CEC 1-809-XXXX
VIBRATION MONITOR / TRANSMITTER

Operation & Maintenance Manual

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Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Contents

Figures

Table

Appendix

1.0 Overview

1.1 Introduction

This document contains information on the operation, installation and maintenance of the Type 1-809 Vibration Monitor / Transmitter. The instrument is manufactured by CEC Vibration Products Inc., Covina, CA, USA.

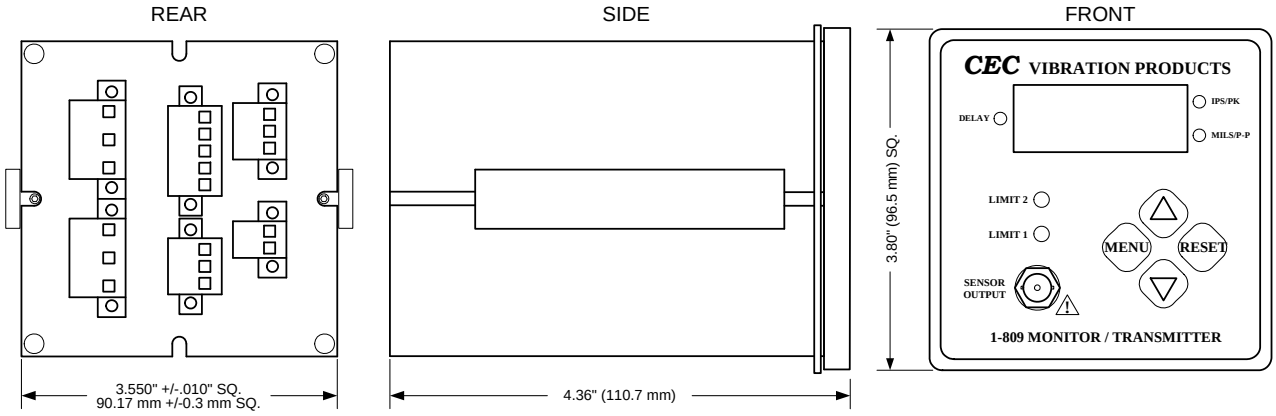
The 1-809 constantly monitors vibration levels on critical machinery and provides feedback in the event of a machinery breakdown. The machine's vibration level is visible on a 4-digit LED display. The reading is displayed in either inches per second (ips) peak velocity, mils peak-to-peak displacement or g's peak acceleration and a 4-20 mA output signal is provided proportional to the scaled display indication. Two programmable alarms are provided for warning of impending machinery breakdowns.

1.2 Description

The 1-809 is a panel mount vibration monitor designed to accept a velocity or pre-conditioned acceleration transducer input. The input signal is filtered via an order specified band-pass filter with very sharp cut off characteristics. The filtering is designed to eliminate frequencies outside of the machinery operational speeds of interest. This allows the 1-809 to track only those energies present within the filter's bandwidth. The resulting vibration level is then displayed on the 4-digit LED display located on the front panel of the 1-809. The display indicates the current vibration level in ips, mils or g's.

Two programmable alarms are provided to indicate warning and shutdown levels have been exceeded. Each alarm features a programmable delay which will prevent false alarm conditions. A start-up trip delay of thirty seconds is available to prevent false alarms during start-up situations. The 1-809 also includes a scaled 4-20 mA output for use in PLC and DCS applications.

Figure 1.1 Dimensional Outline



1.3 Technical Specifications

Table 1.1

Output Mode: (Unit of Measure) ***Ref. Section 5.2***	Velocity: Inches Per Second (ips), Peak Displacement: mils, Peak-to-Peak Acceleration: g's, Peak	
Vibration Range: (Display & 4-20 mA Output) ***Ref. Section 5.2.3***	Adjustable from 001 to 200 units	
Sensitivity: ***Ref. Section 5.2.4***	Adjustable from 0.01 to 500	
Frequency Range:	2 – 20,000 Hz	
Fixed Filter: ***Ref. Selection Guide for filter values***	High Pass Response: 7th Order Inverse Chebyshev Pass band Ripple: 0.2 dB Stop band Ripple: 42 dB per octave Low Pass Response: 10th Order Root Raised Cosine Pass band Ripple: 3 dB Stop band Ripple: 60 dB per octave	
Temperature Range:	Operating: +0° to +158°F (-18° to +70°C) Storage: -67° to +185°F (-55° to +85°C)	
Humidity:	0 to 95% relative humidity (non-condensing)	
Alarm Outputs:	SPST-NO + SPST-NC / Latching & Non-latching (Outputs are isolated from system electronics)	
	Resistive Load (power factor = 1) 3 A at 240 VAC, 50/60Hz 3 A at 30 VDC	Inductive Load (p.f. = 0.4) (L/R = 7ms) 3 A at 240 VAC, 50/60Hz 3 A at 30 VDC
Analog Output:	Active 4-20 mA current loop proportional to full scale. 4-20 mA output load: 1K Ohm minimum	
Alarm Reset/Start Inputs:	External inputs shorted to common to activate.	
Display:	4-digit LED display with decimal point.	
Input Power:	20 - 32 VDC @ 150mA max.	
Note: For Class I, Zone 2 hazardous locations, the power supplied to the 1-809 must be provided with an externally mounted transient voltage limiting device that is rated to limit transient levels to not more than 140% of the values specified above.		

