



**S70-301 OM/NOV 99**

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**Operation - Maintenance**



**BOOSTER ROTARY SCREW COMPRESSOR UNITS**

**MICROPROCESSOR CONTROL**

**THIS MANUAL CONTAINS RIGGING, ASSEMBLY, START-UP, AND MAINTENANCE INSTRUCTIONS. READ THOROUGHLY BEFORE BEGINNING INSTALLATION. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE OR IMPROPER OPERATION OF THE UNIT.**

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Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation or practice which, if not avoided, will result in death or serious injury.

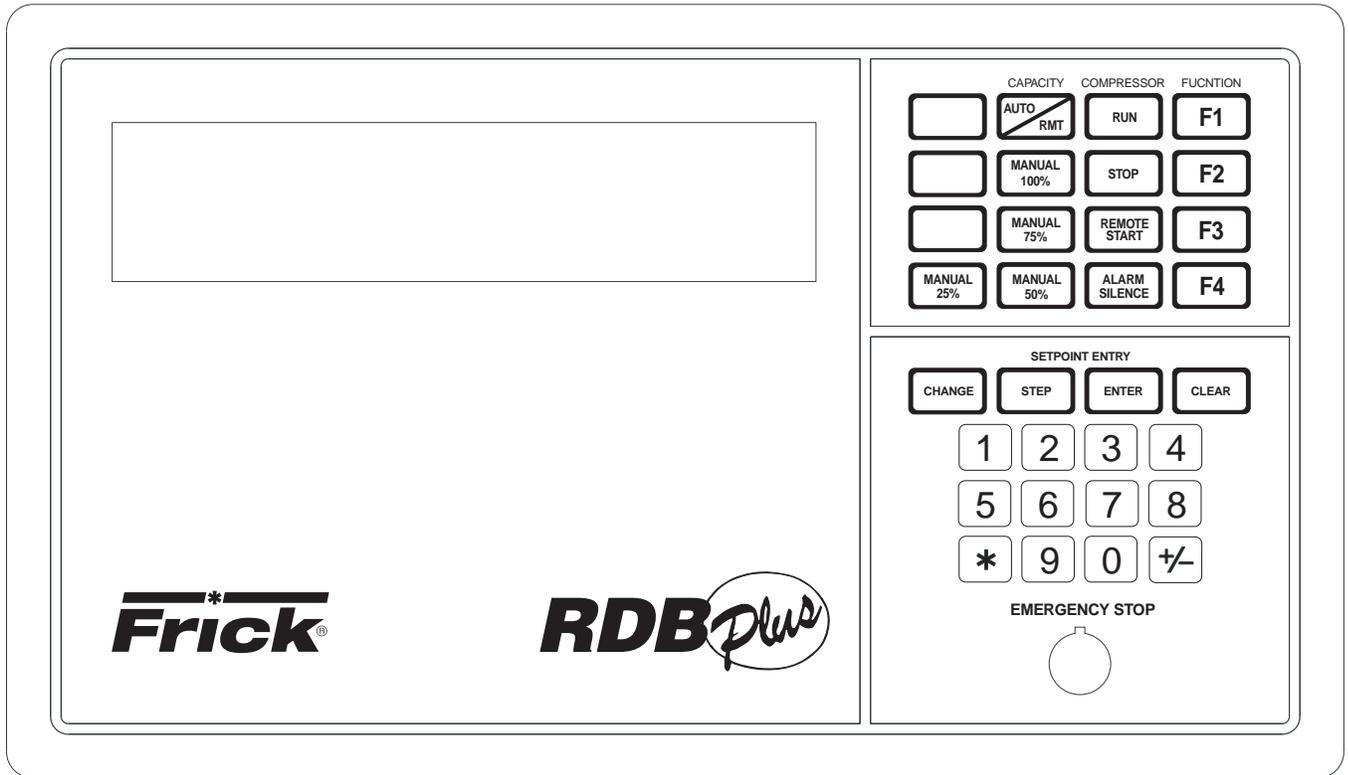


Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.

### NOTE:

Indicates an operating procedure, practice, etc., or portion thereof which is essential to highlight.

MICROPROCESSOR CONTROL PANEL



**THE FOLLOWING SUBSECTIONS MUST BE READ AND UNDERSTOOD BEFORE ATTEMPTING TO START OR OPERATE THE UNIT.**

The RDB PLUS BOOSTER compressor is controlled by a state-of-the-art microprocessor control system. The microprocessor continuously monitors the compressor unit's condition and operation. The microprocessor also directs instructions to the various compressor unit subsystems.

The microprocessor has a membrane switch keyboard. Pressing the keyboard in the area outlined as a key will cause that function to be recognized by the microprocessor. The keyboard has 32 membrane-type keys.

In addition to the keyboard, there is an emergency stop button. Pushing the emergency stop will bypass the computer and remove all power from the outputs.

This will shut down the compressor motor and all high voltage to the compressor auxiliary systems such as the oil pump and liquid injection solenoid. **THE EMERGENCY STOP BUTTON IS FOR EMERGENCY SHUTDOWN SITUATIONS ONLY and MUST NOT BE USED TO ROUTINELY SHUT OFF THE COMPRESSOR.**

The microprocessor continuously monitors the state of the battery which maintains setpoints and various other data. If the battery voltage is low, the message "LOW BATTERY" will flash in the lower right hand corner of the bottom display (refer to S70-301 IOM for description of battery backup).

The microprocessor hardware contains an output watchdog circuit. If the microprocessor should fail, this circuit will disable (turn off) all outputs.

## KEYS AND KEY FUNCTIONS

**NOTE: The microprocessor will automatically return to the operating display after 60 seconds of keyboard nonactivity.**

The [CHANGE] key rotates the display screen through five of eight display modes. The [CHANGE] key is also used to change the status of various setpoints.

The [STEP] key steps or moves a set of flashing brackets through the Adjustable setpoints on the Setpoints displays, the Auto-cycle display, the Security display, and the Setback display. The setpoint enclosed within the flashing brackets may be changed or updated. The [STEP] key is also used when the annunciator display is selected to step through the annunciator's ten information displays.

**NOTE: The [ \* ] key is used to step or move the flashing brackets, described above, backwards.**

The [ENTER] key is used to enter new setpoint limits.

The [CLEAR] key will reset an alarm or cutout indication on the annunciator screen and will clear the microprocessor to allow continued operation or restarting if all conditions have returned to normal and no other control lockouts are in force.

The [NUMERIC KEYPAD] is used to introduce new setpoint limits.

The [+/-] key is used to toggle between pounds per square inch gauge (g) and inches of mercury (hg).

The [RUN], [STOP], and [REMOTE START] keys control the starting and stopping of the compressor unit.

The [ALARM SILENCE] key will deenergize the alarm horn output.

The [AUTO/RMT], [MANUAL 100%], [MANUAL 75%] and [MANUAL 50%] keys control the operation of the compressor capacity control pistons.

The [F1] function key will return the operator to the main operating display. This function may be invoked at any time, even during setpoint entry.

The [F2] function key will call up the Security display. **NOTE: Press the [F2] key, as prompted by the display, to return to the previously selected display.**

The [F3] function key will call up the Setback display. **NOTE: To exit the Setback display, press the [F1] key as prompted by the display.**

The [F4] function key will call up the Auto Cycle display. **NOTE: To exit the Auto Cycle display, press the [F1] key as prompted by the display.**

The microprocessor has a liquid crystal display in a 4 line by 40 character format, for a total of 160 characters. There are 8 different display modes with a total of 23 displays. When power is first applied to the control panel, the unit will be in the Operating display mode. To change to a different display mode, press the [CHANGE] key. The display modes in their order of rotation are:

1. Operating display (2 Pages)
2. Setpoints display (4 Pages)
3. Annunciator display (10 Pages)
4. Shutdown Record display (2 Pages)
5. Freeze display (2 Pages)

- [F2] Security display
- [F3] Setback display
- [F4] Auto Cycle display

**NOTE: On initial powering of the microprocessor, and any time power has been removed from the microprocessor, only the Operating, Setpoints, Annunciator, and Shutdown displays will display information. The freeze display will appear as a dark screen. The Freeze display will only be present after a compressor unit cutout.**

## OPERATING DISPLAY \*

```
OP.DISPLAY PAGE 1 Thu 10-01-87 15:33:36
Suction Disch Oil Filter Compressor
14.3 hg 024 g 060 g 01PSID MAN Mode
-040 F 135 F 135 F RUNNING
```

```
OP.DISPLAY PAGE 2 Thu 10-01-87 15:33:36
Capacity Pump %FLA Sep 132 F
100% C.C.=14.3 g on 098% HTR off
Auto LO-BAT
```

The Operating display is continuously updated and provides a variety of information in regard to the current status of the compressor's condition and performance.

The information furnished by the Operating display is as follows:

The DAY, DATE, and TIME are displayed at the top right of the display.

**NOTE: To set day, date, and time; see TO CHANGE THE ADJUSTABLE SETPOINTS.**

**SUCTION** - Suction Pressure and Temperature are measured at the compressor inlet and are displayed, respectively, in pounds per square inch gauge (g) or inches of mercury (hg) and degrees Fahrenheit.

**DISCH** - Discharge Pressure and Temperature are measured at the compressor outlet and are displayed, respectively, in pounds per square inch gauge (g) and degrees Fahrenheit.

**OIL** - Oil Pressure and Temperature are measured prior to entering the compressor and are displayed, respectively, in pounds per square inch gauge (g) and degrees Fahrenheit.

**COMPRESSOR** - Compressor displays the status of the compressor unit. The mode of operation will be indicated as either manual (MAN MODE) when the [RUN] key has been pressed, automatic (AUTO MODE) when Auto Cycle has been activated, remote (RMT MODE) when the [REMOTE START] key has been pressed, or off (OFF MODE).

\*Display for illustrative purposes only.

**CAPACITY** - Capacity displays the position of the capacity control pistons as a percentage. This percentage reflects the mechanical position of the capacity control pistons and does not reflect the percentage of full-load operation. Immediately below this information, space has been provided to indicate whether Capacity is in the automatic (AUTO), manual (MAN), or remote (RMT) mode. The microprocessor will control this function in the automatic mode.

**C.C.** - Capacity Control, located to the right of % Capacity, indicates the current capacity control suction pressure setpoint in pounds per square inch gauge (g) or inches of mercury (hg).

**PUMP** - Pump displays the current status of the oil pump. The display will read ON or OFF whenever the HAND-OFF-AUTO switch is selected to AUTO and the compressor is running.

**% FLA** - Percent Full-Load Amps displays the percentage of the drive motor full-load amperage rating that the motor is currently using.

**SEP** - Separator displays the oil separator temperature in degrees Fahrenheit.

**HTR** - Heater displays the condition of the oil separator heater(s), indicating ON or OFF.

**ALARM/CUTOUT** - An Alarm or Cutout message indicates an Alarm or Cutout setpoint has been reached, or exceeded. Rotate the display mode to the Annunciator display for details. In the event of a cutout, rotate to the Freeze display for further details.

**FORCED UNLD** - A Forced Unload message indicates that the percentage of motor full-load amps has exceeded the maximum limit and the microprocessor is unloading the compressor until the percentage FLA falls back to normal limits.

**RECYCLE DELAY** - A Recycle Delay message indicates that the compressor has started and has shut down within the time delay setpoint period. The Recycle Delay will prevent the compressor from starting until the delay time expires and is intended to prevent damage to the compressor motor from successive restarts. During Recycle Delay, the microprocessor will alternatively flash "RECYCLE DELAY" and the remaining delay time in minutes.

**NOTE: Consult Motor Manufacturer for the recommended duration of the Recycle Delay.**



If the [RUN] key is pushed while the unit is in Recycle Delay, the compressor will start at the end of the delay period.

