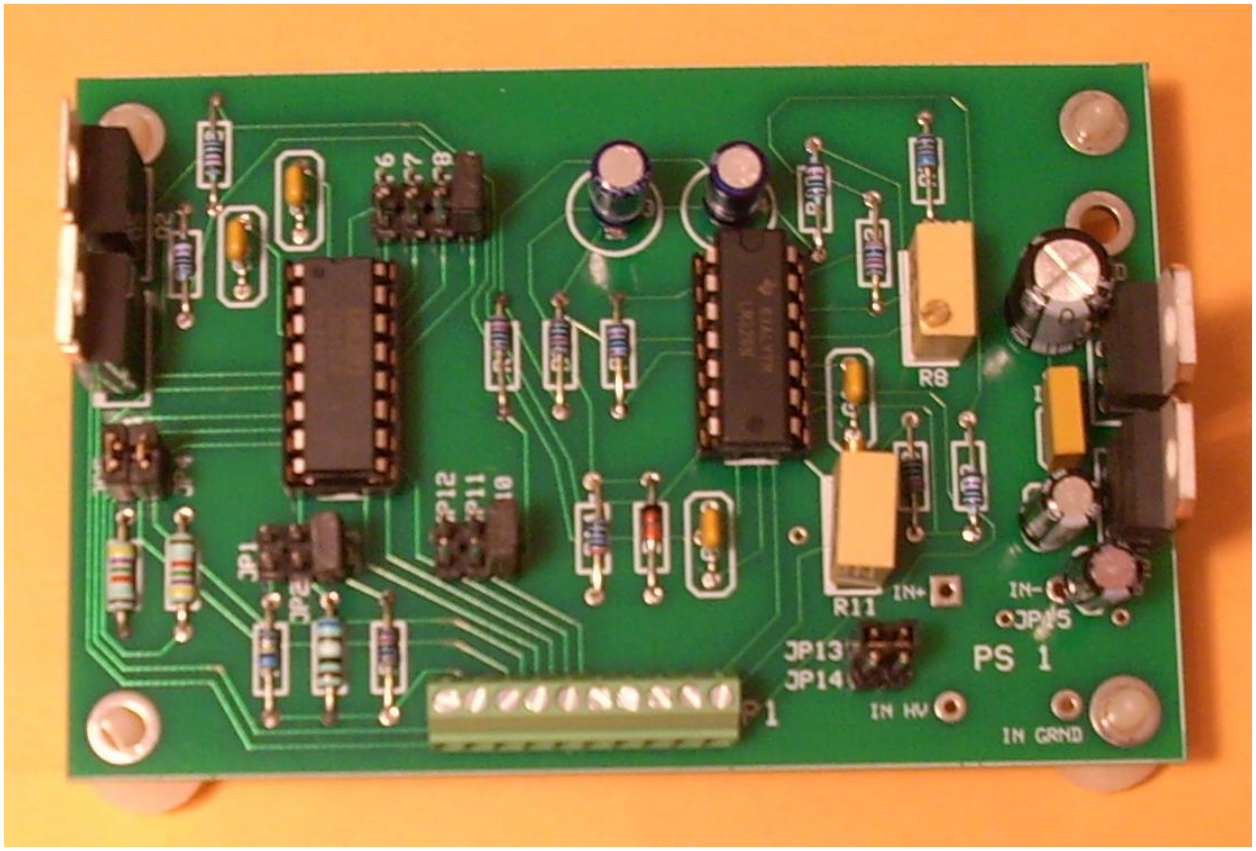
Instrumentation Amplifier Module

Instruction Manual



Thank you for purchasing the INA125 Instrumentation Amplifier Module. The module also contains an active low pass filter and an offset and gain stage. The three functions can be used together or independently therefore eliminating the need for purchasing separate assemblies for each operation. The INA125 module also has a trimmed on board bipolar excitation voltage supply that is useful for powering sensors and sensor bridges. The excitation pass transistors can deliver 1 full amp of current to a load requiring a bipolar supply. On board voltage regulators enable the user to power the module with an unregulated DC supply. Jumpers allow the user to select the functions desired in addition to excitation voltage levels of 1.24, 2.5, 5 and 10 volts. The amplifier gain can be set to 10, 100 or 1000 by jumpers or can be programmed by replacing a resistor on the board for other gain values. The PICOM INA125 was designed to be a versatile general purpose amplifier board at a very affordable price.

