g GE Energy	**Functional Testing Specification**
Parts & Repair Services ***Louisville, KY***	**LOU-GED-IS200TVIB-B**

Test Procedure for a Mark VI Vibration Terminal Card

DOCUMENT REVISION STATUS: Determined by the last entry in the "REV" and "DATE" column

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release	John Madden	6-4-07
B	Shifted setup from 6.2.3 to 6.2.2	John Madden	8-28-07
C			

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John Madden			Charlie Wade
DATE	**DATE**	**DATE**	**DATE**
August 28, 2007			28 Aug 2007

1. **SCOPE**

1.1 This is a functional testing procedure for a Mark VI Vibration Terminal Card.

2. **STANDARDS OF QUALITY**

2.1 Refer to the current revision of the IPC-A-610 standard for workmanship standards.

3. **APPLICABLE DOCUMENTS**

3.1 The following document(s) shall form part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.

3.1.1 N:\Design Folders\IS2\IS200T\TVIB

4. **ENGINEERING REQUIREMENTS**

4.1 Equipment Cleaning

4.1.1 Equipment should be clean and free of debris prior to applying power unless performing an initial check. Refer to the local documented procedures for cleaning guidelines.

4.2 Equipment Inspection

4.2.1 Equipment should be visually inspected for any defects prior to applying power. This inspection should include the following as a minimum:

4.2.1.1 Wires - broken, cracked, or loosely connected
4.2.1.2 Terminal strips / connectors - broken or cracked
4.2.1.3 Components - visually damaged
4.2.1.4 Capacitors - bloated or leaking
4.2.1.5 Solder joints - damaged or cold
4.2.1.6 Circuit board - burned or de-laminated
4.2.1.7 Printed wire runs / Traces - burned or damaged

5. **EQUIPMENT REQUIRED**

5.1 The following equipment is required to perform the process requirements. Equipment may be substituted provided that all accuracy's and test ratios are equivalent or better.

Qty	Reference #	Description
1		Fluke 87 DMM (or Equivalent)
1		Oscilloscope, at least two channels
1		Function generator
1		20uF non-polarized capacitor, 35V rating or higher
1		Tenma dual power supply

6. TESTING PROCESS

6.1 Setup

6.1.1 Setup is as directed in each test step. **NOTE:** *This test was originally written using a TVIBH2A board. It has been found that Salem altered the input circuits of the later HxB revision with the addition of filter networks, thus altering the outputs slightly from what was found on the HxA cards. This causes a slight DC bias to appear between the input-coupling cap used in the test and the input circuits themselves. The resultant output waveforms have been added to this test, along with photos to help guide you. Where there are differences, it will be called out in that step.*

6.2 Testing Procedure

6.2.1 **Continuity tests:** This card is used to connect up to 14 discrete vibration sensors to three separate IS200VVIB cards in TMR configuration, so it has A LOT of redundant connections. Rather than functionally test each of these redundant circuits, it's easiest to do resistance and continuity checks first, then use just the fourteen basic I/O points for quick testing of the amplifier circuits. First, set your meter up to read resistance, and if you prefer, set it to tone out for continuity. You should see around an Ohm or less for the following circuits:

TBx Connector	JR1, JS1, JT1 (JR-S-T1) pin #
TB1-2	JR-S-T1-3
TB1-8	JR-S-T1-5
TB1-14	JR-S-T1-7
TB1-20	JR-S-T1-9
TB1-5	JR-S-T1-23
TB1-11	JR-S-T1-25
TB1-17	JR-S-T1-27
TB1-23	JR-S-T1-29
TB2-26	JR-S-T1-11
TB2-32	JR-S-T1-32
TB2-38	JR-S-T1-35
TB2-29	JR-S-T1-31
TB2-35	JR-S-T1-15

Next, you'll need to check for 10Kohm resistance between the P1-P14 connector center pins and their respective companion d-shell connectors, using the following table:

BNC Conn. #	D-shell Connector & Pin #
P1	JA1-3
P2	JA1-7
P3	JA1-11
P4	JA1-23
P5	JB1-3
P6	JB1-7
P7	JB1-11
P8	JB1-23
P9	JC1-3
P10	JC1-7
P11	JC1-11
P12	JC1-23
P13	JD1-1
P14	JC1-5

And finally, you need to verify 10Kohm resistance between each outer shell of the P1-P14 connectors and PCOM (refer to the prints, but JR1-4 of JR1-6 will do just fine)

6.2.2 Voltage Regulator Outputs: There are fourteen regulated voltage outputs that can feed power to the sensors. They all are set to output –24Vdc, and need to be checked for accuracy. With meter still using PCOM as its common, apply voltage as follows: set to series, for +/- 28Vdc, with Com to JR1, JS1, or JT1 pin 2. +28V goes to JR1, JS1, or JT1 pin 1. -28Vdc goes to JR1, JS1, or JT1 pin 20. See photos in section 8. Now read the outputs at the following points to look for –24Vdc:

TB1-1	**TB1-4**
TB1-7	**TB1-10**
TB1-13	**TB1-16**
TB1-19	**TB1-22**
TB2-25	**TB2-28**
TB2-31	**TB2-34**
TB2-37	**TB2-40**

6.2.3 DC Regulator and Input Bias tests: With meter COM lead still in PCOM, power up the board and measure the DC bias voltages on the fourteen amplifier circuits. The first eight have jumpers that change the bias depending on what kind of vibration sensor is used to drive the circuit, but the last six do not, therefore we'll check them first. P9-P14 should simply have a positive bias of 4.2Vdc. P1-P8 on the other hand, will require the jumpers configured in each of three ways. The jumper sets come in pairs, with "P", "V", & "S" marked. One jumper of each pair stays put for "P" or "V", while the other switches three ways. <u>MAKE SURE TO PULL BOTH JUMPERS IN EACH PAIR</u> before setting up a new configuration. The following table lists the bias voltages for each of the P1-P8 BNC connectors for each jumper setting:

BNC	JP pos. "P"	JP pos. "V"	JP pos. "S"
P1	+4.2Vdc	0.0Vdc	-11.42Vdc
P2	+4.2Vdc	0.0Vdc	-11.42Vdc
P3	+4.2Vdc	0.0Vdc	-11.42Vdc
P4	+4.2Vdc	0.0Vdc	-11.42Vdc
P5	+4.2Vdc	0.0Vdc	-11.42Vdc
P6	+4.2Vdc	0.0Vdc	-11.42Vdc
P7	+4.2Vdc	0.0Vdc	-11.42Vdc
P8	+4.2Vdc	0.0Vdc	-11.42Vdc

6.2.4 Functional Testing: This is the nuts & bolts of the card. Here you'll be looking at your input signal and directly comparing it to the output. When the two match, they will overlap exactly and will appear as one (*only on the HxA card)*. First, connect the function generator directly into Channel 1 (CH1) of the scope. Next, connect Com of CH1 to Eyelet E1 or E2 (SCOM). Connect POS from CH1 of the scope to one end of your non-polarized 20uF blocking capacitor, the other end of which will be connected through an alligator lead to the various circuits you will test. This cap is used to protect the Function Generator from the potential +/-28Vdc input biases you've seen from the first eight op-amp circuits, depending on their jumper configurations. Connect channel 2 (CH2) using a BNC to BNC coax cable to P1. Set both channels of the scope to 5V/div, DC signal, .5mSec/div, and center both channels (GND signal) on the centerline of the grid, X-axis. Use the DC offset function of the Function Generator to center its output in relation to the centered Channel 1 input. See photos in section 8. Looking at photo 8.5, make sure all eight sets of jumpers are set to the "V" position for 0.0Vdc bias.

✍ **NOTE: Failure to use a DC blocking cap during this test can expose the output finals of the function generator to enough DC voltage in one polarity or the other to blow one of the push-pulls within it.**

ALSO: Use of a polarized (electrolytic) capacitor or one of insufficient voltage rating (<30Vdc) is inviting disaster if you forget to flip the cap around every time you change jumper positions, or if the voltage rating is exceeded, possibly blowing the cap & shorting it out, and thus blowing the function generator. It's best to just use a non-polarized cap to begin with to remove the risk altogether.

