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COMPRESSOR CONTROL SYSTEM

SYSTEM OPERATIONS

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MANUAL

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COMPRESSOR CONTROL SYSTEM OPERATIONS MANUAL

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160721R14

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General Operation

The **Compressor Control System (CCS)** is an advanced microprocessor controller designed for efficient and automatic control and monitoring of Screw Compressor Packages.

Screen Types

CCS information is presented to the operator in four formats:

Status Screens

Provides continuously updated information regarding the current or past operating conditions of the equipment.

Menu Screens

The System Operator may select from a list of menu items. Touch the menu button to activate the menu selection.

Information Entry Screens

Control information, such as setpoints, may be accessed and changed from these screens. On these screens, touching the desired setpoint will display a keypad from which a new setting can be entered. The **Ok** button accepts the new setpoint or mode. The **Del** key restores incorrectly typed information back to it's original value. After all desired entries are complete, the **Save** button must be pushed, otherwise all entries will be restored back to their original value. Pressing **Quit** will exit the current screen, and not save the entries.

Trend Logs

A Trend Log is a set of system information, including all analog and digital points as well as compressor modes, that is stored at regular intervals. The intervals are determined by a user adjustable Trend Log Interval Time. The **Microcontroller** stores the past 200 intervals. These intervals are available for Status Review.

Note:
In areas where pressure is represented, kPa, Bars or kgCm may be shown in place of PSIG or PSIA.
In areas where temperature is represented, °C may be shown in place of °F.

Touch Screen Button Functional Description

The **Stop** button immediately causes a orderly shutdown of the compressor. **Note**: the **Stop** button is only available on the status screen. The Emergency Stop switch can be used to shutdown the compressor in the event of an emergency.

Number buttons enter control information into the entry screens. Negative numbers are proceeded with the minus (-) sign. Decimal numbers will use the decimal point (.) where needed.

The **Ok** button accepts the information entered by the operator and returns back to the setpoint screen.

The **Del** (delete) button erases the last character during setpoint entry.

The **Esc** (escape) button cancels any information entered by the operator and returns back to the setpoint screen.

The **Save** button stores information changes to a setpoint screen and exits back to a menu. *Must be used to **Save** control information changes.*

The **Quit** button ignores any new screen information changes and exits back to a menu.

The **Plot** will bring up the plotting tool. **Note**: the **Plot** button is only available on the status screen.

Information Entry Types

Number Entry

Enter the desired number and press **Ok** to accept the entry and return back to the setpoint screen.

Pressure Entry

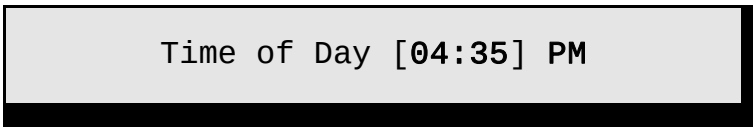
After first typing the desired pressure setting, press **PSIG** or **InHg** to select the appropriate units. A negative number will be converted to inches-mercury. If the units shown are correct, press **Ok** to accept the entry and return back to the setpoint screen.

Selection Entry

Selection Entry fields will have multiple fixed choices from a popup menu. Pressing the desired selection and you will be returned back to the setpoint screen.

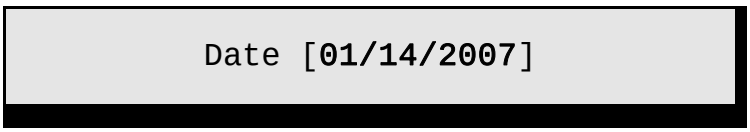
Time Entry

To enter a new time, type the hour followed by the minutes (i.e. 430 for 4:30). Next press **AM** or **PM** to toggle between **AM** and **PM**.



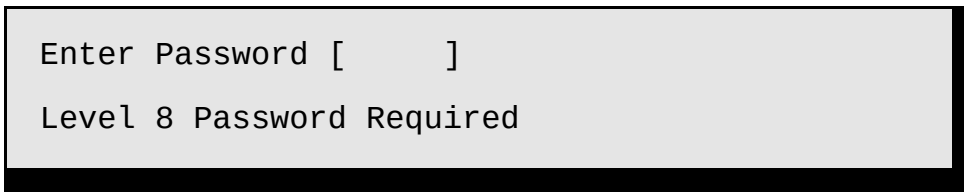
Date Entry

To enter a new date, type the month followed by the day followed by a 4 digit year (i.e. 1142007 is January 14, 2007).



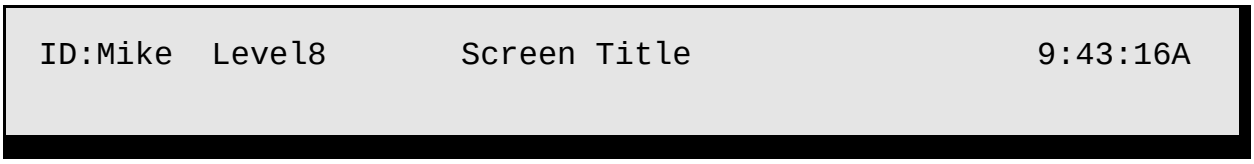
Password Entry

Password Entry fields will appear at the bottom of screens requiring a higher level password than the current users access level or, if no user is currently logged on. On most screens the required access level(s) will be displayed next to the Password Entry field. Enter a password and press **Ok** (Note: The password will not be readable within the field when entered). Entering a valid password will Log-On the user and allow access to the screen.



Screen Header

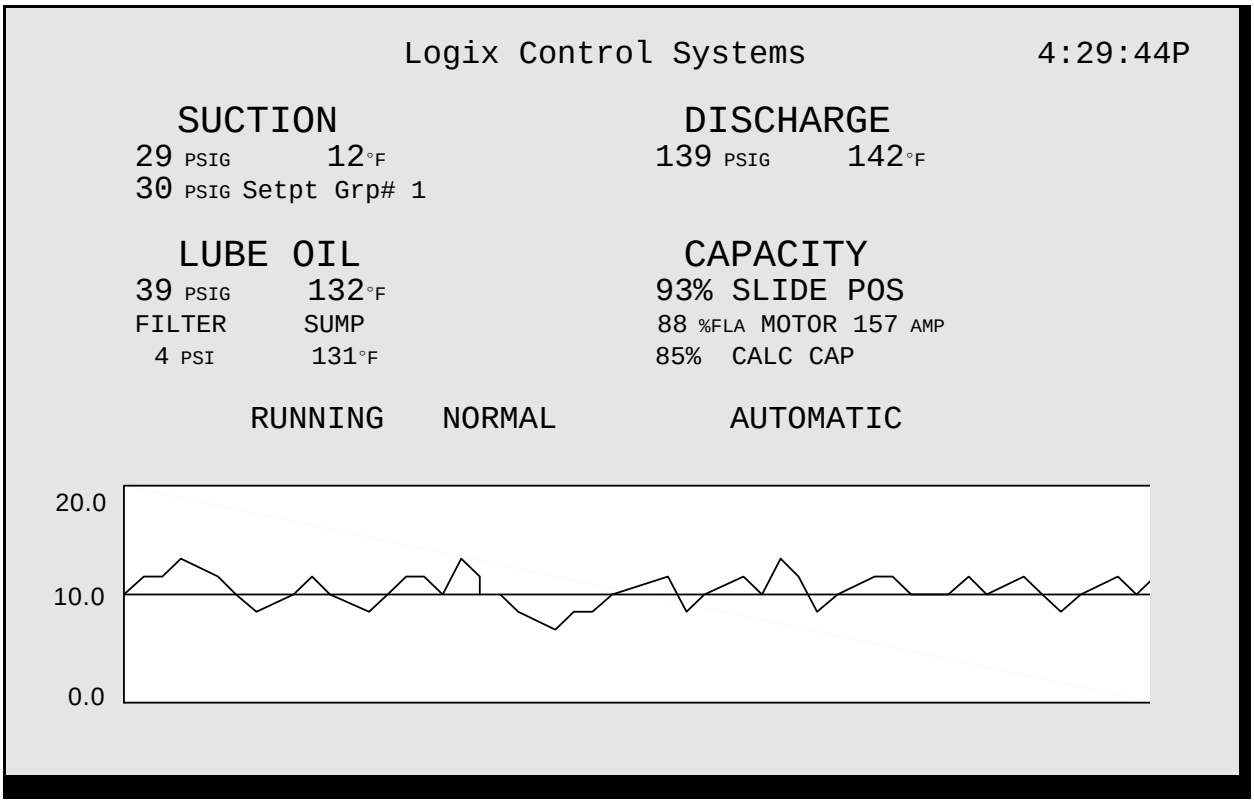
At the top of most screens is a Header that contains the following information:



ID: Current User ID.
Level: Current Password access level.
Screen Title: Indicates the name and general operation of the screen.
Time: Current time of day.

Main Status Screen

The main status screen is continuously updated with the most important operating information. The **CCS** will return to the Main Status Screen from any other Menu or Screen after 10 minutes without touch screen activity.



Parameter Display

The following abbreviations are used for control measurements and operating parameters displayed in this screen:

Setpt Grp	Capacity control setpoint followed by a group# 1. Setpoint 2 is indicated by **Setpt Grp# 2** etc. (Optional) The setpoint may be represented as a Process Temperature.
AMPS	Motor Amps
SUCTION	Suction Pressure to the left side and Suction Temperature to the right.
DISCHARGE	Discharge Pressure to the left side and Discharge Temperature to the right.
LUBE OIL	Net Oil Pressure on the left side and Oil Temperature on the right.
FILTER	Oil Filter Pressure drop.
SUMP	Oil Separator Temperature.
CALC CAP	Percentage of full capacity the screw is operating at. The capacity will show **STOP** when the compressor is not running.
SLIDE VALVE	Percentage the Slide Valve is open.

Additionally, the following information is also displayed:

Current Time of Day

The current time of day is displayed in 24 Hour format (e.g. 14:00 = 2:00pm).

Operation Mode

The five modes of operational control are:

MANUAL
AUTOMATIC
AUTO SEQUENCE
AUTO REMOTE
AUTO COMM

Operation Status

The operational states are:

Operation Status Table

Status Message	Condition
NORMAL	**Normal Operation. No Alarms or Warnings**
RUNNING	**Compressor Running**
STARTING	**Starting Sequence in progress**
STOPPED	**Compressor Stopped**
STOP/UNLOADING	**Compressor Stopped, slide valve unloading**
LOADING	**Slide Valve Movement, Capacity Increasing**
UNLOADING	**Slide Valve Movement, Capacity Decreasing**
SQ-UNLOAD	**Sequencer Forcing Unloading**
MA/DP/SP LIMIT	**Loading Restricted due to excessive MA/DP/SP**
MA/DP/SP UNLOAD	**Forced Unloading due to excessive MA/DP/SP**
WARNING	**Refer to Alarm Message Table on page 8**
ALARMING	**Refer to Alarm Message Table on page 8**
ANTICYCLE [time]	**Anticycle Countdown Timer**

Real-Time Plot

A Real-Time Plot of the suction pressure is constantly displayed on the bottom of the Main Status Screen. The Suction Pressure Setpoint is displayed as a solid line in the middle of the plot. The upper and lower values on the Y-Axis are five times the Suction Pressure Deadband. The plot will graphically show the suction pressure reading over the last 5 minutes at which point it will begin writing over again. The leading edge of the plot is represented as a gap in the plot.

Alarm and Warning Messages

One or more of the following Alarm or Warning Messages may be displayed:

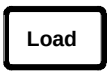
Alarm and Warning Message Table

Safety Message	Condition
LOW SUCT PRES	Low Suction Pressure
LOW SUCT TEMP	Low Suction Temperature
HI DISC PRES	High Discharge Pressure
LOW OIL PRES	Low Oil Pressure
HI OIL PRES	High Oil Pressure
HI OIL FILTER	High Oil Filter Pressure Drop
HI DISC TEMP	High Discharge Temperature
LOW OIL TEMP	Low Oil Separator Temperature
HI OIL TEMP	High Oil Temperature
LOW MOTOR AMP	Low Running Motor Amperage
HI MOTOR AMP	High Motor Amperage
AUX1 FAILURE	Auxiliary Safety Cutout 1
AUX2 FAILURE	Auxiliary Safety Cutout 2
EMERG STOP	Emergency Stop Shutdown
MOTOR STARTER	Motor Starter Failure
CAN'T START	Starting Sequence Failure
POWER FAILED	Power Fail Reset Timer has Elapsed, Auto Start Inhibited
BAD SENSOR	Unreliable Sensor Detected, See Page 44
DATACOMM	Communication Fault Detected
LOW PROC TEMP	Low Process Temperature
TOUCH SCREEN	Touch Screen Problem
SYSTEM FAULT	System Fault Detected
ANALOG OUTPUT	Analog Output Fault Detected

Main Status Screen Key Functions

The **MENU** button terminates the Main Status Screen and displays the Main Menu.

The **ACK** button de-energizes the Alarm Output during a Alarm or Warning condition.



In the MANUAL Mode of Operation, the **Load** button loads the compressor until released.

In the MANUAL Mode of Operation, the **Unld** button unloads the compressor until released.

The **Plot** button presents the plot selection screen.

The **Next>** and **<Prev** buttons presents additional status display screens.

The **Start** button begins the compressor start sequence.

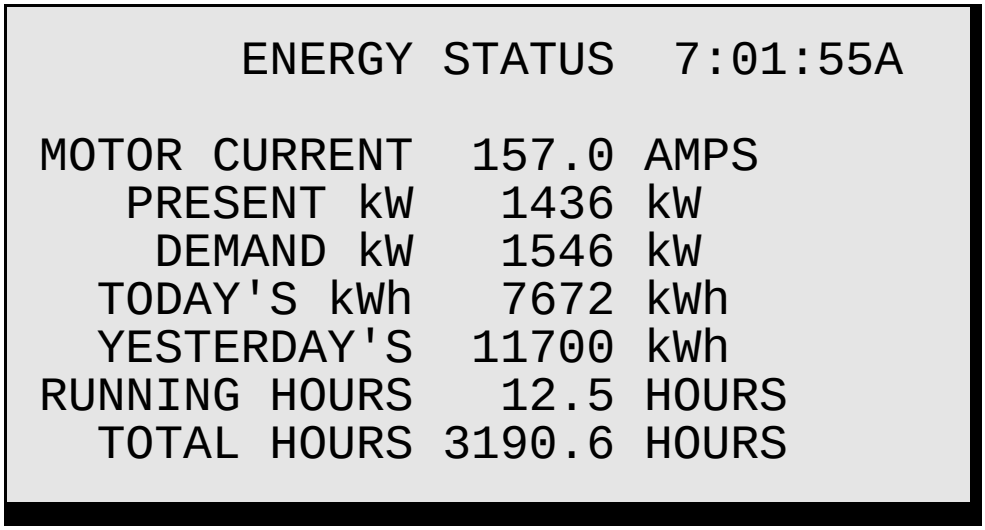
The **Stop** button stops the compressor and resets the operating mode to **Manual**.

After 10 minutes without touch screen activity, the **CCS** will return to the Main Status Screen from any other Menu or Screen.

Additional Status Screens

Additional Status Screens are accessed by pressing the **Next>** or **<Prev** buttons from the Main Status Screen.

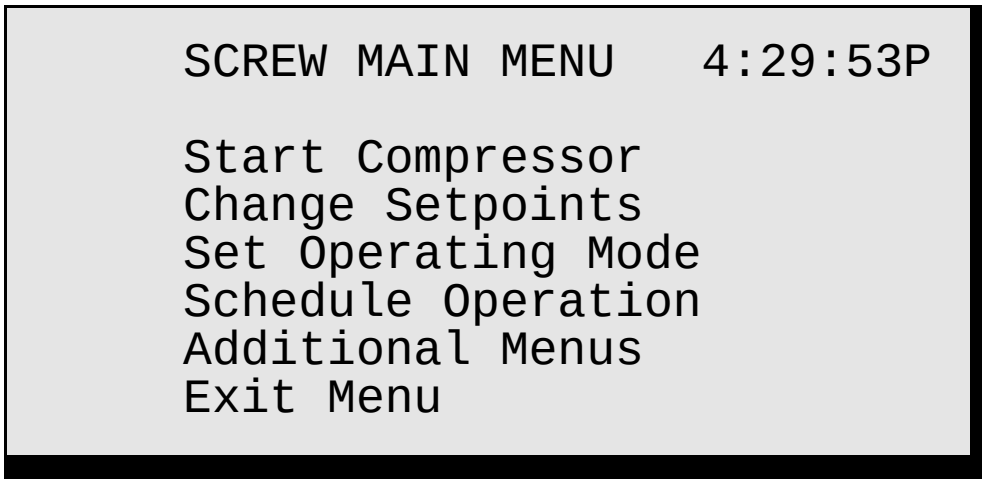
Additional Status Screens are continuously updated with additional operating information.



MOTOR CURRENT	Current Motor Amperage.
PRESENT kW	Immediate compressor electrical consumption.
DEMAND kW	Calculated average electrical demand over the last 15 minutes (sliding time window).
TODAY'S kWh	Total electrical energy consumed since 12 o'clock midnight.
YESTERDAY'S	Total electrical energy consumed on the previous day.
RUNNING HOURS	Number of hours of operation since compressor was last started.
TOTAL HOURS	Total number of compressor running hours.

Main Menu

All Menus and Information Entry Screens are accessed via the Main Menu.



Enter a menu selection or press **Exit Menu** to return to the Main Status Screen.

Start Compressor

Requires a Level 1 Password

Screw Compressor Starting Sequence

The Screw starting sequence may be initialized in a number of ways:

1. Manually through the Start Compressor menu selection
2. Automatically under Auto Local control (only if pressure is above the appropriate setpoint and Auto Start/Stop is enabled)
3. Automatically under Auto Sequence control by a Master Sequencer

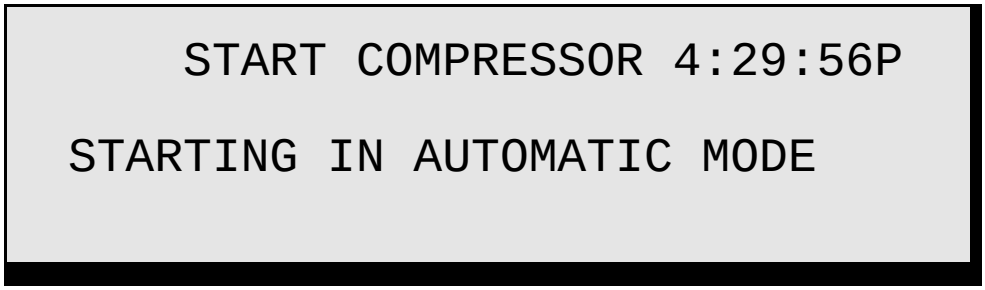
The Start sequence begins by energizing the oil pump and unloader solenoid.

In order for the screw compressor main motor to start, the following conditions all must be met:

1. Oil Pressure must be valid for at least 8 seconds
2. Slide valve position must be less than 5%
3. All Alarm Failure conditions must be in the Non-Failure state, excluding Low Oil Pressure

These conditions are checked for up to 5 minutes, after which a Can't Start Failure occurs. Any failure or the depression of the Stop key will immediately terminate the start sequence.

Selecting Start Compressor will begin the Start sequence for the current mode of operation. The Start Compressor menu selection is only valid when the compressor is in the **MANUAL** or **AUTOMATIC** Modes of Operation. Before attempting to start the compressor the user is asked for a valid password (if passwords are enabled). Upon successful initiation of the compressor start sequence, a verification screen similar to the following will be displayed.



After a momentary pause, the **CCS** will return to the Main Status Screen. If a problem is encountered in the compressor start sequence, one of the four following screens will be displayed:

The compressor can not be started if it is already in operation.

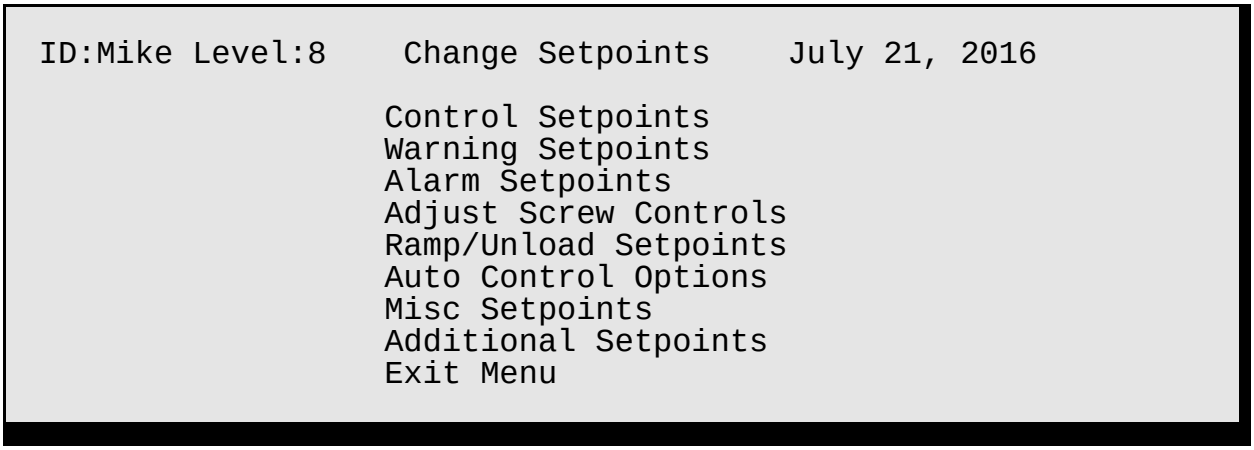
The compressor can not be started manually in the Auto Sequence Mode.

