.	Pins 1-2	Not used
	Analog input 20 (J7, P20) is temperature input.	Pins 2-3	Not used
	Analog input 20 (J7, P8) is 0 to 10VDC or pressure input (J7, P20).	Out	Remote LCWT setpoint
JP27	COM4 serial communications port. Configures COM4 port for either RS-485 (COM4A) or RS-232 for E-Link, (COM4B) GPIC communication.	Pins 1-2	Enables port 4A. Allows an RS-485 connection to microboard J11. (Not used).
		Pins 2-3*	Enables port 4B. Allows an RS-232 connection to microboard GTX & GRX, E-Link communications using J14.

* Normal operating position

TABLE 3 - PROGRAM SWITCHES

SWITCH NO	DESCRIPTION	POSITION	COMMENTS
SW1-1	Not used	OPEN/OFF*	
SW1-2	Not used	OPEN/OFF*	
SW1-3	Diagnostics disable	OPEN/OFF*	
	Diagnostics enable	CLOSED/ON	Refer to Section 27
SW1-4	Diagnostics disable	OPEN/OFF*	
	Diagnostics enable	CLOSED/ON	Refer to Section 27

* Normal operating position

3

KEYPAD INTERFACE

The keypad is read via J18. The keypad is a matrix of conductors arranged in rows and columns (ref Figure 25 and 26). There are 4 rows and 8 columns. When a key is pressed, the conductors are pressed together and the point, creating continuity between the row conductor and the column conductor. The keypad is read by applying a Logic Low to a row while leaving +5VDC pull up on all other rows. The microprocessor then reads the 8 columns. If any column has a Logic Low on it, the key corresponding to that coordinate (row, column) is being pressed. The microprocessor reads the entire keypad by repeating this routine beginning with row 1 and ending with row 4. The entire keypad is continually read while the control center is powered. Refer to Section 9 of this manual for details on the keypad.

PRINTER INTERFACE

An optional printer can be connected to COM 1/ COM4B RS-232 Serial Data Port (J2). J2-4 is TXDI. J2-2 is the DSR (Data Set Ready or busy) signal from the printer. Signal levels are standard RS-232. The microboard sends data to the printer at the selected baud rate until the printer buffer becomes full, whereupon the printer asserts its busy signal. The microboard suspends data transmission until the printer can accept more data. Each printer must be setup/configured to operate properly with the microboard. The baud rate, data bits, parity and stop bits must be programmed on the PRINT screen.

E-LINK GATEWAY INTERFACE

An optional E-Link printed circuit board (p/n YK-ELNK100-0) can be connected to the GPIC, COM4B RS232 Serial Data Port (J2). J2-7 is GTX data to the E-Link Gateway. J2-6 is GRX data from the E-Link Gateway. Signal levels are standard RS-232. The E-Link Gateway polls system pressures, temperatures and status from the microboard; it holds this information for retrieval by third-party devices. (Refer to Section 12 of this document for more details).

DIGITAL INPUTS

The I/O board converts 115VAC input voltage to 0 to 5.0VDC logic level inputs for the microboard at J19. An 115VAC input to the I/O board is converted to a Logic Low (less than 1.0VDC). A 0VAC input to the I/O board is converted to a Logic High (more than 4.0VDC). Refer to Section 4 of this document "I/O Board" for further details.

DIGITAL OUTPUTS

The microboard controls 115VAC relays and solenoids via the I/O board (via J19). The I/O board contains +12VDC relays that isolate the microboard low voltage circuits from the 115VAC device coils. Solid state switching devices are used to control the relays. The microboard energizes the +12VDC relays by applying a ground to the coil input. They are de-energized by opening the ground path. The contacts of these relays switch 115VAC to system relays and solenoids.

The microboard controls actuator motors via triacs on the I/O board. Each actuator has an open winding and a closed winding. Current flowing through a winding causes the actuator to rotate in the respective direction. Each winding is controlled by a triac. The triac is turned on to allow current to flow through a winding. The microboard turns on the triac by applying a Logic Low (less than 1.0VDC) to the triac driver on the I/O board. It turns it OFF by applying a Logic High (more than 4.0VDC).

ANALOG INPUTS

System pressures, in the form of analog DC voltages, are input from pressure transducers. Formulas and graphs are included to calculate the expected transducer output voltage for a given pressure input. See Section 13 for more details.

System temperatures, in the form of analog DC voltages, are input from pressure thermistors. Included in Section 14 of this document are tables to convert the expected output for any temperature applied to the thermistors.

THERMAL-TYPE FLOW SENSORS

Modification level "D" and later chillers are supplied with factory-mounted flow sensors on the chilled liquid and cooling liquid circuits. These are electronic thermal-type sensors. The operating principle of the sensor is thermal conductivity. It uses the cooling effect of a flowing liquid to sense flow.

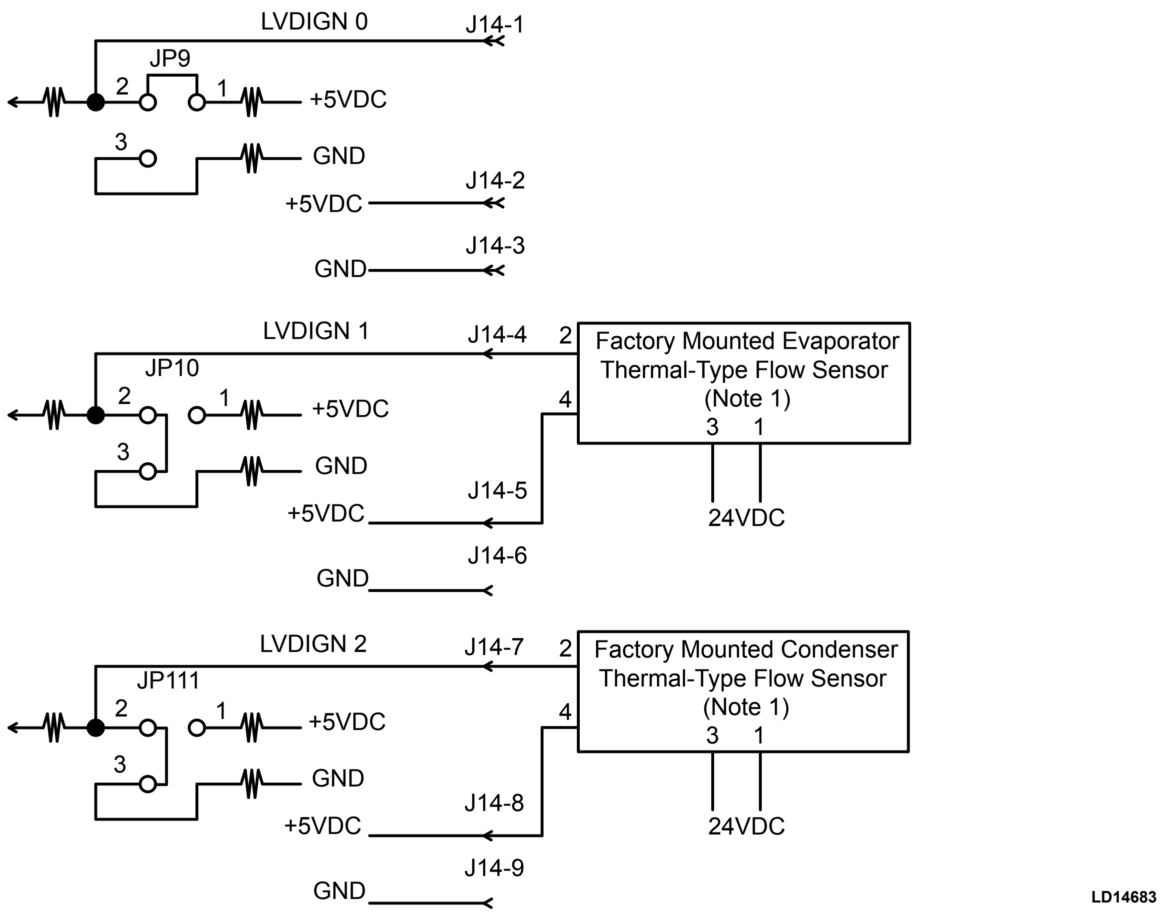
The temperature of the heated sensor tip is sensed by a thermistor located in the tip. A second thermistor, located higher in the tip in a non-heated area, is only affected by changes in liquid temperature. The temperatures sensed by the thermistors are compared to each other. Flowing liquid carries heat away from the heated sensor tip, lowering its temperature. The higher the flow rate, the lower the tip temperature and therefore a lower differential between thermistors. Lower flow rates remove less heat from the tip allowing a higher tip temperature. The lower the flow, the greater the differential between thermistors. The sensor is vendor-calibrated to turn ON its output at a flow rate of 20cm/s (0.6 ft/second). This is the setpoint.

There are 11 LED's on the sensor that reflect the measured flow rate. The center located amber LED illuminates at the setpoint flow rate and above. The 4 LED's to the left of the amber reflect flow rates below the setpoint. The 6 LED's to the right of the amber reflect flow rates above the setpoint. As the flow rate decreases from the setpoint, the LED display moves to the left. As the flow rate increases above the setpoint, the LED display moves to the right.

The sensor operates from a 24VAC power source and has a solid state relay output. On each sensor, one side of the solid state relay (pin 4) is connected to +5VDC on the microboard and the other side (pin 2) is connected to an analog input of the microboard (Refer to Figure 7). After power is applied, there is a thermal warm up period of up to 20 seconds. During this time, the output could be unstable.

When the setpoint (or greater) flow rate is sensed, the solid state relay output is turned ON causing it to conduct current though the 7.5K ohm microboard load resistor to the +5VDC. This applies more than 4.0VDC to the microboard input. When a flow rate less than the setpoint is sensed, the solid state relay output is turned OFF, resulting in no conduction through the load resistor. This applies less than 1.0VDC to the microboard input.

To determine the state of the solid state relay, first confirm that +5.0VDC is present at pin 2 of the flow sensor. Then connect a voltmeter between the microboard TP1 (GND) and the respective flow sensor input to the microboard. The software accommodates either the "paddle-type" sensors connected to the TB4 of the I/O board or the "thermal-type" sensors connected to



NOTES:

1. Each thermal flow sensor is calibrated by the manufacture for 20cm/s (0.6 ft/sec) flow velocity. DO NOT attempt to re-adjust the potentiometer for a different flow velocity. If the sensor is not operating correctly, the complete flow sensor device must be replaced.

FIGURE 7 - LOW VOLTAGE, THERMAL-TYPE FLOW SENSORS

J14 on the microboard. To assure the program reads the correct input from the appropriate type flow sensor refer to Section 2, “System Architecture” in this document.

SERIAL DATA PORTS

Microboard 031-02430-005 is equipped with 6 Serial Data Ports (refer to Figure 8). Each port is dedicated to a specific function as follows:

- COM1 (J2) – Terminals 2 thru 5, printer.
- COM2 (J13) – RS-232 or RS-485, as selected with program jumper JP17.

NOTE

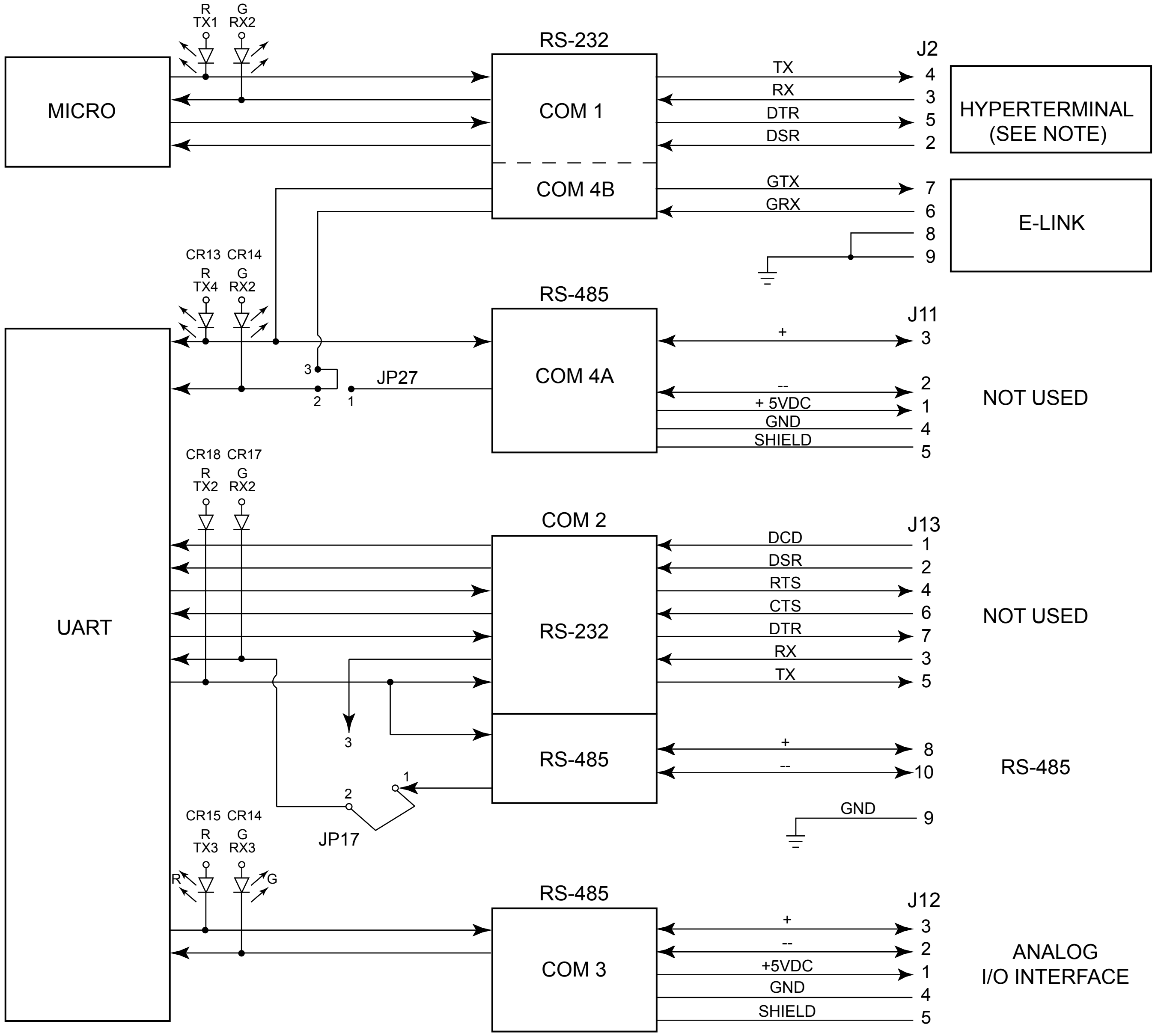
RS-485 is for future use and RS-232 is not used for absorption applications.

- COM3 (J12) – RS-485 analog board.
- COM4A (J11) – Multi-unit (not used).
- COM4B (J2) – Terminals 6 and 7, GPIC/E-Link.
- COM5 (J15) – Not used for absorption.

Each port is equipped with two LED’s. A red TX LED illuminates only when data is transmitted to or requested from another device. A green RX LED illuminates only when data is received from another device. The RS-232 voltages are industry standard +5 to +25VDC and -5VDC to -25VDC logic levels. The RS-484 voltages are industry standard 0VDC and +1.5 to +5.0VDC logic levels. A diagnostic test can be performed on each serial port to confirm proper operation. Refer to Section 31, “Diagnostics and Troubleshooting” in this document for further details.

The LED’s and their functions are as follows:

- RX6 – For future COM6 use, not used.
- TX6 – For future COM6 use, not used.
- RX1 – COM1 serial port receive data
- TX1 – COM1 serial port transmit data
- TX4 – COM4 serial port transmit data
- RX4 – COM4 serial port receive data
- TX3 – COM3 serial port transmit data
- RX3 – COM3 serial port receive data
- RX2 – COM2 serial port receive data
- TX2 – COM2 serial port transmit data
- RX5 – COM5 serial port receive data



NOTE

Any time the computer is shut off remove the cable even for short periods of time!

FIGURE 8 - MICROBOARD SERIAL DATA PORTS

DISPLAY INTERFACE

The graphic screens displayed on the Liquid Crystal Display are created from the program downloaded from the Program Card and stored in the flash memory chip. The data to form these screens is output from J5. This data is in the form of red, green and blue drive signals applied to each of the 307,200 display pixels arranged in a matrix of 640 columns x 480 rows. Each pixel consists of 3 windows, red, green and blue, through which a variable amount of light from the display backlight is permitted to pass to the front of the display. The drive signals determine the amount of light permitted to pass through each window. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass. The drive signal for each pixel is an 18 bit binary word, 6 for each of the 3 colors. The greater the binary value, the more light is permitted to pass. The pixels are driven sequentially from left to right, beginning with the top row. To coordinate the drive signals and assure the pixels in each row are driven from left to right and the columns are driven from top to bottom, the drive signals are accompanied by a clock and horizontal and vertical sync signals.

During the boot-up, the program in the BIOS EPROM reads wire jumper PID0 though PID3 on the Display Interface board to determine the manufacturer of the display. Each display manufacturer requires a slightly different control. The program in the BIOS EPROM configures the microboard for correct operation for the actual display installed.

Different display manufacturers require different supply and control voltages for their displays and backlights. Program jumpers JP2 through JP5 and JP7 and JP8 must be configured to provide the required supply and control voltages to the display and backlight control. Table 2 lists the required program jumper configuration for each display. Also, a label attached to the display mounting plate lists the required program jumper configuration for that display. The position of program jumper JP2 determines whether the supply voltage is +5VDC or +3.3VDC.

The microboard controls the display backlight via J6. The display backlight is the light source for the display. The Backlight Inverter board provides a high voltage AC power source for the lamp. It converts low voltage DC via J6-1 (+12VDC or +5VDC, depending on position of program jumper JP5) to high voltage AC (500 to 1500VAC). This high voltage AC is applied to the lamp to cause it to illuminate. The backlight is turned ON and OFF with the backlight enable signals (J6-5). The position of program jumper JP4 determines whether this is a +12VDC or +5VDC signal. In some displays, the backlight turns ON when this signal transitions from low to high; others turn ON when it transitions from high to low. The position of program jumper JP3 determines the transition that will occur when the microboard outputs the backlight enable signal. JP3 must be positioned according to the display manufacturer's requirement.

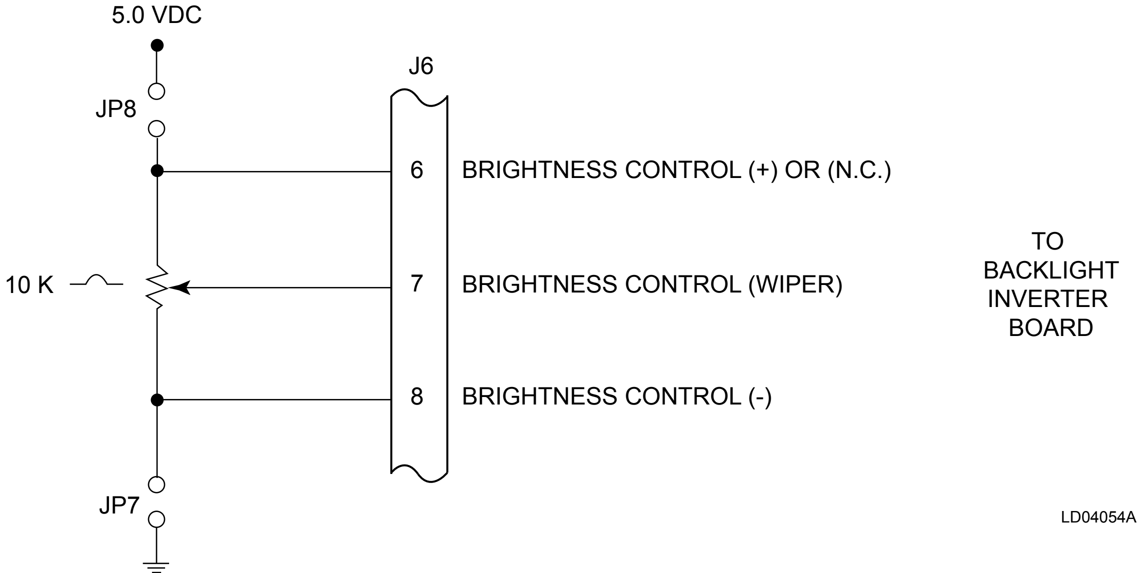
The microboard controls the backlight brightness via the lamp dimmer circuit output at J6-7. In order to extend the life of the backlight lamp, the brightness is driven to 50% after 10 minutes of keypad inactivity. At this brightness level, the graphics are still visible. When keypad activity is detected (a key is pressed), the lamp is driven back to full 100% brightness. Some display manufacturers require a variable voltage to vary the brightness; others require a variable resistance. Program jumpers JP7 and JP8 must be configured to enable the appropriate technique. The lamp dimmer is an integrated circuit that is the electrical equivalent of a 10K ohm potentiometer with 100 positions or steps. See Figure 9 on the next page.

The lamp dimmer controls the position of the potentiometer. The lamp dimmer varies the brightness of the backlight by applying a variable voltage (0 to 5.0VDC) or a variable resistance (0 to 10K ohms) to the Backlight Inverter board. If program jumper JP7 and JP8 are installed, the lamp dimmer output is a variable voltage; if both jumpers are removed, the output is a variable resistance. The lamp dimmer outputs brightness control wiper (J6-7) to the Backlight Inverter board. If configured for variable voltage output, the voltage between J6-7 and J6-8 can be varied from 0VDC (100% brightness) to 5.0VDC (0% brightness). If configured for variable resistance, the resistance between J6-6 and J6-7 varies from 0 ohms (0% brightness) to 10K ohms (100% brightness).

REMOTE SETPOINTS

Remote Leaving Chilled Liquid Temperature setpoint and steam/hot water limit setpoint can be input via the RS-232 E-Link Gateway interface at J2 or directly to the microboard at J22. See Figure 10 on the next page.

The inputs at J22 are configured with program jumpers JP23 and JP24 to accept a 0 to 10VDC analog signal. Refer to Table 2 in this document for program jumper configurations.



NOTES:

1. J6-6 not connected (N.C.) to Backlight Inverter board when display is manufactured by Sharp or NEC.
2. The position of the program jumpers JP7 and JP8 determine the output at J6-7. (In = Variable Voltage; Out = Variable Resistance). Refer to program jumpers Listing in Table 2 for applications.
3. Potentiometer is actually an integrated circuit that is the electrical equivalent of a 10KΩ potentiometer.

FIGURE 9 - DISPLAY INTERFACE

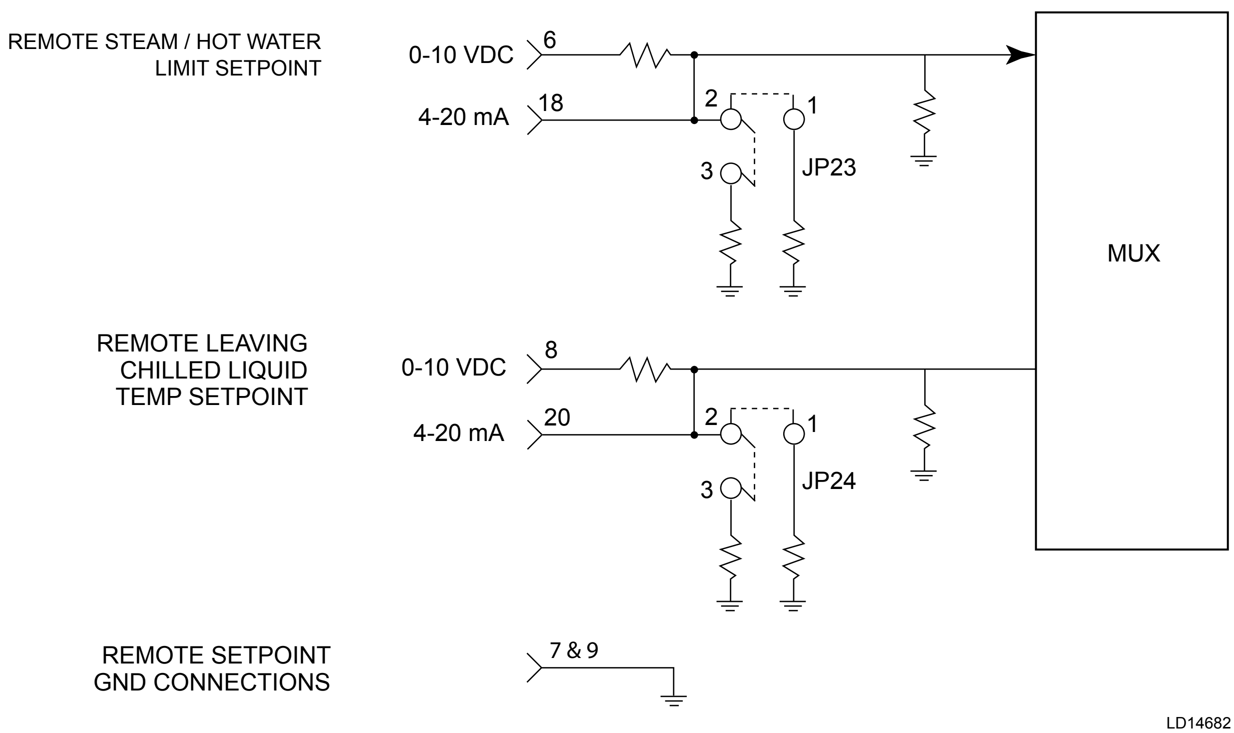


FIGURE 10 - CONFIGURABLE ANALOG AND REMOTE SETPOINT INPUTS

CONFIGURATION/SETUP

The following Operational Setpoints under the SETPOINTS screen are entered as selectable:

- Max Purge Per Week Setpoint
- Purge Pump Service Interval Setpoint
- Purge Pump Warm Up Setpoint
- Manual/Automatic Restart After Power Failure
- Manual/Automatic Restart After Power Failure
- Motor Coolant Solenoid Temperature Open
- Ref Pump Shutdown Timer Setpoint
- Ref Pump Startup Delay
- Ref Pump Shutoff Delay
- Percent Full Valve Stroke
- Strong Solution Generator Temperature Offset (RT3)
- Condenser Leaving Refrigerant Temperature Offset (RT9)
- Strong Solution Heat Exchanger Temperature Offset (RT10)
- Low Leaving Chilled Liquid Offs
- Short Dilution Cycle
- Remote LCHLT Reset Range

These Operational Setpoints are described as follows:

Max Purge Per Week Setpoint

Determines the number of auto purges in a seven day period that the unit will complete without giving a purge warning to the operator. Set between 2 and 6, default is 4.

Purge Pump Service Interval Setpoint

Keeps track of the time period between purge pump oil changes. Set between 5 hours and 100 hours, default is 10 hours.

Purge Pump Warm Up Setpoint

Determines the amount of time the purge pump will operate to heat up the sump oil before a unit purge. Set between 2 minutes and 20 minutes, default is 2 minutes.

Manual/Automatic Restart After Power Failure

This feature selects whether or not a unit will restart after a power failure has occurred. Set MANUAL or AUTOMATIC, default is AUTOMATIC. Please be aware that many conditions occur prior to or during a power failure that may prevent or change the manner in which the unit will react upon power recovery.

Below is a list of conditions that the unit may be in at the time of power failure. This list does not cover every situation and your situation may be different. The list does assume the Manual/Automatic Restart after Power Failure feature is set to “Automatic”. If the Manual/Automatic Restart after Power Failure feature is set to “Manual”, no auto start will be attempted and the system details fault message will read POWER FAILURE OCCURRED.

- Unit is running at time of power failure.
- Unit was off line (shutdown) at time of power failure (local or remote stop).
- The unit was shut down by a safety shutdown.
- The unit was in a cycling shut down at time of power failure, with either a completed or incomplete dilution cycle.

In all cases upon power recovery, the unit will review the strong solution temperature and compare this to the minimum temperature to crystallize. If for any reason this test results in an unsafe condition for the unit to start, the system details box will display RT3 LOW TEMP AFTER POWER FAILURE – CHK CRYST and the control will revert to a manual start.

If the unit is running and configured for AUTOMATIC RESTART AFTER POWER FAILURE mode, when power is restored, the unit looks at the strong solution temperature at RT10 and RT3. If the lowest temperature between the two is:

- More than the minimum crystallization limit temperature before the power failure occurred, the unit will restart. A POWER FAILURE OCCURRED message will momentary display in the system details box. This message will automatically disappear once auto restart is initiated.
- Less than the minimum crystallization limit temperature before the power failure occurred, the unit will NOT restart and will go into a safety shutdown. An RT3 LOW TEMP AFTER POWER FAILURE – CHK CRYST message will display in the system details box. This message will have to be cleared (warning reset in SERVICE mode) and the unit switch toggled OFF then ON to manually start the unit. To check the unit for crystallization, run the solution pump and check the absorber level for a maintained level, or monitor the

ADC spill line for spillage, or check for cold spots in unit piping to and from the solution-to-solution heat exchanger.

If the unit was shut down at time of power failure, either by a local stop or a remote stop, after power recovery, the unit will compare the strong solution temperature to the minimum temperature to crystallize. If for any reason this test results in an unsafe condition for the unit to start, the system details box will display RT3 LOW TEMP AFTER POWER FAILURE – CHK CRYST and the control will revert to a manual start. Otherwise, the unit's configuration will remain the same.

If the unit was shut down by a safety shutdown. the unit will require a manual start in all cases.

If the unit was in a cycling shut down either by a low leaving chilled liquid temperature (LCHLT), multi-unit contact open, daily schedule, or a remote local cycling shutdown:

- A cycling shutdown with a completed dilution cycle results in a safe condition for the unit to restart. Cycling contacts in the closed position are a good indicator the dilution cycle is completed.
- A power failure occurring during a dilution cycle as a result of a cycling shutdown requires the unit to review the contact position at time of power recovery. If the contacts are closed, this means the dilution cycle completed and the solution concentration is diluted enough for a restart. If the cycling contacts are still open upon power recovery, the unit will review the current strong solution temperature and the last recorded minimum crystallization limit temperature before the power failure occurred (SS temperature more than or less than Min Cryst Limit Temperature). If this test results in a safe condition, (where the SST is more than Min Cryst Limit Temperature) the unit will continue to perform the dilution cycle.

NOTE

At every power failure recovery, the unit will compare the current lowest solution temperature between RT10 and RT3 to the minimum crystallization limit temperature before the power failure occurred. If the solution temperature upon unit power recovery is NOT greater (more than) the min crystallization limit temperature (SS Temperature more than Min Cryst Limit Temperature) before the power failure occurred; the unit will NOT restart regardless of the condition the unit was in prior to the power failure.

Motor Coolant Solenoid Temperature Open

This feature is only applicable to units equipped with Franklin pumps. For details on the Franklin pump motor coolant circuit, refer to Operating Instructions, form 155.16-O3.1. A solenoid valve (1SOL) opens during unit operation to allow condensed refrigerant to flow into a coolant reservoir. The opening of (1SOL) is determined upon the strong solution temperature as measured at (RT3). This setpoint can be set between 127°F (52.7°C) and 160°F (71.1°C). Default is 160°F (71.1°C). The (1SOL) will open at more than or equal to the strong solution temperature and close at less than or equal to the setpoint minus10°F (3.5°C).

Ref Pump Shutdown Timer Setpoint

This programmable value determines the number of minutes the unit is allowed to run without the refrigerant pump running. Set between 20 and 60 minutes, default is 30 minutes. After the refrigerant pump has started and the unit enters a system running system status, an insufficient refrigerant level indication at refrigerant pump cut-out level switch 3F will cause the refrigerant pump to shut down after the REF PUMP SHUTOFF DELAY has expired (see description in this section). The refrigerant pump will continue to remain OFF until the pre-programmed time has expired. If the unit has not made a sufficient level of refrigerant to keep 3F closed, after the Ref Pump Shutdown Timer setpoint has expired, the unit will go into a safety shutdown.

Ref Pump Startup Delay

This programmable value determines the number of seconds the refrigerant pump will remain OFF after refrigerant level switch 1F closes. Set between 1 and 900 seconds, default is 120 seconds. Refrigerant pump operation is controlled by two level switches: "Refrigerant level switch 1F" and "Refrigerant pump cut-out level switch 3F". Refrigerant pump operation does not initiate until both switches are closed, indicating a sufficient refrigerant level, and the refrigerant pump startup delay programmed value has elapsed. The refrigerant level will rise to a level that causes 3F to close. As the refrigerant level continues to rise, it will cause 1F to close. When 1F closes, the REF PUMP STARTUP DELAY SETPOINT timer is started. If 1F remains closed for the duration of the timer, the refrigerant pump is started when the programmed delay has elapsed.

Ref Pump Shutoff Delay

This programmable value determines the number of seconds the refrigerant pump will remain running after ref pump cut-out level switch 3F opens. Set between 1 and 45 seconds, default is 30 seconds. After the refrigerant pump has started, if the refrigerant level decreases to the extent that 3F opens, the REF PUMP SHUTOFF DELAY setpoint timer is started. If 3F remains open for the duration of the timer, the refrigerant pump is shut off after the programmed delay has elapsed.

NOTE

The unit pumps use the pumping fluid to cool the motor windings. There may be unit running conditions that cause the refrigerant to be completely transferred over to the solution circuit, allowing no cooling for the pump motor.

Percent Full Valve Stroke

NOTE

This parameter is only used on non-standard valves or valves that have been modified to provide a short stroke.

The programmable value synchronizes the OptiView control valve output signal with the valve's stroke velocity. This is required so the OptiView panel matches the output change of valve signal with the valve stroke speed and the software roughly knows where the valve is at when the actual effect of the valve position hits the system. When a standard valve part number is input into the control panel, the control algorithm knows the control valve stroke time and will adjust the output signal accordingly to reach the desired sample period target destination. This parameter is only applied when the unit is outfitted with a unique valve (other than the pre-selectable valve part numbers in the SALES ORDER screen) or if the full valve stroke travel has been modified (short stroked) for range control. Normally, this valve parameter will not differ from the 100% default valve. This programmed value works completely separate from the valve maximum load limit parameter and has no actual effect on the valves stroke speed. See explanation below:

At the end of each unit Sample Factor the control algorithm will send a signal to the control valve for it to travel to a target destination. This signal would either increment, decrement or hold the control valve at its present position. If the valve part number was selected from the list of standard valves (see Section 30, Table 19 of this document), the control algorithm will know the stroke time that is required to move the valve from complete closed to complete open. It does this by breaking up the total time in 0.1 second increments, then dividing the input value of the Percent Full Valve Stroke by the stroke time. For example, a 3274 analog valve actuator with a 15mm stroke has a total stroke time of 60 seconds. The variable would become 10/stroke time equals 10/60 equals 0.167. If the technician short strokes the valve to 70% open, he would set the Percent Full Valve Stroke to 70%. This would make the percent value variable 0.167/0.7 equals 0.24.

The parameters are 20% to 130% with a default of 100%. A program of setting of 130% will slow the control signal down to match a valve with poor performance at the top end of valve travel. While a lower programmed value will have the opposite effect.

Analog Valves (for standard valves). - Set variable to match the short stroke percentage with the Percent Full Valve Stroke. For non-standard valves, refer to Table 19 "Valve Part Numbers" in Section 30 of this document to determine the valve stroke time. Match this value up to, or as close as possible to the value of the valve to be used. Set between 20% through 130%, default is 100%.

NOTE

Do not change from the default value unless the control valve is not a standard part number or the valve has been short stroked.

Digital Valves (Set default). - Digital valves employed on YIA products must have a feedback potentiometer. The incremental change at the end of each sample period is continuous pulse until the potentiometer feedback signal matches or passes the target value, samples every 0.1 second. Each new sample period target would be based on the actual pot valve position at time of adjustment rather than the last target.

Strong Solution Generator Temperature Offset (RT3)

This programmable value is an offset from the temperature provided by the strong solution sensor RT3 to the OptiView panel. The minimum offset value is -5°F and the maximum is +5°F, default is 0°F. Caution is advised when inputting an offset for this sensor. This sensor's temperature input is one of the parameters used in the calculation for generator solution concentration. A false or incorrect solution temperature value will greatly affect the solution concentration output. Therefore, the control logic may not react accordingly if the concentration becomes critical.

Condenser Leaving Refrigerant Temperature Offset (RT9)

This programmable value is an offset from the temperature provided by the condenser leaving refrigerant temperature sensor RT9 to the OptiView panel. The minimum offset value is -5°F and the maximum is +5°F, default is 0°F. Caution is strongly advised when inputting an offset for this sensor. This sensor's temperature input is one of the parameters used in the calculation for generator solution concentration. A false or incorrect solution temperature value will greatly affect the solution concentration output. Therefore, the control logic may not react accordingly if the concentration becomes critical.

NOTE

An offset for this sensor will affect the REFRIGERANT FROM CONDENSER RT9 OR SHELL PRESSURE PT1 CONFLICT warning message.

Strong Solution Heat Exchanger Temperature Offset (RT10)

This programmable value is an offset from the temperature provided by the strong solution heat exchanger temperature sensor RT10. The minimum offset value is -5°F and the maximum is +5°F, default is 0°F. Caution is strongly advised when inputting an offset for this sensor. This sensor's temperature input directly determines the unit's Minimum Temperature to Crystallize. A false or incorrect solution temperature will greatly affect the ability of the OptiView logic to react with critical solution temperatures. This sensor also directly provides the Strong Solution Concentration Limit (SSC) control logic operation. A false or incorrect value will adversely affect unit operation and control when in the SSC mode. Refer to Section 16 of this document for further details on SSC control.

Low Leaving Chilled Liquid Offset

This programmable value determines how low the Leaving Chilled Liquid Temperature (LCHLT) will go below the LCHLT setpoint before the unit goes into a cycling shutdown. The minimum value is 2°F and the maximum is 4°F, default is 3°F. To calculate the cycling shutdown temperature LCHLT must be less than LCHLT setpoint minus LCHLT offset. The unit will recover when the LCHLT is more than the LCHLT setpoint plus 2.0°F.

NOTE

The unit will go into a cycling shutdown anytime the LCHLT goes below 38°F (3.3 °C) no matter what the programmed offset value is.

NOTE

The unit will retain the last LCHLT setpoint or the last LCHLT offset for 30 minutes.

Short Dilution Cycle

Initiating this condition will allow the unit to shorten the standard dilution cycle time (6 minutes) if solution conditions warrant that it is safe to do so. In some instances the 2SOL stabilizer valve will open during a short dilution cycle to dump refrigerant directly into solution. Set this parameter OFF to allow the unit to perform a normal 6 minute dilution cycle (the 2SOL will not open during a normal dilution cycle). Set ON to perform a short dilution cycle. The duration time of the short dilution cycle will depend on the strong solution concentration. See Table 4.

TABLE 4 - SHORT DILUTION CYCLE

SOLUTION CONCENTRATION	DILUTION CYCLE TIME DURATION	2SOL OPENING DURATION
Less than 57%	60 seconds	N/A
57% - 59%	70 seconds	50 seconds
59% - 61%	110 seconds	90 seconds
61% - 63%	170 seconds	150 seconds
63% - 65%	200 seconds	180 seconds
More than 65%	230 seconds	210 seconds

The above conditions are only applicable when the short dilution cycle parameter is ON. A limited dilution cycle or manual dilution cycle is not applicable to the above.

Remote LCHLT Reset Range

This programmable value sets the maximum allowable offset of the leaving chilled liquid setpoint when operating in REMOTE mode. This offset is either 10°F or 20°F as programmed. If not programmed, the default is value is 20°F. The Remote LCHLT Reset Range must be programmed locally before the LCHLT setpoint can be changed remotely when the control source is in "Digital", "Analog" or "ISN". This parameter is the maximum allowable offset of the leaving chilled liquid setpoint when operation in the REMOTE mode. The value programmed is added to the operator programmed Leaving Chilled Liquid Temperature setpoint (base) and the sum equals the temperature range in which the setpoint can be reset. For example, if the operator has locally programmed a base setpoint of 44°F, into the OptiView Control Center, and the Remote Reset Range is programmed to be 10°F, then the energy management system can remotely reset the setpoint over the range of 44°F to 54°F (44 + 10 = 54).

NOTE: ***The Remote Leaving Chilled Liquid Temperature setpoint cannot be set lower than the base setpoint value. The base or locally programmed setpoint is always shown in the Local LCHLT setpoint box in the lower left corner of the EVAPORATOR / ABSORBER screen.***

Chiller Loading and Unloading

The following functions are entered as selectable Pull down setpoints under the SETPOINTS screen:

- Unit Pull Down Demand
- Ramp Down Interval Setpoint

A description of each follows:

Unit Pull Down Demand

A pull down is used as a soft start to limit the amount of energy being channeled into the unit at start-up. This feature is used when the customer's system or energy demand is such that a hard start would have adverse effects on the system. It is programmable from 1 to 255 minutes of unit operation following a unit start. Instead of allowing the load command to rapidly increase to 100%, due to the typical high load conditions at start, the control valve is restricted to ramping up from a Pulldown Loading Start setpoint to a Pulldown Loading Stop setpoint over the pull down interval. While the unit is operating and the pull down interval has not yet expired, the control status will display UNIT LOAD IS CONTROLLED BY PULLDOWN DEMAND LIMIT. After timeout, the pull down limit is no longer in effect and the control status will display LEAVING CHILLED LIQUID TEMPERATURE CONTROL IN EFFECT.

The programmable range is 20 to 100%. The pull down interval is programmable from 1 to 255 minutes. Each time the unit starts, a timer begins counting down the pull down interval. The control valve load is controlled by the automatic temperature control algorithm. However, during the pull down interval, it cannot load to a value greater than the pull down demand limit will allow. The limit ramps linearly from the programmed START limit to the programmed STOP limit over the programmed interval. The START limit is effective when the unit starts and the STOP limit is effective when the interval timer has elapsed. The limit at any time in between these points can be determined by:

$$\frac{(\text{STOP} - \text{START}) \times \text{Time}}{\text{Interval}} + \text{START} = \%\ \text{LOAD LIMIT}$$

Where:

STOP = STOP limit (pull down loading stop setpoint).

START = START limit (pull down loading start setpoint).

Time = Current pull down in progress time.

Interval = Pull down interval.

% LOAD LIMIT = Maximum pull down limit.

Ramp Down Interval Setpoint

Also called Soft Shutdown, this function is used to avoid shock to the customer's energy supply system. The "Ramp Down Shutdown" or "Soft Shutdown" is called upon when the unit is remotely stopped or when it is requested by the user through the control panel. If it is requested locally through the control panel, a pop-up screen will appear to confirm a unit ramp down. This feature decreases the control valve opening linearly and gradually until the opening reaches the Ramp Down Low Limit. The two programmable parameters for this function are "Ramp Down Time" and "Ramp Down Low Limit".

Ramp Down Time - Allowable range is 0 to 60 minutes, with a default value of 0. The ramp down time is calculated from a 100% valve open position. Hence, the actual ramp down range will equal the percent loading at the ramp start, minus the low limit.

NOTE: ***This means the actual ramp down time may be less than the actual programmed time if the control valve is not at the 100% open position.***

Actual ramp down time is determined by the following formula:

$$\frac{\text{Actual Ramp Down Range} \times \text{Ramp Down Time for Full Range}}{100 - \text{Ramp Down Low Limit}}$$

Ramp Down Low Limit - Allowable range is 0 to 60%, with a default value of 10%.

! NOTE

If the "Low Unload Limit" is set at a higher percentage than the "Ramp Down Low Limit Range" the higher of the two will take precedence.

Each time the unit receives a remote shut down or a local ramp down order, a countdown timer is started for the actual ramp down interval. The control valve loading is still controlled by the automatic temperature control algorithm. However, during the ramp down interval, the control valve will not be loaded to a greater value than the ramp down routine will permit.

The limit ramps linearly from the opening value at the shut down moment to the programmed STOP limit over the actual ramp down interval. The limit at any time in the ramp down process is determined by the following formula:

$$\frac{a - b \times t}{c} + b = d$$

Where:

a = Percent loading at the start of ramp down.

b = Ramp down low limit.

t = Current ramp down in progress time.

c = Actual ramp down interval.

d = Maximum ramp down load limit.

! NOTE

Once initiated, the ramp down will continue until the ramp down low limit is reached.

All unit safety checks will still be active during a unit ramp down.

A hard stop initiated at the control panel rocker switch will deactivate a ramp down.

MICROBOARD SERVICE REPLACEMENT

If the microboard is replaced within the warranty period, The Defective Board Must Be Returned To the Building Efficiency - Warranty Returns Center, email: BE-WRC/Johnson Controls. Please follow all warranty return procedures when returning the board, i.e. Job Number, RMA Number. You may also use the return instructions and return address label provided with the replacement board.

To order a replacement microboard for a YIA chiller, order part number 331-02430-608, this part number provides a microboard that has been pre-programmed with the latest version of YIA control software. It comes equipped with a BRAM (U38) and BIOS (U37). When replacing a microboard, it is sometimes desirable to transfer the BRAM from the defective board to the replacement board to save stored setpoints, history or sales order data. Refer to the "BRAM" section under Section 3 "Microboard" for more details.

3

DOWNLOADING A PROGRAM FROM A PROGRAM CARD

! NOTE

The Program Card write protect switch must be in the "Write Protect" position!

! NOTE

There are 3 steps to the re-programming process:

- ***Erase***
- ***Program***
- ***Verification***

! NOTE

Once the re-programming process is initiated, it automatically proceeds through these steps to completion. It cannot be manually terminated before completion. Therefore, once the process is initiated, the existing on-board will be erased and replaced by the program in the Program Card. Before proceeding, be absolutely certain the Program Card is applicable to your chiller model. For example, if your chiller is a YIA chiller, the Program Card MUST be for a YIA chiller. If an YPC chiller program is downloaded into a YIA chiller, the chiller will be rendered inoperable until this procedure is repeated using the correct Program Card.

A label affixed to the Program Card contains the card version. The version is an alpha-numeric code that identifies the chiller model applicability, language package and program revision level. The version is as follows:

C. OPT. n. nn. nnn.

Where:

C =	Commercial chiller.
OPT =	OptiView Control Center.
n =	Chiller type (15 = YIA).
nn =	Controls Revision Level (00, 01, etc) (revision at time of printing, 08).
n =	Language package (2 = all European languages).
nn =	Not used at this time.

A write protect switch on the edge of the Program Card prevents inadvertent writing to the card during program downloading (see Figure 6). Please handle each card carefully and observe the precautions below:

- Do not allow dirt to enter the connector.
- Always carry the card in its protective sleeve.
- Store the card at a temperature between the storage range of 4 to 140°F (-20 to 65°C).

Download the program as follows:

1. Remove power to the OptiView Control Center.
2. Remove protective cover from microboard connector U33.
3. Reposition microboard program jumper JP6 to pins 2 & 3 (left hand pins).
4. Insert Program Card into microboard connector U33.
5. Restore power to OptiView Control Center. A white screen appears displaying PC CARD FLASH CHECKSUM TEST and microboard 7-segment LED (U22) displays CH. While this is displayed, the microboard is performing a checksum test on the Program Card. This assures the integrity of the card before the download procedure can begin. If the checksum test fails, the card is defective or corrupted and the download procedure cannot be performed. If the checksum test passes, the OPTIVIEW FLASH PROGRAMMER screen is displayed.
6. Press START key to start the downloading process. A dialog box appears asking if you want to ERASE ONBOARD FLASH AND RE-PROGRAM FROM PC CARD? Do not proceed until you understand the above caution!
7. Use the →key to scroll to YES.
8. Press ✓ key. The following steps will be performed:
   A. Erasing - During this procedure, the program in the microboard flash memory will be erased. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
   B. Programming - During this procedure, the program in the Program Card is downloaded in to the microboard flash memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.
   C. Verifying - During this procedure, a checksum test is performed on the new program in the microboard flash memory. A green bar reflects the progress of this procedure. The red LED next to this bar illuminates while this procedure is in progress.

The microboard 7-segment LED display (U22) displays the steps of the programming process while they are in effect. During the erasing procedure, “Er” is displayed. During the Programming procedure, “Pr” is displayed. During the Verifying procedure, “Ch” is displayed. At the completion of the re-programming process, if it is successful, FLASH HAS BEEN SUCCESSFULLY PROGRAMMED is displayed and OPERATION SUCCESSFUL is displayed in the status code box. Otherwise, a message in the status box indicates the step that failed.

9. Remove power from OptiView Control Center.
10. Remove Program Card from microboard connector U33.
11. Install protective cover on microboard connector U33.
12. Reposition microboard program jumper JP6 to pins 1 & 2 (right-hand pins).
13. Apply power to the OptiView Control Center. The re-programming procedure is now complete.

SECTION 4 - I/O BOARD (031-01743-002)

INTRODUCTION

The I/O (input, output) board conditions the Digital inputs for the microboard and conditions the microboard's digital outputs for application to other components and devices. The left side of the I/O board performs the digital inputs function; the right side performs the digital outputs function. Refer to Figure 11.

DIGITAL INPUTS

Digital inputs are ON/OFF inputs to the microboard from relay and switch contacts, such as flow switches, start/stop switch, and remote cycling/safety devices (see Figure 13). The microprocessor reads the state of these contacts and reacts per the program instructions. The contact voltage is 115VAC when closed and 0VAC when open. These voltages are not suitable for direct input to the microboard. Therefore, the I/O board converts the 115VAC / 0VAC contact voltages to 0VDC / +5VDC logic level inputs for the microboard. Individual opto-coupler circuits (see Figure 14) perform the conversion for each digital input. When the input is 115VAC, the output will be 0VDC; when the input is 0VAC, the output will be +5VDC.

Field connected digital inputs, such as those from external devices that cycle the chiller, are connected to terminal strip TB4 or TB2. These inputs are in the form of dry contacts connected as shown in Figure 15. The 115VAC power source that is switched by the remote contacts is supplied by the remote contacts is supplied by the I/O board TB4-1. There are multiple TB4-1 terminals located adjacent to the field input connections.

DIGITAL OUTPUTS

Digital outputs are ON/OFF outputs from the microboard that control solenoid valves, motor contactors, actuators, system relays and provide operating status to external devices (see Figure 16). Per program instructions, the microboard energizes and de-energizes these devices. The coils of these devices operate on 115VAC and therefore cannot be directly connected to the microboard. The digital outputs section of the I/O board contains +12VDC coil relays that are driven by the microboard's logic level outputs. The contacts of these +12VDC relays operate the external 115VAC coil devices. One side of each relay coil is permanently connected to +12VDC at microboard J19-26/27. The other side of each relay coil is connected to the I/O board connector J1. The microboard energizes each relay by driving the appropriate input at J19 to Logic Low voltage level (ground potential). The DC voltage at the appropriate input pin at J19 will be a Logic High (more than +10VDC) when the microboard is commanding a relay to de-energize; Logic Low (less than +1VDC) when commanding a relay to energize.

Relay K18 is different from all other relays on the I/O board, it has an 115VAC coil. It provides the start/stop signal to the unit run switch and provides run status to remote devices. Relay K18 is controlled by DC relays K13 (start) and K14 (stop). To start the unit, the microboard energizes K13 and K14 simultaneously. The 115VAC at TB1-6 is applied to the coil of K18 via K13 contacts, energizing K18. Approximately 0.2 seconds later, K13 is de-energized. K18 remains energized through K14 contacts and holding contacts of K18. To

4

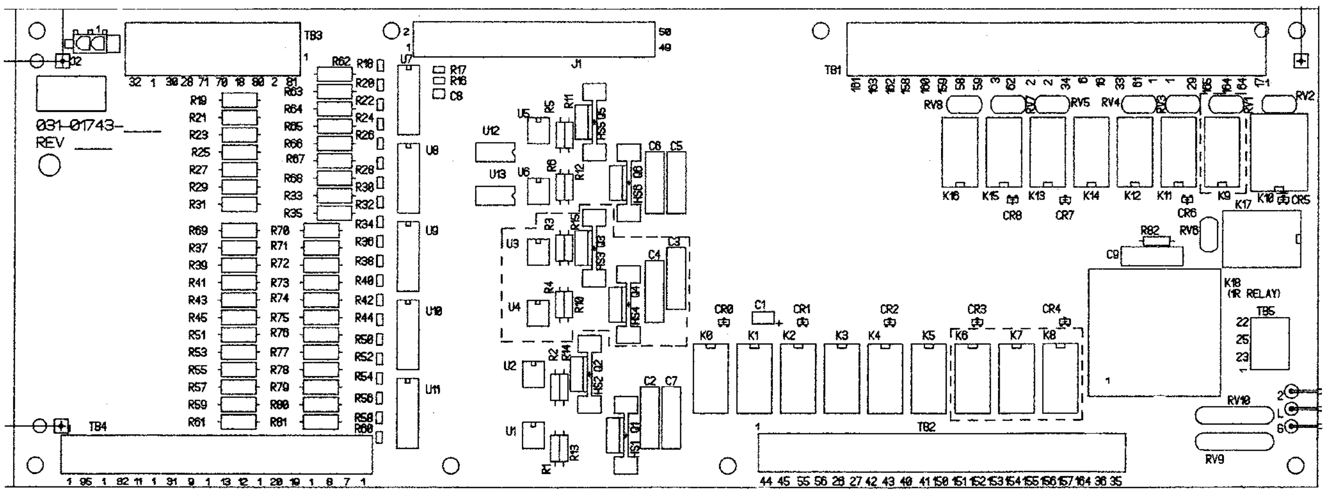


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FIGURE 11 - I/O BOARD

stop the unit, the microboard de-energizes K14. To prevent sags in utility power from chattering K18, the holding contact of K18, along with the contact of K13, creates and anti-chatter circuit for relay K18. Once energized, K18 cannot be re-energized until K13 is again energized; this will not occur until after a controlled shutdown has occurred and another start sequence has been initiated.

