8025B
MULTIMETER

Instruction Manual

FLUKE ®

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8025B

MULTIMETER

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Instruction Manual

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February 1988 Rev. 1, 2/97

FLUKE®

1 FEBRUARY 1988

OPERATOR GUIDE

LOW TEMPERATURE OPERATION (-40°C): Use only those test leads supplied with the meter. Use the TL25B Test Leads for stray voltag applications. Use a lithium battery. Battery annunciator may turn on even with new battery; 100 hrs of battery life remain. Use Touch Hold for eas reading of slow acting LCD.

⚠ READ MANUAL. USE SAFE PRACTICES.
See information and warnings on back of multimeter.

(◉) RANGE: Press once for manual ranging (◉). Press again to increment range. Press for 2 seconds to return to autoranging.

Δ Press to enter Relative mode. Displayed value is stored and the difference between it and subsequent readings is displayed. Press again to update stored digital reading. Press and hold for two seconds to exit.

MIN/MAX Press to enter MIN/MAX mode. Minimum and maximum readings are stored in memory and can be displayed as selected by the operator. (Manual ranging is selected.) Press again to toggle between minimum and maximum readings. Press HOLD/RESET to reset. Press and hold for two seconds to exit.

H HOLD: Press once for TOUCH HOLD (H). TOUCH HOLD automatically holds readings between measurements and beeps when a new stable reading has been captured. Press again to manually update. Press for 2 seconds to exit TOUCH HOLD.

(((➔| DIODE TEST: 0.5 mA nominal test current at 0.6V. Displays voltage drop. 2V full scale. COM terminal is negative. Use this mode for CONTINUITY (((( ) tests. Continuous audible tone for test resistance below ≈ 150 ohms, momentary "beep" for test voltages dropping below 0.7V.

Ω OHMS: Full scale voltage < 420 mV up to 3.2 MΩ range, and < 1.3V on 32 MΩ and 32 nS ranges. Open circuit voltage < 2.8V. Maximum test current < 1.1 mA.

nS CONDUCTANCE: Use for measuring resistance above 32 MΩ. Select Ω, open test leads, and press RANGE button twice. Display shows nano-Siemens (**nS**). 1000/nS ⟺ MΩ. Example: 2 nS converts to 500 MΩ (1000/2).

[- +] LOW BATTERY: At least 60 hours of battery life remains when first displayed.

OL OVERLOAD PROTECTION: 500V for **Ω**, **mV**, and DIODE TEST (➔|). 1000V for **V**. 630 mA fuse in series with 3A fuse for **mA** and **μA**. 20A fuse for **A**.

FUSE TESTS: Select Ω; connect test lead from **VΩ ➔|** input to **A** (Amp) input; reading is ≈ 0.1Ω. Move test lead to **mA/μA** input; reading is ≈ 5.5Ω. Replace fuse(s) if the display shows OL.

INPUT IMPEDANCE (AC ~ and DC ⎓ voltage modes): ≈ 10 MΩ in parallel with < 100 pf.

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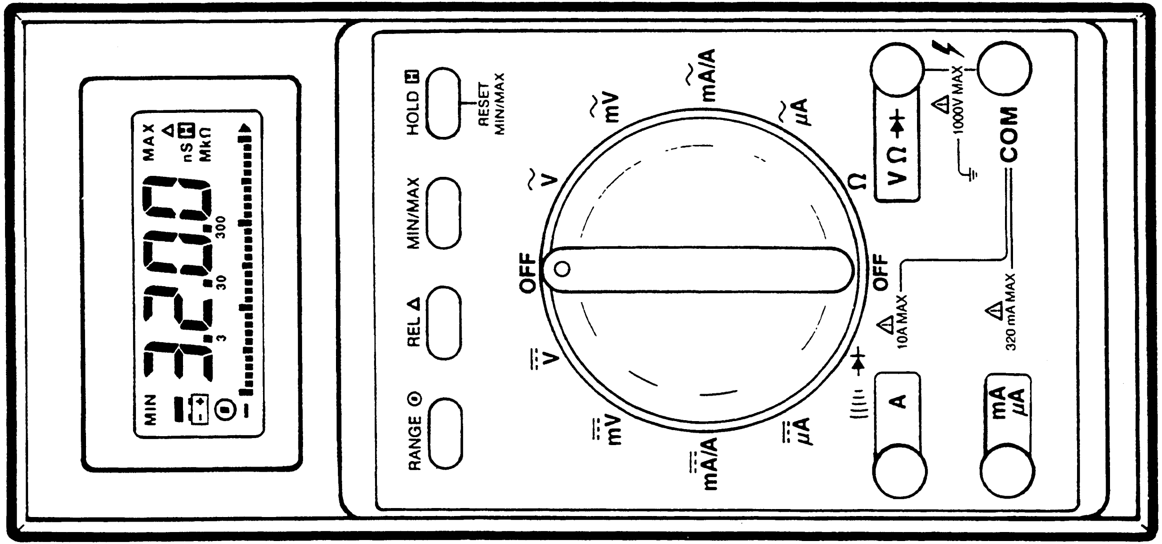


MIN
MAX
nS
MkΩ
3
30
300
HOLD
RESET MIN/MAX
MIN/MAX
REL Δ
RANGE
OFF
OFF
V
mV
mA/A
μA
Ω
V Ω
1000V MAX
COM
10A MAX
320 mA MAX
A
mA μA

Section 1
Introduction and Specifications

1-1. INTRODUCTION

The Fluke 8025B (hereafter, also referred to as the "meter") is a rugged, water and chemical-resistant, multimeter designed for use in military environments. It was designed for MIL-T-28800 Type II, Class 2, Style A instrument.

The 8025B combines the precision of a digital meter with the speed and versatility of an analog bar graph. The minimum and maximum readings of a set of measurements can be displayed. A constant can be stored in memory, and the difference between it and subsequent readings can be displayed. When taking measurements in difficult or hazardous circumstances, you can keep you eyes fixed on the probes, then read the display when it is safe and convenient. The meter's components are housed in a rugged case sealed against dirt, dust, and moisture, and it is powered by a 9V battery with a life of 1000 hours.

The meter's safety features include: extensive overload protection, high energy fuses for all current ranges, non-metallic case and bail, recessed input jacks, safety-designed test leads, and no fuses to replace for voltage and resistance overloads.

Some of the meter's other features are:

- Automatic selection of the appropriate measurement range.

- An audible continuity/diode indicator that allows you to test wiring, diodes, and transistors without having to look at the display.
- Low power resistance measurement that allows in-circuit resistance measurements to be taken without turning on diodes or transistors.
- Test leads (TL25B) for stray voltage applications.

1-2. ACCESSORIES

The Fluke DMM accessories (listed in Table 1-1) are designed to increase the measurement capabilities of your instrument.

Whether you are measuring voltage, current, resistance, or temperature, Fluke DMM accessories help you do the job quickly and accurately.

With Fluke's complete family of probes, you can measure ac current to 600A, temperature to 150 degrees Celsius, and voltage to 40 kV. Fluke test leads simplify circuit connections and let you probe hard-to-reach places.

1-3 SPECIFICATIONS

Unless otherwise stated, the specifications given in Table 1-2 apply for temperatures between 18 and 28°C, at a relative humidity of up to 95%, for one year after calibration.

Table 1-1. Accessories

MODEL NUMBER	DESCRIPTION
Y8134	Deluxe test lead kit. Includes interchangeable tips and two test-tip probes, two alligator clips, two large spade-lug tips, and one spring-loaded hook-tip probe.
Y8140	Slim-Flex test leads. Adjustable length, flexible and insulated steel-needle leads. Sharp needle point will pierce varnish and thin insulations. Will fit into small places.
TL25B	Noise suppressing test leads. De-sensitizes the meter to low energy, spurious sources of interference.
C100	Hard carrying case. Protects against rough handling and bad weather. Includes accessory storage compartment.
80K-6	High voltage probe (divide-by-1000 resistive divider) 0 to 6000V dc or peak ac (0 to 60 Hz).
80K-40	High voltage probe (divide-by-1000 resistive divider) 40,000V dc or peak ac (0 to 60 Hz).
Y8100	200A DC/AC clamp-on current probe. Uses Hall effect to measure ac or dc current without electrical contact. Battery powered. 0 to 1 kHz. 0.75 inch (19 mm) jaw opening.
Y8101	AC clamp-on current probe. 1A to 150A, 48 Hz to 1 kHz. Divide-by-1000 current transformer 0.43 inch (11 mm) jaw opening.

Table 1-1. Accessories

MODEL NUMBER	DESCRIPTION
80i-400	AC clamp-on current probe. 1A to 400A, 48 Hz to 1 kHz. (10A resolution above 320A with 8025B) Divide-by-1000 current transformer 1.18 by 1.97 inch (30 x 50 mm) jaw opening.
80i-410	DC/AC Hall-effect, clamp-on current probe. 1A to 400. Battery powered. Output signal 1mV/A. 1.18 by 1.97 inch (30 x 50 mm) jaw opening.
80i-600	AC clamp-on current probe. 1A to 600A, 30 Hz to 1 kHz. (10A resolution above 320A with 8025B) Divide-by-1000 current transformer 2.0 inch (50.8 mm) jaw opening.
80i-1010	DC/AC, battery powered, clamp-on, current probe. Used with DMM to measure up to 1000A dc or 700A ac. 1.18 by 1.97 inch (30 x 50 mm) jaw opening.
85RF	Radio frequency probe. 100 kHz to 500 MHz. 0.25V to 30V rms.
80T-150U	Universal temperature Probe. P-N junction sensor, 350V dc or peak ac isolation, chemically-resistant housing. -50°C to +150°C and -58°F to 302°F, 0.1 degree resolution. Cable 70°C maximum. Ideal for temperature measurements on circuit boards.

Table 1-2. Specifications

DISPLAY	Liquid crystal, multiplexed drive
Digital Display	3200 counts plus polarity indication, updated 2 times per second
Analog Display	31-segment bar graph plus polarity indication, updated 25 times per second
Annunciators	k, M, (Ω), (◉), (H), (⊟), (Δ) , MIN, MAX, (-) negative polarity, range (3, 30, 300), nS (nanosiemens)
DC VOLTAGE MEASUREMENT	
Accuracy	$\pm$(0.1% of reading, +1 digit)
Ranges	320.0 mV (100 μV resolution) 3.200V (1 mV resolution) 32.00V (10 mV resolution) 320.0V (100 mV resolution) 1000V (1V resolution)
Input Resistance	10-megohms nominal in parallel with $<$100 pF
Normal Mode Rejection Ratio	$>$60 dB @ 50 Hz and 60 Hz

Table 1-2. Specifications (cont)

Common Mode Rejection Ratio	>120 dB @ dc, 50 Hz and 60 Hz with 1 kilohm or less unbalance
Overload Protection	1000V rms (500V rms on 320 mV range)
AC VOLTAGE MEASUREMENT	
Accuracy .... **(320.0 mV-320.0V range)**	40 Hz to 2 kHz: ±(0.5% of reading + 3 digits) 2 kHz to 10 kHz: ±(2% of reading +3 digits) 10 kHz to 30 kHz: ±(4% of reading +10 digits)
Accuracy (1000V range)	40 Hz to 2 kHz: ±(1% of reading + 3 digits) 2 kHz to 10 kHz: ±(3% of reading +3 digits)
Ranges	320.0 mV (100 μV resolution) 3.200V (1 mV resolution) 32.00V (10 mV resolution) 320.0V (100 mV resolution) 1000V (1V resolution)
Conversion Type	Ac coupled, average sensing, calibrated to read rms value of sinewave
Input Impedance	10-megohms nominal in parallel with <100 pf
Common Mode Rejection Ratio	>60 dB, dc to 60 Hz, 1 kilohm or less unbalance

Table 1-2. Specifications (cont)

Overload Protection	1000V rms (500V rms on 320 mV range); 10^7 Volt-Hertz product maximum
AC AND DC CURRENT	
AC Accuracy	±(1.5% of reading +2 digits) 40 Hz to 1 kHz
DC Accuracy	±(0.75% of reading +1 digit)
Ranges	320.0 µA (0.1 µA resolution) 3200 µA (1 µA resolution) 32.00mA (10 µA resolution) 320.0 mA (100 µA resolution) 10.00A (10 mA resolution)
Typical Burden Voltage	320.0 µA range: 0.5mV/µA 3200.0 µA range: 0.5mV/µA 32.0 mA range: 6mV/mA 320.0 mA range: 6mV/mA 10.00A range: 50mV/A
Overload Protection	µA/mA ranges: 630 mA/250V fuse in series with 3A/600V fuse 10.00A range: 20A/600V fuse

Table 1-2. Specifications (cont)

RESISTANCE MEASUREMENT

Accuracy	320.0 ohm range: ±(0.3% of reading +2 digits) 3.200k to 3.200M ranges: ±(0.2% of reading +1 digit) 32.00M range: ±(1% of reading +1 digit) 32.00 nS range: ±(2% of reading +10 digits)	
Ranges	320.0 ohm	(0.1 ohm resolution)
	3.200 kilohm	(1 ohm resolution)
	32.00 kilohm	(10 ohm resolution)
	320.0 kilohm	(100 ohm resolution)
	3.200 megohm	(1 kilohm resolution)
	32.00 megohm	(10 kilohm resolution)
	32.00 nS	(0.01 nS resolution) (manual ranging only)
Overload Protection	500V rms	
Full Scale Voltage	<420 mV up to 3.2 megohm; <1.3V over 3.2 megohm	
Open Circuit Voltage	<3.0V (-40 to 55°C)	

Table 1-2. Specifications (cont)

DIODE TEST AND CONTINUITY

Diode Test Indication	Displays voltage drop; 0.5 mA nominal test current at 0.6V; 2.08V full scale
Continuity Indication	Continuous audible tone for test resistance below 150 ohms. Momentary tone for test voltage dropping below 0.7V (typical silicon diode threshold)
Open Circuit Voltage	<3.3V (-15 to 55°C)

ENVIRONMENTAL SPECIFICATIONS

Temperature	Operating: -40°C to 55°C, Display response time <200 msec @ 25°C, increasing to 10 sec @ -40°C Storage: -55 to 85°C
Temperature Coefficient	0.1 x the applicable accuracy specification per °C (for temperature <18°C or >28°C)
Shock, Vibration, Humidity And Water Resistance	Per MIL-T-28800 for a Style A, Class 2 Instrument.

Table 1-2. Specifications (cont)

GENERAL SPECIFICATIONS

Maximum Voltage	1000V applied to any terminal with respect to earth ground
Power Requirements	Single 9V alkaline battery (NEDA 1604), 1000 hrs. typical
Battery Life at -40°C	100 hours for lithium battery (recommended) 10 hours for alkaline Carbon zinc battery not recommended
Instrument Size	5.6 cm H x 9.5 cm W x 20.3 cm L (2.2 in H x 3.75 in W x 8 in L)
C100 Case Size	12.1 cm H x 32.7 cm W x 39.4 cm L (4.75 in H x13.25 in W x 15.50 in L)
Weight	0.75 kg (1.6 lb) 8025B alone 1.5 kg (3.2 lb) with case and accessories
Safety	Protection Class II as defined in IEC 348 and ANSI C39.5.

Section 2
Operation

2-1. INTRODUCTION

Section 2 describes how to operate the 8025B. Even if you have used a multimeter before, we suggest that you read this material carefully so you can take full advantage of the meter's numerous features. Read "MULTIMETER SAFETY" in Section 3 before using this instrument.

2-2. UNPACKING THE INSTRUMENT

The meter is shipped with two leads (one red and one black), two alligator clips (one red and one black), TL25B stray voltage test lead set, a 9V alkaline battery (installed), this instruction manual, and a case. Contact the place of purchase immediately if anything is missing or damaged.

When reshipping the meter, use the original shipping container. If this container is not available, be sure that adequate protection is provided to prevent damage. We recommend that the instrument be surrounded by at least three inches of shock-absorbing material in the shipping container.

2-3. BATTERY INSTALLATION OR REPLACEMENT

The meter is powered by a single 9V, alkaline battery (NEDA 1604). The instrument is shipped with the battery installed. Typical battery life at 20°C exceeds 1000 hours. The battery symbol on the display will come on when at least 60 hours of battery life remain. (If the meter will be used at temperatures approaching -40°C, we recommend that a lithium battery be used. See "LOW TEMPERATURE OPERATION" in Section 3.)

Refer to Figure 2-1, and use the following procedure to install or replace the battery.

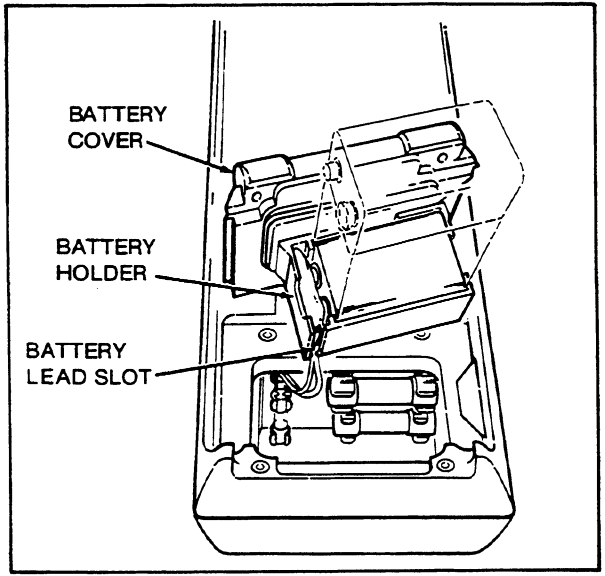


Figure 2-1. Battery Installation

WARNING

TO AVOID ELECTRICAL SHOCK, REMOVE THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE BATTERY.

1. Turn the rotary switch to OFF, and remove the test leads from the meter.

2. Lift the instrument stand on the back of the meter, then remove the four black, #6 X 32, Posi-drive™ screws from the battery cover.

3. Pull the battery cover straight out from the back of the meter. (A thumb-slot in the side of the battery cover facilitates removal.)

4. Remove the battery from the battery holder, then disconnect the battery connector.

5. Snap the battery connector to the terminals on the new battery, then slide the battery into the battery holder. Slip each battery lead into the slot in the holder as shown in Figure 2-1.

6. Insert the battery holder/cover into the meter, then start the four screws removed in step 2. Press firmly on the battery cover while tightening the screws in a diagonal pattern.

