FLUKE®

12B
18
7 Series

Meters

Service Manual

PN 602730
August 1996

LIMITED WARRANTY & LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period for Models 7-300, 7-600, and 12B is two years and begins on the date of shipment. The warranty period for Model 18 is three years and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

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To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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MULTIMETER SAFETY

The Fluke 7-300, 7-600, 12B, and 18 Meters have been designed and tested according to IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus. This manual contains information and warnings that must be followed to ensure safe operation and keep the meter in safe condition. Use of this equipment in a manner not specified herein may impair the protection provided by the equipment.

These multimeters comply with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) these meters may not cause harmful interference, and (2) these meters must accept any interference received, including interference that may cause undesired operation.

Some common international electrical symbols are shown below:

	AC: ALTERNATING CURRENT		DANGEROUS VOLTAGE
	DC: DIRECT CURRENT		EARTH GROUND
	EITHER AC OR DC CURRENT		SEE EXPLANATION IN MANUAL
	FUSE		DOUBLE INSULATION FOR PROTECTION AGAINST ELECTRIC SHOCK

Before using the meter, read the following safety information carefully. In this manual, "Warning" is reserved for conditions and actions that pose hazard(s) to the user; "Caution" is reserved for conditions and actions that may damage your meter.

- Avoid working alone.
- Follow all safety procedures for equipment being tested.
- Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity. Damaged leads should be replaced.
- Be sure the meter is in good operating condition.
- Select the proper function for your measurement.
- To avoid electrical shock, use caution when working above 60V dc or 30V ac rms.
- Disconnect the live test lead before disconnecting the common test lead.
- Disconnect the power and discharge high-voltage capacitors before testing in resistance and diodes or continuity.
- When making a current measurement, turn the circuit power off before connecting the meter in the circuit.
- Check meter fuses before measuring transformer secondary or motor winding current. An open fuse may allow high voltage build-up, which is potentially hazardous.
- Use clamp-on probes when measuring circuits exceeding 10 amps.
- When servicing the meter, use only the replacement parts specified.
- Do not allow the meter to be used if it is damaged or if its safety features are impaired.

Chapter 1
Introduction and Specifications

Introduction

⚠Warning

Service procedures described herein should be performed by qualified personnel only. To avoid electric shock, perform only those service procedures described in this manual.

The 12B, 18, 7 Series Service Manual provides the information necessary to service the Fluke Model 12B, Model 18, and Models 7-300 and 7-600 meters. This manual provides the following information:

- Specifications (Chapter 1)
- Basic theory of operation (Chapter 2)
- Disassembly and reassembly (Chapter 3)
- Performance tests (Chapter 3)
- Calibration (Chapter 3)
- Illustrated parts lists and schematic diagrams (Chapter 4)

Refer to the users instruction sheet for operating instructions.

Specifications

Specifications are in Table 1-1. Accuracy is specified for a period of one year after calibration, at 18ºC to 28ºC (64ºF to 82ºF) with relative humidity to 90%. AC conversions are ac-coupled, average responding, and calibrated to the rms value of a sine wave input.

Accuracy specifications are given as follows:

±([% of reading] + [number of least significant digits])

Table 1-1. Specifications

Maximum Voltage Between any Terminal and Earth Ground (excludes 10% tolerance)	600V ac rms or dc
Display	3-3/4-digits, 4000 counts, updates 4/sec
Operating Temperature	-10°C to 50°C
Storage Temperature	-30°C to 60°C indefinitely (to -40°C for 100 hrs)
Temperature Coefficient	0.1 x (specified accuracy)/°C (<18°C or >28°C)
Relative Humidity	0% to 90% (-10°C to 35°C) 0% to 70% (35°C to 50°C)
Battery Type	9V, NEDA 1604 or IEC 6F22
Battery Life	650 continuous hours with alkaline; 600 hours for Model 7 450 continuous hours with carbon-zinc; 400 hours for Model 7
Shock, Vibration	1 meter shock. Per MIL-T-28800D for a Class 3 Instrument
Size (HxWxL)	1.35 in x 2.75 in x 5.55 in (3.46 cm x 7.05 cm x 14.23 cm)
Weight	10 oz (286g)
EMI Regulations	Complies with FCC Part 15, Class B, and VDE 0871B.
Safety	Designed to Protection Class II requirement of UL1244, ANSI/ISA-S82.01 - 1988, CSA C22.2 No 231, and VDE 0411, and IEC 1010-1 overvoltage category III (CAT III), 600V. Trademark of TÜV Product Services. IEC 348 certification; designed to comply with EN 61010-1: 1993. TÜV PRODUCT SERVICE GS geprüfte Sicherheit CE

Table 1-1. Specifications (continued)

Function	Range	Resolution	Accuracy (50 to 400 Hz)		
			7-300	7-600	12B/18
V~	4000 mV[1]	1 mV	NA	NA	±(1.9%+3)
	4.000V	0.001V	NS[2]	NS[2]	±(1.9%+3)
	40.00V	0.01V	±(2.9%+3)	±(2.9%+3)	±(1.9%+3)
	300.0V	0.1V	±(2.9%+3)	NA	NA
	400.0V	0.1V	NA	±(2.9%+3)	±(1.9%+3)
	600.0V	1V	NA	±(2.9%+3)	±(1.9%+3)
V⎓	4000 mV[1]	1 mV	NA	NA	±(0.9%+2)
	4.000V	0.001V	NS[2]	NS[2]	±(0.9%+2)
	40.00V	0.01V	±(1.5%+1)	±(1.5%+1)	±(0.9%+1)
	300.0V	0.1V	±(1.5%+1)	NA	NA
	400.0V	0.1V	NA	±(1.5%+1)	±(0.9%+1)
	600V	1V	NA	±(1.5%+1)	±(0.9%+1)
Ω	400.0Ω	0.1Ω	±(1.5%+2)	±(1.5%+2)	±(0.9%+2)
	4.000 kΩ	0.001 kΩ	NA	NA	±(0.9%+1)
	40.00 kΩ	0.01 kΩ	NA	NA	±(0.9%+1)
	400.0 kΩ	0.1 kΩ	NA	NA	±(0.9%+1)
	4.000 MΩ	0.001 MΩ	NA	NA	±(0.9%+1)
	40.00 MΩ	0.01 MΩ	NA	NA	±(1.5%+3)
—|(—	1.000 µF	0.001 µF	NA	NA	±(1.9%+2)
	10.00 µF	0.01 µF	NA	NA	±(1.9%+2)
	100.0 µF	0.1 µF	NA	NA	±(1.9%+2)
	1000 µF	1 µF	NA	NA	±(1.9%+2)
	10000 µF	10 µF	NA	NA	±(10%+90) typical
—▶|))) [3]	2.000V	0.001V	NA	NA	±(0.9%+2)

1. The 4000 mV range can be entered only in the manual range mode. Use the 4000 mV range with accessories. The 4000 mV range is not available on the Model 7.
2. Not specified for the Model 7.
3. The beeper is guaranteed to come on at <25Ω and turn off at >250Ω. The meter detects opens or shorts of 250 µs or longer. These values are not specified for the Model 7.

Table 1-1. Specifications (continued)

Function	Overload Protection[1]	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 kΩ Unbalanced)[2]	Normal Mode Rejection[2]
V~	600V rms or dc	>5 MΩ <100pF[2] Automatic Selection and LoZ = >2 kΩ <200pF (ac coupled)[3]	>60 dB at dc 50 or 60 Hz	
V⎓	600V rms or dc	>10MΩ <100pF[2] Automatic Selection and LoZ = >2 kΩ <200pF[3]	>100 dB at dc, 50 or 60 Hz	>50 dB at 50 Hz or 60 Hz
		Open Circuit Test Voltage	**Full Scale Voltage To 4.0 MΩ** / **40 MΩ**	**Short Circuit Current**
Ω	600V rms or dc	<1.5V dc	<450 mV dc / <1.5V dc	<500 µA
→|← [2]	600V rms or dc	2.4-3.0V dc	2.400V dc	0.95 mA (typical)

1. 3 x 10^6 V Hz maximum.
2. Does not apply to Model 7.
3. ~2 kΩ input impedance up to 50V. Impedance increases with input voltage to >300 kΩ at 600V.

MIN MAX Recording Accuracy and Response Time (Models 12B and 18)

Specified accuracy of the measurement function ±12 digits for changes >200 ms in duration (±40 digits in ac). Typical 100 ms response to 80%.

MIN MAX Recording with Elapsed Time (Models 12B and 18)

Elapsed Time: 0 to 100 hours (99.59)

Resolution: 1 minute

Accuracy: 0.3% typical

Continuity Capture™ (Model 12B)
(Open/Short Capture Model 18)

Detects opens or shorts of 250 µs or longer.

Chapter 2
Theory of Operation

Introduction

Chapter 2 provides a basic theory of operation for the Models 7, 12B, and 18 Meters. Electrical components on the printed circuit assembly (A1 Main PCA) are listed in Table 2-1. Refer to Figure 4-3 for the location of these components and Figures 4-4 through 4-7 for the schematic diagrams.

The analog/digital IC (U1) performs the electrical measurement functions. See Table 2-2 for pin names and descriptions. The microcomputer (U2) controls U1, the LCD (U3), and the user interface. Discrete components support U1 and U2, provide reference standards for measurements, and provide input overload protection.

Analog Measurement IC (U1)

U1 performs the following analog functions: a/d converter, ac to dc converter, Automatic Selection circuitry, active filter, passive filter, power supply, range configuration circuitry, signal routing circuitry, beeper driver, digital control circuitry, and digital U2 interface circuitry.

The a/d converter is a patented dual-rate, dual-slope converter. The dual-rate conversion allows for MIN MAX (Models 12B and 18 only) and fast autoranging functions. The ac to dc converter is full-wave rectified and average-responding. The active and passive filters are two-pole and one-pole low-pass filters (respectively) that are used for signal filtering prior to a/d conversion. The internal power supply generates a ground voltage nominally +3V relative to VSS. Range configuration circuitry connects the Z1 resistor network as needed for different ranges. Routing circuitry connects the various signal conditioning circuits as needed. The a/d converter and a counter are controlled by a state machine.

Table 2-1. Electrical Components on Main PCA

Circuit and Function	Component Designator(s)
Analog Measurement IC	U1
Microcomputer IC	U2
Input Divider and Ohms Reference Resistor Network	Z1
Input Divider AC Coupling Capacitor	C14
J2 Input Receptacle Voltage Sense Resistor	R17
J1 Input Receptacle Voltage Sense Resistor	R14
Reference Voltage for Volts Measurements	VR1, R4, R5, R6, R26
A/D Converter Integrate Capacitor	C2
A/D Converter Autozero Capacitor	C1
A/D Converter Gain Resistors	R1, R3, R15
Active Filter Components	R7, R8, C5, C6
Passive Filter Components	R9, C7
AC to DC Converter Gain Resistors	R11, R12, R13
AC to DC Converter AC Coupling Capacitor	C8
Bias Current Setting Resistor	R2
DGND-VSS Voltage Setting Resistors	R10, R24
Power Supply Bypass Capacitors	C3, C15
Reverse Battery Protection	CR1
System Clock	Y1
Automatic Selection Input Current Limiters	R16, R18, R29
Automatic Selection Input Positive Temp. Coef. Thermistor	RT1
Automatic Selection Input Voltage Clamp Circuit	Q1, Q2, CR2, R28
Automatic Selection Input Fusible Resistor	R19
Microcomputer Reset Circuit	R23, R25, C10, C13, CR3
On/Off and Automatic Selection Select Slide Switch	S1
Beeper	LS1
Beeper Current Limiter	R22
Slide Switch Protection	E1
Switch Sense Bypass Capacitor	C9
Input Divider Bypass Capacitor	C16
Zero Ohm Jumpers	R20, R21, R27

Finally, digital circuitry interfaces with U2 via a parallel address and bidirectional data bus.

Voltage is measured using a ratio comparison of the unknown voltage to the reference voltage (REFI pin). Resistance is calculated using a ratio comparison of the voltage across the unknown resistor to the voltage across a precision reference resistor, with the same current in both. Capacitance is measured by determining the amount of charge added for a given dc voltage change.

Microcomputer IC (U2)

U2 writes range settings and a/d converter information to U1. U2 reads a/d converter results and status information. This includes the low battery check, slide-switch position, continuity check, and Automatic Selection data. The microcomputer performs math operations on the raw data from U1 and configures it for the LCD. U2 also reads push-button inputs. Finally, the 2.1 MHz clock signal at U2 is divided down to 131 kHz and sent to U1 (CLK pin) for the counter.

Automatic Selection Input Resistance

As shown in Figure 2-1, the input resistance for the Automatic Selection function is non-linear. The data in the graph are for the volts dc function (any range) and are the steady state values obtained after the PTC thermistor (RT1) has stabilized. The data also apply for the volts ac function.

