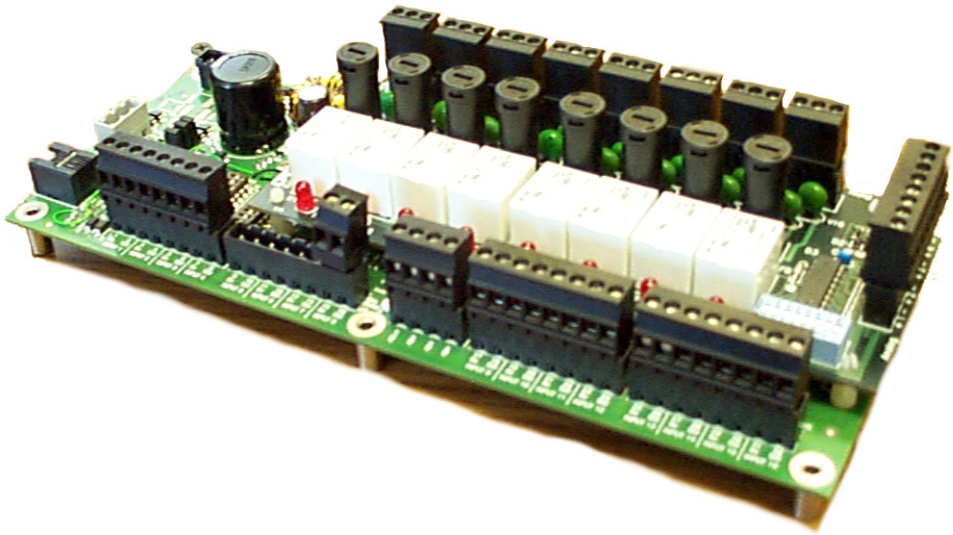
026-1712 Rev 2 09-03-04

MultiFlex PAK Compressor/ Condenser Control Board User's Guide



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READ ALL INSTRUCTIONS CAREFULLY

If the equipment is not used in the manner specified by the manufacturer, the protection provided by the equipment may be impaired.

SAVE THIS INSTRUCTION MANUAL

This instruction manual contains important operating instructions for the MultiFlex PAK boards.

Table of Contents

1 Overview of the Multi-Flex Product Line

The MultiFlex line of control system boards provide a wide variety of input, output, and smart control solutions, all of which are based on a single universal hardware platform. The board design uses flash-uploadable firmware and plug-in expansion boards to configure the base platform board and apply it for use as an input board, relay output board, analog output board, or a combination I/O board.

1.1. MultiFlex PAK

The PAK is a distributed pack (rack) controller that controls compressors and condenser fans. The PAK can control up to 8 compressor groups containing up to 16 compressors. The compressor control strategy is either Fixed Steps with up to 20 fixed combinations of compressor groups, or an alternate Cyclic strategy that distributes compressor activations, with setpoint/deadband using ON and OFF delays.

The PAK can control up to 4 condenser fan groups containing up to 8 total condenser fans. The PAK condenser control strategy is sequential TD control with setpoint/deadband using ON and OFF delays.

The PAK has a compressor/condenser interlock feature that will override TD control and force the condenser fans to stage off using the TD control OFF delay when all compressors are off. This feature can be disabled with an Enable/Disable setpoint or when the discharge pressure is above a configurable setpoint.

1.1.1. Hardware

The MultiFlex PAK boards consist of two circuit boards: a bottom layer with 16 combination digital/analog inputs, and a plug-in top layer which contains a combination of 8 relay outputs and 4 digital DC voltage outputs.

The analog outputs on the Multiflex PAK drive solid state relays to control the fan stages. The relays control the compressor groups.

The communication interface is RS485 I/O using the Standard Extended Address Form for CPC Distributed Controllers. Currently, the PAK is designed to interface with the CPC Einstein controller.

2 Mounting and Powering

The MultiFlex boards are usually installed by the refrigeration or building equipment manufacturer. Therefore, the installer need only make the necessary connections between the boards and the site controller(s).

In some instances, an installer may be required to mount an I/O board. There are no restrictions on the location of these boards; however, for ease of network configuration, it is recommended that the boards be located adjacent to the Einstein. I/O boards may be mounted without an enclosure, but they should be mounted in a location that is not easily accessible to avoid tampering or damage.

2.1. Snap-Track Installation

MultiFlex boards not supplied in a custom panel or other enclosure are supplied with a snap-track for easy installation. The insulation sheet and I/O board must be removed from the track before the track is mounted. The snap-track is mounted using the 0.1875” mounting slots. ***Figure 2-1*** shows this installation procedure.

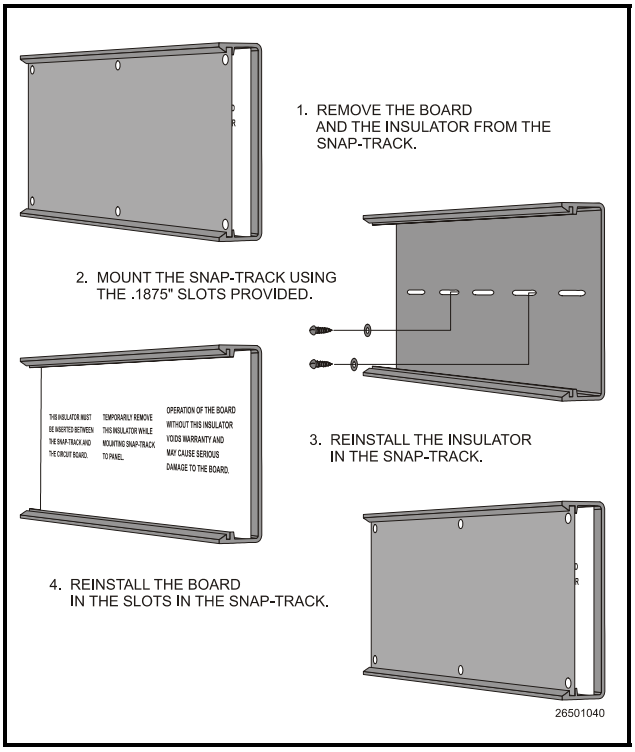

Figure 2-1 *- MultiFlex Snap-Track Mounting*

Figure 2-2 provides mounting dimensions for the MultiFlex board.

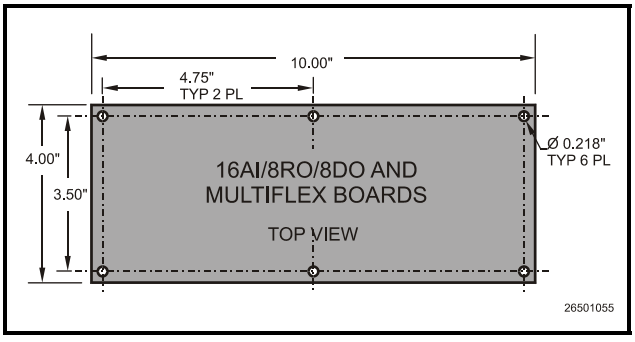

Figure 2-2 *- MultiFlex Board Dimensions*

2.2. The Plug-In Output Board

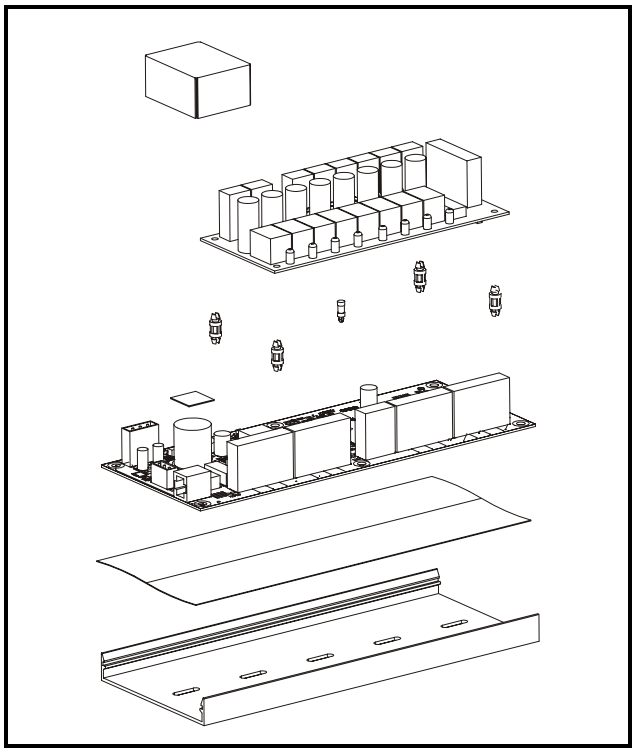

Figure 2-3 *- Exploded View -- MultiFlex Combination I/O Board*

All MultiFlex boards except the MultiFlex 16 have output sub-boards that plug in to the top of the base board. These boards are shipped with the output board pre-installed on the board using stand-offs, so no additional hardware setup should be necessary.

The additional board makes the MultiFlex combination boards considerably taller than the MultiFlex 16 and all previous-generation CPC I/O boards. If you will be mounting these boards in an enclosure, the board will need at least 2.5" of clearance between the base board and the panel door.

2.3. Powering the MultiFlex

All models of MultiFlex require a 24VAC Class 2 input power source. The MultiFlex 16 requires the power source to be ***center-tapped.*** All other models do not use the center tap.

CPC supplies a wide variety of 24VAC transformers with varying sizes and either with or without center taps. ***Table 2-1*** shows the transformer sizes and whether they are center-tapped or non-center-tapped.

Xformer P/N	VA Rating	Primary Voltage	Center Tap?
640-0041	50 VA	110 VAC	No
640-0042	50 VA	220 VAC	No
640-0056	56 VA	Multi-tap (120/208/240 VAC)	Yes
640-0050	75 VA	110 VAC	No
640-0045	75 VA	220 VAC	No
640-0080	80 VA	Multi-tap (120/208/240 VAC)	Yes

Table 2-1 *- Transformers Compatible with MultiFlex Board*

2.3.1. Choosing Transformer Sizes

In most site installations, a single transformer will power multiple devices. Choose a transformer with a VA rating large enough to power all devices that will be attached to it. ***Table 2-2*** gives the VA ratings of the MultiFlex board products. Refer to your site controller's manual for VA ratings of the other I/O boards that may be powered by one of these transformers.

Unit	VA	VAC	Center tapped?
MultiFlex PAK, CUB, RTU, and RCB	15	24	NO
MultiFlex 16	6	24	Yes
MultiFlex 88, 88AO, 168, 168AO and 168DO	15	24	NO

Table 2-2 *- Device Power Requirements*

2.3.2. MultiFlex Combination Input/ Output Board Power Wiring

The MultiFlex PAK boards do not use a center tap. Instead, the 0V terminal on the board should be connected to a separate Earth ground.

Important! The rules that must be followed when connecting a MultiFlex PAK board to a transformer are different depending on whether you have a "new style" MultiFlex board with an isolated power supply (all MultiFlex boards shipped after November 1, 2002) or an "old style" MultiFlex board (all MultiFlex boards shipped before November 1, 2002).

A new-style MultiFlex PAK board has a green power LED located next to the 24VAC connection terminal in the upper right corner of the circuit board (see ***Figure 2-4*** for reference).

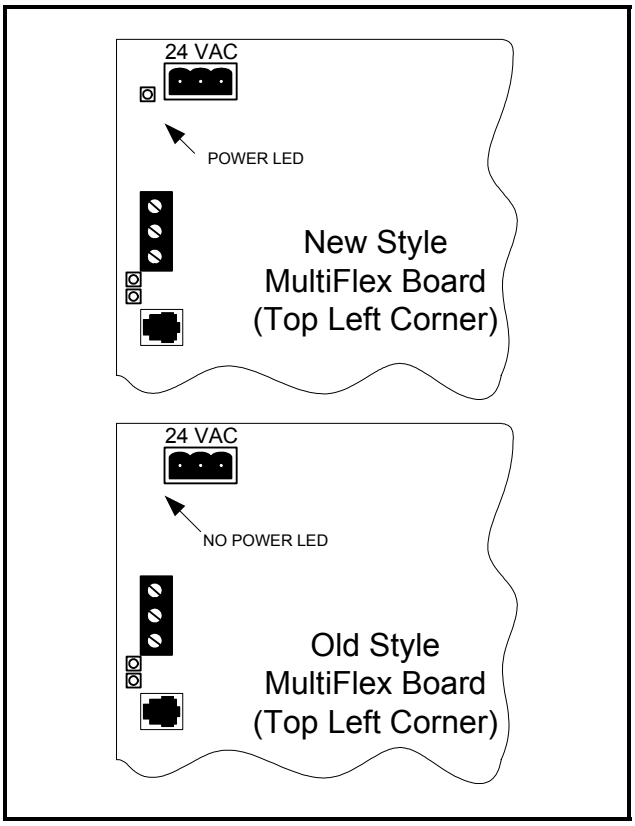

Figure 2-4 *- New-Style vs. Old-Style MultiFlex Board*

If there is a power LED next to the connector, your MultiFlex is a **new-style MultiFlex --** refer to **Section 2.3.2.1.,** *New-Style MultiFlex Combination I/O Boards (with Isolated Power Supply)* for power wiring instructions.

