

CENTURION™ Configurable Controller

Installation and Operations Manual

00-02-0590
10-10-06
Section 50

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time. The latest version of this manual can be found at www.fwmurphy.com.

Warranty - A limited warranty on materials and workmanship is given with this FW Murphy product. A copy of the warranty may be viewed or printed by going to www.fwmurphy.com/support/warranty.htm



FW MURPHY has made efforts to ensure the reliability of the Centurion controller and to recommend safe usage practices in system applications. Please note that in any application, operation and controller failures can occur. These failures may result in full control outputs or other outputs which may cause damage to or unsafe conditions in the equipment or process connected to the Centurion controller. Good engineering practices, electrical codes, and insurance regulations require that you use independent external protective devices to prevent potentially dangerous or unsafe conditions. Assume that the Centurion controller can fail with outputs full on, outputs full off, or that other unexpected conditions can occur.

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT:

- Please read the following information before installing the Centurion controller. This installation information is intended for Centurion controller only. Before installing, visually inspect the product for any damage during shipping.
- Disconnect all power and be sure machine is inoperative before beginning installation.
- Installation is to be done only by qualified technician.
- Observe all Warnings and Cautions at each section in these instructions.
- Device shall be wired in accordance with Class I, Division 2 wiring methods.
- This equipment is suitable for use in Class I, Division 2, Groups B, C, and D hazardous Areas.
- **WARNING**–Explosion Hazard–Substitution of components may impair suitability for Class I, Division 2.
- Please contact Murphy immediately if you have any questions.

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1 Overview

The Centurion configurable controller is a display and controller combination expressly designed to meet the requirements of three specific kinds of applications:

- Screw Compressors
- Reciprocating Compressors
- Pumps

The heart of the Centurion system is the main input/output (I/O) module or controller, which can be mounted on a standard DIN rail. While it is designed to work with any Modbus (Master) compliant HMI (Human Machine Interface) or with no operator interface at all, it is optimally configured and field-configurable through MConfigPro™, powerful software developed to configure the controller. Parameters can be modified in the field without special need for laptop or software by utilizing Murphy's specially programmed controller display.

The controller is designed to monitor, control, protect, and optimize small to medium sized gas operated compressors and pumps in the field. Proper operation is maintained by monitoring set points and digital, analog, and thermocouple input points and providing the logic to take corrective and/or proactive steps.

The controller also allows for controlled shut down and no-flow monitoring as well as auto start up, and engine control capabilities.

The controller provides real-time data via communications ports to a connected display and/or supervisory system. This advanced system offers multiple options for remote communications and operation. The industry standard RTU Modbus protocol means greater support for a wide variety of communication equipment including radio and satellite communications systems.

1.1 Basic Components and Key Features of the C3 Series

The C3 series consists of a display module, a main I/O module, and optional expansion I/O module. No special cables are required. The Centurion system is designed for use within a weatherproof enclosure only.

Display module (C3-3) 128 x 64 LCD graphic display (-40 to 85) °C

- Power
 - 10 - 32 VDC: 1W typical, 6W (max)
 - Storage power able to withstand 12V crank
- **NOTE:** Maximum power ratings based on display heater operating at maximum with 10V supply. Heater is only operational below -10C. Typical based on 24V supply.
- Package and design
 - Same 5" x 5" design as annunciators
 - 12 key keypad
- Communications
 - LED active indication for each port
 - RS232/485 (Modbus Master)
 - RS232/485/USB 1.1 compliant port
- Approvals
 - CSA, CLASS 1, DIVISION 2, Groups B, C and D certifications are approved.

Main I/O module (C3-1)

- 32 digital inputs (DI)
- 10 digital outputs (DO)
- Direct input for analog and thermocouple inputs:
 - 12 analog input (AI)
 - 8 thermocouples (TC)
- 1 magnetic pickup (MPU)

1.2 Optional Components

The C3-1 hardware may be configured with 2 analog outputs and it may be augmented through an expansion module (C3-2) which provides analog outputs and additional analog and thermocouple inputs.

Main I/O Module with analog outputs (C3-1-A)

- Same specifications and I/O as C3-1, plus 2 analog outputs

Expansion I/O Module (C3-2)

- 8 analog inputs (AI)
- 8 thermocouple inputs (TC)
- 4 analog outputs (AO)

2 Input/Output Types

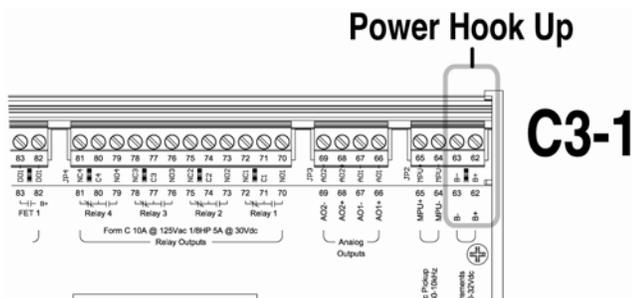
2.1 Power Supply Wiring

NOTE: Maximum power ratings based on all I/O operating in the ON position with 10V supply. Typical based on 24V supply.

2.1.1 Centurion I/O Module

Requirements: (10 to 32) VDC: 30W (max)

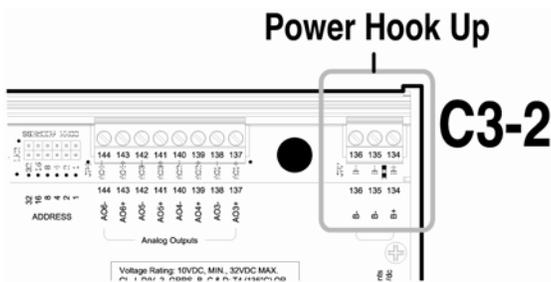
There are two screw terminal connectors for power hookup at terminals 62 and 63, labeled B+ and B- respectively.



2.1.2 Centurion (Optional) Expansion I/O Module

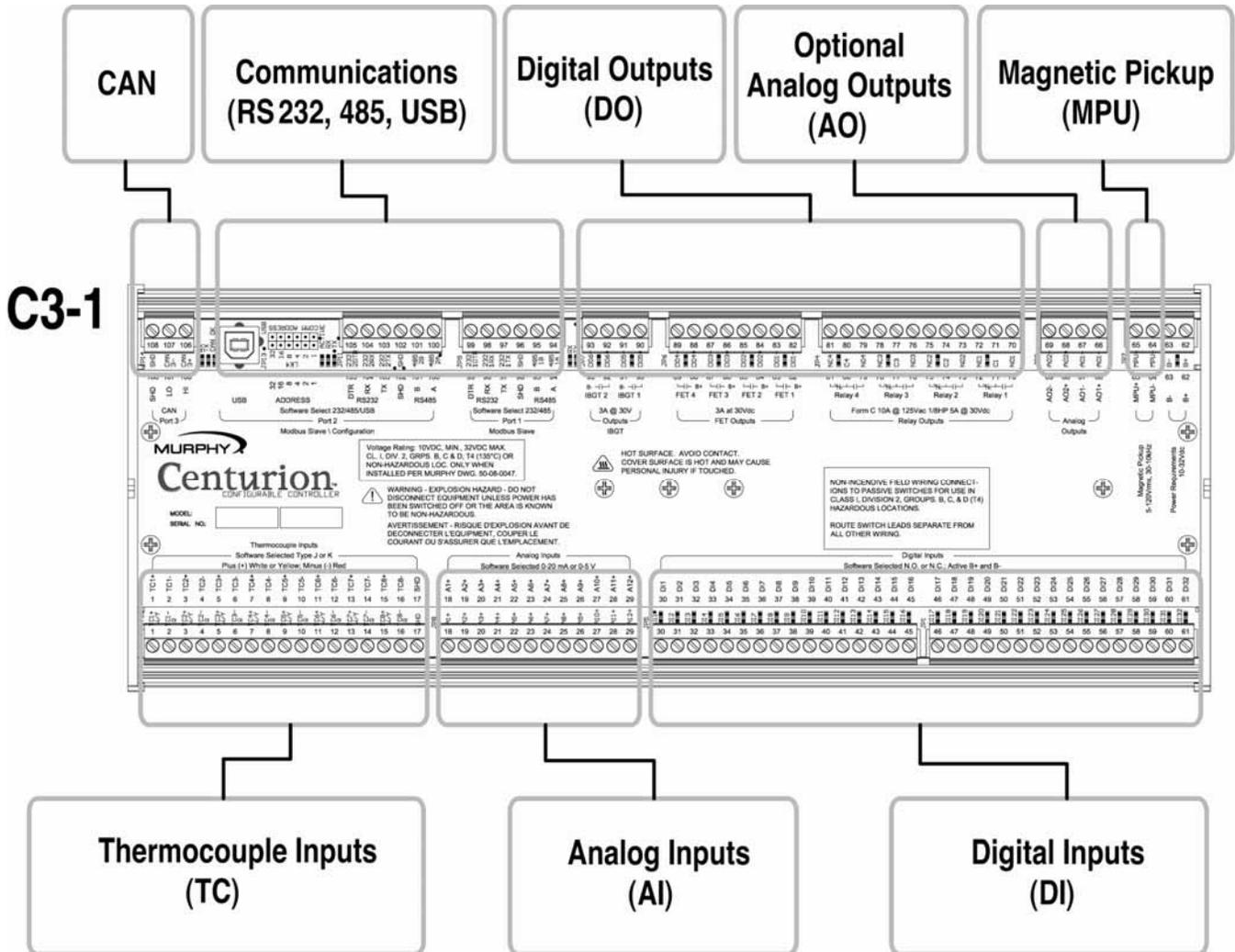
Requirements: (10 to 32) VDC: 6W typical, 30W (max)

There are three screw terminal connectors for power hookup at terminals 134 to 136, labeled B+, B and B- respectively.



NOTE: Run power directly from battery posts to controller power terminals when battery is the power supply.

2.2 Input/Output Types and Specifications for the Main I/O Module



2.2.1 Digital Inputs (DI)

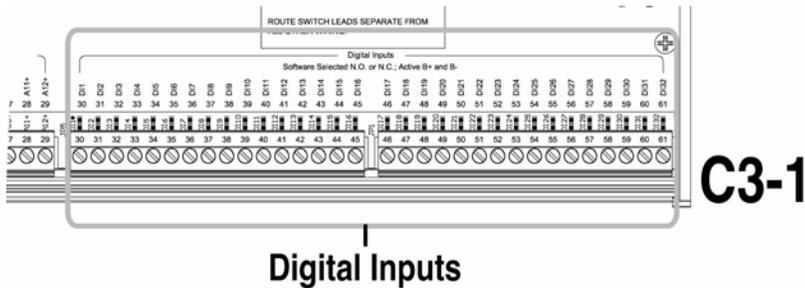
Number of devices: 32

Device types: discrete input, normally open (N/O) or normally closed (N/C), active high/active low, non-incendive.

There is one screw terminal connector for each digital input.

Terminals 30 to 61 are DI terminals.

Green LEDs give visual indication of active input signal.



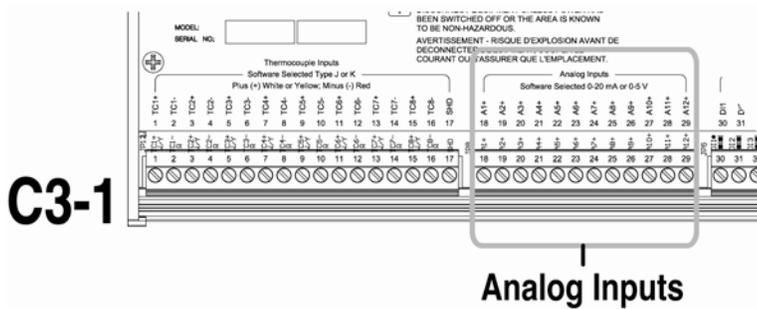
2.2.2 Analog Inputs (AI)

Number of devices: 12

Device types: analog input, (4 to 20) mA or (0 to 5) V, 10 bit hardware.

There is one screw terminal connector for each analog input.

Terminals 18 to 29 are AI terminals.



2.2.3 Thermocouple Inputs (TC)

Number of devices: 8

Device types: thermocouple input, type J or K, 12 bit hardware.

Use ungrounded thermocouples only. Grounded thermocouples are not supported. Errors in readings with grounded thermocouples can be the result of differences in grounding between devices.

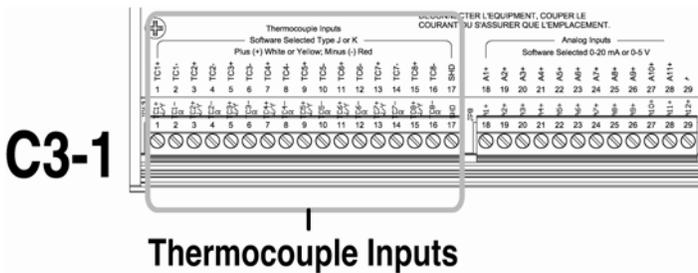
Open thermocouple detection: drives terminal reading high (max of scale).

Automatic cold junction compensation is built-in.

There are two screw terminal connectors for each thermocouple.

Terminals 1 to 16 are TC terminals where white or yellow indicate positive inputs and red indicates negative inputs.

NOTE: An additional terminal connector is provided, identified as SHD, which isolates thermocouple shields. This connection, at terminal 17, is intended to be wired to an isolated bus bar for thermocouple shield wires. If shields are grounded, do connect shields to SHD terminal. Connect all shields to SHD or to ground but never both.



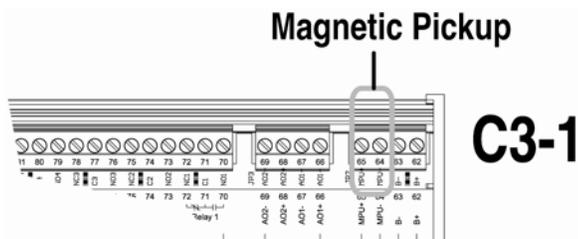
2.2.4 Magnetic Pickup (MPU)

Number of devices: 1

Device types: magnetic pickup (MPU), (5 to 120) Vrms, (30 to 10k) Hz.

There are two screw terminal connectors for the magnetic pickup.

Terminals 64 and 65 are MPU terminals.



2.2.5 Digital Outputs (DO)

Number of devices: 10

Device types: discrete output, normally open (N/O) or normally closed (N/C)

- four (4) relay outputs, form C, dry contacts
- four (4) FETs (high speed)
- two (2) IGBTs (high power)

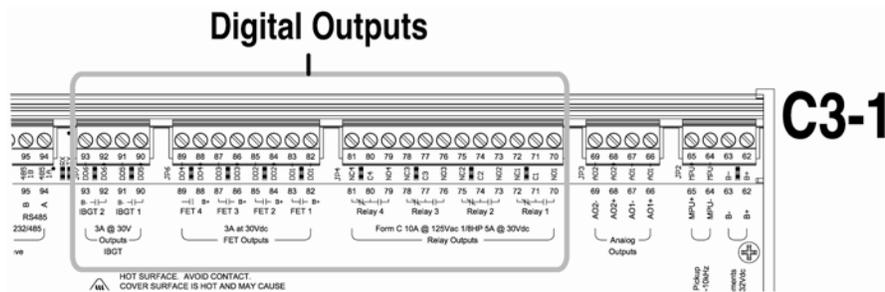
There are three screw terminal connectors for each relay output and two screw terminal connectors for each FET and IGBT output.

Terminals 70 to 81 are for the four relay terminals.

Terminals 82 to 89 are for the four FET terminals.

Terminals 90 to 93 are for the two IGBT terminals.

Green LEDs give a visual indication of active output signal.



Warning: A heat sink is attached to the cover using acorn style nuts. The surface area around these fasteners can become very hot. Avoid contact.

2.2.6 *Optional* Analog Outputs (AO)

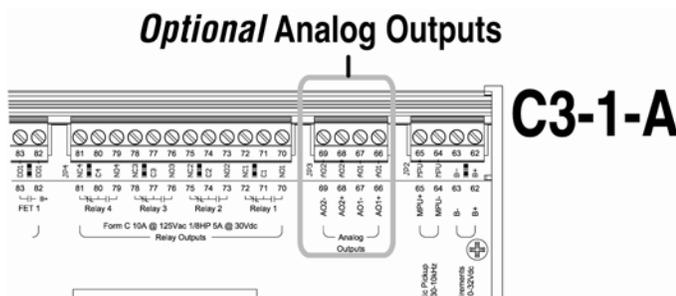
Number of devices: 2

Device types: analog output, (4 to 20) mA or (0-20)mA, 16 bit hardware

There are two screw terminal connectors for each analog output.

Terminals 66 to 69 are AO terminals.

The optional AO module is added to the C3-1 at the factory inside the DIN enclosure. While these terminals are present on all models the feature may not be installed.



2.3 Input/Output Types and Specifications for the *Optional* Expansion Module

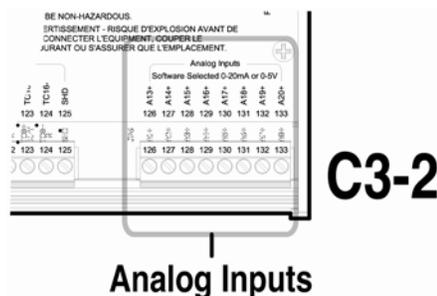
2.3.1 Analog Inputs (AI)

Number of devices: 8

Device types: analog input, (4 to 20) mA or (0 to 5) V, 12 bit hardware.

There is one screw terminal connector for each analog input.

Terminals 126 to 133 are AI terminals.



2.3.2 Thermocouple Inputs (TC)

Number of devices: 8

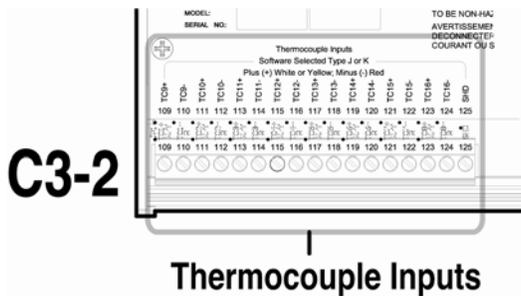
Device types: thermocouple input, type J or K, 12 bit hardware

Open thermocouple detection: drives channel reading high (max of scale).

