YORK BY JOHNSON CONTROLS	Supersedes: 160.75-PW4 (1013) Form 160.75-PW4 (714)
WIRING DIAGRAM	**FIELD CONTROL MODIFICATIONS FOR YK CHILLER (STYLE G)**
CONTRACTOR _____ ORDER NO. _____ YORK CONTRACT NO. _____ YORK ORDER NO. _____	PURCHASER _____ JOB NAME _____ LOCATION _____ ENGINEER _____
☐ REFERENCE DATE _____	☐ APPROVAL DATE _____ ☐ CONSTRUCTION DATE _____

JOB DATA:

CHILLER MODEL NO. YK _____ CHILLER MODEL NO. YK _____

NO. OF UNITS _____ NO. OF UNITS _____

TYPE OF STARTING _____ TYPE OF STARTING _____

Included by YORK® for Field Installation (by others) are:

	YES	NO	PER UNIT
One – Two Unit Sequence Control Kit, Part No. 466-61597T	☐	☐	_____
Condenser Water Temperature Sensor Kit, Part No. 375-01738-000	☐	☐	_____
Condenser Water Flow Switch	☐	☐	_____
_____	☐	☐	_____
_____	☐	☐	_____

Issue Date:
July 31, 2014

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, 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 posseses 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.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the OptiView™ cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office or accessing the Johnson Controls QuickLIT website at http://cgproducts.johnsoncontrols.com.

Operating/service personnel maintain responsibility for the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, the technician should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

LIST OF FIGURES

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ENERGY MANAGEMENT SYSTEMS

The chiller design allows for ease of interfacing with Energy Management Systems (EMS). The OptiView™ Control Center includes unit status contacts, provisions for remote control inputs and provisions for remote setpoint reset of leaving chilled liquid temperature and current limit for EMS interfacing (see Note 7).

Five sets of unit status contacts are factory furnished through a field wiring terminal board in the Optiview™ Control Center. Each set of contacts are single pole, normally open, rated at 5 amperes resistive at 240VAC. Chiller status contacts are provided for unit:

- Remote Mode Ready to Start – *See Figure 1 on page 7*.
- Cycling Shutdown – *See Figure 2 on page 7*.
- Safety Shutdown – *See Figure 3 on page 7*.
- Run (System Operating) – *See Figure 4 on page 8*.
- Anticipatory/Alarm – *See Figure 5 on page 8*.

Four sets of inputs are available to the EMS, allowing for remote control of unit operation. Input device contact rating shall be 5 milliamperes at 115VAC. Field wiring terminal board (TB4) in the OptiView™ Control Center permits connection for the following operation:

- Remote Stop Contacts – *See Figure 6 on page 8*.
- Remote Start Contacts – *See Figure 6 on page 8*.
- Remote/Local Cycling Devices – *See Figure 7 on page 9*.
- Multi-unit Sequence – *See Figure 8 on page 9*.

The chiller should not be cycled by the EMS because the large motor used to drive the centrifugal compressor is limited to one start per 30 minutes. Instead, it is possible to limit the compressor motor amp draw indirectly or directly by the following methods:

1. Application of Sequence Control Kit, so only one unit is running, when a single unit can carry the cooling load – See *Figure 11 on page 10*.
2. When multiple unit installations are controlled by an EMS, remote start and stop contacts are available to start and stop each chiller per *Figure 6 on page 8*. Contact rating shall be 5 milliamperes at 115VAC.
3. The OptiView™ Control Center has a programmable time clock function as a standard feature with holiday capability. This offers one preset automatic Start-Stop per day on a seven day calendar basis with the ability to program a single additional holiday start and stop time up to a week in advance. Chilled liquid pump control contacts (see Note 13) are also provided, allowing for efficient automatic operation of the chilled water pump to reduce energy. Two chilled liquid pump operating modes are available via the SETPOINT > SETUP screen. With the setpoint set to STANDARD, the chilled water pump operates for 30 seconds prior to chiller start, during chiller operation, coastdown, and LWT cycling shutdowns. With the setpoint set to ENHANCED, the chilled water pump operates as above plus it operates during MULTI-UNIT and REMOTE/LOCAL cycling shutdowns.

- Reduce the compressor-motor kW input (and thus amps), by raising the leaving chilled liquid temperature through remote temperature control setpoint in the “remote” operating mode. When remote temperature reset is accomplished by supplying a 1 to 11 second pulse-width modulated signal, refer to *Figure 19 on page 14*. Through use of the remote temperature control analog input on the microboard, the leaving chilled liquid temperature may be reset via a 0 to 20 or 4 to 20mA DC current signal, or a 0 to 10 or 2 to 10VDC signal.

4. Current limiting of demand during pulldown may be accomplished by using the standard PULLDOWN DEMAND LIMIT function provided in the OptiView™ Control Center. The “Pulldown Demand Limit” key can be programmed to limit compressor motor current from 30 to 100 percent of full load amperes, for 1 to 255 minutes following each compressor start. For more details refer to OptiView™ Control Center Instructions, Form 160.54-O1.

5. Controlling the maximum allowable compressor motor amps from 30 to 100% through remote current limit setpoint. Refer to *Figure 19 on page 14* when the remote current limit is accomplished by supplying a 1 to 11 second pulse-width modulated signal in the “remote” operating mode. A jumper configurable analog input is available for remote current limit setpoint via a 0 to 20 or 4 to 20mA DC current signal, or a 0 to 10 or 2 to 10VDC signal.

6. A BAS System may be interfaced with the chiller OptiView™ Control Center to provide unified chiller plant system control. The BAS System directly communicates with the OptiView™ Control Center via the E-Link Gateway card which may be installed in the Control Center. All temperatures, pressures, safety alarms and cycling information known to the OptiView™ Control Center are then available to the BAS System for integrated chiller plant control, data logging, and local and remote operator displays. The E-Link Gateway card also allows the BAS System to start, stop, and reset the chiller’s leaving chilled water and current limit setpoints.

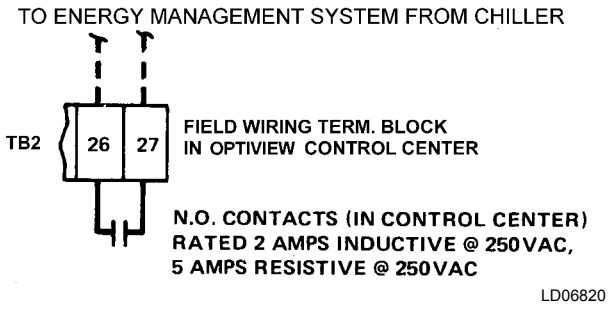


FIGURE 1 - REMOTE MODE READY TO START CONTACTS

REMOTE MODE READY TO START CONTACTS

When closed, these contacts signify the following:

1. The OptiView™ Control Center is in DIGITAL, ANALOG or ISN remote operating mode, allowing for energy management system or remote start/stop control (*Figure 6 on page 8*).
2. All chiller safety cutout controls are in the normal position, so they will allow the unit to start.
3. All chiller cycling cutout controls are in the normal position, so they will allow the unit to start.
4. The OptiView™ Control Center COMPRESSOR switch is in the RUN (**I**) position.
5. The 30 minute anti-recycle timer has timed out. A closure of the Remote Mode Ready to Start Contacts then signifies that the unit shall start when the Energy Management System maintains the Remote Stop Contact (*Figure 6 on page 8*) open and momentarily closes the Remote Start Contact (*Figure 6 on page 8*). When the Remote Mode Ready to Start Contacts close, the OptiView™ Control Center will display SYSTEM READY TO START message.

CYCLING SHUTDOWN CONTACTS

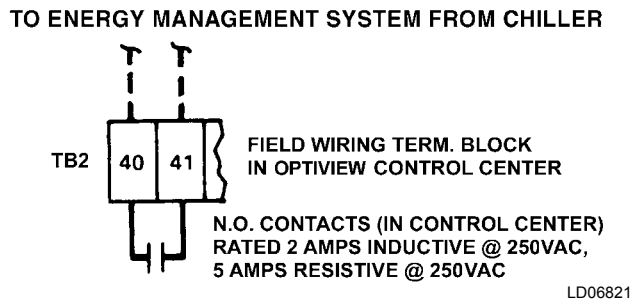


FIGURE 2 - CYCLING SHUTDOWN CONTACTS

When closed, these contacts signify the unit is not permitted to start due to a CYCLING shutdown condition. The unit will automatically restart after the cycling condition is no longer present. YORK Operating and Maintenance Manual 160.54-O1 provides a list and explanation of all Cycling shutdowns. While these contacts are closed, the OptiView™ Control Center will display CYCLING SHUTDOWN – AUTO RESTART on the System Status Bar and the cause of the shutdown on the System Details bar of the display. Cycling Shutdown contacts function in all operating modes.

