

LabJack

Measurement & Automation Simplified

Mux80 AIN Expansion Board Datasheet



[\(/sites/default/files/2011/08/Mux80_U6.JPG\)](http://sites/default/files/2011/08/Mux80_U6.JPG)

Summary

The Mux80 AIN Expansion Board serves to provide an additional 80 analog inputs to any compatible LabJack. It uses 10 multiplexer chips connected to AIN4-AIN13, and splits each channel into 8 additional channels. When a specific extended analog input channel is read on a U6 or UE9, the digital output MIO lines are automatically set, and the correct analog channel is read. The Mux80 has a built-in DC-DC converter which provides the upper and lower rail voltages necessary for powering the multiplexer chips.

Three vertical DB37 connectors provide an easy interface to connect 24 AIN channels each. The remaining connector brings out unused connections (FIO, DAC, etc) from the LabJack, along with the last 8 AIN channels. There are a total of 84 available analog inputs when used in conjunction with a U6 or UE9.

For screw-terminal access simply connect a [CB37 Terminal Board \(http://labjack.com/catalog/cb37-terminal-board-rev-21\)](http://labjack.com/catalog/cb37-terminal-board-rev-21), and reference the chart printed at the top of the Mux80 for connections.

Features

- 80 Multiplexed Channels (or 40 Differential Pairs)
- Built-In DC-DC Converter
- OEM Capability
- Easy-To-Use High Density Connectors
- Snaptrack/DIN-rail compatible

Connection Options

The Mux80 can be connected several ways. The images below demonstrate use with the [CB37 Terminal Board \(http://labjack.com/catalog/cb37-terminal-board-rev-21\)](http://labjack.com/catalog/cb37-terminal-board-rev-21), and several [3ft DB37 Cables \(http://labjack.com/catalog/3ft-db37-mf-serial-cable\)](http://labjack.com/catalog/3ft-db37-mf-serial-cable).



[\(/sites/default/files/2011/04/DSC04774.JPG\)](http://sites/default/files/2011/04/DSC04774.JPG)



[\(/sites/default/files/2011/04\)](http://sites/default/files/2011/04)

[/DSC04785.JPG\)](#)

When connected to a CB37, there is a quick way to determine which screw terminals can be used as analog inputs; reference the chart printed on the top of the Mux80, also shown below for reference.

Mux80 : CB37 Reference

CB37 to Mux80 Connections Chart				
CB37	X2	X3	X4	X5
AIN0-13	*MUX120-127	MUX48-61	MUX72-85	MUX96-109
DAC0-1	DAC0-1	MUX62-63	MUX86-87	MUX110-111
FIO0-7	FIO0-7	MUX64-71	MUX88-95	MUX112-119
PIN2,20	PIN2,20	N/C	N/C	N/C
MIO0-2	MIO0-2	N/C	N/C	N/C
*Start at AIN4				

CB37 Reference

For example: A signal is connected to FIO6 on a CB37. The CB37 is connected to X4 on the Mux80, so on the chart, under X4 and FIO0-7, locate MUX88-95. So the signal is connected to MUX94. To read MUX94 simply perform a standard AIN read for analog input number 94.

When performing differential readings using a Mux80, the appropriate channel pairs must be used. The first pair would be wired to Mux48 and Mux56, and the next 7 sequential channel numbers to Mux55 and Mux63. The next block would be Mux64 to Mux71, paired with Mux72 to Mux79, etc...i.e. blocks of 16 channels wired as 8 differential pairs. After 8 differential pairs are used on the X3 connector, the next 8 pairs will span between X3(P Chan) and X4(N Chan). The next 8 pairs appear solely on the X4 connector. The X5 connector has another block of 8 pairs, along with the positive channel side of the last 8 pairs. Reference the chart below for a summary.

