8502A/AT

Digital Multimeter

Instruction Manual

P/N 577049
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FLUKE®

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Rev. 6/81

Model 8502A/AT
Addendum

This addendum modifies the standard 8502A Instruction Manual to cover operations and servicing of the 8502A/AT Digital Multimeter. If no reference is made to a numbered paragraph, figure, or table, that item in the 8502A manual remains correct, except for the change in nomenclature.

The 8502A/AT is an 8502A that has been altered to operate at 400 Hz ±5% and has a Thermal True RMS Converter module installed. In addition the -02 Ohms Converter, -04 Calibration Memory, -05 IEEE Interface, and -08A Isolator Options are included as standard. The Thermal True RMS Converter module allows the operator to measure the true rms value of an ac signal at accuracies of 50 ppm with a maximum response time of 6 seconds. This response time compares favorably with that of existing thermal transfer standards which can take up to 5 minutes to complete a measurement. Multimeter operation at 400 Hz results in readings that are 5% slower than the standard 60 Hz unit. The 5% slower readings are based on timing of 57 Hz which occurs when the input line frequencies are at 400 Hz ±5%.

+SPECIAL CASE ETC.

Section 1
Introduction and Specifications

ADD THE FOLLOWING PARAGRAPHS:

1-4a. In addition to four 8502A options, the 8502A/AT also includes two special features. One of the special features is a Thermal True RMS Converter that measures rms voltages at accuracies up to 0.015% within a 6-second maximum on eight ranges. The other special feature allows the instrument to operate with a 400-Hz input line frequency in addition to the normal 50 to 60 Hz. The four options included with the 8502A/AT are the Ohms Converter (-02), the Calibration Memory (-04), the Isolator (External Trigger) (-08), and the IEEE Standard 488-1975 Interface (-05).

1-4b. The Thermal True RMS Converter has three front panel selectable modes of operation, the fast mode, the fast enhanced mode, and the high accuracy mode. The fast mode displays a rms value for the unknown input updated every half second, but with reduced accuracies since there is no comparison made to the thermal converter dc output. The high accuracy mode takes approximately 6 seconds per reading, but the accuracies of up to 0.015% rival existing accuracies from thermal transfer standards at a fraction of the time. The fast enhanced mode takes an initial high accuracy reading then normalizes subsequent fast mode readings with the initial high accuracy reading for a fast update at only slightly reduced accuracies. This gives the fast enhanced mode the speed of the fast mode and the accuracy of the high accuracy mode as long as the following conditions are met: the input cannot vary more than 1% from the initial reading, the temperature cannot vary more than 1 °C, and the time lapse cannot exceed 1 hour.

Table 1-3 Specifications: MAKE THE FOLLOWING CHANGES

GENERAL SPECIFICATIONS - OPERATING POWER:

Change the operating frequencies to read: 50, 60, or 400 Hz

INSTRUMENT OPERATING CHARACTERISTICS - DC VOLTS

ACCURACY add the following column to the table:

	180 Days
100 mV	±(0.004% of Input + 6uV)
1V	±(0.003% of Input + 8uV)
10V	±(0.0015% of Input + 80uV)
100V	±(0.003% of Input + 0.8mV)
1000V	±(0.003% of Input + 8mV)

RESPONSE TIME add the following note:

Response times for the 400-Hz input will be between the 50-Hz and 60-Hz figures, varying with the tolerance of the 400-Hz input line frequency.

NOISE REJECTION add the following note:

Noise rejection figures for the 400-Hz input line frequency are similar to the 60-Hz line figures but without the typical digital filtering.

INSTRUMENT OPERATING CHARACTERISTICS - DC Ratio

RESPONSE TIME add the following note:

Response times for the 400-Hz input will be 5% slower than those of the standard 60-Hz unit.

ADD THE FOLLOWING:

INSTRUMENT OPERATING CHARACTERISTICS - AC VOLT (RMS)

ACCURACY — AC Coupled
High Accuracy Mode

180 Days ± 5 °C

Slow filter required for frequency < 40 Hz

500V Range has voltage coefficient error:

Error = $(V_{in}/600)^2$ X 200 ppm

Volts — Hertz product < 10^7

Uncertainty of calibration standard errors are not included

FREQUENCY (HZ)	100 mV RANGE		300 mV TO 500V RANGE	
	FULL SCALE	1/10 FULL SCALE	FULL SCALE	1/10 FULL SCALE
10 - 40	± 0.08%	± 0.12%	± 0.08%	± 0.12%
40 - 20k	± 0.025%	± 0.1%	± 0.015%	± 0.05%
20k - 50k	± 0.06%	± 0.11%	± 0.06%	± 0.11%
50k - 100k	± 0.2%	± 0.25%	± 0.2%	± 0.25%
100k - 200k	± 0.6%	± 0.7%	± 0.5%	± 0.6%
200k - 500k	± 1.5%	± 1.5%	± 1.0%	± 1.0%
500k - 1M	± 3.5%	± 3.5%	± 1.5%	± 1.5%

24 hour ± 1°C (Typical)

Slow filter required for frequency < 40 Hz

500V Range has voltage coefficient error:

Error = $(V_{in}/600)^2$ X 200 ppm

Volts — hertz product < 10^7

Uncertainty of calibration standard errors are not included

Accuracy (% of Input)

FREQUENCY (Hz)	100 mV RANGE		300 mV TO 500V RANGE	
	125 mV* TO 35 mV	35 mV TO 12.5 mV	FULL SCALE* TO 25% FULL SCALE	25% TO 10% FULL SCALE
10 - 40	± 0.08%	± 0.12%	± 0.08%	0.12%
40 - 20k (mid-band)	± 0.25%	± 0.1%	± 0.012%	± 0.05%
20k - 50k	± 0.06%	± 0.11%	± 0.04%	± 0.08%
50k - 100k	± 0.2%	± 0.25%	± 0.2%	± 0.25%
100k - 200k	± 0.6%	± 0.7%	± 0.5%	± 0.6%
200k - 500k	± 1.5%	± 1.5%	± 1.0%	± 1.0%
500k - 1M	± 3.5%	± 3.5%	± 1.5%	± 1.5%

*Note that in autorange the full scale specification gives instrument accuracy except on the extremes of the lowest and highest ranges.

NOTE

The following 90 day and 1 year specifications at first glance may appear to be looser than the 180 day specifications. The qualifiers on the 180 day specification cause this not to be the case. The 180 day specification does not include the calibration source errors and the full scale specification is not applicable at 25% of full scale as it is in the 90 day and 1 year specifications.

90 Days ±5° C (Typical)

Slow filter required for frequency < 40 Hz
500V Range has voltage coefficient error:

$$\text{Error} = (V_{in}/600)^2 \times 200 \text{ ppm}$$

Volts - Hertz product < 10^7

Accuracy (% of Input)

FREQUENCY (Hz)	100 mV RANGE		300 mV TO 500V RANGE	
	125 mV* TO 35 mV	35 mV TO 12.5 mV	FULL SCALE* TO 25% FULL SCALE	25% TO 10% FULL SCALE
10 - 40	± 0.08%	± 0.12%	± 0.08%	0.12%
40 - 20k (mid-band)	± 0.03%	± 0.1%	± 0.016%	± 0.05%
20k - 50k	± 0.06%	± 0.11%	± 0.06%	± 0.11%
50k - 100k	± 0.2%	± 0.25%	± 0.2%	± 0.25%
100k - 200k	± 0.6%	± 0.7%	± 0.5%	± 0.6%
200k - 500k	± 1.5%	± 1.5%	± 1.0%	± 1.0%
500k - 1M	± 3.5%	± 3.5%	± 1.5%	± 1.5%

*Note that in autorange the full scale specification gives instrument accuracy except on the extremes of the lowest and highest ranges.

1 year ± 5° C (Typical)

Slow filter required for frequency < 40 Hz

500V Range has voltage coefficient error:

$$\text{Error} = (V_{in}/600)^2 \times 200 \text{ ppm}$$

Volts — hertz product < 10^7

Accuracy (% of Input)

FREQUENCY (Hz)	100 mV RANGE		300 mV to 500V RANGE	
	125 mV* to 35 mV	35 mV to 12.5 mV	FULL SCALE* to 25% FULL SCALE	25% to 10% FULL SCALE
10 - 40	± 0.15%	± 0.2%	± 0.15%	0.2%
40 - 20k (mid-band)	± 0.04%	± 0.1%	± 0.025%	± 0.07%
20k - 50k	± 0.08%	± 0.15%	± 0.08%	± 0.15%
50k - 100k	± 0.3%	± 0.4%	± 0.3%	± 0.4%
100k - 200k	± 0.8%	± 0.9%	± 0.7%	± 0.8%
200k - 500k	± 2.0%	± 2.0%	± 1.5%	± 1.5%
500k - 1M	± 4.5%	± 4.5%	± 2.5%	± 2.5%

*Note that in autorange the full scale specification gives instrument accuracy except on the extremes of the lowest and highest ranges.

Fast Enhanced Mode (Typical)

Temperature Change from Initial Reading < 1° C

Source Changes by < 1% (The initial reading is automatically reinitiated if this condition is not met)

Same Specification as the High Accuracy Mode Plus:

RANGE	ELAPSED TIME SINCE INITIATION OF FIRST READING:	
	5 MINUTES	30 MINUTES
Full Scale to 25% Full Scale	± 30 ppm of reading plus 10 ppm of Full Scale	± 60 ppm of reading plus 20 ppm of Full Scale
25% Full Scale to 10% Full Scale	± 300 ppm	± 400 ppm

Fast Mode (Typical)

Same Specifications as the High Accuracy Mode for the Appropriate Calibration Period Plus:

RANGE	90 DAYS ± 5°C	1 YEAR ±5°C
Full Scale to 25% Full Scale	± 0.4%	± 0.8%
25% Full Scale to 10% Full Scale	± 0.6%	± 1.1%

ACCURACY — AC + DC Coupled (Typical)

Errors are due to offsets in relays and the input amplifier. Performance superior to the specifications may be achieved by reversing the polarity of the dc component and averaging the readings for each polarity.

To obtain the AC + DC Specification, multiply the AC Specification for the appropriate mode by 1.1 and add the result from the following table.

RANGE	AC + DC ADDER
100 mV 300 mV 1V	± 150 uX X (dc volts / total rms volts)
3V & 10V	± 1 mV (dc volts X / total rms volts)
30V & 100V	± 0 mV (dc volts X / total rms volts)
500V	± 50 mV (dc volts X /total rms volts)

STABILITY — AC Coupled, Fixed Range

High Accuracy Mode

Temperature Change < 1° C

Frequency: 40 Hz to 20 kHz

Elapsed Time: 1 Hour

Full Scale 30 ppm
25% Full Scale 50 ppm
10% Full Scale 250 ppm

Fast Enhanced Mode (Typical)

Temperature Change from Initial Reading < 1° C

Source Changes by < 1% (The initial reading is automatically reinitiated if this condition is not met)

RANGE	ELAPSED TIME SINCE INITIATION OF FIRST READING:	
	5 MINUTES	30 MINUTES
Full Scale to 25% Full Scale	30 ppm of reading plus 10 ppm of Full Scale	60 ppm of reading plus 20 ppm of Full Scale
25% Full Scale to 10% Full Scale	300 ppm	400 ppm

Full Stability will require 45 seconds after a range change if the frequency is greater than 10 kHz and the range is less than 10V. (Typical)

INPUT IMPEDANCE

Input R = 1 Megohm ± 1%
Front Input C < 130 pF

CREST FACTOR

All specifications are met with Crest Factor 2 at full scale. Other Crest Factors acceptable without degraded performance for peak voltage less than twice full scale voltage. This allows signals to Crest Factor 8 to be measured to the best 90 days specification accuracy.

Crest Factor 4 signals may be measured at full scale if the accuracy is degraded by 300 ppm. (Typical).

RESOLUTION

RANGE	NORMAL	HI RESOLUTION (TYPICAL)	FULL SCALE
100 mV	1 uV	100 nV	125 mV
300 mV	1 uV	100 nV	400 mV
1V	10 uV	1 uV	1.25V
3V	10 uV	1 uV	4V
10V	100 uV	10 uV	12.5V
30V	100 uV	10 uV	40V
100V	1 mV	100 uV	125V
500V	1 mV	100 uV	600V

SETTLING TIME

High Accuracy Mode

Sample time = 3.5 seconds
Hold Time = 2.5 seconds

Total time for one measurement is 6 seconds. If the state of the instrument is unknown 12 seconds will be required for the first reading to guarantee a single complete 6 second cycle. Use of the trigger mode allows the user to always measure within 6 seconds.

Fast Enhanced Mode (Typical)

The first reading is the same as the High Accuracy Mode. Subsequent readings are provided every 500 milliseconds. Analog settling time for a 1% change to 90 day, mid-band specification is 1.5 seconds.

Fast Mode (Typical)

Settling time for large changes is non-linear. Zero to full scale changes require 2.0 seconds to settle to 90 day, mid-band specifications. Full scale to 1/10th full scale changes require 3.0 seconds to settle to 1/10 full scale, mid-band ;90 day specifications. Small changes (< 1%) settle to mid-band ;90 day specifications in < 1.5 seconds.

OVERLOAD

Maximum Applied Voltage While in the AC Mode Is:

600V RMS or DC
840V Peak AC
Volts-Hertz Product $< 10^7$

OUT OF BAND RESPONSE

3 dB Bandwidth (Typical)

100 mV Range ≅ 3 MHz
300 mV, 1V, 3V, 10V Ranges ≅ 10 MHz

AUTORANGE POINTS (Typical)

RANGE	UPRANGE	DOWNRANGE
100 mV	126.250 mV	None
300 mV	404 mV	110 mV
1V	1.2625V	0.352V
3V	4.04V	1.1V
10V	12.625V	3.52V
30V	40.4V	11V
100V	126.25V	35.2V
500V	None	110V

OPERATING RANGE (Typical)

RANGE	OVERRANGE HHHHH	MAXIMUM SPECIFIED LEVEL	MINIMUM SPECIFIED LEVEL	UNDERRANGE LLLLL
100 mV	126.25 mV	125 mV	12.5 mV	6.25 mV
300 mV	404 mV	400 mV	40 mV	20 mV
1V	1.2625 mV	1.25V	125 mV	62.5 mV
3V	4.04V	4V	400 mV	200 mV
10V	12.625 mV	12.5V	1.25V	625 mV
30V	40.4V	40V	4V	2V
100V	126.25 mV	125V	12.5V	6.25V
500V	606V	600V	60V	30V

Section 2

Operating Instructions

REPLACE PARAGRAPH 2-8 WITH THE FOLLOWING:

2-8. The 8502A/AT operates from either 123 Vac ±10% or 246 Vac ±10%, 50, 60, or 400 Hz (10% translates to high and low limits of: 110.7V to 135.3V ac, 221.4 to 270.6V ac).

REPLACE PARAGRAPH 2-13 WITH THE FOLLOWING:

2-13. A binding post on the rear panel has been provided as an earth ground connection. Power supply switching (115 Vac or 230 Vac) is explained in Section 4. With the exception of slower reading rates and filter time-outs, operation at 50 Hz and 400 Hz is identical to that at 60 Hz.

ADD THE FOLLOWING TO Table 2-2 Error Codes:

(CODES)	(FAULT)
Error A	Displayed when the Thermal True RMS function is selected and an illegal switch or switch sequence selection is made.
Error E	Displayed at Power On if more than one AC Converter is installed in the instrument.

ADD THE FOLLOWING STEP 5 TO PARAGRAPH 2-19:

5. "LLLLLL" will flash if the input voltage is less than approximately 5% of full scale. The exact percentage will differ slightly with the selected range.

ADD THE FOLLOWING NOTE AFTER PARAGRAPH 2-22:

NOTE

Calibration Memory factors cannot be stored or used if the Thermal True RMS Function is Selected.

REPLACE THE EXISTING PARAGRAPH 2-35 WITH THE FOLLOWING:

2-35. The dc volts and thermal true RMS functions are standard with the 8502A/AT. Also standard are the Ohms converter, Calibration Memory, IEEE-488 Interface, and Isolator (External Trigger). Information on the dc volts function can be found in the basic manual as modified by the 8502A/AT Addendum. Information on the thermal true RMS function can be found in the 8502A/AT Addendum. Information on the remaining functions can be found in Section 6 of the basic manual as modified by the 8502A/AT Addendum. If a function is selected for which the appropriate module is not installed, "Error9" will appear in the display.

REPLACE PARAGRAPH 2-37 WITH THE FOLLOWING:

2-37. DC Volts can be measured on five successive rangs from 100 mV to 1000V. Respective resolutions vary from 1uV to 1mV. Input impedance on the 100V and 1000V ranges is 10 megohms. On the lower three ranges it is greater than 10,000 megohms. RMS volts can be measured on eight ranges (100 mv, 300 mV, 1V, 3V, 10V, 30V, 100V, 500V). Respective resolutions vary from 1 uV to 1 mV. Input impedance is 1 megohm/≤130 pF. Overrange capabilities, dc voltage accuracies, rms voltage accuracies, and overload protection conditions are detailed in Section 1 of this manual.

ADD THE FOLLOWING NOTE AFTER STEP 2 OF PARAGRAPH 2-40:

NOTE

The filter has only two modes (F0 and F1) when the thermal true RMS function is selected. The filter (the FILTER LED illuminated) is used only when the input signal frequency is ≤40 Hz. Degraded accuracies result if the filter is selected at higher signal frequencies.

ADD THE FOLLOWING PARAGRAPH:

2-44a. When the Thermal True RMS Converter is selected the internal dc volt sample rate is fixed at 128 samples per reading; therefore, the SAMPLE switch is not needed to select the sample rate and is used instead to select the operating mode of the Thermal True RMS Converter. When the Thermal True RMS Converter is selected (either AC or AC + DC), the instrument automatically defaults to the fast mode, the filter off, and autorange. To change the mode press the SAMPLE switch once to advance to the fast enhanced mode. Press the SAMPLE switch again to advance the instrument to the high accuracy mode. Press the SAMPLE switch while in the high accuracy mode to return to the fast mode.

ADD THE FOLLOWING NOTE AFTER PARAGRAPH 2-59:

NOTE

Calibration Memory factors cannot be stored or used if the thermal True RMS function is selected.

CHANGE THE BEGINNING OF PARAGRAPH 2-78 AS FOLLOWS:

2-78. Upon applying power to the 8502A/AT, the display will read:

"HI-3.0.0"

(This message identifies the instrument as an 8502A/AT.)

Then: "C2454A 8"

(This confirms that the Ohms Converter (2), Calibration Memory (4), IEEE Interface (5), Thermal True RMS Converter (A), and Isolator (External Trigger) (8), are installed and responding on the instrument bus.)

The instrument ... (The remainder of the paragraph is unchanged).

IN FIGURE 2-4, UNDER FUNCTION, REPLACE STEPS 2, 3, AND 4 WITH THE FOLLOWING:

2. AC VOLTS (V AC) - Standard, 8 ranges.

3. DC CURRENT (A DC) - Not available.

4. AC CURRENT (A AC) - Not available.

MAKE THE FOLLOWING CHANGES TO Figure 2-5:

UNDER ☐ SAMPLE ☐ Change Step 1 and add Step 5 as follows:

1. Press SAMPLE to toggle between samples/reading rates 5 and 7. If the Thermal True RMS function is selected, proceed to Step 5.

5. If the Thermal True RMS function is selected, the reading rate is fixed and the SAMPLE switch is used to select the operating mode. Press SAMPLE to cycle through the Thermal True RMS function modes. The sequence of selection is the fast mode, the fast enhanced mode, and the high accuracy mode. Pressing the SAMPLE switch advances operation to the next mode in sequence. Press the SAMPLE switch as many times as required to reach the proper mode in the sequence.

ADD THE FOLLOWING PARAGRAPH AFTER PARAGRAPH 2-88:

2-88a. AC VOLTAGE (THERMAL TRUE RMS)

2-88b. Thermal transfer measurements can be made using the Thermal True RMS Converter module. Select the mode of operation desired from the three following modes, as determined by the degree of accuracy or speed required. If the AC function is initially selected the fast mode is the default condition. From then on all three modes are selectable using the SAMPLE switch. They sequence from the fast mode to the fast enhanced mode to the high accuracy mode and then back to the fast mode.

2-88c. AC Fast Mode

2-88d. Use the following procedure when measuring ac volts with the fast mode of the Thermal True RMS Converter:

1. Select the VAC function. If the 8502A/AT is in the high accuracy mode, press the SAMPLE SWITCH.

2. The 8502A/AT automatically autoranges when the VAC function is selected. If the instrument is stepped to the fast mode from another mode, i.e. high accuracy, the instrument does not change range. Manual ranging can be selected, if necessary. The available ranges are: 500V, 100V, 30V, 10V, 3V, 1V, 300 mV, and 100 mV.

3. Select the filter by pressing the FILTER switch if the frequency of the input signal is ≤ 40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencies.)

4. Connect the ac voltage to the HI and LO SENSE INPUT terminals.

5. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-bolt range. The ac voltage should be displayed within one-half second after being applied to the INPUT terminals.

NOTE

The selected mode can be ascertained using the Front Panel indicators. The instrument is in the ac fast mode if all of the following indications are present: the VAC indicator is illuminated, the numeric display has no sign, and the SAMPLE indicator cycles approximately twice a second.

2-88e. AC Fast Enhanced Mode

2-88f. Use the following procedure when measuring ac volts with the fast enhanced mode of the Thermal True RMS Converter:

1. The 8502A/AT must have the VAC function selected and be in the fast mode. The unknown ac voltage should still be connected to the HI and LO SENSE INPUT terminals.
2. Press the SAMPLE switch.
3. The 8502A/AT remains in the range selected by either autoranging or manual ranging in the fast mode. The available ranges are: 500V, 100V, 30V, 10V, 3V, 1V, 300 mV, and 100 mV.
4. Select the filter by pressing the FILTER switch if the frequency of the input signal is $\leq$ 40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencies.)
5. The display reads FASt E for the approximately 6 seconds required for the initial high accuracy measurement.

NOTE

The Thermal True RMS Converter automatically takes a new reading to establish a new correction factor if the range changes (either manual or autorange), the filter setting changes, or the difference between the reading and the present correction factor is ≥1%.

6. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-volt range. The ac voltage should be displayed within one-half second of the completion of the initial high accuracy measurement and updated every one-half second thereafter.

NOTE

The selected mode can be ascertained using the front panel indicators. The instrument is in the ac fast enhanced mode if all of the following indications are present: the VAC indicator is illuminated, the numeric display is preceded by a + (plus) sign, and the SAMPLE indicator cycles approximately twice a second.

