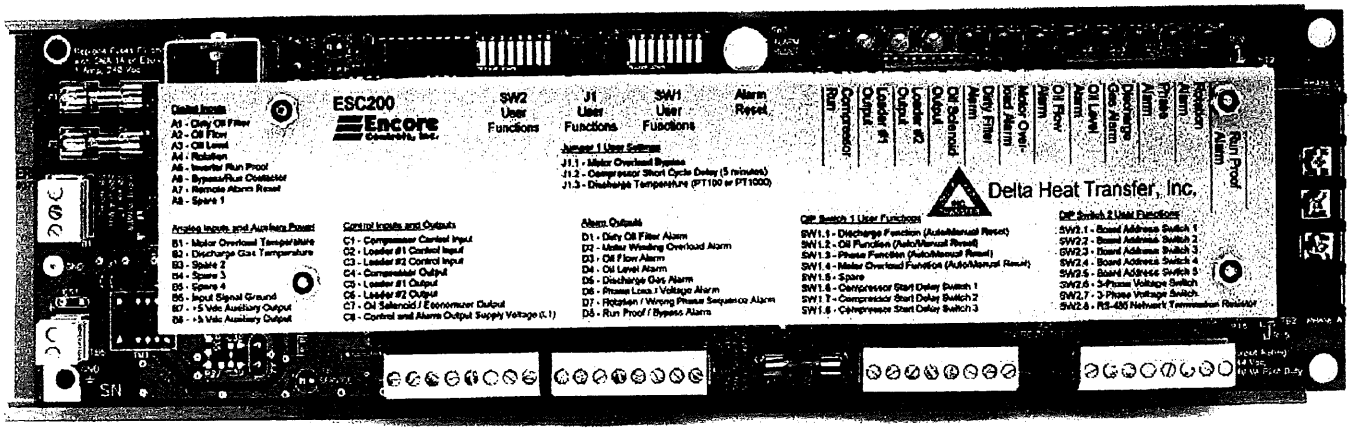
ESC 200 & 200E

Electronic Screw Controller



Installation & Instruction Manual

Delta Heat Transfer, Inc.
4784 Cantrell Road
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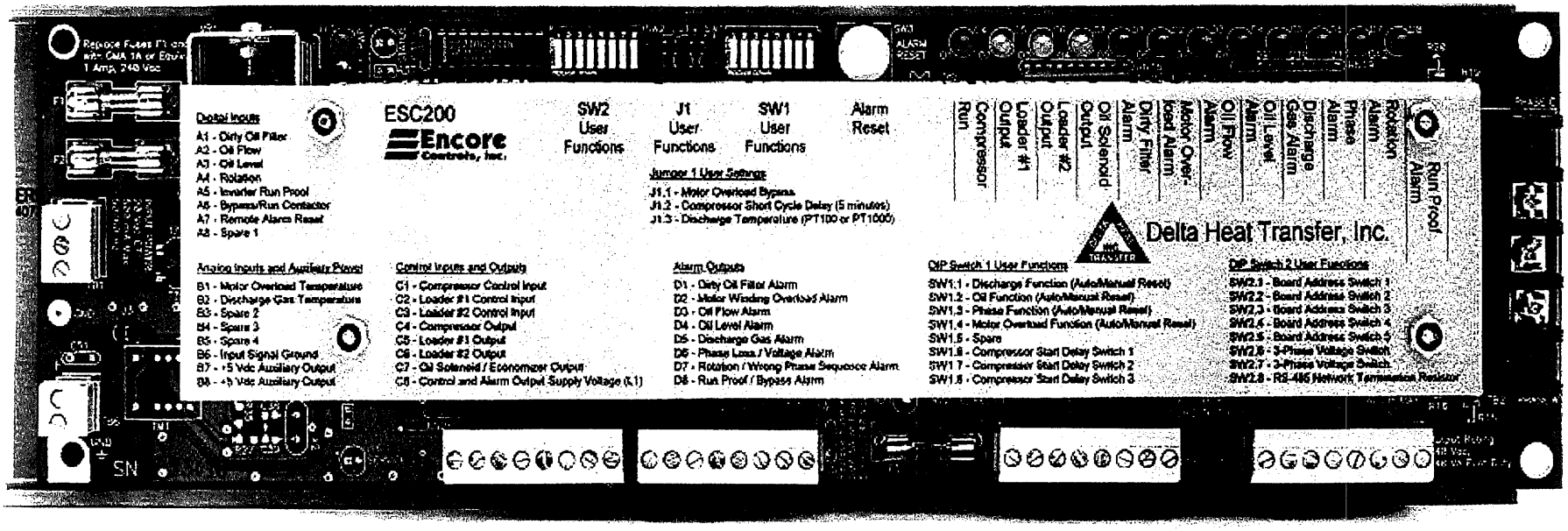
BITZER

ESC 200 & 200E

Electronic Screw Controller



Ultimate Screw Control
for the
Ultimate Screw Compressor

IF YOU DO NOT READ ANY OTHER PART OF THIS MANUAL, YOU MUST READ THIS!!!

Installation & Setup Tips

ESC 200 & ESC 200E
Bitzer Screw Compressors

The following information provides the OEM or Installing Contractor with the most common overlooked areas in wiring and setting up the ESC 200 or ESC 200E. If you have any questions about installing this control, please do not hesitate to contact Delta Heat Transfer, Inc. directly for assistance.

1. Terminals A3 & B6 will require connecting more than one wire. We recommend a common terminal strip for connection of multiple wires. Quantity of terminal points for A3 (oil level sensor), will be one point per compressor in the common system. The total number of terminals required for B6 (common ground) is a maximum of 8, determined by the number of digital and analog functions monitored.

2. The ESC 200 should be referenced to ground by attaching the green ground wire on the circuit board to the electrical panel back plate. If multiple terminal points are used, these terminal points should also be grounded to the back plate.

3. Low voltage transformer used to power the ESC must be a center tapped transformer wired to the electrical panel back plate. Correct transformers can be ordered with the following part numbers:

1-5 board transformer part number 855-3010-00

6-10 board transformer part number 855-3011-00

4. Phase wires connected to the screw terminals must be wired to the load side of the contactor and fused. If these wires have power before an input signal is sensed at terminal C1 the control will fail with a phase alarm.

5. Compressor run proof wires should be run with shielded cable.

6. When using an inverter, an inverter run proof and a by-pass run proof must be supplied.

7. All alarm points will supply a voltage to alarm, requiring an interposing relay for most electronic controller alarming. The ESC 200 is equipped with a 485 communications connection which will alarm directly to a electronic controller without the use of relays. This function requires special software, please consult factory for details .

8. If the ESC is used on an inverter compressor, dip switch 2.5 must be in the up (On) position.

9. If the ESC is used on a inverter compressor, a N/C inverter fault relay must be wired in series to terminal C1. Refer to the wiring diagram found in Appendix B.

10. Direct drive and engine drive ESC units should have jumper pins (J1) in the up position, bypassing the motor overload function.

11. Do not use in-line type timers in the control circuit of the ESC control. Timers with isolated contacts and a separate switching coil are recommended.

12. Do not install any timing device between the ESC output (terminal C4) and the compressor contactor. The ESC operation will be affected by these timers and can cause nuisance tripping.

ESC 200 & ESC 200E
Bitzer Screw Compressor
Installation and Instruction Manual

THE DESCRIPTIONS AND FUNCTIONS DISCUSSED IN THIS MANUAL REFER TO BOTH THE ESC 200 & 200E WITH THE REFERENCE OF THE ESC 200. WHEN A SPECIFIC FEATURE OR FUNCTION PERTAINING TO THE ESC 200E IS DISCUSSED, IT WILL BE NOTED BY USING THE NOMENCLATURE "ESC 200E" WHICH WILL SIGNIFY THIS CONTROL ONLY.

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3.0 Set-up & Starting Procedures

3.1 Factory Function Settings - Switch # 1
User Switch # 1 Settings

Switch # Position	Function Description	Operation	Switch	Type
1.1	Discharge Temperature	Automatic Reset	On (up)	Digital
1.2	Oil Flow	Automatic Reset	On (up)	Digital
1.3	Phase Monitor	Automatic Reset	On (up)	Digital
1.4	Motor Overload	Automatic Reset	On (up)	Digital
1.5	Inverter	Selector	On (up)	Digital
1.6	Start Delay	0 Sec.	Off (dn)	Digital
1.7	Start Delay	0 Sec.	Off (dn)	Digital
1.8	Start Delay	0 Sec.	Off (dn)	Digital

NOTE:

1. Refer to Start Delay Table 3.1-1 for setting other than 0 Sec.
2. OFF (down) position is indicated by arrow, ON (up). Switch is pushed in to determine operation (ON or OFF).
3. Reset button must be pressed before any setting changes will take effect

TABLE 3.1-1

Start Delay (Seconds)	Switch 1.6	Switch 1.7	Switch 1.8
0	OFF	OFF	OFF
5	ON	OFF	OFF
10	OFF	ON	OFF
15	ON	ON	OFF
20	OFF	OFF	ON
25	ON	OFF	ON
30	OFF	ON	ON
35	ON	ON	ON

NOTE:

1. OFF (down) position is indicated by arrow, ON (up). Switch is pushed in to determine operation (ON or OFF)
2. Reset button must be pressed before any setting changes will take effect

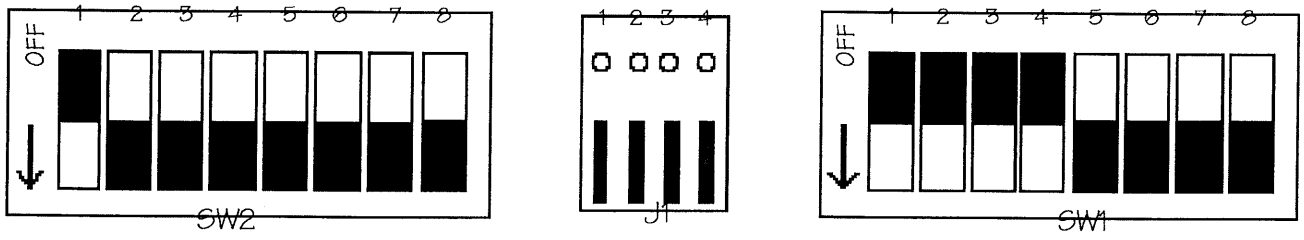


Fig. # 3.1-1

3.2 Factory Function Settings (Jumper Pins) User Jumper 1 (J1) Settings

Jumper #	Function Description	Operation	Jumper	Position	Type
1.1	Motor Overload	Not Bypassed		Down	Digital
1.2	Short Cycle Delay	No Delay		Down	Digital
1.3	Discharge Thermistor	PTC		Down	Digital
1.4	Phase Monitor	Monitor Position	Down	Digital	

NOTE:

1. Up position is closest to the edge of the board.
2. Reset button must be pressed before any setting changes will take effect.

3.3 Factory Network Settings - Switch # 2

User Switch # 2 Settings

Switch #	Function Description	Operation	Switch Position	Type
2.1	Board Network Address	Address Settings	(Table 3.3-1)	Digital
2.2	Board Network Address	Address Settings	(Table 3.3-1)	Digital
2.3	Board Network Address	Address Settings	(Table 3.3-1)	Digital
2.4	Board Network Address	Address Settings	(Table 3.3-1)	Digital
2.5	Board Network Address	Address Settings	(Table 3.3-1)	Digital
2.8	RS-485 Terminating Resistor (Non-Echelon units only)	Board Sequence Location	Switch OFF (ON - only if last board in sequence)	Digital

NOTE:

1. OFF (down) position is indicated by arrow, ON (up). Switch is pushed in to determine operation (ON or OFF)
2. Reset button must be pressed before any setting changes will take effect

Network Board Address Table.

TABLE 3.3-1

I/O Board Address Number	Switch 2.1	Switch 2.2	Switch 2.3	Switch 2.4	Switch 2.5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON
31	ON	ON	ON	ON	ON

NOTE:

1. OFF (down) position is indicated by arrow, ON (up). Switch is pushed in to determine (ON or OFF)
2. Reset button must be pressed before any setting changes will take effect

3.4 Factory Voltage Settings

The ESC 200 is configured automatically to control the following power voltages.