The compressor can not be started manually in the Auto Remote Mode.

The compressor can not be started until the anticycle timer expires.

Change Setpoints

Change Setpoints allows the user access to compressor control setpoints, alarm and warning setpoints and setpoint scheduling.



Enter a menu selection or press **Exit Menu** to return to the Main Menu Screen. ***NOTE*** The "Additional Setpoints" menu selection is present only on **CCS Microcontrollers** with additional control functions such as Variable Vi Control, Condenser Control, Pump Package Control etc.. Refer to an addendum for information on these items.

Control Setpoints

Requires a Level 4 Password

```
ID:01   Level:8         Control Setpoints          Thu 07/21/16 09:43:21

                 Setpoint Group#[  Auto]

                       GROUP1      GROUP2      GROUP3      GROUP4
   Cut-In  Pressure    5.0 PSIG   13.0 PSIG   30.0 PSIG    0.0 PSIG
   Control Setpoint    5.0 "Hg    10.0 PSIG   20.0 PSIG    0.0 PSIG
   Cut-out Pressure   10.0 "Hg     7.0 PSIG   10.0 PSIG    0.0 PSIG

   Minimum Trim Slide Valve Position   25.0 %
     Minimum Pre-trim Slide Position   90.0 %
    Pre-trim Control Setpoint Offset    2.0 PSID

         Minimum Compressor On  Time    5.0 Mins
         Minimum Compressor Off Time    5.0 Mins

      Economizer Min Slide Position   25.0 %
```

SETPOINT GROUP#

Setpoint **Groups** 1-4 can be selected from the pop-up menu. Select "**Sched**" to have the Setpoint Scheduler or Remote Setpoint# Selection choose the current Setpoint Group# (see page 17). Manually selecting a Group# will override all mechanisms that choose the current Setpoint Group# (i.e. Scheduler and Remote Setpoint# Selection).

CUT-IN PRESSURE

Enter the Cut-In Pressure for each setpoint group. In the AUTOMATIC Mode of Operation, the compressor is started when the suction pressure becomes greater than the CUT-IN PRESSURE.

CONTROL SETPOINT

Enter the Control Setpoint for each setpoint group. In the AUTOMATIC and AUTO REMOTE Modes of Operation, the compressor is loaded or unloaded as needed to maintain the target Control Setpoint. In the AUTO SEQUENCE mode the Control Setpoint is sent by the sequencer to the compressor.

CUT-OUT PRESSURE

Enter the Cut-Out Pressure for each setpoint group. In the AUTOMATIC Mode of Operation, the compressor is stopped when the suction pressure becomes less than the CUT-OUT PRESSURE.

MINIMUM TRIM SLIDE VALVE POSITION

Enter the minimum slide valve position of the Trim Compressor. Once the **Trim** screw compressor (last to be started) starts it will be loaded to the Minimum Trim Slide Valve Position and not be allowed to unload below this slide valve position unless being told to stop. Note: All compressor safety unload routines (see page 22) can override this minimum position.

MINIMUM TRIM TOTAL CAPACITY (Slide Times VFD) - only show on VFD equipped CCS

The total capacity of a VFD equipped compressor is a combination of the motor speed and the slide valve position. To set the minimum capacity the operator will take the minimum VFD speed, multiply it by the desired minimum slide valve position and then divide by 100. As an example if the minimum VFD Speed is 50% and the desired minimum slide valve percent is 10%, the operator will enter 5% for the MINIMUM TRIM TOTAL CAPACITY (50 * 10 = 500 / 100 = 5%) . Once the **Trim** screw compressor (last to be started) starts it will be loaded to the Minimum Trim Total Capacity% and not be allowed to unload below this capacity unless being told to stop. Note: All compressor safety unload routines (see page 22) can override this minimum position.

MINIMUM PRE-TRIM SLIDE VALVE POSITION

Enter the minimum slide valve position of the Compressor while it is being operated as a PRETRIM Compressor. The compressor is Pre-Trim if it is in The Auto Sequence Mode and was the second to the last compressor started by the System Compressor Sequencer. When the suction pressure falls well below the Suction Pressure Setpoint the Pre-Trim compressor will be allowed to unload to this minimum slide valve position as needed. This feature

reduces unnecessary starting and stopping of compressors due to temporary system fluctuations.

MINIMUM PRE-TRIM TOTAL CAPACITY (Slide Times VFD) - only show on VFD equipped CCS

The total capacity of a VFD equipped compressor is a combination of the motor speed and the slide valve position. To set the minimum Pre-Trim capacity the operator will take the minimum VFD speed, multiply it by the desired minimum Pre-Trim slide valve position and then divide by 100. As an example if the minimum VFD Speed is 50% and the desired minimum Pre-Trim slide valve percent is 90%, the operator will enter 45% for the MINIMUM TRIM TOTAL CAPACITY (50 * 90 = 500 / 100 = 45%) . Once the **Trim** screw compressor (last to be started) starts it will be loaded to the Minimum Trim Total Capacity% and not be allowed to unload below this capacity unless being told to stop. Note: All compressor safety unload routines (see page 22) can override this minimum position. The compressor is Pre-Trim if it is in The Auto Sequence Mode and was the second to the last compressor started by the System Compressor Sequencer. When the suction pressure falls well below the Suction Pressure Setpoint the Pre-Trim compressor will be allowed to unload to this minimum slide valve position as needed. This feature reduces unnecessary starting and stopping of compressors due to temporary system fluctuations.

MINIMUM COMPRESSOR ON TIME

Enter the minimum duration of compressor operation. Once started the compressor will run for at least the **MINIMUM COMPRESSOR ON TIME**. Note that if this time is set less than the **MOTOR ANTICYCLE TIME**, the screw compressor will not be allowed to start until the anticycle period expires. The **MOTOR ANTICYCLE TIME** minus the **MINIMUM COMPRESSOR ON TIME** will act as a Minimum Compressor OFF Time. As an example, if the **MINIMUM COMPRESSOR ON TIME** is set to 5 minutes and the **MOTOR ANTICYCLE TIME** is 15 minutes, the compressor will run for <u>at least</u> 5 minutes before being stopped. The compressor will be OFF for <u>at least</u> 10 minutes (15 - 5 = 10 Mins) once it has been stopped. If the **MINIMUM COMPRESSOR ON TIME** is 15 minutes the compressor will run for at least 15 minutes once started, and may be restarted immediately if needed after it has been stopped (15 - 15 = 0 Mins). The **MINIMUM COMPRESSOR ON TIME** only applies when the compressor is in the Sequence mode or the Automatic Mode with Auto Local Start/Stop enabled (see AUTO CONTROL OPTIONS).

MINIMUM COMPRESSOR OFF TIME

Enter the minimum duration the compressor will be off once stopped. Once stopped the compressor will be prevented from restarting Automatically for at least the **MINIMUM COMPRESSOR OFF TIME**. Note that if this time is set less than the **MOTOR ANTICYCLE TIME**, the screw compressor will not be allowed to start until the anticycle period expires. The **MOTOR ANTICYCLE TIME** minus the **MINIMUM COMPRESSOR ON TIME** will act as a Minimum Compressor OFF Time. As an example, if the **MINIMUM COMPRESSOR ON TIME** is set to 5 minutes and the **MOTOR ANTICYCLE TIME** is 15 minutes, the compressor will run for <u>at least</u> 5 minutes before being stopped. The compressor will be OFF for <u>at least</u> 10 minutes (15 - 5 = 10 Mins) once it has been stopped. If the **MINIMUM COMPRESSOR ON TIME** is 15 minutes the compressor will run for at least 15 minutes once started, and may be restarted immediately if needed after it has been stopped (15 - 15 = 0 Mins). The **MINIMUM COMPRESSOR ON TIME** only applies when the compressor is in the Sequence mode or the Automatic Mode with Auto Local Start/Stop enabled (see AUTO CONTROL OPTIONS).

ECONOMIZER MINIMUM SLIDE POSITION (Optional)

Enter the minimum slide valve position above which the economizer solenoid will open.

Automatic Setpoint# Selection

There are three (3) mechanisms that can determine the current Setpoint Group#. Below is a list of the three mechanisms and the conditions that must be present for them to be the determining mechanism of the current Setpoint Group#.

Mechanism	Conditions
CCS Setpoint Scheduler	The **SETPOINT GROUP#** must be set for "**Sched**" selection. The compressor must be set for the Automatic, Auto Remote or, Manual mode of operation. The CCS Setpoint Scheduler must be enabled (see page 24).
Master Setpoint Scheduler	In multiple sequenced compressor applications, the Master Setpoint Scheduler (located on a Logix® Axiom Master) will determine the current Group# and suction pressure setpoint. The **SETPOINT GROUP#** must be set for "**Sched**" selection *and* the compressor must be set for the Auto Sequence mode of operation.
Remote Setpoint# Selection	The current Group# is determined externally by a digital input **if** the compressor is set for the Automatic, Auto Remote or Manual mode of operation *and* the CCS Setpoint Scheduler is disabled *and* the **SETPOINT GROUP#** is set for "**Sched**" selection. When the previous conditions are met, a de-energized digital input will select Setpoint Group# 1 and an energized digital input will select Setpoint Group# 2.

Warning Setpoints

Requires a Level 4 Password

```
ID:01   Level:8              WARNING SETPOINTS              Thu 07/21/16 09:43:21

                                GROUP 1     GROUP2      GROUP3     GROUP4
        LOW SUCTION PRESSURE    15.0 "Hg     5.0 PSIG    8.0 PSIG   0.0 PSIG
     LOW SUCTION TEMPERATURE     5.0 °F     15.0 °F     20.0 °F    13.0 °F
     LOW PROCESS TEMPERATURE     5.0 °F     15.0 °F     20.0 °F    13.0 °F
     HIGH DISCHARGE PRESSURE   200.0 PSIG
  HIGH DISCHARGE TEMPERATURE   190.0 °F

           LOW  OIL PRESSURE    30.0 PSIG
           HIGH OIL PRESSURE   175.0 PSIG
        LOW  OIL TEMPERATURE   100.0 °F
        HIGH OIL TEMPERATURE   150.0 °F
    HIGH OIL FILTER PRESSURE    10.0 PSID
             HIGH MOTOR AMPS   200.0 AMPS
```

WARNING SETPOINTS are operator adjustable entries that when exceeded will trigger a warning condition. Under a warning condition, the Alarm Output will activate and the offending condition(s) will be displayed on the Main Status Screen. Additionally, the offending condition(s) will be recorded in the OPERATIONAL LOG Screen and the SAFETY HISTORY Screen (see pages 35 and 38 respectively).

LOW SUCTION PRESSURE

Enter the **LOW SUCTION PRESSURE** Warning setpoint for each group. The four groups allow the warning setpoint to vary with the scheduled Control Setpoints.

LOW SUCTION TEMPERATURE

Enter the **LOW SUCTION TEMPERATURE** Warning setpoint for each group. The four groups allow the warning setpoint to vary with the scheduled Control Setpoints.

LOW PROCESS TEMPERATURE (Optional)

Enter the **LOW PROCESS TEMPERATURE** Warning setpoint for each group. The four groups allow the warning setpoint to vary with the scheduled Control Setpoints.

Alarm Setpoints

Requires a Level 8 Password

```
ID:01   Level:8              ALARM SETPOINTS              Thu 07/21/16 09:43:21

                            GROUP 1     GROUP2      GROUP3     GROUP4
     LOW SUCTION PRESSURE  20.0 "Hg     1.5 PSIG    4.0 PSIG   0.0 PSIG
  LOW SUCTION TEMPERATURE   5.0 °F     15.0 °F     20.0 °F    13.0 °F
  LOW PROCESS TEMPERATURE   5.0 °F     15.0 °F     20.0 °F    13.0 °F
         HIGH DISCHARGE PRESSURE  225.0 PSIG      225.0 PSIG  FIXED LIMIT
      HIGH DISCHARGE TEMPERATURE  210.0 °F       212.0 °F    FIXED LIMIT

               LOW  OIL PRESSURE   25.0 PSIG       20.0 PSIG  FIXED LIMIT
               HIGH OIL PRESSURE  190.0 PSIG      200.0 PSIG  FIXED LIMIT

             LOW  OIL TEMPERATURE   90.0 °F         80.0 °F    FIXED LIMIT
             HIGH OIL TEMPERATURE  175.0 °F        175.0 °F    FIXED LIMIT
                  HIGH MOTOR AMPS  250.0 AMPS
```

ALARM SETPOINTS are operator adjustable entries that when exceeded will force a compressor shutdown. Under any alarm condition, the compressor will shutdown, the Alarm Output will be energized and the offending condition(s) will be displayed on the Main Status Screen. The offending condition(s) will be simultaneously recorded in the OPERATIONAL LOG Screen and the SAFETY HISTORY Screen (see pages 35 and 38 respectively). Also displayed on the screen are fixed factory setpoints that when exceeded will also force a compressor shutdown. These fixed factory setpoints can not be altered from the keypad.

LOW SUCTION PRESSURE

Enter the **LOW SUCTION PRESSURE** Alarm setpoint for each group. The four groups allow the alarm setpoint to vary with the scheduled Control Setpoints.

LOW SUCTION TEMPERATURE (Optional)

Enter the **LOW SUCTION TEMPERATURE** Alarm setpoint for each group. The four groups allow the alarm setpoint to vary with the scheduled Control Setpoints.

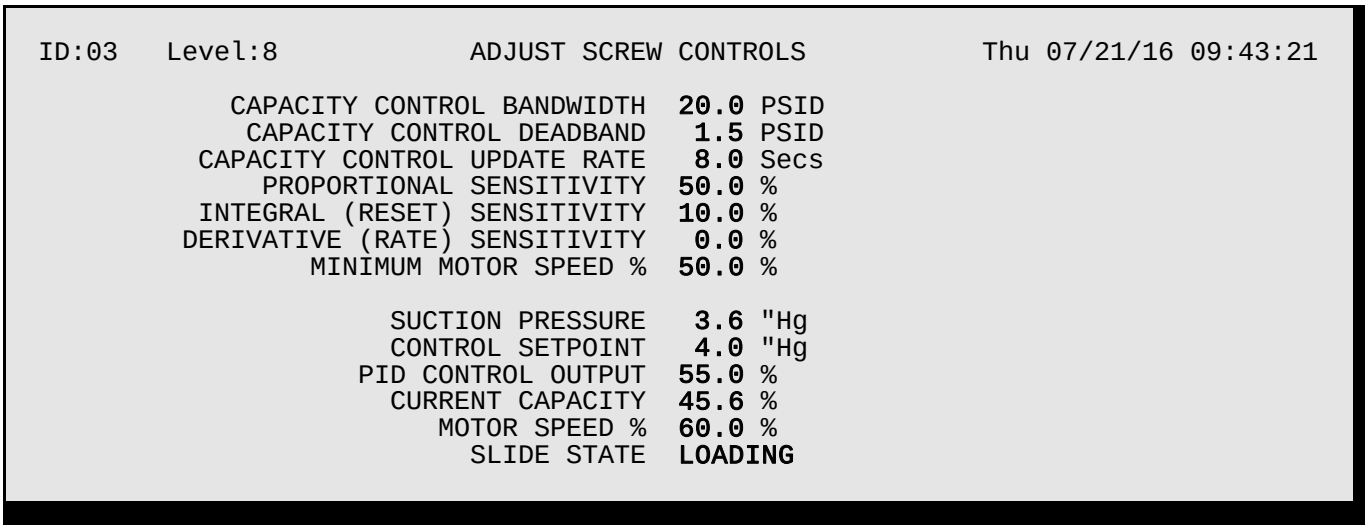
LOW PROCESS TEMPERATURE

Enter the **LOW PROCESS TEMPERATURE** Alarm setpoint for each group. The four groups allow the alarm setpoint to vary with the scheduled Control Setpoints.

Adjust Screw Controls

Requires a Level 8 Password

The Adjust Screw Controls screen allows adjustment of Proportional-Integral-Derivative (PID) control loop.



NOTE To assist the operator in the control loop adjustment, the current suction pressure, control setpoint, PID control output, current capacity, motor speed and state are continuously displayed on the lower portion of the screen. Pressing **Save** after entering the desired adjustments will save the setpoints and re-display the current screw readings. Press **Quit** to exit the screen.

The PID Control Output is determined by several PID Adjustment parameters. They are:

CAPACITY CONTROL BANDWIDTH

The overall sensitivity of the PID control routine is set by the Capacity Control Bandwidth. In general, a wider Bandwidth provides less sensitive control. Like the Deadband, the Bandwidth encompasses the total range above and below setpoint. The adjustments made by the Proportional, Integral and Derivative routines are all relative to Setpoint Error (actual Process Input as compared to the Capacity Control Setpoint) and Bandwidth. For example, if setpoint error lies halfway between the Capacity Control Setpoint and the extreme of the Capacity Control Bandwidth then the Proportional, Integral and Derivative routines will make adjustments at half their respective maximums. A larger Bandwidth provides less responsive staging.

CAPACITY CONTROL DEADBAND

If the Suction Pressure (or process temperature) is within the **CONTROL DEADBAND**, no changes in Compressor Capacity take place . If the **CONTROL DEADBAND** is too narrow, the Slide Valve may continuously "Hunt" resulting in excessive Slide Valve wear. If the **CONTROL DEADBAND** is too wide, the compressor may not hold the suction pressure close to the setpoint, resulting in inefficient capacity control. As with all Logix control mechanisms, a Deadband setpoint represents the total range above and below a setpoint within which no control changes are made.

CAPACITY CONTROL UPDATE RATE

Each portion of the PID routine will be recalculated at the **CONTROL UPDATE RATE**. The PID Control Output will not change in the period between adjustments. Too short of an Update Rate may result in overshooting and control instability as the control routine cannot adapt from its previous adjustment.

PROPORTIONAL SENSITIVITY

Control Output is proportionally adjusted to the control Setpoint Error. The **PROPORTIONAL SENSITIVITY** setpoint defines what percentage of this error is applied to the proportional routine. Higher settings provides a larger response to Process Input variation. Too high a setting will cause instability.

INTEGRAL (RESET) SENSITIVITY

A portion of the Setpoint Error is successively added back into the next calculation. The **INTEGRAL (RESET) SENSITIVITY** setpoint defines this portion. If Process Input remains off Setpoint the Integral error correction grows, having the cumulative effect re-adjusting (resetting) control Output to account for the new load condition. Typical settings for Integral (Reset) Sensitivity are between 2% and 15%. A higher sensitivity setting will have the effect of adding a

larger portion of the error into the adjustment.

Adjust Screw Controls, Cont.

DERIVATIVE (RATE) SENSITIVITY

With derivative action, the Control Output is proportional to the rate of change of the measurement or error. The controller output is calculated by the rate of change of the measurement with time. Derivative action can compensate for a changing measurement. Thus derivative takes action to inhibit more rapid changes of the measurement than proportional action. When a load or set-point change occurs, the derivative action causes the controller gain to move the "wrong" way when the measurement gets near the set-point. Derivative is often used to avoid overshoot.

MINIMUM MOTOR SPEED% (Optional Motor Speed Control)
Enter the minimum allowed motor speed during operation. Screw compressors typically should not run below 50% as the oil seal will not be maintained at lower speeds.

Ramp/Unload Setpoints

Requires a Level 8 Password

The Ramp/Unload Setpoints screen contains setpoints that gradually "Ramp" the compressor from a fully stopped state to the required operating capacity, and also setpoints that will restrict the compressor from loading thus avoiding a Safety condition.

```
ID:01   Level:8            RAMP/UNLOAD SETPOINTS          Thu 07/21/16 09:43:21

                 HIGH MOTOR AMP UNLOAD 200.0 AMPS
           HIGH MOTOR AMP DIFFERENTIAL   5.0 AMPS
                 RAMP START MOTOR AMPS 150.0 AMPS
        HIGH DISCHARGE PRESSURE UNLOAD 200.0 PSIG
  HIGH DISCHARGE PRESSURE UNLOAD DIFF  10.0 PSID
                  RAMP START PRESSURE 175.0 PSIG

                  RAMP START DURATION  15.0 Mins

          HIGH SUCTION PRESSURE UNLOAD  50.0 PSIG
    HIGH SUCTION PRESSURE UNLOAD DIFF   5.0 PSID
    MINIMUM SLIDE% FOR HIGH SP UNLOAD  20.0 %
```

All setpoints in the RAMP/UNLOAD SETPOINT Screen are in effect only while the compressor is in the AUTOMATIC, AUTO SEQUENCE and AUTO REMOTE Modes of Operation. Refer to page 52 for the ramp start/unload diagram.