2-88g. AC High Accuracy Mode

2-88h. Use the following procedure when measuring ac volts with the high accuracy mode of the Thermal True RMS Converter:

1. The 8502A/AT must have the VAC function selected and be in the fast enhanced mode. The unknown ac voltage should still be connected to the HI and LO SENSE INPUT terminals.
2. Press the SAMPLE switch.
3. The 8502A/AT remains in the range slected by either autoranging or manual ranging in the fast enhanced mode. The available ranges are: 500V, 100V, 30V, 10V, 3V, 1V, 300 mV, and 100 mV.
4. Select the filter by pressing the FILTER switch if the frequency of the input signal is ≤40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencies.)
5. The display reads HI ACC for the approximately 6 seconds required for the initial high accuracy measurement.

6. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-volt range. The ac voltage should be displayed at the completion of the initial high accuracy measurement and updated every 6 seconds thereafter.

NOTE
The selected mode can be ascertained using the front panel indicators. The instrument is in the ac high accuracy mode if all the following indications are present: the VAC indicator is iluminated, the numeric display has no sign, and the SAMPLE indicator cycles approximately once every 6 seconds.

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 2-90:

2-90a. AC VOLTAGE ON A DC LEVEL (THERMAL TRUE RMS)

2-90b. Thermal transfer measurements can be made using the 8502A/AT. Select the mode of operation desired from the three following modes, as determined by the degree of accuracy required. If the AC + DC function is initially selected, the fast mode is the default condition. From then on all three modes are selected using the SAMPLE switch, sequencing from the fast mode to the fast enhanced mode to the high accuracy mode and than back to the fast mode.

2-90c. AC + DC Fast Mode

2-90d. Use the following procedure when measuring ac volts with the fast mode of the Thermal True RMS Converer:

1. Select the VAC and VDC functions simultaneously. If the 8502A/AT is in the high accuracy mode, press the SAMPLE switch.
2. The 8502A/AT automatically autoranges when the AC + DC function is selected. If the 8502A/AT is stepped to the fast mode from the fast enhanced or high accuracy mode, the instrument does not change range. Manual ranging can be selected, if necessary. The available ranges are: 500V, 100V 30V, 10V, 3V 1V, 300 mV, and 100 mV.
3. Select the filter by pressing the FILTER switch if the frequency of the input signal is ≤40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencis.)
4. Connect the unknown voltage to the HI and LO SENSE INPUT terminals.
5. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-volt range. The ac voltage should be displayed within one-half second after being applied to the INPUT terminals.

NOTE
The selected mode can be ascertained using the front panel indicators. The instrument is in the ac + dc fast mode if all of the following indications are present: the VAC indicators is illuminated, the VDC indicator is illuminated, the numeric display has no sign, and the SAMPLE indicator cycles approximately twice a second.

2-90e. AC + DC Fast Enhanced Mode

2-90f. Use the following procedure when measuring ac + dc volts with the fast enhanced mode of the Thermal True RMS Converter:

1. The 8502A/AT must have the AC + DC function selected and be in the fast mode. The unknown voltage should still be connected to the HI and LO SENSE INPUT terminals.

2. Press the SAMPLE switch.

3. The 8502A/AT remains in the range previously selected, either by autoranging or manual ranging in the fast mode. The available ranges are: 500V, 30V, 10V, 3V, 1V, 300 mV, and 100 mV.

4. Select the filter by pressing the FILTER switch if the frequency of the input signal is ≤ 40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencies.)

5. The display reads FASt E for the time required for the initial high accuracy measurement.

6. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-volt range. The ac + dc voltage should be displayed within one-half second of the completion of the initial high accuracy measurement and updated every one-half second thereafter.

NOTE

The selected mode can be ascertained using the front panel indicators. The instrument is in the ac + dc fast enhanced mode if all of the following indications are present: the VAC indicator is illuminated, the VDC indicator is illuminated, the numeric display is preceded by a + (plus) sign, and the SAMPLE indicator cycles approximately twice a second.

2-99g. AC + DC High Accuracy Mode

2-99h. Use the following procedure when measuring ac + dc volts with the high accuracy mode of the Thermal True RMS Converter:

1. The 8502A/AT must have the AC + DC function selected and be in the fast enhanced mode. The unknown voltage should still be connected to the HI and LO SENSE INPUT terminals.

2. Press the SAMPLE switch.

3. The 8502A/AT remains in the range previously selected, either by autoranging or manual ranging in the fast enhanced mode. The available ranges are: 500V, 100V, 30V, 10V, 1V, 300 mV, and 100 mV.

4. Select the filter by pressing the FILTER switch if the frequency of the input signal is ≤40 Hz. (The accuracy of the instrument is degraded if the filter is selected for higher input frequencies.)

5. The display reads HI ACC for the approximately 6 seconds required for the initial high accuracy measurement.

6. During autorange each instrument range is displayed as it is selected, e.g., r 3 while in the 3-volt range. The ac + dc voltage should be displayed at the completion of the initial high accuracy measurement and updated every 6 seconds thereafter.

NOTE

The selected mode can be ascertained using the front panel indicators. The instrument is in the ac + dc high accuracy mode if all of the following indications are present: the VAC indicator is illuminated, the VDC indicator is illuminated, the numeric display has no sign, and the SAMPLE indicator cycles approximately once every 6 seconds.

REPLACE PARAGRAPH 2-92 WITH THE FOLLOWING:

2-92. The DC Current capability is not available in the 8502A/AT.

REPLACE PARAGRAPH 2-94 WITH THE FOLLOWING:

2-94. The AC Current capability is not available in the 8502A/AT.

Section 3
Theory of Operation

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 3-30:

3-30a. Thermal True RMS Converter

3-30b. This description is divided into two parts. The first is a theoretical description of the rms converter. The second is the operation of the rms converter within the multimeter.

3-30c. THEORETICAL DESCRIPTION

3-30d. Previously AC/DC transfer measurements were made by sequentially applying an unknown ac voltage and a variable dc voltage to an rms sensor until the outputs were equal. The rms voltage was then assumed to be equal to the value of the dc voltage applied at the time the two inmputs were equal. The Thermal True RMS Converter module differs in that it uses the dc equivalent value of the rms sensors first output to serve as the first approximation for the comparison. Therefore, if a computation capability is available, and the transfer curve of the sensor is reasonably smooth, the first iteration is the only one necessary to obtain a high accuracy measurement.

3-30e. Figure 3-8a shows an ideal curve where the rms input (X) equals the dc output (Y), an example of an actual curve, and the positions on the curves for two separate readings. X_1 represents the value of original unknown rms input and Y_1 represents the dc value of the sensor output. The difference, or error, between the two values is represented by E_1. A second dc voltage (X_2+ equal to Y_1 is applied to the sensor which produces an output Y_2. From these it can be seen that: $Y_1=X_1=E_1$, $Y_2=X_2+E_2$, and $Y_2=Y_1$. Substituting these values into the formula $2(Y_1)-(Y_2)$ the rms value of the original input can be computed from the following derived formula.

X (computed)

$$= 2(Y_1)-(Y_2)$$

$$= 2(X_1=E_1)-(X_2+E_2)$$

$$= 2(X_1=E_1)-(X_1=E_1+E_2)$$

$$= X_1=E_1-E_2$$

3-30f. Solution of the sample formula shows that by doubling the first sensor output and subtracting the second sensor output, the original input can be computed to an accuracy determined by how much the error changes between the two readings. The closer together the two points and the smoother the error curve, the lower the resultant error (E_1-E_2).

3-30g. SYSTEM OPERATION

3-30h. Figure 3-8b is a block diagram of the Thermal True RMS Converter in relation to the multimeter when used in the thermal true rms function. The unknown ac signal is applied through the input attenuators, ranging amplifier, and sensor switching circuits to the Fluke thermal sensor. The sensor output is simultaneously measured by the multimeter and routed through the sensor switching circuits for storage by the sample/hold circuit. The measured value is doubled and the result stored in memory (part of the controller). The controller module then commands the logic control circuit to alter the sensor switching circuits to open the path from the ranging amplifier output and to close the path from the sample/hold output (the stored sensor measurement) to the thermal sensor input. The sensor output is then measured again by the multimeter and the result subtracted from the stored value (twice the first measurement). The difference is displayed as the rms value of the original input signal.

3-30i. The unknown input signal must be within the dynamic range of the measuring circuit to use this technique. The input attenuator circuit and ranging amplifier, as directed by the controller (system software) through the logic circuit, bring the input signal within the range required. AC accuracy limitations at full scale for this technique are primarily due to the flatness of the input attenuator and the ranging amplifier. At one-tenth of full scale the limitation is 1/f noise in the sensor. DC accuracy limitations are primarily due to the input drift of the ranging amplifier. The 6-second response time is determined by the thermal sensor time constants and the associated circuitry.

CHANGE THE FIRST SENTENCE OF PARAGRAPH 3-37 TO READ AS FOLLOWS:

3-37. Shaped line pulses are applied to a phase-locked loop (U26) which runs at eight times the line frequency (480 Hz for 60-Hz line, 400 Hz for 50-Hz line, and 456 Hz for 400-Hz line).

FIGURE 3-9 TIMING CIRCUITS

Change the RT5 input to the shaper U38 that reads 'FROM POWER SUPPLY' to read 'FROM POWER INTERCONNECT ASSY.'

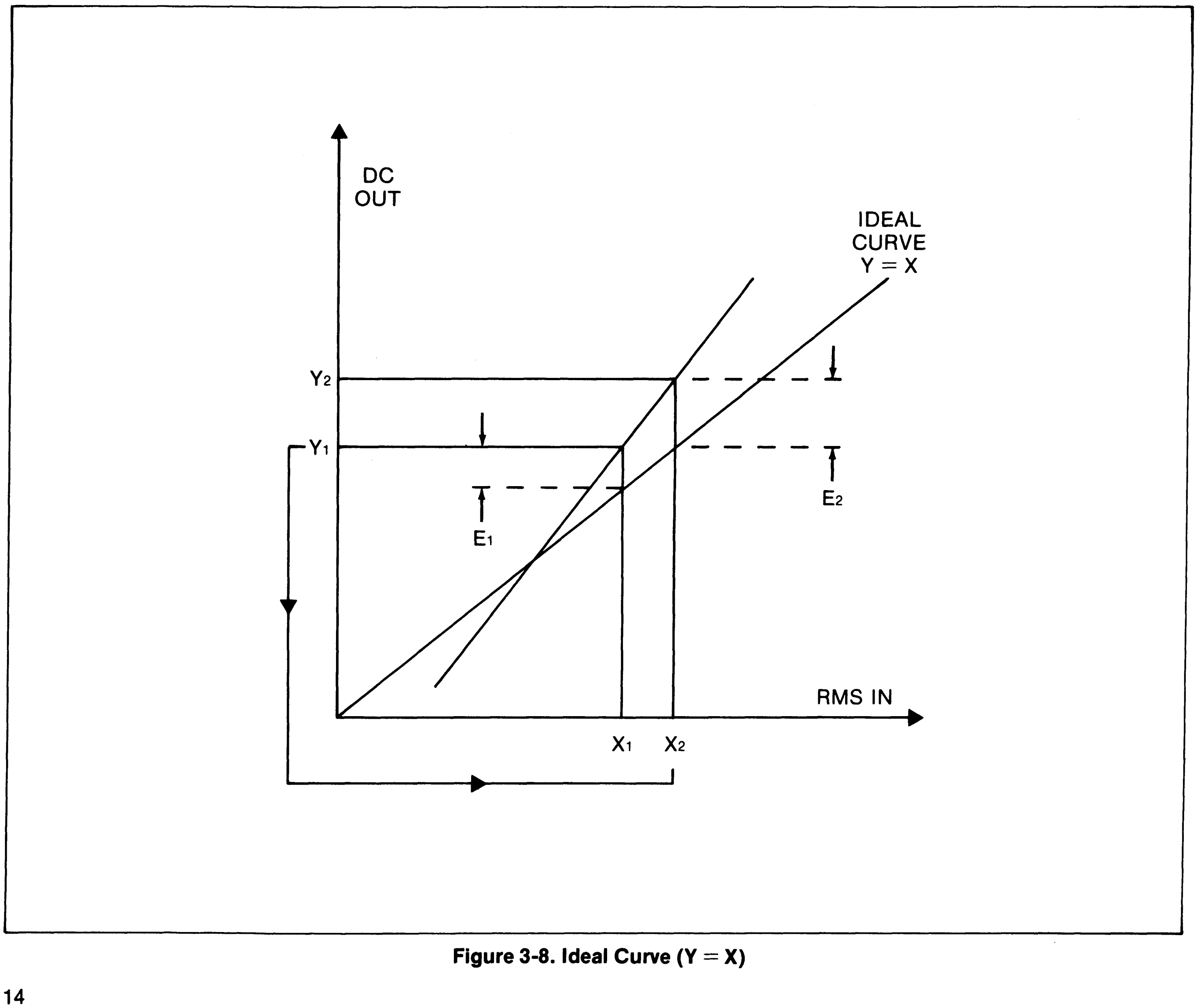


Figure 3-8. Ideal Curve (Y = X)

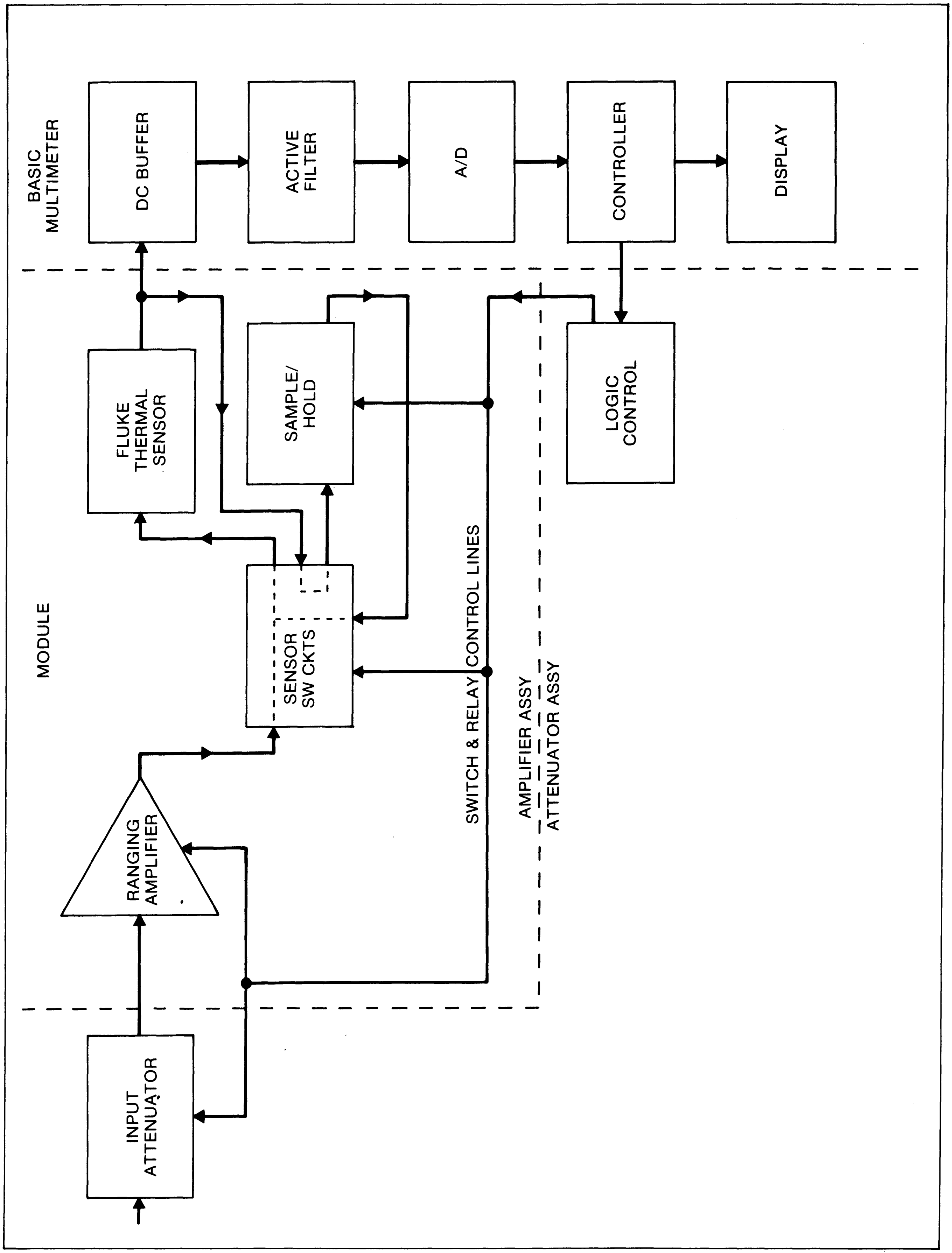


Figure 3-8b. Thermal True RMS Function Block Diagram

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 3-78:

3-79. Thermal True RMS Converter Module

3-80. The following description of the Thermal True RMS Converter module explains a full operating cycle of the high accuracy mode including both a sample mode and hold mode in succession. If the fast method is selected, the module performs only a partial sample mode and displays the uncorrected and unprocessed output of the Thermal Sensor Circuit, which is updated every 0.5 seconds. If the fast enhanced method is selected, one full cycle is performed and then the result of the fast method is compared with the first reading, processed, and displayed every 0.5 seconds. The fast enhanced method is accurate only when the input signal is constant within ≤1%, the temperature variation is less that 1 °C, and the time lapse since the initial reading is less than 1 hour.

3-81. The description of the Thermal True RMS Converter module is divided into four sections. The first explains the mode timing. The second covers the decoding of the logic to control the module operation. The third and fourth sections deal with the two basic modes of operation, the sample mode and the hold mode. Refer to the block diagram of the module in Figure 3-19 and the diagram of the module in the multimeter operation in Figure 3-8b as required during the explanation. In addition, the module includes a Ground Equalizer circuit that ensures that module ground is equal to Ref Common, which establishes reference zero for the A/D Converter.

NOTE
The Thermal True RMS Converter module blocks called out in the block diagram and mentioned in this description are also outlined on the Thermal True RMS Converter schematics for easy cross-reference.

3-82. MODE TIMING

3-83. A full accuracy measurement with the Thermal True RMS Converter module requires a full cycle of operation, i.e. one sample mode (3.5 seconds) and one hold mode (2.5 seconds). The instrument constantly cycles between the two modes; however, if the input is not present at the beginning of the cycle the accuracy of the measurement cannot be guaranteed. To ensure complete accuracy for the first reading, either trigger the instrument from the front panel or wait until the second reading is displayed (a maximum of 12 seconds).

3-84. The measurement takes a total of 6 seconds to complete. Three seconds are required for the thermal sensor to settle, and half a second is required for the dc measurement to be made. Then, while the multimeter processes the sensor output via the normal dc signal path, the stored sensor output is applied to the sensor which requires an additional 2 seconds to settle and another half second for the second dc measurement to be made.

3-85. LOGIC CONTROL

3-86. Controlling instructions enter the module on the IC and ID Bus lines from the controller module. The instructions may originate at the front panel or on the IEEE Bus from a remote source. Address lines IC0, IC1 and IC4 must be high for the module to be addressed. If the proper address is decoded in the Logic Gates/Latches, an ACK is returned to the bus and the data on the ID Bus is latched into flip-flops. The data is then decoded in the Logic Controls block and used to control gain, switches, relays and attenuators in the circuit. The data required on ID4 through ID7 to select the mode of operation (sample or hold), select the filter IN or OUT, select AC or AC + DC coupling, and to activate or deactivate the module is shown in Table 3-2. The data required on ID0 through ID3 to control the Attenuation, Gain, and Range selected is given in Table 3-3.

3-87. SAMPLE MODE

3-88. The unknown rms signal is applied to the Input Circuit where it is coupled to the Input Relays. Either AC (through a capacitor) or AC + DC (bypassing the capacitor) coupling is selected by the Logic Controls. One of the Input Relays is energized by the Logic Controls to route the signal to the Attenuator Circuits for attenuation by either 0.00167, 0.008, 0.08, or 0.8 according to the selected range. The attenuation brings the signal to within a 0.1- to 1-volt span before it is applied to the Ranging Amplifier. When the signal leaves the Attenuator PCB Assembly, it passes through a cable with a driven Guard en route to the Ranging Amplifier, which is on the Amplifier PCB Assembly.

