ESC 201

Installation and Operating Instructions Manual

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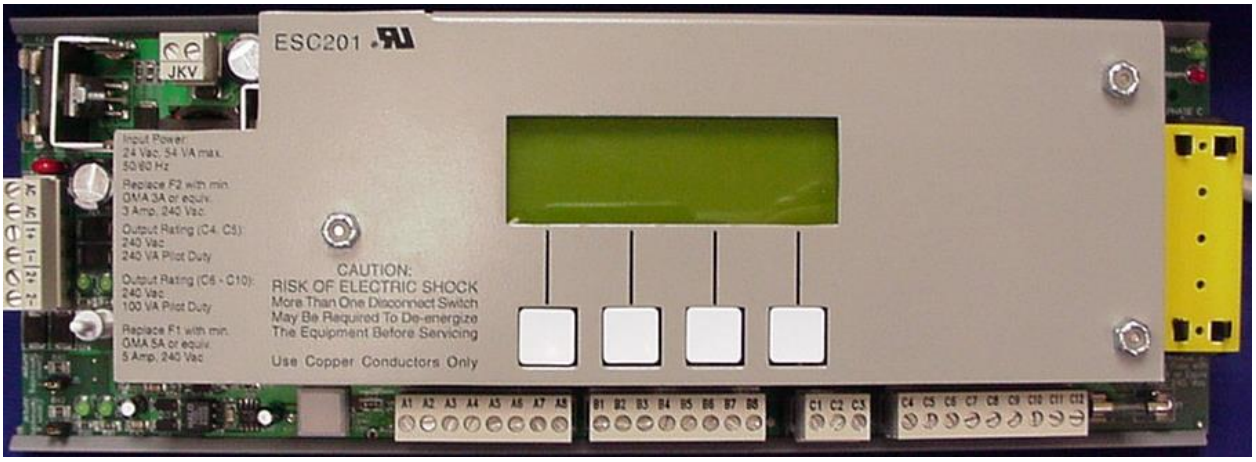

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ESC 201
Installation & Operating Manual

1.0 Functions

1. Compressor Direct on Line Start Initialization
2. Compressor Part Winding Start Initialization
3. Compressor Sequencing Control
4. Compressor Rotation Control and Alarm
5. Compressor Short Cycle Prevention
6. Compressor Loader Start Delay
7. Compressor Direct on Line Run Proof
8. Compressor Inverter Run Proof
9. Discharge Temperature Control and Alarm
10. Motor Overload Control and Alarm
11. Oil Solenoid Control
12. Economizer Control
13. Oil Safety Control with Auto Reset and Alarm
14. Motor Phase Loss Protection
15. Oil Separator Level Control and Alarm
16. Dirty Oil Filter Alarm
17. Jet Kool Operation and Control
18. Critical Discharge Temperature Monitoring and Control
19. Liquid Injection Control
20. Low Discharge Temperature Monitoring and Control
21. Welded Contactor Protection
22. Alarm Logging with Retrieval
23. Echelon Communications Capability
24. RS-485 Communications Capability
25. Direct Compressor Operation via Com. Port

2.0 Features

1. Display Screen – 4 line, 20 Characters per Line
2. Programmable Functions and Alarms
3. Four Button Control
4. Language Selection; English, German, French, Italian, Portuguese, Spanish
5. Flashing Alarm Screens with Priority Levels
6. Input and Output Plug Terminals
7. 1 Amp Fuse Protection on 20VAC Power
8. 5 Amp Fuse Protection on Control Power
9. Horizontal or Vertical Mounting
10. Control Reset Button
11. Remote Control Reset
12. Automatic Configuration of Control and Power Voltages
13. Snap Track Mounting
14. L.E.D. Operational and Communication Lights

3.0 ESC 201 Description

The ESC 201 control is an upgraded version of the ESC 200 with added features and functions to further enhance and protect the BITZER screw compressor. The ESC 201 controls all compressor safety and operation functions through the use of a microprocessor and various types of sensors.

The control will interface with either mechanical or electronic pressure controlled systems. Safety functions requiring a compressor shutdown can be reset with a built-in reset button through the Echelon network or via a remote reset activated by an electronic pressure controller. Compressor alarms can be logged to an electronic pressure controller through the Echelon or 485 networks. A general alarm output is provided to activate a panel light, auxiliary alarm or relay. Internal permanent logging is provided on several functions to record a permanent record on critical functions. This log can be used to assist in troubleshooting or determining warranty. Log functions will record date, time of occurrence and cannot be erased except by the factory.

The ESC 201 will operate BITZER's Screw compressors by several different starting methods, such as: frequency drives, direct on line and part winding start. Compressor starting, stopping and capacity control operations can be controlled directly from the electronic pressure controller or across the Echelon or 485 networks without a controller output point.

Most compressor control functions are compressor model specific requiring configuration via the software by using the program buttons. Once the compressor has been selected, the applicable functions can be established as either manual or automatic reset. Certain functions are locked to specific compressor models and cannot be accessed through the software. Critical compressor functions will alarm and shut down the compressor causing a manual lockout or automatic reset sequence. If the alarm causes the maximum automatic resets, the compressor will be locked out requiring a manual reset. Non-critical alarm functions will generate an alarm notice allowing the compressor to remain operational.

A four line twenty character per line LCD screen displays compressor operational and control information, as well as, compressor notices and alarms. These screen functions can be displayed in six languages: English, German, Italian, Portuguese, Spanish and French. All control functions are programmed with four buttons located under the display screen.

Any ESC 201 can be selected as a master control through programming. The master control is used to perform all communications from the slave controls and/or the Echelon network. Master units are the only controls allowed to operate the Jet Kool function and configure the slave controls for their initial setup. The Master ESC 201 can become Echelon compatible by plugging in the "E" hardware into the master control board.

Snap track mounting provides easy mounting in the control panel. All low and control voltage connections are performed with plug-in connectors for easy installation. A button memory chip is utilized to retain control setting for each control.

4.0 General Operations

The compressor start sequence will be initiated when the ESC 201 receives a valid voltage input signal at (C1). The compressor output relays (C5, C6) will close and allow the compressor to start after all static input functions have been checked to be within acceptable tolerances and all time delays have elapsed. Within the first 2 seconds of operation the ESC 201 will monitor for a valid phase sequence, rotation and run proof signal. If any of these functions do not return a valid signal the compressor will shut down and lockout requiring a manual reset. Once these valid signals are returned to the ESC, the oil solenoid will be energized within 2 seconds after start. After a 7 second delay from start the ESC will energize the loaders as required by the system controller in their proper sequence.

After the compressor is operational for more than 7 seconds the ESC will continue to monitor all safety functions until the next proper shutdown or alarm function occurs. The monitored safety functions consist of: Rotation, Run proof, Phase, Oil Flow, Oil Level, Motor Overload, and Discharge Temperature. Any alarm in these areas will cause a compressor shut down in the manual mode and/or automatic mode.

4.1 Manual Mode Operation

When operating in the manual operation mode any compressor shut down function will alarm and leave the compressor in a shutdown state until the manual reset button is depressed. The manual reset can also be accomplished via the remote reset option. Rotation and run proof function are a mandatory manual mode operation. Oil flow, discharge temperature, motor overload, oil level, and phase monitoring can be set up in either manual or automatic mode.

4.2 Automatic Mode Operation

Automatic mode allows the compressor to be restarted automatically by the ESC with the strategy programmed for the individual function. Each functions automatic reset strategy will be described in the section of the manual pertaining to that function. Functions, which are allowed operation with the automatic resets are: oil flow, discharge temperature, motor overload, phase monitoring and oil level control.

5.0 ESC 201 Installation and Setup Procedures

Proper installation of the ESC 201 and setup of compressor parameters requires adhering to the following procedures. Programming of each compressor and the function parameter will change depending upon the compressor model and type. A default list of parameter can be found in section 5.4

5.1 ESC 201 Mounting procedures

The ESC 201 is provided with plastic snap track mounting. This snap track should be attached to the electrical back panel with tech screws or another type of fastener, which will provide secure mounting for the control.

Ample space must be provided around the control for safety and accessibility purposes to accommodate the removal of any wire, terminal plug or fuse and not hamper access to the manual reset button.

The ESC is provided with a UL required ground wire attached to the ESC electronic circuit board. All input functions reference a ground through terminals A7 and B7. This ground wire is the only ground source for the control and must be attached to the electrical back panel to insure proper operation of the ESC 201.

5.2 Electrical Wiring

Shielded Cable Requirements

Located on the left side of board is a terminal plug with two terminals marked AC. These terminals are the connection points for the 20VAC transformer power. Also located on this plug are the two communication ports market (1+1-) and (2+2-). Shielded cable must be used to connect both the power and the communication ports. It is also recommended all input function wiring should utilize shielded cable from the input device to the ESC terminal point. Terminal points which require shielded cable are, terminals A1-A8, B1 to all other points may be wired using 16-gauge wire.

All shielded cable must be grounded at one end of the cable to the same source as the ESC ground. Shielded cable will provide protection against any possible electrical noise transmission across the input or network wiring to the ESC 201.

Communication Wiring

The ESC 201 is equipped with two communication ports (comm.1 & Comm.2). These ports must be wired with shielded cable to reduce to possibility of noise transmission across the networks. The ESC 201 has an optional alarm board. If used it must be wired with shielded cable and grounded. The master and slave boards are connected across the N2 network using the Comm.2 ports. In any prescribed group, a single master may be connected up to 11 slaves. More than one master can be used on a system where special control requirements exist.

Wiring Multiple Groups of Master and Slaves

When multiple master-slaves combinations are required the master and slave ESC controls must be connected on the N2 network as a group and isolated from other groups. Communications back to the rack controller will be accomplished via the Comm.1 network. If alarm boards are used in the network, these boards are also connected on the N2 network using the comm.2 connector in that group.

Communications Protocol

Comm.1 port has been provided to connect the master ESC controls to rack controller or other device capable of accepting 485 communications. An open protocol will be made available on request to allow other equipment suppliers to read the information from the ESC 201 controls.

5.3 Transformer Installation and wiring

Power Requirements

A 24-Volt, non-center tapped, A/C transformer is required to power the ESC 201. The ESC 201 maximum operating current with Jet Kool and Echelon is 760 mA. As a safety factor, a transformer should be selected with a 900 mA rating to operate one board. Multiple ESC 201 boards can be operated from a single transformer designed to handle the total power requirement. A power terminal block is provided on the left side of the ESC board to accommodate the A/C power and the communication wiring. This terminal block has two designated terminals for the 24 volts marked "AC". ***DO NOT CONNECT ANY POWER TO TERMINALS MARKED [1+, 1- OR 2+, 2-].*** These are serial communication terminals and damage will occur to the ESC if power is applied to these terminals.

Wiring

Power wiring from the transformer to the ESC 201 must be wired using shielded cable, with one end of the shield grounded to the electrical panel back pan. Please refer to Appendix C for the proper transformer wiring and detailed electrical specifications.

Fuse

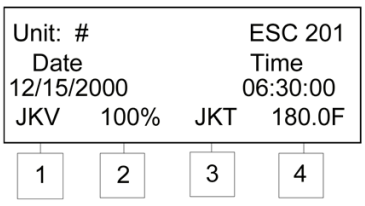
24V power is fused on the board with a 3A fuse located directly above the AC power connector.

5.4 ESC 201 Function Programming

The ESC 201 has the capability to operate all BITZER screw compressor functions. These functions must be programmed as applied to each compressor model and type, as well as, the function capability. Illustrated below are the operations to begin the programming mode. Once the programming mode has been initiated, the programmer must scroll through each function and set that function to the proper application for the compressor operation. The setup screen can be accessed from the main screen or the compressor operational screen by pressing any button.

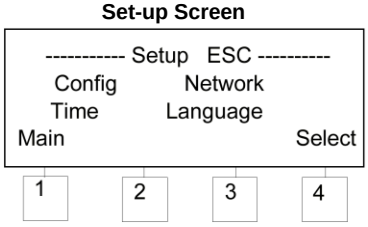
Step #1	Step # 2	Step # 3
Function	Configuration Setup	Initial Default

Main Screen



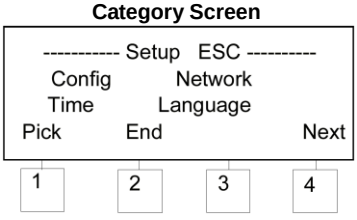
While in the Main Screen, Press any button to go to the Set-up Screen

Set-up Screen



Press the SELECT button (#4) to pick the category or press MAIN to return to the Main Screen

Category Screen



Config will be flashing
Press the PICK button to enter the ESC-201 configuration or Use the NEXT button to Choose a different category and then press PICK. Press the END button to return to the previous screen

Configuration Setup / Programmable Operations

Function	Initial Default
1. Compressor Type	74 Semi
2. Oil Cooling Mode	None
3. Jet Kool Target Temperature	180°F
4. Discharge Temperature Reset	Automatic
5. Motor Overload Reset	Automatic
6. Oil Flow Reset	Automatic
7. Oil Flow Sensor	Digital
8. Phase Protection Reset	Automatic
9. Discharge Pressure Transducer Type	Eclipse 500
10. Discharge Pressure Offset	0
11. Suction Pressure Offset	0
12. Discharge / Suction Pressure	Read Only
13. Motor Overload Monitor	Enable
14. Phase Monitor	Enable
15. Critical Discharge Monitor	Enable
16. 7 Minute Time delay	Enable
17. Compressor Start Delay	0 Seconds
18. Temperature probe Type	PT1000
19. Discharge Temperature Offset	0
20. Refrigerant Type	None
21. Screen Contrast	7 Bars
22. Date & Time	Current
23. Power Frequency	60 Hz
24. Jet Kool Temperature Source	Compressors
25. Slaves on Line	
26. Language	English
27. I.D. Network	1
28. EXT / ECH ID.	1
29. N2 Network Mode	Slave
30. Control By	Local
31. Firmware Version	Read Only
32. Comp 1 Protocol	Open
33. Alarms Boards	Disabled
34. Echelon	Disabled
35. Temperature	Fahrenheit
36. Pressure	PSI
37. Flow Rate	Gallons/Min
38. Date Format	Month/Day

Each of these functions will be covered in detail throughout the manual. Configuration setup mode allows the programmer to scroll through each of the 38 functions for configuration. The setup screen contains 3 short cuts, allowing the programmer to directly access the network, time & date and language screens. These three modes will require more programming accessibility than the other 31 functions, eliminating a lengthy scroll process.

5.5 ESC 201 Screen Displays

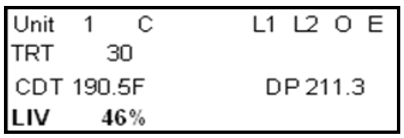
Listed below are the typical screen displays which will appear during the different modes of control operation:

Ready Screen:
The ready screen will be displayed when the Compressor is in a ready state for operation

.

Unit #: displays the assigned unit number as assigned in the comm. 2 network. Unit #1 will always be assigned as a “master control”.
ESC201: displays the model number and version of the software that has been loaded into the control. Letters following the model number designates the version of the software.
Date: displays the programmed date.
Time: displays the programmed time.
JKV: displays the percentage the Jet Kool valve is open, if used.
JKT: displays the average discharge temperature of all compressors operated by Jet Kool on the comm. 2 network.
Note: JKV and JKT will only be displayed on the master ESC201 control board. These will show the current status of these functions regardless of the master control compressor status.

Compressor Run Screen:
The compressor run screen displays the operating status of the compressor during normal operations.
The last display line of the master compressor
Run screen will display the current Jet Kool status.
Jet Kool status will not be displayed on a slave control.



Unit #: displays the assigned unit number as assigned in the comm. 2 network. Unit #1 will always be assigned as a “master control”.
C: displayed when the compressor is in operation.
TRT: displays the total run time of the compressor.
L1: displayed when loader #1 is energized.
L2: displayed when loader #2 is energized.
O: displayed when the oil solenoid is energized.
E: displayed when the economizer solenoid is energized, if used.
CDT: displays compressor discharge temperature when the PT1000 type temperature sensor has been installed. The temperature will not be displayed when using the PTC type sensor.
DP: indicates either differential pressure or discharge pressure depending on the following enabled functions:

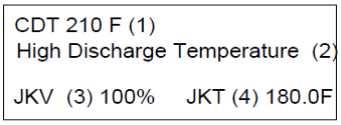
1> **DP:** differential pressure when using analog oil flow switch and both discharge and suction transducers are connected to the ESC201.
2> **DP:** discharge pressure for all other operations when discharge transducer is connected to the ESC201.

