INSTRUCTION BOOK

GTM-88F

FM FREQUENCY MONITOR

M-6588

HARRIS
INTERTYPE
CORPORATION

GATES

A DIVISION OF HARRIS-INTERTYPE

WARRANTY

Seller warrants new equipment manufactured by Gates Radio Company against defects in material or workmanship at the time for delivery thereof, that develop under normal use within a period of one year (6 months on moving parts) from the date of shipment, of which Purchaser gives Seller prompt written notice. Other manufacturers' equipment, if any, including electron tubes, and towers shall carry only such manufacturers' standard warranty.

Seller's sole responsbility for any breach of the foregoing provision of this contract, with respect to any equipment or parts not conforming to the warranty or the description herein contained, is at its option, (a) to repair or replace such equipment or parts upon the return thereof f.o.b. Seller's factory within the period aforesaid, or (b) to accept the return thereof f.o.b. Purchaser's point of installation, whereupon Seller shall either (1) issue a credit to Purchaser's account hereunder in an amount equal to an equitable portion of the total contract price, without interest, or (2) if the total contract price has been paid, refund to Purchaser an equitable portion thereof, without interest.

If the Equipment is described as used, it is sold as is and where is. If the contract covers equipment not owned by Seller at this date it is sold subject to Seller's acquisition of possession and title.

Seller assumes no responsibility for design characteristics of special equipment manufactured to specifications supplied by or on behalf of Purchaser.

Seller shall not be liable for any expense whether for repairs, replacements, material, service or otherwise, incurred by Purchaser or modifications made by Purchaser to the Equipment without prior written consent of Seller.

EXCEPT AS SET FORTH HEREIN, AND EXCEPT AS TO TITLE, THERE ARE NO WARRANTIES, OR ANY AFFIRMATIONS OF FACT OR PROMISES BY SELLER, WITH REFERENCE TO THE EQUIPMENT, OR TO MERCHANTABILITY, INFRINGEMENT, OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE EQUIPMENT ON THE FACE HEREOF.

RETURNS AND EXCHANGES

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. Custom built equipment or merchandise specially ordered for you is not returnable. Where return is at the request of, or for the convenience of the customer, a restocking fee of 15% will be charged. All returned merchandise must be sent freight prepaid and properly insured by the customer. When writing to Gates Radio Company about your order, it will be helpful if you specify the Gates Factory Order Number or Invoice Number.

WARRANTY ADJUSTMENTS

In the event of equipment failure during the warranty period, replacement or repair parts may be provided in accordance with the provisions of the Gates Warranty. In most cases you will be required to return the defective merchandise or part to Gates f.o.b. Quincy, Illinois for replacement or repair. Cost of repair parts or replacement merchandise will be billed to your account at the time of shipment and compensating credit will be issued to offset the charge when the defective items are returned.

MODIFICATIONS

Gates reserves the right to modify the design and specifications of the equipment shown in this catalog without notice or to withdraw any item from sale provided, however, that any modifications shall not adversely affect the performance of the equipment so modified.

INSTRUCTION BOOK

GTM-88F
FM FREQUENCY MONITOR
FCC APPROVAL NO. 3-137

HARRIS INTERTYPE CORPORATION

GATES®

GATES RADIO COMPANY
A Division of Harris-Intertype Corporation
QUINCY, ILLINOIS 62301

888 0956 001

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ADDENDA

GTM-88F FM FREQUENCY MONITOR

PARTS LIST, Page 4, Meter Board:

Change CR3 to read 386 0158 000 Zener Diode, 1N5344A

SCHEMATIC - 852 6317 001:

Change CR3 from 1N4738 to 1N5344A.

ECN-12790

Gates Radio Company
Quincy, Illinois

I GENERAL DESCRIPTION

The GTM-88F FM Frequency Monitor has been designed to meet FCC requirements for measuring the center frequency deviation of an FM broadcast transmitter from its assigned frequency in the range of 88 to 108 Mc.

The accuracy of measurement is within 1000 cycles (.001%) and the effects of modulation of the center frequency of the transmitter have been minimized. The monitor has been designed to provide stability, accuracy and long trouble-free performance. It cannot cause any deteriorative effects on the transmitter or affect the signal being transmitted. It is designed for continuous operation, and does not require frequency adjustment to maintain its accuracy. It is not affected by typical changes of power line voltage, changes of input signal level from the transmitter, ambient temperature variations, or component aging during regular service.

II SPECIFICATIONS

FREQUENCY RANGE:	88 to 108 Mc - fixed.
DEVIATION RANGE:	+3KHz to −3 KHz of specified frequency.
AMBIENT TEMPERATURE:	+10°C to +55°C.
ACCURACY:	Better than .001% or better than 1000 Hz at any frequency.
STABILITY:	Maximum change within 24 hours 100 Hz.
R.F. INPUT:	50 ohms, .2 to 1 watt.
FRONT PANEL INDICATORS:	Deviation meter, AC Power Pilot Light, Crystal Oven Lamp
FRONT PANEL CONTROLS:	Selector switch (Power ON/OFF, RF Input Cal, Monitor Cal, and Operate), Meter Zero, R.F. level, (Recessed) Frequency Adjustment, (Recessed).

