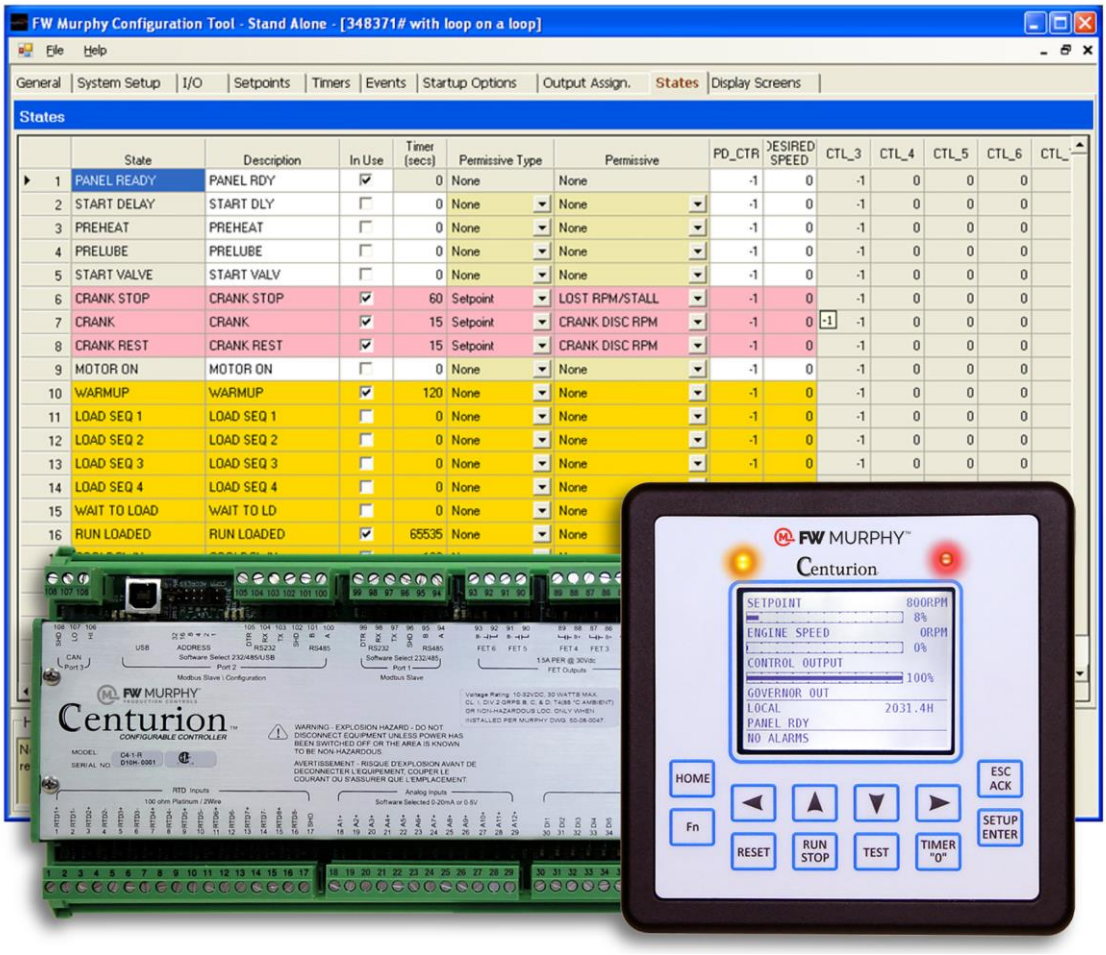
FW MURPHY®
PRODUCTION CONTROLS



CENTURION™ - C4 Series
Configurable Controller

Installation and Operations Manual

00-02-0696
2021-07-26
Section 50

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 http://www.fwmurphy.com/warranty

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 FW 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 FW Murphy immediately if you have any questions.

Table of Contents

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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 (client) compliant HMI (Human Machine Interface) or with no operator interface at all, it is optimally configured and field-configurable through Murphynet Software Suite (Centurion Configuration Tool), powerful software developed to configure the controller. Parameters can be modified in the field without special need for laptop or software by utilizing FW 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 setpoints and digital, analog and thermocouple input points and providing the logic to take corrective and/or proactive steps.

The controller also allows for controlled shutdown 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.

Basic Components and Key Features of the C4 Series

The C4 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 (MV-5-C) 320 x 240 LCD graphic display, -40 to 85° C (185° F)

- Power

Powered by 12 or 24 VDC battery systems. 11W (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 0 C. Typical based on 24V supply. Heater consumes 5.6W typical.

- Package and design
  Same 5” x 5” design as annunciators
  12-key keypad
- Communications
  LED active indication for each port
  RS232/RS485-1 (Modbus Client)
  RS485-2 (Reserved)
  USB 1.1 compliant ports
  -Type A (Reserved)
  -Type B (Firmware Updates)
  CAN 1/2 (Reserved)
- Approvals
  CSA, CLASS 1, DIVISION 2, Groups B, C and D certifications are approved.

Main I/O module (C4-1)

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

Optional Components

The C4-1 hardware may be configured with 1 of 2 expansion I/O modules (MX4 or MX5-A) which provides additional thermocouple inputs or analog inputs/outputs and digital outputs.

Interchange™ Comm Control Module

MX4

- 18 thermocouple (TC)
- 1 magnetic pickup (MPU)

MX5-A

- 8 analog inputs (AI)
- 6 digital outputs (DO)
- 4 analog outputs (AO)
- 1 magnetic pickup (MPU)

Input/Output Types

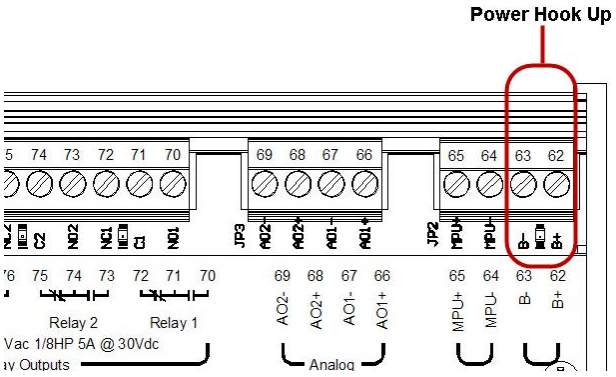
Power Supply Wiring

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

1.1.1 Centurion I/O Module

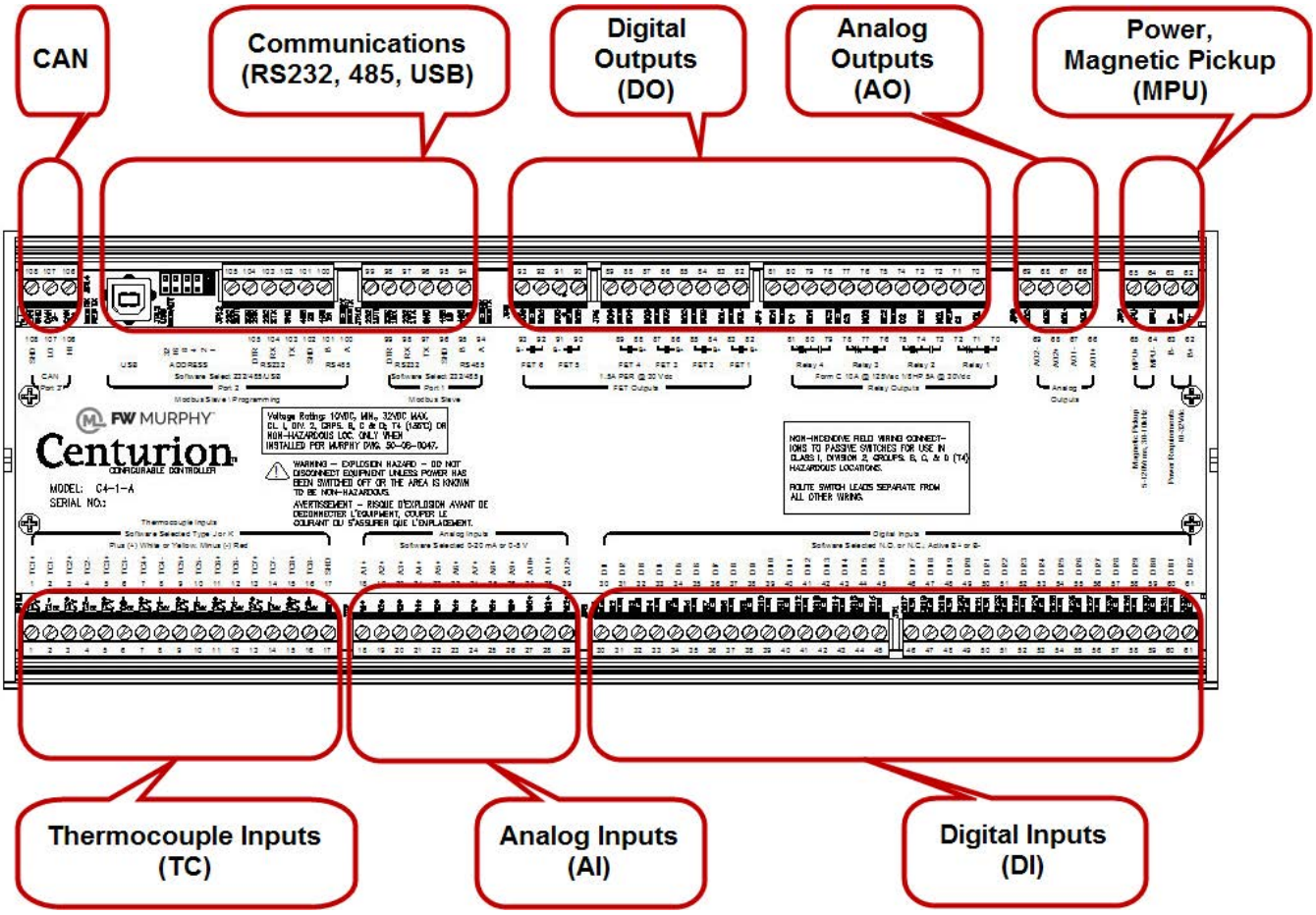
Requirements: Powered by 12 or 24 VDC battery system: 30W (max)

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



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

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



Digital Inputs (DI)

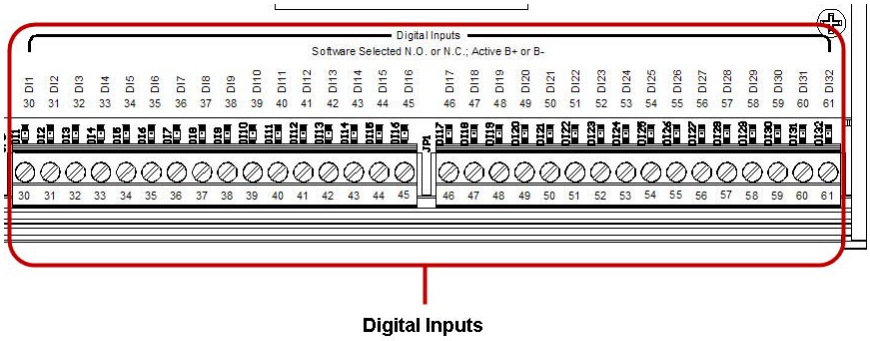
Number of devices: 32

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.



Digital Inputs

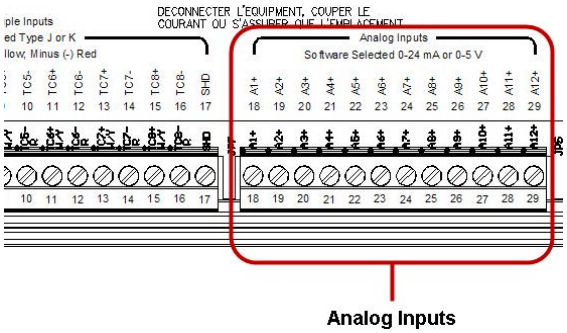
1.1.2 Analog Inputs (AI)

Number of devices: 12

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

There is one screw terminal connector for each analog input.

Terminals 18 to 29 are AI terminals.



Analog Inputs

Thermocouple Inputs (TC)

Number of devices: 8

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

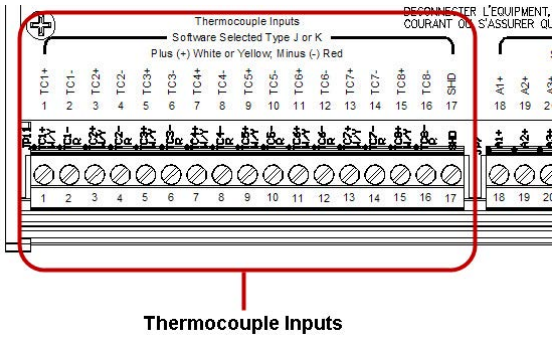
Use ungrounded thermocouples only. Grounded thermocouples are not supported. Errors in readings with grounded thermocouples can be the result of differences in grounding between devices.

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.

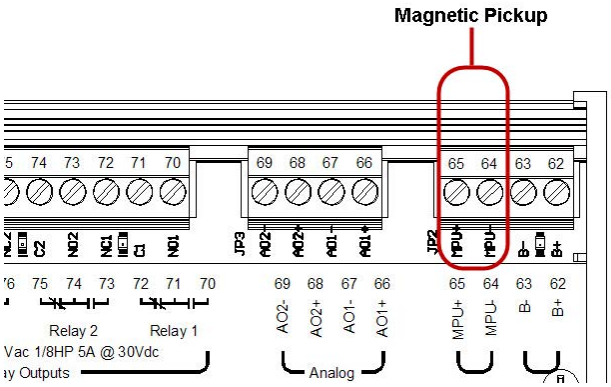
Magnetic Pickup (MPU)

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.



Digital Outputs (DO)

Number of devices: 10

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

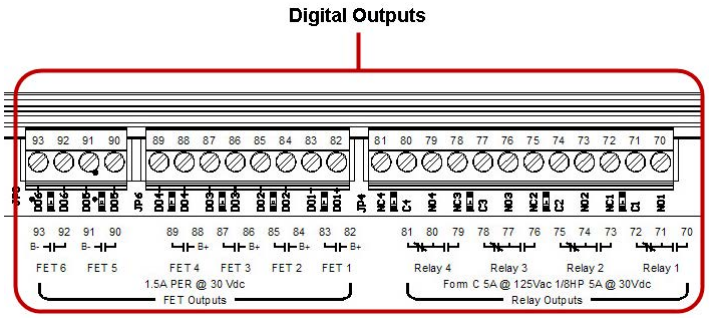
- four (4) relay outputs, form C, dry contacts
- four (4) FETs, source B+ (high speed)
- two (2) FETs, sink B- (high speed)

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

Terminals 70 to 81 are for the four relay terminals.

Terminals 82 to 93 are for the six FET terminals.

Green LEDs give a visual indication of active output signal.



