Field Manual for Phase Transition Control – TECO VFD's (Rev 8/4/2019)

Preface – Handy Things to Know for all Versions of PTC

First: Go to cell phone web browser and pull up the PTC webpage

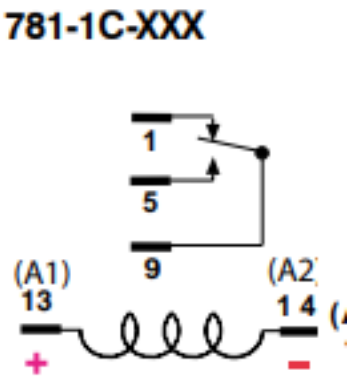
If you don't know the IP address of the cell modem, it is written on top of the cell modem inside the PTC cabinet. Type in this address, where the letters represent the IP address printed on the cell modem: abc.efg.hij.klm:20005/0.HTM

1. The air motor can be fully opened by pushing the "Calibrate, Louver, One, and **then** Accept" buttons. "Accept" must be pushed last. When this happens, the air motor fill solenoid will open for 10 seconds and the buzzer will beep during this period. This should fully open the air motor. After ten seconds, the air motor will slowly return to the normal position slowly. This is very helpful when setting the air restrictor that is on the exhaust solenoid discharge.
2. If desired, calibrate the air motor pressure transducer by going to the webpage and pushing the buttons "Calibrate, Sensor, One, **then** Accept. The pressure will be bled off the air motor for 20 seconds, during which time the buzzer will beep once a second. At the end of 20 seconds, the transducer will be zeroed, and all buttons on the webpage will clear, and beeping will stop. **THIS PROCEDURE SHOULD ONLY BE DONE WITH THE DISCHARGE SOLENOID RESTRICTOR FULLY OPEN!**
3. Sometimes it is necessary to run the fan manually. By flipping the tab on the "VFD Run Relay" as shown on the drawing in the PLC panel door, the fan will come on at 6 Hertz, and speed cannot be changed.
4. If manual operation at different speeds is desired, this can be set by following a certain pushbutton sequence as follows:
    a. With the Green PLC On-Off switch in the ON position, hold the PLC Red pushbutton down for 30 seconds then release. (After 30 seconds there is normally a beep, and the beep repeats every 10 seconds to indicate that the Cooling Fan is in Manual mode.)
    b. When in manual mode, each push the Red button will increase the fan speed by 5 Hertz, or 8% until full speed of 60 Hertz is reached.
    c. To turn off the fan, turn the On-Off switch to the OFF position. D) To slow down the fan, turn if off first, then turn it back on, and push the Red pushbutton until the desired speed is reached.
    d. To restore automatic operation, repeat step A. The ten second beep should go away, indicating a return to automatic mode. The webpage will indicate if in Manual Mode.
5. Pushing the "Cycles" button on the webpage will momentarily display the number of solenoid "Fill" cycles yesterday as well as the 50 day average on the Cooler1 Temp line. The exhaust cycles will appear on the bottom line. These are indiciative of solenoid issues.
6. Pushing the button to the right of "Reset" will cease solenoid operation. On newer PTC's this button is labelled "No Louver" but on older versions it is labelled "Ignore TC".
7. Contact Encline if web setting of Cooler and Discharge Temperature setpoints is desired.

Wiring Between PTC and VFD's

Six Pairs

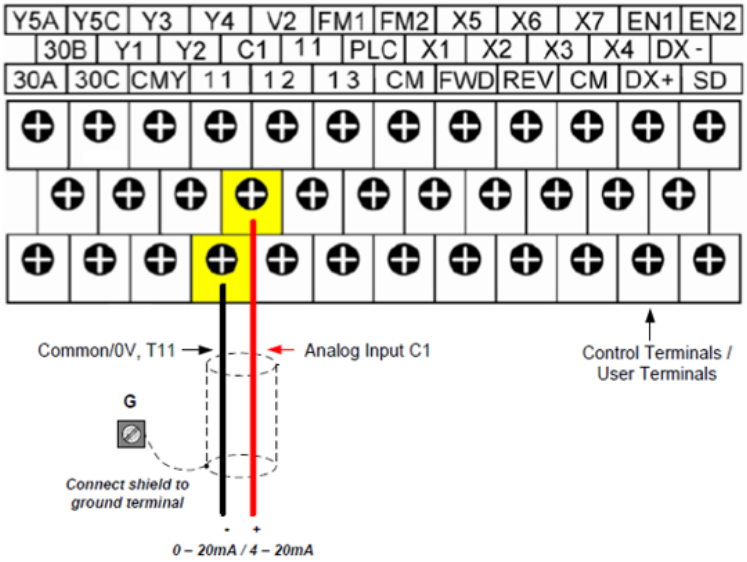
1. 24 Volt DC power from the supplied 10 Amp NDR power supply to black and red terminal blocks. This power supply to have same source as Murphy Centurion panel 24 volt power supply inside the Main VFD cabinet. (Pair 1)