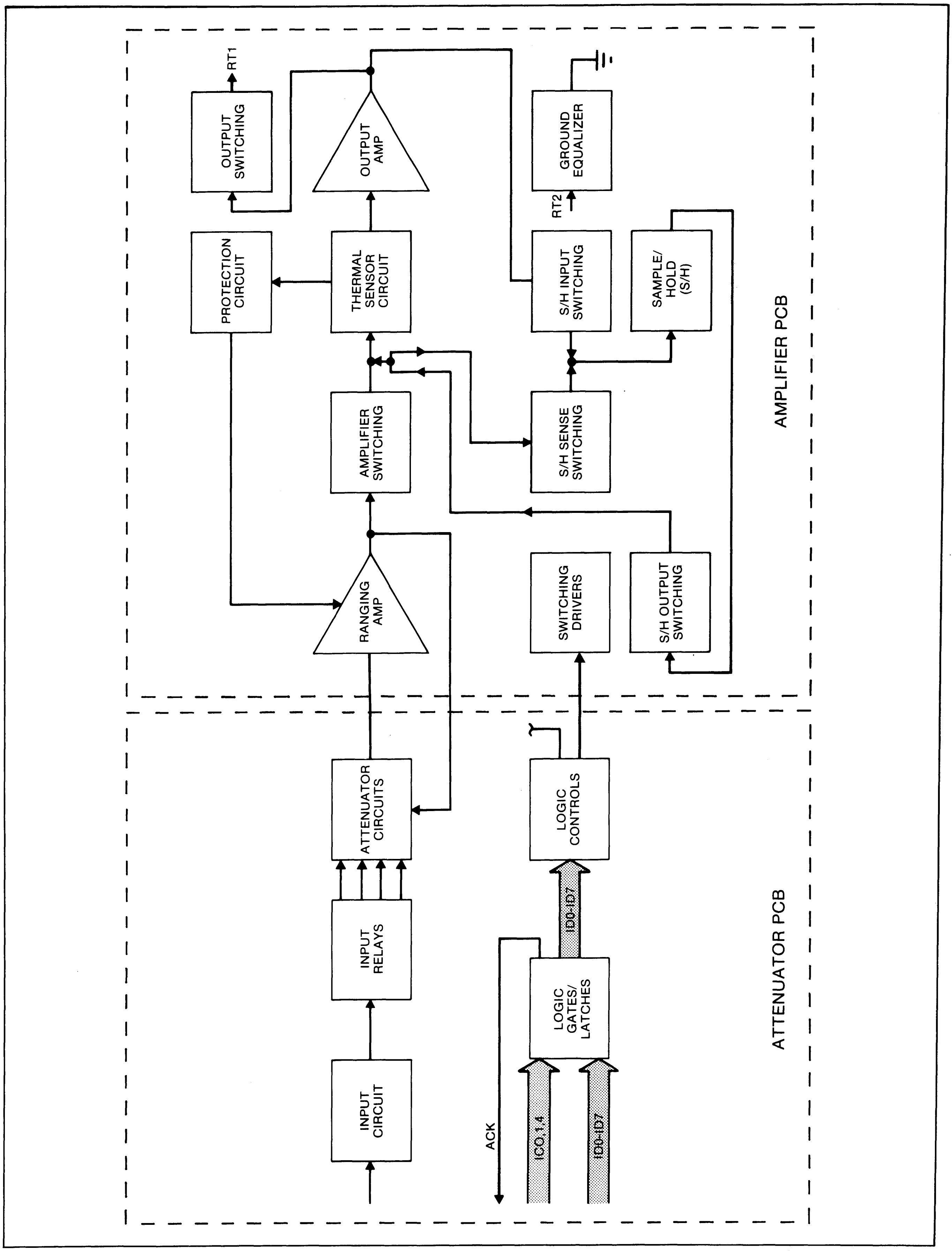


Figure 3-19. Thermal True RMS Function Block Diagram

Table 3-2. Module Commands Logic

ID4	ID5	ID6	ID7	SAMPLE/HOLD	FILTER	COUPLING	MODULE
L	L	L	L	HOLD	OUT	AC	ON
L	L	L	H	HOLD	OUT	AC	OFF
L	L	H	L	HOLD	OUT	AC + DC	ON
L	L	H	H	HOLD	OUT	AC + DC	OFF
L	H	L	L	HOLD	IN	AC	ON
L	H	L	H	HOLD	IN	AC	OFF
L	H	H	L	HOLD	IN	AC + DC	ON
L	H	H	H	HOLD	IN	AC + DC	OFF
H	L	L	L	SAMPLE	OUT	AC	ON
H	L	L	H	SAMPLE	OUT	AC	OFF
H	L	H	L	SAMPLE	OUT	AC + DC	ON
H	L	H	H	SAMPLE	OUT	AC + DC	OFF
H	H	L	L	SAMPLE	IN	AC	ON
H	H	L	H	SAMPLE	IN	AC	OFF
H	H	H	L	SAMPLE	IN	AC + DC	ON
H	H	H	H	SAMPLE	IN	AC + DC	OFF

Table 3-3. Decoded ID Bus Logic

ID0	ID1	ID2	ID3	ATTENUATOR (A_T)	GAIN (A_V)	RANGE
L	L	L	H	0.8	X20	100 mV
L	L	H	L	0.8	X6.25	300 mV
L	L	H	H	0.8	X2	1V
L	H	H	H	0.00167	X2	600V
H	L	H	L	0.008	X6.25	30V
H	L	H	H	0.008	X2	100V
H	H	H	L	0.08	X6.25	3V
H	H	H	H	0.08	X2	10V
NOTE: Logic High = -15 Vdc, Logic Low = -20 Vdc						

3-89. The gain of the Ranging Amplifier is either 2, 6.25, or 20, as determined by the ID Bus inputs to the Logic Controls. The Ranging Amplifier output is applied to the Amplifier Switching circuit and to the Attenuator Circuits on the Attenuator PCB Assembly through a coaxial cable as feedback for compensation at high frequencies. The Amplifier Switching circuit is enabled during the sample mode to allow the input rms signal to be applied to the Thermal Sensor Circuit.

3-90. The Thermal Sensor Circuit consists of a Fluke thermal sensor, a sensor amplifier, and a square root amplifier. Combined they produce a dc output that is equivalent to the rms signal input, plus the error of the sensor. Individually the thermal sensor senses the difference between the dc on the output and the ac on the input, the sensor amplifier provides feedback to bring the output dc to the value equal to the ac input, and the square root amplifier enhances transient response. The output is applied first to the Output Amplifier (X) and then the Output Switching circuit for routing, under software logic control, to the instrument main bus for action by the DC Signal Conditioner. The Protection Circuit monitors the temperature of the Thermal Sensor Circuit. If the internal temperature of the Fluke thermal sensor reaches approximately 100 °C, the Protection Circuit shuts off the Ranging Amplifier.

3-91. The signal from the Output Amplifier is also routed to the S/H Input Switching circuit for application to the sample/hold circuit. When the sample mode is in progress the S/H Input Switching is enabled while S/H Sense Switching and S/H Output Switching are disabled. The sample/hold circuit adds the offset of the internal amplifiers to the signal from the Output Amplifier and then multiplies the result by five and stores the resultant signal on a capacitor (C34). The offset is added to eliminate the effect of drift, temperature, and time changes. The signal is multiplied to reduce the effect of leakage current in the storage capacitor. The sample mode is complete when the signal is stored in the capacitor.

3-92. HOLD MODE

3-93. When the module goes into the hold mode the Amplifier Switching and S/H Input Switching circuits are disabled and the S/H Sense Switching and S/H Output Switching circuits are enabled. The unknown rms signal is still applied to the input circuits but it is blocked at the Amplifier Switching circuit from going into the Thermal Sensor Circuit. Instead, the value stored in the sample/hold circuit is withdrawn from the capacitor, divided by five, and the offset subtracted from the result of the division to return the stored value to the original magnitude. The result is then applied to the Thermal Sensor Circuit through the S/H Output Switching circuit. The signal from the sample/hold circuit is processed by the Thermal Sensor circuit in exactly the same manner as the unknown signal from Input circuit. The output is directed through the Output Amplifier and Output Switching circuits to the DC Signal Conditioner.

3-94. The hold mode result and the sample mode result are processed in the Controller Module to obtain the true rms value of the input signal. The result of the computation is then sent to the Front Panel for display until another cycle is performed.

3-95. Power Supply Interconnect

3-96. The Power Supply Interconnect Assembly provides the 8502A/AT The 400-Hz input line frequency capabiilty. It contains a frequency divider circuit to divide the input line frequency to a figure compatible with the timing requirements of the instrument.

NOTE
Refer to the Power Supply Interconnect schematic at the rear of this addendum during the following discussion.

3-97. The input line frequency is applied to the frequency divider from a 12-volt transformer tap on the Power Supply. ICs U1 and U2 are timers connected in series. They provide division and shaping to the input line frequency. 400-Hz inputs are divided by seven in U1 (eight if the input line frequency is greater than 420 Hz). R3 and C3 control the time at which the timer is allowed to fire so that either seven or eight transitions occur before the timer is allowed to fire again. The output of U1 is shaped in U2 for a square wave and output to he Controller as RT5 for interrupt timing.

Section 4
Maintenance

ADD STEP 6 TO PARAGRAPH 4-12:

6. Remove the Thermal True RMS Converter module twinax cable from the connector near the rear of the front panel terminals before removing the module from the instrument.

CHANGE PARAGRAPHS 4-20 AND 4-21 AS FOLLOWS:

Change all references to the Power Supply Interconnect PCB to the Power Supply Interconnect Assembly (pcb to assy).

REPLACE PARAGRAPHS 4-31 THROUGH 4-35 AND TABLE 4-2 WITH THE FOLLOWING:

4-31. DC Performance Test

4-32. LOW RANGE DC VOLTAGE TESTS

4-33. Perform the Low Range tests as follows:

1. Connect the equipment shown with solid lines in Figure 4-1. Do not connect the 8502A/AT at this time.
2. Verify that the test equipment is operating properly and the respective warm-up periods, as stated in the applicable manuals, are completed.

3. Verify that the 8502A/AT warm-up period of 2 hours has elapsed. Ensure that the VDC and AUTO indicators are illuminated, the SAMPLE indicator flashes approximately eight times per second (32 samples per reading), and all other indicators are extinguished.

4. Set the Voltage Divider controls for one-tenth the standard cell certified value. Adjust the DC Voltage Standard output for a null on the null meter.

5. Disconnect the leads at the Voltage Divider output terminals and connect the 8502A/AT as shown with the broken lines in Figure 4-1.

6. Perform the test listed in Table 4-2, setting the Voltage Divider to the listed outputs. Do not change the output setting of the DC Voltage Standard. After voltage has been applied to the 8502A/AT but prior to the first reading, toggle the instrument into manual ranging.

7. Reverse the leads at the 335A output terminals (the lead previously connected to the HI terminal should now be connected to the LO terminal and vice versa) and repeat the test listed in Table 4-2, ensuring that the listed outputs are now negative.

4-34. HIGH RANGE DC VOLTAGE TEST

4-35. Perform the High Range Test as follows:

1. Connect the equipment as shown in Figure 4-2.

2. Verify that the test equipment is operating properly and any required warm-up period is complete.

3. Verify that the 8502A/AT warm-up period of 2 hours is complete. Ensure that the VDC function is selected with the VDC indicator illuminated and that the instrument is in manual ranging in the 100-volt range. The SAMPLE indicator should be flashing approximately eight times per second (32 samples per reading) and all other indicators should be extinguished.

4. Set the Reference Divider Standard Cell controls to the certified value of the standard cell. Set both the input and output controls to 10 volts.

5. Set the DC Voltage Standard to approximately 10 volts, then adjust its output for a null reading on the null meter.

6. The 8502A/AT display should read between +9.999 and +10.001.

7. Set the Reference Divider input and output controls to 100 volts.

8. Set the DC Voltage Standard to approximately 100 volts, then adjust its output for a null reading on the null meter.

9. The 8502A/AT display should read between +99.996 and +100.004.

10. Increment the 8502A/AT range manually to 1000 volts.

Table 4-2. Low Range DC Voltage Tests

RANGE	DIVIDER SETTING	8502A/AT READING	
		LOW	HIGH
100 mV	.0010000	+ 9.994 (-3)	+ 10.006 (-3)
100 mV	.0100000	+99.990 (-3)	+100.010 (-3)
1V	.0100000	+ 0.09999	+ 0.10001
1V	.1000000	+ 0.99996	+ 1.00004
10V	.1000000	+ 0.9999	+ 1.0001
10V	1.0000000	9.9998	+ 10.0002

11. The 8502A/AT display should read between +99.99 and +100.01.

12. Set the Reference Divider input and output controls to 1000 volts.

13. St the DC Voltage Standard to approximately 1000 volts, then adjust its output for a null reading on the null meter.

14. The 8502A/AT display should read between +999.96 and +1000.04.

15. Set the DC Voltage Standard to standby.

16. Reverse the leads at the DC Voltage Standard and standard cell terminals (lead previously HI to LO and vice versa).

17. Set the DC Voltage Standard to operate and repeat steps 4 through 15, ensuring that the listed outputs are now negative.

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 4-39:

4-39a. Thermal True RMS Tests

4-39b. A characterized 5200A AC Standard and either a characterized 5205A or 5215A Power Amplifier combination are required to complete a Performance Test or Calibration Procedure of the Thermal True RMS Converter at the accuracies specified. Table 4-3a shows the voltage, voltage range, and frequency points at which the 5200A/5205A (5215A) combination must be characterized, and the required accuracy of characterization.

NOTE
If your facility does not have the characterizing capability required, the test can be performed at any standard lab which has traceability to the NBS.

4-39c. Before starting the Performance Test verify that the ambient temperature is 23 ±1° C, the relative humidity is +70%, and the instrument has completed the warm-up period of 2 hours. Also, remember that when the frequency is changed during the test, the characterized voltage also changes and will need to be readjusted to conform to the new frequency.

4-39d. Perform the test with the high accuracy mode selected. If the voltage or frequency output of the source is changed, allow the source to settle before taking a reading for record. This can be accomplished by waiting for the first update of the 8502A/AT display.

4-39e. Connect the 5200A to the 8502A/AT input terminals as shown in Figure 4-3a. Check the voltage/frequency combinations in Tables 4-3b and 4-3c for the stated tolerances.

NOTE
Select the FILTER ON position with the FILTER indicator illuminated when testing with a 20-Hz input. Select the FILTER OFF position with the FILTER indicator extinguished for all input frequencies above 40 Hz.

4-39f. Connect the 5200A to the 8502A/AT input terminals as shown in Figure 4-3b. Check the voltage/frequency combinations in Tables 4-3d through 4-3m for the stated tolerances.

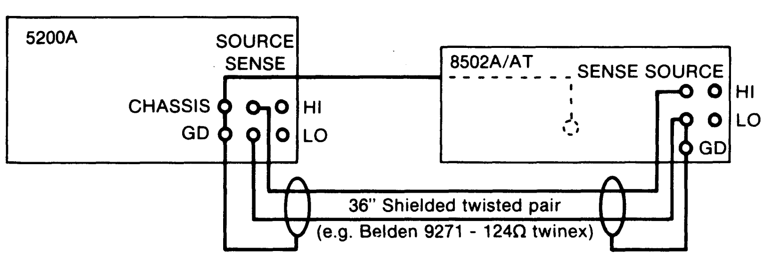
4-39g. Connect the 5200A/5205A (5215A) combination to the 8502A/AT input terminals as shown in Figure 4-3c. Check the voltage/frequency combinations in Table 4-3n for the stated tolerances.

Table 4-3a. Characterization Points (Voltage and Accuracy Requirement for Voltage Range and Frequency)

5200A VOLTAGE Range (V) \ 5200A FREQUENCY (Hz)	20	1k	10k	20k	50k	100k	200k	1M
100m	12.5 mV 0.06%	12.5 mV 0.03%		12.5 mV 0.04%	12.5 mV 0.05%			12.5 mV 0.5%
100m	110 mV 0.016%	110 mV* 0.009%		110 mV 0.01%	110 mV* 0.015%			110 mV 0.25%
1	400 mV 0.01%	400 mV* 0.005%		400 mV* 0.005%	400 mV 0.006%			400 mV 0.05%
1	1V 0.01%	1V* 0.005%		1V* 0.005%	1V 0.006%			1V 0.05%
10	4V 0.01%	4V* 0.005%		4V 0.005%	4V* 0.006%			4V* 0.05%
10	10V 0.01%	10V* 0.005%		10V 0.005%	10V* 0.006%			10V* 0.03%
100	40V 0.01%	40V 0.005%		40V 0.005%	40V 0.006%		40V 0.03%	
100	100V 0.01%	100V* 0.005%		100V 0.005%	100V* 0.006%	100V 0.01%		
1000	600V 0.01%	600V 0.005%	600V 0.005%					

All accuracy tolerances are plus or minus (±)

*Characterized points also used in the Calibration Procedure



5200A SELECT:
VOLTAGE: Per procedure
VOLTAGE RANGE: Per procedure
FREQUENCY: Per procedure
SENSE: Internal (Straps removed)
PHASE LOCK: Off
INPUT POWER: Connect to same source as the 8502A/AT, not through the 5205A
CONNECTIONS: All other instrument or IEEE cable connections must be removed

8502A/AT SELECT:
VOLTAGE RANGE: 100 mV
SENSE: Straps removed
MODE: Per procedure
INPUT POWER: Connect to same source as the 5200A
CONNECTIONS: All other instrument or IEEE cable connections must be removed

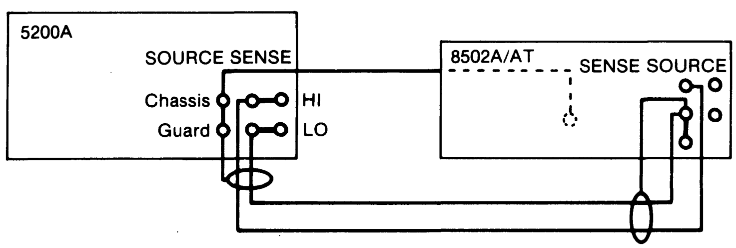
Figure 4-3a. 100mV Range Connections

Table 4-3b. 12.5 mV Tests

FREQUENCY (Hz)	RANGE: 100 mV		
	MINIMUM	NOMINAL	MAXIMUM
20	12.485 (-3)	12.500 (-3)	12.515 (-3)
1k	12.494 (-3)	12.500 (-3)	12.506 (-3)
20k	12.494 (-3)	12.500 (-3)	12.506 (-3)
50k	12.486 (-3)	12.500 (-3)	12.514 (-3)
1M	12.062 (-3)	12.500 (-3)	12.938 (-3)

Table 4-3c. 110 mV Tests

FREQUENCY (Hz)	RANGE: 100 mV		
	MINIMUM	NOMINAL	MAXIMUM
20	109.923 (-3)	110.000 (-3)	110.077 (-3)
1k	109.972 (-3)	110.000 (-3)	110.028 (-3)
20k	109.972 (-3)	110.000 (-3)	110.028 (-3)
50k	109.934 (-3)	110.000 (-3)	110.066 (-3)
1M	106.150 (-3)	110.000 (-3)	113.850 (-3)



5200A SELECT:
VOLTAGE: Per Procedure
VOLTAGE RANGE: Per Procedure
FREQUENCY: Per Procedure
SENSE: External (straps installed)
PHASE LOCK: Off
INPUT POWER: Connect to same source as 8502A/AT, not through 5205A
CONNECTIONS: All other instrument or IEEE cable connectors must be removed

8502A/AT SELECT:
VOLTAGE RANGE: Per Procedure
SENSE: Straps removed
MODE: Per procedure
INPUT POWER: Connect to same source as 5200A
CONNECTIONS: All other instrument or IEEE cable connections must be removed

Figure 4-3b. 300mV-100V Range Connections

Table 4-3d. 400 mV on the 300 mV Range Tests

FREQUENCY (Hz)	RANGE: 300 mV		
	MINIMUM	NOMINAL	MAXIMUM
20	399.800 (-3)	400.000 (-3)	400.200 (-3)
1k	399.940 (-3)	400.000 (-3)	400.060 (-3)
20k	399.940 (-3)	400.000 (-3)	400.060 (-3)
50k	399.760 (-3)	400.000 (-3)	400.240 (-3)
1M	394.000 (-3)	400.000 (-3)	406.000 (-3)

Table 4-3e. 400 mV on the 3V Range Tests

FREQUENCY (Hz)	RANGE: 3V		
	MINIMUM	NOMINAL	MAXIMUM
20	.39952	.40000	.40048
1k	.39980	.40000	.40020
20k	.39980	.40000	.40020
50k	.39956	.40000	.40044
1M	.39400	.40000	.40600

Table 4-3f. 1V on the 1V Range Tests

FREQUENCY (Hz)	RANGE: 1V		
	MINIMUM	NOMINAL	MAXIMUM
20	. 99950	1.00000	1.00050
1k	.99985	1.00000	1.00015
20k	.99985	1.00000	1.00015
50k	.99940	1.00000	1.00060
1M	.98500	1.00000	1.01500

Table 4-3g. 4V on the 3V Range Tests

FREQUENCY (Hz)	RANGE: 3V		
	MINIMUM	NOMINAL	MAXIMUM
20	3.99800	4.00000	4.00200
1k	3.99940	4.00000	4.00060
20k	3.99940	4.00000	4.00060
50k	3.99760	4.00000	4.00240
1M	3.94000	4.00000	4.06000

Table 4-3h. 4V on the 30V Range Tests

FREQUENCY (Hz)	RANGE: 30V		
	MINIUM	NOMINAL	MAXIMUM
20	3.9952	4.0000	4.0048
1k	3.9980	4.0000	4.0020
20k	3.9980	4.0000	4.0020
50k	3.9956	4.0000	4.0044
1M	3.9400	4.0000	4.0600

Table 4-3i. 10V on the 10V Range Tests

FREQUENCY (Hz)	RANGE: 30V		
	MINIMUM	NOMINAL	MAXIMUM
20	9.9950	10.0000	10.0050
1k	9.9985	10.0000	10.0015
20k	9.9985	10.0000	10.0015
50k	9.9940	10.0000	10.0060
1M	9.8500	10.0000	10.1500

Table 4-3j. 40V on the 30V Range Tests

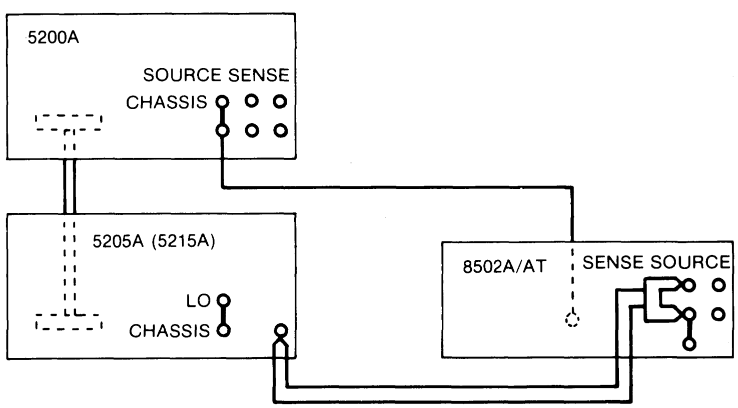
FREQUENCY (Hz)	RANGE: 30V		
	MINIMUM	NOMINAL	MAXIMUM
20	39.9800	40.0000	40.0200
1k	39.9940	40.0000	40.0060
20k	39.9940	40.0000	40.0060
50k	39.9760	40.0000	40.0240
200k	39.8000	40.0000	40.2000

Table 4-3k. 100V on the 100V Range Tests

FREQUENCY (Hz)	RANGE: 100V		
	MINIMUM	NOMINAL	MAXIMUM
20	99.950	100.000	100.050
1k	99.985	100.000	100.015
20k	99.985	100.000	100.015
50k	99.940	100.000	100.060
100k	99.800	100.000	100.200

Table 4-3m. 100V on the 500V Range Tests

FREQUENCY (Hz)	RANGE: 500V		
	MINIMUM	NOMINAL	MAXIMUM
20	99.880	100.000	100.120
1k	99.950	100.000	100.050
20k	99.950	100.000	100.050
50k	99.890	100.000	100.110
100k	99.750	100.000	100.250



5200A/5205A (5215A) SELECT:
VOLTAGE: Per Procedure
VOLTAGE RANGE: 1000V
FREQUENCY: Per Procedure
SENSE: Internal (straps removed)
PHASE LOCK: Off
INPUT POWER: Connect 5205A (5215A) and 8502A/AT to same source. Connect 5200A through 5205A
CONNECTIONS: IEEE cable may be connected provided controller chassis is connected to 5200A chassis. All other instrument connections must be removed

8502A/AT SELECT:
VOLTAGE RANGE: Per Procedure
SENSE: Straps removed
MODE: Per Procedure
INPUT POWER: Connect to same source as 5205A
CONNECTIONS: IEEE cable may be connected provided controller chassis is connected to 5200A chassis. All other instrument connections must be removed.