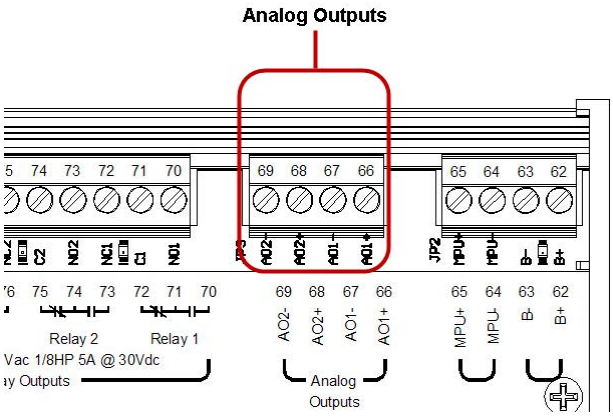
Analog Outputs (AO)

Number of devices: 2

Device types: analog output, 4/20 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.



Hazardous Area Operation

The Centurion certifications:

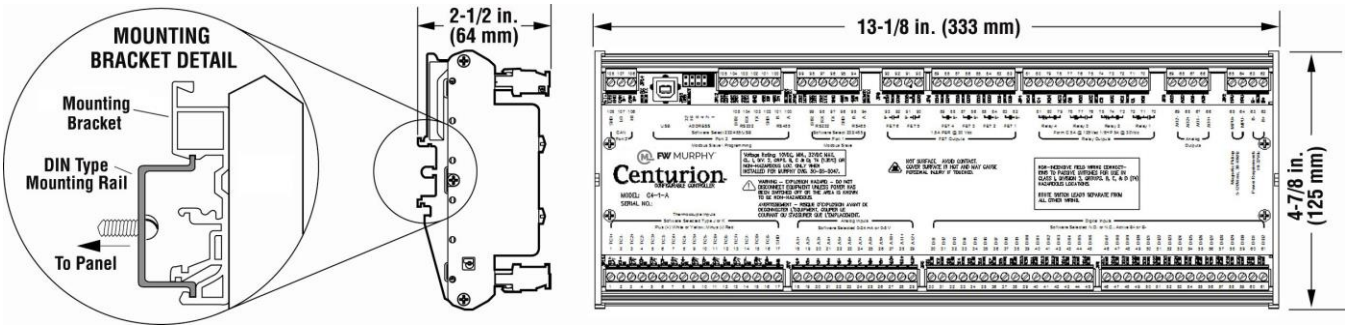
CSA, CLASS 1, DIVISION 2, Groups B, C and D are approved.

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

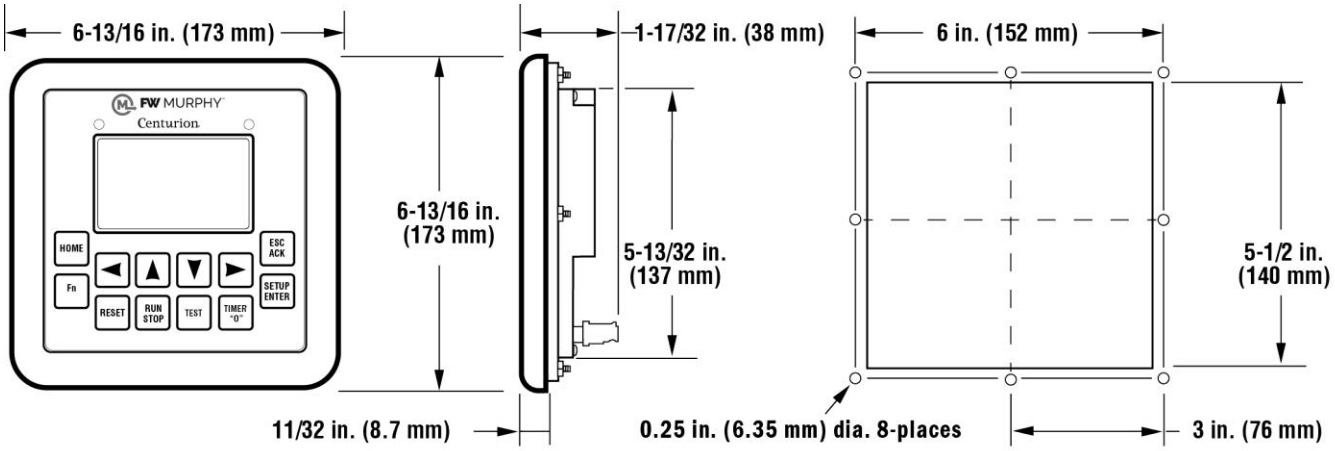
Hardware Installation and Wiring

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.



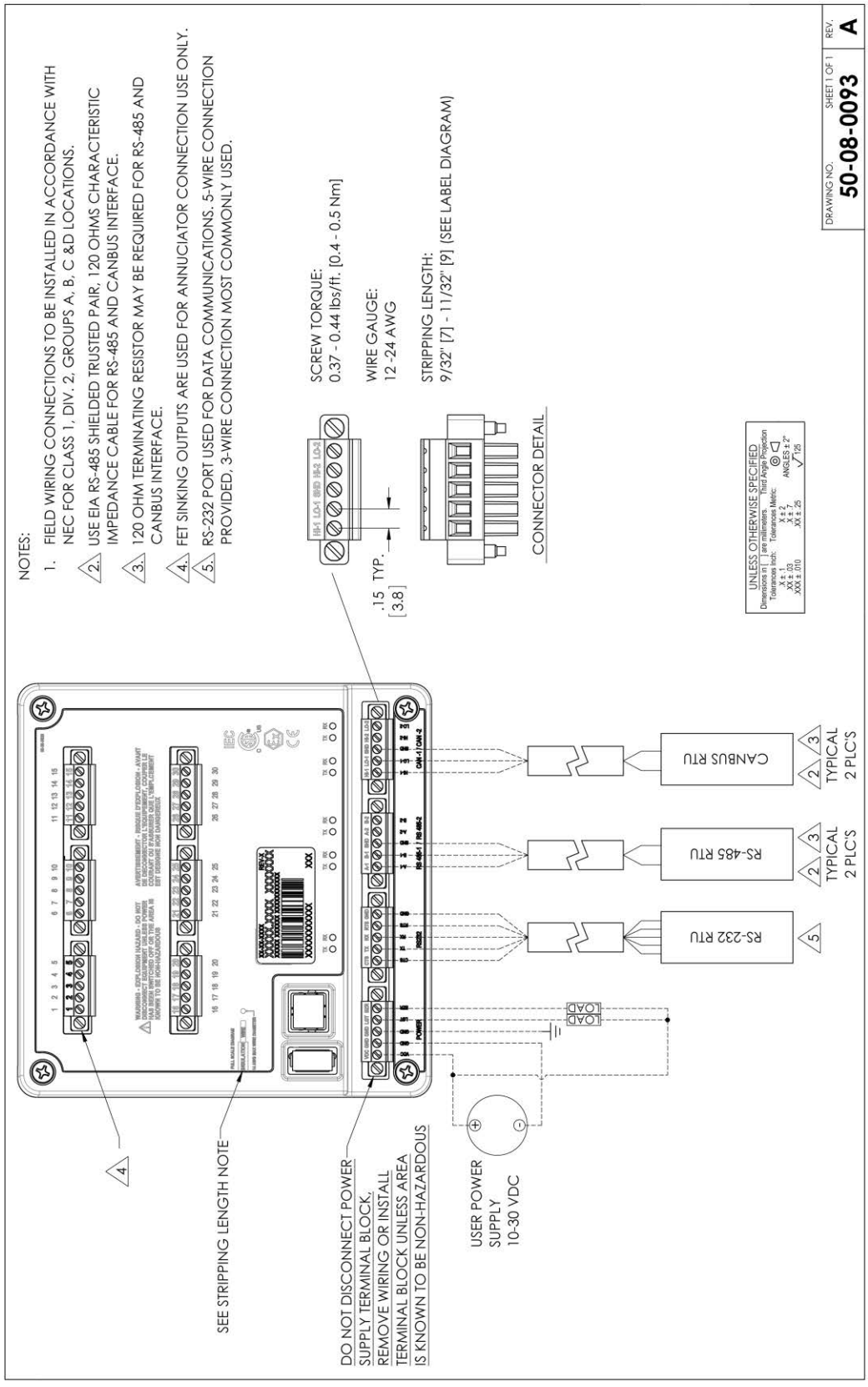
Mounting the Display

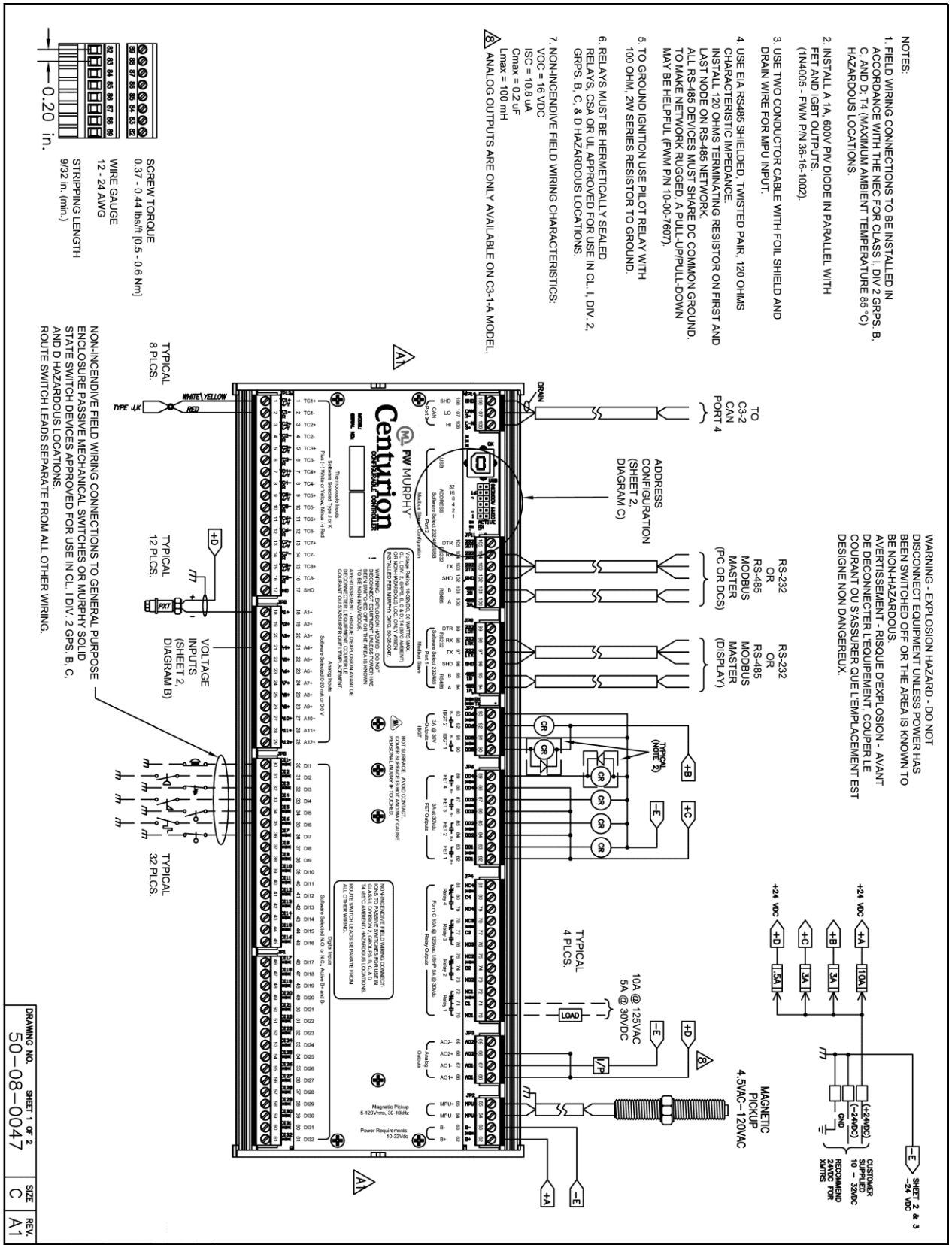


The Centurion display can be mounted in the same hole cutout as the MV-3-C display. Eight studs and star nuts secure the display bezel to the mounting surface.

Backside of MV-5-C showing gasket, studs and tightening sequence

1. Insert the display backside first, from the front side of the panel.
2. Ensure that there is adequate clearance for the edges of the display housing and the back of the case is flush against the outside surface of your panel.
3. Install eight star nuts to the studs from the backside of the panel.
4. Tighten the 5/16” star nuts in sequence to 9 in. lbs. (1 Nm). Do not overtighten.