If there is no power LED next to the connector, your MultiFlex is an **old-style MultiFlex** -- refer to **Section 2.3.2.2.,** *Old-Style MultiFlex Combination I/O Boards (No Isolated Power Supply)* for power wiring instructions.

2.3.2.1. New-Style MultiFlex Combination I/O Boards (with Isolated Power Supply)

The new-style MultiFlex board can be connected to any of the center-tapped transformers mentioned in ***Table 2-2***, provided the 0V terminal of the board is connected to an Earth ground.

A center-tapped transformer may power both center-tapped and non-center-tapped boards at the same time, as long as **none of the non-center-tapped MultiFlex boards are old-style MultiFlex boards.** If an old-style MultiFlex shares the same center-tapped transformer as a device that uses the center tap, boards on the network will be damaged. ***Figure 2-5*** shows how to wire a non-center tapped device to a center-tapped transformer.

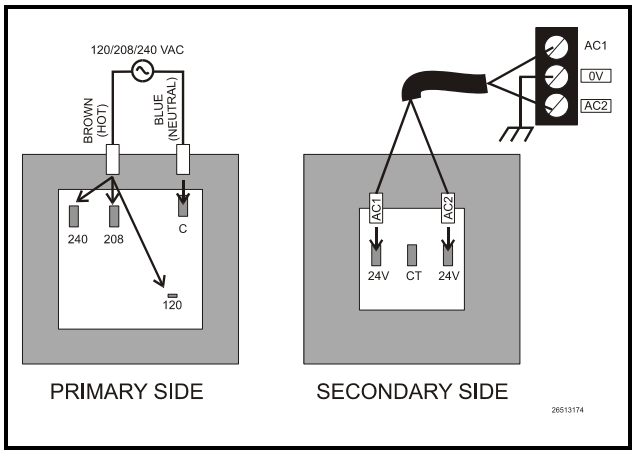

Figure 2-5 *- Wiring Non-Center Tapped MultiFlex Boards to Transformers With a Center Tap*

In addition, the MultiFlex combination boards can be powered by one of the 50VA or 75VA non-center-tapped transformers listed in Table 2-1 on page 3. ***Figure 2-6*** shows how to wire the transformers to the MultiFlex boards.

You may also tie one side of the secondary (but not BOTH sides) or the center tap to an earth ground, provided none of the boards powered by the same transformer are old-style MultiFlex boards (see **Section 2.3.2.2.**).

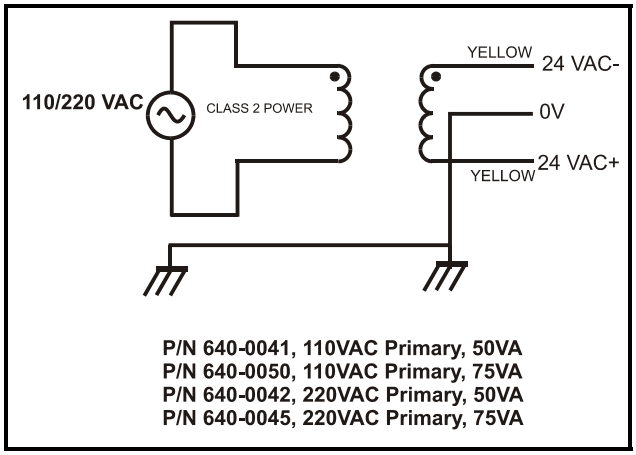

Figure 2-6 *- Non-Center-Tapped Transformer Wiring*

All wire connections to earth ground should be less than six (6) inches long and use a wire gauge of at least 14AWG.

2.3.2.2. Old-Style MultiFlex Combination I/O Boards (No Isolated Power Supply)

Like the new-style MultiFlex board, the old-style MultiFlex board can be connected to any of the center-tapped transformers mentioned in ***Table 2-2***, provided you follow the following three rules:

Rule 1: Ground the 0V terminal on the old-style MultiFlex board to an Earth ground.

Do not connect the center tap of the transformer to the 0V terminal.

Rule 2: Do not power an old-style MultiFlex non-center-tapped board with a transformer that is also powering a center-tapped device.

This means you cannot connect an old-style MultiFlex non-center tapped board to a transformer that is powering a MultiFlex 16, 16AI, 8RO, 4AO, 8DO, a Gateway board, or any previous generation CPC board that uses center-tapped power. Doing so will destroy the MultiFlex board.

Rule 3: The secondary of the transformer must not be grounded on any side.

Verify that neither side of the transformer secondary is connected to earth ground before powering the old-style MultiFlex board. A grounded secondary will damage the MultiFlex board.

In addition, the old-style MultiFlex combination boards can be powered by one of the 50VA or 75VA non-center-tapped transformers listed in Table 2-1 on page 3. ***Figure 2-6*** shows how to wire the transformers to the MultiFlex boards.

2.3.3. Wire Types and Maximum Distances

For powering I/O boards, use only the listed wire types from ***Table 2-3***. Three-conductor non-shielded cables are the recommended wire for connecting between the center tapped transformer and the I/O boards. Shielded cable should not be used for power wiring. The center tap should be wired with the third conductor to earth ground at the transformer.

Each MultiFlex board should have its 0V terminal taken to a short, solid earth ground.

Power Wiring Types	
14 AWG	Belden 9495 or equivalent
18 AWG	Belden 9493 or equivalent

Table 2-3 - *Power Wiring Types*

The wire length from the transformer and the number of boards connected to the same wire determines the type wire gauge used. In most cases, the distance between the I/O boards and the transformer that supplies power to them is not enough to be concerned with. But it is very important not exceed this maximum wire length or the boards will malfunction.

Use these formulas to determine if the wire gauge you are using fits within specification:

14 AWG:
Feet = 0.40/(VA/24) x 0.005
18 AWG:
Feet = 0.40/(VA/24) x 0.013
(VA is the total VA rating of the I/O boards)
For example, if you had an 80 VA load:
14 AWG: 24 ft. (rounded down)
18 AWG: 9 ft.

Figure 2-7 - *Power Wire Lengths*

3 The I/O Network

All MultiFlex PAK boards and controllers use an RS485 network connection to communicate with Einstein site controllers. Technicians who are familiar with CPC's previous generation 16AI, 8IO, and ARTC boards will find the network setup procedure for the MultiFlex boards to be very much the same.

3.1. Wiring Types

CPC specs Belden #8641 shielded twisted pair cables for use as I/O network wiring (or Belden #82641 and Belden #88641 for plenum installations).

If the recommended cable is not available in your area, be sure the wiring meets or exceeds the following specs:

Shielded?	Yes
Conductor Type	Twisted Pair
Gauge	18 - 24 AWG
Capacitance between signal wires	31 pF/ft or less
Capacitance between signal and shield	59 pF/ft or less
Nominal Impedance	120Ω±50Ω

Table 3-1 *- RS485 I/O Network Wiring Specifications*

3.1.1. Daisy Chains

The RS485 Input/Output (I/O) network is wired in a daisy-chain configuration. In a daisy chain, boards are wired together in series with no branches or "star configurations," and the network is terminated at either end of the daisy-chain.

A diagram of this network arrangement is shown in ***Figure 3-1***.

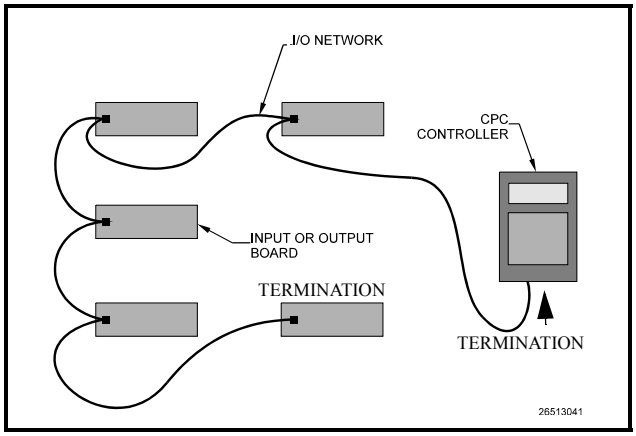

Figure 3-1 *- I/O Network Configurations*

3.1.2. Network ID Numbers

Each device on an RS485 segment has a network dip switch that must be used to assign the board a unique **network ID number**.

The network ID number makes a board unique from other boards on the network of the same type. This allows the site controller to find it and communicate with it.

Boards of the same type should be numbered in sequence, starting with one and continuing with two, three, and so forth.

3.1.2.1. Numbering the MultiFlex PAK

The network ID on the MultiFlex PAK is set using the first five dip switches on dip switch bank S3. Refer to ***Figure 3-2*** for dip switch setting instructions.

NOTE: The MultiFlex PAK may only be numbered up to 10, since Einstein will only speak to a maximum of 10 PAK boards. A PAK numbered above 10 will be ignored.

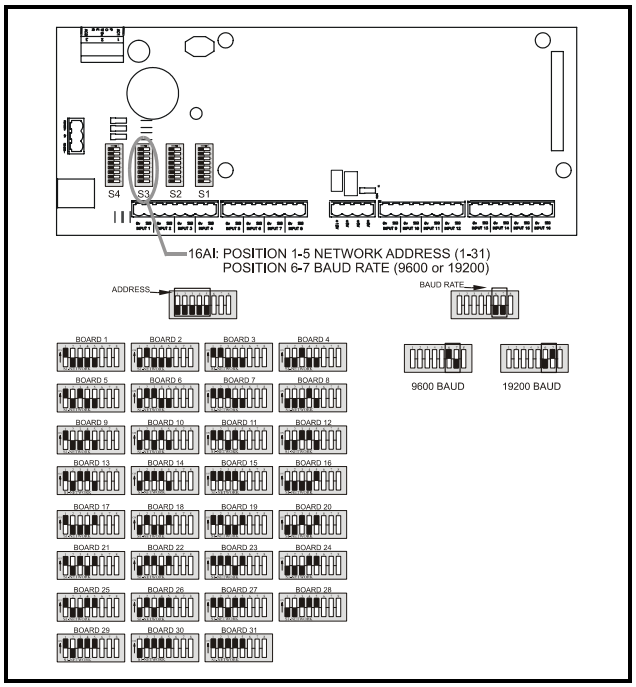

Figure 3-2 *- 16 Network ID and Baud Rate Switches*

3.1.3. Setting the Baud Rate

All I/O boards have dip switches that determine the baud rate at which they communicate. Currently, the baud rate dip switch in network components may be set at either 9600 or 19200 baud. Either may be used -- refer to your site controller's user manual for the baud rate recommendation (currently 9600 baud for both REFLECS and Einstein controllers).

On all MultiFlex boards, switches 6 and 7 on S3 are used to set the baud rate. To communicate at 9600 baud, set switch #6 UP and #7 DOWN. For 19200 baud, set switch #6 DOWN and #7 UP. Refer to ***Figure 3-2*** for a visual look at how the switches must be set.

3.1.4. Setting the Terminating Resistance Jumpers

All MultiFlex boards and other RS485 devices have a set of terminating resistance jumpers (one jumper for each wire lead). These jumpers are labeled JP2, JP3, and JP4 on the MultiFlex board.

The purpose of the jumpers is to indicate the two ends, or termination points, of the segment. On a daisy chain, one device at the beginning and one device on the end must be terminated. On the MultiFlex, this is done by placing all three termination jumpers in the OUT (toward the left edge of the board) position. To unterminate a MultiFlex, these jumpers must be set to the IN (toward the center of the board) position. ***Figure 3-3*** shows the termination jumper settings for all MultiFlex boards.

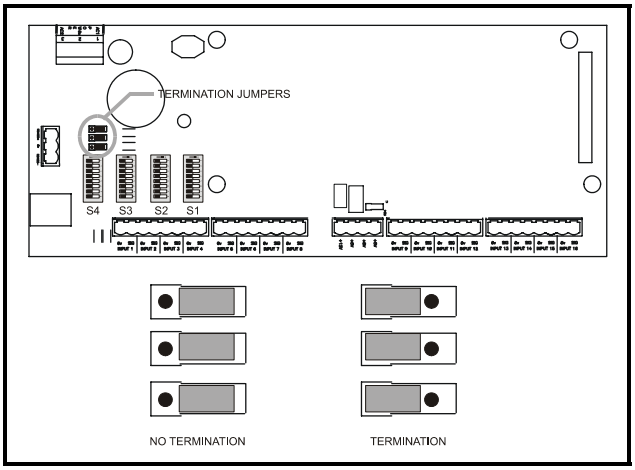

Figure 3-3 *- I/O Network Termination Jumper Settings*

4 I/O Board Input and Output Setup

4.1. The Inputs

The inputs on a MultiFlex board are compatible with a wide range of analog and digital sensors and transducers. In general, the inputs are capable of reading analog voltage signals in the range of 0V to +7VDC and dry-contact (no outside voltage) digital sensors and switches.