208Y
480Y
400Y
380Y
415Y
230 Delta

Note : 575 volt delta 380 delta will require a special version of hardware and software. Consult factory.

NOTE:

1. OFF (down) position is indicated by arrow, ON (up). Switch is pushed in to determine operation (ON or OFF).
2. Reset button must be pressed before any setting changes will take effect.
3. 575 delta and 380 delta will require a special version of hardware and software. Consult factory.

3.5 Power Requirements

Each ESC 200 control requires a 500 mA power supply at 20 VAC. A center tap transformer is required to be grounded to the electrical panel back plate. A 56 VA transformer is available to operate 5 ESC 200 controls and a 100 VA which will operate a quantity of controls over 1Q.

The ESC 200 may also be combined in parallel with any electronic pressure controller power supply using a 20 vac center tapped transformer capable of supplying sufficient power to operate the pressure controller and the required ESC 200 controls.

4.0 General Description

4.1 ESC 200

The ESC 200 control has been specifically designed to operate Bitzer's series of open (Type OS) and semi-hermetic (Type HS) screw compressors. The ESC 200 controls all compressor safety and operating functions through the use of a microprocessor. The ESC 200 will operate with several different control and power voltages.

The control can interface with either mechanical or electronic pressure controlled systems. Safety functions can be reset with the built-in reset button or via a remote operated electronic pressure controller. Alarm functions have the ability to interface with the electronic pressure controller to log any safety alarms.

The ESC 200 will operate with several different types of compressor starting methods such as inverter, direct on line, and part winding start. The control is very compact and can be mounted indirectly with the provided snap track.

A permanent memory has been built in to the ESC 200 to log rotation errors, oil failure occurrences, motor failure occurrences, and high discharge occurrences. This log can not be erased except by the factory and can be used to assist in determining warranty of the compressor. Each ESC 200 control serial number has been recorded and matched to its mating screw compressor at time of installation by the O.E.M.

The ESC 200E is equipped with ECHELON communications network to provide direct access to the status of the control functions for operation and alarm features.

4.2 Installation Tips

The ESC 200 has two terminals A3 and B6 which will require wiring of more than one wire. It is suggested that a common terminal strip be added to allow easy wiring of these two points. The number of common terminals required for A3 is the total number of compressors in the system. B6 will require a maximum of 8 terminal points per ESC 200 to be used as the input common. The ESC 200 should be referenced to earth ground by connecting the green grounding lead to the unit frame. Grounding of the transformers low voltage center tap will also assist in eliminating any control malfunctions due to grounding problems.

4.3 Duplex Mounting Bracket

The control dimensions are 4" wide X 14" long, using 56 sq. in. of panel space. A duplex bracket can be ordered to mount two controls on edge in this same 56 sq. in. area. The bracket Part # 508-1004-12 can be ordered from the factory, if needed.

5.0 Alarms

5.1 Alarm Operation

ESC 200 Alarm function utilizes two methods to signal operational faults.

1. Internal alarm, indicated by individual alarm function lights.
2. Remote alarm output voltage signal for operating a relay and/or panel lights.

Electronic pressure controllers have the ability to record remote signals either through a dry set of contacts or a direct voltage signal, depending upon the controller design. The ESC 200 will alarm when any of the input signals open. All alarms will be retained in the ESC 200 until they are cleared automatically or manually. In the case of a power failure, the alarm will be retained and show as an alarm when power is restored.

5.2 Direct Input Alarming

If the controller is capable of accepting a direct voltage signal, the ESC 200 can alarm directly to the controller and any desired panel lights.

5.3 Indirect Alarming

When a dry set of contacts are required, a relay of the same voltage as the ESC 200 output alarm voltage must be used to interface between the ESC 200 and the electronic controller input board.

5.4 Alarm Voltages

The alarm voltage is supplied to the control at terminal # C8.

NOTE : Terminals C1, C2, C3, and C8 must be supplied by the same voltage source (such as L1).
NOTE: IF THE ALARM DEVICES MUST OPERATE FROM 208 VAC POWER, THE OPERATIONAL DEVICES MUST ALSO BE ABLE TO ACCEPT THIS POWER. THE OPERATIONAL DEVICES ARE AS FOLLOWS:

1. Compressor contactor/starter coil (Terminal C4)
2. Unloader solenoids (Terminals C5 & C6)
3. Oil solenoid / Economizer (Terminal C7)

Alarm and operational voltages can be either A/C or D/C voltages.

6.0 COMPRESSOR SEQUENCE & SHORT CYCLE TIMERS

6.1 Sequence & Short Cycle Function

ESC 200 has the ability to sequence up to six compressors in the event of a failed controller board or with the use of mechanical controls not supporting a compressor sequencing scheme. The compressors can be programmed to initiate a starting sequence with 5 seconds between start intervals, preventing a large power surge in the grid network. These time delays can be set up with a combination of dip switches 1.6, 1.7, & 1.8 as per table 3.1-1 in section 3.1. ESC 200 has a 5 minute short cycle timer function which can be enabled or disabled via jumper 1.2. When the short cycle function is enabled, with J1.2 in the up position, the compressor will remain shut down for a period of 5 minutes each time the compressor is signaled to start. The function is normally used when a single compressor application is required. In cases where multiple compressors are paralleled, the electronic controller or other devices can perform this time delay function.

6.2 Sequence Timer Dip Switch Setup

Compressor sequencing is accomplished with combinations of on - off positions using SW-1.6, 1.7 & 1.8 to setup start interval of 5 seconds per table 3.1-1.

6.3 Short Cycle Jumper Pin Status

Placing jumper J1.2 in the "UP" position will enable the 5 minute timer. To disable the timer, place the jumper J1.2 in the "DOWN" position. See diagram in section 3.2.

7.0 COMPRESSOR LOADER DELAY

7.1 Loader Delay Function

Screw compressors which are equipped with capacity control will require less starting current if the loaders remain de-energized until the screw reaches full operating speed. The ESC 200 provides a method to insure these loaders remain de-energized when the loader solenoid coils are wired from their control output point. Example : the electronic pressure controller or a cycling control to the designated loader point on the ESC 200. The ESC 200 is capable of controlling two loaders. During a start, the ESC 200 will prevent the loaders from receiving power for 5 seconds after the start is initiated. This function is extremely important if part winding start is required. No additional unloading of the screw will be required, other than the 50% capacity control supplied by the two solenoid loaders, to start in a part winding start configuration.

7.2 Loader Delay Function Testing

A volt ohm meter or test light can be used to test this function. When the ESC 200 start sequence is initiated, the loader solenoids will receive a voltage signal 5 seconds after the compressor is started. When the loader control devices are energized, this voltage signal can be detected from terminals C5 & C6 to L2.

7.3 Loader Terminals

1. Loader # 1 input is connected between terminal C2 & control device.
2. Loader # 2 input is connected between terminal C3 & control device.
3. Loader # 1 output is connected between terminals C5 & L2
4. Loader # 2 output is connected between terminals C6 & L2

8.0 COMPRESSOR ROTATION PROTECTION

8.1 Rotation function

Screw compressors are equipped with a rotation switch mounted in the discharge area of the screw compressor before the internal check valve. The switch closes when subject to a pressure greater than 30 Lbs. and opens when pressure is less than 20 Lbs. When the compressor is operating in the proper direction, the switch will remain closed allowing a signal to be returned to the ESC 200. Rotation can also be verified as a function of phase monitoring discussed in section 14.

The compressor is allowed to start for a period of 2 seconds. This 2 second operation permits the rotation switch to close and return a signal back to the ESC 200. Once the rotation has been determined to be in the proper direction, the ESC 200 will signal for the oil solenoid to be energized along with the other output devices.

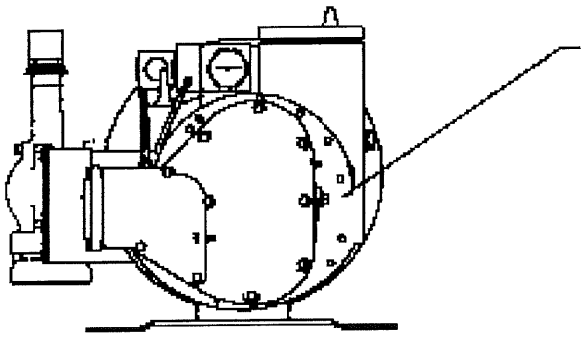
If the screw compressor is operating in reverse, the Vi pressure area of the screw will be in a vacuum within the 2 second allotted time, leaving the rotation switch open. If the switch remains open after the 2 second compressor operation, an incorrect rotation will be alarmed and the compressor will be shutdown and locked out.

8.2 Rotation Switch Positioning

Compressor is supplied with several fittings which permit the proper positioning of the rotation switch. The switch must be positioned 90 degrees to the compressor rotation port on the "53" series screw compressor. HS.53 and OS.53 series screw compressors require two fittings, a 3/8" NPT X 1/8" FPT reducer bushing (Part# 926-0103-01) and a 90 degree elbow 1/8: NPT X 1/*" FPT (Part# 938-0101-00). Figure 8.2.-1 indicates the mounting location for the rotation switch..

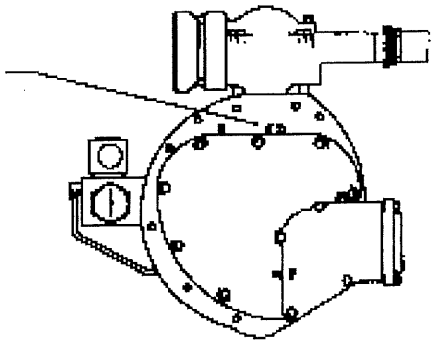
The "64" and "70" series are also positioned at 90 degrees. The required fittings for the HS "64" and Os"70" series are a 3/4" NPT X 1/8" FPT reducing bushing (Part# 926-0106-01) and a 90 degree elbow 1/8" NPT X 1/8" FPT (Part # 938-0101-00). Figure 8.2-2 indicates the mounting location for the rotation switch.

The HS and OS "74" series screw compressor requires only the 90 degree elbow 1/8" NPT X 1/8" FPT (Part # 938-0101-00). Figure 8.2-3 illustrates the mounting position of the switches.



HS "53" Series

Rotation Switch Location



OS "53" Series

Fig. # 8.2-1

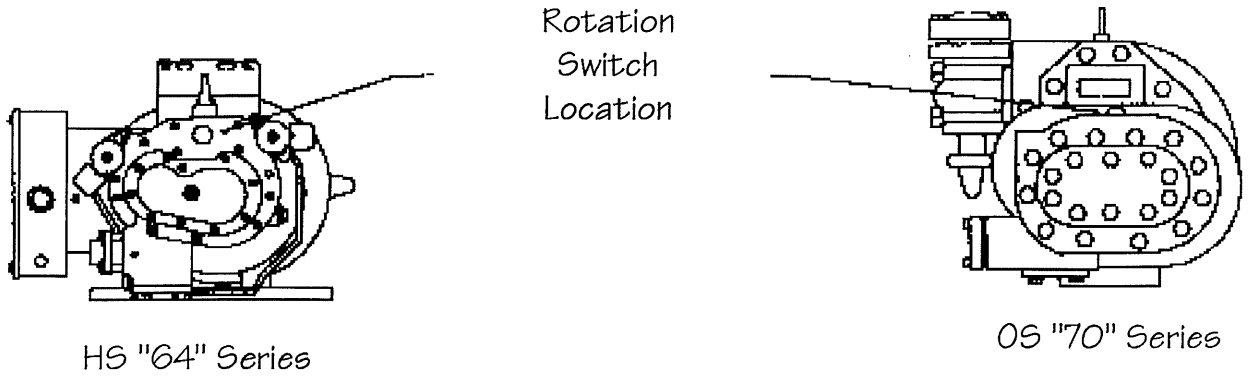


Fig. # 8.2-2

8.3 Rotation Alarm Function

When a compressor rotation fault is detected, the ESC 200 will energize the corresponding control function alarm

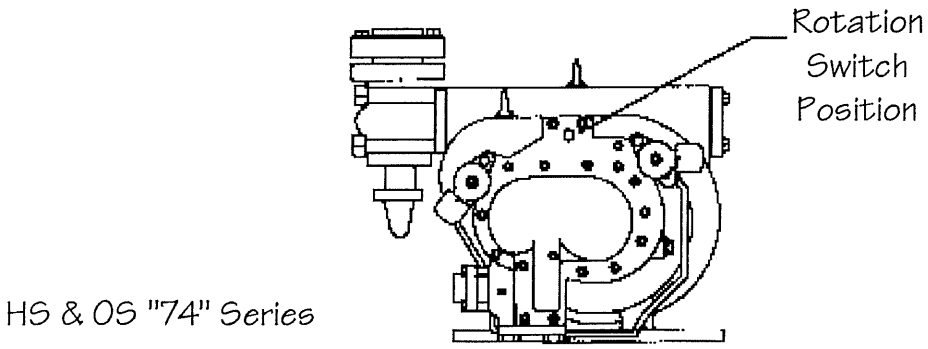


Fig. # 8.2-3

light. A voltage signal will also be supplied at terminal D7 initiating a remote alarm and/or a remote panel light.

