OPERATING AND SERVICE MANUAL

MODEL 4815A

RF VECTOR IMPEDANCE METER

SERIALS PREFIXED 631

Green Pond Road Rockaway, New Jersey, U. S. A.

04815-90011 **Printed: AUGUST 1966**

Table 1-1. Specifications

FREQUENCY

Range: 500 kHz to 108 MHz in five bands: 500 kHz to 1.5 MHz, 1.5 to 4.5 MHz, 4.5 to 14 MHz, 14 to 35 MHz, 35 to 108 MHz.

Accuracy: ±2% of reading, ±1% of reading at 1.592 and 15.92 MHz.

RF monitor output: 150 mV minimum into 50 ohms.

IMPEDANCE MAGNITUDE MEASUREMENT

Range: 1 ohm to 100K ohms; full-scale ranges: 10, 30, 100, 300, 1K, 3K, 10K, 30K, 100K ohms.

Accuracy: $\pm 4\%$ of full scale $\pm \left(\frac{f}{30\ \text{MHz}} + \frac{Z}{25\ \text{K}\Omega}\right)\%$ of reading, where f = frequency in MHz and Z in ohms; reading includes probe residual impedance.

Calibration: linear meter scale with increments 2% of full scale.

PHASE ANGLE MEASUREMENT

Range: 0 to 360° in two ranges: $0 \pm 90^{\circ}$, $180^{\circ} \pm 90^{\circ}$.

Accuracy: $\pm\left(3 + \frac{f}{30\ \text{MHz}} + \frac{Z}{25\ \text{K}\Omega}\right)$ degrees; where f = frequency in MHz and Z is in ohms.

Calibration: increments of 2°.

Adjustments: front panel screwdriver adjustments for Magnitude and Phase Zero.

RECORDER OUTPUTS

Frequency: 0 to 1 volt from 0 to 1K ohm source, proportional to dial rotation.

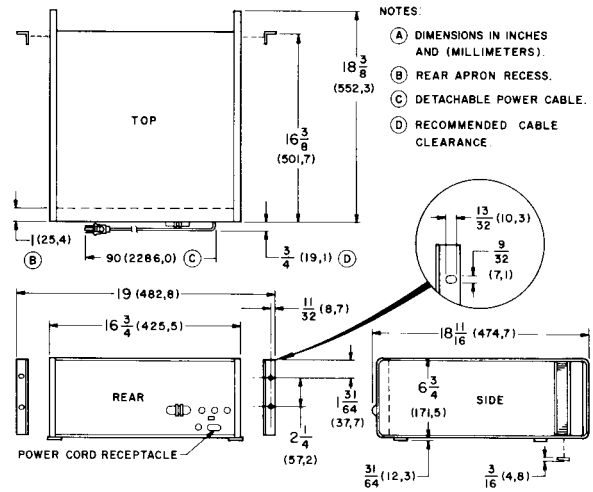
Impedance magnitude: 0 to 1 volt from 1K ohm source.

Phase angle: 0 ± 0.9 volt from 1K ohm source.

ACCESSORIES FURNISHED:

1. 00600A Accessory Kit.
2. Rack Mounting Kit.
3. Plugin board extender.

DIMENSIONS:



WEIGHT: net 39 lbs. (17,6 kg), shipping 50 lbs. (22,5 kg).

POWER: 105 to 125 v or 210 to 250 v, 50 to 400 Hz, 50 w.

Table 1-2. Additional Information

MEASURING TERMINAL CHARACTERISTICS

Configuration: Both excitation and measuring circuits are contained in a single sampling probe attached to instrument by a cable. Measurement is made between probe center pin and ground pin on probe case.

Residuals: indicated impedance includes approximately 0.5 ohm resistance and 8 nH inductance in series with the unknown, and 0.3 pF capacitance in parallel with the unknown.

Impedance: 25 ohms in series with 0.01 μF, looking into probe. Probe is constant-current driving source to circuit being measured.

TEST SIGNAL CHARACTERISTICS

Waveshape: sinusoidal.