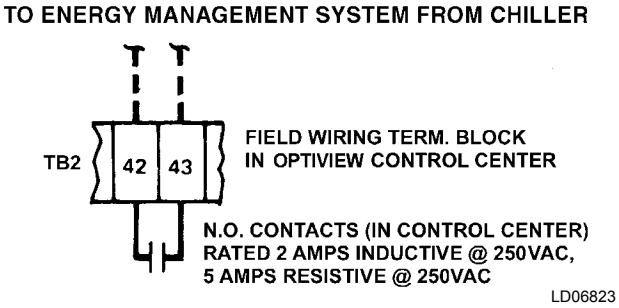


FIGURE 3 - SAFETY SHUTDOWN CONTACTS

SAFETY SHUTDOWN CONTACTS

When closed, these contacts signify the unit is not permitted to start due to a SAFETY shutdown condition. Safety shutdowns require a manual reset procedure be performed before the unit can be restarted. YORK Operating and Maintenance Manual 160.54-O1 provides a list and explanation of all Safety Shutdowns. While these contacts are closed, the OptiView™ Control Center will display SAFETY SHUTDOWN – MANUAL RESTART on the System Status Bar and the cause of the shutdown on the System Details Bar of the display. These contacts will remain closed until the safety condition no longer exists and a manual reset is performed by placing the OptiView™ Control Center COMPRESSOR Switch in the Stop-Reset position (O). The unit can then be restarted. Safety Shutdown contacts function in all operating modes.

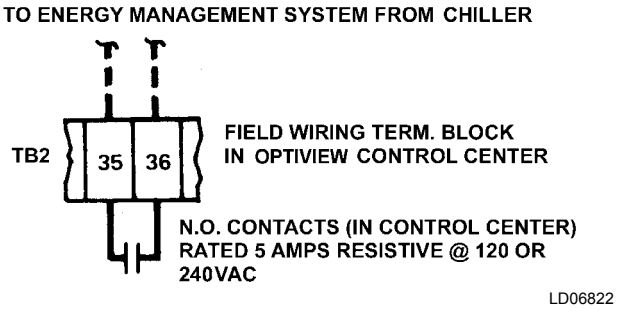


FIGURE 4 - RUN CONTACTS

RUN CONTACTS

When closed, these contacts signify that the unit is operating. The OptiView™ Control Center will display a System Run Message.

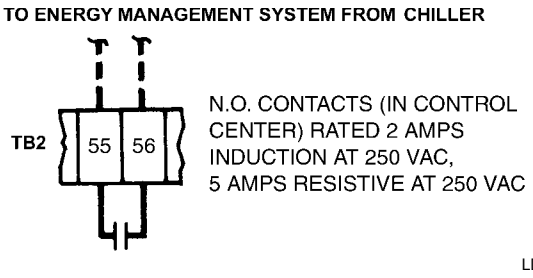


FIGURE 5 - ANTICIPATORY/ALARM CONTACTS

ANTICIPATORY/ALARM CONTACTS

These contacts will close whenever one or more of the following WARNING conditions occurs. They will remain closed as long as the condition is in effect. On most warnings, the contacts automatically open when the condition is no longer present. On those warnings marked with an asterisk, the contacts will open only after the condition is no longer present and the WARNING RESET key is pressed in Operator (or higher) access level.

Real time clock failure, Condenser or Evaporator Transducer Error*, Refrigerant lLevel Out of Range, Standby Lube – Low Oil Pressure*, Setpoint Override*, Condenser-High Pressure Limit, Evaporator-Low Pressure Limit, Vanes Uncalibrated – Fixed speed, Harmonic Filter – Operation Inhibited, Harmonic Filter – Data Loss, Harmonic Filter – Input Frequency Out of Range.

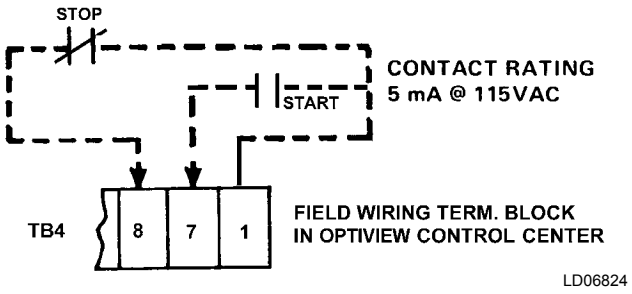
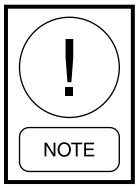


FIGURE 6 - REMOTE START-STOP CONTACTS FROM ENERGY MANAGEMENT SYSTEM (EMS)

REMOTE START AND STOP CONTACTS FROM ENERGY MANAGEMENT SYSTEM

When the OptiView™ Control Center is in the DIGITAL or ANALOG remote operating mode and the COMPRESSOR switch is in the RUN (**I**) position, with the Remote Stop Contacts open, and the Remote Mode Ready to Start Contacts closed (*Figure 1 on page 7*), the unit will start via a closure of the Remote Start Contacts. A subsequent closure of the Energy Management System Remote Stop Contacts causes the chiller to shut down. The OptiView™ Control Center will display REMOTE STOP because the Energy Management System Remote Stop Contact has commanded the unit to shutdown.

It is recommended that maintained contacts be used for both START and STOP.



Even when the chiller is applied with Remote Start-Stop (when the Control Center is in the "remote" operating mode), an EMERGENCY STOP by an operator or others can STOP the compressor from the OptiView™ Control Center and prevent the chiller from restarting. However, the operator cannot locally start the compressor using "compressor" start switch, when the control center is in the "remote" operating mode.

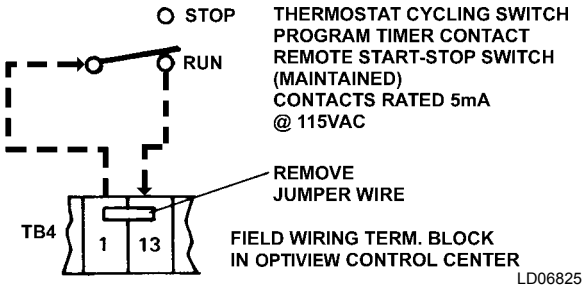


FIGURE 7 - REMOTE/LOCAL CYCLING DEVICES

REMOTE/LOCAL CYCLING DEVICES

The closure of an automatic reset device across this input will permit the unit to operate in all operating modes. Conversely, an opening of the device contacts will inhibit the unit from operating; the OptiView™ Control Center will then display the following messages: CYCLING SHUTDOWN – AUTO RESTART and SYSTEM CYCLING – CONTACTS OPEN.

NOTE

The OptiView™ Control Center contains a seven day time clock to select daily schedule Start/Stop times (Sunday through Saturday including one or more holidays in week) up to one full week at a time. So automatic start and stop of the unit on a daily basis, at predetermined times, can be programmed as a standard feature; an additional program timer is not required for this function.

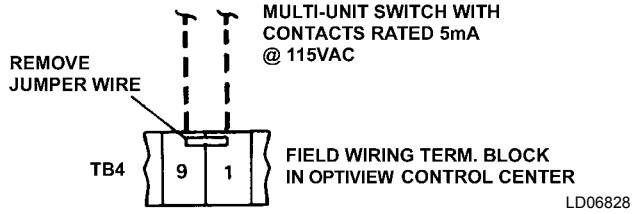


FIGURE 8 - MULTI-UNIT SEQUENCE

MULTI-UNIT SEQUENCE

For multiple chiller installation application, Multi-Unit Sequence contacts are available to start and stop each unit. The maintained closure of a device contacts across terminals 1 and 9 will permit the unit to operate in all the operating modes with the COMPRESSOR switch in the RUN (**I**) position. Conversely, an opening of the device contacts will inhibit the unit from operating; the OptiView™ Control Center will then display the following message: CYCLING SHUTDOWN – AUTO RESTART and MULTIUNIT CYCLING – CONTACTS OPEN. An accessory sequence control kit for two, three or four units is available from YORK – *See Figure 11 on page 10* for Two Unit Sequence Control Kit.