Figure 4-3c. 1000V Range Connections

Table 4-3n. 600V on the 500V Range Tests

FREQUENCY (Hz)	RANGE: 500V		
	MINIMUM	NOMINAL	MAXIMUM
20	599.700	600.000	600.320
1k	599.910	600.000	600.090
10k	599.910	600.000	600.090

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 4-68:

4-68a. Thermal True RMS Converter Adjustments

4-68b. EQUIPMENT PREPARATION

4-68c. A characterized 5200A AC Standard and either a characterized 5205A or 5215A Power Amplifier combination are required to complete a Calibration Procedure of the Thermal True RMS Converter at the specified accuracies. Table 4-3a shows the voltage, voltage range, and frequency points at which the 5200A/5205A (5215A) combination must be characterized, and the required accuracy of the characterization.

NOTE
If your facility does not have the characterizing capability required, the test can be performed at any standard lab which has traceability to the NBS.

4-68d. Before starting the Calibration Procedure verify that the ambient temperature is 23±1°C, the relative humidity is <70%, and the instrument has completed the warm-up period of 2 hours. Remove the instrument top cover and open the Thermal True RMS Module cover to gain access to the module adjustments. Also, remember that when the frequency is changed during the test, the characterized voltage also changes and will need to be readjusted to conform to the new frequency.

4-68e. Perform the Calibration Procedure with the high accuracy mode and Cal Mode selected. When the voltage or frequency output of the source is changed, allow the source to settle before taking a reading for record. This can be accomplished by waiting for the first update of the 8502A/AT display. If an adjustment is required select the fast enhanced mode while making the adjustment, then return to the high accuracy mode to verify the reading before proceeding with the procedure.

4-68f. GROUND EQUALIZER ADJUSTMENT

4-68g. Perform the Ground Equalizer Adjustment using the following procedure:

1. Select the DC Volts function, 100 mV range.

2. Connect the HI input terminal to the metal bar in the center of the Thermal True RMS Converter Module Case. Leave the LO input terminal open.

3. Adjust R50 (Ampl PCB) for a display reading of 0 ±2 uV dc.

4-68h. AMPLIFIER ZERO ADJUSTMENT

1. Select the AC + DC Volts function, fast mode, 500V range.

2. Connect a test DVM LO lead to the metal standoff connecting the amplifier and attenuator board.

3. Connect a test DVM HI lead to TP3 (the left side of R70) through a 10-kilohm resistor. If TP3 is not accessible the lead may be placed on the metal adjustment portion of C12.

4. Adjust R15 for a reading on the test DVM of 0 ±2 uVdc.

4-68i. SENSOR ADJUSTMENT

4-68j. Perform the Sensor Adjustment using the following procedure:

1. Connect the characterized 5200A to the 8502A/AT input terminals as shown in Figure 4-3b.

2. Select the AC Function on the 8502A/AT.

3. Manually select the 1V Range on the 8502A/AT.

4. Select a 1.25V @ 1kHz output from the 5200A.

5. Adjust R35 (Ampl PCB) until the reading displayed in the fast mode is within ± .00065 of the reading obtained in the high accuracy mode.

6. Select a 0.125V @ 1 kHz output from the 5200A.

7. Adjust R26 (Ampl PCB) until the reading displayed in the fast mode is within ±.00013 of the reading obtained in the high accuracy mode.

8. Repeat steps 3 through 7 until no further adjustments are required.

4-68k. ATTENUATOR AND AMPLIFIER ADJUSTMENTS

4-68l. Perform the attenuator and amplifier adjustments using the following procedure:

1. Connect the characterized 5200A/AT input terminals as shown in Figure 4-3b.

2. Select the AC Function on the 8502A/AT.

3. Perform the tests and adjustments, if applicable, in steps 1 through 4 of Table 4-5a.

Table 4-5a. Amplifier and Attenuator Adjustments

STEP	8502A/AT RANGE	5200A/5205A		READING BETWEEN		ADJUSTMENT
		VOLTS	HERTZ	MINIMUM	MAXIMUM	
1	1V	1	1k	.99998	1.00002	R1 (Atten)
2	300 mV	400m	1k	399.994 (-3)	400.006 (-3)	R54 (Ampl)
3	3V	4	1k	3.99994	4.00006	R2 (Atten)
4	10V	10	1k	9.9998	10.0002	R52 (Ampl)
5	100V	100	1k	99.998	100.002	R3 (Atten)
6	600V	100	1k	99.998	100.002	R5 (Atten)
7	300 mV	400m	20k	399.994 (-3)	400.006 (-3)	C8 (Atten)
8	1V	1	20k	.99998	1.00002	C11 (Ampl)
9	3V	4	1M	See Fig. 4-4a	See Fig. 4-4a	See Fig. 4-4a
10	10V	10	1M	See Fig. 4-4a	See Fig. 4-4a	R13 (Atten)
11	10V	10	50k	9.9998	10.0002	C15 (Atten)
12	3V	4	50k	3.99994	4.00006	C12 (Ampl)
13	100V	10	1M	See Fig. 4-4b	See Fig. 4-4b	See Fig. 4-4b
14	30V	10	1M	See Fig. 4-4b	See Fig. 4-4b	R16 (Atten)
15	100V	100	50k	99.998	100.002	C20 (Atten)
16	600V	100	50k	99.996	100.004	C27 (Atten)
17	100 mV	110m	1k	109.997 (-3)	110.003 (-3)	R56 (Ampl)
18	100 mV	110m	50k	109.997 (-3)	110.003 (-3)	R72 (Ampl)

4. Repeat step 1 of Table 4-5a and verify that the displayed reading is within the stated tolerance. If an adjustment is required, perform the four steps until all four readings are within tolerance without any further adjustments.

5. Perform the tests and adjustments, if applicable, in steps 5 and 6 of Table 4-5a.

6. Perform the tests and adjustments, if applicable, in steps 7 and 8 of Table 4-5a. Repeat the tests until both steps are within tolerance without further adjustment.

7. Perform the tests and adjustments, if applicable, in steps 9 and 10 of Table 4-5a. Record the readings for both steps, then use the example shown in Figure 4-4a to compute the adjustment figure for step 10.

8. Perform the tests and adjustments, if applicable, in steps 11 and 12 of Table 4-5a. Repeat the tests until both steps are within tolerance without further adjustment.

9. Verify that the readings in steps 9 and 10 of Table 4-5a are still within the computed tolerance. Repeat steps 9 through 12 of Table 4-5a until all four steps are within tolerance without further adjustment.

10. Perform the tests and adjustments, if applicable, in steps 13 and 14 of Table 4-5a. Record the readings for both steps then use the example shown in Figure 4-4b to compute the adjustment figure for step 14.

11. Perform the tests and adjustments, if applicable, in steps 15 and 16 of Table 4-5a.

12. Connect the characterized 5200A to the 8502A/AT input terminals as shown in Figure 4-3a.

13. Perform the tests and adjustments, if applicable, in steps 17 and 18 of Table 4-5a.

Select the following functions on the instruments indicated:

Characterized 5200A output of 10V at 1 MHz
9502A/AT 10V range

Use the following formula to compute the reading R_{A_1} then adjust R13 for R_{A_1}.

$R_A = [10 + (R_1 * 0.5) - (R_2 * 1.25)] \pm 0.0150$

Where:

R_1 = Recorded reading at 10V, 1 MHz; 10V Range
R_2 = Recorded reading at 4V, 1 MHz; 3V Range

Figure 4-4a. 10V Range Adjustment Computation

Select the following functions on the instruments indicated:

Characterized 5200A output of 10V at 1 MHz
8502A/AT 30V range

Use the following formula to compute the reading R_{A_2} then adjust R16 for R_{A_2}.

$R_{A_2} = [10 + (R_3 * 0.5) - (R_4 * 0.5)] \pm 0.0150$

Where:

R_3 = Recorded reading at 10V, 1 MHz; 30V Range
R_4 = Recorded reading at 10V, 1 MHz; 100V Range

Figure 4-4b. 30V Range Adjustment Computation

ADD THE FOLLOWING PARAGRAPH AFTER PARAGRAPH 4-72:

4-72a. Troubleshooting of the Thermal True RMS Converter for fault isolation is contained in Tables 4-7, 4-8, 4-9, and 4-10. If a component is replaced during troubleshooting, it might be necessary to reselect one of the selected components, adjust one of the non-recurring adjustments, or use a specific procedure to replace the component. If there is any question, refer to the paragraphs covering these topics later in this section.

4-72b. If the troubleshooting requires opening the Thermal True RMS Converter module while power is applied to the instrument the module must be installed a special extender PCB. The extender is available from Fluke by ordering kit 8502A-7001K.

Table 4-7 Thermal True RMS Converter Module Troubleshooting

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Perform the DC Volts Performance Test		
2	Is the DC Volts Performance Test within the listed tolerances?	4	3
3	Troubleshoot the DC portion of the instrument using the procedure in Table 4-6. Repair as required then resume at step 1.		
4	Perform the Thermal True RMS Performance Test.		
5	Is the Thermal True RMS Performance Test within the listed tolerances?	45	6
6	Remove modules not required for Thermal True RMS option, i.e., the Ohms Converter, Calibration Memory, Isolator, and IEEE Interface, then repeat the Thermal True RMS Performance Test.		
7	Is the Thermal True RMS Performance Test now within the listed tolerances?	8	9
8	Replace the modules one at a time until the failed reading returns. Repair or replace the last module reinserted in the instrument then resume at step 4.		
9	Check the Supply voltages. Place the test DMM LO on AR (P11- 9/30). VA1 (P11-28) +14.25 to +15.75 Vdc VA2 (P11-8) -14.25 to -15.75 Vdc VA4 (P11-7) (Ampl PCB only) -29 to -32 Vdc Vcc (P11-12/33) (Atten PCB only) ≅-15 Vdc Vss (P11-11/31) ≅-20 Vdc Vcc (DMM HI) to Vss (DMM LO) +4.9 to +5.2 Vdc		
10	Are the supply voltages within the listed tolerances?	12	11
11	Check the power supply and instrument bus using the procedures previously given. Repair or replace as required then resume at step 4.		
12	Is the voltage between TP1 (DMM HI) and Input Low (DMM LO) equal to 0 $\pm$ 50 uV?	21	13
13	With the DMM LO on TP1 is the signal at U5-7 (Ampl) >5 Vdc and at U5-1 (Ampl) <-5 Vdc?	14	15

Table 4-7. Thermal True RMS Converter Module Troubleshooting (cont)

STEP NO.	ACTION	Go to the step number given for correct response: YES	NO
14	Check U13, Q32, Q33, and their associated components on the Amplifier PCB. Repair as required then resume at step 4.		
15	With the DMM LO on TP1 is the signal at U5-6 (Ampl) >-0.7 Vdc?	16	17
16	Check U5 and its associated components on the Amplifier PCB. Repair as required then resume at step 4.		
17	Remove and disconnect power from the 8502A/AT. Measure the resistance between TP1 and TP2 and between TP1 and TP5 of the Amplifier PCB using a test multimeter whose ohms function output is less than 5 mA.		
18	Is the resistance reading 294 ohms ±7% between TP1 and TP3, and 389 ohms ±8% between TP 1 and TP5?	19	20
19	Check in sequence the following items on the Amplifier PCB: a. Switching transistors Q26, Q12, Q14, Q16, and their associated components. b. Q28 and its associated components. c. Q19, Q18, Q31, and their associated components. d. Q10, Q8, and their associated components. (The gate voltages on Q8 and Q10 normally vary approximately 1V from off to on.) e. Amplifier U1 and its associated components. Repair as required then resume at step 4.		
20	Check the RMS Sensor using the procedure in Table 4-8. Repair or replace then resume at step 4.		
21	Does the fault occur only if the high accuracy and/or the fast enhanced modes are selected?	22	26
22	Connect a test DMM between TP8 (HI) and TP 1 (LO)on the Amplifier PCB, then apply a full scale voltage input to the 8502A/AT terminals. (Apply an input equal to the full scale reading rather than the range title of the defective range.)		
23	With the high accuracy mode selected, does the reading at TP8 remain stable(± 50 uV) after the initial settling period of approximately 0.5 second (the settling period repeats every 3 seconds).	24	25
24	Check the sensor adjustment portion of the Calibration Procedure. Adjust or repair as required then resume at step 4.		
25	Check U11, U12, Q19, Q18, Q31, and their associated components. Repair as required then resume at step 4.		
26	Select the AC + DC Volts function and Autorange. Apply a 1 Vdc signal to the 8502A/AT input terminals.		
27	With the instrument still in Autorange and the input unchanged, select the AC Volts function.		

Table 4-7. Thermal True RMS Converter Module Troubleshooting (cont)

STEP NO.	ACTION	Go to the step number given for correct response YES	NO
28	Is the instrument reading within the required tolerance with the AC + DC Volts function selected and approximately zero with the AC Volts function selected?	29	37
29	Check the following items in the sequence listed until the fault is located, repair as required, then resume at step 4. If the fault is not located in one of these areas, proceed to the next step in the table.		
	a. K2 and K3 on the Attenuator PCB for the proper switching action.		
	b. C1 through C4 on the Attenuator PCB.		
	c. U3 and its associated components on the Amplifier PCB.		
	d. Voltages at Q1-7 using the typical voltages in Table 4-9.		
	e. Attenuator circuits on the Attenuator PCB.		
30	Check the voltages present at TP5 against the typical voltages in Table 4-9.		
31	Are the readings at TP5 comparable to the typical voltages in the Table?	34	32
32	Check the voltages present at TP3 against the typical voltages in Table 4-9.		
33	Are the readings at TP3 comparable to the typical voltages in the Table?	17	19
34	Check the voltages present at TP6 against the typical voltages in Table 4-9.		
35	Are the readings at TP6 comparable to the typical voltages in the Table?	42	36
36	Check U9 and Q22 (for correct switching) on the Amplifier PCB. Repair as required then resume at step 4.		
37	Select the AC Volts function and Autorange. Apply a 1 Vac at 1 kHz signal to the 8502A/AT input terminals.		
38	Is the displayed reading approximately IV?	39	29
39	Are all of the RMS tests at frequencies of 20 kHz or less within tolerance?	41	40
40	Check the attenuator logic levels using the information in Table 4-10. Repair as required then resume at step 4.		
41	Are all of the RMS tests at frequencies greater than 20 kHz within tolerance?	45	42
42	Test the switching hybrids on the Attenuator PCB using the following tests (unless otherwise noted all test points are on the Attenuator PCB and TP1 is LO):		
	a. Apply a 12.5 mV ac input and take a reading in the high accuracy mode for AC and AC DC. The difference in the two readings should be less than 10 uV.		

Table 4-7. Thermal True RMS Converter Module Troubleshooting (cont)

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
	b. With the instrument in the fast mode and no input, the difference in the readings between TP3 and TP1 on the Amplifier PCB in the 1V range and the 500V range should be less than 400 uV.		
	c. U8-6 to TP1 reads +7±1V dc for all ranges.		
	d. U8-9 to TP 1 reads -7±1V dc for all ranges.		
	e. U8-1 to TP1 reads -0.7±0.4V dc for all rangs except 500V.		
	f. U7-1 to TP1 reads -3±1.8V dc for all ranges except 30V and 100V.		
	g. U6-1 to TP1 reads -8±1V dc for all ranges except 4V and 10V.		
	h. U5-1 to TP1 reads -8±1V dc for all ranges except 1V.		
43	Are the switching hybrids within the stated tolerances?	45	44
44	Replace any components indicated. If replacement does not cure the trouble, resume with the tests in step 29.		
45	Perform the Calibration Procedure and Performance Tests for the 8502A/AT.		
46	Does the 8502A/AT pass all tests?	47	2
47	Troubleshooting of the Thermal True RMS Converter is complete.		

Table 4-8 RMS Sensor Troubleshooting and Replacement

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Unsolder the suspect RMS Sensor (U6) from the Amplifier PCB using a grounded soldering iron.		
2	Remove R24 or R28, if either is installed, and replace the resistor in the circuit with a bus wire.		
3	Install the Attenuator PCB and the Amplifier PCB on the special Thermal True RMS Converter extender board in the open configuration. Insure the ground jumper on the back of the Amplifier PCB is installed.		
4	Apply power to the instrument and compare the voltages at Q1-7 for the 100 mV, 300 mV and 1V ranges against the typical voltages in Table 4-9.		
5	Are the readings comparable?	6	7
6	Check the following items in the sequence listed until the fault is located:		

Table 4-8. RMS Sensor Troubleshooting and Replacement (cont)

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
	a. K2 and K3 on the Attenuator PCB for the proper switching action.		
	b. C1 through C4 on the Attenuator PCB.		
	c. U3 and its asociated components on the Amplifier PCB.		
	d. Voltages at Q1-7 using the typical voltages in Table 4-9.		
	e. Attenuator circuits on the Attenuator PCB. Repair as required, then resume at step 4.		
7	Compare the voltages at TP3 on the Amplifier PCB for the 100 mV, 300 mV, and 1V ranges against the typical voltages in Table 4-9.		
8	Are the readings comparable?	10	9
9	Check in sequence the following items on the Amplifier PCB:		
	a. Switching transistors Q26, Q12, Q14, Q16, and their associated components.		
	b. Q28 and its associated components.		
	c. Q19, Q18, Q31, and their associated components.		
	d. Q10, Q8 and their associated components. (The gate voltages on Q8 and Q10 normally vary approximately 1V from off to on.)		
	e. Amplifier U1 and its associated components. Repair as required, then resume at step 7.		
10	Select the Thermal True RMS Function and fix the 8502A/AT in the 1V range. Apply +2 Vdc to the 8502A/AT input terminals.		
11	Does the test DMM connected between TP3 (HI) and TP1 (LO) read ‖+3.2V dc?	15	12
12	Connect a jumper from the cathode of CR1 to TP1.		
13	Does the test DMM connected between TP3 (HI) and TP1 (LO) now read <+2.5V dc?	15	14
14	Check U5, Q24, Q25, and their associated components on the Amplifier PCB. Repair as required, then resume at step 10.		
15	Apply -2V dc to the 8502A/AT input terminals.		
16	Does the test DMM connected between TP3 (HI) and TP1 (LO) read ‖3.2V dc?	20	17
17	Connect a jumper from the cathode of CR1 to TP1.		
18	Does the test DMM connected between TP 3 (HI) and TP1 (LO) now read <-2.5V dc?	20	19

Table 4-8. RMS Sensor Troubleshooting and Replacement (cont)

STEP NO.	ACTION	Go to the step number given for correct response: YES	NO
19	Check U5, Q24, Q25, and their associated components on the Amplifier PCB. Repair as required, then resume at step 15.		
20	Remove power from the instrument and replace the RMS Sensor.		
21	Perform the Sensor Adjustment portion of the Calibration Procedure.		
22	Can the Sensor Adjustment procedure be successfully completed?	27	23
23	Does R26 run out of adjustment in the clockwise direction?	24	25
24	Replace R24 on the Amplifier PCB with a 20-kilohm, 1% metal film resistor, then resume at step 21.		
25	Does R26 run out of adjustment in the counterclockwise direction?	26	21
26	Replace R28 on the Amplifier PCB with a 20-kilohm, 1%, metal film resistor, then resume at step 21.		
27	Remove the ground jumper on the back of the Amplifier PCB, then close and reinsert the module in the 8502A/AT.		
28	Perform the Calibration Procedure and Performance Test.		
29	Does the 8502A/AT Calibrate and pass the Performance Test?	31	30
30	Troubleshoot the instrument using the procedure in Table 4-7.		
31	Troubleshooting of the 8502A/AT is complete.		

Table 4-9. Thermal True RMS Converter Typical Test Voltages

INPUT	RANGE	Q1-7	TP3	TP4*	TP5	TP6	TP7	TP8
SHORT	ALL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1V	1V	0.80	1.60	6.40	1.60	1.60	1.60	1.60
1V	3V	0.08	0.50	0.63	0.50	0.50	0.50	0.50
100 mV	100 mV	0.08	1.60	6.40	1.60	1.60	1.60	1.60
100 mV	300 mV	0.08	0.50	0.63	0.50	0.50	0.50	0.50
1V	10V	0.08	0.16	0.06	0.16	0.16	0.16	0.16
10V	10V	0.80	1.60	6.40	1.60	1.60	1.60	1.60
10V	100V	0.08	0.16	0.06	0.16	0.16	0.16	0.16
100V	100V	0.80	1.60	6.40	1.60	1.60	1.60	1.60
100V	600V	0.16	0.33	0.28	0.33	0.33	0.33	0.33
600V	600V	1.00	2.00	10.00	2.00	2.00	2.00	2.00

All measurements are made on the Amplifier PCB with reference to TP1

*Value at TP4 $\cong 2.50 * (A_V * V_{IN} * A_T)^2$

(See Table 3-3 for A_V and A_T values)

Table 4-10. Thermal True RMS Converter Attenuator Logic Table

FUNCTION \ TEST POINT	J1–W	J1–K	J1–L	J1–M	J1–P	J1–S	J1–N	J1–O	U17–4	U17–3	U17–10	U17–11	U10–6	U10–3	U16–6
SAMPLE: F OUT	X	X	X	X	H	L	H	L	X	X	X	X	X	X	L
HOLD: F OUT	L	H	H	H	L	H	H	L	X	X	X	X	X	X	L
SAMPLE: F IN	X	X	X	X	H	L	L	L	X	X	X	X	X	X	L
HOLD: F IN	L	H	H	H	L	H	L	L	X	X	X	X	X	X	L
RANGE: 600V	L	L	H	H	X	X	X	L	L	H	H	H	X	X	L
RANGE: 100V	L	L	H	H	X	X	X	L	H	L	H	H	X	X	L
RANGE: 30V	H	H	L	H	X	X	X	L	H	L	H	H	X	X	L
RANGE: 10V	L	L	H	H	X	X	X	L	H	H	L	H	X	X	L
RANGE: 3V	H	H	L	H	X	X	X	L	H	H	L	H	X	X	L
RANGE: 1V	L	L	H	H	X	X	X	L	H	H	H	L	X	X	L
RANGE: 300mV	H	H	L	H	X	X	X	L	H	H	H	L	X	X	L
RANGE: 100mV	H	H	H	L	X	X	X	L	H	H	H	L	X	X	L
MODE: AC	X	X	X	X	X	X	X	X	X	X	X	X	H	L	L
MODE: AC + DC	X	X	X	X	X	X	X	X	X	X	X	X	L	H	L

X = Don't Care   H = Logic High = 1 = -15V   L = Logic Low = 0 = -20V

ADD THE FOLLOWING PARAGRAPHS AFTER PARAGRAPH 4-80:

4-81. THERMAL TRUE RMS CONVERTER

4-82. Thermal True RMS Amplifier Assembly

4-83. Variable resistor R34 in the Square Root Amplifier circuit controls the sensor circuit transient response. It is set at the factory and should not require any additional adjustment. If any components in the circuit are replaced during troubleshooting, adjust or verify the R34 setting as follows:

1. Manually select the AC + DC function and the 1V range.
2. Apply an input of 0.625V dc to the 8502A/AT input terminals.
3. Connect a test DVM between TP4 (HI) and TP1 (LO).
4. Adjust R34 for a test DVM reading of 2.5 ±0.03 Vdc.