**SETPOINTS DISPLAY \***

```
SETPOINTS PAGE 1      ID=[33] [10-01-87]
Cap. Control1---[14.3 hg] Thu [15:33:36]
Lo Suct Cutout-[20.0 hg] Baud----[ 2400]
Lo Suct Alarm--[18.0 hg] Recy.Delay-[30]
```

```
SETPOINTS PAGE 2      MLC Stop LD-[095%]
CT Factor-[078]      MLC Force ULD[100%]
Aux1[Alarm][NO] Hi Disch Cutout-[050 g ]
Aux2[Shutd][NC] Hi Disch Alarm--[045 g ]
```

```
SETPOINTS PAGE 3      RDB BOOSTER
Filter-----[25] TD-[1 Min] DB-[1.0 #]
Oil Heater--[113F] Liq Inj Con----[110F]
Hi Disch Cut[212F] Hi Disch Alarm-[194F]
```

```
SETPOINTS PAGE 4
Hi Oil Temp Cutout-[167F] Alarm-[158F]
Lo Oil Temp Cutout--[49F] Alarm--[58F]
Lo Oil Press.Cutout--[005] Alarm--[010]
```

\*Display for illustrative purposes only.

**NOTE: Pages 1 and 2 of the Setpoints display plus "TD" and "DB" on page 3 are adjustable setpoints. Adjustable setpoints define the limits of the compressor package operation. When these limits are reached, or exceeded, an alarm or compressor shutdown will occur.**

The information furnished by the Adjustable Setpoints of the Setpoints display is as follows.

**SETPOINTS DISPLAY, Adjustable, Page 1:**

**CAP CONTROL** - The Capacity Control setpoint, reported in pounds per square inch gauge (g) or inches of mercury (hg), controls the loading and unloading of the compressor when **Capacity** is in the automatic (AUTO) mode.

**LO SUCT CUTOUT** - The Low Suction Pressure Cutout, reported in pounds per square inch gauge (g) or inches of mercury (hg), will shut down the compressor if the suction pressure drops to this limit or lower, for 90 seconds or longer.

**LO SUCT ALARM** - The Low Suction Pressure Alarm, reported in pounds per square inch gauge (g) or inches of mercury (hg), will trigger a prealarm if the suction pressure drops to this limit or lower.

**ID** - The ID number is a programmable identification code used in telecommunications to access a specific compressor.

**DATE** - The Date displays the current date in the following format: Month - Day - Year.

**DAY** - Day will display the current day of the week.

**TIME** - The Time displays the current time in the following format: Hours - Minutes - Seconds. The time is in 24:00:00 hour clock format.

**BAUD** - Shows the baud rate of the RS422 communication ports 1 and 2. Both ports are configured as follows: word = 8 bit, parity = none or even, stop = 1 bit. The communications ports are programmable from 300 to 19200 baud.

**RECY. DELAY** - The Recycle Delay displays the current recycle delay setpoint in minutes. **NOTE: Consult motor manufacturer for recommended setpoint.**

## SETPOINTS DISPLAY, Adjustable, Page 2:

**MLC STOP LD** - The Motor Load Control Stop Load, reported as a percentage of the motor full-load amps (FLA), will prevent the compressor capacity control pistons from loading when the setpoint is equaled, or exceeded. **NOTE: Consult motor manufacturer for recommended setpoint.**

**MLC FORCE ULD** - The motor Load Control Force Unload, reported as a percentage of the motor full-load amps (FLA), will force the compressor to unload until the motor full-load amps (FLA) fall within 1% of the setpoint, or lower. **NOTE: Consult motor manufacturer for recommended setpoint.**

**HI DISCH CUTOUT** - The High Discharge Pressure Cutout, reported in pounds per square inch gauge (g), will shut down the compressor if the discharge pressure equals or exceeds this setpoint.

**HI DISCH ALARM** - The High Discharge Pressure Alarm, reported in pounds per square inch gauge (g) will trigger a prealarm if the discharge pressure equals or exceeds this setpoint.

**CT FACTOR** - The Current Transformer Factor records the proper current transformer factor to match the compressor motor FLA rating to the current transformer primary rating. The CTF factor is programmable and its correct value is determined by the following formula:

$$CTF = \frac{1024 \times FLA \text{ (Full Load Amps)}}{10 \times CT \text{ (Current Transformer Primary Amps)}}$$

EXAMPLE: FLA = 230 Amps  
CT = 300 (300:5)

$$CTF = \frac{1024 \times 230}{10 \times 300} = 78 \text{ (Round to whole number)}$$

**AUX 1** and **AUX 2** - May be configured for either an alarm or shutdown and with either a normally closed (**NC**) or normally open (**NO**) contact.

## SETPOINTS DISPLAY, Adjustable, Page 3:

**TD** - Time Delay, adjustable from 1 to 9 minutes, is a function of capacity control. The default time delay cycle is one minute at which interval the microprocessor compares suction pressure to the capacity control setpoint. If suction pressure falls above or below the capacity control setpoint by more than the Dead Band (see below), the microprocessor will instruct the compressor to step up (load) or step down (unload).

**DB** - Dead Band, adjustable from 0.5 to 9.9 PSI, is a plus or minus pressure range within which the compressor is neither loading or unloading.

## TO CHANGE ADJUSTABLE SETPOINTS

Adjustable Setpoints are stored in RAM (random access memory) and are easily changed in the field.

**IMPORTANT: Adjustable Setpoints are lost if power is interrupted and the battery is not fully charged. To facilitate reentry, we suggest that a list of Adjustable Set-**

**points be affixed to one end of the microprocessor cabinet for reference.**

**NOTE: The following procedure also applies to the changing of the Security, Setback, and Auto Cycle display setpoints.**

1. Press the **[CHANGE]** key to rotate the display to any of the Adjustable Setpoints displays (Pages 1, 2 or 3 of the Setpoints display.

2. Press the **[STEP]** key to move or step a set of flashing brackets through the various setpoints. A setpoint is selected for change or update when it is enclosed by the flashing brackets.

**NOTE: The DAY indicator, itself, will flash when selected for change or update.**

3. Having selected the setpoint to be changed, the **[NUMERIC KEYPAD]** may be used to enter the new setpoint. **NOTE: All digits must be entered, including zeros. For example, (01.0).**

**NOTE: The DAY, AUX 1, and AUX 2 setpoints, once selected, are changed or updated by pressing the [CHANGE] key.**

**NOTE: Certain setpoints may be reported in either pounds per square inch gauge (g) or inches of mercury (hg). To toggle between (g) and (hg), having selected the setpoint, press the [+/-] key to toggle between (g) and (hg).**

4. In the event that an incorrect setpoint is keyed in all or part, press the **[CLEAR]** key to restore the original setpoint. Pressing the **[CLEAR]** key a second time will eliminate the flashing brackets.

5. Having keyed the desired setpoint, press the **[ENTER]** key. The new setpoint will be entered and the flashing brackets will move or step to the next setpoint.

**NOTE: A setpoint entry outside the parameters of the Adjustable Setpoint display will be refused and the original Adjustable setpoint will be restored.**

## HOW TO DETERMINE ADJUSTABLE SETPOINTS

Adjustable Setpoints should reflect values compatible with normal system operation. Too high a Low Suction Pressure Alarm setpoint may cause nuisance prealarms. Similarly, cutout setpoints should not fall within what are considered normal plant operation. As a rule of thumb, set the Low Suction Pressure Alarm 5 PSIG lower than the lowest normal suction pressure. The Low Suction Pressure Cutout should be 5 to 10 PSIG lower than the Low Suction Pressure Alarm setpoint.

The High Discharge Pressure Cutout should be set at 90% of the setting of the lowest high side relief valve. The High Discharge Pressure Alarm should be set 10 PSIG lower than the Cutout.

The Capacity Control setpoint should be the equivalent of the normal suction condition.

**SETPOINTS DISPLAY, Fixed:**

Fixed setpoints define the limits of acceptable compressor operation. Fixed Setpoints are factory determined, stored in programmed memory (PROM), and will remain in memory if power to the microprocessor is interrupted.

**SETPOINTS DISPLAY, Fixed, Page 3:**

**BOOSTER RDB** - Microprocessor program version.

**FILTER** - The Oil Filter setpoint will trigger an alarm when the differential pressure across the oil filter equals or exceeds 25 pounds per square inch (PSI), for 15 seconds or longer.

**OIL HEATER** - The Oil Heater setpoint, reported in degrees Fahrenheit, turns on the oil separator heater(s) when the oil temperature equals or falls below this setpoint whenever the compressor is **NOT** running.

**LIQ INJ CON** - The Liquid Injection Control, reported in degrees Fahrenheit, will shut off the liquid refrigerant supply to the compressor if the oil temperature equals or falls below this setpoint.

**HI DISCH CUT** - The High Discharge Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the discharge temperature equals or exceeds this setpoint.

**HI DISCH ALARM** - The High Discharge Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the discharge temperature equals or exceeds this setpoint.

**SETPOINTS DISPLAY, Fixed, Page 4:**

**HI OIL TEMP CUTOUT** - The High Oil Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the oil temperature equals or exceeds this setpoint.

**HI OIL TEMP ALARM** - The High Oil Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the oil temperature equals or exceeds this setpoint.

**LOW OIL TEMP CUTOUT** - The Low Oil Temperature Cutout, reported in degrees Fahrenheit, will shut down the compressor if the oil temperature equals or falls below this setpoint.

**LOW OIL TEMP ALARM** - The Low Oil Temperature Alarm, reported in degrees Fahrenheit, will trigger a prealarm if the oil temperature equals or falls below this setpoint.

**LO OIL PRESS CUTOUT** - The Low Oil Cutout will shut down the compressor when the oil pressure equals or falls below this setpoint.

**LO OIL PRESS ALARM** - The Low Oil Alarm will trigger a prealarm when the oil pressure equals or falls below this setpoint.

**ANNUNCIATOR DISPLAY \***

ANNUNCIATOR: PG-01	Thu 10-01-8715:33:36
(Use STEP key	to advance PAGE)
High Press. Cutout	*****
High Press. Alarm	*****

ANNUNCIATOR: PG-02	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Low Press. Cutout	*****
Low Press. Alarm	*****

ANNUNCIATOR: PG-03	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Oil Press. Cutout	*****
Oil Press. Alarm	*****

ANNUNCIATOR: PG-04	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Hi Oil Temp Cutout	*****
Hi Oil Temp Alarm	*****

ANNUNCIATOR: PG-05	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Low Temp Cutout	*****
Low Temp Alarm	*****

ANNUNCIATOR: PG-06	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Disch. Temp Cutout	*****
Disch. Temp Alarm	*****

ANNUNCIATOR: PG-07	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Comp. Auxiliary	*****
Pump Auxiliary	*****

ANNUNCIATOR: PG-08	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Oil Level	*****
Comp. Differential	*****

ANNUNCIATOR: PG-09	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Dirty Filter	*****

ANNUNCIATOR: PG-10	Thu 10-01-87 15:33:36
(Use STEP key	to advance PAGE)
Aux. 1 (Alarm)	*****
Aux. 2 (Shutdown)	*****

When a prealarm or cutout occurs, a flashing **ALARM** or **CUTOUT** indicator will appear in the lower right hand corner of the Operating display. To determine the fault, rotate to the Annunciator display by pressing the **[CHANGE]** key.

The Annunciator display lists all key operative points on ten sequential displays. These displays can be rotated from page **#1** thru page **#10** by pressing the **[STEP]** key. When a prealarm or cutout is triggered, the pertinent point will flash, and the time of the occurrence will be recorded to the right of the alarm.

\*Displays for illustrative purposes only.



Prealarms are self-clearing. At this time the alarm will stop flashing, but the time of the first occurrence will still be recorded to the right of the alarm. Pressing the [CLEAR] key while at the Annunciator display will clear all alarms and/or cutouts.

In order to restore the Annunciator display and resume normal operation it will be necessary to go through the following steps:

1. Correct the conditions causing the alarm.
2. Press the [ALARM SILENCE] key. (This action may precede correcting the conditions causing the alarm).
3. To clear or reset the Annunciator pages, press the [CLEAR] key. This will also clear the ALARM or CUTOUT indicator from the Operating display.
4. Press [F1] to call up the Operating display. If the conditions causing the alarm have not been corrected or a new fault has occurred, a new ALARM or CUTOUT message will appear.

