

MultiMux Multiplexer

USER'S GUIDE

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5 Gould Road, PO Box 2155
New London, NH 03257 USA
Voice: (603) 526-9800
e-mail: support@canarysystems.com
web: www.canarysystems.com

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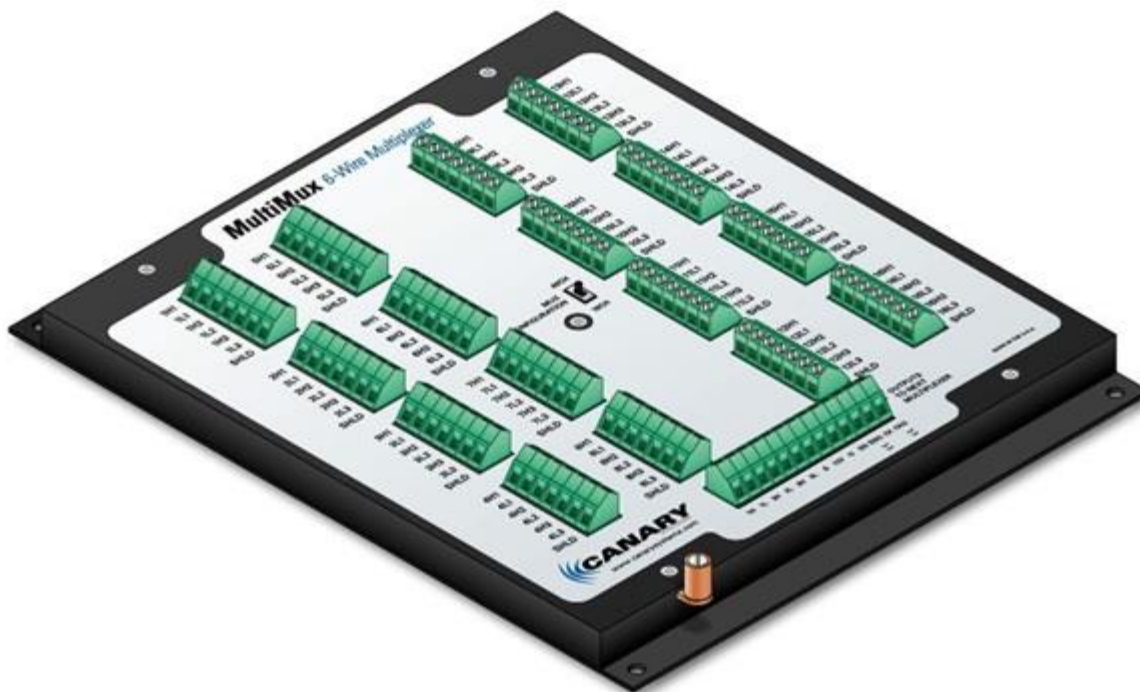
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1.1 Overview

The MultiMux expands the number of instruments that may be read by most all types of 5V/12V dataloggers in increments of 16 or 48 channels depending on the type of sensor being read. In addition, the MultiMux provides integral lightning protection by utilizing plasma surge arrestors. The MultiMux may be purchased installed in a NEMA 4X fiberglass/polyester enclosure or as an assembly for users who supply their own packaging.



The MultiMux utilizes advanced high-reliability components such as terminal blocks from Phoenix Contact®, relays from Panasonic® and a flash microcontroller from Microchip Devices® to help ensure years of reliable and trouble-free operation in almost any environment (components are rated to standard long term temp range of at least -40°C to +85°C). The use of low-contact resistance relays means almost universal instrument support, a high degree of lightning protection, and virtually infinite channel isolation.

The warranty is applicable for two years from date of shipment. It does not cover failure by improper installation, misuse, or by nature including, but not limited to; flood, lightning (by improper grounding), fire, or other catastrophe. Should you encounter problems with your MultiMux, see Section 3.1 for the troubleshooting flowchart.