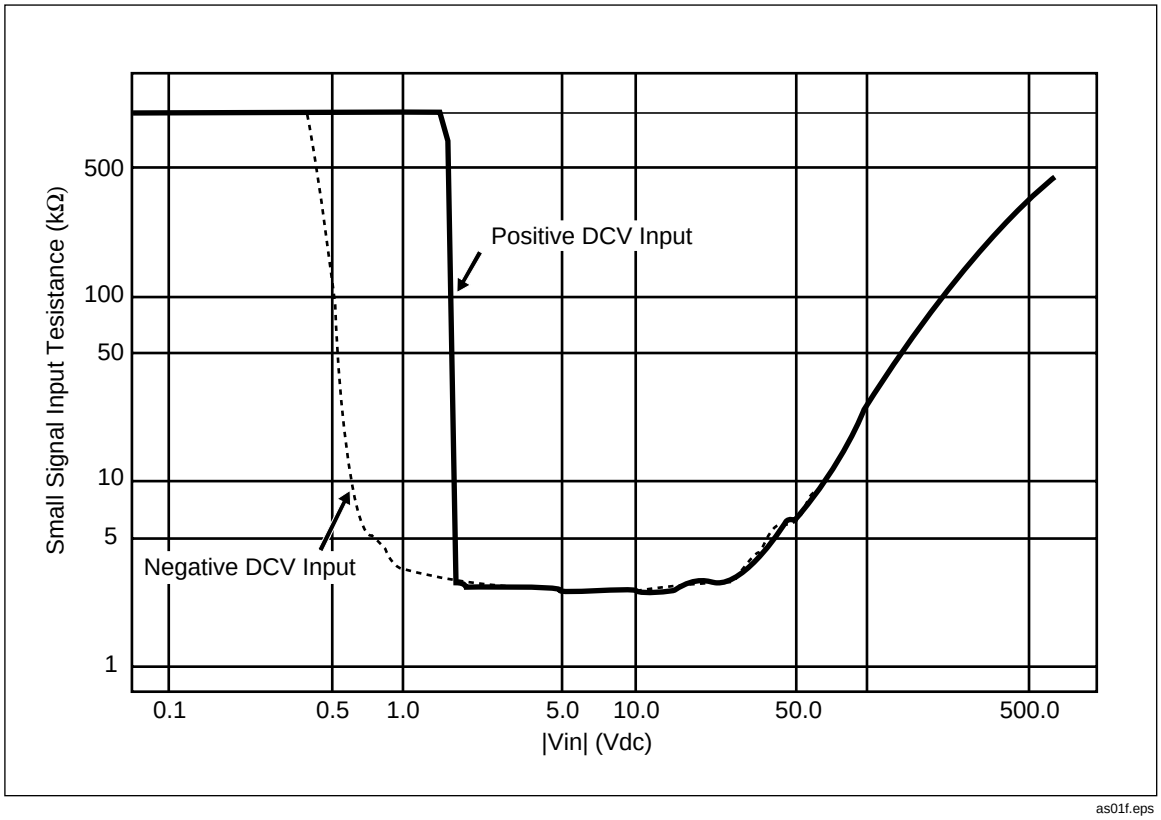


Figure 2-1. Typical Automatic Selection Input Resistance with DC Volts Function Selected

Table 2-2. U1 Pinout Table

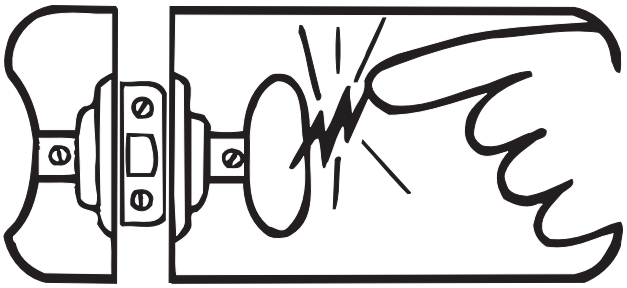
Pin No.	Pin Name	Description
1	READ (L)	When low (VSS), data from addressed register can be read
2	ADR5	Most significant address bus line
3	ADR4	Bit 4 of parallel address bus
4	ADR3	Bit 3 of parallel address bus
5	ADR2	Bit 2 of parallel address bus
6	ADR1	Bit 1 of parallel address bus
7	ADR0	Least significant address bus line
8	VSS	Negative power supply voltage (-3V relative to DGND)
9	VDD	Positive power supply voltage for analog only (Vbat-3V=VDD-DGND)
10	K0	1st a/d gain resistor pin, generally for de-integrate
11	K1	2nd a/d gain resistor pin, generally for integrate
12	K2	3rd a/d gain resistor pin, for autozero
13	AZ	A/D converter pin for autozero capacitor
14	INT	A/D converter pin for integrator capacitor
15	REFI	1.00V reference voltage for de-integrate signal in volts
16	BIAS	Pin for analog bias current generator reference resistor
17	REFH	Connects 1.235V reference voltage to on-chip circuits
18	BGND	Not used
19	AFO	Active filter high output pin (2-pole, low-pass filter)
20	FAO	Internal active filter node
21	FAI	Internal active filter node
22	AFI	Active filter high input pin
23	VSS	Negative power supply voltage (-3V relative to DGND)
24	PFO	Passive filter low output pin (1-pole, low-pass filter)
25	AVAOM	Absolute value amp (full wave rectified) negative output pin
26	AVAOP	Absolute value amp (full wave rectified) positive output pin
27	AVAM	Absolute value amp inverting input (summing node)
28	ACBO	AC buffer output
29	VSET	Voltage divider sense for power supply
30	PSTEST	Pin to disable on-chip power supply for U1 testing
31	DGND	Ground power supply pin connected to common (digital ground)
32	AGND	Common input sense line. No current flow (analog ground).
33	CLAMP	Op amp output voltage for Q2 clamp transistor base drive
34	AMPS	Shunt resistor sense pin. Unused in Fluke Model 18.
35	ISRC	Current source pin for continuity, ohms, and capacitance
36	SWS	Slide-switch position sense pin. Internal pull down.
37	OHMS	Ohms sense resistor input pin. Sense voltage at J2.
38	VSS	Negative power supply voltage (-3V relative to DGND)
39	ACV	AC volts input pin from 10 MΩ resistor

Table 2-2 U1 Pinout Table (continued)

Pin No.	Pin Name	Description
40	APV0	DC volts input pin from 10 MΩ resistor
41	DIVLO	Input divider (Z1) common (low) pin
42	APV1	10-to-1 voltage divider and 1 MΩ reference resistor input
43	APV2	100-to-1 voltage divider and 100 kΩ reference resistor input
44	APV3	1000-to-1 voltage divider and 10 kΩ reference resistor input
45	APV4	10,000-to-1 voltage divider and 1 kΩ reference resistor input
46	GND	Ground power supply pin connected to common (digital ground)
47	DATA3	Most significant bidirectional data bus line
48	DATA2	Bit 2 of parallel data bus
49	DATA1	Bit 1 of parallel data bus
50	DATA0	Least significant bidirectional data bus line
51	N/C	No connection
52	BEEPER (L)	One of two beeper drive lines. Voltage swings VDD to VSS.
53	VSS	Negative power supply line (-3V relative to DGNG)
54	VSS	Negative power supply line (-3V relative to DGNG)
55	CLK	System clock line from U2. 131,072 Hz.
56	BCLK	Beeper frequency (2.3 kHz) clock line from U2
57	TESTCLK	Test clock pin for U1 testing
58	BEEPER	One of two beeper drive lines. Voltage swings VDD to VSS.
59	N/C	No connection
60	WRITE (L)	When driven low (VSS), data is written to addressed register

static awareness

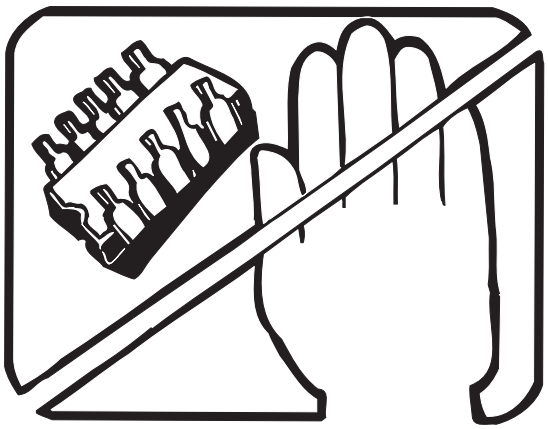
A Message From
Fluke Corporation



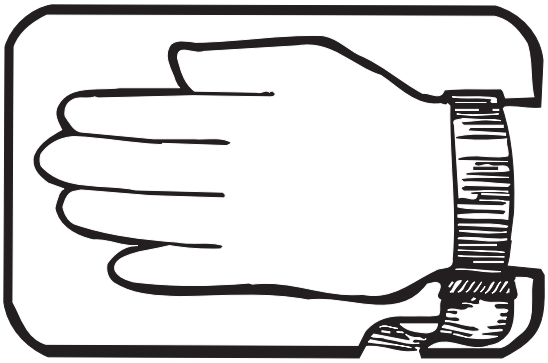
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

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

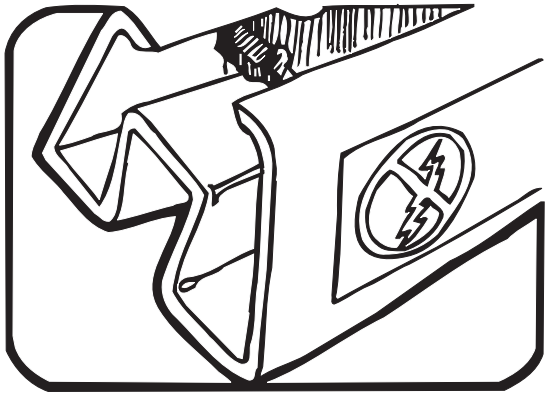
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.



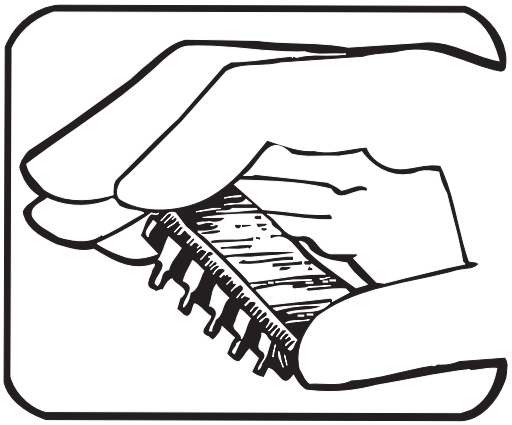
1. MINIMIZE HANDLING



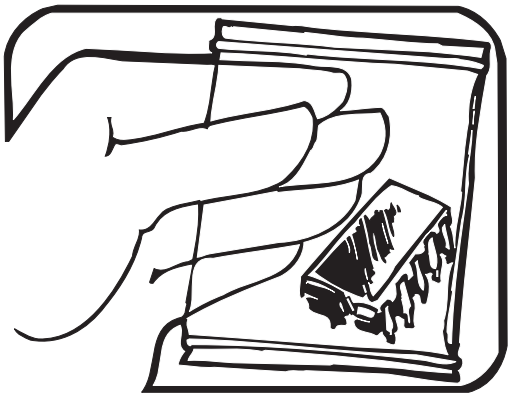
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



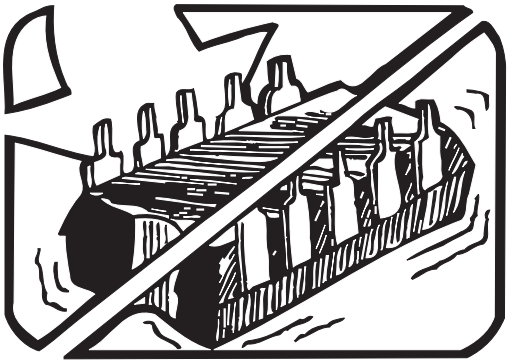
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



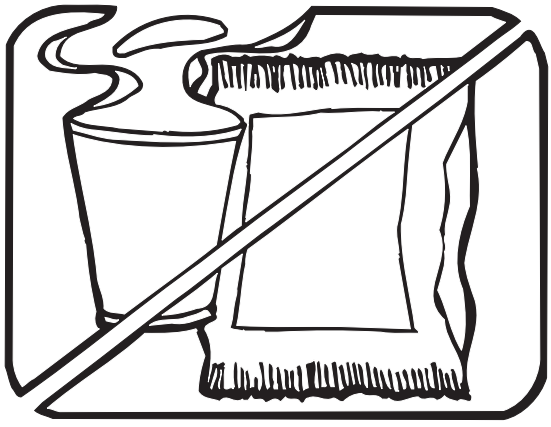
4. HANDLE S.S. DEVICES BY THE BODY.



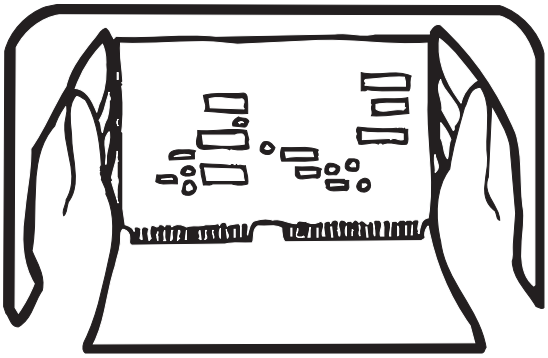
5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.



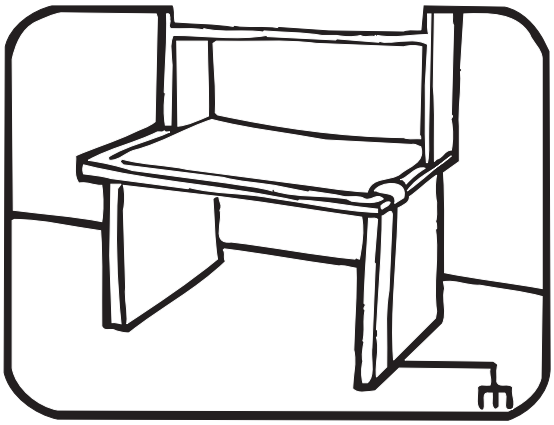
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC,VINYL AND STYROFOAM® IN WORK AREA.



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



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

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

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

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Chapter 3
Maintenance

Introduction

Chapter 3 covers the following:

- Disassembly and reassembly
- Cleaning
- Performance tests
- Calibration

Disassembly and Reassembly

⚠ Warning

To avoid electrical shock, remove test leads and any input signals before opening the case.

Caution

To avoid contamination from the fingers, handle the pca by the edges or wear gloves. PCA contamination can cause failures in humid environments. This meter contains components that can be damaged by static discharge. To avoid damaging these components when servicing the meter, take precautions indicated on the "Static Awareness" at the beginning of Chapter 3.

