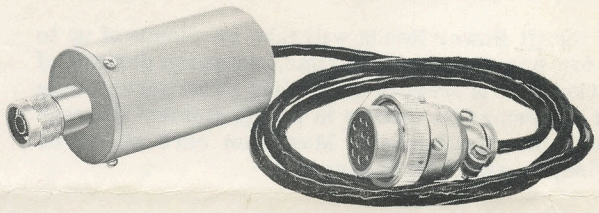
OPERATING INSTRUCTIONS

454A ser. No. 469 LN: 6625-454A
N422 ser. No 285 LN: 6625-N422

INSTRUCTION SHEET



MODEL N420, N421 and N422 COAXIAL
tft POWER HEADS

Description

Model Nos. N420, N421 and N422 denote three coaxial tft™* Power Heads designed for the measurement of radio frequency signals over an extremely wide range of power and frequency. These units are intended for use with the GMC Model 454A Thermoelectric Power Meter and will measure amplitude and frequency modulated as well as CW signals. The power range of the Coaxial tft Power Heads when used with the Model 454A extends from 0.3 microwatt full scale on the most sensitive range to 100 milliwatts full scale on the highest power range. Still higher powers can be measured using suitably calibrated couplers or attenuators. Frequency coverage extends from 10mc to 12.4Gc for each of the three models.

The tft Power Heads incorporate a thin-film metallic load which, acting as a well-matched termination, absorbs the incident r-f power. The load consists of bismuth and antimony sections which are vacuum deposited on a thin Mylar or mica substrate in a geometric configuration that produces a number of thermoelectric junctions. Some of the junctions are thermally "sinked" to the transmission line while the remaining junctions are located in the air space between the lines. The absorbed r-f power raises the temperature of these latter junctions relative to the "sinked" junctions and thus a thermoelectric emf is generated proportional to the temperature rise. By keeping the temperature differential between the junctions small, the unit acts as a true square-law (rms) device producing a d-c output voltage directly proportional to the absorbed power.

* thin-film thermoelectric

The tft Power Heads are designed to be used with the GMC Model 454A, which is equipped with the following special features:

1. Direct reading in power. No conversion required.
2. Automatic adjustment for each tft Power Head sensitivity factor.
3. Interlock circuitry to indicate when incorrect scale ranges are employed.
4. Compensation circuits to correct for sensitivity factor temperature coefficient.
5. Shielded low noise connector.

They may also be used with any other d-c voltmeter that offers adequate sensitivity and accuracy. It is recommended that the factory be consulted on special instrumentation problems.

Operation

To place the tft Power Head into use, first connect it to the Model 454A and zero the instrument to balance out residual thermal emf's. (The detailed operating procedures for the Model 454A are given in the Operation and Service Manual supplied with that instrument.) The tft Power Head should then be connected to the r-f system under test and the r-f power will be indicated on the Model 454A.

Although the tft Power Heads are rugged, dependable units that will give reliable, trouble-free service when operated within their ratings, they are subject to burn-out when overloaded. Table I lists the power ratings for the three models.

GENERAL MICROWAVE CORPORATION

155 MARINE STREET • FARMINGDALE, N.Y. 11735

TABLE I - Power Ratings for tft Power Heads

Model	Avge Power, Continuous Duty	Max. Peak Power*
N420	10 mw	3 W
N421	100 mw	30 W
N422	1 mw	0.3 W

*Tentative Ratings for PRF's greater than 50 cps. At lower frequencies this should be reduced.

While the tft Power Heads will take overloads of up to 300% for short periods of time, extended periods of operation at this level or exceeding these ratings may result in permanent change in the tft element characteristics or even burnout. Maximum care should be exercised to avoid its occurrence.

Maintenance

Except for replacement of tft elements, maintenance should not be required for tft Power Heads.

When spare tft elements are required for field replacement, they should be ordered in accordance with the following:

Model No. tft Power Head	Model No. tft Element
N420	TL-0
N421	TL-1
N422	TL-2

If factory replacement of tft elements is desired, return the unit to the Service Department, General Microwave Corporation, 155 Marine Street, Farmingdale, New York 11735, with a request for this service.