The INA125 board and components are warranted for one year against defects in parts and workmanship. PICOM assumes no legal responsibility for the module's application or use. The purchaser and user assume all risk for any or all damage to persons or property that may be incurred through the use or misuse of this product. It is the responsibility of the user or purchaser to use this product in accordance with the instructions and any local, state, federal or international laws or regulations.

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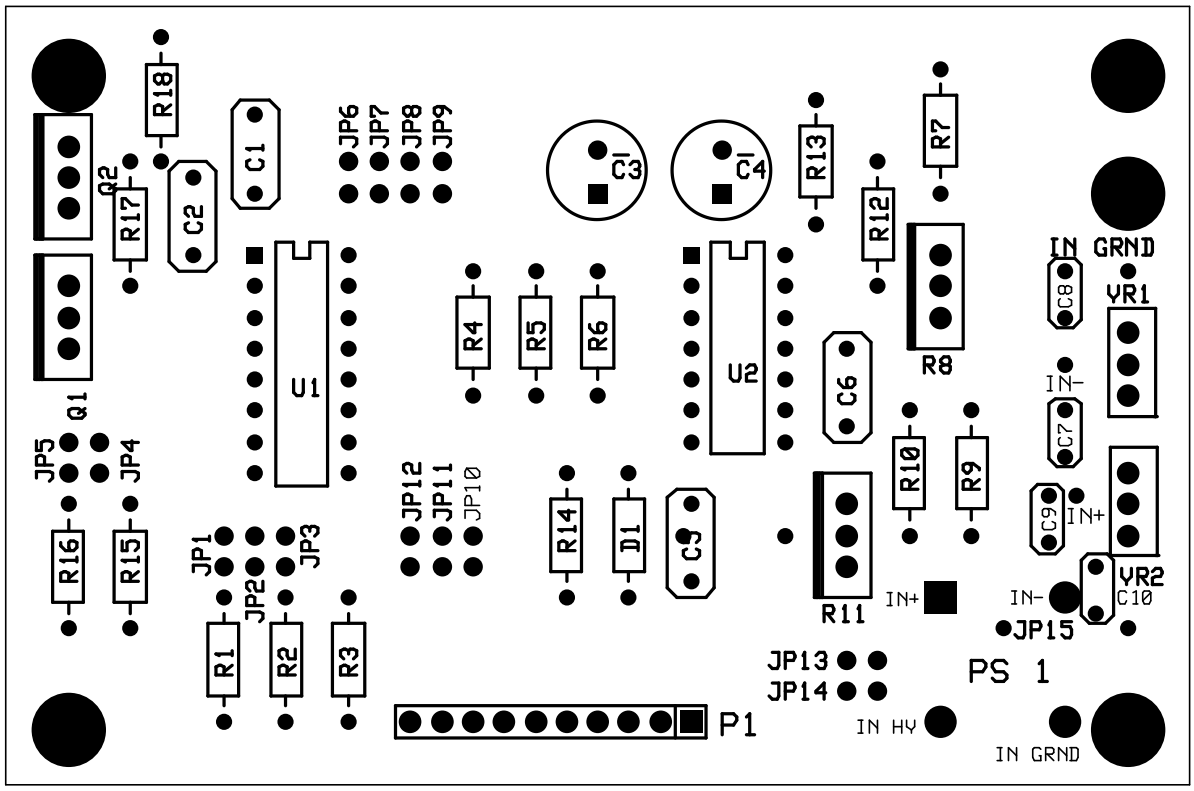
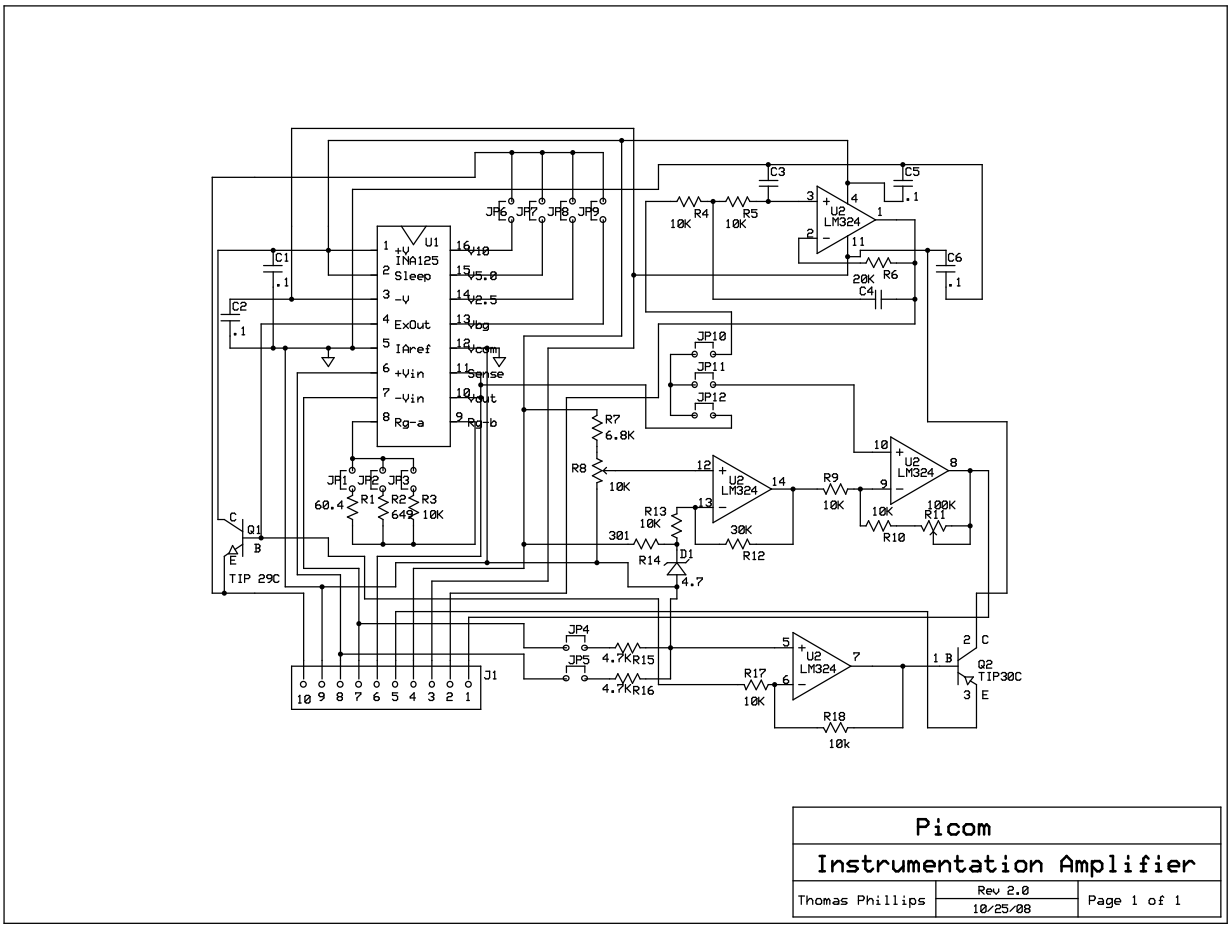
Component location and board layout for the INA125 Amplifier Module.