1.2 Specifications

General

Power requirements: 11-16 VDC (unregulated)
 Quiescent current: 0.1 μ A
 Channel activated current (2-wire): 39mA
 Channel activated current (6-wire): 52mA
 Control line input impedance: <10K Ω
 Control line input levels: 5V/12V
 Transient protection: TVS & Spark Gap
 Operating temperature: -40 to +70° C (-40 to +160° F)

Relays

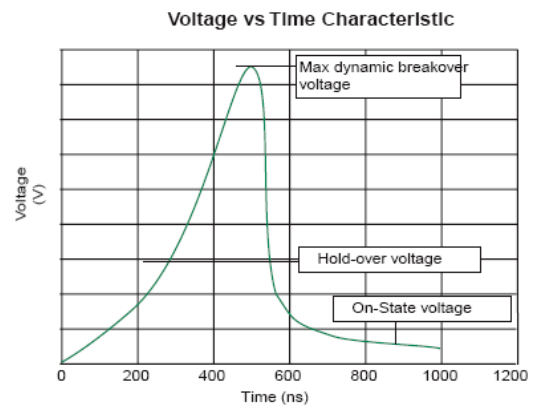
Power: 11 mA @ 12VDC (140 mW)
 Contact type: Gold-clad silver alloy
 Electrostatic capacitance: 3 picofarads
 On resistance: 50 milliohms
 Coil resistance: 1,028 ohms
 Maximum switching voltage: 125 VAC, 110 VDC
 Maximum switching power: 30 W (resistive load)
 Maximum switching current: 2 A
 Operate time: ~2 milliseconds
 Release time: ~1 milliseconds
 Initial contact bounce: ~1 millisecond
 Surge withstand (between open contacts): 1,500 V
 Switching life (mechanical): 100,000,000 operations

Lightning Protection Components

Spark-over Voltage @ 100V/s +/- 20% Tolerance: 75V DC
 Impulse Spark-over Voltage @ 1kV/us: 600V DC
 Impulse Discharge Current 1 kA: 8x20us, 10 hits
 Impulse Discharge Current 100A: 8x20us 300 hits
 Impulse Withstanding Voltage 4kV: 10/700us 10 hits
 Capacitance @ 1MHz: <0.5pF
 Insulation Resistance @ 100VDC: 1000 M Ω
 UL Rating: UL497B #E179610

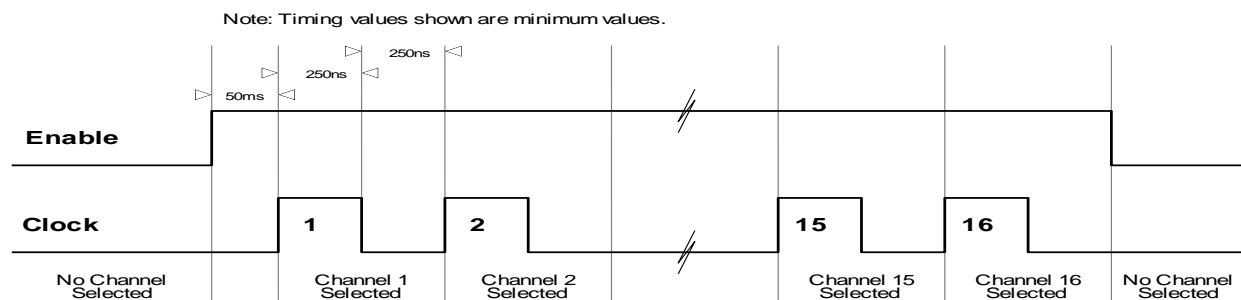
Dimensions:

Overall (L x W x H): 10.75 x 8.875 x 1" (273 x 225 x 25mm)
 Mounting Hole Pattern (LxW): 10.25 x 8.25" (260 x 210mm)
 Mounting Hole ID: 0.216" (5.5mm)



2.1 Operation Details

The MultiMux is controlled by a digital controller using 2 digital control signals. The operation of the MultiMux is simple enough so that virtually any device capable of controlling 2 digital TTL/CMOS type signals can be used to control the multiplexer. Generally speaking, the timing diagram depicted below describes how the two digital signals are used to control the MultiMux.



In the case of the 48 channel modes, the maximum number of pulses to advance through all the channels would be 48.

The channel switching mode is selected by configuring the DIP switch mounted on the MultiMux board.

2.2 Daisy-Chain Operation

Daisy Chaining allows for a single set of digital control signals (and single cable) to control multiple multiplexers. The number of multiplexers that may be connected is technically unlimited as the control signals are re-generated at each multiplexer. Generally however no more than 20 multiplexers should be connected as power losses due to lead wire resistance and control signal latencies will potentially cause problems.