Referring to the exploded view, fig. 1, for parts identification, proceed as follows for field replacement of tft elements. It is recommended that GMC tool kit TK-1 be employed in the replacement procedure to prevent accidental damage to the tft elements.

1. Remove the three screws which hold the housing to the front flange. Slip the housing off the head assembly until it is free on the cable assembly.

2. Remove the three attaching screws which mount the rear block. Disassemble the rear block.

3. Remove the center screw and washer holding the tft element to the front block using the jewelers screwdriver provided with tool kit TK-1. The tft element and cover plates can now be removed from the front block utilizing the tool kit tweezer.

4. Place the replacement tft element and cover sheet(s) provided with it over the pins of the front block. Do not reuse old cover sheets.

   Although these parts will fit over the pins in several orientations, there is only one that will correctly align the center of the element with the center conductor of the front section. Slip the special assembly jig over the pins and insert the washer in the center hole of the jig. Observe that the countersink in the washer faces away from the tft element. Reassemble the center screw making sure that sufficient torque is transmitted to firmly seat the tft element. Reassemble the rear block.

5. To recalibrate the tft Power Head, one of two procedures may be used:

   a. RF Calibration

   With an r-f standard, a known level of power from a well-matched source (VSWR less than 1.02) should be established. A level close to the maximum rating of the tft Power Head is best to minimize drift and noise. The VSWR of the tft Power Head should be measured at the calibration frequency and the return loss computed. With the tft Power Head connected to the Model 454A, apply the r-f signal and adjust the calibration potentiometer R3 (see fig. 3) to produce the desired reading including correction for the return loss.

   b. Audio Calibration

   1. Connect the tft Power Head as shown in fig. 2. Be sure to observe proper ground connections to avoid spurious ground loops. To check for this, prior to connecting the tft Power Head observe the d-c voltmeter as the a-c generator output is varied. There should be no reading under these conditions. Disconnect the d-c voltmeter and observe that there is no change in the a-c voltmeter reading.

   2. Adjust the output of the 1 KC generator to the voltage indicated (approximately 10% below the maximum rated power of the head). Measure the rms audio input voltages (E and E_L) and the d-c output voltage (E_{dc}) and compute the sensitivity (S) as follows:

$$S = \frac{E_{DC}}{\frac{(E-E_L)}{200}\left[E_L - \frac{1.5\,(E-E_L)}{200}\right]}$$

   Compute the required value for the calibration resistance from the formula:

$$R = 971\left[AS - 0.103\right]$$

   where A = 4780 for the N421; Where A=4.78 for the N421
   = 478 " " N420 =0.478 " " N420
   = 47.8 for the N422 =0.0478 " " N422

   Connect a precision resistance bridge between pins 8 and 9 of P1 and adjust R3 to produce the desired resistance.

6. Slip the housing over the O-ring and reattach it to the front flange. Should excessive friction exist between the housing internal diameter and the O-ring apply a silicone grease to the O-ring to facilitate this assembly.

TABLE OF REPLACEABLE PARTS

Ref Sym	Description	P/N	Fed Mfr Code	Quantity Used Per Article		
				N420	N421	N422
—	O-Ring	PRP-568-223	02697	1	1	1
—	Screw, Miniature*	2982-18	11332	1	1	1
—	Washer*	3017	11332	1	1	1
—	Cover Sheet, Front*	3155-3	11332	1	X	1
—	Cover Sheet, Rear*	3155-2	11332	X	1	X
—	Cover Sheet, Rear*	3155-1	11332	1	X	1
—	Cable, Sp, Elec	2978	11332	5 ft.	5 ft.	5 ft.
C1,C2	Capacitor, Fxd, Ceramic; .047 uf	HY-310	93561	2	2	2
C3	Capacitor, Fxd, Ceramic; .005 uf	3031	11332	1	1	1
L1,L2	Choke, Rf, Fxd; 22 uh	3362	11332	2	2	2
P1	Conn, Plug, Elec	2908	11332	1	1	1
R1	Res, Fxd, Film 52.3Ω ±1%	MF52CE52R3F	19701	1	1	X
R2	Res, Fxd, Film 18.2Ω ±1%	MF52CD18R2F	19701	1	1	X
R2	Res, Fxd, Film 9.53Ω ±1%	MF52CD9R53F	19701	X	X	1
R3	Res, Var, WW 100Ω	84-5-6-101	02111	1	1	1
RT1	Thermistor	12E20	83186	1	1	1
TL	tft Element	TL-0	11332	1	X	X
TL	tft Element	TL-1	11332	X	1	X
TL	tft Element	TL-2	11332	X	X	1