6.2.5 With blocking cap connected in series as directed above, apply 1KHz sine wave to TB1-2. You should observe the output depicted in photo 8.6 if the unit is an HxA revision, photo 8.7 if unit is an HxB. On HxA rev units, both channels overlap almost perfectly, because the output should equal the input for this unity gain op-amp circuit, without any DC bias. The "V" setting of jumpers JP1A & JP1B applies no DC bias on HxA units, so the signal is applied directly without any modification. HxB units have a small filter network placed in the input circuits, which causes a slight DC bias, about -1.4V, which causes the shift seen in photo 8.7. Circuits 1-8 (P1-P8) are identical in this respect. With all jumpers configured for "V" position (photo 8.5), you should see the outputs for the following circuits resemble photo 8.6 or 8.7:

Input	Output
TB1-2	P1
TB1-5	P2
TB1-8	P3
TB1-11	P4
TB1-14	P5
TB1-17	P6
TB1-20	P7
TB1-23	P8

6.2.6 Now, configure all jumpers for the "S" setting (photo 8.11). Remember to pull BOTH jumpers for each pair before changing them to a new setting. The same circuits you just tested in the previous step will be retested, but will show an output similar to what's depicted in photo 8.14 for HxA units, 8.15 for HxB units. The bottom waveform is the output (CH2 of the scope) modified by the negative DC bias applied by the jumper setting.

6.2.7 Finally, configure all of the jumpers for the "P" position. This time, you'll test all eight circuits you just tested in the previous two steps, but in addition you'll test the six remaining ones. P1-P4 will display waveforms similar to those in photo 8.9 for HxA units, 8.10 for HxB units; but due to a difference in resistor values controlling the gain in the rest of these circuits, P5-P14 will display the waveform found on photo 8.11(HxA) or 8.12(HxB). The upper waveform in both photos is the output, modified by the positive DC bias applied by the jumper setting. The following is a table of all fourteen circuits, including the ones tested in previous steps:

Input	**Output**	**Photo** HxA (HxB)
TB1-2	P1	8.9 (8.10)
TB1-5	P2	8.9 (8.10)
TB1-8	P3	8.9 (8.10)
TB1-11	P4	8.9 (8.10)
TB1-14	P5	8.11 (8.12)
TB1-17	P6	8.11 (8.12)
TB1-20	P7	8.11 (8.12)
TB1-23	P8	8.11 (8.12)
TB2-26	P9	8.11 (8.12)
TB2-29	P10	8.11 (8.12)
TB2-32	P11	8.11 (8.12)
TB2-35	P12	8.11 (8.12)
TB2-38	P13	8.11 (8.12)
TB2-41	P14	8.11 (8.12)