There are two screw terminal connectors for each thermocouple input.

Terminals 109 to 124 are TC channels where white or yellow indicate positive inputs and red indicates negative inputs.

NOTE: An additional terminal connector is provided, identified as SHD, which isolates thermocouple shields. This connection, at terminal 125, is intended to be wired to an isolated bus bar for thermocouple shield wires. If shields are grounded, do not connect shields to SHD terminal. Connect all shields to SHD or to ground but never both.



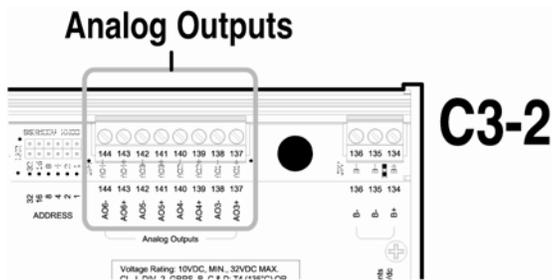
2.3.3 Analog Outputs (AO)

Number of devices: 4

Device types: analog output, (4 to 20) mA or (0-20)mA, 16 bit hardware

There are two screw terminal connectors for each analog output.

Terminals 137 to 144 are AO terminals.



3 Hazardous Area Operation

The Centurion certifications for CSA, CLASS 1, DIVISION 2, Groups B, C and D are approved.

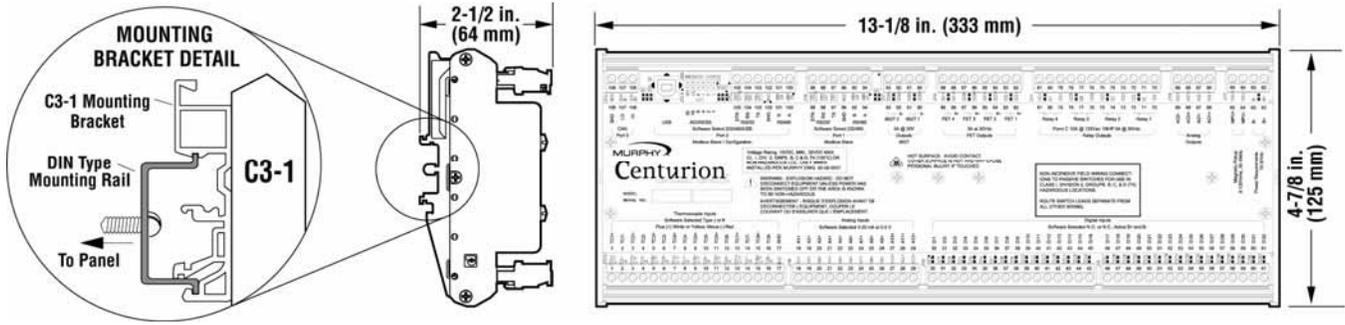


Warning: Explosion hazard – Do not disconnect the equipment unless the power has been switched off, or the area is known to be non-hazardous.

4 Hardware Installation and Wiring

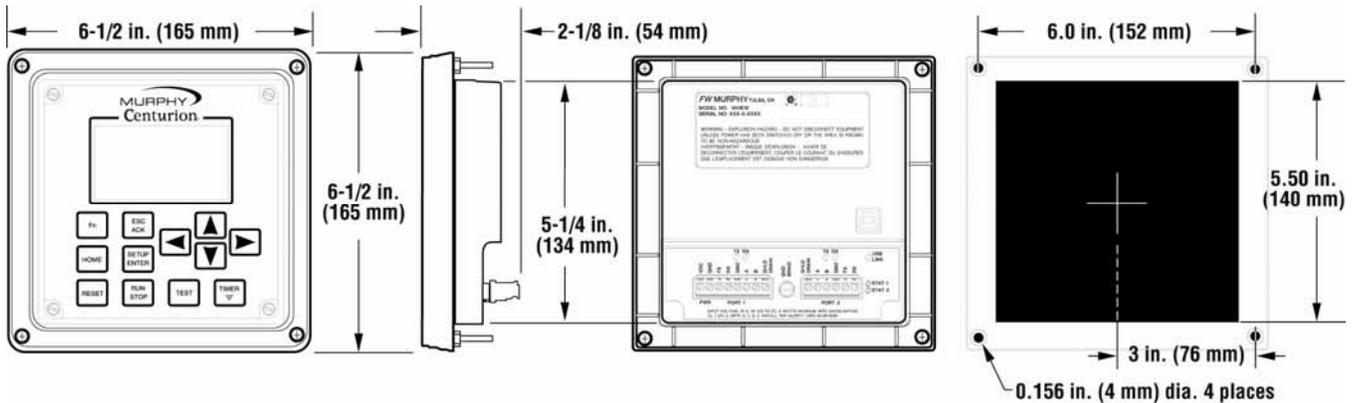
4.1 Mounting the Controller

The Centurion controller can be mounted vertically or horizontally on a standard DIN rail. Three clamp-type feet along the bottom of the controller attach to the DIN rail, however, rail stops are recommended to prevent sliding.

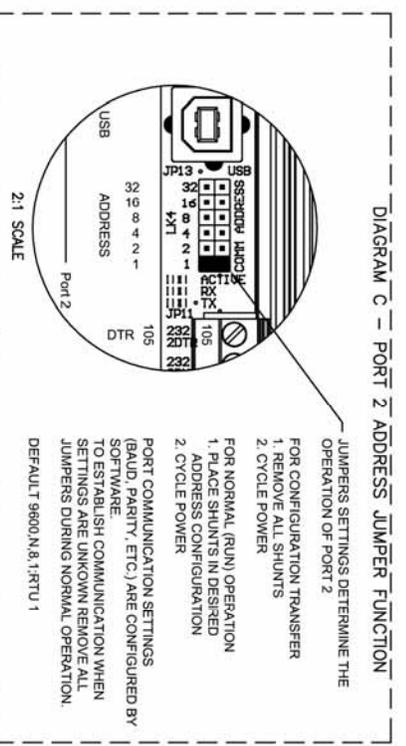
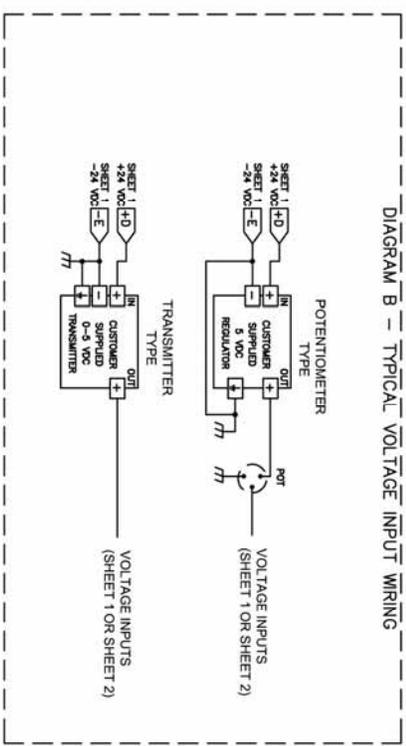
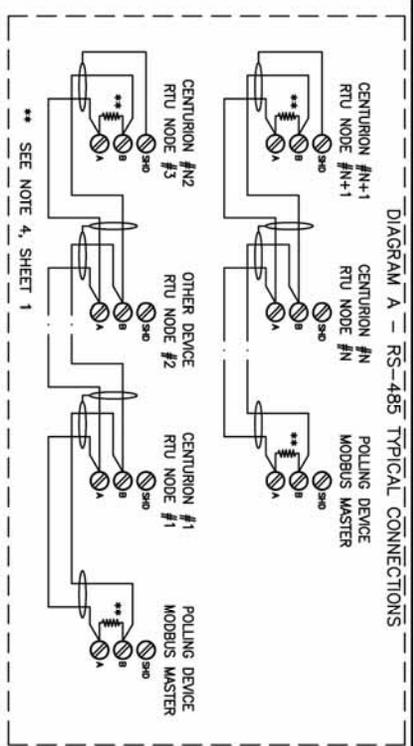


4.2 Mounting the Display

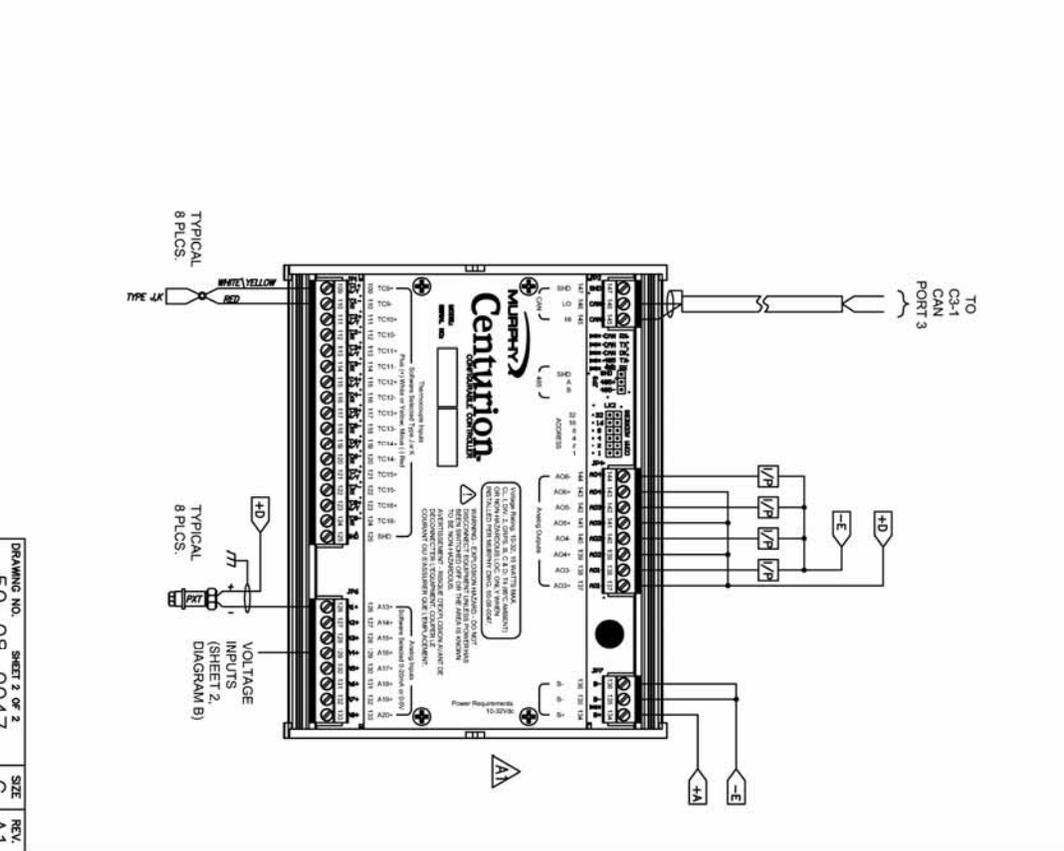
The Centurion display can be mounted in the same hole cutout of other Murphy display modules. Four screws attach the display bezel to the mounting surface.



Wiring the Controller (continued)



WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNÉ NON DANGEREUX.



DRAWING NO. 50-08-0047 SHEET 2 OF 2
SIZE C REV. A1

5 Using the Display

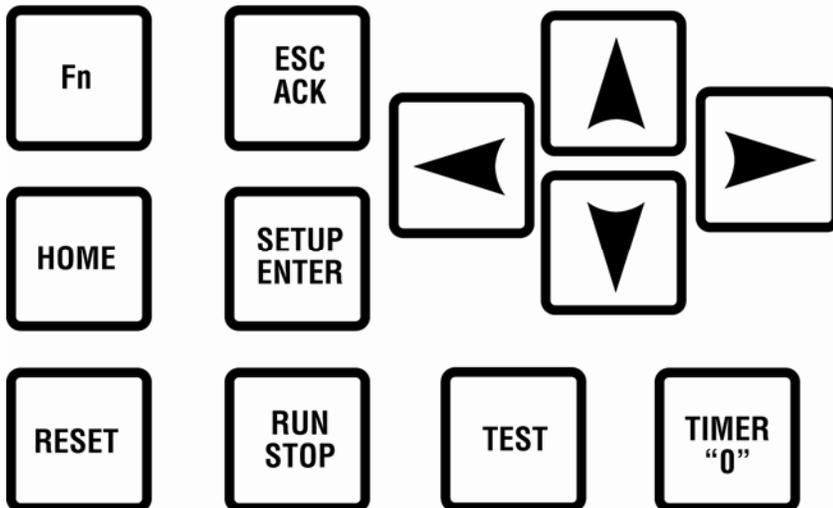


The display module is a highly integrated operator interface specially programmed to complement and support the Centurion controller. The primary purpose of the display is to:

- view controller operational information
- view/edit controller operational parameters
- send commands to controller, such as stop, edit, and reset

5.1 Features

5.1.1 Keypad Description and Navigation



The keypad for the display has 12 keys. The following table describes the keys and their function for each of the three screen types:

- Operating status screens
- Setup screens (password required)
- Edit screens (password required)

Many of the keys have a modified action relative to the current location of the cursor and the current page being displayed.

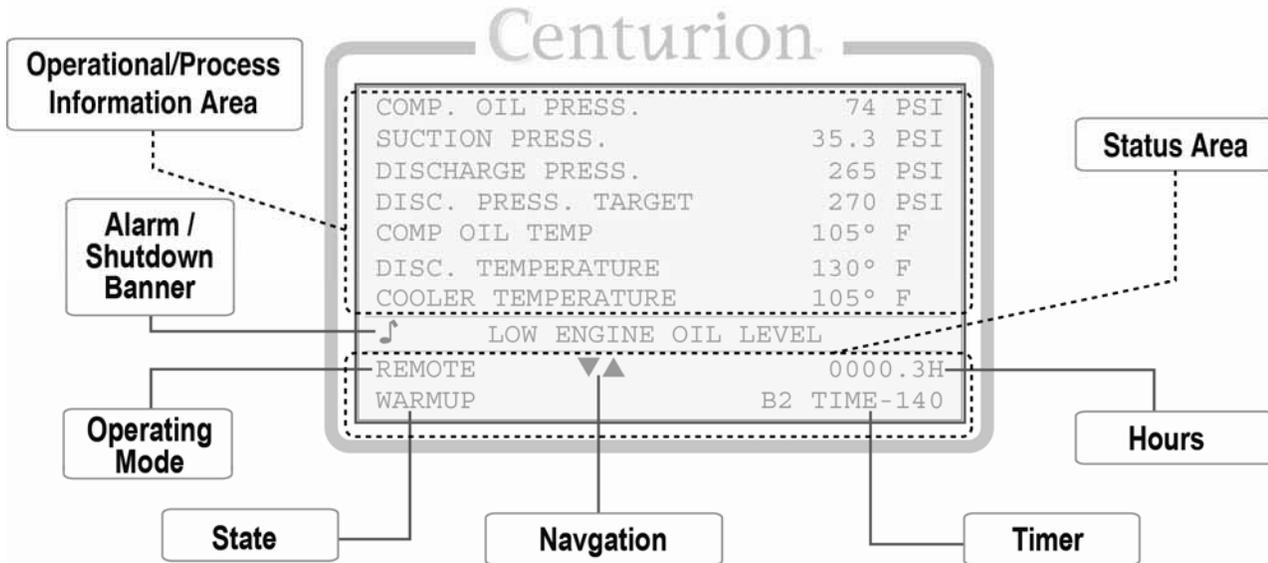
Key	ID	Description
	HOME	<p>Operating Status Screen Allows the user to get to the first line of the current screen, or if pressed again, to get to the default operating status screen.</p> <p>Set Up Screen Allows the user to get to the first line of the current screen.</p> <p>Edit Screen No associated action.</p>
	ESC/ACK	<p>Operating Status Screen Acknowledge the active message/alarm that is currently displayed in the alarm banner. Acknowledges all active messages and alarms displayed in the active alarm screen.</p> <p>Set Up Screen Exit Setup mode.</p> <p>Edit Screen Exit without saving changes to the current configuration.</p>
	Fn (Function Key)	<p>Operating Status Screen Enter "Function mode" and display a dialog box with additional available functions. Automatically cancels upon moving to the next mode, or if no subsequent function is chosen within five seconds.</p> <p>Set Up Screen No associated action.</p> <p>Edit Screen No associated action.</p>
	SETUP/ENTER	<p>Operating Status Screen Enter Setup Mode.</p> <p>Set Up Screen Enter Edit mode or Sub-menu.</p> <p>Edit Screen Accept and save changes made to a current parameter before exiting edit mode.</p>
	RESET	<p>Operating Status Screen Reset any active timers and alarms/faults.</p> <p>Set Up Screen No associated action.</p> <p>Edit Screen No associated action.</p>

Key	ID	Description
	RUN/STOP	<p>Operating Status Screen Initiate or cancel a start sequence. (hold for 2 seconds)</p> <p>Set Up Screen No associated action in either shutdown mode, or remote mode on standby. Initiate stop only sequence when held for two seconds, if equipment is running.</p> <p>Edit Screen No associated action.</p>
	ARROW UP	<p>Operating Status Screen Scroll up one line. Automatically repeats if held down continuously until reaching the first line. For history screens, scrolls up one history (for example: shutdown or event).</p> <p>Set Up Screen Scroll up one line. Automatically repeats if held down continuously until reaching the first line.</p> <p>Edit Screen Increase the digit selected by the cursor (from 0 to 9). The user will not be allowed to increase the selected digit if it would result in exceeding range limits.</p>
	ARROW DOWN	<p>Operating Status Screen Scroll down one line. Automatically repeats if held down continuously until reaching the final line. For history screens, scrolls down one history (i.e. shutdown or event).</p> <p>Set Up Screen Scroll down one line. Automatically repeats if held down continuously until reaching the final line.</p> <p>Edit Screen Decrease the digit selected by the cursor (from 0 to 9). The user will not be allowed to decrease the selected digit if it would result in exceeding range limits.</p>
	ARROW LEFT	<p>Operating Status Screen Display previous screen. Automatically repeats if held down continuously until reaching the first screen.</p> <p>Set Up Screen Display previous screen. This key has no action when in a sub-menu.</p> <p>Edit Screen Move the cursor left one position when a numeric value is displayed.</p>

