MiniMux Multiplexer

USER'S GUIDE

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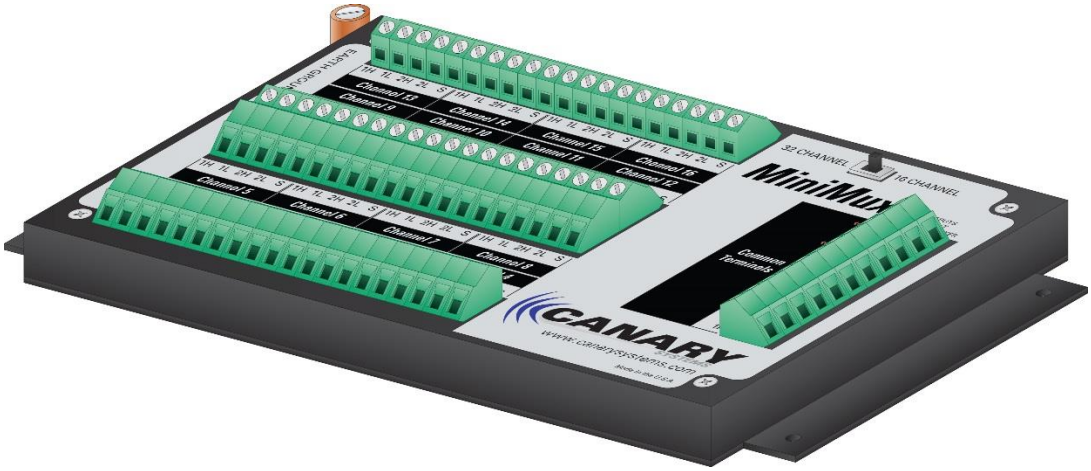
Section 1 – Introduction

1.1 Overview

The MiniMux expands the number of instruments that may be read by a datalogger or other measurement device in increments of 16 or 32 channels, depending on the switch setting of the MiniMux and the type of sensor being read. The MiniMux may be purchased installed in a field enclosure complete with cable glands or as a panel mount enclosure for users supplying their own field packaging.



The MiniMux utilizes advanced high-reliability components such as terminal blocks from Phoenix Contact (www.phoenixcontact.com), relays from Panasonic, (http://na.industrial.panasonic.com/) and a microcontroller from Microchip Devices (www.microchip.com) to help insure years of reliable and trouble-free operation. The use of low contact resistance relays means almost universal instrument support, a high degree of lightning protection and virtually infinite channel isolation.

In addition, each instrument channel is equipped with tripolar surge arrestors. Shield connections are protected with bipolar surge arrestors. These spark gap devices provide resettable high-current transient protection for each channel.

The Warranty is applicable for 2 years from the date of shipment. The Warranty does not cover failure by misuse or by nature including lightning, flood, or other catastrophe. Should you encounter problems with your MiniMux see the troubleshooting flowchart in Section 3.

1.2 Specifications

General
Power requirements: 11-16 VDC (unregulated), nominal 12 VDC
Disabled current: less than 1 µA
Channel activated current (2 or 4-wire): ~40 mA
Control line input impedance: 100 kΩ
Control line input levels: TTL or CMOS (5V logic)
(Maximum Input voltage on any control line: 14 VDC
Power input transient protection: 17.1 VDC, 1500W Transzorbs
Control signal input transient protection: 5.8 VDC, 1500W Transzorbs
Operating temperature: -40 to +70° C (-40 to +160° F)

Lightning Protection
Sparkover Voltage @ 100 V/s +/- 20% Tolerance: 75 VDC
Impulse Sparkover Voltage @ 1kV/µs: 600 VDC
Impulse Discharge Current 8x20µs, 10 hits (5 hits each polarity) 1 kA,
8x20us 300 hits (150 hits each polarity) 100A
Impulse Withstanding Voltage, 10/700 µs 10 hits (5 times each polarity) 4kV
Capacitance @ 1MHz <0.5 pF
Insulation Resistance @ 100 VDC 1000 MΩ
UL Rating UL497B #E179610