DIODE & TRANSISTOR COMPLEMENT

DIODE	QTY.	TRANSISTOR	QTY.
1N54A	2	2N697	1
1N542	2	2N708	10
1N821(Zener)	1	2N709	1
1N914	9	2N2369	1
1N4729(Zener)	1	2N3055	1
1N4738(Zener)	2	2N4036	1
MZ1000-24	1	2N3903	1
COD1 6082 (stabistor)	1	RCA 40314	5
Molded Bridge	1		

POWER INPUT:	100 to 130 VAC, 50/60 Hz, 40 Watts max.
POWER SUPPLY;	Regulated, fused
FUSES: Monitor	3/4 Amp.
DIMEMSIONS:	Standard rack, 19" W, 7" H, 10" Deep
WEIGHT:	20 Lbs, max

III INSTALLATION AND INITIAL ADJUSTMENT

INSPECTION: Upon receipt of your GTM-88F, remove it from the packing material and inspect for any damage caused in transit due to handling or vibration. If damage either concealed or obvious, is determined, immediately call the transportation company that delivered the material to you and go over the damages with them. They will either note the shipping way-bill which you have or give you a damage report indicating that you may proceed with repairs, order the necessary parts from Gates, Gates will bill these parts to you and you in turn can bill the parts to the transportation company under the damage claim.

All Gates equipment is shipped in approved packing containers and anything broken in transit, the transportation company is obligated to pay for, not you.

LOCATION: Installation preferably should be made in a standard equipment rack or cabinet which is well connected electrically to the main station ground and away from strong RF fields created by the transmitter. The monitor should be located near the transmitter in order to take an RF sample directly from the transmitter. If a remote application is desired, RF can be fed from an RF amplifier.

CONNECTIONS, INPUT: Plug the AC line cord into a nominal 115 volt, 50/60 Hz power source.

Connect a 50 ohm coaxial cable (RG-58 or RG-8) between an RF pick-up loop (or RF amplifier) and the input J1 at the monitor. (Amphenol Type 83-ISP connector is used).

CAUTION: DO NOT APPLY MORE THAN 2 WATTS FROM THE PICK-UP LOOP OR THE MONITOR MAY BE DAMAGED.

When using the GTM-88F in conjunction with other existing monitor equipment, simultaneous connection of the RF inputs from the same pick-up can be made. However where other monitors are in use, it may be necessary to incorporate a resistive pad to achieve the correct RF input level for each unit.

Separate pick-up loops or an RF amplifier should eliminate any interference encountered between monitors in the field.

INITIAL ADJUSTMENTS: Turn the power on and allow the monitor to warm-up 1/2 hour for temperature stabilization. The red light will indicate that the power is on.

When the instrument is first plugged in, the amber crystal temperature indicator light will appear. As the oven brings the crystal towards its desired temperature, the light will begin the flash off and on. This lamp will light and turn off in a rather fast and erratic manner. (As fast as 3 to 4 times per second occasionally). THIS IS COMPLETELY NORMAL. The oven maintains the crystal temperature within 1/10th of a degree.

Select the Cal position of the function switch on the front panel. The meter should be within a few hundred cycles of zero, and can be set exactly to zero with the METER ZERO control. With the function switch in the RF INPUT position, the meter pointer should be in the red RF CAL area of the meter; if it does not, the pick-up loop or RF amplifier output should be adjusted so that with the RF LEVEL control at approximately its mid-range, the meter indicates the desired plus 1.5 KHz. Periodic adjustment of the RF level should be made by means of the RF LEVEL control, keeping the indication in the RF CAL area.

IV OPERATION

At this time, the function switch can be set to operate position and any deviation of the transmitter center frequency will be indicated on the zero center meter.

Calibration against an external frequency standard may be made at the station as follows: While in contact with an outside measuring service, the transmitter frequency can be adjusted for the exact assigned frequency. Place the GTM-88F in CAL position and zero the meter. Then place the function switch in operate position and observe any deviation. If the indication is not zero, adjust the FREQ. ADJ. control (C1) until the meter reads zero. If the meter zero is beyond the range of C1 see paragraph on RF oscillator alignment.

An alternate method can be used. The frequency of the transmitter is first measured by the frequency measuring service. The moniter is corrected by adjusting meter zero so the frequency meter indicates the same frequency as determined by the measuring service. Then the transmitter can be adjusted so that zero deviation is measured on the meter. When the monitor reads zero. place the function switch to Calibrate and zero the meter. Return the function to Operate position and adjust the FREQ. ADJ. control for a zero meter reading. The meter zero besides zeroing the meter, temperature compensates the monitor. It is suggested that the function switch be turned to Cal position to be sure that the pointer is on zero every time a reading is taken.

Re-adjust to zero if necessary. This should require very little adjustment unless there has been a major temperature change. Then return the function switch to the OPERATE position for accurate logging of center frequency. It is suggested that the RF level be checked at least daily.

NOTE: The pointer of meter M-1 may peg when switching, between RF INPUT, CAL and OPERATE This is particularly true if the incoming signal is considerably off frequency. The meter can not be damaged under normal operation. However, if the input signal remains considerably off frequency the meter should be returned to the CAL position until the frequency is brought within the range of the monitor.

V CIRCUIT DESCRIPTION

The signal will be traced through the GTM-88F referring to the schematic with the function switch in the OPERATE position.

The sample RF is fed through the input connector J1 to a variable attenuator (C-9). This attenuator offers a nominal input impedance of 50 ohms to the input signal. The output of the attenuator is coupled to the emitter of Q3.

Refer now to Q1. This is a crystal controlled oscillator. The frequency of this oscillator is maintained by a quartz crystal housed in an oven. The oven maintains the crystal temperature within 1/10th of a degree at approximately 70° C. Vernier adjustment of the frequency may be accomplished by FREQ. ADJ. control C-1. The developed frequency appears on the base of Q2. Q2 is a frequency tripler. The tripled frequency is coupled to the base of Q3, and so selected that it is 200 KHz below the input frequency to be monitored. Q3 is a mixer which produces an amplified 200 KC signal.