Referring to Figures 3-1 and 3-2 as necessary, disassemble the meter as follows. A Phillips-head screwdriver and small flat-blade screwdriver are required.

1. Remove the test leads and set the slide switch or rotary knob to OFF.
2. Remove the Phillips-head screws (H1-4) from the case bottom (MP8).
3. Separate the case top (MP2) from the case bottom.
4. TO REPLACE THE BATTERY: Lift the battery from the case bottom and insert a new 9V battery (NEDA 1604, 6F22, or 006P). Be sure the positive and negative battery posts are oriented correctly.
5. TO REMOVE THE PCA (A1): Insert a small, flat-blade screwdriver between the edge of the case top and the pca where shown in Figure 3-3. Gently unsnap a side of the case top from the pca. Repeat on the other side of the pca. Unsnap the case from the top of the pca last.
6. LIFT THE PCA FROM THE CASE TOP BY ITS EDGES. If the elastomeric contact strips (J3, J4)[*] for the switch assembly (S2)[*] and LCD (U3) are stuck to the pca, remove them without touching the conductive edges.

   TO REINSERT THE PCA: Important: First make sure that the slide-switch actuator (MP5), the slide switch (S1), and the rotary knob (for the 12B and 18) are in the OFF position. Place the pca over the four screw posts in the case top, then press gently on the center of the pca while using the small flat-edge screwdriver to shoehorn the pca under the snap on a side of the case top. Repeat on the other side and the top.
7. TO REMOVE THE SWITCH SUPPORT (MP6): Use a small, flat-blade screwdriver to gently unsnap the sides and top of the switch support from the snaps shown in Figure 3-3.
8. The LCD, switch assembly, slide-switch actuator, and elastomeric contact strips (J3, J4) for the LCD and switch assembly are accessible and can be replaced as needed. Do not allow the LCD to get wet. Before installing a new LCD, make sure that all connector contact points are clean.

Caution

Do not touch the conductive edges of the elastomeric strips or the contacts on the switch assembly. If they are contaminated, clean them with isopropyl alcohol.

9. Reassembling the meter is the reverse of disassembling it. After the meter is reassembled, execute the PERFORMANCE TESTS to confirm that the meter is working properly.

[*] J4 and S2 are not present in Models 7-300 and 7-600.

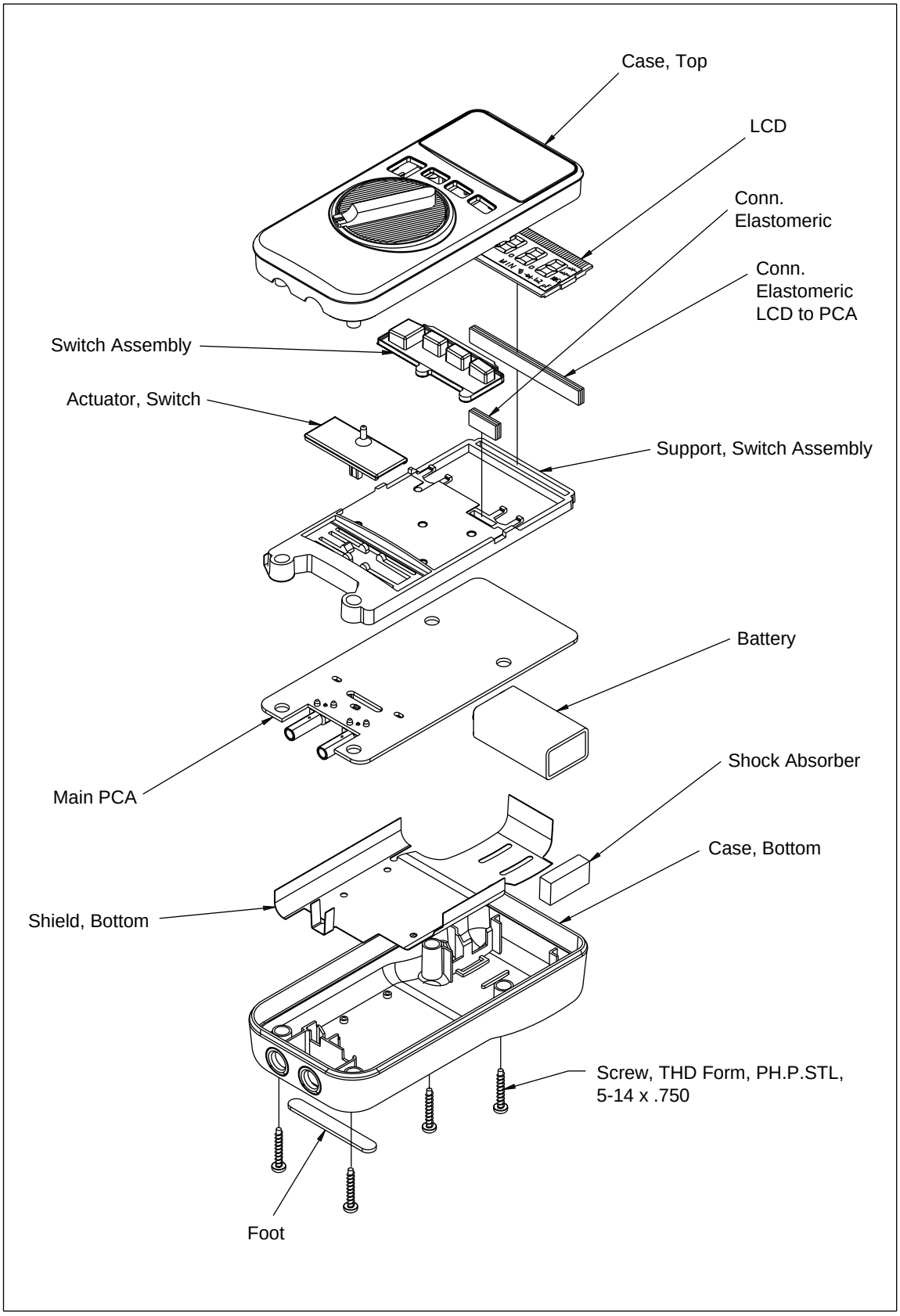

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Figure 3-1. Models 12B and 18 Disassembled Unit

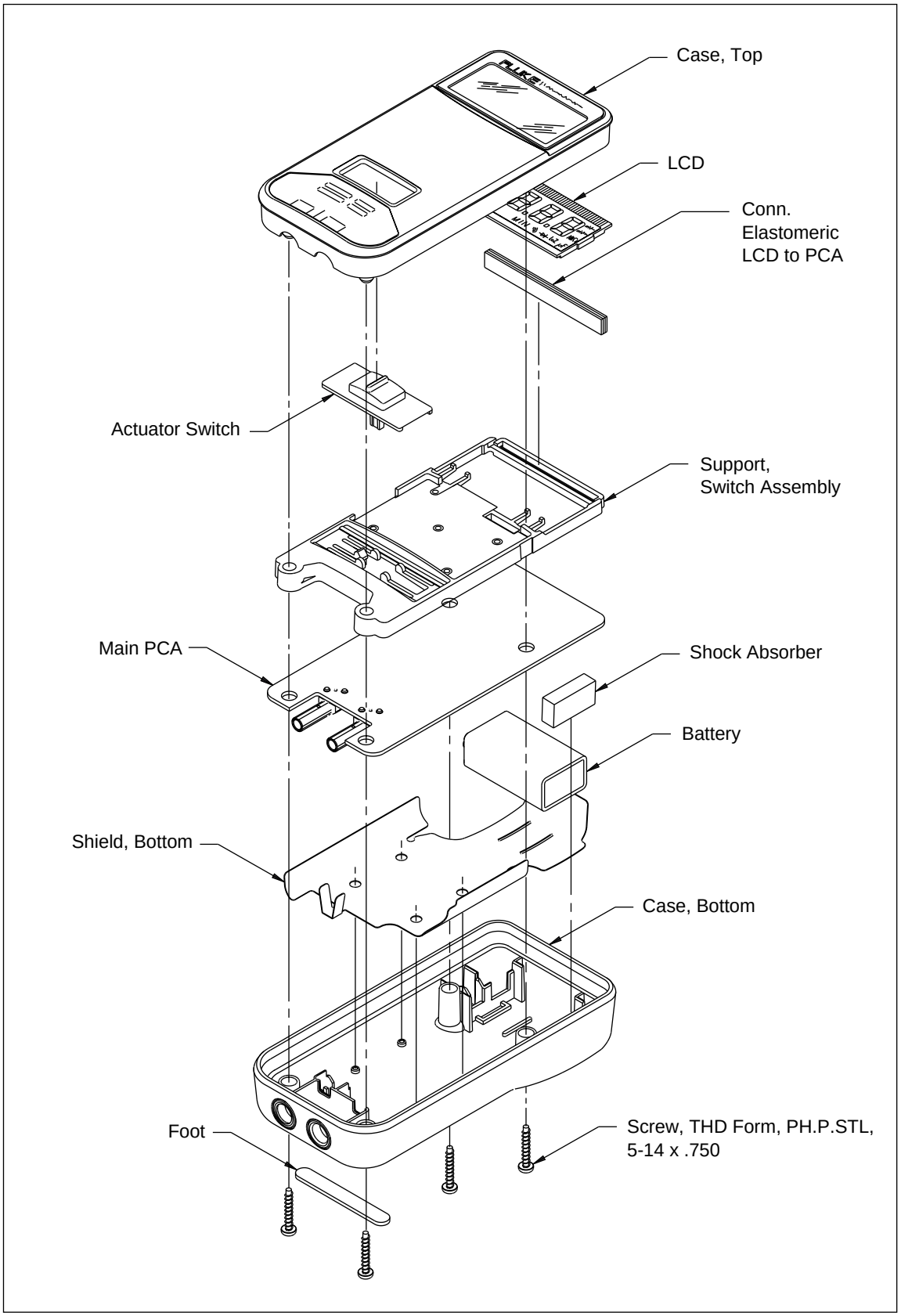

Figure 3-2. Models 7-300 and 7-600 Disassembled Unit

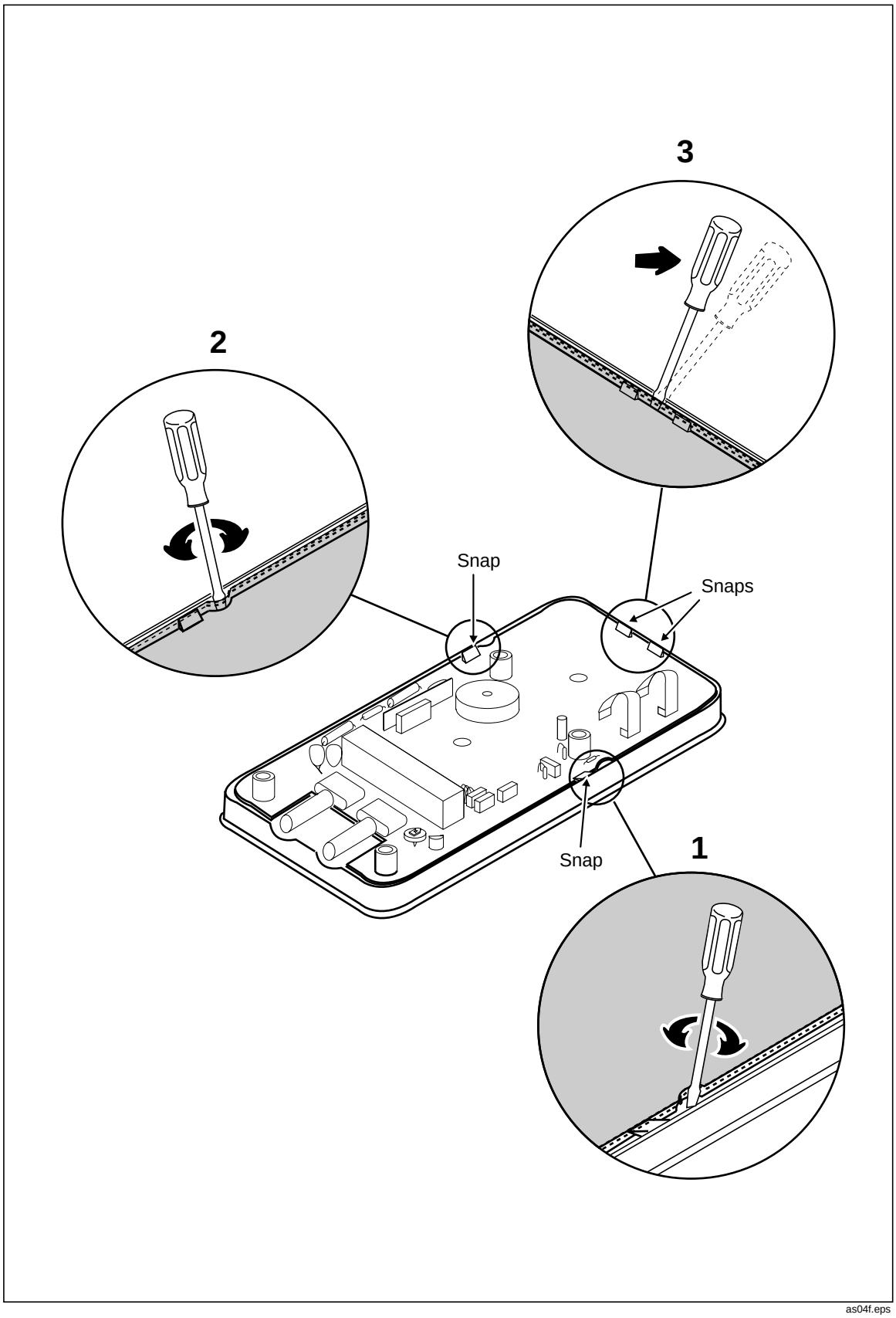

Figure 3-3. Removing and Reinserting the Printed Circuit Assembly

Cleaning

Caution

To avoid damaging the meter, do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastics used in the instruments. Do not get the LCD wet.