2. Connect NO and Common from PLC "VFD Run Command" relay (top and bottom posts 5 and 9) to contacts 5 and 9 of **CR12**. These contacts already have wiring from the Main VFD that normally provides the run command, but these have been disabled. (Wire in same relay terminals with existing wires.) Optionally, pull relay from **CR12**, as we are just using the base as a contact block. (Pair 2)
3. Connect NO and Common from PLC "VFD Fault Reset" relay (top and bottom posts 5 and 9) to Terminal 87 in cooler VFD panel (wired to Teco CM) and then the X7 terminal on the TECO Drive. The X7 default configuration is to reset a fault. (Pair 3)
4. Run 1 wire of a pair from analog output "DA4" to the C1 terminal (wire 82). Connect Terminal 80 (Teco Terminal 11) to the 24V power supply negative, or connect the other wire of this pair to the black 24 negative terminal block in the PLC. (Speed signal.) Note F01 should be set to 2, and C40 to 1. (Pair 4)

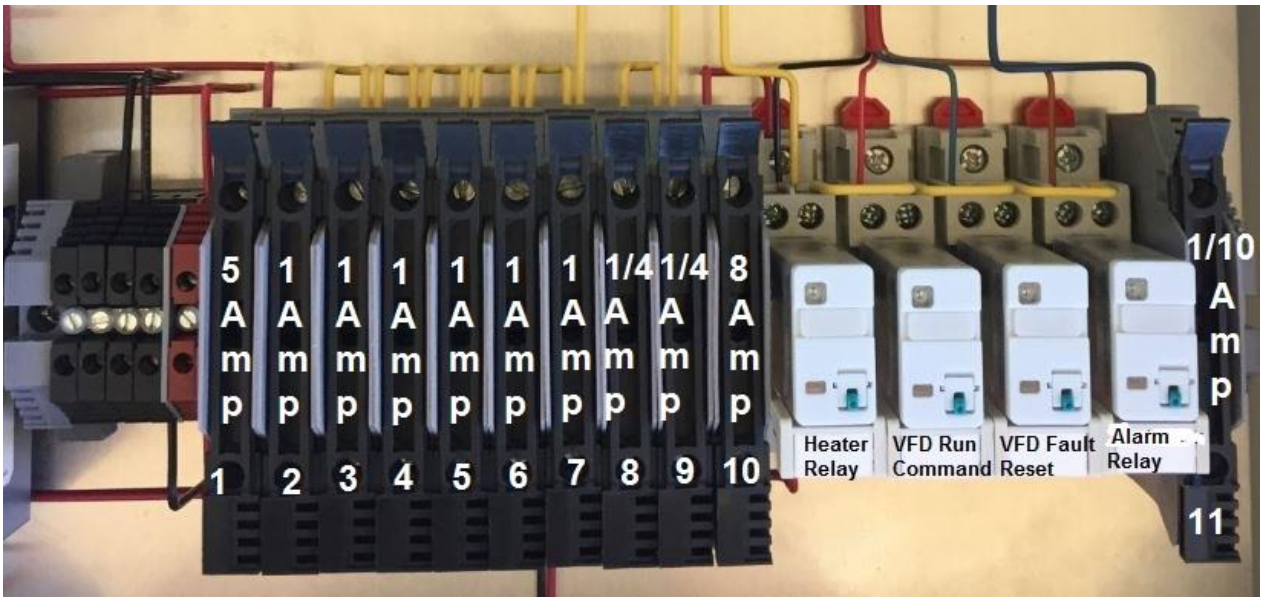
Data for F01	Function
0	Enable ⌃ / ⌄ keys on the keypad.
1	Enable the voltage input to terminal [12] (0 to ±10 VDC, maximum frequency obtained at ±10 VDC).
2	Enable the current input to terminal [C1] (0 to +20mA, +4 to +20 mA DC, maximum frequency obtained at +20 mA DC). (SW5 on the control PCB should be turned to the C1 side (factory default).

Analog Reference: 0 – 20mA / 4 – 20mA (Setting F01 = 2)



Note: When using a 0 – 20mA signal set parameter C40 to 1.

5. Run one wire of a pair from PLC Input 8 to contact 6 (normally open) of **CR32**, and connect contact 10 (common) of **CR32** to the 24V power supply negative for indication of Cooler VFD fault. (This is pair 5.)
6. Run the other wire from the above pair from PLC input 7 to **CR22** in the Cooler VFD panel for VFD run confirmation. Connect this wire to contact 5, and connect contact 9 to the 24 volt power supply negative to provide this confirmation. (This is also Pair 5.)
7. Connect one of the three furnished Thermistors (with red tip) to measure cooling fan VFD cabinet temperature by mounting with zip tie. Install in clear, safe location where a representative temperature will be observed. Connect one end on the top rail of position Analog Input 5 (labelled AD5). The top rail already has red, green, white, brown etc wires. Connect the other lead into Fuse 11. (Pair 6)
8. Connect the second of the three furnished Thermistors (with red tip) to measure compressor motor VFD cabinet temperature by mounting with zip tie. Install in clear, safe location where a representative temperature will be observed. Connect one end on the top rail of position Analog Input 6 (labelled AD6). Connect the other lead into Fuse 11. (Only pair to Main VFD cabinet.)
9. Connect the third of the three furnished Thermistors (with red tip) to measure ambient temperature by hanging in a piece of dead end conduit underneath the PLC. Connect one end on the top rail of position Analog Input 8 (labelled AD8). Connect the other lead into Fuse 11.