The 200 KC signal is coupled to a Schmitt trigger (Q4, Q5) which limits and squares the 200 KHz signal. The 200 KHz square wave is coupled to a monostable multivibrator (Q6, Q7, Q8). The monostable produces a constant width pulse proportional to the input signal frequency.

The constant width pulse is passed through an emitter follower Q9 to a phase splitter Q 10.

Both the in-phase and out-of-phase constant width pulses are passed through emitter followers (Q11, Q12) to pulse amplifiers (Q13 and Q 14).

The pulse amplifiers create a DC voltage proportional to the input frequency. At 200 KHz the developed DC voltage of each pulse amplifier is equal and the meter. reads zero. As the frequency moves away from the 200 KHz, zero point, the DC voltage of the pulse amplifiers changes, causing the meter to deflect.

By placing the selector switch in CAL position a 200 KHz signal from a crystal oscillator (Q18, Q19) is coupled to the Schmitt trigger through an emitter follower (Q20). The meter is then zeroed by adjusting the meter zero control which changes the pulse width of the monostable, and calibrates the monitor circuitry by making the developed DC voltage at the pulse amplifiers equal. When the monitor is placed in the RF CAL position the meter is switched in series with a diode (CR5) and measures the current produced by the diode which is proportional to the RF voltage applied at the input J1.

The heart of the power supply is CR12, a temperature compensated zener diode. CR12 maintains a constant voltage over the temperature range and controls the transistor regulator (Q15, Q16, Q17) which produces +15 DC volts for all monitor circuitry.

The oven, a 117 VAC type, is fused and connected directly to the power cord. It will function immediately when the monitor is plugged into the power source and is not switched by the selector switch (S1). The oven is temperature controlled by a bi-metal thermostat. To indicate that the oven is controlling the crystal temperature an incandescent lamp on the front panel is connected in parallel with the heater circuit of the oven.

VI RF OSCILLATOR ALIGNMENT

If the oscillator frequency can not be adjusted for a meter zero position with correct input frequency by using C1, set C1 at mid-range and adjust C3 until meter is about zero. Then re-adjust C1 until meter is at zero.

Should it be necessary to re-align the RF oscillator follow this procedure -

RF ALIGNMENT PROCEDURE FOR FM FREQUENCY MONITOR, GTM-88F

1. Connect an oscilloscope to IF output at switch S1D.
2. Adjust C1 (FREQ. ADJ.) to mid-range capacity.
3. Connect RF voltage (.2 to 1 watt) to J1. The RF shall be at carrier frequency ±10 cps. Read frequency on a counter.
4. With the Function Switch (S1) in RF position adjust C9 (RF level) to a red line reading on the meter (RF Cal).
5. Switch the Function Switch (S1) to Cal position.
6. Adjust C3 and C4 (Chassis controls) for and IF voltage on the scope. (Range: 10 to 50 Vpp).
7. Adjust the meter to a zero setting with meter zero control R29.
8. Switch the Function Switch (S1) to Operate position. Adjust the meter for a near zero reading with C3 (Chassis control).
9. Switch the Function Switch (S1) to RF position and check to see that the meter is on the red line of Step 5.
10. Switch Function Switch (S1) to Operate position. Adjust C4 (Chassis control) until a .8 to 1.0 volt pp reading is obtained on the scope.
11. The Frequency Adjust control (C1) should be able to adjust the meter ±500 Hz at this time. Check the tuning range. Zero the meter with C1.
12. Switch the Function Switch to Cal position and zero the meter with the meter zero control (R29).
13. Return the Function Switch (S1) to Operate position and recheck the meter zero. If not zero reset with Frequency Adjust control (C1).
14. With normal signal from transmitter at J1 and function switch in Operate position - proceed with a frequency check by an FCC approved method as outlined in the OPERATION section of the instruction book.

VII MAINTENANCE

No periodic maintenance is necessary. If dust or dirt should accumulate in the equipment at any time remove it by use of an air hose.

Should you need to repair a printed circuit board, a printed sheet #1234 is available without charge, on request, covering "How to Replace Items on Printed Boards".