**NOTE: Use of the Emergency Stop Button may trip one or more alarm setpoints.**

**SHUTDOWN RECORD DISPLAY \***

```
SHUTDOWN RECORD P1 Thu 10-01-87 15:33:36
Hi Oil Temp Cutout *****
Hi Oil Temp Cutout *****
Low Temp Cutout *****
```

```
SHUTDOWN RECORD P2 Thu 10-01-87 15:33:36
Low Temp Cutout *****
Disch. Temp Cutout *****
Disch. Temp Cutout *****
```

The Shutdown Record display keeps a record of the last six shutdowns (cutouts). This information will help troubleshoot persistent operational problems. The most recent cutout will appear on the top line of page 1 of the display with the oldest appearing on the last or bottom line of page 2. When a cutout occurs, all information is moved down one line and the new cutout appears at the top of page 1. When the display is full, the oldest record is dropped off the display and is not retained in memory. The information presented is echoed from the Annunciator display; providing the type of cutout, the day, the date, and the time. **NOTE: This information will not be lost due to power failure.**

**FREEZE DISPLAY \***

```
FREEZE DISPLAY P1 Thu 10-01-87 15:33:36
Suction Disch Oil Filter Compressor
14.3 hg 120 g 060 g 01PSID OFF Mode
-040 F 135 F 135 F CUTOUT
```

```
FREEZE DISPLAY P2 Thu 10-01-87 15:33:36
Capacity Pump %FLA Sep 132 F
100% C.C.=14.3 hg OFF 098% HTR off
Auto CUTOUT CUTOUT
```

The Freeze display has the same appearance and contains the same information as the Operating display. (For a description of the information presented by the Freeze display, refer to the Operating display.) The Freeze display freezes the information of the Operating display **AT THE MOMENT OF A COMPRESSOR CUTOUT**. The information on the Freeze display can help the operator to identify the cause of a fault which occurred when no one was present. The Freeze display will retain the information generated by a cutout until a new cutout occurs or power is removed from the microprocessor.

**IMPORTANT: Do not confuse the Freeze display with the Operating display. In order to avoid confusion remember that the displayed information on the Operating display is constantly being updated and changed. The Freeze display is fixed and "FREEZE DISPLAY" appears in the upper left hand corner of the display.**

**NOTE: The Freeze display will appear as a blank screen when power is initially furnished to the unit, and it will return to a blank screen anytime power is removed from the microprocessor.**

**SECURITY DISPLAY \***

```
SECURITY DISPLAY Press F2 To Exit
Setpoints Access--[Enabled ] Keyboard
Enter Access Code--[*****]
```

The [F2] function key will call up the Security display. The Security display allows the operator to either enable or disable the microprocessor's keyboard and, thereby, prevent unauthorized tampering with the various adjustable setpoints. When enabled, the microprocessor keyboard is fully operative and the security lockout is not in effect. When disabled, the keyboard is rendered partially nonfunctional. All displays will still be accessible through the keyboard. If any attempt is made to enter new adjustable setpoints, however, the microprocessor will default to the Security display.

**TO ENABLE THE KEYBOARD**, press the [STEP] key so that the brackets beside Enter Access Code flash, key the proper five digit access code, and press [ENTER]. The Setpoints Access will toggle from disabled to enabled and adjustable setpoint entry is now possible.

**TO DISABLE THE KEYBOARD**, press the [F2] function key to call up the Security display. Press the [STEP] key until the brackets beside Enter Access Code flash, key the proper five digit access code, and press [ENTER]. Now, press the [STEP] key until the brackets beside Setpoints Access flash and press the [CHANGE] key to toggle from enabled to disabled.

**TO CHANGE THE ACCESS CODE**, press the [F2] function key to call up the Security display. Press the [STEP] key until the brackets beside Enter Access Code flash, key the proper five digit access code, and press [ENTER]. Now, select the Enter Access Code a second time by pressing the [STEP] key until the brackets beside Setpoints Access flash, key in the new five digit access code, and press [ENTER].

**NOTE: Power loss will not effect the Security display.**

\*Display for illustrative purposes only.

**NOTE: IF NO ACCESS CODE WAS ENTERED AND THE DISABLED COMMAND WAS SELECTED, THE ACCESS CODE IS [00000].**

**LOST OR FORGOTTEN ACCESS CODE:** Consult Frick for assistance.

### SETBACK DISPLAY \*

```

SETBACK DISPLAY   Thu 10-01-87 15:33:36
Setback Setpoint-[05.0 g ] Active-[No ]
                  Mon Start Time-[---:--]
F1 To Exit       Stop Time-[---:--]
    
```

The [F3] function key will call up the Setback display. The Setback feature enables automatic operation at two separate suction conditions on a preset time schedule. Having entered the desired Setback setpoint, enter the start and stop time or times, and select Active: (Yes) or (No).

**NOTE: To change the Setback setpoints, refer to “TO CHANGE THE ADJUSTABLE SETPOINTS”**

### AUTO CYCLE DISPLAY \*

```

AUTO CYCLE       Compressor Start-[20.0 g ]
F1 To Exit       Compressor Stop--[18.0 hg]
Suct.Press.     Min. Cap. Control-[050%]
=[03.5 g ]      Auto Cycle Active-[No ]
    
```

The Auto Cycle display provides for independently adjustable setpoints to turn the compressor on and off in response to the suction pressure or as an adjustable setpoint to limit the minimum slide valve position.

**NOTE: To change the Auto Cycle setpoints, refer to “TO CHANGE THE ADJUSTABLE SETPOINTS”**

**SUCT.PRESS.** - Constantly monitors and displays the suction pressure in pounds per square inch gauge (g) or inches of mercury (hg).

**COMPRESSOR START** - Compressor Start-up will bring the compressor back on line when the suction pressure rises to the displayed setpoint.

**COMPRESSOR STOP** - Compressor Stop will shut down the unit if the suction pressure drops to or below the displayed setpoint limit. **NOTE: This limit must be set higher than Low Suction Pressure Cutout and the Low Suction Pressure Alarm setpoints.**

**MIN. CAP. CONTROL** - Minimum Capacity Control Position, shown as a percentage, will limit the position of the capacity control pistons to the displayed setpoint.

**AUTO CYCLE ACTIVE** - Indicates whether Auto Cycle is active (YES) or not active (NO). Press the [CHANGE] key while at this setpoint to change the status. Upon deactivation, the compressor will return to the previous mode of operation.

### ANALOG OFFSET DISPLAY\*

```

ANALOG OFFSET:
      Suc Disch Oil Sep Filt Spare Econ
Temp  +0   +0   +0  +0           +0.0
Pres  +0.0 +0   +0           +0       +0
    
```

The Analog Offset Display is accessed by pressing [+/-] key. All analog values can be offset + or - 3 to 9 units depending on which value is being adjusted. Use the [STEP] key to step through the desired setpoint. Press the [CHANGE] key to change the value of the offset by 1. The actual analog value will be displayed on the top line of the display. The “Econ” and channels 10, 12, and 13 are displayed but do not pertain to the program.

### LEAD-LAG OPTION

The lead-lag compressor sequencing option provides the controls for operating two RDB compressors in one system.

### AUTO CYCLE DISPLAY \*

```

AUTO CYCLE       Start[40.0 g ] Timer[01 min]
F1 To Exit       Stop [25.0 g ] Timer[01 min]
Suct Press      Min SV-[50%]   Lead [Yes]
=[35.5 g ]      Active-[No ]
    
```

The software includes user adjustable setpoints on the Auto Cycle setpoints screen (F4 on Main Menu) for the following:

**START** - The suction pressure must be greater than or equal to the “START” setpoint in order to start the compressor. This setpoint works in conjunction with the “Timer” setpoint located to the right of it on the Auto Cycle setpoints screen.

**(Start) TIMER** - This is a time delay used to start the compressor. The timer only accumulates time whenever the pressure rises to or above the “START” setpoint and will reset if the pressure drops below the “START” setpoint.

**STOP** - The suction pressure must be less than or equal to the “STOP” setpoint in order to stop the compressor. This setpoint works in conjunction with the “Timer” setpoint located to the right of it on the Auto Cycle setpoints screen.

**(Stop) TIMER** - This is a time delay used to stop the compressor. The timer only accumulates time whenever the pressure drops to or below the “STOP” setpoint and will reset if the pressure rises above the “STOP” setpoint.

**MIN SV** -This setpoint is the minimum slide valve position and is shown as a percentage. It will limit the slide valve position to the displayed setpoint.

**LEAD** - This setpoint assigns the compressor as the lead or the lag unit. Press the [CHANGE] key while at this setpoint to change the status.

**ACTIVE** - This setpoint indicates whether the Auto Cycle Mode is active or not. Press the [CHANGE] key while at this setpoint to change the status.

\*Display for illustrative purposes only.

## OPERATION

For operation of the LEAD-LAG sequence, both units must be in Auto Cycle compressor mode - one compressor micro selected as the LEAD compressor, the other compressor selected as the LAG compressor - and the slide valves must be in Auto mode.

### With NO Compressor Running

The lead will start when its "START" setpoint is reached for the amount of time selected for the "TIME" setpoint.

### With ONE Compressor Running

#### If the load rises:

The lag compressor will start when its "START" setpoint is reached for the amount of time selected for the "TIME" setpoint and the lead compressor is running at 100% slide valve or running with the motor load inhibit.

#### If the load falls:

The lead compressor will stop when its "STOP" setpoint is reached for the amount of time selected for the "TIME" setpoint.

### With TWO Compressors Running

#### If the load rises:

The lead and lag compressor will load independently.

#### If the load falls:

The lag compressor will unload to its "MIN SV" setpoint. Then the lead compressor will unload to its "MIN SV" setpoint. The lag compressor will stop when the suction pressure drops below the "STOP" setpoint for the amount of time selected for the "TIME" setpoint.

**NOTE: Be careful not to select both compressors as lead compressors or as lag compressors as improper operation will result.**

**NOTE: One compressor will operate as a normal auto cycle compressor when any one of the following occurs:**

- Power is removed from one of the two compressors,
- Either of the compressors is NOT selected to "AUTO", or
- If communication is lost between the compressors for any reason.

## COMMUNICATIONS TROUBLESHOOTING

### Troubleshooting the communications:

Go to the SETPOINTS DISPLAY FIXED Page 2 by using the [CHANGE] key and the [\*] key. The display will appear as:

### SETPOINTS DISPLAY\*

FIXED	PAGE 2	Comm. Activity-[ ]
Hi Oil Temp Cutout-[167F]	Alarm-[158F]	
Lo Oil Temp Cutout--[49F]	Alarm--[58F]	
Lo Oil Press.Cutout--[005]	Alarm--[010]	

If the microprocessor is receiving information in the communications port from the other compressor, a "1" will flash between the brackets. During normal operation a "1" will flash every 5 seconds.

At the same time information is displayed on the lower right hand corner of the Auto Cycle display concerning the lead-lag information:

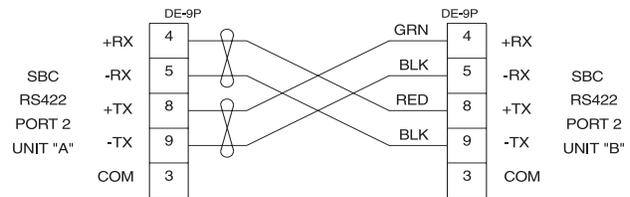
### AUTO CYCLE DISPLAY \*

AUTO CYCLE	Start-[20.0 g]	Timer-[01 min]
F1 to Exit	Stop-[25.0 g]	Timer-[01 min]
Suct Press	Min SV-[50%]	Lead-[Yes]
=[35.5 g]	Active-[Yes]	0101

This information is either "0" or "1" and represents what is being sent from the other compressor. Consult Frick Company if additional information is required.

## TYPICAL LEAD-LAG WIRING

### OPTIONAL WIRING FOR LEAD-LAG SEQUENCING



USE BELDEN #8777 OR EQUAL (3 TWISTED PAIRS)

COLOR CODING SHOWN IS BELDEN #8777

RS 422 WIRING SHALL BE SEPARATE FROM ALL OTHER WIRING

CONNECTORS-#DE-9P MALE WITH DBCH-9 HOOD (2 THUS) JUMPER PIN 1 TO 6 AND 2 TO 7 ON BOTH CONNECTORS

WIRED AT FRICK IF BOTH UNITS ARE ON THE SAME SKID

**NOTE: WHEN USING THE RS422 PORTS FOR LEAD-LAG, THEY CANNOT BE USED FOR ANY OTHER COMMUNICATIONS**

\*Display for illustrative purposes only.