8.4 Rotation Function Testing

ESC 200 compressor rotation function testing can be accomplished by removing the wire from terminal A4. The compressor will immediately shut down. The fault can only be cleared by depressing the control reset button after terminal A4 is reconnected.

NOTE: THIS FAULT CAN ONLY BE CLEARED BY THE MANUAL RESET BUTTON AFTER THE ROTATION IS CORRECTED, IT CAN NOT BE CLEARED VIA THE ELECTRONIC PRESSURE CONTROLLER THROUGH A MODEM.

8.5 Rotation Terminals

1. Rotation switch is connected to terminals A4 & B6.
2. Rotation alarm connected to terminal D7.

9.0 COMPRESSOR STARTING METHODS

9.1 Inverter Operation

Compressors operated by a frequency inverter require special handling due to time delays imposed through the inverter software and varying voltage signals on the load side of the inverter. Each inverter is configured with a dry set of normally open contacts. These contacts are labeled as the inverter run proof relay contacts. The ESC 200 sends a voltage signal from terminal A5 to the inverter run proof relay (N/O contacts), back to terminal B6. A relay closure grounding a 5 volt signal to terminal B6 indicates the compressor is receiving power and should be operational (refer to ESC 200 wiring diagram for inverter operation).

Dip Switch 1.5

Inverter dip switch must be placed in the on or "UP" positions to indicate that the ESC 200 is operating with an inverter. When the ESC 200 is placed in the inverter operation mode via the switch 1.5, all voltage and phase functions are turned over to the inverter for protection while the inverter run proof shows a closure. If the inverter faults and switches into by-pass the ESC200 will monitor the voltage and phase functions while the by-pass run proof indicates a closed connection.

If the inverter run proof relay is required for other proofing, then an interposing relay with the same coil voltage must be used to supply a dry contact for the run proof closure.

Once the run proof relay closure has been determined, the compressor rotation will be verified and all operational functions will commence in sequence. The loss of run proof will be indicated by the run proof alarm light. The compressor output signal will remain energized to the forward run relay while run proof is being verified, permitting the inverter to reset automatically. If the run proof is not verified during the start sequence the ESC 200 will wait 15 seconds and activate the alarm light and terminal point (D8). After an additional 15 seconds, terminal point (C4) will be turned off and the compressor will shutdown. Functional operations, such as: oil solenoid and loader solenoids will remain inactive until the run proof is verified. If the inverter has not successfully restarted or activated the inverter by-pass contactor within 30 seconds, the ESC 200 will shut down the compressor, requiring a manual reset. If the inverter fault scheme has been wired into the control circuit, any run proof loss due to inverter faults will be handled as a normal shutdown.

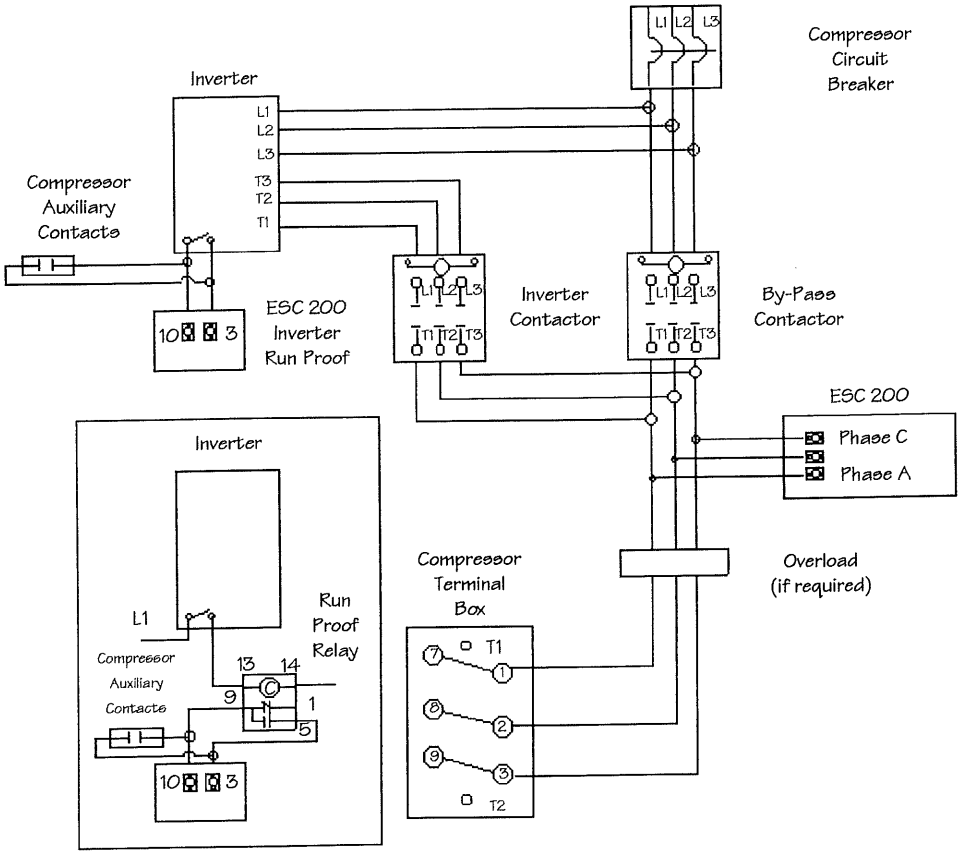


Fig. # 9.1-1

9.2 Inverter Fault Relay

To prevent the ESC 200 from locking out the compressor during inverter faults and restart attempts, an inverter fault relay (IFR in the ESC diagram) with N/C contacts should be placed in series to the compressor input signal supplying terminal C1. When the inverter fault relay receives power from the inverter indicating a fault has occurred, the relay will open and shutdown the ESC 200 as a normal function.

9.3 By-pass Circuit

When a by-pass circuit is installed as a fail-safe to the inverter, a separate compressor run proof signal from terminal A6 should be wired in parallel to a normally open auxiliary contact on the by-pass contactor (refer to ESC 200 wiring diagram for inverter operation). Sending this signal back to terminal B6 indicates a closure. Once the run proof relay or auxiliary contact closure is determined, the compressor rotation will be verified and all operational functions will commence in sequence.

NOTE: POWER CONNECTIONS FOR INVERTER OPERATION MUST BE CONNECTED FROM THE ESC 200 PHASE TERMINALS A, B, C TO THE LOAD SIDE OF THE INVERTER CONTACTOR/STARTER OR BY-PASS CONTACTOR/STARTER (T1,T2,T3) RESPECTIVELY OR ANY CONSECUTIVE SEQUENCE. EXAMPLE : T2,T3,T1, OR T3,T1,T2..

9.4 Direct On Line Operation

Compressors which operate direct on line do not require any additional signals and rely upon voltage returned to the ESC 200 phase terminals A, B, C to determine compressor operation.

A wire from terminal A6 must be connected through a N/O auxiliary contact back to terminal B6 for non-inverter operation (refer to ESC 200 wiring diagram for non-inverter operation).

When connecting terminals A6 and B6 through a normally open auxiliary contact on the compressor contactor or starter, an additional safety function will protect the compressor . Once the run proof relay closure has been determined, the compressor rotation will be verified and all operational functions will commence in sequence. If the run proof is not verified during the start sequence the ESC 200 will wait 30 seconds before opening the compressor output point (C4). If the run proof is lost during compressor operation, the ESC 200 will wait 5 seconds before shutting down the compressor.

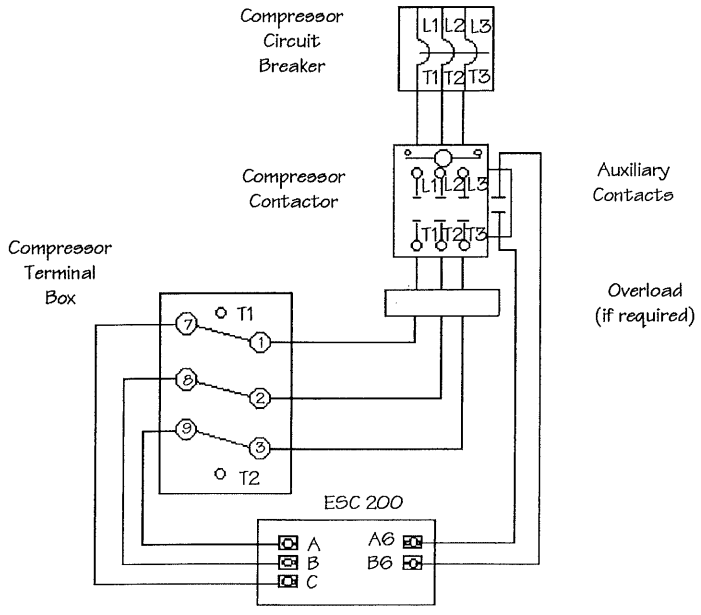


Fig. # 9.4-1

NOTE: POWER CONNECTIONS FOR NON-INVERTER OPERATION MUST BE CONNECTED FROM THE ESC 200 PHASE TERMINALS A,B,C TO COMPRESSOR LOAD SIDE TERMINALS (T1,T2,T3) RESPECTIVELY OR ANY CONSECUTIVE SEQUENCE. EXAMPLE : T2,T3,T1, OR T3,T1,T2...

9.5 Part Winding Operation

Compressors which utilize part winding start do not require any additional signals and rely upon voltage returned to the ESC 200 phase terminals A,B,C to determine compressor operation.

Once the run proof and rotation have been verified , all operational functions will commence in sequence. If the run proof is not verified during start, the ESC 200 will wait 15 sec. and activate the alarm light and terminal (D8), indicating an alarm. If the run proof remains non-operational for an additional 15 sec, terminal (C4) will be turned off, shutting down the compressor, requiring a manual reset. If the run proof is lost during compressor operation, the ESC 200 will wait 5 Seconds before shutting down the compressor. In each case the oil solenoid and loader solenoids will immediately shutdown or remain inactive until run proof is verified.

An interposing timer is required between the two contactor/starters. This timer should be set from between 0.5 and 1 second. Any time greater than 1 second, may interfere with the starting sequence of the ESC 200 or may cause damage to the compressor motor. A wire is required from terminal A6 through a N/O auxiliary contact back to terminal B6 for non-inverter operation (refer to ESC 200 wiring diagram for non-inverter operation).

NOTE: POWER CONNECTIONS FOR PART WINDING OPERATION MUST BE CONNECTED FROM THE ESC 200 PHASE TERMINALS A,B,C TO COMPRESSOR LOAD SIDE TERMINALS (T1,T2,T3) RESPECTIVELY OR ANY CONSECUTIVE SEQUENCE. EXAMPLE : T2,T3,T1, OR T3,T1,T2...