TRIACS

Triacs are normally used to control actuators on a system. An actuator has an open winding and a close winding. Current flowing through a winding will cause the actuator shaft to rotate in the respective direction. Each winding is controlled by a triac. When a triac is turned ON, it permits current to flow through the actuator winding, causing the connecting device to function. On the MOD "D" YIA, a triac is used to control the 3SOL unloader solenoid valve and the 7SOL purge tank solenoid valve. If the YIA unit's control valve receives a PWM signal (older style digital control valve or retrofits), triacs are used at TB1-58 & TB1-3 to control the opening and closing per Figure 12.

Triacs can also be used to open and close a dry contact. This is how the OptiView panel on the Mod D, YIA's use them. TB1 - 161, is used to control the unloader solenoid valve (3SOL) and TB1 - 163, is used to control the purge tank solenoid valve (7SOL).

RELAY TIMING

Under program (Leaving Chilled Liquid Temperature Control in effect) control, the relays are energized and de-energized producing contract operation as follows. Unless otherwise noted, contact rating is 5 amps resistive or 2 amps inductive @ 250 VAC.

K0 – Chilled Water Pump Starter (TB2-44/45)

These are dry closure contacts. When the unit is started, it goes into a 60 second start sequence period. During this 60 second period both the condenser and chilled water pump contacts close to start the respective pump. At the termination of the 60 second period both the chilled and condenser water flow switches must be made or the chiller will go into a safety shut down.

K1 – Alarm (TB2 – 55/56)

These are dry closure contacts. Contacts will close when one of the following warnings occur:

- Low refrigerant temperature less than 35.5°F (1.9°C)
- Low refrigerant temperature less than 34.0° (1.1°C)
- High generator pressure more than 517 mm Hg Abs.
- Purge pump overloads open
- Faulty strong solution temperature sensor RT3
- High hot water supply temperature RT7
- High steam supply temperature RT7
- Purge pump service recommended
- Auto purge failure – purge tank pressure did not decrease

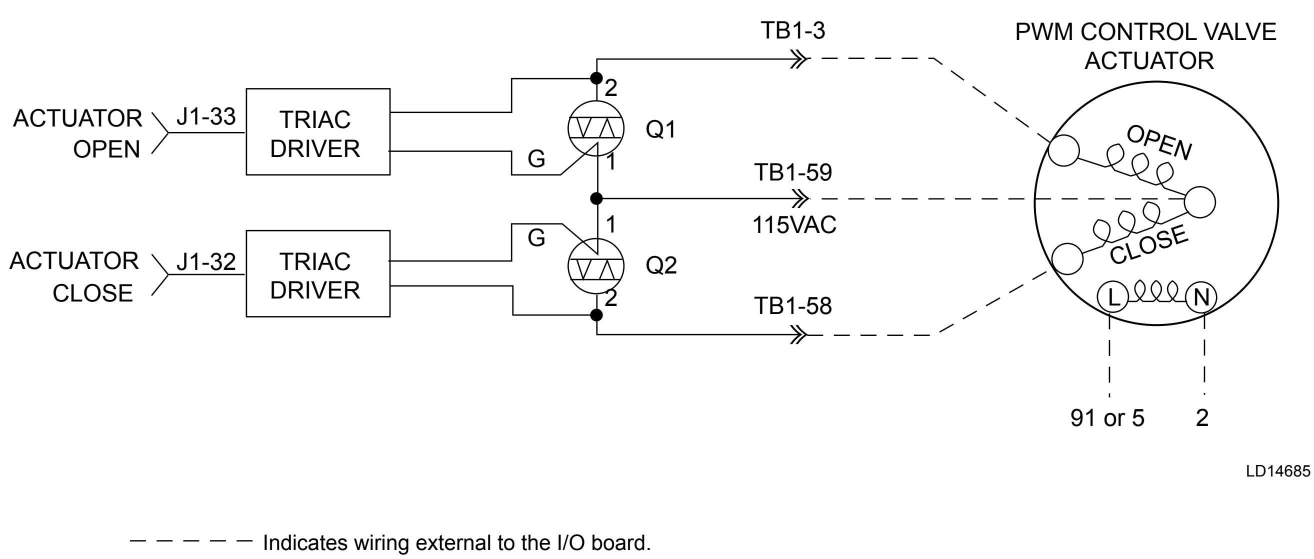

FIGURE 12 - CONTROLLING ACTUATORS WITH TRIACS

- Purge tank pressure is more than 100 mm Hg Abs.
- Purge pump overload contacts are in conflict.
- Purge transducer PT4 out of range.
- 8SOL failure PT3 more than 100 mm Hg abs.
- Purge pump failure.
- Purge failure PT3 more than 15 mm Hg Abs.
- Refrigerant level switch conflict.
- Refrigerant from condenser RT9 or shell pressure PT1 conflict.

K2 – Remote Mode Ready To Start (Control Source: Analog, Digital or ISN Remote) (TB2 – 26/27)

Dry closure status contacts that are closed indicate to a remote device that the chiller will start upon receipt of a remote start signal. The contracts open coincident with any cycling or safety shutdown or anytime the keypad unit switch is placed in the stop reset position. On cycling shutdowns, the contacts will close when the cycling condition clears. On safety shutdowns, the contact will close only after the safety condition clears, a manual reset is performed by placing the unit switch in the Stop - Reset position and then back to the run position.

K3 – Safety Shutdown Status (TB2 – 42/43)

Dry closure status contacts. They close coincident with a safety shutdown. They remain closed until the safety condition clears and a manual reset is performed by placing the unit switch in the Stop - Reset position.

K4 – Cycling Shutdown Contacts (TB2- 40/41)

Dry closure status contacts. They close coincident with a cycling shutdown. They remain closed until the cycling condition clears.

K5 – Condenser Motor Pump Starter (TB2-150/151)

Dry closure contacts. Contacts close within 1 to 30 seconds after a Start Sequence Initiated has occurred. They remain closed until the unit has finished with the dilution cycle and a System Ready To Start condition occurs.

K6–K8

Not used

K9 – 2SOL Stabilizer Refrigerant Solenoid (TB1-165/1)

These dry closure contacts open and close the 2SOL stabilizer refrigerant solenoid dependent upon the unit's operating conditions. If the unit is configured for a short dilution cycle and conditions warrant, the contacts may close to open the solenoid (see Section 3 "Microboard", Configuration /Setup", "Short Dilution Cycle"). Also, under certain Auto De-crystallization modes and refrigerant temperature conditions, the contacts could close.

K10 – 6SOL Steam Condensate Drain Solenoid Valve (TB1-17/64)

This dry closure contact energizes the 6SOL steam condensate drain solenoid valve. This valve is only supplied (by factory) on steam units with a butterfly type control valve. The contacts are energized at all times when the unit is in operation. When the unit is OFF, the closed solenoid valve will act as a redundant safety feature keeping steam/condensate from leaving the generator section of the unit.

K11 – Refrigerant Pump Starter, 2M (TB1-29/1)

This dry contact energizes the 2M, refrigerant pump starter mounted in the power panel. It energizes and de-energizes on command of the chiller's control logic scheme.

K12 – Solution Pump Starter, 1M (TB1-61)

This dry contact energizes the 1M, solution pump starter mounted in the power panel. It energizes and de-energizes on command of the chiller's control logic scheme.

K13 – Unit Start (TB1-6/16)

Contacts close at Start Sequence Initiate; they remain closed for 0.2 seconds then open.

K14 – Unit Stop (TB1-6/16)

Contacts close coincident with the beginning of Start Sequence Initiate. They remain closed for the duration of System Run. They open coincident with the beginning of System Ready to Start – Dilution.

K15 – Purge Pump Solenoid 8SOL (TB1-34/1)

These contacts energize to open the 8SOL, purge pump solenoid valve and remain energized for the duration of the purging process to keep 8SOL open. Contacts are closed (energized) when the chiller's control logic calls for an Auto Purge or when the purge pump is going through a Manual Purge. They are not operated in the “Maintenance” PURGE mode. They are operator dependent in the “Repair” PURGE mode.

K16 – Purge Pump Starter, 3M (TB1-62/1)

This dry contact energizes the 3M, purge pump starter mounted in the power panel. It energizes and de-energizes on command of the chiller’s control logic scheme or operator discretion when purge pump operation is desired.

K17 – Not Used

K18 – Unit Start (TB5-22, 23&25), Run Status (TB2-35/36)

These contacts close coincident with the beginning of Start Sequence Initiate. They remain closed for the duration of System Run. They open coincident with System Ready to Start.

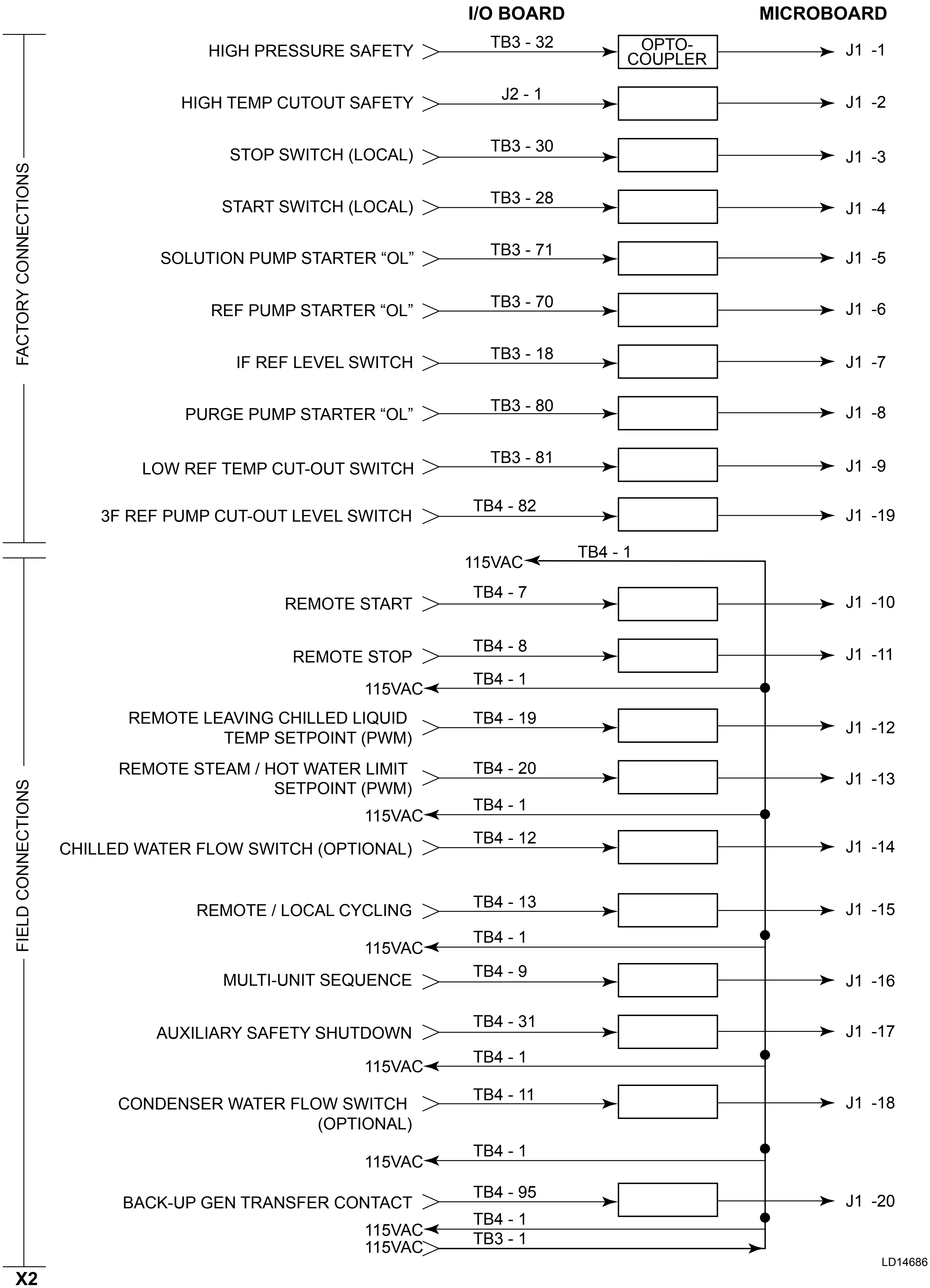

FIGURE 13 - I/0 DIGITAL INPUTS

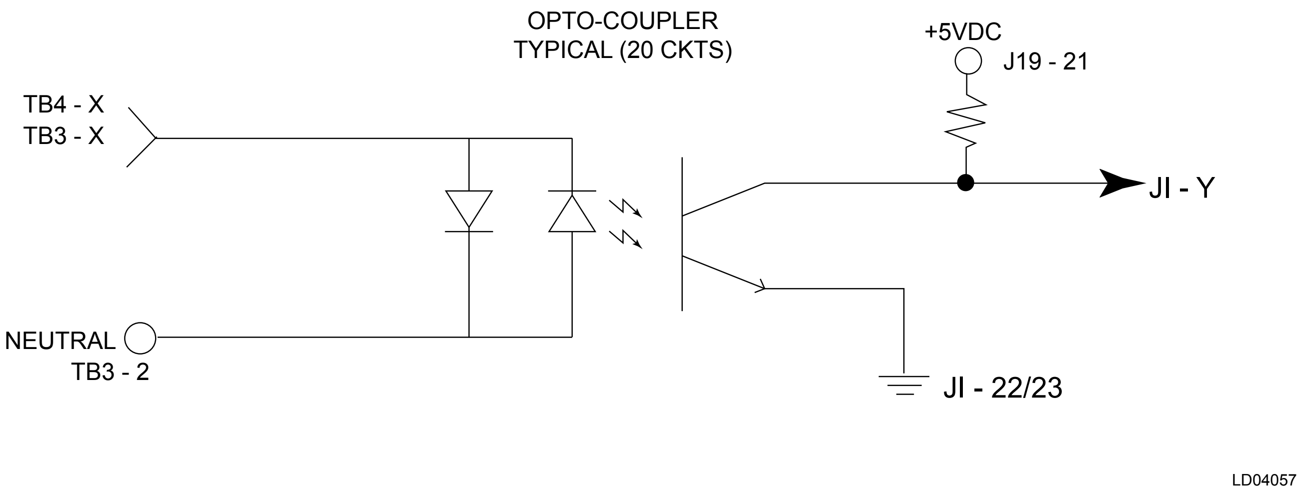

FIGURE 14 - I/O BOARD TYPICAL OPTO-COUPLER CIRCUIT

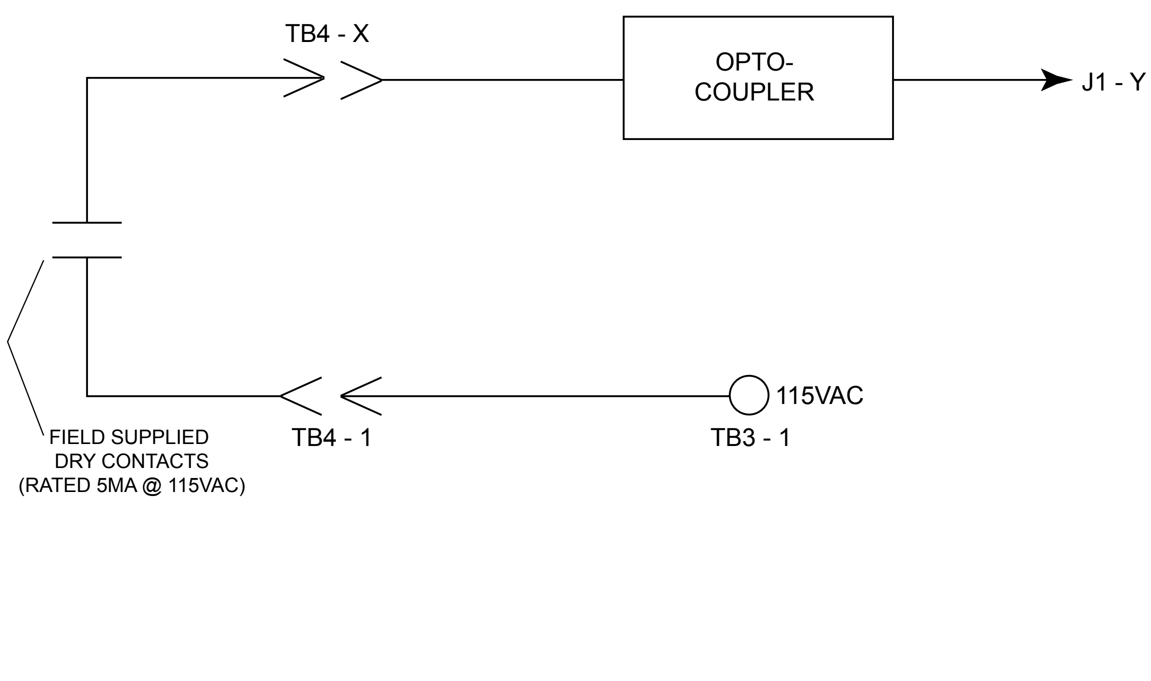

FIGURE 15 - I/O BOARD TYPICAL FIELD CONNECTIONS

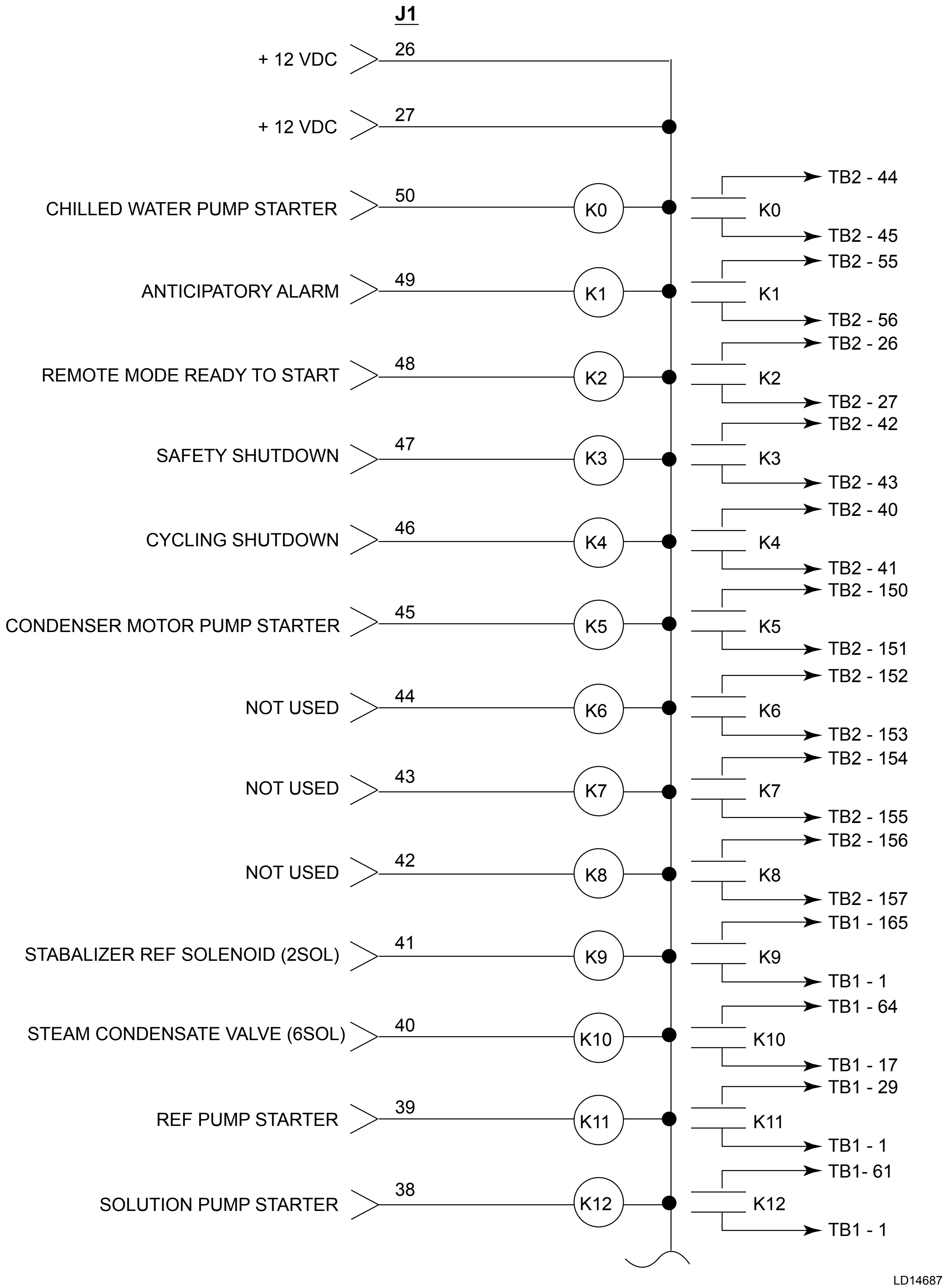

FIGURE 16 - J1 I/O BOARD DIGITAL OUTPUTS

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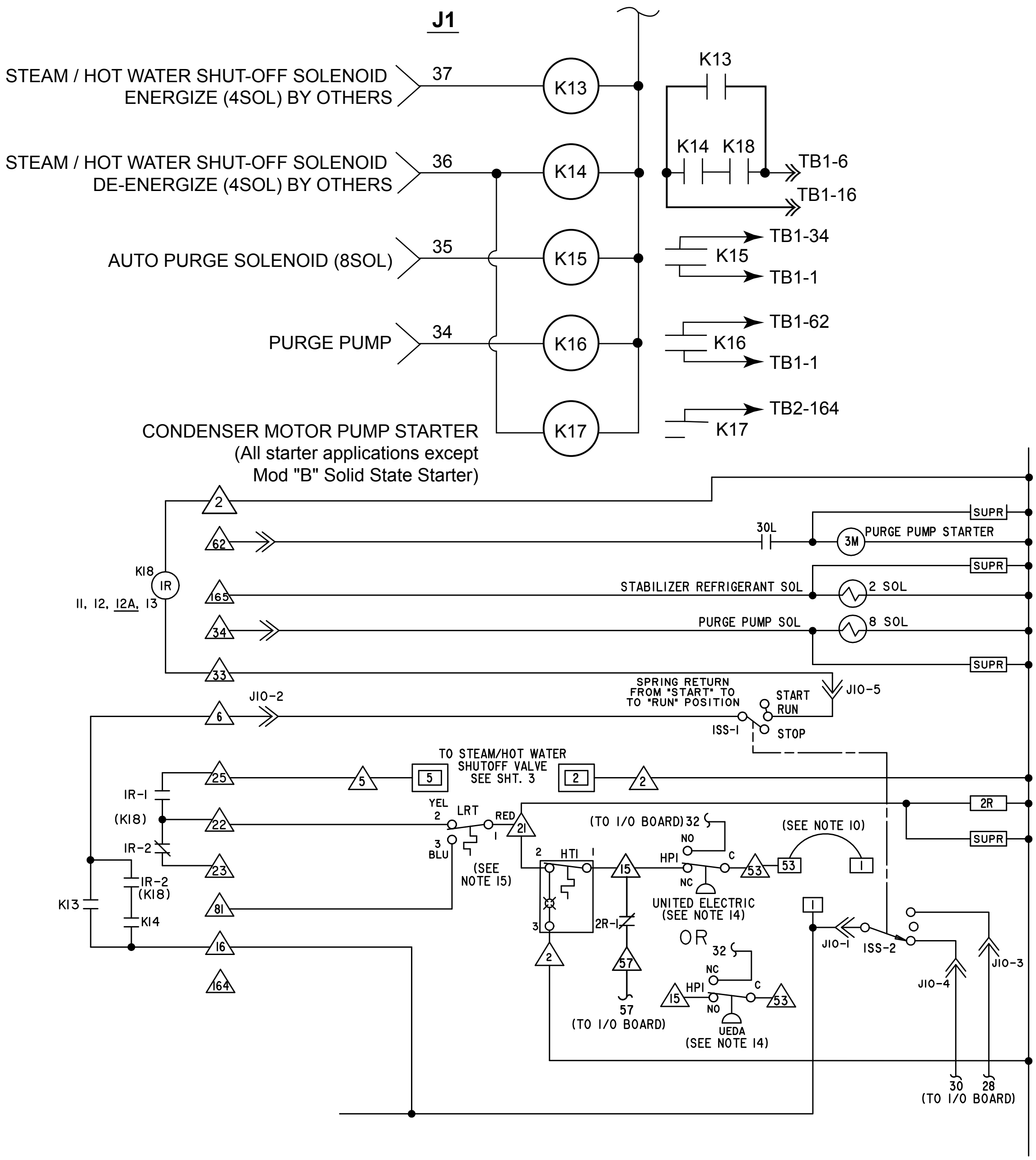

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FIGURE 16 - J1 I/O BOARD DIGITAL OUTPUTS (CONT'D)

SECTION 5 - ANALOG I/O EXPANSION BOARD

INTRODUCTION

The analog I/O expansion board provides additional analog I/O capability for the microboard. There are 16 input ports (at port P9) and 4 output ports (at port P10). The inputs can be individually configured to accept either 4 to 20mA or DC voltage inputs. The outputs can be individually configured to provide either 0 to 20mA or 4 to 20mA outputs. The function and signal type of each port is defined by the factory and should not be field adjusted. For control valve signal P10 - 1 & 2 are used to provide the 4 to 20mA control signal to the control valve actuator.

The board operates from a +5VDC, +12VDC and -12VDC power source. “Power – On” LED illuminates when the +5VDC voltage is present.

This board communicates with the microboard via an RS-485 serial data interface. As the command or request for data arrives, RX D13 LED illuminates. As the serial data is transmitted back to the microboard, TX D14 LED illuminates. The value for each analog output is transmitted via serial data from the microboard. It is converted to a 0 to 20mA or 4 to 20mA output as determined by the position of the output jumpers as described in Tables 5, 6 and 7. The analog inputs are converted to serial data and transmitted back to the microboard.

The program that coordinates the serial communications and I/O board activity resides in the EPROM (U13). A Watchdog circuit assures the entire program is executed and that program latch-ups do not occur. Watchdog LED D15 blinks approximately 1 x per second, indicating the Watchdog protection is active.

Since both the analog I/O expansion board and the digital I/O expansion board use the same serial communications link to the microboard, each I/O board must have an identification number. This number is set by ID dipswitch DP1. The ID number is transmitted to the I/O board along with the serial data. When the board recognizes the transmitted ID number, it responds. The switch settings for the analog I/O expansion board must be:

- DP1 – 1 – ON
- DP1 – 2 – ON
- DP1 – 3 – ON
- DP1 – 4 – ON
- DP1 – 5 – OFF

JUMPER CONFIGURATIONS

The following jumpers In Table 5 configure the board for the RS-485 communications interface. The required positions are indicated by an *.

TABLE 5 - RS-485 JUMPER CONFIGURATION

JUMPER	POSTION	FUNCTION
J33	IN*	RS-485 receives pull down for long communications lines.
	OUT	No pull downs
J34	IN*	RS-485 transmits pull up for long communications lines.
	OUT	No pull up.
J37	IN	RX 120 ohm long communications line termination .
	OUT*	No termination.

Jumpers J1 through J22 configure the inputs for the input signal type and resistance load. The appropriate resistance value is determined by the Johnson Controls factory and should not be field adjusted. The input jumpers must be positioned as shown in Table 6.

TABLE 6 - ANALOG INPUT JUMPER CONFIGURATION

INPUT	SIGNAL TYPE	JUMPER	POSITION
1	DC Voltage	J1	2-3
2	DC Voltage	J2	2-3
3-8	Not used	J3-J8	
9	DC Voltage	J9	2-3
10	DC Voltage	J10	2-3
11-22	Not Used	J11-J22	

The position of jumpers J23 through J26 and J39 through J42 determine whether an analog output is 0-20mA or 4 to 20mA. The output jumpers must be positioned as Table 7.

TABLE 7 - ANALOG OUTPUT JUMPER CONFIGURATION

OUTPUT	SIGNAL TYPE	JUMPER	POSITION
1	4 to 20mA	J26 J39	2-3 1-2
2	Not Used	J25 J40	
3	Not Used	J24 J41	
4	Not Used	J23 J42	

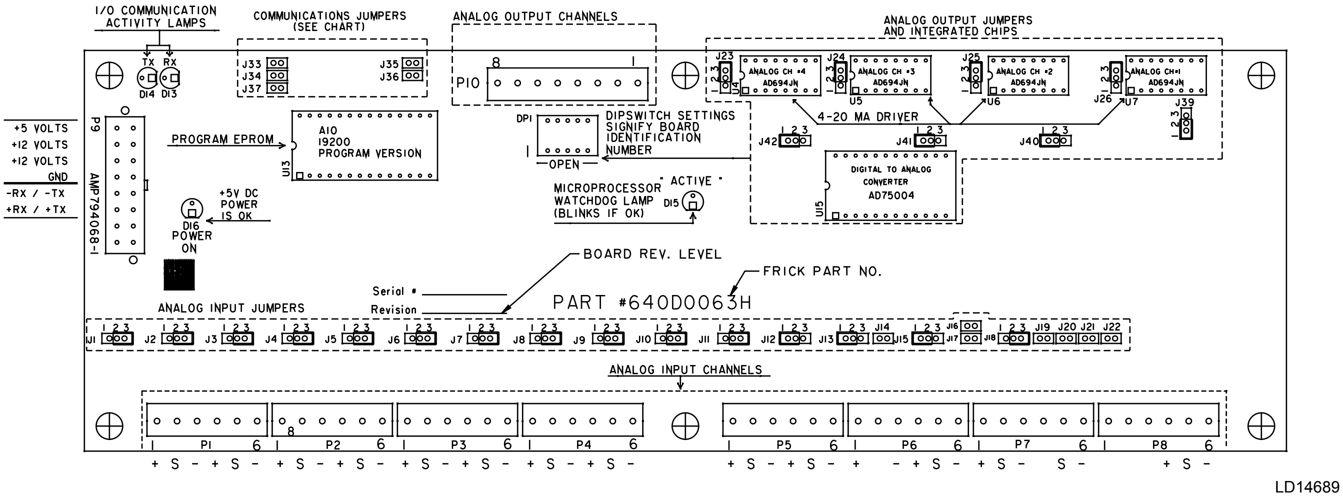

FIGURE 17 - ANALOG I/O EXPANSION BOARD (371-03780-000)

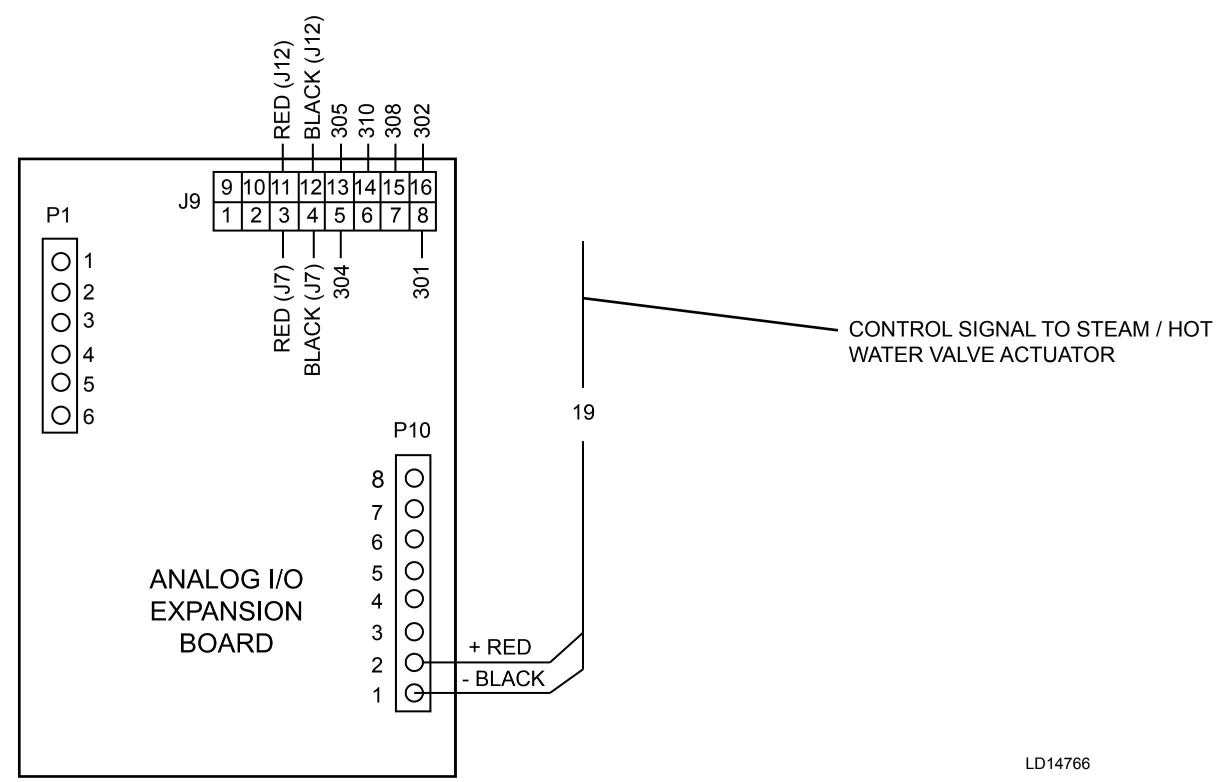

FIGURE 18 - I/0 BOARD DIGITAL OUTPUTS

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SECTION 6 - LIQUID CRYSTAL DISPLAY

INTRODUCTION

A 10.4 inch color Liquid Crystal Display, along with supporting components Display Interface board and Backlight Inverter board are mounted on a plate that is attached to the OptiView Control Center door. A clear plexiglas faceplate prevents display surface damage. System operating parameters are displayed on various color graphic screens. The various display screens are selected for display using the keypad keys.

The OptiView display provided in the OptiView panel is manufactured by different vendors. Each display requires a specific Display Interface board, Backlight Inverter board, Inverter board Interface Cable and Program Command Set. Therefore, service replacement displays or supporting components cannot be arbitrarily selected. Replacement displays are provided as kits to assure compatibility of all components. Non-compatibility of components will result in incorrect operation.

At the time of this writing the SHARP LQ104V1DG61 is the only display currently being supplied.

The YORK part numbers of the Display Interface board, Backlight Inverter board and Inverter Ribbon Cable provided, are listed on a label attached to the display mounting plate. These are the part numbers of the supporting components that are compatible with the installed display. These supporting components can be individually replaced. However, if the Liquid Crystal Display fails, Display replacement kit 331-01771-000 must be ordered as detailed below. This kit contains a replacement Display and all compatible supporting components.

The Display has 307,200 pixels arranged in a 640 columns X 480 rows matrix configuration. Each pixel consists of 3 windows; red, green and blue; through which a variable amount of light from the Display Backlight is permitted to pass through the front of the Display. Imbedded in each window of the pixel is a transistor, the conduction of which determines the amount of light that will pass through the window. The conduction of each transistor is controlled by a signal from the Display Controller on the microboard. The overall pixel color is a result of the gradient of red, green and blue light allowed to pass.

Under program control, the Display Controller on the microboard sends a drive signal for each pixel to create the image on the Display. Each pixel's drive signal is an 18 bit binary word; 6 bits for each of the 3 colors; red, green, and blue. The greater the binary value, the greater the amount of light permitted to pass. The columns of pixels are driven from left to right and the rows are driven top to bottom. To coordinate the drive signals and assure the columns are driven from left to right and the rows are driven from top to bottom, each drive signal contains a horizontal (HYSYNC) and vertical (VSYNC) sync signal. The Display Interface board receives these display drive signals from the microboard J5 and applies them to the Display at connector J1 (see Figure 23).

Figure 18 depicts typical control signals. Since these control signals occur at rates greater than can be read with a Voltmeter, the following description is for information only:

There are 480 horizontal rows of pixels. Each row contains 640 3-window pixels. Beginning with the top row, the drive signals are applied within each row, sequentially left to right, beginning with the left most pixel and ending with the right most pixel. The rows are driven from top to bottom.

The vertical sync (VSYNC) pulse starts the scan in the upper left corner. The first horizontal sync (HSYNC) pulse initiates the sequential application of RGB drive signals to the 640 pixels in row 1. Upon receipt of the enable signal, an RGB drive signal is applied to the first pixel. As long as the enable signal is present, RGB drive signals are then applied to the remaining 639 pixels at the CLK rate of 25.18MHz, or one every 39.72 nanoseconds. Typically it takes 31 microseconds to address all 640 pixels. Similarly, the next HSYNC pulse applies drive signals to row 2. This continues until all 480 rows have been addressed. Total elapsed time to address all 480 rows is approximately 16 milliseconds.

The next VSYNC pulse causes the above cycle to repeat. Displays can be operated in FIXED mode or DISPLAY ENABLE mode. In Fixed mode, the first pixel drive signal is applied a fixed number (48) of clock (CLK) cycles from the end of the HSYNC pulse and the drive signals are terminated a fixed number (16) of CLK cycles prior to the next HSYNC pulse. In DISPLAY ENABLE mode, the pixel drive signals are applied to the pixels only while the enable signal is present. This signal is typically present 4-48 CLKS after the end of the HSYNC pulse and 2-16 CLKS prior to the next HSYNC pulse.

All YORK applications operate in the DISPLAY ENABLE mode. The state of the enable (Display Interface board J1-27) signal from the microboard places the Display in the desired mode. SHARP LQ104V1DG61 (031-02886-000) Displays - When enable is maintained “Low”, the display operates in FIXED mode.

As described above, in OptiView Control Center applications, the Display scan is left to right, beginning with the top row and continuing sequentially through the rows to the last row. However, in Display applications other than OptiView Control Centers, image reversal is sometimes required. In image reversal applications, the scan is reversed; the scan is right to left, beginning with the last row and proceeding to the top row. The SCAN mode is determined by the configuration of wire jumpers on the Display Interface board (refer to Section 7).

Displays by different manufacturers can require different timing and control signals. The microboard must know which Display is present in order provide the correct signals. Therefore, when AC control power is first applied to the OptiView Control Center, as part of the power-up sequence, the microboard reads the Panel ID wire jumpers P1D0 - P1D3 on the Display Interface board and determines which Display is present. It can then provide the correct timing and control signals to produce the graphic image, as required by the Display manufacturer. Since the Display Interface board identifies the Display for the microboard, there is a different Display Interface board required for each Display application and each has a unique jumper configuration that identifies the Display. A complete explanation of this process is included in Section3 “Microboard” and Section 7 “Display Interface Board”.

The DC power source to operate the Display is provided by the microboard J5. Some Display manufacturers require +5VDC; others require +3.3VDC. The position of microboard program jumper JP2 determines which of these power sources is supplied to the Display. JP2 must be positioned according to the Display manufacturers requirements. Refer to Table 2, “Program Jumpers”.

The backlight lamp provides the illumination for the display. Average lamp life is 25,000 hours (2.9 years). Some displays use one lamp. Others use two lamps. Lamps are replaceable, but not interchangeable between different displays. Each Display manufacturer specifies the required lamp for their display. Refer to replacement parts list for appropriate replacement lamp. Service replacement lamps are stocked in the YORK Service Parts Distribution Center.

The lamp is illuminated by applying a high voltage AC (500 to 15,00VAC) to it. This illumination voltage is created from a low level DC voltage (+12VDC or +5VDC as required by the Display manufacturer) by the Backlight Inverter board. Lamp brightness is controlled by varying the high voltage AC. The greater the voltage the brighter the illumination.

The lamp is controlled by ON/OFF commands and brightness control signals applied to the Backlight Inverter board from the microboard. The microboard program determines when the lamp is turned ON and OFF and the lamp brightness.

Each Display manufacturer specifies the Backlight Inverter board to be used. Therefore, it will vary according to the Display manufacturer. The ribbon cable that connects the microboard to the Backlight Inverter board also varies according to the Display manufacturer’s requirements. Microboard program jumpers JP3, JP4, JP5, JP7 and JP8 determine the voltage levels of the control signals sent to the Backlight Inverter board and must be configured per the Display manufacturer’s requirements as listed in Table 2. A detailed description of the operation of this board is in Section 8 “Display Backlight Inverter Board”. Also refer to Section 3 “Microboard” for a detailed description of the Lamp Dimmer circuit.

The actual Display that is installed in the OptiView Control Center of the new chiller is determined by the Display manufacturer contractual agreement in place during the time of OptiView Control Center production. Displays stocked for service replacement are a result of that same agreement. Therefore, the Display received for service replacement may be by a different manufacturer than the one in the OptiView Control Center. Since each Display manufacturer requires a specific Display Interface board, Backlight Inverter board and Inverter Ribbon Cable, replacement Displays are ordered and supplied as a Display Replacement Kit (YORK Part Number 331-01771-000) to assure component compatibility. The items supplied in the kit are compatible with the supplied Display. The kit consists of the following items mounted on a display mounting plate:

1. Liquid Crystal Display with Lamp.
2. Appropriate Display Interface board for item 1.
3. Appropriate Backlight Inverter board for item 1.
4. Appropriate ribbon cable (Backlight Inverter board to microboard) for item 1.

5. Ribbon cable (Display Interface board to microboard).
6. All mounting hardware.
7. Installation instructions. A label attached to the display mounting plate lists the YORK part numbers of the Display supporting components mounted on the display mounting plate and the required microboard program jumper (JP2 through 8) configurations.

Microboard program jumpers JP2- JP8 will have to be configured appropriately for the replacement display.

DISPLAY HANDLING

1. The Display is made of glass. It could break if dropped.
2. The Display front surface is easily scratched. If soiled, wipe with a dry cotton cloth. Use no water or chemicals.
3. The Display is static sensitive. Electrostatic discharges may damage the display.
4. A laminated film is adhered to the Display front glass surface to prevent it from being scratched. Peel off very slowly to prevent static damage.

Always remove control power from the OptiView Control Center before connecting or disconnecting wires to the Display. Connecting or disconnecting wires to the Display with power applied will damage the Display!!!

SHARP LQ104V1DG61 (031-02886-000) DISPLAY (REFER TO FIGURE 22)

Removal

The Lamp slides into the Display from left to right and is secured with a screw. Remove as follows:

1. Remove control power from the OptiView Control Center.
2. Remove protective cover from rear of Display.
3. Disconnect Lamp AC power connector from Backlight Inverter board.
4. Using small Phillips screwdriver, remove lamp retaining screw.
5. Grasp lamp AC power connector and gently pull until lamp housing is completely removed from the Display.

Installation

Installation of the display can be performed as follows:

1. Slide new lamp into Display from left to right until lamp housing is fully inserted.
2. Secure lamp with lamp retaining screw.
3. Connect lamp AC power connector to Backlight Inverter board.
4. Apply AC power to OptiView Control Center.

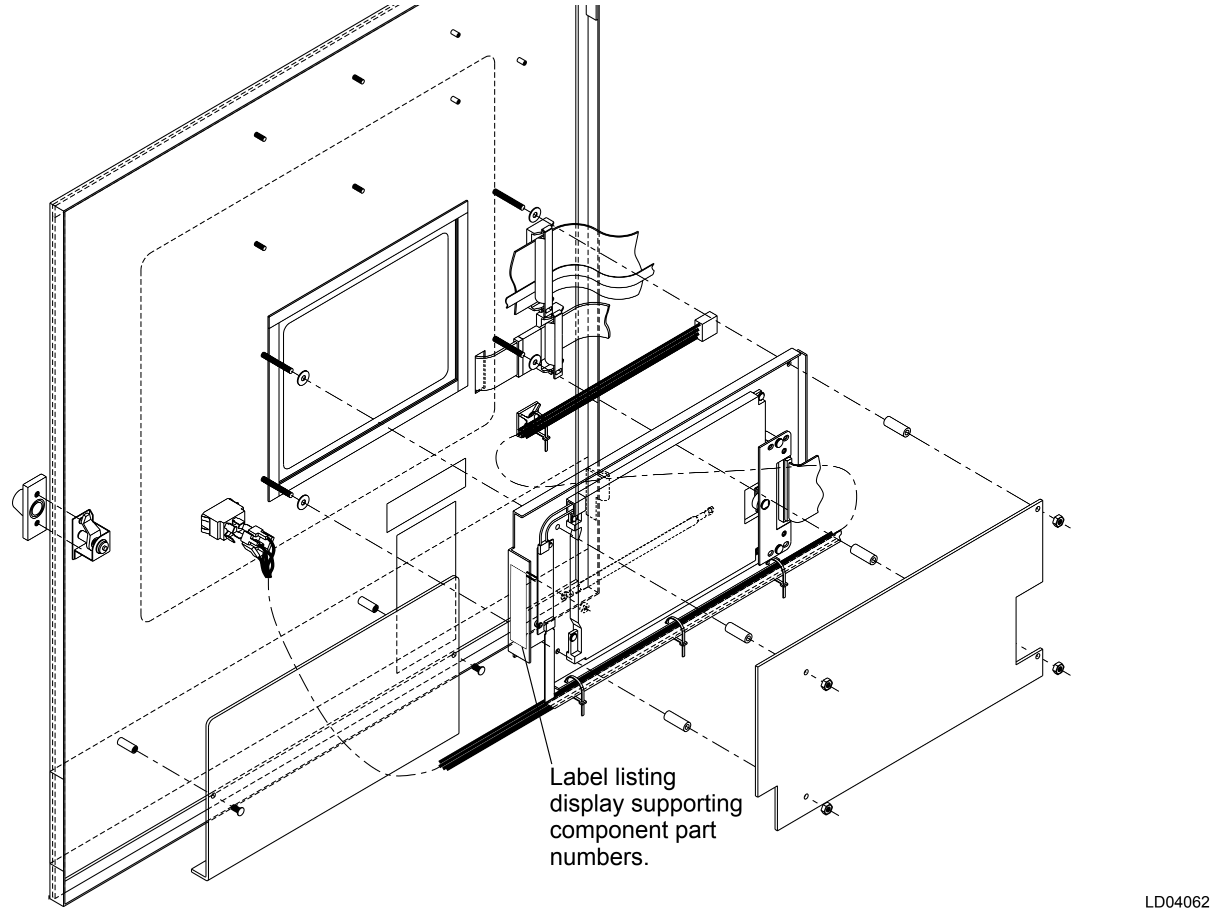
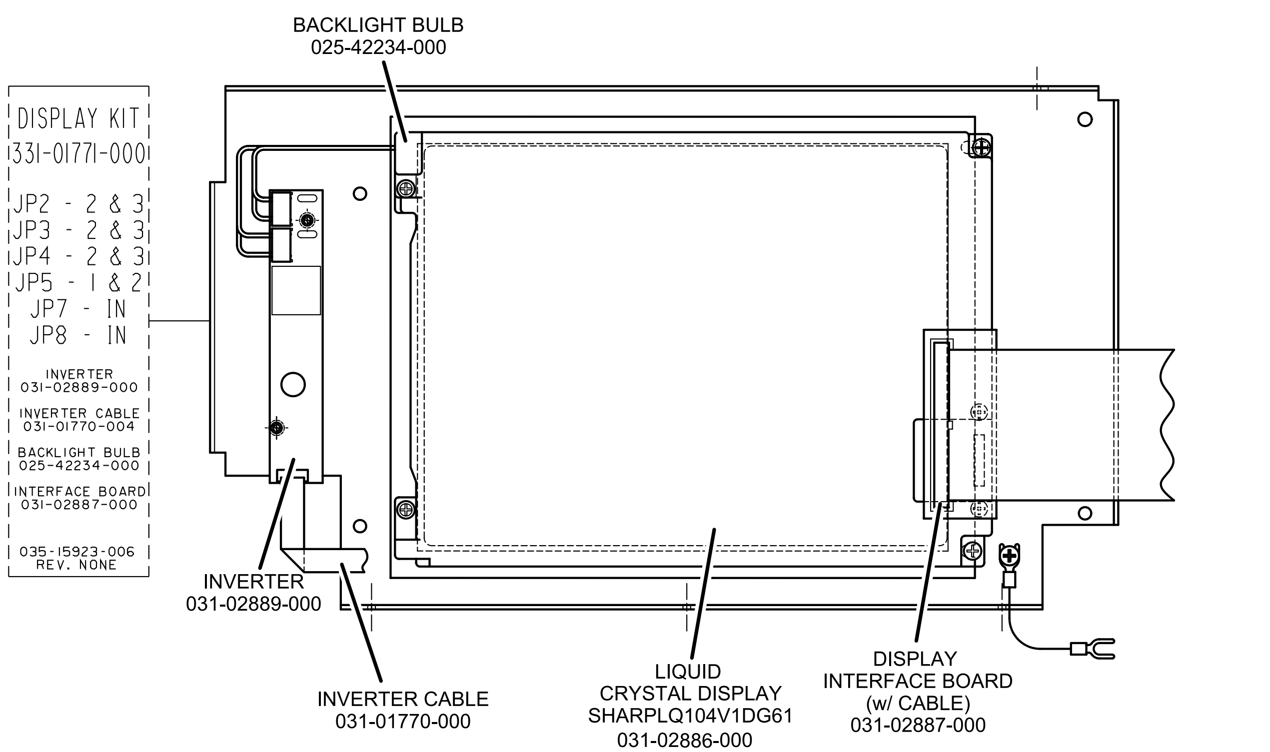


FIGURE 19 - DISPLAY MOUNTING



NOTE:

1. Configure microboard program jumpers per label.

FIGURE 20 - LIQUID CRYSTAL DISPLAY ASSEMBLY – SHARP LQ104V1DG61 (031-02886-000) DISPLAY

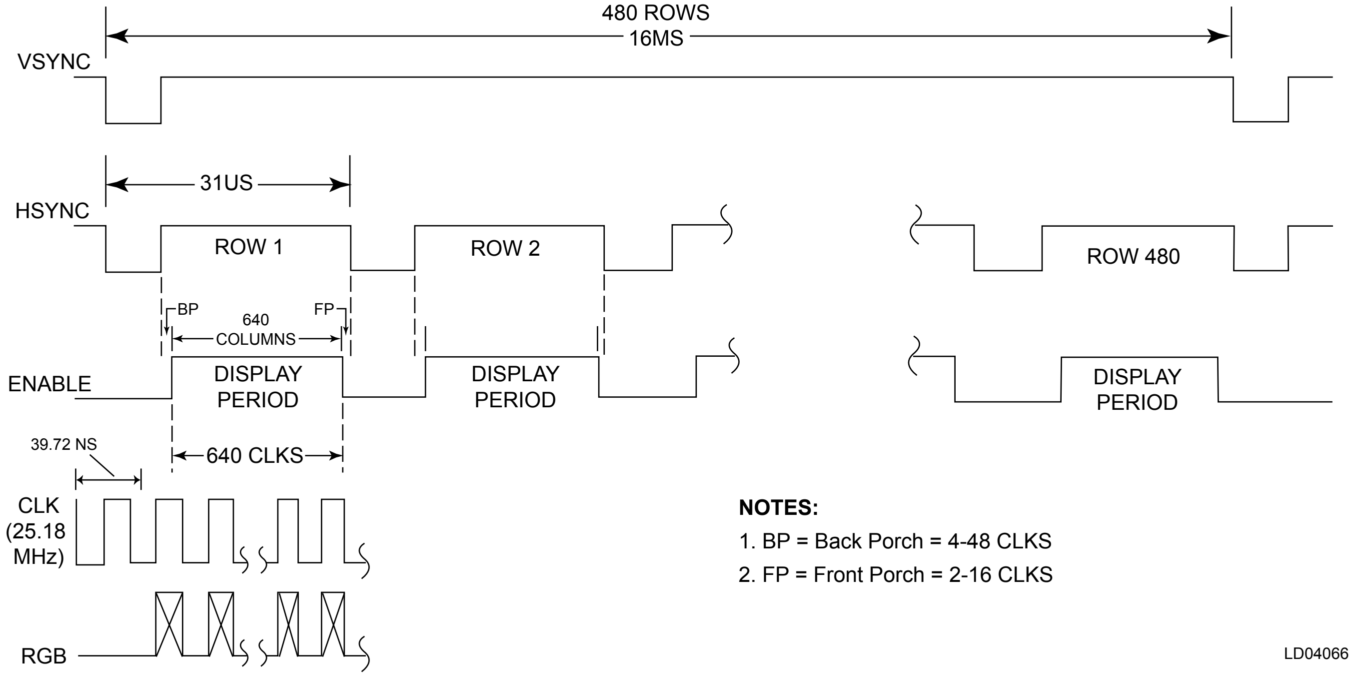


FIGURE 21 - LIQUID CRYSTAL DISPLAY TYPICAL CONTROL SIGNAL TIMING

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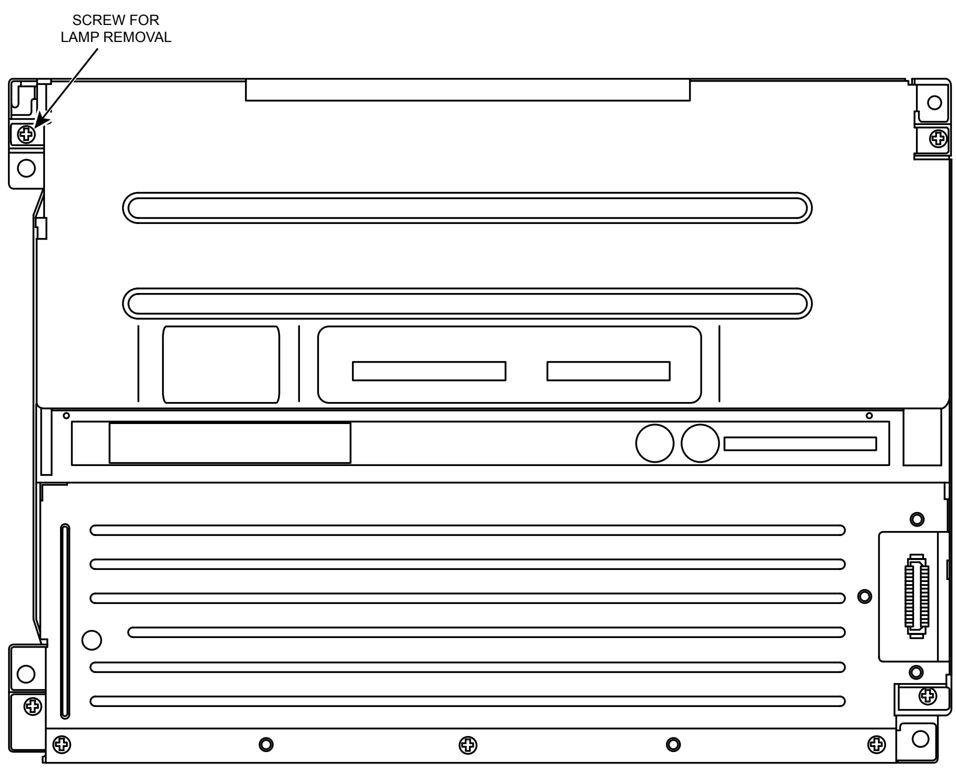

FIGURE 22 - DISPLAY (SHARP LQ104V1DG61 (031-02886-000)

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SECTION 7 - DISPLAY INTERFACE BOARD

INTRODUCTION

The Display Interface board is located on the Liquid Crystal Display and is part of the microboard interface to the Display. It permits the use of Displays by different manufacturers, by providing the microboard with a means of automatically determining which Display is present.