Level: approximately 4 μA on all ranges except 10-ohm scale where it is approximately 13 μA.

External oscillator input: Rear BNC connector accepts excitation signal, 100 mV ±10% into 50 ohms; maximum instantaneous rate of change 1 MHz/s.

RFI CHARACTERISTICS

Conducted and radiated leakage limits are below those specified for MIL-I-6181D, except for RF excitation and sampling pulses emitted from probe. The sampling pulses are approximately 75 mV peak to peak, from 25-ohm source, with a duration of 3 ns occurring at a maximum repetition rate of 1 MHz. Probe may be stored in front panel probe check socket to obtain full compliance with MIL-I-6181D.

SELF-CONTAINED CALIBRATION

Probe check: 100 ohms ±.5% at phase angle of $0^{\circ} \pm 2^{\circ}$.

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Model 4815A RF Vector Impedance Meter (Figure 1-1) is a general purpose, self-contained instrument for measuring complex impedance in a wide variety of laboratory applications as well as production testing of circuits and components. The frequency range is 0.5 to 108 MHz; impedance magnitude is measured in 9 ranges from 10 Ω to 100 KΩ full scale; and phase angle between 0^{o} and 360^{o} is indicated on two ranges.

1-3. Impedance measurement is made at the tip of a probe that is at the end of a 5 ft. cable, with rf test signal and measuring circuits brought close to the probe tip to reduce residual impedances.

1-4. An internal rf oscillator, 0.5 to 108 MHz supplies a test signal to the unknown impedance, 12.6 μa on the 10 ohm range and 4 μa on all other ranges. Provision is made for using an external rf source, particularly useful when measuring quartz crystals and other high Q devices.

1-5. Dc voltages proportional to magnitude, phase and frequency are available at the rear panel for recording equipment.

1-6. Complete specifications are given in Table 1-1.

1-7. Additional information on the Model 4815A is given in Table 1-2. The characteristics are general design parameters that are useful in the application of the Impedance Meter.

1-8. ACCESSORIES FURNISHED.

1-9. Accessory kit number 00600A is supplied with the 4815A. The kit consists of adapters for probe to BNC and Type N connectors, a probe socket for use on circuit boards, a component mounting adapter, probe holder, probe ground assembly and center pins. The probe accessories are described in detail in Paragraphs 1-9 to 1-16 and shown in Figure 1-1 and 1-2. Also supplied is a rack mounting kit with hardware (-hp- Stock No. 5060-0776) and a circuit board extender for servicing.