Jumper Listing:

JP1	Gain Range 1000	JP11	Buck and Gain Jumper
JP2	Gain Range 100	JP12	Amplifier Jumper
JP3	Gain Range 10	JP13	I/O Power Enable
JP4	Input Termination, 4.7 KΩ	JP14	Power Module Enable
JP5	Input Termination, 4.7 KΩ	JP15	Regulator Enable
JP6	10V Excitation		
JP7	5V Excitation		
JP8	2.5V Excitation		
JP9	1.24V Excitation		
JP10	Filter Jumper		



Schematic Diagram.

Theory of Operation:

The PICOM INA125BB module has four major subsections. The first is the excitation supply. The INA125 amplifier IC contains all the necessary components for the generation of a low power unipolar excitation voltage. Additional components have been added to generate a bipolar current boosted excitation source. The jumpers JP6 thru JP9 are used to select 1.24, 2.5, 5 and 10 volt outputs. A negative voltage is generated by passing the excitation signal voltage from the INA125BB to an op amp where the signal is inverted. The op amp output is then routed to a pass transistor (a PNP compliment to the NPN for the positive supply) for the negative portion of the excitation. The transistors Q1 and Q2 allow a sensor to draw up to 1 amp (provided the bipolar 12V supply to the board has sufficient current capacity). The excitation signal has a feedback signal to maintain the excitation at a constant value. The amplifier portion of the board is an INA125 Burr Brown Amplifier Integrated Circuit and is a self contained, laser trimmed instrumentation amplifier. All efforts were made to preserve the specifications of the IC. The input is very high impedance and so 47 KΩ resistors have been added (jumper selectable) to terminate the inputs. The lower termination impedance on the input is necessary to provide a current path when

the amplifier is connected to a high output impedance bridge. The user is advised to reference the data sheet for the INA125 amplifier module to fully realize its performance.

