MicroMux Multiplexer

USER'S GUIDE

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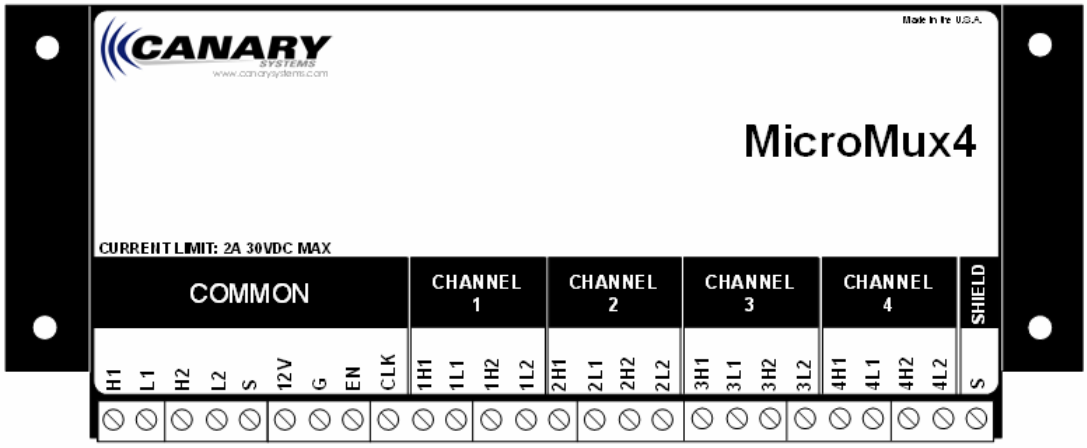
1.1 Overview

The MicroMux expands the number of instruments that may be read by most all types of 5v/12v dataloggers to 4 channels by 4 wire, or 8 channels by two wire, depending on the internal switch settings and the type of sensor being read. In addition the MicroMux provides integral lightning protection by utilizing plasma surge arrestors on the control lines. The MicroMux is provided in a panel mount enclosure.

The MicroMux utilizes advanced high-reliability components such as terminal blocks from Phoenix Contact, Panasonic relays and a flash microcontroller from Microchip Devices to help insure years of reliable and trouble-free operation in most 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 on the control lines, and virtually infinite channel isolation.

Warranty is applicable for 2 years from date of shipment. Warranty 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 MicroMux, see section 3.1 for the troubleshooting flowchart.

A diagram of the MicroMux terminal connections is shown below.



1.2 Specifications

General

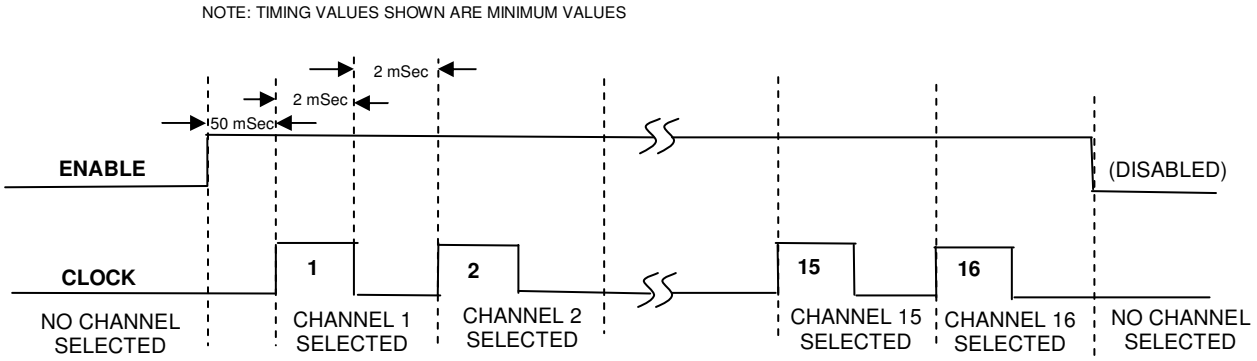
Power requirements: 9-16 VDC (unregulated)
Quiescent current: < 0.1 µA (Mux Not Enabled)
Channel activated current (2-wire): 42mA
Channel activated current (4-wire): 42mA
Standby Current 1.2mA (Mux stepped past maximum channel)
Control line input impedance: <10KΩ
Control line input levels: 5V through 12V (16V Maximum input)
Transient protection: TVS & Spark Gap
Operating temperature: -40 to +85° C (-40 to +185° F)

Relays

Surge withstand between contacts and coil: 2500V
Breakdown voltage between contacts and coil: 1,500V
Initial contact resistance, max (By voltage drop 6V DC 1A): 75mΩ
Nominal switching capacity (resistive load): 2A 30V DC
Max switching current: 2A
Expected Mechanical Life (at 180cpm): 10^8 Cycles

2.1 Operation Details

The MicroMux is controlled by the Datalogger Controller using 2 digital control signals. The operation of the MicroMux 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 2 digital signals are used to control the MicroMux.