1.4 Features

1.4.1 Dual Alarms:

Dual alarm capability provides the operator one alarm limit to warn of an impending mechanical problem and a second alarm limit to be used for actual machinery shutdown *(see Alarm Operation)*. Both alarm limit set points are user programmable from min to max scale. Each alarm also includes a programmable delay from 0 to 120 seconds.

1.4.2 LED Alarm Indication:

An indicator light exists for each alarm limit. When an alarm condition exists, the corresponding "Limit" indicator will illuminate. When in programming mode, the corresponding indicator light will flash on & off indicating which limit set point is being programmed.

1.4.3 Alarm State:

The 1-809 includes both Normally Open (NO) and Normally Closed (NC) contact operation via connections located on the back panel. The NO and NC designation indicates the failsafe modes in case of system failure.

1.4.4 Alarm Reset:

Activated alarms may be remotely reset by momentarily connecting the Reset and common contacts located on the rear of the meter or by pressing the reset button located on the face of the 1-809.

1.4.5 Start-Up Trip Delay:

All alarms are temporarily inactive for thirty seconds at power-up to prevent false alarms. Healthy machinery can exhibit large vibration levels at start-up and may require alarms to be temporarily inactive.

1.4.6 Remote Start Input

To activate a start-up delay while the 1-809 is powered on, connect the Start and common contacts located on the rear panel of the 1-809. While this connection is maintained the alarms will be deactivated, upon removal of this connection the alarms will be activated after a 30 second delay.

1.4.7 Analog Output

An active 4-20 mA output equal to the scaled display is located on the rear panel of the 1-809. The 4-20 mA output is proportional to the specified output mode and vibration range.

1.4.8 Sensor Output

The un-filtered buffered sensor output is available via a BNC connector located on the front panel or connections on the rear panel. The buffered output is available for handheld analyzers to further diagnose machinery health. Analyzers should be set for passive sensor power mode.

EXPLOSION HAZARD - Do not connect or disconnect unless power has been removed or the area is known to be non-hazardous.

2.0 Installation

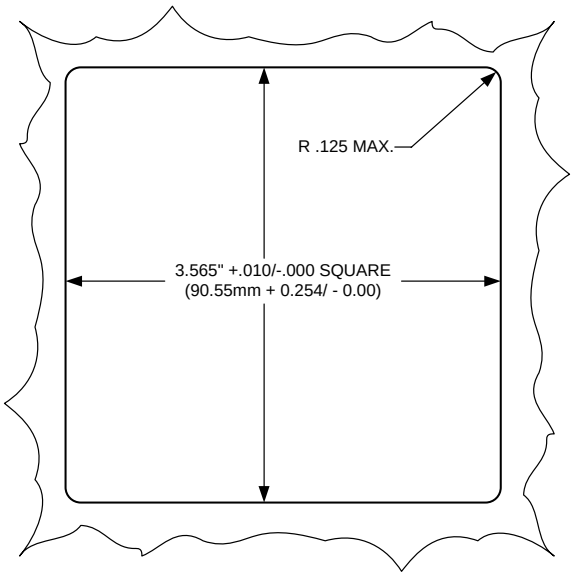
2.1 Monitor Mounting

Installation on a sub-panel consists of:

- Laying out the corner drill points on the panel
- Drilling the holes to accommodate a cutting device or punch
- Cutting out the mounting hole
- Inserting the monitor and securing with the bezel mount bars and set screws

2.1.1 Cut a hole in mounting panel according to the dimensions specified in Figure 2.1.

Figure 2.1 Panel Cutout



2.1.2 Loosen two set screws from the rear of the 1-809 and slide two mounting bars off.

2.1.3 Make sure that gasket part number 700943-02-0000 is properly applied as indicated on Dimensional Outline Drawing 700950-40-0000.