HIGH MOTOR AMP UNLOAD

Enter the **HIGH MOTOR AMP UNLOAD** setpoint. When the motor amperage exceeds this overload value the compressor is forced to unload.

HIGH MOTOR AMP DIFFERENTIAL

Enter the **HIGH MOTOR AMP DIFFERENTIAL**. The compressor is prevented from loading (load limited) when the motor amperage exceeds the **HIGH MOTOR AMP UNLOAD** value minus this differential value. For example, using the above shown values, the compressor will not be allowed to load when the motor amps exceed 195 amps (200 - 5 = 195).

RAMP START MOTOR AMPS

Enter the **RAMP START MOTOR AMPS** setpoint. The **RAMP START MOTOR AMPS** setpoint is the initial high motor amp unload value for Ramp Start. This unload value will gradually increase during the **RAMP START DURATION** until it reaches the **HIGH MOTOR AMP UNLOAD** value. See page 52 for a discussion of Ramp Starts.

HIGH DISCHARGE PRESSURE UNLOAD

Enter the **HIGH DISCHARGE PRESSURE UNLOAD** setpoint. When the compressor discharge pressure exceeds this overload value, the compressor is forced to unload.

HIGH DISCHARGE PRESSURE DIFFERENTIAL

Enter the **HIGH DISCHARGE PRESSURE DIFFERENTIAL**. The compressor is prevented from loading (load limited) when the discharge pressure exceeds the **HIGH DISCHARGE PRESSURE UNLOAD** value minus this differential value. For example, using the above shown values, the compressor will not load above 190 PSIG (200 - 10 = 190).

Ramp/Unload Setpoints, cont.

RAMP START DISCHARGE PRESSURE

Enter the **RAMP START DISCHARGE PRESSURE** setpoint. **RAMP START DISCHARGE PRESSURE** is the initial high discharge pressure unload value for Ramp Start. This unload value will gradually increase during the **RAMP START DURATION** until it reaches the **HIGH DISCHARGE PRESSURE UNLOAD** value.

RAMP START DURATION

Enter the **RAMP START DURATION** setpoint. **RAMP START DURATION** is the total length of time of the Ramp Start sequence. During the Ramp Start sequence, the ramp unload setpoints are gradually increased from the initial Ramp Start values to the final unload values.

HIGH SUCTION PRESSURE UNLOAD

Enter the **HIGH SUCTION PRESSURE UNLOAD** setpoint. If the slide valve position is above the **MINIMUM SLIDE% FOR HIGH SP UNLOAD** percentage value and the compressor suction pressure exceeds this overload value, the compressor is forced to unload.

HIGH SUCTION PRESSURE DIFFERENTIAL

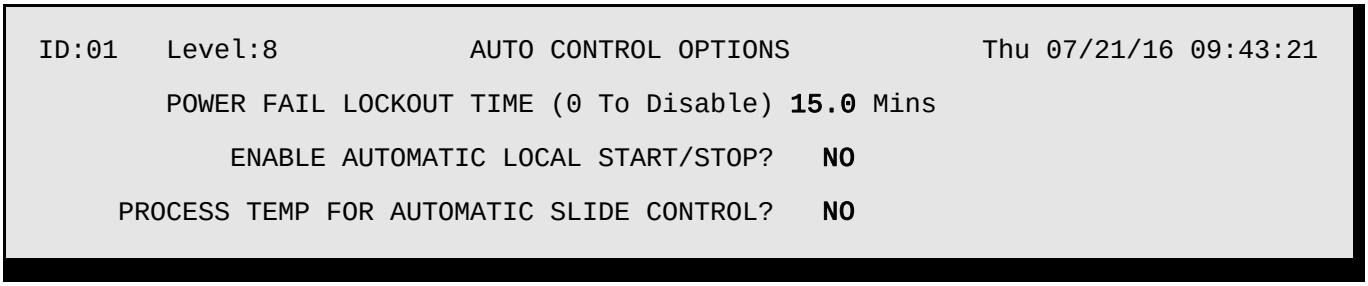
Enter the **HIGH SUCTION PRESSURE DIFFERENTIAL** setpoint. If the slide valve position is above the **MINIMUM SLIDE HIGH SP UNLOAD** percentage value the compressor is prevented from loading (load limited) when the suction pressure exceeds the **HIGH SUCTION PRESSURE UNLOAD** value minus this differential value. For example, using the above shown values, the compressor will not load above 45 PSIG Suction (50 - 5 = 45).

MINIMUM SLIDE% FOR HIGH SUCTION PRESSURE UNLOAD

Enter the **MINIMUM SLIDE % FOR HIGH SP UNLOAD**. If the slide valve position is below the **MINIMUM SLIDE% FOR HIGH SP UNLOAD** value, High Suction Pressure Unloading will not occur. This allows the compressor to "Pull Down" a load slowly.

Auto Control Options

Requires a Level 4 Password



POWER FAIL LOCKOUT TIME

Enter the **POWER FAIL LOCKOUT TIME**. If a power failure lasts longer than this time value, the compressor will not be allowed to restart automatically when power resumes. The compressor must then be started using the START COMPRESSOR screen. A Lockout Time of zero will disable this feature and always allow the compressor to restart automatically.

ENABLE AUTOMATIC LOCAL START/STOP

In the AUTOMATIC Mode of Operation *only*, the **YES** option allows CUT-IN and CUT-OUT PRESSURE setpoints (see page 15) to control the starting and stopping of the compressor. The **NO** option requires the compressor to be manually started and stopped.

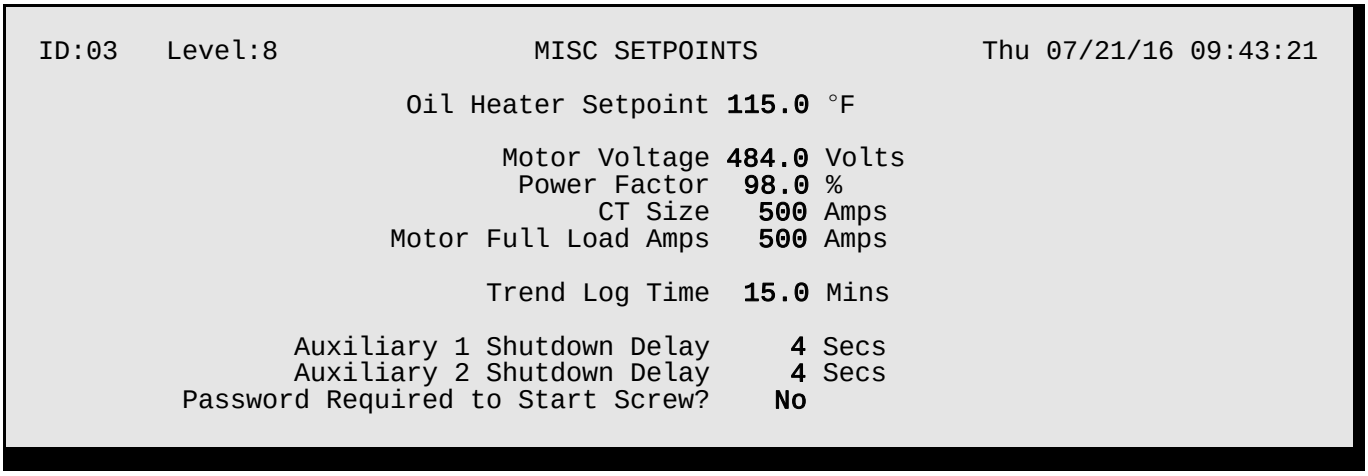
PROCESS TEMP FOR AUTOMATIC SLIDE CONTROL? (Optional)

If the CCS is equipped with a Process Temperature sensor, it can control the slide valve based on either the suction pressure or the process temperature. Select YES to control based on process temperature. This will also change the Control Setpoint units from Pressure to Temperature.

Miscellaneous Setpoints

Requires a Level 8 Password

Miscellaneous Setpoints allows the user to adjust the Oil Heater Temperature setpoint, the Power Factor, Motor Voltage, Current Transformer Size and Trend Log interval.



OIL HEATER SETPOINT
Enter the **OIL HEATER SETPOINT**. The temperature of the oil in the separator will be maintained at the **OIL HEATER SETPOINT**.

MOTOR VOLTAGE
Enter the measured voltage of the electrical supply. The **MOTOR VOLTAGE** value is used along with Motor Amps and **POWER FACTOR** to calculate electrical DEMAND kW and TODAY'S kWH.

POWER FACTOR
Enter the **POWER FACTOR** of the electrical supply to compensate for the difference in phase angle between AC voltage and current. The **POWER FACTOR** value is used along with Motor Amps and **MOTOR VOLTAGE** to calculate electrical DEMAND kW and TODAY'S kWH.

CT SIZE
Enter the **CT SIZE** for the compressor. In the above example a **CT SIZE** of 500 is shown for a 500:5 size CT.

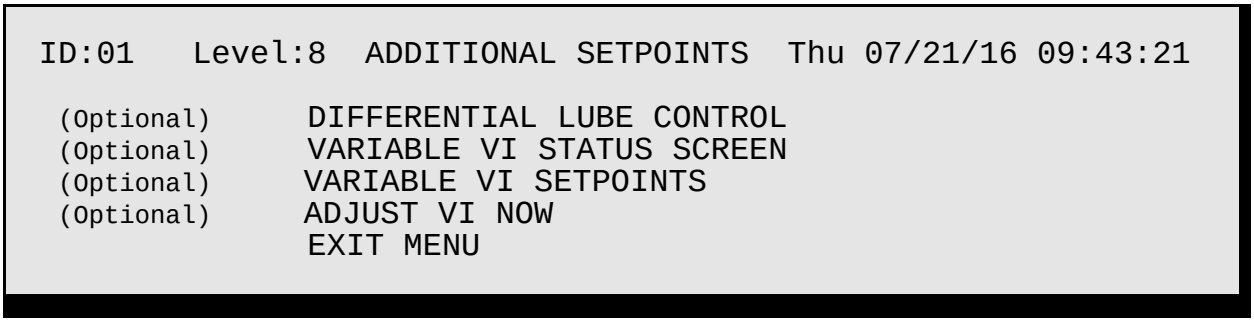
TREND LOG TIME
Enter the **TREND LOG TIME**. The **TREND LOG TIME** is the time interval for the data capture in the TREND LOG (see page 37). In the above example the Trend Log data will be recorded (captured) every fifteen minutes.

AUXILIARY SHUTDOWN DELAY
Enter the length of time the Auxiliary Input can be de-energized before the compressor is failed.

PASSWORD REQUIRED TO START SCREW?
Select YES to require the operator to enter a password (or be logged on) before the compressor can be started.

Additional Setpoints (Optional)

The Additional Setpoints menu selection allows access to setpoints and points of control in addition to the compressor setpoints.



Enter a menu selection or, press **Exit Menu** to return to the previous menu.

Differential Lube Control Setpoints

Requires a Level 8 Password

```
ID:MIKE  Level:8         DIFFERENTIAL LUBE CONTROL         Thu 07/21/16 09:43:21

                  MINIMUM DIFFERENTIAL PRESSURE  40 PSID
      LOW DIFFERENTIAL PRES. FAILURE DELAY TIME   3 MINS

                      SCREW START PRE-LUBE TIME  15 SECS
                 START OIL PRES TRANSITION TIME  60 SECS
```

MINIMUM DIFFERENTIAL PRESSURE and FAILURE DELAY

Enter the **Minimum Differential Pressure** (Discharge above Suction) at which the screw compressor can operate and the **Delay Time** before failure. If the Differential Pressure is below the Minimum for the length of the Delay the screw compressor will fail and stop. If at any time during the Failure Delay the Differential Pressure rises above the Minimum, the Delay timer will be reset. NOTE: Compressor Failure on Low Differential Pressure is only active if the compressor is running.

Oil Pump Control

SCREW START PRE-LUBE TIME

When the Start Compressor command is initiated the oil pump will run (Pre-Lube) for the length of the **Screw Start Pre-Lube Time**. After the Pre-Lube Time expires, the compressor will start, unless the net oil pressure fails to rise above 7 PSID (50kPa).

After the compressor starts, the oil pump will continue to run for the **Start Oil Pressure Transition Time**.

Oil Pressure Safety Control

The control sequence for low oil pressure alarm and warning is as follows:

1) The minimum oil pressure required for compressor start-up is 7 PSID (50 kPa). This value is fixed (not user-adjustable).
2) The low oil pressure cutout & warning will be raised to the normal operating setpoints after a user adjustable **Start Oil Pres Transition Time** delay. The maximum time allowed for the **Transition** is 120 seconds.
3) Once the compressor has started and the **transition** delay has expired, the normal low oil pressure warning, user cutout and fixed cutout setpoints are utilized to verify proper oil pressure.

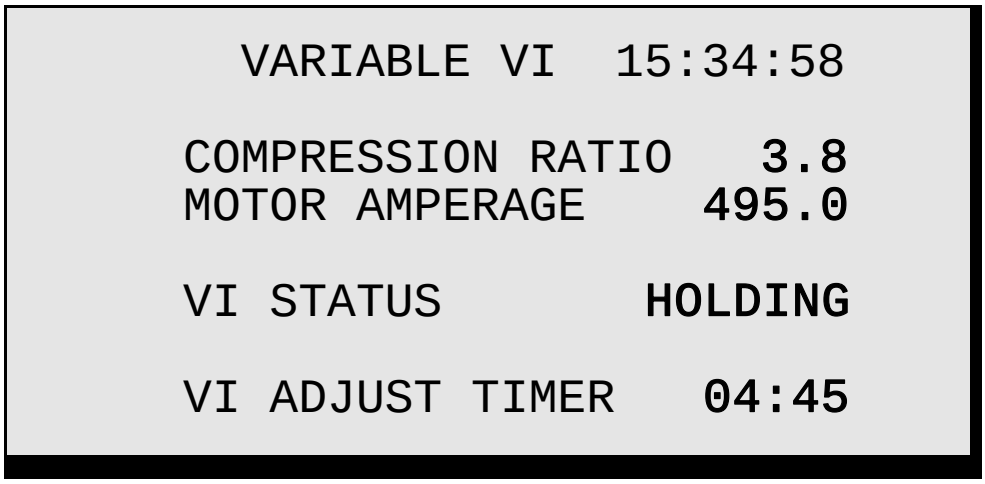
Pre-lube Oil Pump Operation

The Pre-lube oil pump will run under the following conditions:

1) Up to 120 seconds (adjustable) prior to compressor start (pre-lube time).
2) 60 seconds (adjustable) after compressor start (transition time).
3) Up to 60 seconds at compressor shutdown to unload the slide valve.
4) Manual oil pump over-ride via menu selection

Variable VI Status Screen

The Variable VI Status Screen shows the current conditions of the Variable VI. The status screen can be accessed by pressing the **Next>** button.



COMPRESSION RATIO
The ratio of the Discharge Pressure and the Suction Pressure.

MOTOR AMPERAGE
The current Screw Compressor Motor Amps.

VI POSITION
The current status of the VI.

VI ADJUST TIMER
Indicates the amount of time left before the next VI seek is made.

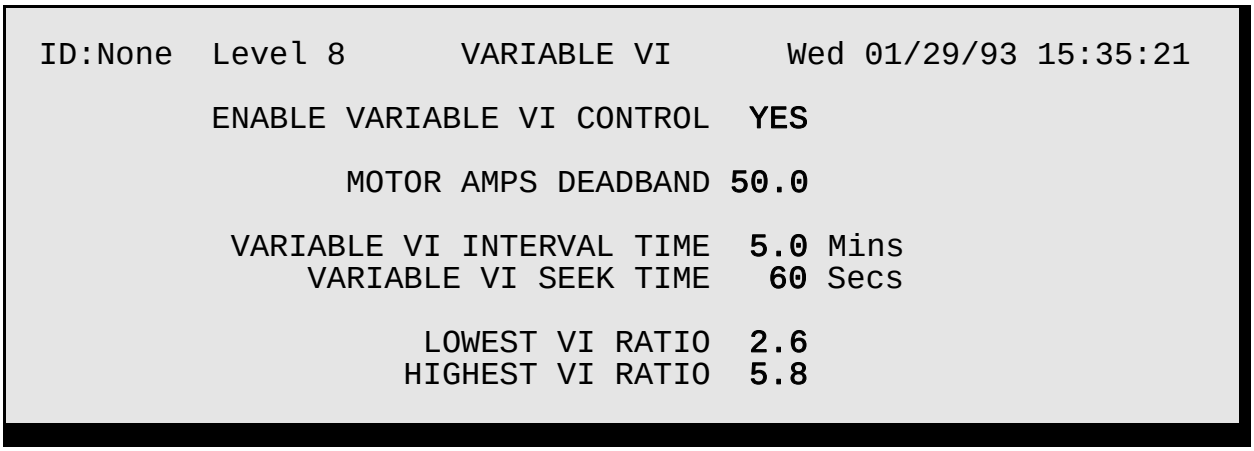
In MANUAL Mode of Operation, the **Load** button continuously loads the Variable Vi Slide Valve until released.

In MANUAL Mode of Operation, the **Unld** button continuously unloads the Variable Vi Slide Valve until released.

Variable VI Setpoints

Requires a Level 8 Password

Variable VI Setpoints allows the user to make adjustments to the Variable VI Controller setpoints.



ENABLE VARIABLE VI CONTROL
Enter **YES** to enable the Variable VI Controller, **NO** to disable.

VARIABLE VI INTERVAL TIME
Enter the **VARIABLE VI INTERVAL TIME**. The **VARIABLE VI INTERVAL TIME** is the interval between VI seek periods.

VARIABLE VI SEEK TIME
Enter the **VARIABLE VI SEEK TIME**. The **VARIABLE VI SEEK TIME** is the maximum length of time the VI will spend searching for the position offering the lowest motor amps. This prevents the VI from constantly seeking if a minimum Motor Amps is not found immediately.

MOTOR AMPS DEADBAND
Enter the **MOTOR AMPS DEADBAND**. The Variable VI controller will make adjustments to the Variable VI position until the resulting change in motor amps remains within the **MOTOR AMPS DEADBAND** or, the **VARIABLE VI SEEK TIME** expires. The deadband avoids minimal adjustments of the Variable VI near the position offering the lowest motor amps.

LOWEST VI RATIO
Enter the Lowest VI Compression Ratio for the compressor.

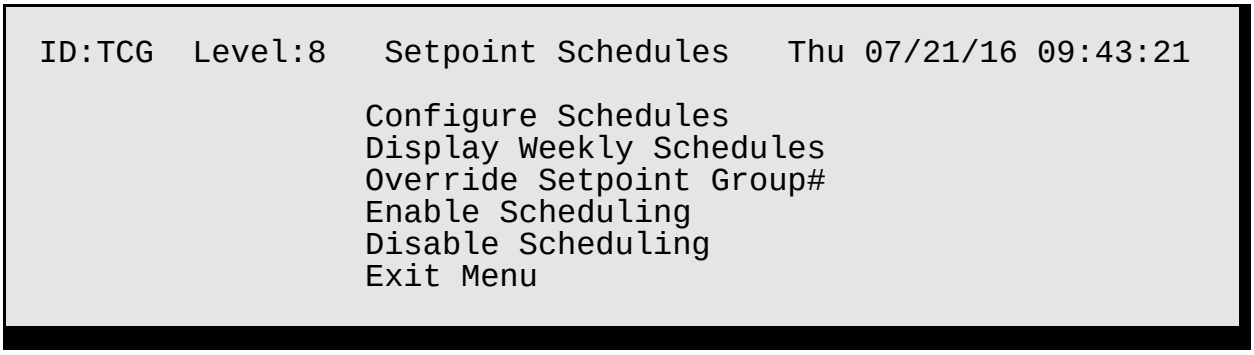
HIGHEST VI RATIO
Enter the Highest VI Compression Ratio for the compressor.

Adjust VI Now

Requires a Level 1 Password

Selecting **Adjust VI Now** will immediately adjust the Variable VI Slide Valve regardless of Slide Valve Position or, Suction Pressure.

Schedule Operation



Setpoint Number Scheduling allows the operator to establish an hourly, daily and weekly schedule of system setpoint changes. The System Setpoints are organized into groups. The Scheduler will load these groups by automatically selecting a **GROUP#** according to the established schedule for the current day. Setpoint (Group#) changes are often utilized to reflect a change in plant operating conditions, different power rate periods or, different product temperatures. Schedule changes can be made manually through menu selection or Automatically by the **CCS**

Enable/Disable Scheduling

Requires a Level 4 Password

Automatic Scheduling is activated by selecting **Enable Scheduling** from the menu. Enabling Automatic Scheduling will load the Schedule assigned to the current day of the week, as establish in the weekly schedule (See Assign Day of Week on page 27).