The specific types of input devices that must be used with MultiFlex is largely dependent on the site controller MultiFlex is connected to; refer to the site controller's user's manual for a full list of compatible sensors and specific sensor wiring instructions.

4.1.1. The PAK Default Input Assignments

Analog Input #	Definition
1	Suction Pressure
2	Discharge/Condensing Pressure
3	Ambient 1 Temperature
4	Ambient 2 Temperature
5	Suction Return Gas Temp
6	Compressor Amps
7	Condenser Amps
8	Liquid Level
9	Compressor #1 Discharge Temp
10	Compressor #2 Discharge Temp
11	Compressor #3 Discharge Temp
12	Compressor #4 Discharge Temp
13	Compressor #5 Discharge Temp
14	Compressor #6 Discharge Temp
15	Compressor #7 Discharge Temp
16	Compressor #8 Discharge Temp

Table 4-1 *- MultiFlex PAK Default Inputs*

4.1.2. Connecting Sensors to Input Boards

Wiring a sensor to the input points on a MultiFlex board requires three steps:

1. Connect the sensor's signal wires to the two terminals of an input point.
2. Set the input type dip switch that corresponds to the point being connected.
3. If necessary, connect the sensor to one of the 5V or 12V power terminals.

4.1.2.1. Wiring

An input point on a MultiFlex board consists of two terminals, as shown in ***Figure 4-1***. One of these terminals, labeled "SIG," reads the signal from the sensor, while the other, labeled "0v" is where the sensor's ground and/or cable shield wire is connected.

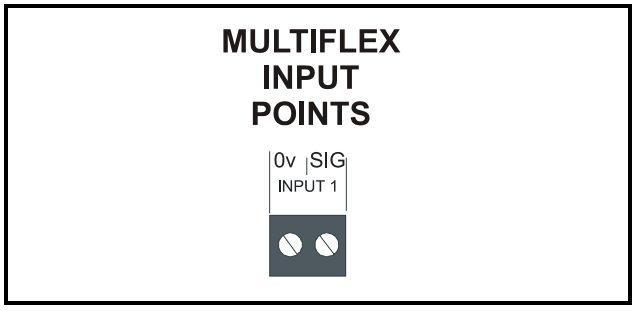

Figure 4-1 *- Input Board Points*

The connectors for points 9-12 and 13-16 on the old board are already correctly oriented, and may be plugged directly into the new MultiFlex without an adapter cable.

4.1.2.2. Sensor Wiring Types

Specific wiring types are required for each type of sensor used with Einstein or RMCC.

<u>All Analog Temperature Sensors and Air Flow Sensors</u>

Temperature and air flow sensors are to be wired with shielded, 2 conductor, at least 22 GA wire (Belden # 8761 or equivalent).

<u>All Pressure Transducers, Humidity Sensors, and Refrigeration Transducers</u>

Pressure and refrigeration transducers and humidity sensors are to be wired with shielded, 3 conductor, at least 22 GA wire (Belden #8771 or equivalent).

<u>Dew Point and Light Level Sensors</u>

These sensors are to be wired with shielded, 4 conductor at least 22 GA wire (Belden # 8729 or equivalent).

4.1.2.3. Input Type Dip Switches

Each MultiFlex input point has an input type dip switch that must be set. Input type dip switches are located in the switch banks labeled S1 and S2.

The input type dip switch tells the input board whether or not the sensor connected to the point is a resistive type sensor. Generally, if the sensor or transducer supplies its own voltage signal to the point, the dip switch should be set to the LEFT (OFF) position. If the sensor uses variable resistance and requires voltage to be supplied to it from the input point, set the dip switch to the RIGHT (ON) position. Dip switches for unused points should be set to the RIGHT (ON) position.

The exception to this rule is for CPC's 5VDC pressure transducers -- though they supply their own voltage signal, the dip switch MUST be set to the RIGHT (ON) position.

4.1.3. Power Connection

If power is needed to operate the sensor, four points are provided on the MultiFlex board that supply DC power: one +12VDC point, and three +5VDC points. See ***Figure 4-2*** for the location of these points.

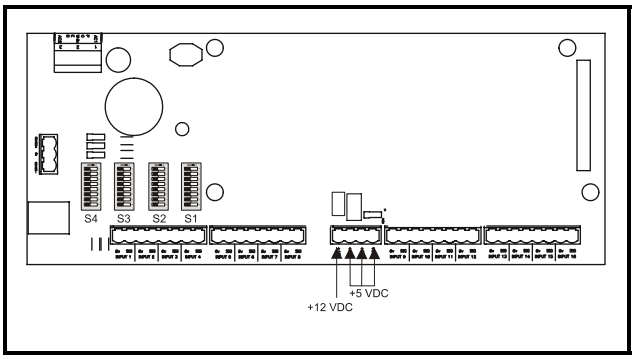

Figure 4-2 *- Input Board Power Sources*

4.1.3.1. Current Ratings for On-Board Power Sources

The maximum current that may be drawn from the +12VDC terminal is 100 milliamps. The maximum current that can be drawn from all three +5VDC terminals COMBINED is 50 milliamps.

4.1.3.2. Powering Sensors Requiring 24VAC Off the Power Transformer

Some sensors that requires 24VAC can be powered off the MultiFlex's own 24VAC power connection. To connect to the 24VAC power source, connect the sensor's power wires to terminals AC1 and AC2.

This can only be done with sensors that keep the 24VAC signal isolated from its DC output signal (such as CPC's Dew Point Probe). If the output signal is not isolated from the 24VAC input, you must use a separate transformer.

4.1.4. Sensor Types for MultiFlex Input Points

Because different controllers may be compatible with different sensor types, this manual cannot list all sensor types and how to wire them to a MultiFlex input point. Refer to your site controller's documentation for sensor wiring information.

4.1.5. Compressor Run Proof Wiring

Because of the limited number of inputs on the MultiFlex PAK board, the PAK does not have separate inputs that can directly read the states of fail-safe devices such as oil fail sensors, low pressure switches, and high pressure switches. Compressor run proofing is achieved by wiring the compressor contactor and a 4750-ohm resistor in parallel with the discharge temperature point for each compressor, as shown in ***Figure 4-3***.

By measuring the change in voltage that occurs when the compressor contactor closes or opens, the MultiFlex PAK is able to detect when the compressor fails to activate or is shut off by a safety device such as an oil failure. The PAK may then perform the necessary actions to automatically reset the failure, and report proof fail alarms to the site controller.

When wired correctly, the PAK will automatically offset the discharge temperature reading based on the state of the compressor contactor. As a result, the discharge temperature reading will remain accurate regardless of the state of the compressor contactor.

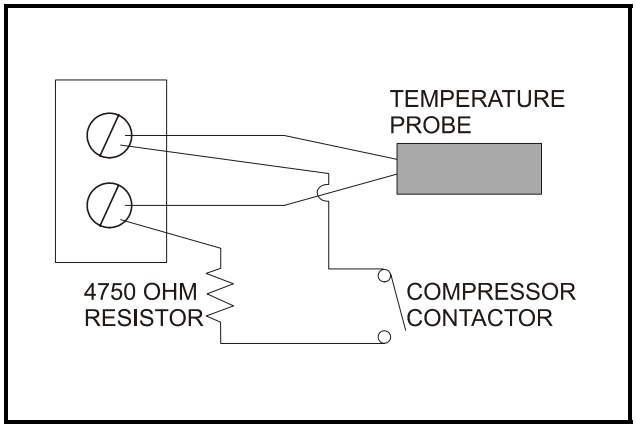

Figure 4-3 *- MultiFlex PAK Discharge Temp Point Proof Wiring*

4.2. The Relay Outputs

4.2.1. The PAK Default Output Assignments

Analog Output #	Definition
1	Compressor 1 ON/OFF
2	Compressor 2 ON/OFF
3	Compressor 3 ON/OFF
4	Compressor 4 ON/OFF
5	Compressor 5 ON/OFF
6	Compressor 6 ON/OFF
7	Compressor 7 ON/OFF
8	Compressor 8 ON/OFF

Table 4-2 *- MultiFlex PAK Default Outputs*

4.2.2. Wiring

The MultiFlex PAK boards have Form C relay contacts. ***Figure 4-4*** shows how to wire the three-terminal Form C contact.

One wire of the two-wire connection should always be connected to the middle terminal. The second wire must either be connected to the N.C. terminal (if you want the path to be closed when the relay is de-energized) or the N.O. terminal (if you want the path to be open during power failure).

The contacts you choose also affect what the board's fail-safe dip switch will need to be set to for proper operation. Refer to ***Table 4-3*** and ***Table 4-4*** on page 13.

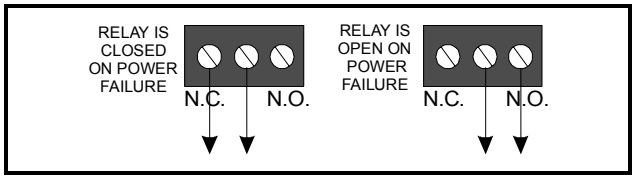

Figure 4-4 *- Form C Contact Wiring*

4.2.3. Output Fail-Safe Dip Switches

When a controller calls for a MultiFlex relay output to be ON, it sends a command to the MultiFlex to turn the output to the ON state (signified by the output LED being ON). The behavior of the relay when it is ON is determined by the position of the **fail-safe switch**. The fail-safe switches for the outputs are on a switch bank at the bottom right corner the plug-in output module. Each switch corresponds to an output on the board (switch #1 = output #1, etc.).

Table 4-3 and ***Table 4-4*** show how the fail-safe switch and Form C contacts should be configured based on how you want the output to perform during both normal operation and during network/power loss.

Note: There are not many cases where you would want a relay to be OPEN when called to be ON. For most applications, you will want to set the fail-safe switch to UP so that an ON command from the controller will close the relay.

	State of Normally Closed (N.C.) Contacts on MultiFlex Relay Points			
Fail-safe Switch	**Light is ON**	**Light is OFF**	**Loss of Communication**	**Loss of Power**
Up (ON)	Closed	Open	Closed	Closed
Down (OFF)	Open	Closed	Closed	Closed

Table 4-3 *- Output Board Fail-Safe and Switch Settings when Contact is Wired Normally Closed (N.C.)*

	State of Normally Open (N.O.) Contacts on MultiFlex Relay Points			
Fail-safe Switch	**Light is ON**	**Light is OFF**	**Loss of Communication**	**Loss of Power**
Up (ON)	Open	Closed	Open	Open
Down (OFF)	Closed	Open	Open	Open

Table 4-4 *- Output Board Fail-Safe and Switch Settings when Contact is Wired Normally Closed (N.O.)*

4.2.4. Relay Output Ratings and Fuse Protection

Each relay output on the MultiFlex Combination I/O boards is rated for up to 240 VAC with a maximum current of 2 amps.

Each relay is fused with a 2A fast-blow 5mm x 20mm fuse, Bussman GMA-2 or equivalent.

4.3. The Analog/Digital Outputs

The MultiFlex PAK board has four analog outputs, which are used primarily for compressor fan control. Each output is rated up to 10 milliamps at 0-10VDC.

The PAK has no hardware-based fail-safe settings (fail-safes are set up in the board firmware). All that is required is to connect the "+" terminal to the positive wire on the device and the "-" terminal to the negative (or ground) wire of the device.

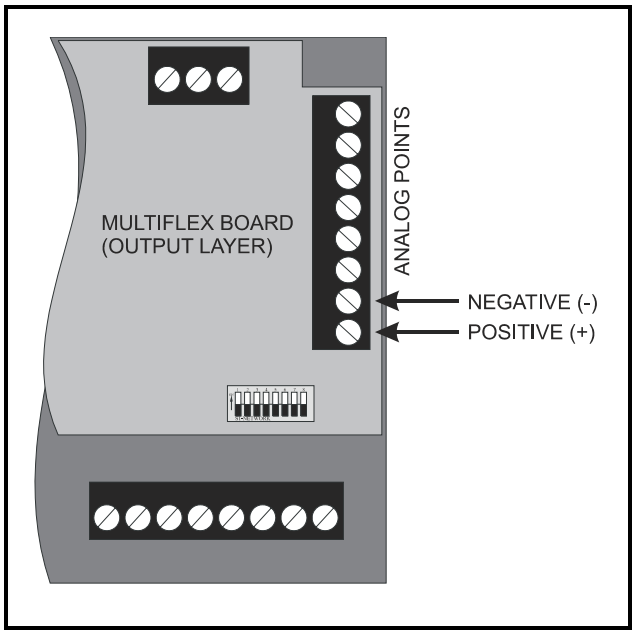

Figure 4-5 *- MultiFlex Analog/Digital Points*

The PAK may be programmed to use the digital outputs in one of three ways.