Other wiring in VFD's:

1. **Connect 24 power supply negatives of both 24 power supplies in the Main and Cooler VFD cabinets together so that there is a common reference.**

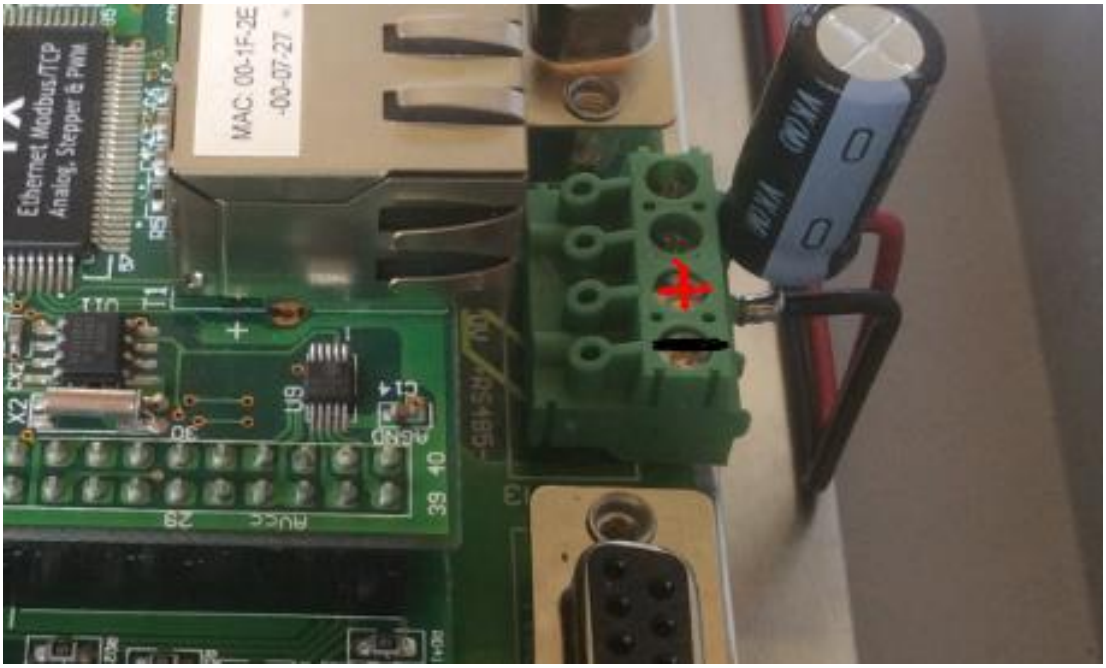
Wiring Between PTC and Murphy Centurion

Two Pairs

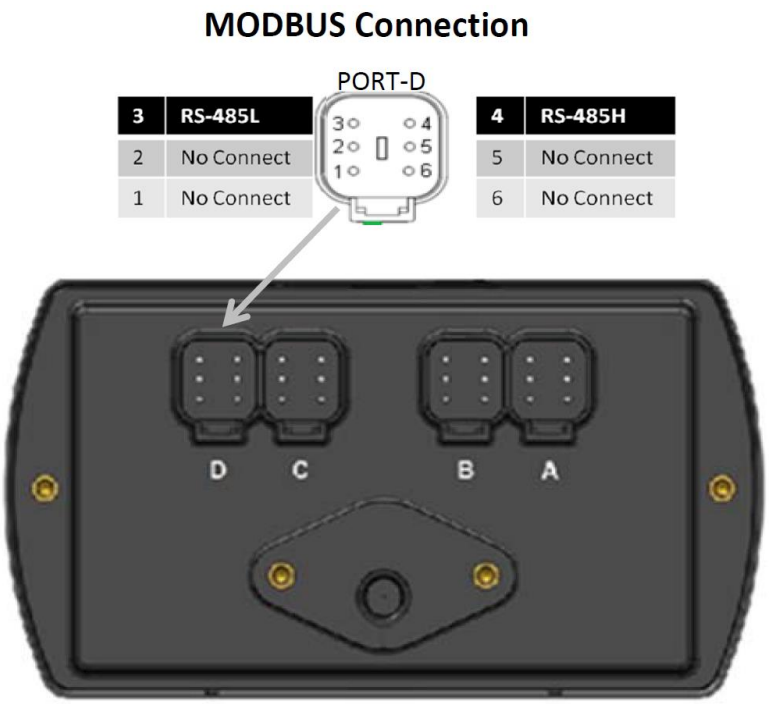
1. Run one wire of a pair from the 8 contact black terminal block to the main common in the Centurion panel. Run the other wire of this pair from the bottom contact 5 of the far right relay

and connect to a digital input in the Centurion that is configured as a VFD temperature alarm, not shutdown. (Input 24?)