To utilize Daisy Mux operation simply connect the ENO (Enable Out) to the EN (Enable) on the next mux. The CKO (Clock Out) is connected to the CK (Clock) of the next mux. When the MultiMux reaches the maximum channel (either 16 or 32 depending on the switch configuration) and more clocks are received, then the ENO becomes logic high. The CK outputs to CKO. The first mux switches to a low current standby mode. This continues until the next mux is at the maximum channel (either 16 or 48 depending on the switch configuration). To reset the entire string of multiplexers simply set EN low on the first multiplexer.

2.3 Instrument Connection

The way instruments are connected to the MultiMux will vary depending on whether it is configured for 16 or 48-channel operation. Use the DIP switch in the center of the assembly to configure the operation.

The default configuration is 16-channel operation.



The following table illustrates typical connection techniques for each of the operating modes:

Mode	Description	Example
16 Channel (4-wire or 6-wire)	Instrument #1 < 1H1 Temperature for Instrument #1 < 1L1 < 1H2 < 1L2 No Connection < 1H3 < 1L3 SHIELD	VW Gage #1 < 1H1 Thermistor in VW Gage #1 < 1L1 < 1H2 < 1L2 No Connection < 1H3 < 1L3 SHIELD
48 Channel (2-wire)	Instrument #1 < 1H1 < 1L1 Instrument #2 < 1H2 < 1L2 Instrument #3 < 1H3 < 1L3 SHIELD	VW Gage #1 < 1H1 < 1L1 VW Gage #2 < 1H2 < 1L2 VW Gage #3 < 1H3 < 1L3 SHIELD

2.4 Digital Controller Connection

The MultiMux is connected to a digital controller using the screw terminals at the bottom of the assembly.

The terminals have the following connections:

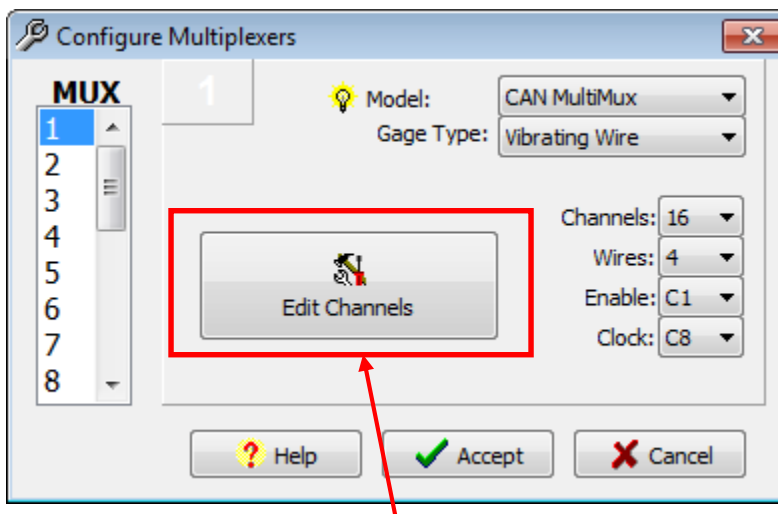
Terminal	Description	MLTB	Mux Cable (5 pair)	Mux Cable (6 pair)
1H	High side of CH1	1H	White	Brown
1L	Low side of CH1	1L	White's Black	Brown's Black
2H	High side of CH2	2H	Red	Red
2L	Low side of CH2	2L	Red's Black	Red's Black
3H	High side of CH3	3H	Blue	White
3L	Low side of CH3	3L	Blue's Black	White's Black
S	Gage shield	S	Overall Shield Drain Wire ¹	Overall Shield Drain Wire ¹
12V	Power	12V	Yellow	Yellow
G	Ground	G	Yellow's Black	Yellow's Black
EN	Mux Enable	EN	Green	Green
ENO	Mux Enable Out	N/A	Green (to next multiplexer)	Green (to next multiplexer)
CK	Mux Clock	CLK	Green's Black	Green's Black
CKO	Mux Clock Out	N/A	Green's Black (to next multiplexer)	Green's Black (to next multiplexer)

Notes:

¹ Individual pair shield drain wires can be cut off.