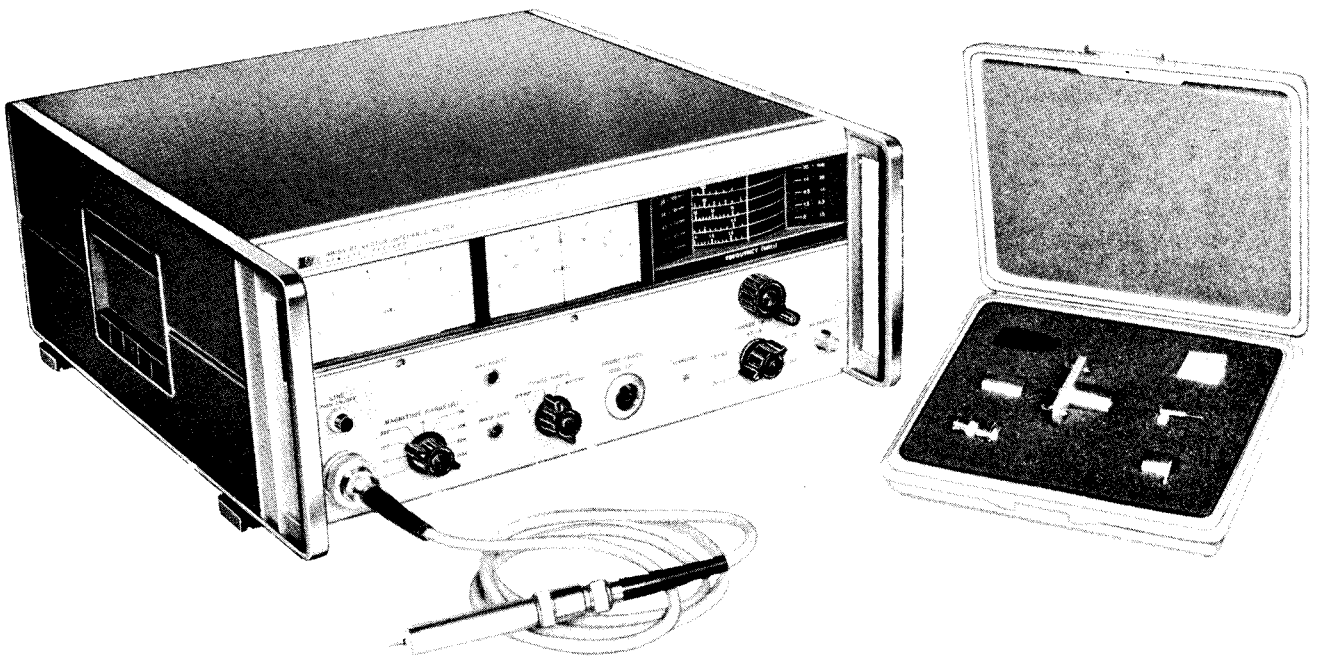


Figure 1-1. Model 4815A RF Vector Impedance Meter with 00600A Probe Accessory Kit

1-10. PROBE ADAPTER. This adapter converts the probe tip to a male type N connector and is available under accessory number 10206A.

1-11. PROBE TO BNC ADAPTER. With the use of the 10206A accessory, this adapter converts the probe tip to a male BNC connector and is available under accessory number 10207A.

1-12. PROBE SOCKET. This socket supports the probe and guides the center pin to the test point. An excellent ground return is obtained with the socket, which is available under accessory number 10210A.

1-13. COMPONENT MOUNTING ADAPTER. This adapter allows many types of components to be measured with minimum addition of residual impedance to affect measurements, and is separately available as accessory number 00601A.

1-14. PROBE GROUND ASSEMBLY is a grounding device that may be positioned at a convenient point on the probe barrel. A spring-loaded pin makes ground contact. This accessory is available as -hp- Stock No. 187B-21A-8.

1-15. PROBE CENTER PINS. Six additional center pins are supplied against possible damage or loss. The small-diameter end of the center pin is inserted into the mating jack in the probe tip.

1-16. PROBE HOLDER. This accessory clips onto the front handle of the 4815A to hold the probe when not in use, and is available separately as -hp- Stock No. 5040-0404

1-17. ACCESSORIES AVAILABLE.

1-18. SHIELDED BANANA PLUGS TO FEMALE BNC. This adapter converts banana post inputs to shielded BNC, and is available as accessory 10111A. The adapter has approximately 10 pF shunt capacity.

1-19. INSTRUMENT IDENTIFICATION.

1-20. Each Model 4815A is identified by an eight-digit (000-00000) serial number on the rear panel. The five digit number is an identification number unique to each instrument and the three digit number is a serial prefix number used to document changes.

1-21. All instruments with the same serial prefix are the same. The group of instruments to which this manual applies directly is identified on the title page. For instruments with serial numbers higher than those listed on the title page, a Manual Change sheet describing the changes is included with the manual. The manual for an instrument having special electrical modifications will include an insert sheet describing that modification. If a change sheet or special information sheet is missing, the information can be supplied by any Hewlett-Packard Sales and Service Office listed at the back of this manual.