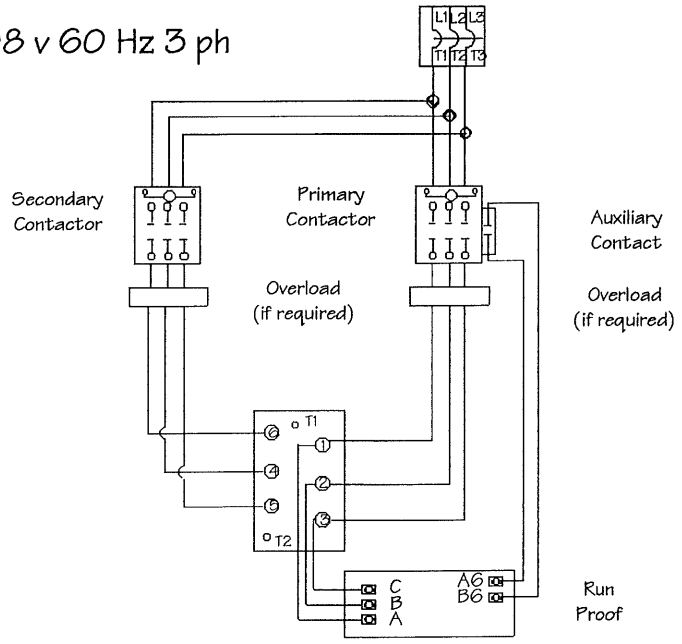


Fig. # 9.5-1

9.6 Inverter Function Testing

The inverter function can be tested by removing terminal A5 while the compressor is operating. This test will open the inverter run proof circuit, shutting down the compressor. The bypass run proof can be tested by removing the A6 connection while the compressor is operating in the bypass mode.

9.7 Terminal Connections

1. Inverter run proof relay is connected to A5, and the by-pass auxiliary contact is connected to terminals A6.
2. Direct on line operation, a run proof wire must be installed from terminal A6 through the contactor auxiliary to terminal B6.
3. Part winding operation , a run proof wire must be installed from terminal A6 through the contactor auxiliary to terminal B6.

10.0 DIRTY OIL FILTER

10.1 Dirty Oil Filter Function

The oil filter has a built-in pressure differential switch set to alarm at a 10# differential across the filter. The switch is configured with either normally open or normally closed contacts. The normally closed contacts are to be used in conjunction with the ESC 200 to alarm for a dirty oil filter. When the filter reaches a 10# differential, the contacts will open, sending a signal to the ESC 200 triggering an alarm.

The dirty oil filter function is NOT a shut down function and ONLY used to alarm.

10.2 Dirty Oil Filter Reset

Dirty oil filter reset is a manual function when a new filter is installed. When the new filter is installed, the internal differential switch returns to the normal position. After the new filter is installed, press the Alarm Reset switch on the ESC 200 to clear the alarm..

10.3 Dirty Oil Filter Alarm

The oil filter differential switch mounted on top of the oil filter will close when a 10# differential is sensed. A switch opening interrupts a signal to ESC 200, indicating the oil filter is dirty. The ESC 200 will energize the corresponding control alarm light. A voltage signal is also supplied to terminal D1 initiating a remote alarm and/or remote panel light.

10.4 Dirty Oil Filter Function Test

Dirty oil filter control function can be tested by removing the wire from terminal A1 which performs the same function as a switch opening.

10.5 Dirty Oil Filter Terminals

Dirty oil filter connects to terminals A1 and B6. Dirty oil filter remote alarm connects to terminal D1.

11.0 DISCHARGE TEMPERATURE PROTECTION

11.1 Temperature Function

Bitzer screw compressors can utilize either a PTC or PT 1000 temperature probe. The PTC has a preset trip point of 212 Deg F and a reset temperature lower for automatic resetting. The PT 1000 is a readable probe which also trips at 212 Deg F. The PT 1000 probe reads the resistance of the probe in ohms to determine the trip and reset points. The ESC 200 has been designed to directly read the discharge temperature through the Echelon network using the PT 1000 probe.

The temperature probe is located in the compressor discharge cavity downstream of the discharge check valve. This probe senses the discharge temperature, signaling back to the ESC 200 when the discharge temperature exceeds a safe limit of 212 degrees F(100 degrees C). If this temperature exceeds the safe limit, the ESC 200 will shut the compressor down.

PTC will cut out @ 4.5 K Ohms and cut in @ 2.75 K Ohms. PT 1000 will cut out @ 1358 K Ohms (212 F) and cut in @ 1309 K Ohms (176 F).

11.2 Temperature Reset Function

The compressor can be configured to reset automatically when the discharge temperature returns to a safe level. The manual shut down feature requires depressing the reset button or a remote electronic pressure controller reset. Dip switch settings to configure for automatic or manual reset are listed in section 11.5.

11.3 Temperature Alarm Function

When a discharge temperature fault is detected, the ESC 200 will energize the corresponding control function alarm light. A voltage signal will also be supplied at terminal D5, initiating a remote alarm and/or a remote panel light.

11.4 Temperature Function Testing

Testing the discharge temperature function requires removing the wire from terminal B2 to shut down the compressor. Reconnecting the wire will restart the compressor when the control function is in the automatic mode. If the temperature function is in the manual mode, the compressor will remain shut down until the reset button is depressed.

11.5 Temperature Terminals And Dip Switch / Jumper Status

1. PTC or PT 1000 probe is connected to terminals B2 & B6
2. Alarm wire is connected to terminals D5.
3. Automatic reset dip switch # 1.1 to "ON" up position.
4. Manual reset dip switch # 1.1 to "OFF" down position.
5. PTC probe configuration , jumper 1.3 in "UP" position.
6. PT 1000 probe configuration , jumper 1.3 in "DOWN" position.

12.0 MOTOR OVERLOAD PROTECTION

12.1 Overload Function

ESC 200 monitors the motor overload thermistor (T1 & T2) in each motor winding. These are located in the compressor terminal box. If any of the three windings overheat due to voltage or amperage limits out of operating range or any malfunction which cause high motor temperature, the ESC 200 will shutdown the compressor. This function is only applicable to semi-hermetic screw compressors. If an open type compressor is used in conjunction with the ESC 200 the motor overload function can be disabled with a jumper pin.

12.2 Overload Reset Function

Motor overload can be configured for either automatic or manual reset. When a fault is detected requiring a compressor shutdown, the ESC 200 will keep the compressor off line until the motor temperature reaches a safe level, when configured in the automatic mode. The manual reset mode will require depressing the control reset button or a remote reset via the electronic pressure controller. The ESC 200 will not reset in the manual mode as long as the motor temperature is above the safe limit.

12.3 Overload Alarm Function

When a motor overload fault is detected, the ESC 200 will energize the corresponding control function alarm light. A voltage signal will also be supplied at terminal D2 initiating a remote alarm and/or a remote panel light.

12.4 Overload Function Testing

Testing the motor overload function requires removing the wire from terminal B1 to shutdown the compressor. Reconnecting the wire will restart the compressor when the control function is in the automatic mode. If the Motor overload function is in the manual mode, the compressor will remain shut down until the reset button is depressed.

12.5 Overload Terminals And Dip Switch / Jumper Pin Status

1. Motor protector wires (Compressor terminals T1 & T2) are connected between terminals B1 & B6.
2. Alarm wire is connected to terminals D2.
3. Automatic reset dip switch 1.4 to "ON".
4. Manual reset dip switch 1.4 to "OFF".
5. Motor protector by-pass jumper pin 1.1 to "UP" for open compressors.
6. Motor protector by-pass jumper pin 1.1 to "DOWN" for semi-hermetic compressors.

13.0 OIL SAFETY CONTROL

13.1 Oil Safety Control Function

ESC 200 oil function monitors the oil flow to the screw compressor with the oil flow switch. Oil flow switch is a normally open switch, measuring both minimum oil flow and differential pressure. When closed, it sends a signal back to the ESC 200 confirming the minimum oil flow is present to operate the compressor. ESC 200 allows the compressor to start for 15 seconds in the automatic reset mode, or 20 seconds in the manual mode. This time delay allows the oil flow to stabilize to the compressor. If the proper oil flow has not been obtained after the allotted time, the ESC 200 will shut down the compressor. If the oil flow falls below the design minimum during operation, the flow switch will open, breaking the signal sent by the ESC 200. When the signal is broken, a 5 second timer is initiated. If oil flow has not been restored before the 5 seconds elapse, the compressor is shut down.

The ESC 200 will allow two additional automatic restarts before a manual shutdown is accomplished. Each time a fault is detected, the ESC 200 will turn on the corresponding alarm light and send a voltage signal to terminal D3 for a remote alarm and/or panel light.

13.2 Oil Reset Function

Oil flow rates may reach minimum flow levels for many reasons. Low oil flow conditions usually indicate the system is out of balance or a malfunction has occurred. If the oil fault is caused by a temporary condition such as a rapid pressure or liquid refrigerant, the oil fault could be resolved by resetting the oil function, allowing the compressor to re-start. These infrequent oil flow failures can be considered nuisance oil faults. The ESC 200 has a built-in automatic reset feature which leaves the compressor shut down for 30 seconds, then sequences a compressor re-start. If the re-start is successful, the compressor resumes normal operation.

The total number of starts before a manual lockout occurs is 3, within a consecutive 10 minute period. After a manual lockout the control reset button must be depressed or a remote reset via the electronic pressure controller performed to restart the compressor. The lockout timer will be reset back to zero when the compressor operates with less than 3 faults within a 10 minute period. If a manual lockout occurs, a service technician will be required to correct the fault causing the oil failure.

13.3 Oil Alarm Function

When an oil fault is detected, the ESC 200 will energize the corresponding control function alarm light. A voltage signal will also be supplied at terminal D3, initiating a remote alarm and/or a remote panel light.

When the oil function is configured for automatic reset, the oil alarm function will remain energized until the fault is automatically or manually cleared, beginning the restart sequence.

13.4 Oil Function Testing

As soon after the compressor or ESC 200 has been commissioned, the oil function should be tested. The following procedures will perform testing of flow switch and the ESC 200 function.

1. While compressor is operating, turn off the oil supply to the compressor.
2. Compressor should shut down in 5 seconds (checking the interruption time delay).
3. Turn oil back on and allow the automatic compressor restart to function.
4. Wait 45 seconds allowing the oil flow to stabilize.
5. Perform steps 1 through 4 two additional times.
6. After the third shut down, the oil fault light should remain permanently on indicating a manual lockout.
7. Turn the oil back on and push the manual reset button to restart the compressor.
8. This test should be included in any preventative maintenance procedures.

13.5 Oil Terminals And Dip Switch Status

1. Oil flow switch wires are connected between terminals A2 & B6.
2. Oil Alarm wire is connected to terminals D3.
3. Automatic reset dip switch 1.2 to "ON".
4. Manual reset dip switch 1.2 to "OFF".

14.0 OIL SOLENOID / ECONOMIZER CONTROL

14.1 Oil Solenoid Control Function

The oil solenoid control function is very critical to the proper operation of the screw compressor. If the solenoid is not operated properly, extreme damage to the compressor will occur. The ESC 200 operates the oil solenoid in conjunction with the safety functions. During the initial starting, the oil solenoid will remain off until the correct rotation can be established (Approx. 2 Sec.).

As an additional safety to prevent compressor operation without oil flow, the oil solenoid will remain energized when the following functions are present

1. Terminal C1 does not have a power signal.
2. Minimum of two phases of compressor power are present on the load side of the contactor.
3. Compressor run proof signal is present.

This oil function is valid for non-inverter use only, and has been designed to protect the compressor against welded contacts and unauthorized operation of the contactor.

14.2 Economizer Control Function

The economizer solenoid is shared with the oil solenoid; the economizer solenoid should be wired parallel to the oil solenoid. This will also enable the compressor to start without the additional load of the sub cooled gas which is delivered to the compressor by the economizer line.

NOTE: ANY TIME THE COMPRESSOR IS SHUT DOWN BY THE ESC 200, OR INTERRUPTION OF CONTROL POWER, THE OIL SOLENOID WILL BE CLOSED BY THE ESC 200.

14.2 Oil Solenoid Function Testing

Testing of this feature should be checked each time an alarm function or normal cycle test is performed. Each time the compressor is shut down, the solenoid should be immediately de-energized.

NOTE: IT IS STRONGLY RECOMMENDED THAT A COIL LIGHT BE INSTALLED ON THE OIL SOLENOID COIL OR A PANEL LIGHT TO DETERMINE IF THE SOLENOID OPERATION IS WORKING IN CONJUNCTION WITH THE COMPRESSOR CYCLING. THESE LIGHTS SHOULD BE IN CLEAR VIEW.

14.3 Oil Solenoid Terminals

1. Oil solenoid is connected from terminal C7 to the oil solenoid valve to L2.
2. Installation of a coil or panel mounted light strongly suggested to determine if the solenoid is energized.

