

DYNALCO®

3211 Fruitland Ave
Los Angeles, CA 90058

Catalyst Monitor

6-Channel Monitor

Version 2

Installation and Operation Manual



Rev. H

P/N145F-12964

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Barksdale®
CONTROL PRODUCTS
CRANE Barksdale, Inc./Barksdale GmbH
A Subsidiary of Crane Co.

IMPORTANT - PLEASE READ BEFORE PROCEEDING!

This manual applies to all Version2 Catalyst Monitors.

The Dynalco Catalyst Monitor is designed for reliable and rugged operation on engines with NSCR and oxidation catalysts. This product has been designed and tested to meet the demands required in many industrial and hazardous locations meeting critical CSA standards. The performance is directly related to the quality of the installation and knowledge of the user in operating and maintaining the instrument. To ensure continued operation to the design specifications, personnel should read this manual thoroughly before proceeding with installation, operation and maintenance of this instrument. If this product is used in a manner not specified by Dynalco, the protection provided by it against hazards may be impaired.



WARNING

- Failure to follow proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.
- For clarification of instructions in this manual or assistance with your application, contact Dynalco as below:
Tech Support: DYN-TechnicalSupport@barksdale.com or 1-866-227-8528
Customer Care: BRK-DYN-CustomerCare@barksdale.com or 1-800-835-1060

Or by mail:

Barksdale Inc.

Barksdale and Dynalco Products

3211 Fruitland Ave

Los Angeles, CA 90058

- Additional manuals and CSA certificates are available at www.dynalco.com
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Use only qualified personnel to install, operate, program and maintain the product.
- Educate your personnel in the proper installation, operation, and maintenance of the product.
- Install equipment as specified in the installation section of this manual. Follow appropriate local and national codes. Only connect the product to power sources and end devices specified in this manual.
- Any repair is only to be performed by Dynalco using factory documented components. Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process.
- All equipment doors must be closed and protective covers must be in place unless qualified personnel are performing maintenance.
- Shutdown / alarms should be tested monthly for proper operation (see page 14)
- Please see page 22 for CSA specific installation instructions.

System Overview

The Dynalco Catalyst Monitor is designed to address the EPA mandate regarding continuous monitoring of catalyst inlet temperature and differential pressure on both spark-ignited and diesel engines. It is capable of reading up to 6 input channels, calculating differential values, providing alarm / shutdown outputs as well as allowing all parameters to be logged to an internal flash memory. An RS-485 Modbus link for communications to a DCS or PLC is also provided.

Additionally, the Catalyst Monitor is capable of calculating the engine catalyst inlet temperature based on a 4 hour rolling average per latest EPA requirements.

Basic operation:

The Catalyst Monitor will be in “stopped” or non-monitoring mode until a run indication is sensed. This is selectable as either a contact closure or magnetic pickup input. Once “running” mode is sensed, the Catalyst Monitor will read all inputs at a rate of 100 msec per channel. If any input crosses either an over or under threshold, the unit will invoke a flashing red LED on the front panel as well as an output trip (solid-state relay) that can be used for alarm or shutdown. Any trips will also cause the Catalyst Monitor to date / time stamp whenever a trip threshold is crossed. The monitor will log the last (10) alarm events for each channel input. These may be viewed on the front display.

All data is also accessible via an RS485 serial Modbus link.

Data logging functions can also be enabled where logged values are saved to an onboard flash memory.

4-Hour Rolling Average Logs:

The EPA 4-hour rolling average is configured to log the instantaneous catalyst inlet temperature every 15 minutes. The instantaneous values are then used to calculate 1-hour averages which are used to calculate a 4-hour average. The 4-hour average is a rolling average allowing logged data from previous engine run times to be included with next run times. When the “EPA Average” is enabled, the Catalyst Monitor will log continuously as long as it has received an engine run signal.

IMPORTANT:

A run signal (either digital or RPM input) must be selected in order to properly log the 4-hour rolling average. (See page 10 for configuring run signal.)

Additional Data Logging:

The Catalyst Monitor also allows additional data logging of any monitored values where they will be saved to an internal flash memory. Up to 10 log events may be selected, including logging of the catalyst differential pressure at user programmable intervals.

Flash Memory:

The onboard flash memory is sufficient to hold up to 500,000 data values with date / time stamp. When the Catalyst Monitor receives an engine run signal (either contact closure or mag pickup signal) the unit begins monitoring all enabled inputs. Following that, the monitor will begin logging data as configured. The logged data is temporarily saved to RAM memory which holds 56 logged values. The logged values remain in RAM until any of (3) events occur:

- 1) The RAM is full.
- 2) The monitor receives an engine stop signal.
- 3) The user initiates a “Stop Logging” command.

Following any of the above events, the data in RAM is transferred to the non-volatile flash memory. These values can be downloaded at any time to a PC using Dynalco’s download cable and Log Reader software.

IMPORTANT - Input Power Requirements:

It is important that the input supply power be a reliable source with battery backup if needed. If input power is interrupted or disconnected while the monitor is logging data, any data that has not yet been stored to flash memory may be lost. This manual contains information on page 14 that describes the steps required to safely disconnect power without risk of losing data.

Additional Features

- 5 - Digit Hourmeter Function (non-resettable)
- Engine RPM Display
- Fully programmable from front keypad
- ¼ DIN package (3 ½” width X 3 ½” height) for panel mount

Specifications

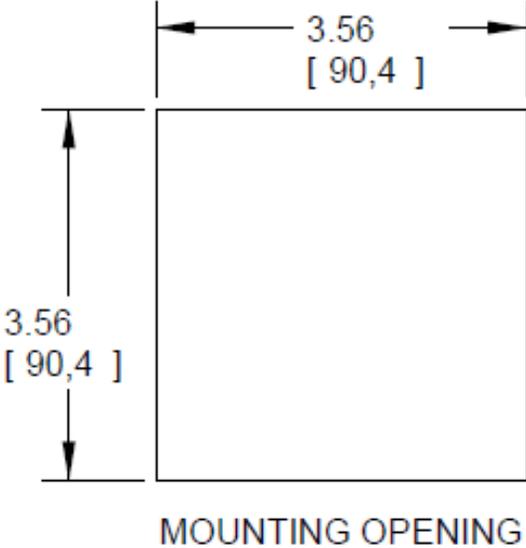
Input Types	J or K type thermocouple (ungrounded) accurate to +/- 0.2 % 4 - 20 mA 0 – 1 VDC 0 - 5 VDC 0 – 10 VDC
Digital Input	Closure to ground indicates run condition (or use pulsed input)
Pulsed Input	Magnetic pickup input for RPM display & to indicate run condition
Relay Outputs	2 Digital Outputs rated @ 0.15 A / 48 VDC
Input Power	10 – 36 VDC
Display	Backlit Graphic Display
Data Logging	Internal Flash Memory to retain data logged values w/ date & time stamp
Communications	Modbus
Connections	Two-Part Terminal Blocks
Operating Temperature Range	- 40 to + 70 Deg C
Certification	CSA Class I, Division 2, Groups A, B, C, D