## HOW THE MICROPROCESSOR WORKS SUMMARY

The Frick microprocessor has 3 major components and a variety of sensors. The major components are the SBC (single board computer), 1 display screen, and the keyboard.

The SBC can be considered the brain of the microprocessor control console. The SBC contains the logic center which provides the rules by which the microprocessor will operate, the integrated circuit chips which store the burned in memory of how the compressor unit is to behave, an analog input to convert VDC from the various sensors into computer binary language, and RAM (random access memory) integrated circuit chips to store information which can be readily changed by the microprocessor or, as in the case of adjustable setpoints, by the operator. The SBC collects information, processes the information, and delivers instructions to the displays and to the output modules.

The SBC gathers information from several sources on the compressor unit. Pressure transducers sense changes in pressure and return a variable DC voltage of 1 to 5 VDC to the SBC. The signals are converted into binary code which the microprocessor understands. The microprocessor scans the incoming data many times per second and compares the information it receives with the instructions programmed in the PROM chips, information stored in the RAM chips and instructions it has received from the console keyboard. As operating conditions change the microprocessor also forwards the information it is receiving to the display screen. When an operating condition or conditions develop which the microprocessor program identifies as requiring a specific action, the microprocessor generates an instruction which is forwarded to the output modules. The instruction triggers a solid state output device capable of handling control voltage and the instruction is executed.

If the microprocessor receives information that indicates an abnormal operating condition has been reached or is present it will generate one or more of the following instructions:

1. If a subsystem on the compressor unit, such as the oil heater(s) or liquid injection, can correct the problem; the microprocessor will energize or deenergize this system.
2. If a prealarm setpoint has been reached the microprocessor will trigger the prealarm and display this information on the Operating display and the Annunciator display.
3. If a cutout setpoint has been reached the microprocessor will trigger the prealarm and shut down the compressor. The microprocessor will indicate **CUTOUT** on the Operating display and the information present on the Operating display at the moment of cutout will be stored and can be retrieved by rotating displays to the Freeze display. Additional information will be available through the Annunciator and Shutdown Record displays.

A typical example of how the microprocessor responds can be illustrated by the responses generated by the microprocessor as oil temperature increases. Assume that the ambient temperature and compressor unit temperature is 45°F, liquid injection, R-717 refrigerant and you have just pressed the **[RUN]** key to start the compressor unit:

### AT 45° F.

Microprocessor receives information that the oil temperature is below 49°F, the low oil temperature cutout setpoint, and triggers an alarm. The microprocessor will prevent the compressor package from being started. The microprocessor also instructs the oil heater(s) output to energize the oil heater(s).

### AT 50° F.

When the oil temperature reached 50°F the microprocessor would allow the Low Oil Temperature Cutout to be cleared and the compressor unit could now be started. (Assume that the **[RUN]** key has been pressed and that the compressor has now started.) The low oil temperature alarm would still be engaged and cannot be cleared until oil temperature exceeds 58°F. The oil heater(s) shut off on compressor start.

### AT 113° F.

The microprocessor instructs the liquid injection solenoid output to deenergize the liquid injection solenoid.

### AT 122° F.

The microprocessor instructs the liquid injection solenoid output to energize and the oil heater(s) output to deenergize (This is a fail-safe. The heater(s) should already be deenergized due to compressor running.)

### AT 110° F TO 150° F.

Normal operating range. The microprocessor continues monitoring oil temperature and reporting this information on the Operating display.

### AT 158° F.

The microprocessor triggers the High Oil Temperature Alarm and displays the alarm on the Operating display and the Annunciator display.

### AT 167° F.

The microprocessor instructs the compressor motor to shut down and displays a **CUTOUT** indication on the Operating display, stores the operating conditions at the moment of cutout in the Freeze display. Information regarding the cutout will also be retained by the Annunciator and the Shutdown Record displays.

**NOTE: If the operator makes an error by attempting to start the compressor under conditions outside safe normal operating conditions, the microprocessor will prevent start-up and advise the operator of the fault.**

### MULTIPLE COMPRESSOR SEQUENCING FOR RDB PLUS BOOSTER COMPRESSOR UNIT WITH MICROPROCESSOR CONTROLS

A - The standard microprocessor panel includes:

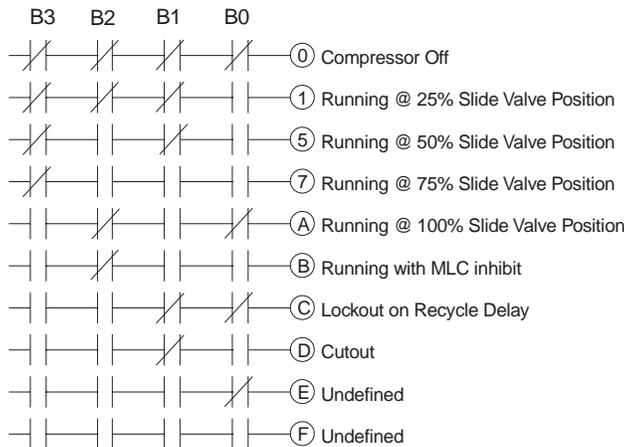
1. Remote Run @25% Input
2. Remote @50% Input
3. Remote @75% Input
4. Remote @100% Input

The remote run input is only recognized when the remote run mode has been selected by pressing the "remote start" key on the front panel of the microprocessor.

The remote capacity control inputs can only be recognized when the "remote" key in the capacity control column on the front panel of the microprocessor has been pressed.

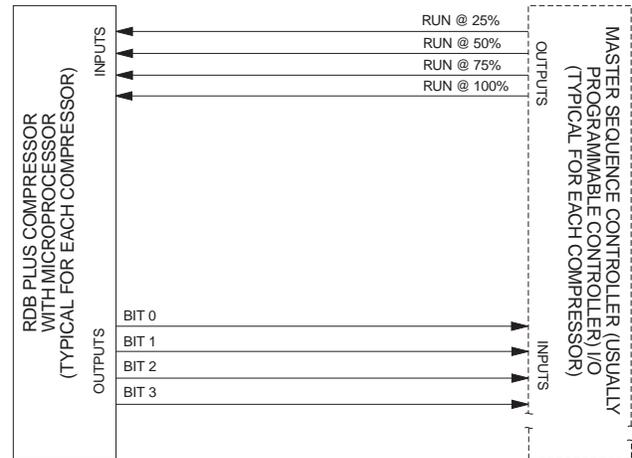
B - If master sequencing between multiple compressors in parallel on a common suction is desired. This output data will permit the compressor microprocessor to be interfaced with a master sequence controller. See electrical diagram for details.

### SUGGESTED PROGRAMMABLE CONTROLLER PROGRAM TO DECODE MICROPROCESSOR OUTPUT DATA CODES



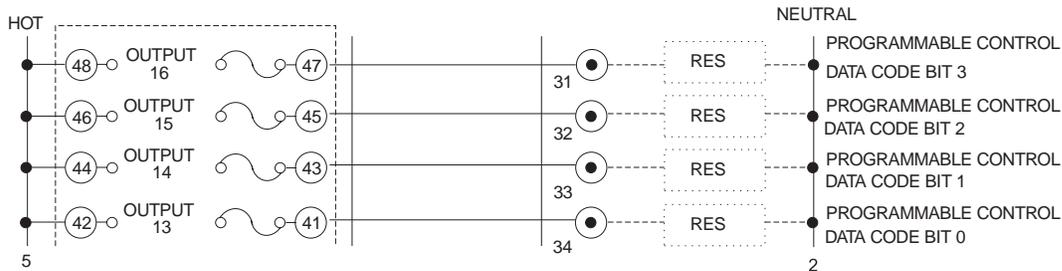
OUTPUT NO.	16	15	14	13	HEX CODES
TERMINAL NO.	31	32	33	34	
MNEMONIC	BIT 3	BIT 2	BIT 1	BIT 0	
MEANING	OUTPUT DATA CODE				
Compressor Off	0	0	0	0	0
Running Capacity Control	25%	0	0	0	1
	50%	0	1	0	1
	75%	0	1	1	1
	100%	1	0	1	0
Running with MLC Inhibit	1	0	1	1	B
Lockout on Recycle Delay	1	1	0	0	C
Cutout	1	1	0	1	D
Undefined	1	1	1	0	E
Undefined	1	1	1	1	F

C - A master sequence controller must be installed to provide the signals to remote start and stop the compressors and remote load and unload the compressors based on the common suction pressure or other parameter and the compressor status based on the optional microprocessor output data feedback. The customer may supply his own master sequencer panel (usually a programmable controller) or Frick, can supply this sequencer if desired (contact Frick for pricing).



### MICROPROCESSOR OUTPUT DATA CODE

A 3.5 K OHM, 10 watt resistor (RES) must be field installed, as shown below, when the 120 VAC outputs of the RDB PLUS are driving 120 VAC solid state input devices such as programmable controllers.



## MICROPROCESSOR TELECOMMUNICATIONS



The following details are typical and may or may not match the software supplied on your compressor.

The telecommunications capabilities are continuously being expanded and improved. Therefore, you **MUST** consult FRICK for the exact details on your particular unit(s) before developing system software to interface with your compressors.

The Frick RDB PLUS Microprocessor comes with an on-board telecommunications interface. The telecommunications feature permits interfacing the microprocessor with a modem, remote data communications terminal, or master computer via RS-422 protocol. In the case of a modem, telephone lines are used for the actual transmission of data permitting communications from a remote location.

The components necessary to utilize the telecommunications feature will vary with the application. Information concerning these items may be obtained from Frick, Waynesboro, Pa.

## COMMUNICATIONS PROTOCOL SPECIFICATIONS

All commands must be in ASCII (CAPS) to be recognized. A compressor with an ID code of [00] is considered disabled. ID Codes from [01] thru [99] are valid and are recognized by the microprocessor.

The following is a complete list of available command types:

COMMAND CODE and DESCRIPTION
I = Returns compressor status information.
R = Compressor start command.
S = Compressor stop command.
V = Compressor capacity control command.
D = Compressors display screens command.
P = Return Pressures information.
T = Return Temperatures information.
A = Return full load amps information.
C = Enter Change setpoints mode.

The following is a detailed description of each command:

RETURN COMPRESSOR STATUS INFORMATION: #01I	
#	Start of command sequence.
01	Compressor ID code.
I	Return Status information command.
RETURNED ANSWER, ie: 09ORRRN340	
Character Position	Description of returned data
1,2,3	Capacity control position.
4	Remote, Auto, Manual (Cap control)
5	Delay-recycle, Running, Off.
6	Rem, Man, Off, Auto (Compressor mode)
7	Cutout, Alarm, Normal.
8,9,10	Suction in PSIA. (Carriage return, line feed.)

COMPRESSOR START COMMAND: #01R01	
#	Start command sequence.
01	Compressor ID code.
R	Start compressor command.
01	ID code repeated for verification
NOTE: The compressor must be in the remote start mode for this command to be executed.	
Returned answer: A01	
Character Position	Description of returned data
1	Acknowledge of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)

COMPRESSOR STOP COMMAND: #01S01	
#	Start command sequence.
01	Compressor ID code.
S	Stop compressor command.
01	ID code repeated for verification
NOTE: The compressor must be in the remote start mode for this command to be executed.	
RETURNED ANSWER: A01	
Character Position	Description of returned data
1	Acknowledge of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)

CAPACITY CONTROL COMMANDS: #01VL #01VU #01V1 #01V7 #01V5 #01V2	
#	Start command sequence.
01	Compressor ID code.
V	Compressor control command.
L	Load command (1 Step).
U	Unload command (1 Step).
1	Set Capacity Control to 100%
7	Set Capacity Control to 75%
5	Set Capacity Control to 50%
2	Set Capacity Control to 25%
NOTE: Capacity Control must be in the remote mode for this command to be executed.	
RETURNED ANSWER: A01	
Character Position	Description of returned data
1	Acknowledge of command sent.
2,3	ID code of compressor. (Carriage return, line feed.)