The gain range of the amplifier IC is from 4 to 10,000. Three gains are jumper selectable (10, 100, 1000). Other gains can be obtained by replacing any of the resistors R1, 2, 3 and using the equation $G=(4+(60K\Omega/R_G)$. The filter section is a single stage active low pass filter and has a default cutoff frequency of approximately 4 HZ at the -3db point if no other frequency is specified when the boards are ordered. Other cutoff frequencies can be obtained by replacing C3,4 and R4, 5, 6. The offset and gain section can provide amplification of a signal with gains of 2 to 12 through the adjustment of the potentiometer R11. The signal offset can be adjusted by use of potentiometer R8. This is a two stage offset and gain stage using two op amps of an LM324 quad amplifier IC. The user is encouraged to consult the data sheet for the LM 324 for its performance characteristics. External regulators allow the user to apply voltages from +/- 15V to +/- 30V. The user must set the jumpers as shown on page 12 for this option.

INA125BB Amplifier Module Parts List

Part Desig.	Value	Digikey Part #			Filter	
C1	0.1	BC1154CT-ND		1 Khz	100Hz	4Hz
C2	0.1	BC1154CT-ND				
C3		Varies		BC1158CT-ND	BC1160CT-ND	P1197-ND
C4		Varies		BC1080CT-ND	BC1103CT-ND	P1199-ND
C5	0.1	BC1154CT-ND				
C6	0.1	BC1154CT-ND				
D1	4.7	1N750ACT-ND		.1 Pin Connector		
J1		277-1281-ND		WM8080-ND		
JP1		SAM1068-12-ND				
JP2		SAM1068-12-ND				
JP3		SAM1068-12-ND				
JP4		SAM1068-12-ND				
JP5		SAM1068-12-ND				
JP6		SAM1068-12-ND				

JP7		SAM1068-12-ND				
JP8		SAM1068-12-ND				
JP9		SAM1068-12-ND				
JP10		SAM1068-12-ND				
JP11		SAM1068-12-ND				
JP12		SAM1068-12-ND				
Q1	TIP 29C	TIP29CFS-ND				
Q2	TIP30C	TIP30C-ND				
R1	60.4	PPC60.4XCT-ND				
R2	649	PPC619YCT-ND				
R3	10K	PPC10.0KXCT-ND				
R4	10K	PPC10.0KXCT-ND				
R5	10K	PPC10.0KXCT-ND				
R6	20K	PPC20.0KXCT-ND				
R7	6.8K	PPC6.8KXCT-ND				
R8	10K	SP064W-10K-ND				
R9	10K	PPC10.0KXCT-ND				
R10	10K	PPC10.0KXCT-ND				
R11	100K	SP064X-100K-ND				
R12	30K	PPC30.0KXCT-ND				
R13	10K	PPC10.0KXCT-ND				
R14	301	PPC301XCT-ND				
R15	47.5K	PPC47.5KYCT-ND				
R16	47.5K	PPC47.5KYCT-ND				
R17	10K	PPC10.0KXCT-ND				

R18	10k	PPC10.0KXCT-ND				
U1	INA125	INA125-ND				
U2	LM324	296-1391-5-ND				
VR1	7912	497-1475-5-ND				
VR2	7812	497-1452-5-ND				
C7	1UF	493-1411-ND				
C8	2.2UF	493-1215-ND				
C9	.33/.47 UF	493-1098-ND				
C10	.1UF	493-1095-ND				
R17	10K	PPC10.0KXCT-ND				
R18	10K	PPC10.0KXCT-ND				
ICS1	16 PIN	AE9992-ND				
ICS2	14 PIN	AE9989-ND				

Module Operation:

The I/O connector assignments are as follows.

Pin Number	Connection/Signal Name
1	Offset and Gain Stage Output
2	Filter Stage Output
3	-12V Power Supply Input
4	+12V Power Supply Input
5	Power Supply Ground, Output Signal Low
6	Instrumentation Amplifier Output
7	Lo- Side Bridge Input
8	Hi-Side Bridge Input
9	Hi Current Drive Negative Excitation Output
10	Hi Current Drive Positive Excitation Output

To prepare the module for normal operation.

