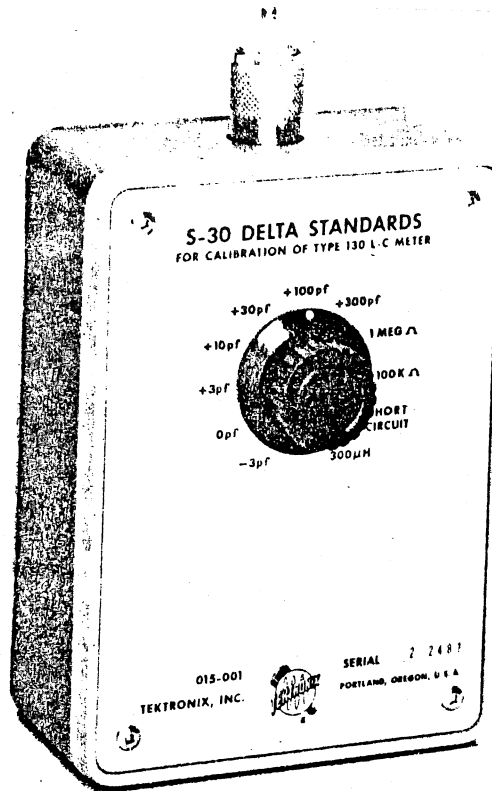


DELTA STANDARD
(Part No. 015-0001-00)



The S-30 Delta Standard provides a means for calibrating the Type 130 L-C Meter. The accuracy of the S-30 is $\pm 1\%$ or better in all ranges.

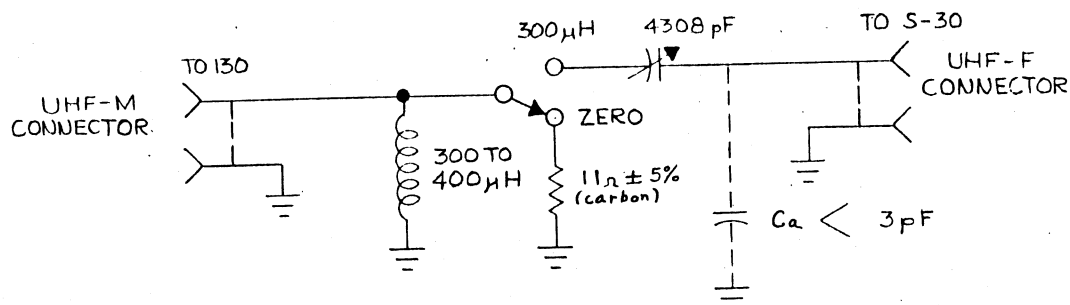
The S-30 provides seven calibrated capacitance ranges, two precision resistors, and one standard inductance of $300 \mu\text{H}$ at 140 kHz .

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ⓐ

CALIBRATION PROCEDURE (cont)
(Part No. 015-0001-00)

Equipment Required

- 10kHz Capacitance Bridge with an accuracy of 0.04% of reading, such as ESI Model 701 •
- Resistance Bridge with an accuracy of 0.25% •
- Parallel measuring Capacitance Bridge with an accuracy of 0.25%, such as Boonton Model 75D •
- Inductance Standardizer, to be constructed from the following schematic:



Assembled in a metal box with approx. 2" x 2" x 3" dimensions.
C = Silver mica and trim capacitor adjusted at 10 kHz to 4308 pF ±0.2%.

Capacitance Ranges

NOTE

Only the stray capacitance of the connector and switch assembly is in the circuit in the -3 pF position. The actual capacitance of these strays is approximately 10 to 20 pF. No effort is made to standardize this value. As the switch is rotated, capacitors are switched into the circuit to provide a change (or "Delta") of capacitance as indicated. In the 0 pF position, an additional 3 pF has been added in addition to the strays.

Calibration of the capacitance ranges is verified by using a 10 kHz capacitance bridge. The procedure is to measure the capacitance of the S-30 in the -3 pF position, then switch to the 0 pF position and determine if the "Delta" change is 3 pF ±1%. Adjustment of C-2 will be necessary if not within tolerance. Continue to switch to each range and measure the capacitance while adjusting the trimmer indicated in Table 1 to give the correct "Delta" changes.