To clean the case, wipe it with a cloth lightly dampened with water and a mild detergent.

Wash the pca with isopropyl alcohol or hot deionized water and a soft brush. Do not use detergent of any kind for cleaning the pca. The pca must be completely dry before the meter is reassembled. Dry the pca with clean dry air at low pressure (<20 psi); then bake it at 50ºC for 2 hours.

Performance Tests

⚠ Warning

To avoid electric shock, do not execute the performance tests procedures unless the meter is fully assembled.

Use the PERFORMANCE TESTS to confirm that the meter is working properly. If the meter fails any of these tests, it needs calibration (see CALIBRATION) or repair. The equipment required is specified in Table 3-1.

1. Connect the calibrator to the [+] and COM jacks on the meter.
2. Referring to Table 3-2 for the Fluke 7-300 or 7-600, or Table 3-3 for the Fluke 12B or 18, put the meter in the function and range shown for Test 1.
3. Apply the input from the appropriate source. The reading on the display should be within the MINIMUM and MAXIMUM values shown in Table 3-2 or 3-3.
4. Test the remaining functions and ranges.

Table 3-1. Required Equipment

Equipment	Minimum Specifications	Recommended Models
DMM Calibrator	DC Voltage: 0-600V Accuracy: ±0.25% AC Voltage: 0-600V Accuracy: ±0.5% Frequency: 50-400 Hz	Fluke Models 5700A, 5500A, 5100B, or equivalent
Decade Resistor	Resistance: 1.0-40 MΩ Accuracy: ±0.25%	General Resistance RDS-77B and 41B or Fluke 5500A
Decade Capacitor	Capacitance: 0-1.000 µF Accuracy: ±0.5%	GenRad 1412-BC or Fluke 5500A

Table 3-2. Performance Tests for Models 7-300 and 7-600

Test No.	Applicable Model(s)[1]	Meter Range	Input To Meter	Display Minimum	Display Maximum
1	7-300/7-600	40.00V ac	4.40V, 50 Hz	4.24	4.56
2	7-300/7-600	40.00V ac	35V, 50 Hz	33.95	36.05
3	7-300/7-600	40.00V ac	35V, 400 Hz	33.95	36.05
4	7-300/7-600	400.0V ac (300.0V ac for 7-300)	100V, 50 Hz	96.8	103.2
5	7-300/7-600	400.0V ac (300.0V ac for 7-300)	150V, 400 Hz	145.4	154.6
6	7-300	300V ac	300V, 50 Hz	291	309
7	7-600	400.0V ac	350V, 80 Hz	339.5	360.5
8	7-600	600V ac	600V, 400 Hz	580	620
9	7-300/7-600	40.00V dc	4.40V dc	4.32	4.48
10	7-300/7-600	40.00V dc	-35V dc	-35.54	-34.46
11	7-300/7-600	400.0V dc	+100V dc	+98.4	+101.6
12	7-300/7-600	400.0V dc (300.0V dc for 7-300)	-150V dc	-152.3	-147.7
13	7-300/7-600	400.0V dc (300.0V dc for 7-300)	300V dc	295.4	304.6
14	7-600	600V dc	-600V dc	-610	-590
15[2]	7-300/7-600	400.0Ω	0.0Ω	0.0	0.2
16[2]	7-300/7-600	400.0Ω	1.0Ω	0.8	1.2
17[3]	7-300/7-600	400.0Ω	350.0Ω	344.5	355.5

1. To avoid overload/current limit condition on the calibrator when testing the Model 7, defeat the 50Ω divider on the calibrator and allow at least 3 seconds at each voltage interval above 40V.
2. Model 7 beeper should be on.
3. Model 7 beeper may be on or off.

Table 3-3. Performance Tests for Models 12B and 18

Test No.	Meter Range (Automatic Selection 12B Only)	Input To Meter	Switch Position	Display Minimum	Display Maximum
1	4.000V ac	0V	Center	0.000	0.003
2	4.000V ac, MIN MAX	0V	Center	0.000	0.040
3	4.000V ac	10 mV, 50 Hz	Center	0.007	0.013
4	4.000V ac	10 mV, 400 Hz	Right[1]	0.007	0.013
5	4.000V ac	3.5V, 50 Hz	Right[1]	3.430	3.570
6	4.000V ac	3.5V, 400 Hz	Center	3.430	3.570
7	40.00V ac	35V, 50 Hz	Center	34.30	35.70
8	40.00V ac	35V, 400 Hz	Right[1]	34.30	35.70
9[2]	400.0V ac	350V, 80 Hz	Right[1]	343.0	357.0
10	600V ac	600V, 400 Hz	Center	586	614
11	4.000V dc, MIN MAX	0V	Center	-0.012	0.012
12	4.000V dc	0V	Right[1]	-0.002	0.002
13	40.00V dc	+20 mV dc	Right[1]	00.01	00.03
14	400.0V dc	-200 mV dc	Center	-000.3	-000.1
15	4.000V dc	+3.5V	Center	+3.466	+3.534
16	40.00V dc	-35V dc	Center	-35.33	-34.67
17	400.0V dc	+100V dc	Center	+99.0	+101.0
18	600V dc	-600V dc	Center	-606	-594
19	Continuity	+2V dc[3]	Right	1.980	2.020
20[3]	Continuity, Automatic Selection	+3.43V dc[3]	Right	3.397[4]	3.463[4]
21[3]	Continuity, Automatic Selection	-0.5V dc[3]	Right	-0.507[4]	-0.493[4]
22	400.0Ω	0.0Ω	Right	0.0	0.2
23	400.0Ω	1.0Ω	Right	0.8	1.2
24	400.0Ω	350.0Ω	Right	346.6	353.4
25	4.000 kΩ	1.0 kΩ	Right	0.990	1.010
26	40.00 kΩ	35 kΩ	Right	34.67	35.33
27	400.0 kΩ	100 kΩ	Right	99.0	101.0
28	4.000 MΩ	2.9 MΩ	Right	2.873	2.927
29	40.00 MΩ	35 MΩ	Right	34.44	35.56
30	Ω, Automatic Selection	1.96V dc	Right	1.940[4]	1.980[4]
31[5]	1.000 µF	0.0 µF	Right	-0.001 µF	0.001 µF
32[5]	1.000 µF	0.95 µF	Right	0.930 µF	0.970 µF

1. Center position for Model 18.
2. In the Automatic Selection mode, the UUT uses a low-impedance thermistor (~2.5k for circuit protection and load testing (referred to as low-Z input circuitry). When using the 5100B, 5500A, or 5700A to drive the UUT with high voltages, avoid an overload/current limit condition by gradually stepping the voltage up (waiting two seconds between each step) from 90.0V, 120.0V, 180.0V, and 350.0V at 80 Hz each step.
3. Calibrator 50Ω divider override.
4. The dc volts annunciator must be on. Test does not apply to Model 18.
5. Conducting performance tests of the 400Ω, 4 kΩ, 40 kΩ, and 1 µF ranges (tests no. 22, 23, 24, 25, 26, 31, and 32) verifies that the discrete and integrated circuitry needed to support the other capacitance ranges are working within specifications. Therefore, the tests indirectly verify that the meter will meet specification in the 10 µF, 100 µF, 1000 µF, and 10,000 µF ranges.

Calibration Adjustments for Models 12B and 18

To ensure that the meter performs to specifications, make calibration adjustments annually using the following procedure:

1. Set the calibrator for 0V dc. Put the meter in the 4.000V dc range.
2. Connect the calibrator to the [+] and COM jacks on the Meter.
3. Apply an input of +4.000V dc ±0.25%

   The meter display should read between 3.997-4.003V. If it does not, adjust R4 (see Figure 3-4) as described below.

To adjust R4, proceed as follows:

1. Remove any input signals to the meter.
2. Remove the four screws on the back and separate the case bottom and case top.

   Notice that when you do so the battery remains in the case bottom and power to the meter is disconnected.
3. Observing correct polarity, connect a 9V battery to the battery contacts using easy hook jumpers or alligator clip leads (see Figure 3-4).

   Note

   To avoid stretching or bending the battery contacts, connect leads to the base of the contacts as shown in Figure 3-4.
4. Set the calibrator for 0V dc. Put the meter in the 4.000V dc range.
5. Connect the calibrator to the [+] and COM jacks on the meter.
6. Apply an input of +4.000V dc ±0.25%
7. Adjust R4 (see Figure 3-4) so that the meter display reads between 3.997 and 4.003V.

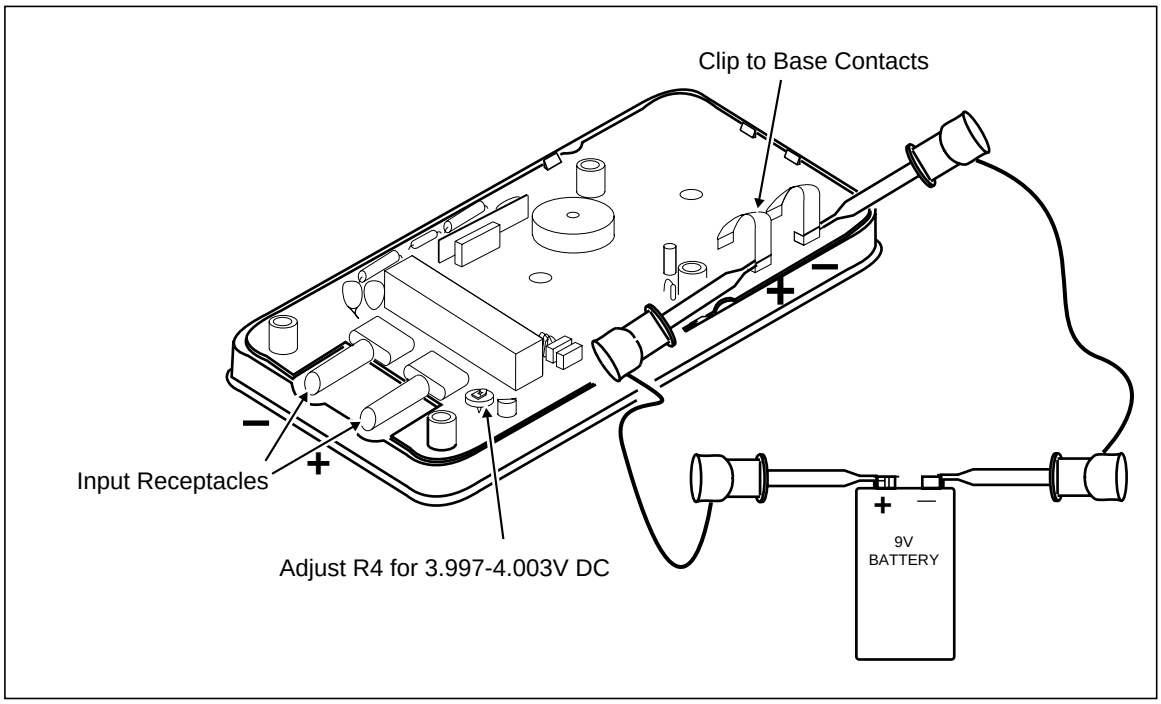

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Figure 3-4. Calibration Adjustment

Calibration Adjustments for Models 7-300 and 7-600

To ensure that the meter performs to specifications, make calibration adjustments annually using the following procedure:

1. Set the calibrator for 0V dc. Switch the meter ON.
2. Connect the calibrator to the [+] and COM jacks on the meter. Defeat the 50Ω divider on the calibrator (if any).
3. Apply an input of 3.500V dc ±0.25%. Wait at least 3 seconds.
4. Apply an input of 3.75V dc ±0.25%. Within 5 seconds the meter should display a reading between 3.747 and 3.753V dc. If it does not, adjust R4 as described below.

To adjust R4, proceed as follows:

1. Remove any input signal to the meter.
2. Remove the four screws on the back and separate the case bottom from the case top.

   Notice that when you do so, the battery remains in the case bottom and power to the meter is disconnected.
3. Observing the correct polarity, connect a known good 9V battery to the battery contacts using easy-hook jumpers or alligator clip leads. Refer to Figure 3-4.

   Note

   To avoid stretching or bending the battery contacts, connect the leads to the base of the contacts, as shown in Figure 3-4.
4. Set the calibrator for 0V dc. Turn the meter ON.

5. Connect the calibrator to the [+] and COM input jacks on the meter. Defeat the 50Ω divider on the calibrator (if any).
6. Apply an input of 3.500V dc ±0.25%. Wait at least 3 seconds.
7. Apply an input of 3.75V dc ±0.25%. Wait 5 seconds.
8. Adjust R4 so that the meter displays a reading between 3.747 and 3.753V dc.
9. Remove the inputs to the meter, disconnect the battery, and reassemble the meter.

Chapter 4
Parts and Schematics

Introduction

This chapter contains an illustrated list of replaceable parts for the 7-300, 7-600, 12B, and 18 Meters. Parts are listed by assembly; alphabetized by reference designator. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge
- Description
- Fluke stock number
- Total quantity
- Any special notes (i.e., factory-selected part)

Caution

A * symbol indicates a device that may be damaged by static discharge.

How to Obtain Parts

Electrical components may be ordered directly from the manufacturer by using the manufacturers part number, or from the Fluke Corporation and its authorized representatives by using the part number under the heading FLUKE STOCK NO. In the U.S., order directly from the Fluke Parts Dept. by calling 1-800-526-4731. Parts price information is available from the Fluke Corporation or its representatives. Prices are also available in a Fluke Replacement Parts Catalog which is available on request.

In the event that the part ordered 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 delivery of the correct part, include the following information when you place an order:

- Instrument model and serial number
- Part number and revision level of the pca containing the part.
- Reference designator
- Fluke stock number
- Description (as given under the DESCRIPTION heading)
- Quantity

Manual Status Information

The Manual Status Information in Table 4-1 defines the assembly revision levels that are documented in the manual. Revision levels are printed on each pca.