In the case of the 4 or 8 channel modes, the maximum number of pulses to advance through all the channels would be 4 and 8, respectively.

The channel switching mode is selected by configuring the DIP switch mounted on the MultiMux board. The table shown below describes the 2 possible configurations.

DIP Settings	Mode	Description
 **8 CHANNEL** **RESERVED**	4 Channel (Default) (All set to “OFF”)	Standard 4 channel mode for switching: 4-wire instruments (4 channel board)
 **8 CHANNEL** **RESERVED**	8 Channel (SW1 set to “ON”)	8 channel mode for switching 2-wire instruments

NOTE: Default Setting for MicroMux is 4 channel unless otherwise specified.

2.2 Datalogger Connections

The MicroMux is connected to the Controller or MultiLogger Mux Terminal Board (or ML MUX TB) using the screw terminals. The common screw terminal block is located on the left side of the terminal strip

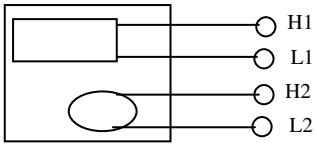
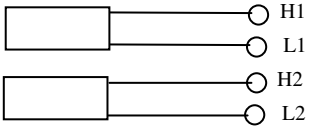
The table below lists the connections for the screw terminal block:

MicroMux 4 Channel	MicroMux 8 Channel	Description	10-Pin Bendix (16/32 board)	Mux Cable (5 pair) (4/8 board)	Mux Cable (6 pair) (48Ch board)
1H	1H	High side of CH1	A	White	Brown
1L	1L	Low side of CH1	B	White's Black	Brown's Black
2H	Not Used	High side of CH2	C	Red	Red
2L	Not Used	Low side of CH2	D	Red's Black	Red's Black
S	S	Cable Shield	K	Shield Wires from White & Red Pair plus Overall	Shield Wires from Brown & Red Pair plus Overall
12V	12V	Power	F	Yellow	Yellow
G	GND	Ground	G	Yellow's Black	Yellow's Black
EN	EN	Enable	H	Green	Green
CLK	CLK	Clock	J	Green's Black	Green's Black

2.3 Instrument Connection

The way instruments are connected to the MicroMux will vary slightly depending on the Mode selection (section 2.1).

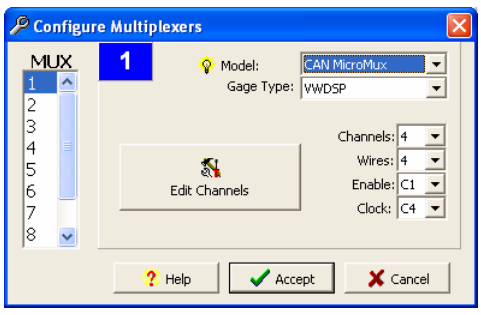
The following table illustrates typical connection techniques for each of the operating modes.

Mode	Description	Example
4 Channel (4-wire)	INSTRUMENT #1 H1 L1 TEMPERATURE #1 H2 L2	
8 Channel *(2-wire)*	INSTRUMENT #1 H1 L1 INSTRUMENT #2 H2 L2	

2.4 MultiLogger Software Configuration

To configure MultiLogger to use the MicroMux select **CAN MicroMux** as your multiplexer **Model** on the **Configure | Multiplexers** form. Before the individual channels may be edited you must select a **Gage Type.** Select either **4 Channels** (default), **8 Channels** to match the DIP switch settings of the MicroMux.

If the VWDSP Interface is being used, be sure to select the VWDSP Gage Type, as shown.



2.5 CR10X Program Example

The following example illustrates how to write custom programs for the CR10X to read instruments connected to the MicroMux. The example assumes a 4 Channel Mode MultiMux reading 4 vibrating wire gages and their respective thermistors.