* Also supplied with each replacement tft element

ACCESSORIES AVAILABLE:

Tool Kit TK-1 consisting of:

a. Assy Jig
b. Screwdriver
c. Tweezers

LIST OF MANUFACTURERS

Code	Mfr
02111	Spectrol Electronics Corp., San Gabriel, Calif.
02697	Parker Seal Co., Cleveland, Ohio
11332	General Microwave Corp., Farmingdale, N.Y.
19701	Electra Mfg. Co., Kansas City, Mo.
83186	Victory Engineering Corp., Union, N.J.
93561	Sprague Electric Corp., No. Adams, Mass.

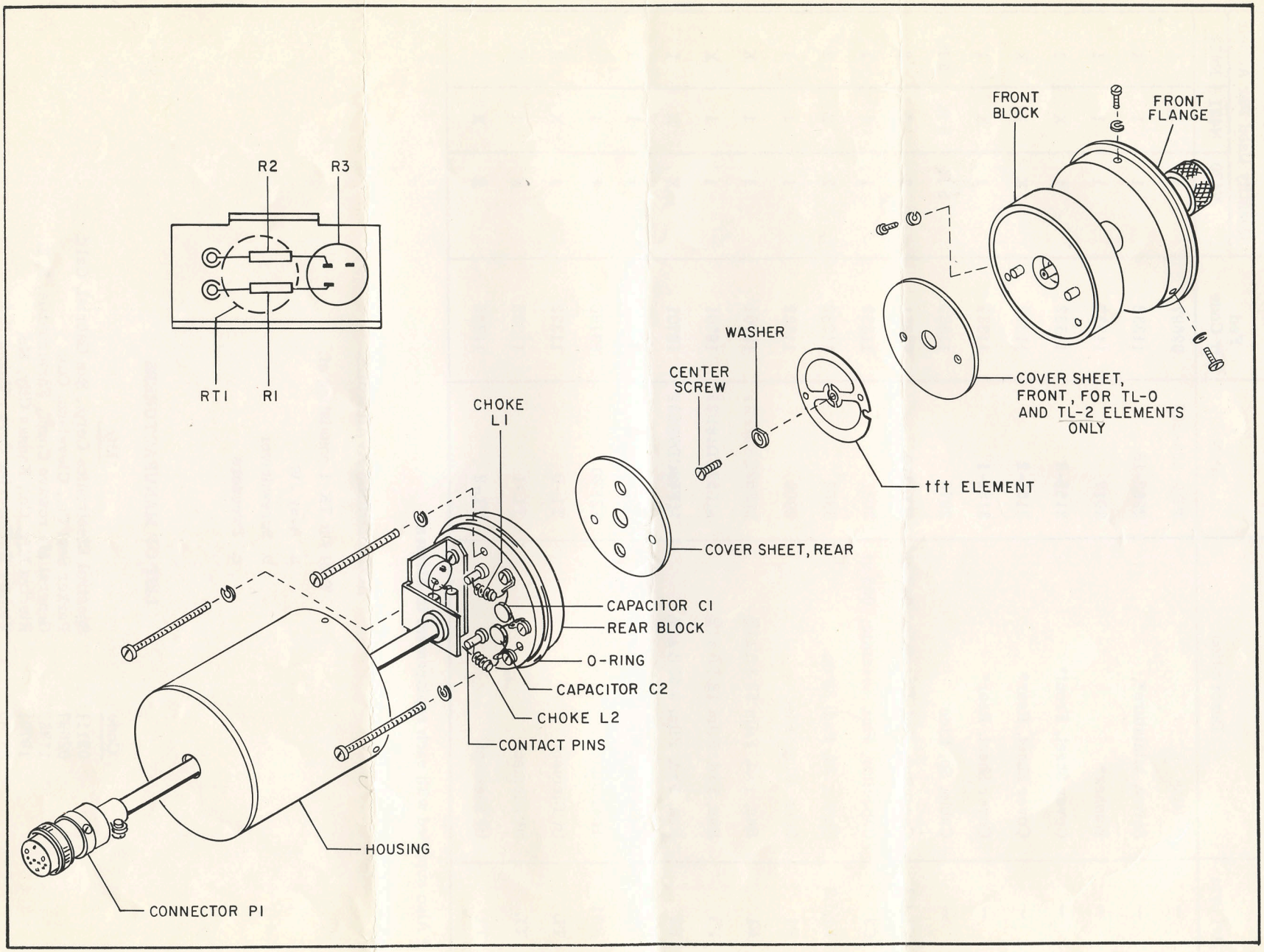


Figure 1. Exploded View, Models N420, N421, N422.

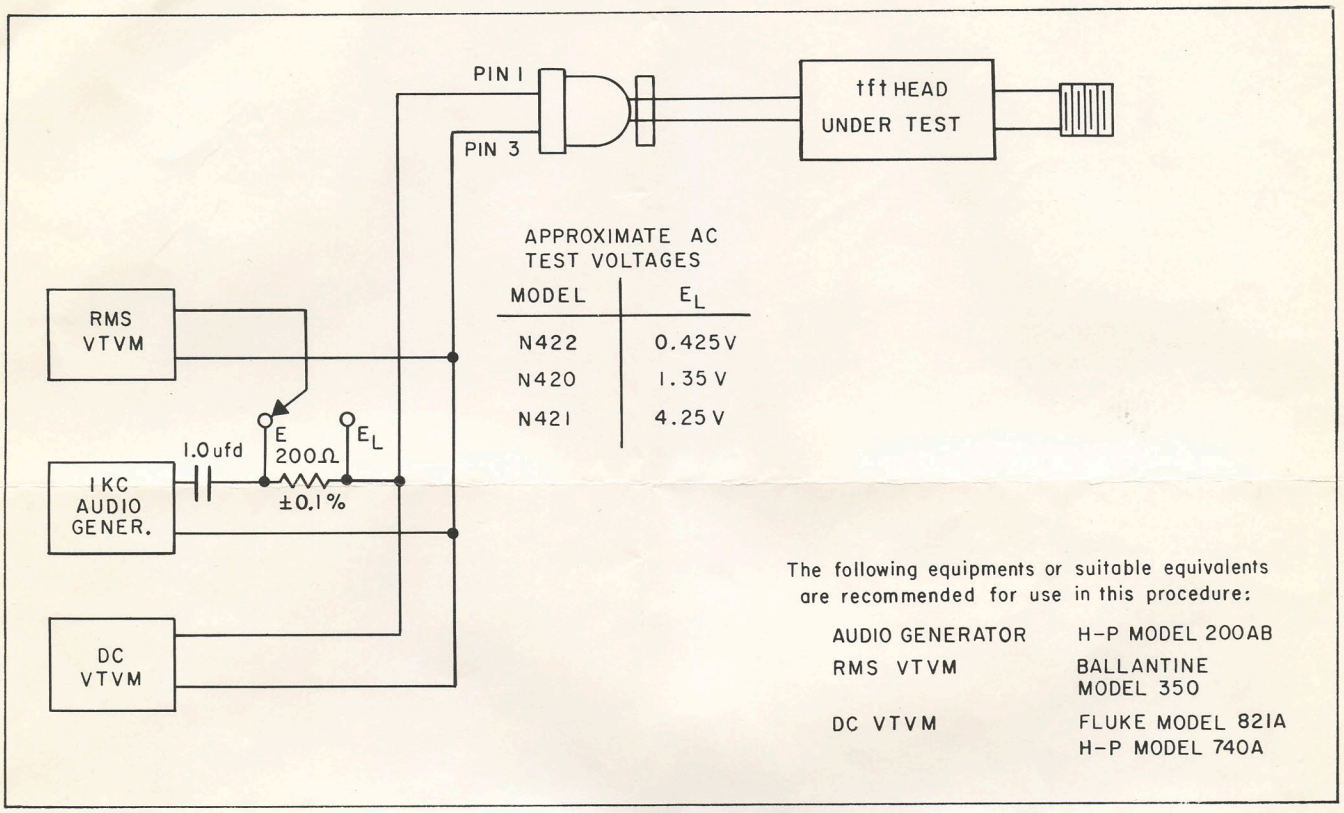


Figure 2. Test Set-Up for Audio Calibration.