Since different display manufacturers require different timing and control signals, the microboard Display Controller must be configured to meet the requirements of the actual display installed. When AC power is applied to the OptiView Control Center, the microboard reads the Panel Identification (PID0 thru PID3) voltage levels on the Display Interface board during the power-up sequence to determine which display is present. These voltage levels indicate the actual display installed and the Display Controller is automatically configured appropriately. To provide the appropriate Panel ID voltage levels for the different displays, there are different Display Interface boards. These boards have permanent wire jumpers that provide the voltage levels to the microboard for Panel ID signals (PID0 thru PID3). These jumpers connect these signals to either ground or open-circuit. When connected to ground, the voltage level for that signal is 0VDC. When open, the voltage level is the VCC logic level, which is either 3.3VDC or 5.0VDC, depending on the display (refer to microboard program jumper JP2).

The Display Interface board and the Panel ID signal that is provided to the microboard is as follows:

Display Interface Board 031-02887-000

Display Applicability:

SHARP LQ104V1DG61 (031-02886-000)

PID0 – OUT (VCC)

PID1 – IN (pin 45 is tied to 44) (GND)

PID2 – No Connection Open (VCC)

PID3 – No Connection Open (VCC)

The Displays can operate in either NORMAL or REVERSE mode for the Right/Left (R/L) and Up/Down (U/D) scan. Normal for the R/L scan is left to right. Normal for the U/D scan is top to bottom. As used in the OptiView Control Center, it is configured to operate in NORMAL mode for both of these scans. The REVERSE mode for R/L is right to left. REVERSE mode for U/D is bottom to top. The Display Interface board provides the appropriate signals to the display to put it in Normal SCAN mode. By hardwired jumper or wiring configuration, the signal is either tied to ground, VCC (+3.3VDC or +5VDC, as determined by microboard program jumper JP2) or left open as follows:

Display Interface Board 031-02887-000

Display Applicability:

SHARP LQ104V1DG61 (031-02886-000)

J1-30 – (VCC)

J1-31 – (GND)

Display Interface board is available individually for service replacement. The part number of the Display Interface board for the installed display is listed on a label attached to the display mounting plate . The appropriate board is also supplied with display kit 331-01771-000.

The red, green and blue display drive and control signals are simply passed through the Display Interface board. The value of VCC is either +5VDC or +3.3VDC, as determined by the position of program jumper JP2 on the microboard.

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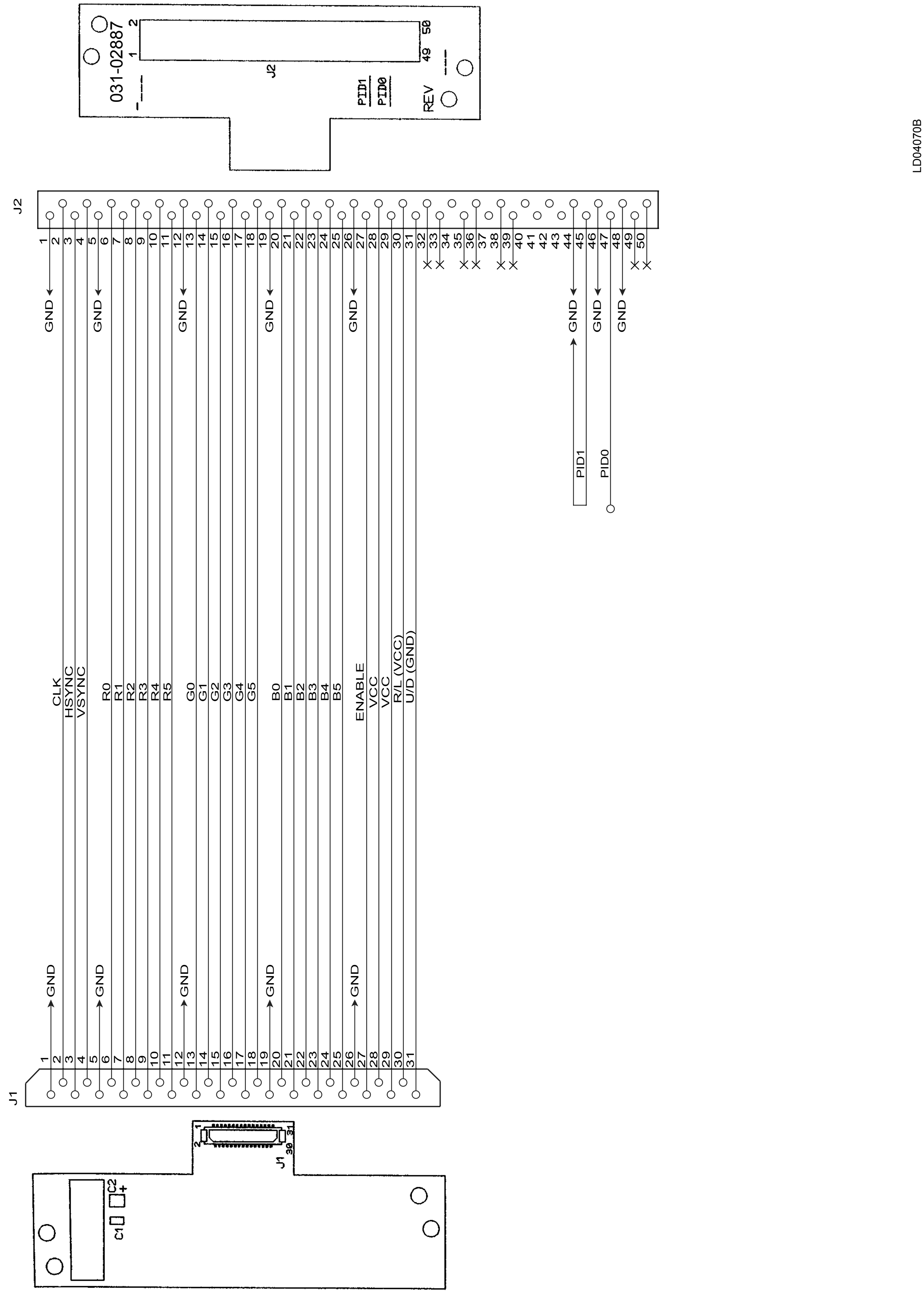


FIGURE 23 - DISPLAY INTERFACE BOARD 031-02887-000 (SHARP LQ104VIDG61)

SECTION 8 - DISPLAY BACKLIGHT INVERTER BOARD

INTRODUCTION

The “Display Backlight Inverter Board” generates a high voltage AC signal that is applied to the backlight lamp, causing it to illuminate. The magnitude of the signal determines the lamp brightness. Displays by some manufacturers have two lamps; one at the top and one at the bottom of the display. Other display manufacturers have only a lamp at the top of the display.

An Inverter converts low level DC voltage (+12VDC or +5VDC, as required by the manufacturer) from the microboard to a 500 to 1500VAC 60KHz signal that is applied to the lamp. The higher the AC voltage, the greater the brightness of the lamp. When this voltage is not present, the lamp is turned OFF.

High voltage, up to 1,500VAC, is present at the output of the Backlight Inverter board. Refer to Figure 23 and locate the output connectors. Use extreme caution when working in this area!

Different Display manufacturers require different Backlight Inverter boards. The different board designs require different control voltage inputs. To accommodate these variations, microboard program jumpers JP3 through JP5, JP7 and JP8 must be configured to provide the required voltage levels. A label attached to the display mounting plate lists the required program jumper configuration for that particular display. Refer to Table 2 for required program jumper configurations for the various Display applications.

Under program control, the microboard generates the control signals that are applied to the Backlight Inverter board. The program determines when the lamp is turned ON and OFF. It also adjusts the lamp brightness. To increase the average lamp life of 25,000 hours, the lamp brightness is normally adjusted to 50%. This brightness level will still allow the display to be visible. When the program senses a keypad key has been pressed, it adjusts the brightness to 100% (maximum).

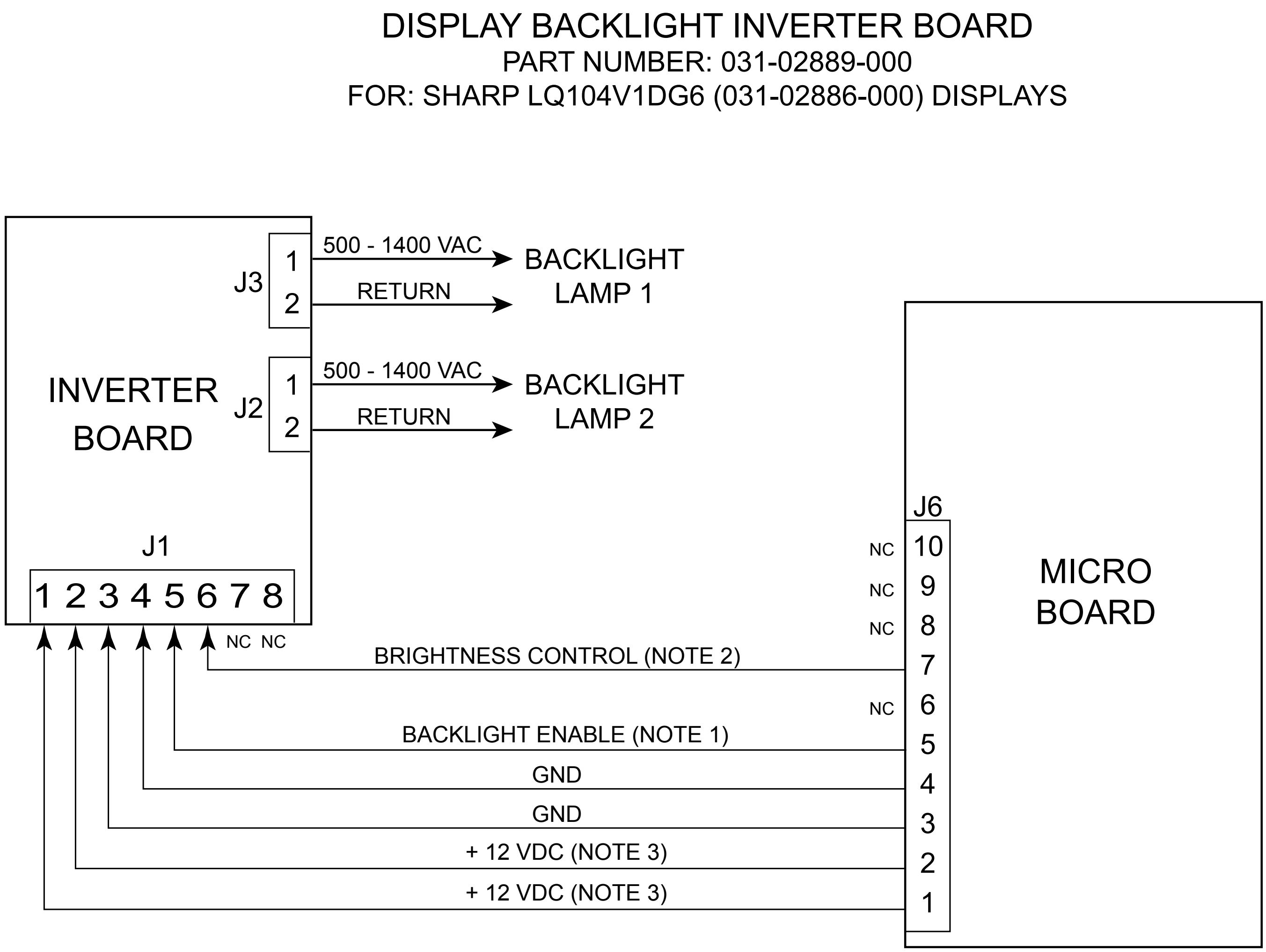
The lamp illumination high voltage AC is generated from either +12VDC or +5VDC as required by the manufacturer. Microboard program jumper JP5 must be positioned to provide the required voltage. The microboard provides the backlight enable signal. This signal turns the lamp ON and OFF. Some manufacturers require this signal to be +12VDC, others require +5VDC. Program jumper JP4 must be positioned to provide the required voltage. Further, some applications require this signal to be a +VDC (+12VDC or +5VDC) to turn on the lamp. Others require this signal to be 0VDC to turn on the lamp. Program jumper JP3 must be positioned to provide the required polarity.

Depending upon the Display manufacturer, the brightness control input from the microboard must be either a variable voltage or a variable resistance. microboard program jumpers JP7 and JP8 are used to provide the appropriate technique (refer to Figure 24). The lamp dimmer circuit on the microboard is an IC that is the electrical equivalent of a 10K ohm potentiometer with 100 positions or steps. The program adjusts the position of the potentiometer. When configured for variable voltage (JP7 and JP8 installed), the output between microboard J6-7 and J6-8 is a 0 to +5.0VDC signal. Not all applications require the full 5.0VDC range. If configured for variable resistance (JP7 and JP8 removed), the output between microboard J6-7 and J6-8 is a 0 to 10K ohm variable resistance.

The OptiView Control Center could be supplied with any of several approved Displays. Each Display requires a specific Backlight Inverter board as specified below and in Figure 24. These boards are individually available as service replacement parts (the required Backlight Inverter board part number is listed on the label attached to the display mounting plate). However, service replacement Displays are provided in a kit (YORK P/N 331-01771-000) that includes the appropriate Backlight Inverter board (refer to Section 6 “Liquid Crystal Display”).

SHARP model LQ104V1DG61 display (031-02886-000) requires Backlight Inverter board 031-02889-000 (ref Figure 24). These boards generate a lamp illumination high voltage AC from +12VDC. When the backlight enable signal is +5VDC, the high voltage signal is applied to the lamp. When the enable is 0VDC, the high voltage is removed from the lamp.

The lamp brightness is controlled by a variable voltage signal, developed by the lamp dimmer circuit (ref Figure 9) on the microboard and applied to the Inverter board. The lamp dimmer circuit varies the voltage over the range of 0 to +3.0VDC. Maximum brightness (100%) is produced by 0VDC and +3.0VDC produces minimum brightness (0%). Voltages between these values produce a linear brightness between 100% and 0%.



NOTES:

1. OFF = 0VDC; ON = + 5VDC. Refer to microboard program jumpers JP3 and JP4.
2. 0- + 3.0VDC. 0VDC = MAX (100%) brightness. +3VDC = MIN (0%) brightness. Refer to microboard program jumpers JP7 and JP8.
3. Refer to microboard program jumper JP5.
4. N.C. = No Connection.

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FIGURE 24 - DISPLAY BACKLIGHT INVERTER BOARD - SHARP LQ104V1DG61 DISPLAY (031-02886-000)

SECTION 9 - KEYPAD

OPERATION

The "Keypad" contains touch-sensitive keys that allow the operator to interface with the OptiView Control Center. The operator presses the keys to request the desired screens of information and enter system setpoints.

The top layer of the keypad contains embossed areas identifying the keys. Under each embossed key area are two conductors, one on top of the other, separated by an air space. The conductors are arranged in a matrix of rows and columns and connected to the keypad connector as shown in Figure 26. The embossed area of each key is located directly over the intersection point of the conductors. Pressing the embossed key area causes contact and electrical continuity between the two conductors. For example, pressing the "1" key creates continuity between the keypad connector pin 5 (column 3) and pin 13 (row 4). Since this connector is interfaced to the microboard (J18), the microboard senses this continuity as described in this section and concludes the "1" key is pressed.

The microboard program continuously scans the keypad to determine if a key is pressed. Beginning with row 1 and proceeding through all rows, the program places a "Logic Low" (less than 1VDC) on a row, a "Logic High" (more than 4VDC) on the remaining rows and reads the columns. A Logic Low in any column indicates a key in that column and row is pressed. For example, if at the time row 4 is being driven low, if column 3 is low, then the microprocessor concludes the key at coordinate of row 4 and column 3 is pressed. Since the coordinates of all keys are stored in the microboard's program, it can identify which key is at this coordinate and responds accordingly. In this example the "1" key is pressed.

In order for the microboard to reliably detect closed and open keys, each key must meet a closed circuit and open circuit resistance requirement. When a key is pressed, the contact resistance must be less than or equal to 100 Ohms. When a key is not pressed, the contact resistance must be more than or equal to 1Meg Ohm. If the microboard is not responding to a pressed key, or if it's detecting a closed key when none are pressed, it could be because the contact resistance requirements are not being met. The operation of each key can be checked with an Ohmmeter. To check the open and closed contact resistance of any key, refer to Section 31 "Diagnostics and Troubleshooting".

REPLACEMENT

The keypad is attached to the front of the OptiView Control Center door with an adhesive backing. If service replacement is required, start at one corner and slowly peel the keypad from the door. The rear side of the replacement keypad is coated with an adhesive covered with a paper backing. Remove the paper backing, align the Display and rocker switch openings and apply the keypad to the door.

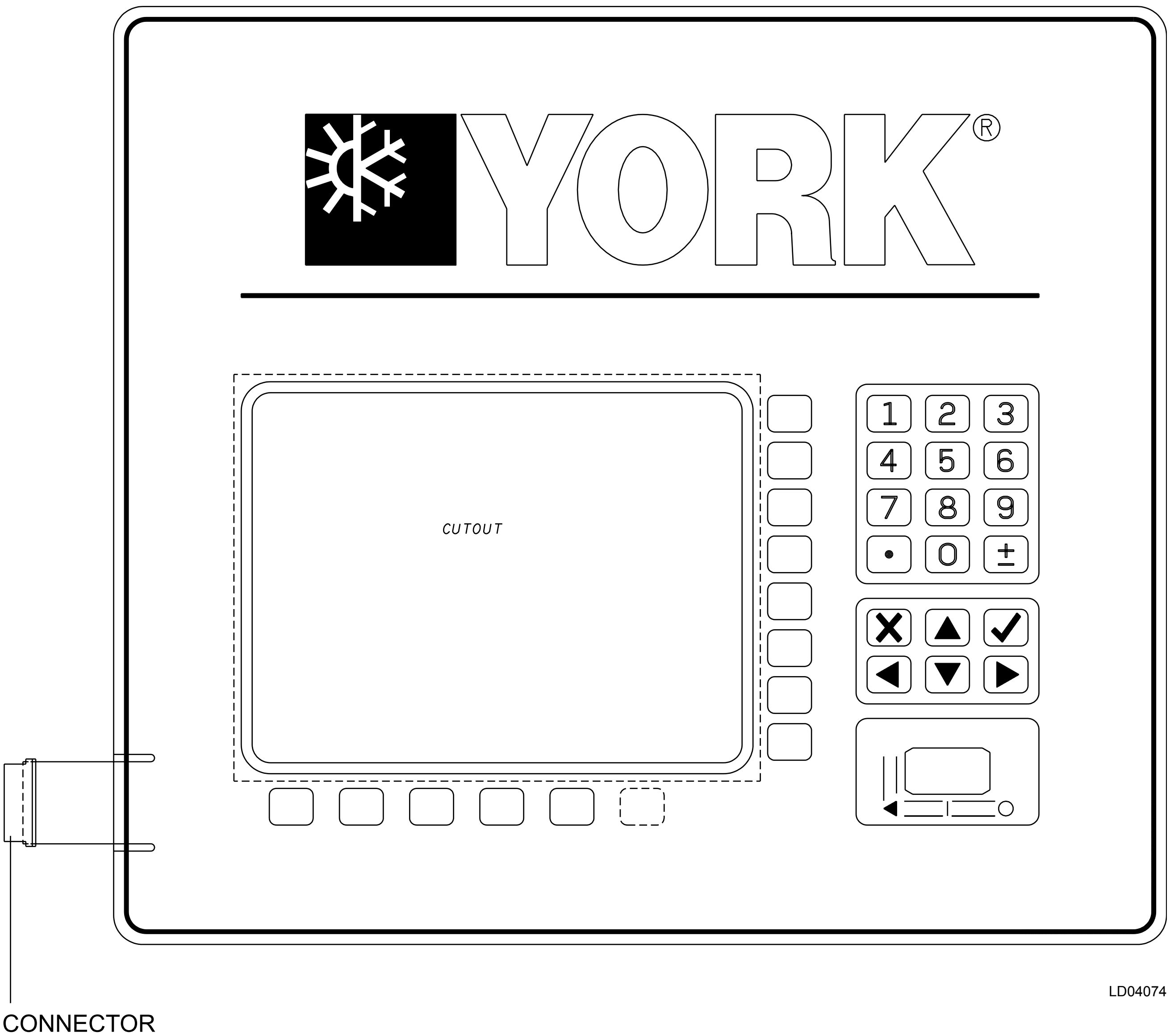
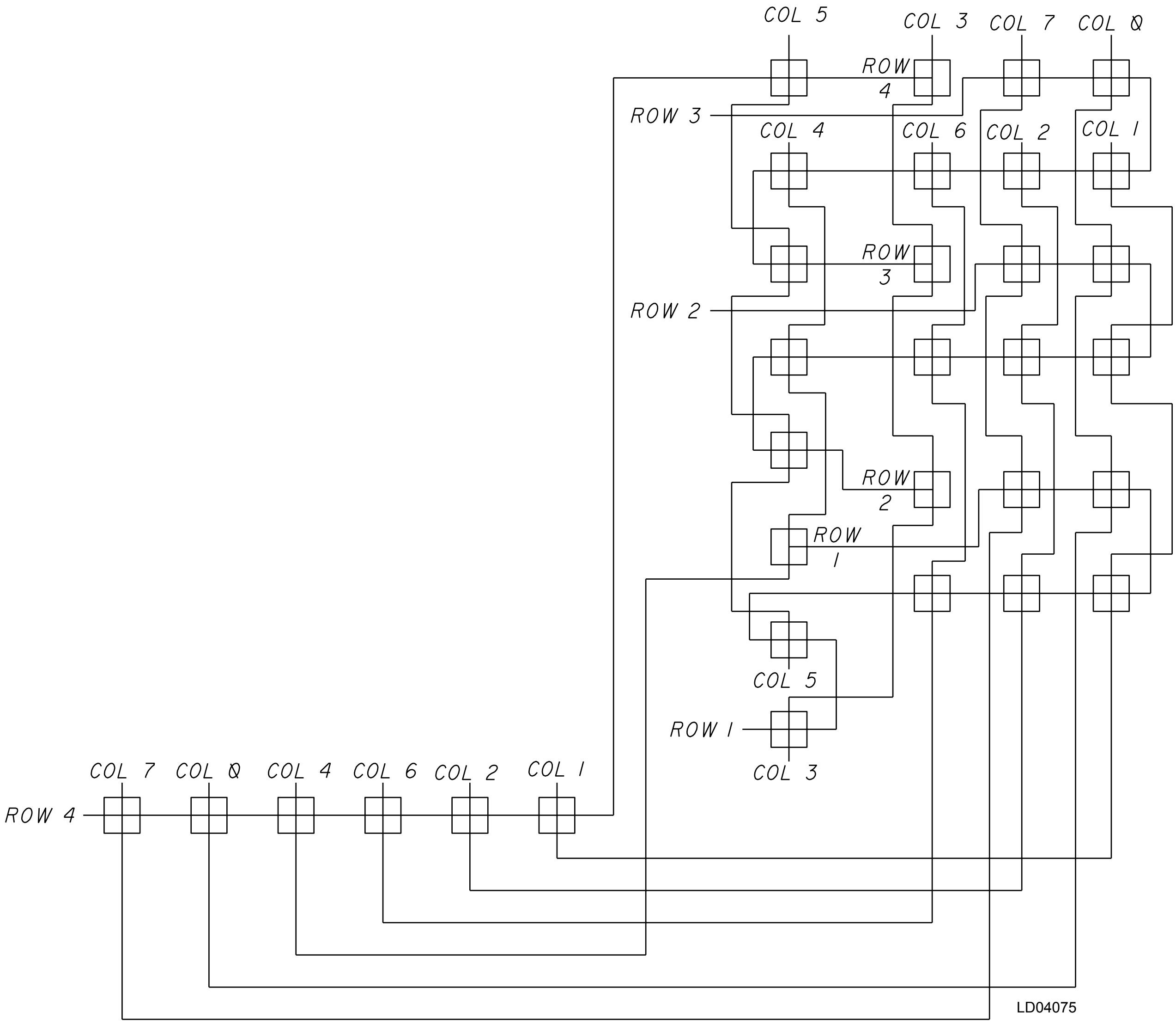


FIGURE 25 - KEYPAD



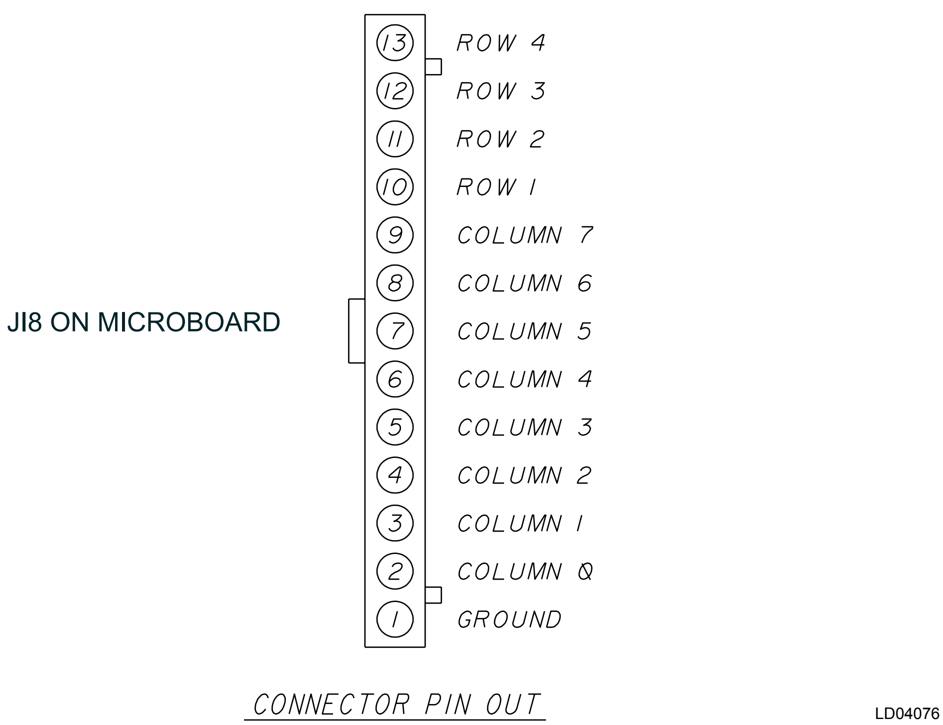


FIGURE 26 - KEYPAD CONDUCTOR MATRIX

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SECTION 10 - POWER SUPPLY

INTRODUCTION

The "Power Supply" provides the DC power for the LCD Display and all the printed circuit boards in the OptiView Control Center. It receives a 102 to 132VAC input from an external power source and provides the following DC outputs:

- -12VDC
- +12VDC
- +5VDC
- +24VDC
- Ground

The -12VDC, +12VDC, GND and +5VDC outputs are applied to the microboard. There, these voltages are applied to the circuits requiring the respective voltage. From the microboard, the +12VDC and +5VDC are distributed to other system components requiring these voltages. These include the E-Link, I/O board, LCD Display and Display Backlight Inverter board. The Condor power supply allows adjustment of the +5VDC output. To account for losses in wiring and connections and assure sufficient voltage level at the microboard input, the "V ADJ" (R51) potentiometer is adjusted to achieve +5.1VDC at the input to the microboard J1-1.

As shown in Figure 4, the microboard contains two voltage regulators that create separate +5VDC and +3.3VDC supplies. The +5VDC supply is dedicated to all the microboard Analog circuits and is labeled as the +5VDC (analog) supply. It is also routed to all

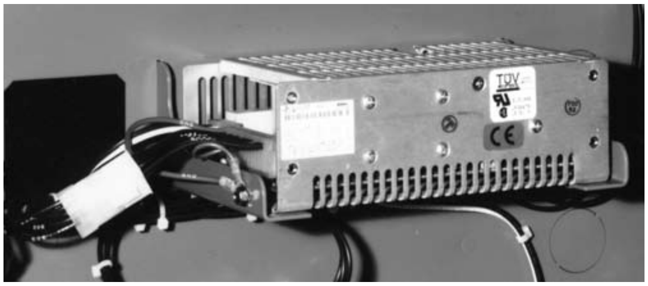

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FIGURE 27 - POWER SUPPLY

pressure transducers and temperature thermistors. This permits all analog circuits to be powered by the same supply, eliminating any offsets caused by voltage regulator drift. Microboard 031-02430-000 has an additional voltage regulator that provides a 2.5VDC power source. The +3.3VDC supply is utilized by the microprocessor, flash memory card and other digital circuits. It could also be applied to the Backlight Inverter board, depending on the Display manufacturer's requirements as explained below.

Different Display manufacturers can require different supply voltages for their display and supporting circuits. To accommodate the different Display manufacturer's voltage requirements, microboard program jumpers JP2 and JP5 must be positioned to provide the required supply voltages to the Display and the Display Backlight Inverter board. Either +5VDC or +3.3VDC, as determined by JP2, is applied to the Display. Either +12VDC or +5VDC, as determined by JP5, is applied to the Display Backlight Inverter board. Refer to Table 2 "Microboard Program Jumpers".

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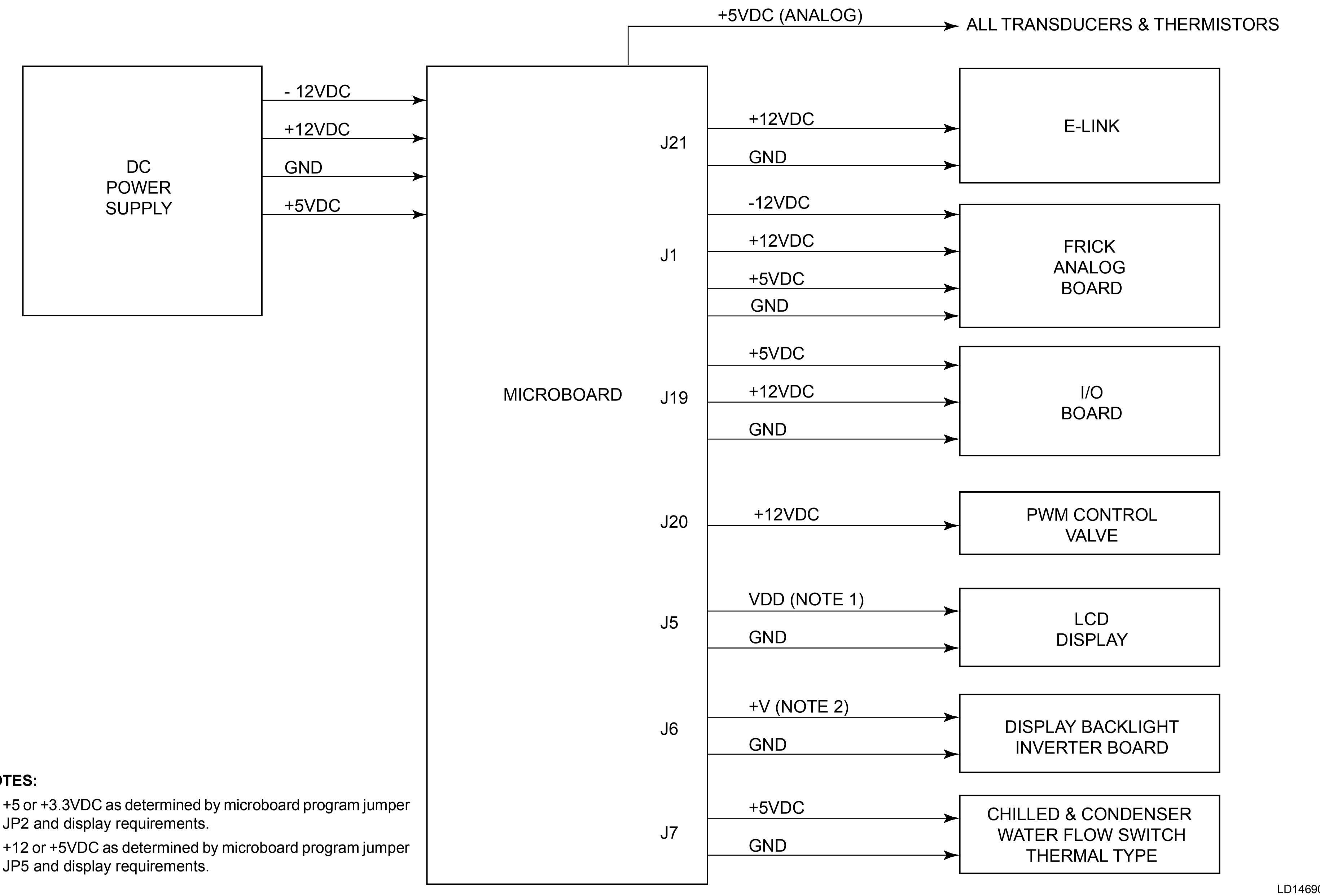


NOTES:

1. +5 or +3.3VDC as determined by microboard program jumper JP2 and display requirements.
2. +12 or +5VDC as determined by microboard program jumper JP5 and display requirements.

FIGURE 28 - POWER SUPPLY – DC POWER DISTRIBUTION (REFER TO OPTIVIEW CONTROL CENTER WIRING DIAGRAM FOR WIRE CONNECTIONS)

SECTION 11 - 1F AND 3F LEVEL SWITCHES

INTRODUCTION

Since Early 2006, YIA chillers have incorporated into their design two, stationary, conductivity probe-style level indicator switches. These switches replaced the float type switches. The new style switches do not have the magnetic float mechanism that rode up and down a shaft with a reed switch in it. Instead, they complete a circuit between the metallic probe and the casing of the chiller. When a level is present on the probe (de-ionized water) the probe makes contact through the liquid with the metallic walls of the chiller, indicating a level is present. When the liquid level does not contact with the probe, no contact is made and thus the circuit cannot be complete, indicating no level. The two switches are identical and function in the same manner but are located in two separate areas on the chiller.

The "1F, Refrigerant Level Switch" is located higher than the other switch and is mounted on the side of the evaporator refrigerant spill over box. The function of this switch is to monitor the amount of available refrigerant in the unit during its operation.

The"3F, Refrigerant Pump Cut-Out Level Switch" is located on the refrigerant line just before the suction of the refrigerant pump. The function of this switch is to monitor the refrigerant going to the refrigerant pump for cooling purposes. (The new style pumps use the pumping fluid to cool the motor)

Each float switch is made up of the following:

- Float switch enclosure with threaded couplet on top.
- Electrode probe
- Wiring harness
- Controller module

For units with NEC, NEMA 1 system wiring, both controller modules will be installed in the control panel cabinet. For units with PED/CE system wiring, both controller modules will be mounted in separate enclosures mounted on the unit remote from the control panel.

Each module works in the following fashion:

The control module receives incoming 115VAC power from terminal 1; I/O board TB6, on terminal L1 and L2 receives the common from terminal 2, I/O board TB6.

A 115VAC signal from terminal 1, I/O board TB4, is landed onto the NO contact on the modules, when the liquid rises to the electrode on terminal LLCO, the control energizes and the LED will light, indicating sufficient level at the probe. The COM terminal on the 1F module will send an 115VAC signal to I/O board terminal 18. For 3F, the COM will send an 115VAC signal to terminal 82 on the I/O board. The control remains energized until the liquid level recedes below the electrode on terminal LLCO. The control then de-energizes and the LED will not be lit, indicating insufficient level at the probe. There is a three second time delay on decreasing liquid level before the control de-energizes. The LLCO terminal on the module is connected, one wire only, to the sensing element. When the refrigerant level rises to contact the probe, the circuit is made complete via the ground to enclosure.

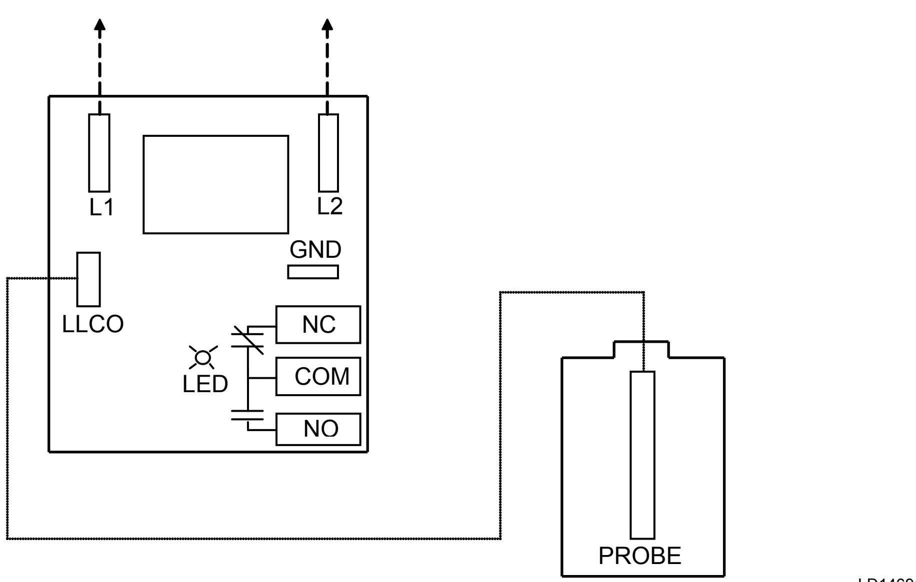
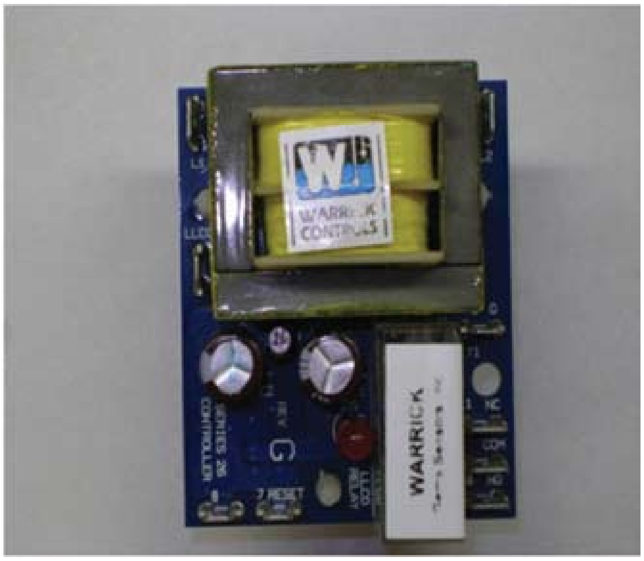


FIGURE 29 - WIRING DIAGRAM, LOW LEVEL CUT-OUT MODULE AND PROBE



LD14692

FIGURE 30 - CONTROL MODULE.

If a replacement probe is ever needed, the probe length as received from Baltimore Parts will need to be cut before installation into the probe enclosure. It is best to cut the replacement probe to the same length as the original probe.

> NOTE
>
> ***The 1F probe and the 3F probe are not the same length.***

If ever replacing the probe, it is absolutely important that the probe does not make contact with any metallic unit surfaces. Contact with these surfaces will enable the device to not function properly. Use Service Information Letter SI0213 for reference when replacing either the 1F probe or 3F probe.

PROBE SET-UP

There are three refrigerant pump parameters that are controlled by the 1F and 3F level switches.

- Refrigerant Pump Shutdown Timer Setpoint
- Refrigerant Pump Start-Up Delay
- Refrigerant Pump Shutoff Delay

To program any of the above values use the following procedure: (also refer to Section 23 *"*Setpoints Screen")

1. From the HOME screen in SERVICE access level, press SETPOINTS key and then OPERATION.
2. Using the white arrow keys, scroll down to "Refrigerant Pump Shutdown Timer Setpoint*"*, press "✓" and a black pop-up box will appear. The box will have the following in it:
   - Minimum value = 30 seconds
   - Maximum value = 60 seconds
   - Default value = 60 seconds
   - Now: 30 seconds

✓ = accept	X = cancel	^ = Default
v = Clear	less than = Back space	

3. The "Now" value is the value presently programmed in the unit. Using the number keys, program in the value you wish to enter and press "✓".
4. When the "✓" key is pressed the pop-up box will disappear and the programmed value will show under the "Current" column.

Repeat this procedure for Refrigerant Pump Start-Up Delay and Refrigerant Pump Shutoff Delay.

> DANGER
>
> ***When the pop-up box appears under the respective refrigerant pump parameter, the Min, Max and Default values maybe different.***

The EVAPORATOR/ABSORBER and SYSTEM screens have indicator lights showing the position of both the 1F and 3F level switches. An illuminated red light indicates the switch position is closed, or that a level of refrigerant is present; if the light is not illuminated there is no liquid level present, hence the switch is in the open position.

PROBE FUNCTION

> NOTE
>
> ***The refrigerant pump will not be allowed to initially start until both 1F and 3F level switches are closed to indicate a level of refrigerant is present. Also see "Refrigerant Pump Start-Up Delay" in this section.***

Refrigerant Pump Shutdown Timer Setpoint

The settings for this setpoint are:

- Min: 20 minutes
- Max: 60 minutes
- Default: 30 minutes

This parameter works off the 3F, refrigerant pump cut-out level switch. It is in effect when the unit is in System Run and the Refrigerant Pump Shutoff Delay has expired. When 3F opens, indicating no refrigerant is in the evaporator circuit, the refrigerant pump will shut OFF while the unit remains running. This allows the unit to make up a sufficient amount of refrigerant while the refrigerant pump remains OFF for the duration of the programmed time. If this parameter times out without the 1F and 3F closing, the unit will go into a safety shutdown and REFRIGERANT PUMP LEVEL SWITCH 3F FAILURE will be displayed.

Refrigerant Pump Start-Up Delay

The settings for this setpoint are:

- Min: 1 second
- Max: 900 seconds
- Default: 120 seconds

This parameter works off the closure of the 1F refrigerant level switch. When 1F and 3F close to indicate a level of refrigerant in the evaporator circuit, the refrigerant pump will delay start up for the duration of time programmed in for this value.

Refrigerant Pump Shutoff Delay

The settings for this setpoint are:

- Min: 1 second
- Max: 45 seconds
- Default: 30 seconds

This parameter works off the opening of the 1F and 3F level switches. When 1F opens then 3F opens, indicating no level of refrigerant present to cool the motor, the refrigerant pump will continue to operate for the programmed duration of time, once expired the pump will shut off. The refrigerant pump must not be allowed to run for extended periods without pumping refrigerant because it is cooled with refrigerant.

OTHER CONDITIONS

The state of each level switch is not recognized as being valid until it has been in the same position for the duration of the respective timer.

- 1F = Refrigerant Pump Start-Up Delay.
- 3F = Refrigerant Pump Shutoff Delay.

If the unit has entered a System Run status and the 1F opens while 3F remains closed, the refrigerant pump will continue to run.

To assure that both 1F and 3F level switches are operational; the program compares the state of 1F to 3F. Since each switch closes as the refrigerant level rises and opens when the level decreases, and 1F is at a higher elevation than 3F, it is not possible that 1F would be indicating a level (closed) when 3F does not (open), unless one of the level switches is not functioning properly. In this case the panel will display REF LEVEL SWITCH CONFLICT – CHK 1F & 3F. The refrigerant pump will shut OFF after the Refrigerant Pump Shutoff Delay has timed out. However, at the closing of 3F level switch the pump will be allowed to run again. Under this condition, the pump will turn ON and OFF depending on the position of 3F and the duration of the Refrigerant Pump Shutoff Delay time.

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SECTION 12 - E-LINK GATEWAY

INTRODUCTION

The complete description of the E-Link Gateway Installation Instructions can be obtained from form PN 24-10404-9 II. This form can be obtained from the Johnson Portal under Equipment Communications and Integration / Documents Library. To prepare for installing and commissioning refer to the shipping instructions included with each E-Link Gateway. There is also a self study training module C-8190-EN which is available on the Learning Network.

The E-Link Gateway provides Johnson Controls and York mechanical equipment such as the YIA chiller with building automation system (BAS) networking connectivity. It is designed with three active serial ports: Port 1 and Port 4 are used for BAS networking, Port 2 is reserved for connecting to the equipment, and Port 3 provides access for auxiliary monitoring and control.

The E-Link Gateway comes as a circuit board that may either be installed directly into the equipment's enclosure or can be supplied already mounted within a line voltage capable enclosure. Accessory mounting kits are used to mount the E-Link Gateway directly into OptiView panels.

If installed in the OptiView Control Center, the E-Link Gateway is powered by +12VDC from the microboard (J21).

The E-Link Gateway communicates with the microboard COM 4B communications port via an RS-232 interface. As shown in Figure 31, microboard program jumper JP21 must be placed on pins 2 and 3 to allow data to be received from the E-Link.

If the remote device that is connected to the E-Link is going to provide Remote Start/Stop Signals, Remote Leaving Chilled Liquid Temperature, and/or Remote Steam/Hot Water Limit setpoints, the OptiView Control Source must be set to ISN.

In operation, the microboard provides chiller pressures, temperatures and status to the E-Link in response to requests from the E-Link. Microboard status LED's illuminate when the microboard transmits and receives data on Com 4B. Green LED CR13 (RX4) illuminates when data is being received from the E-Link. Red LED CR12 (TX4) illuminates when data is being transmitted to the E-Link. Similar LED's on the E-Link annunciate data transfer to/from the microboard. Refer to PN 24-10404-9 II.

If there is a communications problem between the microboard and E-Link, use the LEDs described previously in this section to analyze the problem. The COM 4B loop back test can be used to verify operation of the microboard COM 4B communications port. Refer to Section 31 "Diagnostics and Troubleshooting" in this document.

If further troubleshooting is necessary, the E-Link Factory and Production Date Code will be required when calling the Field Support Center:

Location of this data is shown in Figure 31. In this example a Factory Code is not indicated.

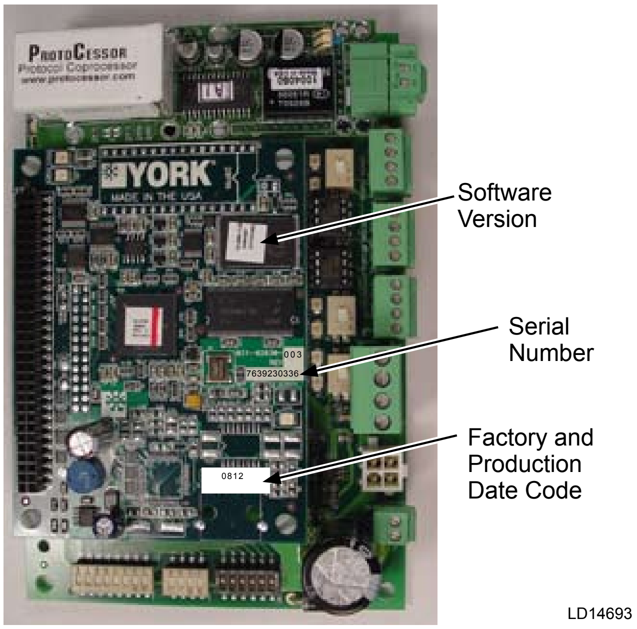

FIGURE 31 - E-LINK CIRCUIT BOARD

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SECTION 13 - PRESSURE TRANSDUCERS

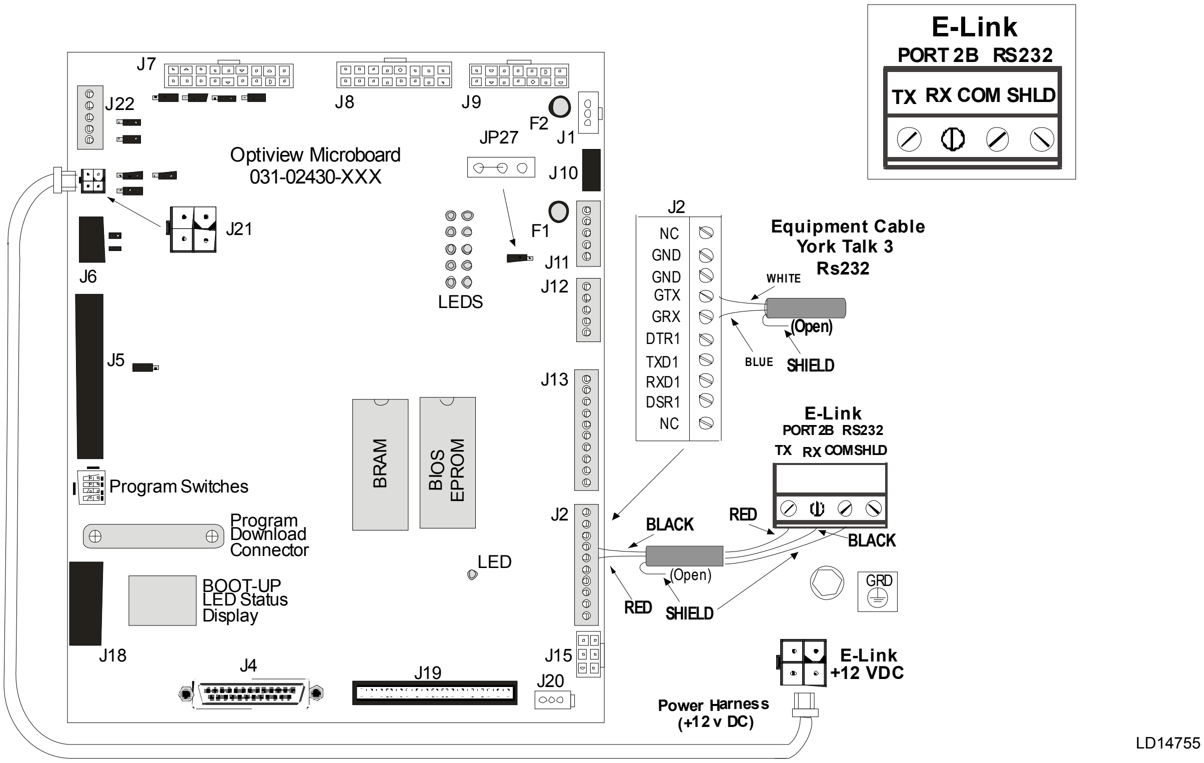

FIGURE 32 - MICROBOARD / E-LINK CONNECTIONS

INTRODUCTION

System pressures are sensed by pressure transducers. In a YIA, MOD D unit the generator shell, steam inlet (steam units only), purge pump and purge tank pressures are sensed via transducers. The transducers output a 0.5 to 4.5VDC voltage that is analogous to the pressure applied to the devise. These outputs are applied to the microboard via feedback voltage; this voltage is interpreted as a pressure value in terms of mm Hg Abs. or in the case of the steam inlet pressure, in PSIA in English or Kpa (Kilo Pascal's) in METRIC mode. The program converts the transducer output voltage to a pressure value with the appropriate formulas (see Figures 34, 35 and 36). The pressures are displayed and used for chiller control and safety shutdowns.