4.3.1. Single-Speed Digital Fan Control

For single-speed applications for up to four fans, the analog outputs may be configured to operate as digital outputs that vary between two states: 0VDC and +8VDC. You may configure in the software whether the 8VDC signal turns the fan ON or OFF.

4.3.2. Linear Sequence

For single-speed applications where more than four fans are being used, the condenser fans may be controlled by a special daughter board that translates an analog voltage from the PAK into a number of fans to be activated.

Based on the settings for the daughter board, the PAK can be configured with a customized minimum analog voltage, maximum analog voltage, and "step rate" to provide the right digital voltage for each fan activation stage. Refer to **Section 6.2.1.2.,** *Fan Sequencer*, for more information.

4.3.3. Variable-Speed Fan Control

In Variable-Speed Fan Control, the analog outputs vary from 0-10V to control the fan speed from 0-100%.

5 Board Status LEDs

When a MultiFlex board is powered up, you will be able to determine the operating status of the board by observing its status LEDs. ***Figure 5-1*** shows the location of the MultiFlex's status LEDs.

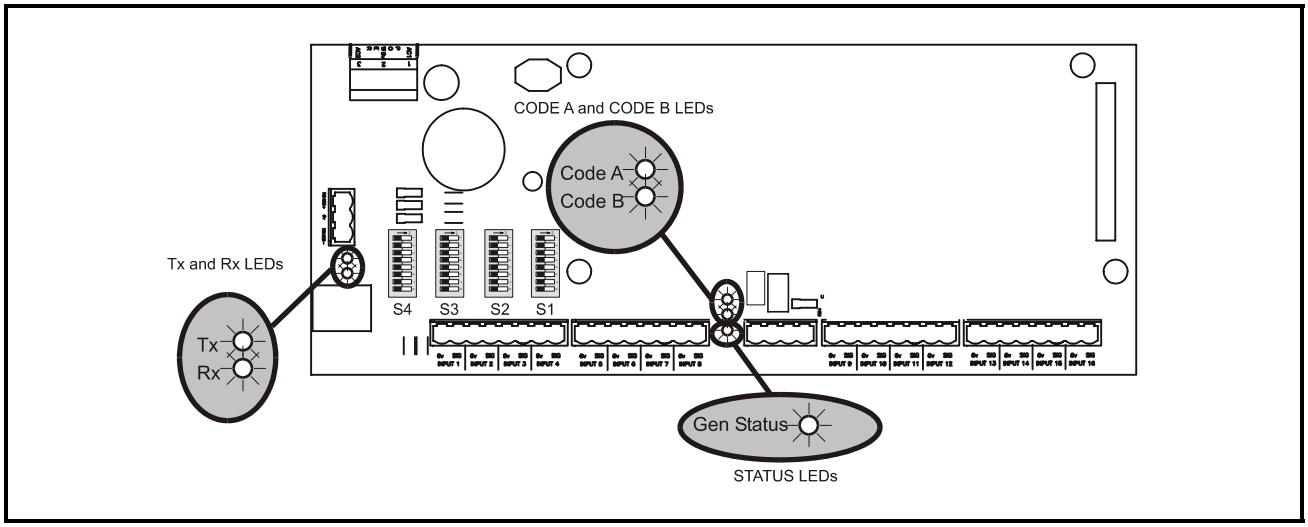

Figure 5-1 *- MultiFlex Status LED Locations*

5.1. Status LED

The Status LED simply blinks GREEN once per second to show that the board is powered and operational. If this light is dark, the board has likely lost power.

5.2. Tx and Rx LEDs

The Tx and Rx LEDs indicate when the MultiFlex is sending or receiving messages on the RS485 network.

The Tx LED blinks once every time the MultiFlex sends a response to the Einstein or REFLECS. The Rx LED blinks once when the MultiFlex receives a message.

If the MultiFlex is connected to the network and set up to communicate with the controller, you should see these lights blinking regularly. If they do not, there may be a problem with the network.

5.3. Code A and Code B LEDs

The MultiFlex PAK has two LEDs labeled Code A and Code B. These LEDs indicate failure conditions. When these LEDs are OFF, there are no failures active. When one or both of these LEDs are blinking, there are failure conditions. The rate of blinking indicates the type of failure:

Code A Failure Conditions

- ***Blinking fast (4 times/second) -*** There is a problem with the flash memory or hardware clock on this board. This generally means the board is bad and must be replaced.
- ***Blinking slow (1 time/second) -*** The board is not receiving any messages addressed to it. This means either the I/O network is down or it has not yet been

commissioned in the Einstein or REFLECS Network Configuration screen.

Code B Failure Conditions

- ***Blinking 2 times/second -*** This indicates the board has lost its configuration. If Code B blinks at this rate on an operational board, it means the board must be reprogrammed.

  This light does not blink if the board is new or is using the unmodified default configuration.

5.4. Relay Output LEDs

Each relay output point on a MultiFlex has an indicator LED that shows the status of the output. This LED is lit to show the output is ON, and unlit to show the output is OFF.

The definition of ON and OFF in this case is determined by the position of the fail-safe dip switch (see ***Table 4-3*** and ***Table 4-4***).

6 PAK Software Overview

6.1. Compressor Groups

6.1.1. Maximum # of Groups

The maximum number of compressor groups is eight. Each compressor group corresponds to a physical relay point on a MultiFlex board. PAK activates and deactivates compressor groups in order to control the suction pressure.

The total maximum number of individual compressors that can be controlled by the PAK is sixteen, regardless of how many compressor groups these compressors are associated with. Compressors are only activated or deactivated as part of a compressor group; however, a PAK input may be set up to read the discharge temperature for any or all of the individual compressors.

The number of compressors that may belong to a single compressor group is limited by the amperage rating on the MultiFlex output point (max. 2A up to 240VAC).

6.1.2. Required Setpoints

The setpoints required for compressor group operation are: Suction Setpoint, Suction Deadband, and fixed-step ON and OFF delay times. You will also need to configure which groups will be ON for each step in the fixed step and cyclic strategies.

Note: When splitting up compressors into the five groups, the total compressor HP should be spread out as much as possible to make use of as many compressor groups as possible.

6.1.3. The Fixed Steps Strategy

The fixed step strategy sequences through a series of compressor group ON/OFF combinations as the PAK requires more or less horsepower to maintain set point.

If the absolute value of the suction setpoint minus the suction control value is less than or equal to the suction control deadband, the algorithm is within the deadband, and the PAK continues to operate the compressor group using the step it is currently on.

If the suction control value is greater than the suction setpoint and the step ON delay timer has expired, the PAK goes to the next highest numbered step.

If the suction control value is less than the suction setpoint and the step OFF delay timer has expired, the PAK goes to the next lowest numbered step.

There is a step on delay and a step off delay in between each transition to prevent rapid cycling.

The maximum number of steps that may be configured is 20.

6.1.4. Example of Fixed steps

Table 6-1 shows an example of a fixed step strategy for a pack of 13 equally sized compressors. The compressors are split into five groups (one for each relay on the MultiFlex PAK). Then, for each of the 14 total steps in the strategy, each step is configured to bring on a different combination of groups, resulting in the total number of compressors increasing or decreasing by 1 every time a step forward or backward is taken. Note that this is not necessarily a recommendation for setting up all packs using a MultiFlex PAK controller; choose a fixed step strategy that is appropriate for each installation.

Group	# Compressors	Step	Group ON	Group OFF	# of Compressors ON
1	1	1	None	1, 2, 3, 4, 5	0
2	3	2	1	2, 3, 4, 5	1
3	3	3	5	1, 2, 3, 4	2
4	4	4	1, 5	2, 3, 4,	3
5	2	5	1, 2	3, 4, 5	4
		6	2, 5	1, 3, 4	5
		7	2, 3	1, 4, 5	6
		8	3, 4	1, 2, 5	7
		9	1, 3, 4	2, 5	8
		10	3, 4, 5	1, 2	9
		11	1, 3, 4, 5	2	10
		12	1, 2, 3, 4	5	11
		13	2, 3, 4, 5	1	12
		14	1, 2, 3, 4, 5	None	13

Table 6-1 *- Example Setup of Fixed Step Strategy*

6.1.5. The Cyclic Compressor Control Strategy

The Fixed Step strategy explained in **Section 6.1.3.** and **Section 6.1.4.** is an effective means of compressor control, but suffers from one minor drawback: the compressors that are switched on in the lowest numbered steps tend to be cycled ON more frequently than those below it. This results in uneven compressor cycling and runtimes, which can have adverse effects on compressor life and preventive maintenance scheduling.

The Cyclic compressor control strategy is similar to the Fixed Step strategy, except it does not activate and deactivate the same compressor groups every time the PAK changes to a new step. Instead, every time a new step is reached, the PAK looks at how many compressor groups must be added or subtracted; when adding, it will turn on the compressor group that has been OFF for the longest period of time, and when subtracting, it will turn OFF the compressor group that has been ON for the longest time.

Over a long period of time, the Cyclic strategy results in a more even distribution of compressor cycles and run time than the Fixed Steps strategy.

6.1.6. Safety Features

6.1.6.1. Compressor Run Proofing

The MultiFlex PAK can detect a failed compressor by reading the state of the compressor contactor wired (along with a resistor) in parallel with the compressor's discharge temperature sensor (see **Section 4.1.5.,** *Compressor Run Proof Wiring*).

When a proof fail is detected, the PAK may be programmed to attempt to reset the failure by shutting the compressor OFF and attempting to reactivate it after a user-defined time delay.

The user can select a maximum number of reset retries. If the PAK exceeds the maximum number of retries within the course of one hour, it will consider the compressor failed, and will lock the compressor OFF until the proof alarm is manually reset.

If using the Cyclic compressor strategy, the PAK will ignore any failed compressors when determining which compressor(s) should be cycled next.

6.2. Condenser Control

The MultiFlex PAK uses a temperature differential (TD) strategy for condenser control.

TD control in the MultiFlex PAK uses a control value that is calculated by subtracting the ambient air temperature near the condenser fans from the discharge temperature.

This control value is compared to a fixed temperature differential set point, and condenser fans and/or sprays are activated or deactivated to attempt to keep the control value at or near the TD set point.

To protect against TD control loss due to ambient temp sensor failure, the MultiFlex PAK may be set up with up to two ambient air temperature sensors. The average of both sensors is used as the ambient temperature if both sensors are connected, and if one sensor fails, the PAK will revert to reading the value of the remaining good sensor.

6.2.1. Condenser Fan Control Strategies

The PAK has three different strategies that may be used for fan control. All three strategies assume the PAK's analog/digital outputs will be used to control the fans (see **Section 4.3.,** *The Analog/Digital Outputs*).

6.2.1.1. Staged Fan Control

In Staged Fan Control, the PAK uses one separate output for each fan to be controlled. Up to four single-speed fan stages may be configured on the PAK.

When condensing is needed, this control strategy sequences the fans ON in numerical order, starting with fan #1 and ending with the highest numbered fan. The fans sequence OFF in reverse numerical order, beginning with the highest numbered fan, and ending with #1.

When the Staged Fan Control strategy is being used, the PAK's analog outputs behave as digital outputs, emitting a +8VDC digital signal when ON and 0VDC when OFF. The PAK also allows the outputs to be configured as 0VDC when ON and +8VDC when OFF.

6.2.1.2. Fan Sequencer

Fan Sequencer Control assumes a daughter board is being used in conjunction with the PAK for translating an analog signal from the PAK into a sequence of ON relays on the daughter board.

The PAK controls the daughter board using a sequence of DC voltage values, which commands the daughter board to make a specific number of fans active. To control this daughter board, the PAK's fan output must be configured

with a minimum voltage, maximum voltage, and "step rate." These parameters determine which voltages on the PAK output correspond to which fan combinations on the daughter board.

- When the PAK wants all fans OFF, the voltage will be 0V.
- When the PAK wants one fan ON, the voltage will be equal to the minimum voltage.
- To cycle more fans ON past fan #1, the PAK will add the step rate voltage to the current voltage, until all fans are on or the voltage reaches the maximum voltage.

Example: A PAK using a Fan Sequencer strategy has six fans. The sequencer daughter board requires a minimum voltage of 2VDC, a maximum voltage of 10VDC, and a step rate of 1.5. The output voltages that PAK will use to sequence fan stages are:

# of Fans	0	1	2	3	4	5	6
Voltage	0V	2V	3.5V	5V	6.5V	8V	9.5V

***Table 6-2** - Example: Fan Sequencer Output Voltages*

6.2.1.3. Variable-Speed (VSD) Fan Control

Variable-Speed (VSD) Fan Control uses an analog input to send a 0-10VDC variable signal to an inverter, which controls the fan(s) at 0-100% of the maximum speed.