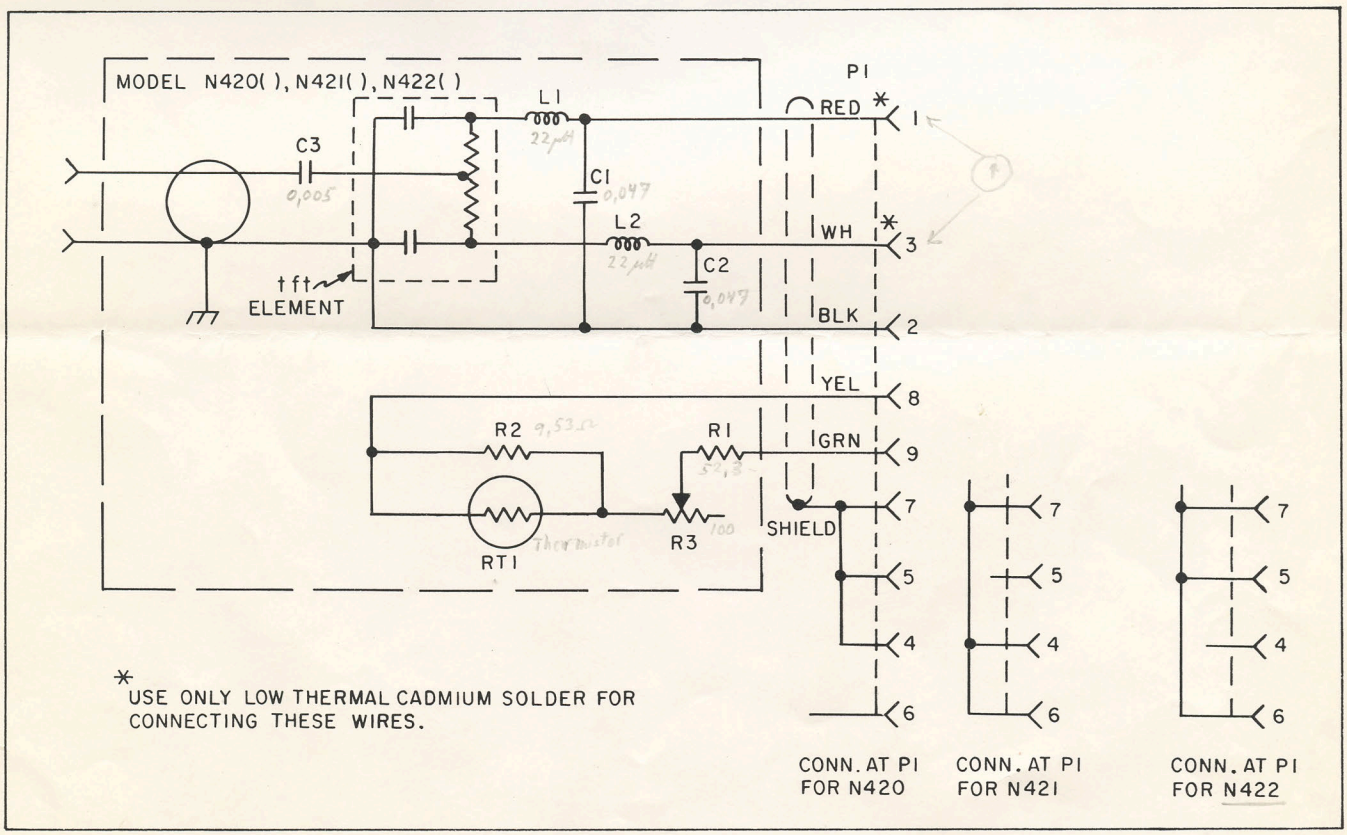


Figure 3. Schematic Diagram, Models N420, N421, N422.