2. Run an RS-485 cable from the RS485+ connection to the 100(A), and the RS485- connection to 101(B). **Connect the shield/drains to the black terminal blocks in the PTC box and also the shield connection on the back of the Centurion display.** Optionally, connect to the RS485-2 A and B connections on the back of the Centurion display instead of terminals 100 and 101. BE CAREFUL NOT TO CONNECT 24V to the RS485 connections, which are next door !



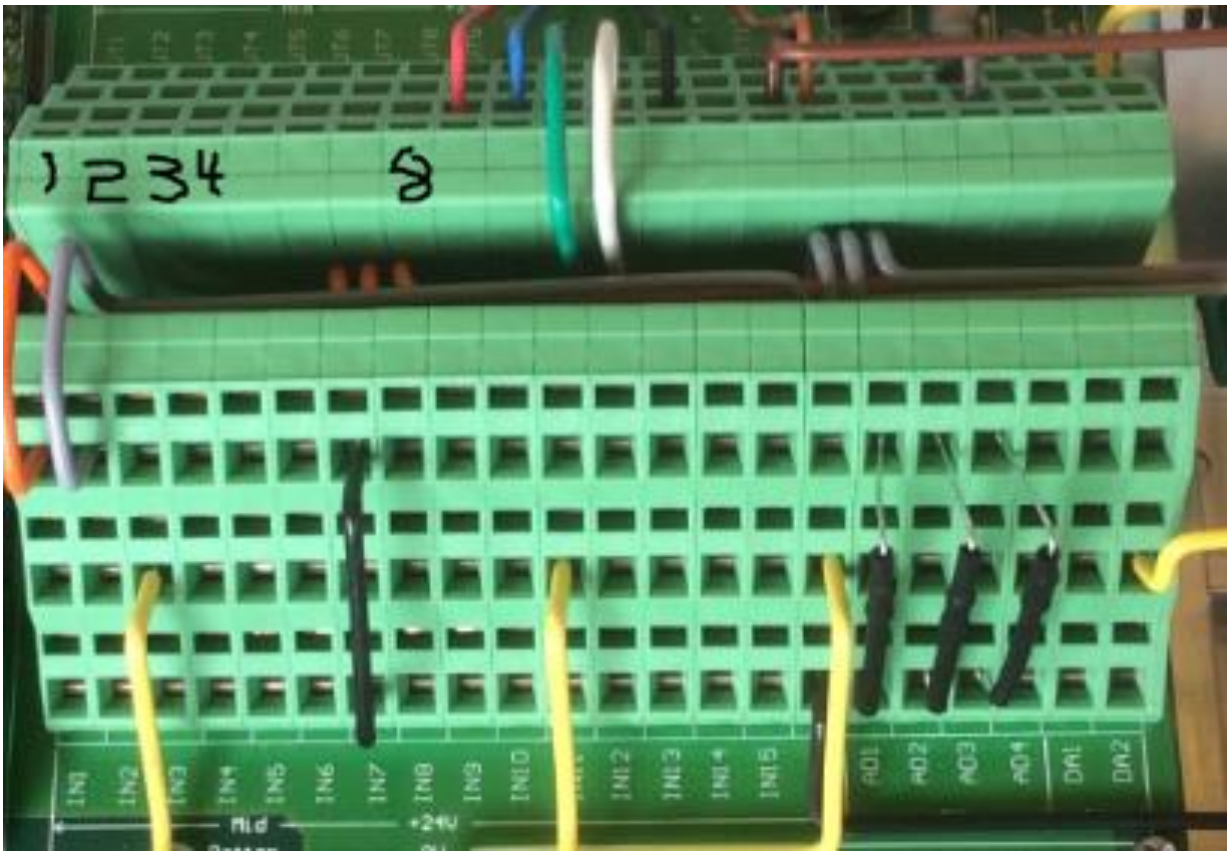
When this has happened, diodes on the main board are damaged, requiring an inexpensive fix. This is the installation of an RS232 to RS485 converter in one of the RS 232 ports, along with jumpering of input 14 and the 24+ rail. This jumper tells the PLC to communicate Modbus over the RS232 port instead of the original RS485 port. Cost of this converter and cable is about $65 from Triangle Research (http://www.triplc.com/)



Optional RS485 Wiring for Engine Equipped with Murphy EICS Engine Control System

In this event, extend the wire from Step 2 above from the Murphy Centurion 100(A) and 101(B) terminals to the EICS Port D wires 3 and 4 respectively as shown to left. The RS485L goes to the A terminal, and RS485H goes to B. The EICS should be set to and address of 3, and a 38400 baud rate. The default Data bit of 8, Parity of N (none), and stop bit of 1 will match the Centurion and PLC.