For variable-speed drive control, the PAK must be programmed with a minimum voltage, an increase volts-per-minute rate, and a decrease volts-per-minute rate.

When the fans are OFF and the calculated TD rises above the TD set point + 1/2 the dead band for an amount of time equal to the Fan On Delay, the output voltage goes from 0V to the value of the minimum voltage, thus activating the variable-speed fan at minimum speed. While the fan is on:

- If the TD is within the setpoint deadband (i.e. in between the setpoint - 1/2 the deadband and the setpoint + 1/2 the deadband) the fan speed will remain at the current speed and will not vary.
- If the TD is above the set point + 1/2 the deadband, the fan speed is increased at the specified increase volts-per-minute rate, until the maximum fan speed (100%) is reached or the TD returns to within the set-point deadband.
- If the TD is below the set point - 1/2 the deadband, the fan speed is decreased at the specified decrease volts-per-minute rate, until the minimum fan speed (20%) is reached or the TD returns to within the set-point deadband.

If the variable-speed fan is operating at minimum speed and the TD remains below the deadband for an amount of time longer than the Fan Off Delay, the fan will deactivate.

6.2.2. Minimum and Maximum Pressure Set Points

To prevent overcooling or undercooling during TD control, the MultiFlex PAK features minimum and maximum discharge pressure set point.

If during TD control the value of the discharge pressure falls below the minimum set point, the PAK will override the TD strategy and begin cycling fans OFF at the rate of one stage every OFF delay, until all fans are OFF or until the pressure rises above the minimum pressure set point.

Likewise, if the discharge pressure rises above the maximum discharge set point, the PAK will override the TD strategy and cycle fans ON at the rate of one stage every ON delay, until all fans are ON or until the pressure falls below the maximum pressure set point.

6.2.3. Condenser Spray

If a condenser spray output is configured, the PAK can be programmed to activate a water spray to keep the discharge pressure from climbing above a user-defined pressure set point.

The spray is activated when the discharge pressure rises above the condenser spray set point, and shuts off when the pressure falls below a return-to-normal set point for an amount of time equal to the return-to-normal time parameter.

To prevent unnecessary activation of the spray when the ambient conditions make evaporative cooling less effective, the PAK can be programmed with an ambient temperature lock out, which prevents the spray from activating if the ambient temperature is below a user-defined ambient lockout set point.

6.2.4. Safety Features

6.2.4.1. Fallback Set Point (Discharge Pressure)

If the PAK is unable to use temperature differential control for the condenser due to an ambient temp sensor failure, the PAK will fall back to a secondary strategy using discharge pressure and a fallback discharge pressure set point. The PAK will stage condenser fans ON when the discharge pressure is higher than the set point, and stage them OFF when the pressure falls below the set point.

The PAK will revert to TD control when the ambient temp sensor failure is resolved and the TD calculation can again be made.

6.2.4.2. Discharge Trip

Discharge trip is a safety feature that will shut down all compressor groups if the discharge pressure rises above a critical user-defined set point.

Discharge trip occurs immediately the moment the pressure rises above the set point. All compressors shut off, and an alarm is generated and sent to Einstein notifying of the trip condition. The status screen will show the status of both the compressor groups and the condenser fans as “Disch Trip.”

The pack remains shut down for a minimum user-defined reset delay. When this delay has passed, the PAK will automatically reset the discharge trip and resume operation if and only if the discharge pressure has fallen to an acceptable level (determined by a user-defined reset pressure differential).

The PAK will only automatically reset a discharge trip a user-defined number of times in a 24-hour period (default is five). After the discharge trip occurs this number of times, the pack will be shut down and will remain shut down until the problem is fixed and the alarm is manually reset in Einstein.

6.2.5. Alarms

The Multiflex PAK will communicate the following alarm conditions:

- High Discharge Pressure Trip
- VSD Fault
- If a defined physical analog input sensor reading is out of range
- If the Multiflex PAK controller has a digital output as an Alarm Output, then the relay will close when any of the alarm conditions listed above are active.
- If set to Yes, the Reset Alarm function will reset all alarms and restart the PAK.

7 MultiFlex PAK Einstein Interface

The MultiFlex PAK is capable of communicating with an Einstein RX refrigeration controller with software version 1.83 or above. No current version of the E2 controller supports MultiFlex PAK.

Using MultiFlex PAK boards with a central Einstein controller offers several benefits over simple stand-alone PAK control, including:

- Reporting of PAK-related alarms in the Alarm Advisory Log
- The ability to log PAK inputs in an Einstein logging group
- Remote access to PAK status and programming from the Einstein front panel or remote communication tools (InSite or UltraSite32).

Communication between Einstein and a PAK takes place over the RS485 I/O Network. Follow the instructions in **Section 3,** *The I/O Network*, to connect the PAKs to the Einstein I/O network. Then, follow the instructions in this chapter to set up the PAKs.

7.1. Adding/Deleting a PAK

7.1.1. Adding a PAK

Before an Einstein will communicate with a PAK, it must be added as an I/O board. This task is performed in the Controller Setup screen. To access this screen:

Einstein

1. Log in to the Einstein.
2. Press F8 Y to access the System Configuration Menu.
3. Press 4 - Network Status/Setup
4. Press 2 - Connected I/O Boards & Controllers.
5. Enter the number of PAK boards that will be networked with this Einstein in the PAK Controllers field.

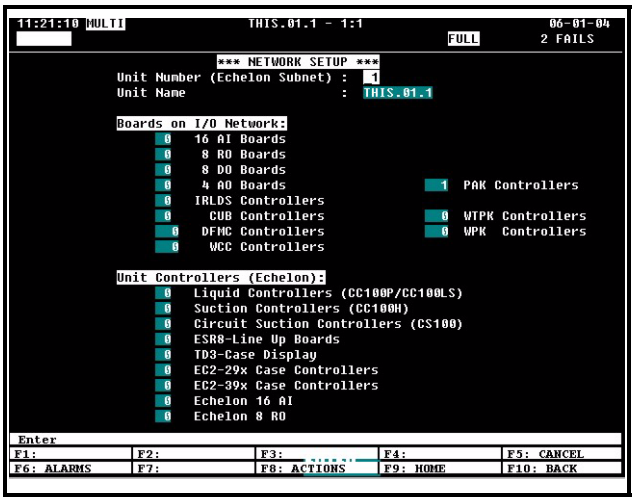

Figure 7-1 *- Controller Setup Screen*

If you have properly set up all MultiFlex PAK boards on this Einstein's I/O Network, you can go view the status of the I/O Network (press F10 to go back to the menu, then press 3 - Controller Status). If Einstein and the PAK boards are communicating, this screen will show the PAK boards as "Online." If not, they will be shown as "Offline."

7.1.2. Deleting a PAK

To remove a PAK from the E2 or Einstein:

Einstein
1. Log in to the Einstein. 2. Press F8 Y to access the System Configuration Menu. 3. Press 4 - Network Status/Setup 4. Press 2 - Connected I/O Boards & Controllers. 5. Change the number of PAK boards in the PAK Controllers field to the correct number of boards.

When PAKs are deleted in this way, Einstein will always delete the highest numbered PAKs first. Therefore, if you have seven PAKs (numbered 1-7) and you change the number of PAKs to five, the Einstein will delete board #6 and #7, leaving boards #1 through #5.

7.2. Viewing the PAK Status Screen

Once you have added a PAK to the Einstein, you will be able to see the status of the PAK board(s) from the front panel.

Einstein
1. From the Main Status Screen, press F5 - MORE. 2. Press +D - PAK If multiple PAKs are associated with this Einstein, a list will appear prompting you to select a single PAK. Use the arrow keys to highlight the PAK you wish to view, and press Enter.

The PAK Status Screen for the PAK you selected will appear (***Figure 7-2***).

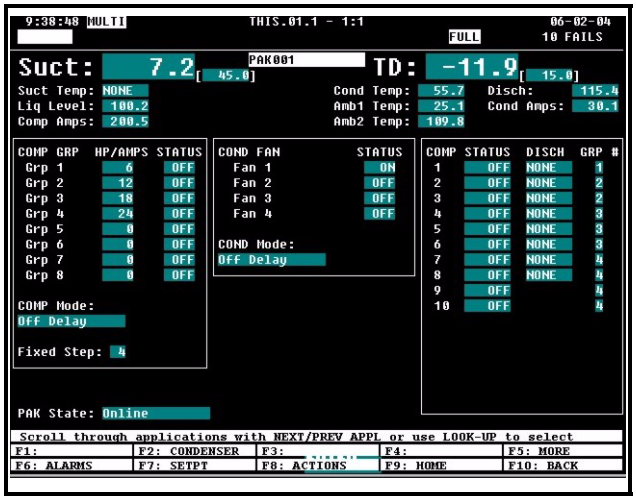

Figure 7-2 *- PAK Status Screen*

The PAK Status Screen shows the current status of all compressors and condensers. Though there is a large amount of information on a PAK status screen, status information is grouped on this screen in several groups of related information in order to make the screen easier to read. These groups are described below.

7.2.1. Inputs and Set Points

The top four lines of the PAK Status Screen show the current values of all the important inputs and set points in the PAK controller.

Suct

The Suct field shows the current value of the suction pressure. The value shown in smaller type to the right of the suction pressure field (enclosed by brackets [ ]) is the suction pressure control set point, displayed here for reference purposes.

TD

The TD field shows the current calculated value of the temperature differential between the discharge temperature and the ambient temperature. The value shown in smaller type to the right of the TD field (enclosed by brackets [ ]) is the TD set point, displayed here for reference purposes.

Liquid Level

This field shows the value of the PAK's liquid level input.

Comp Amps

This field shows the value of the PAK's Compressor Amps input.

Cond Temp

This field shows the condenser temperature calculated by converting the discharge pressure to temperature based on the system refrigerant.

Amb Temp 1 and 2

The Amb Temp 1 and 2 fields show the current values of the ambient temperature sensors on the condenser. These values are combined into a single ambient temperature, which is used in the TD calculation.

Disch

This field shows the current value of the discharge pressure transducer.

Cond Amps

This field shows the current value of the PAK's Condenser Amps input.

7.2.2. Compressor Groups

The box left of the middle of the PAK Status Screen shows the current status of the compressor groups defined for the PAK.

Compressor Group HP/AMPS and Status

Each group from 1 through 8 has a field showing HP/AMPS, which displays the total amount of HP or AMPS of all compressors associated with the group, and a Status field, which shows whether the group is currently ON or OFF.

COMP Mode

The Compressor Group Mode field explains the current state of the fixed step control algorithm in the MultiFlex PAK. There are seven messages that may appear here:

- OFF - No compressor groups are ON, and none are being called to be ON.
- Off Delay - The MultiFlex PAK requires less compressor HP/AMPS, and is trying to cycle backward through the fixed steps, but PAK is currently waiting for the fixed step OFF delay to elapse before moving to the next lower step.
- On Delay - The MultiFlex PAK requires more compressor HP/AMPS, and is trying to cycle forward through the fixed steps, but PAK is currently waiting for the fixed step ON delay to elapse before moving to the next higher step.
- DeadBand - The suction pressure is within the set point dead band. The PAK will remain on the current fixed step and is not attempting to move up or down to a new step.
- Max Cap - The PAK has cycled through the fixed steps all the way to the last step, but the set point is still out of range. In other words, the PAK would activate more HP/AMPS if more were available, but it is operating at maximum capacity.
- XDucer Fail - The suction pressure transducer input has failed.
- Disch Trip - The discharge pressure has exceeded the discharge trip setpoint, causing the compressor group to shut down.

Fixed Step

This field shows the number of the currently active fixed step.

7.2.3. Condenser Fans

The box in the middle of the PAK Status Screen shows the current status of the condenser fans.

Fan 1 through 4

Each fan from 1 through 4 has a field showing the ON/OFF status of the fan.

Cond Mode

The Condenser Mode field explains the current state of the condenser fan control algorithm in the MultiFlex PAK. There are seven messages that may appear here:

- OFF - All condenser fans are OFF, and the discharge pressure/temperature is low enough to not require any fans to be activated.

- OFF Delay - The PAK is calling for fan stages to deactivate, and PAK is waiting for the OFF Delay time period to elapse before deactivating the next fan stage.
- ON Delay - The PAK is calling for fan stages to activate, and PAK is waiting for the ON Delay time period to elapse before activating the next fan stage.
- DeadBand - The discharge pressure is within the setpoint deadband, and therefore the PAK is neither activating nor deactivating any fan stages.
- Max Cap - All condenser fans are ON, but the discharge pressure is still above set point. In other words, PAK would activate more fan stages if more were available, but it is operating at maximum capacity.
- Cond Spray - The condenser spray output is currently ON, meaning the discharge pressure is currently higher than the condenser spray set point.

7.2.4. PAK State

At the very bottom of the PAK Status Screen, the "PAK State" field shows whether the MultiFlex PAK is currently reading as Online or Offline.