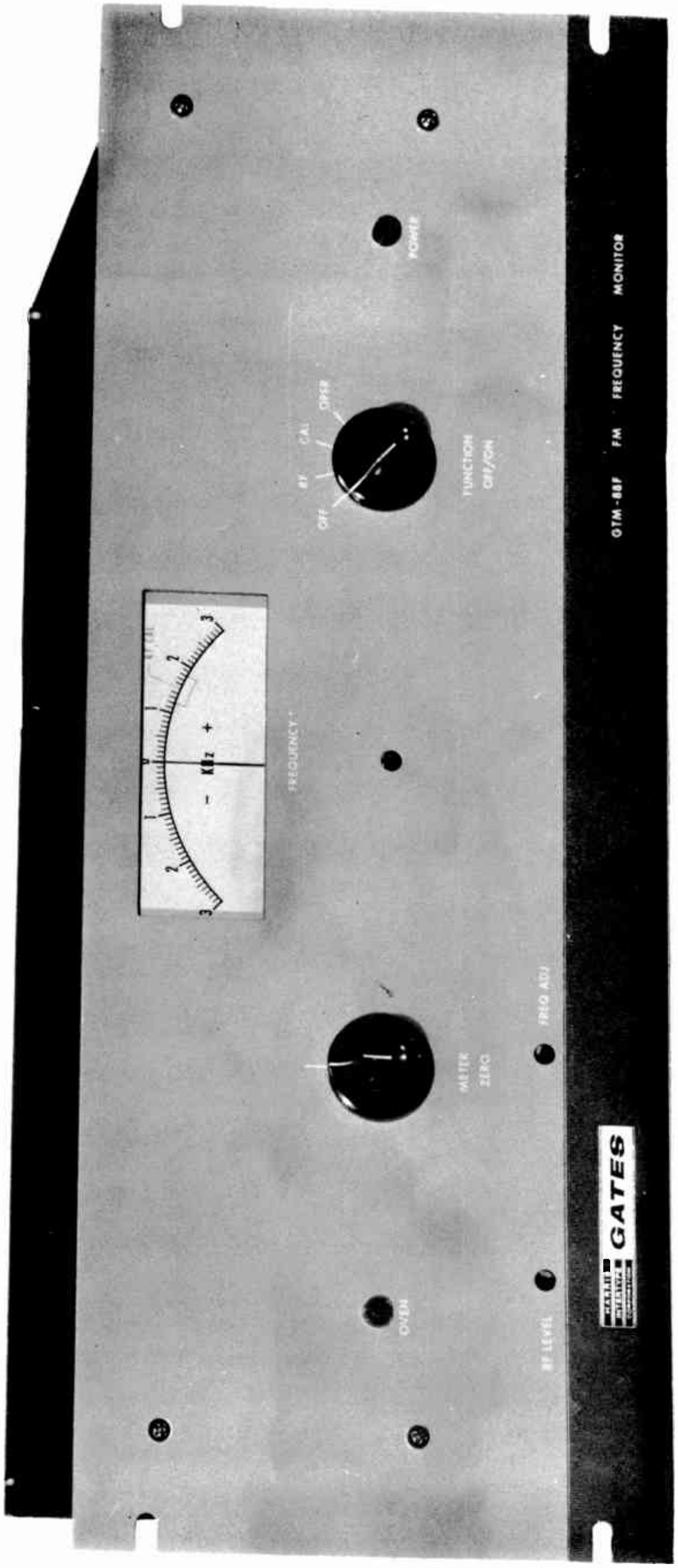
VIII PARTS LIST

CHASSIS

Symbol No.	Gates Part No.	Description
A1	406 0388 000	Pilot Lamp, Red
A2	406 0389 000	Pilot Lamp, Amber
C1	520 0123 000	Cap., Var., 3.2 to 50 pF
C2	500 0822 000	Cap., 75 pF, 500 V. 5%
C3, C4	520 0305 000	Cap., Var., 3.2 to 50 pF
C5	500 0787 000	Cap., 200 pF, 500 V.
C6	522 0218 000	Cap., 5 uF, 15 V.
C7	516 0063 000	Cap., .002 uF, 1 KV
C8	500 0784 000	Cap., 300 pF, 500 V.
C9	520 0125 000	Cap., Var., 4.5 to 100 pF
C10	500 0759 000	Cap., 100 pF, 500 V.
C11	500 0842 000	Cap., 820 pF, 300 V.
C12, C38	516 0375 000	Cap., .01 uF, 50 V.
C13, C14, C15, C16	516 0084 000	Cap., .02 uf, 600 V.
C17	506 0088 000	Cap., .1 uF, 200 V.
C35	524 0135 000	Cap., 1500 uF, 75 V.
C36	522 0372 000	Cap., 2500 uF, 15 V.
C37	516 0054 000	Cap., .001 uF, 1 KV
C40	500 0812 000	Cap., 30 pF, 500 V.
CR25	384 0210 000	Diode, 1N542
F1	398 0016 000	Fuse, .75 A, 250 V, AGC
HR1	558 0029 000	Crystal Oven
J1	612 0230 000	Receptacle
L1	814 7246 000	Coil
L2	814 5572 001	Coil
L3, L10	494 0198 000	Choke
L4, L5	494 0114 000	Choke, R.F.
L9	814 7247 001	Coil
M1	632 0623 000	Meter
Q1	380 0096 000	Transistor, 2N3903
Q2	380 0078 000	Transistor, 2N709
Q3	380 0053 000	Transistor, 40314
Q15	380 0043 000	Transistor, 2N3055
R1	540 0070 000	Res., 7.5K ohm, 1/2 W. 5%
R3	540 0042 000	Res., 510 ohm, 1/2 W, 5%
R4	540 0018 000	Res., 51 ohm, 1/2 W, 5%
R6	540 0056 000	Res., 2.0K ohm, 1/2 W, 5%
R7	540 0032 000	Res., 200 ohm, 1/2 W, 5%
R8	540 0085 000	Res., 33K ohm, 1/2 W, 5%
R9	540 0053 000	Res., 1.5K ohm, 1/2 W, 5%
R10	540 0025 000	Res., 100 ohm, 1/2 W, 5%
R11	540 0060 000	Res., 3K ohm, 1/2 W, 5%
R12	540 0024 000	Res., 91 ohm, 1/2 W, 5%
R13	540 0010 000	Res., 24 ohm, 1/2 W, 5%
R14	540 0306 000	Res., 82 ohm, 1 W, 5%
R29	914 6159 001	Pot., 500 ohm (Mod.)
R71	540 0089 000	Res., 47K ohm, 1/2 W, 5%
R84	540 0067 000	Res., 5.6K ohm, 1/2 W, 5%
S1	927 3319 001	Switch, Rotary, 3 Section
T1	472 0611 000	Transformer
XF1	404 0023 000	Fuseholder
XHR1	404 0016 000	Socket
XQ1, XQ2, XQ3	404 0187 000	Transistor Socket
XQ15	404 0136 000	Transistor Mtg. Kit