2-4. FUSE TEST

The continuity of the fuses can be tested by measuring the resistance on each Current input terminal. The resistance measured will be the sum of lead resistance, fuse resistance and shunt resistance, hence the broad resistance range.

1. Turn the function selector switch to the ohms position.
2. Connect a test lead from the VΩ→+ input jack to the A input jack.
3. The display should indicate < 1Ω.
4. Move one end of the test lead from the A input jack to the mA/μA input jack.
5. The display should indicated between 5.0 ohms and 7.0 ohms.
6. If either of the above display indications is OL (overload), replace the appropriate fuse.

2-5. FUSE REPLACEMENT

There are three fuses mounted inside the battery compartment. Fuse F1 (which protects the μA/mA current input from high energy overloads) is the lower of the two horizontally mounted fuses. The fuse mounted vertically is F2 (in series with F1). F3, the upper of the two horizontally mounted fuses, protects the 10A current input. A spare fuse (for F2) is located under the battery, between the battery holder and the battery cover. Refer to Figure 2-2, and use the following procedure to check or replace the fuses.

1. Perform steps 1 through 3 of the battery replacement procedure.
2. Remove the defective fuse (or check continuity through the suspected fuse) and, if necessary, install a new fuse of the same size and rating.
3. Reinstall the battery cover as instructed in step 6 of the battery replacement procedure.

2-6. TL25B TEST LEADS

Occasionally, a circuit being measured will be subject to stray voltages coupled in from adjacent energized wiring. The TL25B Test Leads (shown in Figure 2-3) are designed to provide a nominal 1000 ohm load to the measured circuit, in effect de-sensitizing the meter to low energy, spurious, sources of interference. The molded section of the TL25B incorporates a thermally sensitive resistor element (thermistor) in shunt with the leads. As voltage is increased across the test leads, the thermistor dissipates power.

From zero to approximately 15V, the dissipated power is low, and the thermistor maintains its nominal value of 1000 ohms. At voltages exceeding 15V, the thermistor is affected by its own internal heating, and its resistance values will tend to vary. Actually, the thermistor will approach a constant power characteristic and total power will level off at approximately 2W. Therefore, if the circuit being measured is capable of furnishing 2W or more, and if the spurious coupled power is much lower (as is usually the case), the true circuit conditions will be measured.

Voltages up to 50V can be applied to the TL25B leads safely and without damage. Note, however, that upon removal of voltage, and because of the thermal mass of the thermistor, it may take 30 seconds or more for recovery to near its initial value.

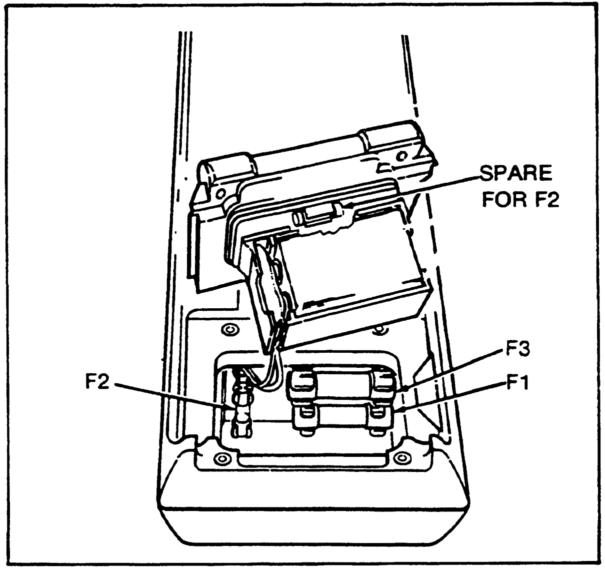


Figure 2-2. Fuse Replacement

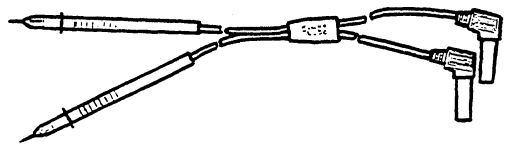


Figure 2-3. TL25B Test Leads

2-7. OPERATING FEATURES

The meter is operated from the the front panel (shown in Figure 2-4). The rotary switch selects measurement functions. The push buttons located above the rotary switch select operating modes (Manual range, Relative, Min/Max, and Touch-Hold modes); the connectors located below the rotary switch provide input for the various types of measurements. All operating features are summarized in Table 2-1.

2-8. Display

The liquid crystal display (LCD), shown in Figure 2-5, displays digital readings, analog bar graph readings, annunciators, and a measurement range.

Measurements are displayed on the 3200-count digital display. There are three full decimal digits, a partial leading digit, a minus sign, and three decimal points in the digital display. The digital display is updated approximately twice per second. The decimal point is positioned automatically for each measurement range. The partial leading digit can display only the digits 1, 2, and 3. If the input is overrange, the display indicates an overload by displaying the letters OL.

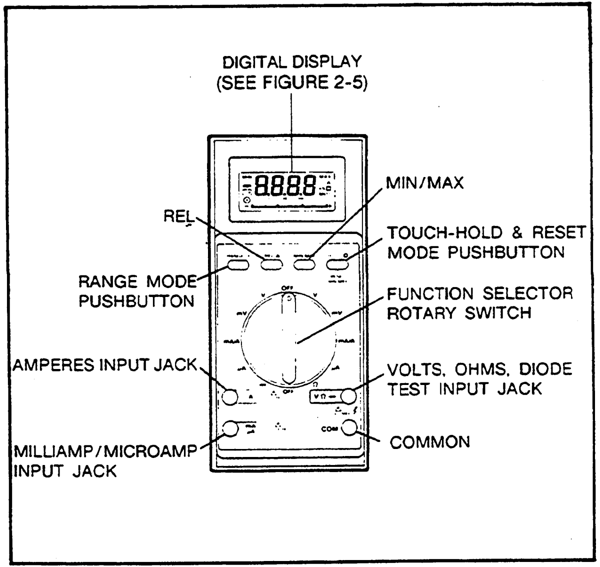


Figure 2-4. 8025B Features

The follow annunciators indicate measurement units, mode, or condition of operation:

 When first displayed, at least 60 hours of battery life remain.

NOTE

At temperatures approaching -40° C, battery voltage drops off very rapidly, and the battery annunciator can come on and stay on even if a new lithium battery is in place. (Carbon-zinc or alkaline batteries may freeze at low temperatures.) See paragraph 3-18. Although several hours of continuous use is possible at -40° C, turn the meter off when not actually in use. This allows the battery to recover between periods of use.

Ω Ω is displayed when the ohms function is selected. M and k indicate the megohm or kilohm range.

nS nS (nanosiemens) is displayed when the top range of the resistance function is manually selected. To convert nanosiemens to megohms, divide the displayed value into 1000. The Ωis not displayed with nS.

Table 2-1. 8025B Features

FEATURES	DESCRIPTION
Digital Display	Displays input data in the 3200 count display, with automatic decimal point positioning. The leading zero is suppressed for the most significant digit.
Touch-Hold Mode Annunciator	Touch-Hold Mode Annunciator is displayed when the touch-hold mode is in use.
Resistance Annunciators	The appropriate annunciator is displayed for the resistance range in use.
Bar Graph Display	Analog representation of input data composed of 31 segments which illuminate starting from the left as the input increases.
Touch-Hold Mode Pushbutton	Press momentarily to enter touch-hold mode, press again to manually update indication, press and hold for 2 seconds to exit touch-hold mode.
Function Selector Rotary Switch	Turn to select any of ten different functions, or off. Functions marked with a straight line are dc functions; those marked with a ~ are ac functions.
Volt, Ohms, Diode Test Input Jack	Input jack used in conjunction with the volts, mV (ac or dc), ohms, or diode test position of the function selector rotary switch.
Common Jack	Common or return connection used for all measurements.

Table 2-1. 8025B Features (cont)

FEATURES	DESCRIPTION
Milliamp/Microamp Input Jack	Used as input connection for current measurements up to 320 mA (ac or dc) with the function selector rotary switch in the mA or μA position.
Amperes Input Jack	Used as input connection for current measurements up to 10A with the function selector rotary switch in the mA/A position (ac or dc).
Manual Range Mode Pushbutton	Push once to enter manual range mode, press again to increment range, press and hold for 2 seconds to return to autorange.
Manual Range Annunciator	The manual range annunciator is displayed when the 8025B is in the manual range mode. Absence of the indicator implies autorange mode in use.
Relative Mode Pushbutton	Press momentarily to enter the Relative mode and store the displayed reading. Press again to update the stored digital reading. Press and hold for 2 seconds to exit the Relative mode.
Relative Mode Annunciator	Indicates that the meter is in the Relative mode and that the value displayed is relative (the difference between the present measurement and the previously stored reading).

Table 2-1. 8025B Features (cont)

FEATURES	DESCRIPTION
MIN/MAX Mode Pushbutton	Press momentarily to enter MIN/MAX mode, press again to toggle between MIN and MAX indications. Press and hold for 2 seconds to exit MIN/MAX mode.
Minimum Value Annunciator	Indicates that the meter is in the MIN/MAX recording mode, and the value displayed is the minimum digital reading taken since reset or since entering MIN/MAX.
Maximum Value Annunciator	Indicates that the meter is in the MIN/MAX recording mode, and the value displayed is the maximum digital reading taken since reset or since entering MIN/MAX.
Decimal Point/Range Indicator	Decimal point position and the digits (3,30,300) under the decimal point indicate range in use.
Low Battery Annunciator	At least 60 hours of battery life remain when first displayed. Battery voltage is tested each time the function switch is moved to a new position.
Auto Polarity	Automatically displays positive or negative polarity inputs and (—) indicates negative polarity for digital and bar graph displays.
Conductance Range Annunciator	Top range of the resistance function is the conductance range. Displays conductance in nS (nanosiemens).

⊙ Indicates that the Manual Range mode is selected.

Δ Indicates that the meter is in the Relative mode and that the value displayed is the difference between the present measurement and previously stored reading.

MIN Indicates that the meter is in the MIN/MAX recording mode, and the value displayed is the minimum digital reading taken since reset or since entering MIN/MAX.

MAX Indicates that the meter is in the MIN/MAX recording mode, and the value displayed is the maximum digital reading taken since reset or since entering MIN/MAX.

H Indicates that the Touch-Hold mode is in use.

The analog bar graph (located below the digital display) consists of a thirty-one segments. The number of bar graph represents the absolute value of the input. (See "Viewing the Bar Graph" in Section 3.) A minus annunciator is located at the left of the bar graph. The bar graph is updated 25 times a second. If an overrange occurs, the bar graph displays all segments plus an overrange arrow.

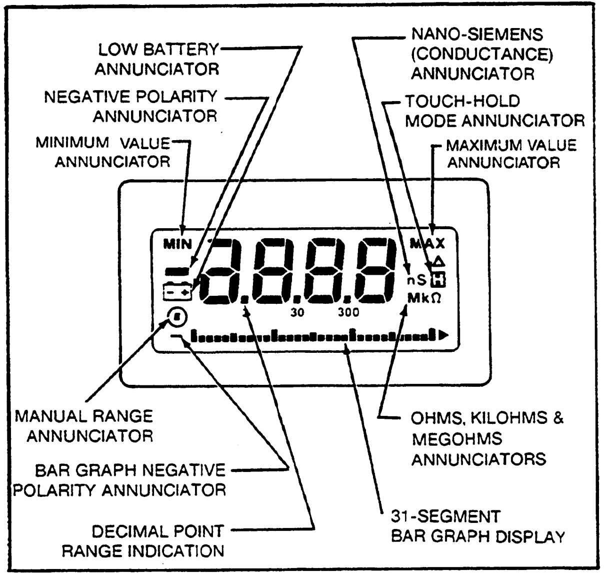


Figure 2-5. Display

The range indicators are located between the analog bar graph and the digital display. A 3, 30, or 300 range indicator is displayed below the decimal point in the digital display. The number displayed indicates the range in use for each of the decimal point positions. No decimal point is displayed in the 1000V or 3200 μA range.

2-9. Audible Indicator

An audible indicator emits a beep, click, or a provides a continuous tone, depending on the function and mode in which the meter is operating. It sounds when a pushbutton is operated in the diode-test mode, and when a new reading is displayed in the touch hold mode.

2-10. POWER-UP TESTS AND OPTIONS

When the function switch is moved from OFF to any position, the meter is powered up and performs a selftest. During the selftest all LCD segments are switched on for about 1 second, then the meter is operational. A battery test is performed at power up and each time you select a different function with the rotary switch. If the battery voltage is below 6.3V, ±0.3V, the low battery annunciator will come on and remain on until a subsequent battery test determines that the battery voltage is above the 6.3V threshold (i.e. the battery recovers or is replaced).

If the HOLD push button is pressed (>1 second) while the function switch is moved from OFF to any ON position, the touch-hold mode will only update to a new reading when the HOLD push button is pressed. Automatic touch-hold updates are defeated. This is useful when you want to take a reading at a specific time and hold it.

If the RANGE push button is pressed (>1 second) while the function switch is moved from OFF to any ON position, the meter defaults to manual ranging. The meter may be returned to autorange mode by pressing the RANGE button for approximately two seconds.

2-11. OPERATION

The following paragraphs describe the functions and modes in which the meter may be operated. (The operation of each function and mode is summarized in Table 2-2.) Four mode push buttons are provided: RANGE, REL, MIN/MAX & HOLD.

2-12. Range

Push the RANGE button to enter the manual range mode. While in the manual range mode, pushing the RANGE button increments the range setting.

Table 2-2. Summary of Operating Functions and Ranges

FUNCTION & MODE	INPUT TERMINALS	RANGES AND DECIMAL POINT POSITIONS
Volts dc, auto- range	VΩ ▶| COM	3.2 Volts (x.xxx), 32 Volts (xx.xx) 320 Volts (xxx.x), 1000 Volts (xxxx)
Volts dc, manual range	VΩ ▶| COM	3.2 Volts (x.xxx), 32 Volts (xx.xx) 320 Volts (xxx.x), 1000 Volts (xxxx)
Millivolts dc	VΩ ▶| COM	320 mV (xxx.x)
Milliamps dc, autorange	mA/μA, COM	32 mA (xx.xx), 320 mA (xxx.x)
Milliamps dc, manual range	mA/μA, COM	32 mA (xx.xx), 320 mA (xxx.x)
Amps dc	A, COM	10 A (xx.xx)
Microamps dc, autorange	mA/μA, COM	320 μA (xxx.x), 3200 μA (xxxx)
Microamps dc, manual range	mA/μA, COM	320 μA (xxx.x), 3200 μA (xxxx)
Volts ac, auto- range	VΩ ▶| COM	3.2 Volts (x.xxx), 32 Volts (xx.xx) 320 Volts (xxx.x), 1000 Volts (xxxx)

Table 2-2. Summary of Operating Functions and Ranges (cont)

FUNCTION & MODE	INPUT TERMINALS	RANGES AND DECIMAL POINT POSITIONS
Volts ac, manual range	VΩ ⊣▶⊢ COM	3.2 Volts (x.xxx), 32 Volts (xx.xx) 320 Volts (xxx.x), 1000 Volts (xxxx)
Millivolts ac	VΩ ⊣▶⊢ COM	320 mV (xxx.x)
Milliamps ac, autorange	mA/μA, COM	32 mA (xx.xx), 320 mA (xxx.x)
Milliamps ac, manual range	mA/μA, COM	32 mA (xx.xx), 320 mA (xxx.x)
Amps ac	A, COM	10 A (xx.xx)
Microamps ac, autorange	mA/μA, COM	320 μA (xxx.x), 3200 μA (xxxx).
Microamps ac, manual range	mA/μA, COM	320 μA (xxx.x), 3200 μA (xxxx).
Diode test/continuity	VΩ ⊣▶⊢ COM	0 to +2.08V (x.xxx) (Beeper clicks as input descends through 0.7V; beeps constantly at 0.1V (~ 150Ω) or less).

Table 2-2. Summary of Operating Functions and Ranges (cont)

FUNCTION & MODE	INPUT TERMINALS	RANGES AND DECIMAL POINT POSITIONS
Resistance, autorange	VΩ ⊳| COM	320 ohms (xxx.x Ω), 3.2 kilohms (x.xxx kΩ) 32 kilohms (xx.xx kΩ) 320 kilohms (xxx.x kΩ) 3.2 megohms (x.xxx MΩ) 32 megohms (xx.xx MΩ)
Resistance and Conductance manual range	VΩ ⊳| COM	320 ohms (xxx.x Ω) 3.2 kilohms (x.xxx kΩ) 32 kilohms (xx.xx kΩ) 320 kilohms (xxx.x kΩ) 3.2 megohms (x.xxx MΩ) 32 megohms (xx.xxx MΩ) 32 nS (xx.xx nS) Conductance range can only be enetered using manual range selection.

The meter powers up in the autorange mode. In autorange, the meter automatically selects the appropriate range for the measurement being taken. If the function selected has only one range, then the ⊙ symbol is displayed. The operating range is indicated by the decimal point position and range indicator in the display, and in the Ohms function by the presence of the M or k annunciators. There is no annunciator for the autorange mode; the absence of the manual range annunciator ⊙ indicates that the instrument is in the autorange mode.

To enter the manual range mode, push and release the RANGE push button. The beeper will click and the manual range annunciator ⊙ will be displayed. In the manual range mode, the meter will increment one range each time the push button is pressed until it cycles back to the lowest range. If a function only has a single range, the meter will display the manual range annunciator ⊙.

To return to autoranging, press the RANGE push button and hold it in for approximately two seconds; when the beeper clicks the second time, the meter has returned to autorange, and the manual range annunciator will no longer be displayed. If you select a different function with the rotary switch while in the manual range mode, the meter automatically switches back to autorange (if possible) on entering the new function.

2-13. Relative

Push the REL buttom momentarily to enter the Relative mode and store the displayed reading in memory. The display will read zero. Press again to update the stored digital reading. Press and hold for 2 seconds to exit the Relative mode.

In the Relative mode, a reading is stored in memory and the difference between this stored reading and subsequent readings is what is displayed. For example, if the stored reading is 15.00V and the present reading is 14.10V, the display will indicate -0.90V. The analog bar graph continues to display the actual reading (14.10V). If the difference exceeds 3999 counts (without overloading the input), OF (overflow) is displayed. The Relative mode selects manual ranging; changing ranges automatically exits the Relative mode.

2-14. Minimum/Maximum

Push the MIN/MAX button momentarily to enter MIN/MAX mode, press again to toggle between MIN and MAX indications. Press and hold for 2 seconds to exit MIN/MAX mode.