7.3. Programming the PAK using Einstein

To begin programming a PAK, navigate to the PAK Status Screen for the board you wish to program (see **Section 7.2.**). For Einstein, press F8 followed by B to enter the Setup Editor.

7.3.1. Screen 1: General

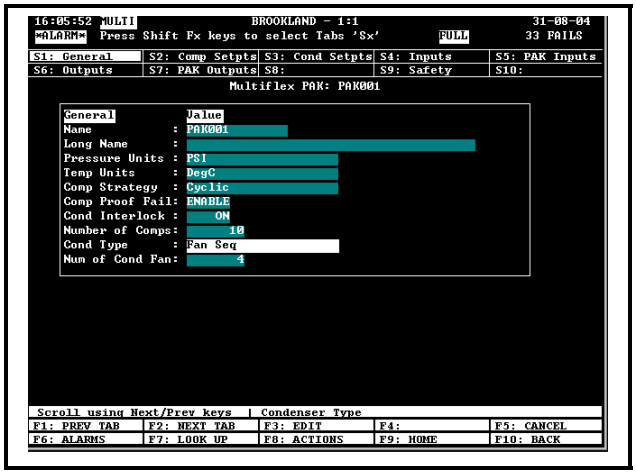

Figure 7-3 *- PAK Screen 1: General*

Name

Enter a name for this PAK in the Name field.

Long Name

If desired, enter a longer description of this PAK in the Long Name field.

Pressure Units

The Pressure Units field specifies whether you want the PAK to display pressure values in PSI or kilopascals (KPA).

Temp Units

The Temp Units field specifies whether you want the PAK to display temperature values in degrees Fahrenheit (DegF) or Celsius (DegC).

Comp Strategy [Cyclic/Fixed Steps]

The Comp Strategy allows you to choose either of two compressor control strategies.

In **Cyclic** compressor control, when an increase or decrease in compressor power is needed, the PAK determines which compressors are activated or deactivated by a First-ON-First-OFF strategy. This has the effect of distributing the number of compressor cycles evenly among all the compressors in the pack.

In **Fixed Step** compressor control, compressor power is increased or decreased by moving up and down a list of fixed step sequences. Each fixed step is programmed with which compressor groups will be ON and which will be OFF.

The main difference between Fixed Step and Cyclic is that Fixed Step always uses the same compressors and does not equalize compressor cycling.

Comp Proof Fail [ENABLE/DISABLE]

This parameter enables or disables the PAK's compressor run proofing capability. Choose "ENABLE" if you are using compressor run proofing. Refer to **Section 4.1.5.,** *Compressor Run Proof Wiring* and **Section 6.1.6.1.,** *Compressor Run Proofing* for more information.

Cond Interlock [Yes/No] [Yes]

The Condenser Interlock feature stages off condenser fans when no compressors are operating (provided the Discharge Pressure is not above the DischPresInterlockDisable setpoint). Setting this field to NO will control the fans independent of the compressors.

Number of Steps [1 - 20] [6]

If you are using the Fixed Step strategy, enter the desired number of fixed steps for compressor control in this field.

Number of Comps [0 - 16] [10]

Enter the number of compressors to be controlled by the PAK in this field.

Cond Type [Single Speed/Linear Seq/VS]

The Condenser Type field specifies how the condenser fans will be controlled.

- Staged Fan - The PAK will use digital outputs to activate the fan stages.
- Fan Seq - The PAK will use an analog output to send an analog voltage to a sequencer daughter board for fan control.
- VSD - The PAK will use an analog output to control a variable-speed drive.

Num of Cond Fan [0 - 8] [4]

Enter the number of condenser fans that will be controlled by the PAK in this field.

7.3.2. Screen 2: Comp Setpts

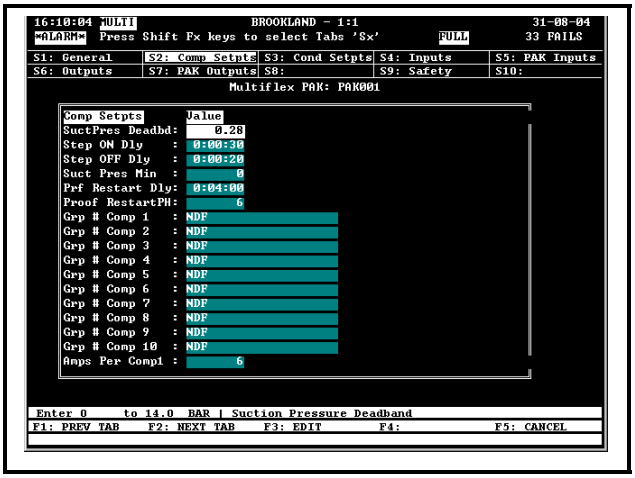

Figure 7-4 *- PAK Screen 2: Comp Setpts*

SuctPrs Deadbd

The Suction Pressure Deadband is a range of pressures surrounding the suction pressure set point within which the suction pressure is considered to be acceptable. When the suction pressure is within the set point plus one-half the dead band and the set point minus one-half the dead band, the PAK will remain on the fixed step it is currently on until the suction pressure moves outside of the dead band.

Step ON Delay

For Fixed Step strategies, the Step ON Delay is the minimum amount of time the PAK must remain on any given fixed step before it is allowed to move up to a higher numbered fixed step.

For Cyclic strategies, the Step ON delay is the minimum amount of time the PAK must wait before activating another compressor group when it is called to do so.

Enter the desired ON delay in HH:MM:SS format.

Step OFF Delay

For Fixed Step strategies, the Step OFF Delay is the minimum amount of time the PAK must remain on any given fixed step before it is allowed to move down to a lower numbered fixed step.

For Cyclic strategies, the Step OFF delay is the minimum amount of time the PAK must wait before deactivating a compressor group when it is called to do so.

Enter the desired ON delay in HH:MM:SS format.

Suct Pres Min

The Suct Pres Min is the minimum allowable suction pressure value.

If the suction pressure falls below this value, all compressors are immediately turned OFF. After this shutdown, the compressors will remain OFF until the pressure rises above the Suct Min Prs set point, at which point fixed step #1 will activate (or, if using Cyclic control, one compressor group will be activated).

The PAK will remain on fixed step #1 (or with one compressor group activated, if using Cyclic) until the suction pressure rises above the Suction Pressure set point + 1/2 the SuctPres Deadband. When this occurs, normal compressor control will resume.

Prf Restart Dly

The Proof Restart Delay is the amount of time the PAK will wait after turning OFF a failed compressor before attempting to restart the compressor by turning it back ON. Enter the desired restart delay in HH:MM:SS.

Proof RestartPH

The Proof Restarts Per Hour (PH) is the maximum number of restarts the PAK will attempt on a failed compressor before locking the compressor OFF and keeping it off until the proof failure alarm can be reset manually.

Grp # Comp 1- 16

The Grp # Comp fields assign the compressors controlled by the MultiFlex PAK to a compressor group number. For each numbered field (which corresponds to the compressor of the same number), choose the group number this compressor will be assigned to.

If you are using Cyclic control, compressors should be evenly spread out over the eight possible compressor groups, so that no more than two belong to any single group. This is because Cyclic control does not take compressor amperage into account when selecting a compressor group to activate or deactivate (it simply looks the amount of time it has been OFF or ON). Uneven compressor groupings on a PAK using Cyclic control will result in decreased control performance.

Amps Per Comp 1-16

The Amps Per Comp fields specify the ampere rating of each compressor. Enter the correct rating for each compressor.

7.3.3. Screen 3: Cond Setpts

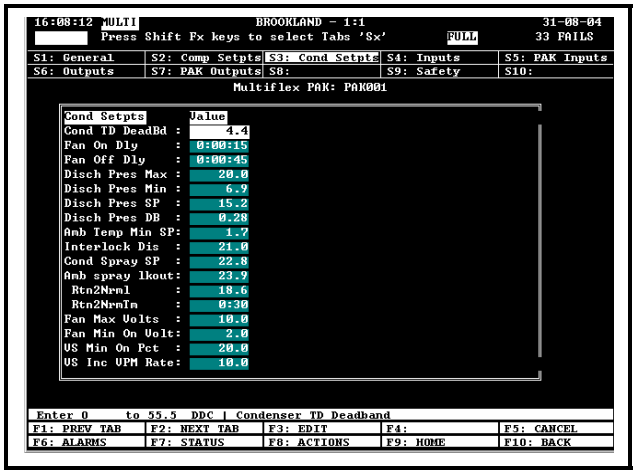

Figure 7-5 *- PAK Screen 3: Cond Setpts*

Cond TD Deadbd

The Condenser TD Deadband is a range of values equally above and below the TD set point within which the TD value is considered to be acceptable. When the TD value is between the TD set point plus 1/2 the dead band and the set point minus 1/2 the dead band, the PAK will not stage any fans ON or OFF.

Fan ON Delay

The Fan ON Delay is the amount of time the PAK will wait between when a condenser fan is called to be ON and when the PAK will activate the relay. Enter the desired delay in HH:MM:SS format.

Fan OFF Delay

The Fan OFF Delay is the amount of time the PAK will wait between when a condenser fan is called to be OFF and when the PAK will deactivate the relay. Enter the desired delay in HH:MM:SS format.

Disch Pres Max

During TD control, if the discharge pressure rises above the value of the Discharge Pressure Max setpoint, the PAK will override the TD fan control and begin staging compressors ON (observing the fan ON delay). It will continue staging until all fans are ON or the pressure falls below the setpoint (at which point normal TD control will resume).

Disch Pres Min

During TD control, if the discharge pressure falls below the value of the Discharge Pressure Min setpoint, the PAK will override the TD fan control and begin staging compressors OFF (observing the fan OFF delay). It will continue staging until all fans are OFF or the pressure falls below the setpoint (at which point normal TD control will resume).

Disch Pres Setpt

The Discharge Pressure Setpoint is used as the fallback control setpoint if the TD calculation cannot be made due to sensor failure. When this method of control is being used, the discharge pressure set point is the discharge pressure the PAK will try to maintain. The PAK will stage fans ON when the discharge pressure is above the set point, and OFF when the pressure is below the set point.

Disch Pres DB

The Discharge Pressure Deadband is the range of discharge pressure values equally above and below the Discharge Pressure Setpoint within which the pressure is considered to be acceptable. The PAK will cycle fans OFF only when the discharge pressure rises above the set point plus one-half the dead band, and turn fans OFF when the pressure falls below the set point minus one-half the dead band.

Amb Temp Min Stpt

The Amb Temp Min Setpoint is the lowest allowable value of the ambient temperature value used in the TD calculation. If the ambient temperature falls below this setpoint, the TD calculation will be made with the value of this set point instead of the actual ambient temperature. This prevents the resulting discharge temperature set point from falling too low as a result of low ambient temperature.

Interlock Dis

The Interlock Disable sets a maximum discharge pressure value above which compressor/condenser interlock is disabled. This prevents the possibility of interlock keeping the fans off when no compressors are running but the discharge pressure is high.

When the discharge pressure is above this set point, the PAK will break the condenser interlock (if active) and begin staging fans ON to bring down the pressure. Interlock will be re-enabled when the pressure falls below the Interlock Disable setpoint.

Cond Spray SP

If a condenser spray is being controlled by the PAK, the Cond Spray SP is the discharge set point that activates and deactivates the condenser spray. The discharge pressure is compared to this setpoint; if higher than the set point, the spray is turned ON. The spray remains ON until the discharge pressure falls below the Disch Press Rtrn2Nrml set point.

Amb Spray Lkout

The Ambient Spray Lockout setpoint is the outside air temperature below which the PAK will lock OFF the condenser spray output.

RTN2Nrml

The Return-to-Normal set point is the cut-off discharge pressure for the condenser spray. If the condenser spray is ON and the discharge pressure falls below this value and remains there for an amount of time equal to the DisPr RTN2Nrml Tm parameter, the condenser spray will be turned OFF.

RTN2Nrml Tm

The Return-to-Normal Time is the amount of time the discharge pressure must remain below the DisPr RTN2Nrml set point before turning the condenser spray OFF.

Fan Max Volts

The Fan Maximum Volts parameter is used only if the Fan Sequencer strategy is being used. This parameter sets the maximum voltage value of the output.

Fan Min ON Volts

The Fan Minimum ON Volts parameter is used only if the Fan Sequencer strategy is being used. This parameter sets the minimum voltage value of the output when the fan is ON.

VS Min ON Pct

The VS Min ON Pct is only used in VSD condenser fan control. This is the lowest possible percentage of the variable-speed fan when it is ON. When the VS fan transitions from being OFF to ON, it will start operating at this percentage.

VS Inc VPM Rate

The VS Increase Volts Per Minute Rate is only used in VSD condenser fan control. This is the rate at which the voltage on the PAK's analog output will increase (in volts per minute) when the PAK calls for an increase in fan speed.