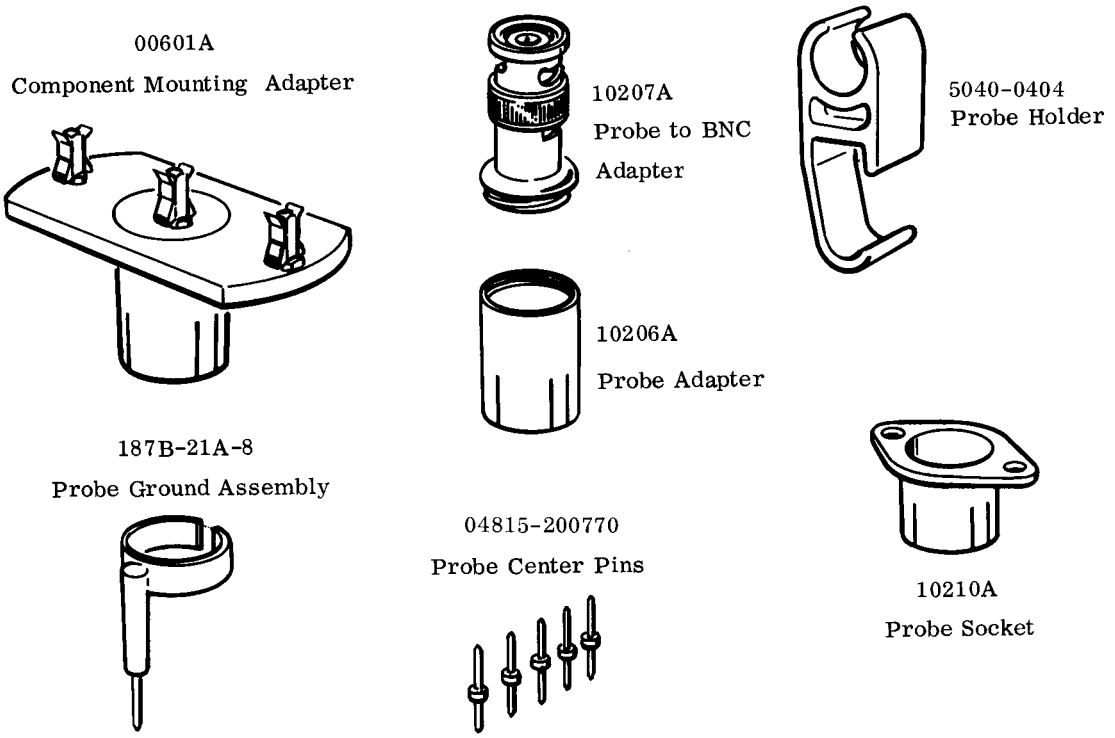


Figure 1-2. Probe Accessories

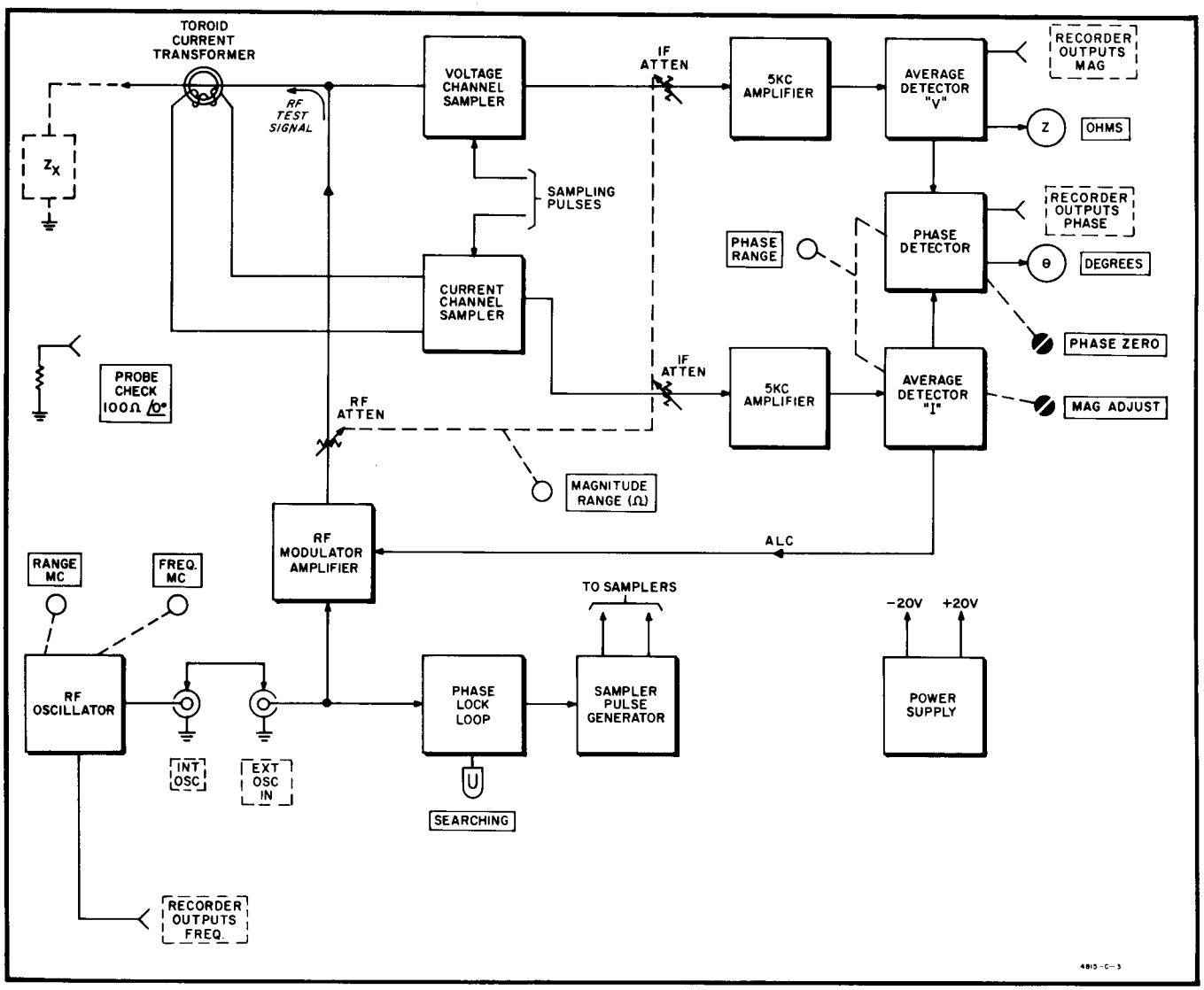


Figure 4-1. Simplified Overall Block Diagram.

A16 PROBE

Sampling gate A16CR1-4 is normally reverse-biased by ac. A positive pulse to A16CR1-2 junction and a simultaneous negative pulse at A16CR3-4 junction let the diodes conduct briefly (about one nano-second). A16C1 charges toward the instantaneous rf voltage across A16R1 during this time. The pulses are so short that A16C1 can only charge about 25%. Positive feedback from A13A1Q3 raises the overall efficiency to between 80% and 100%. The A16C1 charge and A13A1 output voltage are maintained until the next sample is taken.

Sampling gate A16CR5-8 is normally reverse-biased by ac. A positive pulse to A16CR5-6 junction and a simultaneous negative pulse to A16CR7-8 junction let the diodes conduct briefly (about one nanosecond). A16C4 charges toward the instantaneous rf voltage at the output of A16DL1 during this time. The pulses are so short that A16C4 can only charge about 25%. Positive feedback from A13A2Q3 raises the overall sampling efficiency to between 80% and 100%. The A16C4 charge and A13A2 output voltage are maintained until the next sample is taken. A16DL1 allows sampling of both voltage and current at the same point of the rf waveform without interaction between samplers.