1. Connect the power supply leads to the connector J1.
2. Install JP13 for Power supply connections on J1/P1 (Installed at the Factory).
3. Determine appropriate jumper settings from page 8. Set the jumpers as desired. Connect the bridge sensor excitation leads to the terminals as desired for the appropriate excitation levels.
4. Connect the bridge sensor output leads to terminals 7 and 8.
5. See page 9 for interconnection of the functions. Make the connections for the filter and offset and gain stages if desired.
6. Connect the output of the board to an oscilloscope or voltmeter/panel meter with an input impedance of 10 K ohms or higher.
7. Apply power to the board and adjust the offset and gain if those functions are used.

Jumper Instructions:

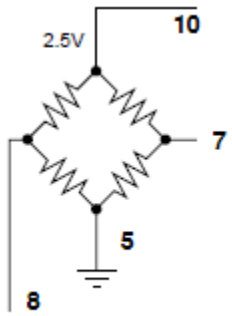
Desired Function or Option	Jumpers to Connect
Select Excitation Voltage	JP6, 7, 8, 9
Select the Amplifier Gain	JP1, 2, 3
Amplifier Input Termination	JP4, 5
Connect Amplifier Output to Filter	JP12, JP10
Connect Amplifier Output to Gain	
And Offset Stage	JP12, JP11

Note On Excitation Voltage:

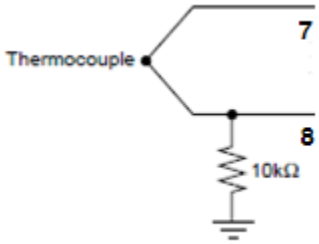
Caution!

Excessive Excitation Voltages can damage sensors. Remember that the bipolar excitation supply will place 20 volts across the load when the excitation jumpers are set to 10V. A typical pressure transducer usually requires only +5 volts (+5 volts from terminal 10 and the low side of the sensor connected to ground). A typical strain gage bridge can be operated with 2.5V to avoid self heating of the gages. Higher voltages will cause excessive currents to flow through a typical 120 ohm or 350 ohm bridge and will damage the strain gages. Ensure that the manufacturer's specifications are followed for the type of sensor being used.

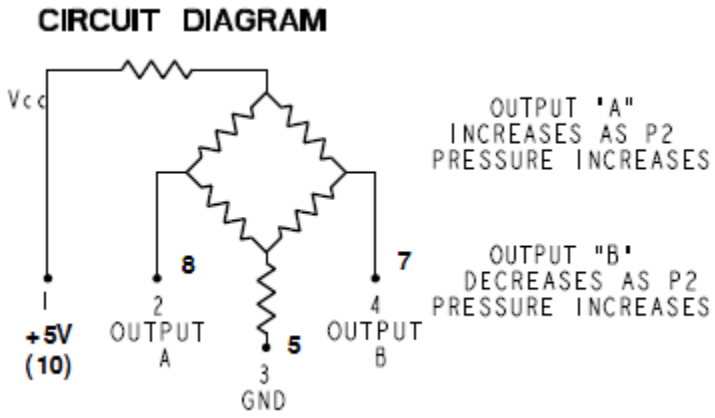
Typical Applications: INA 125BB Connections Shown in Bold Numbers