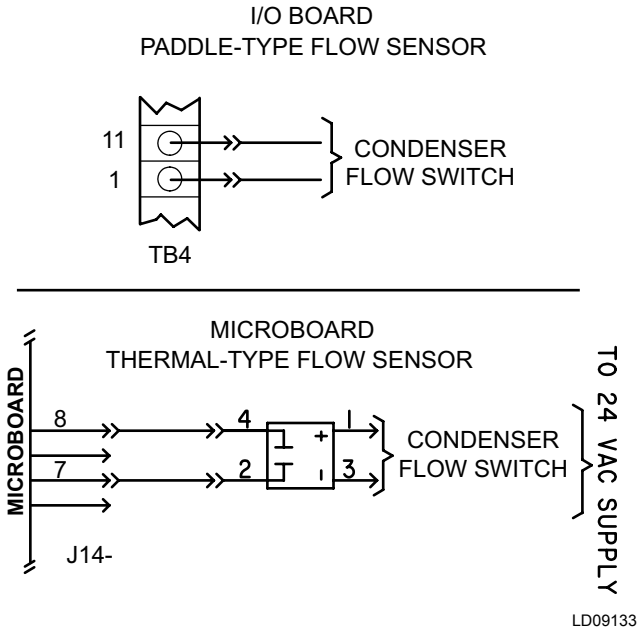


FIGURE 9 - CONDENSER FLOW SWITCHES

CONDENSER FLOW SENSORS

The Thermal-type Flow Sensor interfaces with the Microboard and the Paddle-type Flow Sensor interfaces with the I/O board.

For the program to read the appropriate inputs for the flow sensor status, the actual flow sensor type used must be entered at the keypad OPERATIONS Screen using Service Access Level. Enter ANALOG for Thermal-type or DIGITAL for Paddle-type. Refer to Operation manual 160.54-O1.

When flow is sensed, the flow sensor contacts are closed. Opening of the flow sensor contacts (no flow) for 2 continuous seconds causes a cycling shutdown displaying CONDENSER - FLOW SWITCH OPEN. The flow sensor status is bypassed for the first 30 seconds of SYSTEM RUN.

If Paddle-type (Digital) is selected and no condenser flow sensor is used, a jumper must be installed between terminals 1 and 11.

THERMAL TYPE FLOW SENSOR

When the Thermal-type Flow Switch is used, the flow switch uses the cooling effect of liquid to sense flow.

When the flow of liquid is sensed, the solid state relay output is turned on conducting current through the microboard load resistor to the +5VDC applying >+4VDC to the microboard input J7-16.

When no flow of liquid is sensed, the solid state relay output is turned off, this results in <1VDC to the microboard input and the OptiView™ Control Center will display the following message: CYCLING SHUTDOWN – AUTO RESTART and CONDENSER FLOW SWITCH OPEN.

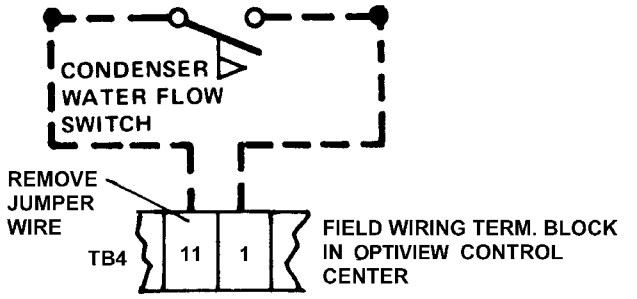


FIGURE 10 - PADDLE TYPE FLOW SENSOR

PADDLE TYPE FLOW SENSOR

If desired, a Condenser Water Flow Interlock can be applied. Flow Switch – McDonnel type FS8W, maximum 150 psi (YORK Part No. 024-15793) available at additional cost. If Condenser Water Flow Switch is not used, a jumper must be installed between terminals 1 and 11.

When condenser water is flowing, the flow switch contact will close. Opening of the Condenser Water Flow Switch Contacts for 2 continuous seconds will cause unit shutdown. The flow switch status is checked 30 seconds into SYSTEM RUN and continuously thereafter. The OptiView™ Control Center will display the following message: CYCLING SHUTDOWN – AUTO RESTART and CONDENSER FLOW SWITCH OPEN.

TWO UNIT SEQUENCE CONTROL

Provides that cycling thermostat RWT will automatically cycle either #1 or #2 unit. Timer 3TR is an additional feature which prevents simultaneous starting of lead and lag unit following a power failure and eliminates nuisance starting of lag unit due to periodic fluctuations in temperature. For two unit sequence control kit, order York Accessory Kit No. 466-61597T for controls as specified with NEMA 1 enclosure.

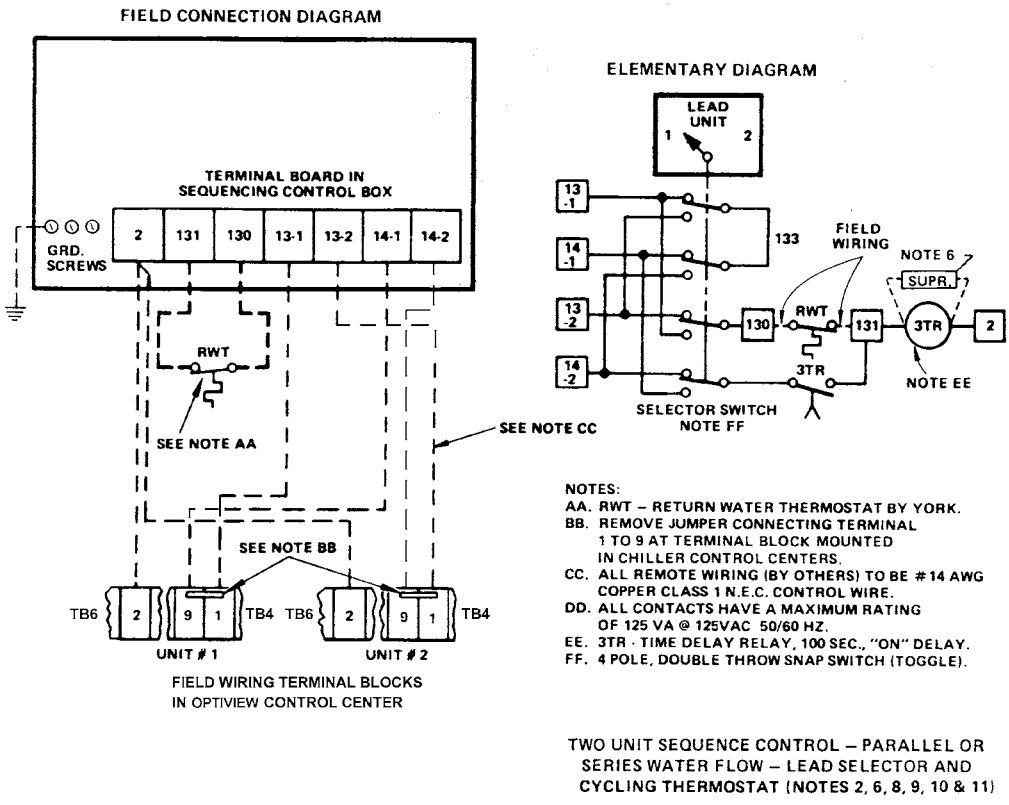


FIGURE 11 - TWO UNIT SEQUENCE CONTROL

RWT has 20°F(-6.7° to 80°F(26.7°C) range with adjustable differential of 3-1/2 to 14°F (1.9 to 7.8°C); 6 ft. of capillary with 3/8" x 5" bulb and 1/2" NPT brass well (maximum liquid DWP 300 psig). The thermostat is drawn to indicate its operation closes on rise. A 1/2" pipe coupling in the return chilled water line from the building must be furnished (by others) for RWT control well.