Key	ID	Description
	ARROW RIGHT	<p>Operating Status Screen Display next screen. Automatically repeats if held down continuously until reaching the final screen.</p> <p>Set Up Screen Display next screen. This key has no action when in a sub-menu.</p> <p>Edit Screen Move the cursor right one position when a numeric value is displayed.</p>
	TEST	<p>Operating Status Screen Enter test mode and start test timer. This is not applicable in shutdown mode.</p> <p>Set Up Screen No associated action.</p> <p>Edit Screen No associated action.</p>
	TIMER "0"	<p>Operating Status Screen Zero displayed timer (global timers, state timers, etc.)</p> <p>Set Up Screen No associated action.</p> <p>Edit Screen No associated action.</p>

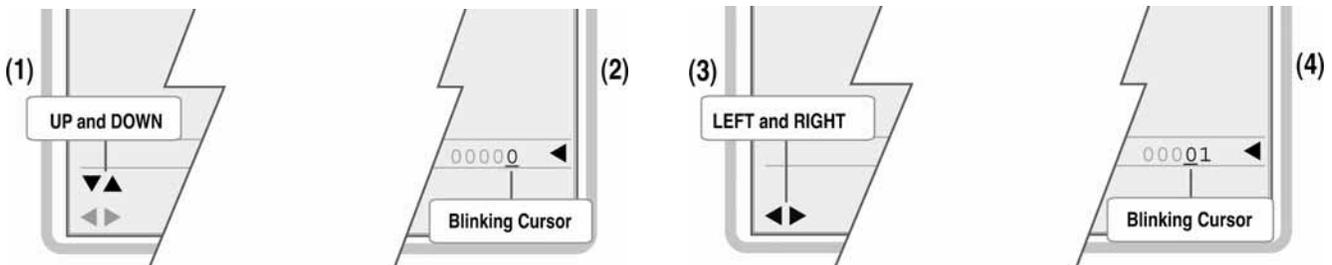
5.1.2 Display Context

The graphic LCD displays are organized around operating status screens and setup screens. The actual number of status screens will be related to the total number of end devices configured for the controller. In either screen set, ten (10) lines are visible at a time; with up and down arrow characters indicating more lines are available on the page. Also, for both screen sets, navigation between screens is accomplished by pressing the left or right arrow keys.



5.1.3 Numeric Entry

The Centurion display allows individual editing of each position of the desired number. This is accomplished by entering the edit mode and using the UP/DOWN arrow keys (1) to adjust the number above the blinking cursor (2) between 0 and 9. To edit another position, simply use the LEFT/RIGHT (3) arrow keys to move the cursor to that position (4) and repeat the edit process until the desired number is displayed.



In this way, values are “built” rather than “scrolled” through. Some digits may not be allowed to increase if it would result in exceeding range limits. Values which can be positive or negative will have a sign (±) to the left of the number. To change the sign value simply move the cursor to the sign using the LEFT arrow key and “toggle” between + and – using the UP and DOWN arrow keys. If the range of the value will exceed range limits the sign may not be allowed to

change. In this case, try reducing the number by decreasing the left most digit by one or more and attempt to change the sign again.

In some instances, a word rather than a value is represented in the Edit Mode. This works like the sign value as an ON/OFF or YES/NO prompt where the value is “toggled” between choices using the UP/DOWN arrow keys. The value is not active in the controller until the ENTER key has been pressed to send the value to the controller. Pressing the ESC key will discard any changes and keep the original value prior to entering the Edit Mode.

5.2 Operational Screens

In addition to the set up screens reviewed in the “Setup Screens and Menus” section, the display offers a number of operational displays. On the Operating Status screens, the two bottom lines display the state, hours, mode and active timer status. This information is key to understanding the “status” of the controller.

Mode refers to the Operating Mode of the controller and can be LOCAL or REMOTE. Depending on the configuration active in the controller, the operation may differ depending on what Mode the controller is currently displaying.

NOTE: The Mode can be changed by pressing certain keys, if the configuration allows for REMOTE mode.

Pressing RESET or RUN/STOP is a Local function and will change the Mode to Local if it is in REMOTE.

Pressing Fn before pressing RESET or RUN/STOP is a REMOTE function and will change the Mode to REMOTE if it is in LOCAL.

5.2.1 Default Operating Screen

After turning on the power, the user will view the Murphy logo screen for three seconds before the next screen displays, which is a software-configured default operating screen. The MConfigPro software allows users to configure up to five screens with controller I/O groupings. Possible custom screen types that may have been configured as a default operating screen, or which may be also displayed, include:

- a) “Custom Line by Line” allows process data to be displayed in a list format with description and value.
- b) “Custom Gage” allows user to display four (4) most important pieces of data on a 2 x 2 table in larger font.
- c) “Custom PID” up to 4 PID screens.

For more information on configuring the optional screens through the MConfigPro software, please refer to the MConfigPro Installation and Operations Manual.

5.2.2 Murphy Logo Screen



Logo Screen

The Murphy logo is the first screen in the sequence of display screens and can be viewed by holding down the left arrow until scrolling left ceases.

5.2.3 Corporate and Version Information Screen



Info Screen

Following the Murphy Logo screen is the Murphy corporate contact information which also lists firmware version information for the Centurion display, the main I/O module and the MConfigPro Software.

5.2.4 Digital Input Status

DIGITAL INPUT STATUS									
X=CLOSED					O=OPEN				
1	X	0	0	X	X	X	0	0	8
9	0	0	0	X	X	X	X	X	16
17	0	0	0	0	0	0	0	0	24
25	0	0	0	0	0	0	0	0	32
DIGITAL OUTPUT STATUS									
1	0	0	0	0	0	0	0	0	10

DIGITAL INPUT/OUTPUT STATUS SCREEN

The user can see the state of each digital input in a table—whether it is open or closed.

5.2.5 Shutdown History Screen

SHUTDOWN HISTORY		1/3
PANEL ESD	00059:16:09	◀
LOW SUCT PRESS	00059:15:11	
OVERCRANK	00054:04:40	

Shutdown History Screen

The history of the last 20 shutdowns is displayed on this screen, with the most recent at the top of the list and the oldest at the bottom.

Each event is displayed with the shutdown label on one line and the hour meter reading on the following line. Pressing the up/down arrows will scroll up/down one shutdown at a time rather than one line at a time.

The “1/3” at the right end of the top line means the user is viewing shutdown one of a total of three stored. The newest shutdown will always be number one and it will push the older shutdowns further down the list.

5.2.6 Shutdown Snapshot

SHUTDOWN SNAPSHOT	
COMP. OIL PRESS.	74 PSI
SUCTION PRESS.	35.3 PSI
DISCHARGE PRESS.	265 PSI
DISC. PRESS. TARGET	270 PSI
COMP OIL TEMP	105° F
DISC. TEMPERATURE	130° F
COOLER TEMPERATURE	105° F
AMBIENT TEMPERATURE	91° F

Shutdown Snapshot Screen

The shutdown snapshot screen is a capture of the values displayed on the Line-by-Line custom screen at the time of a Fault SD or ESD event. These values will be retained and display on the shutdown snapshot screen until the next Fault SD or ESD event occurs. An asterisk displayed instead of a value indicates the shutdown snapshot has not captured any data or is not functioning.

NOTE: Only the first Line-by-Line screen configured will be captured. If no Line-by-Line custom screen is configured, the shutdown snapshot will not function.

5.2.7 Event History Screen

EVENT HISTORY	1/3
PANEL ESD	00059:16:09
PANEL RESET	00059:15:58
LOW SUCT PRESS	00059:15:11

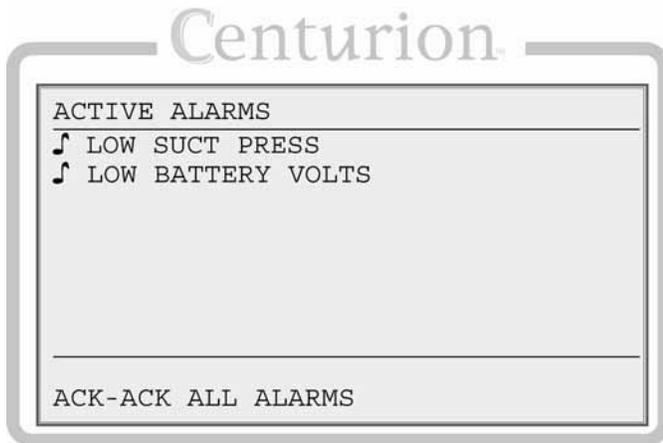
Event History Screen

The history of the last 32 events is displayed on this screen, with the most recent at the top of the list and the oldest at the bottom.

Events include shutdowns, starts, stops, resets, etc.

The user easily can view the events (alarms, etc.) logged before and after a shutdown.

5.2.8 Active Alarms Screen



Alarms Screen

All active alarms and warnings will be displayed on this screen.

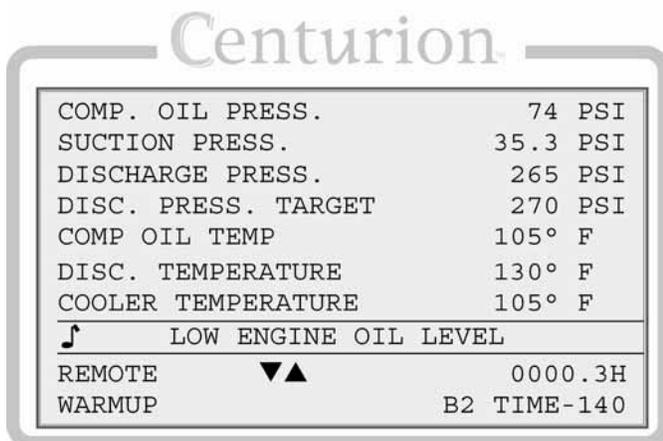
If there are more than six active alarms, there will be up/down arrow icons at the bottom of the screen and the user can press the up/down arrow keys to scroll up or down.

Unacknowledged alarms will be preceded by a musical note character and acknowledged alarms will have a bar through the staff of the note.

Pressing ACK on this screen will acknowledge all active alarms.

A maximum of twenty (20) active alarm will be displayed.

NOTE: Alarms are warnings based on setpoints and/or digital inputs which are separate from shutdowns.

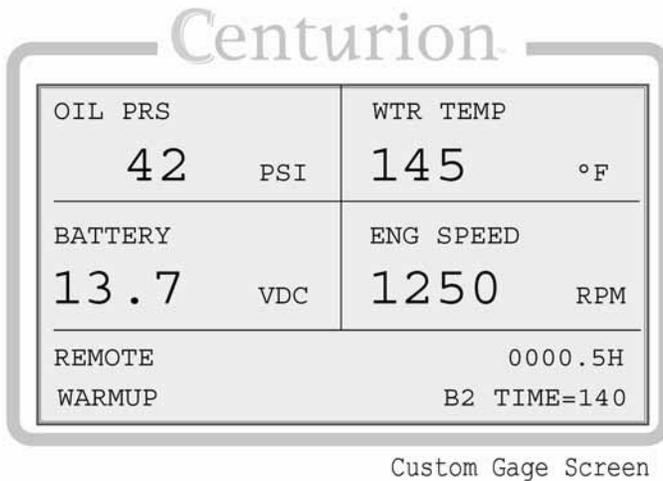


Operating Status Screen 3

This screen shows the alarm annunciation as it will appear on a status screen.

The alarm message(s) will overwrite the bottom line of the active screen area and then briefly clear once a second. This will continue until it is acknowledged with the ACK key, unless it is a self-clearing alarm. If there is more than one unacknowledged alarm active, each alarm will be displayed for one second each until acknowledged. The ACK key will acknowledge the alarm currently displayed. Pressing the Fn key followed by the ACK key will switch to the active alarms screen.

5.2.9 Gage Display

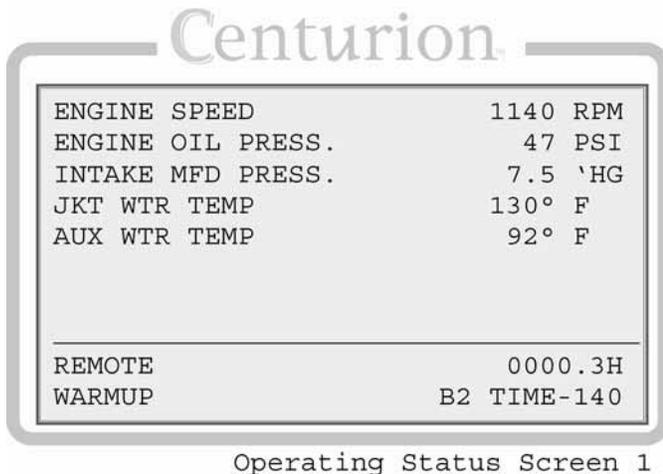


This is an example of a custom gage display. MConfigPro software arranges the data as needed.

This display provides larger characters for easier viewing as well as a means to prominently display items of interest. Unacknowledged alarms will overwrite the bottom half of the lower two gage boxes.

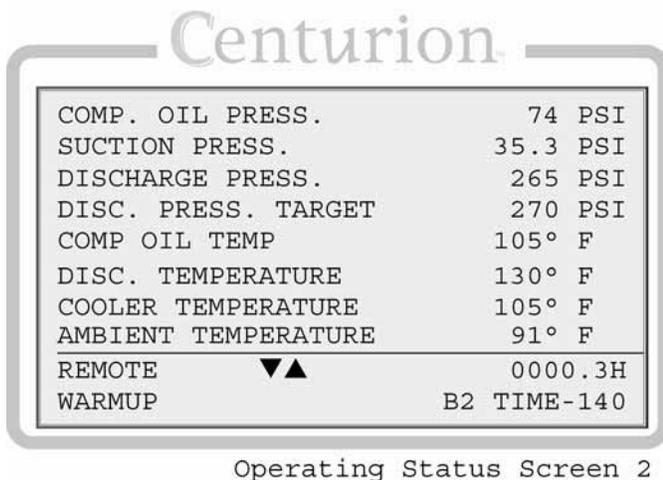
The two bottom lines are used to display the mode, hours, state and active timer status.

5.2.10 Line-By-Line



This is an example of a custom line-by-line status screen. The MConfigPro software arranges the data as needed.

Notice that there are no up/down arrows at the bottom of the screen because there are no additional lines to be displayed on this screen.

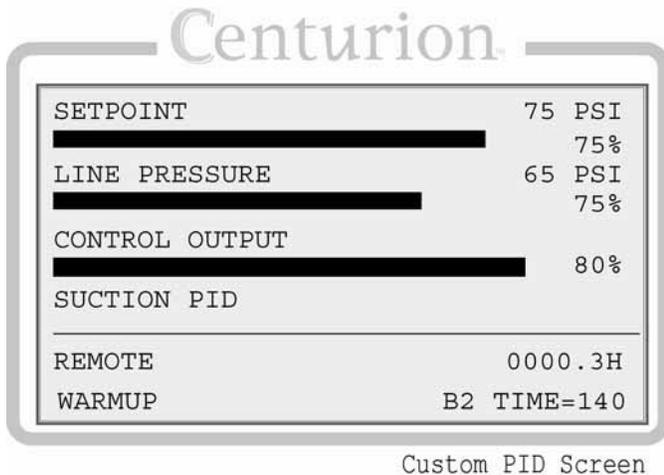


This is an example of a custom line-by-line status screen with more parameters.

If the parameters do not fit in the viewable area of the screen, up/down arrow icons at the bottom of the screen can be used to scroll up or down.

The two bottom lines are used to display the mode, hours, state and active timer status.

5.2.11 Custom PID Screen

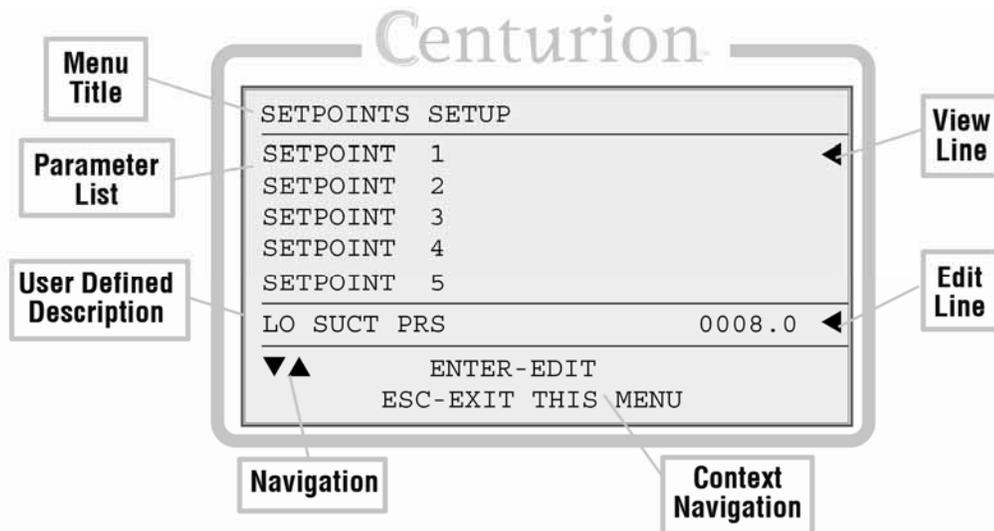


The user may choose to display any configured PID functions in this convenient format. The control output will be displayed as a percentage of the range.

The bottom two lines are used to display the mode, hours, state and active timer status.