The transducers operate from a +5.0VDC power source. This supply voltage is provided from the power supply via the microboard. Each transducer is connected to the microboard with three wires (see Figure 33). A wire provides the +5.0VDC supply voltage, another a ground (GND) and the remaining wire connects the transducer output to the microboard. If the wires are not connected properly the transducer will either not function or will provide an inaccurate reading.

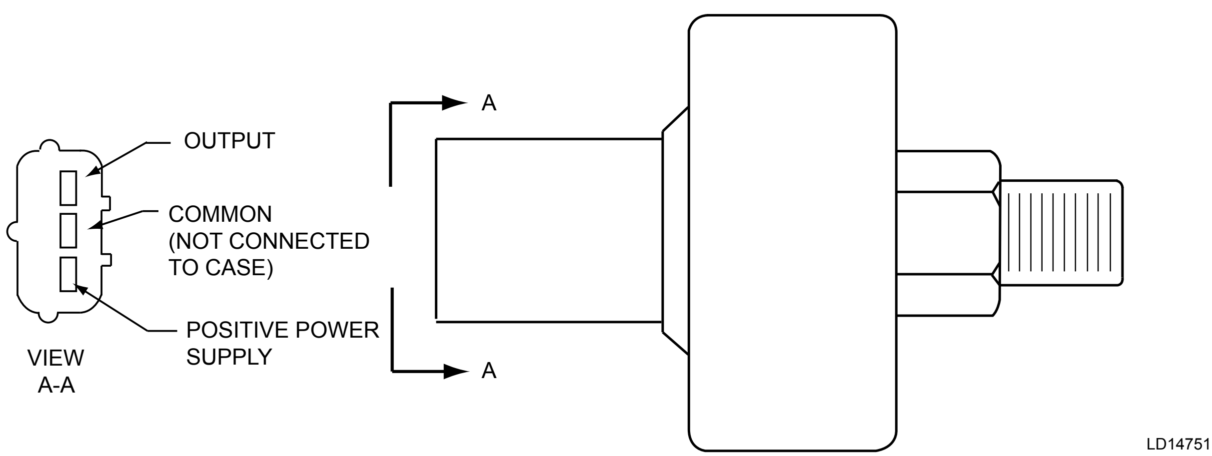

FIGURE 33 - CONNECTIONS FOR TRANSDUCERS

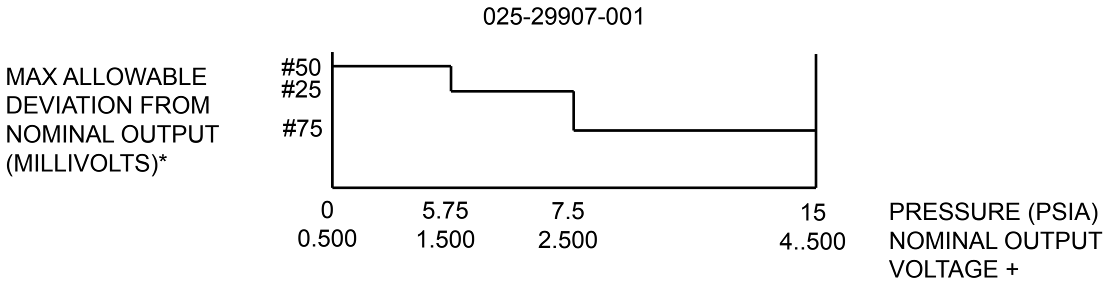

FIGURE 34 - GENERATOR SHELL PRESSURE (PT1)

The voltage output of each transducer can be measured with a voltmeter at the microboard. Measurement should be made from the transducer to ground (GND). For example, the output of the generator shell transducer would be read from microboard J8-21 (input signal) to J8-22 ground (GND).

For clarification purposes at the transducer, (see Figure 33) the output terminal corresponds (connects) with the input terminal on the microboard (this sometimes is the white wire). On above example this would be microboard J8-21. The common terminal on the transducer corresponds (connects) with the ground (GND) terminal on the microboard (sometimes this is the black wire). On above example this would be microboard J8-22. The positive power supply on the transducer terminal corresponds (connects) with the +5.0V terminal on the microboard (sometimes this the red wire). On the above example this would be microboard J8-11.

NOTE

Never rely on wire colors when troubleshooting; always trace them with your multimeter using a point-to-point continuity for ohms or some other similar method.

If any of the wires do not correspond to the correct microboard terminal the function of the transducer will be effected. In some cases the transducer will still output a voltage but it will not be correct.

Figure 34, 35 and 36 have two formulas to convert the output voltage to a pressure or vice versa, refer to the appropriate formula for either pressure or voltage. If a pressure is known, the transducer output can be predicted with the appropriate formula.

GENERATOR SHELL PRESSURE (PT1) (FIGURE 34)

A transducer output between +0.5 and 4.5VDC corresponds to 0 to15 PSIA pressure input. To calculate the transducer output voltage vs. a given input pressure. Use the following formula:

V= (P + 1.875) / 3.75 P = (3.75 x V) – 1.875

Where:

P = pressure in PSIA

V = Volts DC

STEAM SUPPLY PRESSURE (PT2) (STEAM UNITS ONLY) (FIGURE 35)

A transducer output between +0.5 and 4.5VDC corresponds to 10.0 to 40 PSIA pressure input. To calculate the transducer output voltage vs. a given input pressure. Use the following formula:

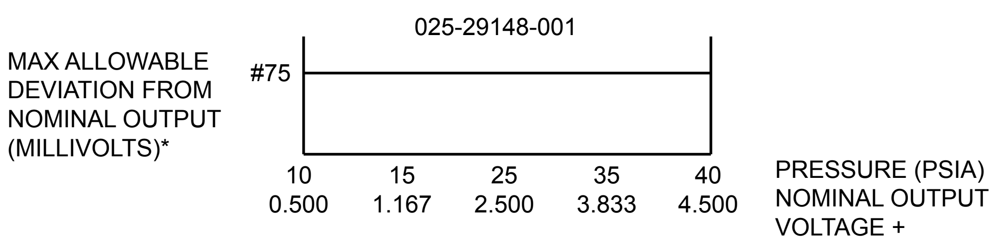

FIGURE 35 - STEAM SUPPLY PRESSURE (PT2) (STEAM UNITS ONLY)

V = (0.1333 x P) – 0.8333 P = (7.5 x V) + 6.25

Where:

P = pressure in PSIA

V = Volts DC

PURGE PUMP AND TANK PRESSURE (PT3 AND PT4) (FIGURE 36)

A transducer output between +0.5 and 4.5VDC corresponds to 0.25 to 4.25 PSIA pressure input. To calculate the transducer output voltage vs. a given input pressure. Use the following formula:

V = P in PSIA + 0.2

V = (P in mmHgA + 0.25) / 51.7

Where V =VDC

P in PSIA = V – 0.25

P mmHgA = (V – 0.25) 51.7

Two pressure transducers on the system (generator shell pressure and inlet steam pressure) sense pressures from elevated temperature areas. To isolate the transducer from the effect of high temperature, (thus accurate readings) a vilter is used. The vilter is a small capillary tube wound in a spring fashion. This arrangement also isolates the transducer from vibration, if any were present on an absorber unit. When troubleshooting a transducer with a vilter, always ensure the vilter opening to the transducer is free and clear of any dirt, debris or condensed liquids. Any obstruction could cause inaccurate readings or no readings at all.

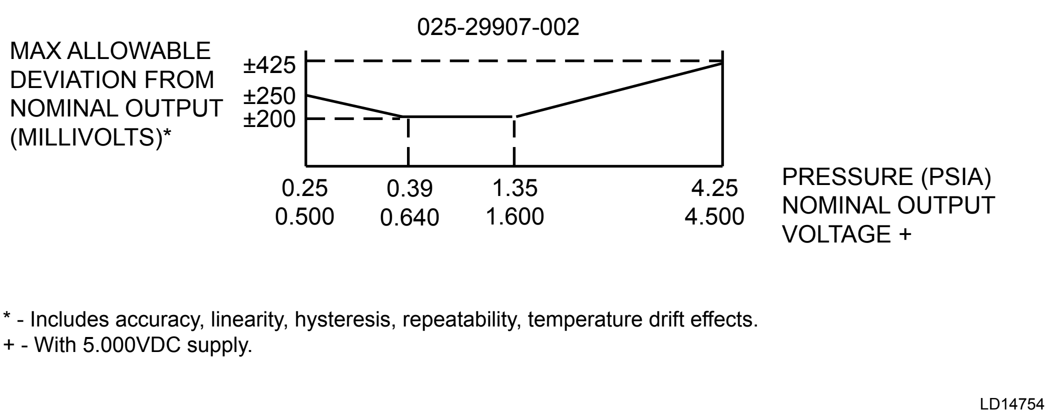

FIGURE 36 - PURGE PUMP AND TANK PRESSURE (PT3 AND PT4)

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SECTION 14 - TEMPERATURE THERMISTORS

INTRODUCTION

System temperatures are sensed by thermistors. There are two different thermistor types used to sense the various system temperatures on the Mod D, YIA's with OptiView (see below). Each type has its own part number and each type has sub-part numbers. Refer to the renewal parts book for the various part numbers and where they are located on the unit. Basically, higher temperature areas of the unit are sensed by 50,000 (50K) ohm thermistors while lower temperature areas are sensed by the 3000 (3K) ohm thermistors.

3K OHM THERMISTORS

- RT1, Leaving chilled water.
- RT4, Leaving condenser water.
- RT5, Entering condenser water.
- RT6, Entering chilled water.
- RT8, Refrigerant temperature.
- RT9, Refrigerant temperature leaving condenser.

50K OHM THERMISTORS

- RT2, Auto De-crystallization (ADC).
- RT3, Strong solution leaving the generator.
- RT7, Steam/hot water supply temperature.
- RT10, Strong solution temperature leaving the heat exchanger.

The 3K ohm thermistors are defined by the characteristic of being 3,000 ohms at 77°F (25°C). Similarly, the 50K ohm thermistors are 50,000 ohms at the same temperature. Both thermistors types vary their resistance as the sensed temperature varies. Both are negative temperature coefficient devices. That is, as the temperature increases, the resistance decreases. As the temperature decreases, the resistance increases.

The thermistors are connected to the microboard. A +5VDC supply voltage is applied to one side of the thermistor. The other side of the thermistor is connected to Ground through a series resistor on the microboard, thus forming a voltage divider network. The temperature applied to the thermistor determines the resistance value. The resistance value determines the amount of current that will flow through the thermistor and thus the voltage drop across it. The program reads this voltage at the input to the microboard and converts it to a temperature value.

Each thermistor is connected to the microboard with two wires. One wire supplies the +5VDC voltage and the other is the output of the thermistor. This output voltage can be measured with a voltmeter. Measurement should be made from the thermistor output to ground (GND). For example, the leaving chilled water temperature would be read from microboard J9-20 (output) to microboard TP1 (GND). To convert this voltage to a pressure, refer to the appropriate volts/ temperature chart as follows:

- Leaving Chilled Liquid Temperature – Table 8.
- Return Chilled Liquid Temperature – Table 9.
- Return and Leaving Condensing Liquid – Table 10.
- Evaporator and Leaving Condenser Refrigerant Temperature – Table 11.
- Strong Solution Leaving Heat Exchanger Temperature – Table 12.
- Auto De-crystallization Temperature – Table 13.
- Steam / Hot Water Supply Temperature and Strong Solution Leaving the Generator Temperature – Table 14.

If any of the displayed temperatures do not appear to be correct (verify with an infrared thermometer), make certain there is sufficient heat conductive compound in the thermo well. Some thermistors may have a layer of insulation over the well and sensor to ensure the ambient temperature does not affect the reading. If this is the case, make certain the insulation is tight fitting.

TABLE 8 - LEAVING CHILLED LIQUID TEMPERATURE

Temp (°F)	Temp (°C)	Vin
9.90	-12.28	1.4280
10.00	-12.22	1.4310
10.09	-12.17	1.4341
10.19	-12.12	1.4371
10.29	-12.06	1.4402
10.39	-12.01	1.4432
10.48	-11.96	1.4463
10.58	-11.90	1.4493
10.68	-11.85	1.4423
10.77	-11.80	1.4554
10.87	-11.74	1.4584
10.97	-11.68	1.4615
11.06	-11.63	1.4645
11.16	-11.58	1.4676
11.25	-11.53	1.4706
11.35	-11.47	1.4737
11.45	-11.42	1.4767
11.54	-11.37	1.4798
11.64	-11.31	1.4828
11.73	-11.26	1.4859
11.83	-11.21	1.4889
11.93	-11.15	1.4920
12.02	-11.10	1.4950
12.12	-11.05	1.4981
12.21	-11.00	1.5011
12.31	-10.94	1.5042
12.40	-10.89	1.5072
12.50	-10.83	1.5103
12.59	-10.78	1.5133
12.69	-10.73	1.5164
12.78	-10.68	1.5194
12.88	-10.62	1.5225
12.97	-10.57	1.5255
13.07	-10.52	1.5286
13.16	-10.47	1.5316
13.26	-10.41	1.5347
13.35	-10.36	1.5377
13.45	-10.31	1.5408
13.54	-10.26	1.5438
13.64	-10.20	1.5469
13.73	-10.15	1.5499
13.83	-10.10	1.5530
13.92	-10.05	1.5560
14.01	-10.00	1.5591
14.11	-9.94	1.5621
14.20	-9.89	1.5652
14.29	-9.84	1.5682
14.39	-9.78	1.5713
14.48	-9.73	1.5743
14.57	-9.68	1.5774
14.67	-9.63	1.5804
14.76	-9.58	1.5835
14.85	-9.53	1.5865
14.95	-9.47	1.5896
15.04	-9.42	1.5926

Temp (°F)	Temp (°C)	Vin
15.13	-9.37	1.5957
15.22	-9.32	1.5987
15.32	-9.27	1.6018
15.41	-9.22	1.6048
15.50	-9.17	1.6079
15.60	-9.11	1.6109
15.69	-9.06	1.6140
15.78	-9.01	1.6170
15.87	-8.96	1.6201
15.97	-8.91	1.6231
16.06	-8.86	1.6262
16.15	-8.81	1.6292
16.24	-8.76	1.6322
16.34	-8.70	1.6353
16.43	-8.65	1.6383
16.52	-8.60	1.6414
16.61	-8.55	1.6444
16.70	-8.50	1.6475
16.80	-8.45	1.6505
16.89	-8.40	1.6536
16.98	-8.35	1.6566
17.07	-8.30	1.6597
17.16	-8.25	1.6627
17.26	-8.19	1.6658
17.35	-8.14	1.6688
17.44	-8.09	1.6719
17.53	-8.04	1.6749
17.63	-7.98	1.6780
17.72	-7.93	1.6810
17.81	-7.88	1.6841
17.90	-7.83	1.6871
17.99	-7.78	1.6902
18.08	-7.73	1.6932
18.17	-7.68	1.6963
18.26	-7.63	1.6993
18.35	-7.58	1.7024
18.44	-7.53	1.7054
18.54	-7.48	1.7085
18.63	-7.43	1.7115
18.72	-7.38	1.7146
18.81	-7.33	1.7176
18.90	-7.28	1.7207
18.99	-7.23	1.7237
19.08	-7.18	1.7268
19.17	-7.13	1.7298
19.26	-7.08	1.7329
19.36	-7.02	1.7359
19.45	-6.97	1.7390
19.54	-6.92	1.7420
19.63	-6.87	1.7451
19.72	-6.82	1.7481
19.81	-6.77	1.7512
19.90	-6.72	1.7542
19.99	-6.67	1.7573
20.08	-6.62	1.7603

Temp (°F)	Temp (°C)	Vin
20.17	-6.57	1.7634
20.26	-6.52	1.7664
20.35	-6.47	1.7695
20.44	-6.42	1.7725
20.53	-6.37	1.7756
20.62	-6.32	1.7786
20.71	-6.27	1.7817
20.80	-6.22	1.7847
20.89	-6.17	1.7878
20.98	-6.12	1.7908
21.07	-6.07	1.7939
21.16	-6.02	1.7969
21.25	-5.97	1.8000
21.34	-5.92	1.8030
21.43	-5.87	1.8060
21.52	-5.82	1.8091
21.61	-5.77	1.8121
21.70	-5.72	1.8152
21.79	-5.67	1.8182
21.88	-5.62	1.8213
21.97	-5.57	1.8243
22.06	-5.52	1.8274
22.15	-5.47	1.8304
22.24	-5.42	1.8335
22.33	-5.37	1.8365
22.42	-5.32	1.8396
22.51	-5.27	1.8426
22.60	-5.22	1.8457
22.69	-5.17	1.8487
22.78	-5.12	1.8518
22.87	-5.07	1.8548
22.96	-5.02	1.8579
23.04	-4.98	1.8609
23.13	-4.93	1.8640
23.22	-4.88	1.8670
23.31	-4.83	1.8701
23.40	-4.78	1.8731
23.49	-4.73	1.8762
23.58	-4.68	1.8792
23.67	-4.63	1.8823
23.75	-4.58	1.8853
23.84	-4.53	1.8884
23.93	-4.48	1.8914
24.02	-4.43	1.8945
24.11	-4.38	1.8975
24.20	-4.33	1.9006
24.29	-4.28	1.9036
24.37	-4.24	1.9067
24.46	-4.19	1.9097
24.55	-4.14	1.9128
24.64	-4.09	1.9158
24.73	-4.04	1.9189
24.82	-3.99	1.9219
24.91	-3.94	1.9250
24.99	-3.89	1.9280

TABLE 8 – LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
25.08	-3.84	1.9311
25.17	-3.79	1.9341
25.26	-3.74	1.9372
25.35	-3.69	1.9402
25.43	-3.65	1.9433
25.52	-3.60	1.9463
25.61	-3.55	1.9494
25.70	-3.50	1.9524
25.79	-3.45	1.9555
25.87	-3.41	1.9585
25.96	-3.36	1.9616
26.05	-3.31	1.9646
26.14	-3.26	1.9677
26.23	-3.21	1.9707
26.31	-3.16	1.9738
26.40	-3.11	1.9768
26.49	-3.06	1.9798
26.58	-3.01	1.9829
26.67	-2.96	1.9859
26.76	-2.91	1.9890
26.84	-2.87	1.9920
26.93	-2.82	1.9951
27.02	-2.77	1.9981
27.11	-2.72	2.0012
27.20	-2.67	2.0042
27.28	-2.62	2.0073
27.37	-2.57	2.0103
27.46	-2.52	2.0134
27.55	-2.47	2.0164
27.64	-2.42	2.0195
27.73	-2.37	2.0225
27.81	-2.33	2.0256
27.90	-2.28	2.0286
27.99	-2.23	2.0317
28.08	-2.18	2.0347
28.17	-2.13	2.0378
28.25	-2.08	2.0408
28.34	-2.03	2.0439
28.43	-1.98	2.0469
28.52	-1.93	2.0500
28.61	-1.88	2.0530
28.69	-1.84	2.0561
28.78	-1.79	2.0591
28.87	-1.74	2.0622
28.96	-1.69	2.0652
29.04	-1.64	2.0683
29.13	-1.59	2.0713
29.22	-1.54	2.0744
29.31	-1.49	2.0774
29.39	-1.45	2.0805
29.48	-1.40	2.0835
29.57	1.35	2.0866
29.66	-1.30	2.0896
29.75	-1.25	2.0927
29.83	-1.21	2.0957

Temp (°F)	Temp (°C)	Vin
29.92	-1.16	2.0988
30.01	-1.11	2.1018
30.10	-1.06	2.1049
30.18	-1.01	2.1079
30.27	-0.96	2.1110
30.36	-0.91	2.1140
30.45	-0.86	2.1171
30.53	-0.82	2.1201
30.62	-0.77	2.1232
30.71	-0.72	2.1262
30.79	-0.67	2.1293
30.88	-0.62	2.1323
30.97	-0.57	2.1354
31.06	-0.52	2.1384
31.14	-0.48	2.1415
31.23	-0.43	2.1445
31.32	-0.38	2.1476
31.41	-0.33	2.1506
31.49	-0.28	2.1536
31.58	-0.23	2.1567
31.67	-0.18	2.1597
31.76	-0.13	2.1628
31.84	-0.09	2.1658
31.93	-0.04	2.1689
32.02	0.01	2.1719
32.10	0.06	2.1750
32.19	0.11	2.1780
32.28	0.16	2.1811
32.37	0.21	2.1841
32.45	0.25	2.1872
32.54	0.30	2.1902
32.63	0.35	2.1933
32.72	0.40	2.1963
32.81	0.45	2.1994
32.89	0.49	2.2024
32.98	0.54	2.2055
33.07	0.59	2.2085
33.16	0.64	2.2116
33.24	0.69	2.2146
33.33	0.74	2.2177
33.42	0.79	2.2207
33.51	0.84	2.2238
33.59	0.88	2.2268
33.68	0.93	2.2299
33.77	0.98	2.2329
33.86	1.03	2.2360
33.94	1.08	2.2390
34.03	1.13	2.2421
34.12	1.18	2.2451
34.21	1.23	2.2482
34.29	1.27	2.2512
34.38	1.32	2.2543
34.47	1.37	2.2573
34.56	1.42	2.2604
34.64	1.47	2.2634

Temp (°F)	Temp (°C)	Vin
34.73	1.52	2.2665
34.82	1.57	2.2695
34.91	1.62	2.2726
34.99	1.66	2.2756
35.08	1.71	2.2787
35.17	1.76	2.2817
35.26	1.81	2.2848
35.34	1.86	2.2878
35.43	1.91	2.2909
35.52	1.96	2.2939
35.51	1.95	2.2970
35.70	2.06	2.3000
35.78	2.10	2.3031
35.87	2.15	2.3061
35.96	2.20	2.3092
36.05	2.25	2.3122
36.13	2.29	2.3153
36.22	2.34	2.3183
36.31	2.39	2.3214
36.40	2.44	2.3244
36.48	2.49	2.3274
36.57	2.54	2.3305
36.66	2.59	2.3335
36.75	2.64	2.3366
36.83	2.68	2.3396
36.92	2.73	2.3427
37.01	2.78	2.3457
37.10	2.83	2.3488
37.18	2.88	2.3518
37.27	2.93	2.3549
37.36	2.98	2.3579
37.45	3.03	2.3610
37.54	3.08	2.3640
37.62	3.12	2.3671
37.71	3.17	2.3701
37.80	3.22	2.3732
37.89	3.27	2.3762
37.98	3.32	2.3793
38.07	3.37	2.3823
38.15	3.42	2.3854
38.24	3.47	2.3884
38.33	3.52	2.3915
38.42	3.57	2.3945
38.51	3.62	2.3976
38.60	3.67	2.4006
38.69	3.72	2.4037
38.77	3.76	2.4067
38.86	3.81	2.4098
38.95	3.86	2.4128
39.04	3.91	2.4159
39.13	3.96	2.4189
39.22	4.01	2.4220
39.30	4.06	2.4250
39.39	4.11	2.4281
39.48	4.16	2.4311

TABLE 8 – LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
39.57	4.21	2.4342
39.66	4.26	2.4372
39.74	4.30	2.4403
39.83	4.35	2.4433
39.92	4.40	2.4464
40.01	4.45	2.4494
40.10	4.50	2.4525
40.19	4.55	2.4555
40.27	4.59	2.4586
40.36	4.64	2.4616
40.45	4.69	2.4647
40.54	4.74	2.4677
40.63	4.79	2.4708
40.71	4.84	2.4738
40.80	4.89	2.4769
40.89	4.94	2.4799
40.98	4.99	2.4830
41.07	5.04	2.4860
41.16	5.09	2.4891
41.24	5.13	2.4921
41.33	5.18	2.4952
41.42	5.23	2.4982
41.51	5.28	2.5012
41.60	5.33	2.5043
41.69	5.38	2.5073
41.78	5.43	2.5104
41.87	5.48	2.5134
41.96	5.53	2.5165
42.05	5.58	2.5195
42.14	5.63	2.5226
42.23	5.68	2.5256
42.31	5.73	2.5287
42.40	5.78	2.5317
42.49	5.83	2.5348
42.58	5.88	2.5378
42.67	5.93	2.5409
42.76	5.98	2.5439
42.85	6.03	2.5470
42.94	6.08	2.5500
43.03	6.13	2.5531
43.12	6.18	2.5561
43.21	6.23	2.5592
43.30	6.28	2.5622
43.39	6.33	2.5653
43.48	6.38	2.5683
43.57	6.43	2.5714
43.65	6.47	2.5744
43.74	6.52	2.5775
43.83	6.57	2.5805
43.92	6.62	2.5836
44.01	6.67	2.5866
44.10	6.72	2.5897
44.19	6.77	2.5927
44.28	6.82	2.5958
44.37	6.87	2.5988
44.46	6.92	2.6019
44.55	6.97	2.6049
44.64	7.02	2.6080
44.73	7.07	2.6110
44.82	7.12	2.6141
44.91	7.17	2.6171
45.00	7.22	2.6202
45.09	7.27	2.6232
45.18	7.32	2.6263
45.27	7.37	2.6293
45.36	7.42	2.6324
45.46	7.48	2.6354
45.55	7.53	2.6385
45.64	7.58	2.6415
45.73	7.63	2.6446
45.82	7.68	2.6476
45.91	7.73	2.6507
46.00	7.78	2.6537
46.09	7.83	2.6568
46.18	7.88	2.6598
46.27	7.93	2.6629
46.36	7.98	2.6659
46.45	8.03	2.6690
46.55	8.08	2.6720
46.64	8.13	2.6751
46.73	8.18	2.6781
46.82	8.23	2.6811
46.91	8.28	2.6842
47.00	8.33	2.6872
47.09	8.38	2.6903
47.18	8.43	2.6933
47.27	8.48	2.6964
47.36	8.53	2.6994
47.45	8.58	2.7025
47.55	8.64	2.7055
47.64	8.69	2.7086
47.73	8.74	2.7116
47.82	8.79	2.7147
47.91	8.84	2.7177
48.00	8.89	2.7208
48.09	8.94	2.7238
48.18	8.99	2.7269
48.27	9.04	2.7299
48.37	9.10	2.7330
48.46	9.15	2.7360
48.55	9.20	2.7391
48.64	9.25	2.7421
48.74	9.30	2.7452
48.83	9.35	2.7482
48.92	9.40	2.7513
49.01	9.45	2.7543
49.11	9.51	2.7574
49.20	9.56	2.7604
49.29	9.61	2.7635
49.38	9.66	2.7665
49.48	9.71	2.7696
49.57	9.76	2.7726
49.66	9.81	2.7757
49.75	9.86	2.7787
49.84	9.91	2.7818
49.94	9.97	2.7848
50.03	10.02	2.7879
50.12	10.07	2.7909
50.22	10.12	2.7940
50.31	10.17	2.7970
50.40	10.22	2.8001
50.50	10.28	2.8031
50.59	10.33	2.8062
50.68	10.38	2.8092
50.78	10.43	2.8123
50.87	10.48	2.8153
50.96	10.53	2.8184
51.06	10.59	2.8214
51.15	10.64	2.8245
51.24	10.69	2.8275
51.34	10.75	2.8306
51.43	10.80	2.8336
51.52	10.85	2.8367
51.62	10.90	2.8397
51.71	10.95	2.8428
51.80	11.00	2.8458
51.90	11.06	2.8458
51.99	11.11	2.8519
52.09	11.16	2.8549
52.18	11.21	2.8580
52.28	11.27	2.8610
52.37	11.32	2.8641
52.46	11.37	2.8671
52.56	11.42	2.8702
52.65	11.47	2.8732
52.75	11.53	2.8763
52.84	11.58	2.8793
52.94	11.63	2.8824
53.03	11.68	2.8854
53.13	11.74	2.8885
53.22	11.79	2.8915
53.32	11.85	2.8946
53.41	11.90	2.8976
53.51	11.95	2.9007
53.60	12.00	2.9037
53.70	12.06	2.9068
53.79	12.11	2.9098
53.89	12.16	2.9129
53.98	12.21	2.9159
54.08	12.27	2.9190
54.17	12.32	2.9220
54.27	12.37	2.9251
54.36	12.42	2.9281
54.46	12.48	2.9312
54.55	12.53	2.9342

TABLE 8 – LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
54.65	12.58	2.9373
54.74	12.63	2.9403
54.84	12.69	2.9403
54.93	12.74	2.9464
55.03	12.80	2.9495
55.12	12.85	2.9525
55.22	12.90	2.9556
55.32	12.96	2.9586
55.41	13.01	2.9617
55.51	13.06	2.9647
55.61	13.12	2.9678
55.70	13.17	2.9708
55.80	13.22	2.9739
55.90	13.28	2.9769
56.00	13.33	2.9800
56.09	13.38	2.9830
56.19	13.44	2.9861
56.29	13.50	2.9891
56.39	13.55	2.9922
56.48	13.60	2.9952
56.58	13.66	2.9983
56.68	13.71	3.0013
56.78	13.77	3.0044
56.87	13.82	3.0074
56.97	13.87	3.0105
57.07	13.93	3.0135
57.17	13.98	3.0166
57.26	14.03	3.0196
57.36	14.09	3.0227
57.46	14.15	3.0257
57.56	14.20	3.0287
57.66	14.26	3.0318
57.76	14.31	3.0348
57.86	14.37	3.0379
57.96	14.42	3.0409
58.06	14.48	3.0440
58.15	14.53	3.0470
58.25	14.58	3.0501
58.35	14.64	3.0531
58.45	14.70	3.0562
58.55	14.75	3.0592
58.65	14.81	3.0623
58.75	14.86	3.0653
58.85	14.92	3.0684
58.95	14.97	3.0714
59.05	15.03	3.0745
59.15	15.08	3.0775
59.25	15.14	3.0806
59.35	15.20	3.0836
59.45	15.25	3.0867
59.55	15.31	3.0897
59.65	15.36	3.0928
59.75	15.42	3.0958
59.85	15.47	3.0989
59.95	15.53	3.1019

Temp (°F)	Temp (°C)	Vin
60.05	15.58	3.1050
60.15	15.64	3.1080
60.25	15.70	3.1111
60.36	15.76	3.1141
60.46	15.81	3.1172
60.56	15.87	3.1202
60.66	15.92	3.1233
60.76	15.98	3.1263
60.86	16.03	3.1294
60.96	16.09	3.1324
61.06	16.15	3.1355
61.17	16.21	3.1385
61.27	16.26	3.1416
61.37	16.32	3.1446
61.47	16.37	3.1477
61.57	16.43	3.1507
61.67	16.48	3.1538
61.78	16.55	3.1568
61.88	16.60	3.1599
61.98	16.66	3.1629
62.08	16.71	3.1660
62.18	16.77	3.1690
62.28	16.82	3.1721
62.39	16.88	3.1751
62.49	16.94	3.1782
62.59	17.00	3.1812
62.69	17.05	3.1843
62.80	17.11	3.1873
62.90	17.17	3.1904
63.01	17.23	3.1934
63.11	17.28	3.1965
63.22	17.35	3.1995
63.32	17.40	3.2025
63.43	17.46	3.2056
63.53	17.52	3.2086
63.63	17.57	3.2117
63.74	17.63	3.2147
63.84	17.69	3.2178
63.95	17.75	3.2208
64.05	17.81	3.2239
64.16	17.87	3.2269
64.26	17.92	3.2300
64.37	17.98	3.2330
64.47	18.04	3.2361
64.58	18.10	3.2391
64.68	18.16	3.2422
64.79	18.22	3.2452
64.90	18.28	3.2483
65.00	18.33	3.2513
65.11	18.40	3.2544
65.21	18.45	3.2574
65.32	18.51	3.2605
65.43	18.57	3.2635
65.53	18.63	3.2666
65.64	18.69	3.2696

Temp (°F)	Temp (°C)	Vin
65.75	18.75	3.2727
65.85	18.81	3.2757
65.96	18.87	3.2788
66.06	18.92	3.2818
66.17	18.98	3.2849
66.28	19.05	3.2879
66.39	19.11	3.2910
66.49	19.16	3.2940
66.60	19.22	3.2971
66.71	19.28	3.3001
66.82	19.35	3.3032
66.93	19.41	3.3062
67.03	19.46	3.3093
67.14	19.52	3.3123
67.25	19.58	3.3154
67.36	19.65	3.3184
67.47	19.71	3.3215
67.58	19.77	3.3245
67.68	19.82	3.3276
67.79	19.88	3.3306
67.90	19.95	3.3337
68.01	20.01	3.3367
68.12	20.07	3.3398
68.23	20.13	3.3428
68.34	20.19	3.3459
68.45	20.25	3.3489
68.56	20.31	3.3520
68.67	20.37	3.3550
68.78	20.43	3.3581
68.90	20.50	3.3611
69.01	20.56	3.3642
69.12	20.62	3.3672
69.23	20.68	3.3703
69.34	20.75	3.3733
69.45	20.81	3.3763
69.56	20.87	3.3794
69.67	20.93	3.3824
69.78	20.99	3.3855
69.89	21.05	3.3885
70.01	21.12	3.3916
70.12	21.18	3.3946
70.24	21.25	3.3977
70.35	21.31	3.4007
70.46	21.37	3.4038
70.58	21.44	3.4068
70.69	21.50	3.4099
70.80	21.56	3.4129
70.92	21.62	3.4160
71.03	21.69	3.4190
71.15	21.75	3.4221
71.26	21.81	3.4251
71.37	21.87	3.4282
71.49	21.94	3.4312
71.60	22.00	3.4343
71.72	22.07	3.4373

TABLE 8 – LEAVING CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
71.83	22.13	3.4404
71.95	22.20	3.4434
72.06	22.26	3.4465
72.18	22.32	3.4495
72.29	22.39	3.4526
72.41	22.45	3.4556
72.52	22.51	3.4587
72.64	22.58	3.4617
72.75	22.64	3.4648
72.87	22.71	3.4678
72.98	22.77	3.4709
73.10	22.84	3.4739
73.21	22.90	3.4770
73.33	22.96	3.4800
73.44	23.02	3.4831
73.56	23.09	3.4861
73.68	23.16	3.4892
73.80	23.22	3.4922
73.92	23.29	3.4953
74.04	23.36	3.4983
74.16	23.42	3.5014
74.28	23.49	3.5044
74.40	23.56	3.0575
74.52	23.62	3.5105
74.64	23.69	3.5136
74.75	23.75	3.5166
74.87	23.82	3.5197
74.99	23.89	3.5227
75.11	23.95	3.5258
75.23	24.02	3.5288
75.35	24.09	3.5319
75.47	24.15	3.5349
75.60	24.22	3.5380
75.72	24.29	3.5410
75.84	24.36	3.5441
75.96	24.42	3.5471
76.08	24.49	3.5501
76.20	24.56	3.5532
76.32	24.62	3.5562
76.44	24.69	3.5593
76.57	24.76	3.5623
76.69	24.83	3.5654
76.81	24.90	3.5684
76.93	24.96	3.5715
77.05	25.03	3.5745
77.18	25.10	3.5776
77.30	25.17	3.5806
77.43	25.24	3.5837
77.55	25.31	3.5867
77.68	25.38	3.5898
77.80	25.45	3.5928
77.93	25.52	3.5959
78.05	25.59	3.5989
78.17	25.65	3.6020
78.30	25.72	3.6050
78.42	25.79	3.6081
78.55	25.86	3.6111
78.67	25.93	3.6142
78.80	26.00	3.6172
78.93	26.07	3.6203
79.05	26.14	3.6233
79.18	26.21	3.6264
79.31	26.29	3.6294
79.44	26.36	3.6325
79.57	26.43	3.6355
79.69	26.50	3.6386
79.82	26.57	3.6416
79.95	26.64	3.6447
80.08	26.71	3.6477
80.20	26.78	3.6508
80.33	26.85	3.6538
80.46	26.92	3.6569
80.59	27.00	3.6599
80.72	27.07	3.6630
80.85	27.14	3.6660
80.98	27.21	3.6691
81.11	27.29	3.6721
81.24	27.36	3.6752
81.37	27.43	3.6782
81.50	27.50	3.6813
81.63	27.57	3.6843
81.76	27.65	3.6874
81.89	27.72	3.6904
82.02	27.79	3.6935
82.15	27.86	3.6965
82.28	27.94	3.6996
82.41	28.01	3.7026

TABLE 9 - RETURN CHILLED LIQUID TEMPERATURE

Temp (°F)	Temp (°C)	Vin
15.01	-9.44	1.5918
15.16	-9.36	1.5967
15.31	-9.27	1.6016
15.46	-9.19	1.6064
15.61	-9.11	1.6113
15.76	-9.02	1.6162
15.91	-8.94	1.6211
16.05	-8.86	1.6260
16.20	-8.78	1.6309
16.35	-8.70	1.6357
16.50	-8.61	1.6406
16.64	-8.53	1.6455
16.79	-8.45	1.6504
16.94	-8.37	1.6553
17.09	-8.28	1.6602
17.23	-8.21	1.6650
17.38	-8.12	1.6699
17.53	-8.04	1.6748
17.68	-7.96	1.6797
17.82	-7.88	1.6846
17.97	-7.80	1.6895
18.11	-7.72	1.6943
18.26	-7.63	1.6992
18.41	-7.55	1.7041
18.55	-7.47	1.7090
18.70	-7.39	1.7139
18.84	-7.31	1.7188
18.99	-7.23	1.7236
19.13	-7.15	1.7285
19.28	-7.07	1.7334
19.43	-6.98	1.7383
19.57	-6.91	1.7432
19.71	-6.83	1.7480
19.86	-6.74	1.7529
20.00	-6.67	1.7578
20.15	-6.58	1.7627
20.29	-6.51	1.7676
20.44	-6.42	1.7725
20.58	-6.34	1.7773
20.73	-6.26	1.7822
20.87	-6.18	1.7871
21.01	-6.11	1.7920
21.16	-6.02	1.7969
21.30	-5.94	1.8018
21.45	-5.86	1.8066
21.59	-5.78	1.8115
21.73	-5.71	1.8164
21.88	-5.62	1.8213
22.02	-5.54	1.8262
22.17	-5.46	1.8311
22.31	-5.38	1.8359
22.45	-5.31	1.8408
22.60	-5.22	1.8457
22.74	-5.14	1.8506
22.88	-5.07	1.8555

Temp (°F)	Temp (°C)	Vin
23.03	-4.98	1.8604
23.17	-4.91	1.8652
23.31	-4.83	1.8701
23.45	-4.75	1.8750
23.60	-4.67	1.8799
23.74	-4.59	1.8848
23.88	-4.51	1.8896
24.02	-4.43	1.8945
24.16	-4.36	1.8994
24.31	-4.27	1.9043
24.45	-4.19	1.9092
24.59	-4.12	1.9141
24.73	-4.04	1.9189
24.87	-3.96	1.9238
25.01	-3.88	1.9287
25.16	-3.80	1.9336
25.30	-3.72	1.9385
25.44	-3.64	1.9434
25.58	-3.57	1.9482
25.72	-3.49	1.9531
25.86	-3.41	1.9580
26.00	-3.33	1.9629
26.14	-3.26	1.9678
26.28	-3.18	1.9727
26.42	-3.10	1.9775
26.56	-3.02	1.9824
26.71	-2.94	1.9873
26.85	-2.86	1.9922
26.99	-2.78	1.9971
27.13	-2.71	2.0020
27.27	-2.63	2.0068
27.41	-2.55	2.0117
27.55	-2.47	2.0166
27.70	-2.39	2.0215
27.84	-2.31	2.0264
27.98	-2.23	2.0313
28.12	-2.16	2.0361
28.26	-2.08	2.0410
28.40	-2.00	2.0459
28.54	-1.92	2.5058
28.68	-1.84	2.0557
28.82	-1.77	2.0605
28.96	-1.69	2.0654
29.10	-1.61	2.0703
29.24	-1.53	2.0752
29.38	-1.46	2.0801
29.52	-1.38	2.0850
29.66	-1.30	2.0898
29.80	-1.22	2.0947
29.94	-1.14	2.0996
30.08	-1.07	2.1045
30.22	-0.99	2.1094
30.36	-0.91	2.1143
30.50	-0.83	2.1191
30.64	-0.76	2.1240

Temp (°F)	Temp (°C)	Vin
30.78	-0.68	2.1289
30.92	-0.60	2.1338
31.06	-0.52	2.1387
31.20	-0.44	2.1436
31.34	-0.37	2.1484
31.48	-0.29	2.1533
31.62	-0.21	2.1582
31.76	-0.13	2.1631
31.90	-0.06	2.1680
32.04	0.02	2.1729
32.18	0.10	2.1777
32.32	0.18	2.1826
32.46	0.26	2.1875
32.60	0.33	2.1924
32.74	0.41	2.1973
32.88	0.49	2.2021
33.02	0.57	2.2070
33.16	0.64	2.2119
33.30	0.72	2.2168
33.44	0.80	2.2217
33.59	0.88	2.2266
33.73	0.96	2.2314
33.87	1.04	2.2363
34.01	1.12	2.2412
34.15	1.19	2.2461
34.29	1.27	2.2510
34.43	1.35	2.2559
34.57	1.43	2.2607
34.71	1.51	2.2656
34.85	1.58	2.2705
34.99	1.66	2.2754
35.13	1.74	2.2803
35.27	1.82	2.2852
35.41	1.89	2.2900
35.55	1.97	2.2949
35.69	2.05	2.2998
35.83	2.13	2.3047
35.97	2.21	2.3096
36.11	2.28	2.3145
36.25	2.36	2.3193
36.39	2.44	2.3242
36.53	2.52	2.3291
36.67	2.59	2.3340
36.81	2.67	2.3389
36.95	2.75	2.3438
37.09	2.83	2.3486
37.23	2.91	2.3535
37.37	2.98	2.3584
37.51	3.06	2.3633
37.66	3.14	2.3682
37.80	3.22	2.3730
37.94	3.30	2.3779
38.08	3.38	2.3828
38.22	3.46	2.3877
38.36	3.53	2.3926

TABLE 9 – RETURN CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
38.51	3.62	2.3975
38.65	3.69	2.4023
38.79	3.77	2.4072
38.93	3.85	2.4121
39.07	3.93	2.4170
39.21	4.01	2.4219
39.35	4.08	2.4268
39.50	4.17	2.4316
39.64	4.24	2.4365
39.78	4.32	2.4414
39.92	4.40	2.4463
40.06	4.48	2.4512
40.20	4.56	2.4561
40.34	4.63	2.4609
40.48	4.71	2.4658
40.62	4.79	2.4707
40.76	4.87	2.4756
40.91	4.95	2.4805
41.05	5.03	2.4854
41.19	5.11	2.4902
41.33	5.18	2.4951
41.48	5.27	2.5000
41.62	5.34	2.5049
41.76	5.42	2.5098
41.90	5.50	2.5146
42.05	5.58	2.5195
42.19	5.66	2.5244
42.33	5.74	2.5293
42.48	5.82	2.5342
42.62	5.90	2.5391
42.76	5.98	2.5439
42.90	6.06	2.5488
43.05	6.14	2.5537
43.19	6.22	2.5586
43.33	6.29	2.5635
43.48	6.38	2.5684
43.62	6.46	2.5732
43.76	6.53	2.5781
43.91	6.62	2.5830
44.05	6.69	2.5879
44.19	6.77	2.5928
44.34	6.86	2.5977
44.48	6.93	2.6025
44.62	7.01	2.6074
44.77	7.10	2.6123
44.91	7.17	2.6172
45.06	7.26	2.6221
45.20	7.33	2.6270
45.35	7.42	2.6318
45.49	7.50	2.6367
45.64	7.58	2.6416
45.79	7.66	2.6465
45.93	7.74	2.6514
46.08	7.82	2.6563
46.22	7.90	2.6611
46.37	7.98	2.6660
46.51	8.06	2.6709
46.66	8.15	2.6758
46.80	8.22	2.6807
46.95	8.31	2.6855
47.09	8.38	2.6904
47.24	8.47	2.6953
47.39	8.55	2.7002
47.53	8.63	2.7051
47.68	8.71	2.7100
47.82	8.79	2.7148
47.97	8.87	2.7197
48.11	8.95	2.7246
48.26	9.03	2.7295
48.41	9.12	2.7344
48.56	9.20	2.7393
48.70	9.28	2.7441
48.85	9.36	2.7490
49.00	9.45	2.7539
49.15	9.53	2.7588
49.30	9.61	2.7637
49.44	9.69	2.7686
49.59	9.77	2.7734
49.74	9.86	2.7783
49.89	9.94	2.7832
50.04	10.02	2.7881
50.19	10.11	2.7930
50.34	10.19	2.7979
50.48	10.27	2.8027
50.63	10.35	2.8076
50.78	10.43	2.8125
50.93	10.52	2.8174
51.08	10.60	2.8223
51.23	10.68	2.8271
51.38	10.77	2.8320
51.53	10.85	2.8369
51.68	10.93	2.8418
51.83	11.02	2.8467
51.98	11.10	2.8516
52.13	11.18	2.8564
52.28	11.27	2.8613
52.44	11.36	2.8662
52.59	11.44	2.8711
52.74	11.52	2.8760
52.89	11.61	2.8809
53.04	11.69	2.8857
53.19	11.77	2.8906
53.34	11.86	2.8955
53.50	11.95	2.9004
53.65	12.03	2.9053
53.80	12.11	2.9102
53.95	12.20	2.0150
54.11	12.28	2.9199
54.26	12.37	2.9248
54.41	12.45	2.9297
54.56	12.53	2.9346
54.72	12.62	2.9395
54.87	12.71	2.9443
55.02	12.79	2.9492
55.17	12.87	2.9541
55.33	12.96	2.9590
55.48	13.05	2.9639
55.64	13.13	2.9688
55.79	13.22	2.9736
55.95	13.31	2.9785
56.11	13.40	2.9834
56.26	13.48	2.9983
56.42	13.57	2.9932
56.57	13.65	2.9980
56.73	13.74	3.0029
56.89	13.83	3.0078
57.04	13.91	3.0127
57.20	14.00	3.0176
57.36	14.09	3.0225
57.51	14.17	3.0273
57.67	14.26	3.0322
57.83	14.35	3.0371
57.99	14.44	3.0420
58.15	14.53	3.0469
58.31	14.62	3.0518
58.47	14.71	3.0566
58.62	14.79	3.0615
58.78	14.88	3.0664
58.94	14.97	3.0713
59.10	15.06	3.0762
59.26	15.15	3.0811
59.42	15.23	3.0859
59.59	15.33	3.0908
59.75	15.42	3.0957
59.91	15.51	3.1006
60.07	15.60	3.1055
60.23	15.68	3.1104
60.39	15.77	3.1152
60.55	15.86	3.1201
60.72	15.96	3.1250
60.88	16.05	3.1299
61.04	16.13	3.1348
61.20	16.22	3.1396
61.37	16.32	3.1445
61.53	16.41	3.1494
61.69	16.50	3.1543
61.85	16.58	3.1592
62.02	16.68	3.1641
62.18	16.77	3.1689
62.34	16.86	3.1738
62.51	16.95	3.1787
62.67	17.04	3.1836
62.84	17.13	3.1885
63.01	17.23	3.1934
63.17	17.32	3.1882

TABLE 9 – RETURN CHILLED LIQUID TEMPERATURE (CONT'D)

Temp (°F)	Temp (°C)	Vin
63.34	17.41	3.2031
63.51	17.51	3.2080
63.68	17.60	3.2129
63.84	17.69	3.2178
64.01	17.78	3.2227
64.18	17.88	3.2275
64.34	17.97	3.2324
64.51	18.06	3.2373
64.68	18.16	3.2422
64.85	18.25	3.2471
65.02	18.35	3.2520
65.19	18.44	3.2568
65.36	18.53	3.2617
65.53	18.63	3.2666
65.70	18.72	3.2715
65.87	18.82	3.2764
66.04	18.91	3.2813
66.21	19.01	3.2861
66.39	19.11	3.2910
66.56	19.20	3.2959
66.73	19.30	3.3008
66.91	19.40	3.3057
67.08	19.49	3.3105
67.25	19.58	3.3154
67.43	19.68	3.3203
67.60	19.78	3.3252
67.77	19.87	3.3301
67.95	19.97	3.3350
68.12	20.07	3.3398
68.30	20.17	3.3447
68.48	20.27	3.3496
68.66	20.37	3.3545
68.83	20.46	3.3594
69.01	20.56	3.3643
69.19	20.66	3.3691
69.36	20.76	3.3740
69.54	20.86	3.3789
69.72	20.96	3.3838
69.90	21.06	3.3887
70.08	21.16	3.3936
70.26	21.26	3.3984
70.45	21.36	3.4033
70.63	21.46	3.4082
70.81	21.56	3.4131
70.99	21.66	3.4180
71.17	21.76	3.4229
71.36	21.87	3.4277
71.54	21.97	3.4326
71.72	22.07	3.4375
71.91	22.17	3.4424
72.09	22.27	3.4473
72.28	22.38	3.4521
72.46	22.48	3.4570
72.64	22.58	3.4619
72.83	22.69	3.4668
73.01	22.79	3.4717
73.20	22.89	3.4766
73.38	22.99	3.4814
73.57	23.10	3.4863
73.76	23.20	3.4912
73.95	23.31	3.4961
74.14	23.41	3.5010
74.33	23.52	3.5059
74.53	23.63	3.5107
74.72	23.74	3.5156
74.91	23.84	3.5205
75.10	23.95	3.5254
75.29	24.05	3.5303
75.48	24.16	3.5352
75.68	24.27	3.5400
75.87	24.37	3.5449
76.07	24.49	3.5498
76.26	24.59	3.5547
76.46	24.70	3.5596
76.65	24.81	3.5645
76.84	24.91	3.5693
77.04	25.02	3.5742
77.24	25.14	3.5791
77.44	25.25	3.5840
77.64	25.36	3.5889
77.84	25.47	3.5938
78.04	25.58	3.5986
78.24	25.69	3.6035
78.44	25.80	3.6084
78.64	25.91	3.6133
78.84	26.02	3.6182
79.04	26.14	3.6230
79.25	26.25	3.6279
79.45	26.36	3.6328
79.66	26.48	3.6377
79.86	26.59	3.6426
80.07	26.71	3.6475
80.27	26.82	3.6523
80.48	26.94	3.6572
80.68	27.05	3.6621
80.89	27.16	3.6670
81.10	27.28	3.6719
81.31	27.40	3.6768
81.52	27.51	3.6816
81.72	27.62	3.6865
81.93	27.74	3.6914
82.14	27.86	3.6963
82.35	27.97	3.7012
82.56	28.09	3.7061