Mux80 : Differential Readings

Differential Blocks	P Channel	N Channel	Connector
Block 1	M48-55	M56-63	X3
Block 2	M64-71	M72-79	X3 & X4
Block 3	M80-87	M88-95	X4
Block 4	M96-103	M104-111	X5
Block 5	M112-119	M120-127	X5 & X2

Differential Readings

For more information on multiplexing with the U6, see [U6 Channel Numbers \(http://labjack.com/support/u6/users-guide/2.6.1\)](http://labjack.com/support/u6/users-guide/2.6.1)

For more information on multiplexing with the UE9, see [UE9 Channel Numbers \(http://labjack.com/support/ue9/users-guide/2.7.1\)](http://labjack.com/support/ue9/users-guide/2.7.1)

Pin-out

J1-J5 are OEM pin-header locations, and appear immediately next to the DB37 connectors. A 40 pin (2x20) 0.1" spacing header fits the location.

X1 is the Male DB37 connector which interfaces with the LabJack.

X2-X5 provide access to the 80 Mux channels, along with the FIO, DAC, VM+, VM-, and MIO lines. Please reference the spreadsheet below for exact pin locations.

Mux80 Pinout					
J1 (2x20 Header .1 in)					
1	GND	2	GND	3	PIN20 (10uA)
4	PIN2 (200uA)	5	FIO7	6	FIO6
7	FIO5	8	FIO4	9	FIO3
10	FIO2	11	FIO1	12	FIO0
13	MIO0/CIO0	14	MIO1/CIO1	15	MIO2/CIO2
16	GND	17	Vs	18	VM-
19	VM+	20	GND	21	DAC1
22	DAC0	23	AGND	24	AIN13
25	AIN12	26	AIN11	27	AIN10
28	AIN9	29	AIN8	30	AIN7
31	AIN6	32	AIN5	33	AIN4
34	AIN3	35	AIN2	36	AIN1
37	AIN0	38	GND	39	GND
40	GND				
J2 (2x20 Header .1 in)					

Specifications

Mux80 : Specifications

Mux80 Specifications						
Parameter	Conditions	Min	Typical	Maximum	Units	
Typical Current Draw	No active readings	4.5	5.5	10	mA	
VMUX+		12.8	13.8	16	V	
VMUX-		-12.8	-13.8	-16	V	
Crosstalk @Input Freq.			@100Hz			
	DG408DVZ		-125		dB	
	LabJack U6		-104		dB	
	Mux80		-100		dB	

Specifications

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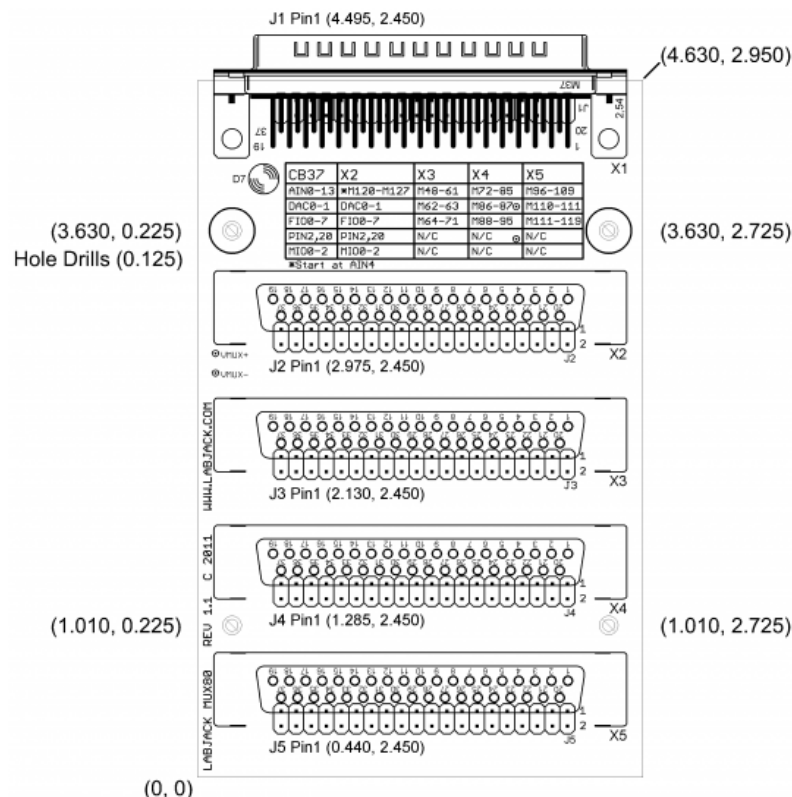
Using Extension Cables