NOTES:
1. FIELD WIRING CONNECTIONS TO BE INSTALLED IN ACCORDANCE WITH NEC FOR CLASS 1, DIV. 2, GROUPS A, B, C &D LOCATIONS.
2. USE EIA RS-485 SHIELDED TRUSTED PAIR, 120 OHMS CHARACTERISTIC IMPEDANCE CABLE FOR RS-485 AND CANBUS INTERFACE.
3. 120 OHM TERMINATING RESISTOR MAY BE REQUIRED FOR RS-485 AND CANBUS INTERFACE.
4. FET SINKING OUTPUTS ARE USED FOR ANNUCIATOR CONNECTION USE ONLY.
5. RS-232 PORT USED FOR DATA COMMUNICATIONS. 5-WIRE CONNECTION PROVIDED, 3-WIRE CONNECTION MOST COMMONLY USED.
SCREW TORQUE:
0.37 - 0.44 lbs/ft. [0.4 - 0.5 Nm]
WIRE GAUGE:
12 -24 AWG
STRIPPING LENGTH:
9/32" [7] - 11/32" [9] (SEE LABEL DIAGRAM)
.15 TYP.
[3.8]
CONNECTOR DETAIL
UNLESS OTHERWISE SPECIFIED
Dimensions in [ ] are millimeters
Tolerances inch: X ± 1
XX ± .03
XXX ± .010
Tolerances Metric: X ± 1
XX ± .5
XXX ± .25
Third Angle Projection
ANGLES ± 2°
125
DRAWING NO. 50-08-0093
SHEET 1 OF 1
REV. A
SEE STRIPPING LENGTH NOTE
DO NOT DISCONNECT POWER SUPPLY TERMINAL BLOCK, REMOVE WIRING OR INSTALL TERMINAL BLOCK UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS
USER POWER SUPPLY 10-30 VDC
LOAD
LOAD
CANBUS RTU
RS-485 RTU
RS-232 RTU
TYPICAL 2 PLC'S
TYPICAL 2 PLC'S


NOTES:
1. FIELD WIRING CONNECTIONS TO BE INSTALLED IN ACCORDANCE WITH THE NEC FOR CLASS I, DIV 2 GRPS. B, C, AND D; T4 (MAXIMUM AMBIENT TEMPERATURE 85 °C) HAZARDOUS LOCATIONS.
2. INSTALL A 1A, 600V PIV DIODE IN PARALLEL WITH FET AND IGBT OUTPUTS. (1N4005 - FWM P/N 36-16-1002).
3. USE TWO CONDUCTOR CABLE WITH FOIL SHIELD AND DRAIN WIRE FOR MPU INPUT.
4. USE EIA RS485 SHIELDED, TWISTED PAIR, 120 OHMS CHARACTERISTIC IMPEDANCE INSTALL 120 OHMS TERMINATING RESISTOR ON FIRST AND LAST NODE ON RS-485 NETWORK. ALL RS-485 DEVICES MUST SHARE DC COMMON GROUND. TO MAKE NETWORK RUGGED, A PULL-UP/PULL-DOWN MAY BE HELPFUL (FWM P/N 10-00-7607).
5. TO GROUND IGNITION USE PILOT RELAY WITH 100 OHM, 2W SERIES RESISTOR TO GROUND.
6. RELAYS MUST BE HERMETICALLY SEALED RELAYS, CSA OR UL APPROVED FOR USE IN CL. I, DIV. 2, GRPS. B, C, & D HAZARDOUS LOCATIONS.
7. NON-INCENDIVE FIELD WIRING CHARACTERISTICS: VOC = 16 VDC ISC = 10.8 uA Cmax = 0.2 uF Lmax = 100 mH
8 ANALOG OUTPUTS ARE ONLY AVAILABLE ON C3-1-A MODEL.
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 DESIGNE NON DANGEREUX.
SCREW TORQUE 0.37 - 0.44 lbs/ft [0.5 - 0.6 Nm]
WIRE GAUGE 12 - 24 AWG
STRIPPING LENGTH 9/32 in. (min.)
0.20 in.
NON-INCENDIVE FIELD WIRING CONNECTIONS TO GENERAL PURPOSE ENCLOSURE PASSIVE MECHANICAL SWITCHES OR MURPHY SOLID STATE SWITCH DEVICES APPROVED FOR USE IN CL. I DIV. 2 GPS. B, C, AND D HAZARDOUS LOCATIONS.
ROUTE SWITCH LEADS SEPARATE FROM ALL OTHER WIRING.
TYPICAL 8 PLCS.
TYPICAL 12 PLCS.
TYPICAL 32 PLCS.
VOLTAGE INPUTS (SHEET 2 DIAGRAM B)
ADDRESS CONFIGURATION (SHEET 2 DIAGRAM C)
TO C3-2 CAN PORT 4
RS-232 OR RS-485 MODBUS MASTER (PC OR DCS)
RS-232 OR RS-485 MODBUS MASTER (DISPLAY)
TYPICAL 4 PLCS.
10A @ 125VAC 5A @ 30VDC
MAGNETIC PICKUP 4.5VAC–120VAC
+24 VDC
CUSTOMER SUPPLIED 10 - 32VDC
RECOMMEND 24 AWG FOR XMTRS
SHEET 2 & 3 -24 VDC
Centurion
FW MURPHY
DRAWING NO. 50–08–0047
SHEET 1 OF 2
SIZE C
REV. A1

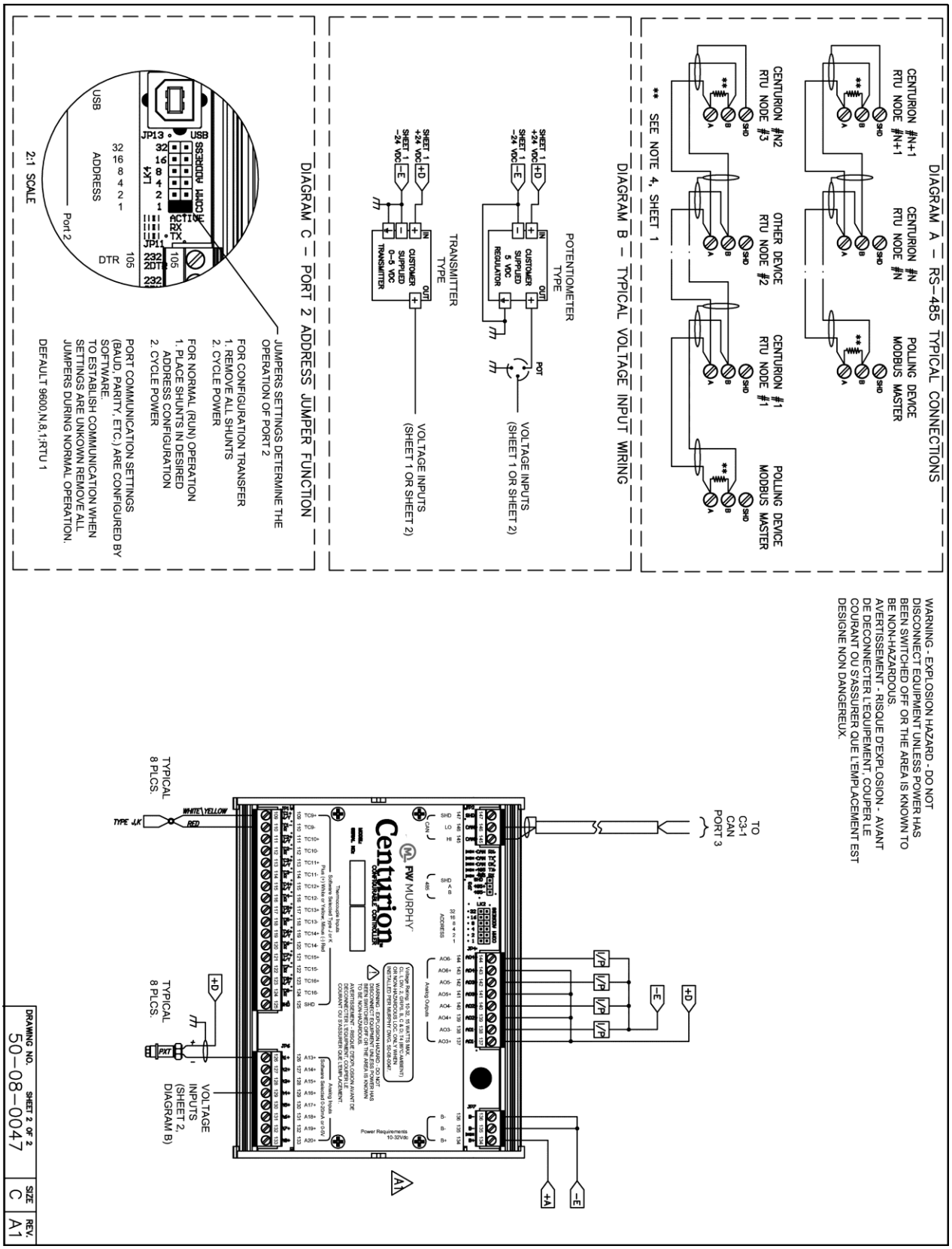
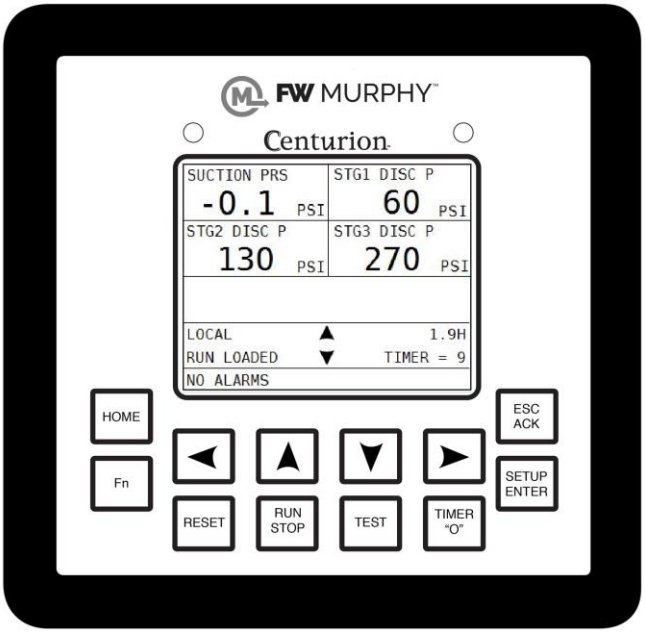


DIAGRAM A – RS-485 TYPICAL CONNECTIONS
CENTURION #N+1 RTU NODE #N+1
CENTURION #N RTU NODE #N
POLLING DEVICE MODBUS MASTER
CENTURION #N2 RTU NODE #3
OTHER DEVICE RTU NODE #2
CENTURION #1 RTU NODE #1
POLLING DEVICE MODBUS MASTER
** SEE NOTE 4, SHEET 1
DIAGRAM B – TYPICAL VOLTAGE INPUT WIRING
POTENTIOMETER TYPE
TRANSMITTER TYPE
VOLTAGE INPUTS (SHEET 1 OR SHEET 2)
DIAGRAM C – PORT 2 ADDRESS JUMPER FUNCTION
JUMPERS SETTINGS DETERMINE THE OPERATION OF PORT 2
FOR CONFIGURATION TRANSFER
1. REMOVE ALL SHUNTS
2. CYCLE POWER
FOR NORMAL (RUN) OPERATION
1. PLACE SHUNTS IN DESIRED ADDRESS CONFIGURATION
2. CYCLE POWER
PORT COMMUNICATION SETTINGS (BAUD, PARITY, ETC.) ARE CONFIGURED BY SOFTWARE.
TO ESTABLISH COMMUNICATION WHEN SETTINGS ARE UNKOWN REMOVE ALL JUMPERS DURING NORMAL OPERATION.
DEFAULT 9600,N,8,1:RTU 1
2:1 SCALE
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 DESIGNE NON DANGEREUX.
TO C3-1 CAN PORT 3
TYPICAL 8 PLCS.
TYPE J,K
WHITE\YELLOW
RED
VOLTAGE INPUTS (SHEET 2, DIAGRAM B)
DRAWING NO. 50-08-0047
SHEET 2 OF 2
SIZE C
REV. A1

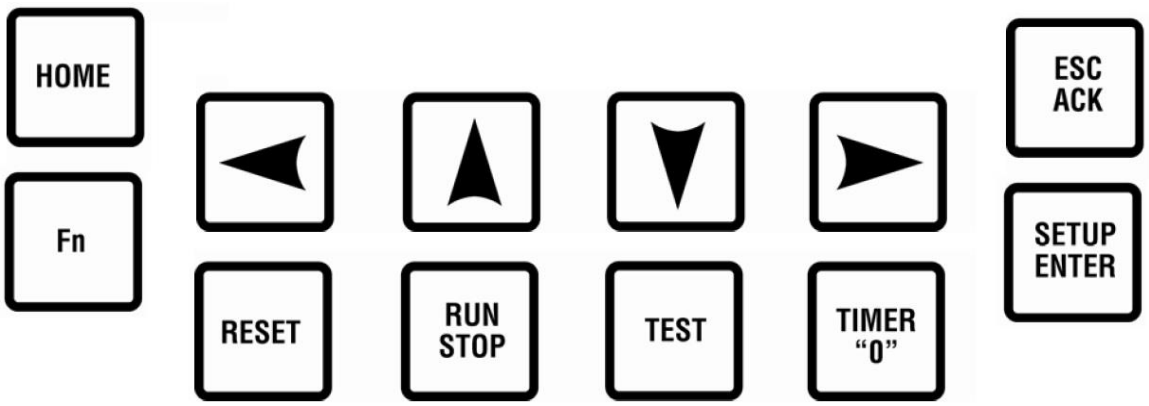
Using the MV-5-C Display



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

Keypad Description and Navigation

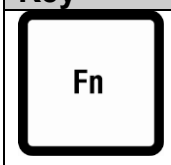
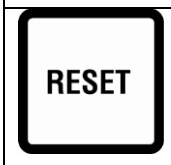


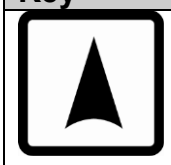
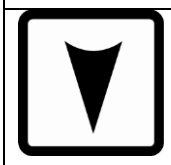
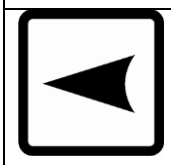
The keypad for the display has 12 keys. The following table describes the keys and their function for each of the three screen types:

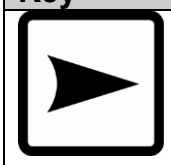
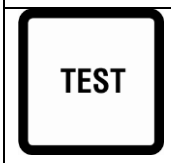
- Operating status screens
- Setup screens (password required)
- Edit screens (password required)

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	**HOME**	**Operating Status Screen** Allows the user to get to the first line of the current screen, if pressed again, to get to the default operating status screen. **Set Up Screen** Allows the user to get to the first line of the current screen, if pressed again, to get to the first setup screen. **Edit Screen** No associated action.
ESC ACK	**ESC/ACK**	**Operating Status Screen** Acknowledges all active messages and alarms displayed in the active alarm screen. **Set Up Screen** Exit Setup mode. **Edit Screen** Exit without saving changes to the current configuration.

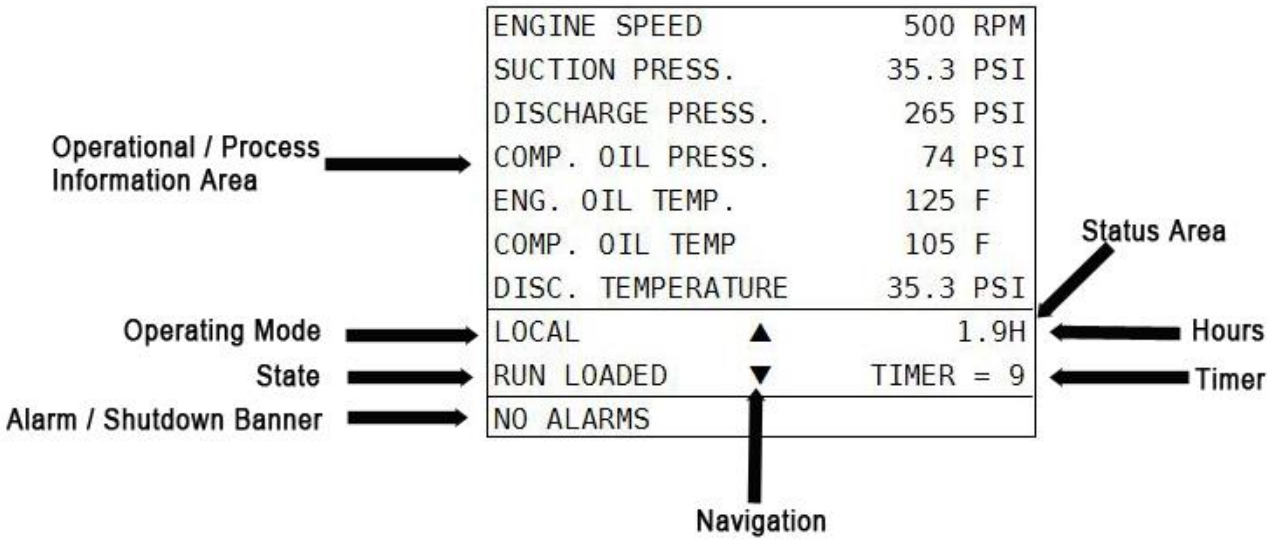
Key	ID	Description
	**Fn (Function Key)**	**Operating Status Screen** Enter “Function mode” and display a dialog box with additional available functions. Automatically cancels upon moving to the next mode or if no subsequent function is chosen within five seconds. **Set Up Screen** No associated action. **Edit Screen** No associated action. **Control Loop Screens** Press FN to toggle control loop mode between Auto and Manual
	**SETUP/ENTER**	**Operating Status Screen** Enter Setup Mode. **Set Up Screen** Enter Edit mode or Submenu. **Edit Screen** Accept and save changes made to a current parameter before exiting edit mode.
	**RESET**	**Operating Status Screen** Reset any active timers and alarms/faults. **Set Up Screen** No associated action. **Edit Screen** No associated action.
	**RUN/STOP**	**Operating Status Screen** Initiate or cancel a start sequence. **Set Up Screen** Cancel a start sequence. **Edit Screen** Cancel a start sequence.