TABLE 10 - RETURN AND LEAVING CONDENSING LIQUID

Temp (°F)	Temp (°C)	Vin
40.12	4.51	1.8408
40.27	4.59	1.8457
40.42	4.68	1.8506
40.58	4.77	1.8555
40.73	4.85	1.8604
40.88	4.93	1.8652
41.03	5.02	1.8701
41.18	5.10	1.8750
41.33	5.18	1.8799
41.48	5.27	1.8848
41.64	5.36	1.8896
41.79	5.44	1.8945
41.94	5.52	1.8994
42.09	5.61	1.9043
42.24	5.69	1.9092
42.39	5.77	1.9141
42.54	5.86	1.9189
42.70	5.94	1.9238
42.85	6.03	1.9287
43.00	6.11	1.9336
43.15	6.19	1.9385
43.30	6.28	1.9434
43.45	6.36	1.9482
43.60	6.44	1.9531
43.75	6.53	1.9580
43.90	6.61	1.9629
44.05	6.69	1.9678
44.20	6.78	1.9727
44.35	6.86	1.9775
44.50	6.95	1.9824
44.65	7.03	1.9873
44.80	7.11	1.9922
44.95	7.20	1.9971
45.10	7.28	2.0020
45.25	7.36	2.0068
45.40	7.45	2.0117
45.55	7.53	2.0166
45.70	7.61	2.0215
45.85	7.70	2.0264
46.00	7.78	2.0313
46.15	7.86	2.0361
46.30	7.95	2.0410
46.45	8.03	2.0459
46.60	8.11	2.0508
46.75	8.20	2.0557
46.90	8.28	2.0605
47.05	8.36	2.0654
47.20	8.45	2.0703
47.35	8.53	2.0752
47.50	8.61	2.0801
47.65	8.70	2.0850
47.79	8.77	2.0898
47.94	8.86	2.0947
48.09	8.94	2.0996
48.24	9.02	2.1045
48.39	9.11	2.1094
48.54	9.19	2.1143
48.69	9.27	2.1191
48.84	9.36	2.1240
48.99	9.44	2.1289
49.14	9.52	2.1338
49.29	9.61	2.1387
49.44	9.69	2.1436
49.59	9.77	2.1484
49.74	9.86	2.1533
49.89	9.94	2.1582
50.03	10.02	2.1631
50.18	10.10	2.1680
50.33	10.18	2.1729
50.48	10.27	2.1777
50.63	10.35	2.1826
50.78	10.43	2.1875
50.93	10.52	2.1924
51.08	10.60	2.1973
51.23	10.68	2.2021
51.38	10.77	2.2070
51.53	10.85	2.2119
51.68	10.93	2.1268
51.83	11.02	2.2217
51.97	11.10	2.2266
52.12	11.18	2.2314
52.27	11.26	2.2363
52.42	11.35	2.2412
52.57	11.43	2.2461
52.72	11.51	2.2510
52.87	11.60	2.2559
53.02	11.68	2.2607
53.17	11.76	2.2656
53.32	11.85	2.2705
53.47	11.93	2.2754
53.62	12.01	2.2803
53.77	12.10	2.2852
53.92	12.18	2.2900
54.07	12.26	2.2949
54.21	12.34	2.2998
54.36	12.42	2.3047
54.51	12.51	2.3096
54.66	12.59	2.3145
54.81	12.67	2.3193
54.96	12.76	2.3242
55.11	12.84	2.3291
55.26	12.92	2.3340
55.41	13.01	2.3389
55.56	13.09	2.3438
55.71	13.17	2.3486
55.86	13.26	2.3535
56.01	13.34	2.3584
56.16	13.42	2.3633
56.31	13.51	2.3682
56.46	13.59	2.3730
56.61	13.67	2.3779
56.76	13.76	2.3828
56.91	13.84	2.3877
57.06	13.92	2.3926
57.21	14.01	2.3975
57.36	14.09	2.4023
57.51	14.17	2.4072
57.66	14.26	2.4121
57.81	14.34	2.4170
57.97	14.43	2.4219
58.12	14.51	2.4268
58.27	14.60	2.4316
58.42	14.68	2.4365
58.57	14.76	2.4414
58.72	14.85	2.4463
58.87	14.93	2.4512
59.02	15.01	2.4561
59.17	15.10	2.4609
59.33	15.18	2.4658
59.48	15.27	2.4707
59.63	15.35	2.4756
59.78	15.43	2.4805
59.93	15.52	2.4854
60.09	15.61	2.4902
60.24	15.69	2.4951
60.39	15.77	2.5000
60.54	15.86	2.5049
60.69	15.94	2.5098
60.85	16.03	2.5146
61.00	16.11	2.5195
61.15	16.20	2.5244
61.30	16.28	2.5293
61.45	16.36	2.5342
61.61	16.45	2.5391
61.76	16.53	2.5439
61.91	16.62	2.5488
62.06	16.70	2.5537
62.21	16.78	2.5586
62.36	16.87	2.5635
62.52	16.96	2.5684
62.67	17.04	2.5732
62.82	17.12	2.5781
62.98	17.21	2.5830
63.13	17.30	2.5879
63.29	17.38	2.5928
63.44	17.47	2.5977
63.59	17.55	2.6025
63.75	17.64	2.6074
63.90	17.72	2.6123
64.06	17.81	2.6172
64.21	17.90	2.6221
64.36	17.98	2.6270
64.52	18.07	2.6318
64.52	18.07	2.6367
64.83	18.24	2.6416

TABLE 10 – RETURN AND LEAVING CONDENSING LIQUID (CONT'D)

Temp (°F)	Temp (°C)	Vin
64.98	18.32	2.6465
65.14	18.41	2.6514
65.29	18.50	2.6563
65.45	18.58	2.6611
65.60	18.67	2.6660
65.76	18.76	2.6709
65.91	18.84	2.6758
66.07	18.93	2.6807
66.22	19.01	2.6855
66.38	19.10	2.6904
66.54	19.19	2.6953
66.69	19.27	2.7002
66.85	19.36	2.7051
66.00	18.89	2.7100
67.16	19.53	2.7148
67.32	19.62	2.7197
67.47	19.71	2.7246
67.63	19.80	2.7295
67.78	19.88	2.7344
67.94	19.97	2.7393
68.10	20.06	2.7441
68.26	20.15	2.7490
68.41	20.23	2.7539
68.57	20.32	2.7588
68.73	20.41	2.7637
68.89	20.50	2.7686
69.05	20.58	2.7734
69.21	20.67	2.7783
69.36	20.76	2.7832
69.52	20.85	2.7881
69.68	20.94	2.7930
69.84	21.02	2.7979
70.00	21.11	2.8027
70.16	21.20	2.8076
70.32	21.29	2.8125
70.48	21.38	2.8174
70.64	21.47	2.8223
70.80	21.56	2.8271
70.96	21.65	2.8320
71.12	21.74	2.8369
71.28	21.82	2.8418
71.44	21.91	2.8467
71.61	22.01	2.8516
71.77	22.10	2.8564
71.93	22.19	2.8613
72.09	22.27	2.8662
72.25	22.36	2.8711
72.41	22.45	2.8760
72.57	22.54	2.8809
72.73	22.63	2.8857
72.89	22.72	2.8906
73.05	22.81	2.8955
73.22	22.90	2.9004
73.38	22.99	2.9053
73.54	23.08	2.9102
73.71	23.17	2.9150
73.87	23.26	2.9199
74.04	23.36	2.9248
74.20	23.45	2.9297
74.37	23.54	2.9346
74.53	23.63	2.9395
74.70	23.72	2.9443
74.86	23.81	2.9492
75.03	23.91	2.9541
75.19	24.00	2.9590
75.36	24.09	2.9639
75.52	24.18	2.9688
75.69	24.27	2.9736
75.85	24.36	2.9785
76.02	24.46	2.9834
76.19	24.55	2.9883
76.35	24.64	2.9932
76.52	24.74	2.9980
76.69	24.83	3.0029
76.85	24.92	3.0078
77.02	25.01	3.0127
77.19	25.11	3.0176
77.36	25.20	3.0225
77.53	25.30	3.0273
77.70	25.39	3.0322
77.86	25.48	3.0371
78.03	25.57	3.0420
78.20	25.67	3.0469
78.37	25.76	3.0518
78.54	25.86	3.0566
78.71	25.95	3.0615
78.88	26.05	3.0664
79.05	26.14	3.0713
79.22	26.24	3.0762
79.40	26.34	3.0811
79.57	26.43	3.0859
79.74	26.52	3.0908
79.91	26.62	3.0957
80.08	26.71	3.1006
80.26	26.81	3.1055
80.43	26.91	3.1104
80.60	27.00	3.1152
80.77	27.10	3.1201
80.95	27.20	3.1250
81.12	27.29	3.1299
81.29	27.39	3.1348
81.47	27.49	3.1396
81.64	27.58	3.1445
81.81	27.67	3.1494
81.99	27.77	3.1543
82.16	27.87	3.1592
82.33	27.96	3.1641
82.51	28.06	3.1689
82.69	28.16	3.1738
82.86	28.26	3.1787
83.04	28.36	3.1836
83.22	28.46	3.1885
83.39	28.55	3.1934
83.57	28.65	3.1982
83.75	28.75	3.2031
83.93	28.85	3.2080
84.10	28.95	3.2129
84.28	29.05	3.2178
84.46	29.15	3.2227
84.65	29.25	3.2275
84.83	29.35	3.2324
85.01	29.45	3.2373
85.19	29.55	3.2422
85.37	29.65	3.2471
85.55	29.75	3.2520
85.73	29.85	3.2568
85.92	29.96	3.2617
86.10	30.06	3.2666
86.28	30.16	3.2715
86.47	30.26	3.2764
86.65	30.36	3.2813
86.84	30.47	3.2861
87.02	30.57	3.2910
87.21	30.67	3.2959
87.39	30.77	3.3008
87.58	30.88	3.3057
87.76	30.98	3.3105
87.95	31.09	3.3154
88.13	31.19	3.3203
88.32	31.29	3.3252
88.51	31.40	3.3301
88.70	31.50	3.3350
88.88	31.60	3.3398
89.07	31.71	3.3447
89.26	31.81	3.3496
89.44	31.91	3.3545
89.63	32.02	3.3594
89.82	32.12	3.3643
90.01	32.23	3.3691
90.20	32.34	3.3740
90.39	32.44	3.3789
90.59	32.55	3.3838
90.78	32.66	3.3887
90.97	32.76	3.3936
91.16	32.87	3.3984
91.35	32.97	3.4033
91.54	33.08	3.4082
91.74	33.19	3.4131
91.93	33.30	3.4180
92.13	33.41	3.4229
92.32	33.51	3.4277
92.52	33.62	3.4326
92.72	33.74	3.4375
92.91	33.84	3.4424
93.11	33.95	3.4473

TABLE 10 – RETURN AND LEAVING CONDENSING LIQUID (CONT'D)

Temp (°F)	Temp (°C)	Vin
93.31	34.06	3.4521
93.51	34.17	3.4570
93.70	34.28	3.4619
93.90	34.39	3.4668
94.10	34.50	3.4717
94.30	34.61	3.4766
94.50	34.73	3.4814
94.70	34.84	3.4863
94.90	34.95	3.4912
95.11	35.06	3.4961
95.31	35.18	3.5010
95.52	35.29	3.5059
95.72	35.40	3.5107
95.93	35.52	3.5156
96.13	35.63	3.5205
96.34	35.75	3.5254
96.54	35.86	3.5303
96.75	35.98	3.5352
96.96	36.09	3.5400
97.17	36.21	3.5449
97.38	36.33	3.5498
97.59	36.44	3.5547
97.80	36.56	3.5596
98.01	36.68	3.5645
98.22	36.79	3.5693
98.43	36.91	3.5742
98.64	37.03	3.5791
98.86	37.15	3.5840
99.07	37.26	3.5889
99.29	37.39	3.5938
99.50	37.50	3.5986
99.71	37.62	3.6035
99.93	37.74	3.6084
100.14	37.86	3.6133
100.36	37.98	3.6182
100.58	38.10	3.6230
100.79	38.22	3.6279
101.01	38.34	3.6328
101.23	38.46	3.6377
101.45	38.59	3.6426
101.67	38.71	3.6475
101.89	38.83	3.6523
102.11	38.95	3.6572
102.33	39.08	3.6621
102.55	39.20	3.6670
102.78	39.33	3.6719
103.00	39.45	3.6768
103.22	39.57	3.6816
103.45	39.70	3.6865
103.67	39.82	3.6914
103.89	39.94	3.6963
104.12	40.07	3.7012
104.35	40.20	3.7061
104.58	40.33	3.7109
104.81	40.45	3.7158
105.04	40.58	3.7207
105.27	40.71	3.7256
105.50	40.84	3.7305
105.73	40.96	3.7354
105.96	41.09	3.7402
106.20	41.23	3.7451
106.44	41.36	3.7500
106.67	41.49	3.7549
106.91	41.62	3.7598
107.14	41.75	3.7646
107.38	41.88	3.7695
107.62	42.01	3.7744
107.86	42.15	3.7793
108.11	42.29	3.7842
108.35	42.42	3.7891
108.59	42.55	3.7939
108.84	42.69	3.7988
109.08	42.83	3.8037
109.32	42.96	3.8086
109.57	43.10	3.8135
109.82	43.24	3.8184
110.06	43.37	3.8232
110.31	43.51	3.8281
110.56	43.65	3.8330
110.81	43.79	3.8379
111.05	43.92	3.8328
111.31	44.06	3.8477
111.36	44.09	3.8525
111.82	44.35	3.8574
112.08	44.49	3.8623
112.34	44.64	3.8672
112.59	44.78	3.8721
112.85	44.92	3.8770
113.11	45.06	3.8818
113.37	45.21	3.8867
113.63	45.35	3.8916
113.88	45.49	3.8965
114.14	45.64	3.9014

TABLE 11 - EVAPORATOR AND LEAVING CONDENSER REFRIGERANT TEMPERATURE

Temp (°F)	Temp (°C)	Vin
0.04	-17.76	1.0107
3.02	-16.1	1.0889
5.87	-14.52	1.167
8.63	-12.98	1.2451
11.3	-11.5	1.3232
13.89	-10.06	1.4014
16.42	-8.66	1.4795
18.89	-7.28	1.5576
21.32	-5.93	1.6357
23.71	-4.61	1.7139
26.07	-3.29	1.792
28.4	-2	1.8701
30.71	-0.72	1.9482
33.01	0.56	2.0264
35.3	1.83	2.1045
37.58	3.1	2.1826
39.87	4.37	2.2607
42.15	5.64	2.3389
44.45	6.92	2.417
46.76	8.2	2.4951
49.09	9.49	2.5732
51.44	10.8	2.6514
53.82	12.12	2.7295
56.23	13.46	2.8076
58.69	14.83	2.8857
61.19	16.22	2.9639
63.74	17.63	3.042
66.35	19.08	3.1201
69.02	20.57	3.1982
71.78	22.1	3.2764
74.62	23.68	3.3545
77.56	25.31	3.4326
80.61	27.01	3.5107
83.77	28.76	3.5889
87.1	30.61	3.667
90.57	32.54	3.7451
94.23	34.57	3.8232
98.13	36.74	3.9014
102.28	39.04	3.9795
106.72	41.51	4.0576
111.53	44.18	4.1357
116.76	47.09	4.2139
122.56	50.31	4.292
129.02	53.9	4.3701
136.37	57.98	4.4482

TABLE 12 - STRONG SOLUTION LEAVING HEAT EXCHANGER TEMPERATURE (RT10)

Temp (°F)	Temp (°C)	Vin
50.09	10.05	0.3064
59.37	15.21	0.3845
67.28	19.6	0.4626
74.24	23.47	0.5408
80.52	26.96	0.6189
86.24	30.13	0.697
91.55	33.08	0.7751
96.51	35.84	0.8533
101.19	38.44	0.9314
105.66	40.92	1.0095
109.94	43.29	1.0876
114.03	45.57	1.1658
117.99	47.77	1.2439
121.85	49.92	1.322
125.58	51.99	1.4001
129.25	54.03	1.4783
132.83	56.02	1.5564
136.38	57.99	1.6345
139.84	59.91	1.7126
143.29	61.83	1.7908
146.72	63.73	1.8689
150.11	65.62	1.947
153.46	67.48	2.0251
156.84	69.36	2.1033
160.24	71.24	2.1814
163.63	73.13	2.2595
167.03	75.02	2.3376
170.44	76.91	2.4158

TABLE 13 - AUTO DE-CRYSTALLIZATION TEMPERATURE (RT2)

Temp (°F)	Temp (°C)	Vin
98.01	36.67	0.99
102.23	39.02	1.0681
106.29	41.27	1.1462
110.21	43.45	1.2244
114	45.56	1.3025
117.69	47.61	1.3806
121.31	49.62	1.4587
124.83	51.57	1.5369
128.3	53.5	1.615
131.71	55.39	1.6931
135.09	57.27	1.7712
138.44	59.13	1.8494
141.76	60.98	1.9275
145.08	62.82	2.0056
148.38	64.66	2.0837
151.65	66.47	2.1619
154.94	68.3	2.24
158.26	70.14	2.3181
161.62	72.01	2.3962
164.99	73.88	2.4744
168.36	75.76	2.5525
171.79	77.66	2.6306
175.27	79.59	2.7087
178.82	81.57	2.7869
182.39	83.55	2.865
186.05	85.58	2.9431
189.8	87.67	3.0212
193.64	89.8	3.0994
197.58	91.99	3.1775
201.64	94.24	3.2556
205.83	96.57	3.3337
210.16	98.98	3.4119
214.69	101.49	3.49
219.4	104.11	3.5681
224.32	106.84	3.6462

TABLE 14 - STEAM / HOT WATER SUPPLY TEMPERATURE (RT7) AND STRONG SOLUTION LEAVING THE GENERATOR TEMPERATURE (RT3)

Temp (°F)	Temp (°C)	Vin
90	32.22	1.0535
93.94	34.41	1.1316
97.73	36.52	1.2097
101.41	38.56	1.2878
104.99	40.55	1.366
108.49	42.49	1.4441
111.9	44.39	1.5222
115.25	46.25	1.6003
118.56	48.09	1.6785
121.83	49.91	1.7566
125.04	51.69	1.8347
128.24	53.47	1.9128
131.41	55.23	1.991
134.58	56.99	2.0691
137.76	58.76	2.1472
140.91	60.51	2.2253
144.1	62.28	2.3035
147.3	64.06	2.3816
150.51	65.84	2.4597
153.72	67.62	2.5378
157.01	69.45	2.616
160.35	71.31	2.6941
163.74	73.19	2.7722
167.17	75.09	2.8503
170.66	77.03	2.9285
174.23	79.02	3.0066
177.9	81.06	3.0847

Temp (°F)	Temp (°C)	Vin
181.64	83.13	3.1628
185.51	85.28	3.241
189.5	87.5	3.3191
193.64	89.8	3.3972
197.92	92.18	3.4753
202.39	94.66	3.5535
207.05	97.25	3.6316
211.95	99.97	3.7097
217.14	102.86	3.7878
222.62	105.9	30866
228.47	109.15	3.9441
234.72	112.62	4.0222
241.48	116.38	4.1003
248.89	120.49	4.1785
257.09	125.05	4.2566
266.25	130.14	4.3347
276.52	135.84	4.4128
288.38	142.43	4.491
302.46	150.26	4.5691
319.8	159.89	4.6472
342.12	172.29	4.7253

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SECTION 15 - REMOTE SETPOINTS

INTRODUCTION

Refer to YORK/Johnson Controls form 155.21-W2 for additional information on the following:

There are three different operating modes that can be selected at the keypad for REMOTE mode. “Analog”, “Digital” and “ISN”. The OptiView Control Center is capable of receiving a remote command from an Energy Management System (EMS). These commands are as follows:

- Remote Stop (contacts)
- Remote Start (contacts)
- Remote Steam/Hot Water Limit setpoint (analog, digital, or PWM)
- Remote Leaving Chilled Liquid Temperature setpoint (analog, digital, or PWM)

The analog remote signal must be in the form of a 0 to 10VDC input. The digital remote signal must be in the form of a Pulse Width Modulation (PWM) signal via 1 to 11 second relay contact closure. The ISN REMOTE mode is via RS-232 serial port E-Link Gateway.

Microboard jumpers JP23 and JP24 must be positioned appropriately to receive the analog signal. Refer to Table 2, “Microboard Program Jumpers” in this document and explanation below for required configurations.

The PWM signal is in the form of a 1 to 11 second relay contact closure that applies 115VAC to the I/O board TB4-19 (Leaving Chilled Water Temperature) and TB4-20 (Remote Steam/Hot Water Limit) for 1 to 11 seconds. The source of the 115VAC is I/O board TB4-1 (see Figure 38).

The PWM input signal must be received at a frequency of at least once every 30 minutes to maintain the setpoint to the desired value. If the setpoint is not received within this time interval, the program assumes the remote device is defective and defaults back to the 100% value for the steam/hot water limit setpoint or in the case of the Remote Leaving Chilled Liquid Temperature, the local setpoint (base) value.

The microboard COM 4B RS-232 serial port (J2) receives the setpoints in the serial data from the E-Link Gateway located inside the OptiView control panel enclosure. The E-Link Gateway receives setpoints from remote external devices and transfers them to the microboard.

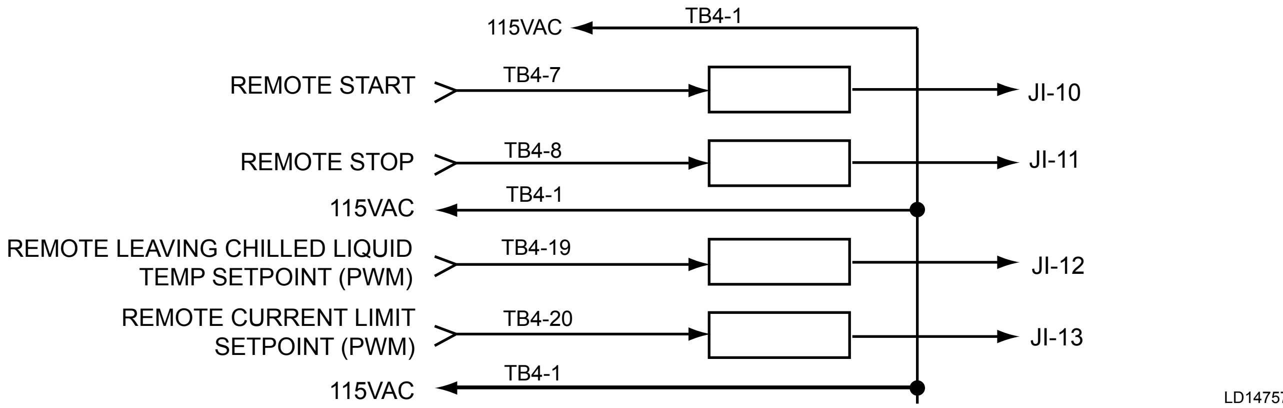

FIGURE 37 - REMOTE LEAVING CHILLED LIQUID AND REMOTE CURRENT LIMIT SETPOINTS (PWM)

CAUTION

Important! The signal type used for Remote Leaving Chilled Liquid Temperature setpoint and Remote Steam/Hot Water Limit setpoint must be the same. Do NOT use an analog signal for one and PMM for another.

REMOTE STEAM/HOT WATER LIMIT SETPOINT (CONTROL SIGNAL - ANALOG, 0 TO 10VDC)

The Remote Steam/Hot Water Limit setpoint limits the control valve position which in turn controls the top end capacity of the unit. The control valve can be remotely set between the ranges of 10% to 100% by supplying (by others) a 0 to 10VDC signal to the OptiView Control Center.

NOTE

Any locally programmed settings will take precedence over the remote settings. For example, if the maximum load limit value is programmed locally for 80% and the remote value is set at 100%, the unit will be limited at the 80% valve position.

The OptiView Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate SIGNAL SOURCE mode must be selected. It is recommended that a qualified YORK/Johnson Controls service technician accomplish this in the LOCAL/SERVICE mode on the OptiView Control Center. ANALOG mode must be selected when using 0 to10VDC.
- Microboard program jumper JP23 must be removed to accept the analog signal. It is recommended that a qualified YORK/Johnson Controls service technician position this jumper.

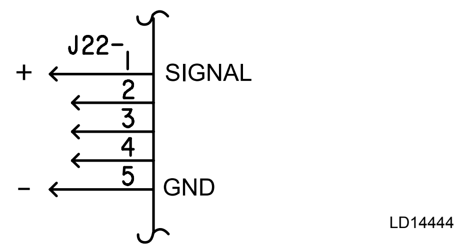

FIGURE 38 - REMOTE STEAM / HOT WATER LIMIT SETPOINT WITH 0 TO 10VDC SIGNAL

As shown in Figure 38, connect the input to microboard J22-1 (signal) and J22-5 (ground). The setpoint varies valve position linearly from 100% to 10% as the input varies from 0 to 10VDC. Calculate the setpoint for various inputs as follows:

SETPOINT (%) = 100 – (VDC x 9)

Example, if the input is 3VDC, the setpoint would be set to 73% as follows:

SETPOINT (%) = 100 - (3 x 9) = 100 - 27 = 73%

REMOTE STEAM/HOT WATER LIMIT SETPOINT (CONTROL SIGNAL - DIGITAL, PWM)

The Remote Steam/Hot Water Limit setpoint limits the control valve position which in turn controls the top end capacity of the unit. The control valve can be remotely set between the range of 10% to 100% by supplying (by others) a 1 to 11 second PWM relay contact closure. The OptiView Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate SIGNAL SOURCE mode must be selected. It is recommended that a qualified YORK/Johnson Controls service technician accomplish this in the LOCAL/SERVICE mode on the OptiView Control Center. DIGITAL mode must be selected when using a 1- 11 PWM signal with contacts rated 5mA @ 115VAC.

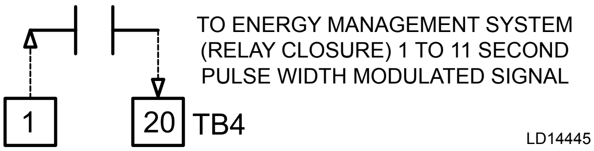

FIGURE 39 - REMOTE STEAM / HOT WATER LIMIT SETPOINT WITH PWM SIGNAL

As shown in Figure 39, 115VAC is applied to the I/O board TB4-20 for 1 to 11 seconds. Connect dry closure relay contacts between I/O board TB4-20 (signal) and TB4-1 (115VAC). The setpoint varies valve position linearly from 100% to 10% as the relay contacts closure time changes from 1 to 11 seconds. The pulse time is receivable in 0.1 second time periods (0.1 seconds equals 1%). The relay contact should close for 1 to 11 seconds at least once every 30 minutes to maintain the setpoint to the desired value. If a 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to 100%. Calculate the setpoint as shown below:

PWM % = (seconds – 1) x 10

Therefore, a 2 second pulse equals 10%, 3 sec equals 20%, 4 sec equals 30% up to 11 sec which will equal 100%

Calculate the setpoint for various pulse widths as follows:

SETPOINT (%) = 100 – (PWM% x 0.9)

Example: if the PWM is 5 seconds, the setpoint would be set to as follows:

PWM % = (5 – 1) x 10 = 40%

SETPOINT (%) = 100 – (40 x .9) = 100 – 36 = 64%

The maximum rate at which the OptiView control panel will accept Remote Steam/Hot Water Limit setpoint pulses is one pulse each 60 seconds. Following a remote setpoint pulse, the Steam/Hot Water Limit setpoint changes to the value corresponding to the pulse-width. If a second reset pulse is not received within 30 minutes of the first pulse, the Steam/Hot Water setpoint reverts to the programmed maximum load limit setpoint. If the Pulldown Demand Limit has been programmed and the unit was started and has run less than the Pulldown Demand Limit Timer setpoint, then the unit will be steam/hot water limited by the lower of the Pulldown Demand Limit and the Remote Steam/Hot Water Limit. The Pulldown Demand Limit will automatically transfer control of Steam/Hot Water Limit function to "Remote" at the end of its programmed timed cycle with the unit in the REMOTE mode.

REMOTE LEAVING CHILLED LIQUID TEMPERATURE SETPOINT

Remote Leaving Chiller Liquid Temperature setpoint allows an operator to change the Leaving Chilled Liquid Temperature from a remote location. Before this can be accomplished the Remote Reset Range must be setup locally on the OptiView panel by a qualified YORK/Johnson Controls service technician. This parameter is the maximum allowable offset of the leaving chilled liquid setpoint when operating in the Remote mode. This offset is either 10°F or 20°F as programmed. If not programmed, the default value is 20°F. This value is added to the operator programmed Leaving Chilled Liquid Temperature setpoint (base) and the sum equal the temperature range in which the setpoint can be reset. For example, if the operator has locally programmed a setpoint for 44°F (base) into the OptiView Control Center, and the Remote Reset Range is programmed to be 10°F, then the energy management system can remotely reset the setpoint over the range of 44°F to 54°F (44 + 10 = 54).

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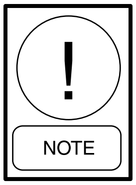

The Remote Leaving Chilled Liquid Temperature setpoint cannot be set lower than the base setpoint value. The base or locally programmed setpoint is always shown in the Local LCHLT setpoint box in the lower left corner of the EVAPORATOR / ABSORBER screen.

REMOTE LEAVING CHILLED LIQUID TEMPERATURE SETPOINT (CONTROL SIGNAL, ANALOG, 0 TO 10VDC)

Remote Leaving Chilled Liquid Temperature setpoint can be accomplished by supplying (by others) a constant 0 to 10VDC signal to the OptiView Control Center. The Leaving Chilled Liquid Temperature setpoint is programmable over the range of 40°F to 97°F (if Remote Reset Range is 20) otherwise 87°F will be the top end of the range. The OptiView Control Center must be configured appropriately to accept the desired signal as follows:

- The appropriate SIGNAL SOURCE mode must be selected. It is recommended that a qualified YORK/Johnson Controls service technician accomplish this in the LOCAL/SERVICE mode on the OptiView Control Center. ANALOG mode must be selected when using a 0-10 voltage.
- Microboard program jumper JP24 must be removed to accept the analog signal. It is recommended that a qualified YORK/Johnson Controls service technician position this jumper.

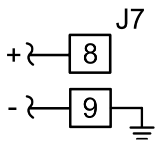

FIGURE 40 - EXTERNAL SIGNAL FOR REFRIGERATION UNIT FAILURE

As shown in Figure 40, connect the input to microboard J7-8 (signal) and J7-9 (ground). The leaving chilled water can then be changed remotely. It cannot be changed lower than the locally set (base) setpoint nor can it go any higher than the remote reset range value. If the OptiView panel is taken out of ANALOG mode for any reason, the setpoint will revert back to the locally programmed setpoint.

REMOTE LEAVING CHILLED LIQUID TEMPERATURE SETPOINT (CONTROL SIGNAL - DIGITAL, PWM)

The pulse width modulation input is in the form of a 1 to 11 second contact closure that applies 115VAC across I/O board terminals TB4-1 (115VAC) and TB4-19 (input) for 1 to 11 seconds. A contact closure time (pulse width) of 1 second produces a 0°F offset. An 11 second closure produces the maximum allowed offset (10 to 20°F) above the local setpoint value. The relay contacts should close for 1 to 11 seconds at least once every 30 minutes to maintain the setpoint to the desired value. If the 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to the local setpoint value. The maximum rate at which the OptiView control panel will accept a remote PWM signal is one pulse each 60 seconds. The OptiView Control Center must be configured appropriately to accept the desired signal.

The appropriate SIGNAL SOURCE mode must be selected. It is recommended that a qualified YORK/Johnson Controls service technician accomplish this in the LOCAL/SERVICE mode on the OptiView Control Center. DIGITAL mode must be selected when using a 1 to 11 pulse width modulated signal with contacts rated 5mA @ 115VAC. Use the following formula to determine setpoint:

$$\frac{a = b \times c}{10} \quad \text{then} \quad d = e + a$$

Where:

a = Offset (°F)

b = Pulse Width in Seconds

c = Remote Reset Temperature. Range

d = Setpoint (°F)

e = Local Setpoint

For example, if the relay contacts close for 5 seconds and the Remote Reset Range setpoint is for 10°F, and the local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F; the setpoint would be set to 44°F (see explanation below).

Offset (°F) = (5-1) (10) = (4) (10) / 10 = 40/10 = 4°F

Setpoint (°F) = 40 + 4 = 44°F

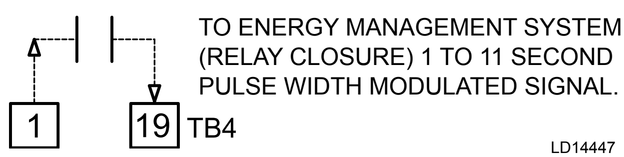

FIGURE 41 - REMOTE LEAVING CHILLED LIQUID TEMPERATURE SETPOINT WITH PWM SIGNAL

SECTION 16 - STEAM / HOT WATER VALVE CONTROL

INTRODUCTION

In March 2004, the design and make of the control valves supplied by the factory on new units (modification level “C”, analog valves) were changed; this document just covers those valves. If your control valve is of the older type (digital), refer to Service manual 155.16-M3.

The control valve is used to regulate the amount of heat input (steam/hot water) to the generator section of the unit. Each valve is chosen for the unit’s duty rating and part load capabilities. Because of this, it is very important to make sure the valve is correctly sized and is working properly in every application and loading parameter. Steam and Hot Water valves are sized by the factory for each new machine depending on the available heat input, inherent flow characteristic of the valve, duty of the unit, and the customer’s supply inlet piping system.

Johnson Controls offers two categories of valves:

- Butterfly
- Cage / Globe (2-way and 3-way)

Butterfly Valves

These valves are basically always used for steam applications. Generally, butterfly valves have a lower pressure drop than the cage/globe valves. Because of this, butterfly valves are a good selection when the available steam supply is at a low pressure. However, butterfly valves usually do not have good flow characteristics at lower part loads. Butterfly valves supplied by the factory are of the non-fail safe design, in other words they will stay in whatever position they happen to be in if a power failure occurs.

Cage/Globe Style Valves

These valves can be used for steam or hot water applications. They generally have good part load control characteristics but exert a higher pressure drop than butterfly valves. A 2-way valve is usually chosen for steam applications. A 3-way valve comes in two types: “Converging (mixing) flow” (2 inlets, 1 outlet) and “Diverting flow” (1 inlet, 2 outlets). Usually diverging, 3-way valves are chosen for hot water applications because of the alternate outlet. A converging (mixing) valve will vary the temperature of the inlet hot water and keep the flow constant. A diverting flow valve will vary the flow while keeping the temperature constant. Factory supplied 2-way valves are of the fail safe design, in other words if a power failure occurs the valve will shut to the closed position. On the other hand, 3-way valves are of the non-fail safe design.

FLOW CHARACTERISTICS

Cage/globe style valves can be further broken down to two flow characteristics: “Linear” and “Equal” Percentage. A linear flow characteristic produces a flow rate directly proportional to the amount of valve plug travel. For instance, at 50% of rated travel, flow rate is 50% of maximum flow. Change of the flow rate is constant with respect to valve plug travel. For an ideal Equal Percentage Flow characteristic with equal increments of valve plug travel; the change in flow rate with respect to travel may be expressed as a constant percent of the flow rate at the time of the change. The change in flow rate observed with respect to travel will be relatively small when the valve plug is near its seat and relatively high when the valve plug is nearly wide open. Therefore, a valve with an inherent equal percentage flow characteristic provides precise throttling control through the lower portion of the travel range and rapidly increasing capacity as the valve plug nears the wide open position.

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Since March 2004, YORK/Johnson Controls has been using an analog control signal. This control signal is in the form of a 4 to 20mA current that the microboard sends to the valve. The signal is proportional to the valve’s opening. A 4.0mA signal will correspond to a closed valve and a 20.0mA signal will correspond to a fully open valve, and 12.0mA signals will correspond to a 50% open valve. There is no feedback from factory supplied analog type valves; therefore, no valve calibration is required for commissioning on analog valves. However, it is important to ensure the relationship between the valve’s position and the control panel signal is correct. Each actuator is adjusted and calibrated by the valve’s manufacturer before shipment. No additional adjustment should be necessary during installation. However during transit, installation and other factors, the actuator may have gotten out of factory adjustment, if this happens to a cage/globe valve refer to Service Instruction SI0100. On butterfly valves, make sure the valve is fully seated closed before applying the control signal to the valve.

NOTE

Under normal conditions, the control valve cannot be moved manually without the unit running. See Section 31, Diagnostics and Troubleshooting for details on how to accomplish this without the unit running.

Some of the new style cage/globe valves incorporate a fail closed design feature. That is, when the power is removed from the valve's actuator the valve will close. This feature is for power failures occurring when the unit is in operation. The control valve will close to prevent steam from going into the unit. Butterfly valves and 3-way cage/globe valves do not have this feature. Units with butterfly valves will have a condensate drain solenoid valve shipped loose from the factory. The drain solenoid valve will also close when power is removed from the unit. One or the other of these safety devices will be employed but not both.

VALVE WIRING

Every valve will receive its 115VAC power from the unit. The power connections will initiate in unit mounted JB3 terminal box TB7. Depending on which valve is being employed the connections maybe different. See Figure 42.

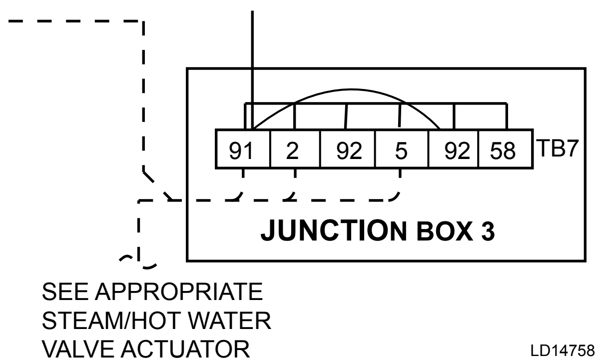

FIGURE 42 - UNIT MOUNTED JB3 TERMINAL BOX

The actuator's control signal wiring will come from the OptiView panel mounted analog I/O expansion board, P10, pins 1 and 2 (wire 19, red and black). See Figure 43 to see where these wires land in the appropriate valve's actuator. For more information on this see Installation Manual 155.21-N1 for further details.

VALVE CONTROL PARAMETERS AND SETPOINTS

NOTE

The new YIA, Mod "D" design incorporates new control logic for the heat input. Along with this change the units will be capable of control with two separate control algorithms. Please read the following carefully to ensure the unit will work to the best of its capability at all loading conditions.

Control Valve Setup

The OptiView panel has 113 valve part numbers preprogrammed into its logic. For a complete listing of all valve part numbers see Table 19 in Section 30 of this document. If the factory supplied the control valve chances are the correct valve part number will already be programmed in the unit OptiView panel.

From the HOME screen in VIEW or OPERATOR access level press the CONTROL VALVE key to view the valve part number, description and type.

- The top field of the CONTROL VALVE screen will display the valve part number.
- The second field will display a description.
- The third field will display the valve type, (analog or digital).

To change the valve part number:

1. With unit shutdown, from the HOME screen, press LOGIN, a pop-up window will be displayed.
2. Scroll using the "►" arrow key to access level SERVICE and press "✓".
3. Type in 1380 access level code and press "✓" again.
4. The unit is now in the SERVICE access mode. Press the SALES ORDER key then CONFIGURE key.

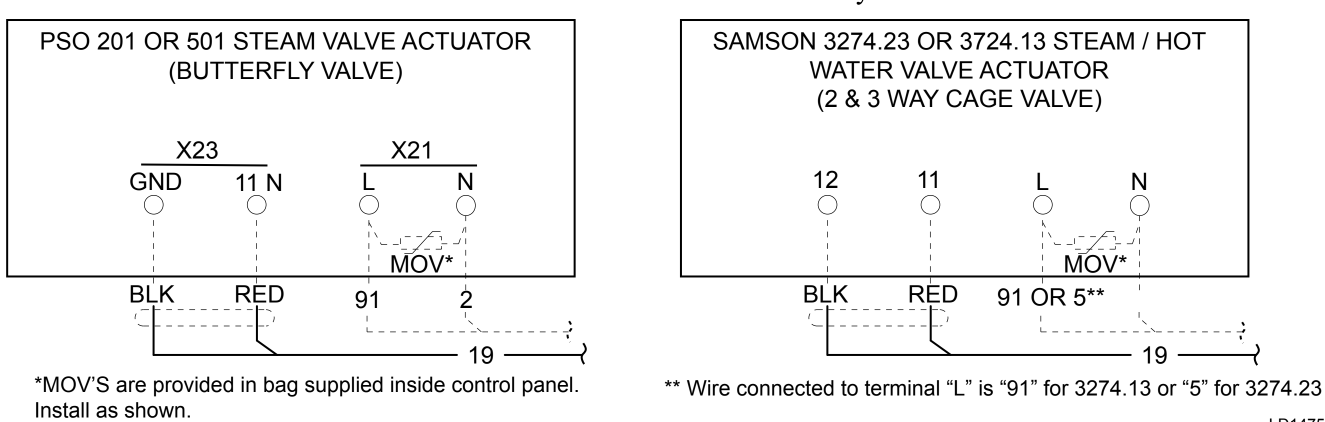

FIGURE 43 - CONTROL VALVE ACTUATOR WIRING

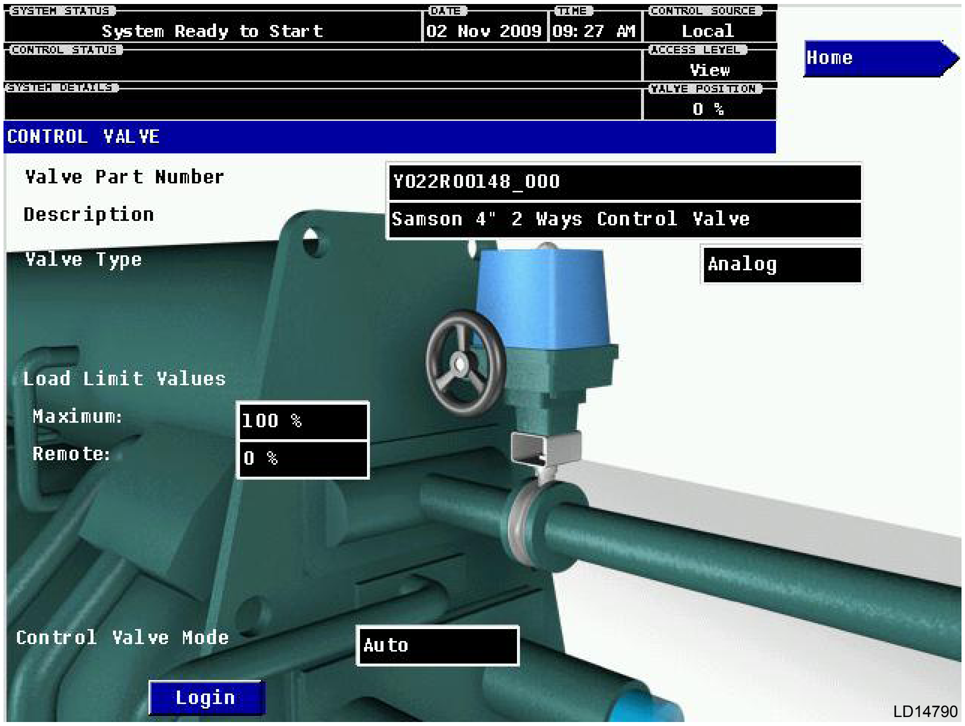

FIGURE 44 - CONTROL VALVE SCREEN - VIEW MODE

5. Using the arrow key scroll to Valve Part Number and press "✓" for a pop-up window to appear.
6. Following the prompts at the bottom use either the "◄ " previous key or "►" advance key to increase or decrease the valve part numbers. When the desired valve part number appears press "✓" to enter it. Pressing the HOME key then CONTROL VALVE key will confirm your valve selection.

NOTE

The valve description and valve type is automatic and will change along with your valve selection.

Under the CONTROL VALVE screen while in VIEW access level only the control valve's part number, de-

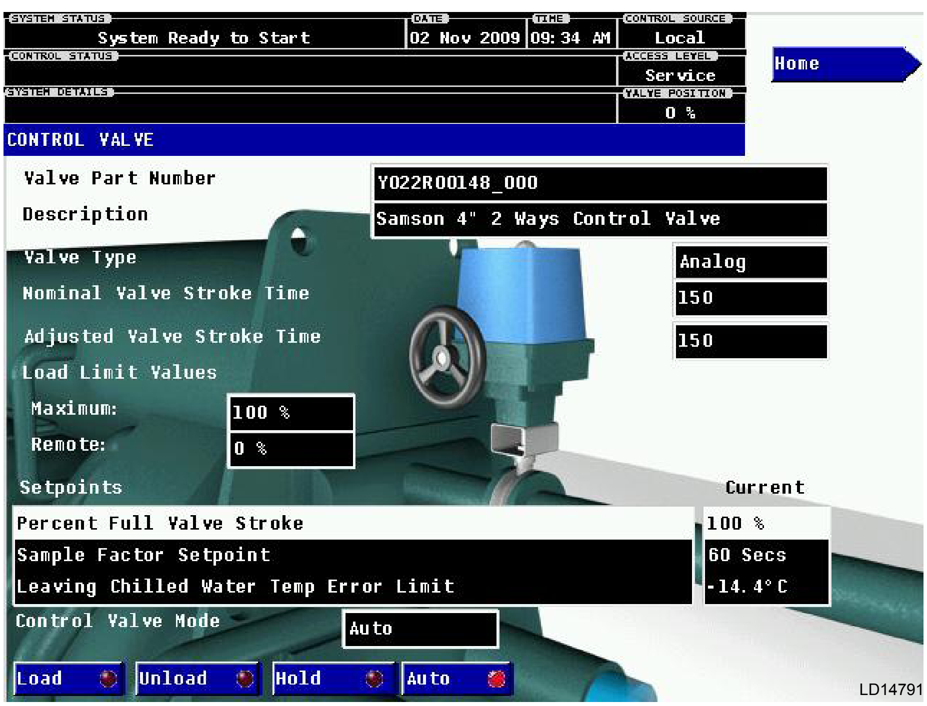

FIGURE 45 - CONTROL VALVE SCREEN - SERVICE MODE

scription, and type can be viewed. Also viewable are the valve's current Load Limit Values, for "Max" (local) and "Remote" load limits. The CONTROL VALVE mode is also displayed; "Auto" will be the only option while in VIEW mode.

One more key is available in the CONTROL VALVE screen while in the VIEW access level mode. That key is the LOGIN key at the bottom of the screen. Pressing this key will bring up a pop-up window:

- Use the "►" arrow key, to advance to access level, SERVICE and press "✓".
- Type in the 1380 Service access level code and press "✓" again. The unit is now in the SERVICE access mode.

Your screen should look like Figure 44.

The control valve part number, description, and type are the same as in the VIEW access level. However, there are two additional fields that appear under the Valve Type. They are: "Nominal Valve Stroke Time" and "Adjusted Valve Stroke Time". The Nominal Valve Stroke Time is a non-adjustable setting that is automatically picked up and displayed under the control valve part number (see Table 19 in Section 30 of this document for valve part number listing). This is the time it takes the valve to fully open from a closed valve position. The Adjusted Valve Stroke Time is a settable parameter and is derived by the calculation of:

$$\frac{\text{Nominal Valve Stroke Time}}{\text{Percent Full Valve Stroke X 100}}$$

Changing the Percent Full Valve Stroke will vary the Adjusted Valve Stroke Time accordingly.

For example:

> The adjusted valve stroke time is 150 seconds and the Percent Full Valve Stroke is 100%, then:
>
> 150 / 100 = 1.5.
>
> 1.5/100 = 150 adjusted valve stroke time.

Within the SERVICE access level, CONTROL VALVE screen will appear a pop-up window with 10 control valve programmable parameters. Using the "↑", "↓" arrow keys, scroll to highlight the valve parameter and press the "✓" key to allow the selected valve parameter pop-up box to appear.

The 10 settable parameter ares:

- Max Load Limit Setpoint
- Min Load Limit Setpoin
- Sample Factor Setpoint
- Leaving Chilled Water Temperature Error Limit
- LCHLT Rate Limit
- Leaving Chilled Water Maximum Output Differential
- Error Limit (SSC Control)
- Rate Limit (SCC Control)
- Maximum Output Differential (SCC Control)
- Percent Full Valve Stroke

Each of the 10 settable parameters are described on the following pages.

Percent Full Valve Stroke

This is used on analog type valves, this field programmable setpoint is used to synchronize or match the valve stroking speed (velocity) to the actual effect of the signal change to the heat input to the generator. This allows better control from change of valve position to the effect on the customer's cooling load or piping system.

Percent Full Valve Stroke has a range from 20% to 130%, with a default value of 100%. It goes past 100% in case the valve being used is unique with a fast valve velocity and the technician needs to slow it down. Each factory valve has a preprogrammed opening time from the fully closed position to the fully open position. This is defined as the valve velocity (see Table 19 in Section 30 of this document for valve part number listing).

The control algorithm takes the valve velocity predetermined value and multiplies it by the programmable Percent Full Valve Stroke then divides it by 100. Then it performs a second equation to convert the change in seconds to a Valve Stroke Differential (see the formula to follow in this section).

Why would anyone want to use this parameter? In some cases where the load is unsteady or rapidly changing and the control valve is of the butterfly type, sensitivity can be lost at the upper end of the valve stroke. This is because once a butterfly valve reaches a certain position open; opening further does not produce a significant change in heat input to the unit. So the technician may decide to short stroke the valve, say limiting the valve to a 70% full open position. Then when the cooling load backs off, the heat input to the unit will respond quicker upon valve closing.

For Example: A butterfly valve has a 77 second nominal stroke time; the technician limits the valve full open stroke to 70% of valve travel (either mechanically or via the maximum load limit setpoint).

The calculation becomes:

$$\frac{\text{Nominal Stroke Time x Percent Full Valve Stroke}}{100}$$

77 x 70 / 100 = 53.9 seconds

Then to calculate the differential for the algorithm to use:

1000 sec / 53.9 sec = 18.55 milliseconds or 0.0185 sec.

To program the Percent Full Valve Stroke:

1. Highlight the "Percent Full Valve Stroke" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired Percent Full Valve Stroke value between 20 and 130 and press "✓".

The window will disappear and the Adjusted Valve Stroke Time field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

Max Load Limit Setpoint

This defines the maximum opening allowed on the control valve when the unit is running. The Max Load Limit setpoint is programmable between 20% minimum to 100% maximum with the default set at 100%. The control valve signal is completely independent of whatever the Max Load Limit setpoint is set at. For example, if the Max Load Limit setpoint is set at 50% the control valve signal will start at the Min Load limit setpoint (say 10%) and stop at 50%. This would correspond to a 5.6mA to 12.0mA range. If a modified signal scale function is desired for better control it would be need to be accomplished through the Percent Full Valve Stroke setpoint.

NOTE

A Max Load Limit setpoint when entered will automatically cause the control valve to adjust to the maximum load limit. If the unit were running at 100% valve opening and 50% were input for the Max Load Limit setpoint the valve will automatically close to 50% independent of the unit load. The Max Load Limit setpoint will override a unit automatic loading such as a Pulldown setting; it will NOT override a manual valve control input.

To program the Max Load Limit setpoint:

1. Scroll to highlight the "Max Load Limit Setpoint" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 20% and 100%) and press "✓".

The window will disappear and the Max Load Limit setpoint field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

At the bottom of the control valve screen in SERVICE access level, there are four blocks with a red led light in each box. There is also a CONTROL VALVE mode indicating field for either MANUAL or AUTO control mode. Pressing the key adjacent to the Auto block sets the valve control to "Auto" and the unit will load and unload automatically to meet the LCHLT setpoint. Pressing the UNLOAD key will close the control valve to the Min Load Limit setpoint position. Pressing the LOAD key will open the valve to the Max Load Limit setpoint. Pressing the HOLD key will hold the control at its present position. Pressing any of the LOAD, UNLOAD or HOLD keys will take the control valve out of AUTO mode and set it in the MANUAL mode. To leave the MANUAL control mode, press the AUTO key. Please note, all unit safeties are in effect no matter what the CONTROL VALVE mode is.