In the MIN/MAX mode, the meter stores the minimum and maximum readings, and displays either as selected by you. Press the HOLD/RESET button to reset the MIN/MAX readings to the present input. When the MIN/MAX mode is entered, manual ranging is automatically selected; use a range that can record the maximum anticipated input. Changing the range resets previously recorded MIN/MAX readings. Exiting the MIN/MAX mode does not reset the previously recorded readings unless the range or function is changed. The MIN/MAX mode overrides the Touch-Hold mode.

2-15. Hold

Push the HOLD button to enter the Touch-Hold mode. In the Touch-Hold mode, the user can take a measurement while watching the test leads. This feature is useful in difficult or hazardous situations. While in the Touch-Hold mode, pushing the HOLD button manually updates the reading. Press and hold the HOLD button for longer than one second to exit the Touch-Hold mode. Touch-hold can be used in either the Manual or Autorange mode.

While in Touch-Hold, the display automatically updates each time a new, stable measurement (more than one bar graph segment of change) has been taken. The new measurement is displayed and the beeper sounds when the display updates. The display can be manually updated at any time by pressing the HOLD push button momentarily. To exit the Touch-Hold mode, press the HOLD push button for approximately 2 seconds (the beeper will click, beep, then click again as the meter exits Touch-Hold).

2-16. Function Selection

Select meter functions by rotating the function selector switch to the appropriate setting. The meter functions are discussed in the following paragraphs.

NOTE

The conductance (nS) function operates with the function switch in the ohms position, and can only be entered through manual range selection.

2-17. VOLTS DC

Turn the function selector switch to the $\overline{\overline{\text{V}}}$ position to select the V dc function. Input voltages between -1000 and +1000V dc can be measured using the V Ω ⊣▶⊢ jack.

The ranges available in the Volts dc function are shown below. The decimal point/range indicator in the display indicates the range currently in use.

RANGE	DISPLAY
3.200 Volts	x.xxx
32.00 Volts	xx.xx
320.0 Volts	xxx.x
1000 Volts	xxxx

2-18. MILLIVOLTS DC ⎓
Turn the function selector switch to the mV position to select the Millivolts function. Input voltages between -320 and +320 mV dc can be measured using the V Ω ⯈⊢ jack.

Only one range is available in the Millivolts dc function: 320 mV (decimal point position xxx.x).

2-19. MILLIAMPS/AMPS DC ⎓
Turn the function selector switch to the mA/A position to measure either milliamps or amps. Two input jacks are associated with the mA/A function. The input jack used determines whether the meter is measuring milliamps or amps.

If the milliamp (marked mA/μA) jack is used, currents between -320 and +320 mA can be measured. If the ampere jack (A) is used, 10A continuous can be measured (Up to 20A [intermittent] can be measured).

The decimal point/range indicators indicate the range in use (xx.xx=32 mA or 10A range and xxx.x=320.0 mA range).

2-20. MICROAMPS DC ⎓
Turn the function selector switch to the μA position to select the microamp function. Input current between 3200 μA and +3200 μA can be measured, using the mA/μA input jack.

Two ranges are available: 320.0 μA (display=xxx.x) and 3200 μA (display=xxxx).

2-21. VOLTS AC ∼
Turn the function selector switch to the V position to select the Volt ac function. Input voltage between 0 and 1000V ac can be measured, using the V Ω⯈⊢ jack.

The minus sign is disabled in this function, and the decimal point/range indicators in the display indicate the range in use. The following ranges are available in the Volts ac function.

RANGE	DISPLAY
3.200 volts	x.xxx
32.00 volts	xx.xx
320.0 volts	xxx.x
1000 volts	xxxx

2-22. MILLIVOLTS AC ∼
Turn the function selector switch to the mV position to select the millivolt ac function. Input voltage between 0 and 320V ac can be measured, using the V Ω⯈⊢ jack.

Only one range is available in the Millivolts ac function: 0 to 320.0 millivolts (display=xxx.x). The minus sign is disabled in this function.

2-23. MILLIAMPS/AMPS AC ~

Turn the function selector switch to the mA/A position to measure either milliamps or amps ac. Two input jacks are associated with the mA/A function. The input jack used determines whether the meter is measuring milliamps or amps.

If the milliamp (marked mA/μA) jack is used, currents between -320 and +320 mA ac can be measured. If the ampere jack (A) is used, 10A continuous can be measured (Up to 20A [intermittent] can be measured).

The decimal point/range indicators indicate the range in use (xx.xx=32 mA or 10A range and xxx.x=320.0 mA range).

2-24. MICROAMPS AC ~

Turn the function selector switch to the μA position to select the microamp ac function. Input current between 3200 μA and +3200 μA ac can be measured, using the mA/μA input jack. Two ranges are available: 320.0 μA (display=xxx.x) and 3200 μA (display=xxxx). The minus sign is disabled in the microamps ac function.

2-25. RESISTANCE/CONDUCTANCE

Turn the function selector switch to the Ω position to select on the resistance function. The Ω annunciator is displayed when the meter enters the resistance function, and either the k or M annunciator is displayed when appropriate for the range in use.

The uppermost range of the Ω position is conductance (nS), and it can only be entered using the manual range mode. To enter the conductance (nS) range, select the resistance function, open the test leads, and press the RANGE push button twice. When the meter enters the conductance range, the nanosiemens (nS) annunciator is displayed and the Ω annunciator is switched off. Megohms equal 1000 divided by nanosiemens. The following ranges are available in the resistance/conductance function.

RANGE	DISPLAY
320.0 ohms	xxx.x Ω
3.200 kilohms	x.xxx k Ω
32.00 kilohms	xx.xx k Ω
320.0 kilohms	xxx.x k Ω
3.200 megohms	x.xxx M Ω
32.00 megohms	xx.xx M Ω
32.00 nS	xx.xx nS

2-26. DIODE TEST

Turn the function selector switch to the •))) ➝| position to initiate the diode or continuity test function. In diode test, there is only one range: 0 to +2.08 volts. The voltage measured is produced by a current output from the meter across the resistance of the device being tested. Open circuit conditions produce an overload, or out-of-limits (OL) indication.

In the diode test function, the beeper produces a continuous tone if the voltage drop is less than 0.1V (150 ohms), and the beeper beeps when the voltage drop descends through the 0.7V threshold.

Section 3
Applications

3-1. INTRODUCTION

Section 3 describes some common applications for the 8025B, supplementing the operating instructions provided in Section 2.

3-2. MULTIMETER SAFETY

The following practices and operating procedures should be followed when using the meter.

- Avoid working alone and follow all safety procedures for the meter and other equipment being used or tested.
- Disconnect the input power and discharge all high-voltage capacitors through a protective impedance before testing with the meter. Electrically disconnect the positive, or hot, test lead before disconnecting the common test lead.
- Inspect the test leads for insulation damage or exposed metal. Check the continuity of the test leads. Damaged leads should be replaced.
- When operating the meter at temperatures approaching -40°C, use only those test leads shipped with the meter. Vinyl clad leads will crack at these temperatures. If the TL25B leads are used, they must not be used at line voltages.
- Be sure the 8025B meter is in good operating condition. During continuity testing of the leads, a reading that goes from overload (OL) to 0 normally means the circuitry is working properly. Select the proper function and range for your measurement.

- Insulate yourself from ground using an insulating floor mat. If possible, use only one hand in taking measurements, keeping the other hand in your pocket to avoid accidentally allowing current to travel through your body. Reduce the risk of accidental contact by using leads with shrouded connectors and finger guards.

- When working with equipment that contains a cathode ray tube (CRT), wear safety glasses and protective clothing to avoid injuries in the event of CRT implosion.

- When using a current shunt, turn the power off before connecting the multimeter in the circuit. Overloading a current shunt will cause excessive heat.

- If the current in the circuit is greater than 10 amps, use clamp-on probes for maximum protection. When measuring transformer secondary or motor winding current, check the meter's fuses first. An open fuse will allow high voltage buildup, which is potentially hazardous.

- When working with automotive circuits, be aware of danger from high voltage (up to 30,000V peak) and the fire hazard from gasoline fumes or leakage.

3-3. INTERNATIONAL ELECTRICAL SYMBOLS

The symbols shown in Figure 3-1 are used internationally to denote functions or conditions pertaining to multimeter operation.

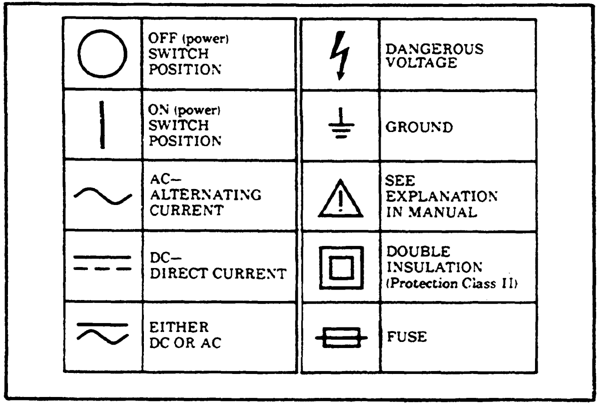


Figure 3-1. International Electrical Symbols

3-4. MEASUREMENT TECHNIQUES

The following paragraphs offer techniques that improve the measurement accuracy of the meter. For highest accuracy and display response time, store the meter at room temperature until needed.

CAUTION

At temperatures approaching -40°C, use only the leads shipped with the meter or the TL25B Test Leads. Vinyl clad leads will crack at these temperatures.

3-5. AC Measurement of Non-Sinusoidal Waves

The meter uses an average responding ac-coupled converter to take ac measurements. This means that the meter measures the average value of the input and displays it as an equivalent rms value for a sine wave. As a result, errors are introduced when the input waveform is non-sinusoidal. Further, any dc component of the input is blocked by the ac-coupled converter. Figure 3-2 shows some common waveforms. If the waveform is known, multiply the displayed reading by the indicated factor for the desired conversion.

3-6. Measuring Voltage (AC/DC)

When making measurements, be careful not to exceed the overload limits as defined in specifications given in Table 1-2.

The five ac/dc voltage ranges each present an input impedance of approximately 10 MΩ in parallel with less than 100 pF. Measurement errors, due to circuit loading, can result when making either ac or dc voltage measurements on circuits with high source resistance. In most cases the error is negligible (0.1% or less) if the measurement circuit source resistance is 10 kilohms or less. If circuit loading is a problem, use the appropriate formula from Figure 3-3 to calculate the percentage of error.

3-7. Measuring Current (AC/DC)

WARNING

THE METER CAN BE DAMAGED AND YOU MIGHT BE INJURED IF THE FUSE BLOWS WHILE CURRENT IS BEING MEASURED IN A CIRCUIT WHICH HAS AN OPEN CIRCUIT VOLTAGE GREATER THAN 600V. DO NOT ATTEMPT AN IN-CIRCUIT CURRENT MEASUREMENT WHERE THE POTENTIAL IS GREATER THAN 600V DC OR RMS AC.

Five ac and five dc current ranges are available on the 8025B. All current ranges are fuse protected. If a fuse opens, refer to the fuse replacement procedures given in Section 2 of this manual.

AC COUPLED INPUT WAVEFORM	DISPLAY MULTIPLIER FOR MEASUREMENT CONVERSION			
	RMS AC+DC	DC COMPONENT ONLY	0-PK	PK-PK
SINE (PK, 0, PK-PK)	1.000	0.000	1.414	2.828
RECTIFIED SINE (FULL WAVE) (PK, 0, PK-PK)	2.375	2.138	3.359	3.359
RECTIFIED SINE (HALF WAVE) (PK, 0, PK-PK)	1.283	0.817	2.566	2.566
SQUARE (PK, 0, PK-PK)	0.900	0.000	0.900	1.800
RECTIFIED SQUARE (PK, 0, PK-PK)	1.274	0.900	1.800	1.800
RECTANGULAR PULSE (D=X/Y, PK, 0, X, Y, PK-PK)	$\frac{0.450}{\sqrt{D}(I-D)}$	$\frac{0.450}{(I-D)}$	$\frac{0.450}{D(I-D)}$	$\frac{0.450}{D(I-D)}$
TRIANGLE SAWTOOTH (PK, 0, PK-PK)	1.040	0.000	1.800	3.600

Figure 3-2. Conversion Factors

1. DC VOLTAGE MEASUREMENTS

Loading Error in % = 100 x Rs ÷ (Rs + 10^7)

Where: Rs = Source resistance in ohms of circuit being measured.

2. AC VOLTAGE MEASUREMENTS

First, determine input impedance, as follows:

$$Z\,in = \frac{10^7}{\sqrt{1 + (2\pi F \bullet Rin \bullet C)^2}}$$

Where: Zin = effective input impedance
Rin = 10^7 ohms
Cin = 100 x 10^{-12} Farads
F = frequency in Hz

Then, determine source loading error as follows:
(Vector algebra required)

$$\text{Loading Error in \%} = \frac{100 \times Zs}{Rs + Zin}$$

Where: Zs = source impedance
Zin = input impedance (calculated)
Rs = source resistance

Figure 3-3. Voltage Measurement Error Calculations

3-8. Current Measurement Error Calculations

Full scale burden voltage (voltage drop across the fuse and current shunt) is given for each range in the specifications (Table 1-2). The burden voltage drops can affect the accuracy of a current measurement if the current source is unregulated and the combined resistance of shunt plus fuse is a significant portion (1/1000 or more) of the source resistance. If burden voltage does present a problem, the percentage of error can be calculated using the formula in Figure 3-4. Approximate terminal resistances for the current ranges are: 0.05 ohms for A, 5.5 ohms for mA, and 500 ohms for μA.

3-9. Measuring Resistance

CAUTION

Turn test circuit power off and discharge all capacitors before attempting in-circuit resistance measurements.

A two-wire configuration is used to measure resistance in all ranges. Although the two-wire configuration yields good results in most cases, the resistance in the test leads can diminish accuracy on the 320-ohm range. The error is usually 0.1 to 0.2 ohms for a standard pair of test leads. To determine the error, short the test leads together and read the resistance of the leads. Correct the measurement by subtracting the lead resistance from the measurement. Alternatively, you can use the Relative (REL) mode to automatically subtract the lead resistance from resistance measurements.

Some in-circuit resistance measurements can be made without removing diodes and transistors from the circuit. The full-scale measurement voltage produced on ranges below 32 MΩ does not strongly forward bias silicon diodes or transistor junctions. Use the highest range you can (except 32 MΩ) to minimize the possibility of turning on diodes or transistor junctions. Full-scale measurement voltage in the 32 MΩ range does strongly forward bias a diode or transistor.

3-10. Diode Test and Continuity

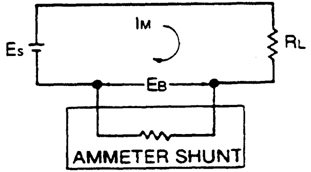
In diode test, there is only one range: 0 to +2.08 volts. The voltage is developed across the component(s) under test by a test current output from the 8025B. Voltages greater than the high limit produce an overload (OL) condition, and negative inputs produce a negative indication (they are not suppressed). In the diode test function, the beeper produces a continuous tone if the input is less than 0.1V, and the beeper beeps once when the input descends through the 0.7V threshold.

Audible continuity testing is also performed with the function selector switch in the diode test/continuity position. A continuous tone sounds for test resistances below approximately 150 ohms. An intermittent connection produces erratic beeps, and can be a valuable troubleshooting aid. Erratic beeps can also occur, due to environmental noise, if a test value is very close to the threshold (150 ohms).

3-11. Measuring Conductance

Conductance measurements are taken with the rotary switch set to the ohms function. The conductance range can only be entered using manual range selection; autorange cannot enter the conductance range. The conductance range can be used both to measure conductance (the inverse of resistance) and to calculate very high resistances (greater than 31 megohms).

Ordinarily, high value resistance measurements are plagued by noise, and require careful shielding. Normal precautions should be taken when measuring resistance in terms of conductance, for measurements up to 10,000 megohms. Conductance measurements are displayed in nanosiemens (nS). To convert nanosiemens to megohms, divide the displayed number (nS) into 1000. For example, 2 nS converts to 500 megohms (1000/2 = 500).



E_S = Source voltage
R_L = Load resistance + Source resistance
I_M = Measured current (display reading in mA)
E_B = Burden voltage (calculated), i.e., Display reading expressed as a % of full-scale ($100 \times \frac{\text{READING}}{\text{FULL-SCALE}}$) times full-scale burden voltage for selected range. See Table:

RANGE	TYPICAL BURDEN VOLTAGE
320 µA	0.16V
3200 µA	1.6V
32 mA	.18V
320 mA	1.8V
10A	0.5V

Maximum current error due to Burden Voltage

$$\text{IN \%} = 100 \times \frac{E_B}{E_S - E_B}$$

$$\text{IN mA} = \frac{E_B \times I_M}{E_S - E_B}$$

Example: $E_S = 15V$, $R_L = 50\Omega$, $I_M = 270$ mA.

$$E_B = 100 \times \frac{270}{320} \times 1.8 \text{ (from Table)} =$$

$$84.4\% \times 1.8 = 1.519V$$

$$\text{Error in \%} = 100 \frac{1.519}{15 - 1.519} = 100 \frac{1.519}{13.481} = 11.3\%$$

Increase displayed current by 11.3% to obtain true current

$$\text{Error in mA} = \frac{1.519 \times 270}{15 - 1.519} = \frac{410}{13.481} = 30.41 \text{ mA}$$

Increase displayed current by 30 mA to obtain true current.

Figure 3-4. Current Measurement Error Calculations

3-12. Leakage Testing

The conductance range effectively extends the resistance measurement capability of the meter so that it can provide useful leakage measurements on passive components. For example, you can detect leaky diodes, cables, connectors, printed circuit boards, etc. In all cases, the test voltage is less than 2V dc.

To test leakage on purely resistive components (such as cables and printed circuit boards) select the ohms function and manually increment the range to conductance (nS). Connect the test leads to the test points on the unit under test, and read the leakage in terms of conductance.

NOTE

There is normally a small residual reading with open test leads in the conductance range. To ensure accurate measurements, connect clean test leads to the 8025B, and (with the leads open) read the residual leakage in nanosiemens. Correct subsequent measurements by subtracting the residual from the readings. This can be done automatically by using the Relative mode (REL).