4-84. Variable resistor R61 in the Sensor protect circuit controls the maximum voltage applied to the rms sensor. It is set at the factory and should not require any additional adjustment. If any components in the circuit are replaced during troubleshooting, the circuit can be adjusted or verified using the following procedure:

1. Adjust R61 fully clockwise (CW).
2. Manually select the AC + DC function and the 1V range.
3. Apply a 2V dc input to the 8502A/AT input terminals.
4. Connect a test DVM between TP6 (HI) and TP1 (LO).

5. Adjust R61 for a test DVM reading of 2.2 ±0.01 Vdc.

4-85. Variable resistor R78 in the Ranging Amplifier is the coarse adjustment for the zero adjustment R15. It is set at the factory and does not require calibration adjustment. However, if any components in the circuit are replaced during troubleshooting, or if R15 is at one extreme without bringing the circuit into tolerance, R78 can be adjusted using the following procedure:

1. Adjust R15 to the center of its adjustment range.

2. Connect a test DVM between TP3 (HI) through a 10-kilohm resistor and TP1 (LO).

3. Adjust R78 for a test DVM reading of 0 ±2 uV dc.

4. Perform the Thermal True Converter Adjustments to verify the calibration of the 8502A/AT.

4-86. Variable capacitor C8 compensates the ranging amplifier in the X20 setting and requires adjustment only if repair or replacement of components takes place in the ranging amplifier. Use the following procedure to adjust C8 if required.

1. Short the center wire of P2 to ground. The shell of the P2 connector is not at ground.

2. Select the 100 mV range on the 8502A/AT.

3. Connect an oscilloscope probe to TP3 with the ground clip at TP1. Select oscilloscope settings of 50 mV/div and 0.5 ms/div.

4. Adjust C8 for minimum noise on the scope display.

5. Select an oscilloscope sweep speed of 0.01 us/div.

6. Verify that the amplifier is stable, i.e., not oscillating.

7. If the amplifier is unstable, readjust C8 until the minimum noise is obtained without causing the amplifier to oscillate.

4-87. Variable capacitor C9 compensates the ranging amplifier in the X6.25 setting and requires adjustment only if repair or replacement of components takes place in the ranging amplifier. Use the following procedure to adjust C9 if required.

1. Short the center wire of P2 to ground. The shell of the P2 connector is not at ground.

2. Select the 300 mV range on the 8502A/AT.

3. Connect an oscilloscope probe to TP3 with the ground clip in TP1. Nominal scope settings are 50 mV/div and 0.01 us/div.

4. Adjust C9 for minimum capacitance, i.e., with the center adjustment screw all the way out.

5. Adjust C9 in toward maximum capacitor until the oscillations stop; however, go at least two full turns in, i.e. 720°.

4-88. Thermal True RMS Attenuator Assembly

4-89. Variable capacitor C13 in the X.08 attenuator circuit is the coarse adjustment for the 10V Ranges adjustment C15. It is set at the factory and does not require calibration adjustment. However, if any components in the circuit are replaced during troubleshooting, or if C15 is at one extreme without bringing the circuit into tolerance, C13 can be adjusted using the following procedure:

1. Adjust C15 to the center of its adjustment range.

2. Manually select the AC function and the 10V range.

3. Apply an input of 10V at 50 kHz to the 8502A/AT input terminals.

4. Adjust C13 for a 8502A/AT reading between 9.9850 and 10.0150V ac.

5. Perform the Thermal True RMS Converter Adjustments to verify the calibration of the 8502A/AT.

4-90. Factory Selected Component Replacement Procedures

4-91. The values of some components in the Thermal True RMS Converter are selected at the factory. These components do not normally need reselection unless there is a failure and subsequent replacement of some component in the circuit. For those cases the selection procedure is given in the following paragraphs.

4-92. AMPLIFIER OFFSET SELECTION

4-93. If the Amplifier U1 or any of its associated components are replaced, there is the possibility that the Amplifier Offset Adjustment R78 will not be able to bring the reading within the accepted tolerance. If this occurs use the following procedure to reselect R2 or R5 so the R78 can adjust the amplifier offset.

1. Set R78 and R15 to approximately the mechanical center of their ranges.

2. Connect the test DMM between TP3 (HI) and TP1 (LO).

3. Insert resistor values from Table 4-11 in the R2 (DMM positive reading) position or in the R5 (DMM negative reading) position until the closest possible reading to zero is obtained.

4. Adjust R78 for a DMM reading of 0±2 uV.

4-94. RMS SENSOR GAIN SELECTION

4-95. If the RMS Sensor U6 or any of its associated components are replaced, there is the possibility that the RMS Sensor Gain Adjustment R26 will not be able to bring the reading within the accepted tolerance. If this occurs, use the following procedure to reselect R24 or R28 so tht R26 can adjust the RMS Sensor Gain.

1. Remove R24 or R28, if either is installed, and replace the resistor in the circuit with a bus wire.

2. Perform the Sensor Adjustment portion of the Calibration Procedure.

3. If the Sensor Adjustment procedure cannot be successfully completed, check the direction of rotation of R26. If R26 runs out of adjustment in the clockwise direction, replace the bus wire in the R24 position on the Amplifier PCB with a 20-kohm, 1%, metal film resistor. If R26 runs out of adjustment in the counterclockwise direction, replace the bus wire in the R28 position on the Amplifier PCB with a 20-kilohm, 1%, metal film resistor.

4. Perform the Sensor Adjustment portion of the Calibration Procedure if a resistor was inserted in either the R24 or R28 position.

4-96. LOW VOLTAGE 50-MHz CAPACITOR SELECTION

4-97. Capacitor C7 is selected depending upon the value of the components installed in C5 and C6. Use the following procedure to select the value of C7.

Table 4-11. Amplifier Offset Resistor Selection

332k	48.7k
169k	43.2k
115k	38.3k
86.6k	34.8k
68.1k	31.6k
57.6k	

1. On the Attenuator PCB, set the variable capacitor C9 for the minimum capacitance and the variable capacitors C20 and C27 for the maximum capacitance; insure that the C7 position is vacant.

2. Select the Thermal True RMS function, high accuracy mode, and the 1V Range on the 8502A/AT.

3. Apply a 1V, 50-MHz input to the 8502A/AT input terminals.

4. Select the column in the Table 4-12 that corresponds to the values of the components installed in the C5 and C6 positions. Find the reading in that column nearest the instrument reading and install in the C7 position the capacitance value for that line.

5. After C7 has been installed, take a new reading and verify that it is within the instrument tolerance for that voltage and frequency. If it is not, decrease the value of C7 to lower the voltage, or increase the value C7 to increase the voltage until the reading is within tolerance. If the reading is > 1.03640, install a 6.2 pF capacitor in the C6 position and repeat the test using the appropriate column.

6. Perform the Calibration Procedure and Performance Test to reset C9, C20, and C27.

4-98. HIGH VOLTAGE 50-MHz CAPACITOR SELECTION

4-99. Select the value of C18 on the Attenuator PCB using the following procedure:

1. Ensure that there is not any component installed in the C18 position.

2. Select the Thermal True RMS function, high accuracy mode, and the 500V Range on the 8502A/AT.

3. Apply a 100V, 50-MHz input to the 8502A/AT input terminals.

4. Compare the 8502A/AT displayed reading to the values in Table 4-13. Install the value of capacitor on the line including the displayed voltage.

5. Perform the Performance Test to verify that the 8502A/AT meets its specifications requirements.

4-100. Select the value of C25 on the Attenuator PCB using the following procedure:

1. Ensure that there is not any component installed in the C25 position.

2. Select the Thermal True RMS function, high accuracy mode, and the 500V Range on the 8502A/AT.

3. Apply a 100V, 50-MHz input to the 8502A/AT input terminals.

4. Compare the 8502A/AT displayed reading to the values in Table 4-14. Install the value of capacitor on the line including the displayed voltage.

5. Perform the Performance Test to verify that the 8502A/AT meets its specifications requirements.

4-101. Select the value of C26 on the Attenuator PCB using the following procedure.

1. Ensure that there is not any component installed in the C26 position.

2. Select the Thermal True RMS function, high accuracy mode, and the 600V Range on the 8502A/AT.

3. Apply a 100V, 50-MHz input to the 8502A/AT input terminals.

4. Compare the 8502A/AT displayed reading to the values in Table 4-15. Use the column of Table 4-15 that corresponds to the value selected for C25 and install in C26 the value of capacitor on the line including the voltage nearest to the displayed reading.

5. Perform the Performance Test to verify that the 8502A/AT meets its specifications requirements.

Table 4-12. C7 Selection Values

C7 (pF)	C5 = 36 pF C6 = OPEN	C5 = 27 pF C6 = OPEN	C5 = 27 pF C6 = 6.2 pF
0.0	< 1.00500	< 1.00600	< 1.00550
1.0	1.00500 to 1.00940	1.00600 to 1.01020	1.00550 to 1.00960
1.5	1.00941 to 1.01160	1.01021 to 1.01280	1.00961 to 1.01190
2.2	1.01161 to 1.01460	1.01281 to 1.01360	1.01191 to 1.01590
3.0	1.01461 to 1.01870	1.01361 to 1.02040	1.01591 to 1.01870
3.9	1.01871 to 1.02190	1.02041 to 1.02490	1.01871 to 1.02280
5.6	1.02191 to 1.02910	1.02491 to 1.03340	1.02281 to 1.03030
6.2	1.02911 to 1.03160	1.043341 to 1.03640	1.03031 to 1.03300

Table 4-13. C18 Selection Values

C18 VALUE	VOLTAGE READING
0 pF	< 100.15
15 pF	100.15 to 100.90
27 pF	100.91 to 101.58
39 pF	101.59 to 102.25
47 pF	102.26 to 102.80
56 pF	102.81 to 103.56
68 pF	103.57 to 104.52

Table 4-14. C25 Selection Values

C25 VALUE	VOLTAGE READING
0 pF	< 100.820
100 pF	100.821 to 100.990
150 pF	100.991 to 101.550
220 pF	101.551 to 102.400
270 pF	102.401 to 103.100
330 pF	103.101 to 104.030

Table 4-15. C26 Selection Values

C26	C25=0	C25=100	C25=150	C25=220	C25=270	C25=330
0	< 100.170	< 100.170	< 100.170	< 100.170	< 100.170	< 100.170
15	100.170 to 100.280	100.170 to 100.310	100.170 to 100.330	100.170 to 100.350	100.170 to 100.370	100.170 to 100.390
27	100.281 to 100.370	100.311 to 100.430	100.331 to 100.460	100.351 to 100.510	100.371 to 100.540	100.391 to 100.570
39	100.371 to 100.460	100.431 to 100.550	100.461 to 100.600	100.511 to 100.660	100.541 to 100.700	100.571 to 100.750
47	100.461 to 100.520	100.551 to 100.630	100.601 to 100.690	100.661 to 100.760	100.701 to 100.810	100.751 to 100.880
56	100.521 to 100.600	100.631 to 100.730	100.691 to 100.790	100.761 to 100.880	100.811 to 100.950	100.881 to 101.020
68	100.601 to 100.700	100.731 to 100.860	100.791 to 100.990	100.881 to 101.050	100.951 to 101.120	101.021 to 101.210
82	100.701 to 100.820	100.861 to 101.010	100.911 to 101.120	101.051 to 101.240	101.121 to 101.330	101.211 to 101.430
100	100.821 to 100.980	101.011 to 101.230	101.212 to 101.340	101.241 to 101.500	101.331 to 101.610	101.431 to 101.730

Section 5
List of Replaceable Parts

Replace Table 5-1 with the following:

Table 5-1. 8502A/AT Final Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
	FINAL ASSY, 8502A/AT FIGURE 5-1 (8502A/AT-5001/T&B)			ADDENDUM PARTS LIST			
A2	MOTHER BOARD PCB ASSY SEE TABLE 5-2 (8502A-4001T)	481713	89536	481713	1		2
A3	BUS INTERCONNECT PCB ASSY SEE TABLE 5-3 (MIS-4081)	459636	89536	459636	1		2
A4	POWER SUPPLY PCB ASSEMBLY SEE TABLE 5-5 (8500A-4051T)	ORDER	FOR	APPROPRIATE VOLTAGE	1		2
	POWER SUPPLY ASSY, 115/230V	608638	89536	608638	1		2
	POWER SUPPLY ASSY, 100V	618785	89536	618785			
A5	POWER SUPPLY INTERCONNECT	544544	89536	544544	1		1
	SEE FIGURE 5-6 (8502A/AT-4032T)	USE	/AT	ADDENDUM, TABLE 5-6			
A6⊗	CONTROLLER ASSY SEE TABLE 5-7 (8502A-4186T)	577072	89536	577072	1		2
A7⊗	FRONT PANEL ASSY SEE TABLE 5-11 (8502A-4023T)	481689	89536	481689	1		2
A8⊗	DC SIGNAL COND PCB ASSY SEE TABLE 5-12 (MIS-4100T)	383901	89536	383901	1		2
A9⊗	ACTIVE FILTER PCB ASSY SEE TABLE 5-13 (MIS-4130T)	383976	89536	383976	1		2
A10⊗	FAST R2 A/D CONVERTER PCB ASSEMBLY (MIS-4140T)	383984	89536	383984	1		2
A22⊗	OHMS CONVERTER ASSEMBLY (MIS-4110T)	383968	89536	383968	1		3
A24⊗	CALIBRATION MEMORY ASSEMBLY (8500A-4160T)	384016	89536	384016	1		3
A25⊗	IEEE INTERFACE ASSEMBLY (8500A-4172T)	384057	89536	384057	1		3
A28A⊗	ISOLATOR ASSEMBLY (8502A-4181T)	486415	89536	486415	1		3
A30⊗	THERMAL RMS CONVERTER ASSEMBLY	576983	89536	576983	1		3
	SEE FIGURE 5-18 (8502A-4125T)	USE	/AT	ADDENDUM, TABLE 5-18			1
E1	POST, BINDING, HEAD GRNDING	225615	20584	3575	1		
E2	POST, BINDING, GRNDING	225623	20584	3576	1		
H1	NUT, HEX, DOUBLE CHAMFER 1/4-28	110619	89536	110619	1		
H2	NUT, HEX, STOP	110841	89536	110841	1		
H3	SHORTING LINK	190728	83330	21171	3		
H4	SCREW, PHP, 6-32 X 1/2	152173	89536	152173	2		
H5	SCREW, CAP, LO HEAD SOCKET #8	295105	74445	8-32UNRC	4		
H6	SCREW, FHP, COUNTERSUNK	114116	73734	20264	8		
H7	SCREW, PHP, 4-40 X 1/4	129882	73734	19022	12		
H8	SCREW, FHP, 2-56 X 1/2	603696	89536	603696	2		
H9	SCREW, PHP, 8-32 X 5/8	293324	73734	23067	2		
H10	SCREW, PHP, SEMS, 6-32 X 1/2	177030	89536	177030	5		

Table 5-1. 8502A/AT Final Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
H11	NUT, HEX, 6-32	110551	89536	110551	2		
H12	WASHER, LOCK, #8	110320	73734	1305	2		
H13	WASHER, LOCK, 1/4	110817	89536	110817	1		
H14	WASHER, BELL	571968	89536	571968	2		
H15	PLASTIC RIVET	100941	89536	100941	4		
H16	SCREW, PHP, 8-32 X 5/8	114983	89536	114983	2		
H17	SCREW, PHP, 6-32 X 3/8	177022	89536	177022	8		
H18	WASHER, LOCK, #8	110320	89536	110320	2		
H19	SCREW, MACHINE	333930	89536	333930	16		
H20	SCREW, FHP, 6-32 X 1/4	320093	89536	320093	6		
KIT	RECOMMENDED SPARE PARTS KIT	633842	89536	633842	AR		
MP1	BRACKET	613588	89536	613588	1		
MP2	BEZEL, I/O	416206	89536	416206	1		
MP3	BRACKET, INNER, CHASSIS LEFT	496372	89536	496372	1		
MP4	BRACKET, INNER, CHASSIS RIGHT	496380	89536	496380	1		
MP5	BRACKET, CONNECTOR	612473	89536	612473	1		
MP6	BUTTON, PWR SWITCH	401646	89536	401646	1		
MP7	CHASSIS ASSEMBLY	481275	89536	481275	1		
MP8	CENTER SUPPORT ASSEMBLY	576637	89536	576637	1		
MP10	CORNER, FINISHED	394346	89536	394364	2		
MP11	CORNER, HANDLE	394304	89536	394304	2		
MP12	CONTACT STRIP	370619	30817	97-500-A	AR		
MP13	COVER, BOTTOM	522722	89536	522722	1		
MP14	CONNECTOR, HV	603712	91637	G16P-A	1		
MP15	CONNECTOR, INSULATOR	612481	89536	612481	1		
MP16	DECAL, FRONT PANEL OVERLAY	586602	89536	586602	1		
MP17	DECAL, TRIGGER	477786	89536	477786	1		
MP18	DECAL, FRONT PANEL	477588	89536	477588	1		
MP19	DECAL, SERIAL NO.	393975	89536	393975	1		
MP20	DECAL, REAR PANEL (OPTIONAL)	536037	89536	536037	1		
MP21	DECAL, FLUKE	604025	89536	604025	1		
MP22	DECAL, REAR OVERLAY	535997	89536	535997	1		
MP23	HOOD (USE WITH MP14)	603720	91637	G16H	1		
MP24	INSERT, FRONT PANEL	381871	89536	381871	1		
MP26	STANDOFF, INSULATED	494922	89536	494922	1		
MP27	LENS DISPLAY, SCREENED	485870	89536	485870	1		
MP28	TRIGGER, CABLE	486332	89536	486332	1		
MP29	EXTRUSION, PCB RETAINER	408476	89536	408476	1		
MP30	FOOT, REAR PANEL	307363	89536	307363	2		
MP31	COVER, TOP	522516	89536	522516	1		
MP32	REAR INPUT COVER PLATE	420679	89536	420679	1		
MP33	CASE ASSEMBLY	536243	89536	536243	1		
MP34	SPACER	158634	89536	158634	2		
S1	SWITCH, PLUG	437855	89536	437855	1		
TM1	MANUAL, INSTRUCTION, 8502A/AT	577049	89536	577049	AR		
W1	WIRE, BROWN	200758	89536	200758	1		
W2	WIRE, YELLOW, 26 GA X 2.5"	200725	89536	200725	1		
W3	CORD SET (NOT SHOWN)	284174	89536	284174	1		

1 THE FOLLOWING ASSEMBLIES ARE LISTED IN THIS ADDENDUM.
A5 - POWER SUPPLY INTERCONNECT
A30 - THERMAL RMS CONVERTER
MARKED WITH FOOTNOTE 1.

Table 5-1. 8502A/AT Final Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
2	SEE TABLE NUMBERS AS LISTED ABOVE IN SECTION 5 OF THE STANDARD 8502A MANUAL, MARKED WITH FOOTNOTE 2.						
3	SEE SECTION 6 OF THE STANDARD 8502A MANUAL FOR THE FOLLOWING ASSEMBLIES: A22, SEE OPTION -02 SECTION A24, SEE OPTION -04 SECTION A25, SEE OPTION -05 SECTION A28A, SEE OPTION -08A SECTION MARKED WITH FOOTNOTE 3.						