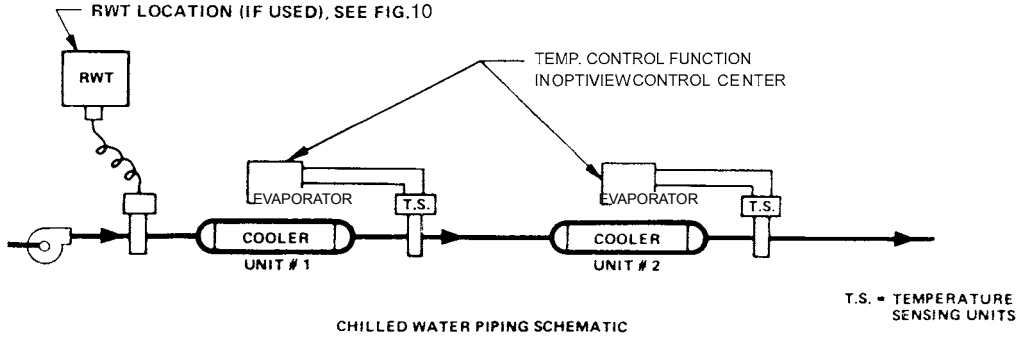


FIGURE 12 - MULTIPLE UNITS (TWO) – SERIES OPERATION (NOTES 8 AND 11)

MULTIPLE UNITS (TWO) - SERIES OPERATION

The supply chilled water temperature to the building is normally determined by the CHILLED LIQUID TEMPERATURE setpoint for Unit #2. When lead selector position of sequence control kit (*Figure 11 on page 10*) is Unit #1, the supply chilled water temperature to the building will be the temperature control setpoint on Unit #1 OptiView™ Control Center. If lower temperature is desired, reprogram the CHILLED LIQUID TEMPERATURE setpoint for Unit #1.

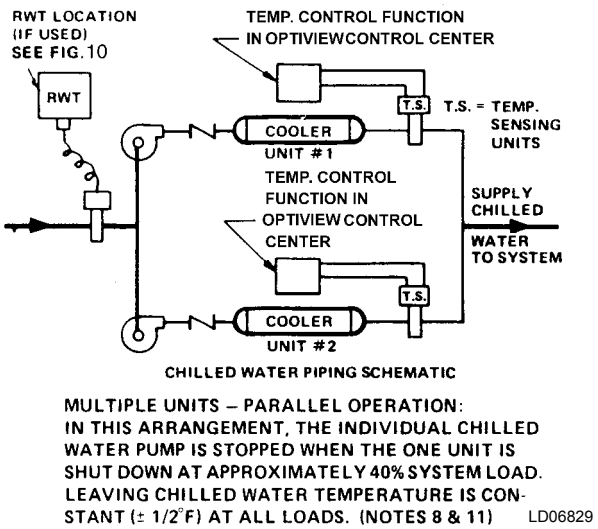


FIGURE 13 - MULTIPLE UNITS (TWO) – PARALLEL OPERATION – INDIVIDUAL UNIT PUMPS

MULTIPLE UNITS (TWO) – PARALLEL OPERATION – INDIVIDUAL UNIT PUMPS

This piping arrangement is the same as *Figure 15 on page 12*, except that the chilled water pumps associated with each evaporator are cycled ON and OFF with the unit. This results in reduced chilled water flow rates whenever a single unit can handle the cooling load. Because no chilled water flows through the inoperative unit, the mixed water temperature peculiar to using a single pump is avoided. When one unit is cut-out by the sequence control (*Figure 11 on page 10*) the temperature of the supply chilled water does not change.

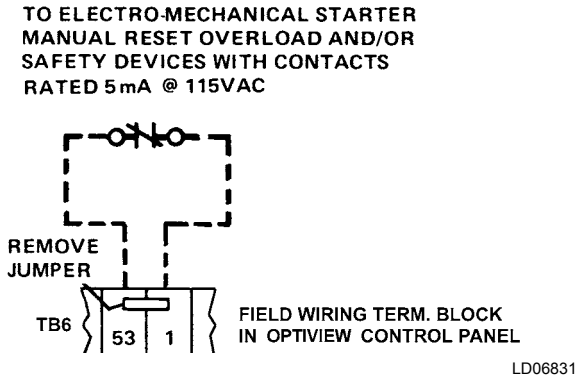


FIGURE 14 - ELECTRO-MECHANICAL STARTER MANUAL RESET OVERLOADS (2300 TO 4160 VOLTS) (U.L. OR C.S.A. APPROVED UNITS ONLY) ALL CHILLERS EXCEPT THOSE EQUIPPED WITH "P" COMPRESSORS

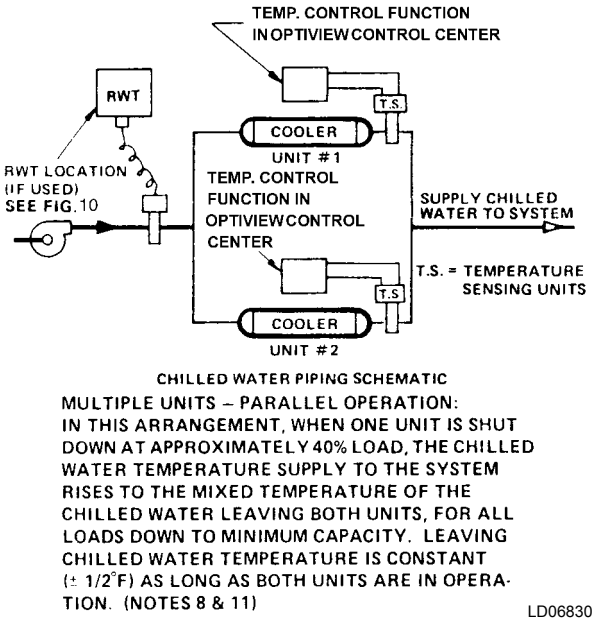


FIGURE 15 - MULTIPLE UNITS (TWO) – PARALLEL OPERATION – SINGLE CHILLED WATER PUMP

MULTIPLE UNITS (TWO) – PARALLEL OPERATION – SINGLE CHILLED WATER PUMP

For this piping arrangement, each chiller's water sensor is located in its own leaving water nozzle. This produces a constant MIXED chilled water temperature when both units are operating. When either unit is cycled off by the sequence control *(Figure 11 on page 10*), mixed chilled water temperature will rise as a result of uncooled return water flowing through the inoperative unit. For individual unit chilled water pump piping, refer to *Figure 13 on page 11*.

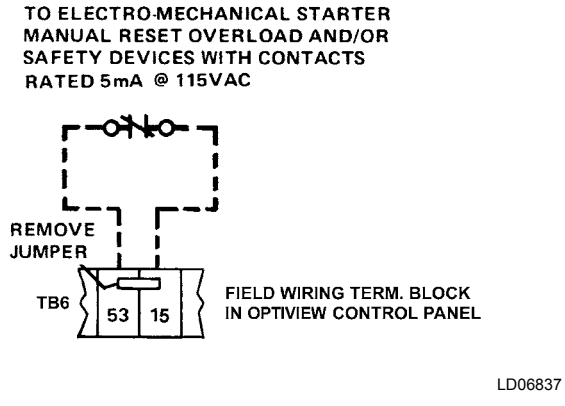


FIGURE 16 - ELECTRO-MECHANICAL STARTER MANUAL RESET OVERLOADS (2300 TO 4160 VOLTS) (U.L. OR C.S.A. APPROVED UNITS ONLY) CHILLERS EQUIPPED WITH "P" COMPRESSORS

ELECTRO-MECHANICAL STARTER MANUAL RESET OVERLOADS

The chiller compressor type determines which terminals must be used for this feature. Failure to use the proper terminals could result in serious chiller damage!

Terminals are available for connection of the manual reset overloads and/or safety devices in the high voltage Electro-Mechanical Starter for U.L. or C.S.A. approved units having 2300 to 4160 volt motors. The appropriate terminals must be selected based on the chiller compressor type. For chillers that are NOT equipped with compressor code "P", use terminals 1 and 53 as shown in *Figure 14 on page 11*. For chillers equipped with compressor code "P", use terminals 15 and 53 as shown in *Figure 16 on page 12*. Refer to appropriate Remote Motor Starter Specification as follows: 160.45-PA5.1 (all compressors except "P"); 160.54-PW14 (chillers equipped with "P" compressors). An opening of the contacts causes the OptiView™ Control Center to display: CYCLING SHUTDOWN – AUTO RESTART and MOTOR CONTROLLER – CONTACTS OPEN" To restart the chiller, reset the external device in the Electro-Mechanical Starter that caused the shutdown. Then the unit will automatically restart.

REMOTE CURRENT LIMIT SETPOINT WITH 0-10VDC, 2-10VDC, 0-20MA, 4-20MA OR PULSE WIDTH MODULATION SIGNAL.