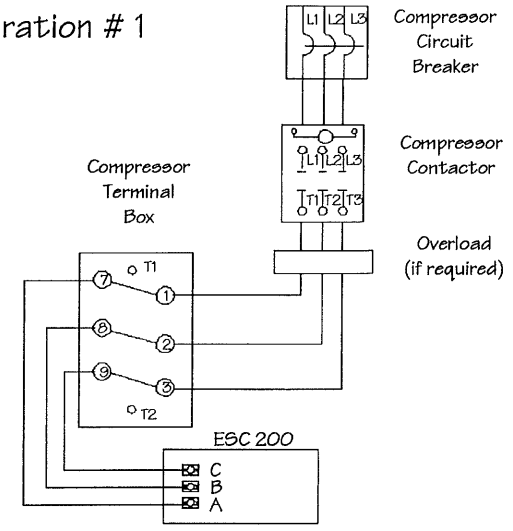
15.0 PHASE MONITORING

15.1 Phase Monitoring Function

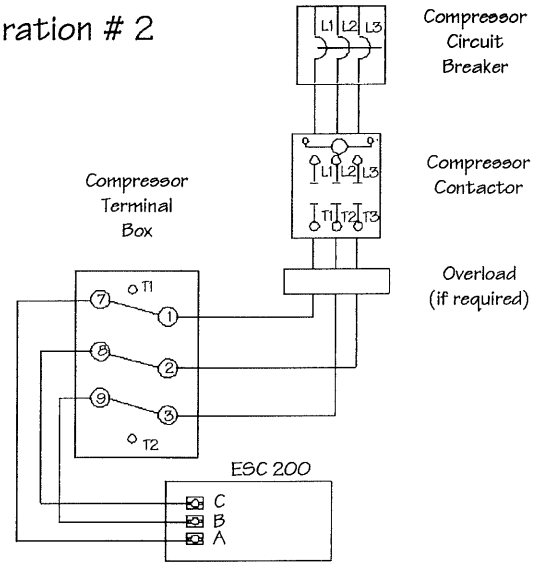
The ESC 200 is equipped to monitor phase loss and sequence between the 3 power phases, L1,L2 and L3. The ESC 200 will be configured for either inverter operation or non-inverter operation automatically, including direct on line or part winding start. Once a signal is returned to the ESC 200 by either the inverter run proof (inverter operation) or the by-pass run proof (Non-inverter operation), the ESC 200 will allow the power to stabilize for 500 milli-seconds (0.5 Sec.) and check for phase loss and proper phase sequence. When these checks are completed, the rotation check can be accomplished and the operational devices activated. ESC 200 phase monitoring terminals #A, B, C should be connected at the compressor motor terminals T1, T2, T3 respectively. When the system is operated by an inverter, these connections should also be made at motor terminals. If any of the three power legs (T1,T2,T3) lose power during operation, or the sequence is changed, the compressor will immediately shutdown, and the ESC 200 will alarm as a phase failure.

NOTE: IF THE PHASE POWER IS CONNECTED TO THE LINE SIDE OF THE CONTACTOR, VOLTAGE WILL BE SENSED AND THE ESC 200 WILL ALARM A PHASE LOSS, INDICATING A WIRING PROBLEM.

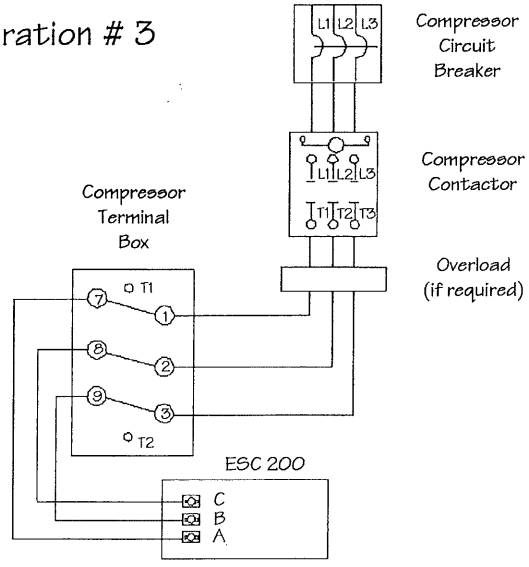
Configuration # 1



Configuration # 2



Configuration # 3



15.2 Phase Rotation

Compressor rotation can be monitored by phase sequence once the proper rotation has been established. The phase connections must always remain connected from each phase to the ESC 200 as follows : (T1 to A), (T2 to B) and (T3 to C). If this consecutive sequence is altered, the compressor will shutdown within 0.5 seconds. An improper consecutive phase sequence will alarm with a Rotation and Phase light simultaneously with 5.02 and higher software.

Configuration #1 illustrates the initial wiring performed during manufacturing or installation.

Configuration #2 illustrates changing the power connections to correct the screw compressor rotation.

NOTE: THE PHASE MONITORING WIRES FROM THE ESC 200 MUST ALSO BE CHANGED TO MAINTAIN THE CORRECT RELATIONSHIP BETWEEN T1 & A, T2 & B, T3 & C AT THE ESC 200 PHASE TERMINALS. THESE WILL STILL REMAIN IN A CONSECUTIVE SEQUENCE.

Configuration #3 indicates a shutdown when a power wire has been wired improperly without changing the ESC 200 monitoring wires. This can be a normal occurrence when an electrical component has been replaced. The ESC 200 will shutdown the compressor within 1/2 Sec. on electrical rotation indicated by a rotation alarm and phase alarm.

15.3 Phase Reset Function

If the ESC 200 detects the loss of a phase, the compressor will be shut down. Compressor will remain off for a period of 30 seconds before a re-start is attempted. This re-start procedure can be accomplished two additional times with a 30 second shutdown between starts. If the compressor fails to start after the first three starts, the off time will be changed from 30 seconds to 5 minutes for two additional attempts. If all 5 attempts have failed to start the compressor, a permanent compressor shut down will occur requiring a service technician to correct the problem.

15.4 Phase Alarm Function

When a phase loss or sequence fault is detected, the ESC 200 will energize the corresponding control function alarm light. A voltage signal will also be supplied at terminal D6, initiating a remote alarm and/or a remote panel light.

15.5 Phase Function Testing

While the compressor is operating, remove any one of the terminal wires A, B or C. The compressor should shut down immediately and alarm.

15.6 Phase Terminal And Dip Switch Status

1. Inverter, Non-inverter and part winding start operation, the phase wires are connected from terminals A to T1; B to T2 ; C to T3. on the load side of the contactor.
2. Phase alarm wire is connected to terminal D6.
3. Engine operations, the phase jumper must be moved to the "UP" position to disconnect the phase function.

16.O OIL LEVEL MONITORING

16.1 Oil Level Function

Each ESC 200 will monitor oil level in the separator with the use of the electronic level sensor. When parallel compressors are installed, all the ESC 200 controls will be linked together to common terminal points and supplied a signal from terminal A3. Since one oil sensor operates multiple ESC 200 controls, the oil sensor will wire from the common terminal block through the oil level sensor back to B6. If low oil is sensed, the ESC 200 will lock out all compressors regardless of their operational status.

16.2 Oil Level Reset

Oil level reset is an automatic function only. When oil level is returned to a safe operating level, the ESC 200 will wait 3 minutes and release the compressors for normal starting sequence established by the built-in time delays.

17.0 OIL SENSOR SWITCH

17.1 Oil Sensor Function

The oil separator is fitted with a 1/2" female pipe mounting collar to accept the electronic oil level sensor switch. The switch part # 791-9906-00 is supplied with a 1/2" male optical well for housing the switch and permitting removal of the electronics without losing separator oil or refrigerant charge. The sensor is an electro-optical type rated from -40 Degrees F to +212 Degrees F., which senses the oil level and sends a signal through N/C contacts back to the ESC 200. If the oil leaves the separator, these contacts open causing the ESC 200 to alarm, shutting down the compressors.

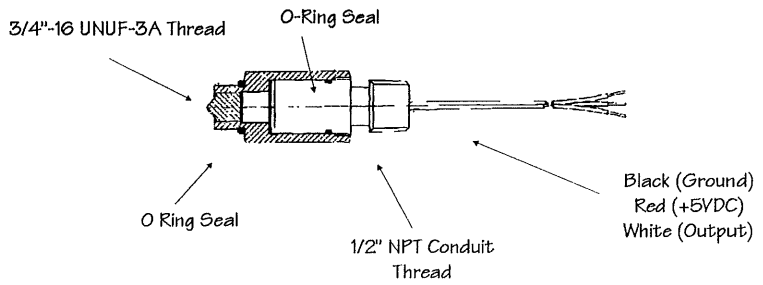


Fig. # 17.1-1

17.2 Oil Sensor Installation

The oil separator is configured with a 1/2" by 16 SAE thread mounting boss to accept the sensor well. The sensor well is to be installed with the supplied o-ring and tightened to a torque setting not to exceed 20 FT-LBS. The sensor requires a 5 VDC, 45 mA signal to power the sensor from B7 (Red) signal input wire connected to A3 (White), and a ground wire connected to B6 (Black).

NOTE : THE POWER SUPPLY (RED) WIRE IS CONNECTED TO TERMINAL B7 ON THE LEAD COMPRESSOR ESC 200.

17.3 Oil Sensor Testing

When either the white wire (A3) or the black wire (B6) is removed, the ESC 200 will shutdown the compressor.

18.0 RESETTING CONTROL FUNCTIONS

18.1 Automatic Reset

The ESC200 has several functions which are automatically reset when the appropriate dip switch is placed in the ON or "UP" position. Refer to section 3.0 "set-up and starting procedures.

18.2 Manual Reset

When functions are set-up as manual reset, the function reset switch must be depressed to clear the function fault. This reset button is located to the right of dip switch SW1. As stated in previous sections, each time a function is changed with dip switch setting or a jumper pin, the reset button must be depressed to initiate the change.

18.3 Remote Reset

The ESC200 provides a method to remotely reset any function except "Rotation". This remote resetting is accomplished by momentarily closing a dry contact point on the rack controller which has been wired from terminal A7 to B6. *DO NOT LEAVE THIS POINT CLOSED PERMANENTLY*, or the ESC 200 will malfunction and show false alarms and reset attempts.

Extreme caution must be taken not to abuse this function and operate the compressor for extended periods of time by using the remote reset. The remote reset has been designed to allow the operator to make a determination of the system malfunction before sending a service technician to the job.

19.0 AUXILIARY POWER OUTPUT

19.1 Auxiliary Power Function

Terminals B7 and B8 are supplied as auxiliary low voltage power outputs to provide power for operating the oil level sensor and transducers. The maximum power is 5 Vdc (regulated +- 5% not exceed 150 mA total).

20.0 LOGGING

20.1 Logging Function & Retrieval Scheme

ESC 200 will log up to 256 alarm logs. The logging functions to be recorded are the manual oil lockout (last automatic trip), rotation alarm, discharge temperature alarm and motor overload alarm. This data is stored in a 2k X 8 serial eeprom. This log cannot be removed or altered. If the data exceeds the 256 logs, the oldest log will be dropped to make room for the newest alarm log.

When the ESC 200 is first powered up, the counter will default to zero. The log retrieval program will display the minutes, hours, days, months, and years since the unit was powered-up. Retrieval of the data will allow the factory to help trouble shoot any problems which may exist with the compressor or system. If a compressor failure occurs, the corresponding ESC 200 will need to be sent back with the compressor. A new ESC 200 will be shipped with the new compressor. The retrieval of data can be accomplished via the Echelon network on the units that have Echelon. Non-Echelon unit will require special hardware and software to retrieve this data.

21.0 ECHELON NETWORK

21.1 Echelon Network Function

Echelon is a communications network which allows direct access to the different functions of the ESC 200 for alarming, accessing alarm logs, reading output information of data generating devices, and controlling operational functions.

22.0 RS-485 COMMUNICATIONS NETWORK

22.1 RS-485 Connection Function

Optional software is available for the ESC 200 allowing direct communications to an electronic controller. The electronic controller must be compatible to read the information transmitted by the ESC 200. This option allows for a direct link from the electronic controller to read all compressor alarms, perform remote compressor resets and determine the status of the compressors and loaders.