COMPRESSOR DISPLAY SCREENS COMMAND: #01DXNN

# Start command sequence.  
01 Compressor ID code.  
D Compressor control command.

X = O Operating display (Page 1 & 2)  
X = S Setpoints display (Page 1 & 2)  
X = X Setpoints display (Page 3 & 4)  
X = R Shutdown record display (Page 1 & 2)  
X = F Freeze display (Page 1 & 2)  
X = C Autocycle display  
X = P Security display  
X = B Setback display  
X = ANN Annunciator display page "NN".

NOTE: "NN" parameter is used to access the annunciator display pages.

If the command was #01DA10, then the micro-processor would dump the annunciator display page number ten.

RETURN PRESSURES COMMAND: #01PX

# Start command sequence.  
01 Compressor ID code.  
P Return pressures command.

X = S Return suction pressure (PSIA).  
X = D Return discharge pressure (g/hg).  
X = O Return oil pressure (g).  
X = F Return filter differential pressure.  
X = A Return all pressures.

If the command was #01PS, then the micro-processor would dump the suction pressure.

RETURNED ANSWER:

XXX = 3 characters followed by a carriage return, line feed.

If using the "A" command, then the returned data would be:

XXXXXXXXXXXX = 12 characters followed by a carriage return, line feed.

RETURN FULL LOAD AMPS COMMAND: #01A

# Start command sequence.  
01 Compressor ID code.  
A Return full load amps command.

If the command was #01A, then the micro-processor would dump the full load amps value.

RETURNED ANSWER:

XXX = 3 characters followed by a carriage return, line feed.

g or h must be lower case - exception to "All commands must be caps" statement at beginning of section.

RETURN TEMPERATURES COMMAND: #01TX

# Start command sequence.  
01 Compressor ID code.  
T Return temperature command.

X = S Return suction temperature.  
X = D Return discharge temperature.  
X = O Return oil temperature.  
X = P Return separator temperature.  
X = A Return all temperatures as a string of data.

If the command was #01TS, then the micro-processor would dump the suction temperature.

RETURNED ANSWER:

XXXX = 4 characters followed by a carriage return, line feed if suction temperature is requested. The first character is "+" or "-" followed by three digits.

XXX = 3 characters followed by a carriage return, line feed for all other temperatures.

If using the "A" command, then the returned data would be:

XXXXXXXXXXXX = 13 characters followed by a carriage return, line feed. The first four characters are Suction Temp, the next 3 are Discharge Temp, the next 3 are Oil, the last 3 are Separator.

NOTE: The "S" command will return 4 characters followed by a carriage return, a line feed and "+ or - .xxx".

CHANGE SETPOINTS COMMAND: #01C

# Start command sequence.  
01 Compressor ID code.  
C Change setpoint command.  
xxx New setpoint  
xx New setpoint  
y g or h for gauge or inches

The following is the complete list of the setpoints that may be changed while in the change setpoints command:

01xxxy Capacity Control Setpoint  
02xxxy Change Low Pressure Cutout Setpoint.  
03xxxy Change Low Pressure Alarm Setpoint.  
04xxx Change High Pressure Cutout Setpoint.  
05xxx Change High Pressure Alarm Setpoint.  
06xxx Change MLC Stop Load Setpoint.  
07xxx Change MLC Force Unload Setpoint.  
08xx Change Recycle Delay Setpoint.  
09xxx Change CTF Setpoint.

01 Compressor ID code.

RETURNED ANSWER:

Axxxx The new setpoint which was sent followed by a carriage return, line feed.

If the command was sent #01C01300g01, the capacity control setpoint would be changed to 30.0g and the returned answer is A300g followed by a carriage return, line feed. If the command sent was #01C0711001, the MLC force unload setpoint would be changed to 110% and the returned answer is A110 followed by a carriage return, line feed. If the command sent was #01C0520002, the returned answer is "BAD" followed by the ID number and a carriage return, line feed.

READ INPUT/OUTPUT COMMAND

#01X  
# Start command sequence.  
01 Compressor ID Code.  
X Read Input/Output(s) command.

Returned Answer:

A10000011000000000100000001

Character Position	Description
1	Acknowledge of command sent.
2	Permissive Start
3	Remote Run Input 2
4	Remote Load Input 3
5	Remote Unload Input 4
6	Compressor Aux Input 5
7	Oil Pump Aux 6
8	Aux 1 Input 7
9	Aux 2 Input 8
10	Compressor Run Output 1
11	75% Capacity
12	100% Capacity
13	50% Capacity
14	Not Used
15	Liquid Injection Output 6
16	Not Used
17	Not Used
18	Alarm Output 9
19	Oil Heater Output 10
20	Oil Pump Start Output 11
21	Spare Output 12
22	Programmable Control Data Bit 0 Output 13
23	Programmable Control Data Bit 1 Output 14
24	Programmable Control Data Bit 2 Output 15
25	Programmable Control Data Bit 3 Output 16
26,27	Compressor ID Code

Example:  
If the answer returned was

A10000011000000000100000001,

the inputs/outputs on compressor #1 which are energized are:

Oil level input 1  
Aux 1 Input 7  
Aux 2 Input 8  
Oil Heater Output 10

CHANGE COMPRESSOR MODE COMMAND:

# IDMCmID Change mode to m.  
0=off A=autocycle R=remote  
Return message-"A" followed by the "ID",  
"CR", 'LF" if successful.

CHANGE SLIDE VALVE MODE COMMAND:

# IDMVmID Change Slide Valve mode to m.  
A=auto R=remote  
Return message-"A" followed by the "ID",  
"CR", 'LF" if successful.

CLEAR FAILURE COMMAND:

# IDKFID Clear Fails  
Return message-"A" followed by the "ID",  
"CR", 'LF" if successful.

CLEAR FAILURE COMMAND:

# IDKRID Clear Recycle Delay  
Return message-"A" followed by the "ID",  
"CR", 'LF" if successful.

READ FAILURES COMMAND: #01F

# Start command sequence.  
01 Compressor ID Code.  
F Read Failures command.

Returned Answer:

A0000000000000000000000000000002

Character Position	Description
1	Acknowledge of command sent.
2	High Press Cutout
3	High Press Alarm
4	Low Press Cutout
5	Low Press Alarm
6	Oil Press Cutout
7	Oil Press Alarm
8	Hi Oil Temp Cutout
9	Hi Oil Temp Alarm
10	Lo Oil Temp Cutout
11	Lo Oil Temp Alarm
12	Disch Temp Cutout
13	Disch Temp Alarm
14	Comp Auxiliary
15	Pump Auxiliary
16	Oil Level
17	Comp Differential
18	Dirty Filter
19	Spare
20	Aux 1 Alarm or Cutout
21	Aux 2 Alarm or Cutout
22	Spare
23	Spare
24	Spare
25,26	Compressor ID Code

Example:  
If the answer returned was

A00000100000000000000000000002,

compressor #2 has an Oil Press Alarm.

## TROUBLESHOOTING THE RDB PLUS MICROPROCESSOR

This section contains information on troubleshooting and making corrections to the microprocessor and control circuits of the RDB PLUS BOOSTER unit. The section is composed of four parts: a general information section, a troubleshooting guide, a repair procedure guide, and a section with illustrative schematics and data.

### GENERAL INFORMATION

**CAUTION** THE COMPONENTS WITHIN THE MICROPROCESSOR CONSOLE CAN BE INADVERTENTLY DAMAGED BY STATIC ELECTRICITY OR MISHANDLING. ONLY QUALIFIED TECHNICIANS SHOULD DIRECTLY HANDLE THESE COMPONENTS.

1. **DO NOT REMOVE** the microprocessor console cover or attempt to make corrections to the microprocessor power supply without shutting off the control power. Accidental shorts can irreparably damage the SBC (single-board computer) or the display screens.

2. **DO NOT HANDLE** the SBC or the display screen boards when their cables are disconnected without first attaching a ground strap to prevent static electrical discharge from your body.

Most problems encountered with the microprocessor and control circuits will be the result of a wiring fault, blown fuse, or failure of a peripheral control such as a solenoid coil or a pressure transducer. Faults in the computer, while possible, are unlikely. If a fault develops in the computer, the probability is that all functions will cease and the display screens will go blank.

The control system of the RDB PLUS BOOSTER compressor consists of a 120 volt AC (high voltage) side and a 0-15 volt DC (low voltage) side. The 120 volt side actuates solenoids, relays, alarms, and other electromechanical functions. The 0-15 volt DC side operates the computer and its various sensors. The microprocessor console contains the SBC (single board computer) and two display screens.

**WARNING** When working within the microprocessor console, 120 VOLTS CAN CAUSE INJURY OR DEATH.

To troubleshoot the low voltage side of the RDB PLUS BOOSTER control circuits, it is necessary to have the following tools:

1. Accurate digital multimeter.\*
2. Small wire stripper.
3. Small screwdriver.
4. Small snip nose pliers.
5. 15 watt soldering iron (no larger).
6. .032,60/40 rosin core solder.
7. IC chip extraction and insertion tools.\*
8. Grounding strap.\*
9. Static free grounded work surface.

\* Available from Frick. Order kit 111Q0451862.

## TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (REFER TO WIRING DIAGRAMS)

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
DISPLAYS ARE INOPERATIVE	<p>Check the 10 amp fuse (2FU) which controls all voltage going to the microprocessor.</p> <p>Shut off power to the microprocessor. Remove the console cover and confirm that all cable and wire connections are made.</p>
OIL PUMP DOES NOT START	<p>Verify that the Oil Pump HAND-OFF-AUTO switch (1SS) is in the AUTO position and that the Emergency Stop Button is not depressed.</p> <p>Output 11 controls the Oil Pump Starter Relay (3CR) when in the AUTO mode. If HAND is selected on 1SS, Output 11 will not have any effect on the operation of the oil pump starter.</p> <p>If AUTO has been selected and the oil pump does not start, check for 120VAC between Wires 39 and 2. If 120VAC is not found when the LED for Output 11 is on, check the fuse (FU11). If the problem persists, check the control relay (3CR).</p> <p>The Oil Pump Starter Auxiliary Contact switches voltage to Input 6 (Wires 28 and 2) when the auxiliary contacts are closed and the AUTO mode is selected on 1SS. If the Input does not turn on and voltage is present at Input 6, consult Frick.</p>

**TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (Continued)**

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
OIL PUMP IS RUNNING BUT THE COMPRESSOR DOES NOT START	<p>The (HAND-OFF-AUTO) Oil Pump Selector Switch (1SS) controls oil pump operation and must be in the AUTO position before the compressor can be started.</p> <p>Output 1 controls the motor starter. Check between terminals 38 and 2 for 120VAC. If 120VAC is not found when the LED for Output 1 is on, check the 5 amp fuse (FU1) and Output 1.</p>
COMPRESSOR AUXILIARY SHUTDOWN	<p>Output 1 controls the Compressor Start Relay (2CR). If the compressor does not start and the LED for Output 1 is on, check the fuse (FU1). If the problem persists, check the interposing relay (2CR) and Output 1.</p> <p>The Compressor Starter Auxiliary Contacts turn on Input 5 when they are closed. These contacts are located on the Compressor Starter.</p>
OIL HEATERS DO NOT OPERATE	<p>The oil heaters should operate only when the compressor is NOT running and the oil in the separator sump is cold.</p> <p>If the oil heaters do not work check fuse 1FU (20 amp). If the fuse is not blown, check between Wires 25 and 2 and between Wires 26 and 2 for 120VAC. If 120VAC is not found, check between wires 25 and 26. If 120VAC is found between wires 25 and 26, the Oil Heater Relay is defective. Next, check the voltage between Wires 9 and 2. If 120 VAC is present, the Oil Heater Relay is defective.</p> <p>If you do not read 120VAC between Wires 9 and 2 when the LED for output 10 is on, check the fuse (FU10) and Output 10.</p>
COMPRESSOR DOES NOT LOAD and/or UNLOAD	<p>Verify that SV3 is energized BEFORE SV1 is energized and that SV1 is energized BEFORE SV2 is energized. Feel hydraulic tubing to SP3, SP1, and SP2. If tubing is hot, inspect unloader pistons for worn parts or being improperly seated.</p> <p>Check that the isolating valves for SV1, SV2, and SV3, as well as those isolating ports SP1, SP2, and SP3 are open.</p> <p>Confirm that hydraulic tubing and wiring is properly done to SV3, SV1, and SV2.</p> <p>Check Outputs 2, 3, and 4 and Fuses 2, 3, and 4 on SBC board.</p> <p><b>NOTE: Verify that the proper setpoint has been programmed into C.C. (Capacity Control) on the Adjustable Setpoints display.</b></p>
COMPRESSOR WILL ONLY PARTIALLY LOAD	<p>With SV1 properly energized, verify SV2 energizes.</p> <p>Check that the isolating valves for SV1, SV2, and SV3, as well as those isolating ports SP1, SP2, and SP3 are open.</p> <p>Check Outputs 2, 3, and 4 and Fuses 2, 3, and 4 on SBC board.</p> <p>Inspect SP1 for worn or improperly seated parts. If parts are alright, inspect SP2 for worn or improperly seated parts. If parts are alright, inspect SP3 for worn or improperly seated parts.</p>