JKV: displays the percentage the Jet Kool valve is open, if used.
JKT: displays the average discharge temperature of all compressors operated by Jet Kool on the comm. 2 network.
LIV: if the oil cooling mode is programmed for liquid injection, the liquid injection valve percentage open “LIV%” will be displayed on the bottom line of the ESC operational screen.

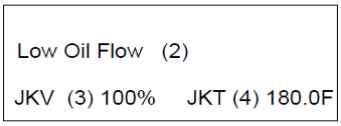
Alarm Screen:
When a compressor alarm has been generated, the following type of display screen will replace the compressor run screen. The actual compressor alarm generated will be a flashing display on the screen. This alarm will remain displayed until the alarm has been cancelled by an ESC201 reset function or by depressing the reset button.

(1): Status of the function in an alarm state when applicable.
(2): Type of alarm. Alarm will be flashing.
(3): JKV or LIV displays the percentage the valve is open.
(4): Displays the average discharge temperature of all Compressors operated on the circuit on the Comm. 2 network.

Example #1



Example #2



6.0 Frequency Inverter Operation

The compressor start sequence will be initiated when the ESC 201 receives a valid voltage input signal at (C1). The compressor output relay (C5) will close the inverter forward run relay, initiating the inverter start sequence and allowing the compressor to start. **NOTE: If a time delay can be programmed between the time the inverter receives a forward run signal and voltage output to the compressor, this delay must be set to zero seconds.** All static input functions must be verified as acceptable for the compressor to remain operational.

Inverter operation is determined automatically when the ESC senses a closure of the inverter run proof at (A4). A 5 VDC signal is sent from the ESC to a dry set of inverter run proof contacts provided by the inverter or a dry set of relay contacts operated by a voltage output from the inverter. The closure of either of these contacts will return a 5 VDC signal to the ESC indicating to the ESC it will be operating in the inverter mode. ***NOTE: DO NOT APPLY A VOLTAGE SIGNAL ABOVE 5VDC TO TERMINAL (A4).***

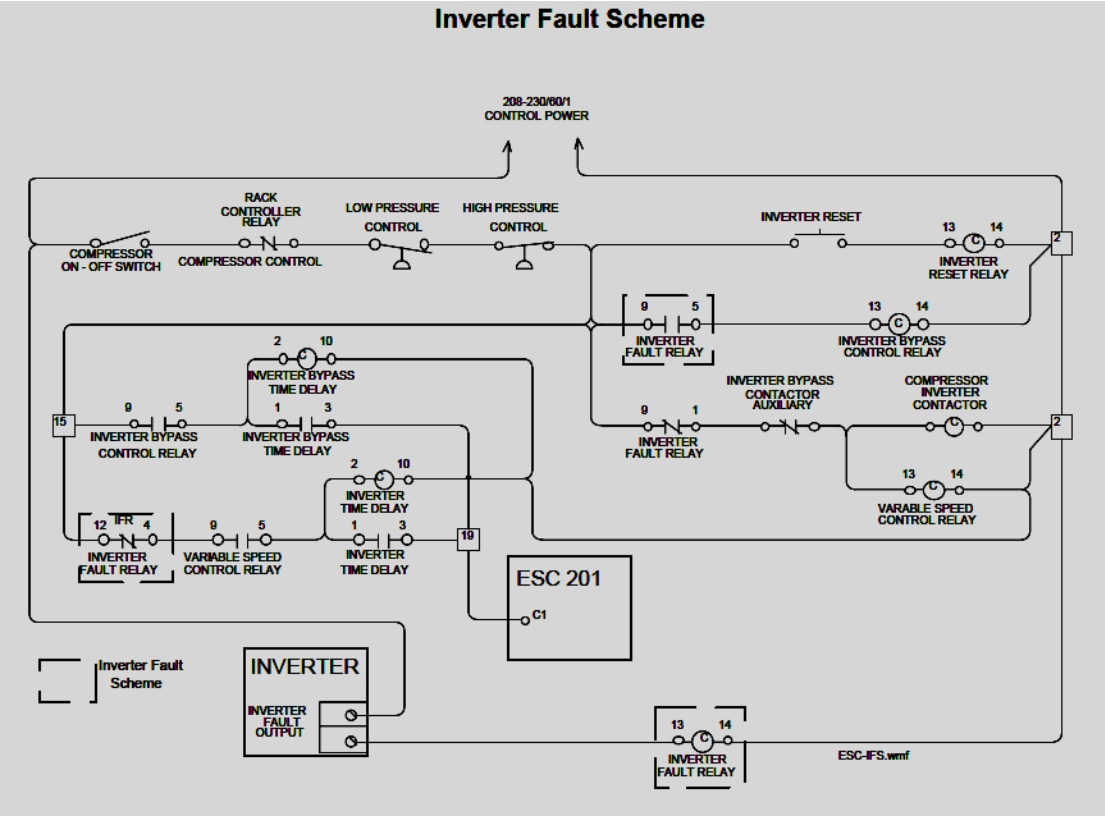
The compressor signal (C5) will remain energized to the inverter forward run relay while run proof is being verified, permitting the inverter to reset automatically in the event of a fault. If the run proof is not verified during the first 5 seconds of start, the alarm will be issued displaying **"Run Proof Failure"** on the display. Functional operations such as: oil solenoid, loader solenoids and economizer solenoid will remain inactive until the run proof is verified. The compressor will remain operational for an additional 5 seconds waiting for the run proof to be verified. Once the 10 seconds has elapsed without a run proof or being switched into the by-pass mode, the compressor will be shut down requiring a manual restart.

If the inverter faults and the compressor is placed in the by-pass mode, the (direct on line) run poof will be indicated by the closure of the auxiliary contacts on the (direct on line) contactor. During this operation the ESC will perform the required phase operations previously performed by the inverter.

NOTE: If both DOL and inverter run proofs are closed together, the compressor will be shut down immediately, and a **"Dual Run Proof"** alarm will be displayed.

6.1 Inverter Fault Operation

Most inverters can be programmed to recognize faults, clear faults and perform automatic restarts, if the fault can be cleared. To prevent the ESC from locking out the compressor during inverter fault retries, the **INVERTER FAULT SCHEME** must be wired into the control circuit. This scheme consists of a N/C relay (IFR) in series with the control voltage signal input to (C4). The (IFR) relay coil is energized by the inverter fault output each time the inverter faults. When the inverter faults, the (IFR) N/C contacts open, removing the voltage signal from (C4), placing the ESC 201 in the ready mode. Additional set of N/O contacts can be utilized on the IFR to place the inverter compressor into by-pass when IRF coil is energized. Example of this scheme is illustrated below.



7.0 Direct-on-Line Operation (DOL)

Compressors operated direct on line rely upon two voltage signals to determine this method of operation. A 115V run proof signal supplied to (C4) and the three-phase voltage signal supplied to right side of the ESC 201, labeled L1 {A}, L2 {B} and L3 {C}.

Two seconds after start, rotation will be verified allowing the oil solenoid to activate. Within this time all operational functions will commence in sequence. Five seconds after all functions have been verified as operational, the loaders will energize and the compressor will remain operational.
If the run proof is not verified within 5 seconds from start, the compressor will be shut down and a **"Run Proof Failure"** alarm will be displayed. If the run proof is lost during operation the oil solenoid and loaders will be turned off immediately. After a five second delay the compressor will be shut down, unless the run proof has been reestablished, at which time the oil solenoid and loaders will be reactivated.

See Appendix a "Direct on Line"

NOTE: If both DOL and inverter run proofs are closed together, the compressor will be shut down immediately, and a **"Dual Run Proof"** alarm will be displayed.

8.0 Part Winding Start Operation

The ESC 201 has been designed to perform the part winding start operation with a primary start winding output (C5) and a secondary winding output (C6). The secondary winding output will energize ½ second after the primary winding output. Voltage monitoring for phase loss and phase symmetry will be accomplished from the primary start contactor.

Run proof verification must be accomplished with N/O auxiliary contacts on the primary and secondary contactors. These auxiliary contacts must be wired in series to terminal (C4). NOTE: Refer to section on "(DOL) Run Proof" for proper wiring procedures.

Two seconds after start, rotation will be verified allowing the oil solenoid to activate. Within this time all operational functions will commence in sequence. Five seconds after all functions have been verified as operational, the loaders will energize and the compressor will remain operational.

If the run proof is not verified within 5 seconds from start, the compressor will be shut down and a **"Run Proof Failure"** alarm will be displayed. If the run proof is lost during operation the oil solenoid and loaders will be turned off immediately. After a five second delay the compressor will be shut down, unless the run proof has been reestablished, at which time the oil solenoid and loaders will be reactivated.

See Appendix A "Part Winding Start"

9.0 Inverter Run Proof

When a frequency inverter operates a compressor, the inverter (due to time delays) must supply the run proof signal and other software configurations. The inverter is configured with a dry set of N/O contacts, which are used to return a 5 VDC signal back to the ESC 201 telling the ESC the compressor is operational. If these contacts are utilized by another device requiring a high voltage signal such as 110V or 230V, an isolation relay can be used with the same coil voltage. This relay can be used as the run proof to supply a signal back to the ESC 201.

Run proof set up is sensed automatically when the inverter run proof contacts closes the circuit to (A4) for inverter operation or the compressor contactor auxiliary closes the circuit to (C4) for direct on line operation. If the ESC 201 senses a closure at both (A4) and (C4) simultaneously the ESC is designed to fail and alarm "Dual Run Proofs", locking out the compressor. All operational functions, such as oil solenoid and loaders; will remain inactive until a run proof is verified. If the run proof is not verified within 5 second from start, the ESC will alarm **"Run Proof Failure"** at the end of an additional 5 seconds. The run proof has not been confirmed the compressor will be shut down requiring a manual reset.

Depending upon the OEM and their methods of controlling inverter compressors, a by-pass scheme may be implemented before the compressor is locked out on the run proof alarm. A method of wiring an automatic by-pass can be found in section 6.1 "Inverter Fault Scheme".
By pass run proof operation is discussed in section 9.1" Direct On Line" run proof.

See Appendix A "Inverter"

9.1 Direct On Line (DOL) / By Pass Run Proof

Direct On Line run proof will automatically be configured when the compressor is started. If a DOL run proof is required, a voltage signal will appear at terminal C4, indicating a DOL run proof is required. This method of run proof sensing is utilized when compressors are operated direct on line or a bypass is required with an inverter compressor. A high voltage signal (110V or 230V) must be supplied from L1 through a compressor contactor auxiliary closure to (C4). A valid run proof signal must be verified before the ESC will activate the oil solenoid. After 5 seconds the ESC 201 will display the Alarm **"Run Proof Failure"** and at the end of 10 seconds the compressor will be shut down requiring a manual reset, if the run proof has not been confirmed. If the ESC 201 senses a closure at both (A4) and (C4) simultaneously, the ESC is designed to fail and alarm **"Dual Run Proofs"**, locking out the compressor.

See Appendix A "Part Winding Start"

10.0 Operational Functions

Operational functions consist of devices which operate valves and devices that are required to start and run the screw compressor. These devices incorporate the oil solenoid, loader solenoids, economizer solenoid, rotation switch, and oil level control. These devices do not require any configuration or programming. The operations for these devices are factory preset and cannot be altered.

10.1 Oil Solenoid Operation

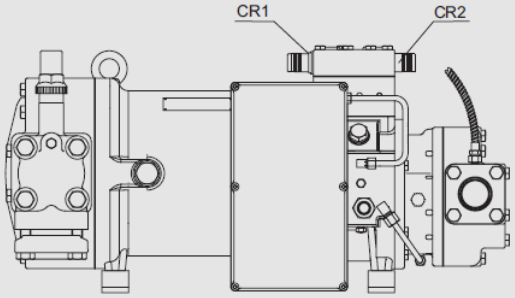
The oil solenoid output relay (C9) will energize 2 seconds after the compressor start sequence has been initiated, allowing oil to flow to the compressor. During the 2 second-time interval, if either the rotation or run proof has not returned a signal to the ESC 201 the compressor will shut down requiring a manual reset. Any time the compressor stops, either normally or due to a fault the oil solenoid will close, preventing oil from flooding the compressor. The 2 second oil solenoid delay will also provide reduced loading during part-winding-start operation.

It is recommended that a solenoid coil light be mounted in the coil and wired in parallel indicating power has been applied to the solenoid coil. This provides the service technician visual proof the solenoid has been energized.

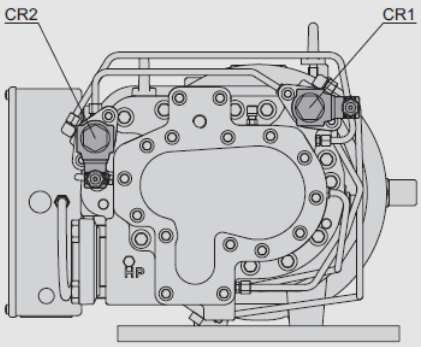
10.2 Capacity Control / Start Unloading

After the compressor start sequence has been initiated for a period of 5 seconds, the capacity control regulators [CR] will activate in accordance with the program prescribed by the ESC 201. These capacity control regulators are referred to as loaders, since they must be electrically energized to load the compressor. The electronic rack controller will perform the operation of controlling the loaders for the purpose of capacity control. The function of the ESC 201 is to insure the loaders remain de-energized during start conditions and their sequence of operation conforms to BITZER's prescribed operation. By insuring these capacity regulators remain de-energizer during start they will also perform the function of start unloading to assist in the part-winding-start operation.

HS.53-3



HS.64 / HS.74



	Full Load (100%)	75% Load	50% Load	Start Unloading
HS.53-3	CR1 = ● CR2 = ●	CR1 = O CR2 = ●	CR1 = O CR2 = O	CR1 = O CR2 = O
HS.64	CR1 = ● CR2 = ●	CR1 = O CR2 = ●	CR1 = O CR2 = O	CR1 = O CR2 = O
HS.74	CR1 = ● CR2 = ●	CR1 = ● CR2 = O	CR1 = O CR2 = O	CR1 = O CR2 = O

The prescribed operation sequence for each model compressor is listed below.

"HS 53-3 & 64"	**Unloading sequence**	**Loading sequence**
Step #1	CR1 de-energize (C7)	CR2 energize
Step #2	CR2 de-energize (C8)	CR1 energize

"HS 74"	**Unloading sequence**	**Loading sequence**
Step #1	CR2 de-energize (C8)	CR1 energize
Step #2	CR1 de-energize (C7)	CR2 energize

Note: for the proper loader identification by model, refer to Appendix B, page 34 in the rear of this manual.

When the loaders are wired in the correct sequence from the ESC 201 to the compressor capacity control regulator solenoid, the ESC will operate these solenoids in the proper order regardless of the input signal sequence from the rack controller. CR1 must be wired from (C7) and CR2 must be wired from (C8). The rack controller will supply a signal to energize either loader #1(C2) or loader #2 (C3) based on the scheme setup by the rack controller manufacture. Different rack controllers have several types of logic to control capacity, which may conflict with the required sequence BITZER needs to insure a safe and efficient compressor operation. For this reason the ESC 201 will perform the proper loading and unloading sequence regardless of the demands set by the rack controller.

Operating voltage for the capacity control regulators is determined by the voltage input to terminals (C2 & C3). The voltage applied to these terminals will be sent out through terminals (C7 & C8) respectively. The ESC capacity control voltage limitations are from 90 – 250 VAC and 12 - 24 VDC

10.3 Rotation

Rotation determination is accomplished by 2 methods, a pressure switch and phase sequence. Both of these methods when used in conjunction will insure the proper rotation of the compressor. This function is a non-programmable function requiring only the proper installation and wiring of the devices used to determine rotation. Rotation failure shutdown can only be reset manually.