User Interface

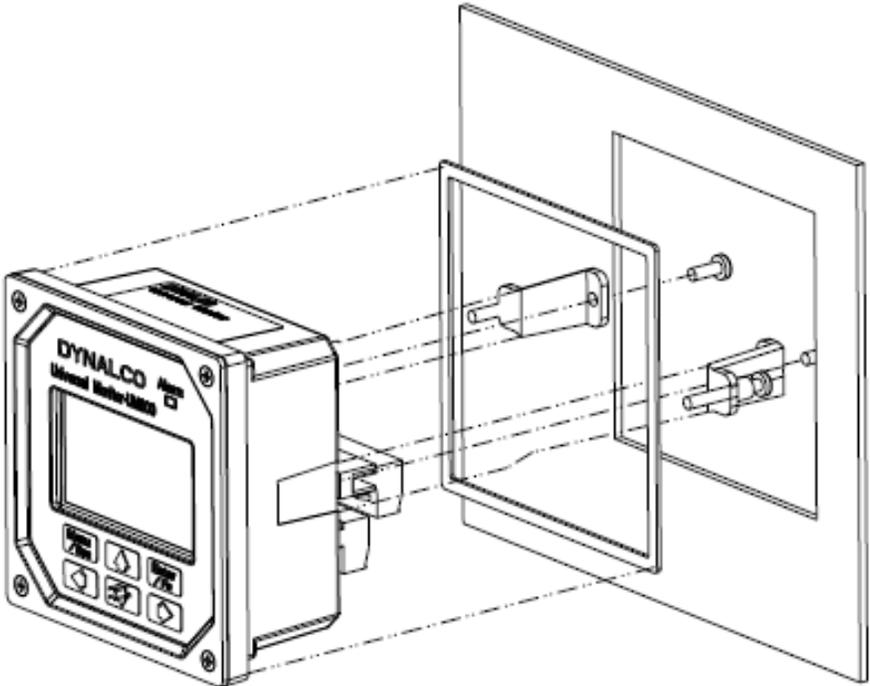
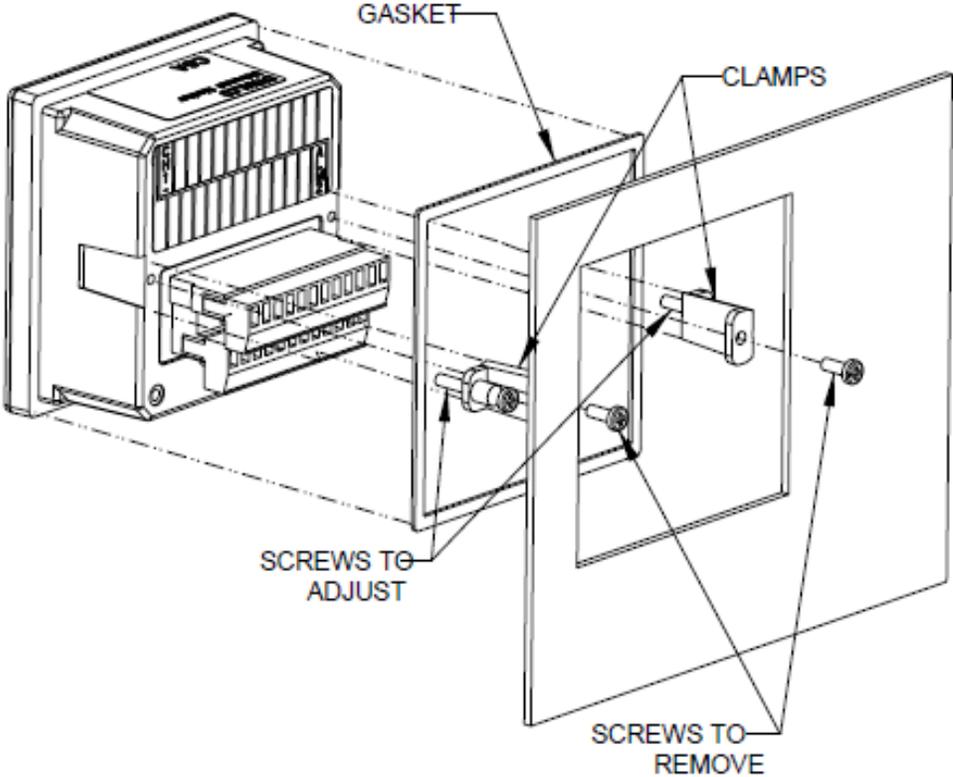
The Catalyst Monitor is configured via the keypad on the front panel which includes a graphical backlit LCD display capable of displaying alpha numeric values and custom engineering units of measure. The keypad implements a menu system, which is navigated using the up, down, left, right, enter and escape buttons.

Installation:

The Catalyst Monitor is a standard ¼ DIN package, designed to be panel mounted. The cutout dimensions are shown below.



The Catalyst Monitor has integral mounting clips for securing into the panel. The following drawings illustrate the mounting procedure.



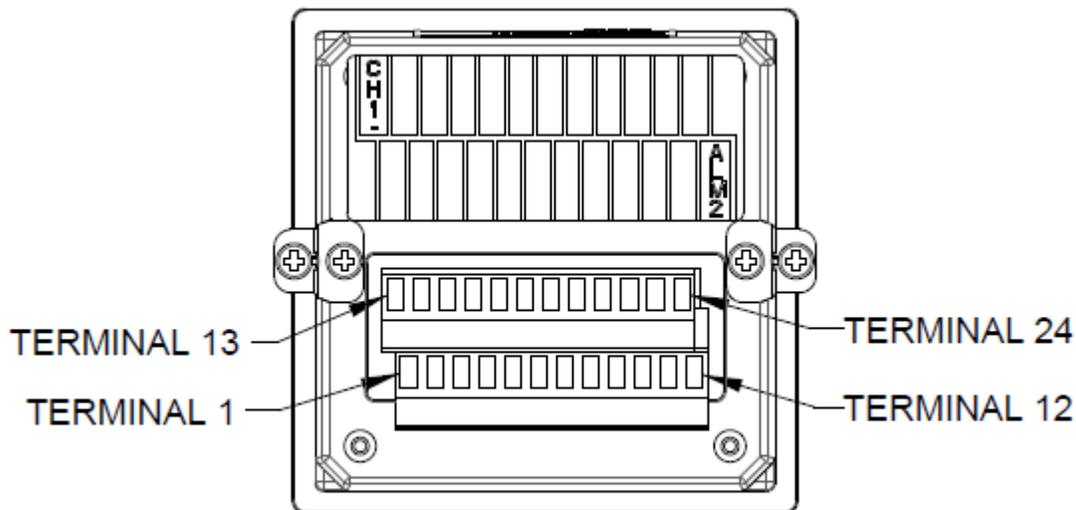
Terminal Connections

All connections are made via the removable connectors on the back of the unit.