Diode leakage tests require that the diode junction be reverse biased when being measured. This is accomplished by connecting the anode of the diode to the COMMON input terminal and the cathode (ring) of the diode to the volts/ohms/diode test terminal. Leakage at the test voltage being applied can then be read in terms of conductance.

3-13. USING THE ANALOG BAR GRAPH

The analog bar graph is easy to use and interpret. It functions like the needle on an analog meter without the overshoot inherent in needle of movements.

Note that every fifth segment of the bar graph is slightly larger than those in between, and every tenth segment is larger yet. The first bar is an indication of 20 counts. These larger segments provide a quick reference for bar graph indications. The largest segments (every tenth segment) divide the display into thirds. Thus, if the bar graph indicates 11 segments on the 32.00V range, the input voltage is 10 volts; if the bar graph indicates 11 segments on the 320.0V range, the input voltage is 100 volts. If the input equals or exceeds 3000 counts on the range selected, the bar graph displays an arrow at the far right of the display, then the meter automatically switches to the next higher range if the input equals or exceeds 3260 counts. If the meter is in the manual range mode, the overrange arrow is displayed until you manually select an appropriate range for the input value.

The bar graph is especially useful for peaking and nulling, and observing rapidly changing inputs. Because bar graph response time is fast and precise (updating approximately 25 times per second), it can be used to make approximate adjustments quickly. The 3200-count digital display can then be used for final adjustment.

The analog bar graph can also be used for some limited diagnostic purposes. In situations where rapidly fluctuating signal levels make the digital display useless, the bar graph is ideal. Like the needle on a Volt-ohm milliammeter (VOM), the analog bar graph excels at displaying trends, or slowly changing signals. In addition, in the Autorange mode, you can monitor signal change through changing ranges. Many diagnostic routines using the bar graph require practice. You will usually be looking for good or bad signal patterns that occur over some span of time. Noisy resistance measurements, for instance, create such patterns. Therefore, familiarity with analog bar graph response and movement is necessary to accurately interpret a signal pattern. Compare the bar graph response when making measurements on a known-good unit to the bar graph response when making measurements on a faulty unit.

The following paragraphs explain some possible uses of the analog bar graph.

3-14. Nulling

The meter's bar graph is ideal for nulling adjustments. As an adjustment approaches zero, fewer bar graph segments are displayed, until no bar graph segments are displayed. The -annunciator flickers when the input level is within 20 counts of zero. The flickering null indication is displayed every time the input approaches zero or swings from one polarity to the other. Watch for the - annunciator indication, then reverse the direction of the adjustment when the polarity sign is displayed. In one or two passes, a near-zero input level is possible, then the digital display can be used for exact zero adjustment.

If you were using an analog VOM without a center scale, you would have to switch the polarity manually between each adjustment. Also, the analog display on a traditional VOM does not permit fine adjustments after the analog needle is at zero. For this a digital display is necessary.

3-15. Contact Bounce

Relay contacts may begin to bounce open when subject to vibration. Testing for this problem is a routine troubleshooting practice for many types of equipment. Since the bounce problem will worsen as the relay fatigues, early diagnosis is important.

When a contact bounces opens, its resistance value changes momentarily from zero to infinity and back. Ordinary hand-held meters take more than 300 ms to update their displays — much too long to detect a brief contact bounce. A VOM needle will move slightly at the instant of contact bounce, but the inertia of the needle movement dampens the response.

The analog bar graph, however, will display at least one segment the moment the contact opens. The bar graph can detect contact bounce as brief as 0.2 ms, while most analog needle movements require a 3 ms opening before they will respond.

Since the analog bar graph is ten times more sensitive to erratic signals than most analog needle movements, the bar graph can detect faulty contacts earlier than ever before. The severity of the problem is indicated by the number of segments displayed.

3-16. Checking Capacitors

VOMs are often used as simple capacitor checkers. In the capacitor kick test, the needle of the VOM in the resistance mode moves quickly from open (infinite ohms) toward short (zero ohms) as the capacitor is placed across the VOM input. The VOM battery charges the capacitor and the needle slowly moves back to the open (infinite ohms) position. The higher resistance ranges offer increased sensitivity for checking smaller capacitors.

The analog bar graph can make similar checks in the resistance function, even in the autoranging mode. As a capacitor is placed across the inputs, the analog bar graph quickly shortens, then rapidly down-ranges, depending on the size of the capacitor. As the capacitor charges, the bar graph slowly extends back to its full 31-segment length, up-ranging if necessary. For capacitors as small as 0.02 μF, only the 30-megohm range is involved, the last few segments blink off, then back on.

In a fixed range (using manual range mode), the time it takes for the bar graph to extend from zero to full scale indicates the approximate capacitance value. Table 3-1 gives typical capacitance values for various charge times on different resistance ranges. For very small capacitors, use the conductance (1/Ω nS) mode.

3-17. Noisy Resistance Measurements

Most digital multimeters are so sensitive that, while making resistance measurements, their digital displays become unreadable in the presence of line noise as low 50 mV. Because of the mechanical inertia of the analog needle, however, the noise alternately pulls the needle to the left and then to the right, averaging out any movement and leaving a fairly stable resistance reading.

The 8025B is designed to tolerate ac noise far better than the usual DMM. 2-kilohm readings can be obtained even in the presence of 1V ac noise. Readings of 1 MΩ may be obtained with up to 2V ac noise. The noise appears as about 50 counts of change and an oscillating bar graph.

3-18. LOW TEMPERATURE OPERATION (BELOW -20°C)

The performance of the meter is degraded if it is operated at very low temperatures (below -20°C) for an extended period of time. In order for the meter to perform at its specified accuracy and response time, you should store the meter at room temperature, if possible, until you are ready to use it. At temperatures of less -20°C, the response time of the LCD begins to increase appreciably until, at -40°C, it has increased to six seconds, typical.

If the meter is to be used in temperatures approaching -40°C, we recommend that a lithium battery be installed in the meter. At these temperatures, a carbon zinc battery is not functional, and the life of an alkaline battery is approximately ten hours.

At -40°C, (with a new lithium battery) the battery voltage will drop off so rapidly that the battery annunciator will come on and stay on. (At this point, about 100 hours of battery life remain.)

When operating at -40°C, use only the test leads shipped with the meter or the TL25B leads. Any vinyl-clad leads will crack.

Table 3-1. Capacitance Vs. Time to Full Scale

Resistance Range	320Ω	3.2kΩ	32kΩ	320kΩ	3.2MΩ	32MΩ
Capacitance Value						
10,000 μF	4 sec	33 sec	5 min	ext	ext	ext
1,000 μF	blink	4 sec	30 sec	ext	ext	ext
100 μF	nil	blink	4 sec	32 sec	ext	ext
10 μF	nil	nil	blink	4 sec	30 sec	ext
1 μF	nil	nil	nil	blink	3 sec	19 sec
0.1 μF	nil	nil	nil	nil	blink	2 sec
0.02 μF	nil	nil	nil	nil	nil	blink
ext = extended time, nil = no indication						

Section 4
Theory of Operation

4-1. INTRODUCTION

Section 4 describes how the 8025B works. An overview of the meter's operation is presented in "FUNCTIONAL DESCRIPTION," and the major circuit functions are described in "BLOCK DIAGRAM DESCRIPTION". Block diagrams and circuit drawings are provided to supplement the descriptions as necessary. A schematic is included in Section 7.

4-2. FUNCTIONAL DESCRIPTION

As shown in Figure 4-1, the 8025B is composed of two major functional sections: the analog section and the digital section. There is one major active component in each section (and a few peripherals for each major component). Most analog functions are performed by a custom analog IC, U1, and analog peripherals to U1. Digital functions are controlled by a CMOS, 4-bit microcomputer, U2.

The custom analog IC contains the A/D Converter circuitry, signal conditioning circuits, and the digital control circuitry required for communication with the microcomputer. Although the custom IC is primarily analog, digital circuits provide state machine control for the A/D converter, a read counter for A/D samples, decoding ROMs for analog switch drive, and bus control for communication with the microcomputer.

The microcomputer controls the A/D Converter, initiates the range and function switching, formats data for display, and drives the display. The mode push buttons and the LCD display are part of the digital circuit section: the push buttons supply input to the microcomputer to initiate various modes, and the LCD display is the microcomputer output device.

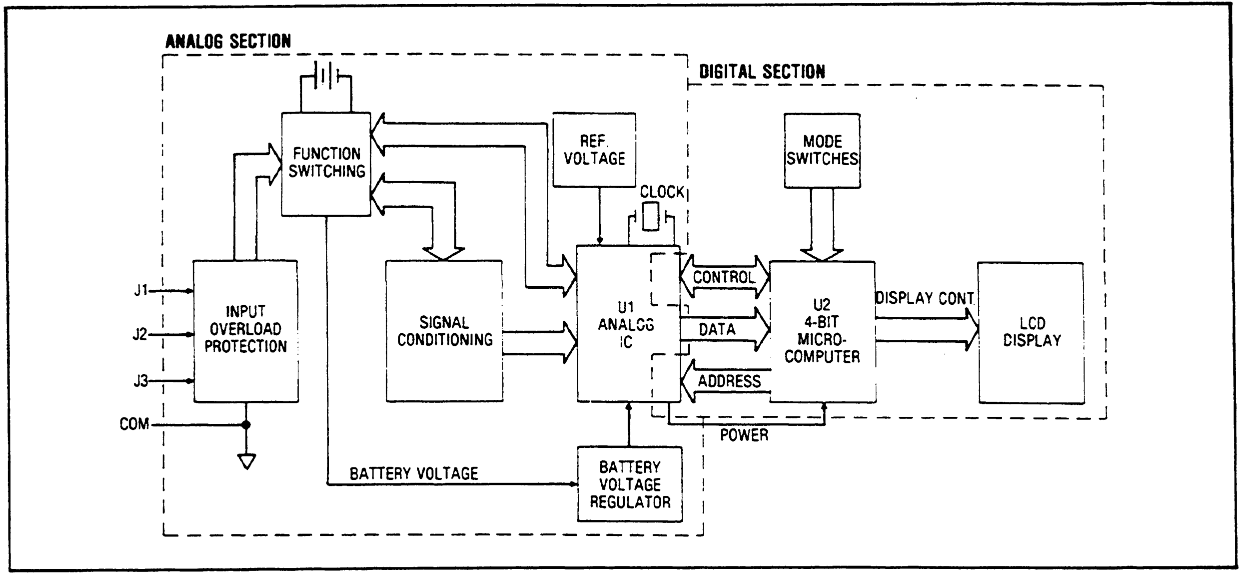


Figure 4-1. 8025B Functional Sections and Block Diagram

4-3. BLOCK DIAGRAM DESCRIPTION

Each element of the block diagram (Figure 4-1) is discussed in the following paragraphs. When circuits are described in greater detail than the block diagram, refer to the schematic (in Section 7) as needed.

4-4. Input Overload Protection

All input lines are routed first through overload protection circuitry. Overload protection for the **V Ω ⊣▶⊢** Test input (J1) is provided by a network of five Metal Oxide Varistors (RJ1 through RJ5) and two current-limiting resistors (R1 and R2). R2 is a 1-kilohm, 2-watt fusible resistor that will open if an extremely high energy signal is present.

Two fuses in series provide protection for the mA/μA input (J2) current shunts: a 3A, 600V fuse and a 630 mA, 250V fuse. A single 20A, 600V fuse provides protection for the 10A input (J3) current shunt. For the μA and mA ranges, a bridge rectifier (U7) and four diodes (CR1, CR2, CR3, CR4) ensure that the fuses (instead of the shunts) open in high current overloads.

Transistors Q1, Q2, and Q11 provide additional overload protection for the millivolt and ohms functions. If sufficient overload voltage is present, the transistors turn on and connect that input to common through limiting resistor R2, thereby protecting the circuitry in U1. A clamp circuit (CR6 and Q15) connected to the Volt/Ohms/Diode Test input through Z1 and C3 provides similar protection for the Volts/Ohms/Diode Test input.

4-5. Function Switching Circuits

Input signals are routed from the overload protection circuits to the function switch. The function switch is a rotary switch with two double-sided wafers which provide the necessary switching to select each of the various functions. In addition, battery voltage is routed through the function switch from the battery voltage regulator to U1, and from U1 to U2.

4-6. Signal Conditioning Circuits

Each input signal is routed through signal conditioning circuitry before reaching U1, the custom IC that contains most of the analog circuitry. Input signals received through the Volts/Ohms/Diode Test input (J1) are routed through Z1, a precision resistor network. The resistor network provides precise input scaling for the various voltage ranges, and it provides precision reference resistors for the ohms function. The capacitors in parallel with the various resistors in Z1 are used in the ac voltage functions; the variable capacitors provide calibration adjustment for the high frequency ac ranges.

Current inputs received through the mA/μA jack (J2) and the A jack (J3) develop a voltage across resistors R14, R20 and R23 (320 μA, 32 mA, and 10A respectively). Resistors R9 and R10 comprise a 10:1 divider for the 3200 microamp and 320-milliamp current ranges.

4-7. Custom LSI (U1) Circuit

The analog-to-digital converter, autorange switching, and most of the remaining active analog circuitry (including additional signal conditioning) is contained in U1. Peripherals to U1 include the system clock, the reference voltage regulator for the A/D converter, and some filtering and amplifier stabilization components. U1 also contains digital circuitry for state machine control over the A/D converter phases, a read counter for A/D samples, decoding ROMs for analog switch drive and read counter preset, and registers to store control outputs from the microcomputer.

Analog-to-digital conversion within the LSI is accomplished using a modified dual-slope A/D converter circuit, as shown in Figure 4-2. The conversion method can be described as a charge-coupled, multiple-slope technique. A series of ten minor conversions occur every 40 mS (each at 1/10th the desired resolution) without taking time for an autozero phase between the conversions. These minor conversions occur at a 25 per-second rate, and they are used to provide fast bar-graph response and fast autoranging.

New samples are taken every 40 mS. Ten samples are summed to produce a full-resolution digital display, with full scale greater than 3200 counts. A 100-millisecond autozero phase occurs following every ten-sample sequence.

Basic A/D conversion elements and waveforms are illustrated in Figure 4-2. Note that a residual charge is retained by the integrator capacitor due to the overshoot past the true-zero base line. In the absence of an autozero phase, the residual charge would normally produce a significant error in the sample next taken. However, a digital algorithm eliminates the error and accounts for the residue as it propagates through all 10 samples.

Digital circuitry in the LSI provides state machine control for the A/D converter, a read counter for A/D samples, decoding ROMs for analog switch drive and for read counter preset, bi-directional bus control for storing control outputs from the microcomputer and to transfer data to the microcomputer. Figure 4-3 illustrates the digital circuitry within the LSI.

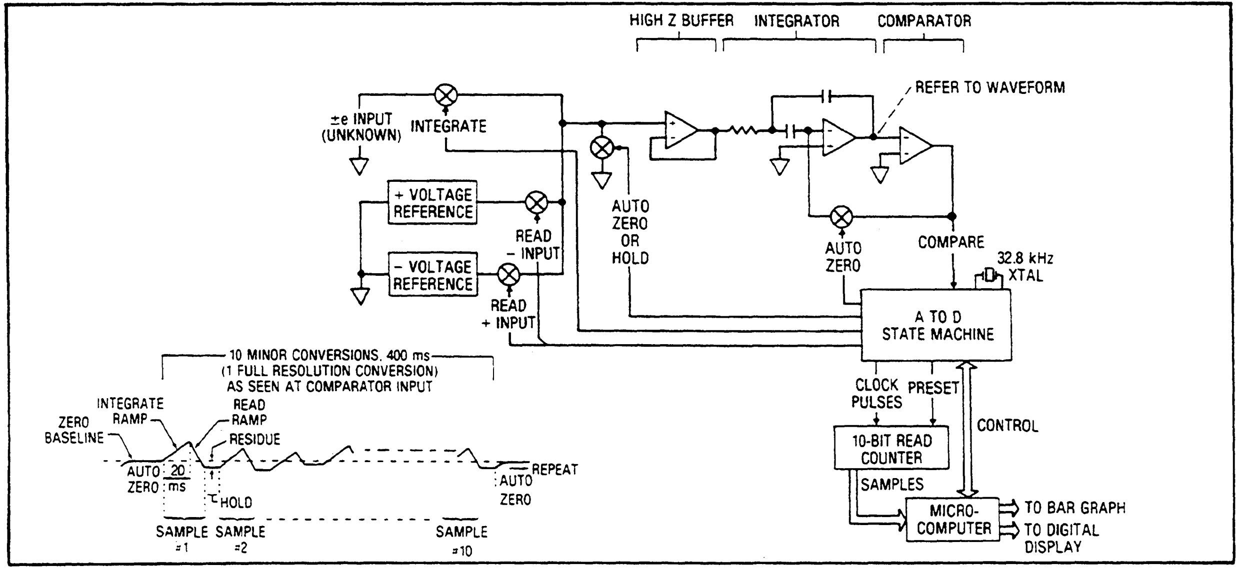


Figure 4-2. A/D Conversion Elements and Waveform

Basic timing for the A/D converter is defined as a series of 10 integrate/read cycles (samples), followed by a 100-millisecond autozero phase. However, the diode test/continuity function, the 32-megohm range, the power-up battery test, the power-up self test, overload recovery, autoranging, and the touch-hold mode all require variations from the basic timing. The state machine, in combination with the ROM and preset read counter, plus an autozero flag under computer control, establishes the timing variances necessary for the various functions.

4-8. Peripherals To The LSI (U1)

Circuitry peripheral to U1 provides regulated battery voltage to power the LSI, a regulated reference voltage for the A/D converter, a system clock, signal conditioning, and amplifier stabilization. The battery voltage regulator consists of AR1, Q12, and associated components; the regulator circuit supplies consistent operating power to the LSI (U1) and, through a second regulator circuit in U1, to the microcomputer (U2). Voltage regulator VR1 (and associated components) supplies a regulated 1.000V reference voltage for the A/D converter. Potentiometer R19 is the reference voltage calibration adjustment.

Additional circuits are necessary for the active filter, integrator, and buffer in the LSI. The active filter response is determined by R13, R16, C18, and C19. Integrator and buffer signal characteristics are determined by C20, C21, and two resistors in Z1. Several components external to the LSI provide for the ac-to-dc converter function. They are C41, C42, C43, R35, R7, C16, R30, R31, and R32.

The system clock, with a frequency of 32.768 kHz, controls all timing synchronization. Y1 is a quartz crystal which determines the frequency of the clock oscillator circuit.