Table 4-1. Manual Status Information

Ref. or Option No.	Assembly Name	Fluke Part No.	Revision Level
A1	PCB ASSEMBLY (FLUKE 12)	879002	M
A1	PCB ASSEMBLY (FLUKE 10/18)	878991	M
A1	PCB ASSEMBLY (FLUKE 7-300)	614963	M
A1	PCB ASSEMBLY (FLUKE 7-600)	614966	M

Newer Instruments

Changes and improvements made to the instrument are identified by incrementing the revision letter marked on the affected pca. These changes are documented on a manual supplement sheet which, when applicable, is included with the manual.

Parts Lists, Drawings, and Schematics

This section contains the parts lists, drawings, and schematics for the meters.

Note Ni-Cd

This instrument may contain a Nickel-Cadmium battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler. Contact your authorized Fluke service center for recycling information.

⚠ Warning

To avoid fire or explosion, replace the fusible resistor only with Fluke PN 867361.

Table 4-2. Models 12B, 18, and 18/AL Final Assembly

Reference Designator	Description	Fluke Stock Number	Total Quantity
A1	MAIN PCA (MODEL 12B)	879002	1
A1	MAIN PCA (MODEL 18)	878991	1
BT1	BATTERY, 9V, 0-15MA	696534	1
H1-4	SCREW, PH, P, AM THD FORM, STL, 5-14, .750	832246	4
J3	CONN, ELASTOMERIC, LCD TO PWB, 2.050 L	867247	1
J4	CONN, ELASTOMERIC, SWITCH TO PWB, .500 L	867242	1
MP2	CASE TOP, (PAD XFER & WINDOW, MODEL 12B)	614948	1
MP2	CASE TOP, (PAD XFER & WINDOW, MODEL 18)	614955	1
MP2	CASE TOP, (PAD XFER & WINDOW, MODEL 18/AL)	615192	1
MP5	ACTUATOR, SWITCH	203445	1
MP6	SUPPORT, SWITCH ASSEMBLY	879031	1
MP8	CASE, BOTTOM, YELLOW (MODEL 12B)	614864	1
MP8	CASE, BOTTOM, GRAY (MODEL 18)	614872	1
MP9	SHIELD, BOTTOM	878277	1
MP10	SHOCK ABSORBER	878983	1
MP11	FOOT, NON-SKID	885884	1
MP12	TEST LEADS	855742	1
S2	SWITCH ASSEMBLY (MODEL 12B)	614799	1
S2	SWITCH ASSEMBLY (MODEL 18)	614807	1
U3	LCD, 3.5 DIGIT, MULTIPLEXED	855226	1
TM1	12B/18 INSTRUCTION SHEET	602000	1

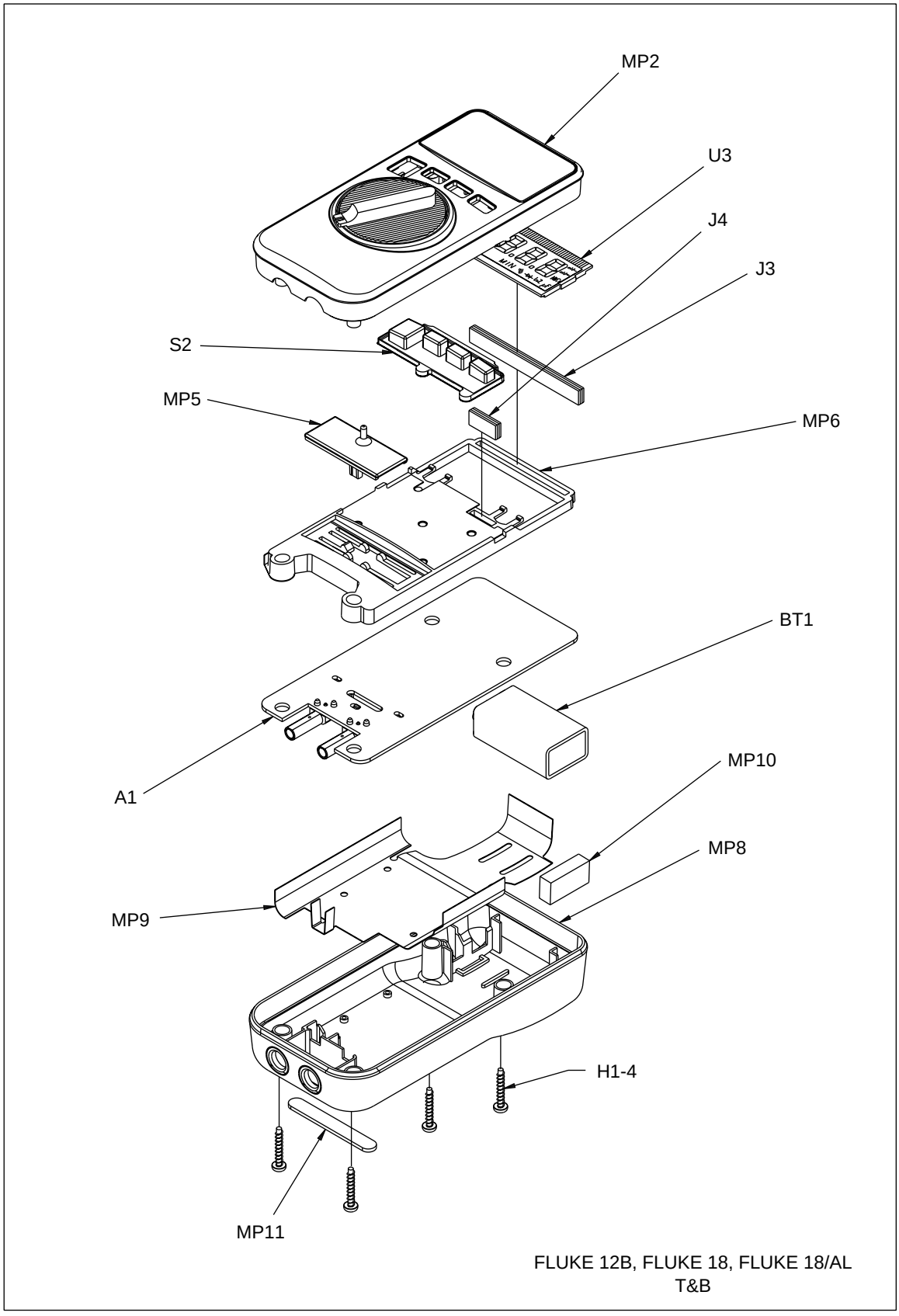


Figure 4-1. Models 12B and 18 Final Assembly

Table 4-3. Models 7-300 and 7-600 Final Assembly

Reference Designator	Description	Fluke Stock Number	Total Quantity
A1	MAIN PCA (MODEL 7-600)	614966	1
A1	MAIN PCA (MODEL 7-300)	614963	1
BT1	BATTERY, 9V, 0-15MA	696534	1
H1-4	SCREW, PH, P, AM THD FORM, STL, 5-14, .750	832246	4
J3	CONN, ELASTOMERIC, LCD TO PWB, 2.050 L	867247	1
MP2	CASE TOP, (PAD XFER & WINDOW, MODEL 7-600)	614930	1
MP2	CASE TOP, (PAD XFER & WINDOW, MODEL 7-300)	614922	1
MP5	ACTUATOR, SWITCH	203452	1
MP6	SUPPORT, SWITCH ASSEMBLY	879031	1
MP8	CASE, BOTTOM, YELLOW	614864	1
MP9	SHIELD, BOTTOM	878277	1
MP10	SHOCK ABSORBER	878983	1
MP11	FOOT, NON-SKID	885884	1
MP12	TEST LEADS	855742	1
U3	LCD, 3.5 DIGIT, MULTIPLEXED	855226	1
TM1	INSTRUCTION SHEET, FLUKE 7	602018	1

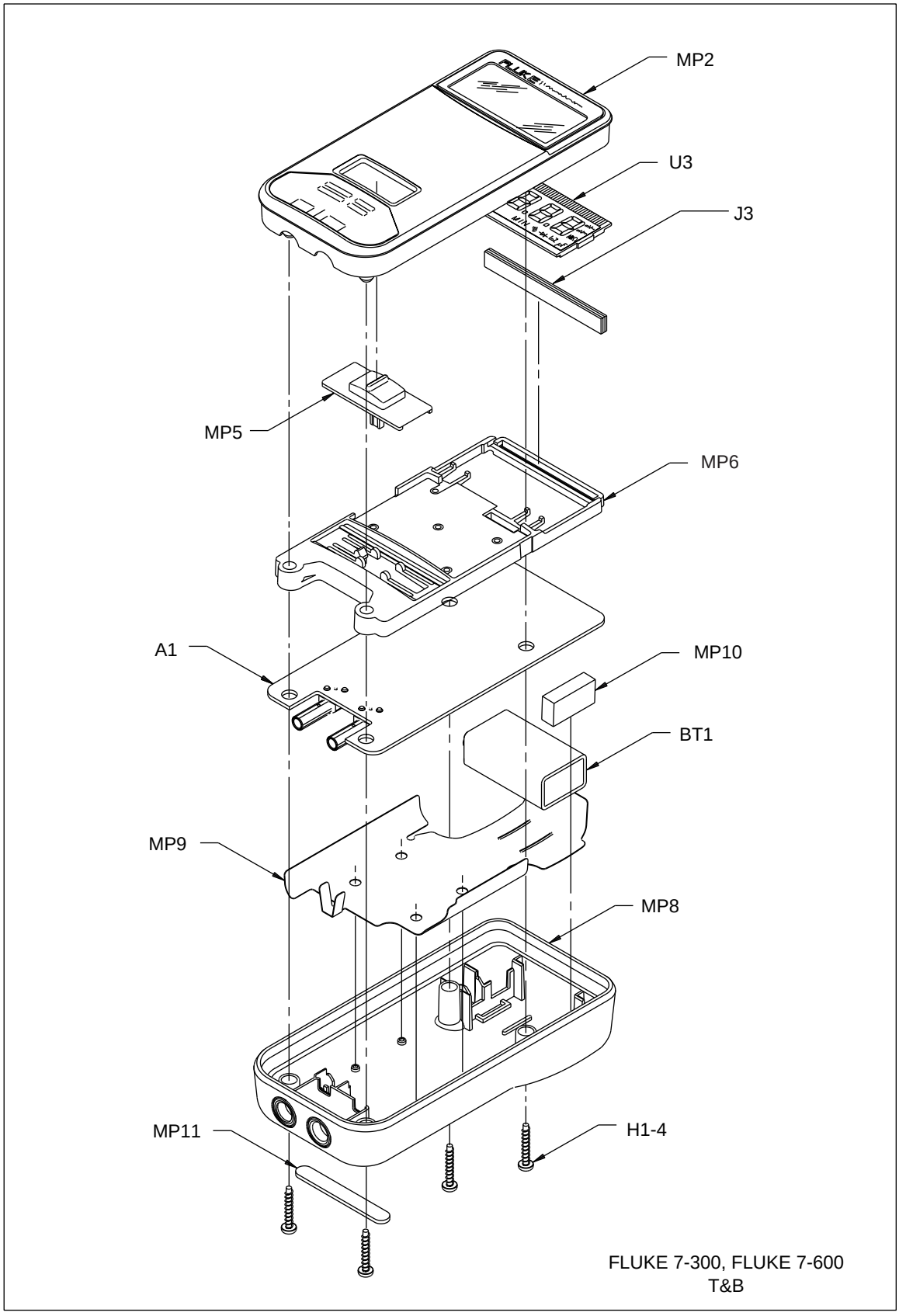


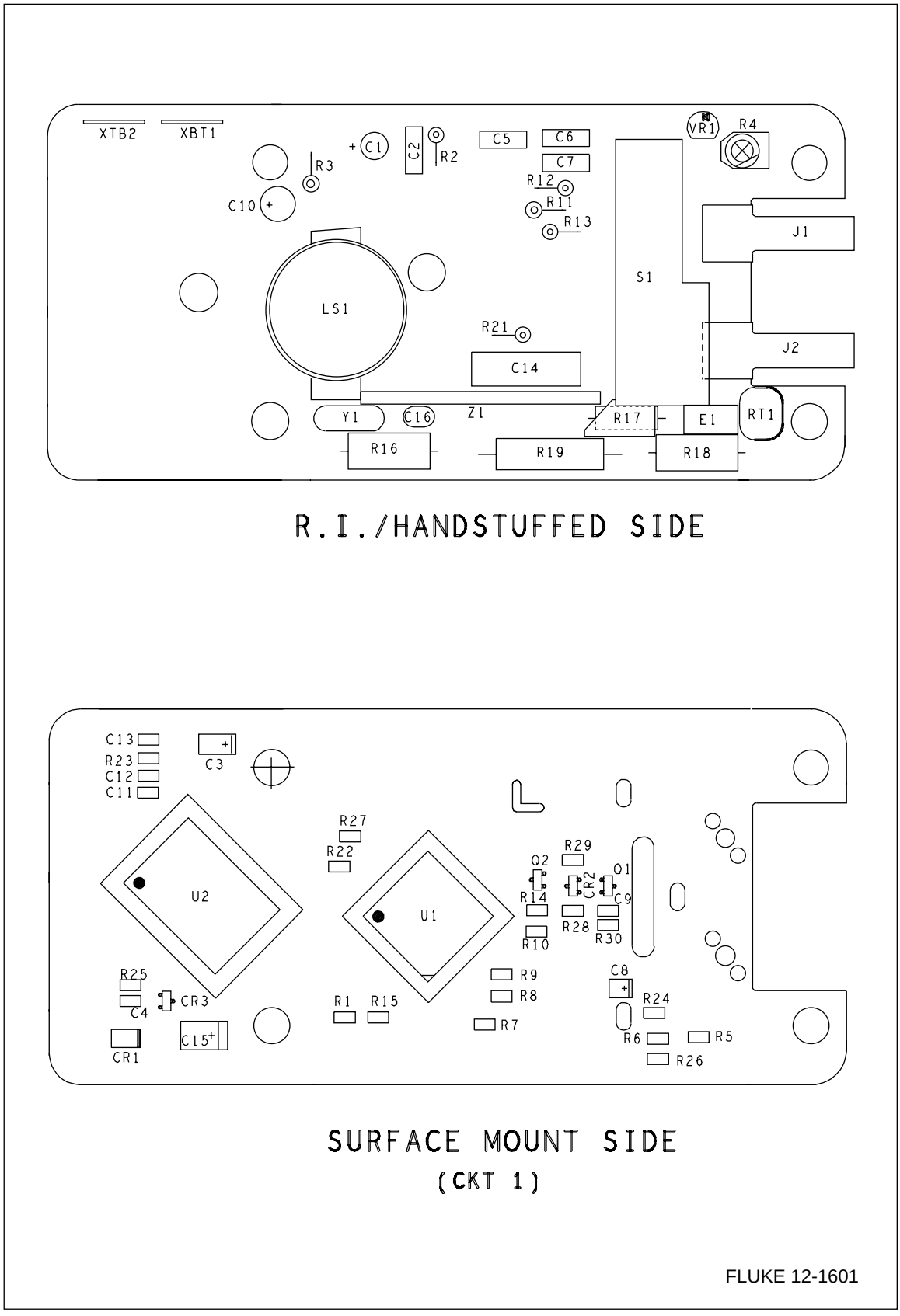
Figure 4-2. Models 7-300 and 7-600 Final Assembly