Wiring Between PTC and Compressor Solenoids and Transducers



Three Pairs

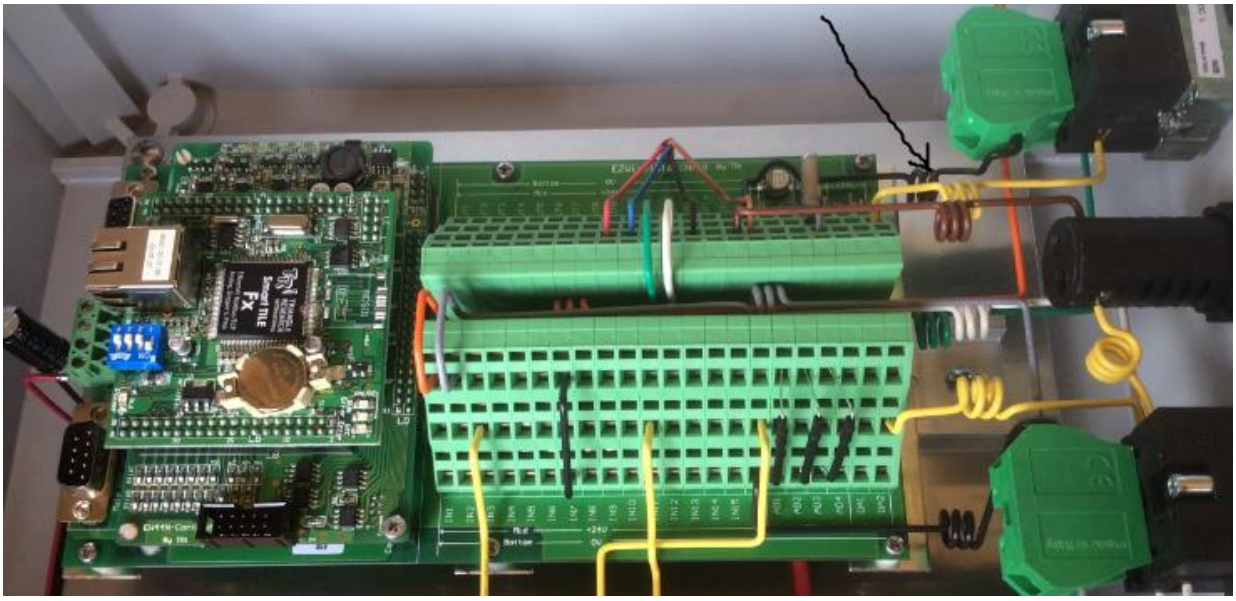
1. One pair from the Murphy PXT-100 pressure transducer on Solenoid Cluster 1 to Analog Input "AD1" on the top rail. Twist negative wire to the existing 255 ohm resistor already located in the top terminal. The other end goes in the bottom of ¼ amp fuse holder 8.
2. One pair from the Fill (supply) Solenoid on Cluster 1 to 1 Amp Fuseholder 2 and Digital Output 1
3. One pair from the Exhaust Solenoid on Cluster 1 to 1 Amp Fuseholder 3 and Digital Output 2
4. If so equipped, run an optional fourth pair from the Inlet Scrubber Drain Solenoid to 1 Amp Fuseholder 6 and Digital Output 8. This output is used for 1) backpressuring the pneumatic level controllers with supply gas, which causes the dump valves to open. This occurs for 5 minutes whenever the compressor shuts down, as judged by the PLC from the inputs and for example lack of Modbus data. Optionally, the solenoid can be used to energize a separate motor valve next to the manual blowdown valve. This automatic blowdown valve should have a 1/8" trim, and be plumbed to the gas sales separator so that this gas can be sold instead of sent to flare.