2.5 MultiLogger® Software Configuration

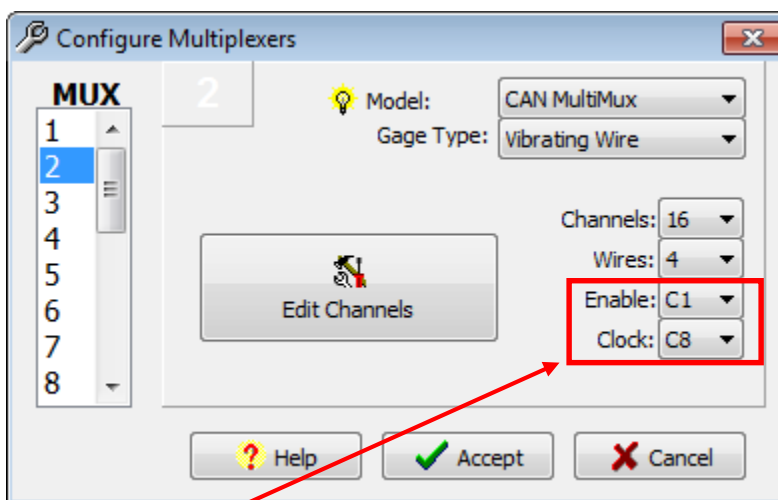
To configure MultiLogger to use the MultiMux select **CAN MultiMux** as your multiplexer **Model** on the **Configure | Multiplexers** form. Before the individual channels may be edited you must select a **Gage Type** of the type of gage connected. Select either **16 Channel** (default) or **32 Channel** to match the DIP switch settings of the MultiMux.



Once the multiplexer is configured press the **Edit Channels** button to configure the channels.

If the MultiMux is being used in Daisy Chain mode then select the same Enable and Clock for all MultiMuxes in the string.

For example, multiplexer #2 (using the same configuration shown above for multiplexer #1) would be configured as follows:



Note the Enable and Clock settings match multiplexer #1.

2.6 CR1000 Program Example

The following example illustrates how to write custom programs for the CR1000 to read instruments connected to the MultiMux.