**TROUBLESHOOTING FRICK SBC MICROPROCESSOR SYSTEM (Continued)**

SYMPTOM	PROBABLE CAUSES and CORRECTIONS
<p>LIQUID INJECTION SOLENOID DOES NOT ENERGIZE (LIQUID INJECTION REFRIGERANT CUTOUT - LICO)</p>	<p>Verify that the Liquid Injection TX valve is modulating properly and not feeding excessive liquid to the compressor. When oil temperature drops too low, the microprocessor SHOULD deenergize this solenoid.</p> <p>Output 6 controls the Liquid Injection Solenoid. If 120VAC is found across Wires 13 and 2, the Liquid Injection Solenoid should be energized. If not, the solenoid is defective. If 120VAC is not found when the LED for Output 6 is on, check the fuse (FU6) and Output 6.</p>
<p>ALARM HORN DOES NOT ENERGIZE</p>	<p>Output 9 controls the Alarm Horn. The Alarm should turn on only when there is a prealarm. If the Alarm does not sound when these conditions are found, check for 120VAC across Wires 10 and 2. If 120VAC is not found, check the fuse (FU9) and Output 9.</p>
<p>CONTROL PANEL DOES NOT RESPOND TO REMOTE CONTROL SIGNALS</p>	<p>Inputs 2 through 4 can be used to operate the compressor from a remote location. <b>NOTE: Check the Operating display to verify that the compressor is in the REMOTE MODE.</b></p> <p>If 120VAC is found (across Wires 21 and 2, 22 and 2, and 23 and 2) and the input does not turn on, consult Frick.</p>
<p>MOTOR LOAD CONTROL (FORCED UNLOAD) OCCURS AT LOW MOTOR AMPS</p>	<p>The current transducer is used to convert the AC motor amps to a DC voltage signal for the microprocessor. If the %FLA reading from the Operating display is incorrect, check the CTF factor and wiring, then consult Frick.</p>
<p>PRESSURES ON THE OPERATING DISPLAY DO NOT APPEAR CORRECT</p>	<p>TEST 1 - Shut down the compressor and allow pressures to equalize. Suction pressure, discharge pressure, and oil pressure should have the same reading.</p> <p>TEST 2 - If either oil pressure or discharge pressure read different pressures, one or both transducers are at fault. Valve off the suction transducer from the unit and open the vent valve on transducer manifold to atmosphere. If the suction transducer reads atmospheric pressure, then the high pressure transducer which agreed with the suction transducer in Test 1 is correct. The transducer which disagreed is defective.</p> <p><b>NOTE: A 1% tolerance is allowed for all transducers.</b></p>
<p>COMPRESSOR DOES NOT AUTOMATICALLY LOAD OR UNLOAD</p>	<p>Verify that the <b>[AUTO]</b> key has been pressed and AUTO appears on the Operating display.</p> <p>If the problem persists, see the Troubleshooting section COMPRESSOR DOES NOT LOAD and/or UNLOAD.</p>
<p>DISPLAY SCREENS DISPLAY SCRAMBLED PATTERN OR LISTS ALPHABET</p>	<p>A loose or improper connection between the displays and the SBC is indicated. Remove fuse (2FU, 10 amp) for 15 seconds and then, restore to reset the displays.</p>

## EPROM Memory I/C Chip Replacement

Microprocessor EPROM memory I/C chips are located inside the microprocessor console on the SBC board. A special tool is required to remove these chips to prevent damaging them (See Troubleshooting The Microprocessor). The procedure to replace EPROM memory chips is outlined below:

1. Shut off control power.
2. Remove the microprocessor console cover.
3. Using a chip extraction tool, remove old and install new chip. **NOTE: The chip labelled \_4\* must be inserted into socket U4 and the chip labelled \_5\* must be inserted into socket U5.**

\* A letter such as A, B, C precedes the numbers, 4 or 5, to create a chip label A4 or A5. The letter designation is dependent on the design operating conditions.



**THE NOTCHED END OF THE CHIP MUST BE UP WHEN THE CHIP IS INSERTED.**

## SBC BOARD REPLACEMENT

The procedure to replace SBC boards is outlined below:

1. Shut off control power.
2. Remove the old board from the machine and the new board from its packing and place both on an antistatic surface.
3. Remove the program chip(s) from the defective board and install them in the replacement board.



**Pay particular attention to the orientation of the notch(es) on the end of the chip(s). Install the chip(s) on the replacement board in exactly the same position as they were on the defective board.**

4. Then install the modified replacement board in the panel.

## MICROPROCESSOR DISPLAY REPLACEMENT

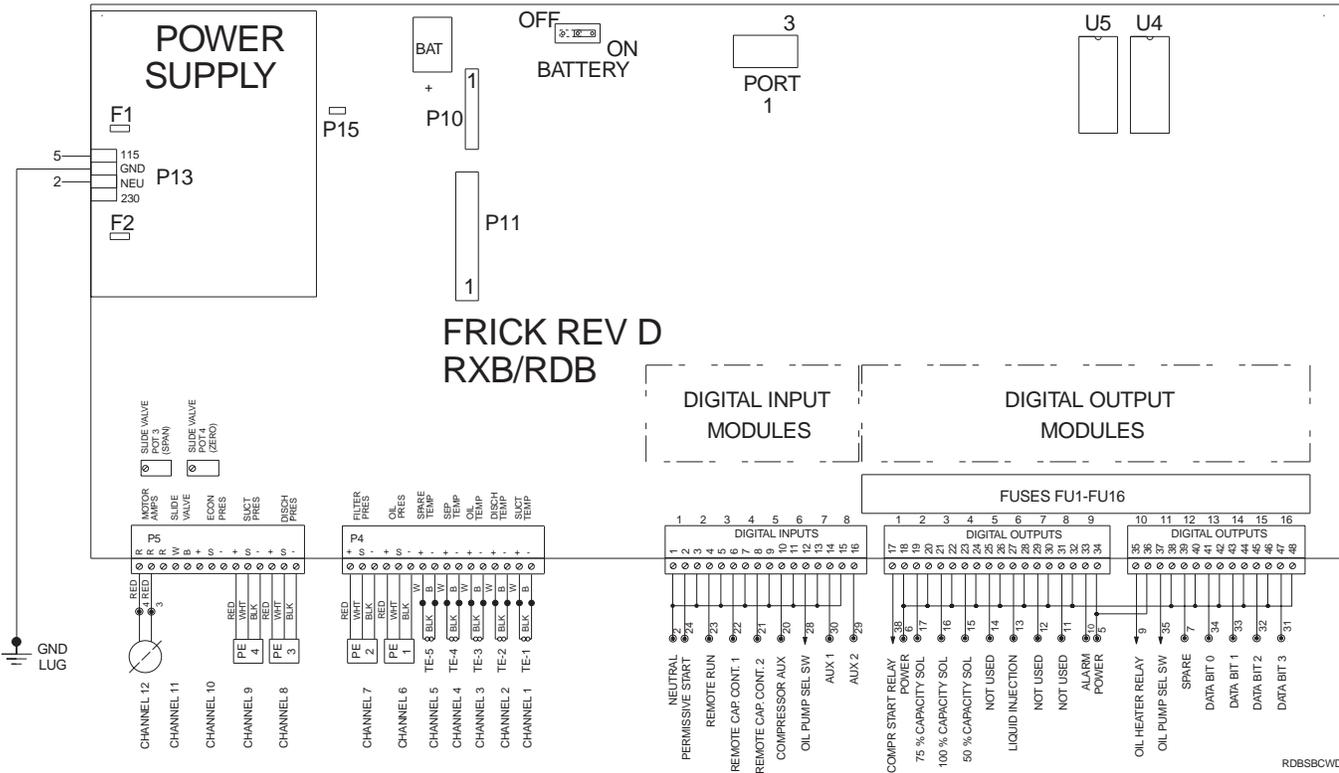
The procedure to replace the microprocessor display is outlined below:

1. Shut off control power.
2. Remove the defective display(s).
3. Install the new display(s).

## OUTPUT FUSE REPLACEMENT

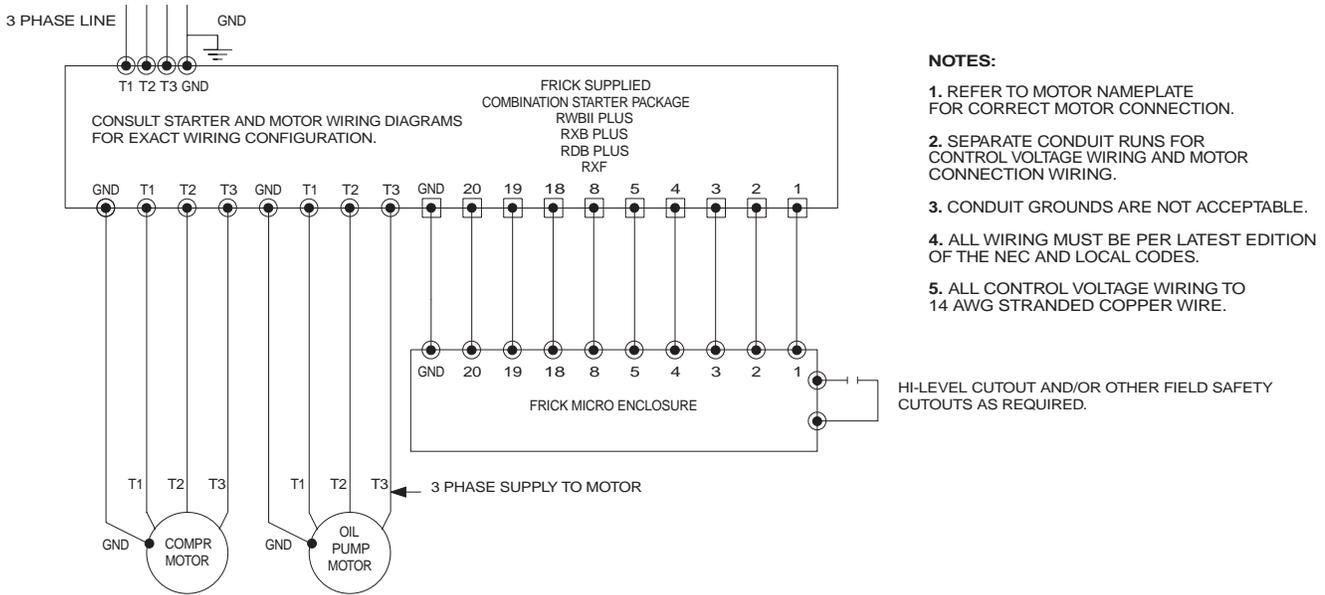
1. Shut off control power.
2. Remove the microprocessor console cover.
3. Identify faulty fuse.
4. Use voltmeter to verify that no voltage is present on either side of the fuse.
5. Remove faulty fuse using fuse puller or screwdriver.
6. Install new plug-type fuse.