PIN	Description
1	GND (Power Gnd)
2	VIN (10 - 36 VDC input)
3	GND (mag pickup input)
4	RPM + (mag pickup input)
5	Receive Data (-)
6	Receive Data (+)
7	Transmit Data (-)
8	Transmit Data (+)
9	Alarm 1
10	Alarm 1
11	Alarm 2
12	Alarm 2

PIN	Description
13	Channel 1 (-)
14	Channel 1 (+)
15	Channel 2 (-)
16	Channel 2 (+)
17	Channel 3 (-)
18	Channel 3 (+)
19	Channel 4 (-)
20	Channel 4 (+)
21	Channel 5 (-)
22	Channel 5 (+)
23	Channel 6 (-)
24	Channel 6 (+)

Also used for USB download cable assembly p/n 270A-13020 (see page 16)



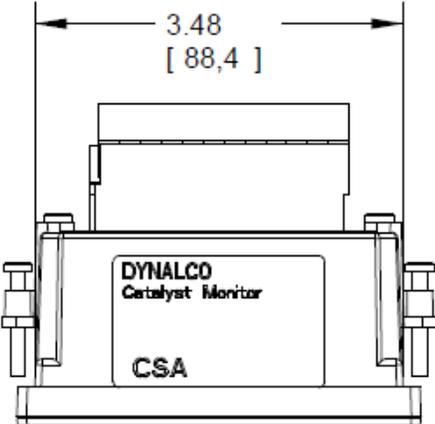
BACK VIEW



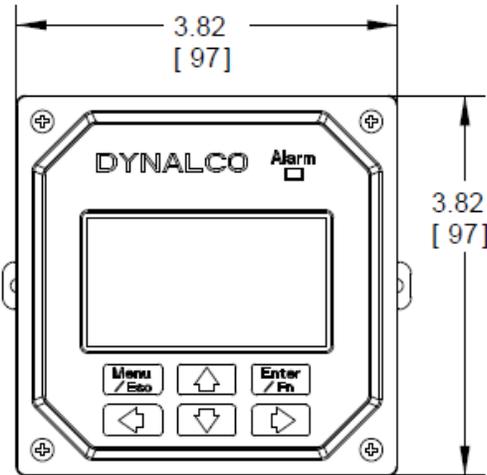
Terminal screws to be tightened to 4 inch-pounds torque.

See page 21 for complete wiring information.

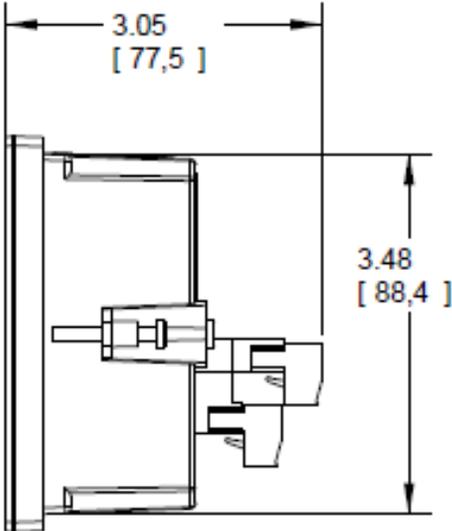
Outline Dimensions



TOP VIEW



FRONT VIEW



SIDE VIEW

Programming Overview

All programming is accomplished through the front keypad. Below is a brief description of each key.



Press to enter or exit the configuration screens



Press to enter or accept values



Select up



Select down



Go back one screen



Select and advance to next screen

Initial configuration consists of the following steps:

- 1) Setting current date / time
- 2) Enabling each input
- 3) Defining each input type
- 4) Defining min. & max. display values for any current or voltage inputs
- 5) Defining measurement display units (PSI, mV, F, C, H2O, etc)
- 6) Setting over / under setpoint trips
- 7) Selecting either output 1 or output 2 (or both) for alarm trips
- 8) Setting either latching or non-latching for output trips
- 9) Defining data logging events

Programming Instructions

Important: The Catalyst Monitor must first be programmed prior to operation.

When initially powering up the unit, the display will first indicate the firmware version and then go to the operational mode. It may also display a screen warning that the time & date need to be entered. This will be explained below.

To configure the Catalyst Monitor, first go to the main programming screen by pressing the Menu / Escape key:



The following menu icons will appear from left to right:



Run Signal

- defines run status input type (if any)



Channel

- enables each channel type and alarm thresholds



Calibration

- defines zero & span values for DCV & mA inputs



Alarm Settings

- for setting high /low alarm thresholds



Alarm Logs

- allows the user to view alarm status



Communication

- Log Reader / Modbus setup



Data Logging

- allows configuration of up to (10) different logging events



System

- allows EPA enable & current date / time settings

A description of each menu item follows:



“Run Signal”

There are (3) run types available. The definitions are as follows:

None: No run indication required. Monitoring is always active.

RPM: Monitoring is active when signal received from magnetic pickup.

Digital: Monitoring is active when contact closure (connection to ground) is sensed.

To select run signal type, use the up / down arrows to select, then press the right arrow to accept and advance to the next screen.

If “**None**” is selected, there is no other action required other than to select “escape.” After selecting escape, you will be asked to select “yes” to save.

If “**RPM**” is selected, you will need to set the # gear teeth, RPM threshold and startup delay. The RPM threshold is the speed above which monitoring will be active. The startup delay can be configured to delay monitoring if desired, allowing time for all inputs to be at normal levels. If no delay is required, set to 0 seconds. The magnetic pickup input terminals are indicated on page 5.

If “**Digital**” is selected, you will only need to set the startup delay (if applicable). In this mode, a run signal will be sensed with a contact closure (or short) between the magnetic pickup input terminals indicated on page 5.