VS Dec VPM Rate

The VS Decrease Volts Per Minute Rate is only used in VSD condenser fan control. This is the rate at which the voltage on the PAK's analog output will decrease (in volts per minute) when the PAK calls for a decrease in fan speed.

Seq Step Volts

The Sequence Step Volts is only used in Fan Sequencer condenser fan control. This parameter determines how many volts will be added to the value of the Fan Sequencer Analog output every time a new fan is to be activated, or subtracted from the value when a fan is to be deactivated.

VS Inv Reset PH

The VS Inverter Resets Per Hour is the maximum number of variable-speed fan inverter resets that will be attempted by the PAK in the course of one hour. If, after the specified number of retries, the inverter experiences another fault, the PAK will cease attempting to automatically reset the inverter and shut down all compressors and condenser fans. The PAK will remain in this state until the VSD fault alarm is reset.

VS Inv ResetDly

The VS Inverter Reset Delay is the amount of time after an inverter fault signal is received that the PAK will keep the fan OFF before retrying.

VS Fault ActLvl

The VS Fault Active Level specifies whether the VS Fault input on the PAK opens or closes to indicate fault. Choose OPEN if you want an open contact to signify fault, or CLOSED if you want a contact closure to signify a fault.

Fan Output Num1-4

The Fan Output Number fields specify which digital or analog output each of the four condenser fans are controlled by. The four options are Output 1, Output 2, Output 3, and Output 4.

When the PAK activates a fan of a certain number, it will turn ON the output number specified here for the fan.

Fan HP or Amps1-4

The Fan HP or Amps fields specify the total horsepower or amperage rating for each of the four fan stages. Enter either horsepower or amps here.

7.3.4. Screen 4: Inputs

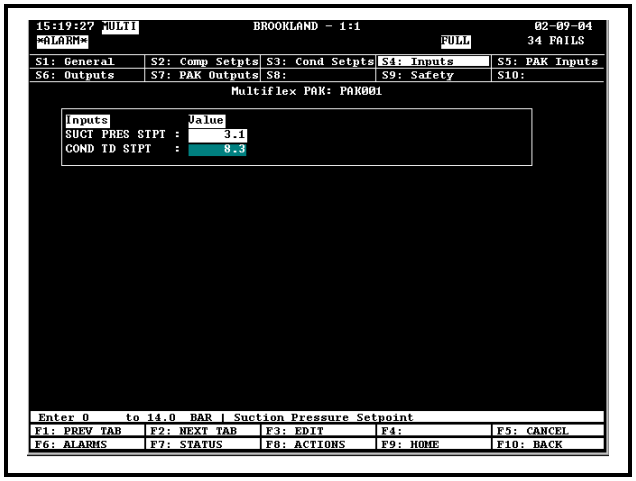

Figure 7-6 *- PAK Screen 4: Inputs*

SUCT PRES STPT

The Suction Pressure Setpoint is the suction pressure the PAK will try to maintain by activating and deactivating compressor groups. Enter the desired suction pressure in this field.

COND TD STPT

The Condenser TD Setpoint is the temperature differential the condenser will attempt to maintain between the discharge temperature and the ambient air temperature. Enter the desired TD set point in this field.

RESET VSFANFAIL

When a variable-speed fan fails, you may choose to reset the fan failure using a push button or switch. To do this, enter the board and point address of the reset button or switch in this input definition.

COND EMER OVR

The Condenser Emergency Override input may be connected to an external switch or button that overrides the condenser to 100% ON (all fans active) when the input is ON.

7.3.5. Screen 5: PAK Inputs

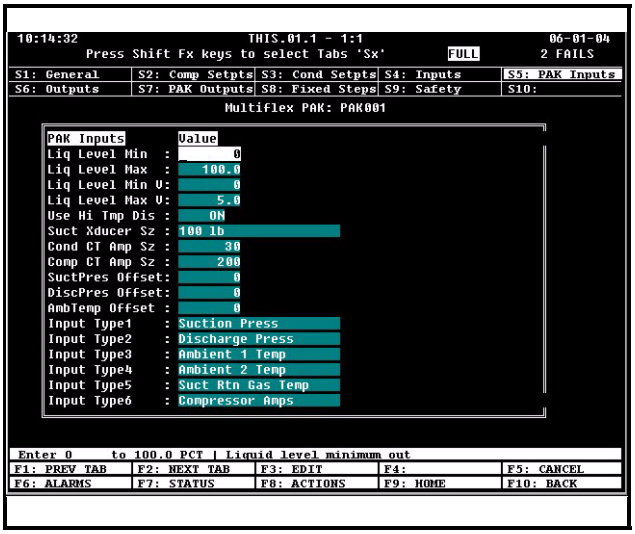

Figure 7-7 *- PAK Screen 5: PAK Inputs*

Liq Level Min, Liq Level Max, Liq Level Min V, Liq Level Max V

The four liquid level fields are required only if the PAK is being configured to read the value of a linear liquid level sensor. By default, these settings are programmed to read a 0-5VDC liquid level sensor output and translate its voltage value to a 0-100% liquid level. If the liquid level sensor being used requires different settings:

- Enter the minimum and maximum sensor voltages in the Liq Level Min V and Liq Level Max V fields.
- Enter the minimum and maximum percentages in the Liq Level Min and Liq Level Max fields.

Use Hi Tmp Dis

If you are using CPC's high-temperature thermistors as the discharge temperature sensors for this pack, set this field to ON. Otherwise, if you are using any of CPC's regular thermistors, set this field to OFF.

Suct Xducer Sz

Enter the size of the pressure transducer being used to measure the suction pressure in this field. Choose either 100 lb or 200 lb.

Cond CT Amp Sz

If you are monitoring the power used by the condenser, enter the size (in amps) of the CTs used to measure the current going to the condenser.

Comp CT Amp Sz

If you are monitoring the power used by the compressor, enter the size (in amps) of the CTs used to measure the current going to the compressors.

SuctPrs Offset

If the suction pressure transducer requires an offset to calibrate its value, enter a positive or negative number in this field. The offset will be added to the raw value of the transducer reading.

DiscPrs Offset

If the discharge pressure transducer requires an offset to calibrate its value, enter a positive or negative number in this field. The offset will be added to the raw value of the transducer reading.

AmbTemp Offset

If the ambient temperature sensor requires an offset to calibrate its value, enter a positive or negative number in this field. The offset will be added to the raw value of the transducer reading.

Input Type 1 through 16

The sixteen Input Type fields specify what types of inputs are connected to each of the input points on the MultiFlex PAK. Configure each of these inputs with the correct input type. ***Table 7-1*** lists the input types and their meanings.

Input Name	Description
None	Input point is empty
Suction Press	Suction pressure transducer
Discharge Press	Discharge pressure transducer
Ambient 1 Temp	Ambient air temp sensor #1
Ambient 2 Temp	Ambient air temp sensor #2
Comp Disch Temp 1	Compressor Discharge Temperature Sensor #1
Comp Disch Temp 2	Compressor Discharge Temperature Sensor #2
Comp Disch Temp 3	Compressor Discharge Temperature Sensor #3
Comp Disch Temp 4	Compressor Discharge Temperature Sensor #4
Comp Disch Temp 5	Compressor Discharge Temperature Sensor #5
Comp Disch Temp 6	Compressor Discharge Temperature Sensor #6
Comp Disch Temp 7	Compressor Discharge Temperature Sensor #7
Comp Disch Temp 8	Compressor Discharge Temperature Sensor #8
Liq Level	Liquid level transducer
Compressor Amps	CT measuring amps to the compressors
Condenser Amps	CT measuring amps to the condenser
Suct Rtn Gas Temp	Suction return gas temperature sensor
External Fault	Indicates VS inverter fault when ON
Alarm Reset	External contact or switch for resetting PAK alarms
VS Fault Input	Connects to fault output on the VS inverter; notifies PAK when a fault has occurred.

Table 7-1 *- MultiFlex PAK Default Inputs*

Table 7-1 *- MultiFlex PAK Default Inputs*

7.3.6. Screen 6: Outputs

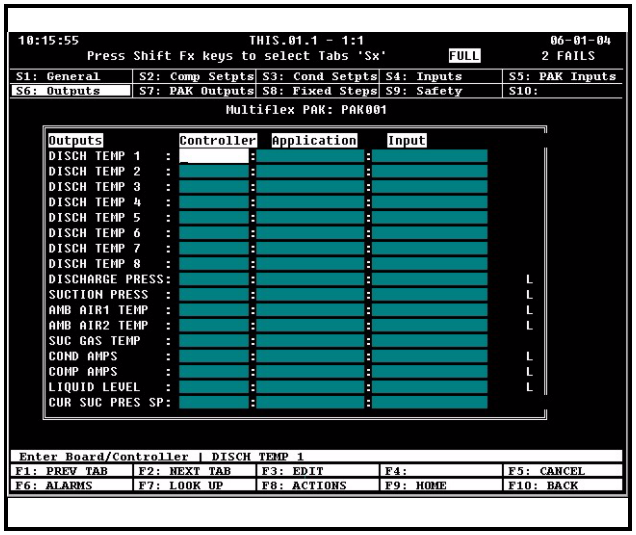

Figure 7-8 *- PAK Screen 6 - Outputs*

The Outputs screen contains output definitions for many of the important input and output values and states that are used by the Einstein and the MultiFlex PAK. Because the outputs themselves are on the MultiFlex PAK board, these output definitions do not need to be configured. They are provided on this screen as outputs primarily to provide the user logging and generic alarming capabilities.

DISCH TEMP 1-8

The Disch Temp 1-8 outputs mirror the value of the discharge temperature inputs 1 through 8 on the MultiFlex PAK.

DISCHARGE PRESS

The Discharge Pressure output mirrors the value of the discharge pressure input on the MultiFlex PAK.

SUCTION PRESS

The Suction Pressure output mirrors the value of the suction pressure input on the MultiFlex PAK.

AMB AIR1 TEMP

The Ambient Air Temp 1 output mirrors the value of ambient air temperature sensor #1 on the MultiFlex PAK.

AMB AIR2 TEMP

The Ambient Air Temp 2 output mirrors the value of ambient air temperature sensor #2 on the MultiFlex PAK.

SUC GAS TEMP

The Suction Gas Temperature output mirrors the value of the suction return gas temperature sensor on the MultiFlex PAK.

COND AMPS

The Condenser Amps output mirrors the value of the current transducer(s) on the MultiFlex PAK measuring the condenser fan current usage.

COMP AMPS

The Condenser Amps output mirrors the value of the current transducer(s) on the MultiFlex PAK measuring the compressor current usage.

LIQUID LEVEL

The Liquid Level output mirrors the value of the liquid level transducer input on the MultiFlex PAK.

CUR SUC PRES SP

The Current Suction Pressure Set Point is the active suction pressure set point being used by the MultiFlex PAK.

COND TEMP CALC

The Condenser Temp Calculated is the discharge temperature at the condenser, calculated by converting the discharge pressure to a temperature value based on the refrigerant type.

TD

The TD output is equal to the current value of the calculated temperature differential.

CUR TD SP

The Current TD setpoint output is equal to the active condenser TD setpoint.

COMP 1-8

The Comp 1-8 outputs show the current state of compressor group outputs #1 through #8 on the MultiFlex PAK.

COMP STATE 1-16

The Comp State outputs show the current ON/OFF state of each of the sixteen compressors.

COMP MODE

The Comp Mode output is a message generated by Einstein that indicates the operating mode of the compressor pack. Refer to "COMP MODE" in **Section 7.2.2.,** *Compressor Groups*, for a complete description of this output.

COND MODE

The Cond Mode output is a message generated by Einstein that indicates the operating mode of the condenser. Refer to "COMP MODE" in **Section 7.2.3.,** *Condenser Fans*, for a complete description of this output.

COND FAN 1-8

The Condenser Fan outputs are the current ON/OFF states of the condenser fans controlled by the MultiFlex PAK board.

COND FAN OUT 1-8

The Condenser Fan Out 1-4 outputs mirror the states of the MultiFlex PAK outputs that control the fans or fan groups.

PAK ALARM

The Pak Alarm output turns ON when one or more unacknowledged or unreset alarms are detected on the MultiFlex PAK.

LIQUID INJECT

The Liquid Inject output mirrors the state of the Liquid Injection output on the MultiFlex PAK.

COND SPRAY

The Cond Spray output mirrors the state of the Condenser Spray output on the MultiFlex PAK.

HI DISCH TRIP

This output turns ON to indicate a high discharge pressure trip has caused a compressor shutdown.

PAK STATUS

The PAK Status output shows whether the PAK is Online or Offline.

PROOFFAIL CMP 1-8

The Prooffail Compressor 1-8 outputs show whether the proof status of each of the compressors is OK or FAIL.

ALG STATUS

This output is used by CPC personnel for troubleshooting purposes.