Symbol No.	Gates Part No.	Description
METER BOARD		
C18	500 0756 000	Cap., 330 pF, ±5%
C19	500 0818 000	Cap., 50 pF, ±5%
C20, C25	522 0210 000	Cap., 100 uF, 12 V.
C21	500 0834 000	Cap., 430 pF, ±5%
C23	500 0803 000	Cap., 5 pF, ±5%
C24	522 0174 000	Cap., 8 uF, 6 VDC
C27, C28	522 0222 000	Cap., 15 UF, 15VDC
C26	522 0153 000	Cap., 15 uF, 3 VDC
C29, C32	500 0759 000	Cap., 100 pF, ±5%
C30, C31, C34	506 0088 000	Cap., .1 uf, 200 V.
C33	500 0754 000	Cap., 220 pF, ±5%
C38, C39	522 0166 000	Cap., 400 uF, 3 V.
C41	522 0160 000	Cap., 100 uF, 3 V.
C42, C43	508 0298 000	Cap., .01 uF, 100 V.
C44	500 0832 000	Cap., 360 pF, ±5%
CR1	386 0046 000	Codistor
CR2	386 0081 000	Zener Diode, 1N4729A
CR3, CR6	386 0091 000	Zener Diode, 1N4738
CR4, CR15, CR16, CR18, CR17, CR19, CR20, CR21, CR22, CR23, CR24	384 0205 000	Diode, 1N914
CR5	384 0210 000	Diode, 1N542
L6, L7	492 0347 000	Coil
L8	494 0165 000	R.F. Choke
Q4, Q5, Q6, Q7, Q8, Q9, Q11, Q12, Q13, Q14	380 0077 000	Transistor, 2N708
Q10	380 0083 000	Transistor, 2N2369
Q18, Q19, Q20, Q21	380 0053 000	Transistor, 40314
R19	540 0085 000	Res., 33K 1/2 W. ±5%
R20, R83	540 0065 000	Res., 4.7K ohm, 1/2 W. ±5%
R21	540 0057 000	Res., 2.2K ohm, 1/2 W, ±5%
R22, R28, R30, R38, R67, R81	540 0073 000	Res., 10K ohm, 1/2, ±5%
R23, R40	540 0050 000	Res., 1.1K ohm, 1/2 W, ±5%
R24	540 0090 000	Res., 51K ohm, 1/2 W, ±5%
R25, R42, R72, R73	540 0049 000	Res., 1K ohm, 1/2 W, ±5%

Symbol No.	Gates Part No.	Description
R26, R52	540 0045 000	Res., 680 ohm, 1/2 W, ±5%
R27	552 0796 000	Potentiometer, 5K ohm
R31	540 0084 000	Res., 30K ohm, 1/2 W, ±5%
R32	540 0046 000	Res., 750 ohm, 1/2 W, ±5%
R33	540 0042 000	Res., 510 ohm, 1/2 W, ±5%
R34	540 0071 000	Res., 8.2K ohm, 1/2 W, ±5%
R35	540 0092 000	Res., 62K ohm, 1/2 W, ±5%
R36, R43, R46, R68	540 0097 000	Res., 100K ohm, 1/2 W, ±5%
R37, R79	540 0056 000	Res., 2K ohm, 1/2 W, ±5%
R39, R74	540 0078 000	Res., 16K ohm, 1/2 W, ±5%
R41	540 0070 000	Res., 7.5K ohm, 1/2 W, ±5%
R44, R47	540 0101 000	Res., 150K ohm, 1/2 W, ±5%
R45, R50	544 1603 000	Res., 825 ohm, 1/2 W, ±1%
R49, R54	540 0032 000	Res., 200 ohm, 1/2 W, ±5%
R51, R57	540 0312 000	Res., 150 ohm, 1 W, ±5%
R53	552 0802 000	Potentiometer, 1K ohm
R55, R56	540 0025 000	Res., 100 ohm, 1/2 W, ±5%
R58	544 1604 000	Res., 332 ohm, ±1%
R59	540 0024 000	Res., 91 ohm, 1/2 W, ±5%
R60	552 0797 000	Potentiometer, 100 ohm
R69	540 0060 000	Res., 3.0K ohm, 1/2 W, ±5%
R75, R77	540 0088 000	Res., 43K ohm, 1/2 W, ±5%
R76	540 0081 000	Res., 22K ohm, 1/2 W, ±5%
R78, R82	540 0044 000	Res., 620 ohm, 1/2 W, ±5%
RT2	559 0013 000	Thermistor, 20K ohm
XY1	404 0132 000	Crystal Socket w/Holder
Y1	444 1232 000	Crystal, 200 kHz
POWER SUPPLY BOARD		
(CR7, CR8, CR9, CR10)	384 0196 000	Silicon Bridge Assembly
CR11	386 0111 000	Zener Diode, MZ1000-24
CR12	386 0044 000	Zener Diode, 1N821
CR13, CR14	384 0006 000	Diode, 1N54AS
Q16	380 0045 000	Transistor, 2N4036
Q17	380 0042 000	Transistor, 2N697
R61	540 0049 000	Res., 1000 ohm, 1/2 W, ±5%
R62, R65	540 0615 000	Res., 1500 ohm, 2 W, ±5%
R63	540 0611 000	Res., 1000 ohm, 2 W, ±5%
R64	552 0776 000	Potentiometer, 500 ohm