TABLE 1

<u>Switch Position</u>	<u>Typical Value</u>	<u>Adj.</u>
-3 pF	13 pF	None
0 pF	16 pF	C-2
+3 pF	19 pF	C-4
+10 pF	26 pF	C-6
+30 pF	46 pF	C-7
+100 pF	116 pF	C-9
+300 pF	316 pF	C-11

CALIBRATION PROCEDURE (cont)
(Part No. 015-0001-00)

Resistance Ranges

Two 1% resistors of identical manufacture are used to standardize the resistance compensation. Measure the resistance with a resistance bridge. The capacitance of the 2 resistance positions should be within 0.1 pF of each other. This is verified by using a parallel measuring capacitance bridge. The capacitance can be adjusted by positioning the 100k and/or 1M Ω resistors with respect to the grounded wire supporting these resistors.

Inductance Range

To calibrate the 300 μ H range of the S-30, construction of the Inductance Standardizer is required.

The 130 LC meter's fixed frequency OSC must be 140 ± 0.2 kHz for this inductance calibration to be valid.

Insert the Inductance Standardizer between the S-30 and the Type 130 LC meter. Place the switch of the Type 130 LC meter in the 3 μ H position. Place the switch on the inductance standardizer to zero. With the COARSE and FINE ZERO controls bring the meter reading of the Type 130 LC meter to 0.

Place the switch on the Inductance Standardizer to the 300 μ H position and adjust L15 until the Type 130 LC meter reading is brought back to 0.

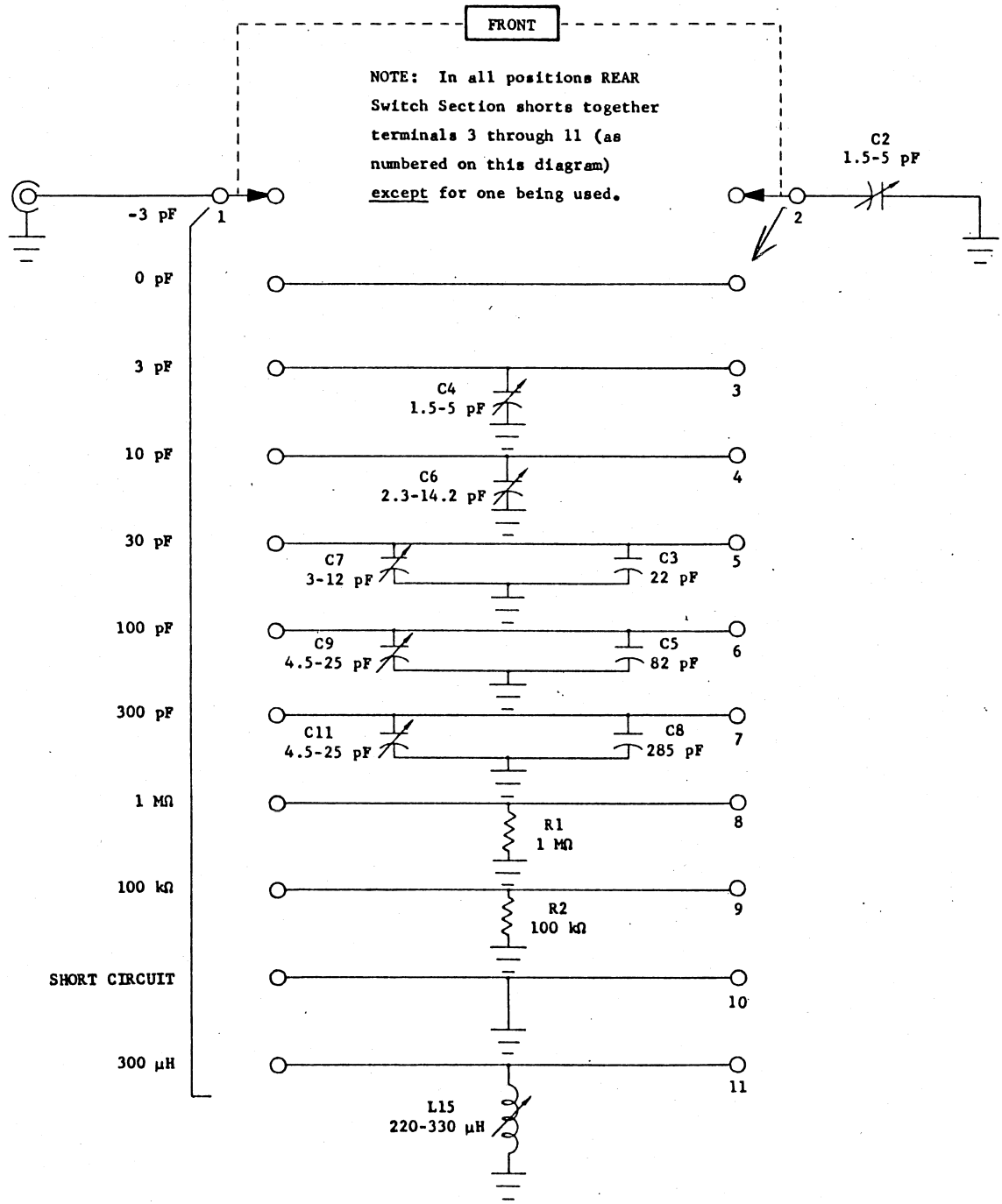
The 4308 pF Capacitor in the Inductance Standardizer is series resonant with the 300 μ H inductor in the S-30 at 140 kHz. Therefore, the 130 LC meter sees only the residual AC resistance ($\approx 11\Omega$) of this inductor.