The example assumes a 16 Channel Mode MultiMux reading 16 MEMS inclinometers (voltage output). The MultiMux Enable is connected to C1, the Clock is connected to C8.

```
'Define Public Variables
Public Mux1CHA(16) as Float
Public Mux1CHB(16) as Float

'Define Other Variables
Dim Channel as FLOAT
Dim ScratchLoc(32) as FLOAT

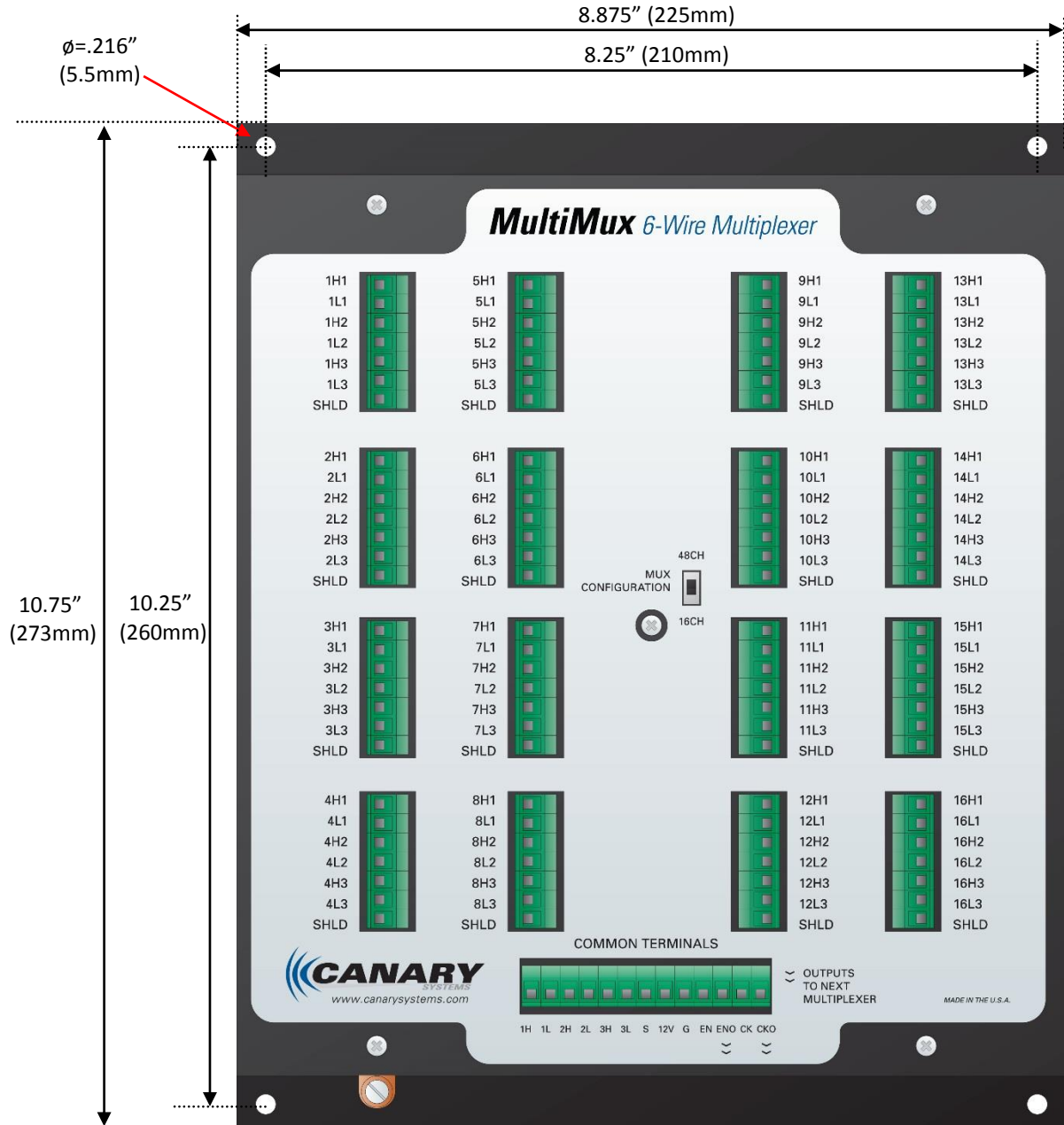
'Define Data Tables
DataTable(FSDATA,1,-1)
    Sample(16,Mux1CHA(),IEEEE4)
    Sample(16,Mux1CHB(),IEEEE4)
ENDTABLE

'Main Program
BeginProg
Scan(60,SEC,1,0)
'Use C1 to Enable MultiMux
PortSet(1,1)
Delay(0,50,MSEC)
'Loop 16 times for entire MultiMux
For Channel = 1 TO 16
    'Use C8 to Send Clocking Pulse
    PulsePort(8,10000)
    Delay(0,100,mSec)
    'Read MEMS Channel A on Differential CH1 - Average 100 measurements
    ScratchLoc(3) = 0
    For ScratchLoc(1) = 1 to 100
        VoltDiff (ScratchLoc(2),1,mV5000,1,False,0,1000,0.001,0)
        ScratchLoc(3) = ScratchLoc(3) + ScratchLoc(2)
    Next
    Mux1CHA(Channel) = ScratchLoc(3) / 100
    'Read MEMS Channel B on Differential CH2 - Average 100 measurements
    ScratchLoc(3) = 0
    For ScratchLoc(1) = 1 to 100
        VoltDiff (ScratchLoc(2),2,mV5000,1,False,0,1000,0.001,0)
        ScratchLoc(3) = ScratchLoc(3) + ScratchLoc(2)
    Next
    Mux1CHB(Channel) = ScratchLoc(3) / 100
Next
'Disable MultiMux
PortSet(1,0)
'Data Output Programming
CALLTABLE(FSDATA)

NextScan
EndProg
```