4-9. Microcomputer Control

A CMOS, 4-bit microcomputer controls the various functions and drives the LCD display. The microcomputer reads and processes data samples from the A/D converter, sends a code to the LSI which represents the operator-selected function, performs the touch-hold algorithm, selects the correct A/D mode for the function in use, controls range, sets the autozero flag, and disables the analog filter during autoranging.

In reading and processing A/D samples, the computer accepts raw sample data, applies necessary corrections as described in the preceding LSI discussion, and accumulates 10 samples which then become the full-resolution conversion for digital display. Each minor conversion is also processed for the bar-graph format. For the diode test and continuity function, the microcomputer evaluates the data and determines whether or not the beeper should be switched on.

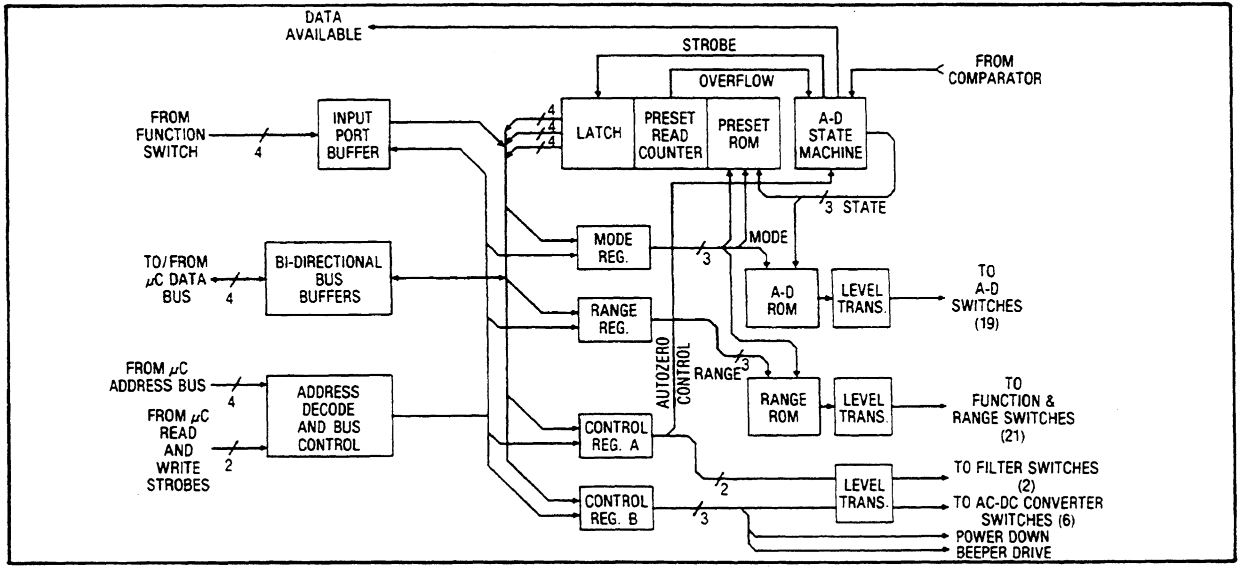


Figure 4-3. LSI Digital Circuitry

Touch-hold operation requires the microcomputer to perform a different algorithm. The microcomputer will not allow a full-resolution conversion to complete unless the input signal is stable. When a stable reading occurs, the conversion completes and the microcomputer generates the corresponding display and freezes it. The microcomputer then waits for a change in the signal to exceed a certain threshold, then begins watching for a stable reading again. There are exceptional cases to this simple algorithm: Open test lead indication will not allow a full-resolution conversion to complete either; the microcomputer continues to wait for a stable signal which is outside the open test lead region. (Open test leads in voltage or current functions result in low readings; open test leads in resistance or diode test functions result in off-scale readings.) If the touch hold button has been pressed, then the full-resolution conversion is forced to complete in spite of input or test lead conditions.

The microcomputer also sets the required A/D converter mode. A single mode is used in all voltage and current conversions, but there are three ohms function A/D converter modes, a diode test mode, and two power-up (battery and self-test) test modes. The microcomputer sends the proper code to the LSI to select the required A/D converter mode. Following each group of ten samples, in normal operation, the microcomputer sets the autozero flag.

Both manual and autoranging are controlled by the microcomputer. The microcomputer loads the LSI range register in conjunction with a mode dependent map. In autorange, the analog filter is disabled to increase the autoranging speed.

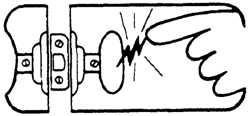
One peripheral circuit for the microcomputer provides a forced reset to the microcomputer when the function switch is moved to OFF. The forced reset components are Q13 and C12. The only other peripheral circuit is a voltage-divider network (R3, R4, and C13) that supplies a mid-level voltage to drive the multiplexed display.

4-10. Display

The display is a liquid crystal display (LCD) that operates under direct control of the microcomputer. Characters are generated by the computer, and displayed on the LCD. Both digital readings and an analog bar-graph display are presented, in conjunction with annunciators and decimal points as discussed in Section 2 of this manual. Refer to Section 2 for further information about the display.

static awareness

A Message From
John Fluke Mfg. Co., Inc.



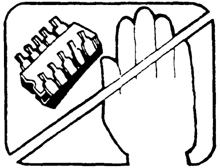
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

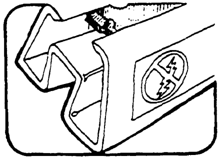
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol

" ".

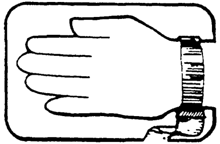
The following practices should be followed to minimize damage to S.S. devices.



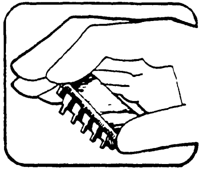
1. MINIMIZE HANDLING



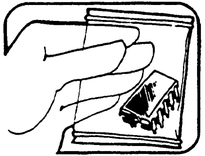
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



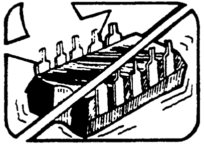
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



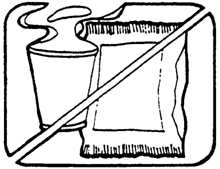
4. HANDLE S.S. DEVICES BY THE BODY



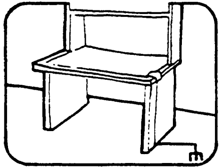
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM©* IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc..

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

* Dow Chemical

Section 5
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

5-1. INTRODUCTION

Section 5 provides procedures for disassembling, reassembling, performance testing, calibrating, and troubleshooting the meter. The performance tests may be used as an acceptance test when the instrument is first received, and can be used later as a preventive maintenance tool.

The meter should be calibrated yearly and seals should be replaced during servicing to ensure that the meter operates at its specifications (Table 1-2). A seal kit (P/N 738112) is available. The equipment required for the performance testing and calibration is listed in Table 5-1. Equipment with equivalent specifications may be used if the models listed are unavailable.

Table 5-1. Recommended Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
DMM CALIBRATOR	Voltage Range: 0-1000V ac, ±.05% Frequency Range: 40-10,000 Hz, ±1% Voltage Range: 0-1000V dc, Accuracy: ±.05% Current Range: 2 mA-2A Accuracy: ±.2% Values: 100 ohm, 1 kilohm, 10 kilohm, 100 kilohm, 1 megohm, 10 megohm Accuracy: ±.05%	John Fluke Models 5100B, 5101B, 5102B, 5215A
TRANSCONDUCTANCE AMPLIFIER	Output Range: 1-10A Accuracy: ±.1%	Fluke Model 5220A

5-2. GENERAL MAINTENANCE INFORMATION

5-3. Handling Precautions For Static-Sensitive Devices

CAUTION

This unit contains CMOS components which can be damaged by static discharge. Static-sensitive components include U1, the custom LSI, and U2, the microcomputer. To prevent static discharge damage, take the following precautions when servicing the instrument.

- Perform all work at a static-free work station.
- Do not handle a component or pca (printed circuit assembly) by its connector(s).
- Wear static ground straps.
- Use conductive foam to store components.
- Remove all plastic, vinyl, and styrofoam from the work area.
- Use a grounded, temperature-regulated soldering iron.

5-4. Disassembly and Reassembly

WARNING

TO AVOID THE POSSIBILITY OF ELECTRIC SHOCK, REMOVE TEST LEADS FROM THE METER PRIOR TO DISASSEMBLY.

CAUTION

Opening the case in damp, humid environments, then moving the instrument to a cooler environment could cause condensation inside the case. Instrument performance may be adversely affected by condensation.

Most maintenance procedures require some disassembling of the meter. The following procedure provides complete step-by-step disassembly and reassembly instructions. (Refer to Figure 5-1 as needed). Completely disassembling the meter is not normally required to service it. What maintenance procedures can be performed at each level of disassembly is noted.

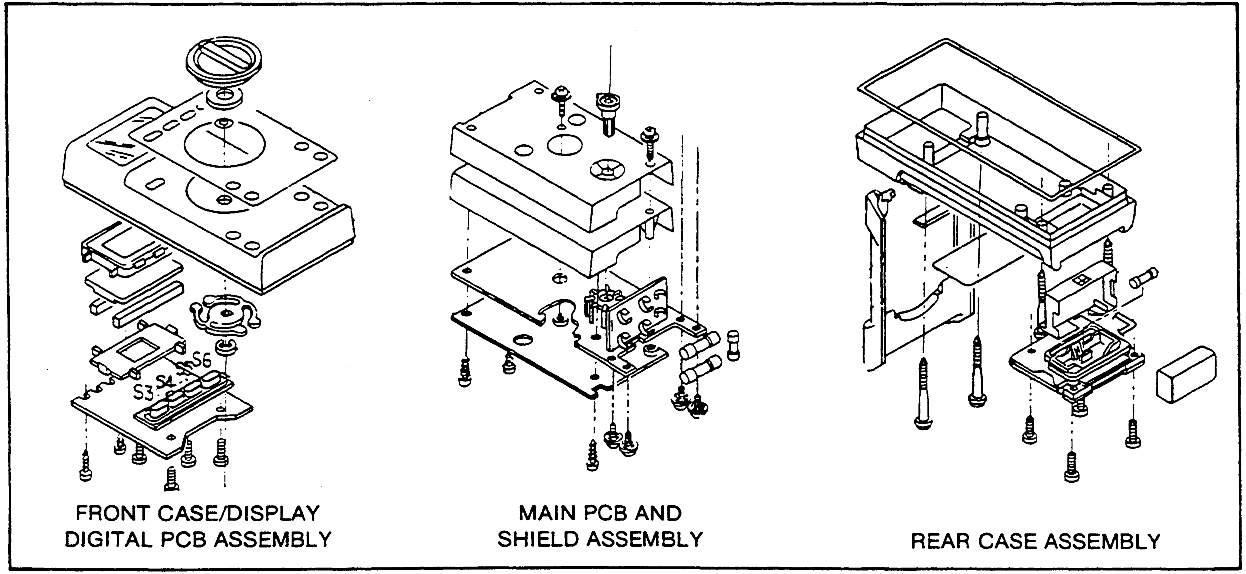


Figure 5-1. 8025B Assembly Drawings

CAUTION

Handle the pcas by the edges or wear gloves to avoid contaminating them. If a pca does become contaminated, refer to "Cleaning" later in this section. Do not allow the LCD to come in contact with moisture.

NOTE

Disassembly requires two tools: a number 6 Posi-drive® screwdriver and a number 4 Phillips screwdriver. Do not use automatic screwdrivers. Reassembly requires silicone lubricant and new seals (P/N 738112). We recommend Parker Super O-lube.

1. Turn the function switch to the upper OFF position.
2. Lift the hinged instrument stand up (about 1 inch up from the back of the meter), then gently pull the edges of the stand out to remove it.
3. Remove the four black number 6x32 Posi-drive machine screws that hold the battery cover to the back of the case, then lift the battery holder out of the instrument.
4. Remove the battery and battery connector from the battery holder, then disconnect the battery.
5. Remove the battery holder from the battery cover by tilting the battery holder toward the non-skid foot and sliding it off (away from the non-skid foot) the battery cover. Remove the old O-ring. Clean the O-ring surfaces of the battery cover and the case. Install the battery holder on the battery cover, then install the new O-ring.
6. Remove the four recessed, black, number 6, thread-forming, Posi-drive screws with the rubber washers from the back cover.
7. Lift the back cover off the meter, and remove the O-ring seal between the case halves. (Always install a new O-ring seal prior to reassembly.)
8. Calibration adjustments can be made through the openings in the side of the pca shield. Refer to the calibration procedure in this manual section to calibrate the instrument.

9. Remove the four number 4x40 Phillips-head screws at the bottom of the pca that connect the pca to the input jacks molded into the front cover.

10. Carefully lift the upper end of the main pca and shield assembly to disconnect the assembly from the digital pca, then lift the main pca and shield clear of the case.

11. Note the position of the rotary switch center shaft. With the switch in the OFF position, the single small pointer on the base of the rotary switch shaft is pointed toward the top of the instrument. Refer to Figure 5-2.

12. Lift the rotary switch shaft off the switch knob shaft.

13. Remove the E-ring retainer and the detent spring from the switch knob shaft.

14. Pull the rotary switch knob out the front of the front cover. Take care not to lose the Teflon bearing washer under the knob.

15. To replace the O-ring on the rotary switch knob shaft, cut off the existing O-ring without scratching the metal shaft. Clean the shaft thoroughly, and slide a new O-ring over the knob shaft into the groove on the shaft.

16. Remove the four black lower screws (number 4x40 Phillips) that secure the digital pca to the top case using a diagonal pattern (i.e., remove the upper-right screw, then the lower-left, then the upper-left, and last the lower-right). Then remove the two black, number 4, Phillips-head, thread-forming screws located above the connector at the top of the digital pca.

17. Carefully lift the digital pca straight up from the front case to remove it.

18. Lift the momentary mode switch unit from the front case.

CAUTION

Do not touch the elastomeric LCD contact strips with bare hands. Wear gloves or remove the contact strips using clean pliers, or tweezers.

19. Remove the elastomeric LCD contact strips and the LCD interconnect support (located on the back of the LCD).

20. Remove the LCD and the LCD mask from the case.

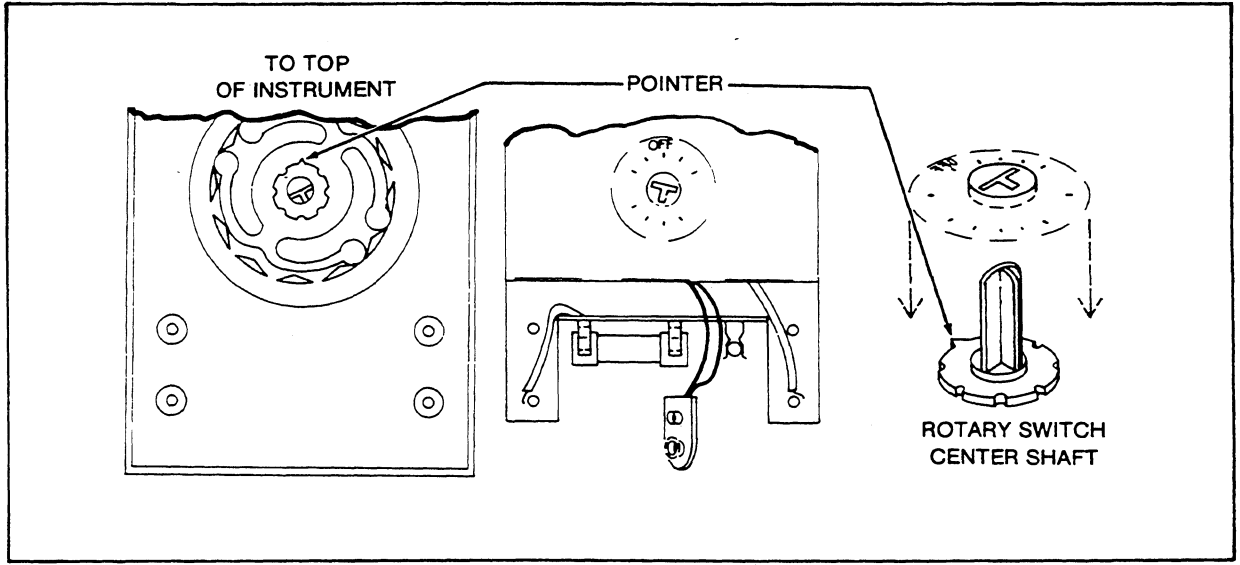


Figure 5-2. Switch Extension Shaft Installation

21. To disassemble the main pca/shield assembly, first remove the two number 4x40 Phillips-head screws in the top shield.

22. Turn the assembly over, and remove the three screws (number 4, thread-forming, Phillips-head) that secure the back shield.

23. Lay the back shield aside, and separate the top shield from the pca.

24. At this point, all main pca components are accessible.

Reassembling the meter is primarily a reversal of the disassembly steps. However, some precautions are necessary to ensure proper sealing and to maintain water-tight integrity. Use the following procedure to reassemble the meter:

1. Position the LCD mask in the top half of the case, then place the LCD in the LCD mask with the John Fluke part number toward the top of the instrument, pressing the LCD lightly to engage the spring action of the LCD mask. Place the LCD interconnect support over the LCD, then place the elastomeric connector strips at the top and bottom of the LCD interconnect support with the black connection strip against the LCD.

2. Note the small bump at the center of one edge of the momentary switch assembly. Place the momentary switch assembly in the case with the bump toward the LCD display.

3. Place the digital pca in the front half of the case with the connector toward the back of the instrument and at the top of the case.

4. Install the four black lower screws (#4x40 Phillip-head) that secure the digital pca over the momentary switch assembly. Note that the momentary switch assembly provides a seal between the case and the digital pca. Install the screws using a diagonal sequence (i.e., upper-right, then lower-left, then upper-left, then lower-right).

5. Install the two black, number 4, Phillips-head, thread-forming screws above the connector that hold the top of the digital pca.

6. Verify that the Teflon washer is on the rotary switch knob shaft, then install a new O-ring on the rotary switch knob shaft (if not previously installed), then install the rotary switch knob in the upper off position.

7. Lubricate the outer edges of the detent spring (with a very thin layer of silicon lubricant) and install the detent spring while holding the switch knob in the off position. Detent spring orientation is not critical.

8. Install the E-ring retainer on the switch knob shaft.

9. Place the rotary switch shaft extension on the rotary switch knob shaft. Note the small pointer on the base of the shaft extension; it must be pointed toward the center of the display with the switch knob in the upper off position.