2.1.4 Insert the monitor into the panel cutout. Be sure the front bezel and gasket are flush to the panel.

2.1.5 Re-Insert two mounting bars onto the monitor from the rear in opposing sides (top/bottom or left/right sides).

2.1.6 Secure the mounting bars with set screws.

3.0 Hazardous Environment Installation

3.1 Enclosure Requirements

This equipment is supplied as “open type” equipment. This equipment must be used within an overall system enclosure that is appropriately designed for the intended environment and rated at least IP54 or higher. The interior of the enclosure must be accessible only by the use of a tool. Suitability of the system enclosure is subject to acceptance by the local authority having jurisdiction at the time of installation.

This equipment is suitable for Class I, Division 2, Group A,B,C,D, Class I, Zone 2, Group IIC hazardous locations or non-hazardous locations only.

For installation in a Zone 2 hazardous area the panel meter must be installed in an enclosure with a degree of protection not less than IP 54 and where the final installation is acceptable to the local inspection authority having jurisdiction.

3.2 WARNINGS:

EXPLOSION HAZARD
Do not connect or disconnect equipment unless power has been removed or the area is known to be non-hazardous.
Do not connect or disconnect connections to this equipment unless power has been removed or the area is known to be non-hazardous. Secure any external connections that mate to this equipment by using set screws, threaded connectors, or other means provided with this product.

EXPLOSION HAZARD
Substitution of components may impair suitability for Class I, Division 2 operation.

DO NOT USE IN THE PRESENCE OF ACETIC ACID OR ETHYLENE CHLORIDE.

3.3 Chemical Vapor Compatibility

Following is a brief list of the chemical vapors in which the alarm relay has been investigated for seal performance:

Table 3.1

Chemical Name	Also Known As
Reference Fuel C	ASTM D 471 Reference Fuel C
2-Propanone; Dimethyl Ketone	Acetone, ACS Grade, 99.5% min. (by GC)
Ammonia Solution	Ammonium hydroxide, 50% v/v aq. Soln.
Benzene	Pyrobenzol
Diethyl Ether; Ethyl Ether; Ethyl Oxide	Ether, Stabilized. ACS Grade, 99.0% min. (by GC)
Ether Acetic	Ethyl Acetate, ACS Grade, 99.5% min. (by GC)
2-Furaldehyde	Furfural, Reagent. ACS Grade, 98.0% min.
n-Hexane	Hexane, UltimAR*. 99.9% min. (95.0% as n-Hexane)
2-Butanone	Methyl Ethyl Ketone, ACS Grade, 99.0% min.
Methyl Alcohol; Carbinol	Methanol, ACS Grade, 99.8% min. (by GC)
2-Nitropropane	2-Nitropropane, 96% 250GR

4.0 Signal Connections

4.1 Wiring Requirements

Use solid or stranded wire. All wiring should meet the following specifications:

- 16 to 24 AWG copper conductors without pretreatment.
- Recommended strip length 0.31 inches (8 mm)
- Minimum insulation rating of 300V

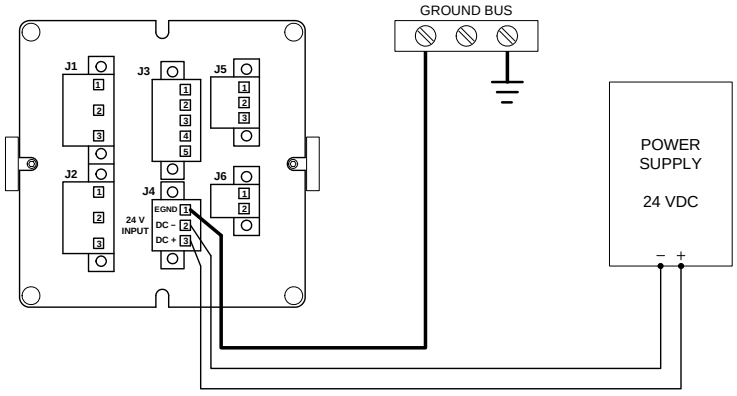
4.2 Grounding Requirements

Use these grounding requirements to ensure safe electrical operating circumstances and to help avoid potential EMI and ground noise that could cause unfavorable operating conditions.

4.2.1 Panel Mount Grounding

The 1-809 should be mounted to a conductive mounting plate that is grounded. Use the screw hole provided on the power input connector J4 when the mounting panel is isolated from ground. See Figure 4.1.