6.2.8 That's all folks…

6.3 Post Testing Burn-in **Required ___ Yes _X_ No**

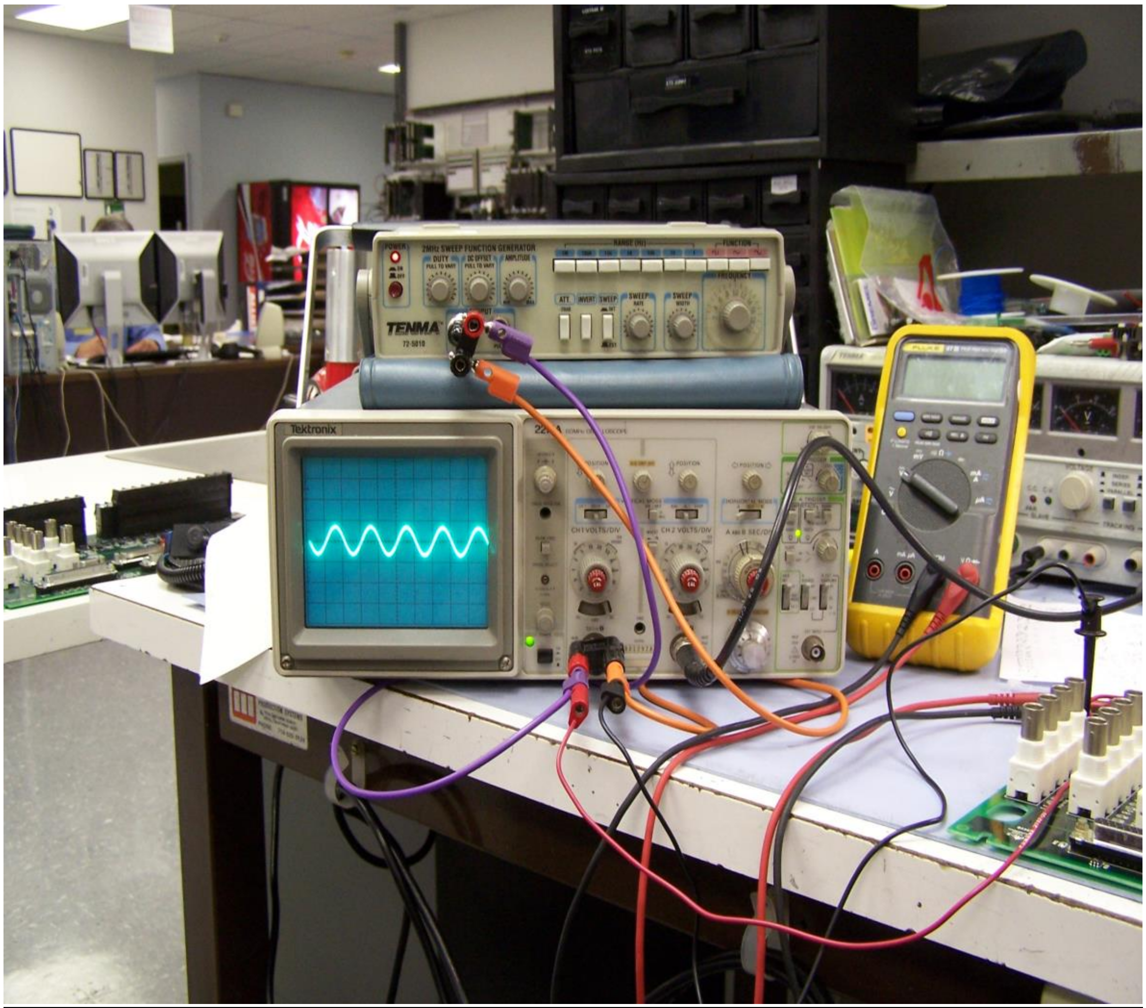
6.3.1

6.4 ***TEST COMPLETE *

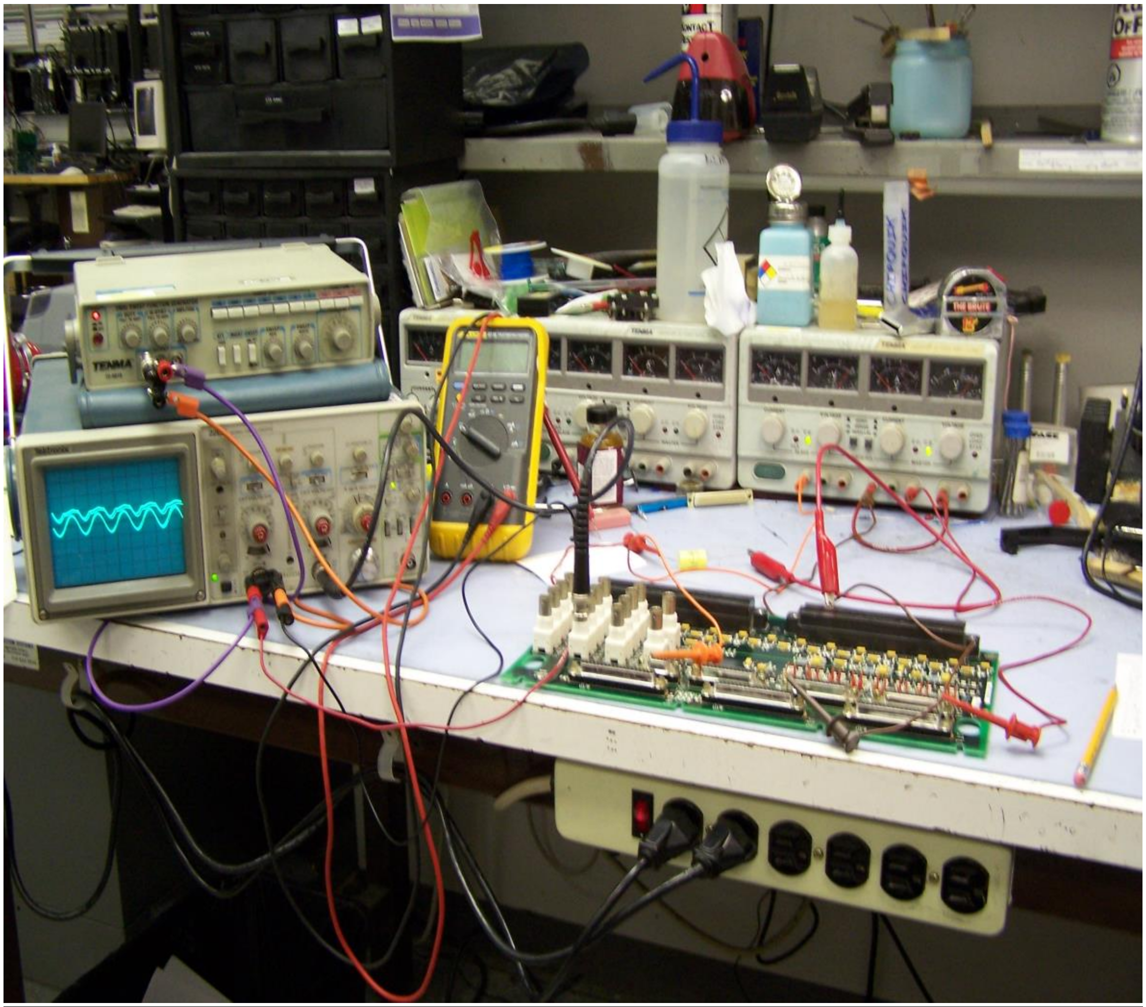
7. NOTES

7.1

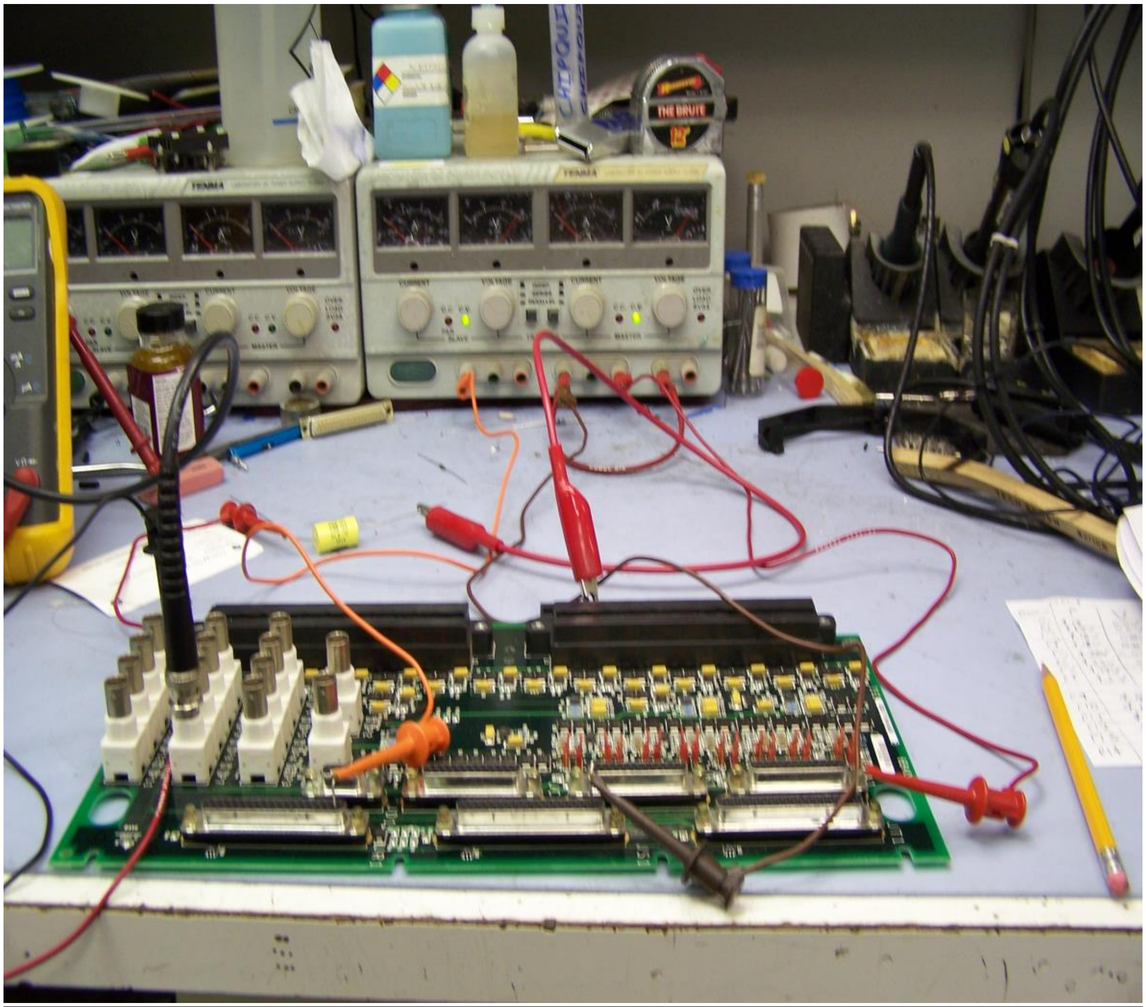
8. ATTACHMENTS

8.1 

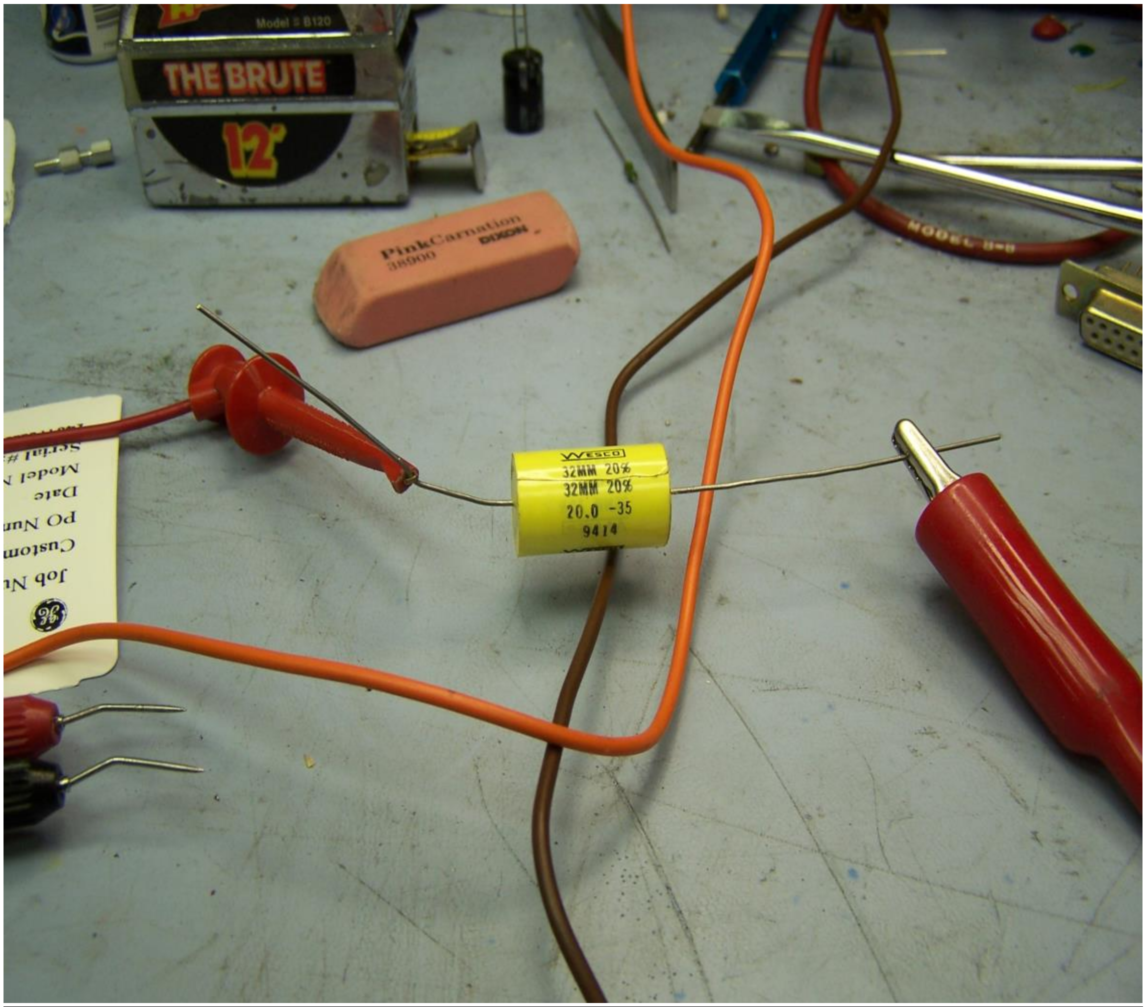
Initial setup. Function Generator connects straight into Channel 1 of the scope, and then runs to the board. CH1 COM goes to eyelet E1 or E2 (SCOM). CH1 POS goes to the blocking cap, then is used to inject signal into the various circuits of the board. CH2 just connects using a BNC cable to the various P1-P14 terminals. NOTICE CH1 & CH2 overlap with jumpers set to "V" as seen here. Jumper settings "P" or "S" will display the DC biases imprinted onto CH2 (see following pictures).