GATES RADIO COMPANY - QUINCY, ILLINOIS
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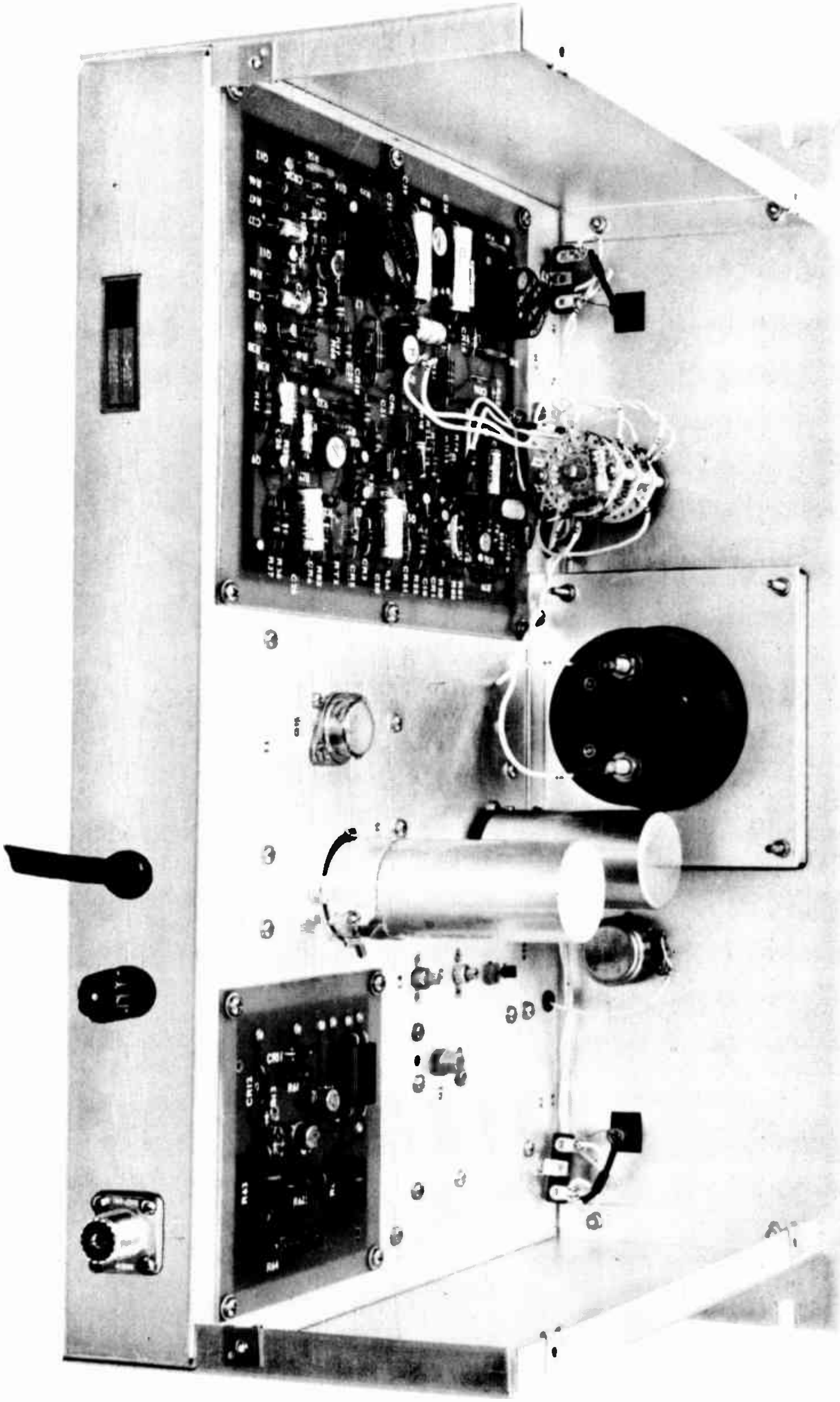
PHOTO, FRONT VIEW GTM-88F