Pressing  at any time during configuration will prompt you to save the changes. Select “Yes” to save any changes made. Selecting “No” will not save changes.



“Channel”

Select the channel number to configure by pressing the up / down arrows, then pressing the right arrow to navigate and select the following:

Enable Channel	Yes / No
Channel Type	0-1 V, 0-5 V, 0-10 V, 4-20 mA, J Type, K Type
Description	name input with up to 20 characters
Engineering Units	up to 3 characters, for example: PSI, mV, F, C etc...

Note: For thermocouple inputs, you must enter either “F” or “C”

Differential calculations between channels 1&2, 3&4, 5&6 are also enabled by selecting the “Channel” icon. Enable “Differential 1” for channels 1&2, “Differential 2” for channels 3&4 and “Differential 3” for channels 5&6.



“Calibration”

Select the channel number to configure by pressing the up / down arrows and pressing the right arrow to select and continue.

The screens allow you to define the “Cal Zero” and “Cal Span” values for any channels that are configured for 0-1 V, 0-5 V, 0-10 V or 4-20 mA inputs.

Example

A pressure transmitter is connected to channel # 1. The transmitter has a 4-20 mA output representing a pressure input of 0 - 500 PSI. The “Cal Zero” and “Cal Span” values would be defined as:

*Cal Zero = 0
Cal Span = 500*

Note that the “Engineering Units” would be input as PSI in “Channel” configuration above.



“Alarm Settings”

Select the channel number to configure by pressing the up / down arrows, then pressing the right arrow to navigate and select the following:

Enable alarms	Yes / No
Alarm Type	Latching / Non-Latching
Alarm Output	None / Output 1 / Output 2 / Output 1 and 2
Alarm Low	threshold for under-trip
Alarm High	threshold for over-trip
Alarm Reset Points	Set Defaults / Set Manually

If “Set Manually” is selected, 2 more screens follow:

Alarm Reset Low	manually set reset hysteresis for low trip
Alarm Reset High	manually set reset hysteresis for high trip



“Alarm Logs”

Selecting the “Alarm Logs” icon will allow you to view any active alarms as well as the history log for each channel. Select any channel number by pressing the up / down arrows. Then press the right arrow to view any active or logged alarms. Once an active alarm is acknowledged, it will be placed into the history log. The history log will continuously store the last 10 alarms for each channel as well as the time & date of each alarm occurrence.



“Communication”

This allows configuration for downloading data and Modbus communications.



“Data Logging”

The setup for EPA required logging of the catalyst inlet temperature based on a 4-hour rolling average is described in the section named “System” on page 14.

Additional data logging may be configured when you select the “Data Logging” icon. The Catalyst Monitor can be configured to log any of the parameters being monitored, at user defined time intervals. The values are saved to an internal flash memory with sufficient memory to hold up to 500,000 data values with date / time stamps. These values can be downloaded at any time to a PC using Dynalco’s “Log Reader” software.

The logging of any parameter is configured as an event. The Catalyst Monitor will allow up to (10) individual events to be defined.

It’s also possible to configure an event that will log the catalyst differential pressure at defined intervals. Note that some users may decide to manually record differential pressure once per month since this value needs to be recorded with engine fully loaded per RICE NESHAP.

Example:

To configure data logging of catalyst differential pressure after engine warm up:

(Note that this configuration will require an input signal from a magnetic pickup to sense engine running.)

Using the arrows on the keypad, select the “Data Logging” icon.

Next, select “Setup Log Events” and press the  arrow.

The next screen will display a list of (10) events that can be configured. If this is the first event to be programmed, select “Event 1” and press the  arrow.

Next select “Enable” and press the  arrow.

The next screen allows you to define an “On” condition. The configuration for logging the differential pressure will require an “On” condition defined by an “engine run” signal. See above (page 9) for the procedure for configuring the “run” signal. In this case, select “Yes” and press the  arrow.

Select “Edit Compare” on the next screen and press the  arrow.

Select “Compare 1” on the next screen and press the  arrow.

Select “RPM” on the next screen and press the  arrow.

Select “Greater Than” on the next screen and press the  arrow.

Select “A Value” on the next screen and press the  arrow.

On the following screen, select an RPM value that will indicate engine running. This value should be lower than the normal engine running speed and higher than the RPM defined as the “run” signal in page 9.

The next screen will ask if you want to “Edit Another?” Select “yes” and press the  arrow.

Select “Compare 2” on the next screen and press the  arrow.

Select “RPM” on the next screen and press the  arrow.

Select “Less Than” on the next screen and press the  arrow.

Select “A Value” on the next screen and press the  arrow.

On the following screen, select an RPM value that will indicate the engine stopping. This value should be lower than the RPM selected above.

The next screen will ask if you want to “Edit Another?” Select “no” and press the  arrow.

Press the  arrow (3) more times until the screen appears as “Enter ON Delay.” Enter this number as the time delay (in seconds) following engine start when you would like to log the catalyst differential pressure. The maximum value configurable is 3600 seconds (60 minutes.) After entering the time delay, press  arrow.

The next screen allows you to define an “Off” condition. Select “Yes” and press the  arrow.

Select “Compare 2” on the next screen and press the  arrow.

The next screen will ask if you want to “Edit Another?” Select “no” and press the  arrow.

The next screen appears as “Enter OFF Delay.” Enter this number as the time delay (in seconds) following engine stop when you would like to stop logging data. The maximum value configurable is 3600 seconds (60 minutes) but this would normally be set to 0 seconds.

After entering the time delay, press  arrow.

The next screen named “Input To Log” allows the user to select which parameter to log. Using the up / down arrows, select the input that is defined as the catalyst differential pressure. Press  arrow.

The next screen named “Log Frequency” allows the configuration of how often (in minutes) the value is to be logged. Entering 0 minutes will allow only (1) data log event following the start delay. If you wanted to continuously log the differential pressure, you would select the frequency in minutes between data logs. Selecting escape  will return to the “Log Frequency” screen.

Press the  arrow and then select “Yes” to save the changes.

Pressing the escape  key two times will escape to the normal monitoring mode.



“System”

“Display defaults” allows the selection of either single channel (absolute) or differential value display. Note that regardless of this setting, pressing the right or left arrow during normal operation will display the alternate display type.