Pressure Switch

Compressor rotation verification is accomplished in two methods, both of which must be verified to continue operating the compressor after the 2 second start sequence. The primary method to detect reverse rotation is a switch mounted on the front of the compressor. This switch senses the pressure in the rotor chamber to determine the proper direction of rotation. The switch will close when the pressure rises above 20 PSI and opens at 10 PSI. The switch becomes an active part of the rotation control scheme after an elapsed starting time of 2 seconds. After this 2 second time delay the ESC will check the status of the switch to determine rotation. If the switch is closed, a 5 VDC signal is sent from terminal (A3) back to (A7), indicating the compressor is operating in the correct direction and allowing the compressor to remain operational. After the 2-second time delay and the ESC determine the switch is open, the compressor will be shut down and the alarm **"Rotation Failure"** will be displayed on the ESC screen. Clearing this alarm will require a manual reset. The pressure switch is a high pressure rated switch designed specifically for this application. This switch requires the use of a vibration damper mounted between the compressor and the switch. If this switch or compressor is changed for any reason the old vibration damper can be utilized. Inspect the damper to determine that the internal filter has not been damaged. ***Do Not use the old vibration damper if it is determined to be defective.*** To determine proper assembly of the rotation switch for each compressor type, refer to appendix B, figures 1 through 4.
Note: as of 1-2010, the mechanical reverse rotation switch has been omitted from the HS/OS74 series screw compressors. If a compressor is replaced with a new compressor which used the rotation switch, the inputs on the ESC201 must be jumper'ed out via terminals A3 and A7.

Phase

The second method to determine rotation is by checking phase sequence. This check is determined with the ESC software utilizing the three phase input signal supplied from the phase terminals. When wired properly the software determines the proper rotation within ½ second from the initial start sequence.

If the rotation is incorrect the compressor will be shut down and the ESC will display the alarm **"Phase Rotation"**. Follow the below listed phase sequence procedures to correct the fault.

Phase Sequence Procedures

During initial startup procedure, check for proper phasing of the ESC 201 to insure Phases [A, B, C] from either the compressor terminals or the load side of the contactor to the corresponding [A, B, C] phases on the ESC 201 are correctly wired. If the compressor is determined to be operating in the correct direction, with pressure gauges or visually on the open type compressors, and the "phase rotation" alarm shuts down the compressor, the phase wiring may be incorrect. This wiring correction can be accomplished by changing the position of any two wires on the ESC phase connector. ***WARNING! Make sure the compressor is operating in the correct direction before any wiring is altered.***

10.4 Economizer Solenoid

Terminal (C11) is designated as the economizer output. This relay point will energize a solenoid to operate the economizer. The economizer output will energize 2 second after the initial compressor start.

The ESC 201 has an enhanced feature to monitor discharge temperatures on both the high and low extremes, providing the best protection possible to the compressor. The low discharge function may require disabling of the economizer to perform certain diagnostic checks on the system. To accomplish this check and others, it is important the economizer (C11) output be utilized with the compressor.

10.5 Oil level Control

Installation

The oil separator is fitted with a ¾" –16 UNJF-3A threaded female adapter to accept a male optical well assembly. The well permits the removal of the electronics without the loss of oil or refrigerant. The sensor well should be tightened by hand not to exceed a torque value of 15 ft-lbs.

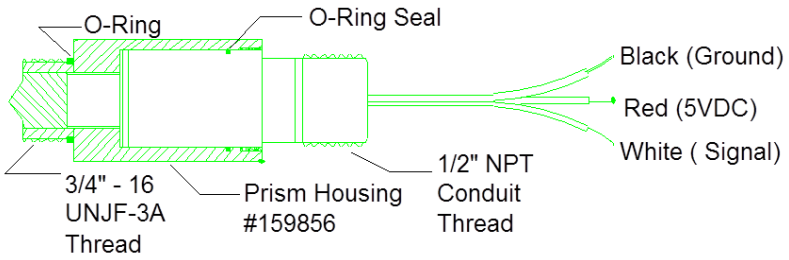
Operation

The switch sends out a light beam that is refracted by the presents of oil. When the oil level falls below the optical sensor, light is no longer refracted opening the electronic contacts in the switch. In normal operation, a 5VDC signal is sent from the ESC 201 to the switch and returned to the ESC indicating a proper level in the oil separator. When the optical switch opens, the ESC 201 reads this signal as a low oil level and shuts down all compressors affected by the low oil function. When the ESC 201 is configured as a master, the oil level control does not affect the compressor assigned to the master ESC. This compressor is allowed to remain in operation, to perform the oil return function return back to the separator, preventing a total rack shut down. The main oil protection for the compressor connected to the master ESC will be the oil flow switch. The compressor connected to the master ESC can be safely operated, since the oil level below the optical sensor is sufficient to operate one compressor. When the oil level returns to a level sensed by the optical sensor, a time delay of three minutes must occur before any compressors are allowed to restart. This three-minute time delay prevents the short cycling of a compressor due to a possible rapid drop in oil level.

Immediately after the optical level sensor sends a low oil level signal to the ESC 201 the compressors affected by the oil level sensor will shut down and a **"Low Oil Level"** alarm will be displayed on the ESC screen. The alarm will clear automatically once the oil level returns and the 3-minute time delay elapses.

Sensor Specifications

Voltage	5VDC
Current	45mA
Pressure Range	0-2500 PSI
Temperature Range	-40°F to 212°F
O-Ring size	#3-908
Housing Torque	15 ft-lbs Max.



10.6 Dirty Oil Filter

Each compressor is equipped with an oil filter. Located on the filter is a differential pressure switch, which reads the pressure drop across the filter assembly. This switch is set to alarm at 25 PSID. The dirty filter switch has 2 methods to indicate this alarm, a visual indicator located on the top of the switch that changes from green to red and the electrical indicator, which closes a set of contacts making a connection between terminals (A1) and (A7). When the ESC 201 receives this signal, an alarm, **"Dirty Oil filter",** will be displayed on the ESC screen. Once the filter has been changed the manual reset button on the ESC must be pushed to clear the alarm.

The dirty oil filter function is not a compressor shut down function; it is only an alarm function.

10.7 Low Economizer Temperature

If the compressor discharge temperature is determined to be less than or equal to 35°F above the condensing temperature for a consecutive period of 30 minutes the ESC 201 will alarm "Low Discharge temperature". The economizer outputs, terminal (C11) will shut down the economizer solenoid for a time period of five minutes. At the end of this 5-minute shutdown the ESC 201 will check the discharge temperature, and if the discharge temperature has not risen to a value of at least 45°F above condensing, the ESC 201 will permanently shut down the economizer requiring a manual reset and display the alarm "LOW ECO TEMP".

If turning off the economizer solenoid does not raise the discharge temperature above the condensing temperature by 45°F the economizer output (C11) will be energized, placing the ECO back into operation, displaying the alarm, "Low Discharge Temperature".

When the discharge temperature remains below the condensing temperature by at least 50°F the conditions exist to condense refrigerant at the outlet of the compressor. Low discharge temperature can be attributed in many cases to low super heat at the economizer inlet. The low discharge temperature will cause premature bearing damage resulting in compressor damage. The above function will protect the compressor from bearing damage caused by low super heat conditions at the economizer. When the "Low Discharge Temperature" alarm appears rather than "LOW ECO TEMP", the low super heat or liquid can be coming from the compressor suction.

11.0 Programmable Operations

Many operational functions require a program change to insure the compressor or function has been configured to perform a specific operation. Follow steps 1 – 3 illustrated in section "5.0 ESC 201 Installation and Setup Procedures" to begin the programming steps for configuration setup.

Selecting Functions

Pick the "Config" category by pressing button #1. The first screen will be the "Compressor Model" screen. If this function selection is not correct, then follow the "Edit Functions" instruction below. If this selection is correct and you want to continue to the next function press the "next button" which will place you in the "Oil Cooling Mode" selection screen. Each time you press the next button you will scroll forward to the next sequential function, or press the "white" button for the previous function. To return to the main menu, press the menu button and then the main button to return back to the Main Screen.

Editing Functions

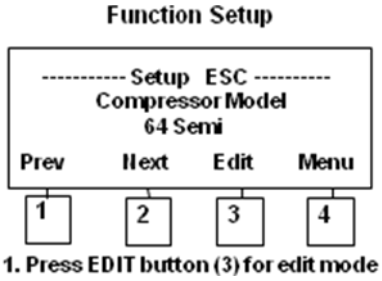
If the correct function selection is not shown on the screen, then press the edit button and the function selections will begin to flash. Next, press either the (+) or (-) sign buttons to scroll forward or backwards through the function selections until the correct selection appears. When the correct selection is flashing on the screen, press the save button, "Saving" that selection in memory. To continue the programming procedure for other functions press the next button to move forward in the process. To return to the main menu, press the menu button and then the main button to return back to the Main Screen.

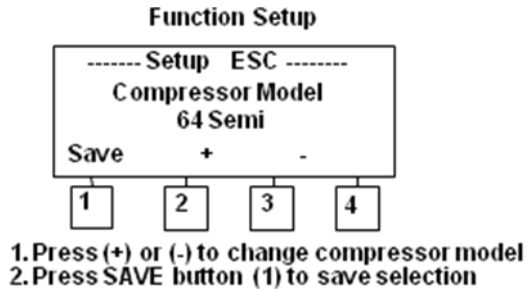
11.1 Compressor Type

Compressor choices are listed as follows: 53 semi, 53 open, 64 semi, 74 open and 74 Semi. Mandatory functions for the compressor will be initialized automatically when the compressor is selected. The correct compressor must be selected to insure the proper protection has been setup for that compressor. Items that are automatically setup by selecting the compressor type is; motor protection, 7-minute start delay, and analog oil flow requirements. The Factory default for the compressor type is **"74 semi"**.

Mode Programming

Changing the compressor type is accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in section **"11.0 Programmable Operations"**. After accessing the edit screen for "Compressor Type", the (+/-) buttons will allow the programmer to scroll and select the required compressor. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.



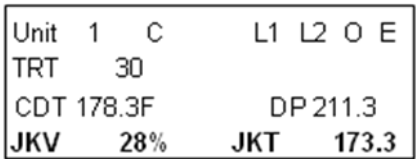


11.2 Oil Cooling Mode

Oil cooling can be accomplished using several different methods. The normal methods consist of Jet Kool, None (Air Cooled, Water Cooled) or Liquid Injection. Factory default for this function is **"None"**.

Jet Kool

When Jet Kool is the method of oil cooling, the ESC control (designated as the master) must be setup in the oil-cooling mode as **"Jet Kool"**. Changing the oil cooling mode is accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in section **"11.0 Programmable Operations"**.
After accessing the edit screen for "Oil Cooling Mode", the (+/-) buttons will allow the programmer to scroll and select "Jet Kool" as the oil cooling method. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.



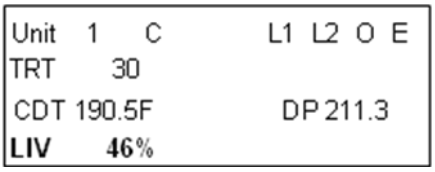
Section **11.20 "Jet Kool Temperature Source"** explains the function setup procedures for the proper temperature probe. The ESC will read either the "Compressors" or the "Rack Sensor "as the temperature source to operate the Jet Kool control valve. The ESC 201 will display the Jet Kool temperature and the percentage the Jet Kool valve is open. Shown in this paragraph is an illustration of the master ESC operating screen in the Jet Kool Mode. The bottom display line shows the Jet Kool Valve "JKV %" and the Jet Kool Temperature "JKT °F or °C". The JKT is an average of all compressor discharge temperatures when the ESC 201 is configured for **"compressors"** as the Jet Kool temperature source, or the discharge header temperature when it is configured as **"Rack Sensor"**. When this function is configured for "compressors" the average temperature is taken only from the operating compressors. The compressor discharge temperature "CDT" is the temperature read in the discharge of each screw compressor. The only time the "JKT" and the "CDT" will read the same value is when a single compressor is in operation. The preferred method to operate the Jet Kool is using the "compressor" source rather than the "Rack Sensor" source. The "Rack Sensor " has been provided to upgrade or replace the old style Jet Kool controls with a single temperature sensor mounted on the discharge line, and the compressors are fitted with a PTC sensor rather than the PT1000 sensor.

A terminal block located in the upper left corner of the ESC board labeled “Jet Kool” is provided to connect the Jet Kool Valve using #18-2 shielded cables. Shielded cable is also recommended for the temperature sensor wires from the compressors and/or the rack sensor temperature probes. The desired discharge temperature can be set in **11.3 “Jet Kool Target Temperature”**.

Liquid Injection

Each ESC 201 has the capability to control the discharge temperature by using a liquid injection valve. This method of oil cooling is limited to a maximum of 10% of the compressor capacity. The target temperature for this function is preset to control the discharge at 190°F (88°C). After accessing the edit screen for “Oil Cooling Mode” the (+/-) buttons will allow the programmer to scroll and select “Liquid Injection” as the oil cooling method. The liquid injection valve percentage open **“LIV %”** will be displayed on the bottom line of the ESC operational screen.

Each ESC 201 will control the liquid injection valve for the connected compressor. A terminal block located in the upper left corner of the ESC board labeled “Jet Kool” is provided to connect the liquid injection valve using #18-2 shielded cables. Shielded cable is also recommended for the temperature sensor wires from the compressors and/or the rack sensor temperature probes.



None

The third option for oil cooling is none. After accessing the edit screen for “Oil Cooling Mode” the (+-) buttons will allow the programmer to scroll and select “None” as the oil cooling method. This method is normally selected when either air cooled, water-cooled and no oil cooling is required. In the case of air and water-cooled oil coolers the preferred device is an oil temperature mixing valve to control discharge temperature. Details on these devices can be obtained by contacting the factory.

The last line of ESC display will be blank when the “None” option is selected for oil cooling.

11.3 Jet Kool Target temperature

Jet Kool Target Temperature can only be accessed if the Jet Kool oil cooling method has been selected. The target range can be set from 165°F (74°C) to 195°F (90°C). Factory default for this function is **“176°F”**.

Temperature Programming

Changing the Jet Kool target temperature can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in section **“11.0 Programmable Operations”**. After accessing the edit screen for “Jet Kool Target Temperature”, the (+/-) buttons will allow the programmer to scroll and select this temperature between 165°F (74°C) and 195°F (90°C). Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.4 Discharge Temperature Reset

Discharge Temperature Reset allows the programmer to configure this function for either automatic or manual reset. The Manual Mode will shut down and lock out the compressor when the discharge temperature reaches 212°F (100°C), requiring an operator to manually reset the ESC 201, clearing the “High Discharge Temperature Alarm” restarting the compressor. The automatic mode will shut down the compressor when the discharge temperature reaches 212°F (100°C). When the discharge temperature falls below 183°F/84°C the “High Discharge Temperature Alarm”, will be cleared, restarting the compressor. When the compressor is reset automatically, the 7-minute short cycle delay **(Section 11.13)** will take precedence over the function to prevent compressor short cycling. Factory Default for this function is **“Automatic”**.

Mode Programming

Changing the discharge temperature reset can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, then follow the instruction found in section **“11.0 Programmable Operations”**. After accessing the edit screen for “Discharge Temperature Reset”, the (+/-) buttons will allow the programmer to scroll and select between automatic and manual. Once the selection has been made,

pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.5 Motor Overload Reset

Motor Overload Reset allows the programmer to configure this function for either automatic or manual reset. The Manual Mode will shut down and lock out the compressor when the motor thermistors exceed a temperature of 212°F (100°C), requiring an operator to manually reset the ESC 201, clearing the “Motor Overload Alarm”, restarting the compressor. The automatic mode will shut down the compressor when the motor temperature reaches 212°F (100°C), and as the motor temperature falls below the reset point, the “Motor Overload Alarm” will be cleared, restarting the compressor. When the compressor is reset automatically the 7-minute short cycle delay **(Section 11.13)** will take precedence over the function to prevent compressor short cycling. Factory default for this function is **“Automatic”**.

Mode Programming

Changing the discharge temperature reset can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section “11.0 Programmable Operations”**. After accessing the edit screen for “Discharge Temperature Reset”, the (+/-) buttons will allow the programmer to scroll and select between automatic and manual. Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.6 Oil Flow Reset

Oil flow reset permits the programmer to configure this function for either automatic or manual reset. The automatic or manual modes monitor the oil flow rate with either a digital or analog switch. These switches are described in section 11.7**, “Oil Flow Sensors”.** The oil flow reset mode is configured at the factory in the **“Automatic Mode”**.