8.2 **<u>A better view of the overall layout…</u>**

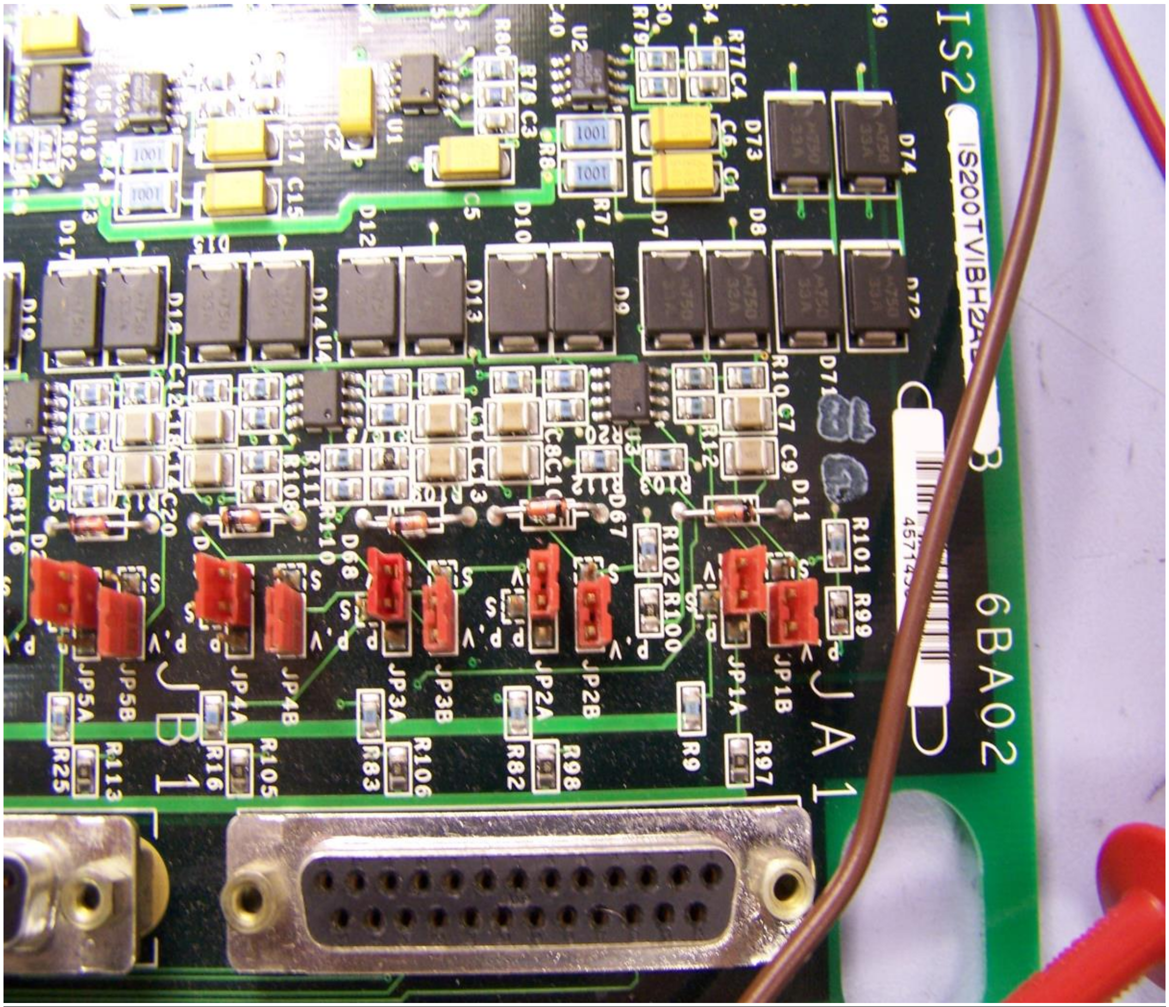
8.3 

A better view of the power supply connections. In this case, -28Vdc=JR1-20, COM=JS1-2, & +28Vdc=JT1-1. Note the blocking cap in the background.

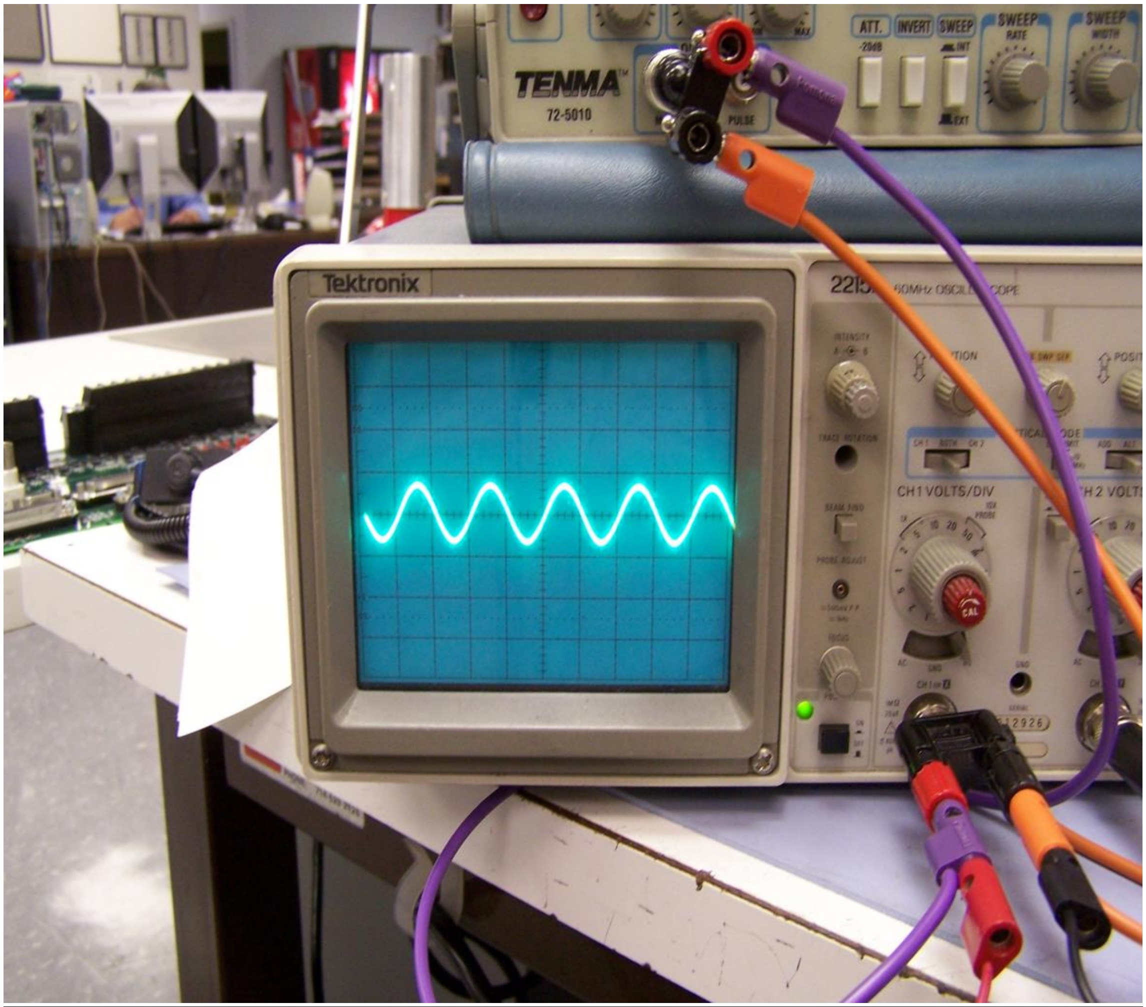


8.4 **<u>DC Blocking Cap, to protect to Function Generator from +/- 28Vdc input bias of certain jumper configurations on TVIB board. CONNECT IN SERIES!</u>**