Replace Figure 5-1 with the following:

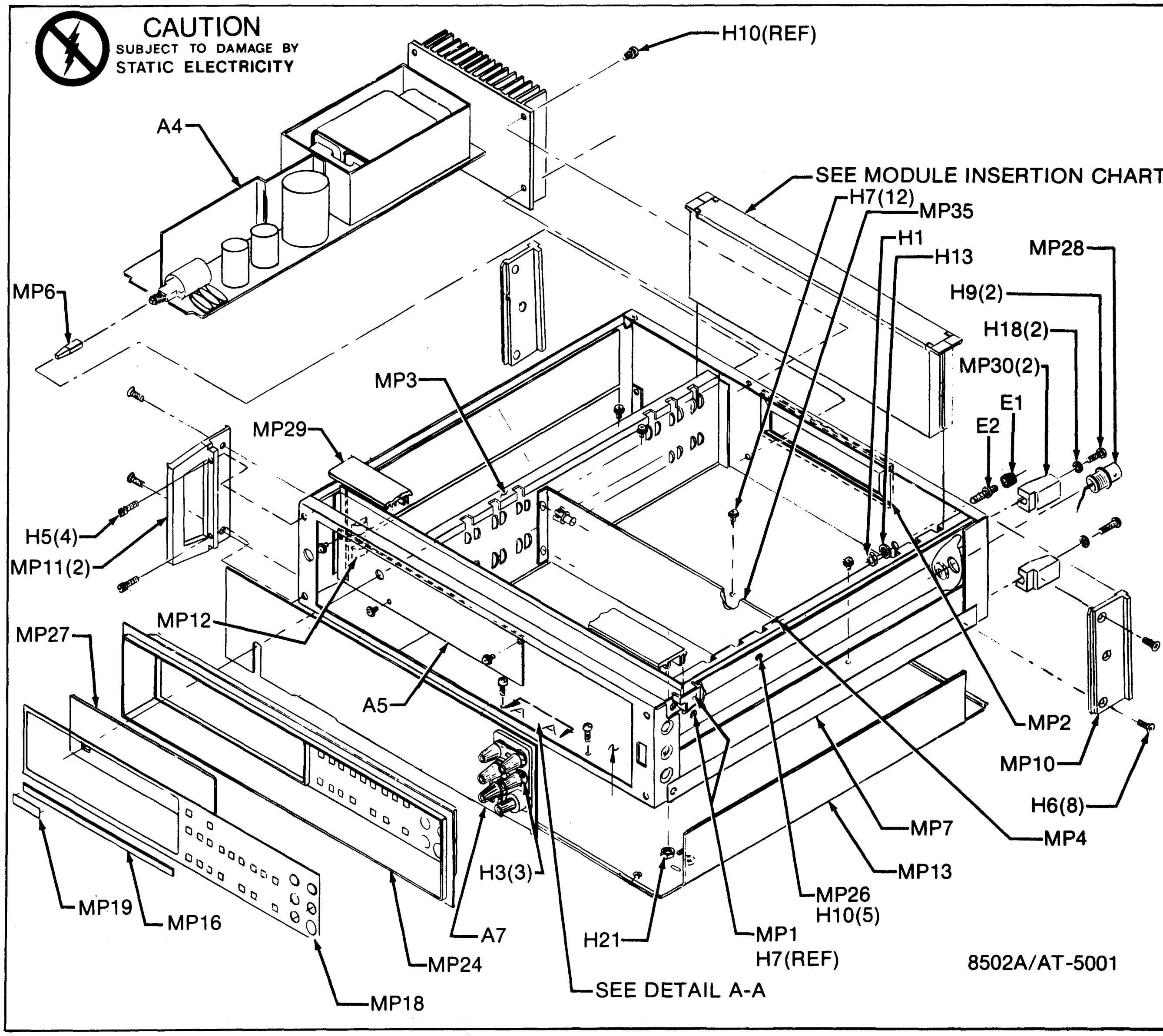


Figure 5-1. 8502A/AT Final Assembly

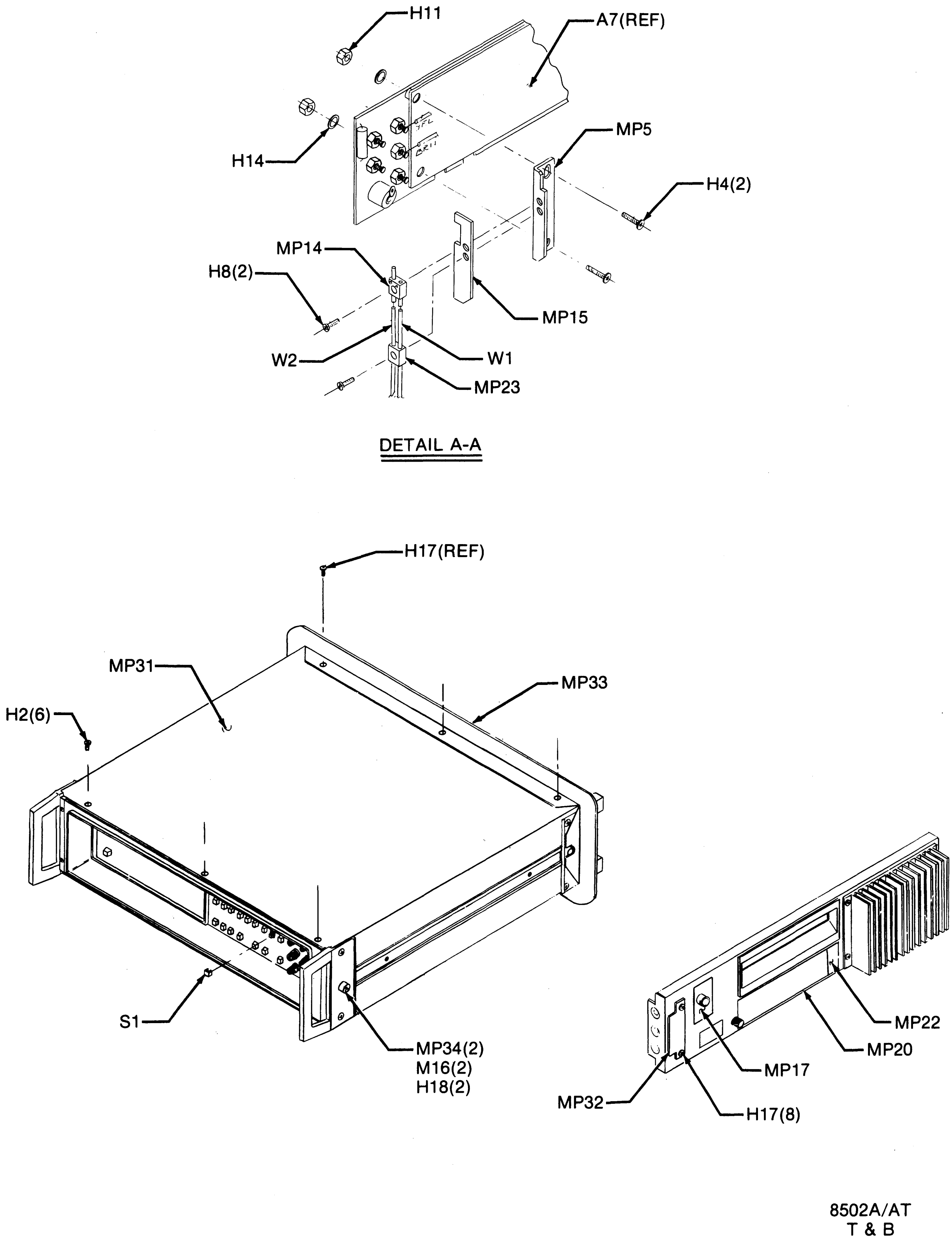


Figure 5-1. 8502A/AT Final Assembly (cont)

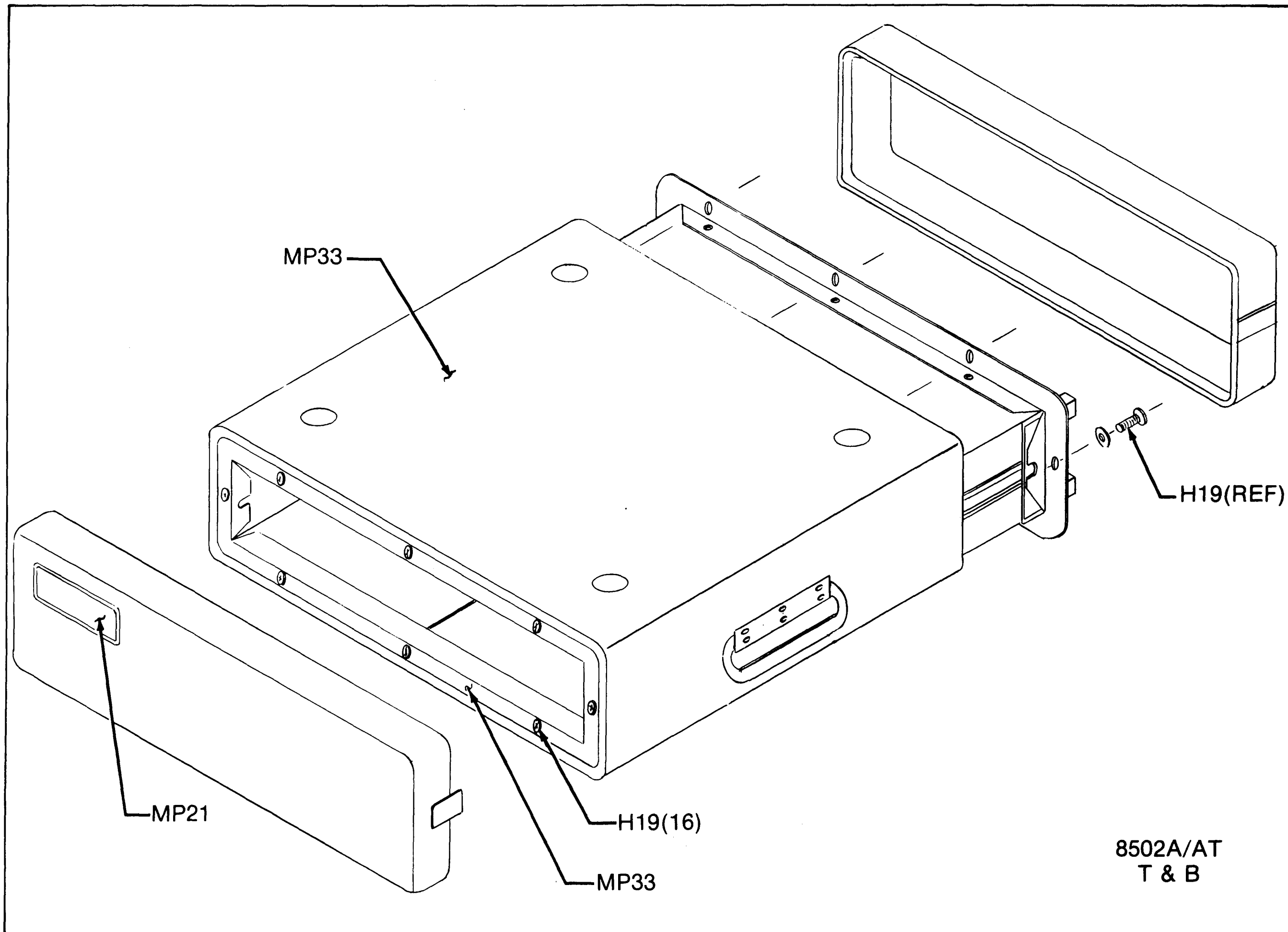


Figure 5-1. 8502A/AT Final Assembly (cont)

Replace Table 5-6 with the following:

Table 5-6. A5 Power Supply Interconnect Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A5	POWER SUPPLY 8502A/AT INTERCONNECT ASSY FIGURE 5-6 (8502A/AT-4032)	544544	89536	544544	REF		
C1	CAP, POLY, 0.01 UF +/-10%, 400V	402818	73445	C280MAF/A10K	2		
C2	CAP, POLY, 0.01 UF +/-10%, 400V	402818	73445	C280MAF/A10K	REF		
C3	CAP, POLY, 0.047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	2		
C4	CAP, POLY, 0.047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	REF		
CR1	DIODE, SI, HI-SPEED	203323	07910	IN4448	2		
CR2	DIODE, SI, HI-SPEED	203323	07910	IN4448	REF		
J1	CONNECTOR, BD EDGE, RECPT	352682	00779	583694-2	1		
J2	CONNECTOR, BD EDGE, RECPT	291625	00779	583650-1	1		
R1	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	1		
R2	RES, DEP. CAR, 330K +/-5%, 1/4W	376640	80031	CR251-4-5P330K	1		
R3	RES, MTL. FILM, 316K +/-1%, 1/8W	289496	91637	CMF553163F	1		
R4	RES, MTL. FILM, 154K +/-1%, 1/8W	289447	91637	CMF551543F	1		
U1	IC, LINEAR TIMER	402610	18324	LM555CN	2		
U2	IC, LINEAR TIMER	402610	18324	LM555CN	REF		

Replace Figure 5-6 with the following:

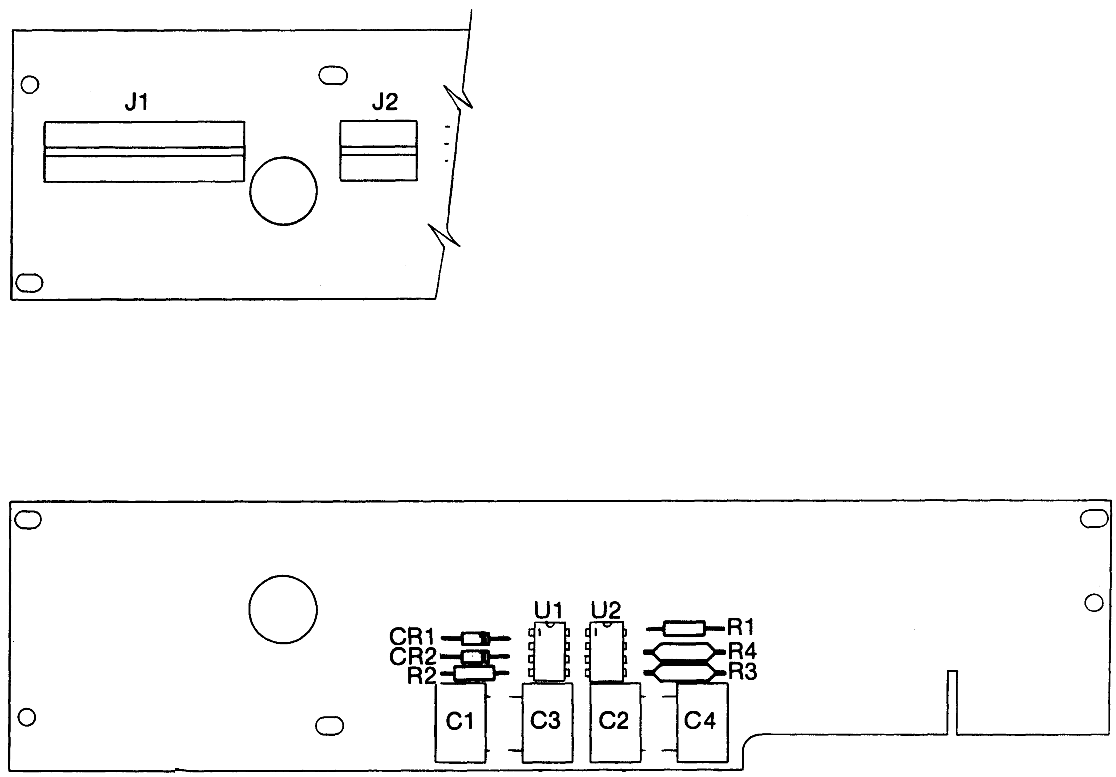


Figure 5-6. A5 Power Supply Interconnect Assembly

Add the following Tables and Figures:

Table 5-18. A30 Thermal True RMS Converter Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A30⊗	THERMAL RMS CONVERTER MODULE ASSEMBLY FIGURE 5-18(8502A-4125T)	576983	89536	576983			
A30A1⊗	ATTENTUATOR PCB ASSEMBLY (8502A-4024)				1		1
A30A2	AMPLIFIER PCB ASSEMBLY (8502A-4025)				1		1
H1	SCREW, PHP, 6-32 X 1/4	152140	89536	152140	3		
H2	SCREW, PHP, 6-32 X 1/2	115006	89536	115006	1		
H3	NUT, ALTERED	617944	89536	617944	1		
MP1	SHIELD, AMPLIFIER	613596	89536	613596	1		
MP2	CASE ASSEMBLY (8502A-4125-CASE)	576991	89536	576991	1		

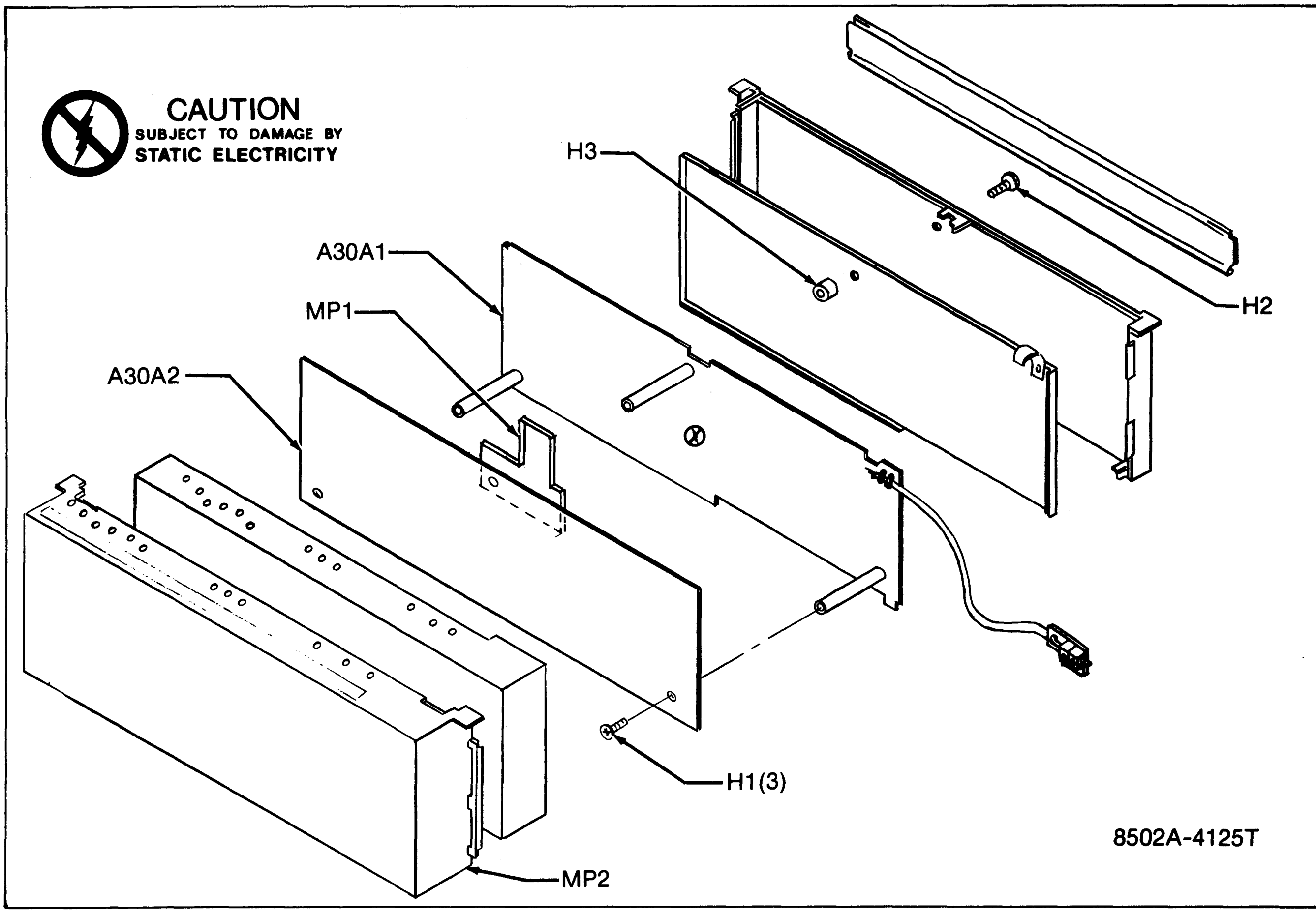


Figure 5-18. Thermal True RMS Converter Assembly

Table 5-19. A30A1 Attenuator PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A30A1⊗	ATTENUATOR PCB ASSEMBLY FIGURE 5-19 (8502A-4024)				REF		
C1	CAP, POLY, 0.22 UF +/-10%	275495	89536	275495	3		
C2	CAP, POLY, 0.22 UF +/-10%	275495	89536	275495	REF		
C3	CAP, POLY, 0.22 UF +/-10%	275495	89536	275495	REF		
C4	CAP, CER, 0.05 UF -20/+80%, 500V	105676	56289	33C58B	1		
C5	CAP, PORC, 36 PF +/-1%, 1000V	614891	95275	VY10CA360FA	1		
C6	SEE FOOTNOTES 1 & 2						
C7	SEE FOOTNOTES 1 & 2						
C8	CAP, VAR, 0.8-10 PF +/-15%, 250V	229930	91293	5201	2		2
C9	CAP, PORC, 3.9 PF +/-0.25 PF, 1000V	603597	95275	VY10CA3R9CE	1		
C10	CAP, PORC, 1.5 PF +/-0.25 PF, 1000V	603589	95275	VY10CA1R5CE	1		
C11	CAP, MICA, 330 PF +/-5%, 500V	148445	72136	DM15E331J	1		
C12	CAP, PORC, 2.2 PF +/-0.25 PF, 1000V	603936	95275	VY10CA2R2CE	1		
C13	CAP, VAR, 1.0-20.0 PF +/-30%, 250V	603449	91293	5501	3		2
C14	CAP, PORC, 1.0 PF +/-0.25 PF, 1000V	603571	95275	VY10CA1R0CE	1		
C15	CAP, VAR, 0.8-10 PF +/-15%, 250V	229930	91293	5201	REF		2
C16	CAP, PORC, 0.5 PF +/-0.25 PF, 1000V	603514	95275	VY10CA0R5CE	2		
C17	CAP, CER, 47 PF +/-2%, 100V	512368	89536	512368	1		

Table 5-19. A30A1 Attenuator PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
C18	SEE FOOTNOTES 1 & 2						
C19	SEE FOOTNOTES 1 & 2						
C20	CAP, VAR, 1.0-20.0 PF +/-30%, 250V	603449	91293	5501	REF		2
C21	CAP, PORC, 0.5 PF +/-0.25 PF, 1000V	603514	95275	VY10CA0R5CE	REF		
C22	CAP, CER, 0.001 UF +/-20%, 500V	402966	72982	8121-A100-W5R-102M	1		
C24	CAP, CER, 220 PF +/-5%, 100V	512111	89536	512111	1		
C25	SEE FOOTNOTES 1 & 2						
C26	SEE FOOTNOTES 1 & 2						
C27	CAP, VAR, 1.0-20.0 PF +/-30%, 250V	603449	91293	5501	REF		2
C28	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D394X0020KA1	1		
C29	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D226X0015KA1	2		
C30	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D226X0015KA1	REF		
C31	CAP, CER, 1.5 PF, 100V	529909	89536	529909	1		
C34	CAP, CER, 56 PF +/-2%, 100V	512970	89536	512970	1		
H1	SCREW, PHP, 4-40 X 3/8	256164	89536	256164	1		
H3	SCREW, SEMS, 6-32 X 3/8	177022	89536	177022	2		
J2	SOCKET, CONNECTOR	352450	98291	51-051-0000	2		
J3	SOCKET, CONNECTOR	352450	98291	51-051-0000	REF		
K1	RELAY, REED, 1 FORM A	603340	71707	CR5131	3		
K2	RELAY, DRY REED, HV SWITCH	441949	71707	UF40094	4		
K3	RELAY, REED, 1 FORM A	603340	71707	CR5131	REF		
K4	RELAY, REED, 1 FORM A	603340	71707	CR5131	REF		
K5	RELAY, DRY REED, HV SWITCH	441949	71707	UF40094	REF		
K6	RELAY, DRY REED, HV SWITCH	441949	71707	UF40094	REF		
K7	RELAY, DRY REED, HV SWITCH	441949	71707	UF40094	REF		
MP1	SHIELD, CAPACITOR	576371	89536	576371	1		
MP2	TIE POINT	172080	06383	SST-1M	2		
MP3	SPRING COIL	424465	89536	424465	1		
MP4	SHIELD, PCB	576942	89536	576942	1		
MP5	POST, CONNECTOR	267500	89536	267500	10		
P1	RIBBON CABLE, 10 CONDUCTOR	603886	89536	603886	1		
Q1	TRANSISTOR, SI, PNP	226290	04713	MPS3640	1		
R1	RES, VAR, 5K +/-20%, 1/2W	267872	11236	190PC502B	1		
R2	RES, VAR, 100 +/-20%, 1/2W	267823	11236	190PC101B	1		
R3	RES, VAR, 1K +/-20%, 1/2W	267856	11236	190PC102B	1		
R4	RES, MTL. FILM, 237K +/-1%, 1/8W	288373	91637	CMF552373F	1		
R5	RES, VAR, 50K +/-10%, 1/2W	330688	75378	190PC503B	1		
R6	RES, DEP. CAR, 47K +/-5%, 1/4W	348896	80031	CR251-4-5P47K	1		
R7	RES, DEP. CAR, 150 +/-5%, 1/4W	343442	80031	CR251-4-5P150E	1		
R8	RES, DEP. CAR, 1.5K +/-5%, 1/4W	343418	80031	CR251-4-5P1K5	2		
R9	RES, DEP. CAR, 1.5K +/-5%, 1/4W	343418	80031	CR251-4-5P1K5	REF		
R10	RES, MTL. FILM, 2.55K +/-1%, 1/8W	325498	91637	CMF552551F	1		
R11	RES, MTL. FILM, 49.9 +/-1%, 1/8W	305896	91637	CMF5549R9F	1		
R12	RES, DEP. CAR, 620 +/-5%, 1/4W	442319	80031	CR251-4-5P620E	1		
R13	RES, VAR, 5K +/-10%	288282	75378	360T052A2	1		
R14	RES, MTL. FILM, 100 +/-1%, 1/8W	168195	91637	CMF551000F	1		
R15	RES, MTL. FILM, 25.5K +/-1%, 1/8W	291377	91637	CMF552552F	1		
R16	RES, VAR, 200 +/-10%	285148	75378	360T200AZ	1		
R17	RES, MTL. FILM, 11 +/-1%, 1/8W	441204	91637	CMF5511R0F	1		
U1	RESISTOR NETWORK, 0.8 ATTEN	540641	89536	540641	1		
U2	RESISTOR NETWORK, 0.08 ATTEN	576025	89536	576025	1		
U3	RESISTOR NETWORK, 0.008 ATTEN	540799	89536	540799	1		