“Digital output” allows the configuration of the solid state relay alarm outputs as either “Normally Open” or “Normally Closed”

“EPA enable” is used to enable a 4-hour rolling average calculation (RICE NESHAP requirement) of the catalyst inlet temperature. Select whichever channel is configured to monitor the catalyst inlet temperature. Once this is enabled, the inlet temperature will be displayed as a 4-hour rolling average value. Specifically, the instantaneous values will be averaged into 1-hour averages which will then be used to calculate the 4-hour average. The 4-hour average will also be continuously logged at 15 minute intervals as long as the monitor is receiving an engine run signal. If the engine does not run for a full 4 hours, then the averaged data from the previous engine run will be used to calculate the next run time. An example of the logging process is on page 18.

“Set date and time” is self-explanatory but is important for proper date / time stamps for both alarm logs and data logging.

IMPORTANT NOTICE REGARDING CORRECT DATE / TIME SETTING:

The correct date / time is imperative for proper data logging.

Please note that the date and time may need to be re-programmed if the Catalyst Monitor loses input power for over 1 week. This will be indicated by a warning upon powering up the unit.

Note that only the date / time may be affected by extended loss of power. Any data logged to the internal flash memory will be held indefinitely.

Alarm Outputs

The Catalyst Monitor will alarm when channel values or differential values are above or below limits as specified. Alarms can be configured as either latching or non-latching. If an alarm condition is met, the red LED on the front panel will blink and the digital output(s) will trip. The alarm point name (ch1, ch2, df1, df2) that caused the alarm will be stored in memory with date/time stamp info. Non-latching alarms will reset the alarm if its value returns to normal. Latching alarms require manual resetting via the front keypad.



WARNING:

The alarm / shutdown output should be tested monthly for proper operation, especially if being used for over temperature shutdown or other critical function.

Catalyst Inlet Temperature Monitoring (per RICE NESHAP requirements)

The Catalyst Monitor will allow you to configure any one channel to monitor the catalyst inlet temperature based on a 4 hour rolling average per the RICE NESHAP mandate. To set this up, first go to the main menu, then select "System." Select "EPA enable" and then select which channel is monitoring the catalyst inlet temperature. Please note that once this is configured, the channel representing the catalyst inlet temperature will always display the 4 hour average, not instantaneous exhaust temperature.

IMPORTANT NOTICE REGARDING POWER INTERRUPTION:

If input power to the Catalyst Monitor is disconnected during a data log operation, there is the possibility of losing data (see page 2).

To prevent this, it is important to turn off the data logging prior to power disconnect. This is accomplished through the "Data Logging" icon on the main menu. When this is selected, the first screen will allow you to select "Stop Logging." Pressing the  arrow will provide instructions for a safe power down.

The data logging will be enabled automatically when power is re-applied.

Downloading logged values to PC using LogReader software

The hardware connection from the Catalyst Monitor to a PC is via a USB cable assembly, Dynalco p/n 270A-13020. The 6 ft cable length allows easy connection via a 4 pin Phoenix plug to the lower connector (terminals 5, 6, 7, 8) on the back of the Catalyst Monitor. When initially plugging the download cable into the PC's USB port, the new device should be recognized and the driver installed automatically.

Please call (954) 739-4300 if the driver is not installed properly or assistance is required.

The Dynalco host software "LogReader" is available as a free download from our website:

www.dynalco.com/downloads

There are (2) versions available:

LogReader Ver. 1 Use for Version 1 Catalyst Monitors

LogReader ver. 2 Use for Version 2 Catalyst Monitors

Following installation, you may click on the icon to open the application. This software will allow date selectable log values to be downloaded to an excel spread sheet on the PC.



There are (3) reports generated by the LogReader software:

The report named “CatalystDataLog” is a spreadsheet of logged values as configured in the Data Logging module (see page 12). This report does not contain 4-hour averaged values but only other events (up to 10 events) that may have been configured. An example of this download is below. Note that in this example, the columns format was selected which lines up the various log events (5 events in this case) in separate columns.

Date	Event1	Event2	Event3	Event4	Event5	Event6	Event7	Event8	Event9	Event10
11/7/2014 9:24	3025.601	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 9:09	3025.601	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 8:54	3025.601	3022.235	-7.09035	-7.12039	0.030042					
11/7/2014 8:39	3025.601	3022.235	-7.09035	-7.12039	0.030042					
11/7/2014 8:24	3025.072	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 8:09	3025.072	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 7:54	3025.072	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 7:39	3025.072	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 7:24	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 7:09	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 6:54	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 6:39	3024.939	3020.116	-7.09035	-7.12039	0.030042					
11/7/2014 6:24	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 6:09	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 5:54	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 5:39	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 5:24	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 5:09	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 4:54	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 4:39	3024.939	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 4:24	3025.204	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 4:09	3025.204	3020.116	-7.09035	-7.12039	0.030042					
11/7/2014 3:54	3025.204	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 3:39	3025.204	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 3:24	3025.204	3020.116	-7.09035	-7.12039	0.030042					
11/7/2014 3:09	3025.204	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 2:54	3025.204	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 2:39	3025.204	3020.116	-7.09035	-7.12039	0.030042					
11/7/2014 2:24	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 2:09	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 1:54	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 1:39	3025.734	3020.116	-7.09035	-7.12039	0.030042					
11/7/2014 1:24	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 1:09	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 0:54	3025.734	3020.116	-7.10756	-7.12039	0.012833					
11/7/2014 0:39	3025.734	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 0:24	3025.999	3022.235	-7.10756	-7.12039	0.012833					
11/7/2014 0:09	3025.999	3020.116	-7.10756	-7.12039	0.012833					

The 2nd report named “CatalystDataLogEPAInstant” contains the instantaneous catalyst inlet temperatures taken at 15 minute intervals.

Date	EventID	Value
7/19/2014 4:31	21	982.2334
7/19/2014 4:16	21	984.1347
7/19/2014 4:01	24	990.7599
7/19/2014 3:46	24	976.5336
7/19/2014 3:31	24	981.5212
7/19/2014 3:16	24	987.4698
7/19/2014 3:01	23	964.6247
7/19/2014 2:46	23	975.8333
7/19/2014 2:31	23	994.2492
7/19/2014 2:16	23	973.9946
7/19/2014 2:01	22	984.0838
7/19/2014 1:46	22	994.2432
7/19/2014 1:31	22	976.2293
7/19/2014 1:16	22	976.3366
7/19/2014 1:01	21	983.6992
7/19/2014 0:46	21	976.2647
7/19/2014 0:31	21	975.4358
7/19/2014 0:16	21	984.9225
7/19/2014 0:01	24	990.2403
7/18/2014 23:46	24	995.9365
7/18/2014 23:31	24	1003.688
7/18/2014 23:16	24	987.3637
7/18/2014 23:01	23	967.9655
7/18/2014 22:46	23	974.2311
7/18/2014 22:31	23	975.6649
7/18/2014 22:16	23	984.3737
7/18/2014 22:01	22	967.9222
7/18/2014 21:46	22	974.2294
7/18/2014 21:31	22	983.8787
7/18/2014 21:16	22	996.2749

Note that the input channel configured to monitor the inlet temperature must also be configured as the “EPA Enabled” channel (see page 14).