After completing the adjustment, lock the slug of L15 in place.

Note

This method calibrates the Delta Standard's inductance to be 300 μ H at 140 kHz. However, when the Delta Standard is connected directly to the 130 LC meter, the meter reading will be about .5% low. The 130 LC meter's measurement frequency is 125 kHz when 300 μ H is connected to it. The frequency coefficient and 11 Ω of residual resistance are the factors that contribute to the 130 LC meter's low reading. This deviation can be neglected in most cases.

ELECTRICAL PARTS LIST
 (Part No. 015-0001-00)



ELECTRICAL PARTS LIST
(Part No. 015-0001-00)

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
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Capacitors

Tolerance $\pm 20\%$ unless otherwise indicated.

C2	281-0017-00			1.5-5 pF, Var	Air		
C3	281-0511-00			22 pF	Cer	500 V	10%
C4	281-0017-00			1.5-5 pF, Var	Air		
C5	295-0041-00			82 pF	Mica	500 V	2%
C6	281-0018-00			2.3-14.2 pF, Var	Air		
C7	281-0009-00	MDL 1	MDL 1	1.5-7 pF, Var	Cer		
C7	281-0007-00	2-1001		3-12 pF, Var	Cer		
C8	295-0042-00			285 pF	Mica	500 V	2%
C9	281-0011-00	MDL 1	MDL 1	5-25 pF, Var	Cer		
C9	281-0010-00	2-1001		4.5-25 pF, Var	Cer		
C9	281-0011-00	MDL 1	MDL 1	5-25 pF, Var	Cer		
C11	281-0010-00	2-1001		4.5-25 pF, Var	Cer		

Inductor

L15	*114-0032-00			200-330 μ H, Var	Core not replaceable		
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Resistors

Resistors are fixed, compensation, $\pm 10\%$ unless otherwise indicated.