The program example illustrates how measurements of instruments connected to the MicroMux are read, it does not include instructions that would store the measurements for later retrieval. Consult the CR10X Operators Manual for more information on storing measurements.

```
1:  Set Port(s) (P20) ;Configure the control ports of the CR10/CR10X, C1=Enable, C8=Clock
 1: 7999      C8..C5 = output/nc/nc/nc
 2: 9994      C4..C1 = nc/nc/nc/10ms

2:  Do (P86) ;Enable the MultiMux
 1: 41        Set Port 1 High

3:  Excitation with Delay (P22) ;50ms delay after enabling the MicroMux
 1: 1         Ex Channel
 2: 0         Delay W/Ex (units = 0.01 sec)
 3: 5         Delay After Ex (units = 0.01 sec)
 4: 0         mV Excitation

4:  Beginning of Loop (P87)
 1: 0         Delay
 2: 4        Loop Count ;Total number of instruments

5:  Do (P86) ;Advance the channel
 1: 78        Pulse Port 8

6:  Vibrating Wire (SE) (P28) ;Read the Vibrating Wire Gage
 1: 1         Reps
 2: 1         SE Channel
 3: 1         Excite all reps w/Exchan 1
 4: 20        Starting Freq. (units = 100 Hz)
 5: 35        End Freq. (units = 100 Hz)
 6: 250       No. of Cycles
 7: 0         Rep Delay (units = 0.01 sec)
 8: 1      -- Loc [ VWGage_1   ]
 9: 1000      Mult
10: 0         Offset

7:  Excite-Delay (SE) (P4) ;Read the Thermistor
 1: 1         Reps
 2: 5         2500 mV Slow Range
 3: 2         SE Channel
 4: 1         Excite all reps w/Exchan 1
 5: 5         Delay (units 0.01 sec)
 6: 2500      mV Excitation
 7: 17     -- Loc [ VWTemp_1   ]
 8: .001      Mult
 9: 0         Offset

8:  Polynomial (P55) ;Convert thermistor voltage to °C
 1: 1         Reps
 2: 17     -- X Loc [ VWTemp_1   ]
 3: 17     -- F(X) Loc [ VWTemp_1   ]
 4: -104.78   C0
 5: 378.11    C1
 6: -611.59   C2
 7: 544.27    C3
 8: -240.91   C4
 9: 43.089    C5

9:  End (P95) ;End of measurement loop
```

2.6 CR1000 Program Example

```
'Enable our multiplexer
PortSet (1,1)
'Wait 100mSec for multiplexer to power up
Delay(0,100,MSEC)
'Cycle through 4 channels
For Channel = 1 TO 4
'Set Clock port high to advance mux channel
PortSet(8,1)
'Wait 10mSec for 50% duty cycle
Delay(0,10,MSEC)
'Set Clock port low
PortSet(8,0)
'Wait 10mSec for channel to settle
Delay(0,10,MSEC)
'Read our vibrating wire gage
VibratingWire(MuxChannel(),1,mV7_5,2,VX1,600,3600,500,-1,20000,500,0,1,0)
'Read our YSI44005 type thermistor
BrHalf(ScratchLoc(1),1,mV2500,2,VX1,1,2500,0,1000,250,2.5,0.0)
ScratchLoc(2) = ScratchLoc(1) / 5000
ScratchLoc(3) = (2.5 - (ScratchLoc(2)*1000) - ScratchLoc(1))/ScratchLoc(2)
MuxChannelTemp() = 1/(.0014051 + (.0002369*Log(ScratchLoc(3))) +
(.0000001019*(Log(ScratchLoc(3))^3))) - 273.2
'End of measurement loop
Next
'Disable our multiplexer
PortSet (1,0)
```

2.7 Using the MicroMux with the VW Comm Module

The VW Comm has built in instructions to directly control the MicroMux, MultiMux, or MiniMux. There are specific gage types in Multilogger Software to configure the VW Comm to be connected to 4 or 8 sensors through the MIcroMux. The VW Comm can be used with a radio, and MicroMux as a remote node for 4 or 8 instruments.