Control Measurements (typical)*
Disabled Current: 0.1 µA (single mux)
Standby Current (No channels engaged): 4 mA (single mux)
Active Current (Channel 1): 40 mA (single mux)
Disabled Current: 0.15 µA (two muxes daisy-chained)
Standby Current (No channels engaged): 5 mA (two muxes daisy-chained)
Active Current (Channel 1): 40 mA (two muxes daisy-chained)
Enable Output Voltage: 4.75 VDC

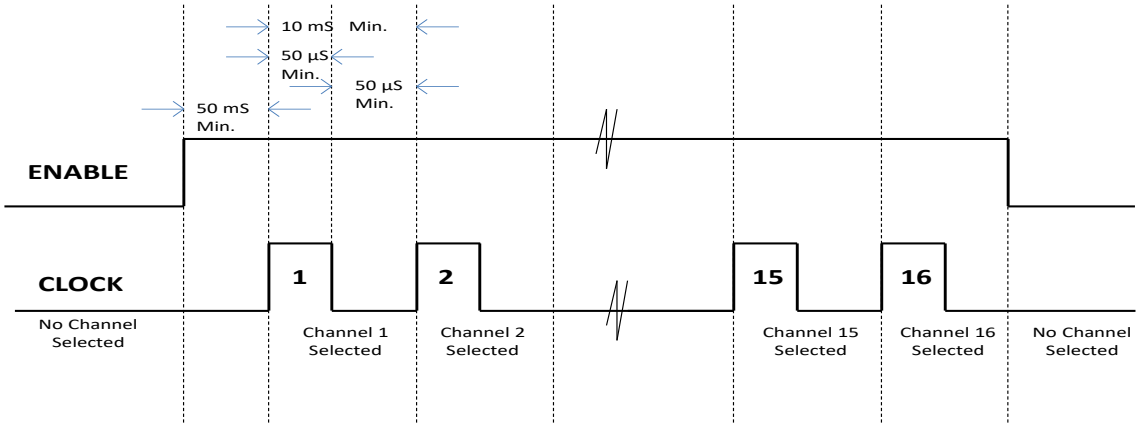
Relays
Power: 11 mA @ 12 VDC (140 mW)
Contact type: Gold-clad silver alloy
Electrostatic capacitance: 3 pF
On resistance: 50 mΩ
Coil resistance: 1,028 Ω
Maximum switching voltage: 125 VAC, 110 VDC
Maximum switching power: 30 W (resistive load)
Maximum switching current: 2 A
Operate time: ~2 ms
Release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

Dimensions:
Overall (L x W x H): 8.5 x 4.25 x 1” (216 x 108 x 25 mm)
Mounting Hole Pattern (L x W): 8.0 x 3” (200 x 75 mm)
Mounting Hole ID: 0.125” (3.2 mm)

Section 2 – MiniMux Operation and Installation Introduction

2.1 Operation Details

The MiniMux is controlled by a digital controller using two digital control signals. The operation of the MiniMux is simple enough so that virtually any device capable of controlling two 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 MiniMux.

