AMADA WELD TECH

User Calibration Procedure for the HF2 2KHz High Frequency Resistance Welding Power Supply

Applicable Models

1-264-XX, 1-264-XX-XX, 1-265-XX, 1-265-XX-XX

Equipment Required

- Digital Oscilloscope (HP54601A or B or equivalent)
- Digital Voltmeter (Keithley Model 2002 or equivalent)
- An appropriate IT-X3A or IT-X11A HF Welding Transformer (9-024-XX-XX, 9-026-XX-XX, 9-027-XX-XX, 9-030-XX-XX, or 9-034-XX)
- Manual Firing Switch (Unitek FS or equivalent)
- RG-58A Coaxial Oscilloscope Lead
- 0.1 milliohm coaxial shunt, T & M Research Products Model W21.1K64-6.5s-0001or equivalent:
- 1.0 milliohm low inductance load, T & M Research Products Model W-8-001-4STUD or equivalent:

  T & M Research Products, Inc.
  139 Rhode Island Street NE
  Albuquerque, NM 87108-2298
  Tel: (505) 268-0316

- 2 x No. 2/0 weld cables, each 1 to 3 feet long

DANGER

High voltages present in the HF2 may cause serious injuries or DEATH. Calibration should ***only*** be performed by a qualified electronics technician since the cover must be removed to provide access to the adjustment potentiometers.

REVISION HISTORY				
REV	DATE	ECO	BY	APPR
E	04/20	45804	S. Loveland	T. Houy

Preliminary Setup

1. Connect the HF2, transformer and test equipment as detailed in Figure 1.
2. Turn the HF2 and test equipment on for 15 minutes before calibrating.

HF2 Main Board Calibration

1. Set the **POWER** switch on the rear panel of the HF2 to the OFF position.

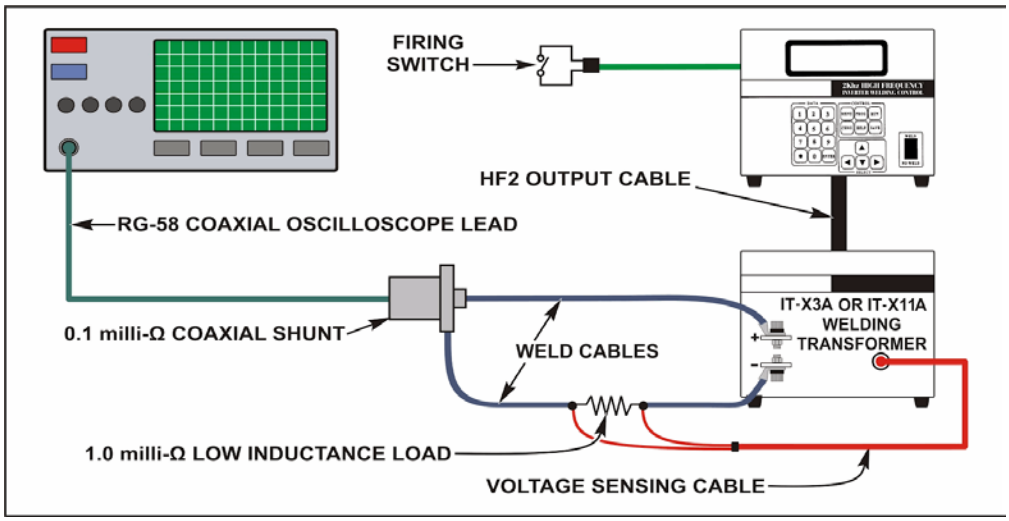

Figure 1

2. Disconnect the three-phase AC input power to the HF2.
3. Remove the HF2 cover.
4. Locate the Main Board (Assembly 4-32889), which is on the right hand side of the HF2. Verify that the position of the Jumper E12 is as follows:
   - None for 230V and 208V unit
   - Top position for 380V unit
   - Bottom position for 460V unit
5. Reconnect the three-phase AC input power to the HF2 and set the **POWER** switch to the ON position.
6. From the **MAIN MENU** screen, select **CALIBRATE HF2** and press **ENTER** to access **the PRE-CALIBRATION** screen. A series of screens will be displayed that will guide you through the pre-calibration procedure. You will need a small, flat blade screwdriver for making potentiometer adjustments.
7. On the Main Board (Assembly 4-32889), move Jumpers E21, E22 and E24 to the Norm position. Leave the E23 MPU jumper installed. Remove the E23 VSAMP jumper. Press **ENTER** to continue.

8. The **1. CALIBRATE BIAS** screen will be displayed. Adjust R70 so that the bar graph stays at 0, ±1, for 10 seconds. If needed, press the **ENTER** key to reset the bar graph to 0. Press the right arrow key > to continue when **PASS** is displayed on the screen.
9. The **2. CALIBRATE CURRENT GAIN** screen will be displayed. Move the jumper on E21 to the **CALIB** position. Adjust potentiometer R67 to set the bar graph to 0. When **PASS** is displayed, press left arrow key < and double check the bias calibration per step 8 (E21 in the **NORM** position). Toggle between steps 8 and 9 and adjust potentiometers R70 and R67 accordingly until **PASS** is displayed on both screens. Press right arrow key > to continue to the 3. **CALIBRATE VOLTAGE GAIN** screen.
10. Move the jumper on E22 to the **CALIB** position. Adjust potentiometer R90 to set the bar graph to 0. Press right arrow key > to continue when **PASS** is displayed on the screen.
11. Move the jumper on E24 to the **CALIB** position. Adjust potentiometer R101 to set the bar graph to 0. Press right arrow key > to continue when **PASS** is displayed on the screen.
12. Use a jumper wire to short R121. Adjust potentiometer R118 to set the bar graph to 0. Press right arrow key > to continue when **PASS** is displayed on the screen.
13. Remove the jumper wire from R121. Move the jumper on E24 to the **NORM** position. If **PASS** is not displayed on the screen, locate the hall effect sensor (see Figure 2) in the HF2 and adjust the zero offset potentiometer on the sensor. When **PASS** is displayed on the screen, press **RUN** to continue. **NOTE:** Both the zero offset and gain potentiometers will be adjusted later in this procedure.

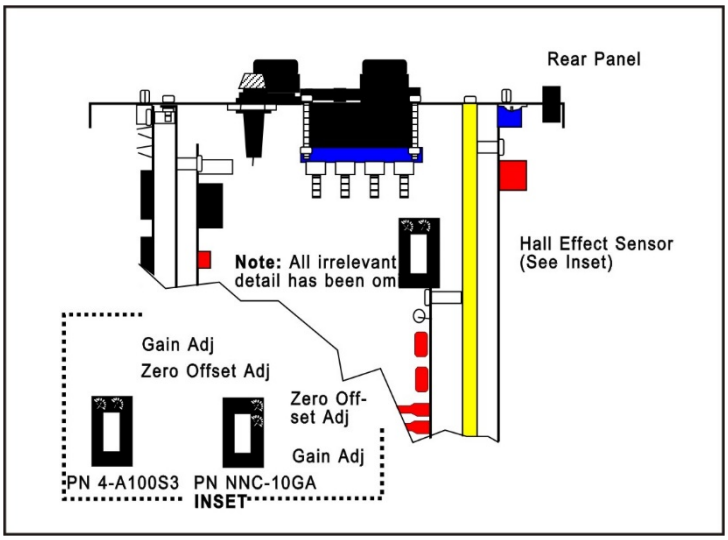

Figure 2

14. Move Jumpers E21, E22 and E24 to the **NORM** position. Replace the E23 VSAMP jumper. E23 should now have jumpers on both the VSAMP and MPU positions. Press **ENTER** to return to the **MAIN MENU**.

HF2 Current Calibration

1. From the **MAIN MENU**, select **TRANSFORMER MODEL** and press **ENTER**. Verify that the selected **TRANSFORMER MODEL** matches the unit connected to the HF2.
2. Verify that the **WELD HEAD TYPE** is programmed for **AUTO**.

   NOTE: WELD HEAD TYPE is on the **OPTIONS 2** screen. From the **MAIN MENU**, select **OPTIONS**.

   Press **RUN** to access the **RUN** screen. Program a schedule with a **BASIC WELD** function, 20ms, 2.0kA.
3. Connect the voltmeter leads to test point TP9 and the grounded side of capacitor C147 on the Main Board. (The grounded side of C147 is the side closest to the rear of the HF2, next to diode CR48.) Verify that the zero offset of the hall effect sensor provides a reading of 0.0 VDC +0V/-3mV. Adjust the zero offset potentiometer if necessary (refer to Figure 2 for the location of the sensor and its adjustments).
4. Fire the HF2 repeatedly. Ignoring the first 5ms of the waveform shown in Figure 3, measure the next 10ms of the waveform with the oscilloscope. Adjust the hall sensor gain potentiometer for a 0.2V peak ± 4mV, reading.

   NOTE: Be sure to measure only the average of the peaks.

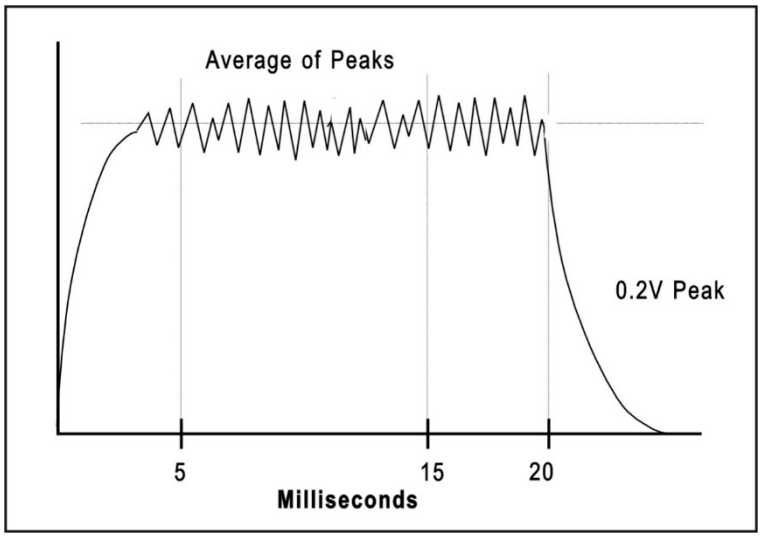

Figure 3

5. Toggle between steps 4 and 5 until both readings are within tolerance.
6. Disconnect the voltmeter leads from **TP9** and **C147**.

HF2 Voltage Calibration Verification

1. Program a schedule with a **BASIC WELD** function, 20ms, 0.7V. Make sure the voltage sense cable leads are connected across the 1.0 milliohm load (see Figure 1).
2. Connect the oscilloscope to the jumper at E22 with the jumper installed at the **NORM** position. Use BP2 as ground.
3. Fire the HF2 repeatedly. Ignoring the first 5ms of the waveform, measure the next 10ms of the waveform with the oscilloscope. Verify an average reading of 0.7 ± 0.050 volts. Note: The R90 adjustment in step 10 of the *HF2 MAIN BOARD CALIBRATION* affects the signal at E22.

   NOTE: Certain dummy load resistors may cause instability in the output waveform. If this occurs, perform the following steps and repeat step 3:

   a) Press **MENU**.

   b) Press 5-6-7-6.

   c) Select **PID ADJUSTMENT** using the arrow keys.

   d) Set Voltage PID gains to: P 0.200
   I 0.300
   D 0.000

   e) Set Power PID gains to: P 0.200
   I 0.300
   D 0.000

   f) Press **RUN**.

HF2 Current Linearity Verification

1. Connect the HF2, transformer and test equipment as detailed in Figure 1.
2. Program a schedule with a **BASIC WELD** function, 20ms, 2.0kA.
3. Fire the HF2 repeatedly. Ignoring the first 5ms of the waveform shown in Figure 3, measure the next 10ms of the waveform with the oscilloscope. Verify an average reading of 0.20V peak ± 0.004Vfor IT-X3A Transformers or +0.010/-0.008 V for IT-X11A Transformers.
4. Check the linearity of the current output from 200A to 2kA. Verify the voltage readings on the oscilloscope per Table 1.

Table 1. Current Output Linearity from 200 A to 2 kA

HF2 Programmed Current (amps)	Oscilloscope Peak Voltage (V)	Transformer Tolerance (V)	
		IT-X3A	IT-X11A
200	0.02	± 0.004	+0.010/-0.000
1000	0.10	± 0.004	+0.010/-0.003
2000	0.20	± 0.004	±0.010/-0.008

5. Disconnect the voltage sense cable and 1.0 milliohm load from the test setup and reconnect the test equipment as shown in Figure 4.
6. Program a schedule with a **BASIC WELD** function, 20ms and 3.0kA.
7. Check the current output at 3.0kA and 4.0kA. Verify that the voltage readings on the oscilloscope are as listed in Table 2.

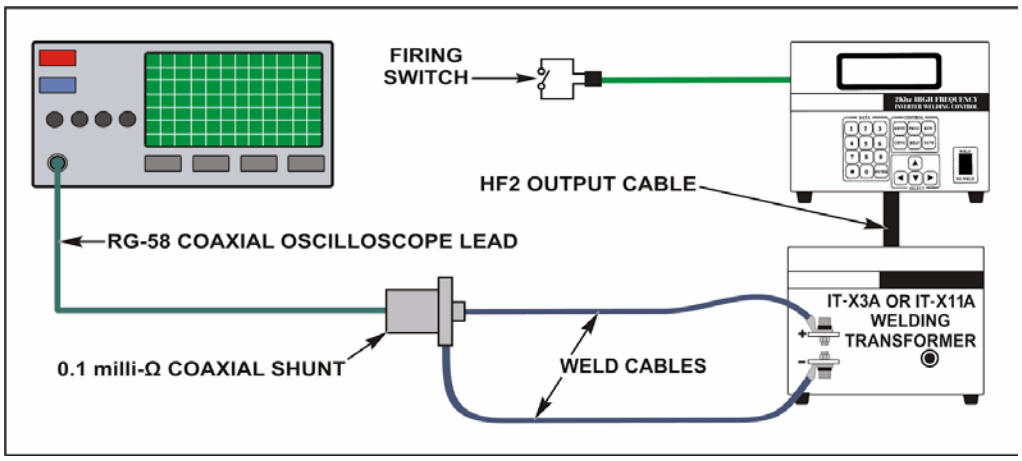

Figure 4

Table 2. Current Output Linearity from 3 kA to 4 kA

HF2 Programmed Current (amps)	Oscilloscope Peak Voltage (V)	Transformer Tolerance (V)	
		IT-X3A	IT-X11A
3000	0.30	± 0.004	+0.010/-0.012
4000	0.40	± 0.004	+0.010/-0.016

8. When the linearity has been confirmed, no more adjustments are necessary. If any of the current readings are out of tolerance, repeat the entire procedure starting from Main Board Calibration.

Built-In Weld Sentry and Transformer Calibration

NOTE: This section and the following *Weld Sentry Voltage and Power Verification* section are applicable to units which have the Weld Sentry installed (Model HF2S). If the Weld Sentry is ***not*** installed, skip these two sections and proceed with the section titled *Resetting the HF2.*

1. The HF2 and test equipment should still be connected as detailed in Figure 4. Locate the Main Board (Assembly 4-32889), which is on the right hand side of the HF2S. Disconnect connector J15 using a small flat blade screwdriver to disengage the clip.
2. From the **MAIN MENU** screen, select **WELD SENTRY** and press **ENTER**. Select **CALIBRATE SENTRY** and press **ENTER**.
3. If displayed **VOLTAGE INPUT** and **CURRENT INPUT** values are less than 3, the Weld Sentry board is in calibration and no adjustments are necessary. In this case, proceed to step 4. If the displayed values are 3 or greater, the following steps are required.
4. Locate the Weld Sentry Board (Assembly 4-32603), which is on the left hand side of the HF2S. Using test point TP0 as the ground reference, check the following voltages at each test point. Adjust the trimpots only if necessary, in the order listed in Table 3. You will need a small, flat blade screwdriver to make the adjustments.

Table 3. Test Point Voltage Adjustments

Trimpot	Description	Test Point	Voltage (mvDC)	Tolerance (mvDC)
R16	First Stage Voltage	TP1	5	± 5
R58	First Stage Current	TP3	5	± 5
R33	Final Stage Voltage	TP2	0	± 1
R75	Final Stage Current	TP4	0	± 1

5. After the trimpot adjustments have been made, verify that the displayed **VOLTAGE INPUT** and **CURRENT INPUT** values are less than 3. No more Weld Sentry board adjustments are necessary.
6. Reconnect J15 on the Main Board.
7. Turn the Weld Sentry ON and set it up as follows:
   - Voltage Gain: 2
   - Current Gain: 2
   - Delay Time: 5ms
   - Measurement Time: 10ms
   - Measurement Parameter: **PEAK AMPS**
     (NOTE: **EXTENDED MODE** must be ON to access **PEAK AMPS**)
8. Program a schedule with a **BASIC WELD** function, 20ms, 3.0kA.
9. Fire the HF2S repeatedly and verify a Weld Sentry reading of 3.0kA ± 40A for IT-X3A Transformers or +100/-150 A for IT-X11A Transformers. Check the current output at 3.0kA and 4kA. Verify the Weld Sentry **PEAK AMPS** readings per Table 4.

Table 4. Current Output Linearity at 3.0 kA and 4.0 kA

HF2S Programmed Current (amps)	Weld Sentry Peak Current (amps)	Transformer Tolerance (amps)	
		IT-X3A	IT-X11A
3000	3000	± 40	+100/-120
4000	4000	± 40	+100/-150

10. Reconnect the test setup voltage sense cable and 1.0 milliohm load. Connect the equipment as shown in Figure 1.
11. Program a schedule with a **BASIC WELD** function at 200 A and 20ms.
12. Check the current output at 200 A, 1.0 kA and 2.0 kA. Verify the voltage readings on the oscilloscope as listed in Table 5.

Table 5. Current Output Linearity at 200 A, 1.0 kA and 2.0 kA

HF2S Programmed Current (amps)	Weld Sentry Peak Current (amps)	Transformer Tolerance (amps)	
		IT-X3A	IT-X11A
200	200	± 40	+100/-0
1000	1000	± 40	+100/-30
2000	2000	± 40	+100/-80

NOTE: If the Weld Sentry readings are out of tolerance, adjust the transformer calibration per steps 11 through 14. If the Weld Sentry readings are within tolerance, skip steps 11 through 14 and continue with the *Weld Sentry Voltage and Power Verification* section.

13. Remove the IT-X3A or IT-X11A Transformer cover. Locate the trimpot on the PCB inside the transformer. **NOTE:** On the newer X11 Transformers, the trimpot can be accessed without removing the cover.
14. Fire the HF2S repeatedly and adjust the trimpot until the Weld Sentry readings are within tolerance.
15. Replace the transformer cover and fire the HF2S again. The Weld Sentry readings may be slightly different with the cover on. Adjust the trimpot so that the Weld Sentry readings fall within tolerance when the transformer cover is on.
16. When the linearity has been confirmed, no more adjustments to the transformer are necessary. Apply Glyptol to the trimpot and replace the transformer cover.

Weld Sentry Voltage and Power Verification

1. Connect the HF2S as detailed in Figure 1. Program a schedule with a **BASIC WELD** function, 20ms, 0.7 volts. Make sure the voltage sense cable leads are connected across the 1.0 milliohm load.
2. Program the Weld Sentry to monitor **VOLT-SEC**.
3. Fire the HF2S repeatedly and verify a Weld Sentry reading of 7.0, ± 0.3 **mVOLT-SECONDS**.
4. Program a schedule with a **BASIC WELD** function, 20ms, 1.0 kW.
5. Program the Weld Sentry to monitor **PEAK WATTS**.
6. Fire the HF2S repeatedly and verify a Weld Sentry reading of 1000, ± 65 **PEAK WATTS**.
7. When the Weld Sentry Voltage and Power readings have been verified, no more adjustments are necessary. If any of the Weld Sentry readings are out of tolerance, repeat the *Built-In Weld Sentry and Transformer Calibration* section.

Resetting the HF2S

1. If the PID settings were changed in the *HF2 Voltage Calibration Verification* section, reset the settings per the following steps:
2. Press **MENU**.
   a) Press 5-6-7-6.
   b) Select **PID ADJUSTMENT** using the arrow keys.
   c) Set the Voltage PID gains to: P 0.200
      I 0.700
      D 0.000
   d) Set the Voltage PID gains to: P 1.200
      I 3.800
      D 0.000
   e) Press **RUN**.
3. Set the **POWER** switch to OFF and disconnect the three-phase AC input power.
4. Apply Glyptol to all of the adjustment potentiometers, and replace the HF2 cover. The calibration procedure is now complete.