The Remote Current Limit Setpoint can be reset over the range of 100% to 30% Full Load Amps (FLA) by supplying (by others) a 0-10VDC, 2-10VDC, 0-20mA, 4-20mA or 1 to 11 second Pulse Width Modulated (PWM) signal to the OptiView™ Control Center. The OptiView™ Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate Remote Mode must be selected: Analog Remote Mode must be selected when using a voltage or current signal input. Digital Remote Mode must be selected when using a PWM input.
- If Analog Remote Mode is selected, the Remote Analog Input Range setpoint must be set to "0-10VDC" or "2-10VDC" as detailed below, regardless of whether the signal is a voltage or current input signal type.

- Microboard Program Jumper P23 must be positioned appropriately per the input signal type as detailed below. It is recommended that a qualified Service Technician position this jumper.

NOTE

Important! The signal type used for Remote Current Limit Setpoint reset and the signal type used for Remote Leaving Chilled Liquid Temperature setpoint reset must be the same. For example, if a 0-10VDC signal is being used for Remote Leaving Chilled Liquid Temperature Reset , then a 0-10VDC signal must be used for Remote Current Limit Reset.

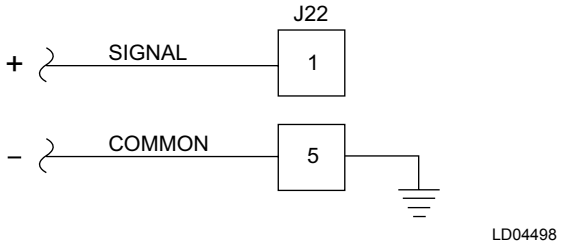


FIGURE 17 - REMOTE CURRENT LIMIT SETPOINT WITH 0-10VDC OR 2-10VDC SIGNAL

0-10VDC - As shown in *Figure 17 on page 13*, connect input to Microboard J22-1 (signal) and J22-5 (Gnd). The setpoint varies linearly from 100% to 30% FLA as the input varies from 0-10VDC. This input will only be accepted when Analog Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for 0-10 volts, and Microboard Program Jumper JP23 has been removed. Calculate the setpoint for various inputs as follows:

```
SETPOINT (%) = 100 – (VDC X 7)
```

For example, if the input is 5VDC, the setpoint would be set to 65% as follows:

```
SETPOINT (%) = 100 – (5 X 7) = 100 – 35 = 65%
```

2-10VDC - As shown in *Figure 17 on page 13*, connect input to Microboard J22-1 (signal) and J22-5 (Gnd). The setpoint varies linearly from 100% to 30% FLA as the input varies from 2 to 10VDC. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for "2-10 Volts" and Microboard Program Jumper JP23 has been removed. Calculate the setpoint for various inputs as follows:

```
SETPOINT (%) = 100 – [(VDC – 2) x 8.75]
```

For example, if the input is 5VDC, the setpoint would be set to 74% as follows:

```
Setpoint (%) = 100 – [(5-2) x 8.75]
             = 100 – [3 x 8.75]
             = 100 – 26.25 = 74%
```

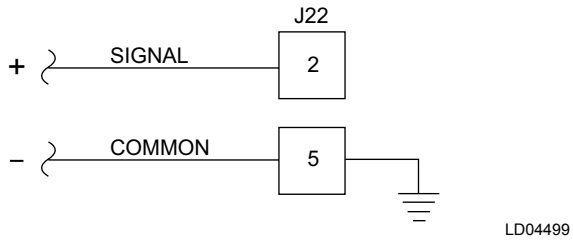


FIGURE 18 - REMOTE CURRENT LIMIT SETPOINT WITH 0-20mA OR 4-20mA SIGNAL

0-20 mA - As shown in *Figure 18 on page 13*, connect input to Microboard J22-2 (signal) and J22-5 (Gnd). The setpoint varies linearly from 100% to 30% FLA as the input varies from 0-20mA. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for 0-10 Volts, and Microboard Program Jumper JP23 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

```
SETPOINT (%) = 100 – (ma x 3.5)
```

For example, if the input is 8mA, the setpoint would be set to 72% as follows:

```
SETPOINT (%) = 100 – (8 x 3.5)
             = 100 – 28 = 72%
```

4-20mA - As shown in *Figure 18 on page 13*, connect input to Microboard J22-2 (signal) and J22-5 (Gnd). The setpoint varies linearly from 100% to 30% FLA as the input varies from 4-20mA. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for "2-10 Volts" and Microboard Program Jumper JP23 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

```
SETPOINT (%) = 100 – [(mA – 4) x 4.375]
```

For example, if the input is 8mA, the setpoint would be set to 83% as follows:

```
SETPOINT (%) = 100 – [(8 – 4) x 4.375]
             = 100 – (4 x 4.375)
             = 100 – 17.5
             = 82.5
             = 83%
```

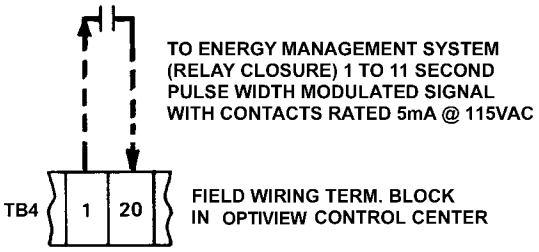


FIGURE 19 - REMOTE CURRENT LIMIT SETPOINT WITH PWM SIGNAL

PWM - The Pulse Width Modulation input is in the form of a 1 to 11 second relay contact closure that applies 115VAC to the I/O Board TB4-20 for 1 to 11 seconds. As shown in *Figure 19 on page 14*, connect dry closure relay contacts between I/O Board TB4-20 (signal) and TB4-1 (115VAC). The setpoint varies linearly from 100% to 30% as the relay contact closure time changes from 1 to 11 seconds. 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 a 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to 100%. A closure is only accepted at rates not to exceed once every 70 seconds. This input will only be accepted in DIGITAL Remote Mode. Calculate the setpoint for various pulse widths as follows:

```
SETPOINT (%) = 100 – [(PULSE WIDTH IN
               SECONDS – 1) X 7]
```

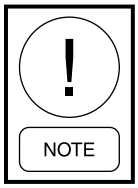
For example, if the relay contacts close for 3 seconds, the setpoint would be set to 86% as follows:

```
SETPOINT (%) = 100 – [(3 – 1) x 7]
       = 100 – (2 x 7)
       = 100 – 14
       = 86%
```

REMOTE LEAVING CHILLED LIQUID SETPOINT WITH 0-10VDC, 2-10VDC, 0-20MA, 4-20MA OR PULSE WIDTH MODULATION SIGNAL

Remote Leaving Chilled Liquid Temperature Setpoint Reset can be accomplished by supplying (by others) a 0-10VDC, 2-10VDC, 0-20mA, 4-20mA or 1 to 11 second Pulse Width Modulated (PWM) signal to the Control Center. The LEAVING CHILLED LIQUID TEMPERATURE SETPOINT is programmable over the range of 38°F(3.3°C) to 70°F(21.1°C) (water applications), 36°F(2.2°C) to 70°F(21.1°C) (water applications with Smart Freeze Protection enabled) or 10°F(-12.2°C) to 70°F(21.1°C) (brine applications). The Remote Input Signal changes the setpoint by creating an offset above the locally programmed Leaving Chilled Liquid Temperature Base Setpoint value. The setpoint can be remotely changed over the range of 10°(5.6°C) or 20ºF(11.1°C) (as per the locally programmed REMOTE RESET TEMPERATURE RANGE setpoint) above the Local Leaving Chilled Liquid Temperature Setpoint. For example, if the Local Setpoint is 40°F (4.4°C) and the REMOTE RESET TEMPERATURE RANGE setpoint is programmed for 10°F(5.6°C), the Leaving Chilled Liquid Temperature setpoint can be remotely reset over the range of 40°F(4.4°C) to 50°F(10°C). The Control Center must be configured appropriately to accept the desired signal type as follows:

- The appropriate Remote Mode must be selected: ANALOG REMOTE MODE must be selected when using a voltage or current signal input. DIGITAL REMOTE MODE must be selected when using a PWM input.
- If ANALOG REMOTE MODE is selected, the REMOTE ANALOG INPUT RANGE setpoint must be set to “0-10VDC” or “2-10VDC” as detailed below, regardless of whether the signal is a voltage or current signal type.
- Microboard Program Jumper JP24 must be positioned appropriately per the input signal type as detailed below. It is recommended a qualified Service Technician position this jumper.