When using extension cables, the effect of ground currents should be considered, especially when substantial current is being sourced/sunk though the CB37 and Mux80 grouping. In an effort to reduce the impact of ground currents, AGND is supplied on the Mux80 in the same pin configuration as on the LabJack. So AGND on the CB37 (while connected to a Mux80) is the same as it would be if it was connected directly to the LabJack.

See the [CB37 Datasheet \(http://labjack.com/support/cb37-v21/datasheet\)](http://labjack.com/support/cb37-v21/datasheet) for more information on AGND, and common techniques for handling offsets created by ground currents.

Dimensions

Below is an image describing the locations of the mounting holes, OEM connectors, and total board size. Based on the origin in the bottom left corner, each coordinate is shown in parenthesis (x, y). OEM connector coordinates (J1-J5), indicate the location of pin 1; the remaining pins follow knowing that the header is a standard 0.1" spacing.



/sites/default/files/2011/04/Mux80_Dimensions2.png

Troubleshooting

It is possible to check Mux80 functionality in [LJControlPanel \(http://labjack.com/support/ud/ljcontrolpanel\)](http://labjack.com/support/ud/ljcontrolpanel) by performing the following steps:

1. Open LJControlPanel
2. Select UD device and click **Test**
3. On test pane, locate **MIO 00**, **MIO 01**, **MIO 02** checkboxes for both **Digital Direction** and **Digital State**
4. Check the boxes for all 3 MIO lines under Digital Direction
5. Check desired boxes under Digital State according to the following table. Simply find the extended channel number to investigate, then trace across the row to the Output State of MIO0, MIO1, and MIO2. Set the output state to high (checked) for 1 and low (un-checked) for 0.
6. Trace the column up to AIN#, this is the analog input that your analog signal will appear on.

Mux80 : MIO Test

Output State			Expected Channel In LJControlPanel									
MIO0	MIO1	MIO2	AIN4	AIN5	AIN6	AIN7	AIN8	AIN9	AIN10	AIN11	AIN12	AIN13
0	0	0	48	56	64	72	80	88	96	104	112	120
1	0	0	49	57	65	73	81	89	97	105	113	121
0	1	0	50	58	66	74	82	90	98	106	114	122
1	1	0	51	59	67	75	83	91	99	107	115	123
0	0	1	52	60	68	76	84	92	100	108	116	124
1	0	1	53	61	69	77	85	93	101	109	117	125
0	1	1	54	62	70	78	86	94	102	110	118	126
1	1	1	55	63	71	79	87	95	103	111	119	127

MIO Test

For example: I have connected an analog signal to Mux65. If I am using a CB37 Terminal Board, this will mean that the CB37 is connected to X3 on the Mux80, and the signal is wired to FIO1 on the CB37. Looking at the above chart I note that 65 shares a row with MIO Output States of 1,0,0. I then set MIO0 checked, MIO1 unchecked, and MIO2 unchecked. Next I follow the column for 65 up to AIN6, so that is the analog input where I will see my analog signal with this MIO configuration.

If there seem to be problems with incorrect readings, also check that VMUX+ and VMUX- are within specified limits by measuring the test points with respect to GND.

Insure your device has the latest [firmware \(http://labjack.com/support/firmware\)](http://labjack.com/support/firmware). **There is a known U6 firmware issue concerning MIO lines in v1.26 and older.** See [revision history \(http://labjack.com/support/u6/firmware-revision-history\)](http://labjack.com/support/u6/firmware-revision-history) for more info.

Comments

#1 (#comment-1285)

Submitted by Julian Gold (not verified) on Thu, 2012-11-29 10:21.