Wiring Between PLC and Optional Local On-Off Switch

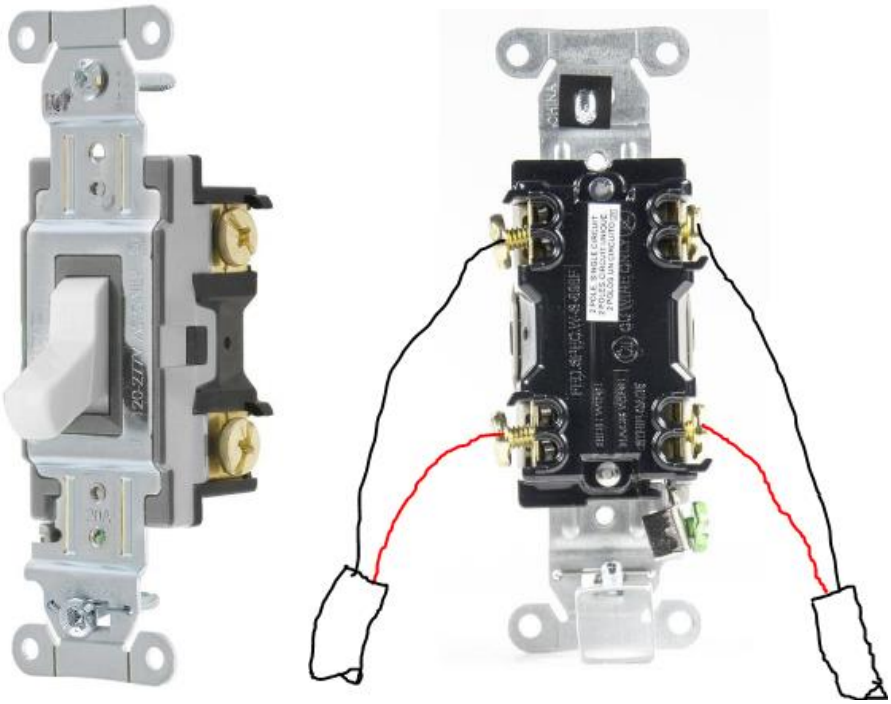
Two Pairs

The On-Off switch on the exterior of the PLC will serve to turn off the fan. However, should the operator also desire a local On-Off switch, a second switch in series with the original switch will serve this purpose. As an additional level of safety, a double pole single throw switch is utilized to also break the circuit from the VFD Run Command Relay to the VFD. Since the relays are equipped with a manual override tab, this will prevent even a manual run .

1. Remove the black wire connecting the existing On-Off switch to the 0 volt rail. Connect a pair of wires to the places that the above black wire was removed (see arrow in below picture). Connect the other end of the wire to one side of the double pole switch.



2. Remove the wire from the bottom of the VFD Run Command relay. Connect a pair of wires, one in the relay and other connected to the wire pulled out of the relay terminal. Connect the other end of the wire to one side of the double pole switch as shown below.



Miscellaneous

1. For engine driven applications, connect engine cooling water return long style Thermistor to Analog input AD6 on the top rail like other thermistors. Connect the other lead into Fuse 11 (and not the center rail). (This thermistor takes the place of the one that normally reads the compressor motor VFD temperature.)
2. Connect Cell Phone Modem power supply to Fuseholder 4. Arrange antenna so that communication is satisfactory.
   NOTE: The below steps 4,5, and 6 require the Centurion C5 program to be setup to for detecting scrubber dumps and outputting same. Disregard if not setup in this manner. This programming allows standard duty switches (not expensive Class 1 Div 2) be utilized for counting scrubber dumps and hung open dump valves / frozen dump lines.
3. To count inlet scrubber dump cycles, connect the normally open and common contacts of a standard pressure switch (tied into the pneumatic level controller output) to Centurion input 13 and common. Configure FET output 8 to energize whenever input 13 exists, and connect via terminal 90 to energize a relay that energizes PLC input 10.
4. To count first interstage scrubber dump cycles, connect the normally open and common contacts of a standard pressure switch (tied into the pneumatic level controller output) to Centurion input 14 and common. Configure FET output 9 to energize whenever input 14 exists, and connect via terminal 90 to PLC input 11. Connect 91 to the Centurion common.
5. To count second interstage scrubber dump cycles connect the normally open and common contacts of a standard pressure switch (tied into the pneumatic level controller output) to Centurion input 15 and common. Configure FET output 10 to energize whenever input 15 exists, and connect via terminal 92 to PLC input 12. Connect 93 to the Centurion common.

Common Wiring Mistakes

1. Solenoids connected to the bottom rail (0 Volts) instead of the top rail near the numbers 1234 on the picture on the previous page. This causes them to continuously blow supply gas.
2. Solenoids physically plumbed backwards. Note check valve direction when installing. Sometimes they are wired in reverse as well.
3. Speed signal to VFD has polarity reversed, in which case the fan will never run more than 6 Hertz.

The service life of a relay is approximately 200,000 times if it is switched ON and OFF at one-second intervals. From EQ7 Manual page 4-88

TECO Drive Setup

C40

Default of 0 is for 4-20mA operation, so this must be changed to 1, which is for 0 to 20 mA operation per page 4-108 of the EQ7 manual.

F01

The EQ7 comes factory set to take speed signals from the terminal board. This is determined by the setting value of F01, which has a default value of 0. This should be changed to a value of 2 to allow speed to be set by a 0 to 20 mA signal, providing C40 is set to 1 per the earlier drawing. Flipping the tab up on the "VFD Run Command" relay will cause the fan to turn on, and off when the tab is lowered.

F02

The default setting of 0 allows the keypad buttons to start and stop the motor, so this value must be changed to 1 to allow the terminals to command this. Once this is done, the PLC run command relay will be the only method to start and stop the motor, other than emergency shutdown or the local "Off-Auto" switch.