There are (4) different events that are assigned to the EPA enabled channel; events 21, 22, 23 & 24.

The (4) temperature values in each event ID are then used to calculate one-hour averages. Note that in some cases, an engine may be stopped before a full hour of data is collected. In this case, if there are at least (2) logged values, a 1-hour average will be calculated, per the EPA ruling.

Finally, the (4) consecutive one-hour averages are used to calculate the EPA 4-hour rolling average.

All values (instantaneous and averaged) will be seen in the 3rd report described next.

The 3rd report named “CatalystDataLogEPAHourly” contains the same instantaneous values logged above plus the hourly averages and finally the four hour averages.

Date	Inst1	Inst2	Inst3	Inst4	HourlyAve
7/19/2014 4:31	982.2334	984.1347			983.1841
7/19/2014 4:01	990.7599	976.5336	981.5212	987.4698	984.0711
7/19/2014 3:01	964.6247	975.8333	994.2492	973.9946	977.1755
7/19/2014 2:01	984.0838	994.2432	976.2293	976.3366	982.7232
			Four Hour Average:		981.7885
7/19/2014 1:01	983.6992	976.2647	975.4358	984.9225	980.0806
7/19/2014 0:01	990.2403	995.9365	1003.688	987.3637	994.3071
7/18/2014 23:01	967.9655	974.2311	975.6649	984.3737	975.5588
7/18/2014 22:01	967.9222	974.2294	983.8787	996.2749	980.5763
			Four Hour Average:		982.6307

Modbus Communication

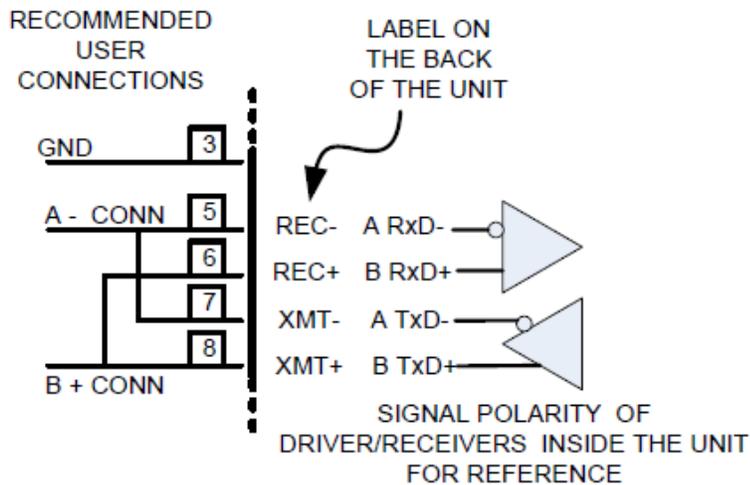
The unit also provides access to the internal registered values using the Modbus Protocol. The diagram below shows the recommended connections to the removable connectors on the back of the unit for either half-duplex or full-duplex (RS485).

Wiring is as follows:

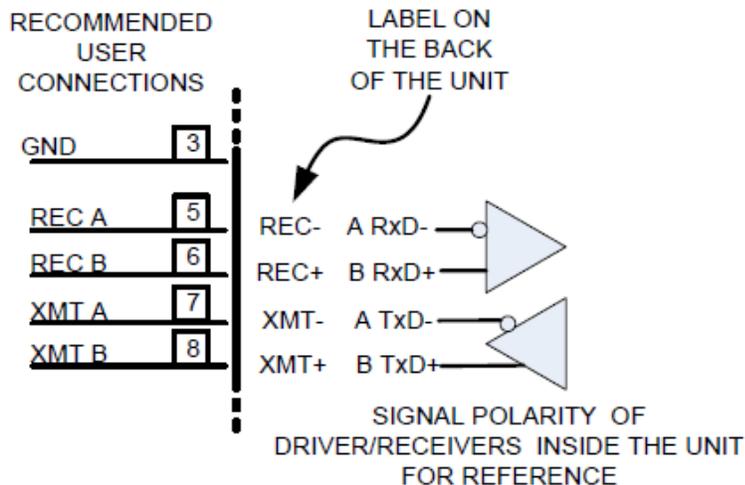
PIN	Description
5	TD(A) **
6	TD(B) **
7	Jumper to PIN 5
8	Jumper to PIN 6

** A 120 ohm termination resistor may need to be installed across pins 5 & 6.

HALF-DUPLEX CONNECTIONS



FULL-DUPLEX CONNECTIONS



Modbus Address Registers:

The Modbus address registers are defined in the tables below.

Input Register Table (table 1)

Modicon Address	Modbus Offset	Description	Min Value	Max Value	Data type
300001	0	Status Register, 0=not running, 1=running.	0	1	16 bit signed integer
300002	1	Reserved	-32768	32768	16 bit signed integer
300003	2	Alarms			Bit mask
		Bit 0 - Channel 1 Alarm	0	1	0001h
		Bit 1 - Channel 2 Alarm	0	1	0002h
		Bit 2 - Channel 3 Alarm	0	1	0004h
		Bit 3 - Channel 4 Alarm	0	1	0008h
		Bit 4 - Channel 5 Alarm	0	1	0010h
		Bit 5 - Channel 6 Alarm	0	1	0020h
		Bit 6 - Channel 1-2 Differential Alarm	0	1	0040h
		Bit 7 - Channel 3-4 Differential Alarm	0	1	0080h
		Bit 8 - Channel 5-6 Differential Alarm	0	1	0100h
		Bit 9 - reserved	0	1	0200h
		Bit 10 - reserved	0	1	0400h
		Bit 11 - reserved	0	1	0800h
		Bit 12 - reserved	0	1	1000h
		Bit 13 – reserved	0	1	2000h
		Bit 14 – reserved	0	1	4000h
		Bit 15 – reserved	0	1	8000h
300004	3	Channel 1 Value	-32768	32767	16 bit signed integer
300005	4	Channel 2 Value	-32768	32767	16 bit signed integer
300006	5	Channel 3 Value	-32768	32767	16 bit signed integer
300007	6	Channel 4 Value	-32768	32767	16 bit signed integer
300008	7	Channel 5 Value	-32768	32767	16 bit signed integer
300009	8	Channel 6 Value	-32768	32767	16 bit signed integer
300010	9	Channel 1 and 2 Differential Value	-32768	32767	16 bit signed integer
300011	10	Channel 3 and 4 Differential Value	-32768	32767	16 bit signed integer
300012	11	Channel 5 and 6 Differential Value	-32768	32767	16 bit signed integer
300013	12	Channel 1 High Alarm Limit	-32768	32767	16 bit signed integer
300014	13	Channel 2 High Alarm Limit	-32768	32767	16 bit signed integer
300015	14	Channel 3 High Alarm Limit	-32768	32767	16 bit signed integer
330016	15	Channel 4 High Alarm Limit	-32768	32767	16 bit signed integer