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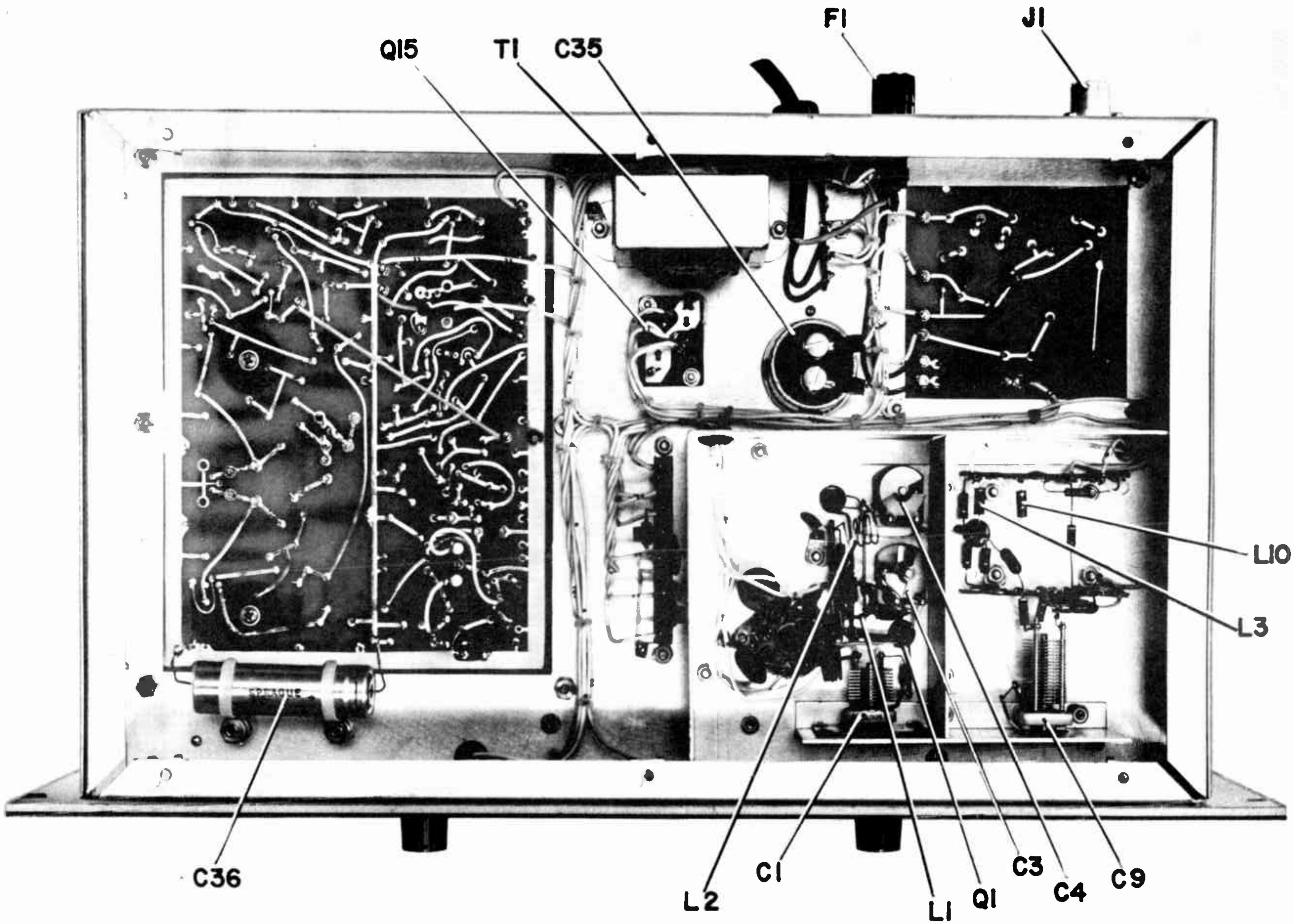