5.3 Setup Screens and Menus

The setup screens provide access to system parameters. These settings can be modified with appropriate password access. The two bottom lines in the setup screens display navigation and command options available such as EDIT, ACCEPT, CANCEL and MORE MENUS.



5.3.1 Password Screen

Some settings are password protected, including the setup screens.

This is the first screen seen when the SETUP/ENTER key is pressed.

The password need only be entered once during any editing session. The password will reset when the editing session is exited, or is timed-out due to keyboard inactivity.

The cursor begins at the last digit on the right. The user can adjust the value of each digit with the up/down arrows while the left/right arrows are used to select the digit to edit.

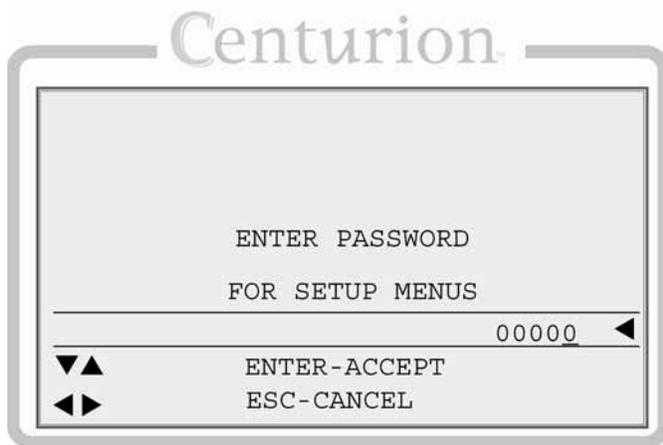
Passwords are assigned using the MConfigPro software and each digit can range from zero to nine (except the first digit on the left) for a total range of 00000 to 65535 for the complete password.

The user will not be allowed to increase the selected digit if it would result in exceeding range limits.

NOTE: If the Standard password is not zero and a password of all zeroes is entered, the user will have “view only” access.

Inactivity Timeout: Setup procedures must be started and completed in a timely manner.

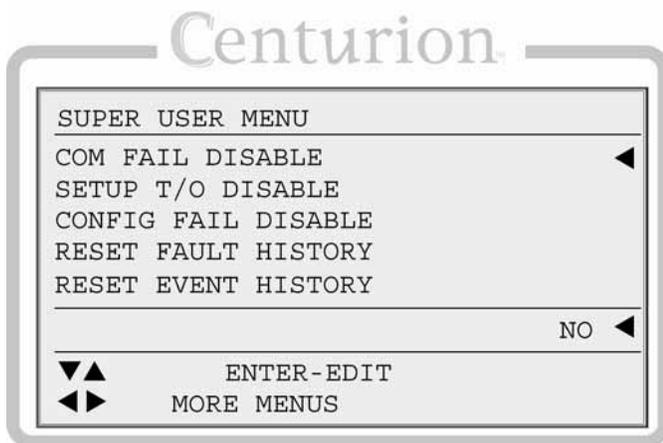
NOTE: After 3 minutes without activity, the keypad returns the default operational screen and a password must be re-entered to return to the setup and edit menus.



Password Screen

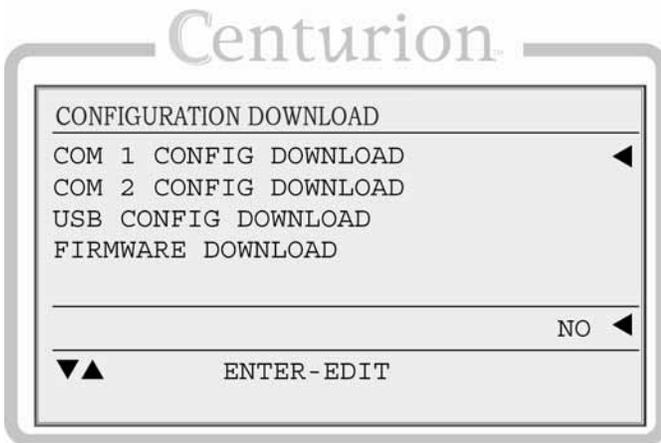
There are three separate levels of passwords to accommodate several security needs:

“Standard” password – Allows access to every feature except the super user menu. Valid standard passwords can be zero or any number between 100 and 65535. If the standard password is set to zero, the result is that anyone can have read/write access to setup menus.



Super User Menu Screen

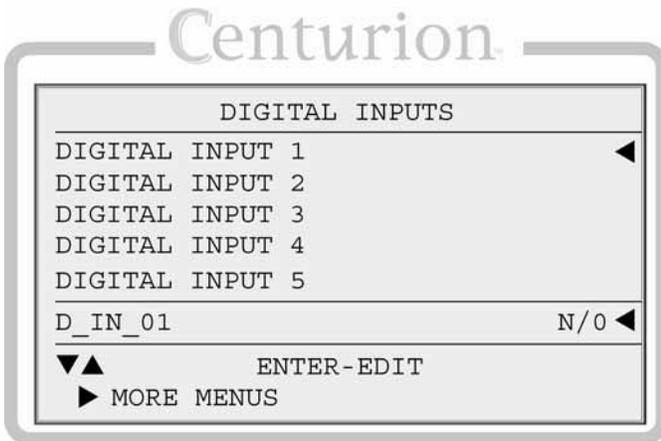
“Super User” password – Adds the super user menu to the standard menus. Valid super user passwords can be in the range of 100 to 65535. The super user password can not be the same as the standard password and cannot be set to zero.



Download Only Screen

“**Download Only**” password – This special 35 jump code allows access to a download menu and is set to a fixed value of 35. This allows a configuration to be downloaded in the event that the current passwords are lost or no initial configuration has been downloaded.

5.3.2 Digital Input



Digital Inputs Setup Screen 1

For up to 32 configured digital input devices, the user may edit:

- a) **Signal Type** - Select normally open (N/O) or normally closed (N/C).
- b) **Signal Filter** - Select None to disable filter function for the digital input. This will not disable the digital input for normal operation.

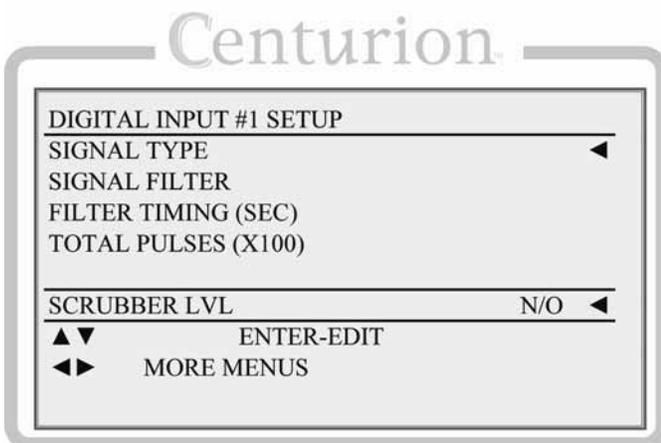
Select Pulse for lubricator divider blocks with a proximity switch output. Select DB to debounce or delay input detection for unstable inputs such as surge tank level.

- c) **Filter Timing** - Delay time in seconds for the selected filter type.

For Pulse, this delay is the transition time for the lubricator divider block to cycle.

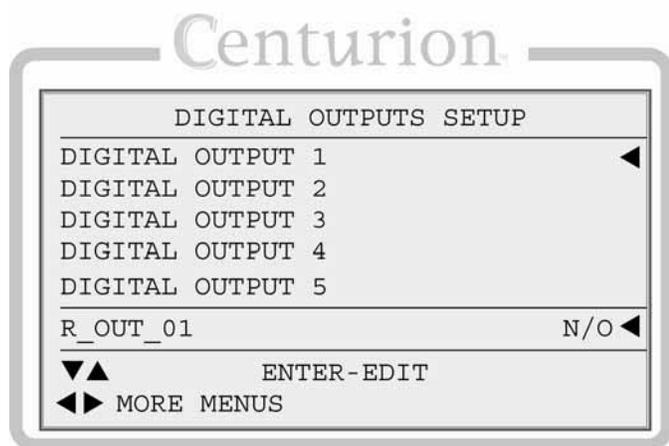
For DB, this is the duration the digital input must remain either ON or OFF before the input will be recognized and accepted as ON or OFF by the sequence. If the input does not remain ON or OFF for the duration of the delay, the timer will reset.

- d) **Total Pulses** - Total number of pulses counted when the filter type is set to Pulse. The value is expressed in hundreds of pulses; a displayed reading of 1 is equal to 100 pulses.



Digital Inputs Setup Screen 2

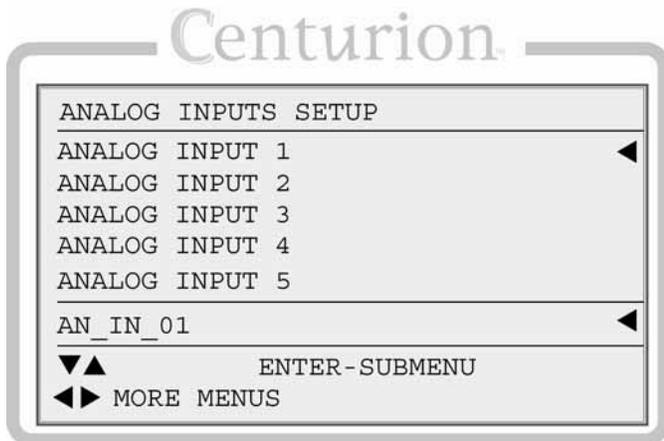
5.3.3 Digital Output



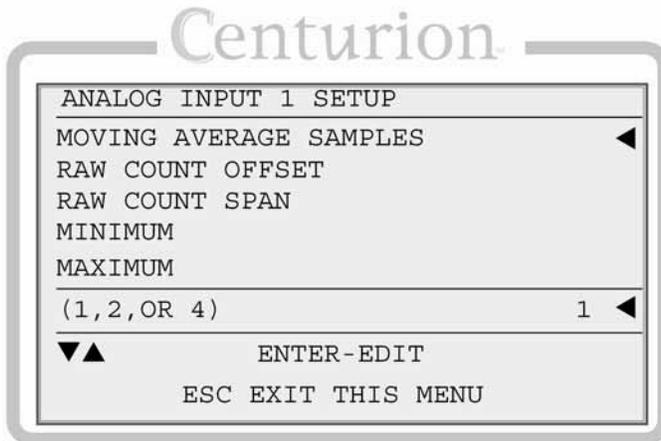
Digital Outputs Setup Screen 1

Digital output: For up to 10 configured digital output devices, the user may select whether an output is normally open (N/O), or normally closed (N/C).

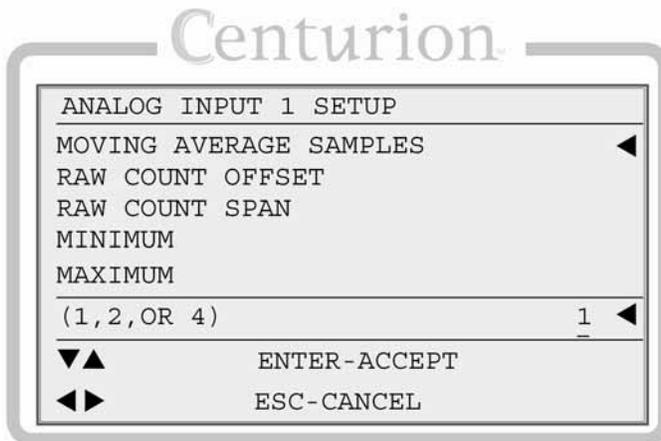
5.3.4 Analog Input



Analog Inputs Setup Screen 1



Analog Input 1 Setup Screen



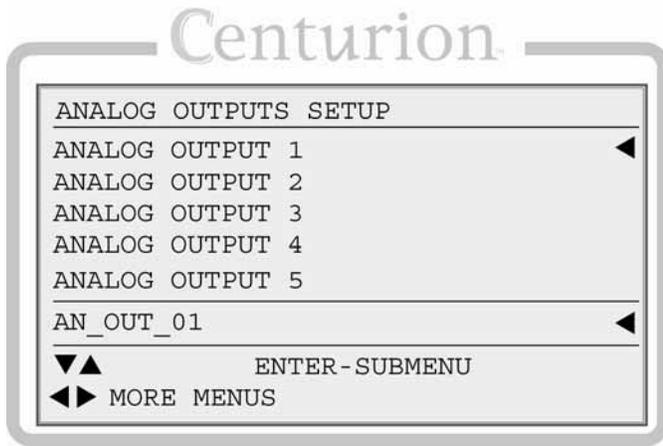
Analog Input 1 Setup Screen

For up to 20 configured analog input devices, the user may edit:

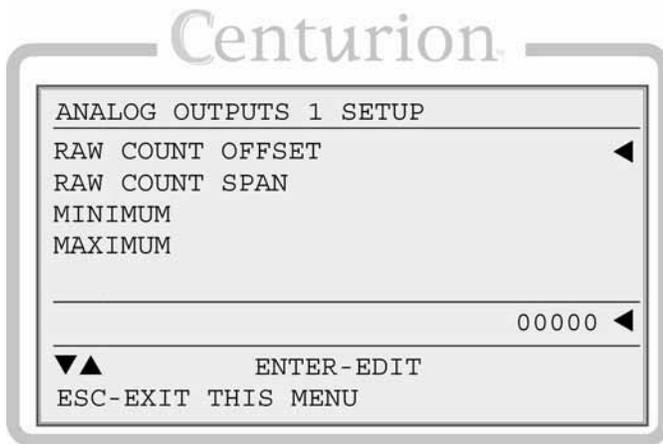
- a) **Moving Average Samples.** (1, 2, 4).
- b) **Raw Count Offset** to determine the lowest reading expected from the device. Typically 147 for 4-20mA or 0 for 0-5VDC
- c) **Raw Count Span** to determine the span from the lowest to highest reading expected from the device. Typically 586 for 4-20mA or 1023 for 0-5VDC
- d) **Minimum** to apply the appropriate minimum engineering scale. Example: 0 PSI for a 0-100 PSI PXT.
- e) **Maximum** to apply the appropriate maximum engineering scale. Example: 100 PSI for a 0-100 PSI PXT.

NOTE: Minimum and Maximum are used to define the input scaled in engineering units. Dual scales are not supported.

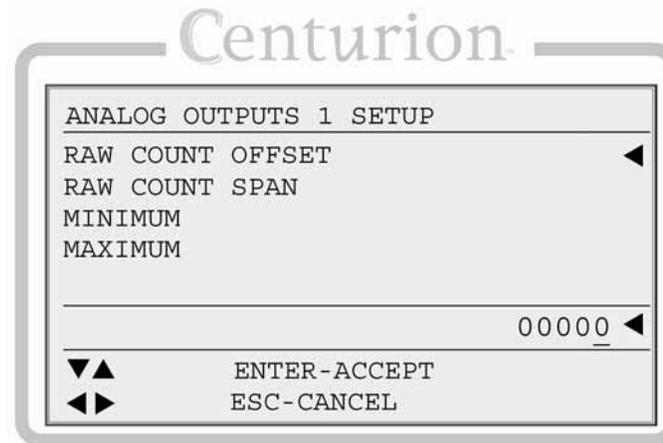
5.3.5 Analog Output



Analog Output Setup Screen



Analog Output 1 Setup Screen

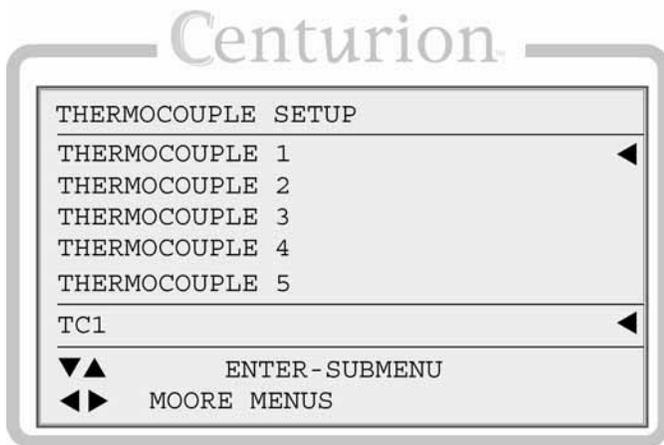


Analog Output 1 Setup Screen 1

For up to 6 analog output devices, the user may edit:

- a) **Raw Count Offset**, the lowest reading expected from the device. Typically set to 0.
- b) **Raw Count Span** to determine the span from the lowest to highest reading expected from the device. Typically set to 10000.
- c) **Minimum** to apply the appropriate engineering scale. In most cases, 0% addresses a typical application and it is the Centurion's default value.
- d) **Maximum** to apply the appropriate engineering scale. In most cases, 100% (10000) addresses a typical application and it is the Centurion's default value.

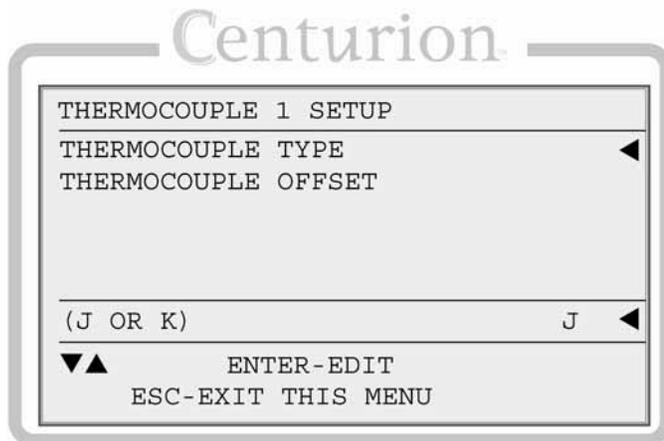
5.3.6 Thermocouple Input



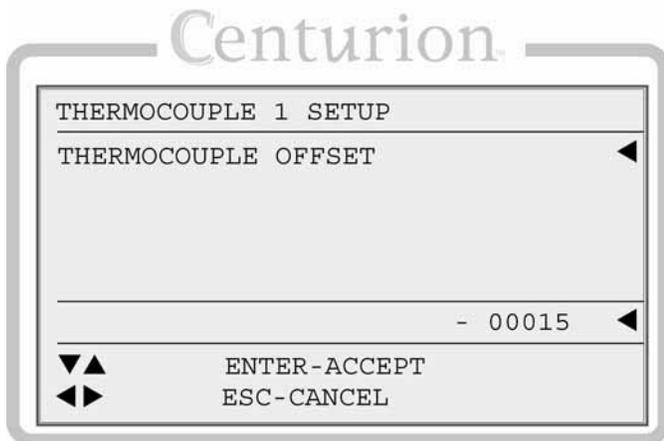
Thermocouple Setup Screen

For up to 16 thermocouple devices, the user may edit:

- a) **Thermocouple Type.** Identify whether the calibration type should be set to J or K.
- b) **Thermocouple Offset.** Assign the thermocouple offset value.