Key	ID	Description
	**ARROW UP**	**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). **Set Up Screen** Scroll up one line. Automatically repeats if held down continuously until reaching the first line. **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. Toggle the value in a list of options if editing a non-numeric value. **Control Loop Screens** Press this in Manual mode to increment the output manually.
	**ARROW DOWN**	**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). **Set Up Screen** Scroll down one line. Automatically repeats if held down continuously until reaching the final line. **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. Toggle the value in a list of options if editing a non-numeric value. **Control Loop Screens** Press this in Manual mode to decrement the output manually.
	**ARROW LEFT**	**Operating Status Screen** Display previous screen. Automatically repeats if held down continuously until reaching the first screen. **Set Up Screen** Display previous screen. This key has no action when in a submenu. **Edit Screen** Move the cursor left one position when a numeric value is displayed.

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

Display Context

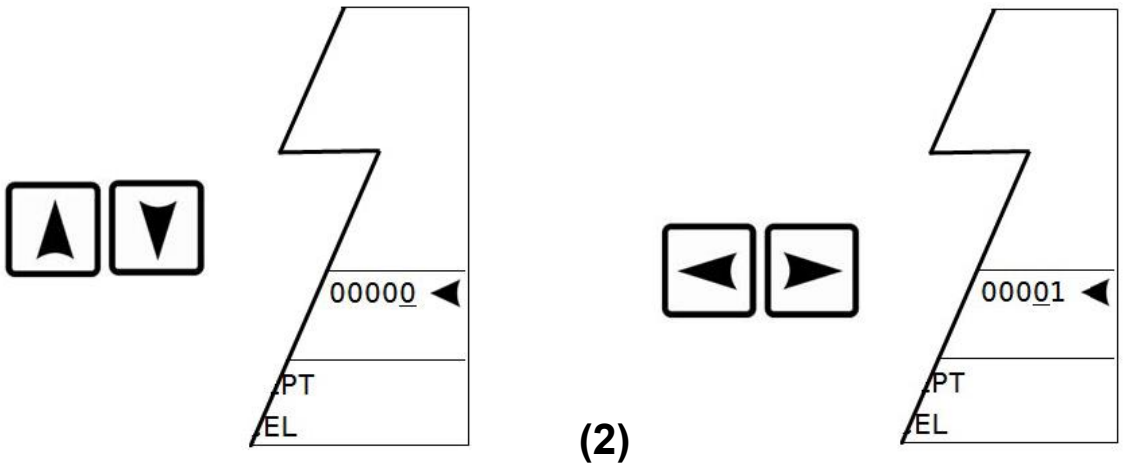
The graphic LCD displays are organized around operating status screens and setup screens. The actual number of status screens will be related to the number configured for the controller. Operating status screens of the Line-by-Line type have seven (7) lines visible at a time. Setup screens have five (5) lines visible at a time. Up and down navigation arrows indicate that more lines are available on the page. Navigation between screens is accomplished by pressing the left or right arrow keys.



> **NOTE**: LEDs on the keypad overlay are used to indicate status also. The AMBER LED (left corner) indicates active alarms. The RED LED (right corner) indicates a shutdown.

Numeric Data 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 between 0 and 9. To edit another position, simply use the LEFT/RIGHT **(2)** arrow keys to move the cursor to that position and repeat the edit process until the desired number is displayed.



(1) **(2)**

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.

Non-numeric Data Entry

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.

> **NOTE**: A select few menu parameters change in real-time when the value is changed. These will be noted in this document.

Operational Screens

The display offers a number of operational displays used for indication of the current values for the signals monitored by the system. 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.

Default Operating Screen

After turning on the power, the user will view the FW Murphy logo screen for two seconds then switch to the default operating screen configured for the system. The Centurion Configuration Tool software allows users to configure up to nine (9) screens with controller input signal 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.

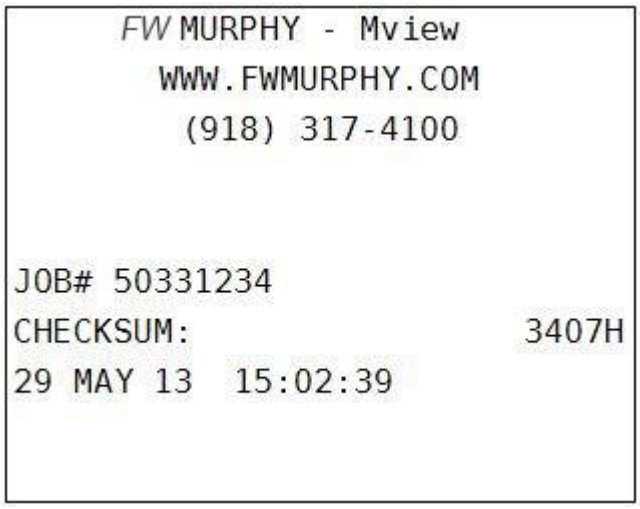
c) Custom PID up to 6 PID screens.

For more information on configuring the optional screens through the Centurion Configuration Tool, please refer to the Configuration Tool Quick Start Guide.

FW Murphy Logo Screen

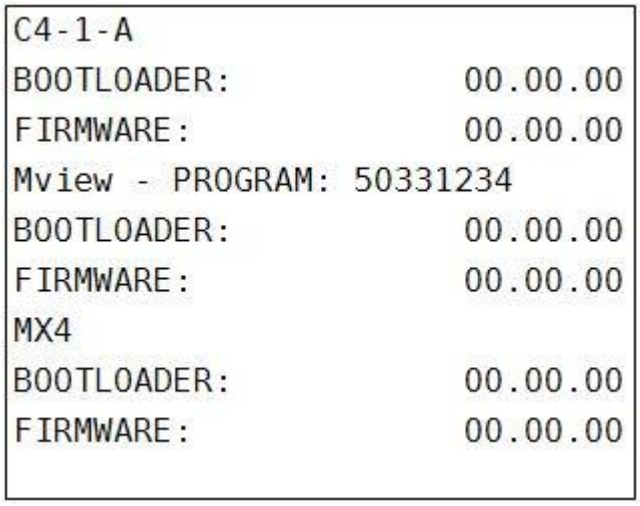
The FW Murphy logo is the first screen in the sequence of display screens and can be viewed by holding down the left arrow until scrolling left ceases.

Corporate and Configuration Information Screen



Following the FW Murphy Logo screen is the FW Murphy corporate contact information which also lists configuration name, checksum and date/timestamp for the configuration loaded in the controller. Any configuration changes subsequent to the factory shipment will be indicated by a unique checksum and new date/timestamp.

Bootloader and Firmware Information Screen



This screen provides information to FW Murphy Technical Support staff which lists the bootloader and firmware versions for the core module, the MView display and the expansion module (if used).

Digital Input Status

DIGITAL INPUT STATUS									
X= CLOSED/ON						0=OPEN/OFF			
1	X	0	0	0	0	0	0	0	8
9	0	0	0	0	0	0	0	0	16
17	X	0	0	0	0	0	0	0	24
25	0	0	0	0	0	0	0	0	32
DIGITAL OUTPUT STATUS									
1	X	0	0	0	0	0	0	0	8
9	0	0	0	0	0	0	0	0	16
NO ALARMS									

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

O = Open

X = Closed

Shutdown History Screen

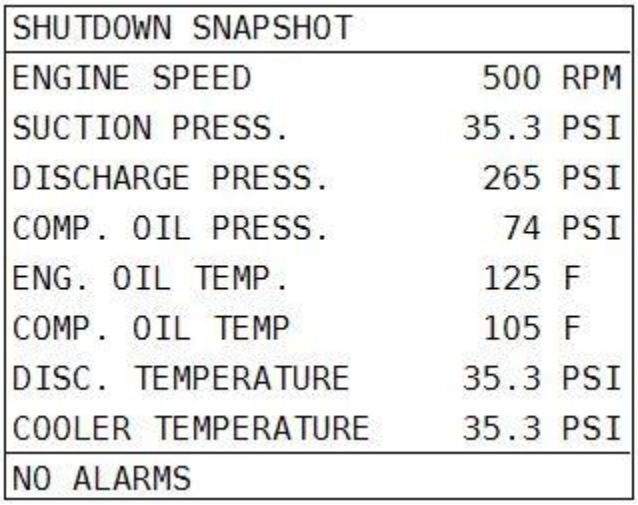
SHUTDOWN HISTORY	20
MX4 COM FAILURE	1
15:31:22	
LOST C OIL PRS XMTR	2
12:18:39	
COMPRESSOR OIL LVL LOLO	3
12:17:24	
HI COMPRESS OIL TMP	4
10:12:00	
NO ALARMS	

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 number displayed in the top right corner indicates how many entries are in the list. The newest shutdown will always be number one, and it will push the older shutdowns further down the list.

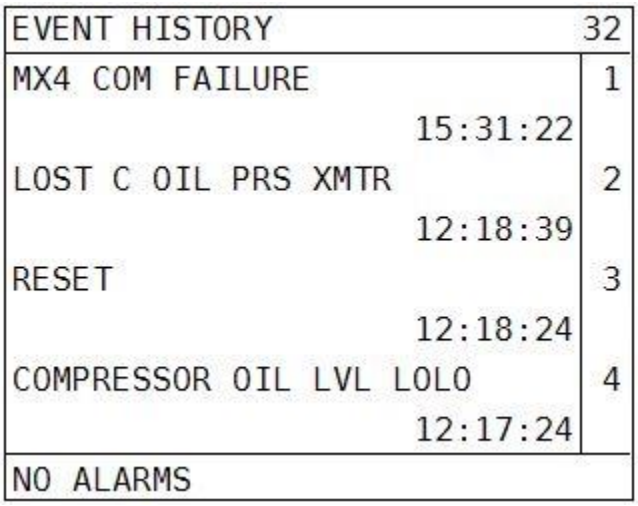
Shutdown Snapshot



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.

> **NOTE:** Only the first two line-by-line screens configured will be captured. If no line-by-line custom screens are configured, the shutdown snapshot will not function.

Event History Screen



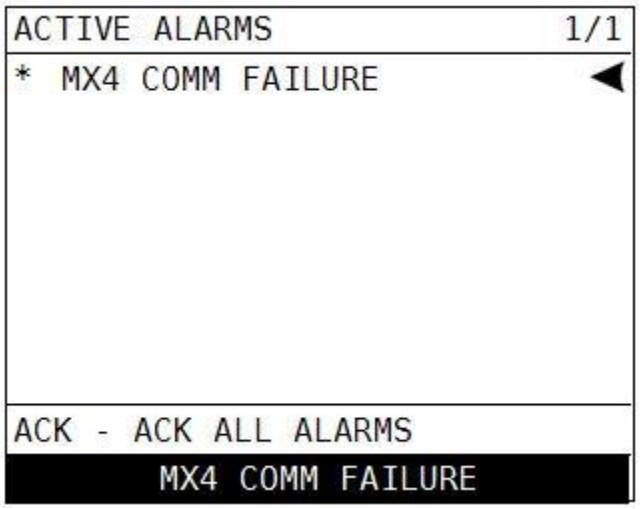
The history of the last 32 events is displayed on this screen, with the most recent at the top of the list and the oldest at the bottom.

The number displayed in the top right corner indicates how many entries are in the list.

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

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

Active Alarms Screen



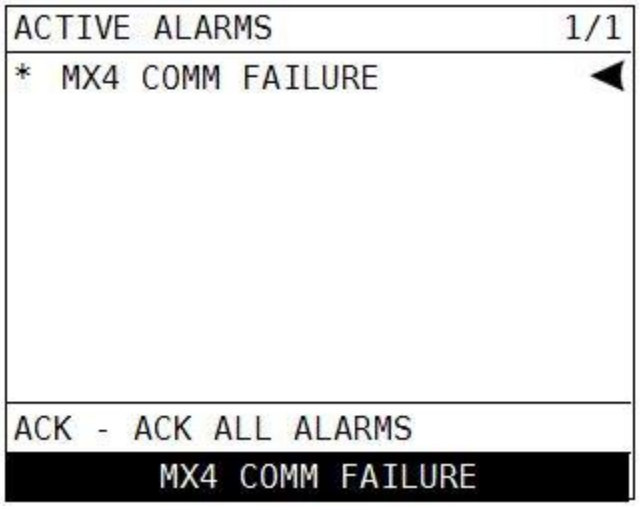
All active alarms and warnings will be displayed on this screen.

Unacknowledged alarms will be preceded by an asterisk, and acknowledged alarms will clear the asterisk.

Pressing ACK on this screen will acknowledge all active alarms.

The top right corner will indicate the number of alarms and which line the cursor is currently on. Example: 3/10 indicates 10 alarms, and the cursor is on line 3 of the list. A maximum of twenty (20) active alarms will be displayed.

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



Alarm / Shutdown Banner

This screen shows the alarm / shutdown annunciation as it will appear on most Operating Status screens.