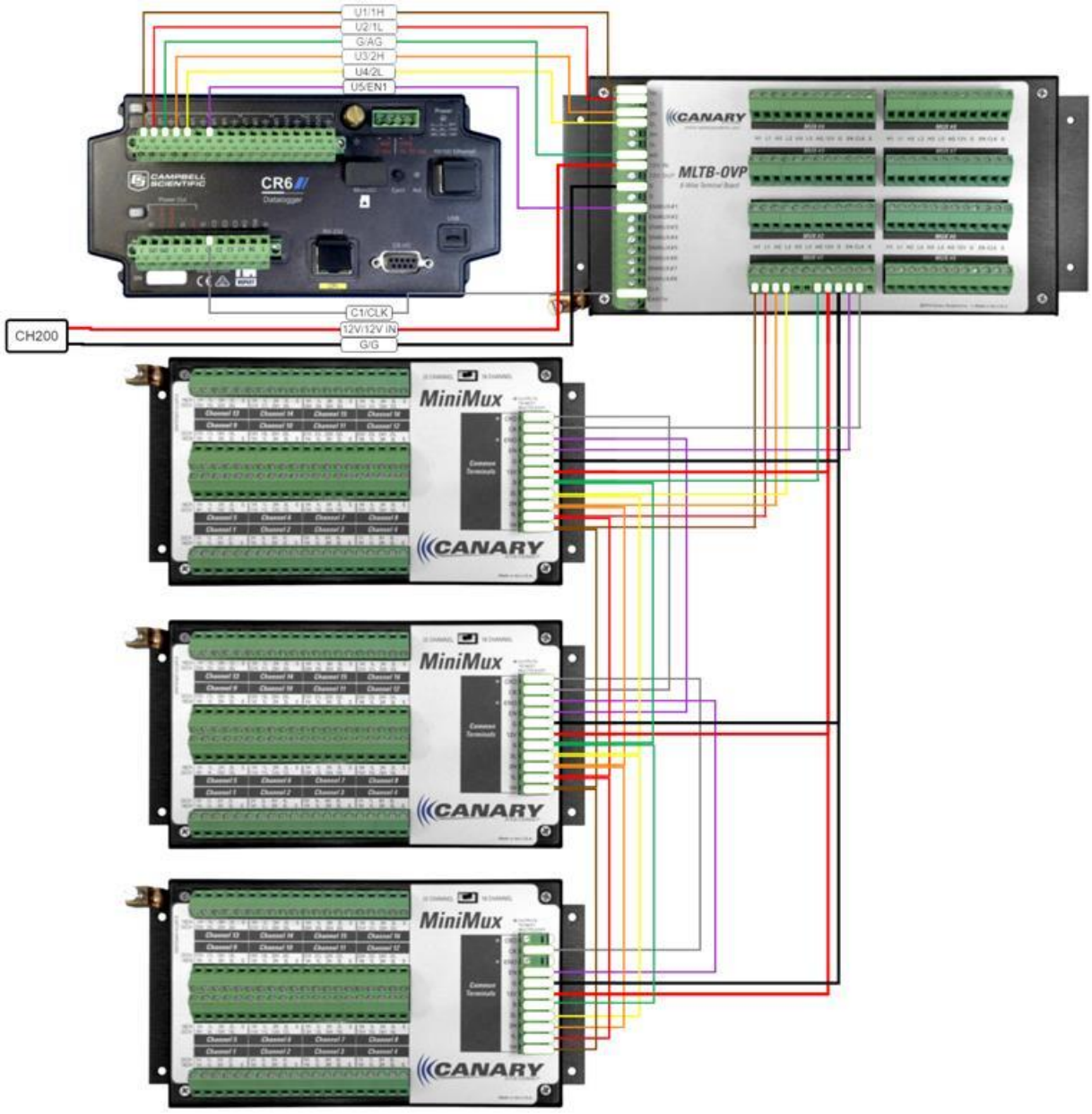


In the 32 channel mode, the maximum number of pulses to advance through all the channels would be 32.

2.2 Daisy Chaining MiniMux

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.

An example of daisy chain wiring for the MiniMux is shown below:



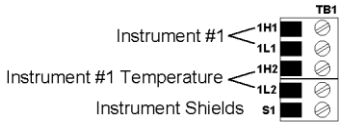
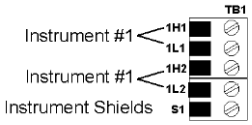
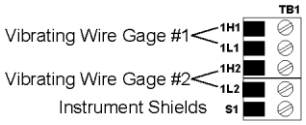
To utilize the Daisy Mux operation, simply connect the ENO (Enable Out) to the EN (Enable) on the next mux. The CKO (Clock Out) is connected to the CK (Clock) of the next mux. When the MiniMux reaches the maximum channel (either 16 or 32, depending on the switch configuration) and more clocks are received, 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 32 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 MiniMux will vary depending on whether it is configured for 16 or 32-channel operation.

Use the DIP switch on the front panel to configure the operation. Default configuration is 16-channel.