Min Load Limit Setpoint

This determines the minimum position of how far the unit will control the valve before it closes. The Min Load Limit setpoint position is programmable between 10% and 20% with a default of 10%. The control valve signal span is NOT adjusted to where the Min Load Limit setpoint is at. For example, if the Min Load Limit setpoint is at 10%, the lowest control signal will be 5.6mA, if the Min Load Limit setpoint is set at 20% the lowest control signal will be 7.2mA, anything smaller than that will close the valve. If a modified signal scale function is desired, it would need to be accomplished through the Percent Full Valve Stroke setpoint.

Keep in mind after the control valve reaches it's programmed Min Load Limit setpoint anything lower will cause the valve to close. For example, if the Min Load Limit setpoint is set at 20% and the valve shuts, the customers piping system (relief valves, etc) must be able to withstand the abrupt stoppage of heat input to the unit.

NOTE

A unit "Pulldown" or unit "Ramp Down" also referred to as "Soft Shutdown", will NOT control the valve in the regions outside the pre-settable ranges. In other words, if the Min Load Limit setpoint is set at 20%, during a unit Pulldown the control will open the valve to 20% opening position, and then start the Pulldown. The Pulldown will continue until either the valve reaches its maximum opening position or reaches the preset Max Load Limit setpoint.

To program the Min Load Limit setpoint, scroll to highlight the "Min Load Limit Setpoint" and press "✓", a pop-up window will appear. Using the number keys, program in your desired setpoint (either 10% or 20%) and press "✓". The window will disappear and the Min Load Limit setpoint field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

Sample Factor Setpoint

This is a field programmable setpoint that determines the duration of the sample periods that occur after the unit enters a System Run condition after a unit Pulldown has expired. The setpoint will work in either LCHLT or SSC control.

While the unit is running, the duration of the operating time is divided into a series of sample periods. Each time the unit is started and enters a System Run condition, the first sample period begins. When the first sample period ends, the next one begins, etc. This continues till the unit is shut down. The output is allowed to change only at the end of each sample period. At that time the logic control recalculates new values for "Error" and "Rate" and the control also gets a new valve opening target value for LCHWT or SSC control.

The range of Sample Factor setpoint is 30 seconds minimum to 180 seconds maximum, the default value is 60 seconds. The default value of 60 seconds should provide proper operation in most applications. However, applications with extremely short or long chilled water loops or with irregular load changes could require the sample period to be longer or shorter.

To program the Sample Factor setpoint:

1. Scroll to highlight the "Sample Factor Setpoint" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired sample period as the Sample Factor setpoint value (between 30 and 180 seconds) and press "✓".

The window will disappear and the Sample Factor setpoint field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

The new OptiView panel for Mod "D", YIA's offers two methods of control:

- **Leaving Chilled Liquid Temperature Control or (LCHLT)** - LCHLT is a fuzzy logic control, its goal is to match the Leaving Chilled Water Temperature with the Leaving Chilled Water Temperature setpoint. It receives an error value (Leaving Chilled Water Temperature – Leaving Chilled Water Temperature setpoint) and a rate value. (Leaving Chilled Water Temperature from the current sample period – Leaving Chilled Water Temperature from the previous sample period) and returns an opening valve variation, this variation is added to the current valve opening value.

NOTE

It is recommended to keep the LCHLT control valve setpoints at the defaulted values unless it is determined absolutely necessary for unit control to change them.

Control is configured through 3 setpoints:

- Error limit for leaving chilled water temperature.
- Rate limit for leaving chilled water temperature.
- Maximum output differential for leaving chilled water temperature.

Strong Solution Concentration Control or (SSC) - SSC is a fuzzy logic control. Its goal is to avoid the unit from going into a high concentration condition that would otherwise crystallize the unit. It gets an error value (strong solution concentration - strong solution concentration limit) and a rate value (strong solution concentration from the current sample period - strong solution concentration from the previous sample period) and returns an opening valve variation; this variation is added to the current valve opening value.

NOTE

SSC is an automatic sub control mode of LCHLT mode. The unit will go into the SSC mode when the solution concentration gets near a critical level. When the solution concentration recovers, the unit will take itself out of SSC mode and re-enter the LCHLT mode. It is recommended to keep the control valve setpoints for SSC control mode the same as the LCHLT mode.

Control is configured through 3 setpoints:

- Error limit for strong solution concentration.
- Rate limit for strong solution concentration.
- Maximum output differential for strong solution concentration.

The following setpoints are for Leaving Chilled Liquid Temperature Control (LCHLT).

Leaving Chilled Water Temperature Error Limit

This calculates the difference between the current LCHLT and the LCHLT setpoint. It is programmable from 0.1°F to 10.0°F in 0.01° increments; default is 6.0°F. When programming the LCHLT error limit setpoint, keep in mind the error sensitivity increases as the programmed value decreases or the lower the value, the faster the response/sensitivity of the control valve will be.

To program the Leaving Chilled Liquid Temperature Error Limit:

1. Scroll to highlight the “Leaving Chilled Water Temperature Error Limit” and press “✓”, a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1°F and 10.0°F) and press “✓”.

The window will disappear and the Leaving Chilled Water Temperature Error Limit field will change under the “Current” column in the CONTROL VALVE screen according to your inputted value.

LCHLT Rate Limit

This calculates the difference between the current LCHLT and the last recorded LCHLT. It is programmable from 0.1°F to 5.0°F in 0.01° increments; default is 1.0°F. When programming the LCHLT he programmed value decreases or the lower the value, the faster the response/sensitivity of the control valve will be.

To program the LCHLT Rate Limit:

1. Scroll to highlight the “LCHLT Rate Limit” and press “✓”, a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1°F and 5.0°F) and press “✓”.

The window will disappear and the “LCHLT Rate Limit field will change under the “Current” column in the CONTROL VALVE screen according to your inputted value.

Leaving Chilled Water Maximum Output Differential

This is a multiplier for the LCHLT control output signal. The LCHLT error limit will output a positive, negative or zero error value. The LCHLT rate limit will output a positive, negative or zero rate limit. Using these two values, the control fuzzy logic will output either a “Load” or “Unload” signal value. Through a control logic computation, a “Load” or “Unload” value is derived. This value will be multiplied by the LCHLT maximum output differential setpoint that is programmed into the panel. The resultant control signal to move the unit control valve either in the open or closed direction will be sent to the valve. Leaving Chilled Water Maximum Output Differential has no units, the minimum is 0.1 and the maximum is 0.5, with default of 0.2.

To program the Leaving Chilled Water Maximum Output Differential:

1. Scroll to highlight the “Leaving Chilled Water Maximum Output Differential” and press “✓”, a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1 and 0.5) and press “✓”.

The window will disappear and the Leaving Chilled Water Maximum Output Differential field will change under the “Current” column in the CONTROL VALVE screen according to your inputted value.

The next three setpoints are for Strong Solution Concentration Control (SSC)

Error Limit (SSC Control)

This defines the scale used in the SSC control for the ERROR value. The control processes an "Error" value by determining the difference between the current SSC and the target SSC. The SSC target is a calculated value according to the strong solution temperature at RT10. This value is being calculated constantly and represents the maximum allowed concentration for the control -0.5%. The Error Limit is programmable from 0.1% to 2.0% with a default of 0.5%.

To program the Error Limit (SSC Control):

1. Scroll to highlight the "Error Limit (SSC Control)" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1% and 2.0%) and press "✓".

The window will disappear and the Error Limit (SSC Control) field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

Rate Limit (SCC Control)

This defines the scale used in the SSC control for the "Rate" value. The control processes a RATE value by determining the difference between the current SSC and the last recorded SSC. The RATE value is then transformed into an output of either a positive, negative or zero. This will then be processed under the output differential parameter. The Rate Limit is programmable from 0.1% to 2.0% with a default of 0.6%.

To program the Rate Limit (SSC Control):

1. Scroll to highlight the "Rate Limit (SSC Control)" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1% and 2.0%) and press "✓".

The window will disappear and the Rate Limit (SSC Control) field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

Maximum Output Differential (SCC Control)

This is a multiplier for the SSC Control output signal. The error limit (SSC Control) will output a positive, negative or zero error value. The Rate Limit (SSC Control) will output a positive, negative or zero rate limit. Using these two values, the control fuzzy logic will output either a "Load" or "Unload" signal value. Through a control logic computation, a "Load" or "Unload" value is derived. This value will be multiplied by the Maximum Output Differential (SSC Control) setpoint that is programmed into the panel. The resultant control signal to move the unit control valve either in the open or closed direction will be sent to the valve. Maximum Output Differential (SSC Control) has no units, the minimum is 0.1 and the maximum is 0.5, with default of 0.2.

To program the Maximum Output Differential (SSC Control):

1. Scroll to highlight the "Maximum Output Differential (SSC Control)" and press "✓", a pop-up window will appear.
2. Using the number keys, program in your desired setpoint (between 0.1 and 0.5) and press "✓".

The window will disappear and the Maximum Output Differential (SSC Control) field will change under the "Current" column in the CONTROL VALVE screen according to your inputted value.

The following setpoints conclude the programmable setpoints within the SERVICE access level, CONTROL VALVE screen pop-up window.

Valve Calibration for Digital Control Valves

The digital valve signal (115VAC) is only sent as an open or close type signal to the valve actuator. To know where the actual valve position is at any time, a positioner potentiometer sends a signal back to the OptiView panel. This signal must be an accurate representation of the valve position for the chiller to perform correctly.

When a calibration procedure starts, the control sends an opening signal to the valve and waits until the valve is fully open. When the signal matches the last three signals sent, the control knows the valve is 100% fully open. The control then repeats this procedure in reverse to determine when the valve is fully closed.

At the onset of the Valve Calibration procedure, ensure the valve is in the fully closed position and the limit stops are correctly set to full closed and full open valve positions. Many valves have a hand wheel or other mechanism to manually stroke the valve open and closed. Run the valve fully open then closed to ensure freedom of valve movement.

When a digital control valve is selected (see Table 19. Section 30 for a list of valves) the Valve Type field will display DIGITAL. Also, an additional VALVE CALIBRATE key will appear adjacent to the AUTO key at the bottom of the display. Pressing the VALVE CALI-

BRATE key at initial unit commissioning will automatically put the unit into the CALIBRATION mode. During the CALIBRATION mode the system details field will display CONTROL VALVE CALIBRATION IN PROGRESS. When complete, the system details field at top of the display will display VALVE CALIBRATION SUCCESSFUL in green lettering.

Control Valve Troubleshooting

This section is written so the Johnson Controls field service technician will have a good understanding of what to look for in the event the control valve response is not correct. The tools needed to perform the following diagnostics are:

- Ohmmeter
- Voltmeter
- A 4 to 20mA signal generator, such as an EXTECH model 412355, (available at Grainger's).

The following literature is also required:

- Service Information SI0100
- Wiring diagram 155.21-W1.

In some cases it may be necessary to stroke the control valve while the unit is shut down. In manual valve control mode the LOAD and UNLOAD keys will not function when the chiller is shut down, refer to Section 31 "Dialogistics and Troubleshooting" of this document for a procedure on valve movement.

The following issues maybe encountered. Corrective actions are listed afterwards.

- The valve will not move in response to the control signal.
- The valve will move but not through the entire stroke range.
- Relationship between the valve's position and the control panel signal is incorrect.

If The Valve is Not Responding

Perform the following troubleshooting steps:

1. Check to make sure the actuator's power wiring is connected properly to the positioner board and that the correct current is being applied. Use Figure 43 wiring diagrams for the appropriate actuator and landing positions.

CAUTION

Landing the power wiring incorrectly on the positioner board and applying power will damage the board, replacement maybe be necessary!

2. Remove the wiring at the actuator and install a dummy resistor load of less than 300 ohms, use a voltmeter to check if the control signal is reaching the actuator through the wiring harness. A signal value (mA) can be obtained using Ohms law: I= [E/R] x 1000.

   Where:

   I = Current in milliamps

   E = Voltage measured

   R = Resistance in ohms (selected resistor value)

Example: A voltmeter measures 0.904 volts when using a 226 ohm resistor load when the unit is signaling the valve to close. Using the above equation I = (0.904 / 226) x 1000 or I = 4.0mA.

If you obtain the correct voltage when pressing the UNLOAD key, Press the LOAD key to check the signal at the upper end of the range. Use Ohms law to calculate the signal value. Example: The voltmeter now reads 4.52 volts, then I = (4.52 / 226) x 1000 or I = 20mA.

It's possible that a board could be DOA, mis-configured, not commutating or the valve's signal wiring is cut or broken. After completing the above tasks, check the boards as follows:

1. Analog I/O expansion board (Refer to Section 5).

   D. Confirm all jumpers and DIP switches are in the correct position for a 4 to 20mA output. Use the valve manufacturer's literature to check the actuator for the correct configuration.

   E. Make sure the Power ON LED is always illuminated when the power is applied.

   F. Ensure the RX D14 LED and TX D14 LED are illuminating as data is received and sent back to the microboard.

   G. The control valve signal comes from P10, pins 1 and 2. Unplug the pin housing and perform a continuity test to the harness to check the integrity.

H. To check the control signal value leaving the analog I/O expansion board, remove wire 19 (harness to the valve) and install a dummy resistor (less than 300 ohms) between P10, pins 1&2. With a voltmeter measure the voltage and use the equation from step 2 to calculate the signal current.

2. Microboard (Refer To Section 3)

   A. Confirm all jumpers and DIP switches are in the correct position.

   B. Ensure the Red CR15 RX3 LED and Green CR16 TX3 LED are illuminating as data is received and sent back to the analog I/O expansion board. If these lights are flashing this is an indication that the signal and 12VDC fed through to the analog expansion board are correct.

   C. Check the ribbon cable between the microboard J12 and analog expansion I/O board J9 for integrity and good connections.

If The Valve Will Move but not Through the Entire Stroke Range

Perform the following troubleshooting steps:

1. Make sure the unit is not being inhibited by a safety or warning limit.
2. Check the Maximum Load Limit setpoint to ensure the max limit is not in effect. This condition can also be in effect by a remote signal.
3. Take the valve control out of AUTO mode and see if the condition is still present in the MANUAL mode. using the LOAD and UNLOAD keys on the OptiView panel.
4. Make sure the valve is not up against any limit switches or mechanical stops. Using the above procedure in item 1, check to make sure the signal from the analog expansion board is sending the correct signal to the valve.
5. Refer to the valve manufacturer's IOM to make sure the Zero/Span adjustments are set correctly and are taking advantage of the full 4 to 20mA control signal over the useful range of valve travel.
6. Using a 4 to 20mA generator, connect the generator to the actuator positioning board control signal landings and stroke it through the range to ensure the actuator positioner board is responding correctly.
7. If the above procedure produces the correct signal, and with the signal generator you are able to Stroke the valve to full open and full closed, make sure the valve or and components between the valve and the board are not imposing an excessive voltage drop. The ohm value on all valve components must not exceed 300 ohms at any time! If the valve were purchased locally and is not a factory supplied or recommended valve, this could be the case.

If the Relationship Between the Valve's Position and the Control Panel Signal is Incorrect

Perform the following troubleshooting steps:

1. In valve MANUAL mode., drive the valve to its closed position using the UNLOAD key on the OptiView panel. Check to make sure the valve is truly closed. If the valve is out of synchronization with the signal, refer to Service Instruction SI0100 for cage type valves. On butterfly type valves, make sure the valve is fully seated closed before applying the control signal to the valve. Refer to the valve manufacturing literature on how to operate the valve manually.
2. Using the valve manufacturing literature, make sure the Zero/Span adjustments are set correctly to take advantage of the full 4 to 20mA control signal over the useful range of travel.

SECTION 17 - HOME SCREEN

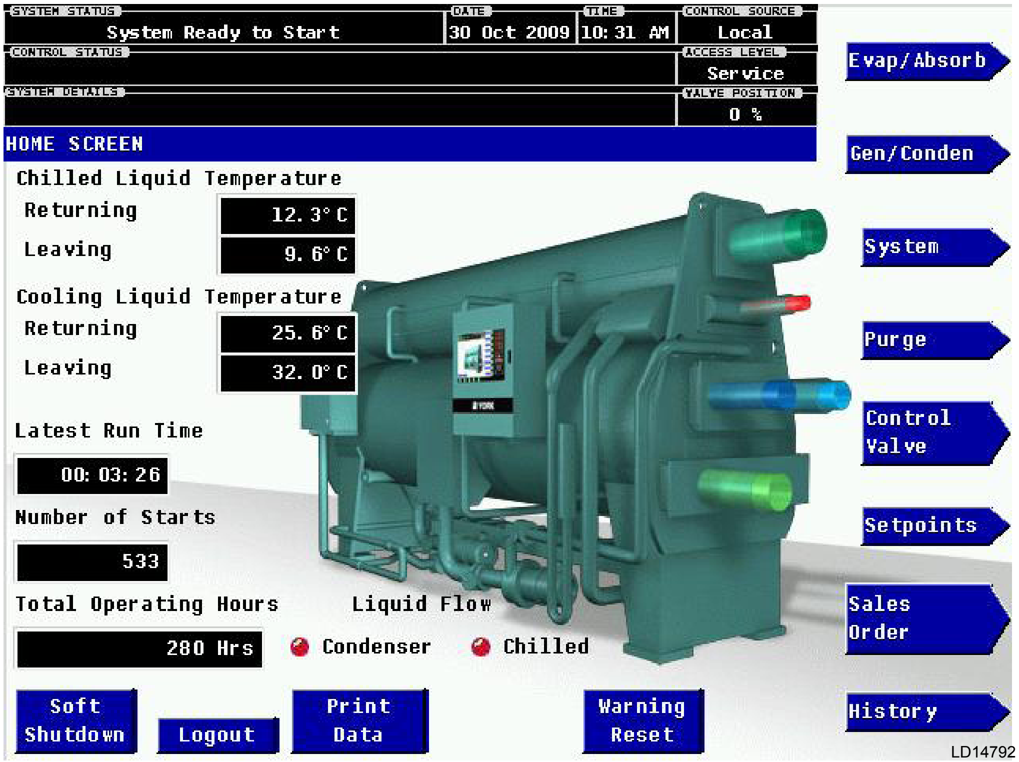

FIGURE 46 - HOME SCREEN - SERVICE MODE

INTRODUCTION

The following screen sections focus mainly on the Service mode functions, navigating to and changing special unit setpoints, and changing operating parameters. This should only be accomplished by a qualified Johnson Controls service technician who is familiar with the absorption process and machinery. Refer to the OptiView Control Center Operators Manual (155.21-O1) for operator functions, warnings and safety messages.

The HOME screen is the base screen for all service procedures. Originally it will be in the VIEW access level. To enter the SERVICE access level, press the LOGIN key at the bottom of the screen and a pop-up window will appear. Using the "►" arrow key, scroll to "Service" and press "✓". Use the number keys to enter the SERVICE access level code 1 3 8 0 and press "✓". The window will disappear and the access level field will change to SERVICE. Also notice the LOGIN key will now say LOGOUT and a SETPOINTS key will be visible to the right hand side of the display.

Pressing the LOGOUT key will automatically take the CONTROL access level back to VIEW mode.

For most warning resets, the access level must be in the SERVICE mode for the WARNING RESET key to function. For safety shutdowns the chiller switch must also be in the OFF position for the WARNING RESET key to function.

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SECTION 18 - ABSORBER / EVAPORATOR SCREEN

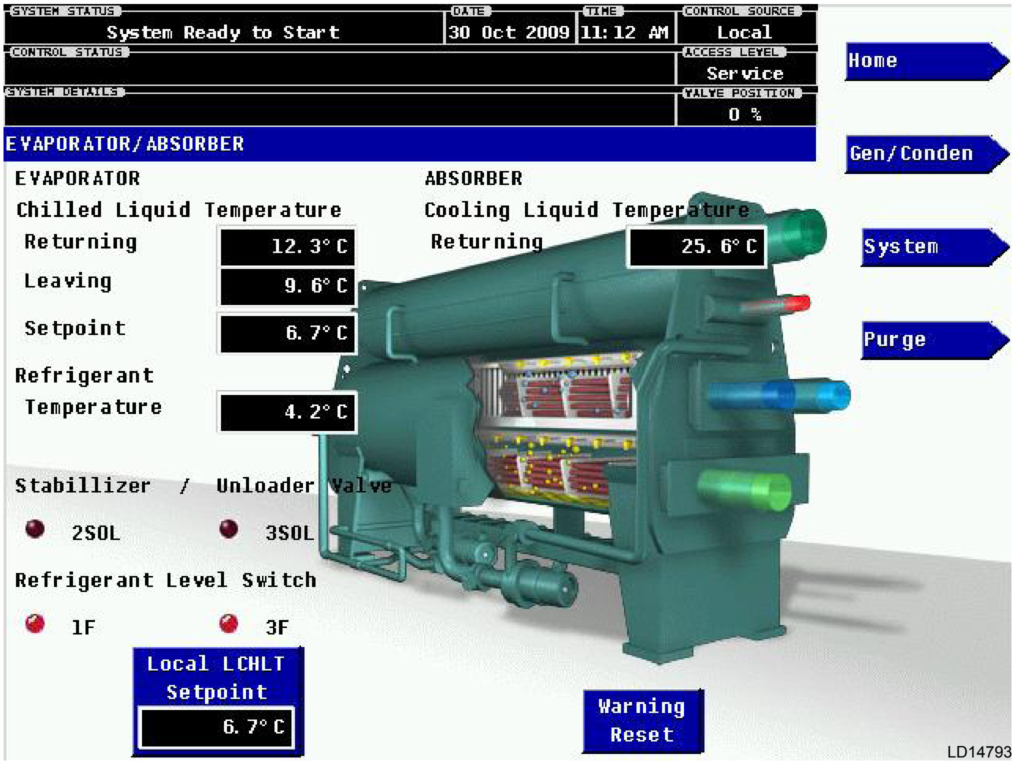

FIGURE 47 - EVAPORATOR / ABSORBER SCREEN - SERVICE MODE

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INTRODUCTION

The only Service function available in this screen while in the SERVICE access level mode is the Leaving Chilled Liquid Temperature setpoint (LCHLT).

To program the LCHLT setpoint, press the key under LOCAL LCHLT SETPOINT, a pop-up window will appear. Using the number keys, program in your desired setpoint (between 40°F and 77°F) and press "✓". The window will disappear and the Local LCHLT setpoint field will change to your inputted value.

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SECTION 19 - GENERATOR / CONDENSER SCREEN

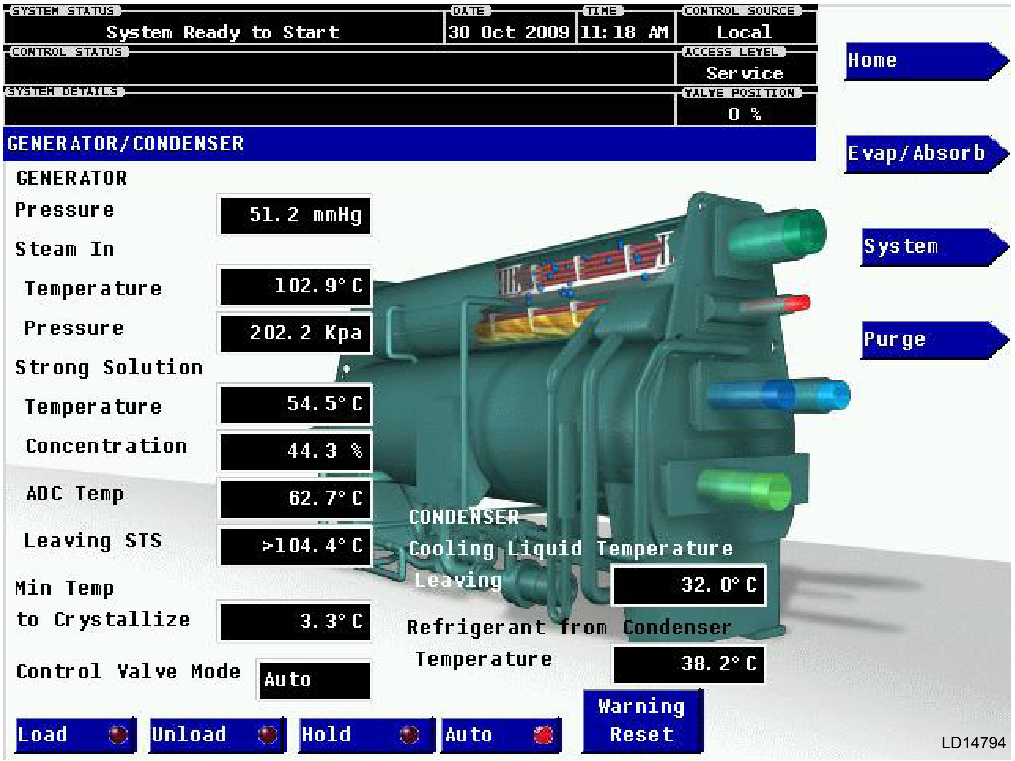

FIGURE 48 - GENERATOR CONDENSER SCREEN - SERVICE MODE

INTRODUCTION

The functions available while in the SERVICE access level are the LOAD, UNLOAD, HOLD and AUTO keys. There is also a WARNING RESET key. See Section 16 for information on the LOAD, UNLOAD, HOLD and AUTO keys. To reset a warning, the unit must be in SERVICE access level with the unit switch off in the recovered condition.

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SECTION 20 - SYSTEM SCREEN

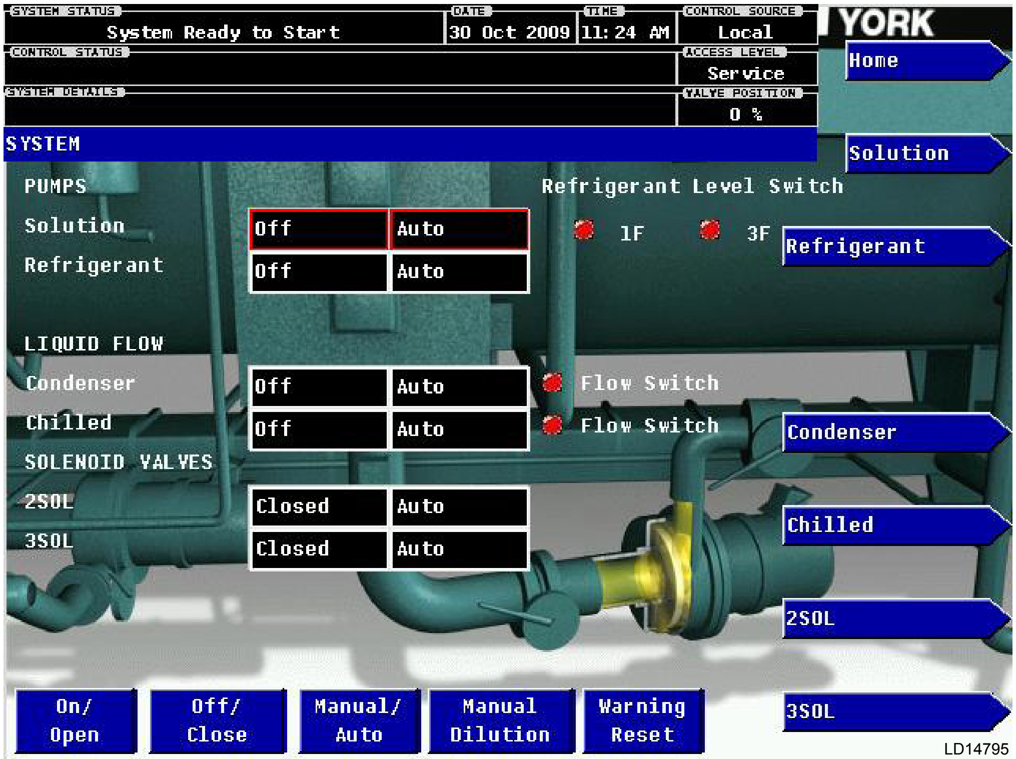

FIGURE 49 - PURGE TREND SCREEN - SERVICE MODE

INTRODUCTION

The SYSTEM screen provides the service technician with a variety of options that will affect the operation of the unit. Please read and understand the descriptions below for each component and what they do before proceeding with any of these functions.

PUMPS

Solution

The solution pump runs continually while the unit is in “System Run operation. Its main function is to transfer the dilute solution from the absorber section to the generator and absorber sprays. It also runs during the dilution cycle. Manual operation of this pump is prohibited when the unit is in the System Run condition. During OFF cycles and for maintenance procedures, it can be manually operated by highlighting the solution pump field by pressing the SOLUTION key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from AUTO mode to MANUAL mode then press the ON/OPEN and OFF/CLOSE keys appropriately. In manual operation the solution pump will run for two continuous hours then automatically shut off. Since the pump uses the pumping fluid to cool the motor and lube the motor bearings, always ensure there is a level of solution visible in the absorber sight glass before operating the pump.

Refrigerant

The refrigerant pump runs continually while the unit is in System Run operation. Its main function is to transfer refrigerant from the evaporator outlet box to the evaporator sprays. It also runs during a normal dilution cycle. Since the pump uses the pumping fluid to cool the motor and lube the motor bearings, the control of the pump is governed by the 1F (refrigerant level switch) and the 3F (refrigerant pump level switch). At times during System Run the possibility could exist that the entire refrigerant charge could be in the solution. During these times the refrigerant pump is allowed to shut down due to insufficient refrigerant levels. It will automatically start back up upon sufficient refrigerant levels. See SETPOINTS screen in this document for more details on the refrigerant pump parameters.

Manual operation of this pump is prohibited when the unit is in the System Run condition. During OFF cycles and for maintenance procedures, it can be manually operated by highlighting the refrigerant pump field by pressing the REFRIGERANT key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from Auto to Manual and the ON/OPEN and OFF/CLOSE keys appropriately. In Manual operation the refrigerant pump will run for two continuous hours then automatically shut OFF.

LIQUID FLOW

Condenser

This pump is a customer pump and control of it must be left up to the absorption unit. (See Installation manual 155.21-N1 for wiring and further details on this pump). During normal dilution cycles this pump must be able to run to reject heat to the customer's tower. Once the dilution cycle is complete the YIA unit will shut it down. A flow switch indicator light is adjacent to the condenser pump field to indicate fluid is in motion through the absorber and condenser sections. To manually operate this pump for maintenance or unit commissioning procedures, highlight the condenser pump field by pressing the CONDENSER key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from Auto to Manual and the ON/OPEN and OFF/CLOSE keys appropriately.

Evaporator (Condenser)

The pump control for this pump is identical to the above condenser pump. (See Installation manual 155.21-N1 for wiring and further details on this pump). The evaporator pump will also continue to run through a normal dilution cycle. Once the dilution cycle is complete the YIA unit will shut it down. A flow switch indicator light is adjacent to the Evaporator pump field to indicate fluid is in motion through the evaporator section. To manually operate this pump for maintenance or unit commissioning procedures, highlight the Evaporator pump field by pressing the EVAPORATOR key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from Auto to Manual and the ON/OPEN and OFF/CLOSE keys appropriately.

SOLENOID VALVES

There are two solenoid valves in which to control from the SYSTEM screen.

NOTE

Purge solenoid valve control cannot be done from this screen (see PURGE screen).

2SOL (Stabilizer Refrigerant Solenoid Valve)

This solenoid valve is located on a separate line that goes between the discharge of the refrigerant pump to the generator's (return) strong solution line. Since the valve depends on a running refrigerant pump, if the pump is OFF this valve will not be allowed to open. The valve opens during the events listed below when the unit is in System Run:

1. In the event when strong solution flow gets restricted from the generator section, it will back up into the generator outlet box and start to flow into the ADC line. When the temperature at RT2 reaches 160°F (71.1°C) the 2SOL solenoid valve will automatically open to allow refrigerant flow into the strong solution return from the generator. For more details on ADC functions, see Operators Manual 155.21-O1, Section 2, "Auto De-crystallization Process".
2. In the event when the refrigerant temperature reaches 35.5°F (1.9°C).
3. Opens automatically during a dilution cycle if the unit is configured for Short Dilution Cycle. Refer to Section 3 "Microboard", "Configuration/Setup" for more details.

The 2SOL Stabilizer Refrigerant Solenoid Valve can be manually opened to transfer the refrigerant into the absorber section. Highlight the 2SOL field by pressing the 2SOL key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from Auto to Manual control, use the ON/OPEN and OFF/CLOSE keys appropriately.

CAUTION

Always monitor this function, lack of refrigerant in the evaporator section will damage the refrigerant pump.

3SOL (Unloader Refrigerant Level Solenoid Valve)

This solenoid valve is located on a separate line between the discharge of the solution pump and the evaporator refrigerant outlet box. When open it will transfer solution from the discharge of the solution pump to the refrigerant circuit. It will open and close automatically when conditions warrant during System Run. It serves the functions listed as follows:

1. Helps the chiller stay on line during light loads with low tower (condenser) water temperatures.

2. Upon low refrigerant levels when 1F (refrigerant level switch) opens, it transfers solution to the refrigerant circuit to contaminate the refrigerant. This will slow down the mass transfer process and accumulate refrigerant in the evaporator pan, thus providing an ample supply of refrigerant to the refrigerant pump.

Highlight the 3SOL field by pressing the 3SOL key to the right of the screen. Use the MANUAL/AUTO key at the bottom of the screen to switch from Auto to Manual control, use the ON/OPEN and OFF/CLOSE keys appropriately.

CAUTION

It is not recommended to open this valve manually, only a Johnson Controls qualified technician who fully understands unit operations should operate this valve.

MANUAL DILUTION

This function only operates when the unit is not running (unit switch in Stop position). When activated the unit pumps solution, refrigerant and generator (Franklin pumps 10E3 through 14F3 only) plus the tower (condenser) water and chilled water will operate for 6 minutes then automatically stop.

When the MANUAL DILUTION key is pressed a pop-up box will appear to confirm the start of the manual dilution cycle. Press "✓" to confirm. To terminate before the 6 minutes expires press the MANUAL DILUTION key again and confirm Stop dilution cycle (Yes/No) by pressing the "✓" key in the box.

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SECTION 21 - PURGE SCREEN

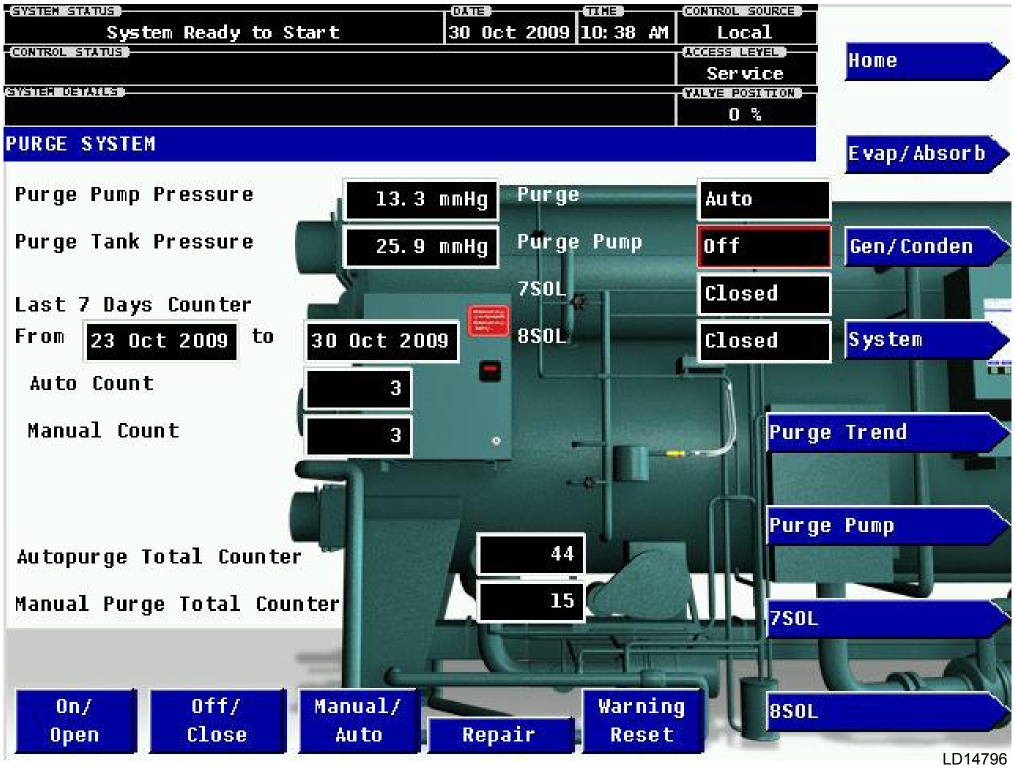

FIGURE 50 - PURGE SCREEN - SERVICE MODE

INTRODUCTION

The purging process and various modes of purging are explained in Operation Manual 155.21-O1 Section 2; refer to this document for details on purging procedures. The PURGE screen in SERVICE mode allows a qualified Johnson Controls technician independent control of all purge components. REPAIR mode gives the service technician full freedom of all purges device operation. It allows troubleshooting and also allows purging directly from the absorber/evaporator shell.

DANGER

To reduce the risk of injury, never operate the purge pump with the belt guard removed!

Pressing the REPAIR key at the bottom of the screen while in LOCAL and SERVICE modes will put the PURGE mode in Repair. If 7SOL or 8SOL are open they will close.

CAUTION

Extreme caution must be taken when ever performing a purge process in REPAIR mode. Never allow air to enter the unit at any time. Only a qualified Johnson Controls Technician should perform purging in the REPAIR mode!

Manually opening the 7SOL and 8SOL will cause a pop-up window with a caution CAUTION! LEAK POTENTIAL IF PURGE PUMP IS OFF. CONTINUE WITH OPERATION? (YES/NO) Press either "✓" to accept or "X" to cancel. With both valves open and the purge pump running, the unit can be purged from the absorber/evaporator section for unit commissioning or returning the unit vacuum from a repair situation. When the MANUAL/AUTO key is pressed both 7SOL and 8SOL will automatically close.

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SECTION 22 - PURGE TREND

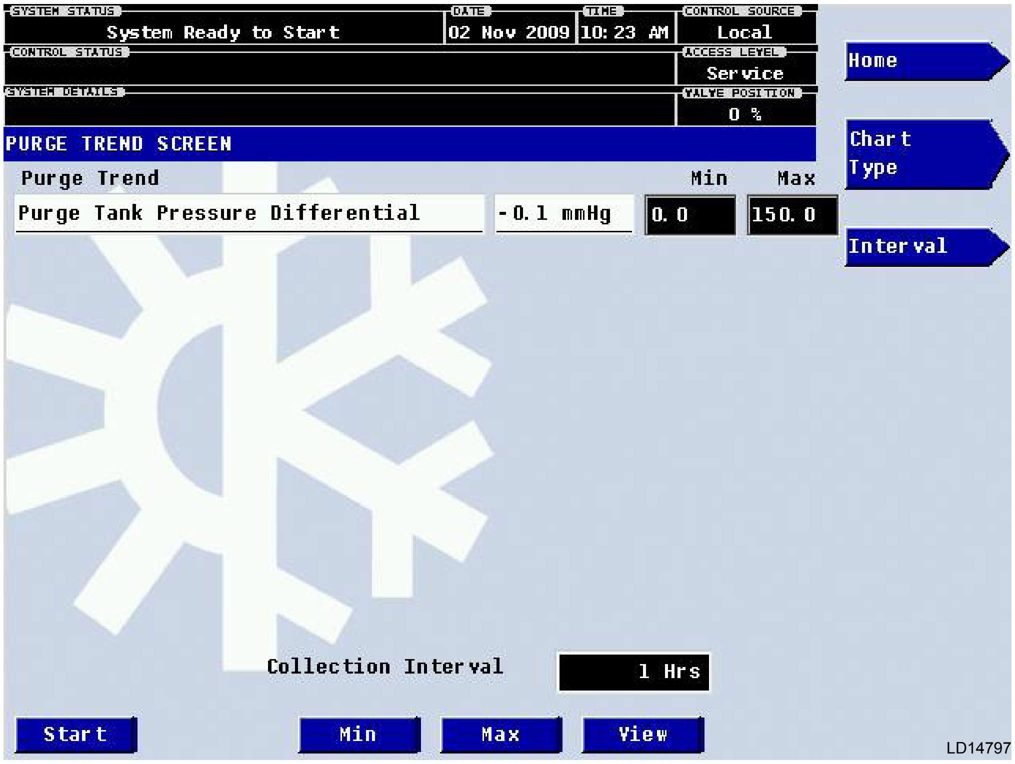

FIGURE 51 - PURGE TREND SCREEN - SERVICE MODE

INTRODUCTION

The PURGE TREND screen is actually intended for the customer or the unit operator end user.

“Trending” is to record a prevailing tendency or series of events over time. Johnson Controls uses purge trending to monitor and record the unit’s non-condensable behavior and develop a pattern or baseline over time. With proper training and screen set up, one can look at the plotted graph on the PURGE TREND screen and be able to determine if the non-condensable production is conducive to a healthy unit or requires further investigation. A technical bulletin is available from Product Technical Support if the service technician requires additional information on how to instruct the end user on proper use.

SCREEN SETUP

Proper screen setup is essential and the default settings need to be modified to see a better visual graphic of the trend. To change the defaults follow the instructions listed in the "Chart Type", "Interval" and Min/Max" sections that follow:

Chart Type

In SERVICE access level go to the PURGE screen using the key on the right hand side of the display. From the PURGE screen press the PURGE TREND key on the right hand side. Select “Chart Type” and a pop-up window will appear, using the “►” key, scroll to “Continuous” and press “✓”. The chart type will now be a continually scrolling graph. The One Screen type will still plot a graph but it will stop when the elapsed time expires.

Interval

To change the interval time (elapsed time axis), press INTERVAL on the right hand side of the PURGE TREND screen. A pop-up window will appear with the default of 24 hours. This elapse time is too long to see a proper trend graph (elapse time will be 5,760 hours, approximately 8 months). Using the number keypad, change the 24 hour time period to the 1 hour (minimum) time and press “✓”.

NOTE

The elapsed time period will not change until the START key is pressed.

Press the START key at the bottom of the display to see this change.

MIN/MAX

To change the Min and Max scale:

If the graph screen is not showing press VIEW at the bottom of the display to bring up the graph.

If the STOP key is showing, this means the trending is activated. Press the STOP key to get the START, MIN and MAX keys to show. Press the MIN key and a pop-up window will appear showing the ranges and the default. If “0” (default) is not shown for “Now”, using the number keypad make it “0” and press “✓”, the pop-up window will disappear.

To change the MAX setting, press MAX and the pop-up window will appear. The default is 300 mmHg Abs, to view a better graph use the number keys to change this to 120 mmHg Abs and press “✓”. The pop-up window will disappear but the axis scale will not change until the START key is pressed. Remember, to change either the Min or Max scales the STOP key must be pressed to deactivate any trending in progress.

SECTION 23 - SETPOINTS SCREEN

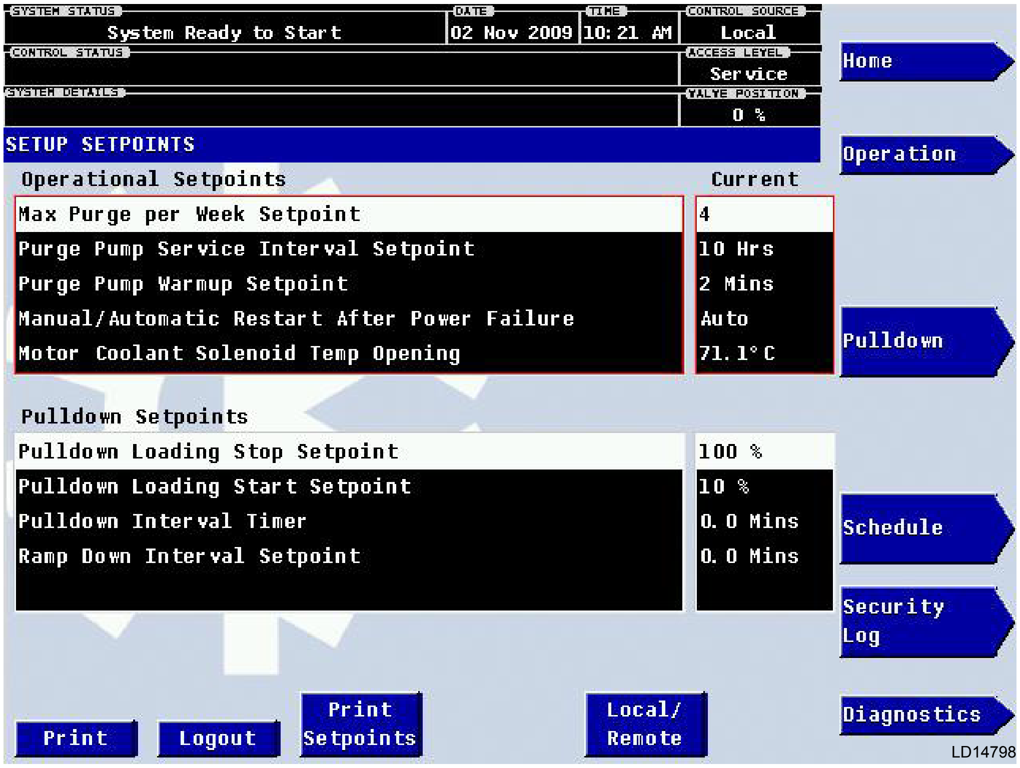

FIGURE 52 - SETUP SETPOINTS SCREEN - SERVICE MODE

INTRODUCTION

The SETPOINTS screen offers two sets of setpoints, “Operational” and “Pulldown”.

Operational Setpoints

To select Operational, press the OPERATION key on the right hand side of the display. The Operational Setpoints window will highlight in red. The Operational Setpoints available are as follows:

- Max Purge per Week Setpoint
- Purge Pump Service Interval Setpoint
- Purge Pump Warm Up Setpoint
- Manual/Automatic Restart After Power Failure
- Motor Coolant Temperature Opening
- Refrigerant Pump Shutdown Timer Setpoint
- Refrigerant Pump Startup Delay
- Refrigerant Pump Shutoff Delay
- Percent Full Valve Stroke
- Strong Solution Gen Temperature Offset (RT3)
- Condenser Leaving Refrigerant Temperature Offset (RT9)
- Strong Solution Heat Exchanger Temperature Offset (RT10)
- Low Leaving Chilled Liquid Offset
- Short Dilution Cycle
- Remote LCHLT Reset Range
- Pulldown Setpoints
- Pulldown Loading Stop Setpoint
- Pulldown Loading Start Setpoint
- Pulldown Interval Timer
- Ramp down Interval Setpoint, (Soft Shutdown)

A description of each setpoint parameter follows:

Max Purge per Week Setpoint

This setpoint sets the threshold of how many autopurges in the last 7 days the unit will undergo before displaying the EXCESS PURGE warning. For it to become enabled the unit must run more than 150 hours in the last 7 days.

To set this parameter:

1. Highlight the Operational Setpoints box in RED.

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2. Using the arrow keys, scroll to highlight the "Max Purge per Week Setpoint". Press "✓" and a pop-up window will appear.
3. Using the number keypad choose the number of purges you want the unit to perform before displaying a warning message (between 2 and 6, default 4) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Purge Pump Service Interval Setpoint

The purge pump running hours is tracked by the OptiView panel. This setpoint will create the message PURGE PUMP SERVICE RECOMMENDED to alert the operator that the purge pump oil and performance check is required. This message will appear each time the interval between purge pump service intervals expire.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Purge Pump Service Interval Setpoint". Press "✓" and a pop-up window will appear.
3. Using the number keypad choose the number of hours between purge pump service intervals before displaying a message (between 5 and 100, default 10) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Purge Pump Warm Up Setpoint

When the purge pump initiates a purge, the pump will run for a certain programmed pre-warm up period settable by this parameter. Refer to the Operation Manual 155.21-O1 for details on the purge pump cycle and when the pump will be affected by this setpoint. Suggestion: if the ambient temperature is cold this setpoint should be set higher than the default value.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Purge Pump Warm Up Setpoint". Press "✓" and a pop-up window will appear.
3. Using the number keypad choose the number of minutes you desire the purge pump to warm up (between 2 and 20, default is 2 minutes) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Manual/Automatic Restart After Power Failure

This parameter is self explanatory. If Automatic Restart is selected, after recovery from a power failure the unit conditions will be checked and if determined safe, the unit will start, if not a warning message will be displayed. See Section 3 "Microboard", "Configuration/Setup" for more details on this parameter.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Manual/Automatic Restart after Power Failure". Press "✓" and a pop-up window will appear.
3. Using the left/right arrow keys change from "Manual" or "Auto" and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Motor Coolant Temperature Opening

This setpoint is for retrofit OptiView panel applications where the unit would still have the older style Franklin Pumps. The setpoint is for the 1SOL, motor coolant solenoid valve, (located off the motor coolant reservoir). It determines at what temperature the strong solution must get to before opening this valve to allow liquid refrigerant returning from the condenser to enter the motor coolant reservoir. Note that the 1SOL is governed by the motor coolant float switch.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Motor Coolant Temperature Opening". Press "✓" and a pop-up window will appear.
3. Using the number keypad choose the temperature you desire the 1SOL to open at, if required by the motor coolant float switch. Choose between 127°F (52.7°C) and 160°F (71.1°C), default is 160°F (71.1°C) and press "✓" to confirm.

The pop-up window will disappear and the “Current” column will display your selection.

Refrigerant Pump Shutdown Timer Setpoint

See Section 11 for additional information

Refrigerant pump operation is controlled by level switches 1F and 3F. The refrigerant pump is not started until both 1F and 3F close and the Refrigerant Pump Startup Delay timer has expired. If 1F and 3F open (to signify a low level of refrigerant), and the Refrigerant Pump Shutoff Delay setpoint has expired. The refrigerant pump will shutdown. This setpoint will control how long the unit will keep operating with the refrigerant pump shutdown in hopes to increase the refrigerant level to close both 3F and 1F level switches. A shut down refrigerant pump will not harm unit operation; however, the cooling capacity will suffer without refrigerant being sprayed over the evaporator tubes. Also see Operation Manual 155.21-O1 for more conditions surrounding this setpoint.

The setpoint for this parameter can be set between 20 and 60 minutes, default is 30 minutes. If the refrigerant level increases so that first 3F then 1F level switches close in the time frame of the setpoint period, the refrigerant pump will restart. If not, the unit will go into a safety shutdown.

To set this parameter:

1. Highlight the “Operational Setpoints” box in RED.
2. Using the arrow keys, scroll to highlight the “Refrigerant Pump Shutdown Timer Setpoint”. Press “✓” and a pop-up window will appear.
3. Using the number keypad choose the time period you desire to have the unit running with insufficient refrigerant level. Choose between 20 and 60 minutes, (default is 30 minutes) and press “✓” to confirm.

The pop-up window will disappear and the “Current” column will display your selection.

Refrigerant Pump Startup Delay

See Section 11 for additional information

When both 1F (refrigerant level switch) and 3F (refrigerant pump cut-out level switch) close (indicating a sufficient level of refrigerant) the refrigerant pump will start the refrigerant pump startup delay timer. When this timer expires, the refrigerant pump will start. This parameter ensures the refrigerant level is steady and not fluctuating up and down.

To set this parameter:

1. Highlight the “Operational Setpoints” box in RED.
2. Using the arrow keys, scroll to highlight the “Refrigerant Pump Startup Delay”. Press “✓” and a pop-up window will appear.
3. Using the number keypad choose the time period you desire to wait before the refrigerant pump starts. Choose between 1 and 900 seconds (15 minutes), (default is 120 seconds) and press “✓” to confirm.

The pop-up window will disappear and the “Current” column will display your selection.

Refrigerant Pump Shutoff Delay

See Section 11 for additional information

This setpoint determines how long the refrigerant pump will continue to operate when 3F (refrigerant pump cutout level switch) opens. The 3F switch must remain open continuously for the duration of the “Refrigerant Pump Shutoff Delay” before the pump will be shut down.

To set this parameter:

1. Highlight the “Operational Setpoints” box in RED.
2. Using the arrow keys, scroll to highlight the “Refrigerant Pump Shutoff Delay”. Press “✓” and a pop-up window will appear.
3. Using the number keypad, choose the time period you desire 3F to be open before shutting down the refrigerant pump. Choose between 1 and 45 seconds, (default is 30 seconds) and press “✓” to confirm.

The pop-up window will disappear and the “Current” column will display your selection.