Table 4-4. A1 Main PCA

Reference Designator	Description	Fluke Stock Number	Total Quantity			
			7-300	7-600	12B	18
C1	CAP, TA, 0.47 µF, ±20%, 35V	655035	1	1	1	1
C2, C5-7	CAP, POLYES, 0.022 µF, ±10%, 50V	715268	0	0	4	4
C2, C7	CAP, POLYES, 0.022 µF, ±10%, 50V	715268	2	2	0	0
C3	CAP, TA, 22 µF, ±20%, 6V, 6032	876545	1	1	1	1
C4, C13	CAP, CER, 0.1 µF, ±10%, 25V, X7R, 1206	747287	0	2	2	0
C4, C12, C13	CAP, CER, 0.1 µF, ±10%, 25V, X7R, 1206	747287	3	0	0	0
C4, C11, C13	CAP, CER, 0.1 µF, ±10%, 25V, X7R, 1206	747287	0	0	0	3
C5, C6	CAP, CER, 4700 PF, ±20%, 100V	743427	2	2	0	0
C8	CAP, TA, 3.3 µF, ±20%, 16V, 3528	876552	1	1	1	1
C9	CAP, CER, 0.022 µF, ±10%, 50V, X7R, 1206	747279	1	1	1	1
C10	CAP, AL, 22 µF, ±20%, 10V, SOLV PROOF	887245	1	1	1	1
C14	CAP,POLY,.01 µF, ±10%,.1000V	822361	1	1	1	1
C15	CAP, TA, 47 µF, ±20%, 10V, 7343	867580	1	1	1	1
C16	CAP, CER, 10 PF, ±20%, 50V, C0G	721589	1	1	1	1
CR1	DIODE, SI, 100 PIV, 1 AMP, SURFACE MOUNT	912451	1	1	1	1
CR2	DIODE,SI,DUAL, BV = 50V, IO = 100 mA, SOT-23	851659	1	1	1	1
CR3	DIODE,SI, BV = 70V, IO = 50 mA, DUAL, SOT-23	742320	1	1	1	1
E1	SURGE PROTECTOR,3750v,±20%	867361	1	1	1	1
J1, J2	RECEPTACLE, INPUT	878988	2	2	2	2
LS1	AF TRANSD, PIEZO, 20MM	876995	1	1	1	1
Q1	TRANSISTOR, SI, NPN, SELECT IEBO, SOT-23	821637	1	1	1	1
Q2	TRANSISTOR, SI, PNP, SELECT ICER, SOT-23	887179	1	1	1	1
R1	RES, CERM, 162K, ±1%, .125W, 100 PPM, 1206	876198	1	1	1	1
R2	RES, MF, 332K, ±1%, 0.125W, 100 PPM	655217	1	1	1	1
R3	RES, MF, 23.4K, ±0.1%, 0.125W, 100 PPM	876292	1	1	1	1
R4	RES,VAR,CERM,25K, ±25%,.2W	876300	1	1	1	1
R5	RES, CERM, 43.2K, ±1%, .125W, 100 PPM, 1206	887109	1	1	1	1
R6	RES, CERM, 226K, ±1%, .125W, 100 PPM, 1206	876524	1	1	1	1
R7-9, R23, R28	RES, CERM, 1M, ±1%, .125W, 100 PPM, 1206	836387	5	5	5	5
R10	RES, CERM, 309K, ±1%, .125W, 100 PPM, 1206	876201	1	1	1	1
R11, R12	RES, MF, 30.1K, ±0.1%, 0.125W, 100 PPM	887161	2	2	2	2
R13	RES, MF, 27.1K, ±0.1%, 0.125W, 100 PPM	876289	1	1	1	1
R14, R15	RES, CERM, 10K, ±5%, .125W, 200 PPM, 1206	746610	2	2	2	2
R16, R18	RES,CERM, 470, ±5%,3W	887117	2	2	2	2
R17	RES,CERM, 1M, ±5%,1W	912589	1	1	1	1
R19	RES, MF, 450, ±10%,	107398	1	1	1	1
R21	RES JUMPER, 0.02, 0.25W	682575	1	1	1	1
R22, R29, R30	RES, CERM, 300, ±5%, .125W, 200 PPM, 1206	746362	3	3	3	3
R24	RES, CERM, 487K, ±1%, .125W, 100 PPM, 1206	887112	1	1	1	1
R25	RES, CERM, 2.2M, ±5%, .125W, 200 PPM, 1206	811778	1	1	1	1

Table 4-4. A1 Main PCA (cont)

Reference Designator	Description	Fluke Stock Number	Total Quantity			
			7-300	7-600	12B	18
R26	RES, CERM, 100K, ±1%, .125W, 100 PPM, 1206	769802	1	1	1	1
R27	RES, CERM, 0, +.05 MAX, .125W, 1206	810747	1	1	1	1
RT1	THERM, POS 1.1K, ±20%, 25C	867192	1	1	1	1
S1	SWITCH, SLIDE, 3 POS, 5 PIN	868117	1	1	1	1
U1	ARTIC, ASSEMBLY TESTED	858472	1	1	1	1
U2	IC, CMOS, 4 BIT MPU, LCD	601575	1	1	0	0
U2	*IC, CMOS, 4 BIT MPU, LCD CNTRLR, 80PNQFP	866913	0	0	1	1
VR1	IC, 1.23V, 150 PPM T.C., BANDGAP V. REF	634451	1	1	1	1
XBT, XBT2	CONTACT, BATTERY	890327	2	2	2	2
Y1	RESONATOR, CERAMIC, PIEZOELEC, 2.10 MHZ	876024	1	1	1	1
Z1	RES NET THK FILLM TESTED	872234	1	1	1	1



as11f.eps

Figure 4-3. Models 12B, 18, 7-300, and 7-600 Main PCA Components

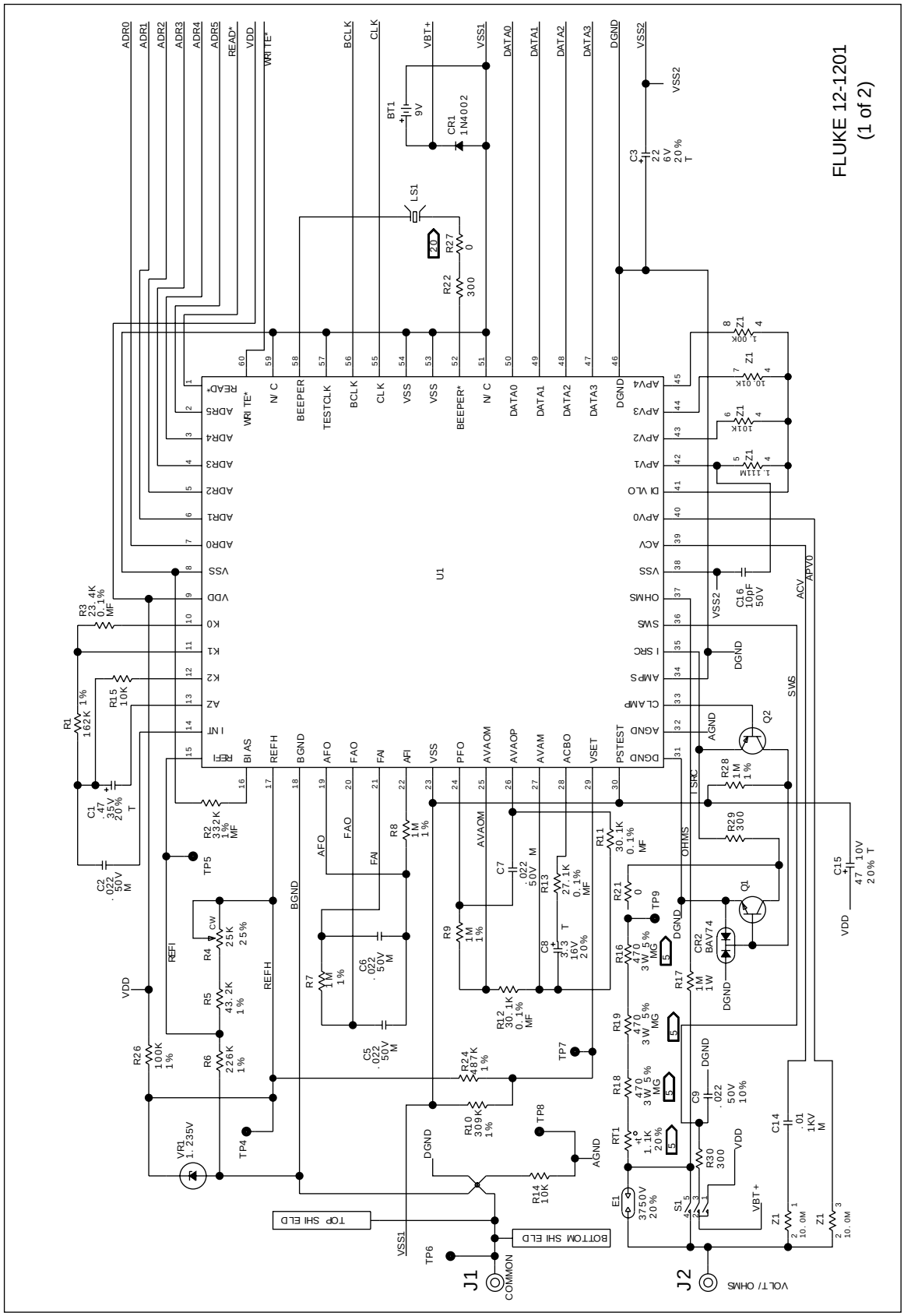
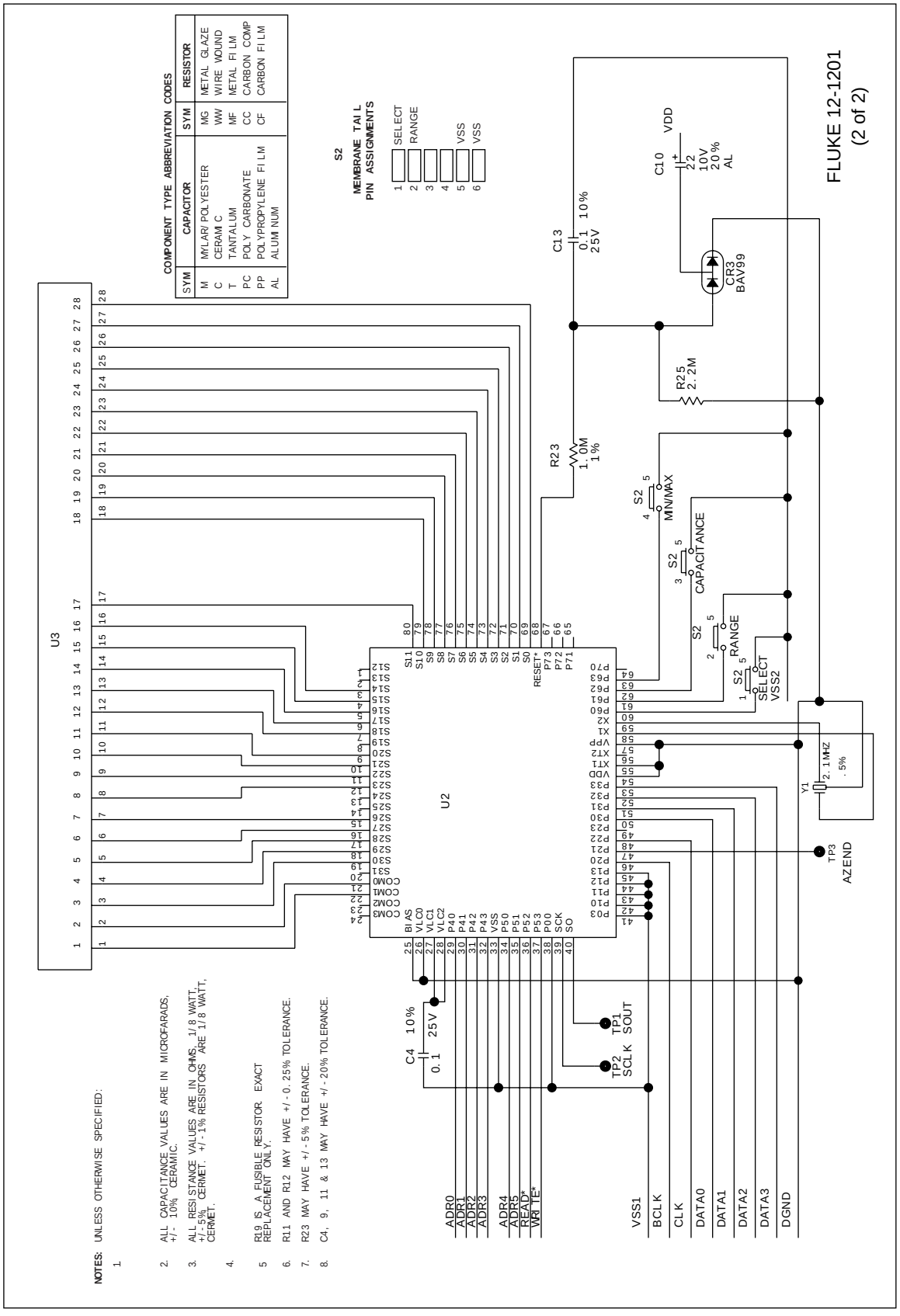