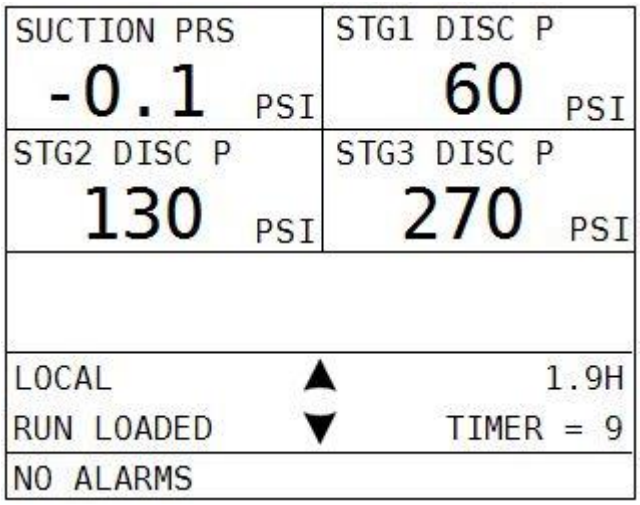
The message(s) will be visible at the bottom line of the status screen area and then briefly clear once a second.

This will continue until alarms are acknowledged and/or shutdowns are cleared.

If there is more than one unacknowledged alarm active, each alarm will be displayed for one second each until acknowledged.

Pressing the Fn key followed by the ACK key will switch to the active alarms screen.

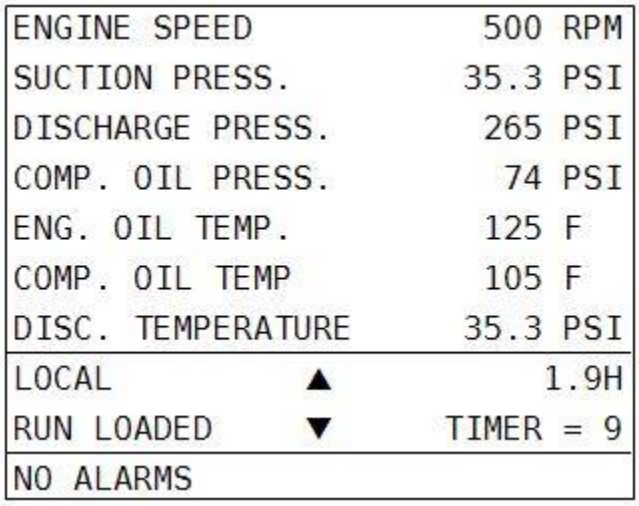
Gage Display



This is an example of a custom gage display.

This display provides larger characters for easier viewing as well as a means to prominently display items of interest.

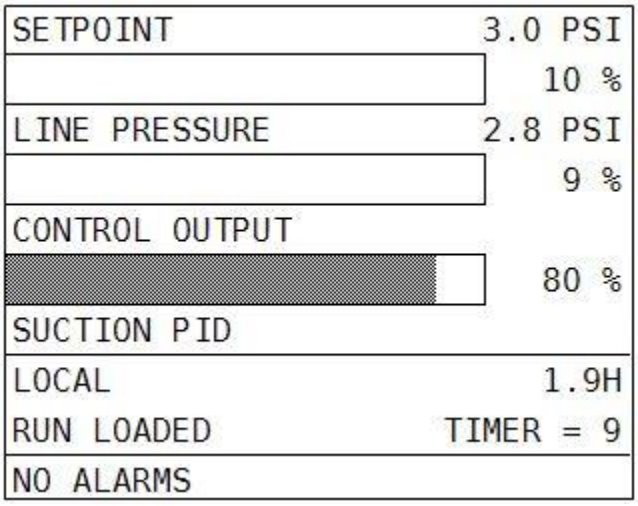
Line-By-Line



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

If the parameters do not fit in the viewable area of the screen, up/down arrow icons at the bottom of the screen indicate the ability to scroll up or down to see additional parameters.

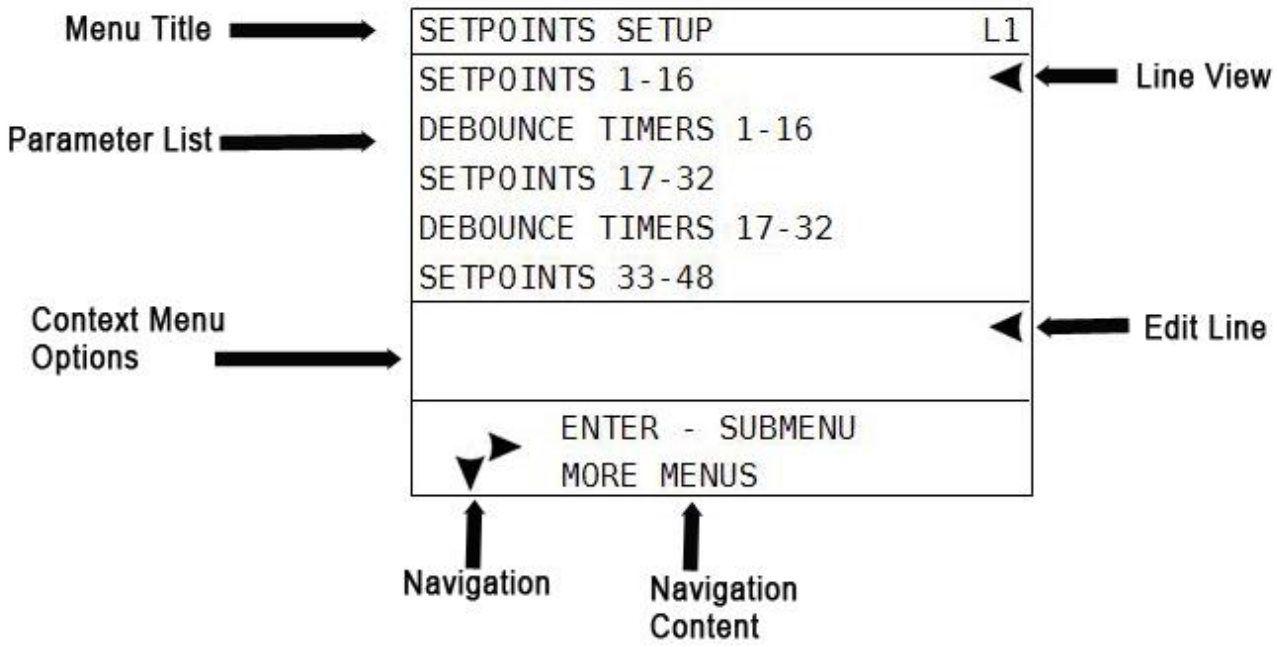
Custom PID Screen



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.

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 READ ONLY, ENTER – EDIT, ENTER – ACCEPT, ESC – CANCEL, MORE MENUS and ENTER - SUBMENU.



Password Screen

Some settings are password protected, including the setup screens.

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

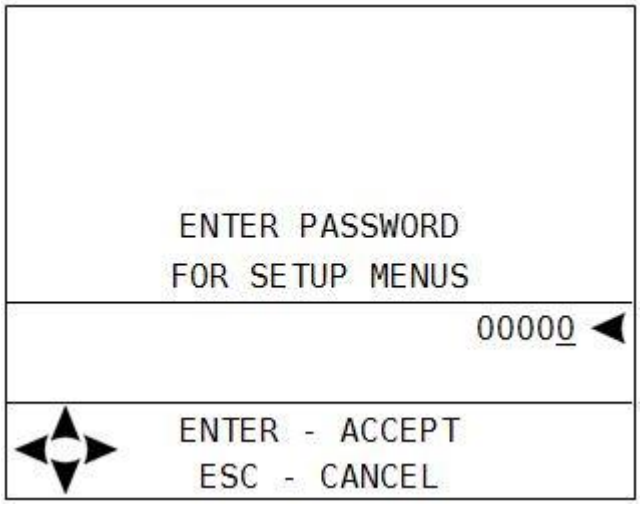
The password need only be entered once during any editing session. The password is timed-out automatically three minutes after the editing session is exited.

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 Centurion Configuration Tool software. Each digit can range from zero to nine (except the first digit on the left).

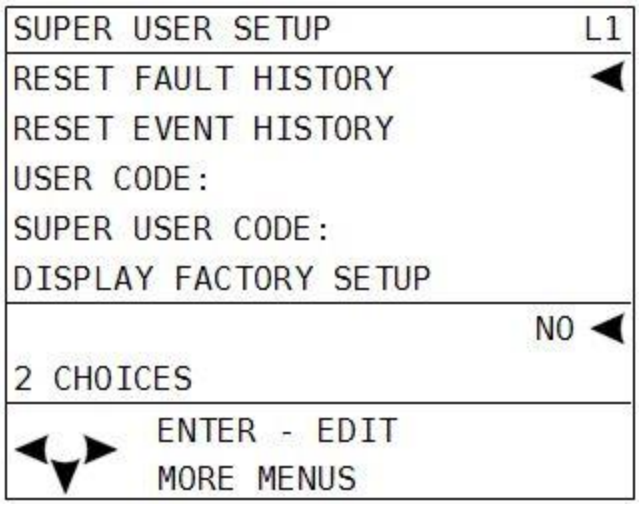
The user will not be allowed to increase the selected digit if it would result in exceeding range limits.

> **NOTE:** If the Standard password is not zero and a password of all zeroes is entered, the user will have view only access.
>
> **NOTE:** After three 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.



There are two 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 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 cannot be the same as the standard password and cannot be set to zero.

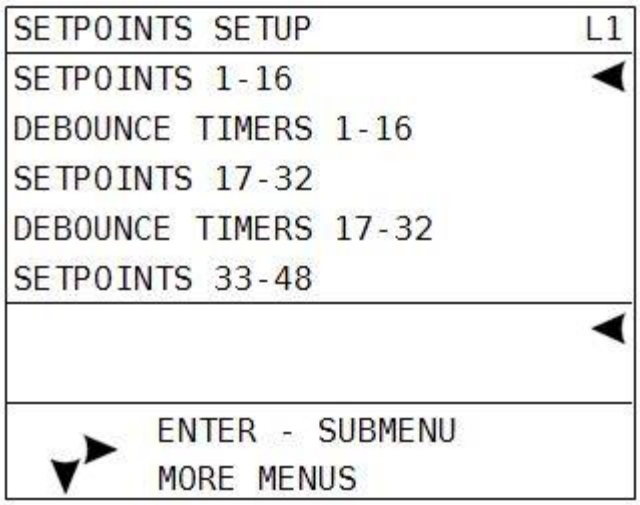
Setpoints Setup

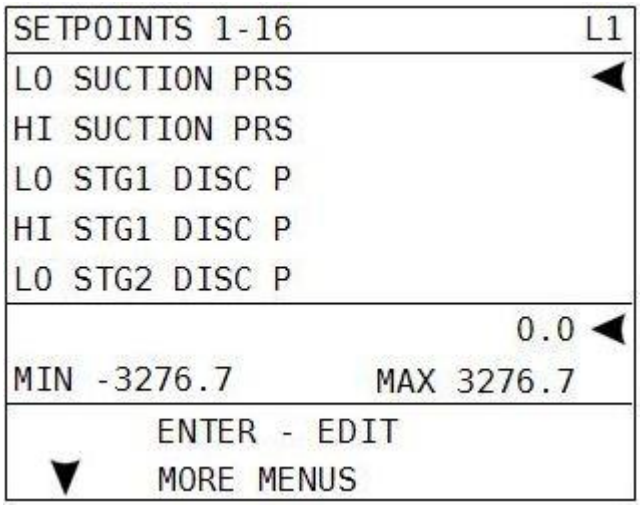
Up to 128 setpoints may be configured in the system by the Centurion Configuration Tool software. The values for the setpoints are user editable.

Setpoints are data entries used in greater than or less than comparisons of signals based on variable input types such as MPU, analog or thermocouples. The setpoint is a threshold, exception or any other out-of-limit event that can be configured to take a required 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)





To edit a configured setpoint:

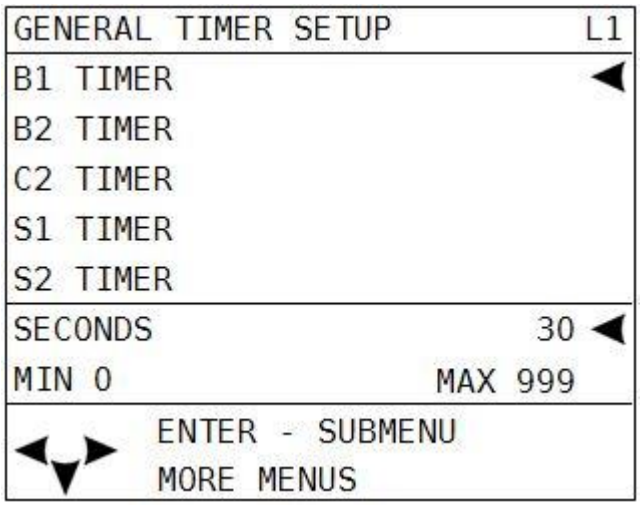
a) Select the setpoint group submenu that requires editing. The configuration listing provided will include a listing of all setpoints and their respective number.

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

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.

> **NOTE:** Setpoints 1-16 and 17-32 can also have debounce timing applied as a signal filter. The setpoint comparison must be sustained through this time delay to see the setpoint as true. This time filter can be used to ignore transients of short duration.

General Timer Setup



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

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 and runs in the running States of the controller operation. 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.

C2: The delay after reaching the Run Loaded State that allows Class C2 events to arm. Class C events require a clear reading sustained for 2 seconds to arm. This time used as stabilization time for any manual loading to be operated and the load to stabilize on the machine.

S1-4: Users have up to four (4) options to assign additional special global 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.

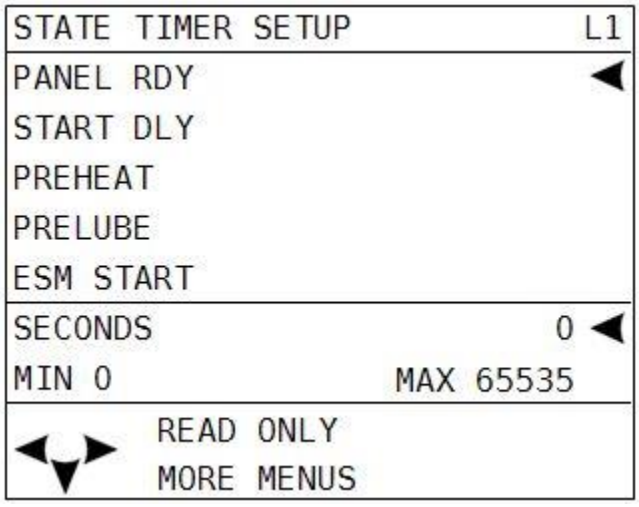
Test: Time given to allow for maintenance testing of end devices without triggering a fault or shutdown condition. The timer initiates when switched to test mode.

Ignition 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.

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.