2.7 Panel Mount Installation

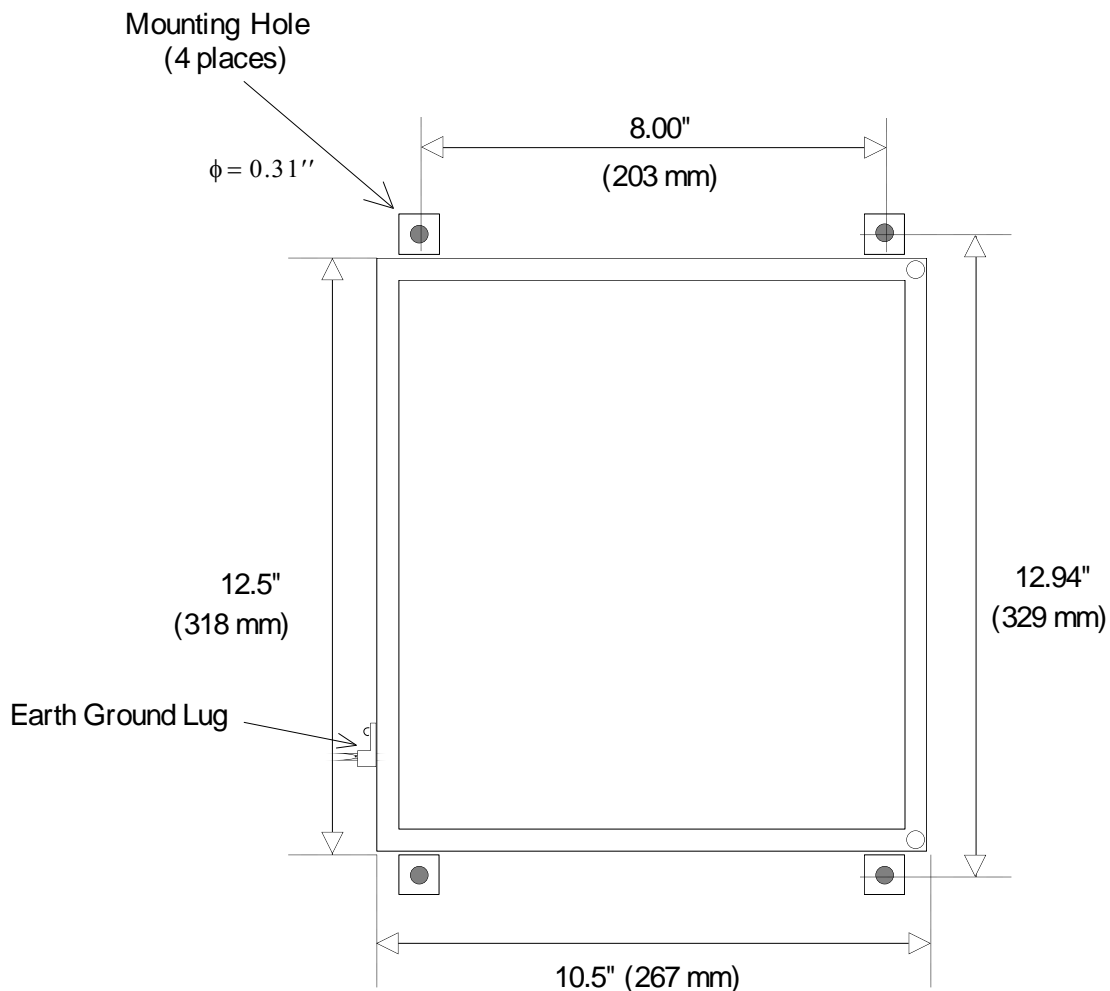
The MultiMux enclosure may be installed on a vertical or horizontal surface. Holes should be drilled and tapped with machine screws used for installation. Self-tapping panel mount screws may also be used. Dimensions are shown in the illustration.



2.8 Enclosure Installation

The standard enclosure for the MultiMux is a Hoffman 12x10 fiberglass/polyester NEMA 4 type. The enclosure can be mounted to a wall or other surface by attaching the 4 supplied mounting tabs to the bottom of the enclosure using the supplied screws.

The placement of the mounting holes is depicted in the illustration below.



2.9 Lightning Protection

The MultiMux is equipped with lightning protection components. As a result, care must be exercised in the installation to maximize their effectiveness. Specifically, an effective earth ground must be attached to the MultiMux or to the Field Enclosure earth ground lug for proper protection.

Copper earth ground stakes and connecting wire are also available from Canary Systems.

3.1 Troubleshooting Flowchart

If you cannot obtain readings using the MultiMux or the readings are unstable then see the troubleshooting flowchart below for help in determining the nature of the problem.