J1-3 L1-6 R1 W1-10	L1 Q1-3 R1-21	L1 Q1-3 R1-21	CR1 R1-5 T1,2	CR1 R1-5 T1,2	CR1-8 DL1 P1 Q1,2 R1-3 T1-3 W1

A13J1 LOOKING INTO FRONT PANEL

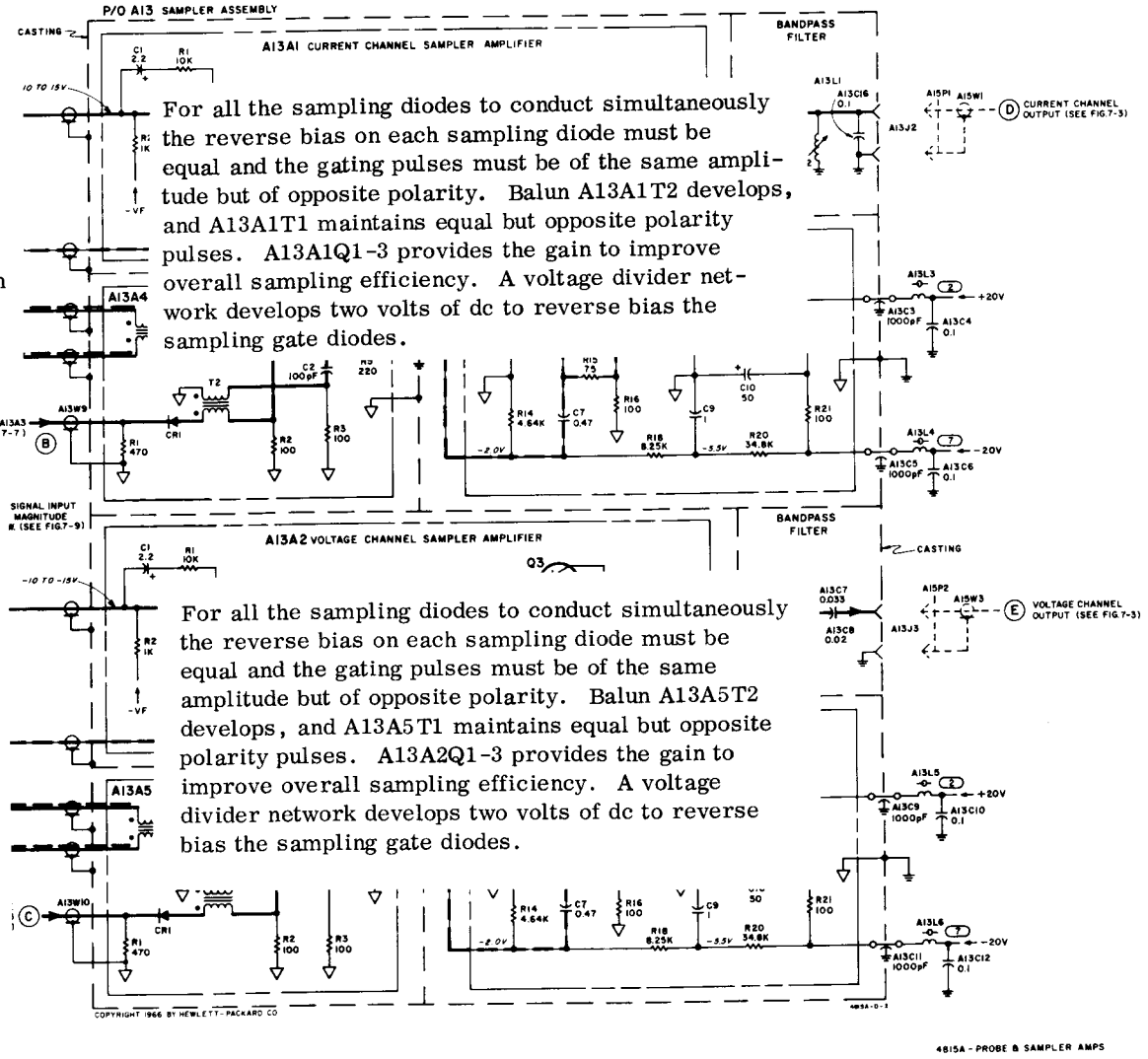


Figure 4-3. Probe and Sampler Circuits (sheet 1 of 2)