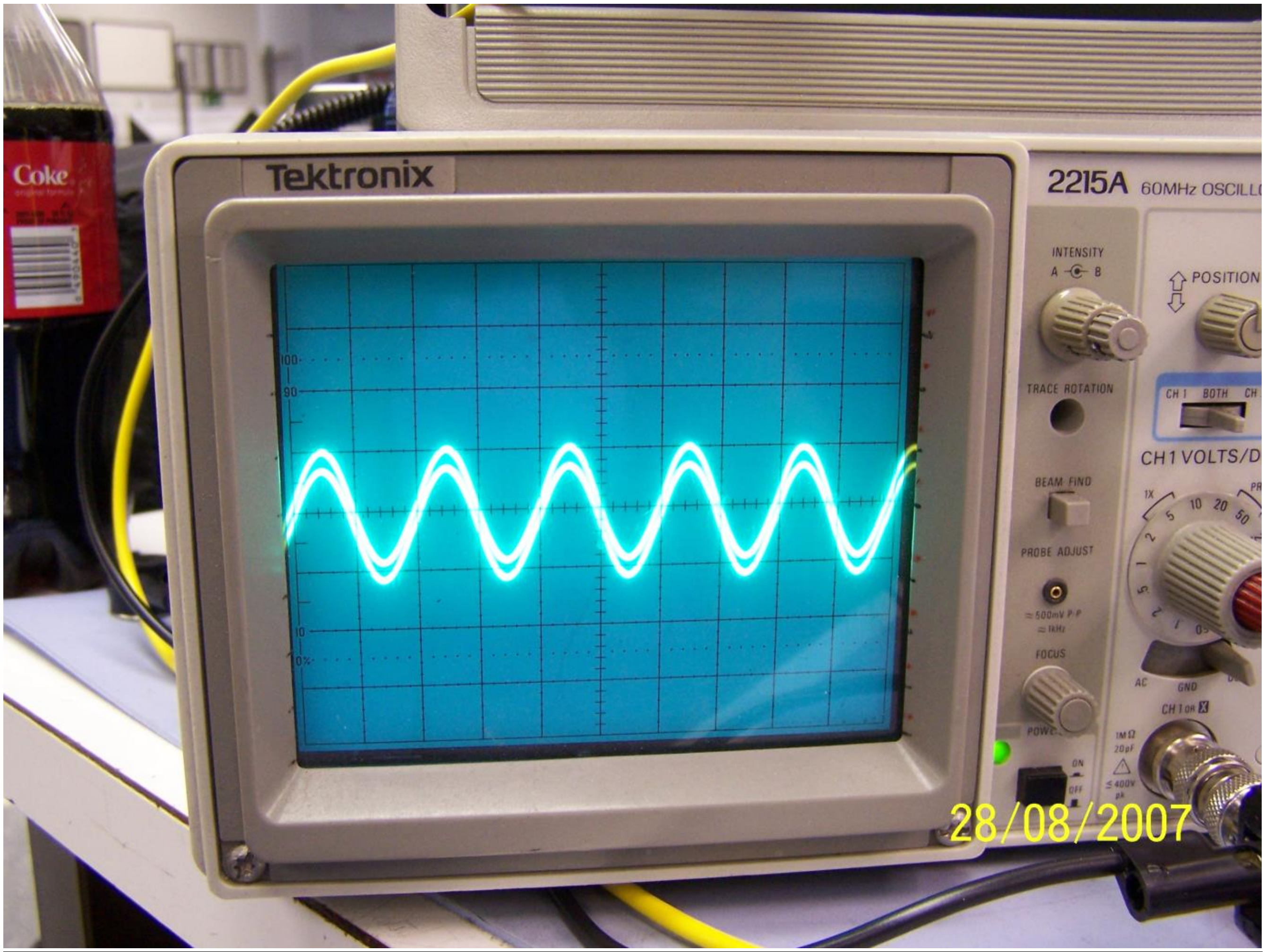
8.5



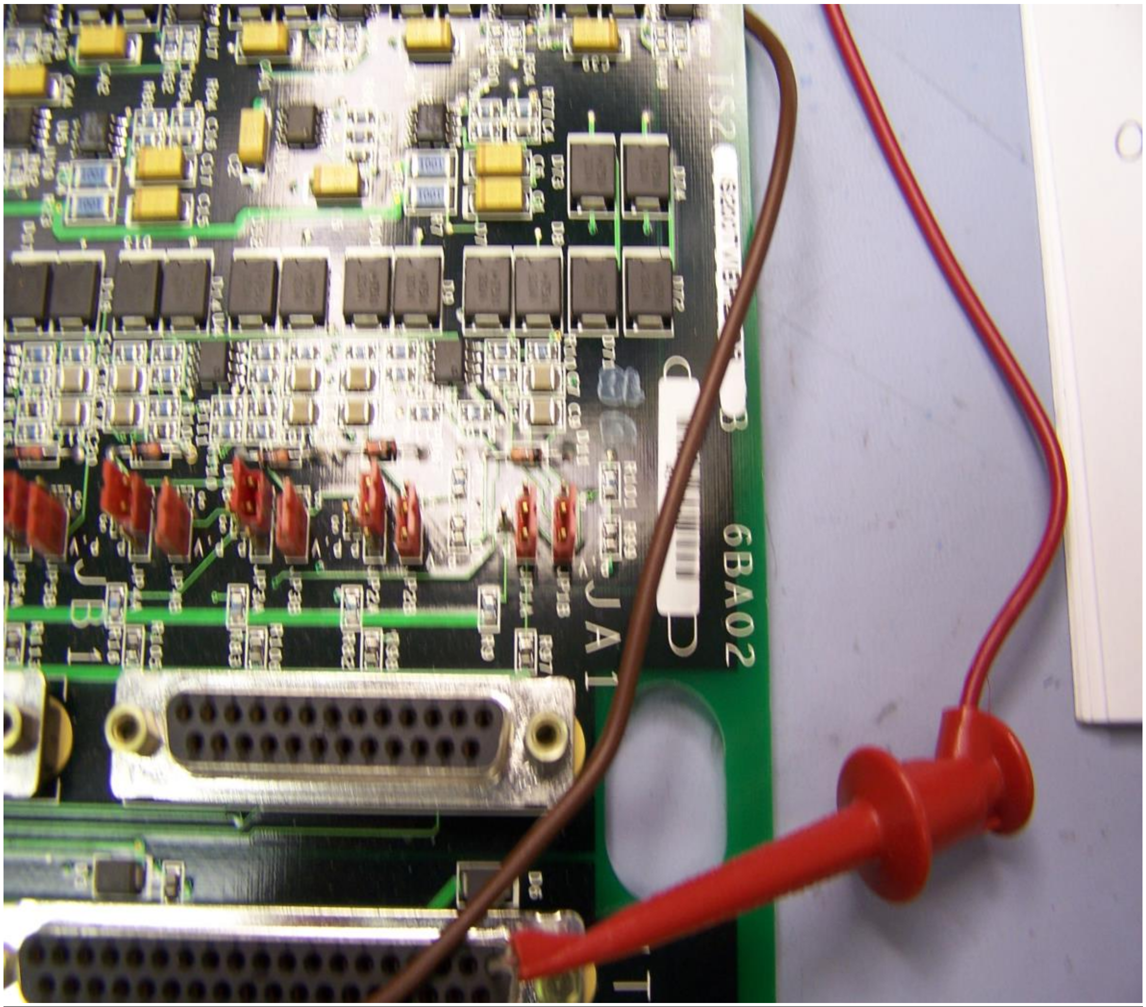
Jumper pairs set to "V" (no DC input bias) setting.