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

Mode	Description	Example
16 Channel (4-wire) (Default)		
32 Channel (2-wire)		

2.4 Datalogger Connection

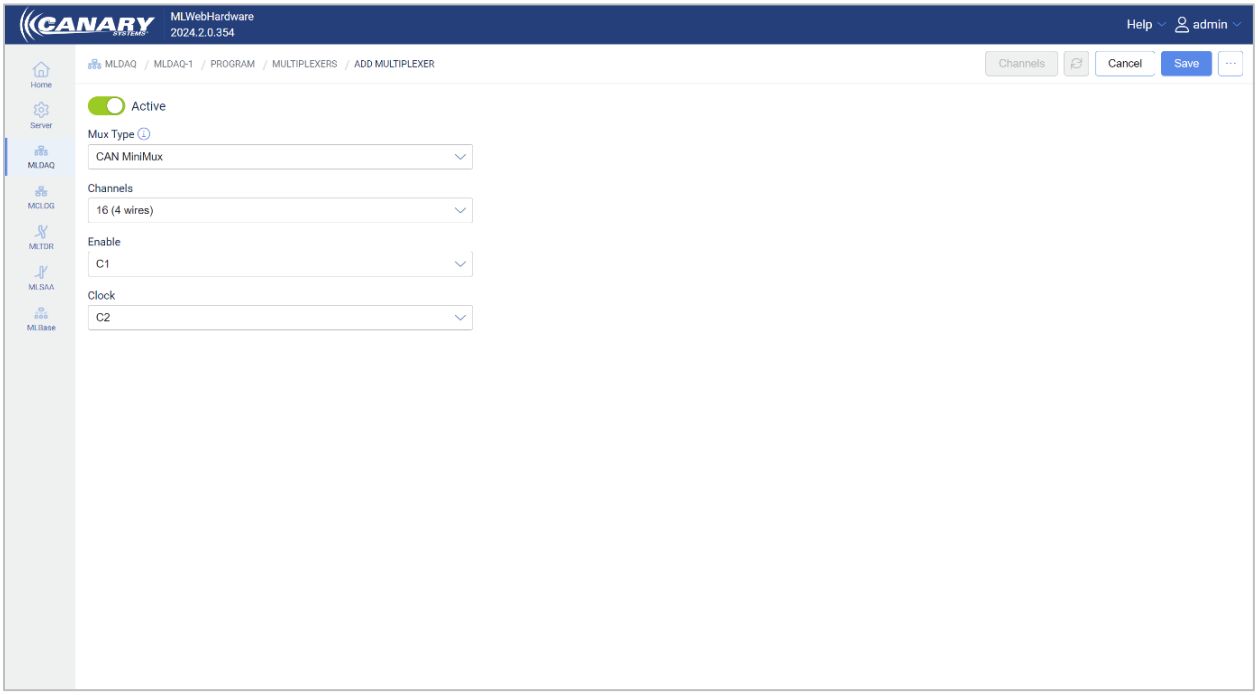
The MiniMux is connected to a digital controller using the screw terminals on the terminal board.

Functions are described in the following table.

MiniMux Terminal	Description	10-Pin Souriau[1]	Mux Cable (Non-Twisted)[2]	Mux Cable (5 Twisted Pair)
1H	High side of CH1	A	Brown	White
1L	Low side of CH1	B	Red	White's Black
2H	High side of CH2	C	Orange	Red
2L	Low side of CH2	D	Yellow	Red's Black
AG	Instrument shield	E	Green	White & Red Pair Drain Wire
12V	Power	F	Blue	Yellow[3]
GND	Ground	G	Purple	Yellow's Black[3]
EN	Enable	H	Grey	Green[3]
ENO	Enable Out	N/A	N/A	Blue[3]
CLK	Clock	J	White	Green's Black[3]
CLKO	Clock Out	N/A	N/A	Blue's Black[3]
SHIELD	Cable Shield	K	Cable Shield	Overall Shield
EARTH	Earth Ground			

Notes:
[1] The 10-Pin Souriau is an optional mil-spec connector available for the MiniMux Field Enclosure.
[2] Not suitable for Daisy Mux configurations or long cable lengths.
[3] Shield drain wires for Yellow, Green and Blue pairs can be cut off.

2.5 MLWebHardware Configuration



To configure MLWebHardware to use the MiniMux, select CAN MiniMux from the Mux Type dropdown of the Multiplexer configuration page for the device being configured. Select either 16 Channel (default) or 32 Channel to match the DIP switch settings of the MiniMux.