Automatic Mode

When the reset mode is configured for automatic the compressor will be allowed to automatically restart 3 times, after each oil flow failure, before a manual lockout occurs. 5-6 seconds after the oil flow falls below the minimum requirements for safe operation the ESC 201 will shut down the compressor, displaying a **“Low Oil Flow Alarm**”. If 3 oil flow resets occur within a 10-minute consecutive period the ESC 201 will lock out the compressor, requiring a manual restart. This 10-minute timer is automatically reset back to “0” once an elapsed time of 10-minutes passes without an oil flow failure. During initial starting sequence the compressor will be allowed to operate for 20-seconds to establish the required oil flow. If the proper oil flow has not been established after the elapsed 20-seconds the compressor will be shut down in either the automatic or manual mode.

When the reset mode is configured for manual start the compressor is allowed to operate for a period of 15-seconds to establish oil flow. The compressor will be shut down if the oil flow falls below the minimum required flow rate. If after 15-seconds, a safe oil flow has not been established the compressor will be shut down and a **“Low Oil Flow Alarm”** will be displayed. Either depressing the reset button or activating the remote reset will accomplish restarting the compressor. This mode is primarily used in trouble shooting procedures.

Mode Programming

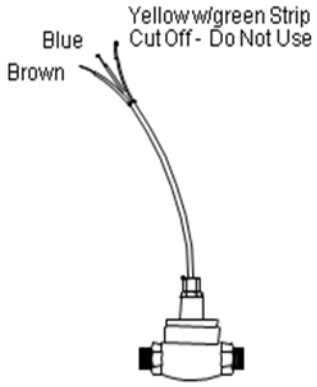
Changing the oil flow reset can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, then follow the instruction found in **section “11.0 Programmable Operations”**. After accessing the edit screen for “Oil Flow Reset” the (+/-) buttons will allow the programmer to scroll and select between automatic and manual. Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.7 Oil Flow Sensor

2 types of oil flow sensors can be used to determine the proper oil flow requirements to the compressor. These consist of a “Digital” flow sensor, which opens an electrical circuit interrupting a signal back to the ESC 201, or the analog sensor, which reads the oil flow. Either switch has an established setting determining the minimum oil flow requirement to safely protect the compressor. Factory default for this function is **“Digital”**.

Digital Sensor

The digital sensor requires a differential pressure and a minimum oil flow to activate the switch. 2 different switches are required to operate the entire series of compressors. The HS"53" series of compressors operate with a minimum (discharge to suction) differential of 45 PSIG (3.06 Bars) and a minimum flow rate of 1.6 GPM'S (6 l/M). The HS"64 & 74" series compressors requires a switch with higher flow requirements of 90PSIG (6 Bars) minimum (discharge to suction) differential and a minimum flow rate of 2.6 GPM'S (10 L/M). The digital switch has a brass plunger, when lifted by the minimum oil pressure and flow combination, closes a contact, sending an electrical signal back to the ESC 201. If the contact is opened after the compressor reaches operational status, the ESC 201 will sense this as an unsafe state and alarm a **"Low Oil Flow"**, shutting down the compressor. Installation of the digital switch must be after the oil filter to prevent foreign particles from obstructing the switch.



Digital Oil Flow Switch
6L P/N 347505-01(HS/OS53)
10L P/N 347504-02 (HS64, HS74/OS74)

Analog Sensor

Analog sensor is a wheel type flow device which uses a magnetic pickup to count the number of wheel rotations, which is converted to a 0-10VDC signal that can be read by the ESC 201 and displayed in either gallons per minute or liters per minute. This sensor provides a greater range of operation while providing the proper oil safety protection for the compressor. If the oil flow falls below the minimum calculated oil flow rate for the present conditions, the ESC 201 will shut down the compressor and display **"Low Oil Flow"**. Installation of the analog switch must be after the oil filter to prevent foreign particles from obstructing the switch.
Note: the Analog sensor has been obsoleted. The information listed is for reference only.

Mode Programming

Changing the oil flow sensor can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Oil Flow Sensor" the (+/-) buttons will allow the programmer to scroll and select between digital and analog. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.8 Phase Protection Reset

Three phase protection has been provided to protect the compressor against loss of phase and phase symmetry. Normal panel mounted phase monitors only monitor power supplied to the equipment. The ESC 201 provides protection to each compressor, monitoring the power supplied through all electrical devices connected to the compressor motor. When the compressor start sequence begins, the ESC 201 will wait ½ second for the power to stabilize and then check for power on all 3 phases and the proper sequence between phases. This function can be configured for either automatic or manual reset. Factory default for this function is **"Automatic"**.

Automatic Mode

During the operation of the compressor, if power is lost to any phase, the compressor will be shut down immediately and the alarm **"Phase Loss"** will be displayed. The ESC 201 will wait 30-seconds and attempt a compressor restart. The ESC 201 will attempt 3 restarts with 30-second delays between starts. If power has not returned after the three restarts, the time delay between restarts will be increased to five minutes for two additional restarts. If all the automatic restarts fail the compressor will be locked out requiring a manual reset.

Manual Mode

When phase protection is configured in the manual mode and power is lost to any phase, the compressor will be shut down and locked off by the ESC 201, displaying the alarm **"Phase Loss"**. Restarting the compressor requires depressing the manual reset button on the ESC.

Mode Programming

Changing the phase protection reset can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Phase Loss Reset" the (+/-) buttons will allow the programmer to scroll and select between automatic and manual. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.9 Pressure Transducer Type

The equipment discharge pressure will read from the equipment electronic pressure transducer. This pressure will be used to make calculations in several ESC 201 functions. Since several different type transducers are supplied which the ESC 201 has the ability to read these transducers once they are configured. Factory Default for this function is **"Eclipse 500"**.

Mode Programming

Changing the discharge pressure transducer type can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Discharge Transducer Type" the (+/-) buttons will allow the programmer to scroll and select between several different types listed below. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

Discharge Pressure Transducer Types Compatible with the ESC201:

1.	Eclipse	500 Lb
2.	4-20 ma	500 Lb
3.	0-10V	500 Lb
4.	1-6V	500 Lb
5.	SA	500 Lb

11.10 Discharge Pressure Offset

The discharge pressure reading is used to calculate the low economizer function and the differential pressure between discharge and suction for the analog oil flow sensor. Note: the analog oil flow sensor is no longer used on the BITZER screw compressors. The pressure transducer used for reading discharge pressure is a supplied component by the manufacture of the equipment. This function is designed to allow the ESC201 pressure reading to be calibrated to the electronic pressure controller transducer.

Discharge pressure offset function can only be accessed when the ESC201 is setup as a **"Master Control"**. The master control will send the discharge pressure values to the connected slave boards. The discharge pressure value can be read in the slave ESC201 under "**Discharge / Suction Pressure"** function described under function 11.12.

Mode Programming

Changing the discharge pressure offset can be accomplished by the following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in section **"11.0 Programmable Operations"**. After accessing the edit screen for "discharge pressure offset", the (+/-) buttons will allow the programmer to scroll up and down to place a positive or negative value in the offset to correct the pressure value. Once the selection has been made, pressing the "Save" button will save the offset value and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.11 Suction Pressure Offset

The suction pressure reading is used to calculate the differential pressure between discharge and suction for the analog oil flow sensor. Note: the analog oil flow sensor is no longer used on the BITZER screw compressors. The pressure transducer used for reading suction pressure is a supplied component by the manufacture of the equipment. This function is designed to allow the ESC201 pressure reading to be calibrated to the electronic pressure controller transducer.

Suction pressure offset function can only be accessed when the ESC201 is setup as a **"Master Control"**. The master control will send the discharge pressure values to the connected slave boards. The discharge pressure value can be read in the slave ESC201 under "**Discharge / Suction Pressure"** function described under function 11.12.

Mode Programming

Changing the suction pressure offset can be accomplished by the following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in section **"11.0 Programmable Operations"**. After accessing the edit screen for "suction pressure offset", the (+/-) buttons will allow the programmer to scroll up and down to place a positive or negative value in the offset to correct the pressure value. Once the selection has been made, pressing the "Save" button will save the offset value and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.12 Discharge / Suction Pressure

This function cannot be edited and is used to display the values read by the suction and discharge pressure transducers. This function displays the discharge and suction pressure values as determined by the discharge and suction pressure offsets. The slave ESC201 receives these values from the master control across the Comm. 2 network.

11.13 Motor Overload Monitor

The motor thermistor will be read by the ESC 201 to determine if the motor temperature is within the limits set by the manufacture. If the motor temperature exceeds these limits the ESC 201 will shut down the compressor in either the automatic or manual mode.

This function is configured at the factory as **"Enabled"** when any Semi-Hermetic compressor is selected and **"Disabled"** when an open type is selected. Any time a Semi-Hermetic compressor is selected the motor overload configuration cannot be disabled.

Mode Programming

Changing the motor overload monitor can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Motor Overload Monitor", the (+/-) buttons will allow the programmer to scroll and select between Enable and Disable for the open type compressor only. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.14 Phase Monitor

The phase monitor function has the ability to be enabled or disabled depending on the application and power source requirements. ***It is not recommended to disable this function***.
Factory default for this function is **"Enabled"**.

Mode Programming

Changing the phase monitor can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Phase Monitor", the (+/-) buttons will allow the programmer to scroll and select between Enable and Disable for the open type compressor only. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.15 Critical Discharge Monitor

If the discharge temperature exceeds 200°F the loaders will be deactivated, relieving some of the load on the compressor. If the discharge temperature falls below 194°F, the Loaders will be automatically activated.

When the compressor remains in this critical discharge temperature range (200°F/100°C to 211°F/99°C) for 20, minutes the compressor will be shut down in the automatic restart mode. The compressor will restart and activate the loaders when the discharge temperature falls below 194°F/90°C.

When the compressor is in the critical discharge temperature range the display will change to **"Critical Discharge Temperature"**. While the compressor is in the critical discharge range, the screen will only display the discharge temperature and no other compressor data, (with the exception of the Jet Kool information if the compressor is configured as a "Master"). If the temperature continues to rise to the high discharge cutout temperature of 212°F/100°C, the screen will display "High Discharge Temperature" and the compressor will be shut down. When in the high discharge temperature automatic mode the compressor will remain off until the high discharge temperature reset point has been reached (approx. 183°F/84°C), not the critical discharge temperature reset point at 194°F/90°C.

11.16 7- Minute Time Delay

This function prevents short cycling of the large compressors which causes damage to the motor. The HS "64 & 74" series compressor should not be cycled more than 7 times and hour. This function is designed to reduce the number of short cycle starts, preventing excessive overload conditions caused by short cycling. The factory default for this function is 7-minute start delay **"Enabled"**.

The timer is a 7-minute from start to start operation, permitting the compressor to start immediately if the compressor has been either shut down for 7-minutes or in operation for 7-minutes with an immediate restart. If the compressor shuts down and attempts an immediate restart, the ESC 201 will delay the start for a period of 30-seconds. After this 30-second delay, the compressor will be allowed to start. If the compressor shuts down immediately for the second time, the ESC 201 will keep the compressor off for the remainder or the 7-minutes or (6 minutes and 30 seconds at that point). The compressor must be in operation or off for a total elapsed time of 7-minutes to obtain an immediate restart.

The last line of the ESC 201 display will flash and alternate between the Jet Kool information and the time remaining to start while in the starting count down mode. The operator will know the exact time left before the compressor will start.

This function cannot be disabled on the HS "64 & 74" series compressors. The HS "53" series compressors is the only series that this function can be disabled <u>but is not recommended</u>.

Mode Programming

Changing the 7-minute time delay can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "7-Minute Time Delay" the (+/-) buttons will allow the programmer to scroll and select between Enable and Disable for the HS "53" type compressors only. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.17 Compressor Start Delay

Compressor start delay function is designed to prevent excessive current inrush to equipment with multiple compressors. Most equipment with multiple compressors utilizes a microprocessor to sequence the compressors, preventing a large inrush of current. If an electronic failure occurs in the microprocessor, the compressors will lose sequence ability provided by the microprocessor. The "Compressor Start Delay" function will act as a fail-safe feature for this function. Factory default for this function is **"0"** seconds.

Each compressor can be programmed with an individual start time delay from 0 – 99 seconds. The programmer has the flexibility to program the compressor starts around their system parameters to insure system safety, preventing long delays during normal starts.

Mode Programming

Changing the compressor start delay can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Compressor Start Delay", the (+/-) buttons will allow the programmer to scroll from 0 to 99 seconds. Once the start time selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.18 Temperature Probe Type

Two different temperature probes can be used for discharge temperature protection. The PTC probe does not have the ability to be read for control and display purposes. The PT1000 probe can be read, allowing the ESC 201 to display the actual discharge temperature of each compressor. Factory default for probe type is **"PT1000"**.

PTC Sensor

This probe has been used for many years as an on/off safety device monitored by many different types of electronic controls to simply supply a signal for shutting down and restarting the compressor within a temperature range. The appearance of these probes has changed over the years. The probe can be identified by having either a metal flexible protection around the wire with the markings PTC 100 stamped into the probe housing, red rubber insulation with the markings PTC 100 stamped into the housing and recently a black insulation cord with a separate sensor (2 pieces). The PTC probe can be used with the ESC 201 for discharge temperature protection by simply selecting "PTC" in the temperature probe type setup. This probe does not have the ability to be read temperature, eliminating the possibility of displaying the discharge temperature.

PT1000 Sensor

Due to enhanced capabilities of the ESC 201 to monitor and control several functions, the requirement of a readable probe was essential. To operate the Jet Kool, Critical Discharge Temperature, High Discharge Temperature and Low Discharge Temperature functions, the PT 1000 temperature must be used. The PT 1000 can be read for display purposes and to operate the above functions. The appearance of this probe will either be a white insulated wire with a yellow shrink band labeled "PT1000" or a dark grey colored cable.

Mode Programming

Changing the temperature probe type can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in section **"11.0 Programmable Operations"**. After accessing the edit screen for "Temperature Probe Type", the (+/-) buttons will allow the programmer to scroll between PTC and PT1000. Once the proper selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.19 Discharge Temperature Offset

This function provides the ability to calibrate the PT1000 discharge temperature sensor probe (if required). The ability to calibrate the PT1000 can be accomplished in either a master or slave control.

Mode Programming

Changing the discharge temperature offset can be accomplished by the following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in section **"11.0 Programmable Operations".** After accessing the edit screen for "discharge temperature offset", the (+/-) buttons will allow the programmer to scroll up and down to place a positive or negative value in the offset to correct the temperature value. Once the selection has been made, pressing the "Save" button will save the offset value and return the programmer back to the function screen allowing the programmer to continue to the next function or return back to the main screen. Note: it must be ensured that when using this feature, the temperature is known to be accurate from a proper temperature measuring device.

11.20 Refrigerant Type

Refrigerant type is extremely important to setup the ESC 201, since a calculation must be performed using data in the pressure-temperature table for the refrigerants to calculate condensing conditions. Refrigerant types to select from are R-22, R404A, R507A, R134a, R717 and None. ***Warning, if the correct refrigerant is not selected improper system operation will occur.*** Factory default for this function is **"R22"**. Note: If using refrigerant R407A or R407F, select R22 as the refrigerant. These refrigerants are close to R22, however, after changing, always obtain an accurate baseline pressure and temperature values to compare against R22.

Mode Programming

Changing the refrigerant type can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Refrigerant Type", the (+/-) buttons will allow the programmer to scroll and select between the refrigerant types. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.21 Screen Contrast

Screen contrast can be made lighter or darker to enhance the display if the ESC 201 is located in a light or dark area. By increasing or decreasing the number of bars displayed in the function configuration the contrast will become lighter or darker. Factory default for this function is **"7 Bars"**.

Mode Programming

Changing the screen contrast can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Screen Contrast", the (+/-) buttons will allow the programmer to increase or decrease a bar indicator from 1 – 10 bars. The more bars displayed the higher the contrast. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.22 Date & Time

The ESC 201 has an internal logging feature and the ability to tag alarms with the current time & date to be transmitted across the 485 network to other devices and controllers. It is important the correct Date & Time be entered into the ESC 201.