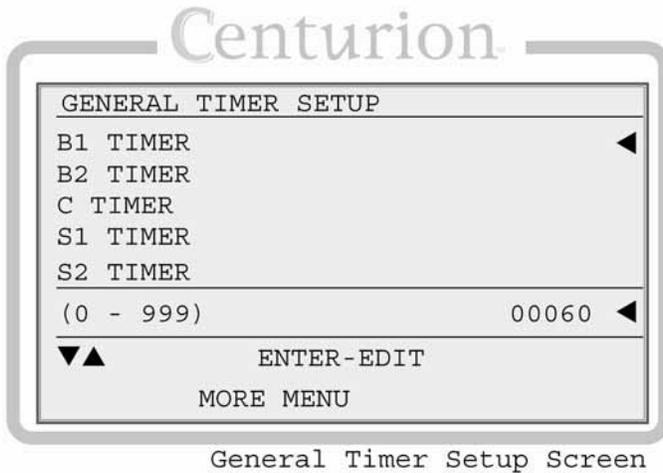


Thermocouple 1 Setup Screen



Thermocouple 1 Setup Screen 1

5.3.7 General Timer Setup



User may edit all general purpose timers. Generally, global timers affect engine operation. They also help define an event.

B1: All event types can be associated with, and locked out by, a Bx timer. B1 is the first global timer used for delaying an event condition detection. The timer starts in a running State (10 – 13) depending on which timers have been marked “In Use”. B1 is also known as the “Lockout Timer”, start bypass or start/run timer.

B2: The second global timer used for delaying event condition detection. B2 is also known as a secondary “Lockout Timer.”

NOTE: The Bx timers start after the Start key has been pressed and the controller has reached a "Running" state. States 10-13 are the "Running" states.

C: The delay allowing a clear reading before beginning testing for the arming of Class C events. The default and typical time for most applications is 2 seconds.

S: Users have up to five (5) options to assign additional special timers to signals. The Sx timers begin concurrently with the Bx timers.

No Flow: The global delay used for delaying the triggering of a no flow event. This global no flow timer is enabled after B1 expires, and begins timing after any of the pulse transition times configured in the digital input dialog expires.

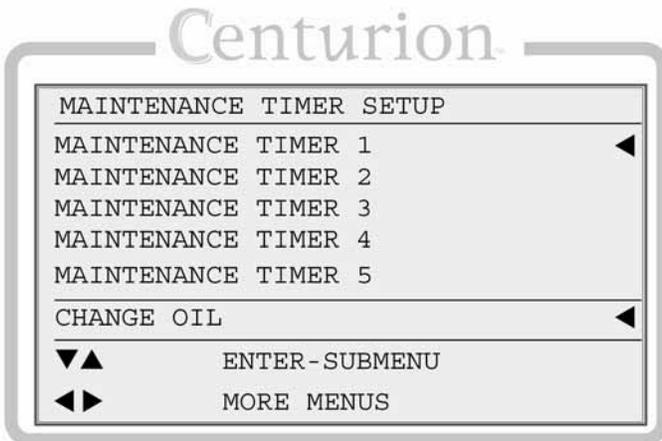
Test: Time given to allow for maintenance testing of end devices without triggering a fault or shutdown condition. The timer initiates when switched to test mode.

Ignition Off Delay: Time delay before the assigned ignition output turns off. This is typically used to burn remaining fuel vapors after the fuel valve is turned off.

Ignition On Delay: Time delay before the assigned ignition output turns on. This is typically used to delay ignition until engine has started cranking (also known as a purge delay).

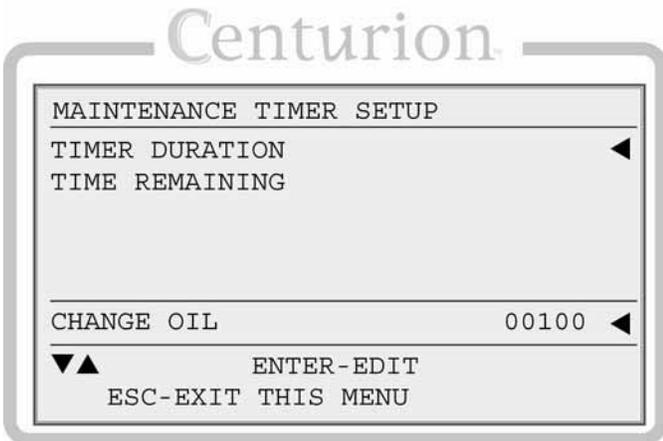
Fuel On Delay: Time delay before the assigned fuel valve output is turned on. This is typically used to delay fuel until ignition has been turned on.

5.3.8 Maintenance Timer Setup



Maintenance Timer Setup Screen

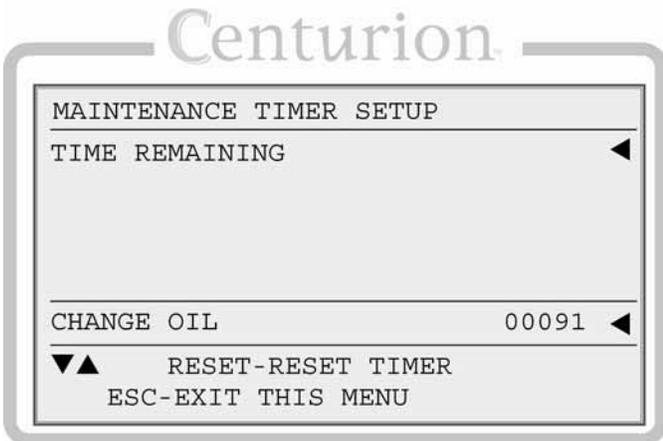
The user may access and edit the ten (10) maintenance settings for timer duration.



Maint_1 Setup Screen

The user may also access and reset all timer duration and time remaining settings. All maintenance timer units are in hours.

NOTE: While these are configured through MConfigPro, they must be manually initiated, or restarted, in Centurion display.



Maint_1 Setup Screen 1

To initiate or reset timers, position cursor on TIME REMAINING and press the reset key.

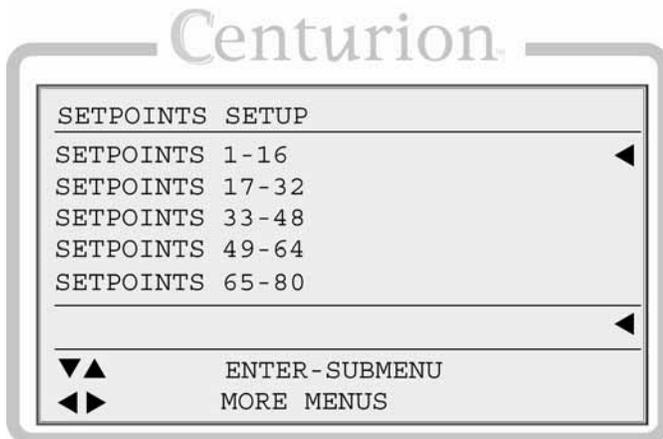
5.3.9 Setpoints Setup

User can edit any of the 128 setpoints that are configured.

Setpoints further configure variable input types such as MPU, analog, or thermocouples by defining a threshold, exception or any other out-of-limit event that may require action. Multiple setpoints are often applied to a process and they may be configured as often as needed to meet changing conditions.

Common alarm and shutdown setpoints a user might have configured include:

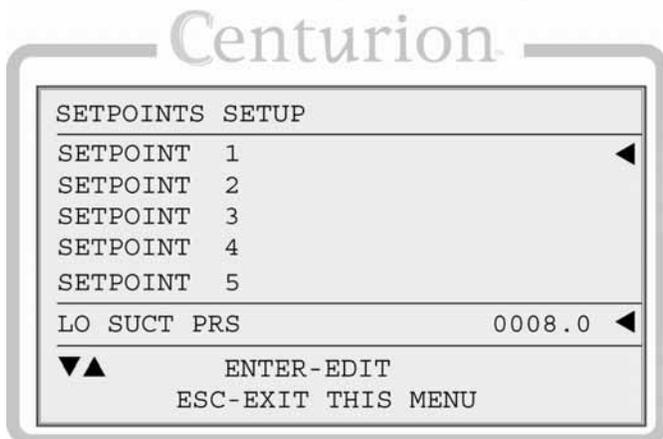
- High shutdown (High-High)
- High warning (High)
- Open warning (Open or Fail)
- Low warning (Low)
- Low shutdown (Low-Low)



Setpoints Setup Screen

To edit a configured setpoint:

a) Assign numeric threshold that if crossed, triggers the setpoint.



Setpoint Setup Screen 1

b) Adjust the sign of the threshold value as plus (+) or minus (-) by moving the cursor to the sign symbol position and use the up and down keys to toggle the sign.

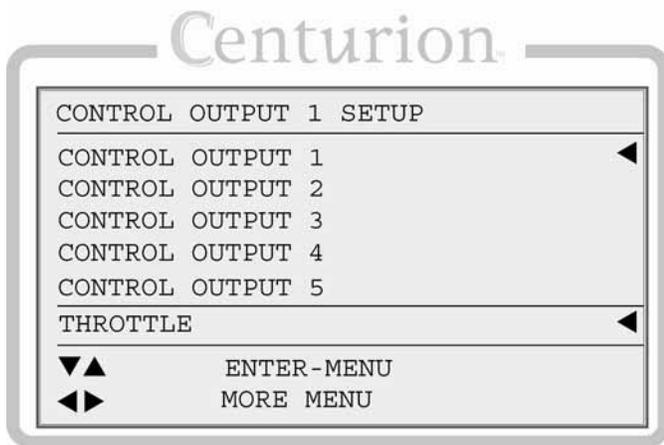
For more on setpoints, please refer to the MConfigPro Installation and Operations Manual.

5.3.10 Control Output Setup

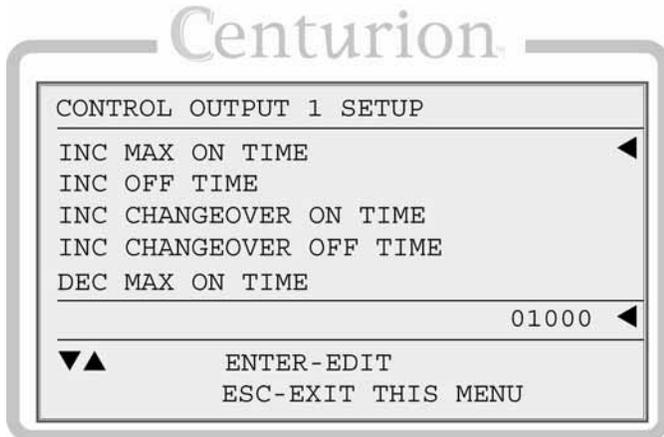
The Centurion controller allows users to define up to eight (8) outputs to augment control not otherwise defined by digital output assignments.

The Centurion can be configured through MConfigPro software to define an analog output, a digital output, a single pulsed digital output, or two pulsed digital outputs.

NOTE: Control outputs 1 through 4, are directly related to PID calculation loops and are further defined in the PID dialog screens described in the PID Setup section. For example, PID 1 is assigned its control from control output 1, PID 2 from control output 2, and so on.



Control Output Setup Screen



Control Output 1 Setup Screen

If the configured output is a pulsed cycle, the user may edit those behaviors by assigning values the following:

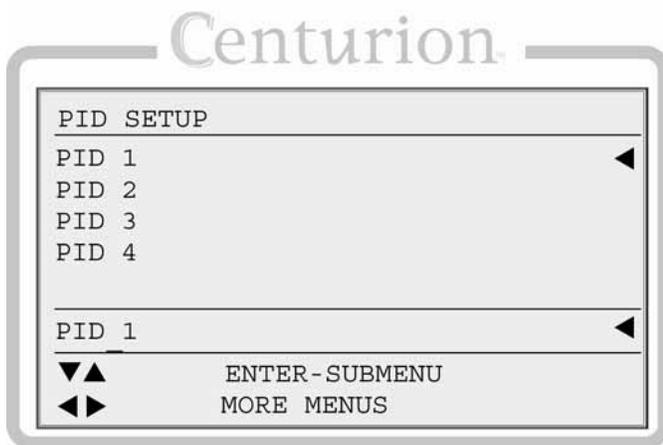
- a) **Increase Max On Time.** Set limit of maximum on-time for Increase pulses.
- b) **Increase Off Time.** Set fixed off-time for Increase pulses.
- c) **Increase Changeover On Time.** Set fixed on-time for single pulse on direction change for Increase.
- d) **Increase Changeover Off Time.** Set fixed off-time for single pulse on direction change for increase.
- e) **Decrease Max On Time.** Set limit of maximum on-time for decrease pulses.
- f) **Decrease Off Time.** Set fixed off-time for decrease pulses.
- g) **Decrease Changeover On Time.** Set fixed on-time for single pulse on direction change for decrease.
- h) **Decrease Changeover Off Time.** Set fixed off-time for single pulse on direction change for decrease.

5.3.11 Proportional Integral Derivative (PID) Setup

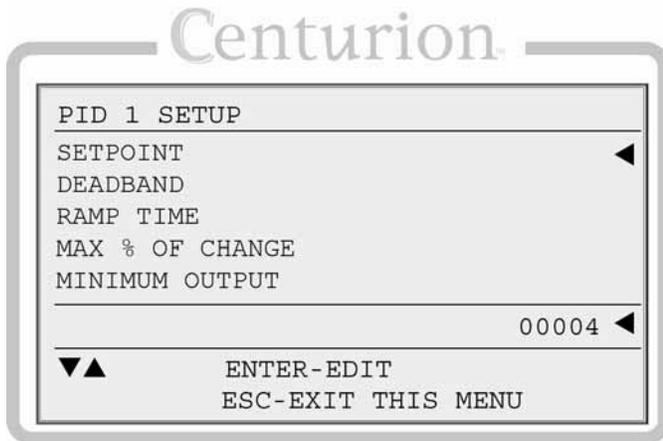
Users may view and edit up to four (4) MConfigPro software configured PID calculation loops. A PID provides a constant feedback loop, in which the PID can correct for a measured process variable against a desired set point, output the corrective action to the process and wait for and recalculate the next measurement.

The ultimate goal of the PID is to reduce the error to zero while maintaining the control setpoint (e.g. speed, load, pressure).

NOTE: During the time a PID is enabled, the PID always overrides control output settings found in the states dialog. PID 1 assumes control of control output 1, PID 2 assumes control of control output 2, and so on.



PID Setup Screen



PID 1 Setup Screen

To view and edit PID settings:

- a) **Setpoint:** Assign the desired goal—the target feedback base value.
- b) **DeadBand:** Assign a value around the setpoint during which the PID will not calculate error or take action.
- c) **Ramp Time:** Assign a time interval for the PID to calculate error.
- d) **Max % of Change:** Assign a percentage rate of change of the output, greater than which may cause harm to the system.
- e) **Minimum Output:** Assign a percentage as minimum output. Typically 0 (zero).
- f) **Maximum Output:** Assign a percentage as maximum output. Typically 10000 (100.00%)
- g) **Proportional:** Assign a constant value for the proportional coefficient of the PID loop calculation that causes a portion of the output to be a fixed amount proportional to the size of the error.
- h) **Integral:** Assign a value for the integral coefficient of the PID loop calculation that causes a portion of the calculated output to change with accumulated error over time.

i) **Derivative:** Assign a constant value for the derivative coefficient of the PID loop calculation that causes a portion of the calculated output to change with the change in the size of error versus time.

j) **OverRide Ramp Time:** Assign a time interval value to wait before making the next override adjustment.

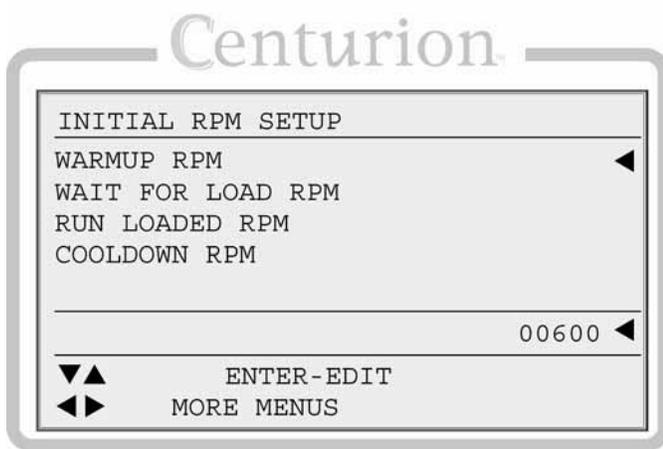
NOTE: Override settings are only used when there is a configuration for overriding the primary PID control loop with another process variable.

k) **OverRide Ramp Amount:** Determine the increments in a given direction (positive or negative) that the primary setpoint should be altered to regain balanced processes. In the example of the discharge and suction pressure application, this value would indicate how much the PID should resist its goal in reaching the setpoint.

l) **OverRide Max Change:** Assign a maximum allowed change. This represents the total amount of change allowed into or out of the ramp amount from the setpoint. The maximum change value should be large enough to effect change.