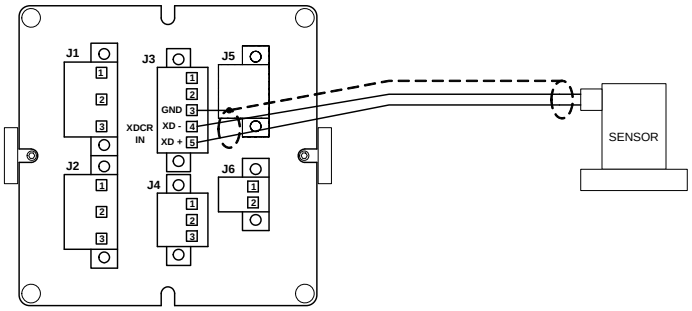
Figure 4.1 Panel Mount Grounding



4.2.2 Transducer Grounding

Make certain the transducer is electrically isolated from earth ground. Cable shields must be grounded at one end of the cable, and the other end left floating or not connected. It is recommended that where possible, the cable shield be grounded at the 1-809 transducer input connector J3-GND and not at the transducer. See Figure 4.2.

Figure 4.2 Transducer Grounding



4.3 Rear Panel Connections

The connectors located at the rear panel of the 1-809 are designed to be securely mounted using two set screws per connector. To connect signal and power wires, each connector must be removed from the 1-809. Note: Complete and verify all signal wire connections before applying power.

Securely connect each wire lead by inserting the wire into the appropriate contact (ref. Table 4.1) and then tighten the individual wire clamps by turning set screws in a clockwise rotation. Verify each wire connection by giving the wire a gentle tug to assure proper installation. Once all wires are properly connected reseat connector and secure by tightening the two mounting screws. When power is applied to the 1-809 you may proceed to programming of the alarm limit levels as shown in Section 5.0 (Programming the Monitor / Transmitter).

Figure 4.3 Rear Panel Diagram

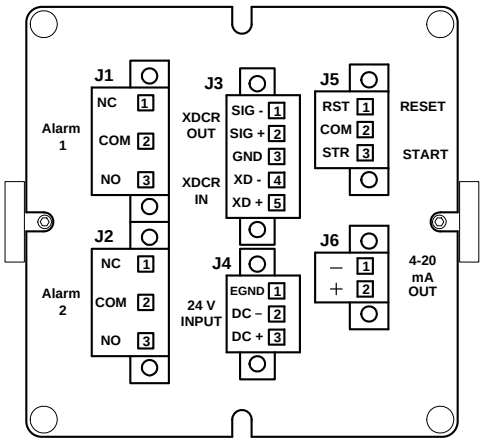


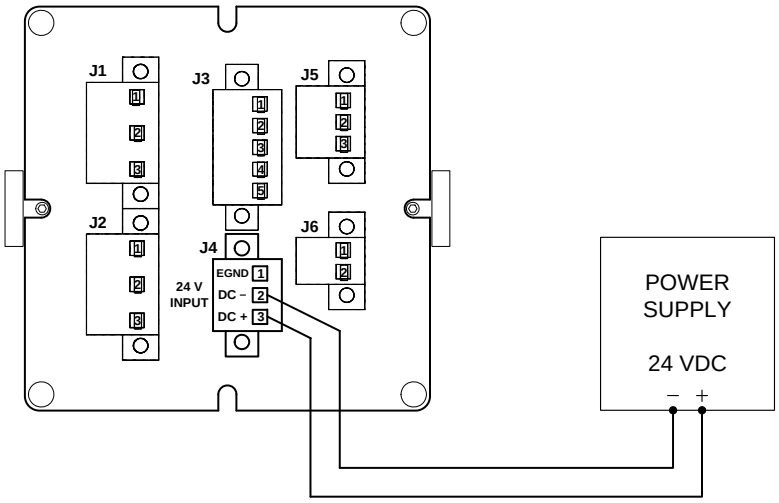
Table 4.1 Connector Assignments

Connection	Label	Description
J1-1	NC	Alarm 1 – normally closed relay contact
J1-2	COM	Alarm 1 – common contact used in conjunction with Alarm 1 NC or NO contact only
J1-3	NO	Alarm 1 – normally open relay contact
J2-1	NC	Alarm 2 – normally closed relay contact
J2-2	COM	Alarm 2 – common contact used in conjunction with Alarm 2 NC or NO contact only
J2-3	NO	Alarm 2 – normally open relay contact
J3-1	SIG –	Buffered transducer output
J3-2	SIG +	Buffered transducer output
J3-3	GND	Isolated ground – apply input transducer shield *only*
J3-4	XD –	Transducer (–) input
J3-5	XD +	Transducer (+) input
J4-1	EGND	Earth ground – DO NOT share with other ground or common connections
J4-2	DC –	24 VDC negative input
J4-3	DC +	24 VDC positive input
J5-1	RST	Remote Reset contact
J5-2	COM	Common contact used with remote reset and start inputs *only*
J5-3	STR	Remote Start contact
J6-1	–	Active analog 4-20 mA output (negative), proportional to display
J6-2	+	Active analog 4-20 mA output (positive), proportional to display

4.3.1 Connecting Power

The power requirement is 24VDC nominal. The connections are electrically isolated from the sensor input and 4-20mA output.