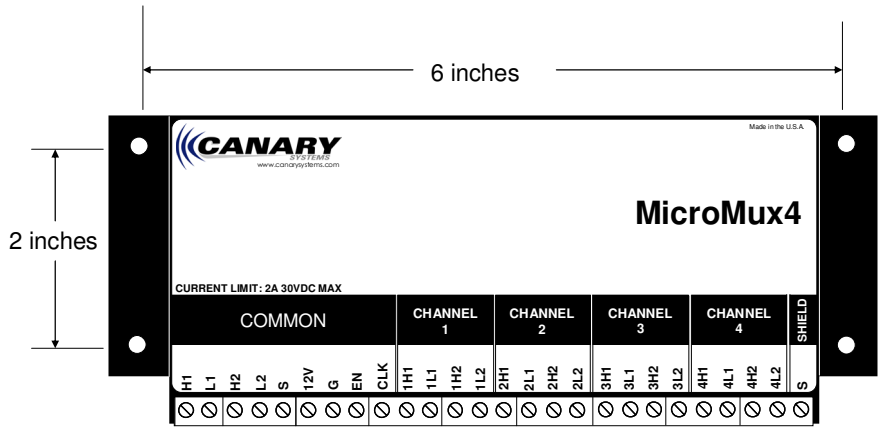
```
'Read vibrating wire gage using a VW Comm at address 0 using Mux channel MicroMux'on a
Digi radio at address 0129. Radio network must match base station
ScratchLoc(1) = -99999
ScratchLoc(2) = -99999
ScratchLoc(3) = -99999
ScratchLoc(4) = -99999
ScratchLoc(5) = -99999
ScratchLoc(6) = -99999
ScratchLoc(7) = -99999
ScratchLoc(8) = -99999
ScratchLoc(9) = -99999
ScratchLoc(10) = -99999
ScratchLoc(11) = -99999
ScratchLoc(12) = -99999

'Open our port
SerialOpen (Com1,9600,0,100,255)

'open COM1 - C1&C2
Delay(0,1000,mSec) 'must wait 1 second before AT Command mode

'Transmit ===, Receive OK (wait up to 10 seconds)
SerialOut (Com1,"===","OK",2,5000)
Delay(0,1000,mSec) 'must wait 1 second after AT Command mode
```

```
'Transmit ATDTnn (where nn = radio address), Receive OK (up to 10 seconds)
SerialOut (Com1,"ATDT0129"+Chr(13),"OK",1,1000)
Delay(0,1000,mSec)

'Transmit ATCN, Receive OK (wait up to 10 seconds)
SerialOut (Com1,"ATCN"+Chr(13),"OK",1,1000)

'Wake up the VW Comm - Try for 5 seconds
ScratchLoc(1) = SerialOut (Com1,"0!","0",50,100)

'Check for valid response
if ScratchLoc(1) <> 0 then

	'Send Set Digital Outputs command (Switch to Gage 1)
	SerialOut (Com1,"0MM00!","00045",5,50)

	'Send Set Up VW Start Freq, End Freq, command
	SerialOut (Com1,"0M110400350002550500!","00045",5,50)
	ScratchLoc(4)= FormatFloat(Channel, "%2g")

	'Send Set Digital Outputs command (Switch to Gage 1)
	SerialOut (Com1,"0MM0"+ScratchLoc(4)+"!","00045",5,50)

	'Send Take Reading command
	SerialOut (Com1,"0M!","00045",5,50)
	SerialFlush(com1)
	Delay(0,1500,mSec)

	'Send Get Readings command
	SerialOut (Com1,"0D0!","0",5,50)

	'Receive response
	SerialIn(sInBuf,Com1,100,CHR(13),75)

	'Get length of response buffer
	ScratchLoc(3) = Len(sInBuf)
	if Len(sInBuf) >= 9 then

		'Split out response values
		Splitstr(ScratchLoc(4),sInBuf,"",12,0)

		'Convert to reading - may be in Digits, Freq, or Period
		mlReading=ScratchLoc(4)
	Else
		'No valid response
		mlReading = -99999
	EndIf

	'Send Set Digital Outputs command (Switch back to Gage 1)
	SerialOut (Com1,"0M6000!","00045",5,250)
Else
	'No valid response
	mlReading = -99998
EndIf

'Close our serial port
SerialClose(Com1)
```

2.8 Enclosure Installation

The MicroMux can be attached to any surface with 4 mounting 6-32 screws.

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



6 inches = 15.2cm
2 inches = 5.1cm

Note: The Micromux can be installed upside down, vertically, or horizontally.

2.9 Input Protection

The MicroMux is equipped with lightning protection components on the control signals. As a result, care must be exercised in the installation to maximize their effectiveness. Specifically, an effective earth ground must be attached to the MicroMux shield (S) for proper protection. Most Vibrating wire instruments also have lightning protection components.

The Enable and Clock inputs can be connected to 12 volts directly without damaging the MicroMux. The connections to the datalogger should be disconnected and insulated from contacting other electrical connections. The 12V tolerant inputs allow the MicroMux to be field tested without the need for a datalogger connection. The enable can be wired to the 12V input while the clock input can be touched to 12V. This action will cause the MicroMux to step channels for each touch to 12 volts.

3.1 Troubleshooting Flowchart

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