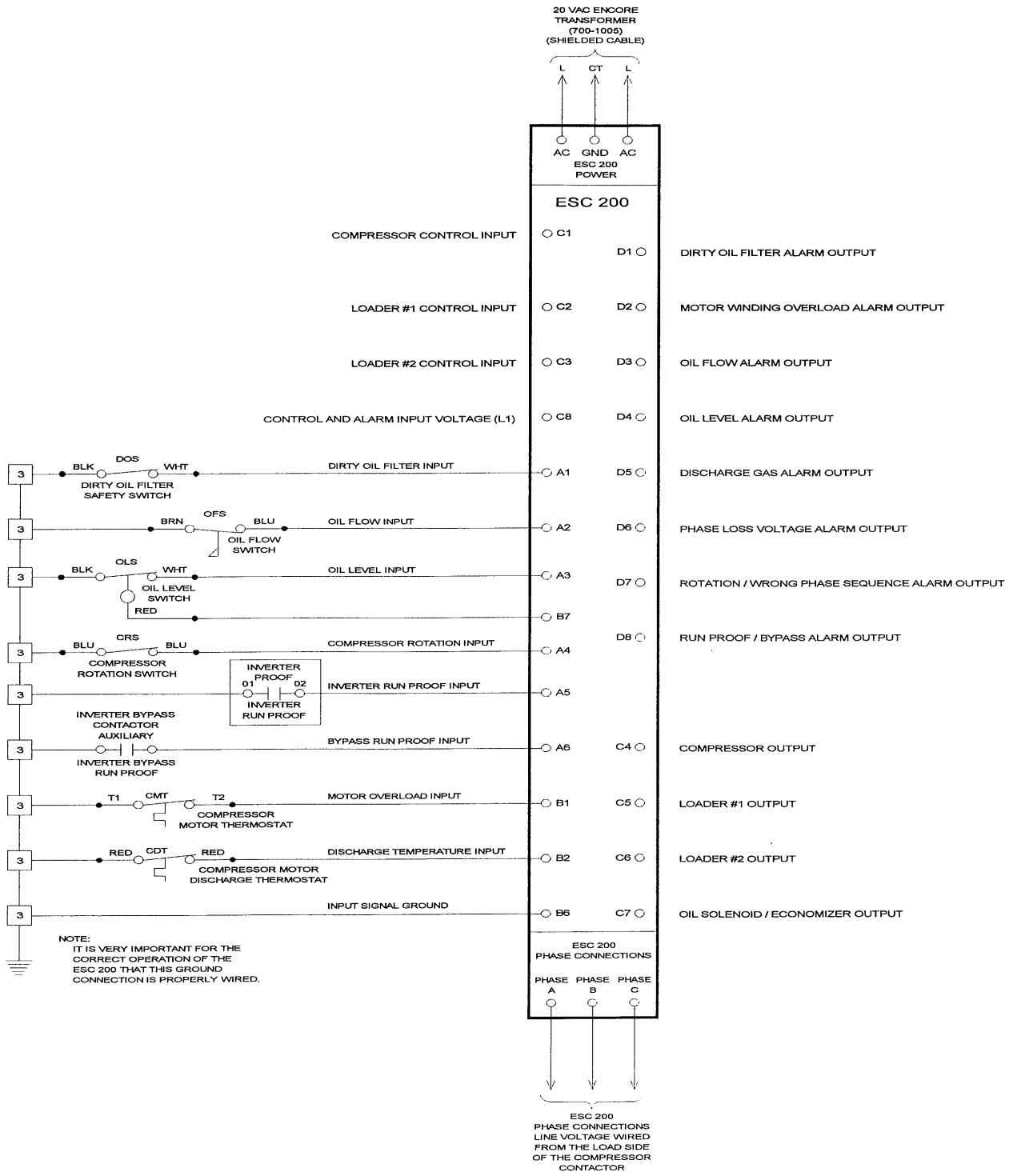
The RS-485 communications network eliminates the use of relays and wiring to supply a digital input required by many electronic controllers for alarm logging.

When utilizing the RS-485 connector the ESC 200 now becomes another input/output board in the electronic controllers network. The board must be configured with an address and a terminating resistor, (when used as the last board in the network). Refer to section, 3.3 Factory Network Setting - Switch #2, for the proper address and terminating resistor configurations.

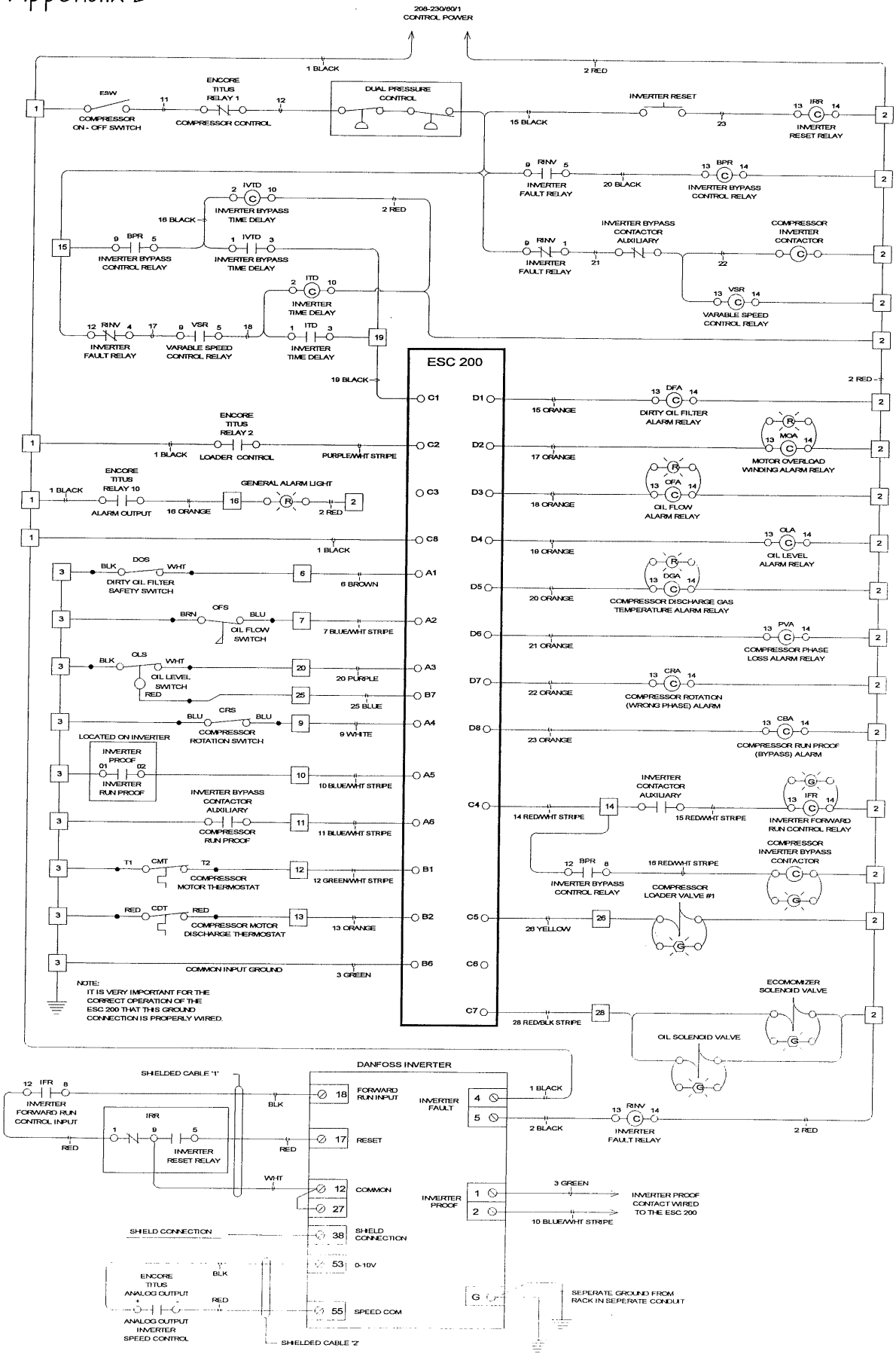
Please consult the factory to determine if the electronic controller installed on your system is compatible with the ESC 200 RS-485 network.