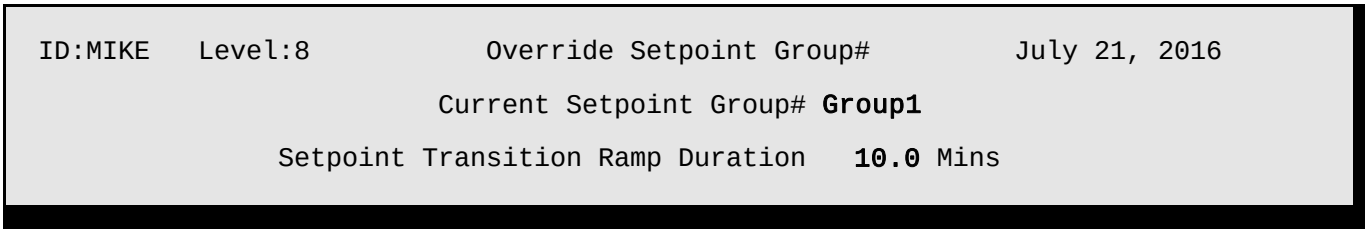
Automatic Scheduling is canceled by selecting **Disable Scheduling** from the menu.

NOTE If Automatic Scheduling is disabled the desired group number can be manually changed using **Override Setpt Group#**.

Override Setpoint Group#

Requires a Level 4 Password

Change Setpoint Group# allows the user to temporarily override the current scheduled setpoint group number and adjust the setpoint transition ramp duration for the new Group# setpoints.



CURRENT SETPOINT GROUP#

Enter the desired setpoint group number. When a new group number is selected from this screen, the current scheduled group number will be overridden until the next scheduled group becomes active (see page 32). ***NOTE*** The Group # selected through this screen will only change control routines with the Setpoint# set to **SCHED**.

SETPOINT TRANSITION RAMP DURATION

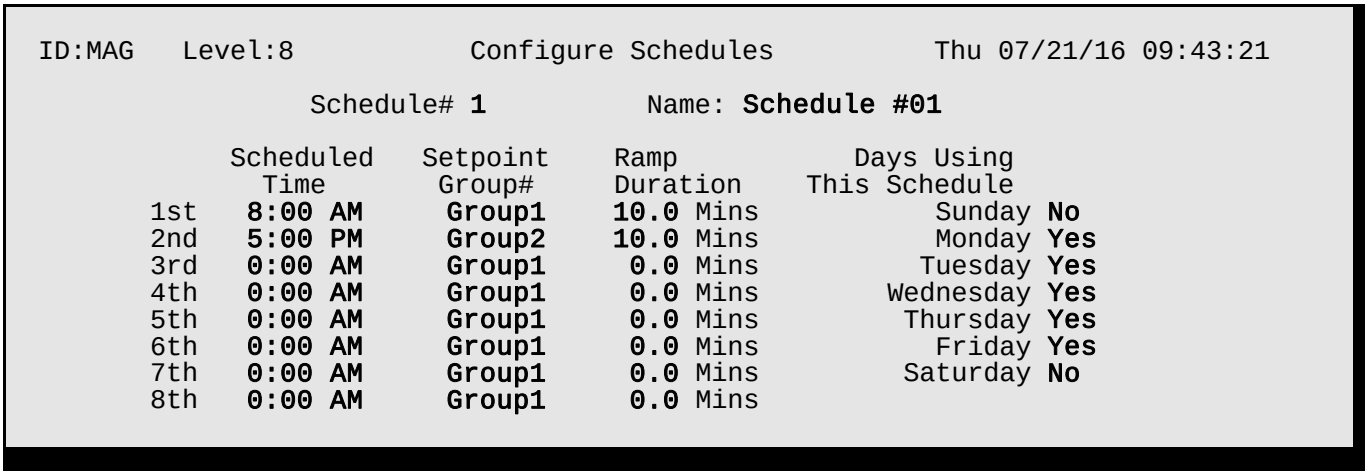
Enter the desired Setpoint Transition Ramp Duration. When a new ramp duration is selected the current ramp duration will be overridden until the next scheduled group becomes active. If scheduling is disabled the ramp duration selected will remain the active duration until either it is manually changed or scheduling is re-enabled. (See page 32)

NOTE The currently active scheduled group number is shown upon first entering this screen.

Configure Schedules

Requires a Level 8 Password

Schedule Setpoint Group#'s allows the user to establish a series of daily automated schedules of various group setpoints and ramp durations. These daily schedules are then utilized in a weekly schedule. The operator can create up to eight unique SETPOINT SCHEDULES. These schedules allow assignment of 1 of 4 control setpoint *Groups* at up to eight specific times of the day. When each scheduled time occurs, the specified setpoint *Group* becomes the current control setpoints.



Select the desired schedule to modify by pressing **PREV** or **NEXT**.

Scheduled Time
Enter the desired time to activate the new Setpoint Group#. A time of zero indicates no schedule change.

Setpoint Group# 1,2,3 or 4
Enter the desired Setpoint Group# to be activated at the Scheduled Time.

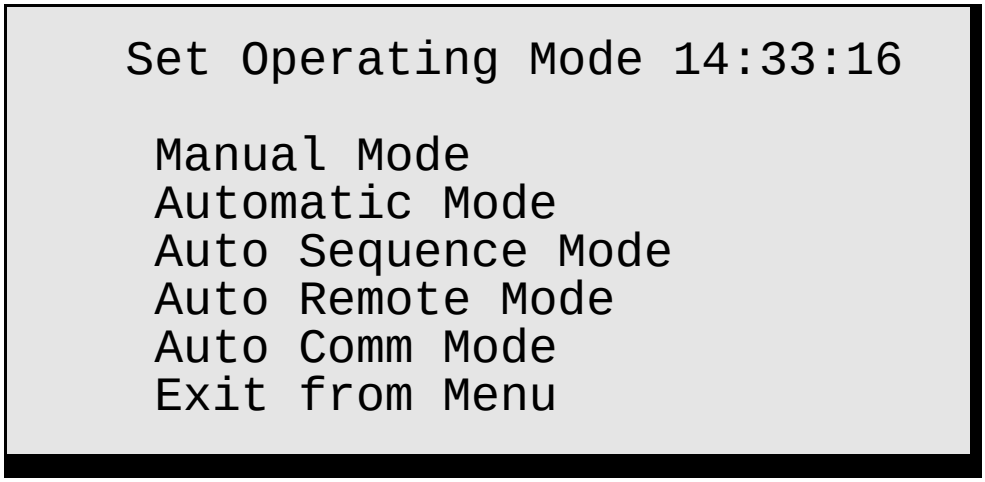
The given example shows that when Schedule 1 is the current Setpoint Schedule, Group 1 will be active between 8:00 am and 5:00 pm and Group 2 will be active until the next Setpoint Group# change on the next day's schedule.

Ramp Duration
Enter the desired Setpoint Change Ramp Duration to be activated at the scheduled setpoint change. The ramp duration allows for a gradual (ramped) setpoint change. In the above example, when Group 2 becomes the active Group# at 5 p.m., all setpoints in Group 1 will ramp up (or down) to Group 2's setpoints over a total time of ten minutes. The ramping feature reduces the corresponding mechanical effects of large changes in system setpoints.

Days Using This Schedule
Select which days of the week will utilize this schedule of operation.

After entries are completed, press **Save** to save the schedule and proceed to the next schedule or, **Quit** to exit.

Set Operating Mode Requires a Level 2 Password



Select the desired Compressor Operating Mode.

MANUAL MODE The compressor is controlled manually by the operator. High Discharge Pressure, High Motor Amps and High Suction Pressure forced unloading (see page 22) are disabled. All safety checks remain in effect.

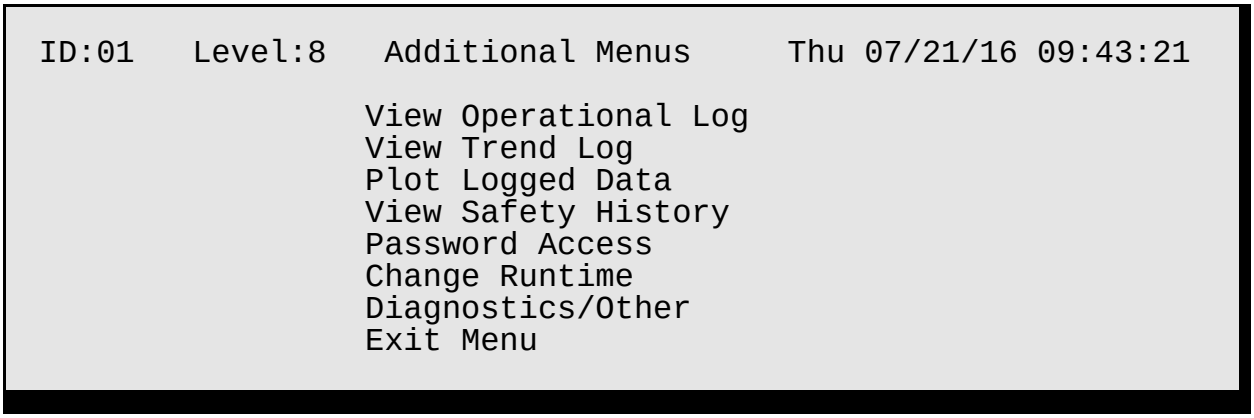
AUTOMATIC MODE All compressor operations are controlled automatically. The compressor can be started through the use of Cut-in and Cut-out pressure setpoints or operator started through the keypad.

AUTO SEQUENCE MODE The compressor is started and stopped by the Master Compressor Sequencer. The compressor will trim the load based upon the System Suction Pressure Setpoint (or Process Temperature Setpoint) and the System Suction Pressure (or Process Temperature). All safety and overload checks remain in effect.

AUTO REMOTE MODE The compressor is started and stopped via a remote signal. Compressor capacity is controlled automatically. All safety and overload checks remain in effect.

AUTO COMM MODE The compressor is started and stopped via a signal via a 3rd Party communications link. Compressor capacity is controlled automatically. All safety and overload checks remain in effect. This MODE will only be displayed if the compressor is equipped with 3rd Party communications capabilities.

Additional Menus



Enter a menu selection or select **Exit Menu** to return to the previous Menu Screen.

View Operational Log

During compressor operation, sensor measurements, operating status' and the control setpoint and group number are logged into the operational log for the past hour at 30 second intervals.

Log Time	SUCT.P	DIS.P	OIL.P	FILTR	DIS.T	OIL.T	SumpT	AMPS	STATUS
14:30:24*	5.4#	126.7	0.0	0.0	135.6	124.4	111.5	0.0	STOP/UNLOADING
14:30:04	5.9#	156.9	55.7	2.1	135.7	124.3	111.4	0.0	STARTING
14:18:02	3.1"	155.1	**F 19.9**	2.1	135.7	124.4	111.6	141.5	**FAILED**
14:18:00	3.1"	153.6	**> 23.5**	2.3	135.6	124.4	111.6	145.2	**WARNING**
14:17:30	2.9"	154.2	35.2	2.2	135.6	124.4	111.5	143.3	RUNNING
14:17:00	3.1"	155.3	47.9	2.2	135.7	124.4	111.5	141.5	RUNNING
14:16:30	3.1"	156.7	55.8	2.3	135.6	124.4	111.5	143.6	**FAILED**
14:16:00	2.9"	156.2	56.1	1.9	135.6	124.4	111.6	141.5	RUNNING
14:15:30	2.9"	155.9	55.9	2.3	135.6	124.4	111.7	142.0	RUNNING
14:15:00	3.1"	156.7	55.8	4.2	135.6	124.4	111.6	141.5	RUNNING
14:14:36	1.6"	156.3	55.9	**> 11.1**	135.7	124.5	111.5	135.8	**WARNING**
14:14:30	2.2#	136.7	56.1	7.3	105.8	124.4	111.5	81.4	RUNNING
14:14:06	4.9#	113.0	55.6	5.6	86.7	124.4	111.6	0.0	STOPPED
14:09:56	5.2#	108.7	0.0	0.0	85.6	124.4	111.5	0.0	STARTING

Oldest Date 03/16/2007

In the event of an alarm or warning or, a start or stop of the compressor, an additional Operational Log entry will be recorded at the time of the event. In the case of an alarm or warning, the offending item will be highlighted and marked with either a **>** (warning) or an **F** (alarm failure) and the status field will indicate either alarm or warning. The past hour of operation can be reviewed to aid in determining the cause of the safety condition.

The following keys are available on an operational log screen:

Page forward in time.

Page backward in time.

Re-display the first page of the Operational log.

Display an additional page of operational information.

Exit Operation Log back to the menu.

OLDEST DATE

In the lower left corner is shown the date of the oldest log currently shown on the page of operational information.

The column labeled "STATUS" will indicate the operating status of the compressor at the time of the log. See page 7 for a list of possible status messages.

View Operational Log, Cont.

Pressing the **More** button displays the next page of compressor operational information.

Log Time	-OP MODE-	SUCT.P	SETPT #	CAP%	SLIDE	SuctT	-AUX-	STATUS
14:30:24*	AUTOMATIC	10.5#	10.0# 2	OFF	12.5	21.9		STOP/UNLOADING
14:30:04	AUTOMATIC	10.6#	10.0# 2	0.0	0.7	21.9		STARTING
14:18:02	AUTOMATIC	10.5#	10.0# 2	72.0	90.7	21.9		**FAILED**
14:18:00	AUTOMATIC	10.8#	10.0# 2	75.1	92.3	21.9		**WARNING**
14:17:30	AUTOMATIC	10.1#	10.0# 2	73.4	91.5	21.9		RUNNING
14:17:00	AUTOMATIC	10.2#	10.0# 2	65.7	84.1	21.9		RUNNING
14:16:30	AUTOMATIC	10.8#	10.0# 2	72.1	90.8	21.9		**FAILED**
14:16:00	SEQUENCE	9.9#	10.0# 2	75.5	92.7	21.9		RUNNING
14:15:30	SEQUENCE	10.2#	10.0# 2	50.1	75.2	21.9		RUNNING
14:15:00	SEQUENCE	10.3#	10.0# 2	54.0	78.7	21.9		RUNNING
14:14:36	SEQUENCE	10.7#	10.0# 2	98.0	98.6	21.9		**WARNING**
14:14:30	SEQUENCE	10.1#	10.0# 2	90.0	93.1	21.9		RUNNING
14:14:06	AUTOMATIC	10.0#	10.0# 2	OFF	0.7	21.9		STOPPED
14:09:56	AUTOMATIC	10.1#	10.0# 2	1.0	2.4	21.9		STARTING

Oldest Date 03/16/2007

The column labeled "AUX" will indicate when a failure is caused by any of the following:

1 Auxiliary contact one
2 Auxiliary contact two
3 Emergency Stop
B Bad sensor
C Communication fault
M Motor Starter
S Can't Start the compressor

View Trend Log

The View Trend Log screen allows the user to view compressor sensor measurements, operating status' and the control setpoint and group number at regular intervals. The information is displayed in the same format as the Operational Log (see above).

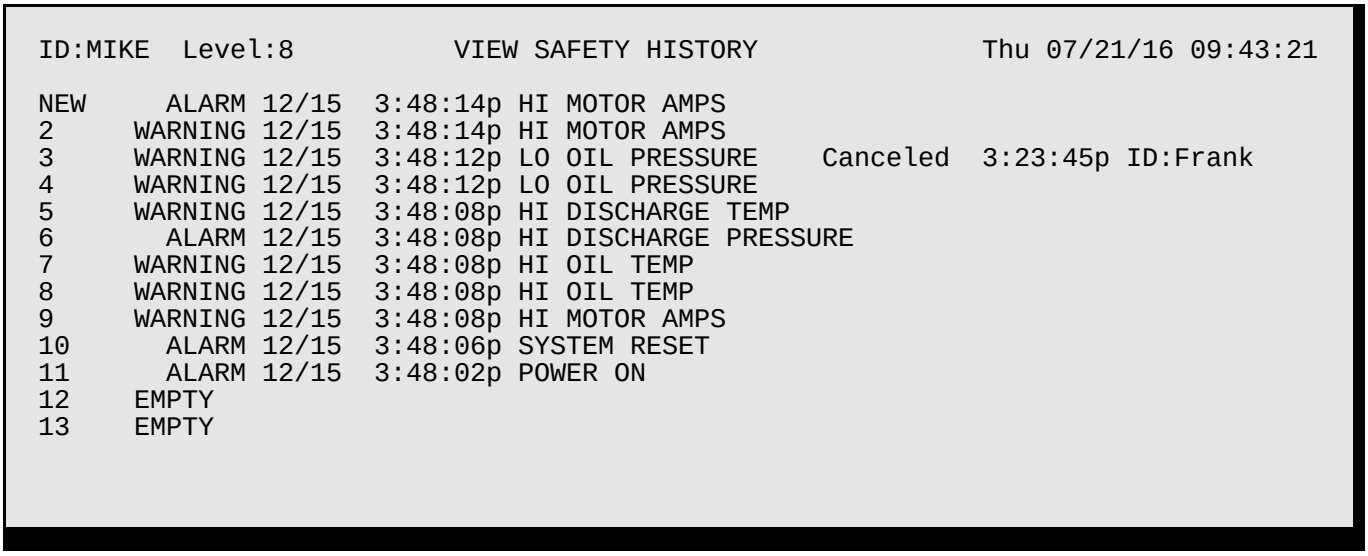
The compressor operating conditions are recorded in the Trend Log at an operator adjustable interval (typically every 15 minutes, see page 25). The Log times are displayed in the left column of the screen. The last 200 log entries are accessed by paging forward and backward with the **Next** button and **Prev** button respectively. The **More** button will display an additional page of logged information. The **Quit** button exits the Trend Log Screen and returns to the previous menu.

The column labeled "STATUS" will indicate the operating status of the compressor at the time of the log or, indicate an alarm or warning. See page 7 for a list of possible status messages. The trend log will record all alarms and warnings that occurred during an interval. The offending items will be highlighted and marked with either a **>** (warning) or an **F** (alarm failure) and the status field will indicate either alarm or warning.

Plot Logged Data

A graphical plot of the Trend Logged or Operational Logged sensor data may be displayed by using **Plot Logged Data**. The operator will first be prompted to select which sensor to plot. A check mark will be displayed by all sensors selected for plotting. Press **PLOT TREND** to display the Trend Logged information. The Trend Logged information is being recorded at regular intervals. Press PLOT OP LOG to display the Operation Log information. The Operational Log information is recorded every 30 seconds while the compressor is running and will enter an additional log when an event occurs (such as starting, or warning).

View Safety History

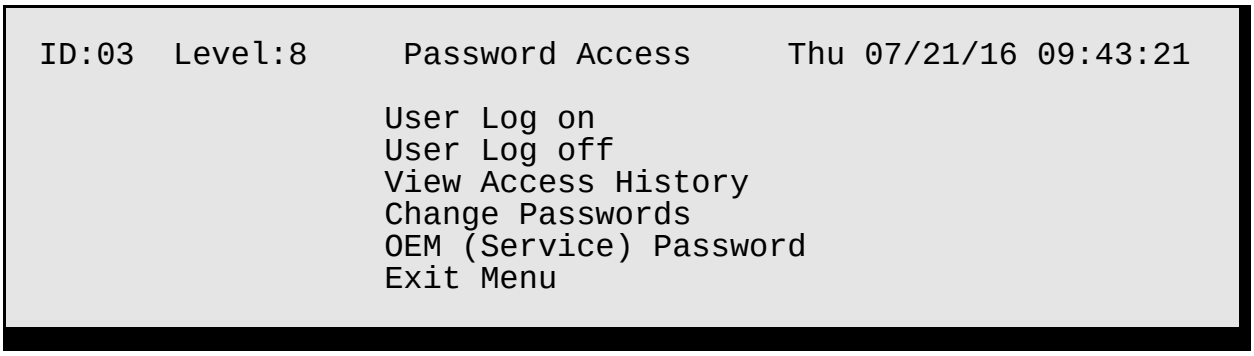


The time and date of the last 200 Safety conditions as well as the time that the alarm was acknowledged and the ID of the personnel who acknowledged the alarm are recorded in the Safety History screen. Use the **PREV** button and **NEXT** button to page forward and backward through the history entries. The **Quit** button exits to the previous menu.

NOTE The ID of the currently logged on personnel (see **User Log On** on page 39) will be recorded in the Safety History when the alarm is acknowledged. An ID will not be recorded when the alarm is acknowledged if there are no passwords defined.

Password Access

The Password Access menu allows the user to Log-on and Log-off and to change or add passwords.



Enter a Menu Selection.