**SBC WIRING DIAGRAM**



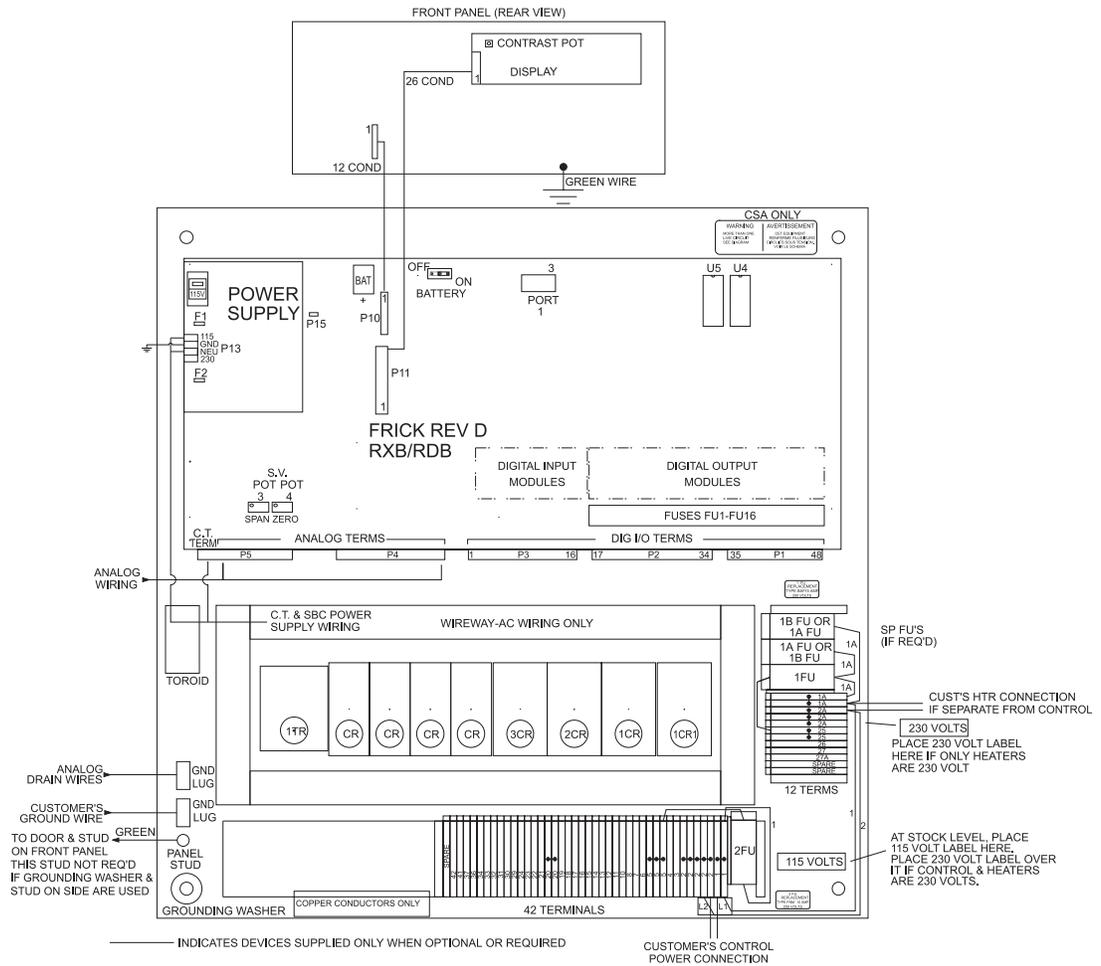
RDBSBCWD

**POINT-TO-POINT FIELD WIRING DIAGRAM**



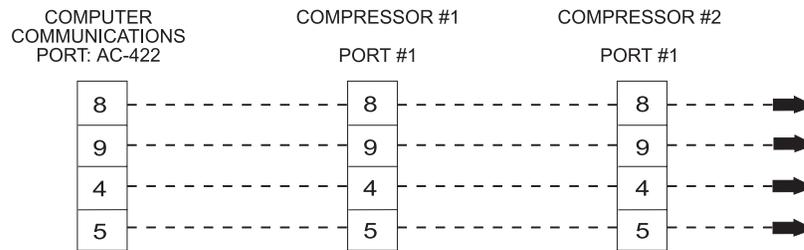
- NOTES:**
1. REFER TO MOTOR NAMEPLATE FOR CORRECT MOTOR CONNECTION.
  2. SEPARATE CONDUIT RUNS FOR CONTROL VOLTAGE WIRING AND MOTOR CONNECTION WIRING.
  3. CONDUIT GROUNDS ARE NOT ACCEPTABLE.
  4. ALL WIRING MUST BE PER LATEST EDITION OF THE NEC AND LOCAL CODES.
  5. ALL CONTROL VOLTAGE WIRING TO 14 AWG STRANDED COPPER WIRE.

**MICRO COMPONENT PLACEMENT DIAGRAM**



**RDB PLUS TELECOMMUNICATIONS**

**COMPUTER TO RDB MICROPROCESSOR WIRING DIAGRAM**



**AC-422 Asynchronous Adapter Card Pinout**

- 1,3 Ground
- 9 - RX (Receive)
- 8 + RX (Receive)
- 5 - TX (Transmit)
- 4 + TX (Transmit)

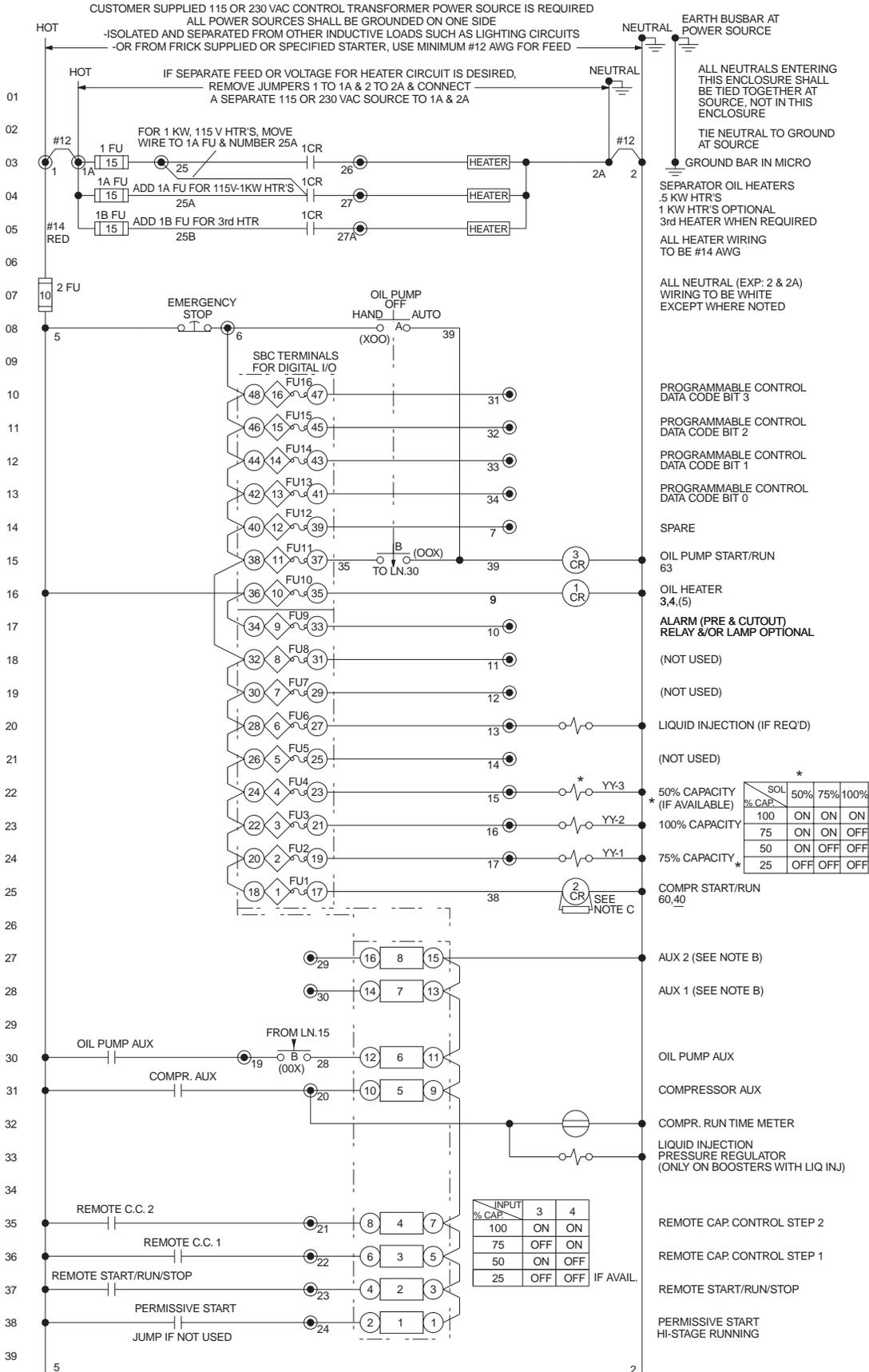
**RDB PLUS MICRO Ports 1 and 2 Pinout**

- 3 Ground
- 5 - RX (Receive)
- 4 + RX (Receive)
- 9 - TX (Transmit)
- 8 + TX (Transmit)

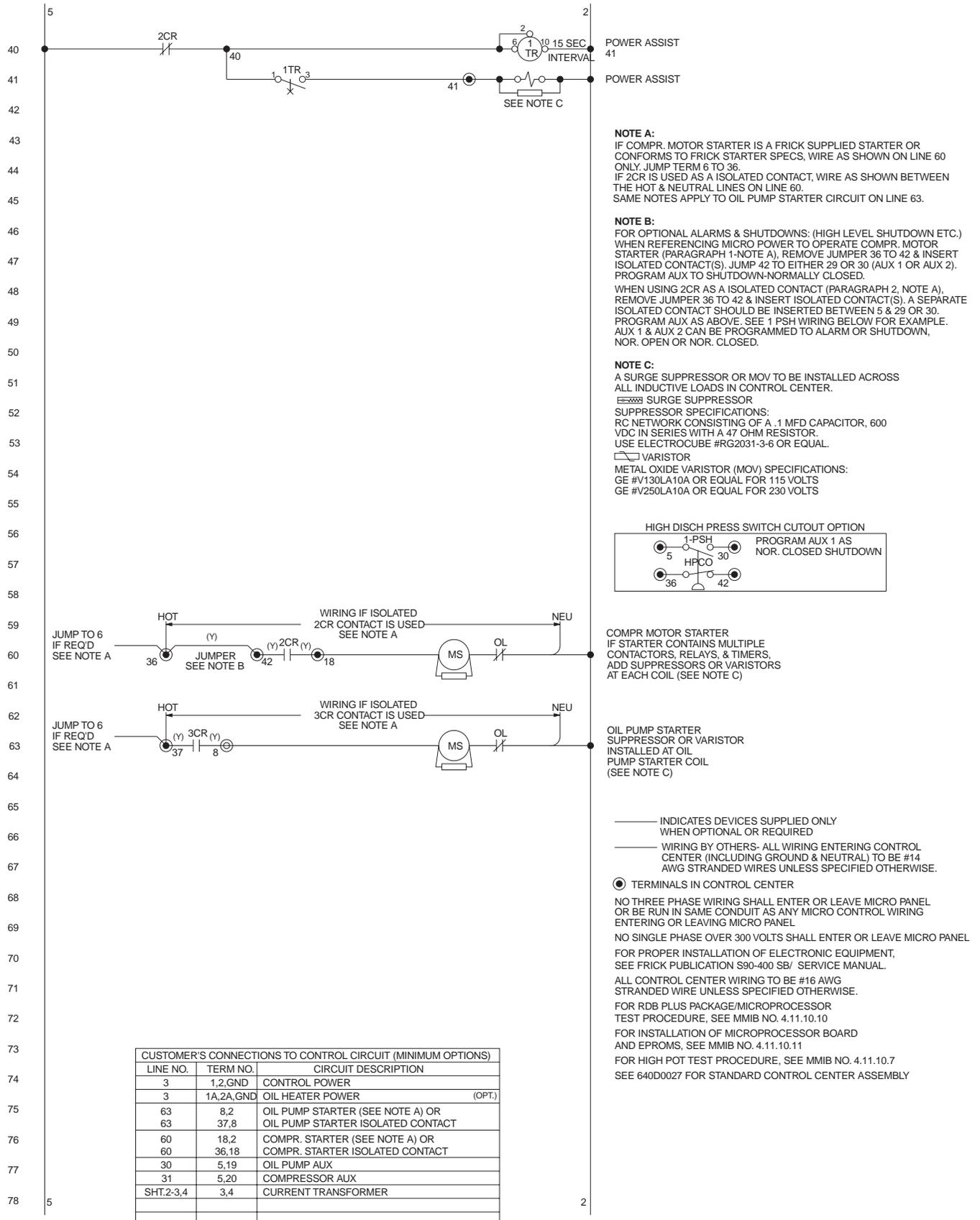
**RS-422 Communication Ports 1 and 2**

- Word = 8 bit
- Parity = None or Even
- Stop = 1 Bit

MICROPANEL ASSEMBLY WIRING DIAGRAM



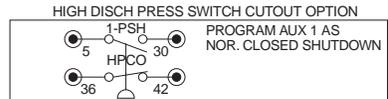
**MICROPANEL ASSEMBLY WIRING DIAGRAM (Continued)**