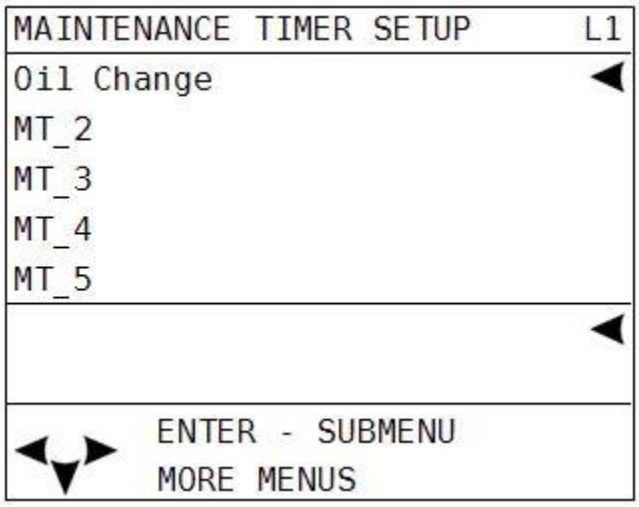
State Timer Setup



User may edit all state timers if marked in use. State 1 – Panel Ready and 23 – Shutdown are Read Only and cannot be edited. The states used for a given application are configured by the Centurion Configuration Tool software.

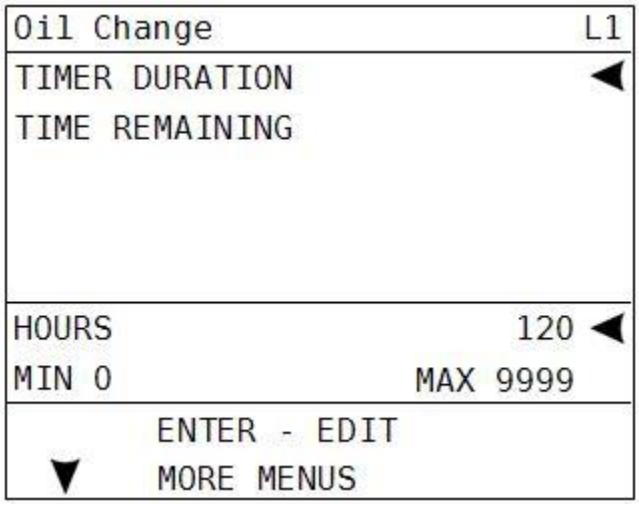
When the state timeout value is reached, the state logic proceeds to the next In Use state. A state timeout may also be configured to trigger a fault event such as a prelube permissive failure; however, the operation depends on the configuration.

Maintenance Timer Setup



The user may access and edit the ten (10) maintenance duration presets and time remaining settings, if used by the configuration. All maintenance timer units are in hours.

> **NOTE:** These are configured by the Centurion configuration tool software and must be manually initialized in Centurion display.



When the timer reaches 0 hours an event may be configured to alarm or generate a message event that maintenance is required.

Start / Restart Maintenance Timers

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

Control Loop Setup

Users may view and edit up to six (6) configured control loops. The settings on this page will differ depending on the type of control configured for the system. The control loops all operate on the principle of a 0-100% calculated output with special considerations for the Digital loop types. Four control loop types are possible.

a) Analog and Digital types use a closed loop PID calculation to calculate the output value, in which a process variable is maintained at a desired setpoint with the PID generating a 0-100% corrective action to the process. The ultimate goal of the PID is to reduce the error to zero effectively maintaining the control setpoint (e.g. speed, load, pressure). PID calculations attempt to model the process being controlled by allowing tuning for the dynamics of the process based on the present (Proportional), past (Integral) and future (Derivative) error of the loop. The controller uses the ISA PID control calculation method (dependent PID) as follows:

$$Out = Kp(Error + Ki\int(error)dt + Kd \times {}^{dError}/_{dt})$$

b) 2 Pulsed Digital type uses a closed loop pulse equation that calculates the On time for either the increase or decrease digital output based on the control error.

Out = (error x Proportional) + 50%

The ultimate goal of the loop is to reduce the error to zero effectively maintaining the control setpoint (e.g. speed, load, pressure). The control algorithm is centered at 50% output. At 50% output, neither digital output is on. The control loop will either add to 50% or subtract from 50% to pulse the increase or the decrease outputs. Larger deviation from 50% will result in longer output pulses.

c) 4-Step Load turns on 4 digital outputs in a 4-step staggered loading scheme with time delays in between the loading steps. The ultimate goal of the loop is to reduce the error to zero while maintaining the control setpoint (e.g. speed, load, pressure). The control loop will turn on the outputs in succession, and the 0-100% control value will step up from 0 to 20%, 40%, 60% and 80% as the time delays expire. If the deadband is reached, the time delays will reset, and no change in control will occur.

d) Open Loop calculates an analog output value using a linear scaling based on a feedback input. In this case, there is no closed feedback and no setpoint to maintain. There are 2 coordinates specified in engineering units for the process being controlled, one for minimum % output and one for maximum % output. A linear scaling function will be applied using these 2 values to range the output between the specified minimum and maximum % settings.

e) Common setpoints to Analog/Digital, 2 Pulsed Digital and 4-Step Load loop types. Open Loop Ramp loop type shares only those setpoints marked with (*).

1. Auto/Manual Mode*: Set the loop to Auto to enable the control. Set to Manual to allow user entry for the control output as a 0.00-100.00% value.

2. Setpoint: Assign the desired value that is to be maintained by the loop. Depending on configuration this may be a variable setpoint based on analog input, not user editable from the display.

3. Deadband: Assign a value around the setpoint during which the loop will not take any corrective action.

4. Minimum Output*: Set the minimum limit on the calculated value during auto control

5. Maximum Output*: Set the maximum limit on the calculated value during auto control.

6. Loop Update time: Loop calculation frequency. This time should be set no shorter than the update rate for the feedback reading.

7. Max Rate Of Decrease/Increase: This is a maximum slew rate setting for the output change per loop update time.

8. Set Output % (Manual) *: This is the control output value data entry for manual mode.

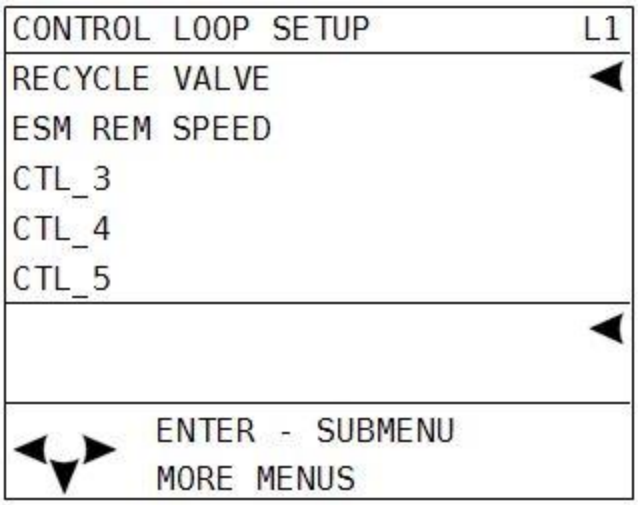
9. Override 1-3 Ramp time*: Set the interval used to modify the calculated output when a configured override signal is active.

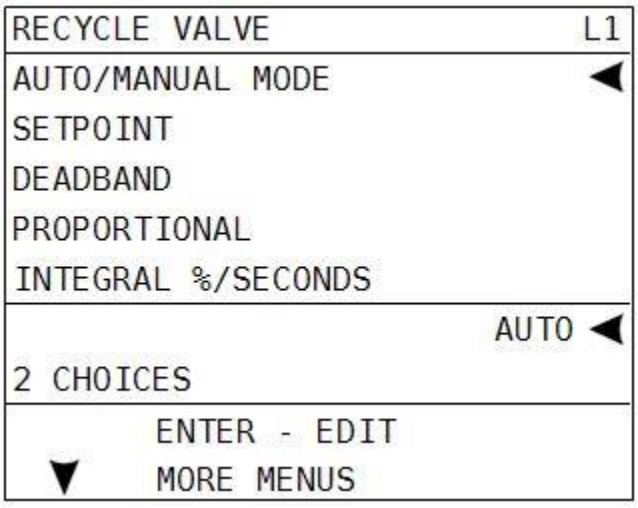
10. Override 1-3 Change %: Set the amount of change either positive or negative required to the calculated output while a configured override signal is active.

> **NOTE:** Override settings are only used when there is a configuration for overriding the control loop with another process variable. Each control loop may have up to 3 control loop override settings based on setpoint or digital inputs signals going true and false.

11. Display Loop Bar Graph*: Set to yes to show a bar graph page for the control loop as it operates.

12. Ref Line Select*: Setting to select any value to be shown on the Display Loop Bar Graph in addition to the setpoint, feedback and control output values. This setting is useful for showing the process value of a different analog, thermocouple or speed input that may be affected by changes to the PID output. Select from available analog, thermocouple or speed inputs or None to disable the Reference Line Select feature.





a) Analog/Digital PID loop specific setpoints:

1. Proportional: Proportional gain tuning for the control process.

2. Integral: Integral time constant (%/sec) tuning for the control process. Integration adjusts the output value on the accumulated of the error over time.

3. Derivative: Derivative time (% seconds) tuning for the control process. Derivative adjusts the output value based on the rate of change of the error over time.

b) 2 Pulse Digital loop specific setpoints:

1. Proportional: Proportional number multiplied by the error to result in the on time for the pulse. Larger numbers here will result in longer on times for the pulse at a given error.

2. Inc/Dec Max On Time 1/20s: Set the maximum on times for the calculated on time of the pulse. This is a clipping value applied to the calculated result.

3. Inc/Dec Sample Time 1/20s: Set the fixed off time between pulses. This should be set long enough to allow the results of the previous pulse to have effect on the process before a new pulse is generated.

4. Inc/Dec Xover On Time 1/20s: Set the fixed on pulse that is generated when the control changes from increasing to decreasing or vice versa. This is optional and typically used to prime hydraulic controls to reverse direction.

5 Inc/Dec Xover Off Time 1/20s: Set the fixed off pulse that is generated when the control changes from increasing to decreasing or vice versa. This is optional and typically used to prime hydraulic controls to reverse direction.

c) 4 Step Load loop specific setpoints:

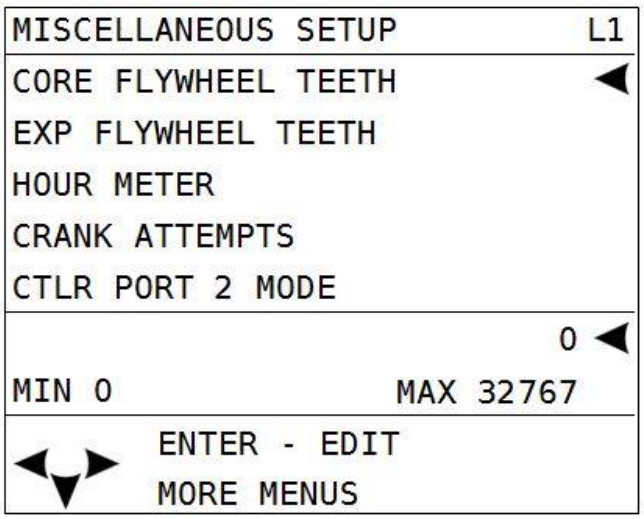
1. Inc/Dec Step Time Sec: These is the time delay between loading steps turning on or off as the loop attempts to reach the setpoint.

d) Open Loop Ramp specific setpoints:

1. Input For Min % Out: This is the engineering unit value for the loop input that will cause the Minimum % output to be calculated. This value will be a pressure, temperature, RPM or other variable signal that controls the output directly.

2. Input For Max % Out: This is the engineering unit value for the loop input that will cause the Maximum % output to be calculated. This value will be a pressure, temperature, RPM or other variable signal that controls the output directly.

Miscellaneous



a) Core/Expansion Flywheel Teeth:
Engine: Define a value for flywheel teeth (Pulses Per Revolution) used to calculate RPM.
Motor: When setpoint set to zero, crank attempts becomes # of starts per hour for electric motor applications.

b) Hour Meter (0.0-999999.9): Reset or preset the internal hour meter.

c) Crank Attempts (1-16):
Engine: Define a value for number of crank attempts after which an over-crank sequence signal will be triggered in the system. If the configuration includes an Overcrank event, it will be triggered by this signal.
Motor: Define a value for number of motor start attempts per hour after which an excess start attempts will be triggered in the system. If the configuration includes an Overcrank/Excess starts event, it will be triggered by this signal.
d) Controller RTU Address (1-247): Provide the value for the Modbus address for port 1 on the C4-1 board. The factory default is 1.

NOTE: Ctrl Port 1 (on the C4-1) settings are reserved by the configuration for the connected display.

e) Ctrl Port 2 Mode: Select communication port 2 as RS232 or RS485.

f) Ctrl Port 2 Reply Delay (0-65535): Optional time delay for the Modbus response.

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

NOTE: All ports use no parity, 8 data bits, 1 stop bit:

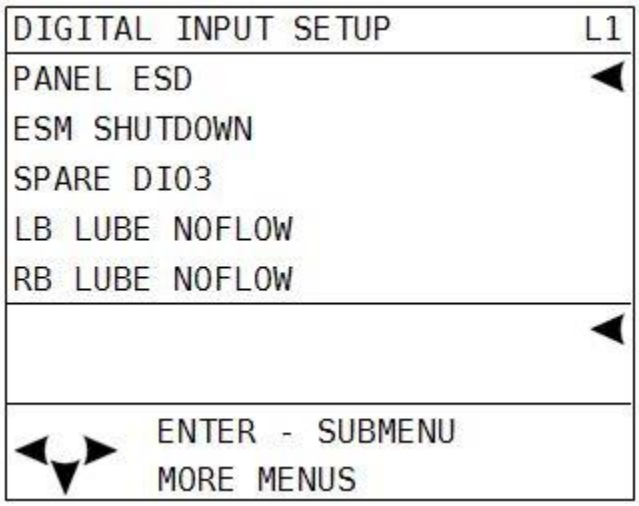
WARNING: The following cold temperature offset values should only be adjusted by personnel with a full working knowledge of the Centurion in conjunction with calibrated reference equipment.

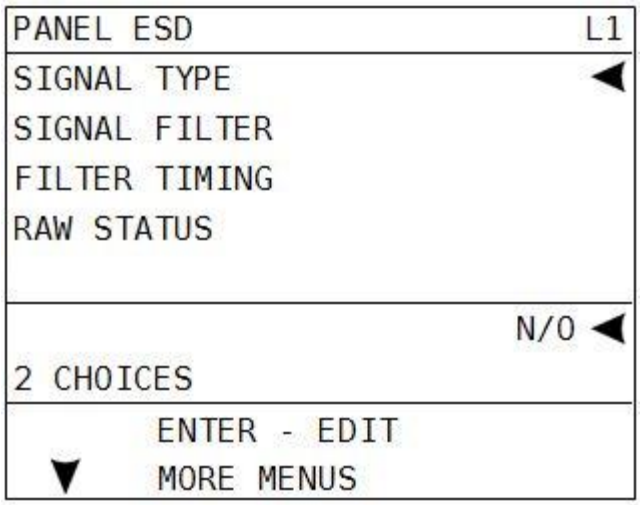
h) Core CJ#1/2 Temp Offset: Enter a non-zero value for temperature adjustment in tenths of a degree to offset the temperature readings. CJ#1 sensor is used for thermocouple inputs 1-4. CJ#2 sensor is used for thermocouple inputs 5-8.

i) Exp CJ#1/2 Temp Offset: Enter a non-zero value for temperature adjustment in tenths of a degree to offset the temperature

readings. CJ#1 sensor is used for MX4 thermocouple inputs 1-9. CJ#2 sensor is used for thermocouple inputs 10-19.