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

Once the multiplexer configuration has been saved, press the Channels button to configure the channels.

For more detailed information on configuring channels and multiplexers in MLWebHardware, see the latest version of the **MLWebHardware User's Guide**.

2.6 CR1000 Program Example

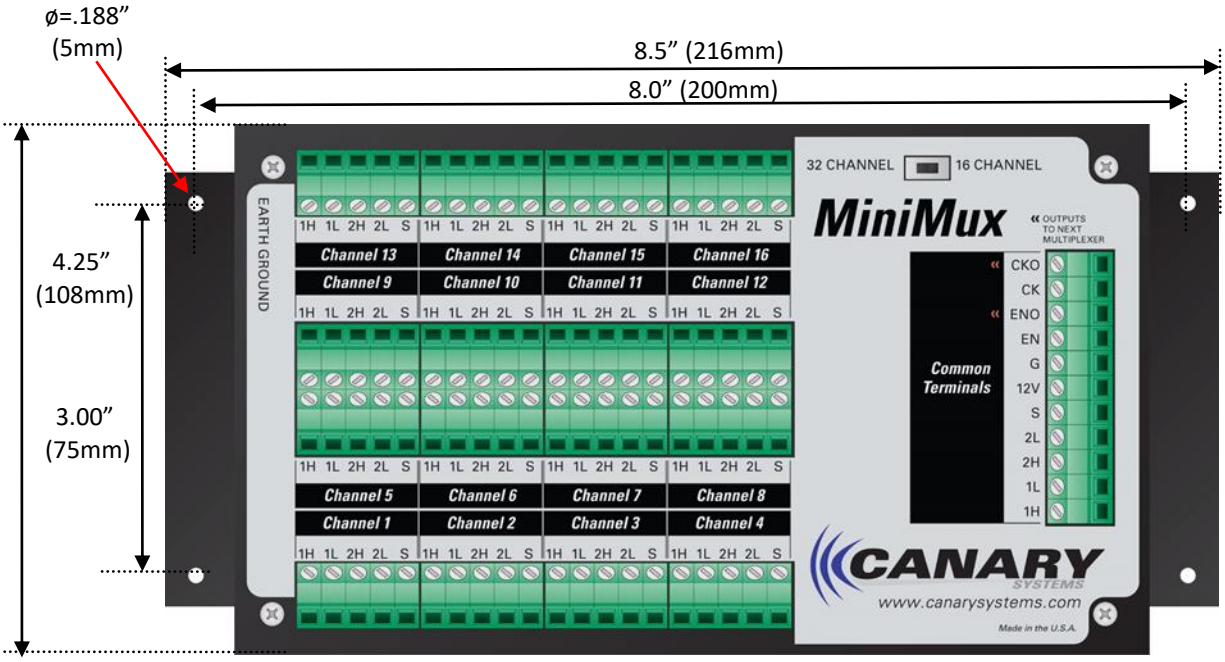
The following example illustrates how to write custom programs for the CR1000 to read instruments connected to the MiniMux.

The example assumes a 16 Channel Mode MiniMux reading 16 vibrating wire gages and their respective thermistors. The MiniMux Enable is connected to C1, the Clock is connected to C8. The AVW200 to read the Vibrating Wire instruments is controlled via SDI-12 connected to C7.

```
'Define Public Variables
Public Mux1CH(16) as Float
Public Mux1TempCH(16) as Float

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

'Define Data Tables
DataTable(FSDATA,1,-1)
      Sample(16,Mux1CH(),IEEE4)
      Sample(16,Mux1TempCH(),IEEE4)
ENDTABLE

'Main Program
BeginProg
Scan(60,SEC,1,0)

'Read Instruments on Multiplexer
'Use C1 to Enable MiniMux
PortSet(1,1)
Delay(0,50,MSEC)

'Loop 16 times for entire MiniMux
For Channel = 1 TO 16
      'Use C8 to Send Clocking Pulse
      PulsePort(8,10000)
      'Configure vibrating wire Gage measurement
      SDI12Recorder (sInBuf,7,0,"XVW400,4000,2!",1.0,0)
      'Now take vibrating wire measurements
      SDI12Recorder (ScratchLoc(2),7,0,"M1!",1.0,0)
      'Convert frequency result to digits
      Mux1CH(Channel) = ScratchLoc(2)^2 * 0.001
      'Convert thermistor resistance to temperature
      Mux1TempCH(Channel) = 1/(.0014051 + (.0002369*Log(ScratchLoc(7))) +
      (.0000001019*(Log(ScratchLoc(7))^3))) - 273.2
Next

'Disable MiniMux
PortSet(1,0)

'Data Output Programming
CALLTABLE(FSDATA)

NextScan

EndProg
```