User Log On

Requires a Level 1-8 Password

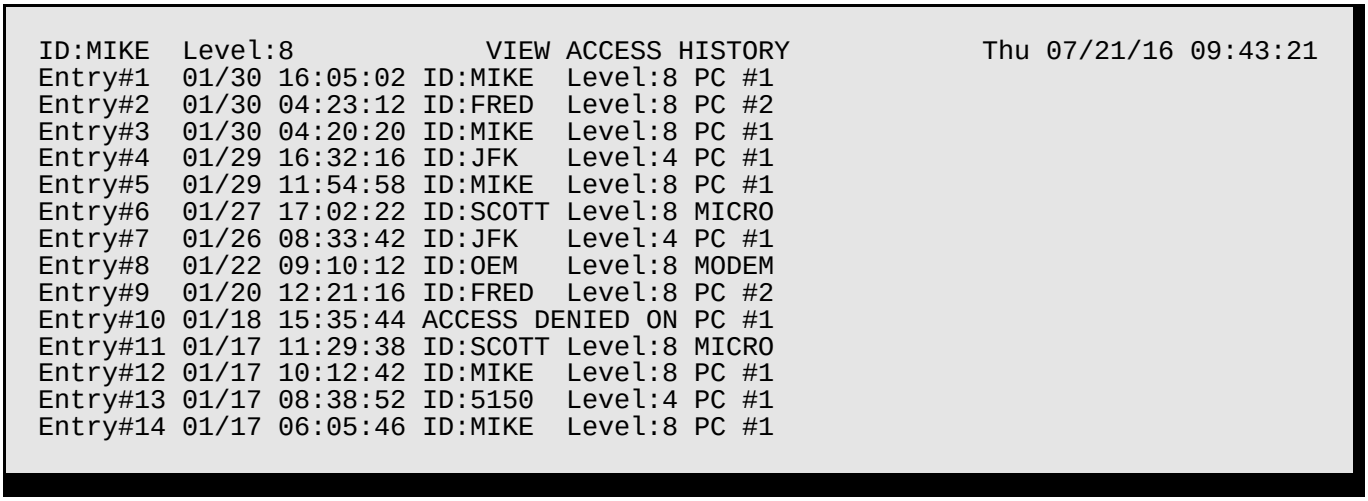
User Log On allows personnel to become the current "Logged On" User. Logging On allows the user access to screens with access levels equal to or, lesser than their own access level. Logging on also enters the current users ID into the Password Access History Log. The user is first prompted to enter their password. If the password is valid the user will become the current user.

User Log Off

User Log Off allows the user to secure the system and remove their ID as the current user. Selecting User Log Off first indicates confirmation of the choice, removes (logs off) the current user and then secures the system.

View Password Access History

View Password Access History allows the user to review recent personnel access the control system and at what times.

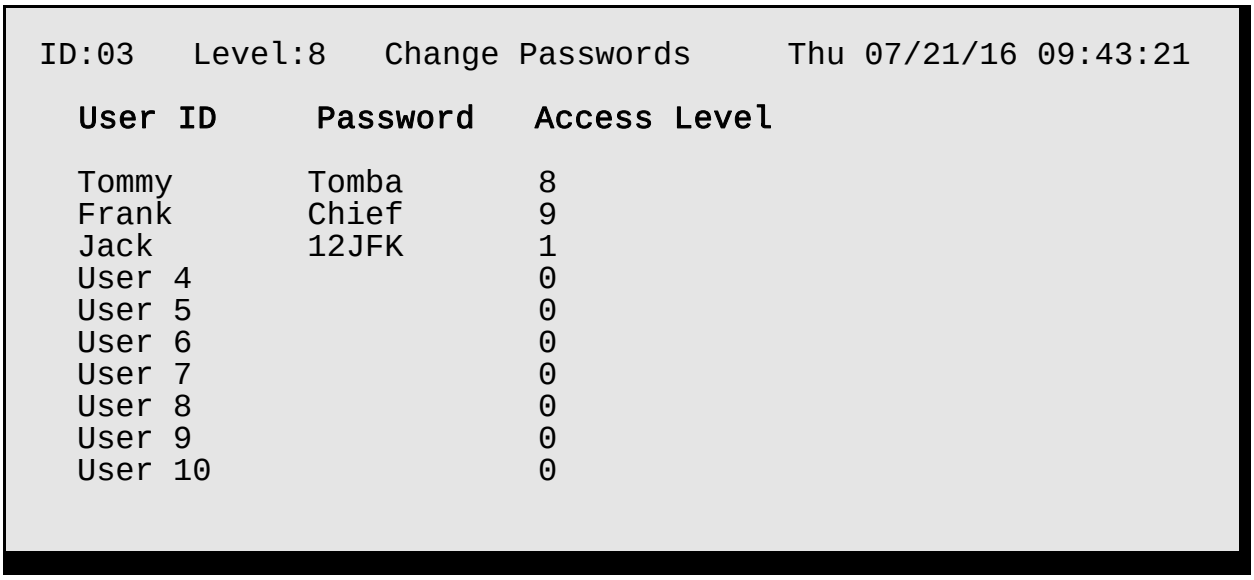


The time, date, access ID, access level and source of the last 96 User Password Accesses are displayed in the Access History screen. Attempted access with an invalid password are indicated with a "ACCESS DENIED" message (see above). Use the **Next** and **Prev** buttons to page forward and backward through the history entries. The **Quit** button exits to the previous menu.

Change Passwords

Requires a Level 8 Password

The Change Passwords Screens allows the assignment of Password codes and their associated Access Level to authorized operators, or Users, of the **Axiom Microcontroller**. This function prevents unauthorized access to **Microcontroller** Screens, Menus and Data.



The user is first prompted to enter a password of level nine (9). If there are no passwords currently in the password screen, an entry of 12345 will allow the user access to the screen. Once any password has been entered in the password screen the password 12345 will no longer be valid.

There are nine (9) different Access Levels. Level 1 is the lowest and has the most restricted **Microcontroller** Access. Level 8 is the highest and has the most Access to the **Microcontroller** Screens, Menus and Data. In addition, Level 9 can change passwords.

Up to ten User Passwords can be defined with any number combination of one to twelve characters.

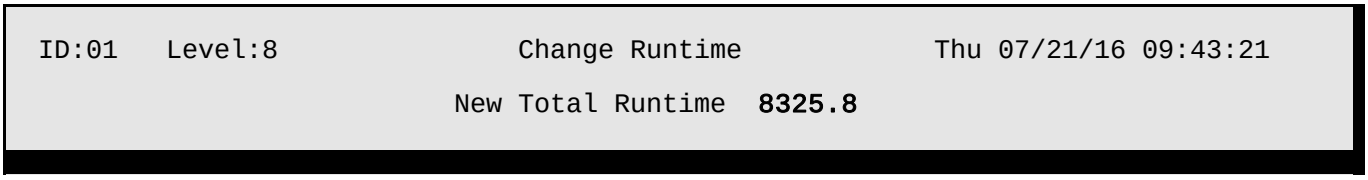
The USER ID identifies each User's unique Password and Access Level. The current USER ID and Access Level are displayed in the upper left corner of the screen (except screens with large characters).

Should a User attempt to Access a Screen or item for which his Access Level is too low, the operator will be prompted to enter a Password with a higher Access Level. Some screens have multiple levels of Access. The current user will only be provided access to the entries with the current Access Level or lower. Entry of a new Password will change the currently logged on User ID and Access Level.

The User will remain "Logged On" for a period of time after their **last** keypad entry. The current User will stay actively Logged On for ten (10) minutes after the **last** keypad entry if they are in any screen but the Main Status Display Screen. If the User returns to the Main Status Display Screen he is Logged Off two (2) minutes after the last keypad entry. To "Log Off" immediately select **User Log Off** from the Password Access Menu or, attempt to access the Change Passwords Screen where upon the user will be prompted for a Password; logging off is then accomplished by pressing the **Quit** button only. Regardless of the method, the Access Level will now be displayed as "Secure" in the upper left corner of the screen.

Password protection may be completely disabled by entering a zero (0) for all Password and Access Level entries.

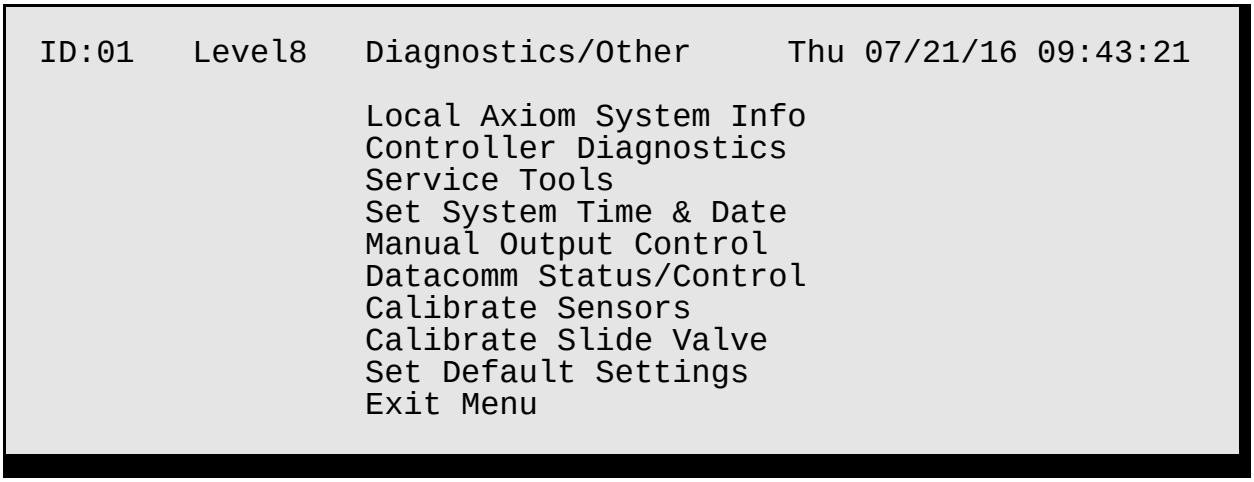
Change Runtime Requires a Level 8 Password



NEW TOTAL RUNTIME

Enter the new total running hours for the compressor. The **CCS** automatically updates the total running hours. This value should only be changed if the current total runtime is inaccurate.

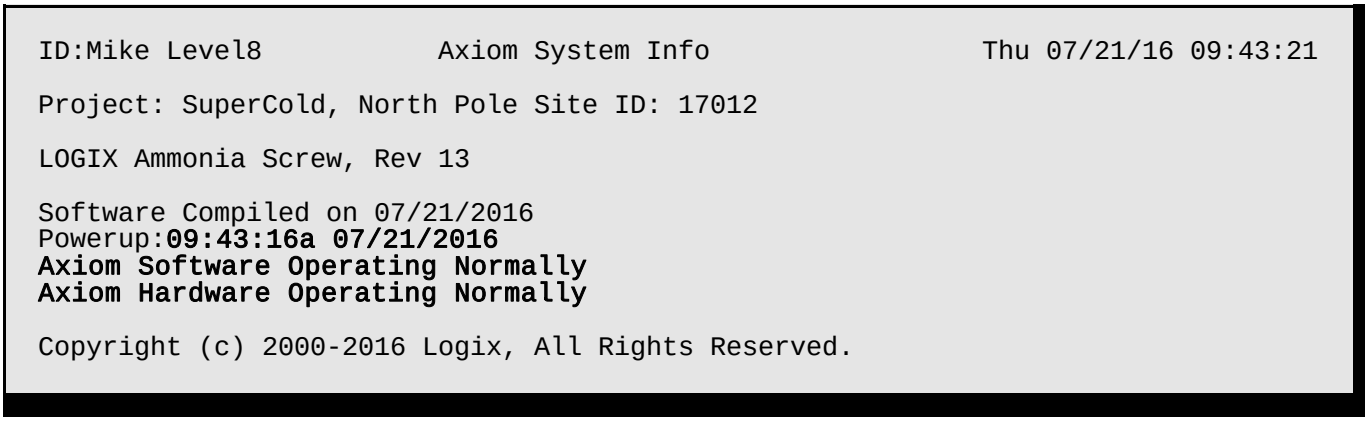
Diagnostics/Other Menu



Enter a menu selection or press **Quit** to return to the previous Menu Screen.

Note The Diagnostics Menu contains specialized routines and should be used with caution.

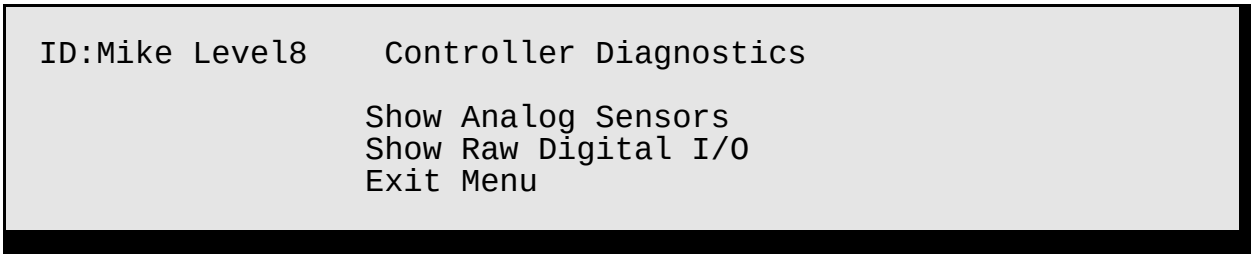
Axiom System Information



The System Information screen displays the software revision date and last time and date that power was applied. In the event of a system error, an error message may appear on this screen describing the condition.

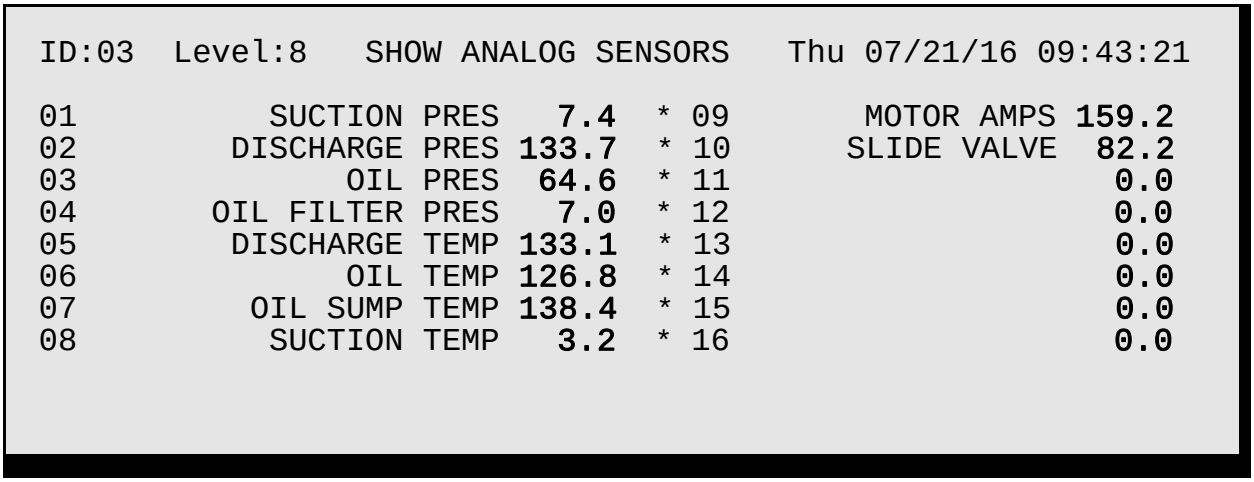
Controller Diagnostics

The Check Controller Menu allows the user to view the current analog values of all sensors and on/off status of all digital I/O monitored by the microcontroller.



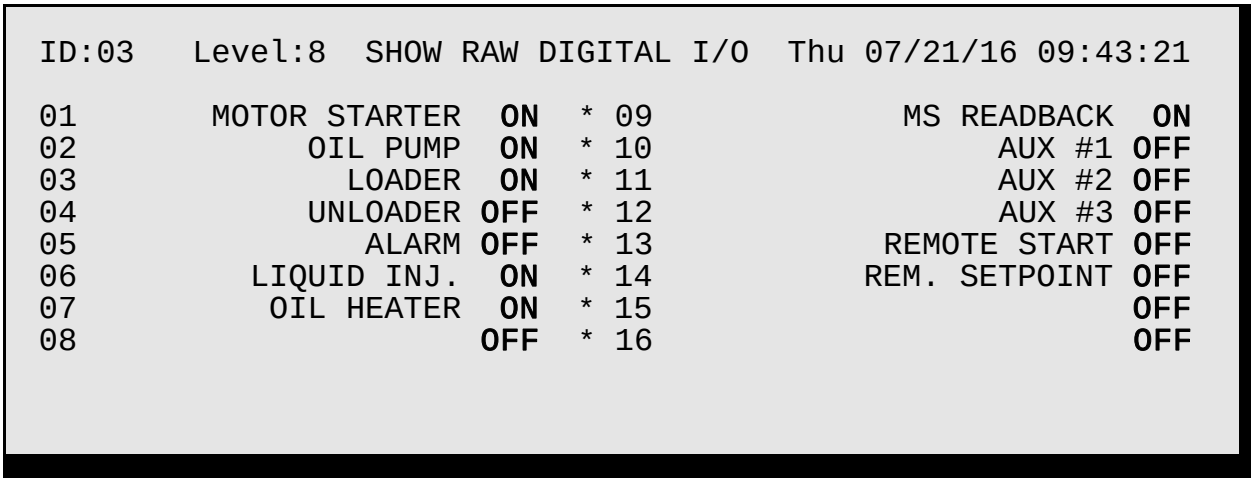
Enter a menu selection or press **Quit** to return to the previous Menu Screen.

Show Analog Sensors



The Show Analog Screen continuously displays analog (sensor) channel numbers and current measurements. This screen is useful for field testing and setup. Note that a faulty sensor (Bad Sensor) will display "Error" in place of the measurement.

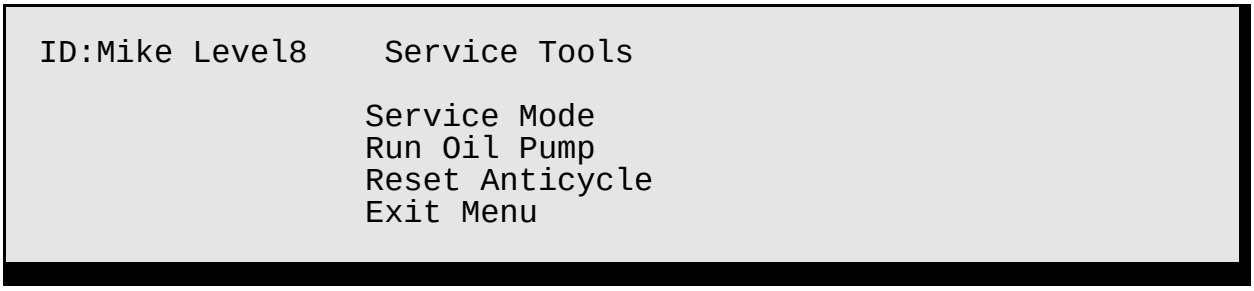
Show Raw Digital I/O



The Show Digital I/O Screen continuously displays digital Input and Output channel numbers and current On/Off states. This screen is useful for field testing and setup.

Service Tools (OEM Password Level Required)

The Service Tools Menu allows the user to view the current analog values of all sensors and on/off status of all digital I/O monitored by the microcontroller.



Service Mode

When in Service Mode, the normal fixed limits for Alarm shutdowns will be ignored.

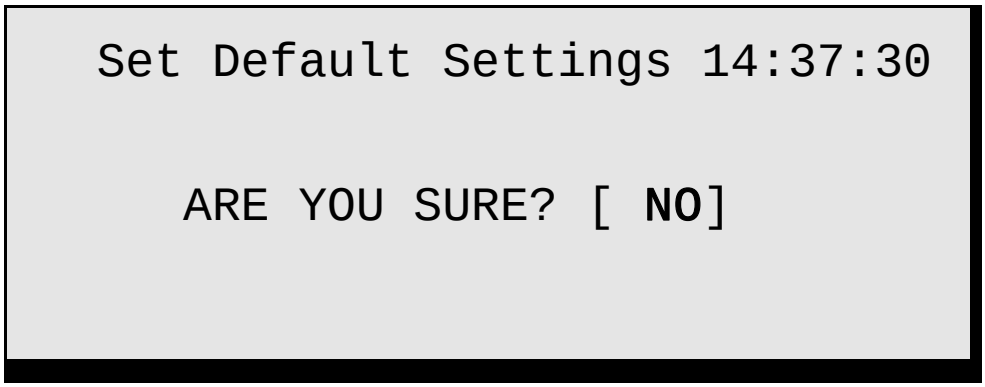
Run Oil Pump

Override the normal oil pump control and run the pump continuously.

Reset Anticycle

Selecting Reset Anticycle will reset the remaining Anticycle time. Use with caution.

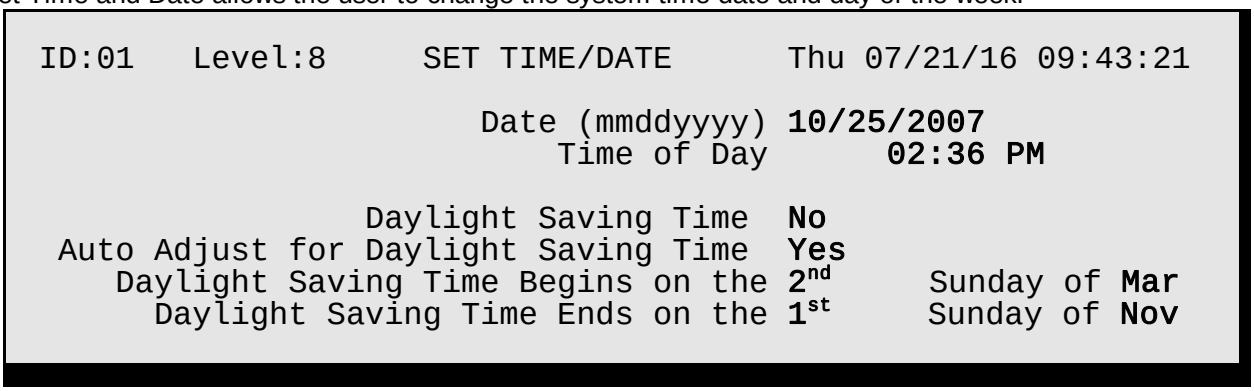
Set Default Settings Requires a Level 9 Password



Entering YES will cause setpoints and all Operational, History and Trend Logs to be completely erased. All Information will be lost. **USE WITH CAUTION**. When defaults are set the panel will reset and the display will temporarily go blank.