R1	309-0148-00			1 M Ω	1/2 W	Prec	1%
R2	309-0260-00			100 k Ω	1/2 W	Prec	1%

Switches

	260-0429-00			Rotary	1 Sec. 11 Pos.		
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MECHANICAL PARTS LIST
(Part No. 015-0001-00)

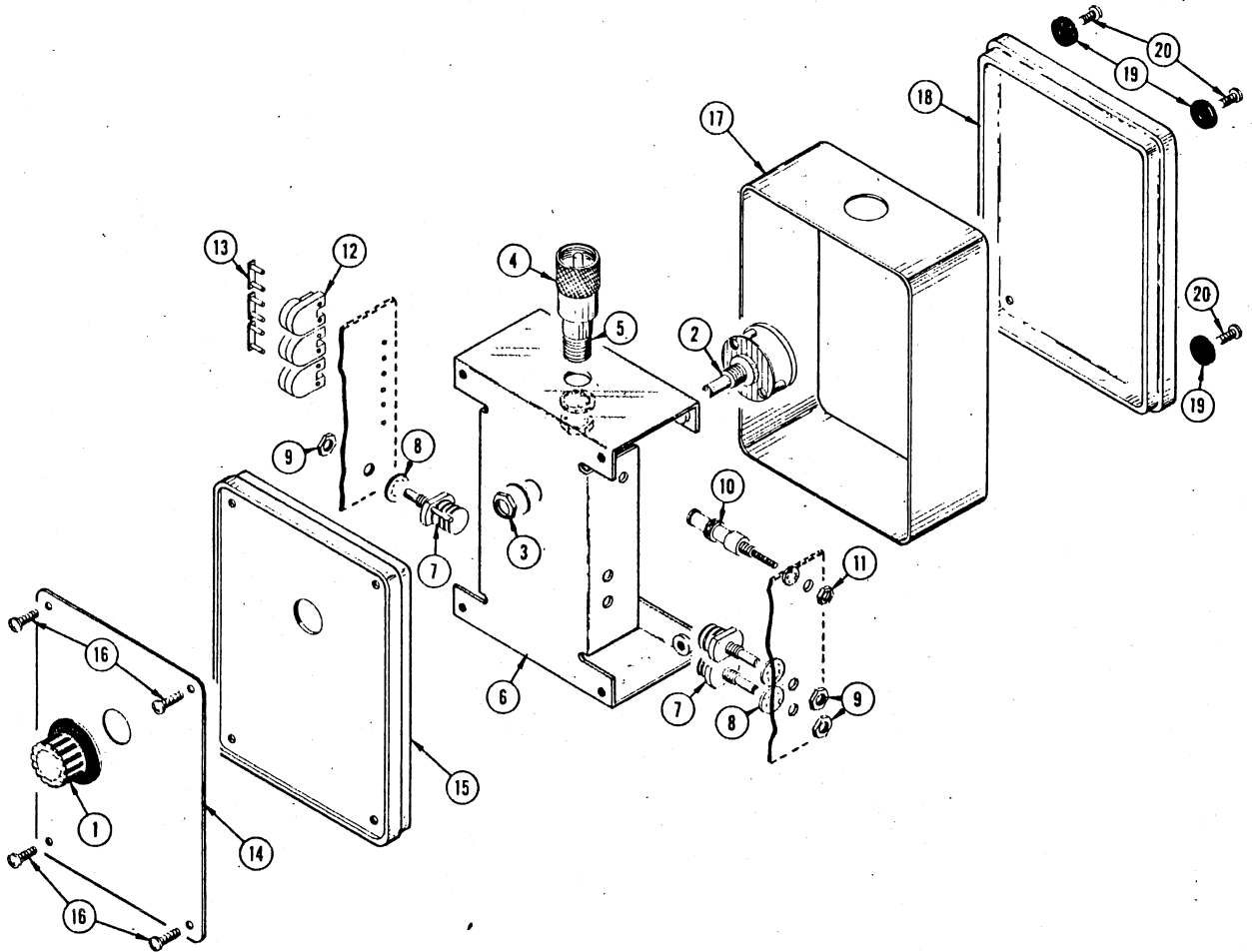


Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	Description	
		Eff	Disc			
1	366-0028-00	MDL 1	MDL 1	1	KNOB, black	
	366-0117-00	2-1001		1	KNOB, charcoal - knob includes:	
2	213-0004-00			1	SETSCREW, 6-32 x 3/16 inch, HSS	
	260-0084-00	MDL 1	MDL 1	1	SWITCH, unwired, delta standard	
	260-0429-00	2-1001	Switch with washers dock	1	SWITCH, unwired mounting hardware: (not included w/switch)	
	210-0840-00	MD1	MDL 1	1	WASHER, flat, 0.390 ID x 0.562 inch OD	
	210-0012-00	2-1001		1	WASHER, lock, internal, 3/8 x 1/2 inch	
	3	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch

MECHANICAL PARTS LIST (cont)
(Part No. 015-0001-00)

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	Description
		Eff	Disc		
4	131-0012-00	MDL 1	MDL 1	1	CONNECTOR, coaxial, female
	131-0146-00	MDL 1	MDL 1	1	CONNECTOR, coaxial
	210-0004-00	MDL 1	1154X	4	WASHER, lock, internal, #4
	210-0406-00	MDL 1	1154X	4	NUT, hex., 4-40 x 3/16 inch
	211-0008-00	MDL 1	1154X	4	SCREW, 4-40 x 0.250 inch, PHS
	200-0026-00			1	COVER, coaxial, male connector
	358-0153-00	X2-1001		1	BUSHING, insulator, plastic
this original desk-mount	131-0196-00	2-1001	1154	1	CONNECTOR, plug, electrical
	131-0168-00	1155		1	CONNECTOR, plug, electrical - mounting hardware: (not included w/connector).
5	102-0006-00	2-1001		1	REDUCER, 7/16 inch diameter x 1 inch long
	210-0012-00	2-1001		1	WASHER, lock, internal, 3/8 x 1/2 inch
	210-0413-00	2-1001		1	NUT, hex., 3/8-32 x 1/2 inch
	386-0342-00	MDL 1	1155X	1	PLATE, adapter
6	441-0058-00	MDL 1	MDL 1	1	CHASSIS
	441-0397-00	2-1001	1154	1	CHASSIS
	441-0441-00	1155		1	CHASSIS
7	- - - - -			3	CAPACITOR
	- - - - -			-	mounting hardware for each: (not included w/capacitor)
8	211-0011-00			1	SCREW, 4-40 x 0.312 inch, BHS
9	210-0442-00			1	NUT, hex., 3-48 x 3/16 inch
10	- - - - -			1	COIL
	- - - - -			-	mounting hardware: (not included w/coil)
11	210-0008-00			1	WASHER, lock, internal, #8
	210-0409-00			1	NUT, hex., 8-32 x 5/16 inch
12	- - - - -			3	CAPACITOR
	- - - - -			-	mounting hardware for each: (not included w/capacitor)
13	213-0034-00	MDL 1	1154	2	SCREW, thread cutting, 4-40 x 5/16 inch, RHS
	214-0153-00	1155		1	FASTENER, snap, plastic
14	333-0117-00	MDL 1	MDL 1	1	PANEL, front
	333-0681-00	2-1001		1	PANEL, front
	211-0504-00	MDL 1	MDL 1	4	SCREW, 6-32 x 0.250 inch, PHS
15	386-0343-00	MDL 1	MDL 1	1	PLATE, subpanel
	211-0502-00	MDL 1	MDL 1	6	SCREW, 6-32 x 0.188 inch, 100° csk, FHS
	200-0331-00	2-1001		1	COVER
	- - - - -			-	mounting hardware: (not included w/cover)
16	211-0071-00	2-1001		4	SCREW, 4-40 x 0.375 inch, THS
17	437-0017-00	MDL 1	MDL 1	1	CABINET
	380-0028-00	2-1001		1	HOUSING, wrap around
18	386-0344-00	MDL 1	MDL 1	1	PLATE, 3 5/16 x 4 1/8 inches
	200-0309-00	2-1001		1	COVER, box
	- - - - -			-	mounting hardware: (not included w/cover)
19	348-0037-00	X2-1001		4	FOOT, rubber
20	211-0012-00	X2-1001		4	SCREW, 4-40 x 0.375 inch, PHS

INSTRUMENT TYPE S-30 DELTA STANDARD

INSPECTION PROCEDURE

FINISHED PRODUCTS QUALITY CONTROL

S-30 DELTA STANDARD
015-0001-00

This procedure has been prepared for the Finished Products department. It will be a guide for a check of the instruments quality. The test limits in this procedure are, in the most part, internal limits set at the factory and are confidential. Inspection procedure test limits are the same as those found in the FCP.