Figure 4-4. Model 12B Schematic



as21f.eps

Figure 4-4. Model 12B Schematic (cont)

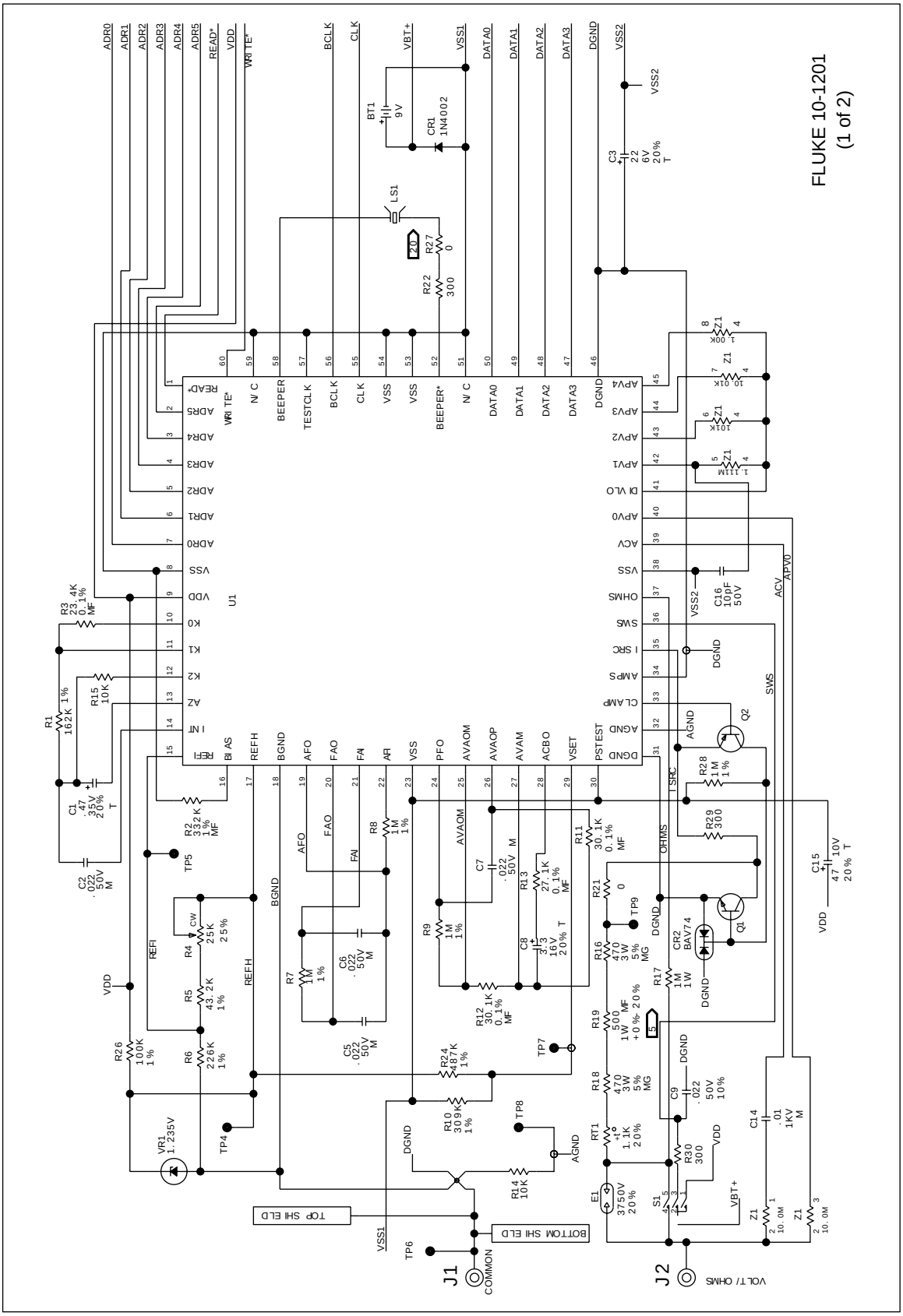
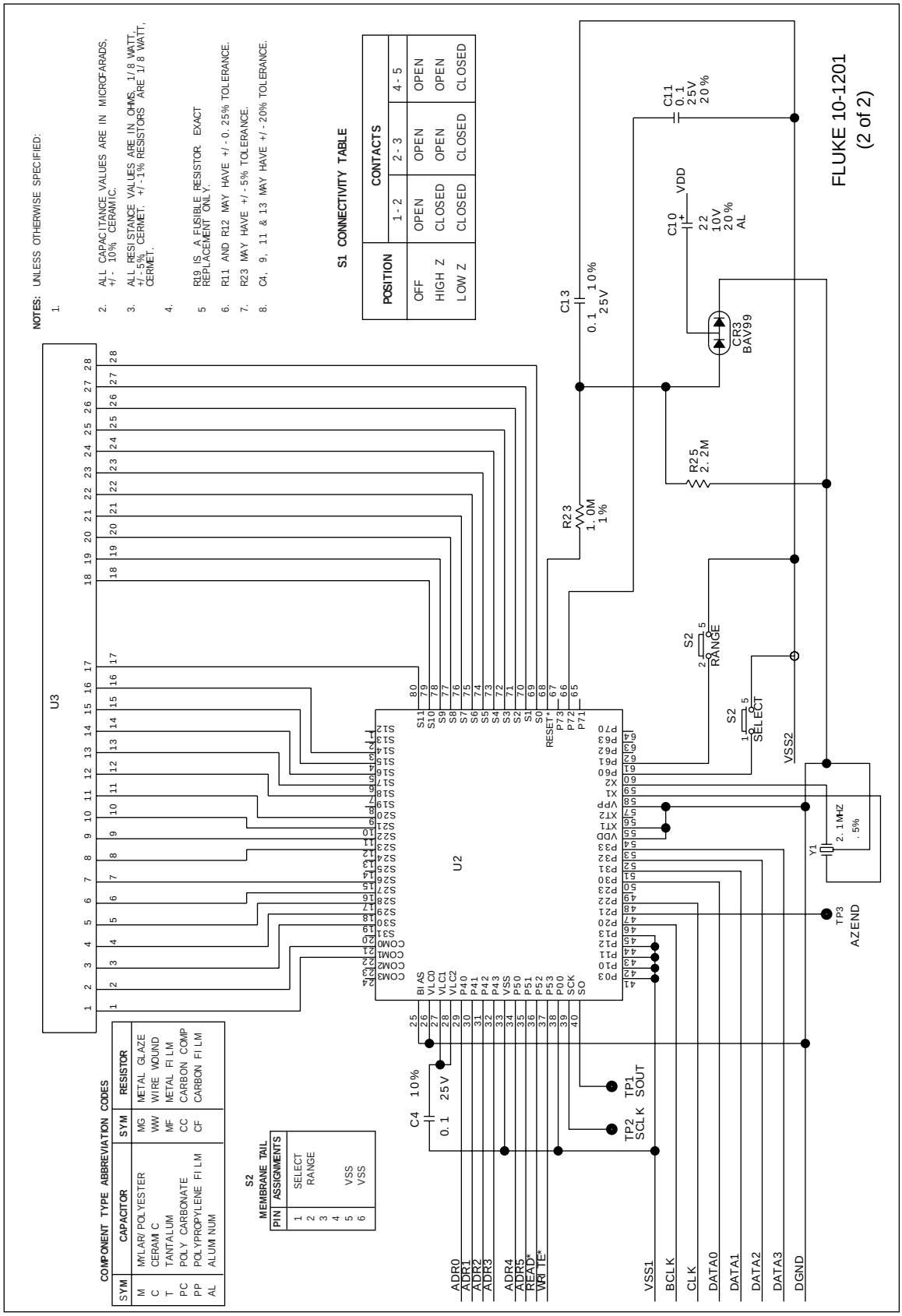


Figure 4-5. Model 18 Schematic



as17f.eps

Figure 4-5. Model 18 Schematic (cont)

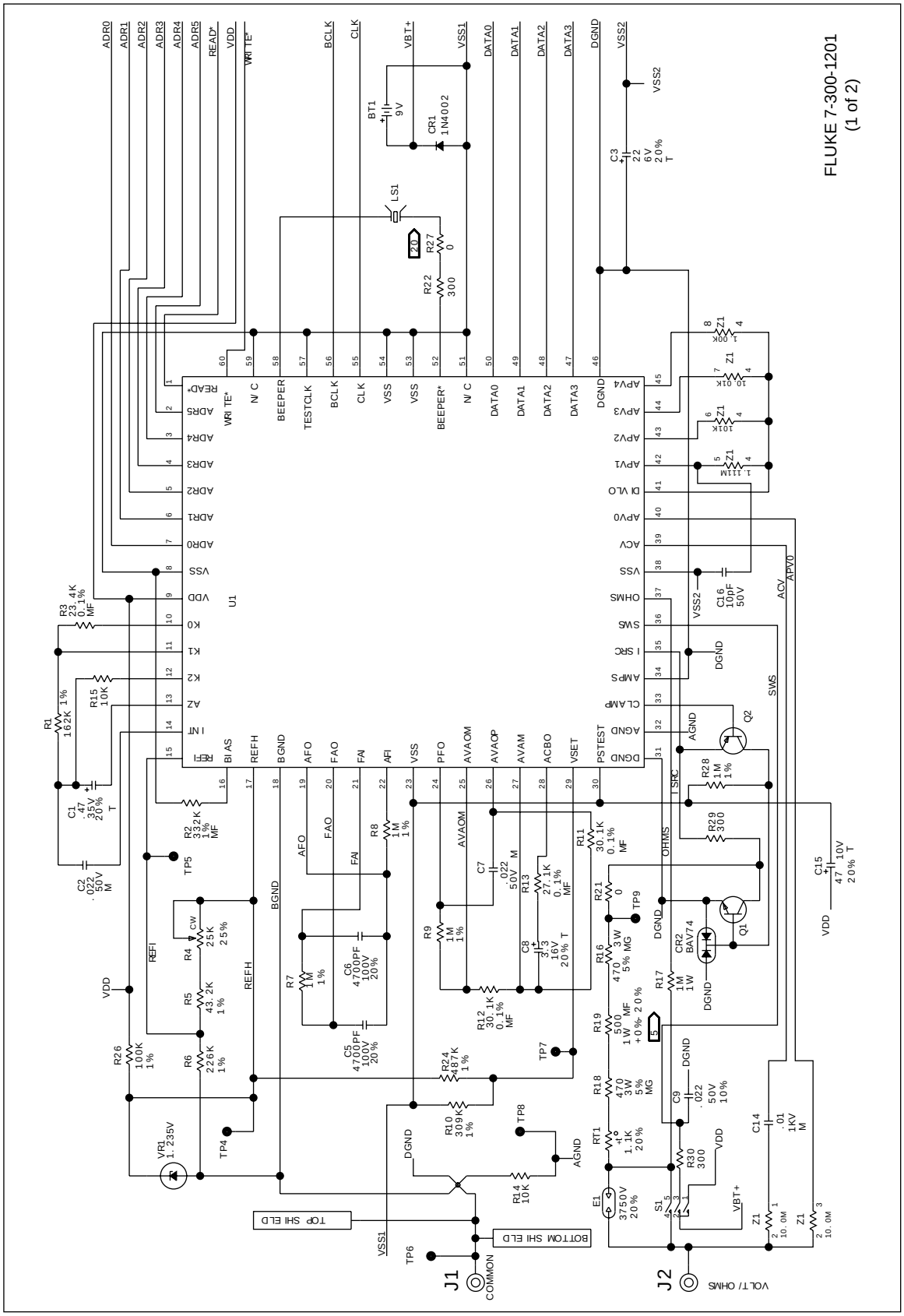
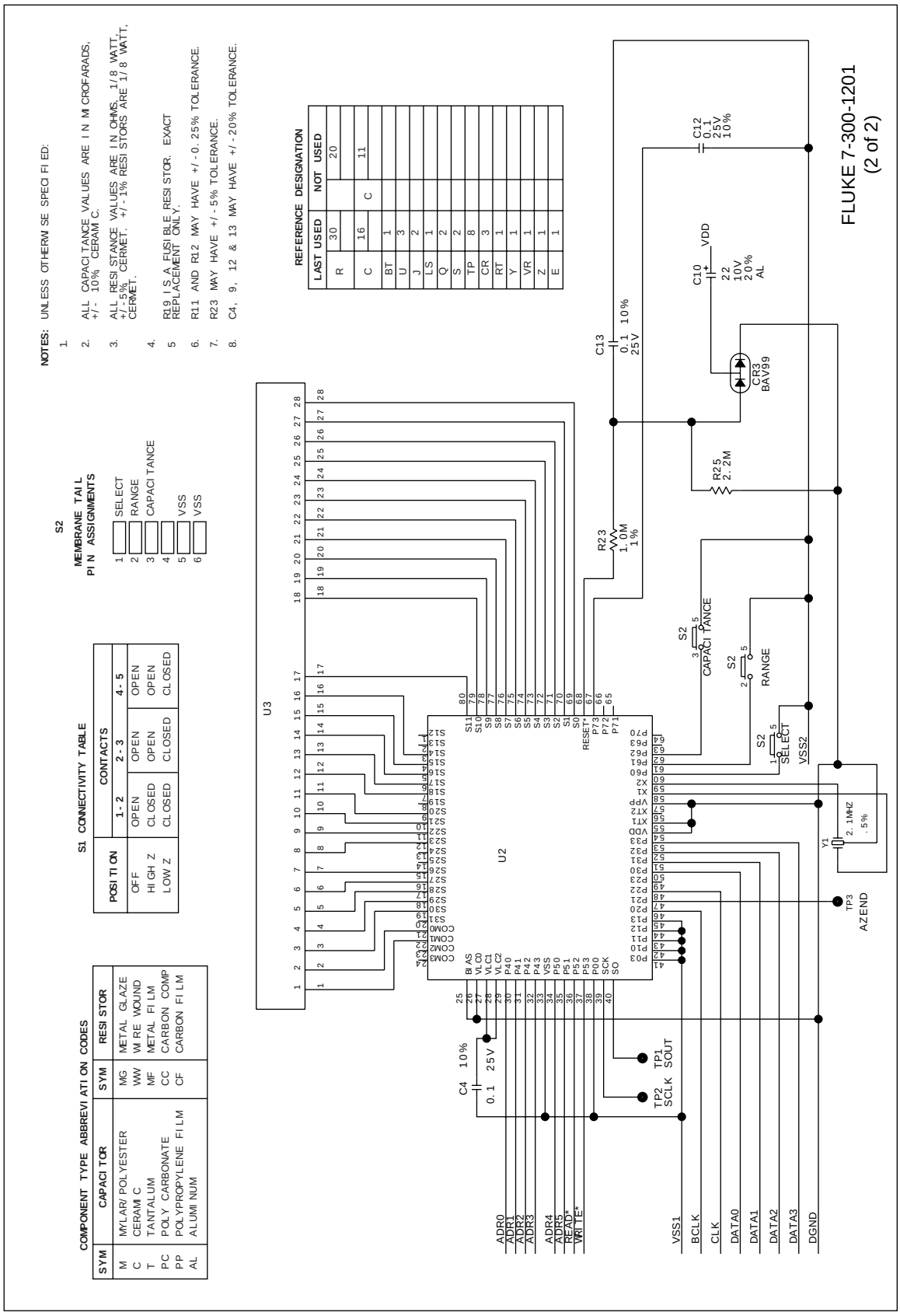