8.6 

HxA Units: <u>Output = Input when jumpers are set to "V" on circuits 1-8.</u>

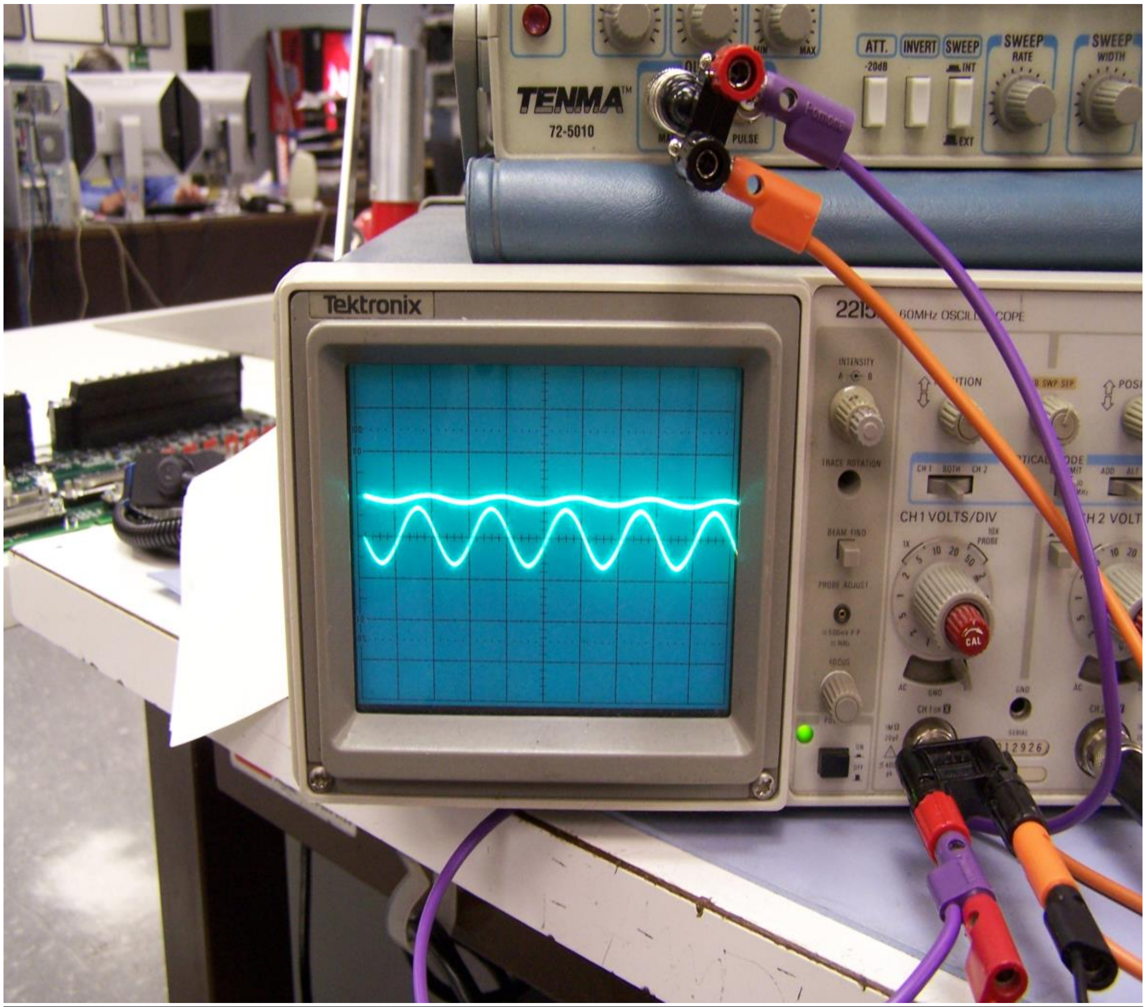
8.7 

HxB Units: Output = Input when jumpers are set to "V" on circuits 1-8.