GTM-88F

BOTTOM VIEW
FREQ. MONITOR

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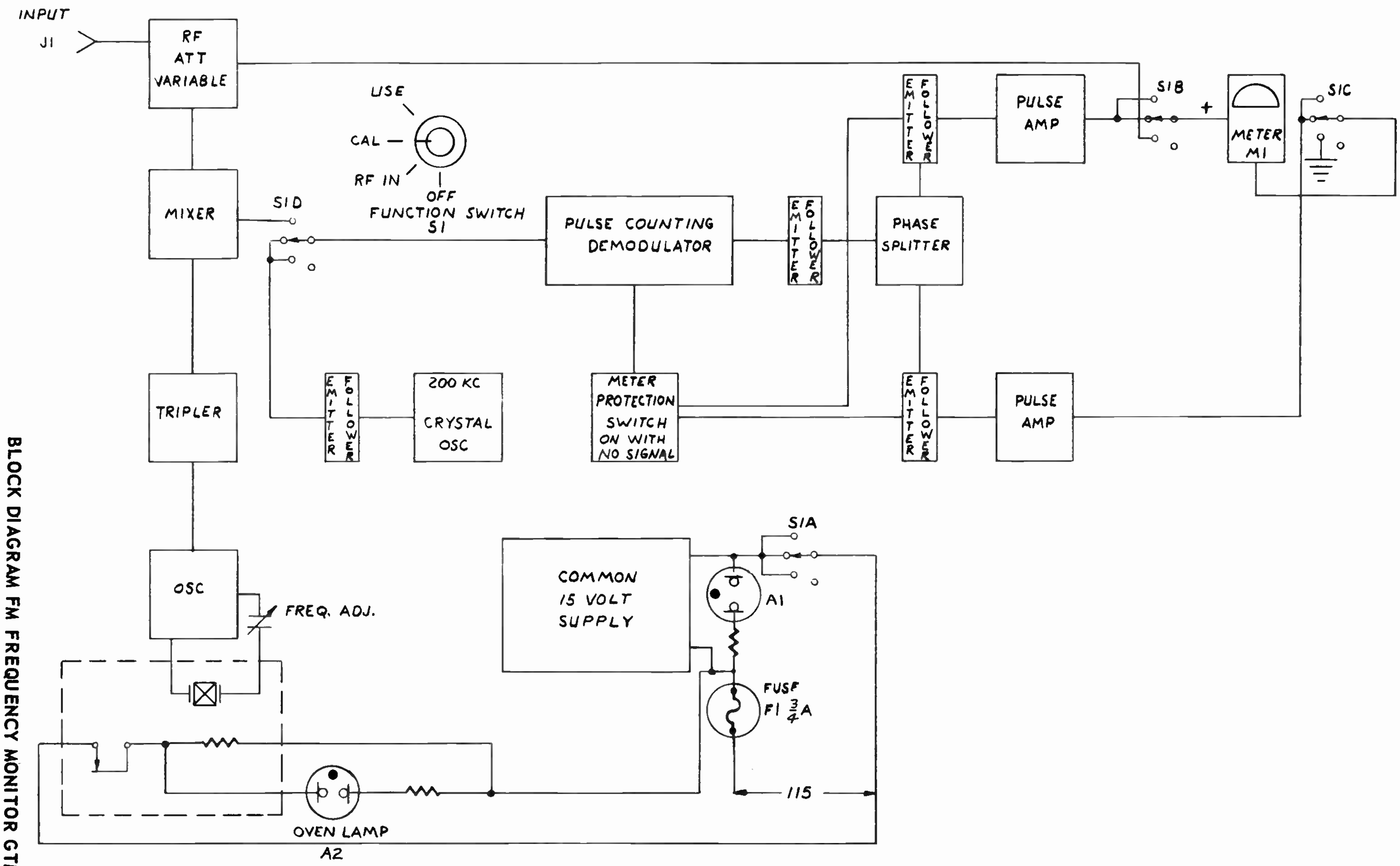
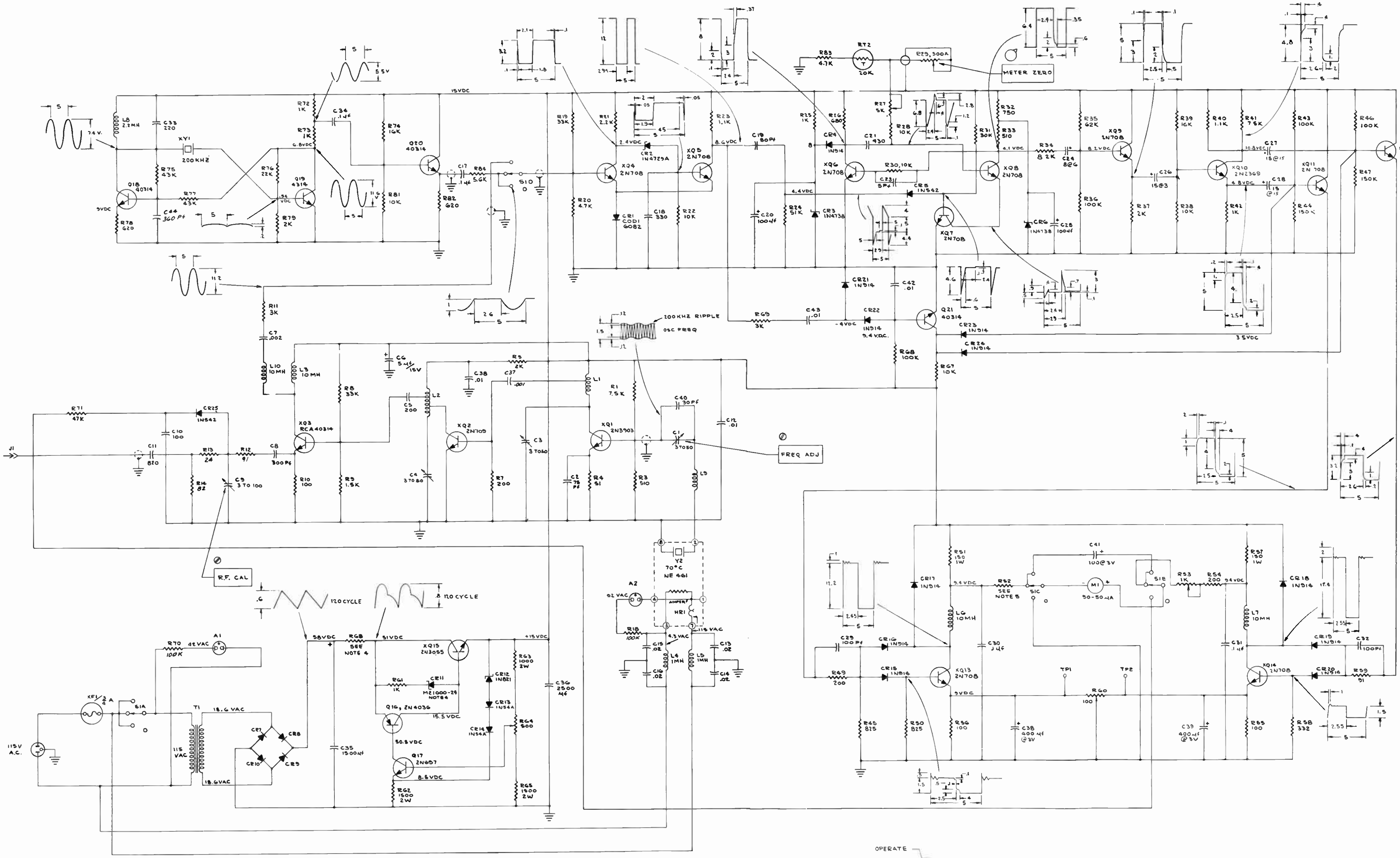
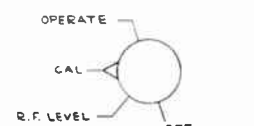


BLOCK DIAGRAM FM FREQUENCY MONITOR GTM-88F

827 3329 001



NOTES
1. AC & DC VOLTAGE MEASUREMENTS MADE TO GROUND WITH A HP 410C
2. PEAK TO PEAK VOLTAGE & WAVE SHAPES MADE WITH TECTRONICS 585 SCOPE
3 ALL TIME PERIODS IN µSEC
4 VALUE SUBJECT TO CHANGE WITH TRANSFORMER MFG
5 R52 VALUE SUBJECT TO CHANGE WITH METER MFG



FUNCTION SWITCH
S1 (4 SECTIONS)

GATES RADIO COMPANY - QUINCY, ILLINOIS
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OVERALL SCHEMATIC FM FREQ MONITOR
852 6317 001