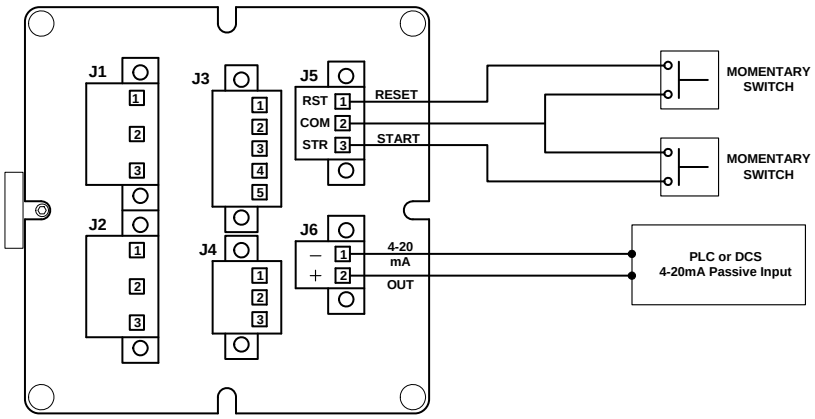
Figure 4.4 Power Supply Connection



4.3.2 Connecting the 4-20mA Active (Powered) Output

The 4-20mA output located on J6 is an active output and should be connected only to a passive input of a PLC controller or other remote device. 4-20 mA output load is 1K ohm minimum.

Figure 4.5 Reset, Start & 4-20mA Output Connections



4.3.3 Remote Reset & Start Connection (See Figure 4.5)

For remote operation of the Reset and Start controls, a momentary switch may be employed to activate these controls. Connect the switches to J5 as indicated.

4.3.4 Connecting the Relays

The 1-809 has two DPDT alarm relays; both relays provide a Normally Open (NO) and Normally Closed (NC) set of contacts. The NO and NC designation indicates the de-energized state of the contact. During normal operation the relays are energized. The relays switch to the de-energized state when an alarm trip occurs or when power is lost. The failsafe mode for all relays is the de-energized state.

Note: Wiring to the alarm circuits must remain physically separated by routing away from wiring to the other circuits of the Monitor/Transmitter.

Figure 4.6 Alarm / Failsafe Mode

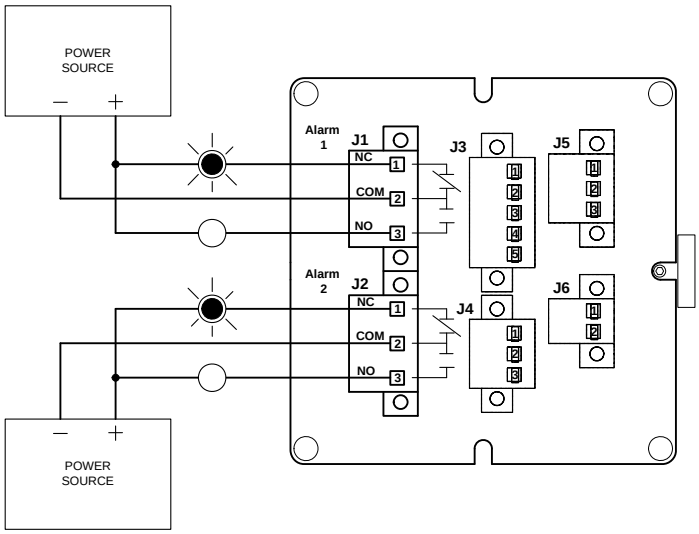
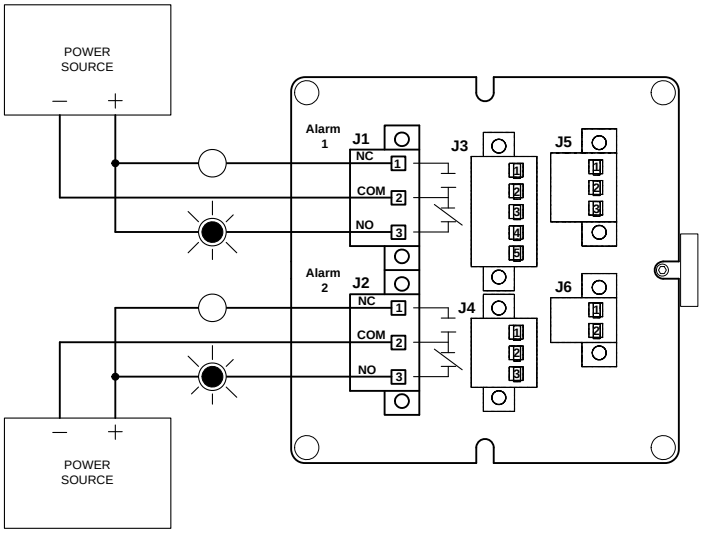


Figure 4.7 Normal Operation / Non-Alarm Mode



5.0 Programming the Monitor / Transmitter

5.1 Alarm Programming Procedure (Reference Figure 5.1)

5.1.1 Setting Alarm 1 Limit (Trip Level)

Press MENU key once and the Limit 1 indicator begins to flash. The 4-digit LED display will indicate the current setting (vibration set point level) for Limit 1. Change current Limit 1 set point by pressing the △ / ▽ keys until desired alarm level is shown on the LED display.