APPENDIX - A

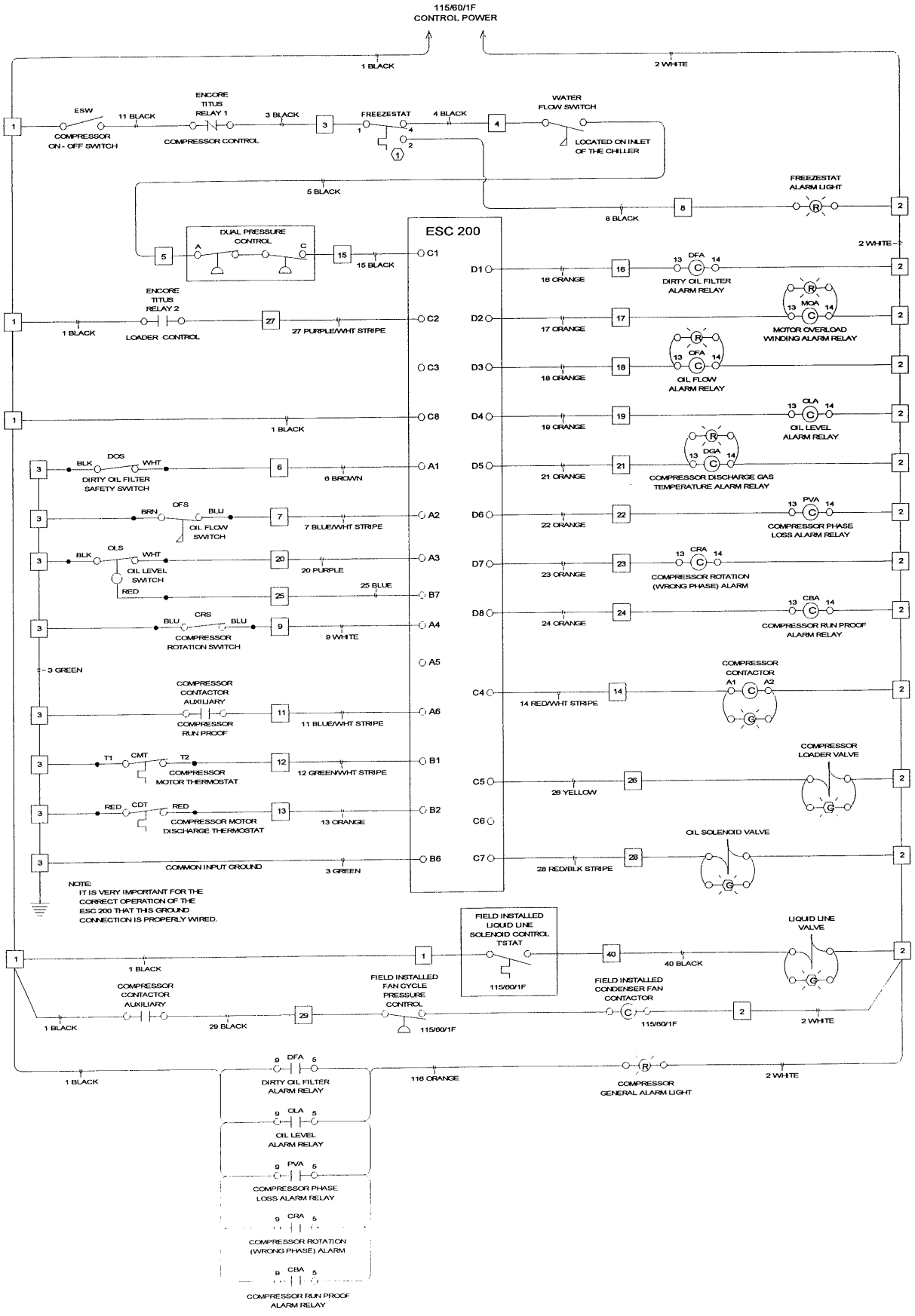
ESC 200 TERMINAL NOMENCLATURE



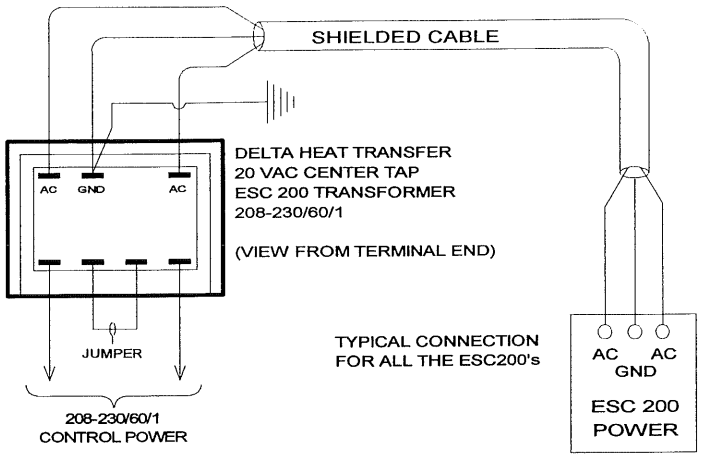
Appendix B

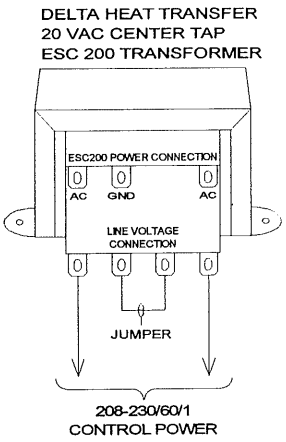

208-230/60/1
CONTROL POWER
1 BLACK
2 RED
ESW
COMPRESSOR
ON - OFF SWITCH
ENCORE
TITUS
RELAY 1
COMPRESSOR CONTROL
DUAL PRESSURE
CONTROL
INVERTER RESET
15 BLACK
23
IRR
INVERTER
RESET RELAY
RINV
INVERTER
FAULT RELAY
20 BLACK
BPR
INVERTER BYPASS
CONTROL RELAY
IVTD
INVERTER BYPASS
TIME DELAY
16 BLACK
INVERTER BYPASS
CONTACTOR
AUXILIARY
COMPRESSOR
INVERTER
CONTACTOR
22
ITD
INVERTER
TIME DELAY
VSR
VARIABLE SPEED
CONTROL RELAY
ESC 200
C1
C2
C3
C8
A1
A2
A3
B7
A4
A5
A6
B1
B2
B6
D1
D2
D3
D4
D5
D6
D7
D8
C4
C5
C6
C7
19 BLACK
15 ORANGE
DFA
DIRTY OIL FILTER
ALARM RELAY
17 ORANGE
MOA
MOTOR OVERLOAD
WINDING ALARM RELAY
18 ORANGE
OFA
OIL FLOW
ALARM RELAY
19 ORANGE
OLA
OIL LEVEL
ALARM RELAY
20 ORANGE
DGA
COMPRESSOR DISCHARGE GAS
TEMPERATURE ALARM RELAY
21 ORANGE
PVA
COMPRESSOR PHASE
LOSS ALARM RELAY
22 ORANGE
CRA
COMPRESSOR ROTATION
(WRONG PHASE) ALARM
23 ORANGE
CBA
COMPRESSOR RUN PROOF
(BYPASS) ALARM
ENCORE
TITUS
RELAY 2
LOADER CONTROL
PURPLE/WHT STRIPE
ENCORE
TITUS
RELAY 10
ALARM OUTPUT
GENERAL ALARM LIGHT
16 ORANGE
2 RED
1 BLACK
DOS
DIRTY OIL FILTER
SAFETY SWITCH
6 BROWN
OFS
OIL FLOW
SWITCH
7 BLUE/WHT STRIPE
OLS
OIL LEVEL
SWITCH
20 PURPLE
25 BLUE
CRS
COMPRESSOR
ROTATION SWITCH
LOCATED ON INVERTER
9 WHITE
INVERTER
PROOF
INVERTER
RUN PROOF
10 BLUE/WHT STRIPE
INVERTER BYPASS
CONTACTOR
AUXILIARY
COMPRESSOR
RUN PROOF
11 BLUE/WHT STRIPE
CMT
COMPRESSOR
MOTOR THERMOSTAT
12 GREEN/WHT STRIPE
CDT
COMPRESSOR MOTOR
DISCHARGE THERMOSTAT
13 ORANGE
COMMON INPUT GROUND
3 GREEN
NOTE:
IT IS VERY IMPORTANT FOR THE
CORRECT OPERATION OF THE
ESC 200 THAT THIS GROUND
CONNECTION IS PROPERLY WIRED.
INVERTER
CONTACTOR
AUXILIARY
14 RED/WHT STRIPE
15 RED/WHT STRIPE
IFR
INVERTER FORWARD
RUN CONTROL RELAY
COMPRESSOR
INVERTER BYPASS
CONTACTOR
16 RED/WHT STRIPE
INVERTER BYPASS
CONTROL RELAY
COMPRESSOR
LOADER VALVE #1
28 YELLOW
ECOMOMIZER
SOLENOID VALVE
28 RED/BLK STRIPE
OIL SOLENOID VALVE
DANFOSS INVERTER
SHIELDED CABLE '1'
INVERTER
FORWARD RUN
CONTROL INPUT
FORWARD
RUN INPUT
RESET
COMMON
SHIELD
CONNECTION
0-10V
SPEED COM
INVERTER
FAULT
INVERTER
PROOF
INVERTER PROOF
CONTACT WIRED
TO THE ESC 200
SHIELD CONNECTION
ENCORE
TITUS
ANALOG OUTPUT
ANALOG OUTPUT
INVERTER
SPEED CONTROL
SHIELDED CABLE '2'
SEPERATE GROUND FROM
RACK IN SEPERATE CONDUIT

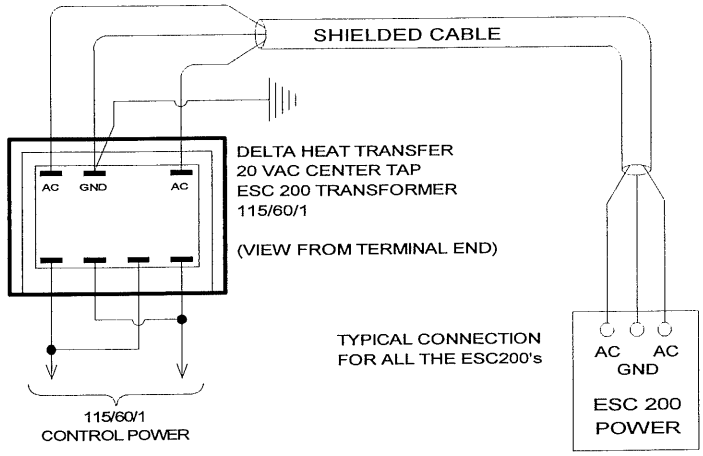
Appendix C

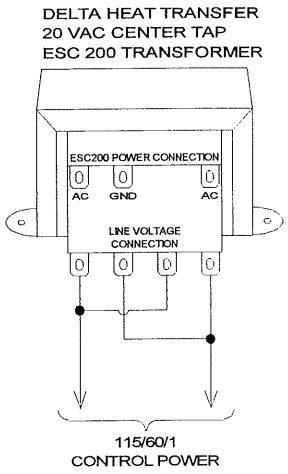

115/60/1F
CONTROL POWER
1 BLACK
2 WHITE
ESW
COMPRESSOR
ON - OFF SWITCH
11 BLACK
ENCORE
TITUS
RELAY 1
COMPRESSOR CONTROL
3 BLACK
FREEZESTAT
4 BLACK
WATER
FLOW SWITCH
LOCATED ON INLET
OF THE CHILLER
5 BLACK
FREEZESTAT
ALARM LIGHT
8 BLACK
DUAL PRESSURE
CONTROL
15 BLACK
ESC 200
C1
D1
16 ORANGE
DFA
DIRTY OIL FILTER
ALARM RELAY
ENCORE
TITUS
RELAY 2
1 BLACK
LOADER CONTROL
27 PURPLE/WHT STRIPE
C2
D2
17 ORANGE
MOA
MOTOR OVERLOAD
WINDING ALARM RELAY
C3
D3
18 ORANGE
OFA
OIL FLOW
ALARM RELAY
C8
D4
19 ORANGE
OLA
OIL LEVEL
ALARM RELAY
BLK
WHT
DOS
DIRTY OIL FILTER
SAFETY SWITCH
6 BROWN
A1
D5
21 ORANGE
DGA
COMPRESSOR DISCHARGE GAS
TEMPERATURE ALARM RELAY
BRN
BLU
OFS
OIL FLOW
SWITCH
7 BLUE/WHT STRIPE
A2
D6
22 ORANGE
PVA
COMPRESSOR PHASE
LOSS ALARM RELAY
BLK
WHT
OLS
OIL LEVEL
SWITCH
RED
20 PURPLE
25 BLUE
A3
B7
D7
23 ORANGE
CRA
COMPRESSOR ROTATION
(WRONG PHASE) ALARM
BLU
BLU
CRS
COMPRESSOR
ROTATION SWITCH
9 WHITE
A4
D8
24 ORANGE
CBA
COMPRESSOR RUN PROOF
ALARM RELAY
3 GREEN
A5
COMPRESSOR
CONTACTOR
AUXILIARY
COMPRESSOR
RUN PROOF
11 BLUE/WHT STRIPE
A6
C4
14 RED/WHT STRIPE
COMPRESSOR
CONTACTOR
A1
A2
T1
CMT
T2
COMPRESSOR
MOTOR THERMOSTAT
12 GREEN/WHT STRIPE
B1
C5
26 YELLOW
COMPRESSOR
LOADER VALVE
RED
CDT
RED
COMPRESSOR MOTOR
DISCHARGE THERMOSTAT
13 ORANGE
B2
C6
OIL SOLENOID VALVE
COMMON INPUT GROUND
3 GREEN
B6
C7
28 RED/BLK STRIPE
NOTE:
IT IS VERY IMPORTANT FOR THE
CORRECT OPERATION OF THE
ESC 200 THAT THIS GROUND
CONNECTION IS PROPERLY WIRED.
FIELD INSTALLED
LIQUID LINE
SOLENOID CONTROL
TSTAT
115/60/1F
LIQUID LINE
VALVE
40 BLACK
1 BLACK
COMPRESSOR
CONTACTOR
AUXILIARY
29 BLACK
FIELD INSTALLED
FAN CYCLE
PRESSURE
CONTROL
115/60/1F
FIELD INSTALLED
CONDENSER FAN
CONTACTOR
115/60/1F
2 WHITE
1 BLACK
DFA
DIRTY OIL FILTER
ALARM RELAY
116 ORANGE
COMPRESSOR
GENERAL ALARM LIGHT
2 WHITE
OLA
OIL LEVEL
ALARM RELAY
PVA
COMPRESSOR PHASE
LOSS ALARM RELAY
CRA
COMPRESSOR ROTATION
(WRONG PHASE) ALARM
CBA
COMPRESSOR RUN PROOF
ALARM RELAY

Appendix D









PART #855-3010-00 WILL POWER UP TO 5 ESC 200's

PART #855-3011-00 WILL POWER UP TO 10 ESC 200's

Appendix E

22.0 ESC 200 & 200E SPECIFICATIONS

22.1 Compressor and Loader Control Input Voltages, Terminals C1,C2,C3.
1. 24-1-60, 0.5mA max
2. 115-1-60, 0.5mA max
3. 240-1-60, 0.5mA max

22.1a Input Voltage Terminal C8
1. 24-1-60, 5A max
2. 115-1-60, 5A max
3. 240-1-60, 5A max

NOTE : C1,C2,C3, AND C8 SHOULD ALL BE SUPPLIED USING THE SAME VOLTAGE SOURCE (SUCH AS L1).