10. To reassemble the main pca/shield assembly, fit the top shield over the component side of the pca, taking care not to bend the connector pins. Make sure the shield posts fit through the holes in the pca, and verify that the rotary switch is in the upper OFF position.

11. Install the two number 4x40, Phillips-head, machine screws and lock washer in the top shield.

12. Position the bottom shield on the back of the pca, with the stand-offs fitted through the pca, then position the top shield on the top of the pca with the molded stand-offs fitted through the pca.

13. Install the two number 4x40, Phillips-head, machine screws and flat washers through the top shield into the bottom shield. Install the three number 4, Phillips-head, thread-forming screws through the bottom shield into the top shield.

14. Carefully fit the main pca/shield assembly into the front case, taking care to ensure that the connector pins on the main pca are lined up properly with the connector on the digital pca, and that the switch shaft extension aligns with the two rotary switch wafers in the OFF position (do not use force). Engage the connector by pressing lightly on the bottom shield at the case-screw holes.

15. Install the four number 4x40, Phillips-head, machine screws with lock washers that secure the main pca/shield assembly to the back of the input jacks, again using a diagonal pattern.

16. Install an O-ring on the back case cover, if it was not replaced during disassembly, and position it at the beginning of the tapered area.

17. Place the rear cover on the front half of the case, then start four new number 6, Posi-drive, thread forming screws with rubber washers. Press the case halves firmly together and tighten the screws in a diagonal pattern (lower-right, upper-left, upper-right lower left,) to ensure a proper seal.

18. If the battery compartment O-ring was not replaced during disassembly, it should be replaced before reassembly. Use the procedure in step 5 of paragraph 5-4.

19. Connect the battery to the battery terminal connector, then slide the battery into the battery holder. Place the wires in the slot in the upper edge of the battery holder.

20. Slide the battery holder/cover assembly into the back of the meter.

21. Start the four screws that secure the battery cover. Press firmly on the battery cover while tightening the screws in a diagonal pattern.

22. Move the function rotary switch from OFF to any function. All segments of the LCD should illuminate briefly if the instrument has been properly assembled.

5-5. Cleaning

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastic materials used in the instrument.

CAUTION

Do not allow the LCD to come in contact with moisture.

Clean the front panel and case using a mild solution of detergent and water on a soft cloth. Clean the outer carrying case with a solution of soap (not detergent) and water. Clean dust from the pcas using clean, dry air at low pressure (less than 20 psi). Clean contaminates from the pcas using isopropyl alcohol and a soft brush, followed by demineralized water and a soft brush (remove the LCD before washing). Bake the pca at 50°C to 60°C for 24 hours after washing (and before reassembly) to assure that no moisture is sealed in the instrument.

5-6. PERFORMANCE TEST

The following procedures allow you to check the performance of your meter against the specifications given in Section 1 of this manual. The procedures are recommended for incoming inspection, periodic calibration verification, and as an aid in troubleshooting. If the instrument fails any test, calibration adjustment or repair is needed.

Prior to performing any of the testing procedures, allow the instrument to stabilize to room temperature (18 to 28 degrees Celsius). Also, check the fuses and if the battery annunciator is displayed, change the battery.

5-7. Display Performance Verification

When the function switch is moved to any position from the OFF position, the meter performs a power-up self test. All LCD segments in the display are switched on while the test is in progress, then the instrument commences normal operation. This automatic self test verifies that the meter is functional and that all LCD segments are functioning.

5-8. Voltage Functions Performance Verification

The following procedure may be used to verify proper operation and calibration of the ac and dc voltage measurement functions. Required test equipment is listed in Table 5-1.

CAUTION

Connect the common terminal of the Digital Multimeter (DMM) calibrator to COM on the 8025B.

1. Verify that both the meter and the Digital Multimeter Calibrator (here after referred to as the DMM Calibrator) are off.
2. Connect the 8025B, using the volts/ohms/diode test input jack, to the ac output connections of the DMM Calibrator.
3. Turn the function selector on the meter to the ac volts position ($\tilde{V}$).
4. Switch on power to the DMM Calibrator, and program it for an output of 2.7V ac, at 100 Hz.
5. Verify that the meter indicates between 2.684 and 2.716V ac.
6. Program the DMM calibrator for an output of 27V ac, at 10k Hz.
7. Verify that the meter indicates between 26.43 and 27.57V ac.
8. Program the DMM calibrator output for 250V ac, 10k Hz.
9. Verify that the meter indicates between 244.7 and 255.3V ac.

10. Program the DMM calibrator for an output of 1000V ac, at 10k Hz.

11. Verify that the meter indicates between 967 and 1033V ac.

12. Program the DMM calibrator for an output of zero volts.

13. Turn the 8025B function selector to dc ($\overline{\overline{V}}$).

14. Program the DMM calibrator output for 2.7V dc.

15. Verify that the meter indicates between 2.697 and 2.703V dc.

16. Program the DMM calibrator for an output of 27V dc.

17. Verify that the meter indicates between 26.97 and 27.03V dc.

18. Program the DMM calibrator output to 250V dc.

19. Verify that the meter indicates between 249.7 and 250.3V dc.

20. Program the DMM calibrator for an output of 1000V dc

21. Verify that the meter indicates between 998 and 1002V dc.

22. Switch off the DMM calibrator. Disconnect the calibrator from the 8025B.

5-9. AC and DC Current Verification

The following procedure may be used to test the ac and dc current functions, and to verify current measurement accuracy.

1. Turn the 8025B function switch to the ac mA/A position ($\widetilde{mA/A}$).
2. Connect the DMM Calibrator output to the 8025B mA/μA input terminal.
3. Switch on power to the DMM Calibrator and program the DMM Calibrator output for 27 mA at 50 Hz.
4. Verify that the meter indicates between 26.58 and 27.42 mA.
5. Program the DMM Calibrator output for 270 mA at 50 Hz.
6. Verify that the meter indicates between 265.8 and 274.2 mA.

7. Program the DMM Calibrator output for zero amps.

8. Switch the 8025B to the ac μA function ($\widetilde{\mu A}$), then program the DMM Calibrator output for 2700 μA at 500 Hz.

9. Verify that the meter indicates between 2658 and 2742 μA.

10. Program the DMM Calibrator output for zero amps.

11. Disconnect the DMM Calibrator from the meter, connect the DMM Calibrator to the Transconductance Amplifier, then connect the Transconductance Amplifier to the UUT amp (A) and common (COM) input terminals.

12. Program the DMM Calibrator output for an output from the Transconductance Amplifier of 5A at 1 kHz.

13. Verify that the meter indicates between 4.91 and 5.09A. Program the DMM Calibrator to standby.

14. Set the 8025B to the dc mA/A function ($\overline{\overline{mA/A}}$).

15. Program the DMM Calibrator output for an output from the Transconductance Amplifier of 5.0A dc.

16. Verify that the meter indicates between 4.94 and 5.06A.

17. Program the DMM Calibrator to standby.

18. Disconnect the DMM Calibrator from the Transconductance Amplifier.

19. Turn the function switch on the 8025B to the dc mA/A position ($\overline{\overline{mA/A}}$).

20. Connect the DMM Calibrator output to the 8025B mA/μA input terminal, then program the DMM Calibrator for an output of 27 mA dc.

21. Verify that the meter indicates between 26.78 and 27.22 mA.

22. Program the DMM Calibrator output for 2700 μA dc. Set the meter to the dc μA function ($\overline{\overline{\mu A}}$).

23. Program the DMM Calibrator for 2.7 mA.

24. Verify that the meter indicates between 2678 and 2722 μA.

5-10. Ohms Function Performance Verification

The following test may be used to verify correct ohms function operation and to verify meter accuracy in the various ohms ranges.

1. Connect the DMM calibrator to the 8025B using the volts/ohms/diode test input jack and common.

2. Turn the function switch to the Ω position.

3. Switch on power to the DMM calibrator. Program the DMM calibrator to the resistance values indicated in Table 5-2, and verify that the reading is within the tolerances given for each input value.

5-11. Diode Test Function Performance Verification

The following procedure may be used to verify proper diode test function operation. (This test cannot be performed unless the source can sink 0.6 mA at 0.9V.)

1. Turn the 8025B function selection switch to the diode test function.

2. The meter should display OL.

3. Connect the DMM Calibrator to the 8025B volt/ohms/diode test input jack and common, and switch on calibrator power.

4. Program the DMM calibrator output for 0.090V, then push the 50-ohm divider override button on the calibrator to place the calibrator in the 2V range.

Table 5-2. Resistance Function Performance Test

STEP	INPUT RESISTANCE	DISPLAY INDICATION
1	100 ohms	99.5 to 100.5
2	1000 ohms	.997 to 1.003k
3	10,000 ohms	9.97 to 10.03k
4	100,000 ohms	99.7 to 100.3k
5	1 megohm	.997 to 1.003M
6	10 megohm	9.89 to 10.11M
*7	open circuit	00.00 to 00.10 nS

*NOTE: Conductance (nS) range must be entered using manual range selection.

5. Verify that the meter indicates approximately 0.090V and the beeper is sounding a continuous tone.

6. Increase the DMM calibrator output to 0.11V. The beeper should turn off.

7. Increase the calibrator output to 1.0V, then slowly decrease the calibrator output to 0.6V. Note that the beeper produces a short beep as the voltage descends through .7V (typical silicon diode threshold).

5-12. CALIBRATION ADJUSTMENT

Under normal operation, the meter should maintain the specifications given in Section 1 of this manual for a period of one year after calibration. If the meter has been repaired, or if it has failed any of the performance tests, the following calibration adjustment procedures must be performed. Use a non-conductive tool for adjustments.

5-13. Calibration Preparation

Allow the instrument to stabilize at an ambient temperature of 21 to 25 degrees Celsius (70 to 77 degrees Fahrenheit) and at a relative humidity of less than 80% with the power off for at least 30 minutes before beginning calibration. Calibration adjustments require removal of the bottom cover. Refer to the Disassembly Procedures given previously in this section, and complete steps 1 through 7, then reconnect the battery to the battery connector.

5-14. DC Voltage Calibration

The dc voltage function must be calibrated before calibrating the other functions. Use the following procedure to calibrate the dc voltage function.

1. Connect the DMM calibrator to the 8025B volts/ohms/diode test input jack and common. Refer to Figure 5-3 for calibration component locations.

2. Select the dc voltage function ($\overline{\overline{\text{V}}}$) on the meter.

3. Switch on power to the DMM calibrator, and program the calibrator output for 2.700V dc.

4. Adjust potentiometer R19 for a display indication of 2.700V on the 3V range.

5. Program the DMM calibrator for zero output, and disconnect the calibrator from the meter.

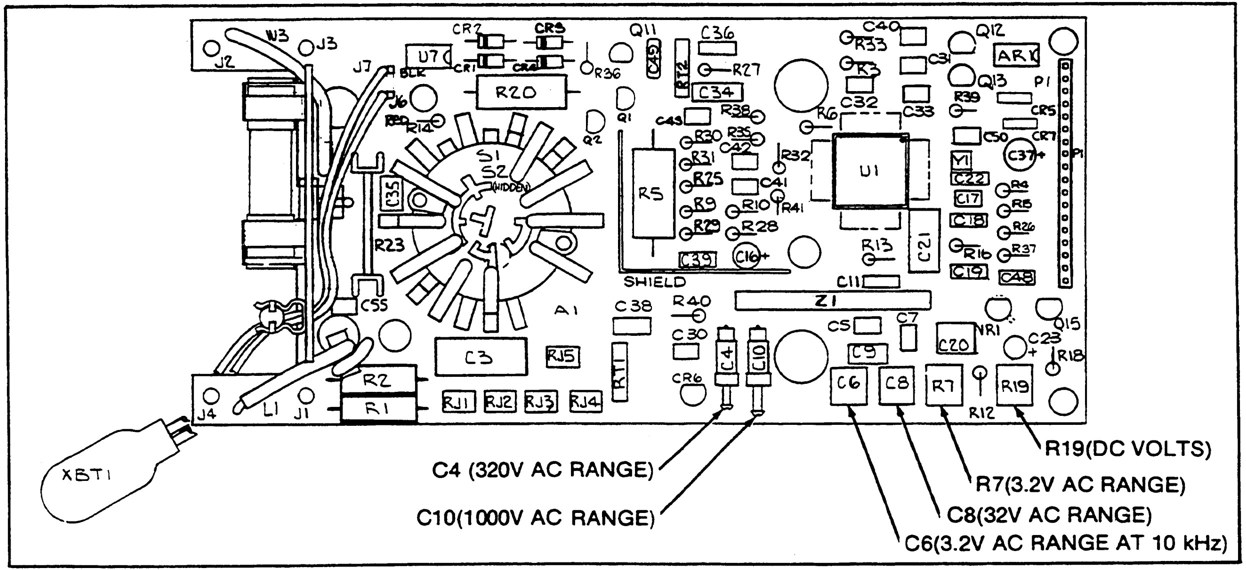


Figure 5-3. Calibration Adjustment Locations

5-15. AC Voltage Calibration

There is one A/D converter adjustment for ac voltage, and each ac voltage range must be calibrated independently for high frequency accuracy. Variable capacitors provide high frequency adjustment. There should be no interaction between the various ranges when adjustments are made in the specified order. Use the following procedure to calibrate the ac voltage ranges.

WARNING

THE FOLLOWING PROCEDURE REQUIRES THAT HIGH VOLTAGES BE SUPPLIED TO THE 8025B FOR CALIBRATION. READ THE SAFETY PRECAUTIONS GIVEN PREVIOUSLY IN THIS SECTION AND IN SECTION 3 BEFORE PERFORMING THE FOLLOWING PROCEDURE.

1. Select the ac volts function $(\widetilde{V})$ on the 8025B.
2. Connect the DMM calibrator to the volts/ohms/diode test input jack on the meter.
3. Program the DMM calibrator output for 2.7V ac at 100 Hz.
4. Adjust R7 to obtain a display of 2.700V ac, ±.001V ac.
5. Program the DMM calibrator output for 270V ac at 10k Hz.
6. Adjust C4 to obtain a display of 270.0V ac, ±0.1V ac.
7. Program the DMM calibrator output for 1000V ac at 10k Hz.
8. Adjust C10 to obtain a display of 1000V ac, ±1V ac.
9. Program the DMM calibrator output for 27.00V ac at 10k Hz.
10. Adjust C8 to obtain a display of 27.00V ac, ±.01V ac.
11. Program the DMM calibrator output for 2.700V ac at 10k Hz.
12. Adjust C6 to obtain a display of 2.700V ac, ±.001V ac.
13. Program the DMM calibrator output for 2.700V ac at 100 Hz.

14. Verify that the meter display indicates 2.700V ac, ±0.017V ac.

15. Switch off both the DMM calibrator and the meter. Disconnect the DMM calibrator from the meter.

16. Refer to the instructions following paragraph 5-4 to reassemble the meter after calibration.

5-16. TROUBLESHOOTING

CAUTION

Static discharge can damage CMOS components U1 and U2. Follow the handling precautions for static sensitive components given previously. Never remove or install components without first disconnecting all inputs to the instrument and turning the function selector switch to OFF.

Refer to the Figure 5-3, the component location diagram, and to the schematics in Section 7 of this manual as necessary during the following troubleshooting procedures.

5-17. Power-up Self Test

When the function switch is moved to any position from the OFF position, the meter performs a power-on self test. All LCD segments are switched on while the test is being performed (about 1 second), then the unit commences normal operation.

5-18. Overall System Check

If the LCD display segments do not light, or if other malfunction indications occur during power-up or operation, perform the following overall system check. All measurements are taken with respect to common. The overall system check is helpful in isolating a malfunction to the component area, and Table 5-3 provides further fault isolation within the component area. Refer to the disassembly procedures following paragraph 5-4 as necessary.

1. Remove the back cover, then reconnect the battery.

2. Select the Volts dc function.

3. Use a DVM (Digital Voltmeter) to check the battery voltage at the battery connector (battery voltage must be above 6.3V). If battery voltage is less than 7.5V, battery replacement is advised. Normal current drain is less than 600 μA.

Table 5-3. Fault Diagnosis Guide

SYMPTOM	RECOMMENDED ACTION	POSSIBLE COMPONENT
Blank display	Do system check given in paragraph 5-19.	BT1, U1, U2, Y1, C13
Display reads zero in volt dc	Do dc signal tracing in paragraph 5-20.	R2, Z1, U1, S1
Display hangs up in self-test mode	Do system check given in paragraph 5-19.	R15, R18, R19, R12, R37, VR1, Z1, U1, C20, C21
Display reads OL or 0 in 320 mA range		R9, R10, U1
Display reads 0 in 320 mA or 10A ranges		F1, F2, F3, R9, R20, R14
AC volts is inaccurate	Check calibration	R31, R32, R29, R30
320 mV range reads OL		Q11, U1
AC volts measurement noisy at 50-60 Hz		R13, R16, C18, C19
Wrong annunciator displayed		S1R, U1
Volts inaccurate	Check calibration	RJ2-RJ5
Ohms inaccurate		Z1, U1
Intermittent display	Clean connectors and connector strips on LCD and pca.	Display Assembly

Table 5-3. Fault Diagnosis Guide (cont)

SYMPTOM	RECOMMENDED ACTION	POSSIBLE COMPONENT
Display reads constant offset in volts		C18, C19, C20 shorted
Ohms reads low or will not read OL		Q1, Q2 shorted or leaky
Ohms reads random or alternates between on scale and OL		R2, RT2

4. Connect either an oscilloscope or frequency counter, using a low-capacitance probe, to pin 54 of U1 or to the junction of C17 and Y1 (the crystal). A 32.768k Hz sinewave with an amplitude of approximately 600 mV peak-to-peak should be present at the junction of C17 and Y1 (3V peak-to-peak at U1, pin 54). Note that U2 and the display will not operate if the clock signal is not present. If the clock signal is not present, the most likely causes are U1, Y1, or C17.

5. Use a DVM to check for a reference voltage of 1.00V dc (adjustable through R19) at pin 13 of U1 or at the junction of R15 and R18. If the reference voltage is not present, the most likely causes are VR1, R12, R15, R18, R19, R37, or U1.

6. Use a DVM to check for Vm (voltage middle) at pin 55 of U2, pin 16 of J8, or at the junction of R3 and R4. Vm should be 1.6V dc, ±.1V. If Vm is not present, the most likely causes are R3, R4, or C13.