This procedure, the test limits and any subsequent changes will be maintained and issued by Finished Products QC. Abbreviations used are taken from Tektronix Standard A-100. Words written in all capital, or upper case letters, are titles of procedure steps, front or rear panel labels, or TEKTRONIX instrument names. LH.

EQUIPMENT REQUIRED

- 1 TEKTRONIX TYPE 130 L-C METER (L-C METER)
- * 1 TEKTRONIX TYPE S-30 DELTA STANDARDS (S-30 DELTA)
- * 1 S-30 INDUCTANCE STANDARDIZER
- 1 UHF T Male to 2 Female (103-0026-00)
- 1 UHF Female to Female (103-0025-00)
- 1 UHF Male to Male (2 UHF Male cable connectors soldered together)
- 1 TRIPLETT MODEL 630 or equivalent Multimeter

* This equipment is calibrated to NBS for factory calibration standard (FC std)

PRESETS

130 L-C METER

RANGE SELECTOR	300 μ F
COURSE ZERO	midr
FINE ZERO	midr

S-30 DELTA

(Cal Standard)

RANGE SELECTOR	Opf
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S-30 INDUCTANCE
STANDARDIZER

SWITCH	ZERO
--------	------

SHORT FORM

- | | | |
|----|--|--|
| 01 | <u>VISUAL INSPECTION</u>
no defects | |
| 02 | <u>SET UP</u> | |
| 01 | <u>CAPACITY RANGE ACCURACY</u>
<u>+1%</u> | |
| 01 | <u>INDUCTANCE</u>
$\leq 1\%$ (3 μ H) | |
| 02 | <u>SHORT CIRCUIT</u>
no resistance (0 Ohms) | |
| 03 | <u>RESISTANCE</u>
<u>+1%</u> | |

VISUAL INSPECTION

no defects

101 CHECK - for defects in workmanship, printed information, paint chips, scratches or any defects

SET UP

102 CONNECT - FC std S-30 Delta to L-C METER UNKNOWN L OR C (see Fig. 1)

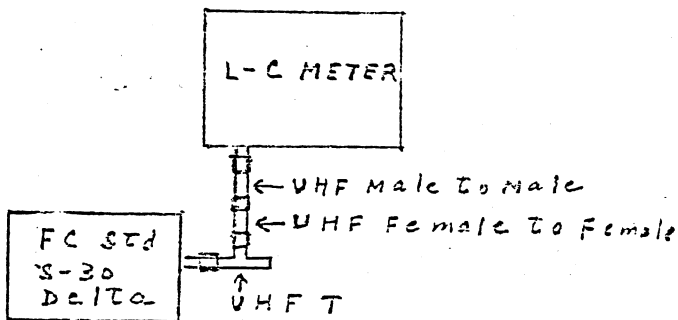


Fig. 1

ADJUST - L-C METER COURSE ZERO and FINE ZERO controls to set meter for 0 reading

SET - L-C METER RANGE SELECTOR to $3\mu\text{F}$
 - S-30 Delta to + 3pf

CHECK - L-C METER reading and make note (should read $3\mu\text{F}$)