Press MENU key again to save Limit 1 set point and advance to Alarm Delay setting or you can exit programming by pressing the RESET key or waiting 10 seconds. See note below.

5.1.2 Setting Alarm Delay

Press the MENU key until a “d” appears in the left most digit. Use the △ **/** ▽ keys to set the desired delay value in seconds. Note: “d_ _3” is the default value for this option. While three seconds is the default Delay value, the value can be changed to any value between 0 seconds up to 120 seconds. The Delay sets the time (in seconds) that a vibration value above the alarm trip limit must be maintained prior to actual alarm trip.

5.1.3 Setting Latching Mode

Press the MENU key until an “L_ _X is displayed. The X will be a 0 or a 1 representing non-latching and latching alarm states. This option allows the user to select the alarms to stay ON until someone manually resets the alarm, or go off automatically when the vibration level drops below the alarm trip level.
L_ _0 = Non-latching, Alarm will auto reset if vibration level drops below trip level.
L_ _1 = Latching, Alarm will stay active (on) until manually reset.

5.1.4 Setting Alarm 2

Press MENU key until the Limit 2 indicator begins to flash. Repeat steps 1 thru 3 for Alarm 2.

NOTES:

a. Pressing the RESET key at any time will exit the programming mode.
b. The 1-809 provides a 10-second time-out window for programming alarm conditions. If no programming activity takes place within 10 seconds the 1-809 will return to run mode.

Figure 5.1 Front Panel Layout

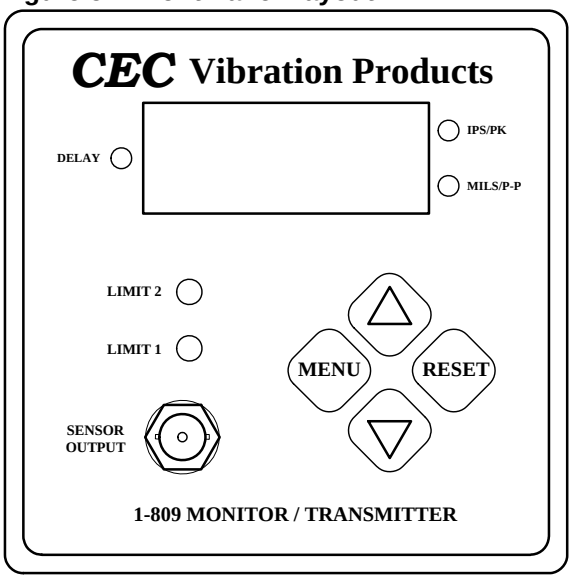
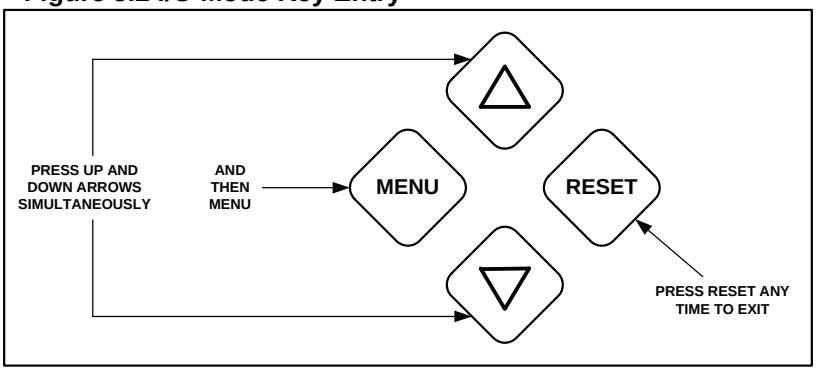


Figure 5.2 I/O Mode Key Entry



5.2 Input & Output Mode Programming Procedure (Reference Figure 5.1, 5.2 and Table 5.1)

5.2.1 Select Input Units

Enter the Main Menu by pressing the △ / ▽ and then the MENU key simultaneously until "In" appears on the 4-digit LED display. The current input units are represented by the indicator LED's to the right of the display. Depending on where the input was set previously, pressing the △ or ▽ key will toggle between three states; Velocity (ips/Pk), Displacement (mils/Pk-Pk) and Acceleration (g's/Pk). (Ref. Table 5-1) You can exit the Programming Mode by pressing the reset key or waiting 10 seconds. (See note below.)