The display screen has a date format of 02/10/01 and a time format of 15:20:36. The time is displayed in Military Time (24 Hr Clock). Follow the instructions below to change the date & time. Factory default for this function is the **"Current Date & Time"**.

Mode Programming

Changing the Date & Time can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Date & Time", the (+/-) buttons will allow the programmer to scroll and change each group of the date or time. The NEXT button will advance the cursor to the next group to allow the programmer to use the (+/-) buttons to change that group. Once the corrections have been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.23 Power Frequency

The ESC 201 is capable of operating with either 50 or 60 Hz power. The frequency can be changed in the configuration mode to either 50 or 60 Hz by following the below procedures.

Mode Programming

Changing the power frequency can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Power Frequency" the (+/-) buttons will allow the programmer to scroll between 50Hz and 60 Hz. Once the corrections have been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.24 Jet Kool Source

Note: Jet Kool Oil Cooling is no longer available. The data given is for informational purposes only for existing systems utilizing Jet Kool.
Jet Kool oil cooler requires the discharge temperature as the input control source for the Jet Kool system. This signal is read by the ESC 201 to operate the Jet Kool Valve (JKV 100). The discharge temperature can be obtained by reading the individual compressor discharge probes (PT1000 only) or a single probe mounted on the discharge header after the last compressor and before the oil separator. Factory default for this function is **"Compressors"**.

Compressors

When the ESC 201 is configured as "Compressors" in the Jet Kool Source mode, the individual compressor discharge probes (PT1000 only) are read and averaged to determine the overall rack discharge temperature. Any compressor in the averaging group that is not in operation will be eliminated from the calculation process. Any time multiple suction groups are used on a single discharge group with oil coolers supplying cool oil to the suction groups, the configuration mode must be "Compressors" and the PT1000 probe must be used as the sensor device.

Rack Sensor

If the ESC 201 is operating an existing Jet Kool oil cooler with a probe mounted on the discharge line, this probe can be used as long as the configuration mode has been set to "Rack Sensor". If the system will not permit the use of the compressor probe, PT 1000 as the source, a rack sensor probe must be used as the source.

Mode Programming

Changing the Jet Kool temperature source can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Jet Kool Temperature Source", the (+/-) buttons will allow the programmer to scroll between Compressor and Rack Source. Once the corrections have been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.25 Language

Six languages can be programmed as screen displays. These languages are English, German, French, Spanish, Portuguese and Italian. These languages can be accessed through the normal setup procedures found below in "Mode Programming" or by using the following short-cut. Factory default for this function is **"English"**.

1. Main Screen - press any button to access the "Setup ESC" Screen.
2. Setup ESC Screen - press the select button and the "Config" will begin to flash.
3. Press the "Next" button to scroll to "language"
4. When the "Language" is flashing press the pick button.
5. The choose language screen will appear.
6. Press the edit button to access the languages.
7. Press the (+/-) buttons to scroll between the languages.
8. When the desired languages appears, press the save button.
9. Press the "Menu" button and then the "Main" button to return to the main screen.

Mode Programming

Changing the Language can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Language", the (+/-) buttons will allow the programmer to scroll between Languages. Once the corrections have been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.26 Slaves on Line

This function can only be read in the master control. When accessing this function the total numbers of slave compressors that are connect to the master on the Comm. 2 network will be listed by their ID numbers. This function can be used to determine if a problem exists with slaves communicating to the master. Accessing the "Network" function on the setup screen will provide direct access to this function.

11.27 I.D. Network

The ESC 201 has the ability to communicate to a rack controller using an open protocol across the 485 network, and the N2 network between the Master ESC and the Slave ESC boards. The ESC 201 can be supplied with Echelon communications from the Master ESC to the rack controller. To identify the slave ESC boards each ESC must be programmed with an I.D. number. This I.D. Number must be set up in each ESC control. When multiple compressors are configured with a master, the ***Master ESC should be setup as # 1.*** The I.D. number range starts at 0 and ends at 12. The slaves should be numbered from 2 –12. The number "0" should be reserved for single compressor operations. Factory default for this function is **"0"**.

Mode Programming

Changing the I.D. Network source can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "I.D. Network", the (+/-) buttons will allow the programmer to scroll between number 0 and 12. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.28 EXT / ECH ID

Note: This feature is rarely used and is included for informational reasons only.
The ESC 201 has the capability to transmit alarms and operational data either directly across the Comm.1 or Echelon Networks. This feature eliminates the use of additional input boards and / or isolation relays to read the alarms generated by the ESC 201.

EXT

When this function is configured for EXT. (External) the rack controller will be able to communicate directly across the Comm. 1 network to the ESC 201, retrieving all the alarm and data logs. The manufacturer of the rack controller must provide the software to allow the rack controller to read the ESC 201 alarms and data. Protocol information to develop the software is available by contacting the factory.

ECH

If the ESC 201 is utilizing Echelon communications the alarms and data logs will be sent via the Echelon network. The information required for communication across the Echelon network will be provided by the factory on request.

Mode Programming

Mode determination between the External or Echelon connections are determined by connecting the communication wires to either Comm.1 (RS-485) or Echelon ports. Do not connect cables to both Comm. 1 and the Echelon ports. EXT/ECH configuration requires a number from 1-31 in this field. This number is used to address the **EXT/ECH** function to identify the Esc 201 on the Comm. 1 (RS-485) network. All master controls in the Echelon network must have the ECHELON FUNCTION "Enabled" for the EXT/ECH function to operate properly. **IMPORTANT: The default setting for the EXT/ECH ID is "1". This function must be set to value great than "0" or the slave boards will not communicate to the master ESC, causing problems with the Jet Kool, critical discharge temperature and economizing functions.**

Do not enable the ECHELON FUNCTION on the slave controllers.

The EXT/ECH function should not be confused with the I.D. Network Function. When programming the I.D. Network, each Master ESC 201 will have slaves that are configured to communicate to that Master ESC 201 for control purposes. The master will always be designated as "1" in the I.D. Network (Function # 22) with slaves to follow as, 2,3,4 in that group. Group #2 on the same equipment will have another master designated as "1" with its slaves to follow as 2,3,4,5 in that group, and so on with group #3.

Note: A control designated as a master with a “1” in the **I.D. Network (#22)** will also be designed with sequential number from 1 to 31 in the **EXT/ECH ID (# 23)**. The First Control in the system will always have an I.D. Network as “1” with the EXT/ECH ID also as “1”. The first control in the second group will have an I.D. Network as “1” with the EXT/ECH ID as “5”.

Example: System with a total of nine (9) ESC 201 Controls configured with 3 groups with 4 Controls in the first group, 3 controls in the second group, and 2 controls in the third group, will be set-up as follows:

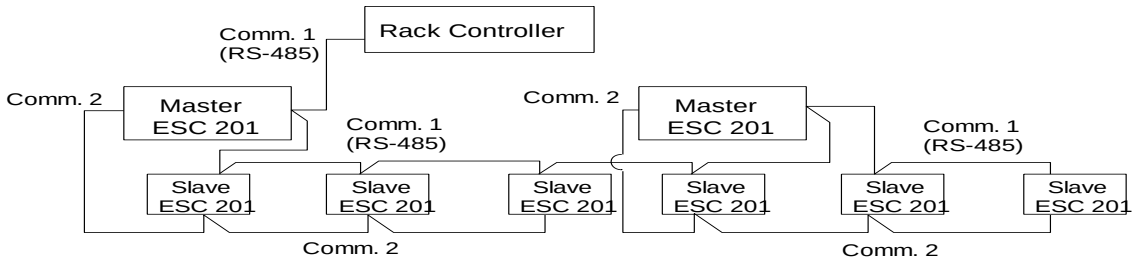
Group Number	Role/Identification	Compressor Number	I.D. Network	EXT/ECH I.D.
Group # 1				
1	**Master**	**1**	**1 Master**	**1**
1	**Slave**	**2**	**2 Slave**	**2**
1	**Slave**	**3**	**3 Slave**	**3**
1	**Slave**	**4**	**4 Slave**	**4**
Group # 2				
2	**Master**	**5**	**1 Master**	**5**
2	**Slave**	**6**	**2 Slave**	**6**
2	**Slave**	**7**	**3 Slave**	**7**
Group # 3				
3	**Master**	**8**	**1 Slave**	**8**
3	**Slave**	**9**	**2 Slave**	**9**

External Function Wiring

Note: This feature is rarely used and is included for informational reasons only.
External Function wiring for the Comm.1 & Comm. 2 ports should be configured according to the following procedure.

Comm. 1 (RS-485)
A shielded cable should be daisy chain connected from the rack controller comm. Port to all ESC 201 Comm.1 ports on the equipment.
Comm. 2 (RS-485)
A shielded cable should be daisy chain connected from the master ESC 201 Comm. 2 port to all the slave Comm. 2 ports in the same group.

Wiring Configuration
For External Connection



Echelon Function Wiring

Note: This feature is rarely used and is included for informational reasons only.
Echelon Function wiring for Echelon & Comm. 2 ports should be configured according to the following procedure. The Echelon hardware is a separate board mounted in the lower left corner of the ESC 201 master control. Terminals to connect the wiring for the Echelon are located on this daughter board. The Echelon daughter board plugs into the master ESC 201. If the master must be replaced for any reason the Echelon board must be moved to the new board.

Echelon

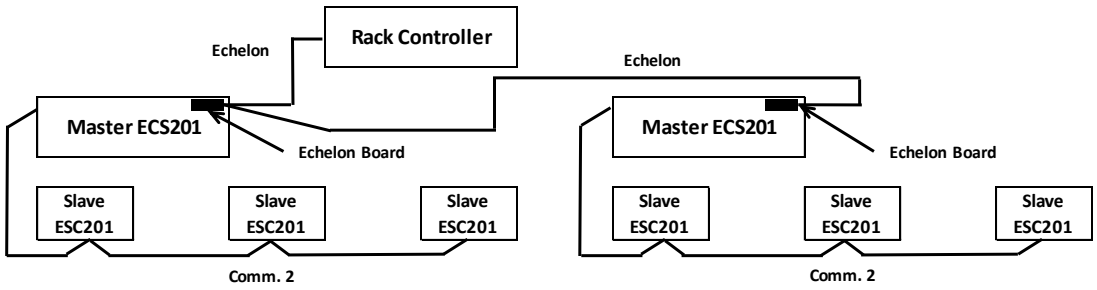
A shielded cable should be daisy chain connected from the rack controller Echelon port to all Master ESC 201 Echelon ports.

Comm. 2

A shielded cable should be daisy chain connected from the master ESC 201 Comm. 2 port to all the slave Comm. 2 ports in the same group.

Note: Make sure the Comm.1 (RS-485) ports are not wired to the Echelon Ports.

Wiring Configuration For Echelon Connections



11.29 N2 network Mode

Note: This is the most common type of communication used with the ESC201 modules.
Three network mode selections are possible when configuring the ESC 201. This configuration must be properly set up to enable the logging of alarms and information back to the rack controller. Factory default for this function is **"Slave"**.

Master

The Master Mode is used when more than one ESC 201 is connected in the network or when Jet Kool oil cooling is required to be controlled. The master is the main communication device between the slaves and the rack controller for alarms and other information data. The master is also used to collect temperature data from the other compressors to calculate the system discharge temperature to operate the Jet Kool oil cooler. More than one master is possible to be set up on a large rack system where multiple Jet Kool oil coolers are used to control the different suction groups.

Slave

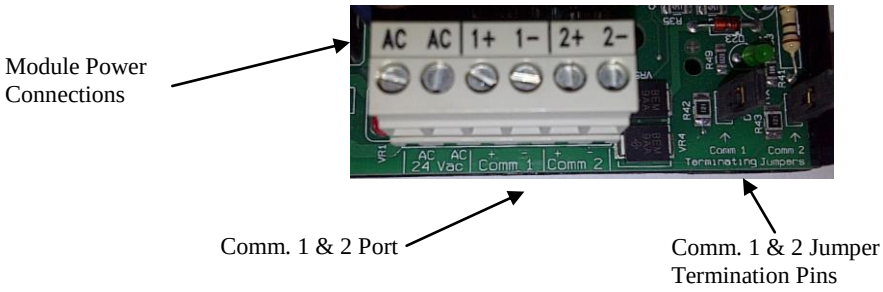
Slave units are wired in series to the master control using the N2 network. The Comm. 2 connector is labeled (2+, 2-) on the bottom 2 terminals of the 6 connector terminal plug, located on the left hand side of the ESC

board. The slaves send the information collected from its compressor across the N2 network to the Master control.

Terminating Jumpers

Terminating jumpers are located on the ESC 201 for Comm.1 and Comm.2. The alarm boards are also equipped with a terminating jumper. The terminating jumper must be placed across the jumper pins on the last board in the network. The Comm.1 network is used to connect the ESC master controls to the equipment controller. The termination jumper on Comm.1 must be in place on the last ESC 201 in that network. Comm.2 jumper is used on the N2 network with the slave and alarm boards. When the slaves are connected to the master, the Comm. 2 terminating jumper must be in place on the last slave board or the last alarm board in that group. NOTE: The slave and alarm terminating jumpers perform the same function. Whichever board of these types is the last in the network is the board must be terminated.

The Comm.1 & Comm.2 terminating jumpers are located on the lower left corner of the ESC 201, labeled respectively.



11.30 Control By

The screw compressors have two methods to be controlled by when using the ESC201. These methods are Local and Echelon. The default control is by Local function.

Local Control

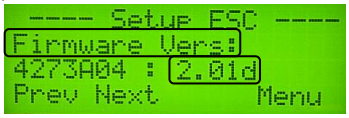
The local method of control consists of wiring through a computerized system controller which operates the compressors and loaders using an electronic relay board. When the relay output is energized, it sends an electrical signal through series of electro-mechanical safety devices to terminal (C1) terminal on the ESC201 board. The ESC201 recognizes this signal to start the compressor and load the loader solenoids. Any interruption in this (C1) signal will shut down the compressors.

Echelon Control

Echelon method to control the compressors and loaders eliminates the electronic relay board. The compressors and loaders are operated directly from the computerized system controller across the Echelon Network. Elimination of the output relay board will simplify the unit wiring and reduce the space requirements in the electrical panel. The (C1) input to the ESC201 will also be required as a safety monitor. An electrical signal is required to be sent through an on-off switch to the standard high and low pressure safety switches, providing a mechanical back-up to the compressor. If this signal to terminal (C1) is broken for any reason, the compressor will be shutdown.

11.31 Firmware Version

This is a non-programmable read only feature that is embedded in the software of the ESC201.
To obtain the version you have, this can be viewed in the “set-up” menus described at the beginning of this manual.



11.32 Comp 1 Protocol

This is no longer supported for the ESC201. Contact application engineering for further information if required. The default programming is “open”.

11.33 Alarm Boards:

The Alarm Board has been obsoleted. The following is for informational data only:

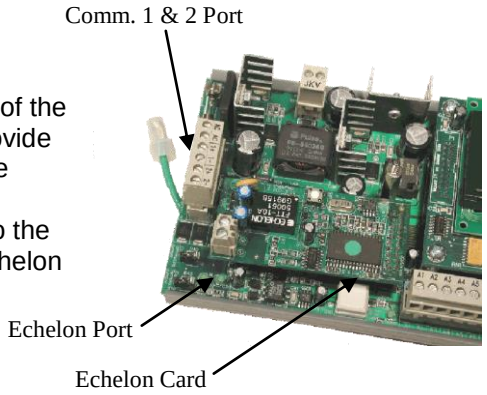
ESC 201 alarm board modes must be configured as “Enabled” to communicate to the designated board for the ESC.

Mode Programming

Changing the alarm board mode can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen and then follow the instruction found in **section “11.0 Programmable Operations”**. After accessing the edit screen for “Alarm Boards”, the (+/-) buttons will allow the programmer to scroll between Enabled and Disabled. Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.34 Echelon

This feature has been obsoleted and is supply for information only.
An optional Echelon card can be installed on the lower left portion of the ESC 201. This card incorporates the hardware and software to provide Echelon communications. The Echelon card is only required on the ESC 201 master control. Information from the slave units will be transmitted across the N2 network to the Echelon card and back to the equipment controller. When using Echelon communication, the Echelon mode must be enabled. The factory default for this function is **“Disabled”**.