So (pardon my ignorance, I am but a humble software engineer :)), I have a UE9 with a Mux80 connected, and I want to read analogue in 67, then I'd just write (in C#)

```
LJUD.eAIN( handle, 67, 0, ref value, (int)range, bitResolution, 0, 0 )
```

is that correct?

How are the 80 channels split across the D connectors?

#2 (#comment-1287)

Submitted by LabJack Support on Fri, 2012-11-30 13:28.

That looks correct. If you are getting an "invalid AIN channel number" error, try downloading the latest UD driver package from here:

<http://labjack.com/support/windows-ud/beta-ud> (<http://labjack.com/support/windows-ud/beta-ud>)

The 80 channels are split according to the table "Mux80 : CB37 Reference". Each connector is labeled with an X number. So X3 for instance has AIN channels numbering 48 through 71. They are called Mux48 - Mux71 on the silkscreen of the Mux80.

If you use a CB37 Expansion board, connect it to X3, and AIN 67 will be the "FIO3" terminal of the CB37. All the acronyms and different names make it complicated, so don't feel bad.

#3 (#comment-1288)

Submitted by Julian Gold (not verified) on Mon, 2012-12-03 03:58.

Thanks! I was getting confused because I thought I might have to be manually toggling the MIO channels and then reading AIN0..AIN14 to get the multiplexed channel data. It's nice that at least asking for channel 48 gets me MUX48 etc (the numbering being a bit confusing

because we had that down as AIN0).

#4 (#comment-834)

Submitted by tech4cars (not verified) on Wed, 2012-02-01 00:00.

Question about the pinout chart.

If DAC1 on X5 is MUX111, isn't FIO0 on X5 MUX112, NOT MUX111?

#5 (#comment-836)

Submitted by LabJack Support on Wed, 2012-02-01 17:13.

That is correct. The datasheet has been updated to reflect this change. Although it is only a labeling mistake, LabJack may send an email update to recent buyers highlighting the error on the silkscreen. "M111-119" should instead read "M112-119"

#6 (#comment-838)

Submitted by tech4cars (not verified) on Thu, 2012-02-02 12:14.

Thanks, I still had the old datasheet. Another question, Are pins 8,9,10,12,19,27,28, & 30 connected on X2, X3, X4, & X5 to the same circuits as on X1?

#7 (#comment-840)

Submitted by LabJack Support on Thu, 2012-02-02 17:42.

- Pin 8 & 10 - GND dedicated to charge pump. Not connected between X1 and others
- Pin 9 & 28 - VM- & VM+, unused on the Mux80, Not connected, since the board has its own charge pump.
- Pin 12 - AIN13, the dedicated input for Mux120-127, Not connected to others
- 19 - GND, the shared GND plane for all headers (X2-X5)
- 27 - VS, the shared 5V rail that appears on all headers (X2-X5)
- 30 - AGND, dedicated analog GND, bypasses the GND plane for more isolated readings, shared on all (X2-X5)

#8 (#comment-638)

Submitted by tech4cars (not verified) on Thu, 2011-09-01 12:11.

I need more analog inputs than the 14 available on my U6. Optimally, I'd like to measure 40 analog inputs. Two alternatives would be to use 3 U6's via a USB hub, OR, the MUX80. If I use the MUX80, will I see a 4X increase in my sampling rate? Currently, I get an update about every 0.1 second. Would this go to roughly 0.4 sec between measurements? How would this compare to using multiple U6s? Would using multiple U6s also slow my sampling rate? If so, how much would you estimate?

#9 (#comment-639)

Submitted by LabJack Support on Thu, 2011-09-01 17:06.

The sample rate for the U6 is dependent on several factors: resolution (settling time), range (gain), and USB communication time. If you know the appropriate resolution and range we can provide an estimate for sampling 40 channels. It's true that using multiple U6s *can* provide the faster sample rates, but one would have to write a program that uses threading in order to see this benefit. Most likely one can improve the sample rate by tweaking the above parameters, even when using a Mux80.

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