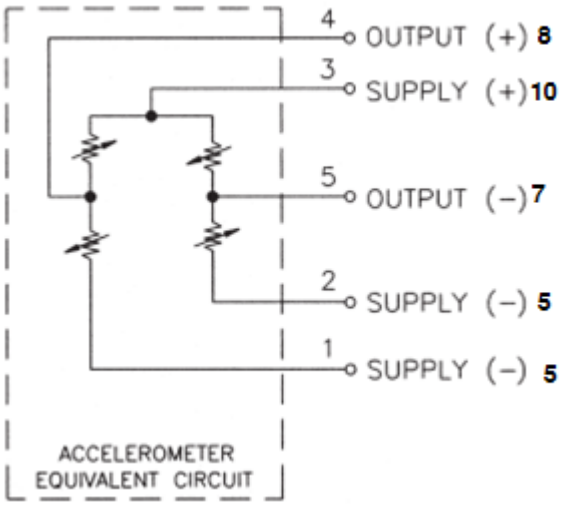
Strain Gage Bridge



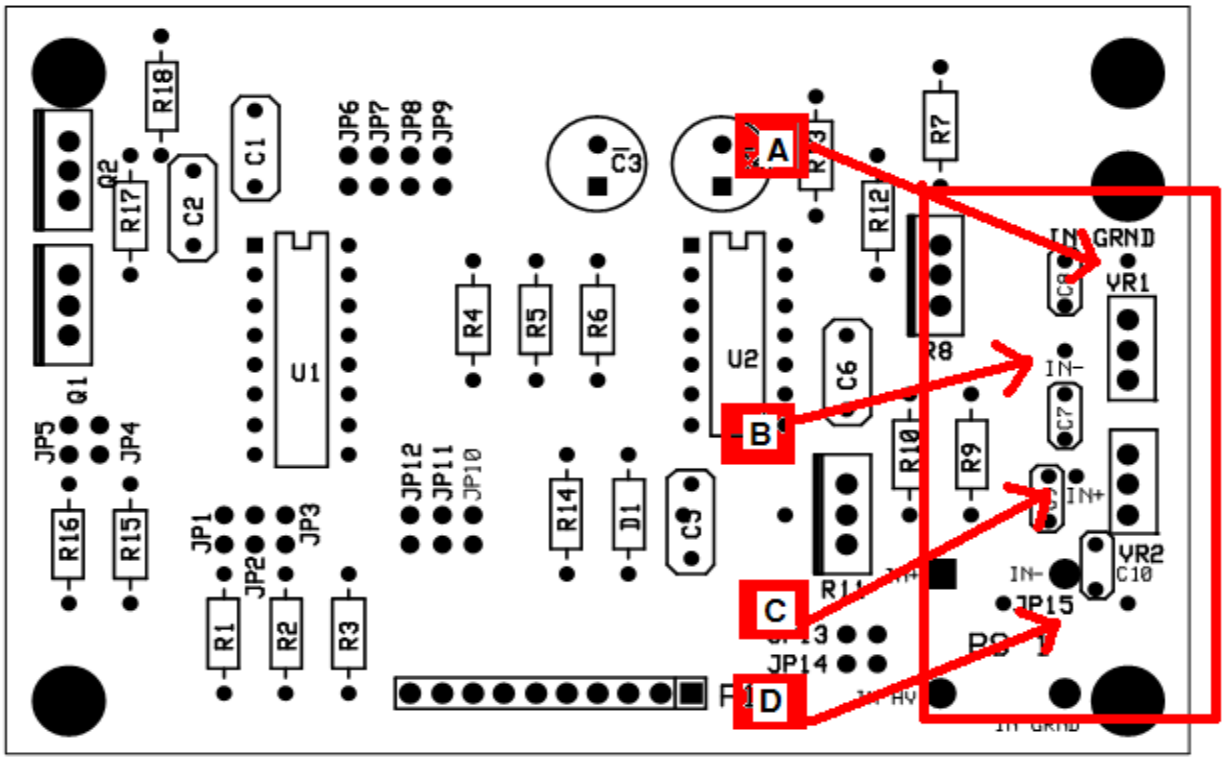
Thermocouple



Honeywell Pressure Transducer (26PC Series)

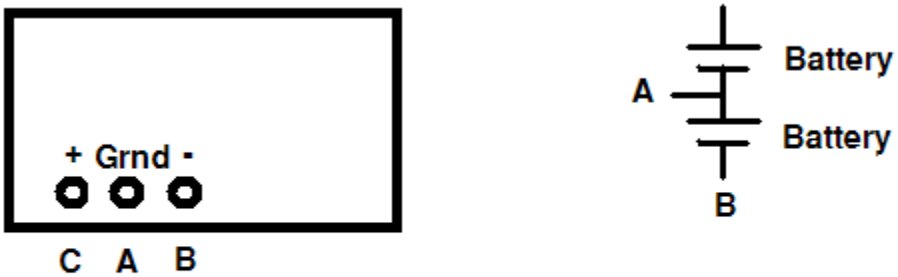


MSI Accelerometer



For Battery Operation or External Unregulated Supply

1. Install Jumper JP15 using a short length of wire (Location D).
2. Ensure jumper JP13 is installed.
3. Install three wires to make connections at locations A, B, C.
4. Connect the battery supply or unregulated supply as shown in the diagrams (+/- 16 to 28V).