F03

This is the maximum frequency setting, and should be set at no more than 60.5 Hertz .

F07

This is the acceleration time, and should be set at a fairly high number due to the fan inertia. It is the time it takes to go from 0 hertz to full speed, and should be a minimum of 10 seconds.

F09

Set torque boost to default of 0.1, but values of 0.1 to 0.9 are suggested on page 8-3.

F11

Per page 8-1, verify that the motor FLA is the same as shown in this parameter.

F14

This is the restart mode after momentary power failure, and should be set at 3 for continuing to run heavy inertial loads per page 4-43 (assuming F42 = 0 or 2). H14 Frequency fall rate? This would be

F16

Set low limit at 6 Hertz

F37

This should be changed from the default value of 1 to 0 for a variable torque load, which describes a fan. See page 8-4

H03

Don't go there unless it is desired to save the settings, which is done by using the values of to save the manual changes, or 2 to initialize the motor parameters if changed in P02.

H06

The internal drive cooling fan is set to run continuously by default of 0, and should be changed to 1 to enable thermostatic control.

H09

Auto search frequency search is enabled by setting this from the default of 0 to the value of 2 per page 4-43. If the fan is turning still from wind or last operation, then the drive will detect and compensate.

H11

The deceleration method should be changed from normal (default of 0) to coast to stop, which is 1. Alternately the input of one of the X terminals can be setup to provide coast to stop, which is and E01 through E07 function. For example, X6 could be given the value of 7 instead of the value 6 (which enables 3 wire operation). The value of 7 also provides coast to stop.

P01

This should be 4 for a 4 pole motor rated at 1800 RPM, or 6 for a 1200 RPM motor, and **in case of JW E200's is 8 for a 900 RPM motor.**

P02

Motor horsepower rating. If P99 set to 4, use the kW rating.

P03

Nameplate motor amperage, which is 12.5 for JW E200's

P04

Auto Tuning should be performed if the cooler drive motor is much smaller than the drive rating. This is the case with the JW E-200's, which utilize a 7.5 HP motor on a drive rated for 20 HP. Choose a value of 1 (while stopped) or 2 (while running) per page 4-110.

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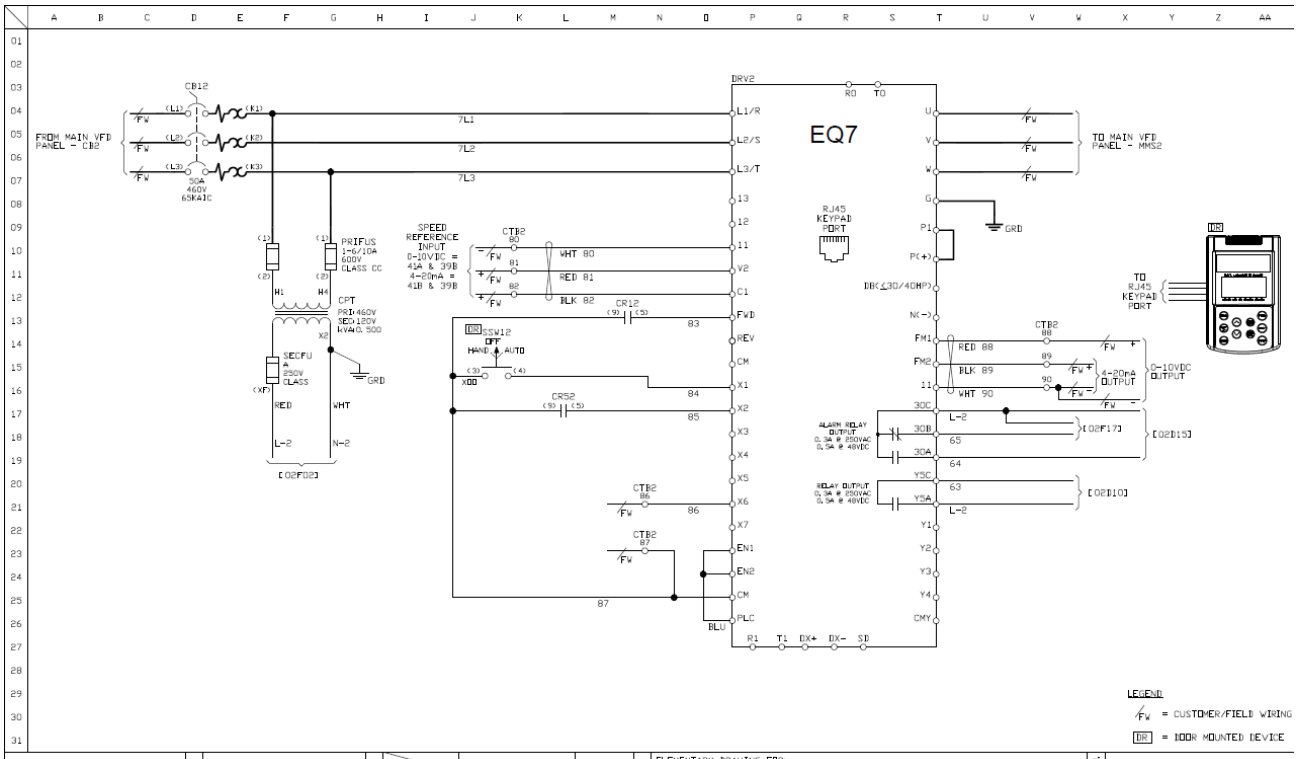