Important! The signal type used for Remote Leaving Chilled Liquid Temperature Setpoint Reset and the signal type used for Remote Current Limit Setpoint Reset must be the same. For example, if a 0-10VDC signal is being used for Remote Current Limit Setpoint, then a 0-10VDC signal must be used for Leaving Chilled Liquid Temperature Reset.

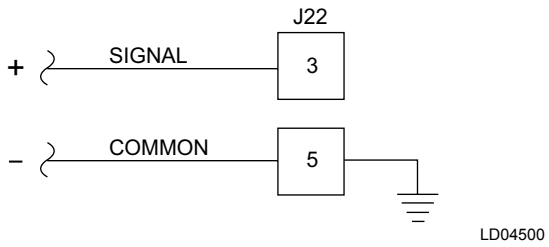


FIGURE 20 - REMOTE LEAVING CHILLED LIQUID TEMP. SETPOINT WITH 0-10VDC OR 2-10 VDC SIGNAL

0-10VDC - As shown in *Figure 20 on page 15*, connect input to Microboard J22-3 (signal) and J22-5 (Gnd). A 0VDC signal produces a 0°F(0°C) offset. A 10VDC signal produces the maximum offset (10 or 20°F(5.6 or 11.1°C) above the Local Setpoint Value). The setpoint is changed linearly between these extremes as the input varies linearly over the range of 0VDC to 10VDC. This input will only be accepted when ANALOG Remote Mode is selected. The REMOTE ANALOG INPUT RANGE setpoint is set for "0-10VDC" and Microboard Program Jumper JP24 has been removed. Calculate the setpoint for various inputs as follows:

$$\text{OFFSET(°F)} = \frac{\text{(VDC)(REMOTE RESET TEMP. RANGE)}}{10}$$

$$\text{SETPOINT (°F)} = \text{LOCAL SETPOINT} + \text{OFFSET}$$

For example, if the input is 5VDC and the Remote Reset Temperature Range Setpoint is programmed for 10°F(5.6°C) and the Local Leaving Chilled Liquid Temperature Setpoint is programmed for 40°F(4.4°C), the setpoint would be set to 45°F(7.2°C) as follows:

$$\text{OFFSET (°F)} = \frac{5 \times 10}{10}$$

$$= \frac{50}{10}$$

$$= 5°\text{F}(2.8°\text{C})$$

$$\text{SETPOINT (°F)} = 40 + 5$$

$$= 45°\text{F}(7.2°\text{C})$$

2-10VDC - As shown in *Figure 20 on page 15*, connect input to Microboard J22-3 (signal) and J22-5 (Gnd). A 2VDC signal produces a 0°F(0°C) offset. A 10VDC signal produces the maximum allowed offset (10 or 20°F (5.6° or 11.1°C) above the Local Setpoint Value). The setpoint is changed linearly between these extremes as the input varies over the range of 2-10VDC. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for "2-10VDC" and the Microboard Program Jumper JP24 has been removed. Calculate the setpoint for various inputs as follows:

$$\text{OFFSET (°F)} = \frac{\text{(VDC} - 2)\text{(REMOTE RESET TEMP. RANGE)}}{8}$$

$$\text{SETPOINT (°F)} = \text{LOCAL SETPOINT} + \text{OFFSET}$$

For example, if the input is 5VDC and the Remote Reset Temperature Range Setpoint is programmed for 40°F(4.4°C), the setpoint would be set to 43.8°F(6.6°C).

$$\text{Offset (°F)} = \frac{(5 - 2)(10)}{8}$$

$$= \frac{(3)(10)}{8}$$

$$= \frac{30}{8}$$

$$\text{Setpoint (°F)} = 40 + 3.8°\text{F}(2.1°\text{C})$$

$$= 43.8°\text{F}(6.6°\text{C})$$

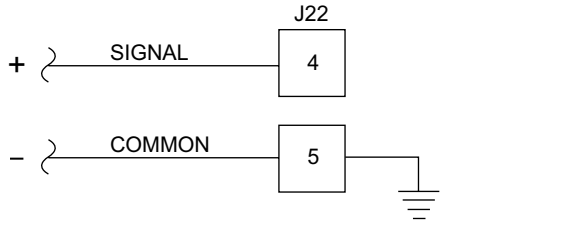


FIGURE 21 - REMOTE LEAVING CHILLED LIQUID TEMP. SETPOINT WITH 0-20MA OR 4-20MA SIGNAL

0-20mA - As shown in *Figure 21 on page 15*, connect input to Microboard J22-4 (signal) and J22-5 (Gnd). A 0mA signal produces a 0°F(0°C) offset. A 20mA signal produces the maximum allowed offset (10 or 20°F (5.6 or 11.1°C) above the local Setpoint value). The setpoint is changed linearly between these extremes as the input varies over the range of 0-20mA. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for "0-10VDC" and Microboard Program Jumper J24 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

$$\text{Offset (°F)} = \frac{\text{(mA)(Remote Reset Temp Range)}}{20}$$

$$\text{Setpoint(°F)} = \text{Local Setpoint} + \text{Offset}$$

For example, if the input is 8mA, the Remote Reset Temperature Range Setpoint is programmed for 10°F(5.6°C) and the Local Leaving Chilled Liquid Temperature Setpoint is programmed for 40°F(4.4°C), the setpoint would be set to 44°F(6.7°C) as follows:

$$\text{Offset (°F)} = \frac{(8)(10)}{20}$$

$$= \frac{(80)}{20}$$

$$= 4°F(2.2°C)$$

$$\text{Setpoint (°F)} = 40 + 4$$

$$= 44°F(6.7°C)$$

4-20mA - As shown in *Figure 21 on page 15*, connect input to MicroBoard J22-4 (signal) and J22-5 (Gnd.). A 4mA signal produces a 0°F (0°C) offset. A 20mA signal produces the maximum allowed offset (10 or 20°F(5.6° or 11.1°C) above the Local Setpoint value). The setpoint is changed linearly between these extremes as the input varies over the range of 0-20mA. This input will only be accepted when ANALOG Remote Mode is selected, the REMOTE ANALOG INPUT RANGE setpoint is set for "2-10VDC" and Microboard Program Jumper JP24 has been placed on pins 1 and 2. Calculate the setpoint for various inputs as follows:

$$\text{Offset(°F)} = \frac{(\text{ma} - 4)(\text{Remote Temp. reset range})}{16}$$

$$\text{Setpoint(°F)} = \text{Local Setpoint} + \text{Offset}$$

For example, if input is 8mA, and the Remote Reset Temperature Range setpoint is programmed for 10°F(5.6°C) and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F(4.4°C), the setpoint would be set to 42.5°F(5.8°C) as follows:

$$\text{Offset (°F)} = \frac{(8 - 4)(10)}{16}$$

$$= \frac{(4)(10)}{16}$$

$$= \frac{40}{16}$$

$$= 2.5°F(1.4°C)$$

$$\text{Setpoint (°F)} = 40 + 2.5$$

$$= 42.5°F(5.8°C)$$

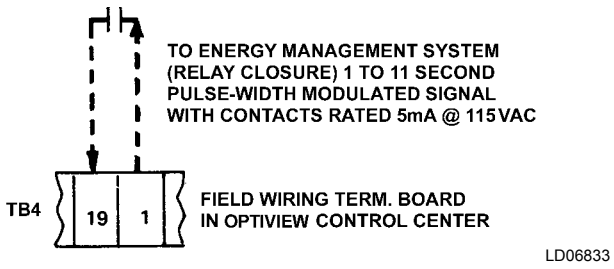


FIGURE 22 - REMOTE LEAVING CHILLED LIQUID TEMPERATURE SETPOINT WITH PWM SIGNAL

PWM – The Pulse Width Modulation input is in the form of a 1 to 11 second relay contact closure that applies 115VAC to the I/O Board TB4-19 for 1-11 seconds. As shown in *Figure 22 on page 16*, connect dry closure relay contacts between I/O Board TB4-19 (input) and TB4-1 (115VAC). A contact closure time (pulse width) of 1 second produces a 0°F(0°C) offset. An 11 second closure produces the maximum allowed offset (10 or 20°F(5.6° or 11.1°C) 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 a 1 to 11 second closure is not received within 30 minutes of the last closure, the setpoint is defaulted to the Local setpoint value. A closure is only accepted at rates not to exceed once every 70 seconds. This input will only be accepted in DIGITAL Remote Mode. Calculate the setpoint for various pulse widths as follows:

$$\text{OFFSET(°F)} = \frac{(\text{PULSE WIDTH IN SECONDS})(\text{REMOTE RESET TEMP. RANGE})}{10}$$