Unregulated Bipolar DC supply and Battery Connections

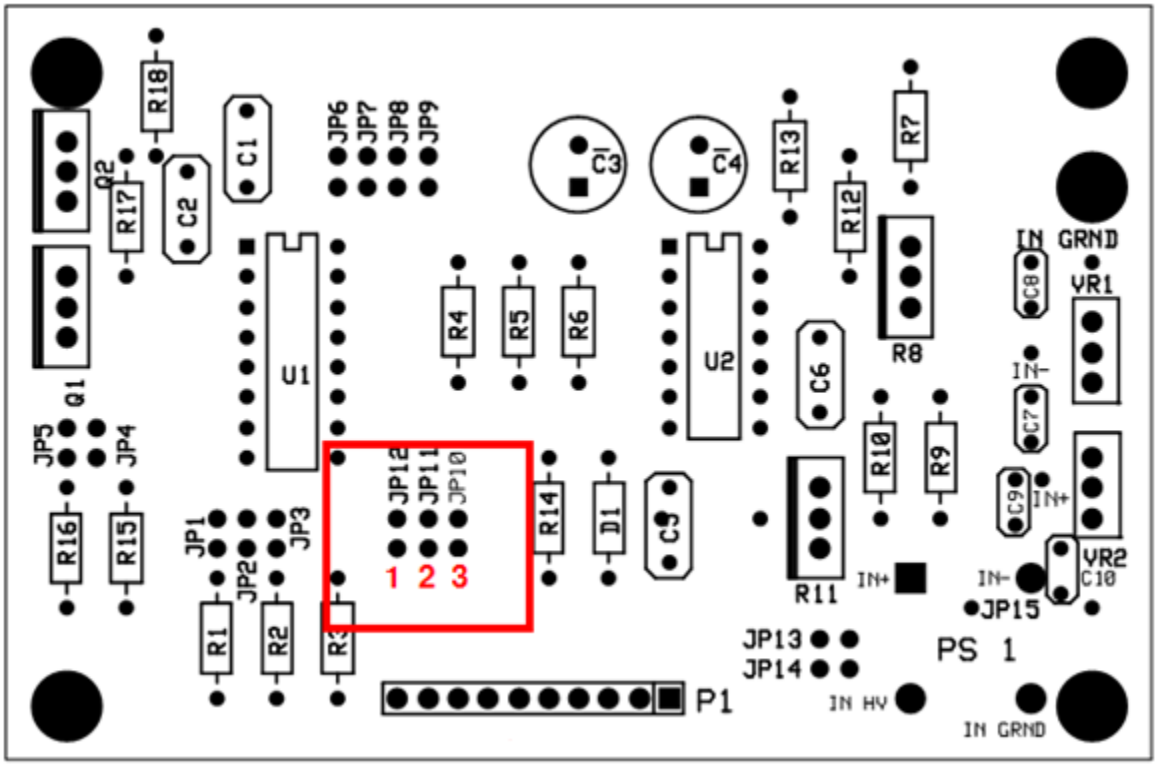
NOTE: It is recommended to add heat sinks to VR1 and VR2 for high currents. See the manufacturers' data sheets for details.

Supplemental Information for the Active Filter

The active filter is a -40 dB/decade Butterworth type and the design equations for selecting the appropriate components for a desired roll off frequency are listed below.

1. Let R4=R5, R6=2*R4 (10Kohm is a good value for most cases for R4 and R5).
2. C3=(.707/(ω * R4))
3. C4=2*C3

Supplemental Information for Sub-circuit Interconnection



1. To connect the amplifier, filter and gain/offset stages together, use a jumper block on JP12 and a jumper block on either JP11 for the Offset and gain or JP 10 for the filter. To connect all three stages in series (ie amplifier output, filter and gain stage) Install JP12 and then JP 11 or JP10 as desired. To connect the third stage, connect the output from P1 pin 1 or pin 2 to locations 2 or 3 as appropriate on input jumper pins. The pins closest to P1 are inputs on JP10 and JP11.
2. Location 1=Amplifier Output (Also P1-6)
3. Location 2=Offset and Gain Input
4. Location 3=Filter Input
5. P1-1=Offset and gain circuit Output
6. P1-2=Filter Output

For Additional information, contact PICOM at TJPhil5588@aol.com or write

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