5-19. Volts DC Signal Tracing

The following procedure is a step-by-step method of tracing a dc voltage input through the meter's circuits to the output of the active filter. Faulty components in the input signal path can be identified using this procedure. All measurements are taken with respect to common.

1. Select the volts dc function, then apply a 2V dc input through the volts/ohms/diode test input jack.
2. Using a DVM, measure the 2V input at the input jack (J1).
3. Check pin 1 of the input divider (Z1) for 2V dc. If 2V dc is not present, R2, S1, RJ1, RJ2, RJ3, RJ4, or RJ5 may be defective.
4. Check pin 3 of Z1 for approximately 200 mV dc. If 200 mV is not present, either Z1 or U1 may be defective. (Measurement may be approximately 10% low if a 10 megohm input impedance meter is being used for signal tracing.)
5. Check the active filter input (pin 28 of U1) for approximately 200 mV dc. If 200 mV is not present, U1 may be defective. (Measurement may be affected by loading.)
6. Check the active filter output (pin 29 of U1) for approximately 200 mV dc. If 200 mV is not present, R13, R16, C18, or C19 may be defective. (Measurement may be affected by loading.)

5-20. Fault Diagnosis Guide

Table 5-3 is a fault diagnosis guide for the meter. Symptoms of malfunction are listed in the left column, recommended actions are given in the center column, and a list of the components most likely to be defective is given in the right column.

Section 6
List of Replaceable Parts

TABLE OF CONTENTS

6-1. INTRODUCTION

This section contains parts breakdown of the instrument. Components are listed alphanumerically by assembly.

Parts lists include the following information:

1. Reference Designation.

2. Description of each part.

3. FLUKE Stock Number.

4. Federal Supply Code for Manufacturers (See rear of manual for the Code-to-Name list.)

5. Manufacturer's part number.

6. Total Quantity of components per assembly.

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked.

6-2. HOW TO OBTAIN PARTS

Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from John Fluke Mfg. Co., or its authorized representative by using the FLUKE STOCK NUMBER.

In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.

2. FLUKE Stock Number.

3. Description.

4. Reference Designation.

5. Printed Circuit Board Part Number and Revision Letter.

6. Instrument Model and Serial Number.

A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the parts list in the quantities recommended.

Parts price information is available from the John Fluke Mfg. Co., Inc. or its representative. Prices are also available in the Fluke Replacement Parts Catalog, which is available on request.

CAUTION

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Indicated devices are subject to damage by static discharge.

Table 6-1. 8025B Final Assembly

REF DES	DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
A1	* MAIN PCA	835454	89536	835454	1	
A2	* DIGITAL PCA	835462	89536	835462	1	
BT1	BATTERY,PRIMARY,ALKALINE,9V,0-200MA	614487	89536	614487	1	
F1	⚠ FUSE,.406X1.375,3A,600V,FAST	756601	89536	756601	1	1
F2	⚠ FUSE,5X20MM,0.63A,250V,FAST	845040	89536	845040	1	1
F3	⚠ FUSE,.406X1.5,20A,600V,FAST	643684	89536	643684	1	1
H1	WASHER,FLAT,TEFLON,.295,.900,.020	696591	89536	696591	1	
H2	SCREW,FIH,P,THD FORM,STL,4-20,.375	682310	89536	682310	2	
H3	SCREW,PH,P,SEMS,STL,4-40,.312	721670	89536	721670	4	
H4	SCREW,PH,P,AM THD FORM,STL,4-14,.375	448456	89536	448456	3	
H5	SCREW,PH,P,EXT SEMS,STL,4-40,.250	107430	89536	107430	4	
H8	SCREW,PH,PO,STL,6-32,.375	682070	89536	682070	4	
H9	SCREW,PH,PO,THD FORM,STL,6-20,1.265	733394	89536	733394	4	
H6	SCREW,PH,P,LOCK,STL,4-40,1.000	157008	89536	157008	2	
H7	WASHER,FLAT,STL,.125,.312,.030	739912	89536	739912	2	

Table 6-1. 8025B Final Assembly (cont)

REF DES	DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
MP1	CASE, TOP	659946	89536	659946	1	
MP2	KNOB, SWITCH	654012	89536	654012	1	
MP3	O-RING,NITRILE N163-70,.114,.070	705947	89536	705947	1	
MP4	SPRING,DETENT	654046	89536	654046	1	
MP5	RING,RET,EXT,FLAT,STL,.188 DIA	697078	89536	697078	1	
MP6	DECAL, CASE TOP, DARK UMBER	659466	89536	659466	1	
MP7	SUPPORT, TOP SHIELD	654038	89536	654038	1	
MP8	SHIELD,TOP	654384	89536	654384	1	
MP9	CASE BOTTOM	654004	89536	654004	1	
MP10	FOOT,CASE	654335	89536	654335	1	
MP11	BAIL, TILT	654053	89536	654053	1	
MP12	O-RING,NITRILE N545-40,6.710,.080	654392	89536	654392	1	
MP13	COVER BATTERY	654061	89536	654061	1	
MP14	O-RING,NITRILE N545-40,1.612,.103	697185	89536	697185	1	
MP15	RETAINER, BATTERY	660985	89536	660985	1	
MP16	SHAFT, SWITCH	655894	89536	655894	1	
MP17	SUPPORT, LCD INTERCONNECT	683664	89536	683664	1	
MP18	MASK,LCD	819375	89536	819375	1	
MP19	DECAL,BLANK	764761	89536	764761	1	

Table 6-1. 8025B Final Assembly (cont)

REF DES		DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
MP21		PROBE,TEST,BANANA JACK,RED,TP20	927777	89536	927777	1	
MP20		PROBE,TEST,BANANA JACK,BLK,TP20	927772	89536	927772	1	
MP22		CASE,MOLDED,TRANSIT,C100	820746	89536	820746	1	
MP23		TEST LEAD,SI,R/A PLG-R/A PLG,BLK,TL22	837120	89536	837120	1	
MP24		TEST LEAD,SI,R/A PLG-R/A PLG,RED,TL22	837112	89536	837112	1	
MP26		CLIP,ALLIGATOR,BANANA,SAFETY,RED MAC20	927582	89536	927582	1	
MP27		CLIP,ALLIGATOR,BANANA,SAFETY,BLK, AC20	927579	89536	927579	1	
MP28		CONN,ELASTOMERIC,LCD TO PWB	682500	89536	682500	2	
MP29	*	BOTTOM SHIELD ASSEMBLY	654079	89536	654079	1	
S1		SWITCH, MOMENTARY	659847	89536	659847	1	
TM1		8025A INSTRUCTION MANUAL	824482	89536	824482	1	
U3		LCD,3.75 DIGIT,BAR GRAPH,MUXED,LOTEMP	742932	89536	742932	1	

⚠ Note 1 = To ensure safety, use exact replacement only.

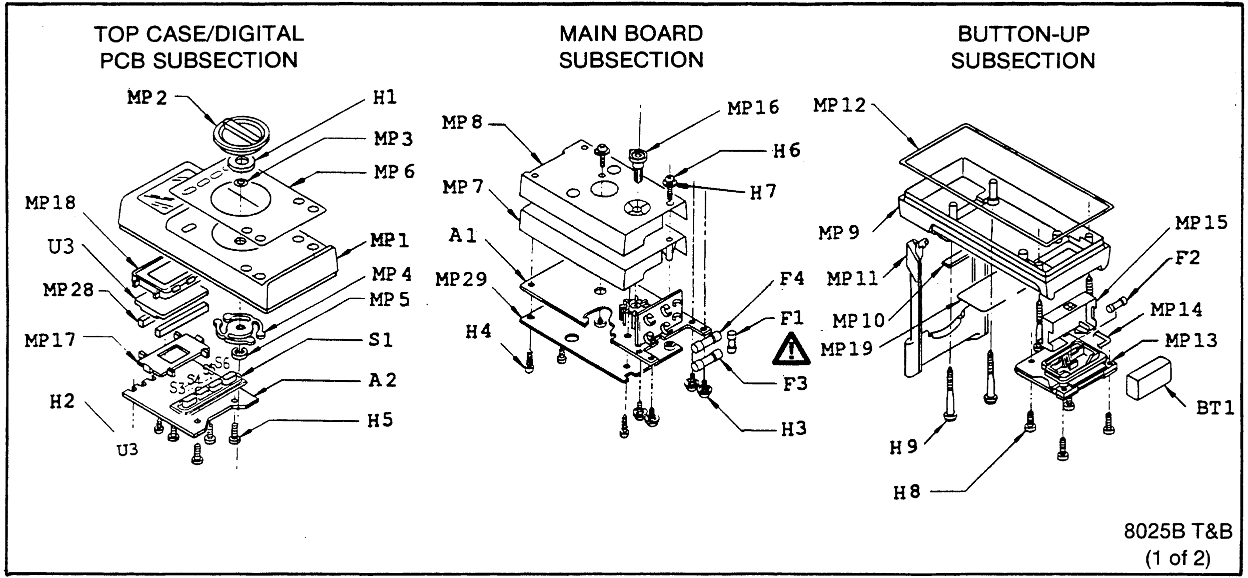


Figure 6-1. 8025B Final Assembly

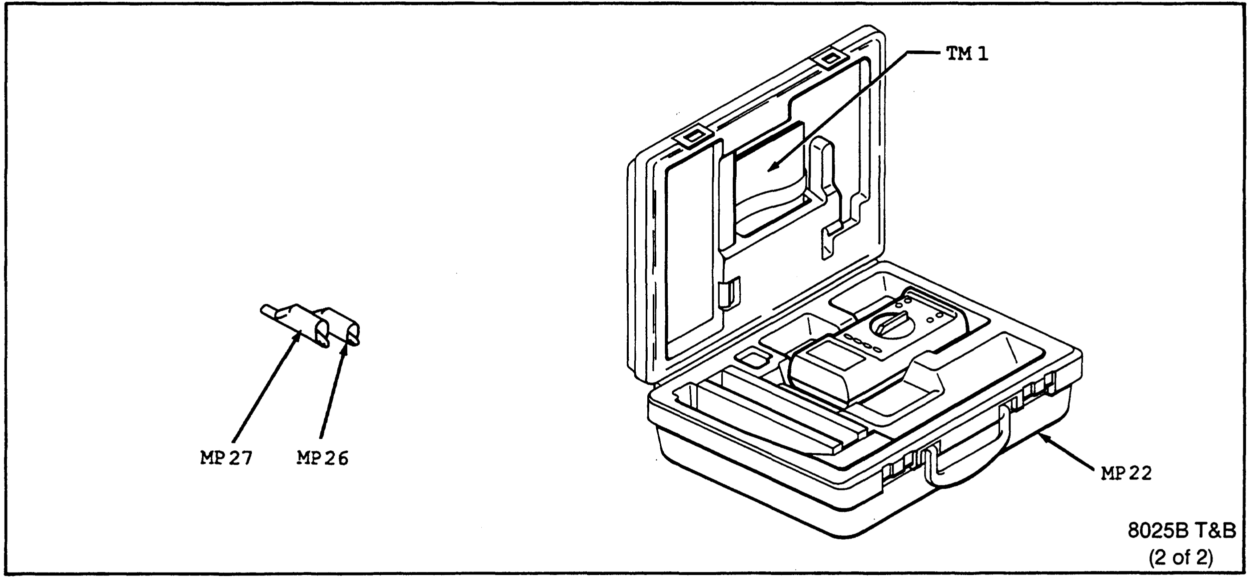


Figure 6-1. 8025B Final Assembly (cont.)

Table 6-2. A1 Main PCA

REF DES		DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
A3		PCB FUSE	835447	89536	835447	1	
AR1	*	IC, OP AMP, LOW POWER	721928	89536	721928	1	
C3		CAP,POLYES,0.022UF,+-10%,1000V	448183	89536	448183	1	
C4,C10		CAP,VAR,0.25-1.5PF,1700V,TEFLON	721480	89536	721480	2	
C5		CAP,CER,2.7PF,+-0.25PF,50V,C0G	773044	89536	773044	1	
C6		CAP,VAR,2-7PF,100V,CER	714600	89536	714600	1	
C7		CAP,CER,430PF,+-5%,50V,C0G	732644	89536	732644	1	
C8		CAP,VAR,6-50PF,50V,CER	714618	89536	714618	1	
C9		CAP,CER,5100PF,+-2%,50V,C0G	732651	89536	732651	1	
C11		CAP,POLYCA,0.027UF,+-5%,63V	733444	89536	733444	1	
C16		CAP,TA,10UF,+-20%,10V	714766	89536	714766	1	
C17,C50		CAP,CER,33PF,+-5%,50V,C0G	714543	89536	714543	2	
C18,C19		CAP,POLYCA,0.027UF,+-10%,63V	720979	89536	720979	2	
C20		CAP,POLYES,0.47UF,+-10%,50V	697409	89536	697409	1	
C21		CAP,POLYPR,0.033UF,+-10%,63V	721050	89536	721050	1	
C22,C36		CAP,POLYES,0.01UF,+-10%,50V	715037	89536	715037	2	
C23,C37		CAP,TA,22UF,+-20%,10V	658971	89536	658971	2	
C30		CAP,CER,4.0PF,+-0.25PF,1500V,C0J	714535	89536	714535	1	
C31-33,C40		CAP,CER,0.22UF,+80-20%,50V,Z5U	733386	89536	733386	4	
C34		CAP,POLYES,1000PF,+-20%,630V	740126	89536	740126	1	

Table 6-2. A1 Main PCA

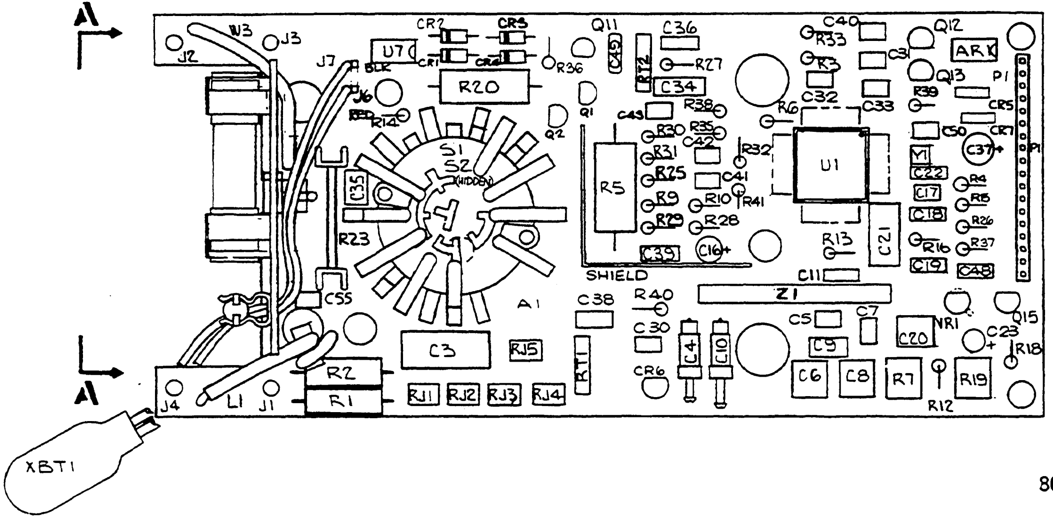
REF DES		DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
C35		CAP,POLYCA,1000PF,+-20%,100V	721472	89536	721472	1	
C38,C39		CAP,POLYES,0.1UF,+-10%,50V	649913	89536	649913	2	
C41,C42		CAP,CER,10PF,+-20%,50V,C0G	721589	89536	721589	2	
C43		CAP,CER,220PF,+-20%,50V,C0G	740654	89536	740654	1	
C48		CAP,POLYCA,0.033UF,+-5%,63V	733451	89536	733451	1	
C49		CAP,CER,0.022UF,+80-20%,500V,Z5U	740340	89536	740340	1	
C55		CAP,CER,0.01UF,+-10%,100V,X7R	557587	89536	557587	1	
CR1-4	*	DIODE,SI,1K PIV,1.0 AMP	707075	89536	707075	4	
CR5		DIODE,SI,1000 PIV,1 AMP	887203	89536	887203	1	
CR6	*	DIODE,SI,BV=35V, LOW LEAKAGE	723817	89536	723817	1	
CR7		DIODE,SI,BV=75V,IO=150MA,500MW	659516	89536	659516	1	
L1		RF COIL ASSEMBLY	857792	89536	857792	1	
MP1		SHIELD, PCB FENCE	722280	89536	722280	1	
MP8		SUPPORT,PCB	656108	89536	656108	1	
P1		CONNECTOR,18 PIN	707646	89536	707646	1	
Q1,Q2,Q11	*	TRANSISTOR,SI,NPN,25V,1.5W,SEL	685404	89536	685404	3	
Q12	*	TRANSISTOR,SI,N-JFET,SEL,TO-92	721936	89536	721936	1	
Q13	*	TRANSISTOR,SI,N-JFET,SEL,TO-92	723734	89536	723734	1	
Q15	*	TRANSISTOR,SI,PNP,40V,350MW,TO-92	698233	89536	698233	1	
R1		RES,CC,220K,+-10%,1W	714485	89536	714485	1	

Table 6-2. A1 Main PCA

REF DES	DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
R2	RES,MF,1K,+-1%,100PPM,FLMPRF, FUSIBLE	650085	89536	650085	1	
R3	RES,MF,301K,+-1%,0.125W,100PPM	655274	89536	655274	1	
R4	RES,MF,332K,+-1%,0.125W,100PPM	655217	89536	655217	1	
R5	RES,CC,100K,+-5%,2W	285056	89536	285056	1	
R6,R25,R33,R4 1	RES,CF,100K,+-5%,0.25W	658963	89536	658963	4	
R7	RES,VAR,CERM,1K,+-20%,0.3W	706655	89536	706655	1	
R9	RES,MF,402K,+-0.1%,0.125W,100PPM	714329	89536	714329	1	
R10	RES,MF,44.8K,+-0.1%,0.125W,100PPM	714311	89536	714311	1	
R12	RES,MF,14.3K,+-1%,0.125W,100PPM	721803	89536	721803	1	
R13	RES,CF,1.5M,+-5%,0.25W	649962	89536	649962	1	
R14	RES,MF,500,+-0.25%,0.25W,100PPM	697557	89536	697557	1	
R15	RES,MF,107K,+-1%,0.125W,50PPM	714295	89536	714295	1	
R16,R28,R29	RES,CF,1M,+-5%,0.25W	649970	89536	649970	3	
R18	RES,MF,412K,+-1%,0.125W,50PPM	714287	89536	714287	1	
R19	RES,VAR,CERM,100K,+-20%,0.3W	658989	89536	658989	1	
R20	RES,WW,4.995,+-.25%,4W	658948	89536	658948	1	
R23	RES,WW,.005,+-.5%,.5W	655423	89536	655423	1	
R26	RES,MF,499K,+-1%,0.125W,100PPM	714980	89536	714980	1	