Set Time and Date Requires a Level 8 Password

Set Time and Date allows the user to change the system time date and day of the week.



DATE
Enter the current date and year using the format mmddyyyy. For example 11232004 is November 23rd 2004.

TIME OF DAY
Enter the current time of day.

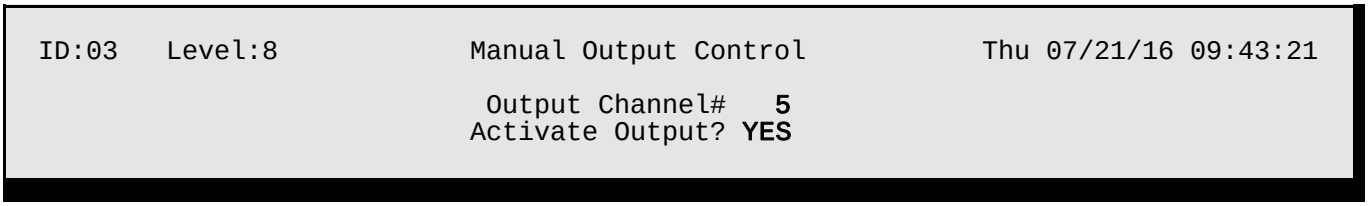
DAYLIGHT SAVING TIME
Enter Yes for Daylight Saving Time, No for Standard Time.

AUTO ADJUST FOR DAYLIGHT SAVING TIME
Enter Yes to automatically adjust Daylight Saving Time.

DAYLIGHT SAVING TIME BEGINS ON
Enter the day and month that Daylight Saving begins.

DAYLIGHT SAVING TIME ENDS ON
Enter the day and month that Daylight Saving ends.

Manual Output Control Requires a Level 8 Password



The Manual Output Control screen allows an operator to manually control all the digital output channels with the exception of a compressor motor starter. Since safety and control routines are always active, certain output channels will resist manual overrides. This screen should be used for field testing and setup only.

Enter the desired unit and channel number followed by a YES to turn on the output or a NO to turn off the output, and then SAVE the screen to execute the manual output control.

Check Datacomm

```
ID:03   Level:8             CHECK DATACOMM                 Thu 07/21/16 09:43:21


ID# 2        #Recved 51932        #Sent 51      #Timeouts 0
             #Errors     0      #Errors 0
```

The Show Communications screen is useful for data communications diagnostics. The #Recv and #Sent represent the number of messages passed and message error counts between the Axiom Master Controller and the compressor.

Calibrate Sensors

Requires a Level 8 Password

The Calibrate Sensors screen allows small adjustments to be made to the Microcontroller's analog sensor readings.

```
ID:03   Level:8              CALIBRATE SENSORS              Tue 07/21/93 13:13:04

01              SUCTION PRES   7.4  *  09                MOTOR AMPS 158.5
02            DISCHARGE PRES 133.4  *  10                SLIDE VALVE  82.3
03                  OIL PRES  64.6  *  11             CONDENSER PRES 152.3
04           OIL FILTER PRES   3.2  *  12                            0.0
05            DISCHARGE TEMP 138.7  *  13                            0.0
06                  OIL TEMP 126.5  *  14                            0.0
07             OIL SUMP TEMP 138.2  *  15                            0.0
08              SUCTION TEMP   6.5  *  16                            0.0

 Enter Correct Value [ 133.4] for Ch# 02  DISCHARGE PRES
     Span Correction     0.0 %
   Offset Correction     0.0 %
```

Enter the correct value (from the calibrating device) for the sensor currently selected (e.g. DISCHARGE PRES) and press **Save**. This will calibrate the sensor and display the adjusted value. Press the **Next** button or the **Prev** button to advance to the next or previous sensor.

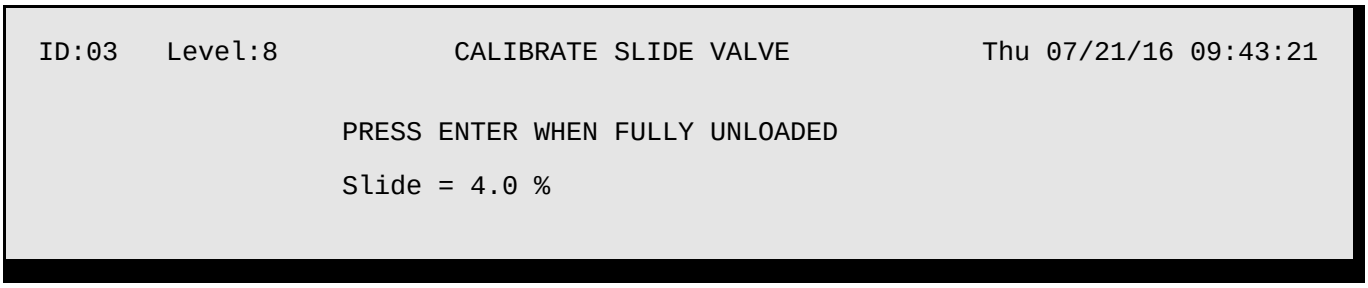
Note for the technically oriented: This calibration routine dynamically adjusts both span and offset parameters in proportion to the value input. For best results, sensors should be calibrated as close to the extremes of the span as possible.

Sensors should only be calibrated against devices **known to be accurate**. Calibration by guesswork or against devices of questionable quality will degrade the performance of the microcontroller. For this reason, adjustments are restricted to +/- 5% of the sensor range. Any sensor that can't be calibrated within +/- 5% of it's sensing range is usually defective or has faulty wiring. If the operator attempts to adjust a sensor beyond 5% an **Out of Range** message will be displayed.

Calibrate Slide Valve

Requires a Level 8 Password

Slide valve full load and full unload positions can easily be calibrated by using the **Calibrate Slide Valve** menu selection. The compressor may be stopped or running in manual to perform the calibration.



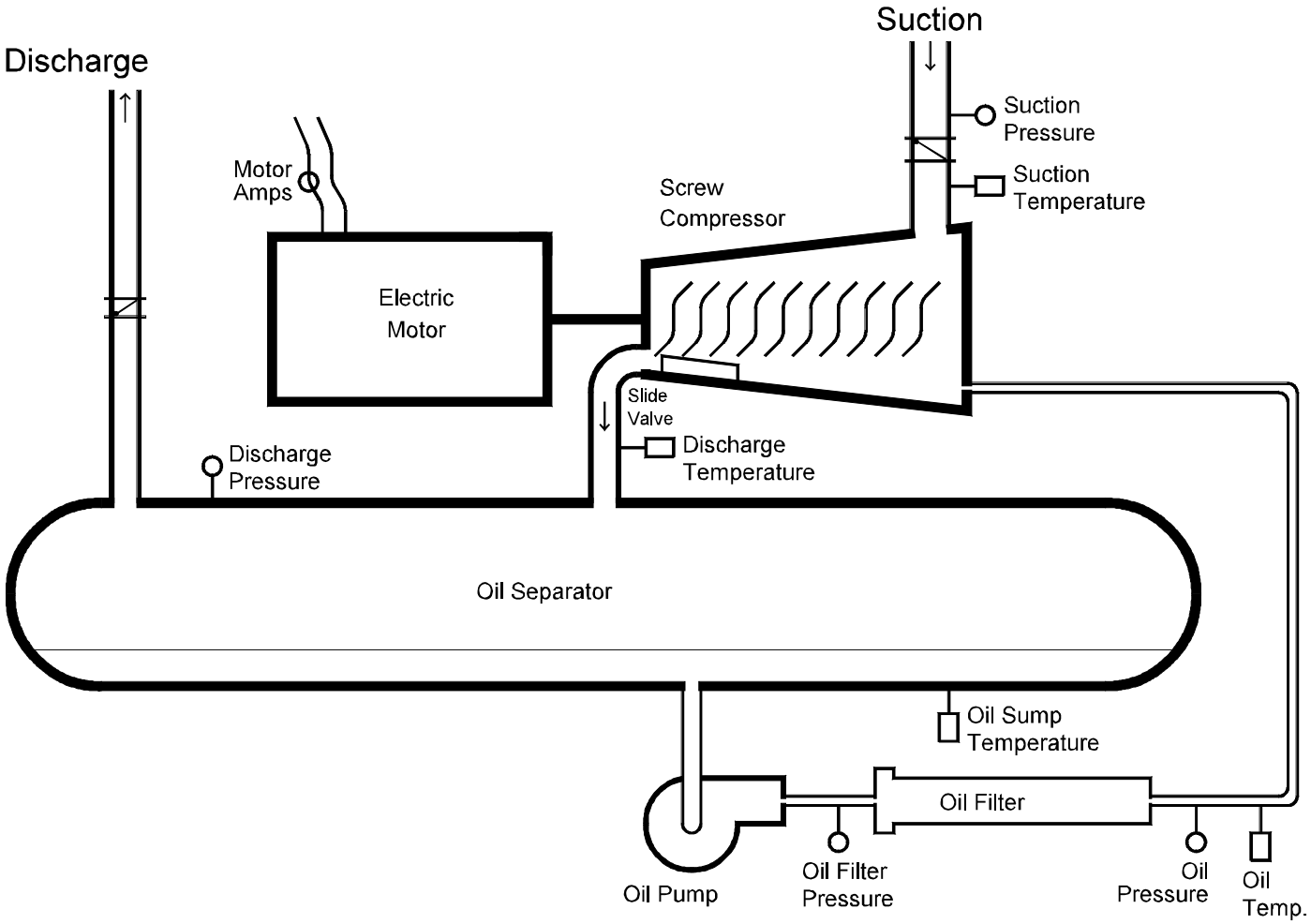
First, the CCS panel will fully **unload** the slide valve and display the current slide valve position. The operator is prompted to press the **Enter** button when the slide valve reaches the end of it's travel. The **minimum** slide valve position is "memorized" when the operator presses the **Enter** button.

Next, the CCS panel will fully **load** the slide valve and display the current slide valve position. The operator is prompted to press the **Enter** button when the slide valve reaches the end of it's travel. The **maximum** slide valve position is "memorized" when the operator presses the **Enter** button.

The Slide Percentage (%) value displayed on the calibration screen is not an indication of the value that will be displayed on the Main Status Screen after calibration. The important thing is that the value increases when the machine is loading. If Slide Percentage value drops back down to a lower value during the loading portion of the calibration, the wiper on the slide pot may be rotating too far. If this happens, fully unload the compressor and physically adjust the pot so that a voltage reading on Analog Input Terminal 10 to Ground is around 0.1 VDC. Lock the pot in position and attempt calibration again.

Pressing the **Quit** button anytime during the calibration will cancel the Slide Valve calibration and exits to the previous menu.

Screw Compressor Layout



Screw Compressor Diagram

The above figure is a simplified diagram of a screw compressor and related analog sensors.

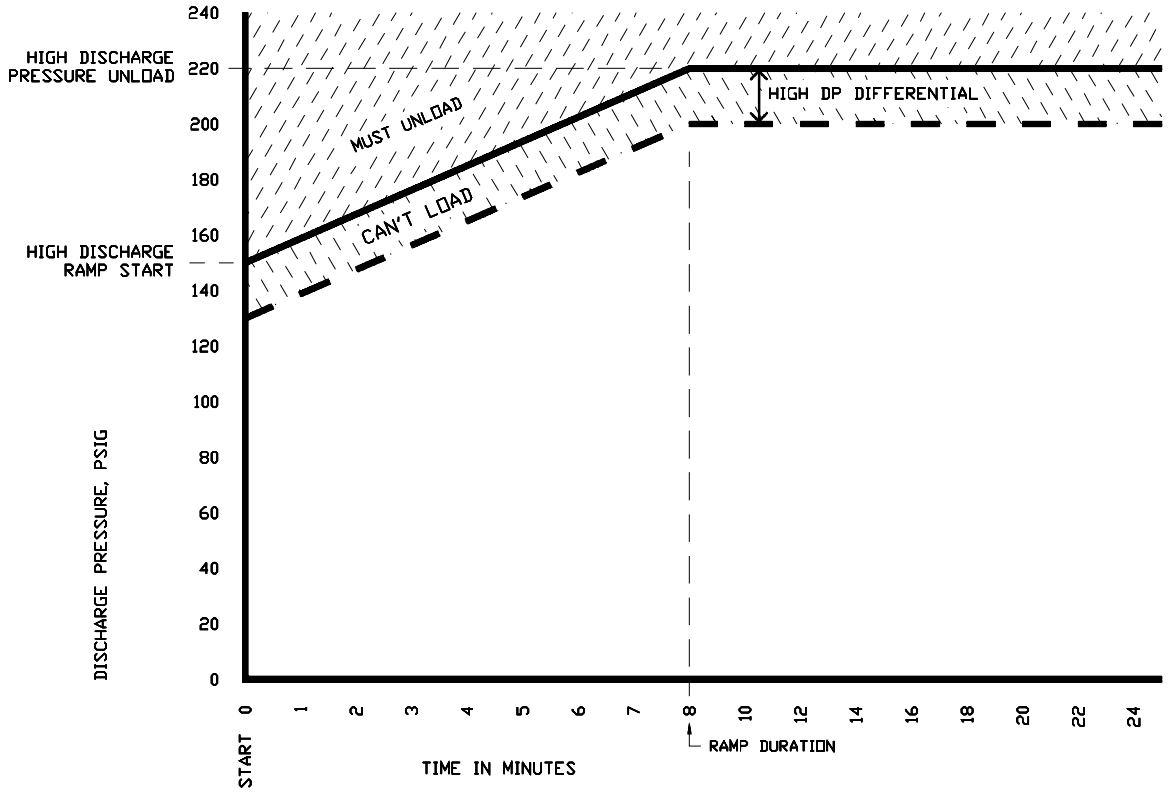
Fixed Safety Limits Table

Description	Safety Type	Fixed Limit
Low Suction Pressure	Warning & Cutout	30 "Hg
High Discharge Pressure	Warning & Cutout	225 PSIG
Low Oil Pressure	Warning & Cutout	20 PSI
High Oil Pressure	Warning & Cutout	200 PSI
Oil Filter Pressure Drop	Warning Only	None
High Discharge Temperature	Warning & Cutout	212 °F
High Oil Temperature	Warning & Cutout	175 °F
Low Oil Sump Temperature	Warning & Cutout	80 °F
Suction Temperature	None	None
Low Motor Amps	Cutout	< 10% Full Scale
High Motor Amps	Warning & Cutout	C.T. Dependent
Slide Valve	Start Under 5%	None

Fixed Time Delay Table

Time	Description
8 Seconds	Minimum compressor start delay
15 Seconds	Delay at start before Low MA, High MA, High OP and Bad Sensors safeties are checked
60 Seconds	Delay on Low Suction Pressure safety checks on setpoint # change
6 Seconds	Oil Pressure must be stable for this period before it is considered good
10 Seconds	Low Oil Pressure failure delay time
5 Minutes	Maximum compressor start time
20 Minutes	Anticycle Timer
5 Minutes	Automatic Mode Minimum On Time
2 Minutes	Automatic Mode Minimum Off Time

Ramp Start Description



Ramp Start Diagram

This discussion regards Discharge Pressure Ramp Start and forced unloading. Motor Amps and Suction Pressure behave similarly. Refer to page 22 for the RAMP/UNLOAD SETPOINT screen.

High Discharge Pressure Forced Unloading and Load Limiting

The HIGH DISCHARGE PRESSURE UNLOAD setpoint forces the compressor to unload due to excessively high discharge pressure. When the compressor discharge pressure exceeds this overload value, the compressor is forced to unload. This unload setpoint is represented by the solid horizontal thick line in the above diagram.

In addition, the HIGH DP DIFFERENTIAL will prevent the compressor from loading as it nears the High Discharge Pressure Unload setpoint. The compressor is prevented from loading (load limited) when the discharge pressure exceeds the High Discharge Pressure Unload value minus this differential value. This Load Limiting setpoint is represented by the dashed horizontal thick line in the above diagram.

Discharge Pressure Ramp Start

Ramp Starting controls the initial loading of the compressor allowing for a smooth and gradual start. The compressor capacity is restricted by limiting the discharge pressure from an initial high discharge RAMP START PRESSURE unload value that gradually increases during the RAMP START DURATION until it reaches the HIGH DISCHARGE PRESSURE UNLOAD value. This "Ramp" is represented by the sloping lines in the above diagram.

The total length of time of the Ramp Start sequence is determined by the RAMP START DURATION. During the Ramp Start sequence, the Ramp Unload setpoints are gradually increased from the initial Ramp Start values to the final Unload values.

Troubleshooting

This Troubleshooting Guide is divided into the following sections:

1. Analog Sensors
2. Digital Inputs/Outputs
3. Axiom Hardware

Analog Sensors

The safety message "Bad Sensor" indicates at least one sensor is sending an excessively low signal (under the normal operating range) to the Axiom Unit or at least one sensor is sending an excessively high signal (over the normal operating range). Typical causes of a low signal are a broken wire or damaged sensor. Typical causes of a over-range signal are a shorted wire or damaged sensor.

A faulty sensor will display a series of question marks or the message "ERROR" instead of a normal sensor reading. View **Show Analog Sensors** in **Controller Diagnostics** to ascertain which sensor is faulting. Moisture penetration into a sensor's enclosure is the most common source of sensor failure. Refer to the sensor wiring diagrams for installation information.

Problem	Test	Possible Solution	Comments
"Sensor Fault" safety message.	Measure +24VDC supply at the sensor. Should be near +24VDC.	1. A wiring short is shorting the +24VDC to Ground. Automatically Resetable fuses protect groups of sensor's +24VDC power. The cause of the short must be removed before +24VDC power will be restored. In some cases, power must be removed by shutting off circuit breaker **CB1** for approximatley 5 seconds. 2. Break in supply wire to sensor. 3. The sensor supply is wired incorrectly. The sensor should be supplied by +24VDC power from the lower terminal block. 4. Axiom +24VDC supply is faulty: contact a Logix Technician for further details.	Refer to the Sensor Diagnostics Diagram
"Sensor Fault" safety message (continued)	Measure the return voltage from the sensor. It should be between 1VDC and 5VDC (approximately).	1. Sensor probe is disconnected if voltage is above +5VDC. 2. Sensor is bad if voltage is not between 1-5VDC, typically from water damage. REPLACE SENSOR. 3. Negative signal wire is broken or disconnected if voltage is near zero.	Refer to the Sensor Diagnostics Diagram .
Sensor reading fluctuates.	Verify cable is shielded and grounded at Axiom panel end only.	1. Use shielded twisted-pair cable such as Belden #9501 and ground the shield at the Axiom panel end only. 2. Sensor is faulty or wet and needs replacing. 3. Sensor cannot support a long probe wire lead length.	Refer to the Sensor wiring diagrams.
Sensor reading is too high or too low.	Compare reading against a **known**, **accurate** sensor.	1. Use the Calibration routine for normal (up to 5%) sensor deviation. 2. Sensor is being affected by external sources (unusual air flow, lights, moisture). If moisture is observed inside sensor enclosure dry completely and retest. Drill a weep hole at the lowest point to limit moisture related problems. 3. Sensor is faulty and needs replacing.	

Digital Inputs/Outputs

Digital Inputs and Outputs are 120VAC or 240VAC solid state relays driven by a low voltage signal from the microcontroller. They are NOT dry contacts. The table refers to Digital Outputs but some sections are relevant when troubleshooting a faulty Digital Input. Review the Digital Output Schematic for reference.