REVISIONS	
REV.	0
DATE	06/26/19
BY	T. WEBB
STATUS	SUBMITTAL

ENGINEERING	NAME	DATE
DRAWN BY:	T. WEBB	06/25/19
APPROVED BY:	T. WEBB	06/26/19

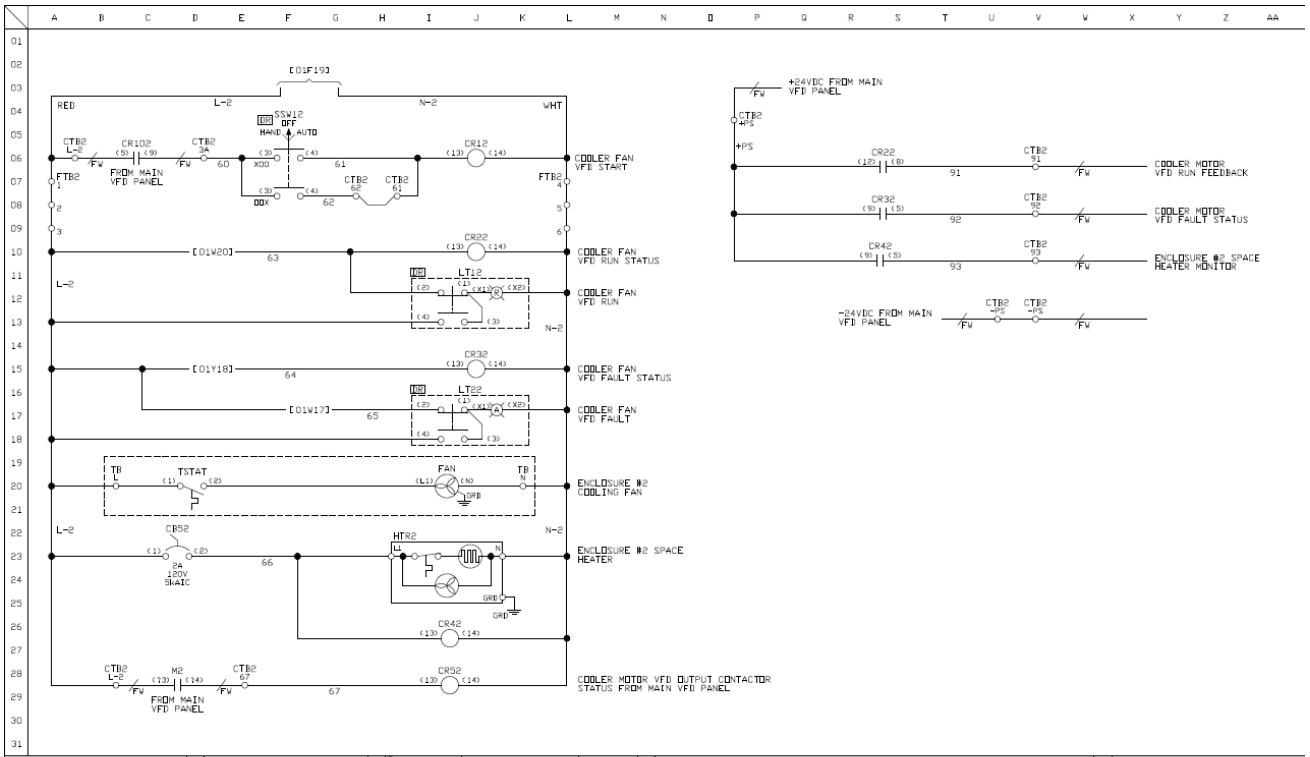
TECO Westinghouse

TITLE

ELEMENTARY DRAWING FOR:
TECO WESTINGHOUSE EQ7 PACKAGED DRIVE
PNL020-NF-46U-190602W1
20HP @ 460V [LD] | UL TYPE 3R
POWER CIRCUIT & DRIVE CONNECTIONS

DWG NO. RDA100761

SH NO. CONT. 02 SH. 01



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TECO Westinghouse

TITLE

ELEMENTARY DRAWING FOR:
TECO WESTINGHOUSE EQ7 PACKAGED DRIVE
PNL020-NF-46U-190602W1
20Hp @ 460V [LD] | UL TYPE 3R
CONTROL CIRCUIT

DWG NO. RDA100761

SH NO. CONT. 03 SH. 02