For more on PID, please refer to the MConfigPro Installation and Operations Manual.

5.3.12 Initial RPM Setup

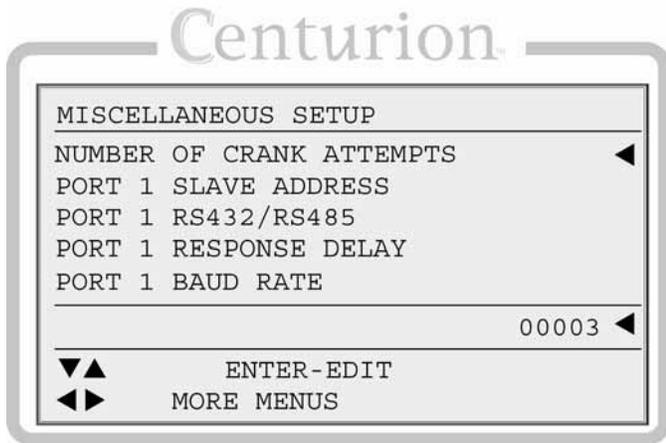


Initial RPM Setup Screen

Assign values for:

- a) **Warmup RPM.**
- b) **Wait to Load RPM.**
- c) **Run Loaded RPM.**
- d) **Cooldown RPM.**

5.3.13 Miscellaneous Setup



Miscellaneous Setup Screen

User can access and edit the miscellaneous settings.

a) **Crank Attempts (1-99):** Define a value for number of crank attempts after which an over-crank sequence will be triggered in the event logic.

b) **Port 1 Slave Address (1-255):** Provide the value for the Modbus address for port 1. The factory default is 1.

c) **Port 1 Mode:** Select communication port 1 as RS232, or RS485.

d) **Port 1 Reply Delay (0-32767):** To ensure sufficient time for the Modbus reply, assign appropriate time value for delay Modbus reply port 1. Typically set to 18. This setting only applies to Port Mode RS485.

e) **Port 1 Baud Rate:** Select appropriate transmission baud rate (9600; 19200; 38400; 57600; 115200)

f) **Port 2 Mode:** Select communication port 2 as RS232, or RS485.

g) **Port 2 Reply Delay (0-32767):** To ensure sufficient time for the Modbus reply, assign appropriate time value for delay Modbus reply port 2. Typically set to 18. This setting only applies to Port Mode RS485.

h) **Port 2 Baud Rate:** Select appropriate transmission baud rate (9600; 19200; 38400; 57600; 115200)

NOTE: All ports use:
-Parity: NONE
-Data Bits: 8
-Stop Bits: 1

i) **Flywheel Teeth:** Define a value for flywheel teeth (Pulses Per Revolution) used to calculate RPM.

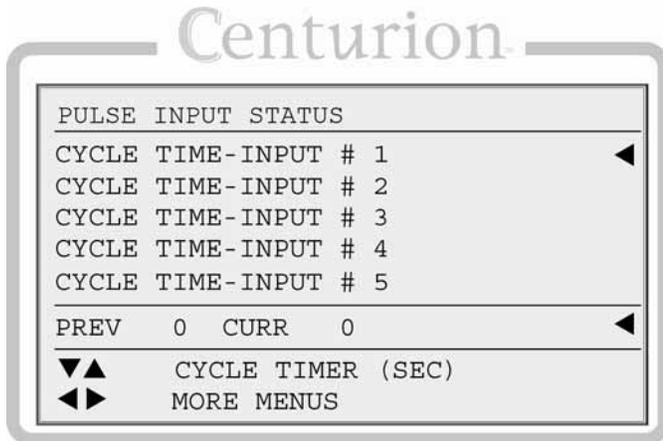
WARNING: The following cold temperature offset values should only be adjusted by personnel with a full working knowledge of the Centurion in conjunction with calibrated reference equipment.

j) **Core Cold Temp Offset:** Enter a non-zero value for core temperature adjustment (in tenths) to adjust the temperature readings for all thermocouple inputs on the main I/O module (C3-1). Entering a non-zero value will adjust the cold junction compensation reading used to calculate temperature.

k) **Exp Cold Temp Offset:** Enter a non-zero value for expansion board temperature adjustment (in tenths) to adjust the temperature readings for all thermocouple inputs on expansion I/O (C3-2). Entering a non-zero value will adjust the cold junction compensation reading used to calculate temperature.

l) **Hour Meter:** The user may make hour meter adjustments. The range is 0 – 65535 hours.

5.3.14 Pulse Input Status

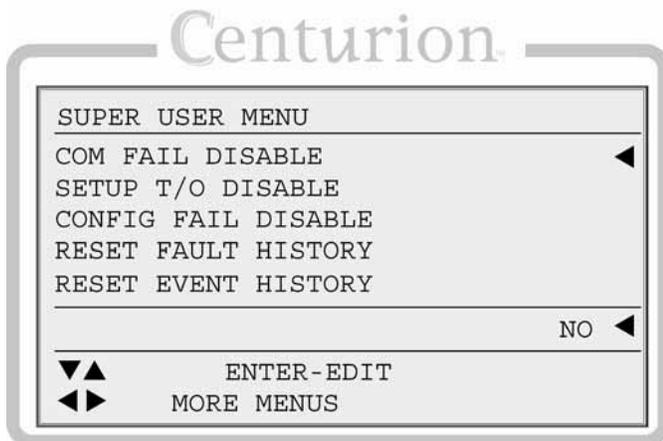


Pulse Input Status Screen

Pulsed inputs are designed to accept a cycling digital output from a lubricator divider block; typically from a general purpose proximity switch.

The user may view information about the pulsed inputs. If a digital input is designated for use as a pulsed input, it will display how much time elapsed before the last transition, and how much time has elapsed since that transition. If the input is not designated as a pulsed input, there will be zeros displayed. Both have a maximum value of 999.

5.3.15 Super User Menu



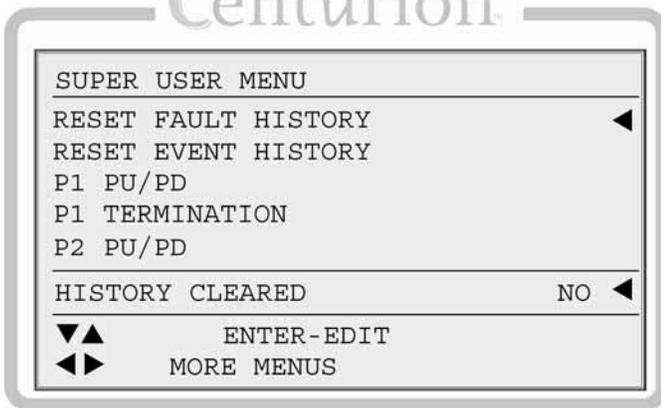
Super User Menu Screen

The super user menu will only be visible if the super user password has been entered.

- a) **Com Fail Disable:** Set to Yes to prevent the Com Fail message from appearing when communication is lost or cannot be established.
- b) **Setup T/O Disable:** Set to Yes to prevent automatic logout from the Setup menu when no keys are pressed for the timeout period.
- c) **Config Fail Disable:** Set to Yes to prevent the Invalid Configuration screen from appearing when the display and controller configurations do not match.

NOTE: Settings a thru c are for troubleshooting purposes and are not retained on power cycle.

Centurion



Super User Menu Screen 2

d) **Reset Fault History:** Set to Yes to clear the Shutdown History screen.

e) **Reset Event History:** Set to Yes to clear the Event History screen.

NOTE: The **Reset History** commands do not permanently switch to Yes when entered, but instead toggle back to No after sending the command to the controller.

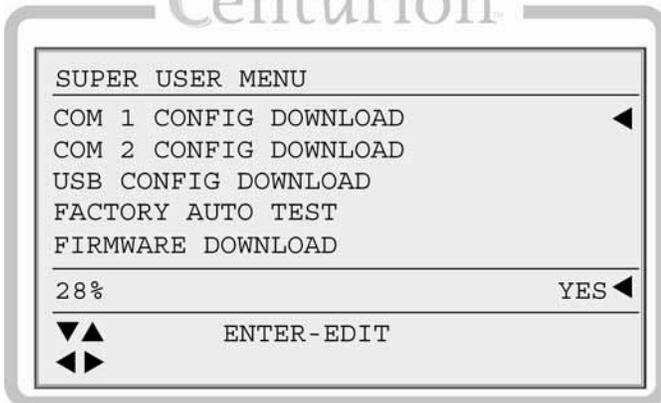
Also, the message “HISTORY CLEARED” will be displayed until another key is pressed.

f) **Restore Defaults:** Set to Yes to overwrite all settings changed through the display to the original configuration settings from the last download.

NOTE: The Restore Defaults command does not permanently switch to Yes when entered, but instead toggles back to No after sending the command to the controller.

Also, the message “DEFAULTS RESTORED” will be displayed until another key is pressed.

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Super User Menu Screen 3

g) **Standard Password:** Set to Yes to enter the Standard User Password edit screen. The current password is displayed and can be changed.

h) **Superuser Password:** Set to Yes to enter the Superuser Password edit screen. The current password is displayed and can be changed.

NOTE: The Password commands do not permanently switch to Yes when entered, but instead toggle back to No after returning from the Password view/edit menu.

The **P1** and **P2** signify communication port 1 and communication port 2 and are for setting up the RS485 interfaces on the display's serial ports.

i) & k) **PU/PD** designates internal pull-up and pull-down resistors. These can be connected or disconnected by these settings.

j) & l) **TERMINATION** designates internal terminating resistors. These can be connected or disconnected by these settings.

NOTE: By default, both PU/PD and TERMINATION settings are set to YES for both Port 1 and Port 2 to enable these features for RS485.

m) **P1 Config Download**

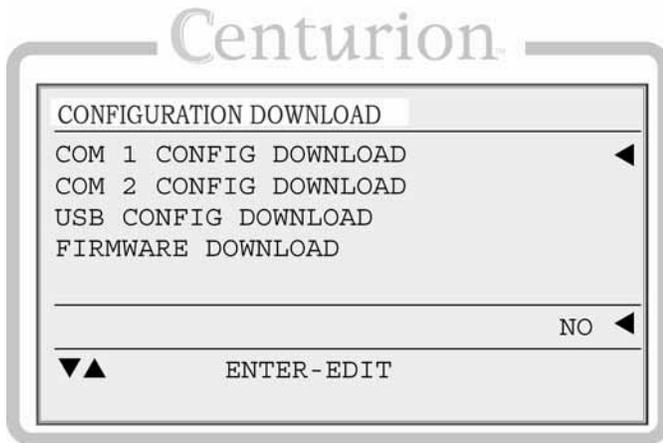
n) **P2 Config Download**

o) **USB Config Download**

p) **Firmware Download**

NOTE: Items m thru p communication port functions are also available for the configuration download menu. Refer to the section "Downloading Configurations to the Display" for details on download functions.

5.3.16 Configuration Download



Download Only Screen

This menu allows for download only and can be accessed through the special jump code 35.

It is the only screen available by entering the password 35.

New configurations can be downloaded to the display by selecting the desired connection.

(Com 1 Config Download, COM 2 Config Download, and USB Config Download)

After enabling the download, download progress is indicated on the left side of the edit box as a percentage complete. After selecting Yes for download, and until No is selected after download is complete, only the enter key will be active.

See the "Operational Screens" section for further details about downloading configurations.

a) **Com 1 Config Download:** Selecting Yes initiates configuration download through communication port 1.

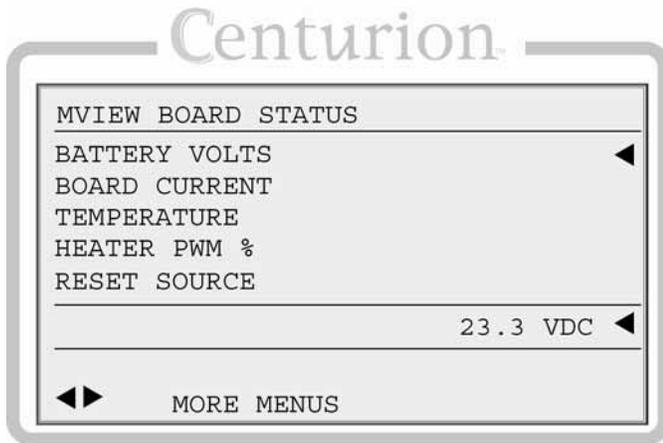
b) **Com2 Config Download:** Selecting Yes initiates configuration download through communication port 2.

c) **USB Config Download:** Selecting Yes initiates configuration download through USB port.

d) **Firmware Download:** Selecting Yes initiates firmware download. This feature only supports USB download. The USB cable must be plugged into the USB port and connected to a pc before activating this selection. A firmware update mode screen will remain until the unit has been reset by remote command or a power cycle.

See section "Downloading Firmware Updates to the display" for downloading new firmware.

5.3.17 Display Board Status



MView Board Status Screen

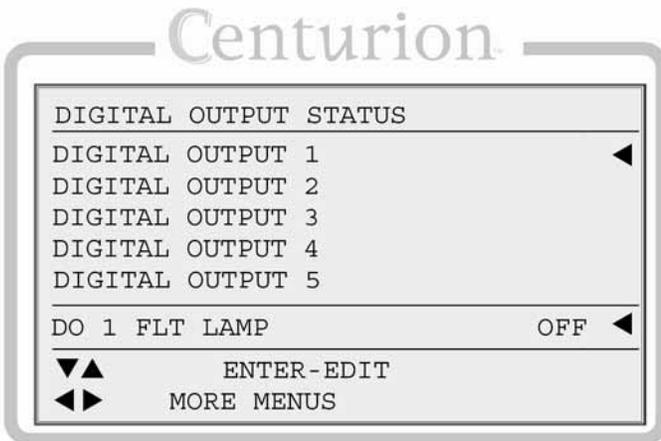
The user may view diagnostic information that reflects the operating conditions of the display only.

- a) **Battery Volts** - Indicates internal voltage measurement of display VDC input.
- b) **Board Current** - Indicates internal power measurement of display. Typical current measured at 24VDC is .04A or 40 milliamperes.

NOTE: This value is higher when ambient temperature is below -10F. During this time the LCD heater will be active and consuming more power.

- c) **Temperature** - Indicates internal temperature measurement of display. This is used primarily to monitor ambient temperature to operate LCD heater.
- d) **Heater PWM %** - Refers to the LCD heater which only operates in cold temperature conditions.
- e) **Reset Source** - Indicates the cause of the last reset. Possible causes include external reset, power-up, brown-out and watch dog.

5.3.18 Digital Output Status

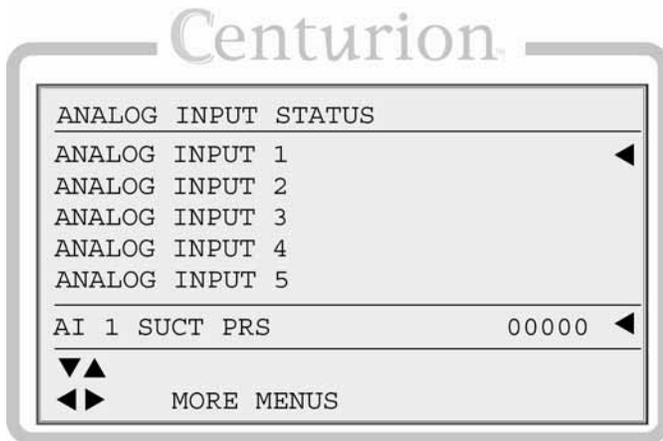


Diagnostic-Digital Outputs State Screen

For each of the devices configured as “In Use” by MConfigPro, the user can see the state of each output and has the ability to force an output for the purpose of testing. A force is associated with a timeout so that it will be automatically cancelled when returning to normal operation. Each force operation resets the timeout to 5 minutes. The force timer expires after 5 minutes if no other forces are activated or when the user navigates away from the digital output status screen.

The Force timer is shown in the bottom right corner of the digital output status screen when forces have been activated.

5.3.19 Analog Input Status



Diagnostic-Analog Inputs Screen

The user can view the raw counts of the analog inputs for troubleshooting.

NOTE: These values are used to establish the offset and span settings.

Typical approximate raw readings for 4-20mA input:

4mA = 147

20mA = 733

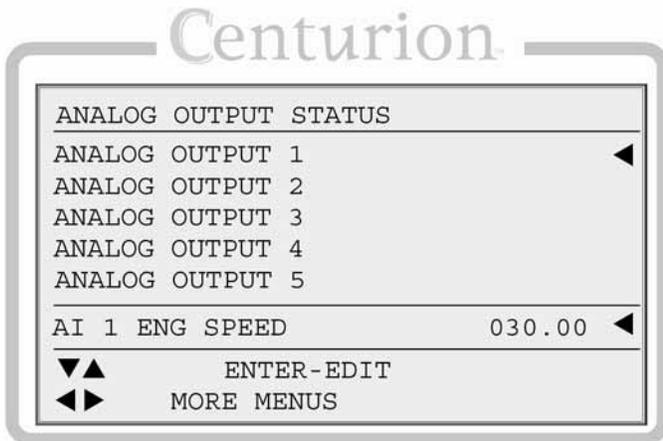
The Span (16mA) is 586, therefore:

8mA = 293

12mA = 439

16mA = 585

5.3.20 Analog Output Status



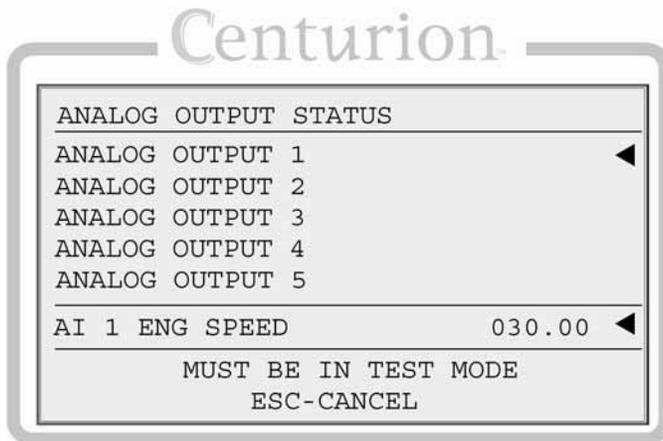
Diagnostic Analog-Outputs Status Screen

The user can see the state of each output, and if in test mode, has the ability to force an output for the purpose of testing.