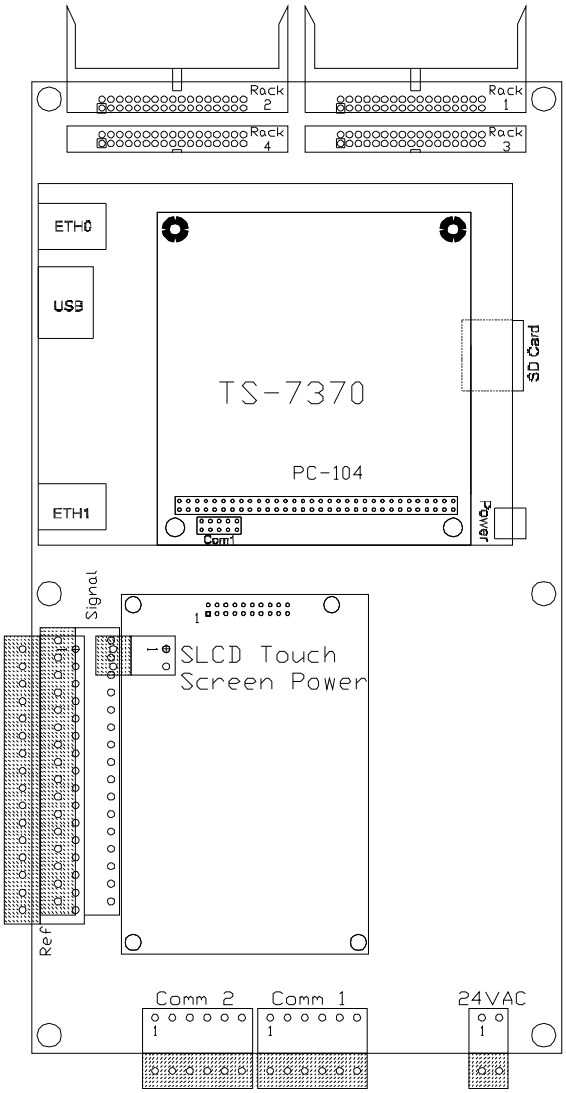
Problem	Test	Possible Solution	Comments
Digital Output fails to **energize**.	Verify that the microcontroller is trying to energize the output by viewing Show Raw Digital I/O .	Enable (or disable) the control mechanism that energizes the output.	
(continued)	Verify Red LED is illuminated for the Digital Output.	1. LED is faulty. 2. I/O Rack ribbon cable is loose or faulty. 3. Controller board is faulty	The LED is in series with the Output. Items 1-4 also apply to Inputs.
(continued)	Verify 120VAC is present on digital output line side.	1. CB2 Circuit breaker in Logix panel is off. 2. Power is disabled at external main breaker.	Item 1 and also apply to Inputs.
Digital Output fails to **de-energize**.	Verify LED is not illuminated for the Digital Output.	1. Enable (or disable) the control mechanism that is keeping the output energized. 2. Manual Output Control is keeping output energized indefinitely.	
(continued)	Measure output voltage with a load connected.	1. Connected load is too low and leakage current is causing the output to stay at or near 120VAC. 2. Connect a larger load and re-measure output voltage.	Refer to the Digital Output Schematic.

Axiom Hardware

Refer to the Axiom Microcontroller Diagram to reference the various components.

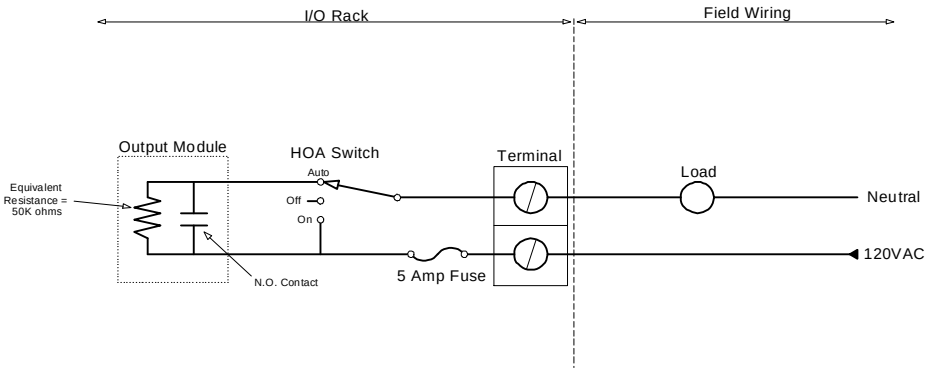
Problem	Possible Solution	Comments
LCD won't display anything.	1. Axiom microcontroller is not on. 2. Axiom board not functioning. Alive LED should have a steady one-second-on one-second-off blink. Backlight in display is burned out. Screen in power-save mode. Touch the display to re-activate.	
Axiom microcontroller not on	1. Verify CB1 2 amp breaker is not tripped. 2. Verify 120VAC coming into the panel at terminal P1. 3. Verify 120 VAC at Line side of Amber Industries surge suppressor. The red LED should be lit. 4. Verify BTR-405 transformer operation by measuring 24VAC at power terminal on lower right hand side of the microcontroller.	
Axiom microcontroller not functioning	1. If Alive LED is either off or constantly on then there is either a program fault or no program is loaded. 2. If Alive LED alternates between a one second blink and a series of rapid blinks. Count the rapid blinks- this is an error code. 3. If Alive LED alternates between one blink and two blinks then turn DIP #1 switches 7 and 8 off and press Reset.	Items 1&2: consult a Logix technician and describe LED behavior. Item 3: Refer to the Axiom Microcontroller Schematic

Axiom II Microcontroller Layout



Analog Inputs
Signal on Upper Block

Digital Output Schematic



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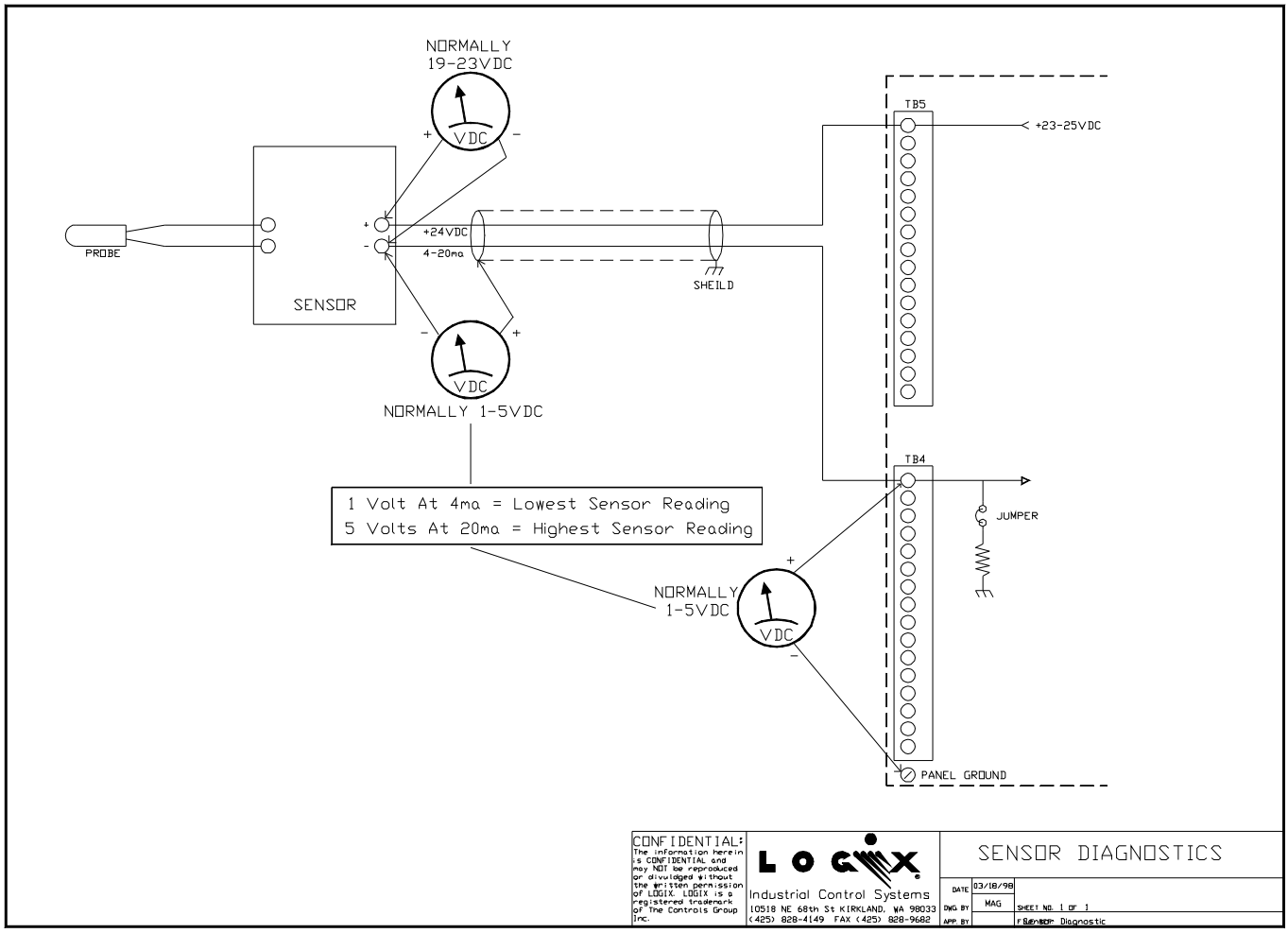
Title: Digital Output Schematic		
Date: 03/22/01	Rev: 01	Drawn by: MDG
Drawing Filename: DigOutSchem.axd		

Sensor Diagnostics Schematic



Loading Axiom Software

The control program running on the Axiom panel can be updated with a USB Flash drive using the following procedure.

1. Turn the Axiom panel power off.
2. Carefully insert the USB Flash Drive into the USB slot on the left side of the TS-7370 processor card. Refer to picture below.
3. Turn the Axiom power back on.
4. Wait one to two minutes until the green Alive LED (located just below the TS-7370 card on the left side) is blinking steadily one second on followed by one second off.
5. Carefully remove the USB Flash Drive.

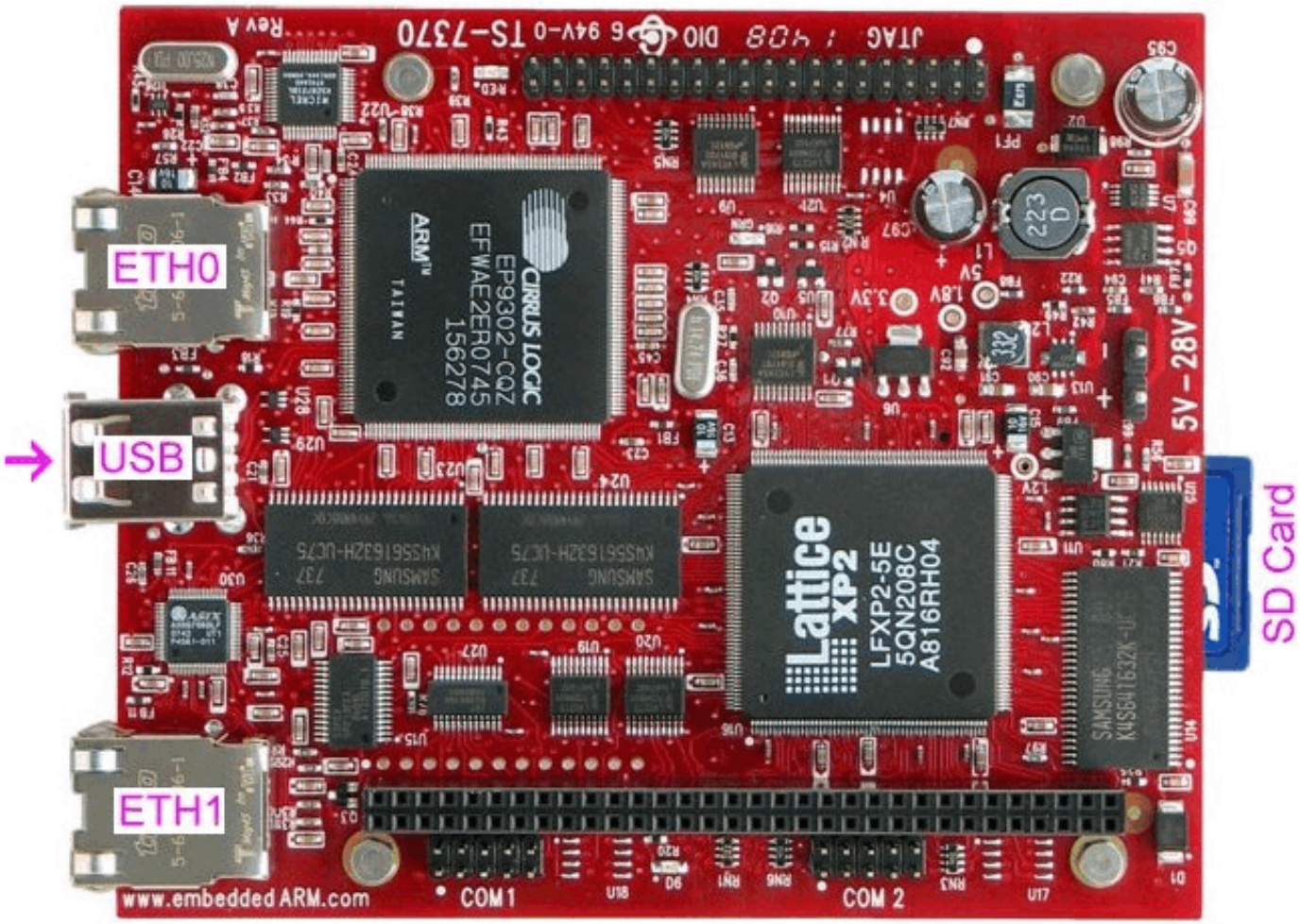


Figure 6 - Axiom TS-76370 Processor Board

Password Access Level Table

Level 0 (No Password Required):
- All Status Display Screens
- View Operation Log
- View Trend Log
- View Safety History
- System Information
- Show Analog Sensors
- Show Digital I/O
- Show DataComm Status
- User Log Off
- Plot Trends

Level 1 (Lowest Level Access)
- Start Compressor (Optional)
- Adjust VI Now

Level 2
- Auto Control Options
- Set Operating Mode

Level 4
- Control Setpoints
- Warning Setpoints
- Override Setpoint Group#
- Enable Scheduling
- Disable Scheduling

Level 8 (Highest Setpoint Access Level)
- Failure Setpoints
- Ramp/Unload Setpoints
- Setpoint# Schedules
- Adjust Screw Controls
- Change Runtime
- Set Time & Date
- Set Total Runtime
- Set Default Settings
- Manual Output Control
- Calibrate Sensors
- Misc Setpoints
- Variable VI Setpoints

Level 9 (Highest System Access Level)
- Change Passwords
- Set Default Settings
- Service Tools

Compressor Unit# Identification Table

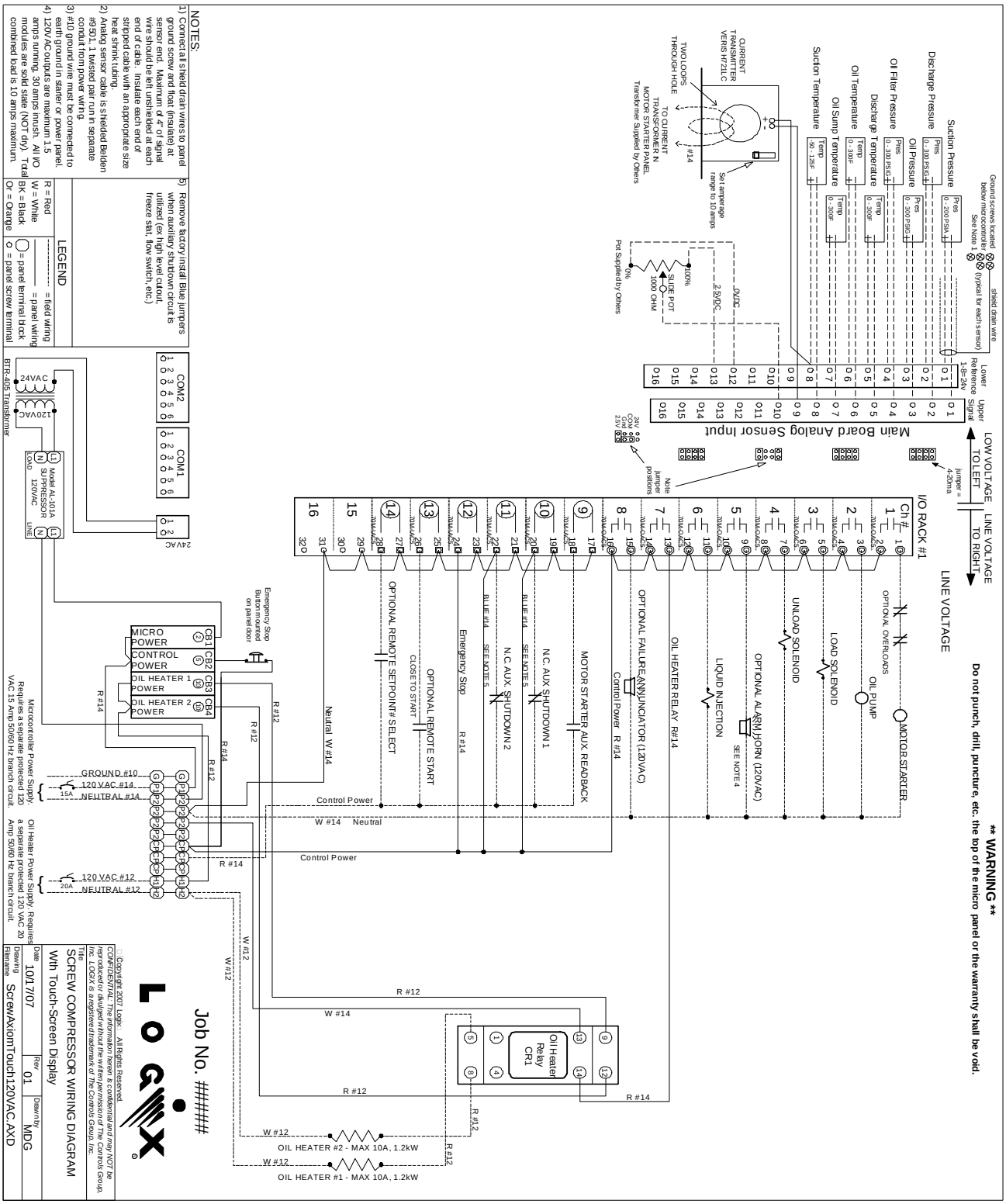
Configuration DIP Switch# 2, Main Microcontroller Circuit Board					
	DIP Switch Position				
Panel ID#	**1**	**2**	**3**	**4**	**5**
1	Off	Off	Off	Off	Off
2	**On**	Off	Off	Off	Off
3	Off	**On**	Off	Off	Off
4	**On**	**On**	Off	Off	Off
5	Off	Off	**On**	Off	Off
6	**On**	Off	**On**	Off	Off
7	Off	**On**	**On**	Off	Off
8	**On**	**On**	**On**	Off	Off
9	Off	Off	Off	**On**	Off
10	**On**	Off	Off	**On**	Off
11	Off	**On**	Off	**On**	Off
12	**On**	**On**	Off	**On**	Off
13	Off	Off	**On**	**On**	Off
14	**On**	Off	**On**	**On**	Off
15	Off	**On**	**On**	**On**	Off
16	**On**	**On**	**On**	**On**	Off
17	Off	Off	Off	Off	**On**
18	**On**	Off	Off	Off	**On**
19	Off	**On**	Off	Off	**On**
20	**On**	**On**	Off	Off	**On**
21	Off	Off	**On**	Off	**On**
22	**On**	Off	**On**	Off	**On**
23	Off	**On**	**On**	Off	**On**
24	**On**	**On**	**On**	Off	**On**
25	Off	Off	Off	**On**	**On**
26	**On**	Off	Off	**On**	**On**
27	Off	**On**	Off	**On**	**On**
28	**On**	**On**	Off	**On**	**On**
29	Off	Off	**On**	**On**	**On**
30	**On**	Off	**On**	**On**	**On**
31	Off	**On**	**On**	**On**	**On**
32	**On**	**On**	**On**	**On**	**On**

In Sequenced Compressor applications each Remote **CCS** requires a Unit number assignment. A Master shall always have a Unit Identification Number of one (all switches off). Non-Master units shall have a number of two or higher.

NOTE After changing a unit's identification the Microcontroller must be reset by pushing the reset button on the main board.