Percent Full Valve Stroke

Refer to Section 16, “Steam/Hot Water Valve Control” for this setpoint.

Strong Solution Gen Temperature Offset (RT3)

This setpoint compensates for any deviation in the RT3 feedback signal to the panel.

CAUTION

This temperature is used for many unit operating calculations, do not use this offset to by-pass any unit safety parameters.

This sensor and RT9 are used for calculating the strong solution concentration.

NOTE

If offsets are necessary to adjust for inaccuracies in solution concentration values, use this offset to make the correction.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Strong Solution Gen Temperature Offset (RT3)". Press "✓" and a pop-up window will appear.
3. Using the number keypad, choose the desired offset. Choose between -5°F (-2.78°C) and 5°F (2.78°C), (default is 0) and Press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Condenser Leaving Refrigerant Temperature Offset (RT9)

This setpoint compensates for any deviation in the RT9 feedback signal to the panel.

Caution, this temperature is used for many unit operating calculations, do not use this offset to by-pass any unit safety parameters.

RT9 and PT1 are continually being compared for temperature versus pressure correlations. Do not make any unnecessary offsets to this sensor as to avoid any nuisance conflict panel warnings.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Condenser Leaving Refrig Temperature Offset (RT9)". Press "✓" and a pop-up window will appear.
3. Using the number keypad, choose the desired offset. Choose between -5°F (-2.78°C) and 5°F (2.78°C), (default is 0) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Strong Solution Heat Exchanger Temperature Offset (RT10)

This setpoint compensates for any deviation in the RT10 feedback signal to the panel.

CAUTION

This temperature is used for limiting the solution concentration percentage and for strong solution concentration control. Do not use this offset to by-pass any unit safety parameters.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Strong Solution Heat Temperature Offset (RT10)". Press "✓" and a pop-up window will appear.
3. Using the number keypad, choose the desired offset. Choose between -5°F (-2.78°C) and 5°F (2.78°C), (default is 0) press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Low Leaving Chilled Liquid Offset

This setpoint controls the cycling shutdown temperature. When the Leaving Chilled Liquid Temperature, (LCHLT) less than or equal to the LCHLT setpoint minus the Low Leaving Chilled Liquid Offset, the unit will display LOW LEAVING CHILLED LIQUID TEMPERATURE and go into a cycling shutdown. The unit recovers when: LCHLT is more than LCHLT setpoint plus 2.0°F (1.12°C).

NOTE

The Low Leaving Chilled Liquid Offset will not allow the LCHLT to go below 38°F (3.3°C). Therefore, a LCHLT of less than 38°F (3.3°C) will automatically cause a cycling shutdown.

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Low Leaving Chilled Liquid Offset". Press "✓" and a pop-up window will appear.
3. Using the number keypad, choose the desired offset. Choose between 2°F (1.12°C) and 4°F (2.24°C), (default is 3°F (1.67°C) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Short Dilution Cycle

The short dilution cycle is a variable length dilution cycle. In some instances the 2SOL, stabilizer refrigerant solenoid will open. The duration time period of the short dilution cycle and the period of how long the 2SOL remains open is dependent on the solution concentration. Solution concentration is calculated via RT3, strong solution return from generator and RT9, refrigerant temperature leaving the condenser (see Table 4 for a list of the time frames).

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Short Dilution Cycle". Press "✓" and a pop-up window will appear.
3. Using the "►" key scroll to turn it ON or OFF and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Remote LCHLT Reset Range

1. This parameter is the maximum allowable offset for the LCHLT setpoint when operation is in the REMOTE mode. The remote signal will always have a minimum value of "0" and the maximum value is determined by the Remote LCHLT Reset Range. The value is added to the operator programmed Leaving Chilled Liquid Temperature setpoint (base) and the sum equals the temperature range in which the setpoint can be reset. For example: if the operator has locally programmed a setpoint of 44°F (base) into the OptiView Control Center, and the Remote LCHLT Reset Range is programmed to be 10°F, then the energy management system can remotely reset the setpoint over the range of 44°F to 54°F (44 + 10 = 54).

To set this parameter:

1. Highlight the "Operational Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Remote LCHLT Reset Range". Press "✓" and a pop-up window will appear.
3. Using the "►" arrow key, scroll between 10 and 20°F (5.56 and 11.12°C), [default is 20°F, (11.12°C)] and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Pulldown Setpoints

The purpose of Pulldown is to slowly start the unit by throttling the steam/hot water control valve open. This limits the energy input to the unit so that the customer's other appliances will not suffer any decrease in performance while the YIA ramps up to full load.

The Pulldown feature will ramp the valve from a maximum allowed starting load limit to a maximum allowed STOP limit over the pull down interval. Each time the unit starts a timer begins counting down the pull down interval. The control valve load is controlled by the automatic temperature control algorithm. However, during the pull down interval, it cannot load to a value greater than the pull down demand limit will allow.

The limit ramps linearly from the programmed START limit (Pulldown Loading Start setpoint) to the programmed STOP limit (Pulldown Loading Stop setpoint) over the programmed interval (Pulldown Interval Timer). The START limit is effective when the unit starts and the STOP limit is effective when the interval timer has elapsed.

The limit at any time in between these points can be determined by:

$$\frac{a - b \times t}{d} + b = e$$

Where:

a = STOP limit

b = START limit

t = Current pull down in progress time

d = Pull down interval

e = MAX_LOAD = Maximum pull down load limit

To select Pulldown setpoints, press the PULLDOWN key on the right hand side of the display. The Pulldown setpoints window will highlight in red. The following is a list of the setpoint parameters available:

- Pulldown Loading Stop Setpoint
- Pulldown Loading Start Setpoint

The Pulldown setpoint parameters are described as follows:

Pulldown Loading Stop Setpoint

STOP Limit Point at which the pull down will cease.

To set this parameter:

1. Highlight the "Pulldown Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Pulldown Loading Stop Setpoint". Press "✓" and a pop-up window will appear.
3. Using the number keys select between 20% minimum and 100% maximum (default is 100%) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Pulldown Loading Start Setpoint

This is the START limit point at which the pull down will start at.

To set this parameter:

1. Highlight the "Pulldown Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Pulldown Loading Start Setpoint". Press "✓" and a pop-up window will appear.
3. Using the number keys select between 10% minimum and 20% maximum (default is 10%) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Pulldown Interval Timer

This is the pull down interval (time period of the Pulldown).

To set this parameter:

1. Highlight the "Pulldown Setpoints" box in RED.
2. Using the arrow keys, scroll to highlight the "Pulldown Interval Timer". Press "✓" and a pop-up window will appear.
3. Using the number keys select between 0 and 255 minutes (default is 0 minutes) and press "✓" to confirm.

The pop-up window will disappear and the "Current" column will display your selection.

Ramp down Interval Setpoint, (Soft Shutdown)

This setpoint is a gradual decrease in the control valve position when the unit is shut down remotely or requested by the user via the OptiView panel. This type of unit shut down is preferable by many end users whose interconnecting steam/hot water piping and components cannot take the shock of the control valve suddenly closing.

There are two parameters surrounding this type of shutdown.

1. Minimum Load Limit Setpoint - see "Section 16, Steam/Hot Water Control" for further details on this function.
2. Ramp down Interval Setpoint - the time in which you desire the valve to close from its open position to the minimum load limit setpoint.

The Ramp Down Interval setpoint is programmable from 0 minutes to 60 minutes, default is 0 minutes. The Ramp Down Interval setpoint always assumes the control valve is at a full, 100% open position when the operator initiates it. Therefore, the actual ramp down range will equal the percent loading at the ramp start, minus the low limit. This means the actual ramp down time may be less than the actual programmed time.

Ramp down time is determined by:

$$\frac{a \times b}{100 - c}$$

Where:

a = Actual Ramp Down Range

b = Ramp Down Time For Full Range

c = Ramp Down Low Limit

The ramp down is in a linear fashion from the open position at time of initiation to the minimum load limit setpoint. At any time during the ramp down the valve position can be calculated by the following formula:

$$\frac{a - b \times t}{c} + d = e$$

Where:

a = Opening at shutdown : percent loading at the ramp start.

b = Minimum load limit setpoint load.

c = Interval : actual ramp down interval.

d = Low Opening : ramp down low limit.

e = Max Load : maximum ramp down load limit.

t = Time : current ramp down in progress time.

To set this parameter:

1. Highlight the “Pulldown Setpoints” box in RED.
2. Using the arrow keys, scroll to highlight the “Ramp Down Interval Setpoint”. Press “✓” and a pop-up window will appear.
3. Using the number keys select between 0 and 60 minutes (default is 0 minutes) and press “✓” to confirm.

The pop-up window will disappear and the “Current” column will display your selection.

NOTE

At the time of this writing, there is no display of Remaining Ramp Down Time.

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SECTION 24 - SCHEDULE SCREEN

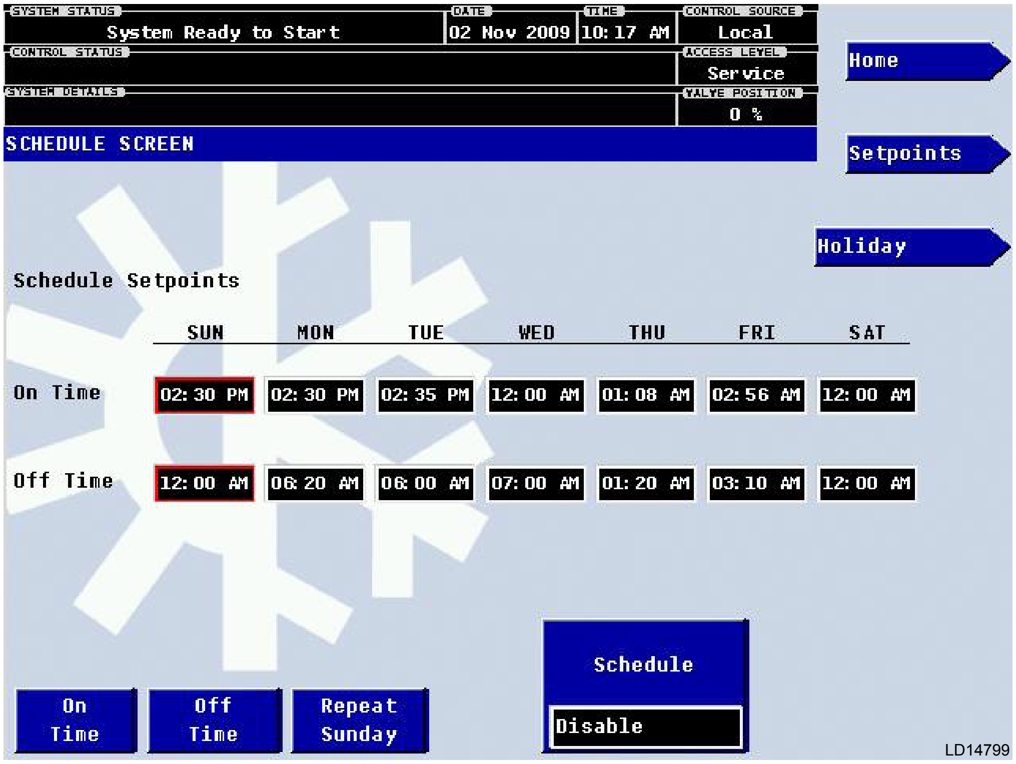

FIGURE 53 - SCHEDULE SCREEN - SEVICE MODE

INTRODUCTION

The SCHEDULE screen is used by the operator to schedule days and times for the unit to turn ON and OFF. A full week can be programmed at one time. If each day has identical ON and OFF times, set Sunday's schedule, then press the REPEAT SUNDAY key at the bottom of the screen to repeat each ON and OFF time for every day of the week. Monday thru Saturday will be filled in automatically with Sunday's ON and OFF times.

To schedule an "On Time", use the "►" arrow key to highlight in RED the day you desire the unit to start on. Press the ON TIME key at the bottom left corner of the SCHEDULE screen. A pop-up window will appear with the heading Enter Daily Schedule Setpoint for "Desired Day" (Starting). Using the number keypad, enter the "hour : minute", (hh : mm). Use the +/- key to toggle between AM and PM. Pressing "✓" will enter your time and the pop-up window will disappear.

Note the time change in the SCHEDULE screen highlighted box to verify your entry.

The "Off Time" is entered in the same fashion as the "On Time" except you press the OFF TIME key at the bottom of the screen to begin.

NOTE

With the current version of software, an Off Time can be entered at an earlier time than an On Time, on the same day! Be careful to verify each entry made.

To enable the schedule, press the SCHEDULE key on the bottom right hand side of the display. A pop-up window will appear. Use the "◄", "►" keys to toggle between enable and disable and press "✓" to enter your selection. Verify your "Enable" or "Disable" selection in the "Schedule" block before going out of the SCHEDULE screen.

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SECTION 25 - HOLIDAY SCREEN

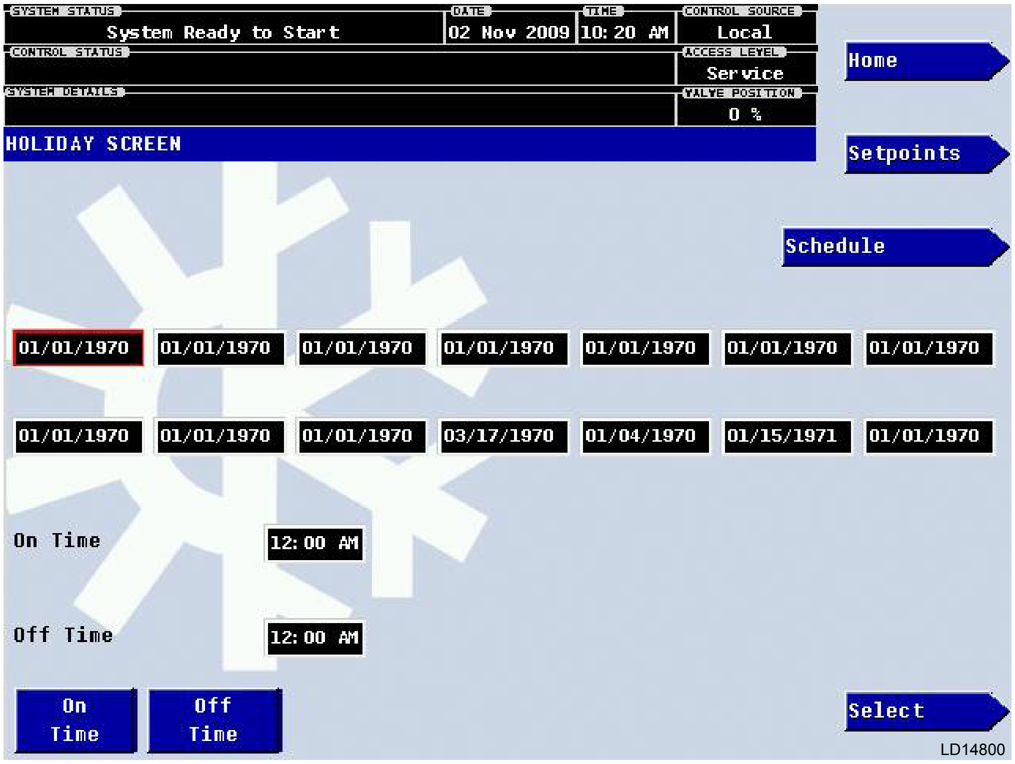

FIGURE 54 - HOLIDAY SCREEN - SERVICE MODE

INTRODUCTION

The HOLIDAY screen is a sub-screen of the SCHEDULE screen, press the HOLIDAY key on the right hand side of the SCHEDULE screen to enter the HOLIDAY screen. Programming the "On Time" and "Off Time" is identical to the SCHEDULE Screen.

To select a holiday, use the "◄", "►" keys to highlight in RED the desired holiday box. Start at the upper left corner for your first holiday then proceed to the right. The highlighted box will move from the upper right to the lower left when switching from the top row to the bottom row.

To enter a date, highlight the first box in RED and press "✓" or "Select", a pop-up window will appear. Use the number keys to enter the date starting with the month, day and year. Use two digits for the month and day, use four digits for the year. Press "✓" to enter your selection.

NOTE

The current software does not allow the operator to enter a different ON Time and OFF Time for each holiday. In other words, the last On Time and Off Time entry made will apply to every holiday.

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SECTION 26 - SECURITY LOG SCREEN

FIGURE 55 - SECURITY LOG SCREEN - SERVICE MODE

INTRODUCTION

The SECURITY LOG screen allows the service technician to view the history of the unit's past 30 setpoint changes. Use the "▲" or "▼" arrow keys to scroll up and down the list. Pressing the VIEW DETAILS key at the bottom of the screen gives the time and date for each change.

Pressing the CLEAR FILE key will clear out ALL values and start a new log screen. Be careful if you press this key because all information will be lost.

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SECTION 27 - DIAGNOSTICS SCREEN

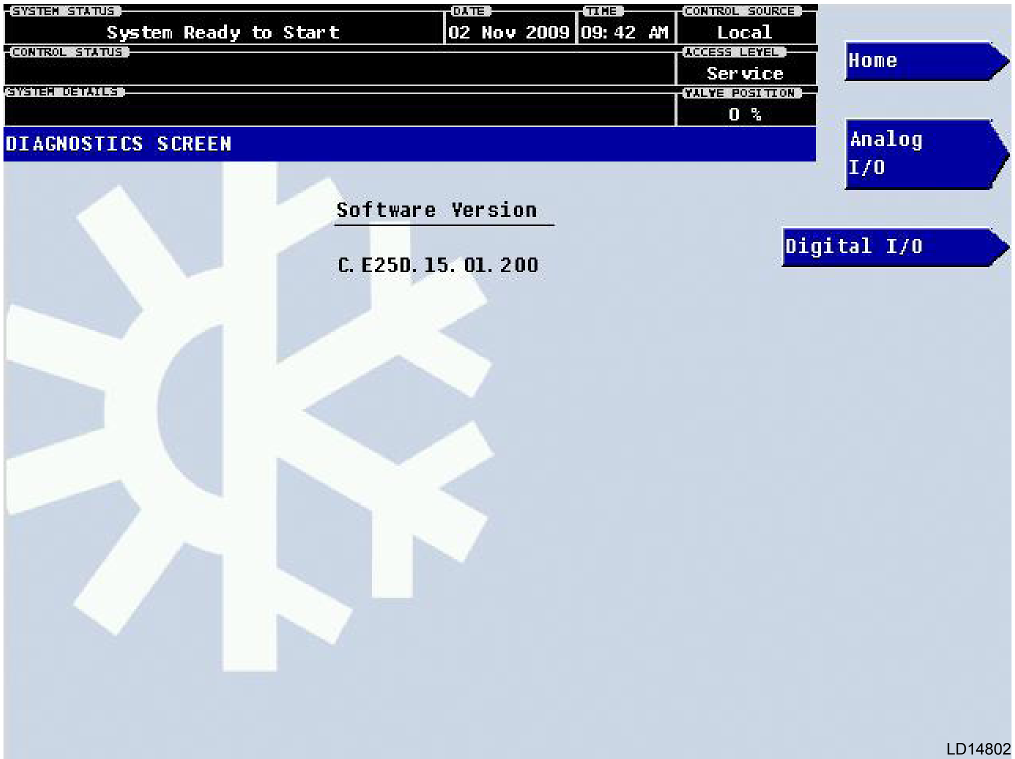

FIGURE 56 - DIAGNOSTICS SCREEN - SERVICE MODE

INTRODUCTION

Pressing the DIAGNOSTICS key in the SETPOINTS screen allows the technician to view the software version of the Program Card. Refer to Section 3 "Microboard", "Program Card" in this document to review the details of the nomenclature.

There are two versions of DIAGNOSTICS screens available, "DIAGNOSTICS - ANALOG screen" and "DIAGNOSTICS - DIGITAL screen".

NOTE

These screens are for monitoring only.

These screens are explained on the following pages.

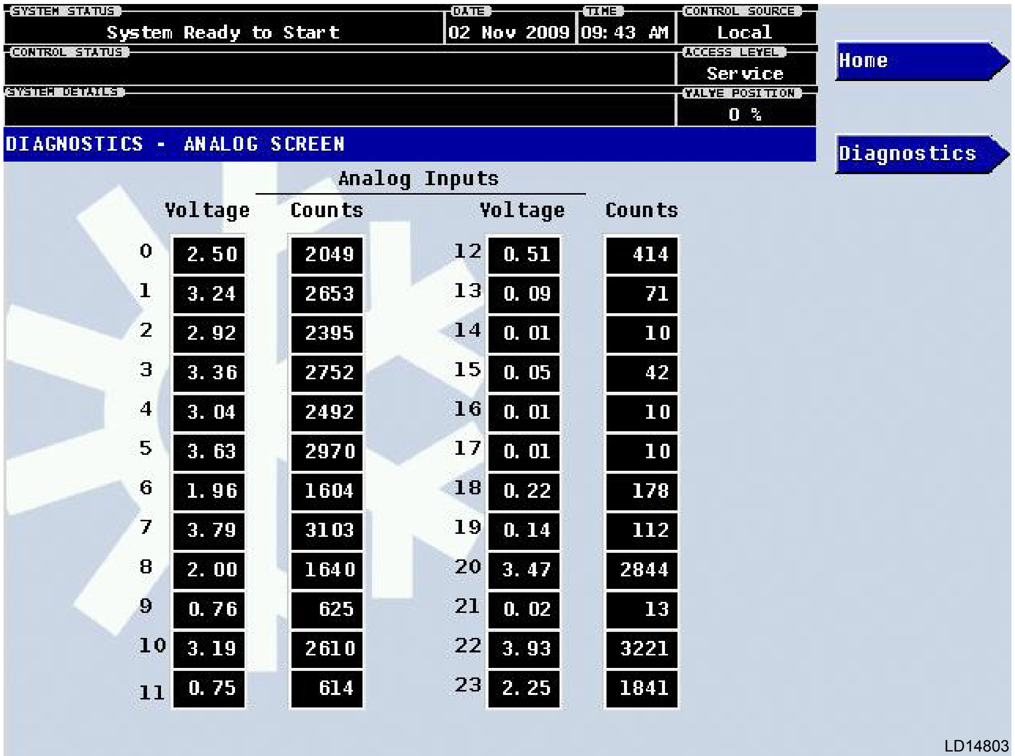

FIGURE 57 - DIAGNOSTICS - ANALOG SCREEN - SERVICE MODE

Analog I/O

The Analog I/O that is accessible under the SETPOINTS screen allows the Johnson Controls service technician to view 23 different channels of analog input to the microboard. This is a Read Only screen; refer to Section 31, “Diagnostics and Troubleshooting” of this document for deeper levels of diagnostics.

There are two columns, “Voltage” and “Counts”. The Voltage is what the microboard interprets from the feedback of the +5.0VDC supply. DO NOT assume this is the actual voltage being fed back from the device on the system. Loose, crimped wires, bare insulation and malfunctioning boards may all contribute to a false signal. Always verify using the correct test points or pins with a voltmeter to assure accuracy in the feedback voltage signal (see Section 3, “Microboard”).

Table 15 identifies each channel with the system device.

TABLE 15 - CHANNELS OF ANALOG INPUT TO THE MICROBOARD

INPUT CHANNEL #	HEADER & PIN ASSIGNMENT	DESCRIPTION
0	N/A	+5/2.5 REFERENCE VOLTAGE (RATIOMETRIC COMPENSATION)
1	J9-10	LEAVING CHILLED WATER TEMPERATURE (RT1)
2	J9-9	RETURN CHILLED WATER TEMPERATURE (RT6)
3	J9-8	LEAVING CONDENSER WATER TEMPERATURE (RT4)
4	J9-7	RETURN CONDENSER WATER TEMPERATURE (RT5)
5	J9-6	CONDENSER LEAVING REFRIGERANT TEMPERATURE (RT9)
6	J9-5	STRONG SOLUTION TEMPERATURE (GENERATOR) (RT3)
7	J9-4	STEAM OR HOT WATER SUPPLY TEMPERATURE (RT7)
8	J9-3	AUTO DE-CRYSTALLIZATION TEMPERATURE (RT2)
9	J8-21	GENERATOR PRESSURE (PT1)
10	J8-18	STEAM SUPPLY PRESSURE (PT2)
11	J9-1	PURGE TANK PRESSURE (AUTO PURGE) (PT4)

TABLE 15 - CHANNELS OF ANALOG INPUT TO THE MICROBOARD (CONT'D)

INPUT CHANNEL #	HEADER & PIN ASSIGNMENT	DESCRIPTION
12	J8-6	PURGE PUMP PRESSURE (AUTO PURGE)(PT3)
13	J9-12	SPARE / NOT USED
14	J8-15	SPARE / NOT USED
15	J10-6	N/A
	"	N/A
	"	N/A
	"	N/A
	"	N/A
	"	N/A
	"	N/A
	"	N/A
16	J8-13	SPARE / NOT USED
17	J8-1	STEAM/HOT WATER VALVE POTENTIOMETER
18	J7-23	SPARE / NOT USED
19	J7-10	SPARE / NOT USED
20	J7-8,20	REMOTE LEAVING CHILLED WATER TEMPERATURE. SETPOINT (JUMPER CONFIGURABLE)
21	J7-6,18	REMOTE STEAM / HOT WATER LIMIT SETPOINT (JUMPER CONFIGURABLE)
22	J7-4,16	STRONG SOLUTION LEAVING HEAT EXCHANGER TEMPERATURE. (RT10)
23	J7-2,14	REFRIGERANT TEMPERATURE (RT8)

The “Counts” listed for each parameter is the Analog-to-Digital (A/D) converter value and is for manufacturing and engineering use only.

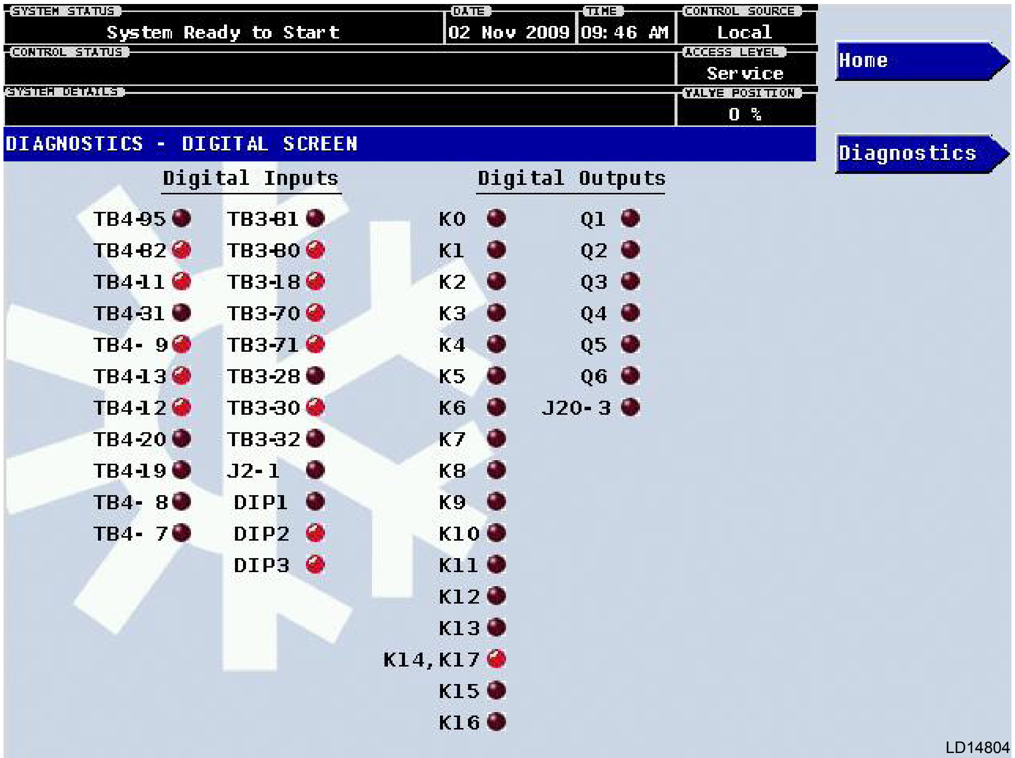

FIGURE 58 - DIAGNOSTICS - DIGITAL SCREEN - SERICE MODE

Digital I/O

The Digital I/O that is accessible under the SETPOINTS screen allows the Johnson Controls service technician to view 20 digital inputs, 3 DIP switch settings and 24 digital output signals to the respective system device. This is a Read Only screen; refer to Section 31, “Diagnostics and Troubleshooting” in this document for deeper levels of Diagnostics.

With 115VAC applied to a particular I/O board digital input/output, the applicable LED should be illuminated. If the LED is not illuminated, see Section 31 “Diagnostics and Troubleshooting” to perform the appropriate Troubleshooting.

Table 16 shows the digital inputs and the respective device on the system for each channel.

TABLE 16 - DIGITAL INPUTS AND THE RESPECTIVE DEVICE ON THE SYSTEM FOR EACH CHANNEL

J19 PIN#	I/O BD REF. #	TB TERM. #	DESCRIPTION YIA
5	U8A	71	SOLUTION OR ABSORBER PUMP & GENERATOR PUMP OVERLOAD (2 - FRANKLIN PUMPS)
6	U8B	70	REFRIGERANT PUMP OVERLOAD
7	U8C	18	REFRIGERANT LEVEL SWITCH (UPPER,1F)
8	U8D	80	PURGE PUMP OVERLOAD
9	U9A	81	REFRIGERANT TEMPERATURE SAFETY DEVICE (LRT)
10	U9B	7,1	REMOTE START SWITCH
11	U9C	8,1	REMOTE STOP SWITCH
12	U9D	19,1	REMOTE LEAVING CHILLED WATER TEMPERATURE SETPOINT
13	U10A	20,1	REMOTE STEAM/HOT WATER LIMIT
14	U10B	12,1	CHILLED WATER PUMP FLOW SWITCH (DIGITAL)
15	U10C	13,1	REMOTE/LOCAL CYCLING
16	U10D	9,1	MULTI-UNIT SEQUENCE
17	U11A	31,1	AUXILIARY SAFETY SHUTDOWN
18	U11B	11,1	CONDENSER WATER FLOW SWITCH (DIGITAL)
19	U11C	82,1	REFRIGERANT PUMP CUTOUT SWITCH (LOWER, 3F) OR MOTOR COOLANT LEVEL FLOAT SWITCH
20	U11D	95,1	BACK-UP GEN. TRANSFER (POWER FAIL) CONTACT
1	U7A	32	HIGH PRESSURE SAFETY (HP, IN GENERATOR)
2	U7B	J2-1,2	HIGH TEMPERATURE SAFETY (HT, IN GENERATOR)
3	U7C	30	LOCAL STOP SWITCH
4	U7D	28	LOCAL START SWITCH
DIP1			SW1 SWITCH1
DIP2			SW2 SWITCH2
DIP3			SW3 SWITCH3

If the program switch (DIP) at SW1 is in the OPEN (OFF) position, the applicable LED should be illuminated. If the program switch (DIP) at SW1 is in the CLOSED (ON) position, the applicable LED is not illuminated.

Table 17 shows the digital outputs and the respective device on the system for each channel.

TABLE 17 - DIGITAL OUTPUTS AND THE RESPECTIVE DEVICE ON THE SYSTEM FOR EACH CHANNEL

J19 PIN#	I/O BD REF. #	TB TERM. #	DESCRIPTION YIA
43	K7	154,155	MOTOR COOLANT SOLENOID
44	K6	152,153	GENERATOR PUMP CONTACT
45	K5	150,151	CONDENSER PUMP CONTACT
46	K4	40,41	CYCLING SHUTDOWN CONTACT
47	K3	42,43	SAFETY SHUTDOWN CONTACT
48	K2	26,27	REMOTE MODE READY TO START CONTACT
49	K1	55,56	ALARM CONTACTS
50	K0	44,45	CHILLED WATER PUMP CONTACT
35	K15	34	PURGE PUMP SOLENOID CONTACT (8SOL)
36	K14,K17	16	STOP CONTACT (K17, NOT USED)
37	K13	16,6	START CONTACT
38	K12	61	SOLUTION PUMP OR ABSORBER PUMP CONTACT
39	K11	29	REFRIGERANT PUMP CONTACT
40	K10	64,17	STEAM CONDENSATE VALVE (6 SOL)
41	K9	165	STABILIZER REFRIGERANT SOLENOID (2 SOL)
42	K8	156,157	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
J20-3	-	-	SPARE OPEN COLLECTOR OUTPUT – NOT USED
34	K16	62	PURGE PUMP CONTACT
28	Q6	162,163	PURGE TANK SOLENOID (7 SOL – AUTO PURGE)
29	Q5	161,162	REGRIGERANT LEVEL SOLENOID (3 SOL)
-	-	-	NOT USED
-	-	-	NOT USED
-	-	-	NOT USED
30	Q4	159,160	SPARE TRIAC
31	Q3	158,159	SPARE TRIAC
32	Q2	58,59	STEAM/HOT WATER VALVE CLOSE TRIAC
33	Q1	3,59	STEAM/HOT WATER VALVE OPEN TRIAC
	J20-3	-	NOT USED
-	-	-	NOT USED

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SECTION 28 - PRINT SCREEN

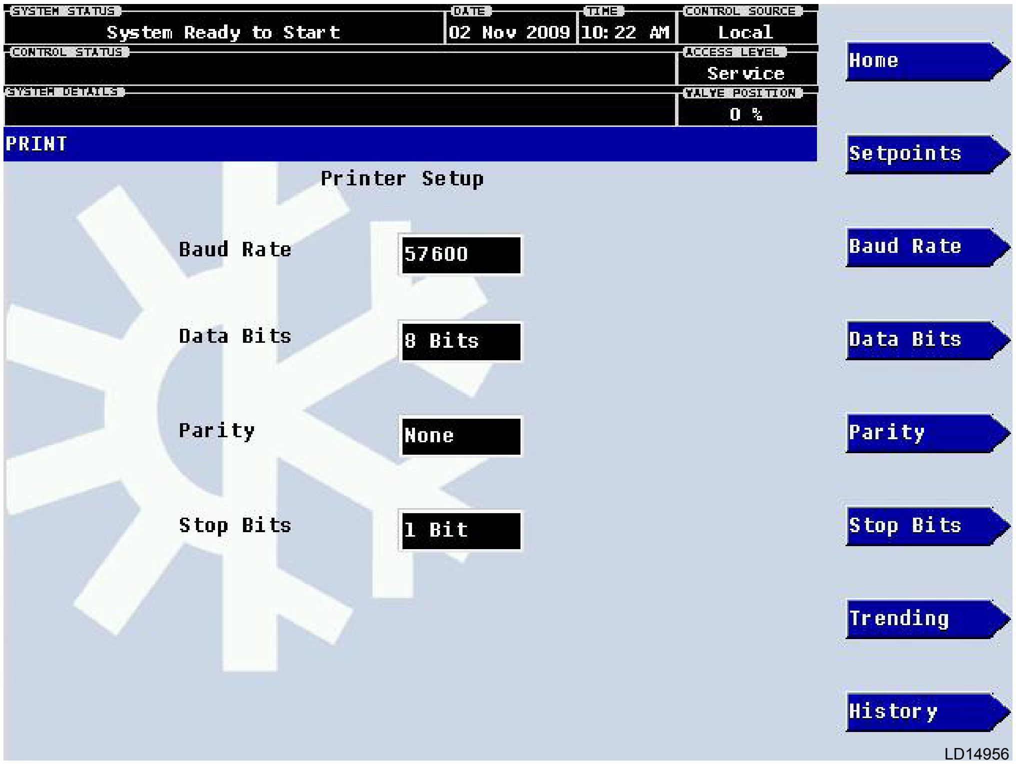
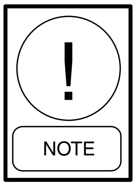


FIGURE 59 - PRINT SCREEN - SERVICE MODE

INTRODUCTION

Pressing the PRINT key in the bottom, left-hand corner of the SETPOINTS screen will bring up the PRINT, PRINTER SETUP screen. This screen allows the technician to configure the OptiView Control Center for transmitting data such as system operating conditions to a printer, computer or laptop.



The OptiView Control Center must be configured to transmit data in the same format as the printer, computer or lap top. No receiving device will function unless the matching configuration is met.

The following values must be entered:

Baud Rate - must match receiving device. Default 1200 bits per second. Choose between 1200, 2400, 4800, 9600, 19200, 34800, 57600 or 115200.

Data Bits - default is 8, choose between 7 and 8.

Parity - default is none, choose between none, even and odd.

Stop Bits - default is 1, choose between 1 and 2.

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SECTION 29 - SALES ORDER SCREEN

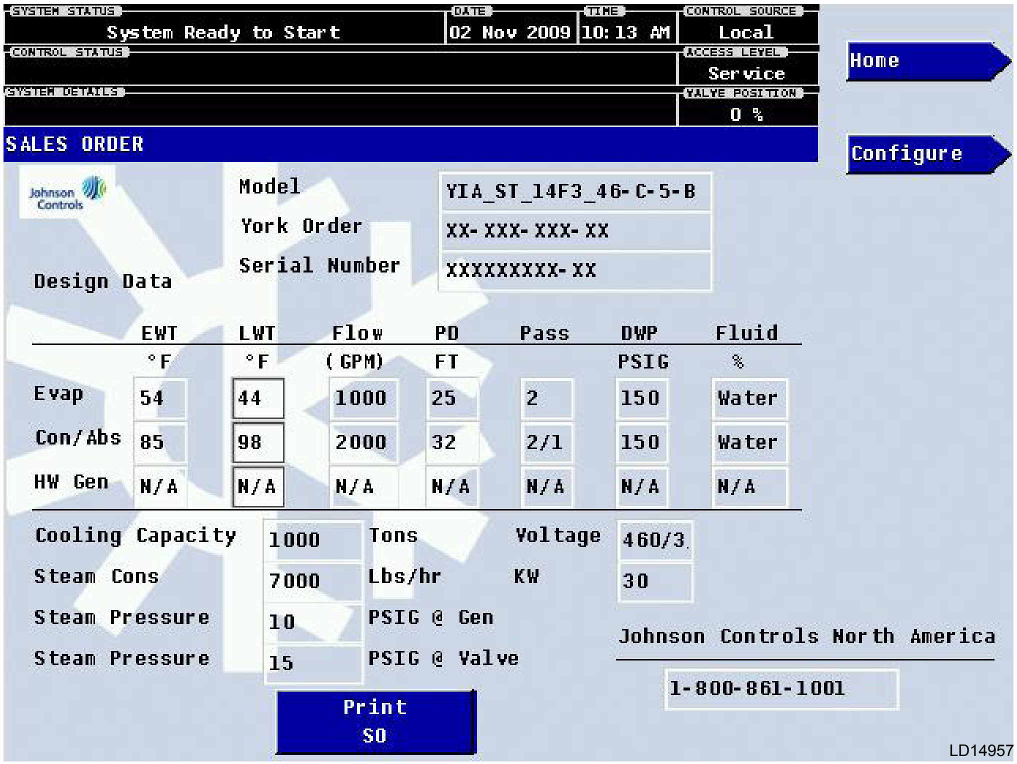

FIGURE 60 - SALES ORDER SCREEN - SERVICE MODE

INTRODUCTION

This screen shows details of the sales order parameters. These values are supplied originally by the Johnson Controls field sales representative and are used for rating the chiller. They should never be changed or entered by anyone other than a qualified Johnson Controls service technician. This screen is populated by the manufacturing facility at time of chiller fabrication.

INSTRUCTIONS FOR DATA ENTRY

1. Edit text below using a text edit such as notepad and save as "somap.xml" to a known location.

NOTE: ***Do not modify the "index =" number!!***

2. Attach serial cable to board com 1.
3. Start HyperTerminal on the PC with com port set to 57600 8-N-1.
4. Connect to the 2430 board by booting up with DIP switch 1 2 3 4 ON.
5. After boot-up is complete, some text will scroll up and finally a message will say WAITING TO RECEIVE.
6. In HyperTerminal select Transfer - >Send File.
7. In box click on Browse.
8. Browse to somap.xml file and select.
9. Click on Protocol down arrow and select "Zmodem with Crash Recovery".
10. Click on Send.
11. The file should then be transferred.
12. Power OFF, change DIP switch to 1 2 3 4 ON, and power ON to complete.

Somap.xml:

<somap>

<model index = "0">YIA_ST_14F3_46-C-5-B</model>

<order index = "1">XX-XXX-XXX-XX</order>

<serialnumber index = "2">XXXXXXXXX-XX</serialnumber>

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<evap>

<ewt index = "3">54</ewt>

<lwt index = "4">44</lwt>

<flow index = "5">1000</flow>

<pd index = "6">25</pd>

<passindex = "7">2</pass>

<dwp index = "8">150</dwp>

<fluid index = "9">Water</fluid>

<fluidcon index = "10">Water</fluidcon>

</evap>

<conabs>

<ewt index = "11">85</ewt>

<lwt index = "12">98</lwt>

<flow index = "13">2000</flow>

<pd index = "14">32</pd>

<passindex = "15">2/1</pass>

<dwp index = "16">150</dwp>

<fluid index = "17">Water</fluid>

<fluidcon index = "18">Water</fluidcon>

</conabs>

Example: To download chiller into the sales order screen

-->

- <somap>

<model index="0">YIA-ST-3B3-46-C-S-C</model>

<order index="1">9EKE0013-02</order>

<serialnumber index="2">UAWMO88735</serialnumber>

- <evap>

<ewt index="3">54</ewt>

<lwt index="4">44</lwt>

<flow index="5">720</flow>

<pd index="6">25</pd>

<pass index="7">2</pass>

<dwp index="8">150</dwp>

<fluid index="9">Water</fluid>

<fluidcon index="10">Water</fluidcon>

</evap>

- <conabs>

<ewt index="11">85</ewt>

<lwt index="12">101</lwt>

<flow index="13">1080</flow>

<pd index="14">25</pd>

<pass index="15">2/1</pass>

<dwp index="16">150</dwp>

<fluid index="17">Water</fluid>

<fluidcon index="18">Water</fluidcon>

</conabs>

- <hwgen>

<ewt index="19">N/A</ewt>

<lwt index="20">N/A</lwt>

<flow index="21">N/A</flow>

<pd index="22">N/A</pd>

<pass index="23">1</pass>

<dwp index="24">150</dwp>

<fluid index="25">Steam</fluid>

<fluidcon index="26">Steam</fluidcon>

</hwgen>

<coolcap index="27">300.0</coolcap>

- <steam>

<cons index="28">5251.9</cons>

<genpress index="29">7.1</genpress>

<valvepress index="30">15.0</valvepress>

</steam>

<voltage index="31">460</voltage>

<kw index="32">7.3</kw>

<phone index="33">1-800-861-1001</phone>

</somap>

SECTION 30 - CONFIGURATION SCREEN

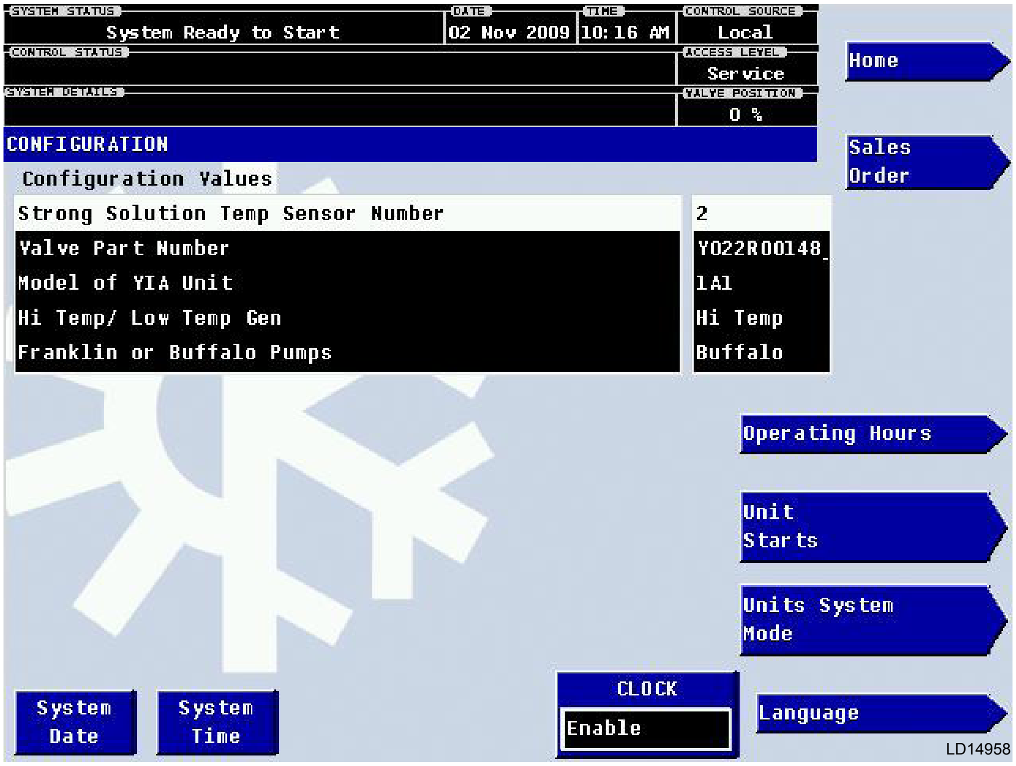

FIGURE 61 - CONFIGURATION SCREEN - SERVICE MODE

INTRODUCTION

Pressing the CONFIGURATION key on the right hand side of the SALES ORDER screen brings up the configuration values menu window. The configuration menu has 8 unit commissioning items that require either verification (new factory units) or modification (retrofit applications) at initial unit start up. Once the correct value or component is selected it should not require further attention unless applicable modifications are made during the unit's life.

The OptiView control panel offers various set up configurations which must be entered or verified by a qualified Johnson Controls service technician before chiller commissioning. If the chiller is new from the factory, many of these selected options will be preprogrammed in the OptiView Control Center from the factory according to the factory order submittal.

NOTE

The service technician will not be able to change any of the settings in the CONFIGURATION screen unless the unit is shutdown. If the chiller is running, this is a Read Only screen.

The configuration menu contains the items listed in Table 18.

TABLE 18 - CONFIGURATION MENU

ITEM	APPLICATION	DESCRIPTION
Strong Solution Temp Sensor Number	New Unit/Retrofit	Controls Function of RT10
Valve Part Number	New Unit/Retrofit	Sets CV Value of Control Valve
Model of YIA Unit	New Unit/Retrofit	N/A
Hi Temp / Low Temp Generator	Retrofit	Sets Warning and Safety Values
Franklin or Buffalo Pumps	Retrofit	Controls Function of MCLF
Energy Source	New Unit/Retrofit	Sets Warning and Safeties to Generator
Electrical Code	New Unit/Retrofit	N/A
Flow Switch Type	New Unit/Retrofit	Sets Function of Flow Switch

To make a selection, use the arrow keys to scroll up or down to your desired variable and press "✓" to bring up the dialog box, use left or right arrow keys to toggle between the entries. Press "✓" again to make your desired selection and escape from the dialog box. At anytime you may press "X" to cancel your selection or escape out of the selection window. The default setting is always available by pressing "▲" (up arrow).

DESCRIPTION OF CONFIGURATION MENU ITEMS

Strong Solution Temperature Sensor Number

Choose either 1 or 2 as follows:

1. If the unit does not have the RT10 [leaving solution-to-solution heat exchanger (STS) temperature] temperature sensor (possible retrofit applications).
2. If the unit has an RT 10 temperature sensor installed (Mod level "D" units).

Valve Part Number

Choose from 113 valves listed in Table 19.

TABLE 19 - VALVE PART NUMBERS

PART NUMBER	SIZE	TYPE	DESIGN WORKING PRESSURE	MAKE	APPLICATION HOT WATER = HW STEAM = ST	FAIL CLOSED Y/N	SIGNAL	STROKE TIME SECONDS
Y022R00136_000	1-1/2"	2-Way Globe	125 psig	Samson	HW	Y	Analog	75
Y022R00138_000	1-1/2"	2-Way Globe	300 psig	Samson	HW	Y	Analog	75
Y022R00139_000	2"	2-Way Globe	125 psig	Samson	HW	Y	Analog	75
Y022R00141_000	2"	2-Way Globe	300 psig	Samson	HW	Y	Analog	75
Y022R00142_000	2-1/2"	2-Way Globe	125 psig	Samson	HW	Y	Analog	75
Y022R00144_000	2-1/2"	2-Way Globe	300 psig	Samson	HW	Y	Analog	75
Y022R00145_000	3"	2-Way Globe	125 psig	Samson	HW	Y	Analog	75
Y022R00147_000	3"	2-Way Globe	300 psig	Samson	HW	Y	Analog	75
Y022R00148_000 *	4"	2-Way Globe	125 psig	Samson	HW	Y	Analog	150
Y022R00150_000	4"	2-Way Globe	300 psig	Samson	HW	Y	Analog	150
Y022R00151_000	6"	2-Way Globe	125 psig	Samson	HW	Y	Analog	150
Y022R00153_000	6"	2-Way Globe	300 psig	Samson	HW	Y	Analog	150
Y022R00154_000	4"	Butterfly	150 psig	Samson/PS	ST	N	Analog	57
Y022R00155_000	6"	Butterfly	150 psig	Samson/PS	ST	N	Analog	77
Y022R00156_000	8"	Butterfly	150 psig	Samson/PS	ST	N	Analog	77
Y022_09536_000	200mm	Butterfly	150 psig	Samson	ST	N	Digital	N/A
Y022_09537_000	250mm	Butterfly	150 psig	Samson	ST	N	Digital	N/A
Y022_09538_000	300mm	Butterfly	150 psig	Samson	ST	N	Digital	N/A
Y022_09130_000	3"	2-Way Cage	125 psig	Honeywell	ST	N	Digital	N/A
Y022_09131_000	4"	2-Way Cage	125 psig	Honeywell	ST	N	Digital	N/A
Y022_09132_000	5"	2-Way Cage	125 psig	Honeywell	ST	N	Digital	N/A
Y022_09133_000	6"	2-Way Cage	125 psig	Honeywell	ST	N	Digital	N/A
Y022_09155_000	1"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09156_000	1"	3-Way Globe	250 psig	Honeywell	HW	N	Digital	N/A
Y022_09157_000	1-1/4"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09158_000	1-1/4"	3-Way Globe	250 psig	Honeywell	HW	N	Digital	N/A
Y022_09159_000	1-1/2"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09160_000	1-1/2"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A
Y022_09161_000	2"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09162_000	2"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A

* = Default Valve

TABLE 19 - VALVE PART NUMBERS (CONT'D)

PART NUMBER	SIZE	TYPE	DESIGN WORKING PRESSURE	MAKE	APPLICATION HOT WATER = HW STEAM = ST	FAIL CLOSED Y/N	SIGNAL	STROKE TIME SECONDS
Y022_09163_000	2-1/2"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09164_000	2-1/2"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A
Y022_09165_000	3"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09166_000	3"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A
Y022_09167_000	4"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09168_000	4"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A
Y022_09169_000	6"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09170_000	6"	3-Way Globe	300 psig	Honeywell	HW	N	Digital	N/A
Y022_09171_000	8"	3-Way Globe	125 psig	Honeywell	HW	N	Digital	N/A
Y022_09173_000	8"	3-Way Globe	250 psig	Honeywell	HW	N	Digital	N/A
Y022_09527_000	40mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09528_000	50mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09529_000	65mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09530_000	80mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09531_000	100mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09532_000	125mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09533_000	150mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09534_000	160mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022_09535_000	200mm	3-Way Diverting	?	Honeywell	HW	N	Digital	N/A
Y022R00118_000	1-1/2"	3-Way Globe	125 psig	Samson	HW	N	Analog	75
Y022R00120_000	1-1/2"	3-Way Globe	300 psig	Samson	HW	N	Analog	75
Y022R00121_000	2"	3-Way Globe	125 psig	Samson	HW	N	Analog	75
Y022R00123_000	2"	3-Way Globe	300 psig	Samson	HW	N	Analog	75
Y022R00124_000	2-1/2"	3-Way Globe	125 psig	Samson	HW	N	Analog	75
Y022R00126_000	2-1/2"	3-Way Globe	300 psig	Samson	HW	N	Analog	75
Y022R00127_000	3"	3-Way Globe	125 psig	Samson	HW	N	Analog	75
Y022R00129_000	3"	3-Way Globe	300 psig	Samson	HW	N	Analog	75
Y022R00130_000	4"	3-Way Globe	125 psig	Samson	HW	N	Analog	150
Y022R00132_000	4"	3-Way Globe	300 psig	Samson	HW	N	Analog	150
Y022R00133_000	6"	3-Way Globe	125 psig	Samson	HW	N	Analog	150
Y022R00135_000	6"	3-Way Globe	300 psig	Samson	HW	N	Analog	150
Y022_09134_000	4"	Butterfly	150 psig	Fisher	ST	N	Digital	N/A
Y022_09135_000	6"	Butterfly	150 psig	Fisher	ST	N	Digital	N/A
Y022_09136_000	8"	Butterfly	150 psig	Fisher	ST	N	Digital	N/A
Y022_09518_000	40mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09519_000	50mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09520_000	65mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09521_000	80mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09522_000	100mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09523_000	125mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09524_000	150mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09525_000	200mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09526_000	250mm	2-Way Cage	?	Samson	ST	N	Digital	N/A
Y022_09550_000	2-1/2"	2-Way Cage	125 psig	Leslie	ST	N	Digital	N/A

TABLE 19 - VALVE PART NUMBERS (CONT'D)

PART NUMBER	SIZE	TYPE	DESIGN WORKING PRESSURE	MAKE	APPLICATION HOT WATER = HW STEAM = ST	FAIL CLOSED Y/N	SIGNAL	STROKE TIME SECONDS
Y022_09551_000	3"	2-Way Cage	125 psig	Leslie	ST	N	Digital	N/A
Y022_09552_000	4"	2-Way Cage	125 psig	Leslie	ST	N	Digital	N/A
Y022_09553_000	6"	2-Way Cage	125 psig	Leslie	ST	N	Digital	N/A
Y022_09717_000	1-1/2"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09718_000	1-1/2"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09719_000	1-1/2"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09720_000	2"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09721_000	2"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09722_000	2"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09723_000	2-1/2"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09724_000	2-1/2"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09725_000	2-1/2"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09726_000	3"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09727_000	3"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09728_000	3"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09729_000	4"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09730_000	4"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09731_000	4"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09732_000	6"	3-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09733_000	6"	3-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09734_000	6"	3-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09763_000	1-1/2"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09764_000	1-1/2"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09765_000	1-1/2"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09766_000	2"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09767_000	2"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09768_000	2"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09744_000	2-1/2"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09769_000	2-1/2"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09770_000	2-1/2"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09745_000	3"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09771_000	3"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09772_000	3"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09746_000	4"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09773_000	4"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09774_000	4"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A
Y022_09747_000	6"	2-Way Cage	125 psig	Fisher	HW	N	Digital	N/A
Y022_09775_000	6"	2-Way Cage	250 psig	Fisher	HW	N	Digital	N/A
Y022_09776_000	6"	2-Way Cage	300 psig	Fisher	HW	N	Digital	N/A

Model of YIA Unit

Choose from the following 21 models:

- 1A1
- 1A2
- 2A3
- 2A4
- 2B1
- 3B2
- 3B3
- 4B4
- 4C1
- 5C2
- 5C3
- 6C4
- 7D1
- 7D2
- 8D3
- 8E1
- 9E2
- 10E3
- 12F1
- 13F2
- 14F3

Hi Temperature / Low Temperature Generator

Choose either "Hi Temperature" or "Low Temperature". Units with high temperature or low temperature generators were produced prior to YIA product line introduction (mid 90's).