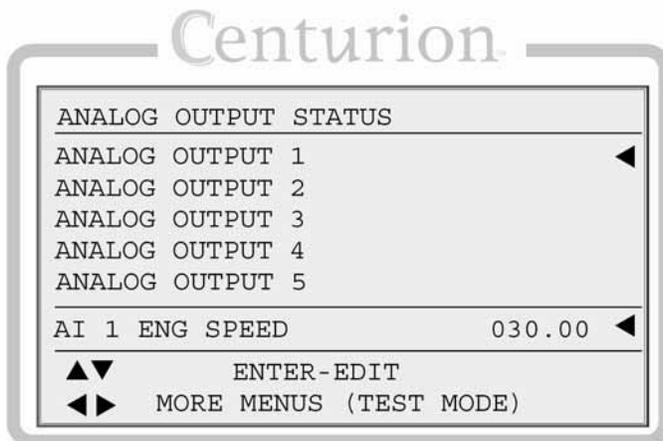
To force the output, enter a value from 0.00% = 4mA to 100.00%. = 20mA

Any value in between will output a portion of the 16mA span proportional to the percent value.

Analog outputs under the control of PID or other control output settings cannot be forced. To force a PID controlled output, place the PID in manual mode and operate the manual output value.

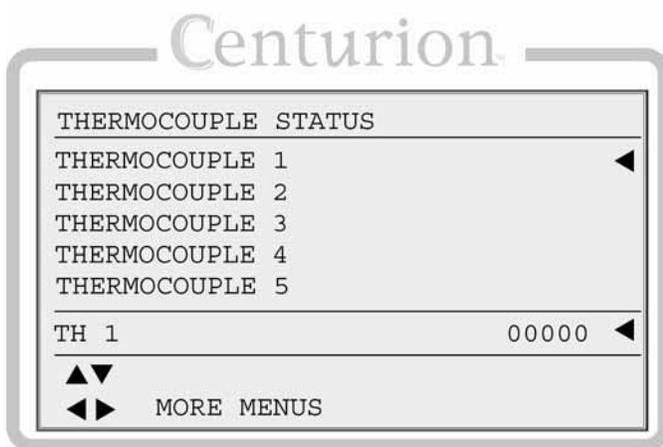


Diagnostic Analog-Outputs Status Screen 2



Diagnostic Analog-Outputs Status Screen 3

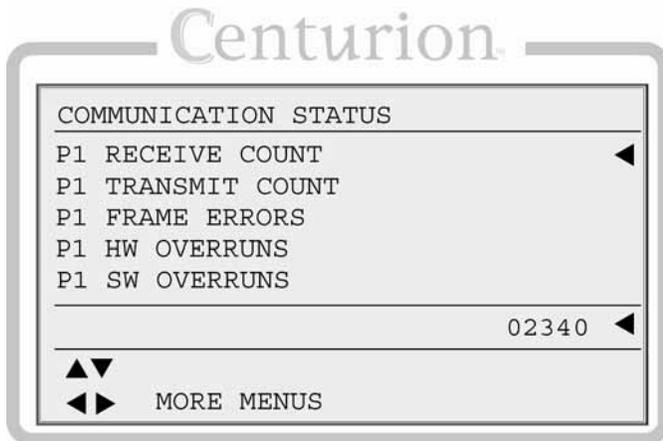
5.3.21 Thermocouple Status



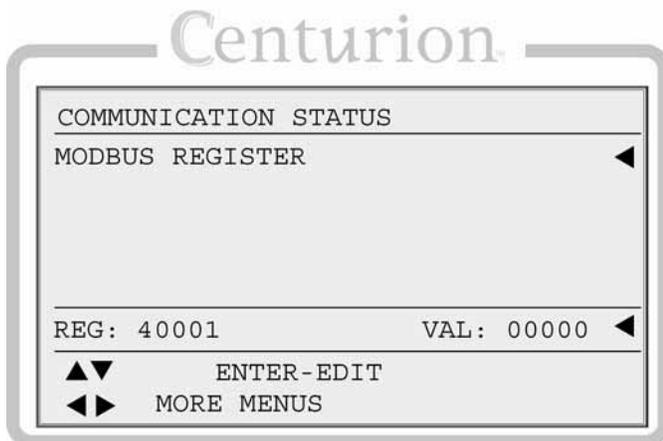
Diagnostic Thermocouples Screen

The user may view the raw counts of the thermocouple inputs for troubleshooting.

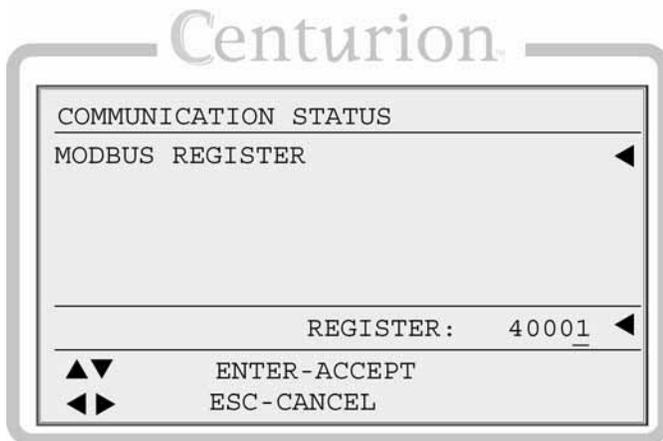
5.3.22 Communication Status



Communication Status Screen 1



Communication Status Screen 2

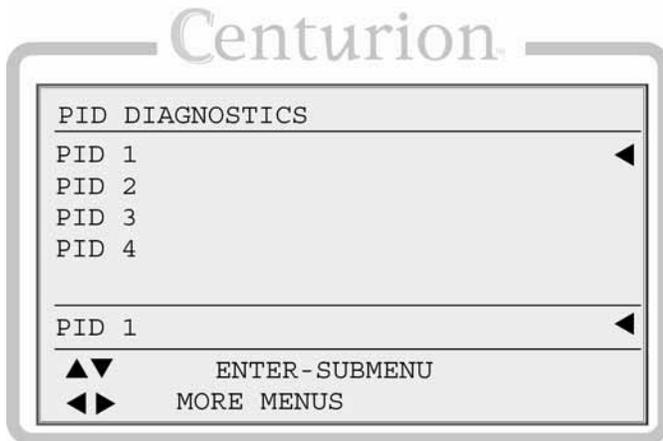


Communication Status Screen 3

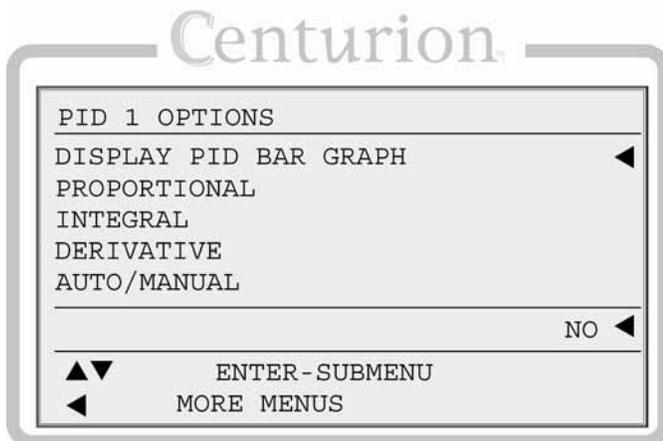
Users may view the statistics for both of the display unit serial ports, including Modbus requests and responses.

- a) **P1 Receive Count**
- b) **P1 Transmit Count**
- c) **P1 Frame Errors**
- d) **P1 HW Overruns**
- e) **P2 SW Overruns**
- f) **P2 Receive Count**
- g) **P2 Transmit Count**
- h) **P2 Frame Errors**
- i) **P2 HW Overruns**
- j) **P2 SW Overruns**
- k) **Modbus Requests**
- l) **Modbus Responses**
- m) **Modbus Exceptions**
- n) **Modbus Invalid Response**
- o) **Modbus No Response**
- p) **Clear Statistics**
- q) **Modbus Register**

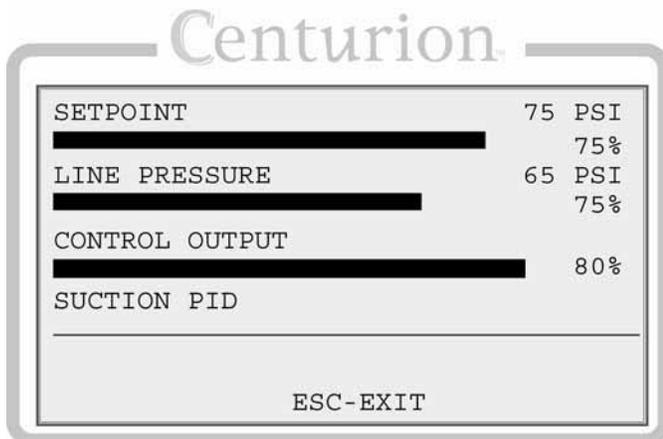
5.3.23 PID Diagnostics



Diagnostic PIDs Screen



Diagnostic PIDs Screen 2



Diagnostic PIDs Screen 3

For each of four (4) possible configured PIDs, user may edit:

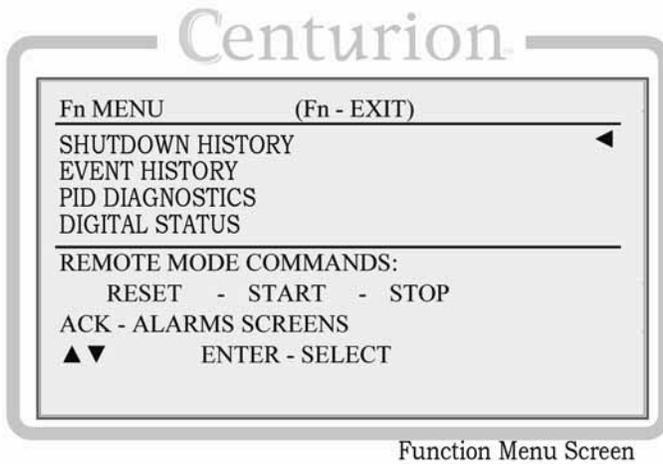
- a) **Display PID Bar Graph:** Monitors the results of modifying the PID components.
- b) **Proportional:** Edit the proportional coefficient value.
- c) **Integral:** Edit the integral coefficient value.
- d) **Derivative:** Edit the derivative coefficient value.
- e) **Auto/Manual:** Setting to manual mode allows the corresponding Set Output value to be adjusted.
- f) **Set Output (Manual):** In manual mode allows adjustment from 000.00 to 100.00. The output will correspond to the control output associated with the PID.
- g) **Reference Line Select:** Setting to select the display value that will appear on the line above the separator line and below the PID name.

This setting is useful for showing the process value of a different analog, thermocouple, or speed input that may be effected by changes to the PID output.

Select from available analog, thermocouple, or speed inputs or None to disable the Reference Line Select feature.

5.4 Additional Navigational Aids

5.4.1 Function Key

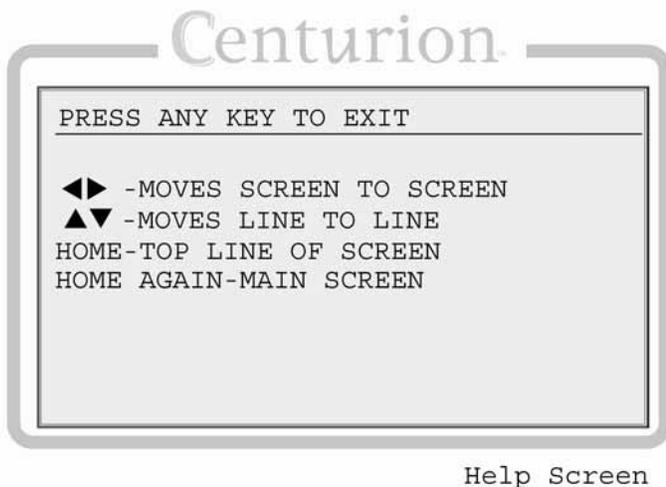


Pressing the function (Fn) key from any screen will display a dialog box on the bottom half of the screen. All available function key commands will be displayed there. The user can then press a single key for the available commands.

In this case, the user can select from a help screen, the alarms screen or issue a remote mode command. If the Fn key is not followed by another key press in five seconds, function mode will time out and the dialog box is replaced with the previous screen.

NOTE: In all cases the Fn key options will be context sensitive. Some options will only be available from certain screens or under certain conditions.

5.4.2 Help Key



This is the help screen the user will see by pressing the HOME key from the Fn dialog box or by pressing the Fn key followed by the HOME key from a normal screen.

6 Communications

6.1 Communication Ports

6.1.1 Port 1 (SERIAL)

Port 1 is intended as the primary port for the local device, the display, and should be utilized for display in order for the boot loader mode to properly execute in pass-through mode.

Interface: Refer to the sequence of operations to determine how the communication port has been configured.

Protocol: Modbus RTU (slave)

Connection: There are three (3) screw terminal connectors for RS485. These are identified as A, B, and SHD.

There are three (3) screw terminal connectors for RS232. These are identified as RX, TX, and DTR.

SHD is common for both ports.

6.1.2 Port 2 (SERIAL)

Interface: Refer to the sequence of operations to determine how the communication port has been configured.

Protocol: Modbus RTU (slave), Proprietary (binary)

Connection: There are three (3) screw terminal connectors for RS485. These are identified as A, B, and SHD.

There are three (3) screw terminal connectors for RS232. These are identified as RX, TX, and DTR.

SHD is common for both ports.

Modbus RTU Slave Address Configuration: The operator may assign a unique Modbus address to each controller (slave) unit that may be in the system. This allows the master controller to differentiate between the modules. For example, to name the controller address 21, place the shunts on LK1, LK4, and LK16 ($1 + 4 + 16 = 21$). Typically, this configuration is set to (1) by the factory.

6.1.3 Port 2 (USB)

Interface: USB 1.1 compliant port capable of emulating RS232 communications via royalty-free pc driver.

Protocol/Services: Modbus RTU (slave), Proprietary (binary)

Connection: There is a USB type B connector.

Automatic selection of USB is provided when a signal is detected on the USB type B connector. Connections for RS485 and RS232 will not be enabled on port 2 when USB is connected.

6.1.4 Port 3 (CAN)

Protocol/Services: Proprietary (binary)

Connection: There are three (3) screw terminal connectors for CAN. These are identified as HI, LOW, and SHD.

On Main I/O Module

Located next to the USB connector is the CAN OK (COP). When in the boot loader the COP LED does not flash.

When the program is running properly the COP LED will flash on and off every 0.5 seconds. If the checksum in the configuration file does not match the calculated checksum of the file, then the program will flash the COP LED 3 times at 0.5 second intervals and then stay off for 1.5 seconds.

On the Expansion I/O Module

When the program is running properly the COP LED will flash on and off every 0.5 seconds.

6.2 Downloading Configurations and Firmware Updates

The Centurion controller and display are configured and upgradeable through software transfers using a PC or laptop computer.

Configurations provide the necessary instructions to the controller and display and install default parameters that can be adjusted through the display or Modbus RTU.

Firmware defines the available features that can be configured in the controller and display using the MConfigPro software.

Since no chips are used to change the behavior of the equipment, Murphy can provide future enhancements and support changes to process requirement for customers using a simple email.

6.2.1 Boot Loader

It is necessary for the Centurion controller to enter boot loader mode in order to receive downloads for a firmware update, and configurations from MConfigPro. During boot loader mode the Centurion is able to receive configuration updates from the MConfigPro software and transmit configuration updates to display through pass-through.

Communications will operate according to default state parameters for configuration transfers. During boot loader mode, the transfer rate is 9600, N, 8, 1 and assumes a serial communication port setting of RS485 or a USB connection.

The controller recognizes whether the incoming data is for a configuration, or firmware update.

In order for the Centurion configurable controller to enter boot loader mode, the address jumpers are removed during power up (power cycled). The display and third party HMI devices will not receive a response to polls on port 1 while the boot loader is active.

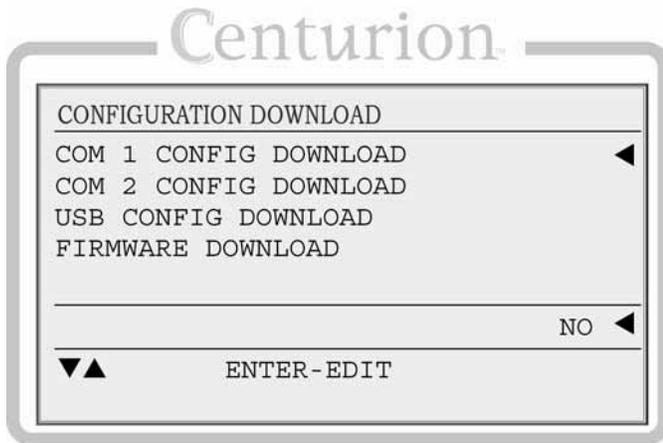
Power on the Centurion must be cycled with the jumper installed to resume normal operation, or run mode. See section "Port 2 (Serial)" in the Controller Communication Ports chapter for more details on address jumpers.

6.2.2 Pass-through

During boot loader, the Centurion controller allows users to remain connected to both the PC and the display and update the two devices with a single connection.

The Centurion controller accepts the message through one port (port 2) and passes it through another port (port 1) directly to the display, as if the pc and display were directly connected.