Digital Input Setup





For all configured digital inputs, the user may edit:

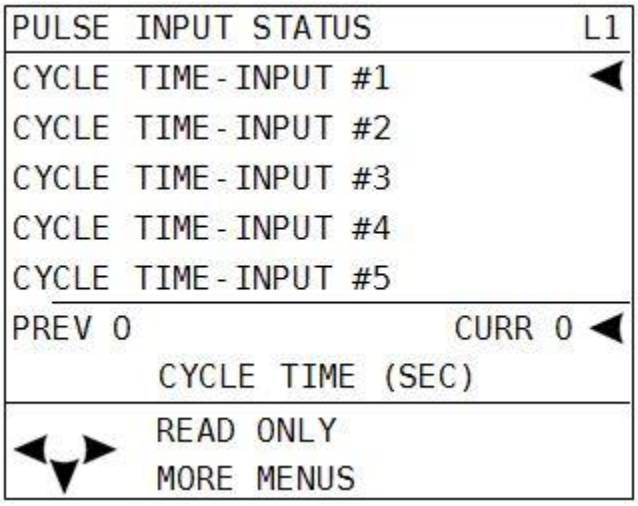
a) Signal Type - Select normally open (N/O) or normally closed (N/C).

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 Pulsed - 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. (*only visible on pulse filter types)

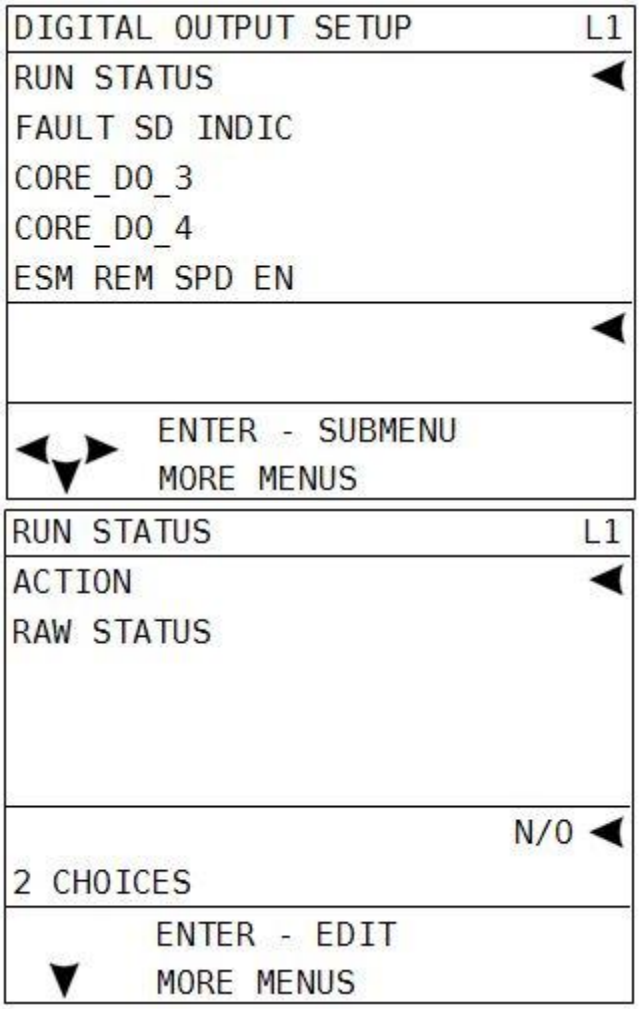
Pulse Input Status



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.

Digital Output Setup

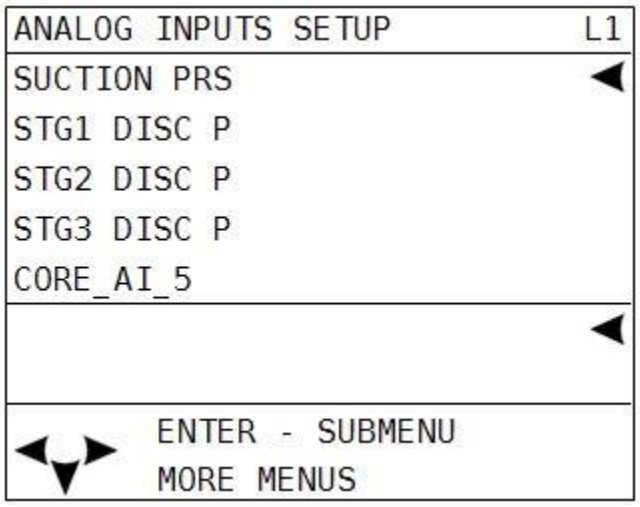


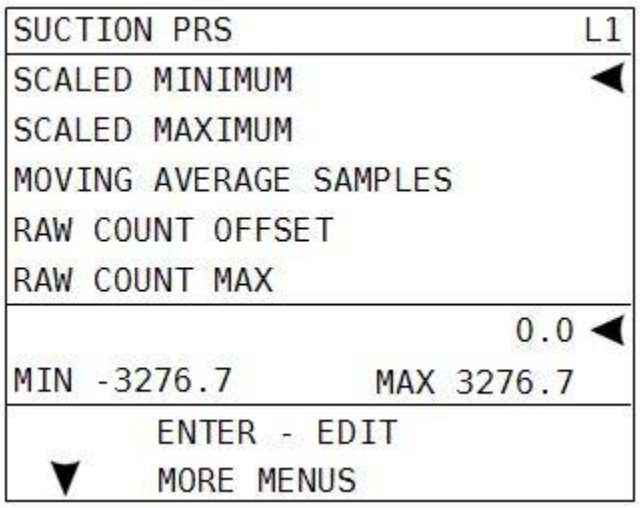
Digital output: For all configured digital outputs, the user may edit:

a) Action - Select normally open (N/O) or normally closed (N/C). Normally closed inverts the logic associated with the output if desired.

To force the output, toggling the NO to NC will cause it to invert state.

Analog Inputs Setup





For all configured analog input devices, the user may edit:

a) Scaled Minimum - Minimum engineering scale for the input when the raw counts are at the raw count offset reading.
Example: 0 PSI for a 0-100 PSI transmitter.

b) Scaled Maximum - Maximum engineering scale for the input when the raw counts are at the raw count offset + raw count max (total raw counts).
Example: 100 PSI for a 0-100 PSI transmitter.

> **NOTE:** To calibrate an analog input, change the raw offset and max settings. The scaled minimum and maximum settings should match the engineering unit range for the device.

c) Moving Average Samples. (1, 2, 4). Apply averaging filter to the input.

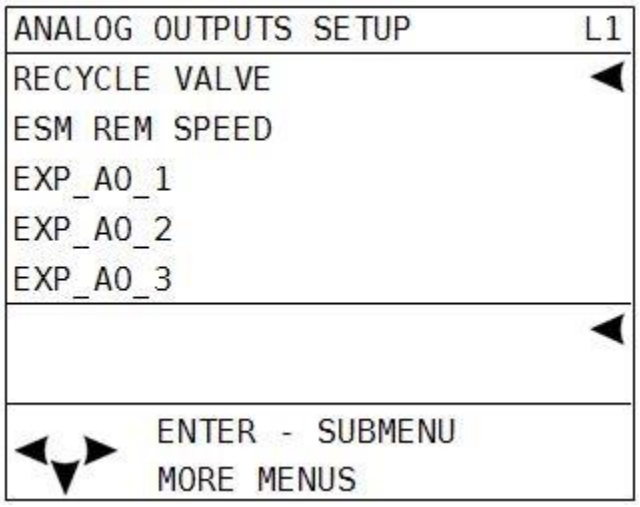
d) Raw Count Offset. Set the lowest raw analog input counts seen from the device.

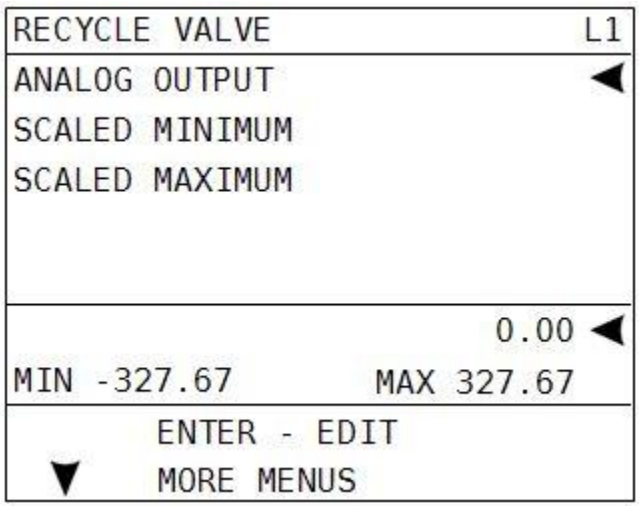
e) Raw Count Max. Set the highest raw analog input counts span seen from the device. This number is added to the raw count offset to equal the actual raw count reading.

The user can view the raw counts of the analog inputs to calibrate the input by adjusting the offset and max raw count readings.

> NOTE: Typical approximate raw readings for 4-20mA input:
> 4mA = 147 counts
> 20mA = 733 counts (147+586)

Analog Outputs Setup





Centurion analog output hardware is ranged to 4-20mA. The actual analog output % will be shown for each channel.

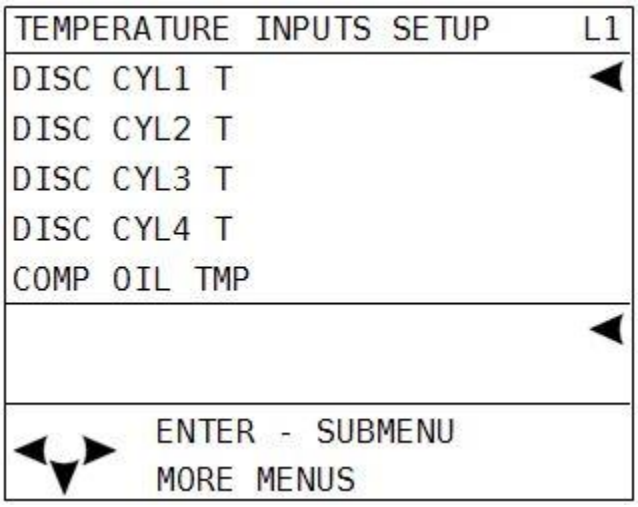
For all configured analog output devices, the user may edit:

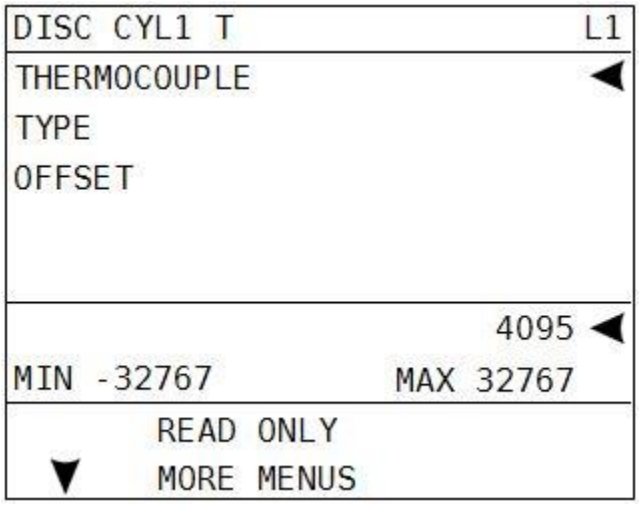
a) Minimum - Minimum % output. In most cases, 0% addresses a typical application (4mA).

b) Maximum – Maximum % output. In most cases, 100% (100.00) addresses a typical application (20mA).

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

Temperature Inputs Setup





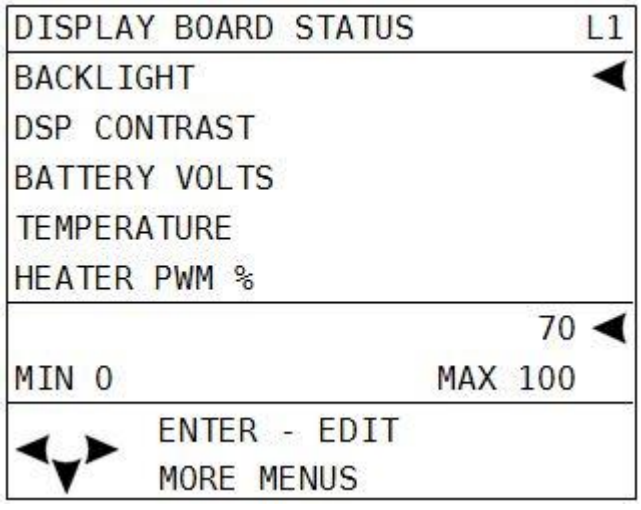
The actual thermocouple reading in degrees will be shown per channel.

For all configured thermocouple devices, the user may edit:

a) Thermocouple Type. Identify whether the input type should be set to J or K.

b) Thermocouple Offset. Assign an optional thermocouple reading offset value.

Display Board Status



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

a) Backlight - Adjust the value from 0 (OFF) to 100 (Full ON) percent to modify the intensity of the backlight. NOTE: This value changes in real-time as adjustment are being made. Pressing ESC will NOT discard the changes made to this value. A password is not required to change this setting.

b) DSP Contrast - Adjust the value from 150 to 180 to modify the LCD contrast. As the

number is increased the active pixels of the display will become darker. Increasing the contrast too much may also increase the darkness of the background. NOTE: This value changes in real-time as adjustment are being made. Pressing ESC will NOT discard the changes made to this value. A password is not required to change this setting.

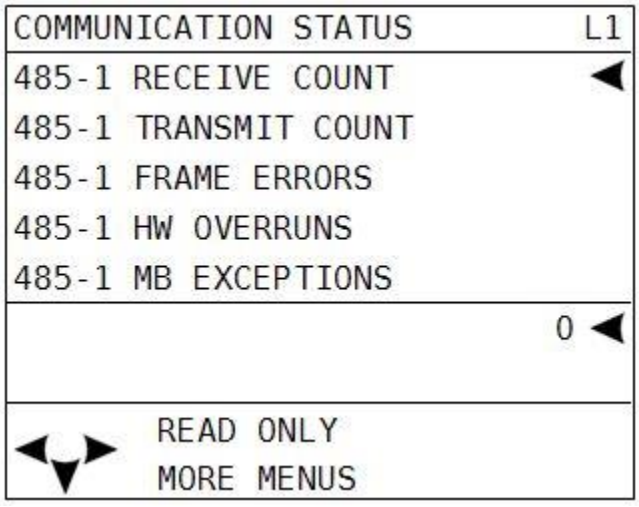
c) Battery Volts - Indicates internal voltage measurement of display VDC input.

d) Temperature - Indicates internal temperature measurement of display. This is used primarily to monitor ambient temperature to operate LCD heater.

e) Heater PWM % - Refers to the LCD heater which only operates in cold temperature conditions.

f) Reset Source - Indicates the cause of the last reset. Possible causes include external reset, power-up, brown-out and watch dog.