Mode Programming

Changing the Echelon Mode can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section “11.0 Programmable Operations”**. After accessing the edit screen for “Echelon”, the (+/-) buttons will allow the programmer to scroll between enabled and disabled. Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.35 Temperature

The screen display for temperature can be changed from Fahrenheit to Centigrade. The factory default for this function is **“Fahrenheit”**.

Mode Programming

Changing the temperature units can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section “11.0 Programmable Operations”**. After accessing the edit screen for “Temperature”, the (+/-) buttons will allow the programmer to scroll between Fahrenheit and Centigrade. Once the selection has been made, pressing the “Save” button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.36 Pressure

The screen display for Pressure can be changed from PSI to Bars. The factory default for this function is **“PSI”**.

Mode Programming

Changing the pressure units can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Pressure" the (+/-) buttons will allow the programmer to scroll between PSI and Bars. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.37 Flow Rate

The screen display for Flow Rate can be changed from Gallons/Min to Liters/Min. The factory default for this function is **"Gallons/Min"**.

Mode Programming

Changing the flow rate can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Flow Rate", the (+/-) buttons will allow the programmer to scroll between Gallons/Min and Liters/Min. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

11.38 Date Format

The date format on the screen display can be change to accommodate the U.S. format and the European Format. The U.S. Format is displayed as "Month/Day", while the European is "Day/Month". The factory default for this function is "**Month/Day**".

Mode Programming

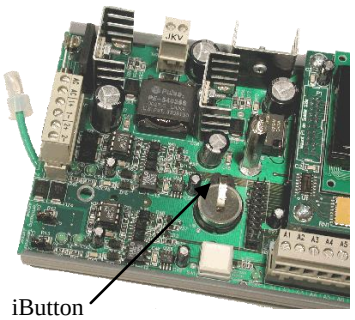
Changing the date format can be accomplished by following steps 1-3 in section 5.0 to obtain the category selection screen, and then follow the instruction found in **section "11.0 Programmable Operations"**. After accessing the edit screen for "Date Format", the (+/-) buttons will allow the programmer to scroll between Month/Day and Day/Month. Once the selection has been made, pressing the "Save" button will save the selection and return the programmer back to the function screen allowing the programmer to continue to the next function or return to the main screen.

12.0 iButton Memory

Note: The iButton has deleted from the ESC201 in 2006. The information below is for reference only.

The ESC201 is equipped with an iButton, non-volatile memory chip located on the lower left hand corner of the ESC board. This memory button holds all the programmable information relating to the controls setup and operation. The iButton looks like a small battery mounted in a well and held in place with a heavy spring clip.

If an ESC 201 must be replaced or exchanged with another ESC201 on the same rack, the iButton can be removed on the control being replaced and inserted in the new control. By replacing the iButton eliminates the process of programming the ESC 201.



13.0 Alarm Boards

The N2 network is also used to communicate to the ESC 201 alarm boards. The ESC 201 is equipped with one alarm output for a general alarm. If a customer requires specific alarms, logging can be accomplished with an alarm board to either the rack controller or an alarm system. The alarm board is configured with an N2 connector for networking to the ESC 201 boards. The alarm signal is sent out across this N2 network to activate the alarm module. When the alarm module receives the signal for an individual alarm, the board closes the related contacts to generate the alarm. The N2 connector labeled (Comm. 2) is located on the lower left portion of the board to the right of the 4-position dipswitch. Located to the right of the Comm. 2 port is the terminating jumper. The jumper must be placed over the two pins (J2) only if it is the last board in the communication chain.

Non-center tapped 24VAC transformer powers the alarm board. The power requirement for each board is 15VA. The 24VAC power supply is connected to the 2-pin connector on the lower left corner of the board labeled 24Vac. 2 contacts are provided for each alarm point, 1 dry set of contacts on terminal block 2 (TB2) providing a closure to signal another device as an alarm, and a voltage output set on terminal block 1 (TB1), normally used for panel lights. The voltage contacts can be utilized with some controllers that accept a voltage input for alarms rather than a dry contact closure. The table to the right shows a schedule of alarm and terminal designations for both the dry and power terminals.

Alarm Designation	Dry Contact	Power Terminal
Dirty Filter	D1	H1
Motor Winding Overload	D2	H2
Oil Flow	D3	H3
Oil Level	D4	H4
Discharge Gas	D5	H5
Phase	D6	H6
Rotation-Wrong Sequence	D7	H7
Run Proof / Bypass	D8	H8
Over Discharge Limit	D9	H9
Low Discharge Temperature	D10	H10
Digital Alarm Common	D11	
Alarm Output Supply Voltage		H11

Alarm Board I.D.

The table shown in this section illustrates the switch positions to address the alarm boards. The **"OFF"** position for the switch is **"UP"**. To place the switch **"ON"** the switch must be in the **"DOWN"** position.

The designation of the alarm board I.D. must correspond to the ESC 201 transmitting the alarm message. Example: if the ESC 201 has an I.D. of "1" the alarm board receiving the information must also an I.D. of "1". Duplicate I.D. numbers are possible on large systems where more than one Master ESC 201 is required. When this type address scheme is used the Master, slave and alarm boards must remain in a wiring group.

The green LED light located in the middle right side of the board is the power light, indicating the unit has power when lit. The green lights next to the Comm. 2 port are communication lights, which will flash when communicating with the ESC 201.

Alarm Board Wiring

Shielded cable must be used to connect the N2 network and the 24 VAC power connections. One end of the shield must be attached to ground. Wiring the dry outputs to another input device should also be wired using shielded cable, unless the manufacture of the input device instructs differently. High voltage output from TB1 can be wired according to standard wiring practices. **Shielded cable, with one end of the shield grounded, will reduce the possibility of noise transmission to the alarm and ESC 201 boards.**

Associated ESC ID	SW5-1	SW5-2	SW5-3	SW5-4
None	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

When more than one master ESC201 is used in a system with a single rack controller, the alarm boards should only be wired to that group of master and slave boards. Each time a new master is used, the address numbering scheme for ESC 201 and alarm boards will start back at “1”.

14.0 Remote Reset

Remote reset can be accomplished by wiring the equipment controller output relay between terminals (A6) and (A7). When the equipment controller is equipped with a phone modem, the operator accesses the output switch wired to (A6 & A7). Closing and opening the switch will reset the ESC 201. Note: the output switch must be opened, since the activation of the remote rest is predicated on the opening not the closing of the switch.

15.0 Manual Reset

The manual reset button is located on the lower portion of the ESC 201 to the left of the green LED power light. This button will allow the operator to clear all alarms and restart the compressor.

16.0 Logging

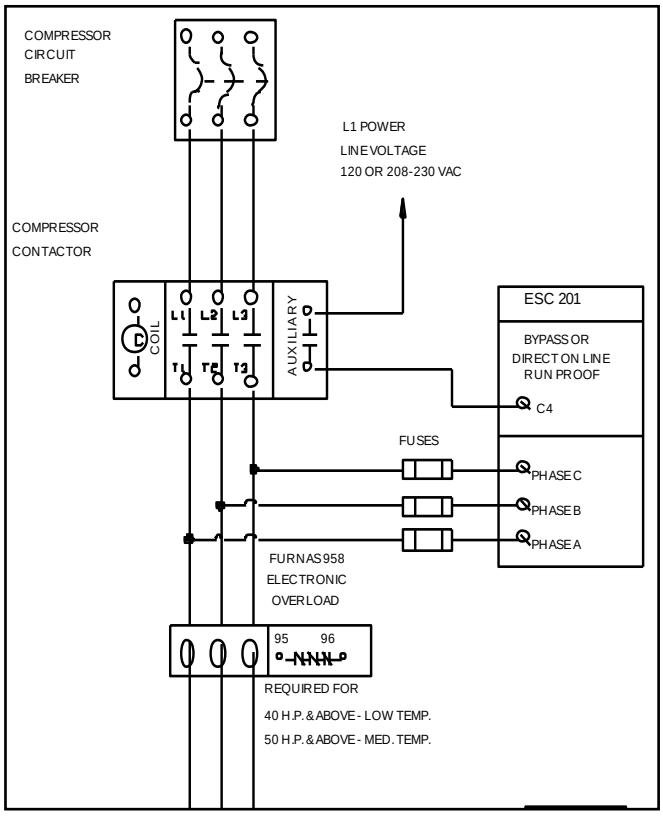
The ESC 201 has a permanent memory which will log the following functions. This logged data can be accessed by the use of a Prolink module and the required software. This memory can be accessed but not erased.

The Prolink and software are optional accessories and can be purchased via normal distribution.

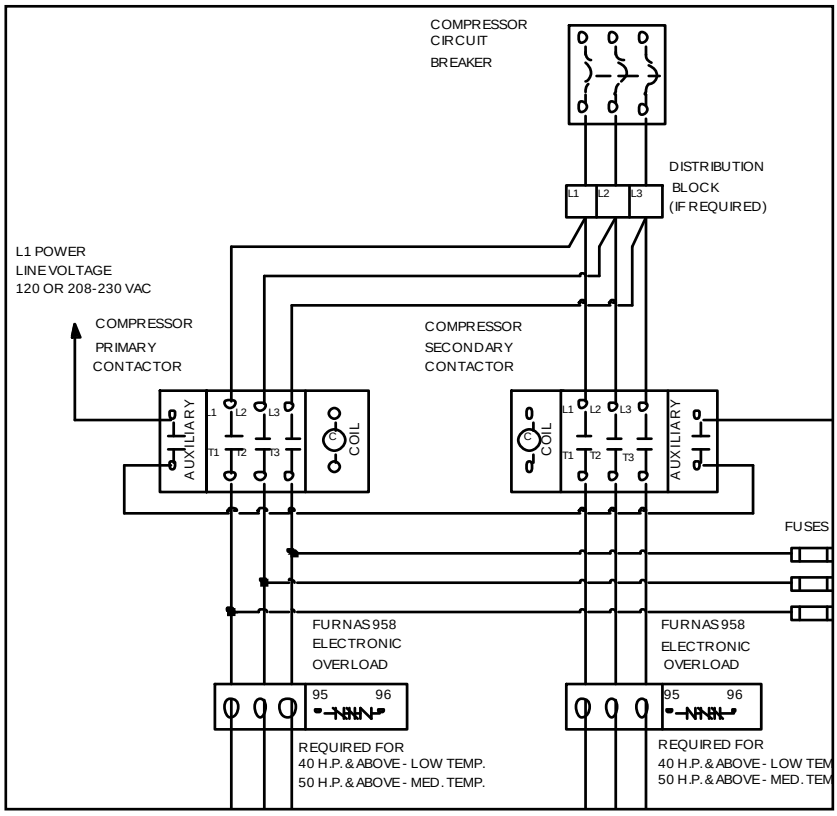
Logged Function

1. Oil Failure, Motor Overload, Discharge Temperature, Rotation and Compressor Starts.

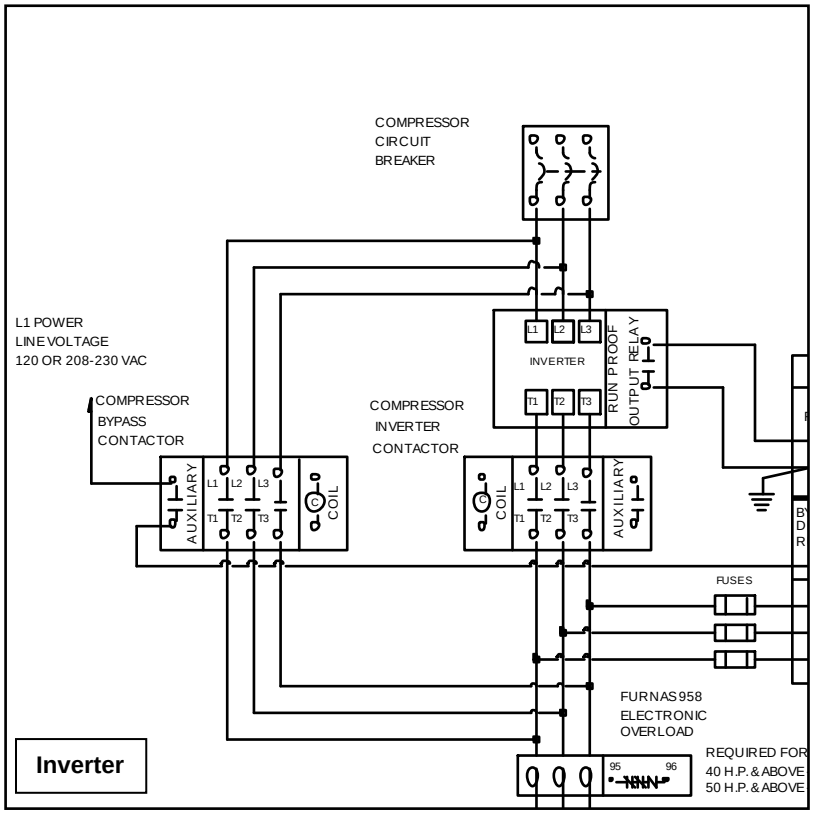
Appendix A
Compressor Motor - Phase- Run Proof Configurations



Direct on Line Start



Part Winding Start



Inverter

Appendix B
Compressor Configurations

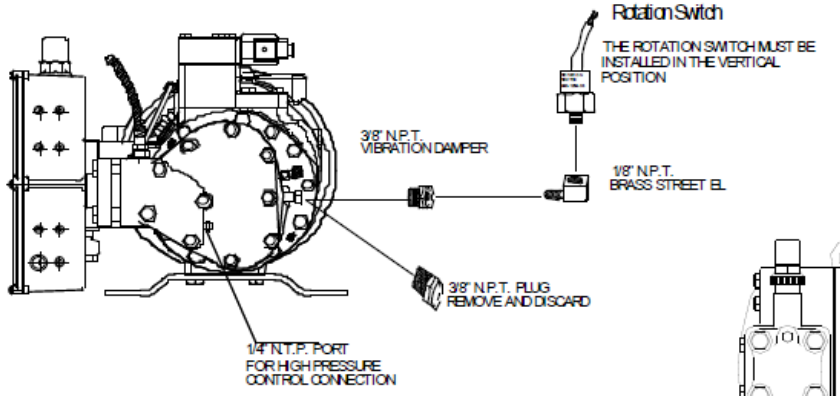


Figure 1: HS53 Front View

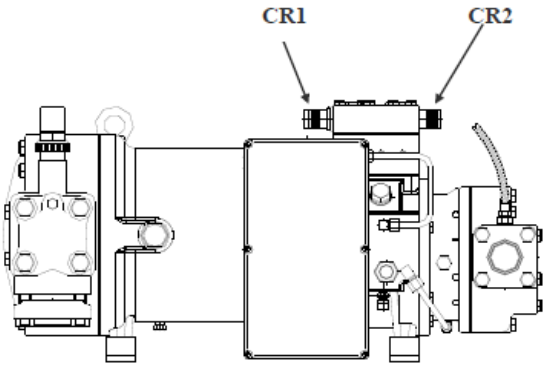


Figure 2: HS53 Side View

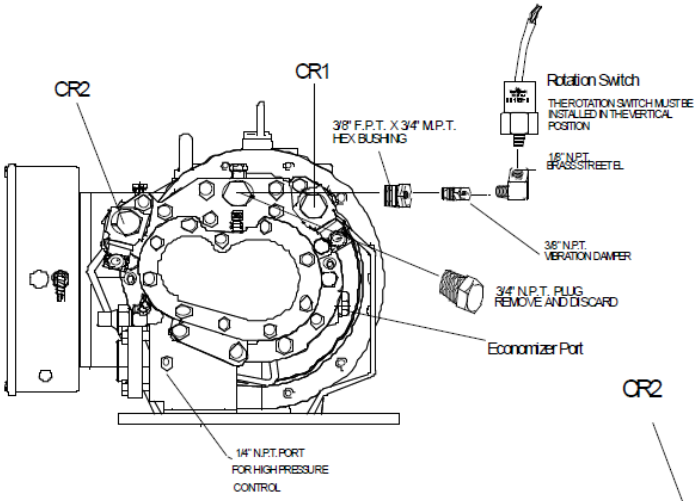


Figure 3: HS64 Front View

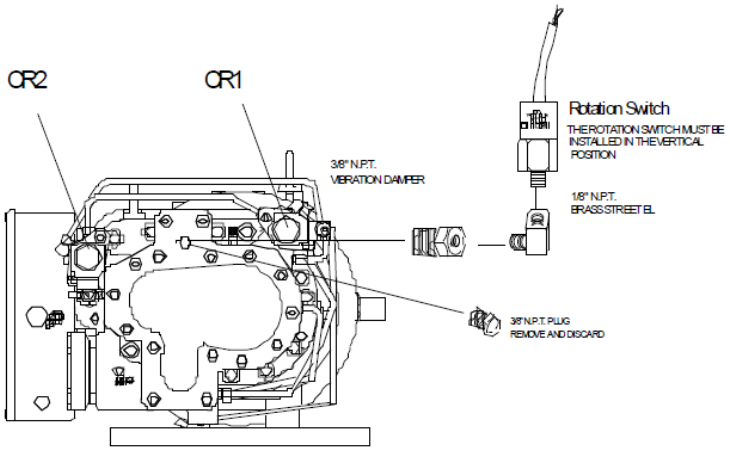


Figure 4: HS74 Front View

HS74 Mechanical rotation switch not used >2010

Appendix C
Electrical Wiring and Power Specifications

1. High Voltage

Power Voltage
- 208-480 VAC 3 ϕ
- Terminal Block – 3 positions
- Voltage Rating 600 VAC
- Current Draw, 0.5 mA Ac
- Voltages are referenced phase to phase