Table 6-2. A1 Main PCA

REF DES	DESCRIPTION	FLUKE PN	SUPPLY CODE	MFRS PN	QTY	NOTE
R27	RES,MF,1.5M,+-1%,0.125W,100PPM	714998	89536	714998	1	
R30	RES,MF,20K,+-0.25%,0.125W,50PPM	715029	89536	715029	1	
R31,R32	RES,MF,22.6K,+-0.25%,0.125W,50PPM	715011	89536	715011	2	
R35	RES,CF,4.7K,+-5%,0.25W	721571	89536	721571	1	
R36	RES,CF,47K,+-5%,0.25W	721787	89536	721787	1	
R37	RES,MF,5.49K,+-1%,0.125W,100PPM	721795	89536	721795	1	
R38	RES,CF,1.5,+-5%,0.25W	732800	89536	732800	1	
R39	RES,CF,300K,+-5%,0.25W	732818	89536	732818	1	
R40	RES,CF,200K,+-5%,0.25W	681841	89536	681841	1	
RJ1-5	VARISTOR,430V,+-10%,1MA	706838	89536	706838	5	
RT1,RT2	THERMISTOR,RECT.,POS.,1K,+-40%	446849	50157	180010200	2	



8025B-1601
(1 of 2)

Figure 6-2. A1 Main PCA

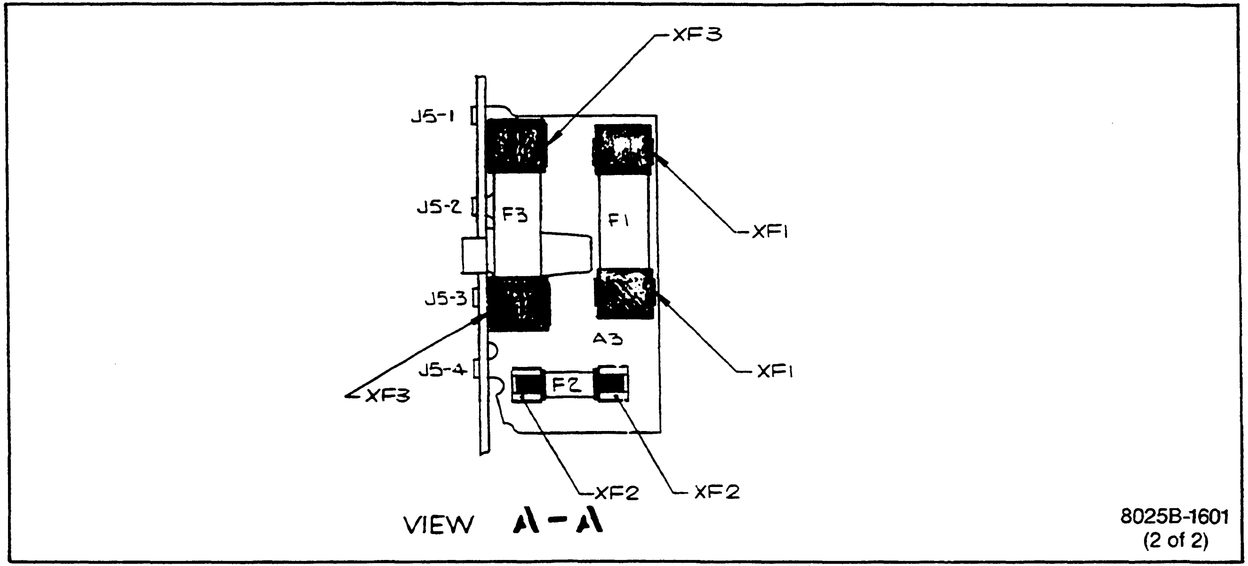


Figure 6-2. A1 Main PCA (cont.)

Table 6-3. A2 Digital PCA
(See Figure 6-3.)

REFERENCE DESIGNATOR -A>	-NUMERICS---->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY -CODE-	MANUFACTURERS PART NUMBER -OR GENERIC TYPE-----	TOT QTY-	R S -Q	N O T -E-
C	12, 13, 44-		CAP,CER,0.22UF,+80-20%,50V,Z5U	733386	89536	733386	6		
C	47			733386					
J	8		SOCKET,1 ROW,PWB,0.100CTR,18 POS	707026	89536	707026	1		
LS	1		AF TRANSD,PIEZO,24 MM	602490	51406	EFB-RD24C01	1		
U	2	*	IC,CMOS,4 BIT MICROCOMPUTER	685628	89536	685628	1		

An * in 'S' column indicates a static-sensitive part.

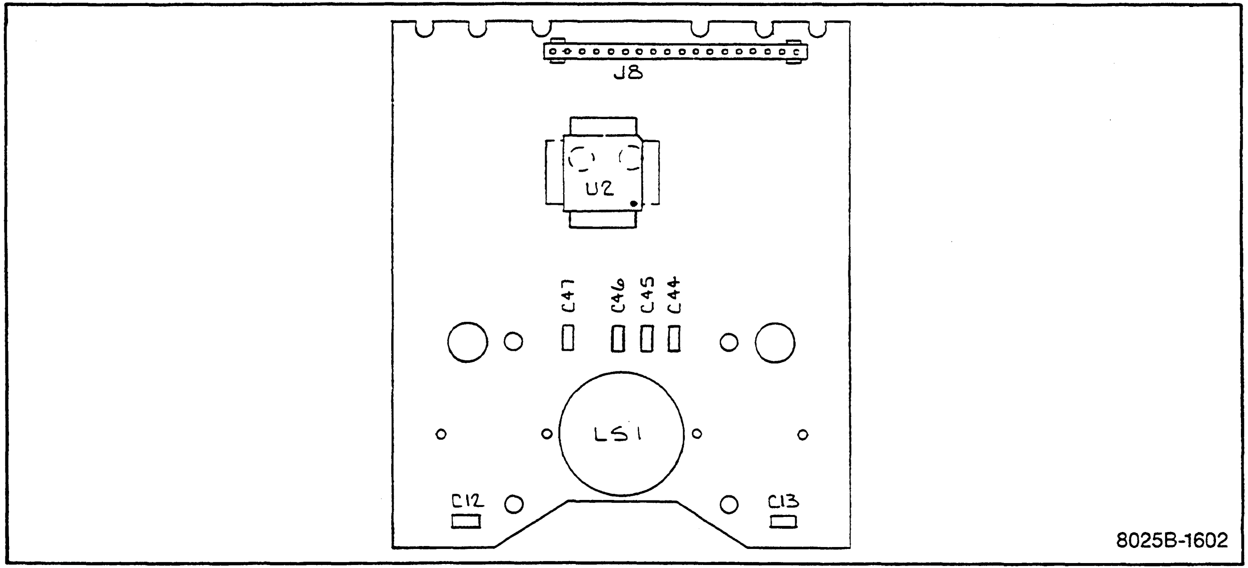


Figure 6-3. A2 Digital PCA

Section 7
Schematics

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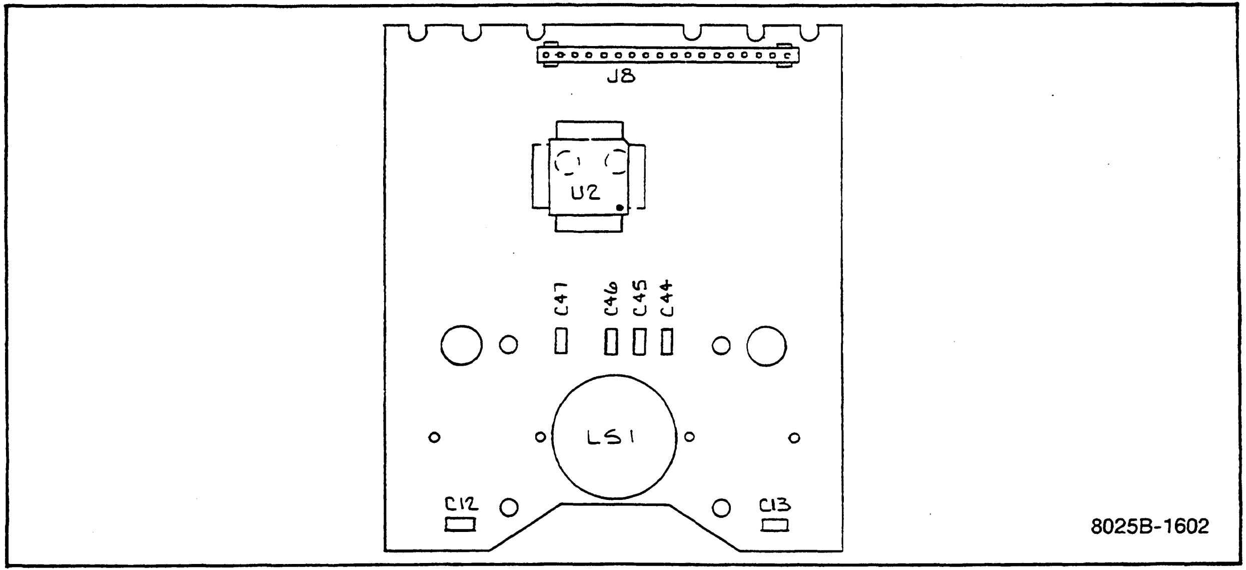


Figure 7-1. A2 Digital PCA

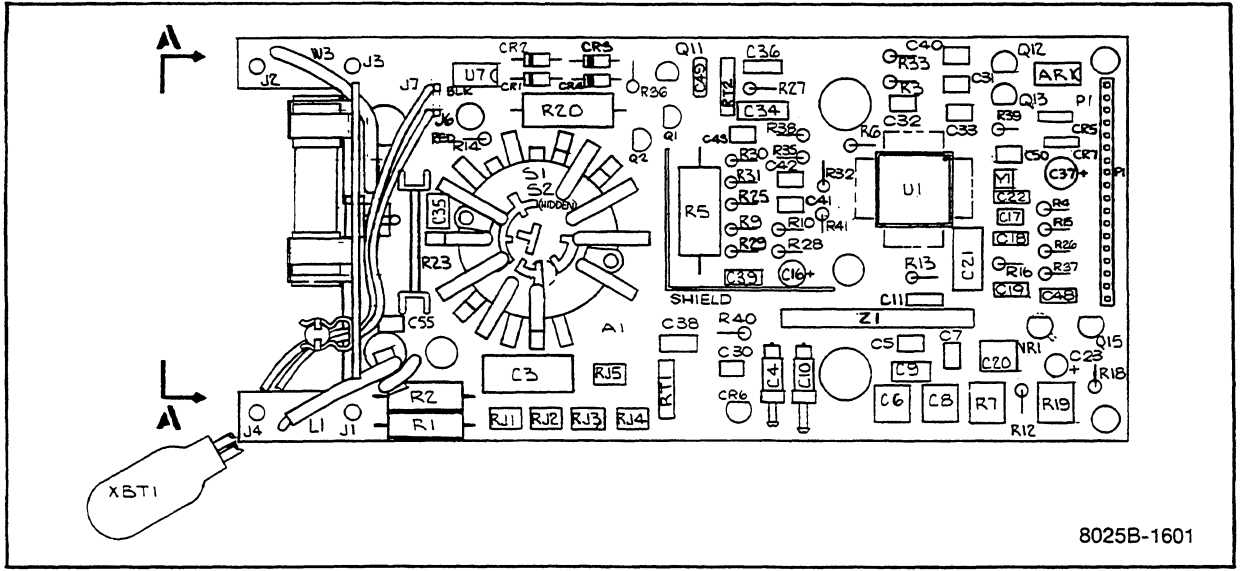
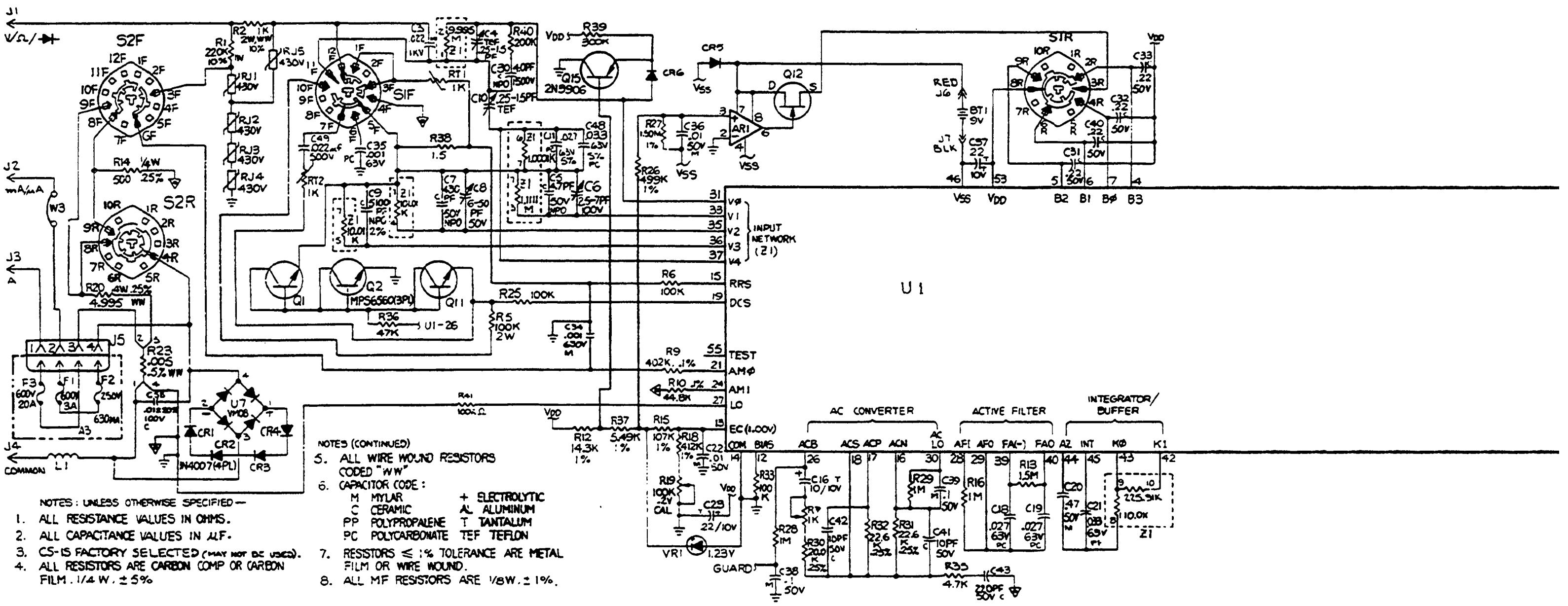


Figure 7-2. A1 Main PCA



NOTES: UNLESS OTHERWISE SPECIFIED—

1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN μF.
3. CS-IS FACTORY SELECTED (MAY NOT BE USED).
4. ALL RESISTORS ARE CARBON COMP OR CARBON FILM. 1/4 W. ± 5%

NOTES (CONTINUED)

5. ALL WIRE WOUND RESISTORS CODED "WW"
6. CAPACITOR CODE:
   - M MYLAR + ELECTROLYTIC
   - C CERAMIC AL ALUMINUM
   - PP POLYPROPALENE T TANTALUM
   - PC POLYCARBONATE TEF TEFLON
7. RESISTORS ≤ 1% TOLERANCE ARE METAL FILM OR WIRE WOUND.
8. ALL MF RESISTORS ARE 1/8W. ± 1%.

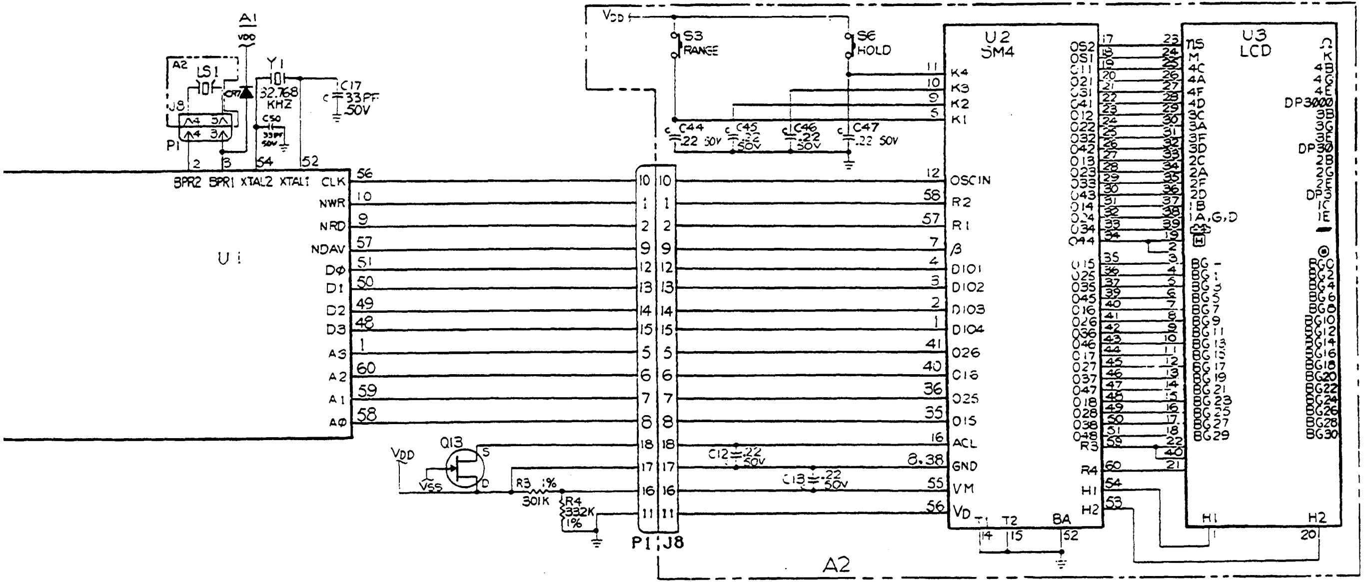


Figure 7-3. A1 Main PCA and A2 Digital PCA Schematic

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