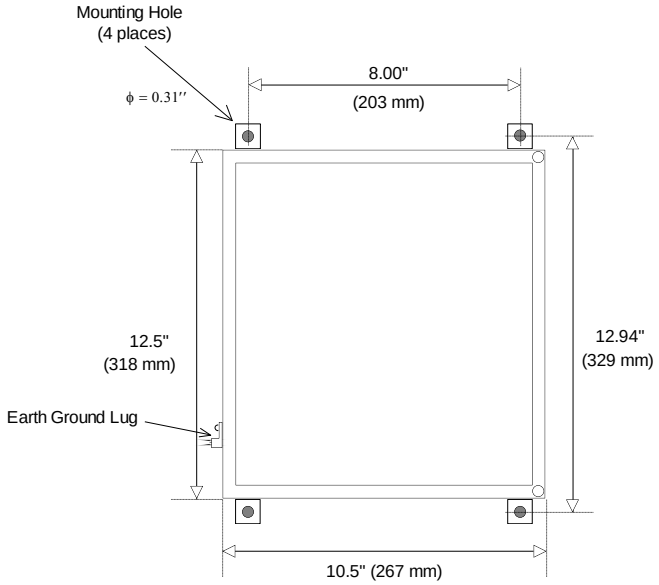
2.7 Panel Mount Installation

The MiniMux 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 Field Enclosure Installation

The standard field enclosure is a fiberglass/polyester composite type; the mounting dimensions are shown below.



2.9 Lightning Protection

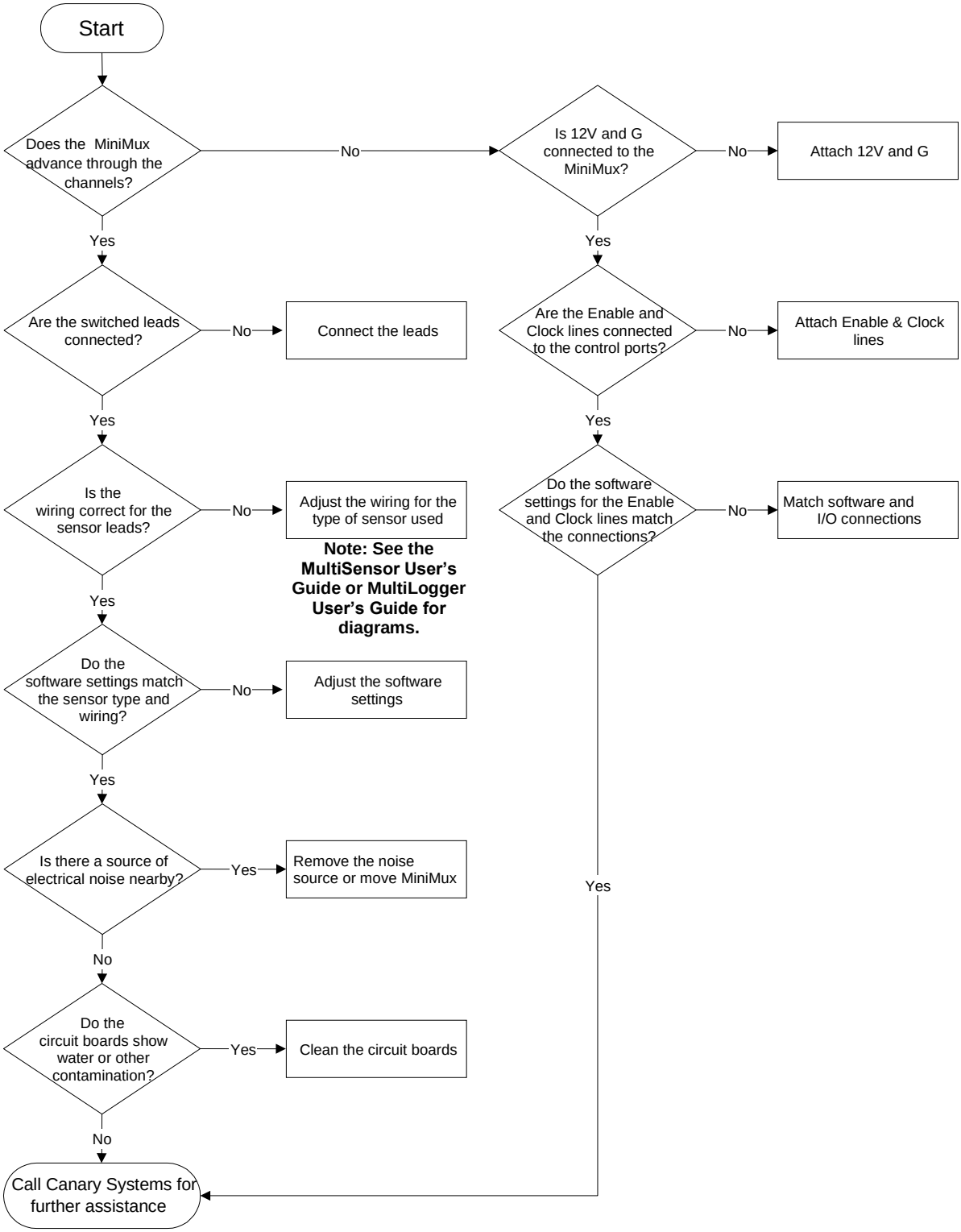
The MiniMux is equipped with lightning protection components. As a result, care must be exercised in installation to maximize their effectiveness. Specifically, an effective earth ground must be attached to the MiniMux or to the Field Enclosure earth ground lug for proper protection.