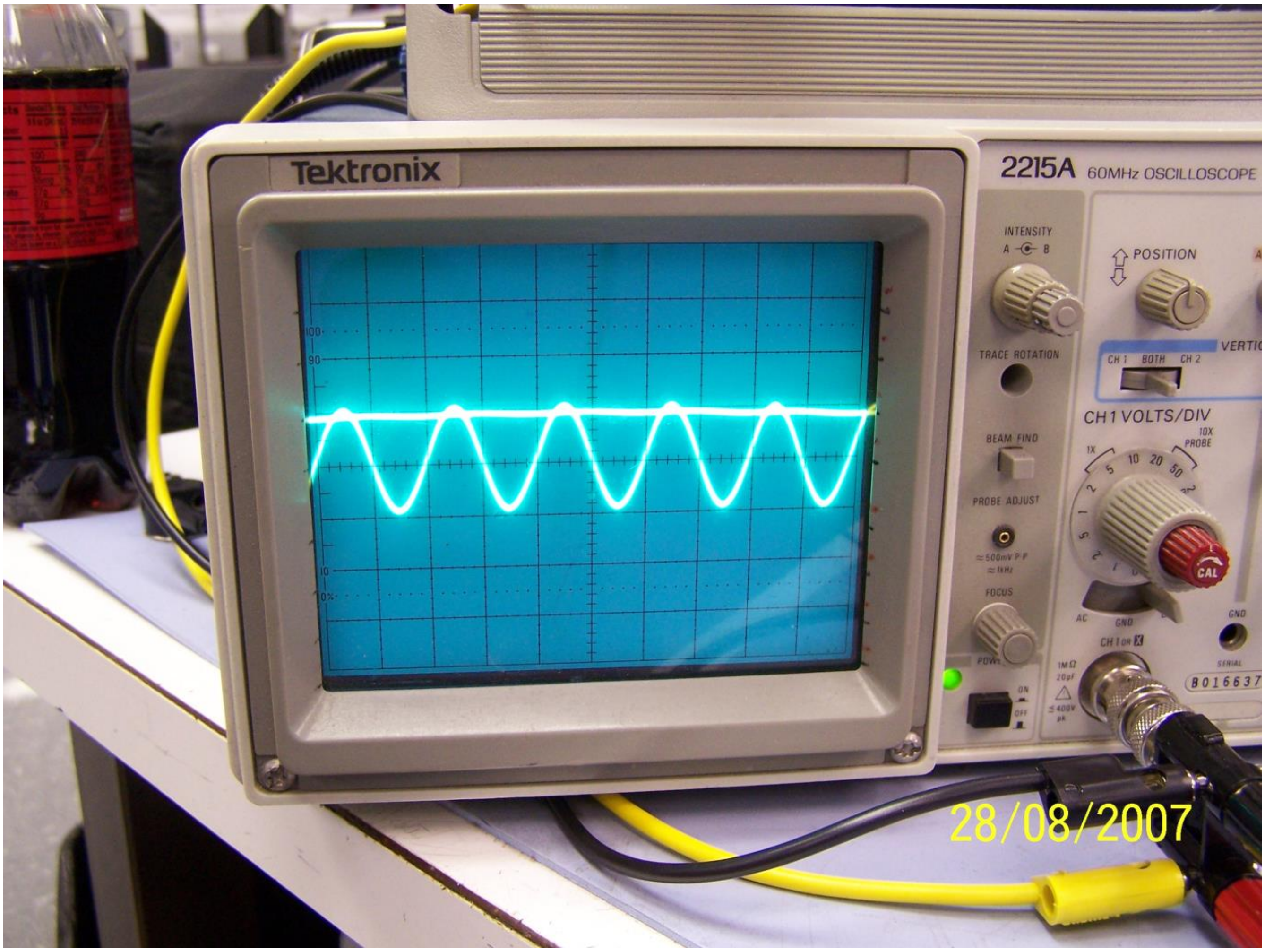
8.8 

<u>Jumper setting on JP1 (A & B) set to "P".</u>

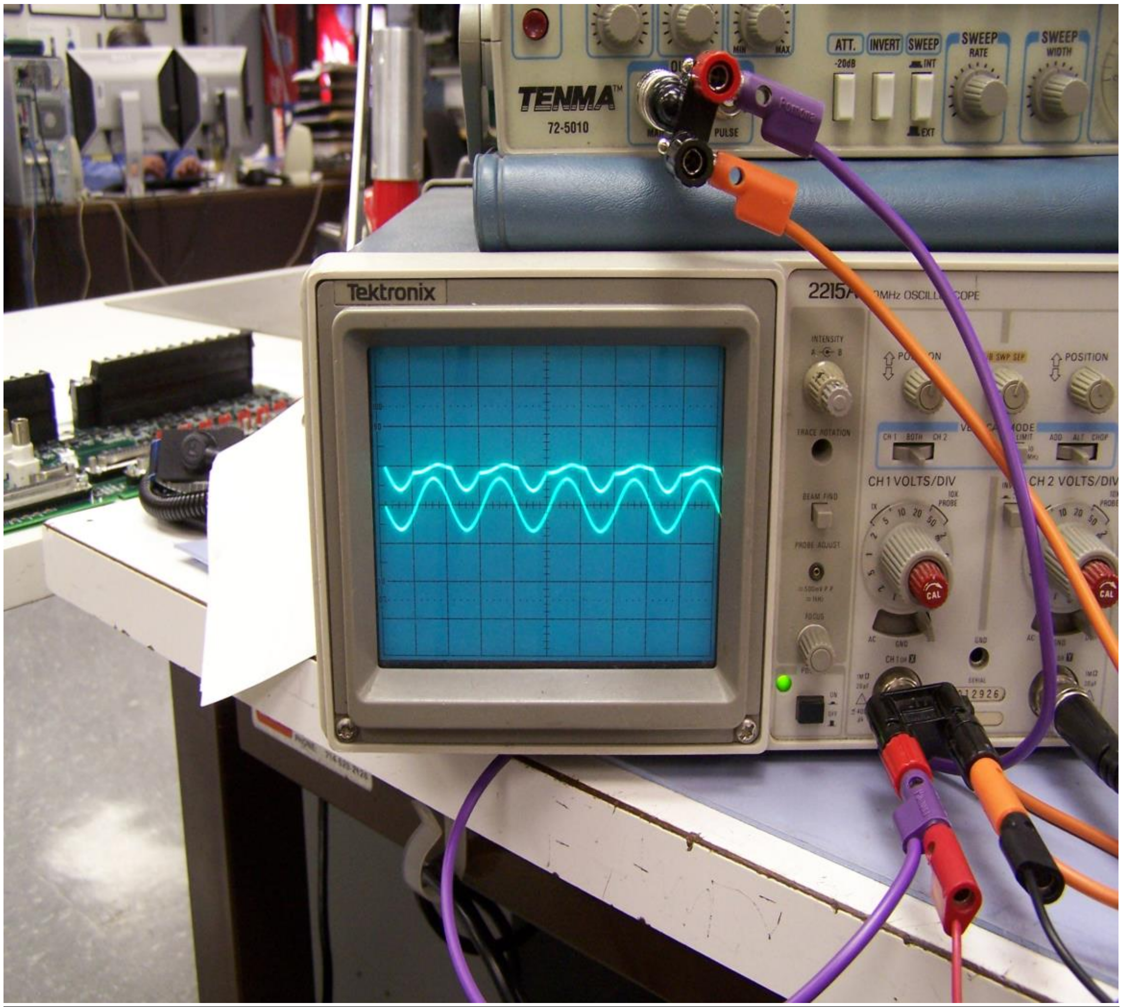
8.9



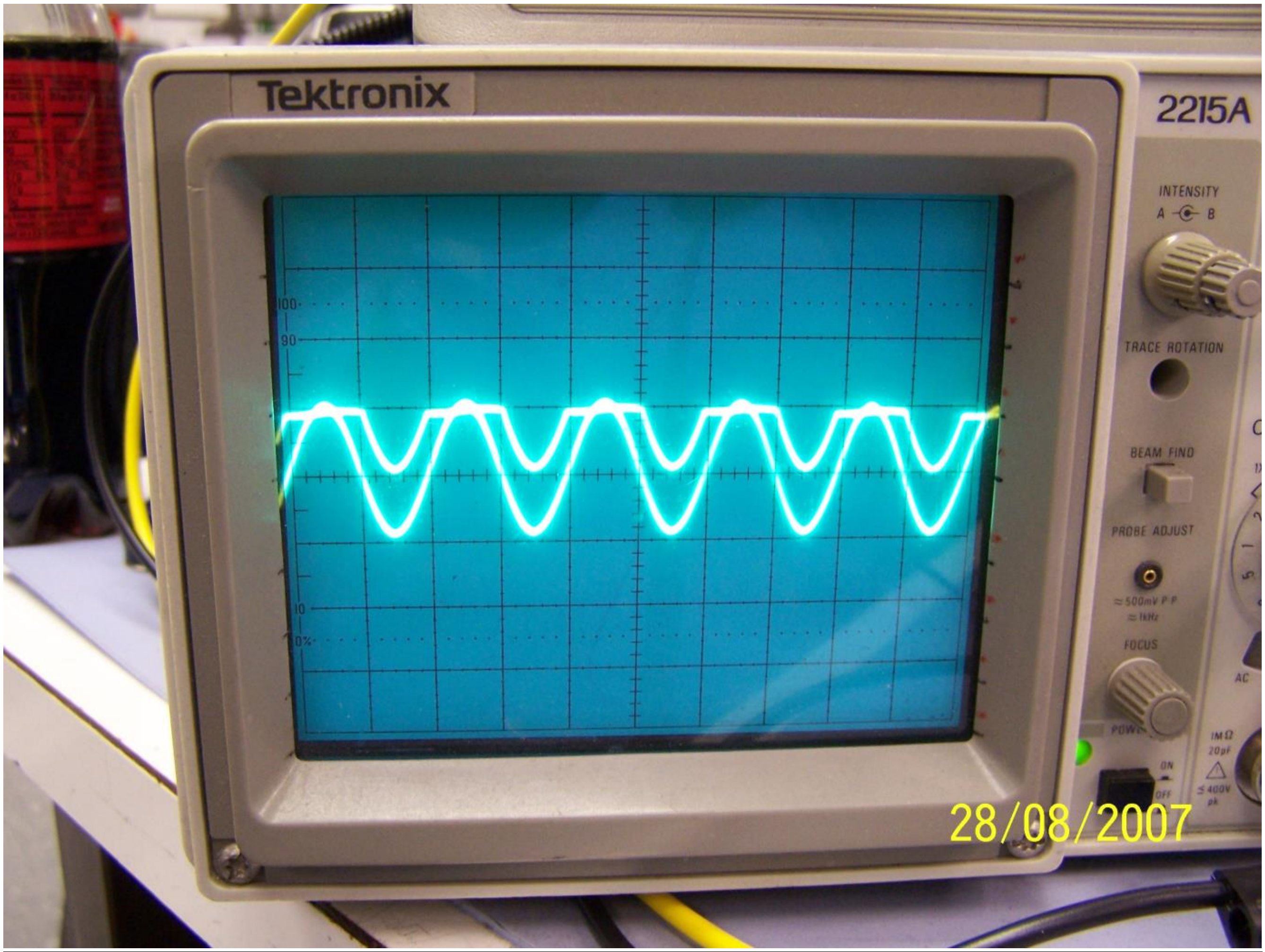
HxA Units: <u>Output = 4Vdc + 1Vpp ripple with jumpers set to "P" on circuits 1-4. Input remains the same as above, scope setting remains unchanged.</u>

8.10 

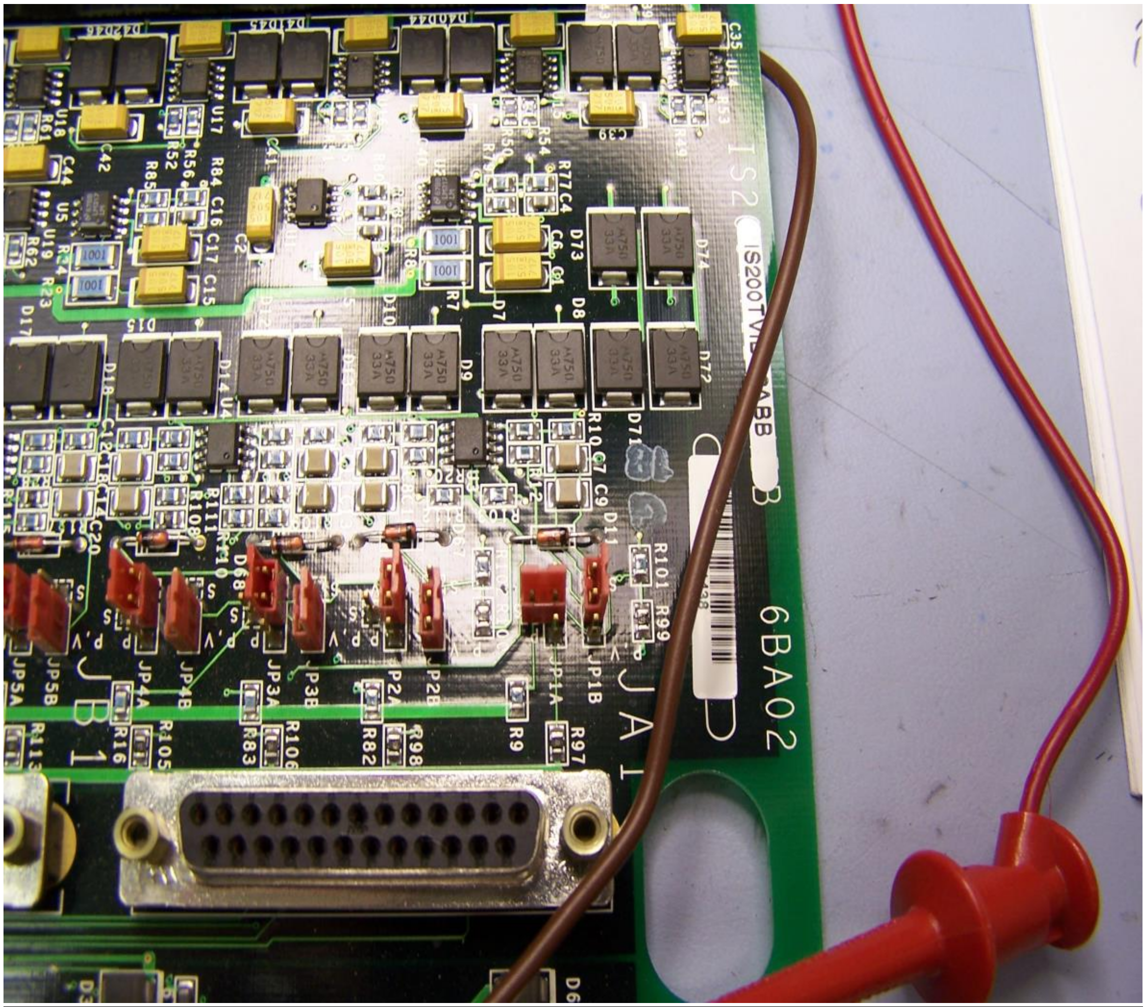
HxB Units: Output = 4Vdc with jumpers set to "P" on circuits 1-4. Input remains the same as above, scope setting remains unchanged.