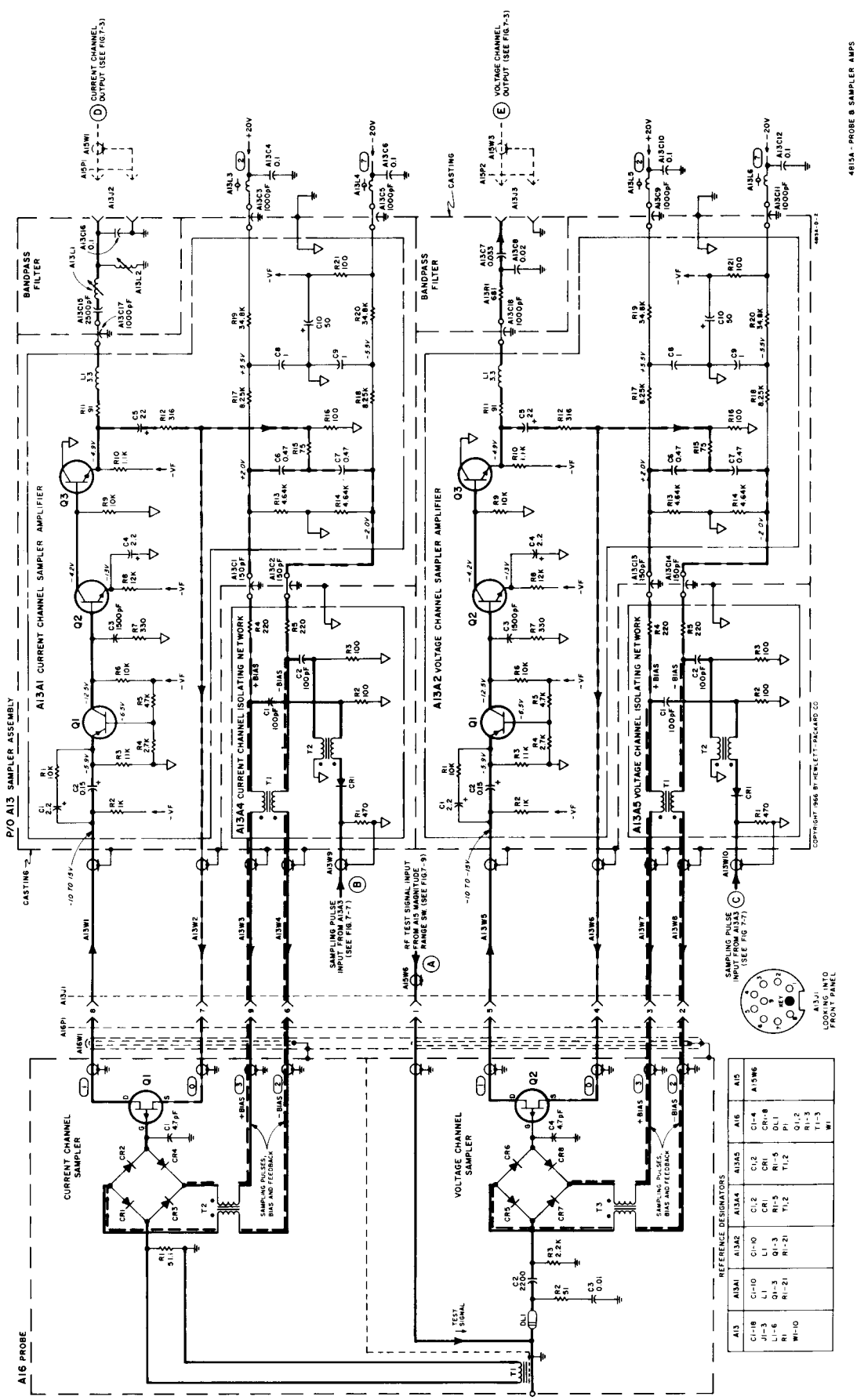


Figure 4-3. Probe and Sampler Circuits (sheet 2 of 2)