Control Voltage
- C1- Compressor Control (on/off)
- C2- Capacity Regulator #1 (on/off)
- C3- Capacity Regulator (on/off)
  - Voltage 120/208/240 VAC
  - Terminal Block Rated 240VAC
  - Current Draw 0.5 mA Ac

Power Input and Serial Communication
- TB1-1. RS-485 Comm2 (-)
- TB1-2. RS-485 Comm2 (+)
- TB1-3. RS-485 Comm1 (-)
- TB1-4. RS-485 Comm1 (+)

- TB1-5. AC 24VAC
- TB1-6. AC 24VAC
  - Fuse 3A
  - Operating Current 760 mA AC
  - Maximum Current 900 mA AC
  - Maximum Power requirement
    - With Jet Kool & Echelon- 22VA
    - Without Jet Kool & Echelon- 16VA
  - Terminal Block, 6-position, 240 VAC

Alarm and Control Outputs
- C4- Direct on Line Run Proof - Input, 120 VAC
- C5- Compressor Output
- C6- Part Winding Start Output
- C7- Capacity Regulator #1 Output
- C8- Capacity Regulator #2 Output
- C9- Oil Solenoid Output
- C10- Alarm Output
- C11- Economizer Output
- C12- Control Output and Alarm Relay Common – 5A fused
  - Terminal Block, 8-position, 240VAC

Appendix C
Electrical Wiring, Power Specifications and Ambient Conditions

2. Low Voltage

Input Signals (Digital)

A1- Dirty Oil Filter
A2- Oil Level
A3- Rotation
A4- Inverter Run Proof
A5- Oil Flow
A6- Remote Alarm Reset
    Max Voltage Output 5VDC
A7- Input Ground
    Max. Input Voltage Input 5VDC- from A1-A6
A8- +15VDC Sensor Supply
    Regulated +-5%, not to exceed 50mADC total

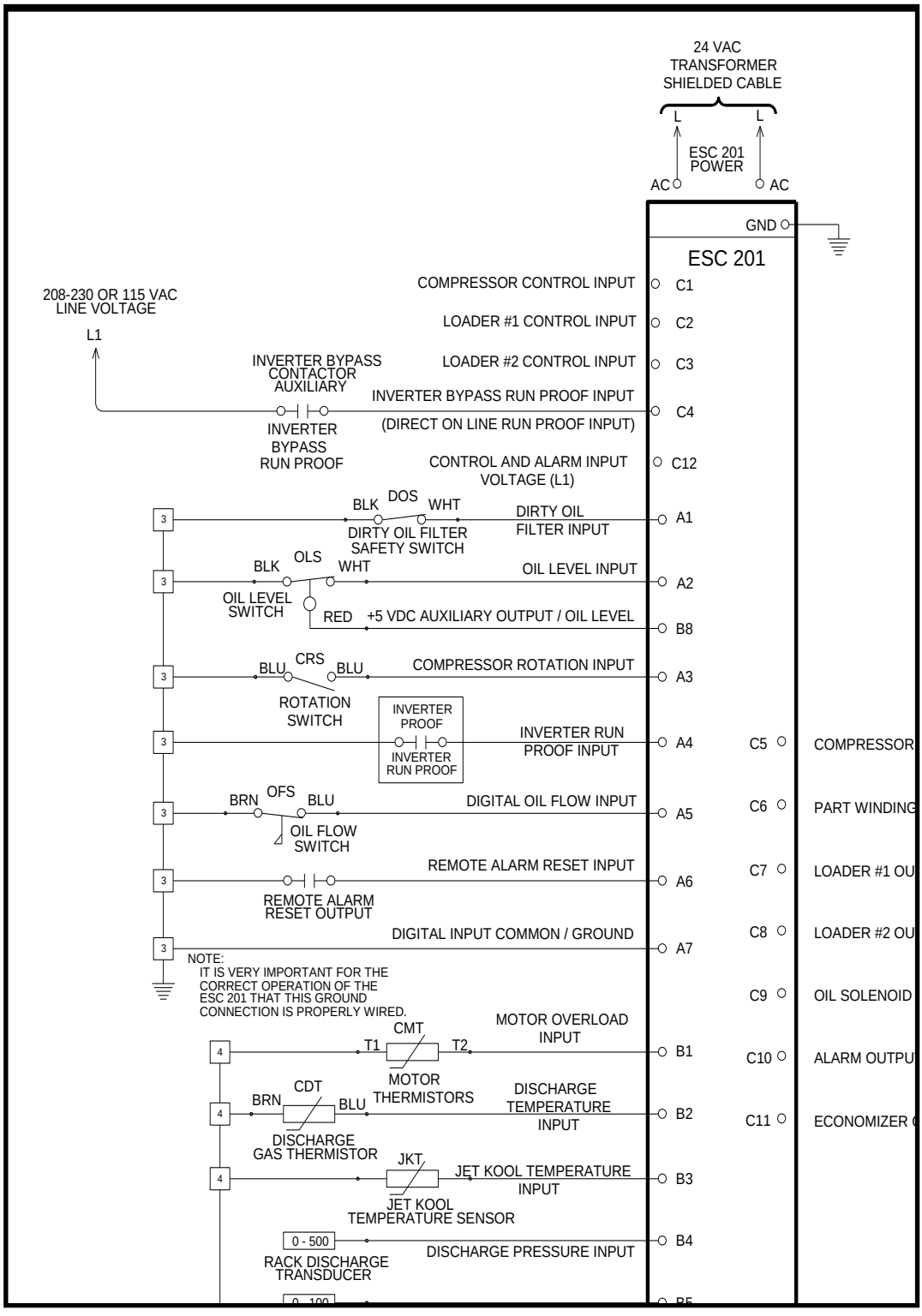
Input Signals (Analog)

B1- Motor Overload
    PTC thermistor cut-out - 4.5k Ω and cut-in -2.75KΩ
B2- Discharge Gas Temperature
    PTC 100 cut-out =1385Ω and cut-in = 1309Ω
    PT1000
B3- Jet Kool Temperature
B4- Discharge Pressure
B5- Suction Pressure
B6- Oil Flow-Analog
B7- Input Ground –Analog
B8- +5VDC Sensor Power +-5%, not to exceed 150 mA total
    Terminal Block- 8 position, 240VAC

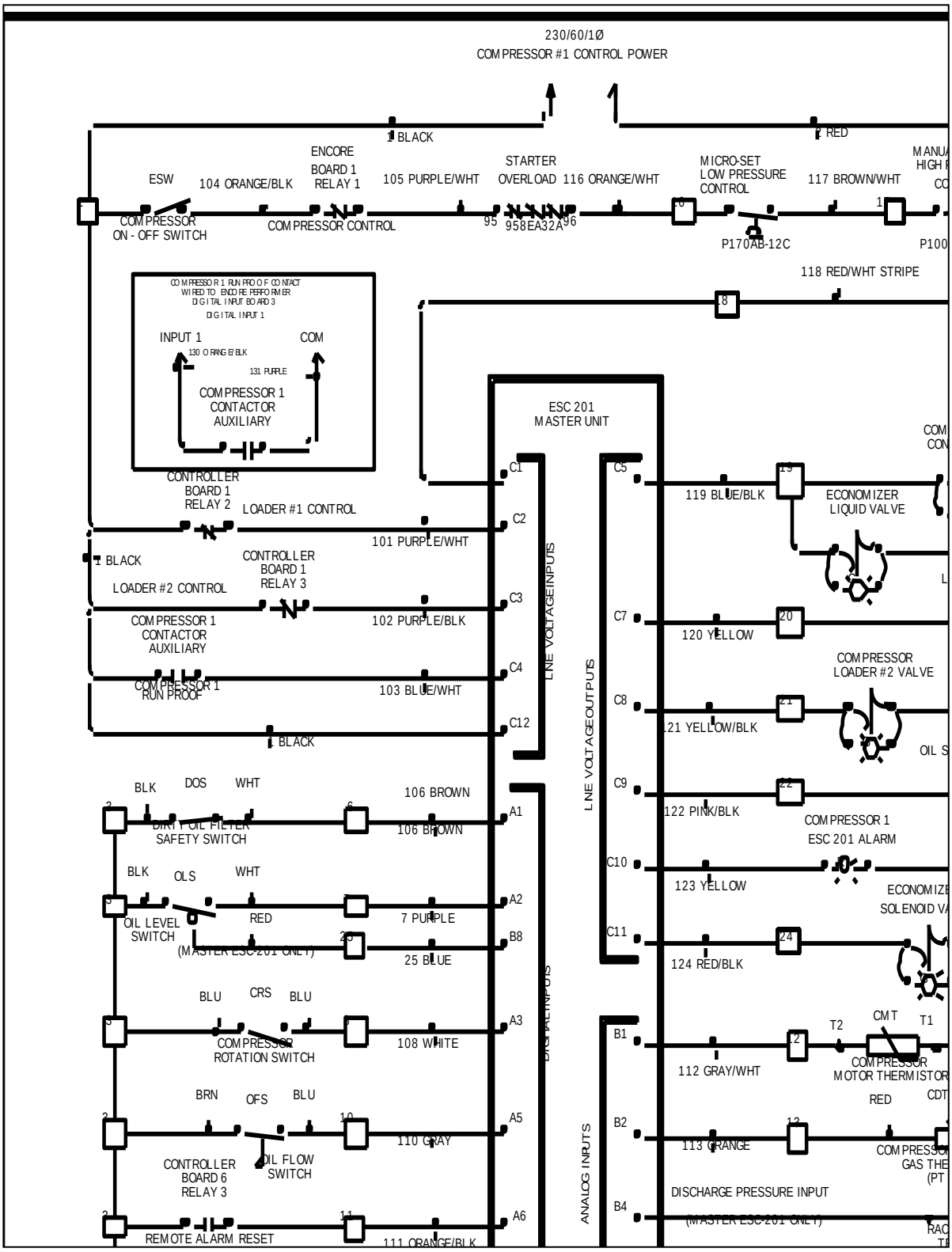
3. Ambient Conditions

Operating Temperature: 32° to 122°F (0 to 50°C).
Storage Temperature: -4° to 140°F (-20 to 60°C).
Humidity: 5 to 95% non-condensing.
Dew point: 85°F (29°C) maximum.

Appendix D
Compressor Control Diagram

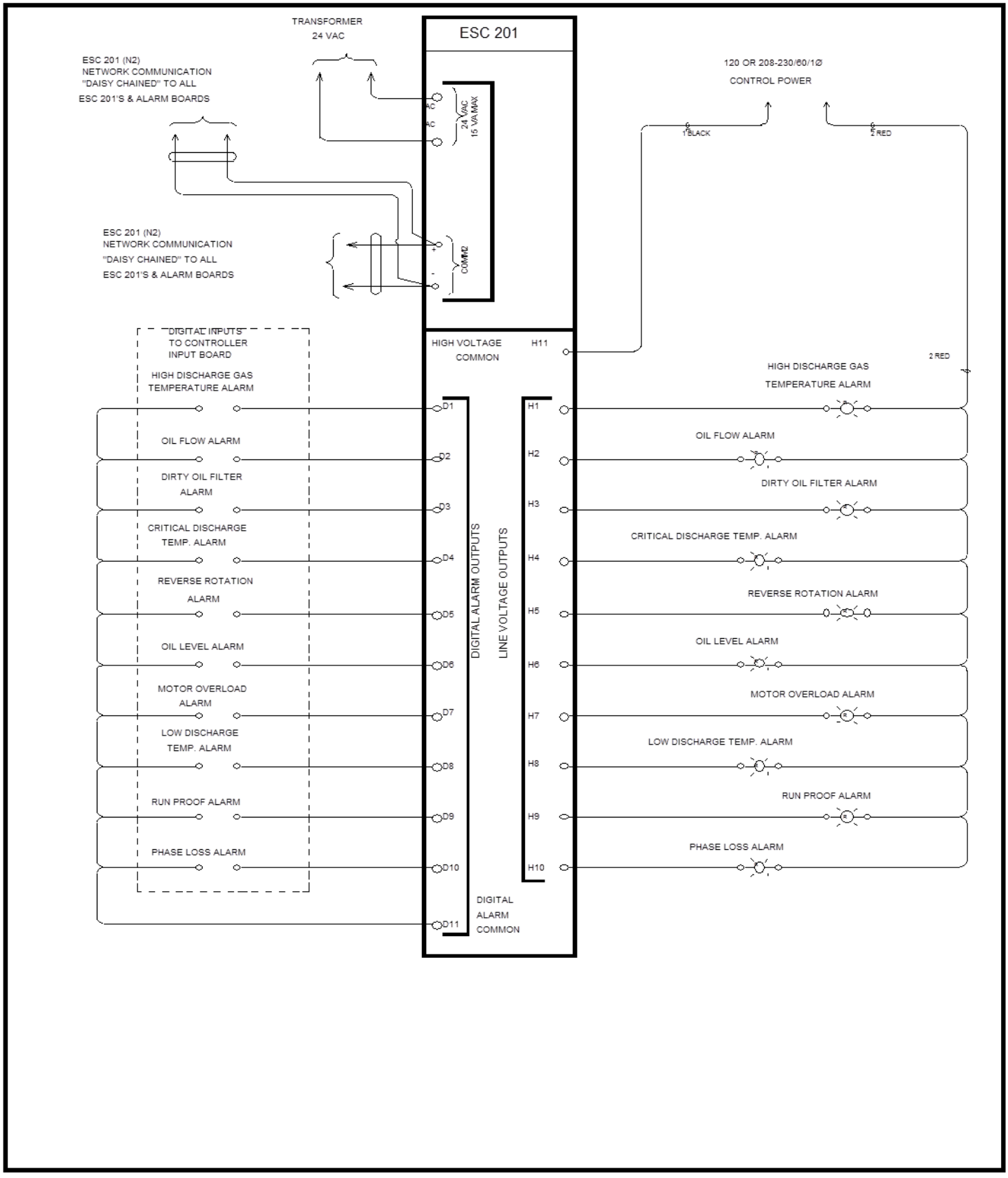


Appendix E
System Wiring Diagram



Appendix F

ESC 201 Alarm Board



Appendix G
ESC 201 Trouble Shooting Guide

Note: After each change has been made in the configuration mode that change must be saved in that section for the change to be initiated.

ESC input voltage will read 5VDC from the function terminals (A1-A6) to ground (A7) and from Terminals (B1-B6) to Ground (B7).

ESC output terminals (C5 – C11) are supplied voltage from Terminal C12. This voltage can be read from terminals (C5 – C11) to L2 when the output function is closed.

Terminal (C1- C4) is high voltage input terminals normally using control voltage as a source.