8.11 

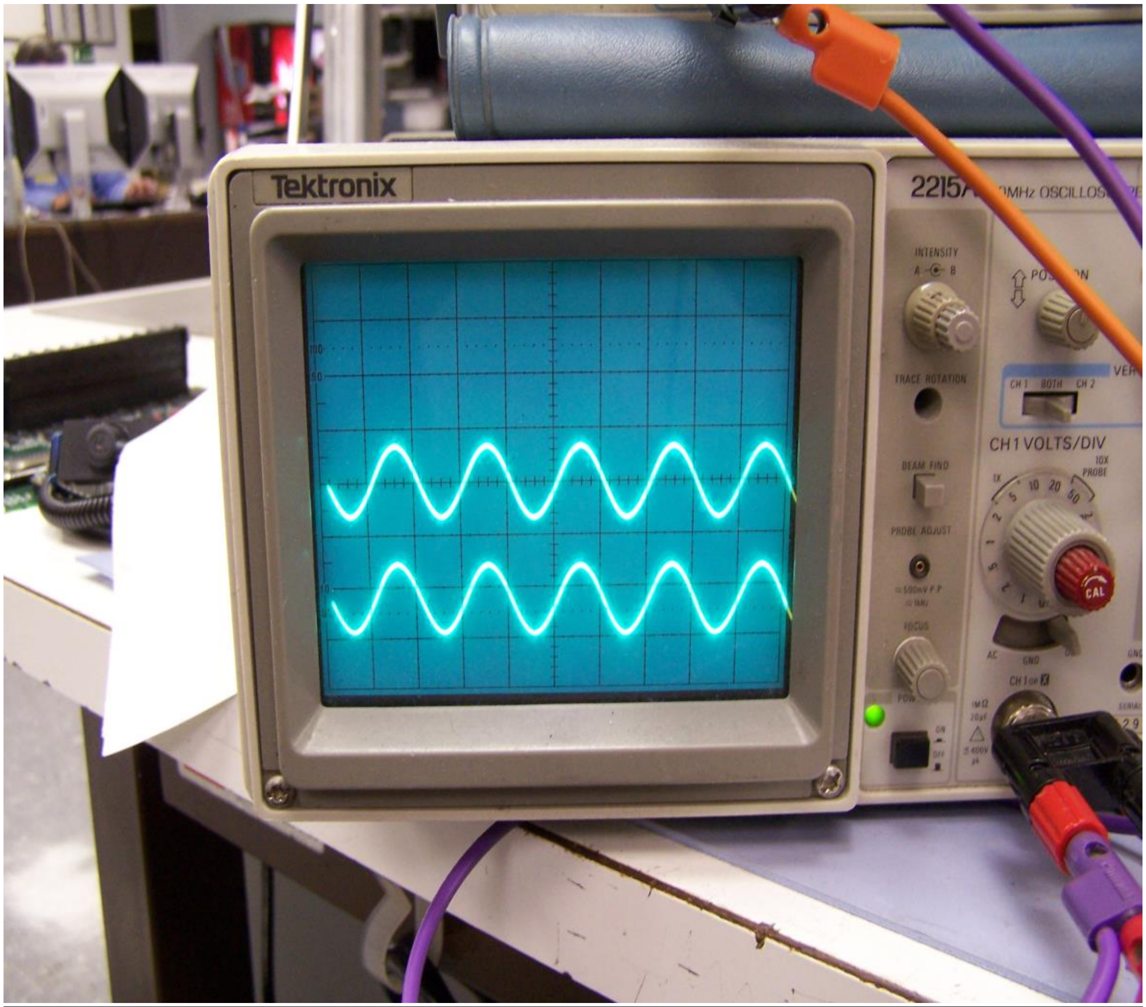
HxA Units: <u>Output = 4Vdc + 1Vpp ripple with jumpers set to "P" on circuits 5-8, & at all times on circuits 9-14. Input remains the same as above, scope setting remain unchanged. The input resistor on these circuit's non-inverting inputs were reduced from 100K to 10k, a factor of ten, thus altering the gain in this particular jumper configuration. Otherwise, all is the same as above.</u>

8.12 

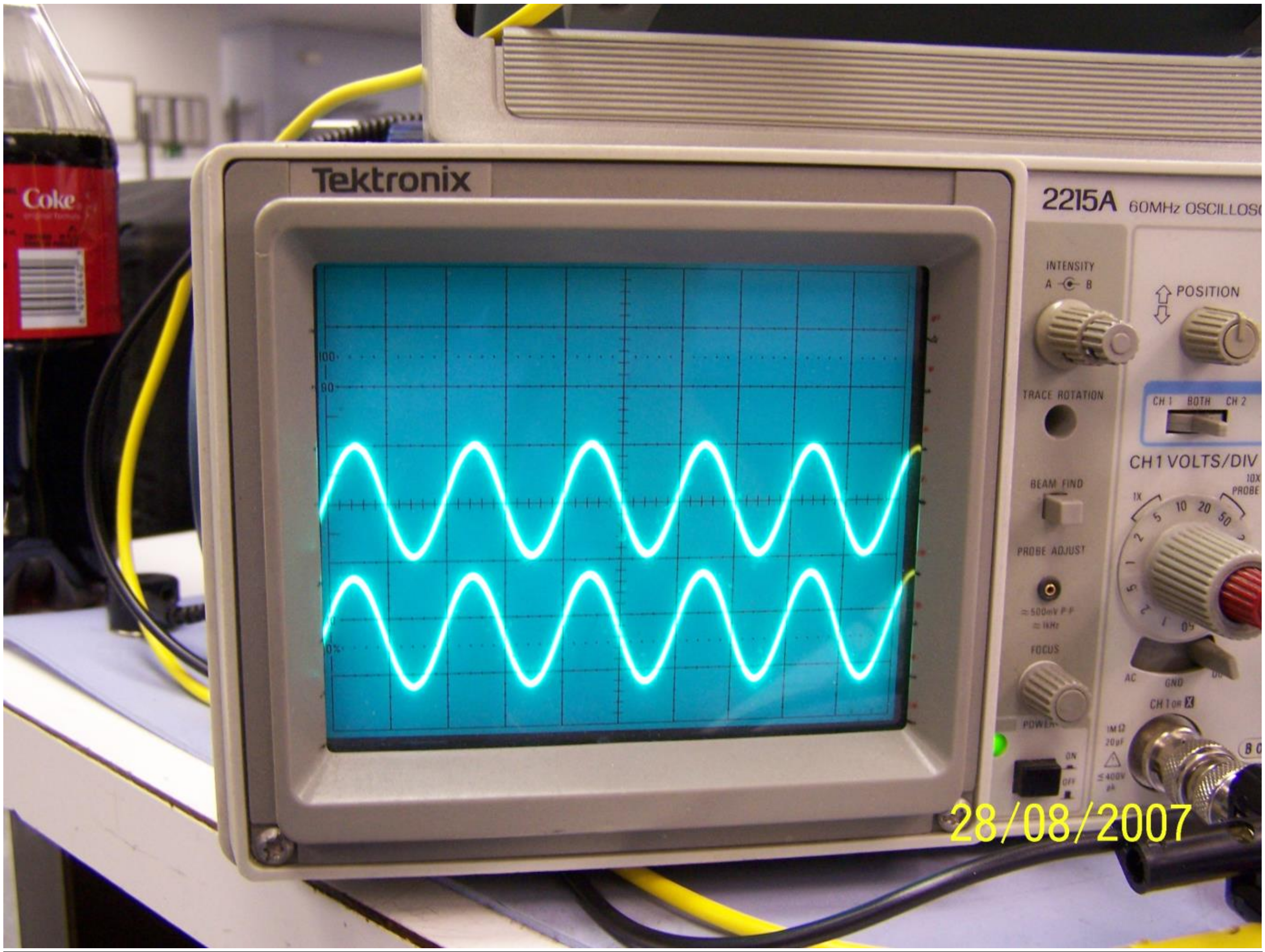
HxB Units: <u>Output = 4Vdc half-wave ripple with jumpers set to "P" on circuits 5-8, & at all times on circuits 9-14. Input remains the same as above, scope setting remains unchanged. The input resistor on these circuit's non-inverting inputs were reduced from 100K to 10k, a factor of ten, thus altering the gain in this particular jumper configuration. Otherwise, all is the same as above.</u>

8.13 

Jumper JP1 (A & B) set to "S". Remove BOTH jumpers before putting the first one on "S". This puts neg. bias on the input.

8.14 

HxA Units: <u>Output = Input, but with a –14Vdc bias with jumpers set to "S". Input (CH1) remains unchanged in center of grid; output (CH2) is on the bottom. Scope settings remain unchanged.</u>

8.15 

HxB Units: <u>Output = Input, but with a –11.4Vdc bias with jumpers set to "S". Input (CH1) remains unchanged in center of grid; output (CH2) is on the bottom. Scope settings remain unchanged.</u>