SET - S-30 Delta to -3pf

CHECK - L-C METER reading and make note

SET - L-C METER RANGE SELECTOR to $10\mu\text{F}$
 - S-30 Delta to +10pf

CHECK - L-C METER reading and make note

SET - L-C METER RANGE SELECTOR to $30\mu\text{F}$
 - S-30 DELTA to +30pf

CHECK - L-C METER reading and make note

SET - L-C METER RANGE SELECTOR to $100\mu\text{F}$
 - S-30 DELTA to +100pf

CHECK - L-C METER reading and make note

SET - L-C METER RANGE SELECTOR to $300\mu\text{F}$
 - S-30 DELTA to +300pf

CAPACITY RANGE
ACCURACY

1%

- CHECK - L-C METER reading and make note
- SET - S-30 DELTA to 0 pf
- L-C METER RANGE SELECTOR to $3\mu\text{F}$
- CHECK - L-C METER for 0 reading
- 201 NOTE - leave FC std. S-30 DELTA range selector at 0 of on all capacity range checks
- SET - S-30 DELTA (to be checked) to 0 pf
- CONNECT - S-30 DELTA to other end of UHF T adapter (see Fig. 1)
- SET - S-30 DELTA to +3pf
- CHECK - L-C METER reading for $\leq 1\%$ ($+0.03\mu\text{F}$, $-0.03\mu\text{F}$) of meter reading you made note of in set up
- SET - S-30 DELTA to -3pf
- CHECK - L-C METER reading for $\leq +0.03\mu\text{F}$, $-0.03\mu\text{F}$ of noted reading
- SET - L-C METER RANGE SELECTOR to $10\mu\text{F}$
- S-30 DELTA to 10pf
- CHECK - L-C METER reading for $\leq +0.1\mu\text{F}$, $-0.1\mu\text{F}$ of noted reading
- SET - L-C METER RANGE SELECTOR to $30\mu\text{F}$
- S-30 DELTA to 30pf
- CHECK - L-C METER reading for \leq to $+0.3\mu\text{F}$, $-0.03\mu\text{F}$ of noted meter reading
- SET - L-C METER RANGE SELECTOR to $100\mu\text{F}$
- S-30 DELTA to 100pf
- CHECK - L-C METER reading for $\leq +1.0\mu\text{F}$, $-1.0\mu\text{F}$ of noted meter reading
- SET - L-C METER RANGE SELECTOR to $300\mu\text{F}$
- S-30 DELTA to 300pf
- CHECK - L-C METER reading for $\leq +3.0\mu\text{F}$, $-3.0\mu\text{F}$ of noted meter reading
- REMOVE - S-30 DELTA from UHF T adapter
- FC standard S-30 DELTA with adapters from L-C METER

INDUCTANCE

$\leq 1\%$ ($3\mu\text{H}$)

- 301 CONNECT - FC S-30 INDUCTANCE STANDARDIZER to L-C METER UNKNOWN L OR C
- S-30 DELTA (to be checked) to INDUCTANCE STANDARIZER (see Fig. 2)
- SET - S-30 DELTA to SHORT CIRCUIT
- L-C METER RANGE SELECTOR to $3\mu\text{H}$
- ADJUST - L-C METER COURSE ZERO and FINE ZERO controls to set meter reading to 0
- SET - S-30 DELTA to $300\mu\text{H}$
- S-30 INDUCTANCE STANDARD to $300\mu\text{H}$
- CHECK - for $\leq 3\mu\text{H}$ on $3\mu\text{H}$ range
- SET - S-30 INDUCTANCE STANDARD to ZERO
- REMOVE - S-30 DELTA from inductance std.

SHORT CIRCUIT

no resistance (0 ohms)

- 302 SET - S-30 DELTA to SHORT CIRCUIT
- Multimeter selector to X100 Ω
- CONNECT - test probes together and adjust Ω adj for 0 reading
- probes to S-30 DELTA input and gnd
- CHECK - meter for 0 Ω (Ohms) reading

RESISTANCE

$\pm 1\%$

- 303 SET - S-30 DELTA to 100K Ω
- CHECK - resistance for 100K $\Omega \pm 1000\Omega$ (1K)
- SET - S-30 DELTA to 1 MEG Ω
- CHECK - resistance for 1 meg $\Omega \pm 10,000\Omega$ (10K)

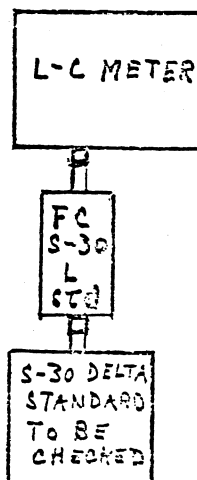


Fig. 2