7.3.7. Screen 7: PAK Outputs

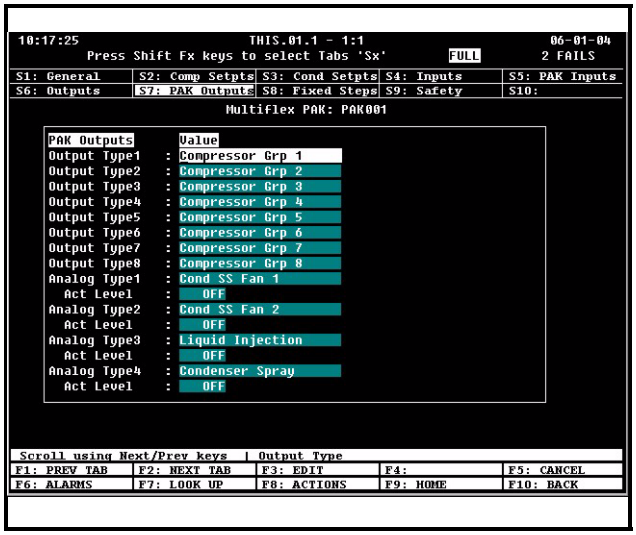

Figure 7-9 *- PAK Screen 7 - PAK Outputs*

Output Type 1 - 8 and Analog Type 1-4

The eight Output Type and four Analog Type 1-4 fields specify what types of outputs are connected to each of the eight relay points and four analog points on the MultiFlex PAK.

Since the PAK controls the analog points as a 0VDC / +8VDC digital output, all output types can be assigned to either the analog points or the relay points.

Configure each of these outputs with the correct output type. ***Table 7-2*** lists the input types and their meanings.

Input Name	Description
None	Output point is empty
Compressor Group 1-8	Compressor group 1 through 8.
Fan Stage 1-4	Used in Staged Fan control, these are fan stages 1-4
Liquid Injection	Liquid injection output
Condenser Spray	Valve that turns ON/OFF the condenser spray
PAK Alarm	Output that turns ON when an unacknowledged/unreset alarm is present for this PAK.
VSD Fan Enable	Output closes when the VSD fan is to be ON at any speed. Meant for connection to "forward-run" input on the inverter.
VSD Fan Bypass	Inverter bypass output
VSD Fan Reset	Inverter reset output
VSD Fan Analog	Analog output whose voltage controls the VSD fan speed
Fan Seq Analog	Analog output whose voltage controls the fan sequencer board in Fan Sequencer control

Table 7-2 *- MultiFlex PAK Default Outputs*

7.3.8. Screen 8: Fixed Steps

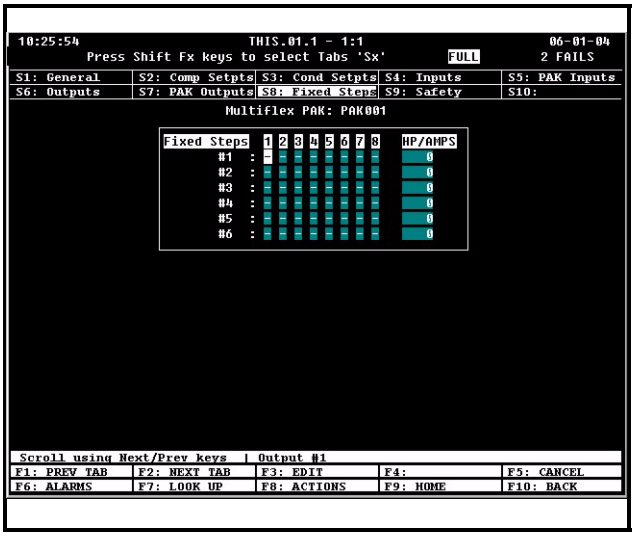

Figure 7-10 *- PAK Screen 8 - Fixed Steps*

The Fixed Steps screen only appears if you selected “Fixed Steps” as the compressor control strategy.

The Fixed Steps screen is where you specify which compressor groups will be ON for each fixed step.

One row will be shown on this screen for each of the fixed steps whose number you specified under Screen 1: General. The eight columns, 1 through 8, represent for each row the activation state of each compressor group 1-8.

If you wish to make a compressor group active for a fixed step, highlight the field in the Fixed Step table for the row of the fixed step you are configuring and the column of the compressor group, and use the PREV (:) or NEXT(.) keys to select “X” (representing ON). All compressor groups marked with an “-” will be OFF for that step.

As you move the cursor from row to row and field to field, the HP/AMPS field for each row is updated to indicate how many total HP or amps will be active for each fixed step.

7.3.9. Screen 9: Safety

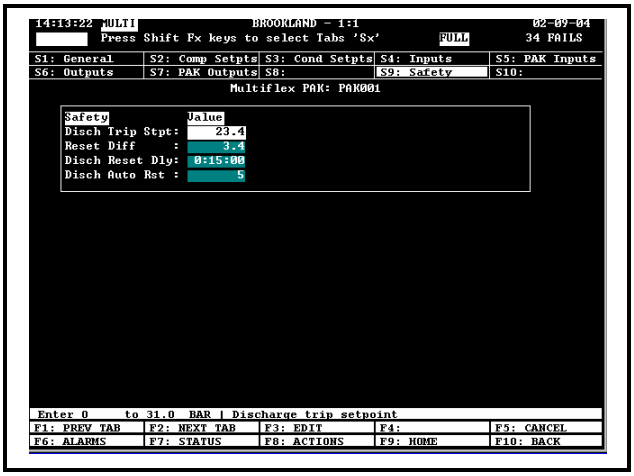

Figure 7-11 *- PAK Screen 9: Safety*

Disch Trip Stpt

The Discharge Trip Setpoint is the discharge pressure above which a discharge trip will occur. When this setpoint is exceeded, all compressors will immediately shut OFF and an alarm will be generated.

Reset Diff

When a discharge trip has occurred, the PAK will automatically "reset" the discharge trip when the pressure has fallen a number of units equal to the Reset Diff set point. In other words, if the discharge trip occurred at 340 PSI and the Reset Diff setpoint is set to 50 PSI, a discharge trip will be reset when the discharge pressure falls to 290 PSI (340 - 50).

A reset will only occur if the PAK has remained in discharge trip mode for an amount of time equal to the Discharge Reset Delay (see below).

Disch Reset Dly

The Discharge Reset delay is the minimum amount of time the PAK will remain in discharge trip mode after a discharge trip has occurred. Once this time delay has elapsed, the PAK may automatically reset the discharge trip condition if the pressure falls a number of units equal to the Reset Diff set point.

Disch Auto Rst

The Discharge Auto Resets parameter specifies the maximum number of automatic resets of a discharge trip that will be attempted within a 24-hour period. If a discharge trip occurs and the PAK has already auto-reset a number of times equal to this parameter within the past 24 hours, the PAK will not attempt another automatic reset, and will lock all compressors OFF until a user resets the discharge trip alarm manually.

8 MultiFlex PAK Hand-Held Terminal Interface

All MultiFlex boards have a Hand-Held Terminal interface, which can be used to view status for the board without having to use the site controller. Though different for each model of MultiFlex, the Hand-Held Terminal interface allows you to perform the same general functions:

- View failure messages that relate to the MultiFlex
- View the status of inputs (both in volts and in engineering units appropriate to the sensor type)
- View the current state of relay outputs (ON or OFF) and analog outputs (both in volts and in percentage)
- Override relay outputs to a fixed ON or OFF state, or override analog outputs to a fixed percentage
- Configure set points

Plugging In the Hand-Held Terminal

The Hand-Held Terminal plugs into the RJ11 jack on the MultiFlex base board (located on the bottom left side of the board, as shown in ***Figure 8-1***). Press the Hand-Held Terminal connector into the jack until it snaps into place. When the connector is correctly seated, the screen to the Hand-Held Terminal will display the message "CPC Handheld Terminal" and then the first screen of the MultiFlex interface.

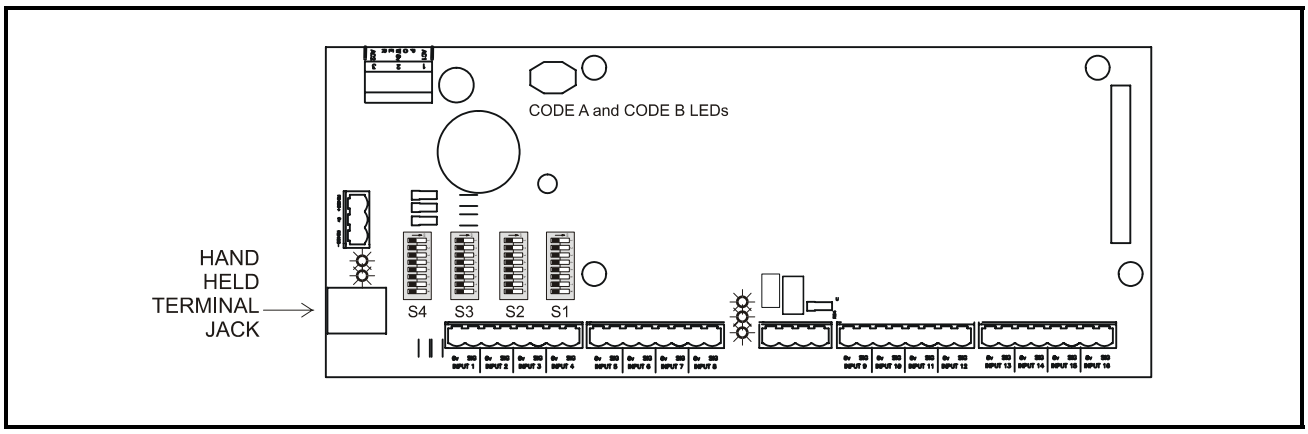

Figure 8-1 *- MultiFlex HHT Jack Location*

8.1. Handheld Display

F1 – Setup

F2 – Status (Status screens auto scroll unless a key is pressed)

1- General

·PAK Name

·Number of Steps

·Number of Compressors

·Number of Condenser Fans

·Pressure Units

·Temperature Units

·Network Alarm

·Special Code

·Condenser and Compressor Interlock

2 - Compressor Setpoints

·Suction Pressure setpoint

·Deadband

·Step ON and OFF delays in seconds

·Suction pressure minimum setpoint

·Compressor HP or Amp setup

·Compressor Output Groups

·Fixed Steps

3 - Outputs

·Analog Output Level

Analog Output 1Condenser Fan 1 On/Off

Analog Output 2Condenser Fan 2 On/Off

Analog Output 3Condenser Fan 3 On/Off

Analog Output 4Condenser Fan 4 On/Off

Note: Each of the 4DO (4AO) Output channels is capable of sourcing 15mA@ 80Vdc. The condenser fan outputs default to 8.0 Vdc for OFF and 0.0 Vdc for ON. The ON/ OFF voltages can be reversed with a configurable parameter in the PAK.

·Digital Output Assignment

Digital Output 1Compressor 1 On/Off

Digital Output 2Compressor 2 On/Off

Digital Output 3Compressor 3 On/Off

Digital Output 4Compressor 4 On/Off

Digital Output 5Compressor 5 On/Off

Digital Output 6Condenser Spray

Digital Output 7Liquid Inject

Digital Output 8Alarm

4 - Condenser Setpoints

·Condenser TD setpoint

·Deadband

·Fan ON and OFF delay in seconds

·Min/ Max TD pressure limits

·TD Fail Ambient temp Discharge pressure and Deadband

·TD Min. Ambient temp

·Disable Interlock Discharge pressure setpoint

·Condenser Fan HP or Amp setup

·Condenser Fan Output Groups

5 - Inputs

·Suction Transducer selection

·Total Compressor Amps

·Total Condenser Amps

·Discharge Sensor Type

·Input Offsets: Suction, discharge and Ambient temperature

·Liquid Level Setup

·Input setup 1-16

Note: Maximum number of discharge temperature sensors is 9

Default Inputs 1-16

Analog Input 1Suction Pressure

Analog Input 2Discharge/Condensing Pressure

Analog Input 3Ambient Temperature (Condenser air on temperature)

Analog Input 4Suction return gas temperature

Analog Input 5Compressor Amps

Analog Input 6Condenser Amps

Analog Input 7Liquid Level

Analog Input 8Compressor 1 discharge temperature

Analog Input 9Compressor 2 discharge temperature

Analog Input 10Compressor 3 discharge temperature

Analog Input 11Compressor 4 discharge temperature

Analog Input 12Compressor 5 discharge temperature

Analog Input 13Compressor 6 discharge temperature

Analog Input 14Compressor 7 discharge temperature

Analog Input 15Compressor 8 discharge temperature

Analog Input 16Compressor 9 discharge temperature

6 - Safety

·Discharge Trip Pressure, Differential, Reset delay in Minutes, number of Auto resets

·Safety Shutdown Status and Reset