6.2.3 Downloading Configurations to the Display



Download Only Screen

All configuration downloads will use a baud rate of 9600. The com 1 selection will use the hardware setup of the current configuration. The com 2 selection is a fixed hardware setup for RS485. Selecting USB for configuration download connects the USB adapter to com 2 internally.

All normal communication with the controller is stopped while in download mode.

The display will indicate the transfer is complete by displaying 100%.

Special 35 Jump Code

In the case that no configuration has been downloaded, or a password has been lost, the display allows a "Download Only" password that will allow access to the download menu.

The password is set to a fixed value of 35.

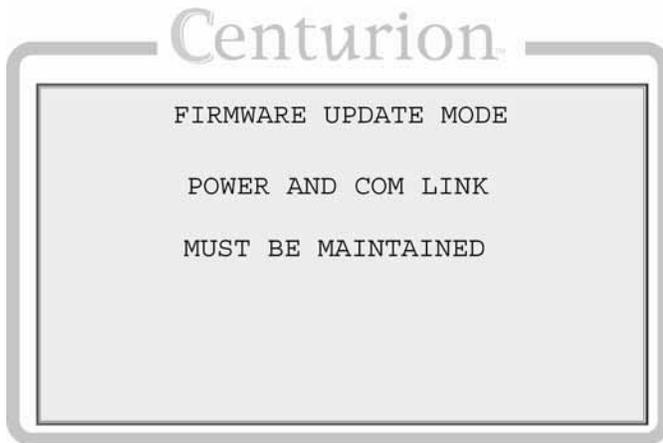
6.2.4 Downloading Configurations via MConfigPro Software

The Centurion controller allows the user to easily download a configuration through the MConfigPro software.

1. Connect your PC to the controller using either the RS485 or USB connection on Port 2. For USB, a PC device driver must be installed. Upon initial connection to the WellPro, a new Com Port will be activated on the PC device manager. Take note of the new Com Port assignment to be used for all future communications with the WellPro.
2. Remove address jumpers from the controller located near the USB connector and cycle power to the controller. Take note of the original location of the jumpers to re-install them correctly after download.
3. Click on the Transfer menu, and then choose Configurations.
4. Select the configuration file supplied by FW Murphy from dialog and click Open. You may need to change the selection for Files of Type to find the file type you wish to download. In most cases, this will be *.MCP, however, other file types are available for specific configuration types.

5. After selecting the configuration file, the next dialog will provide a choice for the target device and PC Com Port to transfer the data. Choose the appropriate Com Port and controller as the target device and click next.
6. Click Begin Transfer from the dialog box that appears and the transfer will begin. When the Status message displays Transmitting 148 lines, the connection has been established and should be providing a progress bar.
7. While the transfer is in progress, the display can be setup to accept the new configuration.
8. From the display keypad, press SETUP and enter password 00035 and press ENTER..
9. The display will show the CONFIGURATION DOWNLOAD screen. Make sure the cursor is positioned on the line COM 1 CONFIG DOWNLOAD and press ENTER.
10. Change the NO to YES in the edit line at the bottom of the screen using the UP ARROW key and press ENTER. The display is now ready to accept a download..
11. At this step, wait for the controller download to complete and click close on the MTransfer dialog.
12. Repeat steps 3 - 6 choosing the display as the target device in Step 5.
13. Click Begin Transfer from the dialog box that appears and the transfer will begin. When the Status message displays Transmitting 655 lines, the connection has been established and should be providing a progress bar.
14. Once the transfer is complete click Close on the dialog and replace the address jumpers on the controller.
15. Cycle power on the controller and display and the new configuration will be loaded and running.

6.2.5 Downloading Firmware Updates to the Display



Firmware Download Screen

Firmware updates for the display require a USB connection. While boot loader mode for the display is not required for configuration downloads, it is required for firmware updates.

The boot loader can be entered by menu selection if the USB cable is currently connected, otherwise the display will reset and restart the current application firmware. Optionally, the boot loader can be entered by connecting the USB cable and cycling power. (This method will leave the display blank while in the boot loader.)

Upon entry to the boot loader, all communication from the display to the controller will stop. There is a red status LED below the USB connector that will blink three times and then remain on while the boot loader is active.

While a file is being transferred, the com 2 transmit LED will be lit continuously. A successful download should complete in approximately five minutes.

Special 35 Jump Code

The Centurion display allows a "Download Only" password that will allow access to the download menu. The password is set to a fixed value of 35. Once at the "Download Only" screen on the display, the user will select to download a firmware update.

Super User Menu

The super user menu is used to download firmware updates.

All normal communication with the controller is stopped while in download mode.

The display will indicate the transfer is complete by displaying 100%.

6.2.6 Error Messages

On occasion an invalid configuration error might display because the configuration between the Centurion controller and its devices are out of synch -- the checksums do not match. The invalid configuration screen will appear briefly after downloading configurations until comparisons are made.

The user may direct the error message to be ignored through a setting at the super user menu. At "CONFIG FAIL DISABLE", the user would select Yes to ignore the data mismatch.

This setting is temporary. Once power is cycled-on, the error message will continue until comparisons between the devices yield no configuration mismatch.

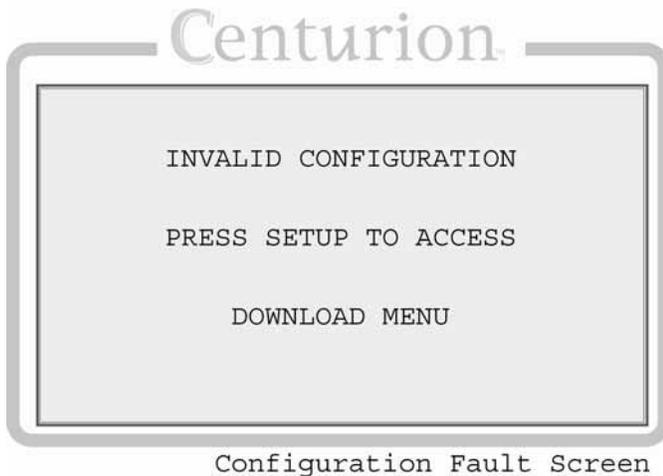
Two options are available for synchronizing data when fine-tuning changes are made in the field. They are:

- A super user could choose to also download the configuration from the super user menu on display.
- A user without access to the super user menu could activate the download through the special jump code 35.



Comm Fail Screen

This screen indicates that the controller is not responding to poll requests. There are only two ways to exit this screen, either by normal responses resuming or if the SETUP/ENTER key is pressed.



This screen will be displayed when a configuration fault is detected.

Possible sources of the fault include a corrupt or missing configuration in the display, a corrupt or missing configuration in the controller or a mismatch of configurations in the display and controller.

This screen will appear briefly after configuration downloads and may appear briefly after initial communication is established until comparisons are complete.

The fault can be resolved by downloading the proper configuration to one or both devices

NOTE: This error message does not always indicate a problem, but may only signify that initial comparisons between devices do not match.

6.3 Modbus™ RTU Protocol

The Centurion configurable controller was programmed with the Modbus protocol which is a system based on a “master” and “slave” relationship. With Modbus protocol, the master and slave are able to continue to communicate with each other through defined messages over a variety of network types. The master initiates the queries or commands, and the slave responds to the query with a message or takes action based on the query.

In this case, the master is either MConfigPro (or another Modbus client software), or display, but never both simultaneously as there can only ever be a single Modbus master.

The Centurion system communicates through Modbus using remote terminal unit (RTU) transmission mode to maximize data processing.

As with all numeric data defined within Modbus, the programming is limited to accepting integers (whole numbers only, no decimals). This is important whenever a decimal point is defined for analog inputs.

For example, for the controller to properly read “100.0” with an implied decimal point of 1, the user would need to enter “1000” and 1000 would be stored in the appropriate Modbus register. From the display, the value will be represented with a decimal in the fixed position.

For additional information, please refer to the “MConfigPro Configuration Software Installation and Operations Manual”.

6.4 Transferring Data in Modbus

Note that text visible in the MConfigPro software and on the display is not stored in the Centurion controller. Except for the version description in the version and security dialog for each configuration file, descriptions assigned in the configuration are not stored in the Centurion controller. Descriptions for various I/O and processes are downloaded to the display and reside as a configuration in that device only. Configurations of the display are one way only.

Parameter changes made in the display are actually communicated to the Centurion controller where the logic resides. No changes made through the display affect the display configuration as the display merely reads from, and writes to the Centurion main I/O module. As such, the display can write numeric parameters to the controller.

6.5 Modbus Register Address Listings

For a complete Modbus address map, please refer to the Centurion Modbus reference document.

7 Replacement Parts and Assemblies

C3-1 Plug Kit	(00000504)	Printed replacement terminal plugs for Centurion Main I/O module
C3-2 Plug Kit	(00000505)	Printed replacement terminal plugs for Centurion Expansion I/O module
C3-3 Plug Kit	(00000543)	Printed replacement terminal plugs for Centurion display module
Choke	(50000774)	Ignition noise (choke) filter

8 Accessories

8.1 Configuration Software

8.1.1 MConfigPro

MConfigPro is the configuration software for modifying sequence of operation, set points, timers, faults, and displays* for Centurion. Includes file transfer utilities for configuration and firmware upgrades.

CD, MConfigPro (50-70-0989) MConfigPro configuration software.

*Display configuration and other settings for display are only for use with the display Module.

9 Glossary

Analog Input	Terminals 18 to 29 are analog inputs on the Centurion Main I/O module. Accepts voltage signals within the range of (0 to 5) VDC or (4 to 20) mA and are compared to controller set points and/or displayed.
Boot Loader	Means by which the Centurion controller communicates with display and MConfigPro to receive and transfer new or updated configurations and firmware; and ensure data and configuration synchronization.
Controller Setpoints	User defines normal operating range for the controller to optimize the equipment. Setpoints can also define some other threshold, exception or event that may require action. Multiple setpoints are often applied to a process and they may be manipulated as needed to meet changing conditions.
DeadBand	The user set range at which input may fluctuate without the controller taking any action. The range may be fixed or variable.
Digital Input	Terminals 30 to 61 are the digital input channels. User selects whether digital input is normally open (N/O), or normally closed (N/C). Users may also associate these inputs with transition times for indicating no-flow conditions on divider blocks.
Event	Defines the action required by the controller in response to any number of parameters. Event actions range from simple alarm message to emergency shutdown (ESD).
No-flow	Designed to protect against compressor or engine failures, the controller monitors the cycle time of lubrication system cycles and if that cycle time falls under a user assigned value, the controller will activate a defined associated action such as an alarm or shutdown.
Offset	User defined value to correct for known variance in the raw data.
Panel Ready	In states, the first logical step in start up.
Permissive	A process condition, (digital input or analog setpoint), that must be met in order for the sequence to proceed to the next state.
Signal	An electrical quantity of voltage or current that is used to represent or signify some other physical quantity such as the state of a switch (ON/OFF) or the status of a device (SHUTDOWN/OK)
Span	The difference between the full scale output and the offset as raw data.
Start Delay	A time delay function to prevent premature start up.

State	Predefined step of multiple logical steps (or states) needed to successfully start and operate a compressor.
Terminal Emulator	Allows a user to modify the firmware to allow upload or download of a record to either the display or the controller. Always download a configuration after a firmware change.
Thermocouple	<p>A device for measuring temperature consisting of two dissimilar metals of high purity for an accurate temperature/voltage relationship. User defines whether the calibration is J or K. Terminals 1 to 17 are for thermocouple inputs.</p> <p>Type J uses Red (-) and White (+) insulation. Type K uses Red (-) and Yellow (+) insulation.</p>

10 Appendices

10.1 Back Panel LED Description

There are a total of seven (7) LED indicators on the back panel, labeled as follows:

10.1.1 (Port 1)

TX – Turned on while port 1 is transmitting data.

RX – Turned on while port 1 is receiving data.

10.1.2 (Port 2)

TX – Turned on while port 2 is transmitting data.

RX – Turned on while port 2 is receiving data.

10.1.3 USB LINK

Turns on while there is a USB connection to a computer.

10.1.4 STAT 1

Turns on for one half second and then turns off for one half second, repeating as long as there is a valid configuration running.

NOTE: This indicator is not active while the boot loader is running.

10.1.5 STAT 2

This LED is only active while the boot loader is running. It flashes briefly three times when the boot loader starts up and then stays on until leaving the boot loader.

10.2 Controller Accuracies, and Tolerances

Refer to the Centurion Configurable Controller Specification Sheet for a detailed breakdown of specifications.

10.3 Restrictions on Numeric Values in Gage and PID Monitor Screens

Due to a combination of the limited space and the spirit of the design objectives, there are certain restrictions imposed upon the formatted size of numbers in display screens.

- Positive numbers with no decimals can be displayed with up to four digits.
- Negative numbers are limited to three digits.
- Numbers of either sign with a decimal place are limited to three digits.
- Numbers with more than two decimal places will not be displayed at all, but will be replaced with dashes.

If a number with decimals is larger than the imposed limits, the display algorithm will attempt to adjust the precision so as to display as many of the most significant digits as possible.

10.4 Set Up Sheet

Refer to The Centurion Configuration Worksheet for a detailed workbook to document field changes to configuration parameters.

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ISO 9001
REGISTERED

CENTURION DISPLAY SCREEN MAP

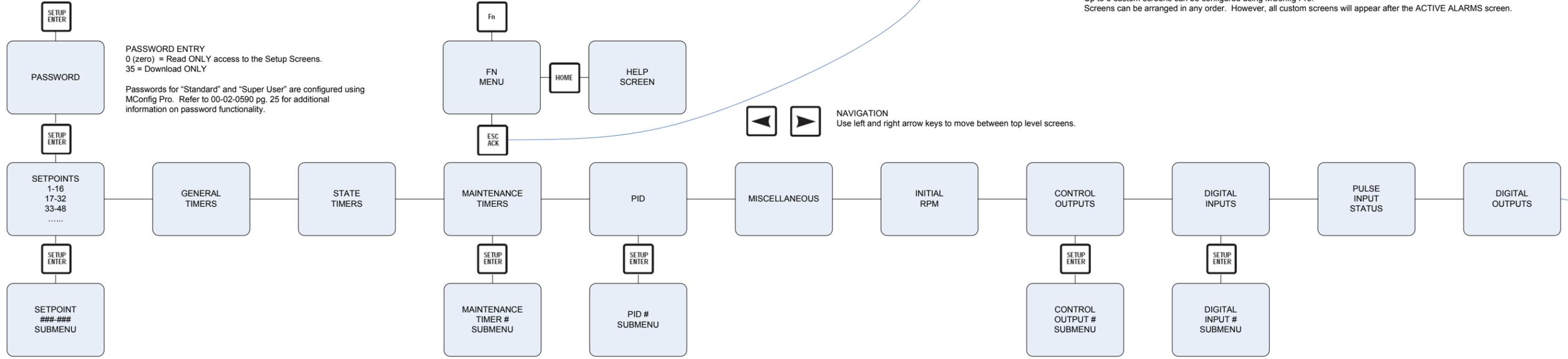
OPERATIONAL
SCREENS



NAVIGATION
Use left and right arrow keys to move between top level screens.

CUSTOM SCREENS
Up to 5 custom screens can be configured using MConfig Pro. Screens can be arranged in any order. However, all custom screens will appear after the ACTIVE ALARMS screen.

SETUP
SCREENS



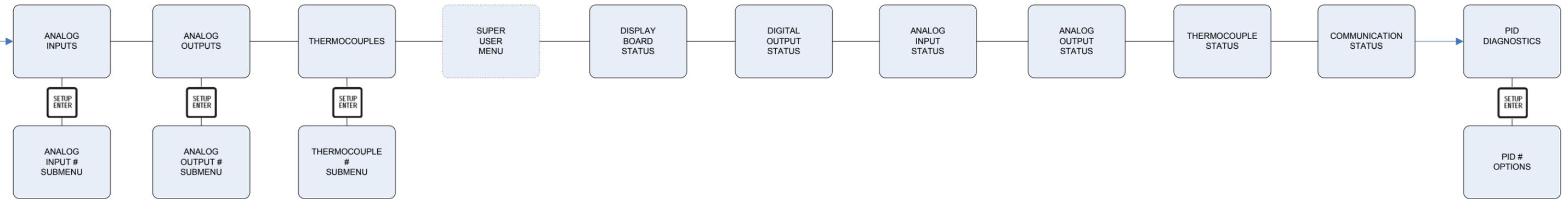
PASSWORD ENTRY
0 (zero) = Read ONLY access to the Setup Screens.
35 = Download ONLY

Passwords for "Standard" and "Super User" are configured using MConfig Pro. Refer to 00-02-0590 pg. 25 for additional information on password functionality.

NAVIGATION
Use left and right arrow keys to move between top level screens.

NAVIGATION
Use left and right arrow keys to move between top level screens.

SETUP
SCREENS
continued...

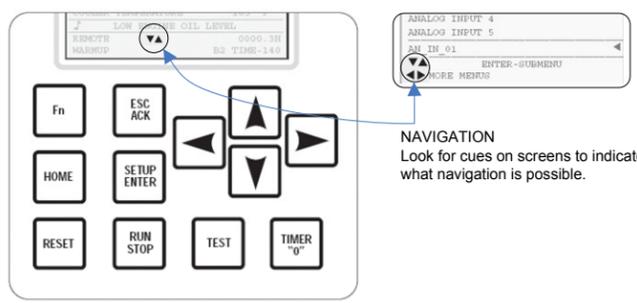


NAVIGATION
Use left and right arrow keys to move between top level screens.

HOME
Up to 5 custom screens can be configured using MConfig Pro.

One custom screen is configured as the default or "HOME" screen. While viewing the OPERATIONAL SCREENS, pressing the HOME key will jump from the currently displayed screen to the configured default screen.

This function is not available in SETUP SCREENS. However, pressing this key on any multi-line display when the first line is not being displayed will jump to the top or "HOME" line on that screen.



NAVIGATION
Look for cues on screens to indicate what navigation is possible.