High temperature generators were produced for both steam and hot water units. The differences between the two are the number of internal tube supports in the generator section. Since the tubes are rolled at the internal generator supports, this also affects the amount of skips on the tubes.

High temperature generators have the below temperature ratings:

- Steam high temperature generators, 337°F (169.5°C).
- Hot water high temperature generators, 266°F (130°C).

Low temperature generators have the below temperature ratings:

- Steam low temperature generators, 285°F (140.5°C).
- Hot water low temperature generators, 240°F (115.5°C).

All generators were produced with the high temperature design after the introduction of the "B" modification level chillers.

Franklin or Buffalo Pumps

Choose either "Franklin" or "Buffalo" pumps, whichever type is on the unit.

Energy Source

Choose either "Steam" or "Hot Water" for your unit.

Electrical Code

Choose one of the following:

- 17 = 208-3-60Hz units
- 28 = 230-3-60Hz units
- 46 = 460-3-60Hz units
- 58 = 575-3-60Hz units
- 50 = 380-3-50Hz units

Flow Switch Type

Flow switch's are either Field installed "Paddle-Type" or factory-mounted "Thermal-Type". The paddle-type interfaces with the I/O board and applies 115VAC digital inputs to TB4-12 (evaporator) and TB4-11 (condenser). The factory installed thermal-type is installed in the appropriate water box outlet nozzle. These sensors interface with the microboard and apply a +5.0VDC to microboard J14 – 4 (evaporator) and J14 – 7 (condenser).

SOFTWARE VERSION

All YIA software versions will support units having:

- Franklin pumps.
- Digital control valve signals.
- Pause Width Modulation (PWM).
- Old style float switches.
- Units with no RT10 temperature sensor installed.

It will not support units without the auto purge feature.

To determine which version of software is loaded in the control panel, from the HOME Screen in SERVICE mode press "Setpoints" then "Diagnostics".

From this menu, the following parameters can be set:

- System Date
- System Time
- Clock
- Operating Hours
- Unit Starts
- Units System Mode
- Language

An explanation of each parameter follows:

System Date

1. To set the date in the display Date field, Press SYSTEM DATE key, a pop-up window will appear.
2. Use the number keys to enter the month, day and year (mm/dd/yyyy) and press "✓".
3. Verify the selected date is displayed in the header.

System Time

1. To set the time in the display Time field, Press SYSTEM TIME key, a pop-up window will appear.
2. Use the number keys to enter the time, (hours/minutes).
3. Use the "+/-" key to switch from "AM" to "PM", press "✓" key to complete the entry. Verify the selected time is displayed in the header.

Clock

The Clock enable must be activated before the unit is commissioned! It may ship from the factory in the disabled position to save the battery life in the BRAM (U38), in the event the unit is not commissioned right away. The clock MUST be enabled to run the program logic correctly and have the time increment.

1. To enable, press the CLOCK key and a pop-up window will appear.
2. Use the "►" key to toggle between "enable" or "disable" function.
3. Press the "✓" key to enter your selection and verify in the Clock field that your entry is correct.

Operating Hours

Pressing the OPERATING HOURS key will bring up the menu window.

CAUTION

Extreme caution must be exercised when this window is displayed! Entering a different value other than the incremented hour display will change the total operating hours of the unit.

The usage of this parameter should only be used if the BRAM (U38) is changed. In those cases, record the operating hours on the HOME screen and re-enter this value after the new BRAM is exchanged. This method will keep the total operating hours of the unit correct for future reference. This function is allowable while the chiller is running.

Unit Starts

Pressing the UNIT STATUS key will bring up the menu window.

CAUTION

Extreme caution must be exercised when this window is displayed! Entering a different value other than the incremented start display will change the total unit starts field in the HOME screen.

The usage of this parameter should only be used if the BRAM (U38) is changed. In those cases, record the number of starts on the HOME screen and re-enter this value after the new BRAM is exchanged. This method will keep the total number of starts correct for future reference. This function is allowable while the chiller is running.

Units System Mode

Pressing this key will bring up the menu window. The Johnson Controls service technician will then use the "◄" or "►" arrow keys to toggle between "English" and "Metric" units. Pressing the "✓" key will enter the selection and all units will be converted to the selected system. This function is allowable while the chiller is running.

Language

Pressing this key will bring up the menu window to select the language that is displayed.

1. Use the "◄" or "►" keys to advance to "English", "Spanish", "Portuguese", "Italian" and "German".
2. Pressing the "✓" will enter the selection and all languages on the screen will convert to the selected language.

This function is allowable while the chiller is running.

SECTION 31 - DIAGNOSTICS AND TROUBLESHOOTING

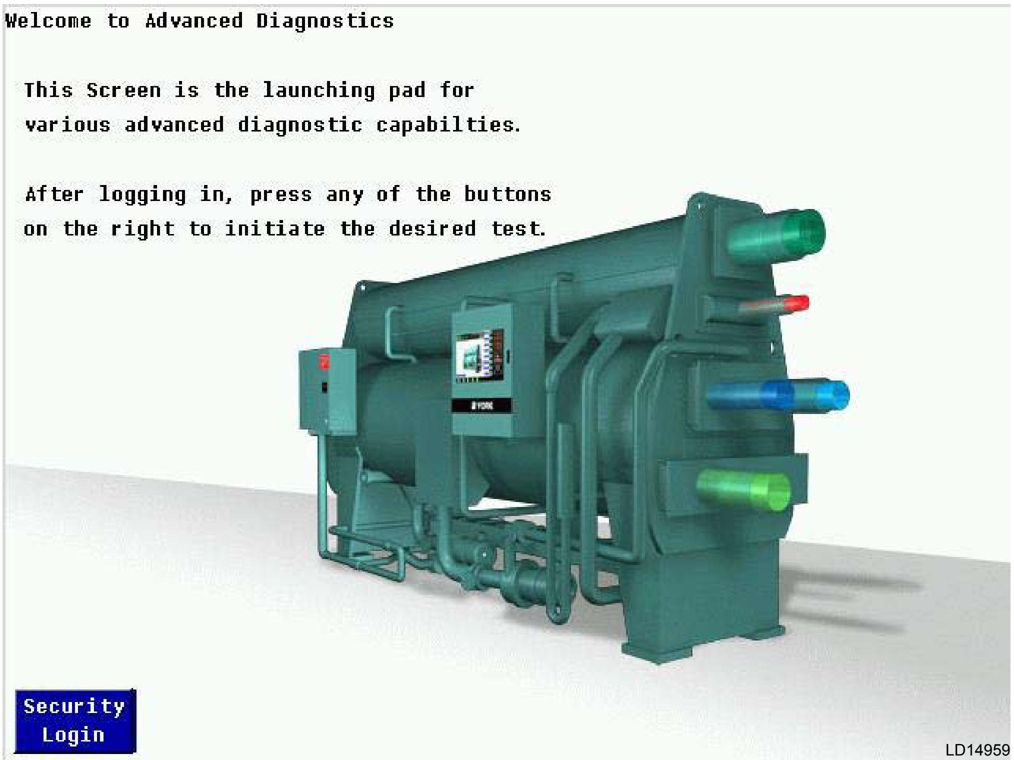

FIGURE 62 - DIAGNOSTICS WELCOME SCREEN

INTRODUCTION

The problems that could be encountered in the OptiView Control Center are in the following categories:

- Keypad
- Display
- Serial Input/Output (I/O)
- Digital Input/Output (I/O)
- Analog Inputs

There is a diagnostic and associated troubleshooting procedure for each category. They are described on the following pages. Each diagnostic is accessed from the MAIN DIAGNOSTICS screen, which is entered using the procedure on the next page (see Figure 63). If there is an OptiView Control Center problem, determine the category of the problem. Then perform the applicable diagnostic. If the diagnostic reveals a malfunction, perform the troubleshooting procedure to locate the defective component.

There are several documents that must be referred to while performing the diagnostics and troubleshooting procedures. Each procedure references the section of this document that describes the operation of the component being tested. Also, the applicable OptiView Control Center wiring diagram must be used as listed in the “Reference Manuals List” table at the front of this document.

The Diagnostics and Troubleshooting” under this section will allow output states to be changed. This level of diagnostics is deeper than the one mentioned under Section 27. Access the MAIN DIAGNOSTICS screen as follows:

1. Power down the chiller and remove power to the OptiView panel.
2. Arrange the SW1 DIP switches as such:
   A. DIP 1 = Open (OFF position)
   B. DIP 2 = Open (OFF position)
   C. DIP 3 = Closed (ON position)
   D. DIP 4 = Closed (ON position)
3. Power up the panel (keep unit shutdown).
4. The MAIN DIAGNOSTICS screen (see Figure 63) will appear after re-boot is complete. Press the SECURITY LOGIN key and a pop-up window will appear. Using the “►” arrow key, scroll to “Service”. Log in to Service using the access level code 1 3 8 0 and press “✓”. The ADVANCED SECURITY key is used during the manufacturing process and has no field service use.

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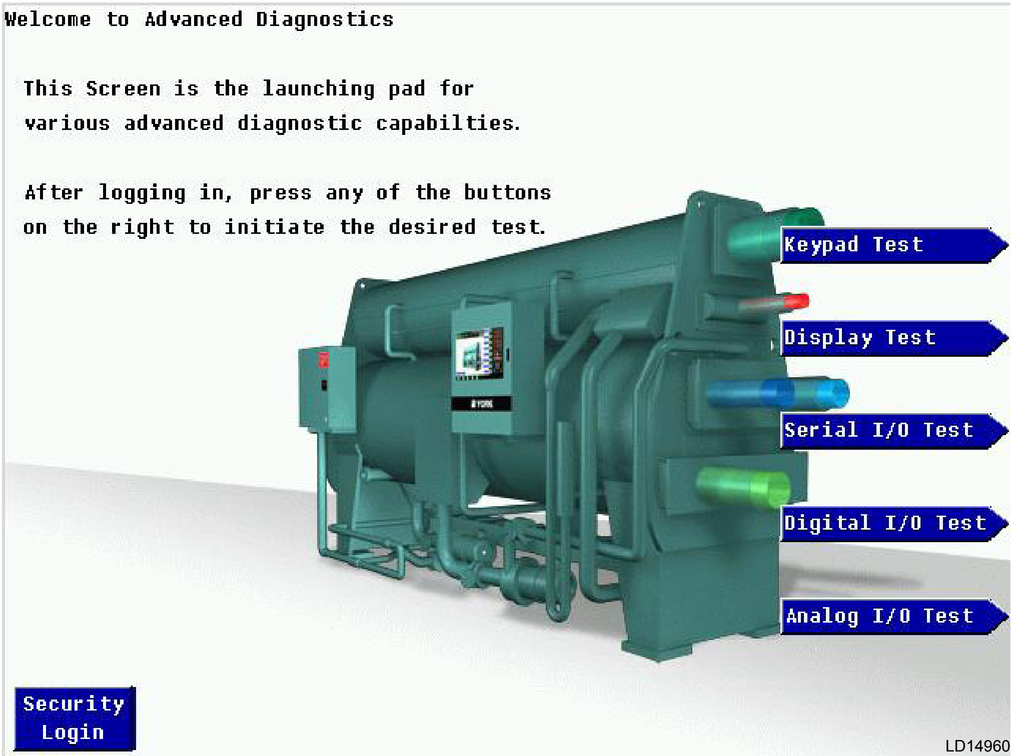

FIGURE 63 - MAIN DIAGNOSTICS SCREEN

Each of the diagnostics are accessed from this screen. Press the appropriate key to select the desired diagnostic. After each diagnostic is performed, return to MAIN DIAGNOSTIC screen, from which the next diagnostic can be selected.

Some of the diagnostics have sub-screens that are accessed from the selected DIAGNOSTIC screen. The sub-screens are shown indented:

- Keypad Test
- Display Test
    - Bit Patterns Test
    - All Red
    - All Green
    - All Blue
    - All White
    - All Black
- Serial I/O Test
- Digital I/O Test
- Analog Inputs

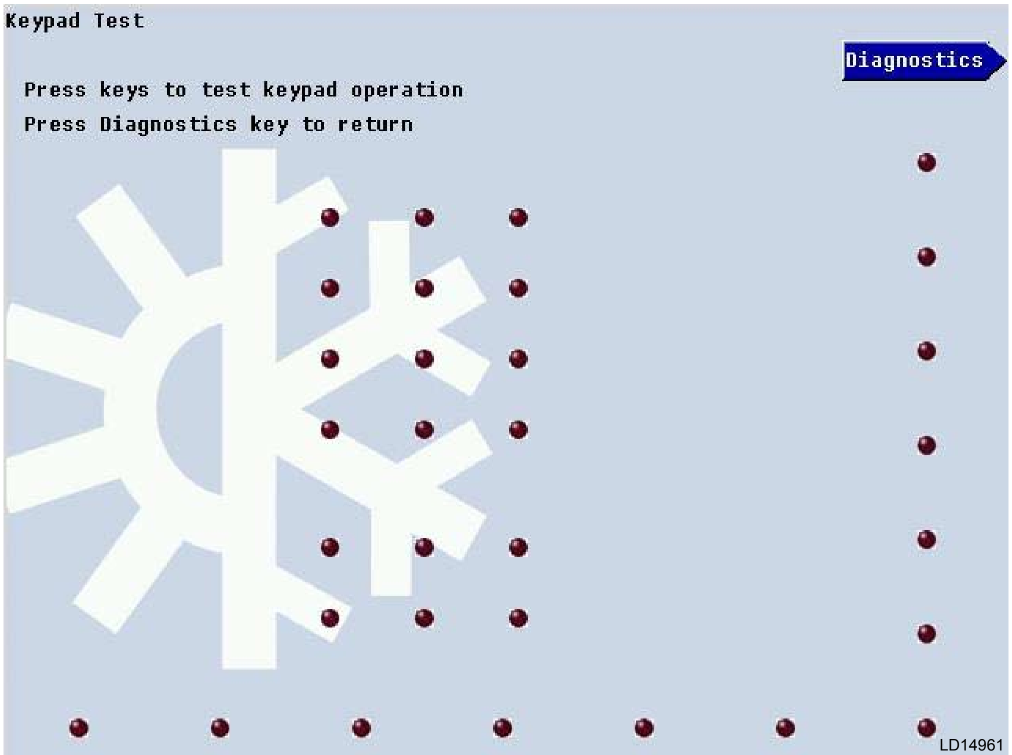

FIGURE 64 - KEYPAD TEST SCREEN

KEYPAD TEST

This diagnostic is used to verify keypad operation and the microboard's ability to respond to a pressed key. Refer to description of "Keypad Operation" in Section 9 of this document and Figure 64.

Procedure

1. Press each keypad key. As the key is pressed, an illuminated LED is displayed corresponding to the key location on the keypad.

NOTE

LED's are in the same pattern as the keys.

2. Press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.

Troubleshooting

If an LED is not displayed when a key is pressed, the keypad, keypad ribbon cable or microboard could be defective. Use the following procedure to locate the defective component.

1. Keypad
   - A. Disconnect the ribbon cable from the keypad.
   - B. Indentify row/column coordinate of the key to be tested. Refer to Figure 26 in Section 9 "Keypad Conductor Matrix".
   - C. In the keypad connector, locate the pins of the row/column coordinate of the key of the key to be tested.
   - D. Insert the leads of an Ohmmeter into the pins indentified in step "C" above.
   - E. Press the key to be tested. If the contact resistance is more than 100 ohms, the keypad is defective.
   - F. Release the key. If the contact resistance is, 1 Meg Ohm, the keypad is defective.
2. Ribbon Cable
3. Using an Ohmmeter, perform a continuity test on all conductors in the ribbon cable. An open circuit would indicate the ribbon cable is defective.
4. Microboard

   There are no checks or measurements to be made on the microboard. If the keypad and ribbon cable check OK per the above procedures, the microboard is most likely the cause of the problem.

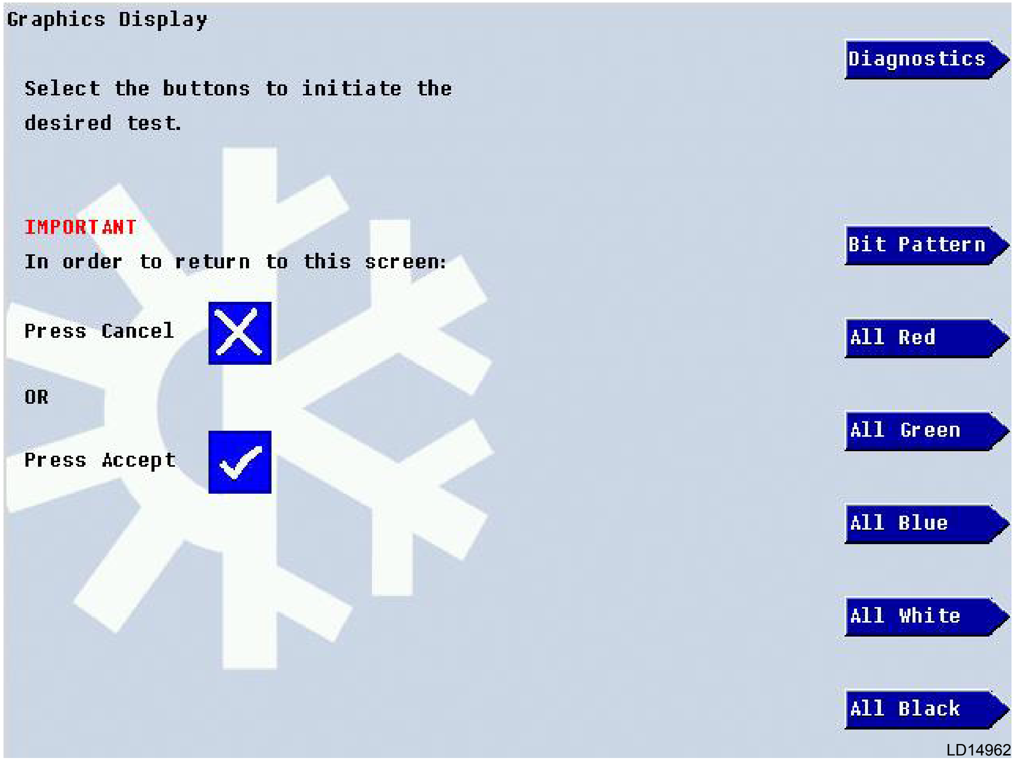

FIGURE 65 - DISPLAY TEST SCREEN

DISPLAY TEST

Pressing the KEYPAD TEST key from the MAIN DIAGNOSTIC screen brings up the screen shown in Figure 65.

Procedure

1. Press the appropriate keypad to perform the desired test from the "Test Descriptions" list below.
2. Press the "Cancel" (X) or "Enter" (✓) key to terminate the test and return to Display Test on the MAIN screen to select another type test.
3. When all the desired tests have been preformed, press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.

Test Descriptions

Bit Patterns – This test is used to detect jitter and alignment defects. It verifies proper operation and compatibility of the microboard display controller with the display. Four vertical bars of green, dark blue, light blue and yellow, outlined by a red border are displayed. If the vertical bars are not stable or straight, or the red border is not completely visible, then either the microboard program jumpers are not configured correctly for the installed display or the microboard display controller is defective.

All Red – This test verifies the operation of all of the red pixels. All of the red pixels are turned ON to create a completely red screen. Any red pixels that do not turn ON will appear as black dots on the display, if any black dots appear, first ascertain it is not caused by dirt that is lodged between the display surface and the protective plastic cover. It is normal for a small number of randomly spaced pixels to not illuminate. It is not necessary to replace the display if a small number of black dots appear. They will not be visible on the normal screen displayed outside of this diagnostic mode. However, large black areas would be indicative of a defective display.

All Green – this test verifies the operation of all of the green pixels. All of the green pixels are turned ON to create a completely green screen. Refer to description of "All Red" test above.

All Blue – This test verifies the operation of all of the blue pixels. All of the blue pixels are turned ON to create a completely blue screen. Refer to description of "All Red" test above.

All White – This test verifies the display's ability to turn on all pixels to display a completely white screen. Any pixel that does not turn ON will appear as a black dot. Refer to description of "All Red" test above.

All Black – This test verifies the display's ability to turn off all pixels to display a completely black screen. Any pixel that does not turn OFF will appear as a red, green, blue or white dot. Refer to description of "All Red" test above.

Troubleshooting

If any of the above tests do not perform correctly as described in the "Test Descriptions", perform the applicable procedure under the "Test Failed" section.

Test Failed

Bit Patterns – If the vertical bars are not straight or if the red border is not completely visible, either the microboard program jumpers are not configured correctly or the installed display or microboard is defective.

All Red, All Green, All Blue, All White, All Black - If these tests do not produce appropriate solid color screens, the "Display Ribbon Cable", "Display Interface Board", "Microboard" or "Display" could be defective. To locate the defective component perform tests in the following order.

1. Display Ribbon Cable - Using an Ohmmeter, perform a continuity test on all conductors in the ribbon cable. An open circuit would indicate the ribbon cable is defective.

2. Display Interface Board - Using an Ohmmeter, perform a continuity test on all conductors of the interface board. An open circuit would indicate the interface board is defective.

3. Microboard - With the "All Red" test selected, the voltage at microboard J5-6 through J5-11 (red drivers bits 0-5), as measured to GND, should be more than 3.0VDC. If not, the microboard is defective.

   With the "All Green" test selected, the voltage at microboard J5-13 through J5-18 (green drivers bits 0-5), as measured to GND, should be more than 3.0VDC. If not, the microboard is defective.

   With the "All Blue" test selected, the voltage at microboard J5-20 through J5-25 (Blue drivers bits 0-5), as measured to GND, should be more than 3.0VDC. If not, the microboard is defective.

   With the "All White" test selected, the voltage at microboard J5-6 through J5-11, J5-13 though J5-18 and J5-20 through J5-25 measured to GND, should be more than 3.0VDC. If not, the microboard is defective.

   With the "All Black" test selected, the voltage at microboard J5-6 through J5-11, J5-13, J5-18, and J5-20 through J25 should be less than 1.0VDC. If not, the microboard is defective.

4. Display - If the Display Ribbon Cable, Display Interface board, and microboard check OK per the above procedures, the Display is most likely the cause of the problem.

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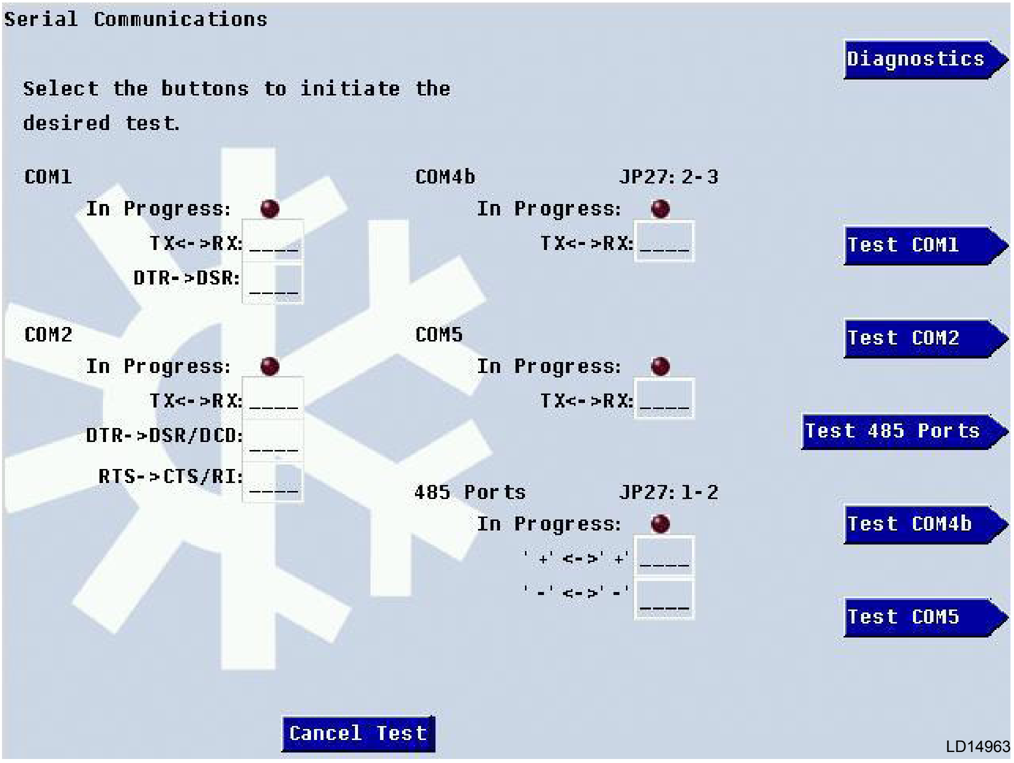

FIGURE 66 - SERIAL I/O TEST SCREEN

SERIAL I/O TEST

This diagnostic is used to verify correct operation of the Serial Data Ports. There is a test for each of the five Serial Data Ports. Each RS-232 port (COM 1, 2 and 4b) is tested by transmitting serial test data from outputs to inputs of each port. Both transmit and receive functions as well as the control lines are tested. The RS-484 ports (COM 3 and 4a) are tested by transmitting serial test data from one RS-485 port to another. The TX/RX opto-coupled port (COM 5) is tested by transmitting serial test data from the TX output to the RX input. If the received data matches the transmitted data, PASS is displayed; this is an indication that the serial port is OK. Otherwise, FAIL is displayed, indicating the serial port is defective. Prior to performing each test, the service technician must install a wire loop-back connection as described in Table 20. Refer to Section 3 *"Microboard"* and Figure 8 of this document for a description of the Serial Data Ports.

Procedure

1. Using small gauge wire, fabricate loop-back connections and install as follows for each port to be tested. Failure to install the loop-back connection or configure the microboard program jumper as noted will result in a FAIL outcome for the test.

TABLE 20 - LOOP BACK CONNECTIONS

	FROM	TO
COM 1	J2-4 (TX)	J2-3 (RX)
	J2-5 (DTR)	J2-2 (DSR)
COM 2	J13-5 (TX)	J13-3 (RX)
	J13-7 (DTR)	J13-1 (DCD) & J13-2 (DSR)
	J13-4 (RTS)	J13-6 (CTS) & J13-8 (RI)
RS-485 (COM 3 & 4A)	J12-3 (+)	J11-3 (+)
	J12-2 (-)	J11-2 (-)
Microboard program jumper JP27 must be installed in position 1 & 2		
COM 4B	J2-7 (GTX)	J2-6 (GRX)
Microboard program jumper JP27 must be installed in position 2 & 3.		
COM 5	J15-1 (TX)	J15-4
	J15-2 (RX)	J15-5
	J15-3 (common)	J15-6

Make individual wire connections or use loop around diagnostic connector 025-33778-000.

2. After making appropriate loop-back connections above, press the appropriate key to initiate the desired test. An LED will illuminate indicating the

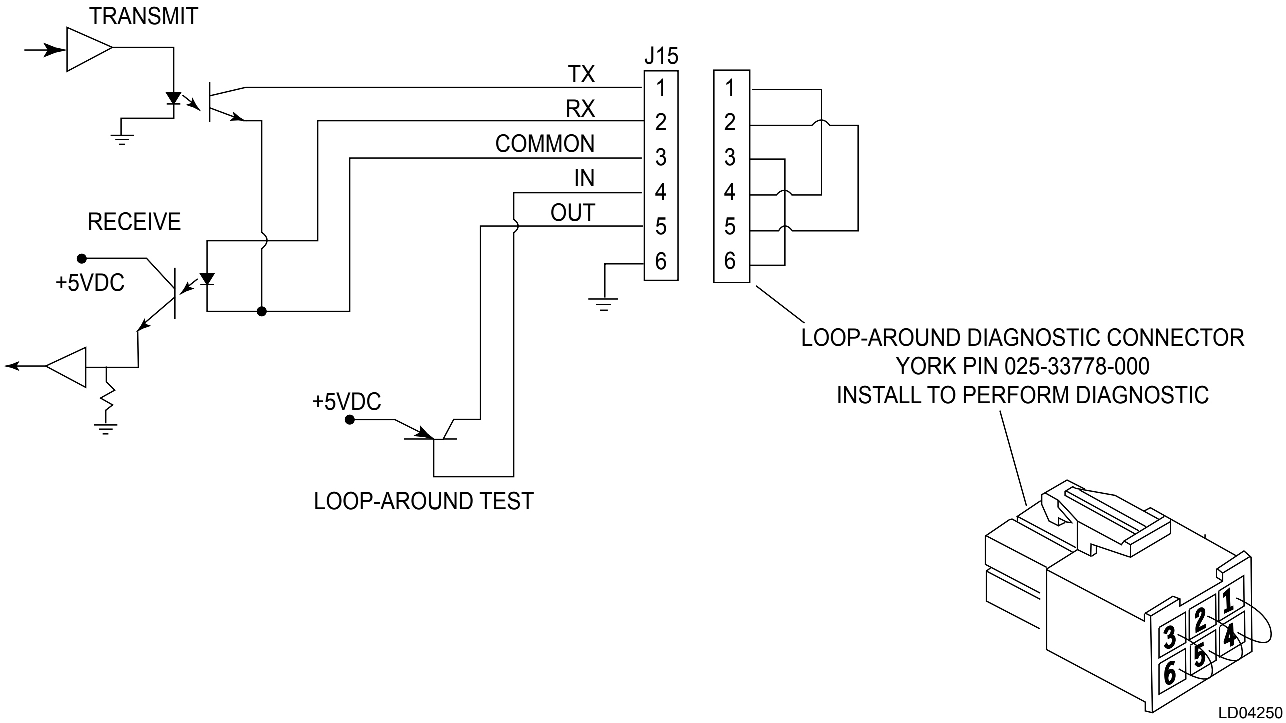

FIGURE 67 - MICROBOARD - COM 5 SERIAL DATA PORT

test is in process. If it is desired to terminate the test, press the CANCEL TEST key. Test data is sent from an output to an input as described below. At the completion of each test, if the data received matches the data sent, the serial port operates properly and PASS is displayed. Otherwise, FAIL is displayed, indicating the serial port is defective. A FAIL result would be indicative of a defective microboard. The following is a description of each test:

- COM 1 – Two tests are performed. Test data is sent from TX (J2-4) to RX (J2-3) at 9600 baud and DTR (J2-5) is set to a Logic High level and read at DSR (J2-2). If any test fails, COM 1 tests are terminated.
- COM 2 – Three tests are performed. Test data is sent from TX (J13-5) to RX (J13-3) at 19200 baud. DTR (J13-7) is set to a Logic High and read at DSR (J13-2) and DCD (J13-1). RTS (J13-4) is set to a Logic High and read at CTS (J13-6) and R1 (J13-8). If any test fails, COM 2 tests are terminated.
- RS-485 (COM 3 and 4a) – Test data is sent from COM 3 RS-485 port to COM 4a RS-485 at 19200 baud. Test data is then sent from COM 4a to COM 3 at the same rate. If either test fails, RS-485 tests are terminated.
- COM 4b – Test data is sent from GTX (J2-7) to GRX (j2-6) at 19200 baud.
- COM 5 – Test data is sent from TX (J15-1) to (J15-4) at 1200 baud. This output turns the microboard’s loop-around test transistor ON and OFF, applying 0 to +5VDC pulses from J15-5 to RX (J15-2) input.

After all desired tests have been performed, press the DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.

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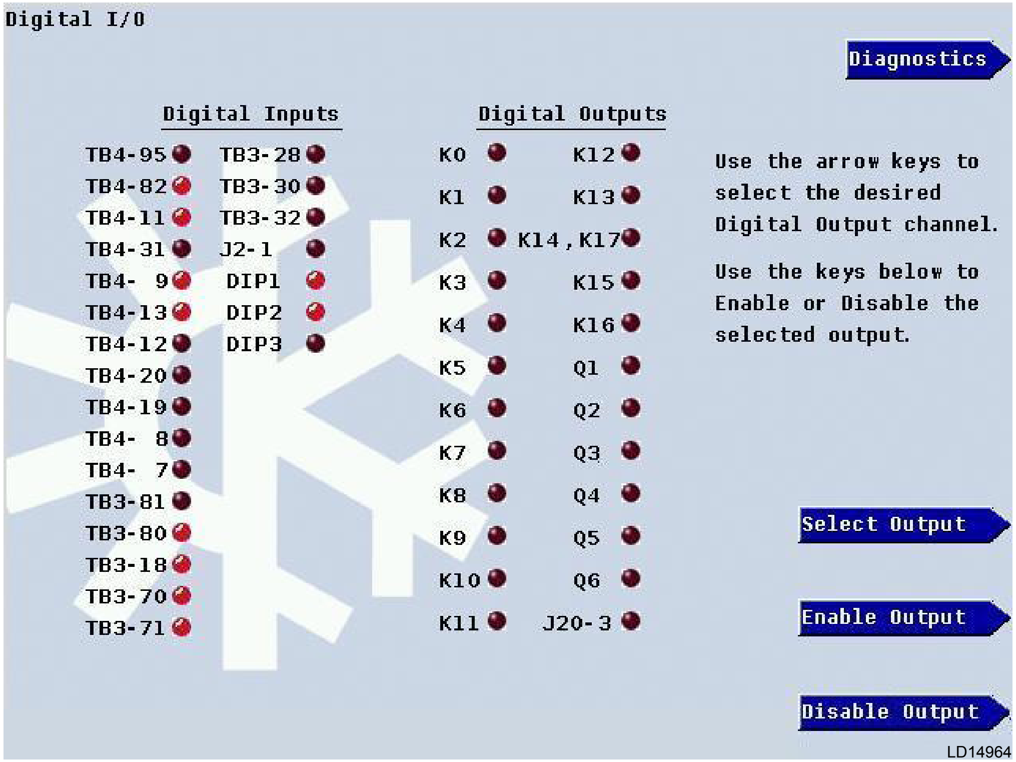

FIGURE 68 - DIGITAL I/O SCREEN

DIGITAL I/O TEST

This diagnostics is used to analyze the digital inputs and outputs of the microboard. Refer to Section 4 “I/O Board” in this document.

The state of each microboard digital input, problem jumper and program switch as interpreted by the microboard, is depicted by an LED. If the microboard interprets its input as being at a Logic Low (less than 1.0VDC) level, the LED is illuminated. If interpreted as being at a Logic High (more than 4.0VDC) level, the LED is extinguished.

The state of the microboard’s intended drive signals to each of the relays on the I/O is depicted by an LED. If the intended output is a Logic Low level (less than 1.0VDC), the red LED is illuminated. If the intended output is a Logic High level (more than 10.0VDC), the red LED is extinguished. Logic Low outputs energize the relays. Logic High outputs de-energize the relays. The state of any output can be manually set to either the “Enable” (Logic Low) or “Disable” (Logic High) state.

Procedure

Digital Inputs

1. The digital inputs are listed on this screen according to:
   A. Terminal number on the I/O board.
   B. Microboard program jumpers and program DIP switches.
2. With 115VAC applied to a particular I/O board digital input, the applicable LED should be illuminated. If the LED is not illuminated, perform appropriate troubleshooting procedure in the “Digital Inputs Troubleshooting” section.
3. With 0VAC applied to a particular I/O board digital input, the applicable LED should be extinguished. If the LED is not extinguished, perform appropriate troubleshooting procedure in the “Digital Inputs Troubleshooting” section.
4. If a program jumper is present, the applicable LED should be extinguished. If the LED is not extinguished, the microboard is defective.
5. If a program jumper is not present, the applicable LED should be illuminated. If the LED is not illuminated, the microboard is defective.
6. If a program switch (DIP) is in the ON position (also closed), the applicable LED should be illuminated. If the LED is not illuminated, the microboard is defective.
7. If a program switch (DIP) is in the OFF position (also open), the applicable LED should be illuminated. If the LED is not illuminated, the microboard is defective.

8. When all desired tests have been performed, press DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.

Digital Outputs

NOTE

IMPORTANT! The following steps cannot be performed until the connection between TB6-1 and TB6-53 has been removed. The program will prevent manual control of digital output devices until this connection is removed.

The digital outputs are listed on this screen according to relay triac number (KI, Q3, etc).

1. Press SELECT OUTPUT key.
2. Select a relay or triac for manual control by using the "▲" or "▼" keys.
3. The process starts at "K0" and counts down from there. Example, if you want the "K2" relay to energize, press SELECT OUTPUT key and push the "▼" key twice and press ENABLE OUTPUT key. The LED should light, closing its contacts. To extinguish the "K2" LED, press SELECT OUTPUT key and push the "▼" key twice and press the DISABLE OUTPUT key, the contact should reopen and the LED should extinguish. If a triac is selected, it will turn ON, energizing the device it is connected to. If the relay does not energize or triac does not turn ON, perform appropriate troubleshooting procedure in the "Digital Inputs Troubleshooting" section.
4. Pressing the DISABLE OUTPUT key should disable the selected output. If it does not, perform the Keypad test in Section 31 "Diagnostics and Troubleshooting". If a relay is selected, it should de-energize, opening its contacts. If a triac is selected, it will turn OFF, de-energizing the device it is connected to. If the relay does not de-energize or triac does not turn OFF, perform appropriate troubleshooting procedure in the "Digital Inputs Troubleshooting" section.
5. When all desired tests have been performed, press DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.
6. Reinstall jumper connection from TB6-1 to TB6-53.

Digital Inputs Troubleshooting

If any of the Digital Inputs tests fail to perform as described in the "Digital Inputs Procedure" located in this section, perform the following steps in sequence. If a defective component is found during any of the following steps, replace the component as instructed and repeat the Digital Inputs Procedure to determine if the problem has been resolved.

1. Remove I/O board ribbon cable. Using an ohmmeter, perform a continuity check on I/O board ribbon cable J1-21 to J19-21, J1-22 to J19-22 and applicable output pin of function that failed. If an open circuit is detected, replace ribbon cable. Otherwise, install ribbon cable and proceed to next step.
2. Measure the +5VDC supply voltage to the I/O board between J1-21 and J1-22 of the I/O board. If more than 4.5VDC, proceed to next step. If less than 4.5VDC, disconnect ribbon cable at I/O board J1 and repeat the measurement at J1. If less than 4.5VDC, replace the microboard. Re-install the ribbon cable.
3. With 115VAC (plus or minus10%) applied to the I/O board digital input that failed, the applicable I/O board output at J1 should be at the Logic Low level (less than 1.0VDC). If it is more than 1.0VDC, replace the I/O board. If the output is at a Logic Low level, the applicable LED should be illuminated. If the LED is not illuminated, replace the microboard.
4. With 0VAC applied to the I/O board digital input that failed, the applicable I/O board output at J1 should be at a Logic High level (more than 4.0VDC). If it is less than 4.0VDC, replace the I/O board. If the output is at a Logic High level, the applicable LED should be extinguished. If it is not extinguished, replace the microboard.

Digital Outputs Troubleshooting

If any of the digital outputs tests fail to perform as described in the "Digital Outputs Procedure" located in this section, perform the following steps in sequence. If a defective component is found during any of the steps, replace the component as instructed and repeat the procedure to determine if the problem has been resolved.

1. Remove I/O board ribbon cable. Using an Ohmmeter, perform a continuity test on the cable J1-25 to J19-25, J1-26 to J19-26 and applicable output pin of function that failed. If an open circuit is detected, replace ribbon cable. Otherwise, install ribbon cable and proceed to next step.
2. Measure the +12VDC supply voltage to the I/O board on I/O board between J1-26 (+12.0VDC) and J1-25 (GND). If more than 11.0VDC, proceed

to next step. If less than 11.0VDC, disconnect ribbon cable at I/O board J1 and repeat measurement at J1. If less than 11.0VDC, replace the microboard. Re-install the ribbon cable.

3. Using the digital outputs procedure above, select the output that failed the digital output test above.
4. Press ENABLE OUTPUT key. The LED adjacent to the selected output will illuminate. The appropriate microboard output pin at J19 for the selected output should be at a Logic Low level (less than 1.0VDC). If it is more than 1.0VDC, replace the microboard. With the output at a Logic Low, the following should occur:
   A. If a Relay is selected as the output, the contacts of the relay should be closed. If they are not closed, replace the I/O board.
   B. If a triac is selected as the output, the triac should be turned ON. If the triac has not turned ON, replace the I/O board.

NOTE

A load must be connected across the triac to determine the ON/OFF state of the triac. The ON/OFF state of the triac can be determined by measuring across the solenoid with an AC voltmeter. If the triac is turned ON, the voltage will be more than 100VAC. If the triac is turned OFF the voltage will be less than 60 VAC.

5. Press DISABLE OUTPUT key. The LED adjacent to the selected output will extinguish.
   A. If a relay is selected as the output, the appropriate microboard output pin at J19 for the selected output should be at a Logic High (more than 10.0VDC) level. With the output at a Logic High level, the relay contacts should be open. If they are not open, replace the I/O board. If it is less than 10.0VDC, remove the ribbon cable from J1 of the I/O board. On the I/O board, measure the resistance from J1-26 to the appropriate pin of J1 on the I/O board for the selected relay. If the resistance is more than 100 ohms, replace the I/O board. If the resistance is less than 100 ohms, replace the microboard.
   B. If a triac is selected as the output, the appropriate microboard output pin at J19 for the selected output should be at a Logic High (more than 10.0VDC) level. If it is less than 10.0VDC, replace the microboard. With the output at a Logic High level, the triac should be turned OFF. If the triac has not turned OFF, replace the I/O board.

NOTE

A load must be connected across the triac to determine the ON/OFF state of the triac. The ON/OFF state of the triac can be determined by measuring across the solenoid with an AC voltmeter. If the triac is turned ON, the voltage will be more than 100VAC. If the triac is turned OFF the voltage will be less than 60 VAC.

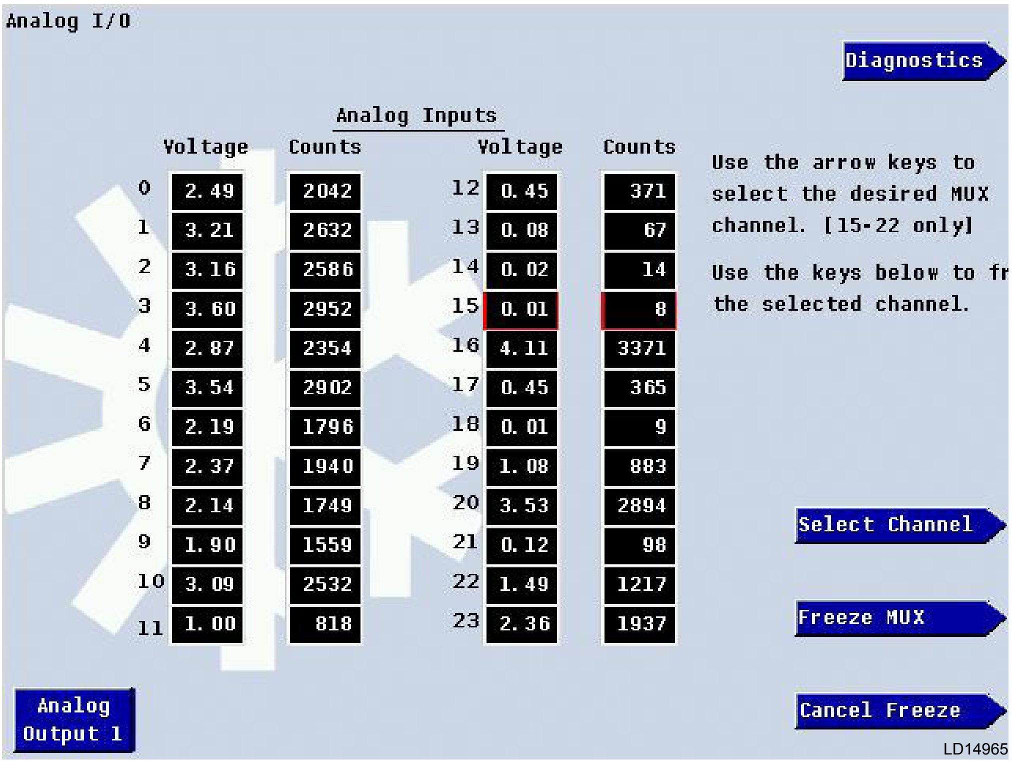

FIGURE 69 - ANALOG I/O SCREEN

ANALOG INPUTS TEST

This diagnostic is used to analyze the analog inputs to the microboard. The voltage level of each analog input, as interpreted by the microboard, is displayed. The "Counts" listed for each parameter is the Analog-to-Digital (A/D) converter value and is for manufacturing and engineering use only.

If the chiller is shut down on an analog safety or is prevented from starting because of an analog input, there is probably an analog problem. This screen can be used in the investigation of this problem.

The following is a list of the analog inputs displayed (see Table 15).

0 - +2.5VDC Analog Supply Voltage, reference microboard TP6.

1 - Leaving Chilled Water Temperature.

2 - Return Chilled Water Temperature.

3 - Leaving Condenser Water Temperature.

4 - Return Condenser (Absorber) Water Temperature.

5 - Refrigerant Leaving Condenser Temperature.

6 - Generator Strong Solution Temperature.

7 - Steam or Hot Water Supply to Generator Temperature.

8 - Auto De-crystallization Temperature.

9 - Generator Pressure.

10 - Steam Supply Pressure to Generator.

11 - Purge Tank Pressure.

12 - Purge Pump Pressure.

13 - Spare.

14 - Spare.

15 - N/A.

16 - Spare.

17 - Steam or Hot Water Valve Potentiometer (digital valves only).

18 - Spare.

19 - Spare.

20 - Remote Leaving Chilled Water Temperature Setpoint (jumper configurable).

21 - Remote Steam / Hot Water Limit Setpoint (jumper configurable).

22 - strong solution leaving solution-to-solution heat exchanger temperature.

23 - Refrigerant temperature.

Procedure

1. From the above, select the analog input that is malfunctioning. All inputs except channel 0, 20 and 21 are sensors that connect directly to the microboard via shielded cable. Channel 0 is a reference voltage for the analog circuits on the microboard. Channels 20 and 21 are remote setpoints inputs used in analog REMOTE mode.
2. Refer to the wiring diagrams as listed in the "Reference Manuals List" table at the front of this document or to Section 27"Diagnostic Screen" to identify the device that performs this function and the header and pin connection on the microboard.
3. Channel 0: Using a voltmeter, measure the voltage between microboard TP6 (+2.5VDC) and TP1 (GND). Compare this measured valve to the displayed value. If the value is not within plus or minus10%, replace the microboard.
4. All Channels except 0, 20 and 21: Using a voltmeter, measure the analog input to the microboard. Make the measurement between the device output and ground connection to the device. For example, measure the output of the generator transducer at microboard J8-21 (signal back from transducer) to J8-22 (GND).
5. When all desired tests have been performed, press DIAGNOSTICS key to return to the MAIN DIAGNOSTICS screen.

NOTE

Press the FREEZE MUX key to lock in the selected signal. Press the CANCEL FREEZE key to unlock the signal.

Troubleshooting

All Channels Except 0, 20 and 21

1. Disconnect both ends of the cable of the analog input that is malfunctioning. Using an Ohmmeter, perform a continuity test on all conductors in the cable. An open circuit would indicate the cable is defective.
2. Using a voltmeter, measure the +12VDC supply voltage input at the microboard J1-3 (+12VDC) to J1-2 (GND). If voltage is, 11.5VDC, check wiring to power supply. If wiring is OK, the power supply is most likely defective.
3. Using a voltmeter, measure the supply voltage (+5VDC, +12VDC or +24VDC) to the sensor. If the voltage is not within plus or minus10% of specified voltage, disconnect J7, J8 and J9 from the microboard. This disconnects all analog devices from the microboard. If the voltage increases to the correct level, a thermistor or transducer is shorted. Locate the shorted device and replace. If, after disconnecting the connectors the supply voltage is still not within 10% of the specified value, the voltage supply source (microboard or power supply) is most likely defective.
4. Verify sensor accuracy using appropriate test device. Replace sensor if necessary.

Channels 20 and 21

1. Refer to Table 2 of this document "Program Jumpers/Program Switches" under Section 3, "Microboard" and verify that the appropriate jumpers are configured correctly for the type of input.
2. Disconnect both ends of the cable for the remote input that is malfunctioning. Using an ohmmeter, perform a continuity check on all conductors in the cable. An open circuit would indicate the cable is defective.
3. If all steps are OK, the problem is most likely in the remote device that supplies the remote signal.

Operating the Control Valve When the Chiller is Not Running.

When the Systems Status display field indicates "System Running", the service technician is able to operate the control valve in AUTO or MANUAL mode. Use the following procedure at unit commissioning or other service procedures when the unit is not operational:

1. Using the above procedure, enter the MAIN DIAGNOSTICS screen and login into SERVICE mode.
2. Press the ANALOG I/O TEST key at the bottom right hand side of the display.
3. Press the ANALOG OUTPUT 1 key at the bottom left of the display. A pop-up window will appear.
4. Use the number keys to select a value between 0% open and 100% open.
5. Press "✓", the window will disappear and the valve will be driven to the selected position.

SECTION 32 - SYSTEM COMMISSIONING

Use YIA Start-up Checklist (*Form 155.21-CL2*) during commissioning to assure all setpoints have been programmed to the desired value and all calibrations have been performed. Most of the programming of the setpoints requires the access level to be in SERVICE mode before beginning. The setpoints are grouped under the display screen in which they appear.

BY JOHNSON CONTROLS

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