Problems	Possible Solutions
ESC will not power up.	Check for 24 VAC control power to terminals marked A/C. Check for proper electrical connections to transformer or faulty transformer. Check F2 fuse on the ESC board upper left corner. Check to insure total number of ESC 201 controls has not exceeded the transformer power limitations.
(C1) input 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.
No output power at (C4 – C11)	Check for proper input voltage at terminals (C1 & C11). Check F1 fuse at lower right corner of board.
ESC operates intermittently	Make sure ground has a good non-painted connection. Make sure all fuses are tight in the fuse holder.
F1 fuse blows when the ESC Is energized	Turn off Compressor Breaker. Check wiring of input and output points for a short. {Step #1} Disconnect (C1) control input and (C5 & C6) control output from the ESC and connect the wires 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, C5 & C6) points on the ESC. Disconnect output points (C7 to C11). Activate the compressor control circuit. If the compressor contactor closes, connect point (C7) and test this point. Test Points (C8 – C11) 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 201 are connected to the line side 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)
ESC fails after an inverter fault.	Compressor input signal (C1) remains active during inverter reset attempts. Check to insure inverter relay is not defective. Check control circuit wiring diagram to insure the inverter isolation scheme has been included. Refer to the inverter fault scheme diagram in section 6.1. (Contact factory for help with this scheme if required)
Phase rotation failure	Correct compressor rotation.
Rotation failure, but compressor Operates in correct direction.	Phase sequence of A, B, C on the Esc 201 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 201 control to align the system electrically.
Open type compressors indicate Motor overload failure.	Configure Esc 201 in the setup program for the motor overload as “Disabled”
All compressors in the same suction group start at the same time.	Check the compressor start time delays to insure they have been configured properly.
Compressor fails on phase	Check voltage at all three phases to determine if voltage exists.
Discharge temperature failure.	Check discharge temperature for out of range. High compressor super heat or insufficient oil cooling will cause this problem.
ESC 201 alarms in critical discharge temperature and shuts down the compressor	Discharge temperature has been above 200°F for more than 20 minutes. Check Oil cooling and other compressor cooling criteria.
Motor overload failure	Check motor temperature to determine if it is out of range. Read DC voltage between terminals (B1 & B7) Voltage should be stable at between 0.3 & 0 .6 VDC. Thermistor trip point is 2.3 VDC. Make sure all Thermistor connection at the compressor are tight on the spade connectors. Check the ESC setup program for proper configurations.
Dirty oil filter failure	If dirty filter alarms on initial starting, depress reset button to initialize the switch. This procedure is required one time after an oil change or possible initial start. Switch opens with oil pressure differential across the filter of 25 PSI. Check wiring of switch for N/C operation when clean.

Oil Flow Failure	Check for low oil conditions: such as dirty oil filter, liquid refrigerant present in the oil system, blocked oil system. Check to make sure oil line blank off plate has been removed from compressor oil fitting. Check to make sure the oil flow switch has been wired properly to the Esc 201. Check to make sure the proper differential pressure exists between discharge and suction to flow the proper amount of oil to the compressor.
Oil level failure	Check oil level in separator for proper level. Check to see if the optical sensor is receiving a 5VDC signal. Check for loose wires form sensor to the ESC.
Compressor fails on run proof	Check to insure run proofs are connected to the proper auxiliary contacts. Check F1 fuse to make sure it is not blown. Make sure run proofs signal on direct on line is connected to C4 with 115 –120 VAC. Make sure the direct–on-line and the inverter run proof are being energize together.
Economizer Solenoid Valve Shutdown	Economizer superheat below minimum set point. ESC 201 has shut down the ECO solenoid to protect compressor against potential bearing damage. “LOW ECO TEMP.” is displayed by ESC 201.
ESC alarm “Low Discharge Temperature”	Suction superheat extremely low causing a low discharge temperature condition. Adjust evaporator expansion valves.

Appendix H

ESC 200 upgrade to ESC 201

The ESC 200 screw controller can be replaced and upgraded to the ESC 201 with modifications. To replace an ESC 200 and replace the control with an ESC 201, follow these steps.

17.10 Removing the ESC 200

1. Unplug all the terminal plugs on the ESC 200.
2. Mark the three phase wires to be placed in the same position on the ESC 201.
3. Disconnect the three phase wires.
4. Remove the ESC 200 from the snap track.

17.20 Installing the ESC 201

1. Place the ESC 201 in the snap track, position the control close to the old terminal plugs.
2. Connect the phase wires in the same position as the ESC200.
3. Remove the control wires from the ESC 200 terminal plugs and wire them on the new terminal connections of the ESC201 per the wiring schematics.
4. **Important:** The ESC 201 requires a 24VAC transformer **without** a center tap ground connection.
    a. The power requirements will be different depending on the controls and operation with or without Jet Kool.
    b. Transformer without Jet Kool and Echelon: 24VAC. 16VA.
    c. Transformer with Jet Kool and Echelon: 24VAC, 22VA.
    d. If more than one each of the ESC200 and ESC201 controls are both used on the same equipment, they will require different power supplies.

17.30 ESC 200 Alarm Function to ESC 201 Alarm Boards

1. The ESC 201 has a provision for one high voltage alarm output to illuminate a panel light. If the alarm outputs from the ESC 200 are required by the customer, an ESC 201 alarm board can be purchased to display all the existing alarms lights.

2. If the system requires the use of only one alarm panel light, the present alarm lights can be eliminated by using the alarm output on terminal C10 of the ESC 201, calling it a “General Alarm”, illuminating one of the existing lights to indicate an alarm has occurred. The alarm can then be read on the ESC 201 display.

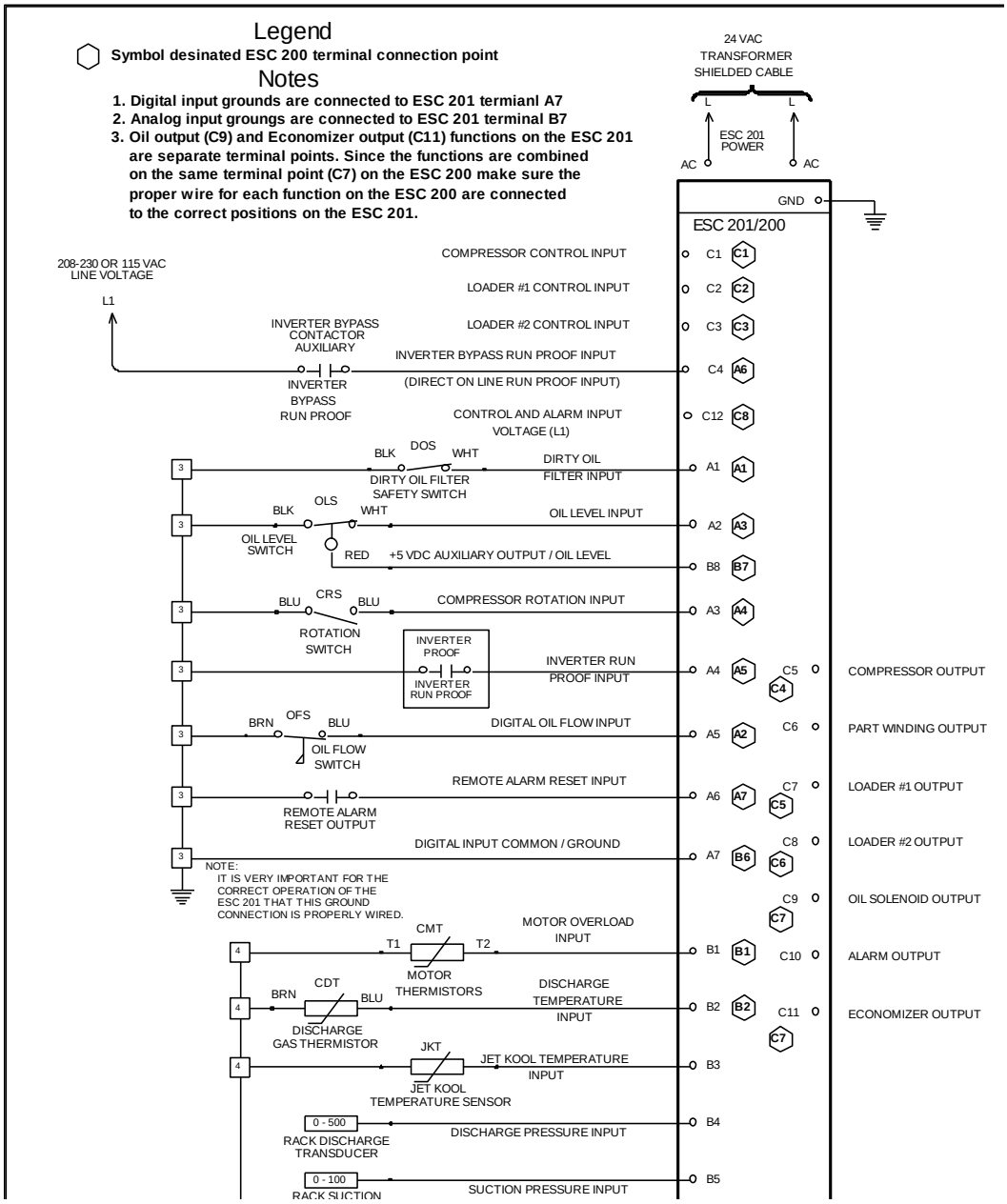
3. Installation of the ESC 201 alarm board will require additional panel space of approximately 6” X 8”. Each alarm board requires 15VA power at 24VAC, as well as, shield cable connections between the comm. 2 networks of the alarm board and the ESC 201. The board provides for 10 high voltage and 10 digital outputs to operate panel lights and low voltage signals to the rack controller for remote alarms.

4. Listed below are the terminal relationships from the high voltage terminals on the ESC 200 to the high voltage terminals on the Esc 201 alarm board.

Description	ESC 200 Outputs	ESC 201 Outputs
1. Dirty Oil Filter Alarm	D1	H1
2. Motor Winding Overload Alarm	D2	H2
3. Oil Flow Alarm	D3	H3
4. Oil Level Alarm	D4	H4
5. High Discharge Gas Alarm	D5	H5
6. Phase Loss Alarm	D6	H6
7. Rotation / Wrong Sequence	D7	H7
8. Run Proof / By-Pass Alarm	D8	H8
9. Over Discharge Limit	N/A	H9
10. Low Discharge Temperature	N/A	H10

5. When wiring alarm boards please refer to section 13.0 “alarm Board I.D. and wiring”. Appendix F, “ESC 201 alarm board wiring” can also be used as a guide.

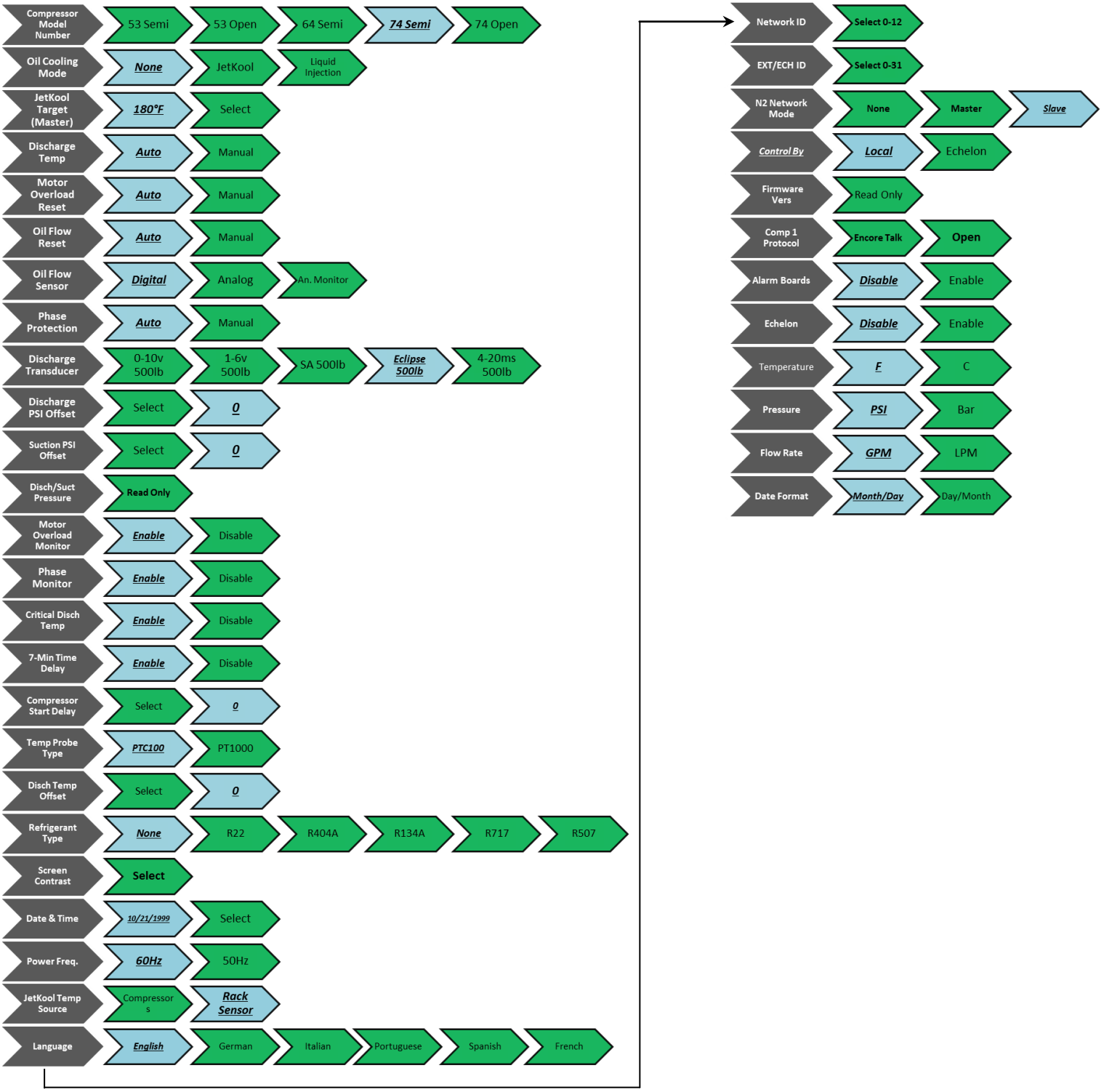
ESC 200 Conversion to ESC 201 Wiring



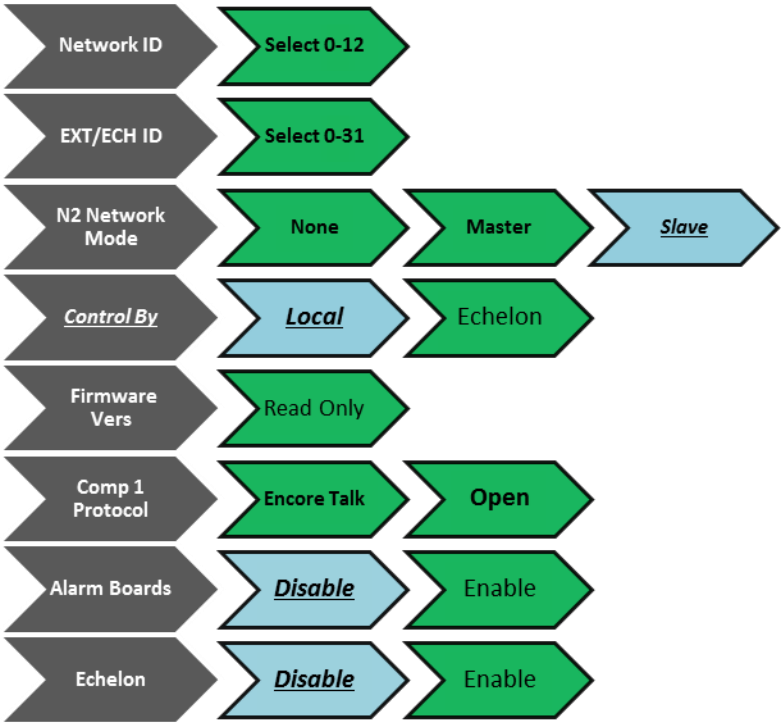
Appendix I

Programming Flowchart / Main Menu:

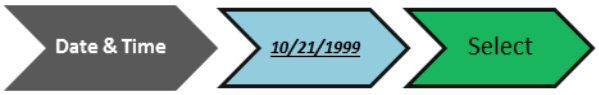
All underlined bold and blue boxes below are the Default ESC201 pre-programmed functions.



Network Short Cut Menu:



Time Short Cut Menu:



Language Short Cut Menu: