

# Wahl

## ST2200 Soldering Iron Tester User Manual



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Palmer Wahl • 234 Old Weaverville Road • Asheville, North Carolina • 28804-1260  
Phone (800) 421-2853 • (828) 658-3131 • Fax (828) 658-0728 • Email: [info@palmerwahl.com](mailto:info@palmerwahl.com)  
[www.palmerwahl.com](http://www.palmerwahl.com)

# ST2200 Soldering Iron Tester User Manual

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**WARRANTY & CALIBRATION  
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Registration is fast and easy. In about a minute you can have your product automatically registered for Warranty Protection and our Calibration Reminder service. Let Palmer Wahl help you protect your investment, and maintain product accuracy and compliance with ISO and other quality standards. Questions? Call Customer Service at 1-800-421-2853 or 828-658-3131 Or email: [register@palmerwahl.com](mailto:register@palmerwahl.com)

## 1.0 INTRODUCTION

The Wahl Instruments Model ST2200 Soldering Iron Tester (see Fig. 1) is designed for the testing of hand-held soldering irons used in the assembly of electronic circuits and components. It is intended to be used as a quality tool to assist manufacturers in complying with Soldering Standard IPC/EIA J-STD-001C or other applicable standards. It provides testing of Temperature, AC voltage, AC + DC voltage and Resistance to Ground. It also has a feature for testing Anti-static Wrist Straps and for detecting voltage spikes which might appear on the soldering iron tip.

## 1.1 MODELS and CONTENTS

Following is a list of the different models available along with a list of contents. The following models include a WST-02B sensor, TC800K -3ft. Type K wire bead probe, sensor cleaning brush (p/n 12408) and operation/calibration manual. NIST Traceable Certificate of Conformance is optional.

<b>ST2200C-110</b>	°C display, 110 volt input voltage
<b>ST2200F-110</b>	°F display, 110 volt input voltage
<b>ST2200C-220</b>	°C display, 220 volt input voltage
<b>ST2200F-220</b>	°F display, 220 volt input voltage
<b>ST220C-220B</b>	°C display, 220 volt input voltage with British Plug and European Receptacle
<b>ST220C-220E</b>	°C display, 220 volt input voltage with European Plug and Receptacle

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The following Kits include 2 WST-02B sensors, TC800K type K Wire Probe, TC801P solder pot probe, sensor cleaning brush, 12423-01 soft carrying case and operation/calibration manual. NIST Traceable Certificate of Conformance is optional.

<b>KST2200C-110</b>	°C display, 110 volt input voltage
<b>KST2200F-110</b>	°F display, 110 volt input voltage
<b>KST2200C-220</b>	°C display, 220 volt input voltage
<b>KST2200F-220</b>	°F display, 220 volt input voltage

The following Kits include 1 WST-03 sensor, 1 WST-02B sensor, TC800K type K Wire Probe, TC801P solder pot probe, sensor cleaning brush, 12423-01 soft carrying case and operation/calibration manual. NIST Traceable Certificate of Conformance is optional.

<b>KST2203C-110</b>	°C display, 110volt input voltage
<b>KST2203F-110</b>	°F display, 110volt input voltage
<b>KST2203C-220</b>	°C display, 220volt input voltage
<b>KST2203F-220</b>	°F display, 220volt input voltage

## 2.0 SPECIFICATIONS

**Input Power:** -110 Models, 110VAC 50/60 Hz., 2 Watts.  
-220 Models, 220VAC 50/60 Hz., 2 Watts.

### **Temperature Specifications:**

Temperature Range: 50°F to 1300°F (10°C to 700°C)

Resolution: Factory set at 0.1°F/C, switchable to 1.0°F/C via internal jumper (see section 6.1 for details).

Meter Accuracy: Greater of ±1.0°F/C or ±0.1% of reading.

Sensor: WST-02B, 0.2 gram thermal mass sensor with bonnet.

Optional Sensors: WST-02, 0.2 gram thermal mass sensor without bonnet.  
WST-03, elevated wire sensor.

### **Resistance Specifications:**

Resistance Range: 0.00 to 100.00 Ohms

Resolution: Factory set at 0.01 Ohms. Switchable to 0.1 Ohm via internal jumper (see section 6.1 for details).

Accuracy: 0-20 Ohms: ±0.15 ohm, ± 1 digit  
20 - 100 Ohms: ±0.5% ± 0.1 ohm

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Test Current: 10 mA DC

LED Warning Indicator: Factory set at 5.00 Ohms. Switchable to 2.00 Ohms via internal jumper (see section 6.1 for details).

## **Millivolt Specifications:**

Voltage Range: 0 - 30mV true RMS AC or AC+DC range.

Resolution: Factory set at 0.01 mV. Switchable to 0.1 mV via internal jumper (see section 6.1 for details).

Accuracy:  $\pm 0.1\text{mV} \pm 1$  digit.

LED Warning Indicator: Indicates at 2.0mV threshold.

## **Digital Display:**

4-1/2 digit LCD, 0.7" high characters.

## **Output Jack:**

Type: .101" Subminiature phone jack

Temperature: 1.0 mV/degree,  $\pm 5^{\circ}\text{F}$ .

Resistance: 100 mV/Ohm for the 0-30 Ohm range,  $\pm 0.15$  Ohm.

Voltage: 100mV/mV for the 0-30mV range,  $\pm 0.15\text{mV}$ .

Protection: Short circuit and Over Voltage protected.

## **Auxiliary AC Outlet:**

Equipped with North American receptacle. Note: 220Volt models also equipped with North American receptacle, marked as 220VAC.

## **Auxiliary T/C Connector:**

Mini Type K thermocouple female connector provided for use with optional T/C probes. User selectable by front panel switch.

## **Wrist Strap Tester:**

Activated in Resistance /Wrist Strap Test position. Bi-color LED indicates Green when in acceptable range of 500K to 10M ohms. Red when outside of acceptable range.

## **Voltage Spike Detector:**

Activated in both Millivolt ranges. Indicates green in no-fault condition and flashes red for approx. 1 sec. when spike detected.

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<b><u>Spike Detect Threshold:</u></b>	>100mV amplitude, > 1 uS pulse width.
<b><u>Ambient Environment:</u></b>	Operational: 45°F to 105°F (7.2°C to 40.5°C) Storage: -4°F to 122°F (-20°C to 50°C)
<b><u>Dimensions:</u></b>	8.5"W x 10.5"D x 3.5"H (21.59cm x 26.67cm x 8.89cm)
<b><u>Weight:</u></b>	3 lbs. (1.36 Kg)
<b><u>Calibration Certificate:</u></b>	NIST Traceable Certificate of Calibration is optional.

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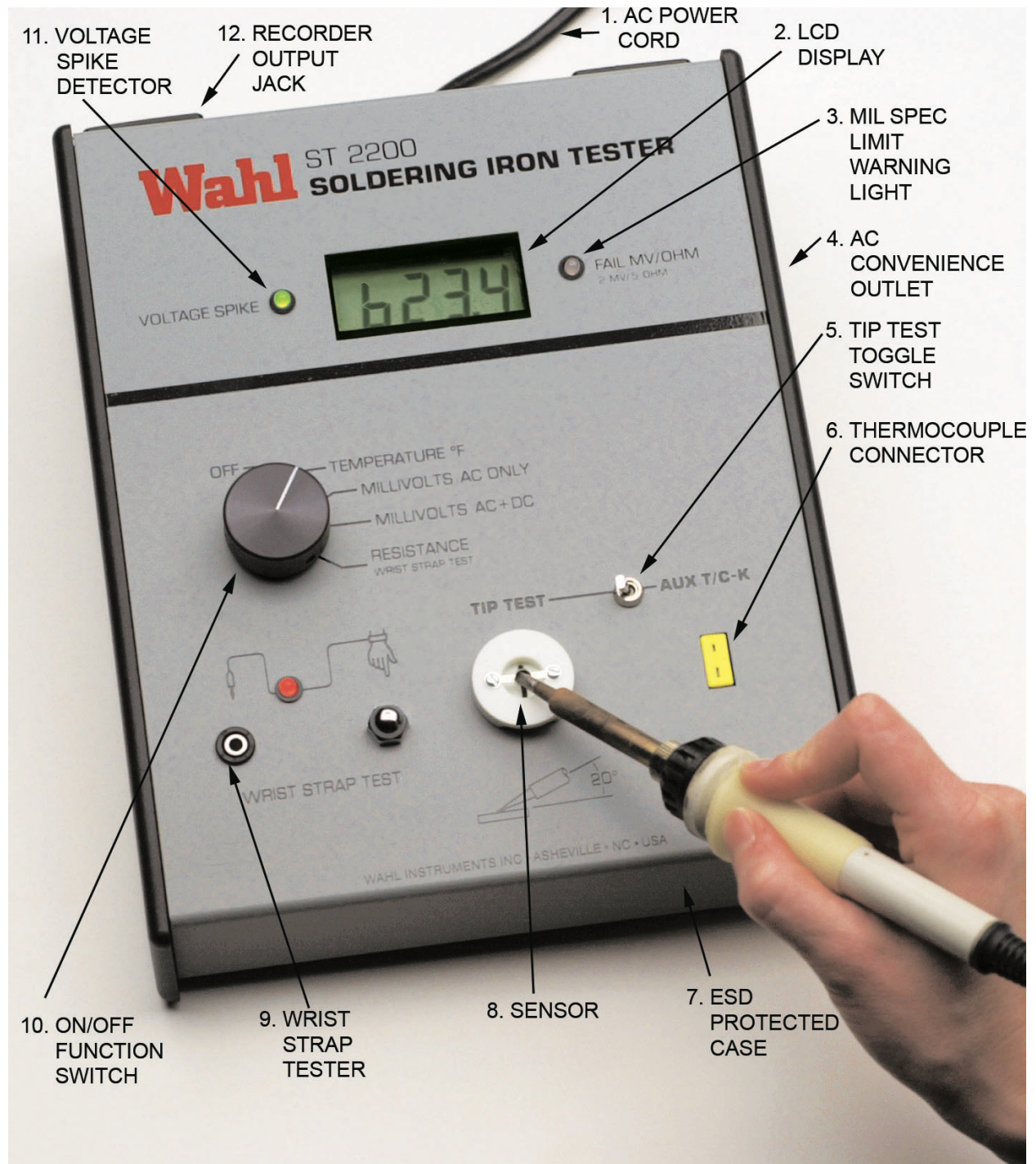


Figure 1. ST2200 Soldering Iron Mil Spec

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## 3.0 CONTROLS AND ITEM DESCRIPTIONS

Numbers in (parenthesis) Reference Figure 1.

### 3.1 (1) AC Power Cord

The ST2200F-110 and ST2200C-110 units come with a 5 foot long 3 wire North American power cord. Models ST2200F-220 and ST2200C-220 come with a 5 foot long 3 wire European power cord. Cord storage is provided on integral cord wraps on rear of the unit.

### 3.2 (2) LCD Display

Easy to read .7 inch high 4-1/2 digit display. Resolution is switchable via internal jumper. See the Maintenance Section 6.1 for details on setting resolution.

### 3.3 (3) FAIL MV/OHM Indicator

This indicator serves as a Pass/Fail indicator for both MV and Resistance measurements. It is a bi-color LED which displays Green when unit under test is acceptable or flashes Red when the unit is unacceptable. See the Specifications section 2.0 or the Operation section 4.0 for details on the threshold limits.

### 3.4 (4) AC Convenience Outlet

This outlet is provided as a power source for the Unit under Test. All units come with a North American receptacle and have power available anytime the ST2200 is plugged in. **NOTE:** 220 volt models supply 220vac at this connector. It is recommended to use this outlet as power source for your unit whenever possible, to achieve optimal results.

### 3.5 (5) Input Selector Switch

This switch selects between the ST2200 sensor and the Type K thermocouple connector inputs. For soldering iron testing set Input Selector Switch to TIP TEST position. Normal operation is the TIP TEST position. For Auxiliary type K thermocouple probe input set Input Selector Switch to "AUX T/C - K" position. Auxiliary probes may be used to test solder pots, wave solder baths, hot air guns or ovens. See Accessories Section 5.0 for optional T/C probes for your specific need.

### 3.6 (6) Auxiliary Thermocouple Connector

This input connector is provided to interface optional Type K thermocouple probes to the ST2200 unit. With the input selector switch set to AUX T/C-K the unit will use the signal input to this connector as the source for measurements.

### 3.7 (7) ESD Protected Case

The ST2200 is designed for use in ESD protected areas. The case is grounded and coated with chloride-free liquid anti-static protectant. The case has been tested for triboelectric effect during normal operation. It will neither generate a charge nor support a static electricity discharge.



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The internal circuitry of the ST2200 is protected against static discharge that may be applied to the sensor during test of soldering irons or when the auxiliary thermocouple connector is used.

## **3.8 (8) Sensor**

ST2200 Soldering Iron Testers are shipped with Model WST-02B heavy duty bead sensor. Sensors with bonnets are designed to aid in the positioning of the iron tip. Sensors plug in for ease of maintenance or replacement. See Accessories Section 5.0 for optional sensors.

## **3.9 (9) Wrist Strap Test**

This area provides convenient go/no-go testing of wrist straps. It consists of a jack for the wrist strap to plug in to, a grounded acorn nut for the operator to touch and a bi-colored LED for test result indication.

## **3.10 (10) Power On-Off / Function Selector Switch**

Power is provided to the unit anytime the Function Selector Switch is in any position other than OFF. In normal operation with the Function Selector Switch in the TEMPERATURE position, the display will indicate ambient room temperature. With the Function Selector Switch set to either MILLIVOLT position or RESISTANCE position the display will indicate "1---" until the soldering iron tip is placed in contact with the sensor.

## **3.11 (11) Voltage Spike Indicator**

This indicator serves as an indicator for the detection of voltage spikes detected during MILLIVOLT testing. It is a bi-color LED which displays Green when no spike is present and flashes Red when the spike is detected. See the Specifications section 2.0 or the Operation section 4.0 for details on the spike threshold limits.

## **3.12 (12) Recorder Output Jack**

.101" Subminiature phone jack (Switchcraft p/n MDPC-2A-RA) for interfacing to chart recorder or analog input card. See Specifications Section 2.0 for details.

## **4.0 OPERATION**

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To make measurements on a soldering iron, connect the instruments as outlined below, and preheat the iron to its operational temperature. For optimal results the Soldering Iron under Test should be plugged into the AC Convenience Outlet on the right side of the ST2200. For technical notes pertaining to measurements see Technical Information Section 8.0.

## 4.1 Connecting to AC Power

The ST2200 is a portable tester powered by 110 or 220VAC, depending on specific model. Unwrap the AC power cord (1) from the integral Cord Wraps located on the rear of the unit. Plug AC plug into appropriate AC receptacle. For optimum operation, plug the soldering iron into the AC Convenience Outlet (4) located on the right side of the ST2200. Note that for testing soldering irons that will not be plugged into the ST2200's AC Convenience Outlet, the ST2200 should be plugged into an AC receptacle with the identical ground wire as the irons to be tested.

## 4.2 System Connections

Figure 2 shows several methods of connecting the ST2200 for Production and Quality Assurance testing.

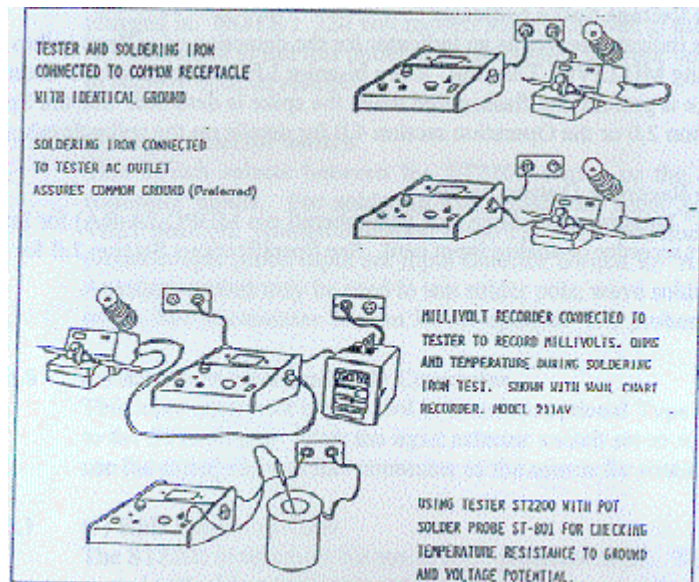


Figure 2. System Connections

## 4.3 Temperature Measurements

For Temperature readings, set the Function Selector Switch to TEMPERATURE , the Input Selector Switch to TIP TEST and touch the soldering iron tip to be tested to the solder bead or wire of the sensor. The normal working area of the tip should be used and the tip should be placed on the sensors cold solder bead, allowing a few seconds for it to melt. This allows the sensing junction of the sensor to be heated to the same temperature as the iron tip. Continue to hold the

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same pressure as in soldering. The wire sensor WST-03, is best used by placing the tip underneath the center of the wire and lifting with gentle pressure to assure good contact. A small bead of solder should be placed on the iron tip at the area to be measured. Watch the display and observe the temperature readings for:

- a. Temperature rise as the tip heats and melts the solder bead on the sensor. Equilibrium will be reached in about 5 - 10 seconds.
- b. Temperature Stability. After reaching equilibrium expect only a few degrees of temperature variations. Watch the display for the maximum and minimum temperatures of the soldering iron over a period of 1 - 2 minutes. Watch for excessive temperature cycling due to a faulty soldering iron controller.
- c. Temperature recording can be made using the Recorder Output Jack.

The ST2200 displays the temperature of the working surface of the tip. It may not agree with the indicated temperature of the soldering station or the setting of the soldering iron control. Following are possible reasons:

- a. The tip may be oxidized and may need to be cleaned and re-tinned.
- b. May be due to the method the iron was last calibrated. Manufacturers may use a special tip for calibration purposes which may be different from your tip.
- c. The ST2200 sensor may need to be cleaned and a new solder bead applied. See section 6.2 for maintenance instructions. In some cases, after prolonged use the sensor may need to be replaced. Replacement sensors or sensor rebuilding kits are available from Wahl Instruments.

## 4.4 Tip Voltage Potential Measurements

The ST2200 has 2 methods of measuring the Voltage potential at the tip, AC only or AC + DC.

### 4.4.1 Millivolts AC Only

When the ST2200 Function Selector Switch is in the MILLIVOLTS AC ONLY position, the instrument will indicate the True RMS voltage of the unit under test, when applied to the sensor. All measurements are made with respect to the Earth Ground pin of the AC line plug.

The FAIL MV/OHM warning indicator (3) will flash red for any reading of 2.00 mV and above while the actual mV value is shown by the digital display. The units range is 0.00 to 30.00 mV True RMS of AC voltage.

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If an oscilloscope is connected to the tip and the waveform viewed, with respect to the soldering iron power ground, the basic frequency of the line power is seen but the waveform may or may not be uniform. In most cases the waveform will be distorted due to the effects of distributed capacitance throughout the soldering iron heater and sensor circuitry. In any case, the True RMS feature of the ST2200 will measure the power content of the available signal and display it as an engineering unit, RMS millivolts.

## 4.4.2 Millivolts AC + DC

When the ST2200 Function Selector Switch is in the MILLIVOLTS AC + DC position the total True RMS value of all AC and all DC voltages at the tip are measured and displayed.

The FAIL MV/OHM warning indicator (3) will flash red for any reading of 2.00 mV and above while the actual mV value is shown by the digital display. The units range is 0.00 to 30.00 mV True RMS of AC + DC voltage.

## 4.4.3 Voltage Spike Detection

The voltage spike detector is operational in mV mode of test only and when the soldering iron tip is in contact with the ST2200 sensor. Detection of a potentially damaging voltage spike is indicated by the Voltage Spike indicator (11) flashing from GREEN to RED. Each voltage spike transient detected will flash the indicator for approximately one second.

## 4.5 Resistance Measurement

The ST2200 measures resistance of the soldering iron probe tip to AC ground. To measure, set the Function Selector Switch to the RESISTANCE setting and touch the tip of the iron to the ST2200 sensor. If the resistance is less than 5.00 ohms the FAIL MV/OHM indicator (3) will be green. When the resistance is equal to or greater than 5.00 ohms the FAIL MV/OHM indicator (3) will flash red. The actual value will be displayed in Ohms on the LCD display.

See Section 8.3 for more technical information on Resistance measurements and Grounds.

## 4.6 Wrist Strap Test

To test the wrist strap, connect the jack on the wrist strap cord to the Wrist Strap Test Jack (9) on the ST2200. Set the Function Selector Switch to the RESISTANCE - WRIST STRAP TEST position. Insure that the wrist strap is worn on the wrist of the operator and is in intimate contact with the skin. Touch the silver acorn nut located next to the Wrist Strap Test Jack with a finger. The WRIST STAP INDICATOR will remain RED if the wrist strap is faulty or change to GREEN if the wrist strap is acceptable.

## 5.0 REPLACEMENT SENSORS AND ACCESSORIES

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## 5.1 Sensors

The ST2200 Soldering Iron Tester has several optional sensors available. The unit comes standard with the WST-02B sensor. Following is a list of model numbers and descriptions of the available sensors.

**WST-02B**, 0.2 gram thermal mass heavy duty sensor with bonnet.

**WST-02**, 0.2 gram thermal mass heavy duty sensor without bonnet.

**WST-03**, elevated wire sensor.

The replaceable temperature sensors WST-02, and WST-02B consist of a high temperature Type K ribbon thermocouple, Stainless steel support strap, solder bead, bonnet (WST-02B only) and glass filled Teflon body.

The replaceable temperature sensor WST-03 consists of a welded thermocouple wire sensor, support posts and glass filled Teflon body. The WST-03 tip may be used when the iron tip is not compatible with the WST-02 sensors. It is best used by placing the tip underneath the center of the wire and lifting with gentle pressure to assure good contact. A small bead of solder should be placed on the iron tip at the area to be measured.

Type K thermocouple material is chosen for its high temperature stability, accuracy and long life in the soldering temperature range of 500 - 900°F. It is a good electrical conductor and therefore allows accurate measurements of tip voltage potential and tip to ground resistance.

The solder bead is important because it simulates a solder joint, provides excellent thermal transfer when melted by the iron and gives a good representation of effective working temperature of the tip. It reforms on cooling. Add new solder to the bead as necessary when the bead becomes dull. Best results occur when the bead is new and shiny. For fast response use only a small amount of solder.

The bonnet acts as a position stop for the tip which gives repeatable temperature readings with different operators, since it measures each tip in the identical position. It also stabilizes the tip to prevent movement during measurement which can cause temperature fluctuations. A 20° angle gives a good position of the tip when placing it on the bead sensor.

The user may choose sensors to match the thermal capacity of the solder joint when rating soldering irons and tips best suited to the work.

### 5.1.1 Sensor Repair Kits

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Sensor repair kits are available for customers who wish to rebuild their own sensors with factory supplied parts. Each kit contains a replacement sensor band, screws, plugs and instructions for rebuilding your sensor. The following kits are available.

**WST-02KIT**

**WST-02BKIT**

**WST-03KIT**

**WST-02RT** - Repair Tool Kit, includes holding fixture, removal tool and screwdriver.

## 5.2 Probes

Many optional probes are available for use with the ST2200. We suggest the following probes as possible solutions to your measurement task.

**TC801P** - Solder Pot probe for immersion measurements of solder pots or wave solder baths. Will sense temperature to 1600°F, mV or resistance.

**TC803** - Surface probe with low-mass. 0.032" diameter tip for measuring pc board surfaces or component temperatures.

**TC305** - Miniature Air probe for ambient air temperature or checking hot air guns.

Please contact Wahl or visit our website for other available probes.

## 5.3 Carrying Case

**12423-01** is a soft carrying case which will hold the ST2200, spare sensors, spare probes and adapters. Provides excellent dust protection for your unit when not in use.

## 6.0 MAINTENANCE

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## 6.1 Display Resolution Setting

Reference Figure 3 for the PC board jumper locations for resolution settings.

### 6.1.1 Temperature, Tip Voltage (mV) and Resistance Display Resolution

The ST2200 LCD display is factory set at 0.1° resolution for Temperature and .01 for Tip Voltage (mV) and Resistance ( $\wedge$ ) readings. To change the resolution from 0.1° to 1.0° resolution for Temperature and from .01 to .1 resolution for Tip Voltage (mV) and Resistance ( $\wedge$ ) measurements, solder a small jumper wire between pads N and P. These pins are also designated on the PC board silk screen as "1 DEG RES". Please note that this changes Temperature, Tip Voltage and Resistance display resolutions. These are not independently changeable.

### 6.1.2 Resistance Threshold

The ST2200 is factory set at 5.00 ohms but is user selectable, via jumpers, to change the FAIL MV/OHM Indicator threshold resistance between 2.00 ohms and 5.00 ohms.

For 2.00 Ohm threshold place the top jumper (indicated by jumper A on Fig. 3) in the lower position labeled 2 $\wedge$  . Place the bottom jumper (indicated by jumper B on Fig. 3) in the lower position labeled 2 $\wedge$ .

For 5.00 Ohm threshold place the top jumper (indicated by jumper A on Fig. 3) in the upper position labeled 5 $\wedge$ . Place the bottom jumper (indicated by jumper B on Fig. 3) in the upper position labeled 5 $\wedge$ .

## 6.2 Sensor Maintenance

Sensors for the ST2200 require periodic maintenance. Wahl recommends that you periodically inspect, clean and re-tin the sensors. Cleaning is performed to remove any buildup of solder flux. Clean with warm water or appropriate solvent, using the brush provided or any other medium stiffness brush. Use care not to apply too much pressure.

Re-tinning the sensor may need to be performed if the solder bead becomes dull and does not wet the tip satisfactorily. The old solder may be removed with solder wick and new solder applied. Be sure to apply a small bead, enough to provide adequate contact between the sensor and the tip. Wahl recommends using Sn63Pb37 solder

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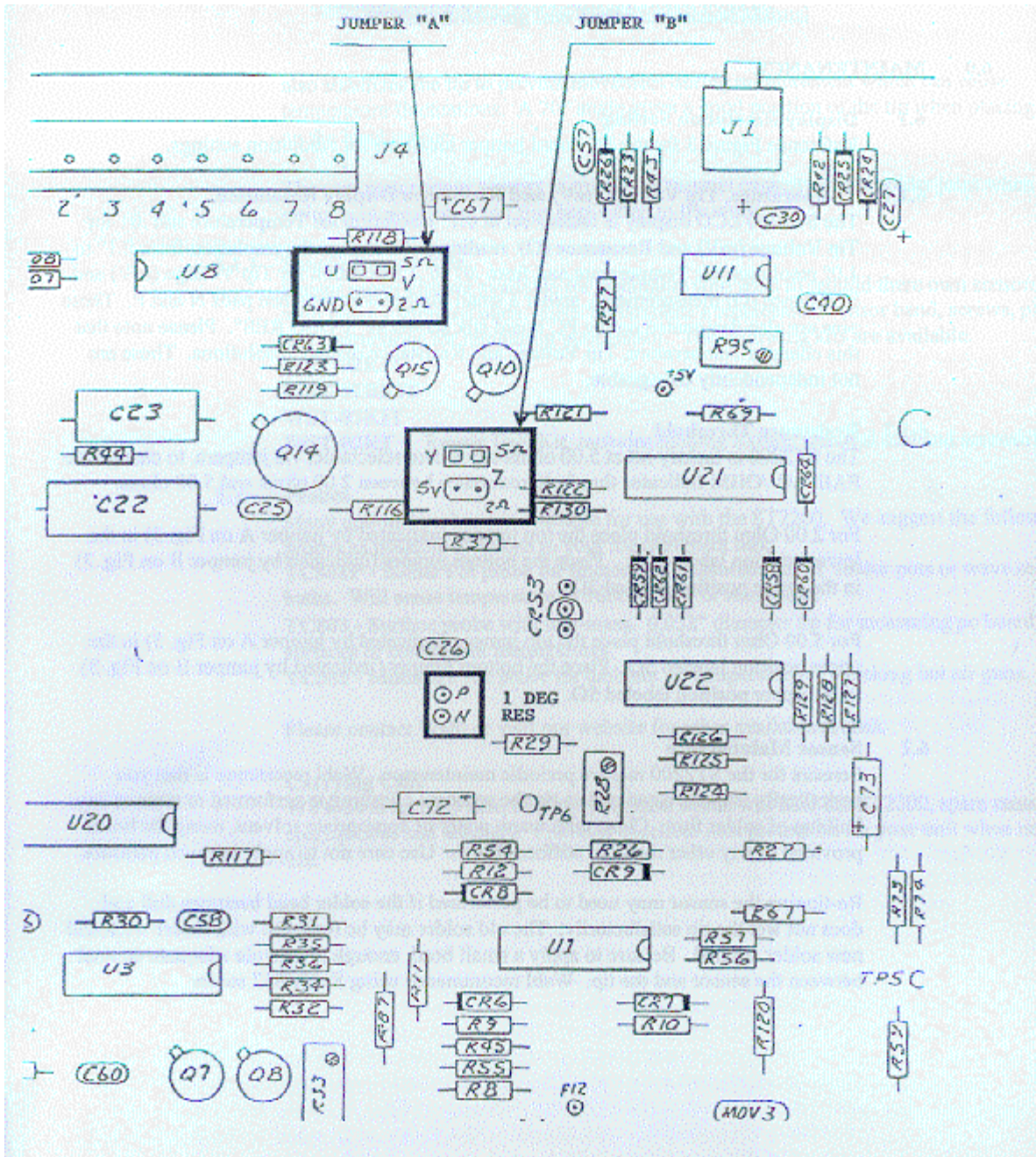


Figure 3

Display Resolution Jumper Locations



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## 6.3 Sensor Repair

Sensors for the ST2200 are very sturdy and will give long life if not subjected to excessive force during use. All sensors are repairable in the field. (with the exception of model WST-01 (Discontinued.) See section 5.2 for repair and tooling kits.

### 6.3.1 WST-02, WST-02B Repair, Band Replacement

All instruction reference Figure 4.

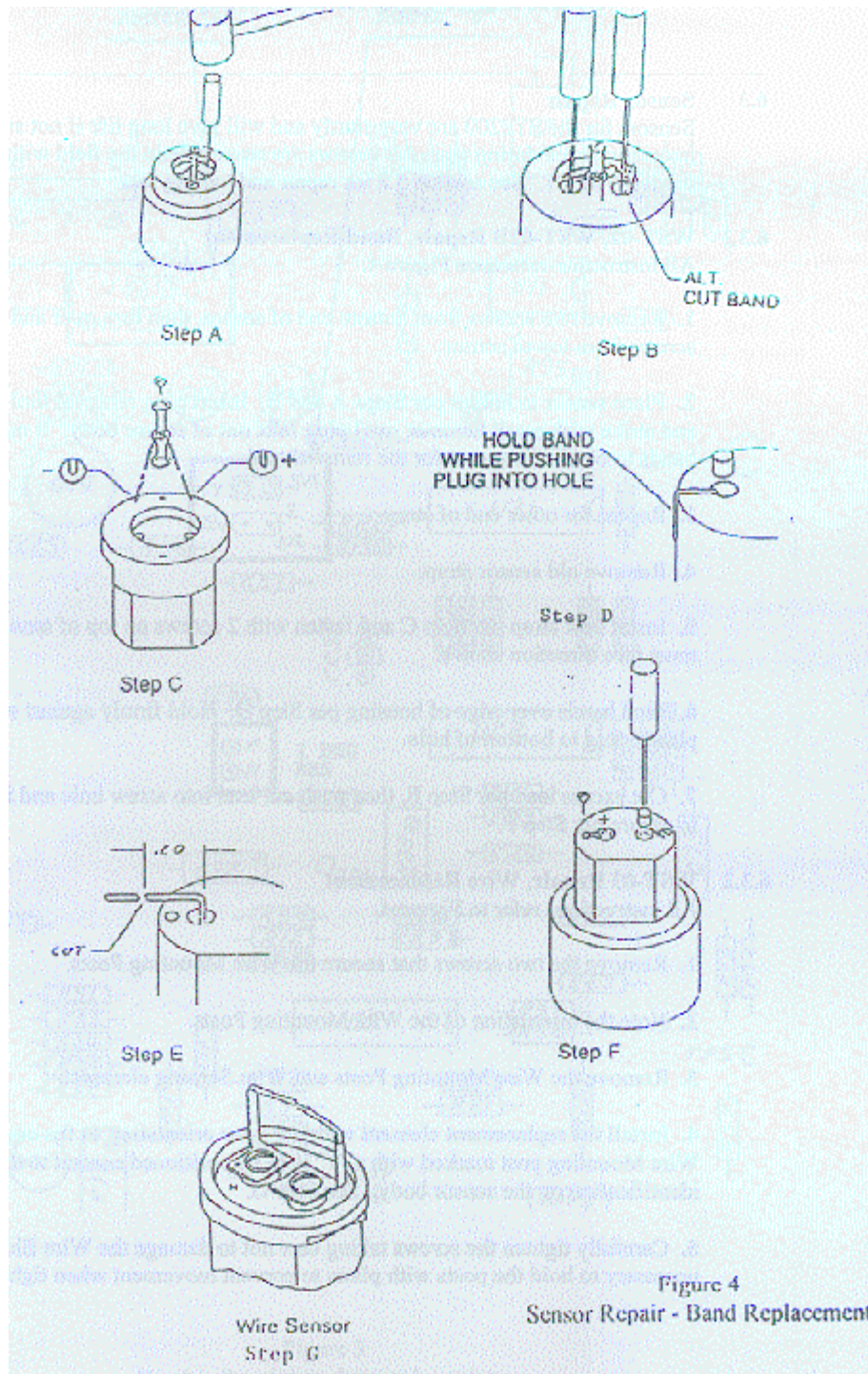
1. Remove two screws from bottom end of sensor, then turn over and remove two screws from top of sensor.
2. Place sensor in holder per Steps A and B. Insert plug removal tool in sensor strap and strike with small hammer until plug falls out of sensor body. It may help to cut the bands to obtain clearance for the removal tool.
3. Repeat for other end of strap.
4. Remove old sensor strap.
5. Insert new strap per Step C and fasten with 2 screws on top of sensor. Arrow point must face direction shown.
6. Bend bands over edge of housing per Step D. Hold firmly against side while pushing plastic plug to bottom of hole.
7. Cut excess lead per Step E, then push cut lead into screw hole and install two screws to secure per Step F.

### 6.3.2 WST-03 Repair, Wire Replacement

All instructions refer to Figure 4.

1. Remove the two screws that secure the Wire Mounting Posts.
2. Note the orientation of the Wire Mounting Posts.
3. Remove the Wire Mounting Posts and Wire Sensing element.
4. Install the replacement element with the same orientation as the one removed. The Wire Mounting post marked with a "+" is to be positioned nearest to the "+" identification on the sensor body. See Step G.
5. Carefully tighten the screws taking care not to damage the Wire Element. It may be necessary to hold the posts with pliers to prevent movement when tightening screws.

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## 7.0 CALIBRATION PROCEDURE

### 7.1 Purpose

To describe instructions to calibrate Soldering Iron Tester Model ST2200 with suffixes F or C and -110 or -220.

### 7.2 Scope

This instruction applies to the above noted models and is to be used by qualified electronic technicians.

### 7.3 Responsibility and Authority

The Quality Manager is responsible for the implementation and effectiveness of this procedure.

### 7.4 Definitions

N.I.S.T.: National Institute of Standards and Technology  
UUT : Unit Under Test

### 7.5 References

N/A

### 7.6 Procedure

**WARNING: AC Line Voltage is present in the cabinet and on the PC Board when unit is plugged in to Power Source. Power switch DOES NOT have to be on for Voltage to be present.**

### 7.7 Equipment Needed

7.7.1 Thermocouple Simulator / D. C. Millivolt Source (referred to as "T/C Sim." hereafter), such as AOIP Calys5 or Wahl C-65.

7.7.2 AC Milli-volt Generator

7.7.3 DVM with 1.0 milli-volt or less resolution and True RMS capability, such as Keithley Instruments 177 or equivalent.

7.7.4 Pulse Generator

7.7.5 100<sup>^</sup> Decade Resistance Box with .01 ohm resolution.

7.7.6 Test leads for above, (1)banana to banana; (1) banana to alligator clip; T/C Type K wire with alligator clips; Type K w/ mini male connector.

7.7.7 Fixed resistors for wrist strap test; approximate values of 450Kohm, 5M ohm, 11M ohm.

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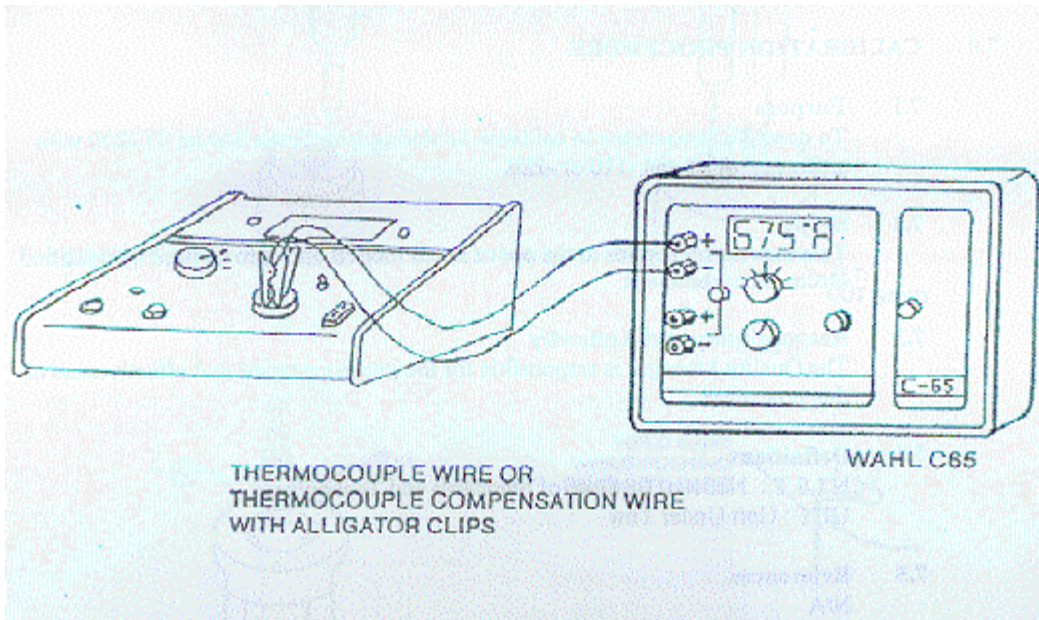


Figure 5. Temperature Calibration

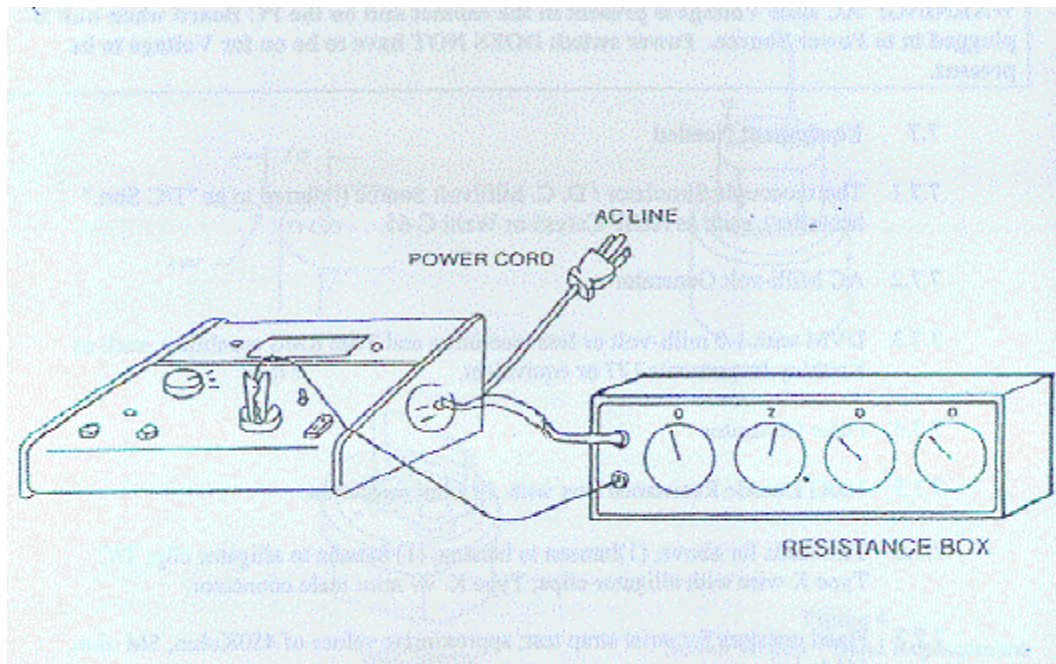


Figure 6. Ohms Calibration

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## 7.8 Set-up – See Figure 5.

7.8.1 Remove bottom cover and place UUT on its side.

7.8.2 Connect DVM (-) to TP3, (+) to TP6.

7.8.3 Remove ST2200 sensor and connect T/C Simulator, via T/C wire set to banana plugs on front panel. Red wire is negative (-). ST2200 banana plug furthest from the LCD is negative input.

7.8.4 Set ST2200 Function Selector Switch to TEMPERATURE position, and Input Selector Switch to TIP TEST.

## 7.9 A/D Calibration

7.9.1 Adjust R28 (ref adj.) until DVM reads 1.0000 VDC  $\pm$ 0.1 mVDC.

7.9.2 Remove DVM connected to (-) to TP3 and (+) to TP6

## 7.10 Low Temperature Calibration

*Note: Allow 5 minutes thermal stabilization period after connecting input wires to the ST2200.*

7.10.1 Adjust T/C Simulator output to 77.0°F (25.0°C)

7.10.2 Adjust R4 (Temp-zero) until UUT display indicates 77.0°F (25.0°C).

## 7.11 High Temperature Calibration

7.11.1 Adjust T/C Simulator for 1300.0°F (704.4°C) and adjust R86 (Span) until UUT display indicates 1300°F (704.4°C)

7.11.2 Adjust T/C Simulator to 77°F (25°C) and verify accuracy of display. UUT must be within  $\pm$ 1.0°F/°C.

7.11.3 Repeat steps 7.10.1 through 7.11.2 as necessary to obtain the most accurate calibration. (There may be some interaction between R86 and R4.)

7.11.4 Measure and record readings for inputs of 77, 700 & 1300°F (25, 371.1 & 704.4°C). Verify accuracy specs from Section 2.0.

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**7.11.5** Set Input Selector Switch to AUX T/C-K, Connect the T/C simulator to the AUX T/C-K input and allow 5 minutes thermal stabilization time.

**7.11.6** Set T/C Simulator for 77, 700 & 1300°F (25, 371.1 & 704.4°C) and record data. Verify within specs from section 2.0.

## **7.12 Ohms Calibration – See Figure 6.**

**7.12.1** Remove the T/C wires from UUT.

**7.12.2** Connect test leads (22AWG or larger wire) to the decade box and set it for 0.00 ohms.

**7.12.3** Measure Decade Box & leads with a precision Ohmmeter, such as the Agilent 3458A. The reading obtained must be added to all future decade box readings for proper calibration. For example, if the leads measure 0.20 ohms, the proper calibration when the decade box is set at 0.00 or 50.00 ohms will be 0.20 and 50.20 ohms respectively.

**7.12.4** Connect the Decade Box as shown in Figure 6. For best results, solder a small piece of wire to the solder bead of the tip sensor and attach the alligator clip from the Decade Box to it.

**7.12.5** Set Function Selector Switch to RESISTANCE and Input Selector Switch to TIP TEST positions.

**7.12.6** Set Decade Box to 0.00 ohms and adjust R33 for a reading equal to the value of lead resistance found in step 7.12.3. For example, the ST2200 display should display 0.20 ohms, for a measured lead resistance of 0.20 ohms.

**7.12.7** Set Decade Box to 50.00 ohms and adjust R50 for a reading equal to the value of lead resistance found in step 7.12.3 plus 50.00 ohms. For example, the ST2200 display should display 50.20 ohms, for a measured lead resistance of 0.20 ohms.

**7.12.8** Repeat steps 7.12.6 and 7.12.7 for the best calibration.

**7.12.9** Verify calibration by measuring and recording readings for inputs of 0.00, 2.00 and 50.00 ohm inputs.

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## 7.13 Millivolt Calibration AC ONLY- See Figure 7.

- 7.13.1** Connect the Millivolt source, True RMS Millivolt meter (AC reference voltmeter) to ST2200 as shown in Figure 7. For best results, solder a small piece of wire to the solder bead of the tip sensor and attach the alligator clip from the AC Millivolt source to it.
- 7.13.2** Set the AC millivolt source to 50 or 60 Hz, depending on your local line frequency. The source should be synchronized to the line frequency for best results. Failure to do so may result in an unstable display for Millivolt readings.
- 7.13.3** Set Function Selector Switch to MILLIVOLTS AC ONLY and Input Selector Switch to TIP TEST positions.
- 7.13.4** With the Millivolt Source power switch set to OFF, note the AC reference voltmeter reading (call this V1) and adjust R19 for an ST2200 display reading of 0.02mV. *NOTE: In the event that the unit is at 0.00mV and fluctuates negative by as little as .01mV the FAIL MV/OHM indicator will flash Red, thus indicating a false failure. To prevent this, an offset bias of .02mV is adjusted in during calibration.*
- 7.13.5** Turn the Millivolt Source power switch ON and adjust it's output to 20.00mV RMS plus V1 reading from step 7.13.4. The AC reference voltmeter should indicate 20.00mV + V1.
- 7.13.6** Adjust R16 for a display of 20.00 mV RMS on the ST2200.
- 7.13.7** Turn the AC Millivolt Source power switch to OFF and touch up R19 as needed for a 0.02 display reading on the ST2200. Repeat Steps 7.13.4 through 7.13.6 as necessary for the best calibration.

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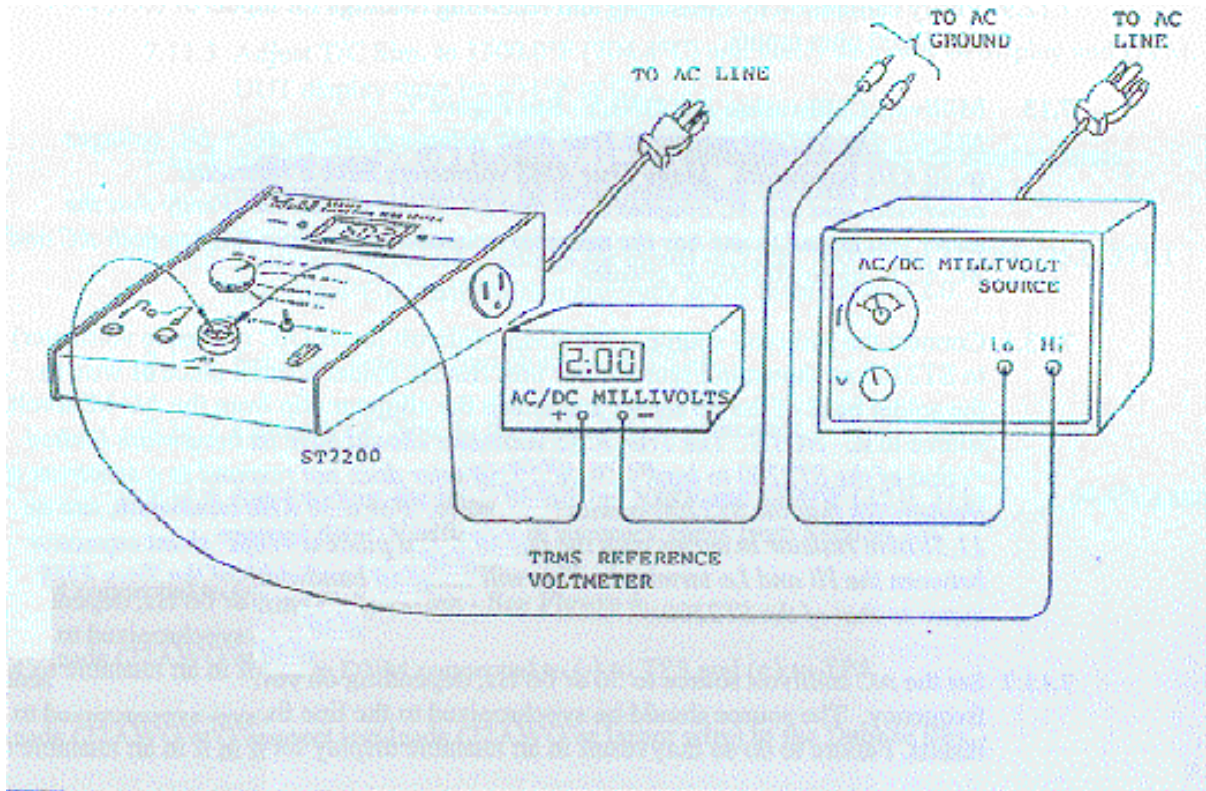


Figure 7. Millivolts Calibration

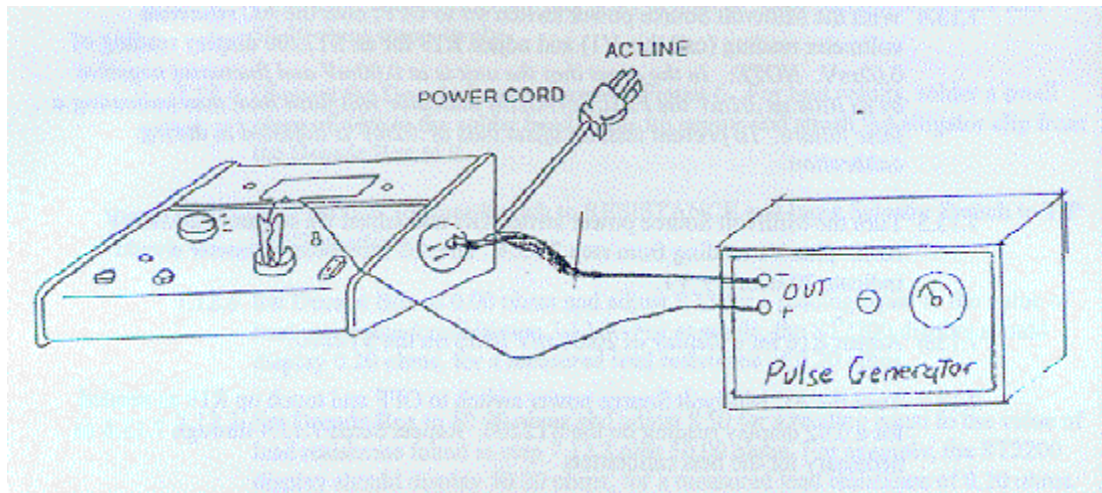


Figure 8. Spike Test



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## 7.14 Millivolt Calibration AC + DC

*NOTE: The ST2200 measures the True RMS of the sum total of AC + DC voltages presented to the sensor with respect to power ground. There is no separate adjustment for the AC + DC function. It is calibrated when the calibration is performed on the AC ONLY function.*

**7.14.1** Connect a DC Millivolt source, True RMS Millivolt meter (AC reference voltmeter) to ST2200 as shown in Figure 7. For best results, solder a small piece of wire to the solder bead of the tip sensor and attach the alligator clip from the DC Millivolt source to it.

**7.14.2** Set the DC millivolt source to 0.00mV. Verify the ST2200 display reads 0.02 millivolts to within its accuracy specifications from Section 2.0. Insert other DC millivolt settings within the 0-30mV range and verify the readings to be within the stated accuracy.

## 7.15 Spike Test Verification

The Spike Test section is to verify the spike detection circuit is functioning properly. There are no adjustments to this circuit, thus a failure of this test would need to be looked at by a qualified technician or returned to Wahl Instruments for evaluation and repair.

**7.15.1** Set the Pulse Generator for a 1 microsecond, 100mV pulse.

**7.15.2** Connect the Pulse Generator to the ST2200 sensor as shown in Figure 8.

**7.15.3** Set Function Selector Switch to MILLIVOLTS AC ONLY and Input Selector Switch to TIP TEST positions.

**7.15.4** Trigger the Pulse Generator and watch for the “VOLTAGE SPIKE” indicator to Flash Red for approximately 1 second.

**7.15.5** Record the results.

## 7.16 Wrist Strap Test Verification

**7.16.1** Set Function Selector Switch to RESISTANCE and Input Selector Switch to TIP TEST positions.

**7.16.2** Connect appropriate resistances between Wrist Strap Test Input Banana Jack and Wrist Strap Test Acorn Nut to test threshold levels of Wrist Strap Test. Wahl recommends using 450K $\wedge$  and 11M $\wedge$  resistors which should indicate failures and a 5M $\wedge$  resistor which should indicate pass.

**7.16.3** Record the results.

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## 8.0 APPLICATIONS, TECHNICAL INFORMATION AND TROUBLESHOOTING

### 8.1 Solder Pot and Wave Solder Machines

The ST2200 may also be used to measure solder pot and solder machine temperature, voltage potential and ground resistance. Use the supplied wire probe or the Optional Pot Solder Probe model TC801P.

1. Connect the probe to the Auxiliary input.
2. Switch the Input Selector Switch to the AUX T/C-K position.
3. Use the Function Selector Switch to select Temperature, Millivolts AC only, or Resistance. Do not use the Millivolts AC + DC function as the thermocouple wire induces a small DC voltage which gives an erroneous reading.

The Voltage Spike Detector is also operational when testing in the AUX T/C-K position. This enables detection of transient voltage spikes in solder pots or wave solder machines.

### 8.2 Embedded Thermocouple in Soldering Iron Tip

A soldering iron with Type K thermocouple embedded in the tip can be measured using the AUX T/C-K input. The tip temperature can be measured either from the AUX T/C-K input or the TIP TEST input.

Tip voltage potential measured from the embedded thermocouple will be accurate on the AC only function. The AC+DC position will be in error due to thermocouple effects. Tip Resistance measured from the embedded thermocouple will be in error due to lead resistance.

### 8.3 Ground Measurement Technical Info

#### 8.3.1 Soldering Iron Ground Circuit

For soldering of electronic components, 3-wire grounded soldering irons are recommended. This is to provide a means of protecting electronic components from damage due to voltage potential at the solder joint for any reason.

The ground path on many soldering irons contains mechanical joints between replaceable tips, heater and the ground wire. These joints are subject to loosening, contamination and aging, all of which affect the ground integrity. Other designs have a direct ground connection to the tip which offers greater promise of reliability in spite of aging.

Ground integrity is improved by frequent disassembly and cleaning of irons.

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## 8.3.2 Resistance to Ground Measurements

All resistance measurements are made with respect to the ground reference of the AC line cord. Therefore, the ST2200 line cord ground wire must be connected to the ground reference as chosen by the user (either power ground or earth ground). If a ground reference is chosen other than the ground available via the AC outlet powering the soldering iron, then the ground reference of the ST2200 must be connected to that ground to make tip resistance measurements.

The test current for resistance measurements is 10 milliamperes DC and the ST2200 will display resistance with a resolution of 0.01 ohms. The operator should be aware that it is possible for circulating ground currents in the AC power distribution system to cause errors during ohms measurements. This will be evidenced by a difference in displayed ohms when the soldering iron power cord and ST2200 power cords are interchanged in their position of connection at the AC power outlet. The reason for this is that a ground current is flowing in the ground line and results in a voltage offset between the two adjacent outlets. In one orientation this offset voltage adds to the ST2200 voltage generated during ohms check and then subtracts if the orientation of the AC power cord connections is reversed. Therefore, as little as 10 millivolts of either polarity will cause a variance of the ST2200 digital display of  $\pm 1.0$  ohms as the scale factor is 1.0 ohms per 10 millivolts of the voltage measured.

Should this phenomenon be seen, it would indicate that there is excessive ground current flowing (caused by a faulty piece of equipment connected to the AC line) or excessive resistance between AC outlets and should be resolved if highest accuracy measurements are to be made.

Methods of avoiding the errors due to differences in ground potential are:

1. Use the AC convenience outlet provided on the right side of the instrument.
2. Use a multiple AC outlet adapter in which both the ST2200 and the soldering iron under test are connected. This essentially connects the ground of the ST2200 and the soldering iron under test to a single point ground reference.

## 8.3.3 Ground Integrity

The Resistance (ohms) measurement will be most easily affected by an unsatisfactory ground connection of either the ST2200 or the soldering iron under test. Contact resistances of the AC power plug and receptacle combination can have a wide variability depending on the surface area of contact, pressure of the contact interface, and cleanliness. An open ground connection would indicate itself as an "1---" on the display. When a Resistance measurement fails, the connections to the AC line should be investigated for intermittent contact.

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## 8.4 Circuit Description

Figure 9 is a simplified block diagram of the ST2200. There are six distinct measuring capabilities shown. During temperature measurement, the thermocouple characteristics of the type K sensor are used and the microvolt signals are amplified by the chopper stabilized amplifier, linearized, and converted to a digital display of engineering units in degrees F or C, depending on the model.

During the measurement of tip millivolts, the sensor is connected via the chopper amplifier to a True RMS-to-DC converter which scales its output to 10 mV/mV of True RMS input voltage. The tip millivolts are displayed in engineering units of millivolts RMS.

The ohms circuitry consists of a precision 10mA DC current source and an ohms converter circuit to provide the scaling and offsets necessary to display the tip resistance to ground yet nulling out the resistance of the instrument and its power cable. Ohms are displayed in engineering units of Ohms.

The analog to digital converter is a 16 bit dual slope converter which features auto zero drift nulling capability and excellent long term stability.

The Display is a 0.7 inch, 4-1/2 digit, bright LCD display. In addition, peripheral LED status indicators provide flashing go/no-go warnings at preset levels when tip voltage or tip resistance exceed default levels.

The AC power inputs and sensor input are transient, static and surge protected for the utmost in damage immunity. The output jack buffer is also protected against shorts to ground and overvoltage inputs.

## 8.5 Troubleshooting

When trouble occurs, it will usually center around three main areas.

1. Defective soldering irons which act erratically.
2. High ground path resistance for the ST2200 or the soldering iron under test.
3. A faulty ST2200.

### 8.5.1 Troubleshooting - Temperature Measurement Problems

Following are some suggestions for obtaining accurate readings or to solve temperature measurement problems.

1. Make sure the soldering iron tip is clean and tinned properly. A small amount of clean solder will insure a good thermal connection.

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2. Apply steady and firm (but not heavy) pressure to the sensor.
3. If display indicates "1---" with or without the soldering iron on it, it may indicate an open ST2200 sensor. First, make sure the Input Selector Switch is in the "TIP TEST" position. If it is install new sensor and try again. If the sensor is working properly, the unit should display room ambient temperature when in TEMPERATURE mode with no iron touching the sensor. If problem persists, ST2200 may be faulty and should be serviced by qualified technician or returned to Wahl for evaluation and repair.

## 8.5.2 Troubleshooting - Millivolt Measurement Problems

If measurements are in doubt, connect a clip lead from the ST2200 sensor to ground at the AC line. The display should indicate 0.00 to 0.10mV for a "zero" input.

If it is out of this range, the ST2200 may need calibration or repair. Try reconnecting the ST2200 AC cord at the AC line and try again. The contact resistance of the ground connection at the AC line is not a major factor, but if it is over 100 ohms, erratic readings may appear. Switch to the "RESISTANCE" and measure the resistance of the soldering iron back to the AC line. If more than the 5 ohms or so is measured, there may be a problem with the ground in the soldering iron or the AC line receptacle.

## 8.5.3 Troubleshooting - Resistance Measurement Problems

The contact resistance from the soldering iron power cord to the AC line and the contact resistance from the ST2200 power cord to the AC line will cause most of the indicated error in this measurement assuming the soldering iron itself is under 5.00 ohms.

Following are some suggestions for obtaining accurate readings or to solve Resistance Measurement problems.

1. High or erratic readings - Remove the AC line cord and reconnect for both the soldering iron and ST2200 and try again. If still high, connect the soldering iron to the AC power receptacle on the ST2200 and measure again. If still high, connect a clip lead from the ST2200 sensor to ground and verify that there is resistance of no more than 0.10 ohms.

If the clip lead test is fine but the soldering iron test was high, it points to the soldering iron as the problem.

2. Display always reads "1---". Replace the ST2200 sensor and try again with a soldering iron or clip lead from ST2200 sensor to ground. If the display still reads open, check the ground where the ST2200 line cord is plugged in. Sometimes the AC receptacle ground clips break and a ground connection is not available even though AC power is available to the ST2200.

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Move equipment to another AC outlet and repeat the above tests. If the ground has been verified and the ST2200 sensor has been replaced but the over range indication of "1---" still exists, return the ST2200 to the factory for evaluation and repair.

## **8.5.4 Troubleshooting - Wrist Strap Test Problems**

If a wrist strap under test indicates a failure, following are possible causes.

1. Check that the wrist strap cable connector is connected properly to the ST2200. See Figure 1, Item 9 for wrist strap connector location. Do not rely on common ground of AC line for wrist strap testing.
2. Make sure the operator is not touching any other conductive material. Ensure that the operator's free hand is not in contact with any other object.
3. Make sure wrist strap is in contact with the skin. Do not wear the wrist strap over clothing.
4. Wrist strap may be defective, replace wrist strap.

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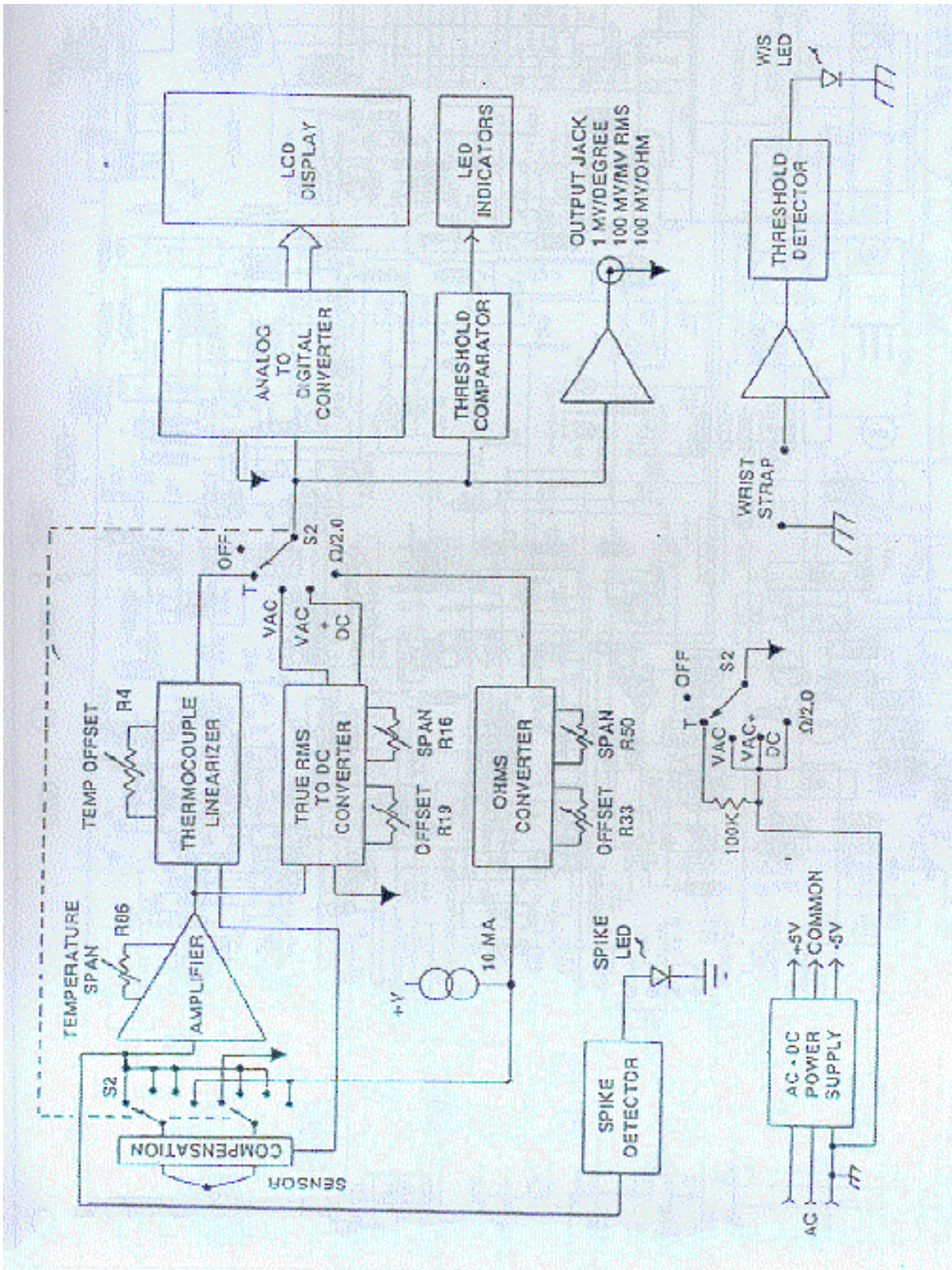


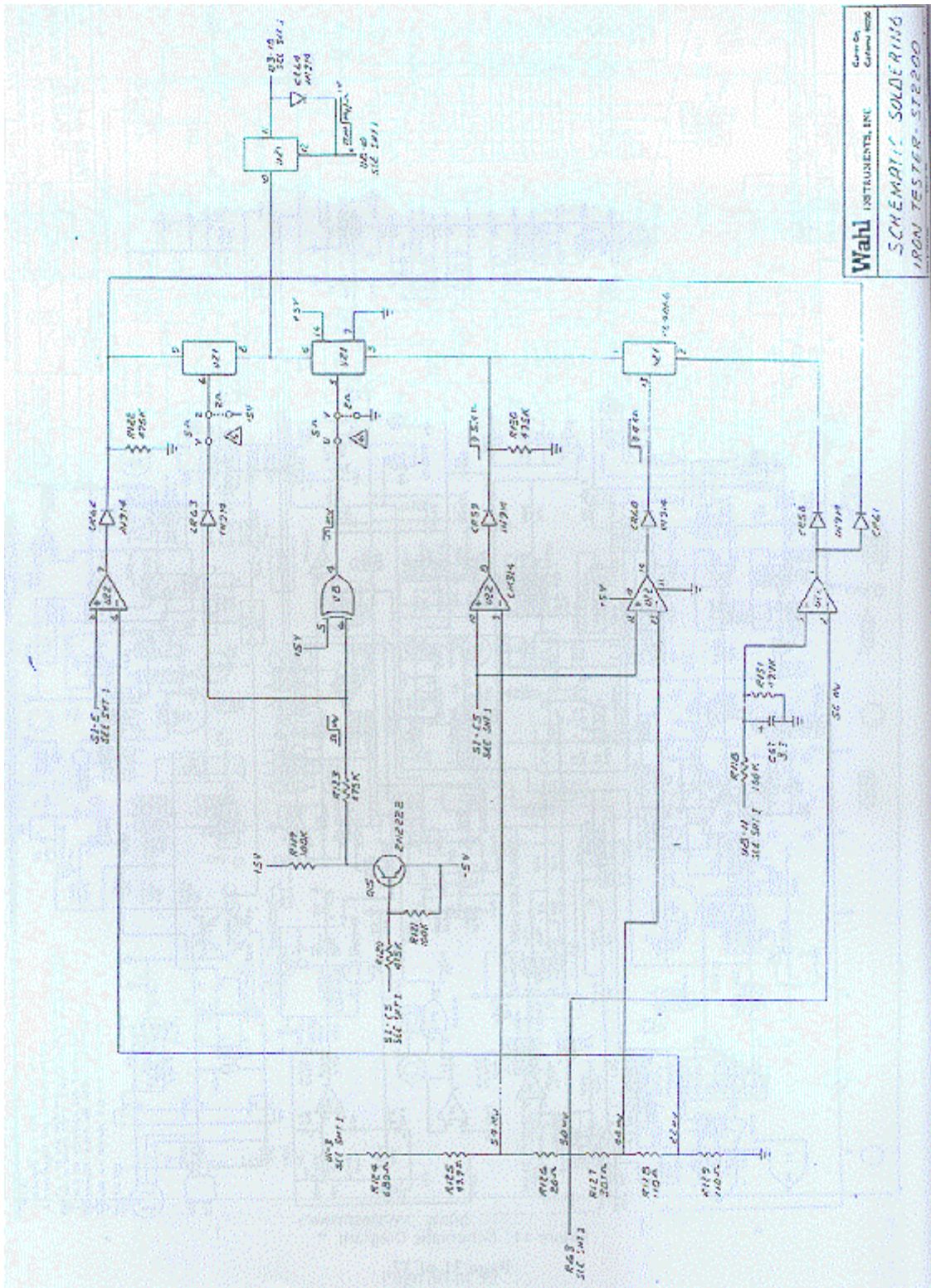
Figure 9. ST2200 Simplified System Block Diagram







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 SCHEMATIC: SOLDERING  
 IRON TESTER - ST2200

Figure 11. Schematic Diagram - page 2