$$\text{SETPOINT(°F)} = \text{LOCAL SETPOINT} + \text{OFFSET}$$

For example, if the relay contacts close for 5 seconds and the Remote Reset Temperature Range setpoint is programmed for 10°F(5.6°C), and the Local Leaving Chilled Liquid Temperature setpoint is programmed for 40°F(4.4°C), the setpoint would be set to 44°F(6.7°C) as follows:

$$\text{Offset (°F)} = \frac{(5 - 1)(10)}{10}$$

$$= \frac{(4)(10)}{10}$$

$$= \frac{40}{10}$$

$$= 4°F(2.2°C)$$

$$\text{Setpoint (°F)} = 40 + 4$$

$$= 44°F(6.7°C)$$

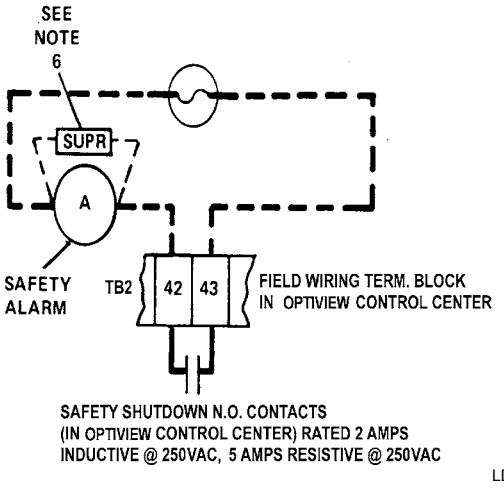
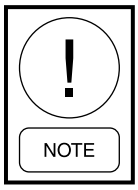


FIGURE 23 - EXTERNAL SIGNAL FOR REFRIGERATION UNIT FAILURE (NOTE 6)

EXTERNAL SIGNAL FOR REFRIGERATION UNIT FAILURE

When the Safety Shutdown Contacts (*Figure 3 on page 7*) are not connected to an Energy Management System they may be employed to energize a local or remote safety alarm (by others). When the normally open Safety Shutdown Contacts close, the alarm will indicate shutdown of the unit. The cause of shutdown will be one or more of the following safety controls: low oil pressure; high oil pressure; high condenser pressure; low evaporator pressure; high oil temperature; high discharge temperature; auxiliary safety; power failure when the AUTO RESTART AFTER POWER FAILURE configuration setting is set to MANUAL, the chiller requires MANUAL RESTART AFTER POWER FAILURE.

On Solid State Starter units only, when the CURRENT IMBALANCE option is selected via the Solid State Starter screen, three phase current imbalance protection is provided. A safety shutdown occurs (following a 45 second by-pass at startup) whenever the % FLA readout exceeds 80% for 45 seconds continuously and the % imbalance is > 30%. When all safety controls are satisfied, and the OptiView™ Control Center compressor switch has been manually RESET (de-energizing alarm) and returned to the RUN position ("l"), the unit may be restarted, if panel is in REMOTE mode, via the Remote Start contacts (*Figure 6 on page 8*); or, if panel is in LOCAL mode by momentarily pressing the keypad compressor switch to the START ("◄") position.



If the unit was shut down because of Cycling Shutdown Contacts (see Figure 2 on page 7) the alarm will not be energized, but the unit will have been shut down. A closure of the safety alarm contacts means that an operator must manually reset and restart the unit.

When the Safety Shutdown contacts close, the OptiView™ Control Center will display the following message: SAFETY SHUTDOWN – MANUAL RESTART, and cause of shutdown.

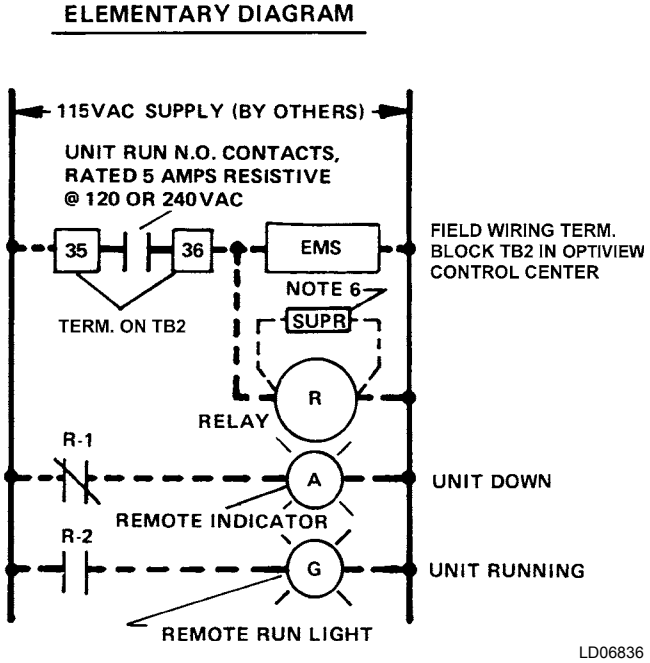


FIGURE 24 - RUN CONTACTS / REMOTE RUN LIGHT AND SHUTDOWN INDICATOR PLUS EMS

RUN CONTACTS/REMOTE RUN LIGHT AND SHUTDOWN INDICATOR PLUS EMS

When run contacts are required for a Remote Run Light and/or Shutdown Indicator AND Energy Management System (EMS), connect (by others) as shown in the diagram. The EMS, control relay, shutdown and run lights are furnished by others. When the N.O. contacts close, between terminals 35 and 36 on field wiring terminal block TB2 in the OptiView Control Center, this indicates that the unit is operating; the remote Run Light will be energized. The unit run contacts open when the unit is shutdown (safety or cycling) and the remote indicator will then be energized. For run contacts to EMS only refer to *Figure 4 on page 8*. When terminals 35 and 36 are not used for an EMS, they may be connected to a remote Run Light. The control relay

scheme shown in *Figure 24 on page 17* can also be applied for a remote Run Light AND a Remote Shutdown Indicator, when an EMS is not used.

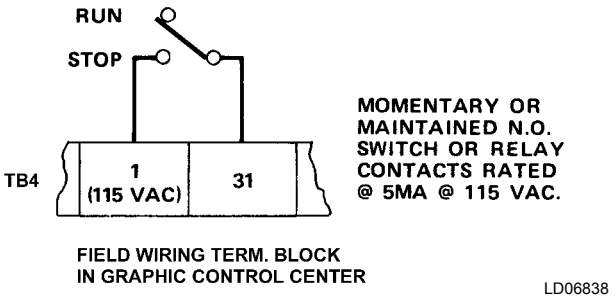


FIGURE 25 - AUXILIARY SAFETY SHUTDOWN INPUT

The closure of a Momentary or Maintained N.O. Switch or Relay Contacts will cause the unit to shutdown and display: SAFETY SHUTDOWN – MANUAL RESTART and AUXILIARY SAFETY – CONTACTS CLOSED. The unit will not restart until the contacts open and the keypad COMPRESSOR switch is moved to the STOP-RESET position (**"O"**) and then to the START ("◀")position.

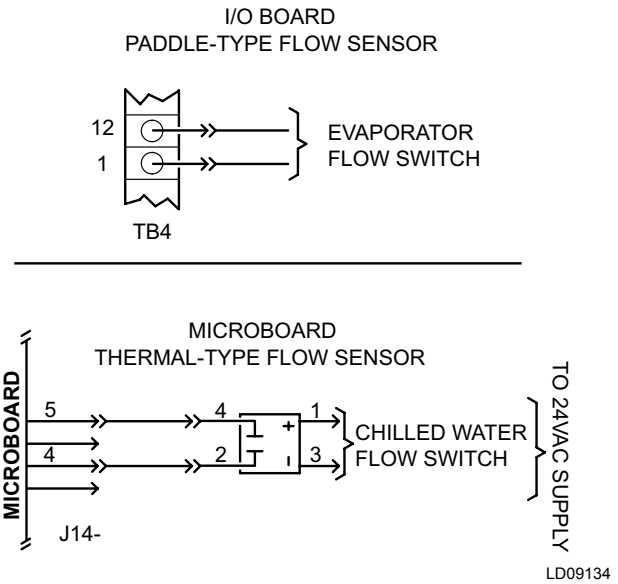


FIGURE 26 - EVAPORATOR FLOW SENSORS

EVAPORATOR FLOW SENSORS

The Thermal-type Flow Sensor interfaces with the microboard and Paddle-type Flow Sensor interfaces with the I/O board.