**NOTE A:**  
IF COMPR. MOTOR STARTER IS A FRICK SUPPLIED STARTER OR CONFORMS TO FRICK STARTER SPECS, WIRE AS SHOWN ON LINE 60 ONLY. JUMP TERM 6 TO 36.  
IF 2CR IS USED AS A ISOLATED CONTACT, WIRE AS SHOWN BETWEEN THE HOT & NEUTRAL LINES ON LINE 60.  
SAME NOTES APPLY TO OIL PUMP STARTER CIRCUIT ON LINE 63.

**NOTE B:**  
FOR OPTIONAL ALARMS & SHUTDOWNS: (HIGH LEVEL SHUTDOWN ETC.) WHEN REFERENCING MICRO POWER TO OPERATE COMPR. MOTOR STARTER (PARAGRAPH 1-NOTE A), REMOVE JUMPER 36 TO 42 & INSERT ISOLATED CONTACT(S). JUMP 42 TO EITHER 29 OR 30 (AUX 1 OR AUX 2). PROGRAM AUX TO SHUTDOWN-NORMALLY CLOSED.  
WHEN USING 2CR AS A ISOLATED CONTACT (PARAGRAPH 2, NOTE A), REMOVE JUMPER 36 TO 42 & INSERT ISOLATED CONTACT(S). A SEPARATE ISOLATED CONTACT SHOULD BE INSERTED BETWEEN 5 & 29 OR 30. PROGRAM AUX AS ABOVE. SEE 1 PSH WIRING BELOW FOR EXAMPLE. AUX 1 & AUX 2 CAN BE PROGRAMMED TO ALARM OR SHUTDOWN, NOR. OPEN OR NOR. CLOSED.

**NOTE C:**  
A SURGE SUPPRESSOR OR MOV TO BE INSTALLED ACROSS ALL INDUCTIVE LOADS IN CONTROL CENTER.  
 SURGE SUPPRESSOR  
 SUPPRESSOR SPECIFICATIONS:  
 RC NETWORK CONSISTING OF A .1 MFD CAPACITOR, 600 VDC IN SERIES WITH A 47 OHM RESISTOR.  
 USE ELECTROCUBE #RG2031-3-6 OR EQUAL.  
 VARISTOR  
 METAL OXIDE VARISTOR (MOV) SPECIFICATIONS:  
 GE #V130LA10A OR EQUAL FOR 115 VOLTS  
 GE #V250LA10A OR EQUAL FOR 230 VOLTS



COMPR MOTOR STARTER  
IF STARTER CONTAINS MULTIPLE CONTACTORS, RELAYS, & TIMERS, ADD SUPPRESSORS OR VARISTORS AT EACH COIL (SEE NOTE C)

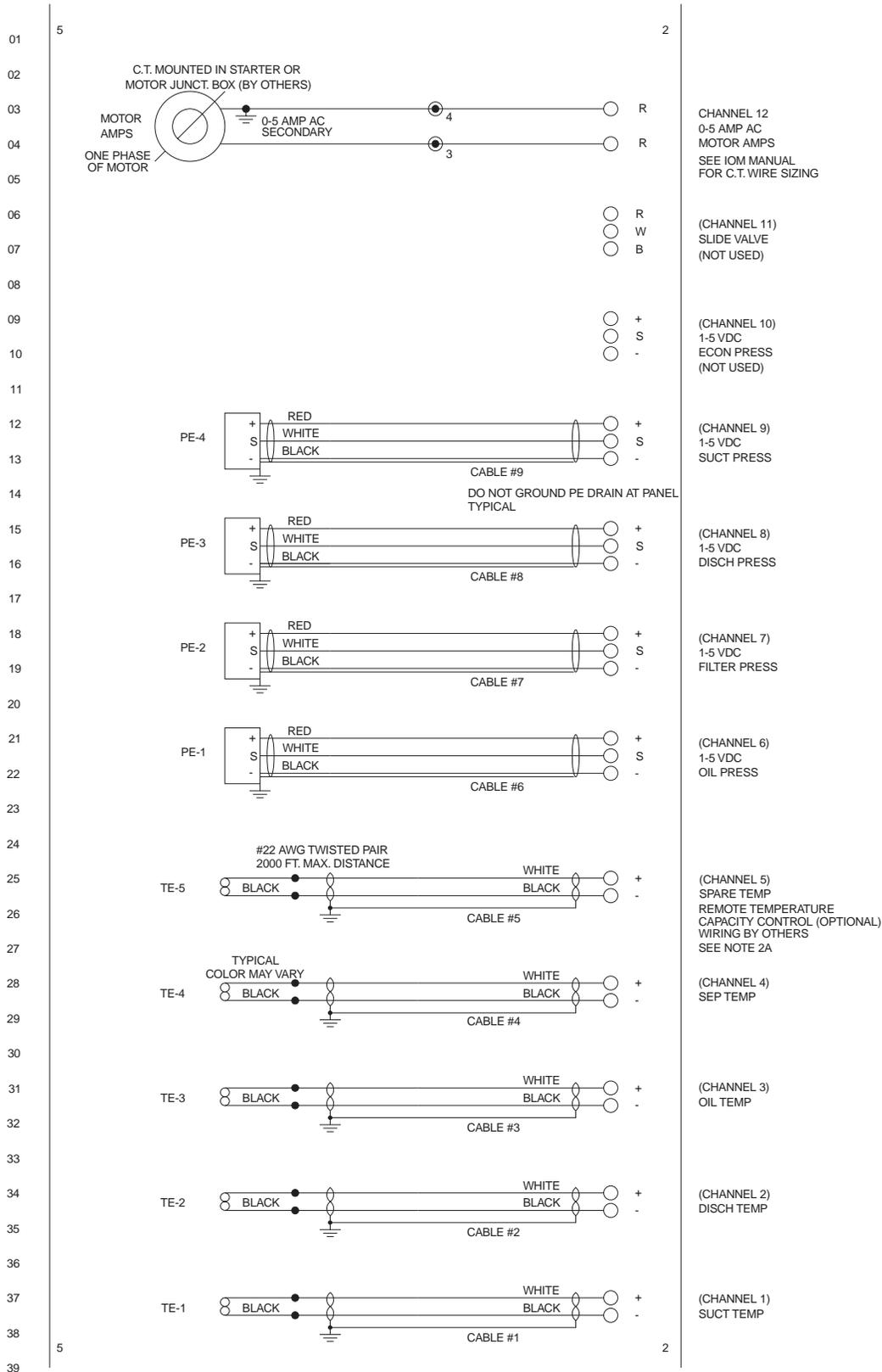
OIL PUMP STARTER  
SUPPRESSOR OR VARISTOR  
INSTALLED AT OIL PUMP STARTER COIL (SEE NOTE C)

— INDICATES DEVICES SUPPLIED ONLY WHEN OPTIONAL OR REQUIRED  
 — WIRING BY OTHERS- ALL WIRING ENTERING CONTROL CENTER (INCLUDING GROUND & NEUTRAL) TO BE #14 AWG STRANDED WIRES UNLESS SPECIFIED OTHERWISE.

● TERMINALS IN CONTROL CENTER  
 NO THREE PHASE WIRING SHALL ENTER OR LEAVE MICRO PANEL OR BE RUN IN SAME CONDUIT AS ANY MICRO CONTROL WIRING ENTERING OR LEAVING MICRO PANEL  
 NO SINGLE PHASE OVER 300 VOLTS SHALL ENTER OR LEAVE MICRO PANEL  
 FOR PROPER INSTALLATION OF ELECTRONIC EQUIPMENT, SEE FRICK PUBLICATION S90-400 SB/ SERVICE MANUAL.  
 ALL CONTROL CENTER WIRING TO BE #16 AWG STRANDED WIRE UNLESS SPECIFIED OTHERWISE.  
 FOR RDB PLUS PACKAGE/MICROPROCESSOR TEST PROCEDURE, SEE MMIB NO. 4.11.10.10  
 FOR INSTALLATION OF MICROPROCESSOR BOARD AND EPROMS, SEE MMIB NO. 4.11.10.11  
 FOR HIGH POT TEST PROCEDURE, SEE MMIB NO. 4.11.10.7  
 SEE 640D0027 FOR STANDARD CONTROL CENTER ASSEMBLY

CUSTOMER'S CONNECTIONS TO CONTROL CIRCUIT (MINIMUM OPTIONS)		
LINE NO.	TERM NO.	CIRCUIT DESCRIPTION
3	1,2,GND	CONTROL POWER
3	1A,2A,GND	OIL HEATER POWER (OPT)
63	8,2	OIL PUMP STARTER (SEE NOTE A) OR
63	37,8	OIL PUMP STARTER ISOLATED CONTACT
60	18,2	COMPR. STARTER (SEE NOTE A) OR
60	36,18	COMPR. STARTER ISOLATED CONTACT
30	5,19	OIL PUMP AUX
31	5,20	COMPRESSOR AUX
SHT.2-3,4	3,4	CURRENT TRANSFORMER

MICROPANEL ASSEMBLY WIRING DIAGRAM (Continued)





**RECOMMENDED SPARE PARTS LIST - CURRENT DESIGN**

ITEM DESCRIPTION	QTY	MODELS	ITEM NO.
<b>MICROPROCESSOR</b>			
SWITCH, THREE POSITION	1	ALL	111Q0451178
BLOCK, CONTACT, 1 N.O.	1	ALL	111Q0451159
BLOCK, CONTACT, 2 N.O.	1	ALL	111Q0451160
BOARD, SBC	1	ALL	333Q0000548
MODULE, INPUT	1	ALL	333Q0000116
MODULE, OUTPUT	1	ALL	111Q0281061
DISPLAY	1	ALL	333Q0000068
KIT, KEYPAD, COVER, AND GASKET	1	ALL	640A0009G03
RIBBON, CABLE 12 COND. (KEYPAD TO SBC)	1	ALL	640B0019H01
ASSEMBLY, CABLE 26 COND.	1	ALL	111Q0280930
FUSE, 2 AMP (F-1 & F-2)	2	ALL	333Q0000573
FUSE, 5 AMP	5	ALL	333Q0000117
FUSE, 15 AMP (Heater Option)	1	ALL	111Q0281053
BUTTON, EMERGENCY STOP	1	ALL	111Q0280832
BLOCK, CONTACT FOR 280832	1	ALL	111Q0280833
RELAY, IDEC, 3PDT	1	ALL	333Q0000206
BASE (FOR 333Q0000206 ABOVE)	1	ALL	333Q0000207
SUPPRESSOR, 600 VDC, IMFD (Multivalve Power Assist)	2	ALL	111Q0280958
FUSE, 10 AMP	1	ALL	111Q0280687
KIT, 3.6 V BACKUP BATTERY	1	ALL	649A0260H01





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