22.2 ESC 200 power voltage - terminals TB1,
20 Vac 500 mA Maximum 50/60 Hz with center tap 1 amp fuse

22.3 ESC 200 phase voltage monitoring - terminals TB2, A, B, C
1. 208 Y, 480 Y
2. 230 Delta , 400 Y
3. 380 Y
4. 415 Y
5. 575 Y and 380 delta (requires special hardware and software change)

22.4 Output alarm and device voltage - terminals

Outputs

D1 - dirty filter	D2 - motor overload temperature
D3 - oil flow	D4 - oil level
D5 - discharge gas temperature	D6 - phase loss / low voltage
D7 - rotation / wrong sequence	D8 - run proof / bypass Device
C4 - compressor	C5 - loader #1
C6 - loader #2	C7 - oil solenoid

Maximum voltage 240V , 240 VA pilot duty

22.5 Input device voltage - terminals

A1 - dirty oil filter	dry contact
A2 - oil flow	dry contact
A3 - oil level	dry contact
A4 - rotation	dry contact
A5 - inverter run proof	dry contact
A6 - bypass / run contactor	dry contact
A7 - remote alarm	dry contact
A8 - spare	
B1 - motor overload temperature	analog (PTC thermistor)
B2 - discharge gas temperature	analog (PTC or PT 1000)
B3 - spare	analog
B4 - spare	analog
B5 - spare	analog

B6 - input ground signal Maximum voltage 5 Vdc
DO NOT APPLY VOLTAGE TO ABOVE TERMINALS

22.6 Dimensions
1. width 4.0 inches
2. height 14.0 inches
3. depth 2.0 inches

22.7 Weight - 1.7 Lbs

22.8 Mounting
1. snap track
2. snap track with duplex bracket

22.9 Terminals
1. terminal block A, B, C, D - 8 position plug-in 240 Vac rated

22.10 Alarm & run lights
1. alarm - red LED
2. device - amber LED
3. run - green LED
4. communication - green LED

22.11 Labeling
1. alarm & terminal labeling - silk screened
2. terminal legend and part number description - silk screen

ESC 200

Trouble Shooting Guide

NOTE: AFTER EACH CHANGE OR CORRECTION TO THE ESC CONFIGURATION, THE RESET BUTTON MUST BE DEPRESSED FOR THE NEW CONFIGURATION TO TAKE EFFECT.

ESC INPUT VOLTAGE WILL READ 5 VDC FROM ANY INPUT TERMINAL (A1 - A8) TO TERMINAL (B6), WHEN THE INPUT DEVICE IS OPEN.

ESC OUTPUT VOLTAGE WILL READ THE VOLTAGE SUPPLIED AT TERMINAL (C8). VOLTAGE CAN BE READ FROM THE OUTPUT TERMINAL (D1 - D8 AND C4 - C7) TO L2, WHEN THE TERMINAL POINT IS ACTIVE.

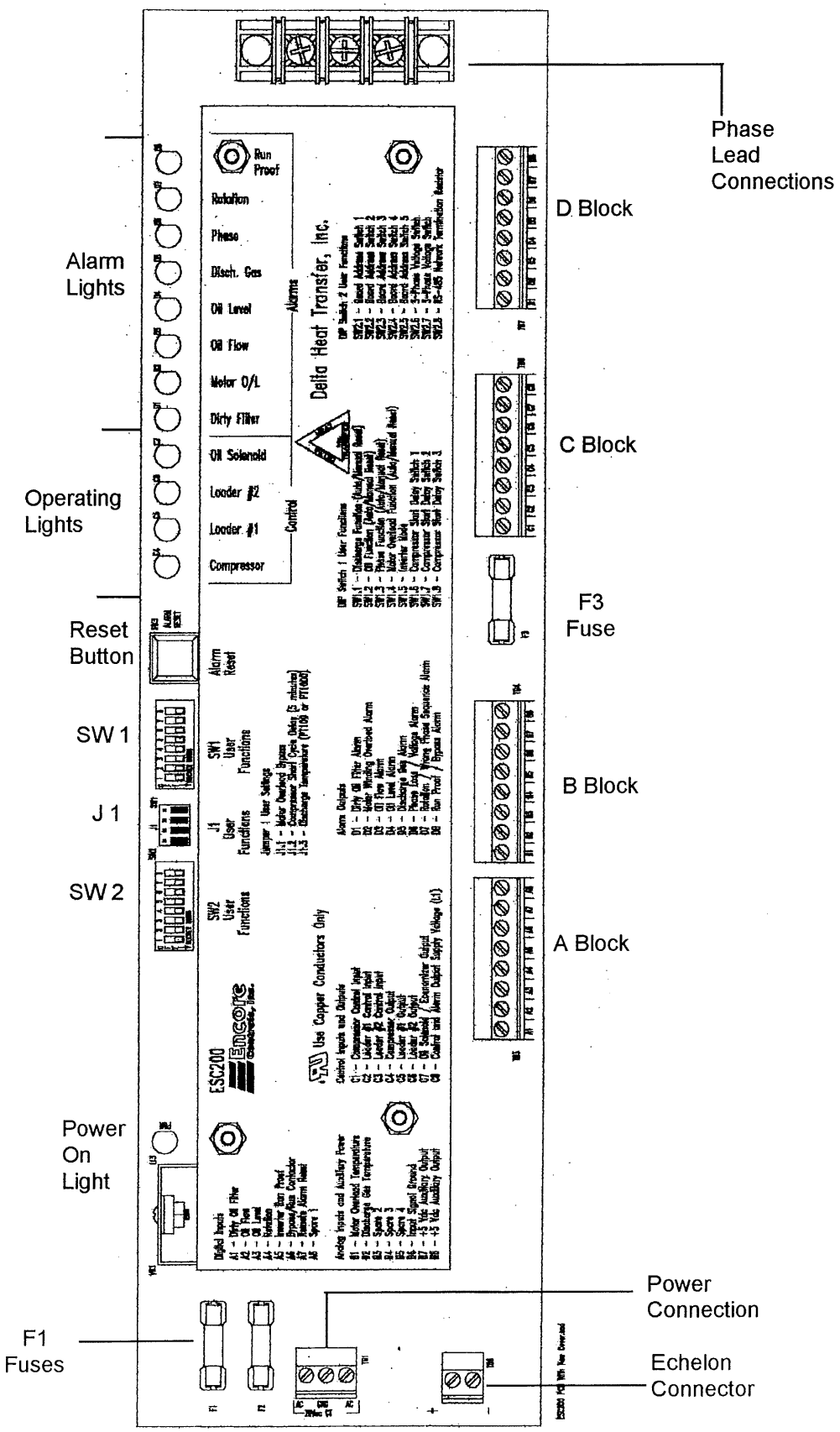
Problem	Solution
ESC will not power up.	Check for 20 VAC control power to the ESC power plug. Check for the proper electrical connections to the transformer and the ESC power plug. Check fuses F1 and F2 on the ESC. If blown, replace with the proper fuse type and size. Check to insure total number of ESC controls have not exceeded the transformer power limitations.
(C1) input signal is not present.	Check for voltage and electrical connections between the compressor control switch, pressure controls, overload contacts and other control devices to input point (C1.)
(C4) output point and (D1 thru D8)	Check for proper input control voltage at alarm points. Terminals (C1) and (C8) do not respond with a voltage signal. Check ESC fuse F3. If blown, replace with proper fuse type and size.
ESC operates intermittently	Make sure the ESC transformer has been properly grounded (center tap of secondary) by grounding the center tap of the ESC transformer and the B6 terminal point to a good ground.

F3 fuse blows when the ESC is energized	Check wiring of input and output points for a short. [Step #1] Disconnect (C1) control input and (C4) control output from the ESC and wire these points together, isolating the ESC control. Activate the compressor control circuit. If the compressor contactor closes, proceed to step #2. [Step #2] De-Activate the compressor control circuit and reconnect (C1) and (C4) points on the ESC. Disconnect output points (C5), (C6), and (C7). Activate the compressor control circuit. If the compressor contactor closes, connect point (C5) and test this point. Test points (C6) and (C7) with the same procedure. If any of these tests produce a blown fuse, then check the corresponding circuit for the short.
Phase loss alarm turns on after a motor breaker closure, while the compressor control circuit is inactive	The phase voltage leads from the ESC are connected to the line of the compressor contactor. Connect leads A, B, C to the load side of the compressor contactor. (preferred location are the compressor terminals T1,T2,T3)
Phase alarm (D6) turns on after the has cycled off.	The compressor contactor could possibly have a compressor welded contact; inspect the contacts in the compressor contactor. Also check for ESC phase leads A, B, C connected to the line side of contactor.
ESC fails after an inverter fault.	Compressor input signal (C1) remains active during inverter reset attempts. Check to insure inverter fault relay (IFR) is not defective. Check control circuit wiring diagram to insure the inverter isolation scheme has been included. Sample of isolation scheme found connected to terminal (C1) in Appendix-B. (Contact factory for detailed description of this isolation scheme)
Phase rotation failure	Correct compressor rotation

Rotation failure, but compressor operates in correct direction	Phase sequence of A,B,C on the ESC must be changed to match the proper electrical rotation sequence. Once the proper sequence has been determined and set, change any two leads of the phase leads on the ESC control to align the electrical
All digital input devices fail on start ESC operates indicating false sporadic alarms.	Check (B6) terminal and terminal block for proper ground. Check the remote reset (A7) terminal to insure the circuit is open. The device operating the remote reset may be locked, closed or wired to a normally closed switch. This function requires a momentary closure.
Compressor will not activate for several minutes after compressor control is energized.	Check jumper J2 for the down position (No time delay).
Open type compressors indicate motor overload failure.	Check Jumper J1 for the up position. (Motor overload bypassed)
Engine drive application indicates a phase failure.	Check jumper J4 for the up position. (No phase monitor)
All compressors in same suction group start at the same time.	Check compressor start sequencing dip switches (SW 1.6 thru SW 1.8) for proper setup.
Compressor fails on phase	Check to insure the proper voltage exists at all terminals.
Discharge temperature failure	Check discharge temperature for out of range condition. Check (B6) terminal for proper ground. Check (J3) jumper for correct position, PTC (jumper down), PT1000 (jumper up).

Motor overload failure	Check motor temperature for out of range condition. Check (B6) terminal for proper ground. Check (J1) jumper for correct position.
Dirty oil filter failure	If dirty filter alarms on initial starting, depress reset button to initialize the switch. This step is required one time only. Check for pressure drop across filter and change filter element if required. Check (B6) terminal for proper ground. Check for proper wiring of filter switch. Differential switch must be wired N/C to operate properly.
Oil flow failure	Check for low oil conditions: such as dirty filter, liquid refrigerant present, temporary pressure drop in discharge system, blocked oil system, oil blank off plate has been removed from oil fitting in side of screw compressor. Check (B6) terminal for proper ground. Check for proper wiring of flow switch. Yellow/ green wire is ground, not used in circuit.
Oil level failure	Check oil level in separator for proper oil level. If electronic optical sensor is in use, check for a 5 VDC signal to sensor. If mechanical float is used, check for a defective float assembly. Check (B6) terminal for proper ground.
Oil level fails, but 1 or more compressors still operate	Check to insure all ESC controls are connected (A3) terminal to level control. Check (B6) terminal for proper ground.
Compressor fails on run proof	Check to insure all run proofs are connected to the proper auxiliary contacts. If inverter compressor run proof fails, check the inverter proof terminals or isolation relay if used. Check (B6) terminal for proper ground.

Appendix F


Phase
Lead
Connections
D Block
Alarm
Lights
C Block
Operating
Lights
F3
Fuse
Reset
Button
SW 1
B Block
J 1
SW 2
A Block
Power
On
Light
Power
Connection
F1
Fuses
Echelon
Connector

ESC200 Microprocessor Replacement Instructions

These instructions describe how to replace the processor of the ESC200.

Make sure that all power has been disconnected from the ESC200.

1. Remove the four nuts on the cover of the ESC200 and remove the cover.
2. Turn the ESC200 so the terminals are located at the bottom and the alarm lights are at the top.
3. Just to the left of the center is a 1.25" x 1.25" chip that should have a sticker on it labeled ESC200 along with a software revision number. This is the microprocessor that will be changed.
4. Insert the chip puller diagonally (lower left hand side to the upper right hand side) into the slots of the socket. Squeeze the chip puller and the chip should pop out.
5. To insert the new chip; find the indentation on the new chip (located on the top center of the chip). Insert the new processor so the direction of the indentation on the chip is toward the top of the board (toward the DIP switches).
6. Push the new processor into the socket evenly with your fingers until it snaps in. Be careful not to crack the socket. Make sure the new chip is seated squarely into the socket. If it is not remove it and try again.
7. After the new chip has been installed restore power to the ESC200.