Figure 4-6. Model 7-300 Schematic



as13f.eps

Figure 4-6. Model 7-300 Schematic (cont)

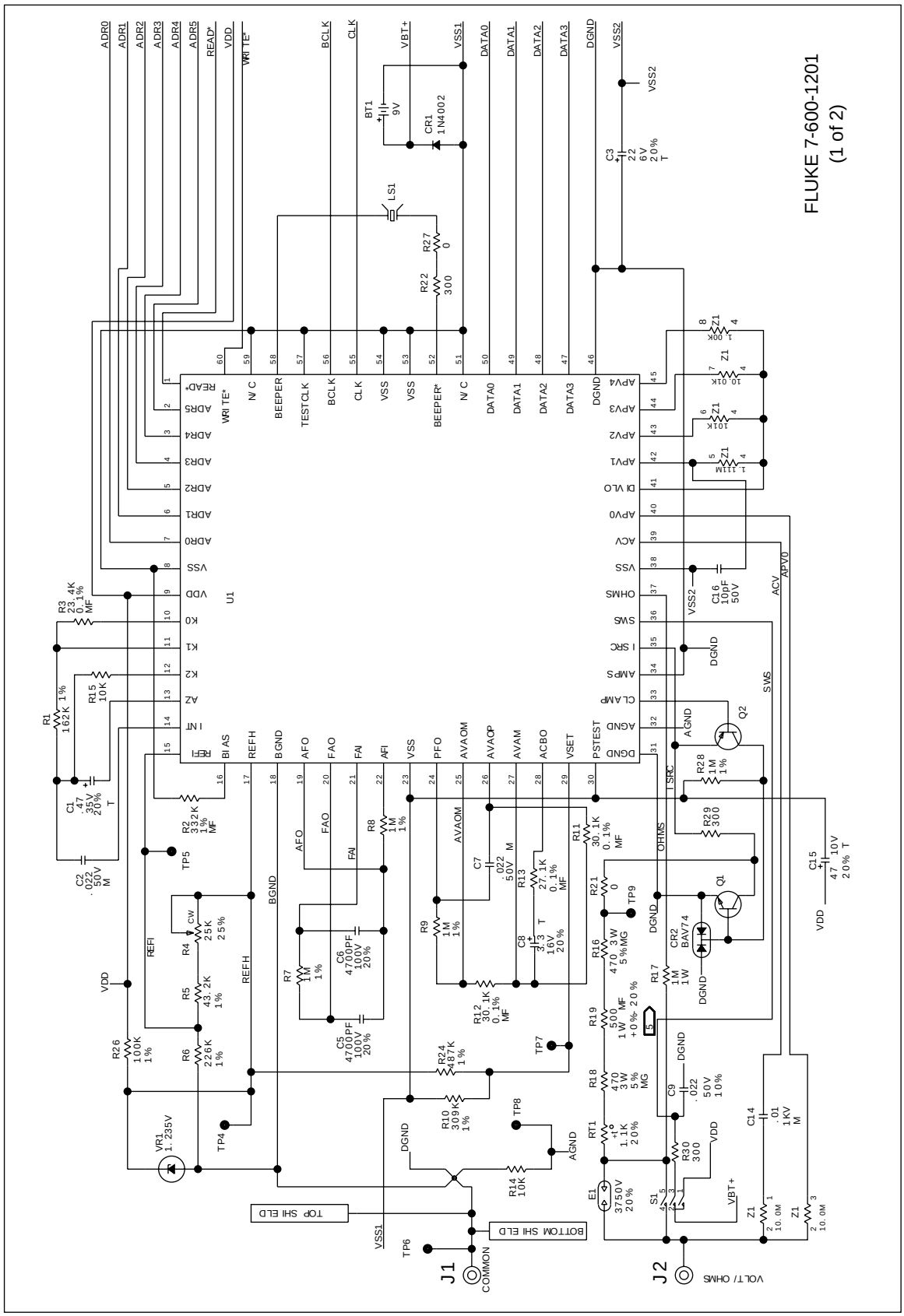


Figure 4-7. Model 7-600 Schematic

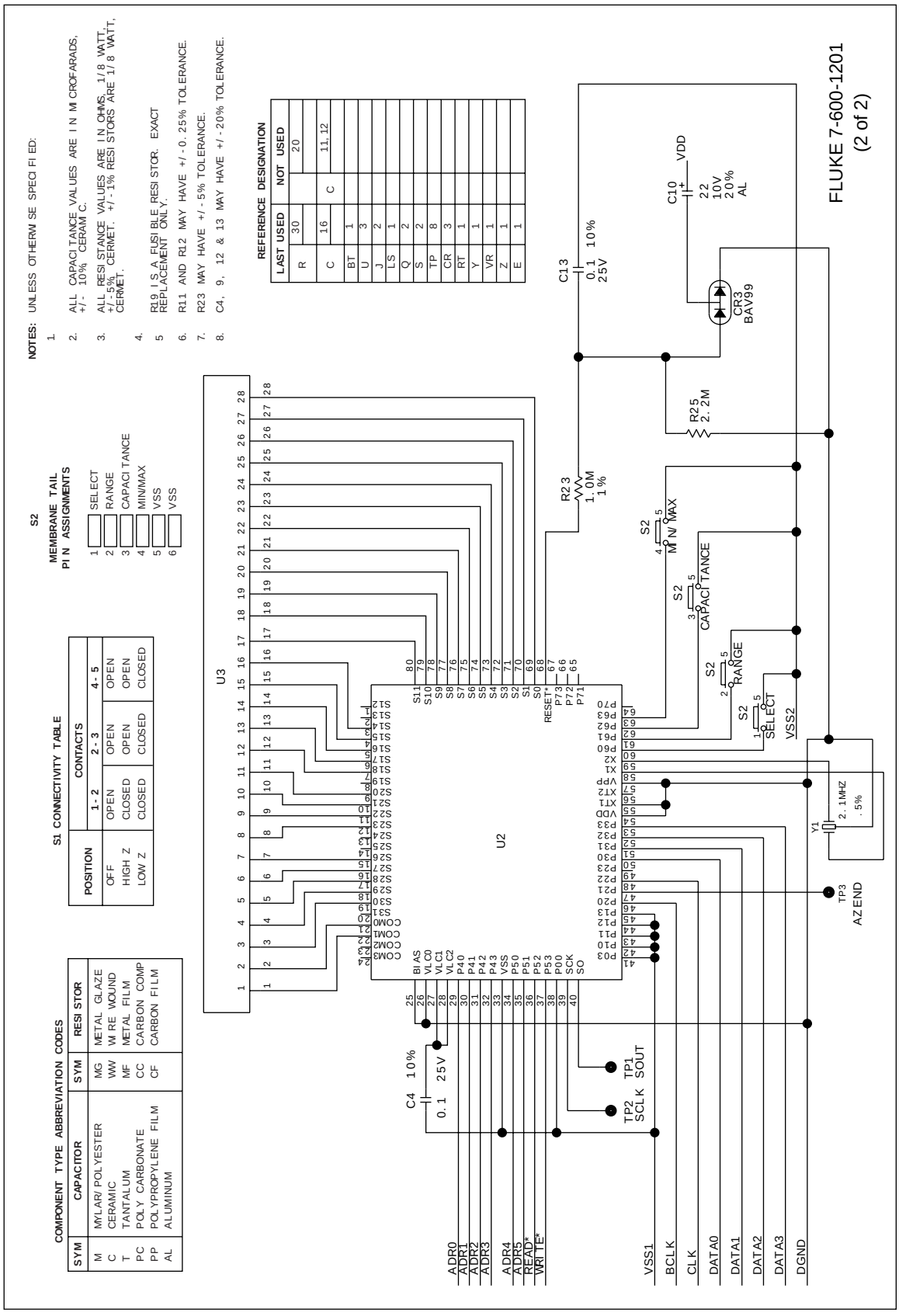


Figure 4-7. Model 7-600 Schematic (cont)

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FAX: 55-11-524-4873 (ID 2148)

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FAX: 55-11-533-3749

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FAX: 359-2-220910

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FAX: 385-41-837237

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FAX: 45-43-43-9192

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Electronic Equipment Mkting Co.
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FAX: 20-2-417-8296

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Servicestutzpunkt VFN5
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85737 Ismaning/Munich
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FAX: 49-89-9961-1270

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Fluke Sales & Service Manager
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FAX: 361-161-1021

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Raj Mahal Vilas Extension
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FAX: 91-33-247-6844

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FAX: 91-33-247-6844

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New Delhi 110 019
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FAX: 91-40-847585

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Jakarta 12950
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FAX: 62-21-520-5189 or 62-21-520-5189

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Airport Road Shuwaikh
13003 Kuwait
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FAX: 965-4847244

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Islamic Cham. of Commerce
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Clifton, Karachi-75600
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FAX: 92-21-577-0348

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FAX: 51-14-31-0707

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FAX: 63-2-721-0491 or 700-709

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Measuretronix Ltd.
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Piso-3
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Caracas 1070-A, Venezuela
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Freeport, Trinidad
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Manual Supplement

Manual Title:	12B,18,7 Series Service	Supplement Issue:	**3**
Part Number:	602730	Issue Date:	12/99
Print Date:	August 1996	Page Count:	1
Revision/Date:			

This supplement contains information necessary to ensure the accuracy of the above manual. Enter the corrections in the manual if either one of the following conditions exist:

1. The revision letter stamped on the indicated PCA is equal to or higher than that given with each change.
2. No revision letter is indicated at the beginning of the change.

FLUKE®

Change #1

On page 3-7, Table 3-2, Test No. 11,

Change: 400.0V dc
To: 400.0V dc[4]

Add footnote 4 to the bottom of the table:

4. Model 7-300 meter range is 300 Vdc.

On page 3-8, Table 3-3, Test No. 4, 12, and 13, change Switch Position,

From: Right
To: Center

On pages 4-3 and 4-5, Tables 4-2 and 4-3:

Delete both A1 entries in their entirety.
On all MP2 entries, remove the word WINDOW from the Description.

On page 4-8, Table 4-4, change the part number for the first U2,

From: 601575
To: 601757

Change #2

On page 3-6, replace Table 3-1 with the following:

Equipment	Minimum Specifications	Recommended Model
DMM Calibrator	DC Voltage: 0-600V Accuracy: ± 0.25% AC Voltage: 0-600V Accuracy: ± 0.5% Frequency: 50-400 Hz Resistance: 1.0Ω– 40 MΩ Accuracy: ± 0.25% Capacitance: 0-1.000 µF Accuracy: ± 0.5%	Fluke 5520A
ALTERNATE		
Equipment	**Minimum Specifications**	**Recommended Models**
DMM Calibrator	DC Voltage: 0-600V Accuracy: ± 0.25% AC Voltage: 0-600V Accuracy: ± 0.5% Frequency: 50-400 Hz	Fluke 5700A
Decade Resistor	Resistance: 1.0 – 40 MΩ Accuracy: ± 0.25%	General Resistance RDS-77B and 41B
Decade Capacitor	Capacitance: 0-1.000 µF Accuracy: ± 0.5%	GenRad 1412-BC