300017	16	Channel 5 High Alarm Limit	-32768	32767	16 bit signed integer
300018	17	Channel 6 High Alarm Limit	-32768	32767	16 bit signed integer
330019	18	Channel 1 and 2 Differential High Alarm Limit	-32768	32767	16 bit signed integer
300020	19	Channel 3 and 4 Differential High Alarm Limit	-32768	32767	16 bit signed integer
300021	20	Channel 5 and 6 Differential High Alarm Limit	-32768	32767	16 bit signed integer
300022	21	Channel 1 Low Alarm Limit	-32768	32767	16 bit signed integer
300023	22	Channel 2 Low Alarm Limit	-32768	32767	16 bit signed integer
300024	23	Channel 3 Low Alarm Limit	-32768	32767	16 bit signed integer
300025	24	Channel 4 Low Alarm Limit	-32768	32767	16 bit signed integer
300026	25	Channel 5 Low Alarm Limit	-32768	32767	16 bit signed integer
300027	26	Channel 6 Low Alarm Limit	-32768	32767	16 bit signed integer
300028	27	Channel 1 and 2 Differential Low Alarm Limit	-32768	32767	16 bit signed integer
300029	28	Channel 3 and 4 Differential Low Alarm Limit	-32768	32767	16 bit signed integer
300030	29	Channel 5 and 6 Differential Low Alarm Limit	-32768	32767	16 bit signed integer
300031	30	RPM	0	65535	16 bit unsigned integer
300032	31	Register Table Version	0	65535	16 bit unsigned integer
301002-301005	1001-1004	Log Buffer Entry #1			Custom (See table 4)
301006-301009	1005-1008	Log Buffer Entry #2			Custom (See table 4)
301010-301013	1009-1012	Log Buffer Entry #3			Custom (See table 4)
301014-301017	1013-1016	Log Buffer Entry #4			Custom (See table 4)
301018-301021	1017-1020	Log Buffer Entry #5			Custom (See table 4)
301022-301025	1021-1024	Log Buffer Entry #6			Custom (See table 4)
301026-301029	1025-1028	Log Buffer Entry #7			Custom (See table 4)
301030-301033	1029-1032	Log Buffer Entry #8			Custom (See table 4)
301034-301037	1033-1036	Log Buffer Entry #9			Custom (See table 4)
301038-301041	1037-1040	Log Buffer Entry #10			Custom (See table 4)
301042-301045	1041-1044	Log Buffer Entry #11			Custom (See table 4)

301046-301049	1045-1048	Log Buffer Entry #12			Custom (See table 4)
301050-301053	1049-1052	Log Buffer Entry #13			Custom (See table 4)
301054-301057	1053-1056	Log Buffer Entry #14			Custom (See table 4)
301058-301061	1057-1060	Log Buffer Entry #15			Custom (See table 4)
301062-301065	1061-1064	Log Buffer Entry #16			Custom (See table 4)
301066-301069	1065-1068	Log Buffer Entry #17			Custom (See table 4)
301070-301073	1069-1072	Log Buffer Entry #18			Custom (See table 4)
301074-301077	1073-1076	Log Buffer Entry #19			Custom (See table 4)
301078-301081	1077-1080	Log Buffer Entry #20			Custom (See table 4)
301082-301085	1081-1084	Log Buffer Entry #21			Custom (See table 4)
301086-301089	1085-1088	Log Buffer Entry #22			Custom (See table 4)
301090-301093	1089-1092	Log Buffer Entry #23			Custom (See table 4)
301094-301097	1093-1096	Log Buffer Entry #24			Custom (See table 4)
301098-301101	1097-1100	Log Buffer Entry #25			Custom (See table 4)
301102-301105	1101-1104	Log Buffer Entry #26			Custom (See table 4)
301106-301109	1105-1108	Log Buffer Entry #27			Custom (See table 4)
301110-301113	1109-1112	Log Buffer Entry #28			Custom (See table 4)
301114-301117	1113-1116	Log Buffer Entry #29			Custom (See table 4)
301118-301121	1117-1120	Log Buffer Entry #30			Custom (See table 4)
302002-302003	2001-2002	Channel 1 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302004-302005	2003-2004	Channel 2 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)

302006-302007	2005-2006	Channel 3 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302008-302009	2007-2008	Channel 4 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302010-302011	2009-2010	Channel 5 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302012-302013	2011-2012	Channel 6 Float Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302014-302015	2013-2014	Channel 1 and 2 Differential Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302016-302017	2015-2016	Channel 3 and 4 Differential Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302018-302019	2017-2018	Channel 5 and 6 Differential Value	-9999.0	99999.0	32 bit Float(IEEE 754)
302020-302021	2019-2020	Channel 1 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302022-302023	2021-2022	Channel 2 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302024-302025	2023-2024	Channel 3 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302026-302027	2025-2026	Channel 4 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302028-302029	2027-2028	Channel 5 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302030-302031	2029-2030	Channel 6 High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302032-302033	2031-2032	Channel 1 and 2 Differential High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302034-302035	2033-2034	Channel 3 and 4 Differential High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302036-302037	2035-2036	Channel 5 and 6 Differential High Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302038-302039	2037-2038	Channel 1 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302040-302041	2039-2040	Channel 2 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302042-302043	2041-2042	Channel 3 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302044-302045	2043-2044	Channel 4 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302046-302047	2045-2046	Channel 5 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)

302048-302049	2047-2048	Channel 6 High Low Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302050-302051	2049-2050	Channel 1 and 2 Differential Low Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302052-302053	2051-2052	Channel 3 and 4 Differential Low Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302054-302055	2053-2054	Channel 5 and 6 Differential Low Alarm Limit	-9999.0	99999.0	32 bit Float(IEEE 754)
302056-302057	2055-2056	RPM	0	99999.0	32 bit unsigned integer
302058-302059	2057-2058	Hourmeter	0	99999.0	32 bit unsigned integer