Communication Status



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

Note: **a)**, **b)**, **c)**, **d)** and **e)** settings are all common to the 485-1, 232 and 485-2 ports.

a) Receive Count – counter for the number of received bytes on the port.

b) Transmit Count – counter for the number of transmitted bytes on the port.

c) Frame Errors – counter for the number of detected packet framing errors.

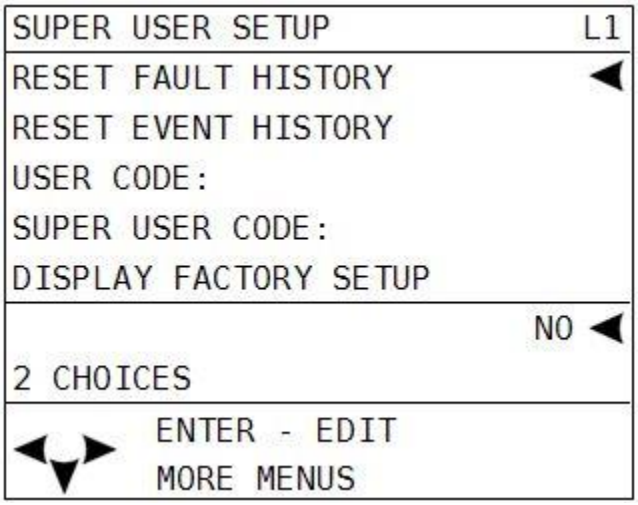
d) Overruns – internal diagnostic counter for factory use.

e) Modbus Exceptions/No Response – internal diagnostic counters for the Modbus traffic.

f) Clear Statistics – Press ENTER key to reset all counters.

g) Modbus Register – Modbus register viewer that allows access to any Modbus register from the controller.

Super User Menu



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

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

b) 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.

c) User Code: Press ENTER key to change the Standard User Password. The current password is displayed and can be changed.

d) Superuser Code: Press the ENTER key to change the Superuser Password. The current password is displayed and can be changed.

e) Display – Factory Setups: Set to Yes to overwrite all settings changed through the display to the original configuration settings from the last downloaded configuration file.

> **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.

f) Centurion Factory Setup

g) 485 – 1 / 2: FS BIAS
485 – 1 / 2: Term RES
485 – 1 / 2: Modbus Address
485 – 1 / 2: Baud Rate
485 – 1 / 2: Mode

h) 232 – Modbus Address
232 – Baud Rate
232 – Mode

i) CAN0 / 1: Address
CAN0 / 1: Arbitrary
CAN0 / 1: Term Res
Lost CAN0 DLY

j) Backlight - Adjust the value from 0 (OFF) to 100 (Full ON) percent to modify the intensity of the backlight. NOTE: This value changes in real-time as adjustments are being made. Pressing ESC will NOT discard the changes made to this value.

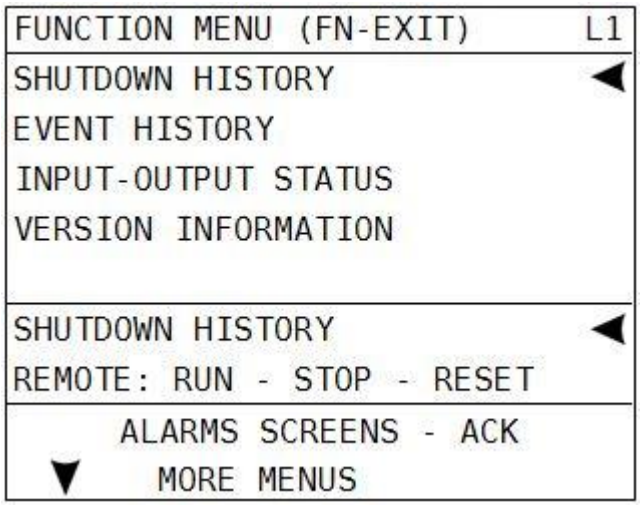
k) DSP Contrast - Adjust the value from 150 to 180 to modify the LCD contrast. As the number is increased the active pixels of the display will become darker. Increasing the contrast too much may also increase the darkness of the background. NOTE: This value changes in real-time as adjustment are being made. Pressing ESC will NOT discard the changes made to this value.

l) Key Press Counter

m) Outputs: 1 – 2
LED: 1 – 2
Outputs: 01 – 10
Outputs: 11 - 20
Outputs: 21 – 30
(Force menus for display outputs including LEDs located on the front of the display).

Additional Navigational Aids

Function Key Menu



Pressing the Function (Fn) key from any Operational screen will display the Function Menu screen momentarily to gain quick access to other pages.

All available function key commands will be displayed there. The user can then press a single key for the available commands.

Remote mode commands are available only while the Fn key is pressed.

If the Fn key is not followed by another key press in five seconds, function mode will time out, and the screen will return to the previous screen.

Communications

C4-1 Controller Communication Ports

Port 1 (Serial) – Used for Display.

Port 1 is intended as the primary port for the local device and the display, and it should be utilized for display in order for the controller and display synchronization to properly execute.

Interface: RS485/RS232 configurable. Refer to the sequence of operation to determine the actual configuration. Baud rates configurable 9600, 19200, 38400, 57600, 115200. No parity, 8 data bits, 1 stop bit.

Protocol: Modbus RTU Server

Connection: Three (3) screw terminal connectors for RS485. These are identified as A, B and SHD. Four (4) screw terminal connectors for RS232. These are identified as RX, TX, DTR and SHD.

Port 2 (Serial) – Used for customer connection.

Interface: RS485/RS232 configurable. Refer to the sequence of operation to determine the actual configuration. Baud rates configurable 9600, 19200, 38400, 57600, 115200.

Protocol: Modbus RTU Server, Proprietary (for firmware/configuration transfer)

Connection: Three (3) screw terminal connectors for RS485. These are identified as A, B and SHD. Three (4) screw terminal connectors for RS232. These are identified as RX, TX, DTR and SHD.

Modbus RTU Server Address Configuration: The operator may assign a unique Modbus address to each controller (server) unit that may be in the system. This allows the client 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. Jumper selectable to address 63.

User can gain additional addresses on Port 2 with the following process.

- If, and only if, Digital Input 30 is ***NOT*** in use, jumper DI 30 to DC+ or DC-. This will provide address 64. User can then add jumpers to LK4 to continue addresses up to 127.
- If, and only if, Digital Input 31 is ***NOT*** in use, jumper DI 31 to DC+ or DC-. This will provide address 128. User can then add jumper to LK4 to continue addresses up to 255. To utilize DI 31, user MUST have DI 30 jumper to DC- installed.

Port 2 (USB) – Used for configuration file transfers/Firmware updates

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

Protocol/Services: Modbus RTU Server, Proprietary (for firmware/configuration transfer).

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.

Port 3 (CAN) – Used for Expansion board communication

Protocol/Services: Proprietary (binary).

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

MV-5-C Display Communication Ports

RS232 – Used for Controller communication.

RS232 is intended as the primary port for the controller.

Interface: RS232. Alternately, RS485-1 may be used if the controller is configured for RS485 on Port 1.

Protocol: Modbus RTU Client/ Proprietary (binary) synchronization to the C4-1 controller

Connection: Five (5) screw terminal connectors for RS232. These are identified as RX, TX, RTS, CTS and GND.

RS485-1

RS485 is intended as the secondary port for the controller.

Protocol: Modbus RTU Client/ Proprietary (binary) synchronization to the C4-1 controller

Connection: RS485-1/RS485-2 shared terminal block. RS485-1 uses A-1, B-1 and common SHD (shield).

> **NOTE:** Shields should only be terminated on one side of the communication cable connection.

RS485-2 – (Reserved)

USB – Used for firmware updates

Interface: USB 1.1 compliant port.

Protocol/Services: Proprietary (for firmware transfer).

Connection: USB type B connector.

USB-A (Not Used)

CAN 1/2 (Not Used)

Downloading Configurations and Firmware Updates

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

Configuration files are generated by the Centurion Configuration Tool software and provide the application specific personality to the controller and display.

Firmware defines the available set of features that can be configured in the controller and display that the configuration file uses to operate.

FW Murphy can provide future enhancements and support changes to process requirement for customers using simple email and obtaining the required transfer utilities from www.fwmurphy.com .

Boot Loader Power Up Mode

Boot Loader power up mode is required for configuration file transfers and firmware updates to the controller. To enter boot loader mode, connect the USB cable to the controller and a PC and apply power to the controller. The display and third-party HMI devices will not receive a response to Modbus requests while the boot loader is active. The controller application will not run, and all outputs will remain off.

An alternate way to enter Boot Loader mode is to apply power to the controller with ALL address selection jumpers for port 2 removed.

Power on the Centurion C4-1 must be cycled with the USB cable removed and at least one address selection jumper installed to resume normal operation, or run mode.

Refer to the Centurion Transfer Guide to obtain step-by-step instruction on file transfer operations.

There is also a bootloader mode for the display to allow for firmware changes. To enter bootloader on the MV-5-C, press and hold the RIGHT ARROW key and SETUP ENTER keys at the same time while applying power to the display. The display may be blank. Simply hit ENTER to see the bootloader screen. The RED LED on the front of the display will be blinking to indicate bootloader mode.

Modbus RTU Protocol

General

The Centurion configurable controller was programmed with the Modbus RTU protocol which is a system based on a client and server relationship. The client initiates the queries or commands, and the server responds to the query with a message or takes action based on the query.

In this case, the client is either the MV-5-C display or another Modbus client but never both simultaneously as there can only ever be a single Modbus RTU client on a network.

As with all numeric data defined within the Modbus RTU specification, the data 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.

The Centurion Controller has all data mapped into Modbus Holding Registers, formatted as signed 16-bit integer data*. The controller responds to Modbus Function Codes 03, 06 and 16. These represent Read Holding Registers, Preset Single Register and Preset Multiple Register Modbus functions. (*Certain data points may be bitmapped data or unsigned data and will be specified on the Modbus RTU map).

Display to Controller Data Transfer

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.

Replacement Parts and Assemblies

C4-1 Plug Kit	**(00000504)**	**Printed replacement terminal plugs for Centurion Main I/O module**
MV-5-C Plug Kit	**(50001150)**	Printed replacement terminal plugs for Centurion display module.
Choke	**(50000774)**	Ignition noise (choke) filter

Accessories

Centurion Configuration Tool Software

The Centurion Configuration Tool software generates and modifies the properties of the system specific to the hardware connected to the controller, the sequence of operation, defined setpoints, timers, faults and displays* for the Centurion system. The software includes file transfer utilities for configuration and firmware upgrades.

CD, Centurion Configuration Tool software. (50-70-2313)

*Display configuration and other settings for display are only for use with the MV-5-C Display Module.

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 (0 to 24) mA and are compared to controller setpoints and/or displayed.
Boot Loader	Means by which the Centurion controller communicates with Centurion Configuration Tool to transfer new or updated configurations and firmware and ensures 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, activated by either a ground or supply voltage level. 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 startup.
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.
Thermocouple	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. Type J uses Red (-) and White (+) insulation. Type K uses Red (-) and Yellow (+) insulation.

Appendices

C4-1 Controller LED Description

Power LED – located next to the power connection, the LED illuminates when supply voltage is applied to the controller.

Digital Input/Output Status LEDs – each digital input/output has a status LED that illuminates when the signal is activated. The LEDs are located next to the terminals.

Port 1/2 RX/TX LEDs – the serial activity LEDs blink with every transmitted or received message. RX LED is red and blinks when a packet is received by the controller. TX LED is green and blinks when a packet is transmitted by the controller. The LEDs are located next to the serial port connections.

Port 2 USB Active LED – the LED illuminates steady when a USB cable is detected on the USB port. The LED is located to the immediate right of the USB type B port.

COP LED – Controller Operating Properly LED, the LED will flash on and off every 0.5 seconds when the controller is running the application program. When the controller is in the bootloader mode, the LED will be illuminated steady. If power is applied (Power LED illuminated) and this LED is not illuminated, contact FW Murphy for technical support.

On the Expansion I/O Module

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

MV-5-C Display Bootloader LEDs

Please be aware of the following conditions and the resulting LED appearances:

- When the unit is powered up and enters the bootloader, the RED and YELLOW LEDs are turned ON.
- If the user held the right arrow and Setup Enter keys on power up, the RED LED will flash and the YELLOW LED will be OFF.
- If the unit has an invalid application or needs to sync (Mview Replacement only), the RED LED is OFF and the YELLOW LED will flash.
- When the bootloader exits to run the application, the RED and YELLOW LEDs are turned OFF.

MV-5-C Display LED Description

All Ports RX/TX LEDs - The serial activity LEDs blink with every transmitted or received message. RX LED blinks when a packet is received by the display. TX LED blinks when a packet is transmitted by the display. The LEDs are located next to the serial port connections.

Modbus RTU Register Map

All data is signed 16-bit integer unless otherwise noted.

- See www.fwmurphy.com for Centurion C4 Modbus map or contact factory representative.

FW MURPHY PRODUCTION CONTROLS

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4646 S. HARVARD AVE.
TULSA, OK 74135

MANUFACTURING

2151 RANDON DYER ROAD
ROSENBERG, TX 77471

5757 FARINON DRIVE
SAN ANTONIO, TX 78249

DOMESTIC SALES & SUPPORT

FW MURPHY PRODUCTS
PHONE: 918 957 1000
EMAIL: INFO@FWMURPHY.COM
WWW.FWMURPHY.COM

FW MURPHY CONTROL SYSTEMS & SERVICES
PHONE: 281 633 4500
EMAIL: CSS–SOLUTIONS@FWMURPHY.COM

INTERNATIONAL SALES & SUPPORT

CHINA
PHONE: +86 571 8788 6060
EMAIL: INTERNATIONAL@FWMURPHY.COM

LATIN AMERICA & CARIBBEAN
PHONE: +1 918 770 8775
EMAIL: INTERNATIONAL@FWMURPHY.COM

SOUTH KOREA
PHONE: +82 70 7951 4100
EMAIL: INTERNATIONAL@FWMURPHY.COM

FM 668576 (San Antonio, TX - USA)
FM 668933 (Rosenberg, TX - USA)

FM 523851 (China) *TS 589322 (China)*