Table 5-19. A30A1 Attenuator PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
U4	RESISTOR NETWORK, 0.0017 ATTEN	546796	89536	546796	1		
U5	IC, HYBRID, SWITCHING NET	544361	89536	544361	4		
U6	IC, HYBRID, SWITCHING NET	544361	89536	544361	REF		
U7	IC, HYBRID, SWITCHING NET	544361	89536	544361	REF		
U8	IC, HYBRID, SWITCHING NET	544361	89536	544361	REF		
U10	IC, DUAL NAND DRIVER	604108	56289	UDN5712N	4		
U11	IC, DUAL NAND DRIVER	604108	56289	UDN5712N	REF		
U12⊗	IC, C-MOS, NAND GATES, TRIPLE, 3-INPUT	375147	02735	CD4023UBE	1	1	
U13⊗	IC, C-MOS, QUAD CLOCK, D-LATCH	355149	02739	CD4042AE	2	1	
U14⊗	IC, C-MOS, QUAD CLOCK, D-LATCH	355149	02739	CD4042AE	REF		
U15⊗	IC, C-MOS, HEX INVERTER	404681	02735	CD4069BE	1	1	
U16	IC, DUAL NAND DRIVER	604108	56289	UDN5712N	REF		
U17⊗	IC, C-MOS, QUAD, 2-INPUT NAND GATES	355198	04713	MC14011CP	1	1	
U18	IC, DUAL NAND DRIVER	604108	56289	UDN5712N	REF		
VR1	DIODE, ZENER, 7.5V +/-5%	256446	04713	1N755A	2		
VR2	DIODE, ZENER, 7.5V +/-5%	256446	04713	1N755A	REF		
W1	CABLE, RIGID	612598	89536	612598	1		
W2	CABLE, INPUT	577031	89536	577031	1		

1 THESE CAPACITORS ARE MATCHED ITEMS AND ARE INSTALLED AT THE TESTED LEVEL

2 THE HARDWARE THAT MAY BE SHIPPED WITH THESE CAPACITORS WILL NOT BE USED

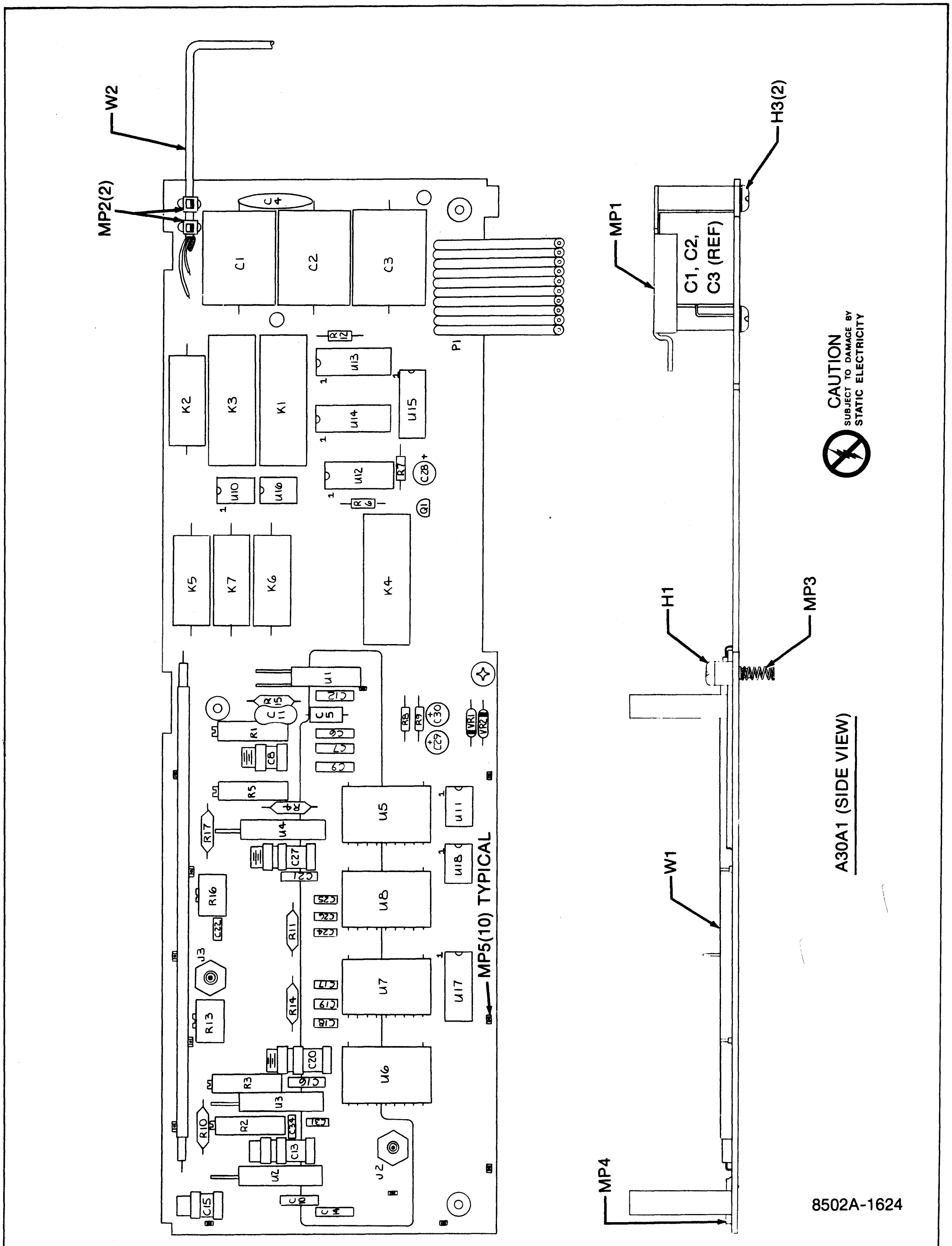


Figure 5-19. A30A1 Attenuator PCB Assembly

Table 5-20. A30A2 Amplifier PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
A30A2	AMPLIFIER PCB ASSEMBLY FIGURE 5-20 (8502A-4025)				REF		
C3	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	5		
C4	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C5	CAP, CER, 0.05 UF -20/+80%, 25V	148924	72982	5855-000-Y5U0-503Z	1		
C6	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C7	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C8	CAP, VAR, 0.35 - 3.5 PF 250V	603456	91293	5801	2		
C9	CAP, VAR, 0.8 - 10 PF +/-15%, 250V	229930	91293	5201	2		
C10	CAP, CER, 27 PF +/-2%, 100V	362749	89536	362749	1		
C11	CAP, VAR, 0.8 - 10 PF +/-15%, 250V	229930	91293	5201	REF		
C12	CAP, VAR, 0.35 - 3.5 PF 250V	603456	91293	5801	REF		
C13	CAP, CER, 4.7 PF +/-0.25%, 100V	362772	89536	362772	1		
C14	CAP, TA, 2.2 UF +/-20%, 15V	364216	56289	196D225X0015HA1	1		
C17	CAP, CER, 3.9 PF +/-0.25%, 100V	512947	89536	512947	1		
C18	CAP, CER, 1.2 PF, 100V	543256	89536	543256	1		
C21	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C0238101F103M	3		
C22	CAP, POLY, 0.15 UF +/-5%, 50V	343616	84411	X46UW0.15-5P50V	2		
C23	CAP, POLY, 1 UF +/-10%, 50V	271619	84411	X463UW1029,50W	1		
C24	CAP, CER, 82 PF +/-10%, 500V	105585	72982	ED-82	1		
C25	CAP, POLY, 0.15 UF +/-5%, 50V	343616	84411	X46UW0.15-5P50V	REF		
C26	CAP, POLY, 0.01 UF +/-2%, 150V	168385	02799	PE103G	2		
C27	CAP, POLY, 0.01 UF +/-2%, 150V	168385	02799	PE103G	REF		
C28	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C0238101F103M	REF		
C29	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C0238101F103M	REF		
C30	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C31	CAP, TA, 39 UF +/-20%, 20V	358234	56289	196D396X0020PE4	2		
C32	CAP, TA, 39 UF +/-20%, 20V	358234	56289	196D396X0020PE4	REF		
C34	CAP, POLY, 1.8 UF +/-10%, 100V	603548	14752	SS910D1C1C185K	1		
C35	CAP, CER, 33 PF +/-2%, 100V	513226	89536	513226	3		
C36	CAP, CER, 33 PF +/-2%, 100V	513226	89536	513226	REF		
C37	CAP, CER, 33 PF +/-2%, 100V	513226	89536	513226	REF		
C38	CAP, CER, 1200 PF +/-20%, 100V	358283	72982	8121-A100-W5R-122M	1		
C39	CAP, CER, 39 PF +/-2%, 100V	512962	89536	512962	1		
CR1	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	9		
CR3	DIODE, SI, L-CAP/LO-LEAK	375907	07263	FD7223	2		
CR4	DIODE, SI, L-CAP/LO-LEAK	375907	07263	FD7223	REF		
CR5	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR6	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR7	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR10	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR11	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR13	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR14	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR15	DIODE, HI-SPEED SWITCH	256339	28480	5082-2900	1		
CR16	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
H1	SCREW, PHP, 2-56 X 1/4	408054	89536	408054	2		
J1	SOCKET, IN-LINE, 10-POS (NOT SHOWN)	477661	00779	583773-1	1		
MP1	COVER, ASSEMBLY	613521	89536	613521	1		

Table 5-20. A30A2 Amplifier PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
MP2	SPACER, ALTERNATE	613604	89536	613604	2		
Q1	TRANSISTOR, DUAL FET	476788	89536	476788	1		
Q2	TRANSISTOR	89536	89536	453829	1		
Q3	TRANSISTOR, MATCHED PAIR (Q3, Q4)	463133	89536	463133	1		
Q4	(PART OF Q3)						
Q5	TRANSISTOR, SI, PNP	225599	07263	2N4250	1		
Q6	TRANSISTOR	333898	89536	333898	2		
Q7	TRANSISTOR	333898	89536	333898	REF		
Q8	TRANSISTOR, J-FET	343830	12040	NSSF50024	5		
Q9	TRANSISTOR, J-FET	343830	12040	NSSF50024	REF		
Q10	TRANSISTOR, J-FET	343830	12040	NSSF50024	REF		
Q11	TRANSISTOR, J-FET	343830	12040	NSSF50024	REF		
Q12	TRANSISTOR, FET	429977	89536	429977	13		
Q13	TRANSISTOR, FET	429977	89536	429977	REF		
Q14	TRANSISTOR, FET	429977	89536	429977	REF		
Q15	TRANSISTOR, FET	429977	89536	429977	REF		
Q16	TRANSISTOR, FET	429977	89536	429977	REF		
Q17	TRANSISTOR, FET	429977	89536	429977	REF		
Q18	TRANSISTOR, FET, MATCHED PAIR (Q18, Q19)	265744	89536	265744	1		
Q19	(PART OF Q18)						
Q20	TRANSISTOR, J-FET	328237		2N4416	1		
Q21	TRANSISTOR, J-FET	343830	12040	NSSF50024	REF		
Q22	TRANSISTOR, FET	393314	17856	5T3824	1		
Q23	TRANSISTOR, SI, NPN	218396	89536	218396	3		
Q24	TRANSISTOR, SI, NPN	330803	07263	MPS6560	1		
Q25	TRANSISTOR, SI, PNP	418707	04713	MPS56562	1		
Q26	TRANSISTOR, FET	429977	89536	429977	REF		
Q27	TRANSISTOR, FET	429977	89536	429977	REF		
Q28	TRANSISTOR, FET	261578	89536	261578	2		
Q29	TRANSISTOR, J-FET	535039	89536	535039	1		
Q30	TRANSISTOR, FET	429977	89536	429977	REF		
Q31	TRANSISTOR, FET	261578	89536	261578	REF		
Q32	TRANSISTOR, SI, NPN	218396	89536	218396	REF		
Q33	TRANSISTOR, SI, PNP	195974	64713	2N3906	2		
Q34	TRANSISTOR, FET	429977	89536	429977	REF		
Q35	TRANSISTOR, FET	429977	89536	429977	REF		
Q36	TRANSISTOR, FET	429977	89536	429977	REF		
Q37	TRANSISTOR, FET	429977	89536	429977	REF		
Q38	TRANSISTOR, SI, NPN	218396	89536	218396	REF		
Q39	TRANSISTOR, SI, PNP	195974	64713	2N3906	REF		
R1	RES, MTL. FILM, 787 +/-1%, 1/8W	459909	91637	CMF557870F	2		
R2	SELECTED AT TEST						1
R3	SELECTED AT TEST						1
R4	SELECTED AT TEST						1
R5	SELECTED AT TEST						1
R6	RES, MTL. FILM, 787 +/-1%, 1/8W	459909	91637	CMF557870F	REF		
R7	RES, DEP. CAR, 510 +/-5%, 1/4W	441600	80031	CR251-4-5P511E	1		
R8	RES, DEP. CAR, 33 +/-5%, 1/4W	414524	80031	CR251-4-5P330E	2		
R9	RES, DEP. CAR, 33 +/-5%, 1/4W	414524	80031	CR251-4-5P330E	REF		
R10	SELECTED AT TEST						1

Table 5-20. A30A2 Amplifier PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
R11	SELECTED AT TEST						1
R12	RES, MTL. FILM, 200K +/-1%, 1/8W	261701	91637	CMF552003F	1		
R13	RES, MTL. FILM, 20 +/-0.5%, 1/8W	494302	91637	CMF5520R0	1		
R14	RES, MTL. FILM, 4.02K +/-1%, 1/8W	235325	91637	CMF554021F	1		
R15	RES, VAR, 20K +/-20%, 1/2W	267898	11236	190PC203B	2		
R16	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	2		
R17	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	REF		
R18	RES, MTL. FILM, 1.58K +/-1%, 1/8W	385344	91637	CMF551581F	1		
R19	RES, MTL. FILM, 8.06K +/-1%, 1/8W	294942	91637	CMF558061F	2		
R20	RES, MTL. FILM, 10K +/-1%, 1/8W	168260	91637	CMF551002F	2		
R21	RES, MTL. FILM, 10K +/-1%, 1/8W	168260	91637	CMF551002F	REF		
R22	RES, MTL. FILM, 40.2K +/-1%, 1/8W	235333	91637	CMF554022F	1		
R23	RES, MTL. FILM, 250K +/-0.25%, 1/8W	340141	91637	CMF552503C	2		
R24	SELECTED AT TEST						1
R25	RES, MTL. FILM, 383K +/-1%, 1/8W	288498	91637	CMF553833F	2		
R26	RES, VAR, 20K +/-20%, 1/2W	267898	11236	190PC203B	REF		
R27	RES, MTL. FILM, 383K +/-1%, 1/8W	288498	91637	CMF553833F	REF		
R28	SELECTED AT TEST						1
R29	RES, MTL. FILM, 250K +/-0.25%, 1/8W	340141	91637	CMF552503C	REF		
R30	RES, MTL. FILM, 357K +/-1%, 1/8W	235002	91637	CMF553573F	1		
R31	RES, MTL. FILM, 20K +/-1%, 1/8W	291872	91637	CMF552002F	1		
R32	RES, DEP. CAR, 2.2K +/-5%, 1/4W	343400	80031	CR251-4-5P2K2	1		
R33	RES, MTL. FILM, 8.06K +/-1%, 1/8W	294942	91637	CMF558061F	REF		
R34	RES, VAR, 10K +/-10%, 1/2W	309674	75378	360T103A	1		
R35	RES, VAR, 2K +/-20%, 1/2W	267864	11236	190PC202B	1		
R36	RES, MTL. FILM, 13.7K +/-1%, 1/8W	236752	91637	CMF551372F	1		
R37	RES, MTL. FILM, 2.80K +/-1%, 1/8W	325670	91637	CMF552801F	1		
R38	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	6		
R39	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R40	RES, MTL. FILM, 2.00K +/-1%, 1/8W	235226	91637	CMF552001F	2		
R41	SELECTED AT TEST						1
R42	RES, MTL. FILM, 178K +/-1%, 1/8W	312769	91637	CMF551783F	1		
R43	RES, MTL. FILM, 1M +/-1%, 1/8W	460535	91637	CMF551004F	1		
R44	RES, MTL. FILM, 2.00K +/-1%, 1/8W	235226	91637	CMF552001F	REF		
R45	RES, MTL. FILM, 39.2K +/-1%, 1/8W	236414	91637	CMF553922F	1		
R46	RES, COMP, 510 +/-5%, 1/2W	108951	01121	RC020GF511JS	2		
R47	RES, COMP, 510 +/-5%, 1/2W	108951	01121	RC020GF511JS	REF		
R48	RES, MTL. FILM, 24.9 +/-1%, 1/8W	296657	91637	CMF5524R9F	1		
R49	RES, MTL. FILM, 499K +/-1%, 1/8W	268813	91637	CMF554993F	2		
R50	RES, VAR, 200K +/-20%, 1/2W	381509	11236	190PC204B	1		
R51	RES, MTL. FILM, 127K +/-1%, 1/8W	291328	91637	CMF551273F	1		
R52	RES, VAR, 50K +/-10%, 1/2W	330688	75378	190PC503B	1		
R53	RES, MTL. FILM, 137.04K +/-0.1%, 1/8W	404046	89536	404046	1		
R54	RES, VAR, 25K +/-20%, 1/2W	285213	11236	190PC253B	2		
R55	RES, MTL. FILM, 64.9K +/-1%, 1/8W	312694	91637	CMF556492F	1		
R56	RES, VAR, 25K +/-20%, 1/2W	285213	11236	190PC253B	REF		
R57	RES, MTL. FILM, 20.5K +/-1%, 1/8W	261669	91637	CMF552052F	2		
R58	RES, MTL. FILM, 110K +/-1%, 1/8W	234708	91637	CMF551103F	1		
R59	RES, MTL. FILM, 20.5K +/-1%, 1/8W	261669	91637	CMF552052F	REF		
R61	RES, VAR, 2K	309666	89536	309666	1		

Table 5-20. A30A2 Amplifier PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
R63	RES, MTL. FILM, 169K +/-1%, 1/8W	289454	91637	CMF551693F	1		
R64	RES, DEP. CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	3		
R65	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R66	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R67	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R68	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R69	RES, MTL. FILM, 60.4K +/-1%, 1/8W	291419	91637	CMF556042F	1		
R70	RES, MTL. FILM, 10K +/-1%, 1/8W	291633	91637	CMF551002F	3		
R71	RES, MTL. FILM, 499 +/-1%, 1/8W	289256	91637	CMF554990F	1		
R72	RES, VAR, CERMET, 50 +/-20%, 1/2W	267815	11236	190PC500B	1		
R74	RES, MTL. FILM, 10K +/-1%, 1/8W	291633	91637	CMF551002F	REF		
R75	RES, DEP. CAR, 15K +/-5%, 1/4W	348854	80031	CR251-4-5P15K	1		
R76	RES, DEP. CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	1		
R77	RES, MTL. FILM, 499K +/-1%, 1/8W	268813	91637	CMF554993F	REF		
R78	RES, VAR, 100K +/-10%, 1/2W	603555	32997	3299W-CR2-104	1		
R79	RES, MTL. FILM, 38.3K +/-1%, 1/8W	241372	91637	CMF553832F	1		
R80	RES, MTL. FILM, 2.49K +/-1%, 1/8W	226209	91637	CMF552491F	1		
R81	RES, COMP. 470M +/-10%, 1/4W	603530	01121	CB477	2		
R82	RES, COMP. 470M +/-10%, 1/4W	603530	01121	CB477	REF		
R83	RES, MTL. FILM, 10K +/-1%, 1/8W	291633	91637	CMF551002F	REF		
R84	RES, DEP. CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R85	RES, DEP. CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
U1	HYBRID, AMPLIFIER OUTPUT	539759	89536	539759	1		
U2	RESISTOR NETWORK	541953	89536	541953	1		
U3	IC, LINEAR, VOLTAGE FOLLOWER	288365	12040	LM310H	1		
U4	IC, HIGH-VOLTAGE DISPLAY DRIVERS	504795	56289	UPH-480	1		
U5	IC, LINEAR OP-AMP	418566	12040	LM358N	2	1	
U6	RMS SENSOR	521625	89536	521625	1	1	
U7	IC, LINEAR, OP-AMP, METAL CAN	288928	12040	LM308AH	3	1	
U8	IC, LINEAR OP-AMP	418566	12040	LM358N	REF		
U9	IC, LINEAR, OP-AMP, METAL CAN	288928	12040	LM308AH	REF		
U10	IC, LIN, NPN, 5-XSTR, SI, ARRAY	248906	02735	CA3046	1		
U11	IC, OP-AMP, J-FET, LO-NOISE	385450	12040	SH29467	1		
U12	IC, OP-AMP, J-FET, LO-NOISE	381962	12040	SH61140	1	1	
U13	IC, LINEAR, OP-AMP, METAL CAN	288928	12040	LM308AH	REF		
U15	IC, HIGH-VOLTAGE DISPLAY DRIVERS	504894	56289	UPH481	1		
U16	RESISTOR NETWORK, 100K	412908	89536	412908	1		
U17	RESISTOR NETWORK	603498	89536	603498	1		
VR1	DIODE	330829	07910	1N4571	1		
VR2	DIODE, ZENER, 5.6V	277236	07910	1N752A	1		
VR3	DIODE, ZENER, 13.0V, +/-5%	110726	04713	1N964B	1		
W1	WIRE, BUS, 22AWG, 0.2'	115469	89536	115469	AR		
W2	CABLE ASSEMBLY	577023	89536	577023	2		
W3	CABLE ASSEMBLY	577023	89536	577023	REF		
X1	SOCKET, 3-PIN, (W/R11, R41)	402958	09922	402958	2		
X2	SOCKET, 4-PIN (W/R2, R3, R4, R5)	417311	30035	SS-109-1-04	2		