Table 5.1

UNITS SELECTION	LED On/Off	
	IPS/PK	MILS/P-P
Velocity, ips/ Peak	ON	OFF
Acceleration, g's/ Peak	OFF	OFF
Displacement, mils/ Pk-Pk	OFF	ON

5.2.2 Selecting Output Units

To select the output units press MENU until "OUT" appears on the 4-digit LED display. Press △ / ▽ to select between Velocity, Displacement or Acceleration units. If Displacement (mils/Pk-Pk) was selected for input units, toggling between Velocity and Acceleration would be rendered inactive at this point. Selecting Displacement (mils/Pk-Pk) on the input will result in a Displacement (mils/Pk-Pk) output.

5.2.3 Selecting Proper Range

When selecting Range press MENU until "R" appears on 4-digit LED display. Press △ / ▽ to select proper range. The range adjustment allows the user to select a value from 1.00 to 200.

5.2.4 Selecting Transducer Sensitivity

When selecting Transducer sensitivity press MENU until " t " appears on the 4-digit LED display. Press the △ or ▽ key until the proper transducer sensitivity is reached. The range of the sensitivity is 0.01-500. Press MENU to save settings.

NOTES:

a. Pressing the RESET key at any time will exit the programming mode.

b. The 1-809 provides a 10 second time-out window when programming the Input and Output Characteristics.

6.0 Maintenance

There are no customer replaceable parts within the 1-809. The 1-809 has been designed for trouble-free service under normal operating conditions. CEC Vibration Products Inc. warrants the equipment for one year from the date of purchase. Should your instrument require repair within the warranty period, you may contact customer service at:

Tel: (626) 938-0200

Fax: (626) 938-0202

Email: info@cecvp.com

7.0 Troubleshooting

Table 7.1

Question	Answer
Is analog output (4-20 mA) working properly?	Connect a current meter in series to verify that displayed output is equal to actual output of vibration switch. Remember that 4.0 mA is equivalent to zero vibration and 20.0 mA is equal to maximum vibration level. (i.e. for a 1.5 ips unit: 0.38 ips = 8 mA)
Does analog output (4-20 mA) represent vibration levels experienced by machinery?	Install velocity sensor on shaker table and compare to output on the 1-809 or input a known vibration signal from a precision signal source and verify 1-809 reading to known value. Vibrations inputted to the 1-809 must be within specified frequency range of Monitor. See technical specifications for exact frequency range.
1-809 does not appear to be functioning.	Check to make sure vibration switch is properly wired and power is supplied.
No vibration level is indicated during start-up.	This is probably due to the start-up trip delay.
Are alarms working properly?	Follow the same procedure as in Answer 2, making sure that the vibration values applied exceed the limit set points. Limit indicators should activate when trip levels exist. A digital volt meter can be placed across the alarm contacts to verify their operation during this test.

8.0 Selection Guide

P/N 1-809-0 | A | B | C

VIBRATION MONITOR / TRANSMITTER
SELECTION GUIDE

A — SENSOR INPUT TYPE

0 =	*mV/ips*	*self-generating (Velocity Coil)*
1 =	*mV/ips*	*constant current (Integrated Accelerometer)*
2 =	*mV/g*	*constant current (Integrated Accelerometer)*
3 =	*mV*	*millivolt input (Customer Defined)*

B — HIGH PASS FILTER (42 dB / octave)

0 =	*None*	**5 =**	*30 Hz*	**A =**	*200 Hz*
1 =	*2 Hz*	**6 =**	*50 Hz*	**B =**	*350 Hz*
2 =	*5 Hz*	**7 =**	*70 Hz*		
3 =	*10 Hz*	**8 =**	*100 Hz*		
4 =	*20 Hz*	**9 =**	*150 Hz*		

C — LOW PASS FILTER (56 dB / octave)