For the program to read the appropriate inputs for the flow sensor status, the actual flow sensor type used must be entered at the keypad OPERATIONS Screen using Service the Access Level. Enter ANALOG for Thermal-type or DIGITAL for Paddle-type. Refer to Operation manual 160.54-O1.

When flow is sensed, the flow sensor contacts are closed. Opening of the flow sensor contacts (no flow) for 2 continuous seconds causes a cycling shutdown displaying LEAVING CHILLED LIQUID - FLOW SWITCH OPEN. The flow sensor status is bypassed for the first 25 seconds of SYSTEM PRELUBE.

THERMAL TYPE FLOW SENSOR

When the Thermal-type Flow Switch is used, the flow switch uses the cooling effect of liquid to sense flow.

When the flow of liquid is sensed, the relay output is turned on conducting current through the microboard load resistor to the +5VDC applying >+4VDC to the microboard input J7-14.

When no flow of liquid is sensed, the relay output is turned off, this results in <1VDC to the microboard input.

PADDLE TYPE FLOW SENSOR

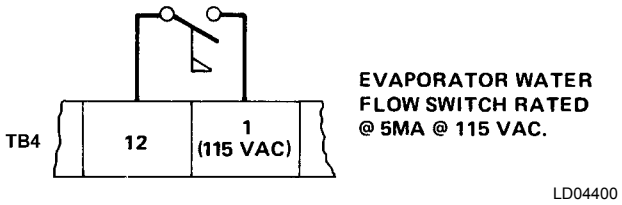


FIGURE 27 - PADDLE TYPE FLOW SENSOR

When Evaporator Water is flowing, the flow switch contact will close. If the flow switch opens for 2 seconds, the unit shuts down.

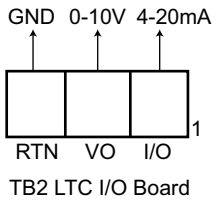


FIGURE 28 - OPTIONAL HEAT RECOVERY / HEAD PRESSURE CONTROL OUTPUT

OPTIONAL HEAT RECOVERY / HEAD PRESSURE CONTROL

The chiller provides optional output for control of system equipment to maintain condenser temperature for heat recovery on a double-bundle condenser unit or for head pressure control. The output may be used to control a converging or diverting valve, pump VSD, or other suitable equipment. The chiller is equipped with the optional LTC I/O board when output is required to control auxiliary equipment to regulate condenser water temperature or flow for the double-bundle heat recovery option or the head pressure control option. LTC I/O board terminal TB2-2 (VO) to TB2-3 (RTN) will provide 0-10VDC output in proportion to the command from the microprocessor for control. LTC I/O board terminal TB2-1 (IO) to TB2-3 (RTN) will provide 4-20mA output in proportion to the command from the microprocessor for control (*Figure 28 on page 19*). The load connected to these terminals must meet the following specification:

- 0-10V - Input resistance should be greater than 1K ohms.
- 4-20mA - Input resistance must be less than or equal 500 ohms.

During head pressure control operation in a configuration where the means used by the particular site is to throttle flow through the single condenser tube bundle in service, the controlled device should be setup to inhibit throttling below the minimum required flow rate through the condenser when the control panel output is at minimum so the flow switch requirement is maintained.

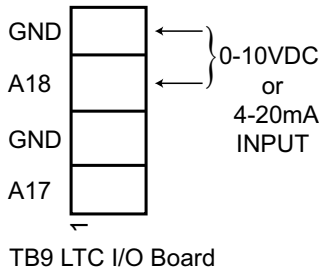


FIGURE 29 - OPTIONAL REMOTE HEATING WATER SETPOINT OFFSET

OPTIONAL REMOTE HEATING WATER SETPOINT OFFSET

When configured for Heat Recovery, the active Hot Water Setpoint can be remotely modulated within a prescribed range during remote control source operation with a 0-10VDC or 4-20mA input to the LTC I/O board terminal TB9-3 (AI8) to TB9-4 (GND) (*Figure 29 on page 19*). The remote hot water setpoint input type (0-10VDC or 4-20mA) is configured in the control software when the control source is set to analog. The active hot water setpoint to which the chiller will control in this mode is the local hot water setpoint minus the remote input value between 0 and 20°F(0 to 11.1°C), proportional to the voltage or current input over its full range.

0VDC or 4mA will apply no offset to the programmed local hot water setpoint, 10VDC or 20mA will apply a 20°F(11.1°C) reduction from the programmed local hot water setpoint. The allowable range for the active hot water setpoint will be the same as the local hot water setpoint allowable range. Therefore, if a remote signal results in a setpoint value less than the minimum allowable, the active setpoint shall be set to the minimum.

NOTES

1. These Figures show recommended field control wiring modifications (by others) to the standard OptiView™ Control Center Wiring Diagram. For those chillers that are not equipped with "P" code compressors, refer to the following Product Drawings: 160.54-PW4 (Electro-Mechanical Starter), 160.54-PW5 (YORK Solid State Starter), 160.54-PW6 (YORK Variable Speed Drive). For those chillers equipped with "P" code compressors, refer to the following Product Drawings; 160.54-PW11 (Electro-Mechanical Starter), 160.54-PW12 (YORK Solid State Starter), 160.54-PW13 (YORK Variable Speed Drive).
2. If more than one of these modifications is to be utilized with a particular unit, additional consideration must be given to the application to insure proper functioning of the control system. Consult your Johnson Controls representative.
3. The additional controls and wiring for these modifications are to be furnished and installed in the field by others (see Warning on page 2).
4. The controls specified are recommended for use, but other controls of equal specifications are acceptable.
5. All wiring shall be in accordance with the National Electrical Code, and applicable State and Local Codes.
6. Each 115VAC field connected inductive load, i.e., relay coil, motor starter coil, etc., shall have a transient suppressor wired (by others) in parallel with its coil, physically located at the coil. Spare transient suppressors are furnished in a bag in the OptiView™ Control Center.
7. The OptiView™ Control Center is factory furnished for Manual Restart After Power Failure as a standard function. The control center can be field changed from Manual Restart to Auto Restart after a power failure by a service technician using a service level password to access the SETPOINTS > SETUP screen.
8. Two (2) unit controls schemes are suitable for 8°(4.4°C) – 12°F(6.7°C) water range. Constant chilled water flow is assumed at all loads. For other requirements contact your Johnson Controls representative.
9. _____
10. Lead selector and cycling control to provide similar lead selection and cycling of lag units for three (3) units is available: Kit No. 366-44684D (see Product Drawing Form 160.00-PA1.1) in NEMA I enclosure. Consult your Johnson Controls representative.
11. Sequence control kits (*Figure 11 on page 10* and Note 10) assume a constant chilled water flow and a constant leaving chilled water temperature to sense the cooling load. Sequence control kits are not designed for variable chilled water flow or with reset of the leaving chilled water temperature – *see Figure 20 on page 15, Figure 21 on page 15, Figure 22 on page 16,* and Note 2.
12. Maximum allowable current draw between circuits 24 and 2 for field installed devices is 2 amp holding and 10 amps inrush – see OptiView™ Control Center Wiring Diagram Form No. in Note 1.
13. For required field wiring connections of the chilled water pump contacts (terminals 44 and 45 on OptiView™ Control Center field wiring terminal block TB2) and chilled water flow switch (terminals 1 and 12 on OptiView™ Control Center field wiring terminal board TB2), see Wiring Diagram – Field Connections: For those chillers that are not equipped with "P" code compressors, refer to the following Product Drawings: 160.54-PW4 (Electro-Mechanical Starter), 160.54-PW5 (YORK Solid State Starter), 160.54-PW6 (YORK Variable Speed Drive). For those chillers equipped with "P" code compressors, refer to the following Product Drawings; 160.54-PW11 (Electro-Mechanical Starter), 160.54-PW12 (YORK Solid State Starter), 160.54-PW13 (YORK Variable Speed Drive).

    The Chilled Water Flow Switch is a safety control. It must be connected to prevent operation of the chiller whenever chilled water flow is stopped. The use of the chilled water flow switch for purposes other than protection of the chiller may be accomplished in several ways. Two flow switches, a flow switch and a relay or separate contacts on the same flow switch.
14. _____
15. Do not apply voltage on field wiring terminal blocks TB4 and TB6 in YORK OptiView™ Control Center, as 115VAC source is fed from terminals 1 and 2.

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