Standard Screw Channel Assignments

Type	Ch#	Unit	Group	Description
OUT	1	1	SCREW	Compressor Motor Starter
OUT	2	1	SCREW	Oil Pump Motor Starter
OUT	3	1	SCREW	Load Solenoid
OUT	4	1	SCREW	Unload Solenoid
OUT	5	1	SCREW	Alarm Output
OUT	6	1	SCREW	Liquid Injection
OUT	7	1	SCREW	Oil Heater Relay
OUT	8	1	SCREW	
INP	9	1	SCREW	Motor Starter Auxiliary Readback
INP	10	1	SCREW	Auxiliary Safety Cutout 1, Normally Energized
INP	11	1	SCREW	Auxiliary Safety Cutout 2, Normally Energized
INP	12	1	SCREW	Emergency Stop, Normally Energized
INP	13	1	SCREW	Remote Start, Energize to Start
INP	14	1	SCREW	Remote Setpoint# Select
INP	15	1		
INP	16	1		
PRES	1	1A	SCREW	SP Suction Pressure 0-200 PSIA 4-20ma 2 Wire
PRES	2	1A	SCREW	DP Discharge Pressure 0-300 PSIG 4-20ma 2 Wire
PRES	3	1A	SCREW	OP Oil Pressure 0-300 PSIG 4-20ma 2 Wire
PRES	4	1A	SCREW	OF Oil Filter Pressure 0-300 PSIG 4-20ma 2 Wire
TEMP	5	1A	SCREW	DT Discharge Temp 0 - 300 F 4-20ma 2 Wire
TEMP	6	1A	SCREW	OT Oil Temp 0 - 300 F 4-20ma 2 Wire
TEMP	7	1A	SCREW	OS Oil Sump Temp 0 - 300 F 4-20ma 2 Wire
TEMP	8	1A	SCREW	ST Suction Temp -50 - 125 F 4-20ma 2 Wire
AMPS	9	1A	SCREW	MA Motor Amps 0 - 10 Amps, 2 Wire, Requires CT
POT	10	1A	SCREW	SV Slide Valve 0 - 100%, 1K Pot, 3 Wire
SPARE	11	1A		
SPARE	12	1A		
SPARE	13	1A		
SPARE	14	1A		
SPARE	15	1A		
SPARE	16	1A		


NOTES:
1) Connect all shield drain wires to panel ground screw and float (insulate) at sensor end. Maximum of 4" of signal wire should be left unshielded at each end of cable. Insulate each end of stripped cable with an appropriate size heat shrink tubing.
2) Analog sensor cable is shielded Belden #9501, 1 twisted pair run in separate conduit from power wiring.
3) #10 ground wire must be connected to earth ground in starter or power panel.
4) 120VAC outputs are maximum 1.5 amps running, 30 amps inrush. All I/O modules are solid state (NOT dry). Total combined load is 10 amps maximum.
5) Remove factory install Blue jumpers when auxiliary shutdown circuit is utilized (ex high level cutout, freeze stat, flow switch, etc.)
LEGEND
R = Red
W = White
BK = Black
Or = Orange
= field wiring
= panel wiring
= panel terminal block
= panel screw terminal
** WARNING **
Do not punch, drill, puncture, etc. the top of the micro panel or the warranty shall be void.
Main Board Analog Sensor Input
I/O RACK #1
LINE VOLTAGE
LOW VOLTAGE TO LEFT
LINE VOLTAGE TO RIGHT
Suction Pressure
Discharge Pressure
Oil Pressure
Oil Filter Pressure
Discharge Temperature
Oil Temperature
Oil Sump Temperature
Suction Temperature
CURRENT TRANSMITTER VERIS H721LC
TWO LOOPS THROUGH HOLE
TO CURRENT TRANSFORMER N MOTOR STARTER PANEL
Transformer Supplied by Others
Set amperage range to 10 amps
SLIDE POT 1000 OHM
Pot Supplied by Others
Ground screws located below microcontroller See Note 1
shield drain wire (typical for each sensor)
Lower Reference 1-8=24v
Upper Signal
Note jumper positions
jumper = 4-20ma
OPTIONAL OVERLOADS
MOTOR STARTER
OIL PUMP
LOAD SOLENOID
UNLOAD SOLENOID
OPTIONAL ALARM HORN (120VAC)
SEE NOTE 4
LIQUID INJECTION
OIL HEATER RELAY R#14
OPTIONAL FAILURE ANNUNCIATOR (120VAC)
Control Power R #14
MOTOR STARTER AUX. READBACK
N.C. AUX SHUTDOWN 1
N.C. AUX. SHUTDOWN 2
Emergency Stop
OPTIONAL REMOTE START
CLOSE TO START
OPTIONAL REMOTE SETPOINT# SELECT
Neutral W #14
Emergency Stop Button mounted on panel door
MICRO POWER
CONTROL POWER
OIL HEATER 1 POWER
OIL HEATER 2 POWER
GROUND #10
120 VAC #14
NEUTRAL #14
120 VAC #12
NEUTRAL #12
Microcontroller Power Supply. Requires a separate protected 120 VAC 15 Amp 50/60 Hz branch circuit.
Oil Heater Power Supply. Requires a separate protected 120 VAC 20 Amp 50/60 Hz branch circuit.
Control Power
W #14 Neutral
Oil Heater Relay CR1
OIL HEATER #2 - MAX 10A, 1.2kW
OIL HEATER #1 - MAX 10A, 1.2kW
Job No. #####
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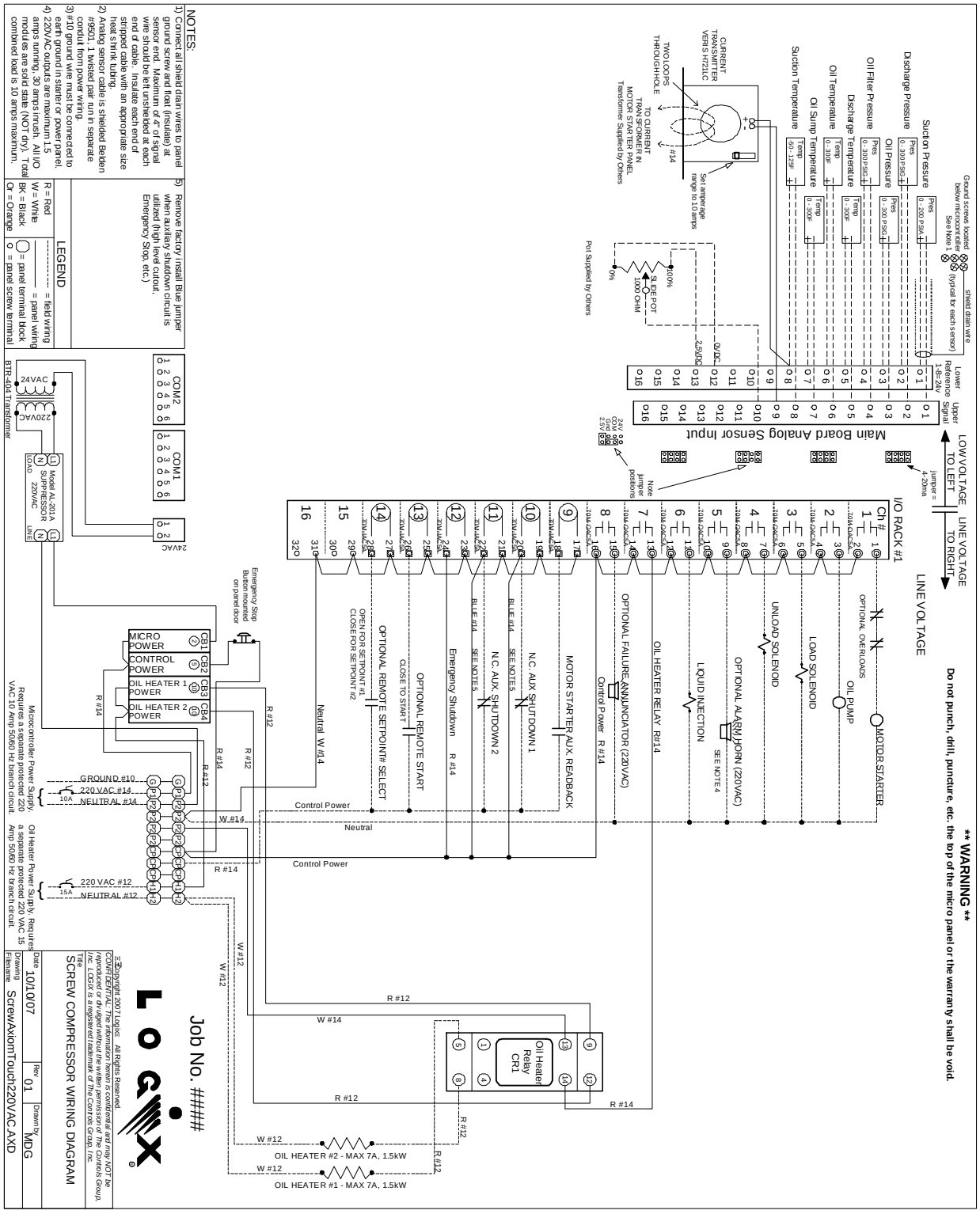
Title
SCREW COMPRESSOR WIRING DIAGRAM
With Touch-Screen Display
Date 10/17/07
Rev 01
Drawn by MDG
Drawing Filename ScrewAxiomTouch120VAC.AXD


** WARNING **
Do not punch, drill, puncture, etc. the top of the micro panel or the warranty shall be void.
LINE VOLTAGE
I/O RACK #1
LOW VOLTAGE TO LEFT
LINE VOLTAGE TO RIGHT
Main Board Analog Sensor Input
Suction Pressure
Discharge Pressure
Oil Pressure
Oil Filter Pressure
Discharge Temperature
Oil Temperature
Oil Sump Temperature
Suction Temperature
CURRENT TRANSMITTER VERIS H721LC
TWO LOOPS THROUGH HOLE
TO CURRENT TRANSFORMER IN MOTOR STARTER PANEL Transformer Supplied by Others
Set amperage range to 10 amps
SLIDE POT 1000 OHM
Pot Supplied by Others
MOTOR STARTER
OPTIONAL OVERLOADS
OIL PUMP
LOAD SOLENOID
UNLOAD SOLENOID
OPTIONAL ALARM HORN (220VAC)
SEE NOTE 4
LIQUID INJECTION
OIL HEATER RELAY R#14
OPTIONAL FAILURE ANNUNCIATOR (220VAC)
Control Power R #14
MOTOR STARTER AUX. READBACK
N.C. AUX SHUTDOWN 1
N.C. AUX SHUTDOWN 2
Emergency Shutdown R #14
OPTIONAL REMOTE START
CLOSE TO START
OPTIONAL REMOTE SETPOINT# SELECT
OPEN FOR SETPOINT #1 CLOSE FOR SETPOINT #2
Emergency Stop Button mounted on panel door
MICRO POWER
CONTROL POWER
OIL HEATER 1 POWER
OIL HEATER 2 POWER
Microcontroller Power Supply. Requires a separate protected 220 VAC 10 Amp 50/60 Hz branch circuit.
Oil Heater Power Supply. Requires a separate protected 220 VAC 15 Amp 50/60 Hz branch circuit.
Oil Heater Relay CR1
OIL HEATER #2 - MAX 7A, 1.5kW
OIL HEATER #1 - MAX 7A, 1.5kW
Control Power
Neutral
Neutral W #14
24VAC
220VAC
BTR-404 Transformer
Model AL-201A SUPPRESSOR 220VAC
NOTES:
1) Connect all shield drain wires to panel ground screw and float (insulate) at sensor end. Maximum of 4" of signal wire should be left unshielded at each end of cable. Insulate each end of stripped cable with an appropriate size heat shrink tubing.
2) Analog sensor cable is shielded Belden #9501, 1 twisted pair run in separate conduit from power wiring.
3) #10 ground wire must be connected to earth ground in starter or power panel.
4) 220VAC outputs are maximum 1.5 amps running, 30 amps inrush. All I/O modules are solid state (NOT dry). Total combined load is 10 amps maximum.
5) Remove factory installed Blue jumper when auxiliary shutdown circuit is utilized (high level cutout, Emergency Stop, etc.)
LEGEND
R = Red
W = White
BK = Black
Or = Orange
= field wiring
= panel wiring
= panel terminal block
= panel screw terminal
Job No. #####
SCREW COMPRESSOR WIRING DIAGRAM
Date 10/10/07
Rev 01
Drawn by MDG
Drawing Filename ScrewAxiomTouch220VAC.AXD
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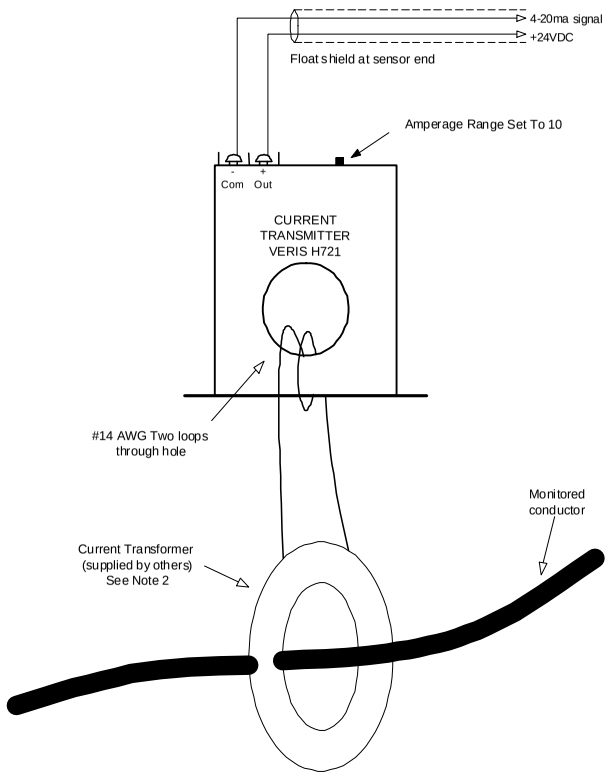

NOTES:

1) Requires 2 conductor #24 AWG shielded cable Belden 9501 or equal up to 2,000' in length. Insulate shield at sensor end, ground at Logix panel.

2) Size Current Transformer between 150% and 200% of Full Load Amps (FLA). For example , a motor with a FLA of 300 amps would require a 500:5 CT. Current Transformer must be in the ratio of xxx:5.

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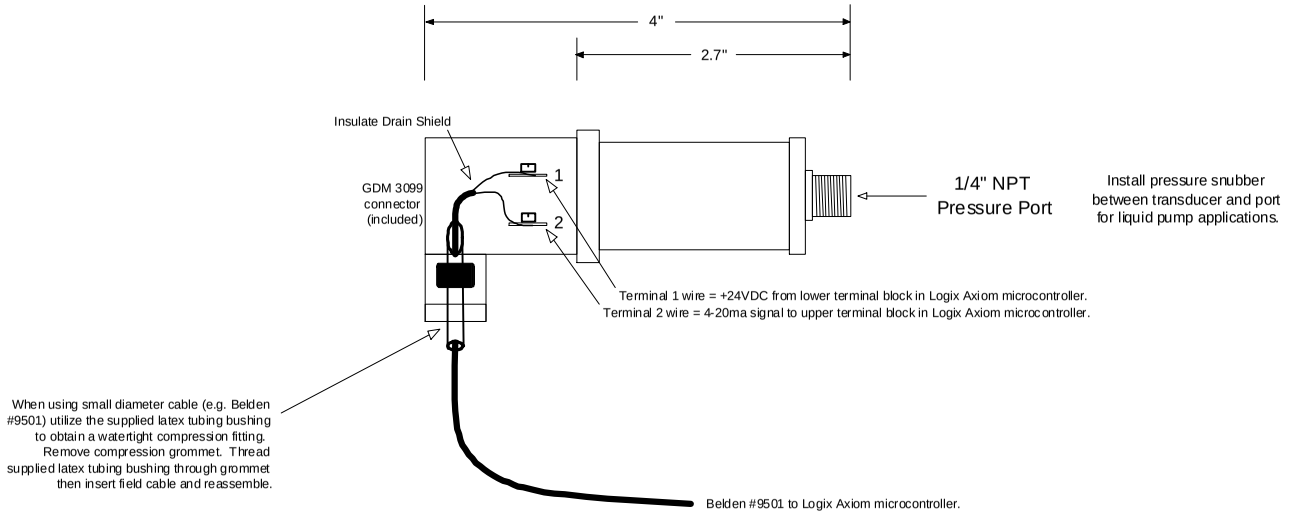
Title: Veris H721 Current Sensor Wiring & Installation Detail		
Date: 1/20/04	Rev: 01	Drawn by: MDG
Drawing Filename: VerisCurrentH721.axd		



NOTES:

1) Requires 2 conductor #24 AWG shielded cable Belden 9501 or equal up to 2000' in length. Ground shield at control panel end only. Insulate shield at sensor end.

2) Installation of a service valve for replacement and maintenance is strongly recommended. Attached electrical conduit must be fully supported - the sensor must not carry any of the conduit's weight. Avoid mounting in a prone position in which the sensor can be damaged or broken off.

3) Liquid pressure applications: WARRANTY WILL BE VOID if a pressure snubber is not used to prevent damage from hydraulic hammering.

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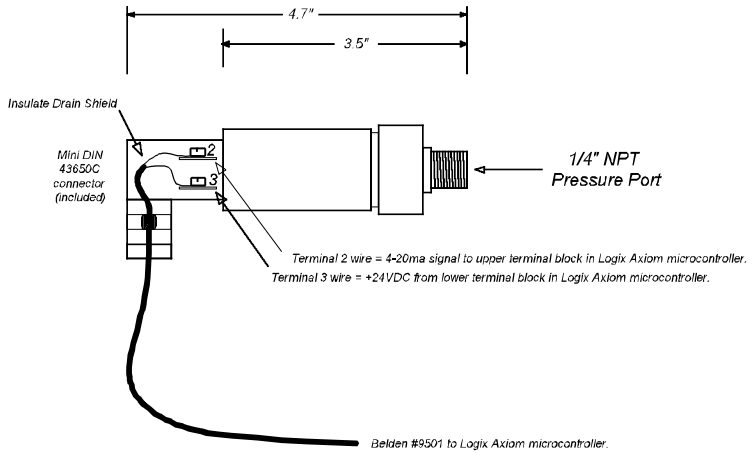
Title: Ashcroft T2 Pressure Sensor
Wiring & Installation Detail
Logix P/N SNR-059 and 060

Date	Rev	Drawn by
01/26/07	01A	MDG

Drawing Filename: SNR-059-060_PressureT2.axd



NOTES:

1) Requires 2 conductor #24 AWG shielded cable Belden 9501 or equal up to 2000' in length. Ground shield at control panel end only. Insulate shield at sensor end.

2) Installation of a service valve for replacement and maintenance is strongly recommended. Attached electrical conduit must be fully supported - the sensor must not carry any of the conduit's weight. Avoid mounting in a prone position in which the sensor can be damaged or broken off.

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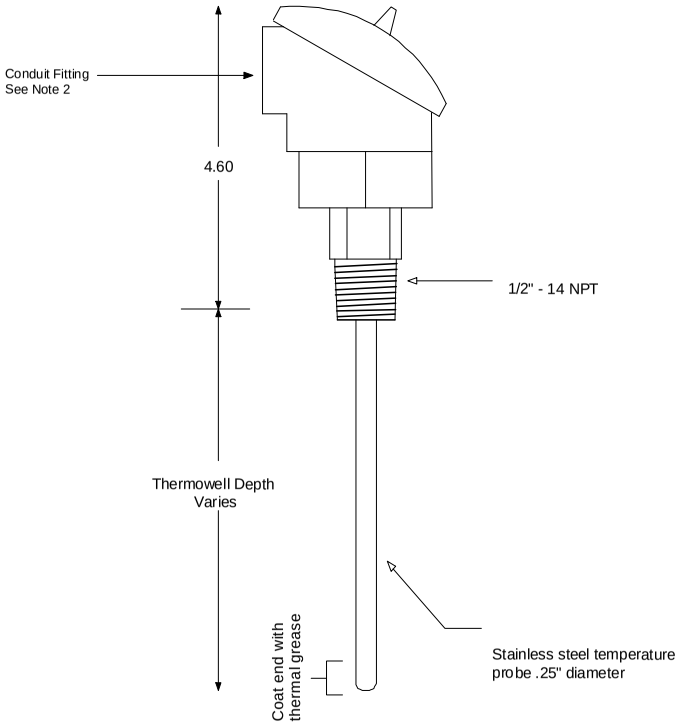
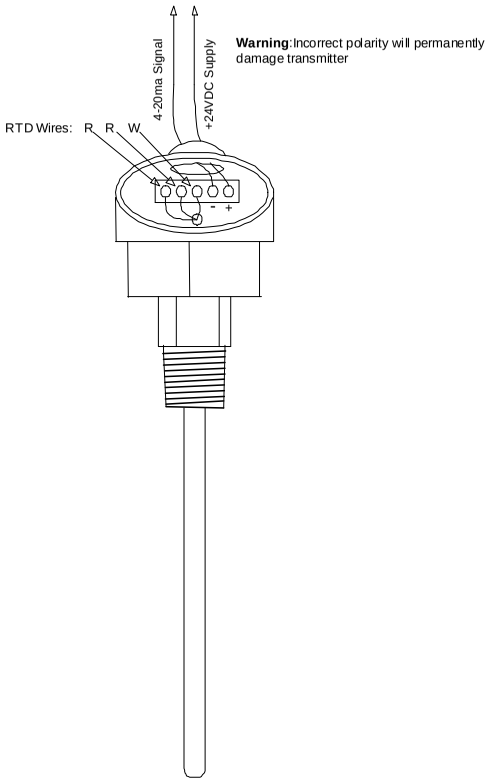
Title: AST Pressure Sensor Wiring & Installation Detail Logix P/N SNR-062 and 063		
Date: 03/11/08	Rev: 01	Drawn By: MDG
Drawing Filename: SNR-062-063 PressureAST.axd		

Side View



Front View

(Cover removed)



NOTES:

1) Requires 2 conductor #24 AWG shielded cable Belden 9501 or equal up to 2000' in length. Ground shield at control panel end only. Insulate shield at sensor end.

2) Conduit fitting must face down for installation. Appropriate water tight conduit fittings must be used.

3) Warning: Sensor must be protected from ingress of moisture. The conduit entering the sensor must be sealed internally with foam or putty to completely prevent air movement. Moisture damage is not cover by warranty.

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Title: Pyromation Thermowell Temperature Sensor Wiring & Installation Detail Logix P/N SNR-013		
Date: 09/12/2007	Rev: 01A	Drawn by: MAG
Drawing Filename: SNR-013_PyromationTemp.axd		

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