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

Section 3 – Troubleshooting

3.1 Troubleshooting Flowchart

If you cannot obtain readings using the MiniMux, or the readings are unstable, then see the troubleshooting flowchart below for help in troubleshooting. If unsuccessful, contact Canary Systems by phone, fax, or email for further assistance. Contact information is found on the front cover.

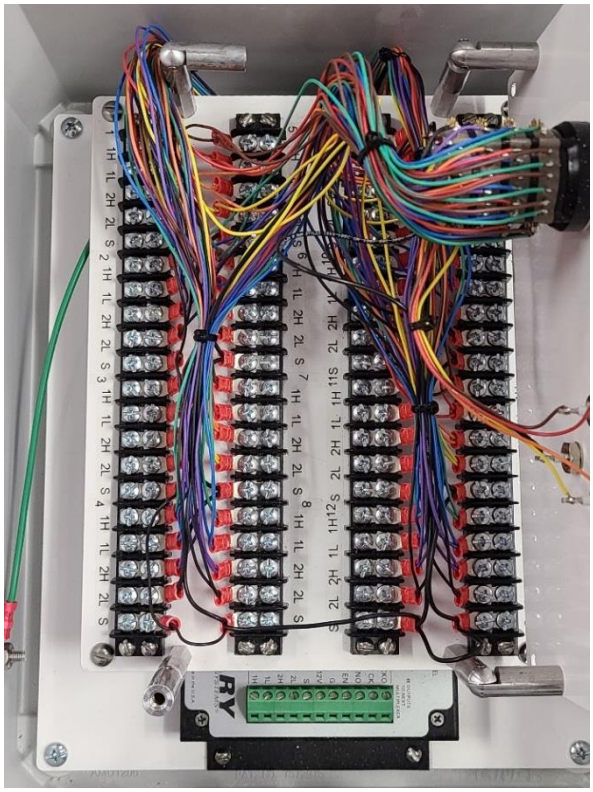


Section 4 – MiniMuxSP Appendix

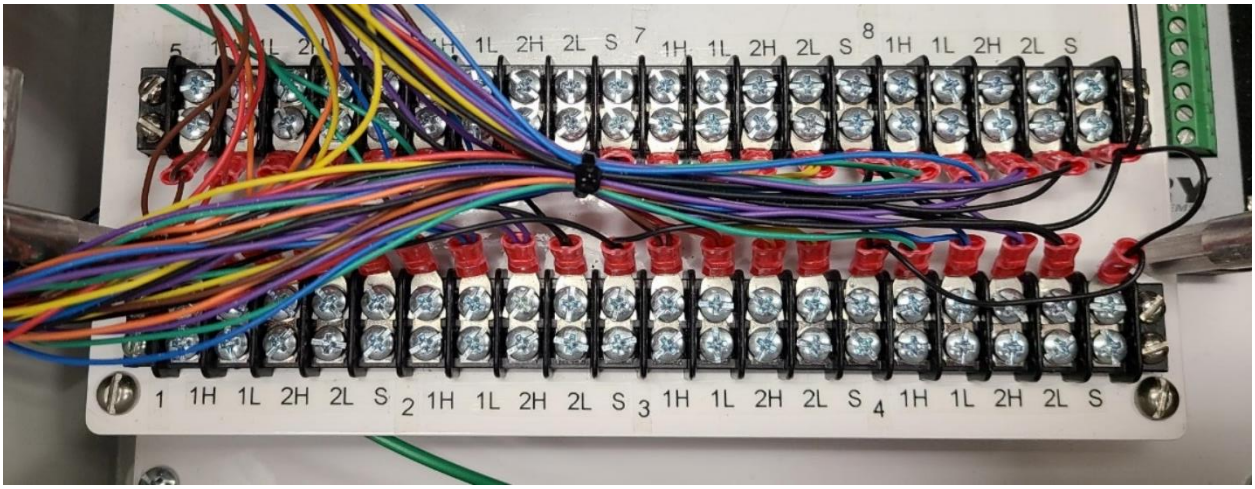
4.1 MiniMuxSP Configuration

To install piezometers into the MiniMuxSP field enclosure, start by opening the latches located on the right side of the box and open the lid.

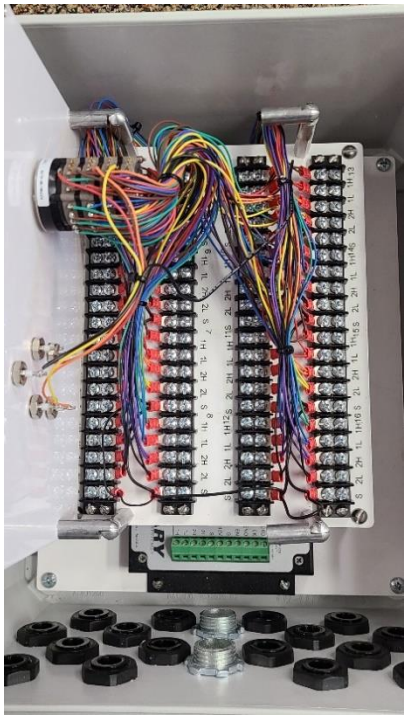
Unscrew the two left screws from the top panel using a flathead screwdriver and place them in a secure location (left image). This will allow you to lift the top plate to the right on its hinges (right image).



Each screw terminal is labeled according to its Mux Channel. Wire the piezometers accordingly. **1H/1L** is used for the Digit Reading Leads, **2H/2L** should be used for the Temperature Reading Leads, and **S** should be used for the Shield.



Once channels 1-12 are wired in, flip the panel back onto its standoffs and reattach its screws (left image). Mux Channels 13-16 can be reached by unscrewing the right two screws (middle image) and lifting the top plate to the left on its hinges (right image). Make sure all four screws are attached before finishing installation.



4.2 MiniMuxSP Usage

The MiniMuxSP field enclosure comes equipped with an internal selection nob and label piezometer terminals to facilitate manual readings of all attach piezometers.

To use this interface, connect your piezometer reading device (i.e. GK-404) to the labeled terminals. **VW+** and **VW-** are the Digit Reading terminals, **T+** and **T-** are Thermistor Temperature terminals and **S** is the shield terminal.

To select the piezometer you want to read, rotate the dial to the corresponding mux channel number. The image below on the left is set to read Mux Channel 1. The right image is set to read Mux Channel 8.