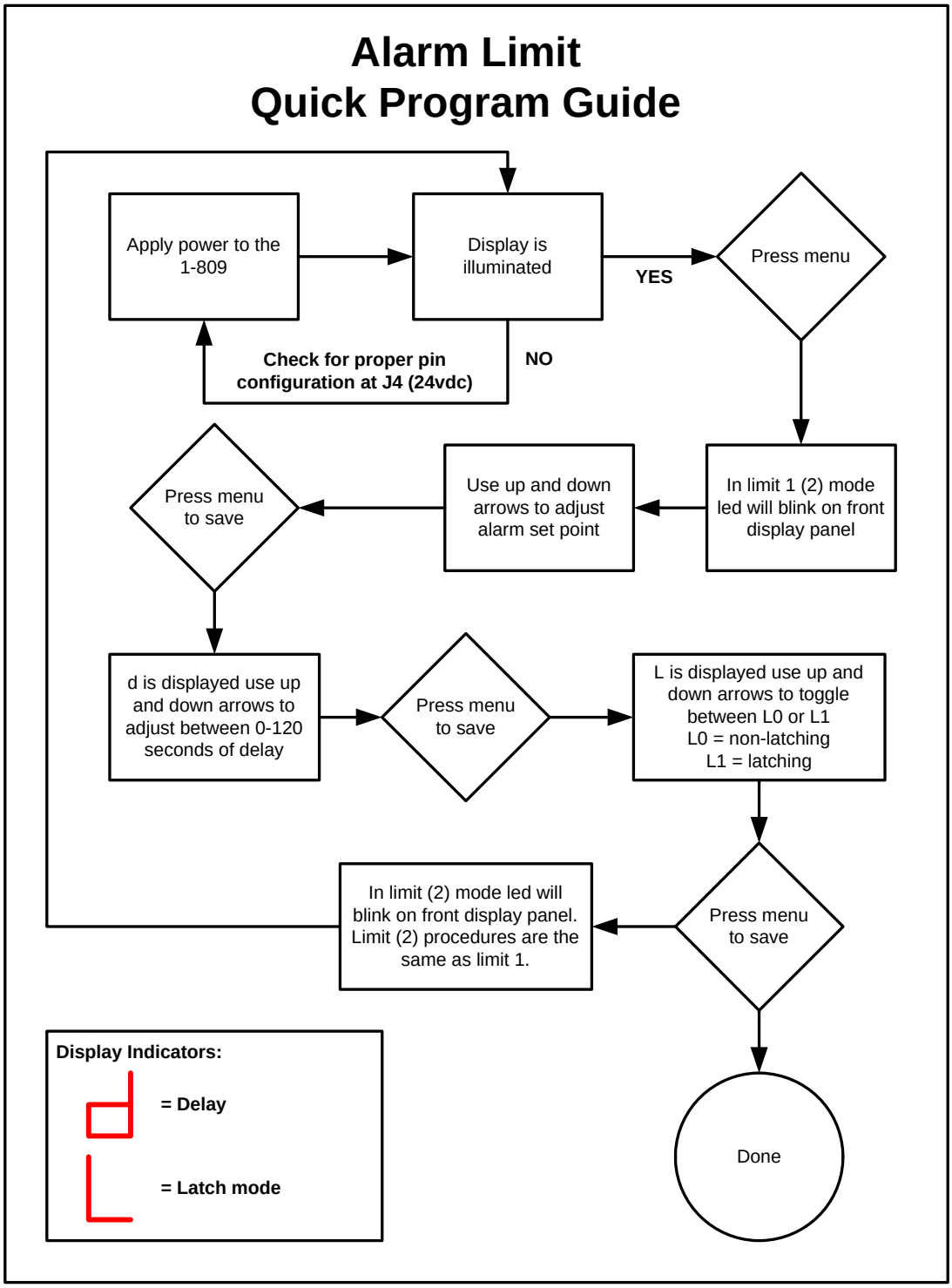
0 =	*None*	**5 =**	*250 Hz*	**A =**	*1,000 Hz*
1 =	*50 Hz*	**6 =**	*300 Hz*	**B =**	*2,000 Hz*
2 =	*100 Hz*	**7 =**	*400 Hz*		
3 =	*150 Hz*	**8 =**	*500 Hz*		
4 =	*200 Hz*	**9 =**	*800 Hz*		

NOTE: Special configurations can be accommodated. Please consult the factory for assistance.

Example: **P/N 1-809-0 | 0 | 3 | A**

The example unit is receiving its input from a self-generating velocity transducer.
The filtering includes a 10 Hz high pass and 1,000 Hz low pass.

Appendix A


Alarm Limit
Quick Program Guide
Apply power to the 1-809
Display is illuminated
YES
Press menu
NO
Check for proper pin configuration at J4 (24vdc)
In limit 1 (2) mode led will blink on front display panel
Use up and down arrows to adjust alarm set point
Press menu to save
d is displayed use up and down arrows to adjust between 0-120 seconds of delay
Press menu to save
L is displayed use up and down arrows to toggle between L0 or L1
L0 = non-latching
L1 = latching
Press menu to save
In limit (2) mode led will blink on front display panel. Limit (2) procedures are the same as limit 1.
Done
Display Indicators:
= Delay
= Latch mode

Appendix B

Input and Output Characteristics
Quick Program Guide