1 THESE RESISTORS ARE MATCHED ITEMS AND ARE INSTALLED AT THE TESTED LEVEL

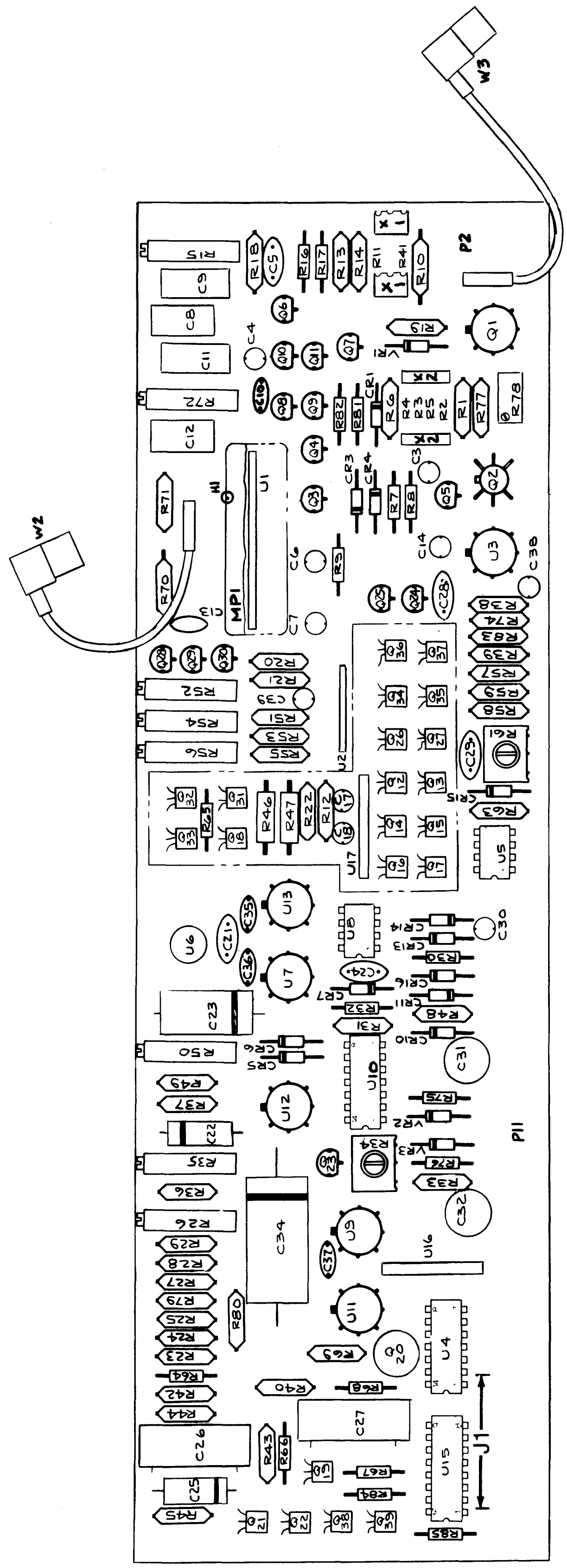


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Figure 5-20. A30A2 Amplifier PCB Assembly

Section 6
Option and Accessory Information

CHANGE Table 602-1. Ohms Converter Specifications as follows:

ACCURACY, NORMAL RESOLUTION

Add the following column

RANGE	180 DAYS
10 ohms	0.007 + 20
100 ohms	0.0045 + 2
1 kilohm	0.0045 + .8
10 kilohms	0.0045 + .8
100 kilohms	0.0045 + .8
1 megohm	0.0045 + .8
10 megohms	0.03 + .8
100 megohms	0.07 + .8

REPLACE PARAGRAPH 602-21 AND TABLE 602-2 WITH THE FOLLOWING:

602-21. Test the Ohms function using the following procedure:

1. Connect four-wire test leads to the instrument.
2. Select the Ohms function and Autoranging.
3. Short the HI and LO Ω SOURCE leads, short the HI and LO SENSE leads, then connect the two pairs of shorted leads together.
4. Zero the instrument by depressing the STORE switch and then the VDC/ΩZERO switch.
5. Remove the shorts from the test leads and sequentially connect the standard resistors in Table 602-2. The 8502A/AT readings should fall within the limits specified.

Table 602-2. Performance Test

STANDARD RESISTOR	8502A/AT READING	
	LOW (exponent)	HIGH (exponent)
10 ohm	9.9973	10.0027
100 ohm	99.993	100.007
1 kilohm	.99995 (+3)	1.00005 (+3)
10 kilohm	9.9995 (+3)	10.0005 (+3)
100 kilohm	99.995 (+3)	100.005 (+3)
1 megohm	.99995 (+6)	1.00005 (+6)
10 megohm	9.9969 (+6)	10.0031 (+6)
100 megohm	99.929 (+6)	100.071 (+6)

CHANGE TABLE 605-6 AS FOLLOWS:

Under PROGRAM SEQUENCE change [S] [5] in Example 1 to read:

[S] [1] Fast Enhanced Mode (128 samples per reading automatically)

Under MODIFIER COMMAND CHARACTERS add the following new heading between the paragraphs SAMPLES PER READING COMMAND CHARACTERS and FILTER COMMAND CHARACTERS:

THERMAL TRUE RMS MODE SELECTION COMMAND CHARACTERS

When the thermal true RMS function is selected, the 8502A/AT automatically assumes a reading rate of 128 samples per reading, and the "S" commands are used to select the mode of operation of the Thermal True RMS Converter. The 8502A/AT defaults to the fast mode "SO" at any time that the "VA" command selects the thermal true RMS function.

[S] [0] Fast Mode

[S] [1] Fast Enhanced Mode

[S] [2] High Accuracy Mode

Under MODIFIER COMMAND CHARACTERS, add the following new heading between the paragraphs FILTER COMMAND CHARACTERS and TRIGGER COMMAND CHARACTERS:

THERMAL TRUE RMS FILTER COMMAND CHARACTERS

Any time that the thermal true RMS function is selected, the slow filter in the 8502A/AT is active. The slow filter has the time-out disabled and a settling time of approximately 0.5 seconds. A special filter installed in the Thermal True RMS Converter may be selected to supplement the active filter when the input signal frequency is 40 Hz or lss. Selection of the thermal true RMS filter for input frequencies about 40 Hz will degrade the accuracy of the module. The following "F" modifier command charactres are used to select the status of the thermal true RMS filter:

[F] [0] Thermal True RMS Filer OFF

[F] [1] Thermal True RMS Filter ON $\leq$ 40 Hz only)

Under MEMORY COMMAND CHARACTERS, RECALL, make the following changes:

Under Sample Codes Make the following changes and additions:

Change the line of text above the codes, which remain, to read as follows:

The fourth status response character contains sample information identified by the following codes when the Function Code in the fifth response character is 0, 2, 3, 4, or 7.

Add the following new line of text and codes:

The fourth status respons character contains thermal true rms function mode information identified by the following codes when the Function Code in the fifth response character is 1 or 5.

0 Fast Mode

1 Fast Enhanced Mode

2 High Accuracy Mode

Section 8
Schematic Diagrams

There are two schematic diagrams for the Thermal True RMS Converter Assembly:

1. A30A1 Attenuator PCB Assembly
2. A30A2 Amplifier PCB Assembly

These schematics and their component location drawings are shown on the following pages. Add these schematics to the end of Section 8 as Figures 8-15 and 8-16.

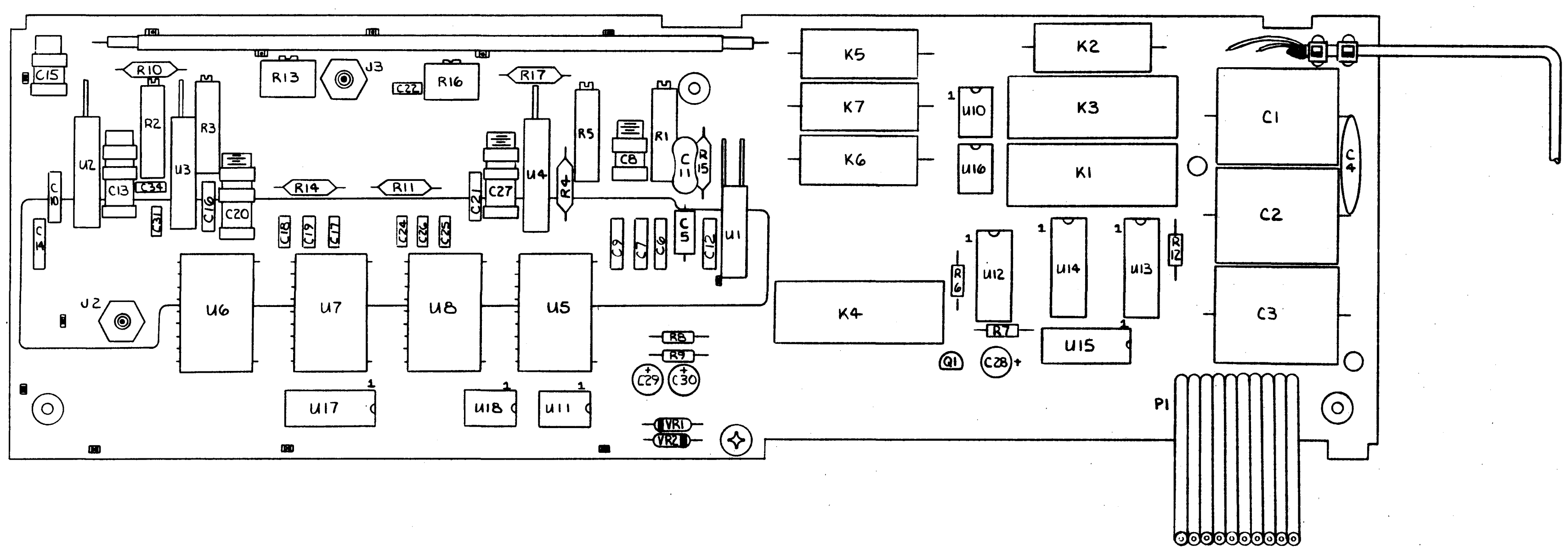

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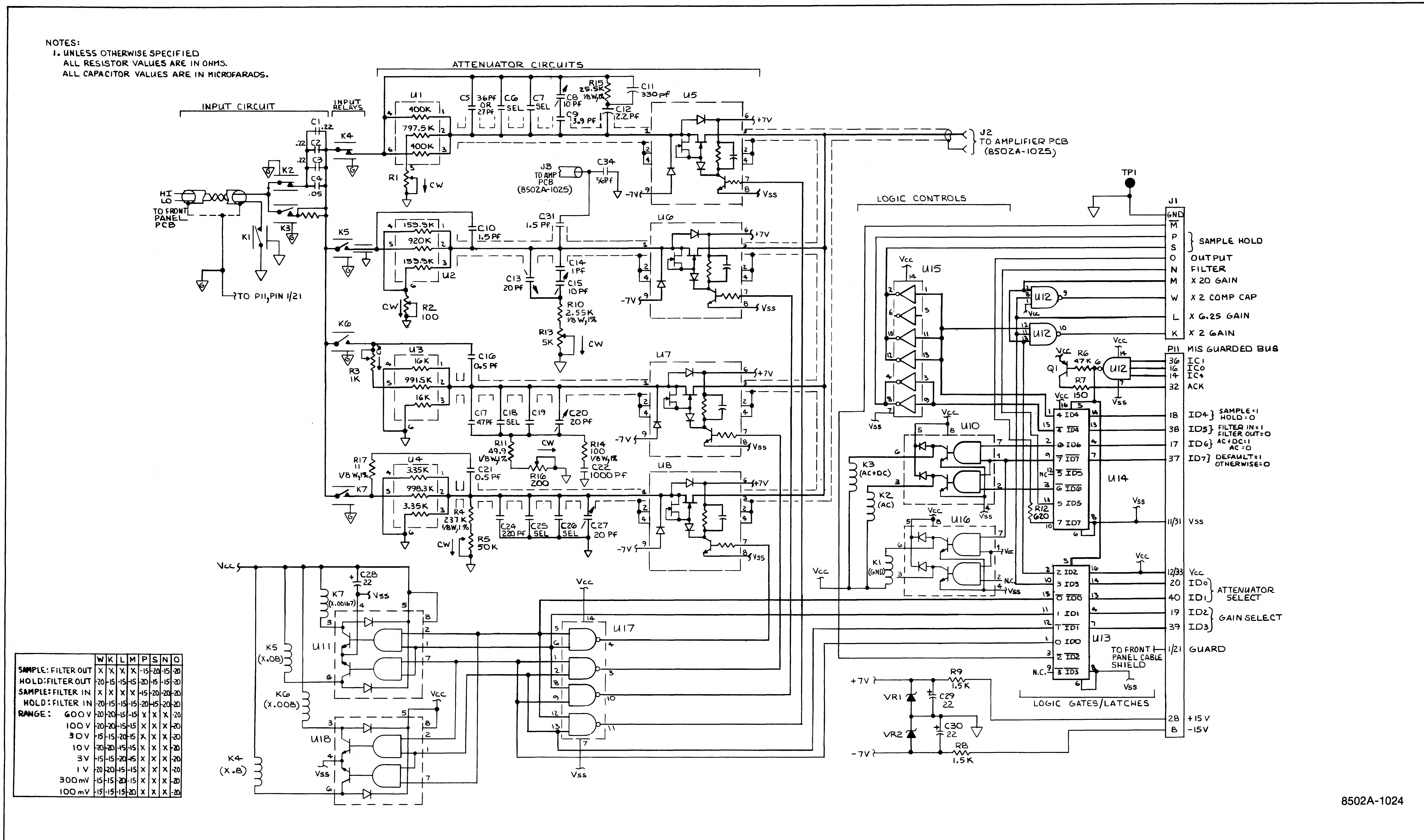
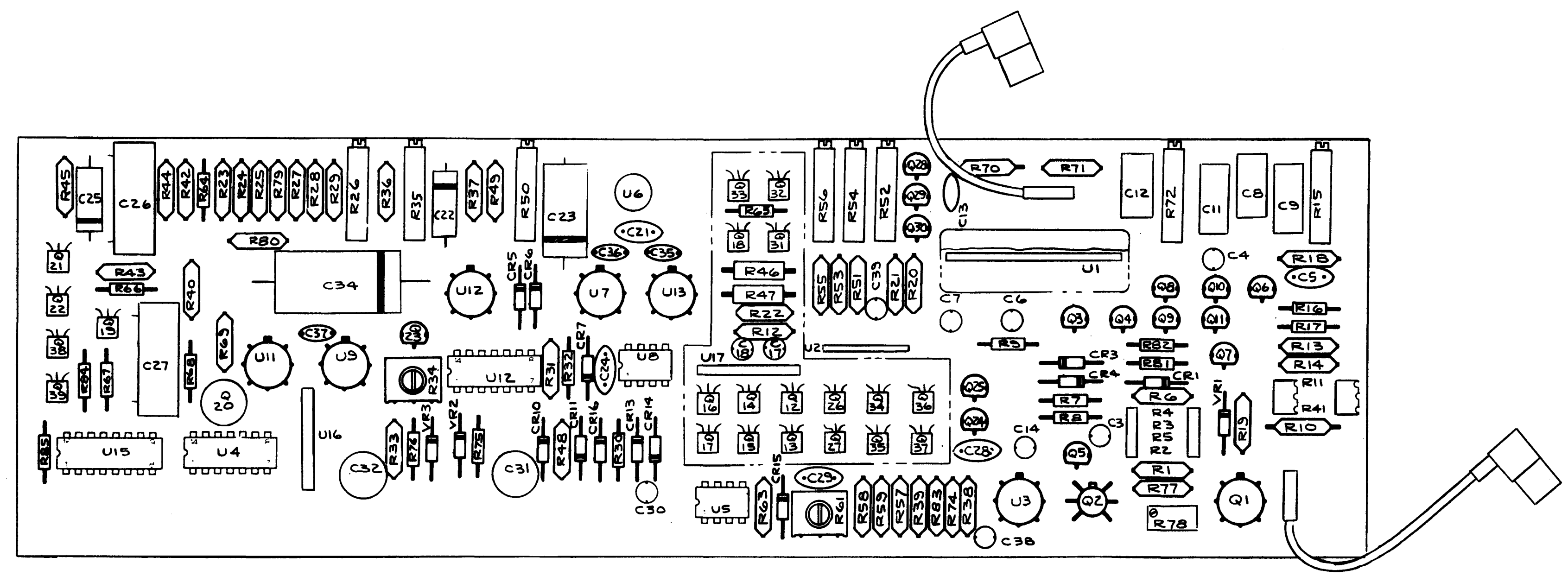
Figure 8-15. A30A1 Attenuator PCB Assembly



NOTES:
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

	W	K	L	M	P	S	N	O
SAMPLE: FILTER OUT	X	X	X	X	-15	-20	-15	-20
HOLD: FILTER OUT	-20	-15	-15	-15	-20	-15	-15	-20
SAMPLE: FILTER IN	X	X	X	X	-15	-20	-20	-20
HOLD: FILTER IN	-20	-15	-15	-15	-20	-15	-20	-20
RANGE: 600 V	-20	-20	-15	-15	X	X	X	-20
100 V	-20	-20	-15	-15	X	X	X	-20
30 V	-15	-15	-20	-15	X	X	X	-20
10 V	-20	-20	-15	-15	X	X	X	-20
3 V	-15	-15	-20	-15	X	X	X	-20
1 V	-20	-20	-15	-15	X	X	X	-20
300 mV	-15	-15	-20	-15	X	X	X	-20
100 mV	-15	-15	-15	-20	X	X	X	-20

Figure 8-15. A30A1 Attenuator PCB Assembly (cont)



8502A-1625

Figure 8-16. A30A2 Amplifier PCB Assembly

NOTES:
1. UNLESS OTHERWISE SPECIFIED;
ALL RESISTOR VALUES ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

	W	K	L	M	P	S	N	O
SAMPLE FILTER OUT	X	X	X	X	-15	-20	-15	-20
HOLD FILTER OUT	-20	-15	-15	-15	-20	-15	-15	-20
SAMPLE FILTER IN	X	X	X	X	-15	-20	-20	-20
HOLD FILTER IN	-20	-15	-15	-15	-20	-15	-20	-20
RANGE: 600 V	-20	-20	-15	-15	X	X	X	-20
100 V	-20	-20	-15	-15	X	X	X	-20
30 V	-15	-15	-20	-15	X	X	X	-20
10 V	-20	-20	-15	-15	X	X	X	-20
3 V	-15	-15	-20	-15	X	X	X	-20
1 V	-20	-20	-15	-15	X	X	X	-20
300 mV	-15	-15	-20	-15	X	X	X	-20
100 mV	-15	-15	-15	-20	X	X	X	-20

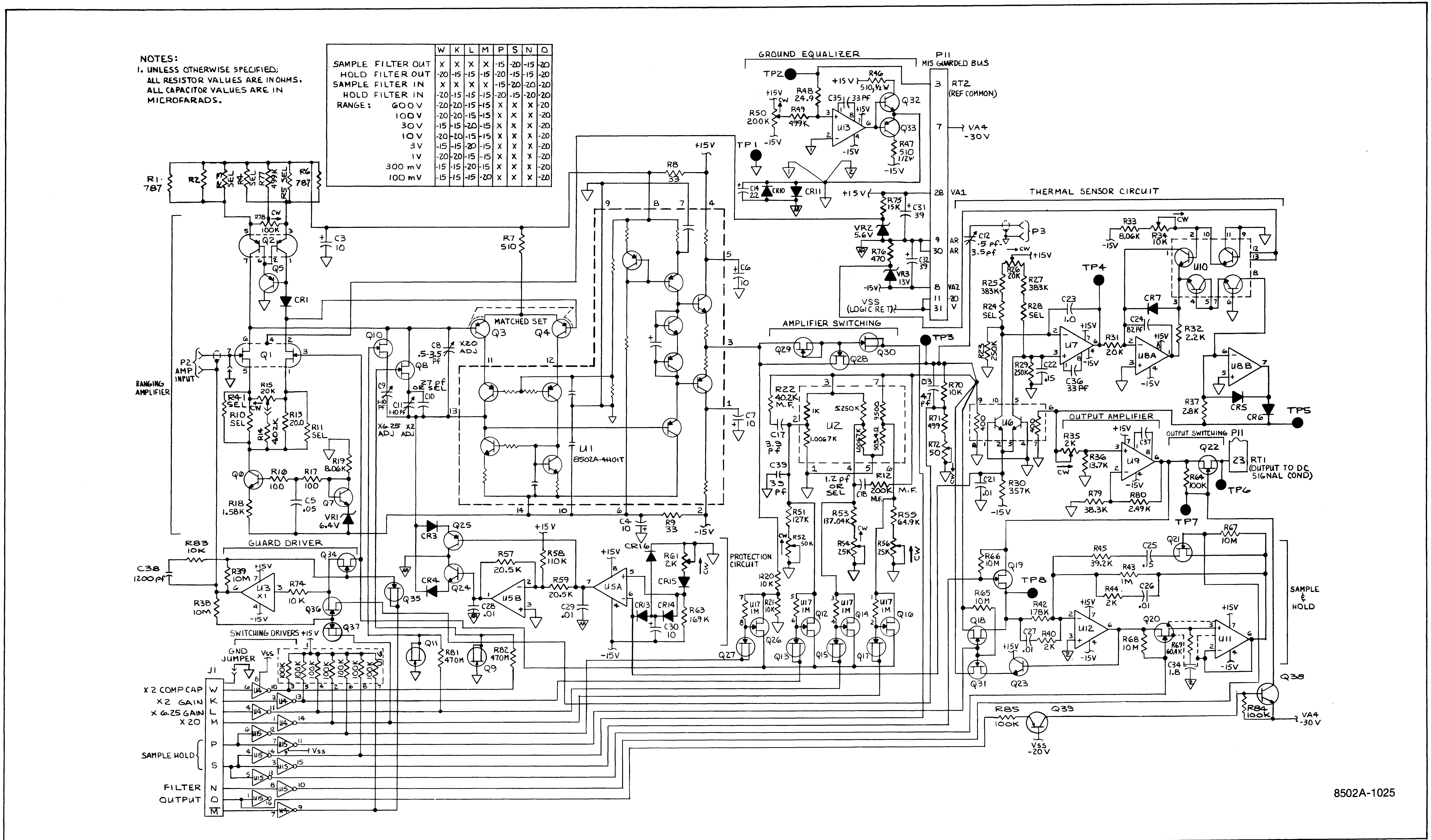


Figure 8-16. A30A2 Amplifier PCB Assembly (cont)