Holding Register Table (table 2)

Modicon Address	Modbus Offset	Description	Min Value	Max Value	Scale	Data type
401001-401002	1000-1001	Log start date (upper 16 bits and lower 16 bits respectively)				Custom (See table 3)

Date Format Table (table 3)

	Second(MSB)	Minute	Hour	Day	Month	Year(LSB)
Bits	6	6	5	5	4	6
Value range	0-59	0-59	0-23	1-31	1-12	0-63(relative to year 2000)

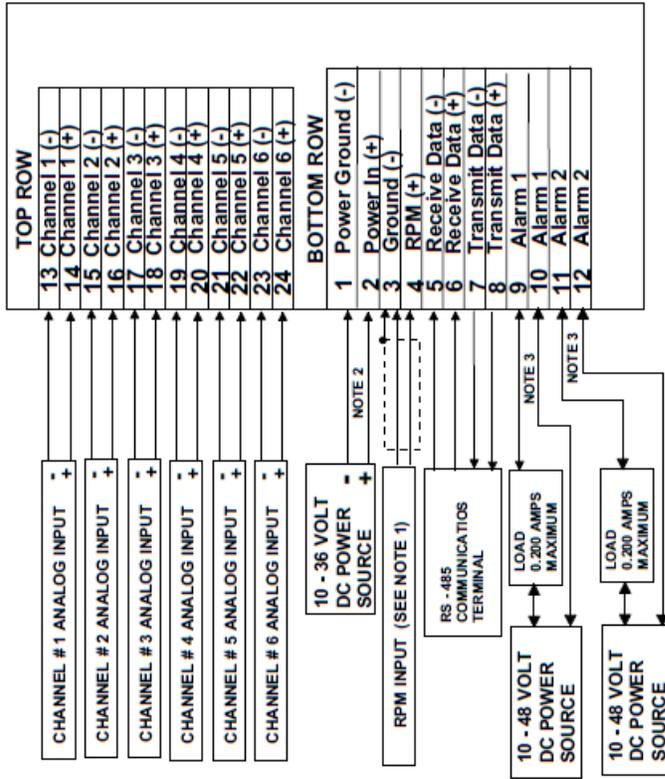
Log Buffer Entry (table 4)

	Date Time	Event ID	Value
Length	4 bytes	2 bytes	2 bytes
Value range	see table 3	1-10	0-65535

WARNING:

1. SUBSTITUTION OF COMPONENTS MAY IMPAIR DIVISION 2 CERTIFICATION.
2. WHEN USED IN DIVISION 2, DO NOT DISCONNECT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS
3. MAXIMUM AMBIENT TEMPERATURE +70 C (+158 F).

**UM-600 MONITOR
OR
CATALYST MONITOR**



NOTES:

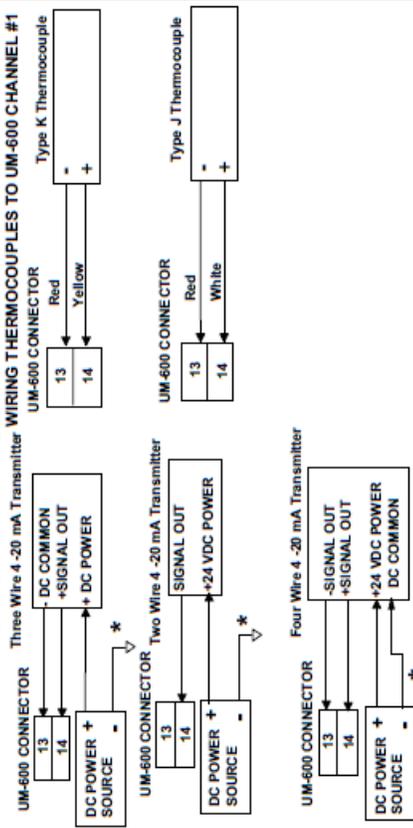
1. The M201, M202, M231, M928, and M928-24 Magnetic Pickups have been approved to be connected to the RPM input. The pickup must be connected with shielded cable with the shield connected to terminal 3 as shown. As an alternative, a contact closure may be connected to the RPM input as a "RUN" signal.
2. The unit is powered by 10 - 36 Volt DC at 0.15 Amp max. DC power wiring must be run in CSA approved solid or flexible conduit.
3. The Alarm outputs may be connected to a load not to exceed 48 Volt DC and 0.2 Amps. Alarm output wiring must be run in CSA approved solid or flexible conduit.
4. The UM-600 and Catalyst Monitor are certified for mounting in a suitable enclosure. Suitability of the final combination is to be determined by CSA or the inspection authority having jurisdiction.

REVISIONS

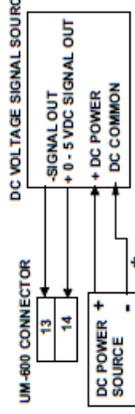
LTR	DESCRIPTION	DATE	APPD

Wiring diagrams below are shown for Channel #1. Channels 2 thru 6 will be wired in a similar manner.

WIRING 4-20 mA TRANSMITTERS TO UM-600 CHANNEL #1



WIRING 0 - 1, 0 - 5, or 0 - 10 VDC INPUT TO UM-6 CHANNEL # 1



* 0 - 1, 0 - 5, 0 - 10 VDC and 4/20 Milliamp Transmitters must be powered by a power supply which has the same common (-) as the power to the UM-600 Monitor.

Any ungrounded thermocouple may be connected to the UM-600 Monitor as the thermocouple input circuit has been evaluated as non-incendive.

THE UM-600 AND CATALYST MONITOR ARE CSA APPROVED FOR USE IN CLASS I, DIVISION 2, GROUP A, B, C, & D LOCATIONS WHEN INSTALLED PER INSTRUCTIONS ON THIS DRAWING.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:		DRAWN	
FRACT.	DEC.	ANGLE	DATE
± .164	XXX ± .005	± 1.0	07/13/11
	XX ± .01	DEGREE	
MATERIAL:		APPROVED	
		D. A. Weaver	
		FT. LAUDERDALE, FL., USA	
DYNALCO CONTROLS			
PRODUCT PART		UM-600	
CATALYST MONITOR			
INTERCONNECTION DRAWING			
CSA APPROVED UNITS			
SCALE	SIZE	DESK NUMBER	PAGE OF
A		80012970	1 1
REVISED			

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